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# Operation & Monitoring of a Bioreactor Landfill in Sainte Sophie, Quebec











Second Intercontinental Landfill Research Symposium  
Asheville, NC  
October 2002

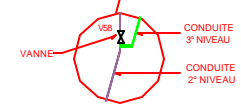
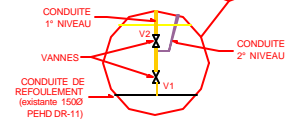
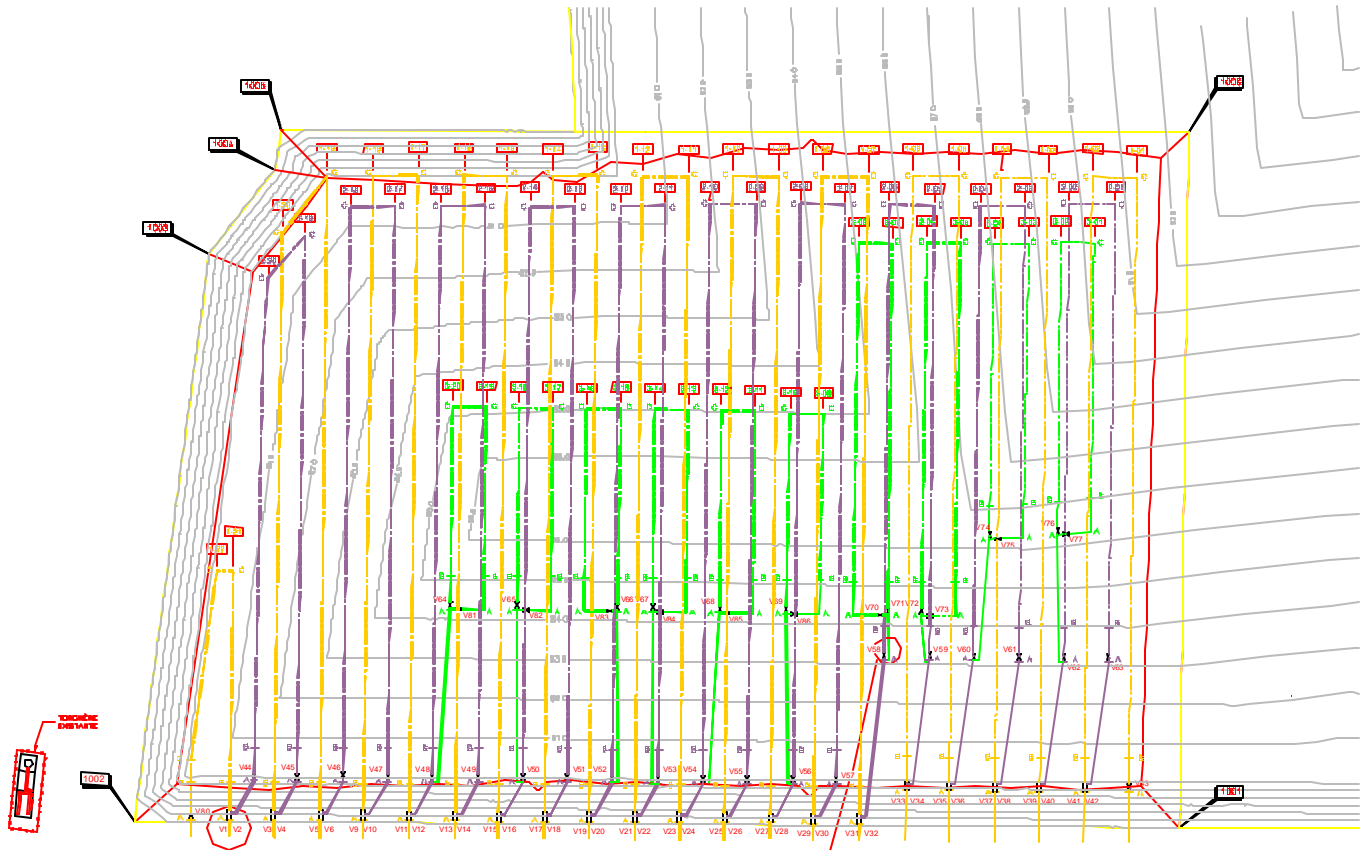
# Key Performance Objectives

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- **Optimize biological processes to stabilize waste**
- **Accelerate gas generation & evaluate system**
- **Evaluate recirculation system**
- **Accelerate settlement, maximize waste capacity**
- **Find effective & safe operating methods**
- **Identify problems, develop solutions**
- **Compare performance to traditional MSW LF**
- **Communicate findings**

# LÉGENDE

-  COURSE DE NIVEAU DU RECOUVREMENT FINAL
-  LIMITE DU SITE
-  CONDUITE DE LIXIVIAT TROISIEME NIVEAU PERFORÉE
-  CONDUITE DE LIXIVIAT TROISIEME NIVEAU NON PERFORÉE
-  CONDUITE DE LIXIVIAT DEUXIEME NIVEAU PERFORÉE
-  CONDUITE DE LIXIVIAT DEUXIEME NIVEAU NON PERFORÉE
-  CONDUITE DE LIXIVIAT PREMIER NIVEAU PERFORÉE
-  CONDUITE DE LIXIVIAT PREMIER NIVEAU NON PERFORÉE
-  VANNE À POSER
-  BOUCHON



VUE EN PLAN  
05L 1408

TABLEAU DES COORDONNEES  
LIGNE DE CONSTRUCTION  
(LIMITE DES RECHERS)

CHASSIS	COORDONNEE X	COORDONNEE Y	COORDONNEE X	COORDONNEE Y
1001	2708.000	2708.000	21 00	21 00
1002	2708.000	2708.000	21 00	21 00
1003	2708.000	2708.000	21 00	21 00
1004	2708.000	2708.000	21 00	21 00
1005	2708.000	2708.000	21 00	21 00
1006	2708.000	2708.000	21 00	21 00

