

APPENDIX 5B: WRFs and Biosolids Assessment of Existing Facilities and Risks

DRAFT

Purpose

This appendix provides additional details for 2050 Facilities Plan (2050 FP) Chapter 5 that are specific to Milwaukee Metropolitan Sewerage District's (MMSD's) Water Reclamation Facilities (WRFs) and Biosolids Asset System. This appendix is not a stand-alone document; it should always be used in conjunction with the 2050 FP, which outlines a coordinated facilities management plan for all of MMSD's asset systems.

5 Assessment of Existing Facilities and Risks

5.1 PURPOSE

This chapter provides an overview of the Water Reclamation Facilities (WRFs) and Biosolids Asset System and describes how this overall system is sub-divided into lower hierarchical levels down to an individual asset level. The chapter includes details on the number of assets within the system and describes the asset information used to assess possible asset system failures.

Assets were evaluated by four possible failure modes. The intent of the failure mode analysis is to provide a summary of identified potential asset system risks. Each failure mode analysis describes the dataset that was used and includes an estimated time period when each risk is predicted to occur. The risk evaluation is presented for a planning period from 2020 to 2050; therefore, assets identified to fail at year 2050 or beyond have generally not been included in the potential risks presented.

Intent of Risk Assessment

Risks are defined as anything that MAY prevent MMSD from managing its assets systems to meet organization goals. The risk assessment process serves as an essential tool to help an organization prioritize its investments and identify the best practices to mitigate risk. The risks discussed in this chapter were identified by MMSD and 2050 FP project team staff and are informed by engineering judgment. When reading these assessments, it is important to note that these are identified as **potential** risks. The projected timing of each risk is based on the risk assessment. Not all of the risks outlined in this chapter are actually occurring, nor may they ever occur.

5.2 WRFs AND BIOSOLIDS ASSET SYSTEM OVERVIEW

A functional overview of the of the WRFs and Biosolids Asset System is provided in Chapter 1. As described in Chapter 1, the WRFs and Biosolids Asset System is separated into the following levels:

- Level 1, Asset System: WRFs and Biosolids Asset System
- Level 2, Facility: Jones Island Water Reclamation Facility (JIWRF), South Shore Water Reclamation Facility (SSWRF), and Interplant Solids Pipeline (ISP)
- Level 3, Facility Division: biosolids processing, liquid processing, support systems
- Level 4, Major Process: 19 major processes identified
- Level 5, Unit Process: 83 active unit processes identified

- Level 6, Sub-Unit Process: Over 2,000 processes identified
- Level 7, Asset System: Over 5,000 systems identified
- Level 8, Asset: Just under 12,000 assets identified

To manage MMSD’s capital planning and the assessment of existing systems in this chapter, the focus is on Level 4, Major Process (MP) and Level 5, Unit Process (UP). The details of the level designations down to Level 5 are provided in Appendix 5B-1, Level Designations. Figures 5B-1 and 5B-2 present the process flow diagrams at JIWRF and SSWRF, respectively, down to UPs for Liquid and Biosolids Processing. The ISP connects the biosolids systems at both WRFs and is shown on both figures.

The asset information development is a work in progress – although over 18,000 assets have been identified as of June 2019, this assessment focuses on the almost 12,000 assets identified as active as of June 2019. Figure 5B-3 presents an overview of the WRFs and Biosolids Asset System by showing the total number and installation decade of the active assets for JIWRF, SSWRF, and ISP facilities. Findings indicate the following:

- There are 51 active assets that do not have installation year data.
- Most of the active assets at JIWRF were installed in the 1990s.
- Most of the active assets at SSWRF were installed in the 2010s.
- Most of the active assets at ISP were installed in the 1990s.

More details of each facility with asset information broken out by MP is shown in Appendix 5B-2, WRFs and Biosolids Asset Summary. The rest of this chapter presents and evaluates the WRFs and Biosolids Asset System at the MP level for the three facilities: JIWRF, SSWRF and ISP.

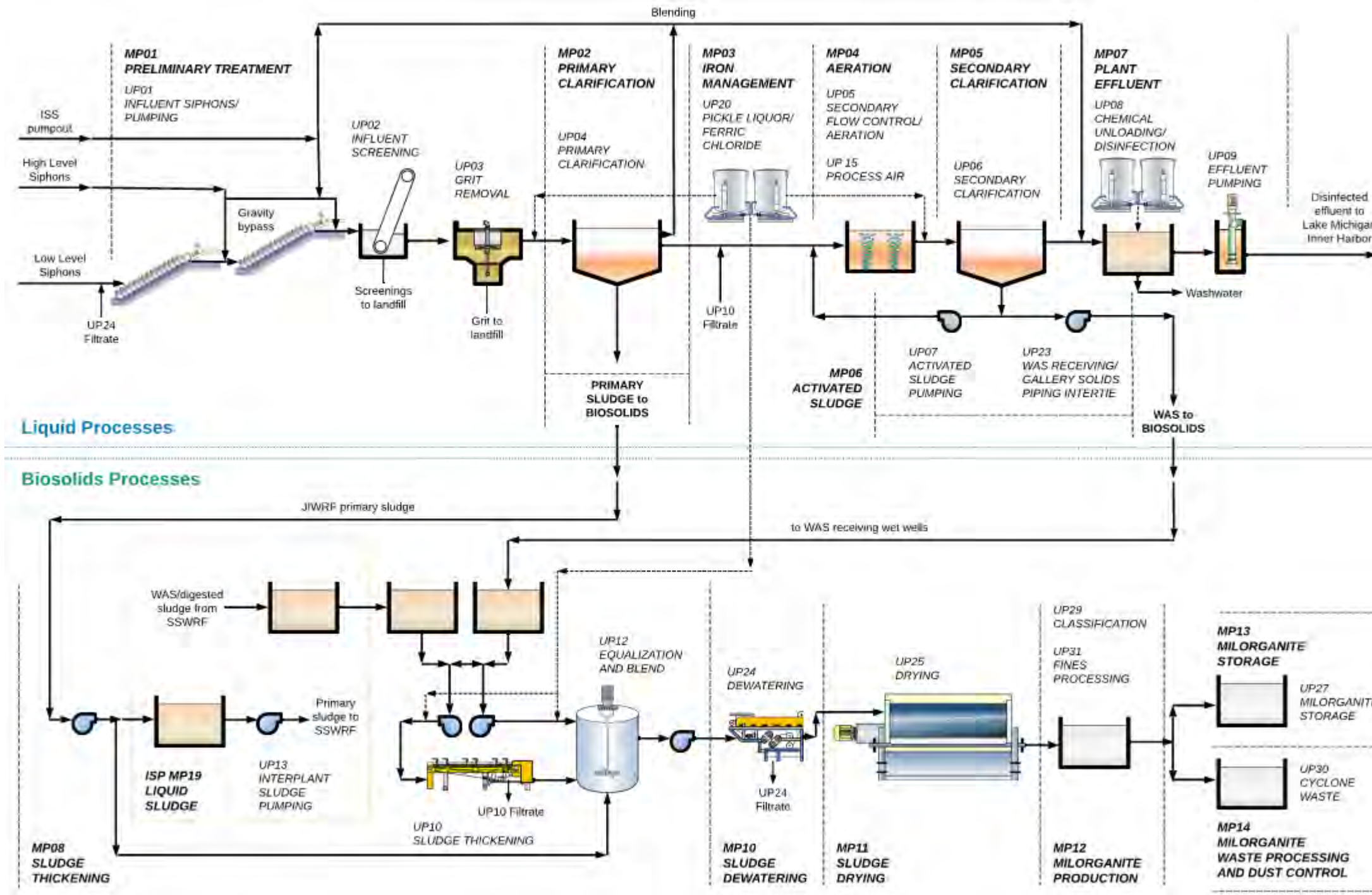


FIGURE 5B-1: JIWRF PROCESS FLOW DIAGRAM

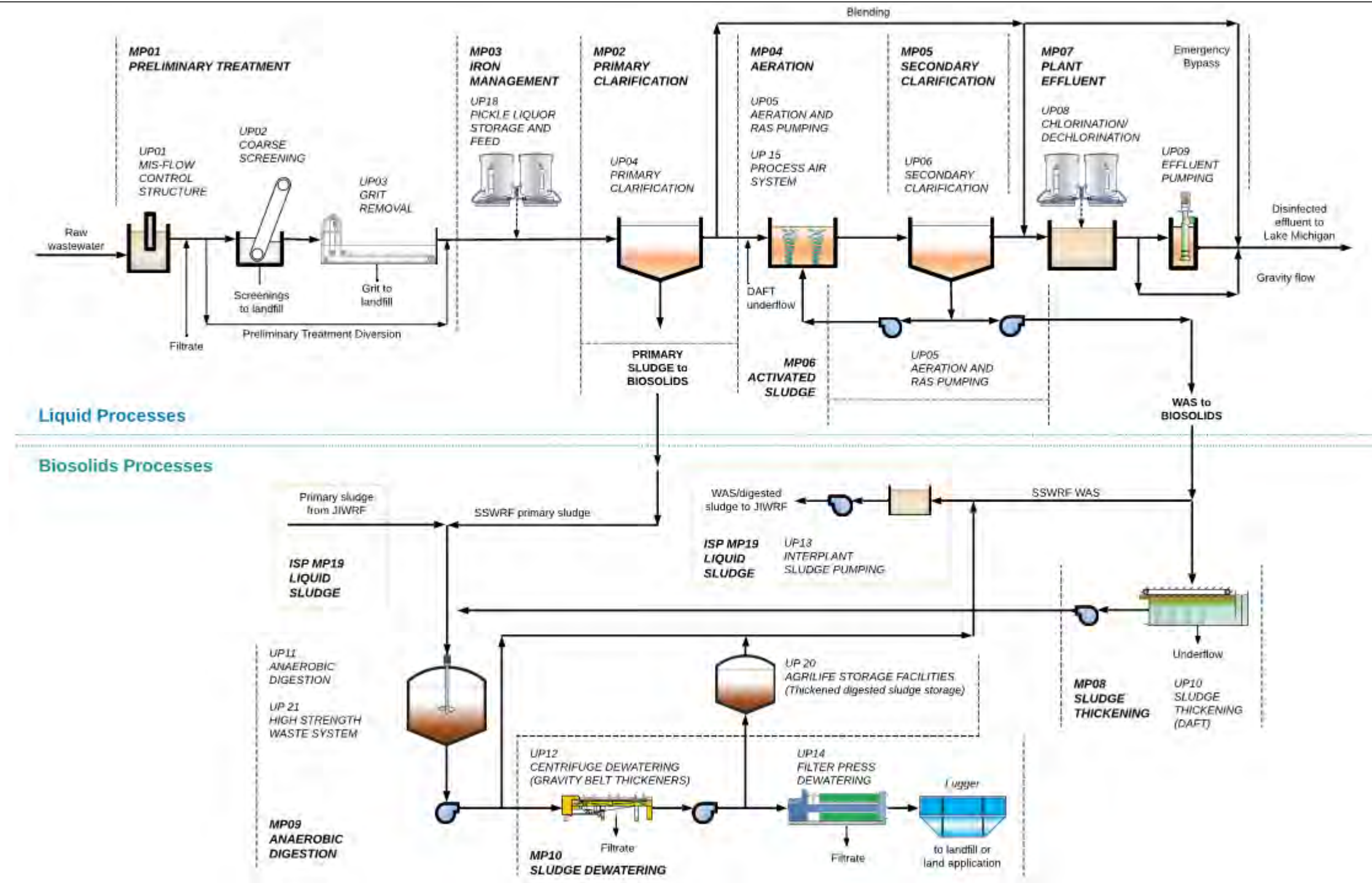
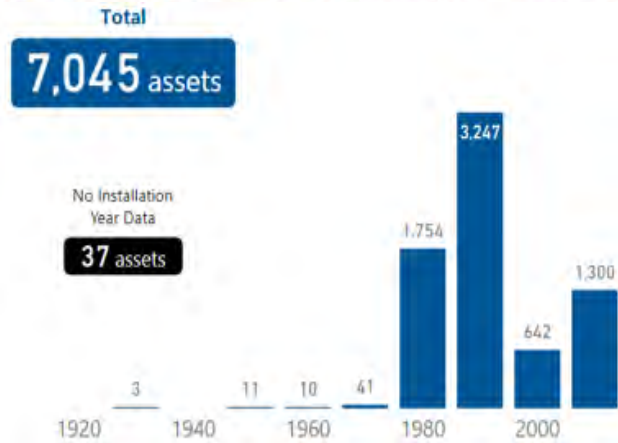


FIGURE 5B-2: SSWRF PROCESS FLOW DIAGRAM

Jones Island WRF: Number of Assets by Installation Decade



South Shore WRF: Number of Assets by Installation Decade



Interplant Pipeline: Number of Assets by Installation Decade

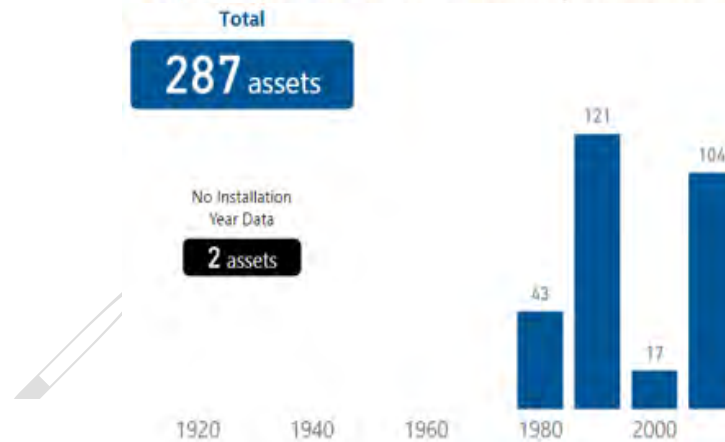


FIGURE 5B-3: INSTALLATION HISTORY OF WRFs AND BIOSOLIDS ASSETS

5.3 RISK-BASED APPROACH

In general, the assessment of WRFs and Biosolids Asset System followed a risk-based approach as described in Chapter 5. The following methodologies were used to assess the WRFs and Biosolids Asset System: the asset-level risk assessments and the Risk Register, as noted below.

Asset-Level Risk Assessments

The following asset-level risk assessments were performed on the WRFs and Biosolids Asset System: a mass balance assessment at the unit process level on JIWRf, hydraulic modeling to determine needed capacity at JIWRf to maintain baseline CSO frequency, single-point failure assessment review with Veolia Water Milwaukee, LLC (Veolia) staff, and an AssetView data assessment of asset useful life.

Risk Register

The risks in the WRFs Risk Register were initially developed based on windshield surveys completed in 2015 at each WRF, which were then field reviewed at a high level to identify major asset classes that needed additional evaluation as part of the WRF Risk Register. Additionally, input from MMSD and Veolia staff familiar with the assets and systems provided guidance on developing the likelihood of failure (LOF) and consequence of failure (COF) ratings, which were used to develop the overall risk level of each risk, and determined whether MMSD had already identified projects to address the risks. MMSD focused on high and moderate risks for the 2050 FP, which are identified in the WRF Risk Register developed in 2016 and provided in Appendix 5B-3. The COF definitions used for the WRF Risk Register developed in 2016 are presented in Appendix 5B-4.¹ MMSD has incorporated the Risk Register into its AssetView system, and all of the risks identified for the WRFs and Biosolids Asset System, including low and minimal risks not presented in the 2050 FP, can be reviewed in that system.

5.4 ASSESSED FAILURE MODES

An overview of the capacity, physical mortality, level of service and economic efficiency failure modes is presented in Chapter 5.

For the WRFs and Biosolids Asset System, the capacity and physical mortality failure modes were analyzed based on asset-level risk assessments and the WRF Risk Register, while the level of service and economic efficiency failure modes were assessed based on the risks identified in the WRF Risk Register. Specifically, the following data sources were used as the basis for analysis for each failure mode in the WRFs and Biosolids Asset System:

- Capacity: WRF Baseline, WRF Future, and Buildout Condition demand projections were developed for influent flow and wasteloads into JIWRf and SSWRF as explained in Chapter 4 and the future flows and wasteloads forecasting methodology, provided in Appendix 4B-1, were used to develop mass balances for the primary basis of analysis. The source for the UP capacities compared against the UP operations was the JIWRf and SSWRF O&M Manual design data as of 2018. In addition, single-point failures were identified with input from Veolia staff. The WRF Risk Register developed by the 2050 FP project team in 2016 was also used to identify capacity risks. The capacity failure mode analysis is presented in Section 5.5, Capacity Failure Mode.

¹ The LOF definitions, which are defined in Chapter 5, are the same across all asset systems.

- **Physical Mortality:** AssetView data were used as the primary basis of analysis. AssetView data from June 5, 2019 were refined and supplemented by the 2050 FP project team for analysis, including data assumptions for missing data. Additionally, the Risk Register developed by the 2050 FP project team in 2016 was used to identify physical mortality risks. The physical mortality failure mode analysis is presented in Section 5.6, Physical Mortality Failure Mode.
- **Level of service:** Limited asset-level data were available to relate asset performance to the key performance indicators (KPIs) and performance indicators (PIs) identified in Chapter 3. Therefore, the primary basis for risk analysis was the WRF Risk Register developed by the 2050 FP project team in 2016. The level of service failure mode analysis is presented in Section 5.7, Level of Service Failure Mode.
- **Economic efficiency:** The primary basis for the economic efficiency risk analysis was the Risk Register developed by the 2050 FP project team in 2016. The economic efficiency failure mode analysis is presented in Section 5.8, Economic Efficiency Failure Mode.

Words of Caution

The demand for Future Conditions was calculated by interpolating data points between the Baseline Conditions and Buildout Conditions. Interpolation is the process of **estimating** unknown data points between two quantities, which in this case are Baseline and Buildout Conditions, where Buildout Conditions are based on MMSD municipalities' projections of growth as documented by the Southeastern Wisconsin Regional Planning Commission (SEWRPC).

All forecasting models rely on historical data and relationships to produce a best estimate about future circumstances. It is important to note that forecasting is an uncertain business and the presence of uncertainty is inherent when making planning, management, or policy decisions. Forecasts invariably turn out to be different than the actual numbers that occur and these forecast errors increase with increased length of the forecast horizon. Therefore, forecasts should be updated when new data, such as 2020 census data, become available.

When reading these projections, it is important to note that the presented numbers are **estimates** of future demand conditions at the time of publication of the 2050 FP based on assumptions and—where noted—on planning judgment and should not be considered precise expectations of future conditions. Actual conditions will almost certainly deviate from these estimates.

5.5 CAPACITY FAILURE MODE

An asset can fail if the demand placed on the asset exceeds its design capacity, which can be caused by growth and system expansion. Capacity assessments in the WRFs and Biosolids Asset System are based on the ability of the UPs in each MP to process and treat the projected flows and wasteloads to meet an expected level of service. A UP is projected to be at risk of failure when the projected flow, wasteload, or other key parameter exceeds its design capacity as identified in the appropriate operating and maintenance (O&M) manuals as referenced. The purpose of this assessment is to identify projected gaps between design capacity and future flows and loads over the planning period. An additional risk for some of the gaps is that if the gap is not addressed, MMSD's 2019 WPDES permit limits could be exceeded. Potential strategies to mitigate these risks, including more detailed analysis and the timing of required projects to address confirmed capacity gaps prior to exceeding design capacity are analyzed in Chapter 6.

Methodology

The future demand for the WRFs and Biosolids Asset System is presented in Chapter 4 and is based on assumptions, projections, and calculations completed under the 2050 FP. WRF Baseline, Future and Buildout Conditions were all used as the basis for influent flows and wasteloads for the capacity assessment. For this assessment, WRF Baseline Conditions were set at 2015,² WRF Future Conditions were set at 2035,³ and WRF Buildout Conditions at 2050 in order to project the year that the demand placed on the UPs under an MP could first exceed design capacity to the point that the UP has deficient capacity. Note that capacity improvements may be required prior to the year identified. However, in terms of presentation, it is simpler to identify the planning year in which flow and wasteload conditions are identified to cause a capacity failure. Capacity was assessed for multiple factors based on the design parameters for the UPs under each MP using O&M Manuals available as of 2018. [1] [2] If one design parameter was exceeded, the UP was considered to have deficient capacity for the purposes of this assessment. All UPs were also assessed against 2017 Wisconsin Administrative Code Chapter NR 110 (NR 110) requirements and 10 States Standards guidance as part of the capacity risk assessment. [3] [4] The capacity failure assessment then interpolated the results into one of the following time periods to identify when a capacity failure was projected to potentially start occurring:

- before 2020
- 2020 to 2024
- 2025 to 2029
- 2030 to 2039
- 2040 to 2049
- 2050 or later

As an example, the maximum month biosolids processed for JIWRf UP25 – Drying, under JIWRf MP11, Sludge Drying, is presented in Figure 5B-4. As can be seen from the figure, by setting projected values for 2015, 2035 and 2050, the time period that the UP is projected to start having deficient capacity is projected to be 2025-2029.

² Although WRF Baseline Conditions were developed from September 2013 through August 2016 data, WRF Baseline Conditions were set at a single year to simplify the assessment.

³ Although WRF Future Conditions were identified as equivalent to 2040, the year 2035 was chosen to be conservative.

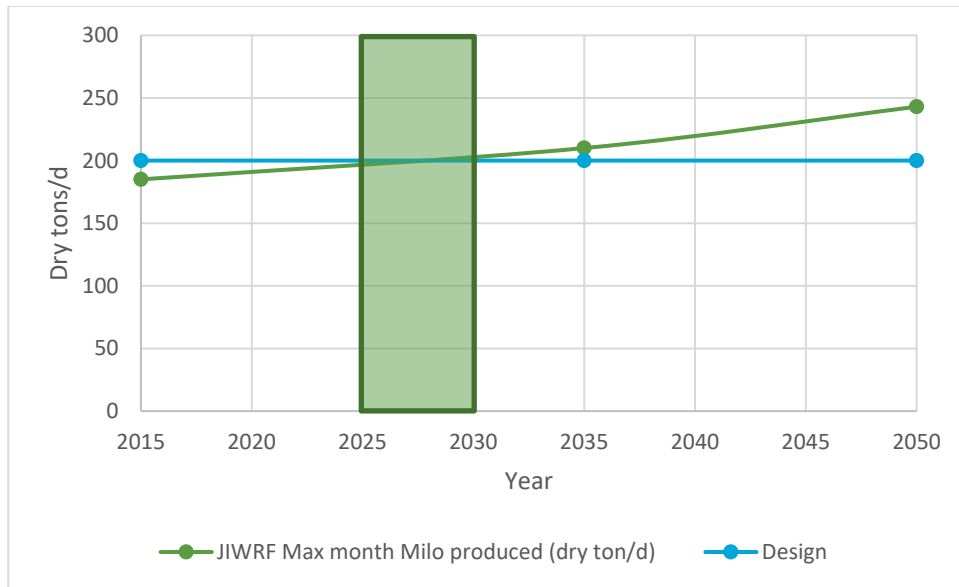


FIGURE 5B-4: EXAMPLE CAPACITY FAILURE TIME PERIOD INTERPOLATION FOR JIWRf UP25 – DRYING, UNDER JIWRf MP11, SLUDGE DRYING

Processes projected to have deficient capacity through the first four time periods (up through the year 2039) are considered to fall within the regulatory planning period established as 2020-2040, and processes projected to have deficient capacity in the last two time periods are identified for long range planning to 2050 or later.

Mass Balance Analysis

The influent flows and wasteloads for the three conditions were run through a simplified mass balance of the facilities. Data provided in the Recent Data Summary - JIWRf and SSWRF, which is provided as Appendix 4B-1, Attachment A was used to calibrate the mass balances under WRF Baseline Conditions, establishing assumed operational parameters (such as percent biochemical oxygen demand [BOD] and total suspended solids [TSS] removal in the primary clarifiers). The WRF Future Condition and Buildout Condition influent flows and wasteloads were then applied to the calibrated mass balances to estimate how unit processes may operate under those conditions.

Results from the mass balance analysis were then compiled in the WRF Capacity Assessment (Appendix 5B-5) to compare against the design conditions established in the JIWRf and SSWRF O&M Manuals to determine whether demands placed on a UP were projected to exceed its design capacity under WRF Baseline, WRF Future, and Buildout Conditions. [1] [2] [3] The results of the mass balance analysis were also assessed against 2017 NR 110 requirements and 10 States Standards guidance to provide an additional perspective to assess capacity risk. In those instances where NR 110 requirements differed from projected values, MMSD is not in violation of the NR 110 requirements, which are applicable to new and modified facilities. Note that JIWRf and SSWRF MP01, Preliminary Treatment, do not break out the UPs under this MP at each WRF in the mass balances. The capacity assessment for these UPs assesses the capacity risk based on influent peak flow under the three conditions listed above against design capacities.

Regarding permit and Veolia operating and maintenance contract limits, the simplified mass balance analysis always depicts scenarios with an equivalent level of service and compliance with Baseline permit and operating and maintenance contract limits. This is because the simplified mass balance analysis applied the WRF Baseline Condition removal rates to each UP when evaluating WRF Future and Buildout scenarios. This approach was used to identify potential gaps in capacity that may need to be addressed in order to maintain the same level of service (i.e. meeting permit and operating and maintenance contract limits). Alternatively, if the gaps are not addressed, the performance of the system will decrease, thereby increasing the risk of failure associated with the desired level of services.

In addition to the WRF Capacity Assessment (Appendix 5B-5), potential single-point failures and redundancy limitations were identified. A single-point of failure is defined as any individual asset, group of assets, or system whose failure would cause significant negative performance to any UP. Single-point failures are typically mitigated by redundancy and reliability of assets. A list of potential single-point failures was developed by first flagging capacity issues that appeared to be due to a lack of redundancy and identifying anecdotal issues, then reviewing the initial list with Veolia staff in meetings in August 2019 to develop a comprehensive list. The detailed list is also included in Appendix 5B-5.

Risk Register

In addition to the mass balance analysis, capacity risks that were identified in the WRF Risk Register in 2016 were reviewed.

Findings

This section provides a summary of projected capacity limitations by MP for JIWRF, SSWRF, and ISP based on the mass balance, single-point failures, and WRF Risk Register assessments. The focus of this capacity assessment is on liquid treatment and biosolids processing facility divisions; therefore, although the MPs that fall under support systems are presented for each facility, they were not assessed. Appendix 5B-5, WRF Capacity Assessment provides the full results in tabular form.

JIWRF Mass Balance Capacity Assessment

The analysis of the WRF Capacity Assessment projected that nine UPs at JIWRF may have deficient capacity within the 2020-2039 regulatory planning period, as shown in Table 5B-1. The projected timing of these potential capacity deficiencies are as follows:

- 3 UPs are projected to exceed capacity before the year 2020
- 2 additional UPs (5 total) are projected to exceed capacity by the year 2024
- 2 additional UPs (7 total) are projected to exceed capacity by the year 2029
- 2 additional UPs (9 total) are projected to exceed capacity by the year 2039
- No additional UPs are projected to exceed capacity by the year 2049

Details about the nine UPs that are projected to have deficient capacity, grouped by associated MP, are as follows:

- MP02 – Primary Clarification: One UP is projected to have deficient capacity. UP04 – Primary Clarification is projected to exceed the average day weir loading rate (WLR) design parameter by the year 2029. Though the projected average annual flow of 101 MGD is less than design average annual flow of 123 MGD, the WLR is exceeded due to a change in operation under WRF Baseline Conditions

that was not assumed in design conditions. The mass balance analysis assumed that one primary clarifier will continue to be out of service under WRF Future and Buildout Conditions as is done under WRF Baseline Conditions, while the design condition WLR was calculated based on all eight primary clarifiers in service.

- MP04 – Aeration: One UP is projected to have deficient capacity. UP05 – Secondary Flow Control/Aeration is projected to exceed the average day and maximum month BOD loading rate design parameters by the year 2020 due to an increase in BOD loading.⁴
- MP05 – Secondary Clarification: One UP is projected to have deficient capacity. UP06 – Secondary Clarification is projected to exceed solids loading rate design parameters by the year 2020 due to a projected increase in biosolids loadings to the UP. The same note regarding the aerated effluent channels stated under MP04 above applies to this MP as well.
- MP06 – Activated Sludge: Two UPs are projected to have deficient capacity. UP23 – Waste Activated Sludge (WAS) Receiving/Gallery Solids Piping Intertie is projected to exceed firm pumping capacity design parameters by year 2024 due to a projected increase in WAS flows. UP07 – Aeration and Return Activated Sludge (RAS) Pumping is projected to exceed firm pumping capacity design parameters by year 2039 due to a projected increase in RAS flows.
- MP08 – Sludge Thickening: One UP is projected to have deficient capacity. UP10 – Sludge Thickening is projected to exceed sludge processing design parameters, including maximum day flow, maximum day tons per day processed design parameter, and maximum month tons of solids per day processed design parameter by the year 2020 due to a projected increase in biosolids flows and wasteloads requiring thickening.
- MP10 – Sludge Dewatering: One UP is projected to have deficient capacity. UP24 – Dewatering is projected to exceed the maximum month tons per day biosolids processed design parameter by the year 2024 due to a projected increase in biosolids requiring dewatering.
- MP11 – Sludge Drying: One UP is projected to have deficient capacity. UP25 – Drying is projected to exceed maximum month tons per day biosolids processing design parameter by the year 2029 due to a projected increase in biosolids requiring drying.
- MP13 – Milorganite® Storage: One UP is projected to have deficient capacity. UP27 – Milorganite Storage is projected to exceed storage design parameter due to a projected need to store more biosolids by the year 2039.

⁴ Anecdotal information from MMSD staff does not indicate JIWRf secondary treatment has capacity issues. That may be because design parameters do not include the large volume of aerated channels provided at JIWRf and these channels may be providing more treatment than the original design conditions identified. An additional analysis of secondary treatment at JIWRf is included as part of the evaluation of this risk in Chapter 6.

TABLE 5B-1: NUMBER OF UNIT PROCESSES PROJECTED TO START BEING CAPACITY DEFICIENT AT JONES ISLAND WRF FOR EACH TIME PERIOD

Major Process	Before 2020	2020 to 2024	2025 to 2029	2030 to 2039	2040 to 2049	2050 or Later	Not Assessed	Total
MP01 - PRELIMINARY TREATMENT						3		3
MP02 - PRIMARY CLARIFICATION			1			2		3
MP03 - IRON MANAGEMENT							1	1
MP04 - AERATION	1					1		2
MP05 - SECONDARY CLARIFICATION	1							1
MP06 - ACTIVATED SLUDGE		1		1				2
MP07 - PLANT EFFLUENT						2		2
MP08 - SLUDGE THICKENING	1					1		2
MP10 - SLUDGE DEWATERING		1						1
MP11 - SLUDGE DRYING			1					1
MP12 - MILORGANITE PRODUCTION						1	1	2
MP13 - MILORGANITE STORAGE				1				1
MP14 - MILORGANITE WASTE PROCESSING & DUST CONTROL						1		1
MP15 - POWER GENERATION							3	3
MP16 - PLANT WATER AND DRAIN							1	1
MP17 - PLANT UTILITIES							4	4
MP18 - FACILITIES MANAGEMENT							3	3
Not Assigned							2	2
Total	3	2	2	2	0	11	15	35

Legend:

Before 2020		2040 to 2049	
2020 to 2024		2050 or Later	
2025 to 2029		Not Assessed	
2030 to 2039			

Interim Level of Service Target to Maintain Baseline CSO Frequency

In addition to the capacity assessment presented in Table 5B-1, a separate assessment was completed to determine the potential risk of JIWRF UPs not being able to maintain the baseline CSO frequency. As discussed in Chapters 3 and 4, MMSD has established an interim target of maintaining the baseline CSO frequency of 3.25 CSOs per year as a step towards achieving zero overflows. One way to achieve this interim goal is to increase the capacity of JIWRF from 390 MGD. Though this is technically a review of an interim level of service target and not a true risk of capacity failure, the discussion is included in this section because the assessment includes a review of design capacity of UPs at JIWRF. This assessment was completed using the Conveyance model; therefore, results are provided using Conveyance Future Conditions rather than WRF Future Conditions, as defined in Chapter 4. Appendix 4B-1, Future Flows and Wasteloads Forecasting Methodology notes that the estimated frequency of CSO events will vary depending on whether the increased peak hydraulic flow at JIWRF is assumed to pass through all JIWRF major liquid processes or be blended, with each processing option presented in Table 5B-2.

TABLE 5B-2: MAXIMUM FLOWS TO JIWRF TO MAINTAIN BASELINE CSO FREQUENCY (MGD)

Processing Option	Required JIWRF Capacity (MGD)			
	Conveyance Future Conditions		Buildout Conditions	
	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Full Peak Hydraulic ¹	365	330	430	330
Blending ²	60	95	60	150
Total	425	425	490	480

- 1) Full peak hydraulic capacity is the peak hydraulic flow that can be passed through all of JIWRF major liquid processes.
- 2) Blending capacity is the flow pumped from the ISS Pump Station to disinfection.

For the purposes of this assessment, two scenarios were considered: 1) full peak hydraulic capacity needed would increase (11 UPs impacted, including all three UPs in MP01, Preliminary Treatment; UP04, Primary Clarification under MP02, Primary Treatment; both UPs under MP04, Aeration; the UP under MP05, Secondary Clarification; both UPs under MP06, Activated Sludge; and both UPs in MP07, Plant Effluent) with blending capacity maintained at 60 MGD; and 2) full peak hydraulic capacity maintained at 330 MGD and blending capacity would need to increase (three UPs impacted, including blending from the ISS Pump Station under MP02, Primary Treatment, along with capacity in both UPs under MP07, Plant Effluent).

- **Scenario 1 findings:** To maintain the baseline CSO frequency, the hydraulic modeling projected JIWRF full peak hydraulic capacity for MPs 01, 02, 04, 05, and 06 would need to increase from 330 MGD in year 2015 to 365 MGD in year 2035 and 430 MGD by year 2050, which includes impacts from climate change along with projected buildout growth. In addition, MP07, Plant Effluent would need to increase to 425 MGD by year 2035 and 490 MGD by year 2050 (projected full treatment plus 60 MGD blending).
- **Scenario 2 findings:** To maintain the baseline CSO frequency, the hydraulic modeling projected blending would need to increase to 95 MGD by year 2035 and 150 MGD by year 2050. In addition, MP07, Plant Effluent would need to increase to 425 MGD by year 2035 and 480 MGD by year 2050 (330 MGD full treatment plus projected blending).

It is important to note that the results for the two scenarios cannot be mixed and matched. For example, the total flow projected to be needed under Buildout Conditions is not 430 MGD (Scenario 2) plus 150 MGD (Scenario 1); it is either 330 plus 150 MGD (total = 480 MGD) or 430 MGD plus 60 MGD (total = 490 MGD).

In either of these scenarios, wastewater processed through JIWRP would increase, thereby increasing the risk of exceeding wasteload allocation (WLA) limits imposed as part of MMSD's 2019 WPDES permit on TSS (monthly and weekly limits) and TP (monthly limits).

SSWRF Mass Balance Capacity Assessment

The analysis of the WRF Capacity Assessment projected that six UPs at SSWRF may have deficient capacity within the 2020 to 2040 regulatory planning period. The review against 2017 NR 110 requirements⁵ identified one additional UP (UP08 under MP07). The projected seven risks are shown in Table 5B-3. The projected timing of risks to these seven UPs is as follows:

- 5 UPs are projected to have deficient capacity or are projected to have parameters above 2017 NR 110 requirements (UP08 under MP07) before the year 2020
- 1 additional UP (6 total) is projected to have deficient capacity by year 2029
- 1 additional UP (7 total) is projected to have deficient capacity by the year 2039

Four of these UPs are related to primary and secondary treatment, which have had capacity issues in recent years and are the subject of a root-cause analysis study and a performance and aeration evaluation report, both of which were anticipated to be final in 2019.

Details about the seven UPs that are projected to have deficient capacity, grouped by associated MP, are as follows:

- MP02 – Primary Clarification: One UP is projected to have deficient capacity. UP04 – Primary Clarification is projected to exceed the weir loading rate (WLR) design parameter by the year 2020 due to increased average day flow projections under WRF Future and Buildout Conditions. In addition, peak hourly surface overflow rate (SOR) is higher than the 2017 NR 110 requirements but does not exceed design parameters.
- MP04 – Aeration: Two UPs are projected to have deficient capacity. An increase in the primary effluent BOD load is projected to exceed the volumetric loading rate of UP05 – Aeration and RAS Pumping by the year 2020. In addition, in setting the mixed liquor suspended solids in the mass balance to calibrate the mixed liquor mass, the average food to micro-organism ratio would be exceeded under Buildout Conditions. This is further evaluated in conjunction with other UPs identified to have deficient capacity in Chapter 6. An increase in the primary effluent BOD and TKN load, resulting in an increased oxygen demand within aeration, is projected to exceed the average day and maximum oxygen demand design parameters of UP 15 – Process Air by the year 2020.
- MP05 – Secondary Clarification: One UP is projected to have deficient capacity. The SOR, WLR, and solids loading rates are identified to exceed the design parameters of UP06 – Secondary Clarification under Baseline Conditions.

⁵ Current (2017) NR 110 requirements were reviewed to provide an additional perspective for assessing the capacity risk of a major process. In instances where NR 110 requirements differ from projected values, MMSD is not in violation of the NR 110 requirements, which are applicable to new and modified facilities.

- MP06 – Activated Sludge: One UP is projected to have deficient capacity. An increase in the primary effluent BOD and TKN load is projected to increase the WAS production beyond the firm pumping capacity of UP05 – Aeration and RAS Pumping by year 2039.
- MP07 – Plant Effluent: One UP is flagged as a risk based on 2017 NR 110 requirements. The contact time of 24 minutes for UP08 – Chlorination/Dechlorination does not meet the portion of NR 110 110.14.3.f that states that contact time shall be 30 minutes at maximum hour design flow.
- MP09 – Anaerobic Digestion: One UP is projected to have deficient capacity. An increase in primary sludge from JIWRf and SSWRF is projected to exceed the TSS and volatile solids (VS) design parameters of UP11 – Anaerobic Digestion by the year 2039.

ISP Mass Balance Capacity Assessment

The WRF Mass Balance Capacity Assessment identified one UP in the ISP facilities that is projected to have deficient capacity, which is projected to occur outside of the 2020 to 2040 regulatory planning period, as shown in Table 5B-4.

Details regarding the one UP that is projected to have deficient capacity, grouped by its MP, are as follows:

- MP19 – Liquid Sludge: One UP is projected to have deficient capacity. An increase in the WAS and DSD flow rates from SSWRF to JIWRf is projected to exceed the firm pumping capacity of UP13 – IPS Pump Station by year 2049.

TABLE 5B-3: NUMBER OF UNIT PROCESSES PROJECTED TO START BEING CAPACITY DEFICIENT AT SOUTH SHORE WRF FOR EACH TIME PERIOD

Major Process	Before 2020	2020 to 2024	2025 to 2029	2030 to 2039	2040 to 2049	2050 or Later	Not Assessed	Total
MP01 - PRELIMINARY TREATMENT						3		3
MP02 - PRIMARY CLARIFICATION	1							1
MP03 - IRON MANAGEMENT						1		1
MP04 - AERATION	2							2
MP05 - SECONDARY CLARIFICATION	1							1
MP06 - ACTIVATED SLUDGE				1		1		2
MP07 - PLANT EFFLUENT	1					1		2
MP08 - SLUDGE THICKENING						1		1
MP09 - ANAEROBIC DIGESTION			1			1	1	3
MP10 - SLUDGE DEWATERING						1		1
MP15 - POWER GENERATION							2	2
MP16 - PLANT WATER AND DRAIN							1	1
MP17 - PLANT UTILITIES							3	3
MP18 - FACILITIES MANAGEMENT							4	4
Not Assigned							1	1
Total	5	0	1	1	0	9	12	28

Legend:





Before 2020		2040 to 2049	
2020 to 2024		2050 or Later	
2025 to 2029		Not Assessed	
2030 to 2039			

TABLE 5B-4: NUMBER OF UNIT PROCESSES PROJECTED TO START BEING CAPACITY DEFICIENT AT INTERPLANT SLUDGE PIPELINE FOR EACH TIME PERIOD

Major Process	Before 2020	2020 to 2024	2025 to 2029	2030 to 2039	2040 to 2049	2050 or Later	Not Assessed	Total
MP19 - LIQUID SLUDGE					1			1
Not Assigned							1	1
Total	0	0	0	0	1	0	1	2

Legend:

- Before 2020
- 2020 to 2024
- 2025 to 2029
- 2030 to 2039
- 2040 to 2049
- 2050 or Later
- Not Assessed

DRAFT

Single-Point/Redundancy Failures

Risk Register Capacity Risks

The WRFs and Biosolids Risk Register identifies four moderate and high risks that are related to capacity, as follows:

- 2 risks at JIWRF
- 2 risks at SSWRF
- 0 risks for ISP facilities
- 0 risks that applied to multiple facilities

These risks are also presented in Appendix 5B-6, WRF Risk Register – Capacity Risks.

The 2050 FP project team determined in a review with MMSD and Veolia staff that MMSD does not already have a strategy to address three of these risks, as summarized in Table 5B-5.

TABLE 5B-5: MODERATE AND HIGH CAPACITY RISKS IDENTIFIED IN RISK REGISTER NOT ALREADY ADDRESSED BY MMSD STRATEGIES

Risk ID	Risk Level	Risk Title
<i>JIWRF</i>		
R240	High	Risk of conveyance system overflows by not maximizing ISS pump out blending at the JIWRF
R039	Moderate	Risk of necessity to implement emergency operations and the corresponding cost impacts due to the insufficient capacity of the D&D sludge cake bypass belt to process all dewatered biosolids in the event that the south side system goes offline
<i>SSWRF</i>		
R190	Moderate	Risk of insufficient solids processing and disposal capacity at SSWRF during a JIWRF D&D extended or short-term shutdown

5.6 PHYSICAL MORTALITY FAILURE MODE

Physical mortality assessments are performed to identify potential failure due to asset deterioration. The rehabilitation/replacement year, which is maintained in MMSD’s AssetView system, was used as the primary basis for this analysis.

Methodology

The physical mortality assessment included the almost 12,000 active WRFs and Biosolids assets identified in the AssetView dataset from June 6, 2019. The data from AssetView is not complete – rehabilitation/replacement year had to be estimated for 26 percent of the active asset data, as presented in Figure 5B-5. These are significant gaps in the information that prevented an accurate assessment of the mortality risks based on raw AssetView data output. MMSD has implemented a methodology to update the raw AssetView data based on progressively detailed investigations. While that effort is ongoing, an interim methodology was developed for this project to estimate the replacement year for assets that had missing information. The interim methodology is summarized in Table 5B-6. After implementing the interim methodology, the total number of assets that did not have rehabilitation/replacement year information was reduced from 26 percent to just 0.5 percent (rounded to 0 in Figure 5B-5).

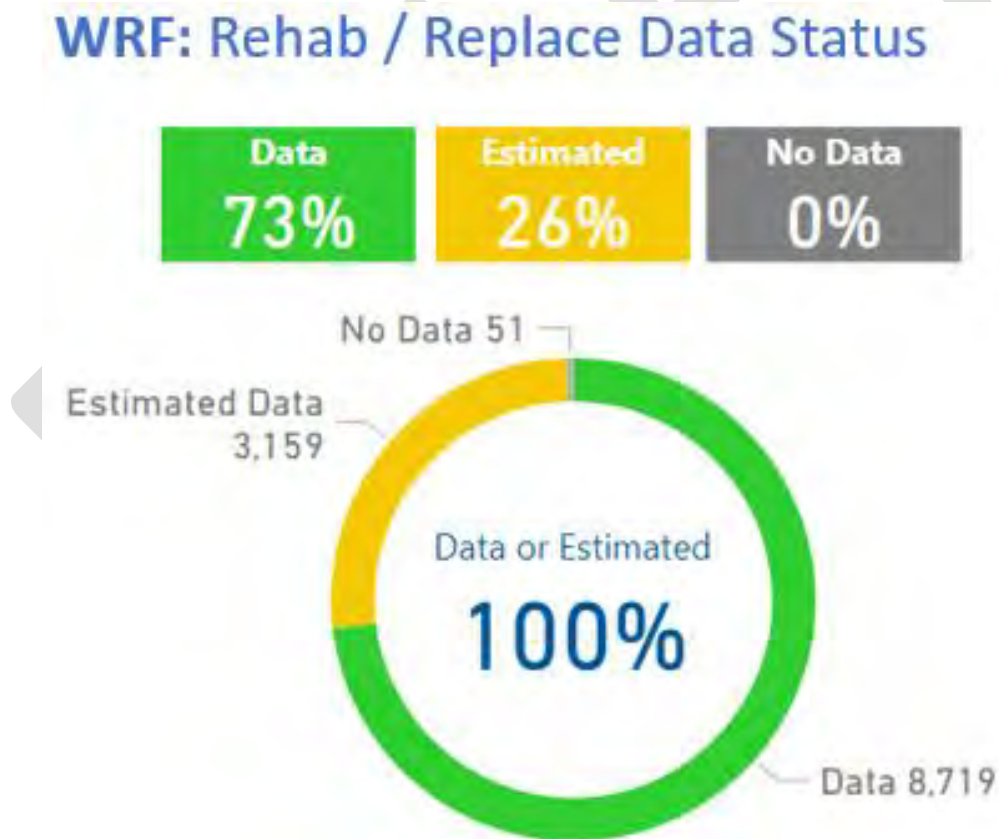


FIGURE 5B-5: STATUS OF ACTIVE ASSETVIEW DATA AS OF JUNE 6, 2019

TABLE 5B-6: INTERIM MORTALITY ASSESSMENT METHODOLOGY

Step	Description	Approach
Step 1	Initial assessment	Only assets that are considered active are included in the assessment.
Step 2	Estimate replacement year	A reasonable service life based on the asset description was set for all assets with missing information. An in-service (installation) year was assigned to all assets using the same in-service year as other assets with the same "Building" information.
Step 3	Assessment	Asset replacement year were generated for each MP at each facility for each time period bracket. This assessment is the initial identification of the WRF and Biosolids asset replacement needs.

The specific methodology for Step 2 listed above in Table 5B-6 on how average replacement years were estimated is provided in Appendix 5B-7, Physical Mortality Assessment – Methodology to Address Gaps in Cost and Replacement Date Information.⁶

Most assets were assigned a specific UP that rolled up to a MP in AssetView. However, there were a significant number of assets that still were not assigned an MP because they had ambiguous or unfilled UP designations in AssetView. These assets were designated as "Not Assigned."

Additionally, the Risk Register developed by the 2050 FP project team in 2016 was used to identify physical mortality risks.

Findings

AssetView Analysis

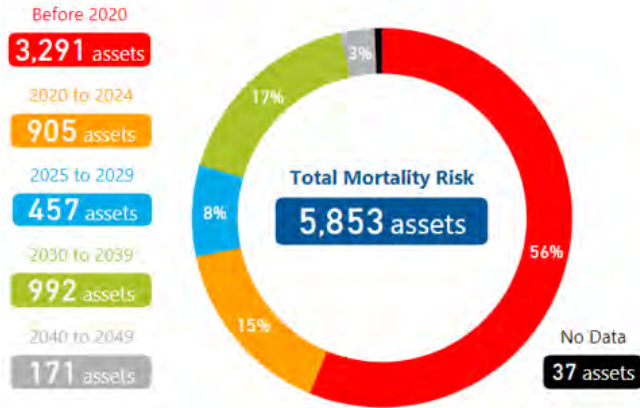
Figure 5B-6 provides a summary of estimated physical mortality failure by facility based on the AssetView analysis. The assets listed for each time period are additional assets over and above the assets listed for prior time periods. Details for the MPs for each facility are provided in Appendix 5B-2, WRFs and Biosolids Asset Summary, which presents the total assets per time period to easily identify which MPs have a significant number of assets needing replacement and when they are expected to occur. Figure 5B-6 presents the number of assets through the year 2049 as well as the number of assets that did not have installation year data. The assets without an installation year are included because replacement for these assets could be imminent but more information needs to be gathered before true replacement timing can be presented. To be conservative, it was assumed these assets will need to be replaced by the year 2050 rather than not including them in this planning period. The total mortality risk identified for JIWRF, SSWRF, and ISP through the year 2049 is over 9,900 assets of the almost 12,000 assets reviewed, representing 83 percent of the system. The ISP facility has significantly fewer assets identified for replacement (280 assets compared to 5,853 assets for JIWRF and 3,779 assets for

⁶ Note that Appendix 5B-7 also discusses replacement costs. That is an asset management tool that is not included in the assessment presented in the 2050 FP.

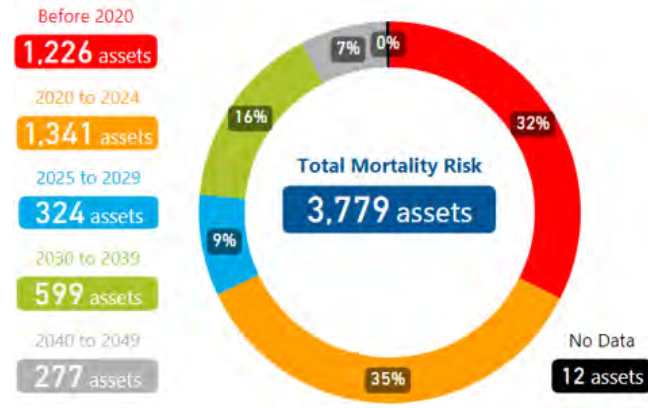
SSWRF); therefore, the physical mortality assessment focused on JIWRf and SSWRF. The potential risks in each time period were identified as follows:

- 4,620 assets are projected to be overdue for renewal by the year 2020. The bulk of these assets are located at JIWRf, which is projected to have a total of 3,291 assets up for renewal by the year 2020. A significant number of these assets fall into the “Not Assigned” category. At SSWRF, MP18, Facilities Management has the largest number of assets identified for replacement. The MPs at JIWRf with the second and third largest set of assets overdue for replacement are MP16, Plant Water and Drain and MP04, Aeration.
- 2,345 assets are projected to need renewal in the 2020-2024 period. The bulk of these assets are located at SSWRF, where the MP with the most assets identified is MP18, Facilities Management. At JIWRf, the “Not Assigned” category has the largest number of assets identified for replacement.
- 788 assets are projected to need renewal in the 2025-2029 period. Over half of these assets are located at JIWRf. Most of these assets are in MP11, Sludge Drying. At SSWRF, MP04, Aeration has the largest number of assets identified for replacement.
- 1,614 assets are projected to need renewal in the 2030-2039 period. Most of these assets are located at JIWRf. Most of these assets are in the “Not Assigned” category. At SSWRF, MP16, Plant Drain has the largest number of assets identified for replacement. The MP at JIWRf with the second largest set of assets identified for replacement is MP11, Sludge Drying.
- 494 assets are projected to need renewal in the 2040-2049 period. Most of these assets are located at SSWRF, with the greatest renewal needs in MP16, Plant Water and Drain. At JIWRf, the MP with the highest number of assets identified for replacement is “Not Assigned.”
- 51 assets do not have an install year but may need renewal in the planning period. Most of these assets are located at JIWRf, where the MP with the highest renewal needs is “Not Assigned.” At SSWRF, the MP with the greatest renewal needs is MP04, Aeration.

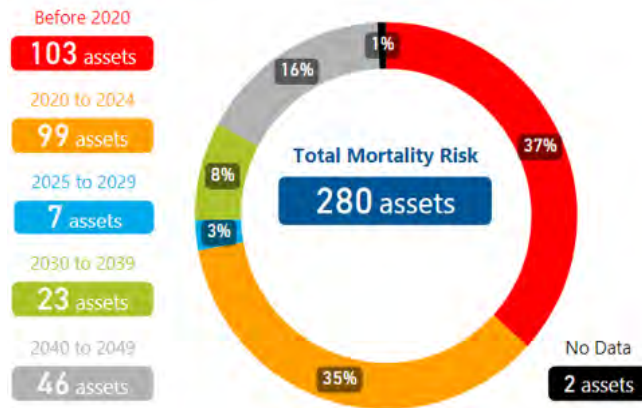
Jones Island WRF: Mortality Risk by Major Process (2020 to 2049)



South Shore WRF: Mortality Risk by Major Process (2020 to 2049)



Interplant Pipeline: Mortality Risk by Major Process (2020 to 2049)



WRF: Mortality Risk (2020 to 2049)



FIGURE 5B-6: OVERVIEW OF WRFs AND BIOSOLIDS PHYSICAL MORTALITY ESTIMATES

Risk Register Physical Mortality Risks

There were 133 moderate and high risks identified that are related to physical mortality for each of the facilities, split as follows:

- 118 risks at JIWRF
- 14 risks at SSWRF
- 1 risk for ISP facilities
- 0 risks that applied to multiple facilities

These risks are also presented in Appendix 5B-8, WRF Risk Register – Physical Mortality Risks.

The 2050 FP project team determined in a review with MMSD and Veolia staff that MMSD does not already have a strategy to address 102 of these risks (100 at JIWRF, two at SSWRF), as summarized in Table 5B-7.

TABLE 5B-7: MODERATE AND HIGH PHYSICAL MORTALITY RISKS IDENTIFIED IN RISK REGISTER NOT ALREADY ADDRESSED BY MMSD STRATEGIES

Risk ID	Risk Level	Risk Title
<i>JIWRF</i>		
R057	High	Risk of excessive power consumption and potential air permit non-compliance due to the condition, performance and power use of D&D wet ESPs
R005	Moderate	Risk of loss of JIWRF electrical power due to the condition of substation equipment (Dewey and Harbor)
R125	Moderate	Risk of loss of power due to age and reliability of electric substations, MCCs, and other power distribution systems
R173	Moderate	Risk of wet weather capacity restrictions and permit violations due to D&D facility drying capacity/reliability issues
Multiple	High/ Moderate	Multiple Dewatering and Drying (D&D) system risks - 12 high and 84 moderate risks (See Appendix 5B-8 for individual risks)
<i>SSWRF</i>		
R111	Moderate	Risk of failure of the plate and frame dewatering system due to the aged PLC system and the fact that parts are no longer supported by the vendor
R112	Moderate	Risk of failure of the plate and frame dewatering system due to costs and long lead times for replacement parts associated with the feed pumps

5.7 LEVEL OF SERVICE FAILURE MODE

Methodology

The WRF Risk Register developed in 2016 was used as the primary basis for assessing level of service failures. For the WRFs and Biosolids Asset System, MMSD focused on high and moderate risks identified under the level of service failure mode. The following level of service categories identified in Chapter 3 were used to determine potential level of service failures using the COF definitions provided in Appendix 5B-4:

- Permit Requirements
- Energy
- Environmental Improvements
- Fiscal Responsibility
- Management Effectiveness
- Safety
- Customer Service, Communication and Employee Development

The 2050 FP project team identified level of service risks and then the risks were reviewed with MMSD and Veolia staff to determine if a strategy had already been identified to address each risk. If it was determined that a strategy was already identified, no action was taken to address the risk as part of this report. Chapter 6 evaluates potential strategies to mitigate the moderate and high level of service risks that were determined to have no strategy.

Findings

There were 19 moderate and high risks identified that are related to level of service for each of the facilities, split as follows:

- 10 risks at JIWRf
- 9 risks at SSWRF
- 0 risks for ISP facilities
- 0 risks that applied to multiple facilities

These risks are also presented in Appendix 5B-9, WRF Risk Register – LOS Risks.

The 2050 FP project team determined in a review with MMSD and Veolia staff that MMSD does not already have a strategy to address seven of the risks (four at JIWRf, three at SSWRF), as summarized in Table 5B-8.

