



Snohomish Basin Biogas Partnership and Feasibility Study

The Tulalip Tribes

Lower Skykomish Conservation Group

The Clark Group

RCM Digesters

Biogas Feasibility Study

- ⇒ Biomass Inventory and Assessment
- ⇒ Technology Review
- ⇒ Financial and Business Plan
- ⇒ Implementation Strategy

Biomass Inventory

⇒ Identify Biomass Resources

- Dairy Farms – 38 assessed
- Other Sources of Organics - 15 under consideration

⇒ Identify Biomass Locations

- Monroe Area – Skykomish Basin
- Snohomish Area – Snohomish River Basin
- Arlington Area – Upper Stillaguamish Basin
- Stanwood Area – Lower Stillaguamish Basin

Dairy Cow Waste



- ⇒ A typical production animal can weigh 1,400 to 1,500 pounds.
- ⇒ Such an animal produces about 15 gallons or 135 pounds of waste per day.
- ⇒ Smaller animals produce less waste, so size matters!

Dairy Cow Waste



- ⇒ As deposited in the barns and walkways, the waste is about 18% solid and 82% water.
- ⇒ It can become diluted with wash water or rain.
- ⇒ Dilution is an important factor in digester design and operation.

Manure Handling by Scraping



- ⇒ Manure is pulled to a pit using a rubber tire
- ⇒ Collection is once or more per day
- ⇒ High concentration of digestible solids
- ⇒ Only slightly diluted
- ⇒ Pumpable – handled as liquid

Manure Handling by Flushing

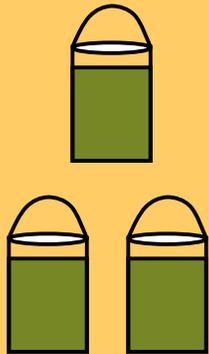


- ⇒ Manure is cleaned from lanes by high volume water flow
- ⇒ Water is recycled from the storage lagoon
- ⇒ Automatic – once or more per day
- ⇒ Low concentration of digestible solids

