CRESCENTA VALLEY WATER DISTRICT

2700 FOOTHILL BOULEVARD
LA CRESCENTA, CALIFORNIA

Agenda for the Meeting of the Engineering Committee
of the Crescenta Valley Water District
To be held on

September 20, 2018 at 9:00 AM

Posted September 19, 2018 at 9:00 AM

Call to Order

Adoption of Agenda

Information Items

1. Status of Groundwater Wells and Well Capacity
2. Status of Water Main Replacement on the 2700, 3000 & 3100 Blocks of Brookhill Ave. - Project E-982
3. Status of TTHM Study and Upgrades to Disinfection System, Project E-995
    - Option 1 – Operational Changes
    - Option 2 – Chloramine Conversion

Public Comments

At this time, members of the public shall have an opportunity to address the Committee on items of interest that are within the subject matter jurisdiction of this Committee. This opportunity is non-transferable and speakers are limited to three (3) minutes each.

Committee Member's Request for Future Agenda Items

Next Engineering Committee Meeting – October 18, 2018

Adjournment

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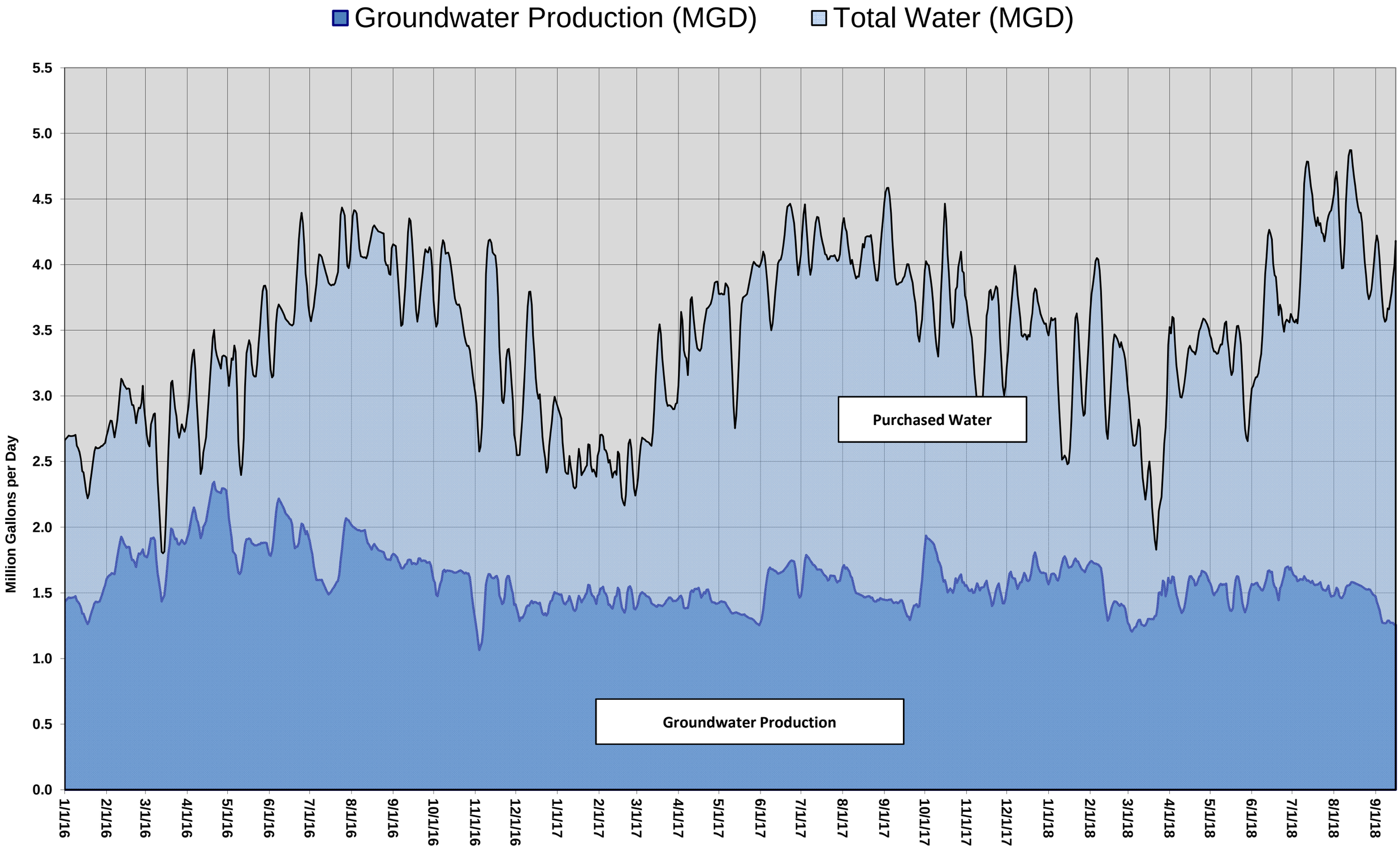
Water Production Chart 2016 - 2018



Average Well Elevation Levels 2005-Present

CRESCENTA VALLEY WATER DISTRICT

STAFF REPORT

Information Item No. 3

To: Engineering Committee — September 20, 2018

From: David S. Gould. P.E. – District Engineer

Subject: **Amendment to Contract for Construction of 8-inch Water Main on the 2700, 3000 and 3100 blocks of Brookhill Street and the 5000 block of La Crescenta Avenue, Project E-982**

INFORMATION ITEM:

CVWD's 8-inch Water Main Construction on Brookhill Street, Project E-982 – Discussion of project cost increases and unforeseen changes that will increase the overall cost of the subject project by an estimated cost of $140,000.

BACKGROUND:

The District's on going goal is to replace a minimum of 2,000 linear feet of pipeline that are 50 years or older per year, which was included as part of the FY 17/18 CIP budget. The pipelines that are being replaced as part of E-982 are on the 2700, 3000, 3100, & 3200 Blocks of Brookhill Ave and the 5000 Block of La Crescenta Ave. These pipelines were undersized (4-inch pipe), located within the parkway, that had experienced numerous leaks over the last 5 years, and were installed in 1946 and 1947. The total amount of pipeline replaced was 2,800 linear feet as of September 14, 2018.

DISCUSSION:

Brkich construction is 90% complete with all construction related activities for the installation of a new 8-inch water main on Brookhill St (Project). All pipe installation has been complete with only eleven (11) residents still needing to be "tied over" to the new 8-inch main. The construction completion date of May 9, 2018 was extended until October 31, 2018 due to the difficulty of attaining easements for the crossing of Quail Creek Canyon.

Over the course of this project, several unforeseen construction items arisen that were not part of the original contract. The following is a list of additional costs that have been compiled and estimated by staff:

- Backfill Permit Requirements (No CMB Allowed) – $25,000
- Extension & Tie-Overs on the 3200 block of Brookhill – $75,000
- Gas Main Break – $25,000
- Boulder Obstruction – $35,000
- Box Culvert Obstruction – $15,000
- Los Angeles County Intervention – $20,000

The estimated total change order amount is $195,000.

In order to reduce costs, staff looked at the design and made adjustments to avoid the costly channel crossing and reduce the number of fire hydrants in the area while still adhering to all fire and safety regulations. Staff estimates these changes will result in a $30,000 credit to the District. Finally, Southern California Gas Company should reimburse the cost for the gas main break response. This brings the total cost increase to approximately $140,000. This represents an 18.8% increase in cost from the original contract amount of $742,800.

FUNDING AVAILABILITY:

There are sufficient funds available in the following account for the project:

Account Description	Amount
FY 17/18 Water CIP– Water Distribution	**$760,000**
Contractor Cost	<$742,800>
Unforeseen or additional work (10% contingency)	<$ 74,280>
Additional costs such as material purchase by CVWD, soils engineer, engineering & inspection labor costs	<$ 95,000>
Original Construction Cost	**<$912,080>**
Change Orders 1-6	<$170,000>
Cost Reduction Measures	$30,000
Estimated Revised Construction Costs	**<$1,052,080>**
Amount Paid in FY 17/18	**$685,426**
Amount in Water CIP – Distribution System, FY 18/19	**$326,700**
E-982 Cost Overrun	**<39,954>**

Prepared by:

Brook Yared, P.E.
Senior Engineer

Submitted by:

David S. Gould, P.E.
District Engineer

Attachments: None

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CRESCENTA VALLEY WATER DISTRICT
STAFF REPORT

Information Item No. 3

To: Engineering Committee — September 20, 2018

From: David S. Gould. P.E. – District Engineer

Subject: **TTHM Mitigation and Disinfection Process Upgrades, Project E-995**

INFORMATION ITEM:

Discussion and update of CVWD's TTHM study and disinfection process upgrades.

- Option 1 – Operational Changes
- Option 2 – Chloramine Conversion

BACKGROUND:

The District uses chlorine as a disinfectant to treat drinking water. Chlorine can create disinfection by-products during treatment, known as total Trihalomethanes or TTHMs, as it reacts with naturally occurring organic matter in untreated water from imported water supplied by FMWD/MWD from either the Colorado River (CRW) or the State Water Project (SWP). The typical water supply blend for CVWD is 60% groundwater and 40% imported water. The water supply blend is now closer to 30 percent groundwater and 70 percent imported water.

CVWD has seen a steady rise in the concentration of TTHMs because CVWD is using more imported water as groundwater levels have not yet recovered from the latest drought. The increase in imported water, coupled with the additional chlorine required to maintain a chlorine residual in the system has led to an increase in TTHMs in the distribution system.

Past Actions:

- August 14, 2018 – discussion by Dr. Issam Najm of WQTS on TTTMs and Chloramines. Staff awarded a $10,000 consulting services contract to WQTS for initial study and evaluation.
- August 28, 2018 – awarded a contract to WQTS for $99,800 for chloramine conversion, public outreach, staff and operator training, Department of Drinking Water (DDW) permitting support, development of necessary mitigation plans, and preparation of 30% design plans.
- August 28, 2018 – Staff awarded a contract to Hazen and Sawyer for $9,971 to perform bench testing of CVWD's source water in a lab to determine proper breakpoint chlorination and formation of TTHMs.
- Staff, WQTS and CV Strategies finalized the brochure and a list of frequently asked questions. Mailed out the brochure, which were received by customers starting on September 10, 2018.
- Staff prepared website information and a press release sent to CV Weekly and Glendale Newspress.
- Staff met with WQTS, Carollo Engineering and Olsson Construction to review the design scope of work and installation for the chloramination system.

DISCUSSION:

Option 1 - Operational changes: Three (3) factors for formation of TTHM in CVWD reservoirs

1) Water Age
2) Chlorine residual levels
3) Water temperature

Operations staff over the last two weeks has done the following adjustments to the distribution system:

1) Water Age – Reduced the amount of water stored in each reservoir. The current water storage available is based upon ultimate demand requirements, which is shown in Table 1 and Table 2 attached.

2) Chlorine residual levels – Reduced the amount of chlorine injected at the Mills and Glenwood Plant to maintain a chlorine level of 1.0 mg/L after breakpoint chlorination. This also based on information provided from the Bench Testing performed by Hazen and Sawyer, which is shown in the attached technical memorandum.

3) Water Temperature – the Bench Testing performed by Hazen and Sawyer showed that higher temperatures (about 30^{o} C or 86^{o} F) increases the TTHM formation in the water.

The results of these changes are shown on the attached TTHM charts for each reservoir site. Overall, the TTHM levels have reduced, however, the upper zones are still above the target level of 64 ug/L.

Staff has discussed with Hazen about the installation of a water aeration system inside Oak Creek Reservoir No. 1 & No. 2 (See Figure 1). Hazen indicated that they have designed these systems for various agencies and have seen a TTHM reduction of 30% to 40%. Staff has requested a preliminary proposal for the design of this system from Hazen.

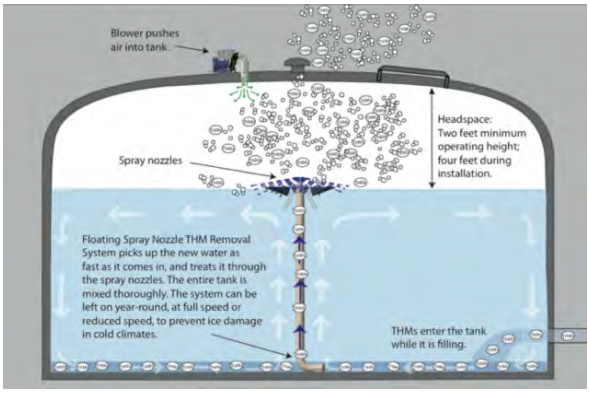


Figure 1
Typical Aeration System inside a reservoir

Option 2 - Chloramine Conversion:

The following is an update of tasks completed by staff and consultants:

- Office & field staff training on the use of chloramines and anticipated questions from the community
- Public workshop at the Glenwood Plant on September 15, 2018
- Received proposal from WQTS and Carollo Engineers for 30% design of chloramination system (See attached proposal from Carollo Engineers)
- System Operations training for conversion to chloramines and preventing nitrification of reservoirs
- Attendance at AWWA –CA-NV Section - chloramines, colorimeters and sample collection workshop
- WQTS and staff working on Nitrification Monitoring & Control Plan for submittal to DDW.

Staff has been working with WQTS & Carollo Engineers on a design/build contract to install the new ammonia system at the Mills and Glenwood plants. Carollo Engineers did provide a proposal for the 30% design of the project. However, the proposed cost estimate for design/build was higher than anticipated. The design proposal from Carollo Engineers (See attached proposal) was for $78,800, which is higher than the original proposal provided by WQTS for $35,000. Staff is going to request a change order to WQTS's contract to include the additional funds for Carollo Engineers.

Staff is looking into completing the work by CVWD and includes hiring an electrical contractor for installation of the electrical system, hiring a system integrator for the SCADA equipment and so on. However, with staff's current workload, a consultant will be needed to assist with contract and construction administration for the chloramine conversion.

Staff requested a proposal from John Robinson Consulting (JRC) to provide contract administration based on the 30% design from Carollo Engineers. Tasks include assistance with the purchase of the ammonia metering pump system, coordinating the electrical work, coordinating the SCADA programing and integration, and assistance with ordering material, coordinating with CVWD crews for installation of on-site piping and project start up. Attached is the proposal from John Robinson Consulting that includes the anticipated hours at a reduced hourly rate.

Project Schedule:

The attached Table 3 shows the project schedule based on meeting the October 1 deadline of reducing TTHM levels below 64 ug/L. The schedule shows that the new ammonia equipment could be installed by the end of 2018. However, it is depended on the lead time for procurement of the equipment, which is estimated to be 6 – 8 weeks.

The attached Table 4 shows the project schedule, if the TTHM levels are not below the target of 64 ug/L on October 1, 2018. The schedule includes operational training to shift to 100% imported water, meeting with FMWD on the amount of water needed and the duration, sampling intervals in critical locations to determine if nitrification is occurring, dead-end main flush out schedule and duration, and schedule for boosting chlorine in critical areas.

