5-2019

Something's in the Water: A Look at How Creativity and Innovation Can Prevent Future Water Crises

Tristan Holiday-Nowden
State University of New York College at Buffalo - Buffalo State College, holidat01@mail.buffalostate.edu

Advisor
Mike Fox

SUNY – Buffalo State
International Center for Studies in Creativity

Something's in the Water: A Look at How Creativity and Innovation Can Prevent Future Water Crises

A Project
in Creative Studies
by
Tristan Holiday-Nowden

Submitted in Partial Fulfillment
of the Requirements
for the Degree of Master of Science

May 2019

May 18, 2019

Abstract of Project

Something's in the Water: A Look at How Creativity
and Innovation Can Prevent Future Water Crises

The purpose of this project is to raise awareness and create a level of consciousness about water, unlike anything we have seen in the past. This project presents a synthesis of current writings and ideologies from the fields of Environmental Science and Water Research. As well as *think pieces* and informative news articles from various publications.

To illustrate the damaging effects of water contamination, water pollution, and water scarcity; Flint, Michigan will serve as a case study. After diagnosing and defining the problem using the Creative Problem Solving (CPS) framework. This project will explore the challenge and look at the conditions that created a city like Flint. Concluding, with the implementation of Creative Thinking Tools, the development of action plans, and integration strategies for all sides. That includes lawmakers, the city's residents, and anyone who might be affected in the future.

Keywords: Auga, Contamination, Environment, Flint, Health, Pollution, Project, Scarcity, Water

Tristan Holiday-Nowden

Date

SUNY – Buffalo State
International Center for Studies in Creativity

Something's in the Water: A Look at How Creativity and Innovation Can Prevent Future Water Crises

A Project
in Creative Studies
by
Tristan Holiday-Nowden

Submitted in Partial Fulfillment
of the Requirements
for the Degree of Master of Science

May 2019

Dates of Approval

_____ _____

Project Advisor: Dr. J. Michael Fox

_____ _____

Candidate: Tristan Holiday-Nowden

May 18, 2019

Table of Contents

#persistentwarrior

May 18, 2019

Acknowledgments

Thank you, friends and family, for pushing me at a time when I needed it most…

…Thank you, International Center for Studies in Creativity for encouraging me to trust process

…And, thank you Ayemashowdem family for reminding me to never doubt my vision.

(Pronounced: I'm a show them) – and I will!

I write for those who do not have a voice because they were so terrified, because we are taught to respect fear more than ourselves. We've been taught that silence would save us, but it won't.

Audre Lorde

May 18, 2019

Preface

If there's one thing Americans agree on, it's that water is a valuable resource. We know that all living things rely on water, and without it, life would be virtually impossible. While the consensus is that, "no matter where we live, we can't live without water" (Mills, 2017). There does appear to be somewhat of a disconnect when it comes to things like water contamination, water pollution, and water scarcity. Which begs the question, does the average American take their drinking water for granted?

Aside from knowing that water is good for us, being that it helps to keep us hydrated and works to promote healthy organ functioning. Our understanding of water and where it comes from is, elementary at best. Research shows that 70% of the water that covers the Earth's surface is approximately 98% seawater. But, due to high salt levels, it is neither drinkable nor is it for human consumption. Only 2% of the water on the planet is fresh, with 1.6% confined to polar ice caps and glaciers. That leaves just 0.036% of the Earth's water supply accessible to lakes and rivers. Let that sink in (Alrumman et. al, 2016).

Water, the thing we consume most and yet we know little about it. To test this theory, ask someone the question, "where does our drinking water come from?" See what the response is. Most people couldn't tell you if their water comes from a lake, reservoir, or waterway (Apec Water, 2017). All we know is that it comes out of our faucet. In the United States, water is plentiful. So, the thought of not having clean and safe drinking water is a concept that escapes us. What most Americans fail to realize is that it is both a luxury and a privilege to have adequate drinking water.

According to the World Health Organization (WHO), people in many parts of the world are still without adequate drinking water. Let me rephrase that. A prerequisite for a healthy life remains inaccessible in communities around the globe (Kumar Reddy et. al, 2012). So, what does that say about the distribution of natural resources? Are they available to some but not to others? It may come as no surprise, that due to water contamination these communities are often predisposed to infectious disease and waterborne illness. Hence, it is the absence of worry when it comes to our drinking water, that most of us associate with living in America.

As luck would have it, the United States is on the verge of a national water crisis, from water contamination to water pollution and even water scarcity in some areas. In the past, our solution was

to turn a blind eye to what was happening globally. But, now that it's happening locally in cities like Flint, Michigan. Can we afford it?

Section 1: It's Not That Deep…

While, the city of Flint, Michigan made headlines. Other communities are now waiting on the sidelines. With hundreds of cities and towns at risk of being exposed to contaminated and poisoned water. Some Americans think that this is only the beginning. A preview of what is to come in cities across the country. Leaving residents to believe that this is the new normal.

In 2013, experts warned city officials that if they failed to treat the Flint River with corrosion inhibitors, they were looking at contaminating the city's drinking water. Despite warning in April 2014, officials changed the city's water source in Flint, Michigan from the treated Detroit River to the untreated Flint River. Regardless of the facts, city officials maintain that they switched the city's water source, in hopes that it would reduce Flint's water fund deficit (Bliss, 2016a).

After terminating the city's contract with Detroit's Water and Sewage Department, and breaking ground on a new pipeline. That was projected to use Lake Huron as a water source. City officials opted to use the Flint River as its primary water supply during the two-year project. Neglecting the city of Flint, it's residents and the city's infrastructure in the process (Bliss, 2016a).

With canals that date back to the late 1880s, the United States has water flowing through pipes almost as old as the country's history. If this is the standard, then it should come as no surprise that the decaying infrastructure in Flint also contributed to lead and neurotoxins seeping into the city's drinking water. Not to mention, immediately following the city's approval of tapping into the Flint River. Fecal matter, coliform bacteria, and other toxic substances, like lead, were pushed through the city's pipes and into the service lines of resident's homes.

What remains a mystery, is how the state-appointed emergency manager gained approval for the switch, after consulting with the Michigan Department of Environmental Quality (MDEQ). Even though MDEQ, helps to enforce the Environmental Protection Agency's (EPA) water standards.

In a 2016 article titled "Why It's So Disturbingly Common for Water Regulations to Fail" author Laura Bliss identifies three reasons, which are:

1) Local politics affects compliance

2) Government can't touch government and

3) It's all one big dysfunctional family (Bliss, 2016b).

