Community Water, Energy & Resource Recovery Infrastructure

Alberta Innovates | Water Innovation Program | Forum 2018

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FISCAL

USA Near-Term Repair/Replace $ 1.2 Trillion

CAN Near-Term Repair/Replace $ 173 Billion

HEALTH

- Contaminants of Growing Concern (AMR)
- Combined sewers, leaking trunks, $H_2S$ emissions & pipe degradation etc.

ENERGY & GHG

- Municipal W&WW is energy-intensive
- Up to 40% of municipal power bill

A new systems approach, coupled with proven innovation, is needed to secure the water future of Canadian communities

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UofA – Alberta Resource Recovery Centre

MISSION: Advance Community Sustainability through innovative water, energy & nutrient solutions.

- Research-Product Development & SME Launch Platform
- Discovery Centre w/ Immersive k-12, PSE & Public Learning, Municipal Outreach & Training
- Onsite Community-Scale Demonstration Opportunity
Regional Showcase - Global Relevance

Community Innovation District

* Conceptual – Discussion Purposes Only
# ARRC - Objectives

<table>
<thead>
<tr>
<th><strong>Water Conservation</strong></th>
<th>Up to <strong>80% Reduction</strong> Potable Water Consumption</th>
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<td><strong>New Energy Source</strong></td>
<td>at <strong>50% Lifecycle Cost &amp; 40% GHG reduction</strong></td>
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<td><strong>Sewer Mining</strong></td>
<td>Capturing energy &amp; <strong>creating capacity</strong></td>
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<td><strong>Nutrient Recovery</strong></td>
<td>Closing loops &amp; <strong>protecting the environment</strong></td>
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Unifying Regional Initiatives

SVSA
(Sturgeon Valley Special Area)

RAMP
(Regional Ag Master Plan)

ANNEX
(SA/SC Annexation)

ARRC & ALES

LHPP

Sturgeon Centennial

Recreation & Trail Connectivity

Sturgeon River Watershed
Innovation District
A = 5,400 ac +/-

Food Innovation
A = 1,920 ac +/-

Community Innovation
A = 220 ac +/-

Riparian & Recreation Innovation
A = 750 ac +/-

‘Metropolitan Land Use’ as per EMRB

Community Innovation District

* Conceptual – Discussion Purposes Only
Innovation – Recreation – Biodiversity

Enhancing community health through restoration & connection to local ecosystems.

- Innovative stormwater & greywater management
- Riparian restoration & habitat enhancement
- Immersive learning, interpretive trails & passive recreational opportunities
Pilot Scale
- MicroPilot
  - NSERC, City of Edmonton, WaterWerx

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

2. Demonstration Community
   - private sector partners, collaborating with UofA & PSE affiliates, SMEs.
   - Community Care Village
   - Sustainable Neighbourhood
     - Designed & staged to demonstrate, support & showcase RRC

3. Riparian Research / Conservation / Park
   - UofA; AEP, clean-tech SMEs
   * Designed & funding approved to serve Community Care Village

Offsite Implementation / Product Launch
4. - Edmonton, Calgary, Okotoks, Red Deer, Pigeon Lake . . .

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

Resource Recovery Centre Initiative
Reserve - Research - Prov Park
Lois Hole Provincial Park &/or Interpretive Trail

ARRC Site Layout
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)
Neighbourhood Resource Recovery - Main Components

BLACK WATER

UASB Digester

UASB DIGESTER

Biogas

District Heating

OLAND

Struvite

NUTRIENT REMOVAL
Blackwater Treatment Project - Objectives

- Short-term objectives (< 2 years)
  - Develop & prove BTP
    - focus on energy & nutrient recovery
    - polishing steps to maximize effluent reuse

- Medium- to long-term objective (> 2 years)
  - Showcase within ‘Demonstration Community’
  - Expand BTP as key component of Sewer Mining
  - Integrate offsite - greenfield & brownfield
Completed Milestones

Water Reuse Guidelines
- Draft developed, within ministries
- Input & published USA non-potable reuse standards

Demonstration:
- Blackwater treatment project (BTP) equipment ordered
- AEP Setback Variance Received (300m reduced to 20m)
- Greywater treatment pilot design completed

IRC Liu Lab Research:
- Blackwater feedstocks evaluated & designed for BTP
- Co-precipitation of contaminants with struvite
- Life-cycle assessment postdoc and students started
Future Performance Testing

As per developing risk-based water regulations in Alberta:

• **Blackwater Treatment**
  • Pathogens, metals and pharmaceutical residuals reductions for released streams (struvite, direct injection liquor etc.)

• **Greywater Treatment**
  • Pathogen reductions using surrogates to assess viral, bacterial and protozoan pathogen reductions fit-for-purpose
  • Evaluation of potential direct potable reuse risks

• **Wetland Treatment**
  • Pathogen reductions using surrogates to assess viral, bacterial and protozoan pathogen reductions fit-for-purpose