CORRECTIVE ACTION PLAN

February, 2019

MOUNTAIN VIEW

WASTEWATER TREATMENT PLANT

PREPARED FOR:

CITY OF MOUNTAIN VIEW, ARKANSAS
P.O. BOX 360
MOUNTAIN VIEW, AR 72560

PREPARED BY:

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CWB **Project # 18-068**

CERTIFICATE OF AUTHORIZATION
CWB ENGINEERS, INC.
No. 1716
ARKANSAS

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 13831
C. KYLE BRECKENRIDGE

C. Kyle Breckenridge
2-8-19

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INTRODUCTION

The City of Mountain View, Arkansas has agreed to a Consent Administrative Order (CAO) LIS No. 18-091 from the Arkansas Department of Environmental Quality (ADEQ). In order to address the deficiencies at the Waste Water Treatment Plant (WWTP) the CAO required the submission of a Corrective Action Plan (CAP) for the Mountain View Wastewater Treatment Plant (WWTP), NPDES Permit # AR0020117. The CAO outlines thirteen (13) NPDES permit violations from February 1, 2015 to February 28, 2018. The permit violations are summarized in the table below.

Date	Parameter	Sample Value	Permit Limit
5/31/15	FCB (7 DAY AVG, CFU)	3,000	400
6/30/15	NH_4^+ (MO AVG, LB/D)	27.3	23.7
6/30/15	NH_4^+ (MO AVG, MG/L)	7.6	3.9
6/30/15	NH_4^+ (7 DAY AVG, MG/L)	11.6	3.9
9/30/15	FCB (7 DAY AVG, CFU)	780	400
4/30/16	NH_4^+ (7 DAY AVG, MG/L)	7.2	3.9
7/31/16	NH_4^+ (7 DAY AVG, MG/L)	5.7	3.9
8/31/16	NH_4^+ (7 DAY AVG, MG/L)	8.2	3.9
8/31/16	FCB (7 DAY AVG, CFU)	850	400
12/31/16	DO (INST MIN, MG/L)	6.9	7.0
2/28/17	DO (INST MIN, MG/L)	6.9	7.0
6/30/17	NH_4^+ (7 DAY AVG, MG/L)	4.8	3.9
1/31/18	FCB (7 DAY AVG, CFU)	420	400

This CAP outlines the planned process required to bring the Mountain view WWTP into compliance. Additional immediate steps are also outlined to maximize the effectiveness of the existing infrastructure in order to minimize violations while the planned improvements are being designed and constructed. A large portion of the planned improvements will be efforts to reduce the amount of infiltration and inflow (I&I) into the Mountain View Wastewater Collection System. These planned improvements are detailed in a separate Corrective Action Plan for the collection system.

EXISTING INFRASTRUCTURE AUDIT

NPDES Permit Parameters

The City of Mountain View WWTP discharges to Hughes Creek under NPDES Permit # AR0020117. The permit includes limits for nitrogen (NH_3 & NO_3 + NO_2), therefore both nitrification and denitrification are required. A summary of the permit parameters is shown on the next page.

