JERFSA Pond Study
September 18, 2022
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~~Table 1:~~

Contaminant	Source	Maximum Contaminant Level (MCL)	Environmental Health	Human Health	Reference
Nitrates	Nitrates enter as fertilizers through run-off waters, sewage, and mineral deposits. Additionally, industrial wastewater, septic tanks, decaying plant debris, refuse dumps, and animal feedlots are all potential sources.	Ground Water 5 - 10 mg/L Surface Water 0 mg/L Drinking Water 10 mg/L	Excess levels of nitrates in water can create conditions that make it difficult for aquatic insects or fish to survive. Excess levels can create "brown blood disease". Algae and other plants use nitrates as a source of food. If algae have an unlimited source of nitrates, their growth is unchecked and eutrophication can occur. Fish can die due to the drop in oxygen concentration.	High levels could result in a change to hemoglobin that decreases the ability to transport oxygen to tissues in infants(blue baby syndrome). Another effect is that it could cause gastrointestinal tract.	https://www.epa.gov/nutrient-policy-data/estimated-nitrate-concentrations-groundwater-used-drinking .http://www.wheatleyriver.ca/media/nitrates-and-their-effect-on-water-quality-a-quick-study/ https://www.atsdr.cdc.gov/phs/phs.asp?id=1448&tid=258 psep.cce.cornell.edu › facts-slides-self › facts › nit-heef-grw8 \http://www.idph.state.il.us/envhealth/factsheets/NitrateFS.htm
Chlorides/ Salinity	Salinity can come from sea water intrusion, oil and gas, field brines, agricultural effluents, road salt, runoff, hydrothermal vents, weathering of rocks, and rainfall, **For chlorides, sources are rocks containing chlorides, wastewater from industries, and oil wells.**	Ground water: 2,000 ppm Surface water: 1,000 ppm drinking water: 500 ppm **Chlorides** Groundwater: 250 Mg/L Freshwater: 1-100ppm	Salinity at high levels decreases plant growth and water quality. This will result in lower crop yields and degraded stock water supplies. Wetlands become degraded and it also damages infrastructure. High salinity levels can also lead to floods and soil erosion. The vegetation biodiversity of an area with high salinity will decrease. It also affects the quality of water for drinking and irrigation. **Chlorides** Chlorides combine with inorganic material in water to form chloride salts, and with organic material in water to form chlorinated organic chemicals. They can escape from water into air. Slight harm typically at low levels,	In most people, the kidneys have trouble keeping up with excess sodium in the blood. There is some evidence that too much salt can damage the heart, aorta, and kidneys without increasing blood pressure, and that it may be bad for bones, too. **Chlorides** Breathing high levels can cause development of pulmonary edema, the buildup of fluid in the lungs. Contact with compressed chloride can cause frostbite in skin and eyes. Important in moderate amounts, helps maintain proper blood volume, pressure, and pH levels.	http://cels.uri.edu/docslink/ww/water-quality-factsheets/Chlorides.pdf https://www.hsph.harvard.edu/nutritionsource/salt-and-sodium/ https://www.lenntech.com/periodic/elements/cl.htm https://ucanr.edu/sites/Salinity/Salinity_Management/Salinity_Basics/Origin_of_soil_salinity_and_m http://www.state.ky.us/nrepc/water/ramp/rmcl.htm ajor_ions/ https://www.lenntech.com/periodic/elements/cl.htm#:~:text=Environmental%20effects%20of%20chlorine,-Chlorine%20dissolves%20when&text=It%20can%20also%20escape%20from%20water%20and%20enter%20air%20under%20certain%20conditions.&text=However%2C%20laboratory%20studies%20show%20that,environmental%20harm%20at%20low%20levels.

