In this essay I will be discussing the ever-growing pollution issue in Northwest Indiana. Lake Michigan provided drinking water for thousands of people in many different states, including Illinois, Michigan, and Wisconsin. In today’s world there is an increasing demand for fresh water for a variety of things that society needs, things such as drinking water, water for cattle, water for crops, and many other uses. It should be no surprise any individual that Lake Michigan is filled with pollution, debris, disease, and chemicals. The need for change and solutions is here and technology is advancing at a pace that gives hope for cleaner waterway.

 Pollution in Lake Michigan is caused by many things such as beach goers leaving plastic bottles and beer cans, boaters dumping chemicals like gasoline, deiseal, antifreeze, oil, transmission fluid, and black water. However, individuals are not the only ones who are dumping things into our waterway, big corporations such as the mills, previously known as Cleveland Cliffs and Arcelor Mittel, have dumped several chemicals into the water such as iron and cyanide. All of these things cause devastating impacts toward our unique regions environment and the damage will become irreversible if no changes are made immediately.

Literature Review

 As the years go on without change researchers are uncovering more and more about the effects pollution has on our environment and have been looking at possible solutions to help get a stable grasp on the problem. Researchers from all over the world has looked into the issues of water pollution and because of how complex the issue is there have been multiple trails on the different levels and kinds of pollution of pollution. Some target issues that were looked into were large amounts of trash and debris, microplastics, heavy metals, chemicals, diseases, and other contaminates that are all present in large bodies of water.

The first issue being the larger plastics and trash pollutants, one way of clean-up is being used by the Ocean Cleanup, an organization set on diminishing the amount of floating trash in the oceans using a large makeshift coastline that catches plastic and trash so that it is easier to remove from the water. These artificial coastlines are floating barriers use the oceans natural currents to move and trap trash so that it is easier to extract from the water. (The Ocean Cleanup. https://theoceancleanup.com).

 Some other researchers looked into the possibility of using different types of plants to filter out heavy metals and chemicals from the water. Plants such as soybean hulls, cornstalks, sugar cane, duckweed, and other aquatic plants. As crops are grown there is a lot of waste that comes from them, this method of filtering pollution is promising because it utilizes plant matter that comes in bulk. Soybean hulls and cornstalks grow across the country and are a great filter for things such as lead, chromium, copper, and cadmium from contaminated waters (Soybean scraps: Nature’s pollution solution: USDA ars. n.d.). This method of water cleaning allows the plant residue to convert to dual functioning ion exchanging resin, the article states “They become a biological magnet for attracting both positively and negatively charged particles of heavy metals in water, working sort of like water softeners that draw out and replace unwanted hard-water particles” (Soybean scraps: Nature’s pollution solution: USDA ars. n.d.). Soybean and cornstalk are not the only promising foliage that could aid researchers in tackling water contaminates, other aquatic plants such as duckweed and azolla, can also help filter and treat water because of their ability to recycle nutrients. While looking through the literature used one researcher, Nazim Muradov, and his colleges states “Aquatic macrophytes improve water quality by accumulating toxic nutrients and heavy metals and by regulating oxygen balance. Various aquatic floating macrophytes have been proposed as agents of choice for the bioremediation of wastewater because of these features and also their very high growth rates and easy maintenance” (Muradov, N., Taha, M., et al 2014, February 28). These plants can help treat wastewater, plants such as duckweed have been used for over thirty years to recover nutrients from wastewater. Azolla was also shown to be effective; this plant is fern that grows in the water and like duckweed will grow rapidly. These aquatic plants will filter out things such as phosphates, ammonia, and microalgal vegetations. (Soybean scraps: Nature’s pollution solution: USDA ars. n.d.).

