STAFF REPORT
FIELD OPERATIONS
MARCH 2018

TRANSMISSION & DISTRIBUTION

MAINTENANCE WORK.

- Crews have been taking care of leaks/maintenance issues.
- 9 Mainline leaks were repaired this month.
- 229 Firefly's have been replaced this month.
- 1 service line was repaired/replaced this month.
- System wide flushing was completed this month.
- 1 hydrant was repaired and 5 heads were replaced this month.
- Leak detection started this month.

PFD/PID JOINT PIPELINE PROJECTS

- Use hydrant surcharge funds to upgrade substandard mains.
- The Country Club project is now complete.
- Crestview/Crestwood project is in beginning stages.

DEVELOPMENT PROJECTS

- None at this time.

CUSTOMER REIMBURSEMENT JOBS (by work order)

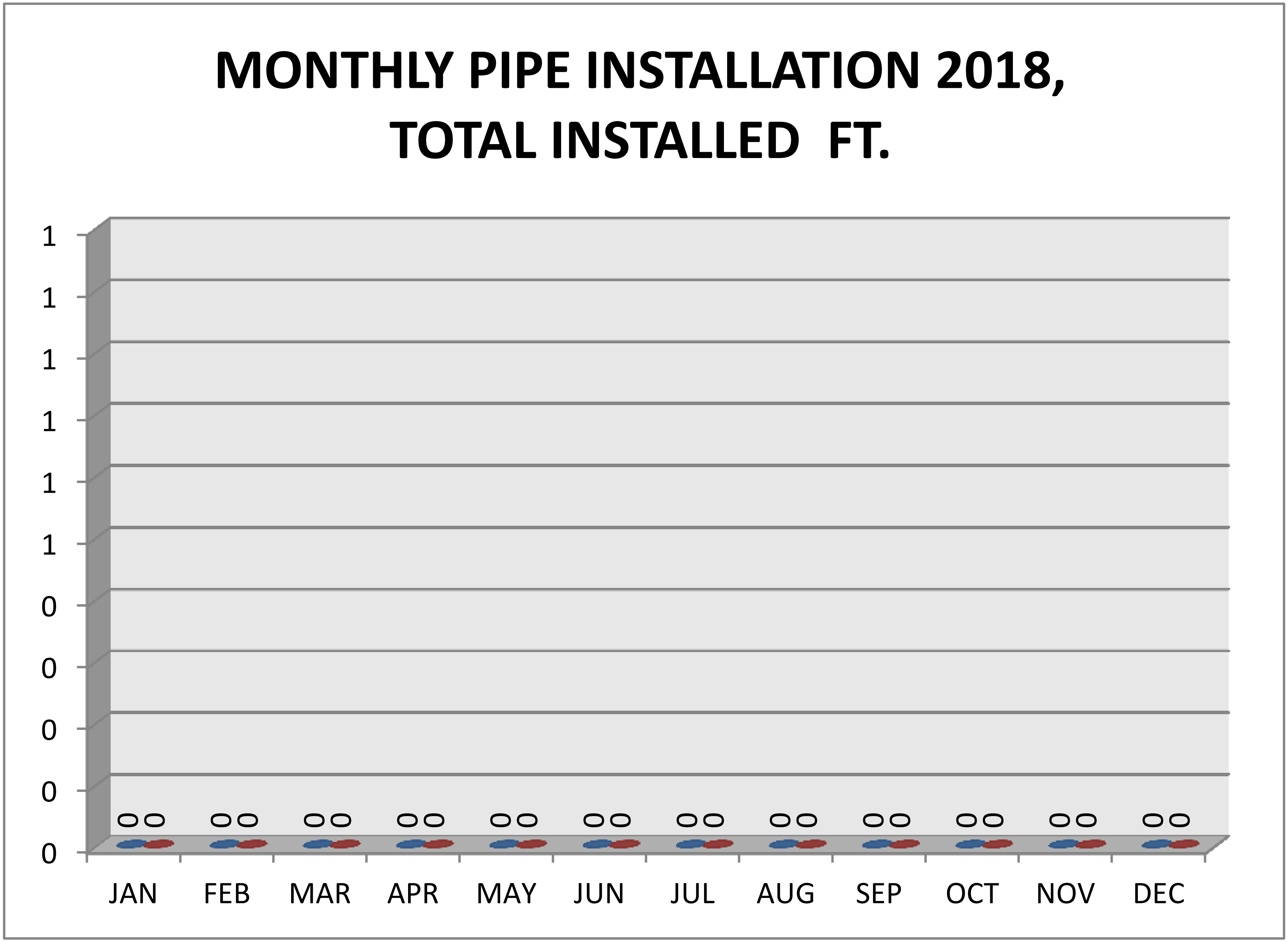
- New mod 35 install at 8693 Skyway.
- Down size from 2" to 1.5" at 6217 Mountain View.

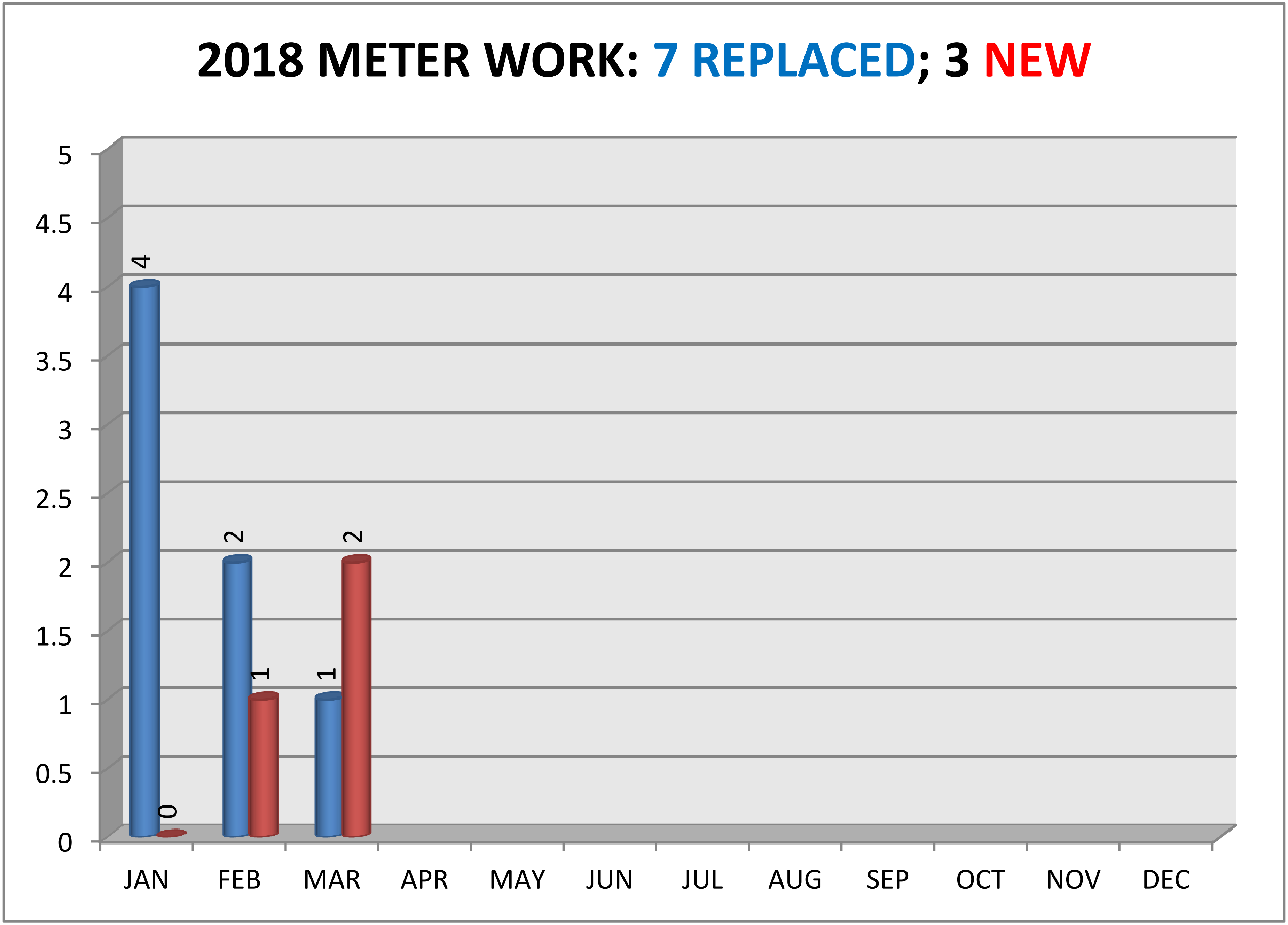
CRESTVIEW/CRESTWOOD PIPELINE PROJECT

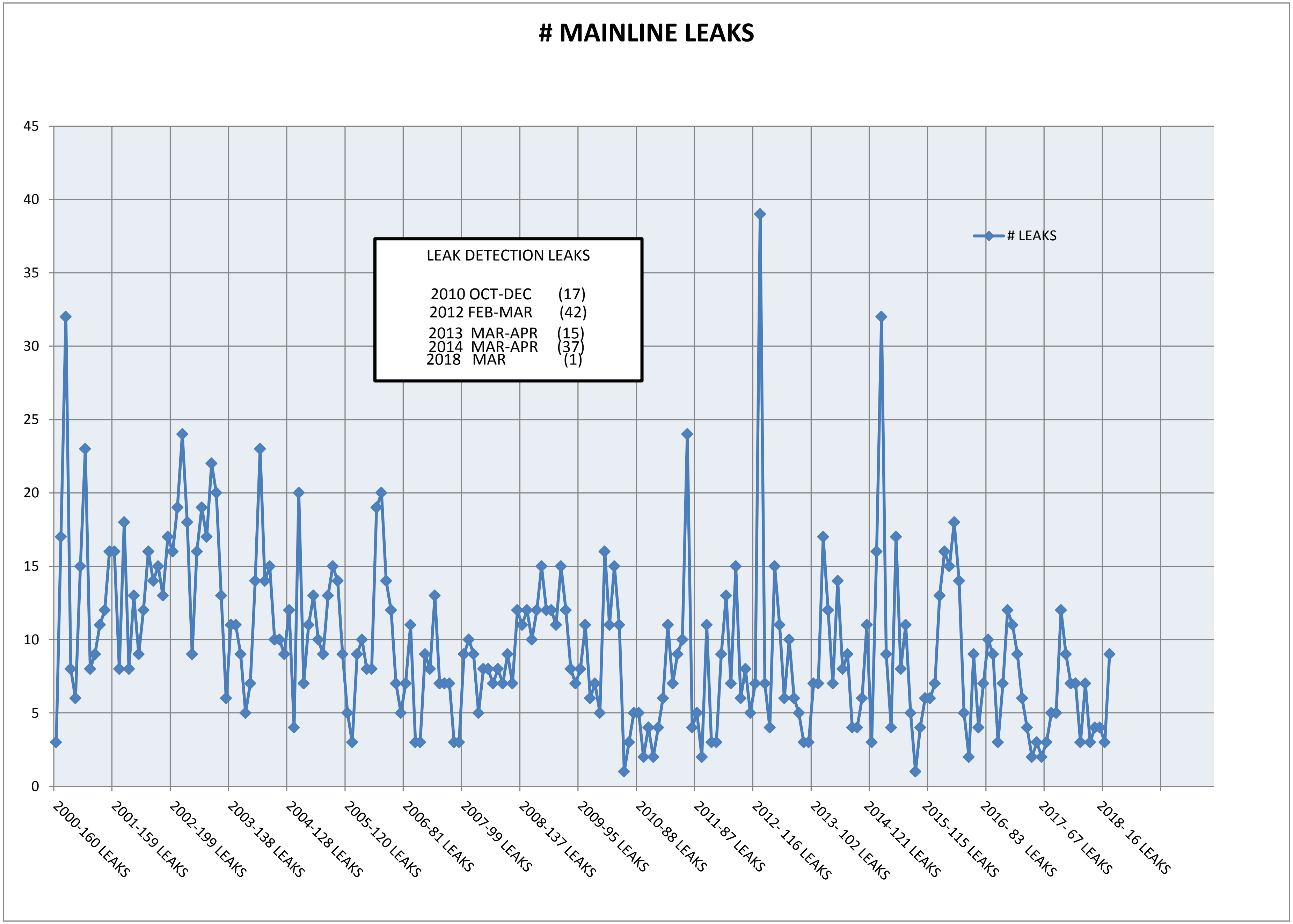
- Project is in beginning stages. Pot-hole work will start this month weather pending.