Despite the federal government's attempt to set environmental standards across the country. The EPA is responsible for imposing environmental standards on a state level. Although, each state is independently responsible for implementing rules and regulations at a local level. Technically, the responsibility falls on all sides from EPA regulators, to federal and state enforcers, all the way down to local water providers. Our water is dependent on the balance and connectivity of these relationships. Or, as Daniel Fiorino Director of the Center for Environmental Policy at American University describes "I compare it to family relationships, you may not get along, but you have to work together" (Bliss, 2016b).

When we look at the role of government in the case of water-quality violations, what we find is that it's complicated. As there is a system of checks and balances intended to restore power on all levels to ensure that the federal, state and local governments fulfill their responsibilities, there are three branches of government: Legislative, Executive, and Judicial. The Legislative branch creates the law. The Executive branch enforces the law. And, the Judicial branch interprets the law.

Even with this well thought out plan, local levels tend to operate a lot like the federal and state levels of government. Meaning local municipalities have ordinances (e.g., laws, rules, and regulations) that are typically enacted by the city council, usually elected officials chosen by the citizens of that community. Now, let's review. At the local level, rules and regulations are enforced by the city government. The governing body with regards to city government is called the city council, which consists of the mayor, council members, and in larger areas – the city manager.

So, now that we have a clear understanding of how government works. We should be able to answer the following questions:

Who dictates who gets clean water?

Who should be aware of a problem with the drinking water?

Who can fix the problem?

Who informs the federal government?

Who is responsible for notifying the public?

Section 2: …The Hell It Ain't

The following is a water contamination timeline starting from 2014, although the list has continued to grow this is only a snapshot of what has happened so far in places like West Virginia, Ohio, North Carolina, Chicago, New Jersey, and Louisiana.

01/2014 – Charleston, West Virginia; Issue: Contamination

04/2014 – Flint, Michigan; Issue: Infrastructure, Water Treatment Problems, Toxic Lead Levels

01/2016 – Sebring, Ohio; Issue: Toxic Lead Levels

07/2016 – Duplin County, North Carolina; Issue: Hog Waste Contamination (residents reported neighboring farms spraying crops with hog waste which polluted the air in addition to their homes and yards nearby) Note: residents are still waiting for the government to step in

12/2016 – East Chicago, Indiana; Issue: 18 out 43 Homes Tested Positive for Lead in Water

01/2017 – Englewood, New Jersey; Issue: Englewood Hospital Drinking Water Tested Positive for Lead Contamination (due to concerns the hospital switched to bottle water)

08/2017 – Tallulah, Louisiana; Issue: Fecal Bacteria, Water Contamination, and Aging Infrastructure

When it comes to water contamination in the United States, most people assume that Flint, Michigan was the first. Sadly, there were earlier cases. But, what made Flint different was the delayed actions of public officials in response to the city's water-quality violations. In fact, it was a probe of exhausting failures that prompted President Obama to declare a state of emergency. Thereby, authorizing the Federal Emergency Management Agency (FEMA) to provide equipment and resources to those in need (ABC News, 2016).

According to the EPA, there are only nine states that have reported "safe levels" of lead contamination in their water supply: Alabama, Arkansas, Hawaii, Kentucky, Mississippi, Nevada,

North Dakota, South Dakota, and Tennessee. With forty-one states reporting an Action Level of Exceedance (ALE) in the last three years. Most states have exceeded the permitted levels of lead contamination in their drinking water.

"The federal government's action level for lead in drinking water is 15 parts per billion" (Environmental Protection Agency, 2016). Even though, 10 parts per billion is the World Health Organization's standard level. Therefore, in any of these cases, samples taken and tested would have exceeded the preferred action level. In other words, the highest level registered in most cases would be a lot more than 15 parts per billion. Alarming, right? But, then again, maybe not. Seeing as though, in most cases, officials did not utilize caution, nor did they inform or notify the public.

Research shows that lead exposure in Flint, Michigan has impaired the cognition of at least 6,000 children. With 12,000 children experiencing a range of other serious health problems. Findings show that there was also an increase in the elevated blood-levels of children. In 2013, the average level was 2.5% and in 2015 levels had risen by as much as 5% (Hanna-Attisha, 2016).

Studies show that the effects weren't much better for adults. With a 58% increase in the number of fetal deaths and miscarriages, compared to women in areas not affected by lead-contaminated water. New research has also discovered a link between water contamination and Legionnaire's disease, a form of pneumonia which likely spread through the city's drinking water. As of this year, ten people have died from this disease (Pearce, 2017).

Now, that we have analyzed the effects of the water crisis, let's look at the conditions that created a city like Flint. Located 70 miles north of Detroit, Flint, Michigan has a population of approximately 98,000 people. With the average household earning a median income of $24,679. 41% of Flint's residents live below the poverty line (Martinez, 2016).

Once home to the nation's most prominent General Motors (GM) plant. The economic decline of Flint, Michigan started in the mid-1980s when GM downsized its vast industrial complex. With many factory workers out of a job, a lot of residents were never able to recover. Which begs the question, how did race and poverty factor into the water crisis in Flint?

> While it might not be intentional, there's this implicit bias against older cities – particularly older cities with poverty (and) majority-minority communities, said Democratic U.S. Rep. Dan Kildee, who represents the Flint area.

> It's hard for me to imagine the indifference that we've seen exhibited if this had happened in a much more affluent community, he said.
>
> For the record, Flint is 57% Black, 37% White, 4% Latino and 4% Mixed Race, according to the U.S. Census (Martinez, 2016).

Section 3: Bottled Hope: Alternative Ways to Build Resident's Confidence

Now that we have examined the actions, decisions, and processes from 2014-onward, that created the water crisis in Flint, Michigan. Let's take a look at the Creative Problem Solving (CPS) framework and explore what it can do for the challenge.

Creative Problem Solving is the process of generating new ideas using the repetitive methods of divergent and convergent thinking (Lim et al., 2010). These ideas can lead to solutions that address problems deemed irresolvable. Or, it can bring fresh new ideas into existence (Ingledew, 2016).

