



UNIVERSITY OF
ALBERTA

ALBERTA RESOURCE RECOVERY CENTRE

STURGEON COUNTY, ALBERTA

PROJECT UPDATE

May 9, 2017

Prof. Nicholas Ashbolt, BAgSc (Hons), PhD

Ken Pacholok, MSc, PEng

We all have a water service problem

- Upgrading aging wastewater collection systems and treatment plants in Canada is estimated to cost \$82 billion*
- Why replace old sewers or build greenfield developments with traditional sewers?

*2016 Canadian
Infrastructure Report Card
www.canadianinfrastructure.ca/

The New York Times Our Water System: What a Waste

By MICHAEL E. WEBBER MARCH 22, 2016



Niv Bavarsky

Austin, Tex. — AMERICA has a water problem. To put it simply, the national network for providing safe, clean water is falling apart.

This state of affairs, which is [the focus of a summit meeting on Tuesday](#) at the White House, threatens more than our drinking water supplies. Water is used in every sector of industry, grows our food, affects our health and props up our energy system.

The price of this neglect will be high. In Flint, Mich., the mayor has estimated that it will cost as much as \$1.5 billion to fix or replace lead pipes. [Over all, repairing our water and wastewater systems could cost \\$1.3 trillion or more](#), according to the American Society of Civil Engineers. We need to do this to improve water quality, protect natural ecosystems and ensure a reliable supply for our cities, agriculture and industry.

“There’s hundreds of billions of dollars of infrastructure aging across this continent in communities that don’t necessarily have the capacity to ... overhaul that infrastructure”

- Mayor Don Iveson (Apr 12, 2017, Postmedia)

NORTH AMERICAN PROBLEM

“If water rates rise at projected amounts over the next five years, conservative projections estimate that **the percentage of U.S. households who will find water bills unaffordable could triple from 11.9% to 35.6%.**”

This is a concern due to the cascading economic impacts associated with widespread affordability issues; these issues mean that utility providers could have **fewer customers over which to spread the large fixed costs of water service.**”

Source: A Burgeoning Crisis? A Nationwide Assessment of the Geography of Water Affordability in the United States (Elizabeth A. Mack, Sarah Wrase; Jan 11, 2017)

“Wastewater” - Current Conventional Approach

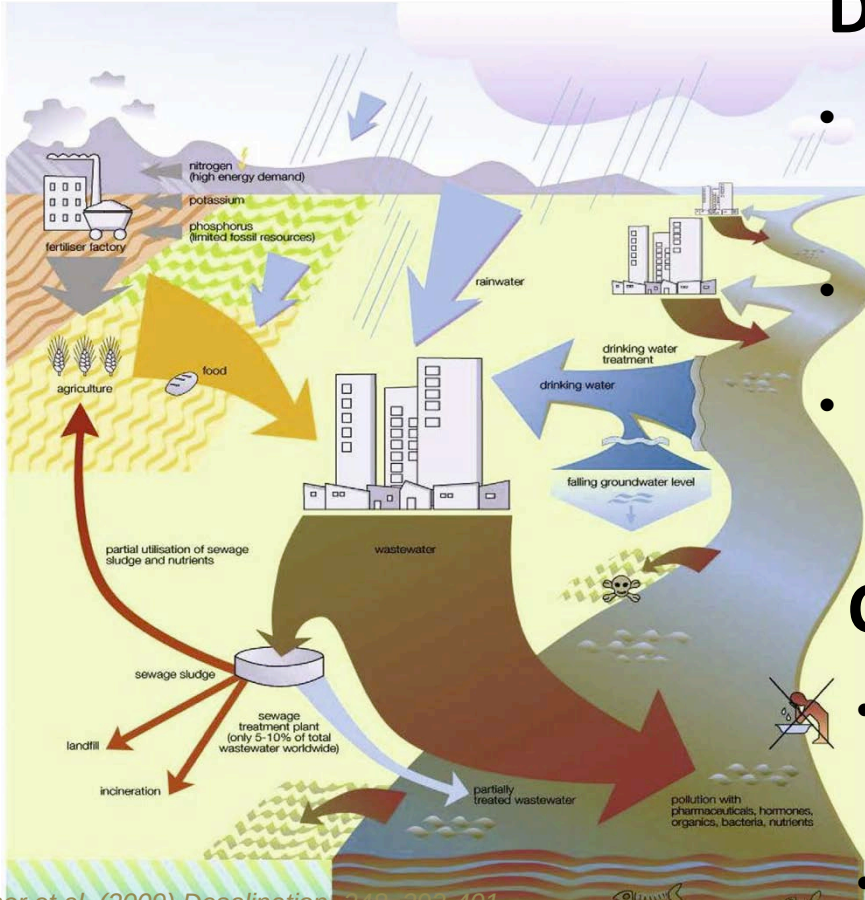
- Use water once, Treat and Dispose of Waste