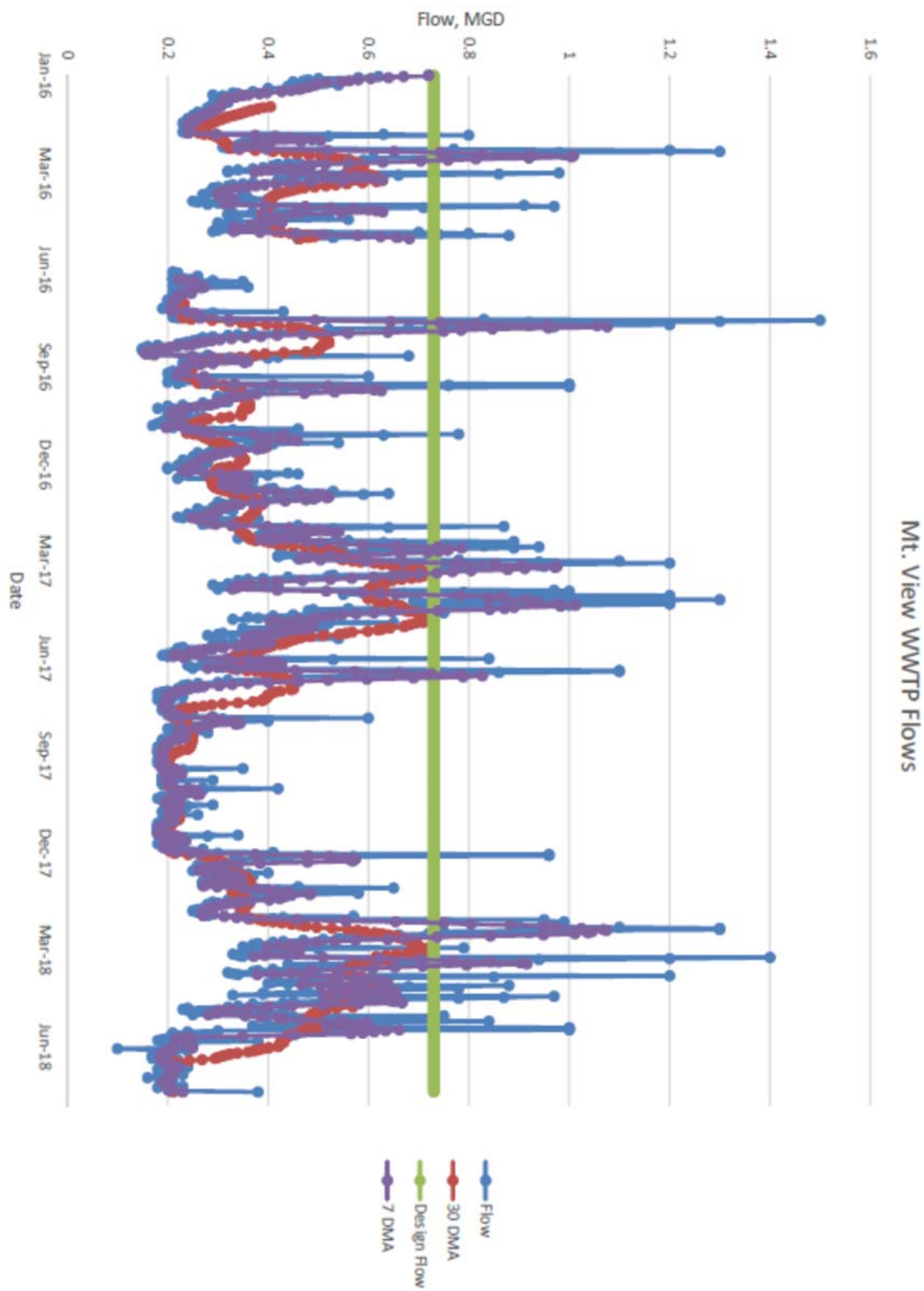
Parameter	Mass (monthly)	Concentration (monthly)	Concentration (7-day)	Monitoring
$CBOD_5$	60.9	10.0	15.0	3/month
TSS	91.0	15.0	23.0	3/month
NH_3-N				
Apr. - Oct.	23.7	3.9	3.9	3/month
Nov. – Mar.	60.9	10.0	10.3	3/month
D.O.				
May – Oct.	-	6 (inst. min.)	-	3/month
Nov. -Apr.	-	7 (inst. min.)	-	3/month
FCB	-	200	400	3/month
$NO_3 + NO_2$	-	-	10.0	3/month
pH	-	6.0 (min.)	9.0 (max.)	3/month

Flow Data

The WWTP is only equipped with an effluent flow meter. While metered influent flow records are desirable; for the purposes of this report the effluent flow was considered an accurate representation of process flow. The current design flow of the WWTP is 730,000 gallons per day (gpd). The table on the next page summarizes the WWTP flow data in millions of gallons per day (MGD) for the dates of violation, for 2016 to present. 2015 data is not included.

Date	Daily Flow (MGD)	Average Daily Flow for Month (MGD)	Maximum Daily Flow for Month (MGD)
5/31/15	-	-	-
6/30/15	-	-	-
9/30/15	-	-	-
4/30/16	0.91	0.39	0.91
7/31/16	0.22	0.23	0.35
8/31/16	0.27	0.50	1.5
12/31/16	0.27	0.30	0.54
2/28/17	0.4	0.35	0.87
6/30/17	0.24	0.33	0.84
1/31/18	0.38	0.35	0.65

The maximum daily flow for the period occurred in August 2016, at 1.5 MGD. The maximum month flow (the largest monthly average of daily flows) for the period occurred in March 2017 and came to 0.655 MGD. The maximum month flow is typically used for the design flow and adjusted upward based upon the expected growth for the planning period. The flow of 0.655 is 89.7% of the WWTP design capacity. Typically, expansion plans begin at 80%. However, as outlined below, the existing WWTP infrastructure is capable of treating flows in excess of 1 MGD. With some repair and improvements, the WWTP should be able to adequately treat the flows expected, especially after the collection system improvements reduce the peaking factor during storm events. The current peaking factor is approximately 3.89. The figure below summarizes the flow data for the previous 2.5 years.



Existing Loads

The Mountain View WWTP influent raw wastewater is characterized as typical domestic sewage flow. The assumptions outlined in the table below were used for the calculations in this CAP. Adequate raw wastewater testing will be performed before the detailed design of the plant improvements begin.

Parameter	Assumed Concentration	Assumed Loading at Max. Month Flow
COD	400 mg/L	2,435 lb/day
BOD	200 mg/L	1,218 lb/day
$BOD_{soluble}$	100 mg/L	609 lb/day
$BOD_{particulate}$	100 mg/L	609 lb/day
TSS	200 mg/L	1,218 lb/day
VSS	133 mg/L ($^{2}/_{3}$ of TSS)	810 lb/day
NH_4^+	30 mg/L	183 lb/day
TKN	40 mg/L	244 lb/day

Existing WWTP Process

The headworks at the WWTP is fed by an 18" gravity line which reduces to 8" just before entering the headworks. This constriction will be investigated during the flow study as discussed in the collection system CAP. The headworks consist of a ¼" spiral screen with high flow bypass through a manual bar screen. From the headworks flow can be diverted to gravity flow to either the oxidation ditch or the equalization basin. Equalization flow is then pumped to treatment by the influent pump station. The existing equalization basin is approximately 200,000 gallons. The oxidation ditch is a 3-track Orbal system (activated sludge loop reactor) followed by final clarification and UV disinfection. Solids handling infrastructure includes aerobic digestion and sludge drying beds. Each process step is analyzed below.