CPS has been known to help individuals and organizations solve difficult problems. The CPS framework consists of four stages aimed at generating ideas and picking one that is most suited to address the challenge (Foursight, 2014):

(1) Clarify – when you need to pinpoint the right challenge to pursue
(2) Ideate – when you have a clearly defined challenge and you need ideas for it
(3) Develop – when you want to turn promising solutions into workable solutions
(4) Implement – when you need buy-in from others and an action plan to follow

In order to effectively utilize CPS, it is essential to use both divergent and convergent thinking. Divergent thinking involves producing a large number of answers to an open-ended problem (Guildford, 1967). Whereas, convergent thinking consists of finding the single best answer to a usually prescribed problem (Guildford, 1967) – see page 17 for diagnosis and Appendix C.

If you're in government, you might be familiar with the term Administrative Creativity. In that case, there are some similarities between the two.

> The ability to engage in such processes depends on contextual factors. For example, cultures of openness and accomplishment are more likely to produce commitment to efficacious new strategies than cultures of complacency, conformity, or cynicism. When people feel unsafe or fear retribution, group processes are unlikely to produce necessary insight, initiative, and commitment. Leaders need to ensure that the culture in their jurisdiction, and that of their

> senior management team specifically, supports creative problem solving (West & Berman, 1997).

The ground rules for divergent and convergent thinking are as follows:

When you Diverge…

- Defer judgement
- Strive for quantity
- Seek wild and unusual ideas
- Build on other ideas

When you Converge…

- Be affirmative
- Be deliberate
- Check objectives
- Consider novelty

When coming up with solutions for how to prevent future water crises. It is vital that all sides (i.e., government, city officials, and community members). be involved in the process of reframing the problem.

To jumpstart your learning, listed below are some alternative ways to build resident's confidence (using the CPS approach of novelty and usefulness) in Flint, Michigan and elsewhere:

- Water Treatment Facility Field Trips (Appendix D): cities may consider reopening these facilities to the public so that residents of all ages can familiarize themselves with the process of water purification (i.e., retrieval, filtration, and treatment)

- Boil Water Advisory: a notification issued by the Department of Public Health and the local water department, this preventative measure could be used to frequently warn residents about their drinking water and the possibility of bacterial contamination

- Water Alert System: (Appendix A) America's Governing Uniform Alert or Aquatic Governing Uniform Alert (AGUA). In addition, there are other abridged versions that this could be called such as the "AGUA Alert" or the "AQUA Alert." AUGA is an alert application (also known an as an app) – that allows residents to receive water advisories and notifications about contamination levels. With the help of a unique camera feature, the app makes checking the pH level of cities drinking water easier than ever before. The application also features a shuffler that pairs environmental factors with various thinking skills models, assisting residents as they try and solve potential challenges. AUGA correspondingly

encourages residents to engage with each other and build community via messenger and through the timeline feature

- Water Testers: the local water department could create a depository for residents to bring in their drinking water to have it tested using a litmus test, in addition to providing residents with pH strips and educational pamphlets about water treatment

- pH strips (Appendix B): making these available would allow residents to test the acidic and alkaline levels of their drinking water

- Groundwater Storage: presents itself as a promising solution, in that, it helps keep cost down while storing stormwater and excess dam flow. In addition to recharging existing aquifers, groundwater basins have the potential to work with nature's infrastructure

- Water Regulators (Independent Agency): seeing as though water-quality issues like water contamination, water pollution, and water scarcity are only progressing. The United States government may want to entertain a federally regulated agency to impose water regulations on cities and states to protect the city's residents. Like the Consumer Financial Protection Bureau (CFPB) that was created in 2008, to ensure the protection of the average American when it comes to big business (e.g., banks, the economy, and other financial institutions)

Water Crisis – Flint, Michigan 2014 – 2019
Checklist (Other Things to Consider)

If you have questions about where begin, start by asking the following questions:

What might creativity do for the challenge?

- Define the problem
- Help city officials solve the right problem
- Put the money to the right use
- Brings water regulations and infrastructure into the 21st century

What will creativity cost?

- It is too early to say
- Looking at the damage the water crisis has already caused. Creativity seems comparable to what the city should have spent in the first place
- I believe it will be impossible to cut corners with something like this

What might be some specific tasks that people in various levels in government might do?

- Create federal water regulators
- Employ the Creative Problem Solving / Design Thinking framework
- Hire a team of creative problem solvers, creativity professionals, or process experts
- Address the issues regarding infrastructure
- Consider some of the other solutions outlined in Section 3: Bottled Hope

What's in it for me?

- Addressing the issue head on will keep it from happening later on down the road
- Addressing the right problem will help cut costs in the long run
- Infrastructure will allow cities and states to support future growth
- Residents will be happy that local and state government is acting on their behalf (meaning public officials are more likely to get re-elected)
- **Clean and safe drinking water for everyone!!!**

Section 4: The Prescription

YOUR PERSONAL PRESCRIPTION INFORMATION

Your Local Innovation Lab
1300 Elmwood Ave
Buffalo, NY 14222
(716) 878 - 4000

IF YOU HAVE QUESTIONS ABOUT YOUR PRESCRIPTION, PLEASE CONTACT YOUR LOCAL PHARMACY OR CALL 1-800-RESOLVE.

PATIENT	FLINT, MICHIGAN
BIRTH DATE	04 / 25 / 2014
MEDICATION	CREATIVE PROBLEM SOLVING
QUANTITY	1
DIRECTIONS	CLARIFY, IDEATE, DEVELOP, IMPLEMENT
DOCTOR	CENTER FOR DISEASE CONTROL
PATIENT ALLERGIES	E.COLI, HAFNIA, ENTEROBACTER AEROGENES, LEIGONELLA

INGREDIENT NAME: Creativity

COMMON USES: Shifting thinking, Novelty, Usefulness, Out-of-the-box thinking

BEFORE TAKING THIS MEDICATION: Gather data and assess the situation. Each step of the Creative Problem Solving process requires three overarching skills: openness to novelty, tolerance for ambiguity, and patience for complexity. TELL YOUR DOCTOR: If you have an allergy to creativity, Creative Problem Solving, or any other part of this medication. Tell your doctor about the allergy and what symptoms you had, like rash; hives; itching; fatigue; or any other signs. Before using this medicine, talk to your doctor. TELL YOUR DOCTOR: If you are uncertain or apprehensive about taking this medication. Do not start, stop, or change the dose of this medication without checking with your doctor or local creativity professional.

