Supplementary Material

Quantification and Characterization of Nanoparticulate Zinc in an Urban Watershed

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**Table S1** Typical running instrument conditions for ICP-MS

**Table S2** Total metal data from ICP-OES and anion data from IC (concentrations in mg/L)

**Table S3** Concentrations of Zn (µg/L) per Fraction for sp-ICP-Q-MS settling experiments.

**Table S4** Concentrations of Zn (µg/L) per Fraction for sp-ICP-QMS filtration experiments.

**Figure S1** Hydrographs for selected sampling locations A) West Clear Creek, B) West Sand Creek, C) South South Platte, D) Cherry Creek at Denver, CO, E) North South Platte, F) Cherry Creek below Cherry Creek Lake

**Figure S2** Turbidity plotted against various metal concentrations.

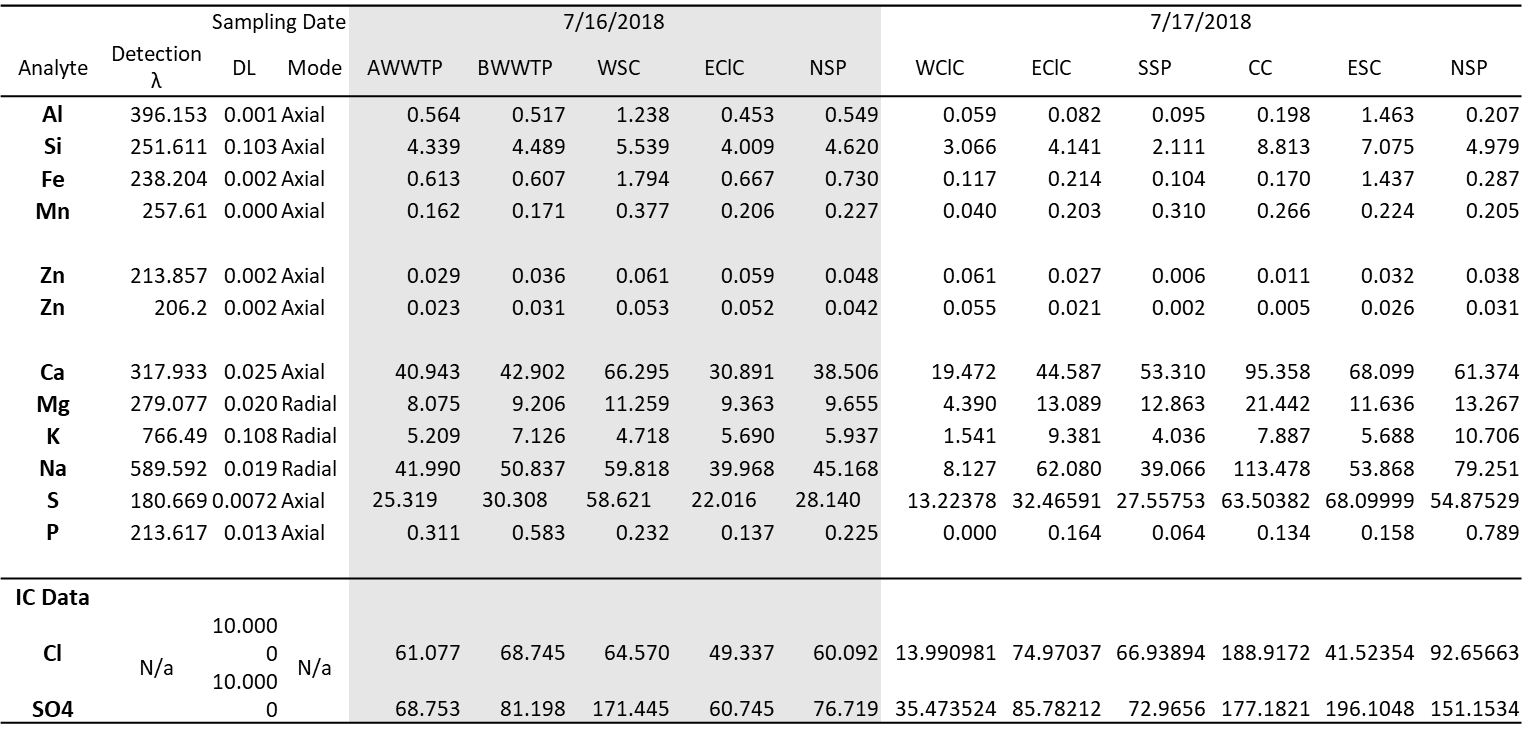
**Figure S3** Size Histograms for sp-ICP-QMS measurements of raw samples.

**Table S1** Typical running instrument conditions for ICP-MS

|  |  |
| --- | --- |
| **ICP-QMS (NexION 300D ICP-MS)** | |
| **Instrument Parameter** | **Value** |
| Nebulizer Gas Flow | 0.86 – 0.98 ml/min |
| Sample Flow Rate | 0.3 ml/min |
| Spray Chamber | Quartz cyclonic |
| ICP RF Power | 1600 W |
| Dwell time | 100 μs |
| Transport efficiency | 6-10% |
| Analytes | 197Au, 64Zn |
| Analysis Time | 60 s |
| Sample Flow Rate | 0.3 ml/min |

|  |  |
| --- | --- |
| **ICP-TOFMS (icpTOF 2R)** | |
| **Instrument Parameter** | **Value** |
| Nebulizer Gas Flow | 0.85 – 1.0 ml/min |
| Sample Flow Rate | 0.28 ml/min |
| Spray Chamber | Quartz cylconic |
| ICP RF Power | 1550 W |
| Dwell time | 3 ms |
| Transport efficiency | 7-15% |
| Analytes | 27Al, 28Si, 48Ti, 55Mn, 56Fe, 57Fe, 58Ni, 60Ni, 63Cu, 64Zn, 65Cu, 66Zn, 68Zn, 110Cd, 111Cd, 112Cd, 113Cd, 114Cd, 197Au, 206Pb, 207Pb, 208Pb |
| Analysis Time | 60 s |
| Sample Flow Rate | 0.3 ml/min |

**Table S2** Total metal data from ICP-OES and anion data from IC (concentrations in mg/L)

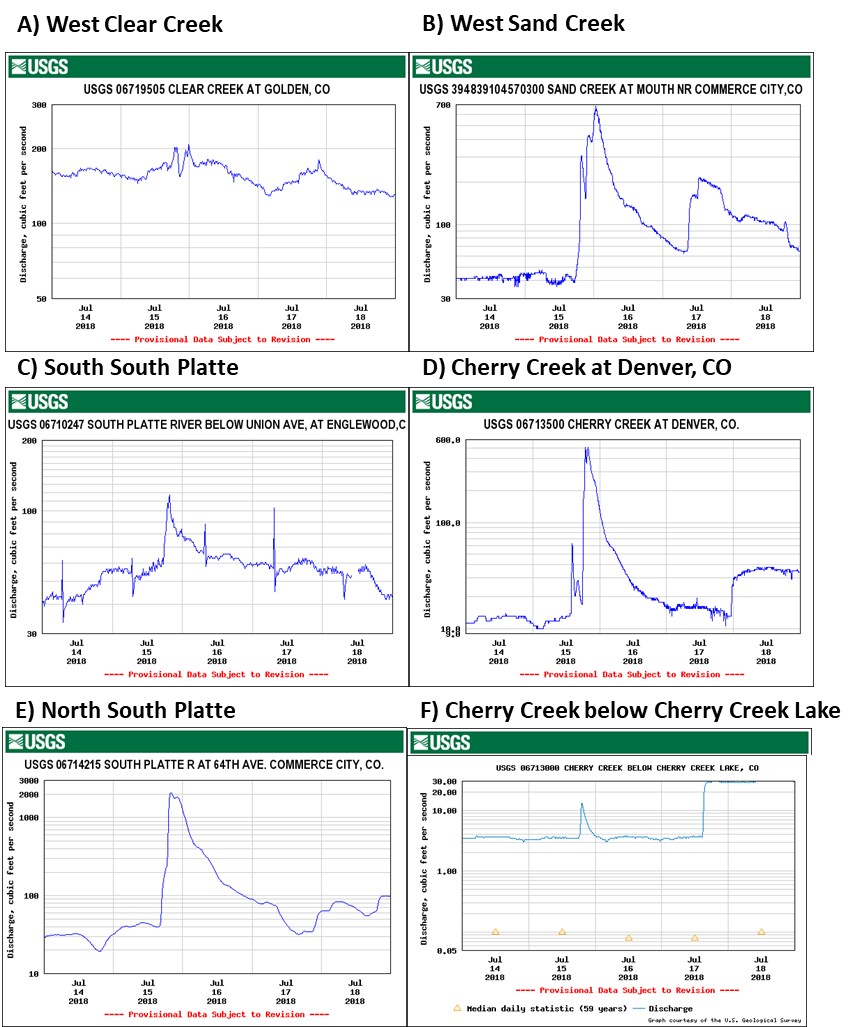


**Table S3** Concentrations of Zn (µg/L) per Fraction for sp-ICP-Q-MS settling experiments.

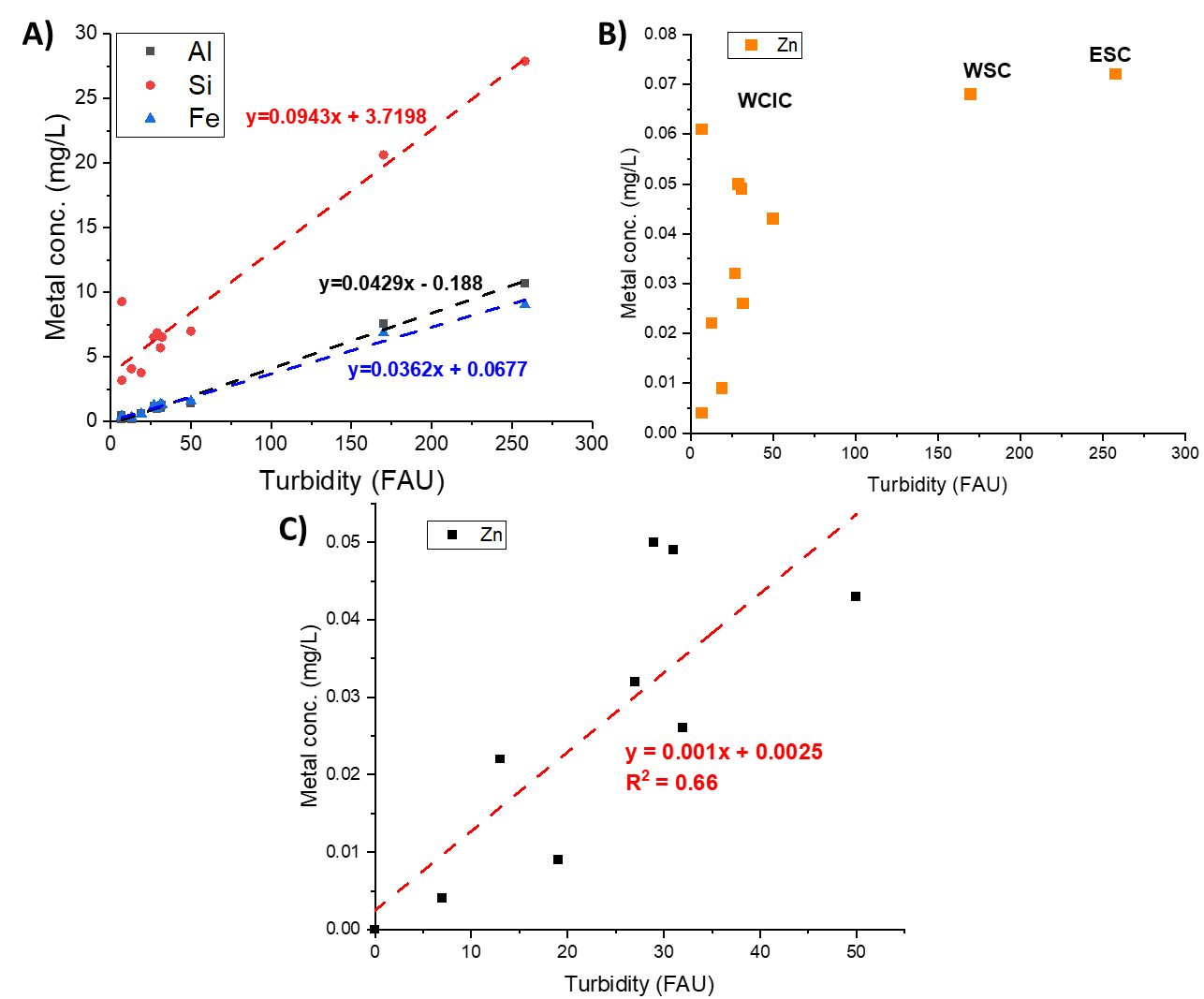
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Fraction*** | | |  |
| **Site** | **Dissolved** | **Colloidal** | **Particulate** | **Total** |
| *Cherry Creek* | 0.42 | 0.36 | 0.39 | 1.17 |
| *E. Clear Creek (7/16)* | 3.95 | 6.16 | 3.19 | 13.29 |
| *E. Clear Creek (7/17)* | 5.21 | 1.42 | 1.77 | 8.40 |
| *N. South Platte (7/16)* | 3.86 | 4.49 | 2.80 | 11.15 |
| *N. South Platte (7/17)* | 1.55 | 6.61 | 5.56 | 13.72 |
| *AWWTP* | 1.74 | 2.81 | 1.78 | 6.33 |
| *BWWTP* | 5.18 | 2.69 | 1.34 | 9.21 |
| *E. Sand Creek* | 0.33 | 13.15 | 6.41 | 19.88 |
| *W. Sand Creek* | 0.91 | 6.28 | 6.71 | 13.90 |
| *S. South Platte* | 0.23 | 0.08 | 1.52 | 1.83 |
| *W. Clear Creek* | 1.93 | 16.62 | 4.63 | 23.19 |

**Table S4** Concentrations of Zn (µg/L) per Fraction for sp-ICP-QMS filtration experiments.

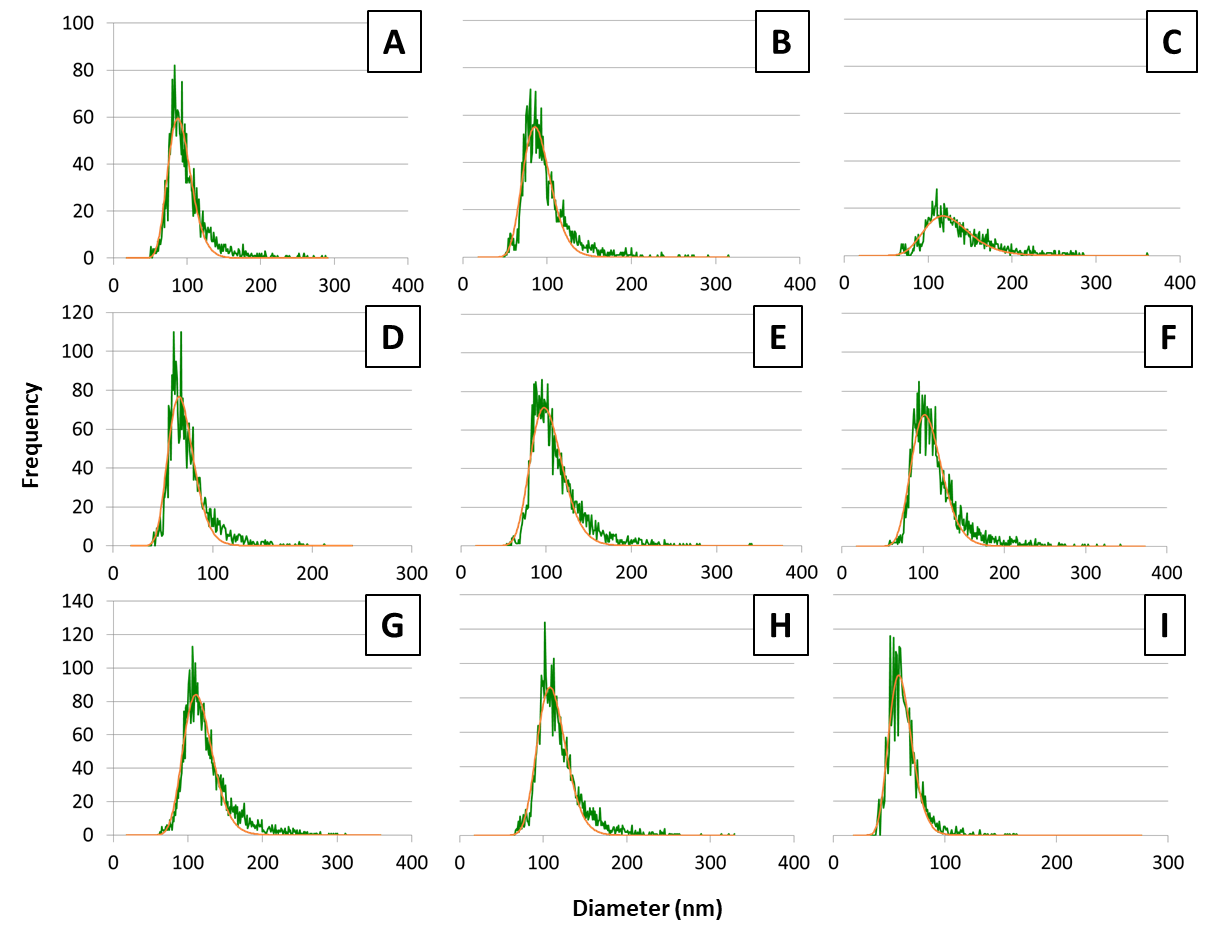
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | ***Fraction*** | | |  |
| **Site** | **Dissolved** | **Resolved Nanoparticulate** | **Unresolved Nanoparticulate** | **Total** |
| *Cherry Creek* | 0.42 | 0.10 | 0.65 | 1.17 |
| *E. Clear Creek (7/16)* | 3.95 | 0.90 | 8.45 | 13.29 |
| *E. Clear Creek (7/17)* | 5.21 | 0.50 | 2.69 | 8.40 |
| *N. South Platte (7/16)* | 3.86 | 0.01 | 7.28 | 11.15 |
| *N. South Platte (7/17)* | 1.55 | 0.26 | 11.91 | 13.72 |
| *AWTTP* | 1.74 | 0.42 | 4.17 | 6.33 |
| *BWTTP* | 5.18 | 0.40 | 3.63 | 9.21 |
| *W. Sand Creek* | 0.33 | 1.05 | 18.51 | 19.88 |
| *E. Sand Creek* | 0.91 | 1.41 | 11.58 | 13.90 |
| *W. Clear Creek* | 1.93 | 0.52 | 20.74 | 23.19 |
| *S. South Platte* | 0.23 | 0.17 | 1.43 | 1.83 |

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**Figure S1** Hydrographs for selected sampling locations A) West Clear Creek, B) West Sand Creek, C) South South Platte, D) Cherry Creek at Denver, CO, E) North South Platte, F) Cherry Creek below Cherry Creek Lake



**Figure S2** Turbidity plotted against various metal concentrations. A) Turbidity plotted against aluminum, silicon, and iron for all sample sites B) Turbidity plotted against zinc for all sample sites A) Turbidity plotted against zinc for all sample sites excluding WClC, ESC, and WSC due to high flow conditions.



**Figure S3** Size Histograms for sp-ICP-QMS measurements of raw samples. Panels correspond to sites: **A.** AWWTP; **B.** BWWTP; **C.** WClC; **D.** SSP; **E.** NSP (7/16); **F.** EClC (7/16); **G.** WSC; **H.** ESC; **I.** CC. Histograms for EClC (7/17) and NSP (7/17) not shown. Diameter calculated by conversion of detected particle mass to a spherical metal Zn particle (ρ = 7.14g/cm3).