SUMMARY

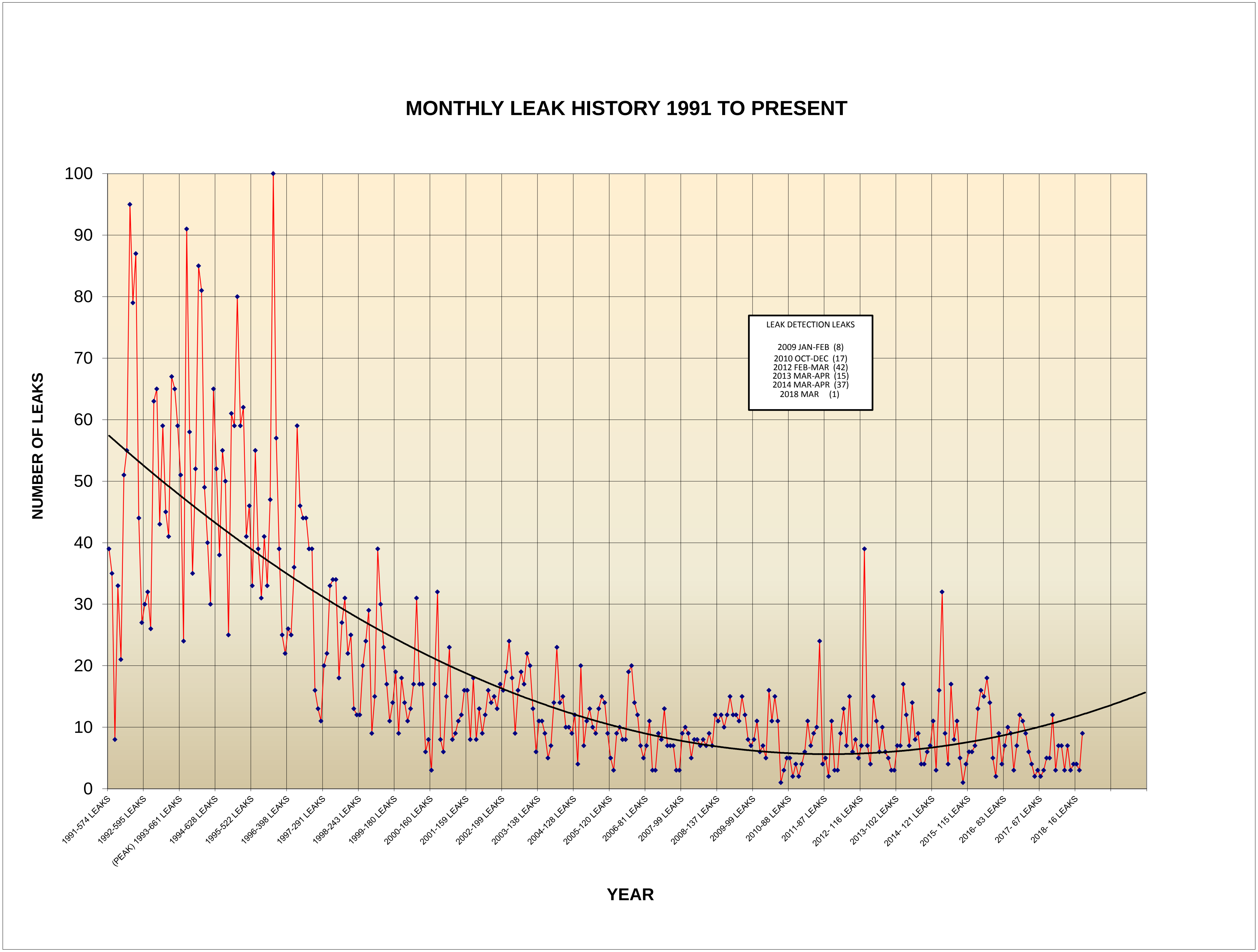
- The crews spent quite a bit of time making repairs around the District this month on blow-offs, control valves, and hydrants that were found during our flushing program. The problems were most often faulty or leaky control and or shut off valves.
- Our three new Utility Workers are working out very well. Two have tested for and received their Class A licenses and the third is scheduled this month to drive test with a DMV instructor. Pete Grout has done a great job preparing our drivers.
- We are assisting the meter shop with the firefly replacements. Two to four of our utility workers are teaming up with the change outs to insure our system is operating properly on a daily basis.
- We started our Leak Detection process late this month. Approximately twelve leaks have been found to date and our crews are currently making repairs at this moment. We will continue with this work as time allows and until the weather clears and will focus our efforts and work force on the Crestview/Crestwood project.
- We continue to take care of the daily needs of the District and maintenance issues providing excellent customer service.

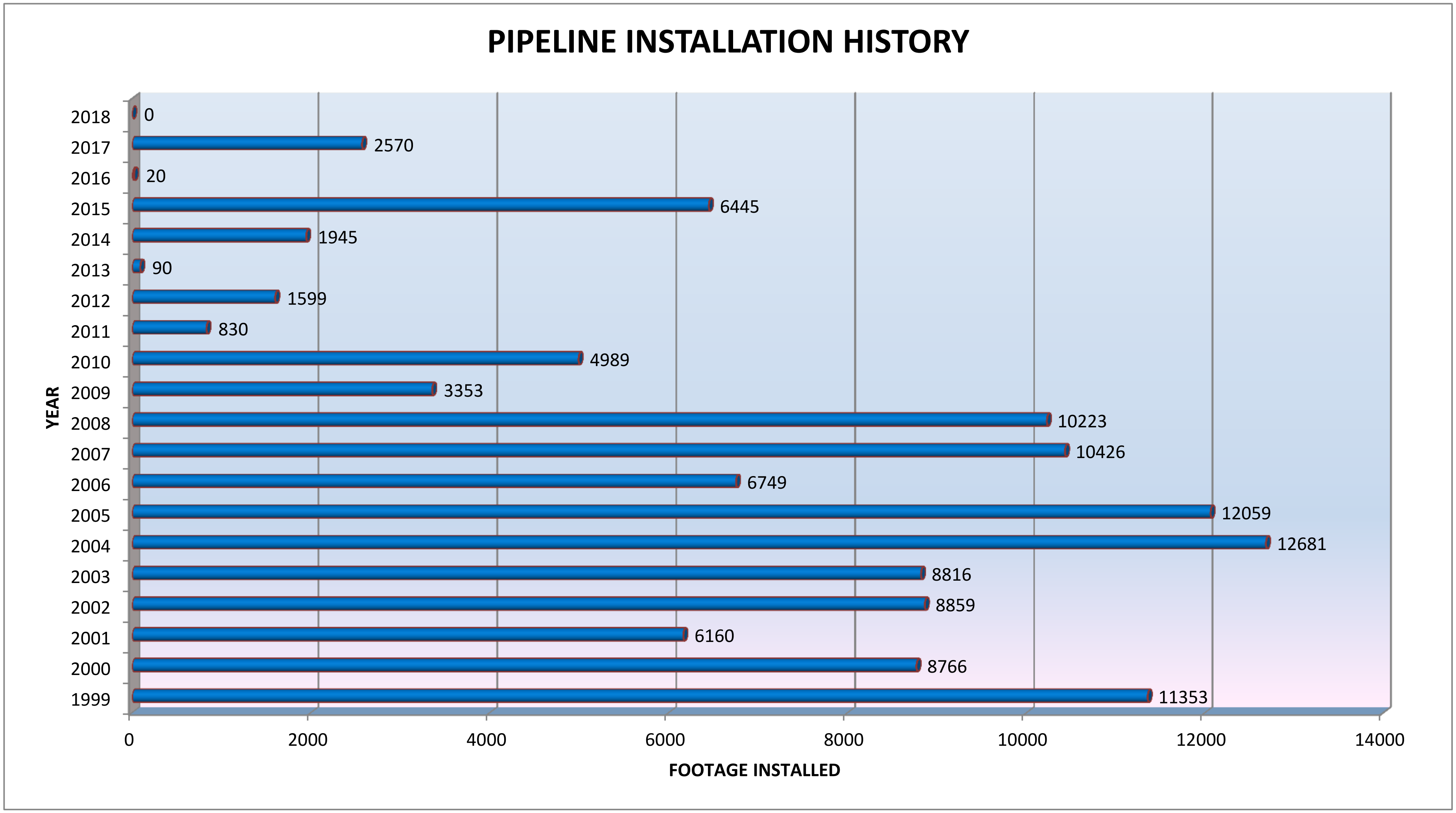

MONTHLY PIPE INSTALLATION 2018,
TOTAL INSTALLED FT.
1
1
1
1
1
1
0
0
0
0
0
0 0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

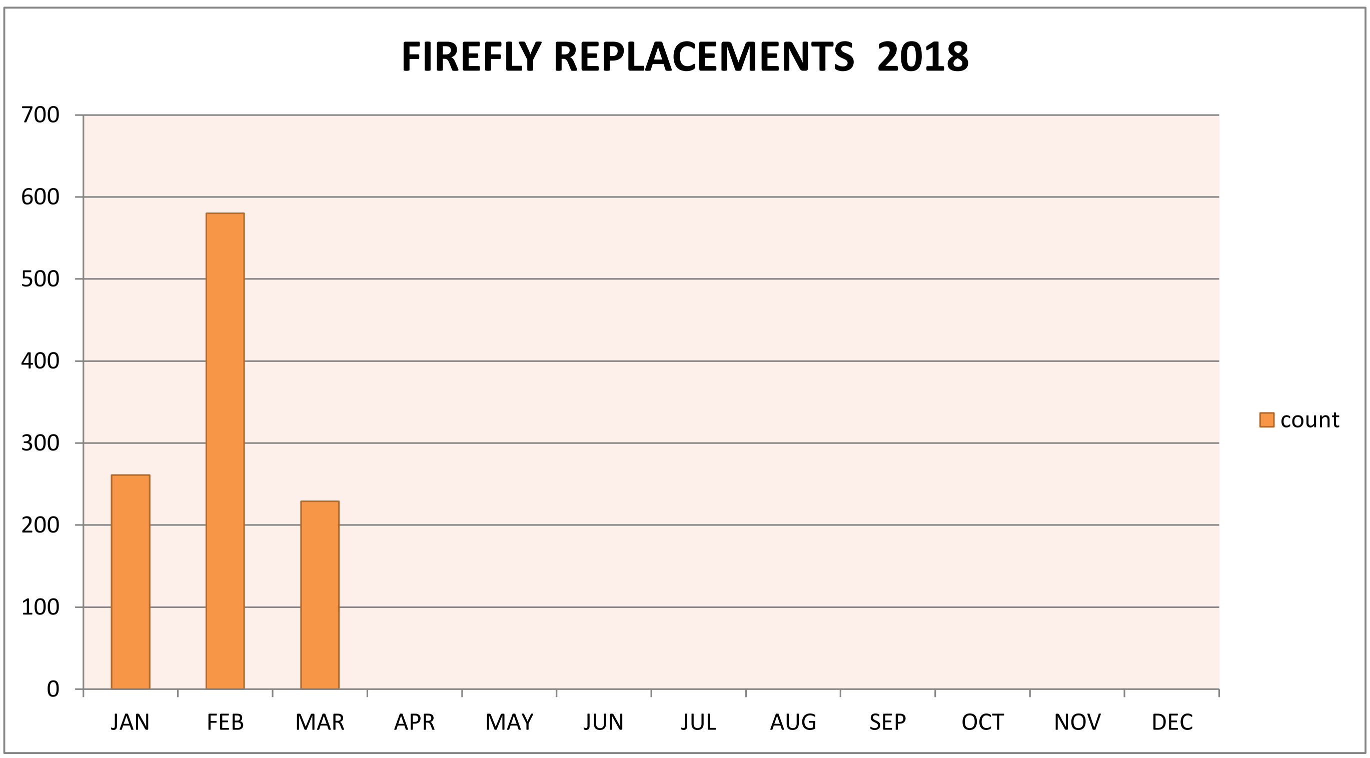

2018 METER WORK: 7 REPLACED; 3 NEW
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
4
0
2
1
1
2
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC



MAINLINE LEAKS
LEAKS
LEAK DETECTION LEAKS
2010 OCT-DEC (17)
2012 FEB-MAR (42)
2013 MAR-APR (15)
2014 MAR-APR (37)
2018 MAR (1)
0
5
10
15
20
25
30
35
40
45
2000-160 LEAKS
2001-159 LEAKS
2002-199 LEAKS
2003-138 LEAKS
2004-128 LEAKS
2005-120 LEAKS
2006-81 LEAKS
2007-99 LEAKS
2008-137 LEAKS
2009-95 LEAKS
2010-88 LEAKS
2011-87 LEAKS
2012- 116 LEAKS
2013- 102 LEAKS
2014-121 LEAKS
2015-115 LEAKS
2016- 83 LEAKS
2017- 67 LEAKS
2018- 16 LEAKS


