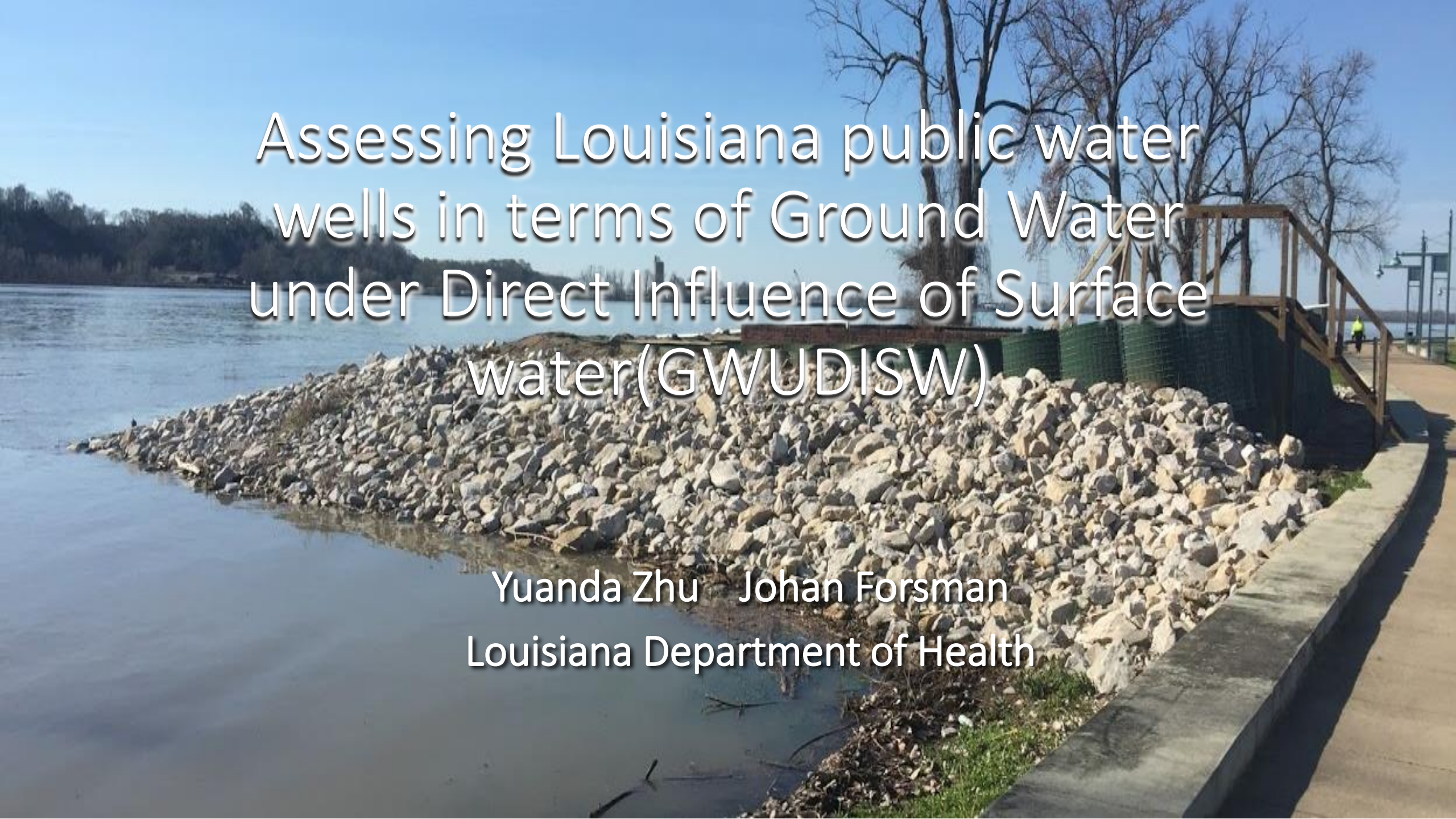


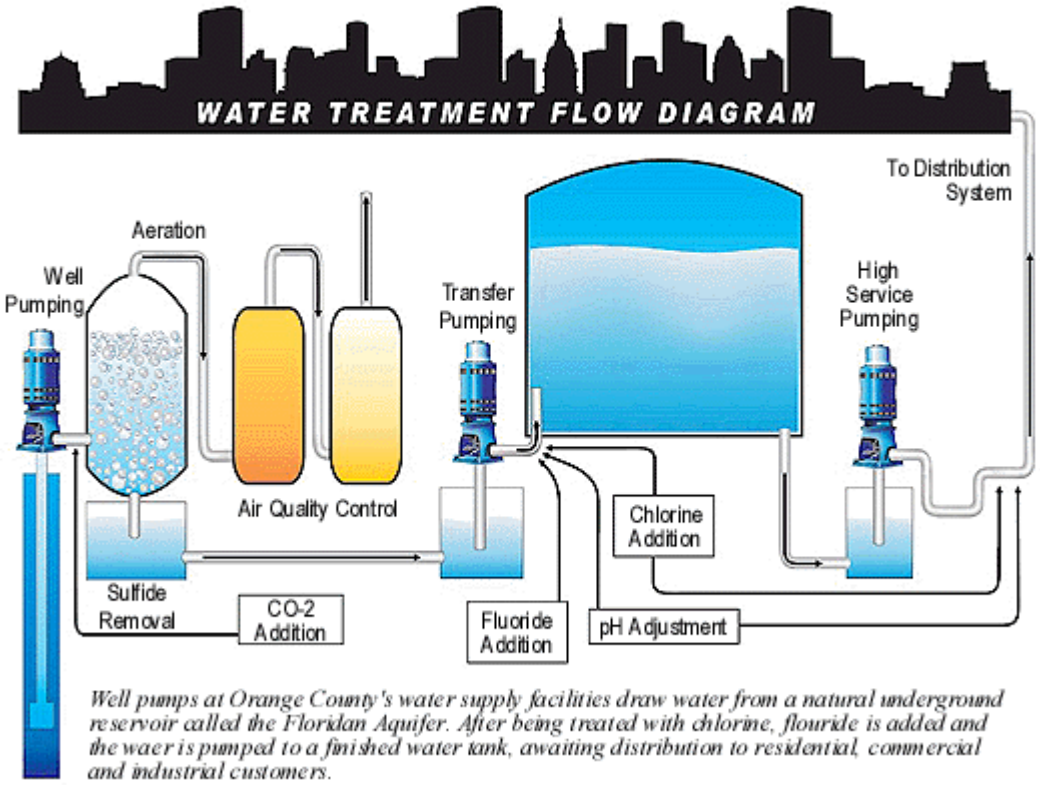
Assessing Louisiana public water wells in terms of Ground Water under Direct Influence of Surface water(GWUDISW)