			however can cause damage to immune system, blood, heart, and respiratory system for all animals		
Dissolved O2	Potential sources are water plants and oxygen in the atmosphere.	0 mg/0 mg/l to 18 mg/l	Oxygen levels that remain below 1-2 mg/l for a few hours can result in large fish kills. Total dissolved gas concentrations in water should not exceed 110 percent. These levels do not impact human health, however it does affect how water tastes and smells.		https://aquaplant.tamu.edu › faq › dissolved-oxygen https://www.water-research.net › Watershed › dissolvedoxygen www.state.ky.us › nrepc › water › wcpdo https://www.clevelandwater.com/blog/do-h2o-what-dissolved-oxygen-and-how-does-it-affect-your-water
Turbidity	Turbidity can come from wind, development, and run off,	conventional or direct filtration, 0.3-1 (NTU), state limits 5 NTUs.	If there is high turbidity because of algae, oxygen is used up. Large amounts of suspended soils or clay may clog the gills of fish and kill them directly; difficult for fish to see and catch prey, and it may bury and kill eggs laid on the bottom of lakes and rivers. Pollutants and harmful bacteria may also be attached to particles that cause turbidity.	Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	https://www.sekid.ca/water-quality/turbidity/ https://www.enr.gov.nt.ca/sites/enr/files/turbidity.pdf https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations file:///home/chronos/u-83c520fb6c37eadbe8cf8980d3e20eb7777feab9/MyFiles/Downloads/tri-review-turbidity-fact-sheet-01-08-15.pdf
Conductivity	**Conductivity** is a measure of water's capability to pass electrical flow. This ability is directly related to the concentration of ions in the water. These ions come from dissolved salts and inorganic materials such as alkalis, chlorides, sulfides and carbonate compounds.		Conductivity measures the water's ability to conduct electricity. The flow of charges and ions constitute an **electric** current - Measure of the water ability to pass an electrical current - Warmer water = higher conductivity Conductivity change can indicate pollution in the environment.		https://www.ncbi.nlm.nih.gov › pmc › articles › PMC2763825 https://www.fondriest.com/environmental-measurements/parameters/water-quality/conductivity-salinity-tds/#:~:text=Conductivity%20Change%20Can%20Indicate%20Pollution&text=An%20oil%20spill%20or%20addition,negative%20impact%20on%20water%20quality.
pH	Changes in pH are due to Acid rain, burning fossil fuels, weathering of rocks, and sulfate/nitrates deposited into lakes.. 6.5-8.5		Pollution can change a water's pH, which in turn can harm animals and plants living in the water If the pH of water is too high or too low, the aquatic organisms living within it will die.	A blood pH imbalance can lead to two conditions: acidosis and alkalosis	https://www.healthline.com/health/alkalosis https://www.usgs.gov/special-topic/water-science-school/science/ph-and-water?qt-science_center_objects=0#qt-science_center_objects https://www.fondriest.com/environmental-measurements/parameters/water-quality/ph/#:~:text=If%20the%20pH%20of%20water,levels%20outside%20of%20this%20range.

