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Metropolitan Water Reclamation District of Greater Chicago

***MONITORING AND RESEARCH
DEPARTMENT***

REPORT NO. 22-17

TUNNEL AND RESERVOIR PLAN

DES PLAINES TUNNEL SYSTEM

ANNUAL GROUNDWATER MONITORING REPORT

FOR 2021

July 2022

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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 Des Plaines Tunnel System Annual Groundwater
Monitoring Report for 2021

The report entitled "Tunnel and Reservoir Plan 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

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

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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 WELLS

Introduction

All monitoring wells are located along the 13A extension, south leg, middle leg, and north leg of the Des Plaines Tunnel System ([Figure 1](#)). The monitoring wells were sampled based on the modified groundwater monitoring program for the Metropolitan Water Reclamation District of Greater Chicago's (District) 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 from a three-year fill event-based groundwater monitoring study conducted by the District from 2017 to 2019 and was submitted to the IEPA in a report dated July 30, 2020.

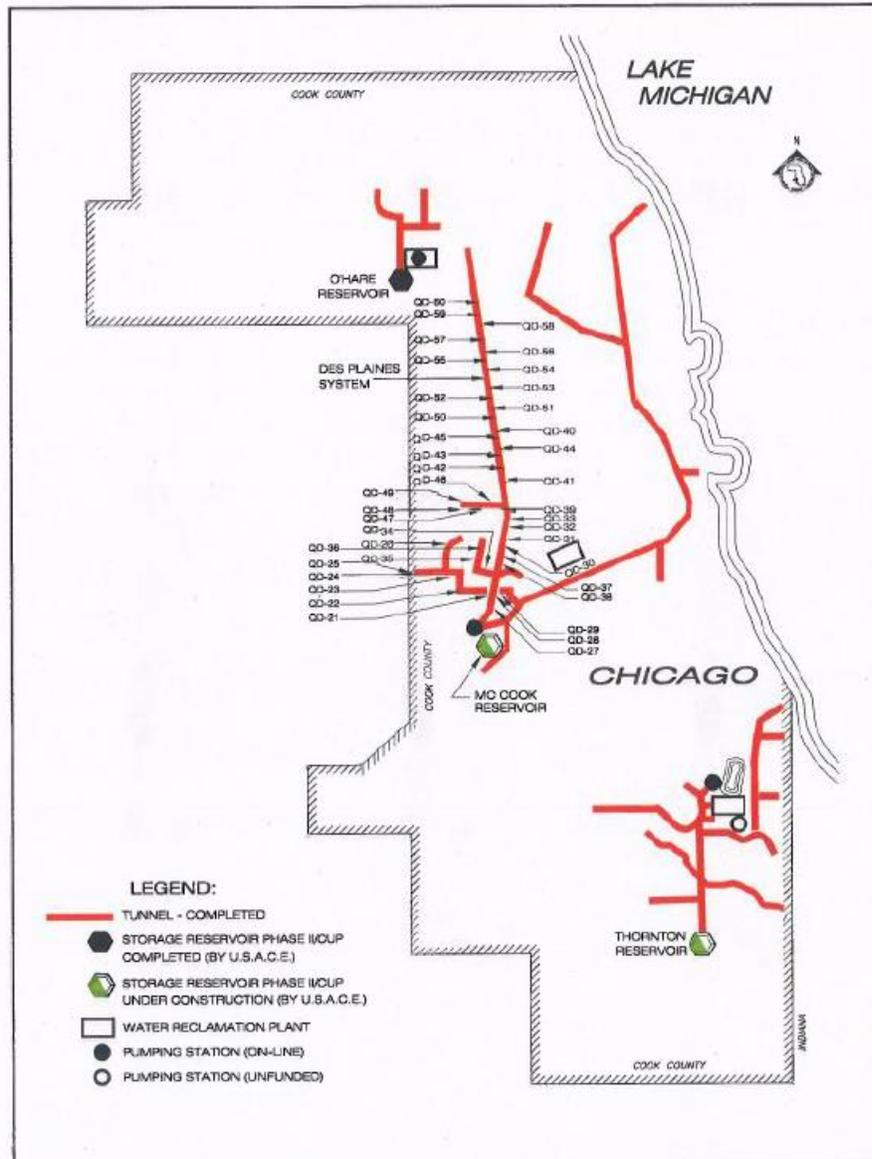
Under the modified monitoring program, nine Des Plaines fill event-based monitoring wells (QD-27, QD-29, QD-30, QD-31, QD-33, QD-34, QD-36, QD-46, and QD-54) are sampled for two tunnel fill events per year, usually following storm events. Fecal coliforms (FC) in these wells were detected in 10 percent or more of samples collected during the period 1995 – 2013. In addition, well QD-57, previously sampled annually, is monitored according to this schedule. Fecal coliforms were detected in this well in all samples collected during 2017 – 2019. The criterion that triggers fill event sampling is that the level of water in the TARP Mainstream tunnels reaches -150 ft Chicago City Datum (CCD). The fill event-based monitoring wells are sampled in two groups. At each fill event, the first group of wells (QD-29, QD-30, QD-54, and QD-57) is sampled during the first week of the fill event, and the second group of wells (QD-27, QD-31, QD-33, QD-34, QD-36, and QD-46) is sampled during the second week of the 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 FC. For the second fill event, samples are analyzed for FC only. Groundwater elevations in the monitoring wells are measured during each sampling event.