Design concept

- Design based on the premise that excreta is a **waste**, and waste should be disposed of
- **Loss** of plant nutrients and trace elements in wastewater and eutrophication impact
- **Assume** that the environment can safely assimilate chemical and microbial waste

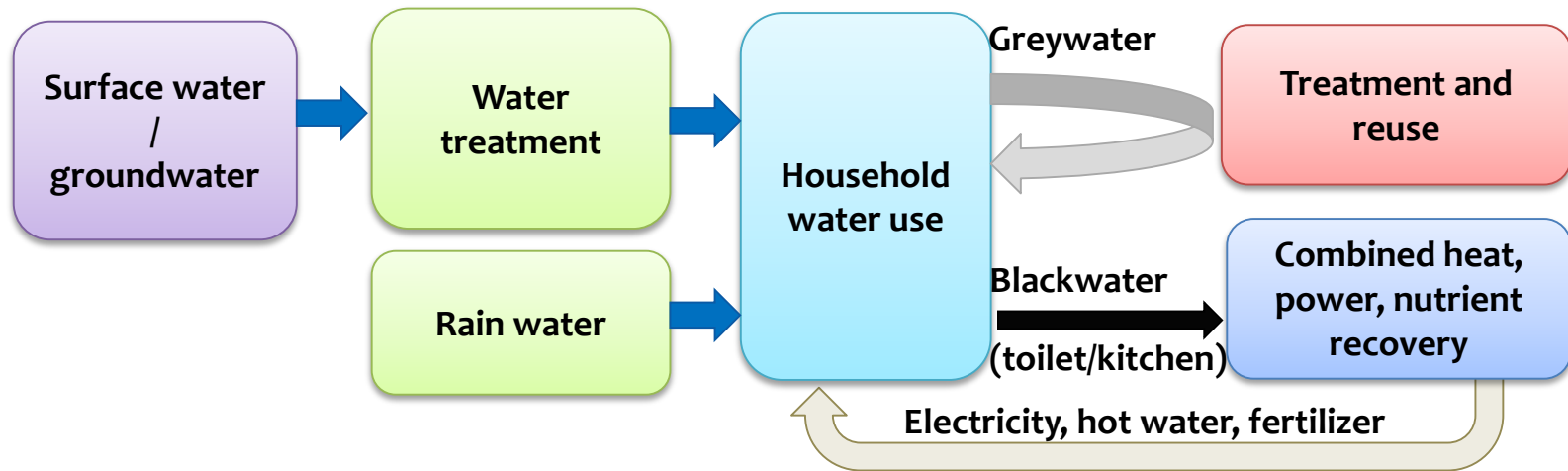
Challenges

- High cost **long distance collection system** financed up-front (30-50 year life) – centralized
- **Energy intensive** treatment processes
- **Combined sewer** overflow/bypasses – release sewage to the environment
- Water **quality deterioration**



