This presentation premiered at WaterSmart Innovations

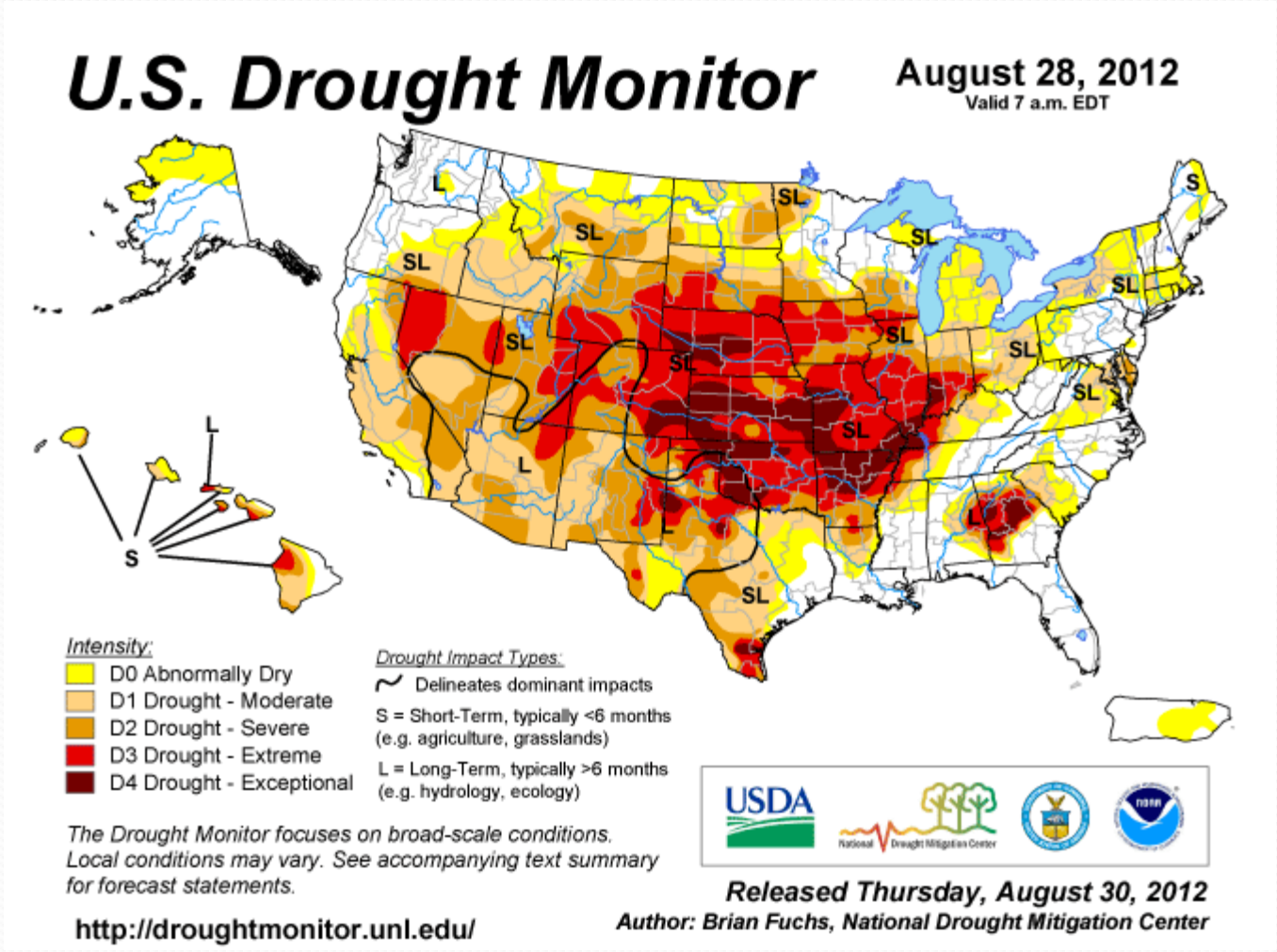
watersmartinnovations.com

watersmart
INNOVATIONS

Water Studies in Times of Drought

Things we would like to know

Presented at Water Smart Innovations Conf
Las Vegas, Nevada
October 2-5, 2012



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com

Is this the new normal?

- ”Widespread annual droughts, once a rare calamity, have become more frequent and are set to become the ‘new normal.’”
- “Future precipitation trends, based on climate model projections, indicate that droughts of this length and severity will be commonplace through the end of the century.”

NY Times, Aug 11, 2012:
CHRISTOPHER R. SCHWALM, CHRISTOPHER A. WILLIAMS and KEVIN SCHAEFER

William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com

Adaptation is Essential

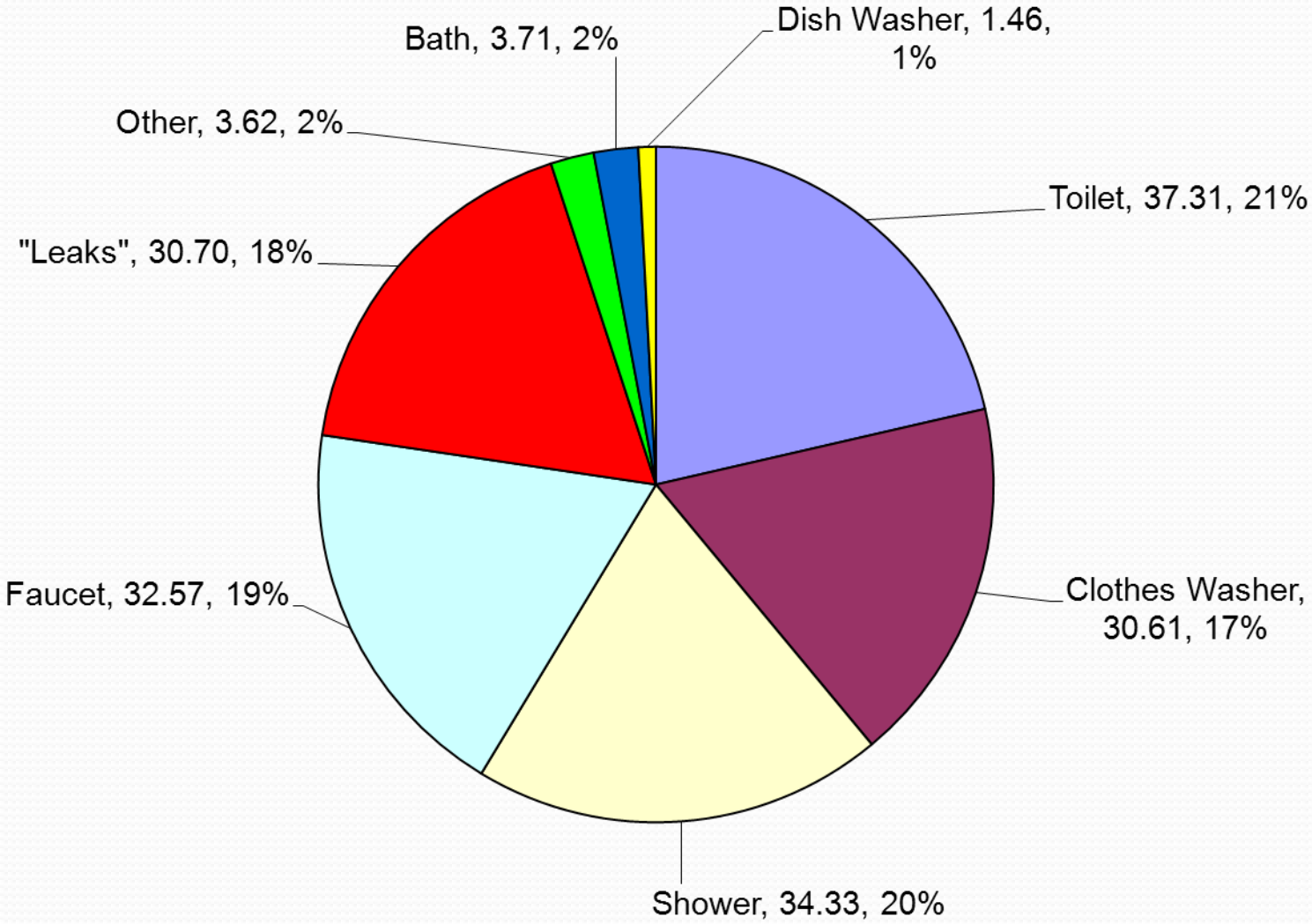
- Some think that only data collected in “normal” times is valid, but that is far from the case
- Collecting data during times of stress is important
- Some uses have more room for discretion
- As water becomes scarce people will curtail less valued uses.
- The customers tell us how they value water by what uses they curtail first (not the other way areound).
- Droughts are opportunities to examine these changes in a real world situation.