MONTHLY LEAK HISTORY 1991 TO PRESENT
NUMBER OF LEAKS
100
90
80
70
60
50
40
30
20
10
0
LEAK DETECTION LEAKS
2009 JAN-FEB (8)
2010 OCT-DEC (17)
2012 FEB-MAR (42)
2013 MAR-APR (15)
2014 MAR-APR (37)
2018 MAR (1)
1991-574 LEAKS
1992-595 LEAKS
(PEAK) 1993-661 LEAKS
1994-628 LEAKS
1995-522 LEAKS
1996-398 LEAKS
1997-291 LEAKS
1998-243 LEAKS
1999-180 LEAKS
2000-160 LEAKS
2001-159 LEAKS
2002-199 LEAKS
2003-138 LEAKS
2004-128 LEAKS
2005-120 LEAKS
2006-81 LEAKS
2007-99 LEAKS
2008-137 LEAKS
2009-99 LEAKS
2010-88 LEAKS
2011-87 LEAKS
2012- 116 LEAKS
2013-102 LEAKS
2014- 121 LEAKS
2015- 115 LEAKS
2016- 83 LEAKS
2017- 67 LEAKS
2018- 16 LEAKS
YEAR


PIPELINE INSTALLATION HISTORY
YEAR
2018
2017
2016
2015
2014
2013
2012
2011
2010
2009
2008
2007
2006
2005
2004
2003
2002
2001
2000
1999
0
2570
20
6445
1945
90
1599
830
4989
3353
10223
10426
6749
12059
12681
8816
8859
6160
8766
11353
0
2000
4000
6000
8000
10000
12000
14000
FOOTAGE INSTALLED



FIREFLY REPLACEMENTS 2018
700
600
500
400
300
200
100
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
count

TREATMENT - STAFF REPORT
March 2018

SUPPLY & QUALITY:

(See Attached Graphs)	March 2018	March 2017	March 6 yr. Avg.
Monthly Production (Million Gallons - MG)	67.3	60.5	80.2

	Range	Average
Plant Production (MGD)	1.8 – 2.5	2.6
Raw Water Turbidity (NTU)	0.42 – 3.45	1.50
Treated Water Turbidity (NTU)	0.04 – 0.05	0.04
Treated Water Chlorine (ppm)	0.90 – 1.34	1.06

WATER TREATMENT:

- **Plant Production and Water Quality**: Average production decreased to **2.2 MGD** from **2.6 MGD** last month. Paradise Lake was the primary source of raw water for treatment during the month. The raw water turbidity increased during the month due to the recent rains.
- **Monthly Residential Water Conservation**: **34%** reduction comparing production in March 2018 – **67.3 MG** to March 2013 – **101.6 MG**.
- **Emergency Response Planning:** Staff is working on the Exercise After-Action list of items, including digitizing the ERP into a searchable format; updating contact information; some are attending SEMS/ICS online training; and contacting beverage distributing companies and the County, and confirming the availability of large quantities of delivered emergency bottled water to the District.
- **Plant & Distribution Operations**: 1. Corrpro Technician completed a condition assessment and training regarding the cathodic protection systems for the tanks; the systems are working properly; staff is working on getting an assessment proposal for the 42-inch transmission pipeline to town. 2. Following a power outage, filter 3B media was disrupted by a valve sequencing problem at restart. Staff inspected the underdrains and found no problems. Photo shows staff re-leveling the filter media. 3. SANCO polymer coagulant testing requested a five (5) gallon sample of Magalia raw water.
- **PGE Energy Conservation Assessment**: Waiting for treatment plant's evaluation of the lighting energy reduction retrofit with LED technology, with a potential rebate determination.
- **Reservoir "B" Replacement; A Zone Pipeline & Pump Station:** 1. Waterworks is moving forward with the 90% design phase scheduled for completion in April/May. 2. Easement acquisition is underway for the A Zone Pipeline along Skyway. 3. $12M SRF Construction Loan Application preparation is nearing completion. 4. Environmental documents are nearing completion.
- **Rehabilitation of C Tank and Cathodic Protection**: Harper and District staff are working on Bid documents. Project bidding planned for mid-summer. District counsel is working on a new set of General Provisions specific to the District.
- **NPDES Permit Renewal Assistance**: Consultants and Staff finalized the mixing zone and dilution credit evaluation memo and transmitted it to the Regional Board in a letter requesting their review and a meeting. See attachments.
- **NPDES Permit for Discharge to Magalia Reservoir:** No violation this month.
- **Process Water Recycle Project**:
  RFP Pond Alternative Design: Consideration of solicitation depending on outcome of NPDES permit renewal.
  Engineering & CEQA: Work Suspended.
  SRF Construction Loan Application: Pending completion of design and CEQA; full design cost recovery is contingent on construction of a project.
  SRF Planning and Design Loan Application: Staff has almost completed the application's requirements
  CalOES/FEMA Grant: All information requests were provided to CalOES/FEMA, and waiting for favorable communication from CalOES.
- **Drinking Water and NPDES Reports:** Completed monthly sampling and reports.
- Miscellaneous repairs to aging equipment and routine instrument calibrations.

RECREATION:

- **Lake Activities:** See attached Parking & Boating Permit Sales Chart & Table.
- **DBW North Lake Boat Launch Grant Project:** Waiting for DBW's response to District's concerns.
- **Kids Fishing Day Planning Committee:** Planning is in the final stages of completion.
- **Annual Trout Purchase:** Order was placed; delivery is planned for the beginning of the third week in April.

WATERSHED - SOURCE of SUPPLY: Monthly Rainfall = 16.95" during 19 days; Greatest Rain Day = 3.17"

Paradise Lake Levels (feet)	2018 Mar. 31 @ + 0.2	2018 Feb. 28 @ + 0.1	2017 Mar. 31 @ + 0.8'

- **Paradise Lake Water Levels:** Calendar Years 2013 – 2018. See Attachment.
- **CalFire Service Crews:** Pending notification to clear homeless camp areas.
- **Paradise Ridge Fire Safe Council:** Discussed homeless camp plans for shaded fuel removal.
- **Little Butte Creek Phase II Shaded Fuel Project:** Project is nearing completion.
- **Prescribed Burning for Shaded Fuel Maintenance:** Met with a new Calfire replacement person to coordinate information. Met with Calfire Forester in charge of planning, who indicated he has a concern with having an available forester to work on the documentation.

Re-leveling Filter 3C Media after Disruption:
Power Outage Caused an Automated Valve Operations Sequencing Problem

PARADISE IRRIGATION DISTRICT
6332 Clark Road, Paradise CA 95969 | Phone (530)877-4971 | Fax (530)876-0483

March 29, 2018

Jeremy Pagan, Senior Water Resource Control Engineer
California Regional Water Quality Control Board - Central Valley Region
364 Knollcrest Drive, Ste. 205
Redding, CA 96002

Subject: NPDES Permit Renewal - Mixing Zone and Dilution Credit Evaluation

Paradise Irrigation District (District) is required by Time Schedule Order No. R5-2010-0058-02 (TSO) to submit a Mixing Zone Study Work Plan by June 22, 2018 (6 months from the effective date of the Order). Regarding the permit renewal process, this is part of the District's plan for coming into compliance with final effluent limits for dichlorobromomethane (DCBM) and aluminum (Al).

The District conducted an evaluation of available dilution using the USEPA approved mixing zone model CORMIX, and determined that the dilution available in Magalia Reservoir is greater than the dilution needed to achieve effluent limitations with which the District can consistently comply. The assumptions used, analysis conducted and results of the evaluation are provided in the attached memorandum, *Paradise Irrigation District Mixing Zone and Dilution Credit Evaluation*.

This evaluation is being provided to meet the requirements of the TSO to determine a method of compliance. The District requests that you and your staff review the memorandum and provide any comments or requested additions or modifications. If the analysis is determined to meet the necessary requirements, the results can be used to develop final effluent limits for DCBM and Al in a renewed permit.

The District can prepare and submit a Report of Waste Discharge (ROWD) within 60 days of receiving approval of the Mixing Zone and Dilution Credit Evaluation to initiate the permit renewal process.

Once you have had a chance to review the evaluation memorandum, we would like to schedule a meeting to discuss the results and the permit renewal schedule and process. Please, feel free to contact me at 530-876-2067 if you need additional information or if I can be of assistance.

Sincerely,

Jim Passanisi

Jim Passanisi
Treatment Superintendent

Attachment: Paradise Irrigation District Mixing Zone and Dilution Credit Evaluation (March 2018)

Memorandum

LARRY WALKER ASSOCIATES

Airy Krich-Brinton

Steve Maricle

1480 Drew Ave, Suite 100

Davis, CA 95616

530.753.6400

530.753.7030 fax

stevem@lwa.com

DATE: March 27, 2018

TO: Jim Passanisi, Paradise Irrigation District

COPY: Sami Kader, WWE

Betsy Elzufon, LWA

Mitch Mysliwiec, LWA

SUBJECT: **Paradise Irrigation District Mixing Zone and Dilution Credit Evaluation**

Paradise Irrigation District (the District) discharges supernatant from their backwash waste ponds at the Paradise Irrigation District Water Treatment Plant to the Magalia Reservoir under a permit issued in 2010 (NO. R5-2010-0057, CA0083488). The initial permit had effluent limits for aluminum and dichlorobromomethane with which the District was unable to consistently comply. A Time Schedule Order (TSO) was issued with interim effluent limits and a compliance schedule in May 2010 (R5-2010-0058) and amended to extend the time schedule in May 2015 (R5-2015-0050). In August 2017, the District requested an additional two-year time extension of the TSO. A second revised TSO was issued in December 2017 (R5-2010-0058-02) providing a final compliance date of April 2020 and additional tasks associated with conducting a Mixing Zone Study.

The District's current permit (R5-2010-0057) contains effluent limits that do not consider dilution. This memo updates the effluent limits based on current criteria and evaluates the dilution credits the District needs for compliance. The effluent limits update uses data collected from two monitoring locations at the District's treatment ponds, EFF-001 and EFF-002. This memo also presents an analysis of available dilution using a mixing zone model based on the current discharge point, which includes effluent from both EFF-001 and EFF-002, and a hypothetical scenario where effluent is discharged through a diffuser.

CURRENT LIMITS AND NO DILUTION

Final effluent limits for aluminum and dichlorobromomethane (DCBM) were recalculated following the 2010 permit method, but using the updated coefficient of variation from the 2013-

2017 dataset collected at EFF-001 and EFF-002 and no dilution. The calculations and results are shown in Table 1. The DCBM effluent limits are calculated based on the California Toxics Rule (CTR) human health (HH) water quality (WQ) criteria of 0.56 µg/L. Both average monthly effluent limitations (AMEL) and maximum daily effluent limitations (MDEL) are derived for DCBM. A comparison of the 2010 permits limits, the TSO interim limits, and the calculated limits are shown in Table 2.

The aluminum effluent limits in the 2010 permit were calculated from a USEPA National chronic criterion of 87 µg/L, which is not applicable to Magalia reservoir, as discussed in the permit (provision VI.C.1.f page 20 and Fact Sheet page F-19). Current practice in the Central Valley is not to use the National criterion chronic criterion based on studies that indicate that it is not applicable to receiving waters with hardness levels greater than 10 mg/L as $CaCO_3$, as is the case in Magalia reservoir. Therefore, effluent limits for aluminum were calculated using the acute criterion of 750 µg/L and the secondary Maximum Contaminant Level (MCL) of 200 µg/L, and not the chronic criterion of 87 µg/L. Furthermore, in recent years it has become common practice to utilize average weekly effluent limitations (AWEL) for non-priority pollutants, such as aluminum.

Table 1. Calculation of Updated Effluent Limits without Dilution

	Aluminum, µg/L		DCBM, µg/L
	Acute	MCL	CTR HH
WQ Criteria	750	200	0.56
Background (max)	270	NA	NA
Background (average)	NA	68	0.56 or low level 0.06
Dilution Credit	0	0	0
Effluent Concentration Allowance (ECA)	750	200	0.56
Coefficient of Variation (CV)	0.414	0.414	0.428
ECA Multiplier	0.429	-	-
Long Term Average (LTA)	322	-	-
Monthly monitoring frequency	4	4	4
AMEL Multiplier (95th%)	1.37	1.37	1.39
AMEL	441	**200**	**0.56**
MDEL Multiplier (99th%)	2.33	2.33	2.39
MDEL HHmultiplier	-	1.70	1.72
MDEL	750	**340**	**0.97**
AWEL Multiplier	2.09	2.09	2.13
AWEL HHmultiplier	-	1.53	-
AWEL	673	305	-

Table 2. Summary of Permit Limits, Interim Limits and Updated Limits

	Aluminum, µg/L		DCBM, µg/L	
	AMEL	MDEL	AMEL	MDEL
2010 Permit limits	77.2	123	0.56	1.12
2010 TSO Interim Limits	790	790	3	3
Calculated updated limits, without dilution	200[a]	340	0.56	0.97[b]

[a] Using the MCL of 200 µg/L and not the chronic criterion of 87 µg/L.

[b] This decrease is caused by a lower coefficient of variation (0.43 instead of the default 0.6).