BT	POUR CONSTRUCTION	07-12-01
ND	REVISION(0)	DATE



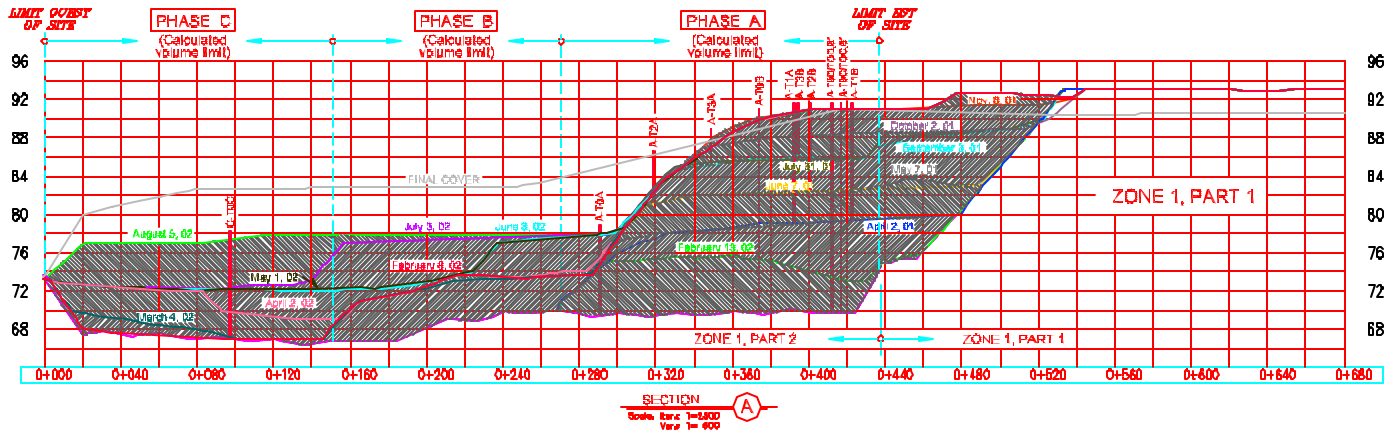
**André Bernard & associés**  
INGÉNIEUR GÉNÉRALISTE, S.A.S. 35000  
 02 99 58 10 00 - 02 99 58 10 01

Client sur	Requis sur
PL BELLEVILLE	J BELLEVILLE
Valeurs pos	Requis pos
J BELLEVILLE, P&R	A. BELLEVILLE BELLEVILLE

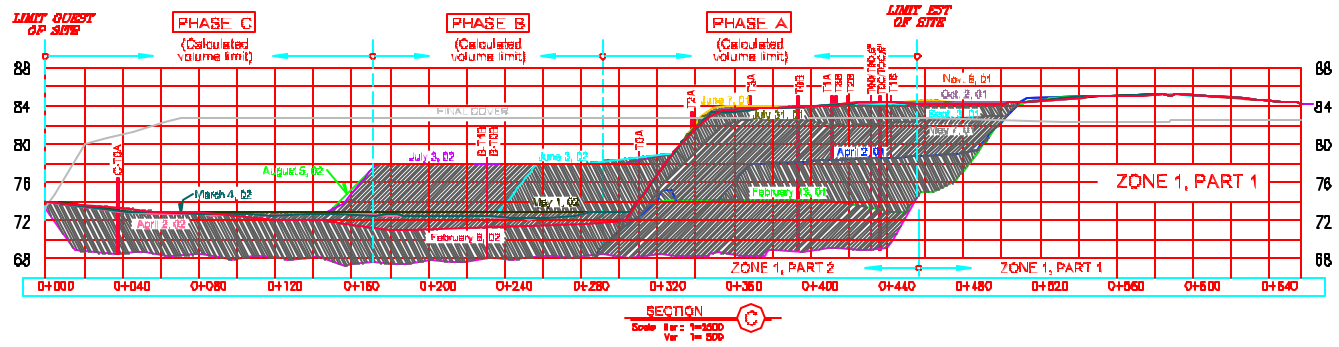
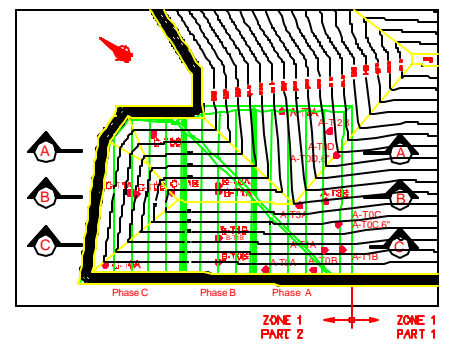
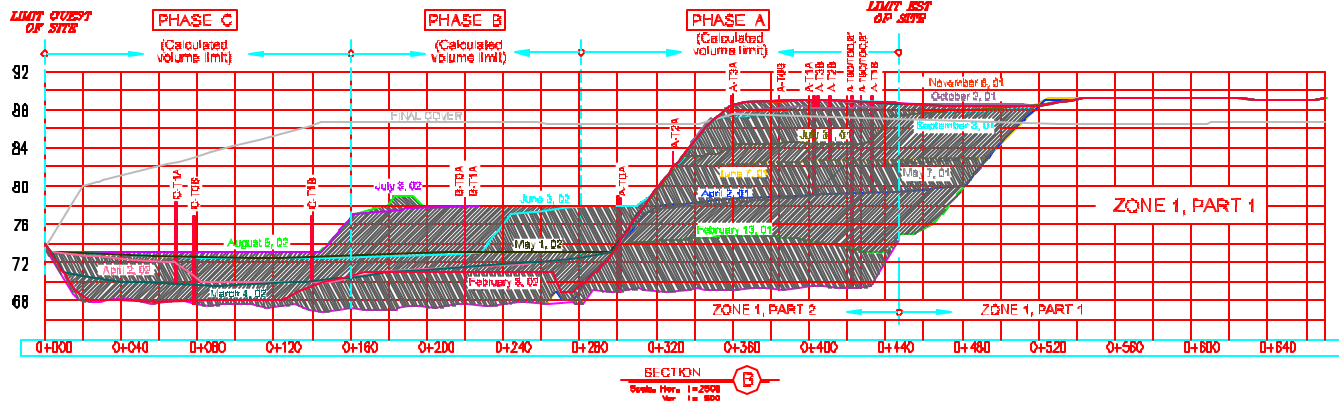
**Titre de projet:**  
**L.E.S. DE STE-SOPHIE**  
 BIORÉACTEUR DE MATIÈRES VALORISABLES