Preliminary Cost Estimated:

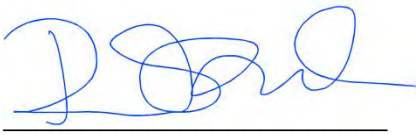
The table below shows a preliminary cost estimate for the conversion to chloramines. It does not include staff labor costs or any flush outs labor cost necessary to maintain water quality.

Consultants - Planning, Design & Construction Admin	**Estimate Cost**		**Glenwood - Ammonia Station**	**Estimate Cost**
WQTS - Planning	$10,000		Ammonia Skid	$50,000
WQTS - Design	$99,800		Electrical Upgrade	$15,000
WQTS - Design - Additional	$43,800		SCADA integration/wiring/conduits	$15,000
Hazen & Sawyer	$9,970		Chlorine Analyzer	$5,000
John Robinson Consulting (Estimate)	$45,225		Ammonia Tank	$2,500
Total - Consultants	**$208,795**		On-site Piping	$8,000
Public Notification			Vault	$5,000
CV Strategies	$3,500		Misc + Welder	$17,000
Printing	$1,500		Subtotal	$117,500
Mailing	$1,500		**Mills - Ammonia Station**	
Total - Public Notification	**$6,500**		Ammonia Skid	$50,000
Sampling			Electrical Upgrade	$15,000
WQ Sampling - From 7/1/18 to Present			SCADA integration/wiring/conduits	$15,000
210 Samples X $60/EA	$12,600		Chlorine Analyzer	$5,000
24-hr Surcharge - 100%	$12,600		Ammonia Tank	$2,500
Samples - 9/18 to 12/31/18 - 14 Weeks	$14,280		On-site Piping	$8,000
24-hr Surcharge - 100%	$14,280		Misc + Welder	$17,000
Total Sampling	**$53,760**		Total	$112,500
Construction Cost	**$276,000**		Total Ammonia Systems	$230,000
Misc	**$10,445**		20% Contingency	$46,000
Total	**$555,500**		**Total**	**$276,000**

RECOMMENDATION:

Staff will continue keeping the Board informed on operational changes and chloramination conversions as shown above as it relates to the TTHMs Mitigation Option Decision Tree.

Prepared by:



David S. Gould, P.E.
District Engineer

Submitted by:

Nem Ochoa
General Manager

Attachments:

1. TTHM charts for each reservoir site
2. Table 1 - Water Storage - ultimate demand requirements
3. Table 2 – Water Storage – reduced reservoir capacity
4. Hazen and Sawyer – Draft Technical Memorandum
5. John Robinson Consulting Proposal
6. Carollo Engineers Proposal
7. Table 3 – Project Schedule
8. Table 4 – Alternative Project Schedule

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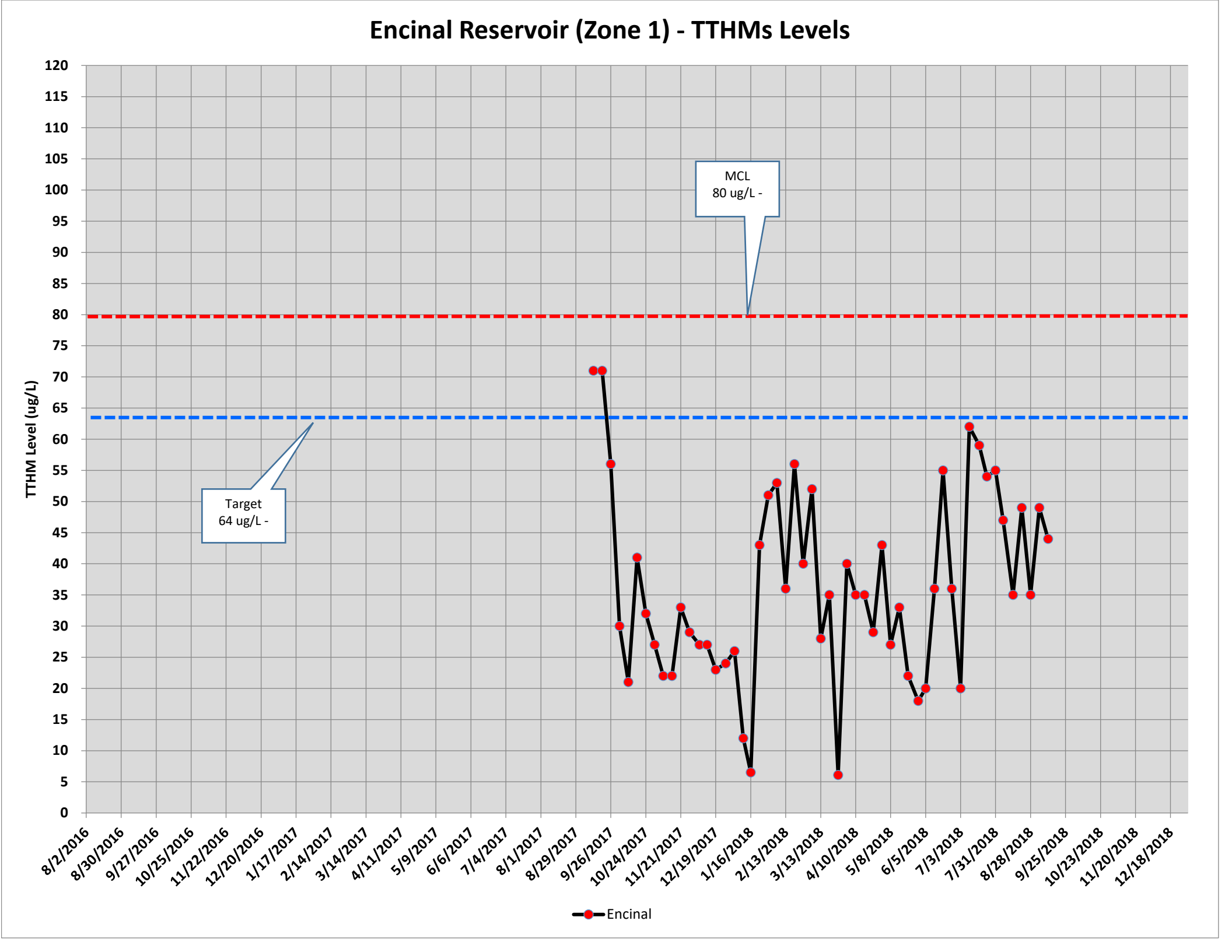
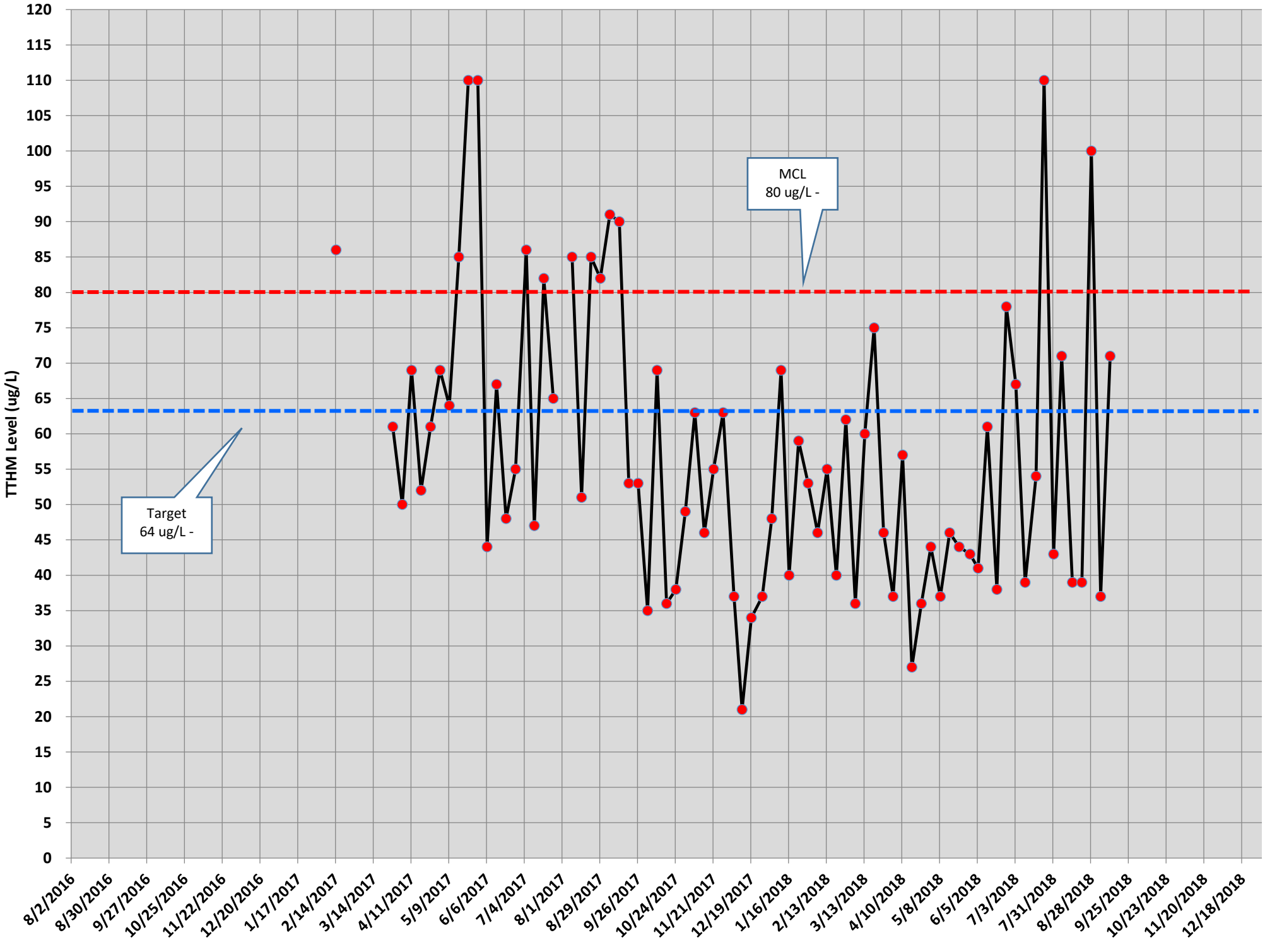
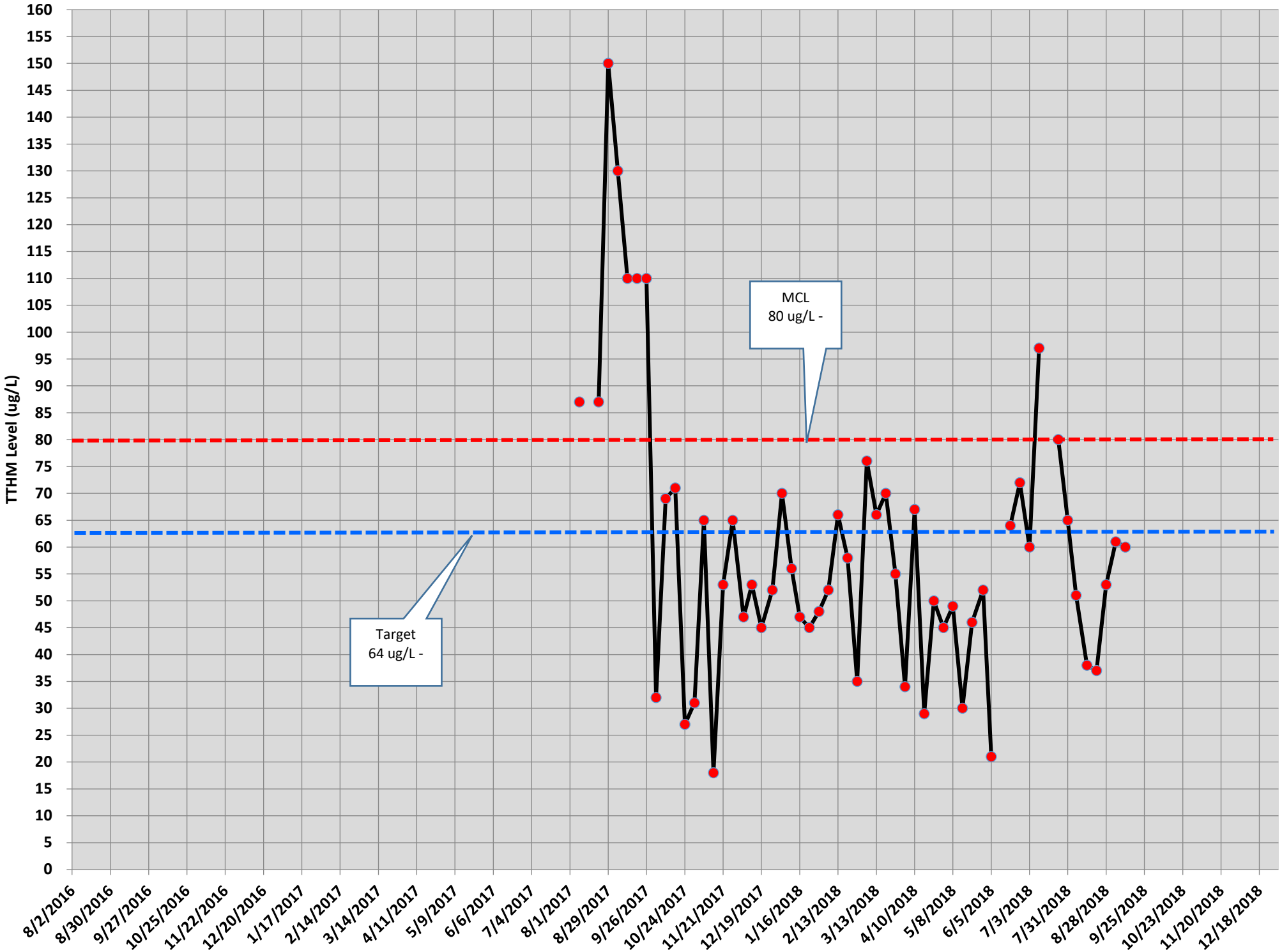

Encinal Reservoir (Zone 1) - TTHMs Levels
TTHM Level (ug/L)
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
MCL
80 ug/L -
Target
64 ug/L -
8/2/2016
8/30/2016
9/27/2016
10/25/2016
11/22/2016
12/20/2016
1/17/2017
2/14/2017
3/14/2017
4/11/2017
5/9/2017
6/6/2017
7/4/2017
8/1/2017
8/29/2017
9/26/2017
10/24/2017
11/21/2017
12/19/2017
1/16/2018
2/13/2018
3/13/2018
4/10/2018
5/8/2018
6/5/2018
7/3/2018
7/31/2018
8/28/2018
9/25/2018
10/23/2018
11/20/2018
12/18/2018
Encinal