COMPLIANCE LEVELS AND DILUTION CREDITS

The effluent data were compared with the updated effluent limits calculated without dilution. The probabilities of compliance are shown in Table 3. The statistical distribution of the data characterizing the discharge was compared to the effluent limits to determine the percentage complying with the effluent limits presented in Table 2. The statistical levels of compliance are the 99.91st percentile (one exceedance in three years, with daily sampling) and the 97.22nd percentile (one exceedance in three years, with monthly average data from daily sampling). The percentiles were calculated using data collected at EFF-001 and EFF-002 between 2013-2017, using a lognormal distribution since the datasets are log-normally distributed. Without the consideration of dilution, the current discharge cannot meet the calculated effluent limitations.

Table 3. Probability of Compliance with Updated Limits

	Aluminum, µg/L		DCBM, µg/L	
	AMEL	MDEL	AMEL	MDEL
Calculated limits with no dilution	200	340	0.56	0.97
Probability of compliance	30.6%	84.8%	0.1%	3.9%

Dilution is available for the discharge and the dilution credits necessary to result in effluent limits above the current levels of the constituents in the discharge were calculated. Effluent limits for dichlorobromomethane were calculated considering the average ambient concentrations, because dichlorobromomethane is a human health carcinogen and the effect is from a long-term exposure. Similarly, the lowest applicable criterion for aluminum is a long-term average MCL; therefore, the ambient average is also appropriate for this criterion.

The SIP states that the ambient average concentration must be calculated after setting non-detected values equal to their reporting limits (or MDLs). In that case, the average ambient DCBM concentration (analyzed by the Purge and Trap method with a method detection level (MDL) of 0.5 µg/L) is 0.555 µg/L, leaving only 0.005 µg/L of assimilative capacity with the CTR human health criterion of 0.56 µg/L. This would not be sufficient to calculate a reasonable dilution to result in compliance. In addition, when analysis methods with higher MDLs are used, the likelihood of false detects increases. Methods with lower detection limits are available, and such a method and disregarding the Purge and Trap method results should be considered and discussed with the Regional Board staff. It is recommended that an ambient sample be analyzed using a low-level analytical method, which (if non-detected) would allow the use of the associated MDL, typically around 0.06 µg/L as the background concentration in the effluent limitation calculation. The low-level analysis MDL was used as the ambient concentration in the calculation, assuming the future receiving water samples will result in non-detect levels of DCBM.

The dilution calculations are shown in Table 4.

Table 4. Calculation of Dilution for Compliance

	Aluminum, µg/L		DCBM, µg/L
	Acute	MCL	CTR HH
WQ Criteria	750	200	0.56
Background (Max or Avg)	270	68	0.06 low level MDL[a]
Assimilative capacity?	Yes	Yes	Yes
AMEL necessary for compliance	441	462	4.74
LTA	322	-	-
ECA	750	462	4.74
Dilution, D	0.0	**2.0**	**8.3**
MDEL necessary for compliance	750	701	8.0
LTA	322	-	-
ECA	750	412	4.63
Daily dilution, D	0.0	1.6	8.1
Necessary dilution credits		**2.0**	**8.3**

[a] Assumes only the data collected using low-level detection limits would be considered in effluent limitation calculations and that all of the data would be non-detect.

A summary of the effluent limits calculated with the necessary dilutions is shown in Table 5.

Table 3. Summary of Effluent Limits for Compliance

	Dilution	AMEL	AWEL	MDEL	MEC
Aluminum, µg/L	2.0	441	673	750	570 EFF-001 790 EFF-002
DCBM, µg/L	8.3	4.7	-	8.1	4.8 EFF-001

Time series graphs of the effluent and receiving water data and limits are shown in Figures 1 through 4. It is unusual for trihalomethanes to be detected in ambient water, as they are a byproduct of chlorination within the treatment works. These ambient data were collected using the Volatile Organic Compounds Purge and Trap method with a method detection level (MDL) of 0.5 μg/L. It is expected that a low-level analytical method (with a MDL of 0.06 μg/L) would result in fewer or lower detected values (or none), allowing more assimilative capacity.

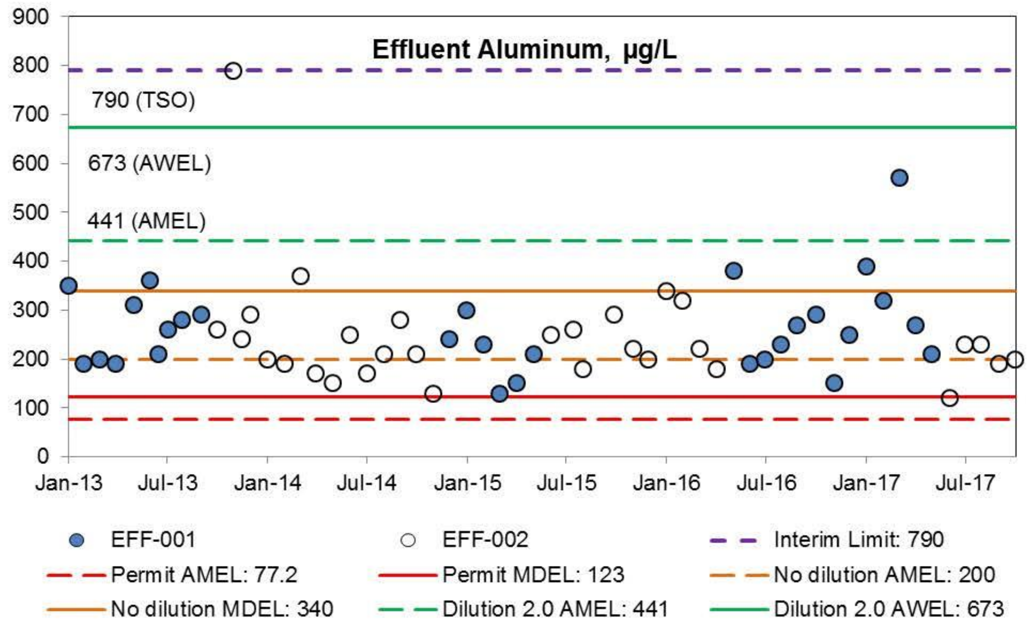


Figure 1. Time Series of Aluminum Effluent Water Results

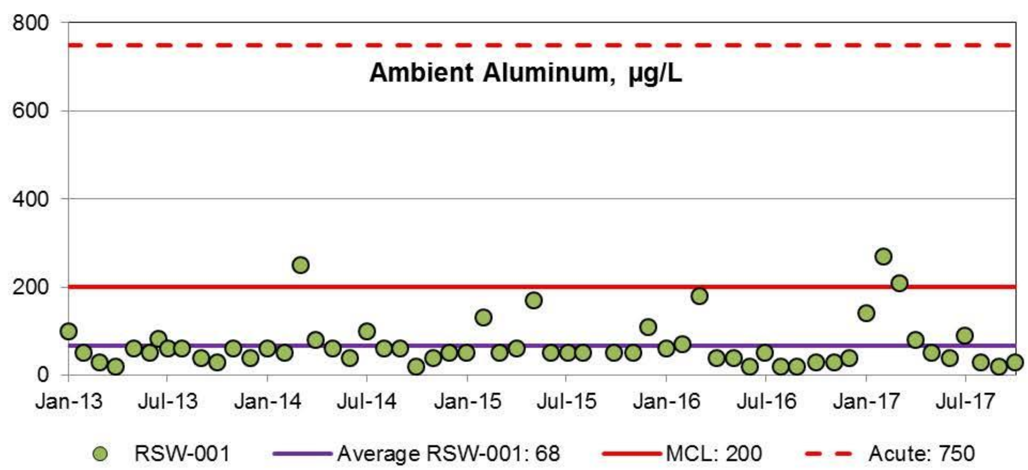


Figure 2. Time Series of Aluminum Ambient Water Results

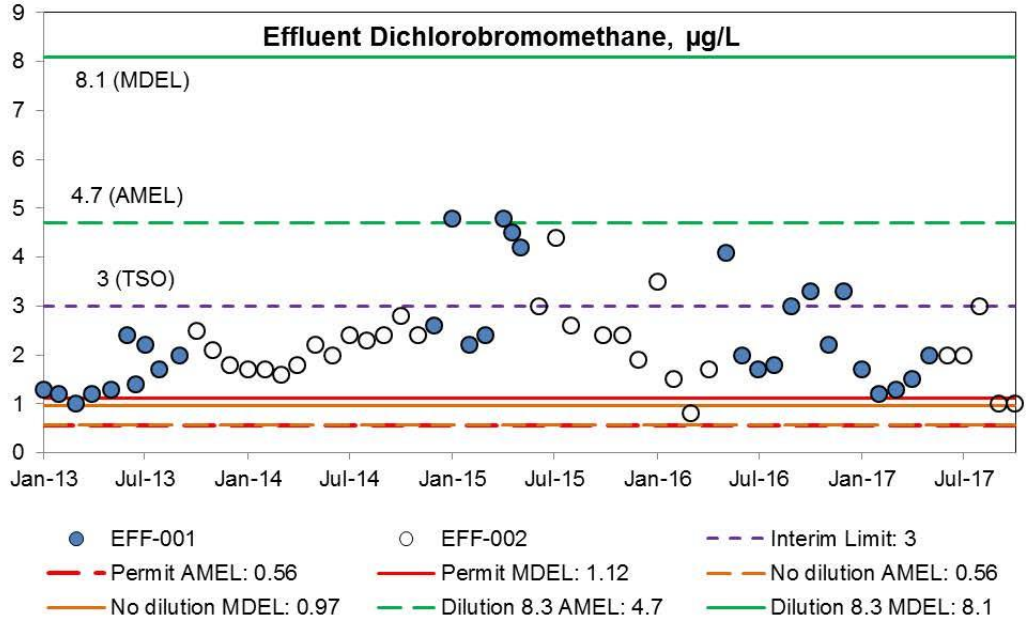


Figure 3. Time Series of Dichlorobromomethane Effluent Water Results

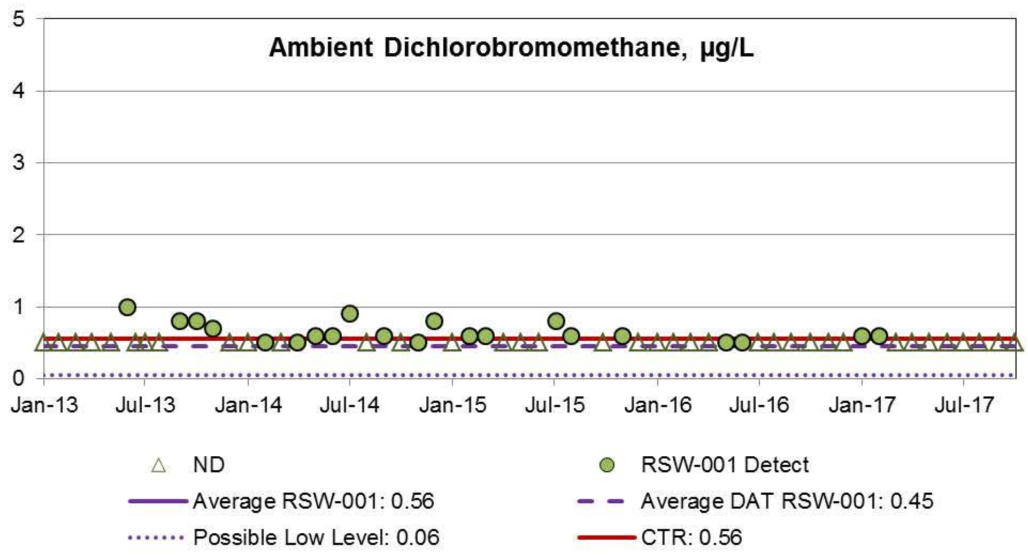


Figure 4. Time Series Graph of Dichlorobromomethane Ambient Water Results

MIXING ZONE MODEL

The USEPA approved mixing zone model CORMIX was used to determine the available dilution from the current discharge. Additionally, scenarios reflecting a modified discharge were modeled to assess the change in dilution. The modeled available dilution is compared to the required dilution as listed in Table 5 to assess the ability of the effluent to comply with effluent limitations. The southernmost portion of the Magalia Reservoir bordering the dam shown in Figure 5 is the area of interest of the model. The reservoir is 800 feet wide at the current discharge point and the intake is located 400 feet from the eastern bank. CORMIX was run with a discharge located at the current location, along the eastern bank, as well as a hypothetical diffuser, 200 feet from the eastern bank.

