

Occurrence and Fate of Pharmaceuticals and Personal Care Products in Select Michigan Waters

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Michigan Department of Environmental Quality

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Sampling Protocol

- Emerging Issues Monitoring through Clean Michigan Initiative – Clean Water Fund
- Ann Arbor and Grand Rapids
 - Source water, finished drinking water
 - WWTP influent/effluent
- Monroe
 - Source water, finished drinking water only
- January, April, July, October 2005

Target Analytes

■ Antibiotics

- Sulfamethoxazole
- Lincomycin
- Tylosin
- Trimethoprim

■ Analgesics

- Acetaminophen
- Codeine
- Ibuprofen

■ Beta-blockers

- Atenolol
- Metoprolol
- Propranolol

■ Lipid Regulators

- Clofibric acid
- Gemfibrozil

Target Analytes (cont'd)

■ Hormones and Sterols

- 17- β -estradiol
- 17- α -ethinylestradiol
- Estrone
- Estriol
- Cholesterol
- Coprostanol

■ Miscellaneous

- Carbamazepine
- Fluoxetine
- Norfluoxetine
- Caffeine

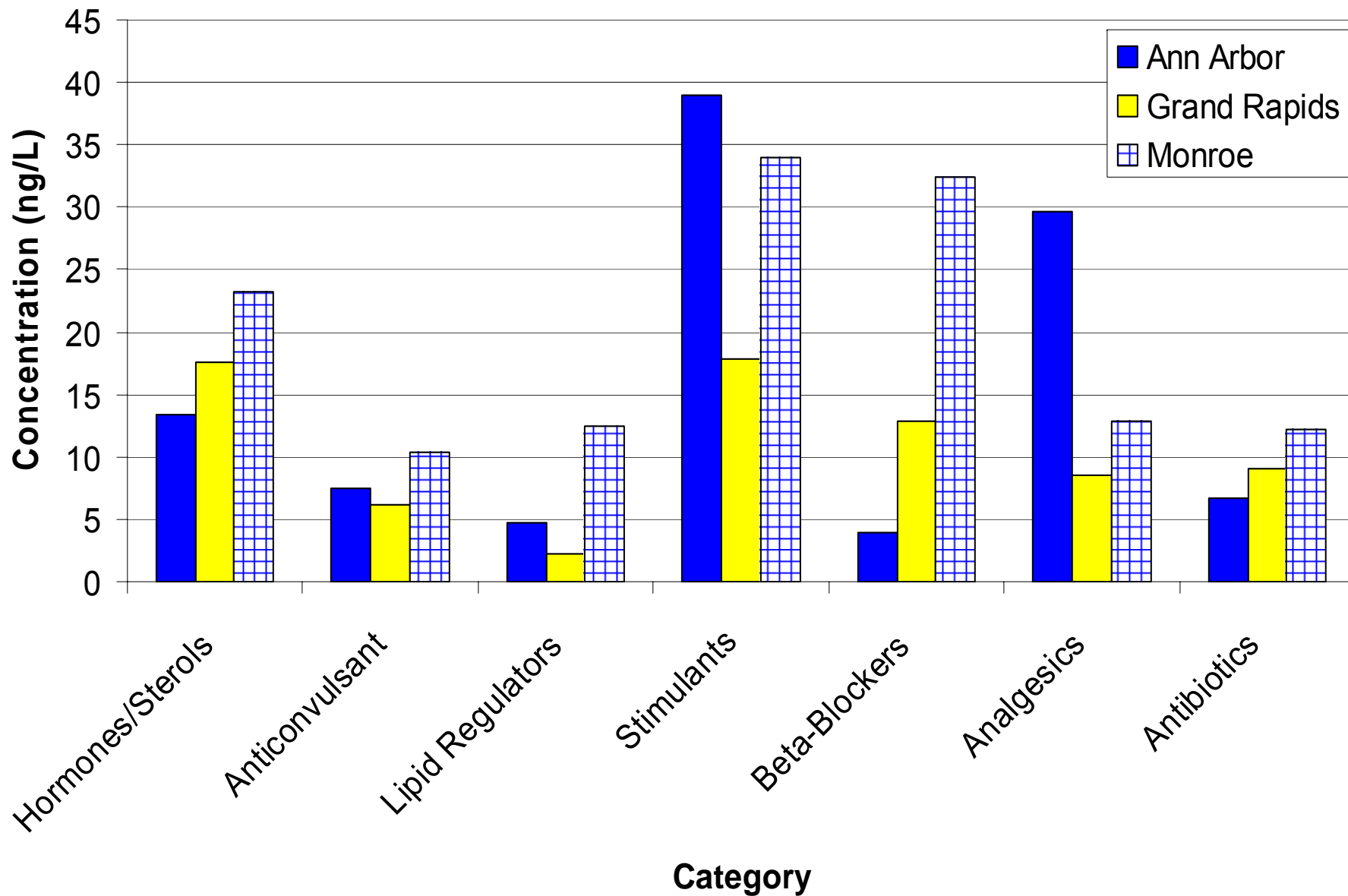
■ Extras

- Cimetidine
- Diltiazem
- 1,7-Dimethylxanthine
- Diphenylhydramine
- Erythromycin
- Miconazole
- Sertraline
- Thiobendazole
- Warfarin

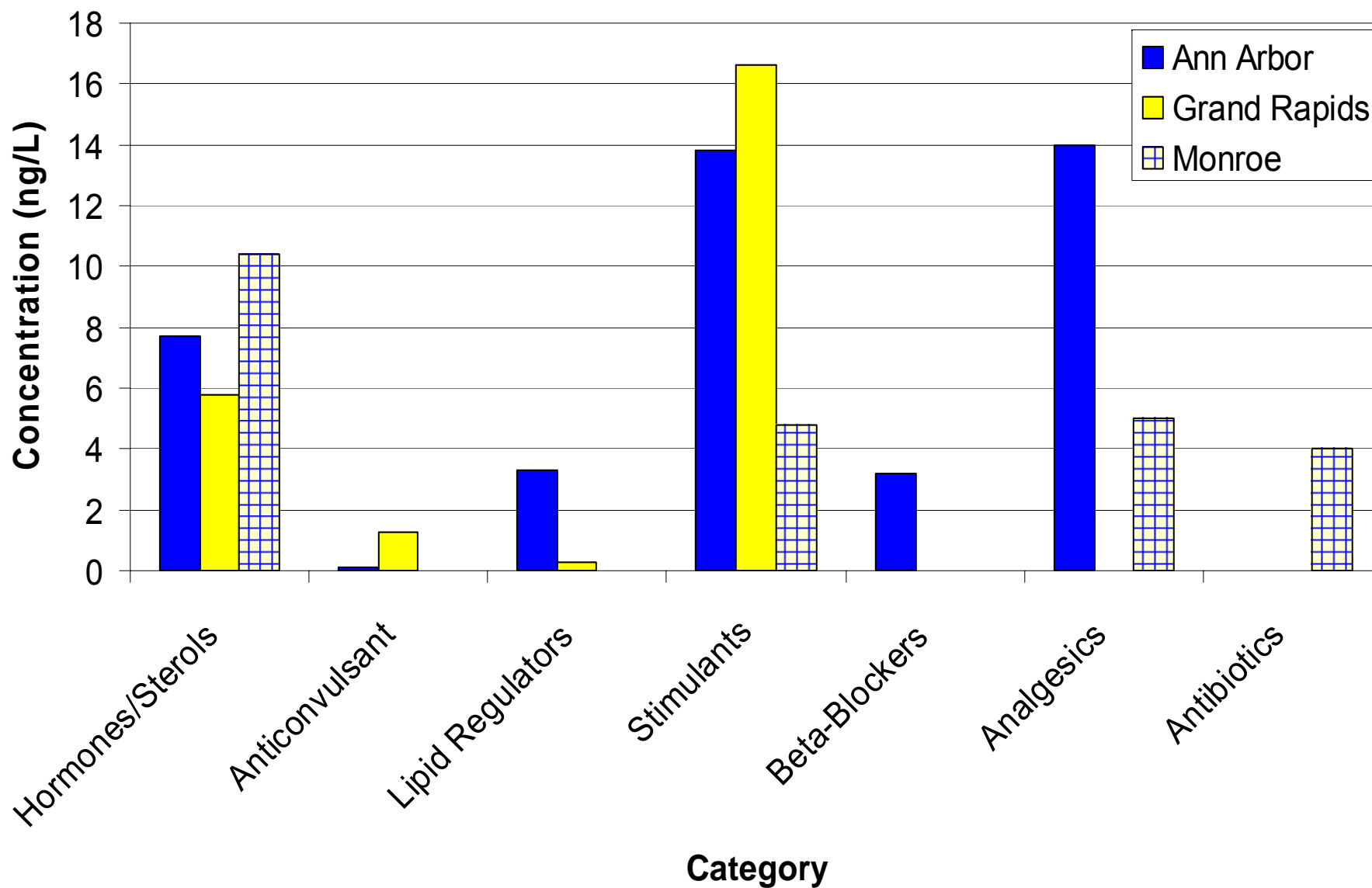
Analytical Methods

- Drs. Bryan W. Brooks and C. Kevin Chambliss - Baylor University Center for Reservoir and Aquatic Systems Research
- GC/MS for hormones/sterols
- LC/MS/MS for remainder

