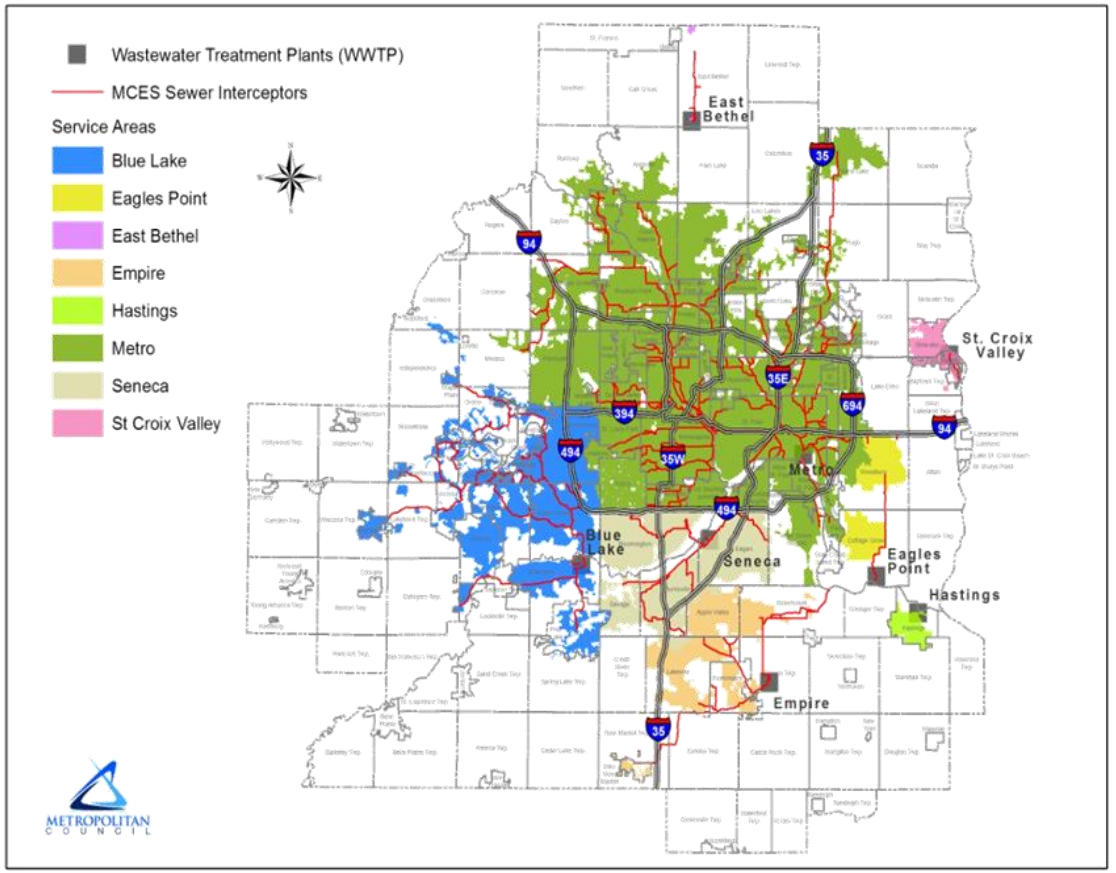
Creative Planning for Wastewater Reuse

Minnesota Groundwater Association Spring 2016 Conference

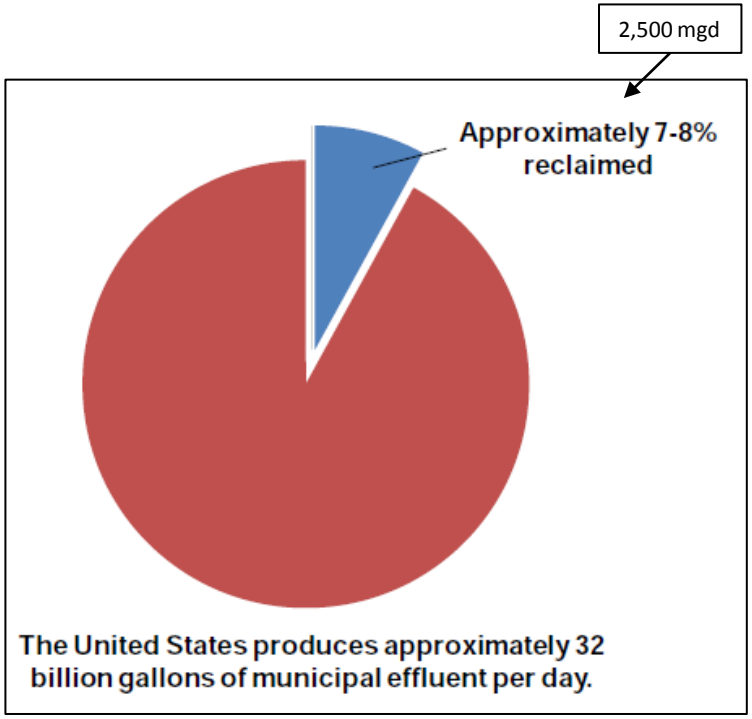
Deborah Manning, P.E., Metropolitan Council Environmental Services

Metropolitan Council Environmental Services Service Area and Facilities

- Serves 7-county Twin Cities Metro Area (3,000 sq mi)
- 250 mgd on average
- 8 WWTPs
- 600 miles of interceptors
- 2+ million wastewater customers in 108 communities



Reclaimed Water Use in U.S.