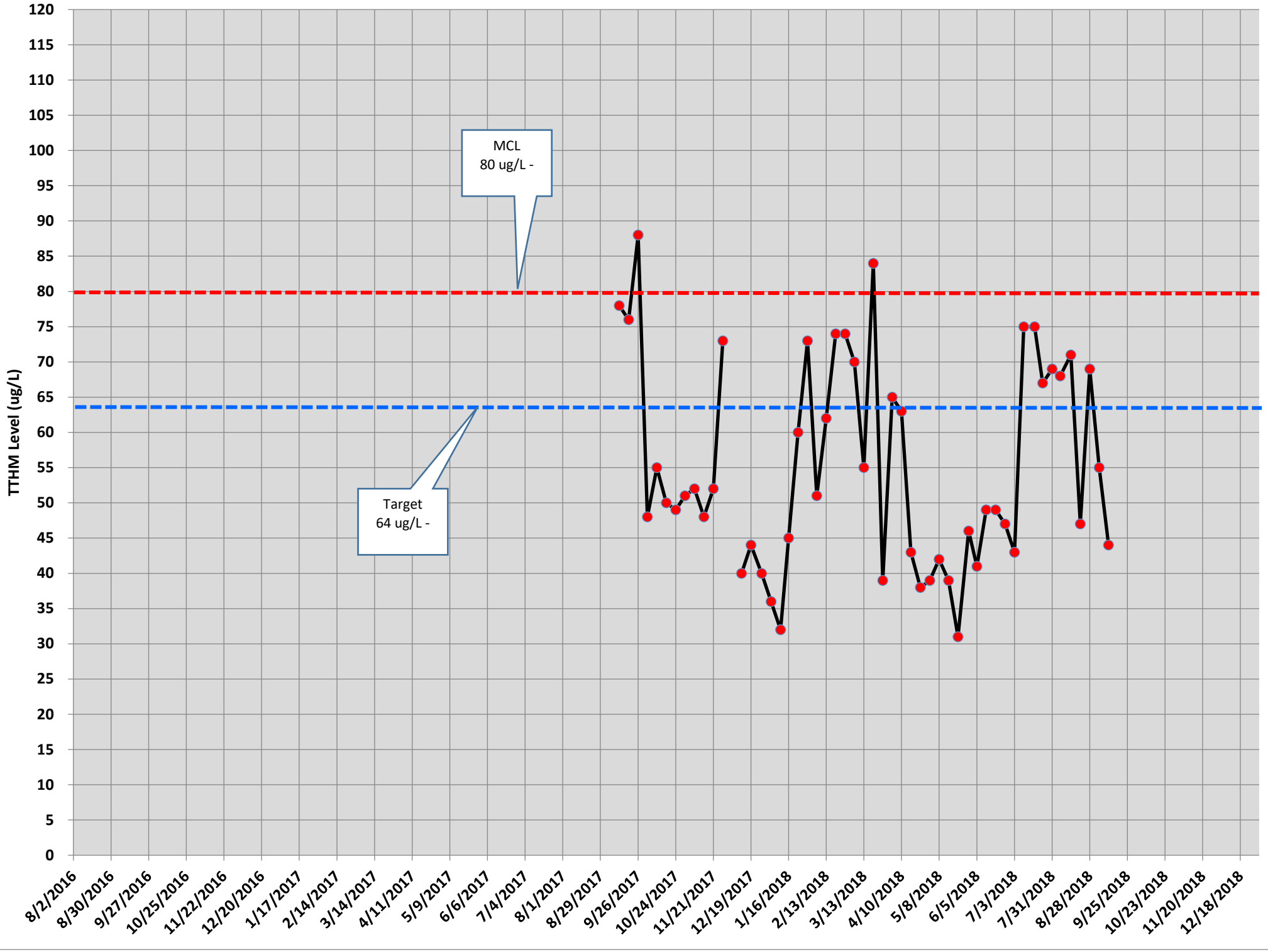
Williams Reservoir (Zone 2) - TTHMs Levels



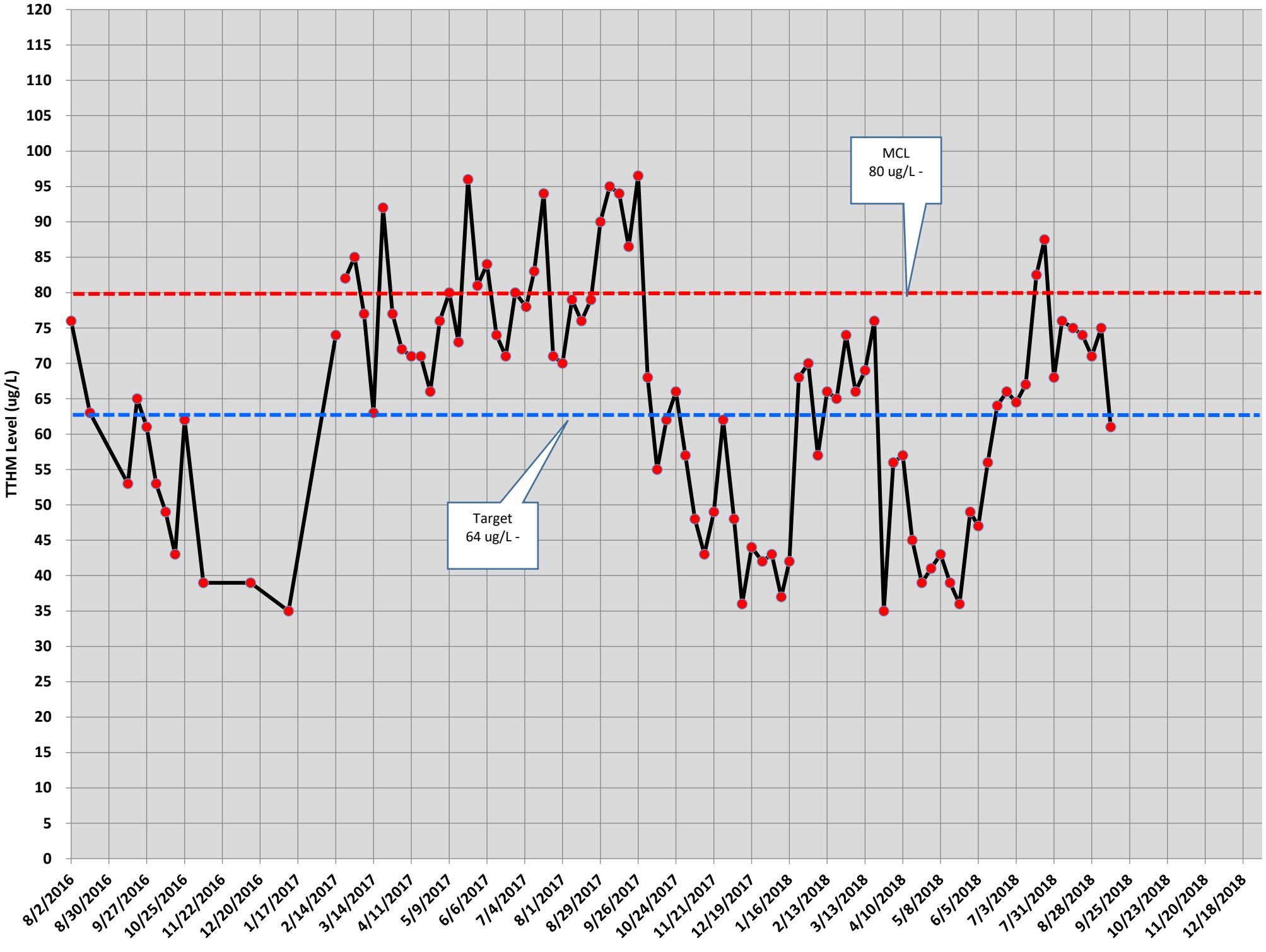
Ordunio Reservoir (Zone 2) - TTHMs Levels



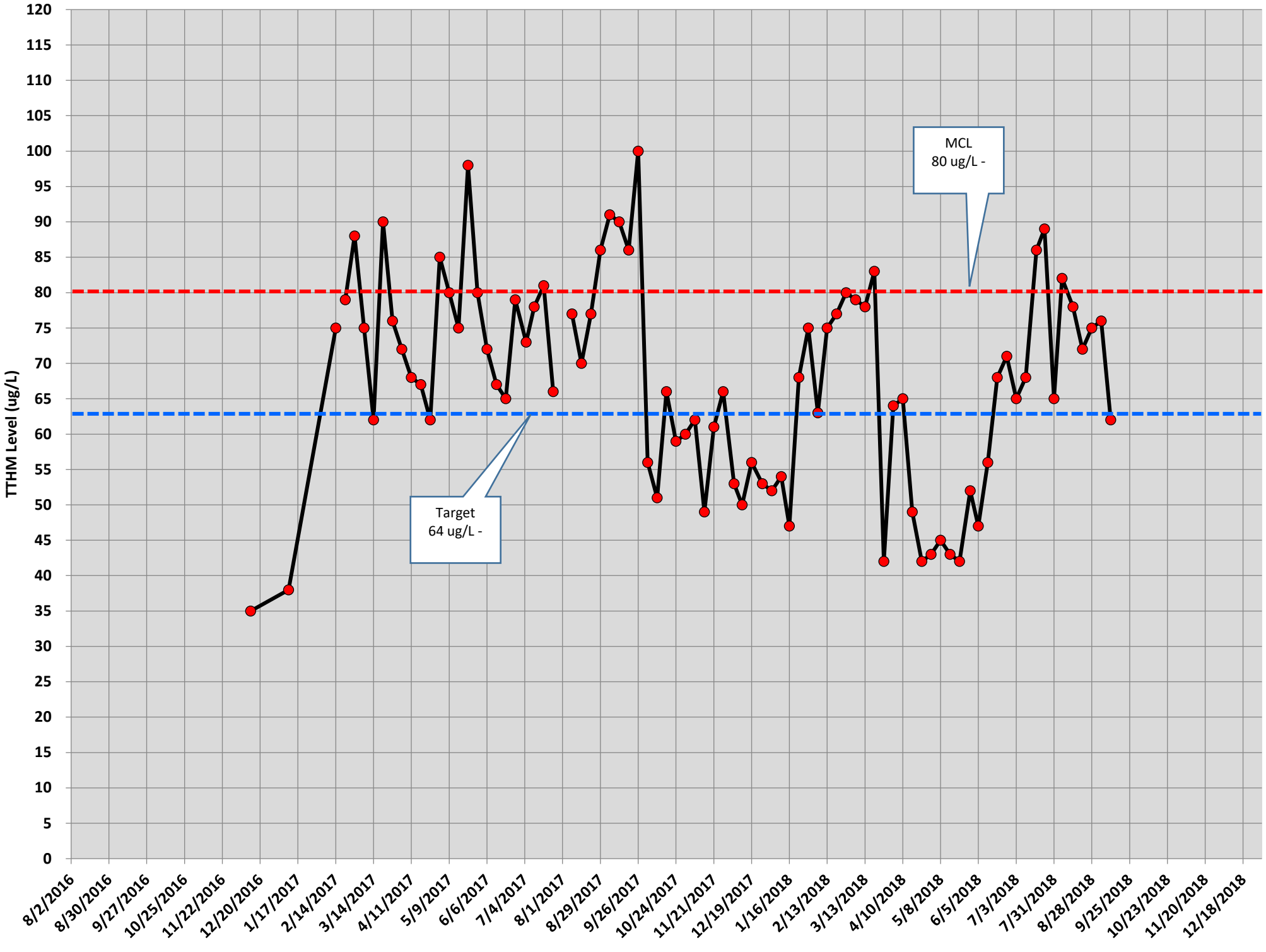
Rosemont Rreservoir (Zone 3) - TTHMs Levels



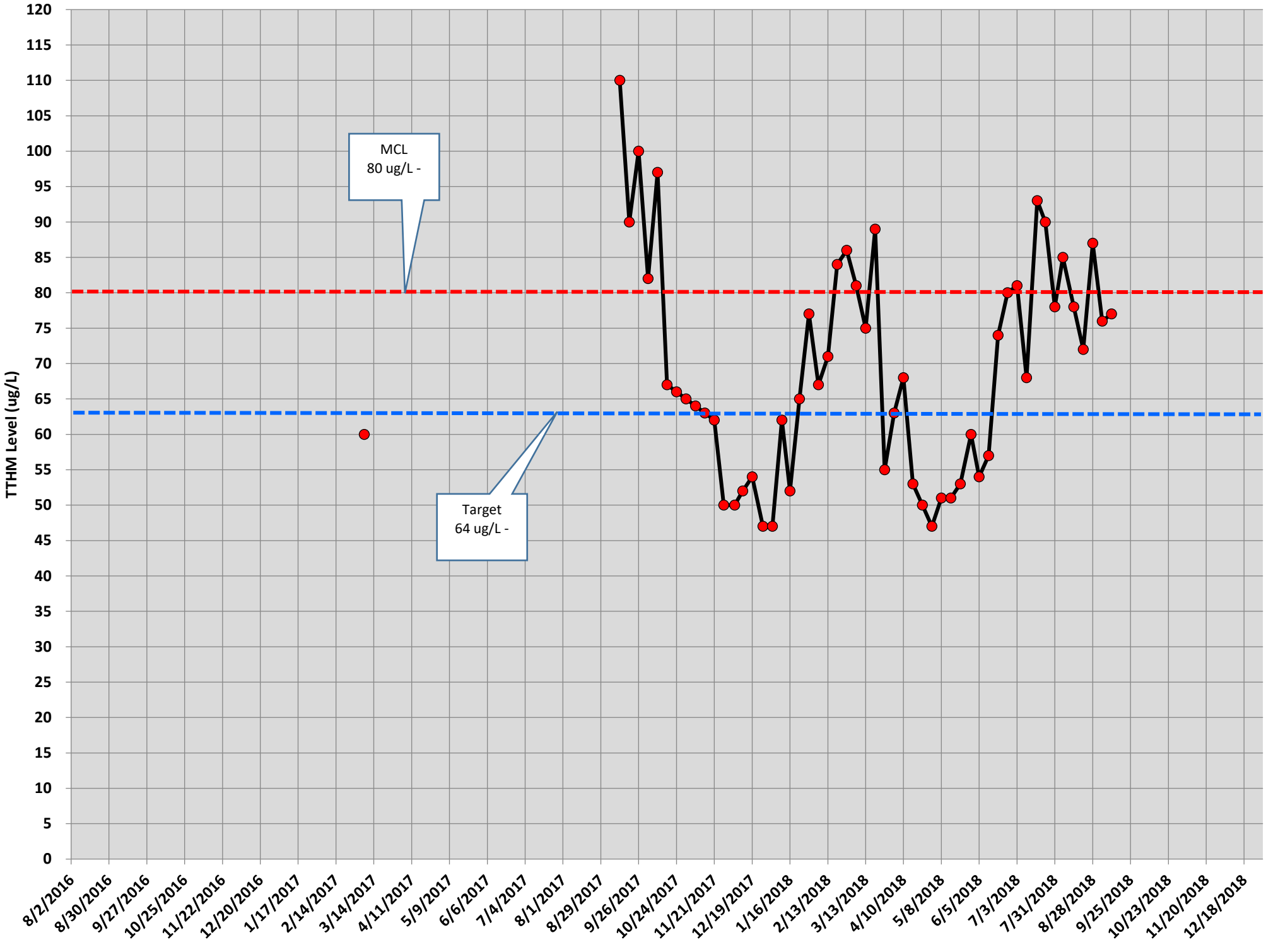
Oak Creek Reservoir (Zone 4) - TTHMs Levels



