

Appendix A

Well No. 5 Information

206377

Quad Minneapolis South
Quad id 104AWELL AND BORING RECORD
MINNESOTA STATUTES CHAPTER 1031Entry Date
Update Date 2002/09/04
Received DateWellname EDINA 5
Township Range Dir Section Subsection Field Located MGS
26 24 W 29 CCBQCD Elevation 873 ft.

Well Depth 443 ft Depth Completed 438 ft Date Well Completed 2002/06/13

Well Owner EDINA 5
3850 69TH ST W
ST FRANCIS MN Changed
Contact
5146 EDEN AV
EDINA MN 55436Drilling Method Cable Tool
Drilling Fluid Water Well Hydrofractured? ☐ YES ☐ NO
From ft. to

Use COMMUNITY SUPPLY

Casing Type Steel (black or low Drive Shoe? ☐ YES ☐ NO Hole Diameter (in.)
Diameter 16 Depth 257
24 in. from 0 to 136 ft. lbs/ft
20 in. from 0 to 200 ft. lbs/ft
16 in. from 0 to 257 ft. lbs/ft

Description	Color	Hardness	From	To (ft.)
SAND & GRAVEL			0	37
CLAY			37	84
MUDDY SAND			84	90
SAND & GRAVEL			90	168
SAND			168	180
SAND & GRAVEL			180	185
SANDSTONE			185	190
CLAY			190	200
ST. PETER SANDSTONE			200	237
SHAKOPEE LIMESTONE			237	365
JORDAN SANDSTONE			365	443

Screen Open Hole(ft.) From 252 to 438
Make Type
Diameter Slot Length SetStatic Water Level (Multiple SWL)
78 ft. Land surface Date measured 2002/06/13Pumping Level (below land surface)
90.00 ft. after 4.00 hrs. pumping 1000.00 g.p.m.

Well Head Completion

Pitless adapter manufacturer Model
☐ Casing Protection ☒ 12 in. above grade
☐ At-grade (Environmental Wells and Borings ONLY) ☐ Basement offsetGrouting Information Well grouted? ☒ YES ☐ NO

Nearest Known Source of Contamination

feet Direction Type
Well disinfected upon completion? ☒ YES ☐ NO

Pump

☐ Not installed Date installed
Manufacturer's name J-LINE
Model number 12 LC HP 100.00 Volts 220
Length of drop pipe 138 Material Capacity 1000 g.p.m.
Type Turbine

Abandoned Wells

Does properly have any not in use and not sealed well(s)? ☐ YES ☒ NO

Variance

Was a variance granted from the MDH for this well? ☐ YES ☒ NO

Well Contractor Certification

Bergerson-Caswell 27058

License Business Name Lic. or Reg No.
MANTHIR, D.

Remarks

CASING: 024 TO 0136; 020 TO 0200; 016 TO 0257.

EDINA NO. 5

G.W.Q. NO.0203

PROJECT #02-5PW (2002/07/09)

First Bedrock SL Peter Aquifer Multiple
Last Strat Jordan Depth to Bedrock 200 ft.

County Well Index v.5

REPORT

Printed on 12/10/03

Name of Driller

Date HE-01205-07 (Rev. 2/99)

CUSTOMER NAME

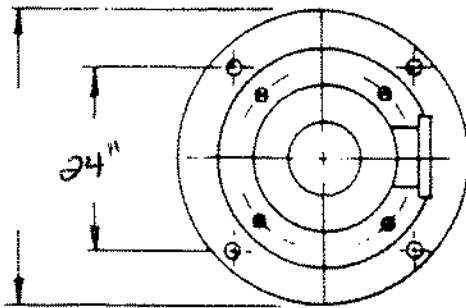
EDINA #5

Date 6-13-02

Job # F02-14053

VERTICAL TURBINE PUMP

Motor Data



Date installed 6-13-02

Model # A504P

Manufacturer A.O. Smith

Serial #

HP 100 Service Factor

Code CD = 39 3/8" RPM 1760

Name Plate Voltage 220/440 Running Voltage 220

Full Load Amps 228 Phase 3 Cycle 60

Running Amps A 212 B 231 C 221

NRR ☒ YES
no

Base Size 10" x 24" Discharge Size 10"

Column Size 10" Thread 8

Length 45 1/2" Straight

Spider Thickness 3/4" Type DROP IN.

Shaft Projection 11 3/4"

Shaft Dia. 1 1/16" S.S. w/STRAIGHTS

Bowl MFG J-LINE Size 12 LCA-5

Stages 5 STAGES Bowl stick up 10 3/8"

Suction Size 8" x 10'

1" poly w/STRAIGHTS w/FLUID TRAK Level INDICATOR

Well Data

Well Size 16" CASRD to 255' reduced to

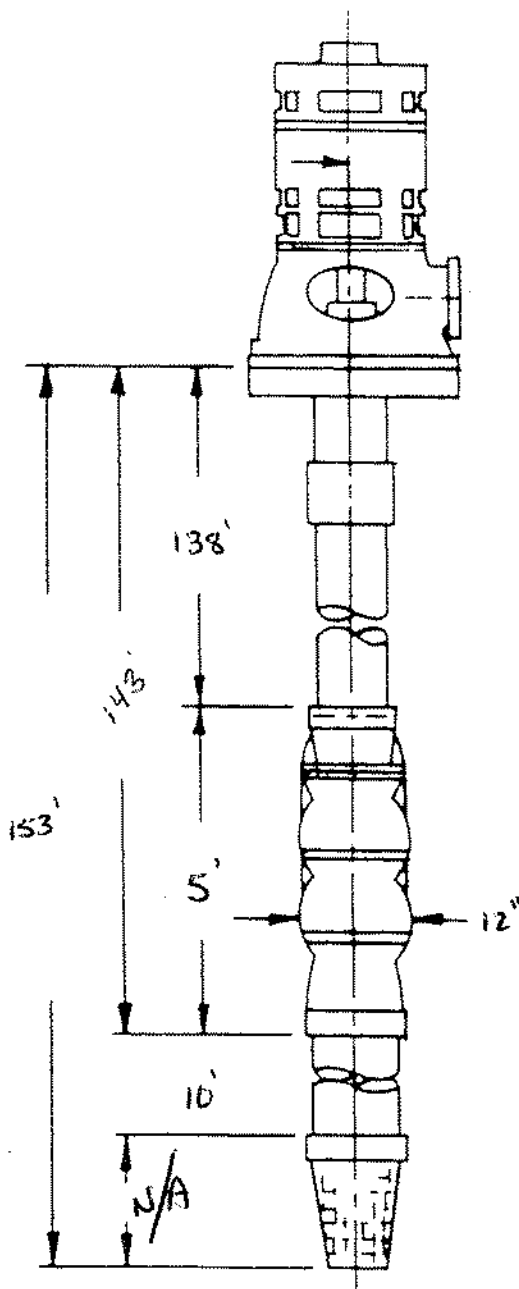
Bottom dia 426' depth 78' dia

depth

Pumping level 90' @ 1,000 GPM

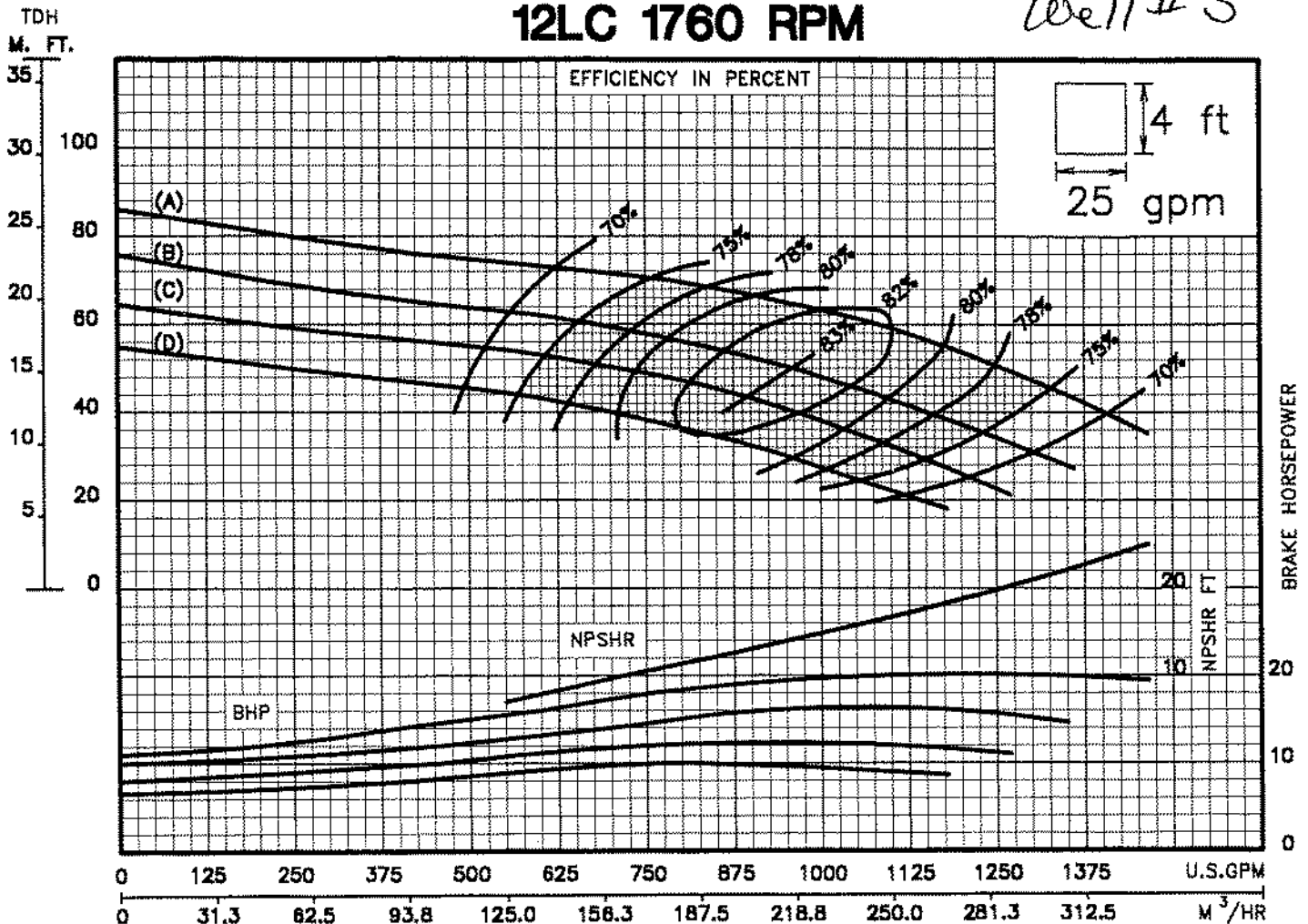
BERGERSON-CASWELL, INC.

TURBINE PUMP



12LC 1760 RPM

Well # 5



CAPACITY

IMPELLER DATA

Impeller Number:	3778	TRIM: (A) 9.375" X 21.5"
Material:	BRONZE	(B) 8.750" X 21.5"
Type:	CLOSED	(C) 8.250" X 21.5"
Thrust Factor:	K=10.60	(D) 7.750" X 21.5"
Eye Area:	20.10 sq. in.	Minimum submergence above eye of bottom impeller: 24 in.
Weight:	15.50 lb.	

BOWL DATA

Bowl Number	2952 C.I./ENAM.
Bowl Dia.	11.563"max 11.250"min
Max. No. Stages	19
One Stage Weight	340 lb
Add'l Stage Weight	100 lb
Std. Shaft Dia.	1.688 in
Std. Lateral	0.875 in
Discharge Size	6-8-10 in
Suction Size	8 - 10 in
Max. Sphere Size	0.625 in
Max. Operation P.S.I.	584 (special)

EFFICIENCY CORRECTION

Number of Bowls	1	2	3	4
Change as follows	-4	-2	-1	0

Change in efficiency may affect both head and horsepower.

Performance based on pumping clear, fresh water at a temperature not over 85° F., and free of gas, air or abrasives, and with bowls properly adjusted and submerged.

TEST PUMPING

DATE: 6/7/02

OWNER: City of Edina

WELL NO: #5 DIAMETER OF WELL: 16"

DEPTH OF WELL: 438'

STATIC WATER LEVEL: Day 1: 86'7" Day 2: 86'

TOTAL LENGTH OF DROP PIPE: 143'

HORSEPOWER: 100

TIME	GPM	PUMPING LEVEL	DRAW DOWN	SPEC. CAP.	RPM	STACK TEMP.	SAND	DISCH PRESS	COLOR WATER
6/7/02									
9:40	330	87'					¼	90	Cloudy
9:48	370						1"		Cloudy
9:50	80								Cloudy
10:00	171			91/91/81			½	92	Cloudy
10:14							¼		Cloudy
10:20	240	88'					¼	90	Cloudy
10:30	227	88'					¼	90	Cloudy
10:45	227	88'					1/8	90	Clear
10:50	340						3/16	90	Clear
11:00	340	89'						88	Clear
11:10	430	89'6"		122/122/111			¼		Clear
11:30	390	89'					3/16	88	Clear
11:35	550						3/16	85	Clear
12:00	550	89'					3/8	85	Clear

TIME	GPM	PUMPING LEVEL	DRAW DOWN	SPEC. CAP.	RPM	STACK TEMP.	SAND	DISCH PRESS	COLOR WATER
12:30	550	89'6"					5/16	85	Clear
12:35	660						3/8	80	Clear
1:00	640	90'					5/16	81	Clear
1:15	650	90'					1/4	80	Clear
6/8/02									
7:30	700	89'					1/2	81	Cloudy
8:00	700	89'		White tint to water			1/4	81	Clear
8:05	820						3/8	74	Clear
8:30	820	91'					1/4	74	Clear
8:35	950						3/8	62	Clear
9:00	950	93'					5/16	62	Clear
9:05	1050			142/156/153			3/8	54	Clear
9:30	1050	94'					1/4	54	Clear
9:35	1120						1/4	46	Clear
10:00	1120	96'					1/4	46	Clear
10:30	1187	96'					1/4	40	Clear
10:35	1285			136/150/148			1/4	25	Clear
11:00	1270	98'					1/4	26	Clear
11:20	1277	98'	Stop				1/4	26	Clear
11:30	1270		Start				1/4	26	Clear
11:40	1270	98'	Stop				1/4	26	Clear
12:15	1270		Start				1/4	26	Clear
12:25	1270	98'	Stop				1/4	26	Clear
12:30	1270		Start	Wide open			1/4	26	Clear
12:40	1260	98'	Stop				3/16	26	Clear
12:45	1260		Start				5/16	26	Clear
12:55	1260	98'	Stop				3/16	26	Clear
1:00	1260		Start				1/4	26	Clear

1:15	1270	98'					3/16	26	Clear
1:30	1270	98'					3/16	26	Clear
2:00	1270	98'					1/8	26	Clear
2:30	1270	98'					1/8	26	Clear
3:00	1000	96'					1/8	55	Clear
3:15	800	94'					Trace	74'	Clear

Appendix B

Well No. 18 Information

PEERLESS PUMP**SURFACE DISCHARGE**

MOTOR: Westinghouse MFR. VHS TYPE
125 H.P. 60 CY. 460 VOLTS
1780 R.P.M. 3 PH. FRAME
 BASE TO ϕ OF DISCHARGE
 DISCHARGE COMPANION FLANGE FOR:
10"
10x10x16-1/2 DISCHARGE HEAD
 O.D. TOP COL. FLANGE
16" I.D. OF WELL
 O.D. OF COUPLING
11-5/8
10" COLUMN Sch 40 PUMP RATING
1-11/16 SHAFT 416SS G.P.M.
N/A TUBE FT. FIELD HD.
 BOWL UNIT: Layne
12RKAH ASSEMBLY
5 STAGE
11-3/4 O.D. OF BOWLS
8 SUCTION PIPE
 STRAINER: N/A
 SIZE O.D.
 TYPE
 DIA. HOLES
 SQ. SQ.
 CONDUIT SIZE
 TOP VIEW

KEYS WELL DRILLING COMPANY
 413 NORTH LEXINGTON PARKWAY
 ST. PAUL, MN 55104

SQ. NO.
 SOLD TO: Edina #18
 ORDER NO.
 USER:
 ITEM NO.
 PUMP IDENTIFICATION:

THIS CERTIFIED PRINT
☐ FOR APPROVAL
 BY _____ DATE _____
☐ FOR CONSTRUCTION
 BY _____ DATE _____



HYDRODYNAMICS DIVISION
PEERLESS PUMP
 Los Angeles 31, Calif. • Indianapolis 8, Ind.

DRN. BY: JWK

CHK'D BY: _____

DATE: 6/11/02

PUMP NO. _____

WELL TEST REPORT

by **Keys Well Drilling Company**

413 Lexington Parkway N., St. Paul, MN 55104-4696

Job	City of Edina	Job No.	2002018
Place		Well No.	#18
Static Water Level	67	From	
Start of Test	8:30 AM (AM)-(PM)	Stop	3:30 PM (AM)-(PM)

Time	GPM	Pumping		PSI	Condition of Water	Sand Content
		Level	Drawdown			
8:30 AM	500	80.00	13.00	13	Cloudy Black	
9:00 AM	500	80.00	13.00	13	Clear	Trace Sand
9:30 AM	600	82.00	15.00	15	Clear	Trace Sand
10:00 AM	700	83.00	16.00	16	Clear	1/8 Circle
10:30 AM	800	90.00	23.00	23	Clear	1/16 Circle
11:00 AM	900	93.00	26.00	26	Clear	1/16
11:30 AM	1000	98.00	31.00	31	Clear	1/4
12:00 PM	1000	98.00	31.00	31	Clear	1/8
12:30 PM	1100	101.00	34.00	34	Clear	3/16
1:00 PM	1200	104.00	37.00	37	Clear	3/16
1:30 PM	1200	104.00	37.00	37	Clear	1/8
2:00 PM	1300	108.00	41.00	41	Clear	1/8
2:30 PM	1300	108.00	41.00	41	Clear	1/16
3:00 PM	1400	112.00	45.00	45	Clear	3/16
3:30 PM	1500	116.00	49.00	49	Clear	3/16

Total Hours Tested Today

7.00

Hours

Date

24-May-02

Day of Week

Friday

Sheet No.

1

Signed

Dave Kraushaar

by **Keys Well Drilling Company**

413 Lexington Parkway N., St. Paul, MN 55104-4696

Job City of Edina

Job No. 2002018

Place

Well No. #18

Static Water Level 67

From

Start of Test 9:00 AM (AM)-(PM)

Stop 3:00 PM (AM)-(PM)

[illegible]

Total Hours Tested Today

6.00 Hours

Date 30-May-02

Day of Week Thursday

Sheet No. 2

Signed Dave Kraushaar

Appendix C

Bench Scale Testing Radium Results

LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

This report may not be reproduced, except in full, without written approval from EEA.

STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Montana	CERT0026
Alaska	IN00035	Nebraska	NE-OS-05-04
Arizona	AZ0432	Nevada	IN00035
Arkansas	IN00035	New Hampshire*	2124
California	2920	New Jersey*	IN598
Colorado	IN035	New Mexico	IN00035
Colorado Radiochemistry	IN035	New York*	11398
Connecticut	PH-0132	North Carolina	18700
Delaware	IN035	North Dakota	R-035
Florida*	E87775	Ohio	87775
Georgia	929	Oklahoma	D9508
Hawaii	IN035	Oregon (Primary AB)*	4074-001
Idaho	IN00035	Pennsylvania*	68-00466
Illinois*	200001	Puerto Rico	IN00035
Illinois Microbiology	17767	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
Missouri	880		

*NELAP/TNI Recognized Accreditation Bodies

110 South Hill Street
 South Bend, IN 46617
 Tel: (574) 233-4777
 Fax: (574) 233-8207
 1 800 332 4345

Laboratory Report

Client: Advanced Engineering & Environmental Services

Report: 391176

Attn: Abbie Browen
 6901 East Fish Lake Road
 Suite 184
 Maple Grove, MN 55369

Priority: Standard Written
 Status: Final
 PWS ID: Not Supplied
 MN Lab ID: 018-999-338

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3717841	Well 5 Raw Water	7110 B	06/19/17 07:00	Client	06/21/17 09:30
3717844	Well 5 Raw Water	7500-Ra B	06/19/17 07:00	Client	06/21/17 09:30
3717844	Well 5 Raw Water	7500-Ra D	06/19/17 07:00	Client	06/21/17 09:30
3717842	Well 5 Filtered Water W/KMnO4	7110 B	06/19/17 12:30	Client	06/21/17 09:30
3717845	Well 5 Filtered Water W/KMnO4	7500-Ra B	06/19/17 12:30	Client	06/21/17 09:30
3717845	Well 5 Filtered Water W/KMnO4	7500-Ra D	06/19/17 12:30	Client	06/21/17 09:30
3717843	Well 5 Filtered Water W/HMO	7110 B	06/19/17 13:30	Client	06/21/17 09:30
3717846	Well 5 Filtered Water W/HMO	7500-Ra B	06/19/17 13:30	Client	06/21/17 09:30
3717846	Well 5 Filtered Water W/HMO	7500-Ra D	06/19/17 13:30	Client	06/21/17 09:30

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Nathan Trowbridge at (574) 233-4777.

Note: This report may not be reproduced, except in full, without written approval from EEA.


 Authorized Signature _____ Title _____
 Client Name: Advanced Engineering & Environmental Services
 Report #: 391176

07/12/2017
 Date _____

Sampling Point: Well 5 Raw Water

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	2.3	3.0	9.5 ± 3.1	pCi/L	06/27/17 14:55	06/28/17 21:37	3717841
13982-63-3	Radium-226	7500-Ra B	---	0.14	1.0	2.2 ± 0.4	pCi/L	06/29/17 09:20	07/11/17 13:43	3717844
15262-20-1	Radium-228	7500-Ra D	---	0.55	1.0	1.1 ± 0.6	pCi/L	06/29/17 09:20	07/03/17 14:29	3717844
---	Combined Radium	calc.	5 *	0.55	1.0	3.3 ± 0.7	pCi/L	06/29/17 09:20	07/11/17 13:43	3717844

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

Sampling Point: Well 5 Filtered Water W/KMnO4

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	2.7	3.0	3.7 ± 2.8	pCi/L	06/27/17 14:55	06/28/17 21:37	3717842
13982-63-3	Radium-226	7500-Ra B	---	0.14	1.0	1.5 ± 0.3	pCi/L	06/29/17 09:20	07/11/17 13:43	3717845
15262-20-1	Radium-228	7500-Ra D	---	0.53	1.0	1.1 ± 0.6	pCi/L	06/29/17 09:20	07/03/17 14:29	3717845
---	Combined Radium	calc.	5 *	0.53	1.0	2.6 ± 0.7	pCi/L	06/29/17 09:20	07/11/17 13:43	3717845

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

Sampling Point: Well 5 Filtered Water W/HMO

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	2.2	3.0	8.7 ± 2.9	pCi/L	06/27/17 14:55	06/28/17 21:37	3717843
13982-63-3	Radium-226	7500-Ra B	---	0.12	1.0	1.7 ± 0.3	pCi/L	06/29/17 09:20	07/11/17 13:43	3717846
15262-20-1	Radium-228	7500-Ra D	---	0.52	1.0	0.94 ± 0.55	pCi/L	06/29/17 09:20	07/03/17 14:29	3717846
---	Combined Radium	calc.	5 *	0.52	1.0	2.64 ± 0.63	pCi/L	06/29/17 09:20	07/11/17 13:43	3717846

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.



Dan Klaybor confirmed with lab that
Aezs would receive results by July 13th.
Eaton Analytical

110 S. Hill Street
South Bend, IN 46617
T: 1.800.332.4345
F: 1.574.233.8207

Order # 321176
Batch # 391176

www.EurofinsUS.com/Eaton

CHAIN OF CUSTODY RECORD

Page 1 of 1

Shaded area for EEA use only

REPORT TO: Abbie Braaten and Aaron Vollmer Aezs, Maple Grove, MN 55369				SAMPLER (Signature) <i>AB</i>				PWS ID #		STATE (sample origin) MN		PROJECT NAME		PO#	
BILL TO: Advanced Engineering & Environmental Services, Inc. 6401 E. Fish Lake Rd, Ste 184 Maple Grove, MN 55369 (11971)				COMPLIANCE MONITORING		Yes		No		POPULATION SERVED		SOURCE WATER Edina, MN			
LAB Number		COLLECTION		SAMPLING SITE				TEST NAME		SAMPLE REMARKS		CHLORINATED			
		DATE		TIME		AM		PM				YES		NO	
1 3717841		6/19/17		9:00		X				Well 5 Raw Water		Gross Alpha + Beta Radium - 226, 228		X	
2 842		6/19/17		12:30		X		X		Well 5 Filtered Water w/ KMnO4				X	
3 843		6/19/17		13:30		X		X		Well 5 Filtered Water w/ HMO				X	
4 844				0700						Well 5 RAW		226/228			
5 845				1230						Filtered KMnO4					
6 846				18:30						HMO					

RELINQUISHED BY: (Signature) <i>AB</i>		DATE 6/19/17		TIME 15:30		RECEIVED BY: (Signature)		DATE		TIME		LAB RESERVES THE RIGHT TO RETURN UNUSED PORTIONS OF NON-AQUEOUS SAMPLES TO CLIENT	
				AM						AM		LAB COMMENTS	
RELINQUISHED BY: (Signature)		DATE		TIME		RECEIVED BY: (Signature)		DATE		TIME			
				AM						AM			
RELINQUISHED BY: (Signature)		DATE		TIME		RECEIVED FOR LABORATORY BY:		DATE		TIME		CONDITIONS UPON RECEIPT (check one):	
				AM		<i>KD</i>				AM		<input type="checkbox"/> Iced: Wet/Blue <input checked="" type="checkbox"/> Ambient <input type="checkbox"/> °C Upon Receipt <input checked="" type="checkbox"/> N/A	

MATRIX CODES:		TURN-AROUND TIME (TAT) - SURCHARGES	
DW-DRINKING WATER RW-REAGENT WATER GW-GROUND WATER SW-EXPOSURE WATER SW-SURFACE WATER PW-POOL WATER WW-WASTE WATER		SW = Standard Written: (15 working days) 0% RV = Rush Verbal: (5 working days) 50% RW = Rush Written: (5 working days) 75% IV = Immediate Verbal: (3 working days) 100% RW = Immediate Written: (3 working days) 125% SP = Weekend, Holiday CALL STAT = Less than 48 hours CALL	

* Please call, expedited service not available for all testing

05-LO-F0435 Issue 6.0 Effective Date: 2016-03-20

Sample analysis will be provided according to the standard EEA Water Services Terms, which are available upon request. Any other terms proposed by Customer are deemed material alterations and are rejected unless expressly agreed to in writing by EEA.

Eurofins Eaton Analytical Run Log

Run ID: **231142** Method: **7110 B**

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3717841	Well 5 Raw Water	GW	DU	06/28/2017 21:37	
FS	3717842	Well 5 Filtered Water W/KMnO4	GW	DU	06/28/2017 21:37	
FS	3717843	Well 5 Filtered Water W/HMO	DW	DU	06/28/2017 21:37	
LRB	3723254		RW	DU	06/28/2017 21:37	
LFB	3723255		RW	DU	06/28/2017 21:37	

QC Summary Report

Sample Type	Analyte	Method	MDA95	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Gross Alpha	7110 B	2.3	Well 5 Raw Water		9.5		pCi/L	---	---	---	---	1.0	06/27/2017 14:55	06/28/2017 21:37	3717841
FS	Gross Alpha	7110 B	2.7	Well 5 Filtered Water W/KMnO4		3.7		pCi/L	---	---	---	---	1.0	06/27/2017 14:55	06/28/2017 21:37	3717842
FS	Gross Alpha	7110 B	2.2	Well 5 Filtered Water W/HMO		8.7		pCi/L	---	---	---	---	1.0	06/27/2017 14:55	06/28/2017 21:37	3717843
LRB	Gross Alpha	7110 B	1.4	---		1.15		pCi/L	---	---	---	---	1.0	06/27/2017 14:55	06/28/2017 21:37	3723254
LFB	Gross Alpha	7110 B	1.51	---		26.7700	28.78	pCi/L	93	80 - 120	---	---	1.0	06/27/2017 14:55	06/28/2017 21:37	3723255

Eurofins Eaton Analytical Run Log

Run ID: **231519** Method: **7500-Ra B**

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3717844	Well 5 Raw Water	GW	DU	07/11/2017 13:43	
FS	3717845	Well 5 Filtered Water W/KMnO4	GW	DU	07/11/2017 13:43	
FS	3717846	Well 5 Filtered Water W/HMO	GW	DU	07/11/2017 13:43	
LRB	3725919		RW	DU	07/11/2017 13:43	
LFB	3725920		RW	DU	07/11/2017 13:43	

QC Summary Report

Sample Type	Analyte	Method	MDA95	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Radium-226	7500-Ra B	0.14	Well 5 Raw Water		2.2		pCi/L	---	---	---	---	1.0	06/29/2017 09:20	07/11/2017 13:43	3717844
FS	Radium-226	7500-Ra B	0.14	Well 5 Filtered Water W/KMnO4		1.5		pCi/L	---	---	---	---	1.0	06/29/2017 09:20	07/11/2017 13:43	3717845
FS	Radium-226	7500-Ra B	0.12	Well 5 Filtered Water W/HMO		1.7		pCi/L	---	---	---	---	1.0	06/29/2017 09:20	07/11/2017 13:43	3717846
LRB	Radium-226	7500-Ra B	0.10	---		0.0100		pCi/L	---	---	---	---	1.0	06/29/2017 09:20	07/11/2017 13:43	3725919
LFB	Radium-226	7500-Ra B	0.120	---		10.4000	10.03	pCi/L	104	90 - 110	---	---	1.0	06/29/2017 09:20	07/11/2017 13:43	3725920

Eurofins Eaton Analytical Run Log

Run ID: **231294** Method: **7500-Ra D**

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
LRB	3725566		RW	DU	07/03/2017 14:21	
LFB	3725567		RW	DU	07/03/2017 14:21	
FS	3717844	Well 5 Raw Water	GW	DU	07/03/2017 14:29	
FS	3717845	Well 5 Filtered Water W/KMnO4	GW	DU	07/03/2017 14:29	
FS	3717846	Well 5 Filtered Water W/HMO	GW	DU	07/03/2017 14:29	

QC Summary Report

Sample Type	Analyte	Method	MDA95	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
LRB	Radium-228	7500-Ra D	0.45	---		0.550		pCi/L	---	---	---	---	1.0	06/29/2017 09:20	07/03/2017 14:21	3725566
LFB	Radium-228	7500-Ra D	0.49	---		7.7200	9.27	pCi/L	83	80 - 120	---	---	1.0	06/29/2017 09:20	07/03/2017 14:21	3725567
FS	Radium-228	7500-Ra D	0.55	Well 5 Raw Water		1.1		pCi/L	---	---	---	---	1.0	06/29/2017 09:20	07/03/2017 14:29	3717844
FS	Radium-228	7500-Ra D	0.53	Well 5 Filtered Water W/KMnO4		1.1		pCi/L	---	---	---	---	1.0	06/29/2017 09:20	07/03/2017 14:29	3717845
FS	Radium-228	7500-Ra D	0.52	Well 5 Filtered Water W/HMO		0.94		pCi/L	---	---	---	---	1.0	06/29/2017 09:20	07/03/2017 14:29	3717846

Sample Type Key

<u>Type (Abbr.)</u>	<u>Sample Type</u>
FS	Field Sample
LFB	Laboratory Fortified Blank
LRB	Laboratory Reagent Blank

END OF REPORT

Appendix D

Pilot Study Field Data

Column Runtime Log

Total Runtime

Total Runtime

Total Runtime

232.67	
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Column 1 & 2																
Date	Time	Flow (gpm)	Chlorine Dose (mg/L)	Chlorine Bulk Conc. mg/L	Chlorine Pump Setpoint %	Chlorine (mL/min)	Perm. Bulk Conc. mg/L	Permanganate Dose (mg/L)	Perm. Pump Setpoint %	Permanganate (mL/min)	HMO Bulk Conc. mg/L	HMO Dose (mg/L)	MO Pump Setpoir %	HMO (mL/min)	Detention (min)	Notes
7/19/2017	11:00:00 AM	2.10	1.20	414	31	22.7	270	0.5	20	15.0	0	0.0	0.0	0.0	7.5	Chlorine Conc. Actually half of assumed after confirming bulk solution only 220 mg/L
7/20/2017	12:00:00 PM	2.10	0.64	220	31	22.7	270	0.5	20	15.0	0	0.0	0.0	0.0	7.5	
7/20/2017	2:00:00 PM	2.10	1.20	480	26	19.7	250	0.6	25	19.0	0	0.0	0.0	0.0	7.5	
7/21/2017	9:30:00 AM	2.10	1.20	480	26	19.7	250	0.7	27	21.0	0	0.0	0.0	0.0	7.5	New 4 gal batch verified at 510 mg/L
7/21/2017	11:00:00 AM	2.10	1.20	510	24	18.7	250	0.7	27	21.0	0	0.0	0.0	0.0	7.5	
7/21/2017	12:00:00 PM	2.10	1.20	510	26		250	0.7	27	21.0	0	0.0	0.0	0.0	7.5	
7/21/2017	12:30:00 PM	2.10	1.20	510	26		250		29		0	0.0	0.0	0.0	7.5	Batch concentrations verified at 510 mg/L Chlorine and 280 mg/L KMnO4
7/21/2017	3:30:00 PM	2.10	1.20	510	26		280	0.7	29		0	0.0	0.0	0.0	7.5	
7/23/2017	5:30:00 PM	2.10	1.20	500	26		300	0.7	29	22.0	0	0.0	0.0	0.0	7.5	
7/24/2017	9:30:00 AM	2.10	1.20	480	27	20.0	377	0.8	23	17.3	0	0.0	0.0	0.0	7.5	Batch concentrations verified at 480 mg/L Chlorine and 377 mg/L KMnO4
7/24/2017	12:30:00 PM	2.10	1.20	480	27	20.0	377	1.0	27	20.7	0	0.0	0.0	0.0	7.5	
7/24/2017	1:45:00 PM	2.10	1.20	480	27	20.0	377	0.5	14	10.6	0	0.0	0.0	0.0	7.5	
7/24/2017	4:00:00 PM	2.10	1.20	480	27	20.0	377	0.3	8	6.5	670	1.0	27	12.6	7.5	HMO batch concentration verified at 670 mg/L
7/24/2017	5:45:00 PM	2.10	1.20	480	27	20.0	377	0.5	14	10.6	670	1.0	27	12.6	7.5	
7/25/2017	8:30:00 AM	2.10	1.20	510	27	20.0	377	0.4	10	8.2	670	1.0	27	12.6	7.5	
7/25/2017	2:30:00 PM	2.10	1.20	510	27	20.0	330	0.4	11	8.3	730	1.0	25	11.5	7.5	
7/26/2017	11:00:00 AM	2.10	1.25	490	27	20.3	330	0.4	11	8.3	715	1.0	25	11.5	7.5	
7/26/2017	1:00:00 PM	2.10	1.20	490	26	19.4	330	0.4	12	9.3	715.0	1.0	25	11.5	7.5	
7/27/2017		2.10	1.20					0.4				1.0				
7/28/2017	11:00:00 AM	2.20	1.20	540	26	19.0	450	0.5	12	9.2	545.0	1.0	32	15.0	30.0	
7/31/2017	11:00:00 AM	2.20	1.20	540	26	19.0	435	0.6	14	11.3	545.0	1.0	32	15.0	30.0	
7/31/2017	2:00:00 PM	2.20	1.20	540	26	19.0	435	0.5	12	9.2	545.0	1.0	32	15.0	30.0	
7/31/2017	8:00:00 PM	2.20	1.20	540	26	19.0	330	0.5	17	13.0	723.0	1.3	32	15.0	30.0	
8/1/2017	8:00:00 AM	2.20	1.20	540	26	19.0	330	0.5	17	13.0	723.0	1.3	32	15.0	30.0	

Column 3																
Date	Time	Flow (gpm)	Chlorine Dose (mg/L)	Chlorine Bulk Conc. mg/L	Chlorine Pump Setpoint %	Chlorine (mL/min)	Perm. Bulk Conc. mg/L	Pernanganate Dose (mg/L)	Perm. Pump Setpoint %	Pernanganate (mL/min)	HMO Bulk Conc. mg/L	HMO Dose (mg/L)	MO Pump Setpoir %	HMO (mL/min)	Detention (min)	Notes
7/19/2017	11:00:00 AM	1.05	1.20	414	15	11.5	270	0.5	10	7.5	0	0.0	0.0	0.0	7.5	
7/20/2017	12:00:00 PM	1.05	0.64	220	15	11.5	270	0.5	10	7.5	0	0.0	0.0	0.0	7.5	
7/20/2017	2:00:00 PM	1.05	1.20	480	13	10.0	250	0.6	13	9.5	0	0.0	0.0	0.0	7.5	
7/21/2017	9:30:00 AM	1.05	1.20	480	13	10.0	250	0.7	14	10.5	0	0.0	0.0	0.0	7.5	
7/21/2017	11:00:00 AM	1.05	1.20	510	12	9.3	250	0.7	14	10.5	0	0.0	0.0	0.0	7.5	
7/21/2017	12:00:00 PM	1.05	1.20	510	13		250	0.7	14	10.5	0	0.0	0.0	0.0	7.5	
7/21/2017	12:30:00 PM	1.05	1.20	510	13		250		15		0	0.0	0.0	0.0	7.5	
7/21/2017	3:30:00 PM	1.05	1.20	510	13		300		15		0	0.0	0.0	0.0	7.5	
7/23/2017	5:30:00 PM	0.95	1.20	490	13		300	0.7	20	10.0	0	0.0	0.0	0.0	7.5	
7/24/2017	9:30:00 AM	1.05	1.20	480	13	10.2	377	0.8	13	8.3	0	0.0	0.0	0.0	7.5	
7/24/2017	12:30:00 PM	1.05	1.20	480	13	10.2	377	1.0	18	10.3	0	0.0	0.0	0.0	7.5	
7/24/2017	1:45:00 PM	1.05	1.20	480	13	10.2	377	0.5	9	5.2	0	0.0	0.0	0.0	7.5	
7/24/2017	4:00:00 PM	1.05	1.20	480	13	10.2	377	0.3	6	3.2	670	1.0	10	6.0	7.5	
7/24/2017	5:45:00 PM	1.05	1.20	480	13	10.2	377	0.5	9	5.2	670	1.0	10	6.0	7.5	
7/25/2017	8:30:00 AM	1.05	1.20	510	13	10.2	377	0.4	7	4.5	670	1.0	10	6.0	7.5	
7/25/2017	2:30:00 PM	1.05	1.20	510	13	10.2	377	0.4	7	4.6	730	1.0	7	5.3	7.5	
7/26/2017	11:00:00 AM	1.05	1.27	490	13	10.3	330	0.4	7	4.6	715.0	1.0	7	5.3	7.5	
7/26/2017	1:00:00 PM	1.05	1.19	490	12	9.7	330	0.4	7	4.6	715.0	1.0	7	5.3	7.5	
7/27/2017		1.27	1.20					0.4				1.0				
7/28/2017	11:00:00 AM	1.27	1.20	540	13	12.2	450	0.5	7 to 8	5.0	545.0	1.0	12	9.0	30.0	
7/31/2017	11:00:00 AM	1.27	1.20	540	13	12.2	450	0.6	8	7.0	545.0	1.0	12	9.0	30.0	
7/31/2017	2:00:00 PM	1.27	1.20	540	13	12.2	435	0.5	7 to 8	5.0	545.0	1.0	12	9.0	30.0	
7/31/2017	8:00:00 PM	1.27	1.20	540	13	12.2	330	0.5	8	6.8	723.0	1.3	12	9.0	30.0	
8/1/2017	8:00:00 AM	1.27	1.20	540	13	12.2	330	0.5	8	6.8	723.0	1.3	12	9.0	30.0	

Edina WTP No. 5 Pilot Study
Chemical Feed Rate Log

Sample Info for Column 1 and 2		Raw Water						
Date	Time	pH	Temp	Fe	Mn	Total Ammonia	Free Ammonia	Mono
			°C	mg/L	mg/L	mg/L	mg/L	mg/L
7/19/2017	7/19/17 11:10	7.66	11.2	0.38	0.226	0.230	0.27	0.00
	7/19/17 14:30	7.49	11.9	0.40	0.209	0.22		
	7/19/17 17:00	7.45	11.5	0.39	0.199		0.22	0.03
7/20/2017	7/20/17 7:15	7.52	11.6	0.35	0.215	0.22		
	7/20/17 9:10	7.54	11.5	0.40	0.197			
	7/20/17 16:50	7.54	11.4	0.36	0.200	0.24		
7/21/2017	7/21/17 8:45	7.51	11.8	0.34	0.192	0.23		
7/23/2017	7/23/17 18:35			0.33	0.192			
7/24/2017	7/24/17 10:35	7.53	13.4	0.37	0.183	0.24		
	7/24/17 17:00			0.50	0.188			
7/25/2017	7/25/17 11:05	7.56	13.1	0.38	0.220	0.22		
	7/25/17 15:55			0.35	0.201			
7/26/2017	7/26/17 11:10			0.37	0.197			
	7/26/17 14:50	7.56	12.8	0.34	0.212	0.23		
7/27/2017	7/27/17 7:25			0.34	0.190			
	7/27/17 10:54			0.37	0.230			
7/28/2017	7/28/17 13:00			0.35	0.202			
7/31/2017	7/31/17 9:00			0.40	0.190			
8/1/2017	8/1/17 17:00			0.38	0.199	0.27		

Sample Info		Column 1 Results													Chem Feed			Notes		
Date	Time	Fe mg/L	Mn mg/L	Total Cl mg/L	Flow gpm	pH	Flow gpm	Delta P inches	Free Cl mg/L	Total Cl mg/L	Fe mg/L	Mn mg/L	Total Ammonia mg/L	Free Ammonia mg/L	Mono mg/L	Chlorine mg/L	KMnO4 mg/L		HMO mg/L	
7/19/2017	7/19/17 11:00					7.44	1.05	18	0	0.74	0.03	0.084		0.02	0.85		1.2	0.5	0	
	7/19/17 13:00											0.043					1.2	0.5	0	
	7/19/17 14:40					7.43	1.05	22	0	0.78	0.05	0.046	0.22				1.2	0.5	0	
	7/19/17 17:40					7.52	1.05	25	0	0.83	0	0.059					1.2	0.5	0	
7/20/2017	7/20/17 7:15					7.45	0.97	40	0	0.59	0	0.030					0.64	0.5	0	
	7/20/17 9:20					7.49	1.05	44	0	0.54	0.02	0.047		0.08	0.6		0.64	0.5	0	
	7/20/17 16:10						1.05	50									1.2	0.6	0	
	7/20/17 17:00					7.50	1.05	57	0	0.89	0.04	0.028					1.2	0.6	0	
	7/20/17 18:10					7.51	1.05	61	0	0.86	0.03	0.055					1.2	0.6	0	
7/21/2017	7/21/17 7:10					7.50	1.05	75	0	0.95	0	0.048					1.2	0.6	0	
	7/21/17 9:00					7.53	1.05	78	0	0.95	0	0.045		0	1.02		1.2	0.6	0	
	7/21/17 11:30						1.05	86	0	0.75	0	0.049					1.2	0.7	0	
	7/21/17 13:30						1.05	87			0	0.051					1.2	0.7	0	
	7/21/17 17:00						1.05	23			0.05	0.048					1.2	0.7	0	
7/22/2017	7/22/17 10:00						1.05	45			0	0.023					1.2	0.7	0	
	7/22/17 21:40						1.05	62									1.2		0	
7/23/2017	7/23/17 9:40						1.05	80									1.2		0	
	7/23/17 18:35						1.05	85			0.02	0.022					1.2	0.7	0	Increased KMnO4 feed
7/24/2017	7/24/17 7:10						1.05	114									1.2	0.7	0	
	7/24/17 7:50						1.05	115	0	0.91	0.05	0.042					1.2	0.7	0	
	7/24/17 10:45					7.52	1.05	118	0	0.9	0.01	0.045		0	0.96		1.2	0.8	0	
	7/24/17 13:15						1.05	123				0.074					1.2	1	0	Breakthrough check: Concentration after hand filtration = 0.071
	7/24/17 14:30						1.05	128				0.052					1.2	0.5	0	
	7/24/17 16:00						1.05	19									1.2	0.3	1	
	7/24/17 17:05						1.05	20		0.77	0.01	0.035					1.2	0.3	1	
7/25/2017	7/25/17 7:40						1.05	34	0	0.95	0	0.046					1.2	0.5	1	
	7/25/17 9:57						1.05	35			0	0.018					1.2	0.4	1	
	7/25/17 11:07					7.53	1.05	37	0	0.87	0.04	0.026		0.01	0.95		1.2	0.4	1	
	7/25/17 13:20						1.05	40			0.02	0.019					1.2	0.4	1	
	7/25/17 16:08						1.05	42		0.81	0.02	0.032					1.2	0.4	1	Verify chem batch concentrations in AM
7/26/2017	7/26/17 10:00						1.05	57		0.85	0	0.034					1.2	0.4	1	
	7/26/17 11:40						1.05	59		0.86	0.03	0.032					1.2	0.4	1	
	7/26/17 14:55					7.52	1.05	61	0	0.85	0	0.042		0.03	0.87		1.2	0.4	1	
	7/26/17 17:50						1.05	63			0	0.046					1.2	0.4	1	
7/27/2017	7/27/17 7:25						1.05	73		0.89	0	0.047					1.2	0.5	1	
	7/27/17 9:45						1.05	75			0	0.066					1.2	0.5	1	
	7/27/17 11:03		0.05				1.05	77			0	0.091					1.2	0.5	1	Top of filter (through 0.45 micron filter) = 0.052
7/28/2017	7/28/17 8:30				2.20		1.05	15									1.2	0.5	1	
	7/28/17 13:00				2.20		1.05	18		0.84	0.01	0.011					1.2	0.5	1	
	7/28/17 14:00				2.20		1.05	19			0	0.02					1.2	0.5	1	
	7/28/17 15:00	0.00	0.02		2.20		1.05	19			0	0.024					1.2	0.5	1	
7/31/2017	7/31/17 9:00				2.20		1.05	21			0.01	0.046					1.2	0.5	1	Only 1.5 hours after startup
	7/31/17 10:40				2.20		1.05	22		0.85	0	0.047					1.2	0.5	1	
	7/31/17 12:30				2.20		1.05	23			0	0.059					1.2	0.6	1	
	7/31/17 15:00				2.20		1.05	23			0	0.046					1.2	0.5	1	
	7/31/17 16:00				2.20		1.05	23				0.061					1.2	0.4	1	
	7/31/17 17:00				2.20		1.05	24				0.045					1.2	0.7	1	
	7/31/17 17:45				2.20		1.05	25				0.039					1.2	0.7	1	
	7/31/17 20:15				2.20		1.05	16									1.2	0.5	1	
8/1/2017	8/1/17 7:40				2.20		1.05	20				0.034					1.2	0.5	1	
	8/1/17 9:45				2.20		1.05	23				0.036					1.2	0.5	0	
	8/1/17 10:40				2.20		1.05	24				0.039					1.2	0.5	0	
	8/1/17 11:30				2.20		1.05	24				0.04					1.2	0.5	0	
	8/1/17 13:50				2.20		1.05	25		0.77		0.034					1.2	0.3	1	
	8/1/17 16:30				2.20		1.05	27				0.039					1.2	0.2	1	
	8/1/17 17:00				2.20		1.05	27		0.59	0.02	0.045					1.2	0.2	1	
	8/1/17 17:50				2.20		1.05	28				0.037					1.2	0.2	1	Permanganate feed shut off 10 minutes before sample
	8/1/17 18:50				2.20		1.05	29				0.032					1.2	0.5	0	
	8/1/17 19:15				2.20		1.05	29				0.039					1.2	0.5	0	

Sample Info		Column 2 Results													Chem Feed			Notes	
Date	Time	Post Detention (filtered through 0.45 micron filter)				Post Filtration								Chlorine	KMnO4	HMO			
		Fe mg/L	Mn mg/L	Total Cl mg/L	Flow gpm	pH	Flow gpm	Delta P inches	Free Cl mg/L	Total Cl mg/L	Fe mg/L	Mn mg/L	Total Ammonia mg/L	Free Ammonia mg/L	Mono mg/L	mg/L	mg/L	mg/L	
7/19/2017	7/19/17 11:00					7.44	1.05	8	0	0.74	0.05	0.062		0.08	0.86	1.2	0.5	0	
	7/19/17 15:00					7.44	1.05	10	0	0.82	0	0.049	0.21			1.2	0.5	0	
	7/19/17 18:00					7.45	1.05	11	0	0.88	0	0.067				1.2	0.5	0	
7/20/2017	7/20/17 7:15					7.49	0.97	20	0	0.69	0	0.031				1.2	0.5	0	
	7/20/17 9:45					7.52	1.05	24	0	0.41	0	0.048		0.1	0.52	0.64	0.5	0	
	7/20/17 16:10							27								1.2	0.6	0	
	7/20/17 17:30					7.51	1.05	30	0	0.99	0.01	0.032				1.2	0.6	0	
	7/20/17 18:30					7.51	1.05	31	0	1.00	0.03	0.053				1.2	0.6	0	
7/21/2017	7/21/17 7:10					7.51	1.05	43	0	0.93	0	0.026				1.2	0.6	0	
	7/21/17 9:00					7.50	1.05	44	0	0.91	0	0.035	0	0.97		1.2	0.6	0	
	7/21/17 11:40						1.05	48	0	0.78	0.02	0.042				1.2	0.7	0	
	7/21/17 13:30						1.05	49			0	0.047				1.2	0.7	0	
	7/21/17 17:00						1.05	7			0.05	0.066				1.2	0.7	0	
7/22/2017	7/22/17 10:00						1.05	20			0.05	0.026				1.2	0.7	0	
	7/22/17 21:40						1.05	32								1.2		0	
7/23/2017	7/23/17 9:50						1.05	45								1.2		0	
	7/23/17 18:35						1.05	48			0.01	0.038				1.2	0.7	0	
7/24/2017	7/24/17 7:10						1.05	65								1.2	0.7	0	Increased KMnO4 feed
	7/24/17 8:10						1.05	66	0	0.89	0.04	0.053				1.2	0.7	0	
	7/24/17 11:05					7.45	1.05	67	0	0.8	0.07	0.056		0.01	1	1.2	0.8	0	
	7/24/17 14:43						1.05	72				0.076				1.2	0.5	0	
	7/24/17 16:00						1.05	5								1.2	0.3	1	
	7/24/17 17:15						1.05	8		0.86	0.03	0.034				1.2	0.3	1	
7/25/2017	7/25/17 7:55						1.05	17		0.95	0	0.033				1.2	0.5	1	
	7/25/17 10:10						1.05	18			0	0.045				1.2	0.4	1	
	7/25/17 11:10					7.55	1.05	19	0	0.88	0.02	0.036		0.03	0.89	1.2	0.4	1	
	7/25/17 13:28						1.05	20			0.01	0.016				1.2	0.4	1	
	7/25/17 16:23						1.05	24		0.9	0	0.033				1.2	0.4	1	Verify chem batch concentrations in AM
7/26/2017	7/26/17 10:07						1.05	33		0.87	0.03	0.031				1.2	0.4	1	
	7/26/17 11:42						1.05	34		0.86	0.01	0.034				1.2	0.4	1	
	7/26/17 15:00					7.52	1.05	35	0	0.86	0	0.039	0.04	0.86		1.2	0.4	1	
	7/26/17 18:15						1.05	36			0.02	0.044				1.2	0.4	1	
7/27/2017	7/27/17 7:26						1.05	44		0.8	0.01	0.064				1.2	0.5	1	
	7/27/17 9:45		0.07				1.05	45			0	0.12				1.2	0.5	1	Breakthrough check = 0.065 (filter effluent through 0.45 filter), Top of filter (filter through 0.45 filter) = 0.069
	7/27/17 11:20		0.05				1.05	46			0.02	0.134				1.2	0.5	1	Top of filter (through 0.45 micron filter) = 0.053
7/28/2017	7/28/17 8:30				2.20		1.05	6								1.2	0.5	1	
	7/28/17 13:00				2.20		1.05	7		0.74	0.01	0.014				1.2	0.5	1	
	7/28/17 14:00				2.20		1.05	8			0.01	0.016				1.2	0.5	1	
	7/28/17 15:20	0.01	0.01		2.20		1.05	9			0	0.018				1.2	0.5	1	
7/31/2017	7/31/17 9:00				2.20		1.05	9			0	0.046				1.2	0.5	1	Only 1.5 hours after startup
	7/31/17 10:40				2.20		1.05	9			0	0.044				1.2	0.5	1	
	7/31/17 12:30				2.20		1.05	10			0	0.058				1.2	0.6	1	
	7/31/17 15:00				2.20		1.05	10			0	0.054				1.2	0.5	1	
	7/31/17 16:00				2.20		1.05	10				0.059				1.2	0.4	1	
	7/31/17 17:00				2.20		1.05	11				0.048				1.2	0.7	1	Increased by couple % to see impact
	7/31/17 18:00				2.20		1.05	11				0.049							Breakthrough check - Mn = 0.045 mg/L (only 0.004 breakthrough)
8/1/2017	7/31/17 20:15				2.20		1.05	3								1.2	0.5	1	
	8/1/17 7:40				2.20		1.05	9				0.041				1.2	0.5	1	
	8/1/17 9:30				2.20		1.05	11		0.77		0.035				1.2	0.5	0	
	8/1/17 10:40				2.20		1.05	12				0.027				1.2	0.5	0	
	8/1/17 11:30				2.20		1.05	12				0.024				1.2	0.5	0	
	8/1/17 12:52				2.20		1.05	13				0.031				1.2	0.3	1	
	8/1/17 13:50				2.20		1.05	13				0.033				1.2	0.3	1	
	8/1/17 15:30				2.20		1.05	14				0.024				1.2	0.2	1	
	8/1/17 16:30				2.20		1.05	14				0.033				1.2	0.2	1	
	8/1/17 17:00				2.20		1.05	14		0.71	0	0.034				1.2	0.2	1	
	8/1/17 18:00				2.20		1.05	15				0.031				1.2	0.2	1	Permanganate feed shut off 10 minutes before sample
	8/1/17 19:00				2.20		1.05	15				0.034				1.2	0.5	0	
	8/1/17 19:15				2.20		1.05	15				0.039				1.2	0.5	0	

Sample Info		Column 3 Results																		Chem Feed			Notes
Date	Time	Fe mg/L	Mn mg/L	Flow gpm	Fe mg/L	Mn mg/L	Total Cl mg/L	pH	Flow gpm	Delta P inches	Aerator gpm	Free Cl mg/L	Total Cl mg/L	Fe mg/L	Mn mg/L	Total Ammonia mg/L	Free Ammonia mg/L	Mono mg/L	Chlorine mg/L	KMnO4 mg/L	HMO mg/L		
7/19/2017	7/19/17 11:00	0.23	0.23					7.66	1.05	14	1.05	0	0.91	0.03	0.082		0.08	1.0	1.2	0.5	0		
	7/19/17 15:20							7.76	1.05	17	1.05	0	1.02	0	0.038	0.21			1.2	0.5	0		
	7/19/17 18:40							7.65	1.05		1.05	0	0.52	0.03	0.043				1.2	0.5	0		
7/20/2017	7/20/17 10:10	0.13	0.23					7.75	1.05	19	1.2	0	0.51	0	0.05		0.13	0.57	0.64	0.5	0		
	7/20/17 16:10									21									1.2	0.6	0		
	7/20/17 16:34									23					0.051				1.2	0.6	0		
	7/20/17 17:45							7.77	1.05	25	1.15	0	1.15	0.02	0.04				1.2	0.6	0		
	7/20/17 18:45							7.77	1.05	26	1.2	0	1.15	0.04	0.046				1.2	0.6	0		
7/21/2017	7/21/17 7:10							7.77	1	37	1.15	0	1.11	0	0.026				1.2	0.6	0		
	7/21/17 9:00	0.05	0.22					7.73	1	38	1.15	0	1.08	0.01	0.044		0	1.12	1.2	0.6	0		
	7/21/17 11:50								1.05	39	1.17	0	0.86	0.03	0.043				1.2	0.7	0		
	7/21/17 13:30								1.05	40	1.17			0.05	0.048				1.2	0.7	0		
7/22/2017	7/22/17 17:00								1.05	7				0.06	0.057				1.2	0.7	0		
	7/22/17 10:00								0.95	13				0.04	0.019				1.2	0.7	0		
	7/22/17 21:40								0.8										1.2		0		
7/23/2017	7/23/17 9:50								0.95	20									1.2		0	Differential pressure outlier (60 inches), likely air in line, actual KMnO4 dose unknown	
	7/23/17 18:35								1	18				0	0.026				1.2	0.7	0	Issues with aerator likely caused low iron removal, actual KMnO4 dose unknown	
7/24/2017	7/24/17 7:10								0.95	37									1.2	0.7	0		
	7/24/17 8:20								1.05	39	1.2	0		0.02	0.066				1.2	0.7	0		
	7/24/17 11:25	0.23	0.21					7.75	1.03	40	1.2	0	0.86	0.03	0.058		0.01	1.1	1.2	0.8	0		
	7/24/17 16:15								1.05	8	1.2								1.2	0.3	0		
	7/24/17 17:25								1.05	10	1.2		0.76	0	0.044				1.2	0.3	0		
7/25/2017	7/25/17 8:08								1.05	21	1.2		1.04	0.03	0.022				1.2	0.5	1		
	7/25/17 10:17								1.05	22	1.2			0	0.043				1.2	0.4	1		
	7/25/17 11:12	0.08	0.18					7.75	1.05	23	1.2	0	0.97	0.02	0.038		0.02	1.02	1.2	0.4	1		
	7/25/17 13:36								1.05	24	1.2			0	0.018				1.2	0.4	1		
	7/25/17 16:35								1.05	25	1.2		1.03	0.03	0.031				1.2	0.4	1	Verify chem batch concentrations in AM	
7/26/2017	7/26/17 10:09								1.05	33	1.2		1.05	0.02	0.036				1.3	0.4	1		
	7/26/17 11:44								1.05	34	1.2		1.07	0	0.05				1.3	0.4	1		
	7/26/17 15:05	0.02	0.21					7.77	1.05	35	1.2	0	0.88	0	0.051		0.05	0.99	1.2	0.4	1		
	7/26/17 18:50								1.05	36	1.2			0	0.055				1.2	0.4	1		
7/27/2017	7/27/17 7:28								1.05	42	1.3		0.97	0	0.026				1.2	0.5	1		
	7/27/17 9:45	0.04	0.22						1.05	43	1.3			0	0.03				1.2	0.5	1		
	7/27/17 11:45					0.05			1.05	44	1.3			0	0.044				1.2	0.5	1	Top of filter (through 0.45 micron filter) = 0.047	
7/28/2017	7/27/17 18:15			1.27					1.05	5	1.3								1.2				
	7/28/17 8:20			1.27					1.05	10	1.35			0	0.019				1.2	0.5	1		
	7/28/17 13:00			1.27					1.05	12	1.3		0.8	0	0.004				1.2	0.5	1		
	7/28/17 14:00			1.27					1.05	13	1.3			0	0.009				1.2	0.5	1		
7/31/2017	7/28/17 15:40			1.27	0.00	0.02			1.05	15	1.3			0	0.013				1.2	0.5	1		
	7/31/17 9:00			1.27					1.05	17	1.3			0.01	0.038				1.2	0.5	1	Only 1.5 hours after startup	
	7/31/17 10:40			1.27					1.05	18	1.3			0.01	0.025				1.2	0.5	1		
	7/31/17 12:30			1.27					1.05	19	1.3			0.01	0.031				1.2	0.6	1		
	7/31/17 15:00			1.27					1.05	19	1.3			0.01	0.044				1.2	0.4	1		
	7/31/17 16:00			1.27					1.05	19	1.3				0.024				1.2	0.7	1	Increased by couple % to see impact	
	7/31/17 17:00			1.27					1.05	20	1.3				0.047				1.2	0.7	1		
	7/31/17 17:40			1.27					1.05	20	1.3				0.031				1.2	0.7	1		
8/1/2017	7/31/17 20:15			1.27					1.05	6	1.3								1.2	0.45	1		
	8/1/17 7:40			1.27					1.05	10	1.3				0.041				1.2	0.45	1		
	8/1/17 9:50			1.27					1.05	13	1.3				0.039				1.2	0.5	0		
	8/1/17 10:40			1.27					1.05	14	1.3				0.039				1.2	0.5	0		
	8/1/17 11:30			1.27					1.05	15	1.3				0.037				1.2	0.5	0		
	8/1/17 13:00			1.27					1.05	19	1.3				0.031				1.2	0.3	1		
	8/1/17 13:50			1.27					1.05	20	1.3				0.035				1.2	0.3	1		
	8/1/17 16:30			1.27					1.05	21	1.3				0.038				1.2	0.2	1		
	8/1/17 17:00	0.05	0.20	1.27					1.05	21	1.3		0.7	0	0.026				1.2	0.2	1		
	8/1/17 18:00			1.27					1.05	22	1.3				0.033				1.2	0.2	1	Permanganate feed shut off 10 minutes before sample	
	8/1/17 19:15			1.27					1.05	23	1.3				0.035				1.2	0.5	1		

Appendix E

Pilot Study Field Calibration Data

Edina WTP No. 5 Pilot Study
Pump Calibration

7/19/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	23.0	14.7		11.5	7.4		mL/min
Stock Solution Strength	414	270		414	270		mg/L
Pump Setpoint Speed	31	20		15	10		%
Start mL on column	0	10		0	60		mL
End mL on column	68	55		35	75		mL
ΔV	68	45		35	15		mL
Drawdown time	3	3		3	2		min
Drawdown	22.7	15.0		11.67	7.50		mL/min
Corresponding dosage	1.18	0.51		1.22	0.51		mg/L
Target Dose	1.20	0.50		1.20	0.50		mg/L
Actual PPD	8.62	5.71		4.44	2.85		lb/day

7/20/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.7	19.0		10.0	9.5		mL/min
Stock Solution Strength	480	250		480	250		mg/L
Pump Setpoint Speed	26	25		13	13		%
Start mL on column	47	47		0	20		mL
End mL on column	86	86		20	67		mL
ΔV	39	39		20	47		mL
Drawdown time	2	2		2	4.75		min
Drawdown	19.5	19.5		10.00	9.89		mL/min
Corresponding dosage	1.18	0.61		1.21	0.62		mg/L
Target Dose	1.19	0.60		1.21	0.60		mg/L
Actual PPD	7.42	7.42		3.80	3.76		lb/day

7/23/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate		21.5			10.8		mL/min
Stock Solution Strength		260			260		mg/L
Pump Setpoint Speed		29			20		%
Start mL on column		0			34		mL
End mL on column		77			64		mL
ΔV		77			30		mL
Drawdown time		3.5			3		min
Drawdown		22.0			10.00		mL/min
Corresponding dosage		0.72			0.65		mg/L
Target Dose		0.70			0.71		mg/L
Actual PPD		8.37			3.80		lb/day

7/24/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.8	17.3		9.3	8.5		mL/min
Stock Solution Strength	480	377		480	377		mg/L
Pump Setpoint Speed	27	23		13	13		%
Start mL on column	70	0		33	38		mL
End mL on column	140	52		63.5	63		mL
ΔV	70	52		30.5	25		mL
Drawdown time	3.5	3		3	3		min
Drawdown	20.0	17.3		10.17	8.33		mL/min
Corresponding dosage	1.21	0.82		1.23	0.79		mg/L
Target Dose	1.20	0.82		1.12	0.80		mg/L
Actual PPD	7.61	6.59		3.87	3.17		lb/day

7/24/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.8	21.0		9.3	10.5		mL/min
Stock Solution Strength	480	377		480	377		mg/L
Pump Setpoint Speed	27	27		13	18		%
Start mL on column	70	104		33	201		mL
End mL on column	140	166		63.5	232		mL
ΔV	70	62		30.5	31		mL
Drawdown time	3.5	3		3	3		min
Drawdown	20.0	20.7		10.17	10.33		mL/min
Corresponding dosage	1.21	0.98		1.23	0.98		mg/L
Target Dose	1.20	1.00		1.12	1.00		mg/L
Actual PPD	7.61	7.86		3.87	3.93		lb/day

7/24/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.8	10.5		9.3	5.3		mL/min
Stock Solution Strength	480	377		480	377		mg/L
Pump Setpoint Speed	27	14		13	7		%
Start mL on column	70	0		33	0		mL
End mL on column	140	45		63.5	22		mL
ΔV	70	45		30.5	22		mL
Drawdown time	3.5	4.25		3	4.25		min
Drawdown	20.0	10.6		10.17	5.18		mL/min
Corresponding dosage	1.21	0.50		1.23	0.49		mg/L
Target Dose	1.20	0.50		1.12	0.50		mg/L
Actual PPD	7.61	4.03		3.87	1.97		lb/day

7/24/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.8	6.4	11.9	9.3	3.2	6.0	mL/min
Stock Solution Strength	480	377	670	480	377	670	mg/L
Pump Setpoint Speed	27	8	27	13	6	10	%
Start mL on column	70	225	50	33	202	176	mL
End mL on column	140	238	94	63.5	211.5	197	mL
ΔV	70	13	44	30.5	9.5	21	mL
Drawdown time	3.5	2	3.5	3	3	3.5	min
Drawdown	20.0	6.5	12.57	10.17	3.17	6.00	mL/min
Corresponding dosage	1.21	0.31	1.06	1.23	0.30	1.01	mg/L
Target Dose	1.20	0.30	1.00	1.12	0.30	1.01	mg/L
Actual PPD	7.61	2.47	4.78	3.87	1.20	2.28	lb/day