Phosphorus	Phosphorus can reach water through runoff from industrial waste, fertilizers, manure, waste water, garage dumps, and septic systems. Some sources are not human caused such as the decomposition of plants and animals. It is also possible for phosphorus to migrate into groundwater flows. 0.1 mg/L		High concentrations of phosphorus indicate poor agricultural practices. They are a limiting factor in aquatic environment but too much phosphorus can lead to dangerous algal growth in the water The high levels of phosphorus causes increased algal growth that could decrease the amount of dissolved oxygen. It can also cause algae blooms that can release toxic chemicals into the environment.	Phosphorus is used for the formation of bones and teeth. It uses carbohydrates and fats needed to make protein for the growth, maintenance, and repair of cells and tissues. While phosphorus used in fertilizers is extremely toxic to humans, it causes severe gastrointestinal damage as well as kidney, liver, cardiovascular, and central nervous system damage. It can also give humans severe burns.	https://www.epa.gov/national-aquatic-resource-surveys/indicators-phosphorus https://www.pca.state.mn.us/sites/default/files/wq-iw3-22.pdf\ https://pubs.usgs.gov/circ/circ1171/html/nutrients.htm https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations https://www.epa.gov/national-aquatic-resource-surveys/indicators-phosphorus https://www.usgs.gov/special-topic/water-science-school/science/phosphorus-and-water?qt-science_center_objects=0#qt-science_center_objects https://www.epa.gov/sites/default/files/2016-09/documents/phosphorus.pdf
TDS	Total dissolved solids come from a range of sources. Some substances may come from sewage water, agricultural runoff, urban runoff or industrial waste water. Others are from natural sources such as rocks. Pipes carrying the water from the home may also increase the TDS.	500 ppm	TDS changes the mineral content of water, which is important to the survival of many fish. Also, dissolved salt can dehydrate the skin of aquatic animals, which can be fatal. It can increase the temperature of the water, which many animals can't survive in.	High levels of TDS can cause several illnesses like nausea, rashes, and vomiting. Drinking water with high levels of TDS for extended periods of time can lead to conditions like cancers, kidney failure, weakened immune system, and birth defects.	https://archive.epa.gov/water/archive/web/html/vms58.html https://www.netmeds.com/health-library/post/how-salts-in-drinking-water-can-affect-health#:~:text=High%20levels%20of%20TDS%20means,conditions%20like%20cancer%2C%20liver%2C%20kidney https://www.wwdmag.com/what-articles/what-total-dissolved-solids-tds https://www.google.com/search?q=TDS+environmental+effects&rlz=1CAOUAQ_enUS966&ei=fOmkYZ-wMpWhwhkPtsiD6AY&ved=0ahUKEwif3vPd6b30AhWVTTABHTbkAG0Q4dUDCA4&uact=5&oq=TDS+environmental+effects&gs_lcp=Cgdnd3Mtd2l6EAMyBQghEKsCOgcIABBHELADOgUIIRCgAToFCAAQgAQ6BggAEBYQHkoFCDwSATIKBAhBGABQtwJYzxFguBNoAnACeACAAY8DiAGcDpIBBzEuNS4zLjGYAQCgAQHIAQjAAQE&sclient=gws-wiz&safe=active&ssui=on&surl=1
Iron	Iron can enter a body of water through rainfall by water seeping through rocks or iron-soil. High levels of iron can also result from corrosion of steel, such as corroded water pipes.	0.3 mg/L (based on aesthetics, not health detriments)	Iron helps organisms to grow and stay alive. Excessive levels can cause problems if a harmful bacteria/algae enters the water. The iron would allow the bad organisms to grow and flourish.	Iron levels do not usually affect humans negatively, as iron is used to grow for humans.	https://www.health.state.mn.us/communities/environment/water/wells/waterquality/iron.html#:~:text=As%20rain%20falls%20or%20snow,well%20casing%20or%20water%20pipes.

Table 1 describes the source, maximum contaminant level, environmental health, and the human health of several parameters/contaminants.

Map 1:

Map 1 shows Jupiter High School along with the surrounding areas. There are key land-use factors marked on the map that affect the JERFSA Pond.

~~Table 2:~~

Freshman Chemical Parameter of JERFSA Pond by Site				
Parameters	**Site 1**	**Site 2**	**Site 3**	**Site 4**
Phosphorus	1	1	1	1
Nitrates	5	5	5	2.5
Dissolved O2	5	3	8	4
pH	7.2	7	7	8
Turbidity (small)	20	20	20	20
Turbidity (large)	4	4	4	4
Salinity	0	0	0	0
Conductivity Probe (ORP)	172	174	184	179
Total Dissolved Solids	8.4	6.5	8	15.7
Wind Speed	6	6	6	6
Air Temp	21	20	20	20.5
Water Temp	22	21	22	21.6

Table 2 is the results for several chemistry parameters from four different testing sites-North, West, South, and East-at the Jupiter High School sampled during Freshman year.

~~Table 3:~~

Chemical Parameter Measured at JERFSA Pond 12/4/2021				
	South	West	East	North
Phosphorus (ppm)	2	0	1	1
Nitrates (ppm)	3	4	3	3
Dissolved O2 (ppm)		2.5	7	
pH	7	6	7	7
Turbidity (large secchi disk) JTU	0	0	4	
Turbidity (small secchi disk) JTU	10	0	20	
Salinity Probe	0.0	0.0	0.0	0.0
Conductivity Probe (ORP) mv	225	222	230	227
Wind Speed	2 mph	2 mph	2 mph	2 mph
Air Temp	62°F	62°F	62°F	62°F
Water Temp	17.7°C	19.8°C	19.9°C	

Table 3 is the results for several chemistry parameters from four different testing sites-North, West, South, and East-at the Jupiter High School sampled during Sophomore year.