Typical drivers:

- Conserve potable water, avoid new water source development
- Mitigate salt water intrusion, land subsidence, etc. due to declining groundwater levels
- Support/augment wetlands, other surface features

Geography:

- 90% of wastewater reuse occurs in: CA, AZ, TX, FL
- Reuse increasing across N. America

Source: *2012 Guidelines for Water Reuse*, U.S. EPA

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Wastewater Reuse in Minnesota

- City of Mankato
  - 1.5 – 2 mgd Mankato Energy Center cooling water
  - 750,000 gallons: city parks and green spaces
  - 175,000 gallons: street sweeping
  - Irrigate gravel bed tree farm on WRF site

- Golf course irrigation
  - Multiple locations
  - 0.2 mgd
- Shakopee Mdewakanton Sioux Community
  - Approx. 1 mgd wetland enhancement
- Numerous spray irrigation applications

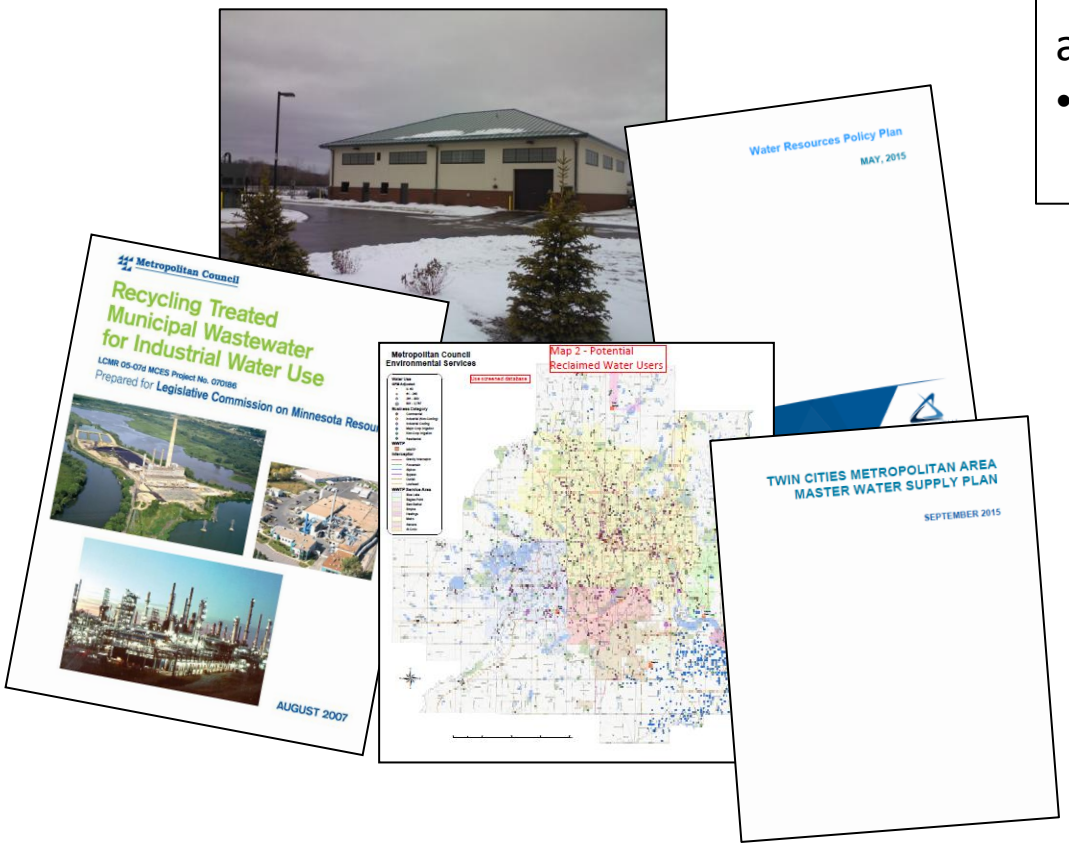
MCES' Wastewater Reuse Drivers & Progress

Drivers:

- Alleviate interceptor capacity constraints
- Conserve & supplement groundwater and surface water
- Help meet receiving water waste load allocations

Progress:

- LCCMR-funded *Industrial Reuse Study,* 2007
- E. Bethel Water Reclamation Facility: July 2014
- Ongoing sub-regional reuse studies
- Water reuse & conservation initiative at MCES WWTPs
- Collaborations (e.g., City of Eagan)