**Titre de dossier:**  
 LOCALISATION DES CONDUITES DE RECIRCULATION DU LIXIVIAT  
 1er, 2ième ET 3ième NIVEAU

Échelle	PROJET SUR	Feuille sur
05L 1408	05L 1408	2 / 8
Date	DAG	
MAPS 2000	JDFPCE	



⊙ SETTLEMENT PLATE  
 WASTE



**André Simard & associée**  
 1825, Ave. Jean-Jacques, Québec, Q.C. H2R 2R8  
 Tél: (418) 628-3111 Téléc: (418) 628-3222

**PROJECT TITLE**  
STE-SOPHIE LANDFILL

**DRAWING TITLE**  
ELEVATION VIEW  
WASTE SURVEY

REVISION	DATE	PARI
	September 10, 2002	J.S.
<b>DRAWN</b>	<b>SCALE</b>	<b>Nº. PROJETI</b>
J.S.	NOTED	01-860
<b>VERIF.</b>	<b>DATE</b>	<b>Nº. FIGURE</b>
K.D.	NOV. 2001	4 de 4

T11X17P01



GEOTEXTILE # 7616 TEXEL  
OR EQUIVALENT ON TOP OF  
TRENCH ONLY

±1000 mm

WASTE

STONE

500 mm  
min.

PERFORATED HDPE BIOGAZ  
EXTRACTION PIPE 150mmØ



VARIABLE

PERFORATED HDPE  
LEACHATE INJECTION PIPE  
75mmØ (SEE DETAIL 2)



500 mm  
min.

WASTE

## CROSS SECTION "A-A"

NO SCALE

301D13



# Recirculation & Gas collection trench



*From everyday collection to environmental protection, look to the NEW Waste Management.*

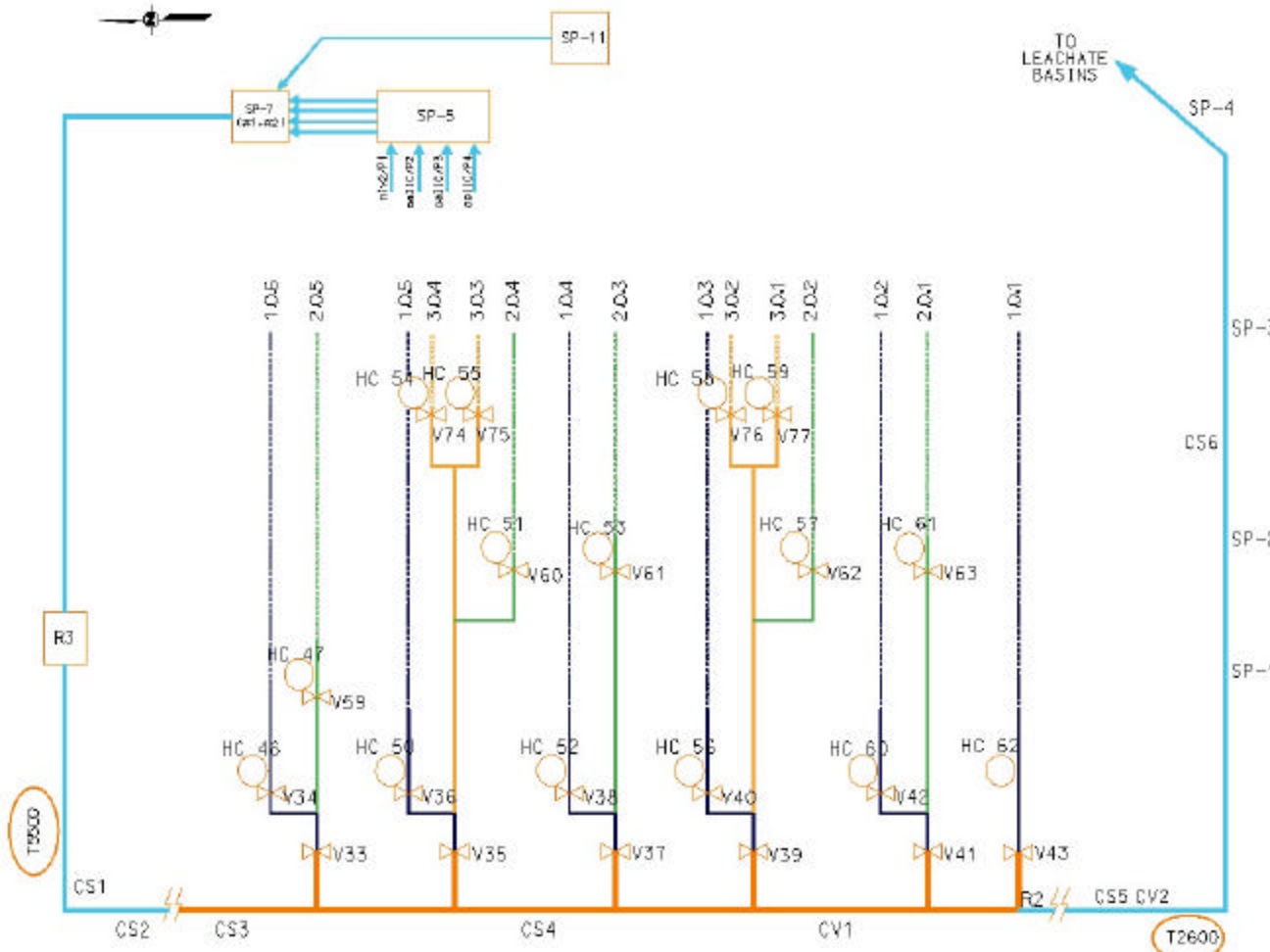
# Buried Valve and Cleanout, Gas Wellhead



# Liquid Recirculation

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- **May 10 to Sept 30 = 8.1 million gallons**
  - 260 gpm, 20k to 170k gpd
- **One connected pair each day.**
- **Recirculation target = (2 x trench gravel void space) = 56 gal / ft**
- **Added 20 to 33 gallons / ton (average)**



*From everyday collection to environmental protection, look to the NEW Waste Management.*





