



Domtar Paper Company, LLC
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July 16, 2024

Ms. Jessica Murphy
Tennessee Department of Environment and Conservation
Manager, Enforcement and Compliance Unit
Division of Water Resources
312 Rosa L. Parks Avenue, 11th Floor
Nashville, TN 37243

Mr. Dane Cutshaw
Tennessee Department of Environment and Conservation
Manager, Johnson City Environmental Field Office
Division of Water Resources
2305 Silverdale Drive
Johnson City, TN 37301

Re: Domtar Paper Company, LLC's Kingsport Mill ("Domtar") Response to Director's
Order and Assessment Case No. WPC23-0153

Dear Ms. Murphy and Mr. Cutshaw:

This letter constitutes Domtar's response to Item 3 under Article XXXI in the Director's Order and Assessment ("Order"), dated April 9, 2024 (received via certified mail on April 22, 2024, through National Registered Agents, Inc.).

Specifically, Article XXXI, Item 3 states:

Within 90 days following receipt of the Order, the Respondent shall submit a corrective action plan/engineering report (CAP/ER) to address the issues with the treatment facility associated with the conversion of the production process, and the biological response documented in the receiving stream. The CAP/ER shall include a schedule with a specific date of completion for each corrective action necessary to bring the facility into compliance. Any changes or modifications to the CAP/ER requested by the Division shall be submitted within 30 days following receipt of Division notice. If the Respondent fails to comply with this Item, the Respondent shall pay \$12,930.00.

Domtar retained, Arcadis, Inc., an environmental engineering firm, ("Arcadis") to complete an engineering evaluation of Domtar's wastewater treatment system and provide recommendations to address Item 3, Article XXXI in the Order concerning the issues with the treatment facility associated with the conversion of the production process, and the biological response

documented in the receiving stream. A copy of Arcadis' Engineering Report and Corrective Action Plan is enclosed with this response.

Background

The BOD exceedances experienced by the mill in February 2023 through May 2023 were related to the start-up of the mill following a 2 ½ year period during which time the mill was not operated. During this inoperable period, the mill was converted from a virgin soda pulp and uncoated freesheet paper mill to a 100% recycled containerboard mill. Contributing factors that led to these exceedances included:

- While the mill was down, the Aerated Stabilization Basin (“ASB”)/lagoon was completely drained so that the biology had to be re-established.
- Due to the challenges of starting up new and rebuilt major equipment, as well as new processes, the BOD load to the lagoon was more erratic than under normal operations.
- Effluent flows and solids to the wastewater treatment plant were higher than expected due to challenges starting up new equipment and processes.
- The ASB/lagoon has 7 to 14 days of retention time, and the settling zone is not plug-flow, so improvements made at the inlet take time to be realized in the final effluent.

Corrective Actions Implemented

The following corrective actions were implemented to address these exceedances, and the BOD levels have been in compliance since June 2023. The mill is fully compliant with its effluent BOD discharge permit limits.

➤ Stabilize mill operations and reduce flow and solids to the wastewater treatment plant

- Optimized equipment and processes to reduce effluent flows and solids to the wastewater treatment plant, mainly around the containerboard machine.
 - February 2023: Began discussions with equipment manufacturer on opportunities to improve performance of Save-all Disk filter, a primary piece of equipment that recycles water and fiber from the containerboard machine. This action was started before becoming aware of the first BOD exceedance.
 - February 2023: Hired equipment suppliers to provide on-site audits of current conditions and make additional recommendations to improve water and solids recycling within the containerboard manufacturing processes.
 - April 2023: Added a Static Mixer to improve the water and fiber distribution across the Save-all Disk Filter.
 - May 2023: Installed capability to add long fiber sweetener to increase the fiber mat across the Save-all Disk Filters for improved filtrate water quality.
 - May – October 2023: Completed equipment manufacturer's recommendations for the Save-All Disk filter.
 - October 2023: Completed several improvement projects during a 12-day outage to reduce solids to the wastewater treatment plant.

- May 2023: Contracted with a consulting firm to update the mill water balance and make recommendations for additional flow reduction opportunities.
 - May 2023: Rebalanced the mill water systems to recycle excess paper machine white water for fiber stock dilution instead of directly sending to the wastewater treatment plant.
 - March 2024: A project to recycle more process water was implemented which reduced effluent flow by approximately 1 MGD.

- **Improve capture and settling of suspended solids in Primary Clarifier**
 - February 2023: Began trialing several strategies to settle solids more effectively in the primary clarifier to improve fiber removal. Reduced fiber losses from the mill after Save-all system modifications in April and May 2023 lessened the load on the primary clarifier.
 - May 2023: Established a temporary system at the primary clarifier to remove floating solids. This is in addition to the regular removal of settled solids continuously pumped from the clarifier.
 - April 2024: Started the permanent pumping system for removing floating solids from the clarifier.