The other 30 wells associated with the Des Plaines Tunnel System, referred to as annual monitoring wells, are sampled once per year. These wells had fecal coliform detected in less than 10 percent of samples during the period 1995 – 2013.

Summary of Monitoring Wells Data

During 2021, the fill event-based sampling was conducted at two fill events occurring on June 26 and October 25, 2021. The groundwater analytical data and physical parameters for the fill event-based monitoring wells QD-27, QD-29, QD-30, QD-31, QD-33, QD-34, QD-36, QD-46, QD-54, and QD-57 is presented in [Table 1](#). Fecal coliform was detected during the two

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



monitored fill events at wells QD-27, QD-34, QD-36, QD-46, and QD-57 and during the second fill event only at wells QD-31 and QD-33. Fecal coliform counts were nondetectable (<1 CFU/100 mL) during the two monitored fill events at wells QD-29, QD-30, and QD-54 (Table 1).

The analytical data for groundwater from the 30 wells sampled once per year are presented in Table 2. Fecal coliform counts in all the annual sampling wells were nondetectable (<1 CFU/100 mL).

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

| Well | Sampled Date | pH | EC mS/m | mg/L | | | | | Hardness | Temp. °C | Water Elevation ² ft | Fecal Coliform CFU/100 mL | Recharge Time hr |
|-------|--------------|-----------------|---------|-------|------|-----------------|-------------------------------|--------------------|----------|----------|---------------------------------|---------------------------|------------------|
| | | | | TDS | TOC | Cl ⁻ | SO ₄ ²⁻ | NH ₃ -N | | | | | |
| QD-27 | 07/09/21 | 7.2 | 179 | 1,528 | 14.6 | 467 | 51 | 26.8 | 479 | 13.3 | -152 | 13 | <48 |
| | 11/03/21 | 7.3 | 220 | — | — | — | — | — | — | 13.8 | -1,171 | 720 | <48 |
| QD-29 | 06/30/21 | 7.2 | 133 | 1,430 | <5.0 | 414 | 262 | 0.8 | 652 | 15.7 | -53 | <1 | <4 |
| | 10/28/21 | 7.1 | 119 | — | — | — | — | — | — | 13.4 | -70 | <1 | <4 |
| QD-30 | 07/02/21 | 7.2 | 69 | 686 | <5.0 | 93 | 159 | 0.3 | 425 | 13.5 | -75 | <1 | <48 |
| | 10/28/21 | 7.2 | 97 | — | — | — | — | — | — | 12.9 | -68 | <1 | <48 |
| QD-31 | 07/09/21 | 7.1 | 87 | 794 | <5.0 | 91 | 168 | <0.3 | 435 | 13.5 | -81 | <1 | <4 |
| | 11/03/21 | 8.1 | 78 | — | — | — | — | — | — | 13.3 | -135 | 7,000 | <4 |
| QD-33 | 07/09/21 | NA ³ | NA | NA | NA | NA | NA | NA | NA | NA | -198 | NA | <48 |
| | 11/03/21 | 9.0 | 107 | — | — | — | — | — | — | 13.3 | -136 | 4,900 | <48 |
| QD-34 | 07/09/21 | 6.9 | 104 | 1,090 | <5.0 | 130 | 242 | 0.5 | 605 | 13.2 | -53 | 390 | <4 |
| | 11/02/21 | 7.0 | 105 | — | — | — | — | — | — | 13.1 | -55 | 6,100 | <4 |
| QD-36 | 07/09/21 | 6.9 | 101 | 1,158 | <5.0 | 119 | 290 | 0.4 | 297 | 12 | -67 | 230 | <4 |
| | 11/02/21 | 6.9 | 120 | — | — | — | — | — | — | 12 | -62 | 23 | <4 |
| QD-46 | 07/09/21 | 7.7 | 64 | 648 | <5.0 | 12 | 132 | <0.3 | 96 | 12.4 | -131 | 9 | <4 |
| | 11/02/21 | 7.8 | 76 | — | — | — | — | — | — | 13.1 | -77 | 120 | <4 |