TABLE 5B-8: MODERATE AND HIGH LEVEL OF SERVICE RISKS IDENTIFIED IN RISK REGISTER NOT ALREADY ADDRESSED BY MMSD STRATEGIES

Risk ID	Risk Level	Risk Title
<i>JIWRF</i>		
R177	High	Risk of safety issues in dryer systems due to the utilization of waste heat and the high oxygen levels in the dryer systems
R120	Moderate	Risk of negative publicity, community impacts and not meeting 2017 NR 110 requirements ¹ due to JIWRF treatment process odors
R172	Moderate	Risk that phosphorus content of Milorganite relative to nitrogen may exceed regulations in some states where Milorganite is currently sold
R228	Moderate	Risk of air permit non-compliance due to increasing trends in emissions (as noted by stack testing)
<i>SSWRF</i>		
R090	High	Risk of conveyance system overflows at BS0405 and DC0103 by not utilizing potential additional capacity at SSWRF
R197	Moderate	Risk of limited black start capability during a power outage because the existing battery has capacity for only one start and backup power capacity is not available in a power outage
R211	Moderate	Risk of incorrect reporting, treatment management, and future planning due to incorrect results from the influent SSWRF sampling system

1) NR 110 requirements are updated regularly; therefore, they may be more stringent than when the design was approved. In these instances, MMSD is not in violation of NR 110 requirements, but it is noted as a potential risk.

After the development of the WRF Risk Register in 2016, one additional level of service risk was identified: the risk that the disinfection systems at JIWRF and SSWRF are not adequate to meet future WPDES permit requirements. As of October 23, 2019, WDNR has approved new regulations that require that *Escherichia coli* (*E. coli*) be used as the pathogen indicator in wastewater as opposed to the historical use of fecal coliform. [5] While this change was not imposed on MMSD in the 2019 permit, it will likely be in the next permit, which will be issued in approximately 5 years. Because this is a risk to meeting future permit requirements, this risk is included in the Level of Service Failure Mode Assessment rather than under the Capacity Failure Mode Assessment, which identifies gaps in capacity that may risk exceeding the active 2019 WPDES permit.

5.8 ECONOMIC EFFICIENCY FAILURE MODE

Economic efficiency assessments are designed to determine if lower cost alternatives are available to meet the required service levels. Due to limited available data, economic efficiency failure risks received limited evaluation in the 2050 FP, but these risks are intended to be analyzed in more detail in future AMPs. For the 2050 FP, broad economic risks were considered and identified in the WRF Risk Register developed in 2016 using the same methodology outlined in Section 5.7, Level of Service Failure Mode: first identifying the moderate and high risks and then focusing on the risks not already being addressed by MMSD. There were two economic efficiency risks identified, split as follows:

- 1 risk at JIWRf
- 1 risk at SSWRF
- 0 risks for ISP facilities
- 0 risks that applied to multiple facilities

These risks are presented in more detail in Appendix 5B-10, WRF Risk Register – Economic Efficiency Risks. Of these two economic efficiency risks, there were two moderate risks, split between JIWRf and SSWRF, and zero high risks. The 2050 FP project team determined in a review with MMSD and Veolia staff that MMSD does not already have a strategy to address either of the risks, which are summarized in Table 5B-9.

TABLE 5B-9: MODERATE ECONOMIC EFFICIENCY RISKS IDENTIFIED IN RISK REGISTER NOT ALREADY ADDRESSED BY MMSD STRATEGIES

Risk ID	Risk Level	Risk Title
<i>JIWRf</i>		
R261	Moderate	Risk of not being able to contract with a Milorganite packaging/bagging vendor due to the limited number of vendors (only one)
<i>SSWRF</i>		
R113	Moderate	Risk of unplanned costs and not meeting MMSD energy goals due to the high maintenance costs and high downtime of the engine generators

5.9 SUMMARY OF FINDINGS

The assessments indicate that the majority of risks fall under the capacity and physical mortality failure modes. The following summarizes the identified risks:⁷

- **Capacity Risks:** There are 17 UPs identified with capacity risks within the 2020 to 2050 planning period: 9 at JIWRf, 7 at SSWRF, and 1 at ISP. In addition, 3 capacity risks from the WRF Risk Register were identified.
 - There are 3 UPs at JIWRf projected to have deficient capacity by 2020 based on the mass balance analysis, under MP02, Primary Clarification, MP04, Aeration, MP05, Secondary Clarification, MP06, Activated Sludge, and MP08, Sludge Thickening.
 - To maintain interim goal of maintaining the baseline CSO frequency (3.25 CSOs per year), which was established in Chapter 4, either 11 UPs (Scenario 1) or 3 UPs (Scenario 2) at JIWRf are projected to need additional peak flow capacity.
 - There are 5 UPs at SSWRF projected to have deficient capacity by 2020 based on the mass balance analysis, under MP01, Preliminary Treatment; MP02, Primary Clarification; MP04, Aeration; and MP05, Secondary Clarification.
 - MMSD already has strategies to address all identified single-point failure risks.
 - In addition, there are three moderate and high risks identified in the WRF Risk Register for which MMSD does not already have a strategy to address.
- **Physical Mortality Risks:** Over 9,900 assets are identified to have physical mortality risks within the 2020-2050 planning period.
 - Over 4,600 assets are identified before 2020.
 - In addition, the WRF Risk Register identifies 102 potential high and moderate risks (100 at JIWRf, two at SSWRF) for which MMSD does not already have a strategy to address.
- **Level of Service Risks:** There are seven moderate and high level of service risks (four at JIWRf and three at SSWRF) from the WRF Risk Register plus one additional risk related to disinfection at both WRFs for which MMSD does not already have a strategy to address.
 - At JIWRf, these risks are related to safety, product quality and air emissions related to Milorganite production and also odors.
 - At SSWRF, these risks are related power and wet weather capacity.
 - At both WRFs, the risk that the disinfection systems are not adequate to meet future WPDES permit requirements to meet *E. coli* effluent limits.
- **Economic Efficiency Risks:** There are two moderate economic risks (one at JIWRf and one at SSWRF) for which MMSD does not already have a strategy to address.
 - At JIWRf, the risk is related to Milorganite vendor availability
 - At SSWRF, the risk is related to power generation related to renewable energy goals

⁷ Note that there is some overlap between the risks identified under each failure mode, which is addressed in Chapter 6.

Chapter 6 identifies potential mitigation strategies to address these risks and identifies recommended projects at the MP level at each facility.

5.10 APPENDICES

Information used to develop this appendix may be found in the following documents:

- Appendix 5B-1: Level Designations
- Appendix 5B-2: WRFs and Biosolids Asset Summary
- Appendix 5B-3: WRF Risk Register
- Appendix 5B-4: WRF Risk Register COF Definitions
- Appendix 5B-5: WRF Capacity Assessment
- Appendix 5B-6: WRF Risk Register – Capacity Risks
- Appendix 5B-7: Physical Mortality Assessment – Methodology to Address Gaps in Cost and Replacement Date Information
- Appendix 5B-8: WRF Risk Register – Physical Mortality Risks
- Appendix 5B-9: WRF Risk Register – LOS Risks
- Appendix 5B-10: WRF Risk Register – Economic Efficiency Risks

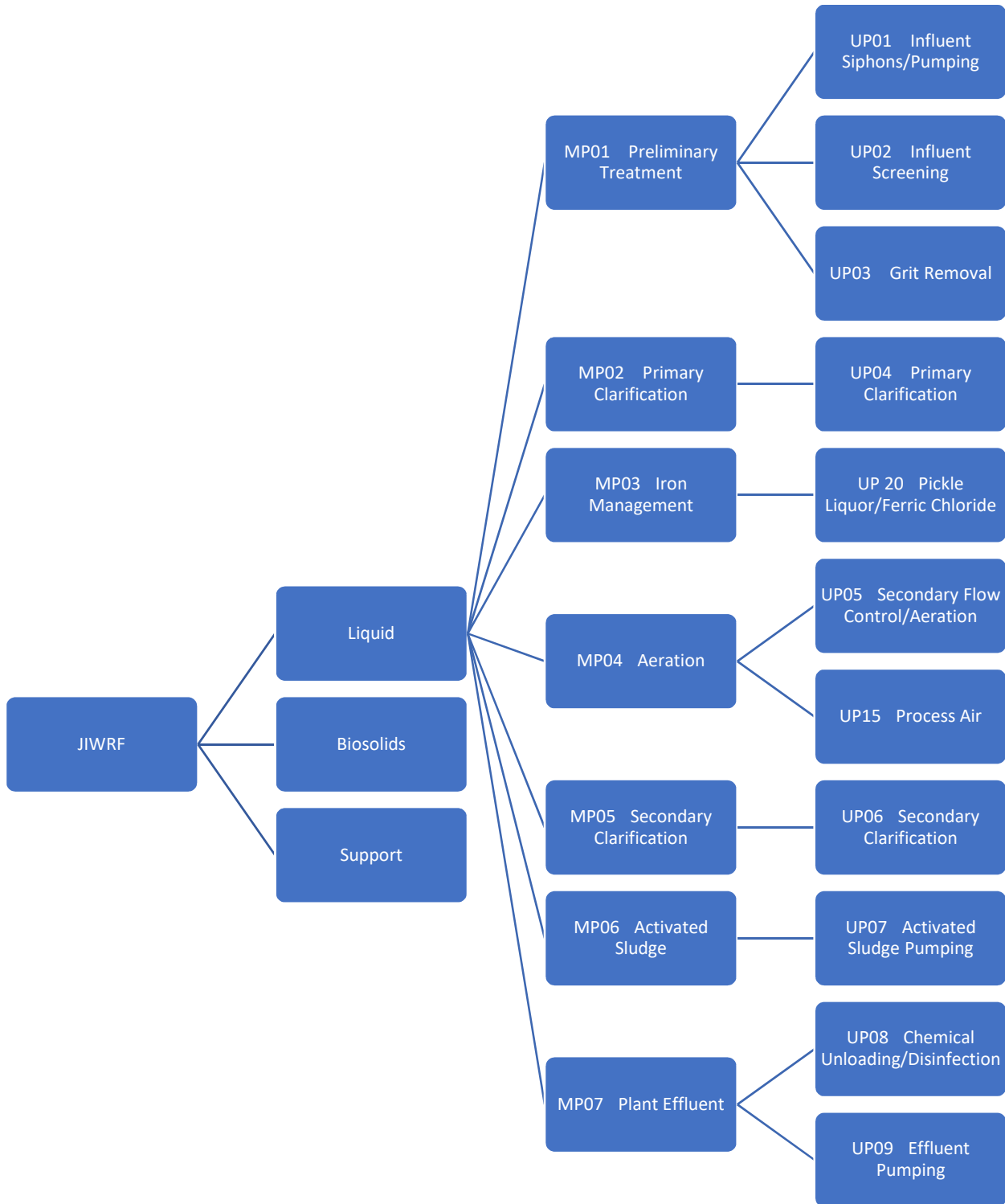
5.11 REFERENCES

- [1] Milwaukee Metropolitan Sewerage District, *Jones Island Operations and Maintenance Manual: Plant Summary and Administration*, Milwaukee, WI: MMSD, 1993.
- [2] Milwaukee Metropolitan Sewerage District, *South Shore Operations and Maintenance Manual: Plant Summary and Administration*, Milwaukee, WI: MMSD, 2016.
- [3] Legislative Reference Bureau, *Wisconsin Administrative Code, Chapter NR 110*, Madison, WI: Legislative Reference Bureau, 2017.
- [4] Health Research Inc., Health Services Division, *Recommended Standards for Wastewater Facilities ("10 States Standards")*, Albany, NY, 2014.
- [5] Wisconsin Department of Natural Resources, "Wisconsin Natural Resources Board Amended Agenda (rev. 10/15/19) Tuesday, October 22, 2019 and Wednesday, October 23, 2019," WDNR, Madison, WI, 2019.

APPENDIX 5B-1: Level Designations Resource for WRF Assessments -

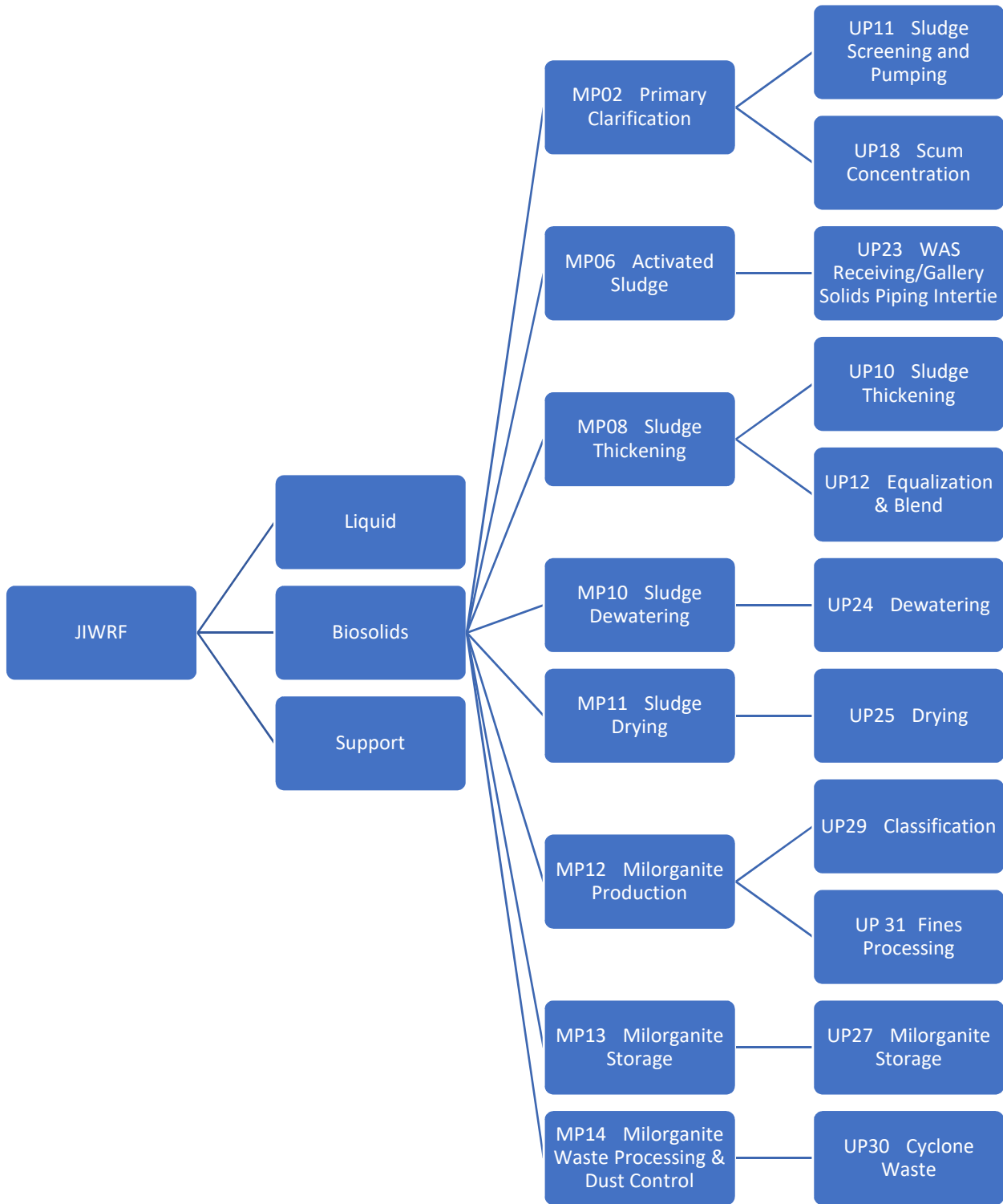
DRAFT

Jones Island WRF: Liquid Facilities Hierarchy -

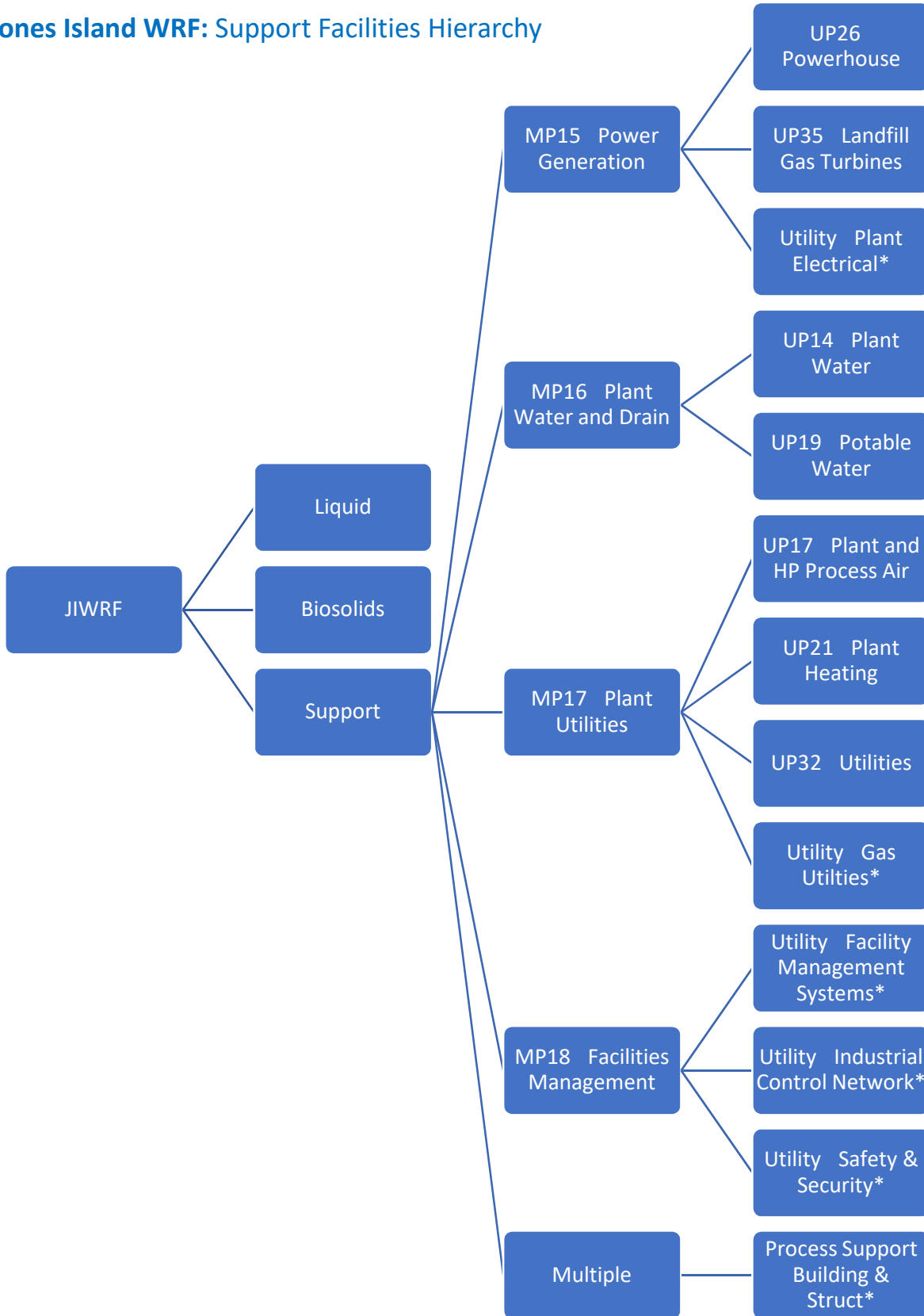


Note: Blending, as shown on the Process Flow Diagram, is not an official UP as it has no assets.

Jones Island WRF: Biosolids Facilities Hierarchy -

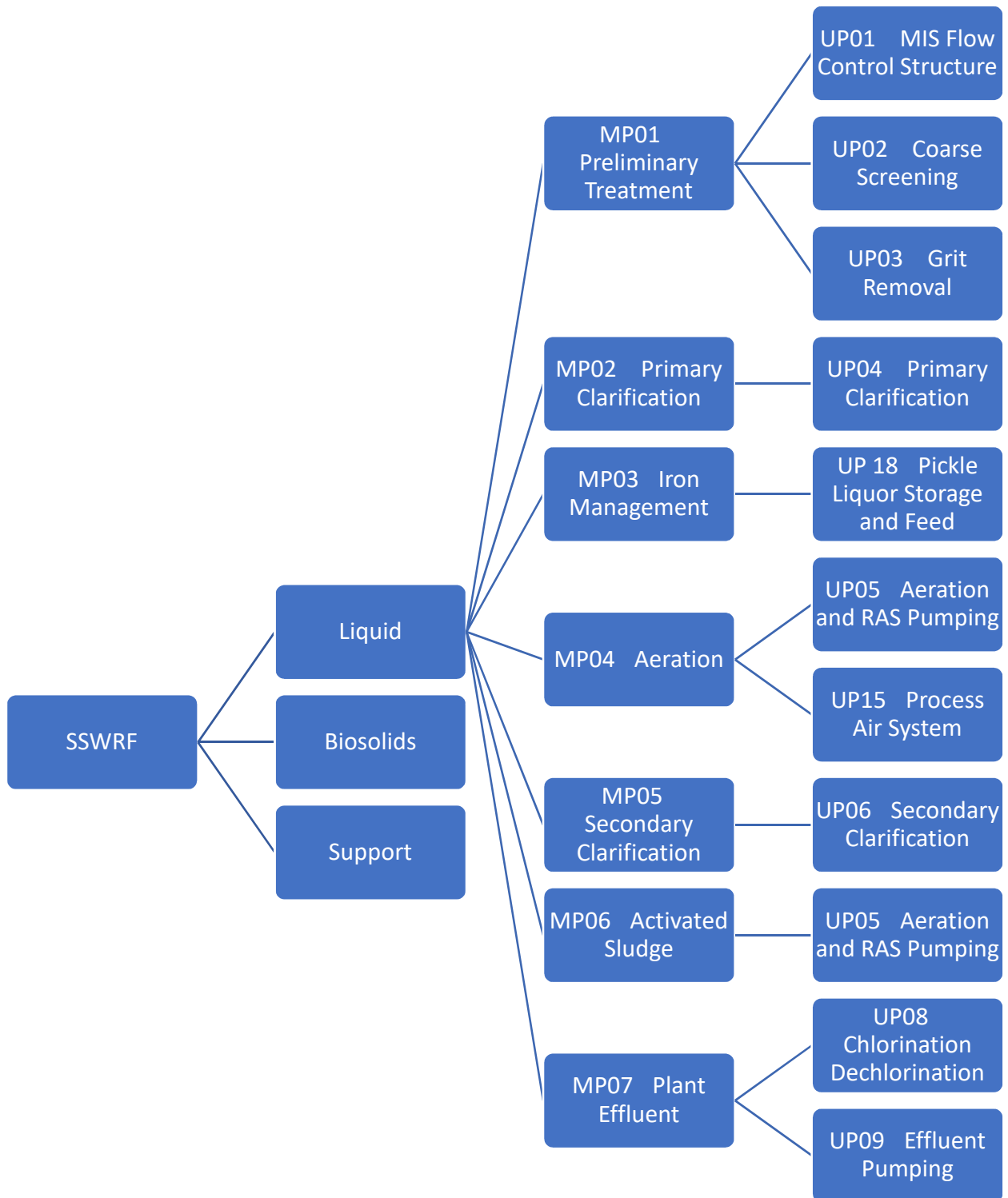


Jones Island WRF: Support Facilities Hierarchy



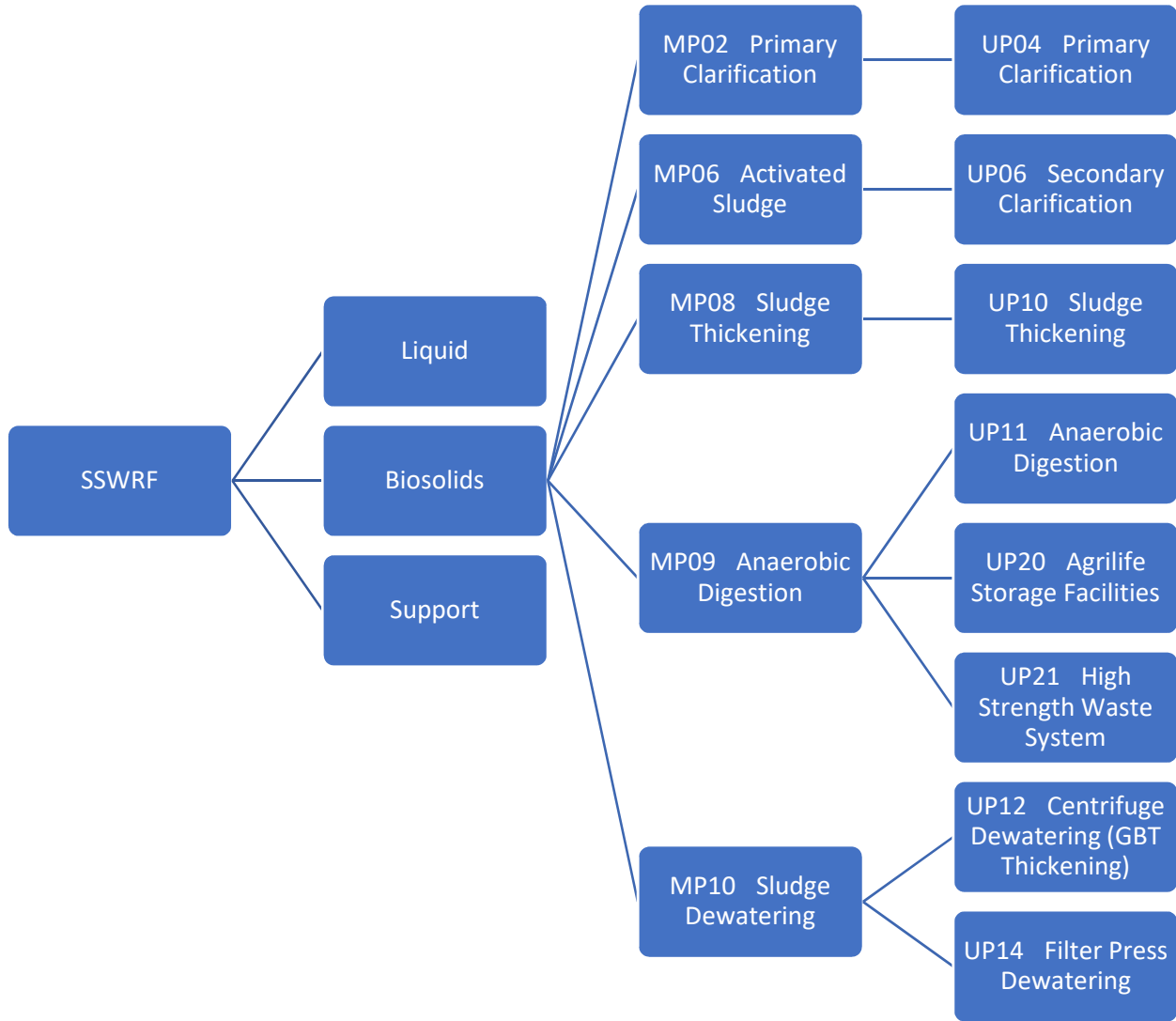
Note: Starred unit process does not have an official UP number.

South Shore WRF: Liquid Facilities Hierarchy -



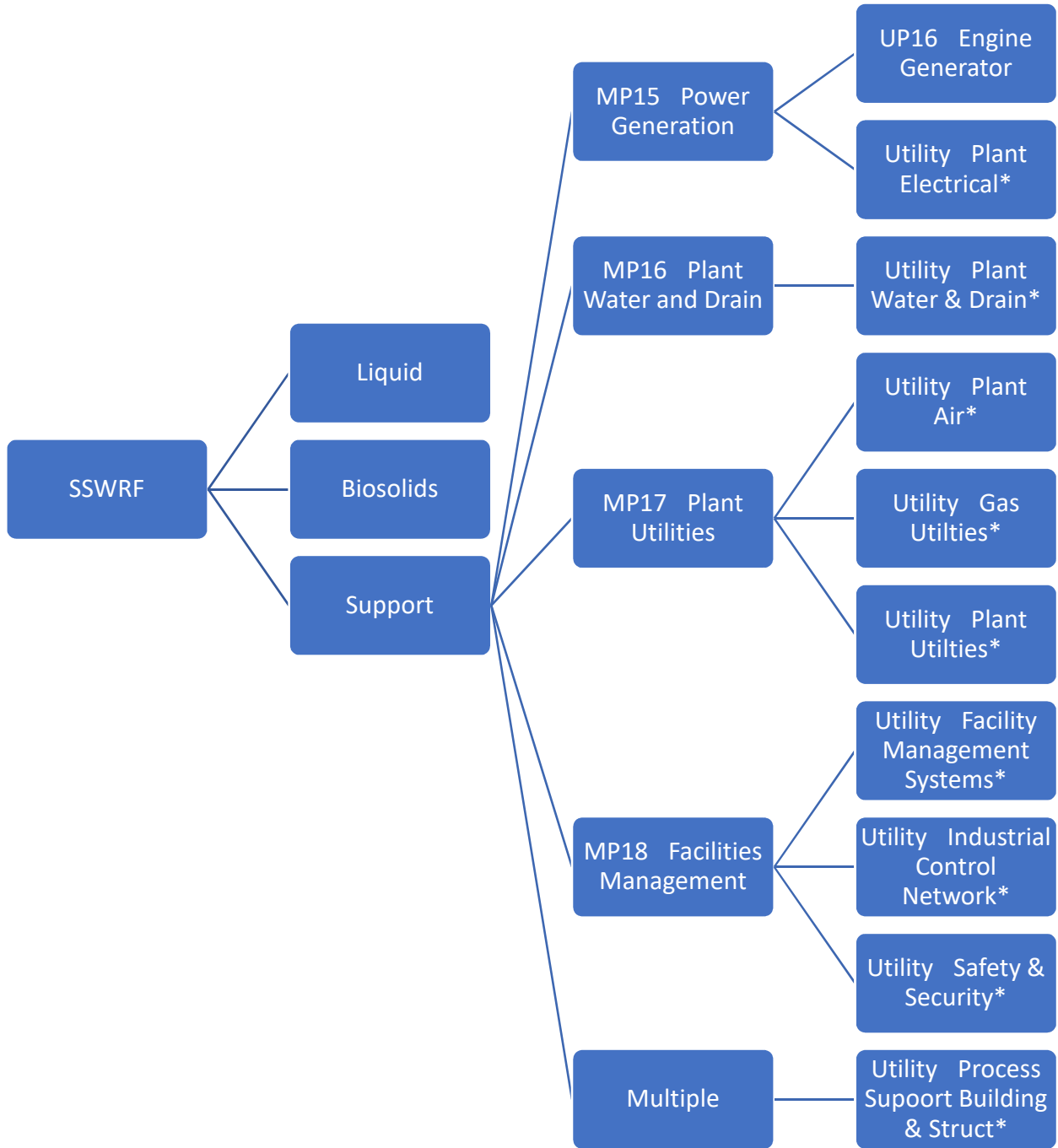
Notes: Blending, as shown on the Process Flow Diagram is not an official UP as it has no assets. UP05 listed under MP04 – is aeration assets. UP05 under MP06 includes RAS assets.

South Shore WRF: Biosolids Facilities Hierarchy -



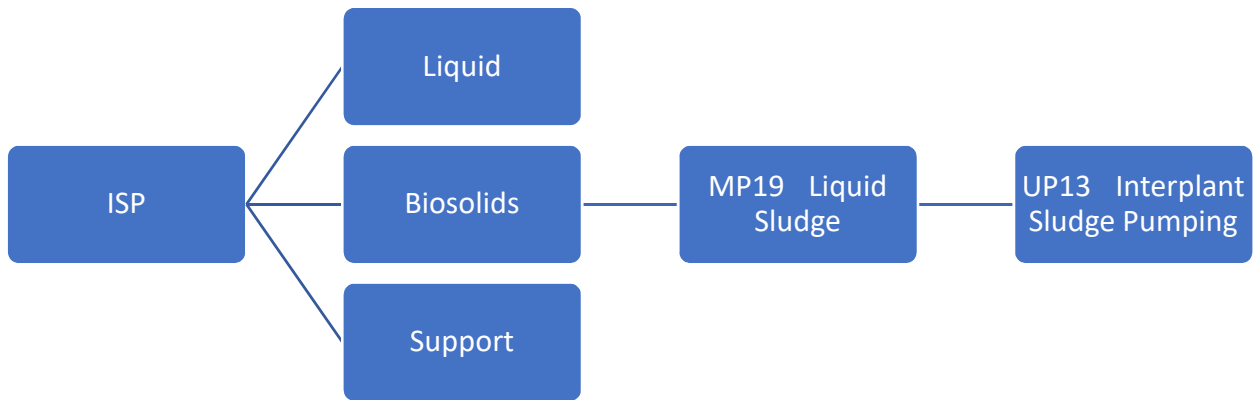
Notes: UP04 assets include primary sludge and scum pumping. UP06 assets include WAS assets. UP12 centrifuge assets are no longer in service, but did not change official name.

South Shore WRF: Support Facilities Hierarchy -



Note: Starred unit process does not have an official UP number. UP19 – Incineration is not listed as there are no assets associated with the UP.

Interplant Sludge Pipeline: Biosolids Facilities Hierarchy -



Note: ISP assets are located at both JIWRf and SSWRF.

APPENDIX 5B-10: WRFs and Biosolids Asset System – Economic Efficiency Risks -

DRAFT

MMSD Asset Management Plan
WRF and Biosolids Asset System
Risk Register - Economic Efficiency Risks

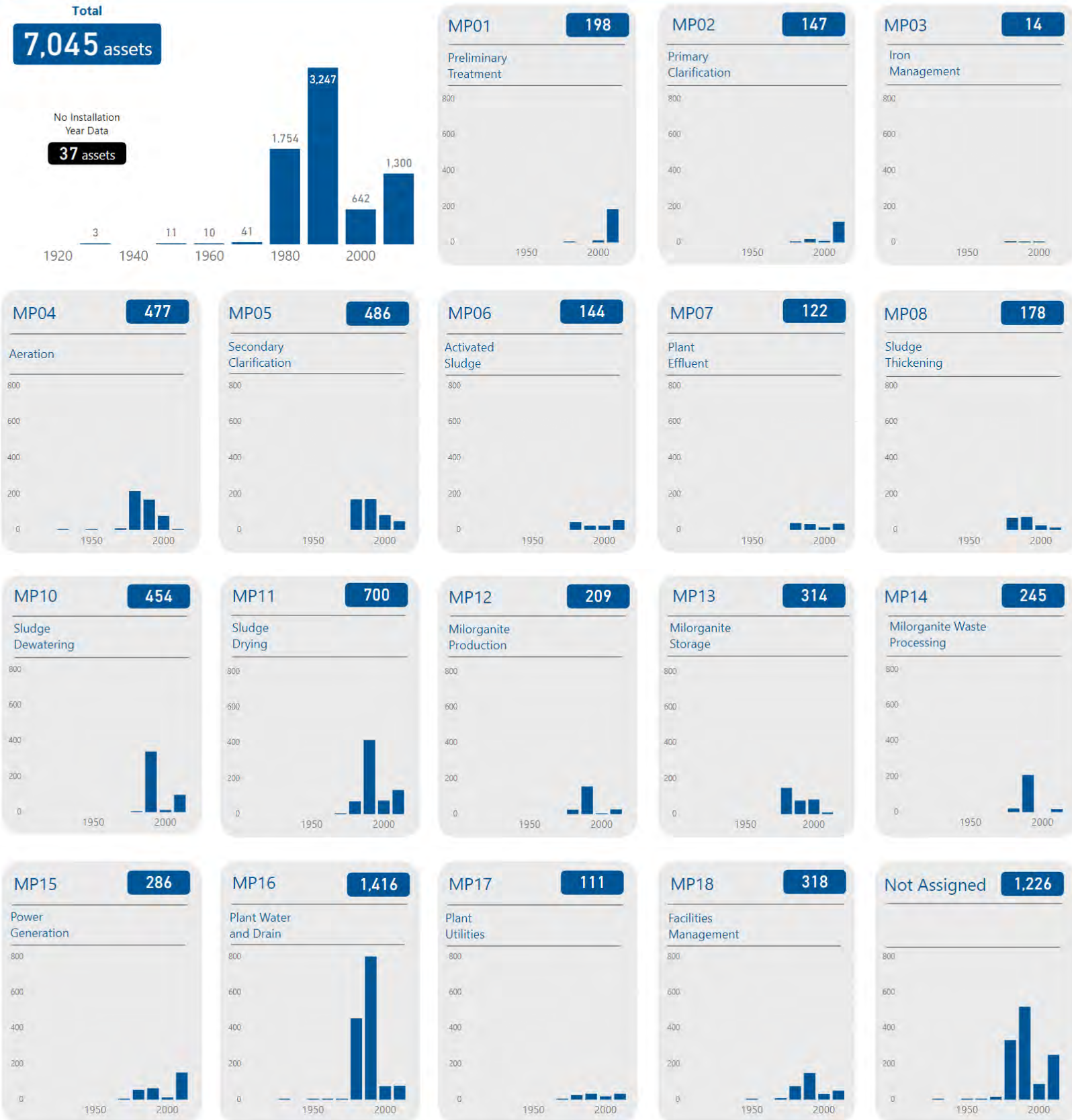
Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R113	Engine generators have high maintenance and high downtime, which is costly and not consistent with MMSD energy goals	multiple issues with generators have resulted in unreliable capacity and waste burning of the excess digester gas	SS - South Shore WRF	generators overhauls, White-Superior major rebuild	High	past /ongoing issues, generators being rebuilt (major failures of occurred in less than 5 years	High	significant Operations cost impact (205K 1M in added elect costs)	Moderate	Economic	Fiscal Responsibility
R261	Lack of more than one Milorganite® packaging/bagging vendor	The lack of more than one packaging vendor presents a risk if the vendor is no longer available or declines to package the Milorganite	JI - Jones Island WRF	Potentially install bagging operation on JI WRF; possible location identified between Thickening and Milorganite storage silos	Medium	The packaging contract is generally bid every 7 years and current vendor may elect not to pursue. In addition it is possible that the vendor may suffer physical damage (e.g. fire) or somehow may not be able to package Milorganite	High	Estimate based on both Fiscal and Operational Risk	Moderate	Economic	Fiscal Responsibility

APPENDIX 5B-2: WRFs and Biosolids Asset Summary -

DRAFT

Jones Island WRF

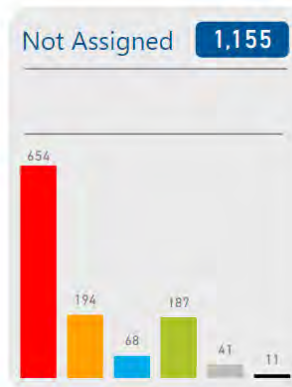
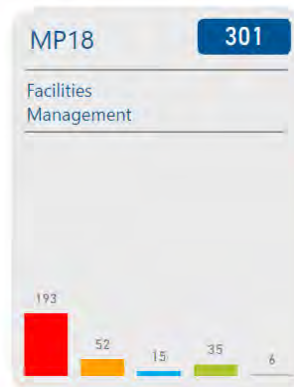
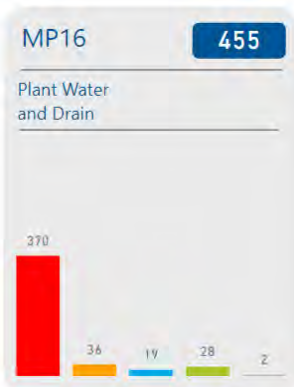
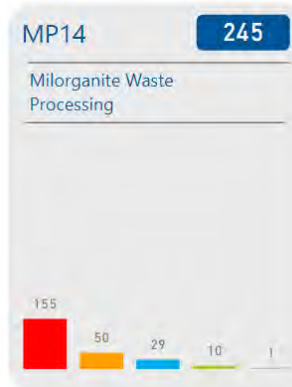
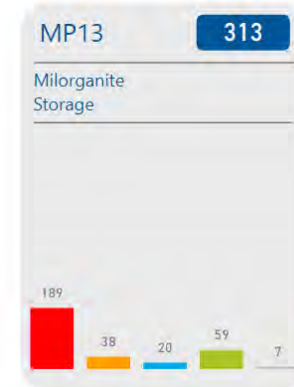
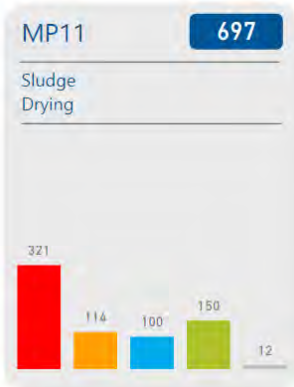
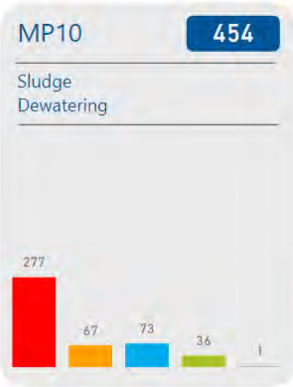
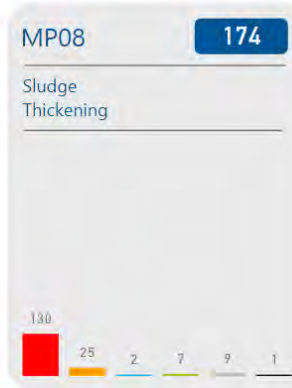
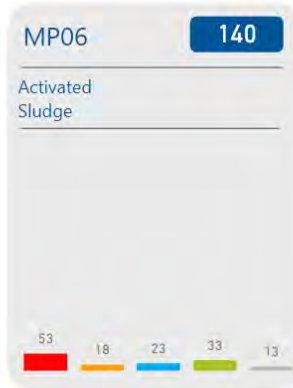
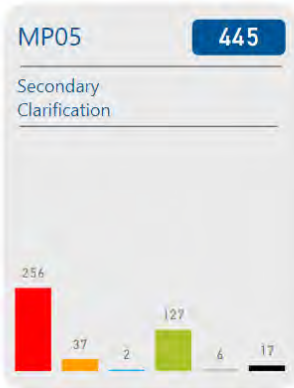
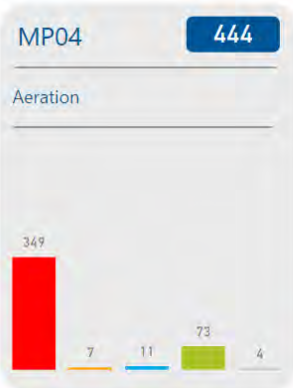
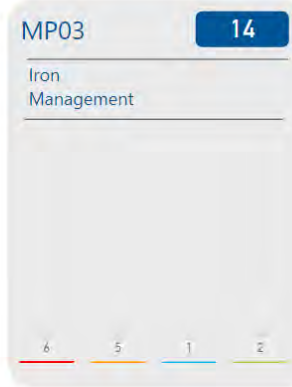
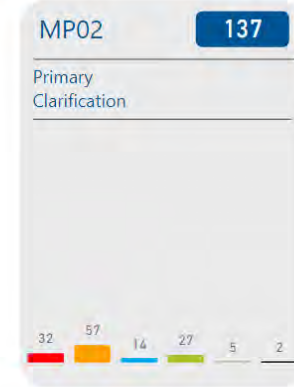
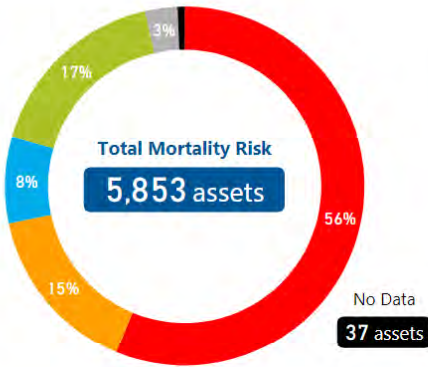
Jones Island WRF: Number of Assets by Installation Decade



Jones Island WRF: Mortality Risk by Major Process (2020 to 2049)

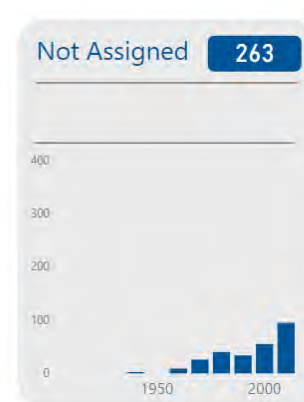
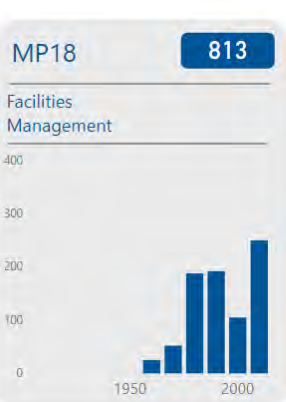
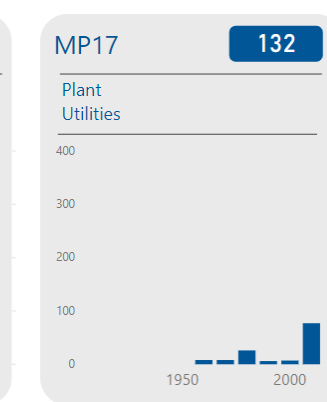
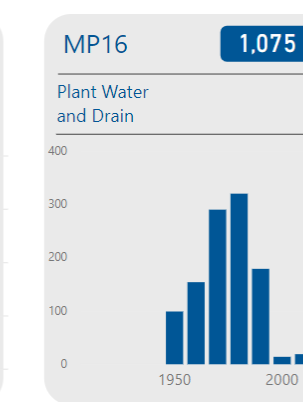
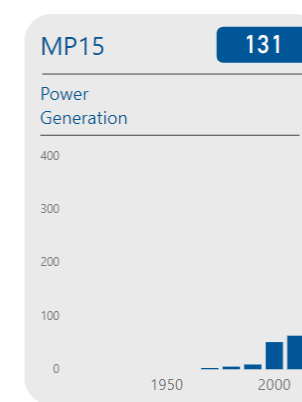
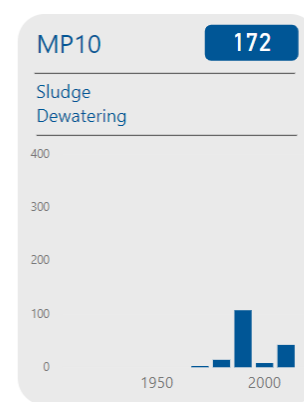
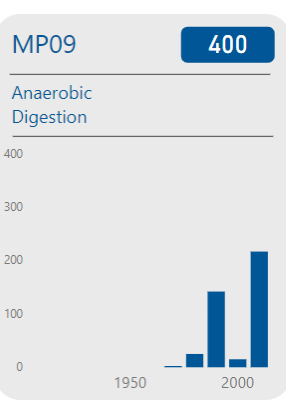
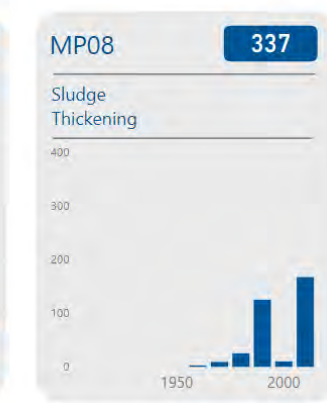
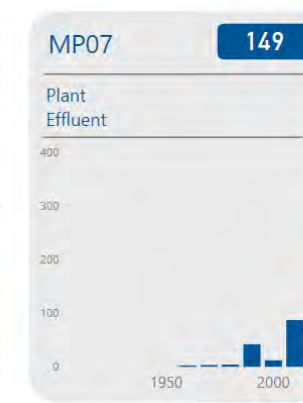
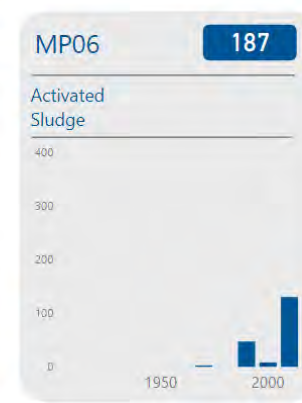
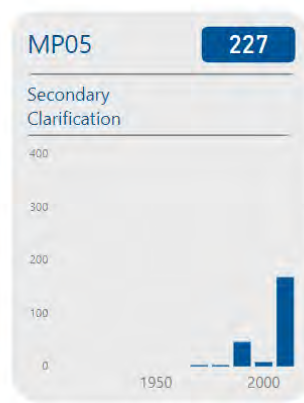
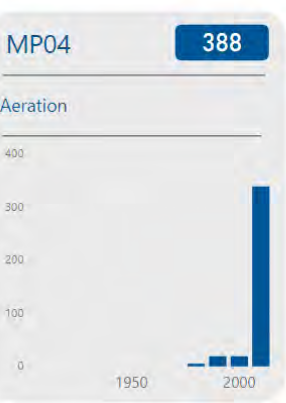
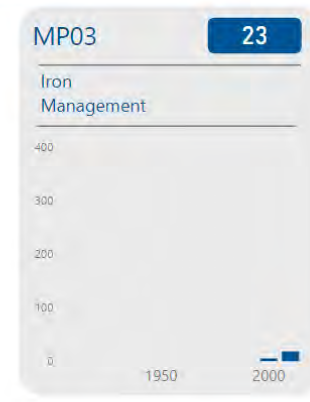
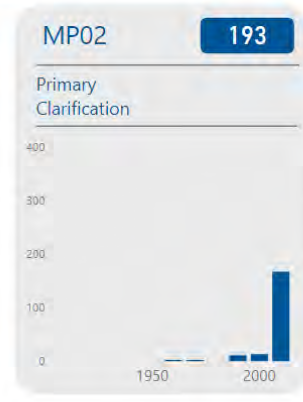
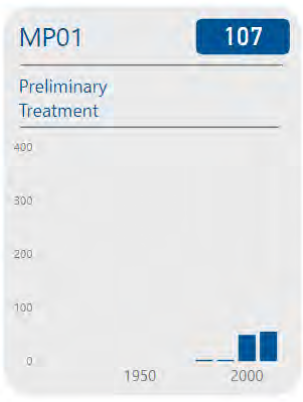
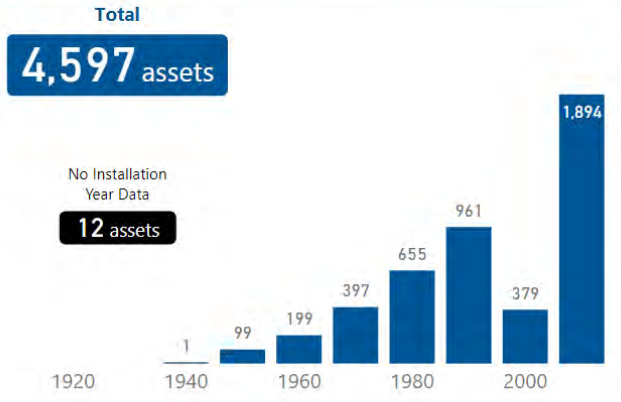


- Before 2020
3,291 assets
- 2020 to 2024
905 assets
- 2025 to 2029
457 assets
- 2030 to 2039
992 assets
- 2040 to 2049
171 assets

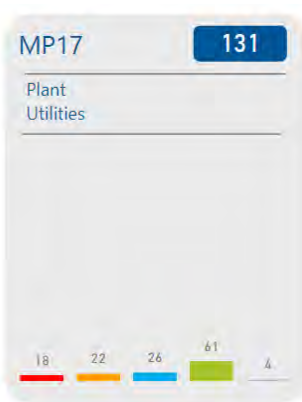
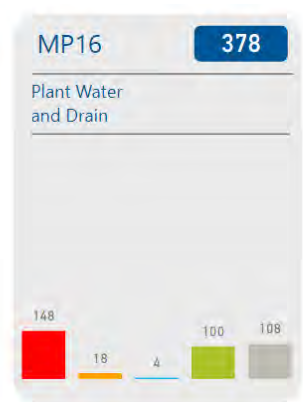
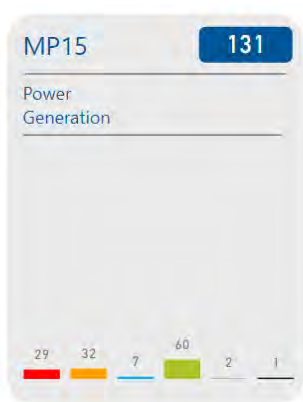
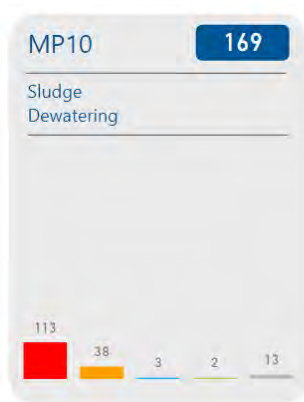
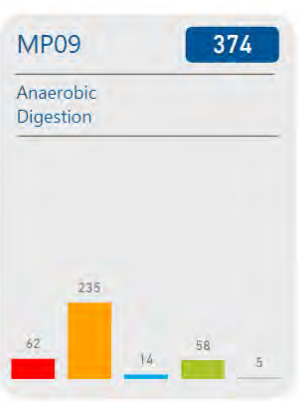
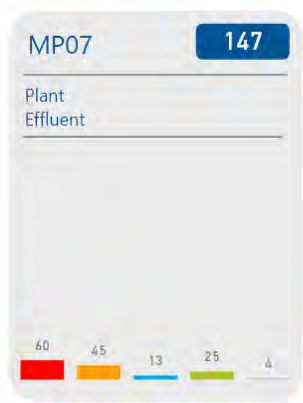
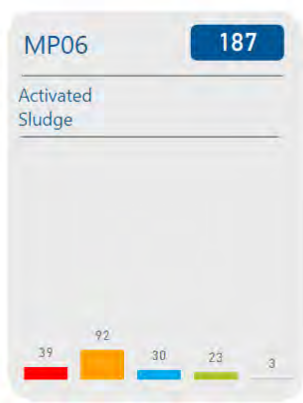
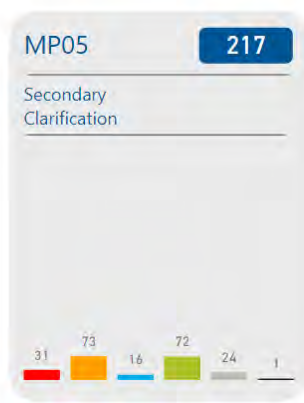
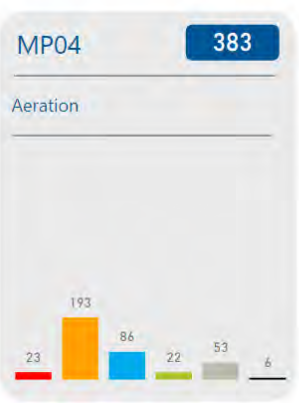
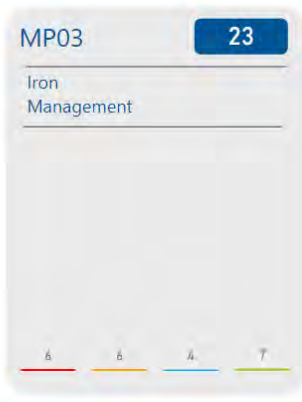
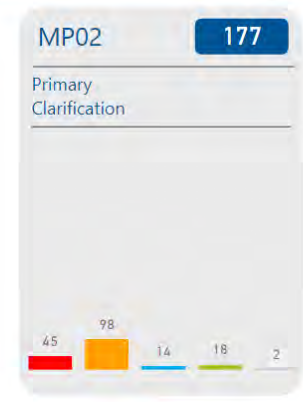
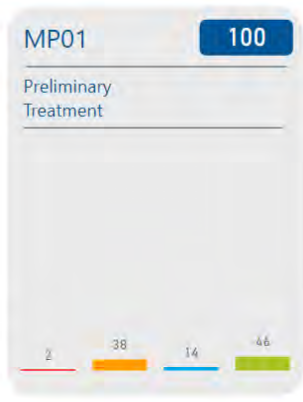
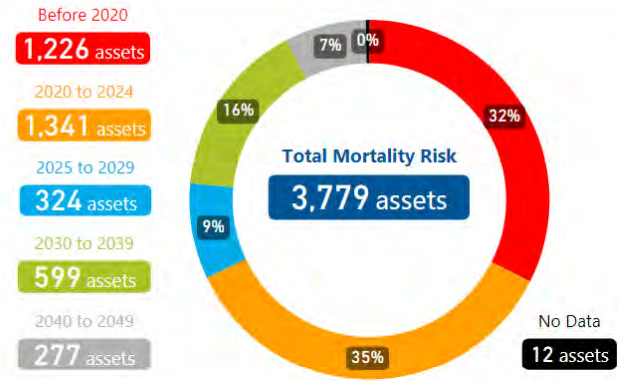