- **Improve health of the ASB/lagoon**
 - November 2022 – August 2023: Added bio-augmentation (as purchased freeze-dried bacteria) daily to the lagoon since start up and increased the daily amount added in March 2023 to improve BOD removal efficiency.
 - December 2022 – April 2023: Brought in seven truckloads of activated sludge from another recycle paper mill in Tennessee before start-up to seed the lagoon. Two additional truckloads of activated sludge from the same mill were added in April 2023.
 - January 2023 - present: Environmental Business Specialists (“EBS”), wastewater treatment consultants, are conducting regular testing, including microbiological, to assess the lagoon health and efficiency of the wastewater treatment system from the ASB inlet through the final effluent outlet.
 - February 2023: Adding MacroGro to the primary clarifier, a source of nitrogen and phosphorus nutrients.
 - March 2023: Installed booms to contain the floating solids on the settling zone of the lagoon; these solids are removed mechanically, as needed.
 - March 2023: Made connections with the National Council for Air and Stream Improvement (NCASI) to review test data and make recommendations for improvements to the wastewater treatment system.
 - March 2023: Engaged wastewater treatment biological consultants from EBS, to identify additional opportunities to improve BOD removal. An EBS representative

came on site to review the wastewater treatment system from the beginning to the end of the process and provided recommendations.

- April 2023 - present: Increased nutrient feed rate to the lagoon and began using urea as a nitrogen source based on recommendations from EBS and NCASI and feeding phosphoric acid as a nutrient source based on recommendations from EBS and NCASI.
- April 2023: Started feeding bleach to the primary clarifier and then changed to a more efficient oxidizer (Redoxx) to improve conditions within the wastewater treatment system and increase biological efficiency.
- April and May 2023, then again May 2024 - present: Batch-feeding a concentrated calcium nitrate source to the ASB to enhance BOD removal and reduce hydrogen sulfide production since the bacteria will use the nitrate in place of sulfates in reduced oxygen conditions, such as in the settling zone of the ASB.
- December 2023 – April 2024: A trial was conducted to introduce an additional oxygen source to improve lagoon BOD removal efficiency, but no substantial improvement was seen due to the limited amount of aeration added by this rental equipment.
- January 2024: A sludge depth study of ASB was conducted to develop a dredging plan.

➤ **Public complaints of white slimy substance attached to substrate and suspended in water column near and downstream of diffuser.**

- April 2023: Domtar collected river water samples (with algae) upstream and downstream of diffuser pipe and sent to EMSL Analytical, Inc. for algae and bacteria species identification.
- May 2023: Shared EMSL lab reports from river water sampling with TDEC.
 - Results of the downstream sample indicated very heavy presence of sheathed bacteria presumptive Leptothrix or Sphaerotilus.
 - Results of the upstream sample indicated no sheathed bacteria present.
 - Results of the algae identification indicated no significant difference in species and abundance between the upstream and downstream samples.
- May 2024: Repeated testing on samples from the river upstream and downstream
 - Results from EMSL lab were similar to 2023, indicating sheathed bacteria downstream, presumptive Sphaerotilus.

Progress of Improvements to Wastewater Treatment Since Mill Start-up

- BOD test results have been within permit limits continuously since June 2023.
- Flows have been reduced by half from March 2023 to June 2024.
- Solids to the Wastewater Treatment System have been reduced by 80% from March 2023 to June 2024.

- Whole Effluent Toxicity testing was conducted in May 2023 and again in April 2024 with all results in compliance with permit limits.

Further Corrective Actions to be Implemented

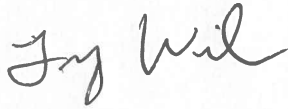
Domtar has reviewed the engineering evaluation conducted by Arcadis (enclosed with this submittal). Based on recommendations from Arcadis, Domtar will implement the corrective actions and timelines listed in the table below.

Corrective Action	Status	Projected Completion Date
Obtain additional analysis of the substance found in the river by a microbiologist familiar with bacterial growth in pulp and paper plant discharges to better identify the source of the substance and provide additional information on the morphology and classification of the bacteria.	Samples have been sent for analysis.	August 30, 2024.
Continue to add calcium nitrate to supplement oxygen in the ASB until another source of oxygen can be substituted. Perform study/research to identify alternative means to increase the oxidation potential in the settling zone. After the study, conduct a full-scale trial of the selected means to add oxygen to the settling zone to reduce or eliminate the addition of calcium nitrate.	Research has started.	Complete research/study by September 30, 2024. Start a trial by November 1, 2024.
Perform a trial using a temporary clarifier to remove solids from the aeration zone discharge. The trial will be performed for three months to collect data to evaluate performance. During the trial, sludge, containing mature biology will be recycled back to the aeration zone from the temporary clarifier.	Trial scheduled to start August 1, 2024.	Trial to be completed November 1, 2024. Evaluation and determination of success by November 30, 2024.
Optimize the aeration process by adjusting addition of nutrients added to the aeration zone influent to ensure that adequate phosphorous is present to maximize BOD5 removal. A study period of three months should be performed concurrently with the clarification study to also optimize nutrient addition.	Continue to optimize nutrients and begin formal trial.	Trial to be conducted August 1 to November 1, 2024.
Perform dredging in settling zone of ASB to improve hydraulic retention time.	Currently obtaining proposals from dredge contractors to finalize dredge plan.	Complete dredging by April 30, 2025.