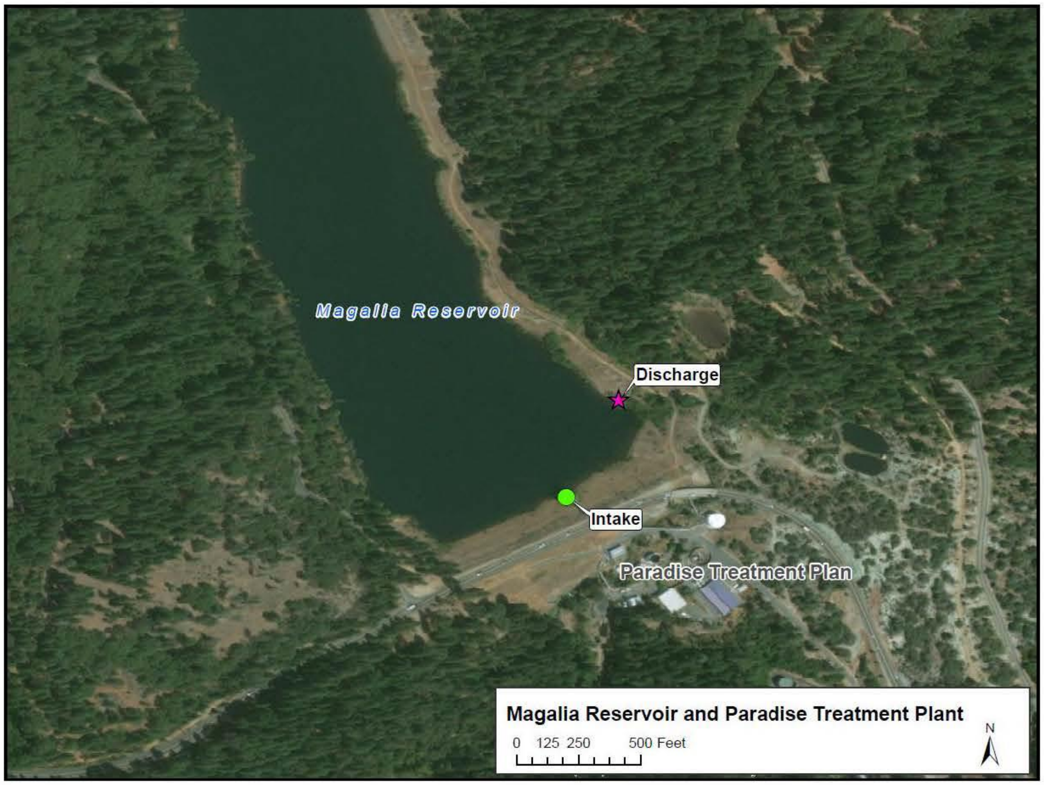


Figure 5. Overview of Magalia Reservoir and WWTP Discharge

Ambient Assumptions

The reservoir was modeled as an unbounded water body with the constant ambient assumptions listed in Table 6. Additional explanation of the modeling assumptions are provided below.

Steady state model framework

As CORMIX is a steady state model and the reservoir is fairly static receiving water, the simulations terminate after the initial mixing energy of the discharge entering the reservoir has dissipated. Further dispersion of the plume would occur after initial mixing, but is not modeled by CORMIX under the low ambient water velocities representative of Magalia Reservoir. Raw water is typically supplied to the water treatment plant via the Magalia bypass pipeline. Water is occasionally withdrawn from Magalia Reservoir for use in the treatment plant such as when clarifiers are being flushed or when the water from the bypass pipeline is difficult to coagulate. Water from Magalia reservoir seeps through the earthen dam forming the reservoir throughout the year. During the winter Magalia Reservoir water is often released downstream and spills infrequently under wet water years. Additionally, water may be withdrawn from the reservoir to provide downstream fish flows. Flow through the reservoir appears sufficient to prevent accumulation of constituents in the discharge as is evidenced by the measured aluminum concentrations in Figures 1 and 2 where the concentration in the reservoir maintains an average well below typical effluent measurements and the ambient concentrations are trending lower over time.

Assumptions associated with SIP Requirements

Section 1.4.2. of the State Implementation Plan (SIP)[1] describes the conditions under which dilution credits and mixing zones ar approved. To be consistent with the SIP, the scenarios modeled reflect critical low flow conditions, and do not consider “high flow” reservoir conditions (i.e., where the flow direction changes and water flows over the spillway which is located between the discharge and the water intake). In addition, consistent with SIP requirements, no reactions of the constituents within the mixing zone are considered within the model. Because DCBM will volatilize, this assumption results in the modeling being additionally conservative.

Constant depth and temperature of reservoir

The model assumed that the depth and temperature of the reservoir were constant across its entire width. Scenarios were modeled where the temperature of the reservoir is varied, however, in each scenario the temperature is assumed to be constant across the cross-section. The discharge enters the reservoir at the shoreline, and mixes through the water column as the plume moves outward. As the dilution is determined by the volume of water the discharge is entering, the ambient depth was conservatively chosen as 10 feet which occurs approximately 30 feet from the shoreline based on topographic maps. The depth 300 feet from shore approaches 45 feet deep. The more sophisticated representation of the reservoir with a shallow depth at the point of discharge and the bottom slope to reflect the reservoir being deeper further from shore does not run properly when a zero current is selected. Part of the investigation included the conservative limiting case of zero currents in the reservoir at the time of discharge. The CORMIX model properly runs the scenario of zero currents with a rectangular ambient cross section. Knowing the discharge would mix vertically near the shoreline and continue to mix vertically as the plume moved further from shore and the water depth increased, the water depth for the rectangular approximation was selected.

[1] SWRCB, 2005. *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California*. State Water Resources Control Board, California Environmental Protection Agency. 2005.

Variation of ambient velocity

To determine if it is an important parameter, multiple scenarios were run using three different ambient velocities. The ambient velocities are assumed to be low, since a majority of the outflow of the reservoir is from the intake. The flow rate of the intake is distributed across the width of the reservoir to determine the ambient velocity.

Buoyancy

The density difference between the discharge and the receiving water may affect the dilution. In freshwater, the temperature of the water is the major variable determining the water density. The reservoir and discharge holding ponds are open to the atmosphere and are assumed to be similar in temperature. To assess potential density effects, the temperature of the effluent and reservoir were varied in several scenarios.

Table 6. Model Assumptions for Ambient Water Body

Ambient	Assumptions
Ambient Depth	10 ft.
Ambient Temperature	5, 10, 15, 20, 25 °C
Wind Speed	0 ft/s
Manning's n	0.03
Velocity	0.0, 0.01, 0.001 ft/s

Scenario 1: Discharge from Bank

The first scenario describes the current conditions for the District's discharge. The effluent enters the east side of the reservoir as an open channel and perpendicular to the shore. The effluent was modeled using CORMIX3, the sub-model for surface discharges. The assumptions for the discharge portion of the model are in Table 7. Multiple instances of the model were run using three different effluent temperatures.

Table 7. Model Assumptions for Effluent Discharge

Effluent	Assumptions
Effluent Flow Rate	2 mgd
Discharge Outlet Width	2 ft
Discharge Outlet Depth	0.5 ft
Effluent Temperature(1)	5, 10, 15, 20, 25 °C

1 CORMIX3 cannot model scenarios where the effluent has a higher density than the ambient water body.

Model Results

The model was run with varying effluent temperatures and ambient velocities. Table 8 contains the results from the different model input scenarios. The "X" and "Y" pertain to the location within the ambient water body relative to the point of discharge where the dilution ratio (D) is met. "X" describes the distance traveled parallel to the shoreline and "Y" describes the distance perpendicular to the shoreline. Each scenario that yielded results contains the size of the mixing zone needed to achieve three dilution ratios. For each of the sub-scenarios, at the first distance from the discharge, the result is a dilution (D) of 2.0 to coincide with the calculated aluminum dilution credit. A second distance is a dilution (D) of 8.3, which is the dilution credit for DCBM. The last distance is a dilution (D) of 19, which is used to show that a distance closer to the drinking water intake will still be in compliance.

The discharge is 150 feet in the X direction and 350 feet in the Y direction away from the intake. All of the modeled dilution credits are well before the intake location. Scenario 4 is represented in Figure 6, to show how all of the plumes in the five scenarios met each of the dilution credits well before the drinking water intake. Generally, as the ambient velocity in the reservoir increases the size of the mixing zone decreases. Likewise, as the temperature of the water increases, the size of the mixing zone decreases. Scenario 1 results in the largest mixing zone of the scenarios evaluated.

Table 8. CORMIX Model Results

CORMIX Run	Ambient Velocity (ft/s)	Ambient Temp (°C)	Effluent Temp (°C)	Plume Direction-X (ft)	Plume Direction-Y (ft)	D[a] (dilution)
				0.0	24.1	2.0
Scenario 1[b]	0	5	5	0.0	78.2	8.3
				0.0	299.3	19.0
				0.0	22.9	2.0
Scenario 2	0.0	5	10	0.0	68.9	8.3
				0.0	143.8	19.0
				0.0	22.4	2.0
Scenario 3	0.0	15	20	0.0	64.4	8.3
				0.0	161.3	19.0
				0.0	22.1	2.0
Scenario 4	0.0	15	20	0.0	64.6	8.3
				0.0	175.3	19.0
				0.0	21.7	2.0
Scenario 5	0.0	20	25	0.0	65.3	8.3
				0.0	186.5	19.0
				0.1	24.3	2.0
Scenario 6	0.0002	20	20	0.2	78.9	8.3
				3.8	298.5	19.0
				0.07	24.1	2.0
Scenario 7	0.001	20	20	0.23	78.2	8.3
				2.66	297.3	19.0
				0.46	24.0	2.0
Scenario 8	0.01	20	20	5.45	73.5	8.3
				19.75	284.2	19.0
				0.1	24.3	2.0
Scenario 9	0.0002	5	5	0.2	78.9	8.3
				3.8	298.5	19.0
				0.1	24.5	2.0
Scenario 10	0.002	5	5	1.2	78.5	8.3
				12.9	290.8	19.0
				0.8	24.5	2.0
Scenario 11	0.02	5	5	10.5	66.8	8.3
				102.5	182.1	19.0

[a] CORMIX calculates dilution, S, as volume of water in plume/volume of effluent, whereas the SIP uses dilution, D, volume of ambient/volume of effluent. D = S-1. The CORMIX output are converted to D to facilitate comparisons with effluent limitation calculations.

[b] Dilution and plume sizes are identical for all cases where ambient and effluent temperatures are equal from 5 to 25 °C

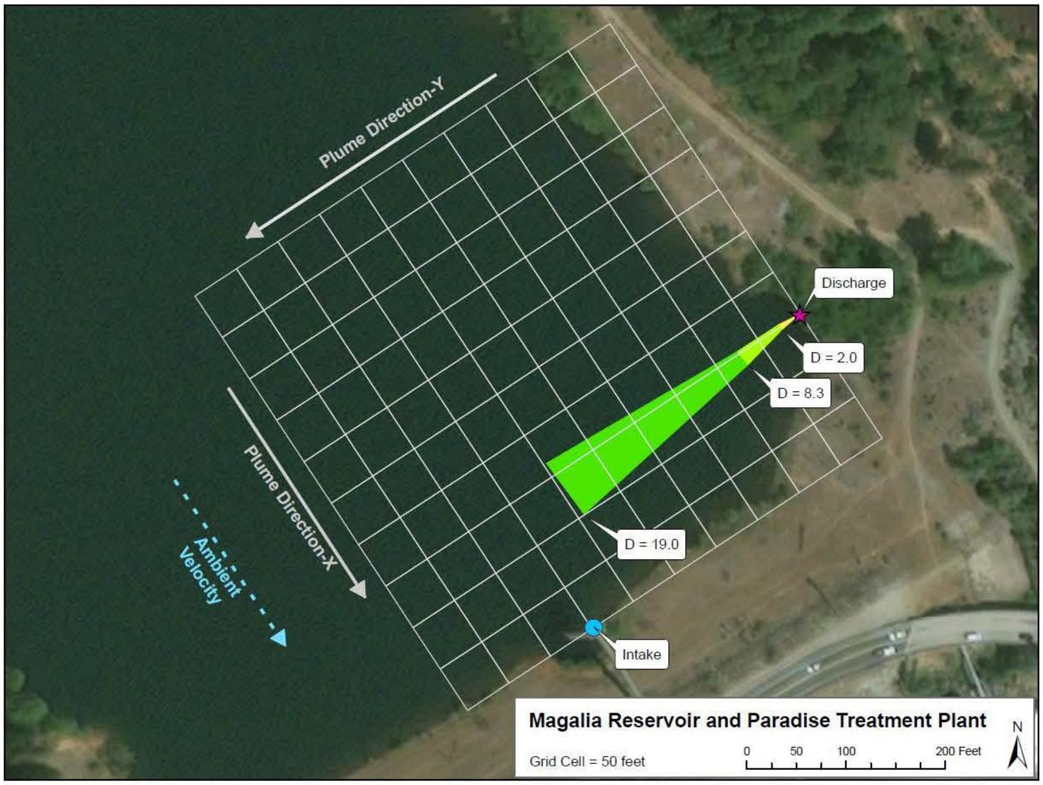


Figure 6. WWTP Discharge Location on Bank with Mixing Zone Scenario 4

Scenario 2: Discharge from Diffuser

The second scenario changes the discharge from an open channel to a diffuser and relocates it 200 feet upstream from the current discharge. This scenario was modeled using CORMIX2, which is for multiport discharges. The ambient assumptions remain unchanged from those in Table 7. The assumptions for the discharge portion of the model are in Table 9. Multiple instances of the model were run using three different effluent temperatures.

