Supplementary Materials

Impacts of Hurricane Harvey on Drinking Water Quality in Two Texas Cities

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Methods and Materials

Sampling Sites. City A purchases its water from a local water district that supplies treated water to seven cities and both untreated and treated water to many industries in a three-county service area. Raw water from two surface water sources is blended and stored in a 200 million-gallon reservoir, where some sedimentation occurs, located next to the district’s treatment plants. Raw water flows by gravity to the treatment facility, and chlorine dioxide is added in the pipeline for algae control and as a TOC removal aid. Two of the plants produce drinking water, and both employ conventional alum-coagulation/flocculation/sedimentation followed by another dose of chlorine dioxide. One plant utilizes microfiltration membranes and the other uses dual media (i.e., anthracite and sand) filtration. Following filtration, zinc orthophosphate and sodium hydroxide are added as corrosion inhibitors, and fluoride and chloramines are added before distribution to the various cities and industries. The district operates and maintains pumping stations, ground and elevated storage tanks, and transmission pipelines throughout the distribution network. Upon leaving the treatment plant, treated water travels 11-km to the city limits of City A, and then 14 km to a valve, where it is split into two streams that comprise a loop of approximately 24 km in total length. The chloramination booster station (Low WA) is located directly before the split in the line, while the water tower (Medium WA) is located immediately following the split in the line and High WA is at the opposite end of the loop. City A is responsible for all infrastructure (i.e., transmission pipelines, storage tanks, etc.) within the city limits.

City B utilizes eight abandoned quarries as storage reservoirs to maintain a raw water supply during low-flow months, a measure implemented by many Central Texas PWS due to recent periods of drought. Treatment at the surface water treatment plant in City B includes pre-chlorination with chlorine dioxide, coagulation/flocculation using polyaluminum chloride,
sedimentation, dual-media filtration, and chloramination. When necessary, powdered activated carbon is added in the flocculation unit for taste and odor control. Fluoride is added at the end of the treatment train. Treated water is stored in two clearwells located at the plant site, then pumped into two separate pressure networks comprised of three (north network) and two (south network) elevated storage towers, as well as ten underground storage reservoirs (in total) [S1].

**Sample Collection.** Water samples were collected following a 10-min flush in three sterilized 1-L glass bottles (Pyrex, Corning, NY). On-site measurements of pH, total dissolved solids (TDS), turbidity, and residual disinfectant were taken before transporting the samples on ice to the laboratory at the University of Texas at Austin. Samples arrived at the University of Texas within 12 h of collection. At the sampling points in the distribution system, faucets were flame-sterilized prior to flushing. Two of the 1-L sample bottles were pre-dosed with 0.1 N sodium thiosulfate to dechlorinate the samples for biological testing. The other 1-L sample aliquot was used for chemical water quality analyses. Additionally, 40-mL samples were collected in triplicate in amber glass vials with no headspace for trihalomethane (THM) analyses.

**Water Quality Analyses.** Several water quality parameters were measured in the field. pH and TDS were measured using an Ultrameter III 9P (Myron L Company, Carlsbad, CA). Turbidity was measured using an Oakton T-100 turbidimeter (Oakton Instruments, Vernon Hills, IL). Monochloramine, total chlorine, and free chlorine were measured using a DR1900 Portable Spectrophotometer (Hach, Loveland, CO) with methods 10171, 10070, and 8021, respectively.

In the laboratories of the University of Texas at Austin, TOC and dissolved organic carbon (DOC) measurements were performed using a Shimadzu TOC-L Analyzer (Shimadzu, Columbia, MD) according to Standard Method 5310 [S2]. DOC measurements represent TOC
values after filtering samples through 0.45-µm nylon membrane filters (VWR, Radnor, PA). Ultraviolet (UV) absorbance was measured using an Agilent 8453E UV-visible spectrophotometer (Agilent, Santa Clara, CA). Specific ultraviolet absorbance (SUVA<sub>254</sub>) values were determined by dividing the UV absorbance measured at λ=254 nm by the DOC concentration and are reported in the units of liter per milligram carbon per meter. Anion concentrations were determined using a Dionex ICS 2100 Ion Chromatograph (IC) with a Dionex IonPac AS19 column (Dionex, Sunnyvale, CA) in accordance with Standard Method 4110 [S2]. Cation concentrations were determined using an Agilent 710-ES Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) (Agilent Technologies, Santa Clara, CA) in accordance with Standard Method 3120 [S2]. Samples were filtered through 0.45-µm nylon membrane filters prior to IC and ICP analyses.

THM samples were collected, stored, and extracted in accordance with United States Environmental Protection Agency (USEPA) Method 551.1 [S3]. The concentrations of individual THM species were analyzed on an Agilent 6980 Series gas chromatograph and summed to produce total trihalomethane (TTHM) concentrations. All standards were measured in triplicate, and all samples were measured in duplicate. Although it is well known that THMs represent only a fraction of the disinfection by-products (DBPs) [S4], they alone were measured in this research as an indicator of DBP formation.

Heterotrophic plate counts (HPCs), Enterococci, and total coliforms/Escherichia coli (fecal indicator bacteria) were quantified according to Standard Methods 9215, 9230, and 9223 [S2] using HPC, Enterolert®, and Colilert®, respectively, in Quanti-Tray®/2000 (IDEXX, Westbrook, Maine) according to the manufacturer’s instructions. Employing these methods, the quantifiable range of the Most Probable Number (MPN) method is between 0.01-24.196 MPN/mL, not including dilution corrections.
Microbial Community Analysis. One of the 1-L sample aliquots that was dosed with sodium thiosulfate was filtered with 14 hours of collection through a 0.2-μm polycarbonate membrane (Pall Life Sciences, Ann Arbor, MI) and stored at −20 °C until DNA could be extracted. DNA was extracted using the DNeasy PowerWater Kit (Qiagen, Germantown, MD) according to the manufacturer’s protocol. Recovered DNA was quantified using a NanoDrop spectrophotometer and a Quant-iT dsDNA high sensitivity assay kit (Thermo Fisher Scientific Inc., Waltham, MA). Samples were stored at −20°C until sequencing. DNA sequencing was completed by the Genomic Sequencing and Analysis Facility at the University of Texas at Austin. Sequence data were processed using the process previously described in Maestre et al. [S5]. In short, bacterial sequences were processed and analyzed in QIIME v.1.8 [S6]. Taxonomy was assigned using the Ribosomal Database Project classifier [S7] with the reference database Greengenes13_8 16S rRNA [S8]. All samples were rarefied to the least number of sequences present in any individual sample, as is recommended by Gihring et al. [S9] and has been implemented in previous studies [S10, S11]. All statistical analyses were performed in the R environment (www.r-project.org). Pairwise similarities between communities were calculated using weighted UniFrac and were used for principal coordinate analyses (PCoA) [S12].
Figures and Tables

**Figure S1.** Monthly average water use over time for City A (personal communication).

* Water use data were not available for City B; however, based on personal communication, we found that seasonal fluctuations in water use were not significant under normal operating conditions, but became prominent in the aftermath of Hurricane Harvey.
*Figure S2. Total organic carbon (TOC) concentrations for monthly raw (solid) and finished (dashed) water samples in City A (red) and City B (blue) from 2016 to 2018. Data shown in Tables S8 and S9 [S1].

