Austin’s Disaggregated Water Demand Model: Using Land Use in a Disaggregated Water Demand Model
April 8, 2019
Determining how and where water is used

- **Residential**
- **Commercial**
- **Industrial**
- **Irrigation**
Breaks down water consumption by end-use

2004

- SF Residential: 19.1%
- Multifamily: 19.8%
- Commercial (inc G and ST): 7.8%
- Wholesale: 7.8%
- Large Volume: 6.7%
- Irrigation: 1.8%
- COA: 0.3%

2004 (w/ SFR End-Uses)

- SFR Showers/Baths: 19.1%
- SFR Toilets: 19.8%
- SFR Clothes Washers: 7.8%
- SFR Faucets/Basins: 7.8%
- SFR Dishwashers: 6.7%
- SFR Leaks: 1.8%
- SFR Outdoor: 0.3%

- Multifamily: 19.8%
- Commercial (inc G and ST): 7.8%
- Wholesale: 7.8%
- Large Volume: 19.1%
- Irrigation: 19.1%
- COA: 19.1%
- COA IR: 19.1%
Development of demand projections
Analysis Timeline

2000 - 2015
Statistical analysis for weather and price elasticity

2011
Billing system change

2013 - 2015
Historical period used to calculate “Base Year”

2000 - 2015
Represents current water use trends among the various demand sectors

2013
Projection years

2015
Baseline projections which can be compared to projections incorporating various demand management strategies

2020
2040
2070
2115
Disaggregation of Customer Data to End Use

- Sectors:
  - Single Family
  - Multi-family
  - Commercial
  - Wholesale
  - Large Volume
  - COA

- Subsectors:
  - Indoor
  - Outdoor

- Indoor End Uses:
  - Shower/Bath
  - Toilet
  - Laundry
  - Dishwasher
  - Faucet/Basin
  - Leaks

- LV Customers:
  - LV Customer1
  - LV Customer2
  - LV Customer3
  - LV Customer4
  - LV Customer5

- Other End Uses:
  - Austin Water
  - Austin Energy
  - Parks and Rec.
  - Other Depts.
  - Outdoor

- Additional End Uses:
  - Laundry
  - Kitchen
  - HV/AC
  - Domestic
  - Misc.
Base Year Consumption Sectors (Averages of 2013-2015)

- Single Family: 35.6%
- Multi-family: 24.9%
- Commercial: 23.1%
- Wholesale: 6.7%
- Large Volume: 7.9%
- City of Austin: 1.8%
Base Year Consumption Subsectors (Averages of 2013-2015)

- **Single Family**
  - Indoor (25.9%)
  - Outdoor (9.7%)

- **Multi-family**
  - Indoor (20.8%)
  - Outdoor (4.0%)

- **Commercial**
  - Hospitals (2.0%)
  - Offices (3.2%)
  - Schools (2.0%)
  - Restaurants (1.9%)
  - Hotels/Hospitals (0.4%)

- **Wholesale**
  - Industrial (1.4%)
  - Retail (2.1%)
  - Hospitality (3.0%)
  - Restaurants (1.9%)
  - Schools (2.0%)
  - Offices (3.2%)
  - Hospitals (2.0%)

- **City of Austin**
  - Single Family (20.8%)
  - Multi-family (25.9%)
  - Commercial (9.7%)
  - Outdoor (4.0%)
  - Indoor (20.8%)
  - Other (0.2%)
  - Parks and Recreation (0.1%)

- **Large Volume**
  - LV1 (4.1%)
  - LV2 (4.1%)
  - LV3 (4.1%)
  - LV4 (4.1%)
  - LV5 (4.1%)

- **Austin Water**
  - Small Volume (0.03%)

- **Austin Energy**
  - Large Volume (0.4%)

- **Parks and Recreation**
  - Indoor (4.0%)

- **City Other**
  - Indoor (1.0%)

- **City Outdoor**
  - Indoor (25.9%)
Spatial Disaggregation of Customers & Demands into DTI Polygons
Demographics Used to Calculate Water Use Factors Among Demand Sectors

2015 Served Population
- 0
- 1 - 3,161
- 3,162 - 4,880
- 4,881 - 6,775
- 6,776 - 10,883
- 10,884 - 17,467

Served Population Distribution

2015 Employment
- 0
- 1 - 3,269
- 3,270 - 6,757
- 6,758 - 13,720
- 13,721 - 25,918
- 25,919 - 49,299

Employment Distribution

Austin's Disaggregated Demand Model
April 8 2019
Austin's Disaggregated Demand Model

April 8 2019

Population

Multifamily  Single Family  Single Family  Multifamily  Multifamily

Units

Multifamily  Single Family  Single Family  Multifamily  Multifamily

Population

Employees

Industrial  Office  Hospitals  Schools  Hospitality  Retail  Restaurant  Subsectors

11
Water Use Factor Development
Eg: DTI polygon 129

- Commercial
- Multi-Family Residential
- Single Family Residential
Water Use Factor (WUF) Calculations

- Single Family WUF
  \[ \frac{\sum \text{SF Billed Volume}}{\sum \text{SF Units}} \] (gal/household/year)

- Multi-family WUF
  \[ \frac{\sum \text{MF Billed Volume}}{\sum \text{MF Units}} \] (gal/household/year)

- Industrial Subsector WUF
  \[ \frac{\sum \text{Industrial Billed Volume}}{\sum \text{Industrial Employees}} \] (gal/employee/year)

- Office Subsector WUF
  \[ \frac{\sum \text{Office Billed Volume}}{\sum \text{Office Employees}} \] (gal/employee/year)
How does it work?