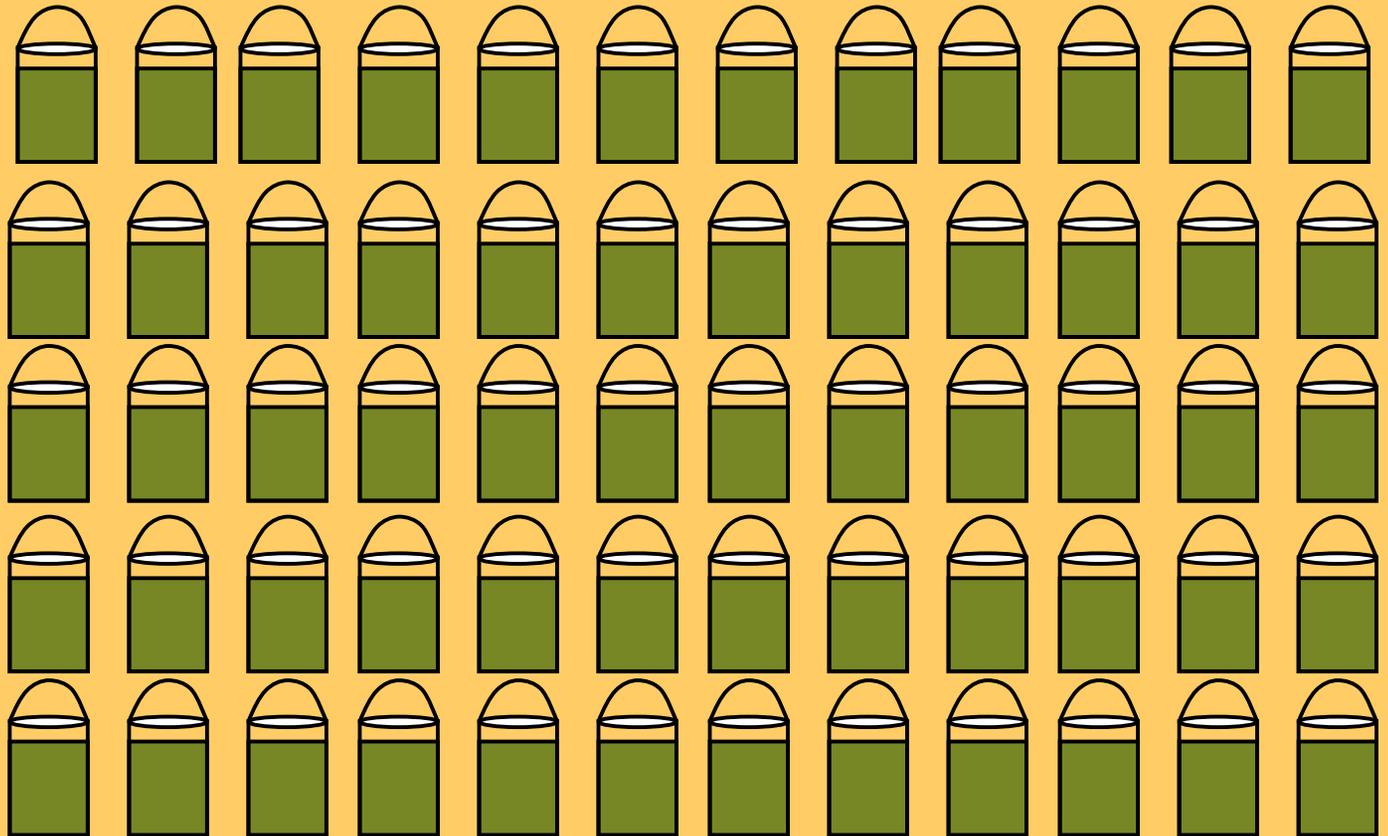
Manure Volume Comparison

One Day Basis

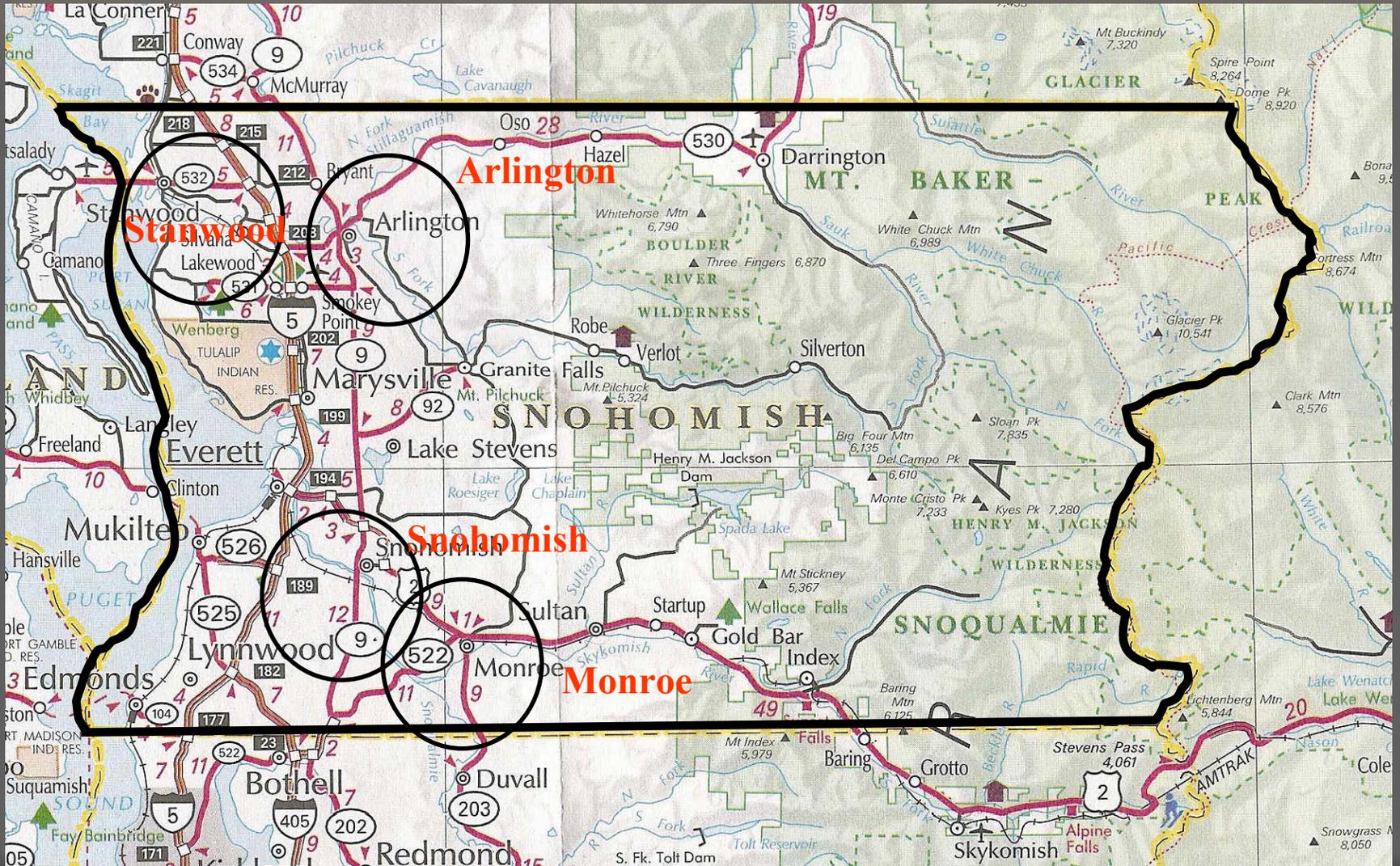
Scraping
One Cow's
Manure



Flushing One Cow's Manure



Survey Areas



Manure Handling Practice

Monroe

1,170 Flushed 1,100 Scraped

Snohomish

2,200 Flushed 985 Scraped

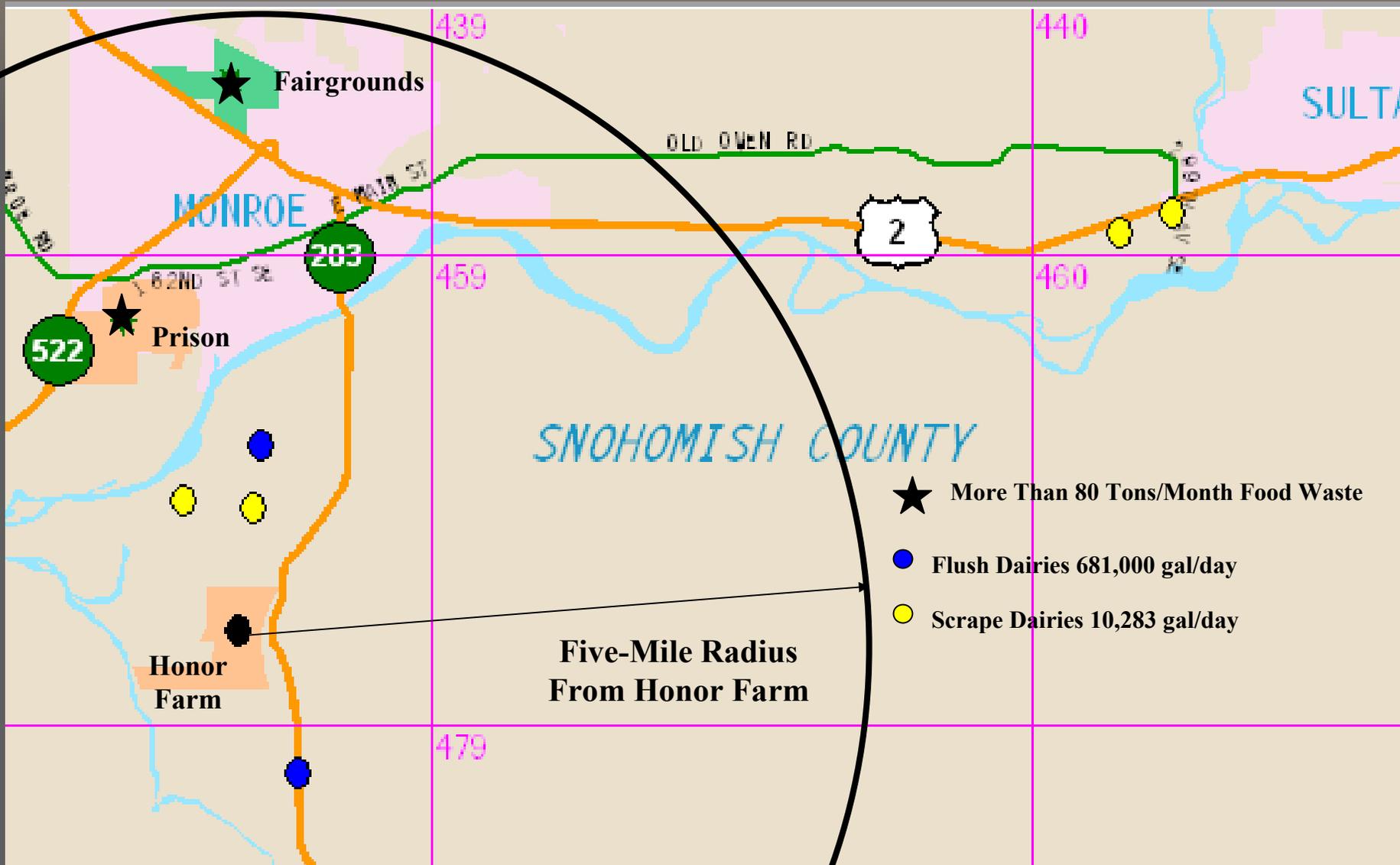
Arlington

700 Flushed 1,900 Scraped

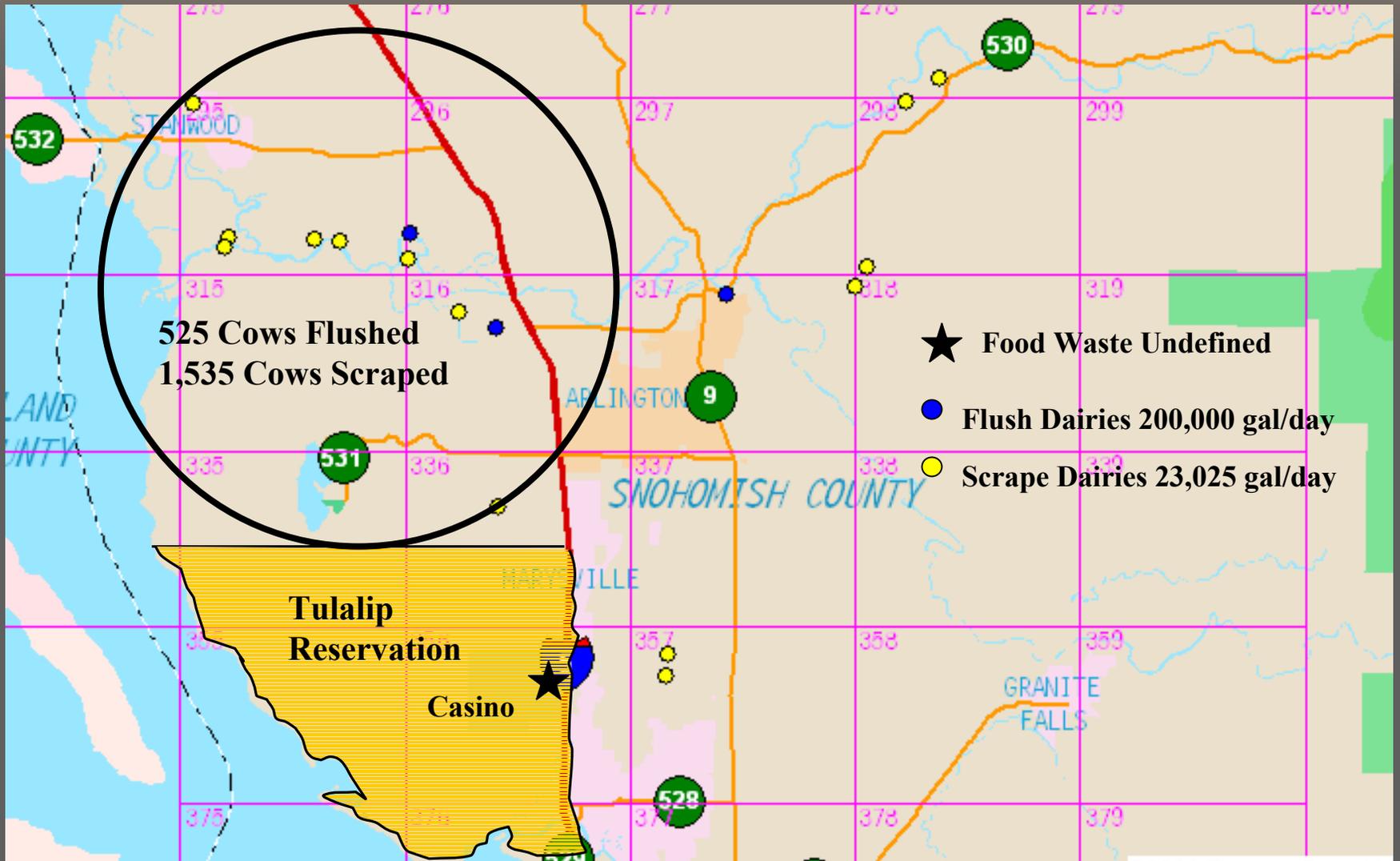
Stanwood

525 Flushed 1,535 Scraped

Monroe Area



Stanwood Area



Non-Dairy Waste

- ⇒ Reformatory – 80 tons per month
 - Constant, low or no contamination
- ⇒ Fairgrounds