William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com

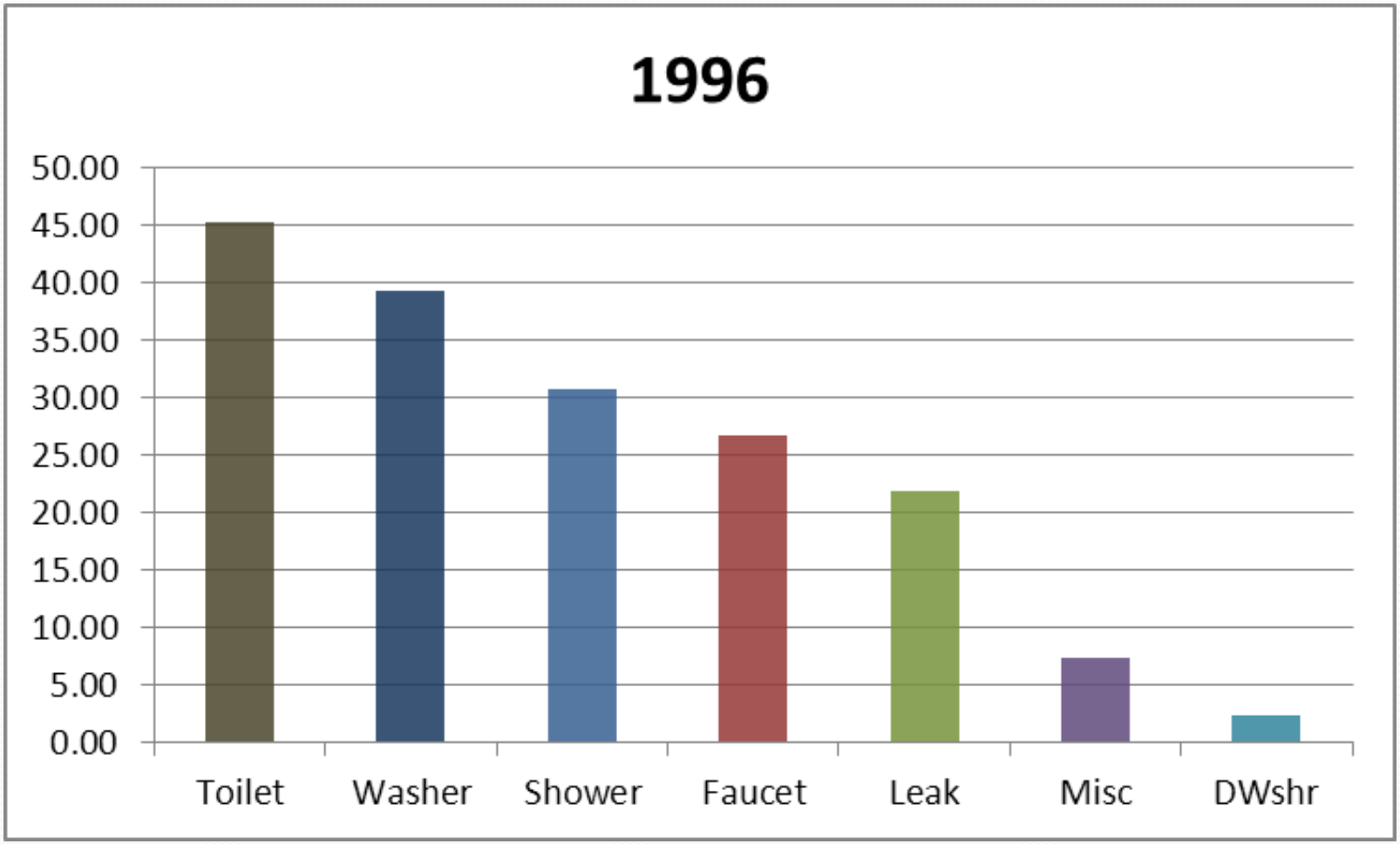
Changing end use patterns since 1996

- Dramatic changes have taken place
- Total indoor water use has dropped from 177 to 105 gphd (in most efficient homes)
- Uses that were at the top have dropped based on technology
- Other uses have remained fairly constant
- See the next five slides:

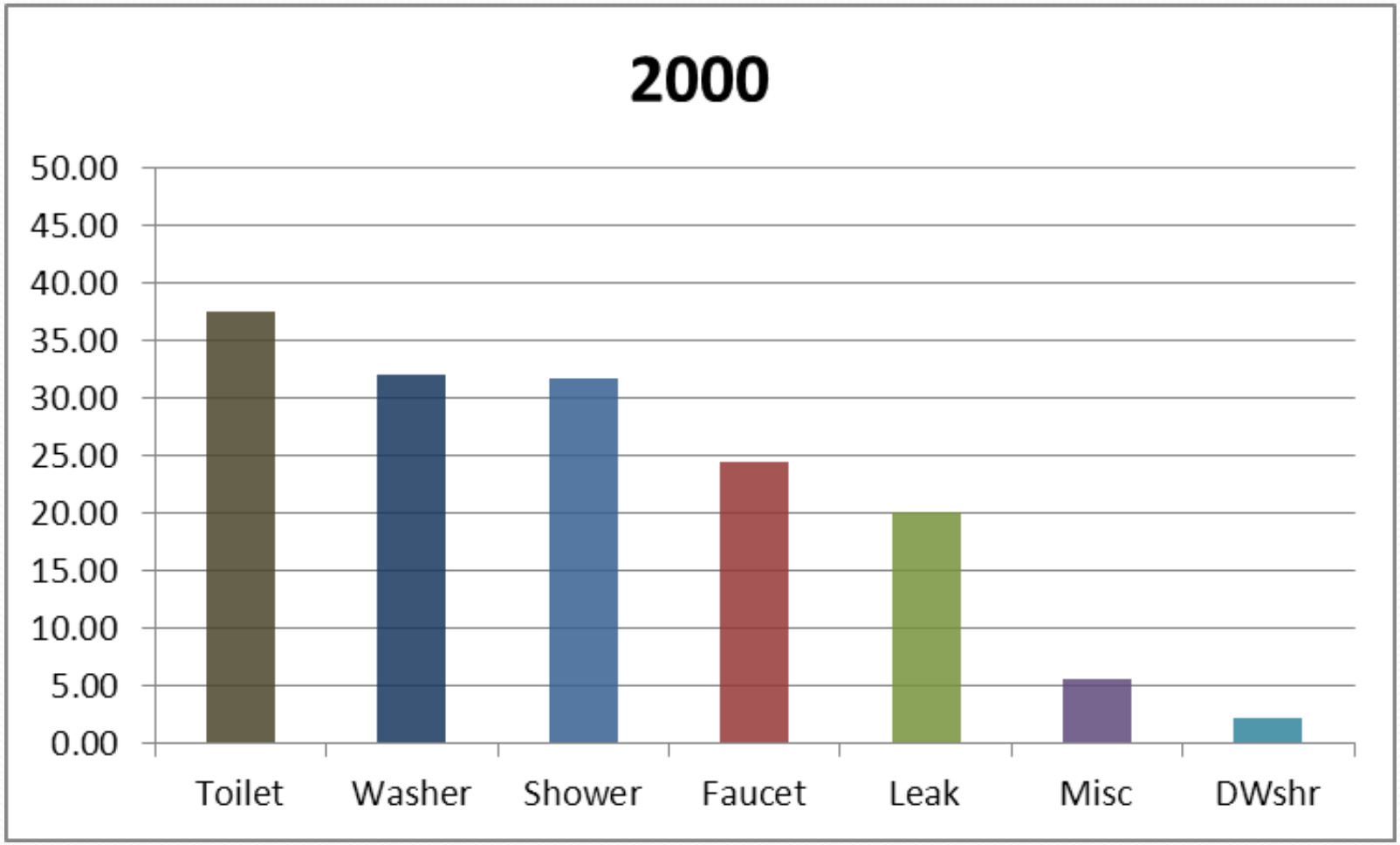
William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com