7/24/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.8		11.9	9.3		6.0	mL/min
Stock Solution Strength	480		670	480		670	mg/L
Pump Setpoint Speed	27		27	13		10	%
Start mL on column	70		50	33		176	mL
End mL on column	140		94	63.5		197	mL
ΔV	70		44	30.5		21	mL
Drawdown time	3.5		3.5	3		3.5	min
Drawdown	20.0		12.57	10.17		6.00	mL/min
Corresponding dosage	1.21		1.06	1.23		1.01	mg/L
Target Dose	1.20		1.00	1.12		1.01	mg/L
Actual PPD	7.61		4.78	3.87		2.28	lb/day

7/25/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.8	8.5	11.9	9.3	4.2	6.0	mL/min
Stock Solution Strength	510	377	670	510	377	670	mg/L
Pump Setpoint Speed	27	10	27	13	8	10	%
Start mL on column	70	69	50	33	0	176	mL
End mL on column	140	93.5	94	63.5	18	197	mL
ΔV	70	24.5	44	30.5	18	21	mL
Drawdown time	3.5	3	3.5	3	4	3.5	min
Drawdown	20.0	8.2	12.57	10.17	4.50	6.00	mL/min
Corresponding dosage	1.28	0.39	1.06	1.30	0.43	1.01	mg/L
Target Dose	1.27	0.40	1.00	1.19	0.40	1.01	mg/L
Actual PPD	7.61	3.11	4.78	3.87	1.71	2.28	lb/day

7/26/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.8	8.5	11.9	9.3	4.2	6.0	mL/min
Stock Solution Strength	490	330	715	490	330	715	mg/L
Pump Setpoint Speed	27	11	25	13	7	7	%
Start mL on column	0	0	34	0	34	53	mL
End mL on column	61	25	68.5	31	50	77	mL
ΔV	61	25	34.5	31	16	24	mL
Drawdown time	3	3	3	3	3.5	4.5	min
Drawdown	20.3	8.3	11.50	10.33	4.57	5.33	mL/min
Corresponding dosage	1.25	0.35	1.03	1.27	0.38	0.96	mg/L
Target Dose	1.22	0.35	1.07	1.15	0.35	1.08	mg/L
Actual PPD	7.73	3.17	4.37	3.93	1.74	2.03	lb/day

7/26/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.8	8.5	11.9	9.3	4.2	6.0	mL/min
Stock Solution Strength	490	330	715	490	330	715	mg/L
Pump Setpoint Speed	26	12	25	12	7	7	%
Start mL on column	140	58		24			mL
End mL on column	203	86		53			mL
ΔV	63	28	0	29	0	0	mL
Drawdown time	3.25	3		3			min
Drawdown	19.4	9.3	11.50	9.67	4.57	5.33	mL/min
Corresponding dosage	1.20	0.39	1.03	1.19	0.38	0.96	mg/L
Target Dose	1.22	0.35	1.07	1.15	0.35	1.08	mg/L
Actual PPD	7.37	3.55	4.37	3.68	1.74	2.03	lb/day

7/27/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.1	2.1	2.1	1.05	1.05	1.05	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate							mL/min
Stock Solution Strength					450		mg/L
Pump Setpoint Speed					8		%
Start mL on column							mL
End mL on column							mL
ΔV					0		mL
Drawdown time							min
Drawdown					4.57		mL/min
Corresponding dosage					0.52		mg/L
Target Dose					0.00		mg/L
Actual PPD					1.74		lb/day

7/28/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.2	2.2	2.2	1.27	1.27	1.27	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	18.5	8.8	15.2	10.7	5.3	8.8	mL/min
Stock Solution Strength	540	450	545	540	450	545	mg/L
Pump Setpoint Speed	26	12	32	13	7	12	%
Start mL on column	0	20	50	0	0	175	mL
End mL on column	19	43	65	164	15	193	mL
ΔV	19	23	15	164	15	18	mL
Drawdown time	1	2.5	1	13.5	3	2	min
Drawdown	19.00	9.2	15.00	12.15	5.00	9.00	mL/min
Corresponding dosage	1.23	0.50	0.98	1.36	0.47	1.02	mg/L
Target Dose	1.20	0.48	0.99	1.20	0.50	1.00	mg/L
Actual PPD	7.23	3.50	5.71	4.62	1.90	3.42	lb/day

7/31/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.15	2.15	2.15	1.27	1.27	1.27	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate		12.6			7.5		mL/min
Stock Solution Strength		320			320		mg/L
Pump Setpoint Speed		12			9		%
Start mL on column		0			0		mL
End mL on column		12.6			7.5		mL
ΔV		12.6			7.5		mL
Drawdown time		1			1		min
Drawdown		12.6			7.50		mL/min
Corresponding dosage		0.50			0.50		mg/L
Target Dose		0.50			0.50		mg/L
Actual PPD		4.79			2.85		lb/day

8/1/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.15	2.15	2.15	1.27	1.27	1.27	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate		12.6			7.5		mL/min
Stock Solution Strength		320			320		mg/L
Pump Setpoint Speed		17			8		%
Start mL on column		0			0		mL
End mL on column		39			20.5		mL
ΔV		39			20.5		mL
Drawdown time		3			3		min
Drawdown		13.0			6.83		mL/min
Corresponding dosage		0.51			0.45		mg/L
Target Dose		0.50			0.50		mg/L
Actual PPD		4.95			2.60		lb/day

8/1/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.15	2.15	2.15	1.27	1.27	1.27	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate					7.5		mL/min
Stock Solution Strength					320		mg/L
Pump Setpoint Speed					9		%
Start mL on column					26		mL
End mL on column					49		mL
ΔV					23		mL
Drawdown time					3		min
Drawdown					7.67		mL/min
Corresponding dosage					0.51		mg/L
Target Dose					0.50		mg/L
Actual PPD					2.92		lb/day

8/1/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.15	2.15	2.15	1.27	1.27	1.27	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.1	7.7	11.3	11.3	4.5	6.7	mL/min
Stock Solution Strength	510	320	723	510	320	723	mg/L
Pump Setpoint Speed	26	10	26	13	6	9	%
Start mL on column	0	0	28	0	61	92	mL
End mL on column	19	15	51	164	70	120	mL
ΔV	19	15	23	164	9	28	mL
Drawdown time	1	2	2	13.5	2	4	min
Drawdown	19.00	7.5	11.50	12.15	4.50	7.00	mL/min
Corresponding dosage	1.19	0.29	1.02	1.29	0.30	1.05	mg/L
Target Dose	1.20	0.30	1.00	1.20	0.30	1.01	mg/L
Actual PPD	7.23	2.85	4.37	4.62	1.71	2.66	lb/day

8/1/2017	Column 1 & 2			Column 3			
Process Flow (gpm)	2.15	2.15	2.15	1.27	1.27	1.27	
	Chlorine	Permanganate	HMO	Chlorine	Permanganate	HMO	
Target Feed Rate	19.1	7.7	11.3	11.3	4.5	5.6	
Stock Solution Strength	510	320	856	510	320	856	
Pump Setpoint Speed	26	10	21	13	6	8	
Start mL on column	0	0	40	0	61	16	
End mL on column	19	15	59	164	70	21.7	
ΔV	19	15	19	164	9	5.7	
Drawdown time	1	2	2	13.5	2	1	
Drawdown	19.00	7.5	9.50	12.15	4.50	5.70	
Corresponding dosage	1.19	0.29	1.00	1.29	0.30	1.02	
Target Dose	1.20	0.30	1.19	1.20	0.30	1.00	
Actual PPD	7.23	2.85	3.61	4.62	1.71	2.17	lb/day

Appendix F

Pilot Study Laboratory Data

August 03, 2017

Aaron Vollmer
Advanced Engineering and Environmental
Services
6901 E Fish Lake Rd
#184
Osseo, MN 55369

RE: Project: Edina Pilot Study
Pace Project No.: 10396660

Dear Aaron Vollmer:

Enclosed are the analytical results for sample(s) received by the laboratory on July 21, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Dan Nguyen
dan.nguyen@pacelabs.com
612-360-0728
Project Manager

Enclosures

cc: Abbie Browen, Advanced Engineering and Environmental
Services



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: Edina Pilot Study

Pace Project No.: 10396660

Minnesota Certification IDs

1700 Elm Street SE, Suite 200, Minneapolis, MN 55414

A2LA Certification #: 2926.01

Alabama Certification #: 40770

Alaska Contaminated Sites Certification #: UST-078

Alaska DW Certification #: MN00064

Arizona Certification #: AZ0014

Arkansas Certification #: 88-0680

California Certification #: MN00064

CNMI Saipan Certification #: MP0003

Colorado Certification #: MN00064

Connecticut Certification #: PH-0256

EPA Region 8 Certification #: 8TMS-L

Florida Certification #: E87605

Georgia Certification #: 959

Guam EPA Certification #: MN00064

Hawaii Certification #: MN00064

Idaho Certification #: MN00064

Illinois Certification #: 200011

Indiana Certification #: C-MN-01

Iowa Certification #: 368

Kansas Certification #: E-10167

Kentucky DW Certification #: 90062

Kentucky WW Certification #: 90062

Louisiana DEQ Certification #: 03086

Louisiana DW Certification #: MN00064

Maine Certification #: MN00064

Maryland Certification #: 322

Michigan Certification #: 9909

Minnesota Certification #: 027-053-137

Mississippi Certification #: MN00064

Montana Certification #: CERT0092

Nebraska Certification #: NE-OS-18-06

Nevada Certification #: MN00064

New Hampshire Certification #: 2081

New Jersey Certification #: MN002

New York Certification #: 11647

North Carolina DW Certification #: 27700

North Carolina WW Certification #: 530

North Dakota Certification #: R-036

Ohio DW Certification #: 41244

Ohio VAP Certification #: CL101

Oklahoma Certification #: 9507

Oregon NwTPH Certification #: MN300001

Oregon Secondary Certification #: MN200001

Pennsylvania Certification #: 68-00563

Puerto Rico Certification #: MN00064

South Carolina Certification #: 74003001

Tennessee Certification #: TN02818

Texas Certification #: T104704192

Utah Certification #: MN00064

Virginia Certification #: 460163

Washington Certification #: C486

West Virginia DW Certification #: 9952 C

West Virginia WW Certification #: 382

Wisconsin Certification #: 999407970

Wyoming via EPA Region 8 Certification #: 8TMS-L

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SAMPLE ANALYTE COUNT

Project: Edina Pilot Study

Pace Project No.: 10396660

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10396660001	R1-01-170719	EPA 200.8	TT3	2	PASI-M
		EPA 350.1	DCL	1	PASI-M
10396660002	F1-01-170719	EPA 200.8	TT3	2	PASI-M
10396660003	F2-01-170719	EPA 200.8	TT3	2	PASI-M
10396660004	F3-01-170719	EPA 200.8	TT3	2	PASI-M
10396660005	R1-01-170720	EPA 200.8	TT3	2	PASI-M
		EPA 350.1	DCL	1	PASI-M
10396660006	F1-01-170720	EPA 200.8	TT3	2	PASI-M
10396660007	F2-01-170720	EPA 200.8	TT3	2	PASI-M
10396660008	F3-01-170720	EPA 200.8	TT3	2	PASI-M
10396660009	R1-01-170721	EPA 200.8	TT3	2	PASI-M
		EPA 350.1	DCL	1	PASI-M
10396660010	F1-01-170721	EPA 200.8	TT3	2	PASI-M
10396660011	F2-01-170721	EPA 200.8	TT3	2	PASI-M
10396660012	F3-01-170721	EPA 200.8	TT3	2	PASI-M

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ANALYTICAL RESULTS

Project: Edina Pilot Study
Pace Project No.: 10396660

Sample: R1-01-170719		Lab ID: 10396660001	Collected: 07/19/17 17:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron	401	ug/L	50.0	1	07/26/17 13:00	07/27/17 13:00	7439-89-6	
Manganese	180	ug/L	0.50	1	07/26/17 13:00	07/27/17 13:00	7439-96-5	
350.1 Ammonia		Analytical Method: EPA 350.1						
Nitrogen, Ammonia	0.25	mg/L	0.040	1		08/03/17 10:04	7664-41-7	

Sample: F1-01-170719		Lab ID: 10396660002		Collected: 07/19/17 18:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron, Dissolved		ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:32	7439-89-6	
Manganese, Dissolved		8.8	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:32	7439-96-5	

Sample: F2-01-170719		Lab ID: 10396660003		Collected: 07/19/17 18:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron, Dissolved		ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:21	7439-89-6	
Manganese, Dissolved		9.4	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:21	7439-96-5	

Sample: F3-01-170719		Lab ID: 10396660004		Collected: 07/19/17 18:40		Received: 07/21/17 17:05		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron, Dissolved		ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:24	7439-89-6	
Manganese, Dissolved		8.8	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:24	7439-96-5	

Sample: R1-01-170720		Lab ID: 10396660005		Collected: 07/20/17 17:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters		Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron		383	ug/L	50.0	1	07/26/17 13:00	07/27/17 13:03	7439-89-6	
Manganese		166	ug/L	0.50	1	07/26/17 13:00	07/27/17 13:03	7439-96-5	
350.1 Ammonia		Analytical Method: EPA 350.1							
Nitrogen, Ammonia		0.24	mg/L	0.040	1		08/03/17 10:05	7664-41-7	

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ANALYTICAL RESULTS

Project: Edina Pilot Study
Pace Project No.: 10396660

Sample: F1-01-170720		Lab ID: 10396660006		Collected: 07/20/17 17:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron, Dissolved	ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:26	7439-89-6		
Manganese, Dissolved	4.7	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:26	7439-96-5		
Sample: F2-01-170720		Lab ID: 10396660007		Collected: 07/20/17 17:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron, Dissolved	ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:29	7439-89-6		
Manganese, Dissolved	4.0	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:29	7439-96-5		
Sample: F3-01-170720		Lab ID: 10396660008		Collected: 07/20/17 17:45		Received: 07/21/17 17:05		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron, Dissolved	ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:51	7439-89-6		
Manganese, Dissolved	4.6	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:51	7439-96-5		
Sample: R1-01-170721		Lab ID: 10396660009		Collected: 07/21/17 08:45		Received: 07/21/17 17:05		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
200.8 MET ICPMS		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron	389	ug/L	50.0	1	07/26/17 13:00	07/27/17 13:06	7439-89-6		
Manganese	168	ug/L	0.50	1	07/26/17 13:00	07/27/17 13:06	7439-96-5		
350.1 Ammonia		Analytical Method: EPA 350.1							
Nitrogen, Ammonia	0.25	mg/L	0.040	1		08/03/17 10:07	7664-41-7		
Sample: F1-01-170721		Lab ID: 10396660010		Collected: 07/21/17 09:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual	
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8							
Iron, Dissolved	ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:53	7439-89-6		
Manganese, Dissolved	3.0	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:53	7439-96-5		

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ANALYTICAL RESULTS

Project: Edina Pilot Study

Pace Project No.: 10396660

Sample: F2-01-170721		Lab ID: 10396660011	Collected: 07/21/17 09:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual

200.8 MET ICPMS, Dissolved

Analytical Method: EPA 200.8 Preparation Method: EPA 200.8

Iron, Dissolved	ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:56	7439-89-6	
Manganese, Dissolved	3.2	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:56	7439-96-5	

Sample: F3-01-170721		Lab ID: 10396660012	Collected: 07/21/17 09:00		Received: 07/21/17 17:05		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual

200.8 MET ICPMS, Dissolved

Analytical Method: EPA 200.8 Preparation Method: EPA 200.8

Iron, Dissolved	ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 02:59	7439-89-6	
Manganese, Dissolved	3.2	ug/L	0.50	1	07/31/17 11:55	08/01/17 02:59	7439-96-5	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Edina Pilot Study
Pace Project No.: 10396660

QC Batch: 487273 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET
Associated Lab Samples: 10396660001, 10396660005, 10396660009

METHOD BLANK: 2652275 Matrix: Water
Associated Lab Samples: 10396660001, 10396660005, 10396660009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron	ug/L	ND	50.0	07/27/17 09:33	
Manganese	ug/L	ND	0.50	07/27/17 09:33	

LABORATORY CONTROL SAMPLE: 2652276

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron	ug/L	2000	2220	111	85-115	
Manganese	ug/L	100	109	109	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2652277 2652278

Parameter	Units	10396816001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Iron	ug/L	ND	2000	2000	2150	2200	107	110	70-130	3	
Manganese	ug/L	ND	100	100	106	110	105	109	70-130	4	

MATRIX SPIKE SAMPLE: 2652279

Parameter	Units	10396888002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Iron	ug/L	726	2000	2910	109	70-130	
Manganese	ug/L	206	100	321	114	70-130	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Edina Pilot Study

Pace Project No.: 10396660

QC Batch:	488134	Analysis Method:	EPA 200.8
QC Batch Method:	EPA 200.8	Analysis Description:	200.8 MET Dissolved
Associated Lab Samples:	10396660002, 10396660003, 10396660004, 10396660006, 10396660007, 10396660008, 10396660010, 10396660011, 10396660012		

METHOD BLANK:	2656904	Matrix:	Water
Associated Lab Samples:	10396660002, 10396660003, 10396660004, 10396660006, 10396660007, 10396660008, 10396660010, 10396660011, 10396660012		

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron, Dissolved	ug/L	ND	50.0	08/01/17 02:18	
Manganese, Dissolved	ug/L	ND	0.50	08/01/17 02:18	

LABORATORY CONTROL SAMPLE:	2656905					
Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Dissolved	ug/L	2000	2070	103	85-115	
Manganese, Dissolved	ug/L	100	107	107	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE:	2656906			2656907							
Parameter	Units	10396660002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Iron, Dissolved	ug/L	ND	2000	2000	2080	2100	104	105	70-130	1	
Manganese, Dissolved	ug/L	8.8	100	100	117	118	108	110	70-130	1	

MATRIX SPIKE SAMPLE:	2656908						
		10396891003	Spike	MS	MS	% Rec	
Parameter	Units	Result	Conc.	Result	% Rec	Limits	Qualifiers
Iron, Dissolved	ug/L	ND	2000	2480	122	70-130	
Manganese, Dissolved	ug/L	49.3	100	183	134	70-130	M1

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QUALITY CONTROL DATA

Project: Edina Pilot Study
Pace Project No.: 10396660

QC Batch: 488930 Analysis Method: EPA 350.1
QC Batch Method: EPA 350.1 Analysis Description: 350.1 Ammonia
Associated Lab Samples: 10396660001, 10396660005, 10396660009

METHOD BLANK: 2660912 Matrix: Water
Associated Lab Samples: 10396660001, 10396660005, 10396660009

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Nitrogen, Ammonia	mg/L	ND	0.040	08/03/17 09:56	

LABORATORY CONTROL SAMPLE: 2660913

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Nitrogen, Ammonia	mg/L	1	1.0	100	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2660914 2660915

Parameter	Units	10396552008 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Nitrogen, Ammonia	mg/L	ND	1	1	1.0	1.0	104	101	90-110	3	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2660916 2660917

Parameter	Units	10396919001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Nitrogen, Ammonia	mg/L	ND	1	1	1.0	1.0	102	101	90-110	1	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: Edina Pilot Study
Pace Project No.: 10396660

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

ANALYTE QUALIFIERS

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Edina Pilot Study

Pace Project No.: 10396660

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10396660001	R1-01-170719	EPA 200.8	487273	EPA 200.8	487608
10396660005	R1-01-170720	EPA 200.8	487273	EPA 200.8	487608
10396660009	R1-01-170721	EPA 200.8	487273	EPA 200.8	487608
10396660002	F1-01-170719	EPA 200.8	488134	EPA 200.8	488316
10396660003	F2-01-170719	EPA 200.8	488134	EPA 200.8	488316
10396660004	F3-01-170719	EPA 200.8	488134	EPA 200.8	488316
10396660006	F1-01-170720	EPA 200.8	488134	EPA 200.8	488316
10396660007	F2-01-170720	EPA 200.8	488134	EPA 200.8	488316
10396660008	F3-01-170720	EPA 200.8	488134	EPA 200.8	488316
10396660010	F1-01-170721	EPA 200.8	488134	EPA 200.8	488316
10396660011	F2-01-170721	EPA 200.8	488134	EPA 200.8	488316
10396660012	F3-01-170721	EPA 200.8	488134	EPA 200.8	488316
10396660001	R1-01-170719	EPA 350.1	488930		
10396660005	R1-01-170720	EPA 350.1	488930		
10396660009	R1-01-170721	EPA 350.1	488930		

REPORT OF LABORATORY ANALYSIS

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[illegible]

Important Note: By signing this form you are accepting Pace's **NET 30** day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.





Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company: AECS	Report To:	Company Name:	Attention:	Page: of	
Address: 6901 E Fish Lake Rd	Copy To:	Address:		2206802	
Email: h66r.666r@AECS.com	Purchase Order No.:	Project Name:	Regulatory Agency:	REGULATORY AGENCY	
Phone: 763-468-5036	Project Number:	Project Manager:	NPDES <input type="checkbox"/> GROUND WATER <input type="checkbox"/> RCRA <input type="checkbox"/> UST <input type="checkbox"/> OTHER <input type="checkbox"/>	DRINKING WATER <input type="checkbox"/>	
Requested Due Date/TAT:			Site Location:	STATE:	

ITEM #	Section D Required Client Information	Matrix Codes MATRIX / CODE Drinking Water Water Waste Water Product Soil/Solid Oil Wipe Air Tissue Other	SAMPLE CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED		SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives										Analysis Test Y/N	Requested Analysis Filtered (Y/N)	Pace Project No./ Lab I.D.									
					COMPOSITE START	COMPOSITE END/GRAB			Unpreserved	H ₂ SO ₄	HNO ₃	HCl	NaOH	Na ₂ S ₂ O ₃	Methanol	Other														
1	R1-01-170721-Metals	DW	W1G	7/21	8:45		14	1			X							X												009
2	R1-01-170721-Ammonia	WT			8:45		14	1			X																			010
3	F1-01-170721-Metals	WW			9:00		14	1			X							X	X	X										011
4	F2-01-170721-Metals	P			9:00		14	1			X							X	X	X										012
5	F3-01-170721-Metals	SL			9:00		14	1			X							X	X	X										
6		Oil																												
7		Wipe																												
8		Air																												
9		Tissue																												
10		Other																												
11																														
12																														

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
	<i>Chris Vetter</i>	7-24-17	17:05	<i>Mandi Pace</i>	7-24-17	17:05	Temp In °C: 22.2 Received on Ice (Y/N): Y Sealed Cooler (Y/N): Y Samples Intact (Y/N): Y
SAMPLER NAME AND SIGNATURE PRINT Name of SAMPLER: SIGNATURE of SAMPLER:							

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

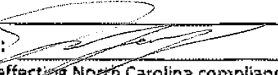
	Document Name: Sample Condition Upon Receipt Form	Document Revised: 19Dec2016 Page 1 of 2
	Document No.: F-MN-L-213-rev.20	Issuing Authority: Pace Minnesota Quality Office


Sample Condition Upon Receipt	Client Name: AE2S	Project #:	WO# : 10396660  10396660
	Courier: <input type="checkbox"/> Fed Ex <input type="checkbox"/> UPS <input type="checkbox"/> USPS <input checked="" type="checkbox"/> Client <input type="checkbox"/> Commercial <input type="checkbox"/> Pace <input type="checkbox"/> Speedee <input type="checkbox"/> Other:	Tracking Number:	

Custody Seal on Cooler/Box Present? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Packing Material: <input type="checkbox"/> Bubble Wrap <input type="checkbox"/> Bubble Bags <input checked="" type="checkbox"/> None <input type="checkbox"/> Other:	Seals Intact? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Temp Blank? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Optional: Proj. Due Date: Proj. Name:
Thermometer Used: <input checked="" type="checkbox"/> 151401163 <input type="checkbox"/> 151401164 Type of Ice: <input checked="" type="checkbox"/> Wet <input type="checkbox"/> Blue <input type="checkbox"/> None <input type="checkbox"/> Samples on ice, cooling process has begun		
Cooler Temp Read (°C): 2.2 Cooler Temp Corrected (°C): 2.2 Temp should be above freezing to 6°C Correction Factor: TRUE	Biological Tissue Frozen? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A Date and Initials of Person Examining Contents: ME 7-21-17	
USDA Regulated Soil (<input checked="" type="checkbox"/> N/A, water sample) Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? <input type="checkbox"/> Yes <input type="checkbox"/> No Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? <input type="checkbox"/> Yes <input type="checkbox"/> No		
If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.		

		COMMENTS:
Chain of Custody Present?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	1.
Chain of Custody Filled Out?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2.
Chain of Custody Relinquished?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	3.
Sampler Name and/or Signature on COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	4.
Samples Arrived within Hold Time?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	5.
Short Hold Time Analysis (<72 hr)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	6.
Rush Turn Around Time Requested?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	7.
Sufficient Volume?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	8.
Correct Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	9.
-Pace Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Containers Intact?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	10.
Filtered Volume Received for Dissolved Tests?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	12.
-Includes Date/Time/ID/Analysis Matrix: wt		
All containers needing acid/base preservation have been checked?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	13. <input checked="" type="checkbox"/> HNO ₃ <input checked="" type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> NaOH Positive for Res. Chlorine? Y N
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO ₃ , H ₂ SO ₄ <2pH, NaOH >9 Sulfide, NaOH >12 Cyanide) Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sample # 1, 3, 8, 11, 14, 13, 15
Headspace in VOA Vials (>6mm)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Initial when completed: ME Lot # of added preservative: 1117030
Trip Blank Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	14.
Trip Blank Custody Seals Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	15.
Pace Trip Blank Lot # (if purchased):		

CLIENT NOTIFICATION/RESOLUTION		Field Data Required? <input type="checkbox"/> Yes <input type="checkbox"/> No
Person Contacted:	Date/Time:	
Comments/Resolution:		

Project Manager Review: 	Date: 7/24/17
Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers).	

	Document Name: Sample Condition Upon Receipt Form	Document Revised: 19Dec2016 Page 2 of 2
	Document No.: F-MN-L-213-rev.20	Issuing Authority: Pace Minnesota Quality Office

SCUR Exceptions:

Workorder #: 10396660

Issue	Sample ID	Container Type/#

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preservative	pH Upon Receipt	Date Preservation Adjusted	Time Preservation Adjusted	Amount of Additional Preservative Added	Lot # of Preservative Added	pH After Adjustment	Initials
F1-01-170719-Metals HAND ₃		6	7-21-17	1735	1.0ml	1117030	2	ME

August 03, 2017

Aaron Vollmer
Advanced Engineering and Environmental
Services
6901 E Fish Lake Rd
#184
Osseo, MN 55369

RE: Project: Edina Pilot Study
Pace Project No.: 10396891

Dear Aaron Vollmer:

Enclosed are the analytical results for sample(s) received by the laboratory on July 25, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Dan Nguyen
dan.nguyen@pacelabs.com
612-360-0728
Project Manager

Enclosures

cc: Abbie Browen, Advanced Engineering and Environmental
Services



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: Edina Pilot Study

Pace Project No.: 10396891

Minnesota Certification IDs

1700 Elm Street SE, Suite 200, Minneapolis, MN 55414

A2LA Certification #: 2926.01

Alabama Certification #: 40770

Alaska Contaminated Sites Certification #: UST-078

Alaska DW Certification #: MN00064

Arizona Certification #: AZ0014

Arkansas Certification #: 88-0680

California Certification #: MN00064

CNMI Saipan Certification #: MP0003

Colorado Certification #: MN00064

Connecticut Certification #: PH-0256

EPA Region 8 Certification #: 8TMS-L

Florida Certification #: E87605

Georgia Certification #: 959

Guam EPA Certification #: MN00064

Hawaii Certification #: MN00064

Idaho Certification #: MN00064

Illinois Certification #: 200011

Indiana Certification #: C-MN-01

Iowa Certification #: 368

Kansas Certification #: E-10167

Kentucky DW Certification #: 90062

Kentucky WW Certification #: 90062

Louisiana DEQ Certification #: 03086

Louisiana DW Certification #: MN00064

Maine Certification #: MN00064

Maryland Certification #: 322

Michigan Certification #: 9909

Minnesota Certification #: 027-053-137

Mississippi Certification #: MN00064

Montana Certification #: CERT0092

Nebraska Certification #: NE-OS-18-06

Nevada Certification #: MN00064

New Hampshire Certification #: 2081

New Jersey Certification #: MN002

New York Certification #: 11647

North Carolina DW Certification #: 27700

North Carolina WW Certification #: 530

North Dakota Certification #: R-036

Ohio DW Certification #: 41244

Ohio VAP Certification #: CL101

Oklahoma Certification #: 9507

Oregon NwTPH Certification #: MN300001

Oregon Secondary Certification #: MN200001

Pennsylvania Certification #: 68-00563

Puerto Rico Certification #: MN00064

South Carolina Certification #: 74003001

Tennessee Certification #: TN02818

Texas Certification #: T104704192

Utah Certification #: MN00064

Virginia Certification #: 460163

Washington Certification #: C486

West Virginia DW Certification #: 9952 C

West Virginia WW Certification #: 382

Wisconsin Certification #: 999407970

Wyoming via EPA Region 8 Certification #: 8TMS-L

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SAMPLE ANALYTE COUNT

Project: Edina Pilot Study

Pace Project No.: 10396891

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10396891001	R1-01-170724	EPA 200.8	TT3	2	PASI-M
		EPA 350.1	DCL	1	PASI-M
10396891002	F1-01-170724-Metals	EPA 200.8	TT3	2	PASI-M
10396891003	F2-01-170724-Metals	EPA 200.8	TT3	2	PASI-M
10396891004	F3-01-170724-Metals	EPA 200.8	TT3	2	PASI-M
10396891005	R1-01-170725	EPA 200.8	TT3	2	PASI-M
		EPA 350.1	DCL	1	PASI-M
10396891006	F1-01-170725-Metals	EPA 200.8	TT3	2	PASI-M
10396891007	F2-01-170725-Metals	EPA 200.8	TT3	2	PASI-M
10396891008	F3-01-170725-Metals	EPA 200.8	TT3	2	PASI-M

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Edina Pilot Study
Pace Project No.: 10396891

Sample: R1-01-170724		Lab ID: 10396891001	Collected: 07/24/17 10:35		Received: 07/25/17 13:19		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron	390	ug/L	50.0	1	07/26/17 13:00	07/27/17 13:08	7439-89-6	
Manganese	166	ug/L	0.50	1	07/26/17 13:00	07/27/17 13:08	7439-96-5	
350.1 Ammonia		Analytical Method: EPA 350.1						
Nitrogen, Ammonia	0.26	mg/L	0.040	1		08/03/17 10:34	7664-41-7	
Sample: F1-01-170724-Metals		Lab ID: 10396891002	Collected: 07/24/17 10:45		Received: 07/25/17 13:19		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron, Dissolved	ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 03:01	7439-89-6	
Manganese, Dissolved	28.7	ug/L	0.50	1	07/31/17 11:55	08/01/17 03:01	7439-96-5	
Sample: F2-01-170724-Metals		Lab ID: 10396891003	Collected: 07/24/17 11:05		Received: 07/25/17 13:19		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron, Dissolved	ND	ug/L	50.0	1	07/31/17 11:55	08/01/17 03:04	7439-89-6	
Manganese, Dissolved	49.3	ug/L	0.50	1	07/31/17 11:55	08/01/17 03:04	7439-96-5	M1
Sample: F3-01-170724-Metals		Lab ID: 10396891004	Collected: 07/24/17 11:25		Received: 07/25/17 13:19		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron, Dissolved	ND	ug/L	50.0	1	07/27/17 10:35	07/28/17 14:20	7439-89-6	
Manganese, Dissolved	17.7	ug/L	0.50	1	07/27/17 10:35	07/28/17 14:20	7439-96-5	
Sample: R1-01-170725		Lab ID: 10396891005	Collected: 07/25/17 11:05		Received: 07/25/17 13:19		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron	388	ug/L	50.0	1	07/26/17 13:00	07/27/17 13:12	7439-89-6	
Manganese	164	ug/L	0.50	1	07/26/17 13:00	07/27/17 13:12	7439-96-5	
350.1 Ammonia		Analytical Method: EPA 350.1						
Nitrogen, Ammonia	0.28	mg/L	0.040	1		08/03/17 10:34	7664-41-7	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Edina Pilot Study

Pace Project No.: 10396891

Sample: F1-01-170725-Metals		Lab ID: 10396891006	Collected: 07/25/17 11:07	Received: 07/25/17 13:19	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual

200.8 MET ICPMS, Dissolved Analytical Method: EPA 200.8 Preparation Method: EPA 200.8

Iron, Dissolved	ND	ug/L	50.0	1	07/27/17 10:35	07/28/17 16:50	7439-89-6
Manganese, Dissolved	2.3	ug/L	0.50	1	07/27/17 10:35	07/28/17 16:50	7439-96-5

Sample: F2-01-170725-Metals		Lab ID: 10396891007	Collected: 07/25/17 11:10	Received: 07/25/17 13:19	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual

200.8 MET ICPMS, Dissolved Analytical Method: EPA 200.8 Preparation Method: EPA 200.8

Iron, Dissolved	ND	ug/L	50.0	1	07/27/17 10:35	07/28/17 16:53	7439-89-6
Manganese, Dissolved	4.4	ug/L	0.50	1	07/27/17 10:35	07/28/17 16:53	7439-96-5

Sample: F3-01-170725-Metals		Lab ID: 10396891008	Collected: 07/25/17 11:12	Received: 07/25/17 13:19	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual

200.8 MET ICPMS, Dissolved Analytical Method: EPA 200.8 Preparation Method: EPA 200.8

Iron, Dissolved	ND	ug/L	50.0	1	07/27/17 10:35	07/28/17 16:55	7439-89-6
Manganese, Dissolved	2.4	ug/L	0.50	1	07/27/17 10:35	07/28/17 16:55	7439-96-5

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Edina Pilot Study

Pace Project No.: 10396891

QC Batch: 487273 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET
Associated Lab Samples: 10396891001, 10396891005

METHOD BLANK: 2652275 Matrix: Water

Associated Lab Samples: 10396891001, 10396891005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron	ug/L	ND	50.0	07/27/17 09:33	
Manganese	ug/L	ND	0.50	07/27/17 09:33	

LABORATORY CONTROL SAMPLE: 2652276

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron	ug/L	2000	2220	111	85-115	
Manganese	ug/L	100	109	109	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2652277 2652278

Parameter	Units	10396816001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Iron	ug/L	ND	2000	2000	2150	2200	107	110	70-130	3	
Manganese	ug/L	ND	100	100	106	110	105	109	70-130	4	

MATRIX SPIKE SAMPLE: 2652279

Parameter	Units	10396888002 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Iron	ug/L	726	2000	2910	109	70-130	
Manganese	ug/L	206	100	321	114	70-130	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL DATA

Project: Edina Pilot Study

Pace Project No.: 10396891

QC Batch: 487547 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET Dissolved
Associated Lab Samples: 10396891004, 10396891006, 10396891007, 10396891008

METHOD BLANK: 2653527 Matrix: Water
Associated Lab Samples: 10396891004, 10396891006, 10396891007, 10396891008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron, Dissolved	ug/L	ND	50.0	07/28/17 14:09	
Manganese, Dissolved	ug/L	ND	0.50	07/28/17 14:09	

LABORATORY CONTROL SAMPLE: 2653528

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Dissolved	ug/L	2000	2100	105	85-115	
Manganese, Dissolved	ug/L	100	105	105	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2653529 2653530

Parameter	Units	10396891004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Iron, Dissolved	ug/L	ND	2000	2000	2010	2080	100	104	70-130	3	
Manganese, Dissolved	ug/L	17.7	100	100	118	121	100	104	70-130	3	

MATRIX SPIKE SAMPLE: 2653644

Parameter	Units	10396520001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Iron, Dissolved	ug/L	<0.050 mg/L	2000	2130	105	70-130	
Manganese, Dissolved	ug/L	0.017 mg/L	100	120	103	70-130	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Edina Pilot Study

Pace Project No.: 10396891

QC Batch: 488134 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET Dissolved
Associated Lab Samples: 10396891002, 10396891003

METHOD BLANK: 2656904 Matrix: Water

Associated Lab Samples: 10396891002, 10396891003

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron, Dissolved	ug/L	ND	50.0	08/01/17 02:18	
Manganese, Dissolved	ug/L	ND	0.50	08/01/17 02:18	

LABORATORY CONTROL SAMPLE: 2656905

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Dissolved	ug/L	2000	2070	103	85-115	
Manganese, Dissolved	ug/L	100	107	107	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2656906 2656907

Parameter	Units	10396660002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Iron, Dissolved	ug/L	ND	2000	2000	2080	2100	104	105	70-130	1	
Manganese, Dissolved	ug/L	8.8	100	100	117	118	108	110	70-130	1	

MATRIX SPIKE SAMPLE: 2656908

Parameter	Units	10396891003 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Iron, Dissolved	ug/L	ND	2000	2480	122	70-130	
Manganese, Dissolved	ug/L	49.3	100	183	134	70-130 M1	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Edina Pilot Study

Pace Project No.: 10396891

QC Batch: 488931

Analysis Method: EPA 350.1

QC Batch Method: EPA 350.1

Analysis Description: 350.1 Ammonia

Associated Lab Samples: 10396891001, 10396891005

METHOD BLANK: 2660918

Matrix: Water

Associated Lab Samples: 10396891001, 10396891005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Nitrogen, Ammonia	mg/L	ND	0.040	08/03/17 10:23	

LABORATORY CONTROL SAMPLE: 2660919

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Nitrogen, Ammonia	mg/L	1	1.0	101	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2660920 2660921

Parameter	Units	10396814003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Nitrogen, Ammonia	mg/L	ND	1	1	1.0	1.1	105	112	90-110	7	M1

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2660922 2660923

Parameter	Units	10396814004 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Nitrogen, Ammonia	mg/L	ND	1	1	1.0	1.0	104	104	90-110	1	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: Edina Pilot Study

Pace Project No.: 10396891

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

ANALYTE QUALIFIERS

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Edina Pilot Study

Pace Project No.: 10396891

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10396891001	R1-01-170724	EPA 200.8	487273	EPA 200.8	487608
10396891005	R1-01-170725	EPA 200.8	487273	EPA 200.8	487608
10396891002	F1-01-170724-Metals	EPA 200.8	488134	EPA 200.8	488316
10396891003	F2-01-170724-Metals	EPA 200.8	488134	EPA 200.8	488316
10396891004	F3-01-170724-Metals	EPA 200.8	487547	EPA 200.8	487902
10396891006	F1-01-170725-Metals	EPA 200.8	487547	EPA 200.8	487902
10396891007	F2-01-170725-Metals	EPA 200.8	487547	EPA 200.8	487902
10396891008	F3-01-170725-Metals	EPA 200.8	487547	EPA 200.8	487902
10396891001	R1-01-170724	EPA 350.1	488931		
10396891005	R1-01-170725	EPA 350.1	488931		

REPORT OF LABORATORY ANALYSIS

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CHAIN-OF-CUSTODY / Analytical Request Document


If the Chain-of-Custody is a LEGAL DOCUMENT, All relevant fields must be completed accurately.

10396891

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	AEZS	Report To:	Abbie Brown @ aezs.com	Attention:	Aaron Vollmer
Address:	6901 E Fish Lake Rd	Copy To:	aaron.vollmer@aezs.com	Company Name:	AEZS
Email To:	Suite 184, Maple Grove			Address:	Same as section A
	abbie.brown@aezs.com	Purchase Order No.:	MN 55364	Pace Quote Reference:	
Phone:	763-463-5036	Project Name:	Edina Pilot Study	Pace Project Manager:	Dan Nguyen
Requested Due Date/TAT:		Project Number:		Pace Profile #:	

Page: / of /		2206806	
REGULATORY AGENCY		<input type="checkbox"/> NPDES <input type="checkbox"/> GROUND WATER <input type="checkbox"/> DRINKING WATER <input type="checkbox"/> UST <input type="checkbox"/> RCRA <input type="checkbox"/> OTHER	
Site Location:		MN	
STATE:			

[illegible][illegible]

	Document Name: Sample Condition Upon Receipt Form	Document Revised: 19Dec2016 Page 1 of 2
	Document No.: F-MN-L-213-rev.20	Issuing Authority: Pace Minnesota Quality Office

Sample Condition
Upon Receipt

Client Name:

Project #:

WO#: 10396891

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☒ Client
☐ Commercial ☐ Pace ☐ Speedee ☐ Other: _____



10396891

Tracking Number: _____

Custody Seal on Cooler/Box Present? ☐ Yes ☒ No Seals Intact? ☐ Yes ☒ No Optional: Proj. Due Date: _____ Proj. Name: _____

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☒ None ☐ Other: _____ Temp Blank? ☒ Yes ☐ No

Thermometer Used: ☒ 151401163
☐ 151401164

Type of Ice: ☒ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

Cooler Temp Read (°C): 2.3 Cooler Temp Corrected (°C): 2.3 Biological Tissue Frozen? ☐ Yes ☐ No ☒ N/A

Temp should be above freezing to 6°C Correction Factor: None Date and Initials of Person Examining Contents: 7/25/17 SD

USDA Regulated Soil (☒ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐ Yes ☐ No Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

		COMMENTS:
Chain of Custody Present?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	1.
Chain of Custody Filled Out?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2.
Chain of Custody Relinquished?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	3.
Sampler Name and/or Signature on COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	4.
Samples Arrived within Hold Time?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	5.
Short Hold Time Analysis (<72 hr)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	6.
Rush Turn Around Time Requested?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	7.
Sufficient Volume?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	8.
Correct Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	9.
-Pace Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Containers Intact?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	10.
Filtered Volume Received for Dissolved Tests?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	12.
-Includes Date/Time/ID/Analysis Matrix: <u>WT</u>		
All containers needing acid/base preservation have been checked?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	13. <input checked="" type="checkbox"/> HNO ₃ <input checked="" type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> NaOH Positive for Res. Chlorine? Y N
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO ₃ , H ₂ SO ₄ <2pH, NaOH >9 Sulfide, NaOH >12 Cyanide) Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Initial when completed: <u>7/25/17</u> <u>SD</u> Lot # of added preservative: <u>1,3-6,8-10</u> <u>2,7-11</u>
Headspace in VOA Vials (>6mm)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	14.
Trip Blank Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	15.
Trip Blank Custody Seals Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Pace Trip Blank Lot # (if purchased):		

CLIENT NOTIFICATION/RESOLUTION

Field Data Required? ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Resolution: _____

Project Manager Review: _____

Date: 7/25/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers).

August 14, 2017

Aaron Vollmer
Advanced Engineering and Environmental
Services
6901 E Fish Lake Rd
#184
Osseo, MN 55369

RE: Project: Edina Pilot Study
Pace Project No.: 10398066

Dear Aaron Vollmer:

Enclosed are the analytical results for sample(s) received by the laboratory on August 03, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Dan Nguyen
dan.nguyen@pacelabs.com
612-360-0728
Project Manager

Enclosures

cc: Abbie Browen, Advanced Engineering and Environmental
Services



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: Edina Pilot Study

Pace Project No.: 10398066

Minnesota Certification IDs

1700 Elm Street SE, Suite 200, Minneapolis, MN 55414-2485

A2LA Certification #: 2926.01

Alabama Certification #: 40770

Alaska Contaminated Sites Certification #: UST-078

Alaska DW Certification #: MN00064

Arizona Certification #: AZ0014

Arkansas Certification #: 88-0680

California Certification #: MN00064

CNMI Saipan Certification #: MP0003

Colorado Certification #: MN00064

Connecticut Certification #: PH-0256

EPA Region 8+Wyoming Certification #: via MN 027-053-137

Florida Certification #: E87605

Georgia Certification #: 959

Guam EPA Certification #: MN00064

Hawaii Certification #: MN00064

Idaho Certification #: MN00064

Illinois Certification #: 200011

Indiana Certification #: C-MN-01

Iowa Certification #: 368

Kansas Certification #: E-10167

Kentucky DW Certification #: 90062

Kentucky WW Certification #: 90062

Louisiana DEQ Certification #: 03086

Louisiana DW Certification #: MN00064

Maine Certification #: MN00064

Maryland Certification #: 322

Massachusetts Certification #: M-MN064

Michigan Certification #: 9909

Minnesota Certification #: 027-053-137

Mississippi Certification #: MN00064

Montana Certification #: CERT0092

Nebraska Certification #: NE-OS-18-06

Nevada Certification #: MN00064

New Hampshire Certification #: 2081

New Jersey Certification #: MN002

New York Certification #: 11647

North Carolina DW Certification #: 27700

North Carolina WW Certification #: 530

North Dakota Certification #: R-036

Ohio DW Certification #: 41244

Ohio VAP Certification #: CL101

Oklahoma Certification #: 9507

Oregon NwTPH Certification #: MN300001

Oregon Secondary Certification #: MN200001

Pennsylvania Certification #: 68-00563

Puerto Rico Certification #: MN00064

South Carolina Certification #: 74003001

Tennessee Certification #: TN02818

Texas Certification #: T104704192

Utah Certification #: MN00064

Virginia Certification #: 460163

Washington Certification #: C486

West Virginia DW Certification #: 9952 C

West Virginia DEP Certification #: 382

Wisconsin Certification #: 999407970

Wyoming via EPA Region 8 Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: Edina Pilot Study

Pace Project No.: 10398066

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10398066001	R1-01-170726	EPA 200.8	RJS	2	PASI-M
		EPA 350.1	DCL	1	PASI-M
10398066002	F1-01-170726	EPA 200.8	RJS	2	PASI-M
10398066003	F2-01-170726	EPA 200.8	RJS	2	PASI-M
10398066004	F3-01-170726	EPA 200.8	RJS	2	PASI-M
10398066005	R1-01-170801	EPA 200.8	RJS	2	PASI-M
		EPA 350.1	DCL	1	PASI-M
10398066006	F1-01-170801	EPA 200.8	RJS	2	PASI-M
10398066007	F2-01-170801	EPA 200.8	RJS	2	PASI-M
10398066008	F3-01-170801	EPA 200.8	RJS	2	PASI-M

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Edina Pilot Study
Pace Project No.: 10398066

Sample: R1-01-170726		Lab ID: 10398066001	Collected: 07/26/17 14:50		Received: 08/03/17 12:40		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron	380	ug/L	50.0	1	08/08/17 05:51	08/11/17 17:46	7439-89-6	M1
Manganese	166	ug/L	0.50	1	08/08/17 05:51	08/11/17 17:46	7439-96-5	M1
350.1 Ammonia		Analytical Method: EPA 350.1						
Nitrogen, Ammonia	0.27	mg/L	0.040	1		08/10/17 09:19	7664-41-7	
Sample: F1-01-170726		Lab ID: 10398066002	Collected: 07/26/17 14:55		Received: 08/03/17 12:40		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Manganese, Dissolved	3.7	ug/L	0.50	1	08/07/17 08:44	08/11/17 15:10	7439-96-5	
Iron, Dissolved	ND	ug/L	50.0	1	08/07/17 08:44	08/11/17 15:10	7439-89-6	
Sample: F2-01-170726		Lab ID: 10398066003	Collected: 07/26/17 15:00		Received: 08/03/17 12:40		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron, Dissolved	ND	ug/L	50.0	1	08/07/17 08:44	08/11/17 15:44	7439-89-6	
Manganese, Dissolved	4.9	ug/L	0.50	1	08/07/17 08:44	08/11/17 15:44	7439-96-5	
Sample: F3-01-170726		Lab ID: 10398066004	Collected: 07/26/17 15:05		Received: 08/03/17 12:40		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS, Dissolved		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron, Dissolved	ND	ug/L	50.0	1	08/07/17 08:44	08/11/17 15:48	7439-89-6	
Manganese, Dissolved	2.1	ug/L	0.50	1	08/07/17 08:44	08/11/17 15:48	7439-96-5	
Sample: R1-01-170801		Lab ID: 10398066005	Collected: 08/01/17 16:55		Received: 08/03/17 12:40		Matrix: Water	
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
200.8 MET ICPMS		Analytical Method: EPA 200.8 Preparation Method: EPA 200.8						
Iron	396	ug/L	50.0	1	08/08/17 05:51	08/11/17 18:20	7439-89-6	
Manganese	169	ug/L	0.50	1	08/08/17 05:51	08/11/17 18:20	7439-96-5	
350.1 Ammonia		Analytical Method: EPA 350.1						
Nitrogen, Ammonia	0.26	mg/L	0.040	1		08/10/17 09:20	7664-41-7	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: Edina Pilot Study

Pace Project No.: 10398066

Sample: F1-01-170801		Lab ID: 10398066006	Collected: 08/01/17 17:00	Received: 08/03/17 12:40	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual

200.8 MET ICPMS, Dissolved Analytical Method: EPA 200.8 Preparation Method: EPA 200.8

Iron, Dissolved	ND	ug/L	50.0	1	08/07/17 08:44	08/11/17 15:52	7439-89-6	
Manganese, Dissolved	4.9	ug/L	0.50	1	08/07/17 08:44	08/11/17 15:52	7439-96-5	

Sample: F2-01-170801		Lab ID: 10398066007	Collected: 08/01/17 17:00	Received: 08/03/17 12:40	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual

200.8 MET ICPMS, Dissolved Analytical Method: EPA 200.8 Preparation Method: EPA 200.8

Iron, Dissolved	ND	ug/L	50.0	1	08/07/17 08:44	08/11/17 15:57	7439-89-6	
Manganese, Dissolved	5.8	ug/L	0.50	1	08/07/17 08:44	08/11/17 15:57	7439-96-5	

Sample: F3-01-170801		Lab ID: 10398066008	Collected: 08/01/17 17:00	Received: 08/03/17 12:40	Matrix: Water			
Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual

200.8 MET ICPMS, Dissolved Analytical Method: EPA 200.8 Preparation Method: EPA 200.8

Iron, Dissolved	ND	ug/L	50.0	1	08/07/17 08:44	08/11/17 16:01	7439-89-6	
Manganese, Dissolved	3.5	ug/L	0.50	1	08/07/17 08:44	08/11/17 16:01	7439-96-5	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Edina Pilot Study

Pace Project No.: 10398066

QC Batch:	489141	Analysis Method:	EPA 200.8
QC Batch Method:	EPA 200.8	Analysis Description:	200.8 MET
Associated Lab Samples: 10398066001, 10398066005			

METHOD BLANK: 2662081 Matrix: Water

Associated Lab Samples: 10398066001, 10398066005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron	ug/L	ND	50.0	08/11/17 16:26	
Manganese	ug/L	ND	0.50	08/11/17 16:26	

LABORATORY CONTROL SAMPLE: 2662082

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron	ug/L	2000	1950	97	85-115	
Manganese	ug/L	100	97.0	97	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2662083 2662084

Parameter	Units	10397802003 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Iron	ug/L	80.3	2000	2000	2290	1900	111	91	70-130	19	
Manganese	ug/L	462	100	100	570	545	108	83	70-130	4	

MATRIX SPIKE SAMPLE: 2662085

Parameter	Units	10398066001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Iron	ug/L		380	2000	3740	168	70-130 M1
Manganese	ug/L		166	100	331	164	70-130 M1

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Edina Pilot Study
Pace Project No.: 10398066

QC Batch: 489137 Analysis Method: EPA 200.8
QC Batch Method: EPA 200.8 Analysis Description: 200.8 MET Dissolved
Associated Lab Samples: 10398066002, 10398066003, 10398066004, 10398066006, 10398066007, 10398066008

METHOD BLANK: 2662061 Matrix: Water
Associated Lab Samples: 10398066002, 10398066003, 10398066004, 10398066006, 10398066007, 10398066008

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Iron, Dissolved	ug/L	ND	50.0	08/11/17 13:52	
Manganese, Dissolved	ug/L	ND	0.50	08/11/17 13:52	

LABORATORY CONTROL SAMPLE: 2662062

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron, Dissolved	ug/L	2000	2020	101	85-115	
Manganese, Dissolved	ug/L	100	99.7	100	85-115	

MATRIX SPIKE SAMPLE: 2662063

Parameter	Units	10397825001 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Iron, Dissolved	ug/L	<0.0068 mg/L	2000	1890	94	70-130	
Manganese, Dissolved	ug/L	0.00034J mg/L	100	95.7	95	70-130	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2662064 2662065

Parameter	Units	10398066002 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Iron, Dissolved	ug/L	ND	2000	2000	2030	2040	102	102	70-130	1	
Manganese, Dissolved	ug/L	3.7	100	100	105	106	101	102	70-130	1	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: Edina Pilot Study

Pace Project No.: 10398066

QC Batch: 490284

Analysis Method: EPA 350.1

QC Batch Method: EPA 350.1

Analysis Description: 350.1 Ammonia

Associated Lab Samples: 10398066001, 10398066005

METHOD BLANK: 2667874

Matrix: Water

Associated Lab Samples: 10398066001, 10398066005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Nitrogen, Ammonia	mg/L	ND	0.040	08/10/17 09:05	

LABORATORY CONTROL SAMPLE: 2667875

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Nitrogen, Ammonia	mg/L	1	1.0	100	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2667876 2667877

Parameter	Units	10397767006 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Nitrogen, Ammonia	mg/L	0.65	1	1	1.6	1.7	98	108	90-110	6	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2667878 2667879

Parameter	Units	10397810001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Qual
Nitrogen, Ammonia	mg/L	77.6	1	1	78.8	78.7	130	115	90-110	0 M6	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: Edina Pilot Study

Pace Project No.: 10398066

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-M Pace Analytical Services - Minneapolis

ANALYTE QUALIFIERS

M1 Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery.

M6 Matrix spike and Matrix spike duplicate recovery not evaluated against control limits due to sample dilution.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: Edina Pilot Study

Pace Project No.: 10398066

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10398066001	R1-01-170726	EPA 200.8	489141	EPA 200.8	490324
10398066005	R1-01-170801	EPA 200.8	489141	EPA 200.8	490324
10398066002	F1-01-170726	EPA 200.8	489137	EPA 200.8	490330
10398066003	F2-01-170726	EPA 200.8	489137	EPA 200.8	490330
10398066004	F3-01-170726	EPA 200.8	489137	EPA 200.8	490330
10398066006	F1-01-170801	EPA 200.8	489137	EPA 200.8	490330
10398066007	F2-01-170801	EPA 200.8	489137	EPA 200.8	490330
10398066008	F3-01-170801	EPA 200.8	489137	EPA 200.8	490330
10398066001	R1-01-170726	EPA 350.1	490284		
10398066005	R1-01-170801	EPA 350.1	490284		


REPORT OF LABORATORY ANALYSIS

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Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	AEZS	Report To:	Abbie Brown @ AEZS.com	Attention:	Aaron Vollmer
Address:	6901 E. Fish Lake Rd. Suite 104 Maple Grove, MN 55369	Copy To:	Aaron.Vollmer @ AEZS.com	Company Name:	AEZS
Email To:		Purchase Order No.:	262455	Address:	Same as Section A
Phone:		Project Name:	Edina Pilot Study	Pose Quote Reference:	
Fax:	763-463-5034	Project Number:		Pose Project Manager:	Dan Nguyen
Requested Due Date/TAT:				Pose Profile #:	

Page:	1	of	1
2206807			
REGULATORY AGENCY			
<input type="checkbox"/> NPDES	<input type="checkbox"/> GROUND WATER	<input type="checkbox"/> DRINKING WATER	
<input type="checkbox"/> UST	<input type="checkbox"/> RCRA	<input type="checkbox"/> OTHER	
Site Location:	MN		
STATE:			

[illegible][illegible]

	Document Name:	Document Revised: 19Dec2016
	Sample Condition Upon Receipt Form	Page 1 of 2
	Document No.: F-MN-L-213-rev.20	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name:

AE2S

Project #:

WO# : 10398066



Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☒ Client
☐ Commercial ☐ Pace ☐ Speedee ☐ Other:

Tracking Number:

Custody Seal on Cooler/Box Present?

☐ Yes ☒ No

Seals Intact?

☐ Yes ☒ No

Optional: Proj. Due Date: Proj. Name:

Packing Material:

☐ Bubble Wrap

☐ Bubble Bags

☒ None

☐ Other:

Temp Blank?

☐ Yes

☒ No

Thermometer

☒ 151401163

Used:

☐ 151401164

Type of Ice:

☐ Wet

☐ Blue

☒ None

☐ Samples on ice, cooling process has begun

Cooler Temp Read (°C):

5.3

Cooler Temp Corrected (°C):

5.2

Biological Tissue Frozen?

☐ Yes

☐ No

☒ N/A

Temp should be above freezing to 6°C

Correction Factor:

-0.1

Date and Initials of Person Examining Contents:

ME 8/3/17

USDA Regulated Soil (☒ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA, MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)?

☐ Yes ☐ No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)?

☐ Yes ☐ No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

		COMMENTS:
Chain of Custody Present?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	1.
Chain of Custody Filled Out?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	2.
Chain of Custody Relinquished?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	3.
Sampler Name and/or Signature on COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	4.
Samples Arrived within Hold Time?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	5.
Short Hold Time Analysis (<72 hr)?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	6.
Rush Turn Around Time Requested?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	7.
Sufficient Volume?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	8.
Correct Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	9.
-Pace Containers Used?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	10.
Containers Intact?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	10. <u>PC 08-03-17</u>
Filtered Volume Received for Dissolved Tests?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	12.
-Includes Date/Time/ID/Analysis Matrix: <u>wt</u>		
All containers needing acid/base preservation have been checked?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	13. <input checked="" type="checkbox"/> HNO ₃ <input checked="" type="checkbox"/> H ₂ SO ₄ <input type="checkbox"/> NaOH Positive for Res. Chlorine? Y N
All containers needing preservation are found to be in compliance with EPA recommendation?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	Sample # <u>1, 5 1/1</u>
(HNO ₃ , H ₂ SO ₄ , <2pH, NaOH >9 Sulfide, NaOH >12 Cyanide)		<u>2-4, 6-8 1/1</u>
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	Initial when completed: Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	14.
Trip Blank Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	15.
Trip Blank Custody Seals Present?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
Pace Trip Blank Lot # (if purchased):		

CLIENT NOTIFICATION/RESOLUTION

Person Contacted:

Date/Time:

Field Data Required? ☐ Yes ☐ No

Comments/Resolution:

Project Manager Review:

Date: 8/3/17

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers).

LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

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STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Montana	CERT0026
Alaska	IN00035	Nebraska	NE-OS-05-04
Arizona	AZ0432	Nevada	IN00035
Arkansas	IN00035	New Hampshire*	2124
California	2920	New Jersey*	IN598
Colorado	IN035	New Mexico	IN00035
Colorado Radiochemistry	IN035	New York*	11398
Connecticut	PH-0132	North Carolina	18700
Delaware	IN035	North Dakota	R-035
Florida*	E87775	Ohio	87775
Georgia	929	Oklahoma	D9508
Hawaii	IN035	Oregon (Primary AB)*	4074-001
Idaho	IN00035	Pennsylvania*	68-00466
Illinois*	200001	Puerto Rico	IN00035
Illinois Microbiology	17767	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA170006	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
Missouri	880		

*NELAP/TNI Recognized Accreditation Bodies

110 South Hill Street
 South Bend, IN 46617
 Tel: (574) 233-4777
 Fax: (574) 233-8207
 1 800 332 4345

Laboratory Report

Client: Advanced Engineering & Environmental Services

Report: 394164

Attn: Abbie Browen
 6901 East Fish Lake Road
 Suite 184
 Maple Grove, MN 55369

Priority: Standard Written

Status: Final

PWS ID: Not Supplied

MN Lab ID: 018-999-338

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3743649	Well 18 Raw Water	7500-Ra B	07/21/17 09:15	Client	07/27/17 09:30
3743649	Well 18 Raw Water	7500-Ra D	07/21/17 09:15	Client	07/27/17 09:30
3743650	Well 18 Raw Water	7110 B	07/21/17 09:15	Client	07/27/17 09:30
3743651	Filter Column 1 Effluent	7500-Ra B	07/21/17 09:15	Client	07/27/17 09:30
3743651	Filter Column 1 Effluent	7500-Ra D	07/21/17 09:15	Client	07/27/17 09:30
3743652	Filter Column 1 Effluent	7110 B	07/21/17 09:15	Client	07/27/17 09:30
3743653	Filter Column 2 Effluent	7500-Ra B	07/21/17 09:15	Client	07/27/17 09:30
3743653	Filter Column 2 Effluent	7500-Ra D	07/21/17 09:15	Client	07/27/17 09:30
3743654	Filter Column 2 Effluent	7110 B	07/21/17 09:15	Client	07/27/17 09:30

Report Summary

Note: The samples submitted for analysis were received outside the five day preservation period.

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Nathan Trowbridge at (574) 233-4777.

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 Authorized Signature Title

08/24/2017
 Date

Client Name: Advanced Engineering & Environmental Services
 Report #: 394164

Sampling Point: Well 18 Raw Water

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	1.2	3.0	6.2 ± 2.0	pCi/L	08/10/17 10:45	08/17/17 20:41	3743650
13982-63-3	Radium-226	7500-Ra B	---	0.12	1.0	2.9 ± 0.5	pCi/L	08/08/17 15:00	08/18/17 11:22	3743649
15262-20-1	Radium-228	7500-Ra D	---	0.46	1.0	2.3 ± 0.6	pCi/L	08/08/17 15:00	08/16/17 17:02	3743649
---	Combined Radium	calc.	5 *	0.46	1.0	5.2 ± 0.7	pCi/L	08/08/17 15:00	08/18/17 11:22	3743649

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

Sampling Point: Filter Column 1 Effluent

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	1.4	3.0	3.5 ± 1.7	pCi/L	08/10/17 10:45	08/17/17 20:41	3743652
13982-63-3	Radium-226	7500-Ra B	---	0.13	1.0	1.8 ± 0.6	pCi/L	08/08/17 15:00	08/22/17 11:37	3743651
15262-20-1	Radium-228	7500-Ra D	---	0.44	1.0	1.2 ± 0.5	pCi/L	08/08/17 15:00	08/16/17 17:02	3743651
---	Combined Radium	calc.	5 *	0.44	1.0	3.0 ± 0.7	pCi/L	08/08/17 15:00	08/22/17 11:37	3743651

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

Sampling Point: Filter Column 2 Effluent

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	1.4	3.0	6.0 ± 2.1	pCi/L	08/10/17 10:45	08/17/17 20:41	3743654
13982-63-3	Radium-226	7500-Ra B	---	0.10	1.0	1.9 ± 0.4	pCi/L	08/08/17 15:00	08/18/17 11:22	3743653
15262-20-1	Radium-228	7500-Ra D	---	0.41	1.0	1.5 ± 0.5	pCi/L	08/08/17 15:00	08/16/17 17:02	3743653
---	Combined Radium	calc.	5 *	0.41	1.0	3.4 ± 0.6	pCi/L	08/08/17 15:00	08/18/17 11:22	3743653

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.

CHAIN OF CUSTODY RECORD

394164 Page 1 of 13

REPORT TO: Abbie Brown - AC25				SAMPLER (Signature): <i>ABrown</i>				PWS ID #		STATE (sample origin): MN		PROJECT NAME: Edina Pilot Study		PC#	
BILL TO: AC25 6901 E. Fish Lake Rd Suite 184 Maple Grove, MN 55369				COMPLIANCE MONITORING		Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		POPULATION SERVED: ~50,000		SOURCE WATER: Edina Well 18					
LAB Number		COLLECTION		SAMPLING SITE				TEST NAME		SAMPLE REMARKS		CHLORINATED		# OF CONTAINERS	
		DATE TIME AM PM										YES NO			
1 3743649		7/21/17 9:15 X		Well 18 Raw Water				Radium-226, Radium-228		w/ KMDy		X		1 GW	
2 3743650		7/21/17 9:15 X		Filter Column 1 Effluent				↓ Gross Alpha		↓		X		1 GW	
3		7/21/17 9:15 X		Filter Column 2 Effluent				↓		↓		X		1 GW	
4		7/26/17 14:50 X		Well 18 Raw Water				Radium-226, Radium-228		w/ HMD		X		1 GW	
5		7/26/17 14:55 X		Filter Column 1 Effluent				↓ Gross Alpha		↓		X		1 GW	
6		7/26/17 15:00 X		Filter Column 2 Effluent				↓		↓		X		1 GW	
7				on other COC (shipped separately)											
8															
9															
10															
11															
12															
13															
14															

Received out of 5 day
preservation period

RELINQUISHED BY: (Signature) <i>ABrown</i>	DATE 7/26/17	TIME 16:00	RECEIVED BY: (Signature)	DATE	TIME	LAB RESERVES THE RIGHT TO RETURN UNUSED PORTIONS OF NON-AQUEOUS SAMPLES TO CLIENT	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME	LAB COMMENTS	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY:	DATE	TIME	CONDITIONS UPON RECEIPT (check one):	
			<i>dmartinez</i>	7/27/17	09:30	<input type="checkbox"/> Iced: Wet/Blue <input checked="" type="checkbox"/> Ambient <input type="checkbox"/> °C Upon Receipt <input type="checkbox"/> N/A	

Cross Offs on COC by Client

OK to proceed per Nathan T. 557-28-17

MATRIX CODES:

DW-DRINKING WATER
RW-REAGENT WATER
GW-GROUND WATER
EW-EXPOSURE WATER
SW-SURFACE WATER
PW-POOL WATER
WW-WASTE WATER

TURN-AROUND TIME (TAT) - SURCHARGES

SW = Standard Written: (15 working days) 0%
RW = Rush Written: (5 working days) 50%
RW* = Rush Written: (5 working days) 75%

IV* = Immediate Verbal: (3 working days) 100%
RW* = Immediate Written: (3 working days) 125%
SP* = Weekend, Holiday CALL
STAT* = Less than 48 hours CALL

* Please call, expedited service not available for all testing



Eaton Analytical

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CHAIN OF CUSTODY RECORD

Page 12 of 13

REPORT TO: Abbie Brown - AE25				SAMPLER (Signature) <i>ABrown</i>		PWS ID #	STATE (sample origin) MN	PROJECT NAME Edina pilot study	PG#	# OF CONTAINERS 1	MATRIX CODE GW	TURNAROUND TIME 3 weeks
BILL TO: AE25 6901 E. Fish Lake Rd Suite 184 Maple Grove, MN 55369				COMPLIANCE MONITORING Yes No X		POPULATION SERVED ~50,000	SOURCE WATER Edina Well 18					
LAB Number	COLLECTION			SAMPLING SITE		TEST NAME		SAMPLE REMARKS	CHLORINATED			
	DATE	TIME	AM PM						YES NO			
1 3743651	7/21/17	9:15	X	Well 18 Raw Water		Radium-226, Radium-228		w/ KMnO4	X	X	1	GW
2 3743652	7/21/17	9:15	X	Filter column 1 Effluent		5 Gross Alpha		↓	X	X	1	GW
3	7/21/17	9:15	X	Filter column 2 Effluent		↓		↓	X	X	1	GW
4	7/26/17	14:50	X	Well 18 Raw Water		Radium-226, Radium-228		w/ HMO	X	X	1	GW
5	7/26/17	14:55	X	Filter column 1 Effluent		5 Gross Alpha		↓	X	X	1	GW
6	7/26/17	15:00	X	Filter column 2 Effluent		↓		↓	X	X	1	GW
7				on other COC (shipped separate)								
8												
9												
10												
11												
12												
13												
14												

**Received out of 5 day
preservation period**

RELINQUISHED BY: (Signature) <i>ABrown</i>	DATE 7/26/17	TIME 16:00	RECEIVED BY: (Signature)	DATE	TIME	LAB RESERVES THE RIGHT TO RETURN UNUSED PORTIONS OF NON-AQUEOUS SAMPLES TO CLIENT
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY:	DATE	TIME	
			<i>dmartinez</i>	7/27/17	09:30	LAB COMMENTS Cross Offs on COC by Client OK to proceed per Nathan T. 557-28-17
MATRIX CODES:			TURN-AROUND TIME (TAT) - SURCHARGES			CONDITIONS UPON RECEIPT (check one):
CW-DRINKING WATER RW-REAGENT WATER GW-GROUND WATER EW-EXPOSURE WATER SW-SURFACE WATER PW-POOL WATER WW-WASTE WATER			SW = Standard Written: (15 working days) 0% RV = Rush Verbal: (5 working days) 50% RW = Rush Written: (5 working days) 75%			Iced: Wet/Blue <input type="radio"/> Ambient <input checked="" type="radio"/> °C Upon Receipt <input type="radio"/> N/A
			* Please call, expedited service not available for all testing			Samples received unannounced with less than 48 hours holding time remaining may be subject to additional charges.