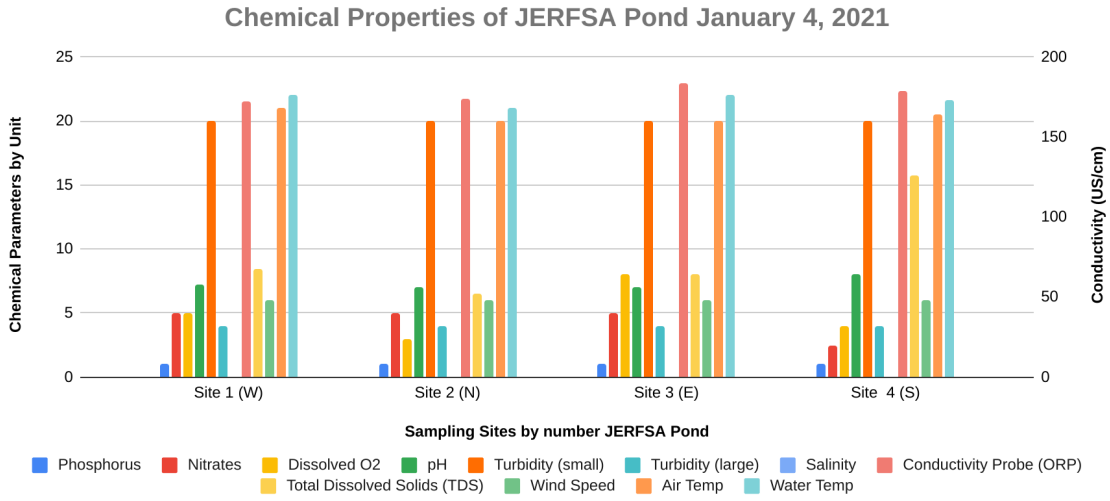
~~Table 4:~~

Junior Chemical Parameter of JERFSA Pond by Site				
Parameters	**Site 1 (N)**	**Site 2 (E)**	**Site 3 (S)**	**Site 4 (W)**
Phosphorus	4	1	1	5
Nitrates	5	5	0	5
Dissolved O2	2	0	0	4
pH	7.5	6	8	7

Ammonia	2	0	0	0
Copper	0	0	0	0.5
Total Dissolved Solids	6.2	6.9	6.2	5.9
Salinity	0	0	0	0
Conductivity Probe (ORP)	330	330	330	330
Iron	0.5	0	1	0
Wind Speed	15	15	15	15
Air Temp	30℃	30℃	30℃	30℃
Water Temp	26.6℃	26.6℃	26.6℃	26.6℃

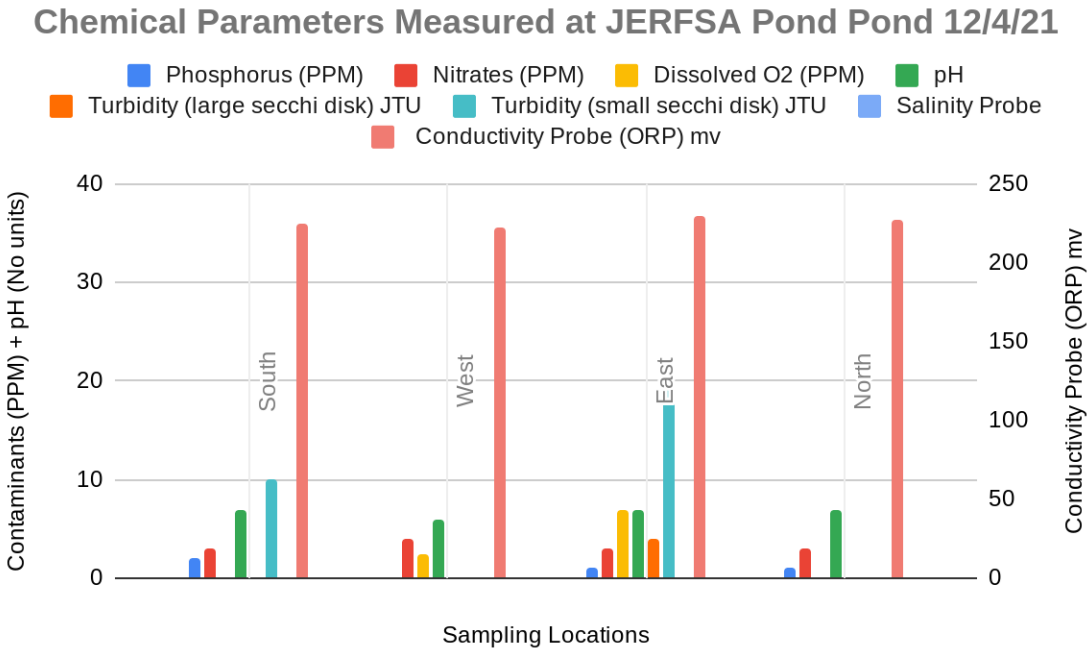
Table 4 is the results for several chemistry parameters from four different testing sites-North, West, South, and East-at the Jupiter High School sampled during Junior year.

