ROAD WASTEWATER VITAL SIGNS!

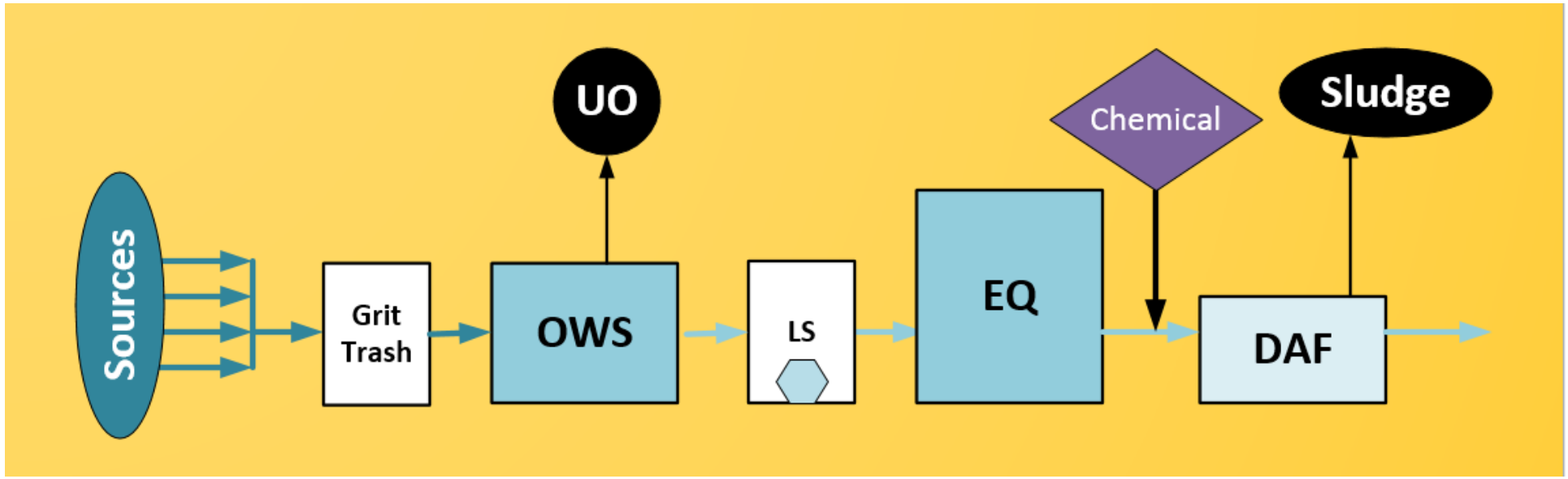
Railroad Environmental Conference

October 25, 2017

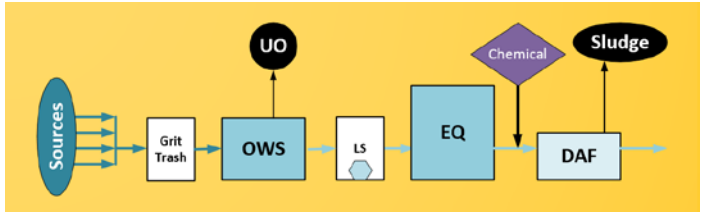
Railroad Wastewater Vital Signs!

- How do you know if your wastewater treatment system is healthy?
- Check these basic vital signs!

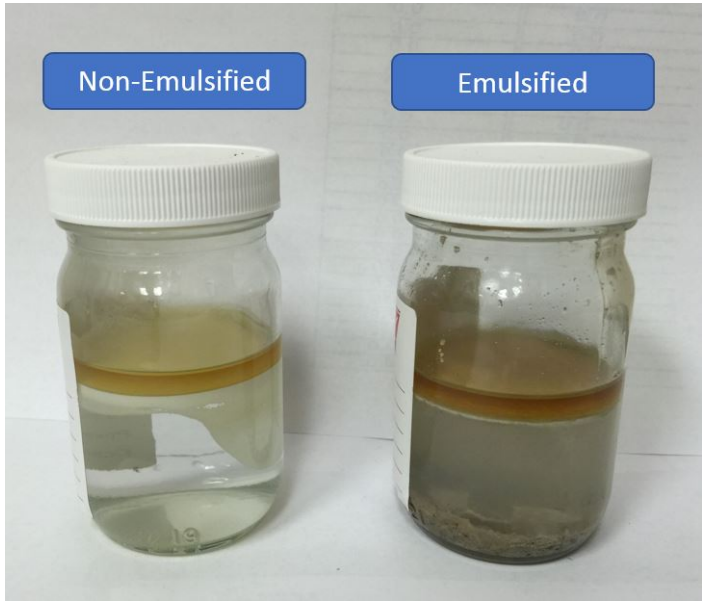
Railroad Wastewater Vital Signs!



