PROGRESSIVE
ENVIRONMENTAL SERVICES

"Protecting What's Built,
Restoring What's Broken

Steve Carl, President
Manny Hernandez, PE, BCEE, EVP

Specialists in Landfill Chemical Cleaning, Leachate Treatment & Re-Use

PROGRESSIVE ENVIRONMENTAL SERVICES

INTRODUCTION

Products:

- Pipe and Well Renew™ Products
- Free Flow™ for Micro Irrigation & Soils

Services:

- Chemical Cleaning
- Leachate Sump Performance Evaluation
- Phytocap Design & Management

Protecting the Environment is a daily choice.

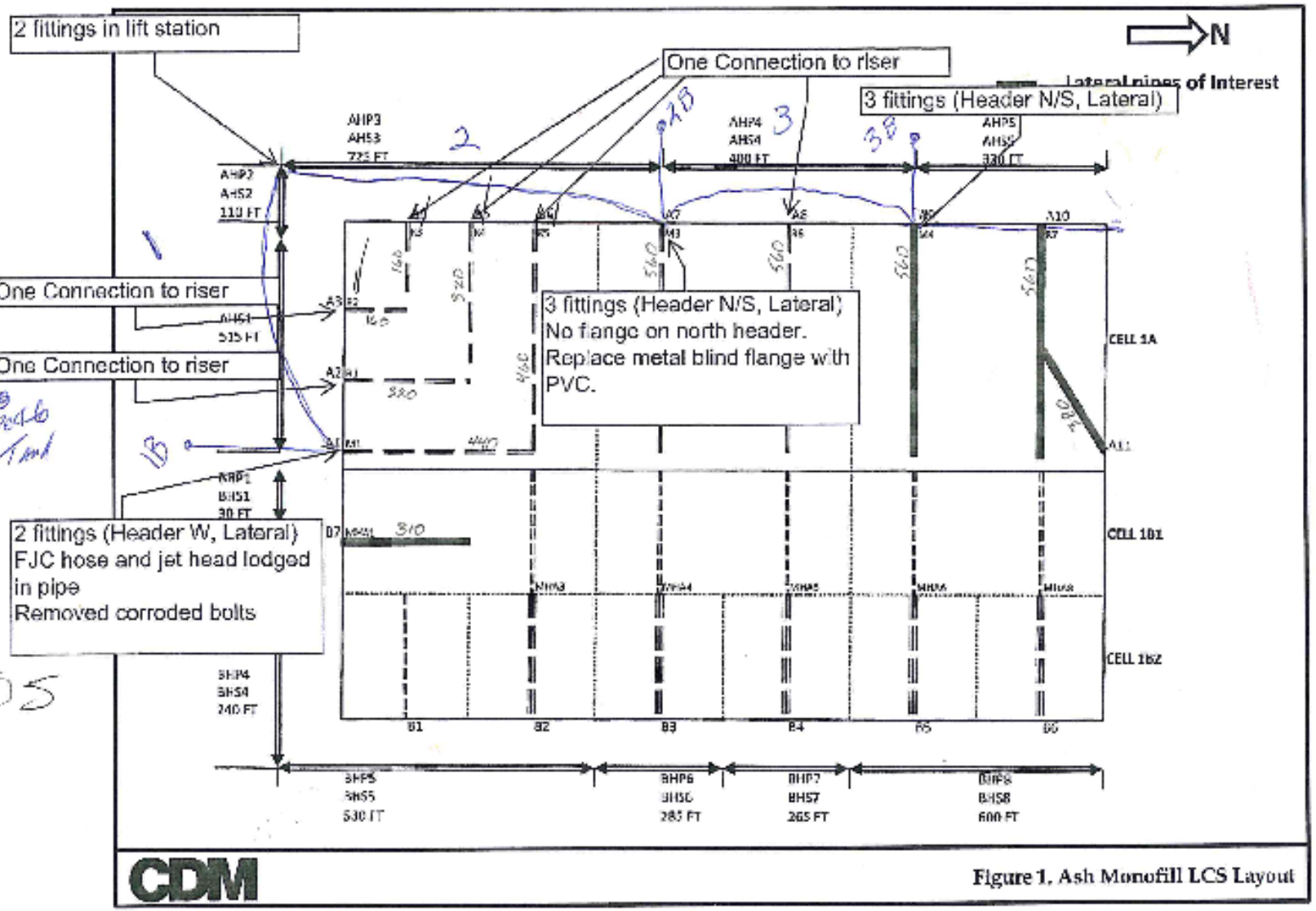
Rodney Hamby, Catawba County, NC

Wastewater Treatment Plants

Landfills

PROGRESSIVE
ENVIRONMENTAL SERVICES

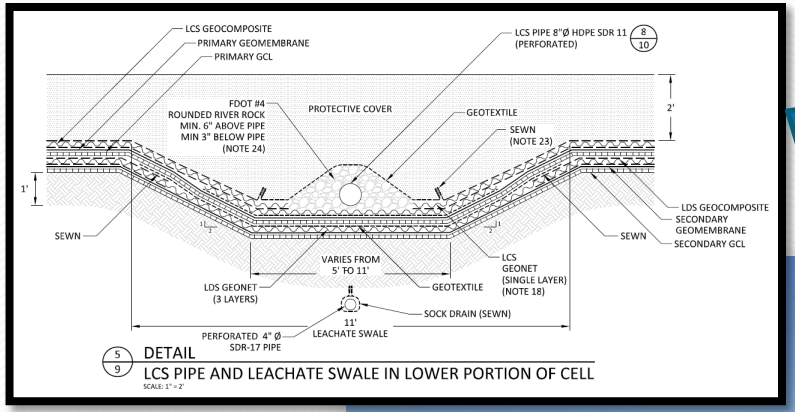
LANDFILLS



CDM

Figure 1. Ash Monofill LCS Layout

Why am I here?


LCS GEOCOMPOSITE
PRIMARY GEOMEMBRANE
PRIMARY GCL
LCS PIPE 8"Ø HDPE SDR 11 (PERFORATED)
8/10
FDOT #4 ROUNDED RIVER ROCK MIN. 6" ABOVE PIPE MIN 3" BELOW PIPE (NOTE 24)
PROTECTIVE COVER
GEOTEXTILE
SEWN (NOTE 23)
2'
1'
SEWN
LDS GEOCOMPOSITE
SECONDARY GEOMEMBRANE
SECONDARY GCL
VARIES FROM 5' TO 11'
LCS GEONET (SINGLE LAYER) (NOTE 18)
LDS GEONET (3 LAYERS)
GEOTEXTILE
SOCK DRAIN (SEWN)
11'
LEACHATE SWALE
PERFORATED 4" Ø SDR-17 PIPE
5/9 DETAIL
LCS PIPE AND LEACHATE SWALE IN LOWER PORTION OF CELL
SCALE: 1" = 2'


2016.07.06

Everyone has it.

What is “it”?

Parameters	Units	MSW/Ash 1	MSW/Ash 2	MSW/Ash 3	MSW/Ash 4	Ash Mono 1	Ash Mono 2
Inorganics							
Chloride	mg/L	18,000	14,000	760	12,000	41,000	44,000
Sulfate	mg/L	630	570	560	990	280	240
Total Alkalinity	mg/L	6,100	780	2,700	9,900	330	330
Total Organic Carbon	mg/L	4,200	390	2,100	12,000	7.0	7.9
Metals							
Calcium	mg/L	920	1,300	34	1,400	6,000	7,600
Iron	mg/L	75	13	3.0	270	0.05	0.6
Magnesium	mg/L	150	110	29	230	30	23
Sodium	mg/L	5,600	4,500	500	5,400	12,000	13,000
Metals, Dissolved							
Iron	mg/L	65	6.0	3.2	21	0.02	0.06
Silica (SiO2)	mg/L	93	38	70	170	141	15
Volatile Fatty Acids							
Acetic Acid	mg/L	2,700	1.8	3,500	8,700		
Propionic Acid	mg/L	940	-	810	3,000		
Butyic Acid	mg/L	1,200	0	1,400	4,000		

Typical Rochem Treatment Results:

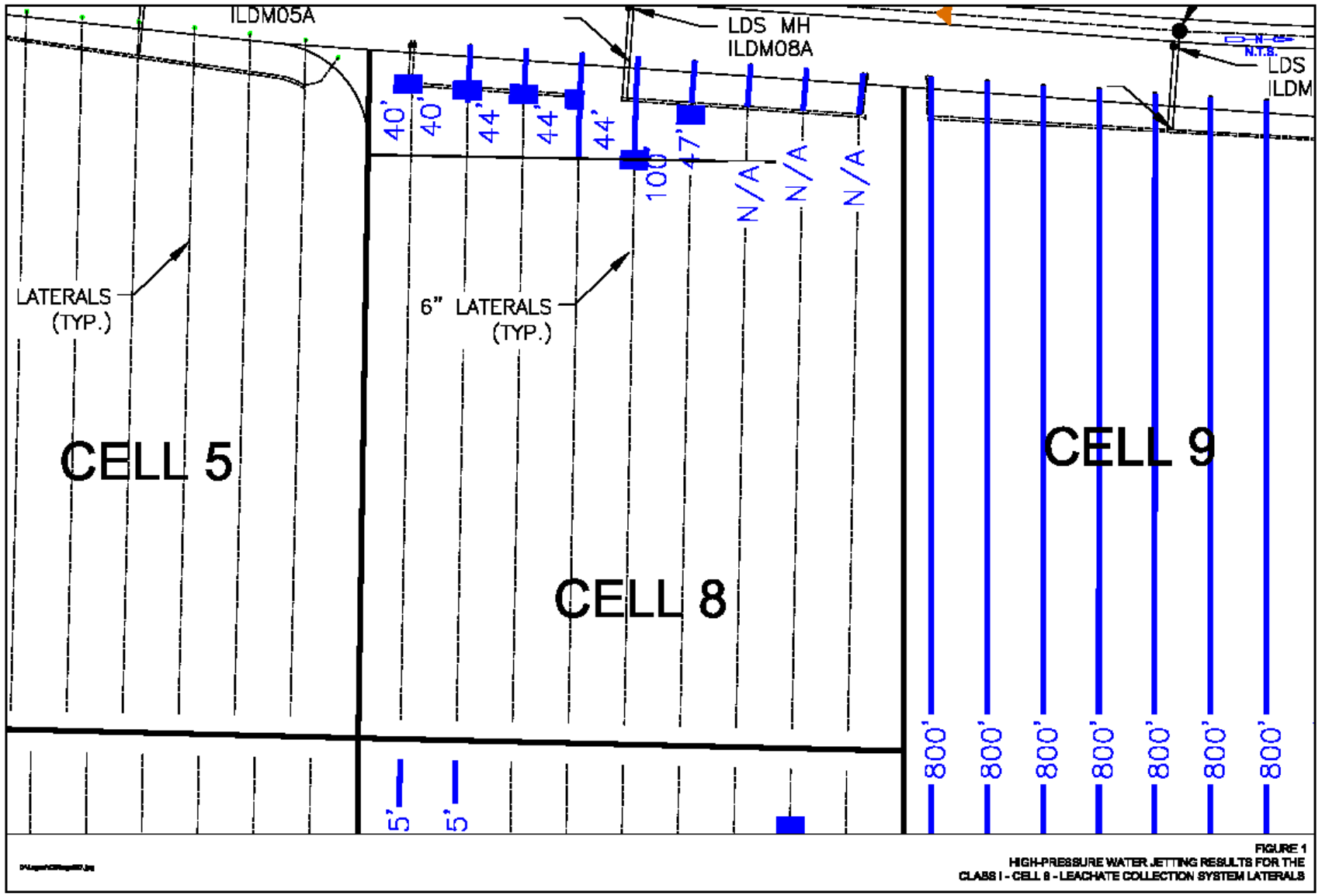
Parameter	Units	Leachate	RO 1 Permeate	RO 2 Permeate	Rejection
Total Dissolved Solids	mg/L	23,800.0	308.31	16.5	99.9309%
Biological Oxygen Demand	mg/L	392.0	39.10	3.4	99.1326%
Chemical Oxygen Demand	mg/L	9,070.0	163.29	2.9	99.9679%
Total Organic Carbon	mg/L	7,330.0	187.00	4.7	99.9365%
Total Suspended Solids	mg/L	57.0	0.80	0.0	99.9805%
Arsenic	mg/L	1.100	0.040	0.001	99.8734%
Chloride	mg/L	5,730.0	151.45	3.902	99.9319%
Chromium	µg/L	780.0	4.19	0.023	99.9971%
Iron	µg/L	4,200.0	3.06	0.002	99.9999%
Kjeldahl Nitrogen	mg/L	7,970.0	841.39	76.822	99.0361%
Ammonia-Nitrogen	mg/L	1,800.0	59.95	1.924	99.8931%
Nitrate	mg/L	0.2	0.02	0.002	99.0361%
Phosphate	mg/L	5.50	0.122	0.003	99.9519%
Potassium	mg/L	2,000.0	47.46	1.103	99.9449%
Sodium	mg/L	5,100.0	118.38	2.694	99.9472%
Zinc	mg/L	0.1	0.00	0.000	99.6487%
Phenol	µg/L	1,100.0	220.01	34.006	96.9085%
Mercury	ng/L	196.0	3.70	1.000	99.4898%
Perfluorooctanoic acid (PFOA)	ng/L	820.0	2.50	<1.9	>99.7682%
Perfluorooctanesulfonic acid (PFOS)	ng/L	200.0	<2	<1.9	>99.0500%
Perfluorohexanoic acid (PFHxA)	ng/L	2,100.0	7.80	<1.9	>99.9095%

Multistage Systems to Meet any Requirement:

Leachate & Precipitate Characteristics

- Leachate analysis and geochemical modeling showed thermodynamically favored precipitation of hydroxyapatite and calcite.
- BART showed high populations of SRB and IRB.
- XRD of precipitate showed presence of calcium carbonate, brushite, and gypsum.
- *Sludge* of Biomass and Mineral Precipitant