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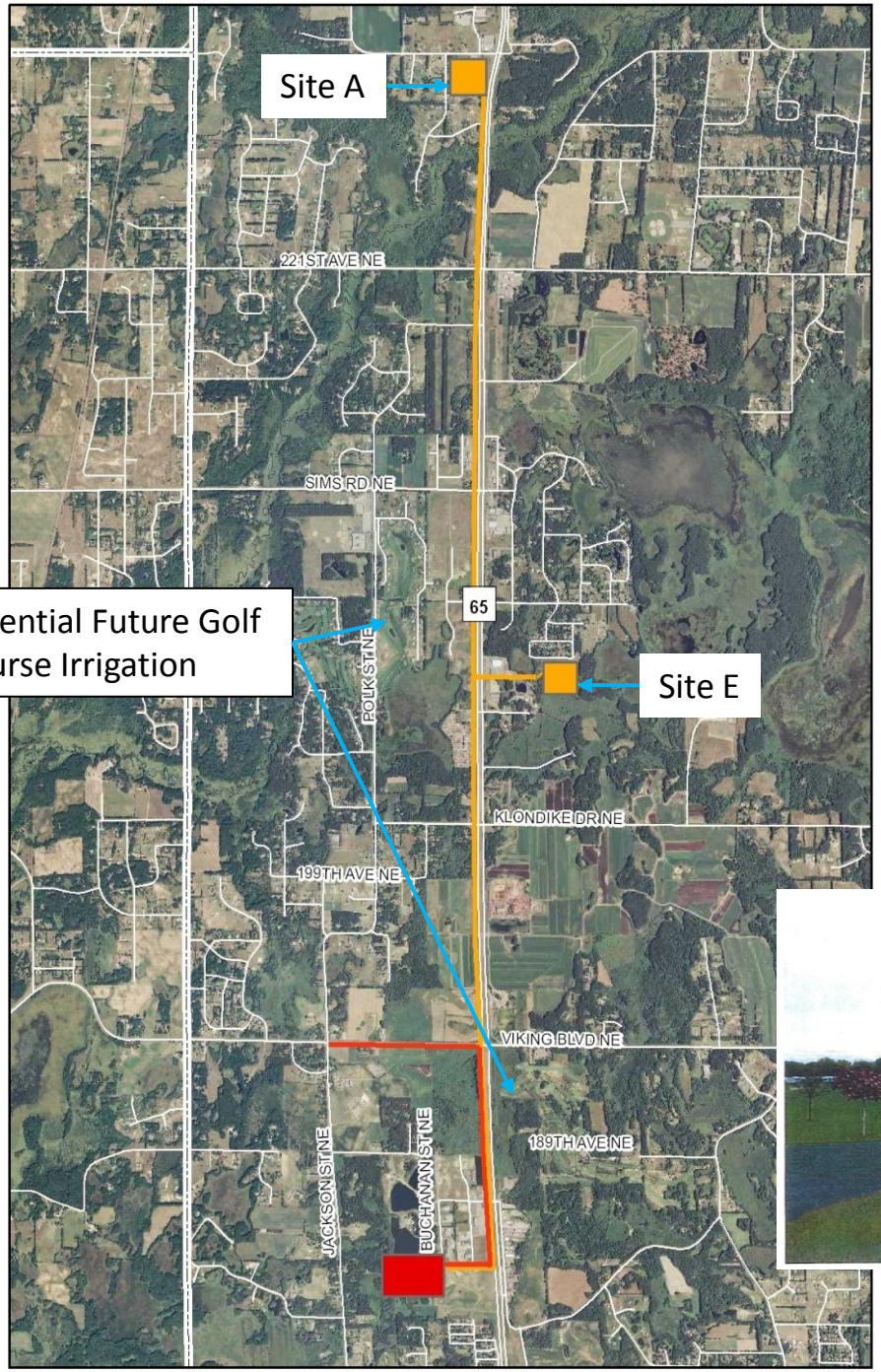
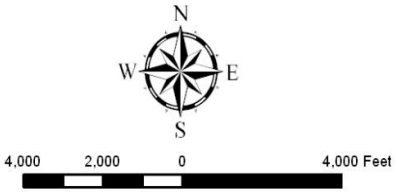
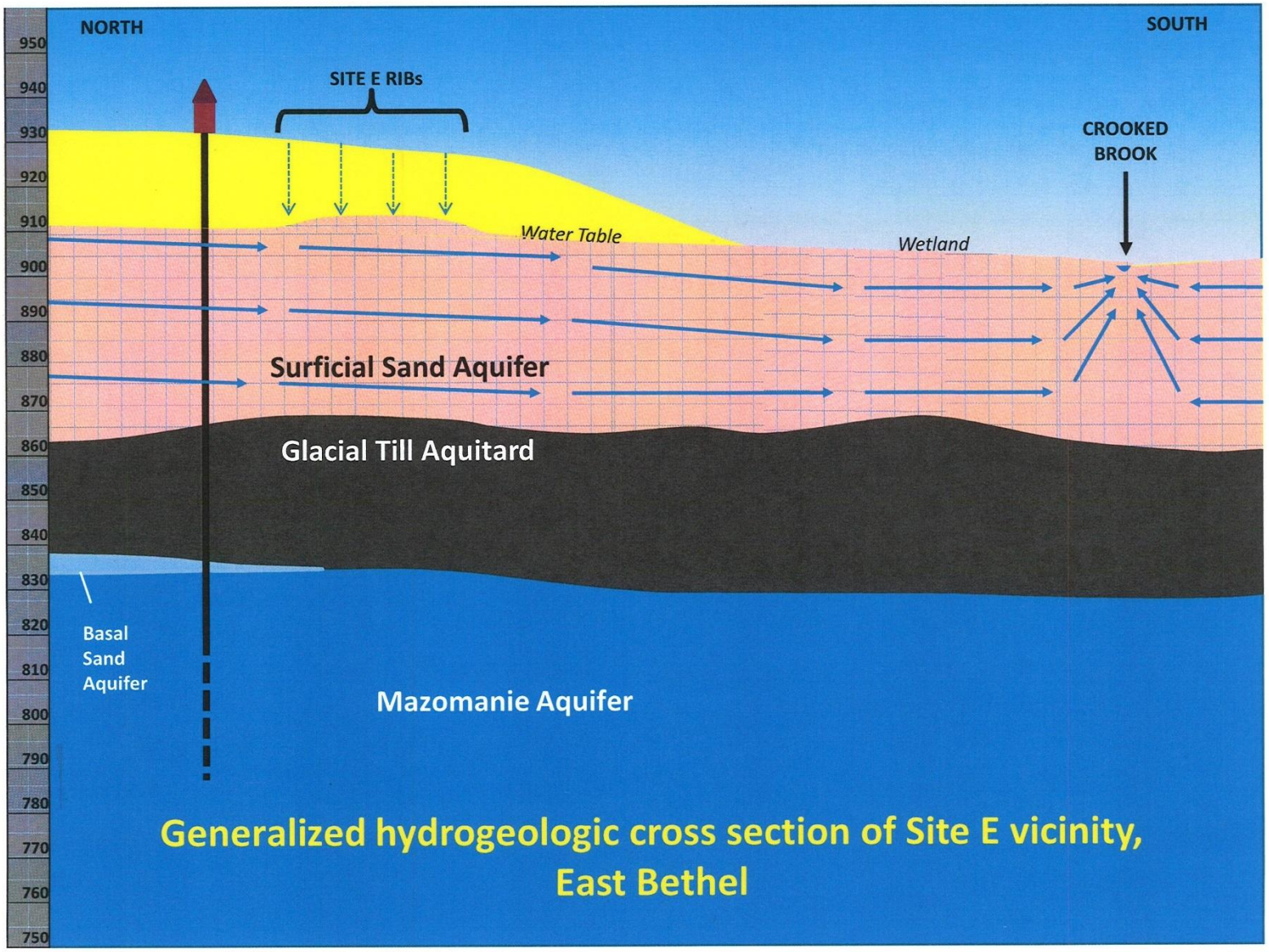
EAST BETHEL WATER RECLAMATION FACILITIES