Werner et al. (2009) *Desalination*, 248, 392-401

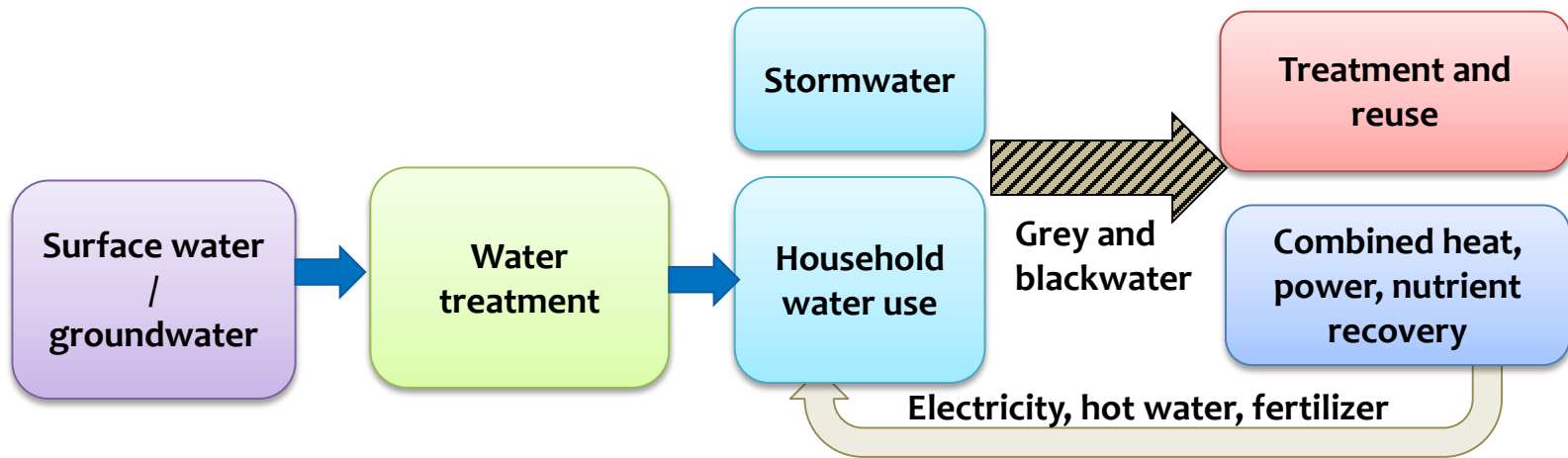
Resource Recovery Option 1: Source Diverted Collection Systems



Application

- For **greenfield developments**, the use of a separate blackwater (toilet and kitchen food streams) pressure or vacuum sewer, and a small local gravity greywater system for non-potable reuse
- **Expansion of existing communities** where connection to the existing sewer system is not realistic (marginal cost is prohibitive)

Resource Recovery Option 2: Conventional Collection Systems



Application

- **Redevelopment** of existing infrastructure, **centralized** and **decentralized** energy-recovery municipal sewer systems
 - Building capacity on existing centralized WWTP
 - Redevelopment options for combined sewer separation, decentralized communities without centralized collection system connection, First Nations and other Indigenous and remote communities

ALBERTA RESOURCE RECOVERY CENTRE

- Western Canadian Clean-Tech Hub –

Mission

Advance community water, nutrient & energy sustainability through development of best practices in innovative water management.

BEST PRACTICES – WHAT WILL THEY ACHIEVE?

Onsite Blackwater Treatment

- **50% lifecycle cost reduction**; 40% reduction associated energy/GHG emissions
- **Enhanced groundwater protection** (traditional sewers leak up to 30% into GWT)

Greywater Reuse

- 80% reduction potable water consumption
- **Optimize existing reservoirs**; defer or eliminate cost/risk of speculating new infrastructure; **Savings = \$Millions per municipality**

Sewer Mining (i.e. upstream of sewage works)

- **Capture energy/nutrients**; create capacity on existing infrastructure
- **Optimize existing sanitary trunks/treatment plants**; defer or eliminate cost/risk of speculating new infrastructure; **Savings = \$Millions per municipality**