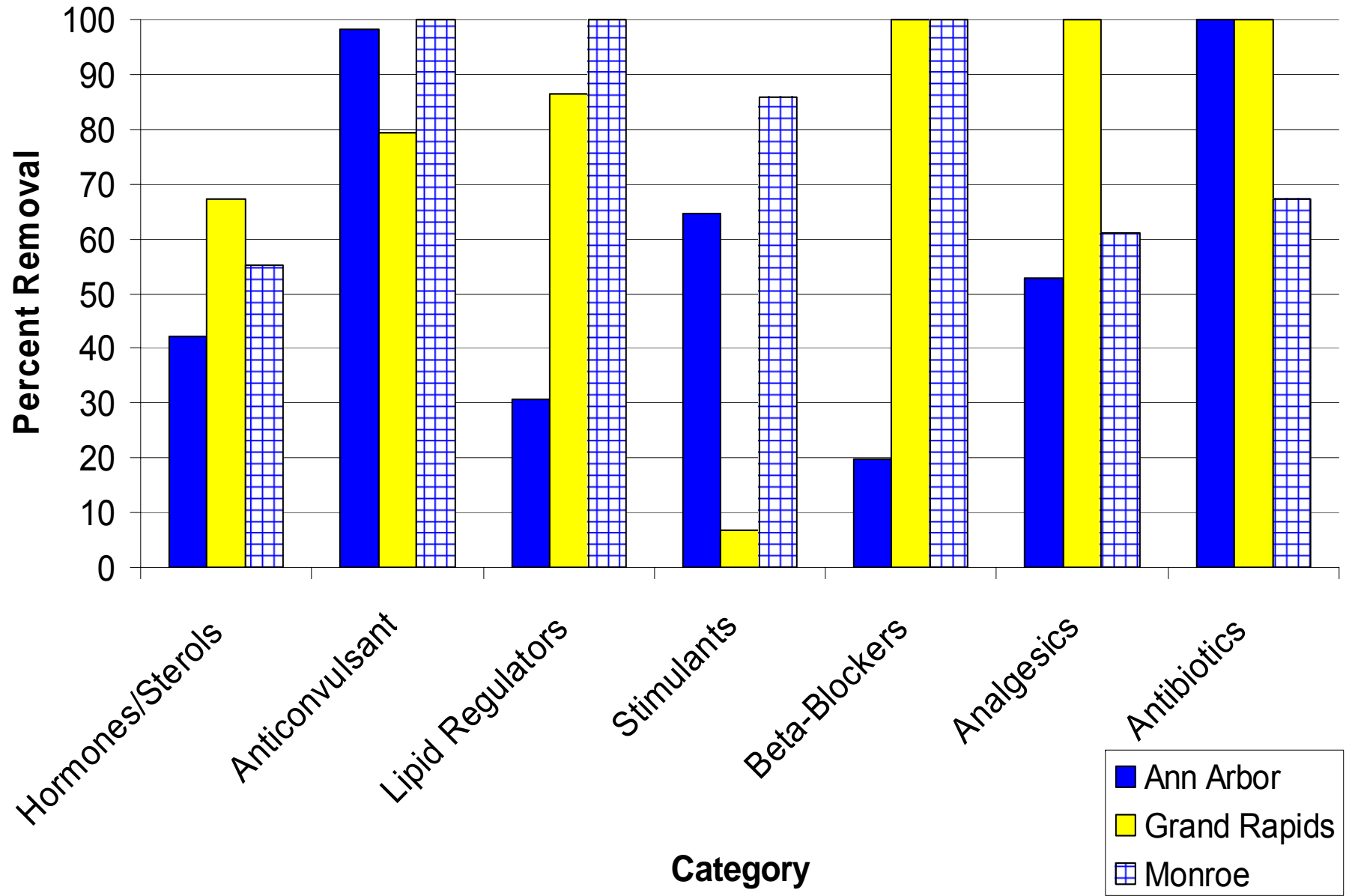
Compounds Detected in Source Water



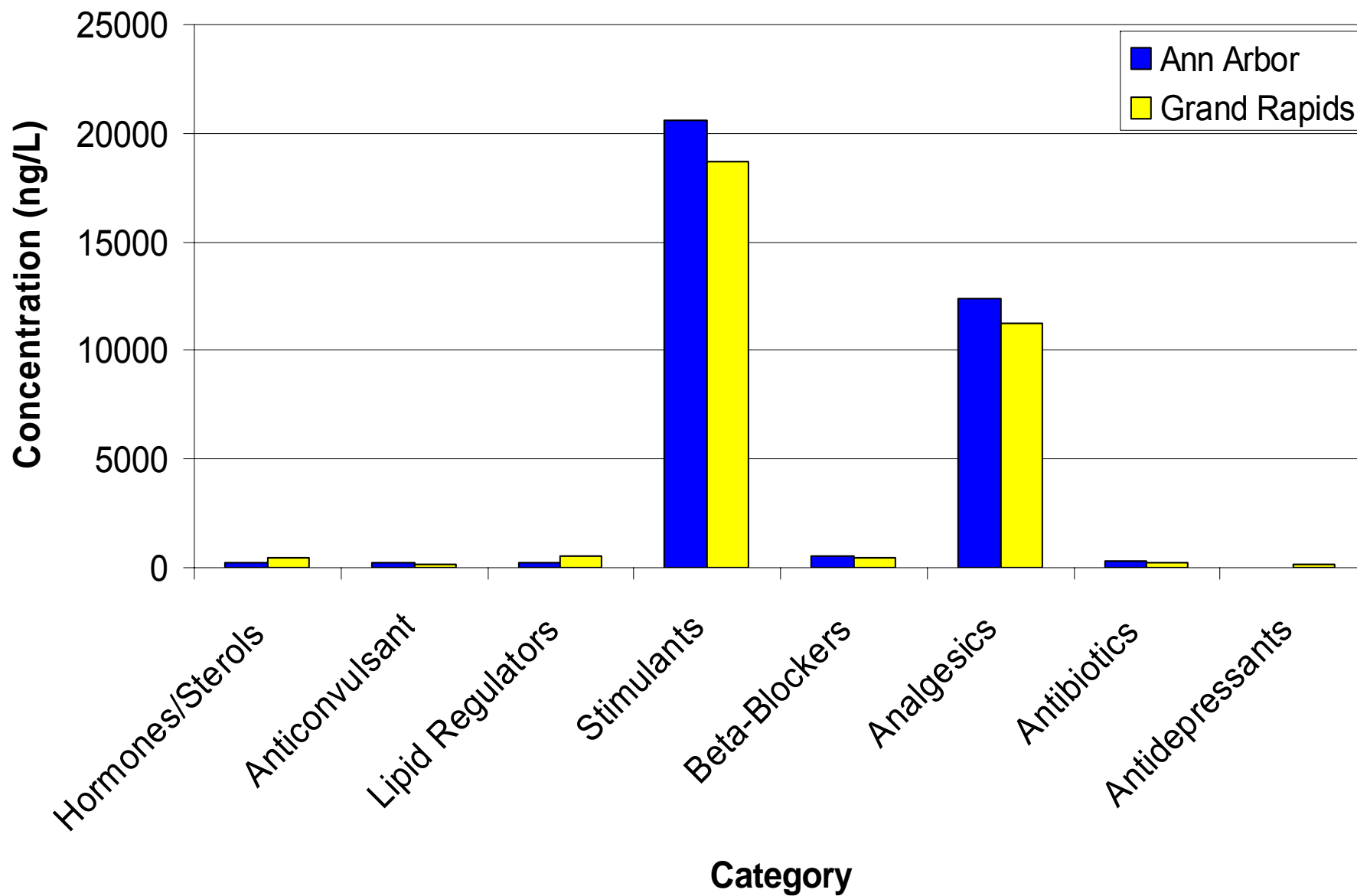
Compounds Detected in Drinking Water



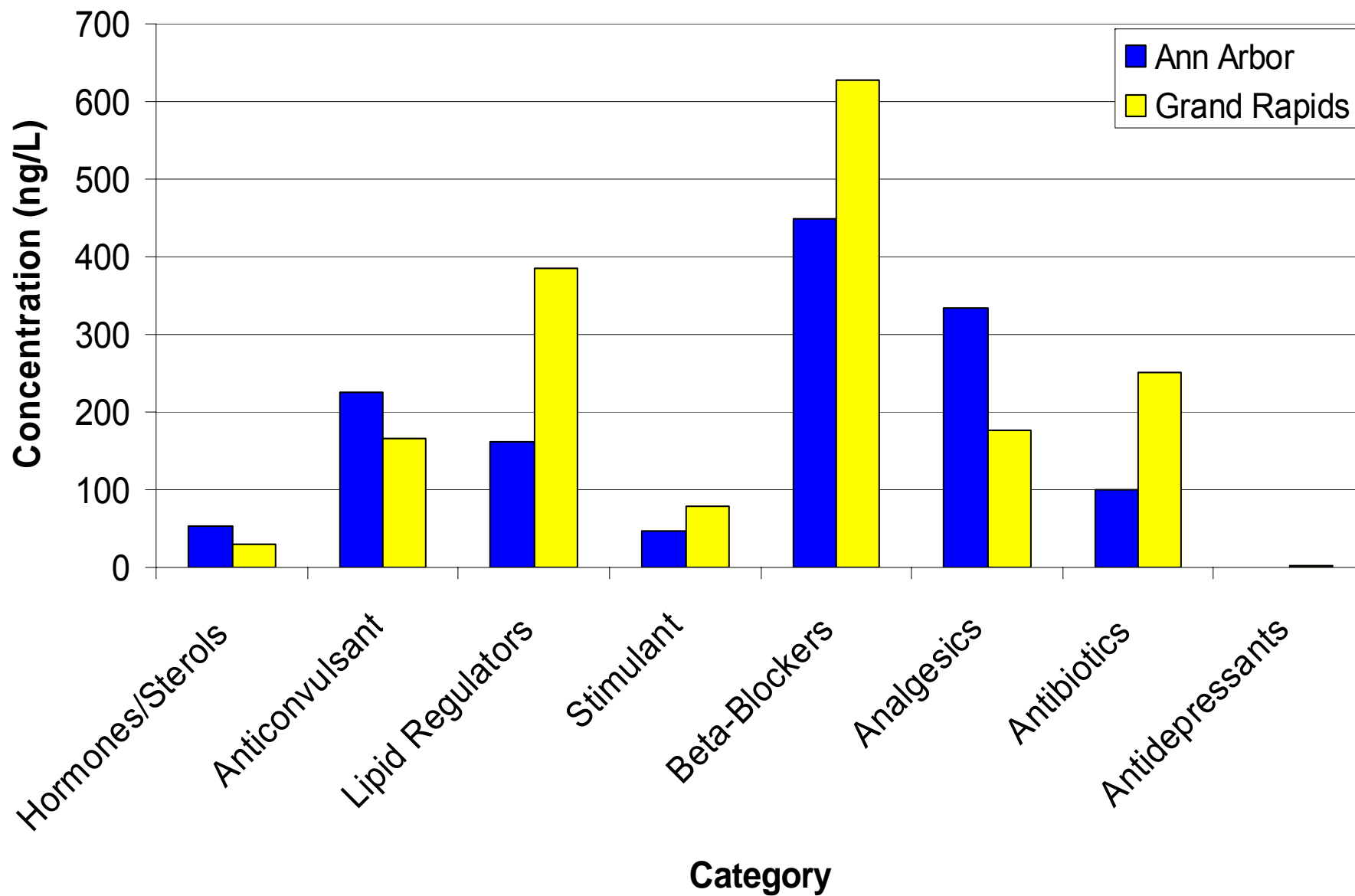
