BEST MANAGEMENT PRACTICES AND WASTELOAD REDUCTION

linesider brewing | east greenwich, rhode island

The Rhode Island Department of Environmental Management (RIDEM) was awarded a US Environmental Protection Agency (EPA) Region 1 Pollution Prevention (P2) grant to study the effectiveness of brewhouse best management practices (BMPs) for reducing wastewater loadings from craft breweries. Upon receiving confirmation of the P2 Grant award, RIDEM reached out to craft breweries in RI to gauge interest in participating in this beneficial study. Weston & Sampson partnered with RIDEM to provide technical assistance on brewery BMPs.

The Brewery. LineSider Brewing in East Greenwich, RI is a small craft brewery located in a newly built office complex. Opening a 10-barrel (BBL), 4,200 square foot brewhouse and taproom in November of 2018, LineSider originally brewed at a capacity of about 325 BBL/year. This production was reduced due to COVID-19 impacts, and they have remained consistently at approximately 230 BBL/year. The brewhouse collects wastewater through a series of trench drains in the floor. This system discharges into a large sump which ultimately gets pumped into a wastewater holding tank where the pH is adjusted before being discharged into the E. Greenwich municipal wastewater collection system. Due to the small size of the craft brewery and the small volume of wastewater generated, LineSider is not considered a Significant Industrial User (SIU) under Federal Categorical Pretreatment Standards. There is only one (1) sanitary connection in the space occupied by LineSider, so wastewater from patron restrooms and the bar sinks entering the wastewater collection system is combined with the brewery wastewater. Wastewater from the brewery consists primarily of vessel wash down and clean- in- place (CIP) system rinse, but no spent grains. Spent grains are sent out from the brewing operation as animal feed and have always been handled in this manner.

E. Greenwich has expressed concern about the potential for high-strength wastewater from the brewery, affecting capacity at the municipal wastewater treatment facility. LineSider learned about the P2 Grant and the Brewery Wastewater Assistance Program with RIDEM and volunteered to participate in the study.

Representatives from RIDEM met with LineSider staff On-site to review brewing operations, identify locations and processes which contributed to the high-strength wastewater flows, and develop a list of suggested BMPs to help reduce overall organic load. The facility consists of a 10-barrel (BBL) brewhouse, which has an average production rate of 230 BBL per year, operating 50 weeks per year. Brewing and cellaring operations take place two (2) days each week, with little water used for the remainder of the week. Meter readings show brewhouse water consumption (post-COVID) averaged 2,190 gallons per month. At two (2) brewing days per week, this equates to approximately 275 gal. per brewing day. Brewhouse wastewater is physically measured, as it is batch-treated before discharge. LineSider reports an average brewing day wastewater discharge of 75 gallons. The typical craft brewing industry average wastewater generation rate is nearly 5 BBL of wastewater for every BBL of beer that is produced. Data from LineSider indicates that they generate wastewater at a typical ratio of 1 BBL of wastewater for every 1 BBL of beer. This is likely due to the small production rate and the type of manual control that they have over such a small brewing operation.

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The Study. Phase I of the study consisted of identifying potential locations and taking representative composite samples of industrial effluent from LineSider's facility. RIDEM staff conducted sampling over the course of three (3) weekdays, which included a composite sampler set up to pull samples each hour from the brewhouse trench drain. Sampling included all wastewater generated by the brewing and cellaring operations but did not include the taproom wastewater.

Because of the small size of this brewery, LineSider chose to focus on sidestreaming efforts. As noted above, they were already sending spent grains to a local farm for animal feed. Additional sidestreaming included the following operations:

- Collect and sidestream wastewater from their canning line (containing beer foam)
- Collect and sidestream residual beer from keg returns, before connecting kegs to the clean-in-place (CIP) equipment
- Collect and sidestream bottoms from their fermenters
- Collect and sidestream the first rinse of the fermenters before connecting the clean-in-place (CIP) equipment

Sidestreamed waste materials were collected manually in 5-gallon pails and composted off-site.

Upon implementation, LineSider provided the RIDEM with additional composite sample analyses representing the same operations that occurred during the background sampling. The purpose of this was to determine the direct effect of these specific sidestreaming BMPs on brewery effluent loadings. The graphs presented on the following page depict the difference in effluent quality between pre- and post-implementation of the above BMPs, including a significant reduction in organic loadings. While many wastewater constituents were monitored, the focus of this effort was on Biochemical Oxygen Demand (BOD) (*Figure 1*), Total Suspended Solids (TSS) (*Figure 2*), and Chemical Oxygen Demand (COD) (*Figure 3*), which are the typical basis for wastewater billing surcharges. While TSS showed a reduction of 8%, BOD and COD were greatly reduced through these efforts: 74% and 63% respectively.

Brewing residuals and wastewater which were sidestreamed during this study were taken off site and composted with other materials. In the instance of LineSider, this is likely a sustainable practice due to the small size of this brewery and the small amount of organic wastes generated from sidestreaming.

During the development of this study, LineSider informed us that prior to the beginning of this study, they found out that chilling beer as it was being conveyed to the canning equipment greatly reduced foaming. This low-cost operational BMP was shown to save 10 cases of wasted beer with each canning run. While this data was not incorporated into our study (already in practice), it is removing 15 lb/canning run of BOD. This would be (averaged over a two-day brewing week) 7 lb. BOD/day.

Cost Considerations. The pollution prevention brewhouse best management practices serve as low-cost operational improvements that should have a noticeable reduction in operating costs. The New England Interstate Water Pollution Control Commission (NEIWPCC) states that the average concentrations of BOD and TSS in domestic wastewater are approximately 250 milligrams per liter (mg/l) and 300 mg/l, respectively. Wastewater generators whose discharge characteristics exceed these limits are usually subject to a surcharge based on the cost of treating the additional organic load. The Town of E. Greenwich is not currently assessing loading surcharges to LineSider, as they are below the 20 lbs./day BOD/COD loading threshold but has issued a permit with monthly monitoring requirements which will likely be used to establish a baseline for future surcharges. Local sewer ordinances state that sewer surcharges will be determined by the Director of Public Works on a case-by-case basis.

As LineSider has no actual sewer surcharges to use as a starting point, Weston & Sampson is providing the calculation below using regional average values to approximate the potential savings from the BMPs implemented. LineSider generates approximately 75 gallons of wastewater per brewing day with a reported total BOD load of 1.0 lb/per brewing day. Adding the pre-study waste beer load from canning would bring this total mass load to 8.0 lb/day of BOD (still under the 20 lb/day local sewer surcharge threshold). Since they ultimately would only pay a surcharge on loadings in excess of 250 mg/L, approximately 7.8 lb/day would be used in this BOD surcharge calculation. Using a low regional average BOD surcharge of $0.15/lb/day, LineSider could hypothetically see surcharges in the range of $121 per year (based on two (2) brewing days per week).

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Figure 1: Biochemical Oxygen Demand (BOD)

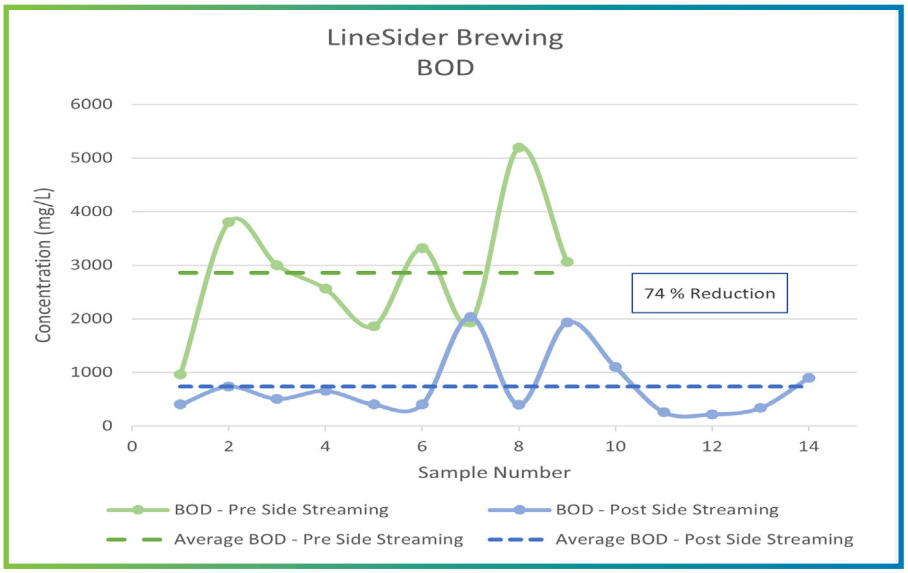


Figure 2: Total Suspended Solids (TSS)

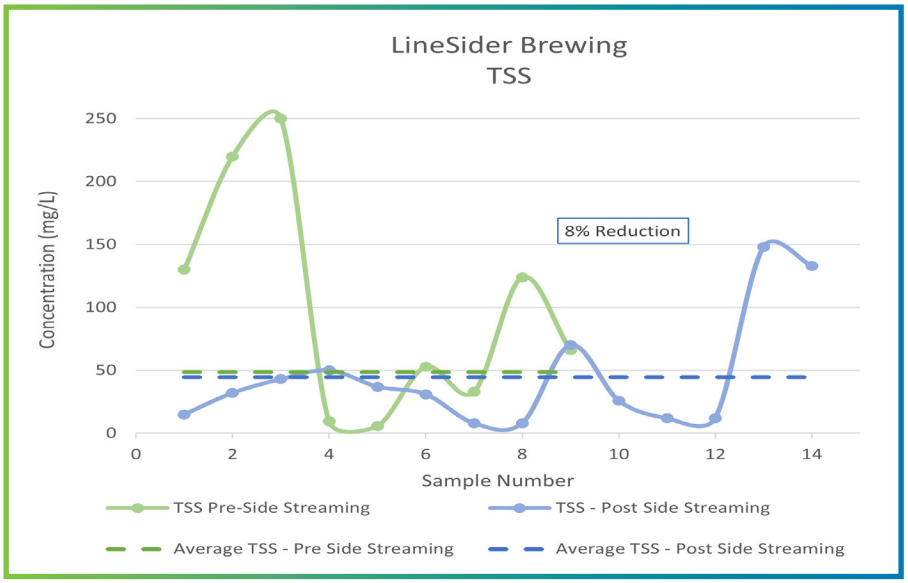
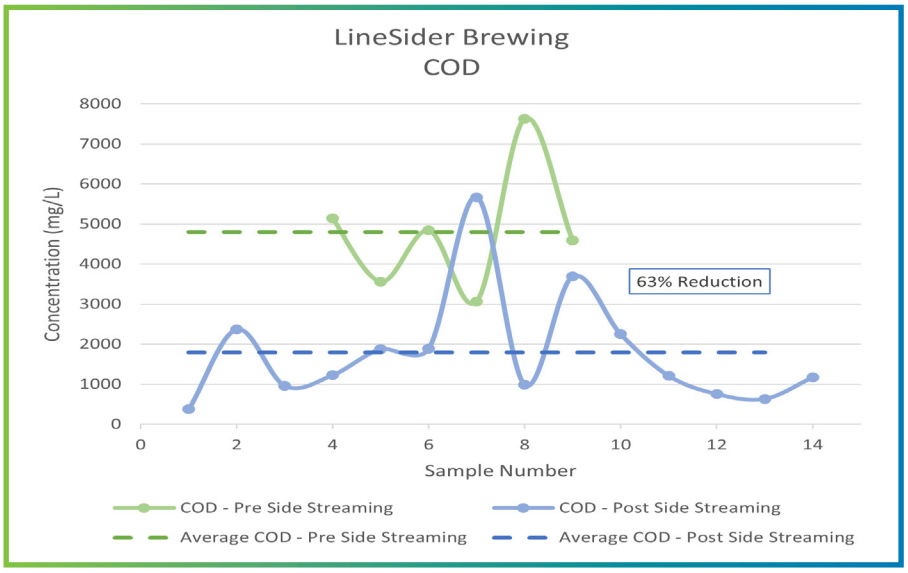


Figure 3: Chemical Oxygen Demand (COD)



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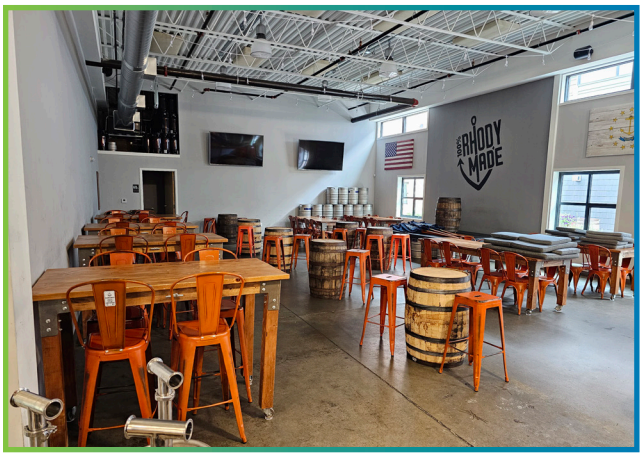
Conclusion. From our evaluation of the pre- and post-BMP sampling data, we saw 74% and 63% reduction in BOD and COD concentrations, respectively, resulting from the four (4) BMPs that LineSider has implemented. Adding in the pre-study wasteload from the canning line waste, these calculated reductions would increase greatly. While the wastewater loadings from this facility are very small, this study demonstrates that a small change in operation, with no added equipment, could result in an organic loading reduction of more than 74%. These BMPs implemented at a brewery of greater scale could have a significant positive impact at a receiving municipal wastewater system.



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