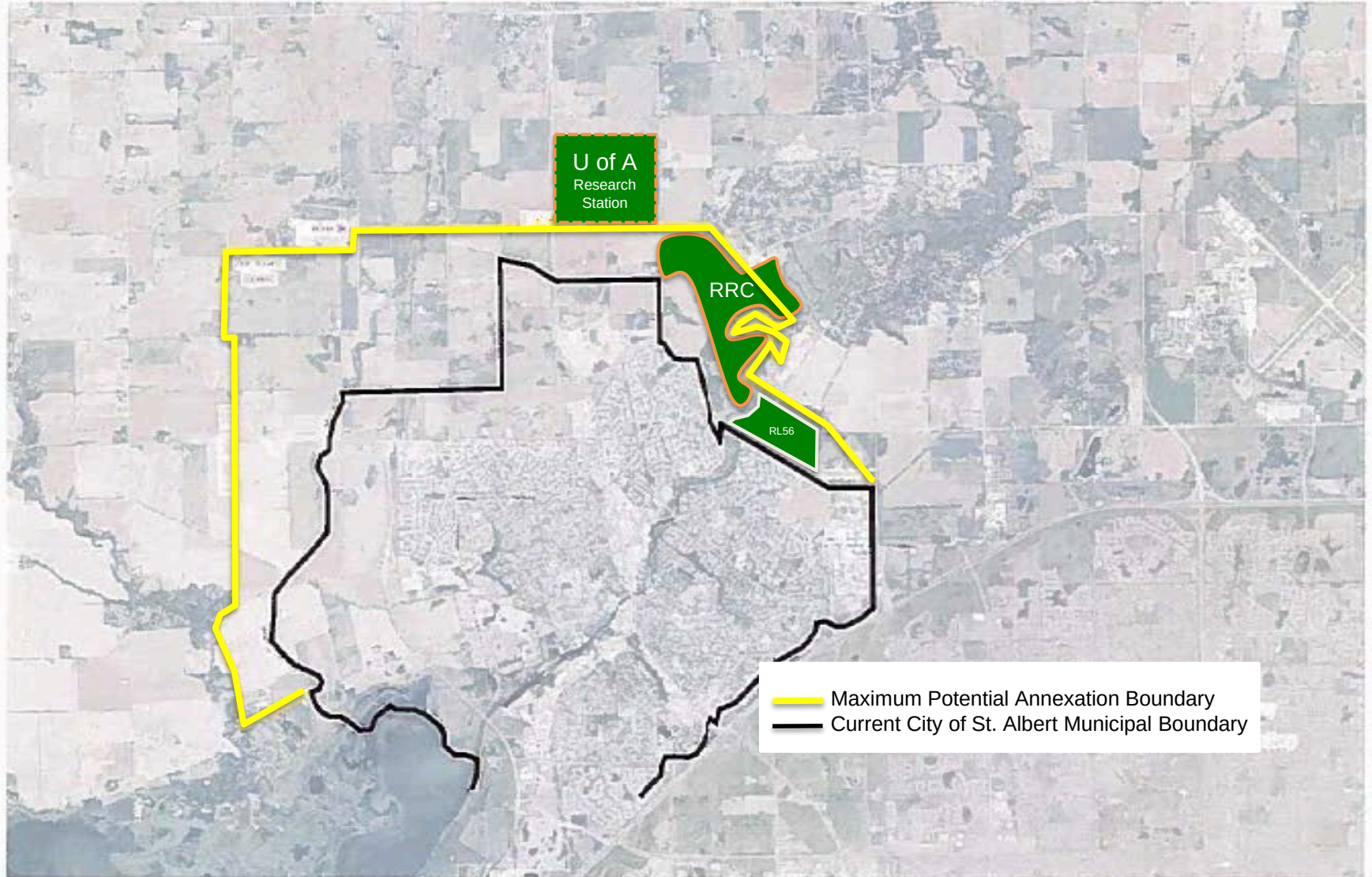
COMPATIBILITY WITH GOC INFRASTRUCTURE OBJECTIVES

‘COMMUNITIES BUILT FOR CHANGE’

- ✓ **ENCOURAGING INNOVATION - SMART CITIES CHALLENGE**
- ✓ **INCLUSIVE NATIONAL HOUSING STRATEGY**
- ✓ **BETTER FUTURE FOR RURAL & NORTHERN COMMUNITIES**
- ✓ **PROGRESS FOR INDIGEOUS COMMUNITIES**
- ✓ **CANADA INFRASTRUCTURE BANK**

SITE CONTEXT:

ARRC



Source document: St. Albert – Sturgeon County Annexation MOU (28 Feb 2017)

SITE LOCATION

ARRC

UofA

Research
Station



Resource Recovery Centre Initiative

Reserve - Research - Prov Park

Lois Hole Provincial Park &/or
InterpetreTrail

Conceptual only; information subject to change and is not guaranteed.

Pilot Scale

0 MicroPilot

- NSERC, City of Edmonton, WaterWerx

2017

Full Scale

1 RRC Facility

- **Blackwater Treatment ***
- AI-EES/SDTC, WaterWerx
- **Greywater Treatment & Sanitary Forcemain Mining**
- UofA / Dr. Liu IRC, NSERC, clean-tech SMEs, WaterWerx, WD**
- **Product Development Platform**
- UofA, clean-tech SMEs, WaterWerx, WD**
- **Learning Centre: Education, Outreach & Training**
- AEP, UofA & PSE affiliates, et.al.
- **Stormwater Management: Treatment & Beneficial Uses**
- AEP, UofA & PSE affiliates, clean-tech SMEs

2017

2 Demonstration Community

- private sector partners, collaborating with UofA & PSE affiliates, SMEs.

- **Community Care Village**
- **Sustainable Neighbourhood**
- Designed & staged to demonstrate, support & showcase RRC

2018

3 Riparian Research / Conservation / Park

- UofA; AEP, clean-tech SMEs

2018

* approved to serve Community Care Village

** pending review by WD

Offsite Implementation / Product Launch

- 4 - Edmonton, Calgary, Devon, Okotoks, Red Deer, Pigeon Lake . . .

