Overview Sampling Protocols and Methods

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AQUA **TEST**
INCORPORATED

Aqua Test Inc.

- Formed in 1986
- Primary function was operation of commercial wastewater treatment Systems
- Operate approximately 1.5 Million GPD
- Certified Environmental Testing Laboratory

Sampling Overview

- Minimum level of credentials/certifications
- Understand the purpose of wastewater sampling
- Typical Sample Parameters
- Equipment
- Identify proper sample collection and handling procedures.
- Documentation related to sampling event

Credentials/ Certifications

- Locally recognized training facility
- Manufacturer rep
- Credibility
- Defensibility

Sampling purpose

- System operation
- Troubleshooting
- Manufacturers requirement
- Compliance for regulatory purposes

Sample Purpose Dictates

- Analysis methods
- Timing of sampling
- Sampling location
- Sample collection
- Sample containers
- Sample volume
- Sample transport
- Laboratory
- Interference

The Goal of Any Sampling Event?

- Representative
- Reproducible
- Defensible
- Useful

System Operation- Nutrient Removal

- Field kits are a viable option
    - Non compliance
    - Information is available immediately
    - System "tweaks" occur immediately

Compliance Monitoring: Biological

- System usage- peak flow
  - Day after Thanksgiving
- Is the site operating properly?
  - Disinfection equipment working
  - Blowers are on
- Laboratory sample acceptance times
- Distance from site to lab

Manufacturers Requirements:

- System guarantees
- Surrogate testing
  - Field testing of a constituent
  - Lower cost

Minimum Equipment and Tools

- Gloves
- Safety Glasses
- Disinfection solution
- Sampling Equipment
- Field instruments / Chemistry Kits
- Sample Bottles with labels and documentation
- Distilled water
- Cooler with blue ice
- Imhoff cone

• Thermometer

• Tool used to measure sludge levels

• Sample collection tool   • Imhoff cone

• Distilled water wash bottle

• pH measuring device

• DO and Temp meter

• DO test kit—

1 to 12

• DO test kit—

0 to 1

• Pocket pH meters & buffer for calibration in the field

Typical Sample Constituents

- BOD5
- CBOD5
- TSS
- F.O.G.
- Cl-
- Nitrogen Species, TKN, NO3, NH3
- Phosphorous
- Biological
  - Fecal and/or Total Coliforms

Sample containers

- Types of containers
  - Glass
  - Polyethylene
- Test specific
- Check with laboratory
- Clearly label the sample container with water proof markings
- Water tight

Sampling requirement examples

- Biochemical oxygen demand (BOD)
  - Container - polyethylene or glass
  - Preservation - 4°C (ice)
  - Maximum holding time - 48 hours

- Oil and grease (FOG)
  - Container - glass
  - Preservation - 4°C and add HCL or H_2SO_4 to pH<2
  - Maximum holding time - 28 days

- Fecal coliforms
  - Container - polyethylene or glass
  - Preservation - 4°C and 0.008% $Na_2S_2O_3^5$
  - Maximum holding time - 6hrs

Sample volume

- Test dependent
- Rule of thumb
  - Quart/Liter
- Check with laboratory
- More tests = more sample
- Cleaner water = more sample
- Fill the container
  - No air gap

Composite, integrated, and grab sample

- Grab sample- one sample taken from one point and time
  - Gives an idea of what is happening right then
- Integrated sample-
  - Combination of grab samples collected at the same time but at different locations.
- Composite sample-
  - Multiple samples taken from one point at multiple times and integrated together for analysis
  - Pulled from a location that provides a composite.
  - Multiple grab samples at different flow periods.
  - Averaging over the course of a day

Grab vs. Composite Sampling

Grab

- A septic tank is a composite sample

    -Typical septic tank is 1000 gallons

    -Typical daily flow is 200 gpd

    -This provides a 5 day composite sample

A system operating at design flows of 450 gpd will have an approximate 2 day composite sample

Grab sampling is considered controversial by some

- No standardized protocol
- Varying Detention Times affect results
- Peak vs. low flow affect results

Composite Sampling

- Typically used in wastewater treatment process
- Requires expensive equipment
- Labor intensive
- Method chosen is time or flow paced

Comparison of Grab and Composite samples

- A grab sample is a single sampling event
- A composite sample may be developed from multiple grab samples or through a composite sampler