Domtar is committed to protecting the environment and the waters of Tennessee and ensuring that the mill continues to operate in compliance with its permit limits.

If you have any questions or need further information, please contact Bonnie DePew at (423) 392-2821 or bonnie.depew@domtar.com.

Sincerely,

A handwritten signature in cursive script that reads "Troy Wilson".

Troy Wilson
Mill Manager

cc: Bonnie DePew, Environmental Manager, Domtar Paper Company, LLC, Kingsport Mill

Preliminary Engineering Report and Corrective Action Plan

Prepared for

Domtar Corporation



Prepared By



July 2024

Preliminary Engineering Report and Corrective Action Plan

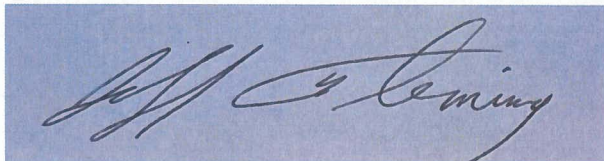
For Submittal to Tennessee Department of Environment and Conservation

Prepared By:

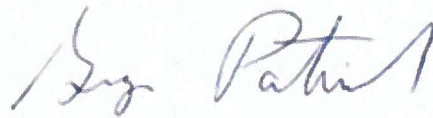
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July 16, 2024

1 Executive Summary

Domtar Paper Company, LLC (Domtar) operates a containerboard mill using recycled corrugated cardboard. The facility is located in Sullivan County, TN at 100 Clinchfield Street, Kingsport, TN. The Tennessee Department of Environment and Conservation (TDEC), Division of Water Resources issued a Director's Order (the Order) for issues with the treatment facility associated with the conversion of the production process, and the biological response documented in the receiving stream. The Order requires Domtar to submit a Corrective Action Plan/Engineering Report (CAP/ER) to address the issues. This report provides an engineering analysis of the issues identified by TDEC and recommended corrective actions for Domtar to make in the CAP/ER submitted in response to the Order.

The five issues identified in the Order are:

- "Staff inspected Outfall 001, a 200-ft iron pipe with holes spaced evenly along its length, and observed a white, slimy substance covering the substrate immediately downstream."
- "Significant buildup of solids and scum on the surface of the primary clarifier".
- "Significant buildup of floating solids in the aerated stabilization basin (ASB) lagoon."
- "The facility had exceeded permit effluent limits for Biological Oxygen Demand (BOD) during February and March 2023. BOD violations were reported on the DMRs for April and May 2023".
- "Staff noted a grey/tan effluent from the diffuser pipe that caused a color contrast in the river extending 30 feet."

Domtar contracted with Arcadis to perform an engineering report with corrective action recommendations. As part of the project, Jeff Fleming and George Patrick, who both have more than 30 years of experience with industrial wastewater treatment systems visited the site on July 2, 2024. During the site visit, Arcadis met with Domtar staff to discuss the improvements made to date, reviewed the operational data and inspected the wastewater treatment facilities.

Based upon the site visit, data review and discussions with Domtar personnel, Arcadis developed the following recommendations:

1. The influent wastewater characteristics were compared to the design criteria for the wastewater treatment system. It was determined that the system is currently operating within the design parameters. Prior to June 2023, the influent characteristics were higher than the design parameters. This caused NPDES exceedances described in the Order and partially filled the settling zone with solids.
2. An additional microbiology laboratory should be contracted to analyze samples of the white, slimy substance and the effluent to provide additional insights on the classification of the bacteria.
3. There is a considerable amount of sludge present in the settling area downstream of the aeration zone. It will be necessary to dredge the zone to remove solids. The dredging should be performed starting in the late fall or early winter to minimize the release of hydrogen sulfide from the dredging and dewatering operations.
4. To prevent additional solids from entering the settling zone, a temporary, portable clarifier should be trialed and evaluated to determine if this will adequately remove solids from the discharge of the aeration zone and improve operation of the aerated stabilization basin system.