2019/20

U of A existing & proposed studies

RESEARCH CENTRE

ARRC

Parking Provided 17
BARRIER FREE STALLS

TOTAL BUILDING AREA	
Area - ft² (CL of Wall)	Area - m² (CL of Wall)
7,892.30 ft²	733.22 m²

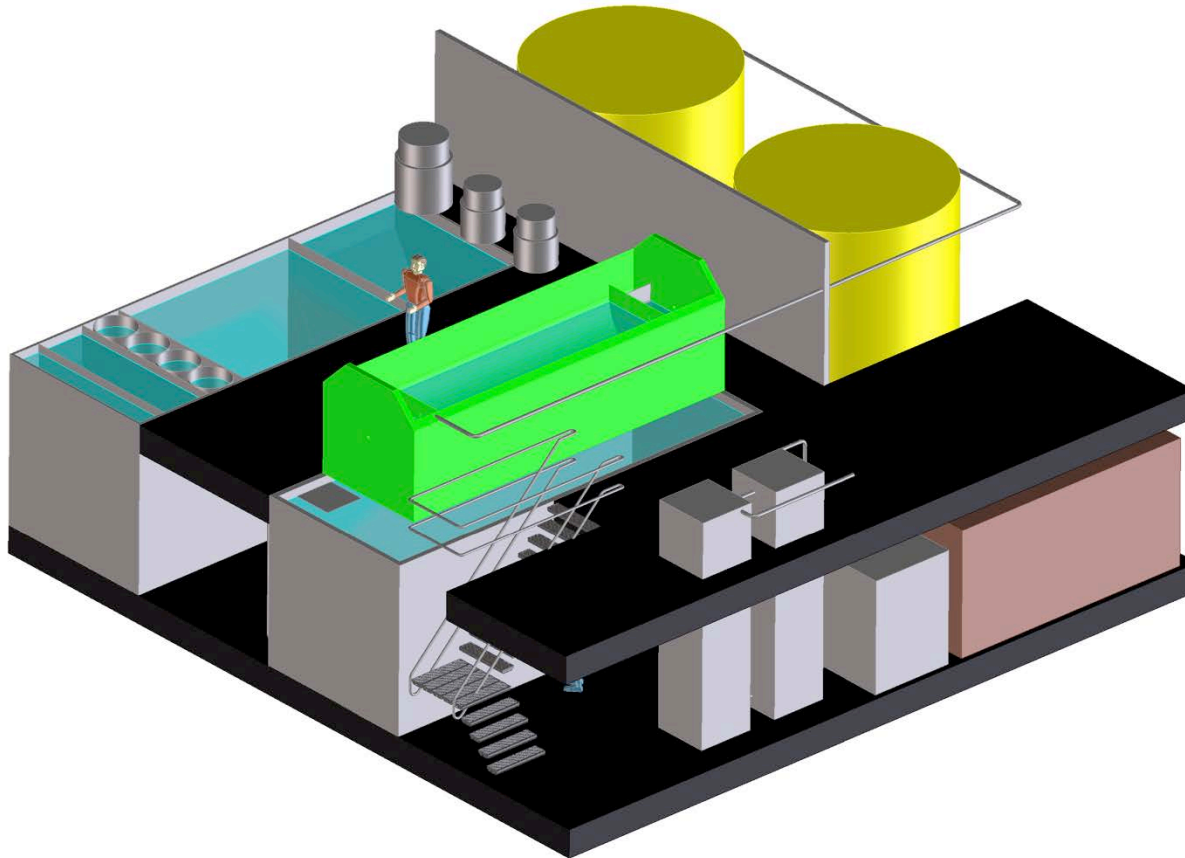
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EXISTING FACILITY (Sneek, Netherlands, 6 yrs old)



PROPOSED FACILITY (Sturgeon County, starts 2017-2018)



TARGETED OUTCOMES & SCOPE

AFFORDABLE GROWTH SOLUTIONS

Create sustainable, resilient and integrated infrastructure & planning solutions essential to:

- Address the evolving market demographics & demand for Affordable/Diverse housing stock;
- Advance the transition to Net Zero Communities.