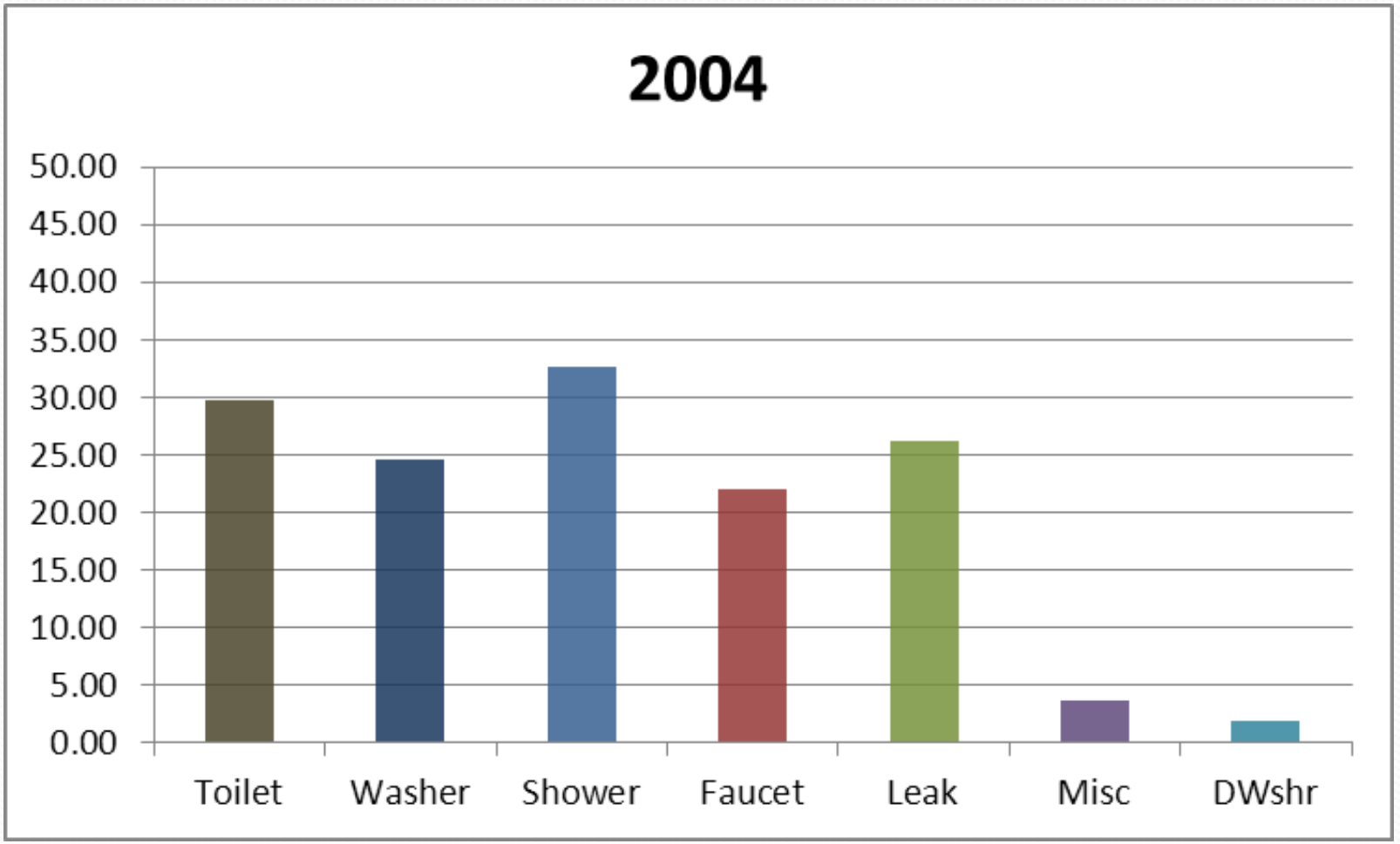
William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com



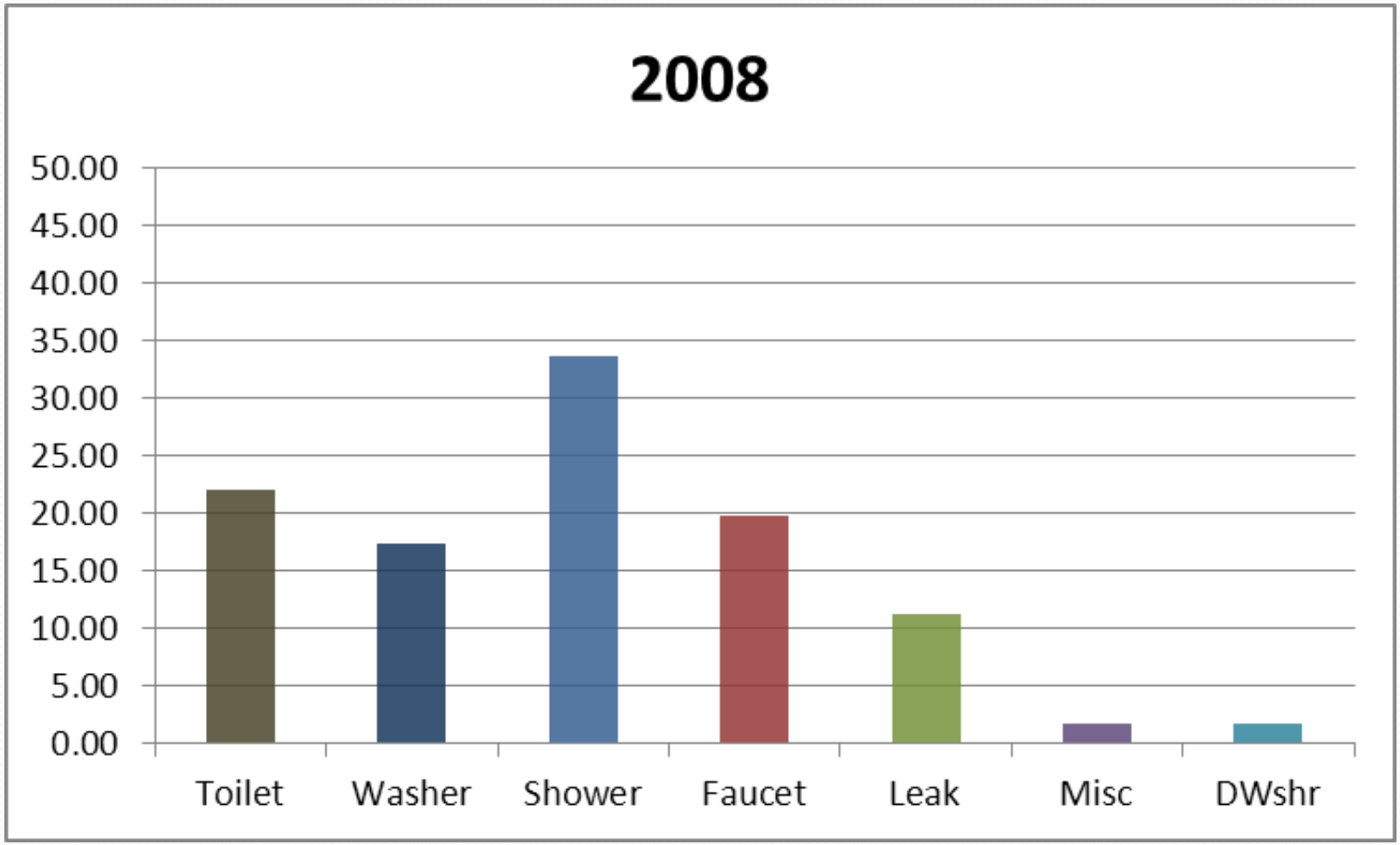
William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com