Source



1. Inventory – Do you know all the sources? Really?
2. Flowrate & Volume – Process (Dry weather vs. Wet Weather)
3. Character
   - Emulsified vs. non-emulsified
   - Diesel, lube oil, hydraulic oil, sanitary, storm water, remediation, etc.
   - Soap
   - Sand
   - Trash: ear plugs, bottle caps, plastic bags, etc.



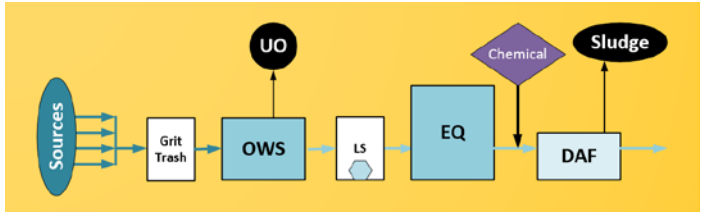
Railyard Wastewater Sources and Pollutants

Wastewater Source	Oil & Grease	Particulates	Fuel	Cleaning Agents	Other Contaminants
Fueling Pads	✓	✓	✓	O	Sand/Trash
Diesel Shop	✓	✓	✓	✓	Sand, Metals/Trash
Tank Car and Truck Unloading Areas	✓	✓	✓		Trash
Engine Maintenance	✓	✓	O	✓	Trash
Wash Bays	✓	✓	✓	✓	Sand/Trash
Parts Cleaner (Proceco Machine)	✓	✓		✓	Metals
Floor Drains	✓	✓	✓	✓	Chemicals/Trash
Stormwater	✓	✓	✓		Runoff Nutrients

✓ = typical pollutant for the given source O = occasional pollutant for the given source

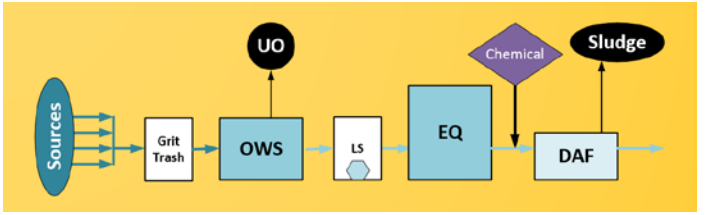
Note: The table above is not a complete list of all industrial wastewater sources and pollutants going to the wastewater treatment plant. Other wastewater sources and pollutants (BOD, Borate, etc.) may be present. For more information, please contact BNSF Environmental.

Collection System



1. Do you know where it is? Mapped?
2. Does it work? Has it ever been cleaned and inspected?
3. Pipe & Structure integrity?

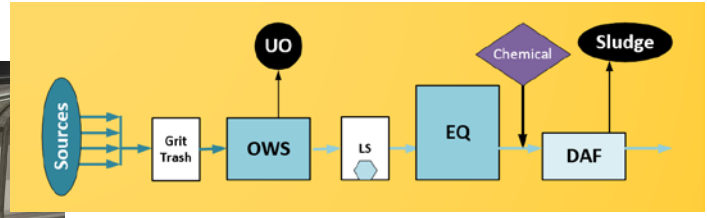
Grit Chamber



1. Does a grit chamber exist?
2. Is it large enough and have dead space to actually settle and retain grit?
3. Has it been cleaned?

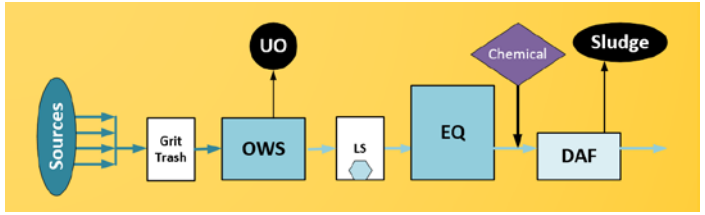
Trash Removal

1. Does a method of trash removal exist?
2. If it exists, does it function?
3. Has it been cleaned?



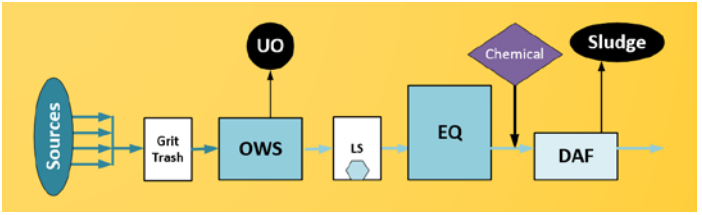
Lift Station

1. Do both pumps function? Have they ever been removed an inspected?
2. Check run time for both pumps. Equal?
3. Discharge pressure?
4. Check valves work?
5. Oil & sludge build up?
6. Centrifugal oil emulsifying pumps?