5. It is recommended that the aeration process be optimized by adjusting addition of nutrients added to the aeration zone influent to ensure that adequate phosphorous, nitrogen, and trace nutrients are present to maximize BOD5 removal.
6. To ensure even distribution of flow in the effluent discharge pipe, a maintenance program should be put in place to inspect and clean (if necessary) the discharge piping on a frequency of at least quarterly.
7. It is recommended that the color of the effluent be monitored during the corrective actions to determine if the implemented corrective actions will reduce the coloration in the effluent. If the corrective actions do not improve the coloration of the effluent, a study should be performed to identify the source of the coloration so that further corrective actions may be completed.
8. Calcium nitrate should continue to be added to the aeration zone discharge on an 'as needed' basis to increase the oxygen potential of the wastewater transferred to the settling zone.
9. A study should be performed to identify alternative means to increase the oxidation potential in the settling zone. If the study identifies a viable alternative to calcium nitrate, then a trial of the selected means to add oxygen to the settling zone should be conducted to determine if this can reduce or eliminate the white slime below the discharge.

2 Introduction

Domtar Paper Company, LLC (Domtar) operates a containerboard mill using recycled corrugated cardboard, located in Sullivan County, TN at 100 Clinchfield Street, Kingsport, TN. In 2022 and early 2023, the mill was converted from a bleached pulp and paper process to an unbleached containerboard process using recycled cardboard as the feedstock. The converted process began on January 15, 2023.

Wastewater from the paper mill is processed in a wastewater treatment system that was upgraded to treat the process wastewater from the recycled pulping and containerboard operations. The treatment process includes primary clarification by an in-ground clarifier used for the same purpose as the original process and an aerated stabilization basin (ASB) lagoon that consists of an upgraded aeration zone and a settling zone. During the start-up of the converted process, several problems occurred in the manufacturing areas that caused higher process losses that contributed to BOD and TSS exceedances in the treatment system.

The Tennessee Department of Environment and Conservation (TDEC) Division of Water Resources issued a Director's Order (the Order) for violations of the Water Quality Control Act on April 9, 2024 (received by Certified Mail on April 22, 2024 through National Registered Agents, Inc.) for issues with the treatment facility associated with the conversion of the production process and the biological response documented in the receiving stream. The Order requires that "the Respondent shall submit a corrective action plan/engineering report (CAP/ER) to address the issues associated with the conversion of the production process and the biological response documented in the receiving stream" [See Article XXXI 3]. This report provides an engineering analysis of the issues identified by TDEC and recommended corrective actions for Domtar to make in the CAP/ER submitted in response to the Order.

Review of the Order reveals five issues requiring corrective action. The Order provides a detailed timeline of all correspondence and issues during the period from start-up of the converted process to the time of the Order. There were several other minor issues identified that were the result of accidental releases on July 27 and September 14-15, 2023. These releases were resolved in prior communications and were not the result of the conversion process, and so are not addressed in this report. The five issues identified in the Order are summarized below:

- "Staff inspected Outfall 001, a 200-ft iron pipe with holes spaced evenly along its length, and observed a white, slimy substance covering the substrate immediately downstream. Staff did not observe the substance upstream of the discharge." See Articles X, XI, XXI and XXII of the Order. As a part of the prior CAP, Domtar conducted analysis of the white, slimy substance which identified it as a sheathed bacteria (*Leptothrix* or *Sphaerotilus* sp.). See Article XV of the Order.
- "Significant buildup of solids and scum on the surface of the primary clarifier". See Article XII of the Order.
- "Significant buildup of floating solids in the aerated stabilization basin (ASB) lagoon." See Article XII of the Order.
- "The facility had exceeded permit effluent limits for Biological Oxygen Demand (BOD) during February and March 2023. BOD violations were reported on the DMRs for April and May 2023". See Articles XIII and XXIV of the Order.
- "Staff noted a grey/tan effluent from the diffuser pipe that caused a color contrast in the river extending 30 feet." See Article XXI of the Order.

3 Background

The primary clarifier was installed in the 1960's to treat wastewater from the virgin fiber mill operating at the site at that time. The clarifier was designed with a treatment capacity of over 10 million gallons per day (MGD) to remove solids from virgin fiber pulping operations. It has operated continuously during various production changes since its installation. During the start-up of the unbleached containerboard from recycled cardboard process, the flowrate was initially much greater than expected (up to 7 MGD) and it contained high solids loading (~40 tons per day). The solids from the process had a lower density than the solids from previous operations, which resulted in the carryover of a large quantity of solids to the ASB from the primary clarifier. Improvements to the production process have reduced the solids loading to approximately 7 tons per day and the flowrate to less than 3 MGD (~2.9 MGD average, January-June 2024). A skimmer pump has been added to remove floating solids from the primary clarifier. These improvements have significantly reduced the quantity of solids discharged from the primary clarifier to the aeration zone and the quantity of solids floating on the surface of the clarifier.

