Drinking Water Safety Initiative

Clean and Safe Drinking Water Workshop 2010

Gander, NL

March 23, 2010

Newfoundland Labrador

CBCL LIMITED
Consulting Engineers

Drinking Water Safety Initiative

Part 1: Program Background & Status

Presented by: *Bob Picco*

Dept. of Municipal Affairs

Part 2: Potable Water Dispensing Units

Presented by: *Mike Chaulk*

CBCL Limited

Background

- April 2008 joint announcement by the Ministers of MA & ENVC

- Joint Program to make safe drinking water available to smaller communities (Pop <500)

Application Process

- 114 communities rated as top priority for water quality improvement

- Invitation to all communities with:
  - Population < 500
  - Existing water supply

  227 letters requesting applications sent

Response

- Initial response: 41
- Total to date: 51
  - 34 from top priority communities

Application Review

- Yes: 22
- No: 15 → 5 for other options
- Maybe: 11
- To be reviewed: 3

Total 51

Design Considerations

- Based on concurrent study by CBCL on seven existing units:
  - Minimize O & M costs
  - Simplify maintenance requirements
  - Standardize process and equipment
  - Stand alone structure
  - Accessibility
  - Health concerns

Construction Process

- Proposal for equipment, ‘standing offer’ agreement
- Pilot system to be installed
- Tenders for construction by region

Proposed Construction Schedule

- Call for proposals for treatment equipment in March, award in April/May

- Construction tenders in the summer/fall 2010

Cost Estimates

PWDU:

Constructions cost

- $250,000 to $270,000 - province/community
- Includes equipment, engineering and HST

Cost shared 90/10 province/community

O & M Costs:

- $2,500 - $3,000/year
- Includes heat, light parts and supplies

Cost Estimates (cont'd)

Full Scale Treatment Plant:

Constructions costs:

- $1.5 M – $2 M
- Includes equipment, engineering and HST

Cost shared 90/10 province/community (Pop<3000)

O & M Costs:

- $50K - $100 K /year
- Includes labour heat, light parts and supplies

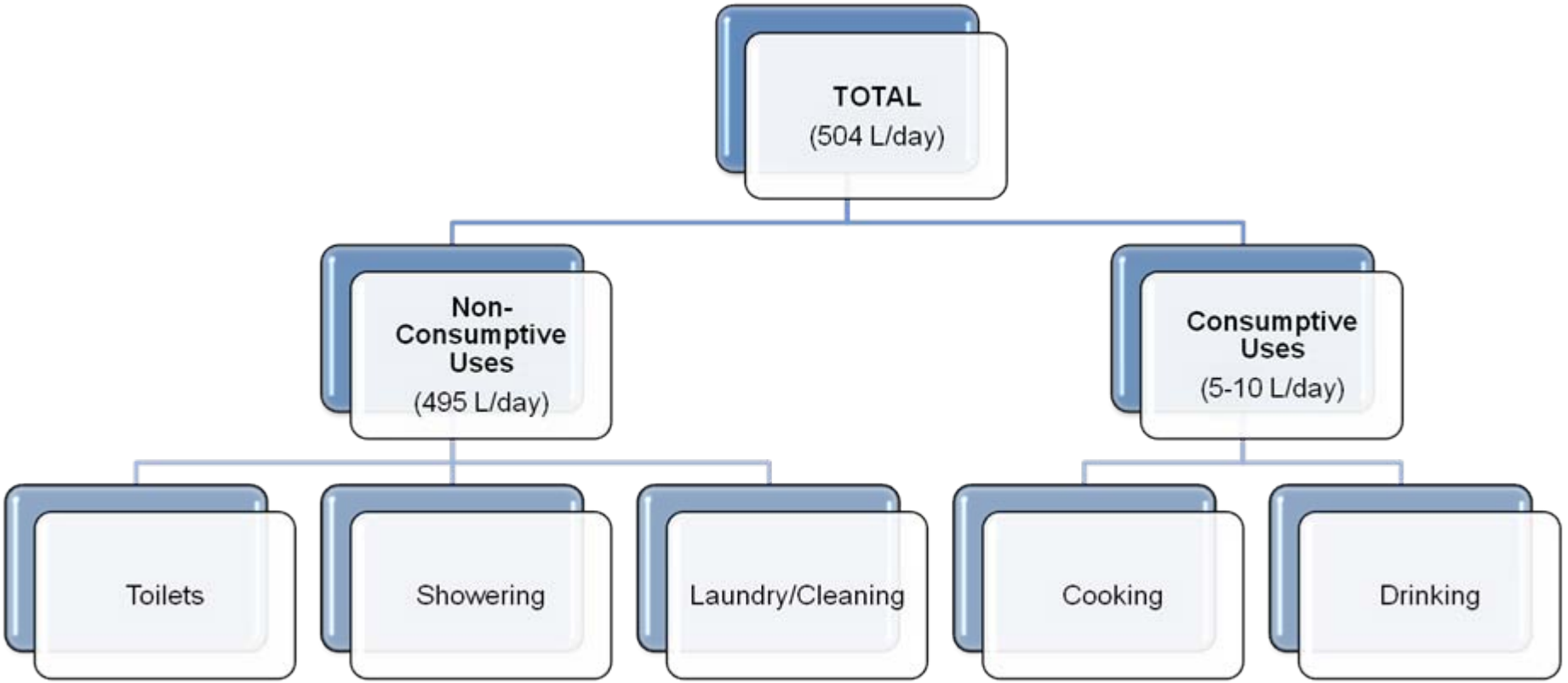
Community Considerations

- PWDU supplies clean, safe easily accessible drinking water at reasonable cost
- Focus on O & M costs
- O & M requirements
  - Low Cost
  - Standardized system
  - Regional service possibilities