URBAN AREAS

Facilitate cost-effective infill densification by creating capacity/optimizing existing infrastructure

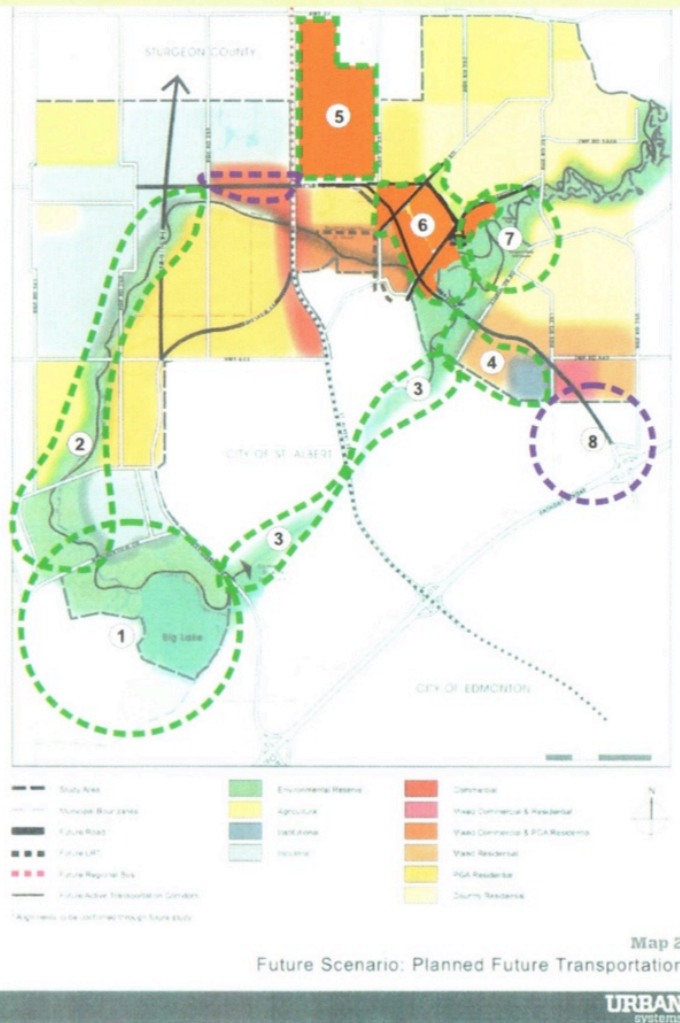
- Foster responsible greenfield development through decentralized solutions.

RURAL & INDIGENOUS PEOPLES' COMMUNITIES

- Provide innovative decentralized water management options required to meet stringent regulatory requirements while remaining economically viable.
- Empower communities through municipal outreach & training programs to transition towards more fiscally and environmentally sustainable models (*e.g., Fit-For-Purpose treatment options*)

Potential Community Benefits

- Regional Conservation -- Sustainability Showcase
- Blue-Tech Hub with National/International Status



• Water Theme

- Conservation
- Sustainability
- Environmental Stewardship
- Academic Research (e.g., Fish Creek PP)
- Recreation (Lois Hole Interpretive Trail?)
- Cultural

• Connectivity / Features:

- ① Lois Hole Provincial Park
- ② Carrot Creek SWMF (future)
- ③ Red Willow Trail System (Botanic Park, Grain Elevator Park, etc.)
- ④ RL56 (Poundmaker, etc.)
- ⑤ UofA / Research Station
- ⑥ UofA / Resource Recovery Centre
- ⑦ Sturgeon River, Park, SVGC
- ⑧ Goodrich Corners (C of E)
- ⑨ CFB Edmonton

Potential Community Benefits

- Provide restorative environmental flow to Sturgeon River
- Provide options to better manage drought-related fire hazards

Sturgeon River - May 5, 2016



Potential Community Benefits

- Mine existing sanitary trunks to create capacity / save \$\$\$
- Create reservoir capacity/support Agri-Business by diverting non-potable consumers to fit-for-purpose treated water



‘River quality’ water at ambient temperature often preferable to chlorinated potable water.