South Shore WRF

South Shore WRF: Number of Assets by Installation Decade

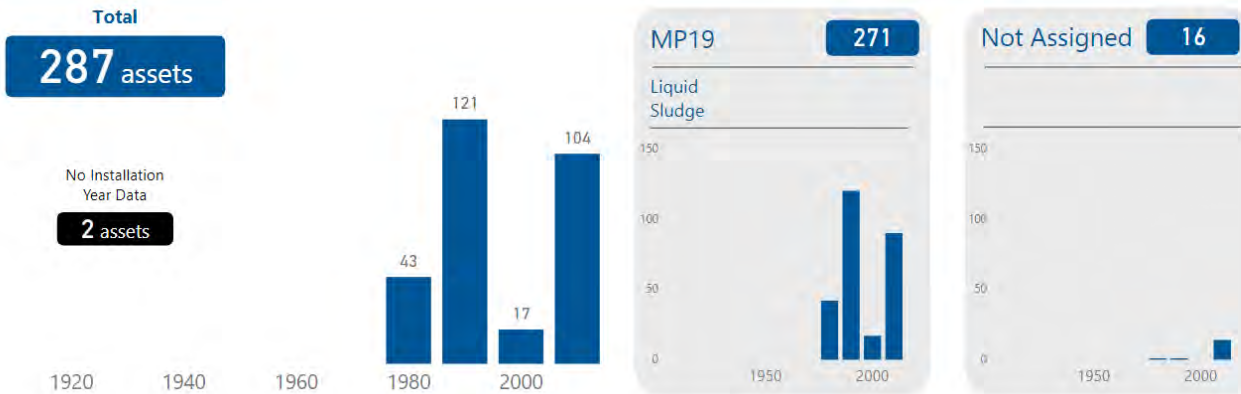


South Shore WRF: Mortality Risk by Major Process (2020 to 2049)



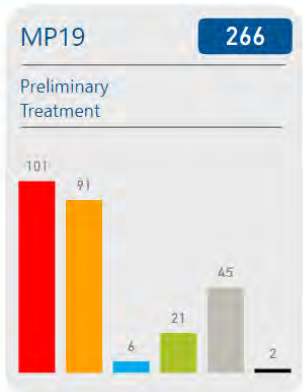
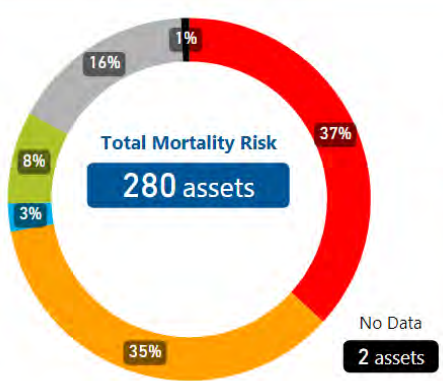
Interplant Pipeline

Interplant Pipeline: Number of Assets by Installation Decade



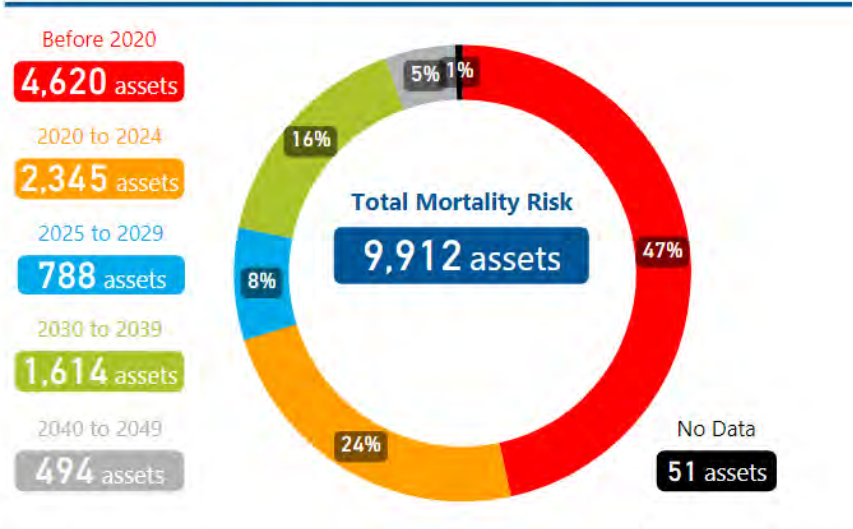
Interplant Pipeline: Mortality Risk by Major Process (2020 to 2049)

- Before 2020
103 assets
- 2020 to 2024
99 assets
- 2025 to 2029
7 assets
- 2030 to 2039
23 assets
- 2040 to 2049
46 assets



WRF Mortality Summary

WRF: Mortality Risk (2020 to 2049)



APPENDIX 5B-3: WRF Risk Register -

DRAFT

MMSD Asset Management Plan
WRF and Biosolids Asset System Risk Register

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R001	Risk of damage to facilities and structures due to ground settlement at JIWRWF West Entrance Ground Settlement	Significant settlement has been observed in the area west of the primary clarifiers at the west JI entrance. This is in the area of the former Harbor Siphons excavation. Settlement has already caused a broken W1 line, damage to pavement and a retaining wall near the clarifiers and could potentially impact other utilities in the area or nearby process facilities.	J1 - Jones Island WRF	A project (emergency?) has been initiated by CCO to perform ground penetrating radar, settlement monitoring and additional investigation to determine the extent and cause of settlement. The area has also been closed off from foot or vehicle traffic.	Very High	Failure of some facilities due to settlement has already occurred and continued settlement is likely.	Medium	Most significant COF - Non-critical systems, facilities, or equipment unavailable for > 7 days (Work arounds available/minor staff inconvenience). Could potentially be Medium COF if costs of investigation and repair exceed \$250,000.	Moderate	Physical Mortality	Fiscal Responsibility
R002	Loss of plant wet weather capacity due to the condition and capacity of Influent Low Level and High Level Pumps	LL Siphons can deliver 140 MGD - controls capped at 110 MGD - impacts CSO and SSO - Both sets of pumps - age, condition and capacity of the pumps vs new siphons, motors not hazardous rated	J1 - Jones Island WRF	operational data & VWM maintenance	Medium	Pumps are functioning and have been rebuilt as needed, there is concern with their current capacity versus their rated capacity (needs verification)	High	Less than full pumping capacity would result in higher volumes and possibly frequency of CSOs. Possible negative coverage or issue being raised by public official.	Moderate	Physical Mortality	Customer Service, Communication and Employee Development
R005	Risk of loss of JIWRWF electrical power due to the condition of substation equipment (Dewey and Harbor)	The District owned assets for the two utility substations (Harbor and Dewey) are possibly near the end of their service life	J1 - Jones Island WRF	HVM Inspections	Medium	need to know details of deterioration/condition concerns	High	failure of one of the substations could impact operation of the plant in particular the starting of a PAC. Potential permit violation or contract non-compliance	Moderate	Physical Mortality	Environmental Improvements
R006	Levels of digester gas siloxane causing damage and reliability issues with SSWRF digester gas engines/systems	siloxane too high to operate the engines	SS - South Shore WRF	Active project to address this risk S04031	High	Event 1-5 years, very high siloxane concentrations experienced in 2015, but apparently back to normal levels?	Very High	M&O effectiveness, > 50% impact on KPI's, inability to operate generators cost of \$4000 per day (demand charge), plus significant cost to repair generators	High	Level of Service	Energy
R009	Loss of plant aeration capacity due to the condition of PACS Air Intake Ductwork	poor condition, reported corrosion failure of exterior cladding	J1 - Jones Island WRF	VWM/CCO will assess this issue	Very High	poor condition - corrosion. If necessary emergency patching would address operational issues	High	If complete failure could impact aeration operation or capacity. Possible permit violation or contract non-compliance.	High	Physical Mortality	Permit Requirements
R010	Structural impact on various tanks on the lakefill at SSWRF due to the inoperable SSWRF south side groundwater dewatering pumps	System does not operate at all - is there risk to damage primary clarifier and aeration basin tanks when they are dewatered	SS - South Shore WRF	VWM to establish/confirm policy to not dewater tanks in winter	Very High	Event pumps OOS ground water dewatering pump station is not operable	High	M&O effectiveness, system not operable, could not fix leaking tank, may prevent dewatering/work in process tanks due to risk of "floating" damage	High	Physical Mortality	Fiscal Responsibility
R014	Increased energy costs due to Aeration air pipes leaks at joints, and pipe condition & exterior painting deteriorated condition	both WP and EP - Several known air leaks at pipe joints, need assessment to determine the condition and risks	J1 - Jones Island WRF	VWM maintenance	Medium	Pipes known to leak. Major joint leak could occur 1-5 yrs.	High	Repair time could impact activated sludge and lead to effluent violation	Moderate	Physical Mortality	Permit Requirements
R015	Risk of damage to the PACs due to the condition of the PACs cooling water control and isolation valves	known issues with PAC cooling water valves, risk unplanned failure and repair. Several valves were replaced under J02008.	J1 - Jones Island WRF	VWM Maintenance	Medium	known issues with valves	High	Repair time could impact activated sludge and lead to effluent violation	Moderate	Physical Mortality	Permit Requirements
R017	Risk that plant process capacity would be impacted due to the condition and capacity of the RAS discharge header piping	Redundant RAS header is not available for service, this spiral steel pipe has known leaks	J1 - Jones Island WRF	capital design project to upgrade the header J02013	Medium	new parallel header installed, leaks are small but may get more severe	High	larger rupture of leaking pipe could cause flooding of equipment-loss of key staff-impacts multiple departments. Negative coverage.	Moderate	Physical Mortality	Multiple LOS
R019	Loss of solids handling capacity and related impacts on the treatment process due to the blended sludge piping and valves condition	possible piping corrosion, valves are not maintainable (?? Not sure about valves)	J1 - Jones Island WRF	Project to assess piping condition J06052 underway	Medium	Poor condition of piping and valves. Failure likely in 5-10 yrs.	High	Possible medium-long term shutdown of D & D to isolate pumps, limited capacity. High impact to operational efficiency.	Moderate	Physical Mortality	Fiscal Responsibility
R020	Loss of solids handling capacity and related impacts on the treatment process due to the blended sludge booster valves condition	valves seal failures, valves not maintainable??	J1 - Jones Island WRF	VWM Maintenance	Medium	Poor condition of piping and valves. Failure likely in 5-10 yrs.	High	Possible medium-long term shutdown of D & D to isolate pumps, limited capacity. High impact to operational efficiency.	Moderate	Physical Mortality	Fiscal Responsibility
R025	Risk of negative overall capacity, cost and process impacts due to the reliability and/or condition of the WAS receiving pumps	Three pumps system with need to operate two - repair parts not supported by manufacturer (Wemco)	J1 - Jones Island WRF	Being evaluated in current IPS upgrade project	Medium	pumps have history of failing	High	would impact blended sludge and D&D operation, repair / replacement could be long lead time. High impact to operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R026	Risk of negative impact to operations due to condition and reliability of the Interplant sludge pumping systems	failures / issues with piping, pumps, valves, supporting equipment	IP - Interplant Pipeline	Evaluate during near future IPS upgrade project	Low	J1 IPS pump station has available redundancy	High	would prevent pumping primary sludge to SSWRF, impact Milorganite production and MMSD/VWM biosolids costs	Moderate	Physical Mortality	Fiscal Responsibility
R031	Risk of negative solids handling and cost impacts due to a potential failure of the D&D belt filter press polymer feed system (including bulk tanks, skid pumps, batch mix tanks, transfer pumps, piping) and associated control systems.	instrument issues with solution level monitoring and control, past feed pump failures. The last few years, ultrasonic and radar level technologies have experienced intermittent interruptions in signals that have led to batch tank problems that lead to dewatering issues that will in turn impact dryer operations. The impacts are systemic and impact all dryers. Potential risk of upset of D&D via loss of filter cake production.	J1 - Jones Island WRF	redundancy/work arounds, MCRR 880 polymer transfer pump #1 replacement, MCRR 889 polymer feed pump #3 replacement	Very High	estimate failure within 5-10 years	Medium	Non-critical component of system with manual workarounds available	Moderate	Physical Mortality	Management Effectiveness
R035	Risk that dryer operations would be negatively impacted at each belt feed for multiple dryers due to inoperability of D&D sludge cake belts lift tables and v-plows	This equipment has required continuous repairs the last few years per Veolia and has reached the end of the component useful life due to corrosion and wear. Replacement with new equipment is required so the material split between dryers functions as intended and stabilizes dryer system operation.	J1 - Jones Island WRF	RFP in progress J04060	Very High	known/past issues	Medium	Sufficient redundancy within BFP system exists that such that failure of equipment warrants a low risk to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R036	Solids handling, safety and cost impacts from the condition of D&D sludge cake bypass, feed, transport belts and belt scales BE-24-88-1...2, BE-24-85-1...6. Without functioning belt conveyors, dryer operations impacted as transport belts and scales impact multiple dryers. BE-24-83-1...6	Belts and belt scales have experienced bearing corrosion, VFDs may be undersized. Recent (last few years) metering belt failures have impacted dryers operation directly. This RR entry is associated with the condition of T037 equipment (tables) which is operates with the belts and scales.	J1 - Jones Island WRF	RFP in progress J04060. North cake bypass belt replaced under MCRR in 2015	High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R037	Solids handling, safety and cost impacts from the condition of D&D sludge cake feed/metering belts plows, B-24-83-1...6, B-24-85-1...6. Without functioning tables and plows, dryer operations impacted as each belt feeds multiple dryers.	This equipment has required continuous repairs the last few years per Veolia and has reached the end of the component useful life due to corrosion and wear. Replacement with new equipment is required so the material split between dryers functions as intended and stabilizes dryer system operation. Linked to condition of T036.	J1 - Jones Island WRF	J04060: Sludge Cake Transport. Total Construction Budgeted: \$3.45MM	Very High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Management Effectiveness
R039	Risk of necessity to implement emergency operations and the corresponding cost impacts due to the insufficient capacity of the D&D sludge cake bypass belt to process all dewatered biosolids in the event that the south side system goes offline	Risk of losing backup biosolids processing alternatives. Operational functionality and flexibility (potential to impact half of BFP production). Right now, there is only 1/2 of the facility with the capability of dewatering biosolids and removing from the building (south).	J1 - Jones Island WRF	District planning action	High	known/past issues	High	Loss of belt does not prevent solids processing. Time for repair should be relatively short (less than 7 days)	Moderate	Capacity	Environmental Improvements
R041	Solids handling, safety and cost impacts from the condition of D&D belt filter press wash water pumps and booster pumps P-24-70-1...3	The risk is these pumps are required to operate the BFPs wash water boxes so if all the pumps are of service, all 24 BFPs and dewatering operations are out of service. 3 pumps exist, two have failure issues, one rebuilt, one to be replaced.	J1 - Jones Island WRF	MCRR 868 wash booster pump #1 replacement, MCRR 870 wash booster pump #2 replacement, These MCRR's do not show up on the present list of MCRR's. Kevin J to add to RFP or create separate project if on-call is used and SOW is too big. Included in Project J04060	Very High	known/past issues	High	Pump failure has direct impact on BFP management and operational effectiveness, but redundancy of pumps and relatively short repair time reduces risk to medium.	High	Physical Mortality	Management Effectiveness
R042	Capacity, solids handling, safety and cost impacts from the condition of D&D Dryer Feed Screws S-25-7-3,4,8-11. Failure of one piece of equipment impacts entire dryer train availability.	The feed screws are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a screw, you lose the dryer train. The screws are in near constant use with regular wear and tear and six of the screws are slated for replacement in an ongoing capital project J04050.	J1 - Jones Island WRF	MCRR 885 #1 Repairs, MCRR 886 #5 Repairs, MCRR 887 #7 Repairs, MCRR 938 #8 Repairs, MCRR 939 #12 Repairs, all 12 screws replaced with new equipment in mid 2000s. J04006C01 in 2004 J04050: Dryer Feed and Discharge Screw Replacement. Total Construction Budgeted: \$2.85MM Advertising for bids Aug 2017 Construction 2018/2019. Coordinate with burner replacement.	High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a medium risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R044	Capacity, solids handling, safety and cost impacts relating to the condition of D&D dryer drum lifting irons, A B and F blades, and bottles. Failure of one piece of equipment impacts entire dryer train availability.	The dryer internals are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a dryer due to the internal components, you lose the dryer train. Wear to blades and bottles. Liner is wearing at inlet and discharge ends	J1 - Jones Island WRF	Potential (future) MCRR's - ABF blades	Very High	known/past issues	Medium	dryer drum failure has direct impact on dryer system management and operational effectiveness, but relatively short repair time and frequent planned maintenance activities reduces risk to low.	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R045	Capacity, solids handling, safety and cost impacts relating to the condition of D&D dryer burner systems. Failure of one piece of equipment impacts entire dryer train availability.	The dryer burners are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a burner, you lose the dryer train. The burners are original (1990s) and require upgrade burners and components to burn landfill gas, failure risks loss of ability to fire dryer system on natural gas and potential dryer shutdown	Jl - Jones Island WRF	J06061D03 - Engineering Services Jl WRF Milorganite Dryer Burner Upgrade Project VWM to provide new burner assessment. Total Construction Budgeted: \$7.09MM 2018 design - upgrade dryer will replace LCP's and PLC's but will NOT replace complete burner package in dryers that are not selected to burn LFG	Medium	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R047	Capacity, solids handling, safety and cost impacts relating to the loss of waste heat control due to the condition of D&D Dryer Waste Heat Guillotine Gates and FV-25-4-1...12-1. Failure of one piece of equipment impacts entire dryer train availability.	The dryer waste heat gates and blowers are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a gate or blower, you lose the dryer train. Numerous gate and damper failures (#4, #10, #6) have taken place in the last couple of years due to corrosion and moisture, successful gate operation is a requirement for dryer PM activities	Jl - Jones Island WRF	MCRR 786 WH guillotine damper removal, MCRR 844 guillotine #6 replacement, REMOVE LARGE DAMPER TWO SEPARATE PROJECTS	High	known/past issues	Medium	Failure of waste heat guillotine gate poses risk of temporary disability or serious illness to staff entering dryer during PM activities.	Moderate	Physical Mortality	Management Effectiveness
R048	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Dryer Drives, Trunnions, Seals, Tires, Bull Gear, and Gear Box Drives: M-25-9-1...12. Failure of one piece of equipment impacts entire dryer train availability.	The dryer drives are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a drive component, you lose the dryer train. Drives and gear boxes are essentially original equipment and are reaching end of their service life.	Jl - Jones Island WRF	MCRR #7 trunnion repairs, J04017 DONE MCRR 979 and 1001 to test tires on 6, 10, and 11 Ask VWM for assessment of drums	Medium	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R049	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Dryer Feed Mixer Feed Screw Conveyors S-25-26-1,3-9,11,12. Failure of one piece of equipment impacts entire dryer train availability.	The feed mixing screws are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a screw, you lose the dryer train. The screw housings and many screw augers are original and have experienced high wear and corrosion item requiring frequent maintenance.	Jl - Jones Island WRF	MCRR 823 dryer #10 mixer screw MCRR 1019 Construction J04050 - construction start 12/2017	Very High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Management Effectiveness
R051	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Dryer Add Back Screws S-25-27-1...12. Failure of one piece of equipment impacts entire dryer train availability.	The add back screws are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a screw, you lose the dryer train. The screw condition is OK at this time but age may be issue	Jl - Jones Island WRF	Potential (future) MCRR	Low	known/past issues	Low	non-critical system component with relatively short time required for repairs (<7 days)	Moderate	Physical Mortality	Management Effectiveness
R052	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Dryer Discharge Screws S-25-24-1...12. Failure of one piece of equipment impacts entire dryer train availability.	The discharge screws are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a screw, you lose the dryer train. Screws are worn and original and require replacement to ensure dryer train operation.	Jl - Jones Island WRF	J04050 Dryer Feed and Discharge Screw Total Construction Budgeted: \$2.85MM MCRR 1011, 1013 Construction	High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R053	The poor condition of D&D Dryer Exhaust Ducting may limit capacity and dryer availability and represents a potential safety hazard. Failure of one dryer exhaust duct section impacts entire dryer train availability.	Dryer exhaust ducting is critical to drying operation and air permit compliance. The condition has been inspected and found to contain localized corrosion and loss of base metal. Process impacts of issues such as safety concerns - corrosion pitting duct and potentially impacting dryer availability. The alternative to discharging through the duct is up out the building roof for dryer exhaust until the duct can be repaired or replaced.	Jl - Jones Island WRF	J04058: Dryer Exhaust Evaluation. Preliminary Engineering: \$214,866 RFP for repairs, MCRR 798 dryer exhaust duct repairs and J04057C01 7th Floor Vent Header Repair	Very High	Several recent leaks over 5-10 years, current project with MMSD and VWM is evaluating cause of corrosion spring 2016	High	potential air permit violation (<1 wk.) with temporary manual workaround	High	Physical Mortality	Safety
R054	Condition of the D&D elevators	Maintenance and operations activities impacted by lack of access or delayed equipment and materials access for repairs and PMs.	Jl - Jones Island WRF	J04040 Elevators	Very High	known/past issues	Low	non-critical system component with relatively short time required for repairs (<7 days)	Moderate	Physical Mortality	Management Effectiveness
R055	D&D Cyclone Dust Rotary Air Lock Valves are unreliable and failure could cause trapping of chaff creating a fire hazard. Failure of the valve impacts entire dryer train availability. M-25-15-1...12-2	The cyclone rotary valves are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a cyclone dust system, you lose the dryer train. Impacts on air emissions, etc. from hole in housing, shear pin issue, risk of dryer system shutdown if no means available to dispose of chaff, trapped chaff could reach temperatures that would pose a fire hazard, Safety Consequences.	Jl - Jones Island WRF	Chaff (Cyclone Waste) 2018 project request for 24 cyclone separators. In J04064 scope of work.	High	known/past issues	Very High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Safety
R057	Risk of excessive power consumption and potential air permit non-compliance due to the condition, performance and power use of D&D wet ESPs	air permit compliance and dryer system shutdown	Jl - Jones Island WRF	MCRR 925 #1 repairs - done 3/17	High	known/past issues	Very High	WESP are key to air permit compliance. Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Permit Requirements
R058	Wet ESPs may have excessive power consumption and may not be performing adequately risking air permit violation. Failure of one piece of equipment impacts entire dryer train availability.	The dryer ESPs are a one to one correlation with the ability to operate a dryer train. Risk is if you lose an ESP, you lose the dryer train. Air permit compliance and dryer system shutdown. Capacity, solids handling, safety and cost impacts relating to the performance and power use of wet ESPs transformers, rectifiers, air purge compartments insulator, probes, lower mist eliminator, vessel, and grout.	Jl - Jones Island WRF	Chaff (Cyclone Waste) 2018 project request covers WESP Repair Work. J04064 greets ESP bases. Repairing mist eliminators improved performance. Rectifiers replaced as needed by MCRR.	High	known/past issues	Very High	WESP are key to air permit compliance. Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Management Effectiveness
R060	ID Fans are becoming unreliable. Fan is required for dryer operation. Failure of one piece of equipment impacts entire dryer train availability. M-25-17-1...12	The dryer ID fans are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a fan, you lose the dryer train. Fan condition and reliability - impact on dryer availability - e.g. Fan #3 needs replacement. Capacity, solids handling, safety and cost impacts relating to the condition of D&D dryer induced draft fan motor and VFD.	Jl - Jones Island WRF	J04046: D&D Energy Conservation Efforts. Total Construction Budgeted: \$1.2MM, Scheduled for April 2018 MCRR 884 #3 ID fan repairs - complete	High	known/past issues	High	Consider revising scope of work for J04046, fan VFD's, to include replacement of fans if needed. Consider performance of cyclones in the evaluation	Moderate	Physical Mortality	Management Effectiveness
R062	Poor condition of ID fans inlet damper risks failure of inlet damper and shutdown of dryer. Failure of one piece of equipment impacts entire dryer train availability.	The dryer dampers are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a damper, you lose the dryer train. Original equipment nearing end of useful life, loss of control of dryer air flow. Capacity, solids handling, safety and cost impacts relating to the condition of D&D dryer induced draft fans inlet damper.	Jl - Jones Island WRF	Chaff (Cyclone Waste) 2018 project request. Being evaluated under J04064.	High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R063	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Recycle Bin Bucket Elevators BE-25-43-1...4	These four are the heart of the recycle system as far as feeding the recycle bins. One of each pair of two BE is required to maintain building capacity and operation. Two BE are being replaced and 2 are ~12 years old. Product material handling, impacts on disorganize production.	Jl - Jones Island WRF	J04041: Milorganite Facilities Improvements - Phase 3 covers BE #1 and #2 construction starts 2017. Total Construction Budgeted: \$4.6MM MCRR 930, 960 Completed elevators have been repaired and replaced in recent projects	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R066	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Main Recycle Air Belts B-25-63-1...3, belts are vital to recycle system operation.	These four belts are critical to the recycle system. One of each pair of two belts is required to maintain building capacity and operation. They have a critical impact on Milorganite production and if two on any side are out, 1/2 of capacity is impacted.	Jl - Jones Island WRF	J04051: Main Recycle Air Belt Feed Screw Replacements: Total Construction Budgeted: \$613,107 MCRR 923, 934, 961 Completed remainder should be replaced in 5 years	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R067	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Main Recycle Screws S-25-41-3...4, screws are key components of entire recycle operation.	These four screws are vital to the recycle system. One of each pair of two screws is required to maintain building capacity and operation. Impact on Milorganite production, if two on any side are out, 1/2 of capacity is impacted.	Jl - Jones Island WRF	J04041: Milorganite Facilities Improvements - Phase 3 covers conveyor S-25-41-3...4. Total Construction Budgeted: \$5.1MM MCRR 862, 944 Completed drop chuted replaced in 2004 with corrosion and wear resistant materials (J04066C01), current OK although dust collection plugs routinely. J04036C01 completed in 2015, MCRR 790 recycle screw conveyor #2 repairs, MCRR 862 main recycle screw #4 repairs, #1 replaced under J04036C01 in 2016, #2 replaced under J04043 in 2016	Low	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R068	Condition of D&D Dryer Recycle Feed Screws and gates S-25-28-1...12. Failure of one piece of equipment impacts entire dryer train availability.	Impact on Milorganite production and dryer system operation	Jl - Jones Island WRF	Potential (future) MCRR's	Medium	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R069	Condition of D&D Recycle Bin Discharge Screws S-25-58-1...2	Risk is impact to recycle system as 100% redundancy with 2 screws. The base of screws wearing out at discharge, should be lined, gates jam.	Jl - Jones Island WRF	#1 and #2 will be replaced under J04041, MCRR 913 recycle bin discharge conveyor #1 replacement, MCRR 914 recycle bin discharge conveyor #2 replacement	Very High	known/past issues	Very Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R070	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Classification Bucket Elevator Feed Screws S-25-60-1...2	Risk is impact to recycle system as 100% redundancy with 2 screws. Screw troughs worn, bucket elevator opening size restriction/choke point.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM, Scheduled 2018/2019 J04056, MCRR 1031 approved for temporary repairs to S-25-60-1, J04052 in 2018. Repairs or MCRR's as necessary	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R071	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Classification Bucket Elevators BE-29-6-1...2	Risk is impact to classification system as 100% redundancy with 2 bucket elevators. BE ability to delivery rated capacity has been an issue last few years, the dust pickup system has moisture/plugging issues, need upgrade for dust collection, housings and chutes in very bad condition.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM J04056 in 2018. MCRR 881: BE #1 Repairs	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R072	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage Surge Bin Feed Screws S-29-7-2	Risk is impact to classification system as 100% redundancy with 2 screws. Screws show high wear item submitted to constant use, housings past useful life.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM #1 drop hatch replaced in 2005, should be replaced within 5 years, feed screw 2 will be replaced under MCRR 899	Medium	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R073	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage Screener Feed Screws S-29-10-1...2	Risk is impact to classification system as 100% redundancy with 2 screws. Original equipment nearing end of useful life	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R076	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 1st Oversize Leveling Screws S-29-17-1...2	Risk is impact to classification system as 100% redundancy with 2 screws. Failure risks loss of mill operation.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Medium	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R078	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Wet Recycle Screws S-29-27-1...2 S-29-28-1...2	Risk is impact to classification system as 100% redundancy with 2 screws. Loss of ability to return milled oversize	Jl - Jones Island WRF	J04041: Milorganite Facilities Improvements - Phase 3 covers S-29-28-1...2. Total Construction Budgeted: \$5.1MM 2 replaced and the other 4 in process, J9491 will replace #1 and #2 J04043 in 2015	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R080	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Cooler Transfer Screws S-29-63-1...2	Risk is impact to Milo product delivery system as 100% redundancy with 2 screws. Original, submitted to frequent use. patches on the housing, discharge gate to product cooler feed screw 2 leaks when trying to transfer to product cooler feed screw 1.	Jl - Jones Island WRF	Potential (future) MCRR's - Feed screw 1	High	known/past issues	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R082	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Coolers M-29-68-1...2	Risk is impact to product delivery system as 100% redundancy with 2 Coolers. Wear and leaking, maintenance requires a dangerous lift, substantial wear expected within 5 years	Jl - Jones Island WRF	J04059: Milorganite Product Cooler Replacement. Complete replacement of Cooler #2, Replacement of Cooling shell in #1. Total Construction Budgeted: \$1.47MM. Work Complete 2017 MCRR 942 Completed MCRR 1032 Construction product coolers rotors replaced in 2001-02, upcoming MCRR 942 for coolers, spare rotor available.	High	known/past issues	Very High	due to high maintenance requirements of cooler systems and long maintenance time required, redundancy is often compromised, resulting in a very high risk of failure to management and operational effectiveness.	High	Physical Mortality	Management Effectiveness
R083	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Bucket Elevators BE-29-74-1...2	Risk is impact to product system as 100% redundancy with 2 elevators. Original, submitted to frequent use. patches on the housing.	Jl - Jones Island WRF	Future capital project outside six years.	High	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R087	Capacity, solids handling, safety and cost impacts relating to the condition of the Silos Rail Loadout Cross Conveyor M-27-24. No redundancy for this conveyor to be out of service.	Risk relates to the Milorganite loading of rail cars as there is no backup or redundant conveyor to this single cross conveyor. Conveyor is original and housing and other components near end of useful life. Motor/gear box, and housing are in OK shape.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM. Construction 2018/2019	High	known/past issues	High	possible increase in complaints from disorganize customers	Moderate	Physical Mortality	Management Effectiveness
R088	Capacity, solids handling, safety and cost impacts relating to the condition of the Silos rail loadout conveyor M-27-26. No redundancy for this conveyor to be out of service.	Risk is impact to product loadout system for rail cars and Milorganite removal from silos. No existing redundancy for conveyor. Motor/gear box are OK. Paddles, housing Veolia estimates the truck fill gate and spouts have less than five years remaining service life.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM, Scheduled 2018/2019 requested capital project J04054, MCRR 888 conveyor repairs	High	known/past issues	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R089	Condition and capacity of the W3 flushing water system	3 W3 pumps and 1 fire water pump out of service. Pumps 1,5,6 out due to VFD issues. The VFD's on the 6 W-3 pumps have been replaced under J06057. Many treatment systems rely on W3 water source. Not sure this should still be an extreme.	Jl - Jones Island WRF	J06057 to replace VFD drives	High	too many pumps and drives currently failed	High	most treatment systems rely on W3 source, further pump failures result in high impact to operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R090	Risk of conveyance system overflows at BS0405 and DC0103 by not utilizing the potential to blend at SSWRF	Can PE blending approval be attained from WDNR. What is the estimated SSWRF wet weather capacity using the blending system.	SS - South Shore WRF	System access gates welded shut in 2003; District planning action	Very High	is not used now and not "approved" for use	Very High	use could prevent overflows and/or basement backups	High	Level of Service	Environmental Improvements
R092	Loss of plant heat and energy recovery due to the condition of the Waste heat boiler	boiler in poor condition, confirm capacity needed	Jl - Jones Island WRF	MCRR 900 to repair boiler #2	Very High	Boiler inoperable	Medium	2 fired boilers are backup. Moderate impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R099	Sewage leaks from Bldg. 316, 317 roof drains and impact on JIWRWF discharges to Lake Michigan	Roof drains routed through PE channel, drain leaks can result in sewage into storm system. Recent project according to G. Olson did not address this.	SS - South Shore WRF	Active project to address this risk	High	known issue with drain	High	WPDES permit issue, SSO	Moderate	Level of Service	Permit Requirements
R111	Risk of failure of the plate and frame dewatering system due to the aged PLC system and the fact that parts are no longer supported by the vendor	Unreliability of the Back up biosolids treatment systems. PLCs are no longer serviceable because the manufacturer no longer provides replacement parts. If there is significant failure of PLCs the presses are not operable.	SS - South Shore WRF	B. Farmer asked Veolia to confirm PLC spare parts are still available.	High	Event 1-5 years, PLC parts not supported	High	presses are backup to D&D, if fail and D&D fail major impact of >250K (portable dewatering equipment would be needed)	Moderate	Physical Mortality	Management Effectiveness
R112	Risk of failure of the plate and frame dewatering system due to the challenges to maintaining the feed pumps	Unreliability of the Back up biosolids systems - feed pumps parts costly and long lead times, fail pump(s) could be out months without a high inventory of spare replacement parts in storage	SS - South Shore WRF	Keep required stock of critical spare parts for pumps and other long lead item equipment parts; District planning action	High	Event 5-10 years, pumps need major repairs & lack of spare parts in storage	High	presses are backup to D&D, if fail and D&D fail major impact of >250K (portable dewatering equipment would be needed)	Moderate	Physical Mortality	Management Effectiveness
R113	Engine generators have high maintenance and high downtime, which is costly and not consistent with MMSD energy goals	multiple issues with generators have resulted in unreliable capacity and waste burning of the excess digester gas	SS - South Shore WRF	generators overhauls, White-Superior major rebuild	High	past /ongoing issues, generators being rebuilt (major failures of occurred in less than 5 years)	High	significant Operations cost impact (205K-1M in added elect costs)	Moderate	Economic	Fiscal Responsibility
R118	Reliability of the effluent pumping system when a power failure occurs	high flow power failure can shut down effluent pumps - effluent pumps may now be required to discharge effluent to Lake Michigan in wet weather event due to higher lake water levels	SS - South Shore WRF	active project to assess but no decision	High	power outages (from both we-Energies feeds) , lake level rising (add back-up for by-pass gates)	High	Impact of 1-10M, potential for flooding with high lake level, need analysis to determine hydraulic capacity without pumps and with current lake water levels	Moderate	Level of Service	Permit Requirements
R120	Risk of negative publicity, community impacts and not meeting current NR 110 requirements from JIWRWF treatment process odors	The District recently received odor complaint from 3rd Ward Business Group. There have been no recorded odor complaints for the JIWRWF for the prior 3 years. Improve the monitoring, reporting and if needed, control of odors, from various processes (primary clarifiers, JI dump and Milorganite).	Jl - Jones Island WRF	District planning action	High	Occasional odor issues have been experienced	High	Occasional odor issues, could be serious issue during high visibility periods -Moderate loss of reputation, negative coverage	Moderate	Level of Service	Customer Service, Communication and Employee Development
R125	Risk of loss of power due to age and reliability of electric substations, MCCs and other power distribution systems	Some electric power systems are nearing the end of their service life, some are known to be problems or no service parts are available	Jl - Jones Island WRF	District planning action	Medium	known issues with age and/or parts availability	High	failure will impact operations capacity or performance	Moderate	Physical Mortality	Environmental Improvements
R126	Age and reliability of electric substations, MCCs and other power distribution systems	Some electric power systems are nearing the end of their service life, some are known to be problems or no service parts are available	SS - South Shore WRF	Active project to address issue	Medium	5-10 years, known issues with age and/or parts availability	High	M&O effectiveness, failure will impact operations capacity or performance, could result in lost of operation of equipment for a week	Moderate	Physical Mortality	Management Effectiveness
R127	age, obsolescence, security of JIWRWF I&C system and network server	system last upgraded in 2003; network server so old that parts are not available	Jl - Jones Island WRF	monitoring	High	age of equipment would allow for failure at any time	High	lack of control and data storage would be lost	Moderate	Physical Mortality	Management Effectiveness
R133	Capacity, solids handling, safety and cost impacts relating to the condition of the Local Control Panels for Belt Filter Press #1 - #24.	Risk relates to the dewatering operations and impacts to solids processing systems. Control system is original (+20 years old). If the BFP LCPs are not functional, dewatering is impacted.	Jl - Jones Island WRF	J04026C01, 2013 replacement	Very High	known/past issues	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	High	Physical Mortality	Management Effectiveness
R136	Cyclones have become unreliable. Dryer Cyclones are a required component of the air emissions control and failure of one piece of equipment impacts entire dryer train availability.	Impacts on dryer availability and air permit emissions - Loss of air emission controls and associated dryer and fines processing ability. Capacity, solids handling, safety and cost impacts relating to the condition of the Dryer Cyclone Separators, Hopper, and Feeder. One to one relationship between cyclone and dryer train availability.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	High	known/past issues	Very High	Dryer exhaust gas particulates have increased by 50% in the last 3 years. Dryer cyclone separator system (including T137) will likely need upgrading to ensure permit compliance.	High	Physical Mortality	Management Effectiveness
R137	The condition of Dryer Cyclone Separator Drop Out Box is deteriorating and at risk of failure. Failure of one piece of equipment impacts entire dryer train availability.	Impacts on dryer availability and air permit emissions - Loss of air emission controls and associated dryer and fines processing ability. Capacity, solids handling, safety and cost impacts relating to the condition of the Dryer Cyclone Separators, Hopper, and Feeder. One to one relationship between cyclone and dryer train availability.	Jl - Jones Island WRF	J031GX010, #1-12 inspected 2001	High	known/past issues	Very High	dryer exhaust gas particulates have increased by 50% in the last 3 years. Dryer cyclone separator system (including T136) will likely need upgrading to ensure permit compliance.	High	Physical Mortality	Management Effectiveness
R140	Capacity, solids handling, safety and cost impacts relating to the condition of the Dryer Recycle Air Belts B-25-25-1...12	The air belts are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a belt, you lose the dryer train. Loss of recycle feed and add back feed for respective dryer. Belt, rollers and scrapers are in bad shape. Possibly MCRR's. May need assessment from VWM	Jl - Jones Island WRF	Potential (future) MCRR's	Medium	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R143	Capacity, solids handling, safety and cost impacts relating to the condition of the DRS Ladder Chute #1 & #2	Risk impacts product conveyance systems from screeners to product transfer screw. 100% redundancy with two ladder chutes. Tiles are falling off.	Jl - Jones Island WRF	J04018C02 - 2010 replacement	High	known/past issues	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis								
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category	
R146	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage Surge Bins T-29-8-1...2	Risk impacts classification system. Loss of redundancy in DNS transfer to first stage screening (2 units installed). Damage to liners causes leaks and other maintenance issues.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Medium	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R147	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage First Cut Mills M-29-15-1...4	Risk impacts classification system. Loss of redundancy in first stage first cut mills for respective classification train (2 per train).	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R148	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage Second Cut Mills M-29-24-1...4	Risk impacts classification system. Loss of redundancy in first stage second cut mills for respective classification train (2 per train).	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. MCR 850 Repair Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Need description of issues being experienced	Medium	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R172	Phosphorus content of Milorganite relative to nitrogen may exceed regulations in some states where Milorganite is currently sold	Excess phosphorus in Milorganite, exceeds agronomic rate for P when applied at agronomic rate for N and is thus P not beneficially used. State regulators may restrict or prevent application of Milo.	Jl - Jones Island WRF	District planning action	High	Occur within one year	High	Significant reduction (>10%) in % beneficially used, also may be regulated in future - possible non-compliance with permit	Moderate	Level of Service	Customer Service, Communication and Employee Development	
R173	Risk of wet weather capacity restrictions and permit violations due to D&D facility drying capacity/reliability issues	Age and condition of dryer systems is such that dryer system availability has been as low as 6 six operating dryer systems during peak solids production. This condition causes excessive solids inventory in the JWRF and SSWRF activated sludge process which can result in wet weather capacity restrictions, poor effluent quality or effluent permit violations.	Jl - Jones Island WRF	District planning action	Medium	Occur within one year	High	Potential permit violation (<1 wk.) due to solids accumulation in system. Major critical system unavailable for 1 to 6 days	Moderate	Physical Mortality	Permit Requirements	
R177	Safety risks in dryer systems due to the utilization of waste heat and the high oxygen levels in the dryer systems	Safety of dryers - Current dryer system does not comply with NFPA 654 - Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, in particular there is greater than 8% oxygen content which does not comply with inerting explosion protection requirement	Jl - Jones Island WRF	District planning action	Very High	occur less than one in 20 years	Very High	Safety - Injury or illness that would require medical treatment.	High	Level of Service	Safety	
R178	Milorganite may not be in compliance with Canadian requirements for Salmonella.	Contamination of Milorganite. Impacts distribution of Milorganite, in particular may violate Canadian biosolids regulations	Jl - Jones Island WRF	Management under Marketing and Milorganite department	High	occurs every 1 to 5 years	Very High	Serious loss of reputation	High	Level of Service	Customer Service, Communication and Employee Development	
R185	Energy impacts and condition of the low pressure air leak @ blower 3 discharge	Known leak on piping @ building wall. This seems to be the same as Risk ID T100.	SS - South Shore WRF	VWM/CCO will assess this issue	High	Event 1-5 years, pipe is leaking underground	High	Loss of air system for 1-6 days	Moderate	Physical Mortality	Permit Requirements	
R190	Risk of insufficient solids processing and disposal capacity at SSWRF during a JWRF D&D extended or short term shutdown	Does the JWRF and SSWRF have needed solids capacity during a unplanned D&D outage? Processes impacted are WAS thickening, digestion, digested sludge GBT thickening, plate and frame press dewatering, belt filter press dewatering and belt filter press cake discharge to landfill trucks.	SS - South Shore WRF	District planning action	Medium	Event 5-10 years	High	Depending on duration of the outage \$500K - \$1M for temp equipment and services needed to handle all of the systems solids	Moderate	Capacity	Permit Requirements	
R196	Concern that leakage of the SSWRF sea wall may be the cause of high groundwater conditions on the lower plant site.	High ground water levels may be caused by leakage at sea wall, could cause damage to buildings, sections of wall > 50 years old	SS - South Shore WRF	VWM maintenance	High	Event 1-5 year	High	Unplanned repairs > 1M	Moderate	Physical Mortality	Fiscal Responsibility	
R197	Black start capability utilization is limited because the existing battery has capacity for only one start and backup power capacity is not available in a power outage	DC battery backup pack only allow 1 try at a black start	SS - South Shore WRF	Battery back-up	Medium	Event 5-10 years	High	Permit issues for < 1 week	Moderate	Level of Service	Management Effectiveness	
R201	Capacity, dryer operation, safety and cost impacts relating to the condition of the D&D outside air guillotine and flow control valves, FV-25-4-1...12-2, FCV-25-6-1...12-2. Failure of one piece of equipment impacts entire dryer train availability.	The flow control valves are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a FCV, you lose the dryer train. Seal air blower and actuator have less than five years remaining service life.	Jl - Jones Island WRF	Assess under J04064.	High	known/past issues	High	Shutdown of dryer system poses possible non-compliance with biosolids regulatory requirements.	Moderate	Physical Mortality	Management Effectiveness	
R203	Condition and operability of the winches at chaff loadout	Potential damage to equipment and increased labor requirements for adjusting roll offs by operators.	Jl - Jones Island WRF	MMMSD Capital project was awarded 9-16 to provide winches in J04047C01	Very High	Event will occur within a year	Medium	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R204	Condition and operability of air supply unit #32	restore the air handling capacity and redundancy of air supply unit #32 which was placed out of service due to age and cost-prohibitive repair	Jl - Jones Island WRF	Active project to address issue	Very High	Event will occur within a year	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness	
R205	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D main recycle bins venting	Risk impacts main recycle system. Dust accumulation in bin creates increased risk of safety issues. Some tiles are falling off ceramic lining.	Jl - Jones Island WRF	J04056: Milorganite Facilities Improvements Phase IV.	Low	Event will occur at least once every 26-50 years	Very High	Shutdown of dryer system poses possible non-compliance with biosolids regulatory requirements.	Moderate	Physical Mortality	Permit Requirements	
R206	Capacity, safety and cost impacts relating to the condition of the D&D building piping inventory and impact on operational reliability	Risk impacts probability of building and process piping failures occurring within the water reclamation facilities buildings, galleries and tunnels.	Jl - Jones Island WRF	District planning action	High	Event will occur at least once every 1-5 years	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R207	Condition of various roofs - do the roofs need replacement	rehabilitation or replacing roofs of buildings 225, 258, 259, 268, 285, 286, and 295 at Jones Island.	Jl - Jones Island WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility	
R208	Components of the Yearly rolling stock needs - definition and adequate budget available, etc.	replacing a transfer pump, a waste heat guillotine, a recycle bin dust collector, and two recycle bin discharge conveyers. The 2016 scope also includes gallery exit light replacements and the purchase of a roll-off truck.	Jl - Jones Island WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility	
R209	The need to complete the power supply optimization to increase system reliability	Is the overall reliability and safety of Jones Island's power supply sufficient. Does the active project address all issues?	Jl - Jones Island WRF	Active project to address issue	Very High	Event will occur within a year	High	Significant failure to meet internal energy targets	High	Level of Service	Energy	
R210	Operation and condition of the primary scum system	improve the effectiveness of the primary treatment system by making improvements to the scum system	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Medium	Moderate level of impact on operational efficiency.	Moderate	Capacity	Management Effectiveness	
R211	Incorrect results from the influent sampling system	determine a new location and upgrade the influent monitoring system	SS - South Shore WRF	active project to address issue	Low	Event will occur at least once every 26-50 years	Very High	Prolonged period of non-compliance with effluent quality permit limits	Moderate	Level of Service	Permit Requirements	
R212	Risk of negative publicity, community impacts and permit violation from SSWRF treatment process odors	During various times such as times of low flow, there have been odors associated with preliminary treatment, which has resulted in odor complaints from SSWRF neighbors	SS - South Shore WRF	Existing MIS odor control system using sodium hypochlorite exists in B344	High	Event will occur at least once every 1-5 years	High	Significant increase in odor issues	Moderate	Level of Service	Customer Service, Communication and Employee Development	
R213	Condition of the aeration galleries RAS header	replace RAS branch piping, fittings, and components from RAS discharge header to the 28 aeration basins and to replace the East and West RAS suction header piping from the RAS pump station to the RAS feed pumps. In addition, associated valves and instrumentation will be replaced	SS - South Shore WRF	Active project to address issue	High	Event will occur at least once every 1-5 years	Very High	Prolonged period of non-compliance with effluent quality permit limits	High	Physical Mortality	Permit Requirements	
R214	Condition of the digester gallery piping rehab	assess the condition of the 5,500 feet of digester gas piping, to evaluate the probability of failures occurring, and to develop an approach for preventing future pipe failures	SS - South Shore WRF	Active project to address issue	High	Event will occur at least once every 1-5 years	Very High	Prolonged period of non-compliance with air permit limits	High	Physical Mortality	Permit Requirements	
R215	Condition of the HW boiler system improvements	design and install replacement of a control system for boiler #3 and #4	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	High	Significant impact on operational efficiency	High	Physical Mortality	Management Effectiveness	
R216	Condition of the aeration basin concrete tanks	repair aeration basin walls to protect worker safety and air diffusers from falling concrete. Repairs to concrete walls in eight basins will	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility	
R217	Condition of the roadways and walkways - safety of workers and vehicles	rehabilitate or replace asphalt and concrete roadways and walkways	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility	
R219	Condition and capacity of the W3 pumps	design, construct, and install the replacement of eight W3 water pumps (four on the lower site and four on the upper site)	SS - South Shore WRF	Active project to address issue	High	Event will occur at least once every 1-5 years	High	\$1M-\$10M financial impact	Moderate	Physical Mortality	Fiscal Responsibility	
R220	Condition of the tunnels concrete structures	Do the tunnels need structural repairs and are there other systems in the tunnels (piping, conduits)? Which need repair?	SS - South Shore WRF	Active project to address issue	High	Event will occur at least once every 1-5 years	High	\$1M-\$10M financial impact	Moderate	Physical Mortality	Fiscal Responsibility	
R221	Flood protection of Bldg. 326	design and construct storm sewer and paving improvements for long-term flood protection at Building 326.	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Very High	Permanent disability or potential fatality	High	Level of Service	Safety	
R222	Condition of building roofs	replace the roofs at South Shore on buildings 327, 328, 331, 333, 334, 335, 336, 344, 346, 347, 351, 355, 359, 360, 380, 384, and 385.	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility	
R225	Suitability of the HVAC system to protect the computer room	heating, ventilation, and air conditioning (HVAC) systems for three work areas within the Jones Island Operations building	Jl - Jones Island WRF	District planning action	High	Event will occur at least once every 1-5 years	Very High	Significant impact on operational efficiency	High	Level of Service	Management Effectiveness	
R226	Lack of I&C improvements to keep SCADA system operational	integrate multiple fiber optic networks and improve data routing through the network	Jl - Jones Island WRF	District planning action	Low	Event will occur at least once every 26-50 years	Very High	Moderate level of impact on operational efficiency.	Moderate	Level of Service	Management Effectiveness	

