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Irrigation Management Plan

Williamsburg Receiving and Storage

General Information:

The maximum discharge rate of the facility will be 42,000 gpd, or 15.3 million gallons per year. The average discharge rate, calculated as a ten hour day versus a twenty hour day for maximum, will be 21,000 gpd. The initial discharged water will be staged in a 1.5 million gallon holding pond. From the holding pond the water will be pumped and applied to the land utilizing a slow rate land treatment system.

The irrigation of the discharge water will be applied in two ways:

1. During the spring and summer months, the discharge will be applied to the 80 acre cherry orchard through a trickle irrigation system.
2. During time in which watering the cherry orchard would be detrimental to the water uptake of the trees, the discharge will be applied to a 29.7 acre field through a spray irrigation system which would be November through March.

Refer to Figure 1 for location of Trickle Irrigation and Spray Irrigation areas.

Trickle Irrigation System

The 80 acre cherry orchard is divided into four zones or cells (refer to Figure 2). Each 20-acre zone consists of 17 acres (740,520 sq ft.) of usable wetted area. Each 17 acre zone will receive 42,000 gpd (5,615 cubic feet) of discharge via a main supply line laid the length of the orchards. Secondary supply lines will run the length of each row of cherry trees. Along these secondary lines, trickle irrigation nodes will be placed every six feet. An isolation distance of 100 feet will be maintained between the irrigation nodes (wetted area) and the property lines. The maximum application rate to each 17 acre zone equates to 0.09 inch/day/17 acres.

The proposed irrigation schedule for the 80 acre cherry orchard will be conducted between May through September of each year. Irrigation of the orchard will be conducted seven days a week during this time frame. However, the orchard application will be rotated between zones each day. Therefore, each zone will be utilized once out of every four days. Application to each of the 20-acre zones will be conducted 24 hours out of each day.

The maximum application rate for each 20 acre zone (17 acres wetted) will be 0.09 inches/day. Each 20 acre zone will be irrigated once out of every four days. The application rate will not exceed 0.004 inches/hr for each 24 hour period. This application rate equates to a 3.46 in/22 week period for the entire 68 acre wetted trickle irrigation system.

Application will not exceed 0.63 inches/week and 13.86 inches/22 week period for any 17 acre wetted area of the trickle irrigation system. The application rates to each zone will be monitored

daily through the use of flow meter attached to each of the four 20 acre zones. Individual gate valves will be utilized to control flow to each of the 20-acre zones.

Spray Irrigation System

During the off season (between October and April) the discharge water from the pond will be applied to a 4.7 acre field (Fields 1,2 & 3) located on the Williamsburg Receiving and Storage property and to a 25 acre field located on an adjacent property. These fields will be planted with a grass forage crop consisting of clover, red fescue or alfalfa, which will be cut approximately three times during the season and removed. The vegetative yield will be approximately 3.5 tons/acre. The application rates described will provide approximately one third of the necessary phosphorous and one half of the necessary potassium to maintain optimum yield, according to the nutrient levels determined through wastewater characterization.

The application to these fields will be conducted between the hours of 8:00 a.m. and 4:00 p.m. to allow maximum evaporation to occur. It is also estimated that during the off-season, the spray irrigation system will operate 5 days out of every week. The system will run longer during dry periods and shorter during wet weather, in order to balance hydraulic loading.

The spray irrigation system is divided into six (5 acre) zones, each consisting of 4 acres of usable wetted area (Refer to Figure 3). Each 4-acre wetted zone will be rotated daily so that each zone is utilized once every six days. The wetted area of each zone comprises 174,240 sq ft. An application rate of 42,000 gpd equated to 5,615 cubic feet per day to each of the 4 acre wetted zones, or 0.4 inches/day/4 acres.

Since the spray irrigation will be utilized for only 8 hr./day, the application rate will be .125 in/hr during operation.

The spray irrigation system will operate for 150 days between October 1 April 30 of each year. This equates to 57.6 in/150 day period for the total 24 acre wetted spray irrigation system. On a one day in six rotation schedule, each 4 acre wetted zone will receive 9.6 in/150 day period.