Potential Community Benefits

- New Provincial-Status Park + Interpretive Trail Connectivity to LHPP
- Joint AEP/SME Collaboration on Riparian & Stormwater Mgmt

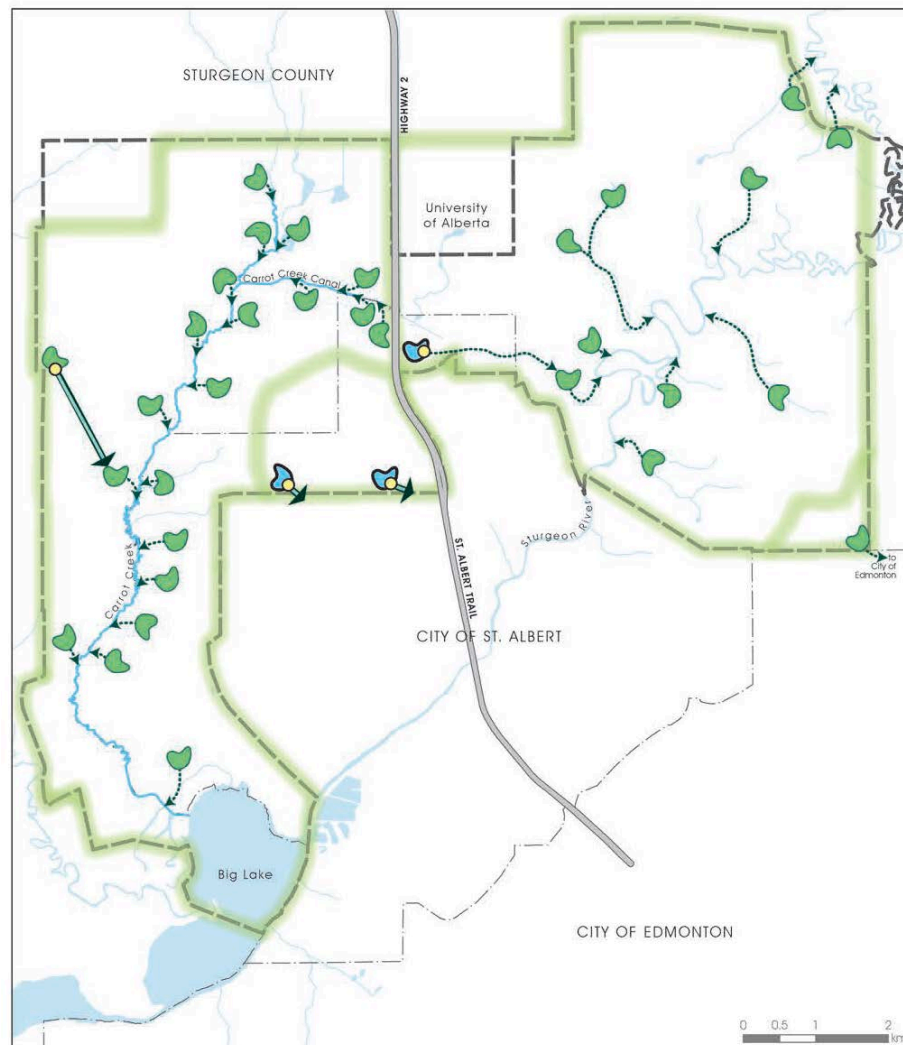


Planned Inter-municipal Infrastructure Estimate

> Status Quo <<

- Potable Water: \$ 40.2 M
- Sanitary Water: \$ 58.0 M
- Stormwater: \$ 258.0 M

EXAMPLE: Innovative SWM Design
= 33 ponds @ \$4M savings / pond
= \$132M savings over 25 yrs