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R228	Stack testing shows increasing trends in emissions which may lead to air permit non-compliance	compliance with all air emission limits and impacts of existing permits on future actions, etc.	Jl - Jones Island WRF	District planning action	Medium	Event will occur at least once every 6-25 years	Very High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Level of Service	Permit Requirements
R230	Reliability of the power feed to Ops Bldg.	install four 300-amp feeds in three conduits from LCUS-P in the Powerhouse building to a circuit breaker in the Operations Building electrical room in order to provide a third source of power for the conveyance SCADA system	Jl - Jones Island WRF	District planning action	Very Low	Event will occur at least once every 51-100+ years	Very High	Moderate level of impact on operational efficiency.	Moderate	Level of Service	Management Effectiveness
R231	Need to comply with all air permit requirements and impacts on operations flexibility	compliance with all air emission limits and impacts of existing permits on future actions, etc.	SS - South Shore WRF	District planning action	Medium	Event will occur at least once every 6-25 years	Very High	Prolonged period of non-compliance with air permit limits	Moderate	Level of Service	Permit Requirements
R239	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Facility Dust Collection System.	Dust collection system to unit process UP 25 and 29 in D&D require evaluation and upgrade. Poor airflow is impacting equipment life and contributes to the safety risk if fugitive dust is created from the dust collection system.	Jl - Jones Island WRF	Future Amendment to M01019P01 \$90,000 budgeted amount	Medium	Known/past issue	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R240	Risk of conveyance system overflows by not maximizing ISS pump out blending at the JI WRF	Flow limit on CSO/diversion capacity is not known - MGD rate critical to development of SSO/CSO LOP - need to determine ISS blending/diversion/treatment capacity	Jl - Jones Island WRF	New flow meter recently installed. District planning action.	Very High	Prior analysis or testing of the diversion capacity has not been conducted	Very High	Could increase CSO volume or cause CSO when there is additional capacity available at the JI WRF	High	Capacity	Environmental Improvements
R241	W4 water screens condition and operations/regulatory issues	W4 used for cooling multiple systems - VWM proposed MCRR to repair screens - also new Fed Regs on intake may impact the project	Jl - Jones Island WRF	VWM has inspected the system	Very High	VWM MCRR request	Medium	Other sources of cooling water exist	Moderate	Physical Mortality	Management Effectiveness
R261	Lack of more than one Milorganite® packaging/bagging vendor	The lack of more than one packaging vendor presents a risk if the vendor is no longer available or declines to package the Milorganite	Jl - Jones Island WRF	Potentially install bagging operation on Jl WRF; possible location identified between Thickening and Milorganite storage silos	Medium	The packaging contract is generally bid every 7 years and current vendor may elect not to pursue. In addition it is possible that the vendor may suffer physical damage (e.g. fire) or somehow may not be able to package Milorganite	High	Estimate based on both Fiscal and Operational Risk	Moderate	Economic	Fiscal Responsibility
R262	Capacity, solids handling, safety and cost impacts relating to the condition of the Main Recycle Belt Feed Screw S-25-54-1...3	The screws are a one to one correlation with the ability to operate the recycle system. Risk impacts main recycle system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy if one screw requires maintenance.	Jl - Jones Island WRF	J04051: Main Recycle Air Belt Feed Screw Replacements: Total Construction Budgeted: \$613,107	High	Event 1-5 year	High	Significant impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R264	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage Product Feed Screws S-29-13-1...2	Risk impacts classification system. Auger, trough, motor are in critical need for repair, ladder chutes to product cooler recently replaced. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R265	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 1st Cut Mill Discharge Screws S-29-18-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R266	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 2nd Cut Mill Discharge Screws S-29-23-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R267	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 1st Oversize Feed Screws S-29-16-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R268	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 2nd Oversize Feed Screws S-29-21-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R269	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 2nd Oversize Transfer Screws S-29-20-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R270	Capacity, solids handling, safety and cost impacts relating to the condition of the Overflow Bucket Elevator BE-29-56-1	Risk impacts classification system. Upon failure will shut down drying train and reduce morganite production redundancy. Less than five years remaining service life.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R271	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage Manual Diverter Valve	Risk impacts greens grade system. Directs cyclone waste to one of two cyclone transfer screw conveyors. Original install.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R273	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Second Stage Oversize Mill Discharge Screws S-29-43-1...2	Risk impacts greens grade system. Receives DRS from the second-stage mills, and any overflow from the second-stage oversize mill leveling screw conveyor. 100% redundancy between two screws.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Short Term Condition Assessment Required by VWM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Impacts processing of DRS from the second-stage mills	Moderate	Physical Mortality	Management Effectiveness
R275	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Third Stage Surge Bin Feed Screws S-29-46-1...2	Risk impacts greens grade system. Discharge from the second stage system into third stage surge bin. 100% redundancy between two screws.	Jl - Jones Island WRF	State of auger and motor/drive is unknown. Overflow door is equipped to deal with surge bin overload North and South GG Train - PCF - J04035 Construction 2019/2020	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R276	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Third Stage Screener Feed Screws S-29-49-1...2	Risk impacts greens grade system. Screws collect discharge from third stage surge bin. 100% redundancy between two screws.	Jl - Jones Island WRF	Flow switch is provided at third drop point to actuate an alarm during overflow condition North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Malfunction or required maintenance will limit DRS processing by third-stage screeners.	Moderate	Physical Mortality	Management Effectiveness
R277	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Third Stage Fines Bin Feed Screws S-29-51-2	Risk impacts greens grade system. Carry CFNS to the fines surge bins. 100% redundancy between two screws.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R278	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Third Stage Product Feed Screws S-29-52-1...2	Risk impacts greens grade system. Screws collect product material from third stage screeners. 100% redundancy between two screws.	Jl - Jones Island WRF	Inspected during 2016 shutdown North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R279	Capacity, solids handling, safety and cost impacts relating to the condition of the Third Stage Screeners M-29-50-2,4	Risk impacts greens grade system. Separation of oversize, product, and classification fines. Internal seams require sealant.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R280	Capacity, solids handling, safety and cost impacts relating to the condition of the Fines Recycle Transfer Screw S-31-49	Risk impacts greens grade system. Observed corrosion in trough. 100% redundancy between two screws.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R281	Capacity, solids handling, safety and cost impacts relating to the condition of the Fines/Wet Recycle Bucket Elevator BE-31-52	Risk impacts greens grade system. Transportation of recycled fines to the wet recycle system. Some patches on housing.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R283	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Cooler Feed Screws S-29-66-1...2	Risk impacts product cooling system. Multiple patches on trough housing. 100% redundancy between two screws.	Jl - Jones Island WRF	Short Term Condition Assessment Required by VWM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R284	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Storage Feed Screws S-29-76-1...2	Risk impacts product cooling system. Sections welded in June 2016, flights had multiple holes. Fill gate condition causes tank 3 to receive product when filling tank 1. 100% redundancy between two screws.	Jl - Jones Island WRF	Future capital project request.	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R286	Capacity, solids handling, safety and cost impacts relating to the condition of the Product Weigh Belts B-29-70-1...2	Risk impacts ability to accurately inventory the product transfer system to Silos and what volumes are being produced and sold. Frequent calibration required for weight instrumentation. Belt, motor/drive, and receiving hopper all have less than five years remaining service life. J04052 has identified replacement technology.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM J04052 to provide Eng. Report on this equipment in 2018 and improve performance under same capital project Weigh cells to be replaced under J04052	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R287	Capacity, solids handling, safety and cost impacts relating to the condition of the Product Storage Day Tank 3 Fill Gate FG-29-76-1	Risk impacts product transfer system. Failure causes tank 3 to receive product when trying to fill tank 1.	Jl - Jones Island WRF	District planning action	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R291	Capacity, solids handling, safety and cost impacts relating to the condition of the Outside Air Butterfly Damper FV-25-1.4..5	The dampers are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a damper, you lose the dryer train. Failure to one unit directly impacts the associated dryer. Seal air blower and actuator have less than five years remaining service life.	Jl - Jones Island WRF	District planning action	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R292	Capacity, solids handling, safety and cost impacts relating to the condition of the Waste Heat Damper FV-25-1-1	Risk impacts drying system. Seal air fan motor bearings fail on new style gate. Upon failure will shut down drying train and reduce morganite production redundancy.	Jl - Jones Island WRF	MCR 786 Completed MCR 823 Construction	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R293	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage 2nd Oversize Leveling Screw S-29-22-1..2	Risk impacts classification system. Transfers biosolids into first stage second mills. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 scope item. Construction 2019/2021	Very High	Occur within one year	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R294	Capacity, solids handling, safety and cost impacts relating to the condition of the Cyclone Discharge Screw S-30-2-1..4	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R295	Capacity, solids handling, safety and cost impacts relating to the condition of the Cyclone Transfer Screws S-30-4-1..4	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R296	Capacity, solids handling, safety and cost impacts relating to the condition of the Cyclone Drag Conveyors DC-30-8-1..4	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R297	Capacity, solids handling, safety and cost impacts relating to the condition of the Cyclone Waste Screener Feed Screws S-30-12-1..2	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R298	Capacity, solids handling, safety and cost impacts relating to the condition of the Container Cross Feed Screws S-30-41-1..2	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R299	Capacity, solids handling, safety and cost impacts relating to the condition of the Container Feed Screw S-30-42-1..2	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R300	Capacity, solids handling, safety and cost impacts relating to the condition of the Luger Chaff loadout System FG-30-42-1-1..2	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R305	Community satisfaction, solids handling, safety and cost impacts relating to the condition of the Odorous Air System from bfp's	Risk impacts utilities systems and personnel working conditions. Observed corrosion in isolation gates. Blowers have limited remaining service life.	Jl - Jones Island WRF	Potential (future) MCR's. Visit to address.	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R307	Safety and cost impacts relating to the condition of the Fire Pumps P-32-39-1..2	Risk impacts utilities and safety systems. Valves, piping, and sprinkler heads have less than five years remaining service life.	Jl - Jones Island WRF	Potential (future) MCR's	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Temporary disability or serious injury	Moderate	Physical Mortality	Safety
R309	Capacity, solids handling, safety and cost impacts relating to the condition of the Building Drains (sump pumps) P-32-35-1..3	Risk impacts utilities system. Equipment near end of useful life. Upon failure will shut down drying train and reduce morganite production redundancy	Jl - Jones Island WRF	Existing levels of redundancy.	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R314	Capacity, solids handling, safety and cost impacts relating to the condition of the Silo Fill, Dust, and Vent Valves at top of silo FV-27-2-1..14 FV-27-52-1..14 FV-27-38-1..14	The silo fill valves are a one to one correlation with the ability to operate a specific silo. Risk is if you lose a fill valve, you lose the silo. Fill valves control if Milorganite is conveyed directly to railcar loadout. Provides operational flexibility.	Jl - Jones Island WRF	Potential (future) MCR's	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Temporary disability or serious injury	Moderate	Physical Mortality	Safety
R315	Capacity, solids handling, safety and cost impacts relating to the condition of the North Transfer Draw-Off Conveyor M-27-12-1	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	Existing levels of redundancy.	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R316	Capacity, solids handling, safety and cost impacts relating to the condition of the North Transfer Bucket Elevator BE-27-15-1	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R318	Capacity, solids handling, safety and cost impacts relating to the condition of the South Transfer Draw-Off Conveyor M-27-12-2	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	District planning action	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R320	Capacity, solids handling, safety and cost impacts relating to the condition of the South Cross-Over Weigh Belt M-27-13-2	Risk impacts silo system and accuracy of material inventory using the weigh belt. Weigh belt is original technology and chutes and directional spouts have limited remaining service life.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.5MM. Confirm that J04052 provides Eng. Report on this equipment in 2018 and replace to improve performance. Chutes and valves in poor condition.	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R321	Capacity, solids handling, safety and cost impacts relating to the condition of the Conditioning Bucket Elevator M-27-15-3	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.5MM	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R322	Capacity, solids handling, safety and cost impacts relating to the condition of the Conditioning Draw-off Conveyor M-27-12-3	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.5MM	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R326	Capacity, solids handling, safety and cost impacts relating to the condition of the Baghouse 5/6 and surge bin exhaust duct M-27-29-5..6	Risk impacts silo system and associated air permit. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	MCR to replace as needed	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Injury requiring medical treatment	Moderate	Physical Mortality	Safety
R330	Capacity, solids handling, safety and cost impacts relating to the condition of the Ribbon Mixer	Risk impacts product loadout as there is no redundant or backup to the dust suppression chemical blender. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	MCR 967 in 2017	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Significant impact on operational efficiency	High	Physical Mortality	Management Effectiveness
R331	Capacity, solids handling, safety and cost impacts relating to the condition of the Dust Suppressant Tank (Mineral Oil Storage Tank) T-27-53	Risk impacts product loadout as there is no redundant or backup to the dust suppression chemical blender. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	VWM to submit capital project request	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Significant impact on operational efficiency	High	Physical Mortality	Management Effectiveness
R332	Capacity, solids handling, safety and cost impacts relating to the condition of the Dust Suppression pumps and strainers P-27-58-1..2	Risk impacts product loadout as there is no redundant or backup to the dust suppression chemical blender. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	District planning action	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R335	Capacity, solids handling, safety and cost impacts relating to the condition of the Surge Bin manual valve to screener and gate at bottom of surge bin. FG-27-21 FV-27-61	Risk impacts silo system. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	MCCR's as required	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R336	Capacity, solids handling, safety and cost impacts relating to the condition of the Third Stage Surge Bins T-29-47-1	Equipment near end of useful life. Upon failure will shut down drying train and reduce morganite production redundancy	Jl - Jones Island WRF	Surge Bin 2 will be replaced under MCCR 931 2018 capital project request	Very High	Event will occur within a year	Medium	CCO/Veolia Meeting Review	Moderate	Physical Mortality	Management Effectiveness
R341	Revise JI WRF sampling system to allow for one sample	change from LL and HL samples to a single sample point	Jl - Jones Island WRF	active project to assess this	High	dual samples are costly and inaccurate	High	cost and duplication and VWM billing	Moderate	Level of Service	Management Effectiveness
R342	Capacity, solids handling, safety and cost impacts relating to the condition of the Dust Drag Conveyor M-27-29-8-1	Equipment near end of useful life. Upon failure will shut down drying train and reduce morganite production redundancy	Jl - Jones Island WRF	District planning action	High	Event will occur at least once every 1-5 years	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R343	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Storage Transfer Screw S-29-75-1...2	Risk impacts product transfer system. Transfer screw 1 auger may be in bad condition. discharge gate to feed screw 2 leaks. 100% redundancy between two screws.	Jl - Jones Island WRF	Future capital project request. Potential (future) MCCR's for discharge gate to screw 2	High	Event will occur at least once every 1-5 years	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R344	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Cooler Transfer Screw Discharge Flow Gate Valve FG-29-63-2	Risk impacts product cooling and transfer system. Leaks when trying to transfer to product cooler feed screw 1. 100% redundancy between two screws.	Jl - Jones Island WRF	District planning action	Very High	Event will occur within a year	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness

APPENDIX 5B-4: WRF Risk Register – COF Definitions -

DRAFT

**MMSD 2050 Facilities Plan
WRF and Biosolids Asset System Risk Register
Risk Definitions - Consequence of Failure**

Ranking	Permit / Legal Requirements	Environmental Improvements (non regulatory, resource recovery)	Energy	Customer Service, Community Economic Development and Organizational Reputation	Safety	Fiscal Responsibility	Management and Operational Effectiveness
Water Reclamation							
Very High	<ul style="list-style-type: none"> • Prolonged period (>1 month) of non-compliance with effluent quality permit limits • Significant (>15%) reduction in % overall capture • Long term WPDES permit violation 	NA	NA	<ul style="list-style-type: none"> • Significant adverse impact to freeways, hospitals, schools, numerous community buildings, major industry, or highly visible public areas • Constrains regional economic development • Negative coverage at national level • Issues raised by State Government and/or multiple public officials/commissioners 	Permanent disability or potential fatality.	> \$10,000,000 total financial impact	<ul style="list-style-type: none"> • Major critical systems, facilities, or equipment unavailable for > 1 month • High turnover of critical staff - organization-wide impact • Broken relationship with contract operator that significantly impacts ability to effectively operate facilities
High	<ul style="list-style-type: none"> • Limited period (<1 month) of non-compliance with effluent quality permit limits • Prolonged period (>1 month) of non-compliance with air emission or biosolids (bacteria, metals, nutrients) regulatory requirements • Short term WPDES permit violation 	<ul style="list-style-type: none"> • Prolonged period (>1 month) of non-compliance with effluent quality contract limits or other significant environmental contract requirements 	NA	<ul style="list-style-type: none"> • Significant adverse impact to arterial streets and/or multiple community or industrial buildings, or widespread residential buildings • Constrains localized economic development, and/or widespread decrease in property values • Significant loss of reputation or long term good will with customers, residents and stakeholders • Negative coverage at state or local (TV and/or newspaper) level • Issues raised by single public official/commissioner • Significant (> 100) increase in odor complaints 	Temporary disability or serious illness.	\$1,000,000 - \$10,000,000 total financial impact	<ul style="list-style-type: none"> • Major critical systems, facilities, or equipment unavailable for < 1 month • Extensive or prolonged adverse reaction - company-wide disengagement • Loss of key staff - impacts multiple locations/departments • Significant impact on operational efficiency, >50% impact on operational KPI's • Damaged relationship with contract operator that reduces effectiveness of operations
Medium	<ul style="list-style-type: none"> • Limited period (<1 month) of non-compliance with air emission or biosolids (bacteria, metals, nutrients) regulatory requirements • Moderate (5-15%) reduction in % overall capture • Possible WPDES permit violation 	<ul style="list-style-type: none"> • Limited period (<1 month) of non-compliance with effluent quality contract limits or other significant environmental contract requirements • Significant reduction (>10%) in % of solids beneficially reused • Significant reduction (>10%) in nutrients recovered (Nitrogen/Phosphorus) • Significant or newsworthy negative impact on biodiversity, fish habitat, access to green space, education, or other environmental aesthetics 	<ul style="list-style-type: none"> • Significant failure to meet annual internal targets (<50% of goals achieved) for % of energy from renewable sources or GHG emissions goals 	<ul style="list-style-type: none"> • Adverse impact to collector streets and numerous residential buildings • Local decrease in property values • Moderate loss of reputation or long term good will with customers, residents and stakeholders • Issues raised by numerous residents • Moderate (<100) increase in odor complaints 	Injury or illness requiring medical treatment.	\$250,000 - \$1,000,000 total financial impact	<ul style="list-style-type: none"> • Employee disengagement among business area or geographic location • Loss of key staff in single location or department • Moderate impact on operational efficiency, 25-50% impact on operational KPI's
Low	<ul style="list-style-type: none"> • Minimal (<5%) reduction in % overall capture • Unlikely WPDES permit violation. 	<ul style="list-style-type: none"> • Moderate reduction (5-10%) in % of solids beneficially reused • Moderate reduction (5-10%) in nutrients recovered (Nitrogen/Phosphorus) • Organization cannot demonstrate commitment to biodiversity, fish habitat, access to green space, education, or other environmental aesthetics 	<ul style="list-style-type: none"> • Moderate failure to meet annual internal targets (50-75% of goals achieved) for % of energy from renewable sources or GHG emissions goals 	<ul style="list-style-type: none"> • Adverse impact to isolated residential street or residential buildings • Isolated decrease in property values • Minimal loss of reputation or long term good will with customers, residents and stakeholders • Issues raised by isolated residents 	Injuries requiring first aid treatment.	\$50,000 - \$250,000 total financial impact	<ul style="list-style-type: none"> • Non-critical systems, facilities, or equipment unavailable for > 1 month • Localized adverse impact on employee morale - single departmental location • Loss of non-critical staff in single department or location • Minimal impact on operational efficiency, <25% impact on operational KPI's
Very Low	NA	<ul style="list-style-type: none"> • Minimal reduction (<5%) in % of solids beneficially reused • Minimal reduction (<5%) in nutrients recovered (Nitrogen/Phosphorus) 	<ul style="list-style-type: none"> • Minimal failure to meet annual internal targets (76-99% of goals achieved) for % of energy from renewable sources or GHG emissions goals 	<ul style="list-style-type: none"> • Negative response internally 	Low potential for minor injury.	0 - \$50,000 total financial impact	<ul style="list-style-type: none"> • Non-critical systems, facilities, or equipment unavailable for < 1 month • Isolated adverse impact on employee morale - single employees • Loss of non-critical staff - single employees

APPENDIX 5B-5: WRF Capacity Assessment -

DRAFT

WRFs and Biosolids Capacity Assessment
Design and NR 110 Assessment

1st draft
Initials
Date: Initials
Developed by: KMZ
See QC worksheet for QC details
Updated by: KMZ

Update based on MMSD review
Date: Initials
3/25/2019
KMZ
4/1/2019
KMZ

Updated based on SSWRF Influent TSS updates
Date: Initials
5/8/2019
KMZ
5/13/2019
KMZ

Updated to better explain procedure and final corrections
Initials
Date:
KMZ
4/13/2020

Purpose: Identify risks that unit process may not have enough capacity to meet project flows and wasteloads, defined as gaps between projected capacity and design capacity, and performance that does not meet NR 110 regulations. (See Notes 1,2)

Procedure:

- Level designations for facility through unit process are first listed, as presented in Appendix 5B-1, Level Designations Resource for WRF Assessments.
- Next, Design Treatment Capacity and Specific Design Criteria information is listed from JIWRWF O&M Manual: Plant Summary and Administration, 1993 and SSWRF O&M Manual: Plant Summary and Administration, 2016. (Notes 3,4)
- Then, most performance projections developed in the Baseline, 2035 and 2050 Conditions Mass Balances, included as Attachments A-C to this document, were added to the table. (See Notes 5,6)

Exceptions:

- WRF capacity needed to maintain Baseline CSO Frequency - shaded in light grey since design isn't exceeded if MMSD choses not to maintain
MP01 - Preliminary Treatment, MP02 - Primary Clarification/Blending and MP07 - Plant Effluent- this capacity was compared against the projections to maintain the baseline LOS, defined as a CSO frequency of 3.25 CSOs annually, under projected influent flows presented in more detail in Attachment C1 .
Maintaining CSO frequency can be managed either by increasing influent flow through UPs01-03 OR through increased blending so both options are presented.
Note: The projected increase in flow is not applied to any other MPs downstream of MP01, except blending. Evaluation of the gap in Chapter 5 will determine if additional assessment of MPs is required.
- Peak hourly parameters identified to compare against NR110 criteria were calculated based on WRF peak hourly flow (JIWRWF 330 MGD, SSWRF 300 MGD)
- Gaps are calculated by Performance - Firm Capacity. If projected performance is less than firm capacity, then the gap is set to 0.
- Finally, if performance is greater than NR 110 criteria, the value is shown in red; if performance is within NR 110 criteria but there is a design capacity gap, the value is shown in blue.
- Using this information, an initial assessment of the information for each design criteria is documented.

Notes:

- Identification of capacity risk evaluation needed does not automatically indicate that a project is warranted. Evaluations in later chapters will gather more information to determine if project is warranted or not, and why.
- Single-point Failure/Redundancy (defined just as Redundancy in table) captured in separate table.
- Not all design criteria details are presented for performance, just those identified in NR110 regulations plus additional items as warranted.
- Unit Process for which performance was compared to multiple design criteria were listed individually for each design criteria. Review "Performance Criteria" column to determine the criteria being compared.
- For simplicity for the analysis: Baseline Condition is the average of 9/1/13 - 8/31/16 so used year 2015; WRF Future Conditions set at 2035 (equivalent to 2040); Buildout Conditions set at year 2050.
- Not all parameters were assessed under Baseline Conditions. For those that were assessed for WRF Future Conditions and Buildout Conditions, performance year 2015 shown with empty blue cell and gap assumed to be "0" for year 2015.

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation	Design Treatment Capacity (If > than NR110, shown in red)			Specific Design Criteria	Performance (If > than NR110, shown in red) (If NR 110 okay but > firm design capacity, shown in blue)			Gap between Performance and Firm Design Capacity			Comparison of Unit Process Operations Under Revised 2020 Baseline Conditions to Current Regulations and Advisory Standards		Initial Assessment	Risk Identified:	Identification of capacity risk evaluation needed	
				UNITS	Total	Firm		2015	2035	2050	2015	2035	2050	Current NR 110 Regulation	Advisory 10-States Standards				
JIWRWF	Liquid	MP01 - PRELIMINARY TREATMENT	UP01 - INFLUENT SIPHONS / PUMPING	MGD	413	330	Low Level (LL) Pumps - 4 Screw Pumps: 46.7 MGD at 24' TDH each High Level (HL) Pumps - 5 Screw Pumps: 82.6 MGD at 13.1' TDH each	MAX DAY INFLUENT FLOW (MGD)	330	365	430	0	35	100	NR 110.14.3.f: meet peak hour design capacity with one unit out of service	Sec 42.31: with any unit out service, handle peak hourly flow	Gap in WRF influent pumping capacity needs to be reviewed in conjunction with Blending under MP02, Primary Clarification. If evaluation determines increase in influent pumping needed, need to meet NR 110 requirements.	Design/NR 110	Capacity risk evaluation needed
JIWRWF	Liquid	MP01 - PRELIMINARY TREATMENT	UP02 - INFLUENT SCREENING	MGD	412.5	330	8 Mechanically Cleaned Bar Screens at 50 MGD each, 1/8" Clear Opening	MAX DAY FLOW (MGD)	330	365	430	0	35	100	NR 110.16 All requirements met in Baseline conditions, see initial assessment	Sec 61.22: with any unit out service, handle peak instantaneous flow	Gap in WRF influent pumping capacity needs to be reviewed in conjunction with Blending under MP02, Primary Clarification. If evaluation determines increase in screening needed, need to meet NR 110 requirements.	Design	Capacity risk evaluation needed
JIWRWF	Liquid	MP01 - PRELIMINARY TREATMENT	UP03 - GRIT REMOVAL	MGD	330	275	6 Pista Grit Vortex Concentrators - 70 MGD hydraulic capacity each = 350 MGD (firm capacity) - 55 MGD treatment capacity each = 275 MGD (firm capacity) - 95 percent removal of particles 70 mesh (0.20 mm) and larger with a specific gravity of 2.65 (silica sand)	MAX DAY FLOW (MGD)	330	365	430	55	90	155	NR 110.17 All requirements met in Baseline conditions, see initial assessment	Sec 63: All requirements met, see initial assessment	Gap in WRF influent pumping capacity needs to be reviewed in conjunction with Blending under MP02, Primary Clarification. If evaluation determines increase in grit removal needed, need to meet NR 110 requirements. Also possible single-point failure/redundancy issue	Design	Capacity risk evaluation needed
JIWRWF	Liquid	MP02 - PRIMARY CLARIFICATION	BLENDING	MGD	60	60	Blending - bypass from ISS Pump Station to Disinfection through bypass channel Capacity listed is previously permitted capacity, not hydraulic capacity	Maximum Blending Capacity Needed (MGD)	60	95	150	0	35	90	No NR 110 regulation	No 10 St Standard Regulation	Gap in WRF influent pumping capacity needs to be reviewed in conjunction with MP01, Preliminary Treatment. Hydraulic capacity has to be evaluated to determine total blending capacity.	Design	Capacity risk evaluation needed
JIWRWF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	gpd/sf	760	760	8 Primary Clarifiers - 160 dia. x 12 swd, each Surface Overflow Rate (SOR), gpd/sf - ave day 760, max day 1,870, max week 1,180, max month 1,000 Weir Loading Rate (WLR), calculated, gpd/lf - ave day 30,400, max day 74,800, max week 47,200, max month 40,000 Sludge Production (ton per day) - ave day 116, max day 236, max week 175, max month 153	Ave SOR (gpd/sf)	704	775	777	0	15	17	NR 110.18.2.d.1 Table 3, for Primary: Surface settling rate (gpd/sf) - ave 1,000	Sec. 72.21 - Ave surface settling rate 1000 gpd/sf	Gap identified	Design	Capacity risk evaluation needed
JIWRWF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	gpd/sf	1,000	1,000		Max month SOR (gpd/sf)	751	827	829	0	0	0	Not included in NR 110.18.2.d.1 Table 3, for Primary	Sec. 72.21 has no monthly requirement	No gap identified	None	
JIWRWF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	gpd/sf	2,052	2,052		Peak hourly SOR (gpd/sf)	2,052	2,269	2,673	0	217	621	NR 110.18.2.d.1 Table 3, for Primary: Surface settling rate (gpd/sf) - max hourly 1,500	Sec. 72.21 - Maximum hourly surface settling rate 2000 gpd/sf	Gap identified under NR 110	Design/NR 110	Capacity risk evaluation needed
JIWRWF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	gpd/lf	30,400	30,400		Ave WLR (gpd/lf)	28,170	31,009	31,061	0	609	661	NR 110.18.2.d.1 Table 3, for Primary: Weir loading rate (gpd/lf) - ave 10,000	Sec. 72.43 - Maximum hourly weir loading rate is 30,000 gpd/sf	Gap identified under NR 110	Design/NR 110	Capacity risk evaluation needed
JIWRWF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	tpd	116	116		Ave Primary Sludge Production (tpd)	36	40	40	0	0	0	NR 110.26.4.a All requirements met	Sec. 73.2 All requirements met		None	
JIWRWF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP18 - SCUM CONCENTRATION	GPM	600	300	2 Rotating drum screen, 300 GPM each 141 cf/hr capacity	Scum press, NOT REVIEWED										NA	
JIWRWF	Liquid	MP03 - IRON MANAGEMENT	UP20 - PICKLE LIQUOR / FERRIC CHLORIDE		N/A	N/A	Pumped Feed: Pickle Liquor Feed - 25 GPM; Iron Addition - 25,200 lb/d Gravity Feed: Pickle Liquor Feed - 15 GPM, Iron Addition - 15,000 lb/d	NOT REVIEWED										NA	

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation	Design Treatment Capacity (If > than NR110, shown in red)			Specific Design Criteria	Performance (If > than NR110, shown in red If NR 110 okay but > firm design capacity, shown in blue)			Gap between Performance and Firm Design Capacity			Comparison of Unit Process Operations Under Revised 2020 Baseline Conditions to Current Regulations and Advisory Standards		Initial Assessment	Risk Identified:	Identification of capacity risk evaluation needed	
				UNITS	Total	Firm		2015	2035	2050	2015	2035	2050	Current NR 110 Regulation	Advisory 10-States Standards				
JWRF	Liquid	MP04 - AERATION	UP05 - SECONDARY FLOW CONTROL / AERATION	lb/1000 cf	25	25	West Plant – 12 single pass channels, 1 MG; East Plant – 20 single pass channels, 1-1.4 MG, 19-1.65 MG · Mixed Liquor Suspended Solids (MLSS) under all conditions – 2400 mg/L · BOD Load, lb/1000 cf/d – ave day 32, max day 85, max week 60, max month 45 (originally conventional treatment) NOTE: SINCE NOW NITRIFYING, COMPARED TO LOWER AVE AND MAX MO VALUES AS SHOWN IN DESIGN PARAMETERS BASED ON ENGINEERS JUDGEMENT · Food to Microorganism Ratio (F/M), lb influent BOD/lb MLVSS-day – ave day 0.3, max day 0.8, max week 0.5, max month 0.4 · Mean Cell Residence Time (MCRT), days [calculated] – ave day 4, max day/week/month 2.8	Ave BOD Loading (lb/1000 cf/d)	31.9	34.9	35.3	7	10	10	NR 110.21.4.b Table 5: · Conventional Volumetric loading (lb BOD/1000 cf/d) - 40: Value assessed against · Extended Aeration Volumetric loading (lb BOD/1000 cf/d) - 15	Sec. 92 - Organic Loading (lb BOD/D/1000 cf) for Conventional - 40 , Extended aeration - 15	Extended aeration has conservative requirement, gap not anticipated to create an issue meeting permit requirements	Design	Capacity risk evaluation needed
JWRF	Liquid	MP04 - AERATION	UP05 - SECONDARY FLOW CONTROL / AERATION	lb/1000 cf	30	30		Max Mo BOD Loading (lb/1000 cf/d)	32	35	35	2	5	5	NR 110.21.4.b Table 5: · Conventional Volumetric loading (lb BOD/1000 cf/d) - 40: Value assessed against · Extended Aeration Volumetric loading (lb BOD/1000 cf/d) - 15	Sec. 92 - Organic Loading (lb BOD/D/1000 cf) for Conventional - 40 , Extended aeration - 15	No gap identified	None	
JWRF	Liquid	MP04 - AERATION	UP05 - SECONDARY FLOW CONTROL / AERATION	mg/L	2,400	2,400		Ave MLSS (mg/L)	4,155	4,153	4,154	0	0	0	NR 110.21.4.b Table 5: · Conventional MLSS (mg/L) - 1,000-3,000: Value assessed against · Extended Aeration MLSS (mg/L) - 3,000-5,000	Sec. 92 -MLSS (mg/L) for Conventional - 1,000-3,000 , Extended aeration - 3,000-5,000	Though does not exceed NR 110, higher MLSS could have impact on secondary clarifier solids loading rate.	NR 110	Capacity risk evaluation needed
JWRF	Liquid	MP04 - AERATION	UP05 - SECONDARY FLOW CONTROL / AERATION	lb BOD/lb MLVSS-d	0.30	0.30		Ave F:M (lb BOD/lb MLVSS-d)	0.16	0.18	0.18	0.00	0.00	0.00	NR 110.21.4.b Table 5: · Conventional F:M - 0.2 - 0.5: Value assessed against · Extended Aeration F:M - 0.05 - 0.15	Sec. 92 -F:M (lb BOD/lb MLVSS-d) for Conventional - 0.2-0.5 , Extended aeration - 0.05-0.1	Gap identified under NR 110	NR 110	Capacity risk evaluation needed
JWRF	Liquid	MP04 - AERATION	UP05 - SECONDARY FLOW CONTROL / AERATION	lb BOD/lb MLVSS-d	0.80	0.80		Max Day F:M (lb BOD/lb MLVSS-d)		0.35	0.35	0.00	0.00	0.00	NR 110.21.4.b Table 5: · Conventional F:M - 0.2 - 0.5 · Extended Aeration F:M - 0.05 - 0.15	Sec. 92 -F:M (lb BOD/lb MLVSS-d) for Conventional - 0.2-0.5 , Extended aeration - 0.05-0.1	Gap identified under NR 110	None	Capacity risk evaluation needed
JWRF	Liquid	MP04 - AERATION	UP05 - SECONDARY FLOW CONTROL / AERATION	days	4.0	4.0		Ave MCRT (days)	10.0	9.1	9.0	0.0	0.0	0.0			No gap identified	None	
JWRF	Liquid	MP04 - AERATION	UP15 - PROCESS AIR	lb/d	1,178,000	566,000	4 blower, 1 - 100,000 cfm, 5000 hp, with VFD, 3 - 118,000 cfm, 5500 hp each · 2 blowers are redundant · Oxygen supply available, lb O2/d - updated based on blower capacity assuming ~555 cf air/lb O2	Ave O2 demand, lb O2/d	259,000	285,000	290,000	0	0	0	NR 110.21.5 - 1.1 lb O2 per lb BOD plus 4.6 lb O2 per lb of TKN	Section 92	No gap identified	None	
JWRF	Liquid	MP04 - AERATION	UP15 - PROCESS AIR	lb/d	1,178,000	566,000		Max month O2 demand, lb O2/d	250,000	275,000	281,000	0	0	0	NR 110.21.5	Section 92	No gap identified	None	
JWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	gpd/sf	410	410	West Plant – 11 at 8,550 sf surface area each; East Plant – 10 at 13,230 sf surface area each; New East Plant – 12 at 6,250 sf surface area each · SOR, gpd/sf: - ave day 410, max day 1,000, max week 630, max month 530, peak hour (calc) 1,095 · Solids Loading Rate (SLR), lb/d/sf: - ave day 12, max day 31, max week 20, max month 16, peak hour (calc) 34 · WLR, calculated, gpd/lf – ave day 8,600	Ave SOR (gpd/sf)	353	389	390	0	0	0	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: · Surface settling rate (gpd/sf) - no ave requirement	· Sec. 72.232 – no average requirement	No gap identified	None	
JWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	gpd/sf	530	530		Max month SOR (gpd/sf)	376	415	417	0	0	0	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: · Surface settling rate (gpd/sf) - no monthly requirement	· Sec. 72.232 – no monthly requirement	No gap identified	None	
JWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	gpd/sf	1095	1095		Peak hourly SOR (gpd/sf)	1095	1095	1095	0	0	0	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: · Surface settling rate (gpd/sf) - max hourly 1,200	· Sec. 72.232 – with chemical addition, maximum hourly surface overflow rate is 900 gpd/sf	No gap identified, 10 St Std guidance, not requirement	None	
JWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	lb/d/sf	12	12		Ave Solids Loading Rate (lb/d/sf)	16.00	17.60	17.70	4.00	5.60	5.70	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: · Solids load rate (lb/h/sf) - ave 1.4 [33.6 lb/d/sf] Data reviewed based on converting to lb/d/sf as presented	· Sec. 72.232 – no average requirement	Though does not exceed NR 110, higher MLSS could have impact on secondary clarifier solids loading rate.	Design	Capacity risk evaluation needed
JWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	lb/d/sf	16.00	16.00		Max month Solids Loading Rate (lb/d/sf)	23.70	26.20	26.30	7.70	10.20	10.30	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: · Solids load rate (lb/h/sf) - no monthly requirement	· Sec. 72.232 – no monthly requirement	Though does not exceed NR 110, higher MLSS could have impact on secondary clarifier solids loading rate.	Design	Capacity risk evaluation needed
JWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	lb/d/sf	31.00	31.00		Max day Solids Loading Rate (lb/d/sf)		50.90	51.20	0.00	19.90	20.20	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: · Solids load rate (lb/h/sf) - max hourly 2 [48 lb/d/sf] Data reviewed based on converting to lb/d/sf as presented	· Sec. 72.232 – with chemical addition, maximum hourly solids loading rate is 40 lb/d/sf (1.67 lb/hr/sf)	NR 110 and design exceeded	Design/NR 110	Capacity risk evaluation needed
JWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	gpd/lf	8,600	8,600		Ave WLR (gpd/lf)	6,919	7,625	7,658	0	0	0	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: · Weir loading rate (gpd/lf) - ave 10,000	Sec. 72.43 - Maximum hourly weir loading rate is 30,000 gpd/sf	No gap identified	None	
JWRF	Liquid	MP07 - PLANT EFFLUENT	UP08 - CHEMICAL UNLOADING / DISINFECTION	min	31.4	37.1	4 Contact Basins, 8.5 MG total volume · Sodium hypochlorite use – average day 4,900 gpd, maximum day 12,000 gpd, emergency 44,000 gpd · Sodium bisulfite use – average day 790 gpd, maximum day 1925 gpd · Design Contact Time: Firm - Peak Hour w/o blending (330 MGD), Total - Peak Hour with 60 MGD blending (390 MGD) · Performance Contact Time: based on MP02 Blending performance plus design peak hour full treatment (330 MGD) = 8.5 MG/(330 + 2015/2035/2050 Performance)*1440 min/d	Contact time (min) at peak hour flow	31.4	28.8	25.5	0.0	2.6	5.9	NR 110.15.5.f Disinfection in accordance with WPDES permit - E.coli limits may be imposed NR 110.23.2.e.2 Contact tank shall be sized for 60 min at average design flow or 30 min at maximum hour design flow	Sec. 102.44 - Min contact period of 15 min	Flagged as red because did not meet 30 min requirement, though does meet average day requirement of 60 min. Requirement to meet WPDES permit needs to be reviewed against anticipated requirement to meet E.coli limits. Contact time requirement needs to consider as part of e. coli issue.	Design/NR 110	Capacity risk evaluation needed

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation	Design Treatment Capacity (If > than NR110, shown in red)			Specific Design Criteria	Performance (If > than NR110, shown in red If NR 110 okay but > firm design capacity, shown in blue)			Gap between Performance and Firm Design Capacity			Comparison of Unit Process Operations Under Revised 2020 Baseline Conditions to Current Regulations and Advisory Standards		Initial Assessment	Risk Identified:	Identification of capacity risk evaluation needed		
				UNITS	Total	Firm		2015	2035	2050	2015	2035	2050	Current NR 110 Regulation	Advisory 10-States Standards					
JWRF	Liquid	MP07 - PLANT EFFLUENT	UP09 - EFFLUENT PUMPING	MGD	520	390	4 propeller pumps, 130 MGD at 10.2' TDH, 300 hp each Performance Pumping Capacity, based on MP02 Blending performance plus design peak hour full treatment (330 MGD)	Peak hourly flow (MGD)	390	425	480	0	35	90	NR 110.14.3.f: meet peak hour design capacity with one unit out of service	Sec 42.31: with any unit out service, handle peak hourly flow	Gap in WRF effluent pumping capacity needs to be reviewed in conjunction with Blending under MP02, Primary Clarification. If evaluation determines increase in influent pumping needed, need to meet NR 110 requirements.	Design/NR 110	Capacity risk evaluation needed	
SSWRF	Liquid	MP01 - PRELIMINARY TREATMENT	UP01 - MIS FLOW CONTROL STRUCTURE	MGD	300	300	2 sluice gates, 6'x10' Water level monitors, 4 upstream, 2 downstream	Peak hour (MGD)	300	300	300	0	0	0	NR 110.14.3.f: meet peak hour design capacity with one unit out of service	Sec 42.31: with any unit out service, handle peak hourly flow	No gap identified	None		
SSWRF	Liquid	MP01 - PRELIMINARY TREATMENT	UP02 - COARSE SCREENING	MGD	350	300	7 fine screens, 50 MGD operating capacity, 0.25" opening each Screenings - 2.2 cy/hr Diversion bar screen - 300 MGD capacity	Peak hour (MGD)	300	300	300	0	0	0	NR 110.16 All requirements met	Sec 61.22: with any unit out service, handle peak instantaneous flow	No gap identified	None		
SSWRF	Liquid	MP01 - PRELIMINARY TREATMENT	UP03 - GRIT REMOVAL	MGD	300	300	7 grit channels, 42.9 MGD treatment capacity 7 grit pumps, 600 GPM each 7 slurry cup grit separation units, 590 GPM each	Peak hour (MGD)	300	300	300	0	0	0	NR 110.17 All requirements met	Sec 63: All requirements met	No gap identified	None		
SSWRF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	gpd/sf	1,100	1,100	Plant flow metering (upstream of primary clarification): 4 magnetic meters, 120 MGD each; 16 rectangular basins - 160x40x10 swd Surface Overflow Rate (SOR), gpd/sf - ave day 1,100, max day 2,440, max week 1,855, max month 1,660 Weir Loading Rate (WLR), calculated, gpd/lf - ave day 24,500, max day 54,200, max week 41,200, max month 36,900 Sludge Production (lb/d) - ave day 183,200, max day 318,900, max week 278,600, max month 234,900	Ave SOR (gpd/sf)	323	426	524	0	0	0	NR 110.18.2.d.1 Table 3, for Primary: Surface settling rate (gpd/sf) - ave 1,000	Sec. 72.21 - Ave surface settling rate 1000 gpd/sf	SOR projected is significantly less than design - need to assess if primary sludge removal rates should be increased to reduce load on MP05, Aeration.	None	Capacity risk evaluation needed	
SSWRF	Liquid	MP02 - PRIMARY CLARIFICATION	BLENDING	MGD	75	75	Blending - primary effluent to disinfection, capacity 75 MGD	Maximum Blending Capacity Needed (MGD)	0	0	0	0	0	0	No NR 110 regulation	No 10 St Standard Regulation	No gap based on limiting SSWRF influent flow to peak hourly design flow but consider based on aeration gaps	None	Capacity risk evaluation needed	
SSWRF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	gpd/sf	1,660	1,660		Max month SOR (gpd/sf)	361	477	586	0	0	0	Not included in NR 110.18.2.d.1 Table 3, for Primary	Sec. 72.21 has no monthly requirement	SOR projected is significantly less than design - need to assess if primary sludge removal rates should be increased to reduce load on MP05, Aeration.	None		
SSWRF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	gpd/sf	2,930	2,930		Peak hourly SOR (gpd/sf)	2,930	2,930	2,930	0	0	0	NR 110.18.2.d.1 Table 3, for Primary: Surface settling rate (gpd/sf) - max hourly 1,500	Sec. 72.21 - Maximum hourly surface settling rate 2000 gpd/sf		NR 110	Capacity risk evaluation needed	
SSWRF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	gpd/lf	24,500	24,500		Ave WLR (gpd/lf)	19,715	26,004	31,987	0	1,504	7,487	NR 110.18.2.d.1 Table 3, for Primary: Weir loading rate (gpd/lf) - ave 10,000	Sec. 72.43 - Maximum hourly weir loading rate is 30,000 gpd/sf		Design/NR 110	Capacity risk evaluation needed	
SSWRF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	lb/d	183,200	183,200		Ave Primary Sludge Production (lb/d)	100,000	128,000	156,000	0	0	0	NR 110.26.4.a All requirements met	Sec. 73.2 All requirements met	SOR projected is significantly less than design - need to assess if primary sludge removal rates should be increased to reduce load on MP05, Aeration.	None	Capacity risk evaluation needed	
SSWRF	Liquid	MP03 - IRON MANAGEMENT	UP18 - PICKLE LIQUOR STORAGE AND FEED	Max Day/lb/d	13,500	13,500	Dose: average day - 5,200 GPM, maximum day - 13,500 lb/d Usage: average day - 8 GPM, maximum day - 21 GPM Storage: 20,000 gal	NOT REVIEWED										NA		
SSWRF	Liquid	MP03 - IRON MANAGEMENT	UP18 - PICKLE LIQUOR STORAGE AND FEED	Max Day gpm	21	21	Dose: average day - 5,200 GPM, maximum day - 13,500 lb/d Usage: average day - 8 GPM, maximum day - 21 GPM Storage: 20,000 gal	NOT REVIEWED											NA	
SSWRF	Liquid	MP04 - AERATION	UP05 - AERATION AND RAS PUMPING	lb/1000 cf	25	25	28 basins, 1.25 MG each MLSS, mg/L - ave day 3,030, max day 2,450, max week 2,570, max month 2,880 BOD Load, lb/1000 cf - ave day 34, max day 95, max week 570, max month 48 NOTE: SINCE NOW NITRIFYING, COMPARED TO LOWER AVE AND MAX MO VALUES AS SHOWN IN DESIGN PARAMETERS Food to Microorganism Ratio (F/M), lb influent BOD/lb MLVSS-day - ave day 0.24, max day 0.84, max week 0.48, max month 0.36 Mean Cell Residence Time (MCRT), days [calculated] - ave day 4.9, max day/week/month 3.1	Ave BOD Loading (lb/1000 cf)	25.3	32.2	41.8	0	7	17	NR 110.21.4.b Table 5: Conventional Volumetric loading (lb BOD/1000 cf/d) - 40: Value assessed against Extended Aeration Volumetric loading (lb BOD/1000 cf/d) - 15	Sec. 92 - Organic Loading (lb BOD/D/ 1000 cf) for Conventional - 40, Extended aeration - 15	Gap identified based on design and NR 110 standards	Design/NR 110	Capacity risk evaluation needed	
SSWRF	Liquid	MP04 - AERATION	UP05 - AERATION AND RAS PUMPING	lb/1000 cf	30	30		Max month BOD Loading (lb/1000 cf)	33.1	42.1	54.5	3	12.1	25	NR 110.21.4.b Table 5: Conventional Volumetric loading (lb BOD/1000 cf/d) - 40: Value assessed against Extended Aeration Volumetric loading (lb BOD/1000 cf/d) - 15	Sec. 92 - Organic Loading (lb BOD/D/ 1000 cf) for Conventional - 40, Extended aeration - 15	Gap identified based on design	Design/NR 110	Capacity risk evaluation needed	
SSWRF	Liquid	MP04 - AERATION	UP05 - AERATION AND RAS PUMPING	mg/L	3,030	3,030		Ave MLSS (mg/L)	3,403	3,402	3,410	0	0	0	NR 110.21.4.b Table 5: Conventional MLSS (mg/L) - 1,000- 3,000: Value assessed against Extended Aeration MLSS (mg/L) - 3,000-5,000	Sec. 92 - MLSS (mg/L) for Conventional - 1,000-3,000, Extended aeration - 3,000- 5,000	Gap identified based on design and NR 110 standards	NR 110	Capacity risk evaluation needed	
SSWRF	Liquid	MP04 - AERATION	UP05 - AERATION AND RAS PUMPING	lb BOD/lb MLVSS-d	0.24	0.24		Ave F:M (lb BOD/lb MLVSS- d)	0.16	0.20	0.26	0.00	0.00	0.02	NR 110.21.4.b Table 5: Conventional F:M - 0.2 - 0.5: Value assessed against Extended Aeration F:M - 0.05 - 0.15	Sec. 92 - F:M (lb BOD/lb MLVSS-d) for Conventional - 0.2-0.5, Extended aeration - 0.05-0.1	Gap identified based on design and NR 110 standards	Design/NR 110	Capacity risk evaluation needed	
SSWRF	Liquid	MP04 - AERATION	UP05 - AERATION AND RAS PUMPING	lb BOD/lb MLVSS-d	0.84	0.84		Max Day F:M (lb BOD/lb MLVSS-d)		0.48	0.62	0.00	0.00	0.00	NR 110.21.4.b Table 5: Conventional F:M - 0.2 - 0.5 Extended Aeration F:M - 0.05 - 0.15	Sec. 92 - F:M (lb BOD/lb MLVSS-d) for Conventional - 0.2-0.5, Extended aeration - 0.05-0.1	Gap identified based on NR 110 standards under 2050 Conditions	NR 110	Capacity risk evaluation needed	
SSWRF	Liquid	MP04 - AERATION	UP05 - AERATION AND RAS PUMPING	days	4.9	4.9		Ave MCRT (days)	10.4	8.2	6.3	0.0	0.0	0.0			Gap identified based on design	None	Capacity risk evaluation needed	
SSWRF	Liquid	MP04 - AERATION	UP15 - PROCESS AIR SYSTEM	lb/d	156,400	156,400	4 blowers, 37,500 cfm, 1500 hp each (with electric motor replacement) Air Flow Rate, cfm - ave day 62,200, max day 134,300, max week 106,200, max month 88,900 Design based on treating BOD Load to aeration	Ave O2 demand, lb O2/d	181,000	235,000	297,000	24,600	78,600	140,600	NR 110.21.5	Section 92	Gap identified based on design	Design	Capacity risk evaluation needed	
SSWRF	Liquid	MP04 - AERATION	UP15 - PROCESS AIR SYSTEM	lb/d	223,700	223,700		Max month O2 demand, lb O2/d	214,000	277,000	352,000	0	53,300	128,300	NR 110.21.5	Section 92	Gap identified based on design	Design	Capacity risk evaluation needed	

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation Unit Process	Design Treatment Capacity (If > than NR110, shown in red)			Specific Design Criteria	Performance (If > than NR110, shown in red If NR 110 okay but > firm design capacity, shown in blue)			Gap between Performance and Firm Design Capacity			Comparison of Unit Process Operations Under Revised 2020 Baseline Conditions to Current Regulations and Advisory Standards		Initial Assessment	Risk Identified:	Identification of capacity risk evaluation needed	
				UNITS	Total	Firm		2015	2035	2050	2015	2035	2050	Current NR 110 Regulation	Advisory 10-States Standards				
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	gpd/sf	480	480	24 octagonal clarifiers, 10,333 sf surface area each SOR, gpd/sf: - ave day 480, max day 1,050, max week 800, max month 714, peak hour (calc) 1,210 Solids Loading Rate (SLR), lb/d/sf: - ave day 18, max day 32, max week 25, max month 25, peak hour (calc) 37 WLR, calculated, gpd/lf - ave day 13,800	Ave SOR (gpd/sf)	395	521	641	0	41	161	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: - Surface settling rate (gpd/sf) - no ave requirement	- Sec. 72.232 - no average requirement	Design	Capacity risk evaluation needed	
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	gpd/sf	714	714		Max month SOR (gpd/sf)	441	582	715	0	0	1	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: - Surface settling rate (gpd/sf) - no monthly requirement	- Sec. 72.232 - no monthly requirement	Design	Capacity risk evaluation needed	
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	gpd/sf	1,210	1,210		Peak hourly SOR (gpd/sf)	1,210	1,210	1,210	0	0	0	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: - Surface settling rate (gpd/sf) - max hourly 1,200	- Sec. 72.232 - with chemical addition, maximum hourly surface overflow rate is 900 gpd/sf, 1200 gpd/sf convention and extended aeration	Gap in aeration warrants inclusion of secondary clarifiers as well	NR 110	Capacity risk evaluation needed
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	lb/d/sf	18	18		Ave Solids Loading Rate (lb/d/sf)	18.50	24.40	30.00	0.50	6.40	12.00	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: - Solids load rate (lb/h/sf) - ave 1.4 [33.6 lb/d/sf] Data reviewed based on converting to lb/d/sf as presented	- Sec. 72.232 - no average requirement	Gap in aeration warrants inclusion of secondary clarifiers as well	Design	Capacity risk evaluation needed
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	lb/d/sf	25	25		Max month Solids Loading Rate (lb/d/sf)	27.50	36.20	44.60	2.50	11.20	19.60	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: - Solids load rate (lb/h/sf) - no monthly requirement	- Sec. 72.232 - no monthly requirement	Gap exceeded in buildout which may not happen by year 2050 so this should be monitored but a parameter that would trigger capacity risk evaluation.	Design	Capacity risk evaluation needed
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	lb/d/sf	37	37		Max day Solids Loading Rate (lb/d/sf)		49.90	61.50	0.00	12.90	24.50	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: - Solids load rate (lb/h/sf) - max hourly 2 [48 lb/d/sf] Data reviewed based on converting to lb/d/sf as presented	- Sec. 72.232 - maximum hourly solids loading rate is 40 lb/d/sf (1.67 lb/hr/sf)	Gap exceeded in buildout which may not happen by year 2050 so this should be monitored but a parameter that would trigger capacity risk evaluation.	Design/NR 110	Capacity risk evaluation needed
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	gpd/lf	13,800	13,800		Ave WLR (gpd/lf)	10,400	13,700	16,800	0	0	3,000	NR 110.18.2.d.1 Table 3, for Final following Activated Sludge: - Weir loading rate (gpd/lf) - ave 10,000	Sec. 72.43 - Maximum hourly weir loading rate is 30,000 gpd/sf	Gap identified, need to assess capacity	Design/NR 110	Capacity risk evaluation needed
SSWRF	Liquid	MP07 - PLANT EFFLUENT	UP08 - CHLORINATION DECHLORINATION	min	24.0	24.0	2 contact basins, 5 MG total volume Sodium hypochlorite use - average day - 3,020 gpd, maximum day - 6,670 gpd, emergency - 44,000 gpd Sodium bisulfite use: average day - 720 gpd, maximum day - 1600 gpd Design/Performance Contact Time: Total/Firm - Peak Hour (300 MGD)	Contact time (min) at peak hour flow	24.0	24.0	24.0	0.0	0.0	0.0	NR 110.15.5.f Disinfection in accordance with WPDES permit - E.coli limits may be imposed NR 110.23.2.e.2 Contact tank shall be sized for 60 min at average design flow or 30 min at maximum hour design flow	Sec. 102.44 - Min contact period of 15 min	Flagged as red because did not meet 30 min requirement, though does meet average day requirement of 60 min. Requirement to meet WPDES permit needs to be reviewed against anticipated requirement to meet E.coli limits. Contact time requirement needs to consider as part of e. coli issue.	NR 110	Capacity risk evaluation needed
SSWRF	Liquid	MP07 - PLANT EFFLUENT	UP09 - EFFLUENT PUMPING	MGD	375	300	5 wet pit axial flow pumps, 75 MGD each Effluent measurement - 15' Parshall flume, not used	Peak hourly flow (MGD)	300	300	300	0	0	0	NR 110.14.3.f: meet peak hour design capacity with one unit out of service	Sec 42.31: with any unit out service, handle peak hourly flow	Gap in WRF effluent pumping capacity needs to be reviewed in conjunction with Blending under MP02, Primary Clarification. If evaluation determines increase in influent pumping needed, need to meet NR 110 requirements.	Design	Capacity risk evaluation needed
ISP	Biosolids	MP19 - LIQUID SLUDGE	UP13 - INTERPLANT SLUDGE PUMPING	MGD	8.64	5.76	Three 2-stage pairs of pumps, 2000 GPM each at JIWWTP, 4 Interplant Solids Pipes between plants: #1 = 14-inch #2 = 12-inch, JIWWTP Primary to SSWWTP Capacities presented in MGD.	Max month primary sludge pumping to SSWRF (MGD)	0.41	0.45	0.46	0.00	0.00	0.00	NR 110.26.4.a All requirements met	Sec. 73.2 All requirements met	No gaps identified	None	
ISP	Biosolids	MP19 - LIQUID SLUDGE	UP13 - IPS PUMP STATION	MGD	5.44	3.34	Three 2-stage pairs of pumps, 1160 GPM each at SSWWTP 4, Interplant Solids Pipes between plants: #1 = 14-inch #2 = 12-inch, SSWWTP WAS & digested sludge to JIWWTP Capacities presented in MGD.	Max month WAS/digested sludge pumping to JIWWTP (MGD)	2.25	2.80	3.46	0.00	0.00	0.12	NR 110.26.4.a All requirements met	Sec. 73.2 All requirements met	No gaps identified by year 2035. Buildout, though presented as year 2050, may not happen by then so should only be monitored at this time.	Design	Capacity risk evaluation needed
JIWWRF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP11 - SLUDGE SCREENING AND PUMPING	Screening MGD	2.88	2.52	Primary Sludge Screening 3 existing Parkson screens, 250 GPM each 5 new Parkson screens, 250 GPM each Screenings Quantity: Average day - 39 cf/hr, Peak Hour - 630 cf/hr Primary Sludge Pumping Screened sludge pumping, 3 units, 1080 GPM each Capacities presented in MGD.	Max day primary sludge screened (MGD)		1.20	1.21	0.00	0.00	0.00	NR 110.26.4.a All requirements met	Sec. 73.2 All requirements met	No gap identified	None	
JIWWRF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP11 - SLUDGE SCREENING AND PUMPING	Pumping MGD	4.67	3.11		Max day primary sludge pumped (MGD)		1.20	1.21	0.00	0.00	0.00	NR 110.26.4.a All requirements met	Sec. 73.2 All requirements met	No gap identified	None	
JIWWRF	Liquid	MP06 - ACTIVATED SLUDGE	UP07 - ACTIVATED SLUDGE PUMPING	MGD	165	120	- West Plant - 3 centrifugal pumps at 14.8 MGD, 28' TDH, 125 hp each - East Plant - 4 centrifugal pumps at 30.2 MGD, 24' TDH, 200 hp each Return activated sludge (RAS), MGD - Ave day 49 (40% of ave flow), max day 160 (130% of ave flow)	Max day RAS flow (MGD)		165	166	0	45	46	NR 110.21.7.a Table 7 Minimum to maximum flow rates as % of ave flow - Conventional - 15-75 - Extended aeration 50-200	Sec. 92.41 Minimum to maximum flow rates as % of ave flow - Conventional - 15-100 - Extended aeration/nitrification - 50-150	Gap identified, MLSS has impact on RAS operation	Design	Capacity risk evaluation needed
JIWWRF	Biosolids	MP06 - ACTIVATED SLUDGE	UP23 - WAS RECEIVING / GALLERY SOLIDS PIPING INTERTIE	MGD	7.76	4.82	JI WAS Pumping - West Plant - 2 centrifugal pumps at 730 gpm, 80' TDH, 25 hp each, - East Plant - 3 centrifugal pumps at 1310 gpm, 80' TDH, 50 hp each Waste Sludge Production - Average Day 218,000 lb/d (109 tpd), Maximum Day 400,000 lb/d (200 tpd) Flow - Average day 2150 gpm, Maximum day 5390 gpm WAS Processing (JIWWRF and SSWRF) - 3 pumps, 1870 GPM at 138' TDH, 100 hp each, 2 Wet Wells, 21,200 gal each Capacities presented in MGD.	Max day WAS Pumping to WAS Processing (MGD)		5.10	5.16	0	0.28	0.34	NR 110.21.7.c - WAS pumping shall be at least 200% of volumetric sludge production rate	Sec. 92.44 WAS capacity at least 25% of design average wastewater flow	Gap identified, need to assess capacity	Design/NR 110	Capacity risk evaluation needed
JIWWRF	Biosolids	MP06 - ACTIVATED SLUDGE	UP23 - WAS RECEIVING / GALLERY SOLIDS PIPING INTERTIE	MGD	8.08	5.39		Max day WAS/DSD Processing to GBT/E/B (MGD)		10.70	11.97	0	5.31	6.58	NR 110 not applicable, this includes WAS from both plants	10 St Stds not applicable, this includes WAS from both plants	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
JIWWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	MGD	7.26	5.44	Four 3-meter GBTs - 1260 gpm, 45.25 ton/d each - Four thickened sludge transfer pumps, 1,800 GPM total capacity Capacities presented in MGD.	Max day flow (MGD)		9.13	10.16	0	3.69	4.72	NR 110.26.2.b requirements met	Sec. 83 requirements met	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
JIWWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	MGD	7.26	5.44		Max month flow (MGD)	4.09	4.74	5.31	0	0.00	0.00	NR 110.26.2.b requirements met	Sec. 83 requirements met	No gap identified	None	
JIWWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	tons/d	181	136		Max day processing (ton/d)		423	468	0	287	332	NR 110.26.2.b requirements met	Sec. 83 requirements met	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
JIWWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	tons/d	181	136		Max month processing (ton/d)	184	213	237	48	77	101	NR 110.26.2.b requirements met	Sec. 83 requirements met	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation Unit Process	Design Treatment Capacity (If > than NR110, shown in red)			Specific Design Criteria	Performance (If > than NR110, shown in red) (If NR 110 okay but > firm design capacity, shown in blue)			Gap between Performance and Firm Design Capacity			Comparison of Unit Process Operations Under Revised 2020 Baseline Conditions to Current Regulations and Advisory Standards		Initial Assessment	Risk Identified:	Identification of capacity risk evaluation needed	
				UNITS	Total	Firm		2015	2035	2050	2015	2035	2050	Current NR 110 Regulation					Advisory 10-States Standards
				Design Criteria Details	PERFORMANCE CRITERIA	2015		2035	2050	2015	2035	2050	Current NR 110 Regulation	Advisory 10-States Standards					
JWRF	Biosolids	MP08 - SLUDGE THICKENING	UP12 - EQUALIZATION & BLEND	MGD	4.94	2.47	2 Mix Tanks, 360,000 gal each · Tank 1 — Primary sludge equalization before pumping to digesters at SS · Tank 2 — Blend portion of JWRF primary, portion of JWRF WAS, JWRF GBT, SSWRF WAS/digested sludge before Belt Filter Presses · Capacities based on design residence time of 3.5 hr and presented in MGD	Max month flow through EQ tanks (MGD)	1.61	1.90	2.15	0.00	0.00	0.00	NR 110.26.2.e requirements met	Sec. 89 requirements met	No gap identified	None	
JWRF	Biosolids	MP10 - SLUDGE DEWATERING	UP24 - DEWATERING	tons/d	240	230	24 2-meter dewatering belt filter presses, 10 dry tons per press	Max month processing (ton/d)	216	253	284	0	23	54	NR 110.26.8 requirements met	Sec. 88.3 requirements met	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
JWRF	Biosolids	MP11 - SLUDGE DRYING	UP25 - DRYING	dry tons/d	240	200	12 rotary drum dryers, each capable of producing 20 dry tons per day · Run in trains of 2 dryers, each	Max month Milo produced (dry ton/d)	185	216	243	0	16	43	NR 110 requirements don't apply	10 St Stds not applicable	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
JWRF	Biosolids	MP12 - MILORGANITE PRODUCTION	UP29 - CLASSIFICATION	dry tons/d	240	200	Two redundant material classification trains · Each train includes: recycle to classification system, first-stage classification, wet recycle system, second-stage classification, third-stage classification, screener feed overflow system	NOT REVIEWED							NR 110 requirements don't apply	10 St Stds not applicable		NA	
JWRF	Biosolids	MP13 - MILORGANITE STORAGE	UP27 - MILORGANITE STORAGE	days storage	45	38	14 silos, arranged in 2 banks of 7 silos · 2 designated for conditioning, west end of south bank · Total storage: 45 days worth of product, which at 200 ton/d equals 9,000 tons · Firm capacity based on 200 ton/d product with 2 conditioning silos excluded (7,700 tons storage) · Milorganite should not be stored more than 30 days	Days storage, at max month production	42	36	32	0	2	6	NR 110.26.10 requirements met	Sec. 89.12 Minimum range of 120-180 days storage unless different period approved by reviewing authority	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
JWRF	Biosolids	MP14 - MILORGANITE WASTE PROCESSING &	UP30 - CYCLONE WASTE				12 exhaust gas treatment systems consisting of a cyclone and wet electrostatic precipitator	NOT REVIEWED							NR 110 requirements don't apply	10 St Stds not applicable		NA	
SSWRF	Liquid	MP06 - ACTIVATED SLUDGE	UP05 - AERATION AND RAS PUMPING	MGD	156	124.8	6 RAS-WAS transfer pumps, 7.7 MGD each, 3 per battery; 10 RAS pumps, 15.6 MGD each, 2 per battery plus backup · Return sludge pumping: ave day - 57 MGD, max day - 125 MGD	Max day RAS flow (MGD)		154	190	0	29	65	NR 110.21.7.a Table 7 Minimum to maximum flow rates as % of ave flow · Conventional 15-75 · Extended aeration 50-200	Sec. 92.41 Minimum to maximum flow rates as % of ave flow · Conventional - 15-100 · Extended aeration/nitrification - 50-150	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
SSWRF	Biosolids	MP06 - ACTIVATED SLUDGE	UP05 - AERATION AND RAS PUMPING	MGD	6.91	5.18	4 WAS pumps, 1200 GPM each · Waste sludge production: ave day - 172,900 lb/d, max day - 320,900 lb/d; Flow: ave day - 1600 GPM, max day - 3810 GPM Capacities presented in MGD	Max day WAS Pumping (MGD)		3.67	4.76	0	0	0	NR 110.21.7.c - WAS pumping shall be at least 200% of volumetric sludge production rate	Sec. 92.44 WAS capacity at least 25% of design average wastewater flow	Though does not meet NR 110, no gap identified; WAS pumping is not anticipated to impact ability to meet permit limits	NR 110	Capacity risk evaluation needed
SSWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	lb/d	178,560	148,800	DISSOLVED AIR THICKENERS (DAFs) · 6 DAFs at 1240 lb/hr each - 1240 sf surface area each - 6% thickened waste activated sludge (TWAS) solids concentration · TWAS pumps - 4 - 150 GPM each; 3 - 225 GPM GRAVITY BELT THICKENERS (GBTs) · Three gravity belt thickeners, 2 m (installed 2005-2008) · 6% - 10% thickened sludge solids · Firm capacity - 2 mgd, 92 dtpd, 1400 GPM · Thickening centrifuges decommissioned Capacities presented in MGD and lb/d	DAF Max month processing (lb/d)	24,000	30,500	39,500	0	0	0	NR 110.26.2.b requirements met	Sec. 83 requirements met	No gap identified	None	
SSWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	TWAS MGD	0.972	0.648		DAF TWAS Max month flow (MGD)	0.068	0.087	0.113	0	0	0	NR 110.26.2.b requirements met	Sec. 83 requirements met	No gap identified	None	
SSWRF	Biosolids	MP09 - ANAEROBIC DIGESTION	UP11 - ANAEROBIC DIGESTION	lb TSS/d	215,800	215,800	Six anaerobic digesters - Four north digesters - 3.2 MG each · Two south digesters - 1.25 MG each - LMM, pump and nozzle and bubble cannon mixing on north digesters · Mechanical propeller mixing on south digesters · VS loading, lb VS/cf/day - Ave .06, max month 0.12 · TSS loading, lb/day - Ave 215,800, max month 405,300 - reduced from O&M based on reduced volume · Detention time, days - Ave 31, max month 15, max week 14, max day 13	Ave TSS Loading (lb/d)	189,600	230,300	266,900	0	14,500	51,100	NR 110.26.5 requirements met	Sec. 84 requirements met	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
SSWRF	Biosolids	MP09 - ANAEROBIC DIGESTION	UP11 - ANAEROBIC DIGESTION	lb TSS/d	405,300	405,300		Max month TSS Loading (lb/d)	246,800	297,400	339,800	0	0	0	NR 110.26.5 requirements met	Sec. 84 requirements met	No gap identified	None	
SSWRF	Biosolids	MP09 - ANAEROBIC DIGESTION	UP11 - ANAEROBIC DIGESTION	lb VS/cf/d	0.12	0.12		Max month VS Loading (lb VS/cf/d)	0.09	0.11	0.13	0.00	0.00	0.01	NR 110.26.5 requirements met	Sec. 84 requirements met	Gap identified, need to assess capacity	Design	Capacity risk evaluation needed
SSWRF	Biosolids	MP09 - ANAEROBIC DIGESTION	UP11 - ANAEROBIC DIGESTION	days	31	31		Ave Detention Time (days)	21.60	17.80	15.50	0.0	0.0	0.0	NR 110.26.5 - 15 days detention time at design flows	Sec. 84 requirements met	Detention time is less than design but more than NR 110 so no gap identified.	NR 110	Capacity risk evaluation needed
SSWRF	Biosolids	MP09 - ANAEROBIC DIGESTION	UP11 - ANAEROBIC DIGESTION	days	13	13		Max Day Detention Time (days)		5.70	5.10	0.0	0.0	0.0	NR 110.26.5 - 15 days detention time at design flows	Sec. 84 requirements met	No gap identified	None	
SSWRF	Biosolids	MP09 - ANAEROBIC DIGESTION	UP20 - AGRILIFE STORAGE FACILITIES	Storage MG	9	7.5	Using old digesters converted to sludge storage - originally converted all eight south digesters but converted 2 back to active digesters - Designed for 1.5 MG storage for each digester	NOT REVIEWED										NA	
SSWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	MGD	3.02	2.02	Capacities presented in MGD	GBT Ave feed (MGD)	0.07	0.09	0.10	0.00	0.00	0.00	NR 110.26.2.b requirements met	Sec. 83 requirements met	No gap identified	None	
SSWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	ton/d	138	92		GBT Ave processing (ton/d)	5.2	6.3	7.3	0	0	0	NR 110.26.2.b requirements met	Sec. 83 requirements met	No gap identified	None	
SSWRF	Biosolids	MP10 - SLUDGE DEWATERING	UP14 - FILTER PRESS DEWATERING	Feed MGD	3.46	2.30	5 plate and frame presses, only 4 operable · 8 pumps, 400 GPM each - 3 pumps per pair of presses for four presses, 2 pumps for fifth press, 13.3 ton/d each · Total capacity assumes all 4 presses operational with 3 pumps per pair of presses; firm assumes all 4 presses but 1 pump out per pair Capacities presented in MGD	Ave feed (MGD)	0.0050	0.0061	0.0070	0	0	0	NR 110.26.8 requirements met	Sec. 88.3 requirements met	No gap identified	None	
SSWRF	Biosolids	MP10 - SLUDGE DEWATERING	UP14 - FILTER PRESS DEWATERING	Cake ton/d	66.3	53		Ave cake production (ton/d)	1.0	1.2	1.4	0.0	0.0	0.0	NR 110.26.8 requirements met	Sec. 88.3 requirements met	No gap identified	None	

