

Seattle's Open Reservoirs

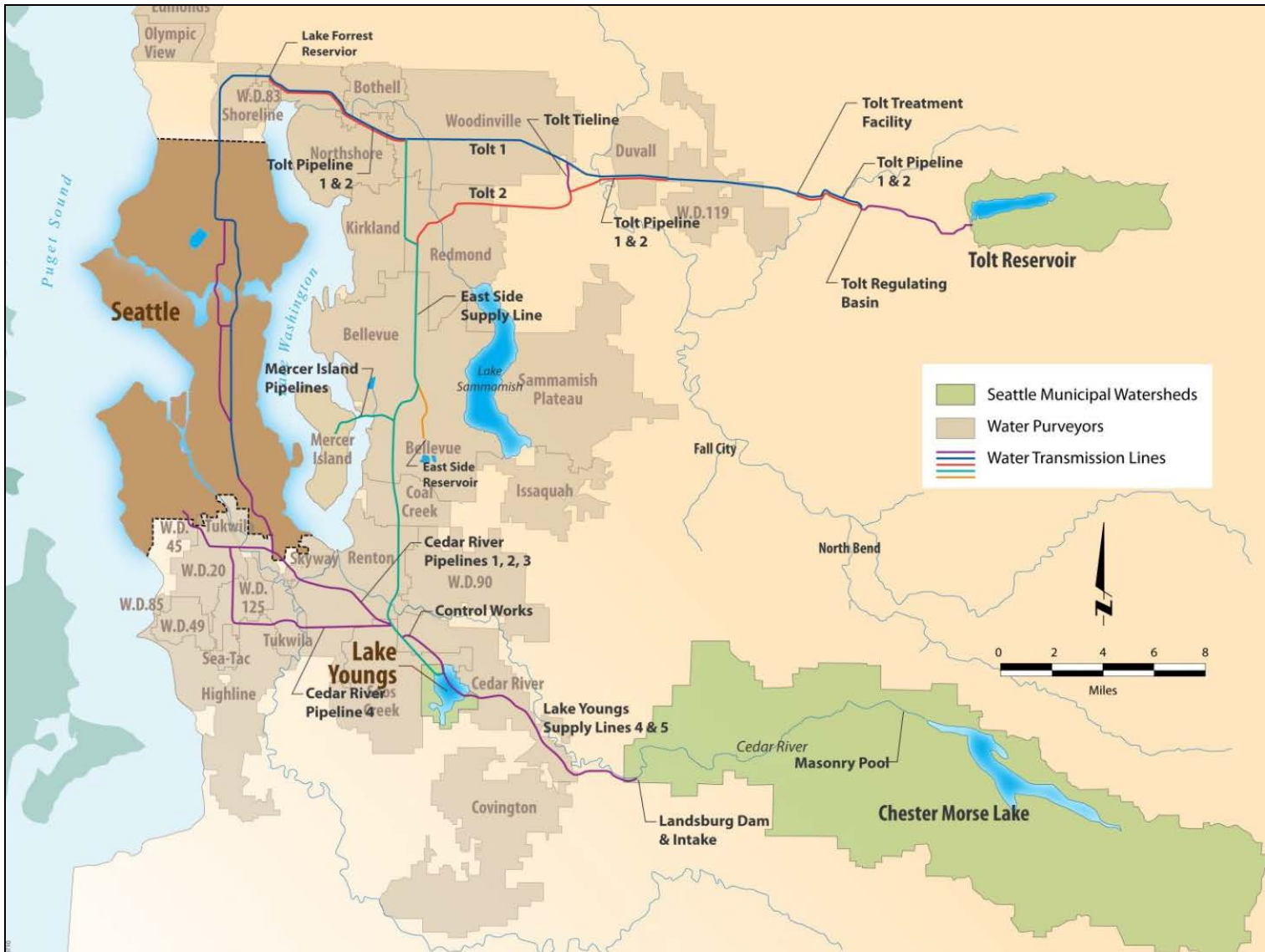
Wylie Harper

Seattle Public Utilities

April 24, 2012



SPU Drinking Water System



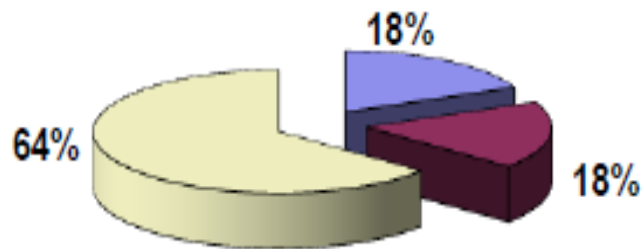
Lake Youngs



- 11 billion gallons
- Can avoid turbidity events through shut down of Cedar River diversion
- Seasonal algae blooms
- Can by-pass Lake Youngs if needed

Seattle's Open Reservoirs

- 2000 - 9 reservoirs held 90% of dist. Storage
- 2004 - 6 reservoirs, 60%
- 2006 - 4 reservoirs, 40%
- 2012 - 2 reservoirs, 18%



■ Open ■ Already Closed ■ Converted to Closed

Open Reservoir Covering

| Reservoir | Open Reservoir Size (MG) | Covered Reservoir Size (MG) | Yr. Original Construction | Completion |
|---------------------|--------------------------|-----------------------------|---------------------------|------------|
| Bitter Lake | 21 | 21 | 1956 | 2001 |
| Lake Forest | 60 | 60 | 1961 | 2003 |
| Lincoln | 20 | 13 | 1901 | 2006 |
| Myrtle | 7 | 5 | 1946 | 2008 |
| Beacon | 61 | 50 | 1911 | 2009 |
| West Seattle | 68 | 30 | 1932 | 2010 |
| Maple Leaf | 60 | 60 | 1910 | 2012 |
| Volunteer | 20 | 0 or 10 | 1901 | 2015 |
| Roosevelt | 50 | 0 | 1910 | 2015 |
| Total | 367 | 239 (or 249) | | |

Before and After...