Yuanda Zhu Johan Forsman

Louisiana Department of Health

Introduction

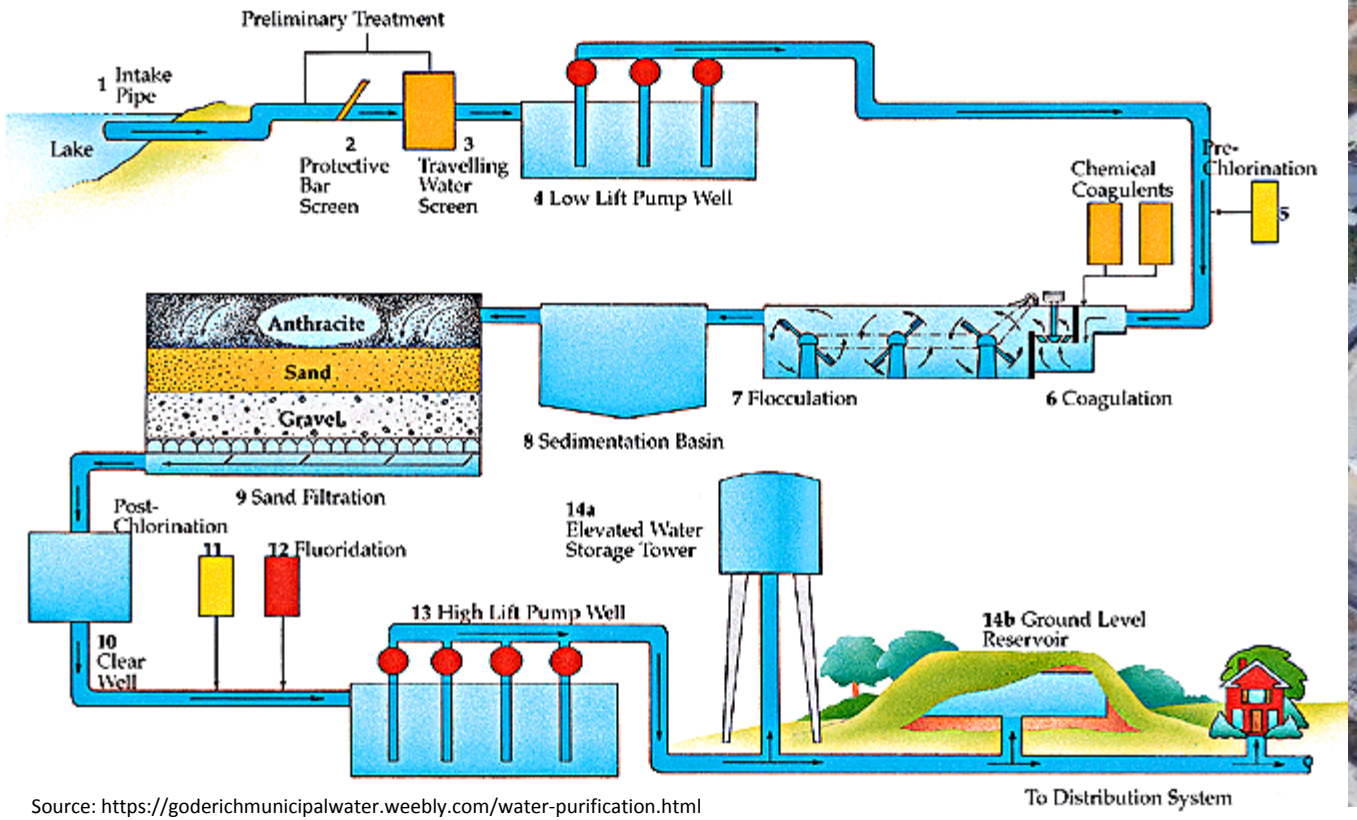
- Groundwater treatment: disinfection



Source: https://www.controldesign.com/articles/2010/networkin10q3/

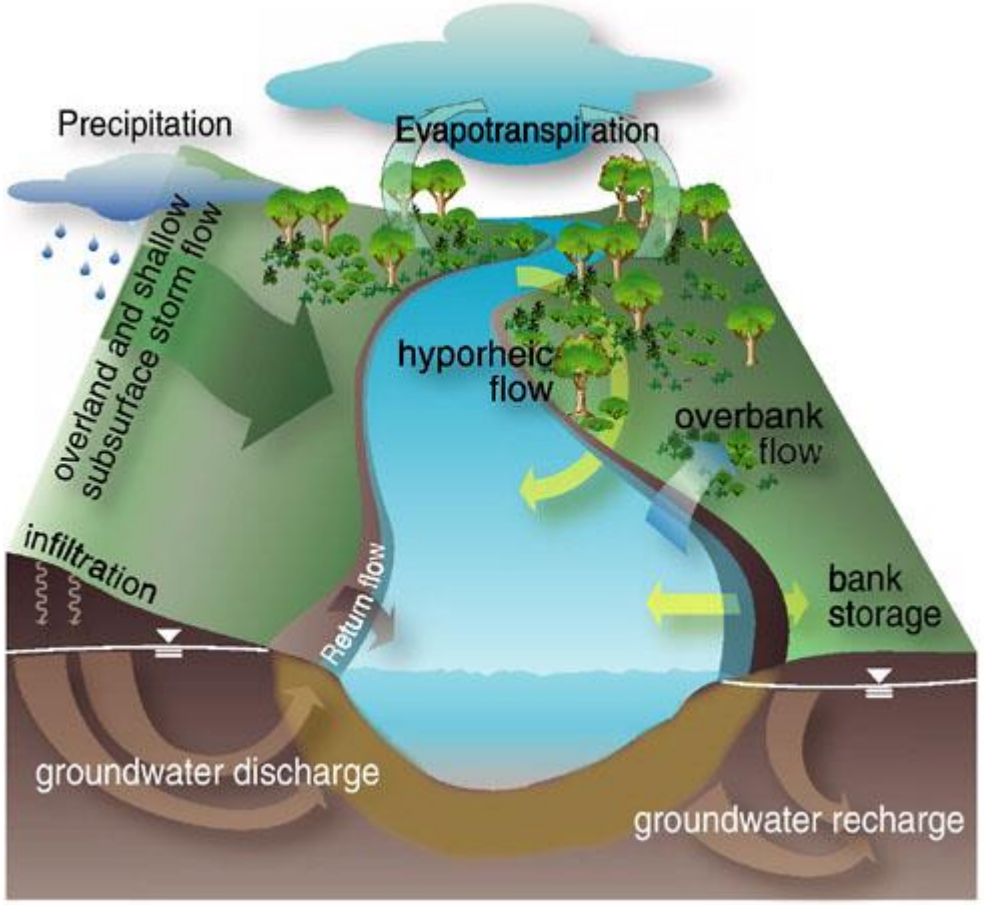
Introduction

- Surface water treatment: clarification (coagulation/flocculation, sedimentation or dissolved air flotation), sand filtration, activated carbon adsorption and disinfection.