The ASB aeration zone was upgraded in 2022 to include fourteen-75 HP surface aerators installed in a 23 million-gallon (MG) plug-flow aeration zone. This was designed to provide adequate treatment for the design basis organic load of 45,000 lb/day BOD in a 3.0 MGD flow. Due to the lack of phosphorous in the influent, supplemental phosphorous is added in the form of phosphoric acid into the aeration zone. The aeration zone is equipped with a recycle line from the settling zone to allow recycling of bacterial sludge to the inlet of the aeration zone to provide bacteria at the front-end of the aerated zone.

The ASB settling zone was designed to remove biological solids from the treated wastewater. Some anoxic or anaerobic biodegradation may occur in the settling zone due to decomposition of the settled solids. Solids collected in the settling zone are periodically removed by dredging. During start-up of the unbleached containerboard from recycled cardboard process, a high level of solids was removed by settling in the settling zone. Partial dredging of the settling zone has been performed since that time, but the settling zone remains partially filled with solids from that event and future dredging operations are needed.

4 Engineering Analysis

The engineering analysis is divided into sections corresponding to the Order and an analysis of the conditions experienced during the conversion and the design conditions. The issues may overlap but are addressed separately to help describe potential causes for each issue.

4.1 Design Criteria vs Current Operating Conditions

Table 4.1 provides the influent data to the ASB from the initial start-up in February 2023 to the present. The ASB was designed for an influent BOD loading of 45,000 lb/d. Examination of the average BOD5 concentration shows the influent BOD has been less than the design basis since after start-up (from June 1, 2023 to present). During the first four months of the start-up, the average BOD5 transferred to the aeration zone exceeded the design limit by an average of 6%. The high influent BOD during start-up was the likely cause of the BOD exceedances recorded during the February-May 2023 period.

Table 4.1 – Summary of Sampling Results for 2023 and 2024⁽¹⁾

Parameter	Units	Start-up (Feb- to May, 2023)	2023 Steady-State (June 1 – Dec 31, 2023)	2024 Data (Jan – June 2024)
Influent BOD5 ⁽²⁾	lb/day	47,880	27,327	39,936
Influent TSS ⁽²⁾	lb/day	16,942	3,806	3,122
Influent Flow ⁽³⁾	MGD	4.6	3.7	2.9
Effluent Soluble Phosphate ⁽⁴⁾	mg/l	0.100	0.038	0.047

⁽¹⁾Average Values

⁽²⁾Measured at the inlet to the Aerated Zone

⁽³⁾Measured at Effluent Monitoring Station for the ASB Treatment System

⁽⁴⁾Measured at the outlet of the Aerated Zone

The influent flow rate to the ASB has decreased from start-up to the present time. During start-up (February-May 2023), the average flow rate (4.6 mgd) exceeded the design specification (3.0 mgd). The high flow rate likely contributed to the BOD exceedances observed in February-May 2023, by not providing sufficient hydraulic retention time.

The quantity of solids transferred to the aeration zone has steadily declined since start-up. The reduction in the Influent TSS since the February-May 2023 period has been greater than 80% and has been mainly a result of improvements in the manufacturing operations which has resulted in lower solids loading to the primary clarifier. The result of the lower TSS is less solids are being discharged into the settling zone of the ASB.

Soluble phosphorous in the outlet of the aeration zone averaged below 0.1 mg/L since the initial start-up even though phosphorus has been added as a nutrient. Examination of the individual sample results shows that many samples were below detection of 0.01 mg/l. This indicates that the aeration zone is often operated at below the

design phosphorous concentration for the system. Arcadis recommends that a target of 0.1 to 0.2 mg/L of soluble residual orthophosphate in the aeration zone discharge be established as the guide for phosphorus addition.

4.2 White, Slimy Substance

A white, slimy substance has been observed by TDEC personnel immediately downstream of Outfall 001 during several inspections. As a part of the corrective action plan submitted to TDEC on June 5, 2023, analysis of the substance was made by Domtar's contract lab, EMSL Analytical, Inc. Samples collected in April 2023 were identified as containing a sheathed bacteria (*Leptothrix* or *Sphaerotilus sp.*). The quantity of sheathed bacteria was described in the analytical report as a very heavy presence downstream of the outfall with none detected upstream of the outfall. No testing was performed for free swimming bacteria in the effluent.

Subsequent testing by EMSL Analytical, Inc. in May 2024 detected what was described as a heavy presence of sheathed bacteria downstream of the outfall with none detected upstream. This testing was performed by a single laboratory and is the basis for the conclusions about how to control formation of this substance. As part of Arcadis due diligence for the Engineering Report, another set laboratory analysis should be performed to determine whether the conditions have changed since start-up in 2023. This analysis should be made on both the Domtar discharge and the water in the river downstream of the discharge.

