

# Micro Study of Water Quality of Elizabeth City's Drinking Wells

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***Abstract-* Micro Study of Water Quality of Elizabeth City's Drinking Wells Fifteen percent of Americans has their own sources of drinking water. These sources are primarily from wells, cisterns, or springs. Unlike public drinking water, these sources are not regularly monitored for quality before consumption. Contaminated water can be a threat to the health of individuals. Natural sources of water pollution can be caused by microorganisms, radionuclide, radon, nitrates heavy metals, and fluoride. Human activities aids in ground water pollution include bacteria and nitrates, concentrated animal feeding operations, fertilizers and pesticides, and household waste.**

**The 2006-2007 research team has investigated the quality of water from drinking wells located in Elizabeth City, North Carolina. The team has visited selected site to collect water samples. Those samples were then processed at the Elizabeth City Water Treatment Facility to determine the presence and levels of several parameters. These parameters include chlorides, alkalinity, iron, monochloramine, and orthophosphate. A database was created using ArcGIS and Visual Basic Applications to input the results of the data processed. Excel was utilized to conduct statistical analysis on the data. Elizabeth City's water sewer infrastructure was illustrated using a digital map in ArcGIS. This study has helped to identify the quality of well water at the selected sites.**

comprises marine, estuarine, freshwater (river and lakes) and groundwater environments, across coastal and inland areas. Water has two dimensions that are closely linked quantity and quality. Water quality is commonly defined by its physical, chemical, biological and aesthetic (appearance and smell) characteristics. A healthy environment is one in which the water quality supports a rich and varied community of organisms and protects public health. Water quality in a body of water influences the way in which communities use the water for activities such as drinking, swimming or commercial purposes. More specifically, the water may be used by the community

## *B. The Objective of the Project*

The purpose of this project was to develop a database of information in regards to Water Quality in the Elizabeth City, North Carolina. The data is presented here for information purposes only. The Water Samples are recorded with time metadata. Metadata consist of Well fields Location, Gallons Per Minute (GPM), Water Temperature and time water sample were recorded. Once the data is obtain The Water quality Team submits the Data to Local Water Quality Planet. Information is updated throughout the sampling season as data is received from Local Water Quality Planet .

## *C. The Area of Study Area*

The United States of America North Eastern North Carolina, Elizabeth City, North Carolina 27909.

## *D. The Significance of the Study*

## I. Introduction

### *A. Overview*

Water is essential to human life and to the health of the environment. As a valuable natural resource, it

To establish water quality data from area well sites, so the Water Quality Team could evaluate<sup>[4]</sup> Pasquotank County and Elizabeth City drinking water from selected Well Fields for comparisons purposes versus the State of North Carolina. Our water resources are of major environmental, social and economic value, and if water quality becomes degraded this resource will lose its market value. Water quality is significant not only to protect public health. As well as water provides ecosystem habitats, is used for farming, fishing, mining, contributes to recreation and tourism. If water quality is not maintained, it is not just the environment that will suffer but the commercial and recreational value of our water resources will also diminish.

The Water Quality Team tested for the following chemicals within the Water Sampling in Spring Semester 2007.<sup>[6]</sup> The Water Quality Team Tested for Turbidity, Chlorides, Alkalinity, Total Hardness, standard units Temp. , C Apparent Color, units, Iron, Manganese, Carbon Dioxide, Dissolved Oxygen, Nitrate, Nitrite, Ammonia-Nitrogen, Free Chlorine, Total Chlorine, Monochloramine, FreeAmmonia, Orthophosphate, Fluoride.

In each parameter measured within water testing there was a reagent added to each parameter. The reagent resembles a silver salt packet. Chlorides, Alkalinity and Total Hardness was measured using a Titration machine. Chlorides reagent was Silver Nitrate, Chloride and it reagent was added to a 50ML container with .50 Potassium Chrome added into the water sample prior to the reagent submission. Alkalinity reagent was Sulfuric Acid and Total Hardness reagent was (ethylenediamine tetraacetic acid) EDTA Titrant.

Once these parameter and reagent was combined. The parameters and reagents were measured against a dripped beaker, which displays how much of reagent has been inserted in efforts of the parameter turning color. Once the parameter colored turned colors the Elizabeth City Water Quality Lab Technician would multiple a factors according to dripped beaker to determine how much of the reagent was added to determine the parameter levels.