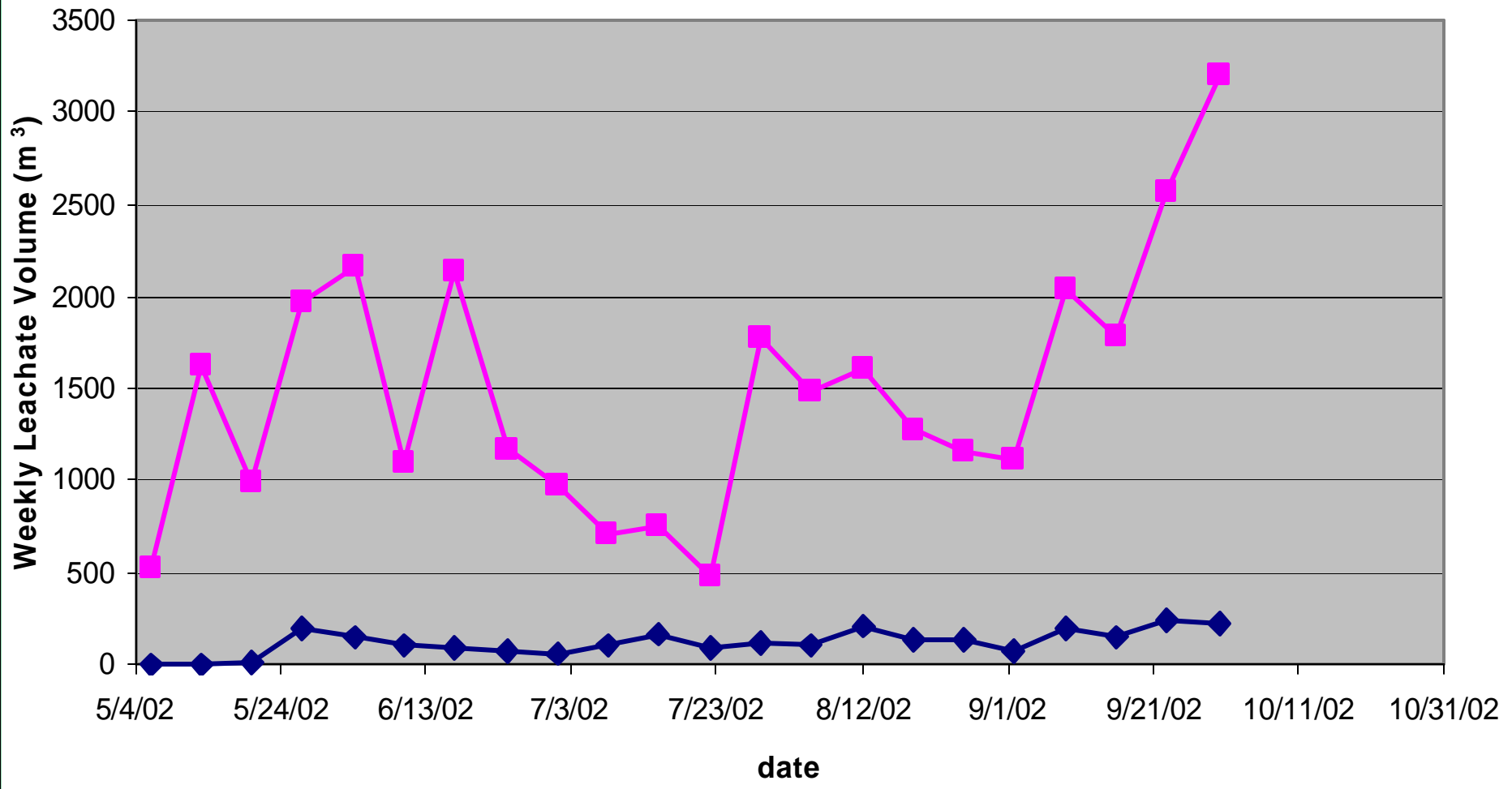
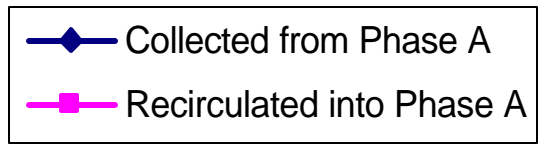
# Leachate Monitoring

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- **Daily flow recirculated & volume collected**
- **Head on Liner - continuous**
- **Surface observations for seeps (one 1st day)**
- **Monthly samples - each phase LCS & recirculation manhole**
  - **Field: pH, specific cond, temperature**
  - **Lab: BOD, COD, heavy metals, ammonia, nitrite, nitrate, sulfate, phosphates, chloride, potassium, volatile organic acids**

# Sainte Sophie Bioreactor

## Weekly Volumes Collected & Recirculated - Phase A



*From everyday collection to environmental protection, look to the NEW Waste Management.*



