Updating the Regional Water Demand Forecast

NWPA Technical Advisory Committee

March 27, 2018

Agenda

- Purpose and timeframe
- Overview of Water 2050 Demand Forecast
- Methodology of ON TO 2050 Water Demand Forecast
- Key similarities and differences
- Potential users of the forecast
- Next steps
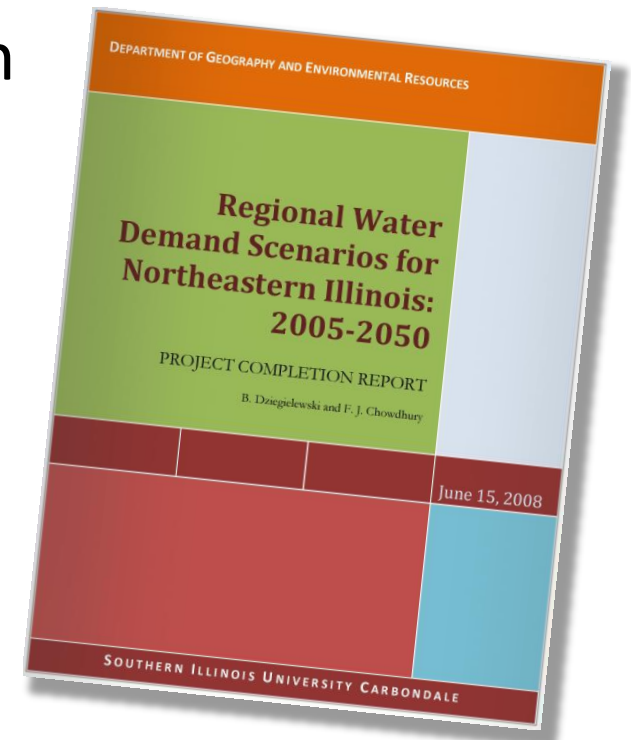
Purpose and timeframe

Purpose

Provide an updated baseline water demand forecast for the 7-county region to the year 2050.

Timeframe

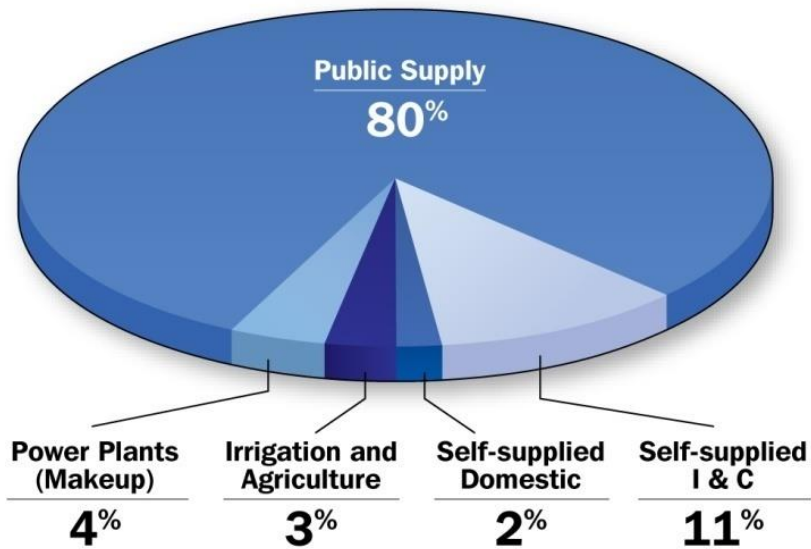Complete analysis by end of June, 2018

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Overview of the Water 2050 Demand Forecast

- Prepare future water-demand scenarios for the 11-county regional planning area of Northeastern Illinois

- Include estimates of water use by major sectors in 5-year increments for the period 2010-2050

- Allocate future water use to major withdrawal points within the region

Water Use

Public Supply 80%

Power Plants (Makeup) 4%
Irrigation and Agriculture 3%
Self-supplied Domestic 2%
Self-supplied I & C 11%