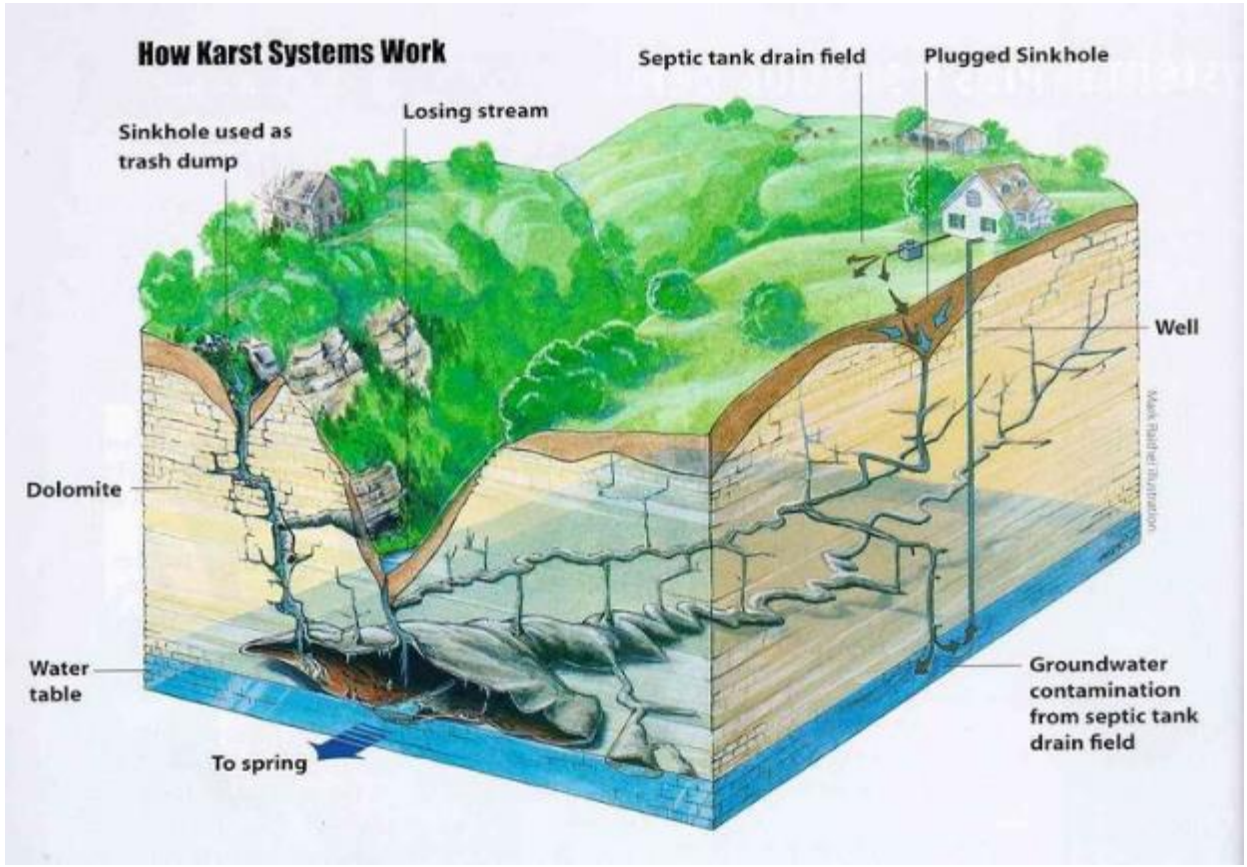


Source: https://goderichmunicipalwater.weebly.com/water-purification.html

Introduction



Source: National Research Council. 2002. Riparian Areas: Functions and Strategies for Management. Washington, DC: The National Academies Press. https://doi.org/10.17226/10327.



Source: https://mostateparks.com/sites/mostateparks/files/karst.jpg

Introduction

- According to the U.S. Environmental Protection Agency (EPA) regulation – 40 CFR 141.2, ground water under the direct influence (GWUDI) is defined as “any water beneath the surface of the ground with: a) significant occurrence of insects or other macro-organisms, algae, organic debris, or large-diameter pathogens such as Giardia lamblia or Cryptosporidium; or b) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions”.
- Withdrawal of GWUDI could potentially cause public health threats from waterborne pathogens include bacteria, viruses, protozoa, and helminthes, if the water system does not properly treat the water.

Introduction

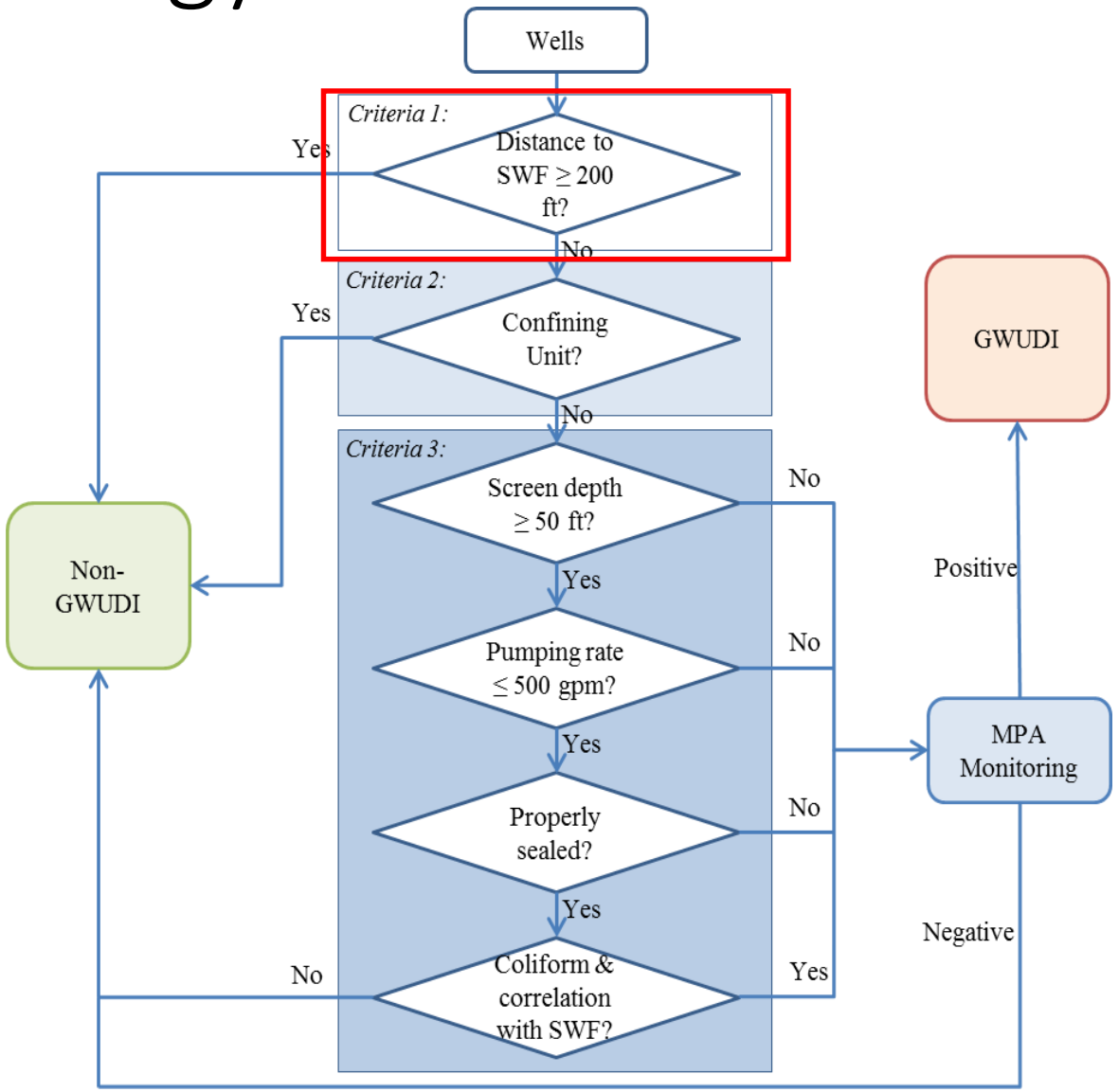
- the Interim Enhanced Surface Water Treatment Rule (SWTR) requires public water systems (PWSs) to install disinfection treatment and filtration equipment, if the systems obtain their water from surface water or from groundwater that is under direct influence of surface water bodies.
- The EPA regulation (40 CFR 142.16(b)(2)(B)) also require the states with drinking water primacy to define a program on how to determine which ground water systems are under the direct influence of surface water for public (community and non-community) water systems (PWSs).