The pH, Standard units and Tem., C was tested in a Phise Meter Temp was measured using wavelengths machinery from the Phise Meter. When finished these results would return in numerical values. Free Chorine and Total Chlorine measured on a Colorimeter machine. When these two parameters are measured the calibration is different each of the two

parameters. Free Chlorine calibration was MonoFree. Nitric Acid was added in bottle to preserve Iron within our sample and each parameter has a set calibration. While some parameters require specific calibration and passes wavelength of light through the spectrum photometer.

Carbon Dioxide was not measured with a machine. There was a 15 ML with Phenolphalien already in the beaker and then a drop of Sodium Peroxide was added until the Parameter Carbon Dioxide turned a pink color. The results would be measured against number of drops that would give the amount of Carbon Dioxide present.

Prior to sampling the calibration is set for each parameter with smaller bottle present so that Spectrophotometer which measures wavelengths and light beans. The parameter would be disbursed into 25ML bottles. With the calibration set and the parameter added into each sample the reagent would be added into the sample. Reagent physical appearance resembles a silver salt packet. The Lab analysis would initiate a button that would make a black cap to go over the bottle. Each Sample was diluted and then removed from machinery and then poured into the sink. With the exception of Manganese had a beaker and when the beaker reached 650 ML the lab Technician would neutralize the Manganese and pour into the sink.

#### *E. Type of impacts the findings have on Pasquotank County/ Elizabeth City*

The 2007 Water Quality team identify the following.

- Above normal averages in water sampling
- Acid rain
- Impact of septic tanks
- <sup>[4]</sup> With Elizabeth City located in Flood Zone 23.
- There is various forms of moisture in the environment for Flood Zone 23
- Potential leakage from area sewage and septic tanks may have influenced out liars within The Water Quality Team Results.

The Water Quality Team testing could assist with<sup>[7]</sup> contaminants that may be in untreated water which

include microorganisms such as viruses and bacteria; inorganic contaminants such as salts and metals; pesticides and herbicides; organic chemical contaminants from industrial processes and petroleum use; and radioactive contaminants. [5] Water quality depends on the local geology and ecosystem, as well as human uses such as sewage dispersion, industrial pollution, and use of water bodies as a heat sink, and overuse which will lower the economy level of the water.

## II. Methods

Microsoft Excel is a spreadsheet program, which is a software package that is key element within Microsoft Office Suite. Within our project Microsoft Excel was used to calculate water quality values, analyze data, as well as produce graphs which was an immense role within the project. In addition, to Microsoft Excel, ArcGIS was used within our project for several purposes. To locate the well sites where Water samples were taken at. Water Samples were collected at well sites three and eight due to time restraints and accessibility. Below is an image of the well sites that were mapped using ArcMap.

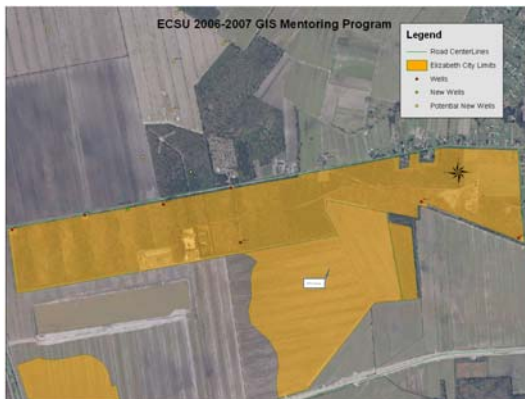


Image of Local Well Fields in Elizabeth City  
Figure.1

### C. Hardware

The Magellan 3100 Global Positioning System was used to pinpoint the exact location of the well site without being at the well site.

### D. Steps taken to collect water data samples.

#### Archer-Where the data samples were collected

To collect data at the Well Site several steps had to be taken. The steps taken are as listed:

**Step 1.** Insert the tables to the wells, and then make analysis on the data the user currently has.

**Step 2** Create two rows; one row for name labels and the second row for the data analysis output.

**Step 3** Navigate to Data menu and then proceed to click add-Ins.

**Step 4** Select analysis pack as well as VBA. Then proceed to selecting OK.

**Step 5** Navigate to import data where the user selects ECSU GIS.

**Step 6** Then import data for Well 3 and Well 8.

**Step 7** Select Total Hardness and then press the shift key. Then navigate to data analysis, and then proceed to selecting descriptive statistics.

Once the data was collected the following steps were used to analyze the data.