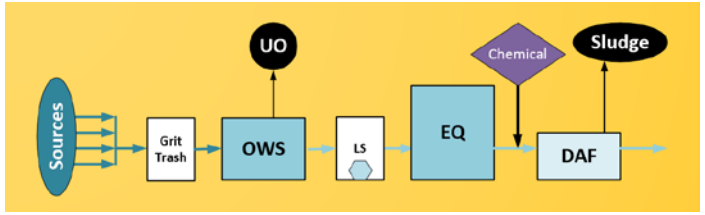
OWS

1. Has it ever been cleaned?
2. Are coalescing packs plugged? Can they be removed?
3. Does used oil removal system work?
4. Do sensors and alarms work?

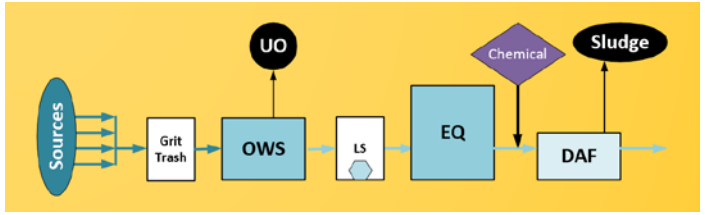


EQ Tank

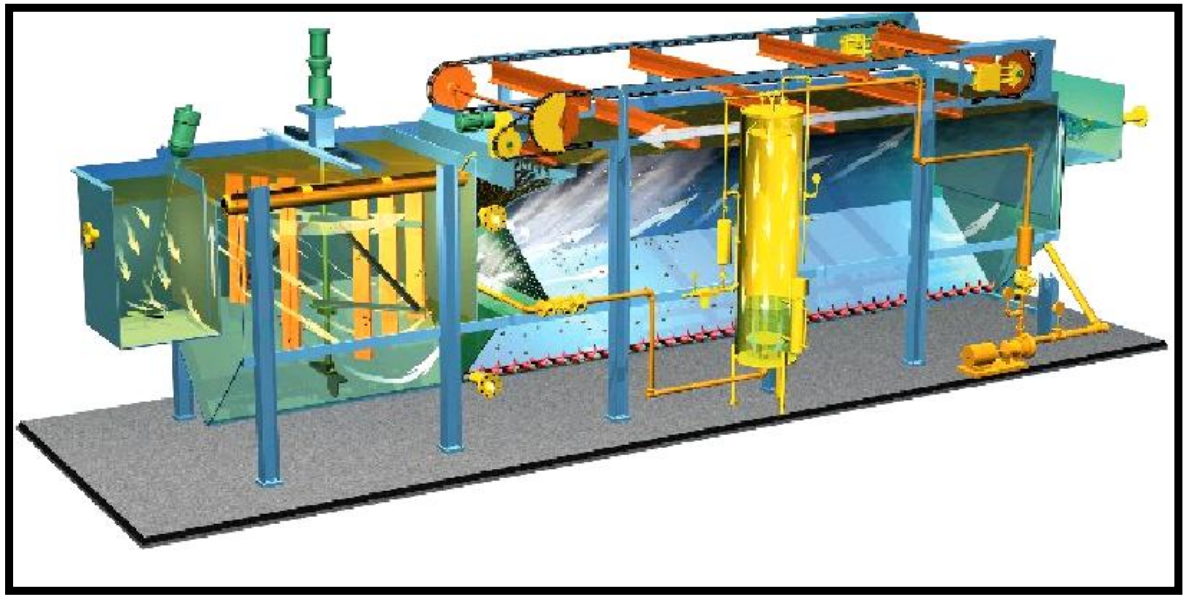
1. Has it ever been cleaned?
2. Is a oil layer floating on top or “pudding skin”?
3. How much sludge is in bottom?
4. Do sensors and alarms work?



DAF

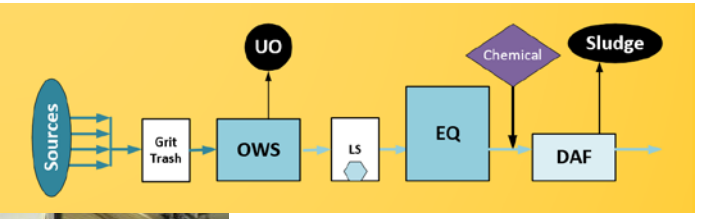


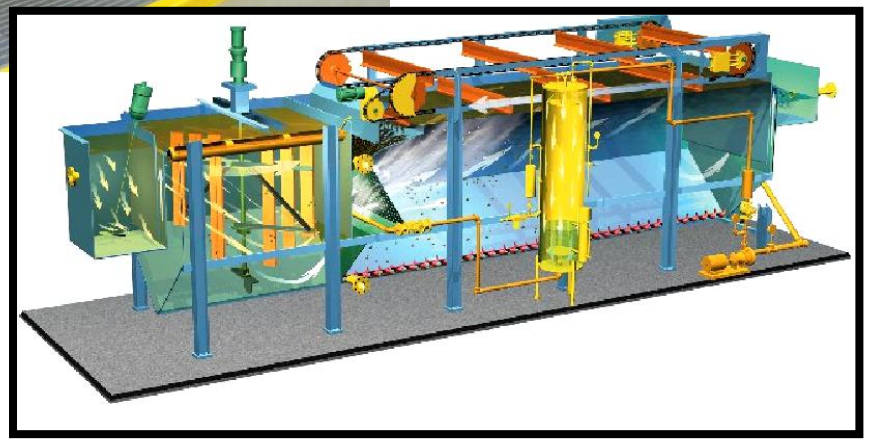
1. Is dissolved air system working?
   - Is it producing “whitewater” or are there large bubbles?
   - Are recycle pressure and flowrate as recommended?
2. How does sludge blanket appear? Not to thick. Not to thin. Not oily. Not to dry.



Chemical Treatment

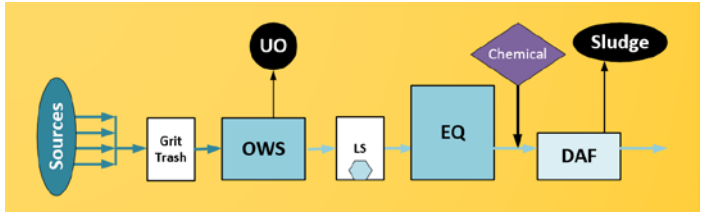
1. Are chemical pumps in working order?
2. Are the chemical still viable? Age? Are they still the “right” chemicals?
3. Are flash and floc mix residence time and energy correct?
4. Does operator know how to jar test? Getting vendor help?
5. Is there floc carry through in DAF effluent?



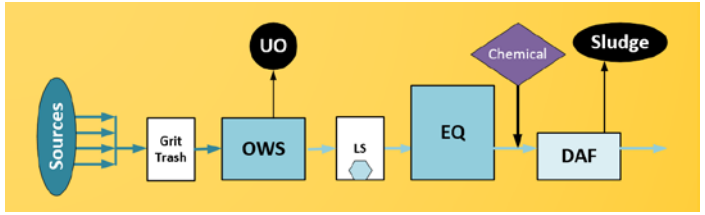


Used Oil Tank

1. Does used oil transfer system work?
2. Can tank be decanted?
3. Do sensors and alarms work?



Sludge Tank



1. Does the sludge transfer system work?
2. Is the sludge in the tank solid?
3. Can sludge be decanted?
4. Do sensors and alarms work?

Questions/Discussion

Thank you!

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Preventing System Upsets

- Emulsified Oil
  - When water and oil are mixed under the right conditions they form what is called an emulsion. If the water is cloudy, it may have emulsified.
- Excess Flow
  - If oily water flows into the separator too quickly it will not have time to separate and will flow right through the oil/water separator without being treated.
- Oily Sludge
  - Light oil and heavy sludge can mix in such a way that they do not float or sink. This oily sludge can pass through the oil/water separator without treatment.

Emulsion

Oily Sludge in the Discharge Tank

Maintenance

- Follow Regular Maintenance Practices
- Empty the sludge chamber regularly to prevent solids buildup.
- Follow a regular schedule for cleaning coalescing media.
- Arrange for removal of captured oil.
- Completely drain and inspect the oil/water separator twice per year.

Clogged Coalescing Media

Partially Drained Oil/Water Separator

Sludge, Oil, and Grease Disposal

Purpose: Dewatered solids, sludge, and separated oil and grease are typically disposed of offsite.