Table 9. Model Assumptions for Effluent Discharge

Effluent	Assumptions
Effluent Flow Rate	2 mgd
Diffuser Length	100 ft
Diffuser Distance from Shore	100 ft
Port Height	1 ft
Port Diameter	0.5 ft
Total Number of Ports	5
Vertical Angle of Diffuser Ports	15 deg
Horizontal Angle of Diffuser	90 deg
Effluent Temperature	15, 20, 25 °C

Model Results

The model was run with varying effluent temperatures and ambient velocities. Table 10 contains the results for the different model input scenarios. The "X" and "Y" pertain to the location within the ambient water body where the dilution ratio (D) is met. "X" describes the distance traveled parallel to the shoreline and "Y" describes the distance perpendicular to the shoreline. These are illustrated in Figure 7. Each scenario that yielded results contains distances traveled for three dilution ratios. The temperature of the effluent did not have an effect on the results. A well designed diffuser provides the energy for mixing through the effluent velocity through the ports. The mixing is sufficient to overcome the density difference produced by the different temperatures of effluent and receiving water. For each of the sub-scenarios, at the first distance from the diffuser, the result is a dilution (D) of 2.0 to coincide with the calculated aluminum dilution credit. A second distance is a dilution (D) of 8.3, which is the dilution credit for DCBM. The last distance is a dilution (D) of 19, which is used to show that a distance closer to the drinking water intake will still be in compliance.

The midpoint of the diffuser is 350 feet in the X direction and 150 feet in the Y direction away from the intake. All of the modeled dilution credits are well within this limit. Scenario 1 is represented in Figure 6, to show how all of the plumes in the seven scenarios met each of the dilution credits well before the drinking water intake.

Table 10. CORMIX Model Results

CORMIX Run	Ambient Velocity (ft/s)	Ambient Temp (°C)	Effluent Temp (°C)	Plume Direction-X (ft)	Plume Direction-Y (ft)	D[a] (dilution)
Scenario 1	0	20	20	0.4	0	2.0
				7.6	0	8.3
				39.7	0	19.0
Scenario 2	0.001	15	15	0.4	0	2.0
				7.5	0	8.3
				39.4	0	19.0
Scenario 3	0.001	20	20	0.4	0	2.0
				7.5	0	8.3
				39.4	0	19.0
Scenario 4	0.001	25	25	0.4	0	2.0
				7.5	0	8.3
				39.4	0	19.0
Scenario 5	0.01	15	15	0.4	0	2.0
				6.5	0	8.3
				34.4	0	19.0
Scenario 6	0.01	20	20	0.4	0	2.0
				6.5	0	8.3
				34.4	0	19.0
Scenario 7	0.01	25	25	0.4	0	2.0
				6.5	0	8.3
				34.4	0	19.0

[a] CORMIX calculates dilution, S, as volume of water in plume/volume of effluent, whereas the SIP uses dilution, D, volume of ambient/volume of effluent. D = S-1. The CORMIX output is converted to D to facilitate comparisons with effluent limitation calculations.

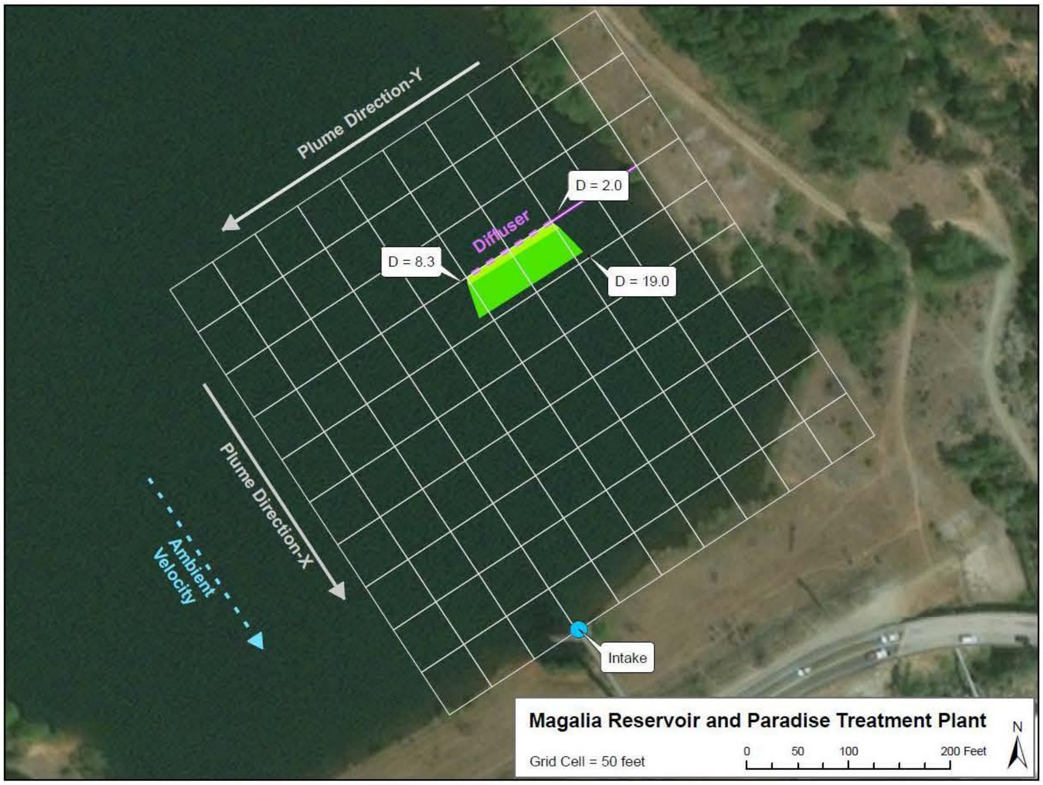


Figure 7. WWTP Discharge Using a Diffuser with Mixing Zone Scenario 1

CONSIDERATION OF THE REQUESTED MIXING ZONES

Section 1.4.2.2 of the SIP stipulates conditions necessary for the approval of mixing zones. The District requests the mixing zones necessary for aluminum and DCBM compliance for the current discharge. The requested mixing zones are displayed in Figure 6. The requested mixing zones are for the aluminum MCL D=2.0 approximately 24 feet from the point of discharge, and for the DCBM human health D=8.3 approximately 78 feet from the point of discharge. Ultimately, with the mixing zone for aluminum, the acute criterion becomes the most stringent and therefore the basis of the aluminum effluent limitations. The SIP requirements are discussed below.

A mixing zone shall not compromise the integrity of the entire water body. The proposed mixing zones are small relative to the area around the discharge. Additionally, the dilution continues to increase after the requested levels further reducing the constituent concentrations in the receiving water.

A mixing zone shall not cause acutely toxic conditions to aquatic life passing through the mixing zone. All acute criteria are met at the point of discharge. There is acute dilution available, and it could be demonstrated that an acute mixing zone, if small enough, would not cause acutely toxic conditions. However, none such mixing zone is requested at this time.

A mixing zone shall not restrict the passage of aquatic life. The requested mixing zones allow free movement of aquatic life around and under the plumes. Additionally, the mixing zones are not for aquatic life criteria, all such criteria are being met at the point of discharge. There are no restrictions to aquatic life with the requested mixing zones.

A mixing zone shall not adversely impact biologically sensitive or critical habitats… None of the requested mixing zones are for aquatic life criteria. There are no restrictions to aquatic life with the requested mixing zones.

A mixing zone shall not produce undesirable or nuisance aquatic life. Aluminum and DCBM are not biostimulatory, and would not affect the levels of undesirable or nuisance aquatic life.

A mixing zone shall not result in floating debris, oil, or scum. All constituents relating to floating debris, oil, or scum are controlled at the point of discharge and not affected by the requested mixing zones.

A mixing zone shall not produce objectionable color, odor, taste, or turbidity. The aluminum secondary MCL will be met at the edge of the requested mixing zone. The requested mixing zones do not affect the other parameters.

A mixing zone shall not cause nuisance. Granting of the mixing zones will not allow constituents that cause objectionable color, odor, taste, turbidity, floating debris, oil, or scum. Granting of the requested mixing zones will not affect the character of the discharge to sensory perceptions.

A mixing zone shall not dominate the receiving water body or overlap a mixing zone from different outfalls. As displayed on Figure 6, the mixing zones are small in relation to the reservoir.

A mixing zone shall not be allowed at or near any drinking water intake. As displayed on Figure 6, the mixing zones do not encompass the drinking water intake. Additionally, the ultimate dilution of D=19 is reached well before the plume reaches the drinking water intake.

As all the requested mixing zones meet the requirements in the SIP, they should be suitable for consideration in the Permit development.

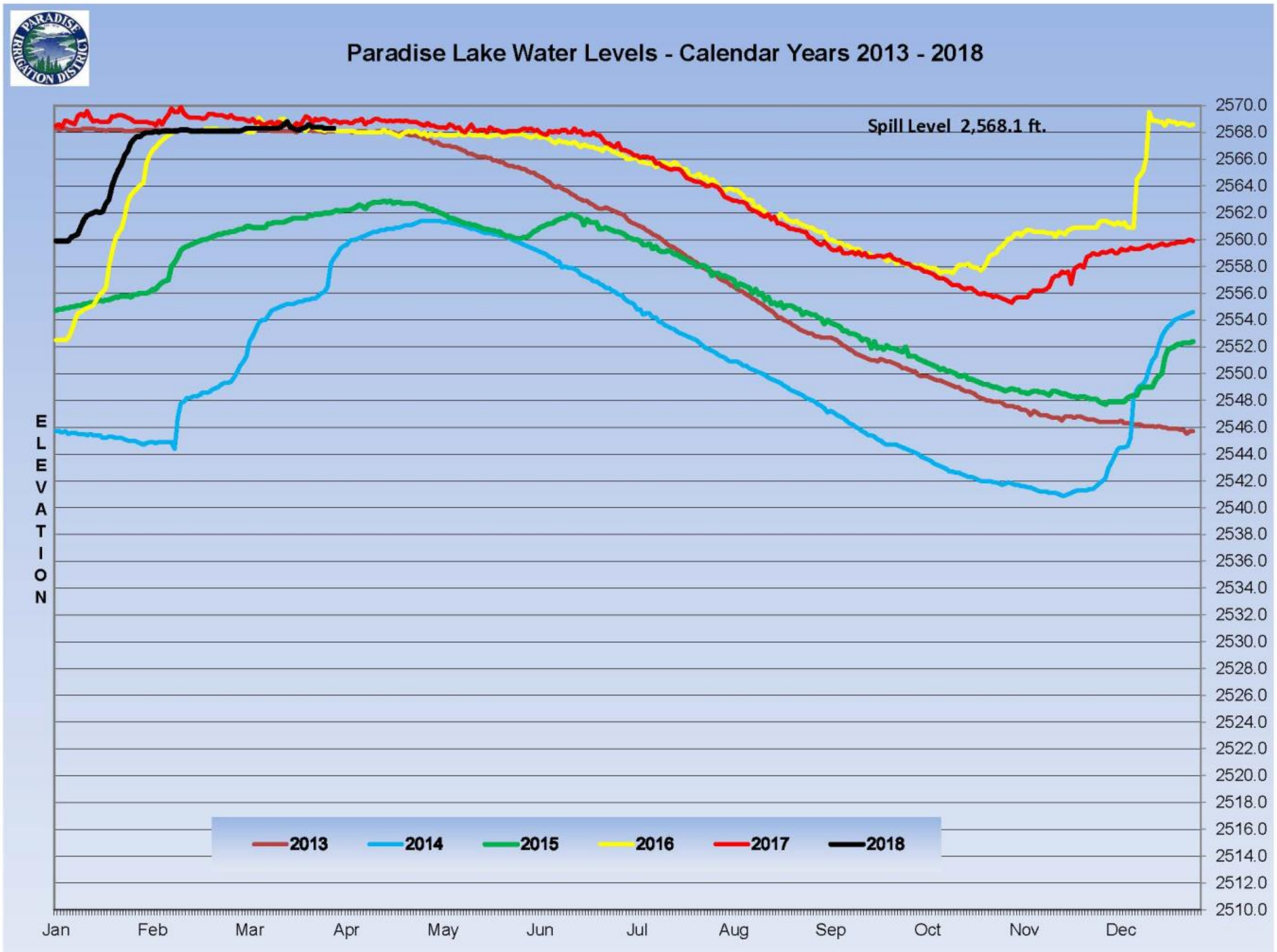
CONCLUSION AND RECOMMENDATION

Dilution is available for the District's open channel discharge to Magalia Reservoir. Dilution credits (D) of 2.0 and 8.3 are necessary to achieve effluent limitations for aluminum and DCBM, respectively, for future compliance of the discharge based on current measured levels of these constituents. Five different scenarios were modeled for varying conditions and for each scenario the mixing zone occurred before the drinking water intake. The scenarios with lower ambient velocity had larger mixing zones, but even then, the mixing zones would not reach the intake for the compliance dilutions (D) of 2.0 and 8.3. The requested mixing zones were evaluated against the conditions listed in Section 1.4.2.2 of the SIP and appear acceptable for use in Permit development. The discharge plume continues to dilute in the reservoir and reaches the ultimate D=19 well before the plume reaches the water intake.