TABLE 1 (Continued): ANALYSIS OF CHEMICAL AND PHYSICAL PARAMETERS AND FECAL COLIFORM IN GROUNDWATER SAMPLED FROM FILL EVENT MONITORING WELLS IN THE DES PLAINES TUNNEL SYSTEM OF THE TUNNEL AND RESERVOIR PLAN DURING 2021

| Well | Sampled Date | pH | EC mS/m | mg/L | | | | | | Temp. °C | Water Elevation ² ft | Fecal Coliform CFU/100 mL | Recharge Time hr |
|-------|--------------|-----|---------|------|------|-----------------|-------------------------------|--------------------|----------|----------|---------------------------------|---------------------------|------------------|
| | | | | TDS | TOC | Cl ⁻ | SO ₄ ²⁻ | NH ₃ -N | Hardness | | | | |
| QD-54 | 07/02/21 | 8.9 | 48 | 448 | <5.0 | 20 | 155 | <0.3 | 28 | 13.2 | -39 | <1 | <48 |
| | 10/28/21 | 9.3 | 57 | — | — | — | — | — | — | 12.5 | -30 | <1 | <48 |
| QD-57 | 07/02/21 | 8.6 | 39 | 356 | <5.0 | 12 | 64 | 0.3 | 42 | 14.1 | -113 | 2,700 | <48 |
| | 10/28/21 | 8.7 | 58 | — | — | — | — | — | — | 11.4 | -68 | 4,600 | <48 |

¹Fill events occurring on June 26 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.

³No sample collected due to pump malfunction.