~~Graph 1:~~



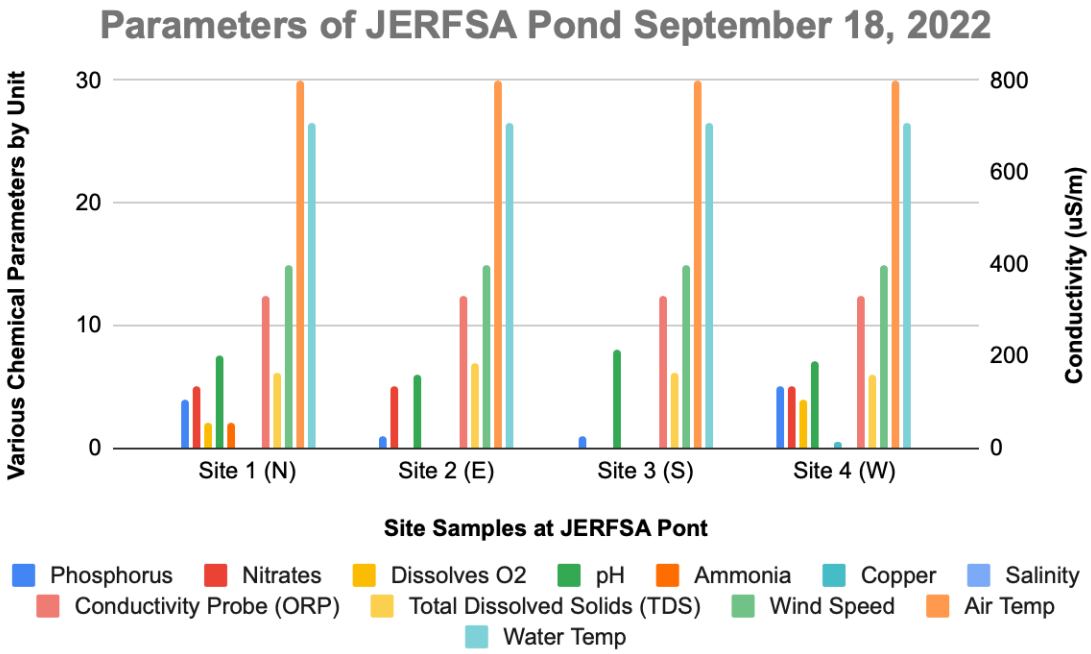
Graph 1 is the chemical results from the JERFSA Pond Study from Freshman year.

~~Graph 2:~~



Graph 2 is the chemical results from the JERFSA Pond Study from Sophomore year.

Graph 3:



Graph 3 is the chemical results from the JERFSA Pond Study from Junior year.