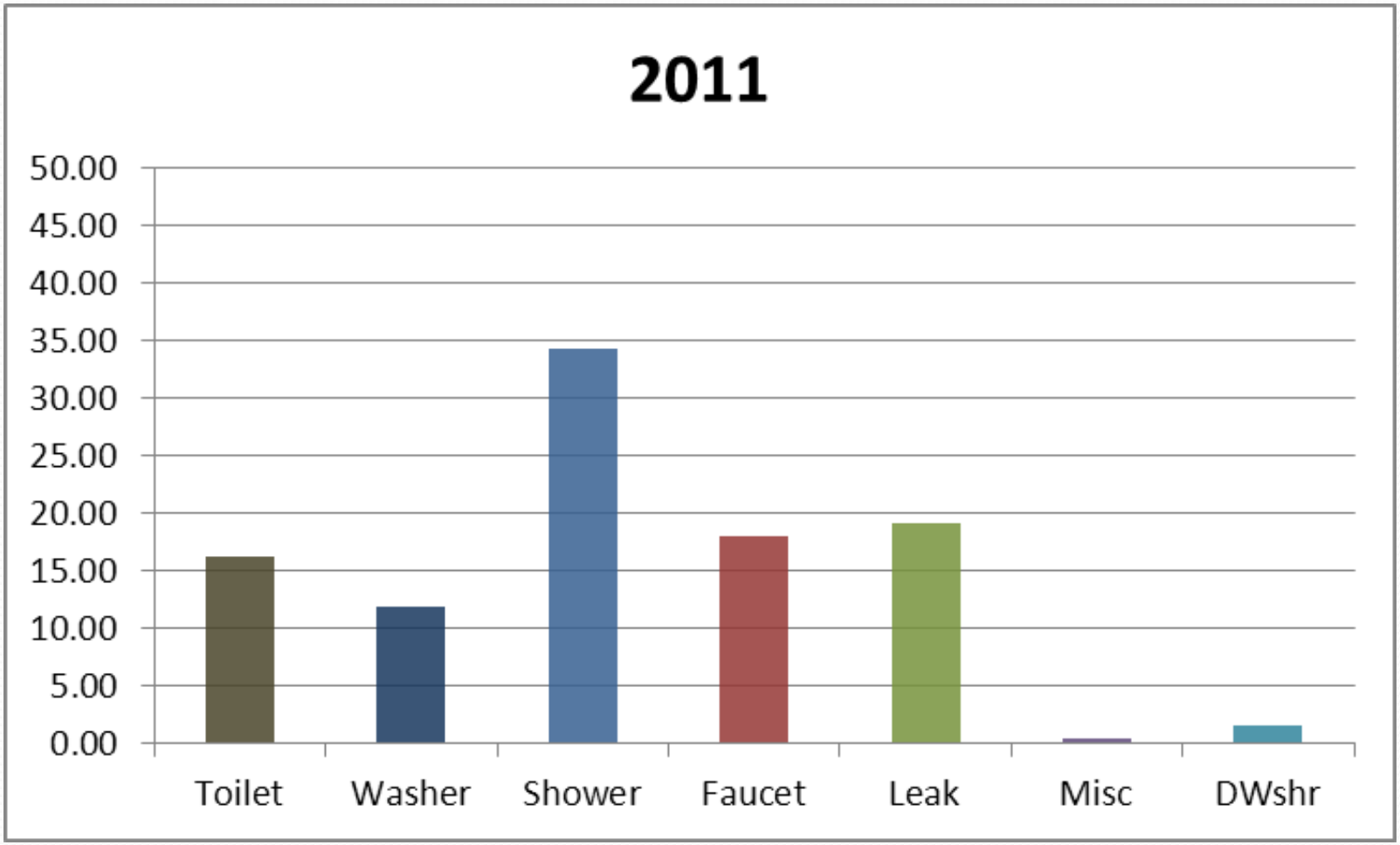
William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com



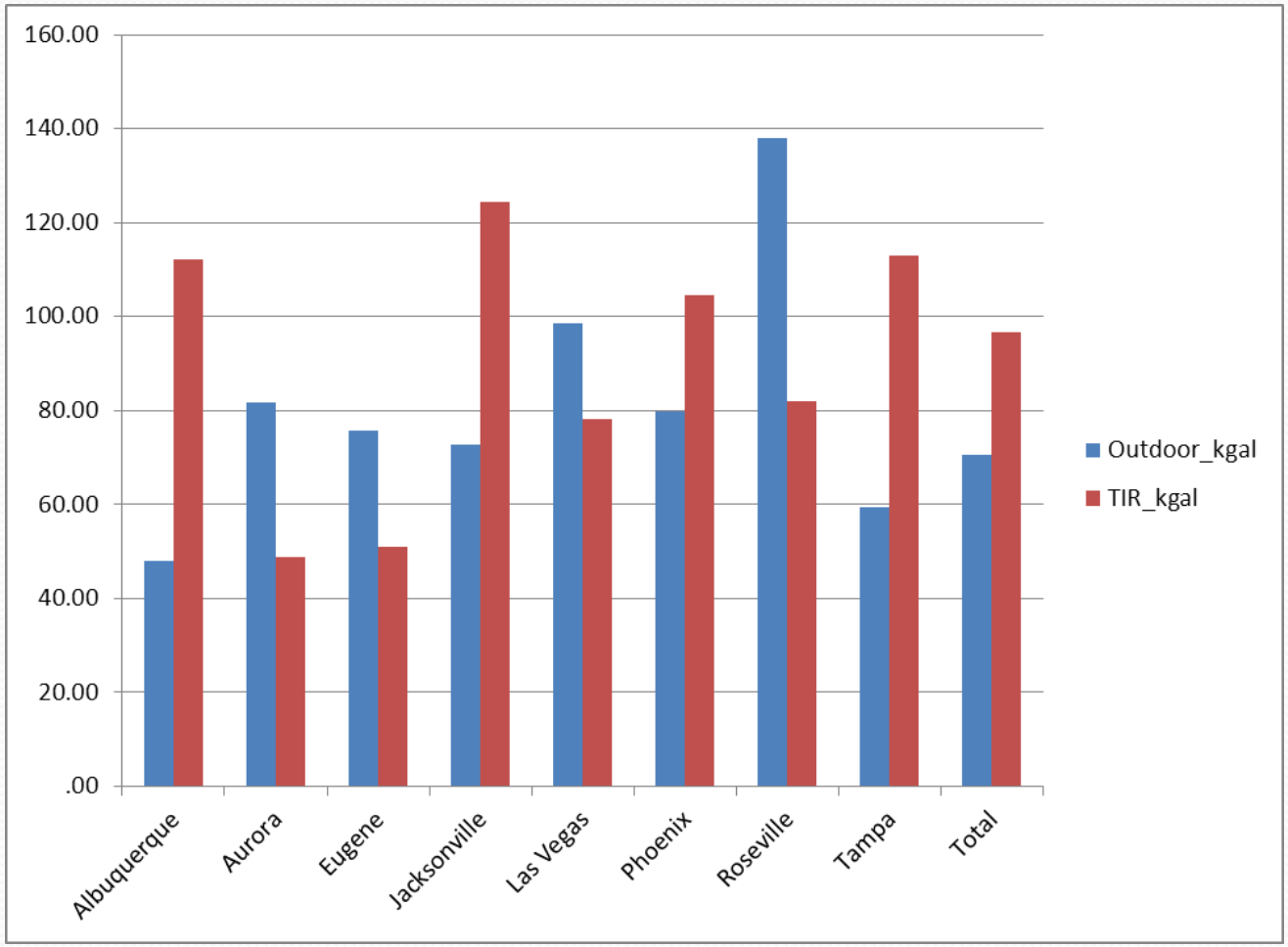
William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com

Outdoor Use is Less Predictable

- Irrigation practices are influenced by the local culture
- Sites with a history of irrigation seem more likely to apply heavily
- While the theoretical requirements can be calculated….
- The actual outdoor use varies widely from TIR.