Introduction

- Louisiana Department of Health (LDH) Office of Public Health (OPH) Safe Drinking Water Program (SDWP), with help from other federal and state agencies, completed an assessment of GWUDI for community water systems between 1994 and 1995 and for non-community water systems in 2000.

	Community system assessment (1994-1995)	Non-community system assessment (1999-2000)
PWS wells evaluated	2,605	829
Numbers of wells near surface water feature	287	56
Numbers of wells tested for GWUDI	33	8
Number of wells requiring additional testing	7	0
Number of wells deemed as GWUDI	0	0

Methodology



Exemption Criteria 1

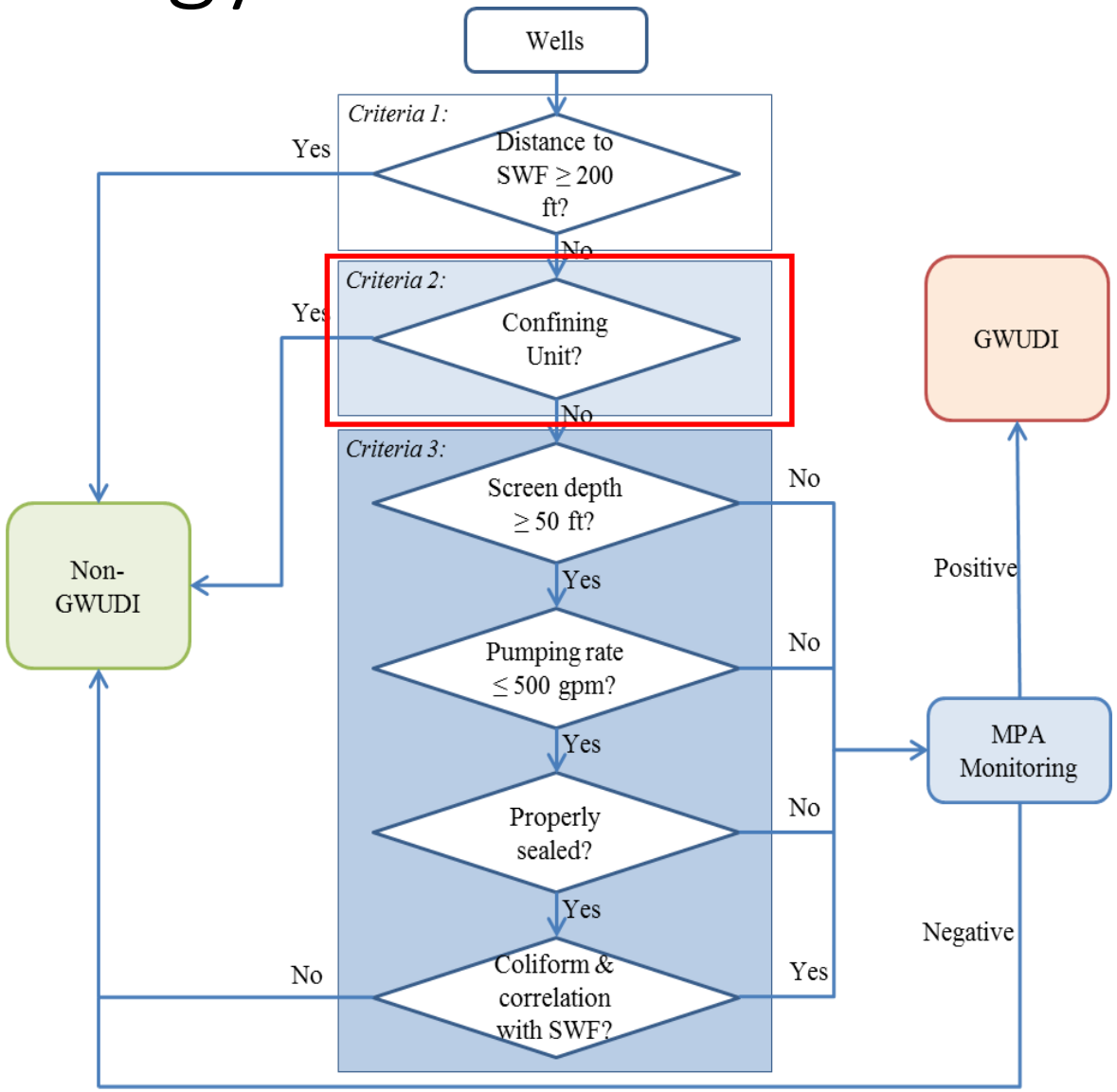
- Active wells of active public water systems (PWSs) from Safe Drinking Water Information System (SDWIS)
  - Locations of 2,689 wells, belonging to 1,209 PWSs
- The high resolution U.S. Geological Survey (USGS) National Hydrography Dataset (NHD)
  - NHDFlowline, NHDArea and NHDWaterbody are selected for GIS analysis

- Exemption Criteria 1: 200 ft
- Location accuracy of PWS wells: ≤25 meters (82 feet)
- The accuracy of high resolution NHD: 40 feet