A second scenario was modeled for a diffuser that would be located upstream from the current discharge. The model showed the scenario would be compliant for both aluminum and DCBM. Although, the modeled mixing zones were smaller for the scenario involving the diffuser, it is not necessary to be compliant. No additional benefit would be gained by installing a diffuser as the depth of the reservoir limits the ultimate dilution. Pursuing the installation of the diffuser is not necessary at the present time.

Because the ultimately available dilution is more than double the requested dilution and none of the criteria being addressed by the mixing zones are for aquatic life, it is our recommendation that a tracer study is not warranted at this time. It is recommended that the results of this modeling analysis be discussed with Regional Board staff and that they are sufficient to show compliance at the current effluent discharge location. A mixing zone tracer study is not necessary to demonstrate that adequate dilution is available.

Effluent limit and dilution credits needed for dichlorobromomethane were based on assumption that DCBM would not be detected in the receiving water using a low level analytical method. Therefore, it is recommended that analysis of the receiving water be conducted using these methods to confirm this evaluation.



Paradise Lake Water Levels - Calendar Years 2013 - 2018
Spill Level 2,568.1 ft.
ELEVATION
2570.0
2568.0
2566.0
2564.0
2562.0
2560.0
2558.0
2556.0
2554.0
2552.0
2550.0
2548.0
2546.0
2544.0
2542.0
2540.0
2538.0
2536.0
2534.0
2532.0
2530.0
2528.0
2526.0
2524.0
2522.0
2520.0
2518.0
2516.0
2514.0
2512.0
2510.0
2013
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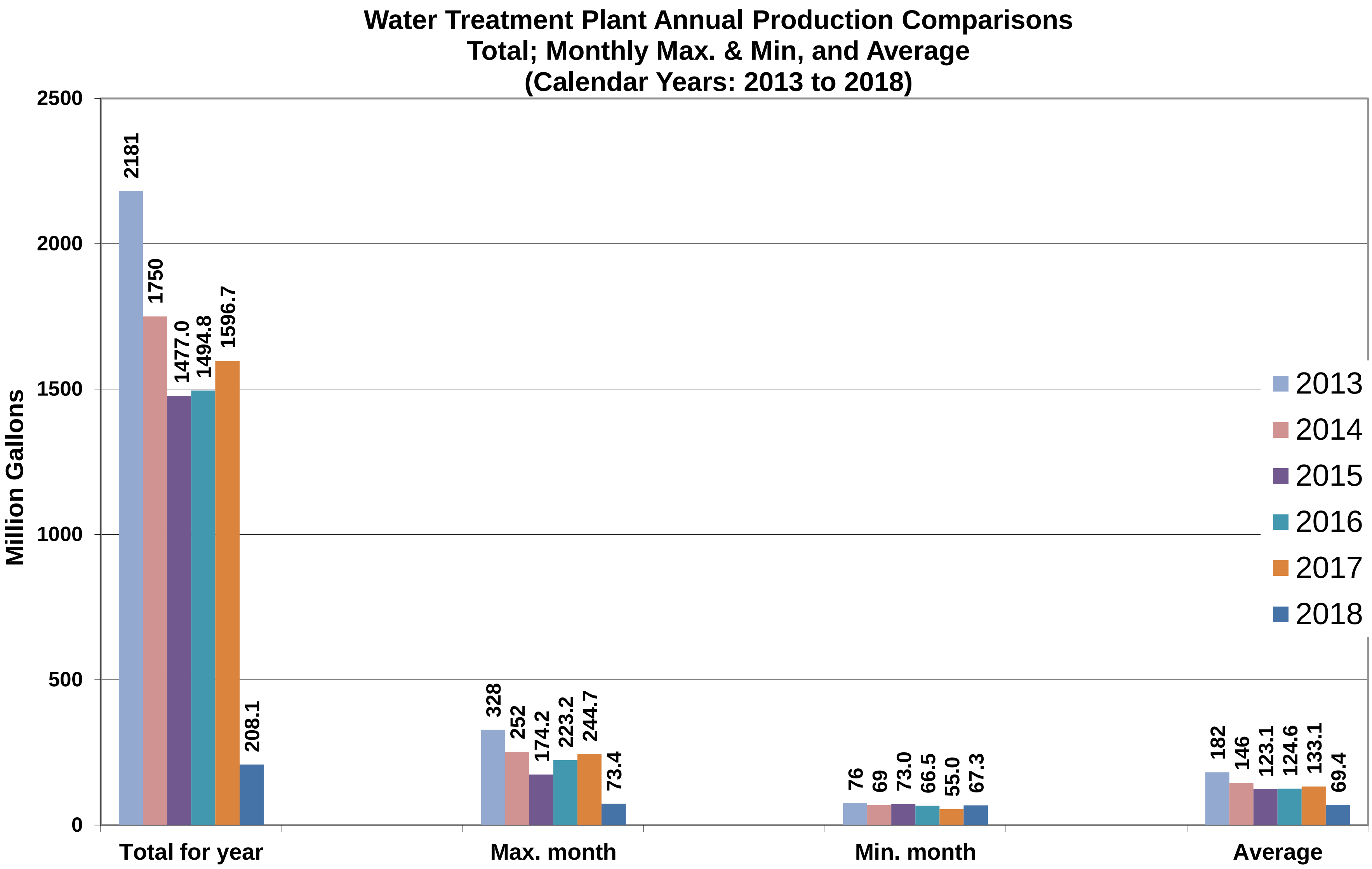
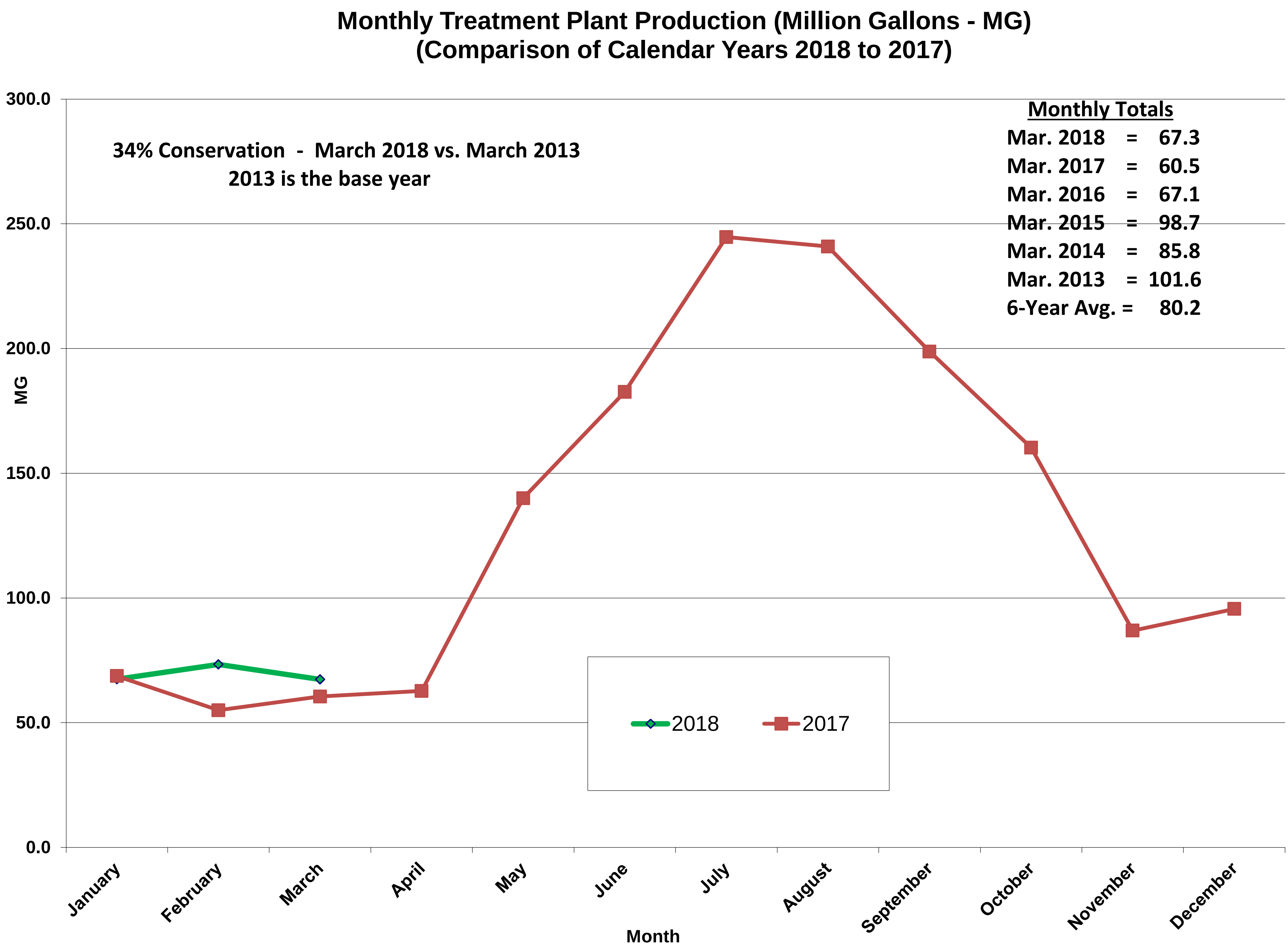
Nov
Dec


Water Treatment Plant Annual Production Comparisons
Total; Monthly Max. & Min, and Average
(Calendar Years: 2013 to 2018)
Million Gallons
2500
2000
1500
1000
500
0
2181
1750
1477.0
1494.8
1596.7
208.1
328
252
174.2
223.2
244.7
73.4
76
69
73.0
66.5
55.0
67.3
182
146
123.1
124.6
133.1
69.4
Total for year
Max. month
Min. month
Average
2013
2014
2015
2016
2017
2018

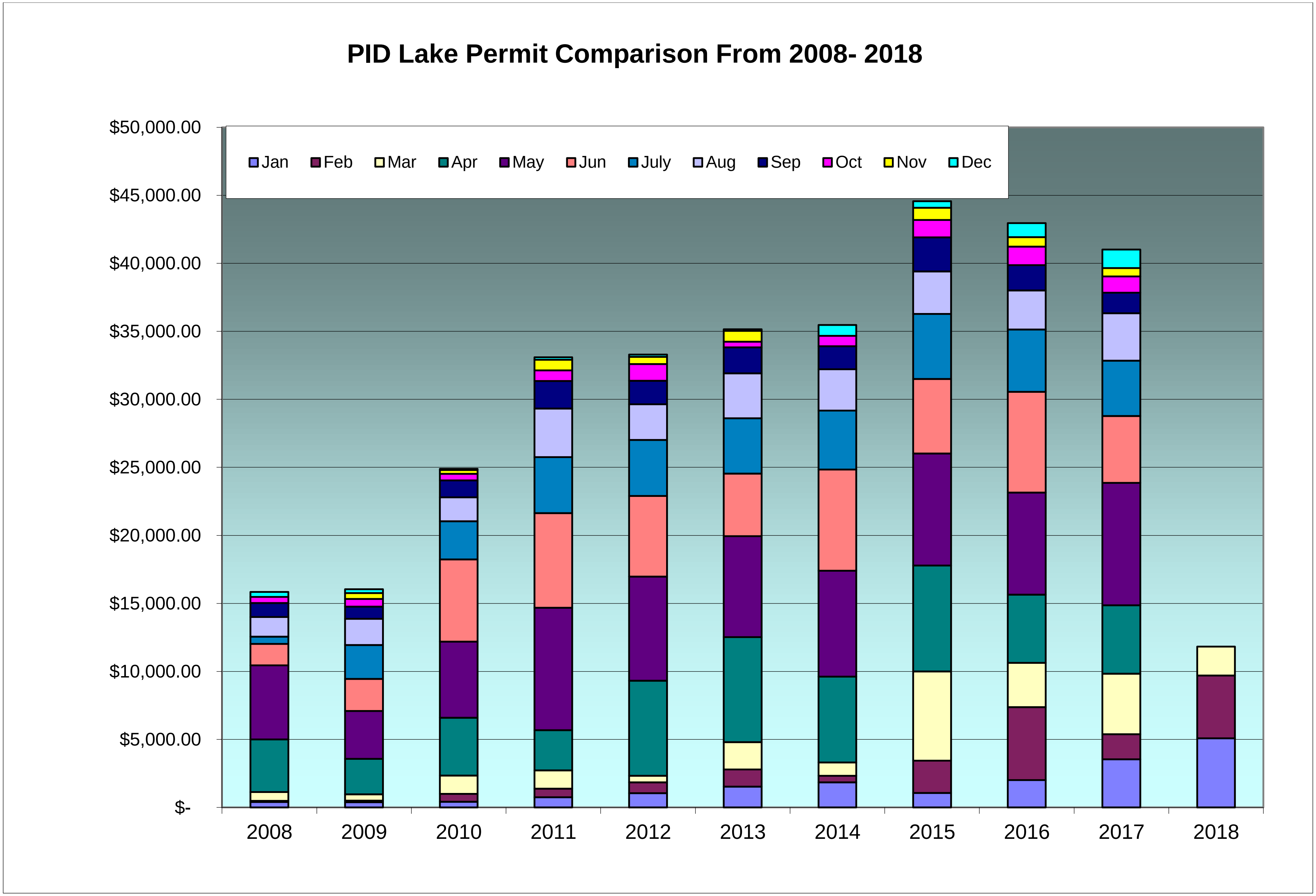

Monthly Treatment Plant Production (Million Gallons - MG)
(Comparison of Calendar Years 2018 to 2017)
34% Conservation - March 2018 vs. March 2013
2013 is the base year
Monthly Totals
Mar. 2018 = 67.3
Mar. 2017 = 60.5
Mar. 2016 = 67.1
Mar. 2015 = 98.7
Mar. 2014 = 85.8
Mar. 2013 = 101.6
6-Year Avg. = 80.2
MG
300.0
250.0
200.0
150.0
100.0
50.0
0.0
January
February
March
April
May
June
July
August
September
October
November
December
Month
2018
2017