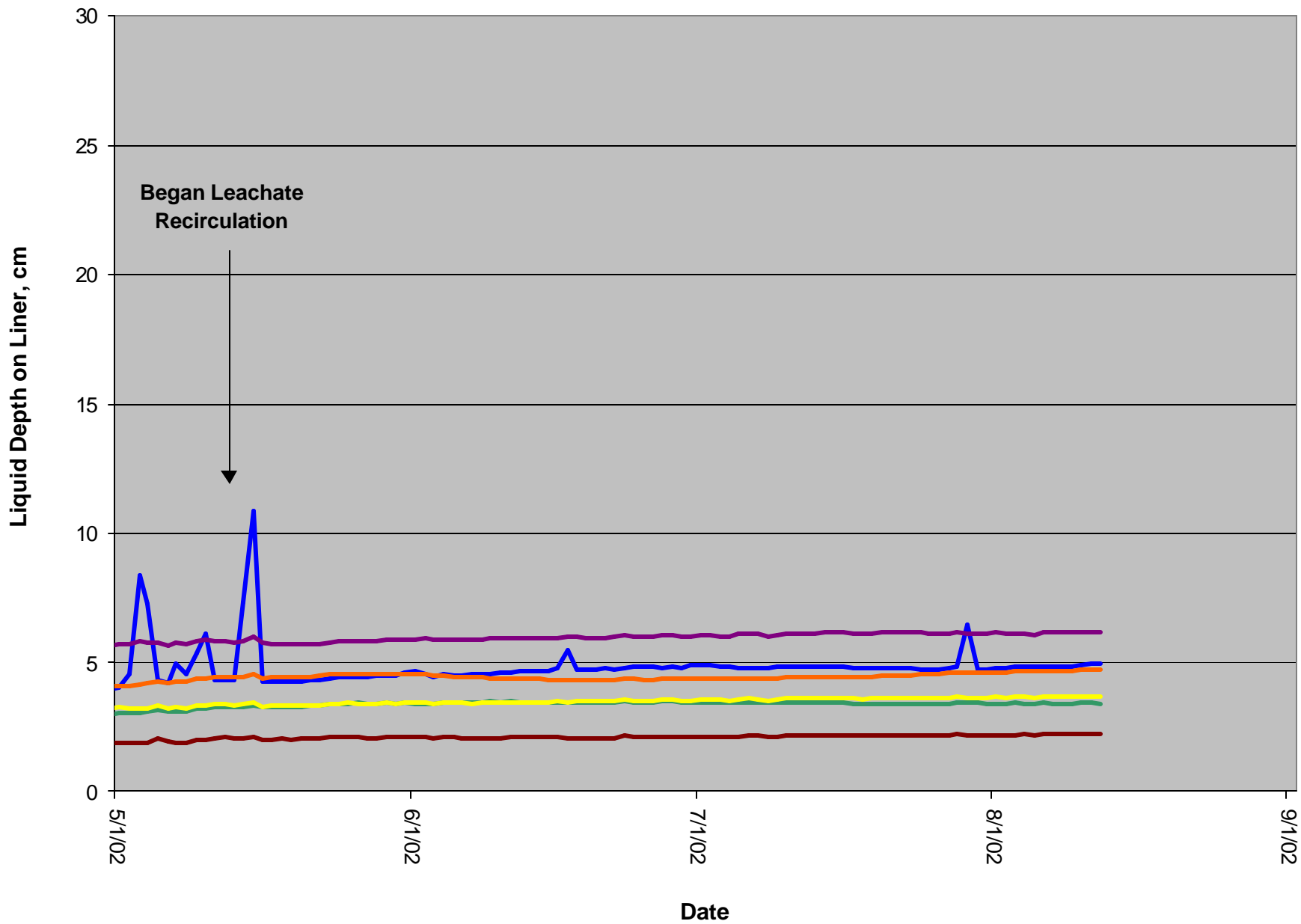
## Head-on-liner sensors & thermistors in the waste

(min, max, avg  
recorded daily)

*From everyday collection to environmental protection, look to the NEW Waste Management.*



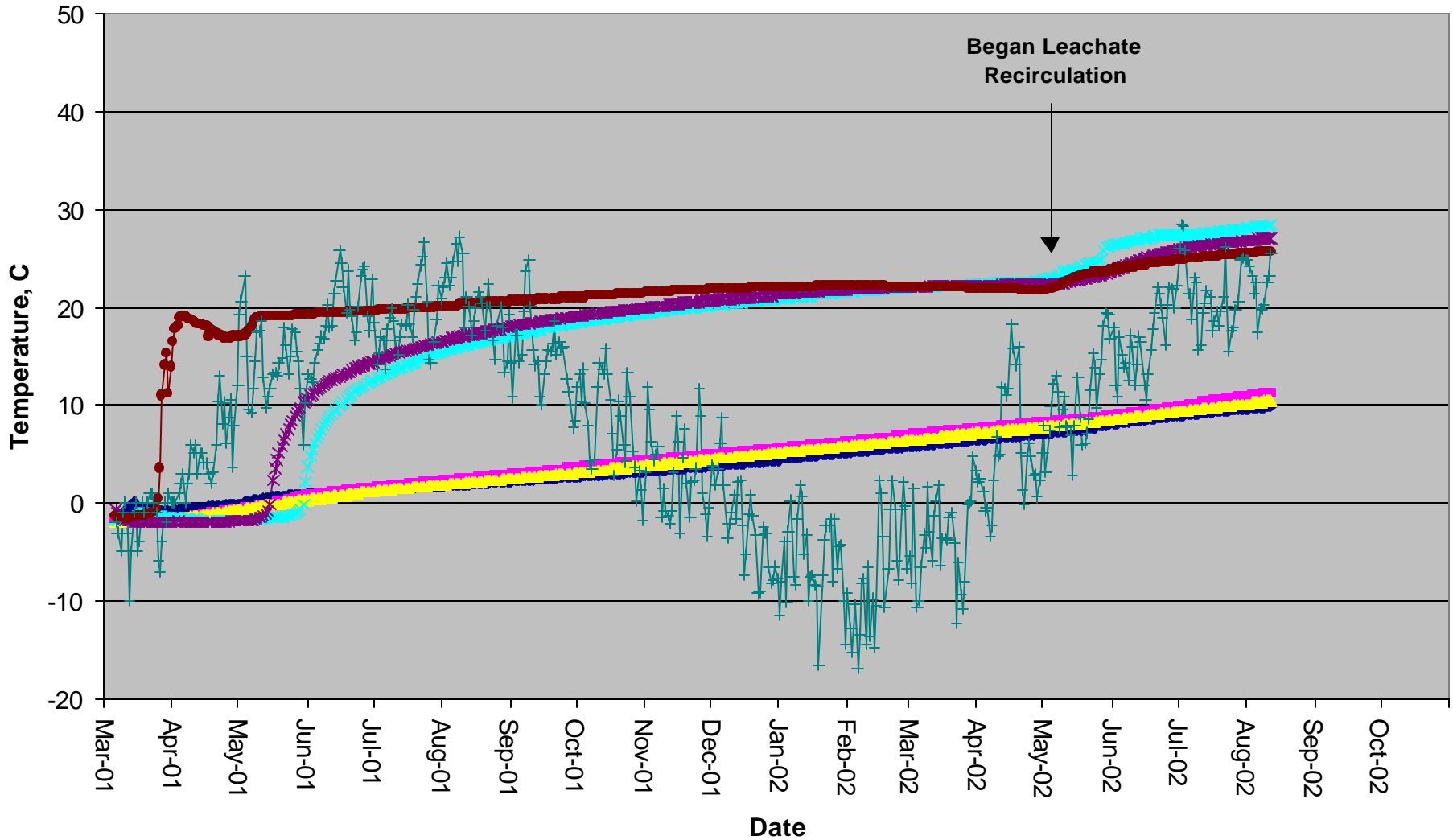
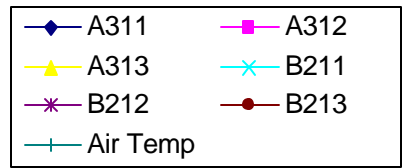
# Sainte Sophie Bioreactor Area A Head on Liner Sensors