*A surge in raw water TOC concentration in City B also occurred in June 2016; that TOC peak coincided with heavy rainfall and flooding in the Guadalupe River. The June 2016 flooding was not as substantial as Hurricane Harvey, and, thus, the timeframe required to return to baseflow TOC concentrations in raw and finished water TOC concentrations was not as long as that of Hurricane Harvey.*
Figure S3. Spatial structure in the water microbiota community present in samples collected in Cities A and B as observed by the weighted UniFrac distances in a Principal Coordinate Analysis plot colored by sampling location. Legend: WA=Water age.

* Figure S3 presents the same data as presented in Figure 4 (in the main text), but in Figure S3, points are colored by sampling location, while that of Figure 4 are colored by sampling date.
| Sample     | Date   | pH (-) | Conductivity (µS/cm) | TDS (mg/L) | Turbidity (NTU) | Tot Cl₂ (mg/L) |
|------------|--------|--------|----------------------|------------|-----------------|----------------|
| City A     | 9/29/17| -      | -                    | -          | -               | -              |
| Low WA     | 11/22/17| 8.16  | 821                  | 574        | 0.05            | 3.6            |
|            | 12/12/17| 8.48  | 836                  | 584        | 0.06            | 3.1            |
|            | 5/23/18 | 8.07  | 795                  | 555        | 0.05            | 2.0            |
| City A     | 9/29/17| 7.92  | 852                  | 596        | 0.06            | 3              |
| Medium WA  | 11/22/17| 7.98  | 768                  | 535        | 0.45            | 2.8            |
|            | 12/12/17| 8.61  | 961                  | 674        | 0.11            | 2.5            |
|            | 5/23/18 | 7.91  | 805                  | 562        | 0.02            | 1.9            |
| City A     | 9/29/17| 7.83  | 856                  | 599        | -               | 0.3            |
| High WA    | 11/22/17| 7.94  | 744                  | 518        | 0.03            | 0.7            |
|            | 12/12/17| 8.27  | 834                  | 583        | 0.08            | 0.3            |
|            | 5/23/18 | 7.81  | 1050                 | 735        | 0.01            | 0.08           |
| City A     | 9/29/17| 8.14  | 751                  | 523        | 18.27           | -              |
| Influent   | 11/22/17| 8.00  | 819                  | 572        | 0.04            | 2.7            |
| Effluent   | 11/22/17| -     | -                    | -          | -               | -              |
| City B     | 9/8/17 | 7.25  | -                    | -          | -               | 2.7            |
| Raw        | 9/29/17| 7.34  | 359                  | 240        | 0.01            | 3.4            |
|            | 11/9/17| 6.67  | 516                  | 354        | 9.01            | -              |
|            | 11/22/17| 8.07  | 485                  | 331        | 6.06            | -              |
|            | 12/12/17| 8.57  | 524                  | 359        | 7.23            | -              |
|            | 5/23/18 | 7.78  | 533                  | 366        | 3.36            | -              |
| City B     | 9/8/17 | 7.25  | -                    | -          | -               | 2.7            |
| Finished   | 9/29/17| 7.34  | 359                  | 240        | 0.01            | 3.4            |
|            | 11/9/17| 8.15  | 504                  | 345        | 0.16            | 3.5            |
|            | 11/22/17| 7.84  | 523                  | 359        | 0.02            | 3.1            |
|            | 12/12/17| 8.54  | 562                  | 386        | 0.07            | 3.3            |
|            | 5/23/18 | 7.79  | 586                  | 404        | 0.02            | 2.9            |
| City B     | 9/8/17 | 7.42  | -                    | -          | -               | 1              |
| Low WA     | 9/29/17| 7.20  | 334                  | 222        | 0.01            | 1.1            |
|            | 11/9/17| 8.14  | 491                  | 335        | 0.03            | 2.3            |
|            | 11/22/17| 7.98  | 501                  | 343        | 0.27            | 1.7            |
|            | 12/12/17| 8.49  | 552                  | 380        | 0.08            | 2.2            |
|            | 5/23/18 | 7.95  | 578                  | 398        | 0.06            | 2.1            |
| City B     | 9/8/17 | 7.40  | -                    | -          | -               | 0.6            |
| Low WA     | 9/29/17| 7.50  | 361                  | 241        | 0.01            | 1.2            |
|            | 11/9/17| 8.19  | 528                  | 362        | 0.18            | 0.7            |
| City B     | 11/22/17| 7.34  | 786                  | 548        | 0.06            | 0.3            |
| High WA    | 12/12/17| 8.38  | 564                  | 388        | 0.14            | 2.2            |
|            | 5/23/18 | 7.79  | 587                  | 404        | 0.03            | 2.7            |
Table S2. Anion concentrations in water samples collected in City A. Legend: WA=Water age.