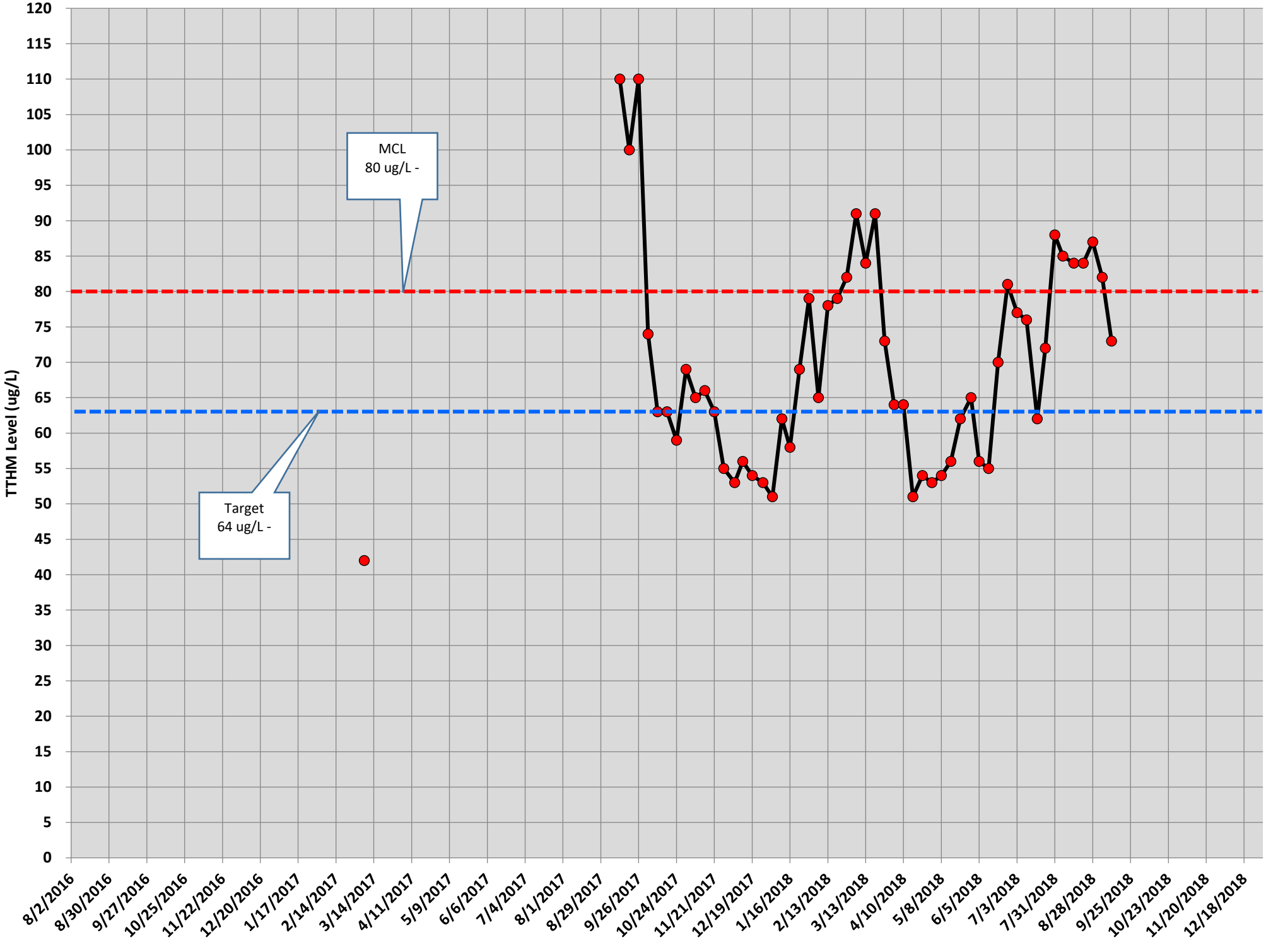
Markridge Reservoir (Zone 5) - TTHMs Levels

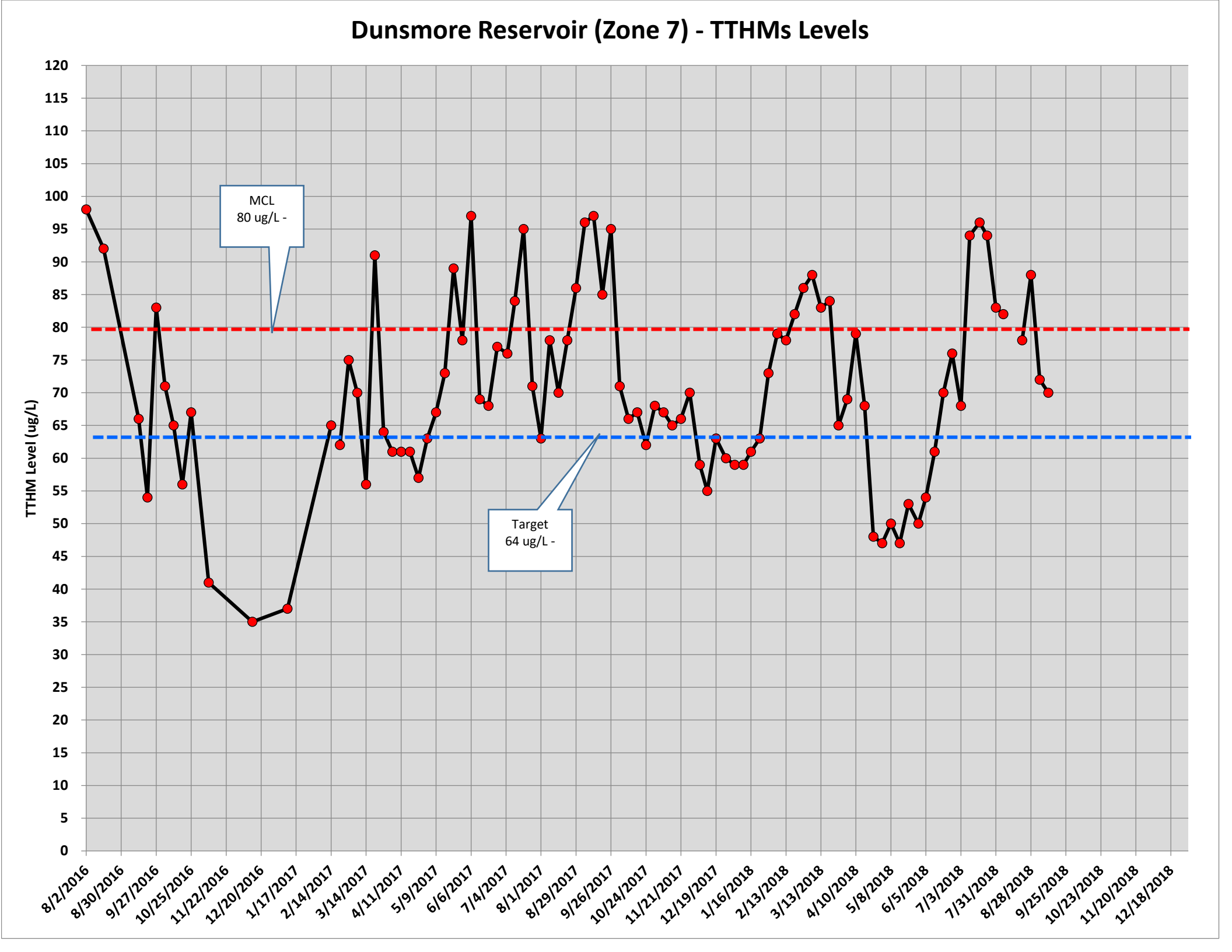


Eagle Canyon Reservoir (Zone 5) - TTHMs Levels

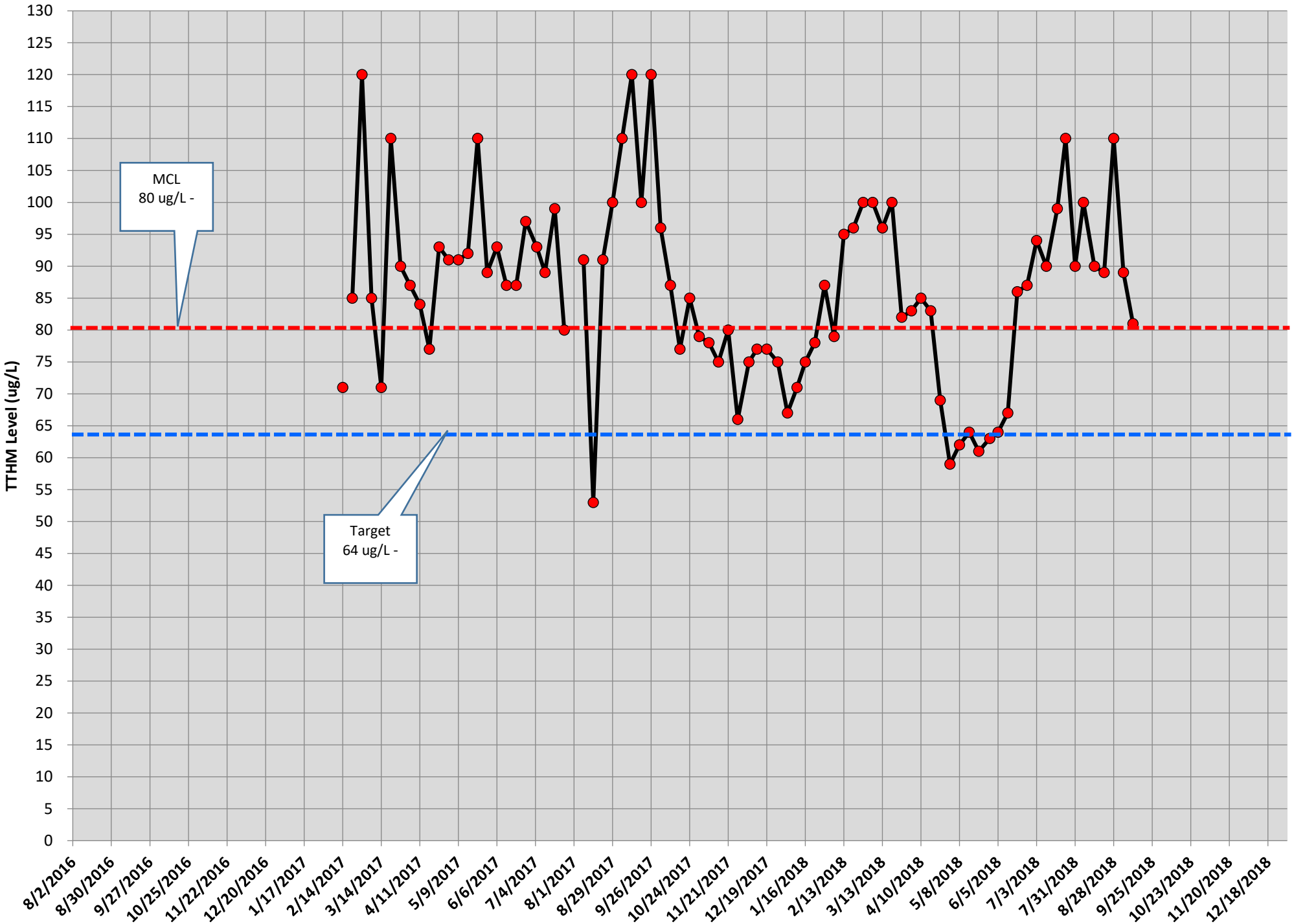


Goss Canyon Reservoir (Zone 6) - TTHMs Levels

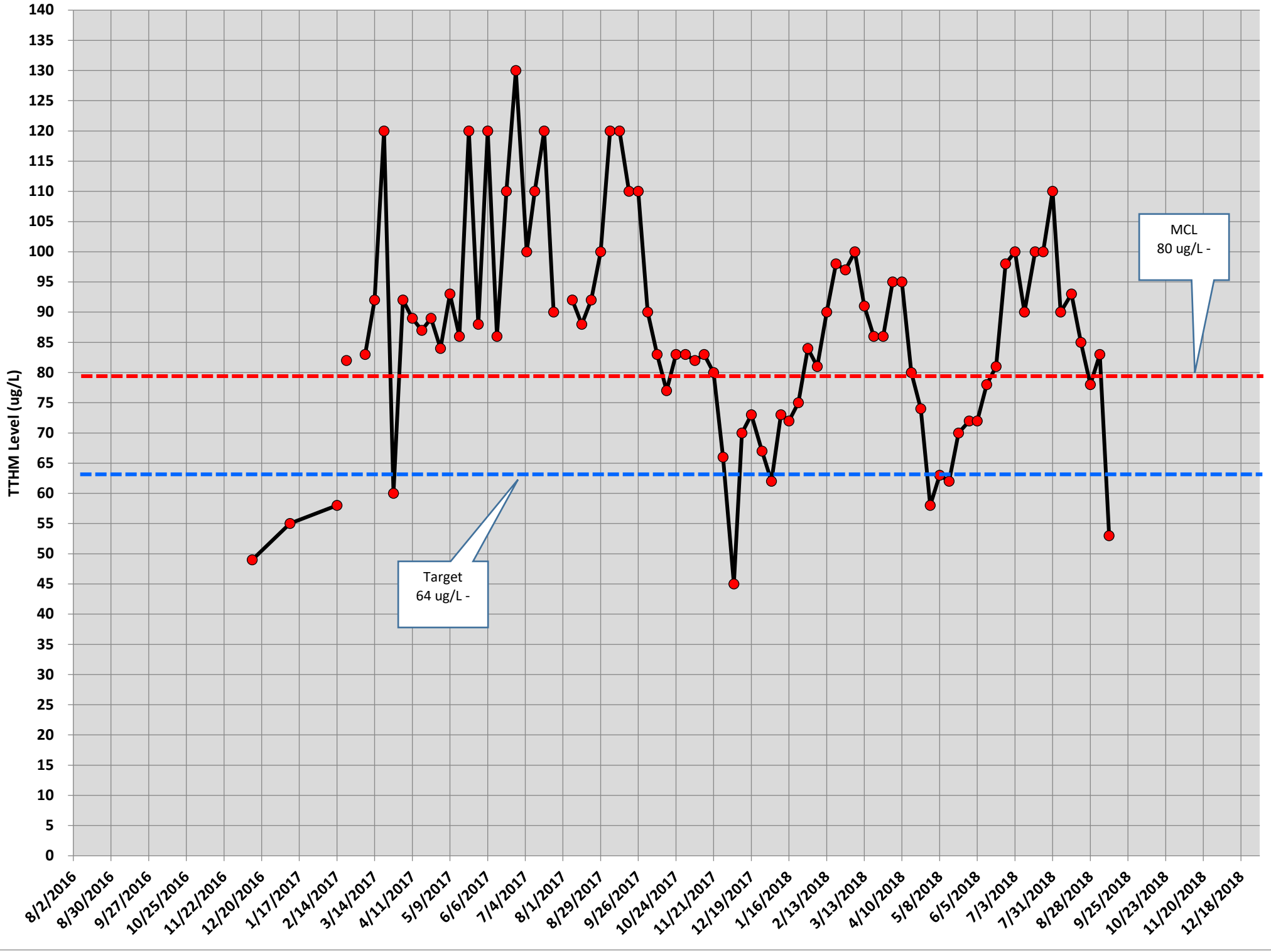



Dunsmore Reservoir (Zone 7) - TTHMs Levels
TTHM Level (ug/L)
MCL
80 ug/L -
Target
64 ug/L -
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
8/2/2016
8/30/2016
9/27/2016
10/25/2016
11/22/2016
12/20/2016
1/17/2017
2/14/2017
3/14/2017
4/11/2017
5/9/2017
6/6/2017
7/4/2017
8/1/2017
8/29/2017
9/26/2017
10/24/2017
11/21/2017
12/19/2017
1/16/2018
2/13/2018
3/13/2018
4/10/2018
5/8/2018
6/5/2018
7/3/2018
7/31/2018
8/28/2018
9/25/2018
10/23/2018
11/20/2018
12/18/2018