PART 2

Potable Water Dispensing Units

Per Capita Water Use in Newfoundland and Labrador



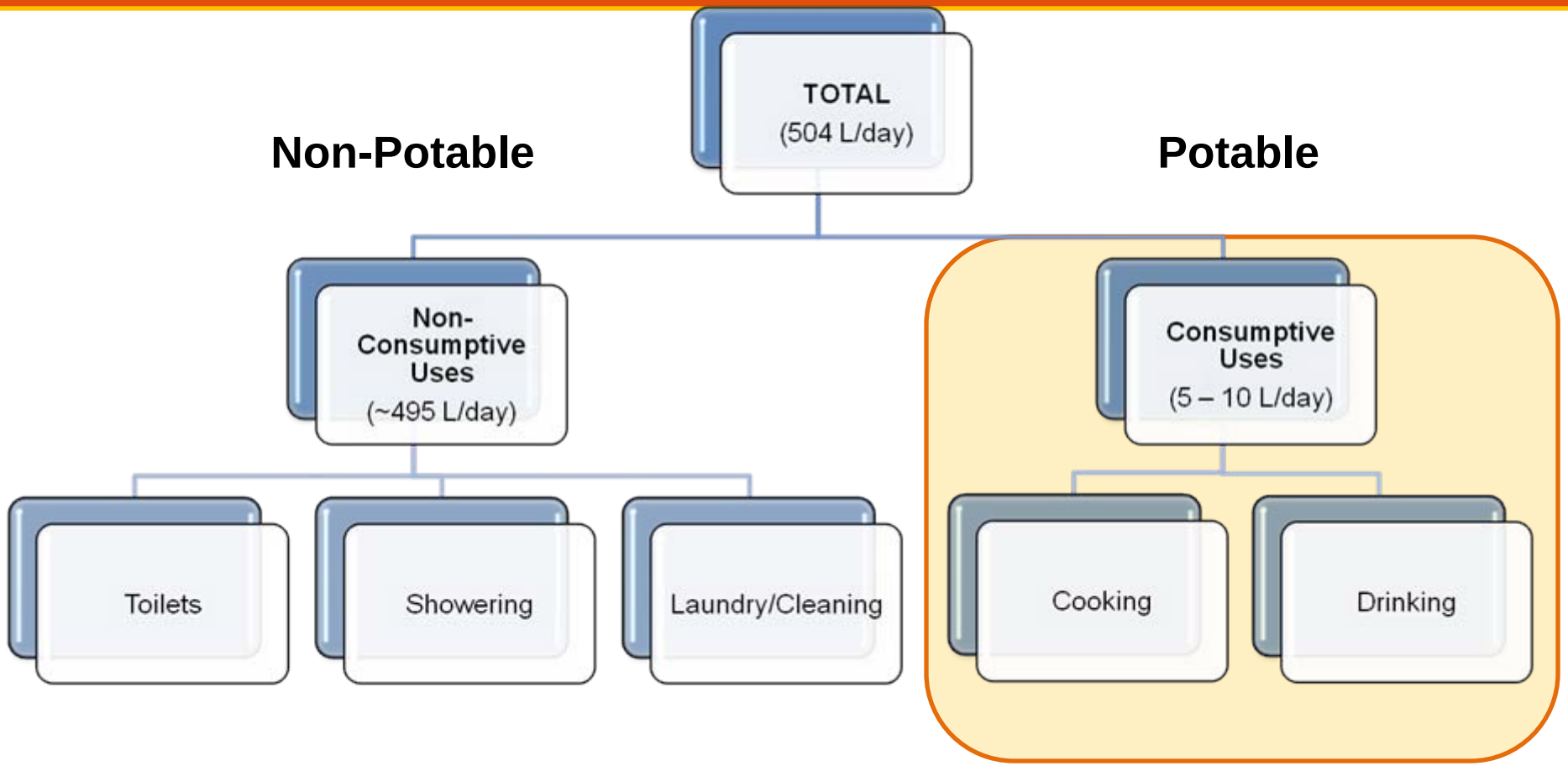
Water Supply, Treatment and Distribution

Water Treatment Perspectives

- Common design approach is to use a centralized WTP to provide all services
- Several provinces have mandated minimum water treatment standards (i.e. ON, NS)
- NL has historically had several hundred boil water advisories in place at any time
- Community infrastructure maintenance has historically been challenging

Challenges - Water Distribution System

Water Quality Requirements



Bottled Water

- **Environmental Impacts:**
  - Energy associated with the treatment of bottled water as well as the production and eventual disposal of plastic bottles
- **Cost Impacts:**
  - Bottled water is significantly more expensive than municipal tap water or PWDU water

Private Wells

- **Private wells can provide clean, safe water if properly managed**

Spring Water

- **Roadside springs and other untreated sources of water are also popular throughout the province**
- **Untreated sources of water are:**
  - Untested
  - Unmonitored
  - Potentially unsafe

What is a potable water dispensing unit?

- A potable water dispensing unit is a small-scale water treatment system located in a convenient, central location
- It treats enough water to fulfill the consumptive needs of a community
- Residents gather water from the dispensing unit using their own containers

Why use a potable water dispensing unit?