Water Treatment Plant Annual Production Figures and 5 Year Averages (2013 - 2018)
(Million Gallons)

Note: 2013 is the conservation comparison/base year

	Years														6-Year Average
	2005	2006	2007	2008	2009	2010	2011	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2013-2018**
January	113.2	113.7	130.8	116.1	105	91.4	91.6	105.2	82.5	111.2	82.3	71.1	68.7	67.4	**80.5**
February	101	104.7	106.9	112.3	88.4	79.2	85.2	85.3	76.1	68.8	73.0	66.5	55.0	73.4	**68.8**
March	129.3	110.7	150.2	147	108.9	100.2	84.6	79.3	101.6	85.8	98.7	67.1	60.5	67.3	**80.2**
April	132	112.5	172	205.9	170.5	96.9	99.8	94.2	145.1	107.7	106.7	84.5	62.7		
May	181.5	243.9	259.3	275	221	140.8	146	214.7	241.6	175.6	136.5	119.6	140.0		
June	250.7	328.5	336.4	321.6	256.7	239.7	183.3	262.7	276.2	230.3	148.1	169.7	182.6		
July	393.2	428.9	384.6	360.5	350.6	344.4	283.3	325.5	327.5	252.1	174.2	207.6	244.7		
August	412.3	391.5	379.6	363.8	338.6	332.4	307.6	331.2	309.9	220.7	171.8	223.2	240.9		
September	312.1	338.4	295.3	317.5	281.4	271.3	280.3	283.7	230.1	196.3	157.9	191.0	198.8		
October	234.9	253.2	156.9	218.1	178.1	185.1	152.2	198.7	170.7	137.3	138.3	115.2	160.3		
November	117.8	128.7	142	124.7	114.2	95.8	107.3	91.7	117.4	85.4	95.6	90.6	86.9		
December	114.3	112.9	115.5	120.7	101.7	105.3	105.1	81.2	102.3	78.5	93.9	88.7	95.6		

	2005	2006	2007	2008	2009	2010	2011	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**5 Year Avg.**
Total for year	2492	2668	2630	2683	2315	2083	1926	2153	2181	1750	1477.0	1494.8	1596.7	208.1	229.5
Max. month	412	429	385	364	351	344	308	331	328	252	174.2	223.2	244.7	73.4	80.5
Min. month	101	105	107	112	88	79	85	79	76	69	73.0	66.5	55.0	67.3	68.8
Average	208	222	219	224	193	174	161	179	182	146	123.1	124.6	133.1	69.4	76.5


PID Lake Permit Comparison From 2008- 2018
Jan
Feb
Mar
Apr
May
Jun
July
Aug
Sep
Oct
Nov
Dec
$50,000.00
$45,000.00
$40,000.00
$35,000.00
$30,000.00
$25,000.00
$20,000.00
$15,000.00
$10,000.00
$5,000.00
$-
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018

Paradise Irrigation District

Lake Permit Sales

January -December 2018

	Recreation				Boating				Total
	Annual		Daily		Season		Daily		
January	62	$ 935.00	269	$ 808.30	71	$ 2,840.00	50	$ 500.00	$ 5,083.30
February	69	$ 1,035.00	206	$ 619.00	65	$ 2,580.00	38	$ 380.00	$ 4,614.00
March	22	$ 335.00	198	$ 594.16	26	$ 1,020.00	18	$ 180.00	$ 2,129.16
April	0		0		0		0		$ -
May	0		0		0		0		$ -
June	0		0		0		0		$ -
July	0		0		0		0		$ -
August	0		0		0		0		$ -
September	0		0		0		0		$ -
October	0		0		0		0		$ -
November	0		0		0		0		$ -
December	0		0		0		0		$ -
Totals	154	$ 2,305.00	674	$ 2,021.46	161	$ 6,440.00	106	$ 1,060.00	$ 11,826.46

ENGINEERING REPORT

March 2018

Activities This Month

This month engineering staff completed water rights reporting for the 2017 calendar year. Staff continued work on securing inundation studies for its two dams and the preparation of updated inundation maps. Staff continued work on the condition assessments for the spillways at Magalia Dam and Paradise Dam. Staff also assisted with the ongoing work on Boat Launch #1 at Paradise Lake.

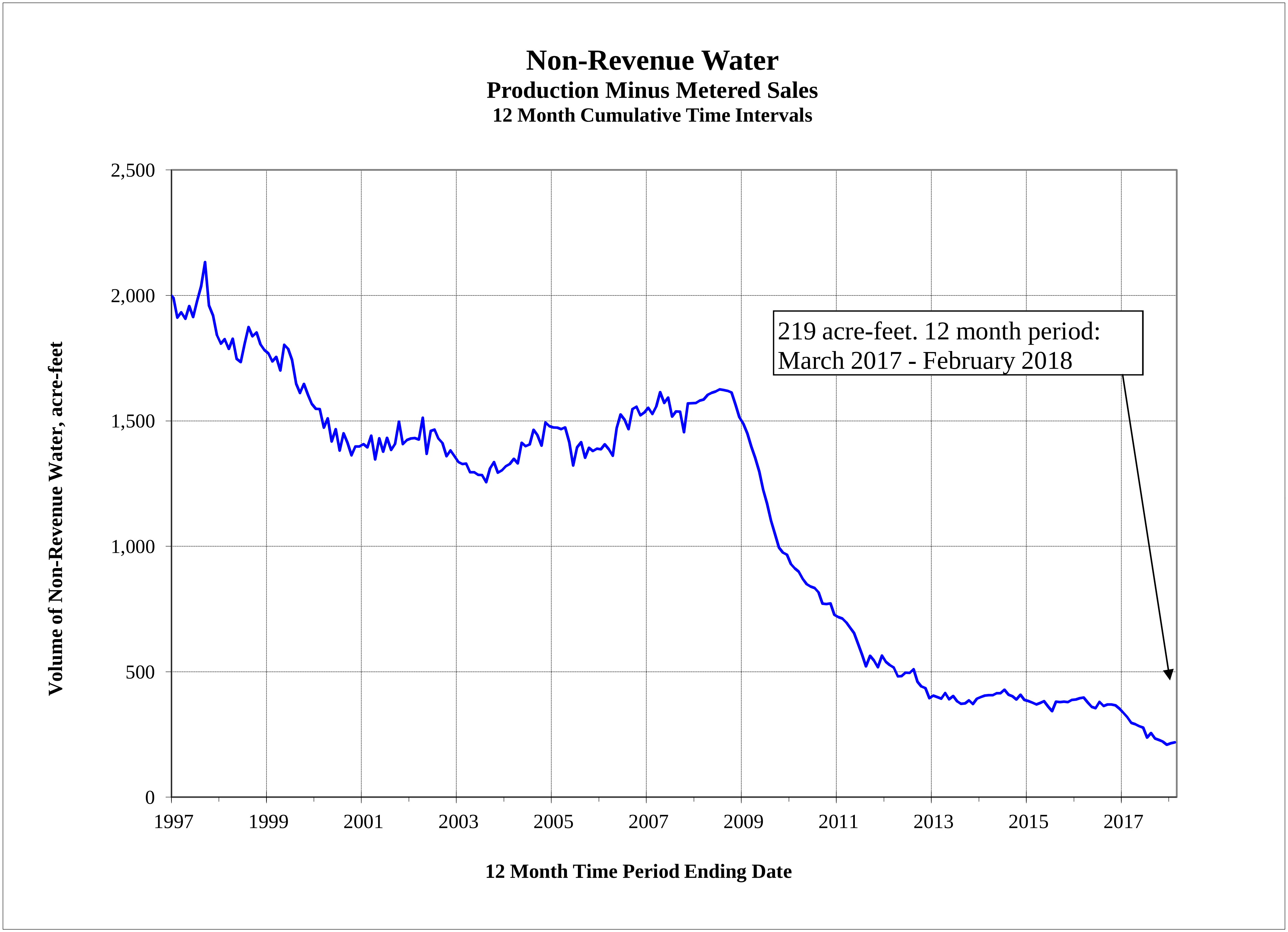
Staff continued efforts in support of the Town of Paradise Almond Street/Gap Closure project. This included preparing revised design drawings for the anticipated pipeline replacement projects on Black Olive Drive and Birch Street. Engineering staff began preparation of the 2017 Water Loss Audit.

Staff prepared an easement document for Gradley Lane in support of the Crestview Drive/Crestwood Drive water main replacement project (see consent agenda). Engineering staff also continued work on the water rights measurement and reporting requirements, including acquiring components for an instrumentation upgrade of the water level measuring device at Magalia Reservoir. Treatment Plant staff installed the new level sensor and it is now operational.

Engineering staff continued work on the Reservoir B expansion project. Staff also continued work on the NPDES permit renewal and water recycling project. Staff reviewed draft contract documents for the tank recoating and repair project. Engineering staff also assisted with the Information Technology policy review. Staff continued work on the solar interconnection agreement in order to 'grandfather' the Time of Use rate structure.

Summary of Development Review and Other Activities

Water Service Requirements Review Requests	3
New/revised projects reviewed in Project Evaluation Committee (TOP)	2
Review and direction of miscellaneous ongoing projects	3
Meter Sizing Audits (total to date)	61
Meter Size Reductions (total to date)	38


Non-Revenue Water
Production Minus Metered Sales
12 Month Cumulative Time Intervals
219 acre-feet. 12 month period:
March 2017 - February 2018
Volume of Non-Revenue Water, acre-feet
2,500
2,000
1,500
1,000
500
0
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
12 Month Time Period Ending Date

Information Technology Report

PID Website

Top 10 Pages - March 1 through March 31, 2018

	Page Title	Pageviews
		5,422 % of Total: 100.00% (5,422)
1.	Pidwater.com - Paradise Irrigation District - Water Utility for Paradise, California - Paradise Irrigation District	2,495 (46.02%)
2.	PID Reservoir Levels: Paradise Lake and Magalia Reservoir - Paradise Irrigation District	473 (8.72%)
3.	Payment Options for Paradise Irrigation District - Paradise Irrigation District	453 (8.35%)
4.	Flushing - Paradise Irrigation District	408 (7.52%)
5.	Search or browse PID documents - Paradise Irrigation District	250 (4.61%)
6.	Search - Paradise Irrigation District	138 (2.55%)
7.	Careers at PID - Paradise Irrigation District	99 (1.83%)
8.	Contact PID - Paradise Irrigation District	84 (1.55%)
9.	Redirect - Paradise Irrigation District	78 (1.44%)
10.	PID Board and Committee Meetings - Paradise Irrigation District	64 (1.18%)

Reduction in Online Payment Fees

As promised, we have kept a close eye on our customer's online payment use so that we may request discounts from Tyler Technologies as more customers use the services. As of January 15, 2018 we successfully reduced our online payment fees by another 12% (in 2017 we reduced the fee by 20%). More than 11% of PID customers are routinely making their payments online. Tyler suggested they may have additional volume discounts available upon a 20% usage rate.

February Regular Meeting on Facebook Live – Post Performance

Security Policy Update

I am continuing to work with PID management staff to revise the update to PID's security policy.

March software subscriptions

1 - Adobe Standard DC @ $12.99	= $12.99
1 - Adobe Pro DC @ $14.99	= $14.99
1 - Creative Cloud Photo Plan @ $19.99	= $19.99
11 – Office 365 ProPlus @ $9.00	= $99.00
Total March:	**=$146.97**

We increased the Office 365 ProPlus plan to 12 subscriptions. The first billing will occur in mid-April.

Mickey Rich
Information Systems Manager
April 2018