Sample analysis will be provided according to the standard EEA Water Services Terms, which are available upon request. Any other terms proposed by Customer are deemed material alterations and are rejected unless expressly agreed to in writing by EEA.



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CHAIN OF CUSTODY RECORD

Page +3 of +3

REPORT TO: Abbie Brown - AE25				SAMPLER (Signature) <i>ABrown</i>		PWS ID #	STATE (sample origin) MN	PROJECT NAME Eaton pilot study	PC#	# OF CONTAINERS 1	MATRIX CODE GW	TURNAROUND TIME 3-4 weeks
BILL TO: AE25 6901 E. Fish Lake Rd Suite 184 Maple Grove, MN 55369				COMPLIANCE MONITORING Yes No X		POPULATION SERVED ~50,000	SOURCE WATER Eaton Well 18					
LAB Number	COLLECTION			SAMPLING SITE		TEST NAME		SAMPLE REMARKS	CHLORINATED			
	DATE	TIME	AM PM						YES NO			
1 3743653	7/21/17	9:15	X	Well 18 Raw Water		Radium-226, Radium-228		W/ KMnO4	X			
2 3743654	7/21/17	9:15	X	Filter column 1 Effluent		8 Gross Alpha			X			
3	7/21/17	9:15	X	Filter column 2 Effluent					X			
4	7/26/17	14:50	X	Well 18 Raw Water		Radium-226, Radium-228		W/ HMO	X			
5	7/26/17	14:55	X	Filter column 1 Effluent		5 Gross Alpha			X			
6	7/26/17	15:00	X	Filter column 2 Effluent					X			
7				on other COC (shipped separate)								
8												
9												
10												
11												
12												
13												
14												

**Received out of 5 day
preservation period**

RELINQUISHED BY: (Signature) <i>ABrown</i>	DATE 7/26/17	TIME 16:00	RECEIVED BY: (Signature)	DATE	TIME	LAB COMMENTS Cross Offs on COC by Client <i>OK to proceed per Nathan T. SS7-2817</i>
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY:	DATE	TIME	
			<i>Smarties</i>	7/27/17	09:30	CONDITIONS UPON RECEIPT (check one): <input type="checkbox"/> Iced: Wet/Blue <input checked="" type="checkbox"/> Ambient <input type="checkbox"/> °C Upon Receipt <input type="checkbox"/> N/A
MATRIX CODES:		TURN-AROUND TIME (TAT) - SURCHARGES				
DW-DRINKING WATER RW-REAGENT WATER GW-GROUND WATER EW-EXPOSURE WATER SW-SURFACE WATER PW-POOL WATER WW-WASTE WATER		SW* = Standard Written: (15 working days) 0% RV* = Rush Verbal: (5 working days) 50% RW* = Rush Written: (5 working days) 75% IV* = Immediate Verbal: (3 working days) 100% IW* = Immediate Written: (3 working days) 125% SP* = Weekend, Holiday CALL STAT* = Less than 48 hours CALL				

05-LO-F0435 Issue 5.0 Effective Date: 2016-09-20

Sample analysis will be provided according to the standard EEA Water Services Terms, which are available upon request. Any other terms proposed by Customer are deemed material alterations and are rejected unless expressly agreed to in writing by EEA.

**Eurofins Eaton Analytical
Run Log**Run ID: **233152** Method: **7110 B**

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3743650	Well 18 Raw Water	GW	CI	08/17/2017 20:41	
FS	3743652	Filter Column 1 Effluent	GW	CI	08/17/2017 20:41	
FS	3743654	Filter Column 2 Effluent	GW	CI	08/17/2017 20:41	
LRB	3760270		RW	CI	08/17/2017 21:49	
LFB	3760271		RW	CI	08/17/2017 21:49	

QC Summary Report

Sample Type	Analyte	Method	MRL	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Gross Alpha	7110 B	1.2	Well 18 Raw Water		6.2		pCi/L	---	---	---	---	1.0	08/10/2017 10:45	08/17/2017 20:41	3743650
FS	Gross Alpha	7110 B	1.4	Filter Column 1 Effluent		3.5		pCi/L	---	---	---	---	1.0	08/10/2017 10:45	08/17/2017 20:41	3743652
FS	Gross Alpha	7110 B	1.4	Filter Column 2 Effluent		6.0		pCi/L	---	---	---	---	1.0	08/10/2017 10:45	08/17/2017 20:41	3743654
LRB	Gross Alpha	7110 B	0.70	---		0.900		pCi/L	---	---	---	---	1.0	08/10/2017 10:45	08/17/2017 21:49	3760270
LFB	Gross Alpha	7110 B	0.760	---		23.6500	28.78	pCi/L	82	80 - 120	---	---	1.0	08/10/2017 10:45	08/17/2017 21:49	3760271

**Eurofins Eaton Analytical
Run Log**Run ID: **233160** Method: **7500-Ra B**

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3743649	Well 18 Raw Water	GW	CI	08/18/2017 11:22	
FS	3743653	Filter Column 2 Effluent	GW	CI	08/18/2017 11:22	
LRB	3760435		RW	CI	08/18/2017 11:22	
LFB	3760436		RW	CI	08/18/2017 11:22	

QC Summary Report

Sample Type	Analyte	Method	MRL	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Radium-226	7500-Ra B	0.12	Well 18 Raw Water		2.9		pCi/L	---	---	---	---	1.0	08/08/2017 15:00	08/18/2017 11:22	3743649
FS	Radium-226	7500-Ra B	0.10	Filter Column 2 Effluent		1.9		pCi/L	---	---	---	---	1.0	08/08/2017 15:00	08/18/2017 11:22	3743653
LRB	Radium-226	7500-Ra B	0.10	---		0.200		pCi/L	---	---	---	---	1.0	08/08/2017 15:00	08/18/2017 11:22	3760435
LFB	Radium-226	7500-Ra B	0.100	---		10.5700	10.03	pCi/L	105	90 - 110	---	---	1.0	08/08/2017 15:00	08/18/2017 11:22	3760436

**Eurofins Eaton Analytical
Run Log**

Run ID: 233308 Method: 7500-Ra B

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3743651	Filter Column 1 Effluent	GW	CI	08/22/2017 11:37	

QC Summary Report

Sample Type	Analyte	Method	MRL	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Radium-226	7500-Ra B	0.13	Filter Column 1 Effluent		1.8		pCi/L	---	---	---	---	1.0	08/08/2017 15:00	08/22/2017 11:37	3743651

Eurofins Eaton Analytical Run Log

Run ID: 233087 Method: 7500-Ra D

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3743649	Well 18 Raw Water	GW	DU	08/16/2017 17:02	
FS	3743651	Filter Column 1 Effluent	GW	DU	08/16/2017 17:02	
FS	3743653	Filter Column 2 Effluent	GW	DU	08/16/2017 17:02	
LRB	3758966		RW	DU	08/16/2017 17:02	
LFB	3758967		RW	DU	08/16/2017 17:08	

QC Summary Report

Sample Type	Analyte	Method	MRL	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Radium-228	7500-Ra D	0.46	Well 18 Raw Water		2.3		pCi/L	---	---	---	---	1.0	08/08/2017 15:00	08/16/2017 17:02	3743649
FS	Radium-228	7500-Ra D	0.44	Filter Column 1 Effluent		1.2		pCi/L	---	---	---	---	1.0	08/08/2017 15:00	08/16/2017 17:02	3743651
FS	Radium-228	7500-Ra D	0.41	Filter Column 2 Effluent		1.5		pCi/L	---	---	---	---	1.0	08/08/2017 15:00	08/16/2017 17:02	3743653
LRB	Radium-228	7500-Ra D	0.40	---		0.0900		pCi/L	---	---	---	---	1.0	08/08/2017 15:00	08/16/2017 17:02	3758966
LFB	Radium-228	7500-Ra D	0.37	---		8.1500	9.13	pCi/L	89	80 - 120	---	---	1.0	08/08/2017 15:00	08/16/2017 17:08	3758967

Sample Type Key

<u>Type (Abbr.)</u>	<u>Sample Type</u>
FS	Field Sample
LFB	Laboratory Fortified Blank
LRB	Laboratory Reagent Blank

END OF REPORT

LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

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State	Certification	State	Certification
Alabama	40700	Montana	CERT0026
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Idaho	IN00035	Pennsylvania*	68-00466
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 South Bend, IN 46617
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 1 800 332 4345

Laboratory Report

Client: Advanced Engineering & Environmental Services

Report: 394054

Attn: Abbie Browen
 6901 East Fish Lake Road
 Suite 184
 Maple Grove, MN 55369

Priority: Standard Written

Status: Final

PWS ID: Not Supplied

MN Lab ID: 018-999-338


Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3742355	Well 18 Raw Water	7500-Ra B	07/26/17 14:50	Client	07/27/17 09:30
3742355	Well 18 Raw Water	7500-Ra D	07/26/17 14:50	Client	07/27/17 09:30
3742358	Well 18 Raw Water	7110 B	07/26/17 14:50	Client	07/27/17 09:30
3742356	Filter Column 1 Effluent	7500-Ra B	07/26/17 14:55	Client	07/27/17 09:30
3742356	Filter Column 1 Effluent	7500-Ra D	07/26/17 14:55	Client	07/27/17 09:30
3742359	Filter Column 1 Effluent	7110 B	07/26/17 14:55	Client	07/27/17 09:30
3742357	Filter Column 2 Effluent	7500-Ra B	07/26/17 15:00	Client	07/27/17 09:30
3742357	Filter Column 2 Effluent	7500-Ra D	07/26/17 15:00	Client	07/27/17 09:30
3742360	Filter Column 2 Effluent	7110 B	07/26/17 15:00	Client	07/27/17 09:30

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Nathan Trowbridge at (574) 233-4777.

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 Authorized Signature _____ Title _____
 Client Name: Advanced Engineering & Environmental Services
 Report #: 394054

08/23/2017

 Date

Sampling Point: Well 18 Raw Water

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	1.21	3.0	12.2 ± 2.6	pCi/L	08/04/17 14:40	08/17/17 01:22	3742358
13982-63-3	Radium-226	7500-Ra B	---	0.12	1.0	2.9 ± 0.4	pCi/L	08/04/17 13:00	08/17/17 12:39	3742355
15262-20-1	Radium-228	7500-Ra D	---	0.51	1.0	2.4 ± 0.6	pCi/L	08/04/17 13:00	08/16/17 16:59	3742355
---	Combined Radium	calc.	5 *	0.51	1.0	5.3 ± 0.8	pCi/L	08/04/17 13:00	08/17/17 12:39	3742355

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

Sampling Point: Filter Column 1 Effluent

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	1.3	3.0	4.0 ± 1.7	pCi/L	08/04/17 14:40	08/17/17 01:22	3742359
13982-63-3	Radium-226	7500-Ra B	---	0.12	1.0	0.67 ± 0.22	pCi/L	08/04/17 13:00	08/17/17 12:39	3742356
15262-20-1	Radium-228	7500-Ra D	---	0.51	1.0	0.68 ± 0.52	pCi/L	08/04/17 13:00	08/16/17 16:59	3742356
---	Combined Radium	calc.	5 *	0.51	1.0	1.35 ± 0.56	pCi/L	08/04/17 13:00	08/17/17 12:39	3742356

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

Sampling Point: Filter Column 2 Effluent

PWS ID: Not Supplied

Radionuclides										
Analyte ID #	Analyte	Method	Reg Limit	MDA 95**	MRL	Result	Units	Preparation Date	Analyzed	EEA ID #
---	Gross Alpha	7110 B	15 *	1.1	3.0	2.9 ± 1.4	pCi/L	08/04/17 14:40	08/17/17 01:22	3742360
13982-63-3	Radium-226	7500-Ra B	---	0.13	1.0	0.72 ± 0.23	pCi/L	08/04/17 13:00	08/17/17 12:39	3742357
15262-20-1	Radium-228	7500-Ra D	---	0.59	1.0	2.1 ± 0.7	pCi/L	08/04/17 13:00	08/16/17 16:59	3742357
---	Combined Radium	calc.	5 *	0.59	1.0	2.82 ± 0.70	pCi/L	08/04/17 13:00	08/17/17 12:39	3742357

** Minimum Detectable Activity (MDA95) shall be that concentration which can be counted with a precision of plus or minus 100% at the 95 % confidence level.

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.



Eaton Analytical

110 S. Hill Street
South Bend, IN 46617
T: 1.800.332.4345
F: 1.574.233.8207

Order # 323484
Batch # 394054

www.EurofinsUS.com/Eaton

CHAIN OF CUSTODY RECORD

Page 1 of 12

REPORT TO:				SAMPLER (Signature)		PWS ID #	STATE (sample origin)	PROJECT NAME	PO#
Abbie Brown - AEZS				<i>Abbie Brown</i>			MN	Edina Pilot Study	
BILL TO: 6901 E. Fish Lake Rd. AEZS Suite 184 Maple Grove, MN 55369				COMPLIANCE MONITORING	Yes No	POPULATION SERVED	SOURCE WATER		
						~ 50,000	Edina Well 18		
LAB Number	COLLECTION				SAMPLING SITE		TEST NAME	SAMPLE REMARKS	CHLORINATED
	DATE	TIME	AM	PM					YES NO
1 <u>3742355</u>	<u>7/26/17</u>	<u>14:50</u>		<u>X</u>	Well 18 Raw Water		<u>Radium-226, Radium-228</u>	<u>w/EMMA</u>	<u>X</u>
2 <u>356</u>	<u>↓</u>	<u>14:55</u>		<u>X</u>	Filter Column 1 Effluent		<u>and Gross Alpha</u>	<u>1st HMO</u>	<u>X</u>
3 <u>357</u>	<u>↓</u>	<u>15:00</u>		<u>X</u>	Filter Column 2 Effluent			<u>X</u>	
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									

Liters Received = 66.5g

to be taken from one container

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME
<i>Abbie Brown</i>	<u>7/26/17</u>	<u>16:00</u>			
		AM PM			AM PM
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME
		AM PM			AM PM
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY:	DATE	TIME
		AM PM	<i>Sheela</i>	<u>7/27/17</u>	<u>0930</u>
		AM PM			AM PM

LAB RESERVES THE RIGHT TO RETURN UNUSED PORTIONS OF NON-AQUEOUS SAMPLES TO CLIENT

LAB COMMENTS

CONDITIONS UPON RECEIPT (check one):

☐ Iced: Wet/Blue ☒ Ambient ☐ °C Upon Receipt ☒ N/A

MATRIX CODES:

DW-DRINKING WATER
RW-REAGENT WATER
GW-GROUND WATER
EW-EXPOSURE WATER
SW-SURFACE WATER
PW-POOL WATER
WW-WASTE WATER

TURN-AROUND TIME (TAT) - SURCHARGES

SW = Standard Written: (15 working days) 0%
RW = Rush Written: (5 working days) 50%
RW* = Rush Written: (5 working days) 75%

* Please call, expedited service not available for all testing

IV* = Immediate Verbal: (3 working days) 100%
RW* = Immediate Written: (3 working days) 125%
SP* = Weekend, Holiday CALL
STAT* = Less than 48 hours CALL

Samples received unannounced with less than 48 hours holding time remaining may be subject to additional charges.

08-LO-F0435 Issue 6.0 Effective Date: 2016-09-20

Sample analysis will be provided according to the standard EEA/Water Services Terms, which are available upon request. Any other terms proposed by Customer are deemed material alterations and are rejected unless expressly agreed to in writing by EEA.

Eurofins Eaton Analytical Run Log

Run ID: 233095 Method: 7110 B

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3742358	Well 18 Raw Water	GW	CI	08/17/2017 01:22	
FS	3742359	Filter Column 1 Effluent	GW	CI	08/17/2017 01:22	
FS	3742360	Filter Column 2 Effluent	GW	CI	08/17/2017 01:22	
LRB	3759118		RW	CI	08/17/2017 01:22	
LFB	3759119		RW	CI	08/17/2017 01:22	
MS	3759120	Well 18 Raw Water	GW	CI	08/17/2017 01:22	
MSD	3759121	Well 18 Raw Water	GW	CI	08/17/2017 01:22	

QC Summary Report

Sample Type	Analyte	Method	MRL	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Gross Alpha	7110 B	1.21	Well 18 Raw Water		12.2		pCi/L	---	---	---	---	1.0	08/04/2017 14:40	08/17/2017 01:22	3742358
FS	Gross Alpha	7110 B	1.3	Filter Column 1 Effluent		4.0		pCi/L	---	---	---	---	1.0	08/04/2017 14:40	08/17/2017 01:22	3742359
FS	Gross Alpha	7110 B	1.1	Filter Column 2 Effluent		2.9		pCi/L	---	---	---	---	1.0	08/04/2017 14:40	08/17/2017 01:22	3742360
LRB	Gross Alpha	7110 B	0.86	---		-0.03		pCi/L	---	---	---	---	1.0	08/04/2017 14:40	08/17/2017 01:22	3759118
LFB	Gross Alpha	7110 B	0.730	---		25.6800	28.78	pCi/L	89	80 - 120	---	---	1.0	08/04/2017 14:40	08/17/2017 01:22	3759119
MS	Gross Alpha	7110 B	0.950	Well 18 Raw Water		36.2900	40.95	pCi/L	84	70 - 130	---	---	1.0	08/04/2017 14:40	08/17/2017 01:22	3759120
MSD	Gross Alpha	7110 B	1.46	Well 18 Raw Water		39.8200	40.95	pCi/L	96	70 - 130	9.3	20	1.0	08/04/2017 14:40	08/17/2017 01:22	3759121

Eurofins Eaton Analytical Run Log

Run ID: 233112 Method: 7500-Ra B

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3742355	Well 18 Raw Water	GW	DU	08/17/2017 12:39	
FS	3742356	Filter Column 1 Effluent	GW	DU	08/17/2017 12:39	
FS	3742357	Filter Column 2 Effluent	GW	DU	08/17/2017 12:39	
MS	3757309	Filter Column 1 Effluent	GW	DU	08/17/2017 12:39	
MSD	3757310	Filter Column 1 Effluent	GW	DU	08/17/2017 12:39	
LRB	3759656		RW	DU	08/17/2017 12:39	
LFB	3759657		RW	DU	08/17/2017 12:39	

QC Summary Report

Sample Type	Analyte	Method	MRL	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Radium-226	7500-Ra B	0.12	Well 18 Raw Water		2.9		pCi/L	---	---	---	---	1.0	08/04/2017 13:00	08/17/2017 12:39	3742355
FS	Radium-226	7500-Ra B	0.12	Filter Column 1 Effluent		0.67		pCi/L	---	---	---	---	1.0	08/04/2017 13:00	08/17/2017 12:39	3742356
FS	Radium-226	7500-Ra B	0.13	Filter Column 2 Effluent		0.72		pCi/L	---	---	---	---	1.0	08/04/2017 13:00	08/17/2017 12:39	3742357
MS	Radium-226	7500-Ra B	0.120	Filter Column 1 Effluent		12.1000	11.63	pCi/L	104	80 - 120	---	---	1.0	08/04/2017 13:00	08/17/2017 12:39	3757309
MSD	Radium-226	7500-Ra B	0.120	Filter Column 1 Effluent		12.8500	11.54	pCi/L	112	80 - 120	6.0	20	1.0	08/04/2017 13:00	08/17/2017 12:39	3757310
LRB	Radium-226	7500-Ra B	0.12	---		0.0600		pCi/L	---	---	---	---	1.0	08/04/2017 13:00	08/17/2017 12:39	3759656
LFB	Radium-226	7500-Ra B	0.100	---		10.5200	10.03	pCi/L	105	90 - 110	---	---	1.0	08/04/2017 13:00	08/17/2017 12:39	3759657

Eurofins Eaton Analytical Run Log

Run ID: **233085** Method: **7500-Ra D**

<u>Type</u>	<u>Sample Id</u>	<u>Sample Site</u>	<u>Matrix</u>	<u>Instrument ID</u>	<u>Analysis Date</u>	<u>Calibration File</u>
FS	3742355	Well 18 Raw Water	GW	CI	08/16/2017 16:59	
FS	3742356	Filter Column 1 Effluent	GW	CI	08/16/2017 16:59	
FS	3742357	Filter Column 2 Effluent	GW	CI	08/16/2017 16:59	
MS	3758961	Filter Column 2 Effluent	GW	CI	08/16/2017 16:59	
MSD	3758962	Filter Column 2 Effluent	GW	CI	08/16/2017 16:59	
LFB	3758964		RW	CI	08/16/2017 16:59	
LRB	3758963		RW	CI	08/16/2017 17:08	

QC Summary Report

Sample Type	Analyte	Method	MRL	Client ID	Result Flag	Amount	Target	Units	% Recovery	Recovery Limits	RPD	RPD Limit	Dil Factor	Extracted	Analyzed	EEA ID #
FS	Radium-228	7500-Ra D	0.51	Well 18 Raw Water		2.4		pCi/L	---	---	---	---	1.0	08/04/2017 13:00	08/16/2017 16:59	3742355
FS	Radium-228	7500-Ra D	0.51	Filter Column 1 Effluent		0.68		pCi/L	---	---	---	---	1.0	08/04/2017 13:00	08/16/2017 16:59	3742356
FS	Radium-228	7500-Ra D	0.59	Filter Column 2 Effluent		2.1		pCi/L	---	---	---	---	1.0	08/04/2017 13:00	08/16/2017 16:59	3742357
MS	Radium-228	7500-Ra D	0.810	Filter Column 2 Effluent		10.0900	11.61	pCi/L	84	70 - 130	---	---	1.0	08/04/2017 13:00	08/16/2017 16:59	3758961
MSD	Radium-228	7500-Ra D	0.630	Filter Column 2 Effluent		12.0200	11.59	pCi/L	105	70 - 130	17	20	1.0	08/04/2017 13:00	08/16/2017 16:59	3758962
LFB	Radium-228	7500-Ra D	0.46	---		7.8700	9.13	pCi/L	86	80 - 120	---	---	1.0	08/04/2017 13:00	08/16/2017 16:59	3758964
LRB	Radium-228	7500-Ra D	0.43	---		0.980		pCi/L	---	---	---	---	1.0	08/04/2017 13:00	08/16/2017 17:08	3758963

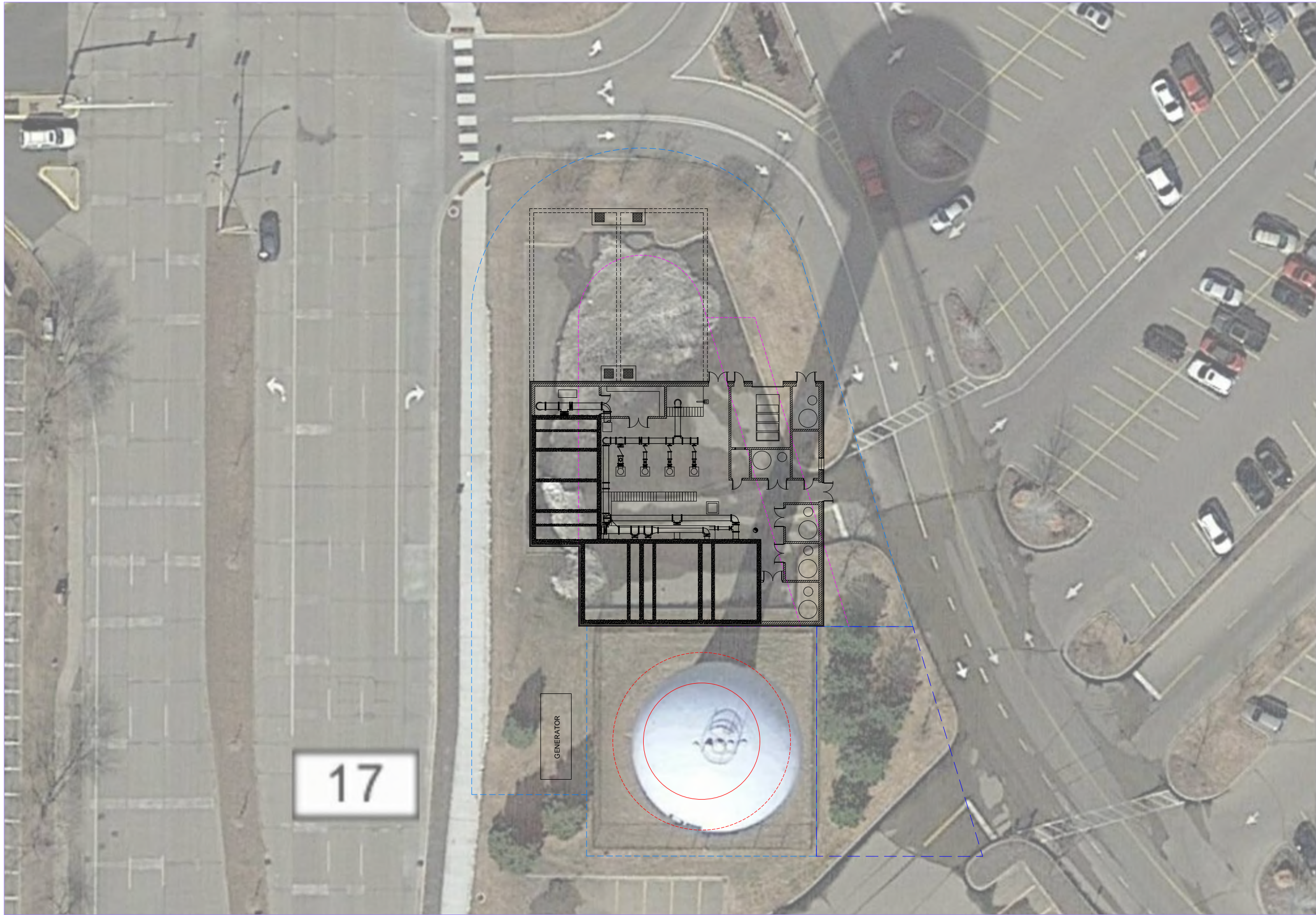
Sample Type Key

<u>Type (Abbr.)</u>	<u>Sample Type</u>
FS	Field Sample
LFB	Laboratory Fortified Blank
LRB	Laboratory Reagent Blank
MS	Matrix Spike
MSD	Matrix Spike Duplicate

END OF REPORT

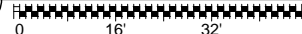
Appendix G

Option 1A – Southdale Site with Gravity Filters Site Layout



1
1A-1

OPTION 1A - SOUTHDALE SITE WITH GRAVITY FILTERS



N
ORTH

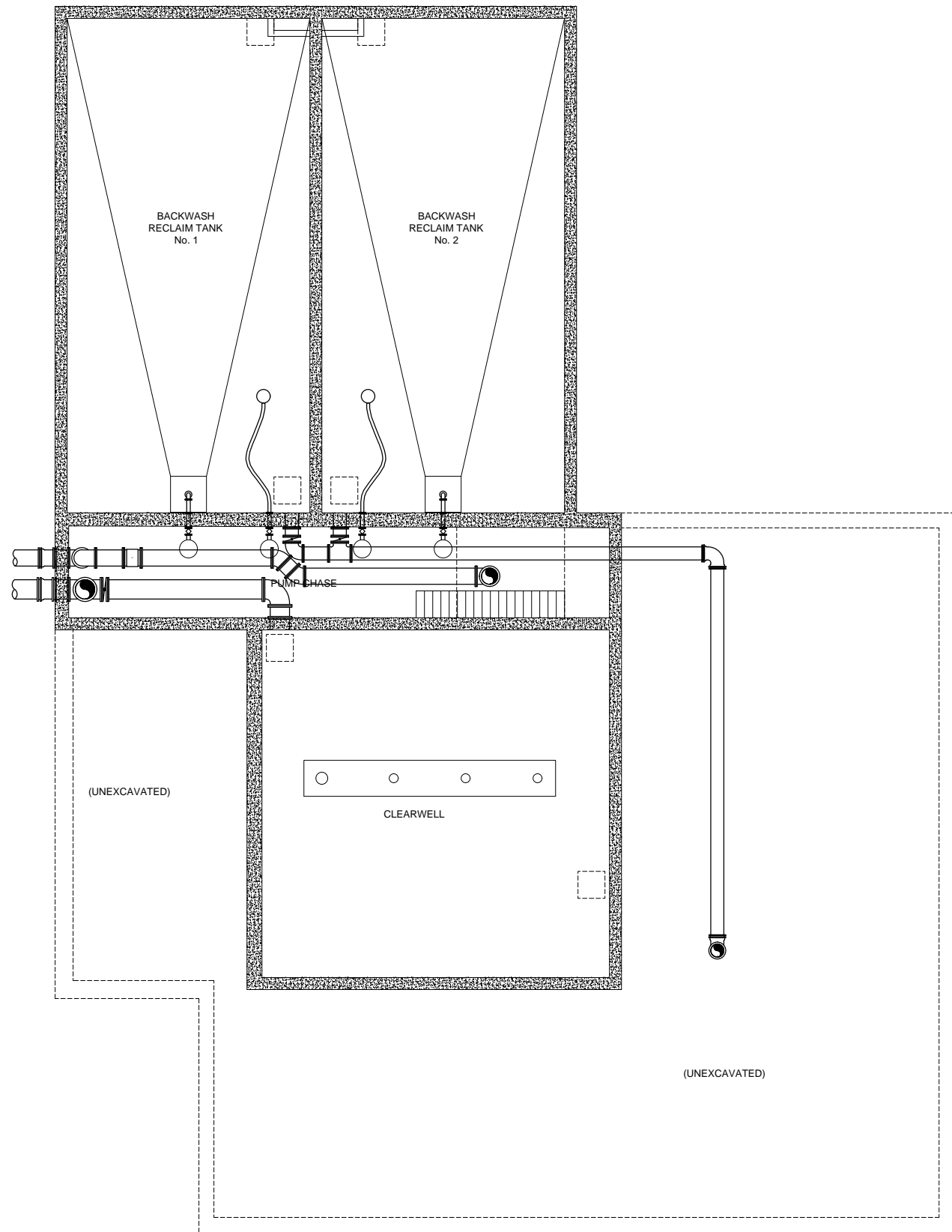
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PREPARED BY
RCL
CHECKED / APPROVED
GLM / ASV
DATE
AUGUST 2017
PROJECT NUMBER
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SHEET
5 of 15
DRAWING

1A- 1

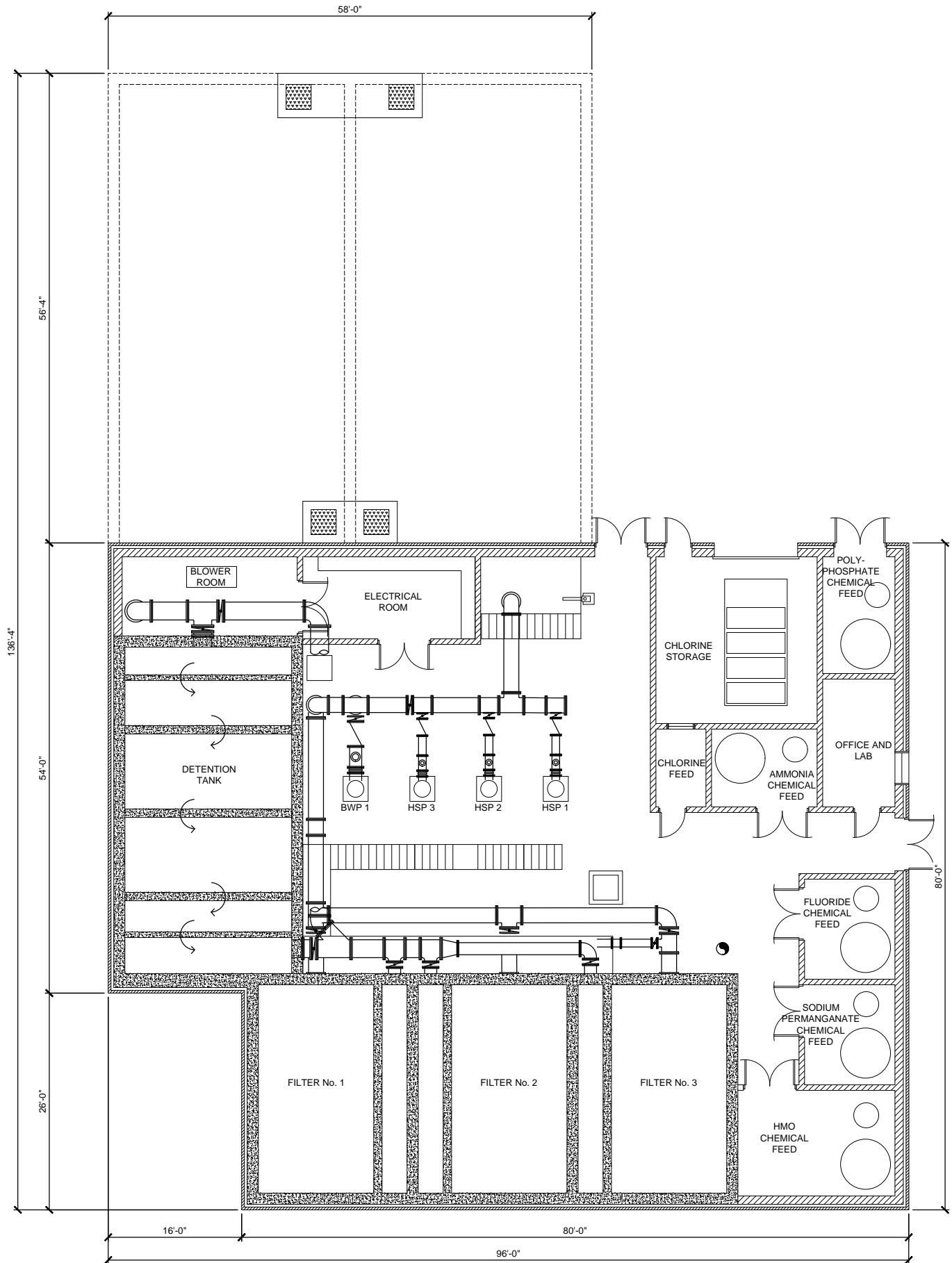
WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 1A - SOUTHDALE SITE WITH GRAVITY FILTERS



PRELIMINARY
NOT FOR CONSTRUCTION
Mileston e - 30%



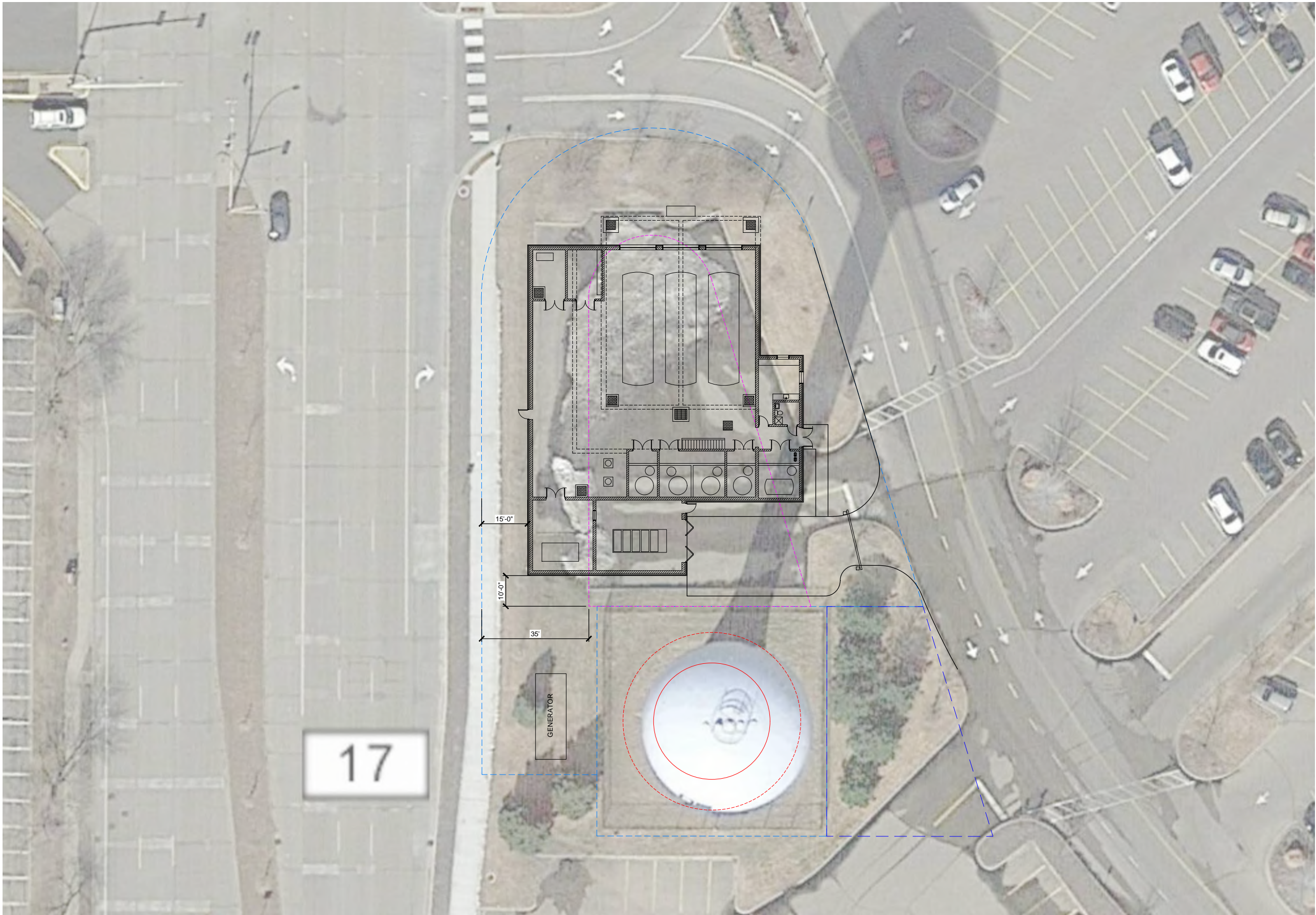
1 LOWER LEVEL PLAN
1A-2



2 MAIN LEVEL PLAN
1A-2

Appendix H

Option 1B – Southdale Site with Pressure Filters Site Layout



1
1B-1
0 16' 32'
OPTION 1B - SOUTHDVALE SITE WITH PRESSURE FILTERS
NORTH

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNATURE:

TYPED NAME: XXXXXXXXXXXXXXXX

JANUARY 22, 2016

REG. NO. XXXXX

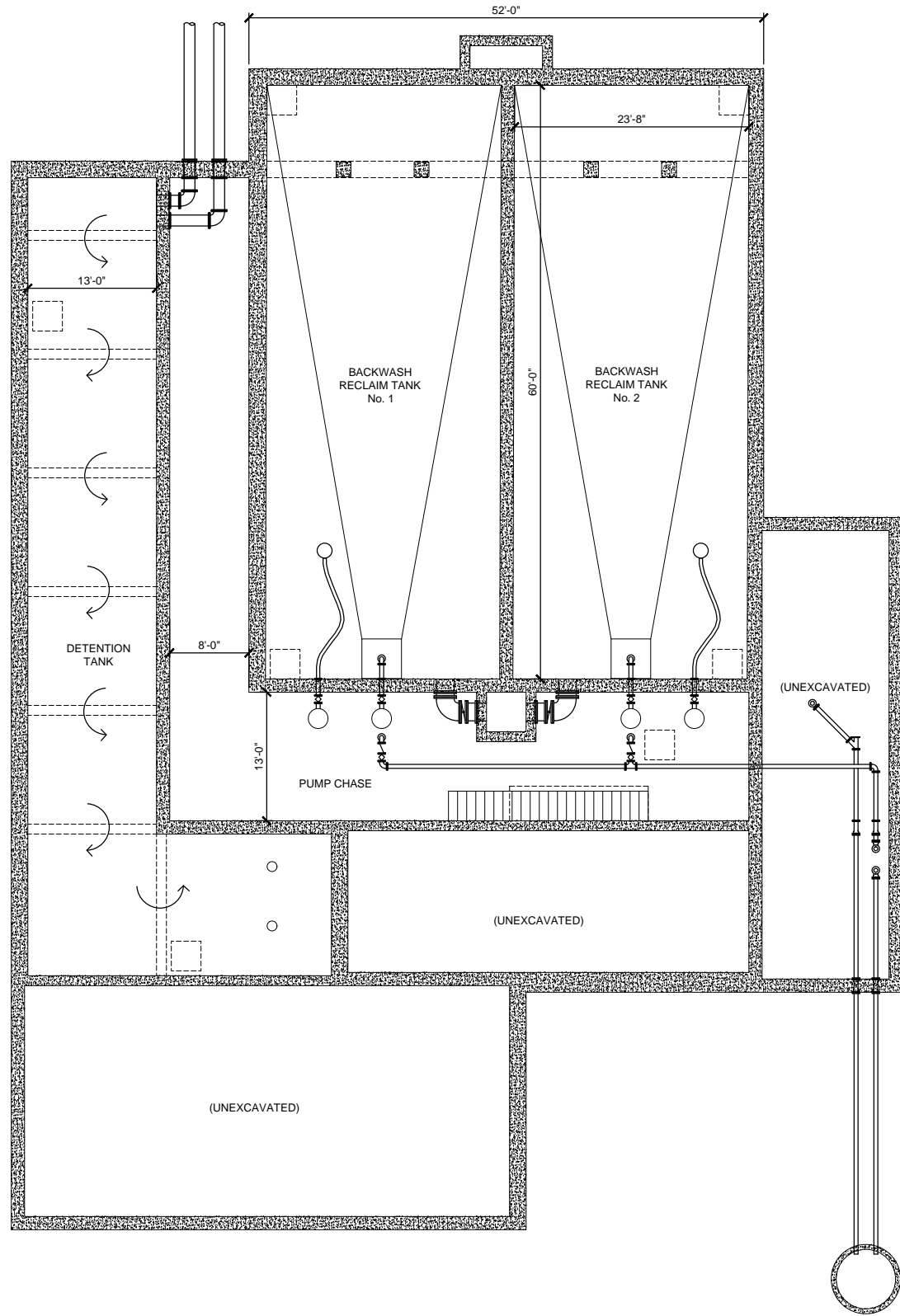
PRELIMINARY
NOT FOR CONSTRUCTION
Mileston e - 30%



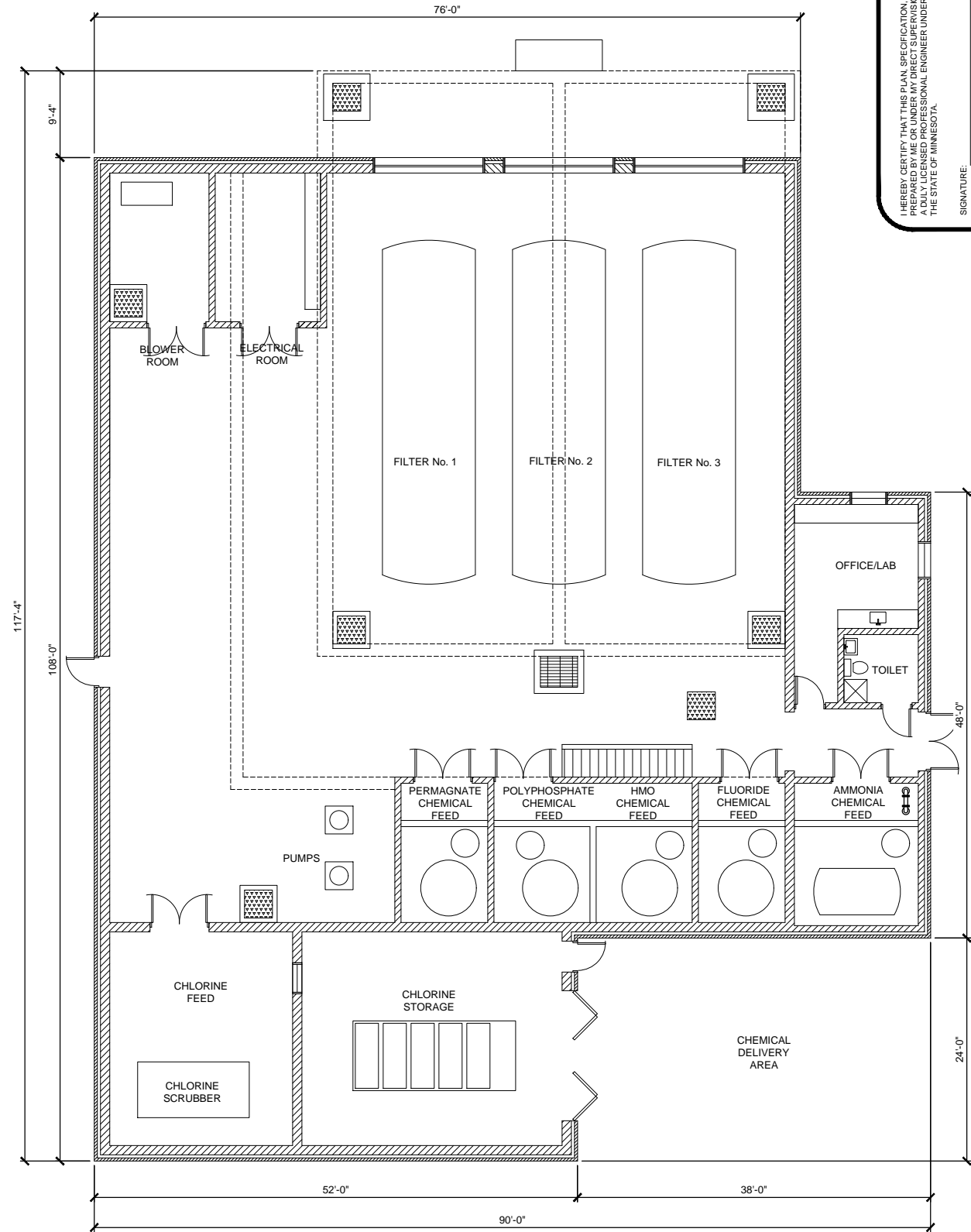
WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 1B - SOUTHDVALE SITE WITH PRESSURE FILTERS

DRAWING TYPE
PRELIMINARY
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3 of 15
DRAWING

1B- 1



1 LOWER LEVEL PLAN
1B-2
0 4' 8' 12' 16' 20'



2 MAIN LEVEL PLAN
1B-2
0 4' 8' 12' 16' 20'

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Milestone - 30%



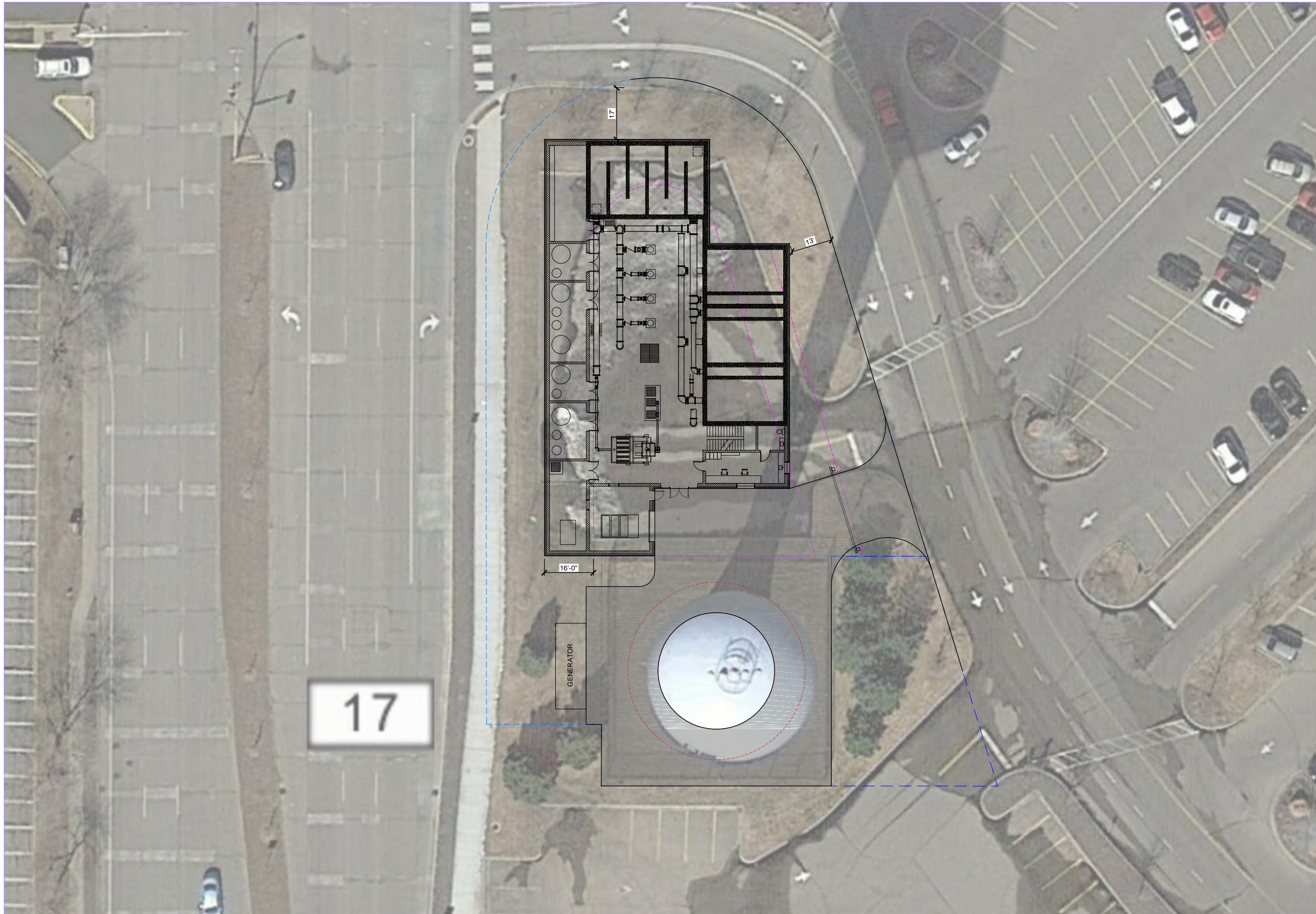
WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 1B - PLAN VIEWS

DRAWING TYPE
PRELIMINARY
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PROJECT NUMBER
P05177-2016-000
SHEET
4 of 15
DRAWING

1B- 2

Appendix I

Option 1C – Southdale Site with Gravity Filters and Above Ground Plate Settler Backwash
Reclaim Site Layout

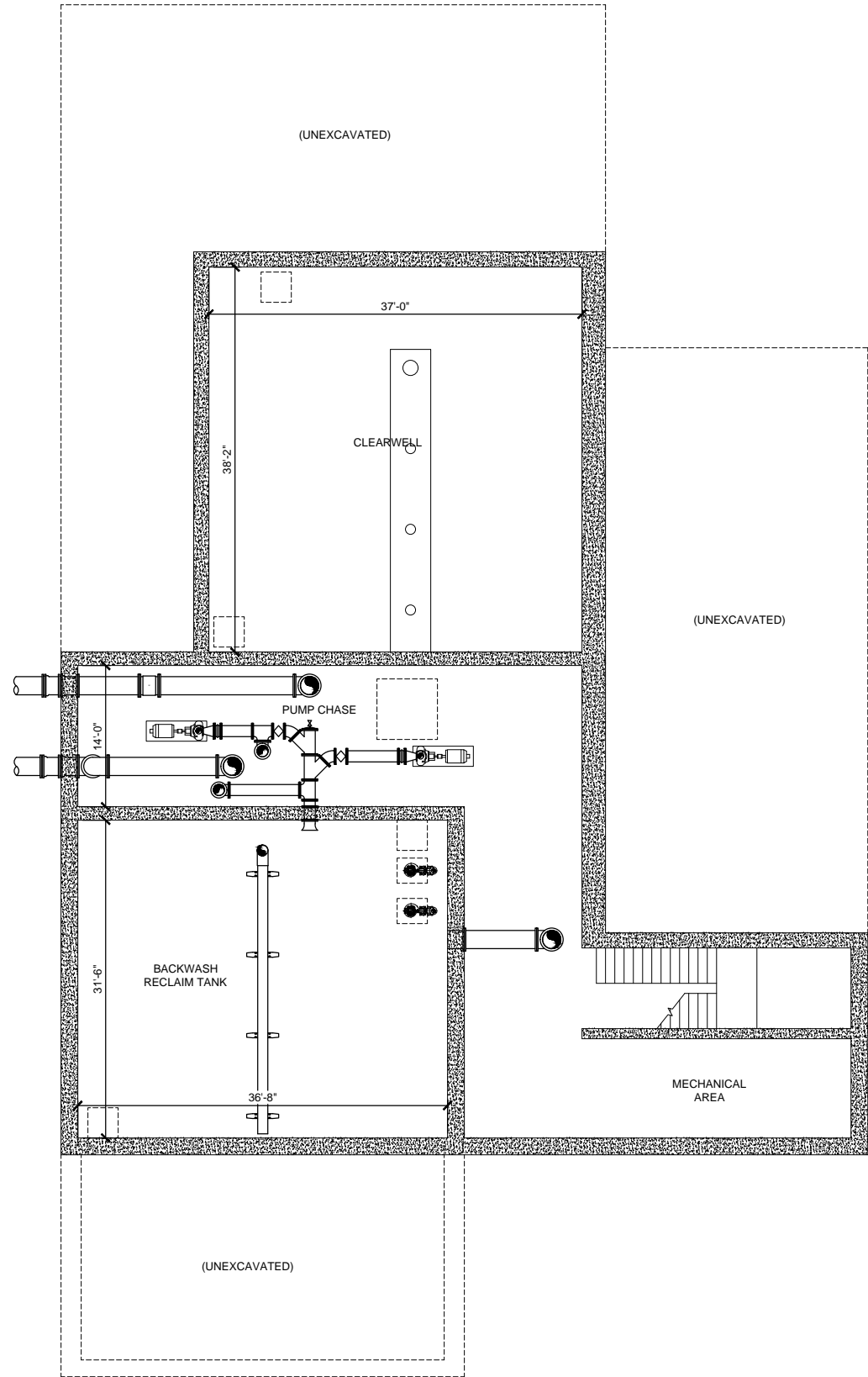


1
1C-1

OPTION 1C - SOUTHDALE SITE WITH GRAVITY FILTERS

0 16' 32'

NORTH



PRELIMINARY
NOT FOR CONSTRUCTION
Mil est one - 30%



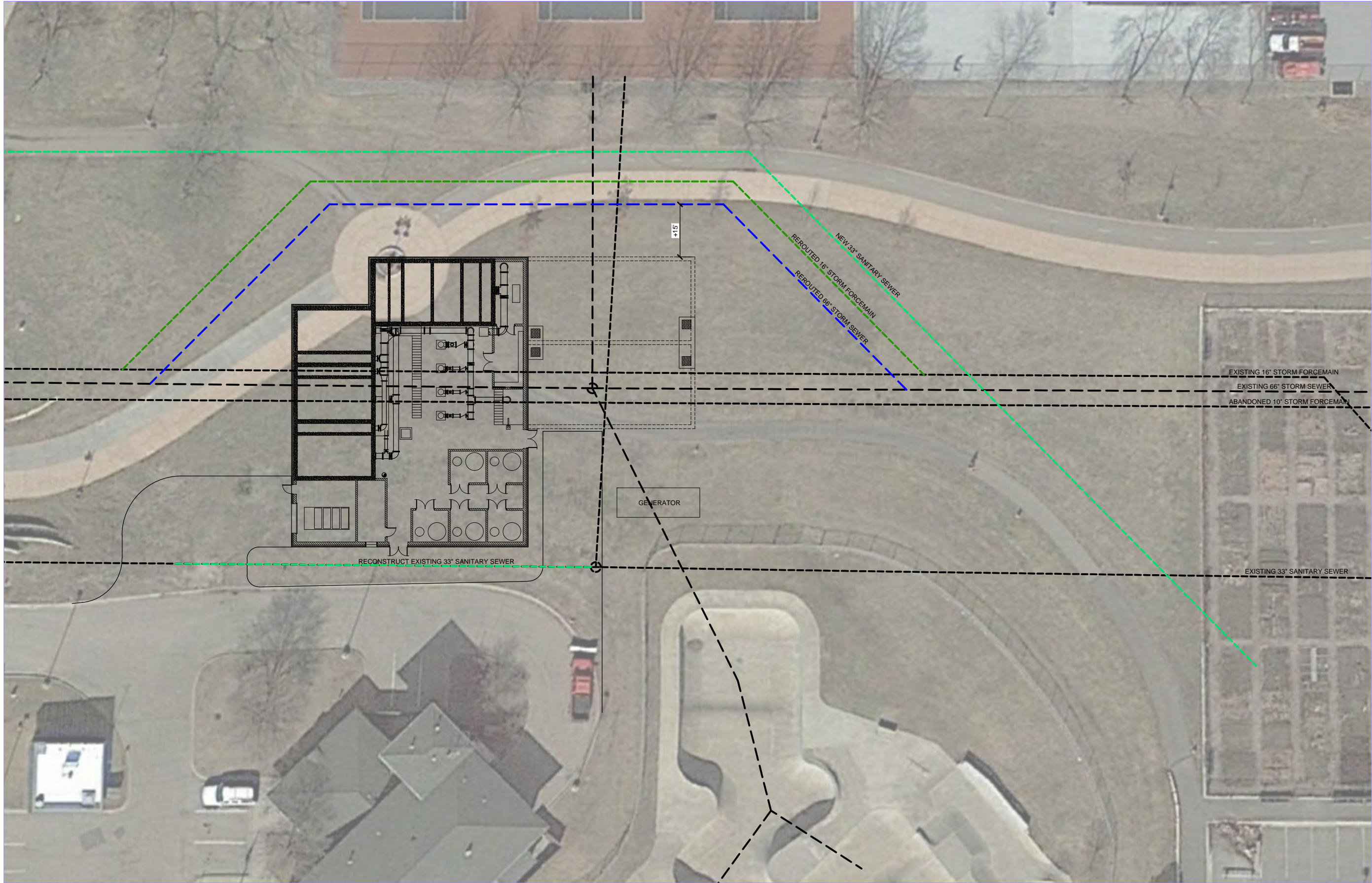
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CITY OF EDINA
EDINA, MINNESOTA
LOWER LEVEL PLAN

DRAWING TYPE
PRELIMINARY
PREPARED BY
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AUGUST 2017
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P05177-2016-000
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6 of 15
DRAWING
P1



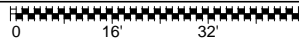
Appendix J

Option 2A – Yorktown Site with Gravity Filters Site Layout



1
2A-1

OPTION 2A - YORKTOWN SITE WITH GRAVITY FILTERS



PRELIMINARY
NOT FOR CONSTRUCTION
Mill estimate - 30%

C:\AE2S_CAD\AE2S_Logos\AE2S_Eng_Logo.png

WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA

OPTION 2A - YORKTOWN SITE WITH GRAVITY FILTERS

DRAWING TYPE
PRELIMINARY

PREPARED BY
RCL

CHECKED / APPROVED
GLM / ASV

DATE
AUGUST 2017

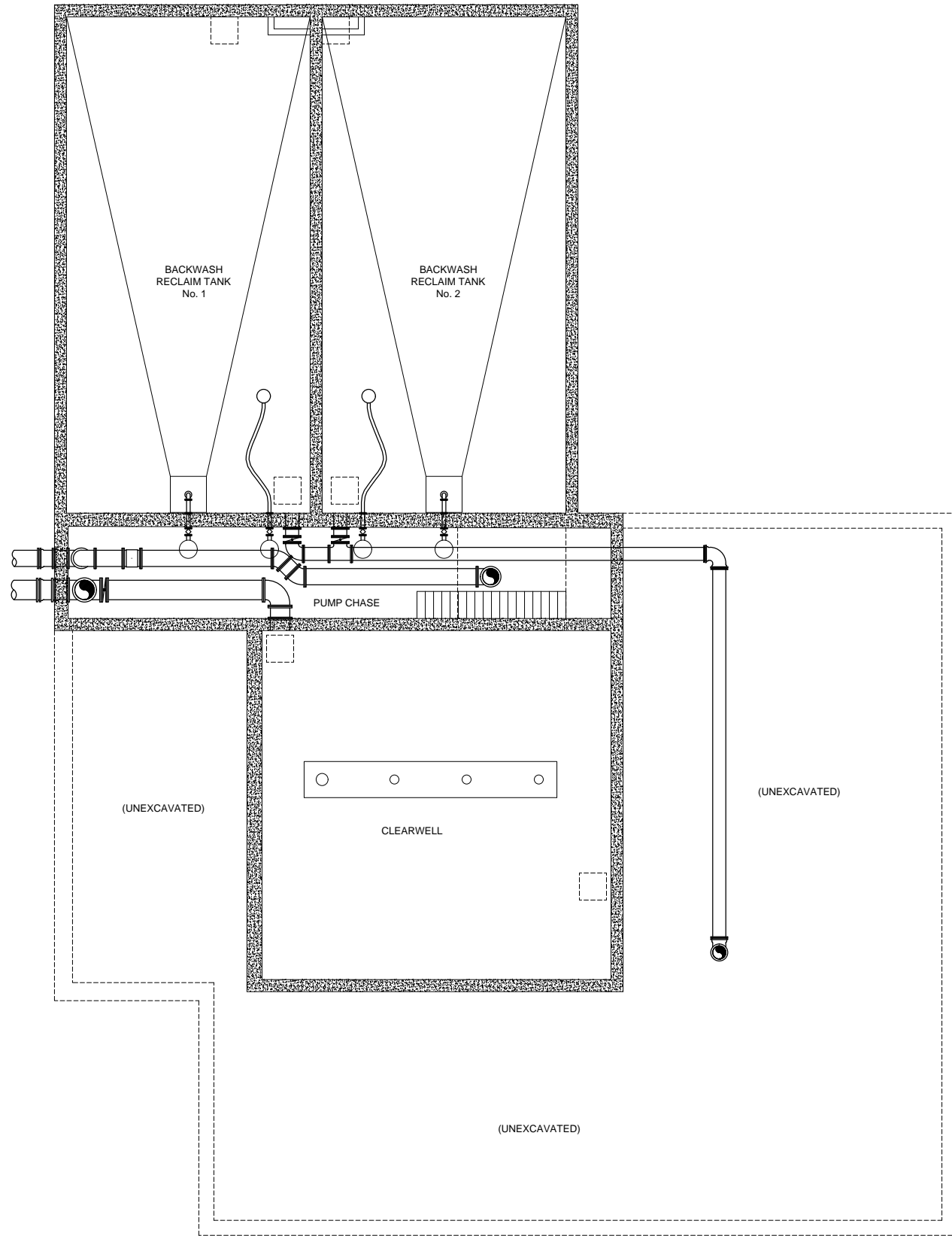
PROJECT NUMBER
P05177-2016-000

SHEET
7 of 15

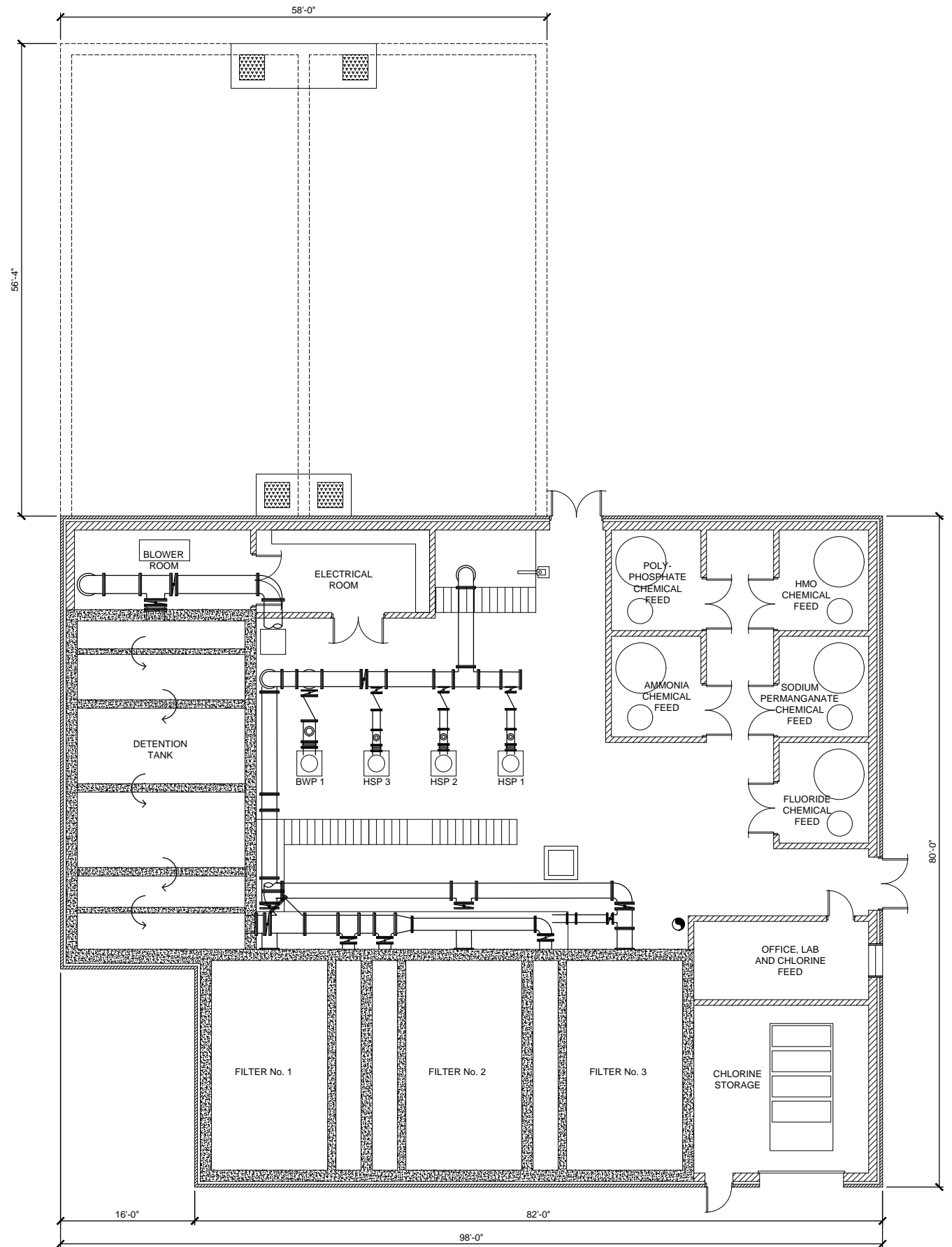
DRAWING
2A-1

Layout: PLANS (3)
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Plotted By: Randy Leppala Date: Tuesday, August 29, 2017 8:31:56 AM
Last Saved By: Randy Leppala Date: Tuesday, August 29, 2017 8:31:56 AM



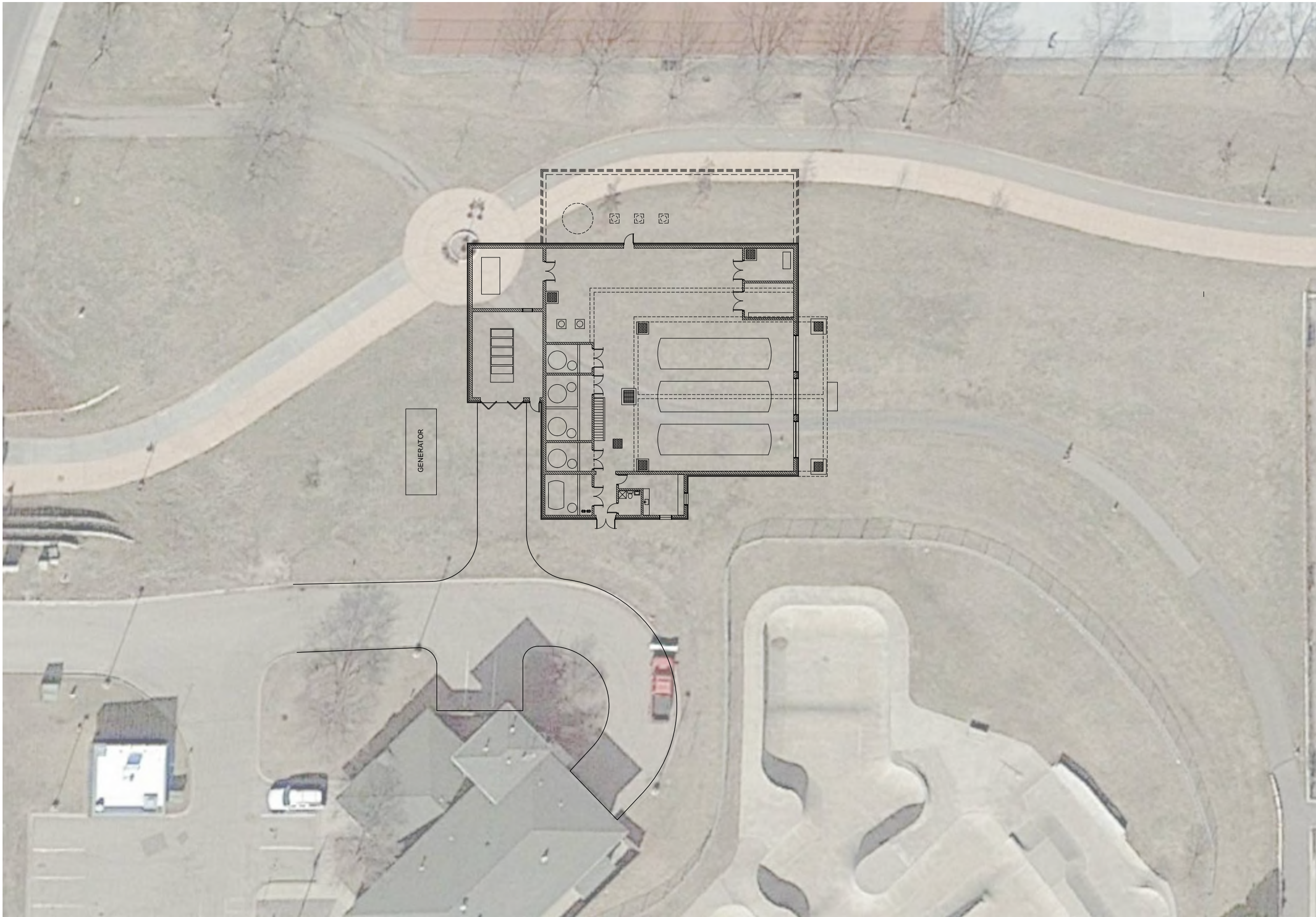
1 LOWER LEVEL PLAN
2A-2
0' 4' 8' 12' 16' 20'
NORTH



2 MAIN LEVEL PLAN
2A-2
0' 4' 8' 12' 16' 20'
NORTH

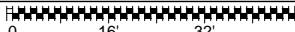
Appendix K

Option 2B – Yorktown Site with Pressure Filters Site Layout



1
2B-1

OPTION 2B - YORKTOWN SITE WITH PRESSURE FILTERS



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Milestone - 30%



WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 2B - YORKTOWN SITE WITH PRESSURE FILTERS

DRAWING TYPE
PRELIMINARY

PREPARED BY
RCL

CHECKED / APPROVED
GLM / ASV

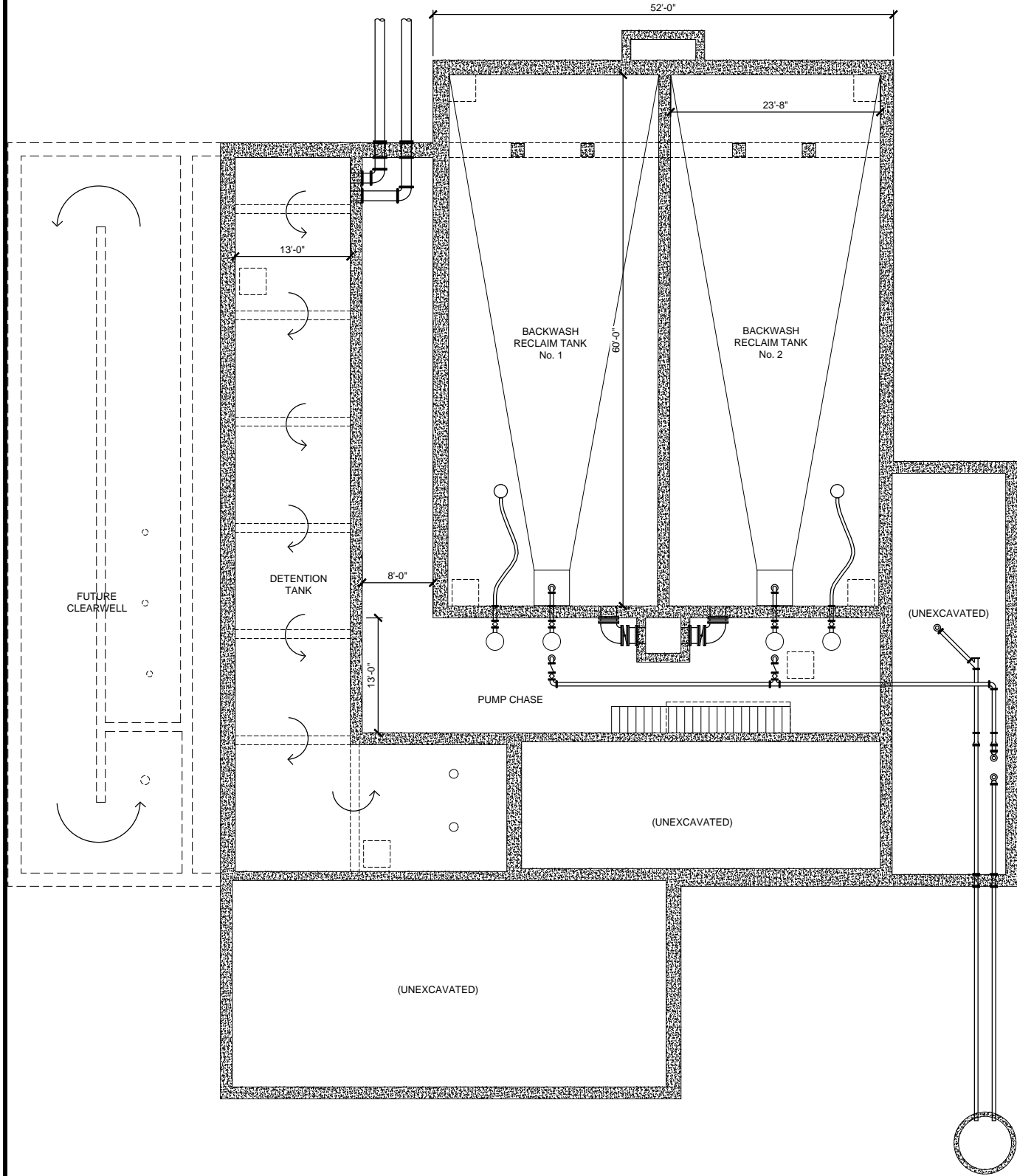
DATE
AUGUST 2017

PROJECT NUMBER
P05177-2016-000

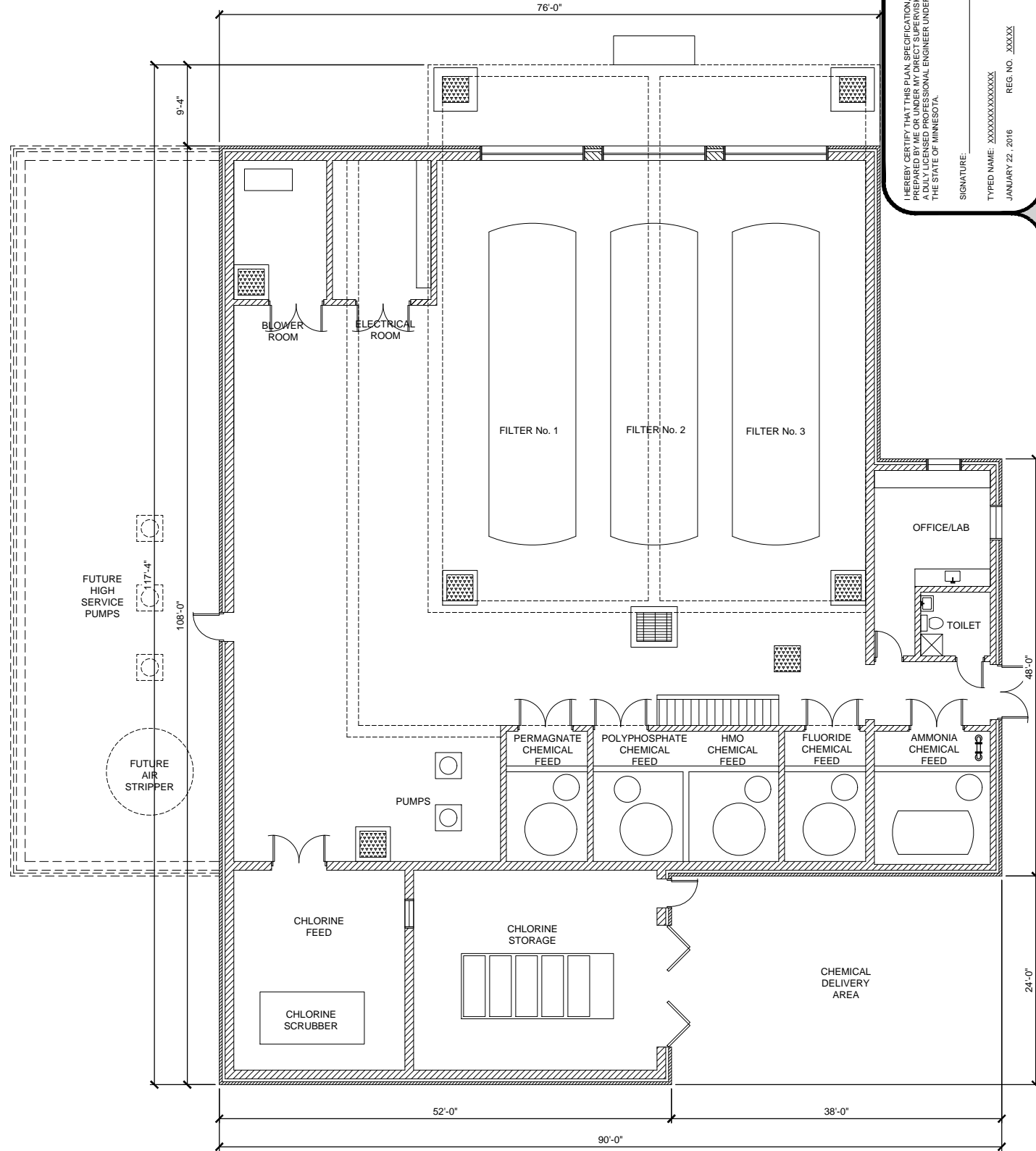
SHEET
10 of 15

DRAWING

2B- 1



1 LOWER LEVEL PLAN
2B-2



2 MAIN LEVEL PLAN
2B-2



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SIGNATURE:

TYPED NAME: XXXXXXXXXXXXXXXX

JANUARY 22, 2016 REG. NO. XXXXX

PRELIMINARY
NOT FOR CONSTRUCTION
Milestone - 30%



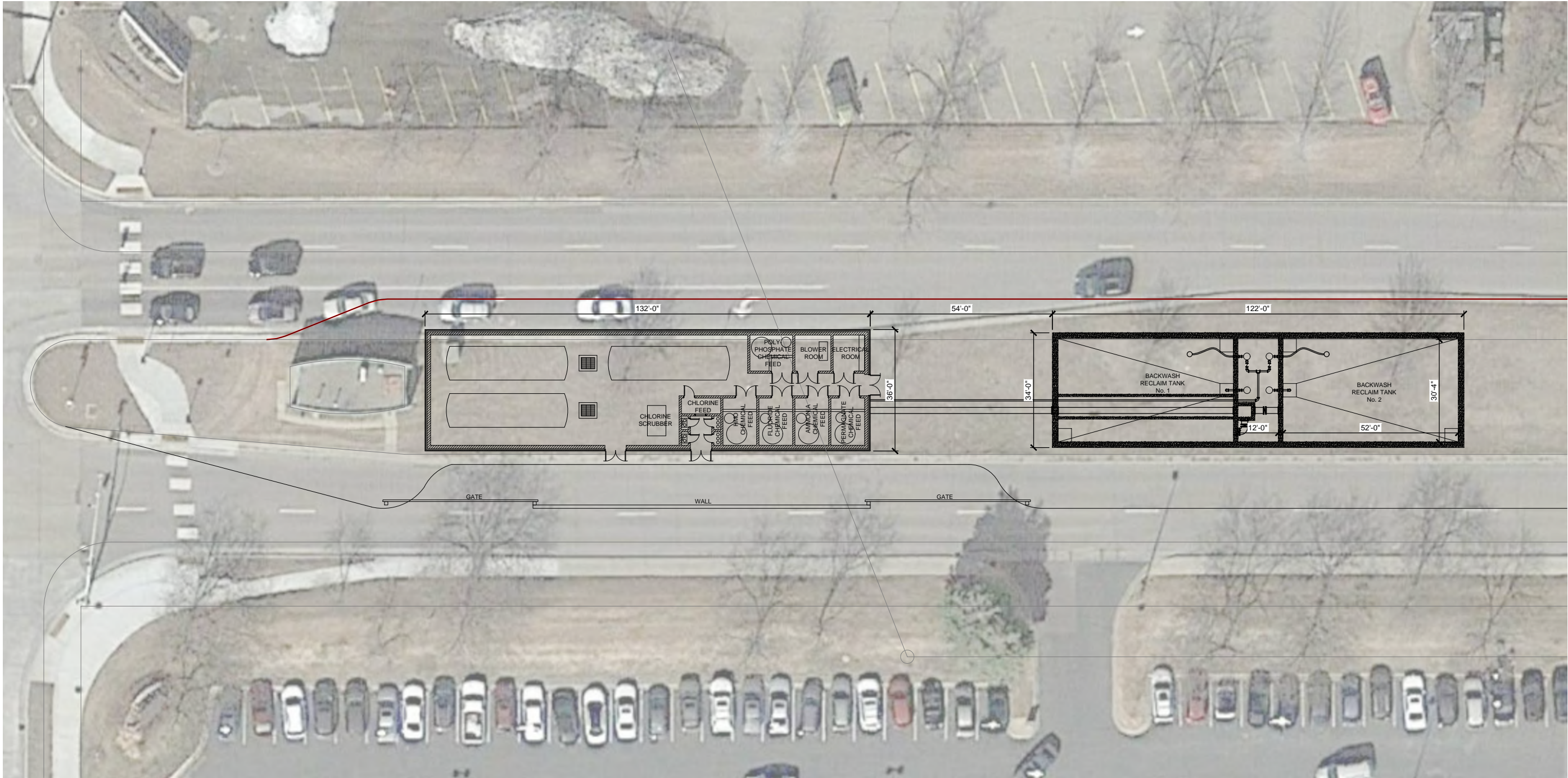
WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 2B - PLAN VIEWS

DRAWING TYPE
PRELIMINARY
PREPARED BY
RCL
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GLM / ASV
DATE
AUGUST 2017
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P05177-2016-000
SHEET
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DRAWING

2B- 2

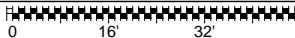
Appendix L

Option 3A – Median Site with Pressure Filters Site Layout



1
3A-1

OPTION 3A - MEDIAN SITE WITH PRESSURE FILTERS



I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNATURE:

TYPED NAME: XXXXXXXXXXXXXXXX

JANUARY 22, 2016

REG. NO. XXXX

PRELIMINARY
NOT FOR CONSTRUCTION
Milest one - 30%



WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 3A - MEDIAN SITE WITH PRESSURE FILTERS

DRAWING TYPE
PRELIMINARY

PREPARED BY
RCL

CHECKED / APPROVED
GLM / ASV

DATE
AUGUST 2017

PROJECT NUMBER
P05177-2016-000

SHEET
9 of 15

DRAWING

3A- 1

Appendix M

Option 4A – Fred Richards Site with Gravity Filters Site Layout



OPTION 4A - FRED RICHARDS SITE WITH GRAVITY FILTERS



PRELIMINARY
NOT FOR CONSTRUCTION
Milest one - 30%

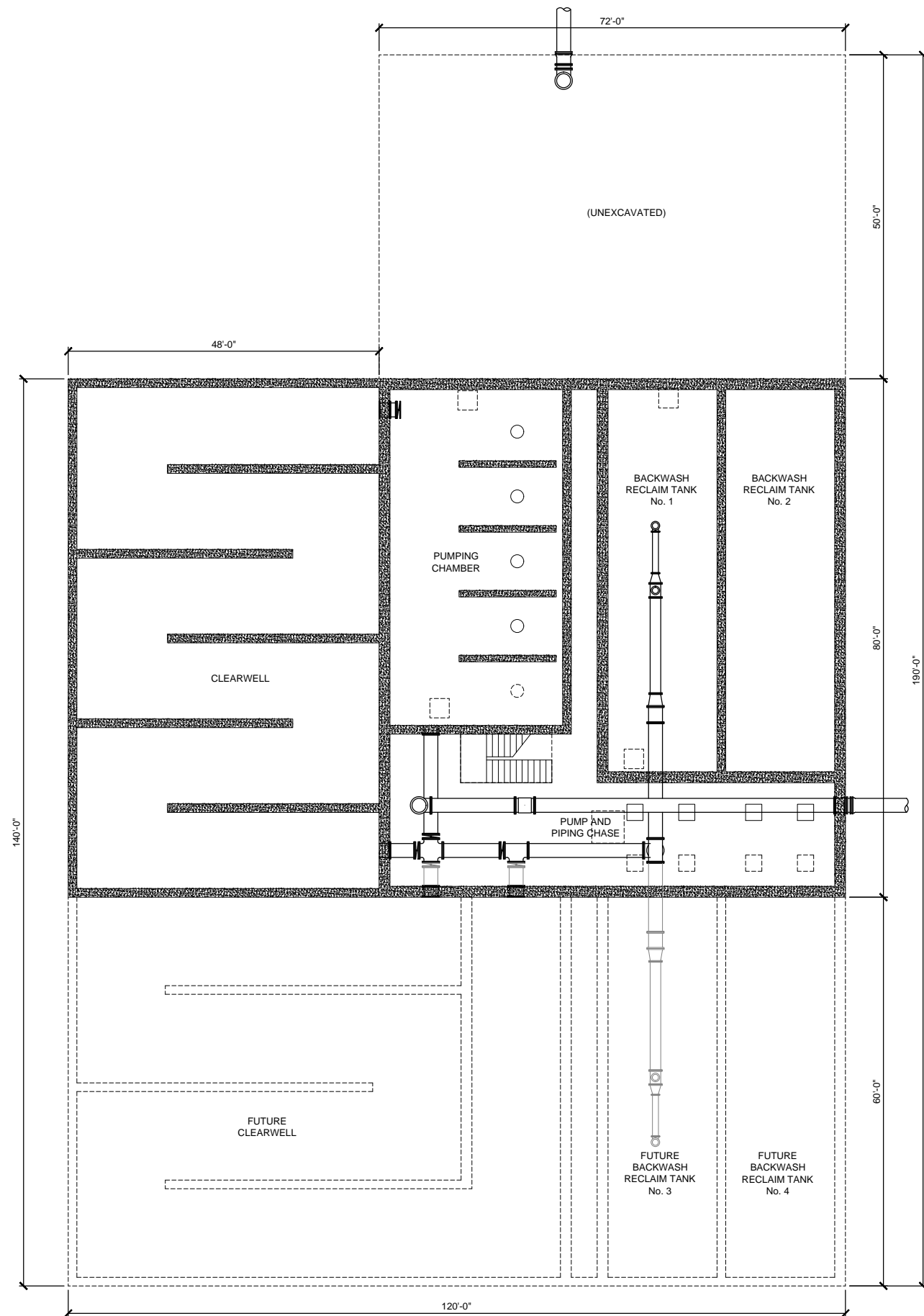


WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 4A - FRED RICHARDS SITE WITH GRAVITY FILTERS

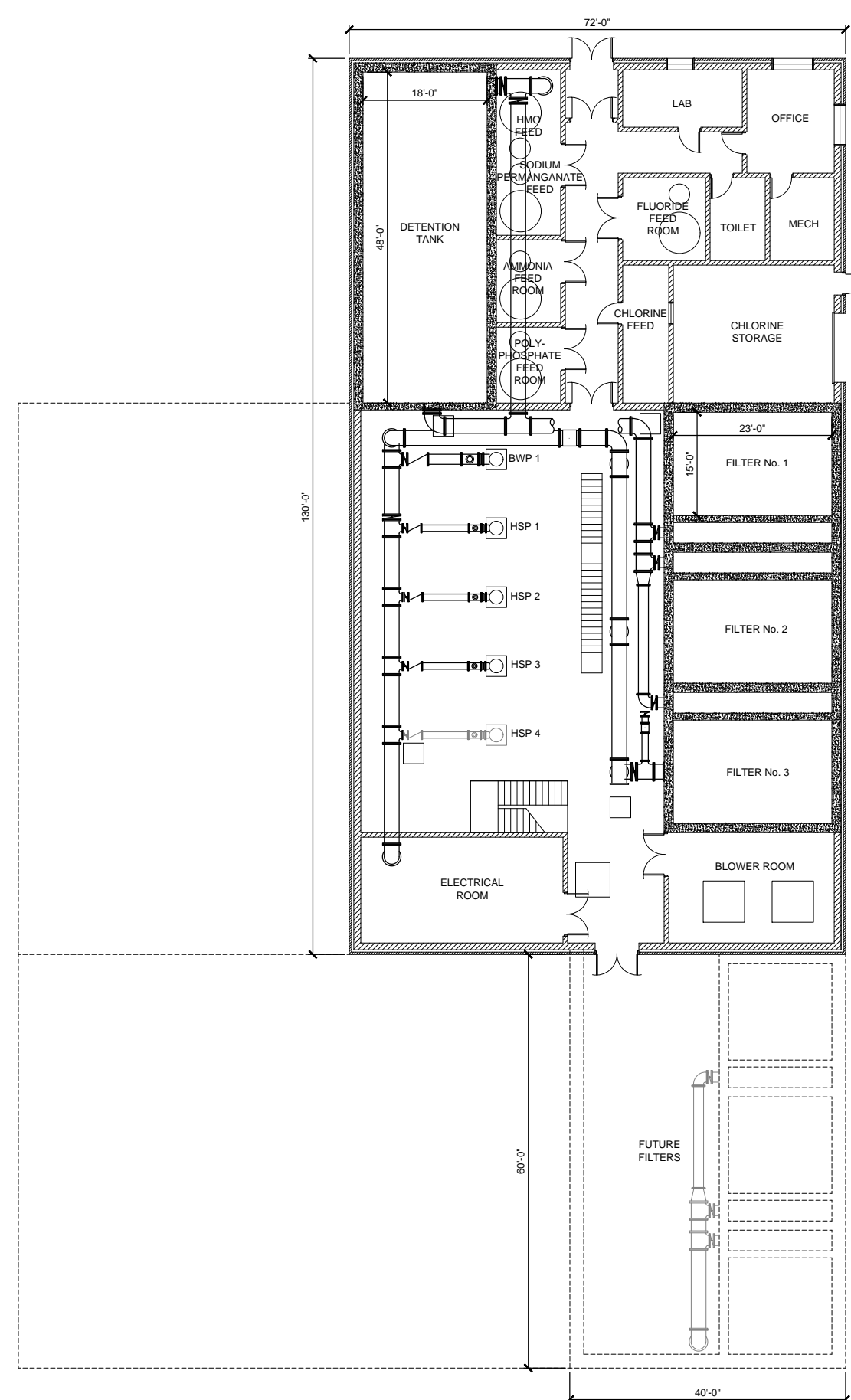
DRAWING TYPE
PRELIMINARY
PREPARED BY
RCL
CHECKED / APPROVED
GLM / ASV
DATE
AUGUST 2017
PROJECT NUMBER
P05177-2016-000

SHEET
12 of 15
DRAWING

4A- 1



1 LOWER LEVEL PLAN
4A-2



2 MAIN LEVEL PLAN
4A-2



PRELIMINARY
NOT FOR CONSTRUCTION
Mileston one - 30%



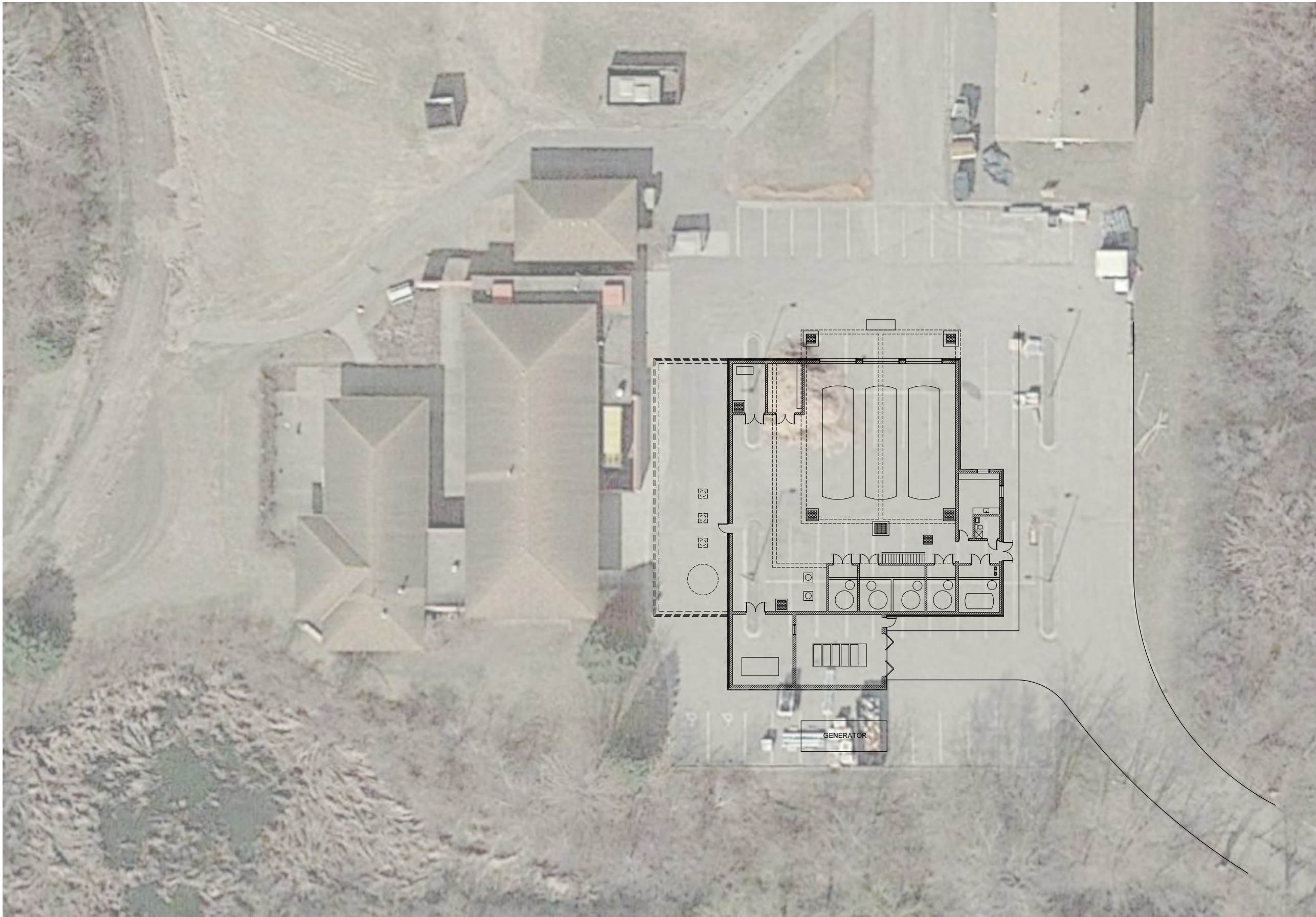
WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 4A - PLAN VIEWS

DRAWING TYPE
PRELIMINARY
PREPARED BY
RCL
CHECKED / APPROVED
GLM / ASV
DATE
AUGUST 2017
PROJECT NUMBER
P05177-2016-000
SHEET
13 of 15
DRAWING

4A-2

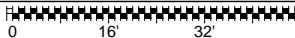
Appendix N

Option 4B – Fred Richards Site with Pressure Filters Site Layout



1
4B-1

OPTION 4B - FRED RICHARDS SITE WITH PRESSURE FILTERS



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JANUARY 22, 2016

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Milestone - 30%



WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA

OPTION 4B - FRED RICHARDS SITE WITH PRESSURE FILTERS

DRAWING TYPE
PRELIMINARY

PREPARED BY
RCL

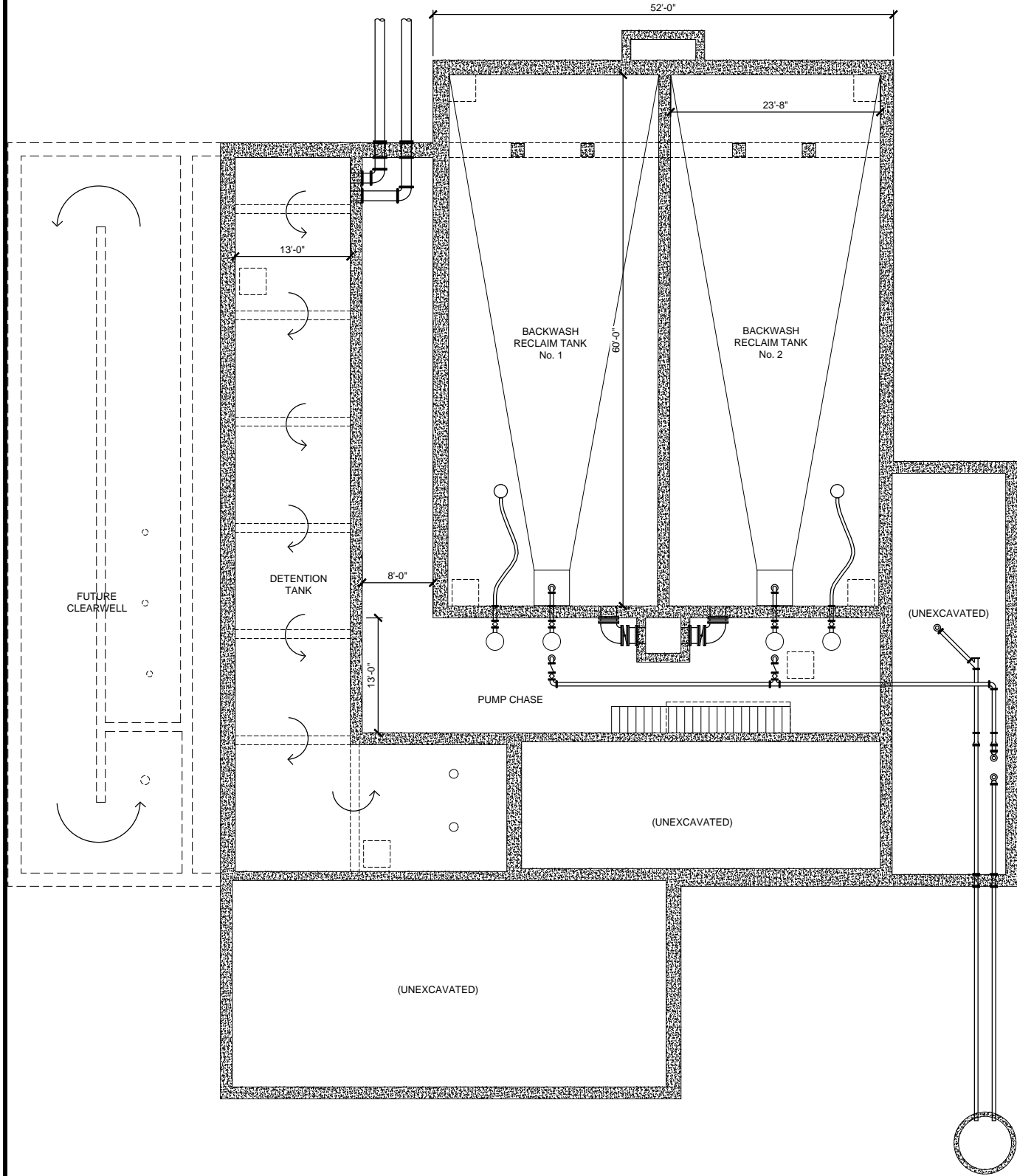
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DATE
AUGUST 2017

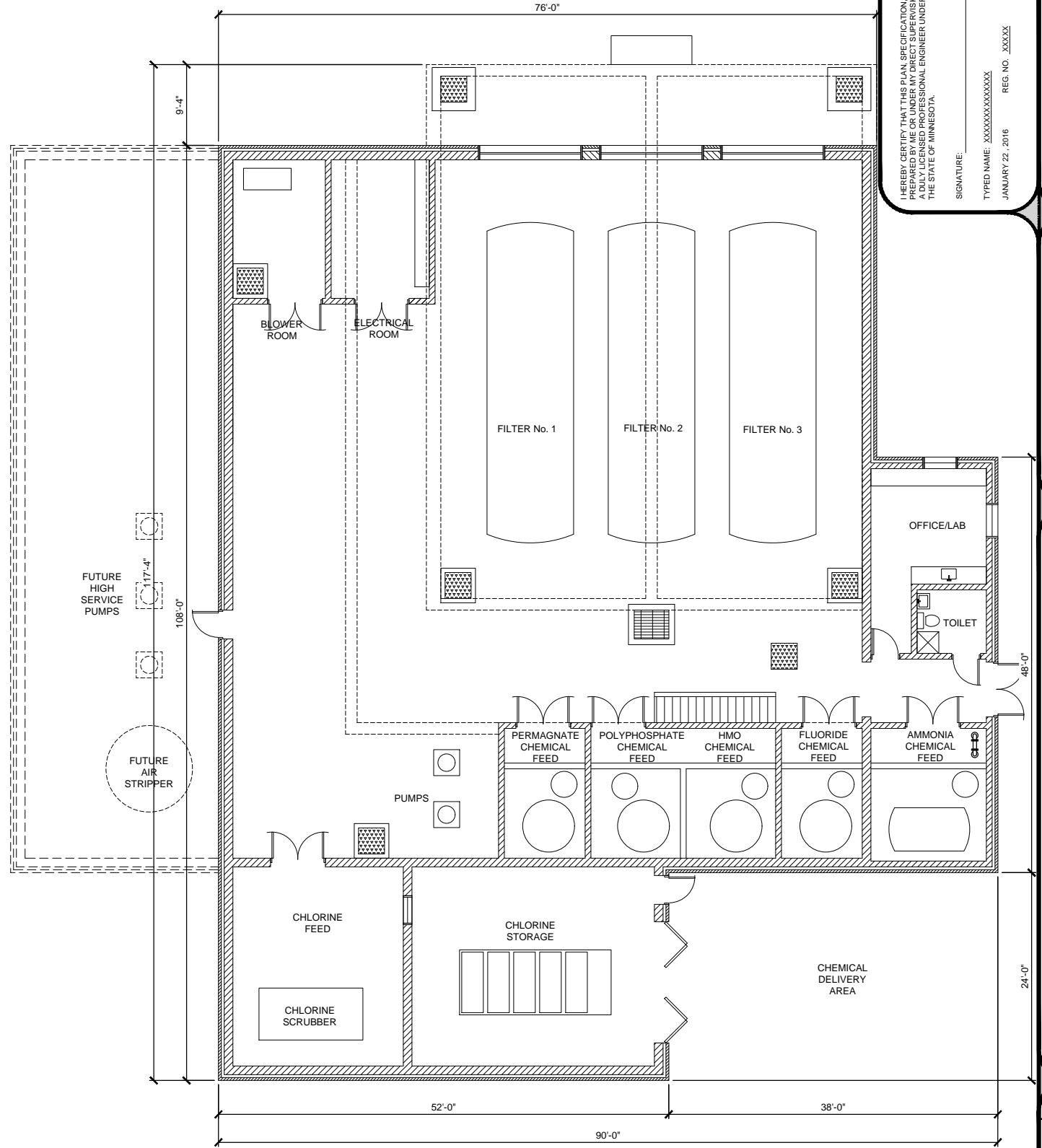
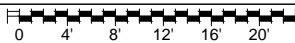
PROJECT NUMBER
P05177-2016-000

SHEET
14 of 15

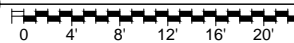
DRAWING
4B- 1



1 LOWER LEVEL PLAN
4B-2



2 MAIN LEVEL PLAN
4B-2



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SIGNATURE:

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JANUARY 22, 2016

REG. NO. XXXXX

PRELIMINARY
NOT FOR CONSTRUCTION
Milestone - 30%



WATER TREATMENT PLANT No. 5
CITY OF EDINA
EDINA, MINNESOTA
OPTION 4B - PLAN VIEWS

DRAWING TYPE
PRELIMINARY
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CHECKED / APPROVED
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DATE
AUGUST 2017
PROJECT NUMBER
P05177-2016-000
SHEET
15 of 15
DRAWING
4B- 2

Appendix O

Water Distribution System Model Analysis Report



Building a Better World
for All of Us™

MEMORANDUM

TO: Aaron Vollmer, PE

FROM: Chad T. Katzenberger, PE

DATE: August 8, 2017

RE: WTP No. 5 Preliminary Design Report - Water Distribution System Model Analysis
SEH No. EDINA 142247 14.00

This technical memo is in response to the correspondence received in June 22, 2017 requesting assistance with strategic water distribution system modeling related to the analysis of the proposed water treatment plant site layouts. The intent of this memo serves to summarize the assumptions and findings related to the water distribution system modeling analysis requested. Additional site options are also considered after initial analysis was completed.

PROJECT UNDERSTANDING

Advanced Engineering and Environmental Services, Inc. (AE²S) is in the processing of preparing a Water Treatment Plant No. 5 Preliminary Engineering Report for the City of Edina. Short Elliott Hendrickson Inc. (SEH[®]) currently maintains the City's water distribution system model and the City has requested that AE²S and SEH work together to evaluate the hydraulic implications of the proposed water treatment plant site alternatives.

- The City is considering four (4) sites for future WTP No.5, The potential locations are as follows:
 1. **Southdale Site** – located in the lot directly north of the Southdale Tower along France Avenue.
 2. **Median Site** – located near the Southdale Site, but in the 69th Street West median adjacent to Well No. 5.
 3. **Yorktown Site** – located near Well No. 18 and Fire Station No. 2 between York Avenue South and Xerxes Avenue South.
 4. **WTP No. 3 Site** – located immediately adjacent to the existing WTP No. 3 and would potentially take the place of WTP No. 3 in the future.
- Previous site analysis (Feasibility Study for WTPs No.5 and No.6, PCE (2007) and Water System Demand and Capacity Analysis, SEH (2013)) have been completed for the Southdale site, however the other sites have yet to be evaluated hydraulically.
- The City initially selected the Southdale site as the preferred site.
- Below is a summary of the requested Water Distribution Model Scenario Analysis outcomes:
 - Evaluate hydraulic capacity of all four sites using the latest water distribution system model (Provide a similar analysis to what was completed for the 2013 analysis).
 - Evaluate pressure increase surrounding each proposed treatment plant site during an average day demand condition.
 - Evaluate site function and operation during peak demands in relation to water tank operation and overall water distribution system function.
- Requested Data (Results):
 1. What impact does the proposed facility have during average day demands?
 2. What impact does the proposed facility have during peak demands?
 3. Identify concerns, if any, in existing pipe capacity and/or fluctuations in water storage levels.
 - Does the water main need to be upsized to accommodate proposed WTP capacity?
 - Are the velocities less than 5 feet per second?
 - Is headloss (per 1000 ft) limited to less than 2-3 ft/1000 ft?

Engineers | Architects | Planners | Scientists

Short Elliott Hendrickson Inc., 3535 Vadnais Center Drive, St. Paul, MN 55110-5196

SEH is 100% employee-owned | sehinc.com | 651.490.2000 | 800.325.2055 | 888.908.8166 fax

- It is understood that the City of Edina, together with AE²S, desires to answer the following questions:
 - Where is the best location to tie WTP No. 5 into the system?
 - Will the existing 10-inch distribution main along York Avenue South handle a 3,000 gpm WTP effluent, or will that pipe need to be upsized to accommodate that site location?
 - Will the existing distribution system infrastructure in the vicinity of WTP No. 3 be able to accommodate an increased flow from 2,000 gpm to a 5,000 gpm?
- The model has been set up to match the site configurations provides by AE²S as described in the request letter dated June 22, 2017.
- Four water treatment plant sites will be evaluated with nine separate water modeling scenarios, described as follows:

Water Model Scenario Summary

Scenario	Site	Total Plant Capacity (gpm)	General Description
1A	Southdale	3,000	Facility effluent pipe ties into the 12" DIP on the west side of France Avenue South
1B		3,000	Facility effluent pipe ties into the 16" CIP Southdale Tower water main
2	Median	3,000	Facility effluent pipe ties into the 12" CIP that runs east/west along 69th Street West
3A	Yorktown	3,000	Facility effluent pipe ties into the 10" DIP that runs north/south along York Avenue South, York Avenue South water main remains as is
3B		3,000	Facility effluent pipe ties into an upgraded 12" main running north/south along York Avenue South between 70th street W and 76th street W
3C		3,000	Facility effluent pipe ties into an upgraded 16" main running north/south along York Avenue South between 70th Street West and 76th Street West
3D		3,000	Facility effluent pipe ties into existing 10" main as well as an upgraded 16" trunk main running between York and France
4A	WTP No.3	5,000	Proposed WTP No.5 replaces WTP No.3 and flow from this site is increased by 3,000 gpm for a total of 5,000 gpm
4B		5,000	Similar to Scenario 4A with 20-inch trunk main installed from WTP 3 North along Kellogg, West along Gilford, then North along W Shore Drive and then connecting into the existing 12-inch main along W 70th Street

HYDRAULIC ANALYSIS

The City's most current water distribution system model was utilized to evaluate each of the water model scenarios identified above. Each of the scenarios described above was constructed into the model incorporating both a steady state and extended period simulation (EPS) for each scenario alternative.

Steady State Analysis

This model operation provides for a comprehensive assessment of overall system operating conditions at a given point in time. For this analysis, average day demands were assumed to be present in the system with WTP's No.2, No.3 & No.6 in operation and elevated storage tank levels at 2-feet below overflow. The purpose of this analysis it to take a comparative look at system pressure and pipe headloss in relation to what is experienced in the current water system. For example, some of the proposed sites may not have large enough distribution piping to transfer the WTP flow to other parts of the system, which in turn will result in elevated discharge pressures and excessive headloss. It should be noted that for purposes of site comparison, similar demand and water tower levels for each scenario were considered. Though the results may indicate a certain pressure increase, in practice, the proposed water plant could be designed and subsequently operated to modulate flow. This in turn would reduce dynamic system pressures and observed pressure increases.

1A Tanks

Elevation (ft)

Time (Hours)

Legend

Pipe Velocity (fps)

0.0 - 5.0

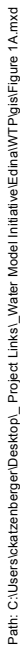
5.0 - 7.0

TANK #2 - GUASIMACHO - OPTIA-EP3 - Hydraulic Grade

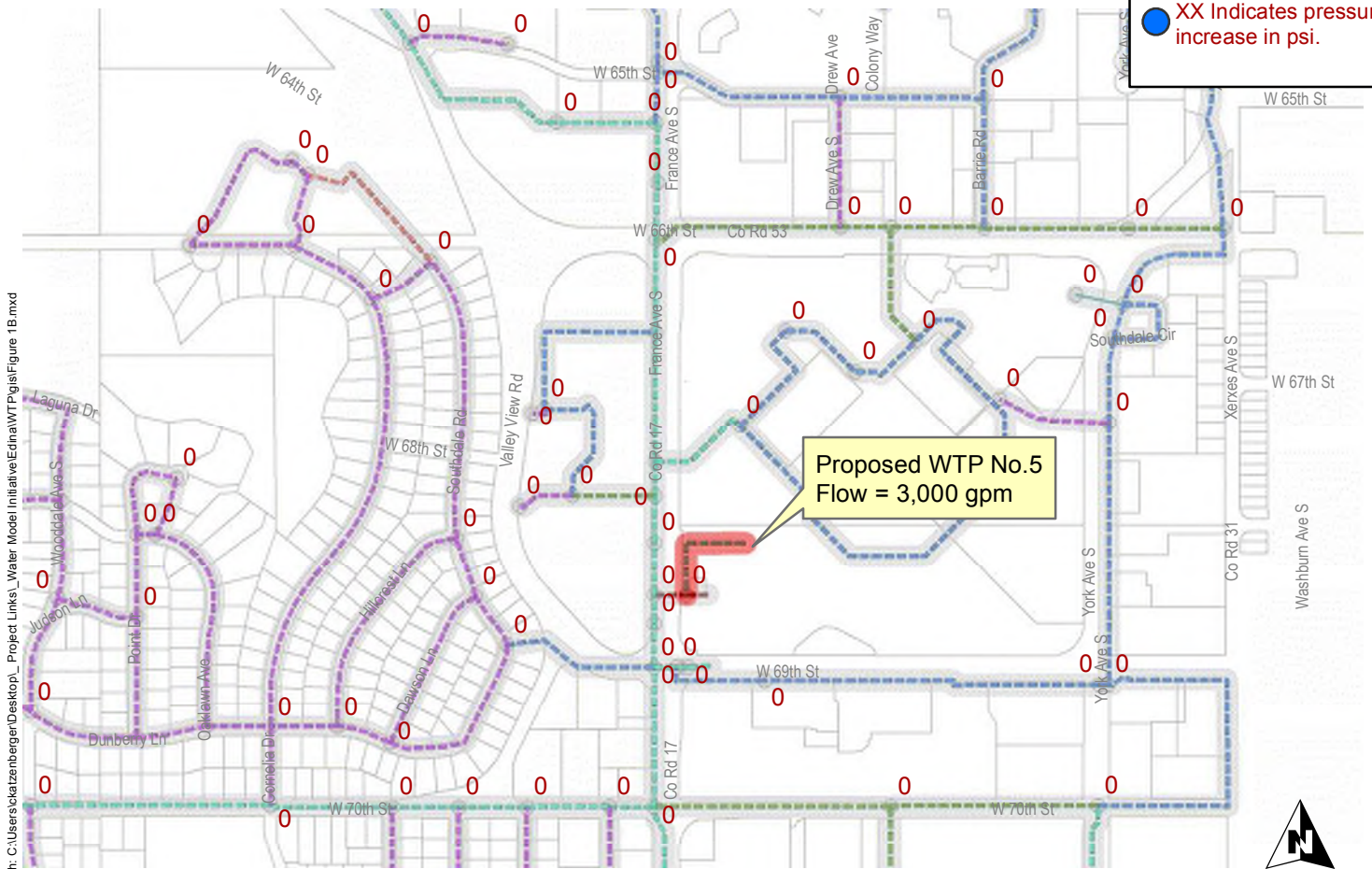
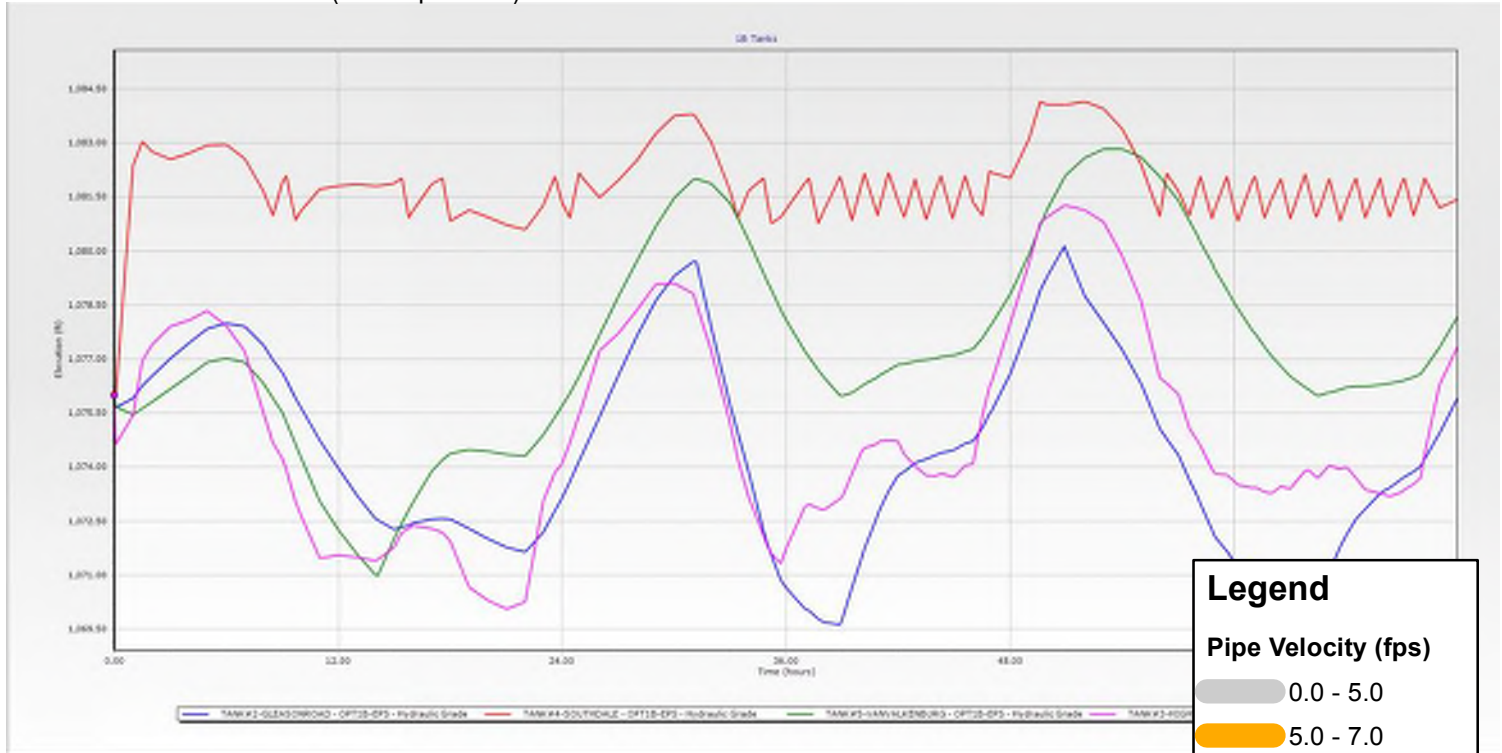
TANK #4 - SOUTHERLE - OPTIA-EP3 - Hydraulic Grade

TANK #5 - VAN ALKEDBURG - OPTIA-EP3 - Hydraulic Grade

TANK #3 - ...



Water Tower Tank Balance (EPS Operation)



Path: C:\Users\calzenberger\Desktop\Project Links\Water Model Initiative\Edina\WTP\Fig1B.mxd



Project Number: EDINA 128385
Print Date: 8/7/2017

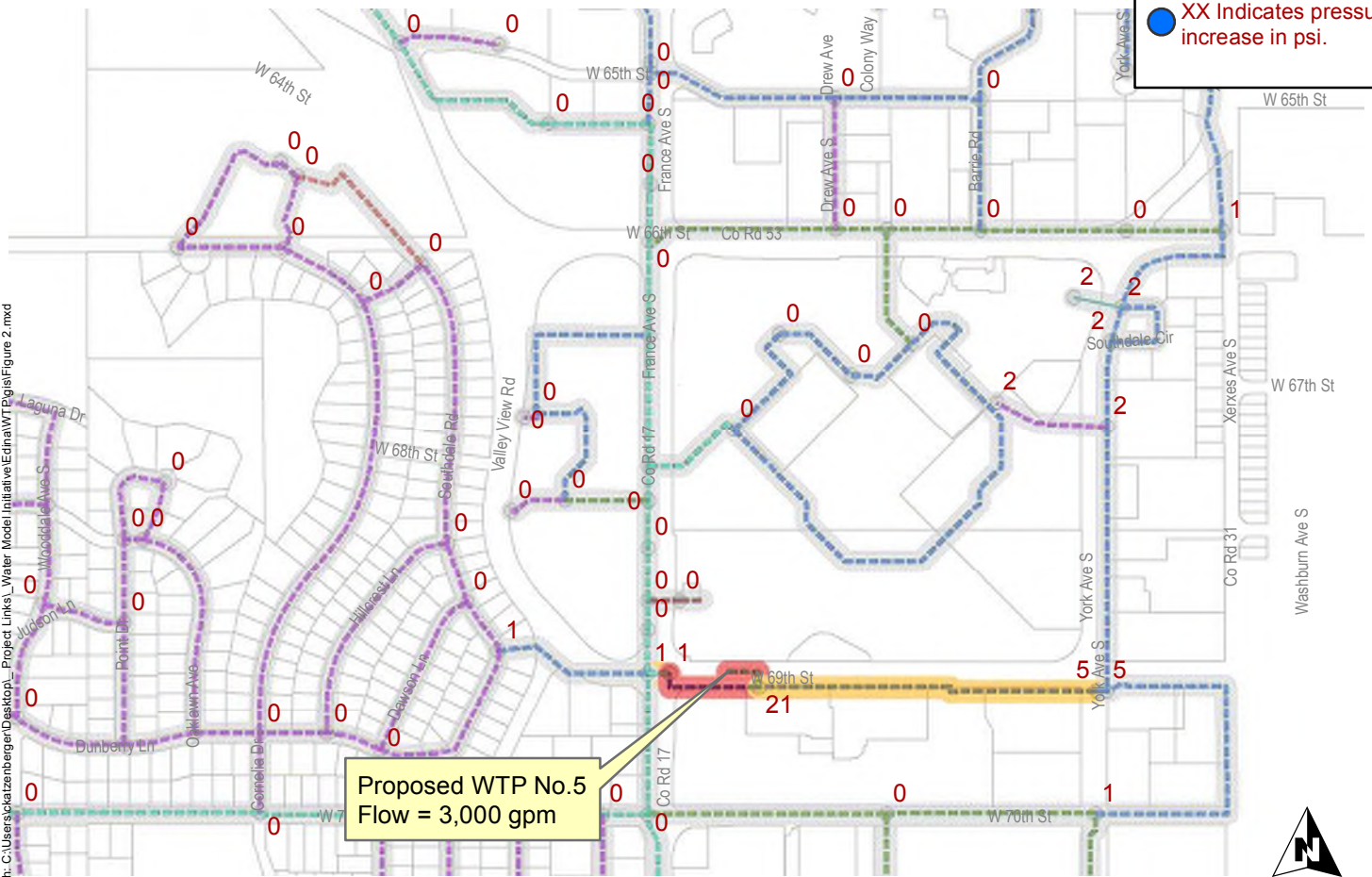
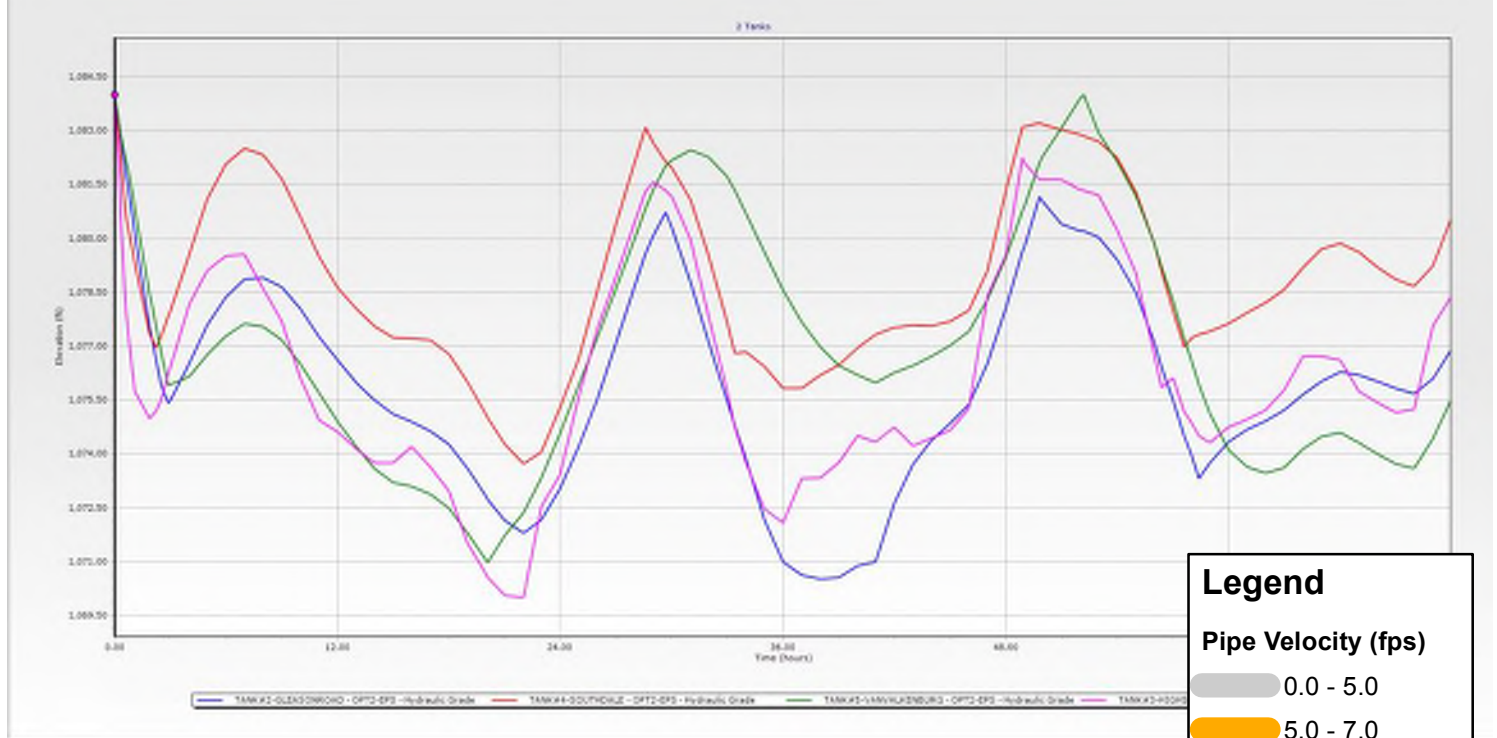
Map by: CTK
Projection: CC
Source: WaterCAD V8i

Water Treatment Plant No.5
Edina, Minnesota

SCENARIO 1B
Average Day Pressure and
Flow Results WTP. No.5

This map is neither a legally recorded map nor a survey map and is not intended to be used as one. This map is a compilation of records, information, and data gathered from various sources listed on this map and is to be used for reference purposes only. SEH does not warrant that the Geographic Information System (GIS) Data used to prepare this map are error free, and SEH does not represent that the GIS Data can be used for navigational, tracking, or any other purpose requiring exacting measurement of distance or direction or precision in the depiction of geographic features. The user of this map acknowledges that SEH shall not be liable for any damages which arise out of the user's access or use of data provided.

Water Tower Tank Balance (EPS Operation)



Project Number: EDINA 128385
Print Date: 8/7/2017

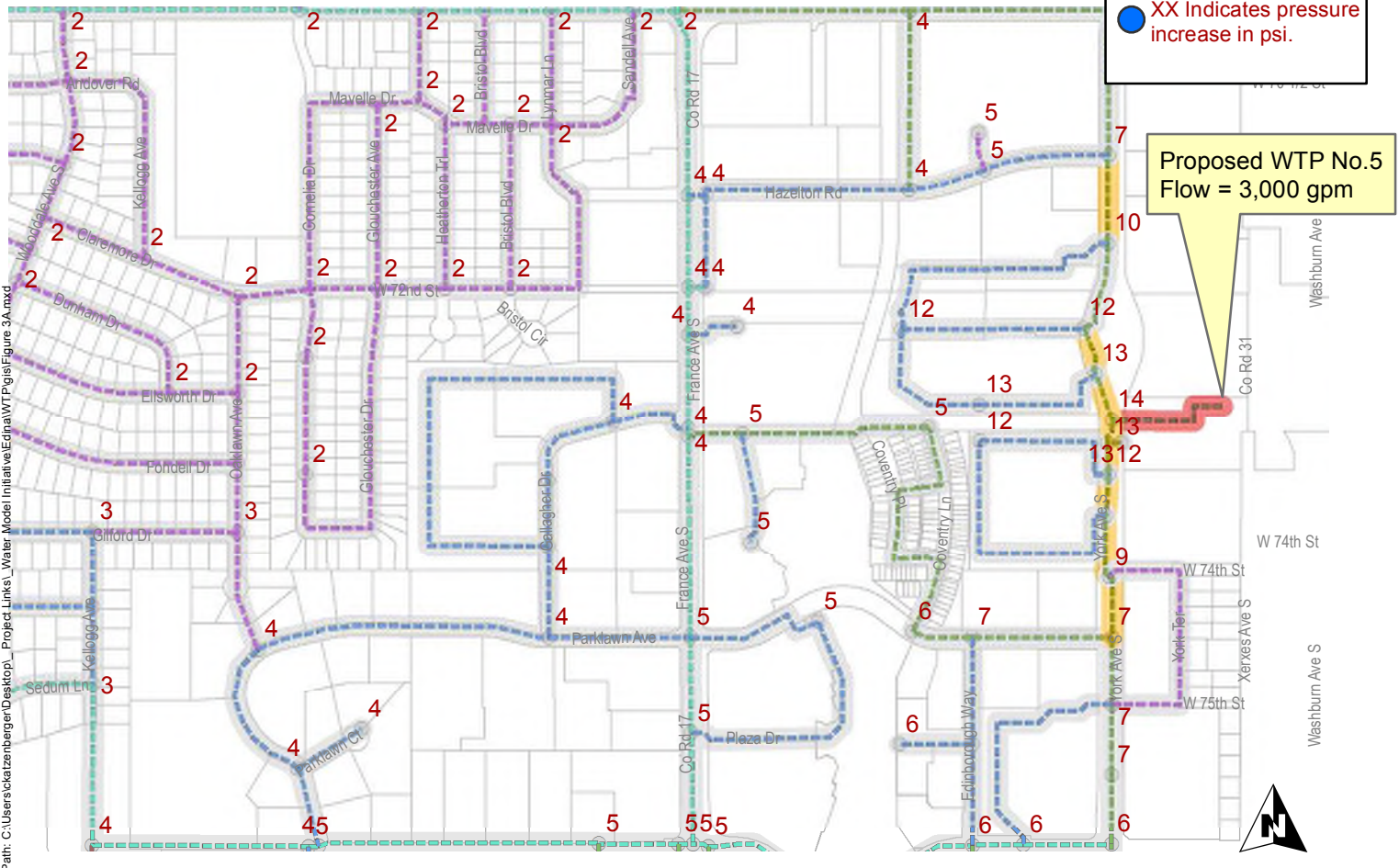
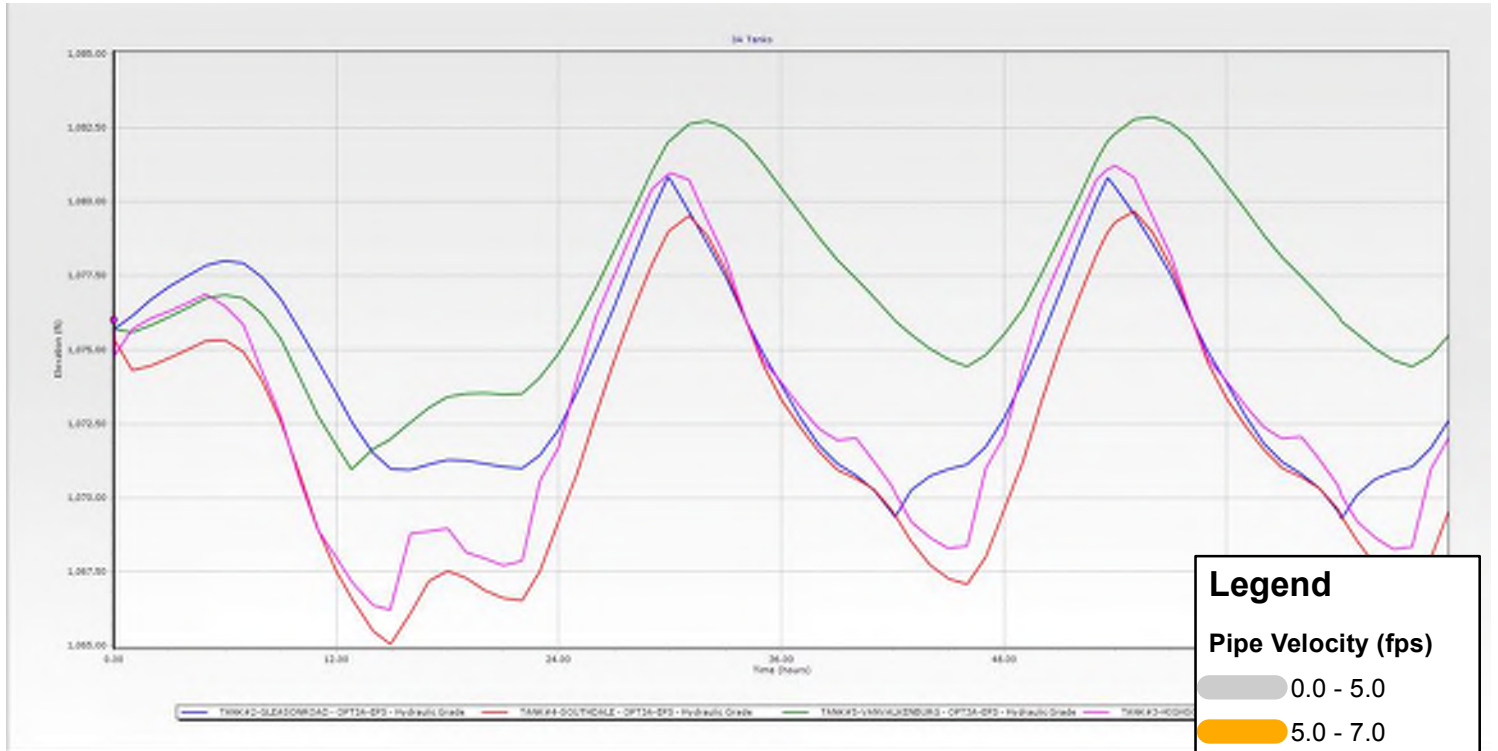
Map by: CTK
Projection: CC
Source: WaterCAD V8i

Water Treatment Plant No.5
Edina, Minnesota

SCENARIO 2
Average Day Pressure and
Flow Results WTP. No.5

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Water Tower Tank Balance (EPS Operation)



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Project Number: EDINA 128385
Print Date: 8/7/2017

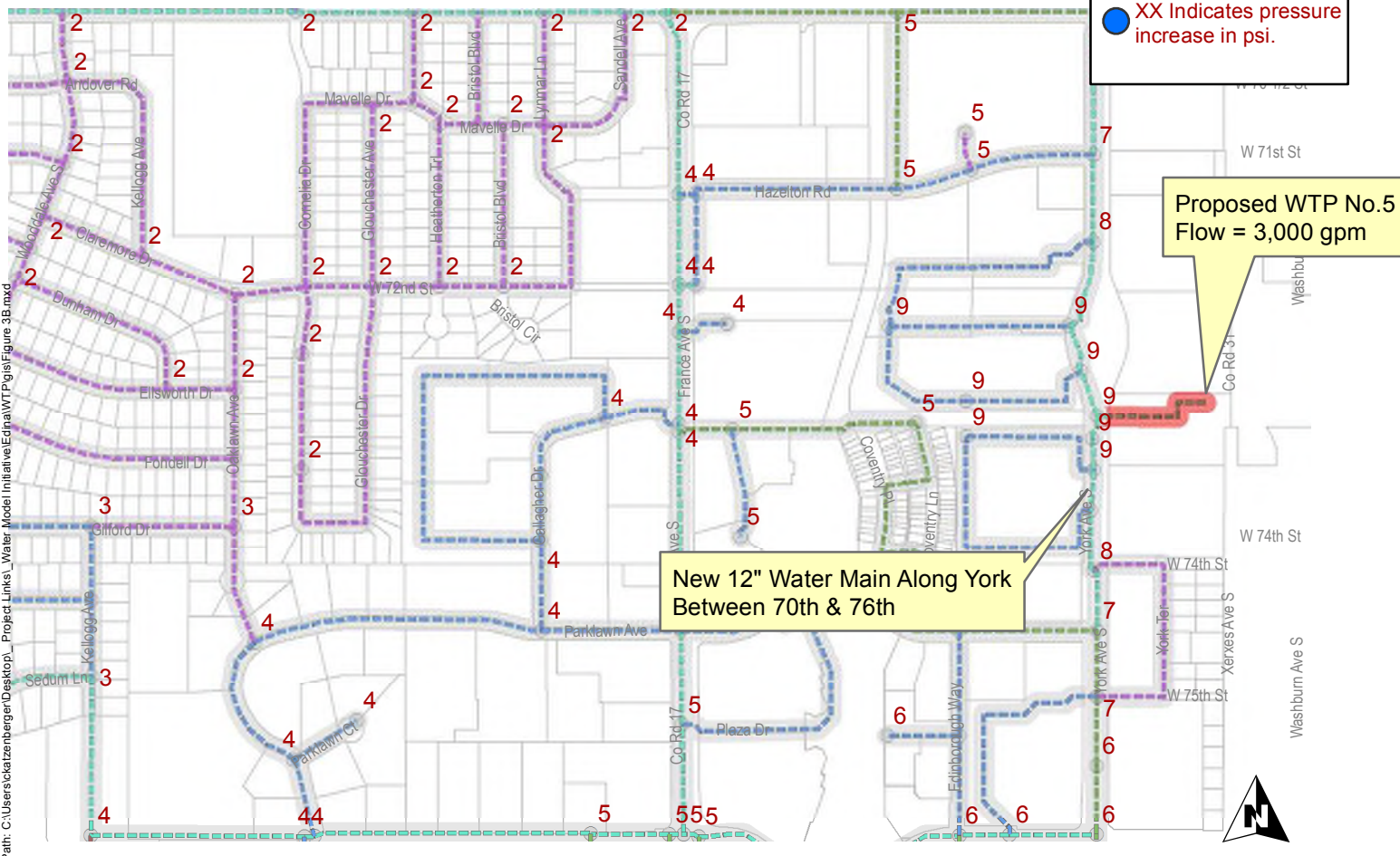
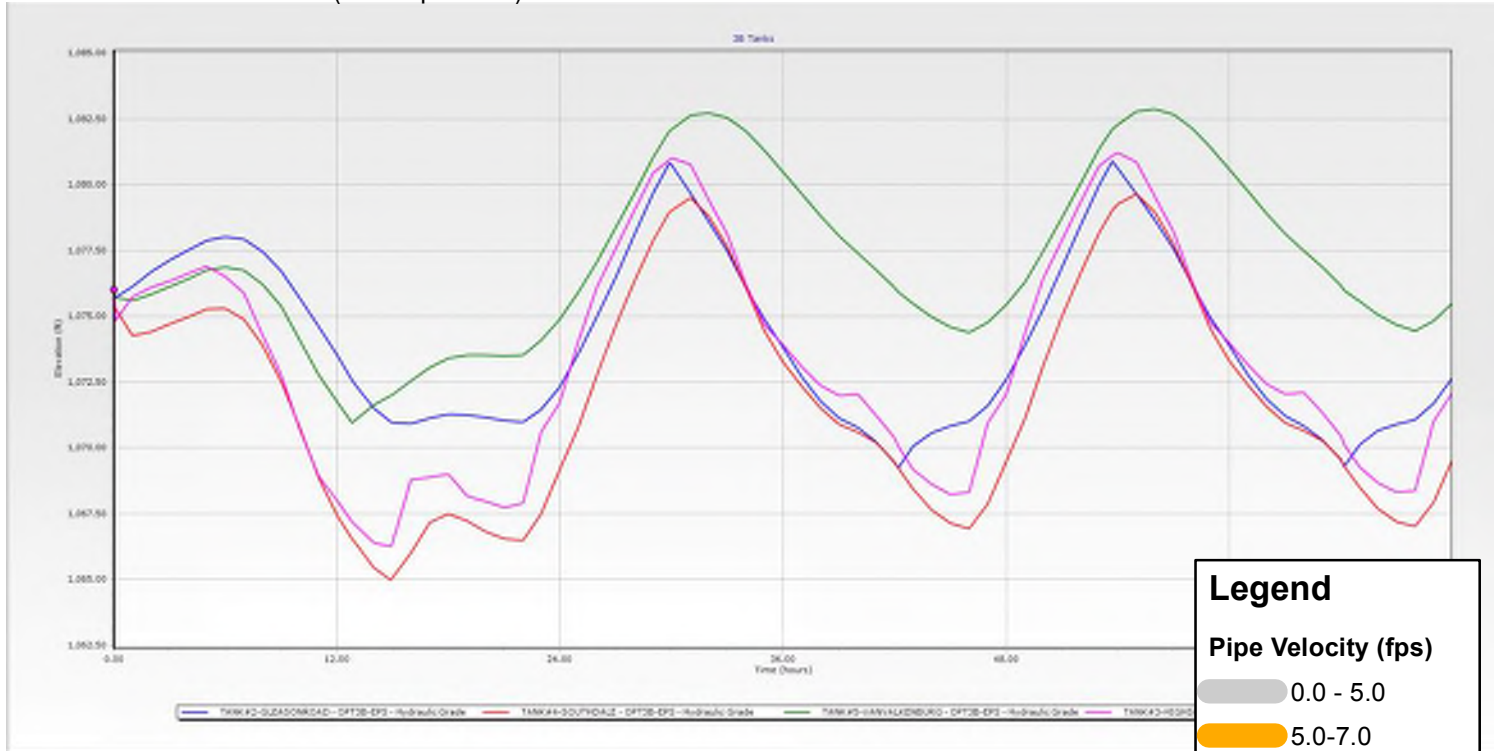
Map by: CTK
Projection: CC
Source: WaterCAD V8i

Water Treatment Plant No. 5
Edina, Minnesota

SCENARIO 3A
Average Day Pressure and
Flow Results WTP. No. 5

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Water Tower Tank Balance (EPS Operation)



Project Number: EDINA 128385
Print Date: 8/7/2017

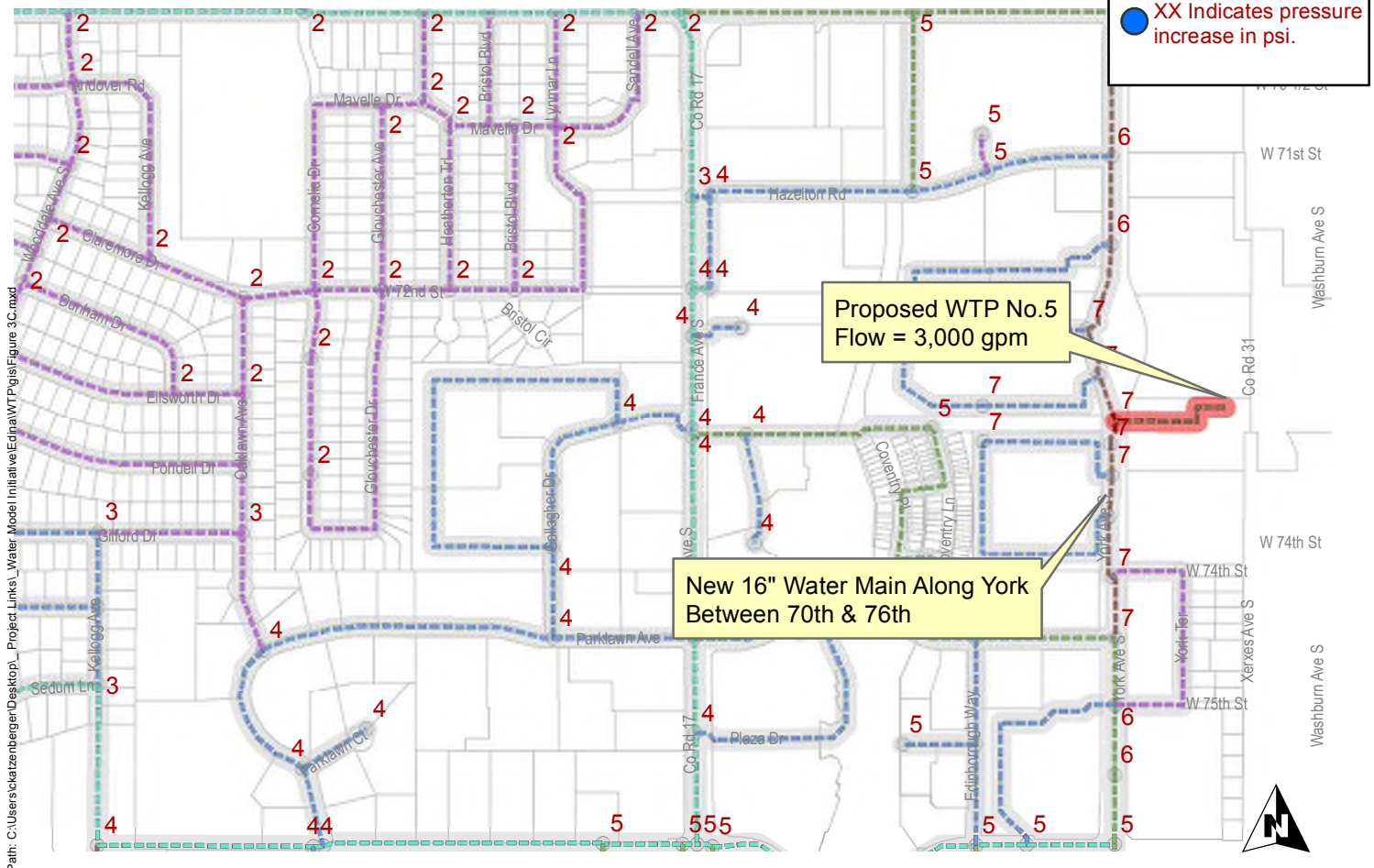
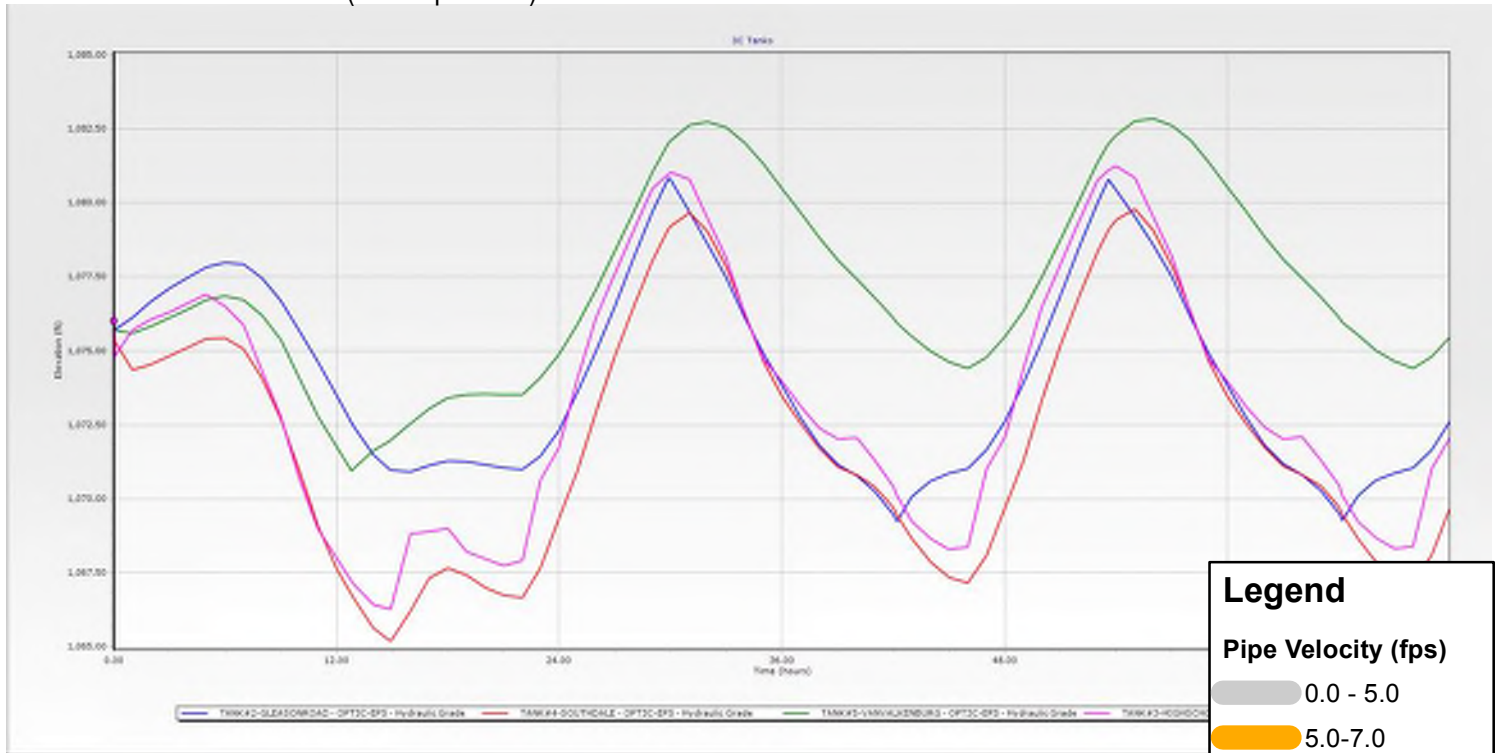
Map by: CTK
Projection: CC
Source: WaterCAD V8i

Water Treatment Plant No.5
Edina, Minnesota

SCENARIO 3B
Average Day Pressure and
Flow Results WTP. No.5

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Water Tower Tank Balance (EPS Operation)



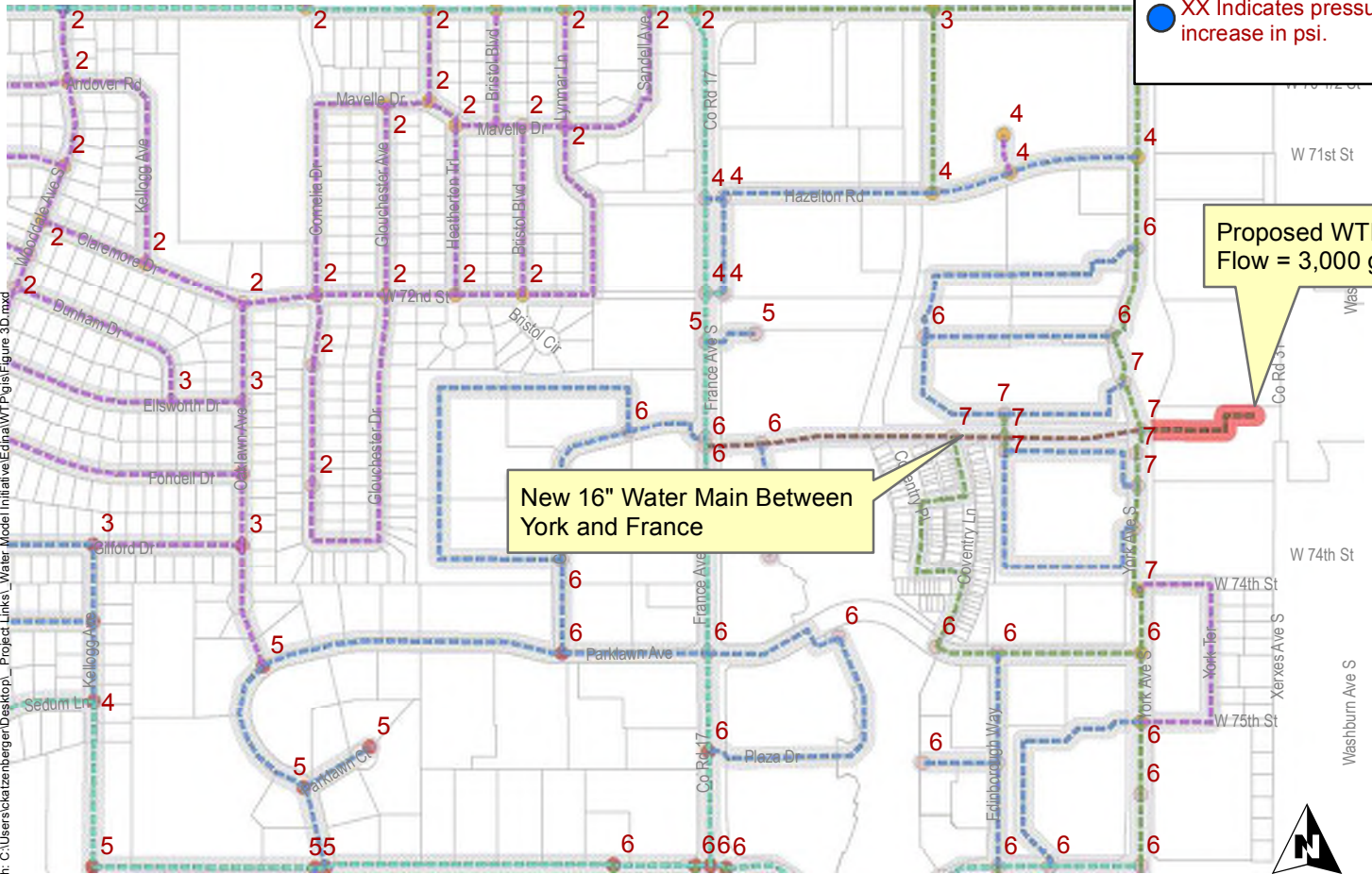
The figure consists of two parts: a line graph at the top and a map at the bottom.

Graph: The y-axis is labeled "Elevation (ft)" and ranges from 5,042.50 to 5,045.00. The x-axis is labeled "Time (hours)" and ranges from 0.00 to 48.00. There are four data series representing different tank configurations:

- Tank #3 - QUASQARSAC - OPTIC-ERS - Hydraulic Grade (Blue line)
- Tank #4 - SOUTHCAL - OPTIC-ERS - Hydraulic Grade (Red line)
- Tank #5 - MOWKLEBAC - OPTIC-ERS - Hydraulic Grade (Green line)
- Tank #3 - MOWKLEBAC - OPTIC-ERS - Hydraulic Grade (Magenta line)

 The graph shows periodic fluctuations in elevation, with peaks occurring around 12, 36, and 48 hours.

Map: The map shows a street network with various streets labeled, including Mowkley Ave S, Quasqarsac Ave S, Southcal Ave S, Mowkley Ave S, and others. A yellow callout box points to a specific location on the map, stating: "New 16" Water Main Between York and France". Another yellow callout box points to a location on the map, stating: "Proposed WTP M Flow = 3,000 gpm". The map also includes a legend for "Pipe Velocity (fps)" with three categories: 0.0 - 5.0 (grey), 5.0 - 7.0 (yellow), and 7.0+ (red). A blue circle with "XX" indicates a pressure increase in psi. A north arrow is located in the bottom right corner.



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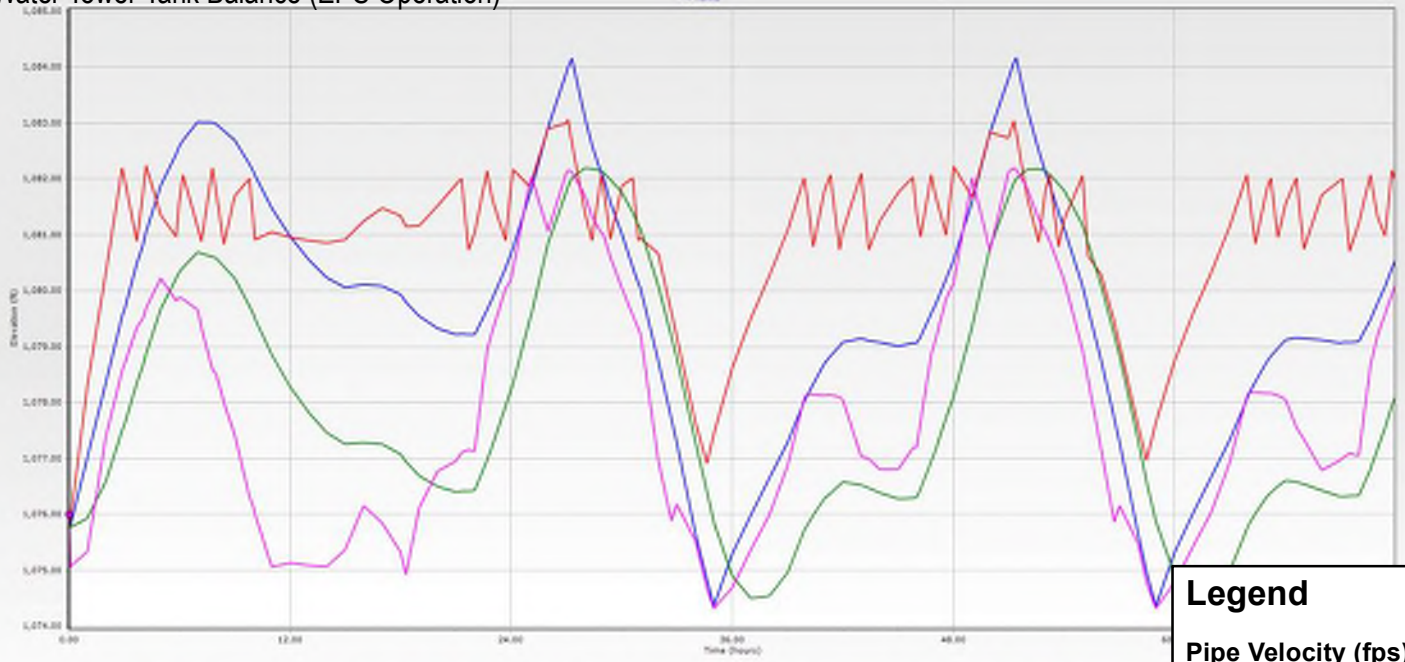
SCENARIO 3D



Map by: CTK
Projection: CC
Source: WaterCAD V8i

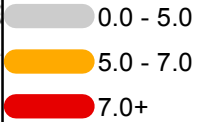
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Water Tower Tank Balance (EPS Operation)

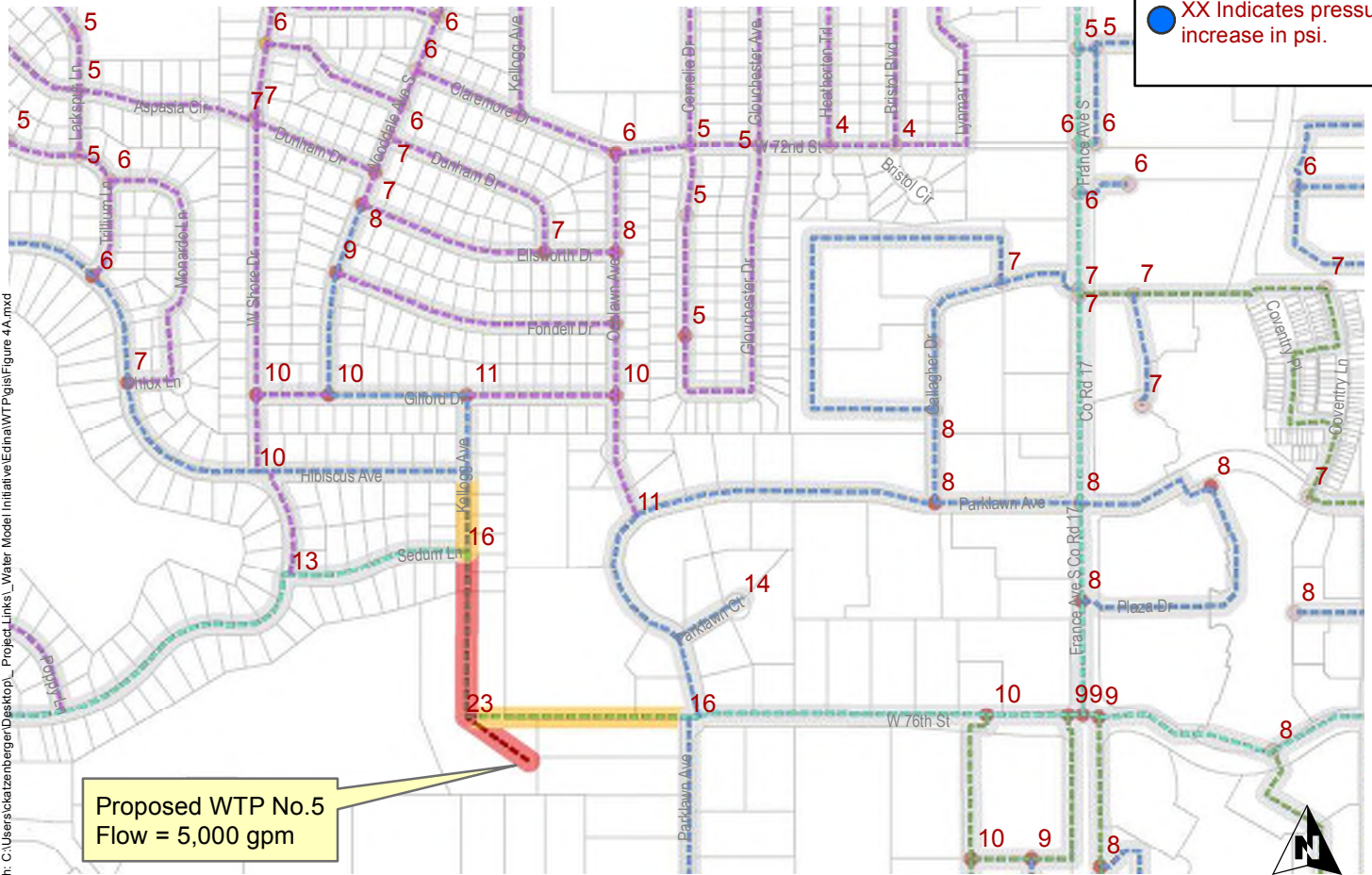


Legend

Pipe Velocity (fps)



● XX Indicates pressure increase in psi.



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Project Number: EDINA 128385
Print Date: 8/7/2017

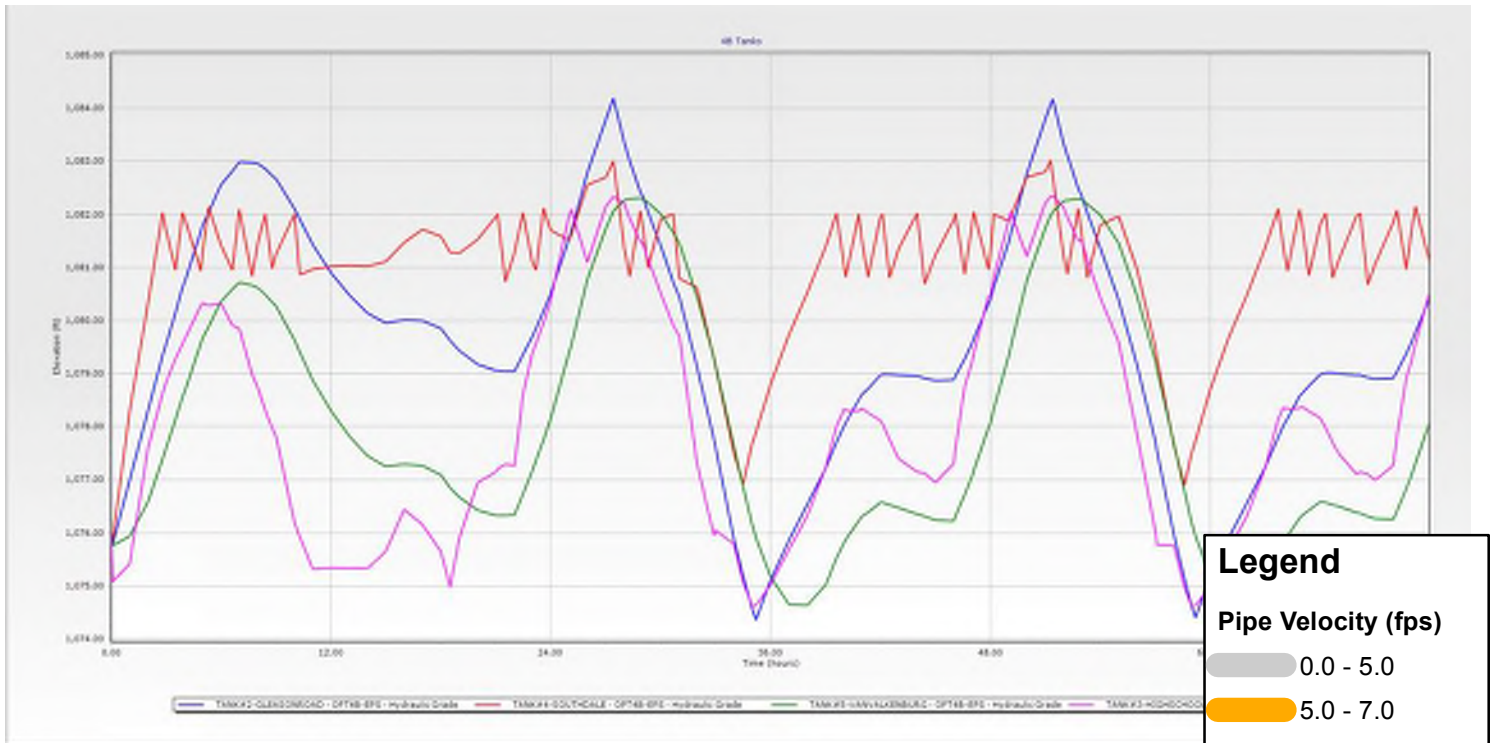
Map by: CTK
Projection: CC
Source: WaterCAD V8i

Water Treatment Plant No.5
Edina, Minnesota

SCENARIO 4A
Average Day Pressure and
Flow Results WTP. No.5

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Water Tower Tank Balance (EPS Operation)

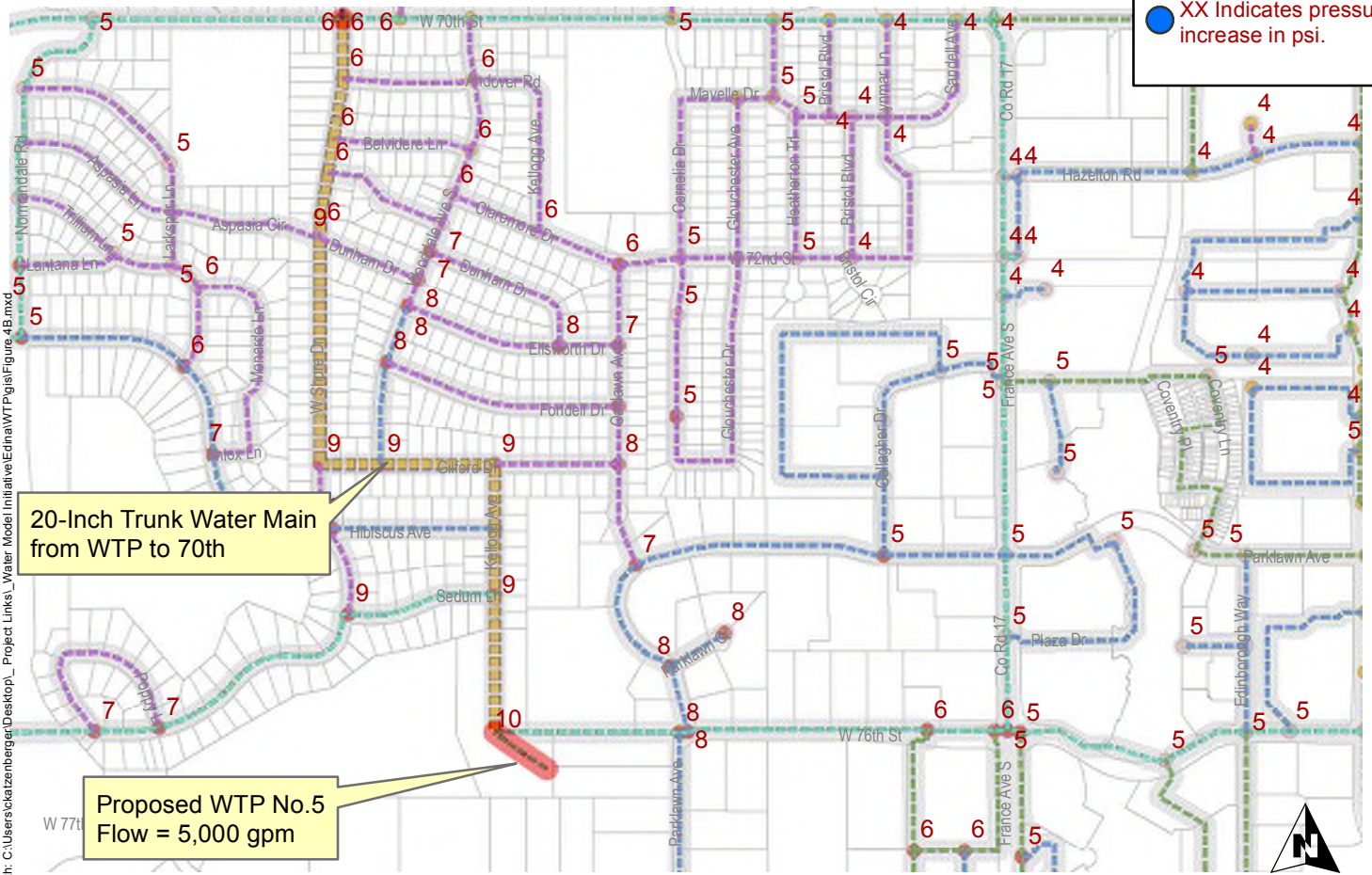


Legend

Pipe Velocity (fps)

- 0.0 - 5.0
- 5.0 - 7.0
- 7.0+

● XX Indicates pressure increase in psi.



Extended Period Simulation (EPS)

An EPS water model operation is utilized to evaluate the effect of the proposed water treatment plant locations in relation to water tank balance. Evaluation of the effect on hydraulic balance of the water towers on the distribution system can depend on many factors such as the geographic distribution of system demands and on the accuracy of pump controls. In most cases, it is during peak demand conditions that tower balance becomes a concern. This is because there is a greater amount of water being moved through the distribution system from supply sources and storage facilities to points of use. Under these conditions it becomes more difficult to push water long distances, and towers tend to drain quickly during periods of the day when demands are highest. As a result, it becomes difficult to keep some towers full without overflowing other towers when these conditions are present.

For purposes of this analysis, a similar water tower balance exercise to what was done as part of the 2013 Water System Demand and Capacity Analysis was completed. The model was run for three consecutive days, with average July water demand, to evaluate tower levels over time. Controls for other water treatment plant sites were set to operate the various facilities on and off to maintain water tower levels. A control assumption was made for the WTP No.5 operation with the plant operating on a continuous basis since each location site location would have unique control implications. This allows for each scenario to be compared against one another while utilizing similar assumptions. For comparison purposes, a model operation utilizing the existing system facilities as completed so that proposed scenario results could be compared with current system hydraulics. Initial water tower levels for all simulations was set to 10-feet below overflow with average July summer demands in place. It should be noted that extensive analysis of system diurnal demands have not been completed, therefore model results for EPS simulations should be relied upon for hydraulic comparison between scenarios and should not be considered a replacement for actual field results.

Maximum Day (MD) fixed Grade Flow Capacity – EPS simulation

An additional site comparison metric was developed analyzing the amount of water that could be pushed into the distribution system at each site while maintaining a fixed hydraulic grade. In essence, signifies the quantity of water that the distribution piping move while maintaining system pressures that consistent with current system pressure and do not exceed the hydraulic grade established by the system water towers. An EPS model simulation for each scenario was conducted assuming maximum day diurnal system demands. In general, as more water is demanded by customers in the system, throughout the day, additional water will be able to be supplied by the WTP without exceeding pressure thresholds. The average 24-hour flow rate from each site is summarized in the model results table. In practice, this type of operation would be consistent with WTP high service pumps operated at variable flows while utilizing variable frequency drives (VFD's) and reserve clearwell storage capacity at each treatment plant site.

MODEL ANALYSIS RESULTS

Steady State and EPS simulations were completed for each of the scenarios identified above. The results of these simulations are summarized below. In addition, figures presenting results from each scenario alternative are attached. Each figure shows the expected system pressure increase on the system with the proposed scenario facilities in place, during average day demand when compared to the existing system average day demand pressures. Additionally, each figure presents simulated tank levels over a 72-hour period during peak demands. The figures help to document the system wide effects of the proposed facilities defined in each scenario.

Scenario 1A – Southdale Site

The operation of this scenario revealed similar results to what was presented in previous reports. During average day demands, the steady state simulation revealed a minimal 2 psi pressure increase near the site with system wide pipe headlosses being similar to current conditions. The existing 12" pipe along France between the proposed WTP connection and exiting water tower feeder line would likely experience flow velocity greater than 5 fps and headloss of greater than 2-3 ft/1000 ft, as water is pumped to the nearby tank and distribution system. Though this exceeds the desired threshold, it appears to be manageable. During peak demands, the EPS simulation supported the idea that the addition of supply at this location will help to maintain levels in the Southdale water tower, bringing this facility to float more closely in line with the other water towers in the City. Additionally the MD site flow capacity is sufficient to conduct water treatment plant production flow without an increase in system pressure during a MD demand event.

Scenario 1B – Southdale Site

This scenario varies slightly when compared to scenario 1A. With the WTP effluent pipe directly connected to the water tower feeder line, the steady state simulation revealed a similar minor pressure increase near the site. Additionally, pipe headloss and velocity conditions are not a major concern. However, the peak demand EPS simulation revealed that with a direct connection to the water tower feeder line, water tends to feed the distribution demands from the plant supply. Over time, depending on system operation, this can lead to limited water moving in and out of the water tower, and increase water age. When compared to scenario 1A, scenario 1B appears to be less desirable.

Scenario 2 – Median Site

The scenario facilities for this site were built based on exhibits provided to SEH by AE²S. It should be noted that the Scenario 1B map figure showed a 12-inch CIP water main along 69th Street West while the water model, and other water system mapping available to SEH indicated that this main is currently an 8-inch. As a result, as built drawings provided by the City were examined and confirmed that this particular main is an 8-inch, as a result, this main was modeled as such. This small pipe size drastically impacts the hydraulic capacity of the nearby water system, which is evident in the model results. During average day demands, pressures near the facility would be increased as water is pushed through the underside pipe. While the EPS simulation produced manageable results, in regards to balanced tank levels, the nearby water system would experience a pressure increase of +/- 15 psi, pipe velocities in excess of 14.4 fps and system pipe headlosses of 113 ft per 1,000 ft of pipe. Moving water through a limited sized pipe would inflate system heads and require more energy for operation. Additionally, the excessive pipe velocities would not be desirable from an operational standpoint. The model results indicate that if this site were to be operated without a substantial increase in system pressure, the maximum flow capacity of the system would be roughly 1,500 gpm.

It is evident that if this site were to be feasible, a new trunk water main would need to be installed between the WTP facility and France to support the supply flow. If this were done, it is anticipated that the site would operate in a similar fashion to Scenario.

Scenario 3A, 3B and 3C – Yorktown Site

The analysis completed at this site anticipated pipe size limitations, by nature of the suggested pipe size upgrades indicated along York Ave. S. (Scenarios 3B and 3C). The existing system pressures in this area are already high, in excess of 90 psi. As a result, the ability for this part of the City to tolerate an increase in system pressure is limited. During average day demand, with existing 10-inch main in place along York Ave. S., a pressure increase of 17 psi would be expected along nearby distribution piping, elevating system pressure to 111 psi+, which is not desirable. In an effort to alleviate this excessive backpressure, due to limited pipe size, Scenarios 3B and 3C were modeled to simulate upgrade system piping (12-inch and 16-inch accordingly) along York Ave. S. Even with these pipe upgrades, the pressure increase remains high in this simulation. Scenario 3C results in a pressure increase of 9 psi (nearby system pressure = 104 psi). Even with the proposed pipe upgrades along York Ave. S., the combined system piping in this area of the City has a limited transmission capacity, resulting in elevated system pressure. Though the modeled pipe upgrades would reduce distribution system pipe velocity in nearby pipes to below 5 fps, headloss on these same pipes would exceed the 2-3 ft/1000 ft threshold. Scenario 3C appears to produce the most desirable results, which would require extensive pipe upgrades. It should be noted that during peak demands all three scenarios would provide for relatively balanced tank operation with water being supplied to areas of demand, and aiding in the filling of the tanks when demands are lower. When examining all three scenarios in relation to fixed pressure flow capacity, Scenarios 3B and 3C would be capable of supplying the desired 3,000 gpm of flow during a MD demand event without a major increase in system pressure.

Scenario 3D– Yorktown Site

After analysis of potential water main upgrades along York were examined, alternative trunk water main routes were explored with suggestion from City Engineering Staff. One such alternative route would be to extend a 16-inch trunk water main straight West from the WTP site all the way to France Ave. This would tie York Ave together with France, providing a direct conduit to the 12-inch main along France, which leads to the nearest elevated water storage tank. This main would also tie into other nearby water main branches along the way to provide redundant water main looping. Results of this alternative simulation indicate a similar result to Scenario 3C. Depending on future water plant operations, this level of pressure increase and pipe headloss may be considered manageable. Also, the MD fixed grade flow analysis indicates that this alternative would allow an average of 3,500 gpm to be supplied to the system on a MD demand without a major increase in pressure.

Scenario 4A – WTP 3 Site

This Scenario assumes additionally supply capacity would be pushed into the water system at existing WTP No.3. This scenario is similar to Scenario 3 in that there is a limited transmission main pipe size in relation to the proposed production flow rate. Pushing a 5,000 gpm of flow into the water distribution system during average day demand at this location would result in an excessive pressure increase of 23 psi and elevate nearby pressures above 135 psi which is not desirable. Additionally, the peak demand EPS simulation indicates that locating a large amount of supply at this location would cause the Southdale tower to fill much faster than the other tanks and potentially overflow. Furthermore multiple sections of distribution piping would experience excessive pipe velocity greater than 5 fps and headloss greater than 2-3 ft/1000 ft. Also, the MD fixed grade flow analysis indicates that if system pressures were to be limited to current levels, the maximum amount of flow that could be conducted from this site would be 2,900 gpm which is 2,100 gpm short of what is needed. In short, increasing supply at this location would not be desirable when compared to other options available.

Scenario 4B – WTP 3 Site

This Scenario is similar to Scenario 4A except it includes trunk water main upgrades in an effort to alleviate excessive pipe headloss and pressure increase at the anticipated 5,000 gpm design flow. This scenario assumes the installation of a 20-inch trunk main installed from WTP No.3 North along Kellogg, West along Gilford, then North along W Shore Drive and then connecting into the existing 12-inch main along W 70th Street. The installation of this main would ultimately reduce dynamic system pressures, however, the rest of the distribution system, primarily piping between WTP No.3 and the nearest water tower(s) would restrict the high capacity flow. The resulting hydraulic conditions indicate a 10 psi increase in pressure compared to current system and operational conditions. Additionally, the MD fixed grade flow analysis indicates that the maximum amount of flow that could be conducted from this site would be 3,900 gpm (1,100 gpm short) while maintaining existing system pressures. Even with the proposed trunk water main upgrades, the site would have a limited ability to supply flow to the greater distribution system.

A summary table of each model scenario is provided below:

Water Model Output Results Summary

Site	Scenario	Existing Avg Day Discharge Pressure at Main (psi)	Anticipated Avg Day Discharge Pressure at Main (psi)	Nearby System Pressure Increase (psi)	Maximum Nearby System Pipe Velocity (fps)	Maximum Nearby pipe Headloss (per 1000 ft) (ft)	*MD Fixed Grade Avg Flow Capacity (gpm)	Average Summer Day EPS Simulation - Tank Balance
Southdale	1A	88	90	2	6.5	16	3,400	All Tanks Trend Together
	1B		88	0	3.7	4	3,400	Southdale fills fastest and stays full (little bounce)
Median	2	88	109	21	10.0	58	1,500	Tanks generally trend together
Yorktown	3A	95	108	14	6.6	21	2,700	Tanks generally trend together
	3B		103.6	9	6.0	8	3,000	Tanks generally trend together
	3C		101.5	7	3.9	8	3,400	Tanks generally trend together
	3D		101.5	7	3.8	6	3,500	Tanks generally trend together
WTP No.3	4A	112	135	23	7.5	21	2,900	Southdale fills fastest and stays full (little bounce)
	4B		122	10	7.5	21	3,900	Southdale fills fastest and stays full (little bounce)

*Indicates flow capacity of site assuming a fixed hydraulic grade operation during a maximum day demand, limiting system pressure to the Hydraulic grade of the existing water towers.

CONCLUSIONS

From a water system modeling and hydraulic perspective, the AE²S project team asked a series of questions, which are noted with a response below:

1. ***Where is the best location to tie WTP No. 5 into the system?***

From a hydraulic perspective, Scenario 1A appears to provide the most favorable hydraulic conditions. When compared to the other options, there is very little dynamic pressure increase expected and the placement of additional supply at this locations aids in the operation of the Southdale water tower.

2. ***Will the existing 10-inch distribution main along York Avenue South handle a 3,000 gpm WTP effluent, or will that pipe need to be upsized to accommodate that site location?***

Model simulations indicate that the main located in this area would restrict flow and require elevated system pressures to move water to other parts of the system. Even with pipe upgrades along York Ave. S., the composite of the area water main would have a limited ability to move water due to restrictive pipe sizes.

3. ***Will the existing distribution system infrastructure in the vicinity of WTP No. 3 be able to accommodate an increased flow from 2,000 gpm to a 5,000 gpm?***

The model shows that increased flow in this area would be restricted by existing system piping. While this piping is not undersized for current supply flows (2,000 gpm), the addition of 3,000 gpm of supply would result in elevated nearby system pressures exceeding desirable levels.

ck/mrb

Attachment

c: Ross Bintner, City of Edina

Toby Muse, SEH

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Appendix P

Sustainability Options

WTP #5 Sustainability Options

One principle that will serve as guide post for all discussions is sustainability. Sustainable or “green” design and environmental analysis is an essential element to any built project, not only as a means of preserving the natural environment but also as a best practice in terms of energy and expense conservation. As the project moves forward, we would recommend that the project team follow one of three sustainability design tracts:

Tract 1 - Sustainability Baseline:

Through our own work and in coordination with the Xcel Energy Design Initiative, we have identified the following systems and strategies as a baseline for all buildings:

- LED or high efficiency lighting fixtures



As the lighting industry has worked to standardize both the fixtures and testing surrounding LED technologies over the past 5-10 years, we have started to recommend the use of LED light fixtures at all interior and exterior locations of the building.

Edina Public Works – New LED Light Fixtures

- Photocells at exterior light fixtures

Automated diurnal control of exterior light fixtures is a simple and maintainable energy and cost saving strategy.

- Vacancy and occupancy sensors

Vacancy and occupancy sensors prolong lamp and fixture life while providing additional safety and security benefits. Sensors will be used in all locations with a few exceptions based on the specific requirements of the facility.

- Multi-Level switching for light fixtures

Providing varying light intensities is less critical in low occupancy facilities such as the water treatment plant. However, based on shared-use feasibility, multi-level switching will be considered for all proposed functions.

- Effective and wisely located daylighting strategies to off-set artificial lighting



Edina Public Works – Daylighting Strategies

Wall and skylight fenestration for daylighting will be used in all areas not negatively affected or restricted by internal use and function.

- Orientation of the building to the prevailing winter air

Building entry and large openings such as overhead door openings will be located as to avoid the direction of the prevailing winter wind. In addition, the design team will use high-efficiency unit heaters at critical locations to supplement the heating system.

- Energy recovery units in combination with HVAC systems

The design team will explore opportunities to extract latent energy from exhaust, water supply, and other sources to supplement the heating and cooling of the facility.

- VFD (variable frequency drive) type motors

VFD's on pumps, fans, and motors have a very short and proven payback and will be used wherever possible.

- Low E and tinted glass, specified by location and sun orientation

Glass and film technology is advancing rapidly. The design team will select glazing and panels based on the unique requirements of each space and its location within the building

- Insulation values greater than code where it is practical

A careful cost/benefit analysis will be done on the wall and roofing systems to identify proper insulation values.

- Low-flow and dual flush plumbing fixtures



Dual flush lavatories and urinals are a simple water-saving measure that allows flexibility and practicality in use. In addition, flush and faucet sensors are recommended to prevent accidental and unmonitored overuse.

- Local materials/suppliers/manufacturers

Using local materials eliminates much of the energy required to transport the product or material from the manufacturer to the jobsite. In addition, the use of local suppliers provides a benefit to the local economy and in some cases, reduces lead times and delays associated with overseas manufacturing.



White Bear Lake Public Works – Local Stone at Entry Features

- Sensor Control of HVAC

Sensor control of interior air quality and occupancy control of ventilation air are (2) very effective strategies for reducing the energy used by the building's HVAC system

- Renewable/Recycled materials

The industry as a whole has recognized the benefit of renewable and recycled materials and many manufacturers and suppliers have implemented programs that are an integral part of their overall operations. Building materials will be accessed and chosen based on their first cost and overall life-cycle costs.

- Storm water management

The project team will work with the watershed to identify best practices for storm water containment, retention, and rate control based on the development parameters.

- Low-Maintenance landscaping

Low or no maintenance landscaping provides a water and resource saving environment that can be easily maintained by city staff without adding significantly to the department workload.

These strategies were selected based on current industry standards, anticipated financial payback, and best practices and it is our recommendation that they should be included on every project. In our experience, a building project that follows these strategies will perform well in terms of first cost and on-going life cycle costs in comparison to a code compliance based building model.

Tract 2 - Sustainability Equivalency:

Often, the project team will choose to follow LEED, B3 (Minnesota Sustainability Guidelines), or another accredited guideline during project development without formal application and enrollment in the program. This method provides an outline for design with verifiable metrics while allowing the flexibility to use best practices, strategy trade-offs specific to the project, or alternate methods of meeting guideline intent. This tract also allows the owner to mitigate costs associated with project registration, tracking/management, and advanced commissioning and modeling.



Mankato Public Works – Renewable Solar Energy B3 Equivalency



White Bear Lake Public Works – Green Roof B3 Equivalency

Tract 3 - Sustainability Certification:

Some projects are required to follow a third-party verification program such as LEED due to the funding mechanism or policy mandate. Privately funded projects can realize tax incentives and unique advantages in their marketplace by achieving certification. On publicly funded projects, municipalities sometimes choose to select high-visibility civic buildings as “leadership buildings”. These projects serve as a prominent display of sustainability stewardship or as a means of educating or aiding the uptake of green building technology within the community. Certification also provides an independent third-party verification process that can be important from a marketing or perception standpoint.

It is difficult to predict the potential financial impact of equivalency or certification on the construction budget. Most long-range studies put the construction premium of LEED at 2%-10% dependent on which level certification the project is hoping to achieve.



LEED-v4 for BC+C: New Construction and Major Renovation			Project Name	Date
Score	Requirement	Points	Requirement	Points
1	1.1.1 Sustainable Sites	1	1.1.1 Sustainable Sites	1
2	2.1.1 Sustainable Sites	2	2.1.1 Sustainable Sites	2
3	3.1.1 Sustainable Sites	3	3.1.1 Sustainable Sites	3
4	4.1.1 Sustainable Sites	4	4.1.1 Sustainable Sites	4
5	5.1.1 Sustainable Sites	5	5.1.1 Sustainable Sites	5
6	6.1.1 Sustainable Sites	6	6.1.1 Sustainable Sites	6
7	7.1.1 Sustainable Sites	7	7.1.1 Sustainable Sites	7
8	8.1.1 Sustainable Sites	8	8.1.1 Sustainable Sites	8
9	9.1.1 Sustainable Sites	9	9.1.1 Sustainable Sites	9
10	10.1.1 Sustainable Sites	10	10.1.1 Sustainable Sites	10
11	11.1.1 Sustainable Sites	11	11.1.1 Sustainable Sites	11
12	12.1.1 Sustainable Sites	12	12.1.1 Sustainable Sites	12
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14	14.1.1 Sustainable Sites	14	14.1.1 Sustainable Sites	14
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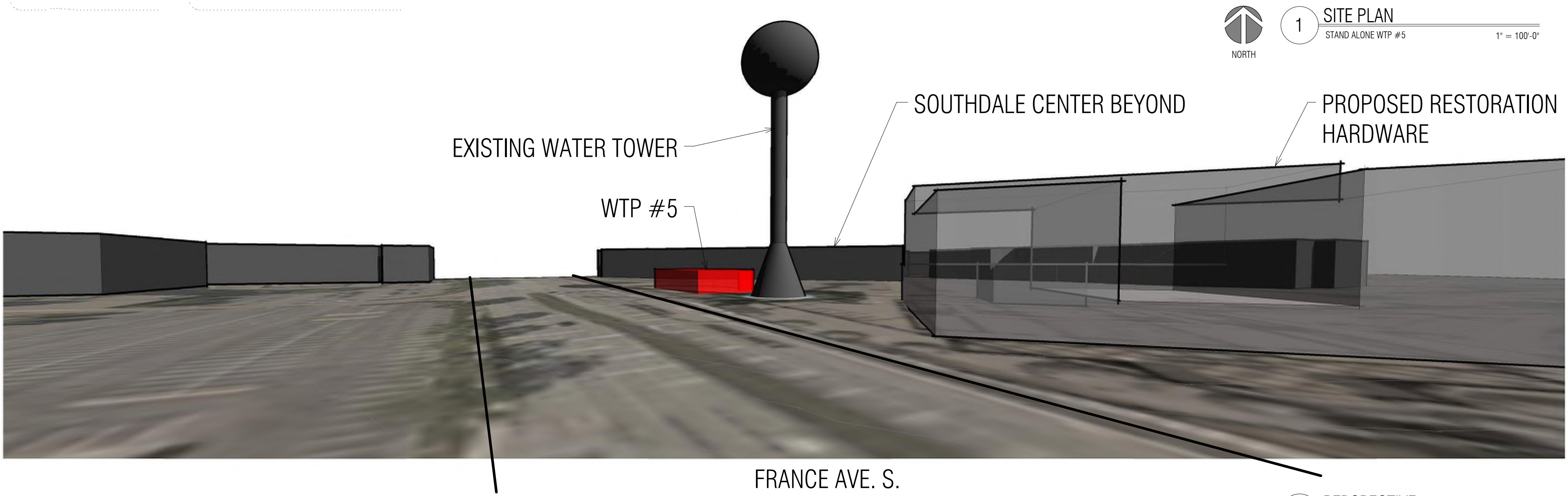
In the end, we believe that sustainability and limiting energy usage is a combination of proven applications, reasonable payback, reduced maintenance, city guidelines, and common sense. Throughout the process, the design team will analyze multiple sustainable options and the initial cost compared to value and cost/energy recovery in an attempt to maximize short-term and long-term sustainability for whichever tract the City chooses to pursue.

Appendix Q

Integrated Southdale Site Architectural Renderings



2 ENLARGED SITE PLAN
STAND ALONE WTP #5
1" = 30'-0"



3 PERSPECTIVE
LOOKING NORTH ON FRANCE AVE.
1" = 100'-0"

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Project Status

Not for Construction

PROJECT NAME
WATER TREATMENT PLANT #5

PROJECT NUMBER
17-10

DATE OF ISSUE
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TRS

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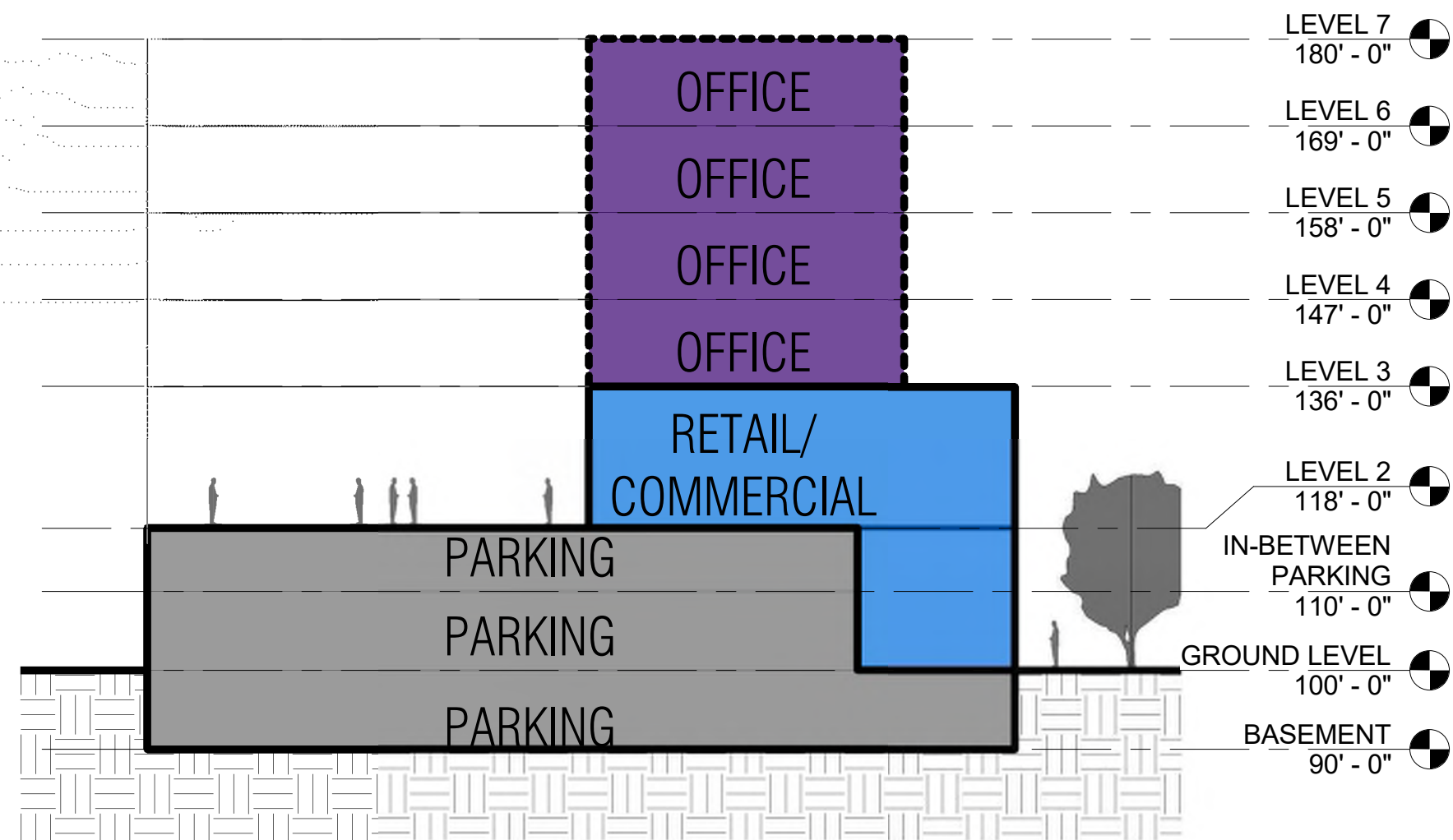
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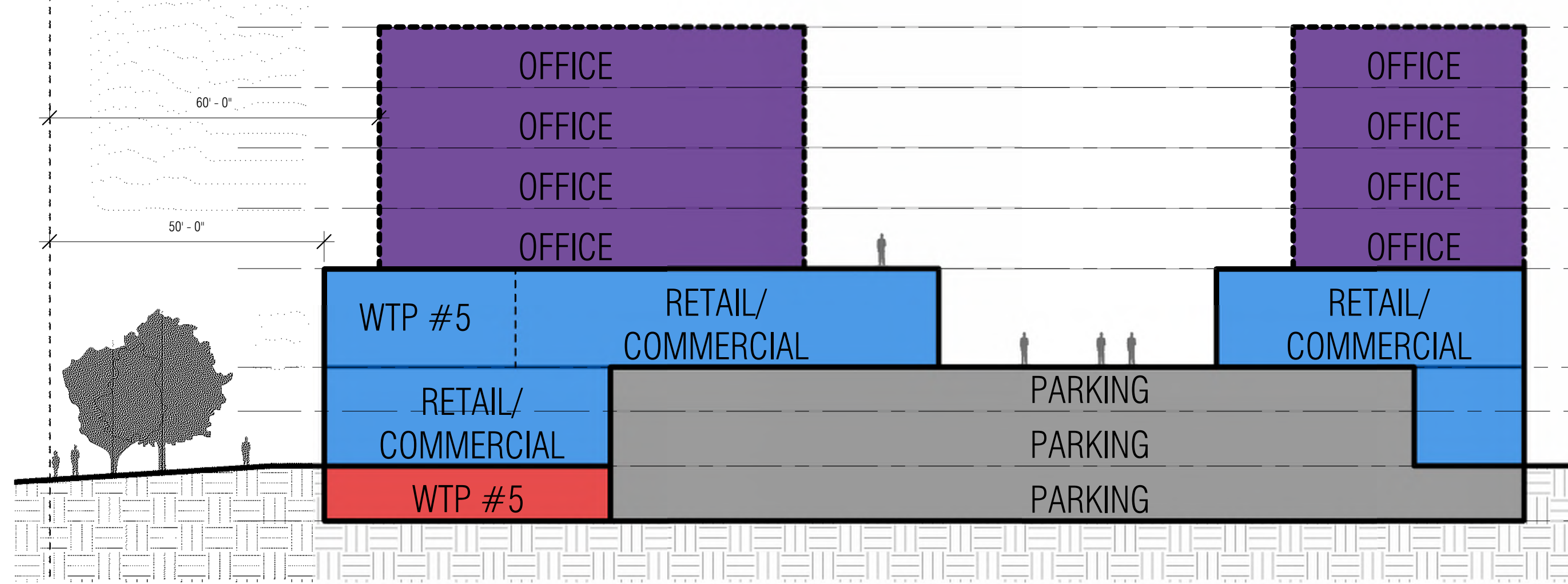
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15840

SHEET NAME
SITE PLAN - STAND ALONE WTP #5

SHEET NO.
OPT. 01



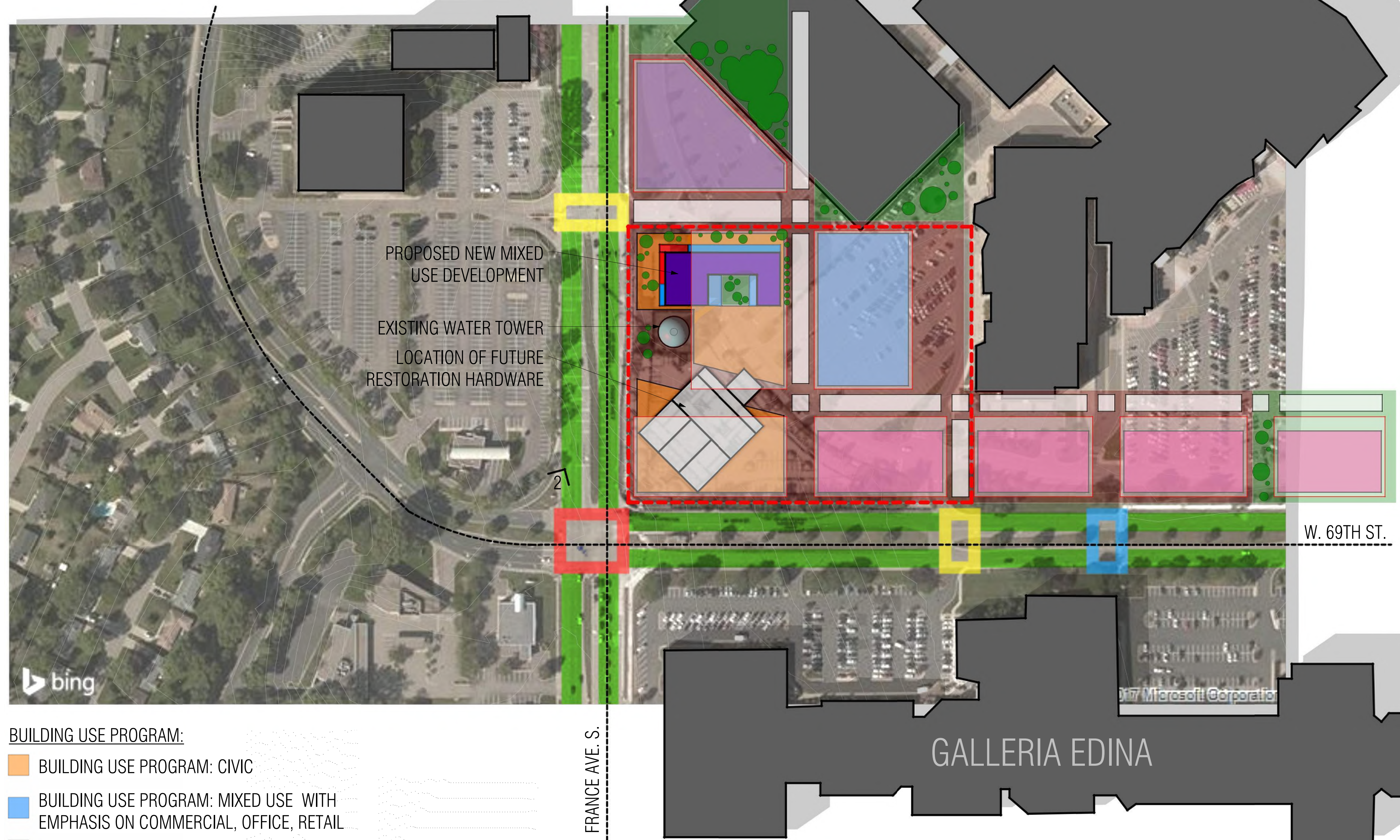
4 SECTION
LOOKING WEST
1" = 20'-0"



5 SECTION
LOOKING NORTH
1" = 20'-0"



2 ENLARGED SITE PLAN
MIXED USE DEVELOPMENT
1" = 30'-0"



BUILDING USE PROGRAM:

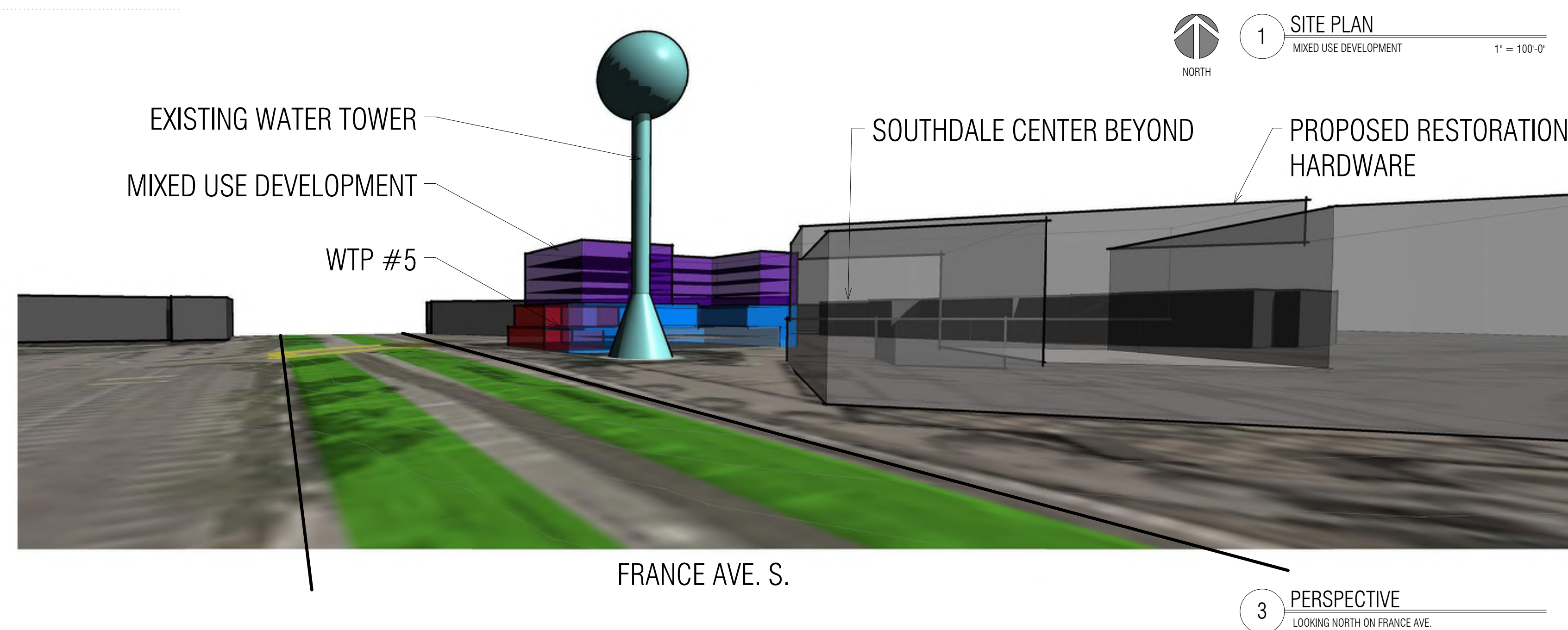
- BUILDING USE PROGRAM: CIVIC
- BUILDING USE PROGRAM: MIXED USE WITH EMPHASIS ON COMMERCIAL, OFFICE, RETAIL
- BUILDING USE PROGRAM: OFFICE
- BUILDING USE PROGRAM: RESIDENTIAL

NEW STREET INTERSECTION:

- EXISTING PEDESTRIAN/BIKE/VEHICULAR INTERSECTION
- NEW PEDESTRIAN/BIKE/VEHICULAR INTERSECTION
- NEW PEDESTRIAN/BIKE INTERSECTION

IN-BETWEEN SPACE:

- PLAZAS AND CONNECTIONS
- PARKS AND GREEN/OPEN SPACE
- NEW PEDESTRIAN/BIKE/VEHICULAR INTERSECTION
- GREEN SPACE
- 'FRAME WORK' BLOCKS
- NEW STREETS (BASED ON BLOCK LAYOUT)



3 PERSPECTIVE
LOOKING NORTH ON FRANCE AVE.
1" = 100'-0"

Mass Floor Schedule

Mass: Type	Usage	Floor Area
Conceptual mass_office	OFFICE	15034 SF
Conceptual mass_office	OFFICE	15034 SF
Conceptual mass_office	OFFICE	15034 SF
Conceptual mass_office	OFFICE	15034 SF
Conceptual mass_office: 4		60136 SF
Conceptual mass_parking	PARKING	13184 SF
Conceptual mass_parking	PARKING	18313 SF
Conceptual mass_parking		13184 SF
Conceptual mass_parking: 3		44680 SF
Conceptual mass_retail commercial	RETAIL/COMMERCIAL	14813 SF
Conceptual mass_retail commercial		7158 SF
Conceptual mass_retail commercial: 2		21971 SF
Conceptual mass_wtp5	WTP #5	3692 SF
Conceptual mass_wtp5	WTP #5	5664 SF
Conceptual mass_wtp5		5720 SF
Conceptual mass_wtp5: 3		15076 SF
Grand total: 12		141863 SF

PROJECT NAME:

WATER TREATMENT PLANT #5

Owner

SHEET NAME:

SCHEDULE

Issued:

04/25/17

SHEET NO:

OPT. 02 -S

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNATURE:

ANDREW N. COOPER

DATE:

04/25/17

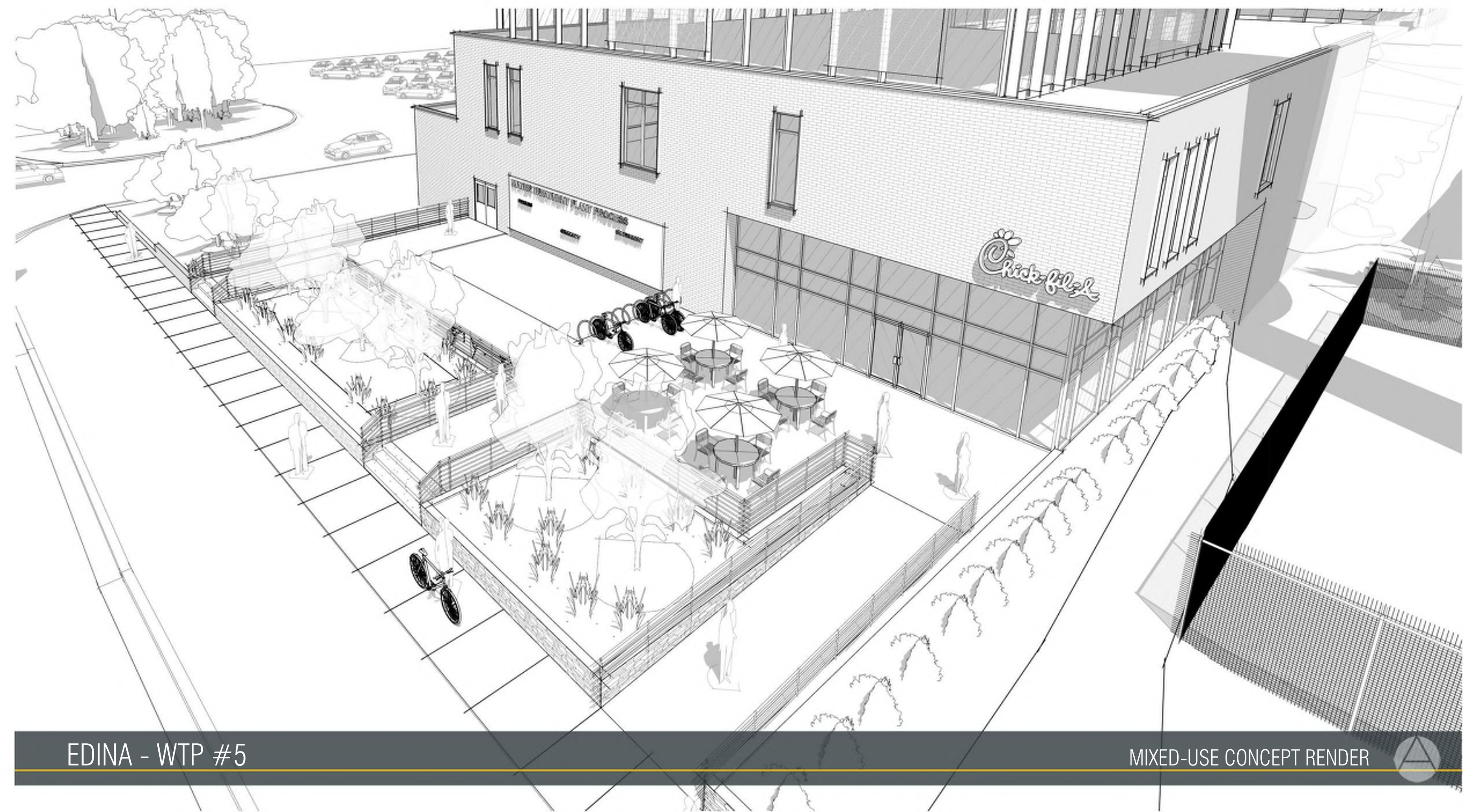
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EDINA - WTP #5

MIXED-USE CONCEPT RENDER









EDINA - WTP #5

MIXED-USE CONCEPT RENDER





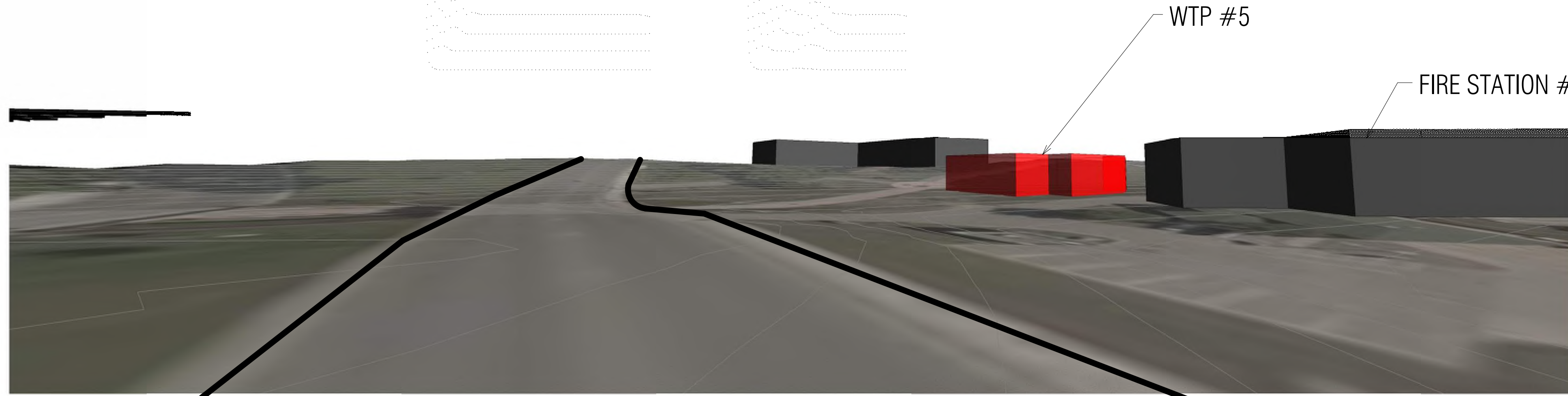
EDINA - WTP #5

MIXED-USE CONCEPT RENDER



Appendix R

Yorktown Site Architectural Renderings



YORK AVE. S.

2 PERSPECTIVE
LOOKING NORTH ON YORK AVE. S.

THE DURHAM

YORK PLAZA APT.

EDINA PLACE

YORK AVE. S.

PUBLIC RESTROOM/
TRAILHEAD
PARK/OUTDOOR
GATHERING SPACE
PUBLIC ART COMPONENT

STAND ALONE WTP #5

ADDITIONAL PARKING

FIRE STATION
#2

DEMONSTRATION GARDENS/
DOG PARK

POSSIBLE SHARED
YMCA COMPONENT

POSSIBLE SHARED FIRE
STATION COMPONENT

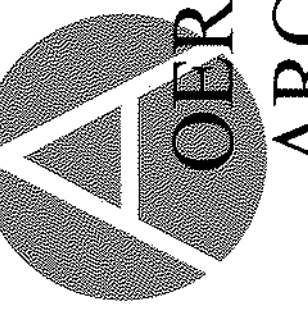
EXISTING COMMUNITY GARDENS

© 2017 Microsoft Corporation



1 SITE PLAN
YORK AVE. STAND ALONE WTP #5

1" = 30'-0"



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YORK SITE - STAND
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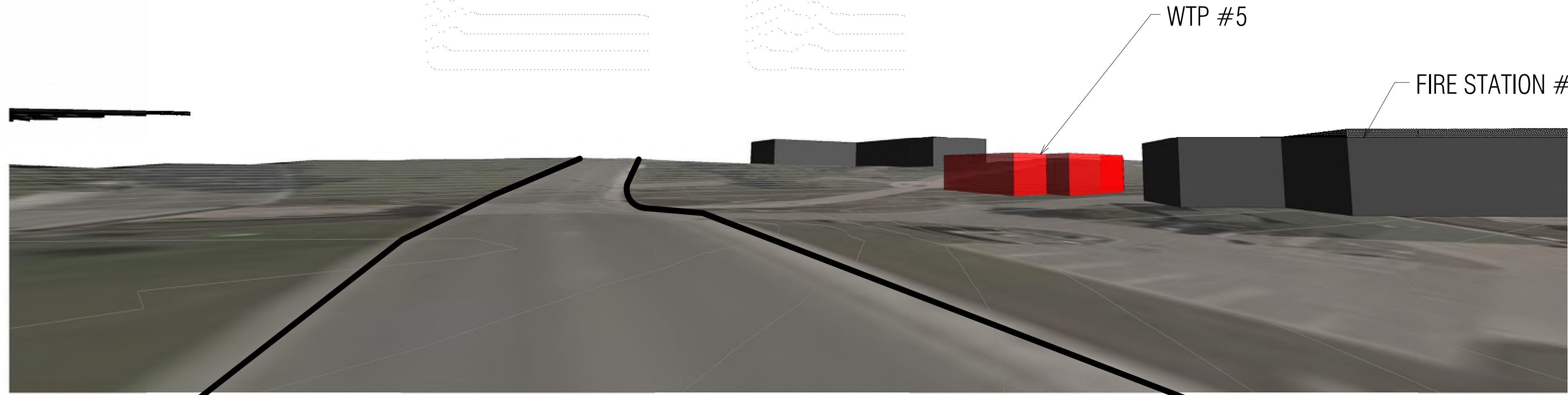
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YORK AVE. S.

2 PERSPECTIVE
LOOKING NORTH ON YORK AVE. S.

THE DURHAM

YORK PLAZA APT.

EDINA PLACE

YORK AVE. S.

PUBLIC RESTROOM/
TRAILHEAD
PARK/OUTDOOR
GATHERING SPACE
PUBLIC ART COMPONENT

STAND ALONE WTP #5

ADDITIONAL PARKING

FIRE STATION
#2

DEMONSTRATION GARDENS/
DOG PARK

POSSIBLE SHARED
YMCA COMPONENT

POSSIBLE SHARED FIRE
STATION COMPONENT

EXISTING COMMUNITY GARDENS

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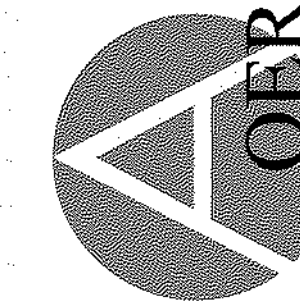


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SITE PLAN

YORK AVE. STAND ALONE WTP #5

1" = 30'-0"



OERTEL
ARCHITECTS, LTD.
1795 Saint Clair Avenue St. Paul, Minnesota 55105
phone: (651) 696-5186
www.oertelarchitects.com

NOTES
Project Status

Not for Construction

PROJECT NAME
WATER TREATMENT PLANT #5

PROJECT NUMBER
17-10

DATE OF ISSUE
-

DRAWN BY
DCE

CHECKED BY
TRS

REVISIONS

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR
REPORT WAS PREPARED BY ME OR UNDER MY DIRECT
SUPERVISION AND THAT I AM A FULLY LICENSED ARCHITECT
UNDER THE LAWS OF THE STATE OF MINNESOTA.

SIGNATURE
JEFFERY L. OERTEL

DATE
??/??/????

REGISTRATION
15840

SHEET NAME
YORK SITE - STAND
ALONE WTP #5

SHEET NO.

OPT. 04



EDINA - WTP #5

YORK SITE CONCEPT RENDER





EDINA - WTP #5

YORK SITE CONCEPT RENDER





EDINA - WTP #5

YORK SITE CONCEPT RENDER



Appendix S

Option 1A – Southdale Site with Gravity Filters Site Layout Cost Estimate

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Gravity Filtration Option 1A

Construction Cost Estimate - Summary

Subtotal 00/01 0000 Contracting and General Requirements	\$757,105
Subtotal 02 0000 Existing Conditions	\$40,000
Subtotal 03 0000 Concrete	\$1,680,000
Subtotal 04 0000 Masonry	\$262,250
Subtotal 05 0000 Metals	\$208,000
Subtotal 06 0000 Carpentry	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$218,800
Subtotal 08 0000 Doors and Windows	\$187,000
Subtotal 09 0000 Finishes	\$135,500
Subtotal 10 0000 Specialties	\$20,000
Subtotal 12 0000 Furnishings	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000
Subtotal 22 0000 Plumbing	\$150,000
Subtotal 23 0000 Mechanical	\$300,000
Subtotal 26 0000 Electrical	\$1,256,710
Subtotal 31 0000 Earthwork	\$1,090,000
Subtotal 32 0000 Exterior Improvements	\$200,000
Subtotal 33 0000 Utilities	\$100,000
Subtotal 40 0000 Process Integration	\$744,900
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment	\$393,600
Subtotal 46 0000 Water and Wastewater Equipment	\$769,748
Subtotal	\$8,607,613

00/01 0000 Contracting and General Requirements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Legal/Administrative				0.75%	\$58,879	1.00
B. Mobilization				0.75%	\$58,879	1.00
C. Supervision				1.0%	\$78,505	1.00
D. Temporary Facilities				0.75%	\$58,879	1.00
E. Temporary Utilities				0.75%	\$58,879	1.00
F. Equipment Rental and Misc. Costs				0.75%	\$58,879	1.00
G. Bonding and Insurance				1.2%	\$94,206	1.00
H. Allowances:						
a. Security and Access Control Hardware					\$50,000	1.00
b. Computer Hardware, Software, and Equipment, SCADA Licensing					\$120,000	1.00
c. Instrumentation & Controls Programming					\$120,000	1.00
Subtotal Allowances					\$290,000	

Subtotal 00/01 0000 Contracting and General Requirements \$757,105

02 0000 Existing Conditions

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Demolition	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00
B. Dewatering	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
Subtotal 02 0000 Existing Conditions					\$40,000	

03 0000 Concrete

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Cast in Place Concrete	2,400	CY	\$700.00	\$1,680,000.00	\$1,680,000	1.00
Subtotal 03 0000 Concrete					\$1,680,000	

04 0000 Masonry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Brick	5,000	EA	\$20.00	\$100,000.00	\$100,000	1.00
B. 8" CMU	4,000	EA	\$10.00	\$40,000.00	\$40,000	1.00
C. 12" CMU	5,000	EA	\$15.55	\$77,750.00	\$77,750	1.00
D. Cast Stone Coping	1,000	EA	\$44.50	\$44,500.00	\$44,500	1.00
Subtotal 04 0000 Masonry					\$262,250	

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Metals & Structural Steel	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
B. Fiberglass	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
C. Floor Hatches	6	EA	\$3,000.00	\$18,000.00	\$18,000	1.00

Subtotal 05 0000 Metals \$208,000

06 0000 Carpentry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Wood Cabinets	1	LS	\$4,000.00	\$4,000.00	\$4,000	1.00
B. Misc. Carpentry	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 06 0000 Carpentry \$44,000

07 0000 Thermal and Moisture Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Nail Base Roof Insulation	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
B. Cavity Wall Vapor Barrier	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
C. Below Grade Waterproofing	1	LS	\$45,000.00	\$45,000.00	\$45,000	1.00
D. Foundation Insulation	1	LS	\$7,800.00	\$7,800.00	\$7,800	1.00
E. Roofing & Hatch	1	LS	\$90,000.00	\$90,000.00	\$90,000	1.00
F. Caulking	1	LS	\$26,000.00	\$26,000.00	\$26,000	1.00

Subtotal 07 0000 Thermal and Moisture Protection \$218,800

08 0000 Doors and Windows

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Doors, Frames & Hard.	1	LS	\$95,000.00	\$95,000.00	\$95,000	1.00
B. Four Fold Door	1	LS	\$32,000.00	\$32,000.00	\$32,000	1.00
C. Alum. Doors & Windows	1	LS	\$60,000.00	\$60,000.00	\$60,000	1.00

Subtotal 08 0000 Doors and Windows \$187,000

09 0000 Finishes

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Floor Tile & Base	1	LS	\$6,000.00	\$6,000.00	\$6,000	1.00
B. Acoustic Cielings	1	LS	\$2,500.00	\$2,500.00	\$2,500	1.00
C. Acoustic @ Blower	1	LS	\$12,000.00	\$12,000.00	\$12,000	1.00
D. Paintings & Coatings	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
E. Flooring System	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 09 0000 Finishes \$135,500

10 0000 Specialties

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plaque & Signs	1	LS	\$18,000.00	\$18,000.00	\$18,000	1.00
B. Toilet & Bath Signs	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00
C. Fire Exsting. & LK. Box	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00

Subtotal 10 0000 Specialties \$20,000

12 0000 Furnishings

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Laboratory Countertops	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00

Subtotal 12 0000 Furnishings \$10,000

WTP Alternative - Southdale
Opinion of Probable Total Construction Cost
Southdale - Gravity Filtration Option 1A
21 0000 Fire Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fire Suppression	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
Subtotal 21 0000 Fire Protection					\$40,000	

22 0000 Plumbing

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plumbing	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
Subtotal 22 0000 Plumbing					\$150,000	

23 0000 Mechanical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Mechanical	1	LS	\$300,000.00	\$300,000.00	\$300,000	1.00
Subtotal 23 0000 Mechanical					\$300,000	

26 0000 Electrical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Site Work						
1. Metering Cabinets	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Equipment Concrete Pads/Basements	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
3. Grounding	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
4. 800A Feeder and Fiber in Ductbank	100	LF	\$400.00	\$40,000.00	\$48,000	1.20
5. Generator and Cables	1	EA	\$300,000.00	\$300,000.00	\$360,000	1.20
B. Interior Work						
1. Main Switchboard	1	EA	\$100,000.00	\$100,000.00	\$120,000	1.20
2. Large Junction Boxes	2	EA	\$3,000.00	\$6,000.00	\$7,200	1.20
3. Small Junction Boxes	8	EA	\$2,000.00	\$16,000.00	\$19,200	1.20
4. LED lights	100	EA	\$650.00	\$65,000.00	\$78,000	1.20
5. Receptacles/ Wall Jacks	30	EA	\$500.00	\$15,000.00	\$18,000	1.20
6. Process Terminations	60	EA	\$750.00	\$45,000.00	\$54,000	1.20
7. Fire alarm System	1	EA	\$30,000.00	\$30,000.00	\$36,000	1.20
8. Access Control and Security	1	EA	\$40,000.00	\$40,000.00	\$48,000	1.20
9. Motor Control Centers	7	EA	\$10,000.00	\$70,000.00	\$84,000	1.20
10. High Service VFDs	3	EA	\$25,000.00	\$75,000.00	\$90,000	1.20
11. BW VFD	1	EA	\$35,000.00	\$35,000.00	\$42,000	1.20
12. Feeders Less than 60A	800	LF	\$40.00	\$32,000.00	\$38,400	1.20
13. 100A Feeder	200	LF	\$65.00	\$13,000.00	\$15,600	1.20
14. Analog I/O	3000	LF	\$4.25	\$12,750.00	\$15,300	1.20
15. Digital I/O	3000	LF	\$5.00	\$15,000.00	\$18,000	1.20
16. Cat 6	1500	LF	\$5.00	\$7,500.00	\$9,000	1.20
17. Distribution Panelboard	4	EA	\$6,000.00	\$24,000.00	\$28,800	1.20
18. Step Down Dry Type Transformer	1	EA	\$15,000.00	\$15,000.00	\$18,000	1.20
19. 30A Disconnect Switches (NEMA 12)	25	EA	\$320.27	\$8,006.63	\$9,610	1.20
20. HVAC Equipment	25	EA	\$500.00	\$12,500.00	\$15,000	1.20
21. Unit Heaters	15	EA	\$1,500.00	\$22,500.00	\$27,000	1.20
22. Lighting Panelboards	3	EA	\$5,000.00	\$15,000.00	\$18,000	1.20
23. Electrical Distribution Equipment	4	EA	\$750.00	\$3,000.00	\$3,600	1.20
Subtotal 26 0000 Electrical					\$1,256,710	

31 0000 Earthwork

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Building Excavation						
1. Common Excavation, (EV)	5,900	CY	\$15.00	\$88,500.00	\$88,500	1.00
2. Common Excavation, (EV) (HAUL OFF)	5,900	CY	\$30.00	\$177,000.00	\$177,000	1.00
3. Common Excavation, TOPSOIL STRIP (EV)	100	CY	\$15.00	\$1,500.00	\$1,500	1.00
4. Common Excavation, STEP FOOTING (EV)	1,600	CY	\$15.00	\$24,000.00	\$24,000	1.00
5. Shoring System	350	LF	\$1,800.00	\$630,000.00	\$630,000	1.00
B. Building Backfill						
1. Granular Engineered Backfill	700	CY	\$20.00	\$14,000.00	\$14,000	1.00
2. Exterior Backfill	7,500	CY	\$20.00	\$150,000.00	\$150,000	1.00
Subtotal 31 0000 Earthwork					\$1,090,000	

WTP Alternative - Southdale
Opinion of Probable Total Construction Cost
Southdale - Gravity Filtration Option 1A
32 0000 Exterior Improvements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Landscaping						
1. Site Grading	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
2. Seeding	1,000	SY	\$5.00	\$5,000.00	\$6,000	1.20
3. Rip Rap (4"-6" River Rock)	0	SY	\$0.00	\$0.00	\$0	1.20
4. Rip Rap (18" depth, D ₅₀ 12")	0	CY	\$0.00	\$0.00	\$0	1.20
5. Plantings/Miscellaneous	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
B. Site Work						
1. Removals						
a. Pavement Removal	1,100	SY	\$12.00	\$13,200.00	\$15,840	1.20
b. Topsoil Stripping	0	LS	\$0.00	\$0.00	\$0	1.20
c. Utility Relocations/Removals	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
d. Fence Removal	0	LF	\$0.00	\$0.00	\$0	1.20
e. SWPPP Items (silt fence, fiber rolls, etc...)	1	ls	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Road and Parking Lot						
a. Site Paving	500	SY	\$100.00	\$50,000.00	\$60,000	1.20
b. Road Restoration	120	SY	\$100.00	\$12,000.00	\$14,400	1.20
c. Curb and Gutter	135	LF	\$50.00	\$6,750.00	\$8,100	1.20
3. Perimeter Fencing						
a. New Estate Style Fence	750	LF	\$50.00	\$37,500.00	\$45,000	1.20

Subtotal 32 0000 Exterior Improvements \$200,000

33 0000 Utilities

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Site Piping	1	LS	\$100,000.00	\$100,000.00	\$100,000	1.00

Subtotal 33 0000 Utilities \$100,000

40 0000 Process Integration

Item Description	Size	Length	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Process Piping								
90 bend	20		5	ea	\$1,200.00	\$6,000.00	\$7,800	1.30
90 bend	18		4	ea	\$925.00	\$3,700.00	\$4,810	1.30
90 bend	16		10	ea	\$600.00	\$6,000.00	\$7,800	1.30
90 bend	10		4	ea	\$350.00	\$1,400.00	\$1,820	1.30
90 bend	8		6	ea	\$250.00	\$1,500.00	\$1,950	1.30
90 bend	6		10	ea	\$175.00	\$1,750.00	\$2,280	1.30
90 bend	4		10	ea	\$120.00	\$1,200.00	\$1,560	1.30
90 bend	3		0	ea	\$100.00	\$0.00	\$0	1.30
Tee	20		5	ea	\$1,025.00	\$5,125.00	\$6,660	1.30
Tee	18		7	ea	\$950.00	\$6,650.00	\$8,650	1.30
Tee	16		6	ea	\$800.00	\$4,800.00	\$6,240	1.30
Tee	12		6	ea	\$650.00	\$3,900.00	\$5,070	1.30
Tee	10		6	ea	\$550.00	\$3,300.00	\$4,290	1.30
Tee	8		6	ea	\$250.00	\$1,500.00	\$1,950	1.30
Tee	6		5	ea	\$150.00	\$750.00	\$980	1.30
Tee	4		1	ea	\$125.00	\$125.00	\$160	1.30

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Gravity Filtration Option 1A

Mag Flow Meter	18	1	ea	\$10,000.00	\$10,000.00	\$13,000	1.30
Mag Flow Meter	16	1	ea	\$8,800.00	\$8,800.00	\$11,440	1.30
Mag Flow Meter	10	3	ea	\$4,100.00	\$12,300.00	\$15,990	1.30
Mag Flow Meter	6	1	ea	\$2,800.00	\$2,800.00	\$3,640	1.30
Mag Flow Meter	4	1	ea	\$2,400.00	\$2,400.00	\$3,120	1.30
Pipe	20	176	-	\$200.00	\$35,200.00	\$45,760	1.30
Pipe	18	100	-	\$180.00	\$18,000.00	\$23,400	1.30
Pipe	16	160	-	\$160.00	\$25,600.00	\$33,280	1.30
Pipe	10	80	-	\$100.00	\$8,000.00	\$10,400	1.30
Pipe	8	0	-	\$80.00	\$0.00	\$0	1.30
Pipe	6	200	-	\$60.00	\$12,000.00	\$15,600	1.30
Pipe	4	80	-	\$40.00	\$3,200.00	\$4,160	1.30
Pipe	3	250	-	\$25.00	\$6,250.00	\$8,130	1.30
BFV w/ Electric	20	4	ea	\$8,850.00	\$35,400.00	\$46,020	1.30
BFV w/ Electric	18	4	ea	\$7,000.00	\$28,000.00	\$36,400	1.30
BFV w/ Electric	16	4	ea	\$6,500.00	\$26,000.00	\$33,800	1.30
BFV w/ Electric	10	9	ea	\$5,200.00	\$46,800.00	\$60,840	1.30
BFV w/ Electric	8	0	ea	\$4,950.00	\$0.00	\$0	1.30
BFV w/ Electric	6	1	ea	\$4,750.00	\$4,750.00	\$6,180	1.30
BFV w/ Electric	4	5	ea	\$4,600.00	\$23,000.00	\$29,900	1.30
BFV w/ Manual	20	2	ea	\$3,000.00	\$6,000.00	\$7,800	1.30
BFV w/ Manual	18	1	ea	\$2,700.00	\$2,700.00	\$3,510	1.30
BFV w/ Manual	16	6	ea	\$2,300.00	\$13,800.00	\$17,940	1.30
BFV w/ Manual	12	3	ea	\$1,200.00	\$3,600.00	\$4,680	1.30
BFV w/ Manual	8	0	ea	\$850.00	\$0.00	\$0	1.30
BFV w/ Manual	6	2	ea	\$775.00	\$1,550.00	\$2,020	1.30
BFV w/ Manual	4	2	ea	\$550.00	\$1,100.00	\$1,430	1.30
Check Valve	18	1	ea	\$15,000.00	\$15,000.00	\$19,500	1.30
Check Valve	12	3	ea	\$6,000.00	\$18,000.00	\$23,400	1.30
Check Valve	6	2	ea	\$1,600.00	\$3,200.00	\$4,160	1.30
Check Valve	4	2	ea	\$1,300.00	\$2,600.00	\$3,380	1.30
Expansion Joints	18	1	ea	\$750.00	\$750.00	\$980	1.30
Expansion Joints	12	3	ea	\$375.00	\$1,125.00	\$1,460	1.30
Expansion Joints	6	2	ea	\$180.00	\$360.00	\$470	1.30
Expansion Joints	4	2	ea	\$150.00	\$300.00	\$390	1.30
PRV	12	1	ea	\$25,000.00	\$25,000.00	\$32,500	1.30
Static Mixer	16	1	ea	\$10,000.00	\$10,000.00	\$13,000	1.30

B. Instrumentation and Control System Devices (40 91 00)

1.	Chemical Feed System Instrumentation						
a.	Ultrasonic Level Transmitters	5	ea	\$800.00	\$4,000.00	\$4,800	1.20
b.	Permanganate Analyzers	1	ea	\$3,600.00	\$3,600.00	\$4,320	1.20
c.	Mono/Free Ammonia Analyzer	1	ea	\$20,500.00	\$20,500.00	\$24,600	1.20
d.	pH Probes and Transmitters	2	ea	\$2,750.00	\$5,500.00	\$6,600	1.20
2.	Conventional Filter Instrumentation						
a.	Ultrasonic Level Transmitters	7	ea	\$800.00	\$5,600.00	\$6,720	1.20
b.	Level Float Switches	9	ea	\$200.00	\$1,800.00	\$2,160	1.20

C. Instrumentation and Control Control Panels (40 91 10)

1.	Control Panels	-					
	a. Master Control Panel	1	ea	\$60,000.00	\$60,000.00	\$60,000	1.00
	b. Control Panel Upgrades	0	ea	\$0.00	\$0.00	\$0	1.00
	c. Network Panel	1	ea	\$30,000.00	\$30,000.00	\$36,000	1.20

Subtotal 40 0000 Process Integration \$744,900

43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Vertical Turbine Pump						
1. High Service Pumps						
a. 1500 GPM (125HP)	3	ea	\$59,900.00	\$179,700.00	\$215,640	1.20
2. Backwash Supply Pump	1	ea	\$110,700.00	\$110,700.00	\$132,840	1.20
3. Chlorine Feed Booster Pumps	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
B. Submersible Liquid Pumps (43 21 39)						
1. Backwash Reclaim Submersible Reclaim Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20
2. Backwash Reclaim Submersible Sludge Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20

Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment \$393,600

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Gravity Filtration Option 1A

46 0000 Water and Wastewater Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fluoride Chemical Feed System						
1. 450-gallon Bulk Storage Tank	1	ea	\$1,200.00	\$1,200.00	\$1,440	1.20
2. Bulk Chemical Delivery Connection	1	ls	\$800.00	\$800.00	\$960	1.20
3. Centrifugal Transfer Pump (Bulk to Day Tank)	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. 100-gallon Day Storage Tank	1	ea	\$600.00	\$600.00	\$720	1.20
5. Weight Scale	2	ea	\$1,000.00	\$2,000.00	\$2,400	1.20
6. Chemical Feed Pump	2	ea	\$3,500.00	\$7,000.00	\$8,400	1.20
7. Injection Point Tap/Diffuser	1	ea	\$380.00	\$380.00	\$460	1.20
8. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
9. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
B. HMO Feed System						
1. Tonka HMO Feed System	1	ls	\$64,000.00	\$64,000.00	\$76,800	1.20
a. TonkaBlend Feed Panel						
b. Two 1000 Gallon Tanks with Mixer and Stand						
c. Controls, Two Electrical Valves, Freight						
2. Bulk Chemical Delivery Connection	1	ea	\$800.00	\$800.00	\$960	1.20
C. Sodium Permanganate Feed System						
1. 755-gallon Storage Tank	1	e.a.	\$1,700.00	\$1,700.00	\$2,040	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
D. Poly/Orthophosphate Feed System						
1. 155-gallon Storage Tank	1	e.a.	\$650.00	\$650.00	\$780	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
E. Ammonium Sulfate Feed System						
1. 1000-gallon Bulk Tank	1	e.a.	\$2,200.00	\$2,200.00	\$2,640	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	2	e.a.	\$3,500.00	\$7,000.00	\$8,400	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,500.00	\$2,500.00	\$3,000	1.20
F. Chlorine Chemical Feed System (WTF)						
1. Scales	2	e.a.	\$4,000.00	\$8,000.00	\$9,600	1.20
a. Single Cylinder 1 Ton						
2. Chlorine Cylinder Piping, Valves and Accessories	1	l.s.	\$9,000.00	\$9,000.00	\$10,800	1.20
3. Chlorine Gas Scrubber System	1	e.a.	\$128,000.00	\$128,000.00	\$153,600	1.20
4. Hydro Omni-Valve 250 ppd feeder	2	e.a.	\$3,000.00	\$6,000.00	\$7,200	1.20
5. Ejector Assembly, Panel, Valves	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
6. Gas Detector and Accessories	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
G. Chlorine Hoist						
1. Crane Rail and Electric Hoist	1	ea	\$50,000.00	\$50,000.00	\$60,000	1.20
2. Lifting Bar for 1 Ton Cylinder	1	ea	\$1,500.00	\$1,500.00	\$1,800	1.20
H. Filter Equipment						
1. Sand Media	1,463	CF	\$10.00	\$14,630.00	\$17,560	1.20
2. Anthracite Media	975	CF	\$20.00	\$19,500.00	\$23,400	1.20
3. Filter Troughs	168	LF	\$350.00	\$58,800.00	\$70,560	1.20
4. Underdrain / In-Cell Airwash	975	SF	\$150.00	\$146,250.00	\$175,500	1.20
I. Filter Air Scour Equipment						
1. PD Airwash Blower	1	ea	\$40,500.00	\$40,500.00	\$48,600	1.20
J. Mixers						
1. Vertical Turbine Mixer for Detention Tank (5 HP)	1	ea	\$39,800.00	\$39,800.00	\$47,760	1.20

Subtotal 46 0000 Water and Wastewater Equipment \$769,748

Appendix T

Option 1B – Southdale Site with Pressure Filters Cost Estimate

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Pressure Filtration Option 1B

Construction Cost Estimate - Summary

Subtotal 00/01 0000 Contracting and General Requirements	\$763,883
Subtotal 02 0000 Existing Conditions	\$40,000
Subtotal 03 0000 Concrete	\$1,332,800
Subtotal 04 0000 Masonry	\$262,250
Subtotal 05 0000 Metals	\$41,000
Subtotal 06 0000 Carpentry	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$202,800
Subtotal 08 0000 Doors and Windows	\$147,000
Subtotal 09 0000 Finishes	\$110,500
Subtotal 10 0000 Specialties	\$20,000
Subtotal 12 0000 Furnishings	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000
Subtotal 22 0000 Plumbing	\$150,000
Subtotal 23 0000 Mechanical	\$300,000
Subtotal 26 0000 Electrical	\$1,214,710
Subtotal 31 0000 Earthwork	\$1,090,000
Subtotal 32 0000 Exterior Improvements	\$200,000
33 0000 Utilities	\$100,000
Subtotal 40 0000 Process Integration	\$799,880
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment	\$260,760
Subtotal 46 0000 Water and Wastewater Equipment	\$1,598,728
Subtotal	\$8,728,311

00/01 0000 Contracting and General Requirements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Legal/Administrative				0.75%	\$59,733	1.00
B. Mobilization				0.75%	\$59,733	1.00
C. Supervision				1.0%	\$79,644	1.00
D. Temporary Facilities				0.75%	\$59,733	1.00
E. Temporary Utilities				0.75%	\$59,733	1.00
F. Equipment Rental and Misc. Costs				0.75%	\$59,733	1.00
G. Bonding and Insurance				1.2%	\$95,573	1.00
H. Allowances:						
a. Security and Access Control Hardware					\$50,000	1.00
b. Computer Hardware, Software, and Equipment, SCADA Licensing					\$120,000	1.00
c. Instrumentation & Controls Programming					\$120,000	1.00
Subtotal Allowances					\$290,000	
Subtotal 00/01 0000 Contracting and General Requirements					\$763,883	

02 0000 Existing Conditions

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Demolition	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00
B. Dewatering	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
Subtotal 02 0000 Existing Conditions					\$40,000	

03 0000 Concrete

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Cast in Place Concrete	1,904	CY	\$700.00	\$1,332,800.00	\$1,332,800	1.00
Subtotal 03 0000 Concrete					\$1,332,800	

04 0000 Masonry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Brick	5,000	EA	\$20.00	\$100,000.00	\$100,000	1.00
B. 8" CMU	4,000	EA	\$10.00	\$40,000.00	\$40,000	1.00
C. 12" CMU	5,000	EA	\$15.55	\$77,750.00	\$77,750	1.00
D. Cast Stone Coping	1,000	EA	\$44.50	\$44,500.00	\$44,500	1.00
Subtotal 04 0000 Masonry					\$262,250	

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Pressure Filtration Option 1B

05 0000 Metals

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Metals & Structural Steel	0	LS	\$0.00	\$0.00	\$0	1.00
B. Fiberglass	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
C. Floor Hatches	7	EA	\$3,000.00	\$21,000.00	\$21,000	1.00

Subtotal 05 0000 Metals \$41,000

06 0000 Carpentry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Wood Cabinets	1	LS	\$4,000.00	\$4,000.00	\$4,000	1.00
B. Misc. Carpentry	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 06 0000 Carpentry \$44,000

07 0000 Thermal and Moisture Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Nail Base Roof Insulation	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
B. Cavity Wall Vapor Barrier	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
C. Below Grade Waterproofing	1	LS	\$45,000.00	\$45,000.00	\$45,000	1.00
D. Foundation Insulation	1	LS	\$7,800.00	\$7,800.00	\$7,800	1.00
E. Roofing & Hatch	1	LS	\$90,000.00	\$90,000.00	\$90,000	1.00
F. Caulking	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00

Subtotal 07 0000 Thermal and Moisture Protection \$202,800

08 0000 Doors and Windows

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Doors, Frames & Hard.	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
B. Four Fold Door	1	LS	\$32,000.00	\$32,000.00	\$32,000	1.00
C. Alum. Doors & Windows	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 08 0000 Doors and Windows \$147,000

09 0000 Finishes

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Floor Tile & Base	1	LS	\$6,000.00	\$6,000.00	\$6,000	1.00
B. Acoustic Cielings	1	LS	\$2,500.00	\$2,500.00	\$2,500	1.00
C. Acoustic @ Blower	1	LS	\$12,000.00	\$12,000.00	\$12,000	1.00
D. Paintings & Coatings	1	LS	\$50,000.00	\$50,000.00	\$50,000	1.00
E. Flooring System	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 09 0000 Finishes \$110,500

10 0000 Specialties

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plaque & Signs	1	LS	\$18,000.00	\$18,000.00	\$18,000	1.00
B. Toilet & Bath Signs	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00
C. Fire Exsting. & LK. Box	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00

Subtotal 10 0000 Specialties \$20,000

12 0000 Furnishings

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Laboratory Countertops	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00

Subtotal 12 0000 Furnishings \$10,000

WTP Alternative - Southdale
Opinion of Probable Total Construction Cost
Southdale - Pressure Filtration Option 1B
21 0000 Fire Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fire Suppression	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
Subtotal 21 0000 Fire Protection					\$40,000	

22 0000 Plumbing

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plumbing	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
Subtotal 22 0000 Plumbing					\$150,000	

23 0000 Mechanical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Mechanical	1	LS	\$300,000.00	\$300,000.00	\$300,000	1.00
Subtotal 23 0000 Mechanical					\$300,000	

26 0000 Electrical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Site Work						
1. Metering Cabinets	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Equipment Concrete Pads/Basements	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
3. Grounding	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
4. 800A Feeder and Fiber in Ductbank	100	LF	\$400.00	\$40,000.00	\$48,000	1.20
5. Generator and Cables	1	EA	\$300,000.00	\$300,000.00	\$360,000	1.20
B. Interior Work						
1. Main Switchboard	1	EA	\$100,000.00	\$100,000.00	\$120,000	1.20
2. Large Junction Boxes	2	EA	\$3,000.00	\$6,000.00	\$7,200	1.20
3. Small Junction Boxes	8	EA	\$2,000.00	\$16,000.00	\$19,200	1.20
4. LED lights	100	EA	\$650.00	\$65,000.00	\$78,000	1.20
5. Receptacles/ Wall Jacks	30	EA	\$500.00	\$15,000.00	\$18,000	1.20
6. Process Terminations	60	EA	\$750.00	\$45,000.00	\$54,000	1.20
7. Fire alarm System	1	EA	\$30,000.00	\$30,000.00	\$36,000	1.20
8. Access Control and Security	1	EA	\$40,000.00	\$40,000.00	\$48,000	1.20
9. Motor Control Centers	7	EA	\$10,000.00	\$70,000.00	\$84,000	1.20
10. Pressure Filter Influent VFDs	3	EA	\$25,000.00	\$75,000.00	\$90,000	1.20
11. BW VFD	0	EA	\$35,000.00	\$0.00	\$0	1.20
12. Feeders Less than 60A	800	LF	\$40.00	\$32,000.00	\$38,400	1.20
13. 100A Feeder	200	LF	\$65.00	\$13,000.00	\$15,600	1.20
14. Analog I/O	3000	LF	\$4.25	\$12,750.00	\$15,300	1.20
15. Digital I/O	3000	LF	\$5.00	\$15,000.00	\$18,000	1.20
16. Cat 6	1500	LF	\$5.00	\$7,500.00	\$9,000	1.20
17. Distribution Panelboard	4	EA	\$6,000.00	\$24,000.00	\$28,800	1.20
18. Step Down Dry Type Transformer	1	EA	\$15,000.00	\$15,000.00	\$18,000	1.20
19. 30A Disconnect Switches (NEMA 12)	25	EA	\$320.27	\$8,006.63	\$9,610	1.20
20. HVAC Equipment	25	EA	\$500.00	\$12,500.00	\$15,000	1.20
21. Unit Heaters	15	EA	\$1,500.00	\$22,500.00	\$27,000	1.20
22. Lighting Panelboards	3	EA	\$5,000.00	\$15,000.00	\$18,000	1.20
23. Electrical Distribution Equipment	4	EA	\$750.00	\$3,000.00	\$3,600	1.20
Subtotal 26 0000 Electrical					\$1,214,710	

31 0000 Earthwork

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Building Excavation						
1. Common Excavation, (EV)	5,900	CY	\$15.00	\$88,500.00	\$88,500	1.00
2. Common Excavation, (EV) (HAUL OFF)	5,900	CY	\$30.00	\$177,000.00	\$177,000	1.00
3. Common Excavation, TOPSOIL STRIP (EV)	100	CY	\$15.00	\$1,500.00	\$1,500	1.00
4. Common Excavation, STEP FOOTING (EV)	1,600	CY	\$15.00	\$24,000.00	\$24,000	1.00
5. Shoring System	350	LF	\$1,800.00	\$630,000.00	\$630,000	1.00
B. Building Backfill						
1. Granular Engineered Backfill	700	CY	\$20.00	\$14,000.00	\$14,000	1.00
2. Exterior Backfill	7,500	CY	\$20.00	\$150,000.00	\$150,000	1.00
Subtotal 31 0000 Earthwork					\$1,090,000	

WTP Alternative - Southdale
Opinion of Probable Total Construction Cost
Southdale - Pressure Filtration Option 1B
32 0000 Exterior Improvements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Landscaping						
1. Site Grading	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
2. Seeding	1,000	SY	\$5.00	\$5,000.00	\$6,000	1.20
3. Rip Rap (4"-6" River Rock)	0	SY	\$0.00	\$0.00	\$0	1.20
4. Rip Rap (18" depth, D ₅₀ 12")	0	CY	\$0.00	\$0.00	\$0	1.20
5. Plantings/Miscellaneous	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
B. Site Work						
1. Removals						
a. Pavement Removal	1,100	SY	\$12.00	\$13,200.00	\$15,840	1.20
b. Topsoil Stripping	0	LS	\$0.00	\$0.00	\$0	1.20
c. Utility Relocations/Removals	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
d. Fence Removal	0	LF	\$0.00	\$0.00	\$0	1.20
e. SWPPP Items (silt fence, fiber rolls, etc...)	1	ls	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Road and Parking Lot						
a. Site Paving	500	SY	\$100.00	\$50,000.00	\$60,000	1.20
Road Restoration	120	SY	\$100.00	\$12,000.00	\$14,400	1.20
d. Curb and Gutter	135	LF	\$50.00	\$6,750.00	\$8,100	1.20
3. Perimeter Fencing						
a. New Estate Style Fence	750	LF	\$50.00	\$37,500.00	\$45,000	1.20

Subtotal 32 0000 Exterior Improvements \$200,000

33 0000 Utilities

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Site Piping	1	LS	\$100,000.00	\$100,000.00	\$100,000	1.00

Subtotal 33 0000 Utilities \$100,000

40 0000 Process Integration

Item Description	Size	Length	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Process Piping								
90 bend	20		2	ea	\$1,200.00	\$2,400.00	\$2,880	1.20
90 bend	16		8	ea	\$600.00	\$4,800.00	\$5,760	1.20
90 bend	10		2	ea	\$350.00	\$700.00	\$840	1.20
90 bend	8		2	ea	\$250.00	\$500.00	\$600	1.20
90 bend	6		4	ea	\$175.00	\$700.00	\$840	1.20
90 bend	4		2	ea	\$120.00	\$240.00	\$290	1.20
90 bend	3		1	ea	\$100.00	\$100.00	\$120	1.20
Tee	16		10	ea	\$800.00	\$8,000.00	\$9,600	1.20
Tee	10		40	ea	\$550.00	\$22,000.00	\$26,400	1.20
Tee	8		20	ea	\$250.00	\$5,000.00	\$6,000	1.20
Tee	6		5	ea	\$150.00	\$750.00	\$900	1.20

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Pressure Filtration Option 1B

Tee	4	14	ea	\$125.00	\$1,750.00	\$2,100	1.20
Reducer	16x10	2	ea	\$650.00	\$1,300.00	\$1,560	1.20
Mag Flow Meter	10	3	ea	\$4,100.00	\$12,300.00	\$14,760	1.20
Mag Flow Meter	8	1	ea	\$3,100.00	\$3,100.00	\$3,720	1.20
Mag Flow Meter	6	1	ea	\$2,800.00	\$2,800.00	\$3,360	1.20
Mag Flow Meter	4	1	ea	\$2,400.00	\$2,400.00	\$2,880	1.20
Pipe	20	5	ea	\$200.00	\$1,000.00	\$1,200	1.20
Pipe	16	120	ea	\$160.00	\$19,200.00	\$23,040	1.20
Pipe	10	144	ea	\$100.00	\$14,400.00	\$17,280	1.20
Pipe	8	120	ea	\$80.00	\$9,600.00	\$11,520	1.20
Pipe	6	232	ea	\$60.00	\$13,920.00	\$16,700	1.20
Pipe	4	180	ea	\$40.00	\$7,200.00	\$8,640	1.20
Pipe	3	356	ea	\$25.00	\$8,900.00	\$10,680	1.20
BFV w/ Electric	16	1	ea	\$6,500.00	\$6,500.00	\$7,800	1.20
BFV w/ Electric	10	12	ea	\$5,200.00	\$62,400.00	\$74,880	1.20
BFV w/ Electric	8	18	ea	\$4,950.00	\$89,100.00	\$106,920	1.20
BFV w/ Electric	6	24	ea	\$4,750.00	\$114,000.00	\$136,800	1.20
BFV w/ Electric	4	14	ea	\$4,600.00	\$64,400.00	\$77,280	1.20
BFV w/ Manual	20	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
BFV w/ Manual	16	4	ea	\$2,300.00	\$9,200.00	\$11,040	1.20
BFV w/ Manual	8	2	ea	\$850.00	\$1,700.00	\$2,040	1.20
BFV w/ Manual	6	6	ea	\$775.00	\$4,650.00	\$5,580	1.20
BFV w/ Manual	4	2	ea	\$550.00	\$1,100.00	\$1,320	1.20
Check Valve	16	2	ea	\$13,000.00	\$26,000.00	\$31,200	1.20
Check Valve	6	2	ea	\$1,600.00	\$3,200.00	\$3,840	1.20
Check Valve	4	2	ea	\$1,300.00	\$2,600.00	\$3,120	1.20
Expansion Joints	16	2	ea	\$600.00	\$1,200.00	\$1,440	1.20
Expansion Joints	6	2	ea	\$180.00	\$360.00	\$430	1.20
Expansion Joints	4	2	ea	\$150.00	\$300.00	\$360	1.20
PRV	12	1	ea	\$9,500.00	\$9,500.00	\$11,400	1.20
Static Mixer	16	1	ea	\$3,500.00	\$3,500.00	\$4,200	1.20

B. Instrumentation and Control System Devices (40 91 00)

1.	Chemical Feed System Instrumentation						
a.	Ultrasonic Level Transmitters	5	ea	\$800.00	\$4,000.00	\$4,800	1.20
b.	Permanganate Analyzers	1	ea	\$3,600.00	\$3,600.00	\$4,320	1.20
c.	Mono/Free Ammonia Analyzer	1	ea	\$20,500.00	\$20,500.00	\$24,600	1.20
d.	pH Probes and Transmitters	2	ea	\$2,750.00	\$5,500.00	\$6,600	1.20
2.	Conventional Filter Instrumentation						
a.	Ultrasonic Level Transmitters	3	ea	\$800.00	\$2,400.00	\$2,880	1.20
b.	Level Float Switches	9	ea	\$200.00	\$1,800.00	\$2,160	1.20

C. Instrumentation and Control Control Panels (40 91 10)

1.	Control Panels	-					
	a. Master Control Panel	1	ea	\$60,000.00	\$60,000.00	\$60,000	1.00
	b. Control Panel Upgrades	0	ea	\$0.00	\$0.00	\$0	1.00
	c. Network Panel	1	ea	\$30,000.00	\$30,000.00	\$36,000	1.20

Subtotal 40 0000 Process Integration \$799,880

43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Vertical Turbine Pump						
1. PF Influent Pumps						
b. 1500 GPM (125HP)	3	ea	\$59,900.00	\$179,700.00	\$215,640	1.20
2. Chlorine Feed Booster Pumps	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
B. Submersible Liquid Pumps (43 21 39)						
1. Backwash Reclaim Submersible Reclaim Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20
2. Backwash Reclaim Submersible Sludge Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20

Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment \$260,760

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Pressure Filtration Option 1B

46 0000 Water and Wastewater Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fluoride Chemical Feed System						
1. 450-gallon Bulk Storage Tank	1	ea	\$1,200.00	\$1,200.00	\$1,440	1.20
2. Bulk Chemical Delivery Connection	1	ls	\$800.00	\$800.00	\$960	1.20
3. Centrifugal Transfer Pump (Bulk to Day Tank)	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. 100-gallon Day Storage Tank	1	ea	\$600.00	\$600.00	\$720	1.20
5. Weight Scale	2	ea	\$1,000.00	\$2,000.00	\$2,400	1.20
6. Chemical Feed Pump	2	ea	\$3,500.00	\$7,000.00	\$8,400	1.20
7. Injection Point Tap/Diffuser	1	ea	\$380.00	\$380.00	\$460	1.20
8. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
9. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
B. HMO Feed System						
1. Tonka HMO Feed System	1	ls	\$64,000.00	\$64,000.00	\$76,800	1.20
a. TonkaBlend Feed Panel						
b. Two 1000 Gallon Tanks with Mixer and Stand						
c. Controls, Two Electrical Valves, Freight						
2. Bulk Chemical Delivery Connection	1	ea	\$800.00	\$800.00	\$960	1.20
C. Sodium Permanganate Feed System						
1. 755-gallon Storage Tank	1	e.a.	\$1,700.00	\$1,700.00	\$2,040	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
D. Poly/Orthophosphate Feed System						
1. 155-gallon Storage Tank	1	e.a.	\$650.00	\$650.00	\$780	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
E. Ammonium Sulfate Feed System						
1. 1000-gallon Bulk Tank	1	e.a.	\$2,200.00	\$2,200.00	\$2,640	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	2	e.a.	\$3,500.00	\$7,000.00	\$8,400	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,500.00	\$2,500.00	\$3,000	1.20
F. Chlorine Chemical Feed System (WTF)						
1. Scales	2	e.a.	\$4,000.00	\$8,000.00	\$9,600	1.20
a. Single Cylinder 1 Ton						
2. Chlorine Cylinder Piping, Valves and Accessories	1	l.s.	\$9,000.00	\$9,000.00	\$10,800	1.20
3. Chlorine Gas Scrubber System	1	e.a.	\$128,000.00	\$128,000.00	\$153,600	1.20
4. Hydro Omni-Valve 250 ppd feeder	2	e.a.	\$3,000.00	\$6,000.00	\$7,200	1.20
5. Ejector Assembly, Panel, Valves	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
6. Gas Detector and Accessories	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
G. Chlorine Hoist						
1. Crane Rail and Electric Hoist	1	ea	\$50,000.00	\$50,000.00	\$60,000	1.20
2. Lifting Bar for 1 Ton Cylinder	1	ea	\$1,500.00	\$1,500.00	\$1,800	1.20
H. Filter Equipment						
1. Pressure Filters	3	ea	\$310,000.00	\$930,000.00	\$1,116,000	1.20
I. Filter Air Scour Equipment						
1. PD Airwash Blower	1	ea	\$40,500.00	\$40,500.00	\$48,600	1.20
J. Mixers						
1. Vertical Turbine Mixer for Detention Tank (5 HP)	1	ea	\$39,800.00	\$39,800.00	\$47,760	1.20

Subtotal 46 0000 Water and Wastewater Equipment \$1,598,728

Appendix U

Option 1C – Southdale Site with Gravity Filters and Above Ground Plate Settler Backwash
Reclaim Cost Estimate

Construction Cost Estimate - Summary

Subtotal 00/01 0000 Contracting and General Requirements	\$699,990
Subtotal 02 0000 Existing Conditions	\$40,000
Subtotal 03 0000 Concrete	\$1,260,000
Subtotal 04 0000 Masonry	\$262,250
Subtotal 05 0000 Metals	\$208,000
Subtotal 06 0000 Carpentry	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$218,800
Subtotal 08 0000 Doors and Windows	\$187,000
Subtotal 09 0000 Finishes	\$135,500
Subtotal 10 0000 Specialties	\$20,000
Subtotal 12 0000 Furnishings	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000
Subtotal 22 0000 Plumbing	\$150,000
Subtotal 23 0000 Mechanical	\$300,000
Subtotal 26 0000 Electrical	\$1,256,710
Subtotal 31 0000 Earthwork	\$360,000
Subtotal 32 0000 Exterior Improvements	\$200,000
Subtotal 33 0000 Utilities	\$100,000
Subtotal 40 0000 Process Integration	\$744,900
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment	\$355,680
Subtotal 46 0000 Water and Wastewater Equipment	\$997,748
Subtotal	\$7,590,578

00/01 0000 Contracting and General Requirements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Legal/Administrative				0.75%	\$51,679	1.00
B. Mobilization				0.75%	\$51,679	1.00
C. Supervision				1.0%	\$68,906	1.00
D. Temporary Facilities				0.75%	\$51,679	1.00
E. Temporary Utilities				0.75%	\$51,679	1.00
F. Equipment Rental and Misc. Costs				0.75%	\$51,679	1.00
G. Bonding and Insurance				1.2%	\$82,687	1.00
H. Allowances:						
a. Security and Access Control Hardware					\$50,000	1.00
b. Computer Hardware, Software, and Equipment, SCADA Licensing					\$120,000	1.00
c. Instrumentation & Controls Programming					\$120,000	1.00
Subtotal Allowances					\$290,000	
Subtotal 00/01 0000 Contracting and General Requirements					\$699,990	

02 0000 Existing Conditions

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Demolition	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00
B. Dewatering	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
Subtotal 02 0000 Existing Conditions					\$40,000	

03 0000 Concrete

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Cast in Place Concrete	1,800	CY	\$700.00	\$1,260,000.00	\$1,260,000	1.00
Subtotal 03 0000 Concrete					\$1,260,000	