- **High quality drinking water that is:**
  - Cost-effective for the community
  - Cost-effective for the user

- **Safer than spring water and cheaper than bottled water**

Two Interconnected Projects

- **Study of Existing PWDUs**
  - Treatment and dispensing area design
  - Water quality
  - Operation and maintenance costs
  - Socioeconomic impacts

- **PWDU Design and Construction**
  - Evaluation of communities
  - Community visits
  - Development of a standardized PWDU design
  - Request for proposals
  - Evaluation of proposals*
  - Construction*

PWDU Study

- **Seven communities in NL currently employ PWDUs**
- **The Department of Environment and Conservation commissioned a study to compare, contrast and evaluate these systems**
- **Deliverables include:**
  - Six technical memos
  - Public education component
  - Final report

Treatment Equipment

- **Three communities use ozone to remove:**
  - Colour (TOC/DOC)
  - Iron
  - Manganese
  - Pathogens*
- **Four communities use reverse osmosis to remove:**
  - Colour (TOC/DOC)
  - Iron
  - Manganese
  - Turbidity
  - Dissolved solids (salts etc)
  - Pathogens*

Dispensing Areas

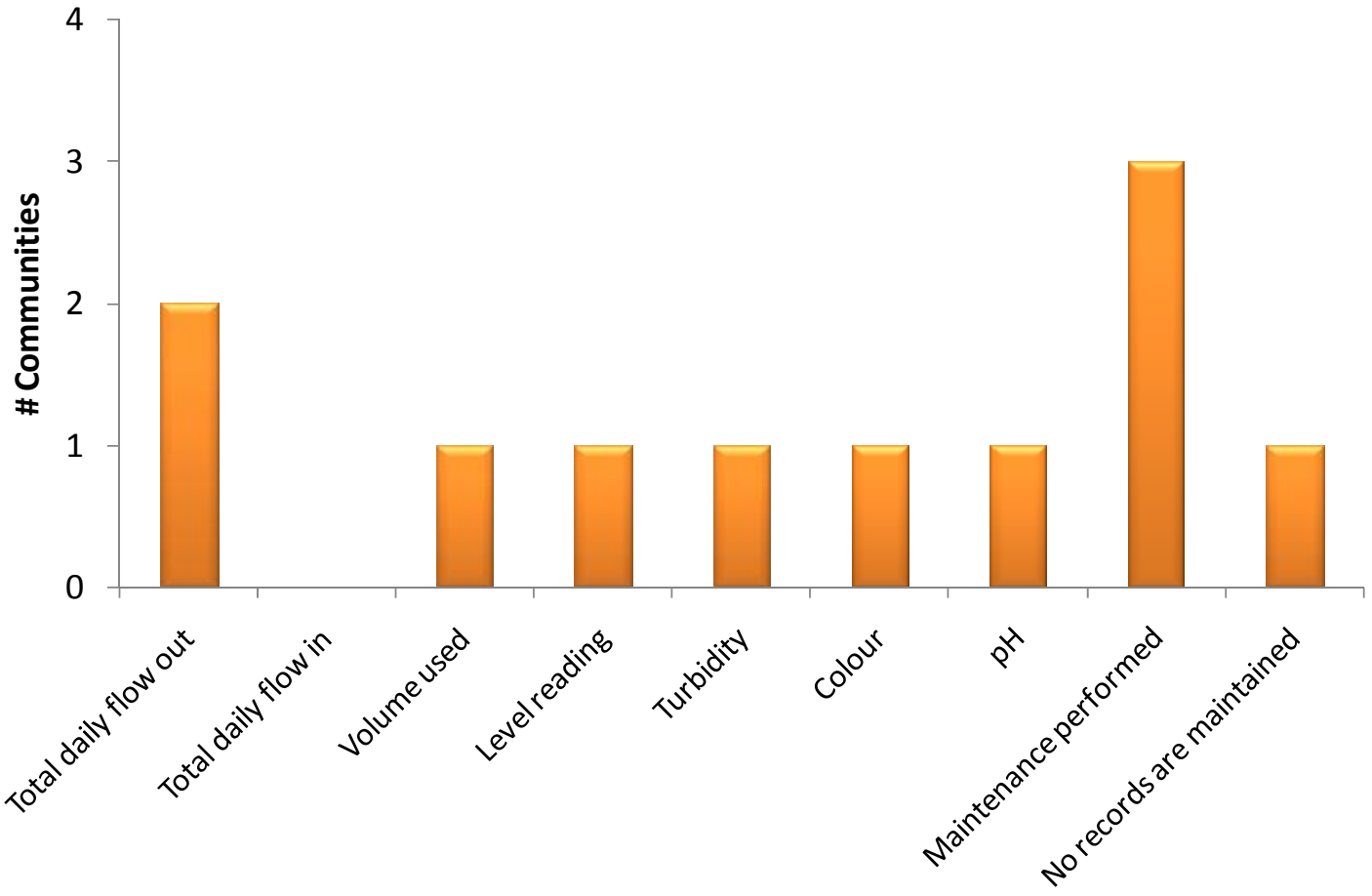
- **The dispensing area is the only part of the PWDU that most users interact with**
- **Adoption of the PWDU may be influenced by the quality of the 'dispensing experience':**
  - Location
  - Access hours
  - Cleanliness
  - Overall design


WATER
TREATMENT PLANT
FLOTECH
ENTERPRISES LTD.