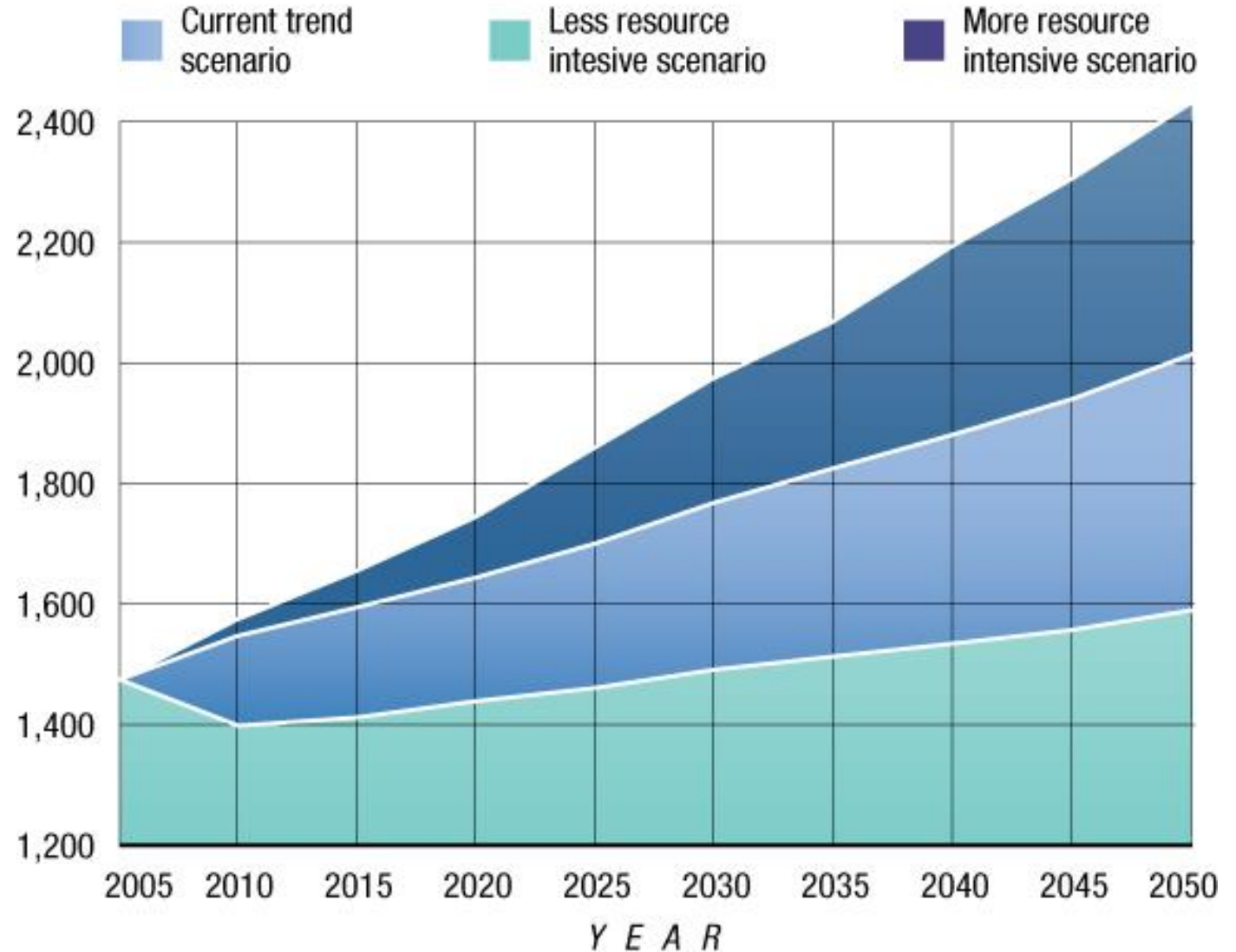Source: B. Dziegielewski and F.J. Chowdhury, 2008

Excluding once-through power

- Public Supply
  - all publicly supplied customer classes (residential, industrial, commercial)
  - 26 water supply service areas
  - 11 county metro areas
- Self Supply (11 counties)
  - Domestic
  - Industrial & Commercial
  - Irrigation & Agriculture
  - Power Generation
    - Individual (9+) thermoelectric power plants

Water 2050

Three scenarios

Scenario water withdrawals: 2005 - 2050,
in million gallons per day

Legend: Current trend scenario | Less resource intesive scenario | More resource intensive scenario

Source: B. Dziegielewski and F.J. Chowdhury, 2008, Southern Illinois University Carbondale

Overview of ON TO 2050 Water Demand Forecast

- **Simple method**

    A simple method will be used for all sectors to provide a baseline forecast.

   Simple assumptions can be made to adjust unit water use over time.

- **Updated demand equation (regression)**

    As project capacity and available data permits, develop updated demand equations using historic data (from 2000-2014)

    Resulting coefficients from these models will be applied to unit use calculations for gpcd/gped, and incorporated into the forecast.

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Current data on water withdrawals

Public supply withdrawals (mgd),
ISWS (2000-2013) and Water 2050 LRI Forecast (2005-2050)