Liquid Sludge Disposal

Dewatered solids are collected to be hauled for offsite disposal

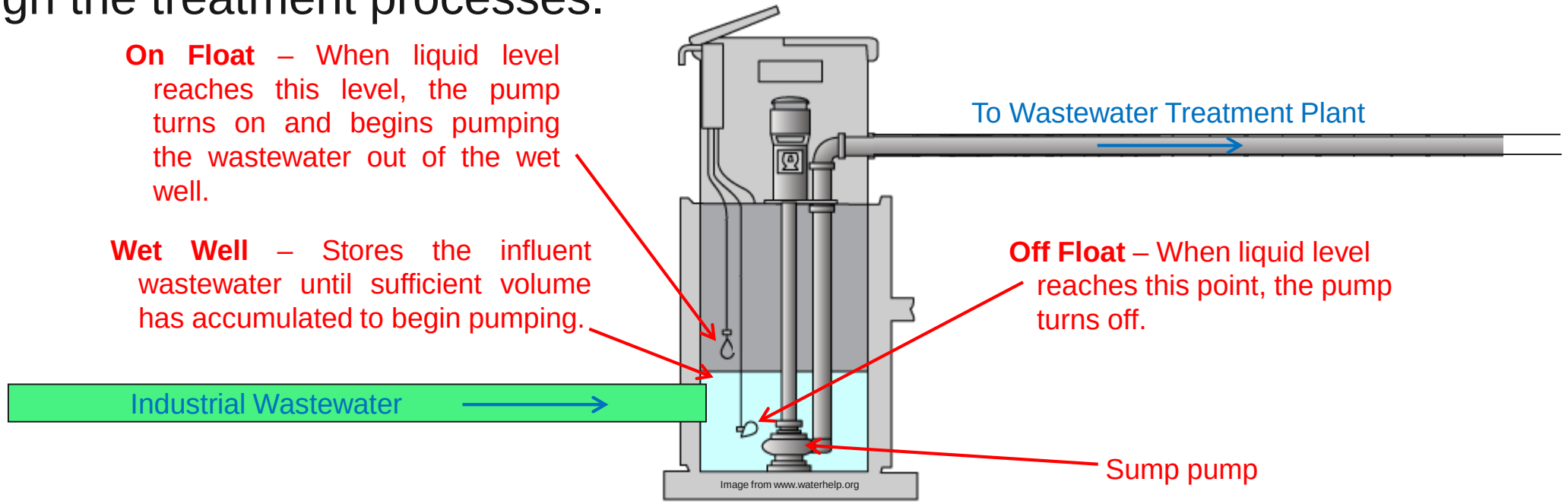
Separated oil and grease can be sold to processing companies for recycling

Influent and Flow Control – Lift/Sump Pump Station

Purpose: Pumps the wastewater up to a high point to allow flow by gravity through the treatment processes.

On Float – When liquid level reaches this level, the pump turns on and begins pumping the wastewater out of the wet well.

Wet Well – Stores the influent wastewater until sufficient volume has accumulated to begin pumping.



Off Float – When liquid level reaches this point, the pump turns off.