Arcadis understands that sheathed bacteria identified in 2023 are known to form in wastewater with low dissolved oxygen. The rod-shaped cells grow within a long, tubular sheath that attach to solid surfaces. These sheaths appear as filaments that provide the characteristic shape observed downstream of the outfall. The white coloration indicates that there is limited iron or manganese present where the bacteria grow, which may impart a yellow-brown color to the bacteria. Bacteria in both genera (*Leptothrix* or *Sphaerotilus sp.*) have a life cycle that includes a free-swimming form (called a swarmer cell) that is not sheathed. The free-swimming forms have flagella at one end of the bacteria that propels the cells along. When encased in the sheath, the bacteria are referred to as sheathed or resting bacteria.

Sheathed bacteria are resistant to treatment by heat, UV radiation, high or low pH, chemical disinfectants and desiccation. Their control is best accomplished through the control of conditions that favor their growth, which requires simple sugars or organic acids as a food supply and inhibition of competing bacteria through low phosphorous concentrations and/or low oxygen concentrations.

Review of the conditions in the settling zone of the ASB shows a potential environment for growth of sheathed bacteria. This environment includes the presence of organic acids, low dissolved oxygen and low orthophosphate. A sample at the settling zone outlet had an organic acid concentration of 12 mg/l. Monthly samples analyzed for orthophosphate at the settling zone inlet (aeration zone outlet) showed soluble orthophosphate concentrations below the detection limit of 0.1 mg/l. Additionally, the oxygen present in the settling zone is less than 1.0 mg/L. The conditions in the ASB settling zone along with the presence of sheathed bacteria below Outfall 001 indicate that the effluent may be contributing to the growth of sheathed bacteria attaching to the diffuser and river substrates and algae downstream of the outfall.

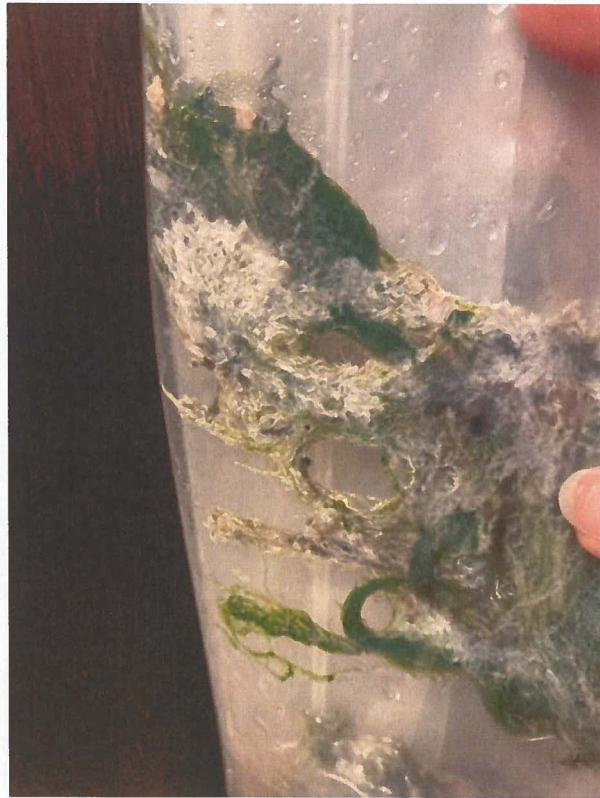
Review of photographs taken in May and July 2024 shows improvement in the quantity of the white slime downstream of Outfall 001. Although still present, the coating appears to be lessened from what was

observed in the past. Figure 1 shows a sample of the algae taken on July 5, 2024 and Figure 2 shows a sample of algae taken from the same location downstream of Outfall 001 on May 1, 2024. These figures show an improvement in the amount of sheathed bacteria since addition of calcium nitrate began on May 1, 2024.

Figure 1: Stream Sample Taken July 5, 2024



Figure 2: Stream Sample taken on May 1, 2024



4.3 Solids Buildup on the Surface of the Primary Clarifier

The solids buildup on the surface of the primary clarifier was observed by TDEC during start-up of the converted process when the TSS and flow loading to the primary clarifier was exceptionally high. The clarifier was designed to treat over 10 MGD of water containing solids from a bleached pulp and papermill process using 100% virgin fiber. Since the current flow rate is one-third the primary clarifier design flowrate and the current wastewater very biodegradable, Arcadis is concerned with anaerobic conditions occurring in the sludge blanket at the bottom of the primary clarifier. The anaerobic conditions can generate gases which can float solids in the primary clarifier.

The skimmer originally installed in the clarifier was ineffective for removal of the floating solids because the collected skimmer trough did not provide an outlet for the sludge. Subsequently, a skimmer pump was installed to remove the floating solids collected on the surface of the primary clarifier. This pump provides adequate removal for the relatively small quantity of floating solids that are currently generated in the primary clarifier.

4.4 Buildup of Floating Solids on the ASB Lagoon

During the start-up of the manufacturing operations, some initial mill operational problems resulted in the discharge of unusually high quantities of solids, up to 40 tons per day. Process improvements have since substantially reduced the quantity of solids to approximately 7 tons per day. This has substantially reduced the quantity of floating solids in the ASB lagoon, with virtually no floating solids present in the aeration zone and a small quantity of solids present in the settling zone.