Soil Information

The soils in each of the irrigation acreas consist predominantly of Emmet Sandy Loam with 0-2% to 2-6% slopes. According to the "Grand Traverse County Soil Survey, Physical and Chemical Properties of the Soils" the bulk density of the Emmet Sandy Loam ranges from 1.3-1.65 g/cm3. The permeability of these soils ranges from 2.6 In/hr. according to this Soil Survey. Refer to Figure 4 for a soils map with the facility property boundaries and the wetted area of the irrigation fields clearly outlined.

Depth to groundwater in the trickle irrigation cherry orchard area ranges from 50' to 87' feet below grade according to local well logs. According to the hydrogeological investigation data obtained from the spray irrigation fields on the Williamsburg Receiving and Storage facility, groundwater lies 10' - 50' below grade.

Wastewater Characterization

Table 1 illustrates the quality of the expected effluent. Samples were collected from the pitting operation at a comparable facility; however, one major difference at the facility where samples were collected is that there is not an initial debrining elimination stage. This means that concentrations of some constituents, particularly chlorides, are higher than what is expected at Williamsburg Storage and Receiving. The samples were collected within a four-hour time period and were tested and measured against discharge standards provided in Rule 323.2222. The average value, standard deviation, standard error, and upper control limits are shown for each parameter tested as described in "Guidesheet III, Characterization of Wastewater", provided by the Michigan Department of Environmental Quality. Results were calculated at a 95 percent confidence level.

The results indicate that the parameters tested are expected to be within the required discharge standards. The upper control limit for chloride concentration exceeds the groundwater application standard, however, since the process at Williamsburg will be recycling the effluent from the eliminator stage, where chloride concentrations are highest, a result lower than the standard is expected. Refer to Figure 5 for assumptions and calculations of expected discharge concentrations, and all analytical results. These calculations show that the expected concentration at discharge would be 234 mg/1, below the 250 mg/l standard.

The level of Biochemical Oxygen Demand for the samples tested indicated a level of 1350 mg/l, which, at the low application rate being proposed, we expect full land treatment without detrimental impact to groundwater quality.

Trickle Irrigation Management Procedures:

1. The Trickle Irrigation System consists of an 80-acre cherry orchard divided into 4 20-acre zones.

2. Open the gate valve at the appropriate (20 acre) zone and document from the flow meter, total gallons pumped to this zone in the Irrigation Management Log Book.

3. Insure that the remaining three irrigation zone gate valves are closed.

4. Implement visual inspection of the zone to be irrigated for detrimental effects of the irrigation process. Note these observations in the Log Book.

5. Make necessary adjustments to the irrigation nodes within the zone prior to start up.

6. Start pump and adjust discharge rate to 29 gpm. Record date, time and flow rate in the Log Book.

7. Visually inspect the irrigation zone for leaks, breaks or other failures.

8. Periodically check the field and flow rate during each day.

9. Alternate trickle irrigation field zones every 24 hrs.

Spray Irrigation Management Procedures:

1. The Spray Irrigation System Is comprised of 4.7 acres on the Williamsburg Receiving and Storage property and a 25-acre field located on the south side of Angell Road.

2. The spray irrigation fields have been divided into six (5-acre) zones.

3. Each (5-acre) zone will be irrigated for 6-8 hours per day at a rate of 29 gpm.

4. Visually inspect the designated spray irrigation field for soil miosture and for detrimental effects of the irrigation process. Note these obesevations in the Log Book.

5. Manually adjust the gate valves to proper 5-acre plot to be irrigated.

6. Make necessary adjustments to the spray gun nozzles and tracking systems within the zone prior to start up, to account for any over-wetted areas.

7. Document total gallons discharged to this particular zone in the Log Book prior to start up.

8. Start pump and adjust discharge rate to 29 gpm. Record date, time and flow rate in the Log Book.

9. Visually inspect the spray irrigation zone to insure proper operation.

10. Periodically check the field and flow rate during each day.

11. Operate the spray irrigation system between the hours of 8:00 a.m. and 4:00 p.m. daily.

12. Alternate the spray irrigation field zones each day.

13. Fields should be mowed and vegetation removed as necessary.

Exemption 9