 Invasive plants are also another noteworthy option, invasive plants can be found is many different bodies of water and are treated as a problem even though they could be solution. These types of plants are often removed from areas, land and sea, by chemicals such as weed killers which can add to water pollutant levels. Researchers have seen a lot of potential in plants such as water hyacinth, which would normally be treated as a separate problem causing secondary waste. However, research from an article about this solution states “Several other adsorbents for pollutants removal from invasive species were well reported such as activated carbons, nanoparticles, composites, and aerogels” (Nguyen DTC; Tran TV; Kumar PS; Din (n.d.). Invasive plants remove pollutants like heavy metals, organic dyes, and oil, and deal with sorbent preparation like sorting, cleaning, drying, and chemical treatment (Nguyen DTC; Tran TV; Kumar PS; Din n.d.). There are many different kinds of plants that have the potential to aid in the water pollutant crisis, overall, this solution is cost effective, energy efficient, and biodegradable. The article also states that “High adsorption capacities of 476.190 mg/g for synthetic dyes and 211 g/g for diesel oils have been observed” (Nguyen DTC; Tran TV; Kumar PS; Din n.d). Invasive plants are prime candidates for water treatment and filtration because of their strong reproduction, fast propagation, high tolerance, and high adaptability (Nguyen DTC; Tran TV; Kumar PS; Din n.d.). The use of plants to treat water will help lower the amount of bacteria, metals, and chemicals in the water is ecologically friendly and beneficial. There are many different options of plants that offer a natural filter to a unnatural water pollutants that contaminate many bodies of water.

 Microplastics are another kind of pollution that needs to be addressed as the amount of microplastics in our water increases by the day. Microplastics take thousands of years to decompose, so the need to figure out a way to get them out of the water is high. One option is the process of flocculation, this process is where a chemical coagulant is added to the water to bond particles to increase their size, making them easier to remove. A more experimental version of this has been developed by a team of researchers in China. Researcher Zongxiong Huang and his team have been studying a process similar to flocculation. This process involves using solar power to act as a bonder for small nano plastics using glass balls to concentrate the light. This melts the plastics together into pieces that can be skimmed out of the water without adding more chemicals into the water.

Local Research

 Local research was conducted after talking to city officials, boaters, marina workers, and DNR officers shows a definite need for change. There is a lot of pollution happening in Northwest Indiana, it happens on all of our beachfronts.

 Portage, Indiana is home to a few local marinas and boat yards that do maintenance and winterizing of watercrafts all year round and have first hand experience with Lake Michigan. The first stop I made was to boat yard called Doyne’s Marine, there are several acres of muddy land and hundreds of boats shrink wrapped in plastic during the winter months, or the off season for boaters. After speaking with one of the worker’s, who requested to remain anonymous, about whether or not they thought water pollution was an issue in Northwest Indiana and they agreed that it is a silent issue in Portage. One question asked was if they knew about the type of pollutants that float within our water ways, the worker nodded and said “Oh yea, the amount of anti-freeze in this yard alone makes up for hundreds of gallons of water pollution alone, gallons get spilled every year when we get busy winterizing and trying to keep up with the amount of people pulling their boats in and out of the water.” This was interesting to hear so I continued to ask about other possible pollutants that come from boat yards, the worker thought for a second and stated “Well besides anti-freeze there is diesel, gasoline, oil, muriatic acid and black water. All of those are could be present in the ditch depending on the circumstances. I would say that boats are the biggest polluter in the waterway” Black water is water that comes from the pump out system inside of boats, in short is human sewage that can leak from boats or from pump-out systems at local marinas and yacht clubs. The final question asked was “What does your business do about pollution and does your business care about the possible damage to the land and water?” The worker responded “Doyne’s does have precautions, they have things such as oil booms, or oil socks, that with suck up oil from the water in the event that nay oil leaks from a boat or from the yard. You can’t do much for the anti-freeze because it dilutes in the water and doesn’t have add a shine to the water like oil does, it is nontoxic and biodegradable though. I would say they do care about adding pollutants to the water, but there is only so much that can be done on our end.” I was also informed that the bilge system within these boats will pump out any liquid resting in the bottom of the hull of the boat, so any potential oil leaks within the engine compartment have a chance of being pushed directly out of the boat and straight into the water ways.