O&M

- **Operating and maintaining complex water treatment technology can be challenging in small, remote communities**
  - Lack of operator training
  - Volunteer labour
  - Shipping distance/time
  - Energy costs (generators)

O&M - Monitoring



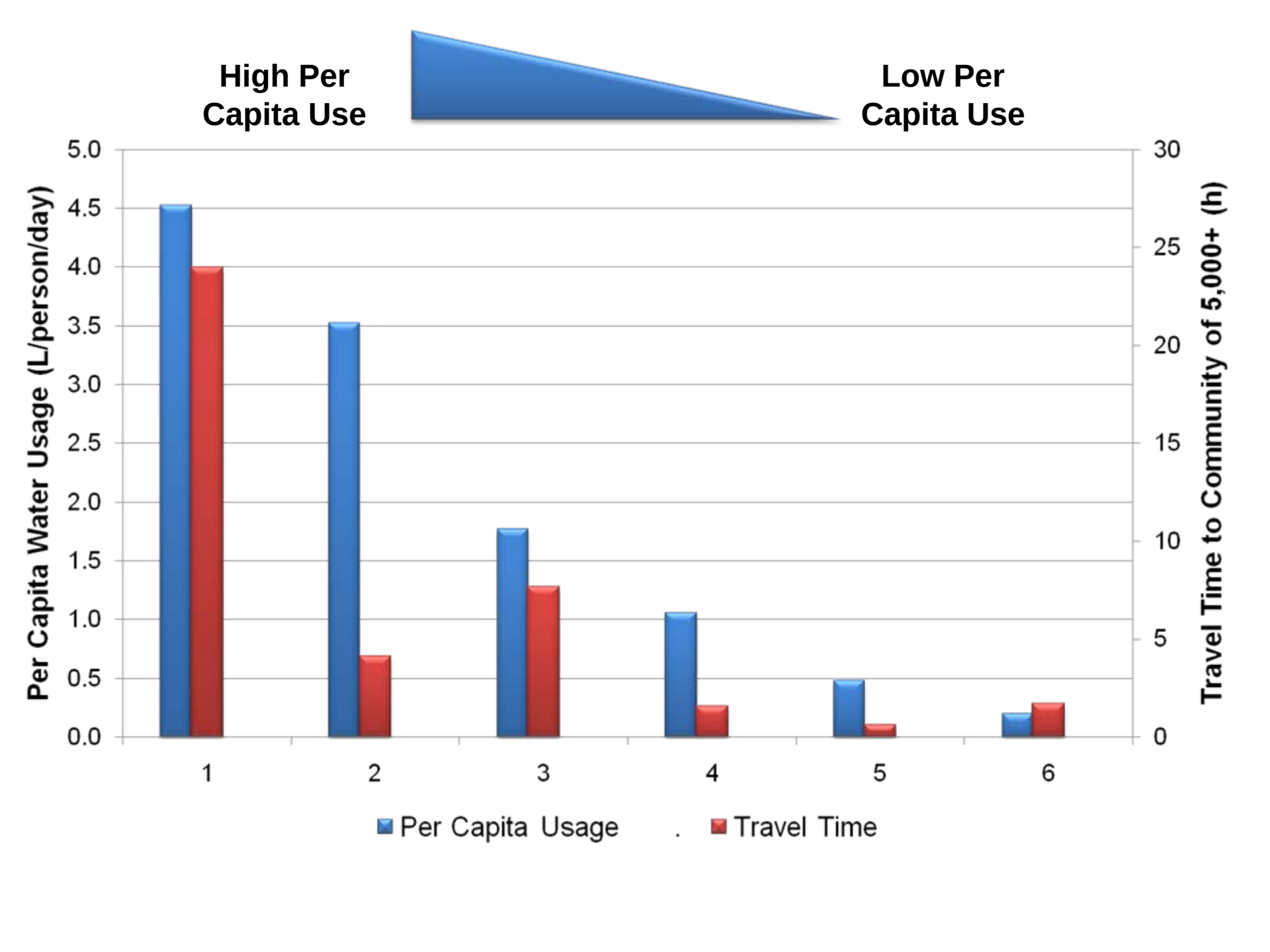
O&M Costs

- **O&M costs include:**
  - Power (equipment, lights, heat)
  - Labour (operator)
  - Equipment (replacement, consumables)