 - Manure, fall seasonal surge, offers some offset for school
- ⇒ Edmonds School District
 - Seasonal, 1,170 gallons per day well-sorted
- ⇒ Red Hook Ale Brewery
 - 8,200 gallons week
 - Constant, no contamination
- ⇒ Chicken/egg producers
 - Reluctant to offer details, but could be significant

Bio-waste Survey Status To Date

- ⇒ All listed dairy farms have been contacted.
- ⇒ 69% of the dairies expressed some level of interest in the digester project.
- ⇒ Non-dairy sources are interested if they can lower disposal fees and transport costs.
- ⇒ Industrial/Institutional organizations like the positive public relations when their waste is turning into energy.

Technology Review

- ⇒ Identification of known technologies
 - 7 types
 - Review of past applications and performance
 - Operating characteristics
- ⇒ Match up with biomass sources
- ⇒ Operating characteristics and constraints
- ⇒ Selection of most feasible technology

Type of Digester	Level of Technology	Influent Solids Concentration	Solids Allowable	Supplemental Heat	HRT (days) (1)
Packed Reactor (2)	Medium	0.1 - 2%	Soluble	Yes	2+
Upflow Anaerobic (2) Sludge Blanket	High	0.1 - 2%	Soluble	Yes	2+
Ambient Temperature Covered Lagoon	Low	0.1 - 2%	Fine	No	40+
Complete Mix	Medium	2.0 -10%	Coarse	Yes	15+
Plug Flow	Low	11.0 -13%	Coarse	Yes	15+
Anaerobic Sequencing Batch reactor (2)	Experimental	0.5 - 8%	Coarse	Yes	2+
High solids	Experimental	20 - 35%	Coarse	Yes	15+

(1) HRT = Hydraulic Retention Time = digester volume/daily influent volume

(2) Attached growth reactors

Remaining Tasks

- ⇒ Match up with our biomass sources
- ⇒ Identification of haul routes and costs
- ⇒ Tipping fees
- ⇒ Compost/mulch/bedding market
- ⇒ Construction and operation
- ⇒ Final feasibility assessment – Spring 2004