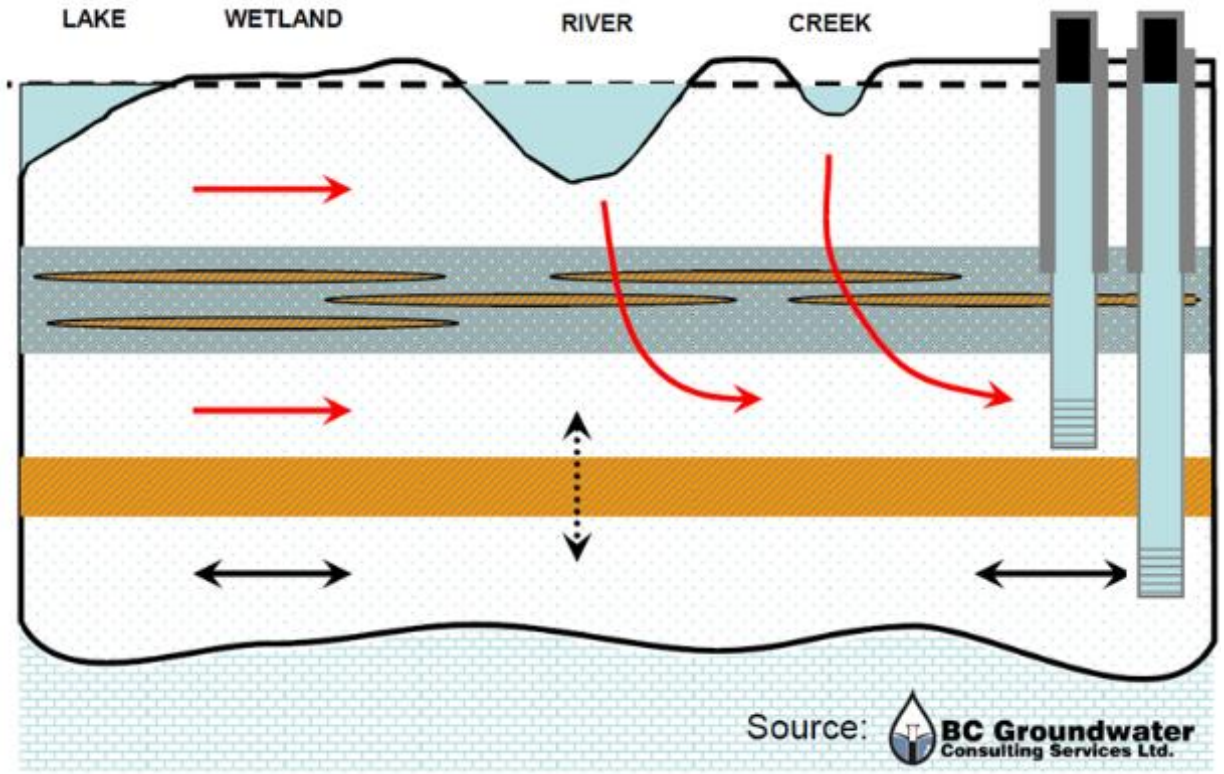
Exemption Criteria 1

- Out of the 491 wells, 75 wells (60 community and 15 non-community) were assessed previously as “Non-GWUDI”.
- With visual examination on satellite images, no near surface water feature were found for 36 wells.

Methodology



Exemption Criteria 2



a)A PWS well has a valid well ID, which is linked with an accurate well depth and existed driller's log containing adequate information;

b)A PWS well has a valid well ID, which is linked to an incomplete well record (e.g., missing well depth) and/or missing or incomplete driller's log;

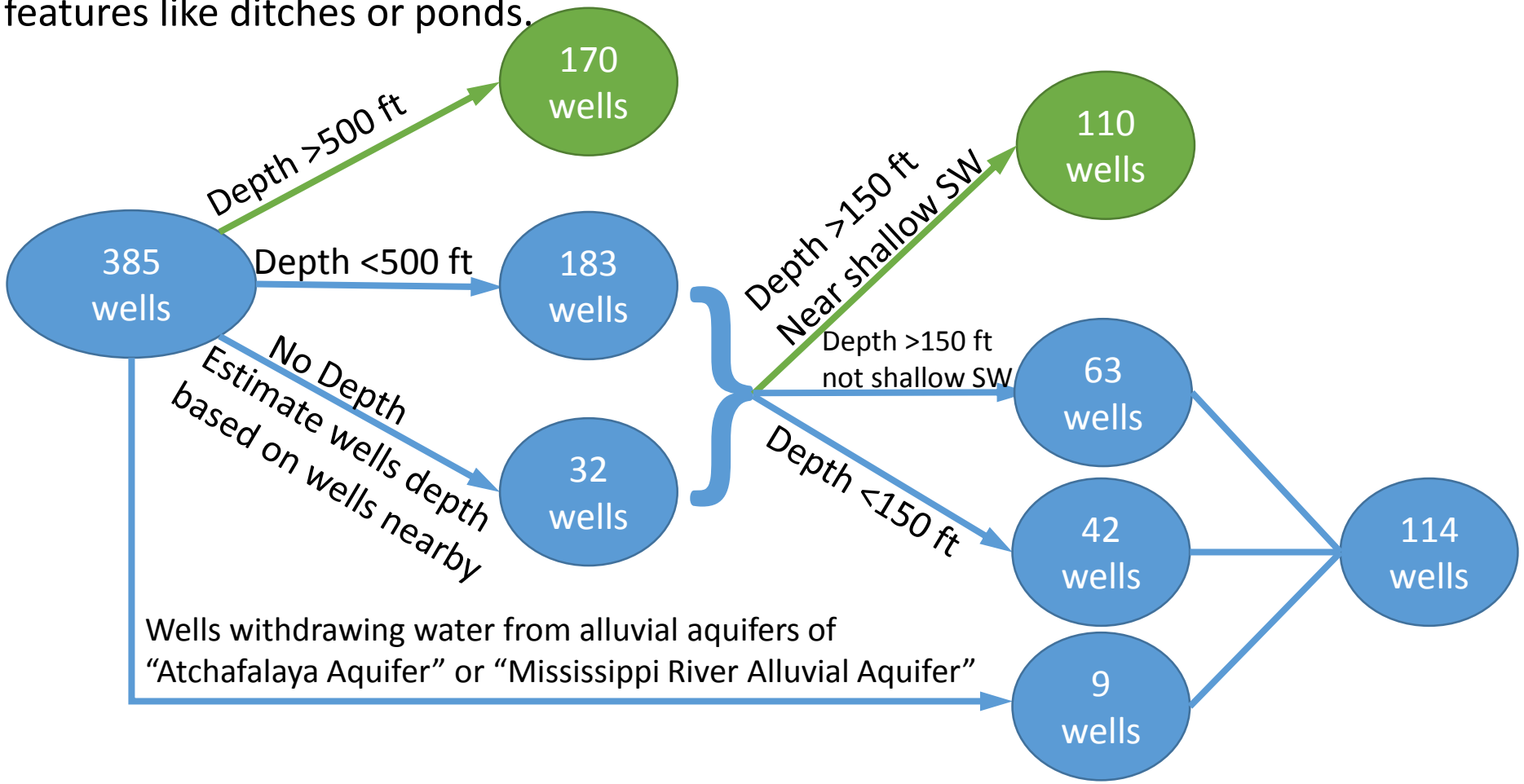
c)A PWS well has been determined "Unregistered" but has well depth recorded in SDWIS;

d)A PWS well has been determined "Unregistered" and also has no depth information recorded.