Water Samples collected by 2007 Water Quality Team was submitted to [4] Local Department of Water Quality in Elizabeth City North Carolina conducted by Eva Goodwin. Within the project we have formed a strong relationship within local government in addition community outreach. As well as the partnership between ECSU and City of Elizabeth City

### F. Steps taken to analyze comparison of data analysis within the Software Package Microsoft Excel

**Step 1.** The user navigates to tools, select the data analysis then the user scrolls down to Descriptive Statistics.

**Step 2.** The user inputs the range of characters. Ex. Numbers, Symbols, Location

**Step 3.** Next the user selects the little box in right corner; the user highlights the section and then proceeds.

**Step 4.** The user clicks on the little right corner box again, check the box labeled in the first row, then under output options name the new worksheet, and then select ok

SampleID	Temp_C	Alkalinity_mg_L	Total_Hardness_mg_L	Iron_mg_L	Apparent_Color_units
1.20607	25.00	72	354	370	21
2.20607	17.00	60	354	366	16
3.20607	36.00	63	362	369	6.9
4.20607	42.00	74	362	342	7.2
5.20607	29.00	60	362	352	6.9

Figure.3  
Image of Water Quality Results

### III. Results

The 2007 Water Quality Team results were that the City of Elizabeth City has been identified in <sup>[4]</sup> Flood Zone 23. According to the <sup>[1]</sup> North Carolina Administrative Code Title 15A Department of Environment and Natural Resources Division of Water Quality Which is a sub Division of <sup>[2]</sup> Environmental Protection Agency (EPA) Water Quality results are as listed.

Parameter	NC State Average	Pasquotank County
Alkalinity	300	250
Chloride	250	60
Iron	0.3	4.0
Turbidity,	300	25
Total Hardness,	220	32
Standard units	17	7
Temp. , C	32	20
Apparent Color	55	44
Manganese	82	65
Carbon Dioxide	30	20
Dissolved Oxygen	90	78
Nitrate	200	150
Nitrogen	150	180
Monochloramine	175	202
Orthophosphate	140	145
Fluoride.	210	190
Nitrite	115	85
Free Ammonia	70	63
Total Chlorine	85	72
Ammonia-Free Chlorine	32	110

Figure. 2  
Water Quality Parameters Results

Compared to the Nationwide, Statewide and counties through North Carolina, our results have led the Water Quality Team to the results that Pasquotank County and Elizabeth City water will require water treatment. Our results display numerical values that when compared to National values Pasquotank County is below average.

### IV. Conclusions

This water quality study will assist future research students to identify the quality of water. At selected sites in the Pasquotank County. According to the results, our results display numerical values that when compared to national values Pasquotank County is below the national average of water quality. The purpose of this project was to develop a database of information in regards to Water Quality and Statistical Data. The Water Quality Team Metadata identified Well fields Location, Gallons per Minute (GPM), Water Temperature and time water sample were recorded. The results have led us to the conclusion that certain parameters are not present within the Pasquotank County water.

### V. Future Works

The 2007 Water Quality recommends that future Water Quality Teams have authorization to access the well field with out a City Representative to conduct sampling various time through out the day. Future teams can test for consistency and inconsistency within the Water Quality due to time measurements. Allow team members to process water samples on campus. To incorporate various data analysis and wavelengths utensils could collect water samples so that researchers could identify outliers. To identify the results of water samples that had expired. They could identify consistency and inconsistency within expired water sampling. Whether outliers were in results of the bottles, Acid, Temperature, Time span, Internal Water purification malfunctions, Seasonal impacts, Corrosion within the water sampling Infrastructure.

### VI. References

- [1] "Environmental Protection Agency 3.0 EnviorMapper", maran, Inc. (2005)
- [2] 2005 from the World Wide Web, <http://www.epa.gov/> "EPA", Retrieved January 19, 2007 from the World Wide
- [3] 2005 <http://ga.water.usgs.gov/edu/waterquality.html> USGS, Retrieved January 27, 2007

[4] "World Wide Web," <http://www.cityofec.com/>, Retrieved February 8, 2007

[5] Web, - <http://www.wqa.org/>  
"World Wide Web Consortium", Retrieved March 3, 2007

[6] 2006 from the World Wide Web, <http://h2o.enr.state.nc.us/>  
"North Carolina Water", Retrieved from the World Wide Web  
March 16, 2007

[7] 2004 from the World Wide Web,  
<http://www.marc.org/Environment/Water/index.htm>  
"MARC", Retrieved from the World Wide Web March 23, 2007