



## Milorganite® Fertilizer Operations Plan and Manufacturing Process

Milorganite® Fertilizer is a byproduct of the water reclamation process from the two wastewater treatment facilities at the Milwaukee Metropolitan Sewerage District (District). The District services 1.1 million people in 28 communities in and around Milwaukee, Wisconsin. The District operates two water reclamation facilities, Jones Island and South Shore. These water reclamation facilities receive wastewater from residential, commercial, institutional and industrial sources. At industrial dischargers, the District enforces effluent limits to prevent the discharge of pollutants that would interfere with or pass through the water reclamation process or contaminate biosolids.

At each water reclamation facility, a typical flow rate is 80 MGD, but flow rates may reach 390 MGD during wet weather. Rain, snow melt, and soil moisture levels affect influent flow rates and pollutant concentrations. As flow rates and pollutant loadings vary, the solids production rate varies and the feed rates of treatment chemicals vary.

The water reclamation process has four steps. First, screening and settling remove solid materials. Second, phosphorus is removed biologically at Jones Island and chemically at South Shore. Third, air is added to promote biological decomposition of organic materials and then settling occurs to remove solids. Fourth, disinfection destroys pathogens. After these steps, both Jones Island and South Shore discharge clean water to Lake Michigan. Process flow diagrams for each plant are included as Figure 3.

Solids are an inevitable byproduct of this treatment process. Solids from the biological treatment step at the primary component of Milorganite® Fertilizer. From the initial solids removal step, digested solids are a secondary component. The chemicals added to remove phosphorus and promote thickening comprise a very small fraction of Milorganite® Fertilizer.

The first water reclamation step produces primary sludge. From both Jones Island and South Shore, primary sludge goes to anaerobic digestions at South Shore. This step reduces and stabilizes organic material and produces methane gas, which the District recovers to generate electricity.

After the biological treatment step, clarifiers remove solids. Much of this material is recycled to seed the biological treatment step. However, some solids must be removed from the process. These solids are called "waste activated sludge." At Jones Island, waste activated sludge goes directly to equalization and blending tanks that feed the dewatering and drying process. At South Shore, the digested primary sludge and the waste activated sludge are mixed and pumped to the Jones Island equalization and blending tanks.

Milorganite® Fertilizer manufacturing starts with the solids from the water reclamation process. The process involves unit operations that are physical, rather than chemical or biological. The tasks are separating solids from water and sizing the pellets.

The first step is gravity belt thickening. Solids are mixed with ferric chloride and polymer. These chemicals agglomerate the solids, enhancing water removal. Gravity separates the solids. The District adds ferric oxide when supplemental iron is necessary to achieve the percentage of iron guaranteed in the final product.

The next step is belt filter press dewatering. Solids are mixed with polymer and ferric chloride. As in the previous step, these chemicals agglomerate the solids, enhancing water removal. The material is spread on a belt. A gravity zone and a compression zone remove water. The resulting filter cake is 16% to 18% solids.

Drying occurs after dewatering. Filter cake is mixed with recycled dried pellets. By wet weight, the dryer is fed with approximately 34% filter cake and 67% recycled dried pellets. The drying system consists of twelve Dryers, three Recycle Bins and several product conveyors. Hot air heats the drums to temperatures in the range of 540 degrees Celsius. The dryers are laid out in two groups - North Side Dryers (1-6) and South Side Dryers (7-12). A recycling bin is at the end of each group of six dryers. The third recycle bin acts as redundant and can serve either side of dryers. From the recycle bin, most pellets return to the dryers. The remaining pellets go to classification and product screening. Figure 1 represents a typical day of biosolids processing with 8 dryers operating (4 Dryers on the North Side and 4 Dryers on the South Side) with Recycle Bins 1 and 2 routing dried product either back to the Dryers or allowing it to go to Classification and Screening through automatic slide gates. The dry mass values on Figure 1 represent annual averages as monitored over the years. Figure 1 also shows the approximate location of the temperature monitoring devices at the discharge end of each dryer and at the discharge end of the recycle bins.

Milorganite® Fertilizer cannot be bagged and sold as a Class A EQ product in the State of Delaware unless it meets the pathogen reduction and vector attraction requirements under 40 CFR 503 and Delaware Administrative Code.

Alternative 5-503.32(a)(7) and Appendix B.B.2 (Heat Drying) is used as the Primary means to demonstrate compliance with 503 Regulation for Class A (7 Del Adm Code 7103-134.1.5.2.3). In this method, dryer discharge product temperatures for all in-production dryers stay above 176°F. Automatic controls in each dryer recycle all product leaving the dryer back to the inlet of the dryers if a discharge temperature falls below 180°F.

Alternative 1-503.32(a)(3) (Time Temperature) is used as the secondary means to demonstrate compliance (7 Del Adm Code 7103-134.1.1.2). This method is only used when the primary method does not demonstrate compliance. In this method, the District continuously monitors the recycle bin discharge temperature and determine detention time of the product through the recycle bin. The District continuously calculates a required temperature by using 40 CFR Part 503(a)(3) Equation 2 for the current detention time. Comparison between the measured recycle bin discharge temperature and the required temperature determines compliance with this method.

If a 15-minute dryer discharge product temperature is below 176°F at any individual dryer discharge, then the District will use recycling bin time and temperature to demonstrate pathogen reduction. Use of time and temperature will continue until 40 minutes after all in-drum product temperatures are higher than the required temperature. 40 minutes is the worst-case product travel time from the dryer farthest from the recycling bin to the outlet of the recycling bin. If time and temperature does not show compliance, then the gates between the recycle bin and classification & screening will automatically CLOSE. In this configuration, all product will return to the dryers. These gates are reopened when time and temperature show compliance or Dryer discharge temperature show continuous compliance for at least 40 minutes. Figure 2 shows the overall strategy to demonstrate compliance with 503 Class A standards.

To comply with vector attraction reduction requirements, all biosolids are required to be dried to a solids content of at least 75%, unless heat drying is the method of pathogen destruction, which requires a solids content of at least 90%. For moisture, the District analyzes daily composite samples, weekly composite samples, and one grab sample per week. The District analyzes fecal coliform at least three times per month to confirm pathogen destruction.

Between drying and short-term storage, sampling occurs. The District continuously collects 24-hour production-weighted composite samples. Depending on the parameter, the District also collects grab samples, weekly composites, or other types of samples.

After obtaining sample results, pellets move from short-term storage to silos. Pellets are segregated into storage silos by production date. Silos contain five to ten days of production.

As shipping occurs, the District collects composite samples and analyzes these samples for nutrients, pellet size, moisture, bulk density, and iron. The District also applies a very light coating of a dust control agent at a rate of one gallon per ton of product.

From Jones Island, all product leaves in bulk. The majority of product goes to a packaging contractor in Milwaukee, Wisconsin, with occasional shipments to a packaging contractor in Jackson, Wisconsin. The contractors package the product into 32-pound bags for retail sale, 50-pound bags for commercial sale, and 5-pound bags for marketing purposes.