Headworks

The existing headworks consist of a mechanically cleaned cylindrical screen with manual bar screen bypass and overflow to equalization. The screen is rated for 3.5 MGD. Currently flows in excess of 1 MGD overtop the screen assembly. The spiral brush and wear shoe should be replaced to ensure adequate cleaning of the screen. The float controlling the initiation of the cleaning cycle may also need to be lowered or changed to timed cleaning initiation. If these efforts do not resolve the issue then the channel seal should be modified to prevent overtopping of the screen assembly and force all bypass water into the manually cleaned bar screen.

Influent Pump Station

The influent pump station is utilized only for equalization return. It has a firm capacity of 4 MGD, and is in good working condition. No improvements are needed for the influent pump station.

Oxidation Ditch

The existing oxidation ditch was installed during plant improvements completed in 2008. The system is a 3-track Orbal System. The system is aerated by four (4) disc rotors. Two 10-HP rotors are installed in the first track, and two 30-HP rotors provide aeration and mixing for the middle and inner tracks. The aeration system is adequate for flows up to approximately 1.3 MGD. The outer channel should be maintained in an anoxic state (D.O. of < 0.5 mg/L). Since the RAS is returned to this channel, the denitrification process is completed in this channel. D.O. levels above 0.5 mg/L will result in inhibition of the denitrification process and subsequent permit violations for the Nitrate + Nitrite limit. D.O. levels increase as flow passes through the middle and inner channels. These channels remove the carbonaceous BOD that was not utilized as a substrate for denitrification in the first channel. The middle channel D.O. level target is approximately 1 mg/L. The inner channel D.O. level target is 2 mg/L. This level should be maintained to ensure that anoxic conditions do not redevelop within the final clarifier and contribute to a rising sludge blanket.

The oxidation ditch volume for all three channels is approximately 430,000 gallons. This volume is sufficient to provide sludge retention times (SRTs) in the typical range needed for nitrification. However; if we were to target a Solids Retention Time (SRT) of >25 days to operate as an extended aeration plant for the sludge benefits (reduction in solids production due to endogenous decay and stable conditioned sludge), typical of oxidation ditches, a larger basin volume would be required to keep the MLSS acceptable for the existing clarifier size. The graphs in Appendix A show the state point analysis for the existing clarifier at varying MLSS, flows, and RAS rates, at an SVI of 200. The existing clarifier is adequate to accommodate a MLSS of 3,500 mg/L up to peak flows of up to 1.5 MGD without requiring intermittent adjustment to the RAS flow. However, MLSS above 3,500 mg/L allow for no intermittent peaking. Due to this, MLSS concentrations should be limited to 3,500 mg/L, which will limit the SRT to 20 days. This is sufficient for adequate treatment but is shorter than most extended aeration plants operated to reduce solids production. The RAS flows in the table below are calculated assuming a solids concentration of 1.0% (10,000 mg/L) off the bottom of the secondary clarifier.

MLSS	Parameter	Calculated Value at Design Flow (0.73 MGD)	Calculated Value at Max. Daily Flow (1.5 MGD)
5,200	SRT	30 days	15 days
	RAS Flow	➢ 264 gpm	➢ 542 gpm
3,500	SRT	20 days	10 days
	RAS Flow	➢ 178 gpm	➢ 365 gpm
2,600	SRT	15 days	7.5 days
	RAS Flow	➢ 132 gpm	➢ 271 gpm

The existing RAS/WAS pumps are VFD controlled and can be operated between 600 and 100 gpm. Currently the station pumps at 600 gpm when pumping to RAS and 300 gpm when pumping to WAS. The estimated solids production is approximately 1,000 pounds per day at the design flow. Assuming a concentration of 1%, the desired WAS flow should be 11,990 gpd. The existing RAS/WAS pump station is adequate.

Secondary Clarification

One (1) existing secondary clarifier unit of 55 ft. diameter follows the oxidation ditch. The unit is a center feed, peripheral discharge unit and was installed prior to the oxidation ditch. The table below summarizes the clarifier parameters at the design flow and at the maximum daily flow. The standard parameters are Surface Overflow Rate (SOR), Weir Overflow Rate (WOR), and Solids Loading Rate (SLR), at an assumed 3,500 mg/L MLSS.

	Parameter	10 State Standards Recommendation	Calculated Value at Design Flow	Calculated Value at Max. Month Flow
Series	SOR	<1,000 gpd/sf	307 gpd/sf	632 gpd/sf
	WOR	<20,000 gpd/lf	4,244 gpd/lf	8,721 gpd/lf
	SLR	<35 lb/day/sf	21.3 lb/day/sf	43.8 lb/day/sf

The existing clarifier size is adequate for the expected flows. The WWTP has only one final clarifier and lacks any redundancy, so the unit cannot be taken out of service for maintenance. Consideration should be given to rehabilitation of the old secondary clarifier to provide some settling capability while the final clarifier is taken down for maintenance.