- Interceptor Alignment
- Reclaimed Water Alignment
- Water Reclamation Plant Site
- Land Application Site

E. Bethel Groundwater Component



Generalized hydrogeologic cross section of Site E vicinity, East Bethel

Effluent Design Targets Surpass Permit Requirements to Protect Groundwater Quality

- Initial Construction Capacity: 0.41 mgd
- Membrane bioreactors with UV disinfection

Parameter	SDS Permit	Effluent Target	Operational Data Avg., Jan. – Dec., 2015
CBOD5	25 mg/L	5 mg/L	<2 mg/L
TSS	30 mg/L	5 mg/L	<1 mg/L
Total N	10 mg/L	5 mg/L	4.8 mg N/L
Total P	1.0 mg/L	0.5 mg/L	0.1 mg P/L
Disinfection	≤2.2 total coliform/100 mL	< 2.2 total coliform/100 mL	<1 total coliform/100 mL

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Increase Wastewater Reuse within MCES WWTPs

- Currently
  - Incineration:
    - 6 mgd for Metro WWTP air quality scrubbers
    - 2 mgd for Seneca after cooler
  - Heat recovery: Eagle's Point WWTP
  - Yard hydrants, tank cleaning, service water in some WWTPs
- Under design
  - Metro WWTP
    - Shift tank flushing/cleanup and seal water use from city water &/or service water (groundwater) to plant effluent
    - 1,150 gpm (1.7 mgd) avg. reduction
  - Other WWTPs in future

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Sub-Regional Wastewater Reuse Scenarios

- Purpose:
  - Develop potential reuse scenario to foster communication & collaboration
  - Identify next steps
  - Not an implementation plan, preliminary engineering study, direction for local communities or potential users
- Significant consultation and collaboration needed
- Current sub-regional areas: SE Metro, NE Metro, City of Eagan