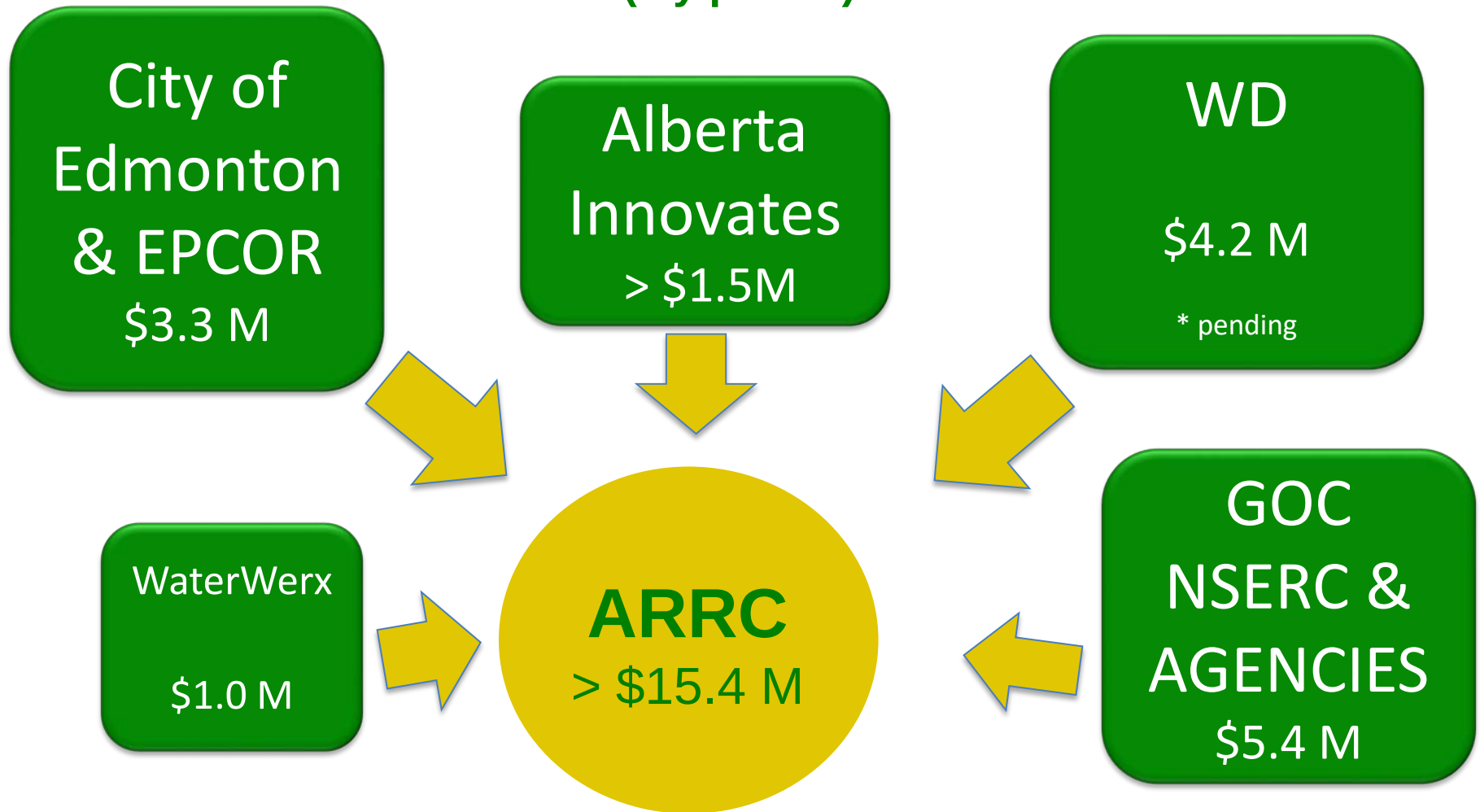


Source: St. Albert – Sturgeon County Joint Infrastructure Study
(Urban Systems 2015)

PROJECT STATUS

- ✓ **Alberta Innovates (Dec 2016)**
 - Received \$1.5 M funding towards Blackwater Treatment Project
 - North American 1st
- ✓ **Alberta Health & Municipal Affairs - led water reuse guidelines (ongoing)**
 - With Alberta Health and Municipal Affairs for system selection-to-use
 - Providing a full-scale demonstration site
- ✓ **Alberta Environment & Parks (Feb 2017)**
 - Exploring synergies & partnerships re: Provincial Park; LHPP Interpretive Trail System, Riparian Research & Learning Centre
- ✓ **Research Facility (Mar 2017)**
 - Development Permit submitted Mar 2017
 - Construction Summer 2017

STAKEHOLDER SUPPORT & FUNDING (5 y period)



NEXT STEPS . . .

➤ Formalizing Stakeholders

- ✓ Cities of Edmonton & Calgary: stakeholder steering committee
- ✓ EPCOR: MicroPilot, Industrial Research Chair
- ✓ Alberta Environment Parks: Park/Trails, SWM, Learning Centre
 - Implementation Communities: Ongoing discussions with other progressive communities (e.g., Okotoks, Devon, etc.)
 - Clean-Tech SME's: Collaborations underway (local & int'l)
 - St. Albert: Notice of Motion re: collaboration

➤ Local Planning Initiatives

- St. Albert Annexation, Sturgeon Valley 'Special Area'
 - 'Special District' status, etc.
 - Proposed LUB – Hazardous Lands Overlay

“The shapers of tomorrow will not only be those who had the vision and expertise to provide (water sustainability) solutions, but also those **regulatory and political bodies who had the foresight to rise above the status quo and implement them.”**

Source: Dr. Lorne Babiuk, VP (Research), University of Alberta