HOW TO USE THIS MEDICATION: Paired Comparison Analysis (PCA) is a convergent focusing tool that can be used to prioritize a set of options. It can be used independently or in groups. If more than one person is involved in the rank-ordering process, they must do their own PCA and compare the results after the other PCA's are completed. Using the scale of: 1 – **SLIGHTLY** *more important*, 2 – **MODERATELY** *more important,* and 3 – **MUCH** *more important*. (1) Compare the 2 factors represented by each box and decide which is more important in your opinion. (2) Place the letter corresponding to the more important factor in the box. (3) Use the scale to assign a degree of importance to the letter you choose (i.e., a valence). (4) Total the numerical scores for each letter. For example, a valence of 1 equals 1 of that letter and a valence of 3 equals 3 of that letter.

CAUTIONS: Doing nothing could cause additional side effects. Such as wheezing, tightness in the chest or throat, trouble breathing or talking, swelling of the face, mouth, or lips. If left untreated, lead poising can cause build up in the body which is known to elevate blood levels in children. At high levels, lead contamination and lead poising can be fatal. Continuous exposure to contaminated water can also promote the growth of toxic bacteria, like Legionella. These are not all of the side effects that may occur. If you have questions about side effects, call your doctor. Call your local creativity professional for advice about creative problem solving.

ADDITIONAL INFORMATION: If your condition worsens and does not improve, call your doctor or your local creativity professional. Check with your local creativity professional for more information about how to use other focusing methods and creative thinking tools. If you have any questions about this medication, please talk to your doctor or local creativity professional. Other questions to consider: What might creativity do for the challenge? What will creativity cost? If creativity is not a part of the purposed decision, what will that cost? And, can you afford not to use it? What might be some specific tasks that people in various levels of government might do? What is in it for me (if I use creative problem solving)?

Call your doctor or local creativity professional for advice about side effects. You may report side effects to ICSC at 1-800-ICSCFIX.

Solving the water crisis in Flint isn't about making things right, it's about doing what's right, and giving the state a second chance at being "Pure Michigan." Amidst, this crisis we have seen nothing but resilience and determination from Flint's residents. And, while they are the true embodiment of the city's motto "strong and proud" unfortunately, the future of Flint and cities like it isn't exclusively in the hands of residents. It's in the hands of lawmakers, public officials, and government to elevate resident's voices and address their concerns.

To the residents of Flint, you have done MORE than your part. And, to the lawmakers and public officials, the world is watching.

References

ABC News. (2016, March 16). FEMA denies request for federal aid for Flint for a second time. Retrieved November 6, 2017, from http://www.abc12.com/home/headlines/FEMA-denies-request-for-federal-aid-for-Flint-second-time-372228992.html

Alrumman, S. A., El-kott, A. F., & Keshk, S. M. (2016). Water pollution: Source & treatment. *Environmental Engineering, 6*(3), 88-98. Retrieved November 05, 2017, from https://www.researchgate.net/publication/304462245_Water_Pollution_Source_and_Treatment.

Apec Water. (2017). How is tap water treated and delivered? Retrieved November 23, 2017, from http://www.freedrinkingwater.com/water-education3/32-water-tab-water.htm

Bliss, L. (2016a, January 20). Flint has been looking at water all wrong. Retrieved November 2, 2017, from https://www.citylab.com/equity/2016/01/flint-water-crisis-lead-michigan/424728/

Bliss, L. (2016b, February 12). Why water regulation so frequently fails. Retrieved November 03, 2017, from https://www.citylab.com/equity/2016/02/flint-water-crisis-epa-regulations-mdeq/462444/

Environmental Protection Agency. (2017). Basic Information about Lead in Drinking Water. Retrieved October 26, 2017, from https://www.epa.gov/ground-water-and-drinking-water/basic-information-about-lead-drinking-water

Hanna-Attisha, M., Lachance, J., Sadler, R. C., & Schnepp, A. C. (2016). Elevated blood lead levels in children associated with the Flint drinking water crisis: A spatial analysis of risk and public health response. *American Journal of Public Health, 106*(2), 283-290. doi:10.2105/ajph.2015.303003

Kumar Reddy, D & Lee, S.M. (2012). Water pollution and treatment technologies. *Environmental & Analytical Toxicology*, 2(5), 1-2. Retrieved November 01, 2017, from https://www.omicsonline.org/water-pollution-and-treatment-technologies-2161-0525.1000e103.pdf

Martinez, M. (2016, January 28). Flint, Michigan: Neglected because city is black, poor? Retrieved October 6, 2017, from http://www.cnn.com/2016/01/26/us/flint-michigan-water-crisis-race-poverty/index.html

Millar, E. (2012, May 30). Only radical thinking will solve environmental problems. Retrieved November 16, 2017, from https://www.theglobeandmail.com/report-on-business/economy/growth/only-radical-thinking-will-solve-environmental-problems/article4217629/

Mills, T. (2017). Holding Water in High Regard. Retrieved November 20, 2017, from http://www.greenshortz.com/holding-water-in-high-regard

Pearce, K. (2017, September 22). Lab report: Flint's water crisis had a 'horrifying' effect on fetal deaths. Retrieved October 6, 2017, from https://www.citylab.com/equity/2017/09/lab-report-the-flint-effect-on-unborn-babies/540807/

Appendix A

The following screens have been selected to highlight the use and functionality of America's Governing Uniform Alert or Aquatic Governing Uniform Alert (AGUA) also known as the "AGUA Alert" or the "AQUA Alert."