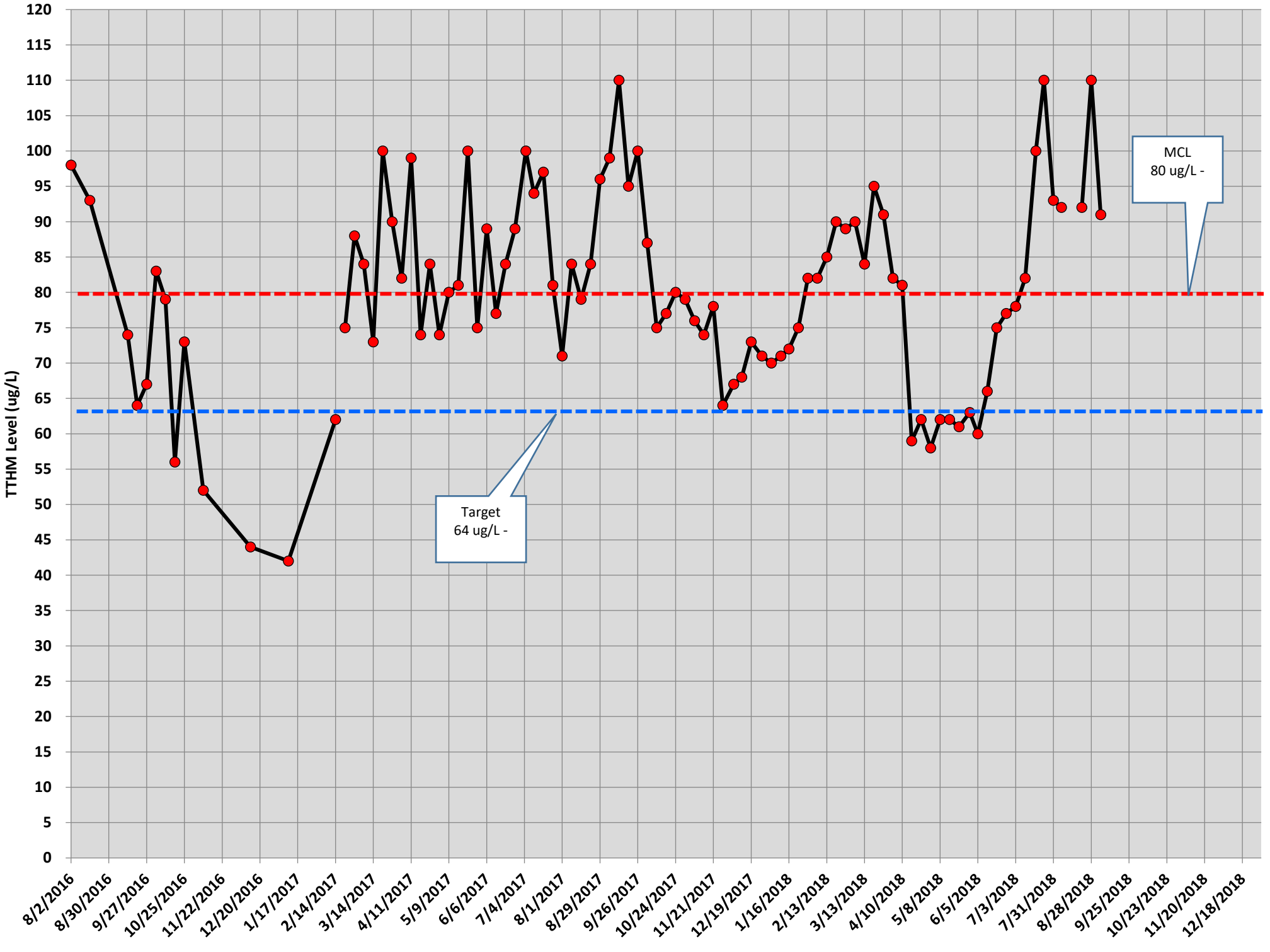
Cresta Heights Reservoir (Zone 8) - TTHMs Levels



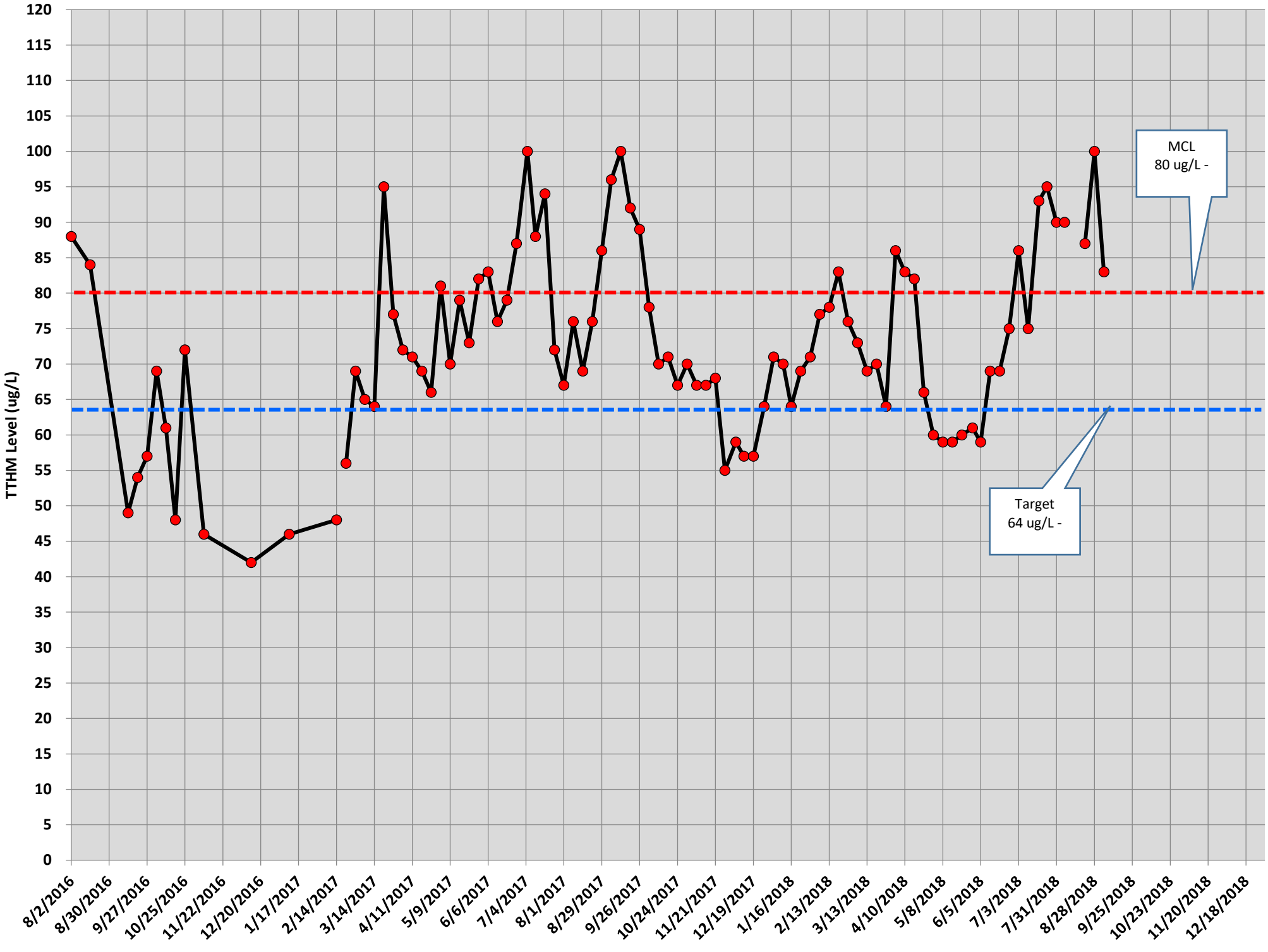
Edmund No. 1 Reservoir (Zone 9) - TTHMs Level



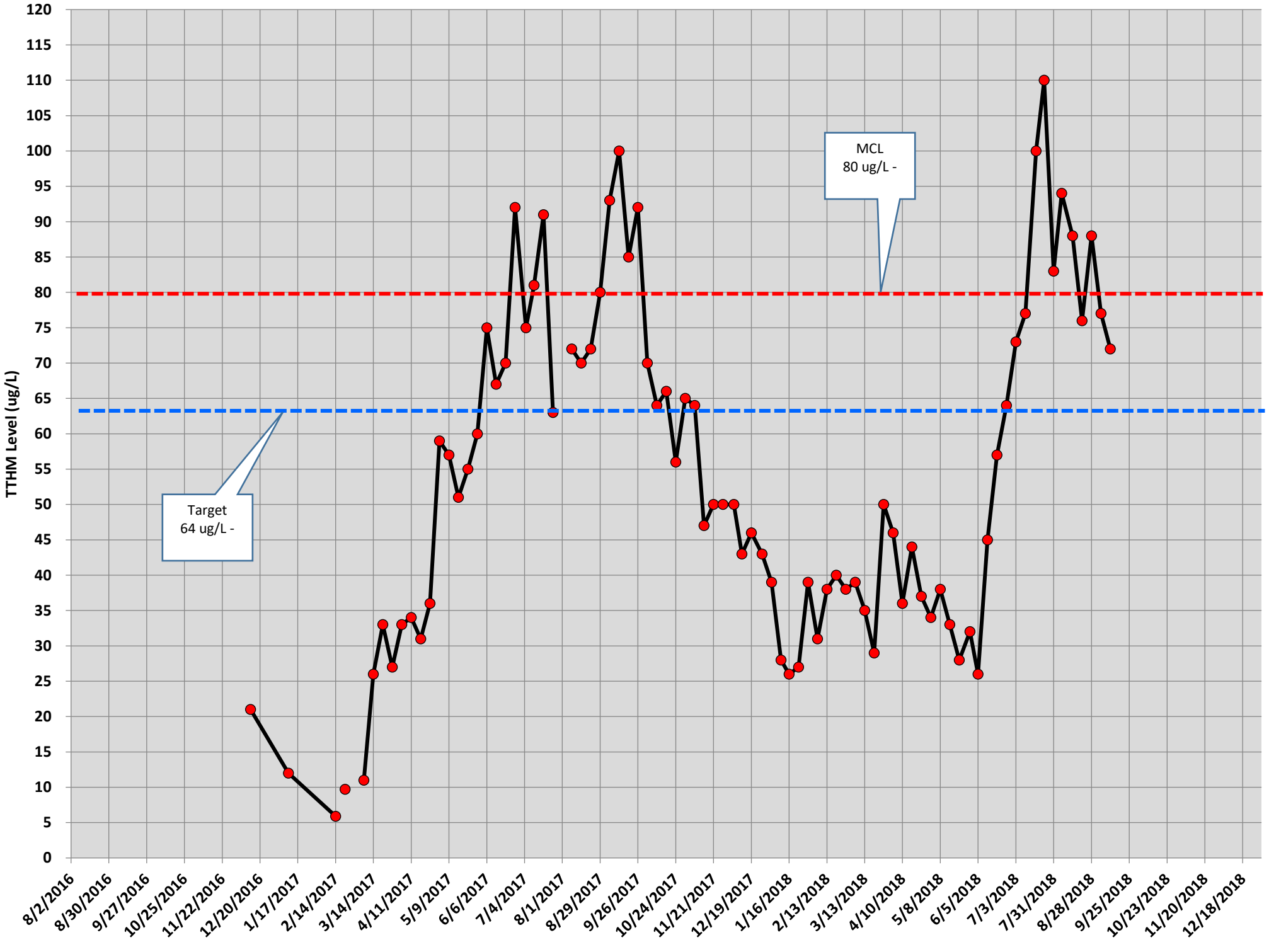
Edmund No. 2 (Zone 9) - TTHMs Level



Shields Reservoir (Zone 10) - TTHMs Levels



Pickens Reservoir (Zone 11) - TTHMs Levels



Crescenta Valley Water District

Table 1 - Analysis of Water Storage with Ultimate Demand Requirements

Site	Zone	Capacity (MG)	ADD (mgd)	MDD (mgd)	Fire Flow (gpm)	Duration (hrs)	Volume (MG)	Operational Storage (MG) (30% ADD)	Emergency Storage (MG) (1.75 X ADD)	**Total Required Storage (MG)**	Surplus/ Defect
Encinal	1	2.96	0.58	1.02	5,000	4.0	1.20	0.31	1.02	**2.53**	0.43
Ocean View/ Ordunio	2	5.93	1.17	2.05	5,000	4.0	1.20	0.61	2.05	**3.86**	2.07
Rosemont	3	0.45	0.09	0.15	5,000	4.0	1.20	0.05	0.15	**1.40**	(0.95)
Oak Creek #1 & 2	4	2.27	0.45	0.79	3,500	3.0	0.63	0.24	0.79	**1.65**	0.62
Markridge/Eagle Canyon	5	1.61	0.32	0.56	1,500	2.0	0.18	0.17	0.56	**0.90**	0.71
Goss Canyon #1 & 2	6	0.84	0.17	0.29	1,500	2.0	0.18	0.09	0.29	**0.56**	0.28
Dunsmore	7	0.38	0.07	0.13	1,500	3.0	0.27	0.04	0.13	**0.44**	(0.06)
Cresta Heights # 1 & 2	8	0.96	0.19	0.33	1,500	2.0	0.18	0.10	0.33	**0.61**	0.35
Edmund #1 & 2	9	1.11	0.22	0.38	1,500	2.0	0.18	0.12	0.38	**0.68**	0.43
Shields	10	0.59	0.12	0.20	1,500	2.0	0.18	0.06	0.20	**0.45**	0.15
Pickens	11	0.44	0.09	0.15	1,500	2.0	0.18	0.05	0.15	**0.38**	0.06
Total		17.55	3.47	6.06			5.58	1.82	6.06	**13.46**	**4.09**