Floating solids remaining in the settling zone may be partially due to the presence of filamentous bacteria growing in the lagoon. Filamentous bacteria do not readily settle. These could include sheathed bacteria and other filamentous bacteria known to grow in nutrient poor environments.

4.5 BOD Exceedances

The permit limits for BOD₅ are 9,009 lb/day (monthly average) and 16,731 lb/day (daily maximum). The discharge exceeded the daily maximum once in February 2023 and twice in March 2023 and exceeded the monthly average in March 2023. A notice of violation was issued on May 5, 2023, for these exceedances. Additionally, daily maximum and monthly average BOD limits were exceeded during April and May 2023. Domtar submitted a corrective action plan on June 5, 2023, detailing actions to be taken to prevent future exceedances. The monthly reports submitted from June 2023 to June 2024 demonstrated compliance with both daily maximums and monthly averages for BOD discharge. On April 29, 2024, Domtar received an e-mail acknowledging compliance with BOD₅ limits and ending the requirement for monthly report submissions. The BOD₅ issue which was due to high BOD loadings and high flow rate has been remedied through modifications of the manufacturing processes.

The presence of filaments in the settling zone of the ASB is likely due to residual available BOD. The likely cause of the residual BOD is insufficient ortho-phosphate in the aerated zone. An examination of the nutrient levels in the wastewater treatment system at the aeration zone discharge shows that

orthophosphate was found at very low levels, often below the detection limit of 0.1 mg/l. The low orthophosphate levels will reduce the BOD removal rate in the aeration zone which results in more BOD conversion in the settling zone basin. Phosphoric acid is added to the aeration zone to supply supplemental phosphorous, but the quantity of the addition is not adequate to maintain detectable residual phosphorous in the aeration zone discharge. Improved control of nutrient addition should increase BOD5 removal in the aerated zone and minimize the growth of filaments in the settling zone.

4.6 Grey/Tan Effluent

TDEC observed a difference in color between the river water upstream of Outfall 001 and the effluent entering the stream. The discoloration was described as a grey/tan effluent. Domtar reported that the discharge piping of Outfall 001 was found to have numerous plugged holes in the pipe after the inspection by TDEC. Cleaning of these diffuser holes was found to significantly reduce the visible coloration found in the stream below the outfall through improved mixing along the full length of the diffuser pipe.

Unlike virgin pulp and paper mills, which was the prior type of operation at the Domtar Kingsport mill, recycle mills do not include pulping of virgin fiber and other operations that generate color bodies. It is possible that some coloration is from low concentrations of dyes contained in the recycled cardboard used in the process.

The most likely source of grey coloration would be from septic conditions or turbidity. Improvements of removing solids from the settling zone by dredging will reduce septic conditions. Also, improving soluble BOD removal in the aerated zone with phosphorus addition will reduce septicity in the settling zone. These improvements will likely reduce color of the final effluent discharge.

5 Recommended Corrective Actions

The recommended corrected actions which address TDECs concerns are discussed in the following subsection.

5.1 Issue: White, Slimy Substance

Recommended corrective actions for the sheathed bacteria which lead to production of the white, slimy substance downstream of the discharge are designed to prevent the optimum conditions for growth of the bacteria, namely raising the oxygen level in the settling zone, raising the phosphorous levels in the aeration zone and reducing the concentration of organic acids in the settling zone. The following corrective actions are recommended to accomplish these goals.

5.1.1 Confirmation of Bacterial Classification

Corrective actions recommended for control of the white, slimy substance downstream of Outfall 001 rely on two analytical results that identify the substance as sheathed bacteria. An additional analysis of this substance by a microbiologist familiar with bacterial growth in pulp and paper plant discharges would confirm that this is the source of the substance and provide additional information on the morphology and classification of the bacteria.

5.1.2 Increasing Oxidation Potential in Settling Zone

Low oxidation potential impedes the growth of bacteria that compete with sheathed bacteria, favoring their growth. Increasing the oxidation potential in the settling zone should help to reduce the formation of sheathed bacteria.

Since the beginning of May 2024, a product called CN-9 containing calcium nitrate $[\text{Ca}(\text{NO}_3)_2]$ has been added to either the aeration zone discharge or to the discharge sump from the primary clarifier at a rate of about three truckloads per week. This addition may be the reason behind the recent decrease in the formation of sheathed bacteria downstream of the outfall. The oxidation potential for CN-9 is stated by the manufacturer to be the equivalent of 11,600 lbs of oxygen per truckload. In low oxygen environments nitrate is utilized as an oxygen source by heterotrophic bacteria in a process known as denitrification to yield nitrogen gas.