Appendix A: Login Screen

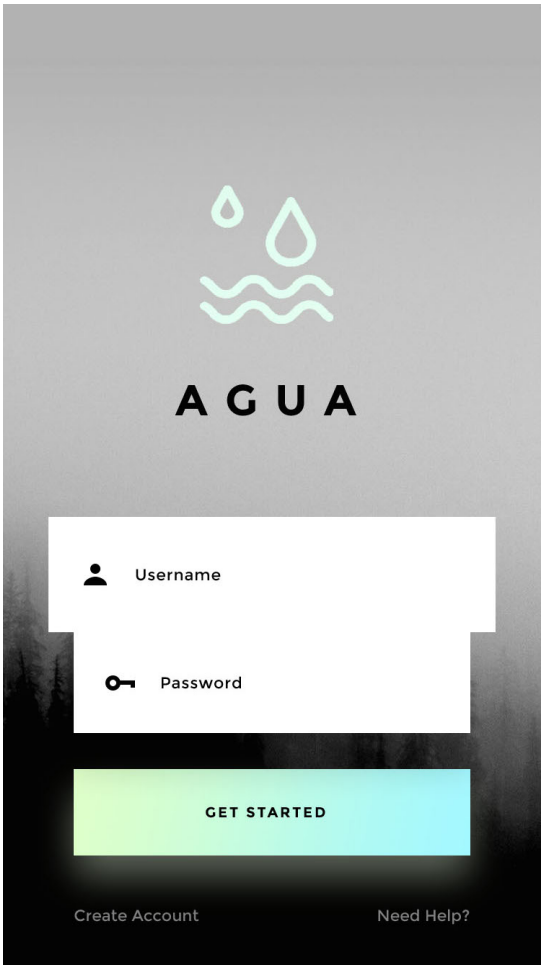

Figure 1: Once the application is made available through the Apple Store or the Google Play Store, the user would download the app to their device. After downloading the application, the AGUA alert icon would show up on the device's home screen. The user would then click on the icon, which would direct them to the login-in screen that you see above. Here the user is asked to create a username and password before connecting with their community online.

Appendix A: Login Screen

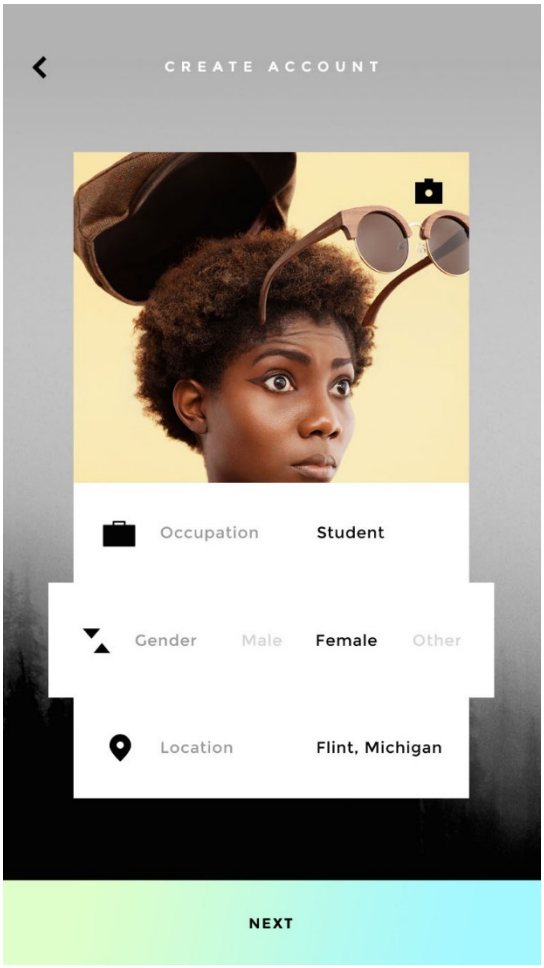

Figure 2: This screen is an extension of the login-in screen. Here the user is asked to share a bit of information about themselves before creating an account. For example, occupation, gender, and location.

Appendix A: Alert Notification Settings

Figure 3: This screen allows users to specify how they would like to receive alerts about the water quality in their area. Users have the option of push notifications, email notifications, or both. The push notifications feature enables users to receive alerts through only the application. Whereas, email notifications can be set to work alongside the push notifications or they can work independently. The email notifications feature enables users to receive alerts through email and are accessible outside of the application.

Appendix A: Water Advisory Chart

Figure 4: This screen works with the previous alert notifications screen and informs the user about current water advisories. Here the user can check to see what the water advisory status is low (i.e., drinkable), guarded, elevated, high, or severe (i.e., undrinkable or hazardous). The chart updates based on local water advisories and reports from cities residents.

Appendix A: Fresh Water Feature

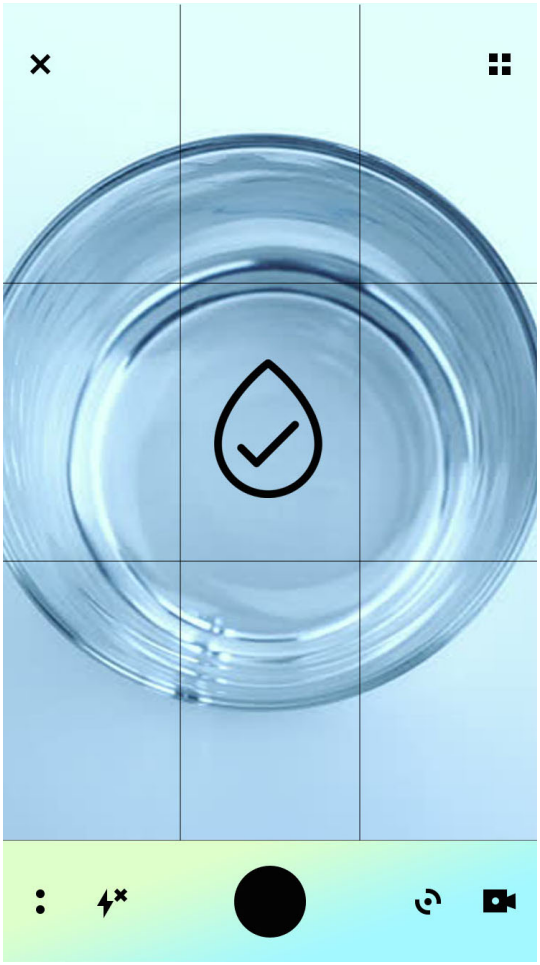

Figure 5: This screen allows users to check the pH level of their drinking water using the camera on their device. The Fresh Water feature utilizes an image recognition software that tests using a scan, to see if the water is drinkable or undrinkable. Once completed, the user receives an icon of a water droplet with either a check or an x.

Appendix A: Fresh Water Feature pH levels

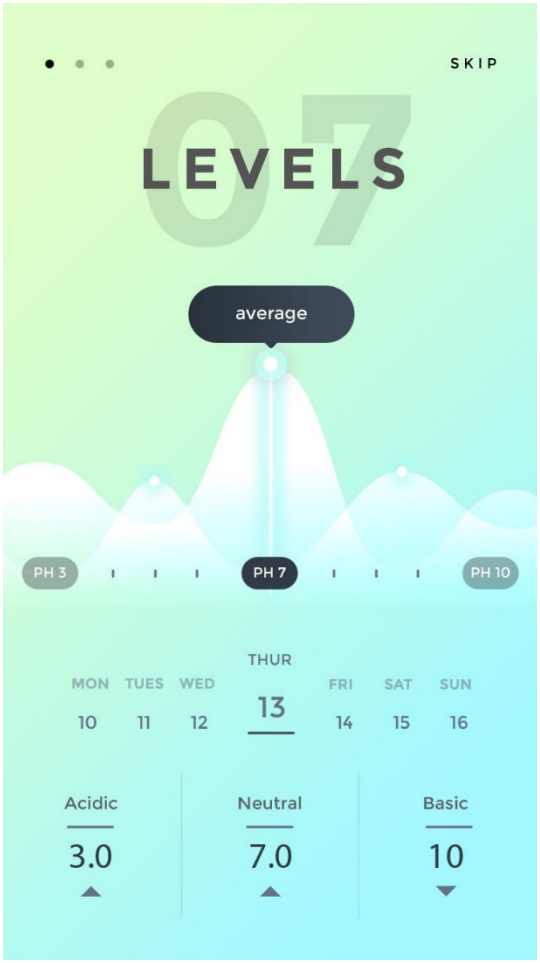

Figure 6: This is another aspect of the Fresh Water feature. Providing users with alternate ways of viewing detailed information about the water they are consuming. In addition to monitoring the current pH levels of their drinking water, which can be done daily, monthly, or yearly at the user's discretion.

Appendix B

The following images explain aspects of the water treatment process. From water and wastewater treatment to aeration tanks to pH testing.

Appendix B: Water Treatment

Figure 7: Water and wastewater treatment facility

Appendix B: Water Treatment

Figure 8: Aeration tanks at water treatment facility (i.e., mechanical, biological, and sludge treatments)