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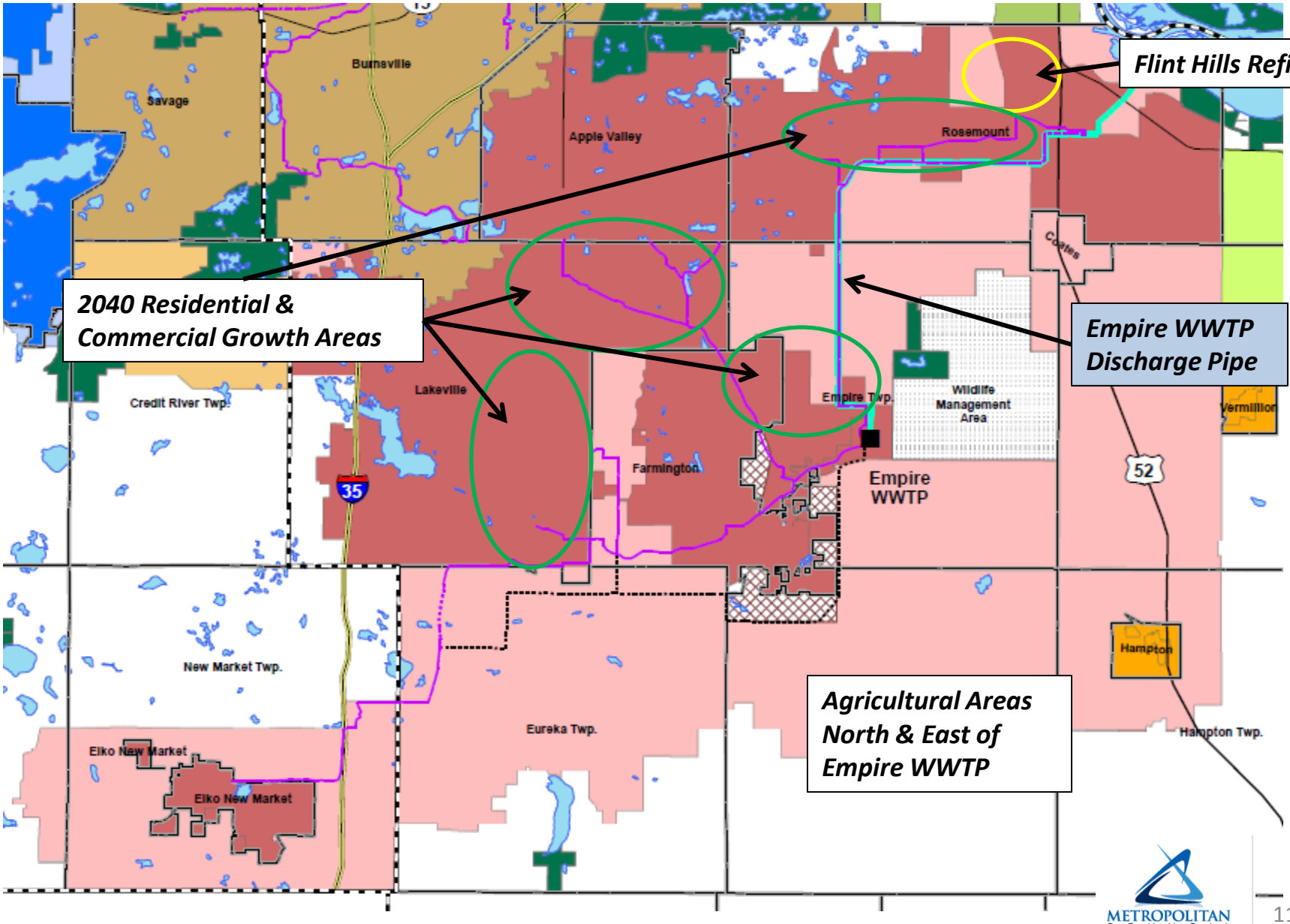
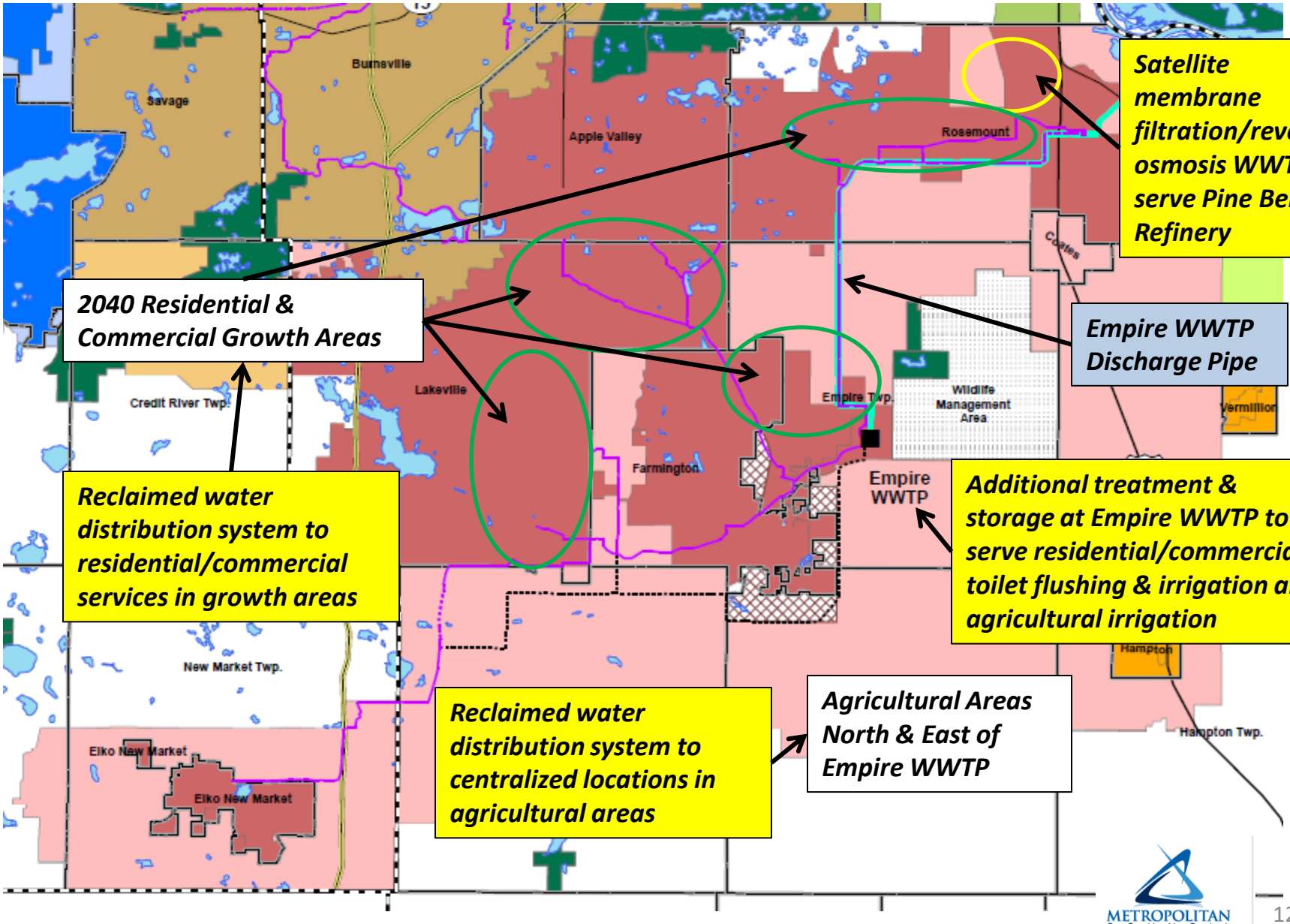
SE Metro Potential Wastewater Reuse Scenario



SE Metro Potential Wastewater Reuse Scenario



SE Metro Potential Wastewater Reuse Scenario

- Assumed reuse demand: 10 mgd ADF/21 mgd peak
- Empire WWTP flow: 10 mgd current/24 mgd avg. design
- Reuse incremental cost estimate: $5 – $10/1,000 gallons
- Cost drivers:
  - Salts & nitrate reduction
  - Distribution system
- Twin Cities water rates: $1 - $5/1,000 gallons

Note: This scenario is a first-cut at potential uses, locations, demand, & treatment requirements in order to estimate costs & begin a collaborative conversation about information needs, issues, & next steps. It is not an implementation plan, preliminary engineering study, or design document & is not intended as direction for local communities or potential users.