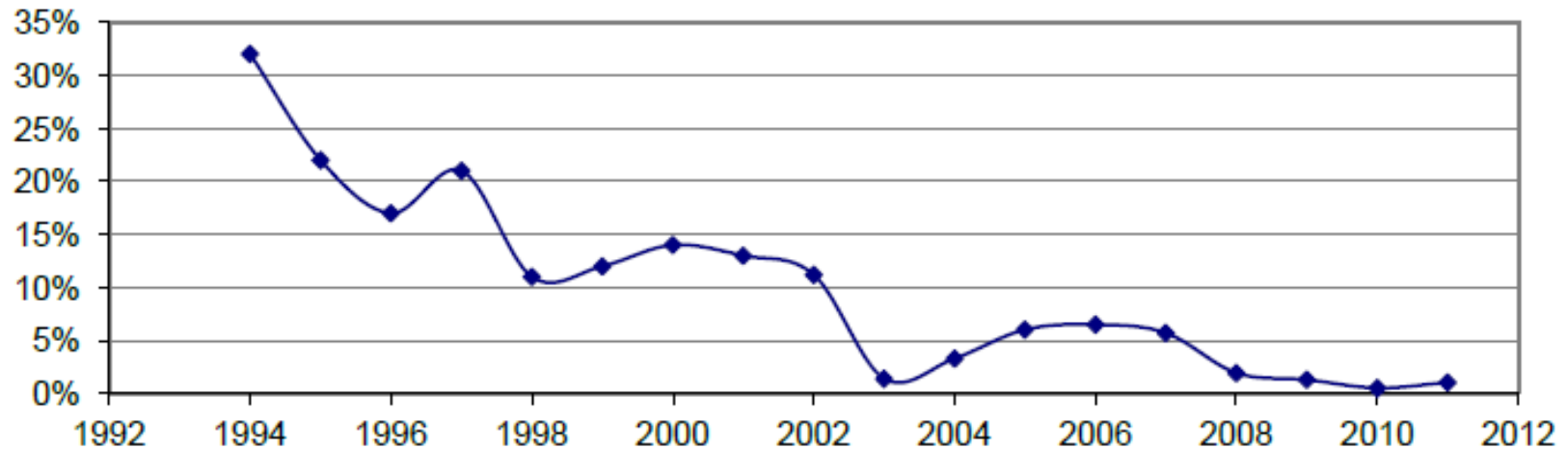
Open Reservoir Protection Program Elements

- Security
- Patrol
- Bird Control
- Reservoir Cleaning
- Outlet Disinfection
- Surface Water Control
- WQ Monitoring
- Reservoir Operations
- Staffing & Training
- Recordkeeping & Reporting
- Emergency Response

Water Quality Monitoring

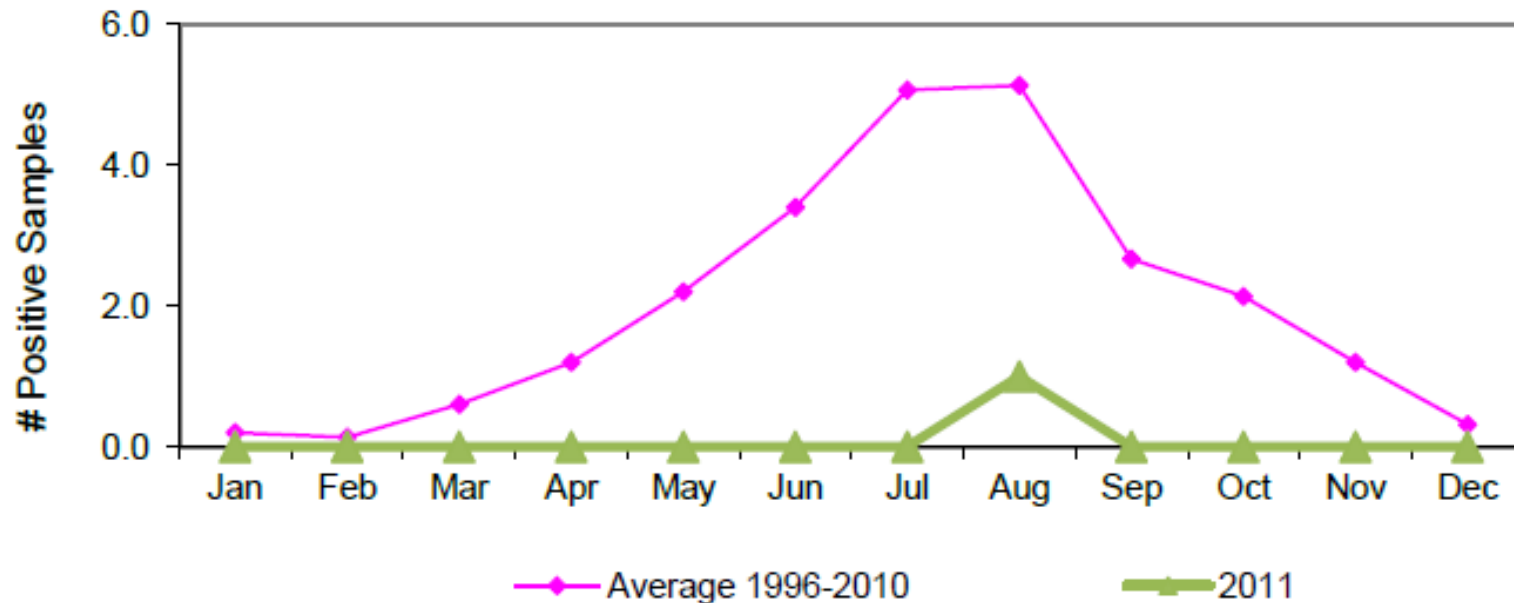
- Microbiology analysis (weekly)
 - Fecal & total coliform
 - HPC
 - *Pseudomonas*
- Chemistry (bi-weekly)
- Bird population and estimated nutrient loading
- Algae (bi-weekly)
- T&O analysis (weekly in summer)