The main problem with the existing clarifier is the existing energy dissipating inlet (EDI). The inlet pipe is not centered within the feed well and does not distribute the flow equally in all directions. The inlet should be renovated to a centrally fed EDI such as the flocculating energy dissipating well arrangement (FEDWA) baffle system. This will serve to equally distribute flow into the clarifier and eliminate the hydraulic short-circuiting.

The operators report difficulty in keeping algae growth in-check on the clarifier effluent weirs. The best solution for this problem is to prevent the algae from growing by installing effluent launder covers. This will reduce the algae breakthrough that may affect disinfection as discussed below. Additionally, periodic overflows of the clarifier feed line manhole occur due to the manhole top not being sufficiently high enough to compensate for the head-loss feeding the clarifier at high flows. The manhole top will be raised to allow a sufficient head to develop to drive peak flows to the clarifier before overflowing the manhole.

U.V. Disinfection

The Ultra-violet disinfection facility is in good working order other than cleaning system malfunctions. It was constructed in the 2008 improvements project along with the Orbal System. The system has sufficient treatment capacity to meet a peak flow of 4.0 MGD. The FCB permit violations were likely due to particle and biofilm interference. Algae on the effluent weir of the final clarifier can break off and effectively shield bacteria from UV inactivation.

Additionally, biofilms may grow in the UV channel and lamp sleeves and contribute to the same issue. This problem is especially likely in open channel UV Systems, such as the Mountain View system. The best control measure is to completely cover the UV channel to eliminate any light exposure into the UV channel. In addition, the cleaning system has been in-operable and the operators have been cleaning the lamp sleeves by hand. This is a labor-intensive process and may occur too infrequently to ensure good UV transmittance. The cleaning system components will be replaced (new wipers, and chemical tubing).

EXISTING SOLIDS HANDLING INFRASTRUCTURE

The existing solids handling treatment train consists of an aerobic digester followed by sludge drying beds. The volume of the digester is approximately 144,000 gallons which allows for an approximate 12-day residence time at the design flow, assuming a total sludge yield of 1,000 pounds per day dry solids. If the more conservative estimate of 1 dry ton per million gallons flow were used, the residence time would be reduced to 8.2 days. Additionally, a 1% solids content is on the higher end of the expected ranges from WAS and, lower solids content would lower the solids residence time. Residence times below 35 days are typically inadequate for acceptable volatile solids and pathogen reduction, necessitating landfill disposal. There are two (2) sludge drying beds with a total surface area of 8,000 sf. These beds are adequate to treat approximately 160,000 lb/year of digested sludge based upon the typical 20 lb/sf/year design value. Assuming a volatile solids reduction of 25%, the sludge beds are adequate for a flow of 213,333 pounds of WAS from the treatment process. The beds are adequate for the expected WAS flow from a WWTP flow of 0.42 MGD, and therefore; will accommodate the current average flow. The current infrastructure is not adequate to meet Class B solids, but the solids processing infrastructure is currently adequate for the existing flows when landfill disposal of the solids is utilized. The solids handling infrastructure is the limiting item for any future WWTP expansions.

The low SRT of the aerobic digestion process will result in higher concentrations of ammonia in the digester supernatant. This could be a contributing factor to the ammonia permit violations. Testing of the influent TKN versus the digester supernatant would be required to determine the magnitude of the effect.

CAUSES OF THE REPORTED VIOLATIONS

The reported violations consist of NH_4^+, FCB, and D.O. excursions. 7 of the 13 violations were for NH_4^+, while 4 were for FCB, and the remaining 2 were for D.O. The current infrastructure, with minor improvements, is adequate to meet the permit limits; therefore, it is assumed that operational limitations are responsible for inadequate treatment efficiencies. Tight control of the anoxic and aerobic zones, and SRT within the oxidation ditch are needed to maximize the nitrification and denitrification efficiencies. Operational adjustments and additional testing regimens should return the process to design treatment efficiencies. This, along with renovations to the inadequate EDI of the clarifier will also improve the settle-ability of the oxidation ditch effluent, thereby increasing the TSS and particulate BOD removal within the clarifier. These improvements are expected to resolve the NH_4^+, and D.O. violation causes. The FCB violations were likely caused due to compromised UV transmittance from inadequate cleaning cycles, algae breakthrough, and biofilm growth. Covering the clarifier effluent launders and UV channel will help to eliminate algae and biofilm growth. Renovations to the cleaning system will automate the cleaning and perform it on a consistent basis.

PROPOSED ACTION PLAN

The preceding analysis has detailed the adequacy of the existing treatment units when they are operating at design efficiency. Various actions including repair, maintenance, and operation adjustments should be implemented to return the treatment units to the design efficiency. Many of these items can be accomplished by the City while a few will likely require a Contractor.