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

| Well | Sample Date | pH | EC mS/m | mg/L | | | | | | Temp. °C | Water Elevation ¹ ft | Fecal Coliform CFU/100 mL |
|-------|-------------|-----|---------|-------|------------------|-----------------|-------------------------------|--------------------|----------|----------|---------------------------------|---------------------------|
| | | | | TDS | TOC ¹ | Cl ⁻ | SO ₄ ²⁻ | NH ₃ -N | Hardness | | | |
| QD-21 | 08/11/21 | 7.0 | 130 | 1,146 | <5.0 | 246 | 253 | <0.3 | 682 | 14 | -42 | <1 |
| QD-22 | 08/11/21 | 7.0 | 103 | 914 | <5.0 | 124 | 211 | 0.4 | 619 | 13.6 | -20 | <1 |
| QD-23 | 08/11/21 | 7.0 | 133 | 1,144 | <5.0 | 193 | 321 | 1.0 | 778 | 13.9 | -28 | <1 |
| QD-24 | 08/11/21 | 7.2 | 72 | 580 | <5.0 | 105 | 125 | 0.4 | 402 | 12.3 | 16 | <1 |
| QD-25 | 04/14/21 | 6.9 | 142 | 1,458 | <5.0 | 524 | 280 | 0.8 | 747 | 11.3 | 29 | <1 |
| QD-26 | 08/26/21 | 7.3 | 51 | 498 | <5.0 | 10 | 95 | 0.3 | 384 | 13.8 | -5 | <1 |
| QD-28 | 08/26/21 | 7.2 | 83 | 862 | <5.0 | 200 | 159 | 1.3 | 459 | 13.8 | -95 | <1 |
| QD-32 | 08/26/21 | 9.1 | 214 | 1,972 | <5.0 | 515 | 225 | <0.3 | 26 | 13.5 | -211 | <1 |
| QD-35 | 04/21/21 | 7.0 | 95 | 866 | <5.0 | 92 | 279 | 0.4 | 598 | 13.2 | -73 | <1 |
| QD-37 | 08/26/21 | 8.5 | 110 | 1,190 | <5.0 | 233 | 281 | <0.3 | 294 | 15.7 | -200 | <1 |
| QD-38 | 08/26/21 | 8.5 | 74 | 762 | <5.0 | 163 | 98 | 0.4 | 236 | 14.3 | -212 | <1 |
| QD-39 | 04/14/21 | 8.5 | 70 | 726 | <5.0 | 29 | 101 | <0.3 | 19 | 11.1 | -151 | <1 |
| QD-40 | 04/14/21 | 9.4 | 73 | 652 | <5.0 | 17 | 378 | <0.3 | 18 | 12.7 | -126 | <1 |
| QD-41 | 04/14/21 | 7.5 | 58 | 698 | <5.0 | 14 | 332 | 0.4 | 412 | 12.7 | -136 | <1 |
| QD-42 | 04/14/21 | 8.0 | 47 | 656 | <5.0 | 18 | 296 | 0.3 | 353 | 12 | -103 | <1 |
| QD-43 | 08/26/21 | 7.7 | 51 | 716 | <5.0 | 48 | 219 | 0.3 | 431 | 13.2 | -136 | <1 |
| QD-44 | 09/16/21 | 7.8 | 62 | 562 | <5.0 | 20 | 202 | 0.4 | 290 | 12 | -13 | <1 |
| QD-45 | 09/16/21 | 8.4 | 63 | 504 | <5.0 | 17 | 203 | 0.4 | 97 | 12.5 | 5 | <1 |
| QD-47 | 09/16/21 | 7.9 | 61 | 466 | <5.0 | 14 | 155 | <0.3 | 228 | 14.5 | 9 | <1 |
| QD-48 | 09/16/21 | 8.5 | 46 | 358 | <5.0 | 7 | 224 | <0.3 | 173 | 14 | -178 | <1 |
| QD-49 | 09/27/21 | 7.7 | 61 | 462 | <5.0 | 12 | 207 | <0.3 | 204 | 17.5 | -184 | <1 |
| QD-50 | 09/22/21 | 9.1 | 79 | 684 | <5.0 | 12 | 280 | <0.3 | 18 | 13 | -147 | <1 |
| QD-51 | 09/22/21 | 8.9 | 65 | 546 | <5.0 | 13 | 126 | <0.3 | 5 | 12.5 | -114 | <1 |
| QD-52 | 09/22/21 | 8.5 | 59 | 506 | <5.0 | 16 | 148 | <0.3 | 15 | 13.5 | -125 | <1 |

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

| Well | Sample Date | pH | EC mS/m | mg/L | | | | | | Temp. °C | Water Elevation ¹ ft | Fecal Coliform CFU/100 mL |
|-------|-------------|-----|------------|------|------------------|-----------------|-------------------------------|--------------------|----------|-------------|---------------------------------------|---------------------------------|
| | | | | TDS | TOC ¹ | Cl ⁻ | SO ₄ ²⁻ | NH ₃ -N | Hardness | | | |
| QD-53 | 10/07/21 | 9.1 | 67 | 620 | <5.0 | 17 | 167 | <0.3 | 9 | 14.2 | -152 | <1 |
| QD-55 | 10/07/21 | 8.0 | 43 | 538 | <5.0 | 15 | 190 | <0.3 | 184 | 12.8 | -141 | <1 |
| QD-56 | 04/07/21 | 8.5 | 38 | 292 | <5.0 | 11 | 8 | 0.3 | 50 | 12.2 | -79 | <1 |
| QD-58 | 04/07/21 | 8.0 | 33 | 228 | <5.0 | 12 | 3 | 0.3 | 114 | 12.3 | -119 | <1 |
| QD-59 | 04/07/21 | 7.8 | 45 | 338 | <5.0 | 67 | 17 | 0.4 | 217 | 12.3 | -46 | <1 |
| QD-60 | 04/07/21 | 7.7 | 47 | 410 | <5.0 | 45 | 103 | 0.5 | 236 | 12.8 | -94 | <1 |

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