Historical Percent Fecal Positives (pre-chlorination)

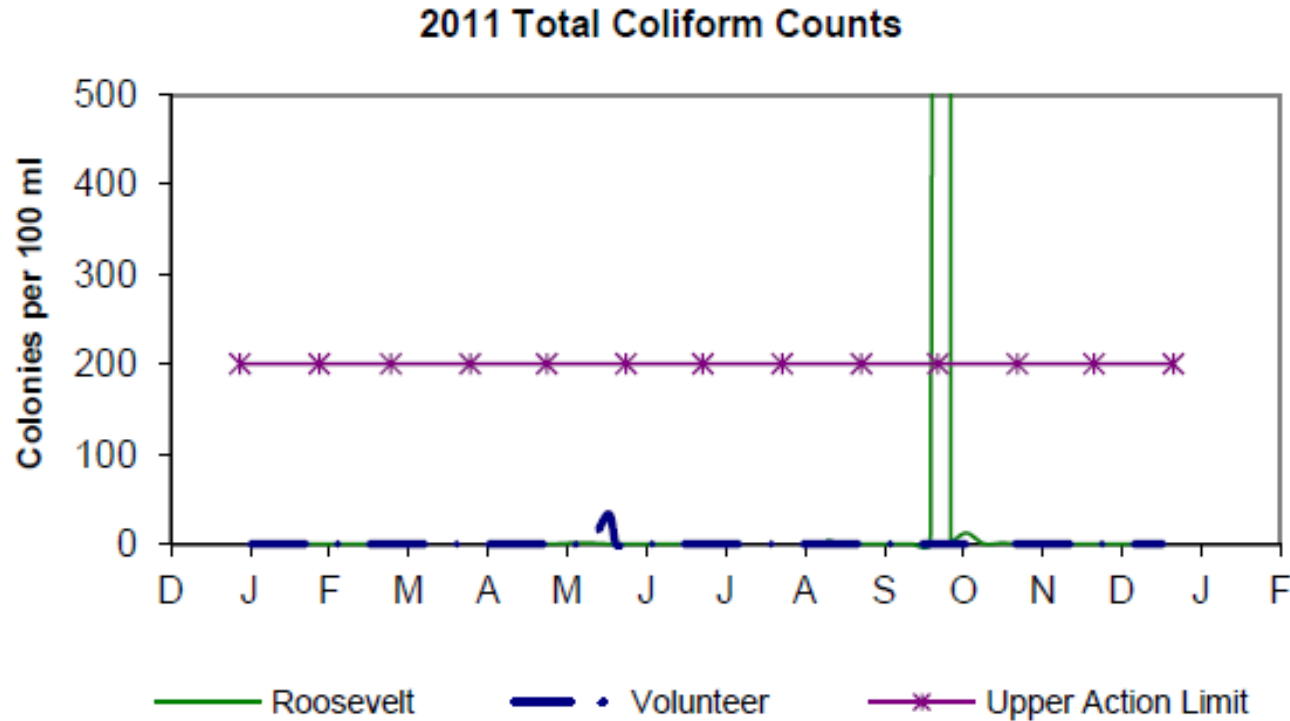


Number of Fecal Positives (pre-chlorination)