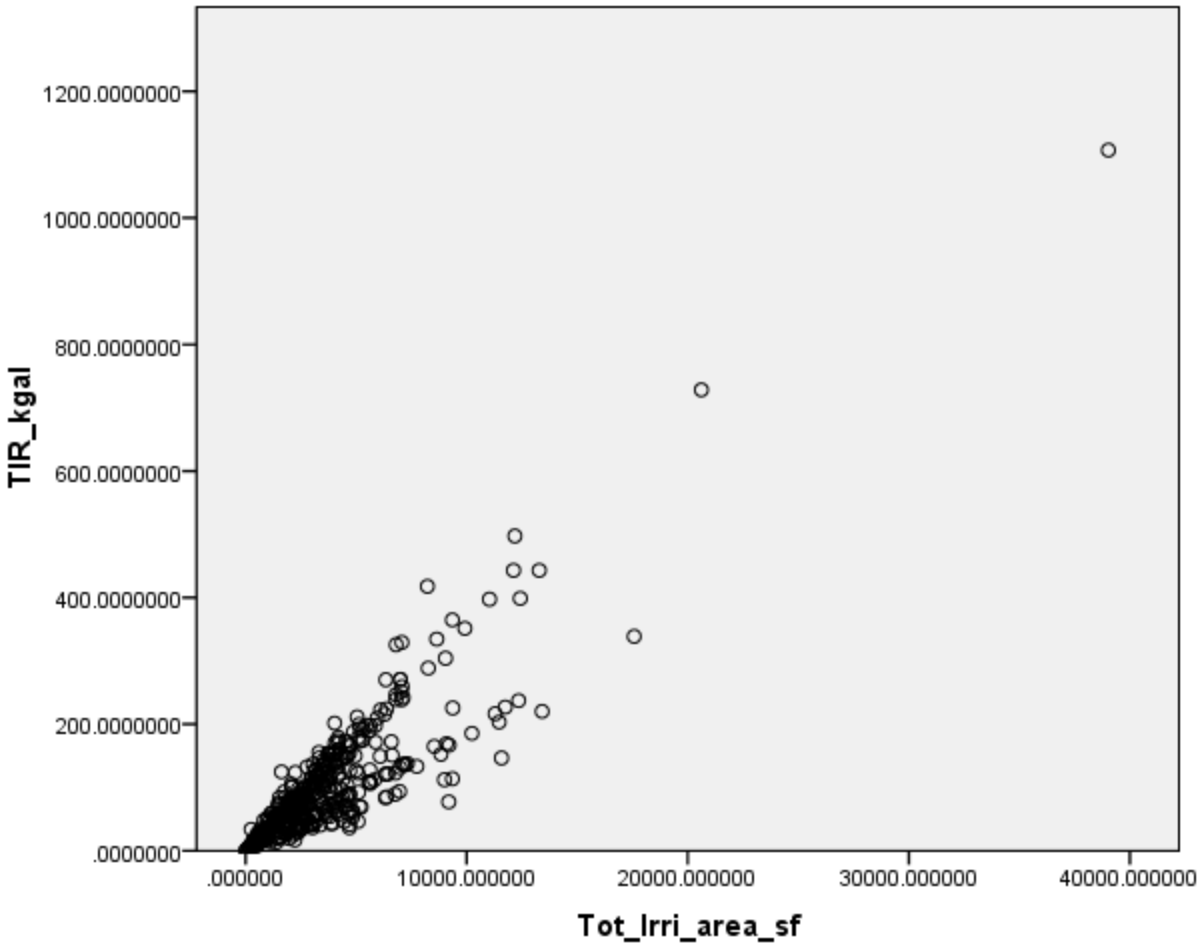
William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com

Outdoor Use v TIR



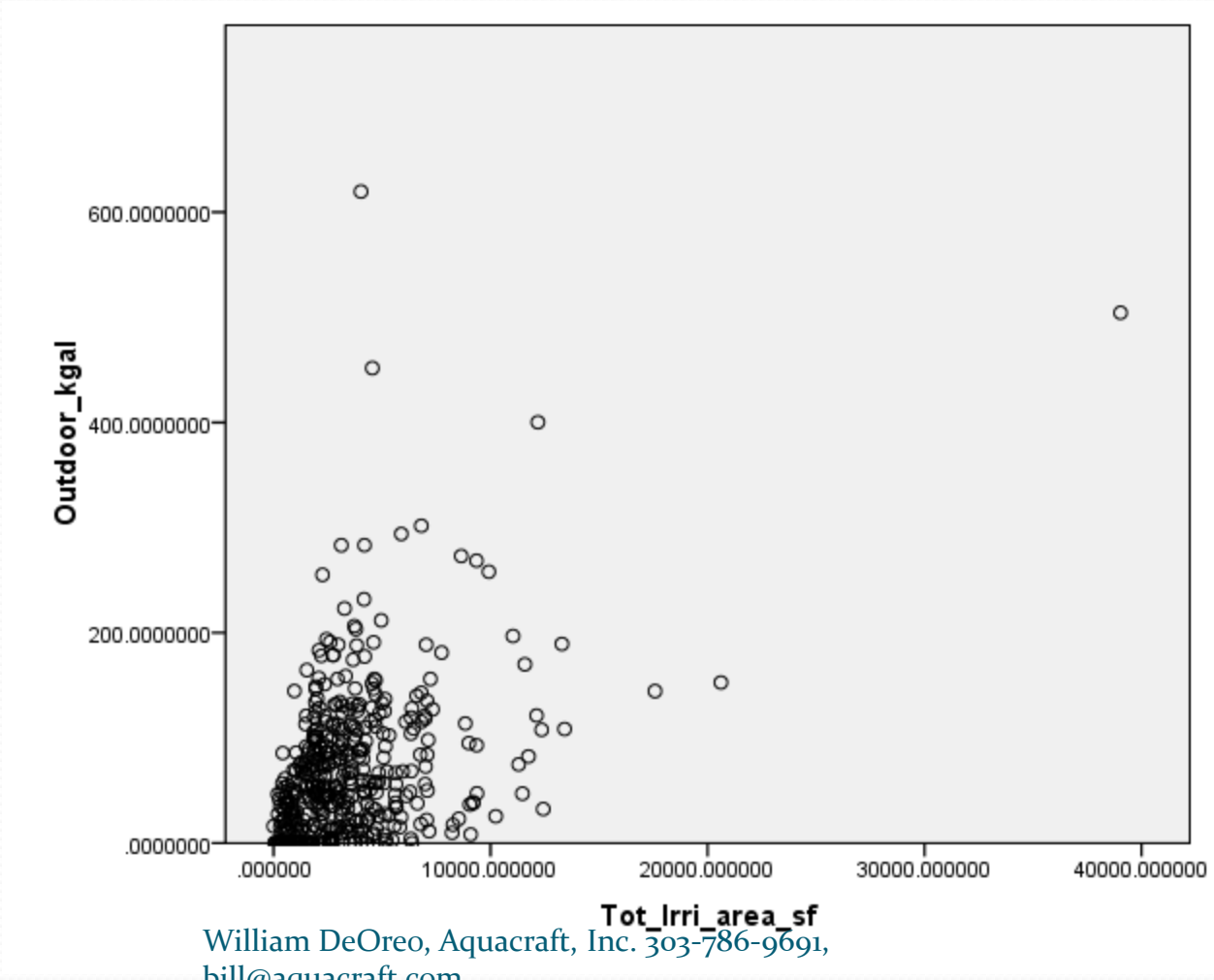
William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com

TIR v Irrigated Area



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com

Outdoor Use v Irrigated Area



William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com

How do Indoor Uses Change in response to drought?

- Which indoor uses drop most during a drought?
  - Do people really take shorter showers
  - Do the number of flushes per day drop
  - Are leaks repaired?
  - Is there less miscellaneous faucet use?
  - What percentage reduction is observed?

William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com

Drought Restrictions v Water Use

City	Indoor demand, normalized for a household of three (gphd)	Flushes (per day)	Clothes washer loads (per day)	showers (per day)	Shower duration (min)	Average landscape application ratio	Median landscape application ratio
Denver	134.0	12.0	0.87	1.7	7.9	0.97	0.73
Fort Collins	137.0	12.2	0.70	1.6	8.1	0.35	0.31
Scottsdale	169.0	12.1	0.70	1.8	6.6	1.56	0.88
Non-restricted average	146.7	12.1	0.76	1.7	7.5	0.96	0.64
San Antonio	142.0	12.8	0.88	1.6	8.3	0.43	0.28

William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com

How does outdoor use change?

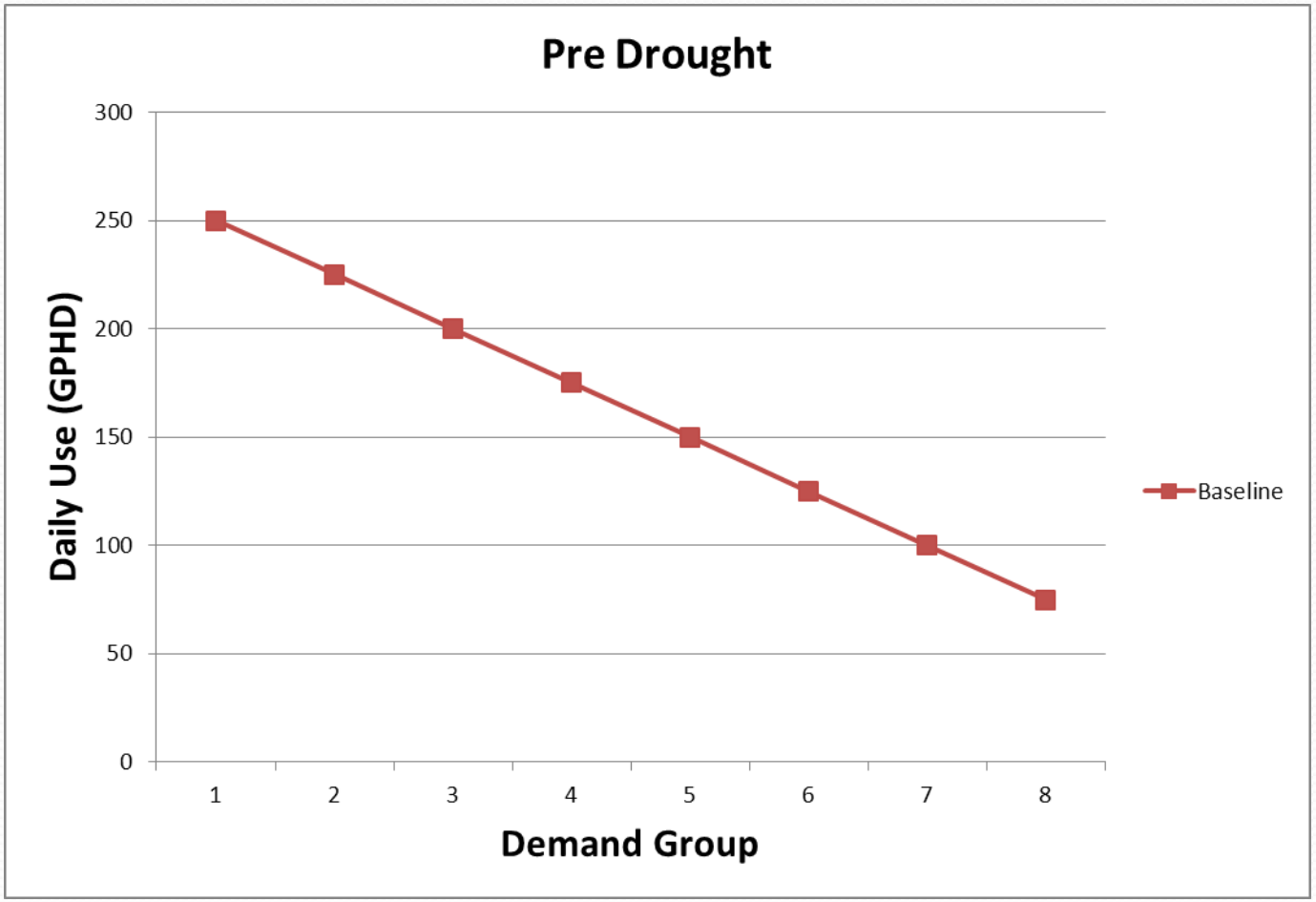
- Does total outdoor use drop?
- By what percentage
- Do people follow day and time restrictions?
- Does that rate of over-irrigation decrease?

William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com

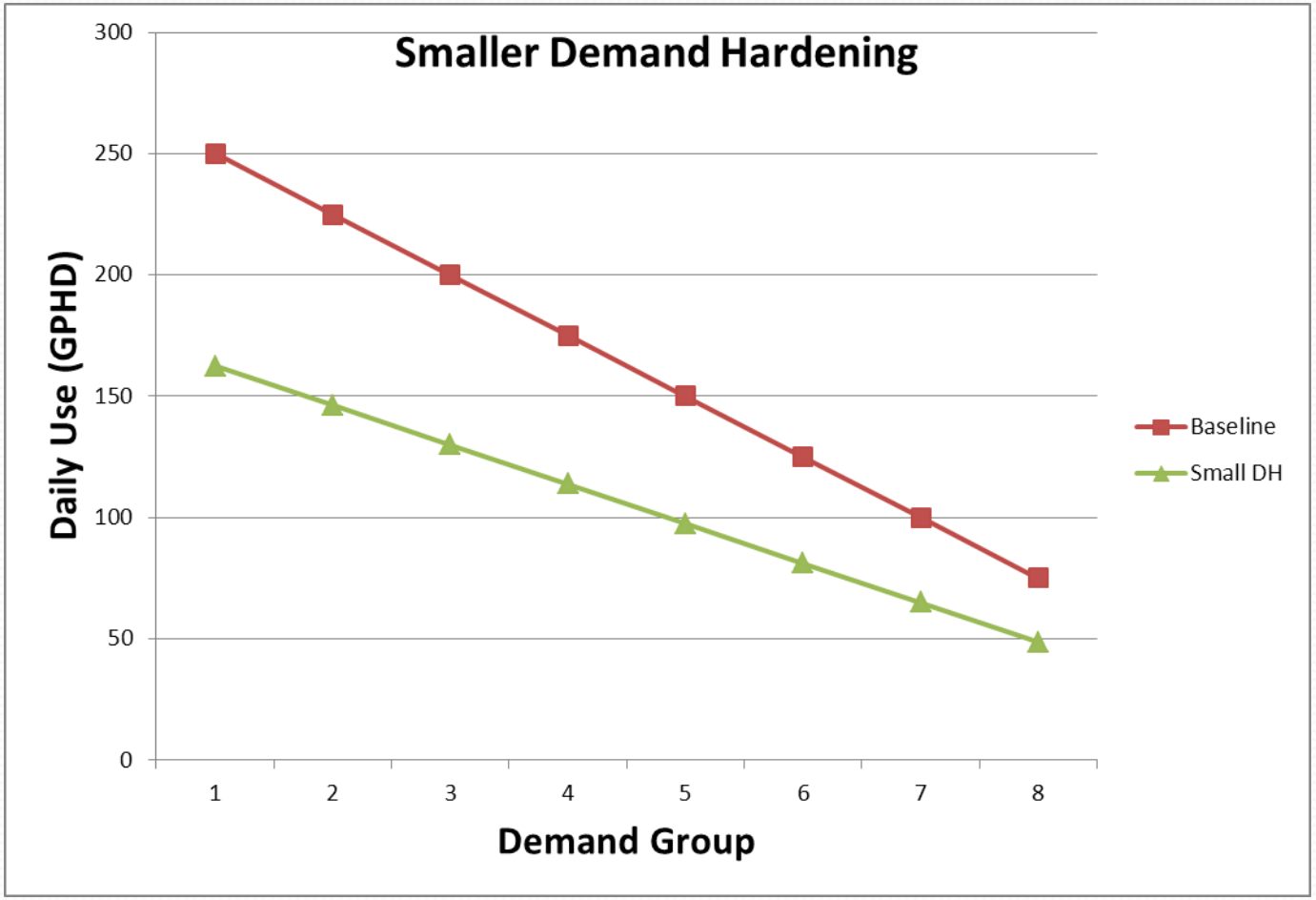
Shed light on Demand Hardening

- End use analysis can shed light on the question of demand hardening.
- Changes in use can be compared between normal and high efficiency houses.
- If demand hardening has reduced the savings potential in high efficiency houses this can be observed.