Legend:
- Total ISWS Reported Withdrawals
- Total LRI Forecast Withdrawals
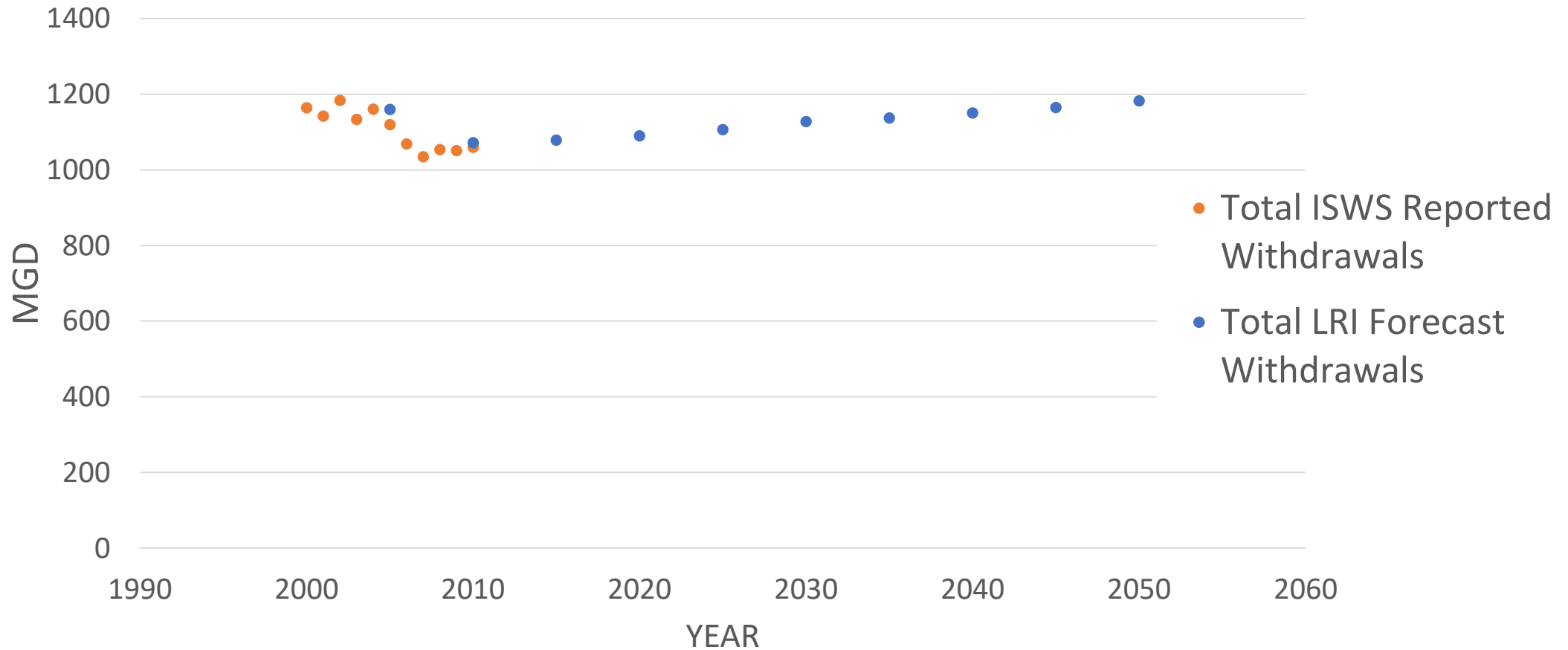
LRI and ON TO 2050 Demand Assumptions

Variable	LRI	ON TO 2050
Price (-)	2.5% real increase/annually	-
Housing Density	-	Population Forecast
Conservation trend* (-)	50% higher than historical trend	-
Sectoral Employment (%)	-	Employment Forecast

Demand estimation

- Priority 1: Residential Community Public Water Supply (CWS)

  gpcd - demand drivers: Price, Conservation Trend, Housing Density

- Priority 2: Non-Residential Municipal Water Supply (CWS & Self-Supply)

  gped - demand drivers: Price, Conservation Trend, Employment by Sector

- Priority 3: Municipal Public Water Supply (non-community)

  gpcd - demand drivers: Conservation Trend, Housing Density

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Key similarities and differences

- Sectors
- Population forecast
- Geography
- Fixed effects

Sectors

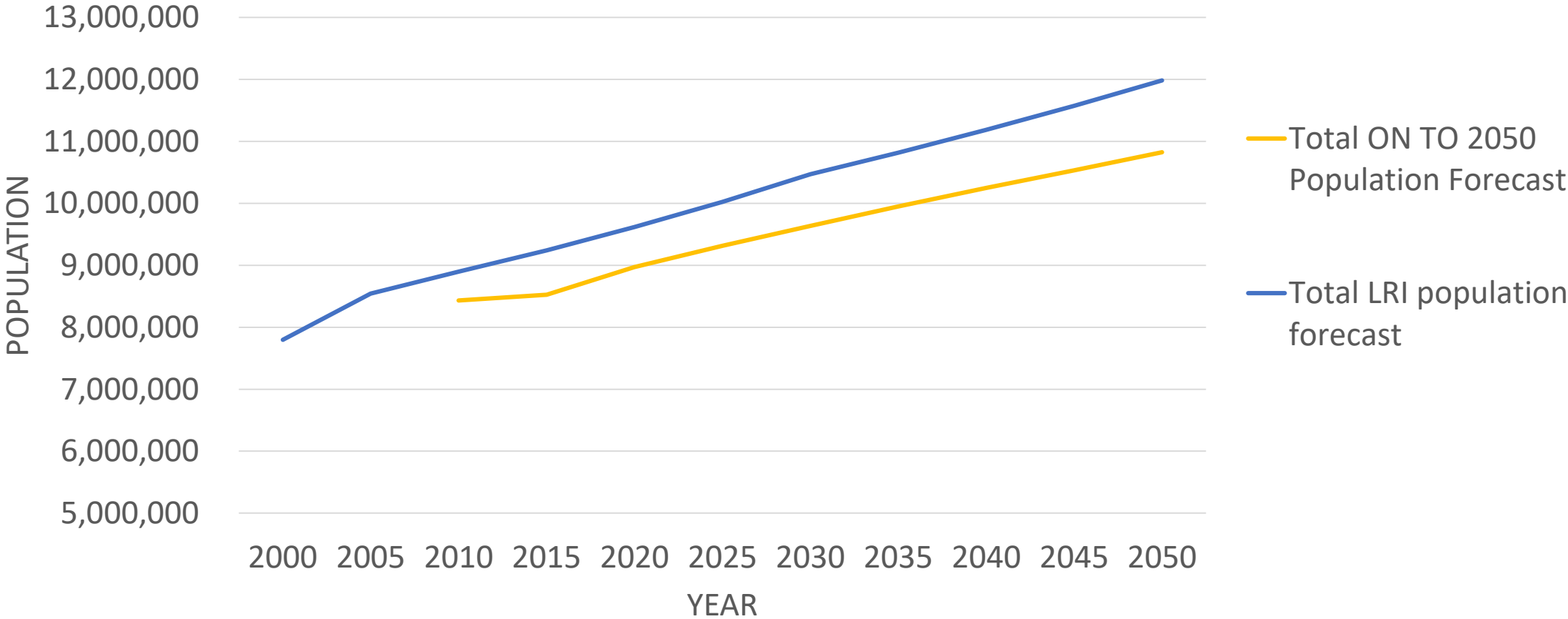Public water supply by customer class:

    Residential

    Non-residential

Self supply:

    Domestic

    Non-residential

Population forecast comparison

Population Projections, Water 2050 LRI Forecast and ON TO 2050 Total

Geography

Sector	Geography (input)	Format of results (output)
Residential Community Public Water Supply (CWS)	Municipality/service area	Municipality/service area
Non-Residential Municipal Water Supply (CWS & Self-Supply)	Municipality/service area, unincorporated county	Reassigned to municipality/service area and unincorporated county based on location and proportional use
Municipal Public Water Supply (non-Community)	County	Reassigned to municipalities and unincorporated county based on location and proportional use
Domestic self-supply	County	Reassigned to municipalities and unincorporated county based on location
Total	Region	7-county regional total; further broken down by county and water source.

Results by geography

Region
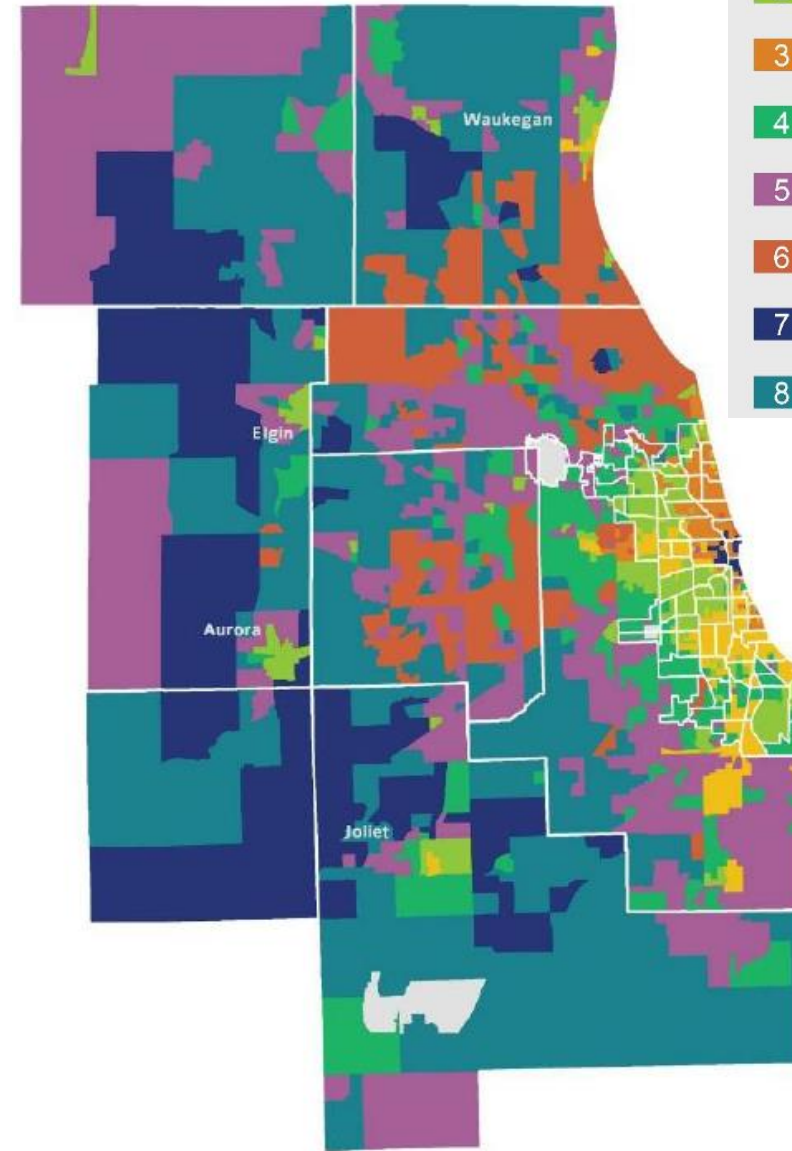
- Totals for each sector

County

- Totals for each sector

Municipality -- may not include all sectors:

- Residential CWS
- Non-residential (CWS+SS)
- Municipal PWS (non-community)
- Domestic self-supply

Fixed Effects

- Grouping analysis
  - Statistical technique that categorizes data into groups
  - Based on 1 or more input variable
  - Ex: Housing submarkets

- Anticipated input: GPCD

1	Higher density urban, high foreclosure and vacancy, low income
2	Higher density urban and suburban, large households, low/moderate income
3	Higher density urban, high income, young, high cost
4	Post-war suburban, moderate- and middle-income, lower cost
5	1960-79 suburban, moderate but declining incomes, lower cost
6	High cost, suburban, high income, aging
7	High population growth, newest housing stock
8	1980-99 suburban, high/middle income, suburban, aging

Potential users of the forecast

Long-range forecast for planning purposes (water & land use)

- Provide water demand information at the municipal scale, for incorporation in planning efforts

- Provide inputs to Lake Michigan allocation, groundwater flow model, and other source assessment analysis

- Others?