WRFs and Biosolids Capacity Assessment
 Redundancy/Single-Point Failure Assessment

Developed by: DD
 Updated by: DD

Initials: DD
 Date: 7/9/2019
 9/20/2019

1st draft
 Updated after meeting with Veolia/MMSD

Notes:

0) Assessment captures Redundancy/Single-point Failure Risks.

1) Risks were identified during Design and NR 110 Assessment, and updated based on feedback from MMSD and review with Veolia Water Management staff.

Meeting on JIWRWF single-point failures held on 8/26/19; meeting on SSWRF single-point failures held on 8/30/19.

2) Identification of capacity risk evaluation needed does not automatically indicate that a project is warranted. Evaluations in later chapters will gather more information to determine if project is warranted or not, and why.

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation Unit Process	Specific Design Criteria Design Criteria Details	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
JIWRWF	Liquid	MP01 - PRELIMINARY TREATMENT	UP01 - INFLUENT SIPHONS / PUMPING	- Modulating HL and LL siphon gates (one each) - 3 ISS pumps each with isolation cone valve, 1 JI Head Tank - Low Level (LL) Pumps - 4 Screw Pumps: 46.7 MGD at 24' TDH each, 3 of 4 = 140 MGD - High Level (HL) Pumps - 5 Screw Pumps: 82.6 MGD at 13.1' TDH each, 4 of 5 = 330 MGD	LOW				
JIWRWF	Liquid	MP01 - PRELIMINARY TREATMENT			LOW	Single pipe from the JI ISS Head Tank to JI Preliminary Treatment. Single valve and flow meter from ISS to Preliminary Treatment. MMSD is conducting a pipe condition assessment.	Implement the recommendations of the pipe condition assessment report. Conduct a condition assessment of the ISS pump out single butterfly valve.	X	MMSD CCO and Veolia to evaluate need for and schedule of valve condition assessment
JIWRWF	Liquid	MP01 - PRELIMINARY TREATMENT	UP02 - INFLUENT SCREENING	- 8 Mechanically Cleaned Bar Screens at 55 MGD each, 1/8" Clear Opening. 6 of 8 screens = 330 MGD.	VERY LOW				
JIWRWF	Liquid	MP01 - PRELIMINARY TREATMENT	UP03 - GRIT REMOVAL	- 6 Pista Grit Vortex Concentrators - 70 MGD hydraulic capacity each = 350 MGD (firm capacity) - 55 MGD treatment capacity each = 275 MGD (firm capacity) - 95 percent removal of particles 70 mesh (0.20 mm) and larger with a specific gravity of 2.65 (silica sand)	VERY LOW	5 of 6 grit tanks can convey and process 330 mgd. 3 grit washers one per two grit tanks. Failure of one washer reduces capacity to 275 MGD. Grit collectors and pumps are currently being replaced	Warehouse inventory for washer key spare parts		MMSD CCO and Veolia to evaluate spare parts inventory requirements
JIWRWF	Liquid	MP02 - PRIMARY CLARIFICATION	BLENDING	Blending - bypass from ISS Pump Station to Disinfection through bypass channel - Capacity listed is previously permitted capacity, not hydraulic capacity which is 180 mgd (per the original hydraulic profile)	LOW	Single valve to direct flow to the diversion channel. Also single channel and single outlet flap valve to the SE channel.	Valve should have high priority for preventive maintenance and schedule replacement prior to reaching end of service life. Periodic condition inspection of discharge flap valve		MMSD CCO and Veolia to evaluate need for and schedule of valve condition assessment
JIWRWF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	- 8 Primary Clarifiers - 160 dia. x 12 swd, each - 7 of 8 primary clarifiers at 55 mgd each = 330 mgd - Surface Overflow Rate (SOR), gpd/sf - ave day 760, max day 1,870, max week 1,180, max month 1,000 - Weir Loading Rate (WLR), calculated, gpd/lf - ave day 30,400, max day 74,800, max week 47,200, max month 40,000 - Sludge Production (ton per day) - ave day 116, max day 236, max week 175, max month 153	NA				

Level 2	Level 3	Level 4	Level 5 - Designation	Specific Design Criteria	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
Facility	Facility Division	Major Process	Unit Process	Design Criteria Details					
JIWRF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP18 - SCUM CONCENTRATION	· 2 Rotating drum screen, 300 GPM each. Scum press, 71 cf/hr capacity. 1 backup scum floatation thickener, 100 gpm.	VERY LOW	Single scum pipe from primary clarifiers to Preliminary Treatment - scum concentrators. Single scum dewatering press.	Conduct pipe condition assessments on a routine schedule		MMSD CCO and Veolia to evaluate need for and schedule of pipe condition assessment
JIWRF	Liquid	MP03 - IRON MANAGEMENT	UP20 - PICKLE LIQUOR / FERRIC CHLORIDE	Pumped Feed: Pickle Liquor Feed – 25 GPM; Iron Addition – 25,200 lb/d Gravity Feed: Pickle Liquor Feed - 15 GPM, Iron Addition – 15,000 lb/d	LOW	Single PVC pipe from chemical storage to Preliminary Treatment. This pipe has frozen in the past. Chemical Unloading heating system is not sized for low winter temperatures	Chemical Unloading heating unit size		MMSD CCO and Veolia to evaluate need for Bldg 243 heating system capacity assessment
JIWRF	Liquid	MP04 - AERATION	UP05 - SECONDARY FLOW CONTROL / AERATION	· West Plant – 12 single pass channels, 1 MG; East Plant – 20 single pass channels, 1-1.4 MG, 19-1.65 MG · Mixed Liquor Suspended Solids (MLSS) under all conditions – 2400 mg/L · BOD Load, lb/1000 cf/d – ave day 32, max day 85, max week 60, max month 45 · Food to Microorganism Ratio (F/M), lb influent BOD/lb MLVSS-day – ave day 0.3, max day 0.8, max week 0.5, max month 0.4 · Mean Cell Residence Time (MCRT), days [calculated] – ave day 4, max day/week/month 2.8	LOW	Single aeration air header from the PACs to the East Aeration basins and to the West Aeration basins	Conduct pipe condition assessments on a routine schedule		MMSD CCO and Veolia to evaluate need for and schedule of pipe condition assessment
JIWRF	Liquid	MP04 - AERATION	UP15 - PROCESS AIR	· 4 blowers, 1 - 100,000 cfm, 4,500 hp, with VFD, 3 - 80-120,000 cfm, 5,500 hp each · 2 blowers are redundant · Oxygen demand, lb O2/d - ave day 184,000, max day 361,000, max week 287,000, max month 245,000	VERY LOW	#1 PAC replaced in the past 10 years, #2 PAC overhauled, #3 and #4 PACs will be scheduled for overhaul when hours set point is reached. PACs #2, #3, #4 each has an obsolete exciter on the motor	Evaluate alternatives to replace the obsolete motor exciters or other modification to eliminate reliance on obsolete key part.		MMSD CCO and Veolia to evaluate alternatives for exciters replacement
JIWRF	Liquid	MP06 - ACTIVATED SLUDGE	UP07 - ACTIVATED SLUDGE PUMPING	- West Plant – 3 centrifugal pumps at 14.8 MGD, 28' TDH, 125 hp each - East Plant – 4 centrifugal pumps at 30.2 MGD, 24' TDH, 200 hp each · Return activated sludge (RAS), MGD - Ave day 49 (40% of ave flow), max day 160 (130% of ave flow)	MEDIUM	RAS system may not have capacity for 50% of max day flow (165 mgd). Testing of RAS system capacity is planned.	Complete RAS system testing to determine if there is a redundancy issue	X	
JIWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	· West Plant – 11 at 7,770 sf surface area each; East Plant – 10 at 13,230 sf surface area each; New East Plant – 12 at 6,360 sf surface area each · SOR, gpd/sf: - ave day 410, max day 1,000, max week 630, max month 530, peak hour (calc) 1,095 · Solids Loading Rate (SLR), lb/d/sf: - ave day 12, max day 31, max week 20, max month 16, peak hour (calc) 34 · WLR, calculated, gpd/lf – ave day 8,600	NA				
JIWRF	Biosolids	MP06 - ACTIVATED SLUDGE	UP23 - WAS RECEIVING / GALLERY SOLIDS PIPING INTERTIE	Jl WAS Pumping - West Plant – 2 centrifugal pumps at 730 gpm, 80' TDH, 25 hp each, - East Plant – 3 centrifugal pumps at 1310 gpm, 80' TDH, 50 hp each · Waste Sludge Production – Average Day 218,000 lb/d (109 tpd), Maximum Day 400,000 lb/d (200 tpd) · Flow – Average day 2150 gpm, Maximum day 5390 gpm WAS Processing (JIWRF and SSWRF) - 3 pumps, 1870 GPM at 138' TDH, 100 hp each, 2 Wet Wells, 21,200 gal each Capacities presented in MGD.	VERY LOW				

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation Unit Process	Specific Design Criteria Design Criteria Details	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
JIWRF	Liquid	MP07 - PLANT EFFLUENT	UP08 - CHEMICAL UNLOADING / DISINFECTION	<ul style="list-style-type: none"> 4 Contact Basins, 2.3 mgal each, 9.22 MG total volume Sodium hypochlorite use – average day 4,900 gpd, maximum day 12,000 gpd, emergency 44,000 gpd Sodium bisulfite use – average day 790 gpd, maximum day 1925 gpd Design Contact Time: Firm - Peak Hour w/o blending (330 MGD), Total - Peak Hour with 60 MGD blending (390 MGD) Performance Contact Time: 330 mgd = 40 min, 390 mgd = 34 min 	LOW	<p>Two hypochlorite lines, one to SE channel 1 and one to SE channel 2, four chemical induction units, two for each channel. Two bisulfite lines, one to FE channel 1 and one to FE channel 2, four chemical induction units, two for each channel.</p> <p>Single chemical lines are potential single point failure.</p> <p>Lines have frozen in the past.</p>	<p>Evaluate alternatives for redundant lines or line cross connections and control modifications to allow chemical feed to both channels if one line is out of service.</p> <p>Upgrade the Heating unit for Chemical Unloading.</p>		<p>MMSD CCO and Veolia to evaluate alternatives for chemical piping</p> <p>MMSD CCO and Veolia to evaluate need for Bldg 243 heating system capacity assessment</p>
JIWRF	Liquid	MP07 - PLANT EFFLUENT	UP09 - EFFLUENT PUMPING	<ul style="list-style-type: none"> 4 propeller pumps, 130 MGD at 10.2' TDH, 300 hp each Performance Pumping Capacity: based on MP02 Blending performance plus design peak hour full treatment (330 MGD) 4 standby submersible pumps, 33.8 mgd each = 135 mgd 	LOW	<p>4 standby submersible pumps also available for spare capacity</p> <p>Effluent pumps designed for a maximum, instantaneous lake level of +2.84 - MMSD datum. Conversion to NAVD88 +580.36 = +583.20</p> <p>Lake Michigan water level tied the July record for high water in 2019 at +582.5, ~0.7 feet below the rated limit of the effluent pumps. Easterly winds can raise the water level at the JIWRF by more than 1 foot</p>	<p>Conduct engineering study of effluent pump station and lake levels to determine whether or not there is a risk posed by future, potentially very high water levels in Lake Michigan.</p>		<p>MMSD CCO and Veolia to evaluate effluent pump capacity impacts as compared to current and projected Lake Michigan water levels</p>
JIWRF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP11 - SLUDGE SCREENING AND PUMPING	<p>Primary Sludge Screening</p> <ul style="list-style-type: none"> 3 existing Parkson screens, 150 GPM each 3 new Huber screens, 150 GPM each Total capacity 1.3 mgd Two grinders - 500 gpm each Screenings Quantity: Average day - 39 cf/hr, Peak Hour - 630 cf/hr <p>Primary Sludge Pumping</p> <ul style="list-style-type: none"> Screened sludge pumping, 3 units, 1080 GPM each 	VERY LOW	<p>Single E&B Tank for transfer of primary sludge to IPS system. If E&B is not available:</p> <ul style="list-style-type: none"> send primary sludge to SSWRF direct waste primary sludge to East Plant send to blended sludge for Milo production, but causes dust problems 			
JIWRF	Biosolids	MP06 - ACTIVATED SLUDGE	UP23 - WAS RECEIVING / GALLERY SOLIDS PIPING INTERTIE	<p>JI WAS Pumping</p> <ul style="list-style-type: none"> West Plant – 2 centrifugal pumps at 730 gpm, 80' TDH, 25 hp each, - East Plant – 3 centrifugal pumps at 1310 gpm, 80' TDH, 50 hp each Waste Sludge Production – Average Day 218,000 lb/d (109 tpd), Maximum Day 400,000 lb/d (200 tpd) Flow – Average day 2150 gpm, Maximum day 5390 gpm <p>WAS Processing (JIWRF and SSWRF)</p> <ul style="list-style-type: none"> 3 pumps, 1870 GPM at 138' TDH, 100 hp each, 2 Wet Wells, 21,200 gal each 	VERY LOW				
JIWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	<ul style="list-style-type: none"> Four 3-meter GBTs · 1260 gpm, 45.25 ton/d each Four thickened sludge transfer pumps, 1,800 GPM total capacity 	MEDIUM	<p>3 of 4 GBTs do not have capacity for maximum day D&D production</p> <p>TAS pumps premature failures impact Milorganite production.</p>	<p>Evaluate need and cost-benefit to add a 5th GBT</p> <p>MMSD project to improve discharge piping and add two new TAS pumps for added redundancy</p>	X	<p>MMSD CCO and Veolia to evaluate need for 5th GBT</p>
JIWRF	Biosolids	MP08 - SLUDGE THICKENING	UP12 - EQUALIZATION & BLEND	<ul style="list-style-type: none"> 2 Mix Tanks, 360,000 gal each Tank 1 — Primary sludge equalization before pumping to digesters at SS Tank 2 — Blend portion of JIWRF primary, portion of JIWRF WAS, JIWRF GBT, SSWRF WAS/digested sludge before Belt Filter Presses Capacities based on design residence time of 3.5 hr and presented in MGD 	LOW	<p>One tank dedicated to D&D production.</p> <p>One tank dedicated to Primary Sludge transfer to IPS.</p> <p>Two gas mixing compressors, one compressor is standby.</p>	<p>If Milo blended sludge E&B tank is out of service for an extended time, use primary sludge E&B tank for blended sludge.</p> <p>Primary sludge is processed as noted above.</p>		

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation Unit Process	Specific Design Criteria Design Criteria Details	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
JIWRF	Biosolids	MP10 - SLUDGE DEWATERING	UP24 - DEWATERING	· 24 2-meter dewatering belt filter presses, 10 dry tons per press	LOW	R036, R037 - condition of sludge cake feed, bypass and transfer belts and belt scales, due to high maintenance requirements redundancy is often compromised	Implement RBC009 recommendations that are related to single point failure	X	MMSD CCO and Veolia to evaluate need for improved spare parts inventory
JIWRF	Biosolids	MP11 - SLUDGE DRYING	UP25 - DRYING	· 12 rotary drum dryers, each capable of producing 20 dry tons per day	MEDIUM	Multiple equipment in each dryer train increases likelihood of train outages R053 - Dryer Exhaust Duct leaks - MMSD has scheduled a repair project R066 - Main Recycle Air Belts - Recent project have addressed some of the issues, but not all? R067 - Main Recycle Screw Conveyors - Were all four recently replaced? R082 - Product Coolers, coolers recently replaced and spare rotor is on site, maintain spare rotor and key spare parts	Implement RBC009 recommendations that are related to single point failure	X	MMSD CCO and Veolia to evaluate need for improved spare parts inventory
JIWRF	Biosolids	MP12 - MILORGANITE PRODUCTION	UP29 - CLASSIFICATION	· Two redundant material classification trains · Each train includes: recycle to classification system, first-stage classification, wet recycle system, second-stage classification, third-stage classification, screener feed overflow system	VERY HIGH	Multiple equipment in each classification train increases likelihood of train outages. RBC265-300, due to high maintenance demands on classification equipment, redundancy is often compromised Refer to TS-2627 Task 8 Tech Memo - Process Reliability Analysis (PRA) for the Classification System - Fines Transfer Bypass Conveyor - no redundant conveyor - Second and Third Stage equipment in the Greens Grade Train - no redundant Greens Grade equipment train - Overflow Bucket Elevator and Screener Feed Overflow Screw - no backup means to handle overflows in a prolonged equipment outage. - Product Coolers chilled water supply - potential issue with power and controls redundancy - Product Storage Bins/Transporters - provide individual local controls, replace aged equipment - Transport Diverter Valves - evaluate manual valve controls, replace aged equipment - 3 Recycle Bins Weigh Elements (09/09/19 email from Jacob Holbert Veolia	Implement RBC009 recommendations that are related to single point failure Incorporate recommendations from J04069	X	MMSD CCO and Veolia to evaluate need for improved spare parts inventory MMSD CCO and Veolia to evaluate alternatives for proactive replacement schedule for key components or improvements to provide redundancy when necessary
JIWRF	Biosolids	MP13 - MILORGANITE STORAGE	UP27 - MILORGANITE STORAGE	· 14 silos, arranged in 2 banks of 7 silos · 2 designated for conditioning, west end of south bank · Total storage: 45 days worth of product, which at 200 ton/d equals 9,000 tons · Firm capacity based on 200 ton/d product with 2 conditioning silos excluded (7,700 tons storage) · Milorganite should not be stored more than 30 days '- Dust Suppression System '- Product Conditioning System	HIGH	R087, R088 - Silo rail loadout conveyors, no redundant conveyors R330 - no redundant ribbon mixer R331, R332 - no redundant dust suppression chemical mixer	Implement RBC009 recommendations that are related to single point failure Maintain spare replacement conveyors in warehouse or evaluate alternative to install redundant conveyors Maintain spare replacement dust suppression equipment or evaluate alternative to install redundant systems	X	MMSD CCO and Veolia to evaluate need for improved spare parts inventory

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation Unit Process	Specific Design Criteria Design Criteria Details	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
JIWRF	Biosolids	MP14 - MILORGANITE WASTE PROCESSING & DUST CONTROL	UP30 - CYCLONE WASTE	12 exhaust gas treatment systems consisting of a cyclone and wet electrostatic precipitator	VERY HIGH	<p>Most of the UP 30 Fines Processing is out of service. A portion of this process is used for Greens Grade transport.</p> <p>Refer to TS-2627 Task 8 Tech Memo - Process Reliability Analysis (PRA) for the Classification System</p> <ul style="list-style-type: none"> - Fines Recycle Transfer Screw and Fines/Wet Recycle Bucket Elevator, no redundant Greens Grade equipment train <p>Refer to "Single Source Failure Risks DD" file:</p> <ul style="list-style-type: none"> - Baghouse Screener Area - Baghouse Dryer Area 6th floor - Explosion Suppression System and Controls Baghouse - Explosion Suppression System and Controls Dryer Area - Dust Containment Screw Conveyors, Dust Drag Conveyor - Dust Duct Structure - Fan Dryer Area (0000012560) - Milorganite Diverter Valves - Overflow Bucket Elevator - Fines Classification Bypass Conveyor <p>Refer to J04069 Tech Memo - Single Point Failure assets include:</p> <ul style="list-style-type: none"> - Fines Recycle Transfer Screw and Fines/Wet Recycle Bucket Elevator, Provide redundant Greens Grade Train 	<p>Implement RBC009 recommendations that are related to single point failure</p> <p>Evaluate alternative solutions to address SPF of items listed in Task 8 TM and in SPF Risks DD file</p>	X	<p>MMSD CCO and Veolia to evaluate alternatives for proactive replacement schedule for key components or improvements to provide redundancy for the Greens Grade train</p> <p>MMSD CCO and Veolia to evaluate alternatives for addressing identified SPFs</p>
						<p>Refer to J04069 Tech Memo - Single Point Failure assets include:</p> <ul style="list-style-type: none"> - Fines Recycle Transfer Screw and Fines/Wet Recycle Bucket Elevator, Provide redundant Greens Grade Train - Screens Area Dust Containment System, Provide redundant system - Fines Transport Bypass Conveyor, Provide redundant conveyor - Second and Third Stage Equipment in GG Train, Provide redundant GG train - Overflow Bucket Elevator and Screener Feed Overflow Screw Conveyor, provide backup means to handle overflows in a prolonged outage - Product Cooler Chilled Water Supply Controls, verify power and controls redundancy - Product Storage Bins/Transporters, revise local control to provide independent control of each Product Storage Bin/Transporter System - Transport Diverter Valves, provide manual valve controls 	<p>Evaluate alternative solutions to address SPF of items listed in J04069 TM. NOTE: Several SPF assets are repeated in the various lists.</p>	X	<p>MMSD CCO and Veolia to evaluate alternatives for addressing identified SPFs</p>

Level 2	Level 3	Level 4	Level 5 - Designation	Specific Design Criteria	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
Facility	Facility Division	Major Process	Unit Process	Design Criteria Details					
JIWRF	Biosolids	MP14 - MILORGANITE WASTE PROCESSING & DUST CONTROL	UP31 - FINES				Implement RBC009 recommendations that are related to single point failure		
JIWRF	Biosolids	MP14 - MILORGANITE WASTE PROCESSING & DUST CONTROL	UP32 - UTILITIES	<ul style="list-style-type: none"> - Dust Control - Central Vacuum - Nitrogen Purge - Building Drain Pump Station - Fire Water Booster Pumps - Compressed Air System 		<p>R239</p> <p>Refer to TS-2627 Task 8 Tech Memo - Process Reliability Analysis (PRA) for the Classification System</p> <ul style="list-style-type: none"> - Screens Area Dust Containment System, no redundant system - Building Drain Pump Station, no single point failure, but capacity issues identified - Compressed Air System, no single point failure, but capacity issues identified 	Implement RBC009 recommendations that are related to single point failure		MMSD CCO and Veolia to evaluate each system for capacity issues, redundancy and or spare parts inventories
SSWRF	Liquid	MP01 - PRELIMINARY TREATMENT	UP01 - MIS FLOW CONTROL STRUCTURE	<ul style="list-style-type: none"> · 2 sluice gates, 6'x10' · Water level monitors, 4 upstream, 2 downstream 	VERY LOW	Sluice gates are redundant			
SSWRF	Liquid	MP01 - PRELIMINARY TREATMENT	UP02 - COARSE SCREENING	<ul style="list-style-type: none"> · 7 fine screens, 50 MGD operating capacity, 0.25" opening each · Screenings – 2.2 cy/hr · Diversion bar screen – 300 MGD capacity. 3 influent sluice gates and 7 bar screen influent sluice gates 	LOW	<p>single belt conveyor for screenings and grit, material can be removed manually short term while belt is being repaired</p> <p>No redundancy for proposed post first flush peak capacity of 375 mgd</p>			
SSWRF	Liquid	MP01 - PRELIMINARY TREATMENT	UP03 - GRIT REMOVAL	<ul style="list-style-type: none"> · 7 grit channels, 42.9 MGD treatment capacity · 7 grit pumps, 600 GPM each · 7 slurry cup grit separation units, 590 GPM each 7 grit basin effluent sluice gates + 2 grit effluent channel divider gates Four primary influent flow control valves and flow meters (upstream of primary clarification), each valve and meter is dedicated to a battery of primary clarifiers 	LOW	<p>One grit washer for a pair of grit basins. Washer failure removes 2 grit basins and two bar screens from available service.</p> <p>All four 42-inch butterfly valves are used to regulate the flow distribution to the downstream liquid unit processes. If one unit is out of service, the associated battery of primary clarifiers is also out of service.</p> <p>No redundancy for proposed post first flush peak capacity of 375 mgd</p>	Review warehouse inventory of key spare parts for grit washers.		<p>MMSD CCO and Veolia to evaluate spare parts inventory</p> <p>MMSD CCO and Veolia to evaluate need for and schedule of valves condition assessment</p>
SSWRF	Liquid	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	<ul style="list-style-type: none"> · Plant flow metering (upstream of primary clarification): 4 magnetic meters, 120 MGD each; 16 rectangular basins - 160x40x10 swd · Surface Overflow Rate (SOR), gpd/sf – ave day 1,100, max day 2,440, max week 1,855, max month 1,660 · Weir Loading Rate (WLR), calculated, gpd/lf – ave day 24,500, max day 54,200, max week 41,200, max month 36,900 · Sludge Production (lb/d) – ave day 183,200, max day 318,900, max week 278,600, max month 234,900 	LOW	Primary clarifiers do not meet standard criteria for wet weather flows. More than one unit out of service may result in capacity restriction			
SSWRF	Liquid	MP02 - PRIMARY CLARIFICATION	BLENDING	Blending - primary effluent to disinfection, capacity 75 MGD	MEDIUM	Blending operations require full scale testing to ID potential issues		X	

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation Unit Process	Specific Design Criteria Design Criteria Details	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
SSWRF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	One scum concentrator tank, one scum dewatering unit	MEDIUM	Single scum pipe from primary clarifiers to - scum concentrators. Single scum dewatering press. Plant has experienced periodic plugging of the scum piping, with ~1 week to resolve. Scum can be manually removed via vacuum truck.	Scum system improvements are being implemented	X	
SSWRF	Biosolids	MP02 - PRIMARY CLARIFICATION	UP04 - PRIMARY CLARIFICATION	Primary Sludge Pumping - 4 progressing cavity sludge pumps XXX gpm, Primary Sludge Screening · 3 Parkson screens, 250 GPM each Screened Primary Sludge Pumping · 3 progressing cavity pumps, XXX GPM each Single belt conveyor for sludge screenings to disposal Single sludge pipeline from the screen sludge pumps to the anaerobic digesters	LOW	Single primary sludge line to the anaerobic digesters	Conduct periodic condition assessment of the sludge pipeline		MMSD CCO and Veolia to evaluate need for and schedule of pipe condition assessment
SSWRF	Liquid	MP03 - IRON MANAGEMENT	UP18 - PICKLE LIQUOR STORAGE AND FEED	· Dose: average day – 5,200 GPM, maximum day – 13,500 lb/d · Usage: average day – 8 GPM, maximum day – 21 GPM · Storage: 20,000 gal	LOW	Single pipe with single flow control valve to convey iron chemical to primary influent, chemical is diluted with flushing water at the point of application. Four flow meters and flow control valves at four PI pipes where the diluted chemical is added.	Buried chemical feed pipe may be approaching 50 years old. Conduct pipe condition assessment. Maintain warehouse inventory of key flow control valves and flow meters.		MMSD CCO and Veolia to evaluate need for and schedule of pipe condition assessment
SSWRF	Liquid	MP04 - AERATION	UP05 - AERATION AND RAS PUMPING	· 28 basins, 1.25 MG each · MLSS, mg/L – ave day 3,030, max day 2,450, max week 2,570, max month 2,880 · BOD Load, lb/1000 cf – ave day 34, max day 95, max week 570, max month 48 · Food to Microorganism Ratio (F/M), lb influent BOD/lb MLVSS-day – ave day 0.24, max day 0.84, max week 0.48, max month 0.36 · Mean Cell Residence Time (MCRT), days [calculated] – ave day 4.9, max day/week/month 3.1	LOW	Aeration system is likely to be overloaded without operation of chemically enhanced primary treatment using ferric chemicals.			
SSWRF	Liquid	MP04 - AERATION	UP15 - PROCESS AIR SYSTEM	· 4 blowers, 37,500 cfm, 1500 hp each (with electric motor replacement) · Air Flow Rate, cfm - ave day 62,200, max day 134,300, max week 106,200, max month 88,900 · Design based on treating BOD Load to aeration	LOW	single pipe conveying aeration air from blowers to aeration basins. Buried steel pipe, with cathodic protection system. Very high CONSEQUENCE if air header pipe fails. Pipe has had a few leaks in the past 20 years.	Conduct pipe condition assessment and cathodic protection system condition assessment on a routine schedule. Veolia notes that aeration basins air flow is limited to 3,400 scfm each x 28 = 95,000 scfm, which is below the capacity of 3 of 4 aeration blowers		MMSD CCO and Veolia to evaluate need for and schedule of pipe condition assessment MMSD CCO and Veolia evaluate increasing the maximum air flow per aeration basin to match the aeration blowers capacity
SSWRF	Liquid	MP06 - ACTIVATED SLUDGE	UP05 - AERATION AND RAS PUMPING	6 RAS-WAS transfer pumps from Battery 5&6, 7.7 MGD each, 3 per battery; 10 RAS pumps, 15.6 MGD each, 2 per battery plus one spare each half plant · Return sludge pumping: ave day – 57 MGD, max day – 125 MGD;	LOW	Two redundant RAS pumps and RAS header repairs recently installed. Other known issues with RAS suction and discharge header piping, currently being addressed.	Replace RAS header piping	X	

Level 2 Facility	Level 3 Facility Division	Level 4 Major Process	Level 5 - Designation Unit Process	Specific Design Criteria Design Criteria Details	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	<ul style="list-style-type: none"> 24 octagonal clarifiers, 10,333 sf surface area each SOR, gpd/sf: - ave day 480, max day 1,050, max week 800, max month 714, peak hour (calc) 1,210 Solids Loading Rate (SLR), lb/d/sf: - ave day 18, max day 32, max week 25, max month 25, peak hour (calc) 37 WLR, calculated, gpd/lf - ave day 13,800 	LOW	Clarifiers 1-16 likely have ineffective target baffle and skirt baffle systems for flocculating the influent mixed liquor. Clarifier #16 will be modified and tested to determine if modifications are effective.	Implement Clarifier 1-15 clarifier modifications if Clarifier 16 modifications are effective.	X	
SSWRF	Liquid	MP05 - SECONDARY CLARIFICATION	UP06 - SECONDARY CLARIFICATION	high Sludge Volume Index (SVI) causes reduced wet weather capacity and risk for effluent quality exceedances.	MEDIUM	Ineffective activated sludge bulking control system, via RAS chlorination process.	Evaluate alternatives to improve the RAS chlorination system. Implement the recommended alternative.		MMSD CCO and Veolia evaluate alternatives to improve the RAS chlorination system
SSWRF	Liquid	MP07 - PLANT EFFLUENT	UP08 - CHLORINATION DECHLORINATION	<ul style="list-style-type: none"> 2 contact basins, 5 MG total volume Sodium hypochlorite use - average day - 3,020 gpd, maximum day - 6,670 gpd, emergency - 44,000 gpd Sodium bisulfite use: average day - 720 gpd, maximum day - 1600 gpd Design/Performance Contact Time: Total/Firm - Peak Hour (300 MGD) 	LOW	Single sodium hypochlorite pipe to each chlorine diffuser. Single sodium bisulfite pipe to each application point.	Evaluate option to add redundant, parallel chemical feed pipes.		MMSD CCO and Veolia evaluate need for parallel chemical feed pipes and if needed, alternatives to provide redundant pipes
SSWRF	Liquid	MP07 - PLANT EFFLUENT	UP09 - EFFLUENT PUMPING	<ul style="list-style-type: none"> 5 wet pit axial flow pumps, 75 MGD each Effluent measurement - 15' Parshall flume, not used 	MEDIUM	one spare effluent pump. Rising Lake Michigan levels may reduce the flow capacity of the pumps	Conduct engineering study of effluent pump station and lake levels to determine whether or not there is a risk posed by future, potentially very high water levels in Lake Michigan.		MMSD CCO and Veolia to evaluate effluent pump capacity impacts as compared to current and projected Lake Michigan water levels
SSWRF	Biosolids	MP06 - ACTIVATED SLUDGE	UP05 - AERATION AND RAS PUMPING	<ul style="list-style-type: none"> 4 WAS pumps, 1200 GPM each Waste sludge production: ave day - 172,900 lb/d, max day - 320,900 lb/d; Flow: ave day - 1600 GPM, max day - 3810 GPM Capacities presented in MGD 	VERY LOW	Two WAS headers			
SSWRF	Biosolids	MP08 - SLUDGE THICKENING	UP10 - SLUDGE THICKENING	<ul style="list-style-type: none"> DISSOLVED AIR THICKENERS (DAFs) <ul style="list-style-type: none"> 6 DAFs at 1240 lb/hr each 1240 sf surface area each 6% thickened waste activated sludge (TWAS) solids concentration TWAS pumps - 4 - 150 GPM each; 3 - 225 GPM GRAVITY BELT THICKENERS (GBTs) <ul style="list-style-type: none"> Three gravity belt thickeners, 3 m (installed 2005-2008) 6% - 10% thickened sludge solids Firm capacity - 2 mgd, 92 dtpd, 1400 GPM Thickening centrifuges decommissioned Capacities presented in MGD and lb/d 	MEDIUM	GBT thickeners do not have capacity to processes all solids under a D&D Shutdown scenario	Consider additional GBTs for capacity to meet D&D shutdown requirements		Review prior Engineering studies and recommendations. Implement SSWRF thickening improvements as needed
SSWRF	Biosolids	MP09 - ANAEROBIC DIGESTION	UP11 - ANAEROBIC DIGESTION	<ul style="list-style-type: none"> Six anaerobic digesters Four north digesters - 3.2 MG each Two south digesters - 1.25 MG each LMM, pump and nozzle and bubble cannon mixing on north digesters Mechanical propeller mixing on south digesters VS loading, lb VS/cf/day - Ave .06, max month 0.12 TSS loading, lb/day - Ave 215,800, max month 405,300 - reduced from O&M based on reduced volume Detention time, days - Ave 31, max month 15, max week 14, max day 13 	LOW	<ul style="list-style-type: none"> Single header pipes for sludge, sludge withdrawal, digester gas to spheres, digester gas to waste gas flares. Digesters 6 and 8 have single systems for heating, with no redundancy. Each digester has a single sludge inlet valve and sludge outlet valve. Digester 6, 8, 9 and 11 mixing systems are not effective, result is fair/poor digestion performance. Digester 6 and 8 mixing systems are planned to be replaced. 	<ul style="list-style-type: none"> Some of the digester gas piping was recently replaced. Conduct pipe condition assessment on a routine basis. Maintain key spares for Digester 6 and 8 heating systems and other key equipment and valves. 		<ul style="list-style-type: none"> MMSD CCO and Veolia to evaluate need for and schedule of pipe condition assessment MMSD CCO and Veolia evaluate spare parts inventories

Level 2	Level 3	Level 4	Level 5 - Designation	Specific Design Criteria	Likelihood of Single Point Failure - Initial Assessment	Single Point Failure Details - Initial Assessment	Single Point Failure Mitigation - Initial Assessment	Current or Planned District Project	Recommend Evaluation
Facility	Facility Division	Major Process	Unit Process	Design Criteria Details					
SSWRF	Biosolids	MP09 - ANAEROBIC DIGESTION	UP20 - AGRILIFE STORAGE FACILITIES	<ul style="list-style-type: none"> Using old digesters converted to sludge storage – originally converted all eight south digesters but converted 2 back to active digesters Designed for 1.5 MG storage for each digester 	MEDIUM	Stored volume of thickened digested sludge must be kept around 50% to provide capacity for emergency conditions.	SOP to keep stored volume low		MMSD CCO and Veolia to develop SOP for storage digesters inventories
SSWRF	Biosolids	MP10 - SLUDGE DEWATERING	UP14 - FILTER PRESS DEWATERING	<ul style="list-style-type: none"> 5 plate and frame presses, only 4 operable 8 pumps, 400 GPM each — 3 pumps per pair of presses for four presses, 2 pumps for fifth press, 13.3 ton/d each Total capacity assumes all 4 presses operational with 3 pumps per pair of presses; firm assumes all 4 presses but 1 pump out per pair Capacities presented in MGD <p>Filter cake storage ~150 ft x ~ 350 ft x ~ 6 ft tall = 315,000 ft3 ~ 2,000 dry tons of cake storage</p>	LOW	<p>3 or 4 of 4 filter presses required for D&D Shutdown scenario</p> <p>Press systems overdue for overhaul, press PLC hardware is no longer supported by the PLC vendor</p>	<p>Review condition of all 4 presses, ancillary systems and PLCs. Repair or replace systems as necessary to assure capacity for D&D shutdown.</p> <p>Maintain low inventory of stored filter cake to assure capacity to dewater biosolids is available for emergency conditions</p>		<p>Review prior Engineering studies and recommendations. Implement Plate and Frame Press improvements as needed</p> <p>MMSD CCO and Veolia to develop SOP for cake storage inventories</p>

WRFs and Biosolids Capacity Assessment

Select review of the PowerBI output of the capacity assessment used to develop capacity assessment Tables 5B-1, 5B-3 and 5B-4 in Appendix 5B.

Note: time period was determined by setting WRF Baseline as 2015, WRF Future as 2035 and Buildout as 2050 from WRF Capacity Assessment tables to plot when design would be exceed.

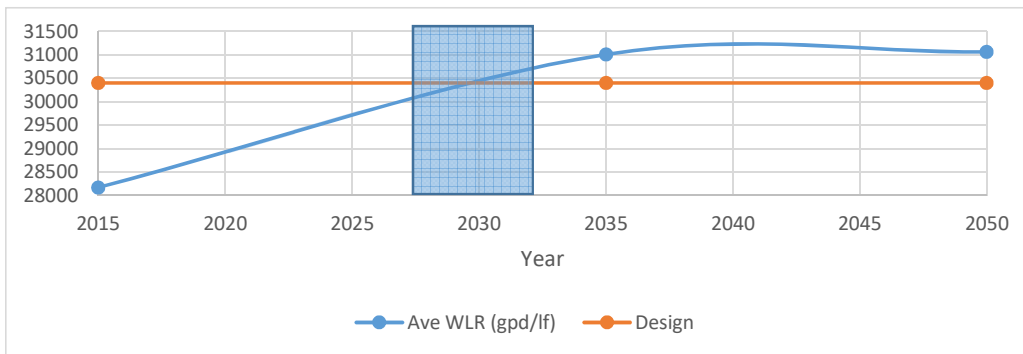
WRF Capacity updates in Nov-19 required review of select parameters, with changes in time periods as indicated.

JIWRF - Table 5B-1

Removed MP01, MP02 blending and MP07 from table since based not on design but instead on maintaining baseline CSO frequency parameter.

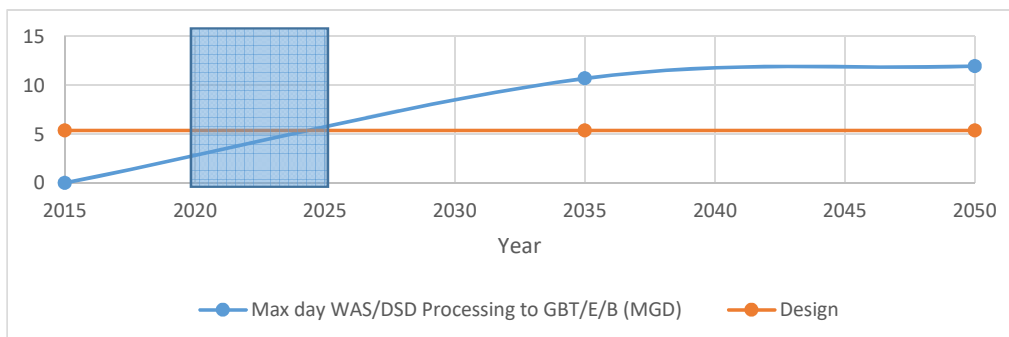
With Blending from MP02 removed, MP02 WLR flagged during planning period as shown below and table adjusted accordingly

MP02 - Primary Clarification	UP04 - Primary Clarification	Ave WLR (gpd/lf)		Design	Original time frame:	2020 Table 5B-1
Year						
2015		28170	30400			
2035		31009	30400		New time frame:	2025-2029
2050		31061	30400			



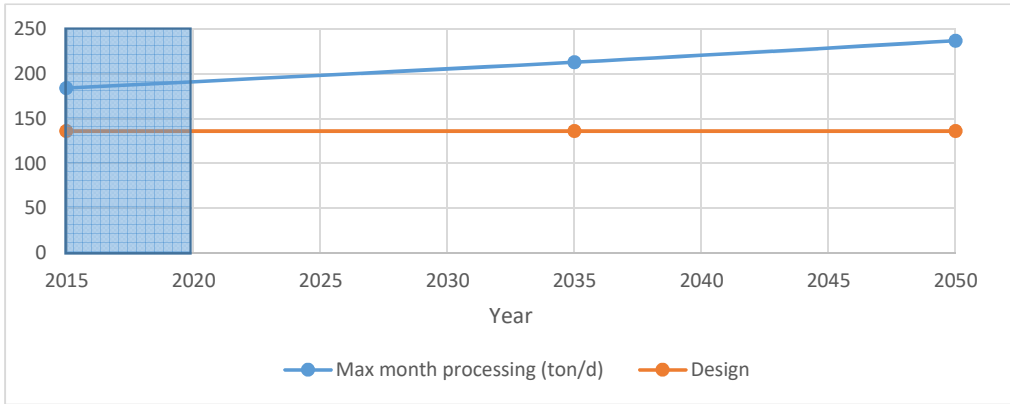
MP06 - ACTIVATED SLUDGE UP23 - WAS RECEIVING / GALLERY SOLIDS PIPING INTERTIE

Year	Max day WAS/DSD Processing to GBT/E/B (MGD)	Design	Original time frame:	2025-2029
2015	0	5.39		
2035	10.7	5.39	New time frame:	2020-2024
2050	11.97	5.39		



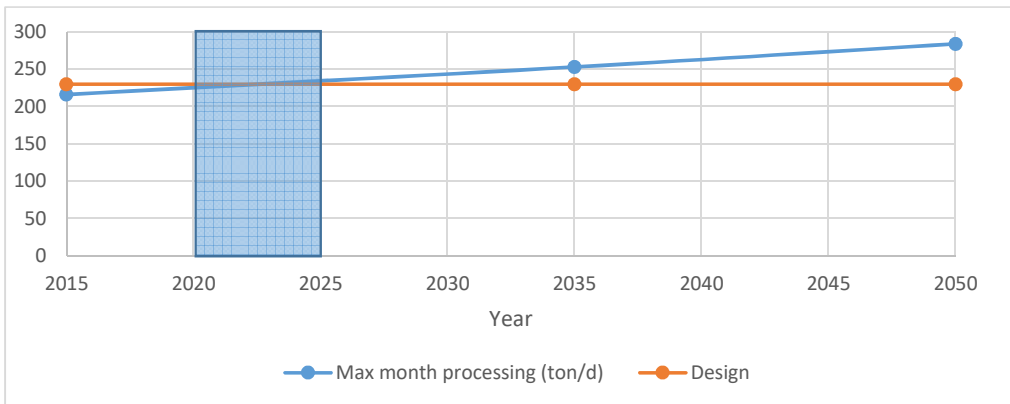
MP08 - SLUDGE THICKENING UP10 - SLUDGE THICKENING

Year	Max month processing (ton/d)	Design	Original time frame:	New time frame:
2015	184	136	2025-2029	2020-2024
2035	213	136		
2050	237	136		



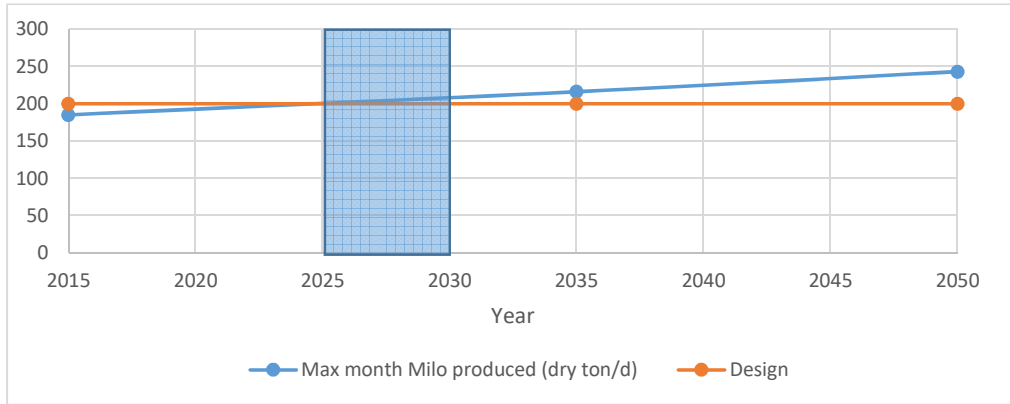
MP10 - SLUDGE DEWATERING UP24 - DEWATERING

Year	Max month processing (ton/d)	Design	Original time frame:	New time frame:
2015	216	230	2020-2024	2020-2024 No change
2035	253	230		
2050	284	230		



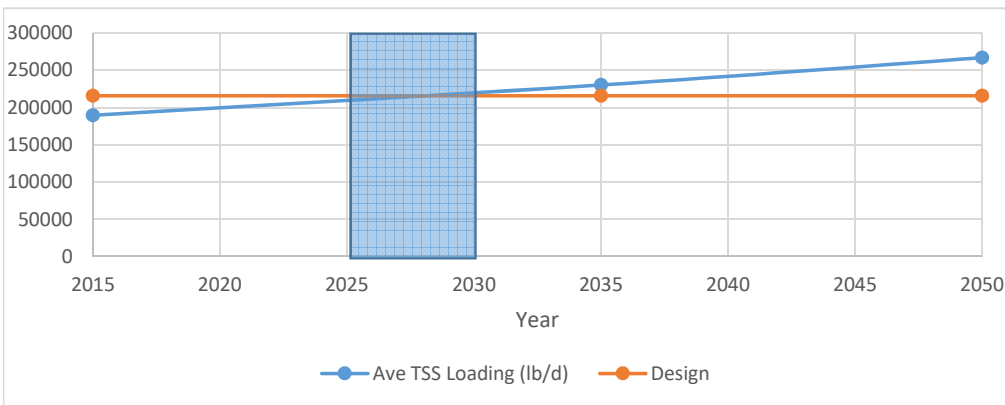
MP11 - SLUDGE UP25 - DRYING
 DRYING

Year	Max month Milo produced (dry ton/d)	Design	Original time frame:	2025-2029
2015	185	200	New time frame:	2025-2029 No change
2035	216	200		
2050	243	200		



SSWRF - Table 5B-3

Year	MP09 - ANAEROBIC DIGESTION Ave TSS Loading (lb/d)	UP11 - ANAEROBIC DIGESTION Design	Original time frame:	2030-2039
2015	189600	215800	New time frame:	2025-2029
2035	230300	215800		
2050	266900	215800		

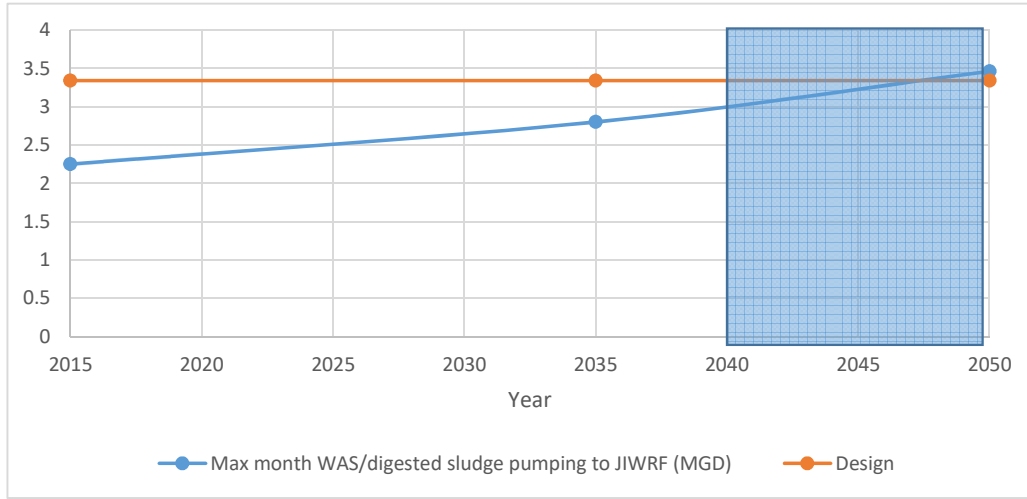


ISP - Table 5B-4

MP19 - LIQUID SLUDGE UP13 - IPS PUMP STATION

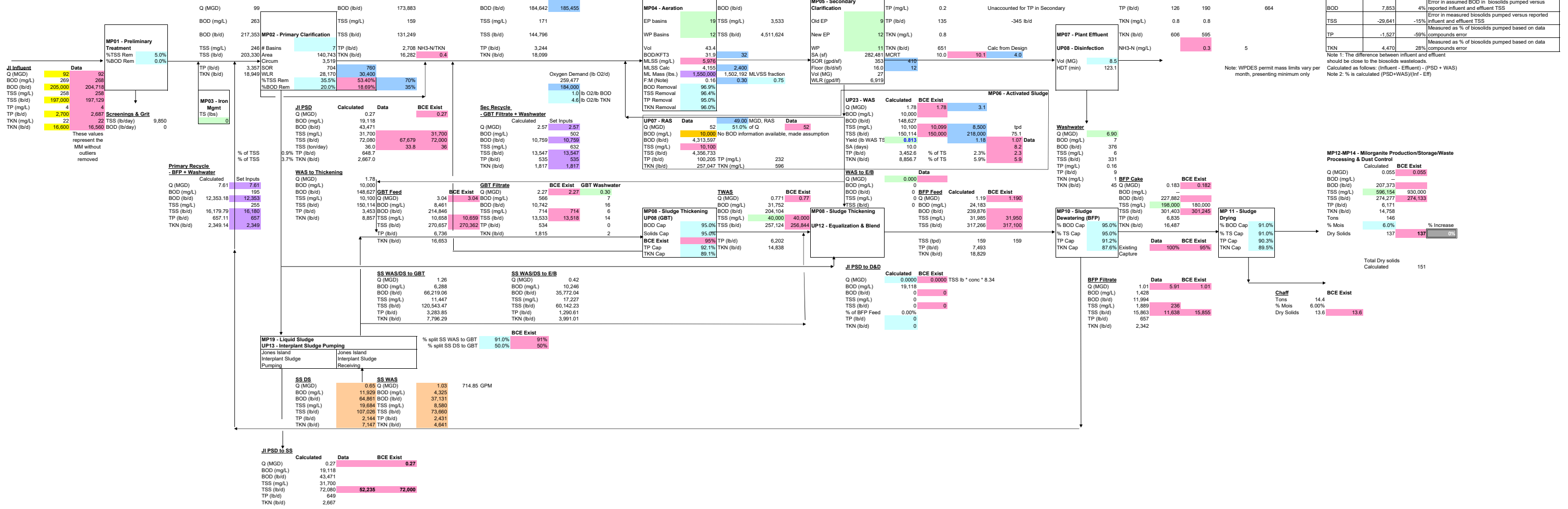
Year	Max month WAS/digested sludge pumping to JIWRP (MGD)	
	Design	Design
2015	2.25	3.34
2035	2.8	3.34
2050	3.46	3.34

Original time frame: 2040-2049
 New time frame: No Change



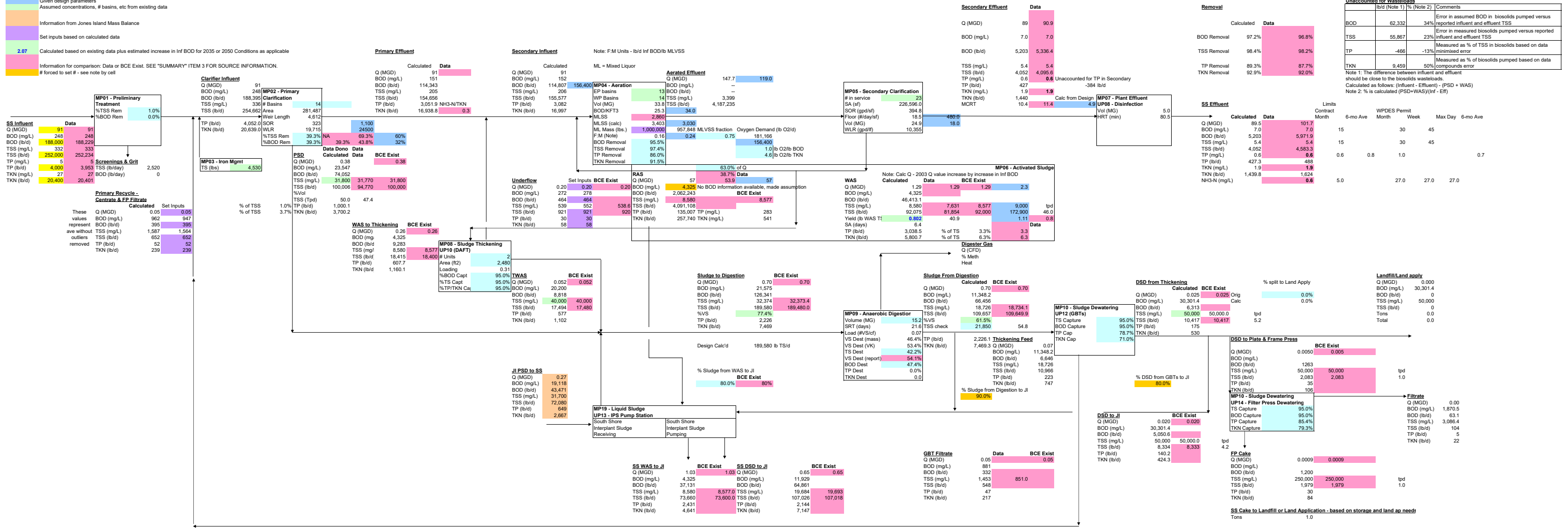
Condition Baseline Jones Island Mass Balance
 DRAFT Average Annual

MP/UP Names MP - Major Process, UP - Unit Process. All MP names listed, some UP names as appropriate, names abbreviated or equipment included in parenthesis for clarity as needed. See Process Flow Diagrams for full names.
 Input from Projected Influent Loads
 Given % Removals, Captures, etc. based on existing data (2013-2016)
 Given design parameters
 Assumed concentrations, # basins, etc. from existing data
 Information from South Shore Mass Balance
 Set inputs based on calculated data
 2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
 Information for comparison: Data or BCE Exist. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
 # forced to set # - see note by cell



MP/UP Name: MP - Major Process, UP - Unit Process. All MP names listed, some UP names as appropriate, names abbreviated or equipment included in parenthesis for clarity as needed. See Process Flow Diagrams for full names.