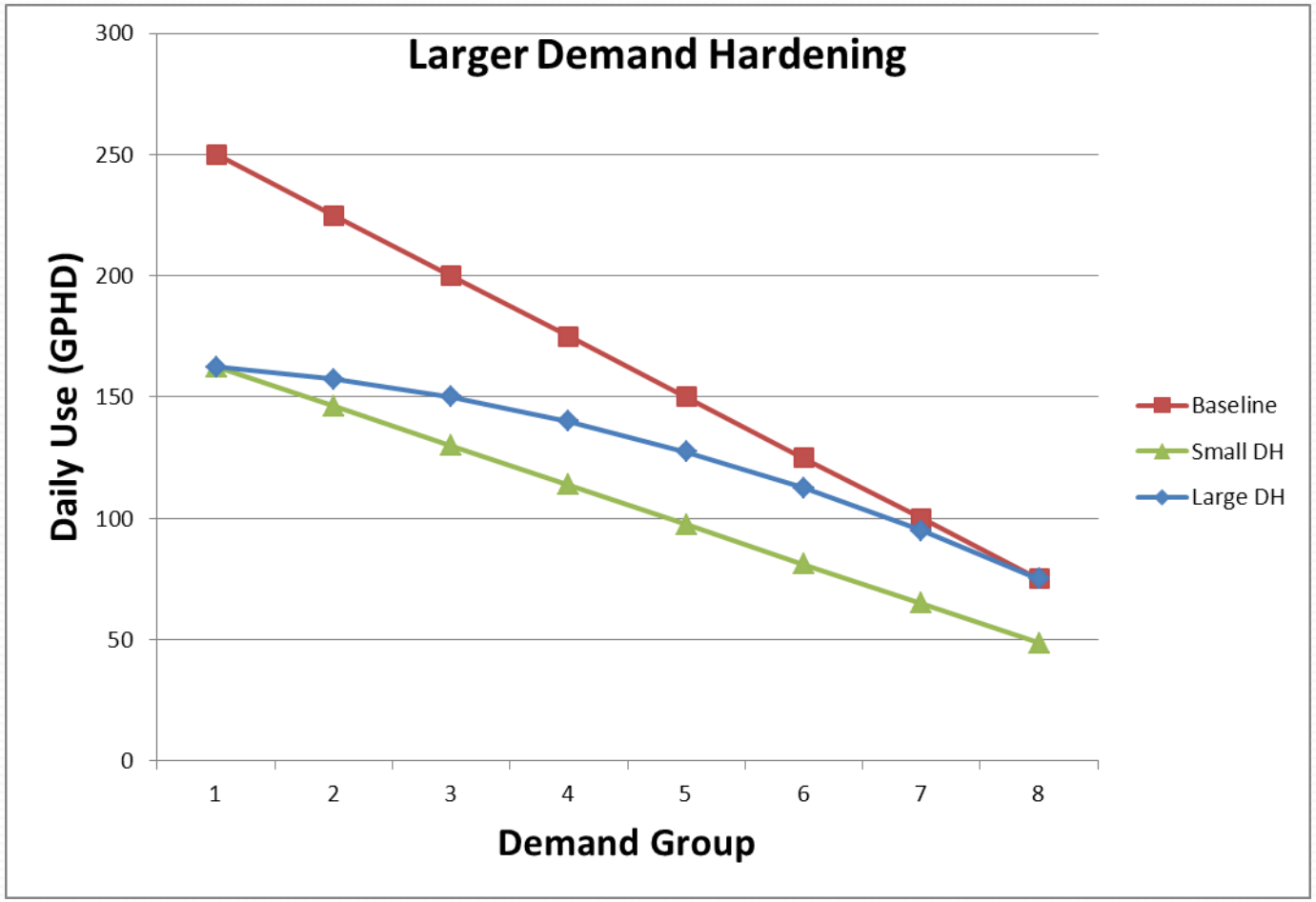
William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com

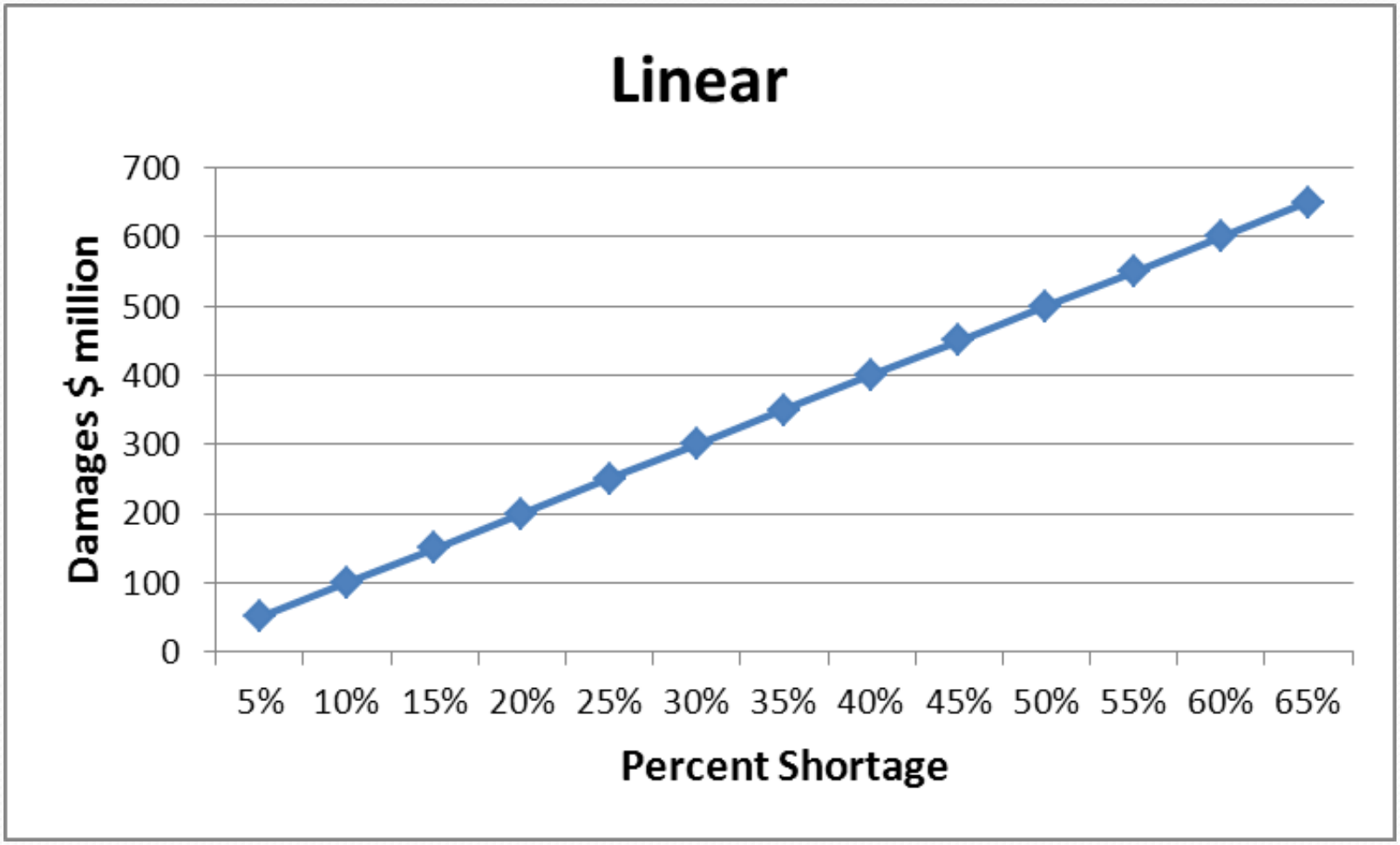


William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com

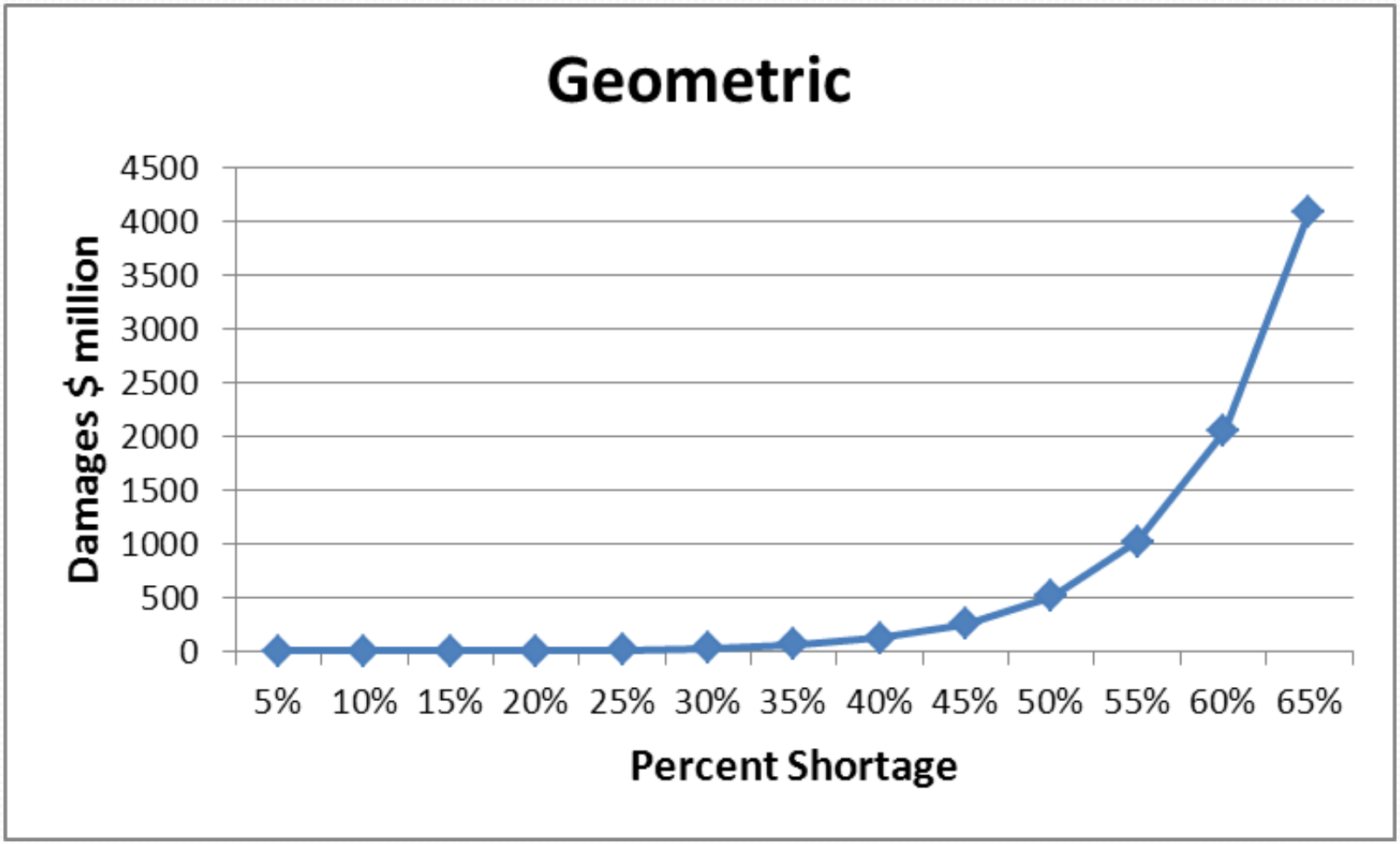
Economic Studies

- Need to have better information on the cost of droughts.
- As the shortages increase as a percent of demand, how do the damages to the municipal system increase?
- Are the linear or geometrical?
- This would help with drought response planning.

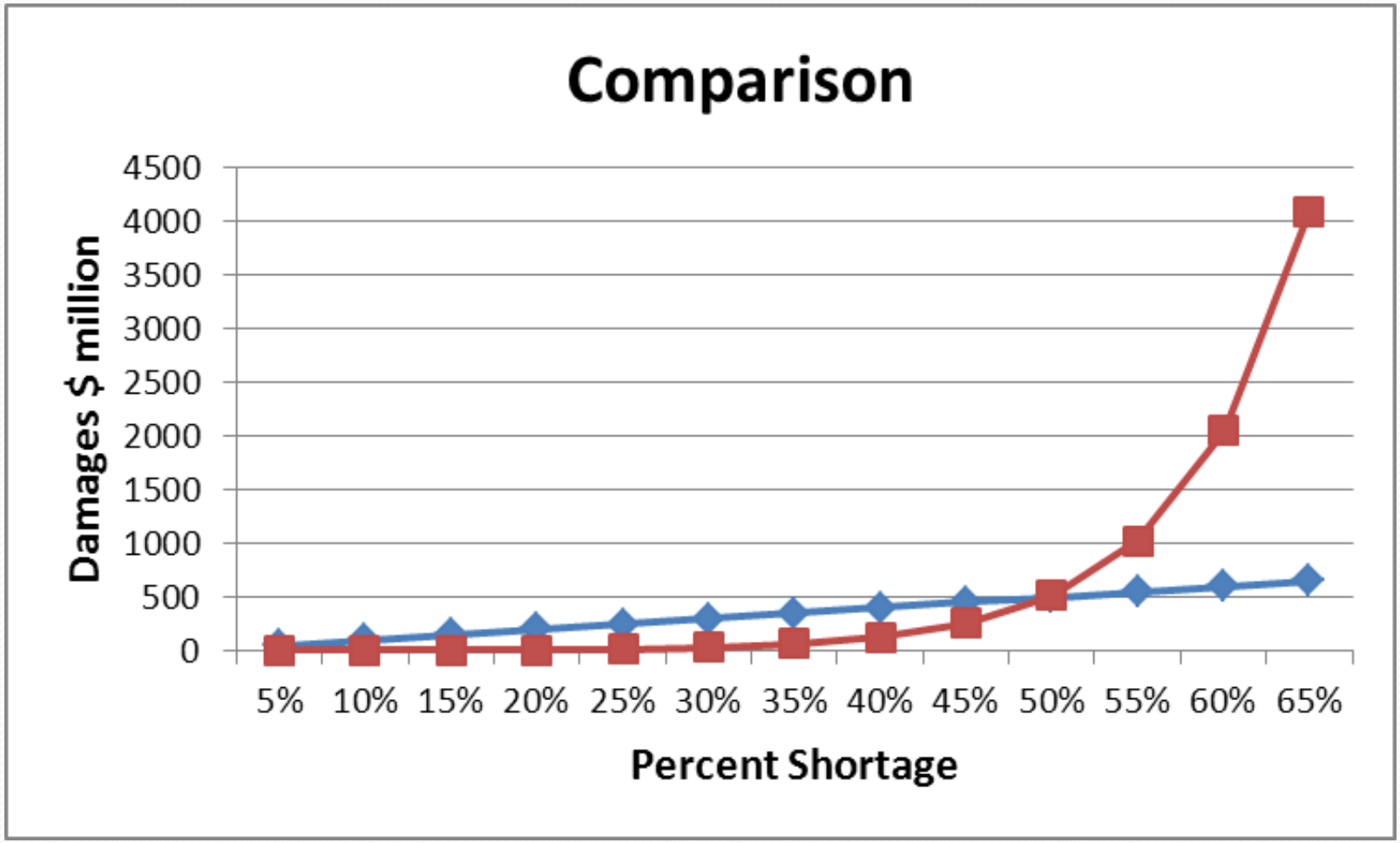
William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com



William DeOreo, Aquacraft, Inc. 303-786-9691,
bill@aquacraft.com

Why study water use during droughts?

- See how customers value water
- See which end uses are most amenable to change
- Learn about demand hardening
- Improve short term demand analysis
- Understand changes by the marginal customers
- Learn more about damages from droughts

William DeOreo, Aquacraft, Inc. 303-786-9691, bill@aquacraft.com