

2013

A case history of use and management of the Baton Rouge fresh water aquifer system

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A CASE HISTORY OF USE AND MANAGEMENT OF THE BATON ROUGE
FRESH WATER AQUIFER SYSTEM

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial Fulfillment of the
requirements for the degree of
Master of Science

in

The Department of Geography and Anthropology

by
A. Hays Town, Jr.
B.S., Louisiana State University, 1958
May 2013

ACKNOWLEDGEMENTS

There are many people I want to thank for helping me through Graduate School.

First and foremost is my wife of fifty-five years, Gay, who tolerated without complaint me having to attend classes every day and us having to forego trips and occasions we normally attended.

Secondly, I owe a great deal of gratitude to my major professor, Dr. Barry Keim, who spent many hours helping, advising and being a good friend. Without him, I would not, without a doubt, have been able to finish my master's requirements and also to Dr. Margaret Reams my co-advisor for her gracious help.

To my thesis committee, I owe much for their patience and guidance. They are Professor Jeffrey Hanor, who provided advice on geological content, and Professor Margaret Reams as well as Professor Barry Keim.

Also much willing computer help and shared friendship was given to me by the graduate students in the Climatology Program.

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ABSTRACT

The Southern Hills Aquifer located in southeastern Louisiana has provided residents of Baton Rouge and surrounding communities with high-quality, fresh drinking water for many decades. However in recent years increasing pumping rates, evidence of saltwater intrusion, and concerns about the equitable and sustainable use of the aquifer have led residents and researchers to begin to examine more critically how groundwater is managed in this area. Louisiana is one of only six states without a groundwater management plan, and to date, the officials in charge of monitoring the Southern Hills Aquifer have not developed any guidelines for limiting withdrawal. This thesis presents a detailed case study of the use and management of the Southern Hills Aquifer in Baton Rouge. Specifically, these research questions will be addressed:

- 1) What is the state of the Southern Hills Aquifer system concerning salt-water intrusion?;
- 2) What is the current State management structure for the aquifer?
- 3) How may a new organization based on the principles of collaborative environmental planning improve the structure of groundwater management in Baton Rouge?

A review of technical reports by the US Geological Survey and others indicates that saltwater intrusion into the aquifer has occurred and is spreading at an increasing rate. The state groundwater management structure includes two organizations. Legal responsibility for management of the aquifer lies with the Louisiana State Department of Natural Resources (DNR) through the Office of the Commissioner of Conservation, while the Capital Area Groundwater Conservation Commission appears to function as a permanent task force, holding quarterly public meetings concerning groundwater issues.

In 2011, a small group of residents formed the Baton Rouge Citizens to Save Our Water, Inc. The group seeks to promote collaborative environmental planning principles and, as a first step,

is working to disseminate technical information about the Aquifer and to encourage residents to lobby for a groundwater management plan that limits industries' use of the water. The case study includes a detailed timeline of the interactions between the citizens group and state groundwater officials. A review of subsequent public statements by the officials indicates that the citizen group has been successful in moving the policy debate toward a more comprehensive groundwater management plan.

CHAPTER ONE

PROBLEM AND RESEARCH OBJECTIVES

The problem examined here is saltwater intrusion into the fresh water aquifers in the Baton Rouge area of southeastern Louisiana. An issue recognized since the 1930s (Duplechin, 2011). To date, Louisiana State government officials in charge of monitoring the aquifer have been only watching and studying the Southern Hills Aquifer, rather than taking action to secure the aquifer to reduce salt water intrusion or to provide a sustainable rate of withdrawal.

Policy makers may find the formulation of new direct regulations of ground water use to be challenging for several reasons. First, it is quite difficult for a decision maker holding a political administration position, for 5 years for example, to pay attention and react to the expected results of processes in aquifers estimated to be observed after 15 years. (Ronen, et. al., 2012). Second, instead of establishing absolute truth or proof, science establishes only a degree of probability or confidence in the validity of an idea usually based on statistical or circumstantial evidence (Miller, 1988).

The Southern Hills Aquifer system is in peril because salt water on the south side of the west to east trending Baton Rouge fault is drawn through the fault to the north (fresh water) side, because of over pumping on the north side. Previous researchers working on salt water intrusion in the Baton Rouge area have generally assumed that down dip in situ marine pore waters were moving northward (up dip) within the aquifers, thereby crossing the Baton Rouge- Denham Springs Fault (e.g., Rollo, 1969; Whiteman, 1979). Displacement on the fault was originally assumed to act as a partial barrier to the fluid movement (Stoessell and Prochaska, 2005), but apparently over pumping is so great that it is drawing salt water across the fault.

Recently, isotope data provided evidence that these brines now present in the shallow aquifers originated from at least 800 meters deeper than where they are found today (Stoessell and Prochaska, 2005), and then migrated horizontally through the fault. These geochemical observations strongly indicate that the Baton Rouge fault forms a leaky barrier through which fluids move horizontally from south to north (Anderson, 2012).

Over recent decades, pumping of fresh water from the aquifer has continued to increase on the north, fresh water side, drawing down the water table. This is causing salt water intrusion to increase across the Baton Rouge Fault line, thus threatening the fresh water supply of East Baton Rouge and nearby parishes.

The institutions responsible for protecting the freshwater supply are, as per the Louisiana State Constitution, Article IX, Section I, the State Legislature along with State agencies. In particular, for the last twelve years, the official and agency in charge of protecting the sustainability of the aquifers are the Louisiana Commissioner of Conservation under the Department of Natural Resources.

To date, the Commission has not developed a management plan for aquifers in Louisiana, and Louisiana as one of only six states in the United States that does not have a groundwater management plan. This failure to have a plan, combined with the dramatic over pumping of the aquifer, threatens the fresh water aquifer. Possibly it is too late already, but one option is one option is to stop all industrial pumping and have industry use fresh water from the Mississippi River. This would extend the useful life of the aquifer.

The three objectives in this thesis are to determine the following:

1. What is the state of the Southern Hills Aquifer system concerning salt-water intrusion?
2. What is the current State management structure for the aquifer?

3. How may a new organization based on the principles of collaborative environmental planning improve the structure of groundwater management in Baton Rouge and for the future?

Having learned of this situation, a small group of local residents, not part of those previously watching and studying the intrusion, have formed a corporation called the Baton Rouge Citizens to Save Our Water, Inc. The purpose of this group Through collaborative planning with the general public is to raise awareness of salt water intrusion and its impacts and the danger of losing our fresh drinking water. Public awareness of groundwater issues is very low.

Department of Natural Resources recent study of citizen knowledge indicates only a very small percentage of the population have an understanding of the aquifer and only a few have knowledge of the threat of salt water intrusion. The purpose of this group, through collaborative planning with the general public and perusing an organization of the local citizens, is to raise awareness of the salt water intrusion and its impacts and the danger of losing our fresh drinking water.

Many proponents of collaborative environmental planning have argued that broad inclusion of community stake holders can lead to better environmental solutions while also establishing legitimacy, building social capital, and overcoming conflicts. Yet broad inclusion may be costly in terms of time, energy, and resources, and may not yield the desired results (Koontz and Johnson 2004).

Robert Dahl's "Principal of Affected Interests" states that participation in policy decisions is best served by the smallest group that can deal with it satisfactorily (Dahl, 1970).

In this case, the new group could help to educate the public, will likely lead to them demanding action of the Commissioner of Conservation to protect our water and ensure its

sustainability. Sustainability means the preservation of the fresh drinking water in the aquifer for future generations to have use of this water as we have today. One problem is that the Louisiana State Government has done nothing for so long that may be difficult to arouse it into action.

This chapter has presented a brief overview of the problem to be addressed and the specific research questions and objectives. Chapter Two includes a technical examination of the Southern Hills Aquifer System and Chapter Three describes the salt-water intrusion in detail.. Chapter Four examines the current groundwater management approach and Chapter Five presents a case history of the new grass roots organization, Baton Rouge Citizens to Save Our Water, Inc. Conclusions and recommendations for the sustainable ground-water management of the Southern Hills Aquifer System are presented in the final Chapter.

CHAPTER TWO

CASE STUDY: GROUND WATER CONDITIONS AND MANAGEMENT

The northern boundary of the Southern Hills aquifer in the Baton Rouge area begins by the Mississippi River at the same latitude as Jackson, Mississippi. The western boundary runs southward along the river to Point Coupee Parish, through West Baton Rouge and Iberville Parishes. The Pearl River is the eastern boundary down to the Gulf of Mexico at the Mississippi-Louisiana border (see Figure 1). The aquifer terminates below the Baton Rouge fault.

The aquifer is cut by a fault that runs across the city of Baton Rouge. The Baton Rouge Fault runs west to east from West Baton Rouge Parish through East Baton Rouge, Livingston, Tangipahoa and Saint Tammany Parishes. In Baton Rouge, it crosses Highland Road between LSU and downtown and crosses City Park Lake under the Interstate 10 bridge. Then the fault crosses College Drive near Wal-Mart just north of I-10 and follows Jefferson Highway until it crosses Airline Highway, and then continues eastward to Livingston Parish (see Figure 2).

The Baton Rouge Fault shows distinctive depth-displacement relations in the Quaternary and pre-Quaternary strata indicating that they are active and are surface expressions of deep sub-surface older Cenozoic faults that were reactivated following extended periods of quiescence (McCullough and Heinrich, 2012). Commonplace recognition of active surface faults throughout south Louisiana now suggest that many of the known deep-surface ground-fault systems have surface expression reflecting their reactivation in the late Cenozoic (McCullough and Heinrich, 2012).

The aquifer system is made up of ten different sands each separated by layers of compacted clay called aquicludes. The sands were named in the 1940s (Meyer and Turcan, 1955) by their depth beneath the industrial area in Baton Rouge. This naming is important

because investigators can be sure they are talking about the same sand layer, hence the same individual sands.

The Baton Rouge Fault divides the aquifer into two parts. The north side has fresh water, while on the south side there is mostly salt water. If there was no differential pumping on the two sides there would be movement from north to the south, however, since there is tremendous pumping on the north (the fresh water) side, as opposed to very little pumping on the south salt water side, the resultant higher water table on the south side pushes the salt water across the fault into the fresh water side. This action is commonly spoken of as salt water intrusion. The greater the differential between the two water tables, the more rapid the intrusion of salt water across the fault.



FIGURE 1. Location of the Southern Hills Aquifer (Louisiana Geological Survey, 2012).

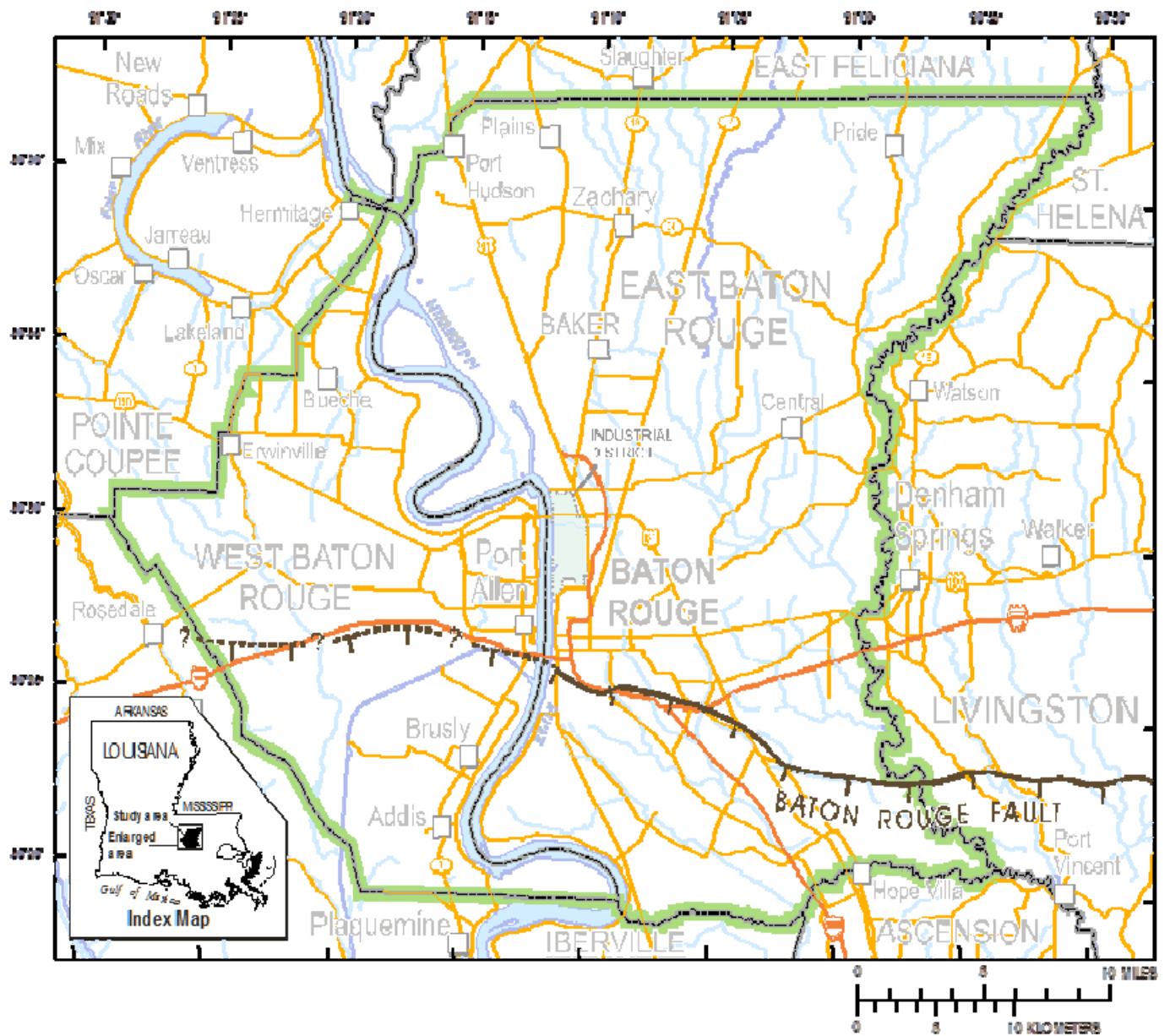


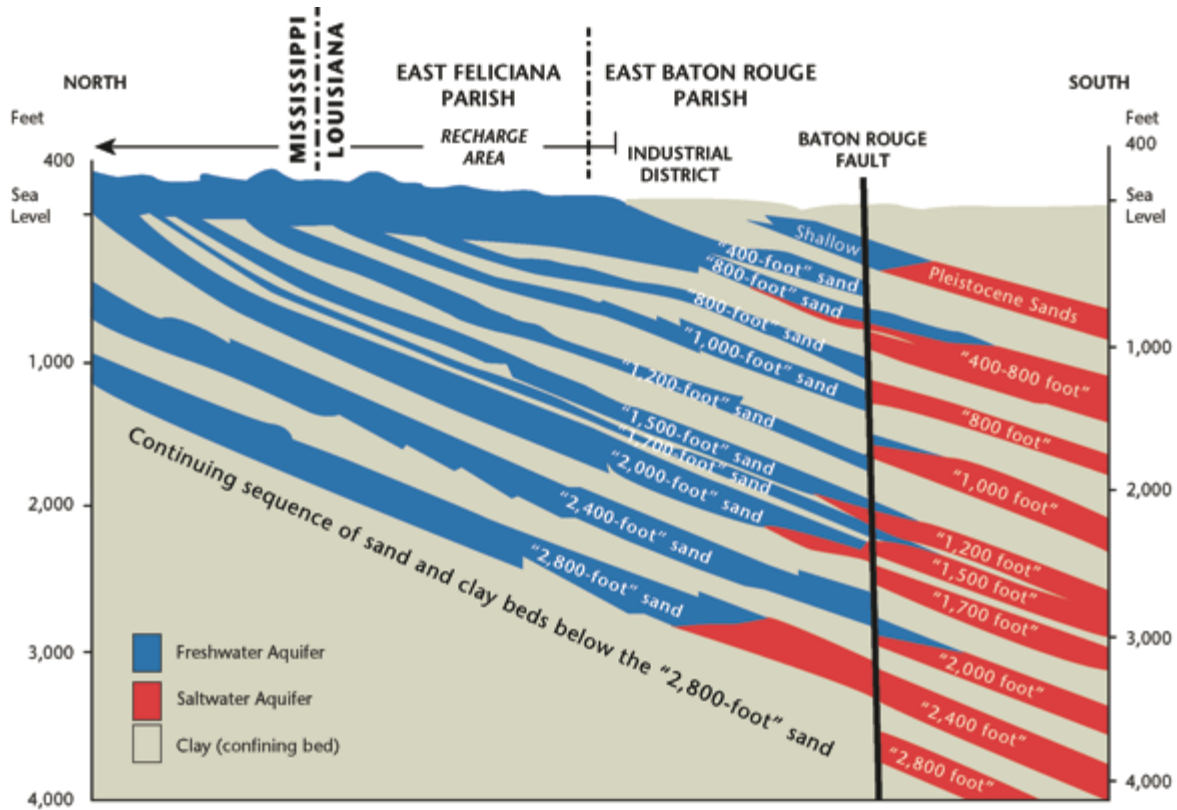
FIGURE 2. Location of the Baton Rouge Fault in East and West Baton Rouge Parishes (USGS, 2005).

CHAPTER THREE

SALT WATER INTRUSION INTO THE FRESH WATER AQUIFER UNDER EAST BATON ROUGE PARISH

The aquifers under Baton Rouge consist of ten separate water bearing sands. The sands were named in the 1940s for their general depth below the ground surface of the industrial area in North Baton Rouge. They are the 400 ft. 600 ft.; 800 ft. 1000 ft.; 1200 ft. 1500 ft. 1700 ft. 2000 ft.; 2400 ft. and the 2800/2900 ft. sands.. The 2900 ft. sands are the deepest of the fresh water sands. The sands are from 75 to 200 feet thick and are separated by aquicludes from 100 to 500 feet thick (Tomaszewski, 1996). The sands crop out in Mississippi and dip to the south in Louisiana. These aquifers are interrupted by the Baton Rouge fault (see Figure 3). It runs in a west to east direction across East Baton Rouge Parish and on to the east. The north side has fresh water and the south side of the Fault generally has salt water. The fault forms a (leaky) barrier between its north and south sides. Figure 3 shows a cross section of the aquifers and the Baton Rouge fault. Figure 3 also shows the recharge area north of Baton Rouge. This is where the water for the natural recharge of the sands enters the surface and infiltrates into the aquifers.

The rate of underground water removal far exceeds the natural recharge rate of the Southern Hills aquifer. The depression of the water tables, under the removal wells, causes an imbalance between the hydrological pressures on the north (fresh water) side of the fault and the pressures on the south (salt water) side of the Fault. This pressure differential has exacerbated the leakage through the fault, from south to north, and is causing an acceleration of the infiltration into and across the fresh water sands under East Baton Rouge Parish. The presence of salt water in costal aquifers is exacerbated by extraction of fresh groundwater in over pumped catchments. (Kacimoy, et.al. 2009).



Depth of aquifers below the Industrial District of Baton Rouge, LA

FIGURE 3. Louisiana Department of Transportation and Development (DOTD), Water Resources Technical Report No. 59, in Cooperation with US Department of the Interior, US Geological Survey and Capital Area Ground Water Conservation Commission (1996).

Sampling of the separate sands using existing supply wells and separate test wells temporarily shows advancement and strengthening of the chloride intrusion into the Baton Rouge fresh water supply (Lovelace, 2007). The leakage through the fault is facilitated by the downward displacement of the aquifers on the south side of the Fault as seen in Figure 3.

This down throw on the south side allows salt water bearing sands to partially align with lower aquifers on the north side. For the purpose of this thesis, salt water is defined as water containing 250mg/L chloride or greater. Concentrations of chloride greater than 250 mg/L exceed the Secondary Maximum Containment Level for drinking water (U. S. Environmental

Protection Agency, 2006). People can detect the taste of the chlorides at 250 mg/L of chloride, and as the concentration increases the fresh taste of the water completely disappears.

The Baton Rouge Water Company is continuously recording the chloride levels, pressure heads, and water tables in its supply wells. Also, test wells have been drilled by the USGS to measure chloride and pressure levels. As pumpage continues and increases, the drawdown of the water table continues to extend further from the ground surface.

Drawdown of the water tables, caused by pumpage which exceeds the natural recharge, lowers the water table and pressure head which enables the higher pressures of the south side of the fault to increase the leakage of salt water across the fault. Figures, 4 & 5, show through potentiometric contours the drawdown of the water tables in the 2000 ft. and the 2400 ft. sands in spring 1990. As this drawdown continues, the flow of salt water will only increase in rate across the aquifers under East Baton Rouge. Figure 4 shows a drawdown from 20 feet below mean sea level at Zachary to 200 feet below mean sea level at the industrial area in North Baton Rouge.

The degree of connectivity between the sand layers in Table 1 should be verified with site-specific testing before drawing final conclusions about the effects of eliminating industrial pumping from the 1500-and-1700-foot sands. However, should Georgia Pacific Paper Mill retire from pumping in the 1700-foot sand, the above table shows increases in the heads and reduction in the leakage through the Baton Rouge fault. This would certainly reduce the rate of salt water intrusion into the 1500-foot sand.

This situation is not limited to Baton Rouge. In many coastal areas , the excessive pumping of groundwater has resulted in a decline of fresh water head and the intrusion of saltwater into the aquifers, a loss of valuable water resources (Qahman, et. al., 2005). Port Allen

well in the 2000 ft. sand across Mississippi River from industrial area dropped in water level below surface forty feet in twelve years (CAGWCC News Letter July 2010).

TABLE 1. Changes in conditions in the 1,500 foot sand due to eliminating industrial pumping (Moore et al., 2012).

| | | |
|----|--|-----------|
| 1. | Increase in heads near Lula Station | 40 ft. |
| 2. | Increase in heads along Baton Rouge Fault | 35-45 ft. |
| 3. | Reduction in leakage rate through the Baton Rouge Fault | 270 gpm |
| 4. | Percent reduction in leakage through the Baton Rouge Fault | 30% |

Table 2 indicates the ground water usage quantities for East Baton Rouge Parish, in 2008 (Capital Area Ground Water Conservation Commission, 2011). This table shows an increase in the pumpage rates as population grows and industrial needs increase. From 2005 to 2008, the public demand increased 12.92 million gallons per day and the industrial/power demand increased by 2.15 million gallons per day (Data from Capital Area Ground Water Conservation Commission, 2011). This increase is expected to continue and accelerate. Public demand was increased by the influx of people from the New Orleans area after Hurricane Katrina in 2005. Obviously the industrial/power consumption is tremendous and equal to that of the public.

TABLE 2. Comparison of Ground Water Usage for East Baton Rouge Parish in 2005 and 2008. (Capital Area Ground Water Conservation Commission).

| YEAR | PUBLIC SUPPLY | INDUSTRIAL SUPPLY |
|------|------------------------|------------------------|
| 2005 | 67.03 million gals/day | 70.67 million gals/day |
| 2008 | 79.95 million gals/day | 80.14 million gals/day |

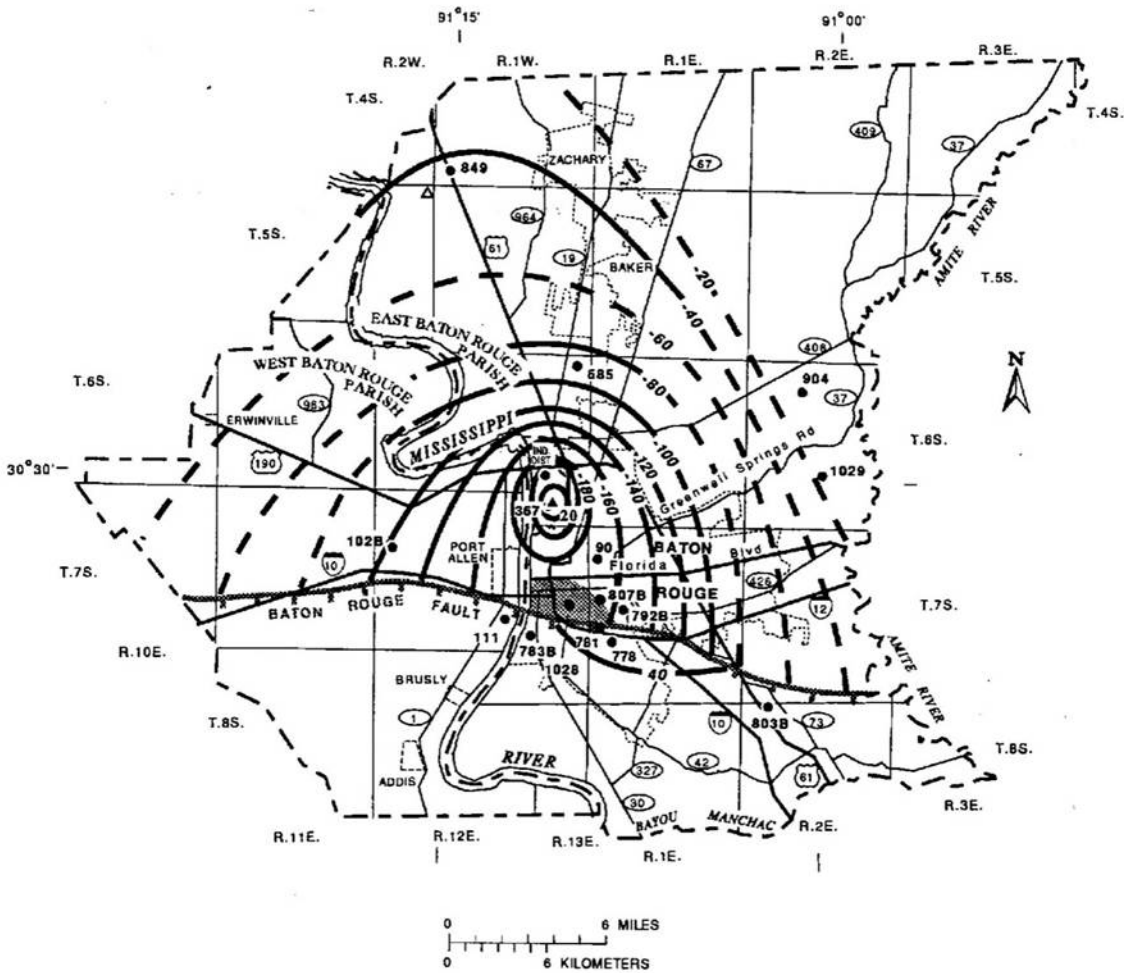


FIGURE 4. Cone of depression in the 2000 ft. sand. Louisiana Department of Transportation and Development (DOTD), Water Resources Technical Report No. 59, in Cooperation with US Department of the Interior, US Geological Survey and Capital Area Ground Water Conservation Commission (1996).

The potentiometric map in figure 4 shows the depression in the water level in the 2000 ft sands, under the Industrial Area in East Baton Rouge Parish in 1992. The shaded area shows the advance of salt water from the fault up to Florida Boulevard in the downtown area from 1966 to 1992. It shows the initial advance of salt water towards the industrial pumping area.

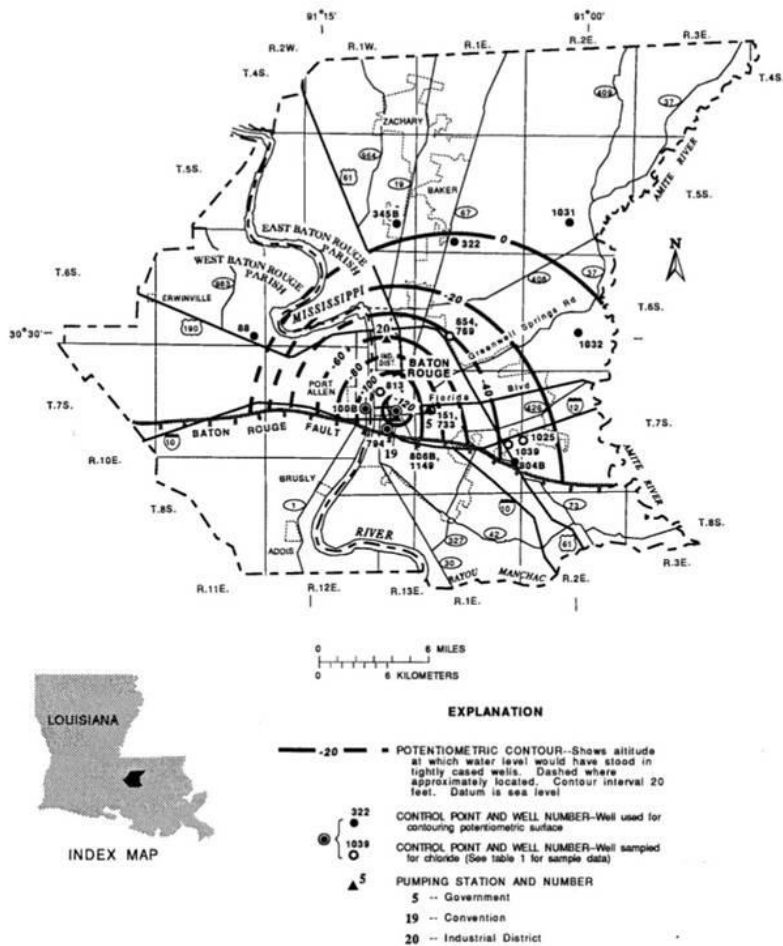


FIGURE 5. Cone of depression in the 2400 ft. sand. Louisiana Department of Transportation and Development (DOTD), Water Resources Technical Report No. 59, in Cooperation with US Department of the Interior, US Geological Survey and Capital Area Ground Water Conservation (1996).

Figure 5 shows a zero ft. contour down to a minus one hundred -twenty foot level near the Downtown district in the 2400 ft. sand. Clearly we cannot continue to draw down these hydraulic heads and expect to maintain fresh drinking water. Again, these two figures were compiled in 1990, over twenty years ago. Only a worsening of these conditions can be imagined.

Figure 6 shows clearly the advancement of chloride concentration temporally at well EB-1028 in the salt water in the 2000 ft. sand from 1981 to 2005. The increase in chloride concentrations between 1981 and 2005 are obvious and that the concentrations are rapidly increasing once the salt water reached the well in 1982 at slightly less than 100 mg/liter, which then continued increasing to just over 250 mg/liter in the year 2005.

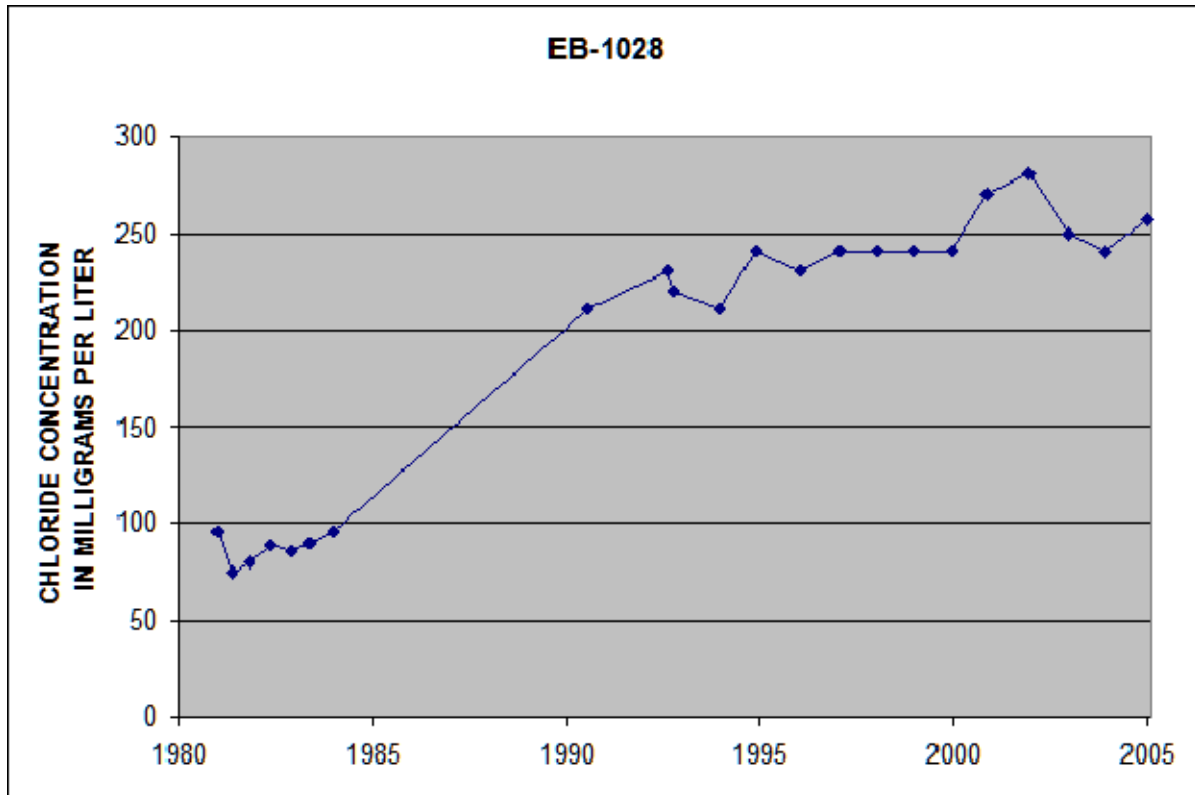


FIGURE 6. Chloride concentrations at well EB-1028 screened in the “2000 ft” sand and located between the Baton Rouge fault and downtown pumping stations. (USGS, Scientific Investigations Report, 2004-05).

Figure 7 shows clearly the advance of salt water in the 2000 ft. sand, advancing from the fault in south Baton Rouge from 1966, 1977, 1992 and then to 2005. Figure 8 shows the chloride concentrations in wells EB-804B and EB-794 (2400 ft. sands) from 1965 to 2005. The salt water reached well EB-804-B about 1993 and increased in chloride concentration from well

below ten mg/L to over a hundred mg/L by 2005 . In 1995, salt water reached well EB-794 and increased from ten mg/l to over 250 mg/l in 2004.

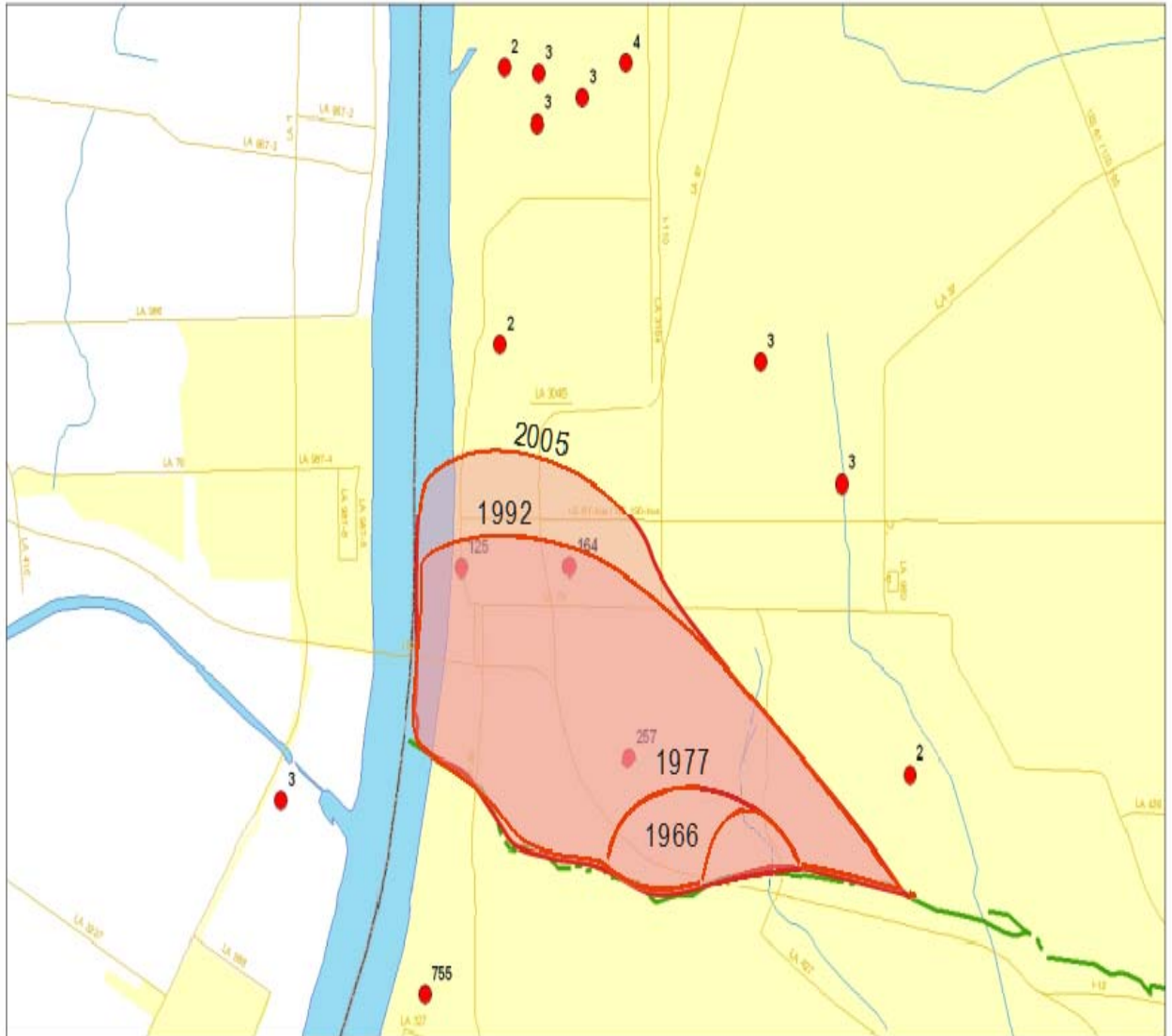


FIGURE 7. Location of saltwater and chloride concentrations at sampled wells and in the “2000 ft.” sand in 1966, 1977,1992, and 2005. (Note: the location of the saltwater interface in 2005 is unpublished and subject to revision.) (USGS, Scientific Investigations Report, 2005)

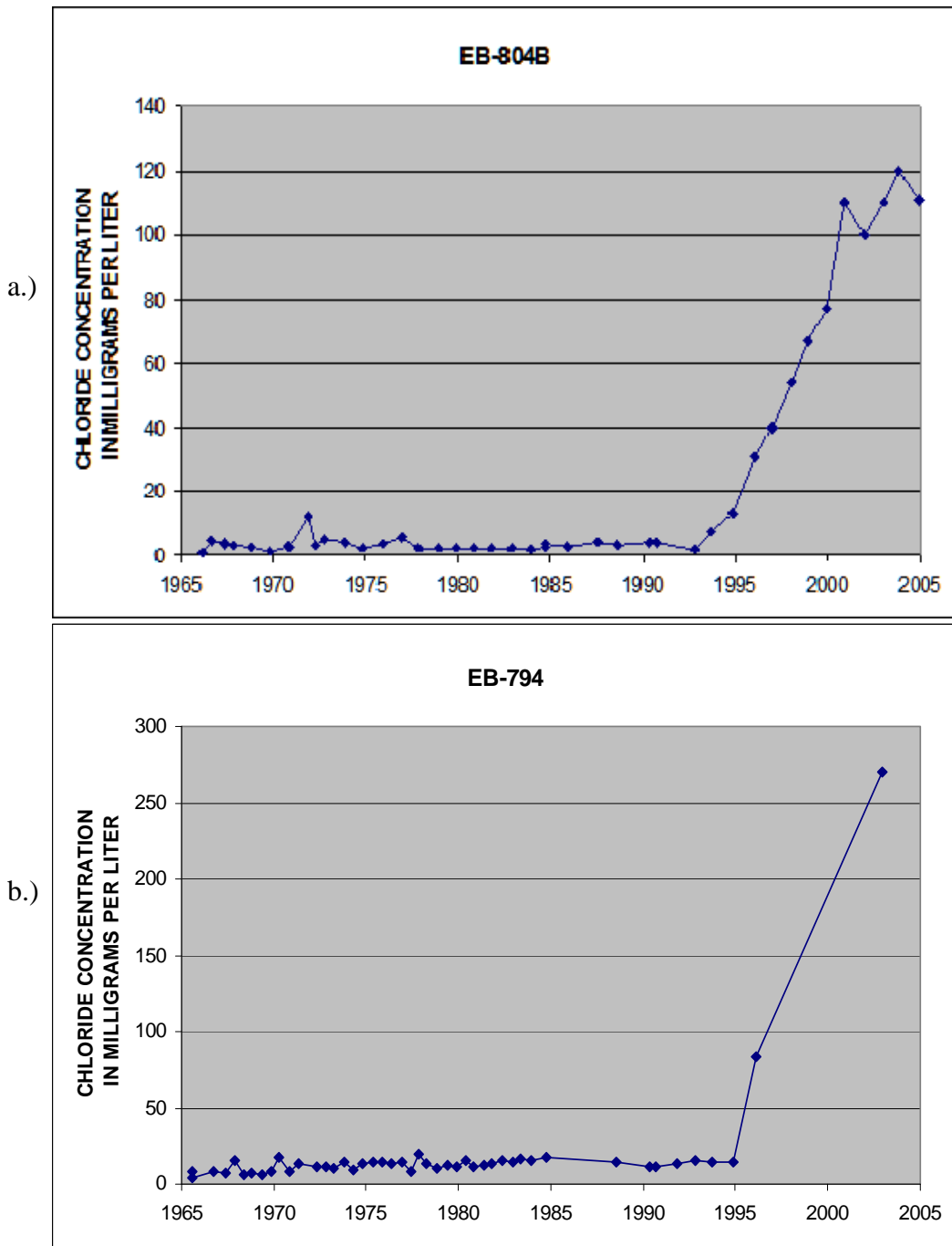


FIGURE 8. Chloride concentration in the “2400 ft” sand at a.) Well EB-804B and b.) Well EB-794 (USGS, Scientific Investigations Report, 2004-05)

Figure 9 indicates movement of salt water in the 2800 ft. sand. The salt water in 2005 extends northward from the fault to the industrial area and in width all the way across East and West Baton Rouge Parishes.(shown as no freshwater) It also shows the salinity stratification of brackish water,(mixture of salt and fresh water), in pink from the salt water to past Scotlandville, also see location of the Scotlandville-Denham Springs fault line. The brackish water and saltwater zones run east-west all the way across East and West Baton Rouge Parishes. This sand is different from the other sands in that it was not completely cleared of salt in the past several million years, as were the other sands. However John Lovelace, (USGS personal communication), states that chloride concentrations are increasing in this sand, indicating further encroachment is occurring.

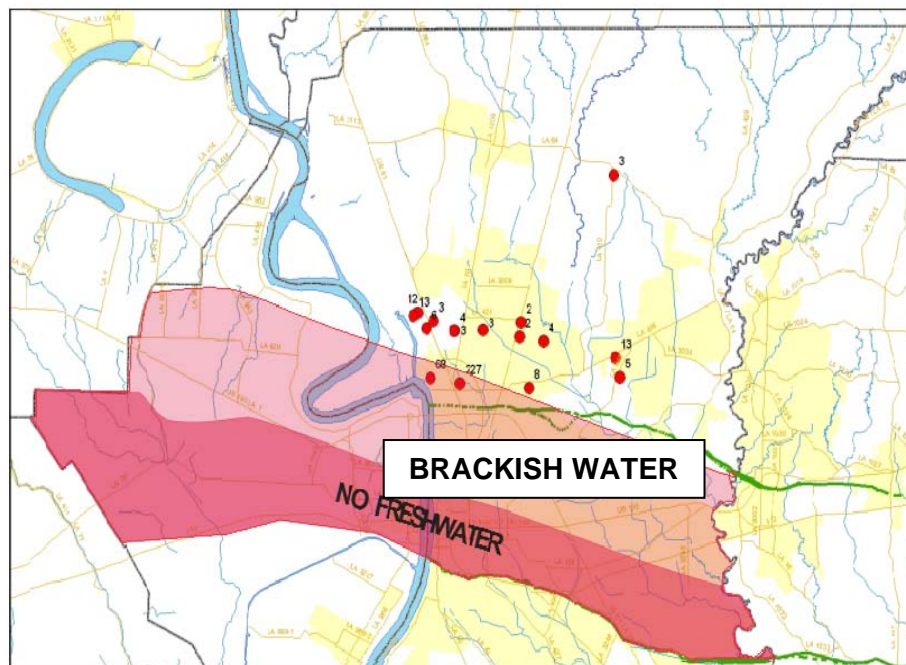
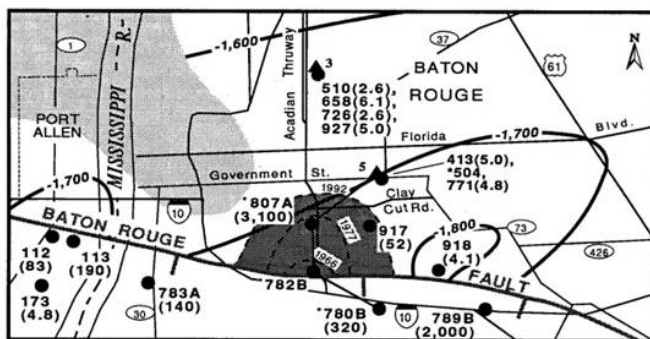


FIGURE 9. Location of saltwater and brackish water (Tomaszewski, 1996) and chloride concentrations at sampled wells screened in the “2,800-foot” sand (USGS, 2004-05).

Figure 10 shows the advancement of salt water, in the 1500 ft. sand, along the Acadian Thruway toward Government Street delineating the 1966 advancement then the 1977 position and finally the 1992 position. This figure clearly shows an increasing rate of intrusion. Compare this figure to Figure 11 to see the rate of advancement in the 1500 ft. sand.



EXPLANATION

- APPROXIMATE AREA WHERE THE AQUIFER CONTAINS SALTWATER NORTH OF THE BATON ROUGE FAULT
- APPROXIMATE AREA WHERE THE AQUIFER IS THIN OR ABSENT
- EXTENT AND DATE OF SALTWATER ENCROACHMENT
- STRUCTURE CONTOUR--Shows base of the aquifer. Contour interval 100 feet. Datum is sea level (Whiteman, 1979)
- CONTROL POINT--Shows location of well sampled for chloride. Top number is well number. Number in parentheses is chloride concentration, in milligrams per liter (see table 1 for sample data)
- PUMPING STATION AND NUMBER
 - 3 -- Lula
 - 5 -- Government
- LINE OF HYDROGEOLOGIC SECTION (see fig. 8). Indicates well on section

Location of saltwater and structure contours in the "1,500-foot" sand north of the Baton Rouge fault in the Baton Rouge area, Louisiana.

FIGURE 10. Saltwater intrusion in the 1500 ft. sand in Baton Rouge, Louisiana, Louisiana Department of Transportation and Development (DOTD), Water Resources Technical Report No. 59, in Cooperation with US Department of the Interior, US Geological Survey and Capital Area Ground Water Conservation Commission (1996).

Figure 11 is included because it is the progression of Figure 10 which was done in 1992 and this new figure again shows the rapid advancement of the salt water in the 1500 ft. sand toward Lula Pumping station by 2005. Lula is the largest station and furnishes almost twenty percent of BRWC's daily water supply. This rapid advance of salt water towards the Lula pumping station shows the need for the Commissioner of Conservation to take action to protect the drinking water supply for future generations in Baton Rouge.

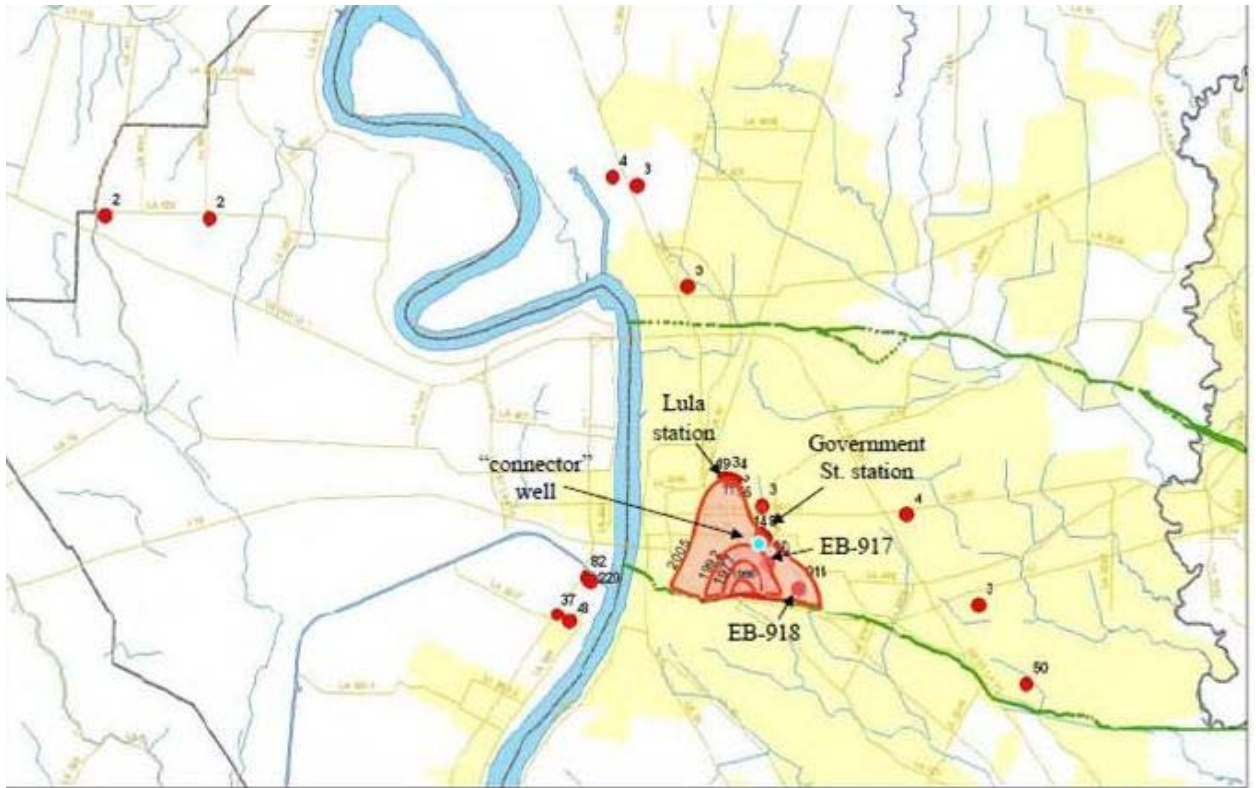


FIGURE 11. Saltwater intrusion in the 1500 ft. sand in Baton Rouge, Louisiana. From "Chloride Concentrations in Ground Water in East and West Baton Rouge Parishes, Louisiana, 2004-05."(Lovelace, 2007)

Figures 12 show two wells in East Baton Rouge Parish - Well EB-918 has a chloride concentration of below ten mg/L until 1991 when the salt water intrusion was recorded as reaching the well. Then the concentration rapidly rose to over 900 mg/L by 2005. Well EB-917 showed concentrations below ten mg/L until 1990 then rose rapidly to over 50 mg/L by 1993

then dropped off to fifteen mg/L in 2002 to again rise to over fifty mg/L by 2005. These figures illustrate the rapid rise of chloride concentrations when salt water reaches the well sites.

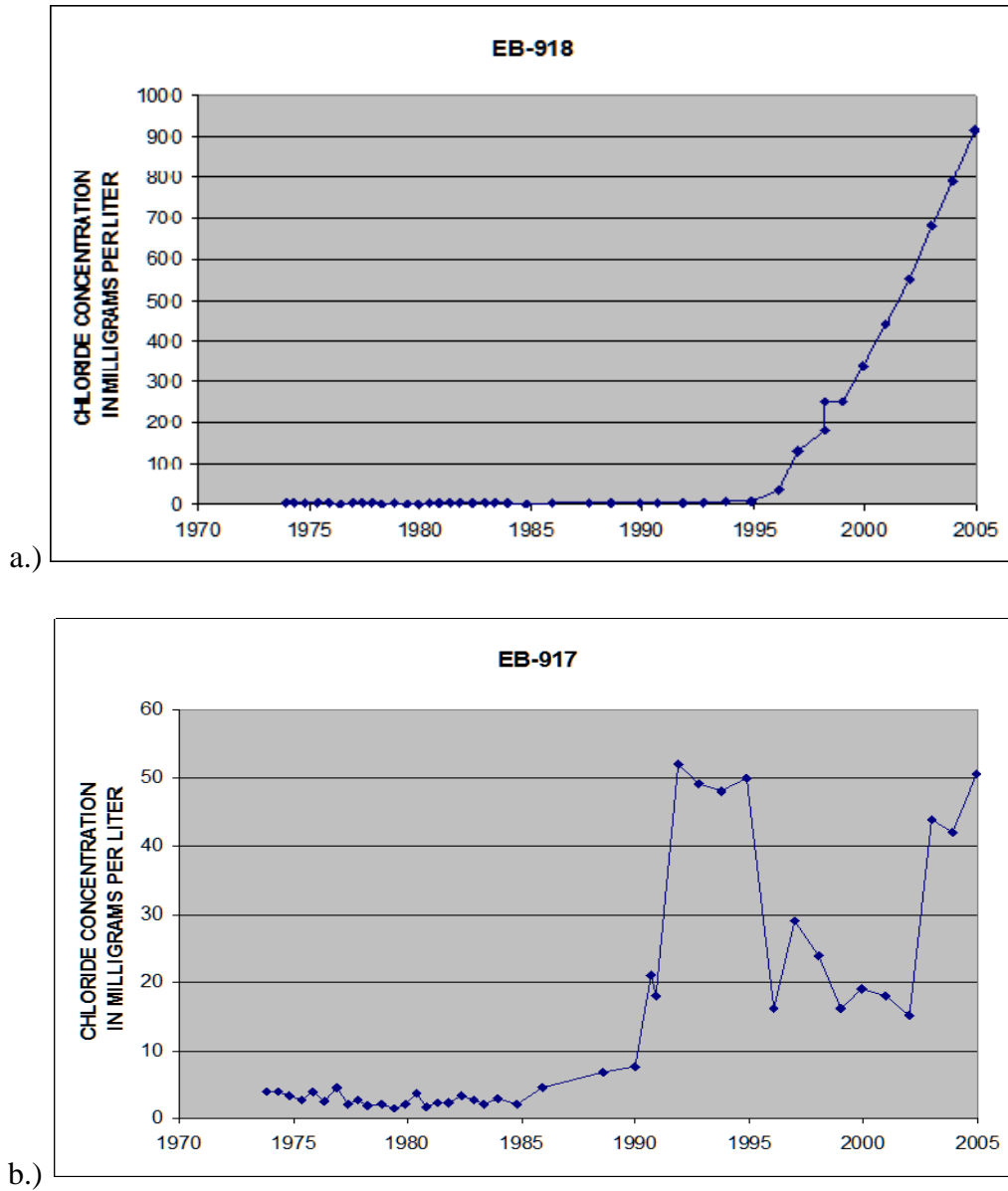


FIGURE 12. Chloride concentration in the USGS observation wells screened in the “1500 ft.” sand and located between the Baton Rouge fault and the connector well. (USGS, Scientific Investigations Report, 2005).

Figure 13 shows again the rapid involvement of the salt water when it first reached the well sites. These graphs were the most recently published by USGS in 2005 and are a good example of salt water advancement temporally. The West Baton Rouge Parish well WBR-112 shows less than 5 mg/l. and in 1970 a rapid rise to 60 in 1975 then a slower rise to over 80 mg/L by 2007. Well WBR-113 starts at near zero mg/L in 1968 and rapidly rises over 150 mg/L by 1972 then drops off only to increase to over 250 mg/L by 2006.

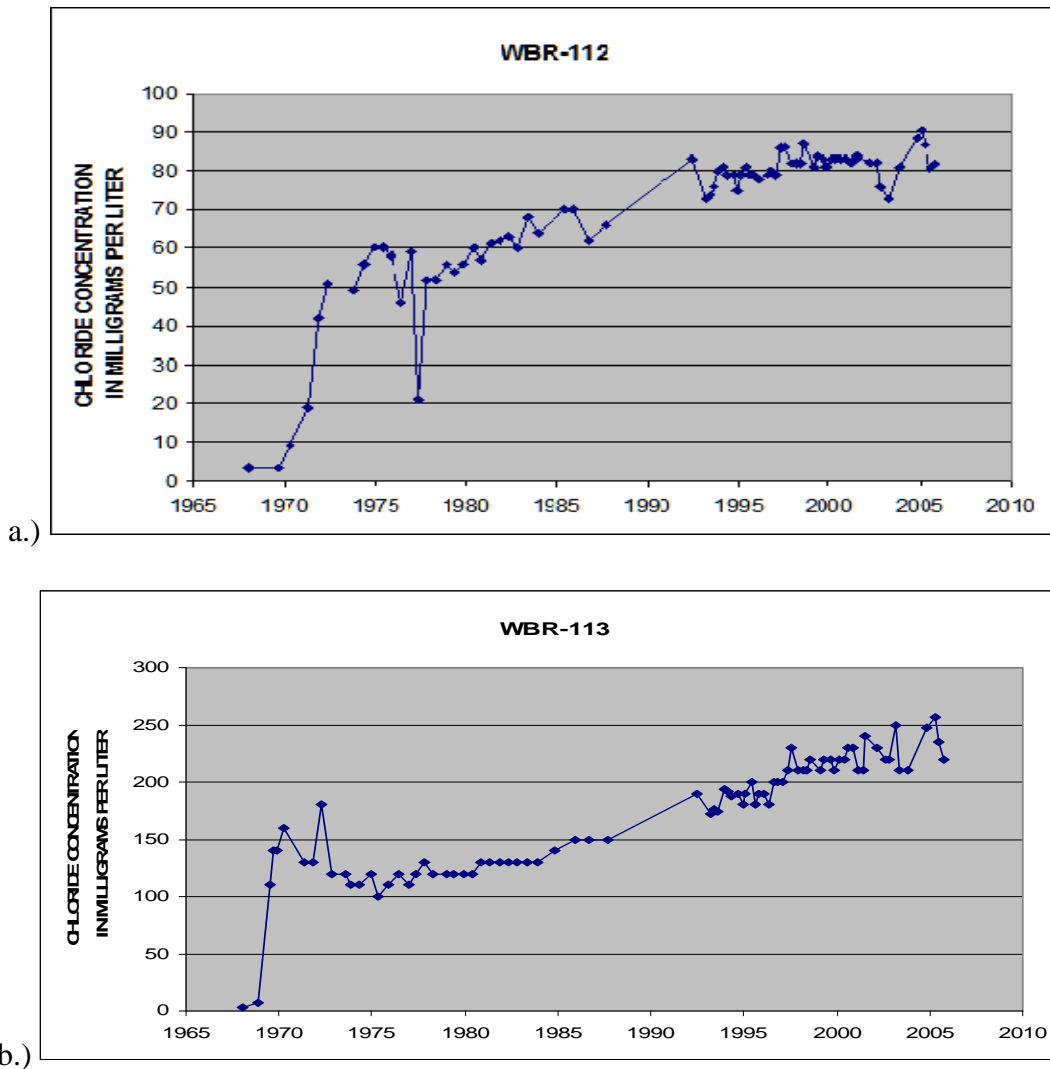


FIGURE 13. Chloride concentration in the “1500 ft.” sand at a.) Well WBR-112 and b.) Well WBR-113. (USGS, Scientific Investigations Report, 2004-05)

CHAPTER FOUR

MANAGEMENT SYSTEMS AND REVIEW OF GROUNDWATER LAWS

The 2012 American Society of Civil Engineers report card on the State of Louisiana Infrastructure, page 43, gives the State an overall grade on drinking water as a D+. The report describes the salt water intrusion as the major damaging factor to the future of our fresh water aquifers. It clearly suggests that industrial plants located near rivers use river water instead of fresh ground water. There is no easy explanation for the fact that the State of Louisiana is far behind other states in groundwater management and is one of only six states that do not to have a ground water management plan according to the State Senator Gerald Long, Chairman, Senate Natural Resource Committee (2013).

Management of the State's ground water has been transferred several times over the years. These shifts in management include the Southern Hills Aquifer under Baton Rouge. The following is a brief history of agency oversight of the Southern Hills Aquifer. While these changes in management were being made, East Baton Rouge Parish officials were aware of subsidence, lowering of the water table and salt water intrusion across the Baton Rouge Fault as early as the 1930 s (Duplechin, 2011).

The Louisiana Legislature established The Louisiana Water Resources Study Commission (1936) which met several times that year. At that time, the aquifer problems were already evident but the Commission took no action. The first meaningful control over underground water was given to the Department of Transportation who in 1972 registered the drilling of water wells and produced several reports and technical papers on salt water intrusion. (DNR Website, dnr.la.gov). No one headed up or took any action on these recommendations.

In 1965, Mayor Woodrow Dumas of East Baton Rouge Parish established a special Water Conservation Commission. (Duplechin, 2011) The Commission was to look with particular interest into salt water encroachment in the Southern Hills Aquifer and to make recommendations for remedial actions. Also in 1965, The Louisiana Water Resources Research Institute proposed a study of possible solutions to the salt water encroachment threat (Duplechin, 2011). Again no action was taken. In 1970, the State legislature established the Greater Baton Rouge Water Conservation District. This Commission proposed legislation to protect the aquifer that was presented to the Legislature, but it failed to pass.

In 1975, the Greater Baton Rouge Water Conservation District was changed to the Capital Area Ground Water Conservation Commission. Their geographic area of responsibility included the parishes of East and West Baton Rouge, East and West Feliciana, and Point Coupee. The Capital Area Ground Water Conservation Commission (CAGWCC) is still very active, having produced many studies on the ground water of the region.

In 1995, Senate Bill 985 was introduced authorizing the Department of Natural Resources, Office of Conservation to assume regulatory control over water well drilling, water well pumping and pumpage of fresh water aquifers in the state. The Board of CAGWCC unanimously opposed this Bill because it duplicated regulatory authority already given the CAGWCC by state law. The CAGWCC officers sent letters conveying their opposition to the Bill to all water users and members of the Senate Natural Resources Committee. The Bill was never called up before the Senate Natural Resources Committee and never advanced.(CAGWCC Quarterly News Letter, July, 1995).

In 2001, the Legislature passed Act No. 446 giving the Commissioner of Conservation authority over state underground water to include aquifers. The Legislature also established at

this time two committees to help manage the underground water. The first was the fifteen-member Ground Water Management Commission in the Office of the Governor. The second group was the 49 member Ground Water Management Advisory Task Force. This act also defined “sustainability” to mean the development and use of ground water in a manner so that it can be maintained for the present and future time without causing unacceptable environmental, economic, social or health consequences. This act defined the establishment of Critical Areas of ground water.(Information from DNR Website dnr.la.gov) From 2001 through 2011 the Commissioner of Conservation took no actions to protect the Southern Hills Aquifer.

Act No. 225 in 2005, changed the term “Critical Ground Water Area” to “Area of Ground Water Concern.” This may have been done to soften the word “critical,” as industries looking to build in the Baton Rouge area might be adversely impacted with the fresh water being declared as in a “critical” state. This Act also certified the “duties and powers” of the Commissioner of Conservation as to his authority to hold public hearings and to determine if an area is in a critical state of ground water concern. The Commissioner may order the restriction of withdrawals by any and all users in the area. In determining restrictions on withdrawals, the Commissioner shall consider the following - *ground water needed for human consumption and public health and safety shall have the highest priority.* This Act clearly identifies these uses as being most important in managing the groundwater resources.(DNR Website, dnr.la.gov)

In a recent draft of “Recommendations for a Statewide Ground Water Management Plan” dated October 21, 2011, by the Office of Conservation, Louisiana Department of Natural Resources, page 1-13 of the introduction states under Figure 1-2 Strategic Planning Road Map “Ground Water is considered a finite and renewable resource. All water groups will be given fair and proportional importance.” However, under the hearings section of Act No. 225 of 2005,

it clearly states on line 21 “(a) ground water needed for human consumption and public health shall have the highest priority.”(DNR Website, dnr.la.gov)

In the Executive Summary of this same document, Recommendations for a Statewide Ground Water Management Plan, page 1 under Introduction, “For purposes of this document, sustainability shall mean the water demand generally shall not exceed supply.” This does not coincide with the definition in Act No. 49, 2003 R.S. 38:3097.2 item 13, “Sustainability means the development and use of ground water in a manner that can be maintained for the present and future time without causing unacceptable environmental, economic, social, or health consequences.”

Act 446, 2001 established the Commissioner of Conservation as the official in charge of and responsible for the management of Louisiana’s ground water. (DNR,dnr.la.gov) A review of the Office of Conservation 2011 draft plan suggests an effort to move away from protecting the fresh, uncontaminated drinking water needed for the health and welfare of the citizens.

CHAPTER FIVE

EMERGENCE OF A CITIZEN ADVOCACY GROUP

As a result of my concern for the portability of drinking water in Baton Rouge, I formed an organization called Baton Rouge Citizens to Save Our Water, Inc. The objective of this new corporation, formed January 10, 2012, is to save fresh drinking water in Baton Rouge and nearby parishes from becoming ruined by salt water intrusion. This organization is trying to accomplish this objective through applying principles of collaborative environmental planning and educating the public about the problem.

The rationale for the group is that by providing an avenue for early and continuous stakeholder involvement, officials will hear voices of the public more clearly and manage the Southern Hills aquifer system for sustainable human consumption, and limit industries' use of the water.

The science shows that: 1) water tables are falling and 2) the salt water is encroaching (see Chapter Three). The State has agreed on these two points, that salt water encroachment is accelerating and the water levels are continuously falling (Jim Welch, Public Meeting, 2012.) These are the two criteria that the Commissioner of Conservation requires to take action to conserve the aquifer. The question is if they have known about this intrusion for at least 37 years, why has the government not taken action?

The solution being put forward by the citizen group is for industry to switch from deep well water usage to using processed water from the Mississippi River. However industry, whose pumping is accelerating the intrusion, does not want to pay the added expense of processing the river water. Processing would involve the removal of sediments. However, numerous industries

along the Mississippi River below Baton Rouge use river water for their processes, not deep well water.

The industries north of the Fault are pumping an amount equal to that being used by the public. Added together, industry + public, the pumpage is so great that is causing rapid movement of salt water across the fault line into north Baton Rouge. The industries, for the most part, were located on the Mississippi River and the obvious answer is to have these industries switch to using Mississippi River water. The problem for industry is simple. It costs more to build the necessary treatment plants and also for the added daily cost to purify the water for plant use than to continue using well water. In discussing this project with four interested experts, I was told by all that it would be an uphill battle, if not impossible, to get State government to take any action that industry did not first approve. Research shows that private economic interest groups have an advantage over public environmental interest groups and generally prevail (Smith, 2004).

The citizen group seeks to disseminate technical information about the salt water intrusion threat, and encourage members to actively voice their concerns and support for restrictions on industry use of fresh water from the Southern Hills aquifer system. Thus starts the process through collaborative planning and action which is described in Table 3. The series of actions describe the events taking place in working toward a sustainable solution for the fresh drinking water of Baton Rouge. The description of the group's actions is divided into two parts: first, those that took place before the formal establishment of Baton Rouge Citizens to Save Our Water, Inc., and second, those that have occurred and will continue to occur after the organization's establishment.

The group launched its website, <http://www.savebrwater.com>, on February 15, 2012. The website provides the viewer with a brief history of the Southern Hills aquifer system, a description of the current salt water intrusion problem, a proposed solution and information on how to get involved with the group. Residents need to have access to scientific and technical information concerning the Southern Hills aquifer system and salt water intrusion in order to participate meaningfully in formulating a groundwater management plan. A study conducted by DNR in December 2012 concerning residents' knowledge of groundwater issues and threats demonstrates the need to provide information to the public –only half of residents could identify the source of their drinking water.

Pre-Corporation Timeline

This project originally started as a class term paper. I decided to study the Southern Hills Aquifer under Baton Rouge. I immediately became involved in the fact-gathering portion of the research and it was obvious that the fresh water was endangered. Researchers including John Randolph have examined options for increased education and collaboration to create long-term management plans for the sustainable use of shared natural resources. The central elements of the collaborative environmental planning approaching are summarized in Table 3. Table 4 concerns collaborative environmental management which requires cooperation between all parties to resolve conflict and find a shared vision. This would be good, except large industrial users have not been willing to meet or discuss voluntary withdrawing from the deep fresh water sands. EXXON MOBIL did have the courtesy to meet with us, but declined to discuss reducing deep well pumping (see Dec. 12, 2011 meeting page 35 this chapter.)

TABLE 3. Elements of Collaborative Environmental Planning and Decision Making (Randolph, 2004).

| | |
|------------------------------|---|
| Stake Holder Involvement | Early and extensive engagement of stakeholders in the process of planning, decision making and implementation. Stakeholders are those effecting change in the environment and those affected by it. |
| Scientific Basis | Strong and sound scientific information and analysis on which to base decisions. |
| Holistic, Proactive Approach | Holistic understanding of environmental problems and their contexts, and proactive efforts to resolve and prevent them. |
| Integrated Solutions | Integration of a wide range of creative solutions to problems, such as flexible regulation, economic incentives and compensation, negotiated agreements, voluntary actions, and educational programs. |

TABLE 4. Objectives of Collaborative Environmental Management (Randolph, 2004).

| | |
|------------------------------|---|
| Develop a “Shared Vision” | Some collaborative efforts intend for the stakeholders to come up with a vision or direction that they can agree to and buy into. |
| Resolve Conflict | Some collaborative efforts aim to engage stakeholders in a process of resolving conflicts among them through negotiation and mediation. |
| Formulate Creative Solutions | All collaborative efforts hope to use dialogue and group processes to develop creative solutions that may not have emerged from traditional planning exercises. |

Because of Industry’s reluctance to discuss changing to the use of river water by industry, we approached the State Commissioner of Conservation, who has the statutory authority to enforce restriction or cessation of pumping.

Broad stake holder involvement has not been evident in this case; government agencies and the Greater Baton Rouge Chamber of Commerce seem to have considered the only stakeholders as primarily those industries using large volumes of ground water and not the public at large. From the perspective of Industries in the area, it is not in their best economic interest to negotiate with ecological interest groups to formulate a restrictive groundwater management plan.

As a result of the industrial users reluctance, we took the road of building an environmental collaborative of the people to try to influence government officials who have the authority and responsibility to bring necessary change. The creation of the new organization, Baton Rouge Citizens to Save Our Water, Inc., is a first step in building the capacity of community residents to participate more fully and from a more informed position in the development of a groundwater management plan for the Southern Hills aquifer system. Sustainability must break from current short-term thinking and planning and adopt a long term perspective. It can never be achieved without democratic processes that engage people in determining their own destiny.(Randolph, 2004)

For a complete timeline of my efforts to gather technical and historical information on the Southern Hills aquifer system, please see Appendix 1.

For a review of selected items from the CAGWCC quarterly newsletter that are pertinent to this issue, please see Appendix 2.

In January 14, 2013 letter to CAGWCC Director Duplechin, James H. Welsh, Commissioner of Conservation wrote:

While we await the final release of the USGS report and model, since the record contains sufficient monitoring data to affirmatively state that the groundwater withdrawal in the Baton Rouge area fails to meet the

statutory definition of sustainability, we are requesting the Capital Area Groundwater Conservation Commission to add the following two items to the agenda for the March 19th meeting:

- 1) Recognition of Unsustainable Pumping Centers at the Lula Street Pumping Station and the Industrial District Requiring Corrective Action;
- 2) General discussion of management actions available and, as the front line manager on this issue, what solutions does the Capital Area Groundwater Conservation Commission propose to resolve the issue.

The work of Baton Rouge Citizens to Save Our Water will not end here; but serves as a foundation for future activism, saving the fresh drinking water for the people of East Baton Rouge and nearby parishes.

CHAPTER SIX

CONCLUSIONS

Reflections and Recommendations

This thesis examines whether or not the Southern Hills Aquifer system is capable of sustaining itself (providing fresh drinking water) under the present and expected future pumpage rate. The three objectives of the thesis were to determine: 1.) What is the state of the Southern Hills aquifer system with respect to saltwater intrusion; 2.) What is the current State management structure for the aquifer system; and 3.) How may a new organization based on the principles of collaborative environmental planning improve the structure of groundwater management in Baton Rouge. I believe that, at the present pumpage rates, the aquifer is not sustainable. Unless large changes occur, the citizens of Baton Rouge will be drinking treated Mississippi River water in the future.

Organizing to involve the citizens of the area to participate in a political process without an election is extremely challenging and difficult. There are those that quickly understand the problem and want to help. Then there are those who understand and are willing to let others carry the load. There are some that do not understand and do not care. It is a question of encouraging and engaging those who do understand to become involved and to make the effort to spend a small portion of time on this most serious topic. It is not an easy job as many good people are willing to stand back and not make the effort for their own benefit. It became apparent that someone should attempt to have State Government take action to protect the fresh drinking water and bring it to a sustainable state or at least to extend its life as long as possible.

The process has so far been slow, but is gaining momentum and is finding traction. Working with the Metro-Council, I approached the Commissioner of Conservation to call a

hearing where the facts could be determined if indeed the salt water intrusion was a threat to Baton Rouge's drinking water. The Commissioner is the official who has the authority to restrict pumping if necessary to protect the aquifer. His attorneys tried to dissuade us, but we convinced the Commissioner that he had the authority to call a hearing and he said he would if we delivered to him a Resolution from the Metro-Council. The Metro-Council did deliver the Resolution and the Commissioner took no action.

Therefore, we, Baton Rouge Citizens to Save Our Water, Inc. began a campaign to enlighten and encourage the people to correspond with the Governor and the Secretary of Natural Resources who may influence the Commissioner of Conservation to reconsider his position. The works and actions taken are all recorded in Chapter Five.

The work is beginning to have a real effect and we have gotten the attention of area Legislators as well as the Secretary of Natural Resources and the Commissioner of Conservation. The Commissioner of Conservation has written a letter, Jan 14, 2013, to the Capital Area Ground Water Conservation Commission. A portion of the letter reads:

“While I await the final release of the USGS report and model, the record contains sufficient monitoring data to affirmatively state that groundwater withdrawal in the Baton Rouge area fails to meet the statutory definition of sustainability. I therefore request the CAGWCC to add the following two items to the agenda for the March 19th meeting” 1.) Recognition of unsustainable Pumping Centers at the LULA Street Pumping Station and the Industrial District Requiring Corrective Action. 2.) There should be a general discussion of management actions available. As the front line manager on this issue, what solutions does the Capital Area Groundwater Conservation Commission propose to resolve this issue?”

With this public recognition, by the Commissioner, of the problem of salt water intrusion and the work of our organization, Baton Rouge Citizens to Save Our Water, Inc., switches to attaining positive changes in the drawdown of fresh water aquifers. Although the issues will not be resolved before the completion of this thesis, we assure the citizens that we will continue our

mission of bringing sustainability to the fresh drinking water source for the citizens of East Baton Rouge and surrounding Parishes. The time for finishing this thesis is now upon us and the successful conclusion of this project will not be in this thesis. However, we will persevere until it is done; hopefully with an outcome that will protect the fresh water for future generations.

REFERENCES

- Abd-Elhamid, H. F. and Javadi, A. A., 2011. "A Cost Effective Method to Control Seawater Intrusion in Coastal Aquifers." *Water Resources Management* 25, Issue 11: 2755-2780.
- American Society of Civil Engineers, 2012. "2012 Report Card, Louisiana Infrastructure" 2012. 42.
- Anderson, Callie Elizabeth, 2012. "Sources of Salinization in the Baton Rouge Aquifer System: Southeastern Louisiana." Louisiana State University, MS Thesis, Dept. of Geology and Geophysics.
- Barlow, Paul M, and Richard, E. G., 2010. "Saltwater Intrusion in Coastal Regions of North America" *Hydrology Journal* Vol. 18 Issue 1. 247-260.
- Bense V. F. and Person, M. A., 2006. "Faults as Conduit Barrier Systems to Fluid Flow in Siliclastic Sedimentary Aquifers". *Water Resources Research* Vol. 42doi:10.1029/2005WR004480/2006.
- Capital Area Ground Water Conservation Commission Quarterly Newsletter, 2010, Volume 36, Issue 1.
- Dahl, R.A., 1970. After the Revolution? New Haven Press.
- Dial, Don, October 2010. Personal Interview.
- Don, N. C., Araki, Hiroyuki, Yamanishi, H., and Koga, Kenichi, 2005. "Simulation of Groundwater Flow and Environmental Effects Resulting from Pumping." *Environmental Geology*, 47:361-37.
- Derr, Patrick, January 2011-February 2011. Personal Interviews.
- Duplechin, Anthony, January 2012. Personal Interview.
- Duplechin, Anthony Letter to James Welsh, December 13, 2011. "East Baton Rouge Parish Metropolitan Council Restoration #48944."
- Hanor, Jeffrey, December 2010. Personal Interview.
- Kacimoy, A.R., Sherif, M. M., Perret, J. S., al-Mushikhi, A., 2009. "Control of Sea-water by saltwater Pumping; Coast of Oman." *Hydrogeology Journal* Page 54.
- Kesel, Richard, November 2011. Personal Interview.

- Koontz, Tomas M. and Johnson, E. M., 2004. "One size does not fit all: Matching breadth of stakeholder participation to watershed group accomplishments." *Policy Sciences*, 37:185-204.
- Louisiana Department of Transportation and Development, 1996. Technical Report No. 59. United States Department of Interior.
- Lovelace, John, 2007. Scientific Investigations Report 2007-5069: Chloride Concentrations in Ground Water in East and West Baton Rouge Parishes, Louisiana, 2004-05. United States Department of Interior; USWGS 2004-5.
- Lovelace, John, October 2010-January 2011. Personal Interviews.
- McCulloh, Richard P. and Heinrich, Paul V., 2012. "Surface Faults of the south Louisiana growth-fault Province." 2012, Louisiana Geological Survey.
- Meyer, R. P. and Turcan, A. N., Jr., 1955. "Geology and ground-water resources of the Baton Rouge area, Louisiana: U. S. Geological Survey Water-Supply Paper 1296, 138p.
- Miller, G. T. 2005, Brooks/Cole –Thompson Learning: Pacific Grove, CA, Fourteenth Edition Living in the Environment. Page 433.
- Moore, Rhett, Kelson, Vic and Anderson, Erik. 2011. Remedial Options for Saltwater Encroachment in the 1,500-Foot Sand: Layne Hydro, Bloomington, Indiana.
- Owen, Eugene, October 2010-December-2010. Personal Interviews.
- Qahman, Khalid-Larabi, Abdelkader-Quazar, Driss-Naji, Ahmed-Cheng, A H.-D., 2005. "Optimal and Sustainable Extraction of Groundwater in Coastal Aquifers." Stochastic Environmental Research and Risk Assessment, Page 1.
- Randolph, John. Environmental Land Use Planning and Management, p 56. Washington, D.C.: Island Press, 2004.
- Rollo, J. R., 1969. "Salt-water encroachment in Aquifers of the Baton Rouge Area, Louisiana." Louisiana Department of Conservation and Louisiana Department of Public Works Water Resources Bulletin 13, 45p.
- Ronen, D., Sorek, S., and Gilron, J. 2012. "Rationales Behind Irrationality of Decision Making in Groundwater Quality Management." *Groundwater* 50 (1):27-36.
- Smith, Zachary, 2004. The Environmental Policy Paradox: Fourth Edition, Prentiss Hall, P50.
- Stoessell, Ronald K. and Prochaska, Lesley, 2005. Chemical Evidence for Migration of Deep Formation Fluids into Shallow Aquifers in South Louisiana; Gulf Coast Association of Geological Societies Transactions Volume 55, Chapter 1:794-808.

Suvedi, Maruri.- Krueger, David- Shrestha, Anil- Bettinhouse, Dixie, 2000. "Michigan Citizens Knowledge and Perceptions About Groundwater." *The Journal of Environmental Education* 31,(2):21.

Tomaszewski, Dan, October 2010-November 2010. Personal Interviews.

U. S. Environmental Protection Agency 2006.

Welsh, James Letter to Anthony Duplechin, January 14, 2013. "Agenda for CAGWCC Meeting Scheduled on Tuesday March 19, 2013."

Whitman, D. C., Jr.,1977. "Saltwater encroachment in the "600-foot" and"1500-foot" sands of the Baton Rouge Area, Louisiana 1966-78, Including a Discussion of other Sands." U. S. Geological Survey, Louisiana Department of Transportation and Development Office of Public Works 1979.

Zun, Zhou & Ying, Wang, 2009. "Brief Review on Methods of Estimation of the Location of a Fresh Water-Salt water Interface with Hydraulic Heads or Pressures in Coastal Zones." *Ground Water Monitoring & Remediation* Volume 4:77-84.

APPENDIX 1

Advocacy/Timeline

The following is a timeline of my efforts to gather technical and historical information about the Southern Hills aquifer, and to lay the foundation for the new advocacy group.

In October, 2010, I met with Mr. Don C. Dial, Director of Capital Area Ground Water Conservation Commission. Mr. Dial provided listings of information and referred me to the U.S. Geological Survey (USGS). I met with Mr. John Lovelace and Mr. Dan Tomaszewski of USGS. They both provided a wealth of information including several publications and technical papers relevant to the subject. Also that same month, I interviewed Mr. Eugene Owen, Chairman of the Board, Baton Rouge Water Company (BRWC). Mr. Owen was tremendously helpful, both in providing technical information and a historical perspective of the fresh water situation in the Baton Rouge area.

In the month of November, 2010, I re-interviewed John Lovelace, Dan Tomaszewski and Eugene Owen. They all were extremely helpful and provided their understanding of the state of the aquifer and additional publications. On January 10, 2010, I met with Amy Wold, environmental writer for The Advocate, the Baton Rouge daily newspaper. It appeared that she was going to write an article concerning the rapid salt water intrusion, but it did not happen initially. I then went to the Baton Rouge Business Report in April and met with the editor and a reporter. The editor said they had run a short story about the intrusion in 2009 and it did not draw any interest; therefore, they could not run another article until something newsworthy changed.

On April 22, 2011, I met with East Baton Rouge Metro Council Member Mr. “Smokie” Bourgeois at my home and presented an overview of salt water intrusion of the Southern Hills

aquifer system. Mr. Bourgeois was concerned about the ground water and arranged for me to speak to the Metro-Council on June 8, 2011. Before the meeting, Mr. Bourgeois circulated my analysis to the other Council Members and also to the area legislators. Because the prescribed time allowed was short, I was unable to give my full presentation and had only time to read several pertinent quotes from experts on the salt water intrusion. Also in May, I presented my analysis to Mayor Kip Holden. The Mayor understood the problem and wished me well, saying he would be glad to lend assistance.

On June 13, 2011, I met with Mayor Pro-Tem Mike Walker and Councilman Bourgeois. At this meeting, I was able to present my Baton Rouge Groundwater Presentation and discussed possible actions. Mr. Walker and I met with Commissioner of Conservation, Mr. Jim Welsh on June 18, 2011. Mr. Welsh had two staff attorneys present. After Mr. Walker asked the Commissioner to call a hearing with respect to the rapid salt water intrusion, the attorneys began to verbally build huge barricades to such a hearing. They cited voluminous regulations and extensive requirements before a hearing could even be considered. Mr. Walker and I convinced the Commissioner that he did, in fact, have the authority to call a hearing on his own volition at which time he agreed to do so, if we would bring him a resolution from the Metro-Council asking for such a hearing.

During the interval, I gave presentations to five additional councilmen individually and the Resolution asking for a hearing passed nine to zero at the October 26, 2011 meeting of the Metro-Council.

On November 1, 2011, Councilmen Walker and Bourgeois hand delivered the Resolution to Commissioner Welsh. The Commissioner said he would have to approach this hearing

scientifically and he would need time to do so. That was the last thing the Council heard from the Commissioner until February 10, 2012.

Post-Corporation Timeline

Early in November, 2011 I met with J. H. Jenkins and Dr. Butler Fuller to discuss forming a corporation for the purpose of attempting to save the fresh drinking water for the people of Baton Rouge and surrounding parishes. On November 7th, 2011, I attended a CAGWCC meeting. At this meeting, it was noted that the Commissioner had mailed a notice to the CAGWCC to ask them of steps or actions the Commission had taken and to list studies involving salt water intrusion. An attorney from the Attorney General's Office, appointed to advise the CAGWCC, addressed the meeting saying she had met with the Commissioner and that he (the Commissioner) did not think anything would come from this Resolution. The Commissioner asked the CAGWCC to answer in 30 days. They answered his letter on December 13, 2011.

On November 28, 2011, I presented my Baton Rouge Groundwater Presentation to classmates in Renewable Natural Resources 7073, Dr. Xu's graduate class at L S U. It was well received, and the students seemed genuinely interested in a solution. I presented my Baton Rouge Groundwater Presentation on salt water intrusion on November 29, 2011, to the Climatology graduate students and staff, at L S U, at their weekly meeting and, again the presentation was well received.

I interviewed Dr. Jeffrey Hanor on December 8, 2011 regarding the age of the Fault and sands of the aquifer. Two days later, J. H. Jenkins and I met with attorney Michael Calabreze to organize a corporation for the public part of the campaign to save Baton Rouge drinking water.

On December 10, 2011, I met with Chuck Sanchez of STUN, Inc., to start working on a web site for Baton Rouge Citizens to Save Our Water.

There was a meeting at EXXONMOBIL on December 12, 2011. In attendance were Councilmen Walker and Bourgeois, Mr. Jenkins and me. We were representing the citizens of Baton Rouge. From EXXONMOBIL were Mr. Steven L. Blume, Refinery Manager, and Mr. Henry T. Graham, Vice President and General Council of Louisiana Chemical Association. There were several others in attendance from EXXONMOBIL. The discussion began on the topic of the amount of deep well water the industries were extracting from the aquifer. Mr. Graham vigorously attacked BRWC for selling water in Ascension and Livingston Parishes. I asked Mr. Blume if EXXONMOBIL would consider taking the lead in announcing the change from deep well water to the use of shallow well water and river water. Mr. Blume, very courteously, replied that the refinery enjoyed an economic advantage using the deep well water and he did not think they would like to take the lead.

On December 14, 2011, I met with a group from the Baton Rouge Growth Coalition at Mr. Chip Songy's office. Attending were Mr. Songy, Scott Bardwell and Hardie Squires. The Baton Rouge Groundwater Presentation was well received and Mr. Songy suggested we meet with the Greater Baton Rouge Area Foundation. He later set the appointment for January 11, 2012.

Mr. Jenkins and I attended the December 14, 2011 meeting of the State Ground Water Advisory Task Force. At the meeting, Mrs. Kathy Wascom, Legislative Aid to the Louisiana Environmental Action Network, proposed a motion for the Task Force to request that the Commissioner of Conservation hold a hearing as requested by the Baton Rouge Metro-Council. The motion passed after Mr. Graham of the Louisiana Chemical Association spoke in opposition

to the motion. At this meeting Mr. Adams, attorney for Commissioner Welsh, spoke twice saying that the Resolution from the Baton Rouge Metro-Council had no validity.

I e-mailed Chuck Sanchez to proceed with the web site.

I met on December 20th, 2011 with John Lovelace to gather more information. The next day I met with Dr. Margaret Reams, Associate Professor in the Department of Environmental Sciences at LSU to discuss taking her Environmental class to help BRC SOW in its movement through public collaboration to save the fresh drinking water. I visited Shawn Scallan at CAGWCC to secure additional newsletters for background information in the case involving the recent history of the aquifer use.

I presented to Mr. Mike Miller of Star Services the Baton Rouge Groundwater Presentation. Mr. Miller referred me to Mrs. Judy McCleary, a popular lobbyist at the legislature. Mrs. McCleary would later be and still is a good source of information concerning governmental matters.

On January 10, 2012, I met with Gene Owen and Patrick Kerr at BRWC to discuss problems with the aquifer and BRWC's work to stay ahead of them. We also discussed the new report from Layne Hydro, "Remedial Options for Salt Water Encroachment in the 1,500-Foot Sand", dated January 3, 2012. Wednesday, January 11, 2012, I met with the Baton Rouge Area Foundation. Present from the Baton Rouge Growth Coalition were Mr. Songy, Mr. Bardwell, Mr. Squires, and Mr. John Davies from the Foundation, I presented my Baton Rouge Groundwater Presentation and a general discussion followed. Mr. Davies said the Foundation was about to announce the forming of the Water Institute which was to be in complete charge of the planning and selection of all consultants for all things water, including costal restoration, in

the delta of Louisiana. He felt that saving the drinking water was not timely for them and that possibly in two or three years they could help.

I met with and presented my Baton Rouge Groundwater Presentation to the Baton Rouge Federation of Subdivision Associations on January 12, 2012. The group was interested and asked many questions. This meeting led to several other presentations. On the thirteenth of January, I met with Mr. Willie Fontenot, retired Environmental Officer with the State Justice Department. Mr. Fontenot was very knowledgeable about ground water problems as well as the operation of the Office of the Commissioner of Conservation. He arranged and accompanied me to a meeting with the editorial board of The Advocate on January 19, 2012. I presented my Baton Rouge Groundwater Presentation which has led to several articles in The Advocate. The first front page article by environmental writer Amy Wold really helped launch the campaign of BRCROW. On January 16, 2012, I e-mailed the content to Mr. Sanchez to be incorporated into the web site.

On January 18, 2012, Mr. Jenkins and I met with Senators Dan Claitor and Evoyene Dorsey. Also present were Councilman Walker and Assistant Parish Attorney Kristen Craig. The discussion included salt water intrusion and the problem of getting movement toward a solution. Senator Dorsey suggested having the Commissioner appear before her Senate Committee.

Wednesday, January 18, 2012, Mr. Jenkins and I met with Public Service Commissioner Jimmy Fields and his assistant Mr. Cangelosi. We discussed that we should meet with Mr. Steven Morette, Director of Economic Development for the State of Louisiana, to possibly consider incentives for industry, if necessary, to get them to stop using our drinking water for industrial purposes.

On January 19, 2012, I e-mailed my Baton Rouge Groundwater Presentation to Mr. Carl Redman, Executive Editor of The Advocate. The same day I e-mailed administrative questions to Kristen Craig of the Parish Attorney's Office.

On January 23, 2012, I met with Holly Forret of Donohue Patrick, PLLC to arrange for a federal tax number for BRC SOW and start the process for registering as a Not for Profit Corporation. On January 24, 2012, I did a radio interview with Mr. Jim Engster on WRKF-Baton Rouge covering the topic. The interview is to be broadcast later over the Louisiana Public Broadcast Network. That same day, I met with the Capital Area Legislative Delegation and made a presentation without the projector or power point presentation. They voted to send a letter to the Commissioner of Conservation asking him to honor the request of the East Baton Rouge Parish Metro-Council to have a hearing. This was important in getting some action by the Commissioner.

On January 26 and 27, 2012, I worked on the wording for the web site and on the 29th filled out the application for non-profit status for BRC SOW. On January 31, 2012, I made a Presentation to Dr. