

Protecting Our Water Environment



Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 22-21

TUNNEL AND RESERVOIR PLAN

UPPER DES PLAINES TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2021

July 2022

Kari K. Steele
President

Barbara J. McGowan
Vice President

Marcelino Garcia
Chairman of Finance

Cameron Davis

Kimberly Du Buclet

Josina Morita

Chakena D. Perry

Eira L. Corral Sepúlveda

Mariyana T. Spyropoulos

Metropolitan Water Reclamation District of Greater Chicago

CECIL LUE-HING RESEARCH AND DEVELOPMENT COMPLEX
6001 WEST PERSHING ROAD CICERO, ILLINOIS 60804-4112

Edward W. Podczewinski, P.E.

Director of Monitoring and Research

July 22, 2022

Mr. Sanjay Sofat
Bureau of Water
Illinois Environmental Protection Agency
P. O. Box 19276
Springfield, IL 62794-9276

Dear Mr. Sofat:

Subject: Tunnel and Reservoir Plan Upper Des Plaines Tunnel System Annual
Groundwater Monitoring Report for 2021

The report entitled "Tunnel and Reservoir Plan Upper Des Plaines Tunnel System Annual
Groundwater Monitoring Report for 2021" is attached.

Very truly yours,



Albert E. Cox, Ph.D.

Environmental Monitoring and Research Manager
Monitoring and Research Department

AC:EE:lf

Attachment

cc: Mr. Ryan Bahr (USEPA Region 5 - WC15J) - (2)

Mr. E. Podczewinski

Dr. H. Zhang

cc w/o att: Mr. J. Murray

Mr. S. Serafino

Metropolitan Water Reclamation District of Greater Chicago
100 East Erie Street Chicago, Illinois 60611-2803 (312) 751-5600

**TUNNEL AND RESERVOIR PLAN
UPPER DES PLAINES TUNNEL SYSTEM
ANNUAL GROUNDWATER MONITORING REPORT
FOR 2021**

By

**Essam El-Naggar
Environmental Soil Scientist**

**Guanglong Tian
Principal Environmental Scientist**

**Albert Cox
Environmental Monitoring and Research Manager**

**Heng Zhang
Assistant Director of Monitoring and Research
Environmental Monitoring and Research Division**

TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	ii
LIST OF FIGURES	iii
LIST OF ABBREVIATIONS	iv
ANNUAL DATA FOR MONITORING AND OBSERVATION WELLS	1
Introduction	1
Modified Groundwater Monitoring Program	1
Summary of Data for Monitoring and Observation Wells	1
Monitoring Wells.	1
Observation Wells.	4

LIST OF TABLES

<u>Table No.</u>		<u>Page</u>
1	Analysis of Chemical and Physical Parameters and Fecal Coliform in Groundwater Sampled from Fill Event Monitoring Wells in the Upper Des Plaines Tunnel System of the Tunnel and Reservoir Plan During 2021	3
2	Analysis of Chemical and Physical Parameters and Fecal Coliform in Groundwater Sampled from Annual Monitoring Wells in the Upper Des Plaines Tunnel System of the Tunnel and Reservoir Plan Sampled During 2021	5
3	Groundwater Elevations for Observation Wells MW-1 Through MW-9 in the Upper Des Plaines Tunnel System of the Tunnel and Reservoir Plan Measured During 2021	6

LIST OF FIGURES

<u>Figure No.</u>		<u>Page</u>
1	Map of Monitoring and Observation Wells in the Upper Des Plaines Tunnel System	2
2	Minimum, Mean, and Maximum Water Elevations for Monitoring/Observation Wells MW-1 Through MW-9 in the Upper Des Plaines Tunnel System of the Tunnel and Reservoir Plan Measured During 2021	7

LIST OF ABBREVIATIONS

°C	degrees Celsius
CCD	Chicago City Datum
CFU	colony forming units
Cl ⁻	chloride
District	Metropolitan Water Reclamation District of Greater Chicago
EC	electrical conductivity
FC	fecal coliform
ft	feet
hr	hour
IEPA	Illinois Environmental Protection Agency
L	liter
m	meter
mg	milligram
mS	millisiemens
NH ₃ -N	ammonia nitrogen
SO ₄ ²⁻	sulfate
TARP	Tunnel and Reservoir Plan
TDS	total dissolved solids
Temp.	temperature
TOC	total organic carbon

ANNUAL DATA FOR MONITORING AND OBSERVATION WELLS

Introduction

This system consists of two subsystems, Upper Des Plaines (UDP) 20 and UDP 21. The UDP 20 subsystem contains six monitoring wells, MW-1 through MW-6, while the UDP 21 subsystem contains three monitoring wells, MW-7 through MW-9 ([Figure 1](#)). Groundwater elevations in the monitoring wells were measured during each sampling event. In addition, groundwater elevations were measured biweekly since these wells also function as observation wells. The monitoring wells were sampled based on the modified groundwater monitoring program for the Metropolitan Water Reclamation District of Greater Chicago's (District)'s Tunnel and Reservoir Plan (TARP) as briefly described below.

Modified Groundwater Monitoring Program

In a letter dated May 14, 2021, the Illinois Environmental Protection Agency (IEPA) approved a modified TARP groundwater monitoring program for the District's Calumet, Mainstream, Des Plaines, and Upper Des Plaines tunnel systems effective January 2021. The modification of the TARP groundwater monitoring program was based on the key findings of a three-year fill event-based groundwater monitoring study conducted by the District from 2017 to 2019 and submitted to IEPA in a report dated July 30, 2020.

Under the modified monitoring program, four UDP wells (MW-5, MW-6, MW-7, and MW-8) are sampled for two tunnel fill events per year, usually following storm events. Fecal coliform in these wells were detected in 10 percent or more of samples collected during 1995 – 2013. The criterion that triggers fill event sampling is that the water from UDP Tunnel starts to enter the Gloria Alitto Majewski Reservoir. Sampling is conducted during the first week following each fill event. For the first fill event, samples are analyzed for all parameters including pH, temperature (Temp.), electrical conductivity (EC), total dissolved solids (TDS), hardness, ammonia nitrogen (NH₃-N), total organic carbon (TOC), chloride (Cl⁻), sulfate (SO₄²⁻), and fecal coliform (FC). For the second fill event, samples are analyzed for FC only.

The other five wells associated with the UDP Tunnel System, referred to as annual monitoring wells, are sampled once per year. These wells had FC detected in less than 10 percent of samples during the period 1995 – 2013.

Summary of Data for Monitoring and Observation Wells

Monitoring Wells. During 2021, the fill event-based sampling was conducted at two events occurring on June 25 and October 25, 2021. The groundwater analytical data and physical parameters for the fill event-based monitoring wells MW-5, MW-6, MW-7, and MW-8 are presented in [Table 1](#).

FIGURE 1: MAP OF MONITORING AND OBSERVATION WELLS IN THE UPPER DES PLAINES TUNNEL SYSTEM

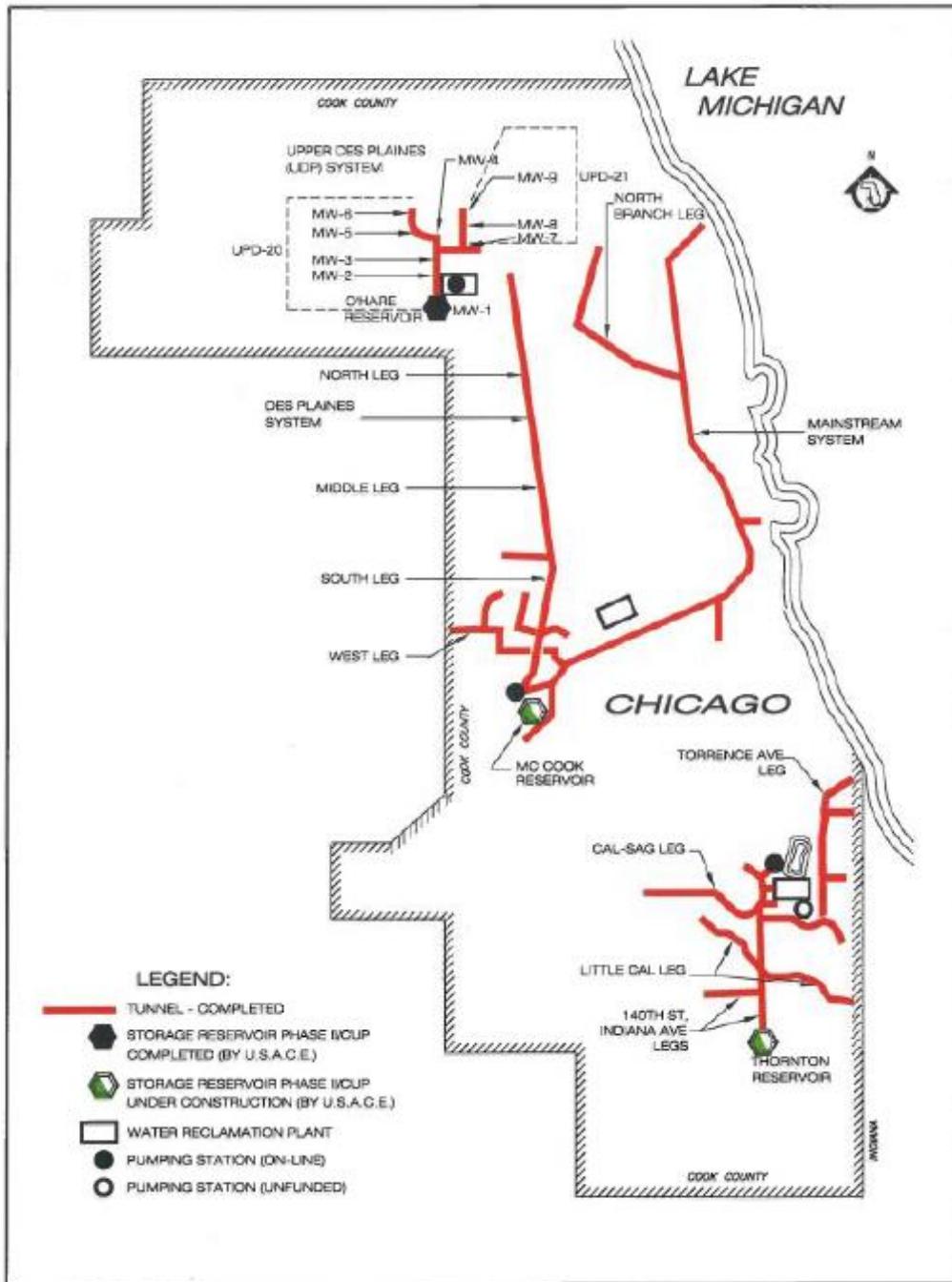


TABLE 1: ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER SAMPLED FROM FILL EVENT MONITORING WELLS IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2021¹

Well	Sample Date	pH	EC mS/m	TDS	TOC	Cl ⁻	SO ₄ ²⁻ mg/L	NH ₃ -N	Hardness	Temp. °C	Water Elevation ² ft	Fecal Coliform CFU/100 mL	Recharge Time hr
MW-5	07/01/21	7.9	114	1028	<5.0	82	366	<0.30	384	14.5	-49	2	<48
	10/29/21	8.0	95	—	—	—	—	—	—	14.3	-51	4	<48
MW-6	07/01/21	7.6	101	710	<5.0	38	334	0.55	341	13.7	65	130	<4
	10/27/21	7.7	82	—	—	—	—	—	—	13.5	67	<1	<4
MW-7	07/01/21	7.3	108	814	<5.0	39	354	0.58	446	15.1	23	<1	<4
	10/29/21	7.4	97	—	—	—	—	—	—	15.4	24	<1	<4
MW-8	07/01/21	7.9	105	948	<5.0	63	318	<0.30	405	14.6	-28	1	<48
	10/29/21	8.2	98	—	—	—	—	—	—	14.8	-29	32	<48

¹Two fill events on June 25 and October 25, 2021; chemistry parameters need to be analyzed for first fill event only.

²Relative to Chicago City Datum (579.48 ft above mean sea level) at intersection of State and Madison Streets.