Effect of Water Treatment



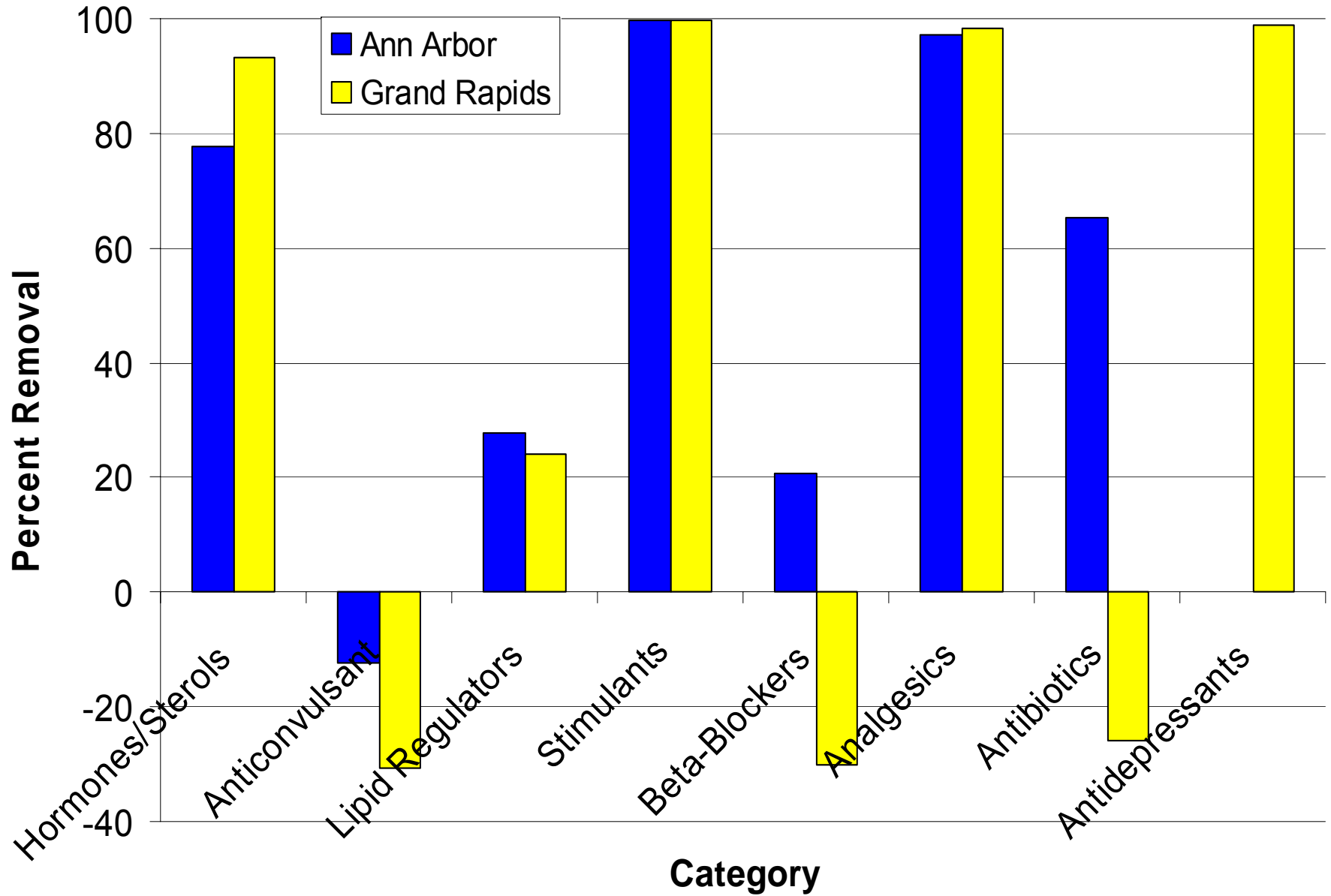
Compounds Detected in Wastewater Influent



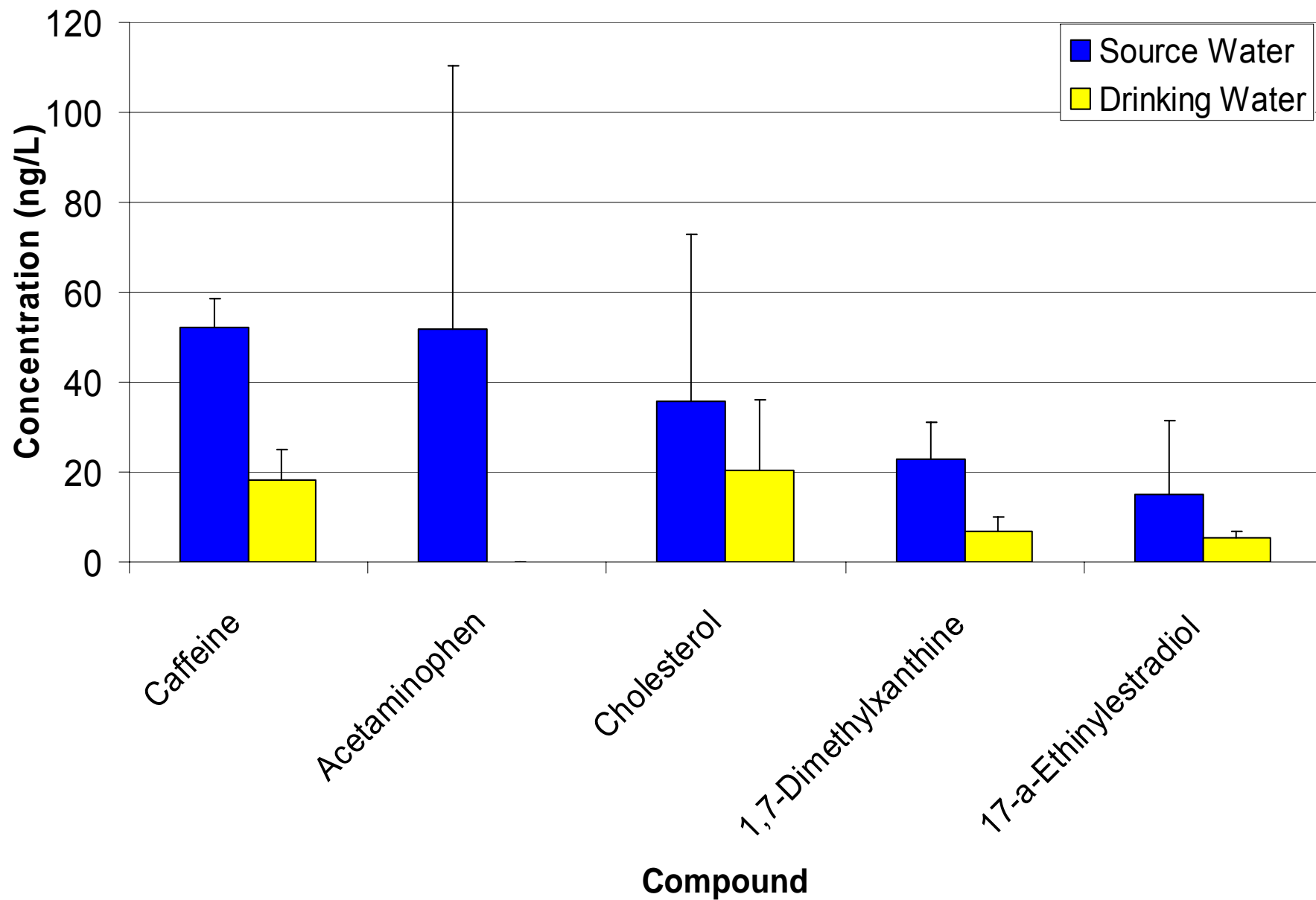
Compounds Detected in Wastewater Effluent