# Sainte Sophie Bioreactor Area A - Lift 1 Temperature Sensors

( sensor elev 73.5m ) ( 5.3m over liner, 12 m waste above )



# Gas Flow & Quality

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- **Weekly readings at wellheads & header**
  - Flow, Temp, CH<sub>4</sub> CO<sub>2</sub> N<sub>2</sub> O<sub>2</sub>
- **Surface observations for venting**
- **Quarterly Gas samples**
  - NMOCs & VOCs (HAPs)

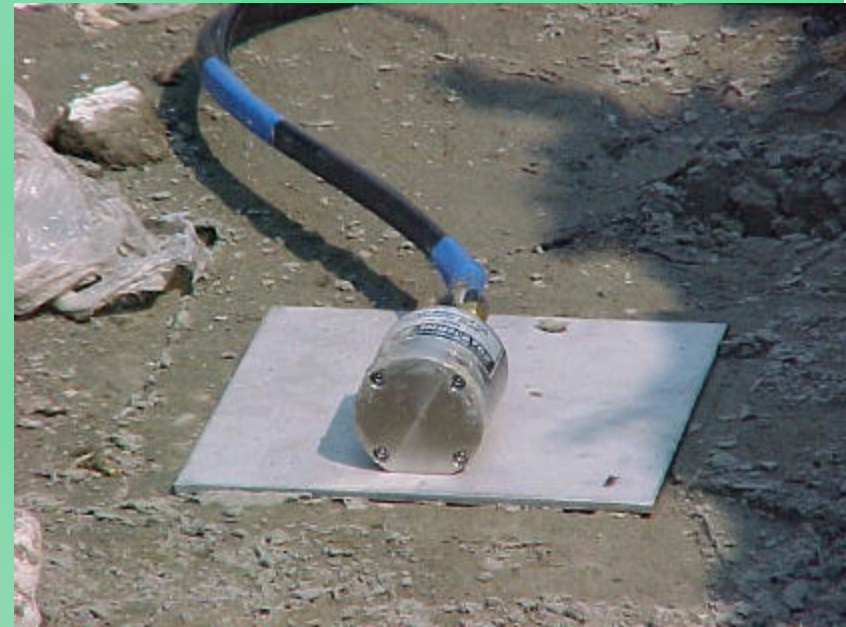


# Settlement Monitoring

## Settlement Plates and Cells

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Surveyed monthly

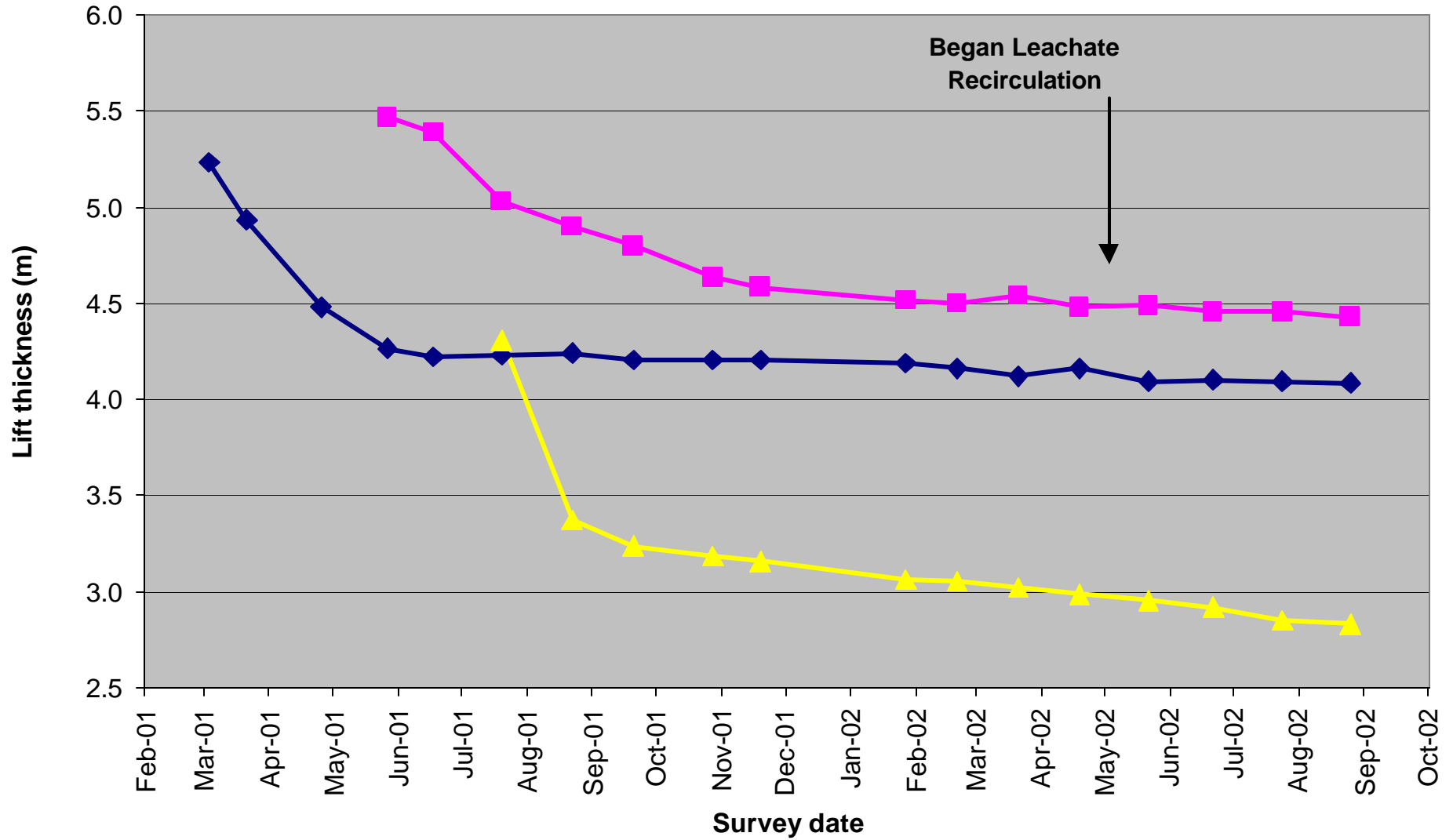
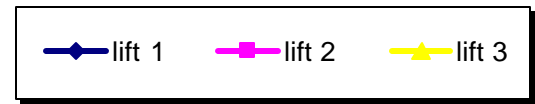