Crescenta Valley Water District

Table 2 - Analysis of Water Storage with Reduced Water Storage Capacity

Site Information					Reservoir Capacity					Existing Reservoir Level Set Points					Proposed Reservoir Level Set Points				
No.	Site	Zone	Material	Year Installed	Dia (ft.)	Depth Total (ft.)	Design Capacity (MG)	Actual Depth based on location of overflow outlet (ft.)	Calculated Capacity based on Actual Depth (MG)	Depth Low Level (ft)	Capacity Low Level (MG)	Depth High Level (ft)	Capacity High Level (MG)	Total Usage (MG)	Proposed Depth Low Level (ft)	Proposed Capacity Low Level (ft)	Proposed Depth High Level (ft)	Proposed Capacity High Level (ft)	Total Proposed Usage (MG)
1	Encinal	1	Concrete	1983		23.5	3.00	22.5	2.96	9.0	1.02	18.0	2.05	**1.02**	7.0	0.80	16.0	1.82	**1.02**
2	Ocean View	2	Concrete	1985		26.0	3.60	26.0	3.62	16.0	1.87	22.0	2.57	**0.70**	14.0	1.63	20.0	2.33	**0.70**
3	Ordunio	2	Steel	1970	123	26.0	2.75	26.0	2.31	7.0	0.62	16.0	1.42	**0.80**	5.0	0.44	14.0	1.24	**0.80**
4	Rosemont	3	Steel	1949	65	18.0	0.50	18.0	0.45	8.0	0.20	15.0	0.37	**0.17**	6.0	0.15	13.0	0.32	**0.17**
5	Oak Creek #1	4	Steel	1958	110	16.0	1.60	16.0	1.14	11.0	0.78	16.0	1.14	**0.36**	9.0	0.64	14.0	1.00	**0.36**
6	Oak Creek #2	4	Steel	1961	110	16.0	1.60	16.0	1.14	11.0	0.78	16.0	1.14	**0.36**	9.0	0.64	14.0	1.00	**0.36**
7	Eagle Canyon	5	Steel	1961	90	25.0	1.50	25.0	1.19	13.0	0.62	17.0	0.81	**0.19**	10.0	0.48	14.0	0.67	**0.19**
8	Markridge	5	Steel	1951	65	17.0	0.50	17.0	0.42	10.0	0.25	16.5	0.41	**0.16**	7.5	0.19	14.0	0.35	**0.16**
9	Goss Canyon #1	6	Steel	1954	54	22.0	0.42	22.0	0.38	14.0	0.24	18.0	0.31	**0.07**	12.0	0.21	16.0	0.27	**0.07**
10	Goss Canyon #2	6	Steel	1961	60	22.0	0.50	22.0	0.47	14.0	0.30	18.0	0.38	**0.08**	12.0	0.25	16.0	0.34	**0.08**
11	Dunsmore	7	Steel	1954	54	22.0	0.42	22.0	0.38	12.0	0.21	17.0	0.29	**0.09**	10.0	0.17	15.0	0.26	**0.09**
12	Cresta Heights # 1	8	Steel	1966	61	22.0	0.50	22.0	0.48	14.0	0.31	18.0	0.39	**0.09**	12.0	0.26	16.0	0.35	**0.09**
13	Cresta Heights # 2	8	Steel	1965	61	22.0	0.50	22.0	0.48	14.0	0.31	18.0	0.39	**0.09**	12.0	0.26	16.0	0.35	**0.09**
14	Edmund #1	9	Concrete	1956	70	22.0	0.50	22.0	0.63	6.0	0.17	10.0	0.29	**0.12**	5.0	0.14	9.0	0.26	**0.12**
15	Edmund #2	9	Steel	1966	61	22.0	0.50	22.0	0.48	14.0	0.31	17.0	0.37	**0.07**	12.0	0.26	15.0	0.33	**0.07**
16	Shields	10	Steel	1967	58	30.0	0.60	30.0	0.59	13.0	0.26	15.0	0.30	**0.04**	11.0	0.22	13.0	0.26	**0.04**
17	Pickens	11	Steel	1962	55	25.0	0.50	25.0	0.44	15.0	0.27	21.0	0.37	**0.11**	12.0	0.21	18.0	0.32	**0.11**
	Total Storage						**19.49**		**17.55**	*48%*	**8.50**	*74%*	**13.00**	**4.50**	*40%*	**6.96**	*65%*	**11.46**	**4.50**

Hazen *Technical Memorandum*

September 18, 2018

To: David Gould, Crescenta Valley Water District

From: Nicole Blute, PhD, PE
Vivy Dong, PhD, PE
Michelle Chebeir, PhD

Reviewed: William Becker, PhD, PE
Lynn Grijalva, PE

cc: Christy Scott, Crescenta Valley Water District

Re: Bench Testing of Disinfectant By-Product (DBP) Formation

DRAFT

1. Introduction

Crescenta Valley Water District (CVWD) is using approximately 70% imported surface water from Foothill Municipal Water District (FMWD) and 30% groundwater for its potable water system. An increase in surface water from past percentages (40% FMWD and 60% groundwater) has resulted in elevated total trihalomethane (TTHM) levels, necessitating action by CVWD to decrease TTHM concentrations to continue meeting the regulatory limit of 80 µg/L TTHM.

CVWD is currently conducting an evaluation of chloramination as an approach to decrease DBPs as a separate effort. Hazen was retained by CVWD to assess chlorine dosing and time dependence of DBP formation to provide information on which to base operational decisions. This technical memorandum provides the results of the latter analysis, including necessary dosing for breakpoint chlorination and time dependency of TTHM formation.

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2. Testing Objectives

Water sources currently used by CVWD include:

- FMWD water from three turnouts (Paschall, Oceanview, and Briggs)
- Groundwater from wells 1, 5, 7, and 9 routed through the Mills Plant and Forebay
- Groundwater from wells 6, 8, 10, 12, 14, 15, and 16 routed through the Glenwood Plant and Forebay
- Groundwater from well 11 added to the treated water from the Glenwood Plant after the forebay

FMWD water contains chloramines for secondary disinfection. CVWD adds a high dose of chlorine (approximately 10 mg/L or more) at the Mills and Glenwood Plants to breakpoint chlorinate the FMWD water and convert chloramines to free chlorine. CVWD operates the distribution system with free chlorine residual.

CVWD has experienced elevated DBPs in the distribution system and initiated the first step of bench testing to evaluate potential operational modifications. This first step involves:

1. Characterization of the breakpoint curve,
2. Determination of groundwater chlorine demand, and
3. Evaluation of time dependence in DBP formation.

Additional work could be conducted to test the impact of lower chlorine doses (if feasible).

3. Methodology

Water for this study was collected on Tuesday, September 4, 2018 from the following locations. The approximate percentages of water contributions to the system flow are provided in parentheses:

- FMWD Paschall (70%)
- Groundwater (30%), with relative proportions of the three reflecting their flow rates below:
    - Mills Plant (420 gpm) – prior to aeration and disinfection
    - Glenwood Plant (344 gpm) – prior to aeration and disinfection
    - Well 11 (57 gpm) – prior to disinfection

Raw groundwater samples were collected in clean plastic 1-gallon containers. Chloraminated FMWD water was collected in 1-liter amber glass bottles to minimize any reaction of disinfectant with plastic

surfaces. All bottles were rinsed three times with the water before collecting the sample and were obtained from BC Labs.

Samples were transported in coolers to the Hazen office, where they were analyzed for chlorine decay and breakpoint chlorination the same day or the next. If not sampled on the day collected, water was stored at 4º C.

Testing was conducted using 4% as chlorine sodium hypochlorite (NaOCl), which was diluted with distilled water to 1 g/L for addition to samples. Chlorine strength and residuals, and total ammonia, were analyzed using a Hach 1900 instrument.

DBP samples for laboratory analysis were collected in 125 mL amber glass bottles with sodium thiosulfate preservative (BC Labs, Bakersfield, CA).

4. Results

Bench tests were conducted to assess the chlorine dose necessary to achieve breakpoint chlorination in FMWD water and the FMWD/groundwater blend (Section 4.1), chlorine demand of the groundwater (Section 4.2), and the time dependence of DBP formation (Section 4.3).

4.1 Breakpoint Chlorination

Figures 4-1 and 4-2 provide plots from bench testing that show (1) the total chlorine and total ammonia concentrations with a series of chlorine doses (i.e., additions to chlorine already present), and (2) the ratio of chlorine dose to initial ammonia concentration. The theoretical breakpoint ratio is 7.6:1, but chlorine demand in the water typically increase this ratio to between 8:1 to 11:1. As shown in Figures 4-1 and 4-2, breakpoint (i.e., where ammonia is zero) was observed at 9:1.

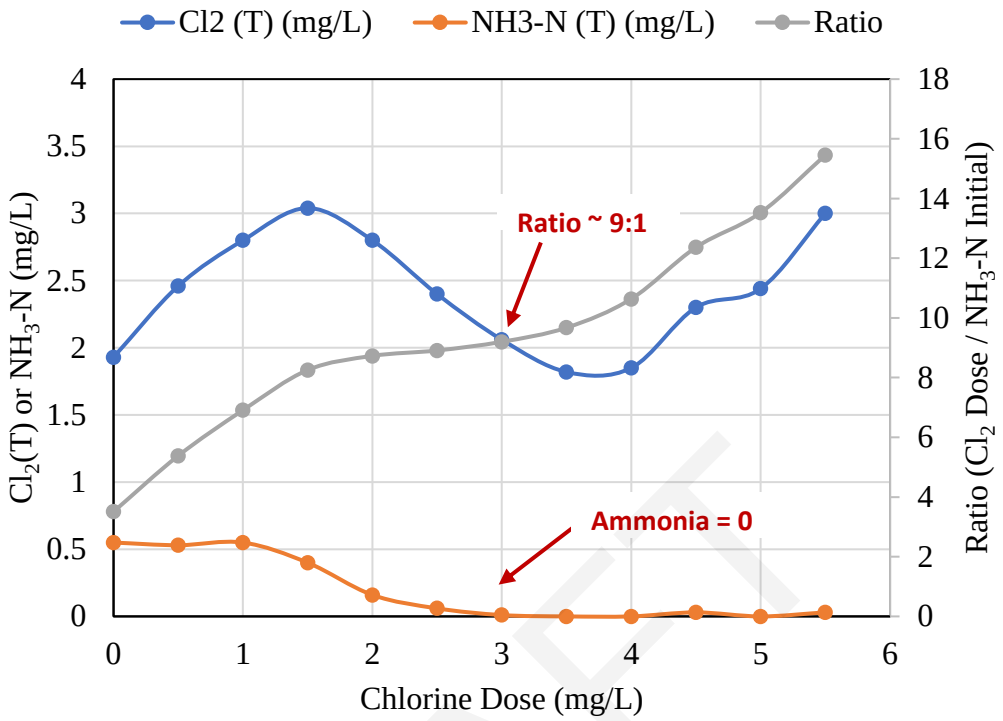

FIGURE 4-1: Breakpoint Chlorination Curve for 100% FMWD Water

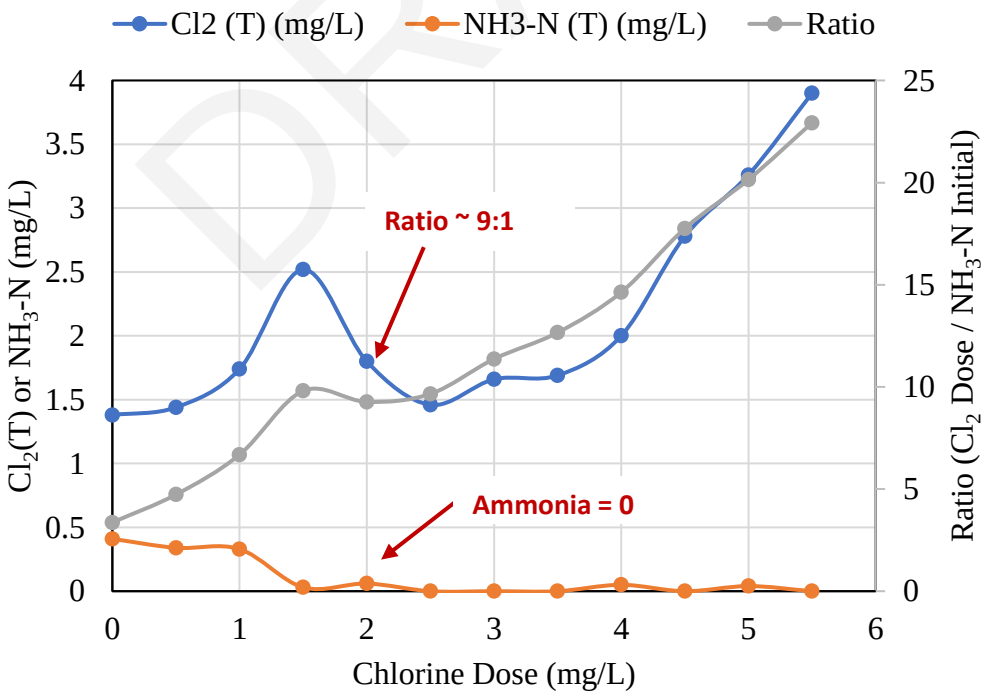

FIGURE 4-2: Breakpoint Chlorination Curve for 70% FMWD Water and 30% Groundwater

The samples collected for Figures 4-1 and 4-2 were analyzed for total chlorine and total ammonia after approximately 1 minute of rapid mixing. It was observed that the breakpoint did not reach a low total chlorine residual as has often been observed by our team in the past (i.e., approximately 0.5 mg/L) within that time. A follow up test was conducted to evaluate whether kinetics (time dependency) impacted residual chlorine. As shown in Figure 4-3, rapid total chlorine decay was observed after breakpoint in the first several hours, reaching 0.5 mg/L after 18 hours. This was an unusual finding, as typically the chloramine breakpoint reaction is rapid. Nevertheless, breakpoint is identifiable from the curves produced by evaluating ammonia concentrations and the shape of the curves.