City

- Replace spiral screen brushes and wear shoe
- Adjust spiral screen cleaning cycle to ensure a clean screen
- Purchase Centrifuge for lab
- Begin Daily Operation Recommendations as detailed below
- Install channel seal to prevent over-topping of spiral screen
- Replace wiper assemblies on UV System

Contractor

- Replace wiper assemblies on UV System
- Raise the clarifier inlet manhole
- Install new EDI (FEDWA or other design) on clarifier inlet
- Install clarifier effluent launder covers
- Install UV channel covers

The contracted actions will be detailed within a Preliminary Engineering Report (PER). The PER will serve as the initial design and cost estimating phase of the proposed improvements. A proposed time to completion schedule of the process from the PER stage to estimated project commissioning is shown on the next page. If USDA or ANRC loan programs are utilized additional financing and review time will likely be needed.

Action	Estimated Days to Completion Once Begun
City Action Items	**120**
Draft Preliminary Engineering Report	90
Final Preliminary Engineering Report	30
Financing Arrangements (concurrent with final design)	120
90% Construction Documents	90
Final Construction Documents	30
Regulatory Review/Permitting	90
Bidding	60
Begin Construction	60
Substantial Completion/Start-up	180
Contractor Action Items	**630**

<u>IMMEDIATE ACTIONS FOR MITIGATING PERMIT VIOLATIONS</u>

<u>DAILY OPERATIONAL RECOMMENDATIONS</u>

Add the following testing to the tri-monthly sampling for 2-months (6 samples) to correlate the MLSS with the centrifuge % solids:

- MLSS (TSS of aeration basin)
- WAS MLSS

Each day the operator should add the following items to the checklist of tasks:

- Pull a 30 min. settle-o-meter test from the aeration basin using 1,000 mL column (use wider column, 4” to 6” diameter)
- Perform a sludge judge in the clarifier
- Check D.O. in each aeration basin channel (outer, middle and inner; targets of 0-1-2)
- Perform a 15 minute centrifuge to estimate MLSS using centrifuge % solids

Good settling sludge should settle to <80% in 5 minutes (800 mL in column)
If it doesn’t you likely have 1) poor biomass or 2) too much biomass

Using the data from above perform the following calculations.

Calculate the SVI as follows:

$$SVI = \frac{Settle\ Sludge\ Volume\ (from\ 30\ Min.settleometer, mL) * 1{,}000}{MLSS\ (from\ latest\ centrifuge\ result, mg/L)}$$

An SVI below 150 is a good settling sludge, if above 175 conditions need to be changed to promote floc forming bacteria. Check pH, D.O., SRT, F:M

Calculate the RAS Rate as follows:

$$RAS\ Rate\ (\%\ of\ WWTP\ Flow) = \frac{Settled\ Sludge\ Volume\ (from\ 30\ Min.settleometer, mL)}{1{,}000 - Settle\ Sludge\ Volume\ (from\ 30\ min.settleometer, mL)}$$

Adjust VFD on RAS pumps to target the calculated flow rate from above. Re-adjust this if flow changes by more than 50%, otherwise it won't have to be changed every day.

Maintain sludge blanket in clarifier (sludge judge reading) between 3 ft and 5 ft. If above 5 ft, increase RAS rate slowly. If below 3 ft., reduce RAS rate slowly until back above 3 ft.

The Solid Retention Time (SRT) should be kept at 15 days in order to ensure nitrifier populations. The SRT is controlled by the WAS rate. Calculate the WAS volume to waste each day as follows:

$$WAS\ Volume\ (GPD) = \frac{MLSS\ \left(\frac{mg}{L}\right) * Aeration\ Basin\ Volume(MG)}{SRT\ (days) * WAS\ MLSS(\frac{mg}{L})} * 1{,}000{,}000$$