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# Ste-Sophie landfill - Part A

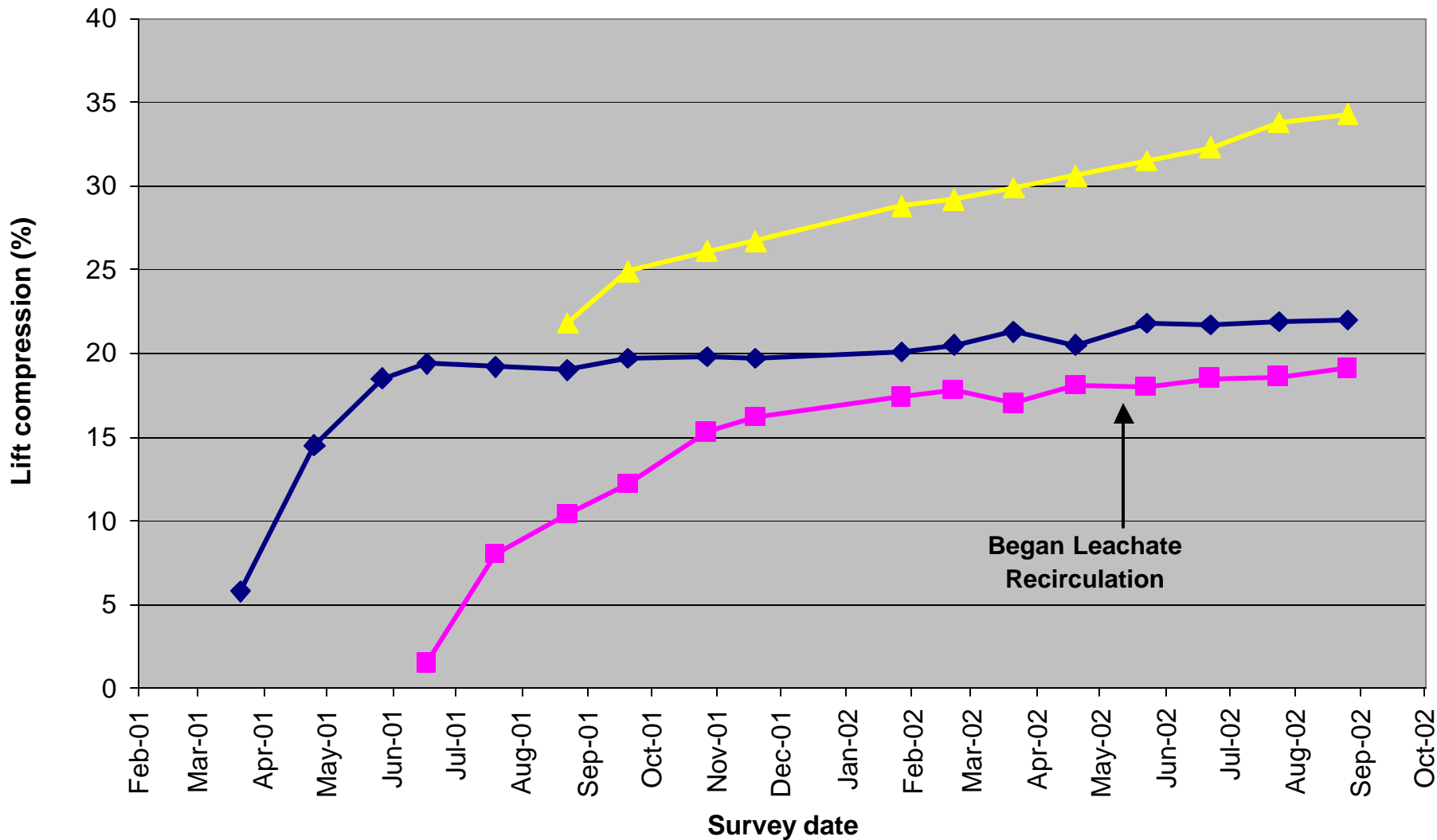
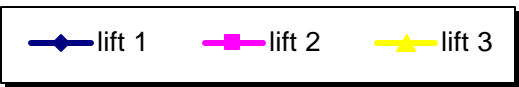
## Lift thickness vs time