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Eagan Reuse Feasibility Study

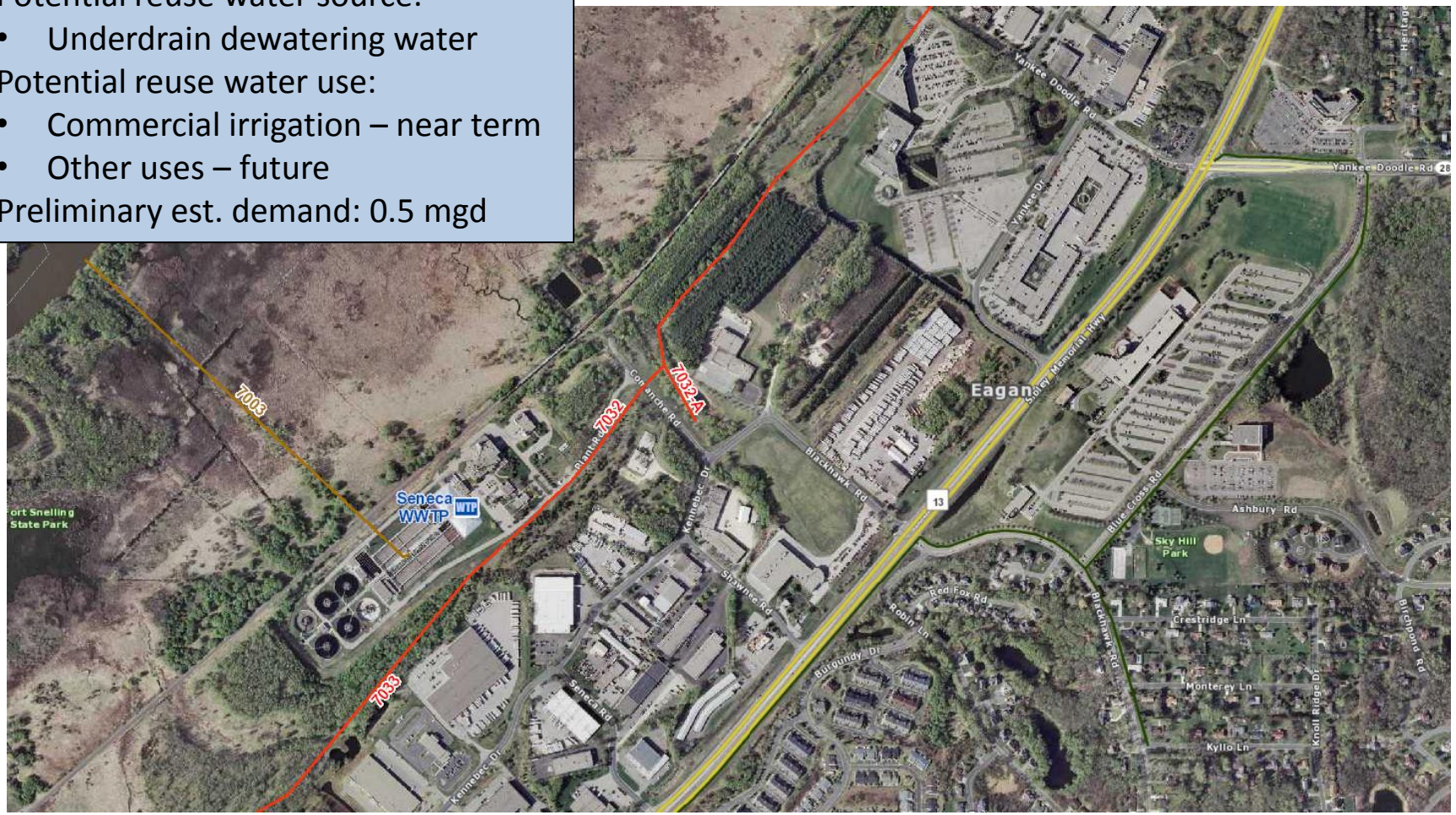
Potential reuse water source:

- Underdrain dewatering water

Potential reuse water use:

- Commercial irrigation – near term
- Other uses – future

Preliminary est. demand: 0.5 mgd



Overall Findings

1. WWTP effluent quality requirements drive reuse treatment costs:
   - Total dissolved solids, sodium, chlorides
   - Nitrogen reduction: avoid contributing nitrates to groundwater

Constituent	Metro	E. Bethel	Other WWTPs (Avg. & Range)
TDS, mg/L	797	654	1236 (688 – 2176)

Constituent	Impact on Irrigation		
	None	Slight to Moderate	Severe
TDS, mg/L	< 450	450 – 2,000	> 2,000

Impact on irrigation information from Food & Agriculture Organization of the United Nations (FAO). 1985. FAO Irrigation and Drainage Paper, 29 Rev.1. FAO: Rome, Italy (as reported in *2012 Guidelines for Water Reuse*, EPA, September 2012).
WWTP sampling data is average for 3 months of sampling (1) sample/week) June – August, 2015 by MCES.

Overall Findings

2. Location of potential users/uses drive distribution system costs:

- Few large potential users
- Limited number of large, contiguous future development areas
- Where there are:
  - Distribution system costs from existing WWTPs are high
  - Costs may offset cost of new or relieving interceptors
  - Concept of satellite WRFs

Overall Findings

3. Comparisons among water management alternatives needed

- Potable water is inexpensive and supply is currently adequate
  - Twin Cities water rates: $1 - $5/1,000 gallons
  - Estimated incremental reuse cost: $5 – $10/1,000 gallons

- Integrated, total water cost/benefit analyses using consistent methodology needed, considering:
  - Cost of new water source
  - Cost/benefit of reuse for groundwater recharge or other water sustainability benefits

Next Steps

- Collaboration
  - Reclaimed water feasibility studies
  - Total dissolved solids (including chlorides) reduction
  - Comparison among water management alternatives
- MCES outreach
  - Local communities/MCES wastewater customers
  - Regulatory agencies
  - Potential users & partners