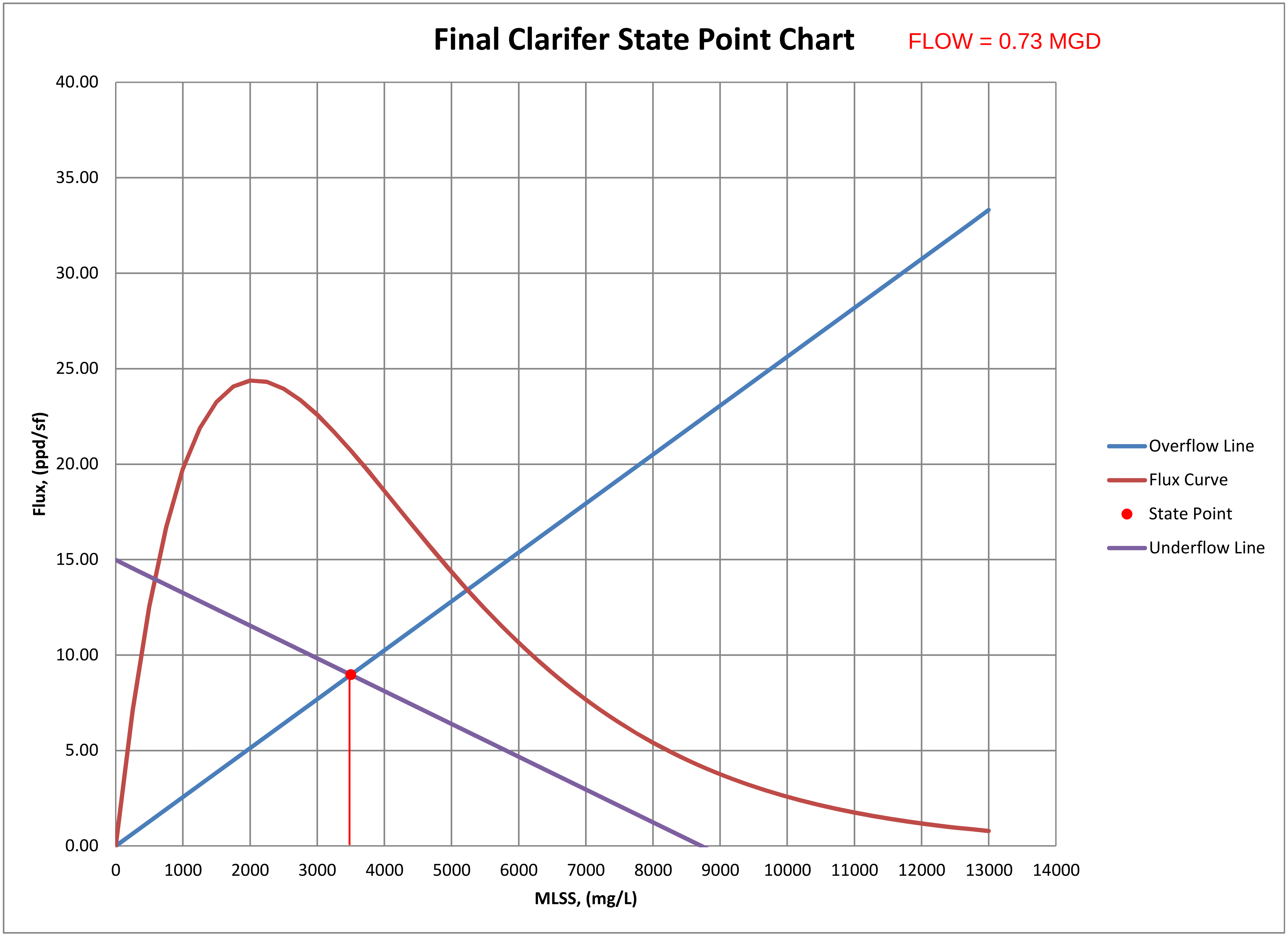
Waste the calculated number of gallons by diverting the RAS flow to WAS for a calculated number of minutes determined by taking the WAS gallons found above and dividing by the rate of the WAS pump. This will tell you how many minutes to waste each day.

CONCLUSIONS

The Mountain View WWTP staff and City officials are committed to resolving the issues resulting in NPDES permit violations. The schedule outline above gives estimated days for the project progress milestones, to which the City of Mountain View and CWB Engineers, Inc. are devoted to meeting and, where possible, exceeding. The City of Mountain View will give every effort in implementing the immediate actions outlined to mitigate future permit violations until the necessary WWTP repairs and improvements can be implemented. ADEQ will be updated as the project progresses with appraisals of actions to date and projection of any potential changes to the estimated days required. All action items should be complete by November 1, 2020.