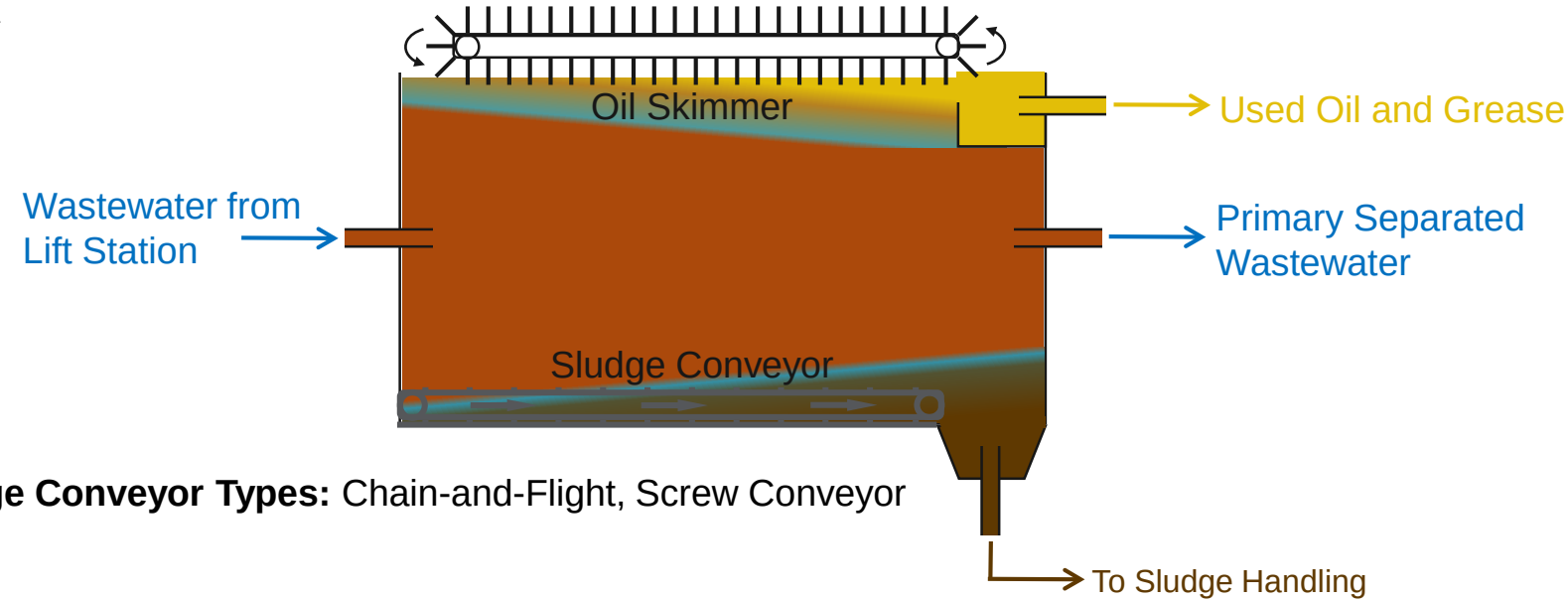
Sump pump

Flow Control: Wastewater often enters the facility in surges, but wastewater treatment occurs most efficiently at a steady flow. The lift station helps produce a more consistent flowrate through the wastewater treatment facility.

Primary Separation

Purpose: To remove the oil, grease, and sludge from the wastewater. Typically accomplished in an oil/water separator.

Oil Skimmer Types: Paddle Skimmer, Belt Skimmer, Floating Drum Skimmer



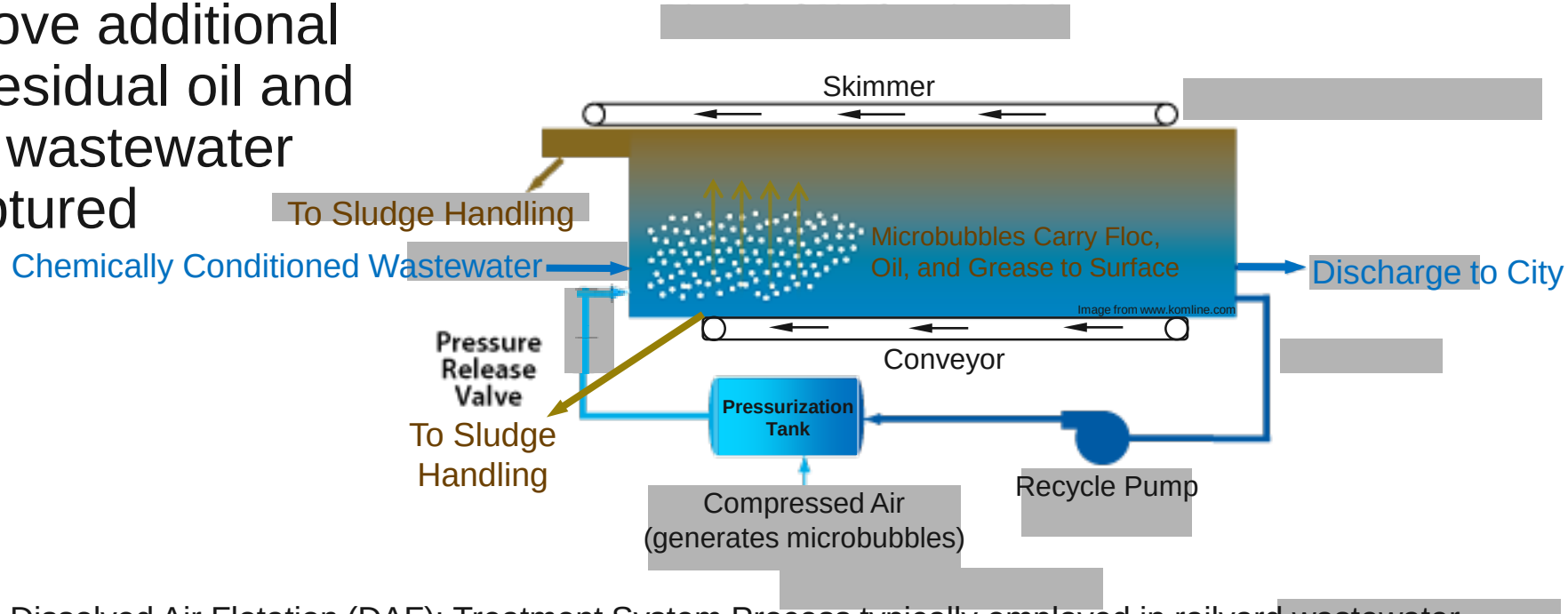
Sludge Conveyor Types: Chain-and-Flight, Screw Conveyor