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Next steps

- Review draft forecast results in May

- Finalize forecast based on **draft** ON TO 2050 Socioeconomic forecast in June

- Finalize based on **approved** ON TO 2050 Socioeconomic forecast in October

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Comments, questions?

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Background information
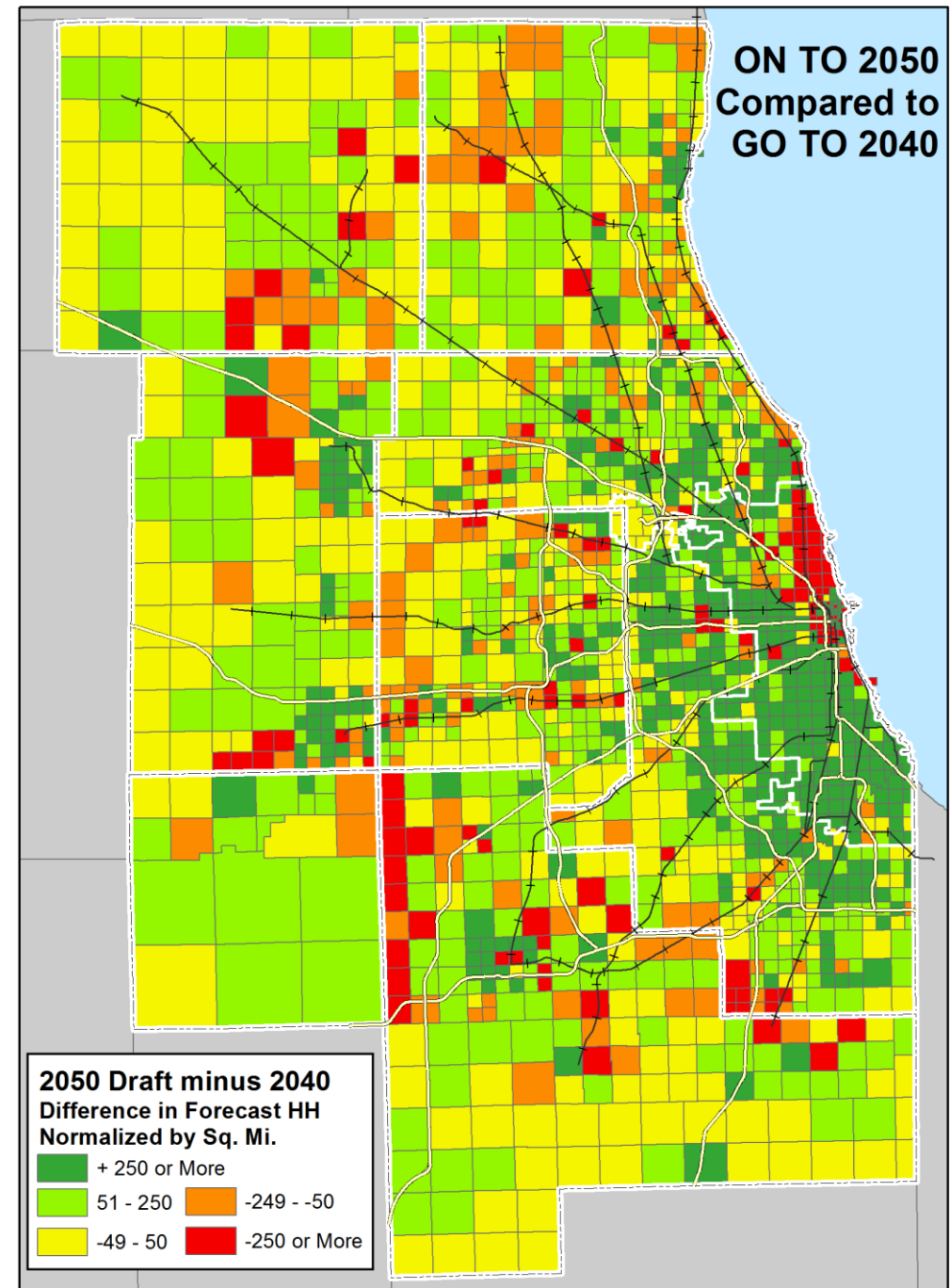
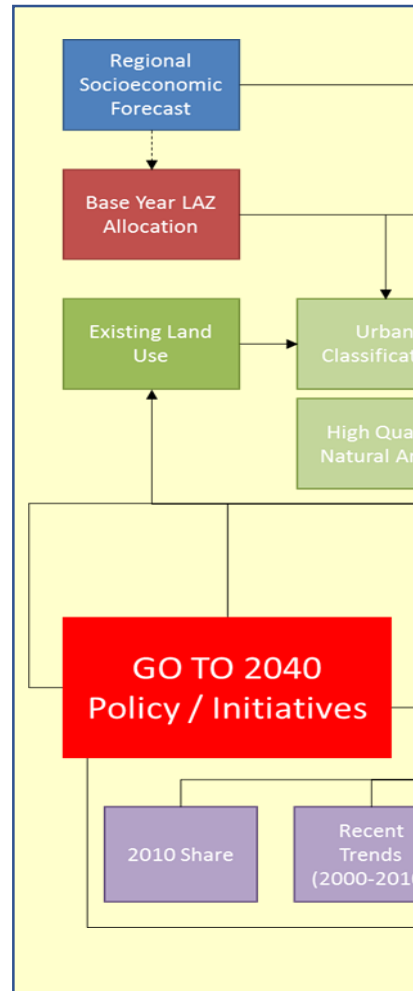# ON TO 2050 Socioeconomic Forecast