Gravity Systems



Reaching the Back

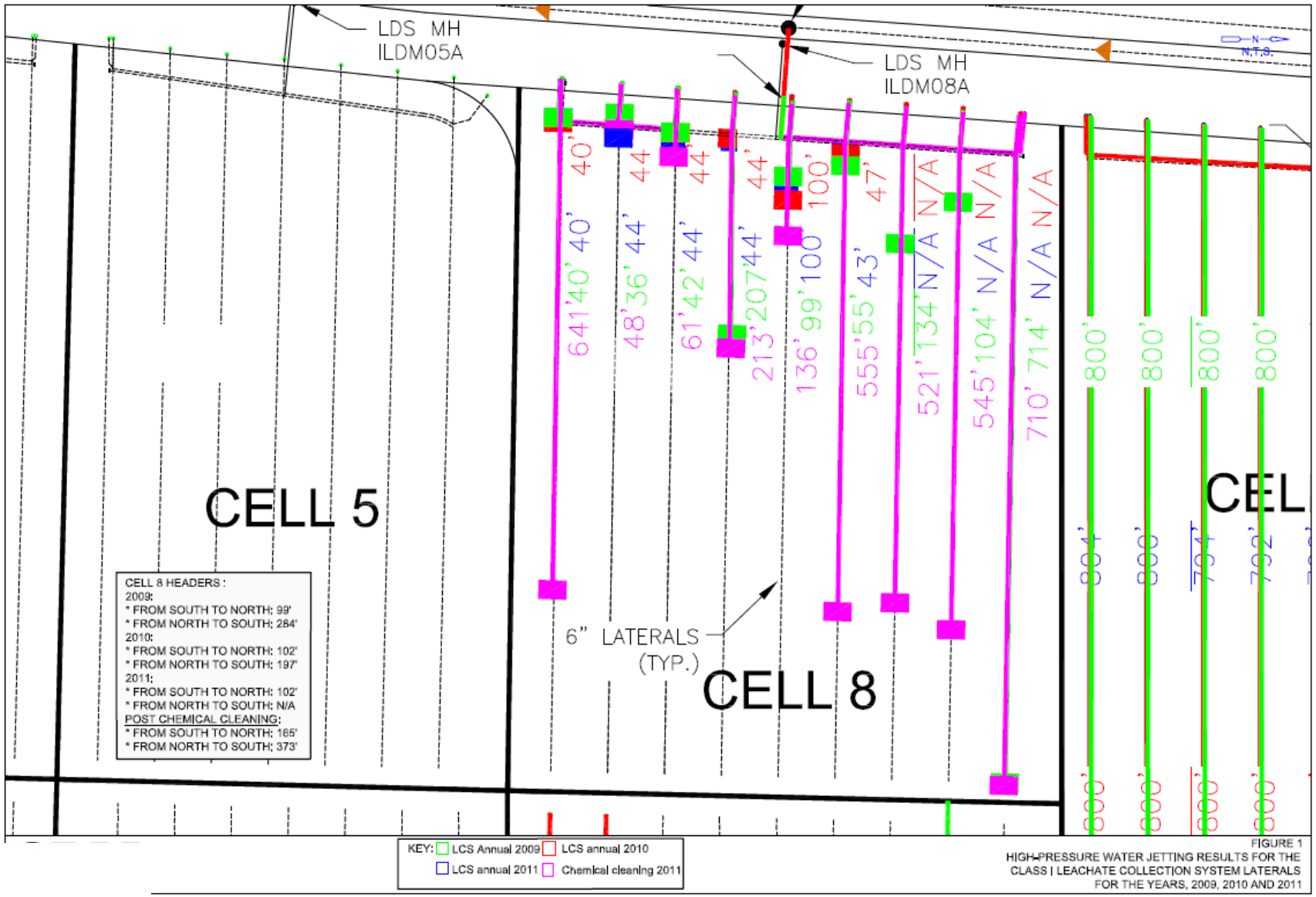


FIGURE 1
HIGH-PRESSURE WATER JETTING RESULTS FOR THE CLASS I LEACHATE COLLECTION SYSTEM LATERALS FOR THE YEARS, 2009, 2010 AND 2011

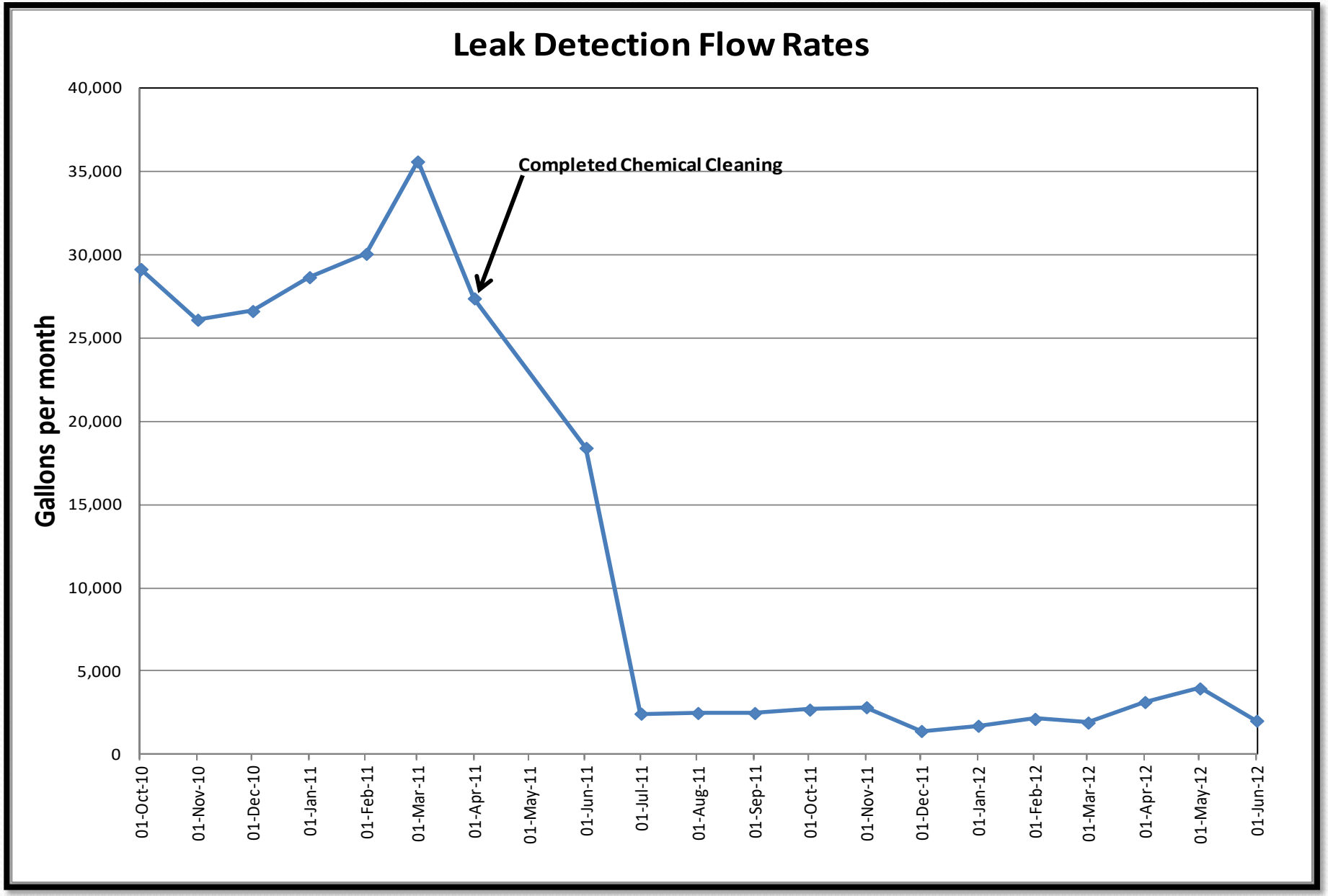

037827

Chemical Cleaning - FOAM

Cleaning Demonstration Results

- Chemical Cleaning
  - Over 2,000 feet per week (up to 12,000)
  - $20 to $40/foot (as low as $6/foot)
  - Flow increases to 6X-8X+

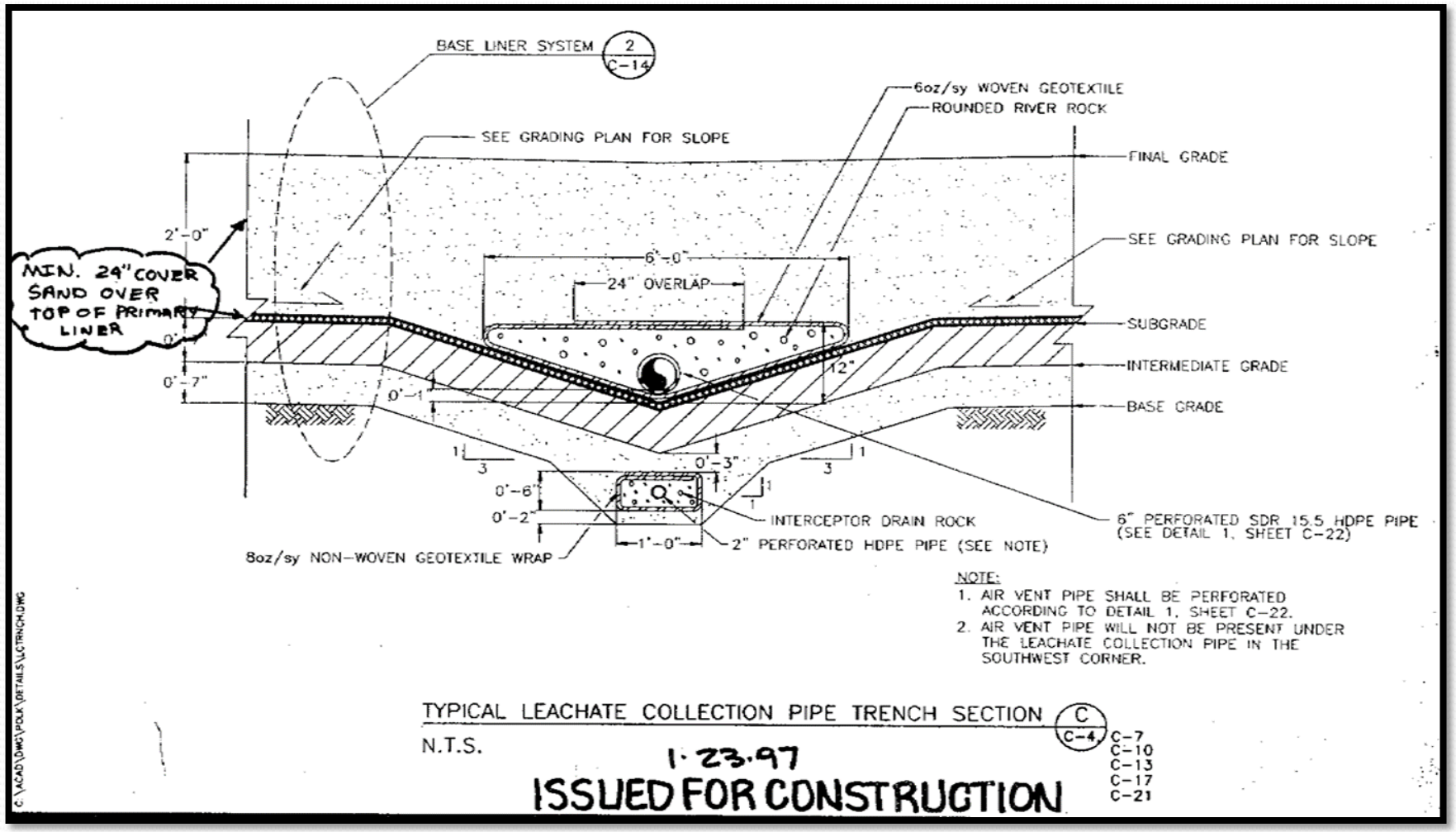
"Chemical cleaning determined to be the best technology for removing heavy precipitate buildup" – CDM Smith