Oil and grease float to the top, where a skimmer pushes the material to a trough for disposal.

Grit and other solids sink to the bottom and form a sludge layer. A conveyor transports the sludge to an outlet to be processed further in another process.

Treatment System

Purpose: To remove additional pollutants (floc, residual oil and grease) from the wastewater that were not captured in the primary separation.

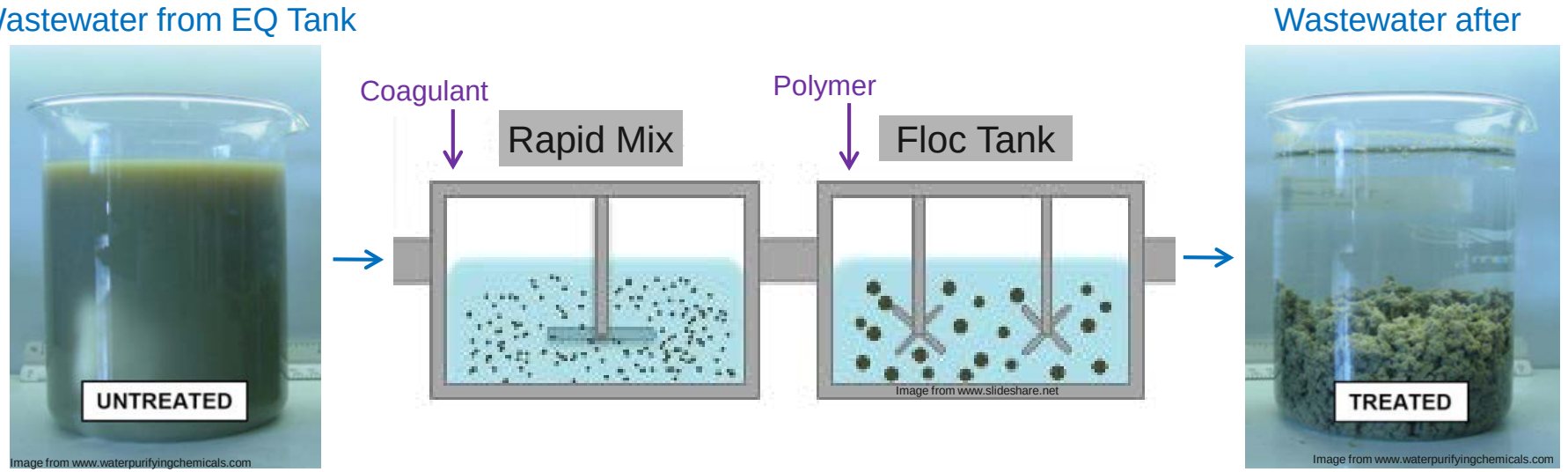


Dissolved Air Flotation (DAF): Treatment System Process typically employed in railyard wastewater systems. Compressed air is dissolved in the wastewater, which is then released in the process to form microbubbles in the DAF tank. The microbubbles capture floc/oil/grease and float the sludge to the surface, where a skimmer pushes the accumulated material to an outlet to the sludge handling system.

Instead of DAF, some facilities use a second oil/water separator (as with the primary separation process described previously) or a clarifier for the treatment system.

Chemical Conditioning

Purpose: To promote removal of pollutants from the wastewater. Adding chemicals to clump together small particulates to form dense “flocs” that are easily separated from the water.



A chemical called a coagulant is added to the wastewater in a rapidly mixed tank. This gives the particles an affinity for one another, enabling them to clump together to form large particles.

A polymer is typically added to the coagulated wastewater in a gently mixed tank to promote growth to larger particles called “flocs” that can be more easily separated from the water.