- Report at 5-year intervals
- Report employment by industry (2-digit NAICS)
- Local Area Allocation Tool
  - 21,977 Local Area Zones (LAZ) in region
  - Existing population and employment
  - Available capacity (Land Use and Development database)
  - Incremental (5-yr) growth
  - Planned land use and transportation projects
  - Policy & market considerations
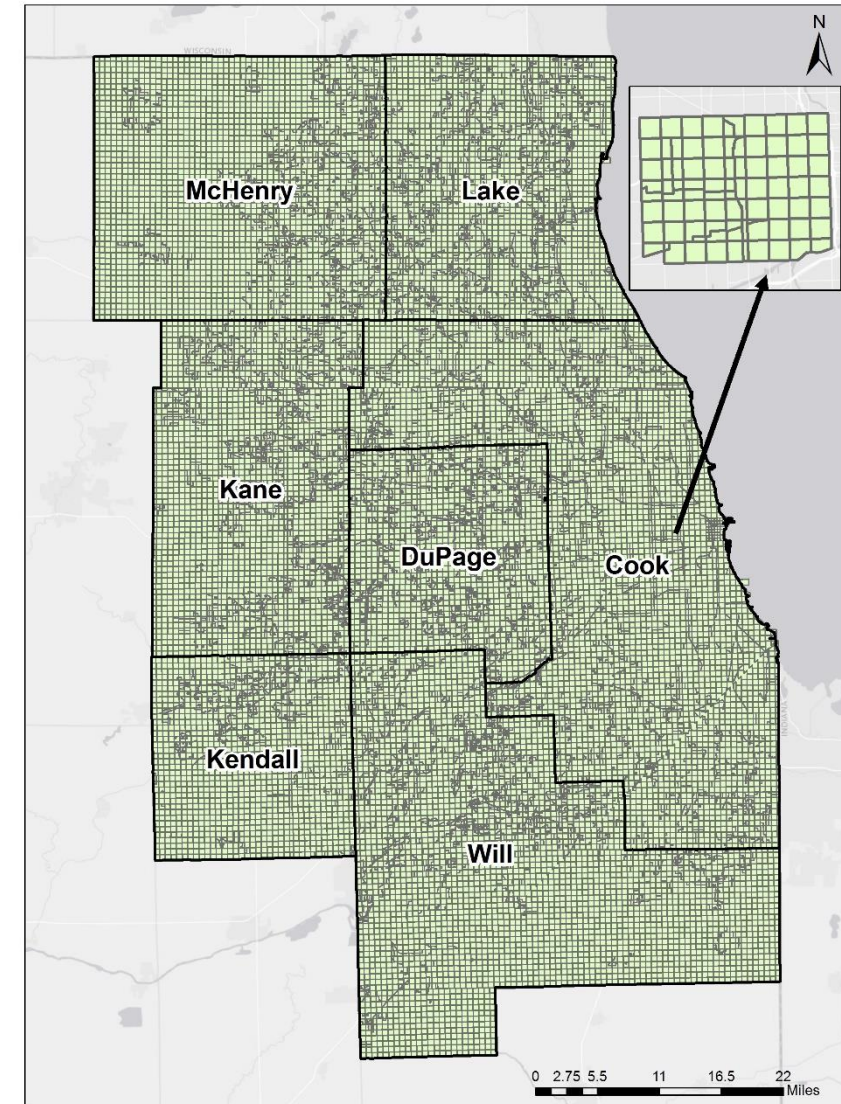
Local Area Allocation Tool

Policy & market considerations

- 2010 share
- Recent trends
- Infill opportunity areas
- Disinvestment areas
- Transit/highway accessibility
- Land value
- Municipal envelope

Regional Socioeconomic Forecast

Base Year LAZ Allocation

Existing Land Use → Urban Classificat...

High Qual... Natural Ar...

GO TO 2040 Policy / Initiatives

2010 Share

Recent Trends (2000-2010...