Appendix B: Water Treatment

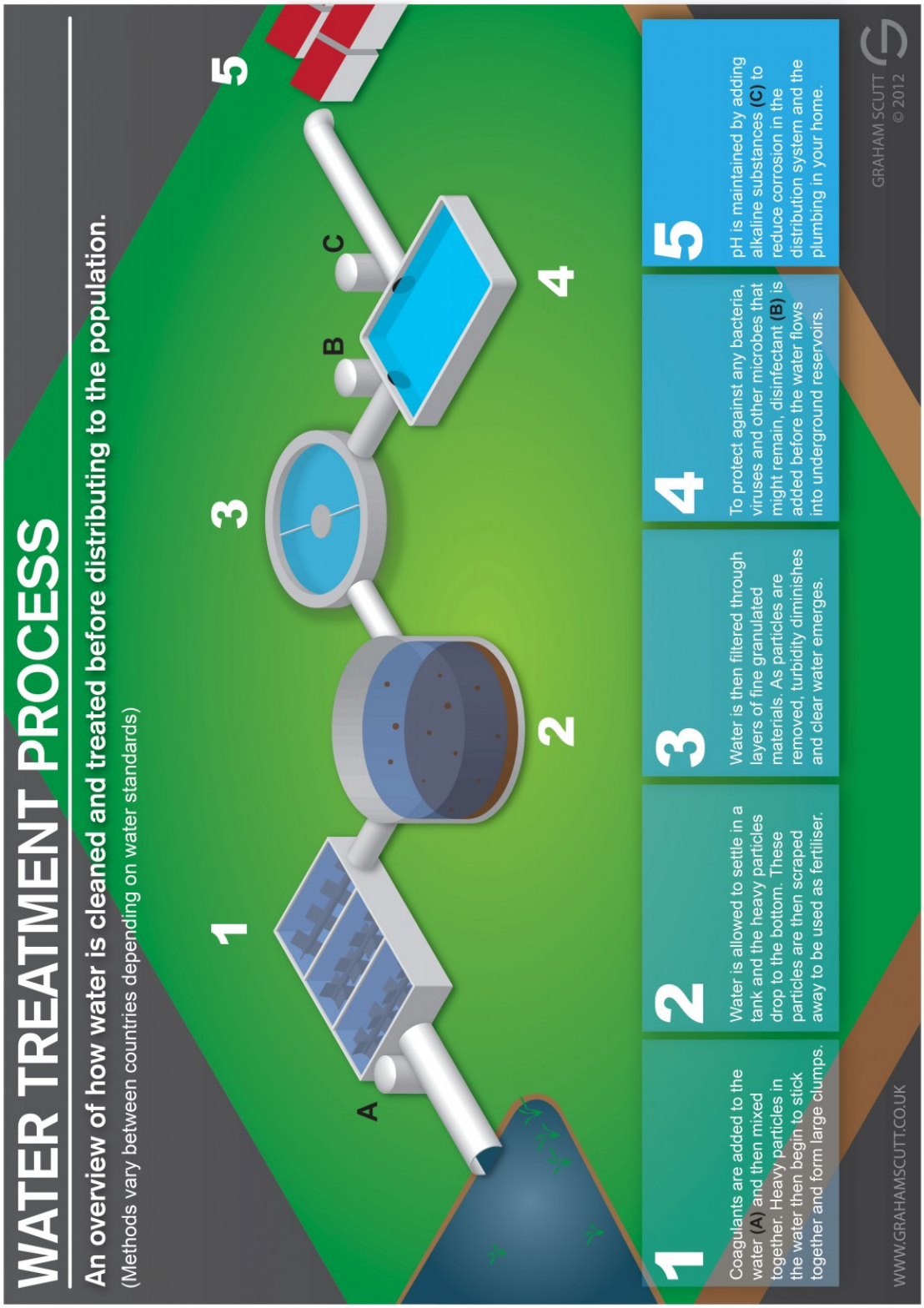

Figure 9

Appendix B: Water Testing

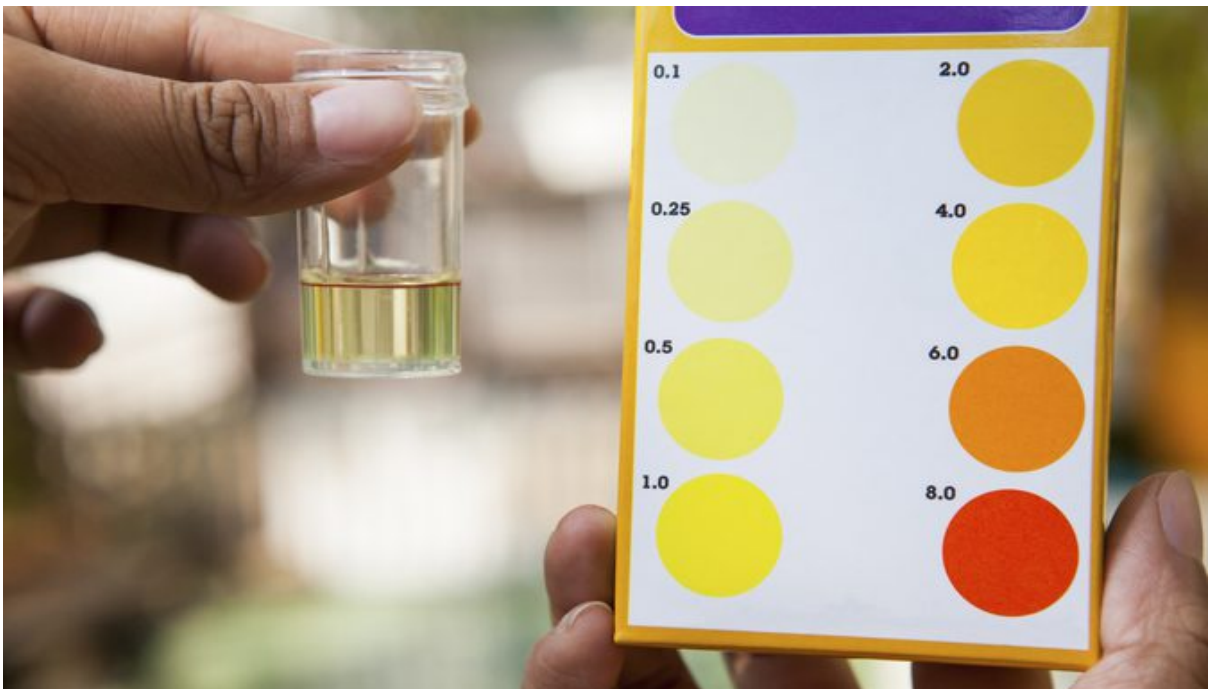

Figure 10: Person holding test tube and color chart, testing the pH level of drinking water

Appendix B: Water Testing

Figure 11: Person holding test tube and color chart, testing the pH level of drinking water

Appendix C

Paired Comparison Analysis (PCA) is a convergent focusing tool that can be used to prioritize a set of options. It can be used independently or in groups. If more than one person is involved in the rank-ordering process, they must do their own PCA and compare the results after the other PCA's are completed.

Paired Comparison Analysis (PCA)

Paired Comparison Analysis (PCA) is a convergent focusing tool that can be used to prioritize a set of options. It can be used independently or in groups. If more than one person is involved in the rank-ordering process, they must do their own PCA and compare the results after the other PCA's are completed.

Instructions

1. Compare the 2 factors represented by each box and decide which is more important in your opinion.

2. Place the letter corresponding to the more important factor in the box.

3. Use the scale to assign a degree of importance to the letter you choose (i.e., a valence).

4. Total the numerical scores for each letter. For example, a valence of 1 equals 1 of that letter and a valence of 3 equals 3 of that letter.

Scale

1 – SLIGHTLY *more important*

2 – MODERATELY *more important*

3 – MUCH *more important*

Striving for Group Consensus Using a Paired Comparison Analysis (PCA)

1. As a group, narrow the number of generated options to less than a dozen. A tool such as hits can only help narrow a large number of options.

2. Check to see that each option is separate and distinct from every other option, so that they can be compared. Also check to see that everyone in the group understands the meaning of each option.

3. State each of the options in positive terms.

4. Each person in the group individually completes a paired comparison form weighing the selected options.

5. Use a large matrix to record each person's name/initials and his/her total scores for each option.

6. Structure a discussion around the information on the matrix. Often it is beneficial to start the discussion by having the people with the highest and the lowest scores for an option discuss their reasons for scoring the option high or low. The discussion allows the full range of opinions/attitudes used in decision-making to be aired.

For more information on the PCA technique see: Isaksen, S., Dorval, B., & Treffinger, D. (1994). Creative approaches to problem solving. Dubuque, Iowa: Kendall-Hunt.

Adapted from Creative Problem Solving: The Basic Course by Isaksen & Treffinger, 1985

Paired Comparison Analysis Form (PCA)

Ideas: A _____ D _____

B _____ E _____

C _____ F _____

For each pair, circle the letter of the one you consider better. In the box, enter 3, 2, or 1 to indicate how much better it is, with 3 indicating that the option is strongly favored.

A/B		A/C		A/D		A/E		A/F	
		B/C		B/D		B/E		B/F	
				C/D		C/E		C/F	
						D/E		D/F	
								E/F	

Total Scores for: A_____: B_____: C_____: D_____: E_____: F_____

Paired Comparison Analysis Form (PCA)

Rank or Priority:

My top choice was _____

2nd choice was _____

3rd choice was _____

4th choice was _____

5th choice was _____

6th choice was _____

Total Scores for: A_____: B_____: C_____: D_____: E_____: F_____

Group Grid of Individual PCA Results (Example)						
	Decaying Infrastructure	Health Concerns	Clean and Safe Drinking Water	Community	Multiple Uses	Program Deficiencies
Name	**A**	**B**	**C**	**D**	**E**	**F**
Daniel	6	11	0	4	10	2
Muench	5	15	0	3	8	4
Davis	8	13	0	5	3	2
Campbell	10	6	0	7	12	3
Peterson	9	10	0	6	8	3
Gustafson	1	1	14	9	0	12
Slick	8	6	5	1	3	2
Carlton	11	15	3	0	3	3
Lockhart	7	13	0	4	5	10
Stevenson	3	15	0	1	6	2
Rotecki	9	3	9	9	0	15
McCarthy	12	4	0	10	4	1
Boatwright	7	4	1	5	1	3
Kronberg	1	1	6	3	5	8
Canterbury	1	1	15	8	0	12
Hummel	2	2	12	7	0	12
Finerman	6	0	8	9	3	12
Cheshire	8	14	0	2	6	4
McIntosh	9	8	0	5	3	1
Hiatt	4	7	0	3	13	2
Hill	12	5	4	6	4	1
Wolf-Tallman	12	10	0	0	11	5
TOTAL	**240**	**214**	**146**	**172**	**158**	**232**

Shaded boxes symbolize the highest and lowest numbers*

Water Crisis – Flint, Michigan 2014 – 2019
Paired Comparison Analysis Items (Example)

Each item has a headline and a more complete set of content data to be considered when making a choice between any two items. Compare content-to-content when comparing items – not headline-to-headline.