Analytical Constituent Requirements

Standard Methods for the Examination of Water and Wastewater. 20th ed

Grab Required	Grab or Composite
Alkalinity	BOD_5
Oil & Grease	Nitrogen species
Dissolved Oxygen	Solids
pH	Phosphorous
Temperature	
Biological	

Example 1			
Sample I.D	pH	Dissolved Oxygen mg/L	BOD_5 mg/L
Initial Grab	6.25	.65	243
Mid Point Grab	6.60	.47	245
Final Grab	6.72	.46	238
Composite Sample Based on Grabs			242
Composite automated	7.12	5.19	215

Example 2

Sample I.D	pH	Dissolved Oxygen mg/L	BOD_5 mg/L
Initial Grab	6.25	.65	243
Mid Point Grab	6.61	.55	230
Final Grab	6.65	.75	222
Composite Sample Based on Grabs			232
Composite automated	6.81	5.45	207

Peak Flow Sampling		
Sample Number	Flow	BOD$_5$ mg/L
1		275
2	11.2	267
3	39.64	256
4	1.5	266
5	20.2	252
6	71.8	211
7	6.0	220
8	129.4	190

Summary Results	
Composite	242 mg/L
Flow Weighted Composite	227 mg/L
Daily Flow	280 gpd

Sampling safety

- Use proper Personal Protection Equipment
  - Gloves
- Never enter confined spaces
- Be cautious of toxic gases
- Disinfect hands and equipment

Usually samples are collected from the following points:

- Pressure distribution - pump tank
- Gravity system - outlet of the septic tank
- Propriety system - use manufacturers' recommendations