Positive Fecal Coliform Samples By Month
2011 vs. Average 1996-2010

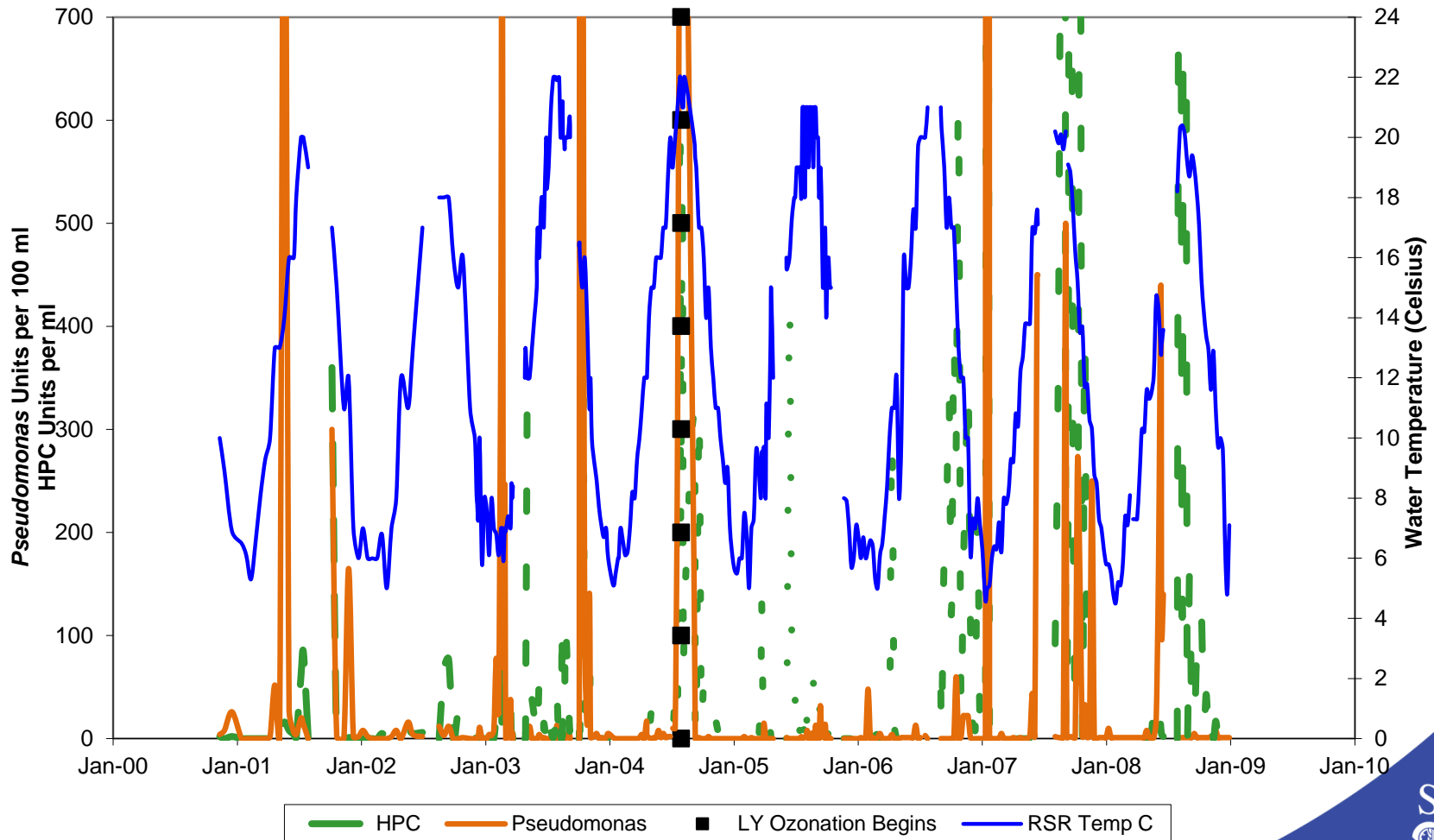


2011 Total Coliform Count (pre-chlorination)

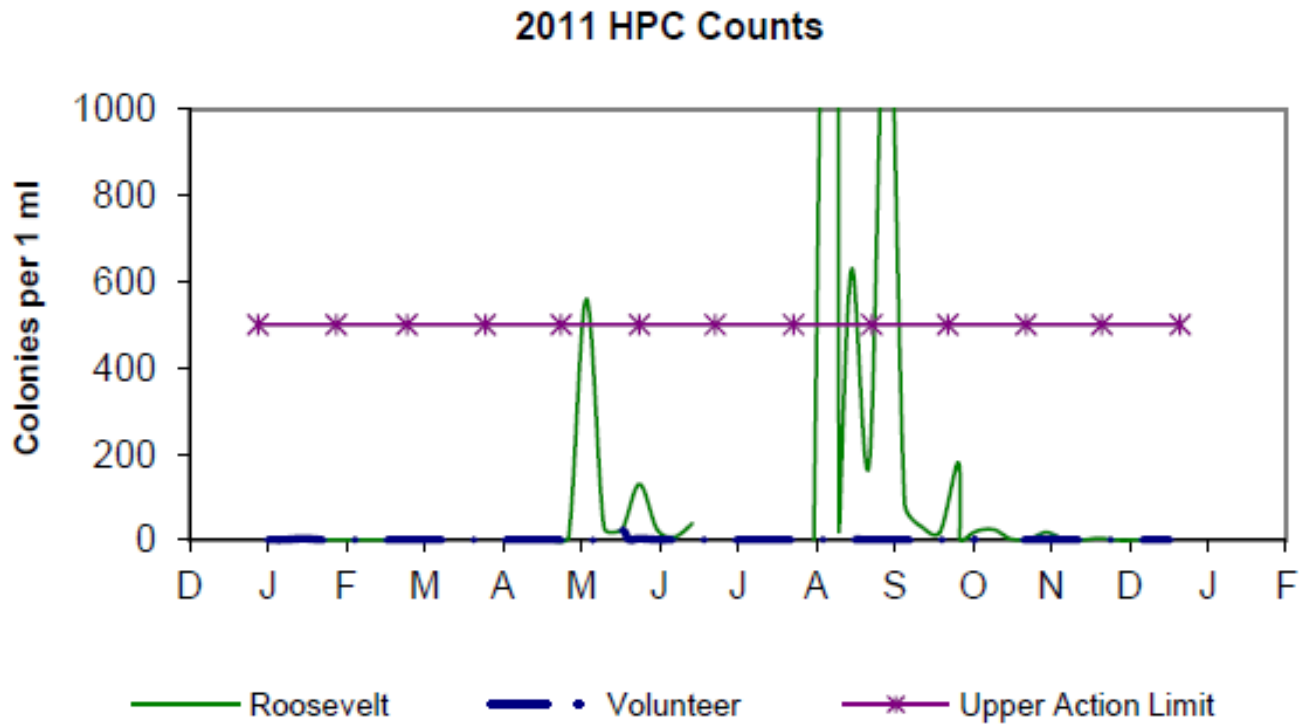


Historical HPC & *Pseudomonas*

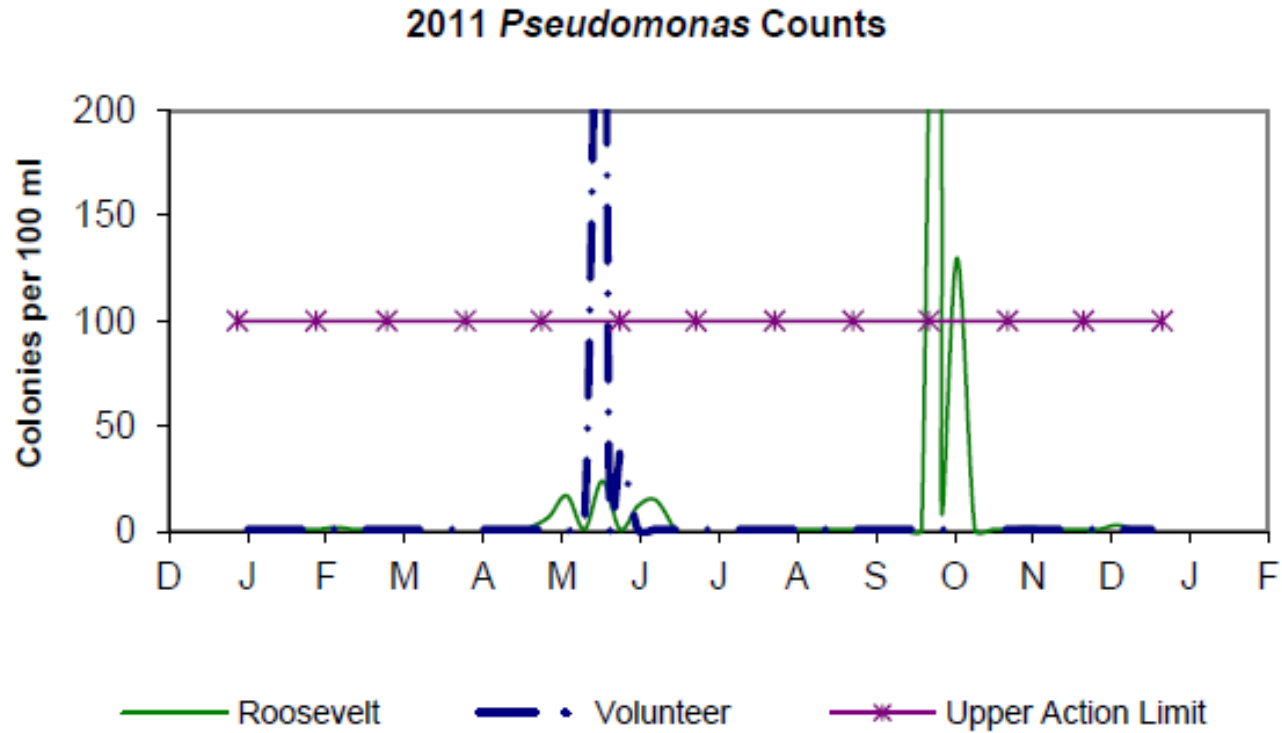
Roosevelt Reservoir
Temperature vs Heterotrophic Plate and *Pseudomonas* Counts
2001-2008