$$C_{Total} = C_{Power} + C_{Labour} + C_{Equipment}$$

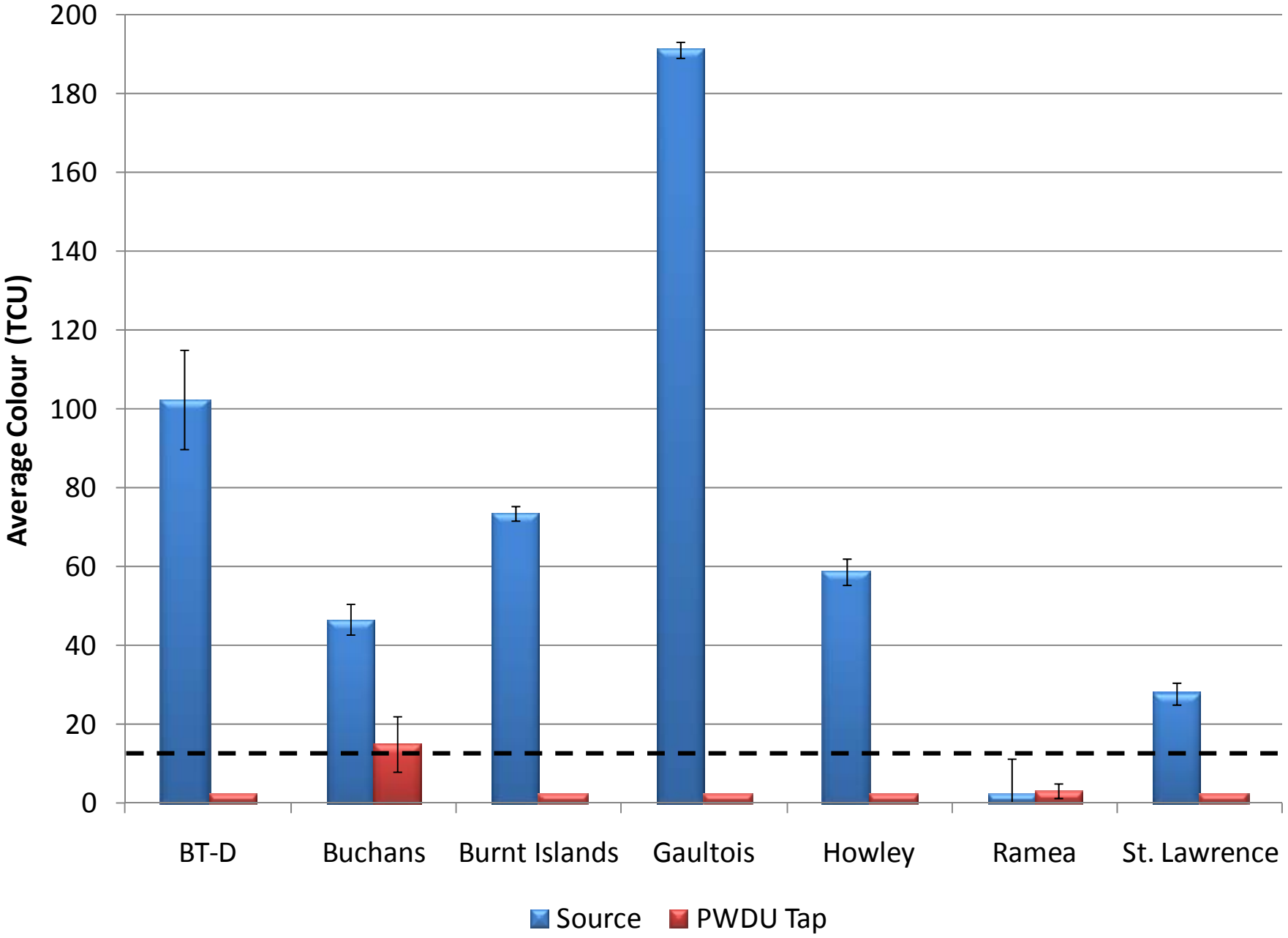
Socioeconomic Factors

- **Who uses the PWDUs?**
  - Small communities
    - Possible reasons:
      - Lack of resources to afford more complex options
      - More ‘buy-in’
  - Remote communities
    - Possible reasons:
      - Ingrained self-sufficiency
      - Lack of access to/experience of high quality, distributed drinking water


High Per Capita Use
Low Per Capita Use
Per Capita Water Usage (L/person/day)
Travel Time to Community of 5,000+ (h)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
30
25
20
15
10
5
0
1
2
3
4
5
6
Per Capita Usage
Travel Time

Water Quality

- **The PWDUs exist to provide safe, aesthetically pleasing water for users**
- **People are unlikely to use the systems if the water quality is suspect**
- **We sampled the feed and treated water streams at all of the locations to evaluate whether the systems were accomplishing their goals**
  - Some systems were not available at some points for different reasons


200
180
160
140
120
100
80
60
40
20
0
Average Colour (TCU)
BT-D
Buchans
Burnt Islands
Gaultois
Howley
Ramea
St. Lawrence
Source
PWDU Tap

	Health Related Parameters	Aesthetic Parameters	Perceived Water Quality Assessment	Per Capita Daily Flow
Black Tickle-Domino	None	pH	Acceptable	4.5 L
Buchans	None	Colour	Unacceptable	0.2 L
Burnt Islands	None	pH	Acceptable	3.5 L
Gaultois	None	None	Excellent	Unknown
Howley	Turbidity*	pH	Unacceptable	1.1 L
Ramea	None	pH	Acceptable	1.8 L
St. Lawrence	None	pH, Mn	Unacceptable	0.5 L