APPENDIX A

STATE POINT ANALYSIS GRAPHS


Final Clarifer State Point Chart
FLOW = 0.73 MGD
Flux, (ppd/sf)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
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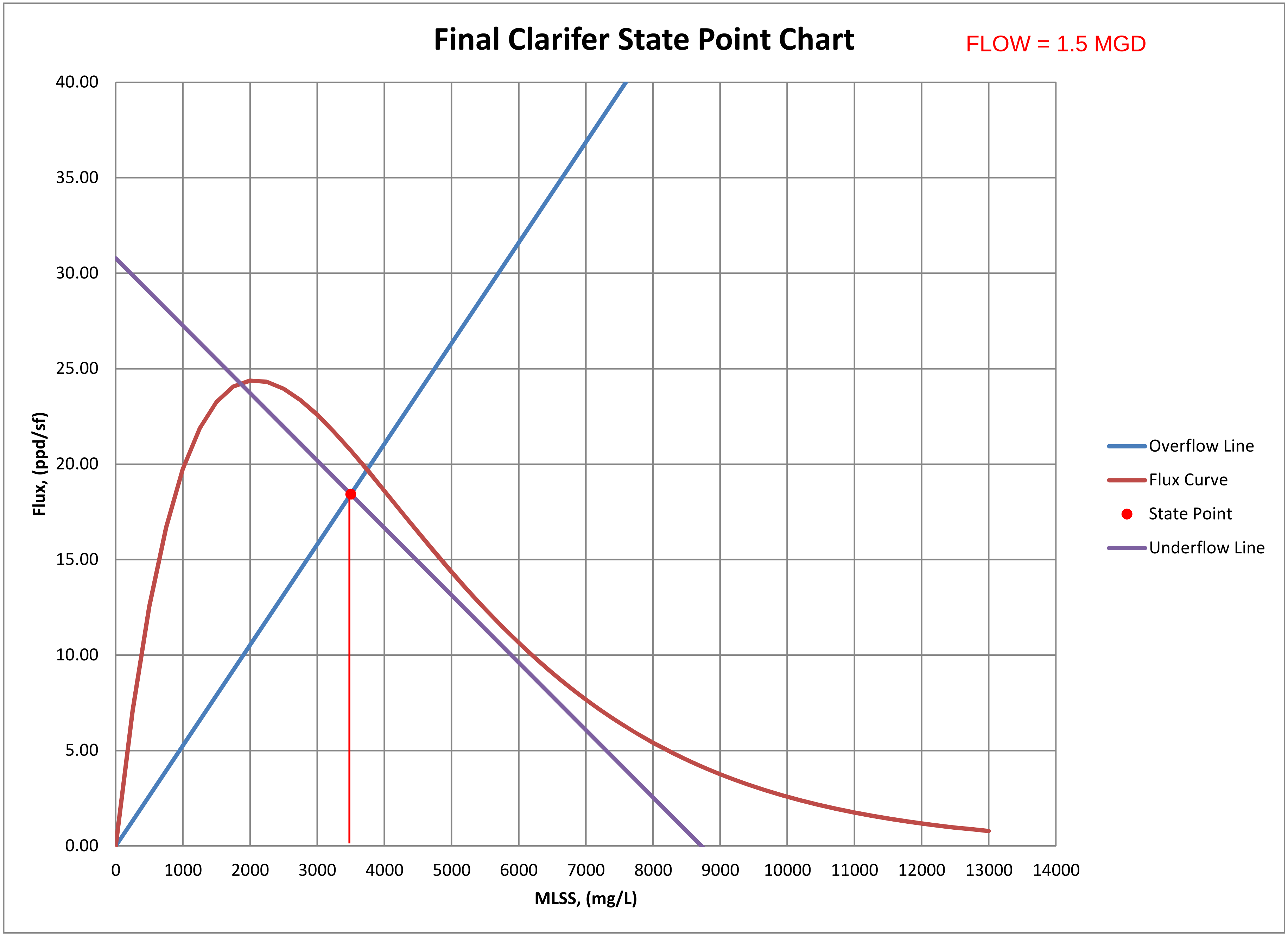
MLSS, (mg/L)
Overflow Line
Flux Curve
State Point
Underflow Line



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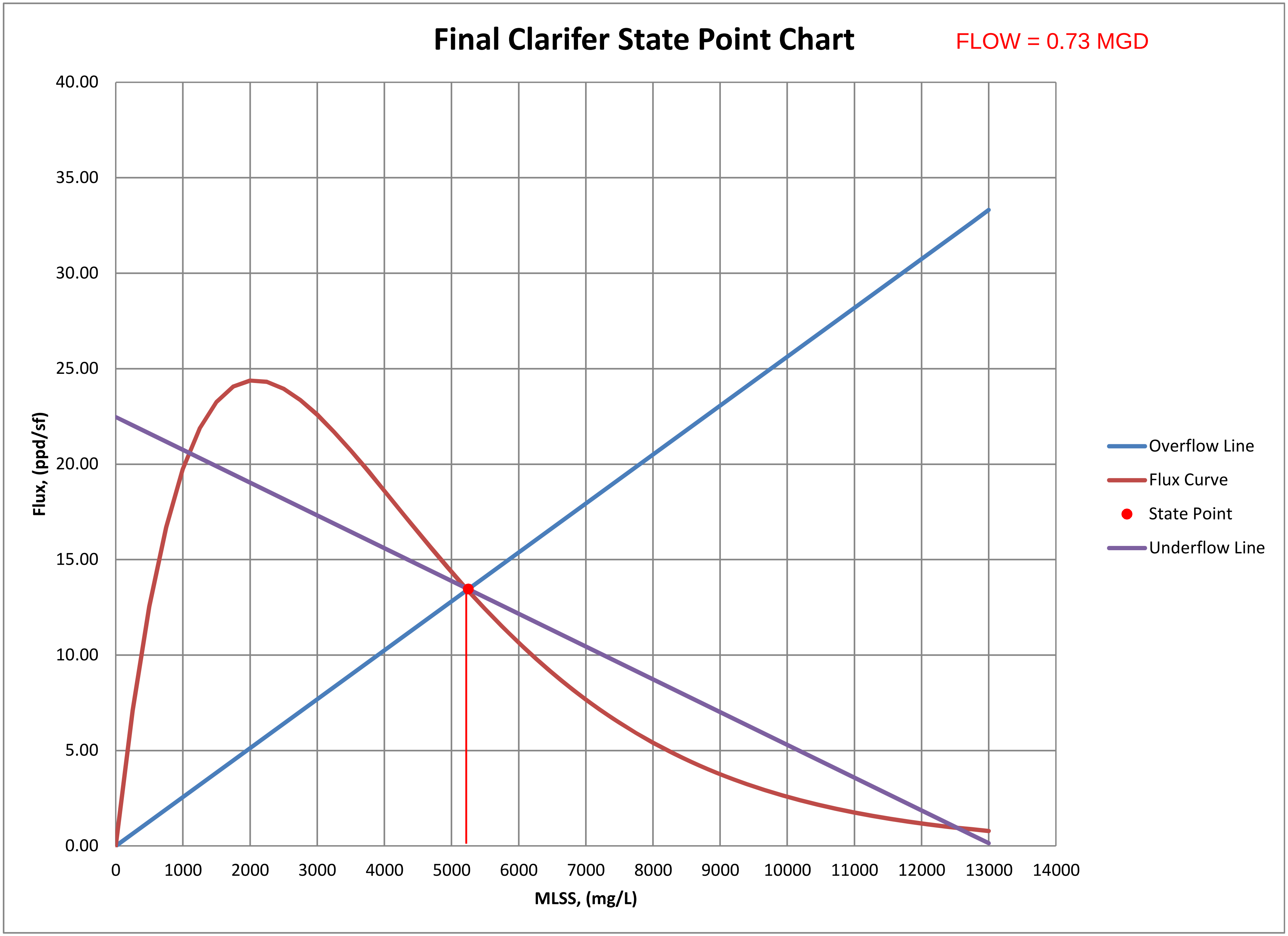