Influent vs. effluent

- Influent samples are collected from the beginning of a component.
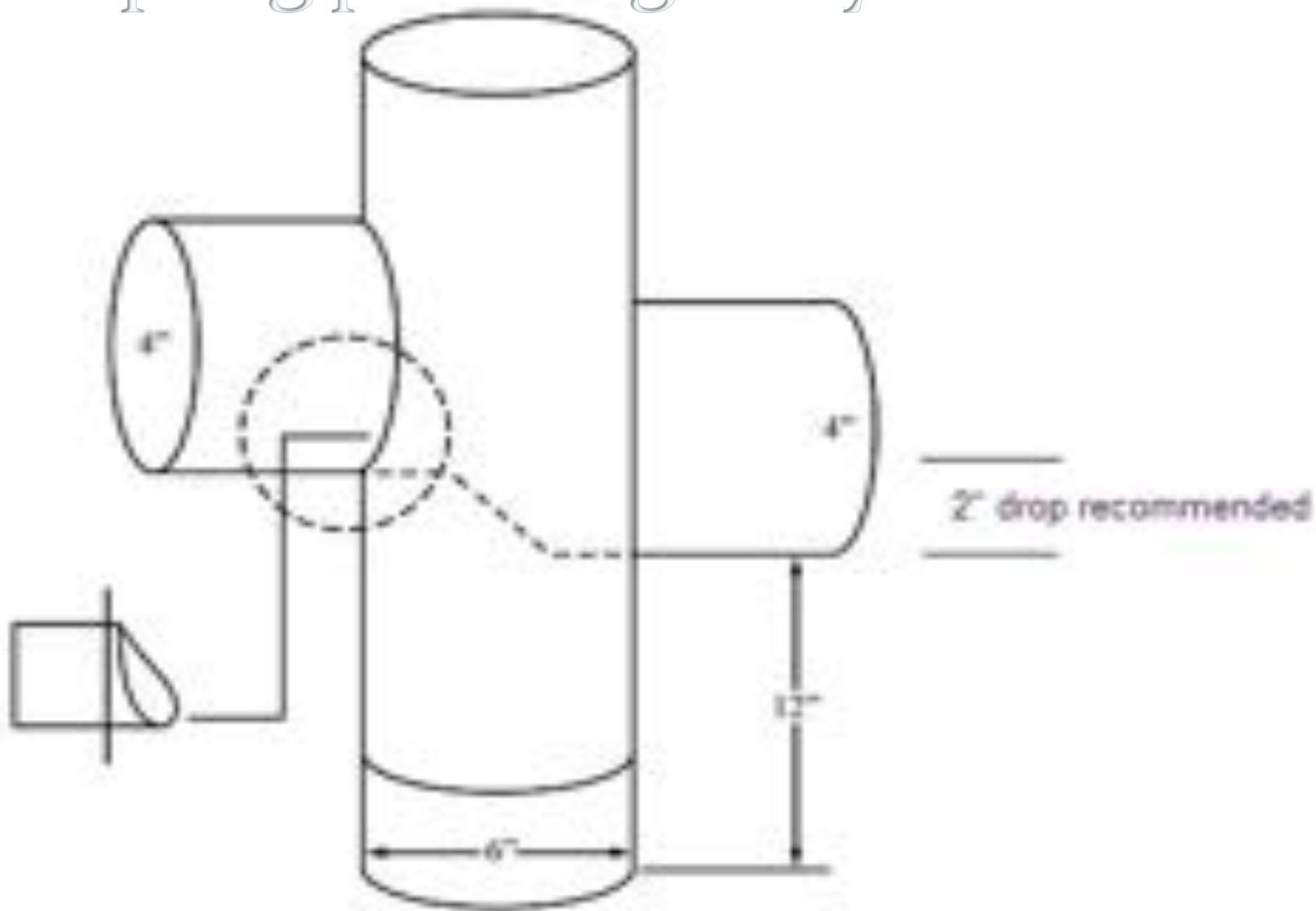- Effluent sample is collected from the outlet of a component.
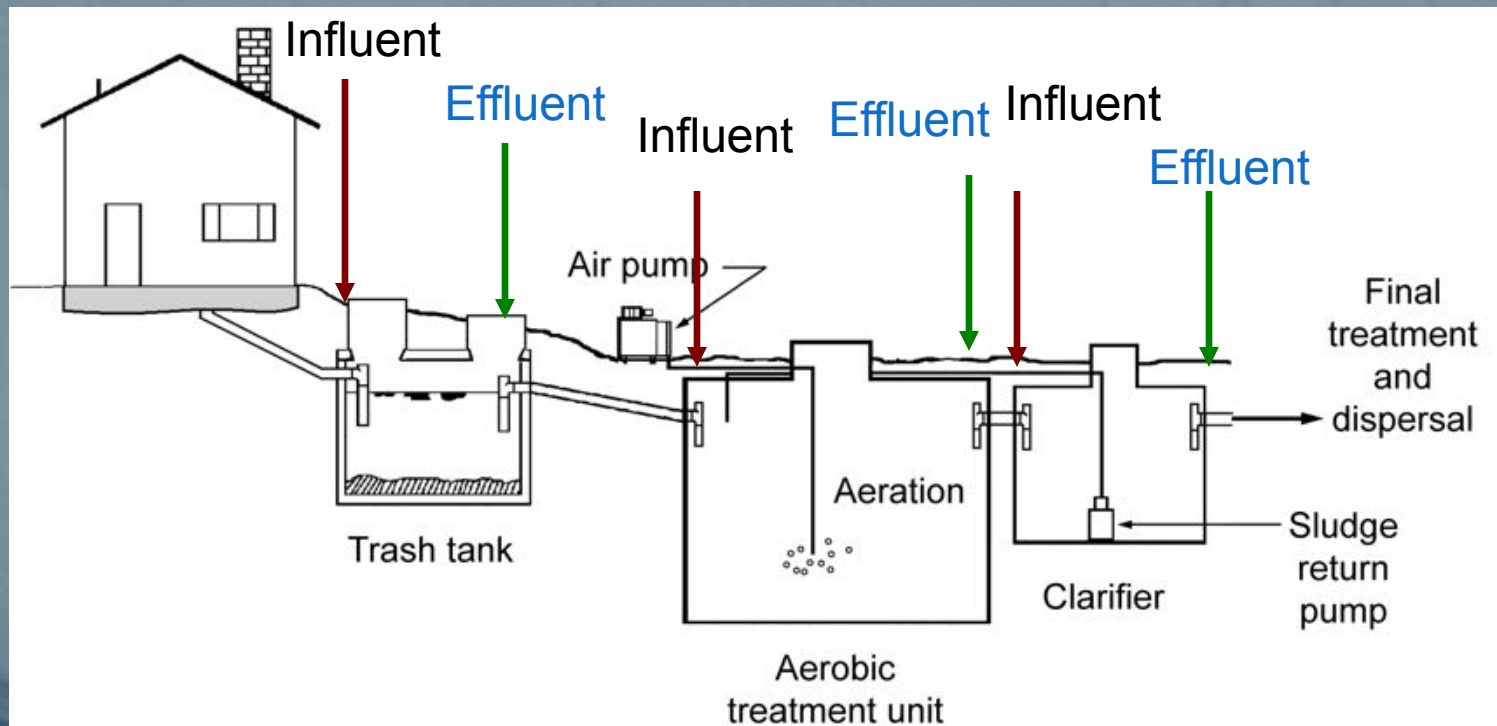
Sampling location

- Depends on test
- Process performance
- Best – external sampling port
- Outlet baffles
- Discharge from system
- Consistency

Single-compartment trash tank

Chlorinator

Spray heads

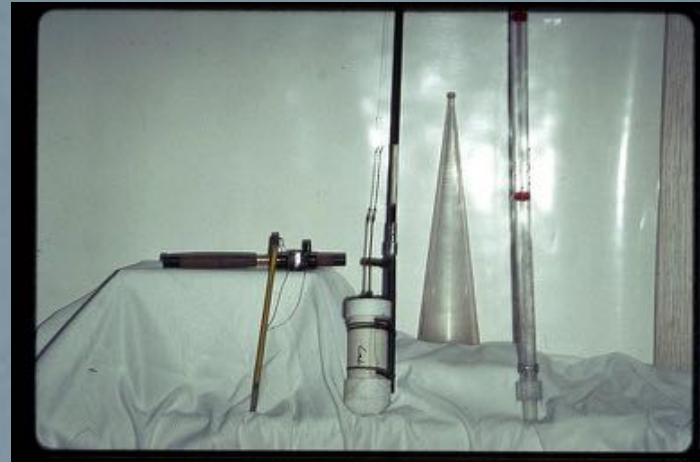Aerobic treatment unit
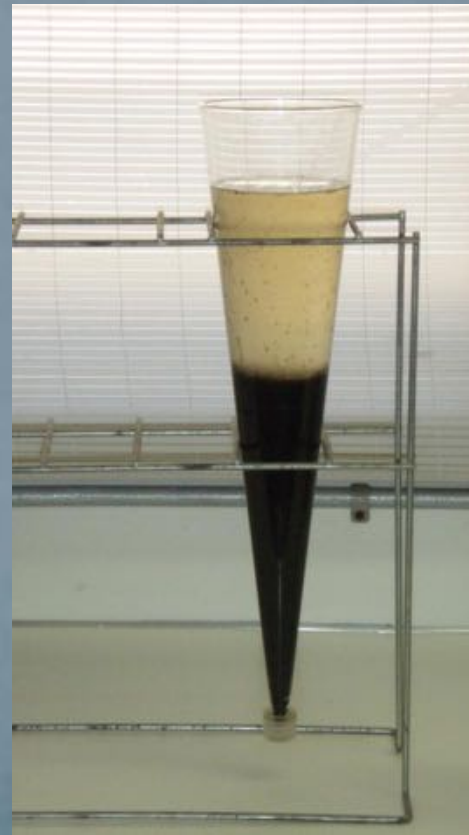
Pump tank
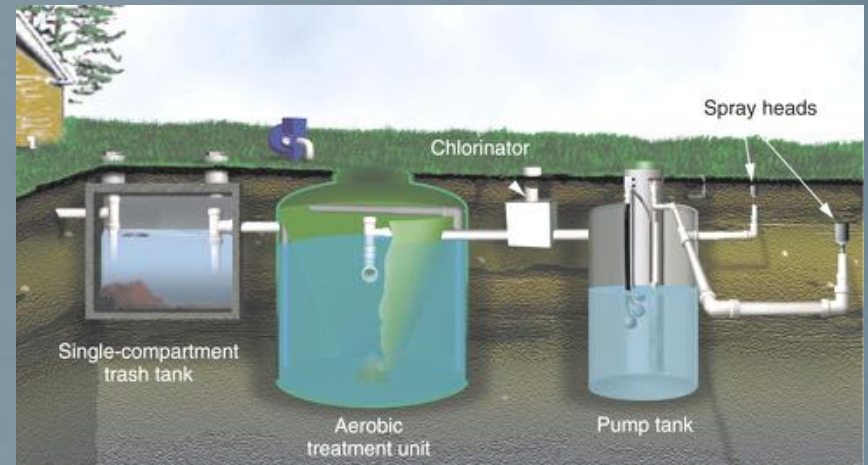
Sampling port for gravity line