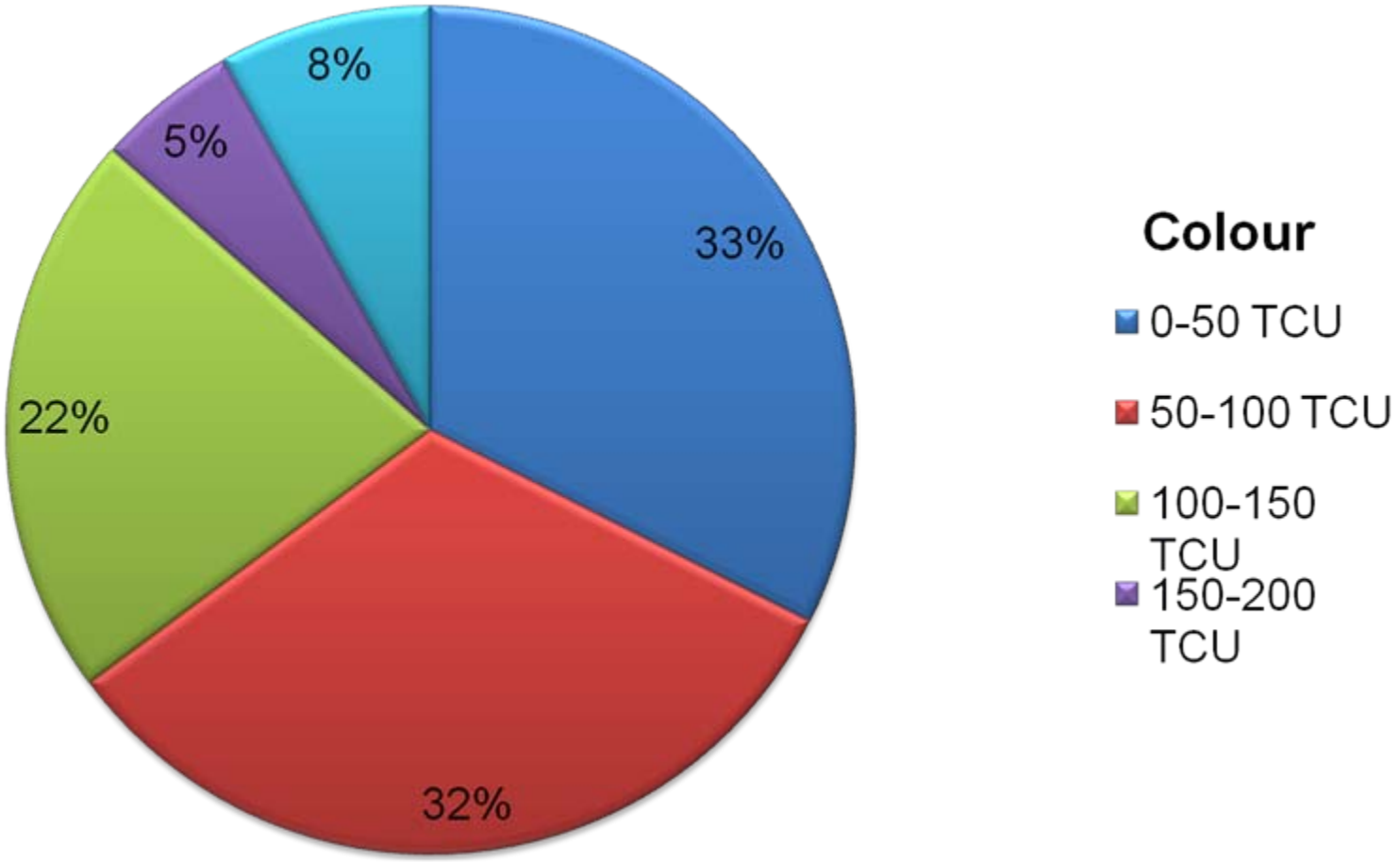
Standardized PWDU Design

- Project offers opportunity to approach municipal infrastructure differently
- Can a single robust treatment system be designed that fulfills the needs of all participating communities?
- Design, Installation, Operation, Maintenance

Community Evaluations

- **Each community was evaluated for inclusion in the project based on:**
  - Water quality
  - Existing infrastructure
  - Socioeconomic factors
  - Community visits

Water Quality



Existing Infrastructure

- **The majority of the communities have:**
  - A surface water source
  - Challenging water quality
  - No water treatment equipment
  - A history of boil order advisories

Socioeconomic Factors

- **Most of the communities:**
  - Have small populations (50 to 500 people)
  - Are located in remote parts of the province
  - Face challenges relating to unemployment and a shrinking population

- **Many of the communities:**
  - Have seasonal industries

- **Based on the findings of the PWDU study, these communities should benefit from the installation of a PWDU**