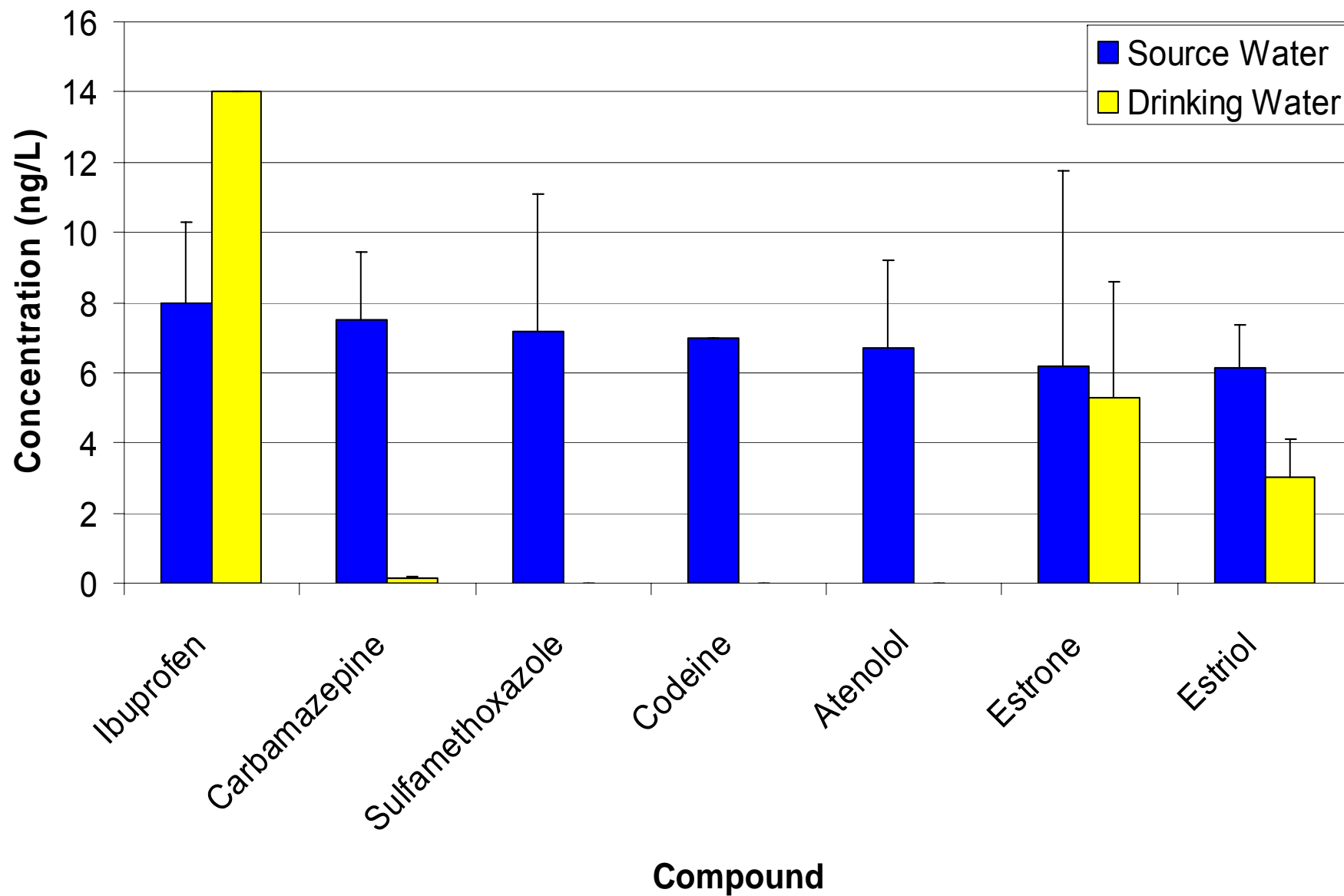
Effect of Wastewater Treatment



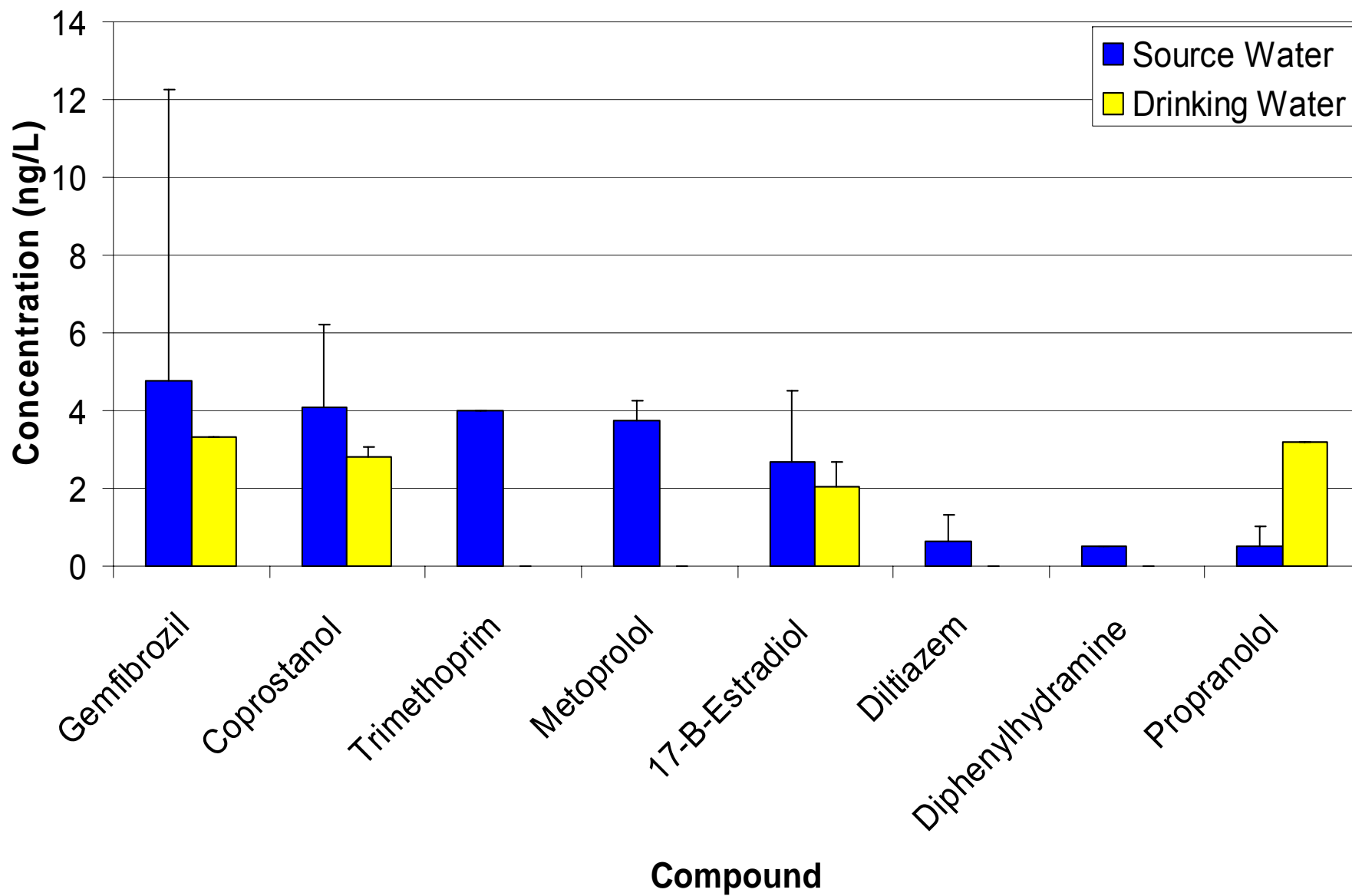
Ann Arbor Source Water vs. Drinking Water



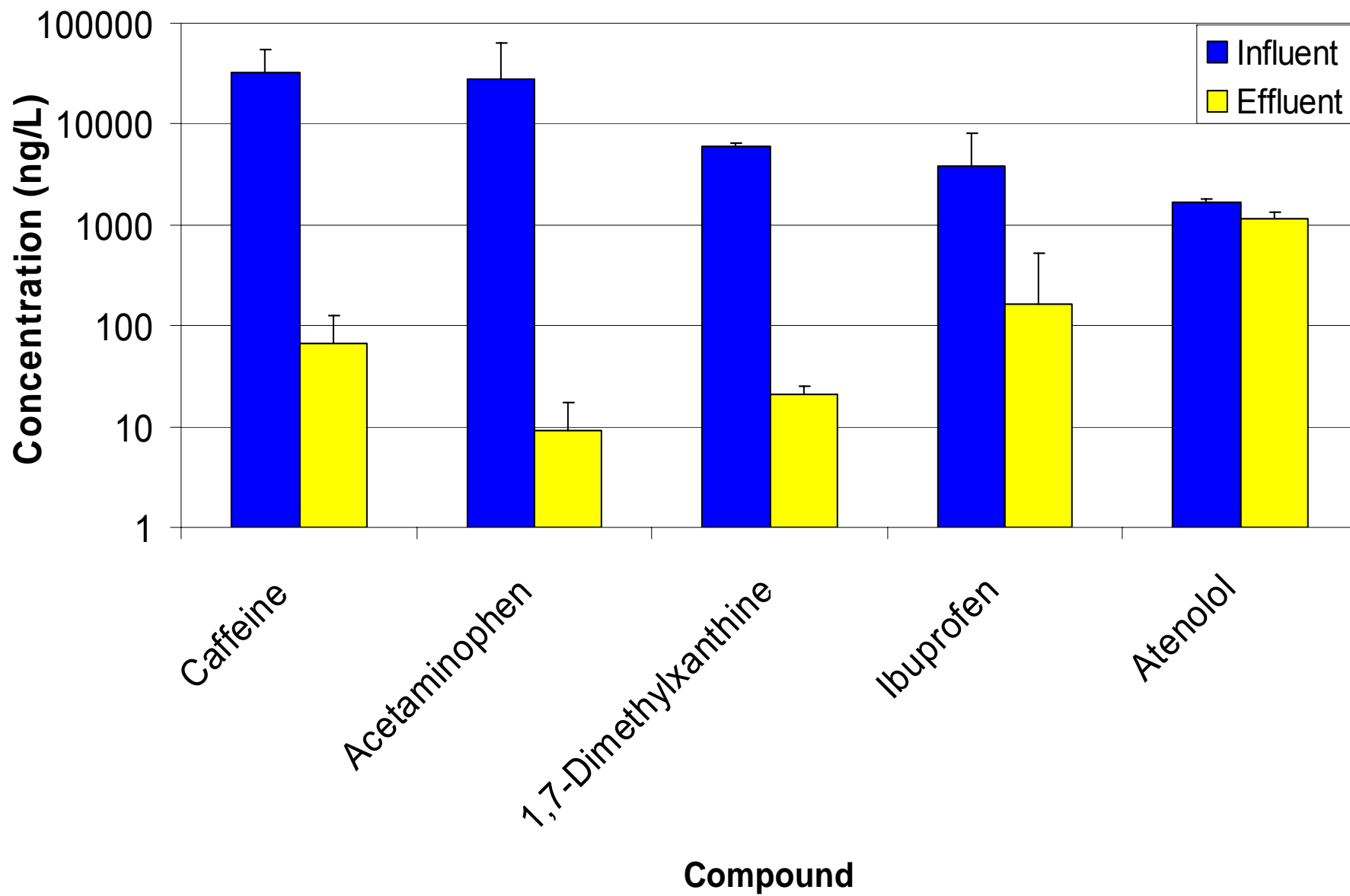
Ann Arbor Source Water vs. Drinking Water