Leak Detection Flow Rates
Gallons per month
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Completed Chemical Cleaning
01-Oct-10
01-Nov-10
01-Dec-10
01-Jan-11
01-Feb-11
01-Mar-11
01-Apr-11
01-May-11
01-Jun-11
01-Jul-11
01-Aug-11
01-Sep-11
01-Oct-11
01-Nov-11
01-Dec-11
01-Jan-12
01-Feb-12
01-Mar-12
01-Apr-12
01-May-12
01-Jun-12

MSW Bioreactor

"Jetting fine, not enough leachate production"

Bioreactor Landfill



Results LCS 1 Cleaned, LCS 2 Control

Month	Rain (Inches)	NCLF Phase I Collected Gallons	Phas			
			LCS #1 Subcells 1 & 2 Gallons		LCS #2 Subcells 3 & 4 Gallons	
			Primary **See Note #4**	Secondary	Primary	Secondary
2012						
January	0.00	112,488	42,811	70	26,111	210
February	0.00	89,130	32,479	0	32,865	90
March	0.99	99,292	41,250	50	34,336	270
April	0.79	94,065	41,190	40	31,451	271
May	2.32	91,733	51,862	50	33,794	280
June	11.11	125,786	41,374	30	47,717	6,229
July	6.47	96,999	114,836	490	29,042	3,697
August	7.69	112,521	71,227	370	31,031	7,088
September	4.26	144,561	68,099	250	26,717	6,199
October						
November						
December						
YEAR TO DATE TOTALS	33.63	966,576	505,127	1,350	293,064	24,334

Single LCS Lateral Ash Monofill

- Time to fill a 5 gallon bucket
- Before
  - 2 minutes, 34 seconds
  - 2.57 minutes
  - 2.95 gallons per minute
- After
  - 19 seconds
  - 0.32 minutes
  - 15.6 gallons per minute

8X improvement in flow

- Video Inspector: “We’ve never seen this much flow”

MSW LF, Force Main, 37 Sumps, 2 Boosters

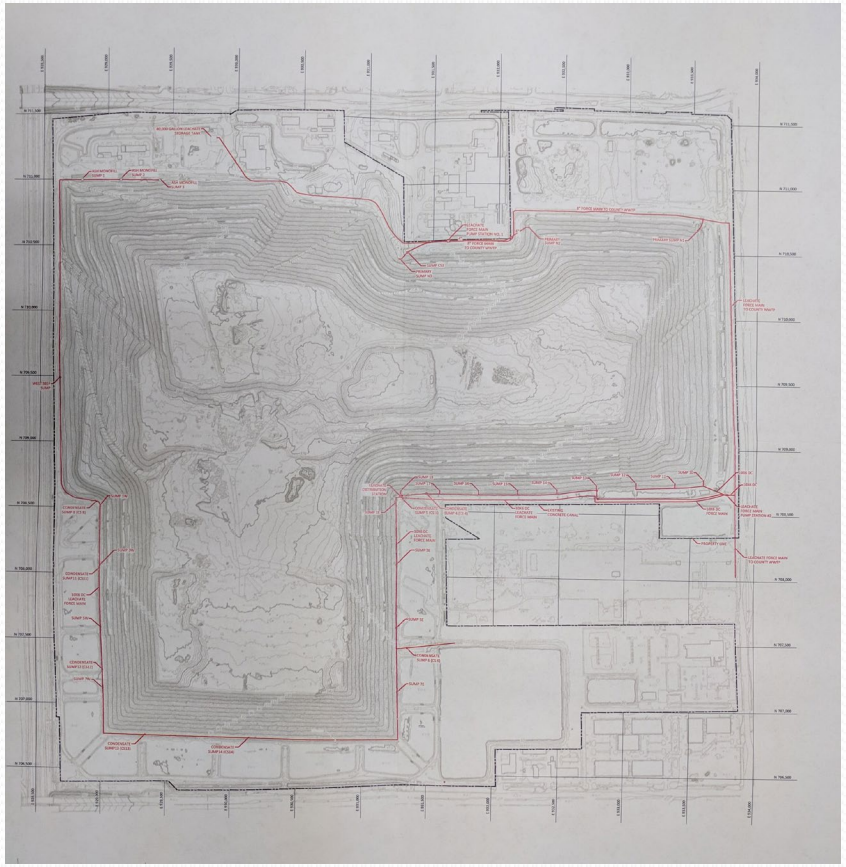
Before

- Operating Pressure: 80-100 psi
- Multiple pumps per station
- Booster pump Stns-2
- Flow rates: 5-25 gpm per pump

After

- Operating Pressure: 5-10 psi
- Single pumps in Auto
- Booster pumps taken off line
- Flow rates: 55-100 gpm per pump

Time reduction on liner?



Chemical Cleaning

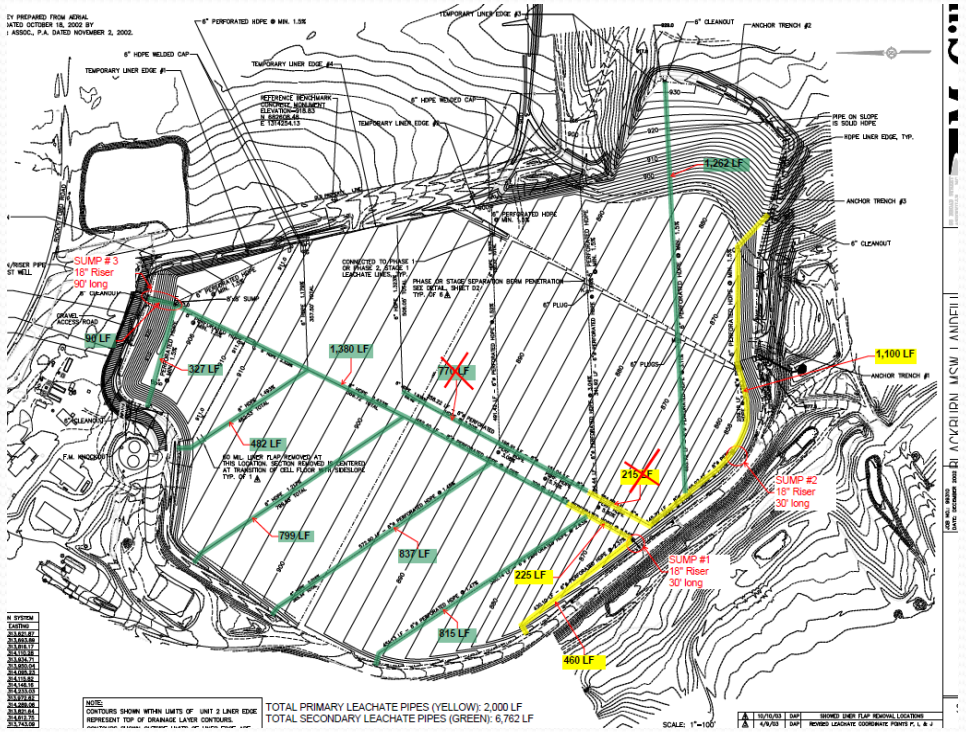
Side Slope Risers & LCS Line

Before

- Monthly discharge of 100,000 gallons per month.

After

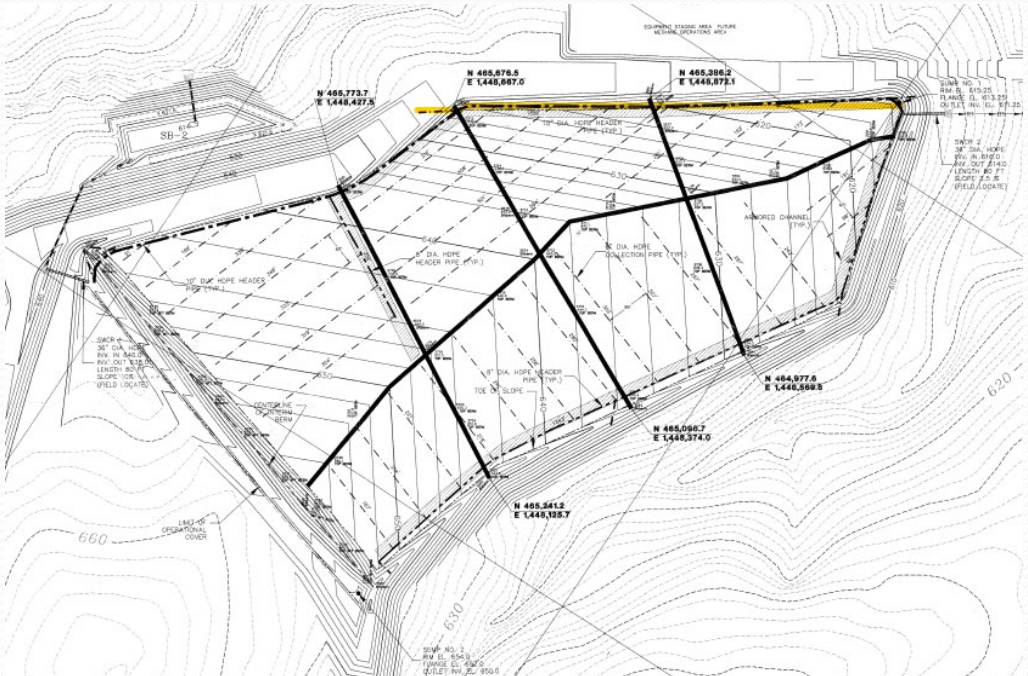
- Monthly discharge of 500,000 gallons in month post cleaning



Time reduction on liner?

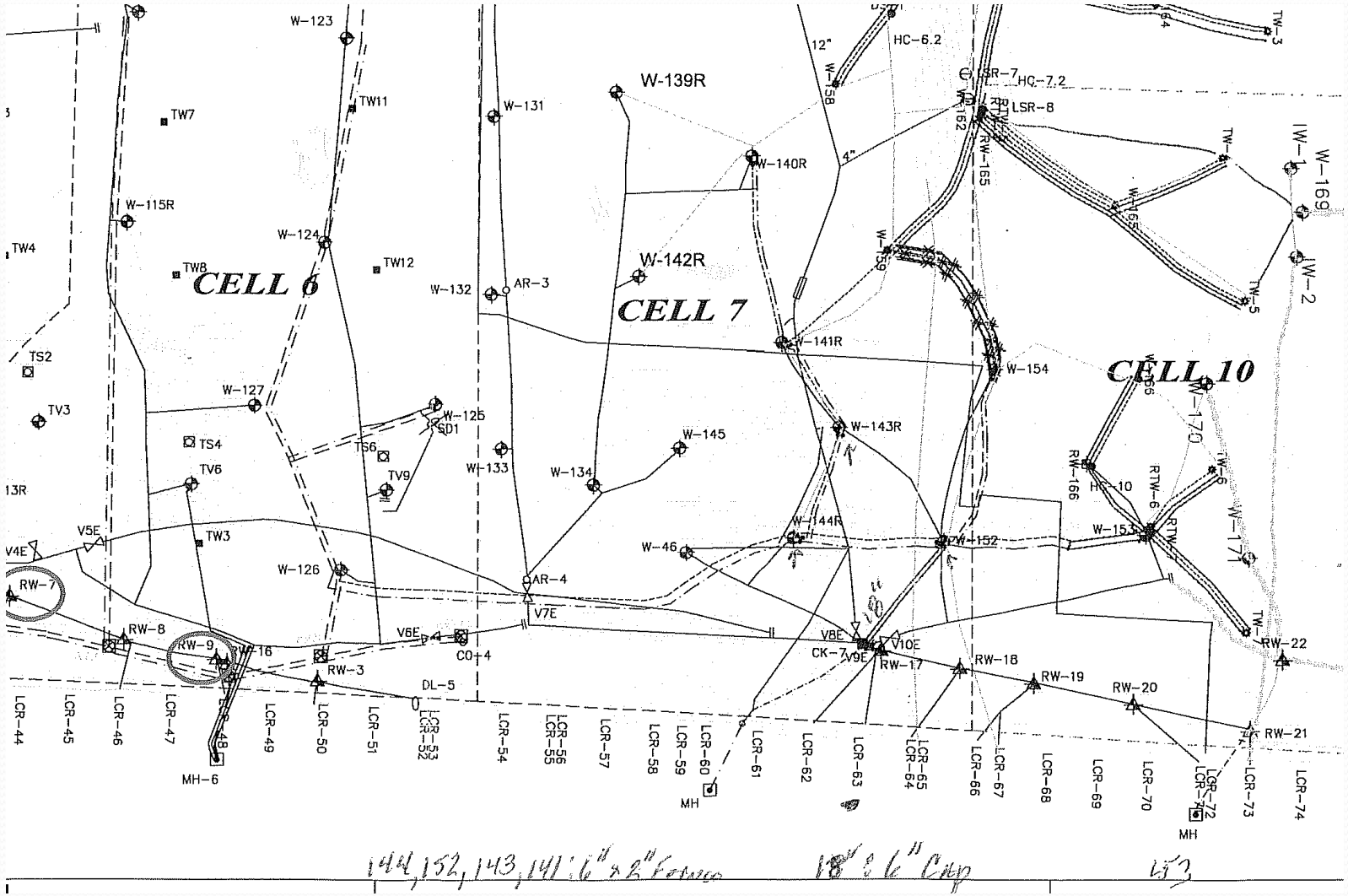
C & D Landfill

- Gravity Main & LCS blockages
- Severe Seeps on LF side
- Perforated LCS, GMs and Manholes.
- Cleaning next to site discharge: Neutralization



Landfill Gas Systems

Chemical Cleaning – LFG Wells



Chemical Cleaning - LFG

Well Data Log Sheet, Monthly Testing Report

Well #	Date Time	PH	PW	D.P.	T°f	OP	CFM	Landfill Gas Analysis: CH4	CO2	O2	Bal.	Status: Well	Valve	Req. Action	Days: 5	15	120
154	01/14/15 9:20	-17.9	-16.9	0.23	99	1.000	5.91	39.6	31.3	3.6	25.5	ACTIVE	OPEN				
154	02/12/15 13:22	-6.8	-6.5	0.20	92	1.000	5.66	32.9	30.9	4.6	31.6	ACTIVE	OPEN				
154	03/18/15 9:17	-11.8	-11.2	0.10	120	1.000	3.79	34.6	33.7	4.5	27.2	ACTIVE	OPEN				
154	04/06/15 13:50	-9.6	-9.2	0.20	105	1.000	5.51	33.2	26.8	2.6	37.4	ACTIVE	OPEN				
154	05/11/15 12:29	-6.2	-3.2	0.24	122	1.000	5.89	57.6	42.4	0.0	0.0	ACTIVE	OPEN				
154	06/03/15 9:48	-5.7	-2.0	0.21	122	1.000	5.51	55.3	44.7	0.0	0.0	ACTIVE	OPEN				