| Sample         | Date     | Bromide (mg/L) | Chloride (mg/L) | Fluoride (mg/L) | Nitrate (mg/L as NO₃) | Nitrite (mg/L as NO₂) | Phosphate (mg/L as PO₄) | Sulfate (mg/L as SO₄) |
|----------------|----------|----------------|-----------------|------------------|------------------------|-----------------------|------------------------|----------------------|
| City A Low WA  | 9/29/17  | -              | 0.20            | 149              | -                      | -                     | -                      | -                    |
|                | 11/22/17 | 0.19           | 148             | 0.61             | 1.5                    | 0.78                  | 2.2                    | 52.7                 |
|                | 12/12/17 | 0.26           | 118             | 0.47             | 2.4                    | 0.74                  | 1.8                    | 56.2                 |
|                | 5/23/18  | 0.26           | 118             | 0.47             | 2.2                    | 0.90                  | 0.80                   | 46.3                 |
| City A Medium WA | 9/29/17 | 0.12           | 135             | 0.39             | 0.78                   | 0.31                  | 1.3                    | 84.7                 |
|                | 11/22/17 | 0.24           | 138             | 0.04             | 2.6                    | 0.80                  | 2.4                    | 49.4                 |
|                | 12/12/17 | 0.31           | 149             | 0.56             | 1.8                    | 0.77                  | 1.8                    | 55.3                 |
|                | 5/23/18  | 0.26           | 123             | 0.47             | 0.87                   | 0.93                  | <0.10                  | 47.8                 |
| City A High WA | 9/29/17  | 0.12           | 136             | 0.41             | 0.85                   | 0.18                  | 2.2                    | 86.6                 |
|                | 11/22/17 | 0.64           | 129             | 0.56             | 2.6                    | 0.71                  | 2.3                    | 47.1                 |
|                | 12/12/17 | 1.1            | 154             | 0.49             | 2.3                    | 0.78                  | 1.8                    | 54.3                 |
|                | 5/23/18  | 1.1            | 124             | 0.47             | 1.6                    | 0.96                  | <0.10                  | 50.0                 |
| City A District | Influent | <0.10          | 133             | 0.16             | 0.58                   | 0.56                  | 2.9                    | 46.5                 |
|                | Effluent | 0.20           | 152             | 0.02             | 0.94                   | 0.73                  | 2.0                    | 53.2                 |
| Sample       | Date     | Bromide (mg/L) | Chloride (mg/L) | Fluoride (mg/L) | Nitrate (mg/L as NO₃) | Nitrite (mg/L as NO₂) | Phosphate (mg/L as PO₄) | Sulfate (mg/L as SO₄) |
|--------------|----------|----------------|-----------------|-----------------|------------------------|-----------------------|------------------------|-----------------------|
| City B Raw   | 9/8/17   | <0.10          | 6.37            | 0.13            | 0.23                   | <0.10                 | 1.5                    | 11.7                  |
|              | 9/29/17  | 0.11           | 12.6            | 0.15            | 0.31                   | 0.10                  | 2.7                    | 16.0                  |
|              | 11/9/17  | <0.10          | 27.3            | 0.19            | 1.8                    | 0.17                  | 2.6                    | 27.2                  |
|              | 11/22/17 | 0.10           | 32.8            | 0.23            | 1.7                    | 0.25                  | 1.8                    | 30.2                  |
|              | 12/12/17 | 0.13           | 36.8            | 0.26            | 2.4                    | 0.26                  | <0.10                  | 35.3                  |
|              | 5/23/18  | 0.12           | 49.5            | 0.26            | 0.80                   | 0.39                  | <0.10                  | 33.0                  |
| City B Finished | 9/8/17   | <0.10          | 31.1            | 0.50            | 0.33                   | <0.10                 | 1.7                    | 16.2                  |
|              | 9/29/17  | <0.10          | 27.5            | 0.39            | 0.61                   | 0.14                  | 1.6                    | 17.4                  |
|              | 11/9/17  | <0.10          | 42.2            | 0.03            | 2.2                    | 0.71                  | 1.4                    | 26.2                  |
|              | 11/22/17 | <0.10          | 44.1            | 0.46            | 2.0                    | 0.54                  | 2.3                    | 33.4                  |
|              | 12/12/17 | <0.10          | 44.9            | 0.49            | 2.7                    | 0.42                  | 1.5                    | 37.5                  |
|              | 5/23/18  | 0.12           | 63.3            | 0.55            | 0.85                   | 0.84                  | 0.37                   | 34.6                  |
| City B Low WA | 9/8/17   | <0.10          | 23.5            | 0.41            | 0.47                   | <0.10                 | 1.8                    | 14.0                  |
|              | 9/29/17  | 0.12           | -               | 0.39            | 0.78                   | 0.31                  | 1.3                    | 84.7                  |
|              | 11/9/17  | <0.10          | 41.5            | 0.04            | 2.3                    | 0.63                  | 1.6                    | 25.8                  |
|              | 11/22/17 | <0.10          | 44.3            | 0.02            | 2.2                    | 0.56                  | 2.5                    | 31.3                  |
|              | 12/12/17 | <0.10          | 45.9            | 0.48            | 2.8                    | 0.47                  | 1.5                    | 36.9                  |
|              | 5/23/18  | 0.12           | 64.2            | 0.55            | 0.71                   | 0.87                  | 0.42                   | 34.4                  |
| City B High WA | 9/8/17   | <0.10          | 22.9            | 0.39            | 0.52                   | <0.10                 | 1.9                    | 13.3                  |
|              | 9/29/17  | 0.19           | 27.1            | 0.39            | 0.55                   | 0.10                  | 1.8                    | 16.3                  |
|              | 11/9/17  | <0.10          | 40.5            | 0.03            | 2.4                    | 0.57                  | 1.6                    | 25.1                  |
|              | 11/22/17 | <0.10          | 25.4            | 0.32            | 0.76                   | 0.30                  | 2.5                    | 30.4                  |
|              | 12/12/17 | <0.10          | 45.4            | 0.48            | 2.8                    | 0.45                  | 1.6                    | 37.0                  |
|              | 5/23/18  | 0.13           | 64.7            | 0.56            | 0.81                   | 0.85                  | 0.43                   | 34.9                  |
Table S4. Cation concentrations in water samples collected in City A. Legend: WA=Water age.

| Sample     | Date     | Calcium (mg/L) | Copper (mg/L) | Iron (mg/L) | Potassium (mg/L) | Magnesium (mg/L) | Sodium (mg/L) | Lead (mg/L) | Zinc (mg/L) |
|------------|----------|----------------|---------------|-------------|------------------|------------------|----------------|-------------|-------------|
| City A     | 9/29/17  | -              | <0.02         | -           | 11.2             | 9.0              | 83.5           | <0.015      | 0.03        |
| Low WA     | 11/22/17 | 69.0           | <0.02         | <0.02       | 11.0             | 10.2             | 83.5           | <0.015      | 0.04        |
|            | 12/12/17 | 73.1           | <0.02         | <0.02       | 11.6             | 9.2              | -              | <0.015      | 0.04        |
|            | 5/23/18  | 70.3           | <0.02         | 0.02        | 11.6             | 9.2              | -              | <0.015      | 0.04        |
| City A     | 9/29/17  | 52.9           | <0.02         | <0.02       | 10.3             | 8.8              | 87.7           | <0.015      | 0.03        |
| Medium WA  | 11/22/17 | 65.7           | <0.02         | <0.02       | 11.1             | 8.4              | 77.8           | <0.015      | 0.03        |
|            | 12/12/17 | 71.4           | <0.02         | <0.02       | 11.2             | 9.7              | 84.5           | <0.015      | 0.05        |
|            | 5/23/18  | 72.9           | <0.02         | <0.02       | 11.9             | 9.5              | 72.9           | <0.015      | 0.04        |
| City A     | 9/29/17  | 53.1           | <0.02         | <0.02       | 9.9              | 8.6              | 86.1           | <0.015      | 0.03        |
| High WA    | 11/22/17 | 63.9           | <0.02         | <0.02       | 12.5             | 8.2              | 73.1           | <0.015      | 0.04        |
|            | 12/12/17 | 69.2           | <0.02         | <0.02       | 11.2             | 9.2              | 84.8           | <0.015      | 0.04        |
|            | 5/23/18  | 72.1           | <0.02         | <0.02       | 12.6             | 9.5              | 77.6           | <0.015      | 0.03        |
| City A     | Influent | 67.5           | <0.02         | 0.50        | 11.6             | 8.9              | 74.1           | <0.015      | <0.02       |
| District   | Effluent | 68.8           | <0.02         | <0.02       | 12.2             | 9.1              | 86.0           | <0.015      | 0.05        |
Table S5. Cation concentrations in water samples collected in City B. Legend: WA=Water age.