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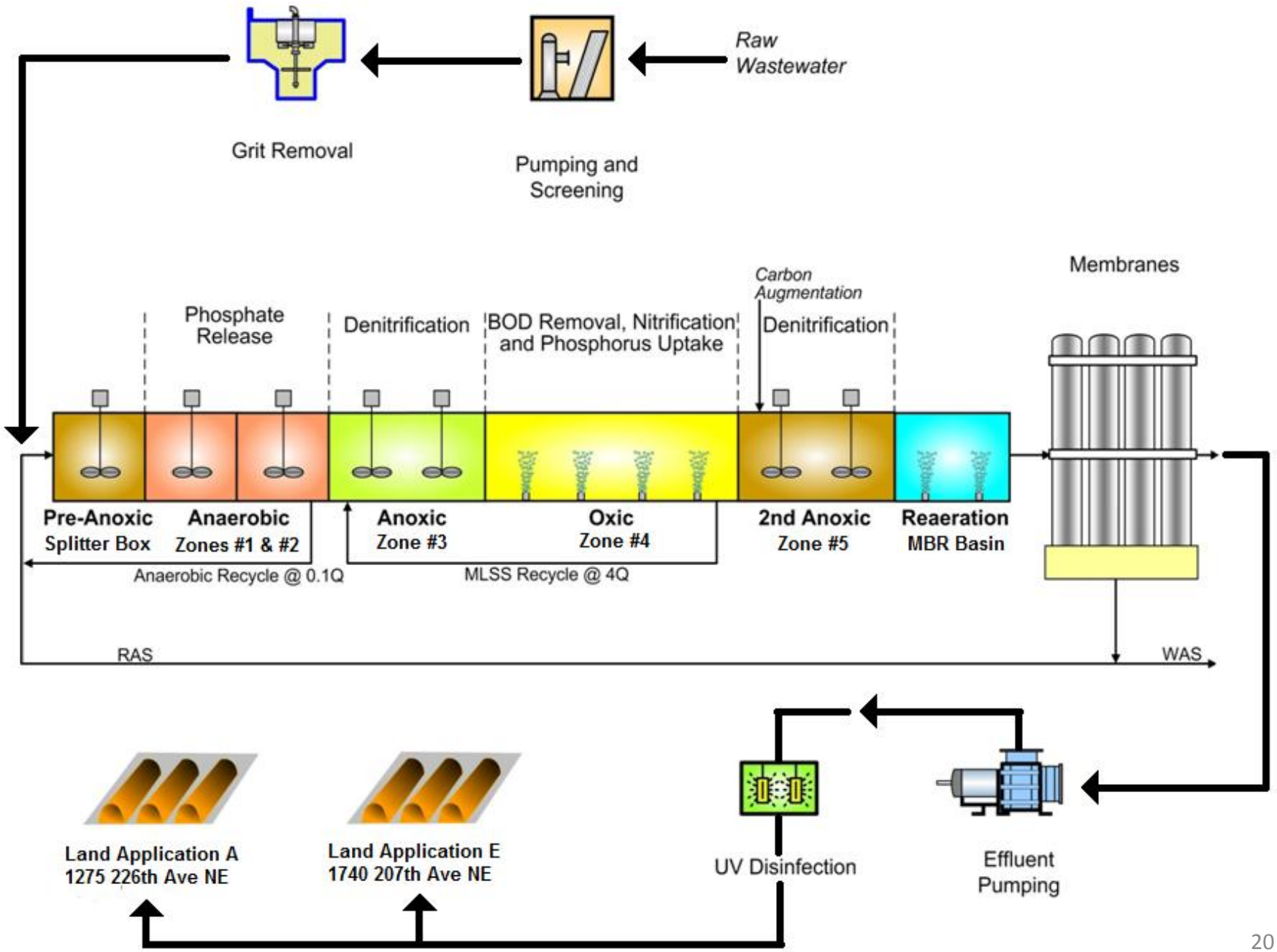

Raw
Wastewater
Grit Removal
Pumping and
Screening
Membranes
Carbon
Augmentation
Phosphate
Release
Denitrification
BOD Removal, Nitrification
and Phosphorus Uptake
Denitrification
Pre-Anoxic
Splitter Box
Anaerobic
Zones #1 & #2
Anoxic
Zone #3
Oxic
Zone #4
2nd Anoxic
Zone #5
Reaeration
MBR Basin
Anaerobic Recycle @ 0.1Q
MLSS Recycle @ 4Q
RAS
WAS
Land Application A
1275 226th Ave NE
Land Application E
1740 207th Ave NE
UV Disinfection
Effluent
Pumping

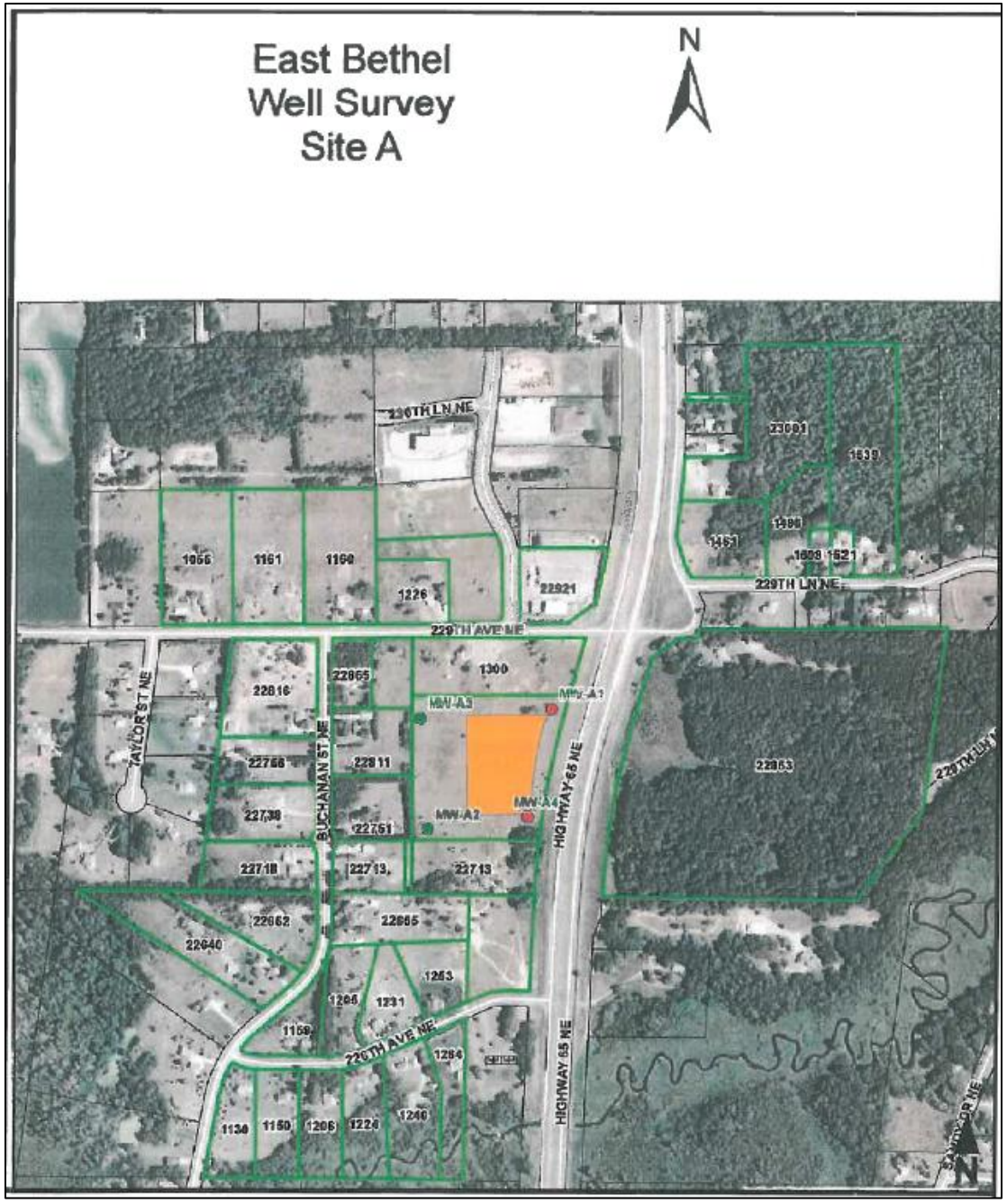
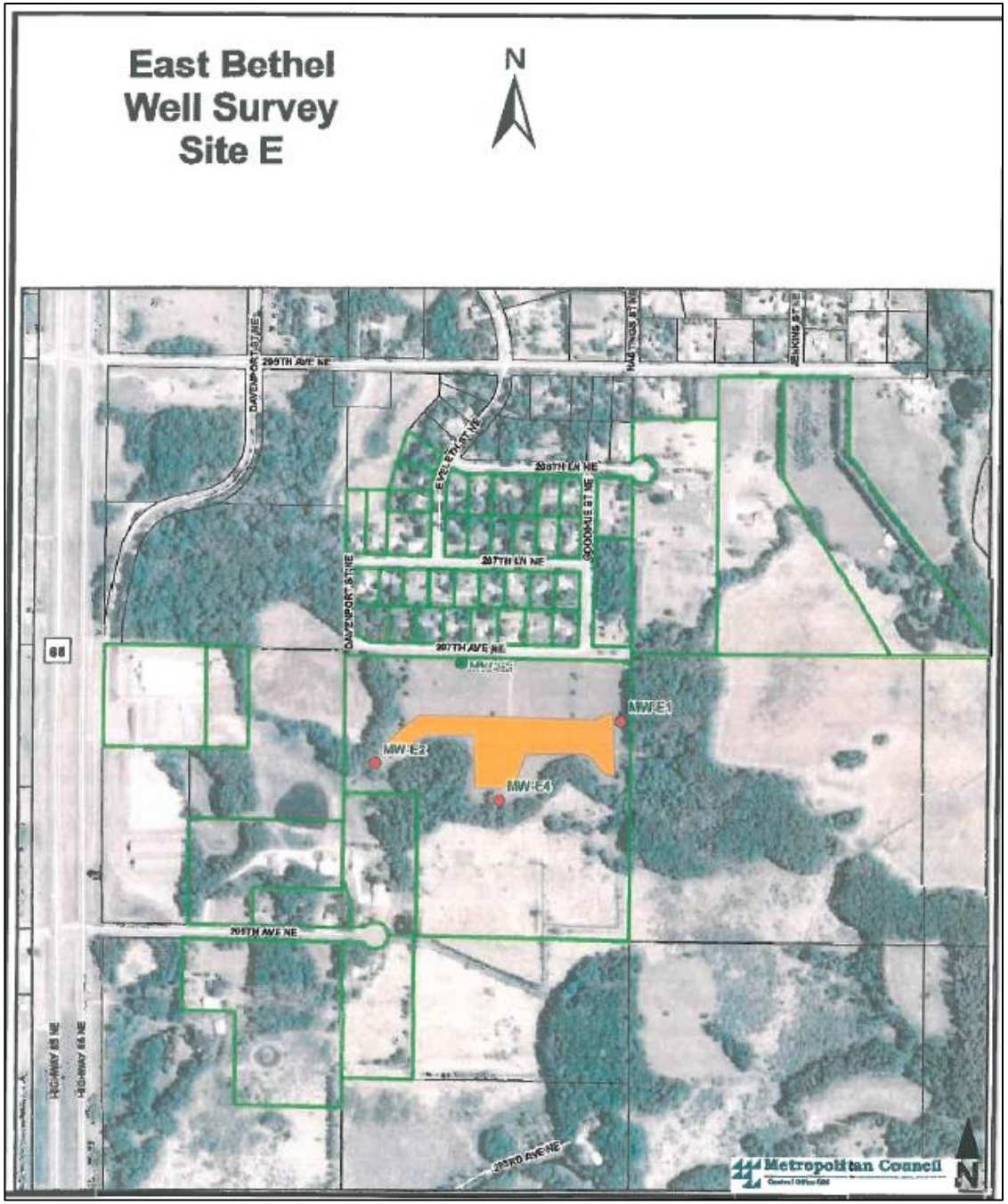


Figure by Braun Intertec



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