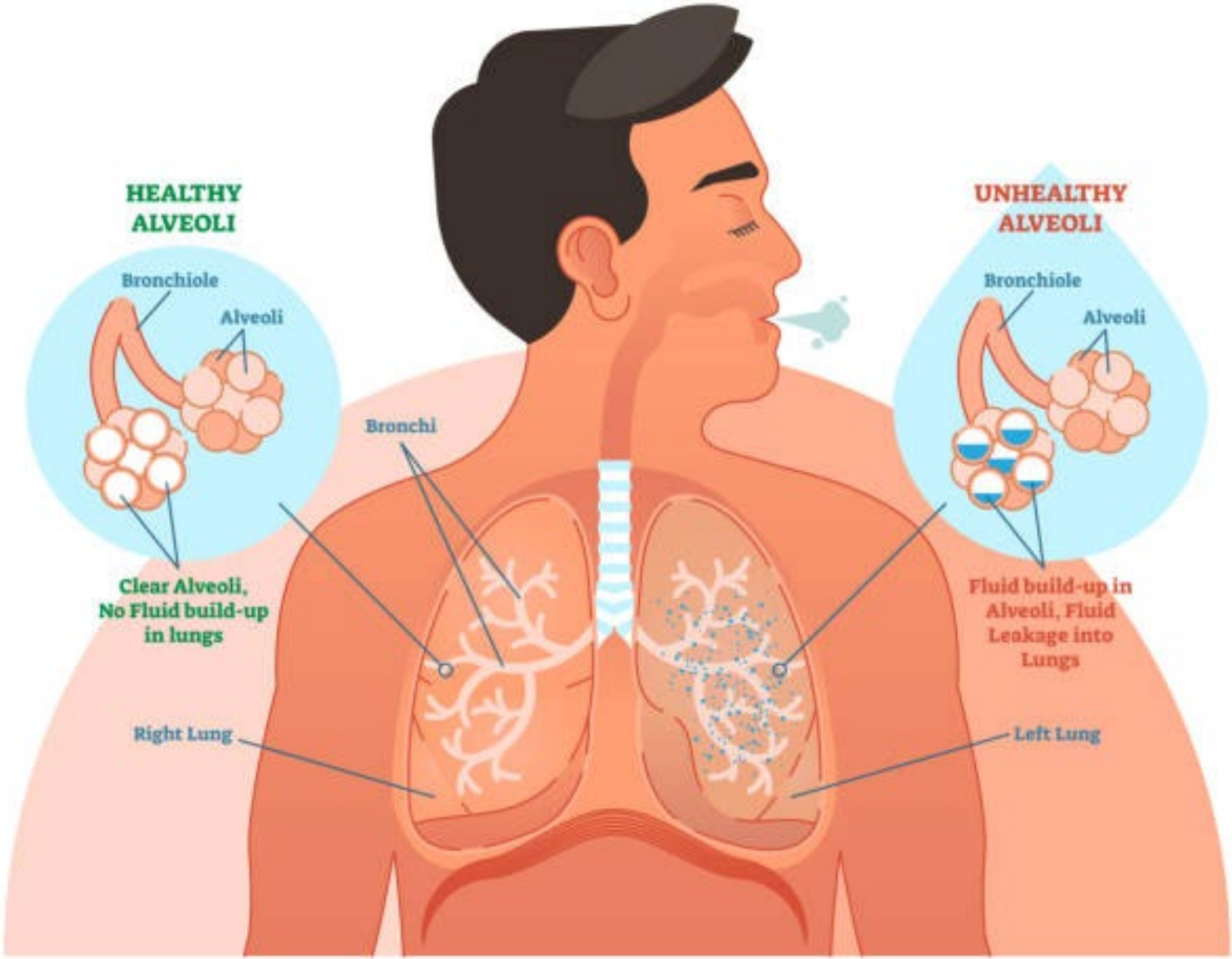
Flooded — Diff. Pressure, header vac, well vac

low DP, equal PH & PW

Jan – Apr 15 ⇒ flooded

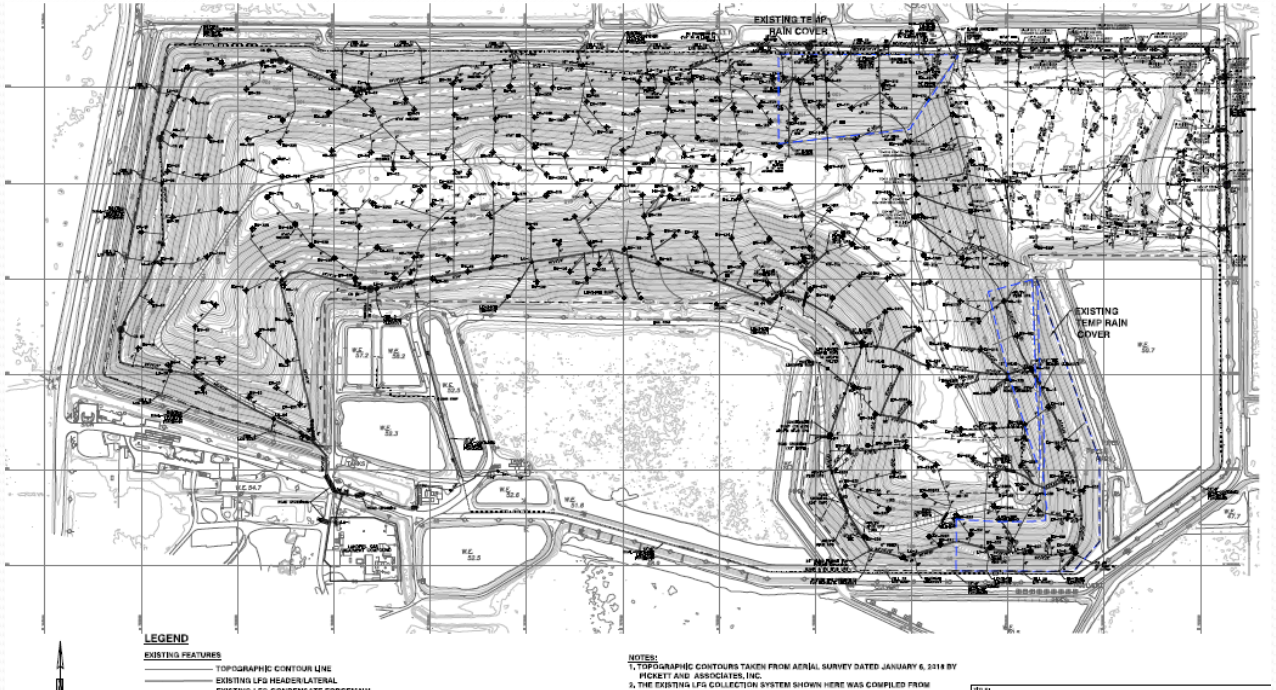
May & June ⇒ ~~bette~~ & higher quality gas

PULMONARY EDEMA



Gas Collection Changes

- Multiple Sumps and Gas Wells
- Following 4 sites now
- Increase Gas output 30-40%
- GTE plant results: Cost of cleaning in 6-8 weeks.



What have we learned

Every landfill has differences and similarities.

Cells within landfills have differences and similarities

High leachate levels from heavy scaling and Goo are a common major problem

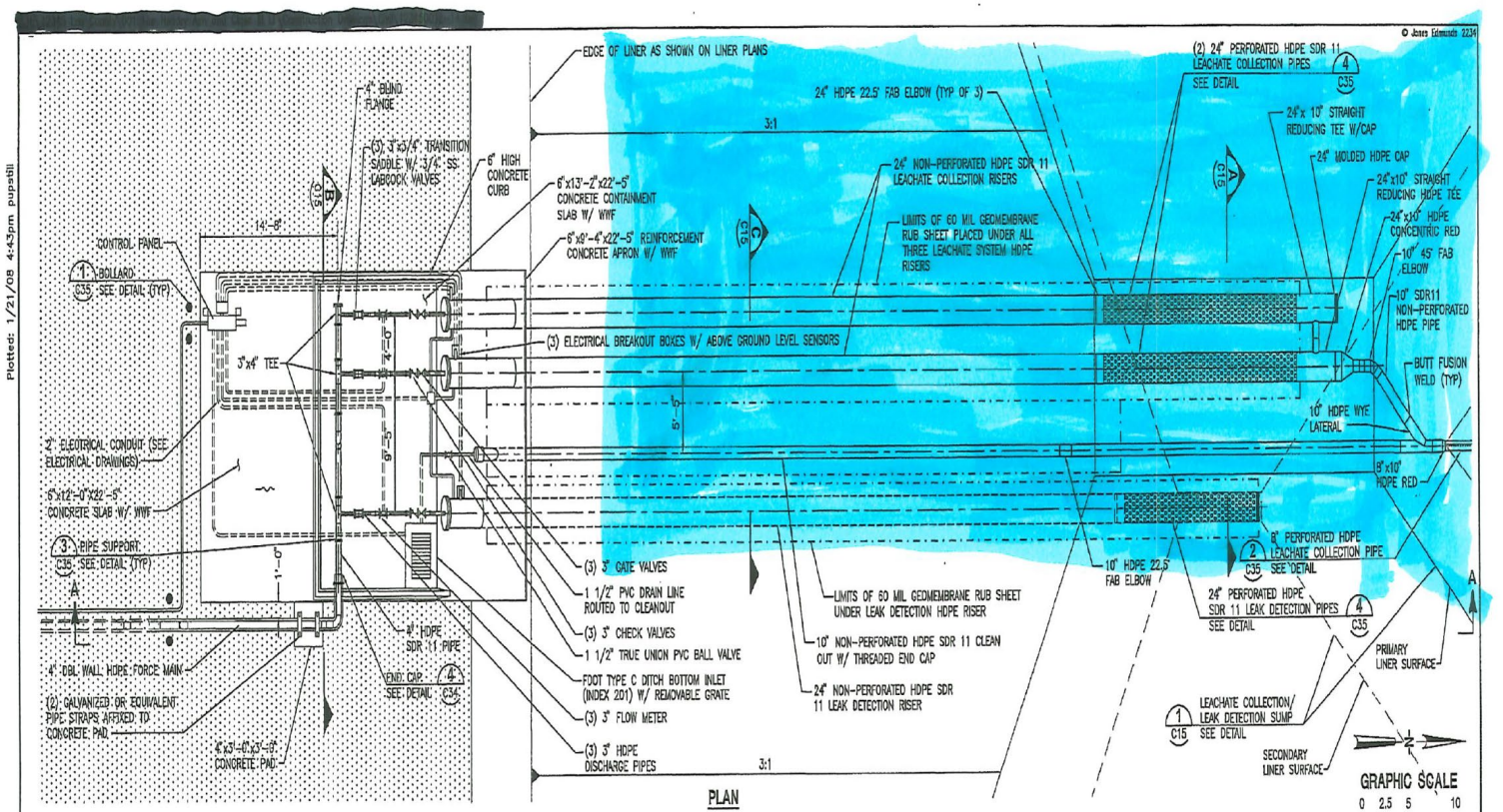
What have we learned

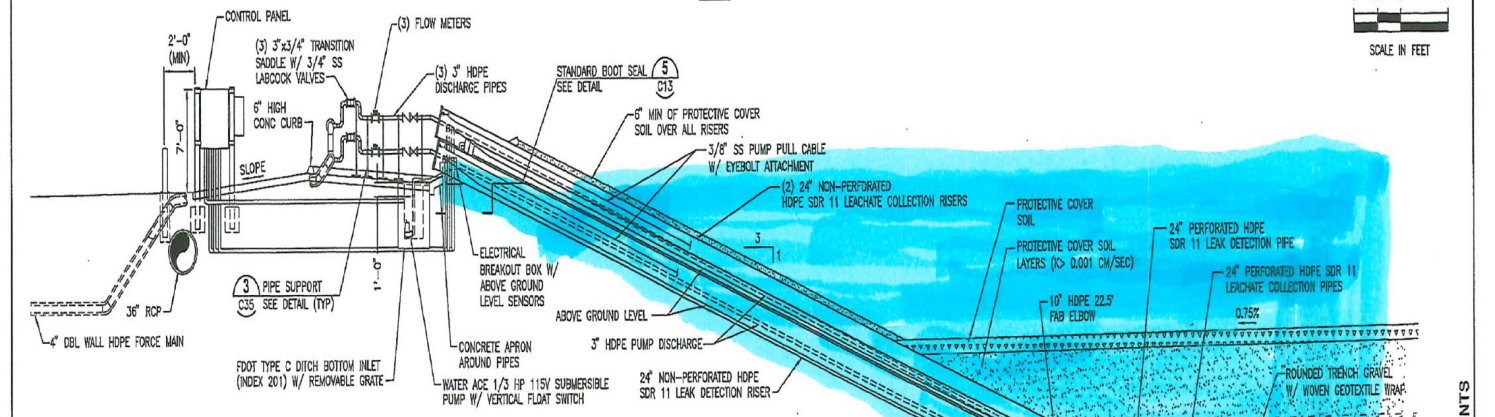
Goo progressively gets worse.

Goo can travel from cell to cell.

Goos are very similar chemically but they change with age.

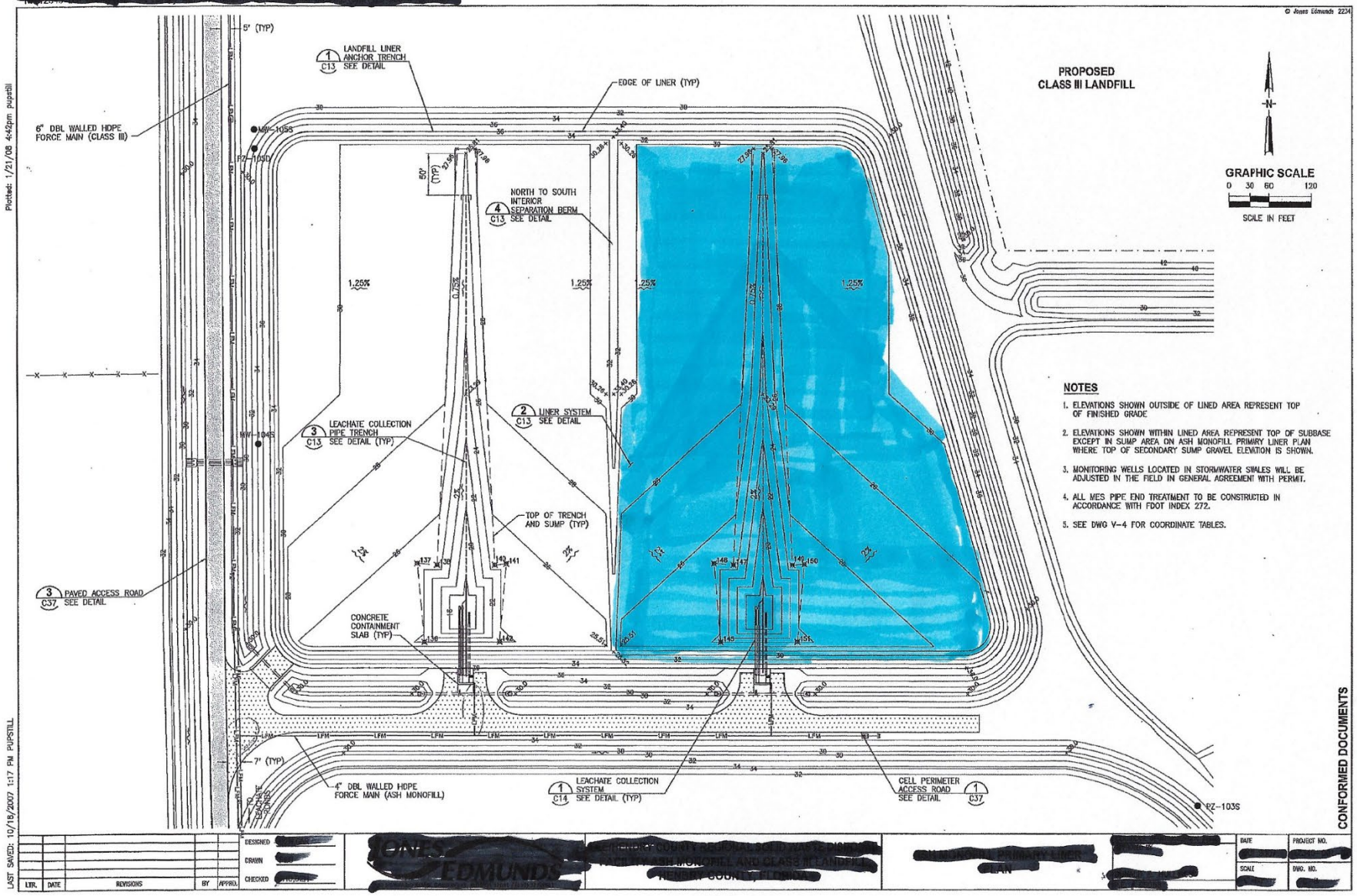
Chemical Cleaning
Re-builds new systems.





LEACHATE COLLECTION PUMP CONTROL POINTS TABLE		LEAK DETECTION PUMP CONTROL POINTS TABLE	
EL (FEET)	SETTING	EL (FEET)	SETTING
19.5	HIGH LEVEL ALARM	18.05	PUMP ON
18.75	LAG PUMP ON	14.55	PUMP OFF
18.25	LEAD PUMP ON	14.0	LOW LEVEL ALARM

NOTE
RAIN TARP NOT TO BE INSTALLED IN SOUTHWEST QUADRANT OVER SOUTHERN PORTION OF WESTERN COLLECTION SYSTEM. RAIN TARP OVER EASTERN COLLECTION SYSTEM NOT SHOWN FOR CLARITY.

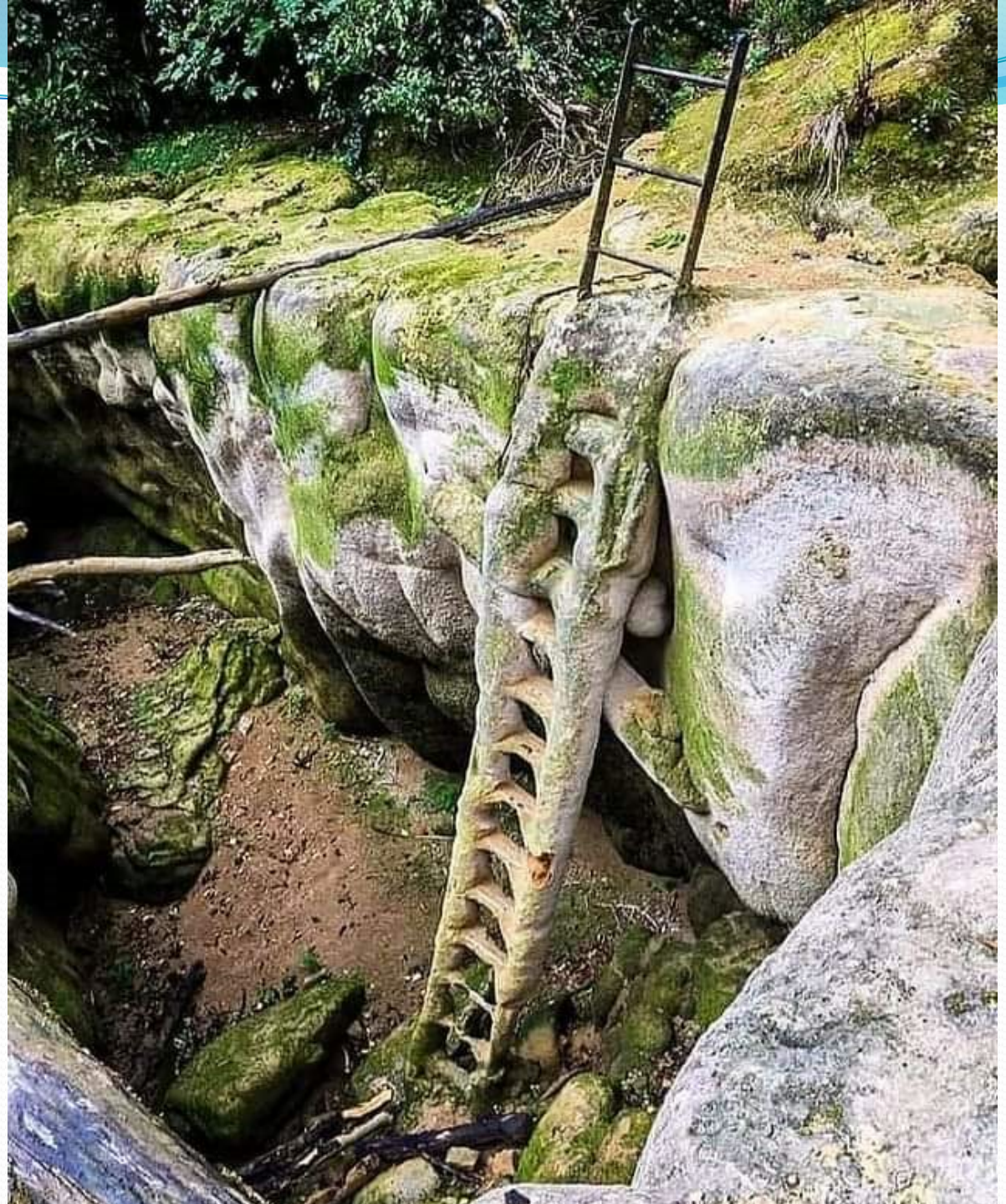

© Jones Edmunds 2234
PROPOSED
CLASS III LANDFILL
GRAPHIC SCALE
0 30 60 120
SCALE IN FEET
NOTES
1. ELEVATIONS SHOWN OUTSIDE OF LINED AREA REPRESENT TOP OF FINISHED GRADE
2. ELEVATIONS SHOWN WITHIN LINED AREA REPRESENT TOP OF SUBBASE EXCEPT IN SUMP AREA ON ASH MONOFILL PRIMARY LINER PLAN WHERE TOP OF SECONDARY SUMP GRAVEL ELEVATION IS SHOWN.
3. MONITORING WELLS LOCATED IN STORMWATER SWALES WILL BE ADJUSTED IN THE FIELD IN GENERAL AGREEMENT WITH PERMIT.
4. ALL MES PIPE END TREATMENT TO BE CONSTRUCTED IN ACCORDANCE WITH FDOT INDEX 272.
5. SEE DWG V-4 FOR COORDINATE TABLES.
1 C13 LANDFILL LINER ANCHOR TRENCH SEE DETAIL
EDGE OF LINER (TYP)
6" DBL WALLED HDPE FORCE MAIN (CLASS III)
MW-103S
PZ-103D
MW-104S
4 C13 NORTH TO SOUTH INTERIOR SEPARATION BERM SEE DETAIL
2 C13 LINER SYSTEM SEE DETAIL
3 C13 LEACHATE COLLECTION PIPE TRENCH SEE DETAIL (TYP)
TOP OF TRENCH AND SUMP (TYP)
3 C37 PAVED ACCESS ROAD SEE DETAIL
CONCRETE CONTAINMENT SLAB (TYP)
4" DBL WALLED HDPE FORCE MAIN (ASH MONOFILL)
1 C14 LEACHATE COLLECTION SYSTEM SEE DETAIL (TYP)
CELL PERIMETER ACCESS ROAD SEE DETAIL 1 C37
PZ-103S
5' (TYP)
7' (TYP)
50' (TYP)
1.25%
0.75%
CONFORMED DOCUMENTS
Plotted: 1/21/08 4:42pm pupstill
LAST SAVED: 10/18/2007 1:17 PM PUPSTILL
DESIGNED
DRAWN
CHECKED
LTR. DATE REVISIONS BY APPRO.
DATE
PROJECT NO.
SCALE
DWG. NO.

Know your Gravel Pack

(also please share with PES…Please.)

Calcium Carbonate (lime) Travels

Adjust expectations



What have we learned

Transducers Scale

Timing of sump pump & recharge plus level confirmation for assessment

Scheduled/Routine maintenance for system integrity is better than crisis fix.

What have we learned

The longer you wait the worse it gets.

Severe Goo/Scaled Cells require cleaning 2-3 times before clearing up.

Severe Goo clogs Gas Wells and reduces gas collection.

Planned cleaning programs stay ahead.

“P&WR Goo” Injection for Maintenance

Design & Operational Considerations

- Correlation between precipitate formation & leachate flow.
- Access to the system in future designs.
- CDMSmith
  - Minimal flow / stagnant conditions create saturated zones, allowing formation and growth of precipitate
    - Keep leachate levels as low as possible
    - Minimize outflow response time
- PES Hypothesis (working with EREF-Dr. Craig Benson)
  - Perched Leachate leads to “Goo”, “Flubber”, “Jelly”, etc.
    - (Maybe?.....Probably): Other contributing factors.

PROGRESSIVE
ENVIRONMENTAL SERVICES

Questions, Answers and Surmisals

"Protecting the Environment is a daily choice."

Rodney Hamby,
Landfill Superintendent, Catawba County, NC

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