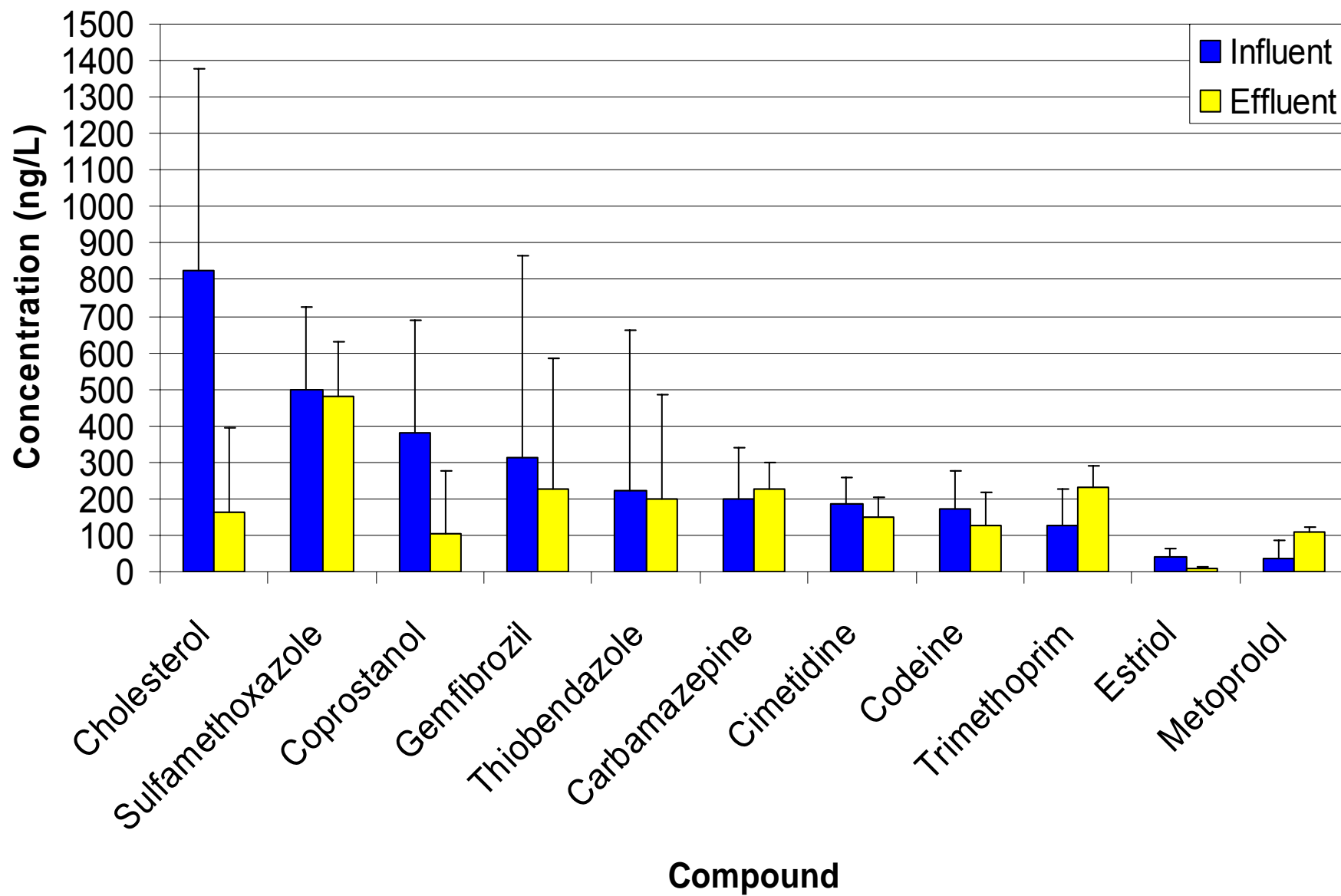
Ann Arbor Source Water vs. Drinking Water



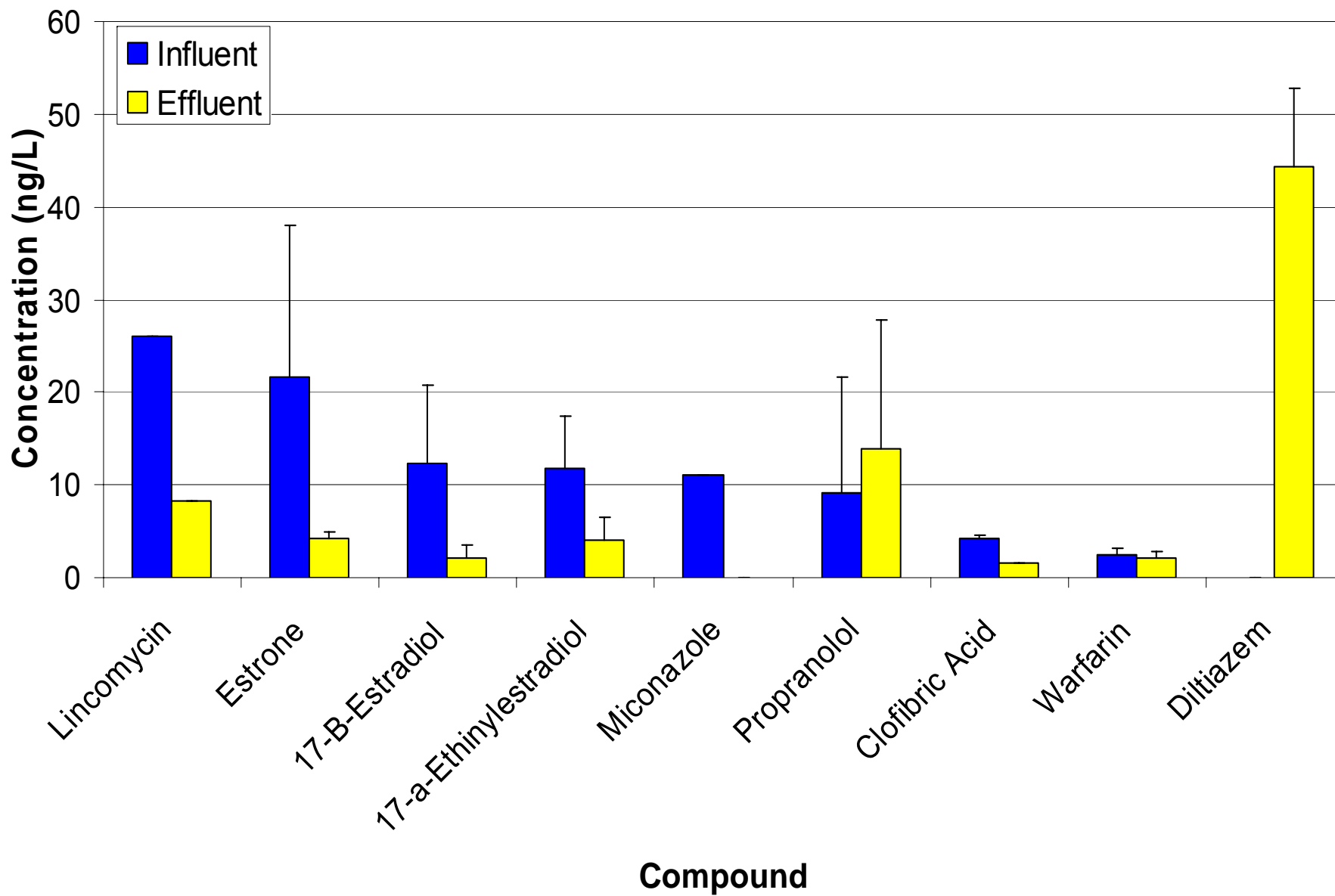
Ann Arbor Wastewater Influent vs. Effluent



Ann Arbor Wastewater Influent vs. Effluent



Ann Arbor Wastewater Influent vs. Effluent



Should We Regulate PPCPs?

- “Not everything that counts can be counted, and not everything that can be counted counts.”
 - often attributed to Albert Einstein

Unanswered Questions

- Is any of this a problem?
 - Antibiotic resistance
 - Endocrine disruption
 - Aquatic life
 - Persistence and bioaccumulation?
 - Wildlife
 - Human health
 - Allergic reactions?
- How can these compounds be removed?
 - Cost, technical feasibility

Acknowledgments

- **Bryan Brooks** and **Kevin Chambliss**, Baylor University Center for Reservoir and Aquatic Systems Research
- **Janice Skadsen**, City of Ann Arbor Water Utilities
- **John Wierenga**, City of Grand Rapids Lake Michigan Filtration Plant
- **Scott Allen**, City of Monroe
- **Daniel Meyering** and **Brian Rice**, Fleis and VandenBrink Engineering
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- SEIU Local 517m – Professional Development Fund