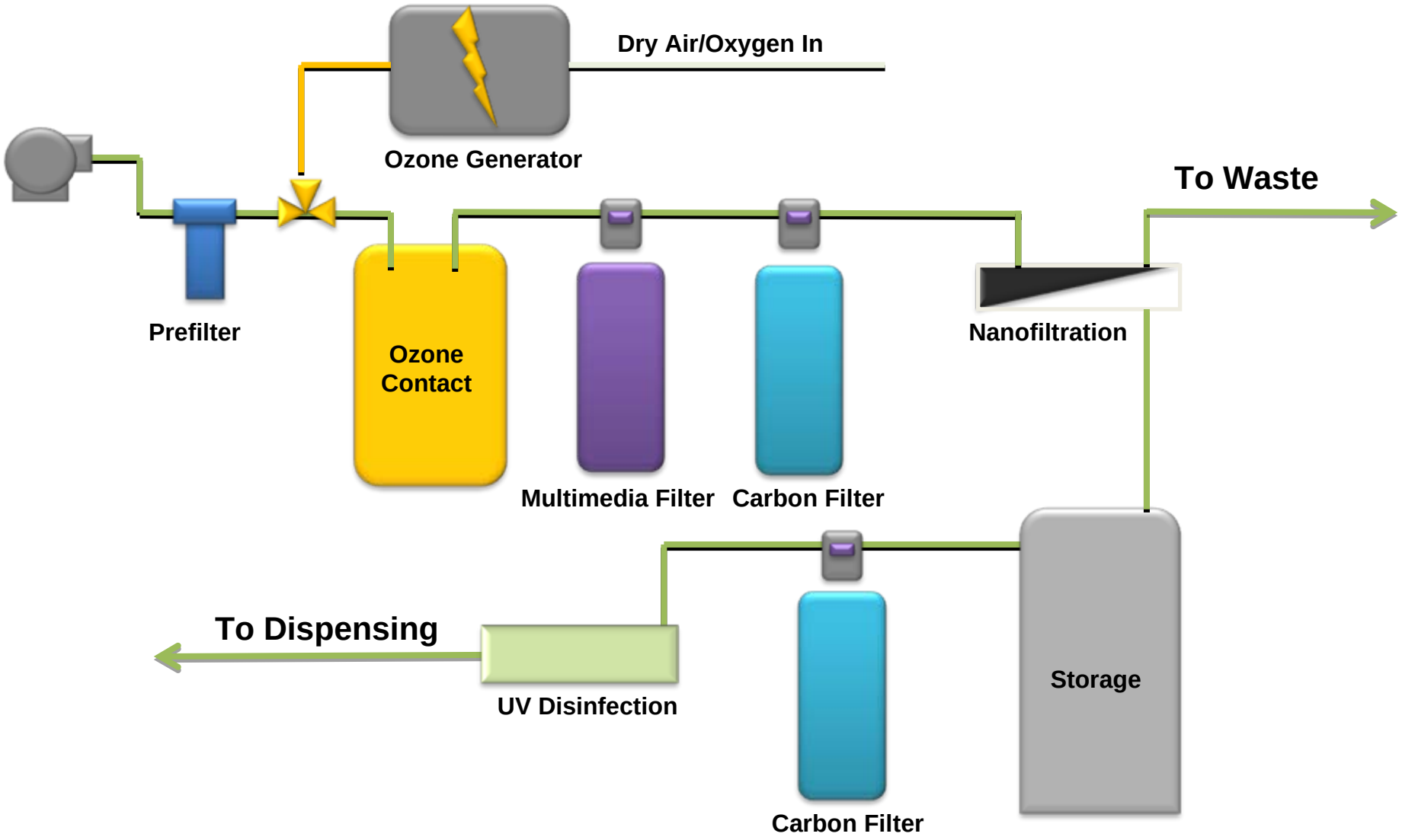
Community Visits

- **Three CBCL employees traveled around the province in the summer of 2009**

- **They met with community government officials and maintenance people**
  - Briefly assessede the water supply and distribution system
  - Determined an ideal location for a PWDU
  - Established whether the community was interested in the PWDU and whether they were able to afford it

Design

- **The standardized PWDU design includes:**
  - Optional pressure boost
  - Prefiltration
  - Oxidation with ozone
  - Filtration (multimedia filter, carbon filter)
  - Reverse osmosis (nanofiltration)
  - Storage
  - Carbon filter for taste and odour control
  - UV disinfection
  - Dispensing


Dry Air/Oxygen In
Ozone Generator
To Waste
Prefilter
Ozone Contact
Multimedia Filter
Carbon Filter
Nanofiltration
To Dispensing
UV Disinfection
Carbon Filter
Storage

Pressure and Pretreatment

- **Optional Pressure Boost**
  - Many of the existing water supply systems are gravity fed
    - There is sometimes insufficient pressure available to feed water through the proposed treatment process
  - Other communities experience periodic high demands that can affect the pressure available:
    - Fish plant operation
    - Running water to keep pipes from freezing
- **Prefiltration**
  - Solids in the water are removed before the other treatment processes using a prefilter

Ozone and Filtration

- **Ozone will be used to oxidize:**
  - Colour-causing compounds
  - Metals
    - Iron
    - Manganese
- **Ozone is created on-site using an ozone generator fed by clean, purified oxygen drawn from the surrounding atmosphere**
- **The ozone is injected into the water and allowed to react for a set period of time**
- **The water is then filtered to remove the particulate products of the reaction**

Nanofiltration

- **Nanofiltration is similar to reverse osmosis but occurs at a lower pressure**
  - Minimizing the energy demands of the system

- **Nanofiltration will be used to remove any remaining:**
  - Colour
  - Iron
  - Manganese
  - TDS
  - Other contaminants

Storage

- **Storage is provided as a buffer so that there is always enough water available for users**
  - Process runs at 8 LPM
  - Taps provide water at 20 LPM

- **When the level in the storage tank drops below a certain level, the treatment system starts to operate to fill it back up again**