- Use similar graphic to slide 12 with % listed for end use boxes

End use calculations

Get percentages from Katherine

Base Year Demand Projections

Projection year calculations for each DTI:

Base Year Subsector WUF

# of projected units or employees

Total subsector volume for projection year
Served Population Projections

Imagine Austin Centers

Activity Centers for Redevelopment in Sensitive Environmental Areas
Job Center
Neighborhood Center
Regional Center
Town Center

Served Population

- 0
- 1 - 5,000
- 5,001 - 10,000
- 10,001 - 25,000
- 20,001 - 40,000
- 40,001 - 75,000
- 75,001 - 154,962

2040
2115
Employment Projections for 2040 and 2115

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<th>Range</th>
<th>2040 Employment</th>
<th>2115 Employment</th>
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<td>97,523 - 188,090</td>
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Imagine Austin Centers
Activity Centers for Redevelopment in Sensitive Environmental Areas
Job Center
Neighborhood Center
Regional Center
Town Center

Austin's Disaggregated Demand Model
April 8, 2019
Results From the Model
Baseline Demand Projections

Billions of Gallons Per Year

BASE YEAR 2020 2040 2070 2115

Thousands of Acre-Feet Per Year

- Single-Family
- Multi-Family
- Wholesale
- City of Austin
- Commercial
- Outdoor
- Climate Change Adjustment
Baseline Demand Projections

Billions of Gallons Per Year

Thousands of Acre-Feet Per Year

Single-Family
Multi-Family
Commercial
Wholesale
City of Austin
Outdoor
Climate Change Adjustment

Near-term Strategy
Present
Decision Points
2020
2040
2070
2115

BASE YEAR
2020
2040
2070
2115

Austin's Disaggregated Demand Model
April 8 2019

Present
Near-term Strategy
Decision Points
2115
2070
2020
2115 Demand Disaggregation
Projected Consumption by DTI Polygon

2020

2040

Annual Water Demand (MGY)

- 0 - 50
- 51 - 100
- 101 - 250
- 251 - 500
- 501 - 1,000
- 1,001 - 2,500
- 2,501 - 5,000
Projected Consumption by DTI Polygon

2070

2115

Annual Water Demand (MGY)

- 0 - 50
- 51 - 100
- 101 - 250
- 251 - 500
- 501 - 1,000
- 1,001 - 2,500
- 2,501 - 5,000
Applications of the DDM
Water Forward
Integrated Water Resource Plan (IWRP)

• Austin Water is leading the development of a 100 year water plan that reflects our community’s values
• Goal: Ensure a diversified, sustainable, and resilient water future, with strong emphasis on water conservation
• Incorporates planning for drought and climate change
• Council-appointed Task Force meets monthly
• Interdepartmental coordination and coordination with the community to make sure plan is implementable
• Plan projected to be completed in mid-2018 with planned updates on a five year cycle
DDM & Decentralized Water Supply Planning

High-level demand & supply planning

Evaluation and Implementation

Water Forward Task 6.3: Spatial Analysis
Using spatial information to inform strategic planning in the water sector
- Location
- Spatial variability
- Geometric attributes
- Scale

Innovative Water Strategies: AW IWS Working Group
Convened to develop a guiding process and framework for the evaluation and implementation of innovative decentralized water and wastewater systems
Task 6.3: Matching End Use Demands to Decentralized Supply Options

Decentralized Options

Lot scale
- Rainwater Harvesting
- Stormwater Harvesting
- Greywater Harvesting
- Building Scale Wastewater Reuse

Community scale
- Rainwater Harvesting
- Stormwater Harvesting
- Sewer Mining
- Distributed Wastewater Reuse
Task 6.3: Sewer Mining Example

Suitable Extraction Points
- Manhole
- Minimum 16-inch sewer line
- Maximum 50-foot sewer depth
- Adequate open space for treatment
- Substantial demands within 0.5-mile radius
IWS Pilot Opportunity: New Development Services Building at Highland Park

Pilot System Goals

- Onsite collection and reuse:
  - blackwater
  - condensate
  - rainwater

- Maximum offset of nonpotable demands

- Technology test & verification

- Data collection:
  - water quantities & quality
  - energy consumption
  - operations & monitoring

- Showcase utility innovation

- Explore new business model approaches
Austin's Disaggregated Demand Model

**DEMANDS**
- 1,730 GPD potable
- 2,725 GPD non-potable
- 685-3,274 GPD irrigation

**SUPPLIES**
- 2,453-5,241 GPD rainwater
- 3,805-8,130 GPD stormwater
- 170-1,953 GPD condensate
- 1,730 GPD graywater
- 4,455 GPD blackwater

MATCH SUPPLY TO DEMAND
Infrastructure Planning
Infrastructure Planning

- Future Water Demands in Hydraulic Models
- Forecasts for WTP Budgeting and Capacity
- Future Water Demands for CIP Project Capacity Analysis
- Impact Fee Analysis
- Wastewater Flow Analysis
- Water Conservation Impacts on Infrastructure
Base Year Consumption Subsectors & End Uses (Averages of 2013-2015)
Base Year Single Family Daily Household Consumption

MEDIAN: 184
MEAN: 207
Base Year Multi-Family Daily Household Consumption

MEDIAN: 138
MEAN: 148

Multi-family household consumption

Gallons/Household/Day

- 0
- 1 - 110
- 111 - 134
- 135 - 159
- 160 - 196
- 197 - 244
- 245 - 479
Base Year Commercial Annual Consumption

Total Consumption (Gallons/Year)
- 205,767 - 31,642,622
- 33,485,570 - 78,989,262
- 81,085,439 - 146,817,696
- 188,837,818 - 371,615,468
- 580,619,414

Annual total commercial consumption
Median: 18.8M  Mean: 37.8M
Served Population Projections

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