Fecal coliform was detected at wells MW-5 and MW-8 for the two monitored fill events and at MW-6 for the first fill event. Fecal coliform was not detected at well MW-7 for the two monitored fill events.

The analytical data for groundwater sampled from the five wells sampled once per year are presented in Table 2. Fecal coliform in all annual wells were undetectable (<1 CFU/100 mL).

Observation Wells. Groundwater elevations were measured twice per month at observation wells MW-1 through MW-9. Groundwater elevations were calculated relative to the Chicago City Datum (579.48 ft above mean sea level) at the intersection of State and Madison Streets and are presented in Table 3. The minimum, mean, and maximum values for each well were calculated and plotted to determine fluctuations in groundwater elevations during the year (Figure 2).

TABLE 2: ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER SAMPLED FROM ANNUAL MONITORING WELLS IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN SAMPLED DURING 2021

Well	Sample Date	pH	EC mS/m	TDS	TOC	Cl ⁻	SO ₄ ²⁻	NH ₃ -N	Hardness	Temp. °C	Water Elevation ¹ ft	Fecal Coliform CFU/100 mL
				-----mg/L-----								
MW-1	12/09/21	7.7	86	664	<5.0	35	379	0.48	435	14.2	4	<1
MW-2	12/08/21	7.7	98	846	<5.0	66	407	0.75	521	13.6	47	<1
MW-3	10/21/21	8.0	86	760	<5.0	16	429	0.33	447	15.0	43	<1
MW-4	10/21/21	7.8	101	892	<5.0	77	355	0.30	538	13.9	0	<1
MW-9	10/21/21	7.9	81	712	<5.0	33	336	0.41	361	14.4	9	<1

¹Relative to Chicago City Datum (579.48 ft above mean sea level) at intersection of State and Madison Streets.

TABLE 3: GROUNDWATER ELEVATIONS FOR OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2021

Date	Observation Well No.								
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9
	-----Elevation (ft) ¹ -----								
01/22/21	38	46	42	2	-35	67	23	19	6
01/29/20	38	47	43	2	NA ²	67	22	20	6
02/11/21	38	46	42	2	-35	68	23	NA	NA
02/26/21	38	46	43	3	-34	68	22	NA	6
03/12/20	37	46	43	3	-35	67	23	21	7
03/30/21	39	47	43	4	-34	69	24	19	8
04/09/21	39	48	43	5	-34	69	24	19	24
04/23/21	38	47	43	4	-33	68	24	19	10
05/14/21	38	47	43	4	-34	67	24	21	8
05/27/21	37	47	42	4	-35	65	24	21	8
06/11/21	38	47	43	5	-34	64	24	21	8
06/25/21	NA	47	42	5	-38	67	24	15	8
07/08/21	37	46	42	6	NRR ³	65	23	NRR	9
07/30/21	37	47	42	5	-34	66	22	22	5
08/13/21	37	46	42	3	-35	66	23	20	5
08/27/21	38	48	42	3	-35	65	23	23	5
09/22/21	38	48	42	4	-35	64	22	20	5
09/30/21	37	46	41	4	-35	63	23	20	4
10/18/21	38	47	41	5	-35	65	23	19	4
10/29/21	40	47	43	4	NRR	67	24	NRR	12
11/12/21	40	47	43	6	-45	67	23	20	13
11/29/21	39	48	42	4	-40	67	23	22	11
12/10/21	NRR	47	42	3	-39	65	23	22	10
12/21/21	40	47	42	3	-40	67	23	22	9

¹Relative to Chicago City Datum (579.48' above mean sea level) at intersection of State and Madison Streets.

²No measurements were obtained due to road works at MW-1, or snow accumulation at MW-5, MW-8, and MW-9.

³No reportable data, as depth measurements were affected by well purging for fill event sampling wells (MW-5 and MW-8) or annual sampling well (MW-1).

FIGURE 2: MINIMUM, MEAN, AND MAXIMUM WATER ELEVATIONS FOR MONITORING/OBSERVATION WELLS MW-1 THROUGH MW-9 IN THE UPPER DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN MEASURED DURING 2021