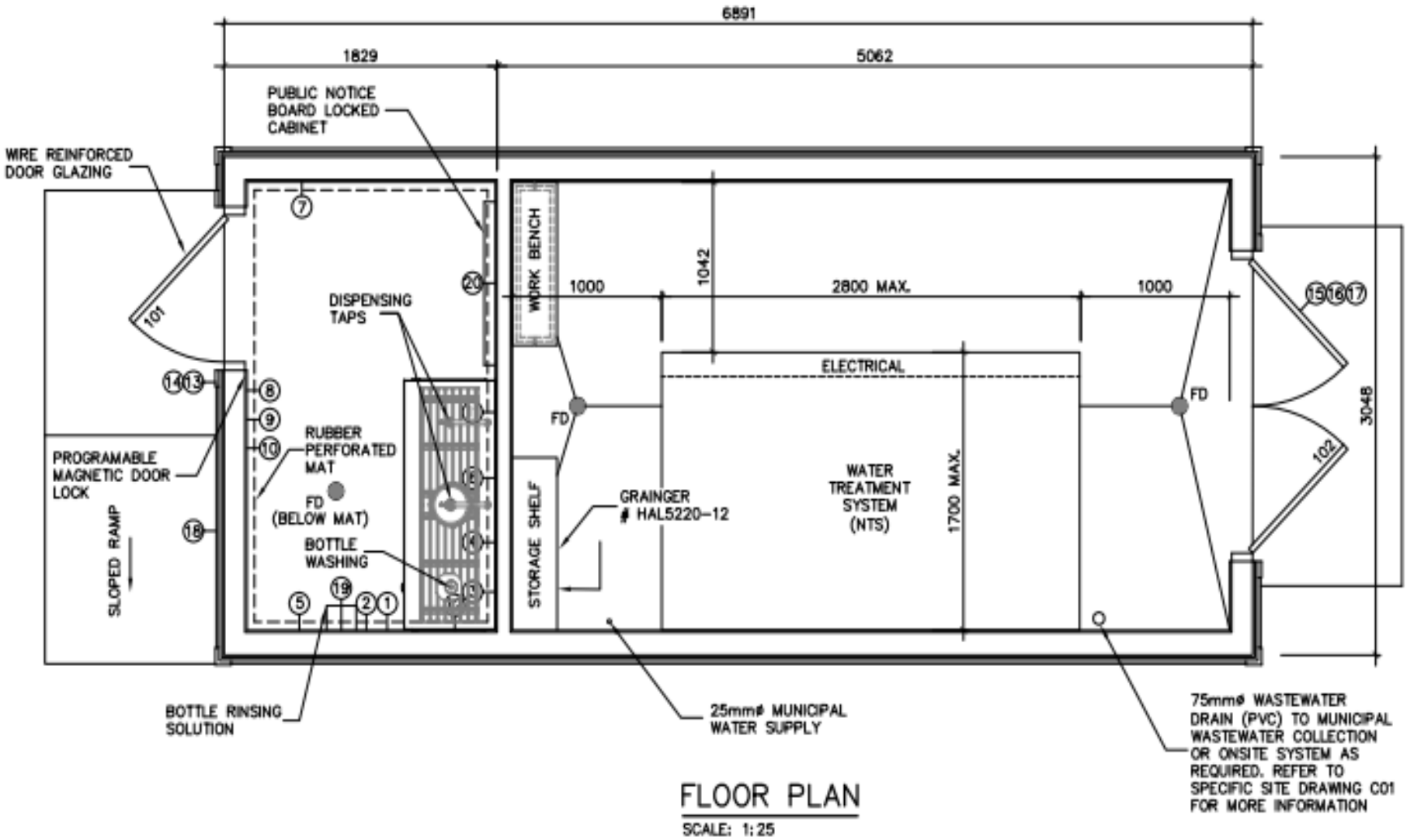
Post-Storage

- **Carbon Filter**
  - An activated carbon filter is provided after the storage tank to remove taste and odour compounds that may accumulate in the treated water
- **UV Disinfection**
  - UV light is used to inactivate any pathogens remaining after ozonation, reverse osmosis filtration and storage

Building

- **Standard Design**
  - A single type of detached structure used for all systems
  - Will include separate treatment and dispensing areas
  - Dispensing area to be same in all locations
  - PWDUs across the province will have consistent look
  - User access is by magnetic lock – programmable by owner
  - Dispensing area includes bottle washing/rinsing

Building


6891
1829
5062
PUBLIC NOTICE BOARD LOCKED CABINET
WIRE REINFORCED DOOR GLAZING
WORK BENCH
1000
1042
2800 MAX.
1000
DISPENSING TAPS
ELECTRICAL
FD
FD
RUBBER PERFORATED MAT
FD (BELOW MAT)
PROGRAMABLE MAGNETIC DOOR LOCK
SLOPED RAMP
BOTTLE WASHING
STORAGE SHELF
GRAINGER # HAL5220-12
WATER TREATMENT SYSTEM (NTS)
1700 MAX.
3048
101
102
BOTTLE RINSING SOLUTION
25mmø MUNICIPAL WATER SUPPLY
75mmø WASTEWATER DRAIN (PVC) TO MUNICIPAL WASTEWATER COLLECTION OR ONSITE SYSTEM AS REQUIRED. REFER TO SPECIFIC SITE DRAWING C01 FOR MORE INFORMATION
FLOOR PLAN
SCALE: 1:25

Why use standard building & treatment design?

- **Long term O&M - regionalization**
- **Access to parts, supplies, and experience**
- **Consistent appearance makes a recognizable product across the province**
- **Validated process helps ensure optimal value for each community**

Current Status

- **Government will issue a request for proposals (RFP) for the treatment system**
  - It will contain our design (specifications, drawings)
- **Proposals will be solicited from a variety of equipment suppliers**
  - Their submissions will need to conform to our designProposals will be solicited from a variety of equipment suppliers
- **Equipment supplier submissions will be evaluated by CBCL, Municipal Affairs, and DOEC**
  - Weighted evaluation of suppliers (cost, parts, service etc)
- **Site designs for each location will be completed and tender packages prepared.**
  - Multiple sites will be included in a single tender

Critical Factors for Success

- **Excluding socioeconomic factors there are several key factors to overall success:**
  - Treated water quality (short term)
  - Perceived benefit (short term)
  - Reliability (short and long term)
  - Trained operator (long term)
  - Adequate O&M financing (long term)

Questions