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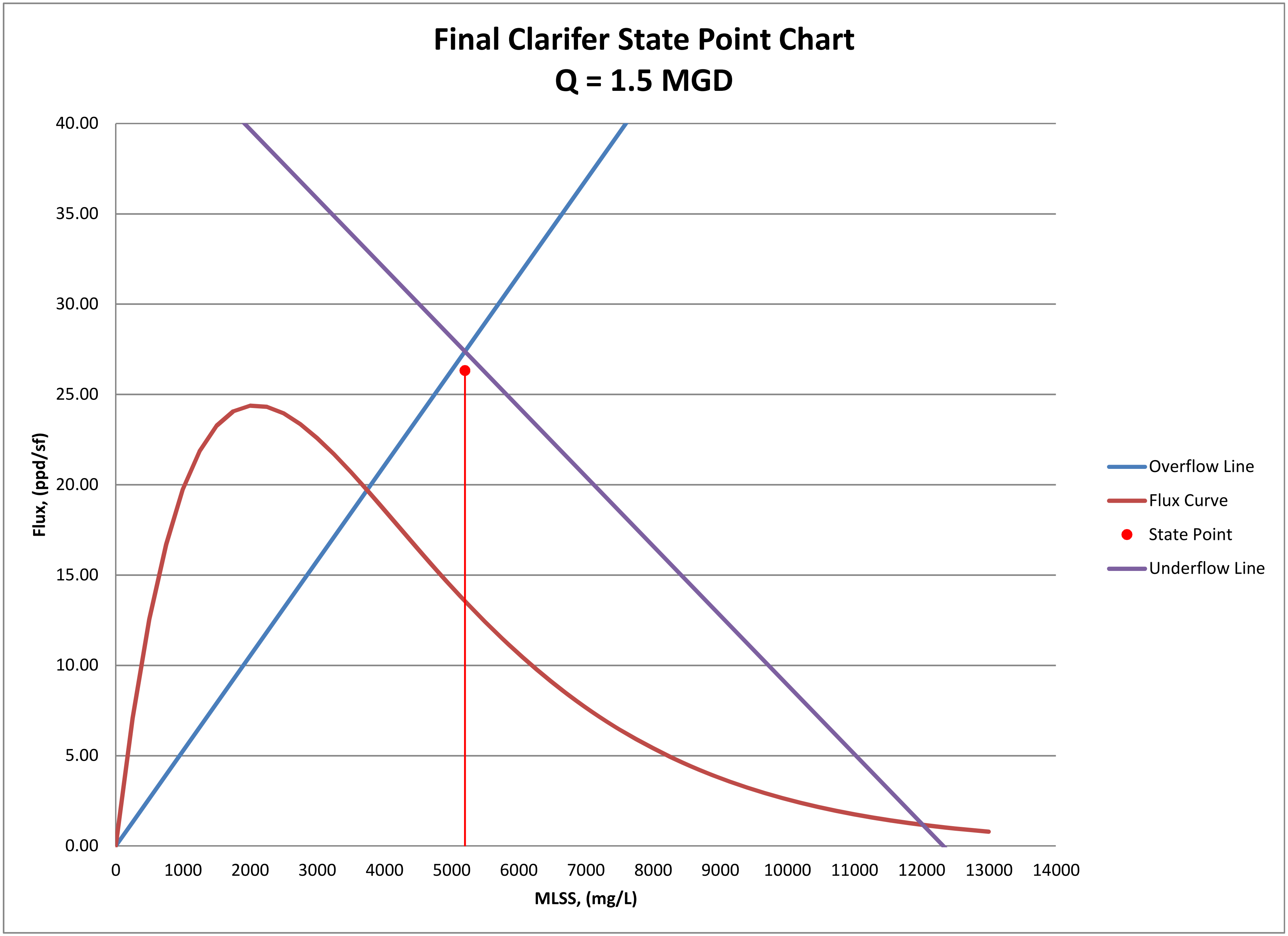
MLSS, (mg/L)
Overflow Line
Flux Curve
State Point
Underflow Line


Final Clarifer State Point Chart
Q = 1.5 MGD
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3000
4000
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7000
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9000
10000
11000
12000
13000
14000
MLSS, (mg/L)
Overflow Line
Flux Curve
State Point
Underflow Line