 My next stop was the Sammie L. Maletta Marina, previously known as the Portage Public Marina. I have worked at the marina since graduating high school back in 2019 and have seen a fair share of what goes on and into the water. Sitting down with the harbor master, Barb Lusco, we discussed some of the things that the marina workers have witnessed in recent years as well as things that she has seen during her extensive years working for the city of Portage. A little over two summers ago there was a sudden issue with the fish that swim in the ditch and the mouth of lake, mass amounts of fish were dying from an unknown cause. Working alongside only one other person on staff there was an accumulation of over 600 dead fish in the marina basin alone. Walking along all ten docks and down every finger we used fishing nets to remove the mass amounts of fish from the water, we later got on the staff boat and traveled up and down the ditch to see the extent of the damage, hundreds more fish floating. It would not be another three days before the mills revealed the information that they dumped more cyanide than what was usually allowed and it causes a mass murder of unlucky animals in the water. Many staff members of all the neighboring marinas as well as hundreds of members of the public had already come into contact with the water without safety gear or prior knowledge of the spill. Staff have also seen the pump-out systems malfunction and break, causing human sewage to immediately start going into the water which gets moved out into the ditch and the lake from traffic in the marinas and water ways. Another issue to come out of the marina is the amount of trash come from the boaters, there is a large amount of people that throw mass amounts of garbage into the marina and into the lake directly. Staff have also witnessed sinking boats that sit for days because the owners refuse to come take care of their property, DNR and environmental officials have to come in and fine thousands of dollars a day before people start to care. Fisherman come in and talk about how there are not the same amount of fish in the lake anymore and how certain species of fish are hard to come by. Charter captains complaining about catching fish and getting them tested with DNR officials and finding plastics and heavy metals present. The general theme of things around Lake Michigan in Northwest Indiana shows everyone contributing to a problem and becoming upset that the problem effects them.

 Next on the list is Lyondell Bassall in Morris, Illinois. This plant can be used as an example of how to improve and handle waste water management. This plant is a leading manufacturer of nano/micro plastics in the forms of powders or beads. This plant is known to have its own separate water filtration system with multiple tanks and units used to recycle and replenish the water they use themselves to try and keep it as closed of a system as possible. Inside of the plant is a system of water ways and ditches that run throughout a private sewer system and is pumped directly to their filtration units. This means that any of the potential plastic or chemical run offs stays within the plants. Along with their ditch system, around each major plastic unit is a closed off grating system that is pumped out by the plants sump pumps, or in extreme occasions they call in dedicated companies that will come in with specialized vacuum trucks that will remove and clean out any of the contaminants. This lowers the chances of any plastics or chemicals from entering into any ground water or any waterways that could end up in the lake. The water used in this filtration system is cleaned and reused throughout the plant so that it does not enter the cities filtration systems. Unlike the mills in Northwest Indiana that deposits water used for cool down processes back into Lake Michigan which leads to heavy metals getting pumped directly into the water in warm run offs, this water could easily be reused within the mill systems and could be cleaned and filtered so that levels of heavy metals within the water ways can be lowered.

Reflection

 After looking over research on water pollution and solutions and conducting local research and comparing it to the problem in Lake Michigan the solutions look promising. The state-of-the-art solutions, like using glass and solar energy to melt microplastics, can be applied to the microplastic pollutants in the lake. The use of plants, invasive, land, and aquatic, can be used to absorb heavy metals, chemicals, and other contaminates that are all present in Lake Michigan. Also, the use of artificial coast lines, like the ones used in the Ocean Cleanup, compares with the trash that floats throughout the lake and help remove it from the water. All of the possible state-of-the-art ideas compare perfectly with the issues that plaque Lake Michigan. The solutions found parallel a problem that needs to be addressed and offers Northwest Indiana multiple options to improve the water quality and lower the amount of pollutants in the water.