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data
- 2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



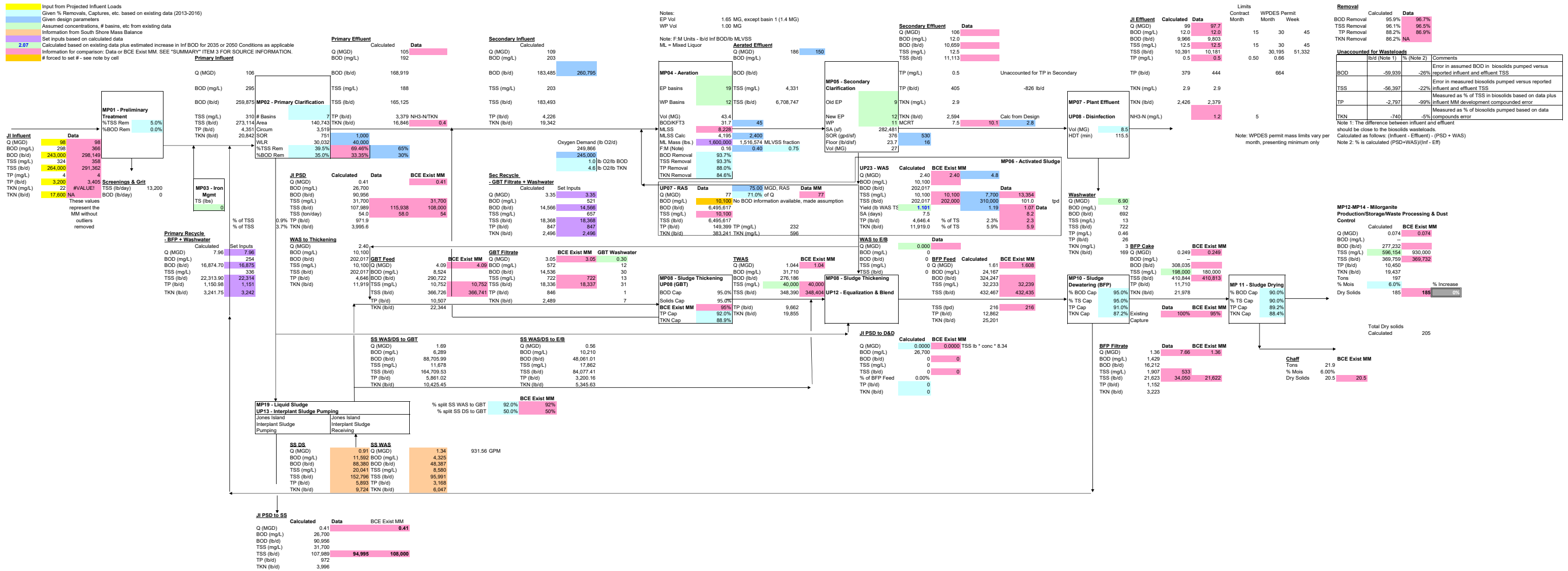
Unaccounted for Wasteloads			
	lb/d (Note 1)	% (Note 2)	Comments
BOD	62,332	34%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	55,867	23%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	-466	-13%	Measured as % of TSS in biosolids based on data
TKN	9,459	50%	Measured as % of biosolids pumped based on data

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
 Calculated as follows: (Influent - Effluent) - (PSD + WAS)
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

	Limits Contract Month	WPDES Permit			
		6-mo Ave	Month	Week	Max Day
Q (MGD)	15	30	45		
BOD (mg/L)	15	30	45		
TSS (mg/L)	0.6	0.8	1.0		0.7
TP (lb/d)	5.0	27.0	27.0	27.0	

Condition Baseline Jones Island Mass Balance
DRAFT Max Month

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from South Shore Mass Balance
- 2.07 Set inputs based on calculated data
- Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



Removal	Calculated	Data
BOD Removal	95.9%	96.7%
TSS Removal	96.1%	96.5%
TP Removal	88.2%	86.9%
TKN Removal	86.2%	NA

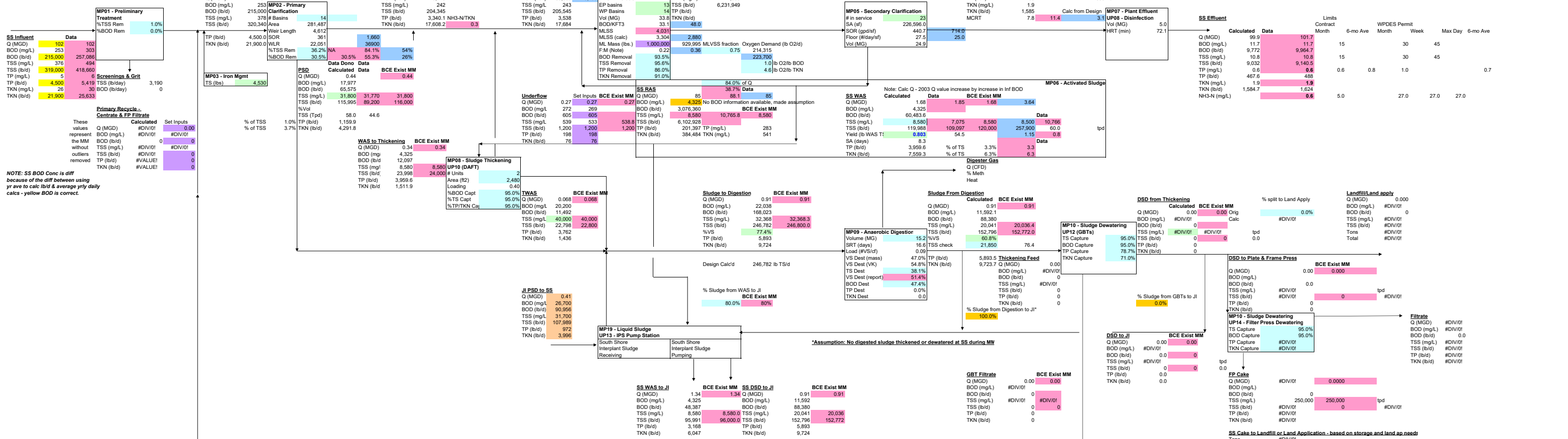
Unaccounted for Wasteloads	(lb/d) (Note 1)	% (Note 2)	Comments
BOD	-59,939	-26%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	-56,397	-22%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	-2,797	-99%	Measured as % of TSS in biosolids based on data plus influent MM development compounded error
TKN	-740	-5%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads. Calculated as follows: (Influent - Effluent) - (PSD + WAS)

Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

MP12-MP14 - Milorganite Production/Storage/Waste Processing & Dust Control	Calculated	BCE Exist MM
Q (MGD)	0.074	0.074
BOD (mg/L)	-	-
BOD (lb/d)	277,232	277,232
TSS (mg/L)	596,154	930,000
TSS (lb/d)	369,759	369,732
TP (lb/d)	10,450	19,437
TKN (lb/d)	19,437	197
Tons	197	197
% Mois	6.0%	% Increase
Dry Solids	185	185

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data
- Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



Unaccounted for Wasteloads			
	lb/d (Note 1)	% (Note 2)	Comments
BOD	79,169	39%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	73,985	24%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	-1,087	-27%	Measured as % of biosolids pumped based on data compounds error
TKN	8,464	42%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
 Calculated as follows: (Influent - Effluent) / (FSD + WAS)
 Note 2: % is calculated (FSD+WAS)/(Inf - Eff)

Limits Contract	6-mo Ave	WPDES Permit Month	Week	Max Day	6-mo Ave
15	15	30	45	45	
0.6	0.8	1.0	0.7	0.7	
5.0	27.0	27.0	27.0	27.0	

NOTE: SS BOD Conc is diff because of the diff between using yr ave to calc lb/d & average yrly daily calcs - yellow BOD is correct.

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from South Shore Mass Balance
- Set inputs based on calculated data
- Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison. Data or BCE Exist. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell

MP01 - Preliminary Treatment

Parameter	Data	BCE
Q (MGD)	101	92
BOD (mg/L)	264	268
BOD (lb/d)	223,000	204,718
TSS (mg/L)	257	255
TSS (lb/d)	217,000	197,129
TP (mg/L)	5	4
TP (lb/d)	4,000	2,687
TKN (mg/L)	22	22
TKN (lb/d)	18,200	16,560

Screenings & Grit

Parameter	Data	BCE
TSS (lb/day)	10,850	0

These values represent the MM without outliers removed

Primary Recycle - BFP - Washwater

Parameter	Calculated	BCE Exist
Q (MGD)	7.79	218
BOD (mg/L)	14,154.44	14,154
BOD (lb/d)	291	291
TSS (mg/L)	18,925.24	18,925
TSS (lb/d)	778.14	778
TP (lb/d)	2,769.12	2,769
TKN (lb/d)		

WAS to Thickening

Parameter	Calculated	BCE Exist
Q (MGD)	1.95	
BOD (mg/L)	10,000	
BOD (lb/d)	162,262	
TSS (mg/L)	10,100	
TSS (lb/d)	164,208	
TP (lb/d)	3,777	
TKN (lb/d)	9,688	

MP19 - Liquid Sludge

Parameter	Calculated	BCE Exist
Q (MGD)	0.30	0.27
BOD (mg/L)	18,844	
BOD (lb/d)	47,431	
TSS (mg/L)	31,700	
TSS (lb/d)	79,789	52,235
TP (lb/d)	718	
TKN (lb/d)	2,952	

SS WAS/DS to GBT

Parameter	Calculated	BCE Exist
Q (MGD)	1.59	
BOD (mg/L)	6,210	
BOD (lb/d)	82,165.28	
TSS (mg/L)	11,354	
TSS (lb/d)	150,219.81	
TP (lb/d)	4,128.64	
TKN (lb/d)	9,721.56	

SS WAS/DS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.51	
BOD (mg/L)	10,151	
BOD (lb/d)	43,462.56	
TSS (mg/L)	17,152	
TSS (lb/d)	73,440.78	
TP (lb/d)	1,594.93	
TKN (lb/d)	4,884.48	

SS DS

Parameter	Calculated	BCE Exist
Q (MGD)	0.79	1.31
BOD (mg/L)	11,885	4,325
BOD (lb/d)	78,429	47,198
TSS (mg/L)	18,703	8,580
TSS (lb/d)	130,028	93,633
TP (lb/d)	2,634	3,090
TKN (lb/d)	8,707	5,999

SS WAS

Parameter	Calculated	BCE Exist
Q (MGD)	0.79	1.31
BOD (mg/L)	11,885	4,325
BOD (lb/d)	78,429	47,198
TSS (mg/L)	18,703	8,580
TSS (lb/d)	130,028	93,633
TP (lb/d)	2,634	3,090
TKN (lb/d)	8,707	5,999

SS WAS

Parameter	Calculated	BCE Exist
Q (MGD)	0.30	0.27
BOD (mg/L)	18,844	
BOD (lb/d)	47,431	
TSS (mg/L)	31,700	
TSS (lb/d)	79,789	52,235
TP (lb/d)	718	
TKN (lb/d)	2,952	

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

Aerated Effluent

Parameter	Calculated	Data
Q (MGD)	100	116
BOD (mg/L)	209	185,455

Primary Effluent

Parameter	Calculated	Data
Q (MGD)	109	189,724
BOD (mg/L)	261	160
BOD (lb/d)	237,154	145,286
TSS (mg/L)	247	4,060
TSS (lb/d)	225,075	18,017
TP (lb/d)	7	4,060
TKN (lb/d)	140,743	18,017

MP02 - Primary Clarification

Parameter	Calculated	Data
Q (MGD)	775	760
BOD (mg/L)	31,009	30,400
BOD (lb/d)	79,789	67,679
TSS (mg/L)	39.9	33.8
TSS (lb/d)	718.1	72,000
TP (lb/d)	2,952.2	36
TKN (lb/d)	2,952.2	36

MP03 - Iron Mgmt

Parameter	Calculated	BCE Exist
Q (MGD)	0.30	0.27
BOD (mg/L)	18,844	
BOD (lb/d)	47,431	
TSS (mg/L)	31,700	
TSS (lb/d)	79,789	52,235
TP (lb/d)	718	
TKN (lb/d)	2,952	

Sec Recycle - GBT Filtrate + Washwater

Parameter	Calculated	BCE Exist
Q (MGD)	2.94	2.94
BOD (mg/L)	500	
BOD (lb/d)	12,254	
TSS (mg/L)	12,254	
TSS (lb/d)	15,736	
TP (lb/d)	628	
TKN (lb/d)	2,118	

MP04 - Aeration

Parameter	Calculated	Data
Q (MGD)	4.153	2,400
MLSS Calc	1,550,000	
ML Mass (lbs)	0.18	0.30
F:M (Note)	96.9%	
BOD Removal	96.4%	
TSS Removal	95.0%	
TKN Removal	96.0%	

MP05 - Secondary Clarification

Parameter	Calculated	Data
Q (MGD)	112	116
BOD (mg/L)	217	
BOD (lb/d)	201,978	185,455
TSS (mg/L)	173	
TSS (lb/d)	161,022	
TP (lb/d)	4,688	
TKN (lb/d)	20,135	

MP06 - Activated Sludge

Parameter	Calculated	BCE Exist
Q (MGD)	1.95	1.78
BOD (mg/L)	10,000	
BOD (lb/d)	162,262	
TSS (mg/L)	10,100	10,099
TSS (lb/d)	164,208	150,000
TP (lb/d)	3,776.8	2.3
TKN (lb/d)	9,688.3	5.9

MP07 - Plant Effluent

Parameter	Calculated	Data
Q (MGD)	8.5	
BOD (mg/L)	6	
BOD (lb/d)	372	
TSS (mg/L)	6	
TSS (lb/d)	332	
TP (mg/L)	0.22	
TP (lb/d)	13	
TKN (mg/L)	13	
TKN (lb/d)	45	

MP08 - Sludge Thickening

Parameter	Calculated	BCE Exist
Q (MGD)	0.896	0.77
BOD (mg/L)	232,510	
BOD (lb/d)	4,753,055	
TSS (mg/L)	10,650	40,000
TSS (lb/d)	270,362	40,000
TP (lb/d)	627	1
TKN (lb/d)	2,116	2

MP09 - RAS

Parameter	Calculated	Data
Q (MGD)	57	51.0%
BOD (mg/L)	10,000	
BOD (lb/d)	4,753,055	
TSS (mg/L)	10,100	
TSS (lb/d)	164,208	
TP (lb/d)	3,776.8	
TKN (lb/d)	9,688.3	

MP10 - Sludge Dewatering (BFP)

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

MP11 - Sludge Drying

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

MP12 - Sludge Control

Parameter	Calculated	BCE Exist
Q (MGD)	0.065	0.055
BOD (mg/L)	238,578	
BOD (lb/d)	598,154	930,000
TSS (mg/L)	321,721	274,133
TSS (lb/d)	353,540	301,245
TP (lb/d)	8,095	
TKN (lb/d)	19,420	

Washwater

Parameter	Calculated	BCE Exist
Q (MGD)	6.90	
BOD (mg/L)	6	
BOD (lb/d)	372	
TSS (mg/L)	6	
TSS (lb/d)	332	
TP (mg/L)	0.22	
TP (lb/d)	13	
TKN (mg/L)	13	
TKN (lb/d)	45	

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

BFP Filtrate

Parameter	Calculated	BCE Exist
Q (MGD)	1.19	5.91
BOD (mg/L)	1,385	1,011
BOD (lb/d)	13,799	
TSS (mg/L)	1,867	238
TSS (lb/d)	18,607	11,638
TP (lb/d)	778	15,855
TKN (lb/d)	2,758	

Chaff

Parameter	Calculated	BCE Exist
Q (MGD)	1.19	5.91
BOD (mg/L)	1,385	1,011
BOD (lb/d)	13,799	
TSS (mg/L)	1,867	238
TSS (lb/d)	18,607	11,638
TP (lb/d)	778	15,855
TKN (lb/d)	2,758	

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

WAS to E/B

Parameter	Calculated	BCE Exist
Q (MGD)	0.000	0.000
BOD (mg/L)	18,844	
BOD (lb/d)	0	0
TSS (mg/L)	0	0
TSS (lb/d)	0	0
TP (lb/d)	0	0
TKN (lb/d)	0	0

Notes:
EP Vol 1.65 MG, except basin 1 (1.4 MG)
WP Vol 1.00 MG

Note: F:M Units - lb/d Inf BOD/lb MLVSS
ML = Mixed Liquor

Aerated Effluent

Parameter	Calculated	Data
Q (MGD)	160	116
BOD (mg/L)	160	
BOD (lb/d)	160	
TSS (mg/L)	160	
TSS (lb/d)	160	
TP (mg/L)	0.2	
TP (lb/d)	0.2	
TKN (mg/L)	0.8	
TKN (lb/d)	0.8	

MP04 - Aeration

Parameter	Calculated	Data
Q (MGD)	4.153	2,400
MLSS Calc	1,550,000	
ML Mass (lbs)	0.18	0.30
F:M (Note)	96.9%	
BOD Removal	96.4%	
TSS Removal	95.0%	
TKN Removal	96.0%	

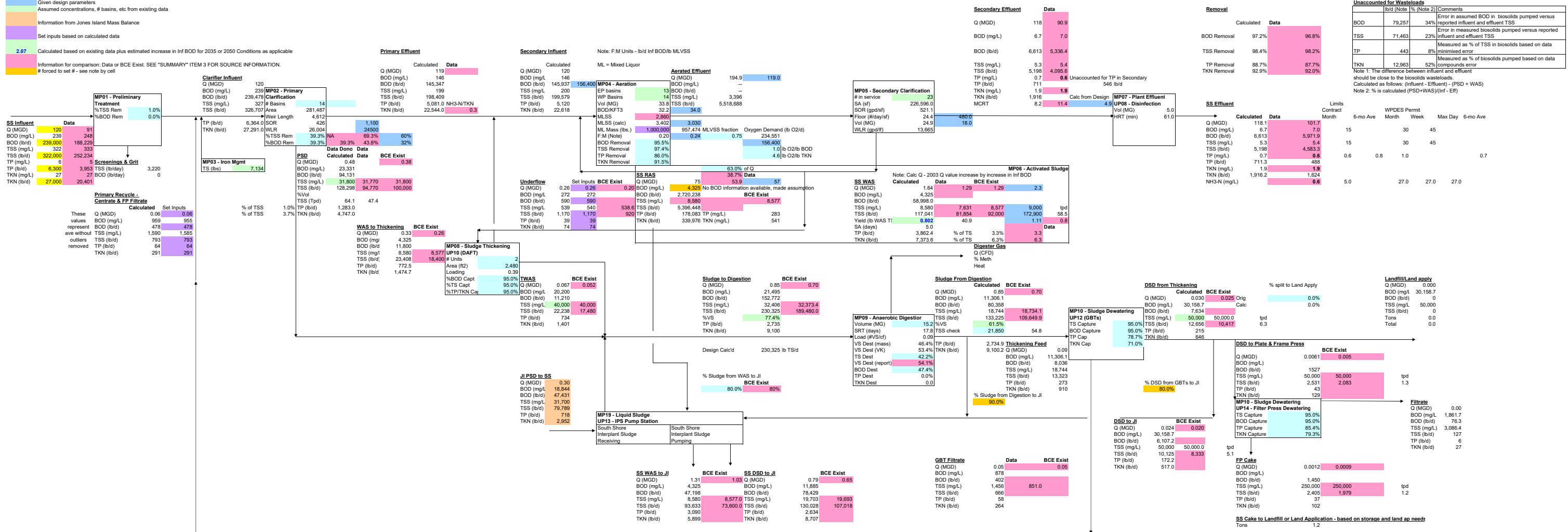
MP05 - Secondary Clarification

Parameter	Calculated	Data
Q (MGD)	112	116
BOD (mg/L)	217	
BOD (lb/d)	201,978	185,455
TSS (mg/L)	173	
TSS (lb/d)	161,022	
TP (lb/d)	4,688	
TKN (lb/d)	20,135	

MP06 - Activated Sludge

Parameter	Calculated	BCE Exist
Q (MGD)	1.95	1.78
BOD (mg/L)	10,000	
BOD (lb/d)	162,262	
TSS (mg/L)	1	

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data
- 2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell

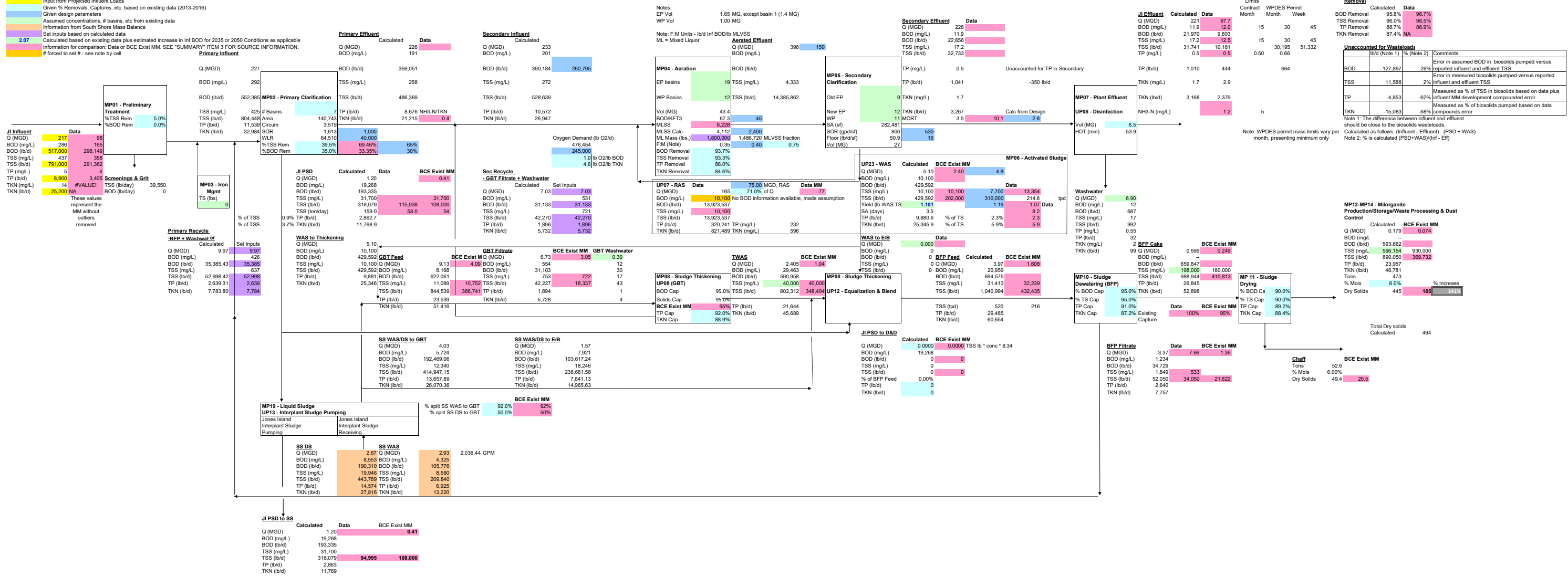


Component	lb/d (Note 1)	% (Note 2)	Comments
BOD	79,257	34%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	71,463	23%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	443	8%	Measured as % of TSS in biosolids based on data minimized error
TKN	12,963	52%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
 Calculated as follows: (Influent - Effluent) - (PSD + WAS)
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

Component	Contract Month	6-mo Ave	WPDES Permit Month	Week	Max Day	6-mo Ave
Q (MGD)	118.1	101.7	15	30	45	
BOD (mg/L)	6.7	7.0	15	30	45	
BOD (lb/d)	6,613	5,971.9	0.6	0.8	1.0	0.7
TSS (mg/L)	5.3	5.4				
TSS (lb/d)	5,198	4,583.3				
TP (mg/L)	0.7	0.6				
TP (lb/d)	711.3	488				
TKN (mg/L)	1.9	1.9				
TKN (lb/d)	1,916.2	1,624				
NH3-N (mg/L)	0.6	0.6				

Input from Projected Influent Loads
 Given % Removals, Captures, etc. based on existing data (2013-2016)
 Given design parameters
 Assumed concentrations, # basins, etc from existing data
 Information from South Shore Mass Balance
 Set inputs based on calculated data
 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
 Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
 # forced to set # - see note by cell



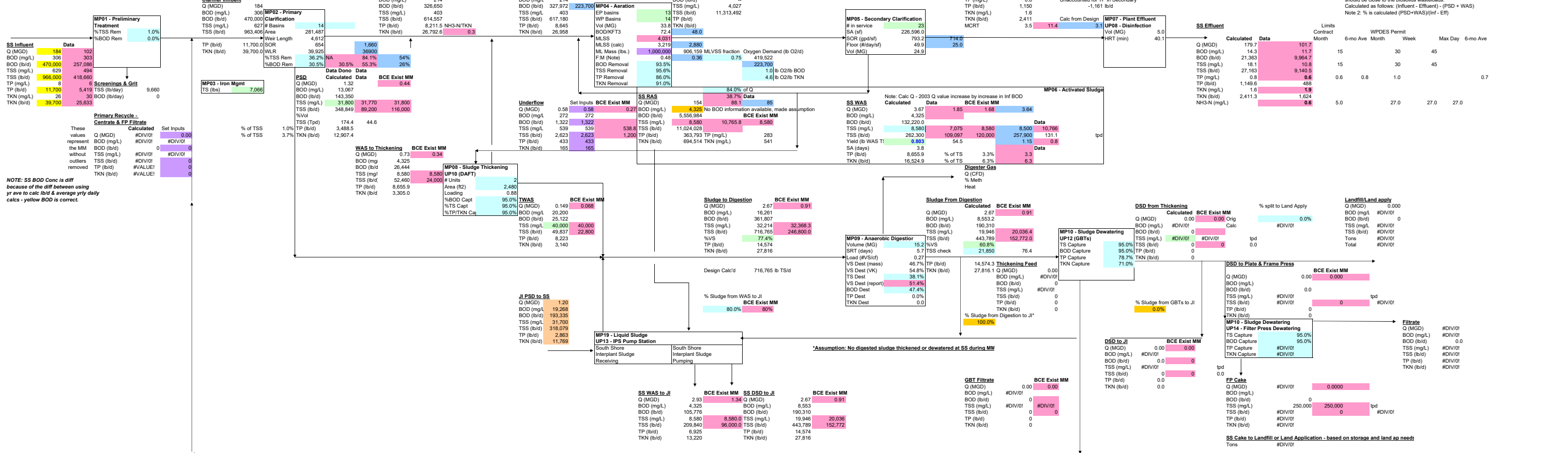
Removal	Contract Month	WPDES Permit Month	WPDES Permit Week	Calculated	Data
BOD Removal		15	30	95.5%	96.7%
TSS Removal		15	30	86.0%	86.5%
TP Removal		15	30	88.7%	86.9%
TKN Removal		15	30	87.4%	NA

Unaccounted for Wasteloads	lb/d (Note 1)	% (Note 2)	Comments
BOD	-127,897	-26%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	11,588	2%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	-4,853	-62%	Measured as % of TSS in biosolids based on data plus influent MM development compounded error
TKN	-15,083	-8%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)
 Note: WPDES permit mass limits vary per month, presenting minimum only

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data

2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
 Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
 # forced to set # - see note by cell



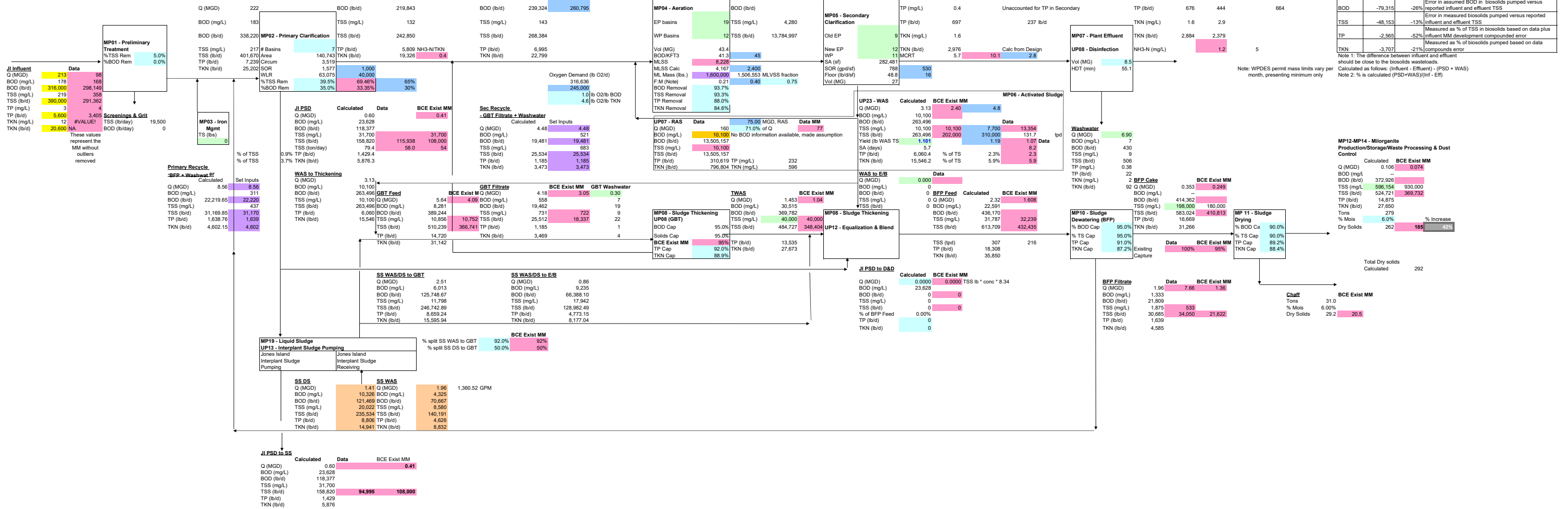
	lb/d (Note 1)	% (Note 2)	Comments
BOD	173,067	39%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	327,687	35%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	-1,594	-15%	Measured as % of biosolids pumped based on data compounds error
TKN	7,856	21%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
 Calculated as follows: (Influent - Effluent) - (PSD + WAS)
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

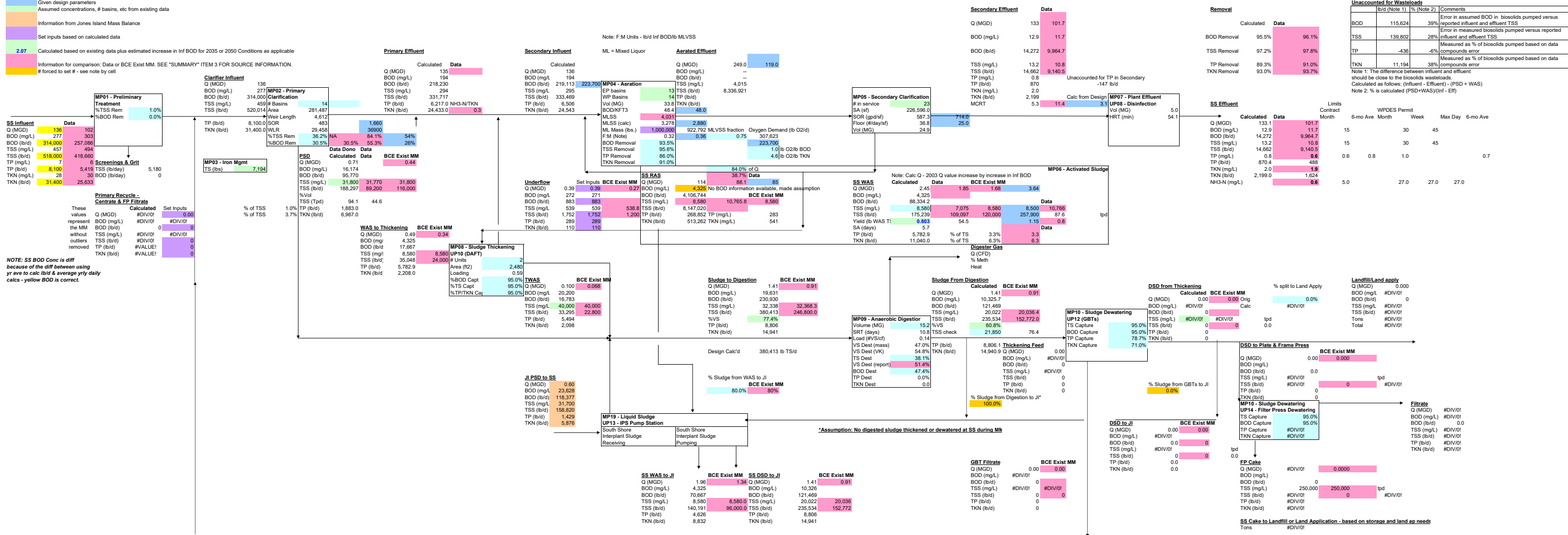
Contract Month	WPDOS Permit		Max Day	6-mo Ave
	Week	Year		
15	30	45	45	0.7
0.6	0.8	1.0		
5.0	27.0	27.0	27.0	

NOTE: SS BOD Conc is diff because of the diff between using yr ave to calc lb/d & average dry daily calcs - yellow BOD is correct.

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from South Shore Mass Balance
- Set inputs based on calculated data
- Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data
- 2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



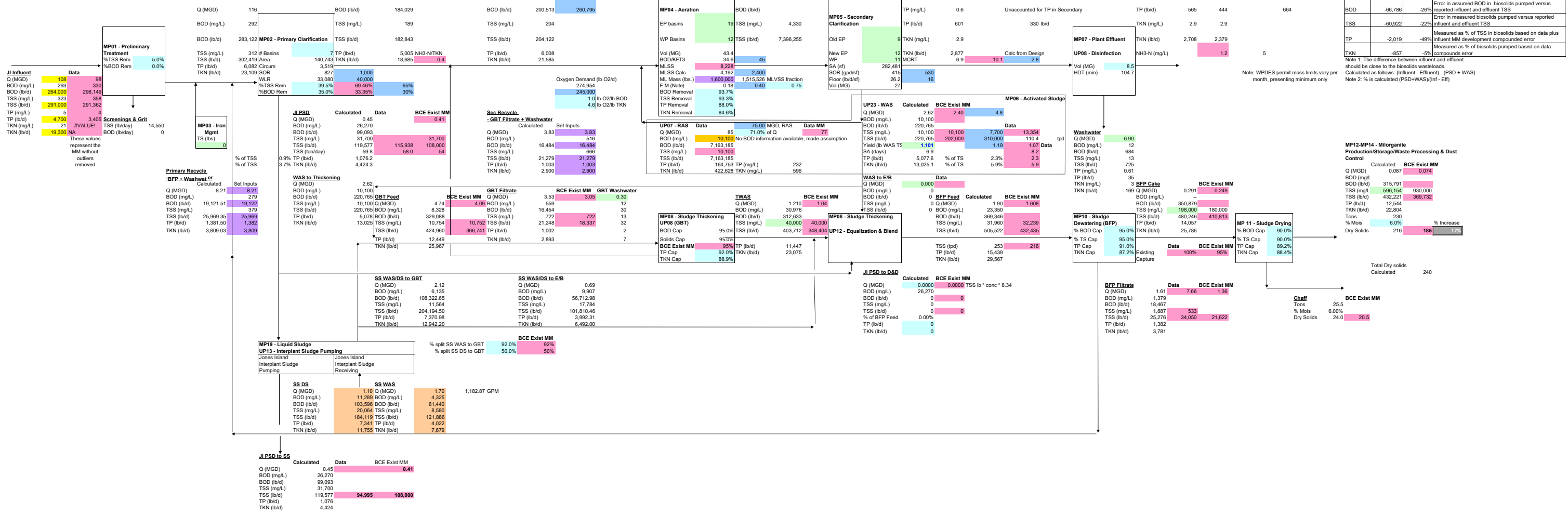
	BOD (lb/d)	% (Note 1)	% (Note 2)	Comments
BOD	115,624	39%		Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	139,802	28%		Error in measured biosolids pumped versus reported influent and effluent TSS
TP	-436	-6%		Measured as % of biosolids pumped based on data compounds error
TKN	11,194	38%		Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
 Calculated as follows: (Influent - Effluent) - (PSD + WAS)
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

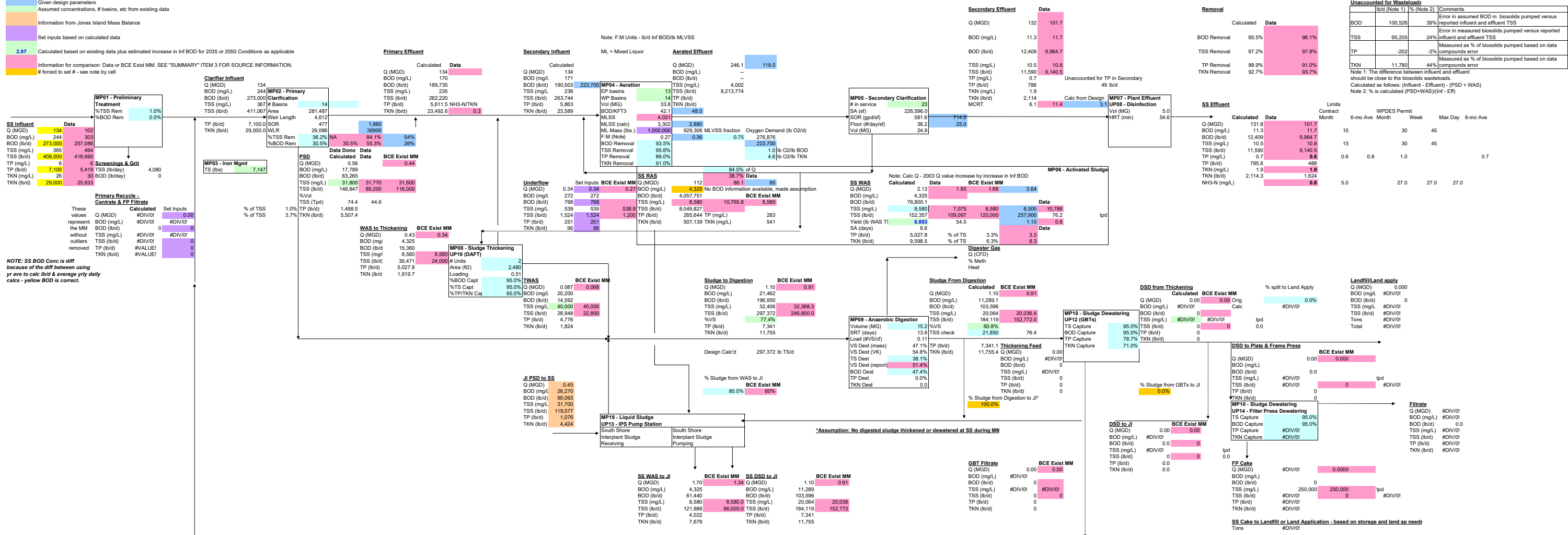
	Limits Contract Month	6-mo Ave	WPDES Permit Month	Week	Max Day	6-mo Ave
Calculated	133.1	12.9	101.7	15	30	45
Data	12.9	11.7	9,964.7	15	30	45
BCE Exist MM	13.2	10.8	14,662	0.6	0.8	1.0
	14,662	9,140.5	0.8	0.6	0.8	0.7
	870	488	1.9	5.0	27.0	27.0
	2,199.0	1,624	0.6			

NOTE: SS BOD Conc is diff because of the diff between using yr ave to calc lb/d & average yry daily calcs - yellow BOD is correct.

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from South Shore Mass Balance
- Set inputs based on calculated data
- Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data
- 2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



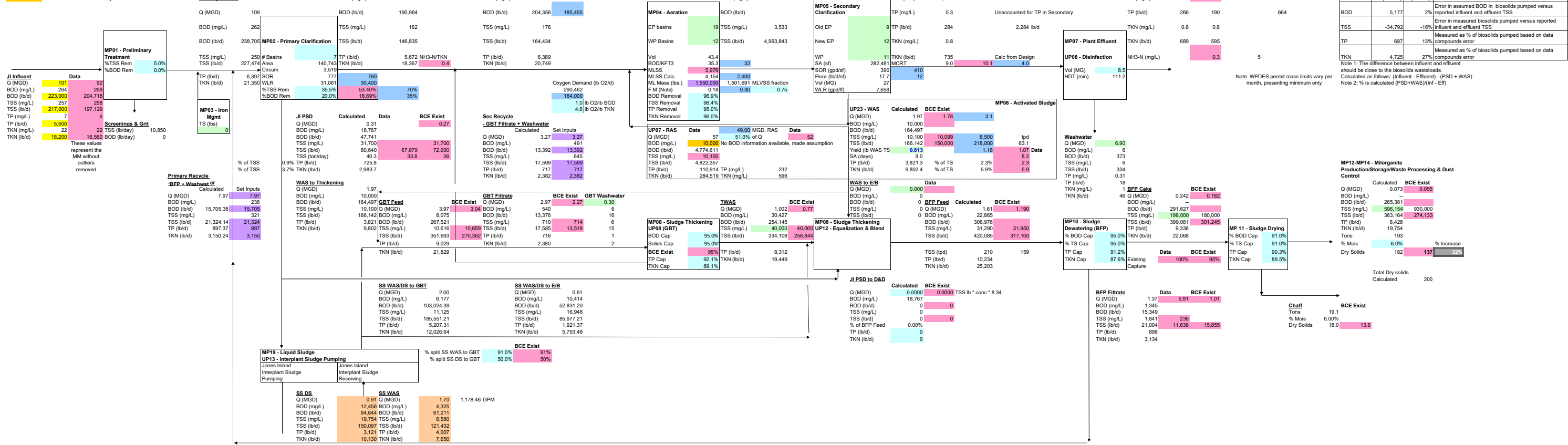
Unaccounted for Wasteloads			
	lb/d (Note 1)	% (Note 2)	Comments
BOD	100,526	39%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	95,205	24%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	-202	-3%	Measured as % of biosolids pumped based on data compounds error
TKN	11,780	44%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)
 Calculated as follows: (Influent - Effluent) - (PSD + WAS)

	Limits Contract Month	6-mo Ave	WPDES Permit Week	Max Day	6-mo Ave	
						Q (MGD)
Calculated		131.8	11.7	10.5	1.9	1.624
Data		101.7	9,964.7	9,140.5	0.6	4.8
Calculated		11.3	12,409	11,590	0.7	1.9
Data		11.7	9,964.7	9,140.5	0.6	4.8
Calculated		10.5	10.8	10.5	0.7	1.9
Data		10.8	9,964.7	9,140.5	0.6	4.8
Calculated		1.9	1.9	1.9	0.6	4.8
Data		1.9	9,964.7	9,140.5	0.6	4.8
Calculated		1.624	1.624	1.624	0.6	4.8
Data		1.624	9,964.7	9,140.5	0.6	4.8

NOTE: SS BOD Conc is diff because of the diff between using yr ave to calc lb/d & average yty daily calcs - yellow BOD is correct.

Input from Projected Influent Loads
 Given % Removals, Captures, etc. based on existing data (2013-2016)
 Given design parameters
 Assumed concentrations, # basins, etc from existing data
 Information from South Shore Mass Balance
 2.07 Set inputs based on calculated data
 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
 Information for comparison: Data or BCE Exist. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
 # forced to set # - see note by cell



JI Influent	Calculated	Data	BCE Exist
Q (MGD)	100	100	100
BOD (mg/L)	210	210	210
TSS (mg/L)	162	162	162
TP (lb/d)	6,389	6,389	6,389
TKN (lb/d)	20,749	20,749	20,749

Primary Influent	Calculated	Data	BCE Exist
Q (MGD)	109	109	109
BOD (mg/L)	190,964	190,964	190,964
TSS (mg/L)	162	162	162
TP (lb/d)	5,672	5,672	5,672
TKN (lb/d)	18,367	18,367	18,367

MP02 - Primary Clarification	Calculated	Data	BCE Exist
Q (MGD)	7	7	7
BOD (mg/L)	31,061	31,061	31,061
TSS (mg/L)	53,406	53,406	53,406
TP (lb/d)	35.5%	35.5%	35.5%
TKN (lb/d)	18.69%	18.69%	18.69%

MP05 - Secondary Clarification	Calculated	Data	BCE Exist
Q (MGD)	112	112	112
BOD (mg/L)	204,356	204,356	204,356
TSS (mg/L)	176	176	176
TP (lb/d)	6,389	6,389	6,389
TKN (lb/d)	20,749	20,749	20,749

MP06 - Activated Sludge	Calculated	Data	BCE Exist
Q (MGD)	1.97	1.97	1.97
BOD (mg/L)	10,000	10,000	10,000
TSS (mg/L)	164,497	164,497	164,497
TP (lb/d)	3,921	3,921	3,921
TKN (lb/d)	9,802	9,802	9,802

MP10 - Sludge Dewatering (BFP)	Calculated	Data	BCE Exist
% BOD Cap	95.0%	95.0%	95.0%
% TS Cap	91.2%	91.2%	91.2%
TKN Cap	87.6%	87.6%	87.6%

MP11 - Sludge Drying	Calculated	Data	BCE Exist
% BOD Cap	91.0%	91.0%	91.0%
% TS Cap	90.3%	90.3%	90.3%
TKN Cap	89.5%	89.5%	89.5%

Removal	Calculated	Data
BOD Removal	97.5%	97.6%
TSS Removal	97.7%	97.8%
TP Removal	95.2%	92.9%
TKN Removal	96.2%	NA

Unaccounted for Wasteloads	(lb/d) (Note 1)	(%) (Note 2)	Comments
BOD	5,177	2%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	-34,792	-16%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	687	13%	Measured as % of biosolids pumped based on data compounds error
TKN	4,725	27%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads. Calculated as follows: (Influent - Effluent) - (PSD + WAS)
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

WAS to Thickening	Calculated	Data	BCE Exist
Q (MGD)	1.97	1.97	1.97
BOD (mg/L)	10,000	10,000	10,000
TSS (mg/L)	164,497	164,497	164,497
TP (lb/d)	3,921	3,921	3,921
TKN (lb/d)	9,802	9,802	9,802

MP12-MP14 - Milorganite Production/Storage/Waste Processing & Dust Control	Calculated	BCE Exist
Q (MGD)	0.073	0.055
BOD (mg/L)	-	-
TSS (mg/L)	265,381	930,000
TP (lb/d)	363,164	274,133
TKN (lb/d)	19,754	-

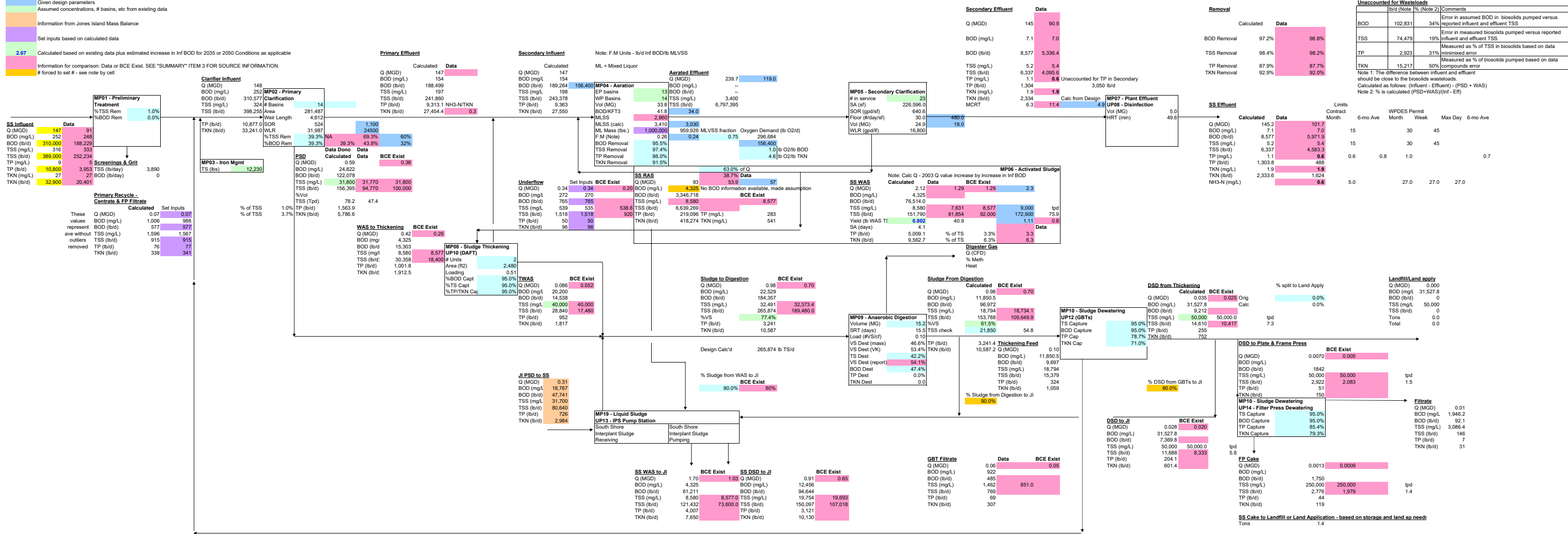
MP10 - Sludge Dewatering (BFP)	Calculated	Data	BCE Exist
% BOD Cap	95.0%	95.0%	95.0%
% TS Cap	91.2%	91.2%	91.2%
TKN Cap	87.6%	87.6%	87.6%

MP11 - Sludge Drying	Calculated	Data	BCE Exist
% BOD Cap	91.0%	91.0%	91.0%
% TS Cap	90.3%	90.3%	90.3%
TKN Cap	89.5%	89.5%	89.5%

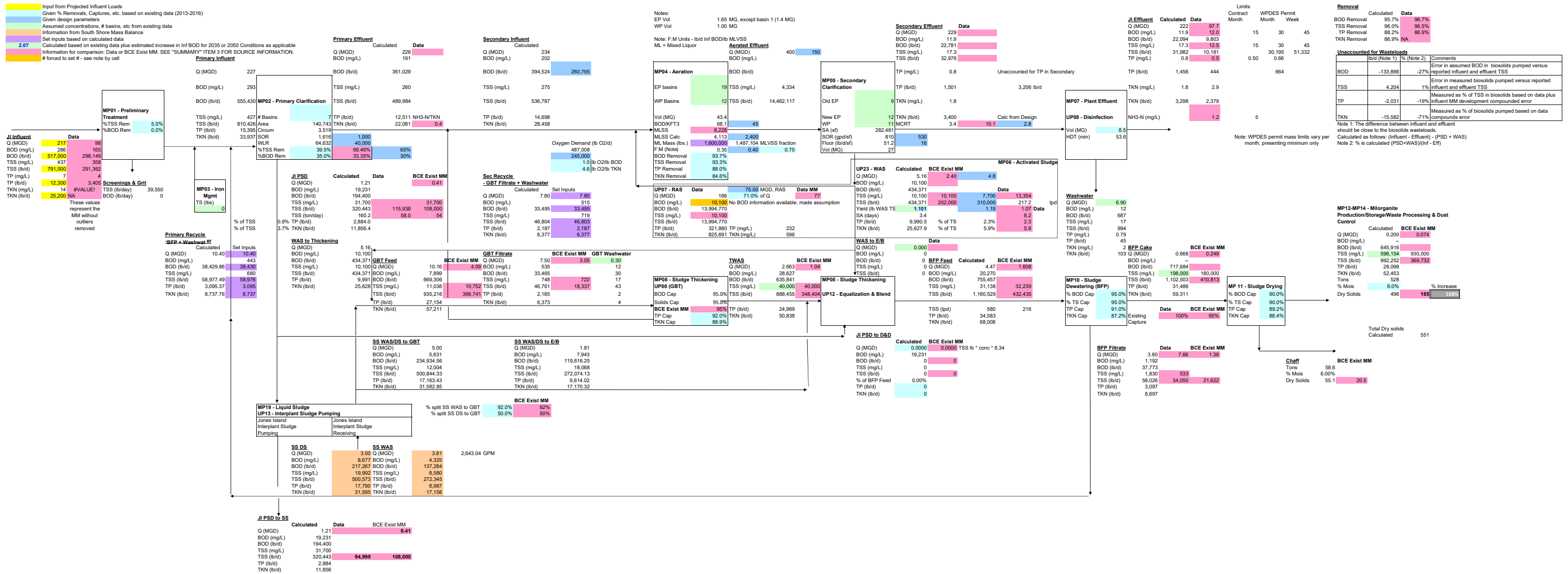
Chaff	Calculated	Data	BCE Exist
Tons	19.1	19.1	19.1
% Moist	6.00%	6.00%	6.00%
Dry Solids	18.0	18.0	18.0

JI PSD to SS	Calculated	Data	BCE Exist
Q (MGD)	0.31	0.31	0.27
BOD (mg/L)	18,767	18,767	18,767
TSS (mg/L)	47,741	47,741	47,741
TP (lb/d)	31,700	31,700	31,700
TKN (lb/d)	80,640	80,640	80,640

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data
- 2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell

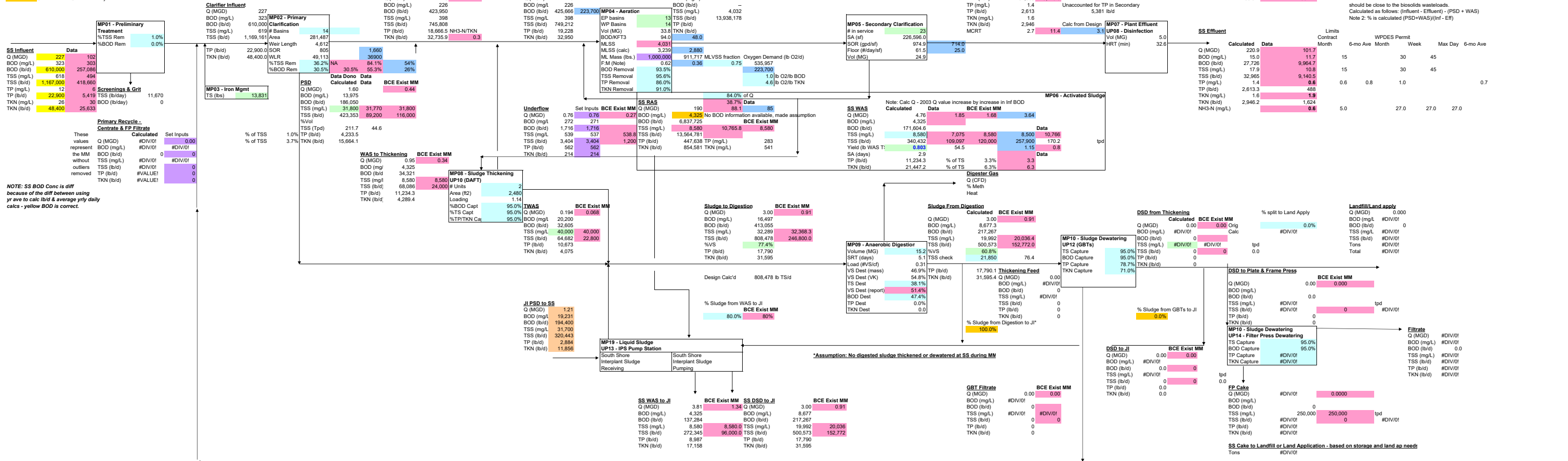


- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from South Shore Mass Balance
- Set inputs based on calculated data
- Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data

2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
 Information for comparison: Data or BCE Exist MM. SEE 'SUMMARY' ITEM 3 FOR SOURCE INFORMATION.
 # forced to set # - see note by cell

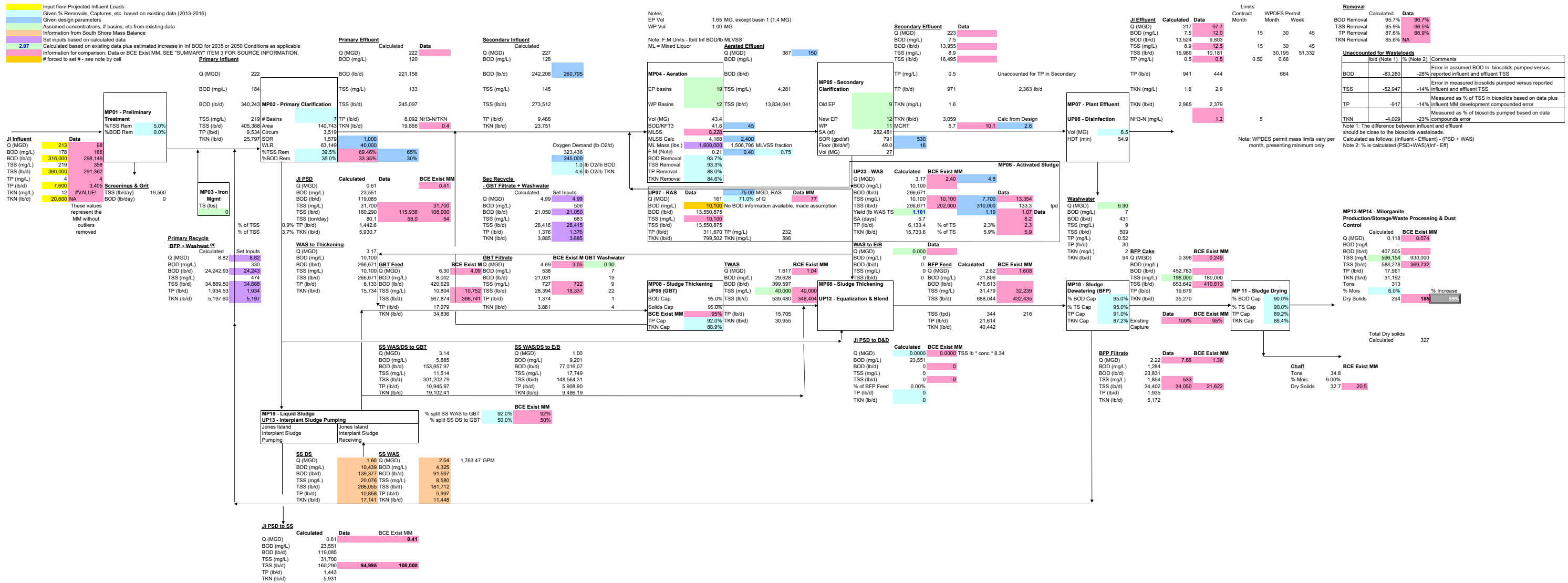


Unaccounted for Wasteloads			
	lb/d (Note 1)	% (Note 2)	Comments
BOD	224,619	39%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	370,250	33%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	4,819	24%	Measured as % of biosolids pumped based on data compounds error
TKN	8,342	18%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads. Calculated as follows: (Influent - Effluent) - (PSD + WAS)
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

NOTE: SS BOD Conc is diff because of the diff between using yr ave to calc lb/d & average yrlly daily calcs - yellow BOD is correct.

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc. from existing data
- Information from South Shore Mass Balance
- 2.07 Set inputs based on calculated data
- Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



Removal	Calculated	Data
BOD Removal	95.7%	98.7%
TSS Removal	95.9%	96.5%
TP Removal	87.6%	86.9%
TKN Removal	85.6%	NA

Unaccounted for Wasteloads	lb/d (Note 1)	% (Note 2)	Comments
BOD	-83,280	-28%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	-52,947	-14%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	-917	-14%	Measured as % of TSS in biosolids based on data plus influent MM development compounded error
TKN	-4,020	-23%	Measured as % of biosolids pumped based on data compounds error

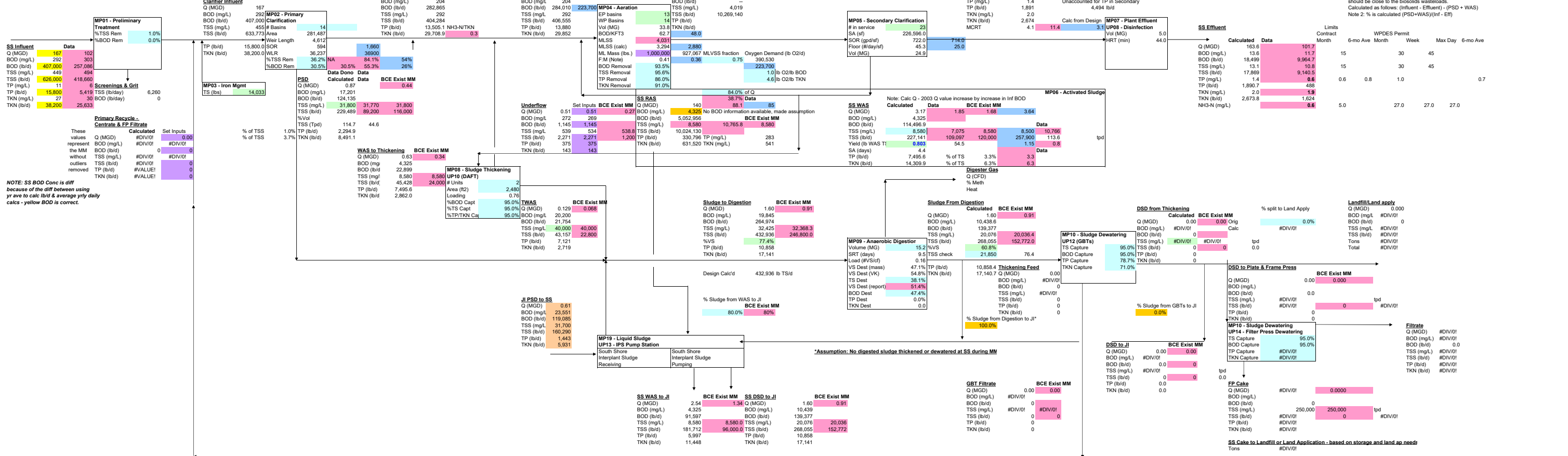
Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
 Calculated as follows: (Influent - Effluent) - (PSD + WAS)
 Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

MP12-MP14 - Milorganite Production/Storage/Waste Processing & Dust Control	Calculated	BCE Exist MM
Q (MGD)	0.118	0.074
BOD (mg/L)	-	-
BOD (lb/d)	407,505	-
TSS (mg/L)	596,154	930,000
TSS (lb/d)	588,278	369,732
TP (lb/d)	17,561	-
TKN (lb/d)	31,192	-
Tons	313	-
% Moist	6.0%	% Increase
Dry Solids	294	165

Total Dry solids	Calculated
Total Dry solids	327

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data

2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
forced to set # - see note by cell

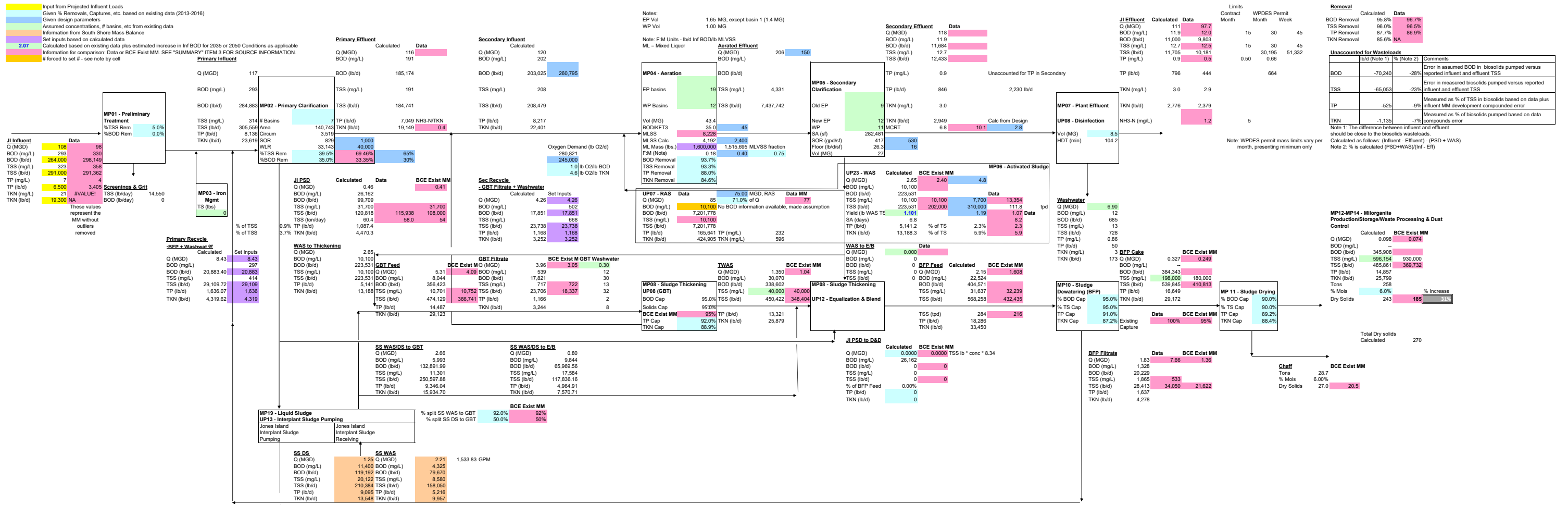


Unaccounted for Wasteloads			
	lb/d (Note 1)	% (Note 2)	Comments
BOD	149,869	39%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	151,501	25%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	4,119	30%	Measured as % of biosolids pumped based on data compounds error
TKN	12,725	36%	Measured as % of biosolids pumped based on data compounds error

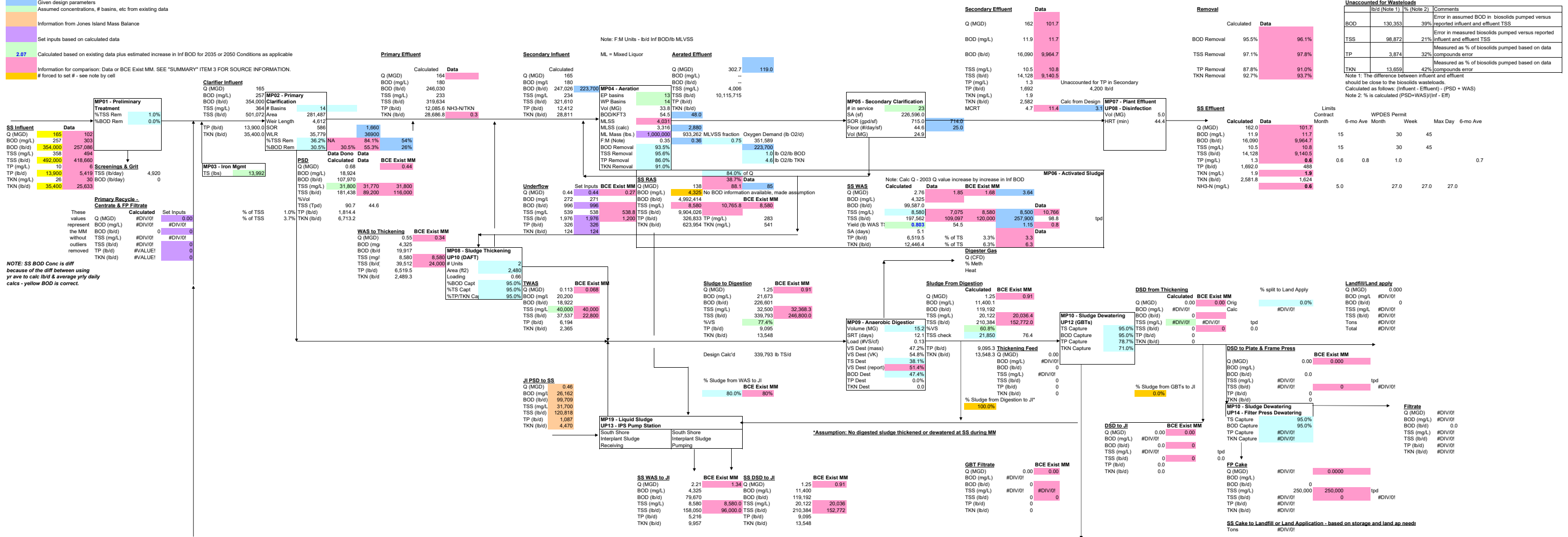
Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
Calculated as follows: (Influent - Effluent) - (PSD + WAS)
Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

NOTE: SS BOD Conc is diff because of the diff between using yr ave to calc lb/d & average yrly daily calcs - yellow BOD is correct.

- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from South Shore Mass Balance
- 2.07 Set inputs based on calculated data
- Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison. Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



- Input from Projected Influent Loads
- Given % Removals, Captures, etc. based on existing data (2013-2016)
- Given design parameters
- Assumed concentrations, # basins, etc from existing data
- Information from Jones Island Mass Balance
- Set inputs based on calculated data
- 2.07 Calculated based on existing data plus estimated increase in Inf BOD for 2035 or 2050 Conditions as applicable
- Information for comparison: Data or BCE Exist MM. SEE "SUMMARY" ITEM 3 FOR SOURCE INFORMATION.
- # forced to set # - see note by cell



	lb/d (Note 1)	% (Note 2)	Comments
BOD	130,353	39%	Error in assumed BOD in biosolids pumped versus reported influent and effluent TSS
TSS	96,872	21%	Error in measured biosolids pumped versus reported influent and effluent TSS
TP	3,874	32%	Measured as % of biosolids pumped based on data compounds error
TKN	13,659	42%	Measured as % of biosolids pumped based on data compounds error

Note 1: The difference between influent and effluent should be close to the biosolids wasteloads.
Calculated as follows: (Influent - Effluent) * (PSD + WAS)
Note 2: % is calculated (PSD+WAS)/(Inf - Eff)

Contract Month	WPODES Permit		Max Day
	6-mo Ave	Week	
15	30	45	
0.6	0.8	1.0	0.7
5.0	27.0	27.0	27.0

NOTE: SS BOD Conc is diff because of the diff between using yr ave to calc lb/d & average yrlly daily calcs - yellow BOD is correct.

APPENDIX 5B-6: WRFs and Biosolids Asset System – Capacity Risks -

DRAFT

MMSD Asset Management Plan
WRF and Biosolids Asset System
Risk Register - Capacity Risks

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R039	Risk of necessity to implement emergency operations and the corresponding cost impacts due to the insufficient capacity of the D&D sludge cake bypass belt to process all dewatered biosolids in the event that the south side system goes offline	Risk of losing backup biosolids processing alternatives. Operational functionality and flexibility (potential to impact half of BFP production). Right now, there is only 1/2 of the facility with the capability of dewatering biosolids and removing from the building (south).	Jl - Jones Island WRF	District planning action	High	known/past issues	High	Loss of belt does not prevent solids processing. Time for repair should be relatively short (less than 7 days)	Moderate	Capacity	Environmental Improvements
R190	Risk of insufficient solids processing and disposal capacity at SSWRF during a JI WRF D&D extended or short term shutdown	Does the JI WRF and SSWRF have needed solids capacity during a unplanned D&D outage? Processes impacted are WAS thickening, digestion, digested sludge GBT thickening, plate and frame press dewatering, belt filter press dewatering and belt filter press cake discharge to landfill trucks.	SS - South Shore WRF	District planning action	Medium	Event 5-10 years	High	Depending on duration of the outage \$500K - \$1M for temp equipment and services needed to handle all of the systems solids	Moderate	Capacity	Permit Requirements
R210	Operation and condition of the primary scum system	improve the effectiveness of the primary treatment system by making improvements to the scum system	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Medium	Moderate level of impact on operational efficiency.	Moderate	Capacity	Management Effectiveness
R240	Risk of conveyance system overflows by not maximizing ISS pump out blending at the JI WRF	Flow limit on CSO/diversion capacity is not known - MGD rate critical to development of SSO/CSO LOP - need to determine ISS blending/diversion/treatment capacity	Jl - Jones Island WRF	New flow meter recently installed. District planing action.	Very High	Prior analysis or testing of the diversion capacity has not been conducted	Very High	Could increase CSO volume or cause CSO when there is additional capacity available at the JI WRF	High	Capacity	Environmental Improvements

APPENDIX 5B-7: WRFs Physical Mortality Gap Methodology

DRAFT

ATTACHMENT 5B7

PHYSICAL MORTALITY ASSESSMENT – METHODOLOGY TO ADDRESS GAPS IN WRF COST AND REPLACEMENT DATE INFORMATION

LEAD ENGINEER: D. DINEEN, B. STEPHENS/DONOHUE & ASSOCIATES

DATE: 07/17/19

1. PURPOSE

The purpose of this document is to discuss the methods employed to address gaps in the water reclamation facilities' (WRF) asset dataset for the assets at Jones Island Water Reclamation Facility (JIWRF), South Shore Water Reclamation Facility (SSWRF), and Interplant Sludge Pipeline (ISP). This dataset, which is a part of MMSD's AssetView database, was used as part of the physical mortality assessment.

MMSD provided the WRF asset dataset from its AssetView database as of June 6, 2019 for the physical mortality assessment. The methodology discussed in this document covers 11,929 active assets in the WRF asset dataset. Upon limited review of the assets contained in this database, several issues were identified that prevented meaningful data analysis. These included:

1. Incomplete replacement costing information
2. Incomplete governing rehabilitation or replacement (rehab/replace) year date information
3. Lack of information on what assets are currently planned for removal
4. Lack of information on whether assets are to be replaced or rehabbed
5. Lack of rehab costing data
6. Incomplete projected lifetime estimates
7. Possibly inaccurate data based on engineering judgement
8. Incomplete data organization

Replacement cost information in AssetView is based on the original installed cost plus Construction Cost Index inflation to the current year or a substituted cost based on additional or new information.

Governing rehab/replace year information in AssetView is based on the original installed date or rehabilitated date plus the estimated service life or a substituted date based on a condition assessment or other new information.

Most of these issues could not be fully addressed within the scope of this project. However, an effort was made to address the first two points in order to provide a more meaningful assessment of the data and provide a more representative asset valuation for future capital rehabilitation or replacement. To

capture the scope of the first two issues listed above, Table 1 displays the percent of assets in the database missing cost or replacement date information.

TABLE 1: MISSING DATA FROM ACTIVE ASSETS IN WRF DATASET

Missing Field	JIWRF	SSWRF	ISP	Total
Cost	50.2%	61.6%	66.6%	55.0%
Governing Rehab/Replace Year	27.8%	24.5%	43.2%	26.9%
Missing Both	27.8%	24.4%	43.2%	26.9%

Unless the missing data displayed in the table can be filled in with some degree of accuracy, any assessment of the data will be using less than half of the active assets in the dataset. The methodology for estimating the missing data is presented herein. Note that Interplant Solids Pipeline (ISP) assets in AssetView are located at both JIWRF and SSWRF so the methodology used the JIWRF and SSWRF data and then—after the methodology was applied—the ISP assets were split out and grouped together for presentation in the assessment.

2. DATA MODIFICATION / ESTIMATING

Asset Costs

Cost was estimated by taking the average cost of all assets with cost data of the same “Asset Type” field (referred to as just asset type for remainder of document) across JIWRF and SSWRF and assigning the calculated average cost to those same asset types that were missing cost data. The asset type field was chosen since it is present for 99.9 percent of active assets and—after a limited review—it was determined that it gave more accurate values than the similar “Asset Class” field. For example, the asset class “Conveyors” includes asset types for belt conveyors, vibrating chutes, bucket elevators, chain/rake conveyors, pneumatic conveyors, vibratory conveyors, and screw conveyors. All of these asset types have different costs, and using the asset type provides a more specific categorization of the assets. In order to maximize the accuracy of the estimate, all assets were used to develop these estimates, including assets that are inactive, retired, etc.

An example is asset 111667, a pump for a cooling loop with no cost assigned that is listed as a “Pump, Centrifugal” asset type. The estimated cost that was used for this asset was the average cost of \$65,265 for all “Pump, Centrifugal” assets that have costing data.

These estimates were manually reviewed by senior staff at Donohue & Associates for every asset type, and assets with values that were suspected to be inaccurate were resolved or selected to be left without a cost estimate. A notable exception is the asset type “Motor (all), Electrically Driven,” where the estimate of \$50,773 was suspected to be nonrepresentative for the following reasons:

- There were a large number of assets affected.
- The high estimate was weighted by several high value motor assets.
- The \$15,000 number was deemed more reasonable / representative.

Attachment 5B7-A, Asset Type Average Cost Estimate Review, contains a table of these estimates and how much value these estimates added to the database, including which assets were not viable for estimated valuations and the reason they were excluded.

The potential error of this estimation method was investigated on the basis of 95 percent confidence intervals for the various asset types in addition to the manual review. This estimating method is believed to be reasonable for asset types that have a narrow range of asset sizes and costs. For asset types with a broad range of asset sizes and costs, the findings show that the estimates can be extremely inaccurate. The recommendations of the physical mortality evaluation projects identified in the 2050 Facilities Plan (2050 FP) reference this information to identify where costs are based on estimated data and note that evaluation is required before recommended projects should move forward.

Asset Rehab/Replace Year

Asset rehab/replace year is reported using the in-service date or most recent rehabilitation date and adding the estimated useful/service life. While nearly all assets have an estimated useful life, a large number of assets have no in-service date or rehabilitation date; therefore, an estimate had to be generated. The chosen method to estimate these in-service dates was to use a common database field. A similar approach as above was used; however, there were two differences in the method: 1) instead of using the asset type, the building field was used, and 2) only active assets were included. The building field was chosen based on the assumption that the assets were installed in their entirety when the building was installed. While this assumption can be inaccurate and prone to error for rehabilitated or replaced assets, a more accurate approach was not identified. Only active assets were included for estimating the rehab/replace year, as it is believed these assets have accurate information.

Error for asset rehab/replace year was investigated but is not displayed or reported for date estimates. This is due to the error not being as easily quantifiable. It should be noted that the capital project rehabilitation or replacement projects are already being grouped into year ranges (2020-2024, 2025-2029, 2030-2039), which absorbs some of the error inherent in the rehabilitation or replacement year.

The recommendations of the physical mortality evaluation projects identified in the 2050 FP reference the cost estimating methods and the rehab/replace year estimating methods to identify where more information and evaluation is required before the recommended asset rehabilitation or replacement should move forward.

3. SUMMARY

The recommended physical mortality projects over the 2020-2049 period have a total rehabilitation or replacement cost of \$900 million, without including estimates for assets that do not have data in AssetView. The application of the above estimating methods provides a revised cost opinion of \$1,300 million over the same period.

The percent of assets without either AssetView data or estimated data both before and after the estimation methodology was applied is reported in Table 2. The asset cost and rehab/replace year estimating methods provide a significant improvement for the overall estimate of future physical mortality capital budgets.

TABLE 2: DATA FROM JUNE 6, 2019 ASSETVIEW DATABASE BEFORE AND AFTER ESTIMATION METHODOLOGY

Field	JIWRF	SSWRF	ISP	Total
Before Estimation Methodology				
Percent of Assets Evaluated	50%	38%	34%	45%
Number of Assets Evaluated	3,503	1,761	99	5,363
Asset Value (2020-2049) (Million \$)	\$641	\$251	\$5	\$896
After Estimation Methodology				
Percent of Assets Evaluated	78%	70%	95%	75%
Number of Assets Evaluated	5,493	3,240	272	9,005
Asset Value (2020-2049) (Million \$)	\$775	\$523	\$8	\$1,306

4. ATTACHMENTS

- Attachment A: Asset Type Average Cost Estimate Review

**APPENDIX 5B-7 -
Attachment A: Asset Type Average Cost Estimate Review -**

DRAFT

**Physical Mortality Assessment - Methodology to Address Gaps in Cost and Replacement Date Information
WRFs and Biosolids Asset System
Attachment A, Asset Type Average Cost Estimate Review**

Note: All Asset Types with "Total Value to be added based on Estimate" show as \$0 were not included in Physical Mortality Assessment as explained in accompanying comment.

Asset Type	Estimate	Sample Size (includes inactive)	Number of Assets which will be assigned Estimate	Total Assets in Class	Percent of Assets Receiving Cost Estimates	Revised Estimate	Total Value to be added based on Estimate	Comment
AERATION, BASIN	\$9,450,450	12	52	64	81%	\$9,450,450	\$491,423,400	
BUILDING, CONCRETE/MASONRY	\$13,616,248	74	15	88	17%	\$13,616,248	\$204,243,720	
GROUNDS, UNIMPROVED, EARTHWORK	\$9,524,823	5	11	16	69%		\$0	Could have wide range of costs
DISINFECTION, BASIN	\$15,282,572	2	6	8	75%		\$0	conservative, probably based on two SSWRF basins, four JIWRf are smaller
CLARIFIER, BASIN	\$3,912,458	85	22	105	21%	\$3,912,458	\$86,074,076	
BLOWER, CENTRIFUGAL	\$4,843,635	27	17	42	40%		\$0	Very, very conservative, there are 8 large blowers, 4 at JI and 4 at SS Donohue estimates the installed cost for the SS blowers at \$2M?? Unless I am not understanding what this asset is?
DIGESTER, BASIN \ STRUCTURE, ALL TYPES	\$5,519,971	1	12	13	92%		\$0	There are only 12, 8 are 1.25 mgal, 4 are 3 mgal, not sure which size the cost is based on?
ROOFING SYSTEM	\$650,920	17	62	79	78%		\$0	Wide variation in roof sizes and costs, not sure if the 17 roofs used are a representative sample?
PRESS, BELT	\$1,614,908	33	15	45	33%	\$1,614,908	\$24,223,620	
CHANNEL, CONCRETE	\$5,841,138	20	4	24	17%	\$5,841,138	\$23,364,552	
MOTOR (ALL), ELECTRICALLY DRIVEN	\$50,773	71	242	301	80%	\$15,000	\$3,630,000	Seems very conservative, \$50,000 is a very large motor. (replaced with \$15,000 as that is deemed more accurate)
HVAC AIR HANDLING UNITS	\$48,819	248	219	451	49%	\$48,819	\$10,691,361	
VALVES, GATE TYPE	\$22,555	47	393	437	90%	\$22,555	\$8,864,115	
MOTOR CONTROL CENTER (ALL), A.C. ELECTRICAL,	\$125,393	119	57	174	33%	\$125,393	\$7,147,401	
STRUCTURE, CHAMBER	\$569,792	1	12	13	92%		\$0	This type of asset, is expected to have large variation in type, size and cost. Estimate only based on 1 of 13.
GEARBOX,	\$111,472	9	58	66	88%		\$0	Possibly very conservative, probably based on 8 large gear boxes out of a total 66 gear boxes
SUBSTATION	\$305,654	36	21	53	40%	\$305,654	\$6,418,734	

Note: All Asset Types with "Total Value to be added based on Estimate" show as \$0 were not included in Physical Mortality Assessment as explained in accompanying comment.

Asset Type	Estimate	Sample Size (includes inactive)	Number of Assets which will be assigned Estimate	Total Assets in Class	Percent of Assets Receiving Cost Estimates	Revised Estimate	Total Value to be added based on Estimate	Comment
VALVES, PLUG	\$19,889	103	313	407	77%	\$19,889	\$6,225,257	Cost appears to be for relatively large valves (16' or greater). 407 large plug valves seem reasonable.
GATES, ALL TYPES	\$32,681	652	158	730	22%	\$32,681	\$5,163,598	
CLARIFIER MECHANISM	\$153,726	8	33	41	80%	\$153,726	\$5,072,958	
NETWORK COMPUTERS, SERVERS, MONITORS, PRINTERS & BACKUP DEVICES	\$1,429,447	24	3	23	13%	\$1,429,447	\$4,288,341	
VALVES, BALL	\$16,664	257	245	451	54%	\$16,664	\$4,082,680	
HOIST, OVERHEAD	\$58,916	41	64	104	62%	\$58,916	\$3,770,624	
DOORS, OVERHEAD/ROLLUP	\$24,104	40	137	177	77%	\$24,104	\$3,302,248	
CONTROL PANEL, GENERAL	\$33,811	403	96	440	22%	\$33,811	\$3,245,856	
BUILDING, METAL\STEEL	\$1,622,134	7	2	9	22%	\$1,622,134	\$3,244,268	
PUMP, CENTRIFUGAL	\$65,285	304	45	294	15%	\$65,285	\$2,937,825	
VALVES, KNIFE	\$15,405	84	188	272	69%	\$15,405	\$2,896,140	
TANK, STEEL	\$180,177	45	15	54	28%	\$180,177	\$2,702,655	
BURNER, DRYER MULTI-HEARTH	\$259,804	39	10	49	20%	\$259,804	\$2,598,040	
BAR SCREEN \ RACK	\$231,853	30	11	38	29%		\$0	There are 9 screens and one rack at JI and 7 screens and 1 rack at SS, the cost seems ok for those, what are the other 20?
MECHANICAL AIR DAMPERS, AIR FLOW CONTROL	\$34,617	94	61	150	41%	\$34,617	\$2,111,637	
VALVES, BUTTERFLY	\$14,658	143	143	280	51%	\$14,658	\$2,096,094	
TRANSFORMER, AC ELECTRIC	\$127,023	45	16	60	27%	\$127,023	\$2,032,368	
PROCESS PIPING, PRESSURE	\$35,507	5	57	61	93%		\$0	Wide variation in size and length of process piping, only 4 of 61 assets have a cost. Average cost seems low or very low??
ELECTROSTATIC PRECIPITATOR, WET	\$164,331	1	12	12	100%		\$0	Seems very low for these very large units.
FAN, CENTRIFUGAL	\$22,243	154	85	222	38%	\$22,243	\$1,890,655	
TANK, PRESSURE	\$95,534	24	17	39	44%	\$95,534	\$1,624,078	
ELEVATORS, ALL TYPES	\$174,373	4	9	13	69%	\$174,373	\$1,569,357	
PLC, GENERAL	\$34,191	26	43	69	62%	\$34,191	\$1,470,213	
SAFETY, FIRE PROTECTION, ALARMS, SUPPRESSION	\$74,943	3	19	22	86%		\$0	Seems like there would be a wide variety of types and sizes for this Asset Type.
CONVEYOR, SCREW	\$61,822	235	23	207	11%	\$61,822	\$1,421,906	
FLOW METER, MAGNETIC	\$19,389	367	69	398	17%	\$19,389	\$1,337,841	

Note: All Asset Types with "Total Value to be added based on Estimate" show as \$0 were not included in Physical Mortality Assessment as explained in accompanying comment.

Asset Type	Estimate	Sample Size (includes inactive)	Number of Assets which will be assigned Estimate	Total Assets in Class	Percent of Assets Receiving Cost Estimates	Revised Estimate	Total Value to be added based on Estimate	Comment
FILTER, AIR INTAKE CLEANER	\$117,347	21	11	30	37%	\$117,347	\$1,290,817	
HOIST, GANTRY	\$97,093	47	13	55	24%	\$97,093	\$1,262,209	
SWITCHGEAR	\$249,228	18	5	21	24%	\$249,228	\$1,246,140	
ELECTRICAL, BREAKERS & FUSES	\$200,466	1	6	6	100%	\$200,466	\$1,202,796	
PUMP DRY, PROGRESSING CAVITY	\$48,216	138	24	124	19%	\$48,216	\$1,157,184	
PUMP, SUBMERSIBLE, SCREW	\$950,386	9	1	9	11%	\$950,386	\$950,386	
HEAT EXCHANGER, TUBE	\$167,279	20	5	21	24%	\$167,279	\$836,395	
CONVEYOR, BELT	\$103,126	54	8	54	15%	\$103,126	\$825,008	
STRAINER, AUTOMATIC	\$56,204	36	12	38	32%	\$56,204	\$674,448	
BOILER, WATER HEATER	\$111,509	21	6	21	29%	\$111,509	\$669,054	
HVAC, COOLING UNIT, CONDENSER\CHILLER, FREON\WATER-GLYCOL	\$21,419	38	31	67	46%	\$21,419	\$663,989	
MIXER, FIXED	\$47,375	105	14	96	15%	\$47,375	\$663,250	
COMPRESSOR, RECIPROCATING	\$64,128	45	10	50	20%	\$64,128	\$641,280	
MOTOR STARTER	\$203,746	7	3	8	38%		\$0	There are many motor starters, these must be unique large ones?
HVAC HEAT, ELECTRIC OR GAS FIRED	\$10,824	30	52	80	65%	\$10,824	\$562,848	
VARIABLE FREQUENCY DRIVERS < 1000 HP	\$18,591	185	28	183	15%	\$18,591	\$520,548	
SAFETY EQUIPMENT, FIXED	\$25,875	30	20	40	50%	\$25,875	\$517,500	
MONITOR, WEIGHT	\$21,015	26	23	45	51%	\$21,015	\$483,345	
POWER SUPPLY, BACKUP	\$17,750	34	27	53	51%	\$17,750	\$479,250	
TANK, CONCRETE	\$24,365	4	15	15	100%		\$0	Wide variety in type and size of concrete tanks. \$24K seems very, very low for any of them?
MONITOR, LEVEL	\$5,359	95	67	132	51%	\$5,359	\$359,053	
CONVEYOR, CHAIN/RAKE	\$119,125	35	3	36	8%	\$119,125	\$357,375	
MIXER, SUBMERSIBLE	\$312,116	6	1	1	100%		\$0	Do not recall one very large submersible mixer?
GENERATOR, NATURAL GAS	\$127,441	6	2	4	50%		\$0	Assume these are emergency generators, OK
FILTER, GRAVITY BELT	\$232,728	8	1	8	13%	\$232,728	\$232,728	
ELECTRICAL, BATTERY	\$110,863	2	2	4	50%	\$110,863	\$221,726	
MONITOR, GAS, PROCESS	\$5,525	65	40	81	49%	\$5,525	\$221,000	
MONITOR, PRESSURE	\$2,845	57	74	125	59%	\$2,845	\$210,530	
PORTABLE POWER TOOLS, FUEL	\$51,030	7	4	7	57%	\$51,030	\$204,120	

Note: All Asset Types with "Total Value to be added based on Estimate" show as \$0 were not included in Physical Mortality Assessment as explained in accompanying comment.

Asset Type	Estimate	Sample Size (includes inactive)	Number of Assets which will be assigned Estimate	Total Assets in Class	Percent of Assets Receiving Cost Estimates	Revised Estimate	Total Value to be added based on Estimate	Comment
VALVES, PSI CONTROL	\$10,082	39	20	47	43%	\$10,082	\$201,640	
TANK, HIGH DENSITY POLYETHYLENE	\$39,261	8	5	12	42%	\$39,261	\$196,305	
AUTOMATIC TRANSFER SWITCH	\$23,386	24	8	29	28%	\$23,386	\$187,088	
PUMP SUBMERSIBLE, CENTRIFUGAL	\$22,953	38	8	39	21%	\$22,953	\$183,624	
DUCTWORK, CONDITIONED AIR CONTAINMENT & MOVEMENT	\$28,326	26	6	14	43%	\$28,326	\$169,956	
HEAT EXCHANGER, COIL	\$55,800	12	3	14	21%	\$55,800	\$167,400	
FLOW METER, ULTRASONIC	\$7,894	102	20	59	34%	\$7,894	\$157,880	
HVAC, SMALL SPACE AIR COOLING OR HEATING, WINDOW A/C, BASEBOARD\WALL HEATERS	\$6,772	65	23	86	27%	\$6,772	\$155,756	
AIR, PRESSURE PIPE, INSTRUMENT AIR, COMPRESSED AIR SERVICE	\$13,559	4	8	11	73%	\$13,559	\$108,472	
PUMP DRY, GEAR	\$8,220	23	13	31	42%	\$8,220	\$106,860	
CHAINFALLS, COMEALONGS, PORTABLE HOISTS	\$25,903	4	4	8	50%	\$25,903	\$103,612	
TANK, FIBERGLASS	\$48,983	56	2	54	4%	\$48,983	\$97,966	
MONITOR, TEMPERATURE	\$3,318	9	29	32	91%	\$3,318	\$96,222	
FLOW METER, OPEN CHANNEL, WEIR	\$44,573	3	2	3	67%	\$44,573	\$89,146	
PRODUCT COOLER, CHILLER	\$44,101	2	2	2	100%	\$44,101	\$88,202	
BACKFLOW PREVENTERS, ALL	\$1,601	16	51	66	77%	\$1,601	\$81,651	
PLUMBING, PIPING, POTABLE WATER DISTRIBUTION AND DRAINAGE	\$39,788	1	2	2	100%	\$39,788	\$79,576	
PUMP, SUMP	\$9,908	14	8	17	47%	\$9,908	\$79,264	
LABORATORY EQUIPMENT, FIXED	\$15,588	42	5	24	21%	\$15,588	\$77,940	
PUMP DRY, DIAPHRAGM	\$37,902	21	2	17	12%	\$37,902	\$75,804	
FLOW METER, THERMAL MASS	\$17,333	34	4	37	11%	\$17,333	\$69,332	
MONITOR, MOTION, MOVEMENT	\$11,304	35	6	37	16%	\$11,304	\$67,824	
VALVES, DISC	\$5,798	58	11	37	30%	\$5,798	\$63,778	
HAND TOOLS, GROUP	\$63,614	20	1	20	5%	\$63,614	\$63,614	
SECURITY GATES & FENCING	\$28,606	2	2	4	50%	\$28,606	\$57,212	
WELLS, WET, DRY	\$2,408	1	23	24	96%		\$0	Can't think of any well that would have a cost of \$2,400?
PIPE TRAPS, CLEAN-OUTS	\$6,694	13	8	15	53%	\$6,694	\$53,552	
MONITOR, DENSITY	\$13,187	3	4	4	100%	\$13,187	\$52,748	
DRYER, AIR	\$24,018	29	2	26	8%	\$24,018	\$48,036	
BIN, BIOSOLIDS	\$41,422	19	1	11	9%	\$41,422	\$41,422	

Note: All Asset Types with "Total Value to be added based on Estimate" show as \$0 were not included in Physical Mortality Assessment as explained in accompanying comment.

Asset Type	Estimate	Sample Size (includes inactive)	Number of Assets which will be assigned Estimate	Total Assets in Class	Percent of Assets Receiving Cost Estimates	Revised Estimate	Total Value to be added based on Estimate	Comment
FORKLIFTS, MATERIAL HANDLERS	\$39,247	4	1	5	20%	\$39,247	\$39,247	
PUMP DRY, PERISTALIC	\$9,791	34	4	24	17%	\$9,791	\$39,164	
MONITOR, FLOW	\$2,368	4	16	20	80%	\$2,368	\$37,888	
CLARIFIER FLIGHTS AND CHAIN SYSTEMS	\$37,067	64	1	61	2%	\$37,067	\$37,067	
HEAT EXCHANGER, PLATE	\$18,054	5	2	7	29%	\$18,054	\$36,108	
VALVES, 3 WAY	\$4,226	2	8	9	89%	\$4,226	\$33,808	
MONITOR, TURBIDITY	\$9,943	2	3	4	75%	\$9,943	\$29,829	
MONITOR, ENERGY (GAS/ELEC)	\$29,708	6	1	4	25%	\$29,708	\$29,708	
HVAC HOT WATER HEAT, HOT WATER RADIANT HEAT	\$3,514	26	8	34	24%	\$3,514	\$28,112	
MANLIFTS, WORK PLATFORMS	\$27,429	7	1	8	13%	\$27,429	\$27,429	
PUMP DRY, MULTI-STAGE CENTRIIFUGAL	\$13,459	138	2	6	33%	\$13,459	\$26,918	
CATHODIC PROTECTION	\$12,841	3	2	4	50%	\$12,841	\$25,682	
POWER PACK, HYDRAULIC	\$24,235	1	1	2	50%	\$24,235	\$24,235	
FLOW METER, AREA VELOCITY	\$23,801	1	1	2	50%	\$23,801	\$23,801	
SAMPLING EQUIPMENT, AUTOMATIC	\$11,260	11	2	12	17%	\$11,260	\$22,520	
MONITOR, ELECTRICAL CURRENT	\$2,209	1	10	11	91%	\$2,209	\$22,090	
SAFETY EQUIPMENT, WASH\SHOWER STATIONS, EMERGENCY EYEWASH	\$2,499	2	8	10	80%	\$2,499	\$19,992	
HVAC, STEAM GENERATOR, STEAM RADIANT HEAT	\$1,544	3	12	15	80%	\$1,544	\$18,528	
PUMP DRY, LOBE (ROTORY)	\$16,586	7	1	6	17%	\$16,586	\$16,586	
POWER DISTRIBUTION PANEL	\$5,429	4	3	5	60%	\$5,429	\$16,287	
TOWABLE, TRAILER	\$11,245	2	1	3	33%	\$11,245	\$11,245	
BIN, RECYCLE	\$8,291	4	0	8	0%	\$8,291	\$0	All assets have cost, no estimate needed
CLASSIFIER, SEPARATOR - CYCLONIC	\$66,872	32	0	25	0%	\$66,872	\$0	All assets have cost, no estimate needed
EXHAUST STACKS, ALL	\$819,889	1	0	1	0%	\$819,889	\$0	All assets have cost, no estimate needed
NETWORK SWITCHES, ROUTERS, WIRELESS ACCESS POINTS, COMPUTER INTERFACES	\$803,882	1	0	7	0%	\$803,882	\$0	All assets have cost, no estimate needed
STRUCTURE, MANHOLE	\$13,591	2	0	2	0%	\$13,591	\$0	All assets have cost, no estimate needed
TUNNEL, SERVICE	\$534,784	15	0	15	0%	\$534,784	\$0	All assets have cost, no estimate needed
MONITOR, LIQUID - CONCENTRATION	\$64,179	5	0	3	0%	\$64,179	\$0	All assets have cost, no estimate needed
GENERATOR, NATURAL GAS/DIGESTER GAS	\$686,485	6	0	5	0%	\$686,485	\$0	All assets have cost, no estimate needed

Note: All Asset Types with "Total Value to be added based on Estimate" show as \$0 were not included in Physical Mortality Assessment as explained in accompanying comment.

Asset Type	Estimate	Sample Size (includes inactive)	Number of Assets which will be assigned Estimate	Total Assets in Class	Percent of Assets Receiving Cost Estimates	Revised Estimate	Total Value to be added based on Estimate	Comment
COMMUNICATION, WIRED-RADIO-CELL	\$8,771	2	0	0		\$8,771	\$0	All assets have cost, no estimate needed
PORTABLE POWER TOOLS, AC ELECTRIC	\$11,079	2	0	2	0%	\$11,079	\$0	All assets have cost, no estimate needed
COMPRESSOR, ROTARY	\$370,466	11	0	8	0%	\$370,466	\$0	All assets have cost, no estimate needed
LABORATORY EQUIPMENT, BENCHTOP	\$10,162	5	0	4	0%	\$10,162	\$0	All assets have cost, no estimate needed
VAULT, GATE, METER, VALVES	\$431,617	6	0	6	0%	\$431,617	\$0	All assets have cost, no estimate needed
FILTER, CHARCOAL ODOR CONTROL	\$355,667	3	0	2	0%	\$355,667	\$0	All assets have cost, no estimate needed
ACTUATOR, ELECTRIC	\$7,414	78	0	78	0%	\$7,414	\$0	All assets have cost, no estimate needed
BIN, MATERIALS E.G. SALT, ROCK, SOIL	\$141,644	2	0	2	0%	\$141,644	\$0	All assets have cost, no estimate needed
BLOWER, LOBE (ROTARY)	\$18,461	2	0	1	0%	\$18,461	\$0	All assets have cost, no estimate needed
BOILER, VAPORIZER	\$26,113	1	0	1	0%	\$26,113	\$0	All assets have cost, no estimate needed
CENTRIFUGE	\$1,142,231	7	0	5	0%	\$1,142,231	\$0	All assets have cost, no estimate needed
CHUTE, VIBRATING	\$3,800	8	0	1	0%	\$3,800	\$0	All assets have cost, no estimate needed
CLASSIFIER, SCREENING	\$58,498	18	0	9	0%	\$58,498	\$0	All assets have cost, no estimate needed
CONVEYOR, PNEUMATIC	\$49,163	10	0	8	0%	\$49,163	\$0	All assets have cost, no estimate needed
ELECTRICAL, INVERTER	\$8,563	4	0	4	0%	\$8,563	\$0	All assets have cost, no estimate needed
FAN, EXHAUST PROPELLER TYPE	\$38,770	1	0	0		\$38,770	\$0	All assets have cost, no estimate needed
FLOW METER, VORTEX	\$2,051	24	0	24	0%	\$2,051	\$0	All assets have cost, no estimate needed
GENERATOR, DIESEL	\$41,130	1	0	1	0%	\$41,130	\$0	All assets have cost, no estimate needed
GENERATOR, GASOLINE	\$33,652	1	0	1	0%	\$33,652	\$0	All assets have cost, no estimate needed
GRINDER/COMMINUTOR	\$56,498	12	0	12	0%	\$56,498	\$0	All assets have cost, no estimate needed
HOIST, DOCK LEVELER	\$13,471	1	0	0		\$13,471	\$0	All assets have cost, no estimate needed
LAGOON, BASIN	\$93,372	1	0	1	0%	\$93,372	\$0	All assets have cost, no estimate needed
LUBRICATOR, GRAPHITE	\$11,794	12	0	12	0%	\$11,794	\$0	All assets have cost, no estimate needed
MECHANICAL AIR LOCK, AIR FLOW CONTROL	\$15,458	7	0	7	0%	\$15,458	\$0	All assets have cost, no estimate needed
NATURAL GAS/LANDFILL GAS POWERED TURBINE GENERATOR	\$4,329,552	3	0	3	0%	\$4,329,552	\$0	All assets have cost, no estimate needed
PHOTOVOLTAIC SYSTEM	\$103,365	1	0	1	0%	\$103,365	\$0	All assets have cost, no estimate needed
SECURITY SYSTEM(S) , ALARM SYSTEMS	\$28,082	1	0	1	0%	\$28,082	\$0	All assets have cost, no estimate needed
SECURITY SYSTEM(S) , CAMERA SYSTEMS	\$3,101	3	0	2	0%	\$3,101	\$0	All assets have cost, no estimate needed
SIL0	\$571,609	10	0	10	0%	\$571,609	\$0	All assets have cost, no estimate needed

Note: All Asset Types with "Total Value to be added based on Estimate" show as \$0 were not included in Physical Mortality Assessment as explained in accompanying comment.