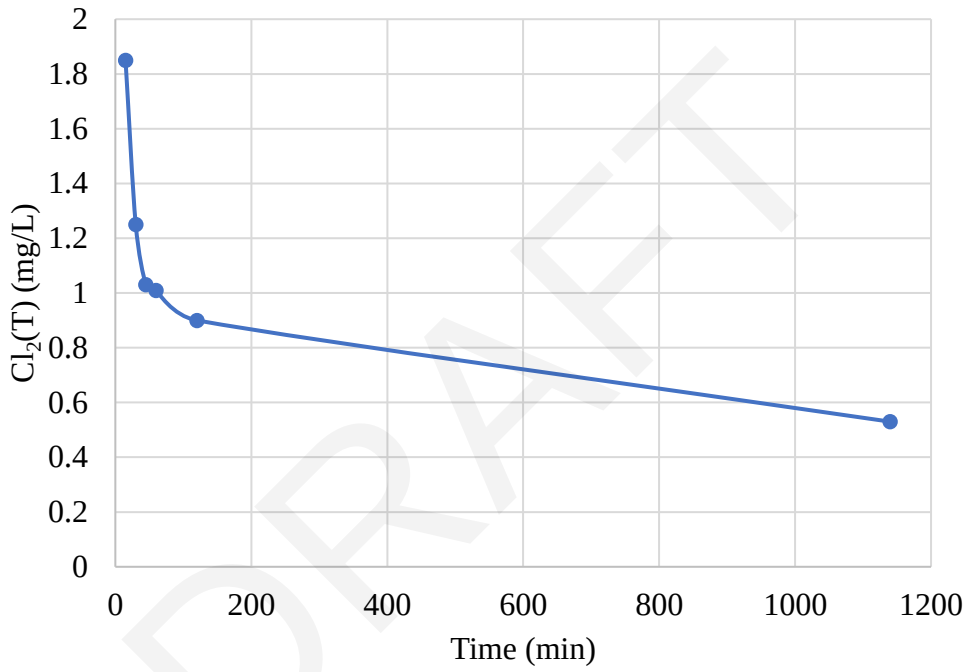

FIGURE 4-3: Chlorine Decay Curve for 100% FMWD Water with 3.5 mg/L Chlorine Dose Added

CVWD currently breakpoint chlorinates FMWD water by adding more than 10 mg/L free chlorine to the groundwater. Mass balance provides the following calculation of approximate breakpoint and remaining residual, demonstrating that the chlorine dose is beyond the 9:1 breakpoint ratio and may be able to trim the dose to simultaneously breakpoint and yield a sufficient residual:

Total chlorine:

FMWD total chlorine x % flow		GW total chlorine x % flow		Total chlorine in blend
2.0 mg/L x 70%	+	10 mg/L x 30%	=	4.4 mg/L

Total ammonia:

FMWD total ammonia x % flow		GW total ammonia x % flow		Total ammonia in blend
0.5 mg/L x 70%	+	0 mg/L x 30%	=	0.35 mg/L

Ratio: 4.4 mg/L total chlorine / 0.35 mg/L total ammonia = 12.5 (past breakpoint)

Total chlorine in blend to reach breakpoint = 0.35 mg/L x 9 = 3.2 mg/L

Assuming breakpoint has a total chlorine concentration of 0.5 mg/L, addition of approximately 1.2 mg/L (4.4 mg/L – 3.2 mg/L = 1.2 mg/L) would yield 1.7 mg/L free chlorine (1.2 mg/L + 0.5 mg/L breakpoint residual = 1.7 mg/L).

The calculations above show that CVWD may be able to trim the chlorine dose to simultaneously breakpoint chlorinate and yield a sufficient secondary disinfectant residual. Further, some data reveals that FMWD water may be higher than 2 mg/L and groundwater doses may exceed 10 mg/L at times, which would only increase the residual in the above calculations. CVWD will need to determine the necessary dose to provide a lasting residual in the distribution system for bacteriological control, but may be able to decrease the dose from current practice by 0.5 mg/L – 0.7 mg/L or more (yielding approximately 1 mg/L free chlorine) based on these calculations. If CVWD reduces applied chlorine dose, the distribution system should be carefully monitored to ensure that desired residuals are maintained.

4.2 Groundwater Chlorine Demand

Naturally occurring substances in the groundwater, such as iron, manganese, ammonia, sulfide, and organic carbon, can exert a chlorine demand when a chlorine dose is applied. The chlorine demand of CVWD's groundwater was evaluated in this bench test.

Figure 4-4 shows that chlorine concentration was stable after 20 hours, indicating that the chlorine demands for Glenwood Plant, Mills Plant, and Well 11 are all minimal and similar to the demand observed for the control, which was distilled water. This information is useful in evaluating the chlorine dose that should be applied to a groundwater and surface water blend.

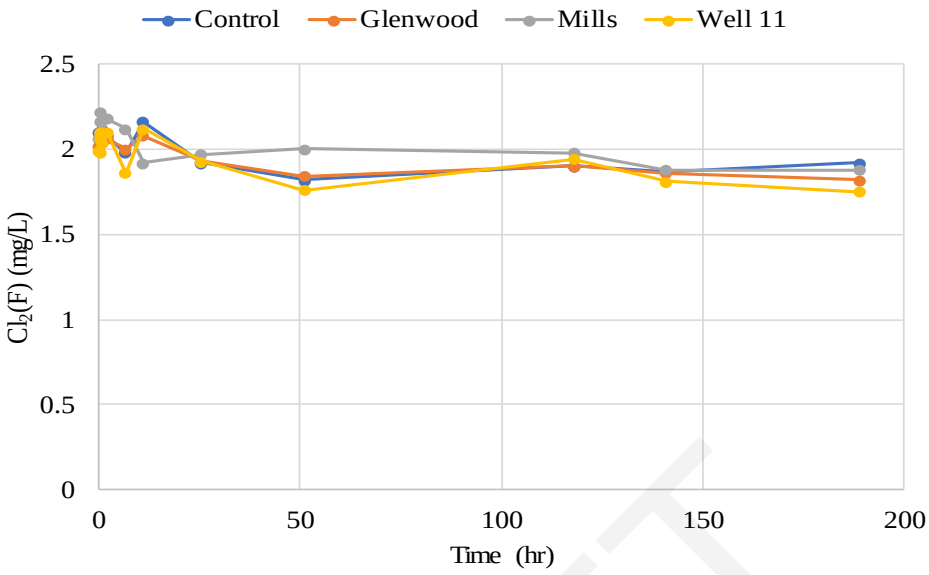

FIGURE 4-4: Chlorine Residual for 100% Groundwater with 2.0 mg/L Chlorine Dose Added

4.3 Time Dependence of DBP Formation

Bench testing was conducted to evaluate the time dependence of DBP formation in the 70% FMWD and 30% groundwater blend. Samples were held at either 20º C or 30º C to determine the impact of temperature on DBP formation. A duplicate of the 20º C run was included to evaluate variability.

A chlorine dose of 6 mg/L was used to ensure that a detectable total chlorine residual was present at the end of a week of hold time. This residual is higher than is necessary to achieve breakpoint (approximately 2.5 mg/L dose as shown in Figure 4-2). Figure 4-5 depicts the total chlorine residual measured during the week of DBP sampling.

Figure 4-6 shows that the development of DBPs was not instantaneous for the 6 mg/L chlorine dose applied to the blend. However, the TTHM MCL was exceeded in approximately 3 days for the 20º C condition and 1 ½ days for the 30º C condition, providing evidence of that warmer temperatures can result in higher TTHM development, as observed by CVWD.

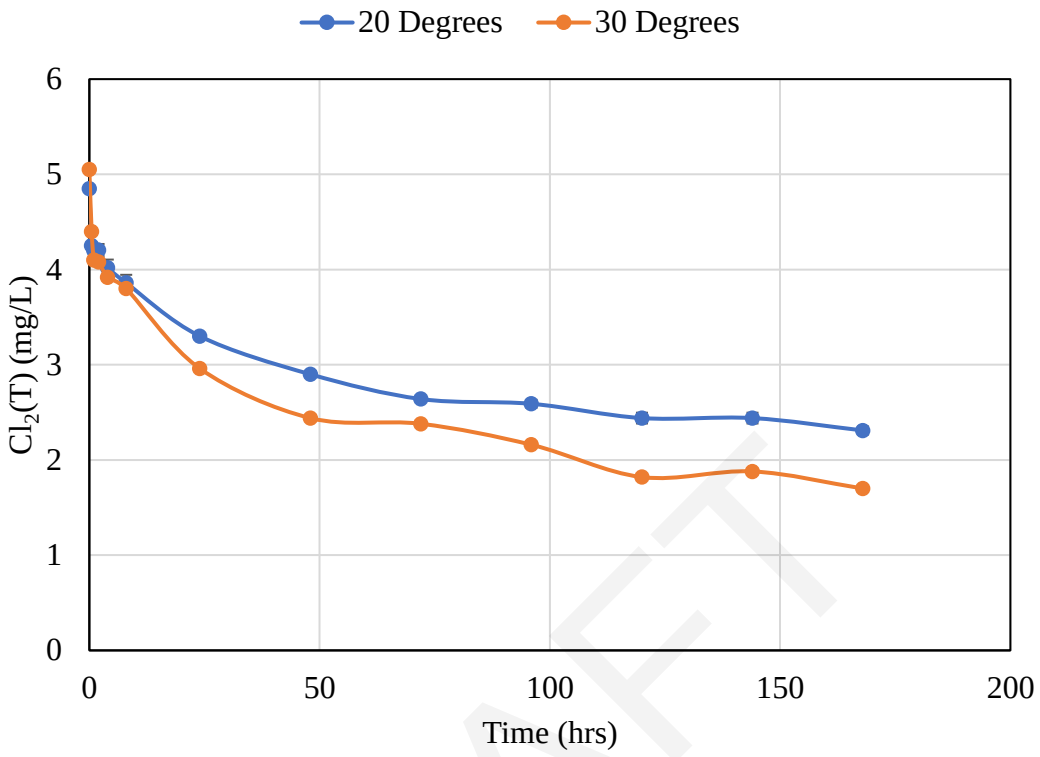

FIGURE 4-5: Chlorine Residual for 100% Groundwater with 2.0 mg/L Chlorine Dose Added

Additional testing is recommended using a lower chlorine dose, such that CVWD could evaluate TTHM formation under more optimized conditions. At this time, only one dose was included in the current scope but CVWD may find value in determining if lower DBPs would be expected from a lower dose.

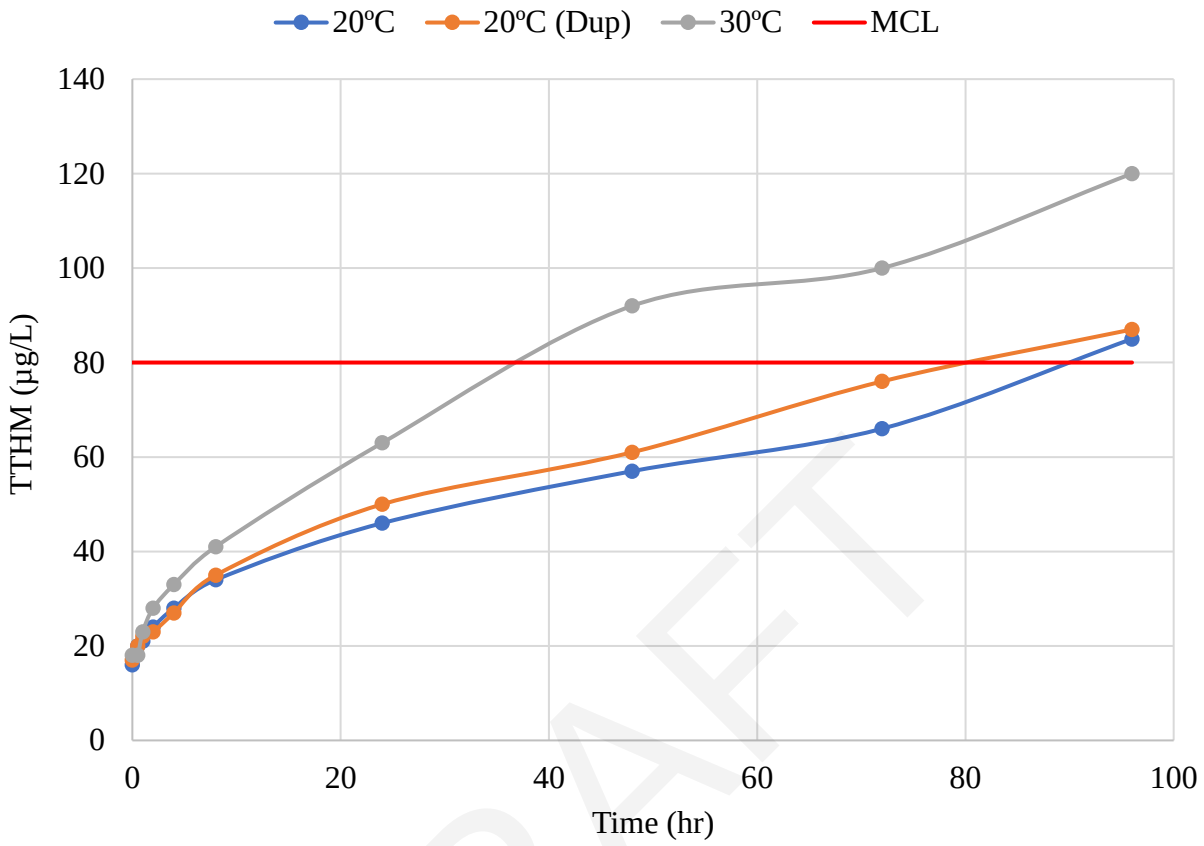

FIGURE 4-6: Time Dependency of DBP Formation with 6 mg/L Chlorine Dose Added to 70% FMWD and 30% Groundwater Blend

5. Summary and Next Steps

The results of this bench testing will allow CVWD operations staff to more closely refine the breakpoint chlorination dose. Measurements and calculations indicate that CVWD may be able to decrease the chlorine dose by 0.5 to 0.7 mg/L or more to simultaneously breakpoint chlorinate and yield a sufficient secondary disinfectant residual. However, the findings from the time dependency test show that even a relatively low water age of 3 to 4 days results in problematic TTHM levels. If CVWD reduces applied chlorine dose, the distribution system should be carefully monitored to ensure that desired residuals are maintained.

The findings of these tests support CVWD's actions to evaluate alternate approaches for TTHM control, since the current practice of breakpoint chlorination and use of 70% FMWD is unlikely to yield consistently low enough DBPs within several days of water age, particularly during warmer months. Potential alternative approaches being investigated include spray aeration to remove DBPs from reservoirs if breakpoint chlorination is continued and use of chloramines if breakpoint chlorination is not continued.

September 17, 2018

Mr. David Gould
District Engineer
Crescenta Valley Water District
2700 Foothill Boulevard
La Crescenta CA 91214

Subject: Letter Proposal to Provide Ammonia Feed Systems Project Management

Dear Mr. Gould:

John Robinson Consulting, Inc. (JR Consulting) is pleased to offer this letter proposal to Crescenta Valley Water District (CVWD) based on information provided on September 14th and per our discussion on September 17th which provided the overall ammonia feed system project goals for Glenwood Plant and Mills Plant. Our firm is a California S Corporation, is certified as Small Business Enterprise (SBE) by Metropolitan Water District and California Department of General Services and is located locally in Pasadena.

This letter proposal outlines our recommended scope of service, time schedule and compensation.

SCOPE OF SERVICES

Planning Assistance - JR Consulting will assist CVWD by completing the following services:

- Conduct a site visit at Glenwood Plant and Mills Plant.
- Reviewing the 30-percent plans being prepared by Engineer of Record.
- Develop a Request of Qualifications in order to obtain three quotes from Ammonia Pump Skid vendors.
- Evaluate Ammonia Pump Skid vendor quotes and coordinate with CVWD staff to order the equipment.
- Coordinate with the Engineer of Record to evaluate Ammonia Pump Skid shop drawings.
- Research and confirm Liquid Ammonia Sulfate is the best source of chemical for the project.
- Investigate with CVWD's staff the electrical requirements at the two locations and develop electrical specifications in order for power supply to the new equipment.
- Develop a Request of Qualifications in order to obtain quote from Tesco Controls Inc. for programming and potential installation of a new subpanel at Glenwood to support RTU 20 and programming at Mills Plant for RTU 1.
- Develop a Request of Qualifications in order to obtain quote from Apex Controls Inc. for the screen updates and alarms at the Human-Machine Interface (HMI).
- Assist with City of Glendale Fire Department permitting after completion of the 30% plans.