Evaluation

 The problem in Lake Michigan has been evaluated and it has become increasing worse, the lake is filling with pollutants and wildlife is slowing down. City officials have ignored the problem and have done very little to stop and prevent dumping directly into the lake or to individual parties for polluting the water ways. There is hardly even a search to find who is directly responsible for these crimes. The people of Northwest Indiana do not seem to mind the mass amounts of pollution, some do not even think the problem exists, however this is not the case for all of those in this region. Many people want to see real change but do not how or where to get involved or where to start.

Proposed Solution

 After reviewing the literature and local research there are clear solutions that can be applied to Lake Michigan. The first solution that can be addressed is issue of nano/micro plastics, while the plastics are tiny, but damages they cause are anything but small. The solution is very ambitious but it is achievable, while looking over the study done in China it seemed very possible to lower the amount of microplastics in Lake Michigan with this method. Buoys are placed in strategic spots to mark things such as ‘no wake zones’, so if the city places a similar structure make of glass that would magnify sunrays and melt these plastics that are nearly invisible to the naked eye. This process acts like a coagulant that bonds the plastics that have been found all over the lake. These glass structures could be places in the Little Calumet, the mouth of the lake, and other locations that have high rates of nano/micro plastics.

 The second step of the solution is to create artificial coast lines around Lake Michigan in all bordering territories, the lake has its own system of currents that can push trash and large pollutants into nets for easy removal. The Ocean Cleanup uses this strategy on a large scale in the ocean and has collected over 220,462 pounds, or 110 tons, of trash using this method. Using artificial coastlines will lower the amount of trash from Lake Michigan and create a cleaner source of drinking water.

 Another part of the solution involves plants, both ones grown on land and in water. Plants that are grown in or can be grown in Indiana or neighboring states will be used to filter out heavy metals and chemicals in a cost effective and energy efficient way. Plants such as corn and soybeans are grown in multiple states, such as Indiana, and usually ends up with waste. Soybean hulls are considered waste that does provide a few other uses, but there is still a mass amount of plant waste from crops that could be used to absorb chemicals such as anti-freeze, oil, and fuel. Plants such as duckweed, or invasive plants, can also be used and grow very quickly and are able to recycle nutrients efficiently. This can used to help lower the amount human sewage and blackwater from Lake Michigan, which would help lower the amount if bacteria and diseases like E. coli that often present in large enough qualities for cities to prohibit the public from entering the water. Plants like duckweed, cornstalks, and soybean hulls are all easily accessible in Northwest Indiana and offer the perfect solution to this part of the complex water contaminate issue.

Lake Michigan is important to protect, it is detrimental that citizens contact city and government officials to get proper legislations put in place. The last step of the solution is reform of the laws, regulations, and guidelines and make them stronger for Lake Michigan. There needs to be stronger laws and regulations about what is being put into Lake Michigan, especially from big corporations like the mills. The mills alone have put mass amounts of contaminates into the water and have faced little to no disciplinary action. Accountability for fishermen and boaters who pollute the waterways is also needed, chemicals from marinas, mechanical shops, and the boats often leak into the lake. Filtration systems within these large chemical plants and mills needs to be mandatory. Some plants, such as Lyondell Bassall, already have these systems in place. These systems might not be completely perfect but they greatly cut the amount of contaminates that enter the water ways.

Conclusion

 The research conducted for this paper was very eye opening and has provided a new outlook on the future of Lake Michigan and the residents of Northwest Indiana. The solutions proposed offer some good insight on how to fix the problem at hand. Pollution is not just one simple problem so one simple solution is not going to help. A complex networking of different solutions such as plants use, solar energy, and stronger regulations and laws will push the odds in societies favor and lessen the impact of contaminates in Lake Michigan. There needs to be action immediately, there is no time for people to wait and decide. Humanity is on borrowed time and the time for action is now, the research shows an immediate call to action.