Exemption Criteria 2

Assumption:

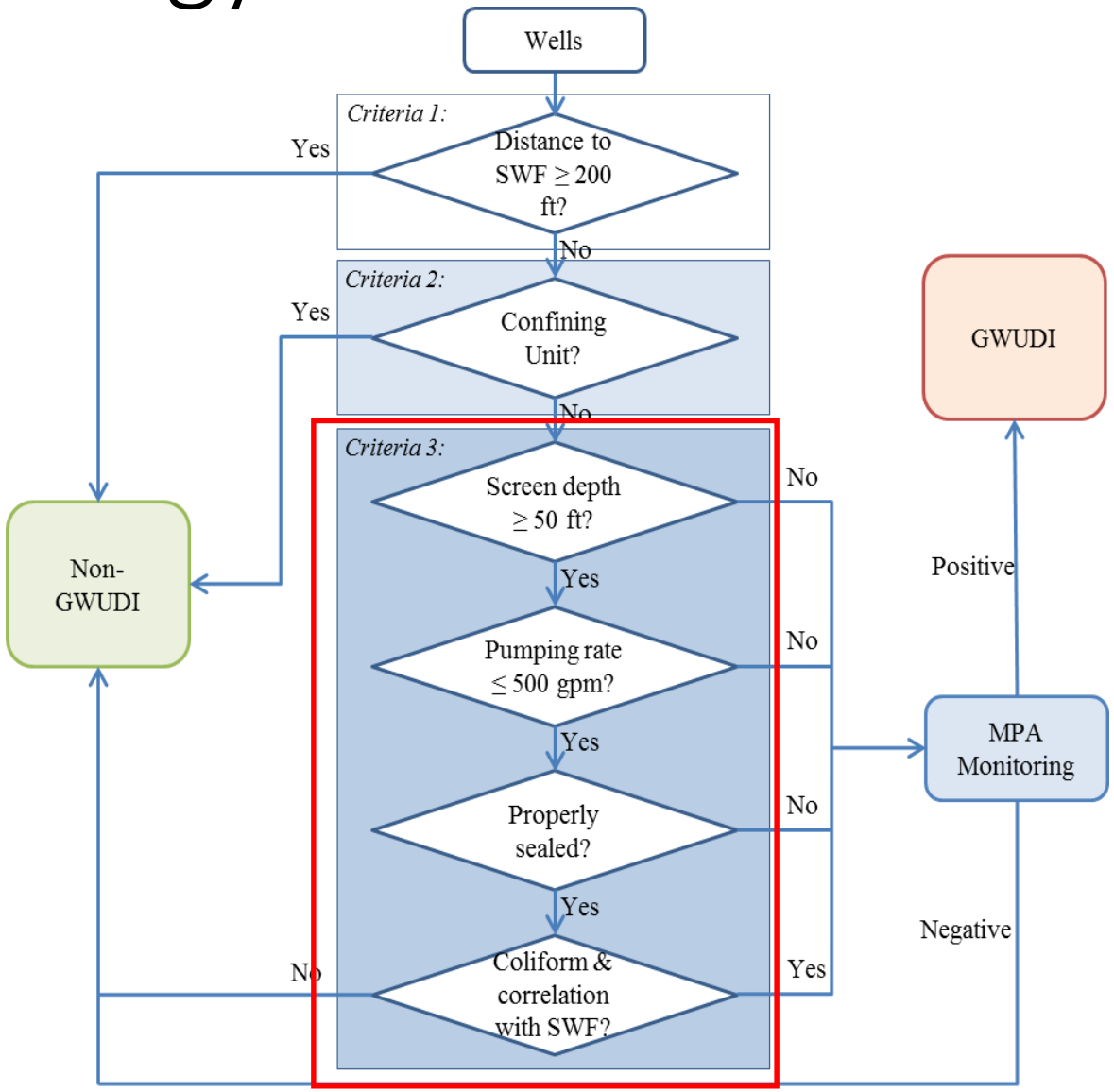
- Aquifers other than alluvial aquifer with depths greater than 500 ft are confined in LA.
- Wells with depths greater than 150 ft will not be affected by small and shallow surface water features like ditches or ponds.



Exemption Criteria 2

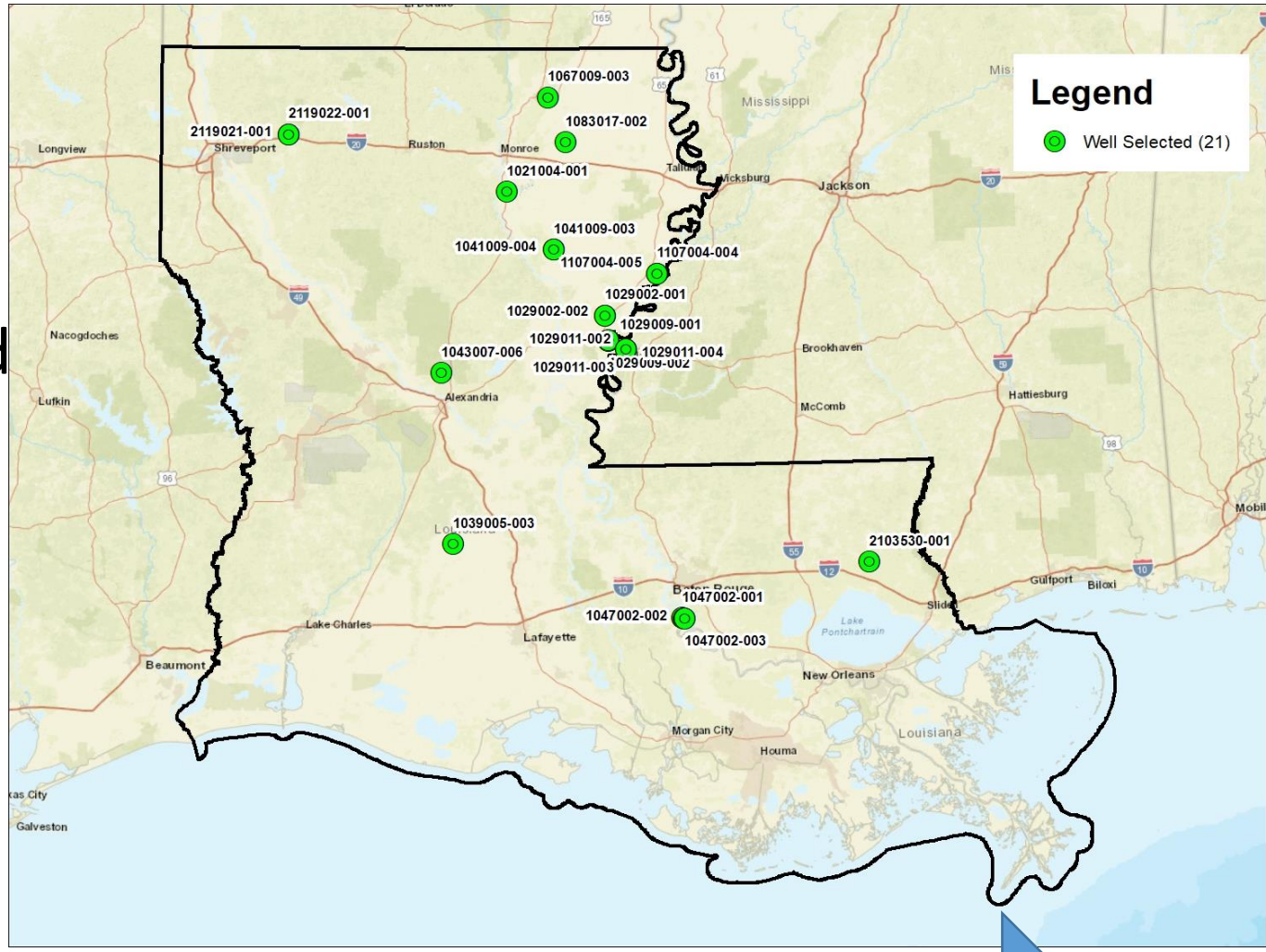
- Request all the driller's logs for the 114 wells from LDNR
  - Wells with known well registry ID
  - Wells with known well registry ID, but no driller's log available
  - Well registry ID is unknown
- Examine each driller's log to determine if it has a confining unit