- Assist with State Water Resource Control Board Division of Drinking Water permitting which might include Application for Domestic Supply Permit Amendment and Water Supply Permit Environmental Information.
- Assist with environmental documentation (i.e. Class 1 Exemption or Notice of Exemption).

Construction Assistance - JR Consulting will assist CVWD by completing the following services:

- Coordinate with a contractor for a new concrete pad at Mills Plant for the equipment.
- Coordinate with CVWD staff and Engineer of Record to repurpose existing fiberglass shelters for vertical turbine pumps to cover the new equipment.
- Coordinate with CVWD to purchase the necessary piping and valves then review the installation.
- Coordinate the installation of 1 or 2 new eye washes for the project.
- Coordinate the installation of electrical conduits by CVWD staff.
- Determinate size and coordinate with CVWD to order the injection vault for the Glenwood Plant. Significant water pipeline depth issues will need to be taken into consideration.
- Coordinate with welder for the two points of connection required (one at Glenwood Plant and one at Mills Plant).
- Coordinate with an electrical subcontractor in order to install required electrical.
- Coordinate and supervise Tesco integration of the RTU programming and installation.
- Coordinate and supervise Apex integration of the HMI equipment including signals from chlorine analyzers, metering, tank levels and other project signals.
- Confirm chlorine analyzer locations and supervise relocation, if necessary.
- Coordinate the chlorine analyzer system interface at both Glenwood and Mills Plants.
- Coordinate the installation of new chlorine analyzer probes (free to total).

Post Construction Assistance - JR Consulting will assist CVWD by completing the following services:

- Coordinate Project Start-up with CVWD staff.
- Coordinating as-built drawings with Engineer of Record.
- Review modified Operations and Maintenance Manual.
- Coordinate Operational Training with the Ammonia Pump Skid vendor.

TIME SCHEDULE

JR Consulting will commence with the proposed scope of services after the Professional Services Agreement (PSA) has fully been executed. JRC will provided a copy of our Certificate of Insurance per the PSA requirements and will keep the insurance valid throughout the project. JR Consulting has discussed the project schedule with CVWD staff who has developed an estimated project schedule of approximately September 21 through November 24, 2018 but might extend to the end of 2018 which has the rough completion of the project in approximately 3 months.

COMPENSATION

JR Consulting will provide the scope of services with the proposed schedule as set forth in this proposal to CVWD on a time and material basis. Based on JR Consulting's present knowledge of the services described above, it is recommended that $45,225 and is based on 335 hours at $135 per hour which is $15,075 per month but hours will only be charged for those hours worked as this is a not a lump sum proposal.

JR Consulting has decreased the hourly rate for John Robinson from $150 per hour to $135 per hour (10-percent reduction) in order to assist CVWD with additional hours and to support CVWD for requesting JR Consulting to assist with this important project.

JR Consulting commits to timely, responsive services, and to deliver excellence in the offered services. If there are any questions, please feel free to contact me at (626) 375-9389 or jrobinson@johnrobinsonconsulting.com

Very truly yours,

John Robinson Consulting, Inc.

John Robinson, Principal

CRESCENTA VALLEY WATER DISTRICT
AMMONIA FEED SYSTEMS ENGINEERING

The Crescenta Valley Water District is in need of design and construction services to add ammonia injection systems to their Glenwood and Mills water plants to reduce disinfection by-product formation through the formation of chloramines in their water distribution system. Ammonia will be added downstream of chlorine injection in the form of liquid ammonium sulfate. Because of the critical nature of the project and the short timeline, design services will be provided simultaneously with equipment procurement and construction. The District will make the improvements themselves or will hire a Contractor. The District will also manage the project. Below is our scope of work based on our understanding of the above referenced project from our recent site visit and meeting with the District. This proposal does not include services for preparing an operations and maintenance manual, final record drawings, or providing system operational training.

TASK 1 – DESIGN SERVICES

Carollo will assist with design services for this project. In order to move the project directly into construction phase, Carollo will only develop a few drawings which include the following for each of the two project sites:

- Process flow diagram
- Basic plan sheet
- Piping and instrumentation drawings (P&IDs)

The purpose of the process flow diagrams and basic plan sheets will be to give the builder a basis for construction. Pipe routing details will be coordinated and worked through during construction. The P&IDs will be to help the integrator understand the scope of the project, including the number of signals passed to/from the new process equipment. It is our understanding the District has subconsultant integrators and programmers that understand their system such that P&IDs will be sufficient to complete integration and programming. It is assumed design services may require up to two coordination meetings that will be conducted remotely via video/teleconference (WebEx). As part of the design services, no specifications will be developed. Rather, equipment used will be based on District preferences or Carollo standards which will be coordinated with the builder.

Design assumptions for this project are based on discussions with the District from our 9/5/2018 site visit. These assumptions include the following:

- Chemical metering of the Liquid Ammonium Sulfate (LAS) will use a pump skid patterned after the pump skid for the sodium hypochlorite system at the Glenwood Plant.
- The LAS system at the Glenwood Plant will be housed underneath the existing parking canopy located along the north site boundary. The system will utilize chemical totes.
- The LAS system at the Mills Plant will be located on a concrete slab that will be placed adjacent to and on the south side of the existing sodium hypochlorite system. The system

will utilize a small polyethylene tank and an existing fiberglass structure will be installed over the system.

- The City will provide all necessary power and instrumentation wire to new junction boxes near the LAS systems.

TASK 2 –CONSTRUCTION SUPPORT

Carollo will provide support during construction as needed. This support will include shop drawing review for critical components (metering pumps, tanks, and associated equipment). It is assumed that the District will manage construction and perform daily inspection. Carollo will provide milestone project inspection and start-up assistance (up to two site visits for a total of three days). These inspection services are intended to ensure overall construction meets the intent of design.

TASK 3 – PERMITTING SUPPORT

It is our understanding that the only permitting needed for the project will be coordination with the local fire authority and the Division of Drinking Water (DDW). It is assumed the District will coordinate with the fire authority and the District and/or WQTS will coordinate with DDW for project approvals. It is anticipated the fire authority will only require emergency eyewash/showers and secondary containment vessels at each site and no fire sprinklers or emergency alarms/beacons will be needed. Carollo will provide support, as needed, which will include making minor adjustments to the design drawings, one site visit and up to two coordination meetings that will be conducted remotely via video/teleconference (WebEx).

TASK 4 – ADDITIONAL ELECTRICAL SUPPORT

Basic services provided above assumes the District will provide power and controls to field located junction boxes. This task includes a site visit by an electrical engineer and additional services for providing design support and construction services to route power and controls from existing panels to the above referenced junction boxes. This task assumes existing lighting panels have adequate space to accommodate power and existing control panels have adequate spare input/output for this project. The District will be responsible for field coordinating conduit runs.

BUDGET

TASKS	FEE
Task 1 - Design Services	$39,600
Task 2 - Construction Support	$19,400
Task 3 - Permitting Support	$11,100
Task 4 – Additional Electrical Support	$8,700
TOTAL	**$78,800**

Table 3 - Project Schedule forAmmonia Treatment System & DDW Approval
(Revised 9/17/18)

Task No.	Task	Start Date	End Date	Person Responsible	Calendar Days
1	Review Carollo Proposal	Friday, September 14, 2018	Friday, September 14, 2018	DG	0
2	Scope of Work - Construction Admin	Friday, September 14, 2018	Monday, September 17, 2018	DG/JR	3
3	Equipment - Review - Lead Time	Monday, September 17, 2018	Tuesday, September 18, 2018	DG	1
4	**Carollo - Start 30% Design**	**Monday, September 17, 2018**	**Monday, October 8, 2018**	**WQTS /Carollo**	**21**
5	Staff Report - Engineering Committee	Tuesday, September 18, 2018	Thursday, September 20, 2018	DG	2
6	Engineering Committee	Thursday, September 20, 2018	Thursday, September 20, 2018	Eng. Com.	0
7	Staff Report	Thursday, September 20, 2018	Friday, September 21, 2018	DG	1
8	**Award of Contract 1. WQTS - Extend with Carollo Costs 2. JRC for Const. Admin and Coordination**	**Friday, September 21, 2018**	**Tuesday, September 25, 2018**	**DG**	**4**
9	Notice of Award/Agreements	Tuesday, September 25, 2018	Wednesday, September 26, 2018	DG	1
10	Carollo - Preliminary 30% Design Submittal for quantities for cost estimate	Wednesday, September 26, 2018	Thursday, October 4, 2018	WQTS /Carollo	8
11	**Staff Report - Construction Costs**	Thursday, October 4, 2018	Friday, October 5, 2018	DG	**1**
12	**Construction Costs - Total Cost Approved**	**Friday, October 5, 2018**	**Tuesday, October 9, 2018**	**DG**	**4**
13	Ordering Material & Equipment	Tuesday, October 9, 2018	Monday, October 15, 2018	DG/JR	6
14	Carollo - Finalize 30% Design	Thursday, October 4, 2018	Thursday, October 11, 2018	WQTS /Carollo	7
15	Electrical - RFQ - Bidding	Thursday, October 11, 2018	Monday, October 15, 2018	JR	4
16	Electrical - RFQ - Back with Quote, approve, agreement	Monday, October 15, 2018	Thursday, October 25, 2018	Contractor /DG	10
17	RTU - Intergration - RFQ send out	Thursday, October 11, 2018	Monday, October 15, 2018	JR/RD/MH	4
18	RTU - Intergration - RFQ - Back with Quote, approve, agreement	Monday, October 15, 2018	Thursday, October 25, 2018	TESCO	10
19	HMI - Intergration - RFQ	Thursday, October 11, 2018	Monday, October 15, 2018	JR/RD/MH	4
20	HMI - Intergration - RFQ - Back with Quote, approve, agreement	Monday, October 15, 2018	Thursday, October 25, 2018	APEX	10
21	**Submittal & Review - DDW**	**Thursday, October 11, 2018**	**Thursday, October 25, 2018**	**DG/CS**	**14**
22	Equipment - Shop drawing review; fabrication & delivered to Site	Monday, October 15, 2018	Monday, December 3, 2018	JR	49
23	Construction - CVWD Crews; Electrical Contractor	Monday, December 3, 2018	Monday, December 31, 2018	JR/DG	28
24	**Approval from DDW**	**Thursday, October 25, 2018**	**Saturday, November 24, 2018**	**DG/CS**	**30**

Table 4 - Project Schedule for 100% MWD water and Ammonia Treatment System & DDW Approval

(Revised 9/17/18)

Task No.	Task	Start Date	End Date	Person Responsible	Calendar Days
1	Review Carollo Proposal	Friday, September 14, 2018	Friday, September 14, 2018	DG	0
2	Scope of Work - Construction Admin	Friday, September 14, 2018	Monday, September 17, 2018	DG/JR	3
3	Equipment - Review - Lead Time	Monday, September 17, 2018	Tuesday, September 18, 2018	DG	1
4	**Carollo - Start 30% Design**	**Monday, September 17, 2018**	**Monday, October 8, 2018**	**WQTS /Carollo**	**21**
5	Staff Report - Engineering Committee	Tuesday, September 18, 2018	Thursday, September 20, 2018	DG	2
6	Engineering Committee	Thursday, September 20, 2018	Thursday, September 20, 2018	Eng. Com.	0
7	Staff Report	Thursday, September 20, 2018	Friday, September 21, 2018	DG	1
8	**Award of Contract 1. WQTS - Extend with Carollo Costs 2. JRC for Const. Admin and Coordination**	**Friday, September 21, 2018**	**Tuesday, September 25, 2018**	**DG**	**4**
9	Notice of Award/Agreements	Tuesday, September 25, 2018	Wednesday, September 26, 2018	DG	1
10	Operations Meeting - Planning for 100% MWD Water	Wednesday, September 26, 2018	Thursday, September 27, 2018	DG/Operators	1
11	Carollo - Preliminary 30% Design Submittal for quantities for cost estimate	Wednesday, September 26, 2018	Thursday, October 4, 2018	WQTS /Carollo	8
12	Meet with FMWD on increased flow	Thursday, September 27, 2018	Friday, September 28, 2018	FMWD/ CVWD	1
13	Tune off Wells & increase flow from FWMD	Friday, September 28, 2018	Monday, October 1, 2018	CVWD	3
14	Nitrification - Sample Distribution System	Monday, October 1, 2018	Friday, October 5, 2018	CVWD	4
15	TTHM Sample at Reservoir Sites	Tuesday, October 2, 2018	Wednesday, October 3, 2018	CVWD	1
16	**Staff Report - Construction Costs**	Thursday, October 4, 2018	Friday, October 5, 2018	DG	**1**
17	**Construction Costs - Total Cost Approved**	**Friday, October 5, 2018**	**Tuesday, October 9, 2018**	**DG**	**4**
18	Ordering Material & Equipment	Tuesday, October 9, 2018	Monday, October 15, 2018	DG/JR	6
19	TTHM Sample at Reservoir Sites	Wednesday, October 10, 2018	Thursday, October 11, 2018	CVWD	1
19	Carollo - Finalize 30% Design	Thursday, October 4, 2018	Thursday, October 11, 2018	WQTS /Carollo	7
20	Electrical - RFQ - Bidding	Thursday, October 11, 2018	Monday, October 15, 2018	JR	4
21	Electrical - RFQ - Back with Quote, approve, agreement	Monday, October 15, 2018	Thursday, October 25, 2018	Contractor /DG	10

Table 4 - Project Schedule for 100% MWD water and Ammonia Treatment System & DDW Approval

(Revised 9/17/18)

Task No.	Task	Start Date	End Date	Person Responsible	Calendar Days
22	RTU - Integration - RFQ send out	Thursday, October 11, 2018	Monday, October 15, 2018	JR/RD/MH	4
23	RTU - Integration - RFQ - Back with Quote, approve, agreement	Monday, October 15, 2018	Thursday, October 25, 2018	TESCO	10
24	HMI - Integration - RFQ	Thursday, October 11, 2018	Monday, October 15, 2018	JR/RD/MH	4
25	HMI - Integration - RFQ - Back with Quote, approve, agreement	Monday, October 15, 2018	Thursday, October 25, 2018	APEX	10
26	**Submittal & Review - DDW**	**Thursday, October 11, 2018**	**Thursday, October 25, 2018**	**DG/CS**	**14**
27	Equipment - Shop drawing review; fabrication & delivered to Site	Monday, October 15, 2018	Monday, December 3, 2018	JR	49
28	Construction - CVWD Crews; Electrical Contractor	Monday, December 3, 2018	Monday, December 31, 2018	JR/DG	28
29	**Approval from DDW**	**Thursday, October 25, 2018**	**Saturday, November 24, 2018**	**DG/CS**	**30**