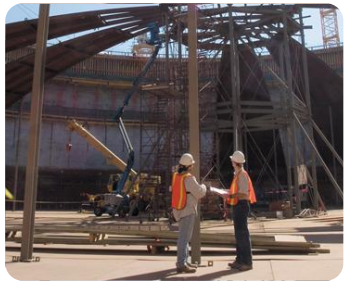
Madison Water Utility

BLACK & VEATCH


CAP Technical Workshop

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Agenda

- Level of Service
- East Side Population Projections
- Water Demands Methodology
- Eastside Water Demands
- Peaking Factors
- Well Capacity Evaluation
- Next Steps

MWU is seeking CAP input on population, conservation, and water demand assumptions to be used in the East Side Study

Level of Service

- The Level of Service goals are the criteria used for evaluating existing facilities and designing future facilities.
- Level of Service Criteria is a combination of:
  - Regulations established by the Wisconsin Department of Natural Resources (DNP)
  - Madison Water Utility (MWU) service level goals
  - Industry Standards

Level of Service

- Planning and Design Criteria is established for the following:
  - Unit wells
  - Pressure
  - Pipelines
  - Booster pump stations and storage
  - Fire fighting

Level of Service – Unit Wells

Unit Well Planning and Design Criteria	
Criteria	Guideline
Well Capacity	For each pressure zone served by a well: • Average run time on unit wells less than 12 hours during the average day demand (ADD). • Total capacity of wells at least 115% of the maximum day demand (MDD). • Firm capacity of wells at least 100% of MDD. For pressure zones 6E and 6W, firm capacity shall be based on two wells out of service
Emergency Operation	Emergency power generation (or engine powered pump capacity) to meet at lease the ADD.

Level of Service – Pressure

Pressure Planning and Design Criteria Minimum Allowable Pressure	
Criteria	Guideline
Minimum Pressure Peak Demands Non-emergency Emergency	 40 psi 20 psi (at any point in the pressure zone)
Preferred Operating Pressure	50 – 90 psi
Maximum Operating Pressure	< 125 psi (everywhere) < 100 psi (expansion areas

Level of Service – Pipelines

Pipeline Planning and Design Criteria	
Criteria	Guideline
Maximum Velocity:	
Maximum Hour during MDD	< 5 feet per second (fps)
Fire during MDD	< 10 fps
Hazen-William Roughness Coefficient (C)	
Existing Pipes	125 (1)
High Density Polyethylene (HDPE)	150 (2) (horizontal directional drilling only)
Ductile Iron (new, cement lined)	140 (2)

Notes:
(1) From the 2006 IDSE hydraulic model calibration
(2) WAC NR 811.70

Level of Service – Pipelines (continued)

Pipeline Planning and Design Criteria	
Criteria	Guideline (minimum diameter)
Pipe Diameter(1)	
General Grid Considerations	16-inch on 1 mile grid 12-inch on 0.5 mile grid (Larger diameter or closer spacing may be required based on use or zoning)
Arterial Collector Roads	12-inch
ICI Areas	10-inch
Residential Areas	8-inch (6-inch may be permitted for residential dead-end lines that are less than 200 feet in length with a fire flow requirement of less than 1000 gpm).
Pipe Material	Ductile Iron Class 52 or greater (2)

Notes:
(1) MWU Planning Guidelines
(2) HDPE is permitted for directional drilling or slip lining only (minimum pressure class 160 psi).

Level of Service – Booster Pump Stations and Storage

Booster Pump Station and Storage Planning and Design Criteria	
Criteria	Guideline
Booster Pump Stations	
Capacity	Firm Capacity (largest pump out of service) able to meet either: • MDD for pressure zone with equalization storage
Storage	
Volume	Every pressure zone be able to meet both of the following: • 12 hour supply at ADD • Fire flow plus equalization storage
Equalization storage	Volume required to deliver difference between MH demand and MDD for each pressure zone (normally 15 -30% of MDD)
Fire storage	Fire flow goal times fire duration (refer to Fire Fighting Criteria)

Level of Service – Fire Fighting Criteria

Fire Fighting Planning and Design Criteria (1)				
Land Use		Fire Flow Goal (gpm)	Fire Duration (hours)(2)	Hydrant Spacing (feet)
Low Density Residential (LDR) Neighborhood Planning Area (NPA) Traditional Neighborhood Development (TND)		1,000	2	400
Medium Density Residential (MDR) Neighborhood Mixed Use (NMU)		2,000	2	375
High Density Residential (HDR) Community Mixed Use (CMU) General Commercial (GC)		2,500	2	360
Regional Mixed Use (RMU) Regional Commercial (RC) Employment (E) Special Institutional (SI)	Downtown (D) Campus (C) Airport (SP) Industrial (I)	3,500	3	300

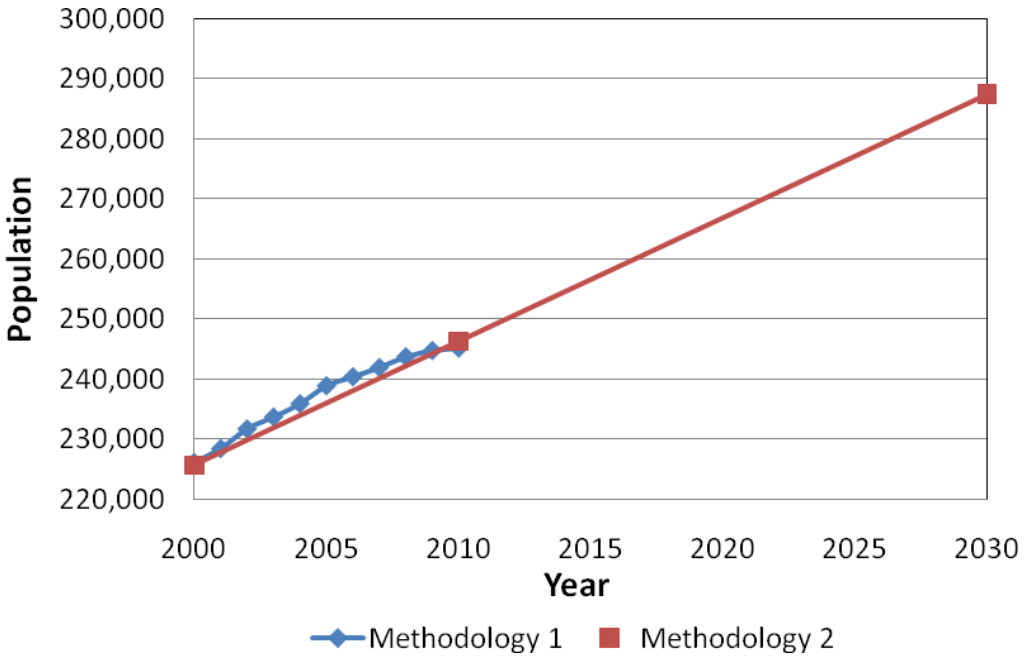
Notes:
(1) Fire flow in addition to MDD.
(2) *Distribution System Requirements for Fire Protection*, AWWA M31, 1989

Level of Service

Questions?

Population Projections – System wide

- Methodology 1: Wisconsin Department of Administration Demographic Service Center
- Methodology 2 - Madison Area Transportation and Planning Board



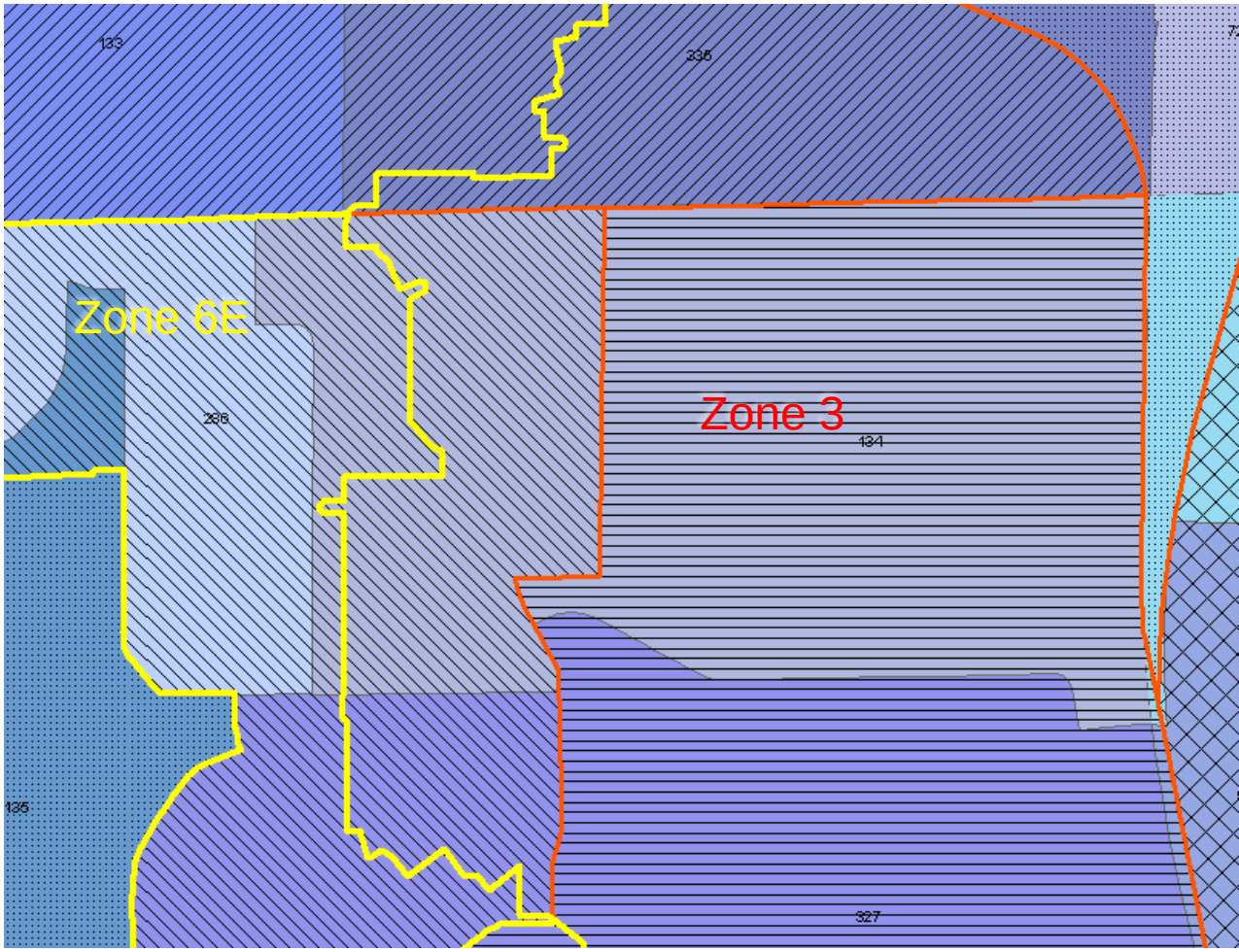
Projections are within 1% of each other

Population & Employment Projections – System wide

Year	Population	Employment
2000	225,650	190,840
2010	246,270	214,450
2015	256,580	214,450
2030	287,520	251,660
Build Out	381,240	322,460

Population Projections – Methodology

- Traffic Analysis Zones (TAZs) contain population and employment data
- Overlay TAZ with
  - Service Zones
  - Neighborhoods
- Aggregate by
  - Service Zones
  - Neighborhoods



Population & Employment – East Side by Service Zone

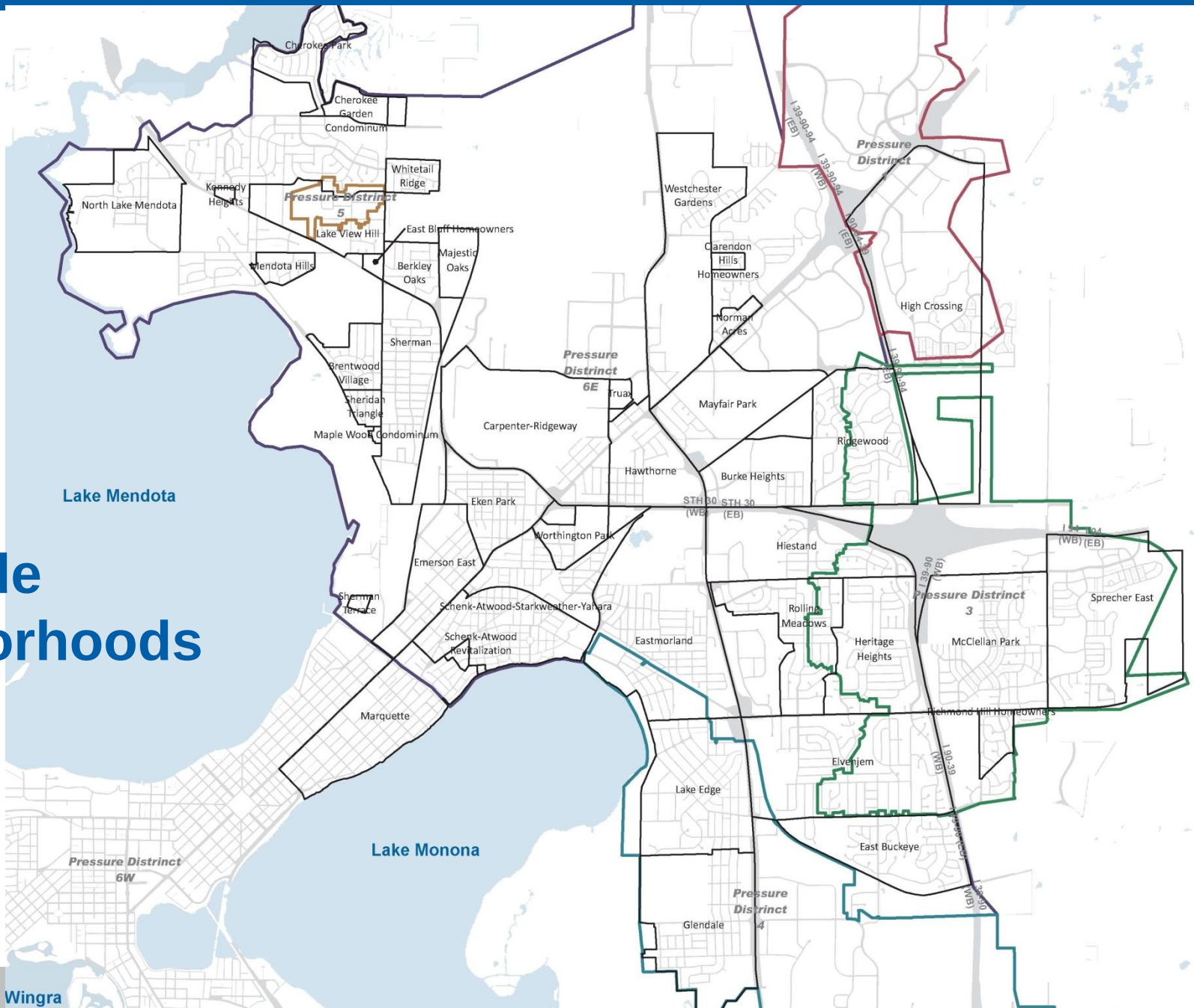
Population

Year	3	4	5	6E
2010	13,130	6,150	760	59,650
2015	14,810	6,370	760	60,100
2030	19,850	7,030	760	61,450
Build Out	26,565	9,220	780	64,860

Employment

Year	3	4	5	6E
2010	10,680	10,380	200	41,320
2015	13,070	11,450	200	43,260
2030	20,180	14,640	200	49,070
Build Out	33,890	18,320	200	53,090

East Side Neighborhoods



Population – East Side by Neighborhood

- See Handout

Population

Questions?

Water Demand - Definitions

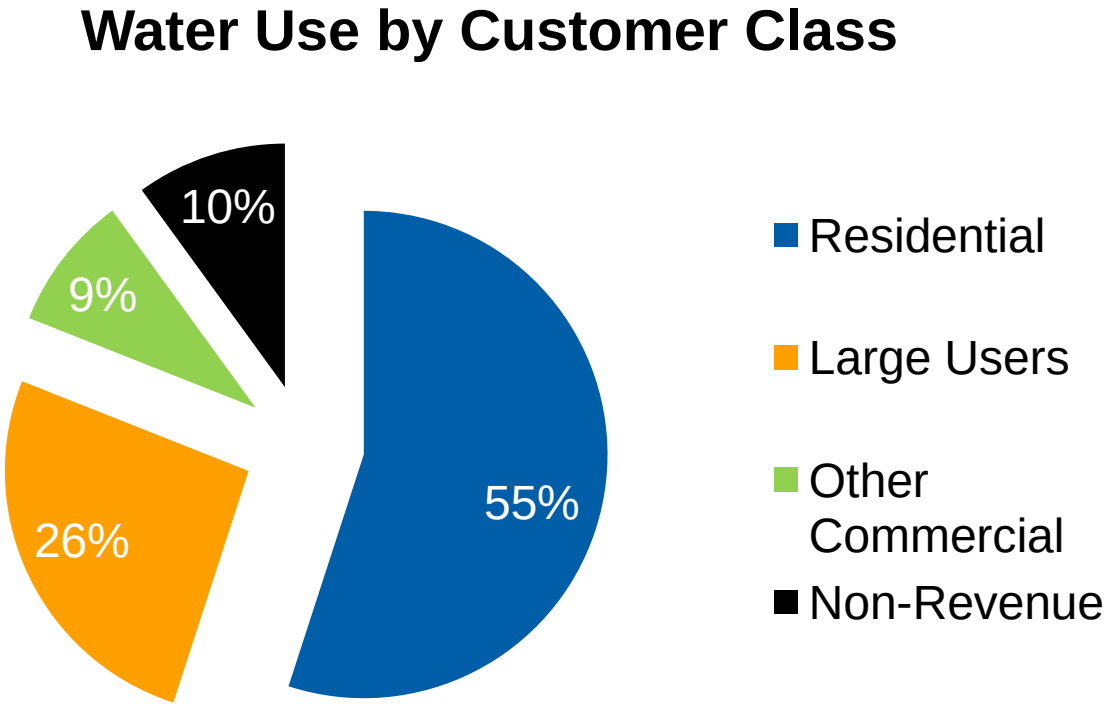
- Average Day (AD) – The total volume of water used during the year, divided by the number of days. Used as a basis for evaluation of water supply.
- Maximum 10 Day (M10D) – The average rate of water use during the maximum 10 day period in a year. M10D is will be used of hydraulic modeling of water age.
- Maximum Day (MD) – The average rate of water use during the maximum day of a year. Used to evaluate water supply, treatment, storage, and pumping capacity.
- Maximum Hour (MH) – The maximum rate of water use during the MD. Use to evaluate water pumping, storage, and pipe capacity.

Water Demand – Data Sources

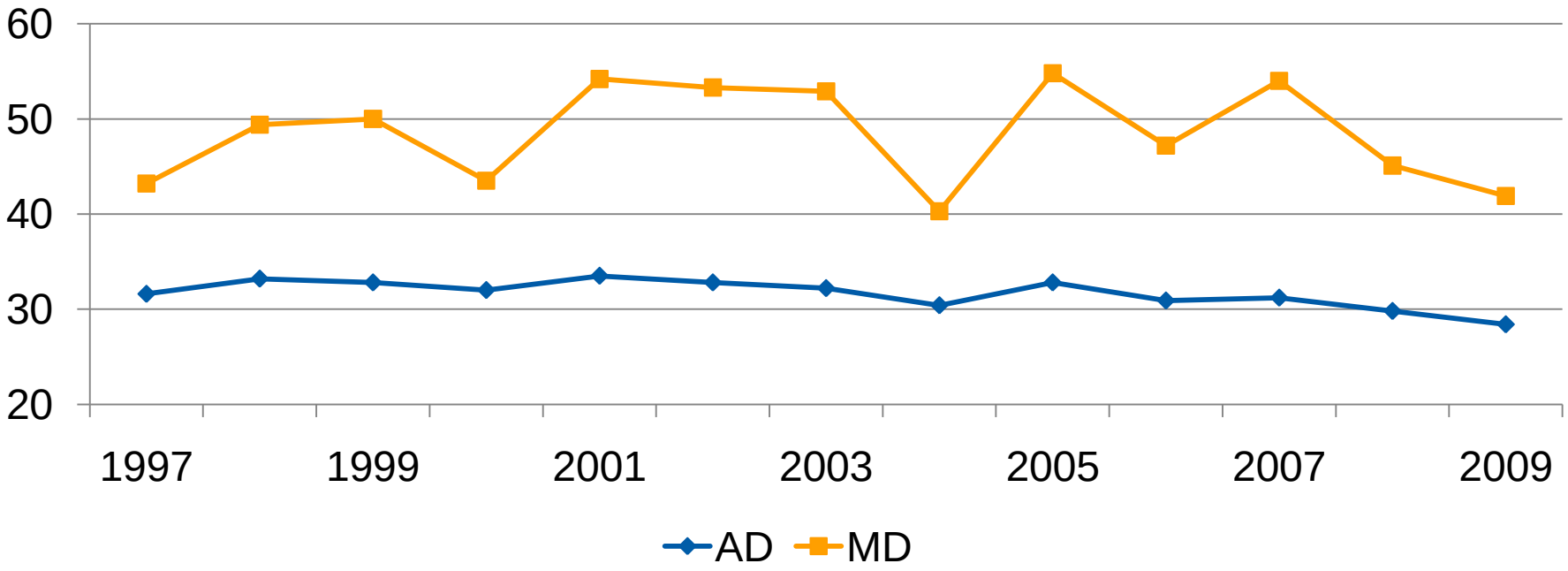
- Water Production: Data gathered from the unit well pumping information. Available on a daily basis and used to calculate AD, M10D, and MD usage.
- Water Billing: Data gathered from billing records. Available in rotating 6 month summaries. Used in combination with water production to calculate non-revenue water.
- Tank and Booster Pumping: Data normally available hourly. Used to calculate MH water use.

Water Demand – Average Day Historical Calculations

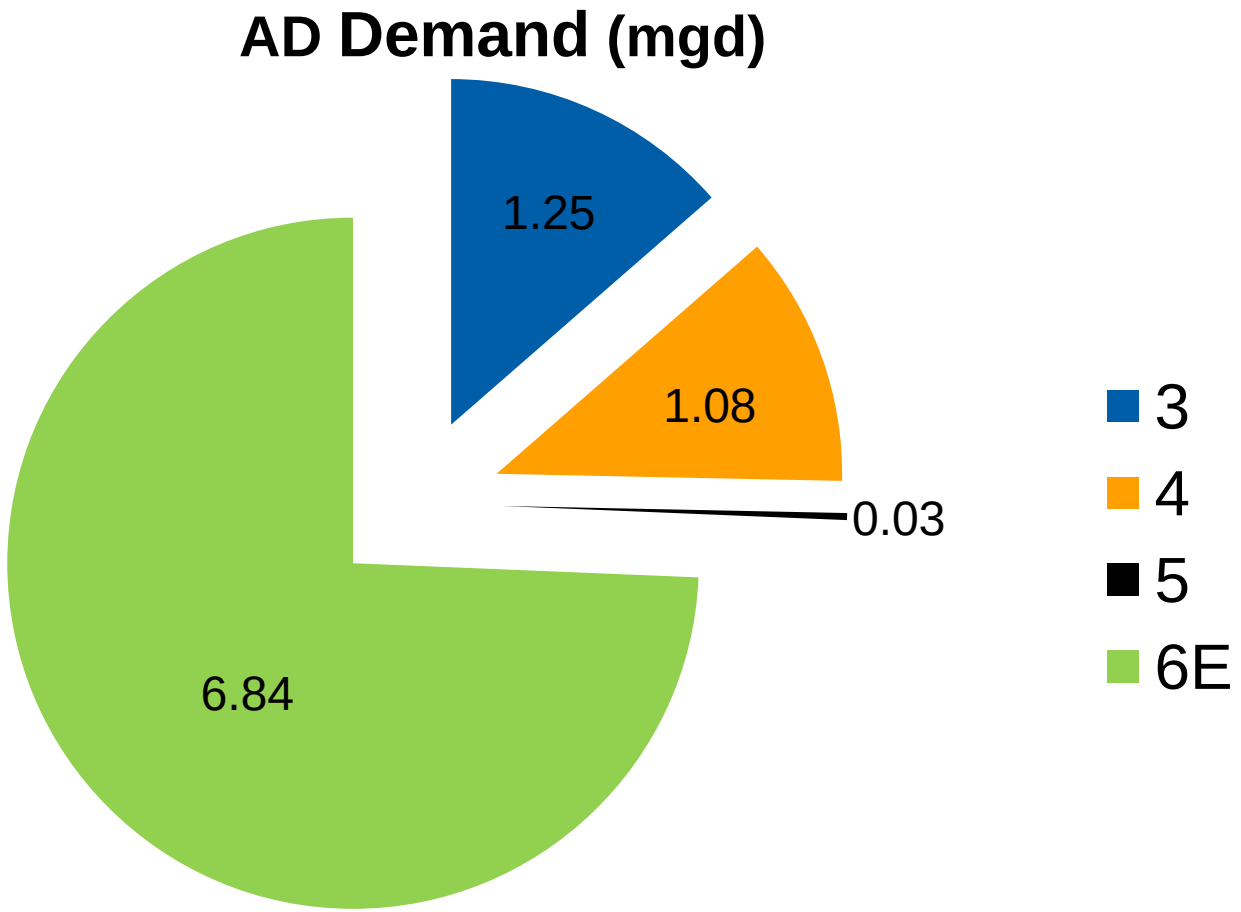
- Residential = Single Family + Multi-Family Billing
- Large Users = Billing Data for Customers Using > 100,000 gallons/month
- Other Commercial = Commercial billing – multi-family – large users
- Non-Revenue = AD Usage – AD Billing



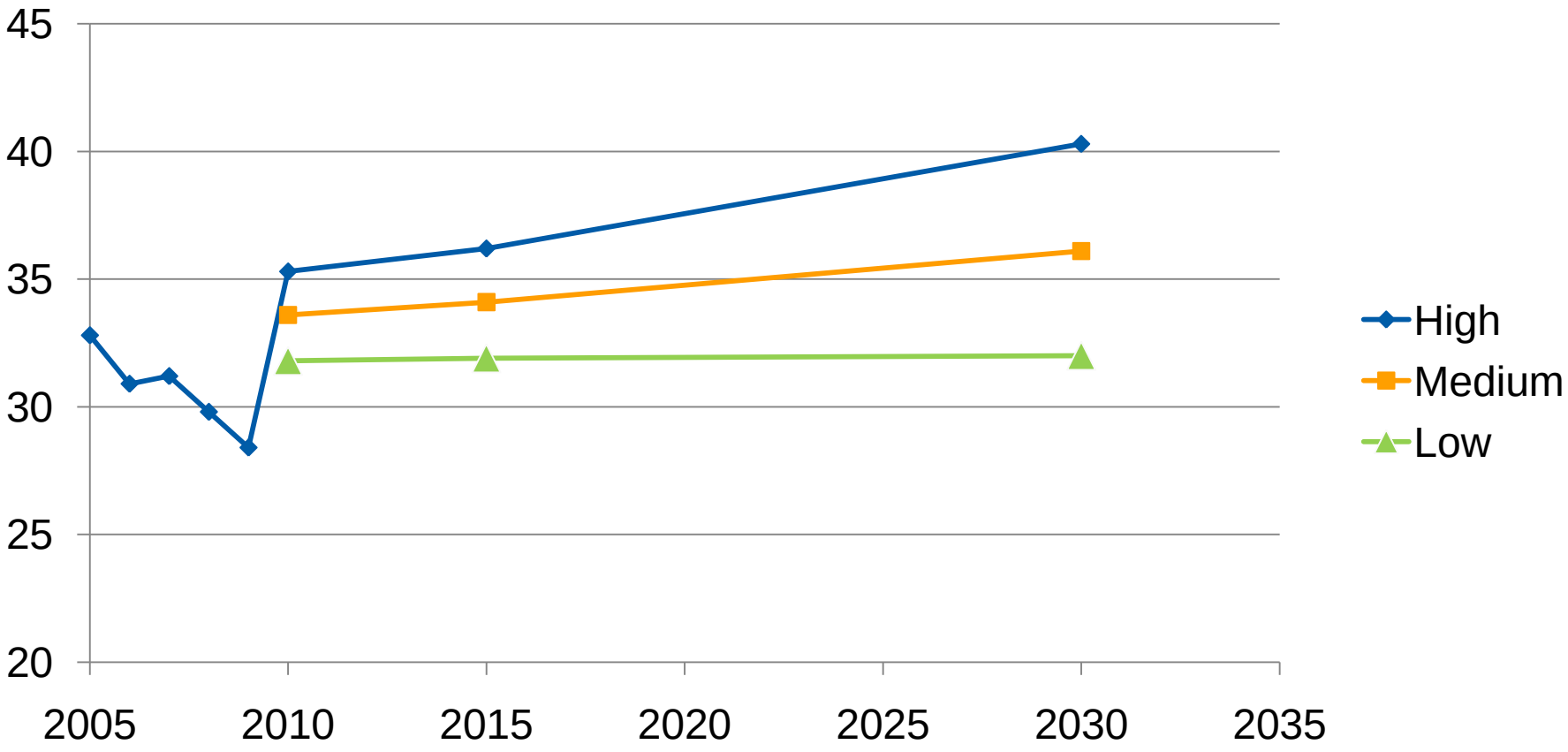
Water Demand – Historical AD and MD Summary



Water Demand – Historical AD Summary by Service Zone



Water Demand – Future AD for High, Medium, and Low

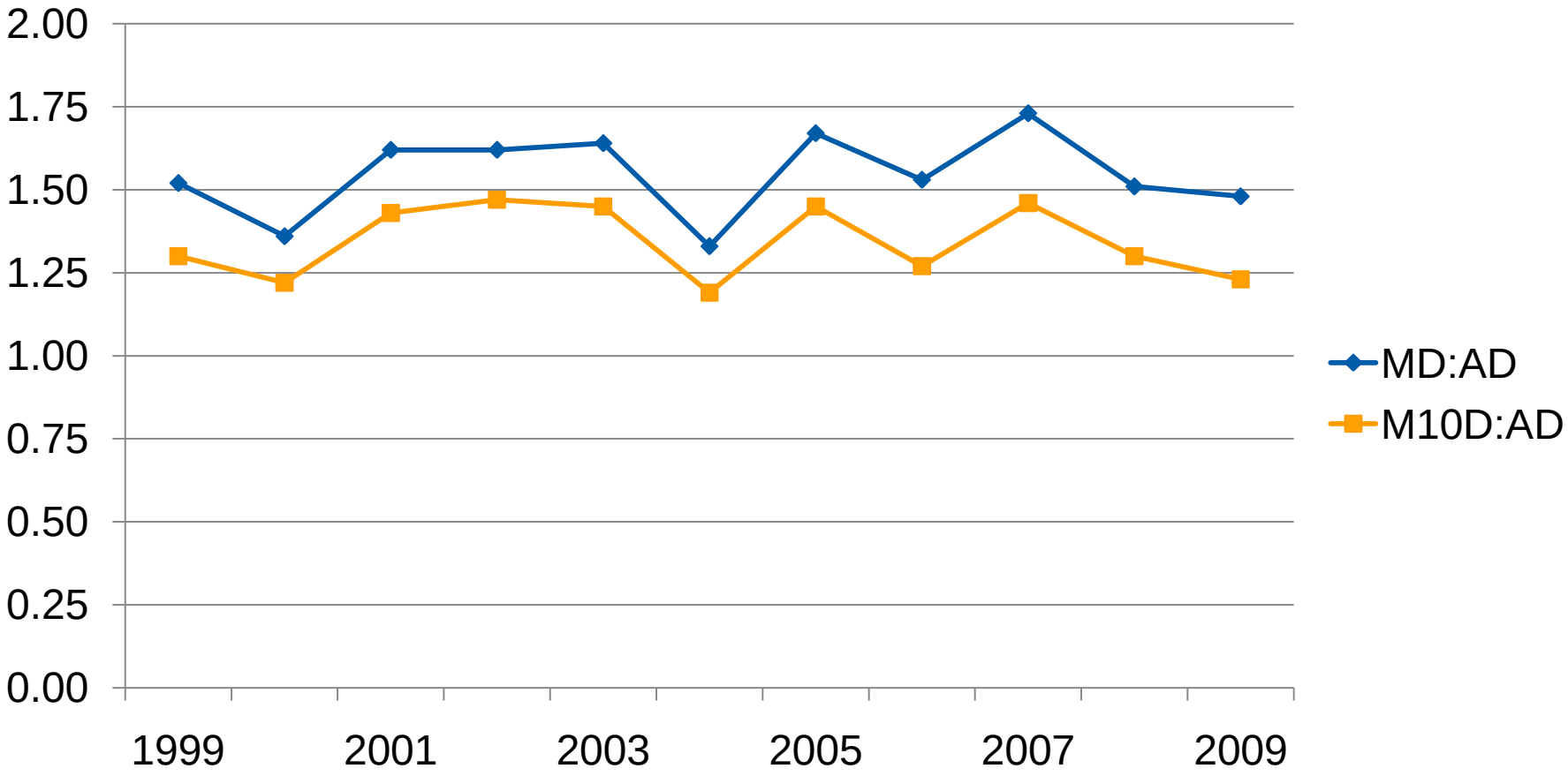


Water Demand – Discussion of Low Demand Selection

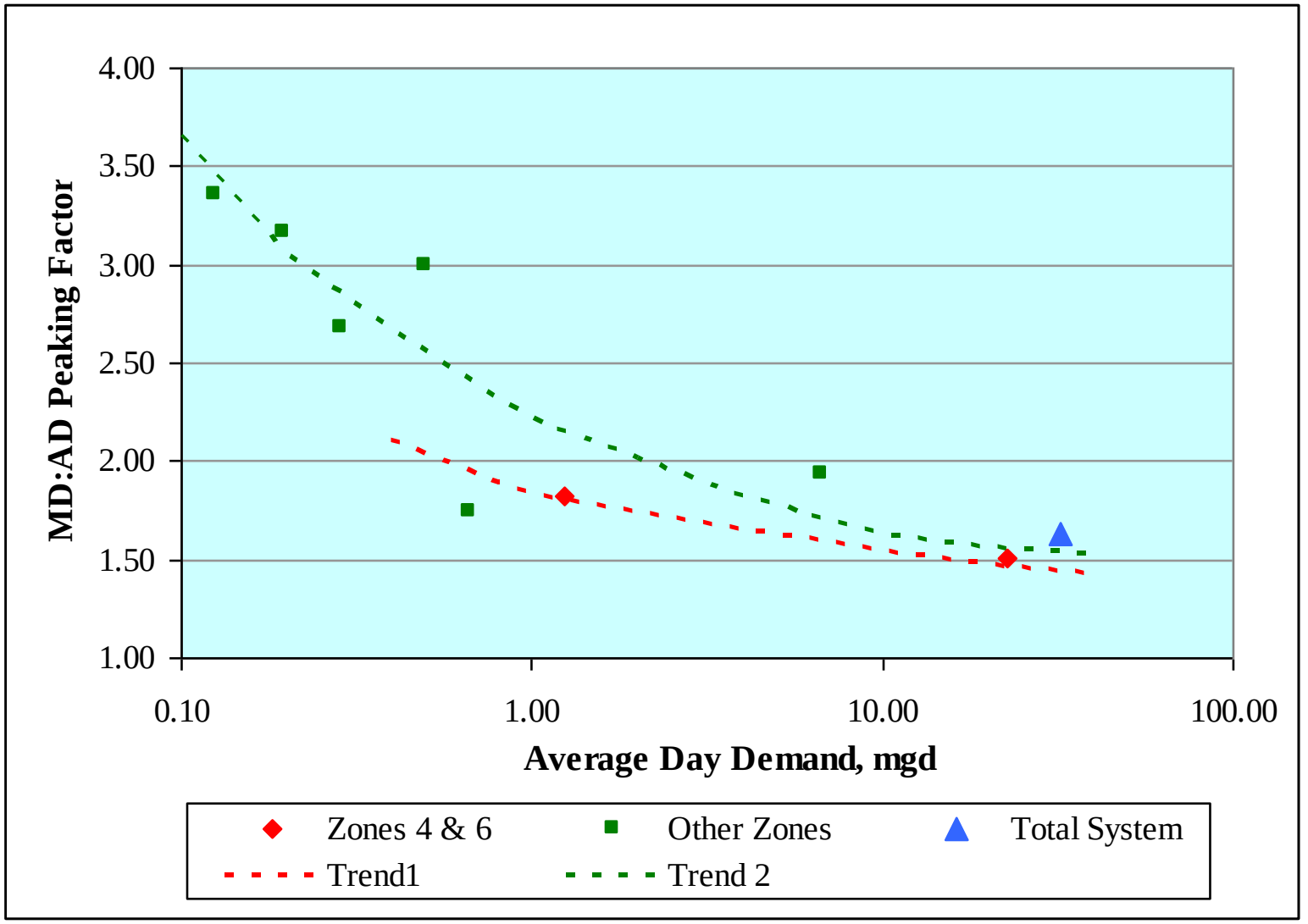
- Pro
  - Consistent with Conservation Plan
  - Keeps the goal in the planning documents
  - Demands appear to be decreasing already
- Cons
  - Planned conservation activities may not be enough to achieve goal
  - Conservation goal is an average, so even if the goal is met the demand may be higher in drought years

Recommendation: Use the low demands, but track progress and make adjustments as needed.

Water Demand – Peaking Factors



Water Demands – Peaking Factor by Service Zone



Water Demands – Peaking Factor Adjustment

- Conservation efforts aimed at indoor water usage
- Outdoor usage largely weather dependent
- Reduced average usage will result in higher peaking factor even if peak usage remains the same.

Recommendation: Increase peaking factors by 10% . Track progress and adjust in the future if needed.

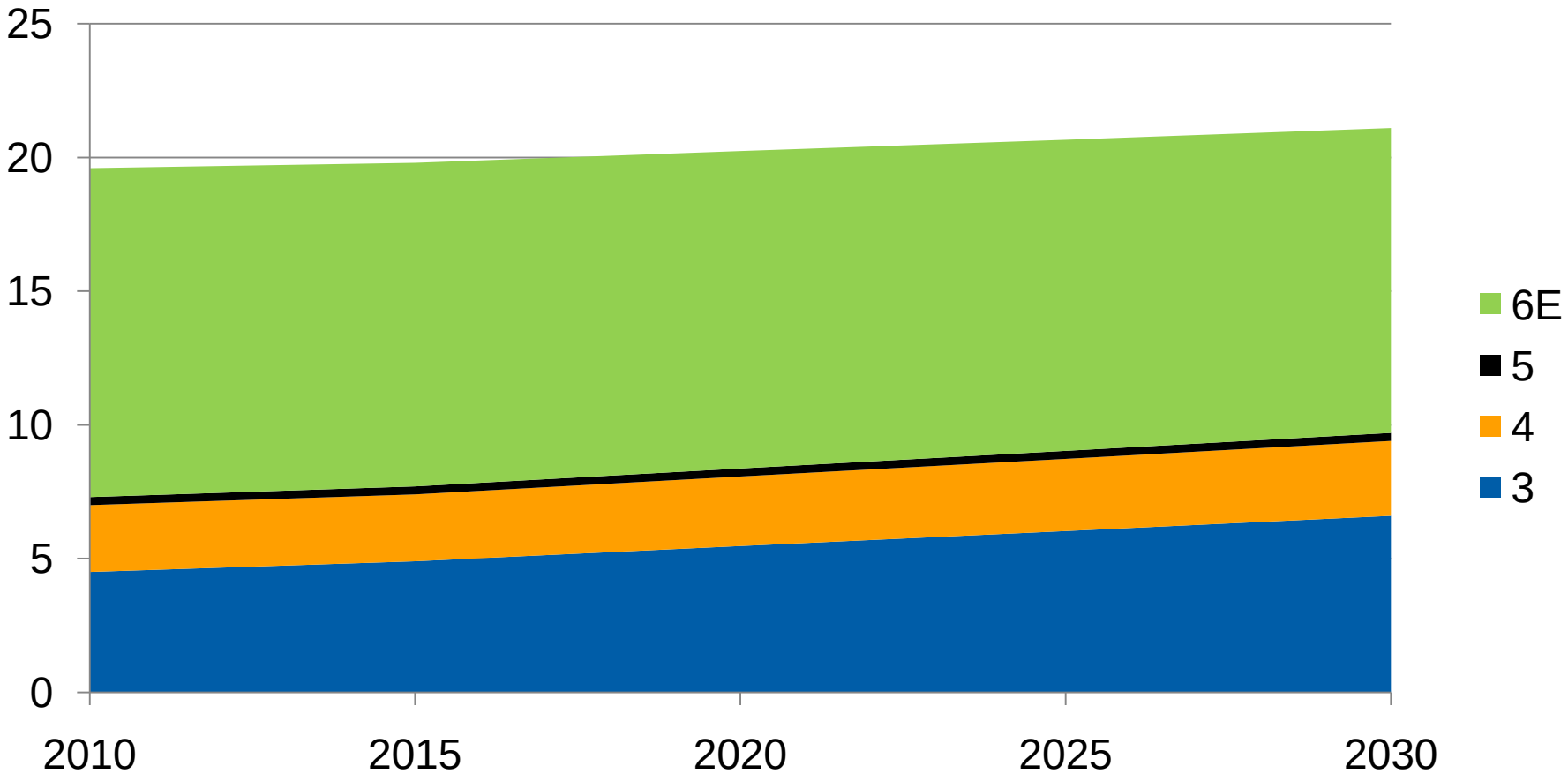
Water Demands – Peaking Factors

- Show example of peaking factor calculation for Zone 6E

Water Demand – Summary of Peaking Factors

Zone	AD: AD	M10D:AD	MD:AD	MH:AD
3	1.0	1.82	2.16	2.66
4	1.0	1.67	1.98	2.45
5	1.0	3.58	4.24	5.23
6E	1.0	1.49	1.76	2.17

Water Demands – Summary of MD by Service Zone for East Side



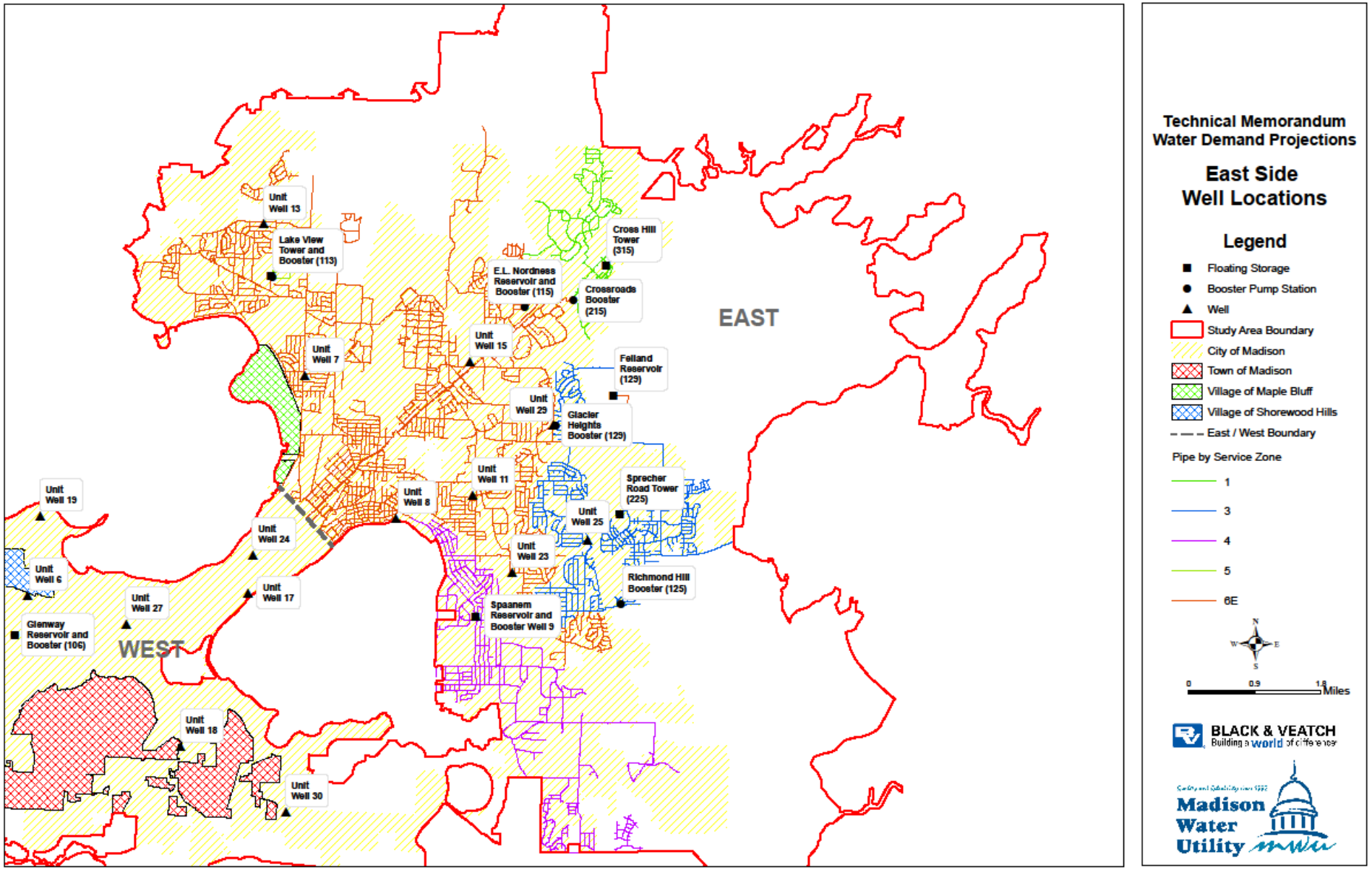
Water Demands

Questions?

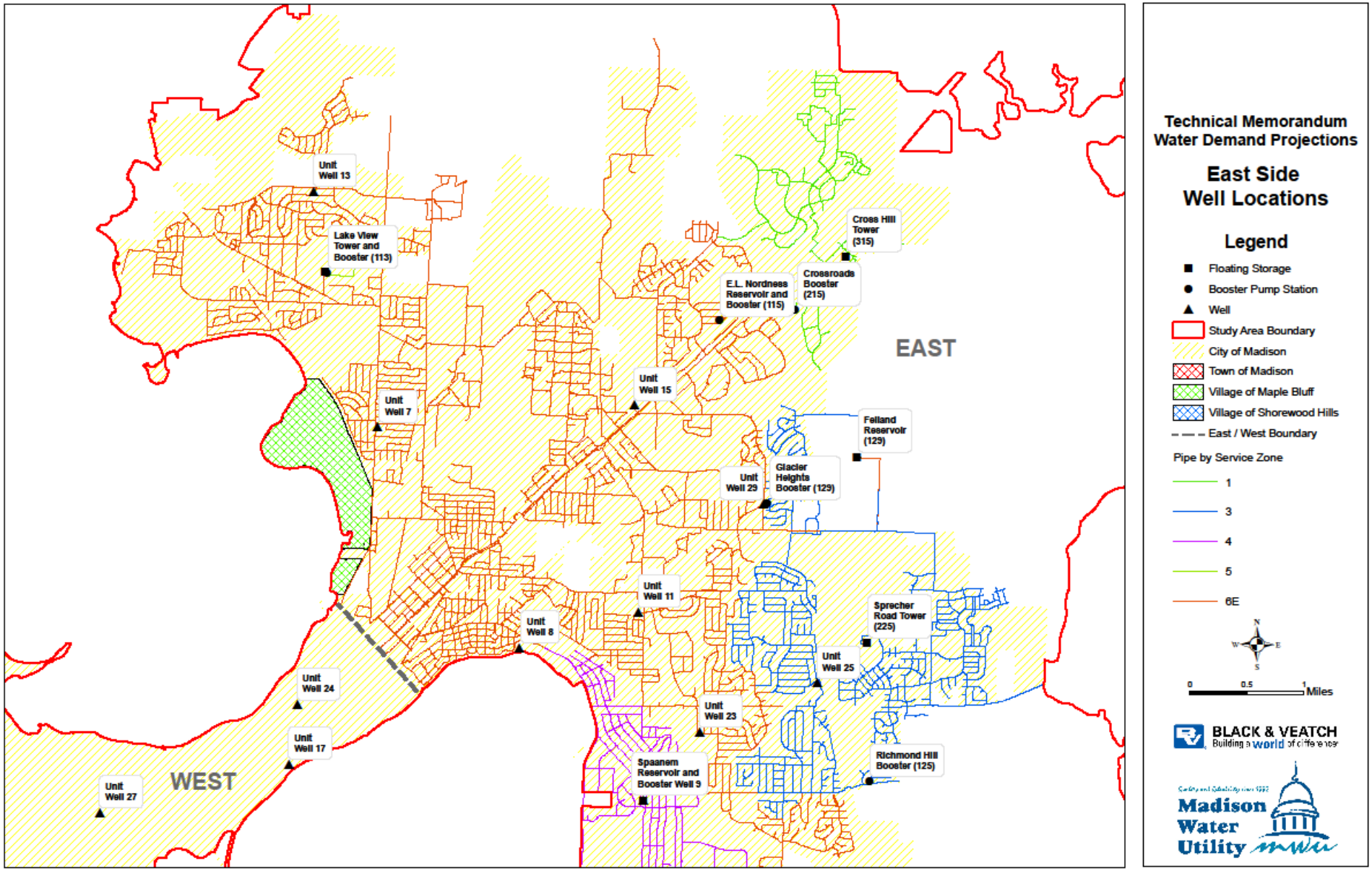
Well Capacity Analysis

- Well Capacity Criteria
  - AD demand is < 50% of well capacity
  - MD demand is < firm well capacity (two for Zone 6E)
- Caution: Evaluation only considers supply vs. demand
  - Does not consider ability to transfer water
  - Does not consider operational limitations
  - Does not consider vulnerability concerns

Well Capacity Analysis



Well Capacity Analysis



Well Capacity Analysis

Zone	Unit Well	Booster Pump Capacity	Capacity with one well out of service
3	25	3.0	0.0
4	9	2.5	0.0
5	--		
6E	7 8 11 13 15 23 29	3.0 2.4 3.0 3.0 3.0 1.4 1.6 17.4	11.4
East Service Area Total		22.9	16.9 – 18.4 13.9 – 15.4

Well Capacity Analysis

- Zone 3, 4, and 5 analysis

Well Capacity Analysis

- Zone 6 E Evaluation

Well Capacity Analysis

Questions?

Summary and Conclusions

- Population Summary
  - Map with growth areas?
  - Total increase

Summary and Conclusions

- Demand Summary

Summary and Conclusions

- Well Capacity Evaluation

Summary and Conclusions

Questions?