Methodology



Exemption Criteria 3

- We added additional 11 wells based on historic chemistry and bacterial sample results, and recommendations from regional staff.
- During the scouting trip, we found that on the list two wells were deactivated and three wells are not able to be sampled.



21 wells

Sampling

- Schedule
  - 1st round: September – October 2018 ☑
  - 2nd round: January – February 2019 ☑
  - 3rd round: April – June 2019
- No less than 500 gallons of raw water at a rate approximate 1 gallon per minute
  - Best scenario: 8 hours and 20 minutes with continuous pumping
  - Real world: 24 hours – 72 hours

Sampling

Envirochek HV sampling capsule
By Pall Corporation

Figure 1a: Sampling system with pump

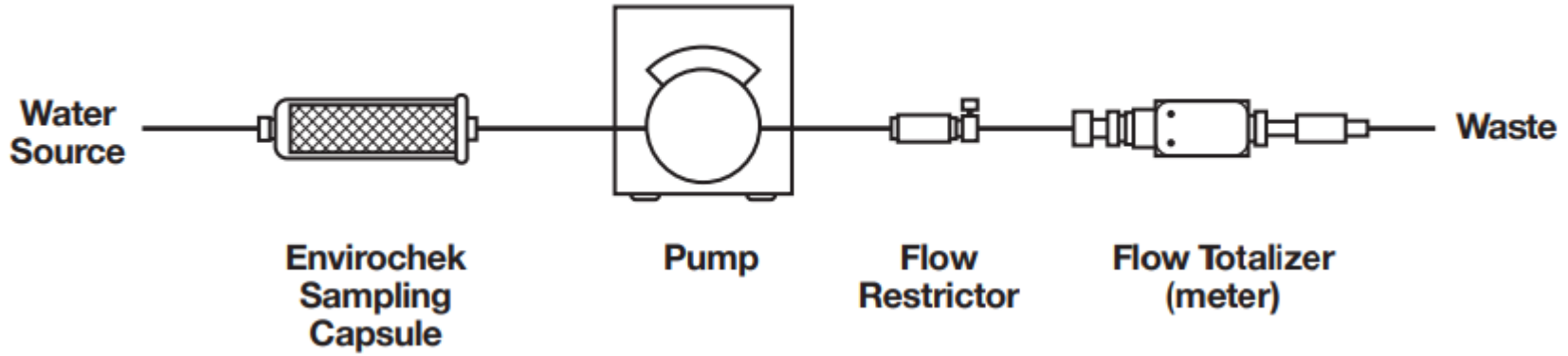
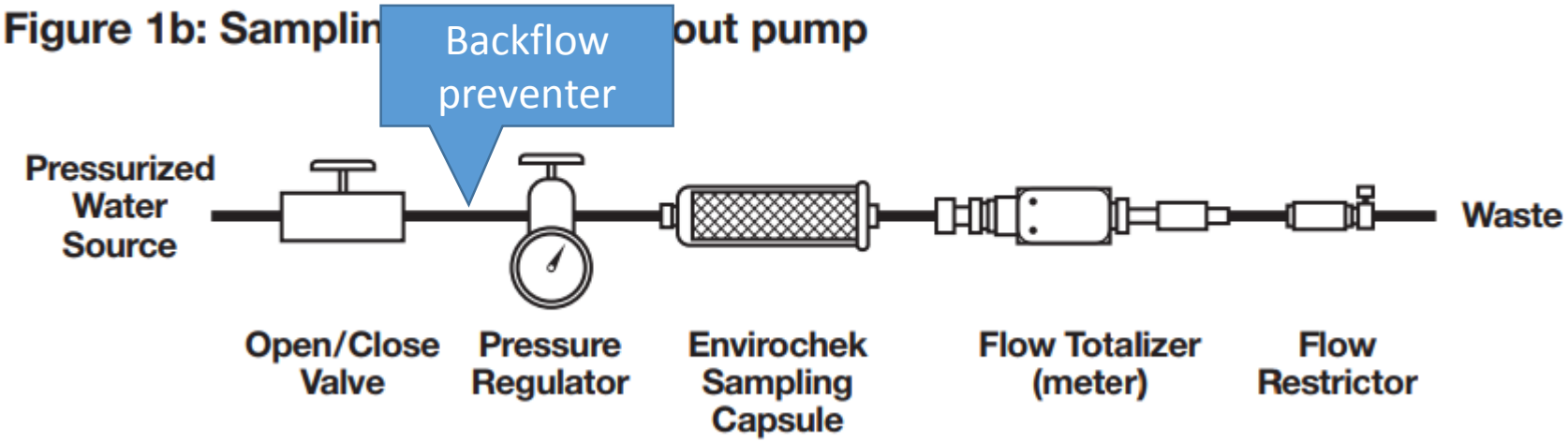


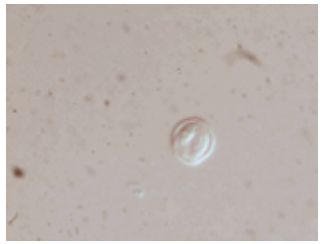
Figure 1b: Sampli out pump



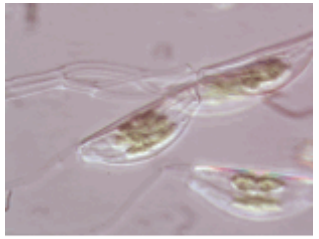
Sampling

Sample Analysis

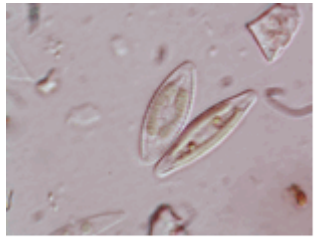
- Half of the sample is used for Crypto and Giardia analysis and the other half for Microscopic Particulate Analysis (MPA).
- Biological particulates in each sample are identified and counted within discrete size classes and the resulting data used to assess the risk level for each well.