| Sample    | Date    | Calcium (mg/L) | Copper (mg/L) | Iron (mg/L) | Potassium (mg/L) | Magnesium (mg/L) | Sodium (mg/L) | Lead (mg/L) | Zinc (mg/L) |
|-----------|---------|----------------|---------------|-------------|------------------|------------------|---------------|-------------|-------------|
| City B    | 9/8/17  | 37.4           | <0.02         | 0.05        | 5.6              | 4.0              | 3.9           | <0.015      | <0.02       |
|           | 9/29/17 | 45.5           | <0.02         | 0.10        | 5.2              | 6.3              | 9.0           | <0.015      | <0.02       |
| Raw       | 11/9/17 | 71.0           | <0.02         | 0.18        | 5.8              | 11.1             | 21.2          | <0.015      | <0.02       |
|           | 11/22/17| 68.5           | <0.02         | 0.11        | 5.3              | 12.4             | 22.6          | <0.015      | <0.02       |
|           | 12/12/17| 75.3           | <0.02         | 0.16        | 4.6              | 13.9             | 27.1          | <0.015      | <0.02       |
|           | 5/23/18 | 50.2           | <0.02         | 0.03        | 4.4              | 14.2             | 54.3          | <0.015      | <0.02       |
| Finished  | 9/8/17  | 35.8           | 0.03          | <0.02       | 4.9              | 5.4              | 15.4          | <0.015      | <0.02       |
|           | 9/29/17 | 44.3           | 0.05          | <0.02       | 5.4              | 6.0              | 15.9          | <0.015      | <0.02       |
|           | 11/9/17 | 72.6           | 0.04          | <0.02       | 5.9              | 10.8             | 26.9          | <0.015      | <0.02       |
|           | 11/22/17| 66.3           | 0.03          | <0.02       | 5.3              | 12.3             | 29.6          | <0.015      | <0.02       |
|           | 12/12/17| 73.7           | 0.02          | <0.02       | 4.7              | 13.9             | 33.7          | <0.015      | <0.02       |
|           | 5/23/18 | 41.0           | <0.02         | <0.02       | 5.4              | 14.1             | 60.6          | <0.015      | <0.02       |
| Low WA    | 9/8/17  | 36.5           | 0.06          | 0.03        | 5.4              | 4.8              | 11.3          | <0.015      | 0.02        |
|           | 9/29/17 | 41.6           | 0.07          | <0.02       | 5.5              | 5.1              | 13.8          | <0.015      | <0.02       |
|           | 11/9/17 | 74.1           | 0.07          | <0.02       | 6.0              | 10.6             | 26.9          | <0.015      | <0.02       |
|           | 11/22/17| 71.7           | 0.06          | <0.02       | 5.5              | 11.8             | 29.9          | <0.015      | <0.02       |
|           | 12/12/17| 73.6           | 0.02          | <0.02       | 4.8              | 13.6             | 33.0          | <0.015      | <0.02       |
|           | 5/23/18 | 40.7           | 0.03          | <0.02       | 4.5              | 14.0             | 56.6          | <0.015      | <0.02       |
| High WA   | 9/8/17  | 35.9           | 0.03          | 0.03        | 5.1              | 6.6              | 11.2          | <0.015      | 0.03        |
|           | 9/29/17 | 42.8           | 0.04          | <0.02       | 5.5              | 5.7              | 14.6          | <0.015      | <0.02       |
|           | 11/9/17 | 74.9           | 0.03          | 0.02        | 6.2              | 10.1             | 26.4          | <0.015      | <0.02       |
|           | 11/22/17| 74.5           | 0.02          | <0.02       | 4.9              | 13.3             | 33.2          | <0.015      | <0.02       |
|           | 5/23/18 | 42.6           | <0.02         | 0.03        | 4.6              | 13.7             | 60.4          | <0.015      | 0.03        |
Table S6. Hardness and alkalinity values determined from water samples collected in Cities A and B. Legend: WA=Water age.

| Sample   | Date     | Hardness (meq/L) | Hardness (mg/L as CaCO₃) | Alkalinity (meq/L) | Alkalinity (mg/L as CaCO₃) |
|----------|----------|------------------|--------------------------|-------------------|----------------------------|
| City A   | Low WA   |                  |                          |                   |                           |
| 9/29/17  | -        | -                | -                        | -                 | -                          |
| 11/22/17 | 4.2      | 209              | 2.8                      | 138               |                            |
| 12/12/17 | 4.5      | 224              | 3.0                      | 148               |                            |
| 5/23/18  | 4.3      | 213              | -                        | -                 |                            |
| City A   | Medium WA|                  |                          |                   |                           |
| 9/29/17  | 3.4      | 168              | 1.8                      | 92                |                            |
| 11/22/17 | 4.0      | 199              | 2.7                      | 133               |                            |
| 12/12/17 | 4.4      | 218              | 2.9                      | 144               |                            |
| 5/23/18  | 4.4      | 221              | 3.4                      | 168               |                            |
| City A   | High WA  |                  |                          |                   |                           |
| 9/29/17  | 3.4      | 168              | 1.6                      | 81                |                            |
| 11/22/17 | 3.9      | 193              | 2.6                      | 129               |                            |
| 12/12/17 | 4.2      | 211              | 2.5                      | 127               |                            |
| 5/23/18  | 4.4      | 219              | 3.3                      | 165               |                            |
| City A   | District |                  |                          |                   |                           |
| 11/22/17 | Influent | 4.1              | 205                      | 2.9               | 145                        |
|          | Effluent | 4.2              | 209                      | 2.8               | 141                        |
| City B   | Raw      |                  |                          |                   |                           |
| 9/8/17   | 2.2      | 110              | 2.1                      | 104               |                            |
| 9/29/17  | 2.8      | 139              | 2.6                      | 131               |                            |
| 11/9/17  | 4.5      | 223              | 4.2                      | 208               |                            |
| 11/22/17 | 4.4      | 222              | 4.0                      | 198               |                            |
| 12/12/17 | 4.9      | 245              | 4.4                      | 219               |                            |
| 5/23/18  | 3.7      | 184              | 4.0                      | 201               |                            |
| City B   | Finished |                  |                          |                   |                           |
| 9/8/17   | 2.2      | 112              | 1.8                      | 89                |                            |
| 9/29/17  | 2.7      | 135              | 2.4                      | 118               |                            |
| 11/9/17  | 4.5      | 226              | 4.0                      | 202               |                            |
| 11/22/17 | 4.3      | 216              | 3.7                      | 187               |                            |
| 12/12/17 | 4.8      | 241              | 4.3                      | 214               |                            |
| 5/23/18  | 3.2      | 160              | 3.4                      | 171               |                            |
| City B   | Low WA   |                  |                          |                   |                           |
| 9/8/17   | 2.2      | 111              | 1.9                      | 93                |                            |
| 9/29/17  | 2.5      | 125              | -                        | -                 |                            |
| 11/9/17  | 4.6      | 229              | 4.1                      | 207               |                            |
| 11/22/17 | 4.6      | 228              | 4.0                      | 202               |                            |
| 12/12/17 | 4.8      | 240              | 4.2                      | 210               |                            |
| 5/23/18  | 3.2      | 159              | 3.2                      | 158               |                            |
| City B   | High WA  |                  |                          |                   |                           |
| 9/8/17   | 2.3      | 117              | 2.0                      | 100               |                            |
| 9/29/17  | 2.6      | 130              | 2.2                      | 112               |                            |
| 11/9/17  | 4.6      | 228              | 4.2                      | 208               |                            |
| 11/22/17 | -        | -                | -                        | -                 |                            |
| 12/12/17 | 4.8      | 240              | 4.2                      | 212               |                            |
| 5/23/18  | 3.3      | 163              | 3.4                      | 169               |                            |

* Hardness was calculated as the sum of multivalent cations and alkalinity was calculated as the difference of the sum of conservative anions and cations, which are shown in Tables S2-S5.
Table S7. Total Organic Carbon (TOC), Specific Ultraviolet Absorbance (SUVA\textsubscript{254}), and Total Trihalomethane (TTHM) data for water samples collected in Cities A and B. Legend: DOC=Dissolved organic carbon; UV\textsubscript{254}=Ultraviolet absorbance at 254 nm; WA=Water age.

| Sample          | Date     | TOC (mg/L) | DOC (mg/L) | UV\textsubscript{254} (cm\textsuperscript{-1}) | SUVA\textsubscript{254} (L\textsuperscript{1}mg\textsuperscript{-1}m\textsuperscript{-1}) | TTHM (µg/L) |
|-----------------|----------|------------|------------|-----------------------------------------------|----------------------------------------------------------------|-------------|
| City A          | 9/29/17  | -          | -          | -                                             | -                                                             | -           |
| Low WA          | 11/22/17 | 3.87       | 3.56       | 0.188                                         | 5.28                                                          | 43.0        |
|                 | 12/12/17 | 3.67       | 3.65       | 0.194                                         | 5.32                                                          | 52.5        |
|                 | 5/23/18  | 3.87       | 3.79       | 0.102                                         | 2.69                                                          | 33.1        |
| City A          | 9/29/17  | 3.80       | 3.50       | 0.091                                         | 2.60                                                          | -           |
| Medium WA       | 11/22/17 | 4.34       | 3.61       | 0.168                                         | 4.65                                                          | 37.8        |
|                 | 12/12/17 | 4.33       | 4.09       | 0.216                                         | 5.28                                                          | 48.7        |
|                 | 5/23/18  | 3.96       | 3.85       | 0.102                                         | 2.65                                                          | 28.5        |
| City A          | 9/29/17  | 4.47       | 3.59       | 0.073                                         | 2.03                                                          | -           |
| High WA         | 11/22/17 | 3.68       | 3.48       | 0.162                                         | 4.66                                                          | 34.4        |
|                 | 12/12/17 | 3.85       | 3.84       | 0.180                                         | 4.69                                                          | 44.0        |
|                 | 5/23/18  | 3.88       | 3.74       | 0.096                                         | 2.57                                                          | 26.6        |
| City A          | 11/22/17 | Influent   | 5.71       | 5.55                                          | 0.225                                                        | 4.05        |
| District        | 11/22/17 | Effluent   | 3.86       | 3.80                                          | 0.116                                                        | 3.05        |
| City B          | 9/8/17   | 7.08       | 6.97       | 0.460                                         | 6.60                                                          | -           |
| Raw             | 9/29/17  | 8.13       | 6.26       | 0.288                                         | 4.60                                                          | -           |
|                 | 11/9/17  | 5.17       | 3.95       | 0.132                                         | 3.34                                                          | -           |
|                 | 11/22/17 | 3.29       | 3.18       | 0.117                                         | 3.68                                                          | -           |
|                 | 12/12/17 | 4.09       | 2.31       | 0.120                                         | 5.19                                                          | -           |
|                 | 5/23/18  | 2.24       | 2.21       | 0.060                                         | 2.71                                                          | -           |
| City B          | 9/8/17   | 3.78       | 3.69       | 0.050                                         | 1.36                                                          | -           |
| Finished        | 9/29/17  | 5.28       | 3.02       | 0.082                                         | 2.72                                                          | -           |
|                 | 11/9/17  | 3.38       | 2.95       | 0.066                                         | 2.24                                                          | 107         |
|                 | 11/22/17 | 2.98       | 2.56       | 0.059                                         | 2.30                                                          | 63.6        |
|                 | 12/12/17 | 3.01       | 2.32       | 0.140                                         | 6.03                                                          | 43.3        |
|                 | 5/23/18  | 2.24       | 1.35       | 0.040                                         | 2.96                                                          | 40.7        |
| City B          | 9/8/17   | 4.88       | 4.70       | 0.109                                         | 2.32                                                          | -           |
| Low WA          | 9/29/17  | 4.07       | 3.11       | 0.064                                         | 2.06                                                          | -           |
|                 | 11/9/17  | 2.99       | 2.93       | 0.054                                         | 1.84                                                          | 153         |
|                 | 11/22/17 | 2.99       | 2.55       | 0.067                                         | 2.63                                                          | 63.1        |
|                 | 12/12/17 | 2.88       | 2.08       | 0.140                                         | 6.73                                                          | 47.5        |
|                 | 5/23/18  | 1.57       | 1.49       | 0.035                                         | 2.35                                                          | 40.9        |
| City B          | 9/8/17   | 4.87       | 4.51       | 0.097                                         | 2.15                                                          | -           |
| High WA         | 9/29/17  | 4.27       | 3.96       | 0.094                                         | 2.37                                                          | -           |
|                 | 11/9/17  | 3.26       | 2.81       | 0.059                                         | 2.10                                                          | 243         |
|                 | 11/22/17 | 0.90       | 0.83       | 0.060                                         | 7.23                                                          | 2.0         |
|                 | 12/12/17 | 2.54       | 2.05       | 0.148                                         | 7.22                                                          | 44.9        |
|                 | 5/23/18  | 1.52       | 1.33       | 0.040                                         | 3.01                                                          | 40.3        |
Table S8. Monthly operating data for several water quality parameters for raw and finished water samples collected at the water district that supplies City A from 2016 to 2019. Data were obtained from the TCEQ Drinking Water Watch Database [S1]. Legend: TOC=Total organic carbon; TTHM=Total trihalomethane.

| Month | Raw TOC (mg/L) | Finished TOC (mg/L) | Raw Alkalinity (mg/L as CaCO₃) | Distribution System* TTHM (µg/L) |
|-------|----------------|---------------------|--------------------------------|---------------------------------|
| 01/2016 | 6.2            | 4.9                 | 158                            | 59.9                            |
| 02/2016 | 6.8            | 4.9                 | 170                            | -                               |
| 03/2016 | 6.9            | 4.8                 | 150                            | -                               |
| 04/2016 | 7.1            | 4.4                 | 142                            | 54.4                            |
| 05/2016 | 6.5            | 4.0                 | 140                            | -                               |
| 06/2016 | 6.5            | 4.4                 | 132                            | -                               |
| 07/2016 | 7.3            | 5.0                 | 142                            | -                               |
| 08/2016 | 6.5            | 4.9                 | 156                            | -                               |
| 09/2016 | 6.1            | 4.5                 | 110                            | 25.7                            |
| 10/2016 | 6.4            | 4.5                 | 114                            | 17.8                            |
| 11/2016 | 6.6            | 5.3                 | 118                            | -                               |
| 12/2016 | 6.2            | 3.8                 | 102                            | -                               |
| 01/2017 | 5.9            | 3.4                 | 106                            | 23.8                            |
| 02/2017 | 6.2            | 4.2                 | 112                            | -                               |
| 03/2017 | 6.3            | 4.2                 | 102                            | -                               |
| 04/2017 | 6.8            | 3.6                 | 106                            | 24                              |
| 05/2017 | 7.1            | 3.3                 | 104                            | -                               |
| 06/2017 | 7.2            | 3.6                 | 111                            | -                               |
| 07/2017 | 6.4            | 4.2                 | 146                            | 23.8                            |
| 08/2017 | 5.9            | 4.2                 | 148                            | -                               |
| 09/2017 | 6.2            | 3.7                 | 114                            | -                               |
| 10/2017 | 6.8            | 4.2                 | 112                            | -                               |
| 11/2017 | 7.3            | 5.1                 | 130                            | -                               |
| 12/2017 | 7.1            | 5.0                 | 122                            | 31.8                            |
| 01/2018 | 6.9            | 4.6                 | 130                            | -                               |
| 02/2018 | 7.1            | 5.0                 | 135                            | 59.4                            |
| 03/2018 | 6.4            | 4.6                 | 112                            | -                               |
| 04/2018 | 6.0            | 4.5                 | 158                            | -                               |
| 05/2018 | 5.9            | 4.4                 | 144                            | -                               |
| 06/2018 | 5.9            | 4.4                 | 161                            | 22.8                            |
| 07/2018 | 5.8            | 4.3                 | 140                            | -                               |
| 08/2018 | 5.9            | 4.4                 | 160                            | 24.8                            |
| 09/2018 | 6.1            | 4.6                 | 127                            | -                               |
| 10/2018 | 5.5            | 3.9                 | 116                            | -                               |
| 11/2018 | 6.1            | 4.0                 | 138                            | 26.7                            |
| 12/2018 | 7.4            | 4.6                 | 87                             | -                               |

* TTHM concentrations represent the average of eight samples taken in the distribution system.

** Chlorine residuals were not available for the sampling points in City A, but it is reported that all monthly chlorine measurements in finished waters from the water district were compliant with TCEQ standards (>0.2 mg/L free chlorine or >0.5 mg/L chloramine, <4 mg/L total chlorine).
Table S9. Monthly operating data for several water quality parameters for water samples collected throughout City B from 2016 to 2019. Data were obtained via personal communication and from the TCEQ Drinking Water Watch Database [S1]. Legend: TOC=Total organic carbon; WA=Water age; TTHM=Total trihalomethane.

| Month   | Raw TOC (mg/L) | Finished TOC (mg/L) | Raw Alkalinity (mg/L as CaCO₃) | Low WA Total Cl₂ (mg/L) | High WA Total Cl₂ (mg/L) | Distribution System* TTHM (µg/L) |
|---------|----------------|---------------------|--------------------------------|------------------------|-------------------------|---------------------------------|
| 01/2016 | 2.1            | 1.0                 | 168                            | 2.9                    | 2.5                     | 44.6                            |
| 02/2016 | 2.8            | 1.6                 | 180                            | 2.8                    | 2.7                     | -                               |
| 03/2016 | 3.8            | 2.4                 | 142                            | 2.7                    | 2.3                     | -                               |
| 04/2016 | 2.9            | 2.4                 | 160                            | 1.6                    | 1.7                     | -                               |
| 05/2016 | 2.4            | 1.3                 | 142                            | 1.7                    | 2.0                     | 43.4                            |
| 06/2016 | 7.2            | 2.9                 | 144                            | 2.4                    | 1.8                     | -                               |
| 07/2016 | 4.5            | 2.5                 | 132                            | 2.5                    | 2.2                     | 59.2                            |
| 08/2016 | 2.8            | 1.8                 | 130                            | 2.7                    | 2.5                     | -                               |
| 09/2016 | 2.6            | 2.1                 | 122                            | 2.6                    | 2.5                     | -                               |
| 10/2016 | 2.0            | 1.3                 | 134                            | 2.5                    | 2.5                     | -                               |
| 11/2016 | 1.7            | 1.5                 | 169                            | 2.1                    | 1.9                     | -                               |
| 12/2016 | 1.9            | 1.0                 | 176                            | 2.6                    | 2.0                     | 27.8                            |
| 01/2017 | 2.1            | 1.3                 | 174                            | 3.2                    | 2.7                     | 33.8                            |
| 02/2017 | 2.2            | 1.4                 | 157                            | 2.7                    | 2.3                     | -                               |
| 03/2017 | 2.2            | 1.5                 | 147                            | 2.5                    | 2.9                     | -                               |
| 04/2017 | 2.9            | 1.7                 | 129                            | 2.0                    | 1.1                     | -                               |
| 05/2017 | 2.9            | 1.8                 | 128                            | 3.0                    | 3.0                     | 44.6                            |
| 06/2017 | 2.3            | 1.6                 | 122                            | 3.4                    | 3.1                     | -                               |
| 07/2017 | 2.3            | 1.3                 | 138                            | 2.0                    | 2.7                     | 37.2                            |
| 08/2017 | 2.2            | 1.5                 | 132                            | 2.4                    | 2.7                     | -                               |
| 09/2017 | 11.7           | 5.4                 | 102                            | 1.3                    | 1.0                     | -                               |
| 10/2017 | 7.6            | 6.0                 | 127                            | 0.9                    | 0.5                     | -                               |
| 11/2017 | 5.7            | 3.9                 | 170                            | 1.4                    | 0.8                     | -                               |
| 12/2017 | 3.8            | 2.4                 | 182                            | 1.9                    | 2.3                     | 52.7                            |
| 01/2018 | 2.7            | 1.8                 | 198                            | 2.9                    | 2.1                     | -                               |
| 02/2018 | 2.3            | 1.6                 | 196                            | 2.4                    | 2.1                     | 32.7                            |
| 03/2018 | 2.1            | 1.5                 | 194                            | 2.4                    | 3.1                     | -                               |
| 04/2018 | 2.1            | 1.5                 | 172                            | 2.1                    | 2.3                     | -                               |
| 05/2018 | 2.4            | 1.7                 | 190                            | 2.4                    | 2.0                     | -                               |
| 06/2018 | 2.1            | 1.6                 | 156                            | 2.5                    | 0.7                     | 36.8                            |
| 07/2018 | 2.0            | 1.4                 | 158                            | 1.3                    | 3.2                     | -                               |
| 08/2018 | 1.8            | 1.2                 | 154                            | 2.0                    | 2.5                     | 29.6                            |
| 09/2018 | 1.8            | 1.3                 | 172                            | 2.1                    | 1.7                     | -                               |
| 10/2018 | 1.9            | 1.4                 | 174                            | 1.9                    | 1.0                     | -                               |
| 11/2018 | 2.4            | 1.9                 | 182                            | 2.1                    | 1.1                     | -                               |
| 12/2018 | 3.6            | 2.6                 | 154                            | 3.0                    | 2.6                     | 54.3                            |