04 0000 Masonry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Brick	5,000	EA	\$20.00	\$100,000.00	\$100,000	1.00
B. 8" CMU	4,000	EA	\$10.00	\$40,000.00	\$40,000	1.00
C. 12" CMU	5,000	EA	\$15.55	\$77,750.00	\$77,750	1.00
D. Cast Stone Coping	1,000	EA	\$44.50	\$44,500.00	\$44,500	1.00
Subtotal 04 0000 Masonry					\$262,250	

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Metals & Structural Steel	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
B. Fiberglass	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
C. Floor Hatches	6	EA	\$3,000.00	\$18,000.00	\$18,000	1.00

Subtotal 05 0000 Metals \$208,000

06 0000 Carpentry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Wood Cabinets	1	LS	\$4,000.00	\$4,000.00	\$4,000	1.00
B. Misc. Carpentry	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 06 0000 Carpentry \$44,000

07 0000 Thermal and Moisture Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Nail Base Roof Insulation	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
B. Cavity Wall Vapor Barrier	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
C. Below Grade Waterproofing	1	LS	\$45,000.00	\$45,000.00	\$45,000	1.00
D. Foundation Insulation	1	LS	\$7,800.00	\$7,800.00	\$7,800	1.00
E. Roofing & Hatch	1	LS	\$90,000.00	\$90,000.00	\$90,000	1.00
F. Caulking	1	LS	\$26,000.00	\$26,000.00	\$26,000	1.00

Subtotal 07 0000 Thermal and Moisture Protection \$218,800

08 0000 Doors and Windows

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Doors, Frames & Hard.	1	LS	\$95,000.00	\$95,000.00	\$95,000	1.00
B. Four Fold Door	1	LS	\$32,000.00	\$32,000.00	\$32,000	1.00
C. Alum. Doors & Windows	1	LS	\$60,000.00	\$60,000.00	\$60,000	1.00

Subtotal 08 0000 Doors and Windows \$187,000

09 0000 Finishes

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Floor Tile & Base	1	LS	\$6,000.00	\$6,000.00	\$6,000	1.00
B. Acoustic Cielings	1	LS	\$2,500.00	\$2,500.00	\$2,500	1.00
C. Acoustic @ Blower	1	LS	\$12,000.00	\$12,000.00	\$12,000	1.00
D. Paintings & Coatings	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
E. Flooring System	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 09 0000 Finishes \$135,500

10 0000 Specialties

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plaque & Signs	1	LS	\$18,000.00	\$18,000.00	\$18,000	1.00
B. Toilet & Bath Signs	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00
C. Fire Exsting. & LK. Box	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00

Subtotal 10 0000 Specialties \$20,000

12 0000 Furnishings

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Laboratory Countertops	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00

Subtotal 12 0000 Furnishings \$10,000

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fire Suppression	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
Subtotal 21 0000 Fire Protection					\$40,000	

22 0000 Plumbing

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plumbing	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
Subtotal 22 0000 Plumbing					\$150,000	

23 0000 Mechanical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Mechanical	1	LS	\$300,000.00	\$300,000.00	\$300,000	1.00
Subtotal 23 0000 Mechanical					\$300,000	

26 0000 Electrical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Site Work						
1. Metering Cabinets	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Equipment Concrete Pads/Basements	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
3. Grounding	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
4. 800A Feeder and Fiber in Ductbank	100	LF	\$400.00	\$40,000.00	\$48,000	1.20
5. Generator and Cables	1	EA	\$300,000.00	\$300,000.00	\$360,000	1.20
B. Interior Work						
1. Main Switchboard	1	EA	\$100,000.00	\$100,000.00	\$120,000	1.20
2. Large Junction Boxes	2	EA	\$3,000.00	\$6,000.00	\$7,200	1.20
3. Small Junction Boxes	8	EA	\$2,000.00	\$16,000.00	\$19,200	1.20
4. LED lights	100	EA	\$650.00	\$65,000.00	\$78,000	1.20
5. Receptacles/ Wall Jacks	30	EA	\$500.00	\$15,000.00	\$18,000	1.20
6. Process Terminations	60	EA	\$750.00	\$45,000.00	\$54,000	1.20
7. Fire alarm System	1	EA	\$30,000.00	\$30,000.00	\$36,000	1.20
8. Access Control and Security	1	EA	\$40,000.00	\$40,000.00	\$48,000	1.20
9. Motor Control Centers	7	EA	\$10,000.00	\$70,000.00	\$84,000	1.20
10. High Service VFDs	3	EA	\$25,000.00	\$75,000.00	\$90,000	1.20
11. BW VFD	1	EA	\$35,000.00	\$35,000.00	\$42,000	1.20
12. Feeders Less than 60A	800	LF	\$40.00	\$32,000.00	\$38,400	1.20
13. 100A Feeder	200	LF	\$65.00	\$13,000.00	\$15,600	1.20
14. Analog I/O	3000	LF	\$4.25	\$12,750.00	\$15,300	1.20
15. Digital I/O	3000	LF	\$5.00	\$15,000.00	\$18,000	1.20
16. Cat 6	1500	LF	\$5.00	\$7,500.00	\$9,000	1.20
17. Distribution Panelboard	4	EA	\$6,000.00	\$24,000.00	\$28,800	1.20
18. Step Down Dry Type Transformer	1	EA	\$15,000.00	\$15,000.00	\$18,000	1.20
19. 30A Disconnect Switches (NEMA 12)	25	EA	\$320.27	\$8,006.63	\$9,610	1.20
20. HVAC Equipment	25	EA	\$500.00	\$12,500.00	\$15,000	1.20
21. Unit Heaters	15	EA	\$1,500.00	\$22,500.00	\$27,000	1.20
22. Lighting Panelboards	3	EA	\$5,000.00	\$15,000.00	\$18,000	1.20
23. Electrical Distribution Equipment	4	EA	\$750.00	\$3,000.00	\$3,600	1.20
Subtotal 26 0000 Electrical					\$1,256,710	

31 0000 Earthwork

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Building Excavation						
1. Common Excavation, (EV)	4,400	CY	\$15.00	\$66,000.00	\$66,000	1.00
2. Common Excavation, (EV) (HAUL OFF)	4,400	CY	\$30.00	\$132,000.00	\$132,000	1.00
3. Common Excavation, TOPSOIL STRIP (EV)	100	CY	\$15.00	\$1,500.00	\$1,500	1.00
4. Common Excavation, STEP FOOTING (EV)	1,600	CY	\$15.00	\$24,000.00	\$24,000	1.00
5. Shoring System	0	LF	\$1,800.00	\$0.00	\$0	1.00
B. Building Backfill						
1. Granular Engineered Backfill	650	CY	\$20.00	\$13,000.00	\$13,000	1.00
2. Exterior Backfill	6,000	CY	\$20.00	\$120,000.00	\$120,000	1.00
Subtotal 31 0000 Earthwork					\$360,000	

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Gravity Filtration With Plates Option 1C

32 0000 Exterior Improvements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Landscaping						
1. Site Grading	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
2. Seeding	1,000	SY	\$5.00	\$5,000.00	\$6,000	1.20
3. Rip Rap (4"-6" River Rock)	0	SY	\$0.00	\$0.00	\$0	1.20
4. Rip Rap (18" depth, D ₅₀ 12")	0	CY	\$0.00	\$0.00	\$0	1.20
5. Plantings/Miscellaneous	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
B. Site Work						
1. Removals						
a. Pavement Removal	1,100	SY	\$12.00	\$13,200.00	\$15,840	1.20
b. Topsoil Stripping	0	LS	\$0.00	\$0.00	\$0	1.20
c. Utility Relocations/Removals	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
d. Fence Removal	0	LF	\$0.00	\$0.00	\$0	1.20
e. SWPPP Items (silt fence, fiber rolls, etc...)	1	ls	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Road and Parking Lot						
a. Site Paving	500	SY	\$100.00	\$50,000.00	\$60,000	1.20
b. Road Restoration	120	SY	\$100.00	\$12,000.00	\$14,400	1.20
c. Curb and Gutter	135	LF	\$50.00	\$6,750.00	\$8,100	1.20
3. Perimeter Fencing						
a. New Estate Style Fence	750	LF	\$50.00	\$37,500.00	\$45,000	1.20

Subtotal 32 0000 Exterior Improvements \$200,000

33 0000 Utilities

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Site Piping	1	LS	\$100,000.00	\$100,000.00	\$100,000	1.00

Subtotal 33 0000 Utilities \$100,000

40 0000 Process Integration

Item Description	Size	Length	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Process Piping								
90 bend	20		5	ea	\$1,200.00	\$6,000.00	\$7,800	1.30
90 bend	18		4	ea	\$925.00	\$3,700.00	\$4,810	1.30
90 bend	16		10	ea	\$600.00	\$6,000.00	\$7,800	1.30
90 bend	10		4	ea	\$350.00	\$1,400.00	\$1,820	1.30
90 bend	8		6	ea	\$250.00	\$1,500.00	\$1,950	1.30
90 bend	6		10	ea	\$175.00	\$1,750.00	\$2,280	1.30
90 bend	4		10	ea	\$120.00	\$1,200.00	\$1,560	1.30
90 bend	3		0	ea	\$100.00	\$0.00	\$0	1.30
Tee	20		5	ea	\$1,025.00	\$5,125.00	\$6,660	1.30
Tee	18		7	ea	\$950.00	\$6,650.00	\$8,650	1.30
Tee	16		6	ea	\$800.00	\$4,800.00	\$6,240	1.30
Tee	12		6	ea	\$650.00	\$3,900.00	\$5,070	1.30
Tee	10		6	ea	\$550.00	\$3,300.00	\$4,290	1.30
Tee	8		6	ea	\$250.00	\$1,500.00	\$1,950	1.30
Tee	6		5	ea	\$150.00	\$750.00	\$980	1.30
Tee	4		1	ea	\$125.00	\$125.00	\$160	1.30
Mag Flow Meter	18		1	ea	\$10,000.00	\$10,000.00	\$13,000	1.30
Mag Flow Meter	16		1	ea	\$8,800.00	\$8,800.00	\$11,440	1.30
Mag Flow Meter	10		3	ea	\$4,100.00	\$12,300.00	\$15,990	1.30
Mag Flow Meter	6		1	ea	\$2,800.00	\$2,800.00	\$3,640	1.30
Mag Flow Meter	4		1	ea	\$2,400.00	\$2,400.00	\$3,120	1.30

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Gravity Filtration With Plates Option 1C

Pipe	20	176	-	ea	\$200.00	\$35,200.00	\$45,760	1.30
Pipe	18	100	-	ea	\$180.00	\$18,000.00	\$23,400	1.30
Pipe	16	160	-	ea	\$160.00	\$25,600.00	\$33,280	1.30
Pipe	10	80	-	ea	\$100.00	\$8,000.00	\$10,400	1.30
Pipe	8	0	-	ea	\$80.00	\$0.00	\$0	1.30
Pipe	6	200	-	ea	\$60.00	\$12,000.00	\$15,600	1.30
Pipe	4	80	-	ea	\$40.00	\$3,200.00	\$4,160	1.30
Pipe	3	250	-	ea	\$25.00	\$6,250.00	\$8,130	1.30
BFV w/ Electric	20		4	ea	\$8,850.00	\$35,400.00	\$46,020	1.30
BFV w/ Electric	18		4	ea	\$7,000.00	\$28,000.00	\$36,400	1.30
BFV w/ Electric	16		4	ea	\$6,500.00	\$26,000.00	\$33,800	1.30
BFV w/ Electric	10		9	ea	\$5,200.00	\$46,800.00	\$60,840	1.30
BFV w/ Electric	8		0	ea	\$4,950.00	\$0.00	\$0	1.30
BFV w/ Electric	6		1	ea	\$4,750.00	\$4,750.00	\$6,180	1.30
BFV w/ Electric	4		5	ea	\$4,600.00	\$23,000.00	\$29,900	1.30
BFV w/ Manual	20		2	ea	\$3,000.00	\$6,000.00	\$7,800	1.30
BFV w/ Manual	18		1	ea	\$2,700.00	\$2,700.00	\$3,510	1.30
BFV w/ Manual	16		6	ea	\$2,300.00	\$13,800.00	\$17,940	1.30
BFV w/ Manual	12		3	ea	\$1,200.00	\$3,600.00	\$4,680	1.30
BFV w/ Manual	8		0	ea	\$850.00	\$0.00	\$0	1.30
BFV w/ Manual	6		2	ea	\$775.00	\$1,550.00	\$2,020	1.30
BFV w/ Manual	4		2	ea	\$550.00	\$1,100.00	\$1,430	1.30
Check Valve	18		1	ea	\$15,000.00	\$15,000.00	\$19,500	1.30
Check Valve	12		3	ea	\$6,000.00	\$18,000.00	\$23,400	1.30
Check Valve	6		2	ea	\$1,600.00	\$3,200.00	\$4,160	1.30
Check Valve	4		2	ea	\$1,300.00	\$2,600.00	\$3,380	1.30
Expansion Joints	18		1	ea	\$750.00	\$750.00	\$980	1.30
Expansion Joints	12		3	ea	\$375.00	\$1,125.00	\$1,460	1.30
Expansion Joints	6		2	ea	\$180.00	\$360.00	\$470	1.30
Expansion Joints	4		2	ea	\$150.00	\$300.00	\$390	1.30
PRV	12		1	ea	\$25,000.00	\$25,000.00	\$32,500	1.30
Static Mixer	16		1	ea	\$10,000.00	\$10,000.00	\$13,000	1.30

B. Instrumentation and Control System Devices (40 91 00)

1.	Chemical Feed System Instrumentation						
a.	Ultrasonic Level Transmitters	5	ea	\$800.00	\$4,000.00	\$4,800	1.20
b.	Permanganate Analyzers	1	ea	\$3,600.00	\$3,600.00	\$4,320	1.20
c.	Mono/Free Ammonia Analyzer	1	ea	\$20,500.00	\$20,500.00	\$24,600	1.20
d.	pH Probes and Transmitters	2	ea	\$2,750.00	\$5,500.00	\$6,600	1.20
2.	Conventional Filter Instrumentation						
a.	Ultrasonic Level Transmitters	7	ea	\$800.00	\$5,600.00	\$6,720	1.20
b.	Level Float Switches	9	ea	\$200.00	\$1,800.00	\$2,160	1.20

C. Instrumentation and Control Control Panels (40 91 10)

1. Control Panels	-						
a. Master Control Panel	1		ea	\$60,000.00	\$60,000.00	\$60,000	1.00
b. Control Panel Upgrades	0		ea	\$0.00	\$0.00	\$0	1.00
c. Network Panel	1		ea	\$30,000.00	\$30,000.00	\$36,000	1.20

Subtotal 40 0000 Process Integration \$744,900

43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Vertical Turbine Pump						
1. High Service Pumps						
a. 1500 GPM (125HP)	3	ea	\$59,900.00	\$179,700.00	\$215,640	1.20
2. Backwash Supply Pump	1	ea	\$110,700.00	\$110,700.00	\$132,840	1.20
3. Chlorine Feed Booster Pumps	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
B. Submersible Liquid Pumps (43 21 39)						
1. Backwash Reclaim Submersible Reclaim Pumps	0	ea	\$7,900.00	\$0.00	\$0	1.20
2. Backwash Reclaim Submersible Sludge Pumps	0	ea	\$7,900.00	\$0.00	\$0	1.20

Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment \$355,680

WTP Alternative - Southdale

Opinion of Probable Total Construction Cost

Southdale - Gravity Filtration With Plates Option 1C

46 0000 Water and Wastewater Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fluoride Chemical Feed System						
1. 450-gallon Bulk Storage Tank	1	ea	\$1,200.00	\$1,200.00	\$1,440	1.20
2. Bulk Chemical Delivery Connection	1	ls	\$800.00	\$800.00	\$960	1.20
3. Centrifugal Transfer Pump (Bulk to Day Tank)	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. 100-gallon Day Storage Tank	1	ea	\$600.00	\$600.00	\$720	1.20
5. Weight Scale	2	ea	\$1,000.00	\$2,000.00	\$2,400	1.20
6. Chemical Feed Pump	2	ea	\$3,500.00	\$7,000.00	\$8,400	1.20
7. Injection Point Tap/Diffuser	1	ea	\$380.00	\$380.00	\$460	1.20
8. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
9. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
B. HMO Feed System						
1. Tonka HMO Feed System	1	ls	\$64,000.00	\$64,000.00	\$76,800	1.20
a. TonkaBlend Feed Panel						
b. Two 1000 Gallon Tanks with Mixer and Stand						
c. Controls, Two Electrical Valves, Freight						
2. Bulk Chemical Delivery Connection	1	ea	\$800.00	\$800.00	\$960	1.20
C. Sodium Permanganate Feed System						
1. 755-gallon Storage Tank	1	e.a.	\$1,700.00	\$1,700.00	\$2,040	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
D. Poly/Orthophosphate Feed System						
1. 155-gallon Storage Tank	1	e.a.	\$650.00	\$650.00	\$780	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
E. Ammonium Sulfate Feed System						
1. 1000-gallon Bulk Tank	1	e.a.	\$2,200.00	\$2,200.00	\$2,640	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	2	e.a.	\$3,500.00	\$7,000.00	\$8,400	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,500.00	\$2,500.00	\$3,000	1.20
F. Chlorine Chemical Feed System (WTF)						
1. Scales	2	e.a.	\$4,000.00	\$8,000.00	\$9,600	1.20
a. Single Cylinder 1 Ton						
2. Chlorine Cylinder Piping, Valves and Accessories	1	l.s.	\$9,000.00	\$9,000.00	\$10,800	1.20
3. Chlorine Gas Scrubber System	1	e.a.	\$128,000.00	\$128,000.00	\$153,600	1.20
4. Hydro Omni-Valve 250 ppd feeder	2	e.a.	\$3,000.00	\$6,000.00	\$7,200	1.20
5. Ejector Assembly, Panel, Valves	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
6. Gas Detector and Accessories	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
G. Chlorine Hoist						
1. Crane Rail and Electric Hoist	1	ea	\$50,000.00	\$50,000.00	\$60,000	1.20
2. Lifting Bar for 1 Ton Cylinder	1	ea	\$1,500.00	\$1,500.00	\$1,800	1.20
F. Filter Equipment						
1. Sand Media	1,463	CF	\$10.00	\$14,630.00	\$17,560	1.20
2. Anthracite Media	975	CF	\$20.00	\$19,500.00	\$23,400	1.20
3. Filter Troughs	168	LF	\$350.00	\$58,800.00	\$70,560	1.20
4. Underdrain / In-Cell Airwash	975	SF	\$150.00	\$146,250.00	\$175,500	1.20
I. Filter Air Scour Equipment						
1. PD Airwash Blower	1	ea	\$40,500.00	\$40,500.00	\$48,600	1.20
J. Mixers						
1. Vertical Turbine Mixer for Detention Tank (5 HP)	1	ea	\$39,800.00	\$39,800.00	\$47,760	1.20
I. Backwash Reclaim Plate Settler						
1. Plate Settler system with polymer, waste pump, and mixing pump	1	ea	\$190,000.00	\$190,000.00	\$228,000	1.20

Subtotal 46 0000 Water and Wastewater Equipment \$997,748

Appendix V

Option 2A – Yorktown Site with Gravity Filters Cost Estimate

Construction Cost Estimate - Summary

Subtotal 00/01 0000 Contracting and General Requirements	\$719,620
Subtotal 02 0000 Existing Conditions	\$40,000
Subtotal 03 0000 Concrete	\$1,680,000
Subtotal 04 0000 Masonry	\$262,250
Subtotal 05 0000 Metals	\$208,000
Subtotal 06 0000 Carpentry	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$218,800
Subtotal 08 0000 Doors and Windows	\$187,000
Subtotal 09 0000 Finishes	\$135,500
Subtotal 10 0000 Specialties	\$20,000
Subtotal 12 0000 Furnishings	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000
Subtotal 22 0000 Plumbing	\$150,000
Subtotal 23 0000 Mechanical	\$300,000
Subtotal 26 0000 Electrical	\$1,256,710
Subtotal 31 0000 Earthwork	\$460,000
Subtotal 32 0000 Exterior Improvements	\$200,000
Subtotal 33 0000 Utilities	\$100,000
Subtotal 40 0000 Process Integration	\$744,900
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment	\$393,600
Subtotal 46 0000 Water and Wastewater Equipment	\$769,748
Subtotal	\$7,940,128

00/01 0000 Contracting and General Requirements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Legal/Administrative				0.75%	\$54,154	1.00
B. Mobilization				0.75%	\$54,154	1.00
C. Supervision				1.0%	\$72,205	1.00
D. Temporary Facilities				0.75%	\$54,154	1.00
E. Temporary Utilities				0.75%	\$54,154	1.00
F. Equipment Rental and Misc. Costs				0.75%	\$54,154	1.00
G. Bonding and Insurance				1.2%	\$86,646	1.00
H. Allowances:						
a. Security and Access Control Hardware					\$50,000	1.00
b. Computer Hardware, Software, and Equipment, SCADA Licensing					\$120,000	1.00
c. Instrumentation & Controls Programming					\$120,000	1.00
Subtotal Allowances					\$290,000	
Subtotal 00/01 0000 Contracting and General Requirements					\$719,620	

02 0000 Existing Conditions

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Demolition	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00
B. Dewatering	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
Subtotal 02 0000 Existing Conditions					\$40,000	

03 0000 Concrete

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Cast in Place Concrete	2,400	CY	\$700.00	\$1,680,000.00	\$1,680,000	1.00
Subtotal 03 0000 Concrete					\$1,680,000	

04 0000 Masonry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Brick	5,000	EA	\$20.00	\$100,000.00	\$100,000	1.00
B. 8" CMU	4,000	EA	\$10.00	\$40,000.00	\$40,000	1.00
C. 12" CMU	5,000	EA	\$15.55	\$77,750.00	\$77,750	1.00
D. Cast Stone Coping	1,000	EA	\$44.50	\$44,500.00	\$44,500	1.00
Subtotal 04 0000 Masonry					\$262,250	

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Metals & Structural Steel	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
B. Fiberglass	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
C. Floor Hatches	6	EA	\$3,000.00	\$18,000.00	\$18,000	1.00

Subtotal 05 0000 Metals \$208,000

06 0000 Carpentry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Wood Cabinets	1	LS	\$4,000.00	\$4,000.00	\$4,000	1.00
B. Misc. Carpentry	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 06 0000 Carpentry \$44,000

07 0000 Thermal and Moisture Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Nail Base Roof Insulation	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
B. Cavity Wall Vapor Barrier	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
C. Below Grade Waterproofing	1	LS	\$45,000.00	\$45,000.00	\$45,000	1.00
D. Foundation Insulation	1	LS	\$7,800.00	\$7,800.00	\$7,800	1.00
E. Roofing & Hatch	1	LS	\$90,000.00	\$90,000.00	\$90,000	1.00
F. Caulking	1	LS	\$26,000.00	\$26,000.00	\$26,000	1.00

Subtotal 07 0000 Thermal and Moisture Protection \$218,800

08 0000 Doors and Windows

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Doors, Frames & Hard.	1	LS	\$95,000.00	\$95,000.00	\$95,000	1.00
B. Four Fold Door	1	LS	\$32,000.00	\$32,000.00	\$32,000	1.00
C. Alum. Doors & Windows	1	LS	\$60,000.00	\$60,000.00	\$60,000	1.00

Subtotal 08 0000 Doors and Windows \$187,000

09 0000 Finishes

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Floor Tile & Base	1	LS	\$6,000.00	\$6,000.00	\$6,000	1.00
B. Acoustic Cielings	1	LS	\$2,500.00	\$2,500.00	\$2,500	1.00
C. Acoustic @ Blower	1	LS	\$12,000.00	\$12,000.00	\$12,000	1.00
D. Paintings & Coatings	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
E. Flooring System	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 09 0000 Finishes \$135,500

10 0000 Specialties

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plaque & Signs	1	LS	\$18,000.00	\$18,000.00	\$18,000	1.00
B. Toilet & Bath Signs	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00
C. Fire Exsting. & LK. Box	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00

Subtotal 10 0000 Specialties \$20,000

12 0000 Furnishings

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Laboratory Countertops	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00

Subtotal 12 0000 Furnishings \$10,000

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fire Suppression	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
Subtotal 21 0000 Fire Protection					\$40,000	

22 0000 Plumbing

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plumbing	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
Subtotal 22 0000 Plumbing					\$150,000	

23 0000 Mechanical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Mechanical	1	LS	\$300,000.00	\$300,000.00	\$300,000	1.00
Subtotal 23 0000 Mechanical					\$300,000	

26 0000 Electrical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Site Work						
1. Metering Cabinets	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Equipment Concrete Pads/Basements	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
3. Grounding	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
4. 800A Feeder and Fiber in Ductbank	100	LF	\$400.00	\$40,000.00	\$48,000	1.20
5. Generator and Cables	1	EA	\$300,000.00	\$300,000.00	\$360,000	1.20
B. Interior Work						
1. Main Switchboard	1	EA	\$100,000.00	\$100,000.00	\$120,000	1.20
2. Large Junction Boxes	2	EA	\$3,000.00	\$6,000.00	\$7,200	1.20
3. Small Junction Boxes	8	EA	\$2,000.00	\$16,000.00	\$19,200	1.20
4. LED lights	100	EA	\$650.00	\$65,000.00	\$78,000	1.20
5. Receptacles/ Wall Jacks	30	EA	\$500.00	\$15,000.00	\$18,000	1.20
6. Process Terminations	60	EA	\$750.00	\$45,000.00	\$54,000	1.20
7. Fire alarm System	1	EA	\$30,000.00	\$30,000.00	\$36,000	1.20
8. Access Control and Security	1	EA	\$40,000.00	\$40,000.00	\$48,000	1.20
9. Motor Control Centers	7	EA	\$10,000.00	\$70,000.00	\$84,000	1.20
10. High Service VFDs	3	EA	\$25,000.00	\$75,000.00	\$90,000	1.20
11. BW VFD	1	EA	\$35,000.00	\$35,000.00	\$42,000	1.20
12. Feeders Less than 60A	800	LF	\$40.00	\$32,000.00	\$38,400	1.20
13. 100A Feeder	200	LF	\$65.00	\$13,000.00	\$15,600	1.20
14. Analog I/O	3000	LF	\$4.25	\$12,750.00	\$15,300	1.20
15. Digital I/O	3000	LF	\$5.00	\$15,000.00	\$18,000	1.20
16. Cat 6	1500	LF	\$5.00	\$7,500.00	\$9,000	1.20
17. Distribution Panelboard	4	EA	\$6,000.00	\$24,000.00	\$28,800	1.20
18. Step Down Dry Type Transformer	1	EA	\$15,000.00	\$15,000.00	\$18,000	1.20
19. 30A Disconnect Switches (NEMA 12)	25	EA	\$320.27	\$8,006.63	\$9,610	1.20
20. HVAC Equipment	25	EA	\$500.00	\$12,500.00	\$15,000	1.20
21. Unit Heaters	15	EA	\$1,500.00	\$22,500.00	\$27,000	1.20
22. Lighting Panelboards	3	EA	\$5,000.00	\$15,000.00	\$18,000	1.20
23. Electrical Distribution Equipment	4	EA	\$750.00	\$3,000.00	\$3,600	1.20
Subtotal 26 0000 Electrical					\$1,256,710	

31 0000 Earthwork

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Building Excavation						
1. Common Excavation, (EV)	5,900	CY	\$15.00	\$88,500.00	\$88,500	1.00
2. Common Excavation, (EV) (HAUL OFF)	5,900	CY	\$30.00	\$177,000.00	\$177,000	1.00
3. Common Excavation, TOPSOIL STRIP (EV)	100	CY	\$15.00	\$1,500.00	\$1,500	1.00
4. Common Excavation, STEP FOOTING (EV)	1,600	CY	\$15.00	\$24,000.00	\$24,000	1.00
5. Shoring System	0	LF	\$1,800.00	\$0.00	\$0	1.00
B. Building Backfill						
1. Granular Engineered Backfill	700	CY	\$20.00	\$14,000.00	\$14,000	1.00
2. Exterior Backfill	7,500	CY	\$20.00	\$150,000.00	\$150,000	1.00
Subtotal 31 0000 Earthwork					\$460,000	

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Landscaping						
1. Site Grading	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
2. Seeding	1,000	SY	\$5.00	\$5,000.00	\$6,000	1.20
3. Rip Rap (4"-6" River Rock)	0	SY	\$0.00	\$0.00	\$0	1.20
4. Rip Rap (18" depth, D ₅₀ 12")	0	CY	\$0.00	\$0.00	\$0	1.20
5. Plantings/Miscellaneous	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
B. Site Work						
1. Removals						
a. Pavement Removal	1,100	SY	\$12.00	\$13,200.00	\$15,840	1.20
b. Topsoil Stripping	0	LS	\$0.00	\$0.00	\$0	1.20
c. Utility Relocations/Removals	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
d. Fence Removal	0	LF	\$0.00	\$0.00	\$0	1.20
e. SWPPP Items (silt fence, fiber rolls, etc...)	1	ls	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Road and Parking Lot						
a. Site Paving	500	SY	\$100.00	\$50,000.00	\$60,000	1.20
b. Road Restoration	120	SY	\$100.00	\$12,000.00	\$14,400	1.20
c. Curb and Gutter	135	LF	\$50.00	\$6,750.00	\$8,100	1.20
3. Perimeter Fencing						
a. New Estate Style Fence	750	LF	\$50.00	\$37,500.00	\$45,000	1.20

Subtotal 32 0000 Exterior Improvements \$200,000

33 0000 Utilities

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Site Piping	1	LS	\$100,000.00	\$100,000.00	\$100,000	1.00

Subtotal 33 0000 Utilities \$100,000

40 0000 Process Integration

Item Description	Size	Length	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Process Piping								
90 bend	20		5	ea	\$1,200.00	\$6,000.00	\$7,800	1.30
90 bend	18		4	ea	\$925.00	\$3,700.00	\$4,810	1.30
90 bend	16		10	ea	\$600.00	\$6,000.00	\$7,800	1.30
90 bend	10		4	ea	\$350.00	\$1,400.00	\$1,820	1.30
90 bend	8		6	ea	\$250.00	\$1,500.00	\$1,950	1.30
90 bend	6		10	ea	\$175.00	\$1,750.00	\$2,280	1.30
90 bend	4		10	ea	\$120.00	\$1,200.00	\$1,560	1.30
90 bend	3		0	ea	\$100.00	\$0.00	\$0	1.30
Tee	20		5	ea	\$1,025.00	\$5,125.00	\$6,660	1.30
Tee	18		7	ea	\$950.00	\$6,650.00	\$8,650	1.30
Tee	16		6	ea	\$800.00	\$4,800.00	\$6,240	1.30
Tee	12		6	ea	\$650.00	\$3,900.00	\$5,070	1.30
Tee	10		6	ea	\$550.00	\$3,300.00	\$4,290	1.30
Tee	8		6	ea	\$250.00	\$1,500.00	\$1,950	1.30
Tee	6		5	ea	\$150.00	\$750.00	\$980	1.30
Tee	4		1	ea	\$125.00	\$125.00	\$160	1.30
Mag Flow Meter	18		1	ea	\$10,000.00	\$10,000.00	\$13,000	1.30
Mag Flow Meter	16		1	ea	\$8,800.00	\$8,800.00	\$11,440	1.30
Mag Flow Meter	10		3	ea	\$4,100.00	\$12,300.00	\$15,990	1.30
Mag Flow Meter	6		1	ea	\$2,800.00	\$2,800.00	\$3,640	1.30
Mag Flow Meter	4		1	ea	\$2,400.00	\$2,400.00	\$3,120	1.30

Edina WTP Design
AE2S Project #P05177-2016-000
WTP Alternative - York Town Ave
Opinion of Probable Total Construction Cost
Yorktown - Gravity Filtration Option 2A

Revision: 9/21/2017

Pipe	20	176	-	ea	\$200.00	\$35,200.00	\$45,760	1.30
Pipe	18	100	-	ea	\$180.00	\$18,000.00	\$23,400	1.30
Pipe	16	160	-	ea	\$160.00	\$25,600.00	\$33,280	1.30
Pipe	10	80	-	ea	\$100.00	\$8,000.00	\$10,400	1.30
Pipe	8	0	-	ea	\$80.00	\$0.00	\$0	1.30
Pipe	6	200	-	ea	\$60.00	\$12,000.00	\$15,600	1.30
Pipe	4	80	-	ea	\$40.00	\$3,200.00	\$4,160	1.30
Pipe	3	250	-	ea	\$25.00	\$6,250.00	\$8,130	1.30
BFV w/ Electric	20		4	ea	\$8,850.00	\$35,400.00	\$46,020	1.30
BFV w/ Electric	18		4	ea	\$7,000.00	\$28,000.00	\$36,400	1.30
BFV w/ Electric	16		4	ea	\$6,500.00	\$26,000.00	\$33,800	1.30
BFV w/ Electric	10		9	ea	\$5,200.00	\$46,800.00	\$60,840	1.30
BFV w/ Electric	8		0	ea	\$4,950.00	\$0.00	\$0	1.30
BFV w/ Electric	6		1	ea	\$4,750.00	\$4,750.00	\$6,180	1.30
BFV w/ Electric	4		5	ea	\$4,600.00	\$23,000.00	\$29,900	1.30
BFV w/ Manual	20		2	ea	\$3,000.00	\$6,000.00	\$7,800	1.30
BFV w/ Manual	18		1	ea	\$2,700.00	\$2,700.00	\$3,510	1.30
BFV w/ Manual	16		6	ea	\$2,300.00	\$13,800.00	\$17,940	1.30
BFV w/ Manual	12		3	ea	\$1,200.00	\$3,600.00	\$4,680	1.30
BFV w/ Manual	8		0	ea	\$850.00	\$0.00	\$0	1.30
BFV w/ Manual	6		2	ea	\$775.00	\$1,550.00	\$2,020	1.30
BFV w/ Manual	4		2	ea	\$550.00	\$1,100.00	\$1,430	1.30
Check Valve	18		1	ea	\$15,000.00	\$15,000.00	\$19,500	1.30
Check Valve	12		3	ea	\$6,000.00	\$18,000.00	\$23,400	1.30
Check Valve	6		2	ea	\$1,600.00	\$3,200.00	\$4,160	1.30
Check Valve	4		2	ea	\$1,300.00	\$2,600.00	\$3,380	1.30
Expansion Joints	18		1	ea	\$750.00	\$750.00	\$980	1.30
Expansion Joints	12		3	ea	\$375.00	\$1,125.00	\$1,460	1.30
Expansion Joints	6		2	ea	\$180.00	\$360.00	\$470	1.30
Expansion Joints	4		2	ea	\$150.00	\$300.00	\$390	1.30
PRV	12		1	ea	\$25,000.00	\$25,000.00	\$32,500	1.30
Static Mixer	16		1	ea	\$10,000.00	\$10,000.00	\$13,000	1.30

B. Instrumentation and Control System Devices (40 91 00)

1.	Chemical Feed System Instrumentation						
a.	Ultrasonic Level Transmitters	5	ea	\$800.00	\$4,000.00	\$4,800	1.20
b.	Permanganate Analyzers	1	ea	\$3,600.00	\$3,600.00	\$4,320	1.20
c.	Mono/Free Ammonia Analyzer	1	ea	\$20,500.00	\$20,500.00	\$24,600	1.20
d.	pH Probes and Transmitters	2	ea	\$2,750.00	\$5,500.00	\$6,600	1.20
2.	Conventional Filter Instrumentation						
a.	Ultrasonic Level Transmitters	7	ea	\$800.00	\$5,600.00	\$6,720	1.20
b.	Level Float Switches	9	ea	\$200.00	\$1,800.00	\$2,160	1.20

C. Instrumentation and Control Control Panels (40 91 10)

1. Control Panels	-						
a. Master Control Panel	1		ea	\$60,000.00	\$60,000.00	\$60,000	1.00
b. Control Panel Upgrades	0		ea	\$0.00	\$0.00	\$0	1.00
c. Network Panel	1		ea	\$30,000.00	\$30,000.00	\$36,000	1.20

Subtotal 40 0000 Process Integration \$744,900

43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Vertical Turbine Pump						
1. High Service Pumps						
a. 1500 GPM (125HP)	3	ea	\$59,900.00	\$179,700.00	\$215,640	1.20
2. Backwash Supply Pump	1	ea	\$110,700.00	\$110,700.00	\$132,840	1.20
3. Chlorine Feed Booster Pumps	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
B. Submersible Liquid Pumps (43 21 39)						
1. Backwash Reclaim Submersible Reclaim Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20
2. Backwash Reclaim Submersible Sludge Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20

Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment \$393,600

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fluoride Chemical Feed System						
1. 450-gallon Bulk Storage Tank	1	ea	\$1,200.00	\$1,200.00	\$1,440	1.20
2. Bulk Chemical Delivery Connection	1	ls	\$800.00	\$800.00	\$960	1.20
3. Centrifugal Transfer Pump (Bulk to Day Tank)	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. 100-gallon Day Storage Tank	1	ea	\$600.00	\$600.00	\$720	1.20
5. Weight Scale	2	ea	\$1,000.00	\$2,000.00	\$2,400	1.20
6. Chemical Feed Pump	2	ea	\$3,500.00	\$7,000.00	\$8,400	1.20
7. Injection Point Tap/Diffuser	1	ea	\$380.00	\$380.00	\$460	1.20
8. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
9. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
B. HMO Feed System						
1. Tonka HMO Feed System	1	ls	\$64,000.00	\$64,000.00	\$76,800	1.20
a. TonkaBlend Feed Panel						
b. Two 1000 Gallon Tanks with Mixer and Stand						
c. Controls, Two Electrical Valves, Freight						
2. Bulk Chemical Delivery Connection	1	ea	\$800.00	\$800.00	\$960	1.20
C. Sodium Permanganate Feed System						
1. 755-gallon Storage Tank	1	e.a.	\$1,700.00	\$1,700.00	\$2,040	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
D. Poly/Orthophosphate Feed System						
1. 155-gallon Storage Tank	1	e.a.	\$650.00	\$650.00	\$780	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
E. Ammonium Sulfate Feed System						
1. 1000-gallon Bulk Tank	1	e.a.	\$2,200.00	\$2,200.00	\$2,640	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	2	e.a.	\$3,500.00	\$7,000.00	\$8,400	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,500.00	\$2,500.00	\$3,000	1.20
F. Chlorine Chemical Feed System (WTF)						
1. Scales	2	e.a.	\$4,000.00	\$8,000.00	\$9,600	1.20
a. Single Cylinder 1 Ton						
2. Chlorine Cylinder Piping, Valves and Accessories	1	l.s.	\$9,000.00	\$9,000.00	\$10,800	1.20
3. Chlorine Gas Scrubber System	1	e.a.	\$128,000.00	\$128,000.00	\$153,600	1.20
4. Hydro Omni-Valve 250 ppd feeder	2	e.a.	\$3,000.00	\$6,000.00	\$7,200	1.20
5. Ejector Assembly, Panel, Valves	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
6. Gas Detector and Accessories	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
G. Chlorine Hoist						
1. Crane Rail and Electric Hoist	1	ea	\$50,000.00	\$50,000.00	\$60,000	1.20
2. Lifting Bar for 1 Ton Cylinder	1	ea	\$1,500.00	\$1,500.00	\$1,800	1.20
F. Filter Equipment						
1. Sand Media	1,463	CF	\$10.00	\$14,630.00	\$17,560	1.20
2. Anthracite Media	975	CF	\$20.00	\$19,500.00	\$23,400	1.20
3. Filter Troughs	168	LF	\$350.00	\$58,800.00	\$70,560	1.20
4. Underdrain / In-Cell Airwash	975	SF	\$150.00	\$146,250.00	\$175,500	1.20
I. Filter Air Scour Equipment						
1. PD Airwash Blower	1	ea	\$40,500.00	\$40,500.00	\$48,600	1.20
J. Mixers						
1. Vertical Turbine Mixer for Detention Tank (5 HP)	1	ea	\$39,800.00	\$39,800.00	\$47,760	1.20

Subtotal 46 0000 Water and Wastewater Equipment \$769,748

Appendix W

Option 2B – Yorktown Site with Pressure Filters Cost Estimate

WTP Alternative - Yorktown

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 2B

Construction Cost Estimate - Summary

Subtotal 00/01 0000 Contracting and General Requirements	\$726,398
Subtotal 02 0000 Existing Conditions	\$40,000
Subtotal 03 0000 Concrete	\$1,332,800
Subtotal 04 0000 Masonry	\$262,250
Subtotal 05 0000 Metals	\$41,000
Subtotal 06 0000 Carpentry	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$202,800
Subtotal 08 0000 Doors and Windows	\$147,000
Subtotal 09 0000 Finishes	\$110,500
Subtotal 10 0000 Specialties	\$20,000
Subtotal 12 0000 Furnishings	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000
Subtotal 22 0000 Plumbing	\$150,000
Subtotal 23 0000 Mechanical	\$300,000
Subtotal 26 0000 Electrical	\$1,214,710
Subtotal 31 0000 Earthwork	\$460,000
Subtotal 32 0000 Exterior Improvements	\$200,000
33 0000 Utilities	\$100,000
Subtotal 40 0000 Process Integration	\$799,880
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment	\$260,760
Subtotal 46 0000 Water and Wastewater Equipment	\$1,598,728
Subtotal	\$8,060,826

00/01 0000 Contracting and General Requirements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Legal/Administrative				0.75%	\$55,008	1.00
B. Mobilization				0.75%	\$55,008	1.00
C. Supervision				1.0%	\$73,344	1.00
D. Temporary Facilities				0.75%	\$55,008	1.00
E. Temporary Utilities				0.75%	\$55,008	1.00
F. Equipment Rental and Misc. Costs				0.75%	\$55,008	1.00
G. Bonding and Insurance				1.2%	\$88,013	1.00
H. Allowances:						
a. Security and Access Control Hardware					\$50,000	1.00
b. Computer Hardware, Software, and Equipment, SCADA Licensing					\$120,000	1.00
c. Instrumentation & Controls Programming					\$120,000	1.00
Subtotal Allowances					\$290,000	

Subtotal 00/01 0000 Contracting and General Requirements \$726,398

02 0000 Existing Conditions

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Demolition	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00
B. Dewatering	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
Subtotal 02 0000 Existing Conditions					\$40,000	

03 0000 Concrete

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Cast in Place Concrete	1,904	CY	\$700.00	\$1,332,800.00	\$1,332,800	1.00
Subtotal 03 0000 Concrete					\$1,332,800	

04 0000 Masonry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Brick	5,000	EA	\$20.00	\$100,000.00	\$100,000	1.00
B. 8" CMU	4,000	EA	\$10.00	\$40,000.00	\$40,000	1.00
C. 12" CMU	5,000	EA	\$15.55	\$77,750.00	\$77,750	1.00
D. Cast Stone Coping	1,000	EA	\$44.50	\$44,500.00	\$44,500	1.00
Subtotal 04 0000 Masonry					\$262,250	

WTP Alternative - Yorktown

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 2B

05 0000 Metals

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Metals & Structural Steel	0	LS	\$0.00	\$0.00	\$0	1.00
B. Fiberglass	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
C. Floor Hatches	7	EA	\$3,000.00	\$21,000.00	\$21,000	1.00

Subtotal 05 0000 Metals \$41,000

06 0000 Carpentry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Wood Cabinets	1	LS	\$4,000.00	\$4,000.00	\$4,000	1.00
B. Misc. Carpentry	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 06 0000 Carpentry \$44,000

07 0000 Thermal and Moisture Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Nail Base Roof Insulation	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
B. Cavity Wall Vapor Barrier	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
C. Below Grade Waterproofing	1	LS	\$45,000.00	\$45,000.00	\$45,000	1.00
D. Foundation Insulation	1	LS	\$7,800.00	\$7,800.00	\$7,800	1.00
E. Roofing & Hatch	1	LS	\$90,000.00	\$90,000.00	\$90,000	1.00
F. Caulking	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00

Subtotal 07 0000 Thermal and Moisture Protection \$202,800

08 0000 Doors and Windows

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Doors, Frames & Hard.	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
B. Four Fold Door	1	LS	\$32,000.00	\$32,000.00	\$32,000	1.00
C. Alum. Doors & Windows	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 08 0000 Doors and Windows \$147,000

09 0000 Finishes

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Floor Tile & Base	1	LS	\$6,000.00	\$6,000.00	\$6,000	1.00
B. Acoustic Cielings	1	LS	\$2,500.00	\$2,500.00	\$2,500	1.00
C. Acoustic @ Blower	1	LS	\$12,000.00	\$12,000.00	\$12,000	1.00
D. Paintings & Coatings	1	LS	\$50,000.00	\$50,000.00	\$50,000	1.00
E. Flooring System	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 09 0000 Finishes \$110,500

10 0000 Specialties

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plaque & Signs	1	LS	\$18,000.00	\$18,000.00	\$18,000	1.00
B. Toilet & Bath Signs	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00
C. Fire Exsting. & LK. Box	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00

Subtotal 10 0000 Specialties \$20,000

12 0000 Furnishings

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Laboratory Countertops	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00

Subtotal 12 0000 Furnishings \$10,000

WTP Alternative - Yorktown

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 2B

21 0000 Fire Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fire Suppression	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
Subtotal 21 0000 Fire Protection					\$40,000	

22 0000 Plumbing

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plumbing	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
Subtotal 22 0000 Plumbing					\$150,000	

23 0000 Mechanical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Mechanical	1	LS	\$300,000.00	\$300,000.00	\$300,000	1.00
Subtotal 23 0000 Mechanical					\$300,000	

26 0000 Electrical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Site Work						
1. Metering Cabinets	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Equipment Concrete Pads/Basements	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
3. Grounding	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
4. 800A Feeder and Fiber in Ductbank	100	LF	\$400.00	\$40,000.00	\$48,000	1.20
5. Generator and Cables	1	EA	\$300,000.00	\$300,000.00	\$360,000	1.20
B. Interior Work						
1. Main Switchboard	1	EA	\$100,000.00	\$100,000.00	\$120,000	1.20
2. Large Junction Boxes	2	EA	\$3,000.00	\$6,000.00	\$7,200	1.20
3. Small Junction Boxes	8	EA	\$2,000.00	\$16,000.00	\$19,200	1.20
4. LED lights	100	EA	\$650.00	\$65,000.00	\$78,000	1.20
5. Receptacles/ Wall Jacks	30	EA	\$500.00	\$15,000.00	\$18,000	1.20
6. Process Terminations	60	EA	\$750.00	\$45,000.00	\$54,000	1.20
7. Fire alarm System	1	EA	\$30,000.00	\$30,000.00	\$36,000	1.20
8. Access Control and Security	1	EA	\$40,000.00	\$40,000.00	\$48,000	1.20
9. Motor Control Centers	7	EA	\$10,000.00	\$70,000.00	\$84,000	1.20
10. Pressure Filter Influent VFDs	3	EA	\$25,000.00	\$75,000.00	\$90,000	1.20
11. BW VFD	0	EA	\$35,000.00	\$0.00	\$0	1.20
12. Feeders Less than 60A	800	LF	\$40.00	\$32,000.00	\$38,400	1.20
13. 100A Feeder	200	LF	\$65.00	\$13,000.00	\$15,600	1.20
14. Analog I/O	3000	LF	\$4.25	\$12,750.00	\$15,300	1.20
15. Digital I/O	3000	LF	\$5.00	\$15,000.00	\$18,000	1.20
16. Cat 6	1500	LF	\$5.00	\$7,500.00	\$9,000	1.20
17. Distribution Panelboard	4	EA	\$6,000.00	\$24,000.00	\$28,800	1.20
18. Step Down Dry Type Transformer	1	EA	\$15,000.00	\$15,000.00	\$18,000	1.20
19. 30A Disconnect Switches (NEMA 12)	25	EA	\$320.27	\$8,006.63	\$9,610	1.20
20. HVAC Equipment	25	EA	\$500.00	\$12,500.00	\$15,000	1.20
21. Unit Heaters	15	EA	\$1,500.00	\$22,500.00	\$27,000	1.20
22. Lighting Panelboards	3	EA	\$5,000.00	\$15,000.00	\$18,000	1.20
23. Electrical Distribution Equipment	4	EA	\$750.00	\$3,000.00	\$3,600	1.20
Subtotal 26 0000 Electrical					\$1,214,710	

31 0000 Earthwork

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Building Excavation						
1. Common Excavation, (EV)	5,900	CY	\$15.00	\$88,500.00	\$88,500	1.00
2. Common Excavation, (EV) (HAUL OFF)	5,900	CY	\$30.00	\$177,000.00	\$177,000	1.00
3. Common Excavation, TOPSOIL STRIP (EV)	100	CY	\$15.00	\$1,500.00	\$1,500	1.00
4. Common Excavation, STEP FOOTING (EV)	1,600	CY	\$15.00	\$24,000.00	\$24,000	1.00
5. Shoring System	0	LF	\$1,800.00	\$0.00	\$0	1.00
B. Building Backfill						
1. Granular Engineered Backfill	700	CY	\$20.00	\$14,000.00	\$14,000	1.00
2. Exterior Backfill	7,500	CY	\$20.00	\$150,000.00	\$150,000	1.00
Subtotal 31 0000 Earthwork					\$460,000	

WTP Alternative - Yorktown
Opinion of Probable Total Construction Cost
Yorktown - Pressure Filtration Option 2B
32 0000 Exterior Improvements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Landscaping						
1. Site Grading	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
2. Seeding	1,000	SY	\$5.00	\$5,000.00	\$6,000	1.20
3. Rip Rap (4"-6" River Rock)	0	SY	\$0.00	\$0.00	\$0	1.20
4. Rip Rap (18" depth, D ₅₀ 12")	0	CY	\$0.00	\$0.00	\$0	1.20
5. Plantings/Miscellaneous	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
B. Site Work						
1. Removals						
a. Pavement Removal	1,100	SY	\$12.00	\$13,200.00	\$15,840	1.20
b. Topsoil Stripping	0	LS	\$0.00	\$0.00	\$0	1.20
c. Utility Relocations/Removals	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
d. Fence Removal	0	LF	\$0.00	\$0.00	\$0	1.20
e. SWPPP Items (silt fence, fiber rolls, etc...)	1	ls	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Road and Parking Lot						
a. Site Paving	500	SY	\$100.00	\$50,000.00	\$60,000	1.20
Road Restoration	120	SY	\$100.00	\$12,000.00	\$14,400	1.20
d. Curb and Gutter	135	LF	\$50.00	\$6,750.00	\$8,100	1.20
3. Perimeter Fencing						
a. New Estate Style Fence	750	LF	\$50.00	\$37,500.00	\$45,000	1.20

Subtotal 32 0000 Exterior Improvements \$200,000

33 0000 Utilities

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Site Piping	1	LS	\$100,000.00	\$100,000.00	\$100,000	1.00

Subtotal 33 0000 Utilities \$100,000

40 0000 Process Integration

Item Description	Size	Length	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Process Piping								
90 bend	20		2	ea	\$1,200.00	\$2,400.00	\$2,880	1.20
90 bend	16		8	ea	\$600.00	\$4,800.00	\$5,760	1.20
90 bend	10		2	ea	\$350.00	\$700.00	\$840	1.20
90 bend	8		2	ea	\$250.00	\$500.00	\$600	1.20
90 bend	6		4	ea	\$175.00	\$700.00	\$840	1.20
90 bend	4		2	ea	\$120.00	\$240.00	\$290	1.20
90 bend	3		1	ea	\$100.00	\$100.00	\$120	1.20
Tee	16		10	ea	\$800.00	\$8,000.00	\$9,600	1.20
Tee	10		40	ea	\$550.00	\$22,000.00	\$26,400	1.20
Tee	8		20	ea	\$250.00	\$5,000.00	\$6,000	1.20
Tee	6		5	ea	\$150.00	\$750.00	\$900	1.20
Tee	4		14	ea	\$125.00	\$1,750.00	\$2,100	1.20
Reducer	16x10		2	ea	\$650.00	\$1,300.00	\$1,560	1.20
Mag Flow Meter	10		3	ea	\$4,100.00	\$12,300.00	\$14,760	1.20
Mag Flow Meter	8		1	ea	\$3,100.00	\$3,100.00	\$3,720	1.20
Mag Flow Meter	6		1	ea	\$2,800.00	\$2,800.00	\$3,360	1.20
Mag Flow Meter	4		1	ea	\$2,400.00	\$2,400.00	\$2,880	1.20

WTP Alternative - Yorktown

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 2B

Pipe	20	5	-	ea	\$200.00	\$1,000.00	\$1,200	1.20
Pipe	16	120	-	ea	\$160.00	\$19,200.00	\$23,040	1.20
Pipe	10	144	-	ea	\$100.00	\$14,400.00	\$17,280	1.20
Pipe	8	120	-	ea	\$80.00	\$9,600.00	\$11,520	1.20
Pipe	6	232	-	ea	\$60.00	\$13,920.00	\$16,700	1.20
Pipe	4	180	-	ea	\$40.00	\$7,200.00	\$8,640	1.20
Pipe	3	356	-	ea	\$25.00	\$8,900.00	\$10,680	1.20
BFV w/ Electric	16		1	ea	\$6,500.00	\$6,500.00	\$7,800	1.20
BFV w/ Electric	10		12	ea	\$5,200.00	\$62,400.00	\$74,880	1.20
BFV w/ Electric	8		18	ea	\$4,950.00	\$89,100.00	\$106,920	1.20
BFV w/ Electric	6		24	ea	\$4,750.00	\$114,000.00	\$136,800	1.20
BFV w/ Electric	4		14	ea	\$4,600.00	\$64,400.00	\$77,280	1.20
BFV w/ Manual	20		2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
BFV w/ Manual	16		4	ea	\$2,300.00	\$9,200.00	\$11,040	1.20
BFV w/ Manual	8		2	ea	\$850.00	\$1,700.00	\$2,040	1.20
BFV w/ Manual	6		6	ea	\$775.00	\$4,650.00	\$5,580	1.20
BFV w/ Manual	4		2	ea	\$550.00	\$1,100.00	\$1,320	1.20
Check Valve	16		2	ea	\$13,000.00	\$26,000.00	\$31,200	1.20
Check Valve	6		2	ea	\$1,600.00	\$3,200.00	\$3,840	1.20
Check Valve	4		2	ea	\$1,300.00	\$2,600.00	\$3,120	1.20
Expansion Joints	16		2	ea	\$600.00	\$1,200.00	\$1,440	1.20
Expansion Joints	6		2	ea	\$180.00	\$360.00	\$430	1.20
Expansion Joints	4		2	ea	\$150.00	\$300.00	\$360	1.20
PRV	12		1	ea	\$9,500.00	\$9,500.00	\$11,400	1.20
Static Mixer	16		1	ea	\$3,500.00	\$3,500.00	\$4,200	1.20

B. Instrumentation and Control System Devices (40 91 00)

1.	Chemical Feed System Instrumentation						
a.	Ultrasonic Level Transmitters	5	ea	\$800.00	\$4,000.00	\$4,800	1.20
b.	Permanganate Analyzers	1	ea	\$3,600.00	\$3,600.00	\$4,320	1.20
c.	Mono/Free Ammonia Analyzer	1	ea	\$20,500.00	\$20,500.00	\$24,600	1.20
d.	pH Probes and Transmitters	2	ea	\$2,750.00	\$5,500.00	\$6,600	1.20
2.	Conventional Filter Instrumentation						
a.	Ultrasonic Level Transmitters	3	ea	\$800.00	\$2,400.00	\$2,880	1.20
b.	Level Float Switches	9	ea	\$200.00	\$1,800.00	\$2,160	1.20

C. Instrumentation and Control Control Panels (40 91 10)

1. Control Panels		-					
a.	Master Control Panel	1	ea	\$60,000.00	\$60,000.00	\$60,000	1.00
b.	Control Panel Upgrades	0	ea	\$0.00	\$0.00	\$0	1.00
c.	Network Panel	1	ea	\$30,000.00	\$30,000.00	\$36,000	1.20

Subtotal 40 0000 Process Integration \$799,880

43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Vertical Turbine Pump						
1. PF Influent Pumps						
b. 1500 GPM (125HP)	3	ea	\$59,900.00	\$179,700.00	\$215,640	1.20
2. Chlorine Feed Booster Pumps	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
B. Submersible Liquid Pumps (43 21 39)						
1. Backwash Reclaim Submersible Reclaim Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20
2. Backwash Reclaim Submersible Sludge Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20

Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment \$260,760

WTP Alternative - Yorktown

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 2B

46 0000 Water and Wastewater Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fluoride Chemical Feed System						
1. 450-gallon Bulk Storage Tank	1	ea	\$1,200.00	\$1,200.00	\$1,440	1.20
2. Bulk Chemical Delivery Connection	1	ls	\$800.00	\$800.00	\$960	1.20
3. Centrifugal Transfer Pump (Bulk to Day Tank)	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. 100-gallon Day Storage Tank	1	ea	\$600.00	\$600.00	\$720	1.20
5. Weight Scale	2	ea	\$1,000.00	\$2,000.00	\$2,400	1.20
6. Chemical Feed Pump	2	ea	\$3,500.00	\$7,000.00	\$8,400	1.20
7. Injection Point Tap/Diffuser	1	ea	\$380.00	\$380.00	\$460	1.20
8. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
9. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
B. HMO Feed System						
1. Tonka HMO Feed System	1	ls	\$64,000.00	\$64,000.00	\$76,800	1.20
a. TonkaBlend Feed Panel						
b. Two 1000 Gallon Tanks with Mixer and Stand						
c. Controls, Two Electrical Valves, Freight						
2. Bulk Chemical Delivery Connection	1	ea	\$800.00	\$800.00	\$960	1.20
C. Sodium Permanganate Feed System						
1. 755-gallon Storage Tank	1	e.a.	\$1,700.00	\$1,700.00	\$2,040	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
D. Poly/Orthophosphate Feed System						
1. 155-gallon Storage Tank	1	e.a.	\$650.00	\$650.00	\$780	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
E. Ammonium Sulfate Feed System						
1. 1000-gallon Bulk Tank	1	e.a.	\$2,200.00	\$2,200.00	\$2,640	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	2	e.a.	\$3,500.00	\$7,000.00	\$8,400	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,500.00	\$2,500.00	\$3,000	1.20
F. Chlorine Chemical Feed System (WTF)						
1. Scales	2	e.a.	\$4,000.00	\$8,000.00	\$9,600	1.20
a. Single Cylinder 1 Ton						
2. Chlorine Cylinder Piping, Valves and Accessories	1	l.s.	\$9,000.00	\$9,000.00	\$10,800	1.20
3. Chlorine Gas Scrubber System	1	e.a.	\$128,000.00	\$128,000.00	\$153,600	1.20
4. Hydro Omni-Valve 250 ppd feeder	2	e.a.	\$3,000.00	\$6,000.00	\$7,200	1.20
5. Ejector Assembly, Panel, Valves	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
6. Gas Detector and Accessories	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
G. Chlorine Hoist						
1. Crane Rail and Electric Hoist	1	ea	\$50,000.00	\$50,000.00	\$60,000	1.20
2. Lifting Bar for 1 Ton Cylinder	1	ea	\$1,500.00	\$1,500.00	\$1,800	1.20
H. Filter Equipment						
1. Pressure Filters	3	ea	\$310,000.00	\$930,000.00	\$1,116,000	1.20
I. Filter Air Scour Equipment						
1. PD Airwash Blower	1	ea	\$40,500.00	\$40,500.00	\$48,600	1.20
J. Mixers						
1. Vertical Turbine Mixer for Detention Tank (5 HP)	1	ea	\$39,800.00	\$39,800.00	\$47,760	1.20

Subtotal 46 0000 Water and Wastewater Equipment \$1,598,728

Appendix X

Option 3A – Median Site with Pressure Filters Cost Estimate

WTP Alternative - Median

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 3A

Construction Cost Estimate - Summary

Subtotal 00/01 0000 Contracting and General Requirements	\$746,400
Subtotal 02 0000 Existing Conditions	\$40,000
Subtotal 03 0000 Concrete	\$1,330,000
Subtotal 04 0000 Masonry	\$262,250
Subtotal 05 0000 Metals	\$41,000
Subtotal 06 0000 Carpentry	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$202,800
Subtotal 08 0000 Doors and Windows	\$115,000
Subtotal 09 0000 Finishes	\$110,500
Subtotal 10 0000 Specialties	\$19,000
Subtotal 12 0000 Furnishings	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000
Subtotal 22 0000 Plumbing	\$150,000
Subtotal 23 0000 Mechanical	\$300,000
Subtotal 26 0000 Electrical	\$1,124,710
Subtotal 31 0000 Earthwork	\$1,500,000
Subtotal 32 0000 Exterior Improvements	\$290,000
Subtotal 33 0000 Utilities	\$120,000
Subtotal 40 0000 Process Integration	\$559,440
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment	\$45,120
Subtotal 46 0000 Water and Wastewater Equipment	\$1,366,768
Subtotal	\$8,416,988

00/01 0000 Contracting and General Requirements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Legal/Administrative				0.75%	\$57,529	1.00
B. Mobilization				0.75%	\$57,529	1.00
C. Supervision				1.0%	\$76,706	1.00
D. Temporary Facilities				0.75%	\$57,529	1.00
E. Temporary Utilities				0.75%	\$57,529	1.00
F. Equipment Rental and Misc. Costs				0.75%	\$57,529	1.00
G. Bonding and Insurance				1.2%	\$92,047	1.00
H. Allowances:						
a. Security and Access Control Hardware					\$50,000	1.00
b. Computer Hardware, Software, and Equipment, SCADA Licensing					\$120,000	1.00
c. Instrumentation & Controls Programming					\$120,000	1.00
Subtotal Allowances					\$290,000	
Subtotal 00/01 0000 Contracting and General Requirements					\$746,400	

02 0000 Existing Conditions

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Demolition	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00
B. Dewatering	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
Subtotal 02 0000 Existing Conditions					\$40,000	

03 0000 Concrete

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Cast in Place Concrete	1,900	CY	\$700.00	\$1,330,000.00	\$1,330,000	1.00
Subtotal 03 0000 Concrete					\$1,330,000	

04 0000 Masonry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Brick	5,000	EA	\$20.00	\$100,000.00	\$100,000	1.00
B. 8" CMU	4,000	EA	\$10.00	\$40,000.00	\$40,000	1.00
C. 12" CMU	5,000	EA	\$15.55	\$77,750.00	\$77,750	1.00
D. Cast Stone Coping	1,000	EA	\$44.50	\$44,500.00	\$44,500	1.00
Subtotal 04 0000 Masonry					\$262,250	

WTP Alternative - Median

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 3A

05 0000 Metals

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Metals & Structural Steel	0	LS	\$0.00	\$0.00	\$0	1.00
B. Fiberglass	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
C. Floor Hatches	7	EA	\$3,000.00	\$21,000.00	\$21,000	1.00

Subtotal 05 0000 Metals \$41,000

06 0000 Carpentry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Wood Cabinets	1	LS	\$4,000.00	\$4,000.00	\$4,000	1.00
B. Misc. Carpentry	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 06 0000 Carpentry \$44,000

07 0000 Thermal and Moisture Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Nail Base Roof Insulation	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
B. Cavity Wall Vapor Barrier	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
C. Below Grade Waterproofing	1	LS	\$45,000.00	\$45,000.00	\$45,000	1.00
D. Foundation Insulation	1	LS	\$7,800.00	\$7,800.00	\$7,800	1.00
E. Roofing & Hatch	1	LS	\$90,000.00	\$90,000.00	\$90,000	1.00
F. Caulking	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00

Subtotal 07 0000 Thermal and Moisture Protection \$202,800

08 0000 Doors and Windows

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Doors, Frames & Hard.	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
B. Four Fold Door	0	LS	\$32,000.00	\$0.00	\$0	1.00
C. Alum. Doors & Windows	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 08 0000 Doors and Windows \$115,000

09 0000 Finishes

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Floor Tile & Base	1	LS	\$6,000.00	\$6,000.00	\$6,000	1.00
B. Acoustic Cielings	1	LS	\$2,500.00	\$2,500.00	\$2,500	1.00
C. Acoustic @ Blower	1	LS	\$12,000.00	\$12,000.00	\$12,000	1.00
D. Paintings & Coatings	1	LS	\$50,000.00	\$50,000.00	\$50,000	1.00
E. Flooring System	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 09 0000 Finishes \$110,500

10 0000 Specialties

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plaque & Signs	1	LS	\$18,000.00	\$18,000.00	\$18,000	1.00
B. Toilet & Bath Signs	0	LS	\$1,000.00	\$0.00	\$0	1.00
C. Fire Exsting. & LK. Box	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00

Subtotal 10 0000 Specialties \$19,000

12 0000 Furnishings

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Laboratory Countertops	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00

Subtotal 12 0000 Furnishings \$10,000

WTP Alternative - Median
Opinion of Probable Total Construction Cost
Yorktown - Pressure Filtration Option 3A

21 0000 Fire Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fire Suppression	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
Subtotal 21 0000 Fire Protection					\$40,000	

22 0000 Plumbing

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plumbing	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
Subtotal 22 0000 Plumbing					\$150,000	

23 0000 Mechanical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Mechanical	1	LS	\$300,000.00	\$300,000.00	\$300,000	1.00
Subtotal 23 0000 Mechanical					\$300,000	