Figure 1

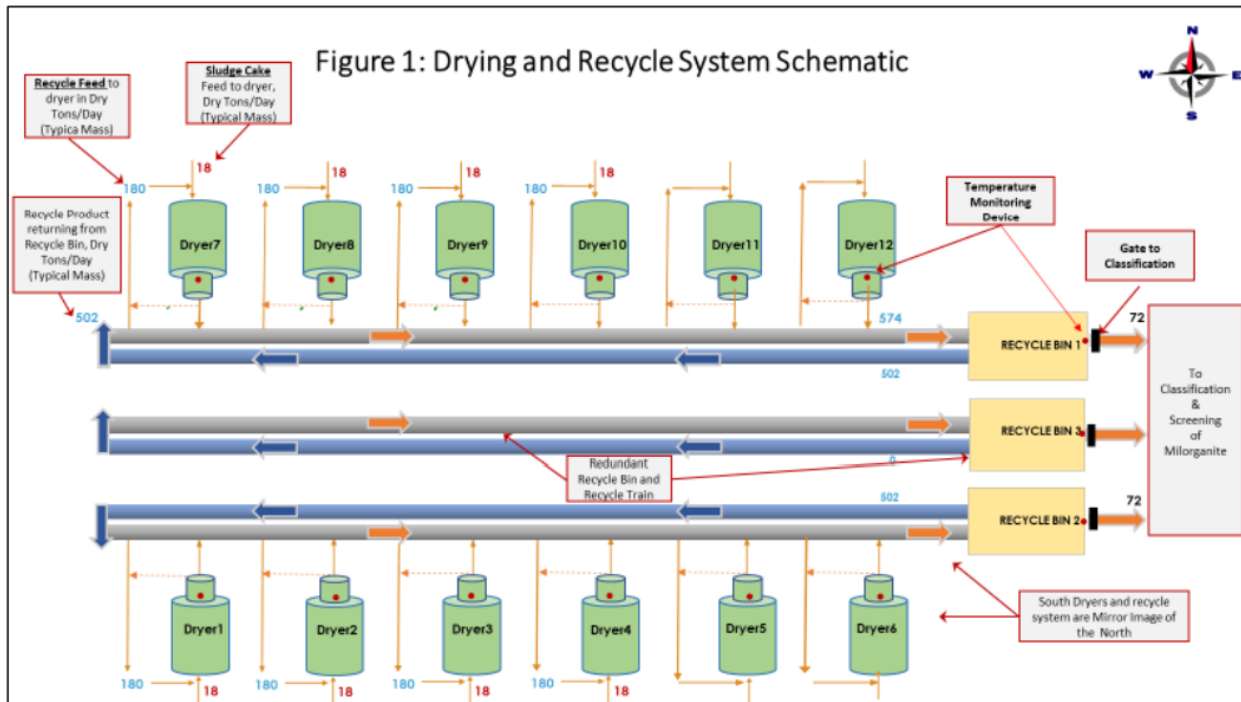


Figure 2

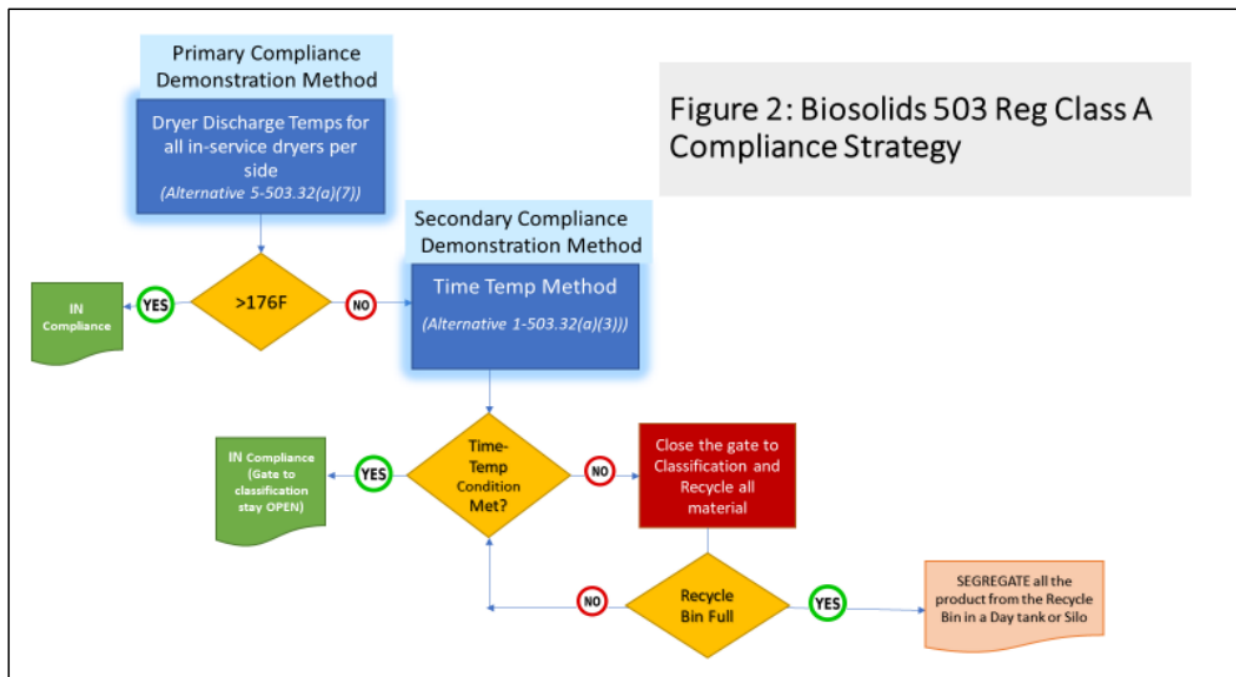
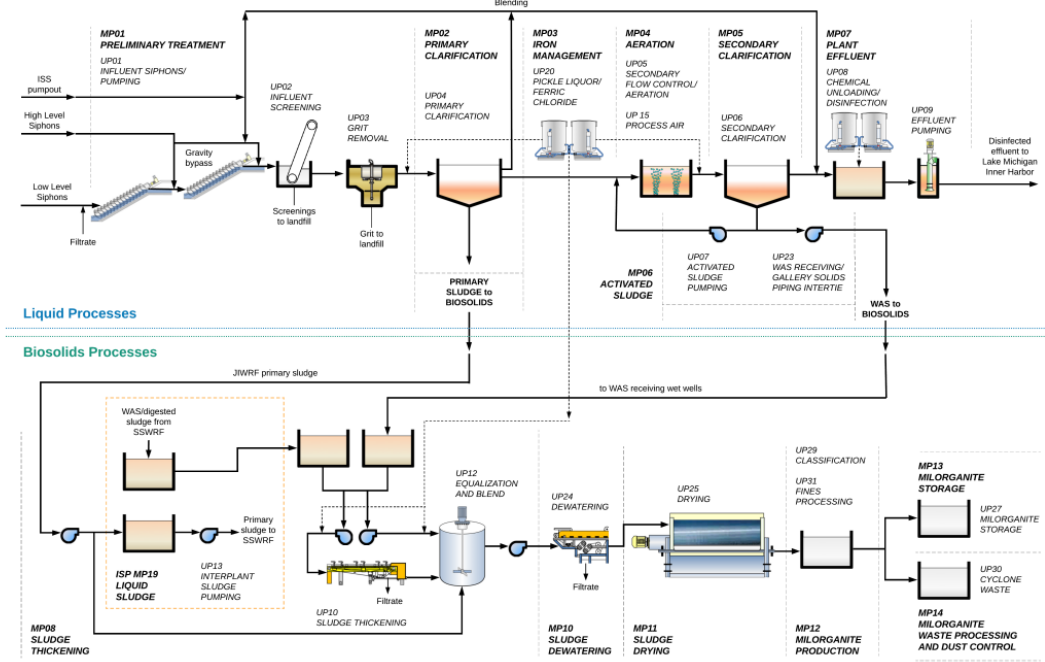
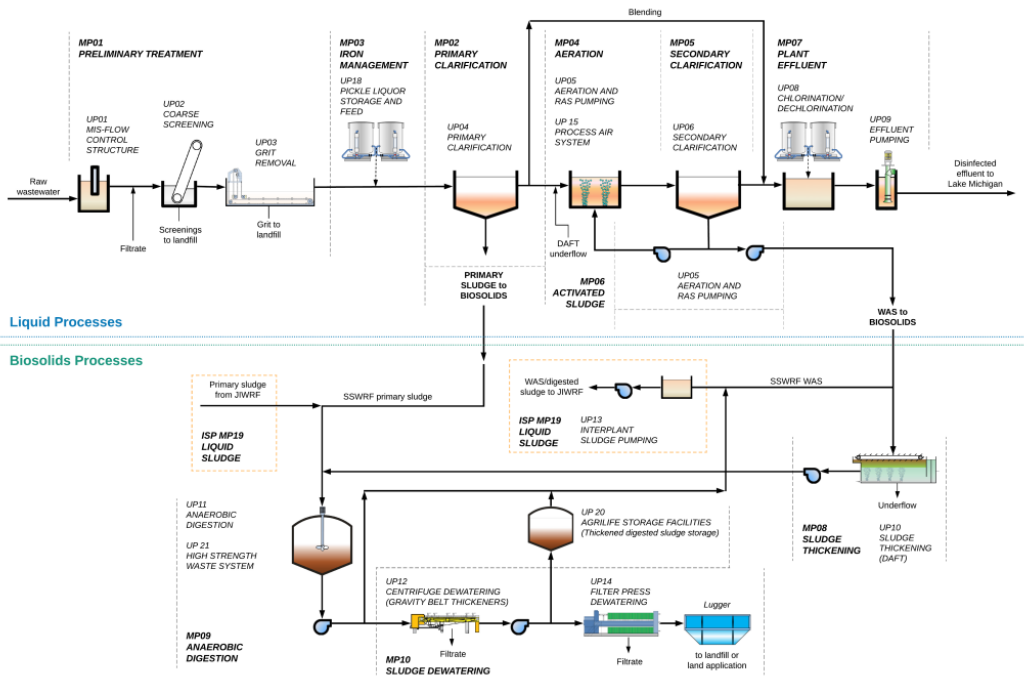


Figure 3



JIWRF Process Flow Diagram

NOTE: Not all equipment and flow configurations shown for simplicity.



SSWRF Process Flow Diagram

NOTE: Not all equipment and flow configurations shown for simplicity.