* TTHM concentrations represent the average of eight samples taken in the distribution system.
Table S10. Biological water quality data for water samples collected in Cities A and B. Legend: WA=Water age.

| Sample      | Date     | Total Coliform (MPN/mL) | E. Coli (MPN/mL) | Enterococci (MPN/mL) | Heterotrophic Plate Counts (MPN/mL) |
|-------------|----------|-------------------------|------------------|----------------------|-------------------------------------|
| City A      | 9/29/17  | -                       | -                | -                    | -                                   |
| Low WA      | 11/22/17 | <0.01                   | <0.01            | <0.01                | 68.3                                |
|             | 12/12/17 | <0.01                   | <0.01            | <0.01                | 14.6                                |
|             | 5/23/18  | <0.01                   | <0.01            | <0.01                | 5.2                                 |
| City A      | 9/29/17  | <0.01                   | <0.01            | <0.01                | 279                                 |
| Medium WA   | 11/22/17 | 0.06                    | <0.01            | <0.01                | 121.2                               |
|             | 12/12/17 | <0.01                   | <0.01            | <0.01                | 8.4                                 |
|             | 5/23/18  | <0.01                   | <0.01            | <0.01                | 4.1                                 |
| City A      | 9/29/17  | <0.01                   | <0.01            | <0.01                | 241.96                              |
| High WA     | 11/22/17 | <0.01                   | <0.01            | <0.01                | 24.3                                |
|             | 12/12/17 | <0.01                   | <0.01            | <0.01                | 0.193                               |
|             | 5/23/18  | <0.01                   | <0.01            | <0.01                | 1                                   |
| City A      | Influent | 5.83                    | <0.01            | 0.37                 | 517.2                               |
| District    | 11/22/17 | <0.01                   | <0.01            | <0.01                | 0.02                                |
| City B      | 9/8/17   | 9.139                   | 0.097            | 0.576                | >24.196                             |
| Raw         | 9/29/17  | 11.191                  | 0.02             | 1.112                | >241.96                             |
|             | 11/9/17  | 12.997                  | 0.041            | 0.35                 | >241.96                             |
|             | 11/22/17 | 13.54                   | 0.01             | 0.465                | 517.2                               |
|             | 12/12/17 | 5.794                   | 0.01             | 0.146                | 275.5                               |
|             | 5/23/18  | 10.19                   | <0.01            | 0.02                 | 116.2                               |
| City B      | 9/8/17   | <0.01                   | <0.01            | <0.01                | 0.01                                |
| Finished    | 9/29/17  | <0.01                   | <0.01            | <0.01                | 14.94                               |
|             | 11/9/17  | <0.01                   | <0.01            | <0.01                | <0.01                               |
|             | 11/22/17 | <0.01                   | <0.01            | <0.01                | 0.041                               |
|             | 12/12/17 | 0.01                    | <0.01            | <0.01                | 0.02                                |
|             | 5/23/18  | <0.01                   | <0.01            | <0.01                | 0.052                               |
| City B      | 9/8/17   | <0.01                   | <0.01            | <0.01                | 9.606                               |
| Low WA      | 9/29/17  | <0.01                   | <0.01            | <0.01                | 14.84                               |
|             | 11/9/17  | <0.01                   | <0.01            | <0.01                | <0.01                               |
|             | 11/22/17 | 0.01                    | 0.01             | <0.01                | 10.14                               |
|             | 12/12/17 | <0.01                   | <0.01            | <0.01                | 8.664                               |
|             | 5/23/18  | <0.01                   | <0.01            | <0.01                | 0.41                                |
| City B      | 9/8/17   | <0.01                   | <0.01            | <0.01                | >24.196                             |
| High WA     | 9/29/17  | <0.01                   | <0.01            | <0.01                | 82.94                               |
|             | 11/9/17  | 0.086                   | <0.01            | <0.01                | 3.73                                |
|             | 11/22/17 | <0.01                   | <0.01            | <0.01                | 106.70                              |
|             | 12/12/17 | <0.01                   | <0.01            | <0.01                | 0.48                                |
|             | 5/23/18  | <0.01                   | <0.01            | <0.01                | 4.10                                |
**Table S11.** Selected metagenomics data showing the relative abundances of the top 8 bacteria present in water samples collected in City A. Legend: WA=Water age.

| Sample        | Date     | Methylobacterium | Acidimicrobiales, C111 cluster, Genus unidentified | Mycobacterium | Stramenopiles, Genus unidentified | Actinomycetales, ACK-M1 cluster, Genus unidentified | Pelagibacteraceae, Genus unidentified | Methyloptera | Rhodospirillum |
|---------------|----------|-------------------|---------------------------------------------------|--------------|----------------------------------|---------------------------------------------------|--------------------------------------|--------------|----------------|
| Low WA        | 9/29/17  | -                 | -                                                 | -            | -                                | -                                                 | -                                    | -            | -              |
|               | 11/22/17 | 0.2%              | 24.8%                                             | 0.1%         | 0.1%                             | 3.1%                                              | 5.7%                                                | 12.8%        | 0.2%           |
|               | 12/12/17 | 1.0%              | 17.9%                                             | 0.1%         | 0.0%                             | 6.1%                                              | 12.4%                                               | 4.1%         | 0.7%           |
|               | 5/23/18  | 0.1%              | 15.0%                                             | 1.4%         | 0.5%                             | 1.6%                                              | 9.4%                                                | 1.2%         | 26.5%          |
| Medium WA     | 9/29/17  | 1.9%              | 5.3%                                              | 2.4%         | 0.1%                             | 2.6%                                              | 12.1%                                               | 12.6%        | 5.1%           |
|               | 11/22/17 | 0.3%              | 15.6%                                             | 3.4%         | 0.1%                             | 3.9%                                              | 5.0%                                                | 16.5%        | 1.5%           |
|               | 12/12/17 | 0.6%              | 21.6%                                             | 1.9%         | 0.0%                             | 5.8%                                              | 8.6%                                                | 8.1%         | 1.7%           |
|               | 5/23/18  | 4.1%              | 11.6%                                             | 0.8%         | 0.3%                             | 0.9%                                              | 5.4%                                                | 1.3%         | 34.6%          |
| High WA       | 9/29/17  | 0.6%              | 5.5%                                              | 2.6%         | 0.1%                             | 3.8%                                              | 19.0%                                               | 9.4%         | 9.6%           |
|               | 11/22/17 | 1.0%              | 17.7%                                             | 2.5%         | 0.2%                             | 3.2%                                              | 8.1%                                                | 13.6%        | 3.2%           |
|               | 12/12/17 | 0.9%              | 18.4%                                             | 6.9%         | 0.0%                             | 5.3%                                              | 7.3%                                                | 8.0%         | 1.7%           |
|               | 5/23/18  | 5.6%              | 8.2%                                              | 0.7%         | 0.1%                             | 0.8%                                              | 5.1%                                                | 0.8%         | 32.6%          |
| Water District| Influent | 0.0%              | 12.1%                                             | 0.0%         | 0.1%                             | 2.5%                                              | 5.2%                                                | 4.0%         | 0.0%           |
|               | Effluent | 0.2%              | 32.0%                                             | 0.1%         | 0.0%                             | 26.6%                                             | 13.7%                                               | 0.0%         | 0.0%           |
### Table S12. Selected metagenomics data showing the relative abundances of the top 8 bacteria present in water samples collected in City B. Legend: WA=Water age.

| Sample | Date     | Methylobacterium | Acidimicrobales, C111 cluster, Genus unidentified | Mycobacterium | Stramenopiles, Genus unidentified | Actinomycetales ACK-M1 cluster, Genus unidentified | Pelagibacteraeae, Genus unidentified | Methyloptenera | Rhodospirillum |
|--------|----------|------------------|--------------------------------------------------|---------------|----------------------------------|--------------------------------------------------|---------------------------------------|----------------|---------------|
|        |          |                  |                                                  |               |                                  |                                                   |                                       |                |               |
|        |          |                  |                                                  |               |                                  |                                                   |                                       |                |               |
| Raw    | 9/8/17   | 0.1%             | 2.5%                                             | 0.1%          | 0.2%                             | 17.9%                                            | 0.5%                                  | 0.2%           | 0.0%          |
|        | 9/29/17  | 0.0%             | 8.0%                                             | 0.1%          | 3.7%                             | 13.5%                                            | 1.8%                                  | 0.1%           | 0.0%          |
|        | 11/9/17  | 0.0%             | 8.3%                                             | 1.1%          | 17.2%                            | 19.0%                                            | 4.3%                                  | 0.0%           | 0.0%          |
|        | 11/22/17 | 0.0%             | 7.7%                                             | 0.0%          | 8.7%                             | 18.9%                                            | 5.8%                                  | 0.0%           | 0.0%          |
|        | 12/12/17 | 0.0%             | 5.4%                                             | 0.1%          | 3.2%                             | 11.6%                                            | 5.7%                                  | 0.0%           | 0.0%          |
|        | 5/23/18  | 0.0%             | 12.5%                                            | 0.2%          | 1.5%                             | 23.4%                                            | 11.6%                                 | 2.2%           | 0.0%          |
| Finished| 9/8/17   | 0.0%             | 0.1%                                             | 2.5%          | 66.1%                            | 0.3%                                             | 0.0%                                  | 0.1%           | 0.0%          |
|        | 9/29/17  | 2.5%             | 3.4%                                             | 10.5%         | 2.4%                             | 6.6%                                             | 1.7%                                  | 21.4%          | 0.0%          |
|        | 11/9/17  | 0.0%             | 8.5%                                             | 18.3%         | 24.6%                            | 3.8%                                             | 2.2%                                  | 0.0%           | 0.0%          |
|        | 11/22/17 | 0.3%             | 0.1%                                             | 1.0%          | 54.3%                            | 0.3%                                             | 0.2%                                  | 0.1%           | 0.0%          |
|        | 12/12/17 | 15.9%            | 0.3%                                             | 36.1%         | 8.1%                             | 0.3%                                             | 0.2%                                  | 0.1%           | 0.0%          |
|        | 5/23/18  | 24.0%            | 0.7%                                             | 5.4%          | 0.5%                             | 0.5%                                             | 0.4%                                  | 0.0%           | 0.4%          |
| Low WA | 9/8/17   | 78.6%            | 0.0%                                             | 10.7%         | 1.7%                             | 0.1%                                             | 0.0%                                  | 0.2%           | 0.0%          |
|        | 9/29/17  | 69.0%            | 0.2%                                             | 13.2%         | 5.5%                             | 0.2%                                             | 0.1%                                  | 1.1%           | 0.0%          |
|        | 11/9/17  | 1.2%             | 0.1%                                             | 15.2%         | 25.7%                            | 0.0%                                             | 0.0%                                  | 0.7%           | 0.0%          |
|        | 11/22/17 | 0.3%             | 0.2%                                             | 2.3%          | 24.5%                            | 0.0%                                             | 0.2%                                  | 0.0%           | 0.0%          |
|        | 12/12/17 | 3.3%             | 0.0%                                             | 32.9%         | 3.2%                             | 0.3%                                             | 0.1%                                  | 2.7%           | 0.1%          |
|        | 5/23/18  | 9.8%             | 0.7%                                             | 1.4%          | 0.2%                             | 0.1%                                             | 0.3%                                  | 0.6%           | 0.0%          |
| High WA| 9/8/17   | 33.3%            | 0.0%                                             | 11.1%         | 1.1%                             | 0.1%                                             | 0.0%                                  | 7.9%           | 0.0%          |
|        | 9/29/17  | 79.3%            | 0.0%                                             | 2.2%          | 3.2%                             | 0.0%                                             | 0.1%                                  | 0.1%           | 0.0%          |
|        | 11/9/17  | -                | -                                                | -             | -                                | -                                                | -                                     | -              | -             |
|        | 11/22/17 | 0.0%             | 0.0%                                             | 0.1%          | 0.1%                             | 0.0%                                             | 0.0%                                  | 0.0%           | 0.0%          |
|        | 12/12/17 | 2.0%             | 0.1%                                             | 23.9%         | 3.7%                             | 0.2%                                             | 0.1%                                  | 0.1%           | 0.0%          |
|        | 5/23/18  | 3.6%             | 0.0%                                             | 31.9%         | 0.6%                             | 0.1%                                             | 0.0%                                  | 3.3%           | 0.0%          |
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