Asset Type	Estimate	Sample Size (includes inactive)	Number of Assets which will be assigned Estimate	Total Assets in Class	Percent of Assets Receiving Cost Estimates	Revised Estimate	Total Value to be added based on Estimate	Comment
STRUCTURE, SMALL FIBERGLASS	\$8,138	1	0	1	0%	\$8,138	\$0	All assets have cost, no estimate needed
VACUUM, GENERAL	\$62,817	1	0	0		\$62,817	\$0	All assets have cost, no estimate needed
VALVES, DIAPHRAGM	\$11,673	12	0	9	0%	\$11,673	\$0	All assets have cost, no estimate needed
VARIABLE FREQUENCY DRIVERS > 1000 HP	\$592,159	1	0	1	0%	\$592,159	\$0	All assets have cost, no estimate needed
VEHICLE, AUTO, LIGHT TRUCK, DIESEL	\$113,062	2	0	2	0%	\$113,062	\$0	All assets have cost, no estimate needed
VEHICLE, AUTO, LIGHT TRUCK, GASOLINE	\$6,026	1	0	1	0%	\$6,026	\$0	All assets have cost, no estimate needed
SHOP MACHINES & TOOLS	\$7,387	2	0	2	0%	\$7,387	\$0	All assets have cost, no estimate needed
PRESS, SCREEN	\$15,270	9	0	9	0%	\$15,270	\$0	All assets have cost, no estimate needed
SAFETY EQUIPMENT, PORTABLE	\$17,990	2	0	1	0%	\$17,990	\$0	All assets have cost, no estimate needed

APPENDIX 5B-8: WRFs and Biosolids Asset System – Physical Mortality Risks -

DRAFT

MMSD Asset Management Plan
WRF and Biosolids Asset System
Risk Register - Physical Mortality Risks

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R001	Risk of damage to facilities and structures due to ground settlement at JI WRF West Entrance Ground Settlement	Significant settlement has been observed in the area west of the primary clarifiers at the west JI entrance. This is in the area of the former Harbor Siphons excavation. Settlement has already caused a broken W1 line, damage to pavement and a retaining wall near the clarifiers and could potentially impact other utilities in the area or nearby process facilities.	Jl - Jones Island WRF	A project (emergency?) has been initiated by CCO to perform ground penetrating radar, settlement monitoring and additional investigation to determine the extent and cause of settlement. The area has also been closed off from foot or vehicle traffic.	Very High	Failure of some facilities due to settlement has already occurred and continued settlement is likely.	Medium	Most significant COF - Non-critical systems, facilities, or equipment unavailable for > 7 days (Work arounds available/minor staff inconvenience). Could potentially be Medium COF if costs of investigation and repair exceed \$250,000.	Moderate	Physical Mortality	Fiscal Responsibility
R002	Loss of plant wet weather capacity due to the condition and capacity of Influent Low Level and High Level Pumps	LL Siphons can deliver 140 MGD - controls capped at 110 MGD - impacts CSO and SSO - Both sets of pumps - age, condition and capacity of the pumps vs new siphons, motors not hazardous rated	Jl - Jones Island WRF	operational data & VWM maintenance	Medium	Pumps are functioning and have been rebuilt as needed, there is concern with their current capacity versus their rated capacity (needs verification)	High	Less than full pumping capacity would result in higher volumes and possibly frequency of CSOs. Possible negative coverage or issue being raised by public official.	Moderate	Physical Mortality	Customer Service, Communication and Employee Development
R005	Risk of loss of JI WRF electrical power due to the condition of substation equipment (Dewey and Harbor)	The District owned assets for the two utility substations (Harbor and Dewey) are possibly near the end of their service life	Jl - Jones Island WRF	HVM Inspections	Medium	need to know details of deterioration/condition concerns	High	failure of one of the substations could impact operation of the plant in particular the starting of a PAC. Potential permit violation or contract non-compliance	Moderate	Physical Mortality	Environmental Improvements
R009	Loss of plant aeration capacity due to the condition of PACS Air Intake Ductwork	poor condition, reported corrosion failure of exterior cladding	Jl - Jones Island WRF	VWM/CCO will assess this issue	Very High	poor condition - corrosion. If necessary emergency patching would address operational issues	High	if complete failure could impact aeration operation or capacity. Possible permit violation or contract non-compliance.	High	Physical Mortality	Permit Requirements
R010	Structural impact on various tanks on the lakefill at SSWRF due to the inoperable SSWRF south side groundwater dewatering pumps	System does not operate at all - is there risk to damage primary clarifier and aeration basin tanks when they are dewatered	SS - South Shore WRF	VWM to establish/confirm policy to not dewater tanks in winter	Very High	Event pumps OOS ground water dewatering pump station is not operable	High	M&O effectiveness, system not operable, could not fix leaking tank, may prevent dewatering/work in process tanks due to risk of "floating" damage	High	Physical Mortality	Fiscal Responsibility
R014	Increased energy costs due to Aeration air pipes leaks at joints, and pipe condition & exterior painting deteriorated condition	both WP and EP - Several known air leaks at pipe joints, need assessment to determine the condition and risks	Jl - Jones Island WRF	VWM maintenance	Medium	Pipes known to leak. Major joint leak could occur 1-5 yrs.	High	Repair time could impact activated sludge and lead to effluent violation	Moderate	Physical Mortality	Permit Requirements
R015	Risk of damage to the PACs due to the condition of the PACs cooling water control and isolation valves	known issues with PAC cooling water valves, risk unplanned failure and repair. Several valves were replaced under J02008.	Jl - Jones Island WRF	VWM Maintenance	Medium	known issues with valves	High	Repair time could impact activated sludge and lead to effluent violation	Moderate	Physical Mortality	Permit Requirements
R017	Risk that plant process capacity would be impacted due to the condition and capacity of the RAS discharge header piping	Redundant RAS header is not available for service, this spiral steel pipe has known leaks	Jl - Jones Island WRF	capital design project to upgrade the header J02013	Medium	new parallel header installed, leaks are small but may get more severe	High	larger rupture of leaking pipe could cause flooding of equipment- loss of key staff-impacts multiple departments. Negative coverage.	Moderate	Physical Mortality	Multiple LOS
R019	Loss of solids handling capacity and related impacts on the treatment process due to the blended sludge piping and valves condition	possible piping corrosion, valves are not maintainable (?? Not sure about valves)	Jl - Jones Island WRF	Project to assess piping condition J06052 underway	Medium	Poor condition of piping and valves. Failure likely in 5-10 yrs.	High	Possible medium-long term shutdown of D & D to isolate pumps, limited capacity. High impact to operational efficiency.	Moderate	Physical Mortality	Fiscal Responsibility
R020	Loss of solids handling capacity and related impacts due to the blended sludge booster valves condition	valves seal failures, valves not maintainable??	Jl - Jones Island WRF	VWM Maintenance	Medium	Poor condition of piping and valves. Failure likely in 5-10 yrs.	High	Possible medium-long term shutdown of D & D to isolate pumps, limited capacity. High impact to operational efficiency.	Moderate	Physical Mortality	Fiscal Responsibility
R025	Risk of negative overall capacity, cost and process impacts due to the reliability and/or condition of the WAS receiving pumps	Three pumps system with need to operate two - repair parts not supported by manufacturer (Wemco)	Jl - Jones Island WRF	Being evaluated in current IPS upgrade project	Medium	pumps have history of failing	High	would impact blended sludge and D&D operation, repair / replacement could be long lead time. High impact to operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R026	Risk of negative impact to operations due to condition and reliability of the Interplant sludge pumping systems	failures / issues with piping, pumps, valves, supporting equipment	IP - Interplant Pipeline	Evaluate during near future IPS upgrade project	Low	Jl IPS pump station has available redundancy	High	would prevent pumping primary sludge to SSWRF, impact Milorganite production and MMSD/VWM biosolids costs	Moderate	Physical Mortality	Fiscal Responsibility
R031	Risk of negative solids handling and cost impacts due to a potential failure of the D&D belt filter press polymer feed system (including bulk tanks, skid pumps, batch mix tanks, transfer pumps, piping) and associated control systems.	instrument issues with solution level monitoring and control, past feed pump failures. The last few years, ultrasonic and radar level technologies have experienced intermittent interruptions in signals that have led to batch tank problems that lead to dewatering issues that will in turn impact dryer operations. The impacts are systemic and impact all dryers. Potential risk of upset of D&D via loss of filter cake production.	Jl - Jones Island WRF	redundancy/work arounds, MCCR 880 polymer transfer pump #1 replacement, MCCR 889 polymer feed pump #3 replacement	Very High	estimate failure within 5-10 years	Medium	Non-critical component of system with manual workarounds available	Moderate	Physical Mortality	Management Effectiveness
R035	Risk that dryer operations would be negatively impacted at each belt feed for multiple dryers due to inoperability of D&D sludge cake belts lift tables and v-plows	This equipment has required continuous repairs the last few years per Veolia and has reached the end of the component useful life due to corrosion and wear. Replacement with new equipment is required so the material split between dryers functions as intended and stabilizes dryer system operation.	Jl - Jones Island WRF	RFP in progress J04060	Very High	known/past issues	Medium	Sufficient redundancy within BFP system exists that such that failure of equipment warrants a low risk to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R036	Solids handling, safety and cost impacts from the condition of D&D sludge cake bypass, feed, transport belts and belt scales BE-24-88-1...2, BE-24-83-1...6, B-24-85-1...6. Without functioning belt conveyors, dryer operations impacted as transport belts and scales impact multiple dryers. BE-24-83-1...6	Belts and belt scales have experienced bearing corrosion, VFDs may be undersized. Recent (last few years) metering belt failures have impacted dryers operation directly. This RR entry is associated with the condition of T037 equipment (tables) which is operates with the belts and scales.	Jl - Jones Island WRF	RFP in progress J04060. North cake bypass belt replaced under MCCR in 2015	High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R037	Solids handling, safety and cost impacts from the condition of D&D sludge cake feed/metering belts plows, B-24-83-1...6, B-24-85-1...6. Without functioning tables and plows, dryer operations impacted as each belt feeds multiple dryers.	This equipment has required continuous repairs the last few years per Veolia and has reached the end of the component useful life due to corrosion and wear. Replacement with new equipment is required so the material split between dryers functions as intended and stabilizes dryer system operation. Linked to condition of T036.	Jl - Jones Island WRF	J04060: Sludge Cake Transport. Total Construction Budgeted: \$3.45MM	Very High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Management Effectiveness
R041	Solids handling, safety and cost impacts from the condition of D&D belt filter press wash water pumps and booster pumps P-24-70-1...3	The risk is these pumps are required to operate the BFPs wash water boxes so if all the pumps are of service, all 24 BFPs and dewatering operations are out of service. 3 pumps exist, two have failure issues, one rebuilt, one to be replaced.	Jl - Jones Island WRF	MCCR 868 wash booster pump #1 replacement, MCCR 870 wash booster pump #2 replacement, These MCCR's do not show up on the present list of MCCR's. Kevin J to add to RFP or create separate project if on-call is used and SOW is too big. Included in Project J04060	Very High	known/past issues	High	Pump failure has direct impact on BFP management and operational effectiveness, but redundancy of pumps and relatively short repair time reduces risk to medium.	High	Physical Mortality	Management Effectiveness
R042	Capacity, solids handling, safety and cost impacts from the condition of D&D Dryer Feed Screws S-25-7-3,4,8-11. Failure of one piece of equipment impacts entire dryer train availability.	The feed screws are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a screw, you lose the dryer train. The screws are in near constant use with regular wear and tear and six of the screws are slated for replacement in an ongoing capital project J04050.	Jl - Jones Island WRF	MCCR 885 #1 Repairs, MCCR 886 #5 Repairs, MCCR 887 #7 Repairs, MCCR 938 #8 Repairs, MCCR 939 #12 Repairs, all 12 screws replaced with new equipment in mid 2000s. J04060C01 in 2004 J04050: Dryer Feed and Discharge Screw Replacement. Total Construction Budgeted: \$2.85MM Advertising for bids Aug 2017 Construction 2018/2019. Coordinate with burner replacement.	High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a medium risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R044	Capacity, solids handling, safety and cost impacts relating to the condition of D&D dryer drum lifting irons, A B and F blades, and bottles. Failure of one piece of equipment impacts entire dryer train availability.	The dryer internals are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a dryer due to the internal components, you lose the dryer train. Wear to blades and bottles. Uner is wearing at inlet and discharge ends	Jl - Jones Island WRF	Potential (future) MCCR's - ABF blades	Very High	known/past issues	Medium	dryer drum failure has direct impact on dryer system management and operational effectiveness, but relatively short repair time and frequent planned maintenance activities reduces risk to low.	Moderate	Physical Mortality	Management Effectiveness
R045	Capacity, solids handling, safety and cost impacts relating to the condition of D&D dryer burner systems. Failure of one piece of equipment impacts entire dryer train availability.	The dryer burners are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a burner, you lose the dryer train. The burners are original (1990s) and require upgrade burners and components to burn landfill gas, failure risks loss of ability to fire dryer system on natural gas and potential dryer shutdown	Jl - Jones Island WRF	J06061D03 - Engineering Services Jl WRF Milorganite Dryer Burner Upgrade Project VWM to provide new burner assessment. Total Construction Budgeted: \$7.09MM 2018 design - upgrade dryer will replace LCP's and PLC's but will NOT replace complete burner package in dryers that are not selected to burn LFG	Medium	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R047	Capacity, solids handling, safety and cost impacts relating to the loss of waste heat control due to the condition of D&D Dryer Waste Heat Guillotine Gates and Blower FV-25-4-1...12-1. Failure of one piece of equipment impacts entire dryer train availability.	The dryer waste heat gates and blowers are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a gate or blower, you lose the dryer train. Numerous gate and damper failures (#4, #10, #6) have taken place in the last couple of years due to corrosion and moisture, successful gate operation is a requirement for dryer PM activities	Jl - Jones Island WRF	MCCR 786 WH guillotine damper removal, MCCR 844 guillotine #6 replacement, REMOVE LARGE DAMPER TWO SEPARATE PROJECTS	High	known/past issues	Medium	Failure of waste heat guillotine gate poses risk of temporary disability or serious illness to staff entering dryer during PM activities.	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R048	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Dryer Drives, Trunnions, Seals, Tires, Bull Gear, and Gear Box Drives: M-25-9-1...12. Failure of one piece of equipment impacts entire dryer train availability.	The dryer drives are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a drive component, you lose the dryer train. Drives and gear boxes are essentially original equipment and are reaching end of their service life.	Jl - Jones Island WRF	MCRR #7 trunnion repairs, J04017 DONE MCRR 979 and 1001 to test tires on 6, 10, and 11 Ask VWM for assessment of drums	Medium	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R049	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Dryer Feed Mixer Feed Screw Conveyors S-25-26-1.3-9,11,12. Failure of one piece of equipment impacts entire dryer train availability.	The feed mixing screws are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a screw, you lose the dryer train. The screw housings and many screw augers are original and have experienced high wear and corrosion item requiring frequent maintenance.	Jl - Jones Island WRF	MCRR 823 dryer #10 mixer screw MCRR 1019 Construction J04050 - construction start 12/2017	Very High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Management Effectiveness
R051	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Dryer Add Back Screws S-25-27-1...12. Failure of one piece of equipment impacts entire dryer train availability.	The add back screws are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a screw, you lose the dryer train. The screw condition is OK at this time but age may be issue	Jl - Jones Island WRF	Potential (future) MCRR	Low	known/past issues	Low	non-critical system component with relatively short time required for repairs (<7 days)	Moderate	Physical Mortality	Management Effectiveness
R052	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Dryer Discharge Screws S-25-24-1...12. Failure of one piece of equipment impacts entire dryer train availability.	The discharge screws are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a screw, you lose the dryer train. Screws are worn and original and require replacement to ensure dryer train operation.	Jl - Jones Island WRF	J04050 Dryer Feed and Discharge Screw Total Construction Budgeted: \$2.85MM MCRR 1011, 1013 Construction	High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R053	The poor condition of D&D Dryer Exhaust Ducting may limit capacity and dryer availability and represents a potential safety hazard. Failure of one dryer exhaust duct section impacts entire dryer train availability.	Dryer exhaust ducting is critical to drying operation and air permit compliance. The condition has been inspected and found to contain localized corrosion and loss of base metal. Process impacts of issues such as safety concerns - corrosion pitting duct and potentially impacting dryer availability. The alternative to discharging through the duct is up out the building roof for dryer exhaust until the duct can be repaired or replaced.	Jl - Jones Island WRF	J04058: Dryer Exhaust Evaluation. Preliminary Engineering: \$214,866 RFP for repairs, MCRR 798 dryer exhaust duct repairs and J04057C01 7th Floor Vent Header Repair	Very High	Several recent leaks over 5-10 years, current project with MMSD and VWM is evaluating cause of corrosion spring 2016	High	potential air permit violation (<1 wk.) with temporary manual workaround	High	Physical Mortality	Safety
R054	Condition of the D&D elevators	Maintenance and operations activities impacted by lack of access or delayed equipment and materials access for repairs and PMs.	Jl - Jones Island WRF	J04040 Elevators	Very High	known/past issues	Low	non-critical system component with relatively short time required for repairs (<7 days)	Moderate	Physical Mortality	Management Effectiveness
R055	D&D Cyclone Dust Rotary Air Lock Valves are unreliable and failure could cause trapping of chaff creating a fire hazard. Failure of the valve impacts entire dryer train availability. M-25-15-1...12-2	The cyclone rotary valves are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a cyclone dust system, you lose the dryer train. Impacts on air emissions, etc. from hole in housing, shear pin issue, risk of dryer system shutdown if no means available to dispose of chaff, trapped chaff could reach temperatures that would pose a fire hazard, Safety Consequences.	Jl - Jones Island WRF	Chaff (Cyclone Waste) 2018 project request for 24 cyclone separators. In J04064 scope of work.	High	known/past issues	Very High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Safety
R057	Risk of excessive power consumption and potential air permit non-compliance due to the condition, performance and power use of D&D wet ESPs	air permit compliance and dryer system shutdown	Jl - Jones Island WRF	MCRR 925 #1 repairs - done 3/17	High	known/past issues	Very High	WESP are key to air permit compliance. Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Permit Requirements
R058	Wet ESPs may have excessive power consumption and may not be performing adequately risking air permit violation. Failure of one piece of equipment impacts entire dryer train availability.	The dryer ESPs are a one to one correlation with the ability to operate a dryer train. Risk is if you lose an ESP, you lose the dryer train. Air permit compliance and dryer system shutdown. Capacity, solids handling, safety and cost impacts relating to the performance and power use of wet ESPs transformers, rectifiers, air purge compartments insulator, probes, lower mist eliminator, vessel, and grout.	Jl - Jones Island WRF	Chaff (Cyclone Waste) 2018 project request covers WESP Repair Work. J04064 grouts ESP bases. Repairing mist eliminators improved performance. Rectifiers replaced as needed by MCRR.	High	known/past issues	Very High	WESP are key to air permit compliance. Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	High	Physical Mortality	Management Effectiveness
R060	ID Fans are becoming unreliable. Fan is required for dryer operation. Failure of one piece of equipment impacts entire dryer train availability. M-25-17-1...12	The dryer ID fans are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a fan, you lose the dryer train. Fan condition and reliability - impact on dryer availability - e.g. Fan #3 needs replacement. Capacity, solids handling, safety and cost impacts relating to the condition of D&D dryer induced draft fan motor and VFD.	Jl - Jones Island WRF	J04046: D&D Energy Conservation Efforts. Total Construction Budgeted: \$1.2MM, Scheduled for April 2018 MCRR 884 #3 ID fan repairs - complete	High	known/past issues	High	Consider revising scope of work for J04046, fan VFD's, to include replacement of fans if needed. Consider performance of cyclones in the evaluation	Moderate	Physical Mortality	Management Effectiveness
R062	Poor condition of ID fans inlet damper risks failure of inlet damper and shutdown of dryer. Failure of one piece of equipment impacts entire dryer train availability.	The dryer dampers are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a damper, you lose the dryer train. Original equipment nearing end of useful life, loss of control of dryer air flow. Capacity, solids handling, safety and cost impacts relating to the condition of D&D dryer induced draft fans inlet damper.	Jl - Jones Island WRF	Chaff (Cyclone Waste) 2018 project request. Being evaluated under J04064.	High	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R063	Capacity, solids handling, safety and cost impacts relating to the condition of D&D Recycle Bin Bucket Elevators BE-25-43-1...4	These four are the heart of the recycle system as far as feeding the recycle bins. One of each pair of two BE is required to maintain building capacity and operation. Two BE are being replaced and 2 are ~12 years old. Product material handling, impacts on disorganize production.	Jl - Jones Island WRF	J04041: Milorganite Facilities Improvements - Phase 3 covers BE #1 and #2 construction starts 2017. Total Construction Budgeted: \$4.6MM MCRR 930, 960 Completed elevators have been repaired and replaced in recent projects	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R066	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Main Recycle Air Belts B-25-63-1...3, belts are vital to recycle system operation.	These four belts are critical to the recycle system. One of each pair of two belts is required to maintain building capacity and operation. They have a critical impact on Milorganite production and if two on any side are out, 1/2 of capacity is impacted.	Jl - Jones Island WRF	J04051: Main Recycle Air Belt Feed Screw Replacements: Total Construction Budgeted: \$613,107 MCRR 923, 934, 961 Completed remainder should be replaced in 5 years	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R067	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Main Recycle Screws S-25-41-3...4, screws are key components of entire recycle operation.	These four screws are vital to the recycle system. One of each pair of two screws is required to maintain building capacity and operation. Impact on Milorganite production, if two on any side are out, 1/2 of capacity is impacted.	Jl - Jones Island WRF	J04041: Milorganite Facilities Improvements - Phase 3 covers conveyor S-25-41-3...4. Total Construction Budgeted: \$5.1MM MCRR 862, 944 Completed drop chuted replaced in 2004 with corrosion and wear resistant materials (J04066C01), current OK although dust collection plugs routinely. J04036C01 completed in 2015, MCRR 790 recycle screw conveyor #2 repairs, MCRR 862 main recycle screw #4 repairs, #1 replaced under J04036C01 in 2016, #2 replaced under J04043 in 2016	Low	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R068	Condition of D&D Dryer Recycle Feed Screws and gates S-25-28-1...12, Failure of one piece of equipment impacts entire dryer train availability.	Impact on Milorganite production and dryer system operation	Jl - Jones Island WRF	Potential (future) MCRR's	Medium	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R069	Condition of D&D Recycle Bin Discharge Screws S-25-58-1...2	Risk is impact to recycle system as 100% redundancy with 2 screws. The base of screws wearing out at discharge, should be lined, gates jam.	Jl - Jones Island WRF	#1 and #2 will be replaced under J04041, MCRR 913 recycle bin discharge conveyor #1 replacement, MCRR 914 recycle bin discharge conveyor #2 replacement	Very High	known/past issues	Very Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R070	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Classification Bucket Elevator Feed Screws S-25-60-1...2	Risk is impact to recycle system as 100% redundancy with 2 screws. Screw troughs worn, bucket elevator opening size restriction/choke point.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM, Scheduled 2018/2019 J04056, MCRR 1031 approved for temporary repairs to S-25-60-1, J04052 in 2018. Repairs or MCRR's as necessary	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R071	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Classification Bucket Elevators BE-29-6-1...2	Risk is impact to classification system as 100% redundancy with 2 bucket elevators. BE ability to delivery rated capacity has been an issue last few years, the dust pickup system has moisture/plugging issues, need upgrade for dust collection, housings and chutes in very bad condition.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM J04056 in 2018. MCRR 881: BE #1 Repairs	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R072	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage Surge Bin Feed Screws S-29-7-2	Risk is impact to classification system as 100% redundancy with 2 screws. Screws show high wear item submitted to constant use, housings past useful life.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM #1 drop hatch replaced in 2005, should be replaced within 5 years, feed screw 2 will be replaced under MCRR 899	Medium	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R073	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage Screener Feed Screws S-29-10-1...2	Risk is impact to classification system as 100% redundancy with 2 screws. Original equipment nearing end of useful life	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis								
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category	
R076	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 1st Oversize Leveling Screws S-29-17-1...2	Risk is impact to classification system as 100% redundancy with 2 screws. Failure risks loss of mill operation.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Medium	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R078	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Wet Recycle Screws S-29-27-1...2 S-29-28-1...2	Risk is impact to classification system as 100% redundancy with 2 screws. Loss of ability to return milled oversize	Jl - Jones Island WRF	J04041: Milorganite Facilities Improvements - Phase 3 covers S-29-28-1...2. Total Construction Budgeted: \$5.1MM 2 replaced and the other 4 in process, J94941 will replace #1 and #2 J04043 in 2015	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R080	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Cooler Transfer Screws S-29-63-1...2	Risk is impact to Milo product delivery system as 100% redundancy with 2 screws. Original, submitted to frequent use. patches on the housing, discharge gate to product cooler feed screw 2 leaks when trying to transfer to product cooler feed screw 1.	Jl - Jones Island WRF	Potential (future) MCCR's - Feed screw 1	High	known/past issues	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R082	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Coolers M-29-68-1...2	Risk is impact to product delivery system as 100% redundancy with 2 Coolers. Wear and leaking, maintenance requires a dangerous lift, substantial wear expected within 5 years	Jl - Jones Island WRF	J04059: Milorganite Product Cooler Replacement. Complete replacement of Cooler #2, Replacement of Cooling shell in #1. Total Construction Budgeted: \$1.47MM. Work Complete 2017 MCCR 942 Completed MCCR 1032 Construction product coolers rotors replaced in 2001-02, upcoming MCCR 942 for coolers, spare rotor available.	High	known/past issues	Very High	due to high maintenance requirements of cooler systems and long maintenance time required, redundancy is often compromised, resulting in a very high risk of failure to management and operational effectiveness.	High	Physical Mortality	Management Effectiveness	
R083	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Bucket Elevators BE-29-74-1...2	Risk is impact to product system as 100% redundancy with 2 elevators. Original, submitted to frequent use. patches on the housing.	Jl - Jones Island WRF	Future capital project outside six years.	High	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R087	Capacity, solids handling, safety and cost impacts relating to the condition of the Silos Rail Loadout Cross Conveyor M-27-24. No redundancy for this conveyor to be out of service.	Risk relates to the Milorganite loading of rail cars as there is no backup or redundant conveyor to this single cross conveyor. Conveyor is original and housing and other components near end of useful life. Motor/gear box, and housing are in OK shape.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM. Construction 2018/2019	High	known/past issues	High	possible increase in complaints from disorganize customers	Moderate	Physical Mortality	Management Effectiveness	
R088	Capacity, solids handling, safety and cost impacts relating to the condition of the Silos rail loadout conveyor M-27-26. No redundancy for this conveyor to be out of service.	Risk is impact to product loadout system for rail cars and Milorganite removal from silos. No existing redundancy for conveyor. Motor/gear box are OK. Paddles, housing Veolia estimates the truck fill gate and spouts have less than five years remaining service life.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM, Scheduled 2018/2019 requested capital project J04054, MCCR 888 conveyor repairs	High	known/past issues	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R089	Condition and capacity of the W3 flushing water system	3 W3 pumps and 1 fire water pump out of service. Pumps 1,5,6 out due to VFD issues. The VFD's on the 6 W-3 pumps have been replaced under J06057. Many treatment systems rely on W3 water source. Not sure this should still be an extreme.	Jl - Jones Island WRF	J06057 to replace VFD drives	High	too many pumps and drives currently failed	High	most treatment systems rely on W3 source, further pump failures result in high impact to operational efficiency.	Moderate	Physical Mortality	Management Effectiveness	
R092	Loss of plant heat and energy recovery due to the condition of the Waste heat boiler	boiler in poor condition, confirm capacity needed	Jl - Jones Island WRF	MCCR 900 to repair boiler #2	Very High	Boiler inoperable	Medium	2 fired boilers are backup. Moderate impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness	
R111	Risk of failure of the plate and frame dewatering system due to the aged PLC system and the fact that parts are no longer supported by the vendor	Unreliability of the Back up biosolids treatment systems. PLCs are no longer serviceable because the manufacturer no longer provides replacement parts. If there is significant failure of PLCs the presses are not operable.	SS - South Shore WRF	B. Farmer asked Veolia to confirm PLC spare parts are still available.	High	Event 1-5 years, PLC parts not supported	High	presses are backup to D&D, if fail and D&D fail major impact of >250K (portable dewatering equipment would be needed)	Moderate	Physical Mortality	Management Effectiveness	
R112	Risk of failure of the plate and frame dewatering system due to the challenges to maintaining the feed pumps	Unreliability of the Back up biosolids systems - feed pumps parts costly and long lead times, fail pump(s) could be out months without a high inventory of spare replacement parts in storage	SS - South Shore WRF	Keep required stock of critical spare parts for pumps and other long lead item equipment parts; District planning action	High	Event 5-10 years, pumps need major repairs & lack of spare parts in storage	High	presses are backup to D&D, if fail and D&D fail major impact of >250K (portable dewatering equipment would be needed)	Moderate	Physical Mortality	Management Effectiveness	
R125	Risk of loss of power due to age and reliability of electric substations, MCCs and other power distribution systems	Some electric power systems are nearing the end of their service life, some are known to be problems or no service parts are available	Jl - Jones Island WRF	District planning action	Medium	known issues with age and/or parts availability	High	failure will impact operations capacity or performance	Moderate	Physical Mortality	Environmental Improvements	
R126	Age and reliability of electric substations, MCCs and other power distribution systems	Some electric power systems are nearing the end of their service life, some are known to be problems or no service parts are available	SS - South Shore WRF	Active project to address issue	Medium	5-10 years, known issues with age and/or parts availability	High	M&O effectiveness, failure will impact operations capacity or performance, could result in lost of operation of equipment for a week	Moderate	Physical Mortality	Management Effectiveness	
R127	age, obsolescence, security of JIWRP I&C system and network server	system last upgraded in 2003; network server so old that parts are not available	Jl - Jones Island WRF	monitoring	High	age of equipment would allow for failure at any time	High	lack of control and data storage would be lost	Moderate	Physical Mortality	Management Effectiveness	
R133	Capacity, solids handling, safety and cost impacts relating to the condition of the Local Control Panels for Belt Filter Press #1 - #24.	Risk relates to the dewatering operations and impacts to solids processing systems. Control system is original (+20 years old). If the BFP LCPs are not functional, dewatering is impacted.	Jl - Jones Island WRF	J04026C01, 2013 replacement	Very High	known/past issues	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	High	Physical Mortality	Management Effectiveness	
R136	Cyclones have become unreliable. Dryer Cyclones are a required component of the air emissions control and failure of one piece of equipment impacts entire dryer train availability.	Impacts on dryer availability and air permit emissions - Loss of air emission controls and associated dryer and fines processing ability. Capacity, solids handling, safety and cost impacts relating to the condition of the Dryer Cyclone Separators, Hopper, and Feeder. One to one relationship between cyclone and dryer train availability.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	High	known/past issues	Very High	Dryer exhaust gas particulates have increased by 50% in the last 3 years. Dryer cyclone separator system (including T137) will likely need upgrading to ensure permit compliance.	High	Physical Mortality	Management Effectiveness	
R137	The condition of Dryer Cyclone Separator Drop Out Box is deteriorating and at risk of failure. Failure of one piece of equipment impacts entire dryer train availability.	Impacts on dryer availability and air permit emissions - Loss of air emission controls and associated dryer and fines processing ability. Capacity, solids handling, safety and cost impacts relating to the condition of the Dryer Cyclone Separators, Hopper, and Feeder. One to one relationship between cyclone and dryer train availability.	Jl - Jones Island WRF	J0316X010, #1-12 inspected 2001	High	known/past issues	Very High	dryer exhaust gas particulates have increased by 50% in the last 3 years. Dryer cyclone separator system (including T136) will likely need upgrading to ensure permit compliance.	High	Physical Mortality	Management Effectiveness	
R140	Capacity, solids handling, safety and cost impacts relating to the condition of the Dryer Recycle Air Belts B-25-25-1...12	The air belts are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a belt, you lose the dryer train. Loss of recycle feed and add back feed for respective dryer. Belt, rollers and scrapers are in bad shape. Possibly MCCR's. May need assessment from VWM	Jl - Jones Island WRF	Potential (future) MCCR's	Medium	known/past issues	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness	
R143	Capacity, solids handling, safety and cost impacts relating to the condition of the DRS Ladder Chute #1 & #2	Risk impacts product conveyance systems from screeners to product transfer screw. 100% redundancy with two ladder chutes. Tiles are falling off.	Jl - Jones Island WRF	J04018C02 - 2010 replacement	High	known/past issues	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R146	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage Surge Bins T-29-8-1...2	Risk impacts classification system. Loss of redundancy in DRS transfer to first stage screening (2 units installed). Damage to liners causes leaks and other maintenance issues.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Medium	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R147	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage First Cut Mills M-29-15-1...4	Risk impacts classification system. Loss of redundancy in first stage first cut mills for respective classification train (2 per train).	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Medium	known/past issues	Low	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R148	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage Second Cut Mills M-29-24-1...4	Risk impacts classification system. Loss of redundancy in first stage second cut mills for respective classification train (2 per train).	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. MCCR 850 Repair Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Need description of issues being experienced	Medium	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness	
R173	Risk of wet weather capacity restrictions and permit violations due to D&D facility drying capacity/reliability issues	Age and condition of dryer systems is such that dryer system availability has been as low as 6 six operating dryer systems during peak solids production. This condition causes excessive solids inventory in the JIWRP and SSWRF activated sludge process which can result in wet weather capacity restrictions, poor effluent quality or effluent permit violations.	Jl - Jones Island WRF	District planning action	Medium	Occur within one year	High	Potential permit violation (<1 wk.) due to solids accumulation in system. Major critical system unavailable for 1 to 6 days	Moderate	Physical Mortality	Permit Requirements	
R185	Energy impacts and condition of the low pressure air leak @ blower 3 discharge	Known leak on piping @ building wall. This seems to be the same as Risk ID T100.	SS - South Shore WRF	VWM/CCO will assess this issue	High	Event 1-5 years, pipe is leaking underground	High	Loss of air system for 1-6 days	Moderate	Physical Mortality	Permit Requirements	
R196	Concern that leakage of the SSWRF sea wall may be the cause of high groundwater conditions on the lower plant site.	High ground water levels may be caused by leakage at sea wall, could cause damage to buildings, sections of wall > 50 years old	SS - South Shore WRF	VWM maintenance	High	Event 1-5 year	High	Unplanned repairs > 1M	Moderate	Physical Mortality	Fiscal Responsibility	
R201	Capacity, dryer operation, safety and cost impacts relating to the condition of the D&D outside air guillotine and flow control valves, FV-25-4-1...12-2, FCV-25-6-1...12-2. Failure of one piece of equipment impacts entire dryer train availability.	The flow control valves are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a FCV, you lose the dryer train. Seal air blower and actuator have less than five years remaining service life.	Jl - Jones Island WRF	Assess under J04064.	High	known/past issues	High	Shutdown of dryer system poses possible non-compliance with biosolids regulatory requirements.	Moderate	Physical Mortality	Management Effectiveness	

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R203	Condition and operability of the winches at chaff loadout	Potential damage to equipment and increased labor requirements for adjusting roll offs by operators.	Jl - Jones Island WRF	MMSD Capital project was awarded 9-16 to provide winches in J04047C01	Very High	Event will occur within a year	Medium	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R204	Condition and operability of air supply unit #32	restore the air handling capacity and redundancy of air supply unit #32 which was placed out of service due to age and cost-prohibitive repair	Jl - Jones Island WRF	Active project to address issue	Very High	Event will occur within a year	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R205	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D main recycle bins venting	Risk impacts main recycle system. Dust accumulation in bin creates increased risk of safety issues. Some tiles are falling off ceramic lining.	Jl - Jones Island WRF	J04056: Milorganite Facilities Improvements Phase IV.	Low	Event will occur at least once every 26-50 years	Very High	Shutdown of dryer system poses possible non-compliance with biosolids regulatory requirements.	Moderate	Physical Mortality	Permit Requirements
R206	Capacity, safety and cost impacts relating to the condition of the D&D building piping inventory and impact on operational reliability	Risk impacts probability of building and process piping failures occurring within the water reclamation facilities buildings, galleries and tunnels.	Jl - Jones Island WRF	District planning action	High	Event will occur at least once every 1-5 years	High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Physical Mortality	Management Effectiveness
R207	Condition of various roofs - do the roofs need replacement	rehabilitation or replacing roofs of buildings 225, 258, 259, 268, 285, 286, and 295 at Jones Island.	Jl - Jones Island WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility
R208	Components of the Yearly rolling stock needs - definition and adequate budget available, etc.	replacing a transfer pump, a waste heat guillotine, a recycle bin dust collector, and two recycle bin discharge conveyers. The 2016 scope also includes gallery exit light replacements and the purchase of a roll-off truck.	Jl - Jones Island WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility
R213	Condition of the aeration galleries RAS header	replace RAS branch piping, fittings, and components from RAS discharge header to the 28 aeration basins and to replace the East and West RAS suction header piping from the RAS pump station to the RAS feed pumps. In addition, associated valves and instrumentation will be replaced	SS - South Shore WRF	Active project to address issue	High	Event will occur at least once every 1-5 years	Very High	Prolonged period of non-compliance with effluent quality permit limits	High	Physical Mortality	Permit Requirements
R214	Condition of the digester gallery piping rehab	assess the condition of the 5,500 feet of digester gas piping, to evaluate the probability of failures occurring, and to develop an approach for preventing future pipe failures	SS - South Shore WRF	Active project to address issue	High	Event will occur at least once every 1-5 years	Very High	Prolonged period of non-compliance with air permit limits	High	Physical Mortality	Permit Requirements
R215	Condition of the HW boiler system improvements	design and install replacement of a control system for boiler #3 and #4	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	High	Significant impact on operational efficiency	High	Physical Mortality	Management Effectiveness
R216	Condition of the aeration basin concrete tanks	repair aeration basin walls to protect worker safety and air diffusers from falling concrete. Repairs to concrete walls in eight basins will	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility
R217	Condition of the roadways and walkways - safety of workers and vehicles	rehabilitate or replace asphalt and concrete roadways and walkways	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility
R219	Condition and capacity of the W3 pumps	design, construct, and install the replacement of eight W3 water pumps (four on the lower site and four on the upper site)	SS - South Shore WRF	Active project to address issue	High	Event will occur at least once every 1-5 years	High	\$1M-\$10M financial impact	Moderate	Physical Mortality	Fiscal Responsibility
R220	Condition of the tunnels concrete structures	Do the tunnels need structural repairs and are there other systems in the tunnels (piping, conduits)? Which need repair?	SS - South Shore WRF	Active project to address issue	High	Event will occur at least once every 1-5 years	High	\$1M-\$10M financial impact	Moderate	Physical Mortality	Fiscal Responsibility
R222	Condition of building roofs	replace the roofs at South Shore on buildings 327, 328, 331, 333, 334, 335, 336, 344, 346, 347, 351, 355, 359, 360, 380, 384, and 385.	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Medium	<\$1,000,000 financial impact	Moderate	Physical Mortality	Fiscal Responsibility
R239	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Facility Dust Collection System.	Dust collection system to unit process UP 25 and 29 in D&D require evaluation and upgrade. Poor airflow is impacting equipment life and contributes to the safety risk if fugitive dust is created from the dust collection system.	Jl - Jones Island WRF	Future Amendment to M01019P01 \$90,000 budgeted amount	Medium	Known/past issue	High	due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R241	W4 water screens condition and operations/regulatory issues	W4 used for cooling multiple systems - VWM proposed MCRR to repair screens - also new Fed Regs on intake may impact the project	Jl - Jones Island WRF	VWM has inspected the system	Very High	VWM MCRR request	Medium	Other sources of cooling water exist	Moderate	Physical Mortality	Management Effectiveness
R262	Capacity, solids handling, safety and cost impacts relating to the condition of the Main Recycle Belt Feed Screw S-25-54-1...3	The screws are a one to one correlation with the ability to operate the recycle system. Risk impacts main recycle system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy if one screw requires maintenance.	Jl - Jones Island WRF	J04051: Main Recycle Air Belt Feed Screw Replacements: Total Construction Budgeted: \$613,107	High	Event 1-5 year	High	Significant impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R264	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage Product Feed Screws S-29-13-1...2	Risk impacts classification system. Auger, trough, motor are in critical need for repair, ladder chutes to product cooler recently replaced. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R265	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 1st Cut Mill Discharge Screws S-29-18-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R266	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 2nd Cut Mill Discharge Screws S-29-23-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R267	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 1st Oversize Feed Screws S-29-16-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R268	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 2nd Oversize Feed Screws S-29-21-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R269	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D First Stage 2nd Oversize Transfer Screws S-29-20-1...2	Risk impacts classification system. Frequent use leading to high levels of corrosion and required maintenance. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R270	Capacity, solids handling, safety and cost impacts relating to the condition of the Overflow Bucket Elevator BE-29-56-1	Risk impacts classification system. Upon failure will shut down drying train and reduce morganite production redundancy. Less than five years remaining service life.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R271	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage Manual Diverter Valve	Risk impacts greens grade system. Directs cyclone waste to one of two cyclone transfer screw conveyors. Original install.	Jl - Jones Island WRF	J04065 1st Stage Equipment Project. Total Construction Budgeted: \$4.6MM Construction Scheduled 2020/2021	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R273	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Second Stage Oversize Mill Discharge Screws S-29-43-1...2	Risk impacts greens grade system. Receives DRS from the second-stage mills, and any overflow from the second-stage oversize mill leveling screw conveyor. 100% redundancy between two screws.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Short Term Condition Assessment Required by VWM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Impacts processing of DRS from the second-stage mills	Moderate	Physical Mortality	Management Effectiveness
R275	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Third Stage Surge Bin Feed Screws S-29-46-1...2	Risk impacts greens grade system. Discharge from the second stage system into third stage surge bin. 100% redundancy between two screws.	Jl - Jones Island WRF	State of auger and motor/drive is unknown. Overflow door is equipped to deal with surge bin overload North and South GG Train - PCF - J04035 Construction 2019/2020	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R276	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Third Stage Screener Feed Screws S-29-49-1...2	Risk impacts greens grade system. Screws collect discharge from third stage surge bin. 100% redundancy between two screws.	Jl - Jones Island WRF	Flow switch is provided at third drop point to actuate an alarm during overflow condition North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Malfunction or required maintenance will limit DRS processing by third-stage screeners.	Moderate	Physical Mortality	Management Effectiveness
R277	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Third Stage Fines Bin Feed Screws S-29-51-2	Risk impacts greens grade system. Carry CFNS to the fines surge bins. 100% redundancy between two screws.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R278	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Third Stage Product Feed Screws S-29-52-1...2	Risk impacts greens grade system. Screws collect product material from third stage screeners. 100% redundancy between two screws.	Jl - Jones Island WRF	Inspected during 2016 shutdown North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R279	Capacity, solids handling, safety and cost impacts relating to the condition of the Third Stage Screeners M-29-50-2,4	Risk impacts greens grade system. Separation of oversize, product, and classification fines. Internal seams require sealant.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R280	Capacity, solids handling, safety and cost impacts relating to the condition of the Fines Recycle Transfer Screw S-31-49	Risk impacts greens grade system. Observed corrosion in trough. 100% redundancy between two screws.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R281	Capacity, solids handling, safety and cost impacts relating to the condition of the Fines/Wet Recycle Bucket Elevator BE-31-52	Risk impacts greens grade system. Transportation of recycled fines to the wet recycle system. Some patches on housing.	Jl - Jones Island WRF	North and South GG Train - PCF - J04035 Construction 2019/2020	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R283	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Cooler Feed Screws S-29-66-1...2	Risk impacts product cooling system. Multiple patches on trough housing. 100% redundancy between two screws.	Jl - Jones Island WRF	Short Term Condition Assessment Required by VWM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R284	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Storage Feed Screws S-29-76-1...2	Risk impacts product cooling system. Sections welded in June 2016, flights had multiple holes. Fill gate condition causes tank 3 to receive product when filling tank 1. 100% redundancy between two screws.	Jl - Jones Island WRF	Future capital project request.	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R286	Capacity, solids handling, safety and cost impacts relating to the condition of the Product Weigh Belts B-29-70-1...2	Risk impacts ability to accurately inventory the product transfer system to Silos and what volumes are being produced and sold. Frequent calibration required for weight instrumentation. Belt, motor/drive, and receiving hopper all have less than five years remaining service life. J04052 has identified replacement technology.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM J04052 to provide Eng. Report on this equipment in 2018 and improve performance under same capital project Weigh cells to be replaced under J04052	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R287	Capacity, solids handling, safety and cost impacts relating to the condition of the Product Storage Day Tank 3 Fill Gate FG-29-76-1	Risk impacts product transfer system. Failure causes tank 3 to receive product when trying to fill tank 1.	Jl - Jones Island WRF	District planning action	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of morganite production, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R291	Capacity, solids handling, safety and cost impacts relating to the condition of the Outside Air Butterfly Damper FV-25-1-4...5	The dampers are a one to one correlation with the ability to operate a dryer train. Risk is if you lose a damper, you lose the dryer train. Failure to one unit directly impacts the associated dryer. Seal air blower and actuator have less than five years remaining service life.	Jl - Jones Island WRF	District planning action	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R292	Capacity, solids handling, safety and cost impacts relating to the condition of the Waste Heat Damper FV-25-1-1	Risk impacts drying system. Seal air fan motor bearings fail on new style gate. Upon failure will shut down drying train and reduce morganite production redundancy.	Jl - Jones Island WRF	MCR 786 Completed MCR 823 Construction	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R293	Capacity, solids handling, safety and cost impacts relating to the condition of the First Stage 2nd Oversize Leveling Screw S-29-22-1...2	Risk impacts classification system. Transfers biosolids into first stage second mills. 100% redundancy between two screws.	Jl - Jones Island WRF	J04065 scope item. Construction 2019/2021	Very High	Occur within one year	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R294	Capacity, solids handling, safety and cost impacts relating to the condition of the Cyclone Discharge Screw S-30-2-1...4	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R295	Capacity, solids handling, safety and cost impacts relating to the condition of the Cyclone Transfer Screws S-30-4-1...4	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R296	Capacity, solids handling, safety and cost impacts relating to the condition of the Cyclone Drag Conveyors DC-30-8-1...4	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R297	Capacity, solids handling, safety and cost impacts relating to the condition of the Cyclone Waste Screener Feed Screws S-30-12-1...2	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R298	Capacity, solids handling, safety and cost impacts relating to the condition of the Container Cross Feed Screws S-30-41-1...2	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R299	Capacity, solids handling, safety and cost impacts relating to the condition of the Container Feed Screw S-30-42-1...2	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R300	Capacity, solids handling, safety and cost impacts relating to the condition of the Luggage Chaff loadout System FG-30-42-1-1...2	Risk impacts dryer, fines systems and air permit through cyclone operation. If cyclones are not able to be operational and material removed, air permit and dewatering are impacted. Auger experiences coupling bolt failures. Wear on housing results in leakage. 100% redundancy between four screws.	Jl - Jones Island WRF	J04064 Chaff (Cyclone Waste) 2018 project. Total Construction Budgeted: \$9.4MM	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R305	Community satisfaction, solids handling, safety and cost impacts relating to the condition of the Odorous Air System from bfp's	Risk impacts utilities systems and personnel working conditions. Observed corrosion in isolation gates. Blowers have limited remaining service life.	Jl - Jones Island WRF	Potential (future) MCR's. Visit to address.	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Due to high maintenance requirements of dryer systems, redundancy is often compromised, resulting in a high risk of failure to management and operational effectiveness.	Moderate	Physical Mortality	Management Effectiveness
R307	Safety and cost impacts relating to the condition of the Fire Pumps P-32-39-1...2	Risk impacts utilities and safety systems. Valves, piping, and sprinkler heads have less than five years remaining service life.	Jl - Jones Island WRF	Potential (future) MCR's	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Temporary disability or serious injury	Moderate	Physical Mortality	Safety
R309	Capacity, solids handling, safety and cost impacts relating to the condition of the Building Drains (sump pumps) P-32-35-1...3	Risk impacts utilities system. Equipment near end of useful life. Upon failure will shut down drying train and reduce morganite production redundancy	Jl - Jones Island WRF	Existing levels of redundancy.	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R314	Capacity, solids handling, safety and cost impacts relating to the condition of the Silo Fill, Dust, and Vent Valves at top of silo FV-27-2-1...14 FV-27-52-1...14 FV-27-38-1...14	The fill valves are a one to one correlation with the ability to operate a specific silo. Risk is if you lose a fill valve, you lose the silo. Fill valves control if Milorganite is conveyed directly to railcar loadout. Provides operational flexibility.	Jl - Jones Island WRF	Potential (future) MCR's	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Temporary disability or serious injury	Moderate	Physical Mortality	Safety
R315	Capacity, solids handling, safety and cost impacts relating to the condition of the North Transfer Draw-Off Conveyor M-27-12-1	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	Existing levels of redundancy.	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R316	Capacity, solids handling, safety and cost impacts relating to the condition of the North Transfer Bucket Elevator BE-27-15-1	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.1MM	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R318	Capacity, solids handling, safety and cost impacts relating to the condition of the South Transfer Draw-Off Conveyor M-27-12-2	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	District planning action	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R320	Capacity, solids handling, safety and cost impacts relating to the condition of the South Cross-Over Weigh Belt M-27-13-2	Risk impacts silo system and accuracy of material inventory using the weigh belt. Weigh belt is original technology and chutes and directional spouts have limited remaining service life.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.5MM Confirm that J04052 provides Eng. Report on this equipment in 2018 and replace to improve performance. Chutes and valves in poor condition	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R321	Capacity, solids handling, safety and cost impacts relating to the condition of the Conditioning Bucket Elevator M-27-15-3	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.5MM	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R322	Capacity, solids handling, safety and cost impacts relating to the condition of the Conditioning Draw-off Conveyor M-27-12-3	Risk impacts silo system. If you cannot operate the draw off conveyors, operations is unable to move Milo from silos to meet spec and loadout product to meet customer specs. Tracking is very touchy. Rollers have remaining service life of five years or less.	Jl - Jones Island WRF	J04052: Milorganite Facilities Improvements Phase IV. Total Construction Budgeted: \$2.5MM	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R326	Capacity, solids handling, safety and cost impacts relating to the condition of the Baghouse 5/6 and surge bin exhaust duct M-27-29-5...6	Risk impacts silo system and associated air permit. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	MCRR to replace as needed	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	Medium	Injury requiring medical treatment	Moderate	Physical Mortality	Safety
R330	Capacity, solids handling, safety and cost impacts relating to the condition of the Ribbon Mixer	Risk impacts product loadout as there is no redundant or backup to the dust suppression chemical blender. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	MCRR 967 in 2017	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Significant impact on operational efficiency	High	Physical Mortality	Management Effectiveness
R331	Capacity, solids handling, safety and cost impacts relating to the condition of the Dust Suppressant Tank (Mineral Oil Storage Tank) T-27-53	Risk impacts product loadout as there is no redundant or backup to the dust suppression chemical blender. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	VWM to submit capital project request	Very High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Significant impact on operational efficiency	High	Physical Mortality	Management Effectiveness
R332	Capacity, solids handling, safety and cost impacts relating to the condition of the Dust Suppression pumps and strainers P-27-58-1...2	Risk impacts product loadout as there is no redundant or backup to the dust suppression chemical blender. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	District planning action	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R335	Capacity, solids handling, safety and cost impacts relating to the condition of the Surge Bin manual valve to screener and gate at bottom of surge bin. FG-27-21 FV-27-61	Risk impacts silo system. Equipment near end of useful life. Upon failure will shut down drying train and reduce Milorganite production redundancy	Jl - Jones Island WRF	MCRR's as required	High	Nov. 2016 D&D CCO/Veolia Equipment assessment meeting decision	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R336	Capacity, solids handling, safety and cost impacts relating to the condition of the Third Stage Surge Bins T-29-47-1	Equipment near end of useful life. Upon failure will shut down drying train and reduce morganite production redundancy	Jl - Jones Island WRF	Surge Bin 2 will be replaced under MCRR 931 2018 capital project request	Very High	Event will occur within a year	Medium	CCO/Veolia Meeting Review	Moderate	Physical Mortality	Management Effectiveness
R342	Capacity, solids handling, safety and cost impacts relating to the condition of the Dust Drag Conveyor M-27-29-8-1	Equipment near end of useful life. Upon failure will shut down drying train and reduce morganite production redundancy	Jl - Jones Island WRF	District planning action	High	Event will occur at least once every 1-5 years	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R343	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Storage Transfer Screw S-29-75-1...2	Risk impacts product transfer system. Transfer screw 1 auger may be in bad condition. discharge gate to feed screw 2 leaks. 100% redundancy between two screws.	Jl - Jones Island WRF	Future capital project request. Potential (future) MCRR's for discharge gate to screw 2	High	Event will occur at least once every 1-5 years	High	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness
R344	Capacity, solids handling, safety and cost impacts relating to the condition of the D&D Product Cooler Transfer Screw Discharge Flow Gate Valve FG-29-63-2	Risk impacts product cooling and transfer system. Leaks when trying to transfer to product cooler feed screw 1. 100% redundancy between two screws.	Jl - Jones Island WRF	District planning action	Very High	Event will occur within a year	Medium	Moderate level of impact on operational efficiency.	Moderate	Physical Mortality	Management Effectiveness

APPENDIX 5B-9: WRF Risk Register – LOS Risks -

DRAFT

**MMSD Asset Management Plan
WRF and Biosolids Asset System Risk Register**

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R006	Levels of digester gas siloxane causing damage and reliability issues with SSWRF digester gas engines/systems	siloxane too high to operate the engines	SS - South Shore WRF	Active project to address this risk S04031	High	Event 1-5 years, very high siloxane concentrations experienced in 2015, but apparently back to normal levels?	Very High	M&O effectiveness, > 50% impact on KPI's, inability to operate generators cost of \$4000 per day (demand charge), plus significant cost to repair generators	High	Level of Service	Energy
R090	Risk of conveyance system overflows at BS0405 and DC0103 by not utilizing the potential to blend at SSWRF	Can PE blending approval be attained from WDNR. What is the estimated SSWRF wet weather capacity using the blending system.	SS - South Shore WRF	System access gates welded shut in 2003; District planning action	Very High	is not used now and not "approved" for use	Very High	use could prevent overflows and/or basement backups	High	Level of Service	Environmental Improvements
R099	Sewage leaks from Bldg. 316, 317 roof drains and impact on JIWRF discharges to Lake Michigan	Roof drains routed through PE channel, drain leaks can result in sewage into storm system. Recent project according to G. Olson did not address this.	SS - South Shore WRF	Active project to address this risk	High	known issue with drain	High	WPDES permit issue, SSO	Moderate	Level of Service	Permit Requirements
R118	Reliability of the effluent pumping system when a power failure occurs	high flow power failure can shut down effluent pumps - effluent pumps may now be required to discharge effluent to Lake Michigan in wet weather event due to higher lake water levels	SS - South Shore WRF	active project to assess but no decision	High	power outages (from both we-Energies feeds) , lake level rising (add back-up for by-pass gates)	High	Impact of 1-10M, potential for flooding with high lake level, need analysis to determine hydraulic capacity without pumps and with current lake water levels	Moderate	Level of Service	Permit Requirements
R120	Risk of negative publicity, community impacts and not meeting current NR 110 requirements from JIWRF treatment process odors	The District recently received odor complaint from 3rd Ward Business Group. There have been no recorded odor complaints for the JIWRF for the prior 3 years. Improve the monitoring, reporting and if needed, control of odors, from various processes (primary clarifiers, JI dump and Milorganite).	JI - Jones Island WRF	District planning action	High	Occasional odor issues have been experienced	High	Occasional odor issues, could be serious issue during high visibility periods - Moderate loss of reputation, negative coverage	Moderate	Level of Service	Customer Service, Communication and Employee Development
R172	Phosphorus content of Milorganite relative to nitrogen may exceed regulations in some states where Milorganite is currently sold	Excess phosphorus in Milorganite, exceeds agronomic rate for P when applied at agronomic rate for N and is thus P not beneficially used. State regulators may restrict or prevent application of Milo.	JI - Jones Island WRF	District planning action	High	Occur within one year	High	Significant reduction (>10%) in % beneficially used, also may be regulated in future - possible non-compliance with permit	Moderate	Level of Service	Customer Service, Communication and Employee Development
R177	Safety risks in dryer systems due to the utilization of waste heat and the high oxygen levels in the dryer systems	Safety of dryers - Current dryer system does not comply with NFPA 654 – Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, in particular there is greater than 8% oxygen content which does not comply with inerting explosion protection requirement	JI - Jones Island WRF	District planning action	Very High	occur less than one in 20 years	Very High	Safety - Injury or illness that would require medical treatment.	High	Level of Service	Safety
R178	Milorganite may not be in compliance with Canadian requirements for Salmonella.	Contamination of Milorganite. Impacts distribution of Milorganite, in particular may violate Canadian biosolids regulations	JI - Jones Island WRF	Management under Marketing and Milorganite department	High	occurs every 1 to 5 years	Very High	Serious loss of reputation	High	Level of Service	Customer Service, Communication and Employee Development
R197	Black start capability utilization is limited because the existing battery has capacity for only one start and backup power capacity is not available in a power outage	DC battery backup pack only allow 1 try at a black start	SS - South Shore WRF	Battery back-up	Medium	Event 5-10 years	High	Permit issues for < 1 week	Moderate	Level of Service	Management Effectiveness
R209	The need to complete the power supply optimization to increase system reliability	Is the overall reliability and safety of Jones Island's power supply sufficient. Does the active project address all issues?	JI - Jones Island WRF	Active project to address issue	Very High	Event will occur within a year	High	Significant failure to meet internal energy targets	High	Level of Service	Energy

Risk Identification				Risk Analysis							
Risk ID	Risk Title	Risk Description	Level 2 - Facility	Existing Controls to Manage the Risk	Likelihood of Failure	Justification of Likelihood Score	Consequence of Failure	Justification of Consequence Score	Risk Level	Failure Mode	LOS Category
R211	Incorrect results from the influent sampling system	determine a new location and upgrade the influent monitoring system	SS - South Shore WRF	active project to address issue	Low	Event will occur at least once every 26-50 years	Very High	Prolonged period of non-compliance with effluent quality permit limits	Moderate	Level of Service	Permit Requirements
R212	Risk of negative publicity, community impacts and permit violation from SSWRF treatment process odors	During various times such as times of low flow, there have been odors associated with preliminary treatment, which has resulted in odor complaints from SSWRF neighbors	SS - South Shore WRF	Existing MIS odor control system using sodium hypochlorite exists in B344	High	Event will occur at least once every 1-5 years	High	Significant increase in odor issues	Moderate	Level of Service	Customer Service, Communication and Employee Development
R221	Flood protection of Bldg. 326	design and construct storm sewer and paving improvements for long-term flood protection at Building 326.	SS - South Shore WRF	Active project to address issue	Very High	Event will occur within a year	Very High	Permanent disability or potential fatality	High	Level of Service	Safety
R225	Suitability of the HVAC system to protect the computer room	heating, ventilation, and air conditioning (HVAC) systems for three work areas within the Jones Island Operations building	Jl - Jones Island WRF	District planning action	High	Event will occur at least once every 1-5 years	Very High	Significant impact on operational efficiency	High	Level of Service	Management Effectiveness
R226	Lack of I&C improvements to keep SCADA system operational	integrate multiple fiber optic networks and improve data routing through the network	Jl - Jones Island WRF	District planning action	Low	Event will occur at least once every 26-50 years	Very High	Moderate level of impact on operational efficiency.	Moderate	Level of Service	Management Effectiveness
R228	Stack testing shows increasing trends in emissions which may lead to air permit non-compliance	compliance with all air emission limits and impacts of existing permits on future actions, etc.	Jl - Jones Island WRF	District planning action	Medium	Event will occur at least once every 6-25 years	Very High	Non-critical component of system with sufficient redundancy such that failure poses a low risk to management and operational effectiveness	Moderate	Level of Service	Permit Requirements
R230	Reliability of the power feed to Ops Bldg.	install four 300-amp feeds in three conduits from LCUS-P in the Powerhouse building to a circuit breaker in the Operations Building electrical room in order to provide a third source of power for the conveyance SCADA system	Jl - Jones Island WRF	District planning action	Very Low	Event will occur at least once every 51-100+ years	Very High	Moderate level of impact on operational efficiency.	Moderate	Level of Service	Management Effectiveness
R231	Need to comply with all air permit requirements and impacts on operations flexibility	compliance with all air emission limits and impacts of existing permits on future actions, etc.	SS - South Shore WRF	District planning action	Medium	Event will occur at least once every 6-25 years	Very High	Prolonged period of non-compliance with air permit limits	Moderate	Level of Service	Permit Requirements
R341	Revise JI WRF sampling system to allow for one sample	change from LL and HL samples to a single sample point	Jl - Jones Island WRF	active project to assess this	High	dual samples are costly and inaccurate	High	cost and duplication and VWM billing	Moderate	Level of Service	Management Effectiveness