Analysis:

- According to Graph One, the average phosphate level for the sites was 1 ppm. In Table Four, the average phosphate level was 2.75 ppm. Map One supports this result because it shows where nearby sources of surface water, pesticides, and fertilizers are that Table One states are the sources of phosphates. These sources have become more prevalent in the pond, as the average increase of 1.75 ppm occurred within three years.
- Graph One displays the nitrate level to be 3 ppm in site locations one, three, and four. This supports the information from Table One, for it states that nitrates mostly come from fecal matter. Map One identifies that birds and fertilizers can have an effect on the level of nitrates in the pond. According to Tables Three and Four, nitrate levels have stayed relatively around the 5 level, except for site 3 in Table 4. This is consistent with the land use map, as the sources have been the same for nitrate levels for the past three years.
- The dissolved oxygen (DO) average from all four sites in Table Two is 3.875 ppm. DO can enter a pond by plants and algae, as stated in Table One. Map One further supports this data, because fertilizers are used in close proximity to the lake. Graphs Two and Three display increases of DO from December of 2021 to September of 2022. These results were most likely due to the increase of plant growth that affects DO levels (Table One).
- Table Two states that the pH is averaged at 7.3 for all sites. In Table Three, pH is averaged at 6.75. Source wise, noted in Table One, the maximum contaminant level is 6.5-8.5. Both sets of data are similar, evidently, they support each other. Marine life can live at the current levels. The decrease in pH levels could be due to the fact that Table Two has results during the heart of covid where there was slightly less acidification occuring due to the decrease in transportation admissions.
- Table Four is the only table that includes ammonia levels. The only site with detectable levels was site 4 with a level of 2. Map One supports this finding because there appears to be fertilizer close to the North-end of the pond where the levels are detected.
- The copper results in Graph Three conclude that the main copper level is 0, except for 1 site. This means that copper is not a major factor, nor a factor at all, in potential contaminants in the pond.
- From Table Two to Table Four, there is a trend of a decrease in Total Dissolved Solids. For example, Table Two has site 1 at 8.4 and Table Four measured site 1 at 6.2. This is a considerable decrease of 2.2. This is a good change, regarding the health of the late. Table One states that a source of TDS can be from sewage treatment. A possible explanation for the trend may be that the sewage system has improved between the two sampling times.
- Salinity is shown to be 0 ppm for all of the testing sites in Tables Two, Three, and Four. This does not support the information found in Table One because it states that salinity can enter a pond by runoff and Map One shows where fertilizers are

used close to the pond. It is possible to come to the conclusion that there is not enough salinity in the runoff to make a difference in the freshwater.

- Conductivity is presented in Graph One to have a range from 180 to 230 uS/cm. This result supports the information on Map One because it expresses where pesticides are being used near the pond. Pesticides include alkalis, chlorides, and sulfides. Table One supports the conductivity levels because it includes how those dissolved salts and inorganic materials contribute to conductivity.
- The mid-high turbidity levels shown in Graph One, 0-40 NTU, is supported by Table One, which states that runoff can be a source to increase turbidity. Map One further supports this data by presenting areas where runoff can come from, and how it can be carried into the pond. Unfortunately, Table Three has some blank results regarding turbidity and Graph Three does not include turbidity at all. With that being stated, no additional claims can be made or supported.
- According to Table Four, iron levels range from 0 to 1. This result supports Table One because it states that one source of iron can be from rainfall and runoff of soil. Map One supports both of these claims because it rains heavily in Florida and there is a baseball and football field located very close to the pond.

The YSI is a one-stop source of instrumentation for environmental water quality testing. To briefly sum it up, the YSI contains four probes that individually measure certain parameters, like nitrates and total dissolved solids. An o-ring is utilized to seal the gap and create a watertight seal. The salinity tester is a refractor in the kit. One advantage of using the YSI is that it is used in situ, rather than having to test water back in the lab. The YSI is way more time efficient then having to test for each chemical individually. The room for human error is also reduced as the machine can replicate each testing at the multiple locations it is deployed at. Data is stored in the machine itself, so if one loses track, they can resort back to the machine. It is also easier to carry out the singular piece of testing material over all of the components to Fat Max, Conversely, one disadvantage is that it is highly expensive. The YSI can also produce wrong results if it is not well-kept (due to corrosion). Additionally, one can receive completely wrong readings if they do the procedure incorrectly. The operator may not even realize their mistakes and go on analyzing false data.