# Ste-Sophie landfill - Part A

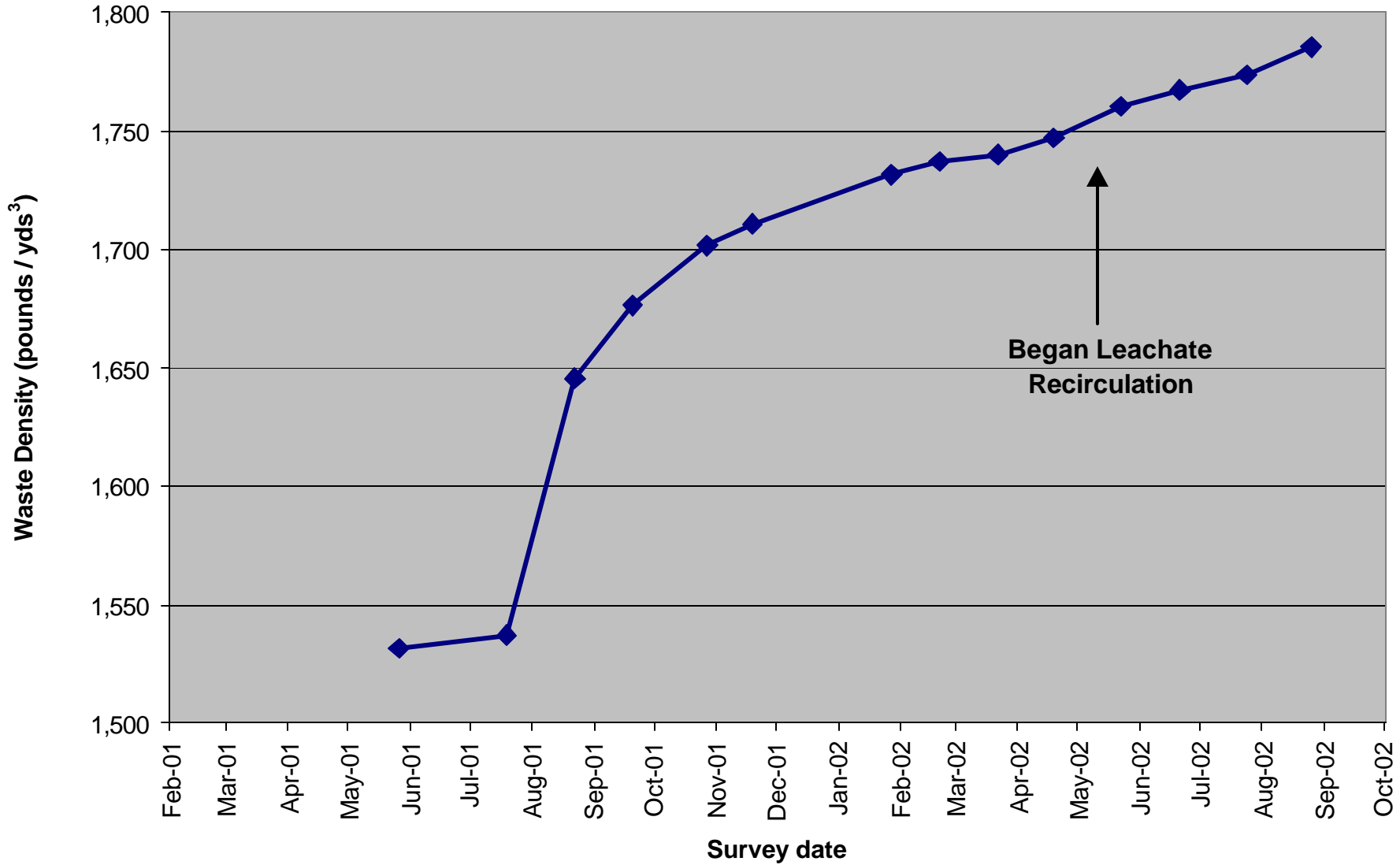
## Lift compression vs time



# Sainte Sophie Landfill - Bioreactor Phase A

## Waste Density

◆ Lift 3 Surface to Base

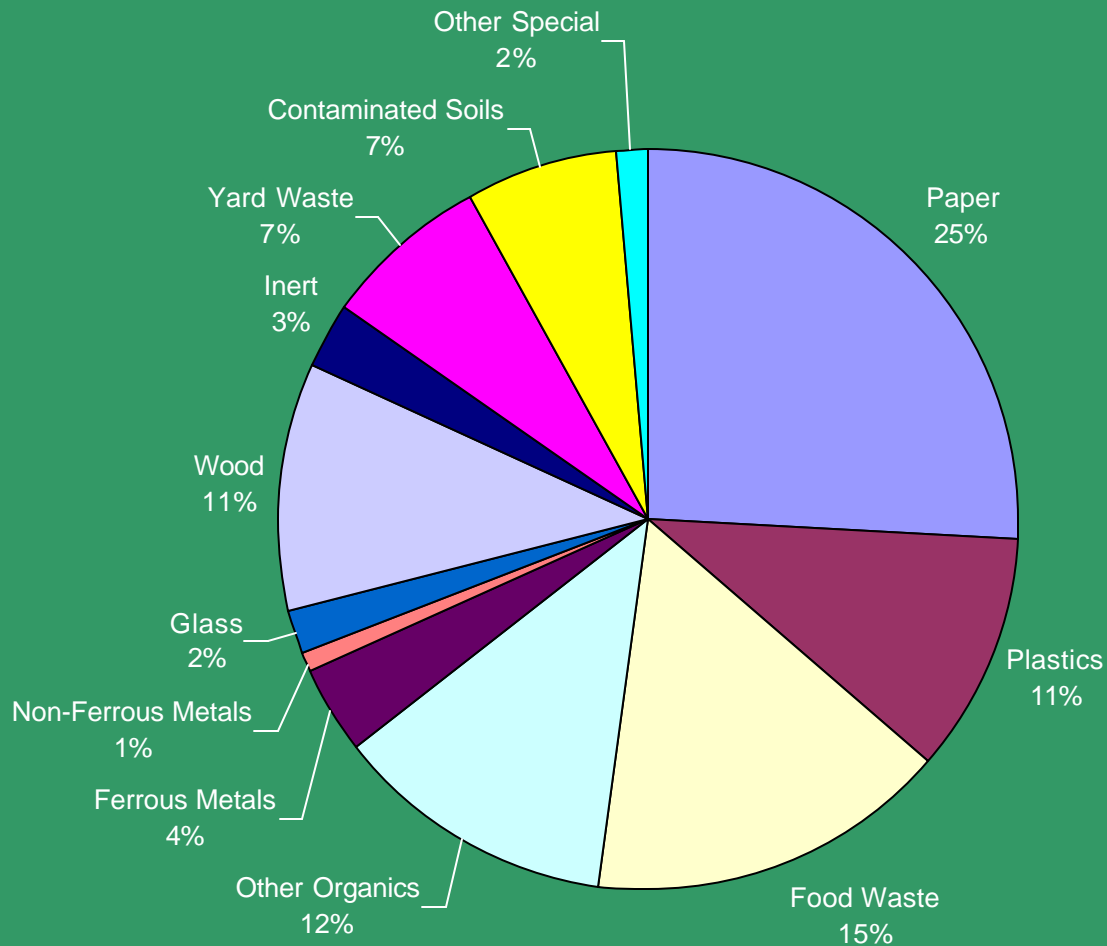


# Waste Moisture Content

- 15 TDRs at 4 levels, datalogger
- volumetric moisture converted to wet wt. basis
- Initial readings = 21 to 31%
- Plan to:
  - Compare TDR to samples w%
  - Compare TDR to balance w%
  - Plot waste density vs. w%
  - Plot gas flow vs. w%



**DAILY AGGREGATE WASTE COMPOSITION**  
**MAY 6-9, 2002**  
**(Based on Manual Sort, Visual Inspection and Scale House Data)**



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# Organic Indicators

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Cellulose, Hemi, Lignin for 19 waste components

ORG: Food, wood, yard, other org, paper (9 types)

InORG: Plastics, Fe metals, non-Fe, glass, inert,  
special (soil)

Estimate for Total Bioreactor (by dry weight)

- cellulose 22%    hemi 6%    lignin 11%

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