26 0000 Electrical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Site Work						
1. Metering Cabinets	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Equipment Concrete Pads/Basements	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
3. Grounding	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
4. 800A Feeder and Fiber in Ductbank	100	LF	\$400.00	\$40,000.00	\$48,000	1.20
5. Generator and Cables	1	EA	\$300,000.00	\$300,000.00	\$360,000	1.20
B. Interior Work						
1. Main Switchboard	1	EA	\$100,000.00	\$100,000.00	\$120,000	1.20
2. Large Junction Boxes	2	EA	\$3,000.00	\$6,000.00	\$7,200	1.20
3. Small Junction Boxes	8	EA	\$2,000.00	\$16,000.00	\$19,200	1.20
4. LED lights	100	EA	\$650.00	\$65,000.00	\$78,000	1.20
5. Receptacles/ Wall Jacks	30	EA	\$500.00	\$15,000.00	\$18,000	1.20
6. Process Terminations	60	EA	\$750.00	\$45,000.00	\$54,000	1.20
7. Fire alarm System	1	EA	\$30,000.00	\$30,000.00	\$36,000	1.20
8. Access Control and Security	1	EA	\$40,000.00	\$40,000.00	\$48,000	1.20
9. Motor Control Centers	7	EA	\$10,000.00	\$70,000.00	\$84,000	1.20
10. Pressure Filter Influent VFDs	0	EA	\$25,000.00	\$0.00	\$0	1.20
11. BW VFD	0	EA	\$35,000.00	\$0.00	\$0	1.20
12. Feeders Less than 60A	800	LF	\$40.00	\$32,000.00	\$38,400	1.20
13. 100A Feeder	200	LF	\$65.00	\$13,000.00	\$15,600	1.20
14. Analog I/O	3000	LF	\$4.25	\$12,750.00	\$15,300	1.20
15. Digital I/O	3000	LF	\$5.00	\$15,000.00	\$18,000	1.20
16. Cat 6	1500	LF	\$5.00	\$7,500.00	\$9,000	1.20
17. Distribution Panelboard	4	EA	\$6,000.00	\$24,000.00	\$28,800	1.20
18. Step Down Dry Type Transformer	1	EA	\$15,000.00	\$15,000.00	\$18,000	1.20
19. 30A Disconnect Switches (NEMA 12)	25	EA	\$320.27	\$8,006.63	\$9,610	1.20
20. HVAC Equipment	25	EA	\$500.00	\$12,500.00	\$15,000	1.20
21. Unit Heaters	15	EA	\$1,500.00	\$22,500.00	\$27,000	1.20
22. Lighting Panelboards	3	EA	\$5,000.00	\$15,000.00	\$18,000	1.20
23. Electrical Distribution Equipment	4	EA	\$750.00	\$3,000.00	\$3,600	1.20
Subtotal 26 0000 Electrical					\$1,124,710	

31 0000 Earthwork

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Building Excavation						
1. Common Excavation, (EV) (HAUL OFF)	6,902	CY	\$30.00	\$207,071.11	\$248,490	1.20
2. Common Excavation, TOPSOIL STRIP (EV)	247	CY	\$15.00	\$3,705.00	\$4,450	1.20
3. Common Excavation, STEP FOOTING (EV) (HAUL OFF)	0	CY	\$15.00	\$0.00	\$0	1.20
4. Shoring System	600	LF	\$1,800.00	\$1,080,000.00	\$1,080,000	1.00
5. Traffic Control	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
B. Building Backfill						
1. Granular Engineered Backfill	2985	CY	\$20.00	\$59,697.78	\$71,640	1.20
2. Exterior Backfill	500	CY	\$20.00	\$10,000.00	\$12,000	1.20
Subtotal 31 0000 Earthwork					\$1,500,000	

WTP Alternative - Median

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 3A

32 0000 Exterior Improvements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Landscaping						
1. Site Grading	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
2. Seeding	1,052	SY	\$5.00	\$5,260.56	\$6,310	1.20
3. Rip Rap (4"-6" River Rock)	0	SY	\$0.00	\$0.00	\$0	1.20
4. Rip Rap (18" depth, D ₅₀ 12")	0	CY	\$0.00	\$0.00	\$0	1.20
5. Plantings/Miscellaneous	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
B. Site Work						
1. Removals						
a. Pavement Removal	944	SY	\$12.00	\$11,333.33	\$13,600	1.20
b. Topsoil Stripping	0	LS	\$0.00	\$0.00	\$0	1.20
c. Utility Relocations/Removals	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
d. Fence Removal	0	LF	\$0.00	\$0.00	\$0	1.20
e. SWPPP Items (silt fence, fiber rolls, etc...)	1	ls	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Road and Parking Lot						
a. Geotextile Fabric	0	SY	\$80.00	\$0.00	\$0	1.20
b. Class 5 Gravel	0	CY	\$80.00	\$0.00	\$0	1.20
c. 4" Bituminous Pavement	944	SY	\$50.00	\$47,200.00	\$56,640	1.20
d. Curb and Gutter	820	LF	\$6.00	\$4,920.00	\$5,900	1.20
e. 6" Concrete Pavement	180	SY	\$35.00	\$6,300.00	\$7,560	1.20
f. PaveDrain	0	SF		\$0.00	\$0	1.20
3. Perimeter Fencing						
a. New Chain Link Fence	0	LF	\$50.00	\$0.00	\$0	1.20
d. New Barbed/Woven Fence	0	LF	\$0.00	\$0.00	\$0	1.20
c. New Estate Style Fence	650	LF	\$50.00	\$32,500.00	\$39,000	1.20
d. New Fence Gates	0	LF	\$0.00	\$0.00	\$0	1.20
e. Bollards	50	EA	\$300.00	\$15,000.00	\$18,000	1.20
4. Staging Area Repairs						
a. Mill 1.5" Existing Parking Lot	3,000	SY	\$4.00	\$12,000.00	\$14,400	1.20
b. 1.5" Bituminous Overlay	3,000	SY	\$25.00	\$75,000.00	\$90,000	1.20

Subtotal 32 0000 Exterior Improvements \$290,000

33 0000 Utilities

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. WTP Influent Water Main	1	LS	\$25,000.00	\$25,000.00	\$25,000	1.00
B. WTP Effluent Water Main	1	LS	\$25,000.00	\$25,000.00	\$25,000	1.00
C. Storm Sewer	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
D. Sanitary Sewer	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 33 0000 Utilities \$120,000

40 0000 Process Integration

Item Description	Size	Length	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Process Piping								
90 bend	20		2	ea	\$1,200.00	\$2,400.00	\$2,880	1.20
90 bend	18		6	ea	\$925.00	\$5,550.00	\$6,660	1.20
90 bend	16		7	ea	\$600.00	\$4,200.00	\$5,040	1.20
90 bend	10		4	ea	\$350.00	\$1,400.00	\$1,680	1.20
90 bend	8		0	ea	\$250.00	\$0.00	\$0	1.20
90 bend	6		6	ea	\$175.00	\$1,050.00	\$1,260	1.20
90 bend	4		3	ea	\$120.00	\$360.00	\$430	1.20
90 bend	3		0	ea	\$100.00	\$0.00	\$0	1.20
Tee	20		1	ea	\$1,025.00	\$1,025.00	\$1,230	1.20
Tee	18		7	ea	\$950.00	\$6,650.00	\$7,980	1.20
Tee	16		11	ea	\$800.00	\$8,800.00	\$10,560	1.20
Tee	12		3	ea	\$650.00	\$1,950.00	\$2,340	1.20
Tee	10		3	ea	\$550.00	\$1,650.00	\$1,980	1.20
Tee	8		0	ea	\$250.00	\$0.00	\$0	1.20
Tee	6		5	ea	\$150.00	\$750.00	\$900	1.20
Tee	4		1	ea	\$125.00	\$125.00	\$150	1.20
Mag Flow Meter	18		1	ea	\$10,000.00	\$10,000.00	\$12,000	1.20
Mag Flow Meter	16		1	ea	\$8,800.00	\$8,800.00	\$10,560	1.20
Mag Flow Meter	10		3	ea	\$4,100.00	\$12,300.00	\$14,760	1.20
Mag Flow Meter	6		1	ea	\$2,800.00	\$2,800.00	\$3,360	1.20
Mag Flow Meter	4		1	ea	\$2,400.00	\$2,400.00	\$2,880	1.20

WTP Alternative - Median

Opinion of Probable Total Construction Cost
Yorktown - Pressure Filtration Option 3A

Pipe	20	28	-	ea	\$200.00	\$5,600.00	\$6,720	1.20
Pipe	18	77	-	ea	\$180.00	\$13,860.00	\$16,630	1.20
Pipe	16	210	-	ea	\$160.00	\$33,600.00	\$40,320	1.20
Pipe	10	40	-	ea	\$100.00	\$4,000.00	\$4,800	1.20
Pipe	8	0	-	ea	\$80.00	\$0.00	\$0	1.20
Pipe	6	240	-	ea	\$60.00	\$14,400.00	\$17,280	1.20
Pipe	4	45	-	ea	\$40.00	\$1,800.00	\$2,160	1.20
Pipe	3	220	-	ea	\$25.00	\$5,500.00	\$6,600	1.20
BFV w/ Electric	20		3	ea	\$7,200.00	\$21,600.00	\$25,920	1.20
BFV w/ Electric	18		4	ea	\$7,000.00	\$28,000.00	\$33,600	1.20
BFV w/ Electric	10		9	ea	\$5,200.00	\$46,800.00	\$56,160	1.20
BFV w/ Electric	8		0	ea	\$4,950.00	\$0.00	\$0	1.20
BFV w/ Electric	6		1	ea	\$4,750.00	\$4,750.00	\$5,700	1.20
BFV w/ Electric	4		5	ea	\$4,600.00	\$23,000.00	\$27,600	1.20
BFV w/ Manual	20		0	ea	\$3,000.00	\$0.00	\$0	1.20
BFV w/ Manual	18		1	ea	\$2,700.00	\$2,700.00	\$3,240	1.20
BFV w/ Manual	16		8	ea	\$2,300.00	\$18,400.00	\$22,080	1.20
BFV w/ Manual	12		3	ea	\$1,200.00	\$3,600.00	\$4,320	1.20
BFV w/ Manual	8		0	ea	\$850.00	\$0.00	\$0	1.20
BFV w/ Manual	6		2	ea	\$775.00	\$1,550.00	\$1,860	1.20
BFV w/ Manual	4		2	ea	\$550.00	\$1,100.00	\$1,320	1.20
Check Valve	18		1	ea	\$9,500.00	\$9,500.00	\$11,400	1.20
Check Valve	12		3	ea	\$4,700.00	\$14,100.00	\$16,920	1.20
Check Valve	6		2	ea	\$1,800.00	\$3,600.00	\$4,320	1.20
Check Valve	4		2	ea	\$1,600.00	\$3,200.00	\$3,840	1.20
Expansion Joints	18		1	ea	\$750.00	\$750.00	\$900	1.20
Expansion Joints	12		3	ea	\$375.00	\$1,125.00	\$1,350	1.20
Expansion Joints	6		2	ea	\$180.00	\$360.00	\$430	1.20
Expansion Joints	4		2	ea	\$150.00	\$300.00	\$360	1.20
PRV	12		1	ea	\$9,500.00	\$9,500.00	\$11,400	1.20
Static Mixer	16		1	ea	\$3,500.00	\$3,500.00	\$4,200	1.20

B. Instrumentation and Control System Devices (40 91 00)

1.	Chemical Feed System Instrumentation						
a.	Ultrasonic Level Transmitters	5	ea	\$800.00	\$4,000.00	\$4,800	1.20
b.	Permanganate Analyzers	1	ea	\$3,600.00	\$3,600.00	\$4,320	1.20
c.	Mono/Free Ammonia Analyzer	1	ea	\$20,500.00	\$20,500.00	\$24,600	1.20
d.	pH Probes and Transmitters	2	ea	\$2,750.00	\$5,500.00	\$6,600	1.20
2.	Conventional Filter Instrumentation						
a.	Ultrasonic Level Transmitters	3	ea	\$800.00	\$2,400.00	\$2,880	1.20
b.	Level Float Switches	9	ea	\$200.00	\$1,800.00	\$2,160	1.20

C. Instrumentation and Control Control Panels (40 91 10)

1.	Control Panels	-					
	a. Master Control Panel	1	ea	\$60,000.00	\$60,000.00	\$60,000	1.00
	b. Control Panel Upgrades	0	ea	\$0.00	\$0.00	\$0	1.00
	c. Network Panel	1	ea	\$30,000.00	\$30,000.00	\$36,000	1.20

Subtotal 40 0000 Process Integration \$559,440

43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Vertical Turbine Pump						
1. PF Influent Pumps						
a. 1500 GPM (125HP)	0	ea	\$59,900.00	\$0.00	\$0	1.20
2. Chlorine Feed Booster Pumps	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
B. Submersible Liquid Pumps (43 21 39)						
1. Backwash Reclaim Submersible Reclaim Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20
2. Backwash Reclaim Submersible Sludge Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20

Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment \$45,120

WTP Alternative - Median

Opinion of Probable Total Construction Cost

Yorktown - Pressure Filtration Option 3A

46 0000 Water and Wastewater Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fluoride Chemical Feed System						
1. 450-gallon Bulk Storage Tank	1	ea	\$1,200.00	\$1,200.00	\$1,440	1.20
2. Bulk Chemical Delivery Connection	1	ls	\$800.00	\$800.00	\$960	1.20
3. Centrifugal Transfer Pump (Bulk to Day Tank)	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. 100-gallon Day Storage Tank	1	ea	\$600.00	\$600.00	\$720	1.20
5. Weight Scale	2	ea	\$1,000.00	\$2,000.00	\$2,400	1.20
6. Chemical Feed Pump	2	ea	\$3,500.00	\$7,000.00	\$8,400	1.20
7. Injection Point Tap/Diffuser	1	ea	\$380.00	\$380.00	\$460	1.20
8. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
9. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
B. HMO Feed System						
1. Tonka HMO Feed System	1	ls	\$64,000.00	\$64,000.00	\$76,800	1.20
a. TonkaBlend Feed Panel						
b. Two 1000 Gallon Tanks with Mixer and Stand						
c. Controls, Two Electrical Valves, Freight						
2. Bulk Chemical Delivery Connection	1	ea	\$800.00	\$800.00	\$960	1.20
C. Sodium Permanganate Feed System						
1. 755-gallon Storage Tank	1	e.a.	\$1,700.00	\$1,700.00	\$2,040	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
D. Poly/Orthophosphate Feed System						
1. 155-gallon Storage Tank	1	e.a.	\$650.00	\$650.00	\$780	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
E. Ammonium Sulfate Feed System						
1. 1000-gallon Bulk Tank	1	e.a.	\$2,200.00	\$2,200.00	\$2,640	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	2	e.a.	\$3,500.00	\$7,000.00	\$8,400	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,500.00	\$2,500.00	\$3,000	1.20
F. Chlorine Chemical Feed System (WTF)						
1. Scales	4	e.a.	\$1,000.00	\$4,000.00	\$4,800	1.20
a. Single Cylinder 150 lb						
2. Chlorine Cylinder Piping, Valves and Accessories	1	l.s.	\$9,000.00	\$9,000.00	\$10,800	1.20
3. Automatic Shutoff	1	e.a.	\$30,000.00	\$30,000.00	\$36,000	1.20
4. Hydro Omni-Valve 250 ppd feeder	2	e.a.	\$3,000.00	\$6,000.00	\$7,200	1.20
5. Ejector Assembly, Panel, Valves	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
6. Gas Detector and Accessories	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
G. Chlorine Hoist						
1. Crane Rail and Electric Hoist	0	ea	\$50,000.00	\$0.00	\$0	1.20
2. Lifting Bar for 1 Ton Cylinder	0	ea	\$1,500.00	\$0.00	\$0	1.20
H. Filter Equipment						
1. Pressure Filters	3	ea	\$310,000.00	\$930,000.00	\$1,116,000	1.20
I. Filter Air Scour Equipment						
1. PD Airwash Blower	1	ea	\$40,500.00	\$40,500.00	\$48,600	1.20
J. Mixers						
1. Vertical Turbine Mixer for Detention Tank (5 HP)	0	ea	\$39,800.00	\$0.00	\$0	1.20

Subtotal 46 0000 Water and Wastewater Equipment \$1,366,768

Appendix Y

Option 4A – Fred Richards Site with Gravity Filters Cost Estimate

Construction Cost Estimate - Summary

Subtotal 00/01 0000 Contracting and General Requirements	\$726,165
Subtotal 02 0000 Existing Conditions	\$40,000
Subtotal 03 0000 Concrete	\$1,680,000
Subtotal 04 0000 Masonry	\$262,250
Subtotal 05 0000 Metals	\$208,000
Subtotal 06 0000 Carpentry	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$218,800
Subtotal 08 0000 Doors and Windows	\$187,000
Subtotal 09 0000 Finishes	\$135,500
Subtotal 10 0000 Specialties	\$20,000
Subtotal 12 0000 Furnishings	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000
Subtotal 22 0000 Plumbing	\$150,000
Subtotal 23 0000 Mechanical	\$300,000
Subtotal 26 0000 Electrical	\$1,256,710
Subtotal 31 0000 Earthwork	\$340,000
Subtotal 32 0000 Exterior Improvements	\$410,000
Subtotal 33 0000 Utilities	\$120,000
Subtotal 40 0000 Process Integration	\$744,900
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment	\$393,600
Subtotal 46 0000 Water and Wastewater Equipment	\$769,748
Subtotal	\$8,056,673

00/01 0000 Contracting and General Requirements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Legal/Administrative				0.75%	\$54,979	1.00
B. Mobilization				0.75%	\$54,979	1.00
C. Supervision				1.0%	\$73,305	1.00
D. Temporary Facilities				0.75%	\$54,979	1.00
E. Temporary Utilities				0.75%	\$54,979	1.00
F. Equipment Rental and Misc. Costs				0.75%	\$54,979	1.00
G. Bonding and Insurance				1.2%	\$87,966	1.00
H. Allowances:						
a. Security and Access Control Hardware					\$50,000	1.00
b. Computer Hardware, Software, and Equipment, SCADA Licensing					\$120,000	1.00
c. Instrumentation & Controls Programming					\$120,000	1.00
Subtotal Allowances					\$290,000	
Subtotal 00/01 0000 Contracting and General Requirements					\$726,165	

02 0000 Existing Conditions

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Demolition	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00
B. Dewatering	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
Subtotal 02 0000 Existing Conditions					\$40,000	

03 0000 Concrete

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Cast in Place Concrete	2,400	CY	\$700.00	\$1,680,000.00	\$1,680,000	1.00
Subtotal 03 0000 Concrete					\$1,680,000	

04 0000 Masonry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Brick	5,000	EA	\$20.00	\$100,000.00	\$100,000	1.00
B. 8" CMU	4,000	EA	\$10.00	\$40,000.00	\$40,000	1.00
C. 12" CMU	5,000	EA	\$15.55	\$77,750.00	\$77,750	1.00
D. Cast Stone Coping	1,000	EA	\$44.50	\$44,500.00	\$44,500	1.00
Subtotal 04 0000 Masonry					\$262,250	

05 0000 Metals

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Metals & Structural Steel	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
B. Fiberglass	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
C. Floor Hatches	6	EA	\$3,000.00	\$18,000.00	\$18,000	1.00

Subtotal 05 0000 Metals \$208,000

06 0000 Carpentry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Wood Cabinets	1	LS	\$4,000.00	\$4,000.00	\$4,000	1.00
B. Misc. Carpentry	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 06 0000 Carpentry \$44,000

07 0000 Thermal and Moisture Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Nail Base Roof Insulation	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
B. Cavity Wall Vapor Barrier	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
C. Below Grade Waterproofing	1	LS	\$45,000.00	\$45,000.00	\$45,000	1.00
D. Foundation Insulation	1	LS	\$7,800.00	\$7,800.00	\$7,800	1.00
E. Roofing & Hatch	1	LS	\$90,000.00	\$90,000.00	\$90,000	1.00
F. Caulking	1	LS	\$26,000.00	\$26,000.00	\$26,000	1.00

Subtotal 07 0000 Thermal and Moisture Protection \$218,800

08 0000 Doors and Windows

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Doors, Frames & Hard.	1	LS	\$95,000.00	\$95,000.00	\$95,000	1.00
B. Four Fold Door	1	LS	\$32,000.00	\$32,000.00	\$32,000	1.00
C. Alum. Doors & Windows	1	LS	\$60,000.00	\$60,000.00	\$60,000	1.00

Subtotal 08 0000 Doors and Windows \$187,000

09 0000 Finishes

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Floor Tile & Base	1	LS	\$6,000.00	\$6,000.00	\$6,000	1.00
B. Acoustic Cielings	1	LS	\$2,500.00	\$2,500.00	\$2,500	1.00
C. Acoustic @ Blower	1	LS	\$12,000.00	\$12,000.00	\$12,000	1.00
D. Paintings & Coatings	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
E. Flooring System	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 09 0000 Finishes \$135,500

10 0000 Specialties

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plaque & Signs	1	LS	\$18,000.00	\$18,000.00	\$18,000	1.00
B. Toilet & Bath Signs	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00
C. Fire Exsting. & LK. Box	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00

Subtotal 10 0000 Specialties \$20,000

12 0000 Furnishings

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Laboratory Countertops	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00

Subtotal 12 0000 Furnishings \$10,000

21 0000 Fire Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fire Suppression	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
Subtotal 21 0000 Fire Protection					\$40,000	

22 0000 Plumbing

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plumbing	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
Subtotal 22 0000 Plumbing					\$150,000	

23 0000 Mechanical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Mechanical	1	LS	\$300,000.00	\$300,000.00	\$300,000	1.00
Subtotal 23 0000 Mechanical					\$300,000	

26 0000 Electrical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Site Work						
1. Metering Cabinets	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Equipment Concrete Pads/Basements	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
3. Grounding	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
4. 800A Feeder and Fiber in Ductbank	100	LF	\$400.00	\$40,000.00	\$48,000	1.20
5. Generator and Cables	1	EA	\$300,000.00	\$300,000.00	\$360,000	1.20
B. Interior Work						
1. Main Switchboard	1	EA	\$100,000.00	\$100,000.00	\$120,000	1.20
2. Large Junction Boxes	2	EA	\$3,000.00	\$6,000.00	\$7,200	1.20
3. Small Junction Boxes	8	EA	\$2,000.00	\$16,000.00	\$19,200	1.20
4. LED lights	100	EA	\$650.00	\$65,000.00	\$78,000	1.20
5. Receptacles/ Wall Jacks	30	EA	\$500.00	\$15,000.00	\$18,000	1.20
6. Process Terminations	60	EA	\$750.00	\$45,000.00	\$54,000	1.20
7. Fire alarm System	1	EA	\$30,000.00	\$30,000.00	\$36,000	1.20
8. Access Control and Security	1	EA	\$40,000.00	\$40,000.00	\$48,000	1.20
9. Motor Control Centers	7	EA	\$10,000.00	\$70,000.00	\$84,000	1.20
10. High Service VFDs	3	EA	\$25,000.00	\$75,000.00	\$90,000	1.20
11. BWV VFD	1	EA	\$35,000.00	\$35,000.00	\$42,000	1.20
12. Feeders Less than 60A	800	LF	\$40.00	\$32,000.00	\$38,400	1.20
13. 100A Feeder	200	LF	\$65.00	\$13,000.00	\$15,600	1.20
14. Analog I/O	3000	LF	\$4.25	\$12,750.00	\$15,300	1.20
15. Digital I/O	3000	LF	\$5.00	\$15,000.00	\$18,000	1.20
16. Cat 6	1500	LF	\$5.00	\$7,500.00	\$9,000	1.20
17. Distribution Panelboard	4	EA	\$6,000.00	\$24,000.00	\$28,800	1.20
18. Step Down Dry Type Transformer	1	EA	\$15,000.00	\$15,000.00	\$18,000	1.20
19. 30A Disconnect Switches (NEMA 12)	25	EA	\$320.27	\$8,006.63	\$9,610	1.20
20. HVAC Equipment	25	EA	\$500.00	\$12,500.00	\$15,000	1.20
21. Unit Heaters	15	EA	\$1,500.00	\$22,500.00	\$27,000	1.20
22. Lighting Panelboards	3	EA	\$5,000.00	\$15,000.00	\$18,000	1.20
23. Electrical Distribution Equipment	4	EA	\$750.00	\$3,000.00	\$3,600	1.20
Subtotal 26 0000 Electrical					\$1,256,710	

31 0000 Earthwork

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Building Excavation						
2. Common Excavation, (EV) (HAUL OFF)	6,000	CY	\$30.00	\$180,000.00	\$216,000	1.20
3. Common Excavation, TOPSOIL STRIP (EV)	500	CY	\$15.00	\$7,500.00	\$9,000	1.20
4. Common Excavation, STEP FOOTING (EV) (HAUL OFF)	0	CY	\$15.00	\$0.00	\$0	1.20
B. Building Backfill						
1. Granular Engineered Backfill	556	CY	\$20.00	\$11,111.11	\$13,330	1.20
2. Exterior Backfill	4166.666667	CY	\$20.00	\$83,333.33	\$100,000	1.20
Subtotal 31 0000 Earthwork					\$340,000	

32 0000 Exterior Improvements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Landscaping						
1. Site Grading	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Seeding	1,000	SY	\$3.00	\$3,000.00	\$3,600	1.20
3. Rip Rap (4"-6" River Rock)	0	SY	\$0.00	\$0.00	\$0	1.20
4. Rip Rap (18" depth, D ₅₀ 12")	0	CY	\$0.00	\$0.00	\$0	1.20
5. Plantings/Miscellaneous	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
B. Site Work						
1. Removals						
a. Pavement Removal	3,189	SY	\$12.00	\$38,266.67	\$45,920	1.20
b. Topsoil Stripping	0	LS	\$0.00	\$0.00	\$0	1.20
c. Utility Relocations/Removals	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
d. Fence Removal	0	LF	\$5.00	\$0.00	\$0	1.20
e. SWPPP Items (silt fence, fiber rolls, etc...)	1	LS	\$15,000.00	\$15,000.00	\$18,000	1.20
2. Road and Parking Lot						
a. Geotextile Fabric	3,189	SY	\$1.25	\$3,986.11	\$4,780	1.20
b. Class 5 Gravel	531	CY	\$80.00	\$42,518.52	\$51,020	1.20
c. 4" Bituminous Pavement	3,189	SY	\$50.00	\$159,444.44	\$191,330	1.20
d. Curb and Gutter	450	LF	\$6.00	\$2,700.00	\$3,240	1.20
e. 6" Concrete Pavement	750	SY	\$35.00	\$26,250.00	\$31,500	1.20
f. PaveDrain	0	SF	\$0.00	\$0.00	\$0	1.20
3. Perimeter Fencing						
a. New Chain Link Fence	0	LF	\$50.00	\$0.00	\$0	1.20
d. New Barbed/Woven Fence	0	LF	\$0.00	\$0.00	\$0	1.20
c. New Estate Style Fence	600	LF	\$0.00	\$0.00	\$0	1.20
d. New Fence Gates	40	LF	\$0.00	\$0.00	\$0	1.20
4. Staging Area Repairs						
a. Mill 1.5" Existing Parking Lot	787	SY	\$4.00	\$3,148.00	\$3,780	1.20
b. 1.5" Bituminous Overlay	787	SY	\$25.00	\$19,675.00	\$23,610	1.20

Subtotal 32 0000 Exterior Improvements \$410,000

33 0000 Utilities

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. WTP Influent Water Main	1	LS	\$25,000.00	\$25,000.00	\$25,000	1.00
B. WTP Effluent Water Main	1	LS	\$25,000.00	\$25,000.00	\$25,000	1.00
C. Storm Sewer	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
D. Sanitary Sewer	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 33 0000 Utilities \$120,000

40 0000 Process Integration

Item Description	Size	Length	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Process Piping								
90 bend	20		5	ea	\$1,200.00	\$6,000.00	\$7,800	1.30
90 bend	18		4	ea	\$925.00	\$3,700.00	\$4,810	1.30
90 bend	16		10	ea	\$600.00	\$6,000.00	\$7,800	1.30
90 bend	10		4	ea	\$350.00	\$1,400.00	\$1,820	1.30
90 bend	8		6	ea	\$250.00	\$1,500.00	\$1,950	1.30
90 bend	6		10	ea	\$175.00	\$1,750.00	\$2,280	1.30
90 bend	4		10	ea	\$120.00	\$1,200.00	\$1,560	1.30
90 bend	3		0	ea	\$100.00	\$0.00	\$0	1.30
Tee	20		5	ea	\$1,025.00	\$5,125.00	\$6,660	1.30
Tee	18		7	ea	\$950.00	\$6,650.00	\$8,650	1.30
Tee	16		6	ea	\$800.00	\$4,800.00	\$6,240	1.30
Tee	12		6	ea	\$650.00	\$3,900.00	\$5,070	1.30
Tee	10		6	ea	\$550.00	\$3,300.00	\$4,290	1.30
Tee	8		6	ea	\$250.00	\$1,500.00	\$1,950	1.30
Tee	6		5	ea	\$150.00	\$750.00	\$980	1.30
Tee	4		1	ea	\$125.00	\$125.00	\$160	1.30
Mag Flow Meter	18		1	ea	\$10,000.00	\$10,000.00	\$13,000	1.30
Mag Flow Meter	16		1	ea	\$8,800.00	\$8,800.00	\$11,440	1.30
Mag Flow Meter	10		3	ea	\$4,100.00	\$12,300.00	\$15,990	1.30
Mag Flow Meter	6		1	ea	\$2,800.00	\$2,800.00	\$3,640	1.30
Mag Flow Meter	4		1	ea	\$2,400.00	\$2,400.00	\$3,120	1.30

Pipe	20	176	-	ea	\$200.00	\$35,200.00	\$45,760	1.30
Pipe	18	100	-	ea	\$180.00	\$18,000.00	\$23,400	1.30
Pipe	16	160	-	ea	\$160.00	\$25,600.00	\$33,280	1.30
Pipe	10	80	-	ea	\$100.00	\$8,000.00	\$10,400	1.30
Pipe	8	0	-	ea	\$80.00	\$0.00	\$0	1.30
Pipe	6	200	-	ea	\$60.00	\$12,000.00	\$15,600	1.30
Pipe	4	80	-	ea	\$40.00	\$3,200.00	\$4,160	1.30
Pipe	3	250	-	ea	\$25.00	\$6,250.00	\$8,130	1.30
BFV w/ Electric	20		4	ea	\$8,850.00	\$35,400.00	\$46,020	1.30
BFV w/ Electric	18		4	ea	\$7,000.00	\$28,000.00	\$36,400	1.30
BFV w/ Electric	16		4	ea	\$6,500.00	\$26,000.00	\$33,800	1.30
BFV w/ Electric	10		9	ea	\$5,200.00	\$46,800.00	\$60,840	1.30
BFV w/ Electric	8		0	ea	\$4,950.00	\$0.00	\$0	1.30
BFV w/ Electric	6		1	ea	\$4,750.00	\$4,750.00	\$6,180	1.30
BFV w/ Electric	4		5	ea	\$4,600.00	\$23,000.00	\$29,900	1.30
BFV w/ Manual	20		2	ea	\$3,000.00	\$6,000.00	\$7,800	1.30
BFV w/ Manual	18		1	ea	\$2,700.00	\$2,700.00	\$3,510	1.30
BFV w/ Manual	16		6	ea	\$2,300.00	\$13,800.00	\$17,940	1.30
BFV w/ Manual	12		3	ea	\$1,200.00	\$3,600.00	\$4,680	1.30
BFV w/ Manual	8		0	ea	\$850.00	\$0.00	\$0	1.30
BFV w/ Manual	6		2	ea	\$775.00	\$1,550.00	\$2,020	1.30
BFV w/ Manual	4		2	ea	\$550.00	\$1,100.00	\$1,430	1.30
Check Valve	18		1	ea	\$15,000.00	\$15,000.00	\$19,500	1.30
Check Valve	12		3	ea	\$6,000.00	\$18,000.00	\$23,400	1.30
Check Valve	6		2	ea	\$1,600.00	\$3,200.00	\$4,160	1.30
Check Valve	4		2	ea	\$1,300.00	\$2,600.00	\$3,380	1.30
Expansion Joints	18		1	ea	\$750.00	\$750.00	\$980	1.30
Expansion Joints	12		3	ea	\$375.00	\$1,125.00	\$1,460	1.30
Expansion Joints	6		2	ea	\$180.00	\$360.00	\$470	1.30
Expansion Joints	4		2	ea	\$150.00	\$300.00	\$390	1.30
PRV	12		1	ea	\$25,000.00	\$25,000.00	\$32,500	1.30
Static Mixer	16		1	ea	\$10,000.00	\$10,000.00	\$13,000	1.30

B. Instrumentation and Control System Devices (40 91 00)

1.	Chemical Feed System Instrumentation						
a.	Ultrasonic Level Transmitters	5	ea	\$800.00	\$4,000.00	\$4,800	1.20
b.	Permanganate Analyzers	1	ea	\$3,600.00	\$3,600.00	\$4,320	1.20
c.	Mono/Free Ammonia Analyzer	1	ea	\$20,500.00	\$20,500.00	\$24,600	1.20
d.	pH Probes and Transmitters	2	ea	\$2,750.00	\$5,500.00	\$6,600	1.20
2.	Conventional Filter Instrumentation						
a.	Ultrasonic Level Transmitters	7	ea	\$800.00	\$5,600.00	\$6,720	1.20
b.	Level Float Switches	9	ea	\$200.00	\$1,800.00	\$2,160	1.20

C. Instrumentation and Control Control Panels (40 91 10)

1. Control Panels	-						
a. Master Control Panel	1		ea	\$60,000.00	\$60,000.00	\$60,000	1.00
b. Control Panel Upgrades	0		ea	\$0.00	\$0.00	\$0	1.00
c. Network Panel	1		ea	\$30,000.00	\$30,000.00	\$36,000	1.20

Subtotal 40 0000 Process Integration \$744,900

43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Vertical Turbine Pump						
1. High Service Pumps						
a. 1500 GPM (125HP)	3	ea	\$59,900.00	\$179,700.00	\$215,640	1.20
2. Backwash Supply Pump	1	ea	\$110,700.00	\$110,700.00	\$132,840	1.20
3. Chlorine Feed Booster Pumps	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
B. Submersible Liquid Pumps (43 21 39)						
1. Backwash Reclaim Submersible Reclaim Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20
2. Backwash Reclaim Submersible Sludge Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20

Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment \$393,600

46 0000 Water and Wastewater Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fluoride Chemical Feed System						
1. 450-gallon Bulk Storage Tank	1	ea	\$1,200.00	\$1,200.00	\$1,440	1.20
2. Bulk Chemical Delivery Connection	1	ls	\$800.00	\$800.00	\$960	1.20
3. Centrifugal Transfer Pump (Bulk to Day Tank)	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. 100-gallon Day Storage Tank	1	ea	\$600.00	\$600.00	\$720	1.20
5. Weight Scale	2	ea	\$1,000.00	\$2,000.00	\$2,400	1.20
6. Chemical Feed Pump	2	ea	\$3,500.00	\$7,000.00	\$8,400	1.20
7. Injection Point Tap/Diffuser	1	ea	\$380.00	\$380.00	\$460	1.20
8. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
9. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
B. HMO Feed System						
1. Tonka HMO Feed System	1	ls	\$64,000.00	\$64,000.00	\$76,800	1.20
a. TonkaBlend Feed Panel						
b. Two 1000 Gallon Tanks with Mixer and Stand						
c. Controls, Two Electrical Valves, Freight						
2. Bulk Chemical Delivery Connection	1	ea	\$800.00	\$800.00	\$960	1.20
C. Sodium Permanganate Feed System						
1. 755-gallon Storage Tank	1	e.a.	\$1,700.00	\$1,700.00	\$2,040	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
D. Poly/Orthophosphate Feed System						
1. 155-gallon Storage Tank	1	e.a.	\$650.00	\$650.00	\$780	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
E. Ammonium Sulfate Feed System						
1. 1000-gallon Bulk Tank	1	e.a.	\$2,200.00	\$2,200.00	\$2,640	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	2	e.a.	\$3,500.00	\$7,000.00	\$8,400	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,500.00	\$2,500.00	\$3,000	1.20
F. Chlorine Chemical Feed System (WTF)						
1. Scales	2	e.a.	\$4,000.00	\$8,000.00	\$9,600	1.20
a. Single Cylinder 1 Ton						
2. Chlorine Cylinder Piping, Valves and Accessories	1	l.s.	\$9,000.00	\$9,000.00	\$10,800	1.20
3. Chlorine Gas Scrubber System	1	e.a.	\$128,000.00	\$128,000.00	\$153,600	1.20
4. Hydro Omni-Valve 250 ppd feeder	2	e.a.	\$3,000.00	\$6,000.00	\$7,200	1.20
5. Ejector Assembly, Panel, Valves	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
6. Gas Detector and Accessories	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
G. Chlorine Hoist						
1. Crane Rail and Electric Hoist	1	ea	\$50,000.00	\$50,000.00	\$60,000	1.20
2. Lifting Bar for 1 Ton Cylinder	1	ea	\$1,500.00	\$1,500.00	\$1,800	1.20
F. Filter Equipment						
1. Sand Media	1,463	CF	\$10.00	\$14,630.00	\$17,560	1.20
2. Anthracite Media	975	CF	\$20.00	\$19,500.00	\$23,400	1.20
3. Filter Troughs	168	LF	\$350.00	\$58,800.00	\$70,560	1.20
4. Underdrain / In-Cell Airwash	975	SF	\$150.00	\$146,250.00	\$175,500	1.20
I. Filter Air Scour Equipment						
1. PD Airwash Blower	1	ea	\$40,500.00	\$40,500.00	\$48,600	1.20
J. Mixers						
1. Vertical Turbine Mixer for Detention Tank (5 HP)	1	ea	\$39,800.00	\$39,800.00	\$47,760	1.20

Subtotal 46 0000 Water and Wastewater Equipment \$769,748

Appendix Z

Option 4B – Fred Richards Site with Pressure Filters Cost Estimate

Construction Cost Estimate - Summary

Subtotal 00/01 0000 Contracting and General Requirements	\$734,847
Subtotal 02 0000 Existing Conditions	\$40,000
Subtotal 03 0000 Concrete	\$1,332,800
Subtotal 04 0000 Masonry	\$262,250
Subtotal 05 0000 Metals	\$41,000
Subtotal 06 0000 Carpentry	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$202,800
Subtotal 08 0000 Doors and Windows	\$147,000
Subtotal 09 0000 Finishes	\$110,500
Subtotal 10 0000 Specialties	\$20,000
Subtotal 12 0000 Furnishings	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000
Subtotal 22 0000 Plumbing	\$150,000
Subtotal 23 0000 Mechanical	\$300,000
Subtotal 26 0000 Electrical	\$1,256,710
Subtotal 31 0000 Earthwork	\$330,000
Subtotal 32 0000 Exterior Improvements	\$410,000
Subtotal 33 0000 Utilities	\$120,000
Subtotal 40 0000 Process Integration	\$799,880
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment	\$260,760
Subtotal 46 0000 Water and Wastewater Equipment	\$1,598,728
Subtotal	\$8,211,275

00/01 0000 Contracting and General Requirements

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Legal/Administrative				0.75%	\$56,073	1.00
B. Mobilization				0.75%	\$56,073	1.00
C. Supervision				1.0%	\$74,764	1.00
D. Temporary Facilities				0.75%	\$56,073	1.00
E. Temporary Utilities				0.75%	\$56,073	1.00
F. Equipment Rental and Misc. Costs				0.75%	\$56,073	1.00
G. Bonding and Insurance				1.2%	\$89,717	1.00
H. Allowances:						
a. Security and Access Control Hardware					\$50,000	1.00
b. Computer Hardware, Software, and Equipment, SCADA Licensing					\$120,000	1.00
c. Instrumentation & Controls Programming					\$120,000	1.00
Subtotal Allowances					\$290,000	

Subtotal 00/01 0000 Contracting and General Requirements \$734,847

02 0000 Existing Conditions

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Demolition	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00
B. Dewatering	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
Subtotal 02 0000 Existing Conditions					\$40,000	

03 0000 Concrete

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. General Cast in Place Concrete	1,904	CY	\$700.00	\$1,332,800.00	\$1,332,800	1.00
Subtotal 03 0000 Concrete					\$1,332,800	

04 0000 Masonry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Brick	5,000	EA	\$20.00	\$100,000.00	\$100,000	1.00
B. 8" CMU	4,000	EA	\$10.00	\$40,000.00	\$40,000	1.00
C. 12" CMU	5,000	EA	\$15.55	\$77,750.00	\$77,750	1.00
D. Cast Stone Coping	1,000	EA	\$44.50	\$44,500.00	\$44,500	1.00
Subtotal 04 0000 Masonry					\$262,250	

WTP Alternative - Fred Richards

Opinion of Probable Total Construction Cost

Fred Richards - Pressure Filtration Option 4B

05 0000 Metals

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Misc. Metals & Structural Steel	0	LS	\$0.00	\$0.00	\$0	1.00
B. Fiberglass	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
C. Floor Hatches	7	EA	\$3,000.00	\$21,000.00	\$21,000	1.00

Subtotal 05 0000 Metals \$41,000

06 0000 Carpentry

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Wood Cabinets	1	LS	\$4,000.00	\$4,000.00	\$4,000	1.00
B. Misc. Carpentry	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 06 0000 Carpentry \$44,000

07 0000 Thermal and Moisture Protection

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Nail Base Roof Insulation	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
B. Cavity Wall Vapor Barrier	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00
C. Below Grade Waterproofing	1	LS	\$45,000.00	\$45,000.00	\$45,000	1.00
D. Foundation Insulation	1	LS	\$7,800.00	\$7,800.00	\$7,800	1.00
E. Roofing & Hatch	1	LS	\$90,000.00	\$90,000.00	\$90,000	1.00
F. Caulking	1	LS	\$20,000.00	\$20,000.00	\$20,000	1.00

Subtotal 07 0000 Thermal and Moisture Protection \$202,800

08 0000 Doors and Windows

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Doors, Frames & Hard.	1	LS	\$75,000.00	\$75,000.00	\$75,000	1.00
B. Four Fold Door	1	LS	\$32,000.00	\$32,000.00	\$32,000	1.00
C. Alum. Doors & Windows	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 08 0000 Doors and Windows \$147,000

09 0000 Finishes

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Floor Tile & Base	1	LS	\$6,000.00	\$6,000.00	\$6,000	1.00
B. Acoustic Cielings	1	LS	\$2,500.00	\$2,500.00	\$2,500	1.00
C. Acoustic @ Blower	1	LS	\$12,000.00	\$12,000.00	\$12,000	1.00
D. Paintings & Coatings	1	LS	\$50,000.00	\$50,000.00	\$50,000	1.00
E. Flooring System	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 09 0000 Finishes \$110,500

10 0000 Specialties

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plaque & Signs	1	LS	\$18,000.00	\$18,000.00	\$18,000	1.00
B. Toilet & Bath Signs	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00
C. Fire Exsting. & LK. Box	1	LS	\$1,000.00	\$1,000.00	\$1,000	1.00

Subtotal 10 0000 Specialties \$20,000

12 0000 Furnishings

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Laboratory Countertops	1	LS	\$10,000.00	\$10,000.00	\$10,000	1.00

Subtotal 12 0000 Furnishings \$10,000

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fire Suppression	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00
Subtotal 21 0000 Fire Protection					\$40,000	

22 0000 Plumbing

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Plumbing	1	LS	\$150,000.00	\$150,000.00	\$150,000	1.00
Subtotal 22 0000 Plumbing					\$150,000	

23 0000 Mechanical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Mechanical	1	LS	\$300,000.00	\$300,000.00	\$300,000	1.00
Subtotal 23 0000 Mechanical					\$300,000	

26 0000 Electrical

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Site Work						
1. Metering Cabinets	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Equipment Concrete Pads/Basements	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
3. Grounding	1	EA	\$10,000.00	\$10,000.00	\$12,000	1.20
4. 800A Feeder and Fiber in Ductbank	100	LF	\$400.00	\$40,000.00	\$48,000	1.20
5. Generator and Cables	1	EA	\$300,000.00	\$300,000.00	\$360,000	1.20
B. Interior Work						
1. Main Switchboard	1	EA	\$100,000.00	\$100,000.00	\$120,000	1.20
2. Large Junction Boxes	2	EA	\$3,000.00	\$6,000.00	\$7,200	1.20
3. Small Junction Boxes	8	EA	\$2,000.00	\$16,000.00	\$19,200	1.20
4. LED lights	100	EA	\$650.00	\$65,000.00	\$78,000	1.20
5. Receptacles/ Wall Jacks	30	EA	\$500.00	\$15,000.00	\$18,000	1.20
6. Process Terminations	60	EA	\$750.00	\$45,000.00	\$54,000	1.20
7. Fire alarm System	1	EA	\$30,000.00	\$30,000.00	\$36,000	1.20
8. Access Control and Security	1	EA	\$40,000.00	\$40,000.00	\$48,000	1.20
9. Motor Control Centers	7	EA	\$10,000.00	\$70,000.00	\$84,000	1.20
10. Pressure Filter Influent VFDs	3	EA	\$25,000.00	\$75,000.00	\$90,000	1.20
11. BW VFD	1	EA	\$35,000.00	\$35,000.00	\$42,000	1.20
12. Feeders Less than 60A	800	LF	\$40.00	\$32,000.00	\$38,400	1.20
13. 100A Feeder	200	LF	\$65.00	\$13,000.00	\$15,600	1.20
14. Analog I/O	3000	LF	\$4.25	\$12,750.00	\$15,300	1.20
15. Digital I/O	3000	LF	\$5.00	\$15,000.00	\$18,000	1.20
16. Cat 6	1500	LF	\$5.00	\$7,500.00	\$9,000	1.20
17. Distribution Panelboard	4	EA	\$6,000.00	\$24,000.00	\$28,800	1.20
18. Step Down Dry Type Transformer	1	EA	\$15,000.00	\$15,000.00	\$18,000	1.20
19. 30A Disconnect Switches (NEMA 12)	25	EA	\$320.27	\$8,006.63	\$9,610	1.20
20. HVAC Equipment	25	EA	\$500.00	\$12,500.00	\$15,000	1.20
21. Unit Heaters	15	EA	\$1,500.00	\$22,500.00	\$27,000	1.20
22. Lighting Panelboards	3	EA	\$5,000.00	\$15,000.00	\$18,000	1.20
23. Electrical Distribution Equipment	4	EA	\$750.00	\$3,000.00	\$3,600	1.20
Subtotal 26 0000 Electrical					\$1,256,710	

31 0000 Earthwork

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Building Excavation						
2. Common Excavation, (EV) (HAUL OFF)	6,408	CY	\$30.00	\$192,251.11	\$230,700	1.20
3. Common Excavation, TOPSOIL STRIP (EV)	0	CY	\$15.00	\$0.00	\$0	1.20
4. Common Excavation, STEP FOOTING (EV) (HAUL OFF)	0	CY	\$15.00	\$0.00	\$0	1.20
B. Building Backfill						
1. Granular Engineered Backfill	996	CY	\$20.00	\$19,925.93	\$23,910	1.20
2. Exterior Backfill	2778	CY	\$20.00	\$55,555.56	\$66,670	1.20
Subtotal 31 0000 Earthwork					\$330,000	

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Landscaping						
1. Site Grading	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
2. Seeding	1,000	SY	\$3.00	\$3,000.00	\$3,600	1.20
3. Rip Rap (4"-6" River Rock)	0	SY	\$0.00	\$0.00	\$0	1.20
4. Rip Rap (18" depth, D ₅₀ 12")	0	CY	\$0.00	\$0.00	\$0	1.20
5. Plantings/Miscellaneous	1	LS	\$5,000.00	\$5,000.00	\$6,000	1.20
B. Site Work						
1. Removals						
a. Pavement Removal	3,189	SY	\$12.00	\$38,266.67	\$45,920	1.20
b. Topsoil Stripping	0	LS	\$0.00	\$0.00	\$0	1.20
c. Utility Relocations/Removals	1	LS	\$10,000.00	\$10,000.00	\$12,000	1.20
d. Fence Removal	0	LF	\$5.00	\$0.00	\$0	1.20
e. SWPPP Items (silt fence, fiber rolls, etc...)	1	LS	\$15,000.00	\$15,000.00	\$18,000	1.20
2. Road and Parking Lot						
a. Geotextile Fabric	3,189	SY	\$1.25	\$3,986.11	\$4,780	1.20
b. Class 5 Gravel	531	CY	\$80.00	\$42,518.52	\$51,020	1.20
c. 4" Bituminous Pavement	3,189	SY	\$50.00	\$159,444.44	\$191,330	1.20
d. Curb and Gutter	450	LF	\$6.00	\$2,700.00	\$3,240	1.20
e. 6" Concrete Pavement	750	SY	\$35.00	\$26,250.00	\$31,500	1.20
f. PaveDrain	0	SF	\$0.00	\$0.00	\$0	1.20
3. Perimeter Fencing						
a. New Chain Link Fence	0	LF	\$50.00	\$0.00	\$0	1.20
d. New Barbed/Woven Fence	0	LF	\$0.00	\$0.00	\$0	1.20
c. New Estate Style Fence	600	LF	\$0.00	\$0.00	\$0	1.20
d. New Fence Gates	40	LF	\$0.00	\$0.00	\$0	1.20
4. Staging Area Repairs						
a. Mill 1.5" Existing Parking Lot	787	SY	\$4.00	\$3,148.00	\$3,780	1.20
b. 1.5" Bituminous Overlay	787	SY	\$25.00	\$19,675.00	\$23,610	1.20

Subtotal 32 0000 Exterior Improvements \$410,000

33 0000 Utilities

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. WTP Influent Water Main	1	LS	\$25,000.00	\$25,000.00	\$25,000	1.00
B. WTP Effluent Water Main	1	LS	\$25,000.00	\$25,000.00	\$25,000	1.00
C. Storm Sewer	1	LS	\$30,000.00	\$30,000.00	\$30,000	1.00
D. Sanitary Sewer	1	LS	\$40,000.00	\$40,000.00	\$40,000	1.00

Subtotal 33 0000 Utilities \$120,000

40 0000 Process Integration

Item Description	Size	Length	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Process Piping								
90 bend	20		2	ea	\$1,200.00	\$2,400.00	\$2,880	1.20
90 bend	16		8	ea	\$600.00	\$4,800.00	\$5,760	1.20
90 bend	10		2	ea	\$350.00	\$700.00	\$840	1.20
90 bend	8		2	ea	\$250.00	\$500.00	\$600	1.20
90 bend	6		4	ea	\$175.00	\$700.00	\$840	1.20
90 bend	4		2	ea	\$120.00	\$240.00	\$290	1.20
90 bend	3		1	ea	\$100.00	\$100.00	\$120	1.20
Tee	16		10	ea	\$800.00	\$8,000.00	\$9,600	1.20
Tee	10		40	ea	\$550.00	\$22,000.00	\$26,400	1.20
Tee	8		20	ea	\$250.00	\$5,000.00	\$6,000	1.20
Tee	6		5	ea	\$150.00	\$750.00	\$900	1.20
Tee	4		14	ea	\$125.00	\$1,750.00	\$2,100	1.20
Reducer	16x10		2	ea	\$650.00	\$1,300.00	\$1,560	1.20
Mag Flow Meter	10		3	ea	\$4,100.00	\$12,300.00	\$14,760	1.20
Mag Flow Meter	8		1	ea	\$3,100.00	\$3,100.00	\$3,720	1.20
Mag Flow Meter	6		1	ea	\$2,800.00	\$2,800.00	\$3,360	1.20
Mag Flow Meter	4		1	ea	\$2,400.00	\$2,400.00	\$2,880	1.20

WTP Alternative - Fred Richards

Opinion of Probable Total Construction Cost

Fred Richards - Pressure Filtration Option 4B

Pipe	20	5	-	ea	\$200.00	\$1,000.00	\$1,200	1.20
Pipe	16	120	-	ea	\$160.00	\$19,200.00	\$23,040	1.20
Pipe	10	144	-	ea	\$100.00	\$14,400.00	\$17,280	1.20
Pipe	8	120	-	ea	\$80.00	\$9,600.00	\$11,520	1.20
Pipe	6	232	-	ea	\$60.00	\$13,920.00	\$16,700	1.20
Pipe	4	180	-	ea	\$40.00	\$7,200.00	\$8,640	1.20
Pipe	3	356	-	ea	\$25.00	\$8,900.00	\$10,680	1.20
BFV w/ Electric	16		1	ea	\$6,500.00	\$6,500.00	\$7,800	1.20
BFV w/ Electric	10		12	ea	\$5,200.00	\$62,400.00	\$74,880	1.20
BFV w/ Electric	8		18	ea	\$4,950.00	\$89,100.00	\$106,920	1.20
BFV w/ Electric	6		24	ea	\$4,750.00	\$114,000.00	\$136,800	1.20
BFV w/ Electric	4		14	ea	\$4,600.00	\$64,400.00	\$77,280	1.20
BFV w/ Manual	20		2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
BFV w/ Manual	16		4	ea	\$2,300.00	\$9,200.00	\$11,040	1.20
BFV w/ Manual	8		2	ea	\$850.00	\$1,700.00	\$2,040	1.20
BFV w/ Manual	6		6	ea	\$775.00	\$4,650.00	\$5,580	1.20
BFV w/ Manual	4		2	ea	\$550.00	\$1,100.00	\$1,320	1.20
Check Valve	16		2	ea	\$13,000.00	\$26,000.00	\$31,200	1.20
Check Valve	6		2	ea	\$1,600.00	\$3,200.00	\$3,840	1.20
Check Valve	4		2	ea	\$1,300.00	\$2,600.00	\$3,120	1.20
Expansion Joints	16		2	ea	\$600.00	\$1,200.00	\$1,440	1.20
Expansion Joints	6		2	ea	\$180.00	\$360.00	\$430	1.20
Expansion Joints	4		2	ea	\$150.00	\$300.00	\$360	1.20
PRV	12		1	ea	\$9,500.00	\$9,500.00	\$11,400	1.20
Static Mixer	16		1	ea	\$3,500.00	\$3,500.00	\$4,200	1.20

B. Instrumentation and Control System Devices (40 91 00)

1. Chemical Feed System Instrumentation								
a. Ultrasonic Level Transmitters		5		ea	\$800.00	\$4,000.00	\$4,800	1.20
b. Permanganate Analyzers		1		ea	\$3,600.00	\$3,600.00	\$4,320	1.20
c. Mono/Free Ammonia Analyzer		1		ea	\$20,500.00	\$20,500.00	\$24,600	1.20
d. pH Probes and Transmitters		2		ea	\$2,750.00	\$5,500.00	\$6,600	1.20
2. Conventional Filter Instrumentation								
a. Ultrasonic Level Transmitters		3		ea	\$800.00	\$2,400.00	\$2,880	1.20
b. Level Float Switches		9		ea	\$200.00	\$1,800.00	\$2,160	1.20

C. Instrumentation and Control Control Panels (40 91 10)

1. Control Panels		-						
a. Master Control Panel		1		ea	\$60,000.00	\$60,000.00	\$60,000	1.00
b. Control Panel Upgrades		0		ea	\$0.00	\$0.00	\$0	1.00
c. Network Panel		1		ea	\$30,000.00	\$30,000.00	\$36,000	1.20

Subtotal 40 0000 Process Integration \$799,880

43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Vertical Turbine Pump						
1. PF Influent Pumps						
a. 1500 GPM (125HP)	3	ea	\$59,900.00	\$179,700.00	\$215,640	1.20
2. Chlorine Feed Booster Pumps	2	ea	\$3,000.00	\$6,000.00	\$7,200	1.20
B. Submersible Liquid Pumps (43 21 39)						
1. Backwash Reclaim Submersible Reclaim Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20
2. Backwash Reclaim Submersible Sludge Pumps	2	ea	\$7,900.00	\$15,800.00	\$18,960	1.20

Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage Equipment \$260,760

WTP Alternative - Fred Richards

Opinion of Probable Total Construction Cost

Fred Richards - Pressure Filtration Option 4B

46 0000 Water and Wastewater Equipment

Item Description	Quantity	Unit	Unit Cost	Cost	Installed Cost	Multiplier
A. Fluoride Chemical Feed System						
1. 450-gallon Bulk Storage Tank	1	ea	\$1,200.00	\$1,200.00	\$1,440	1.20
2. Bulk Chemical Delivery Connection	1	ls	\$800.00	\$800.00	\$960	1.20
3. Centrifugal Transfer Pump (Bulk to Day Tank)	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. 100-gallon Day Storage Tank	1	ea	\$600.00	\$600.00	\$720	1.20
5. Weight Scale	2	ea	\$1,000.00	\$2,000.00	\$2,400	1.20
6. Chemical Feed Pump	2	ea	\$3,500.00	\$7,000.00	\$8,400	1.20
7. Injection Point Tap/Diffuser	1	ea	\$380.00	\$380.00	\$460	1.20
8. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
9. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
B. HMO Feed System						
1. Tonka HMO Feed System	1	ls	\$64,000.00	\$64,000.00	\$76,800	1.20
a. TonkaBlend Feed Panel						
b. Two 1000 Gallon Tanks with Mixer and Stand						
c. Controls, Two Electrical Valves, Freight						
2. Bulk Chemical Delivery Connection	1	ea	\$800.00	\$800.00	\$960	1.20
C. Sodium Permanganate Feed System						
1. 755-gallon Storage Tank	1	e.a.	\$1,700.00	\$1,700.00	\$2,040	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
D. Poly/Orthophosphate Feed System						
1. 155-gallon Storage Tank	1	e.a.	\$650.00	\$650.00	\$780	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	1	e.a.	\$3,500.00	\$3,500.00	\$4,200	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,000.00	\$2,000.00	\$2,400	1.20
E. Ammonium Sulfate Feed System						
1. 1000-gallon Bulk Tank	1	e.a.	\$2,200.00	\$2,200.00	\$2,640	1.20
2. Bulk Chemical Delivery Connection	1	e.a.	\$800.00	\$800.00	\$960	1.20
3. Weight Scale	1	ea	\$1,000.00	\$1,000.00	\$1,200	1.20
4. Chemical Feed Pump	2	e.a.	\$3,500.00	\$7,000.00	\$8,400	1.20
5. Injection Point Quill	1	e.a.	\$380.00	\$380.00	\$456	1.20
6. 1/8" Polyethylene Tubing Installed in Carrier	150	lf	\$3.50	\$525.00	\$630	1.20
7. Piping, Appurtenances, and Valves	1	ls	\$2,500.00	\$2,500.00	\$3,000	1.20
F. Chlorine Chemical Feed System (WTF)						
1. Scales	2	e.a.	\$4,000.00	\$8,000.00	\$9,600	1.20
a. Single Cylinder 1 Ton						
2. Chlorine Cylinder Piping, Valves and Accessories	1	l.s.	\$9,000.00	\$9,000.00	\$10,800	1.20
3. Chlorine Gas Scrubber System	1	e.a.	\$128,000.00	\$128,000.00	\$153,600	1.20
4. Hydro Omni-Valve 250 ppd feeder	2	e.a.	\$3,000.00	\$6,000.00	\$7,200	1.20
5. Ejector Assembly, Panel, Valves	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
6. Gas Detector and Accessories	1	e.a.	\$3,000.00	\$3,000.00	\$3,600	1.20
G. Chlorine Hoist						
1. Crane Rail and Electric Hoist	1	ea	\$50,000.00	\$50,000.00	\$60,000	1.20
2. Lifting Bar for 1 Ton Cylinder	1	ea	\$1,500.00	\$1,500.00	\$1,800	1.20
H. Filter Equipment						
1. Pressure Filters	3	ea	\$310,000.00	\$930,000.00	\$1,116,000	1.20
I. Filter Air Scour Equipment						
1. PD Airwash Blower	1	ea	\$40,500.00	\$40,500.00	\$48,600	1.20
J. Mixers						
1. Vertical Turbine Mixer for Detention Tank (5 HP)	1	ea	\$39,800.00	\$39,800.00	\$47,760	1.20

Subtotal 46 0000 Water and Wastewater Equipment \$1,598,728

Appendix AA

Summary of Total Project Costs for All Options

Edina WTP No. 5 Design AE2S Project #P05177-2016-000 WTP Construction, Integration, and Optional Premium Costs Opinion of Probable Total Construction Cost			Revision: 9/21/2017					
Edina WTP No. 5 Opinion of Probable Construction Cost								
Site Site Option	Southdale		York Town		Median		Fred Richards	
	1A - Gravity	1B - Pressure	1C - Gravity*	2A - Gravity	2B - Pressure	3A - Pressure	4A - Gravity	4B - Pressure
Subtotal 00/01 0000 Contracting and General Requirements	\$757,105	\$763,883	\$699,990	\$719,620	\$726,398	\$746,400	\$726,165	\$734,847
Subtotal 02 0000 Existing Conditions	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000
Subtotal 03 0000 Concrete	\$1,680,000	\$1,332,800	\$1,260,000	\$1,680,000	\$1,332,800	\$1,330,000	\$1,680,000	\$1,332,800
Subtotal 04 0000 Masonry	\$262,250	\$262,250	\$262,250	\$262,250	\$262,250	\$262,250	\$262,250	\$262,250
Subtotal 05 0000 Metals	\$208,000	\$41,000	\$208,000	\$208,000	\$41,000	\$41,000	\$208,000	\$41,000
Subtotal 06 0000 Carpentry	\$44,000	\$44,000	\$44,000	\$44,000	\$44,000	\$44,000	\$44,000	\$44,000
Subtotal 07 0000 Thermal and Moisture Protection	\$218,800	\$202,800	\$218,800	\$218,800	\$202,800	\$202,800	\$218,800	\$202,800
Subtotal 08 0000 Doors and Windows	\$187,000	\$147,000	\$187,000	\$187,000	\$147,000	\$115,000	\$187,000	\$147,000
Subtotal 09 0000 Finishes	\$135,500	\$110,500	\$135,500	\$135,500	\$110,500	\$110,500	\$135,500	\$110,500
Subtotal 10 0000 Specialties	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$19,000	\$20,000	\$20,000
Subtotal 12 0000 Furnishings	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Subtotal 21 0000 Fire Protection	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000
Subtotal 22 0000 Plumbing	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000	\$150,000
Subtotal 23 0000 Mechanical	\$300,000	\$300,000	\$300,000	\$300,000	\$300,000	\$300,000	\$300,000	\$300,000
Subtotal 26 0000 Electrical	\$1,256,710	\$1,214,710	\$1,256,710	\$1,256,710	\$1,214,710	\$1,124,710	\$1,256,710	\$1,256,710
Subtotal 31 0000 Earthwork	\$1,090,000	\$1,090,000	\$360,000	\$460,000	\$460,000	\$1,500,000	\$340,000	\$330,000
Subtotal 32 0000 Exterior Improvements	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$290,000	\$410,000	\$410,000
Subtotal 33 0000 Utilities	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$120,000	\$120,000	\$120,000
Subtotal 40 0000 Process Integration	\$744,900	\$799,880	\$744,900	\$744,900	\$799,880	\$559,440	\$744,900	\$799,880
Subtotal 43 0000 Process Gas and Liquid Handling, Purification, and Storage	\$393,600	\$260,760	\$355,680	\$393,600	\$260,760	\$45,120	\$393,600	\$260,760
Subtotal 46 0000 Water and Wastewater Equipment	\$769,748	\$1,598,728	\$997,748	\$769,748	\$1,598,728	\$1,366,768	\$769,748	\$1,598,728
WTP No. 5 Subtotal	\$8,607,613	\$8,728,311	\$7,590,578	\$7,940,128	\$8,060,826	\$8,416,988	\$8,056,673	\$8,211,275
Required Integration Costs								
Raw Water Pipeline	\$145,000	\$145,000	\$145,000	\$65,000	\$65,000	\$35,000	\$2,300,000	\$2,300,000
Finished Water Pipeline	\$55,000	\$55,000	\$55,000	\$90,000	\$90,000	\$135,000	\$1,700,000	\$1,700,000
Sanitary and Storm Sewer Relocation				\$1,750,000	\$1,750,000	\$1,000,000		
Distribution System Improvements				\$1,500,000	\$1,500,000			
Well 5 Rehab	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Well 18 Rehab	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000	\$100,000
Required Integration Subtotal	\$400,000	\$400,000	\$400,000	\$3,605,000	\$3,605,000	\$1,370,000	\$4,200,000	\$4,200,000
Contingencies 15%								
	\$1,351,142	\$1,369,247	\$1,198,587	\$1,731,769	\$1,749,874	\$1,468,048	\$1,838,501	\$1,861,691
Estimated Total Construction Costs	\$10,358,755	\$10,497,558	\$9,189,165	\$13,276,897	\$13,415,700	\$11,255,036	\$14,095,174	\$14,272,967
WTP Engineering Design Phase Services 10%	\$1,035,876	\$1,049,756	\$911,000	\$1,327,690	\$1,341,570	\$1,125,504	\$1,409,517	\$1,427,297
WTP Construction Phase Services 5%	\$517,938	\$524,878	\$459,458	\$663,845	\$670,785	\$562,752	\$704,759	\$713,648
Estimated Total Project Costs	\$11,912,568	\$12,072,192	\$10,559,623	\$15,268,432	\$15,428,056	\$12,943,292	\$16,209,450	\$16,413,912
* Option 1C Engineering Design Phase Services estimate is consistent with the Design and Bidding Phase Services Letter Agreement, dated September 21, 2017								
Optional Premium Costs								
Chlorine Alternatives								
On Site Generation	\$379,400	\$379,400	\$379,400	\$379,400	\$379,400		\$379,400	\$379,400
Aeration								
Forced Draft Aeration	\$350,000	\$350,000	\$350,000	\$350,000	\$350,000		\$350,000	\$350,000
Misc								
Improved structural integrity	\$500,000	\$500,000	\$500,000					
Well 5 Conversion to Submersible	\$100,000	\$100,000	\$100,000			\$100,000		
Chlorine Scrubber						\$90,000		

Appendix AB

Option 1C Site Architectural Renderings

Iteration 1



WATER TREATMENT PLANT #5

VIEW FROM FRANCE AVE.





WATER TREATMENT PLANT #5

VIEW FROM FRANCE AVE.





WATER TREATMENT PLANT #5

AERIAL - S.E. CORNER





WATER TREATMENT PLANT #5

AERIAL - N.W. CORNER





WATER TREATMENT PLANT #5

AERIAL - S.W. CORNER



Iteration 2



WATER TREATMENT PLANT #5

VIEW FROM FRANCE AVE.





WATER TREATMENT PLANT #5

VIEW FROM FRANCE AVE.





WATER TREATMENT PLANT #5

AERIAL - S.E. CORNER





WATER TREATMENT PLANT #5

AERIAL - N.W. CORNER





WATER TREATMENT PLANT #5

AERIAL - S.W. CORNER