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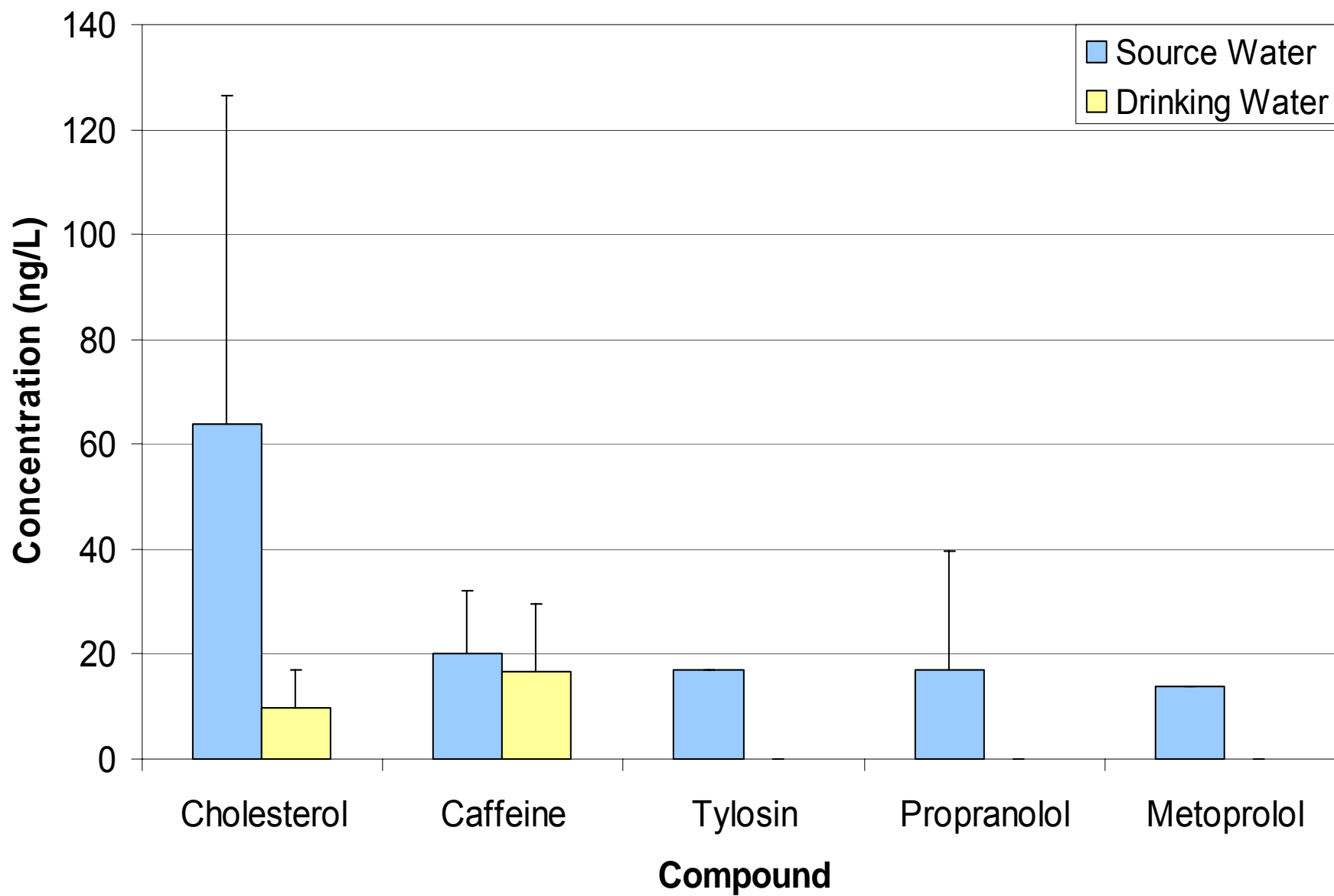
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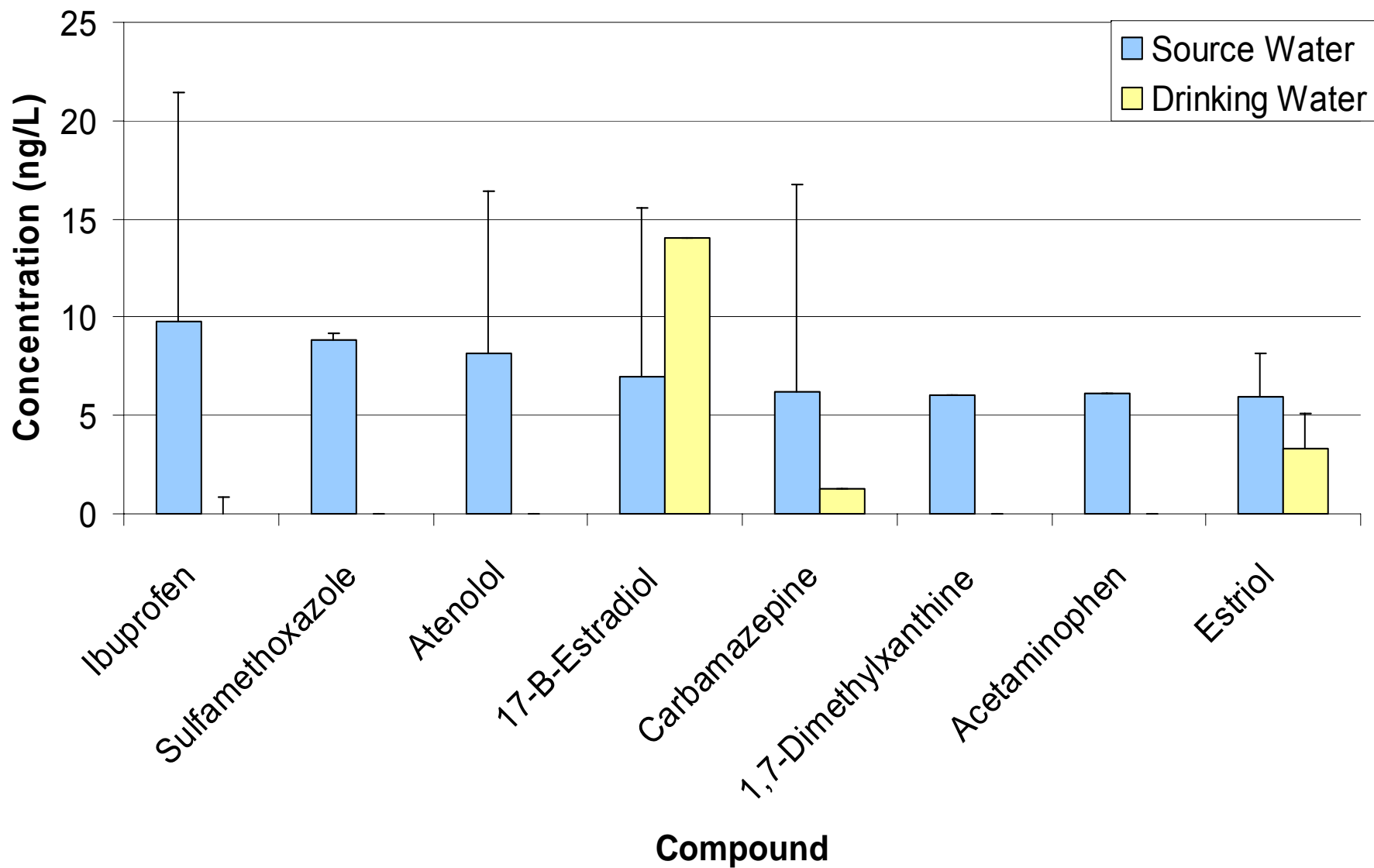
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<http://www.michigan.gov/deq>

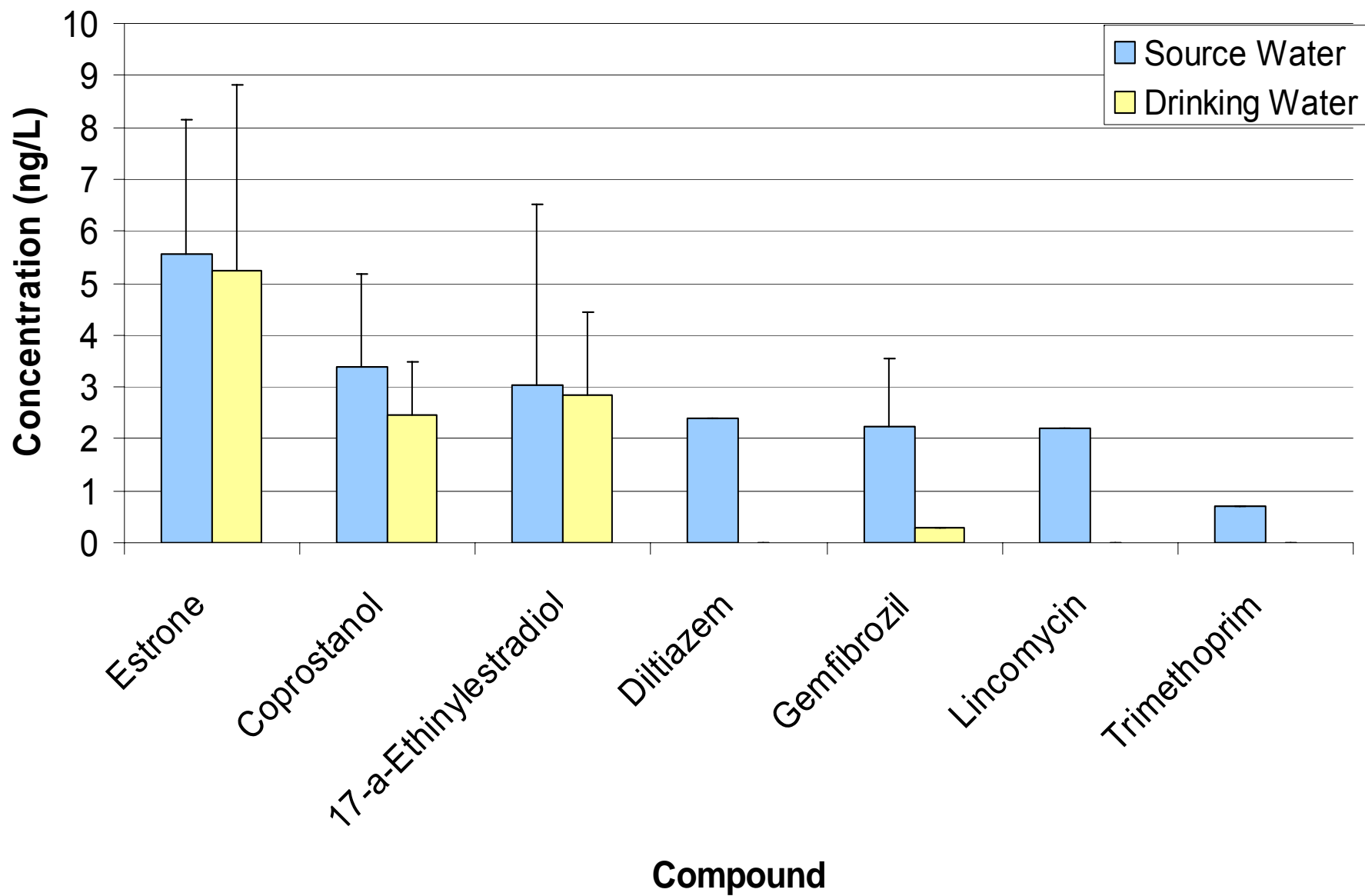
Grand Rapids Source Water vs. Drinking Water



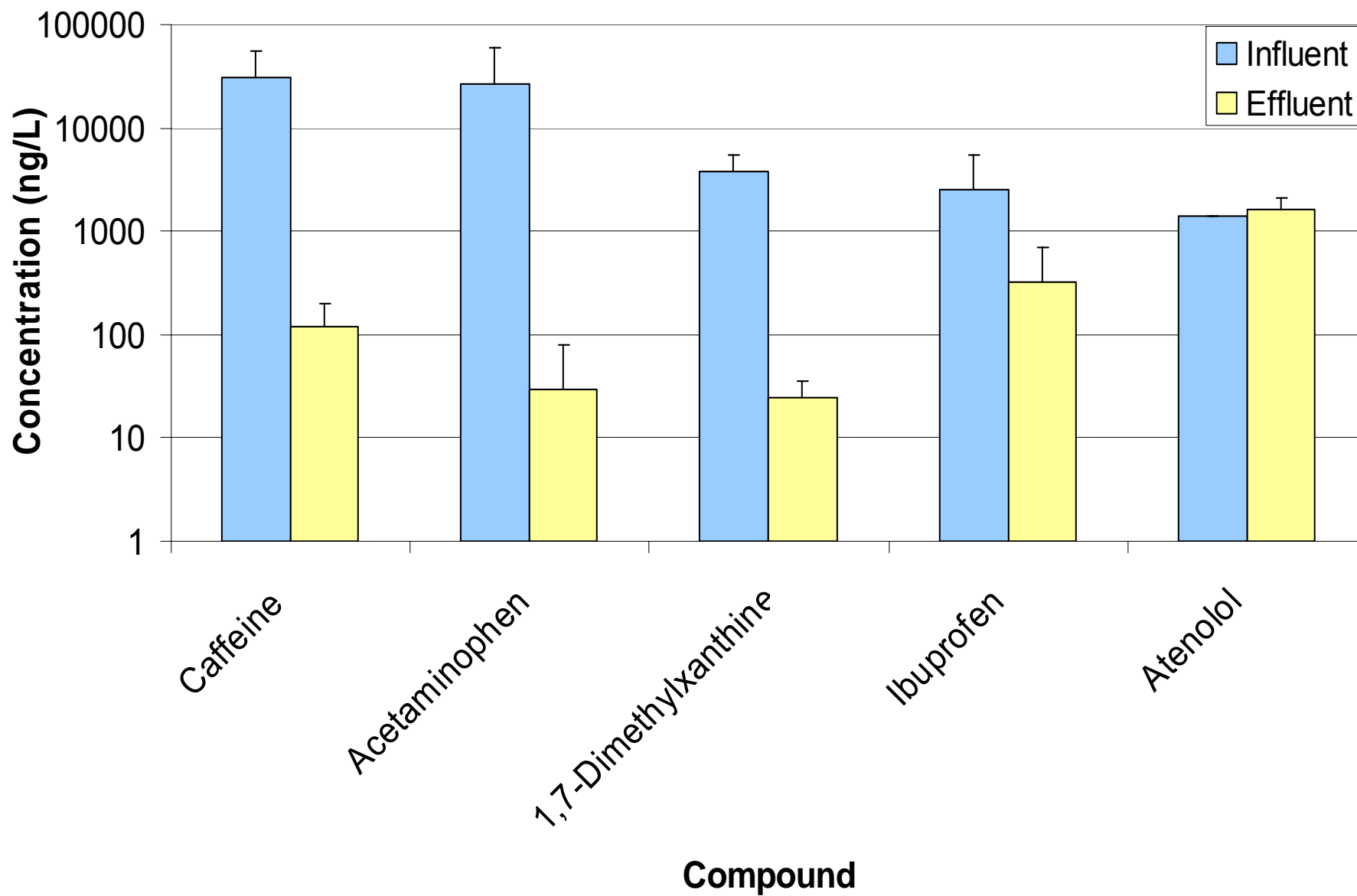
Grand Rapids Source Water vs. Drinking Water