Sludge Separation Control – Jar Testing

Purpose: To ensure compliance with the facility's discharge permit and how well the sludge is being separated from the water.

Underdosing of chemicals will result in a less effective separation process, but overdosing is wasteful and costly. Regular jar testing will determine the balancing point for the most efficient and cost effective chemical conditioning of the wastewater. The basic steps to performing jar testing are:

1. A series of jars are filled with wastewater.
2. Different amounts of coagulant and polymer are added to each one.
3. All jars are rapidly and gently mixed with the gang stirrer to simulate the chemical conditioning process.
4. The best dosage for the specific wastewater by the jar with the best sludge settling.
5. The operator then inputs changes to the SCADA system to reflect these results to ensure the best wastewater treatment possible.

Oil and Grease Removal

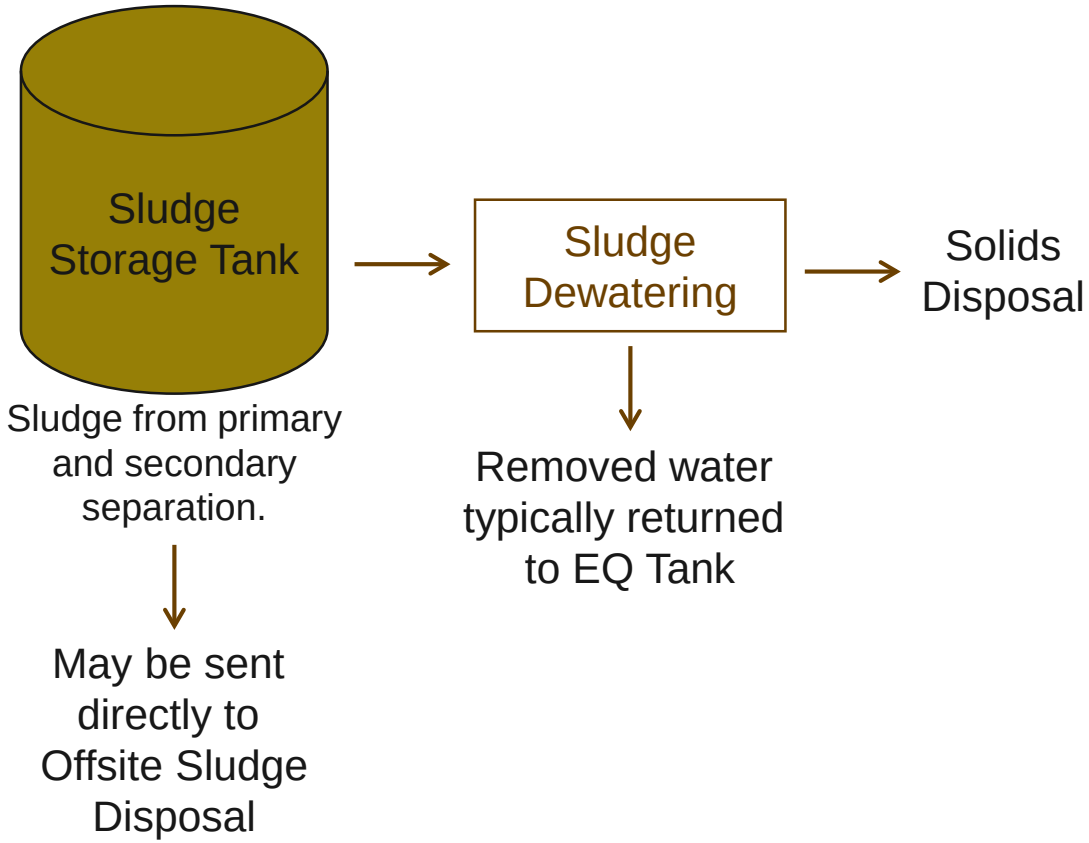
Purpose: To ensure oil and grease removal, taking a sample for a visual inspection prior to the treatment system can often be helpful.

If the wastewater is overly cloudy, the oil and grease may have emulsified into an oil/grease/water mixture that is difficult to separate. The use of a chemical emulsion breaker may be needed to help separate the oil and grease from the water.

If there is oil still floating on top of the water prior to entering the treatment system, the primary separator skimmer may not be functioning or the system may be overloaded. Lowering the flow into the primary separator may improve the treatment process.

Sludge Handling

Purpose: To remove additional water from sludge so there is a reduced volume for more cost efficient disposal.



Typical Dewatering Processes:

Sludge Drying Beds

Filter Press
(Plate-and-Frame, Belt Press, Screw Press, Centrifuge)