ON TO 2050 Compared to GO TO 2040

2050 Draft minus 2040 Difference in Forecast HH Normalized by Sq. Mi.

- + 250 or More
- 51 - 250
- -49 - 50
- -249 - -50
- -250 or More

ON TO 2050 Population Forecast

ON TO 2050 Draft Forecast: Households by Local Allocation Zone
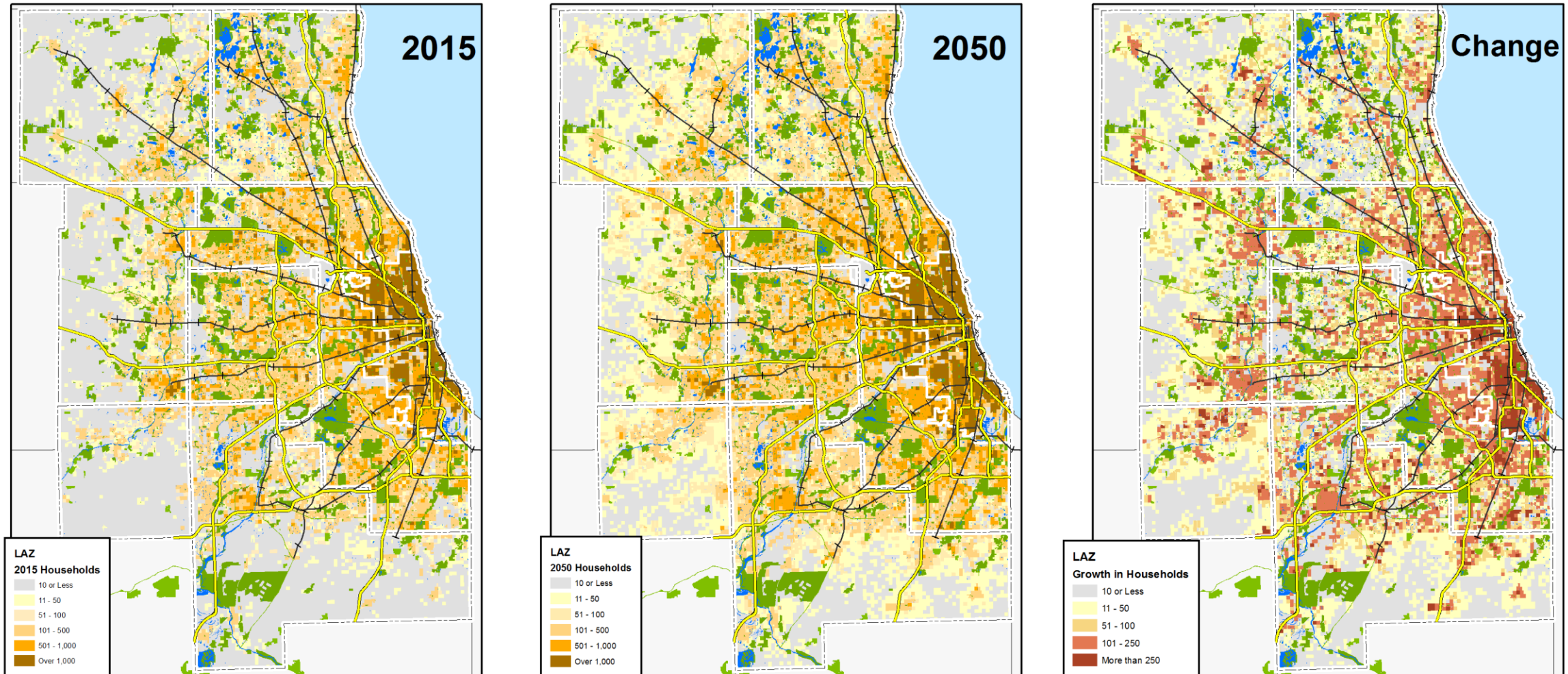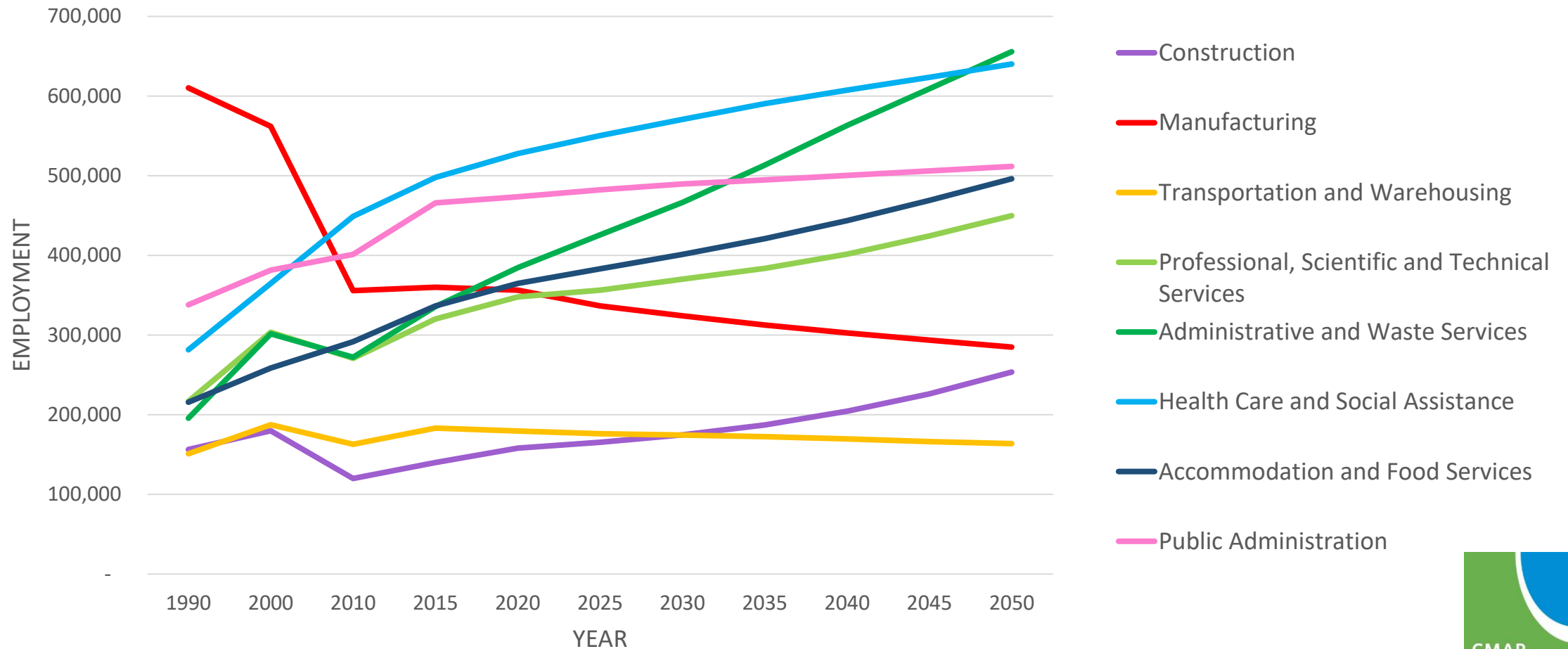
ON TO 2050 Employment Forecast