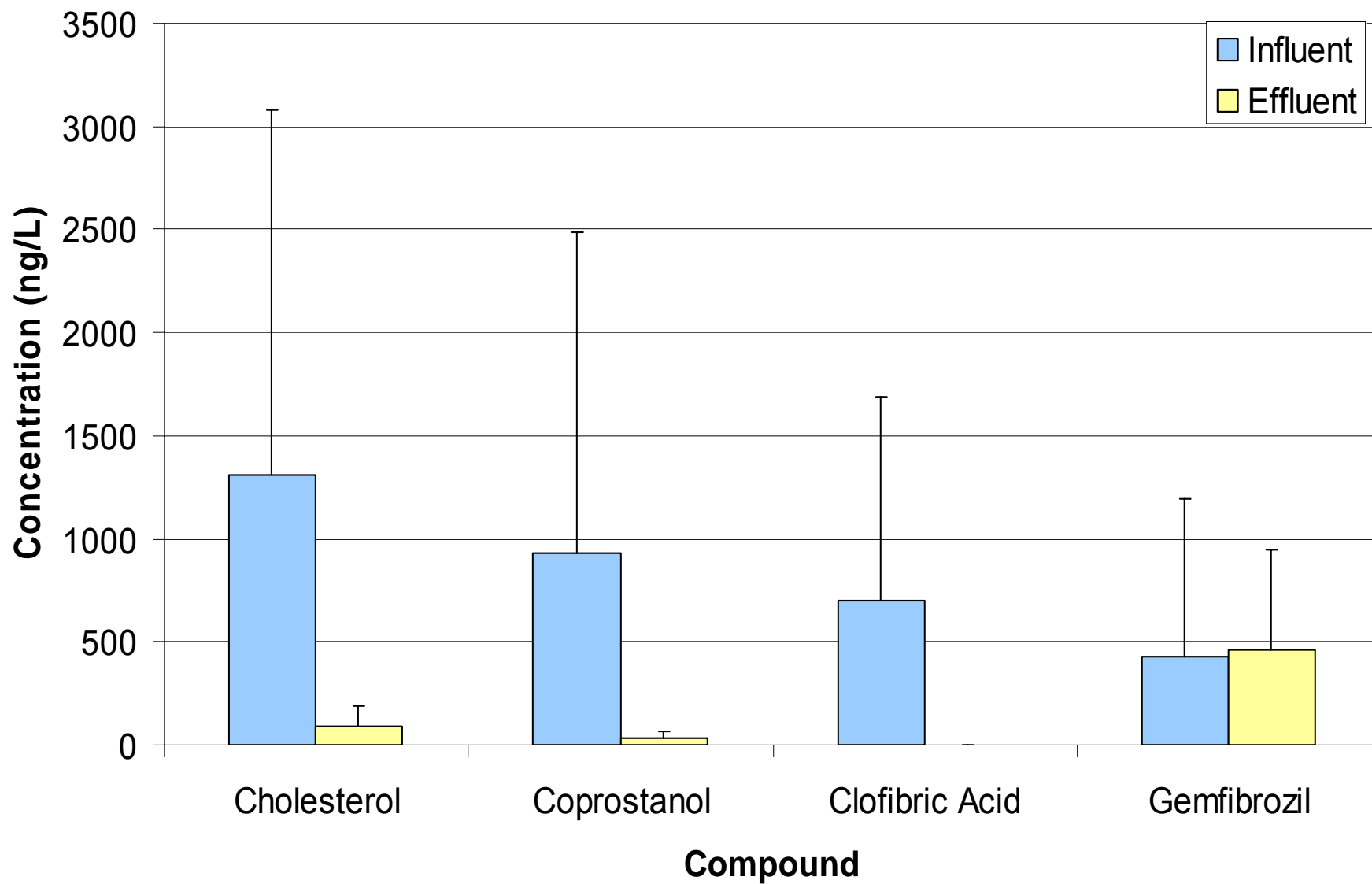
Grand Rapids Source Water vs. Drinking Water



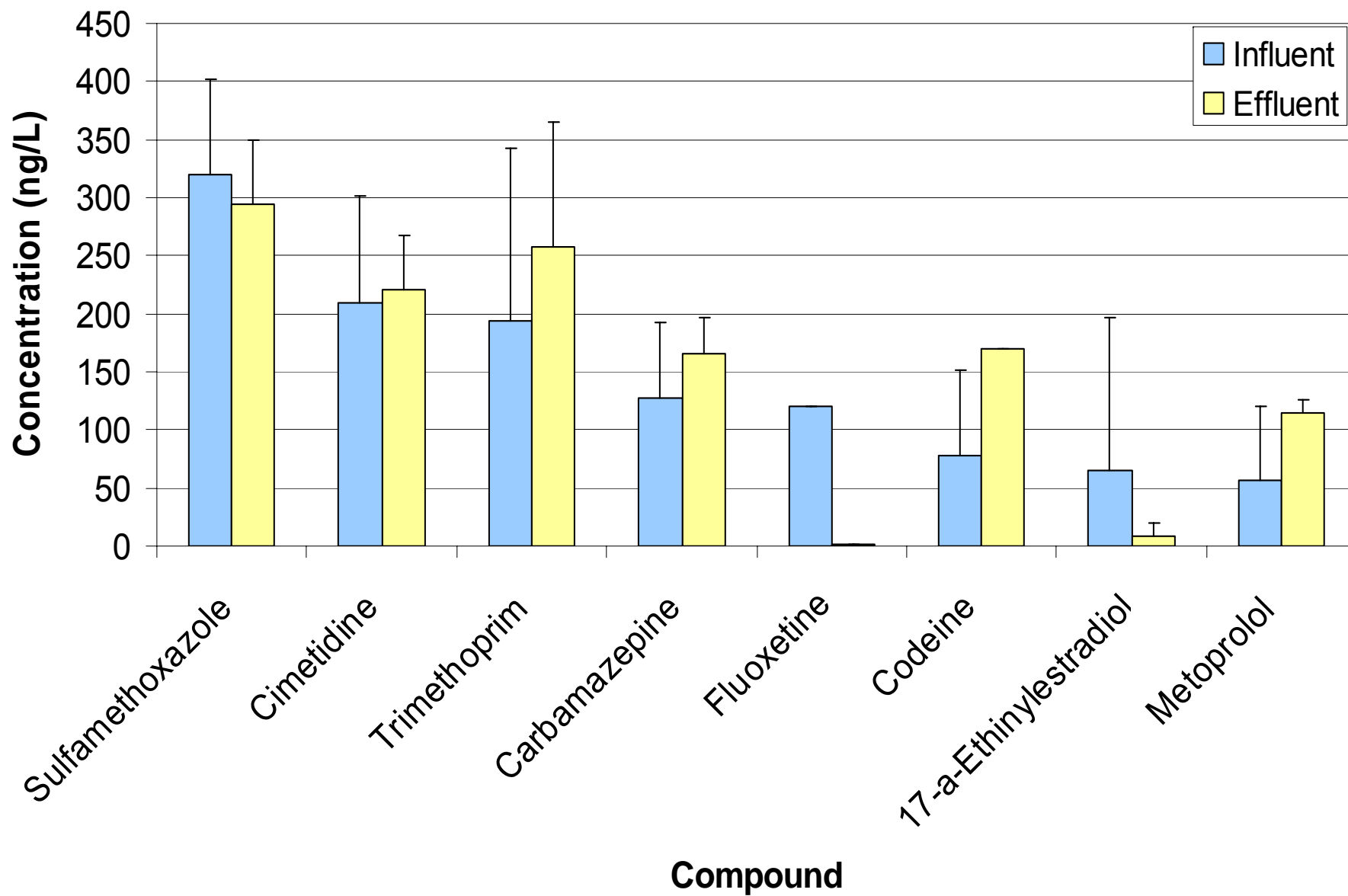
Grand Rapids Wastewater Influent vs. Effluent



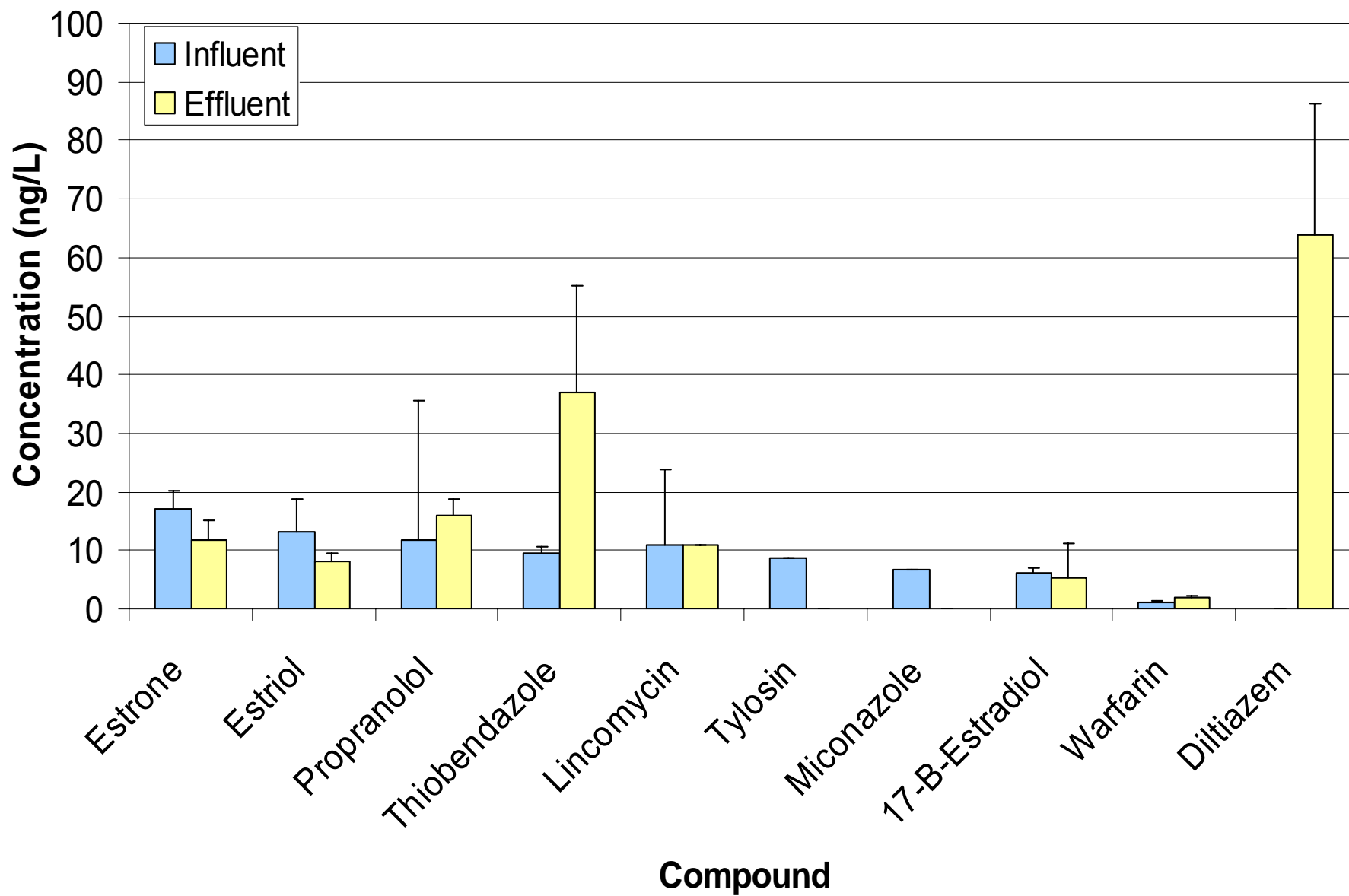
Grand Rapids Wastewater Influent vs. Effluent



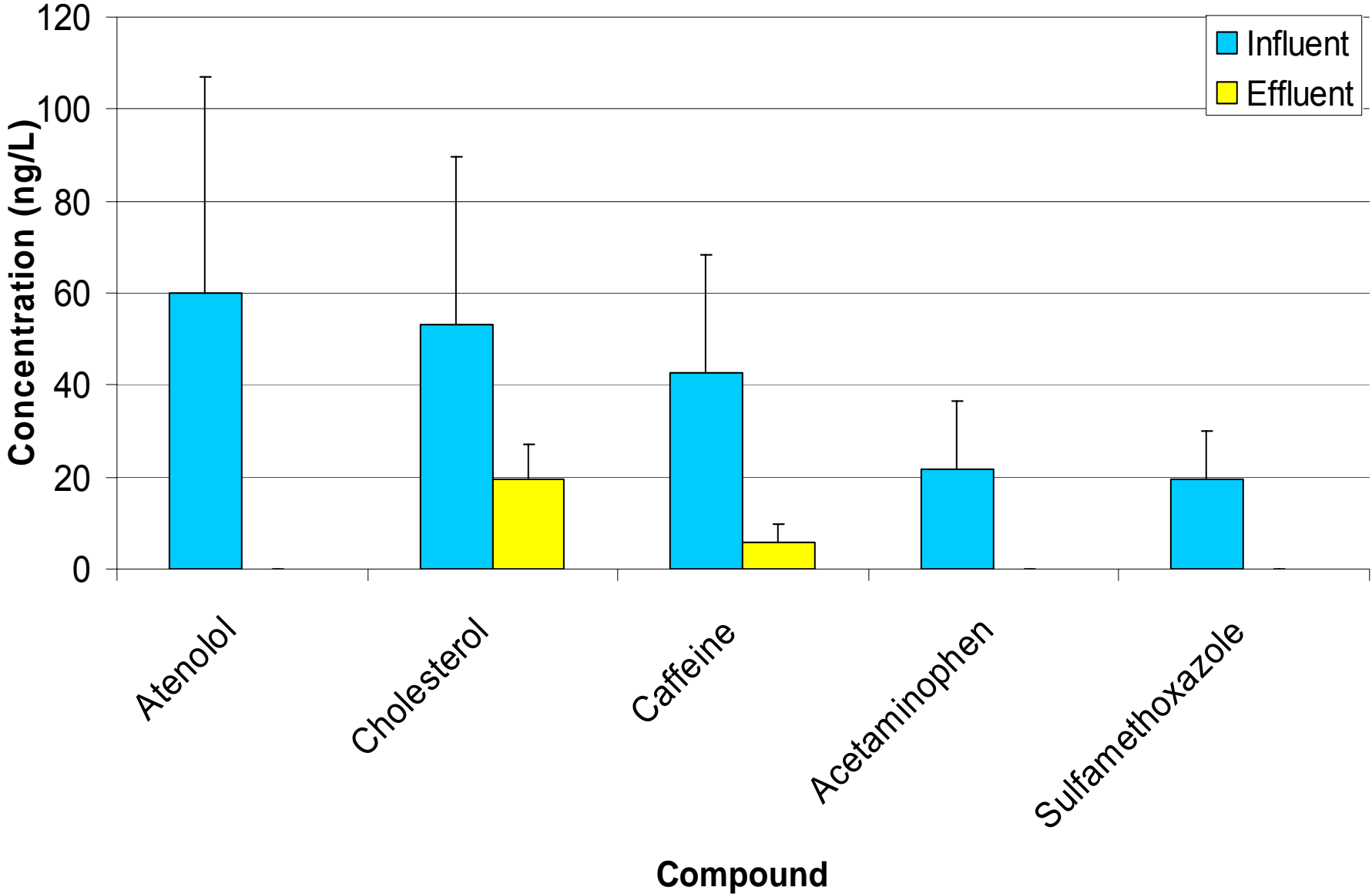
Grand Rapids Wastewater Influent vs. Effluent



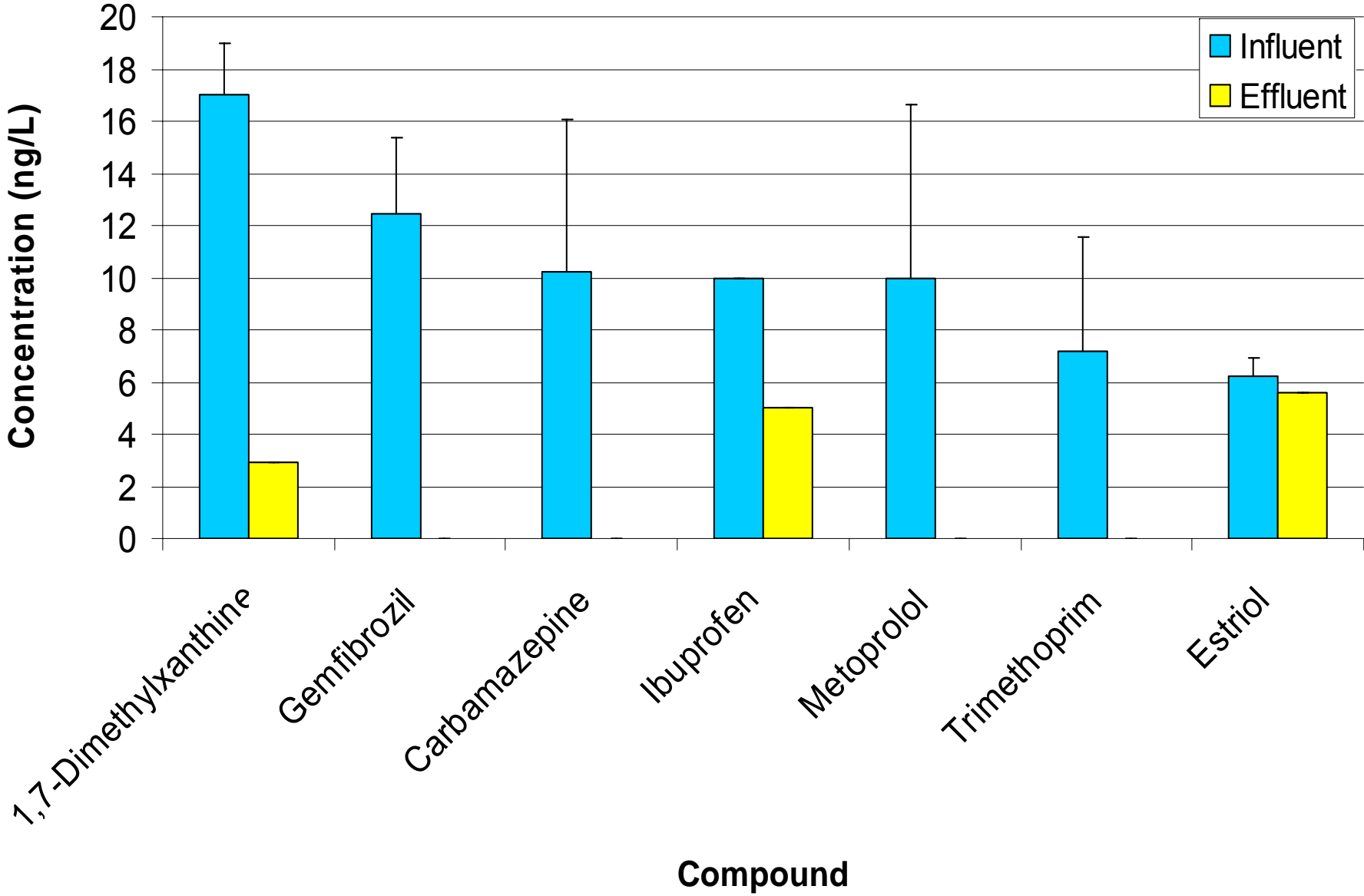
Grand Rapids Wastewater Influent vs. Effluent



Monroe Source Water vs. Drinking Water



Monroe Source Water vs. Drinking Water



Monroe Source Water vs. Drinking Water