Sample collection

- Selecting right tool for the job.
  - Sludge judge
  - Dip stick
  - Sample bottle
  - Dipper
  - Vacuum pump
- Use clean collection equipment
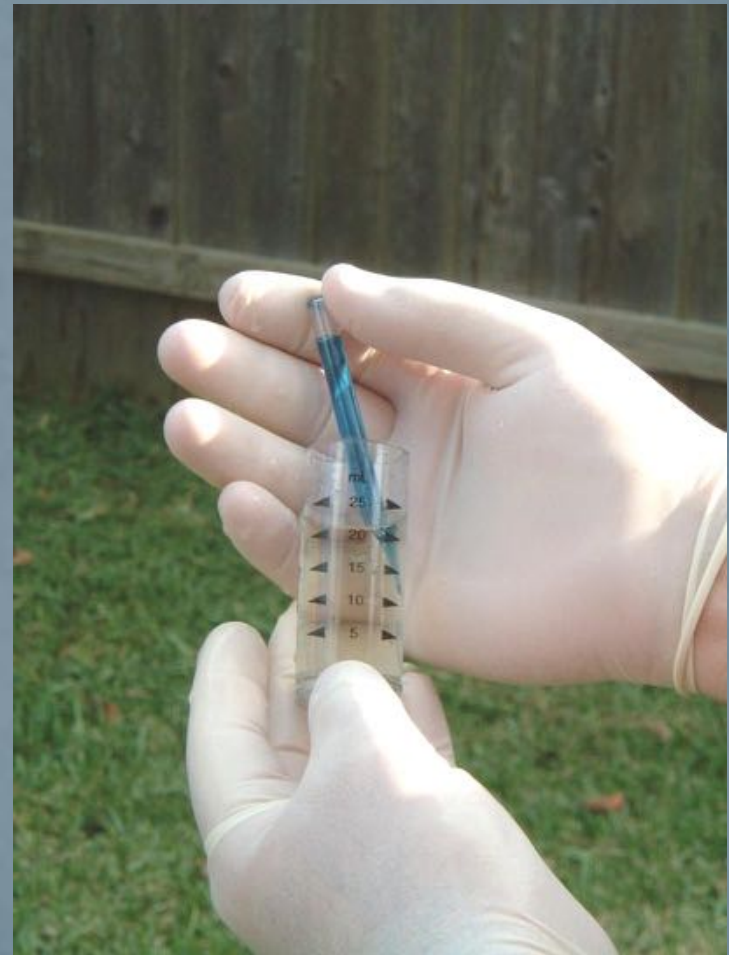- Collect from "cleanest" end first

Outlet Baffles and Test Ports:

- Care must be taken not to entrain Bio-growth
- Use an Imhoff Cone

Onsite analysis methods

- Dissolved oxygen
  - Measured at sample source
- pH
- Temperature
- Turbidity
- Chlorine residual
- Odor

Laboratory analysis methods

- BOD_5
- CBOD
- COD
- Solids
- TSS
- TN
- TP
- Chloride
- Alkalinity
- FOG
- Fecal / Total Coliforms

Sampling documentation

- Chain of custody
  - Name of person collecting sample
  - Each person having custody (w/ date and time)
  - Sample number
  - Sample description
  - Qc/Qa
  - Required for lab validation of results

A sample is in your "custody" when:

- It is in your actual physical possession.
- It is in your view, after being in your physical possession.
- It was secure beyond a reasonable doubt if not in your view.

CHAIN OF CUSTODY RECORD

Lab ID No: _____

This information will be used for reporting/billing

Name: _____

Attention: _____

Address: _____

_____

Phone: _____

Lab Use	Sample ID /Collection Point	Collection Data				No. of bottles	INSTRUCTIONS: use one line per sample & indicate tests to be performed by checking appropriate boxes												Notes
		Date	Time	Comp.	Grab		BOD$_5$	TSS	O&G	pH	FC	TC	TKN	NH3-N	NO$_2$	NO$_3$			

Samplers Signature: _____

Print Name: _____

Relinquished To Lab By: _____

Special Instructions - Client:

Shipped Via:

☐ UPS
☐ Hand
☐ Other _____

Temperature Acceptable:

☐ Yes   ☐ No

Sample transport

- Ice chest w/ ice
  - Label cooler "not for food"
- Check with lab for constraints on analysis
- Maximum holding time
  - Test must be started w/in the time requirement
- Document COC

Laboratory

- Standard methods
- Testing methods
- Data range
  - Non-detection
  - Greater than X
  - Too numerous to count
- Purpose of the data
- Lab accreditation
  - Check for specific test

Summary

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- Analysis methods
- Timing of sampling
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Thank You!