2011 Heterotrophic bacteria

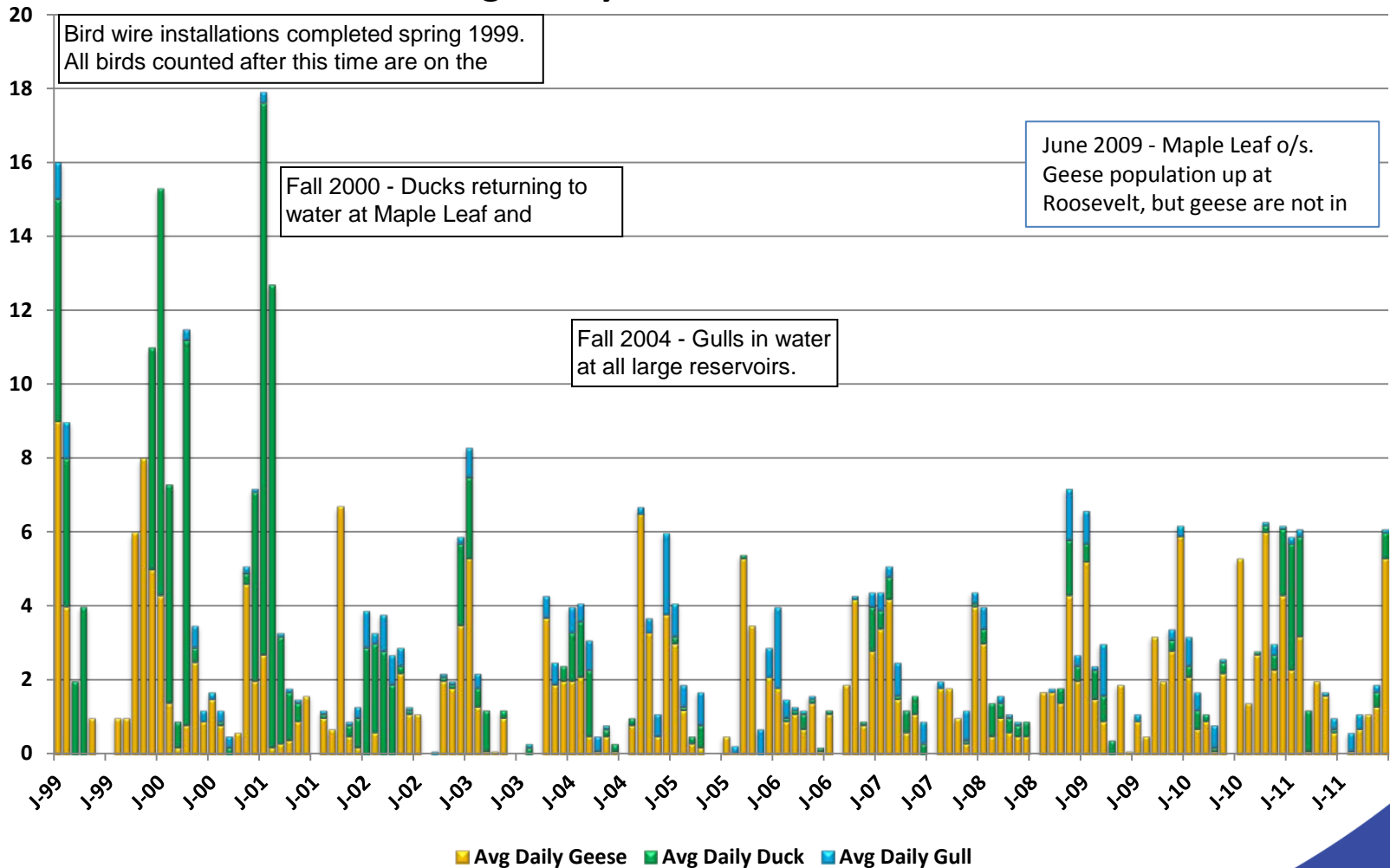


2011 *Pseudomonas*



Historical Bird Population

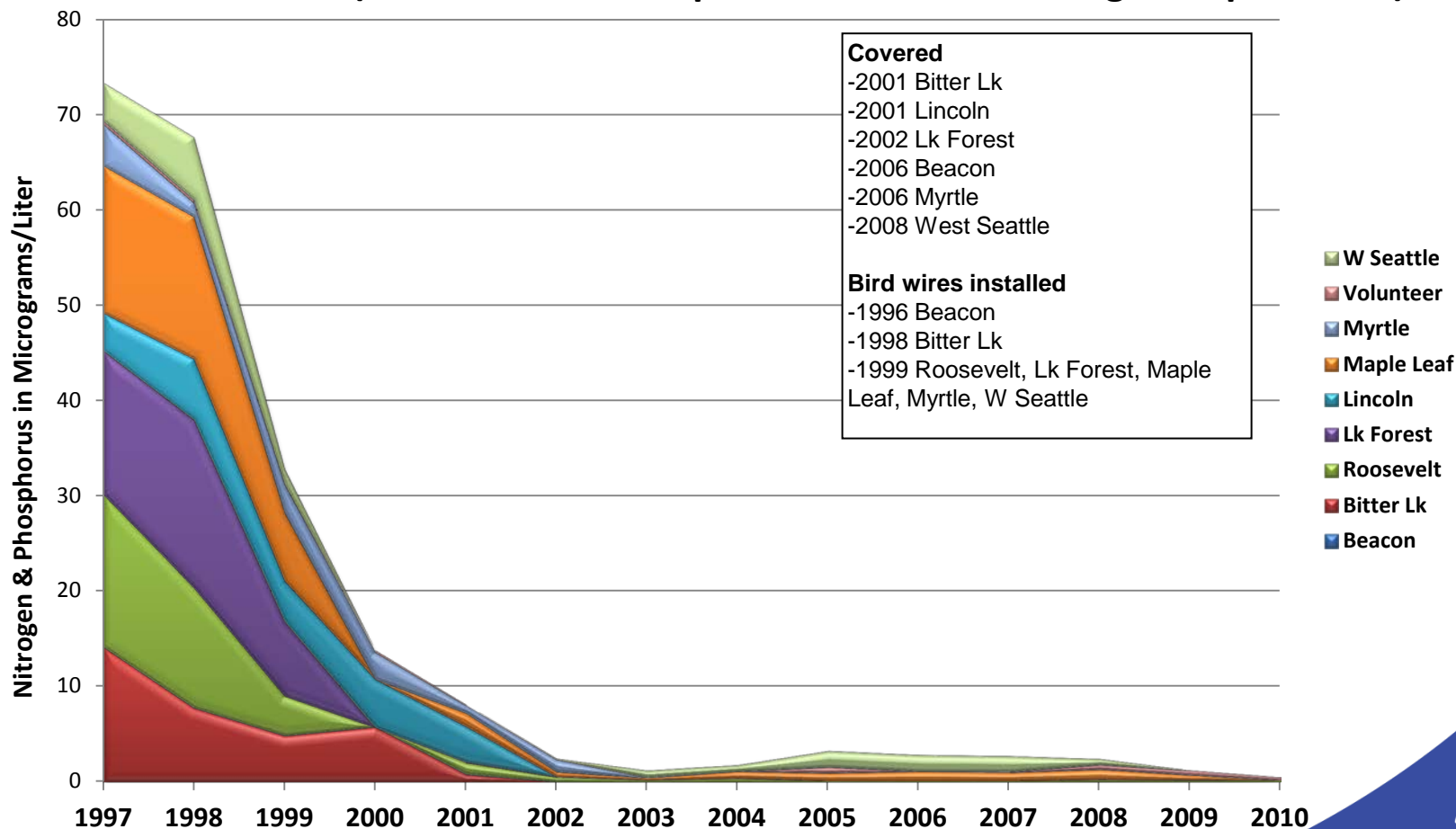
Average Daily Bird Counts at Roosevelt Reservoir