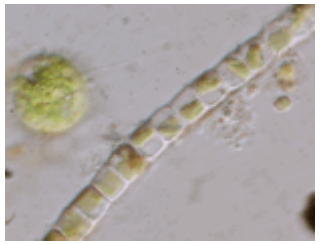
Cryptosporidium



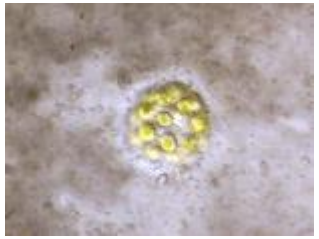
Cymbella (Diatom)



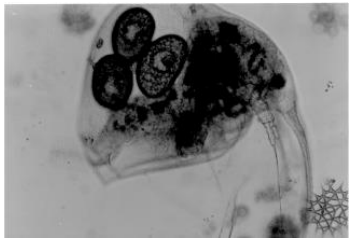
Naviculla (Diatom)



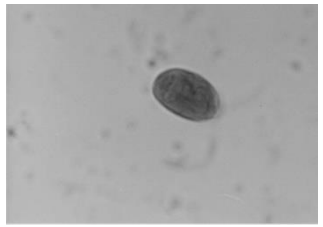
Golenkinia (Green Alga) & *Cyclotella* (Diatom)



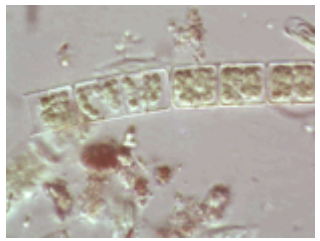
Coelastrum (Green Alga)



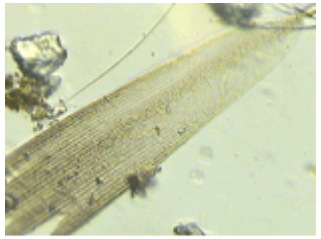
Insects and Crustacea



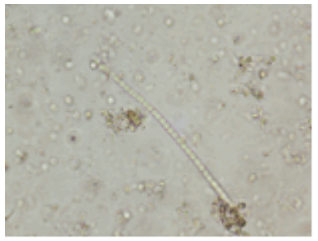
Giardia Cysts



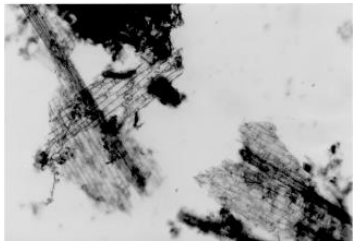
Tribonema (Golden Alga)



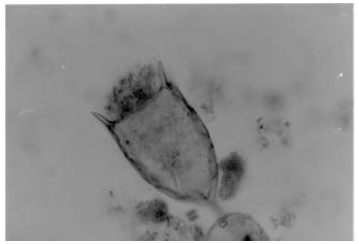
Insect Wing Scale



Anabaena (Blue-Green Alga)



Cellular Plant Debris



Rotifers

Source: https://eal-labs.com/microscopic-particulate-analysis-mpa-for-ground-water-under-direct-influence-gwudi-guide/
https://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/FilterPlant/Pages/Microscopic-Particulate-Analysis.aspx

Sample Analysis

Client: Louisiana Department of Health
Analysis: *Cryptosporidium spp. Enumeration*
Project Name: GWUDI- MPA Testing- 2018
Client Sample ID: 1029011-002 BCS Sample ID: 1810099
Amount Submitted: 1950.8 L Sample Description: Envirochek HV Filter
Sampling Date: October 01, 2018 10:15 Percent Solids: N/A
Date Received: October 04, 2018 11:42 Receipt Temperature: 11.8 deg C Preserved: Yes
Amount Analyzed: 975.4 L Analyst:
Analysis Start: October 04, 2018 11:43 Analysis Stop Date: October 05, 2018 9:21
Primary Value: ≤0.1 Cryptosporidium Oocysts/100 liters
Secondary Value: ≤0.1 Potentially Viable Oocysts/100 liters*
Qualifier: U
Analysis Notes: Undetected: Analyte was not detected in the sample analyzed; Value represents the method's detection limit for the amount of sample analyzed as per the method's standard reporting units

Client: Louisiana Department of Health
Analysis: *Giardia spp. Enumeration*
Project Name: GWUDI- MPA Testing- 2018
Client Sample ID: 1029011-002 BCS Sample ID: 1810099
Amount Submitted: 1950.8 L Sample Description: Envirochek HV Filter
Sampling Date: October 01, 2018 10:15 Percent Solids: N/A
Date Received: October 04, 2018 11:42 Receipt Temperature: 11.8 deg C Preserved: Yes
Amount Analyzed: 975.4 L Analyst:
Analysis Start: October 04, 2018 11:43 Analysis Stop Date: October 05, 2018 9:21
Primary Value: ≤0.1 Giardia Cysts/100 liters
Secondary Value: ≤0.1 Potentially Viable Cysts/100 liters*
Qualifier: U
Analysis Notes: Undetected: Analyte was not detected in the sample analyzed; Value represents the method's detection limit for the amount of sample analyzed as per the method's standard reporting units

Client: Louisiana Department of Health
Analysis: *Microscopic Particulate Analysis*
Project Name: GWUDI- MPA Testing- 2018
Client Sample ID: 1029011-002 BCS Sample ID: 1810099
Amount Submitted: 1950.8 L Sample Description: Envirochek HV Filter
Sampling Date: October 01, 2018 10:15 Percent Solids: N/A
Date Received: October 04, 2018 11:42 Receipt Temperature: 11.8 deg C Preserved: Yes
Amount Analyzed: 975.4 L Analyst:
Analysis Start: October 04, 2018 11:43 Analysis Stop Date: October 08, 2018 14:00

Bioindicator Category	Number/100 gallons	Numerical Range	Relative Risk Factor
Giardia	None Detected	Not Significant	0
Coccidia	None Detected	Not Significant	0
Diatoms	3.9	Rare	6
Other Algae	11.2	Rare	4
Insects/Larvae	0.7	Not Significant	0
Rotifers	1.5	Rare	1
Plant Debris	20.5	Rare	0
Qualifier: U or None			Total: 11

Analysis Notes: According to the USEPA Consensus Method the relative risk of surface water contamination for this sample is moderate. In addition, 216 nematodes (83.5/100 gallons) were observed in this sample.

Results

- So far, only one sample in the first round was deemed as moderate risk of GWUDISW, but the follow-up sample in the second round was rated as low risk.
- Forty one out of 42 samples was rated as low risk of GWUDISW.


Thank you!
Questions or comments?