In addition to adding calcium nitrate, it is recommended that a study be performed to identify alternative means to increase the oxidation potential in the settling zone without addition of calcium nitrate. After the study, a full-scale trial of the selected means to add oxygen to the settling zone should be conducted to determine if this can reduce or eliminate the white slime below the discharge.

5.1.3 Clarification of Aeration Zone Discharge

It is presumed that the formation of sheathed bacteria occurs in the settling zone due to conditions that favor their growth. If solids were removed from the aeration zone discharge, it is possible that the clarifier effluent could be discharged directly without treatment in the settling zone. In addition, clarification would provide a means to provide more bacteria to the aeration zone which will provide a higher quality effluent coming out of the aerated zone.

It is recommended that a pilot test be performed using a temporary clarifier to remove solids from the aeration zone discharge. The pilot test should be performed for several months to collect data to evaluate performance before and after the clarifier is added. During the trial, sludge recycle to the aeration zone should be from the temporary clarifier, with no recycle from the settling zone. The pilot test should be conducted concurrently with process optimization discussed in Section 5.1.4.

5.1.4 Optimization of Aeration Zone BOD5 Removal

The ASB lagoon system has been meeting final effluent BOD5 discharge limits since June 2023 and adequately treats this parameter. However, treatment to achieve more complete BOD5 removal in the aerated zone should be established to reduce the concentration of organic acids entering the settling zone. The sheathed bacteria, which are believed to contribute to the presence of the white substance in the river, are thought to grow in the settling zone from organic acids.

It is recommended that the aeration process be optimized by adjusting addition of nutrients added to the aeration zone influent to ensure that adequate phosphorous is present to maximize BOD5 removal. A study period of three months should be performed concurrently with the clarification study (see Section 5.1.3) to also optimize nutrient addition.

5.1.5 Settling Zone Dredging

Low oxygen conditions are exacerbated in the settling zone by the presence of a large quantity of sludge that collected there during the initial start-up of the converted process. Although some dredging has been performed since mill started up to remove the sludge, the settling zone contains too many solids. The excessive sludge solids allow for formation of anoxic and anaerobic zones in the settling zone that may contribute to the growth of sheathed bacteria.

It is recommended the mill develop a dredge plan for dredging the settling zone

Arcadis believes that the actions listed above will resolve the issue of the white, slimy substance in the river.

5.2 Issue: Solids Buildup on the Surface of the Primary Clarifier

The Corrective Action Plan submitted to TDEC on August 4, 2023, described the corrective actions taken to address this issue. That plan identified all actions as having been completed, with no further actions necessary to address the issue. To reiterate from that plan, the corrective action was: "Solids and flow to the wastewater treatment plant have been reduced through source identification and elimination. This has been the largest impact on reducing the solids buildup. A temporary solids removal system has been in service since May and a permanent pump has been ordered." Since that CAP was submitted, the permanent pump has been received and installed. The status/scheduled completion in the August 4, 2023 CAP was: "Completed. Buildup is no longer significant, and a process is in place for removal if solids start to increase."

Arcadis believes that the issue has been resolved by Domtar.

5.3 Buildup of Floating Solids on the ASB Lagoon

The Corrective Action Plan submitted to TDEC on August 4, 2023, described the corrective actions taken to address this issue. That plan identified all actions as having been completed, with no further actions necessary to address the issue. To reiterate from that plan, the corrective action was: "Solids and flow to the wastewater treatment plant have been reduced through source identification and elimination and this has reduced solids in the lagoon. A temporary solids removal system has been in service as needed. The status/scheduled completion in the August 4, 2023, CAP was: "Completed. Buildup is no longer significant, and a process is in place for removal if solids start to increase." Since that time, there have been no significant issues with solids buildup in the settling zone, so no additional corrective actions are recommended.

Arcadis believes that the corrective actions described above (Section 5.1) will reduce/eliminate floating solids in the settling lagoon portion of the ASB.

5.4 BOD5 Exceedances

BOD5 exceedances were recorded between February and May 2023 and were corrected as described in Section 4.5.

Arcadis believes that by maintaining the influent flow rate and BOD loading below the design criteria will prevent future BOD exceedances.

5.5 Grey/Tan Effluent

The source of coloration in the effluent is not known but could be a function of several factors. Proper maintenance of the discharge piping will improve the mixing of the effluent, reducing the appearance of discoloration. It is recommended that a maintenance program be put in place to inspect the discharge piping at least quarterly and clean any clogged holes to ensure proper mixing of the effluent.

The potential causes of the discoloration include septic conditions in the settling zone, dye from the recycled cardboard received, and the presence of free-swimming bacteria in the effluent. No additional recommendations are made specifically for the control of discoloration. The color of the effluent should be monitored to observe if the recommended corrective actions for control of sheathed bacteria also decrease the coloration of the effluent.

Arcadis believes that the effluent color will be reduced with the improvements in Section 5.1.