Item & Short Title (*followed by the content to be considered with each comparison*)

A **Decaying Infrastructure**
- corrosion of pipes
- lead contamination
- aging service lines

B **Health Concerns**
- legionella increased microbial risk
- elevated blood levels in children, developmental disabilities
- toxicity, loss of life, miscarriages

C **Clean and Safe Drinking Water**
- limited access
- EPA regulations

D **Community**
- residents instructed to boil contaminated water
- direct correspondence to notify residents
- access to new fresh water source

E **Multiple Uses**
- includes resource development
- includes economic development

F **Program Deficiencies**
- relaxed water regulation, water fund deficit
- water switch approved despite health concerns

Appendix D

School field trips were one of the first things to go due to budget cuts and lack of funding. That said, I think it's time for educators to own up to the fact that learning doesn't happen in a bubble. For students to learn, they must first be able to play. And, second, they must be given room to explore. I hope that in the future, schools allow students to be curious again. Affording them opportunities to connect with the world around them, inside and outside of the classroom.

For that reason, I have attached a school permission slip as a visual reminder to administrators and superintendents to warn against limiting students learning opportunities. Instead, I urge them to shift their thinking, change policy, and put this tool to use.

Field Trip Permission Form

Dear Parent or Guardian,

Your child is going on a field trip. Please read the information at the top of this form, then sign and return the permission slip at the bottom of this form by _____.

Field Trip Information:

Date: _____

Location: _____

Purpose: _____

Means of Transportation: _____

Leave school: _____ Arrive back at school: _____

Save this part of the form for future reference.

Cut here ---------- *Cut here*

Sign this part of the form and return it to your child's teacher.

_____ has permission to attend a field trip to

_____ on _____ from

_____ to _____.

I give my permission for _____ to receive emergency medical

treatment. In an emergency, please contact:

Name: _____ Phone: _____

Parent/Guardian Signature: _____ Date: _____

Appendix E

Additional Resources

Adams, D. (2014, April 24). City switched to Flint River water slated to happen Friday. Retrieved from http://www.mlive.com/news/flint/index.ssf/2014/04/hold_switch_to_flint_river_wat.html

Basadur, M. (2004). Leading others to think innovatively together. *Creative Leadership. Leadership Quarterly*, 15, 103-121

Basadur, M. (1995). The power of innovation: How to make innovation a way of life and put creative solutions to work. London, UK: Pitman Publishing.

Bronson, P. & Merryman, A. (2010, July 10). The creativity crisis. *Newsweek*. Retrieved from http://www.newsweek.com/2010/07/10/the-creativity-crisis.html

CBS News. (2015, April 22). 6 Crazy, creative ideas for solving California drought crisis. Retrieved from http://sanfrancisco.cbslocal.com/2015/04/22/6-creative-ideas-for-solving-the-california-drought-crisis-water-conservation/

Creative problem solving in the face of extreme limits. (n.d.). Retrieved from http://www.ted.com/talks/navi_radjou_creative_problem_solving_in_the_face_of_extreme_limits/transcript

CNN. (2016, October 23). Flint water crisis fast facts. Retrieved from http://www.cnn.com/2016/03/04/us/flint-water-crisis-fast-facts/

Davis, G. (2004). *Creativity is forever* (5th ed.). Dubuque, Iowa: Kendall / Hunt Publishing Company.

Fonger, R. (2016, May 4). Accused water plant operator takes plea deal in Flint water crisis. (2016). *The Flint Journal*. Retrieved from http://www.mlive.com/news/index.ssf/2016/05/accused_water_plant_operator_t.html

Gordon, W. (1980). The new art of the possible. Cambridge, MA: Porpoise Books.

Got a wicked problem? First, tell me how you make toast. (n.d.). Retrieved from http://www.ted.com/talks/tom_wujec_got_a_wicked_problem_first_tell_me_how_you_make_toast?share=17deff2efc

Howell, S. (2016, June 25). Thinking for ourselves: Better answers. Retrieved from http://www.d-rem.org/thinking-for-ourselves-better-answers/

IISD Reporting Services. (2016, November 23). Re-thinking the water crisis: With a little creativity, we can meet our water needs. *Regeneration International*. Retrieved from http://regenerationinternational.org/re-thinking-water-crisis

Isaksen, S., Lauer, K. (2002). The climate for creativity and change in teams. *Creativity and Innovation Management*, *11*, 74-86.

Kennedy, M. (2016, April 20). Lead-laced water in Flint: A step-by-step look at the makings of a crisis. Retrieved from http://www.npr.org/sections/thetwo-way/2016/04/20/465545378/lead-laced-water-in-flint-a-step-by-step-look-at-the-makings-of-a-crisis

Miller, B., Vehar, J., Firestien, R., Thurber, S., Nielsen, D. (2004). *Creativity unbound* (4th ed.). Buffalo, NY: THinc Communications.

Moore, M. (2017). 10 Things they won't tell you about the Flint water tragedy, but I will. Retrieved from http://michaelmoore.com/10FactsOnFlint/

Osborn, A. (1961). Your creative power: how to use imagination. New York, NY: Dell Publishing.

Puccio, G., Mance, M., Barbero-Switalski, L., & Reali, P. (2012). Creativity rising: Creative thinking and creative problem solving in the 21st Century. Buffalo, NY: ICSC Press.

Ross, J. (2016, February 02). The crisis in Flint is about more than poisoned water. Retrieved from https://www.fordfoundation.org/ideas/equals-change-blog/posts/the-crisis-in-flint-is-about-more-than-poisoned-water/

Tahari, F. (2014). Environmental planning for identifying analyzing and solving environmental problems of the city of Rasht based on applying creative problem-solving techniques. *International Journal of Economy, Management and Social Sciences.*

Treffinger, D. (1999). Assessing creativity: A creative challenge. In *Creativity assessment: readings and Resources* (pp. 34-41). Buffalo, NY: Creative Education Foundation Press.

WNEM-TV. (2016, January 18). United Way estimates cost of helping children $100M. (2016). Retrieved from http://www.wnem.com/story/30995770/united-way-estimates-cost-of-helping-children-100m

Wilson, S. (2015, October 7). How the Flint water crisis emerged. Retrieved from http://www.mlive.com/news/flint/index.ssf/2015/10/how_the_flint_water_crisis_eme.html

International Center for Studies in Creativity

May 18, 2019