Estimated Nutrient Loading

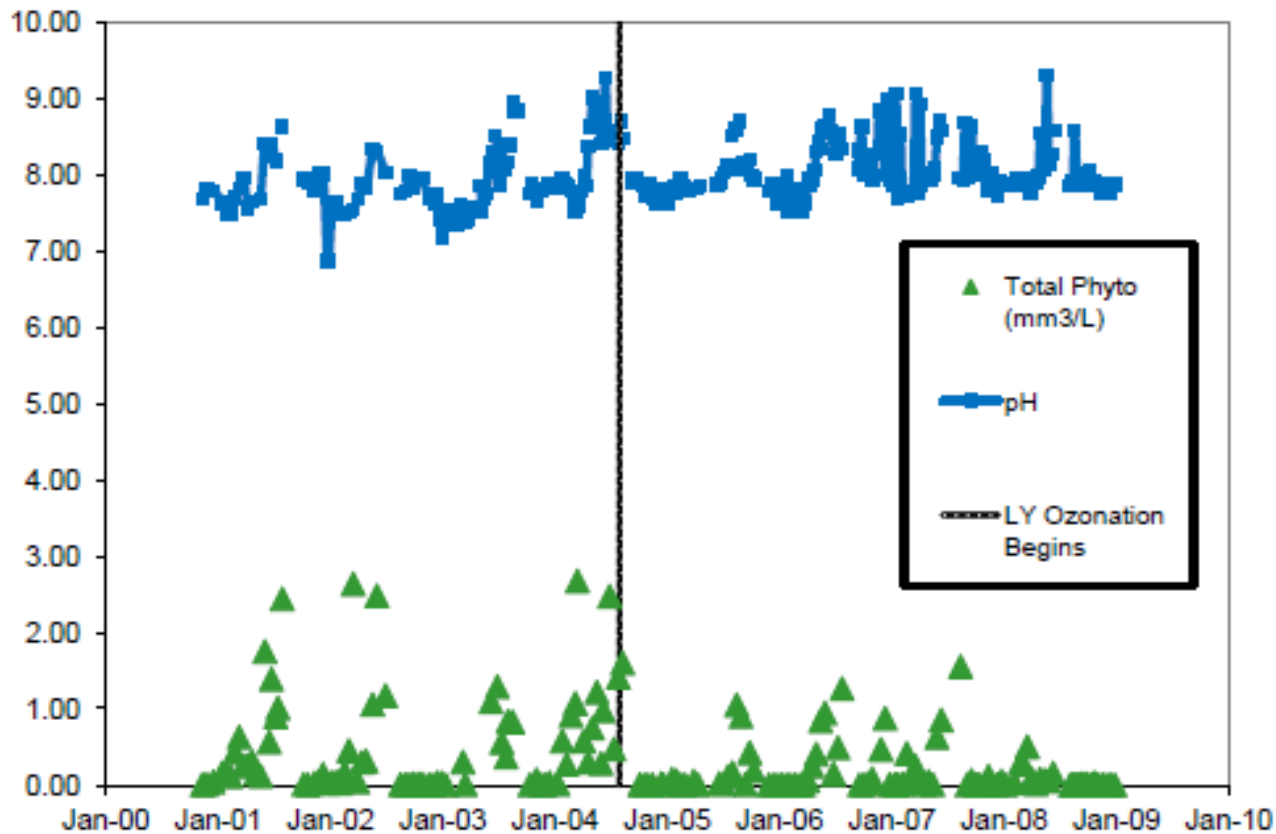
Seattle Public Utilities

Estimated Total Nutrient Loadings at Open Reservoirs
(Estimates Based Upon Geese, Duck & Seagull Populations)

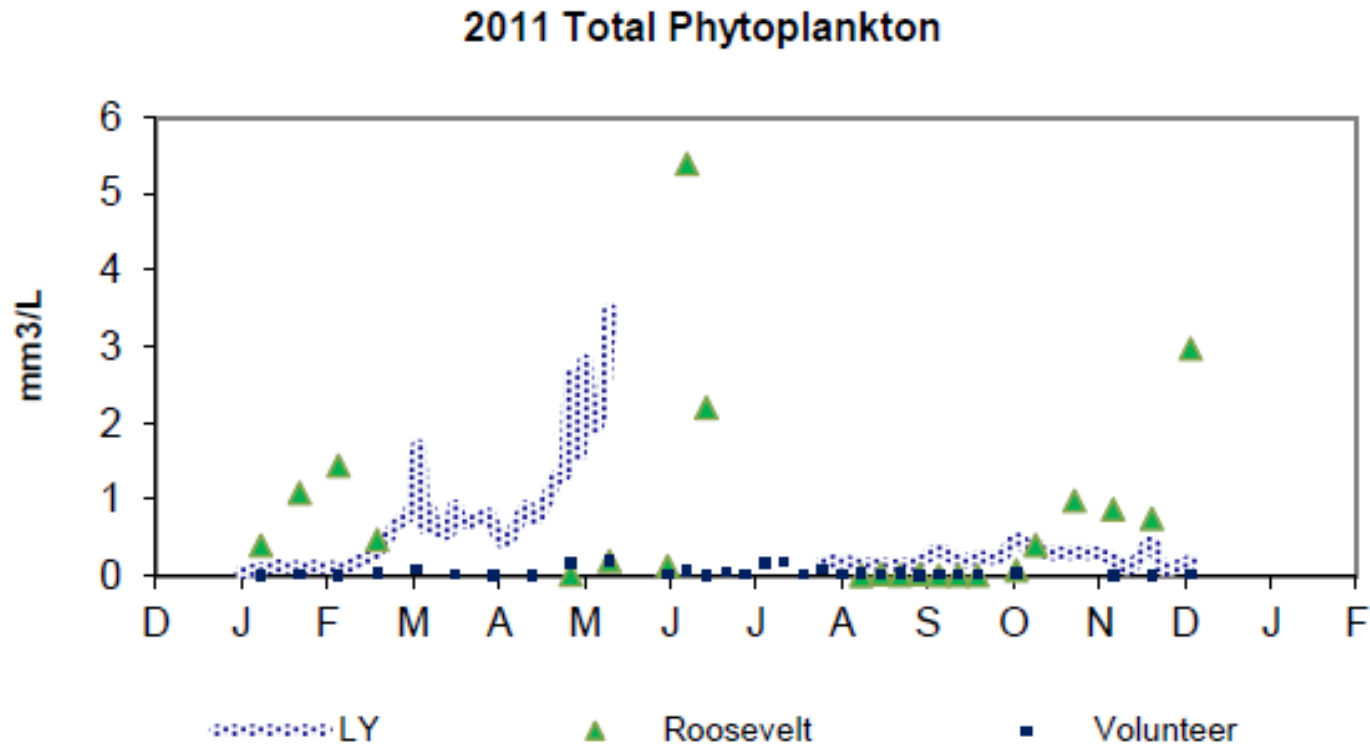


Historical Algae

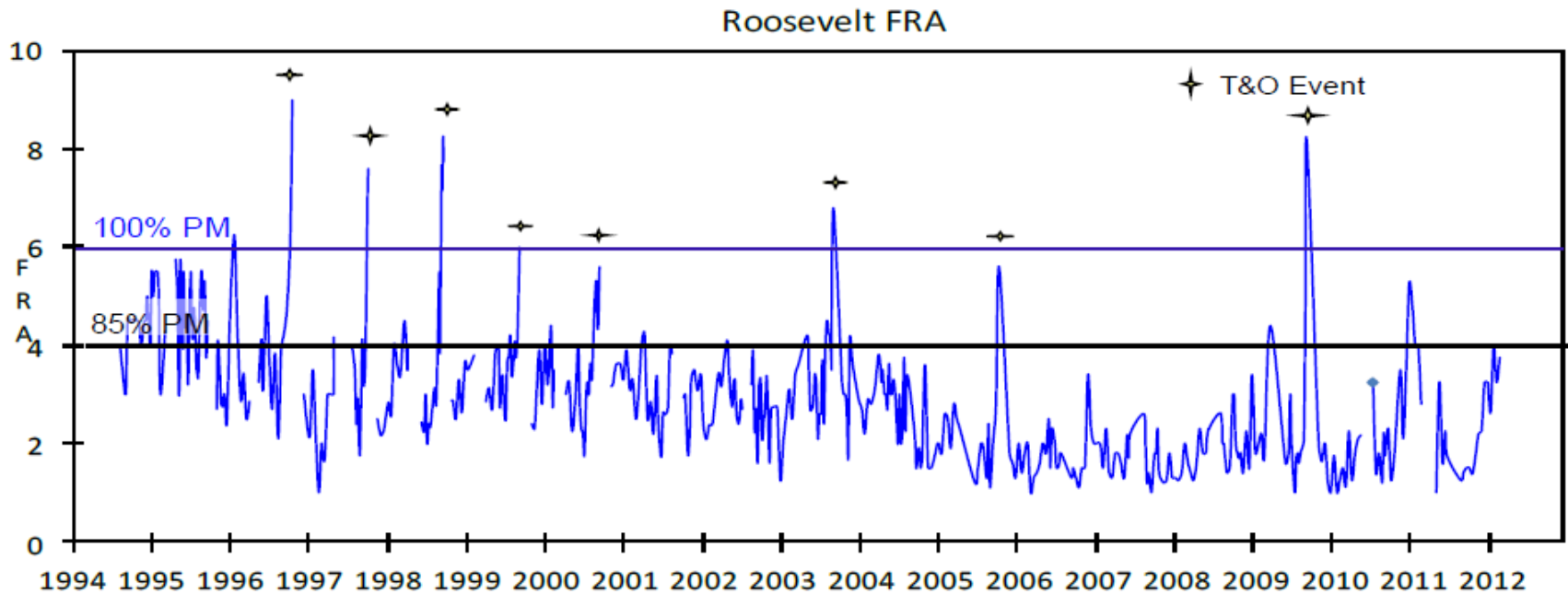
Roosevelt Reservoir
Total Phytoplankton vs pH
2001-2008



2011 Algae



T&O Analysis



Questions?