Employment by Select Industry, Recent Past (1990-2015) and ON TO 2050 Socioeconomic Forecast

Data Attributes

Primary inputs available to us:

- ISWS annual withdrawals by well/intake (~3922): 1980 – 2014
- ISWS annual withdrawals by public supply (~503): 2000-2014
  - Account breakdown (Residential, Commercial, Industrial)
  - LMO-2 details (account breakdown, Non-revenue and UFF/MUL, etc)
- CMAP ON TO 2050 Socioeconomic Forecast, 5-yr increments: 2015-2050
  - By municipality boundary
  - By local area allocation zone (LAZ)

Residential Community Public Water Supply (CWS)

Variable Name	Variable Definition	Cross Section Geography	Time series	Variable Data Source (s)
Dependent Variable				
GPCD	Water Supply Withdrawals in Gallons Per Capita per Day (GPCD) Calculated as Average Annual MGD divided by population served.	Municipal	Annual 2000-2014	ISWS IWIP USGS NWUIP U.S. EPA SDWIS U.S. Census
Independent Variables				
Price (-)	Marginal residential price of water Calculated as difference in the total water bill at 5,000 gallons and 6,000 gallons.	Municipal	Annual 2000-2014	Dziegielewski, Kiefer, Bik, 2004; IDNR Water Rates Survey IISG Water Rates Survey
Housing Density	Housing Units/land area	Municipal	Annual 2000 - 2015	U.S. Census, Decennial U.S. Census, ACS
Conservation trend* (-)	zero for 2000, 1 for 2001, 2 for 2002 etc.	n/a	Annual 2000-2014	Definitional
Dummy Variables	To account for municipal level fixed effects, drought years (2005, 2012), polar vortex years (2013-2014), geographical discrepancies, outliers	n/a		Cluster Analysis Definitional

Non-residential Community Public Water Supply (CWS & Self-Supply)

Variable Name	Variable Definition	Cross Section Geography	Time series	Variable Data Source (s)
Dependent Variable				
GPED	Water Supply Withdrawals in Gallons Per Employee per Day (GPED) Calculated as Average Annual MGD divided by number of employees.	Municipal, unincorporated county	Annual 2001-2015	ISWS IWIP USGS NWUIP Longitudinal Employment and Household Dynamics (LEHD)
Independent Variables				
Sectoral Employment (%)	Sectoral Employment by 2-digit Standard Industrial Classification (SIC)/North American Industry Classification System (NAICS) calculated as: annual compound growth rate in percent.	Municipal, unincorporated county	Annual 2001-2015	Longitudinal Employment and Household Dynamics (LEHD)
Conservation trend* (-)	zero for 2000, 1 for 2001, 2 for 2002 etc.	n/a	Annual 2000-2014	Definitional
Dummy Variables	To account for municipal and county level fixed effects, drought years (2005, 2012), polar vortex years (2013-2014), geographical discrepancies, outliers	n/a		Definitional

Public Water Supply (non-community)

Variable Name	Variable Definition	Cross Section Geography	Time series	Variable Data Source (s)
Dependent Variable				
GPCD	Water Supply Withdrawals in Gallons Per Capita per Day (GPCD) Calculated as Average Annual MGD divided by population served.	County	Annual 2000-2014	ISWS IWIP USGS NWUIP U.S. EPA SDWIS U.S. Census
Independent Variables				
Housing Density	Housing Units/land area	County	Annual 2000 - 2015	U.S. Census, Decennial U.S. Census, ACS
Conservation trend* (-)	zero for 2000, 1 for 2001, 2 for 2002 etc.	n/a	Annual 2000-2014	Definitional
Dummy Variables	To account for county level fixed effects, drought years (2005, 2012), polar vortex years (2013-2014), geographical discrepancies, outliers	n/a		Definitional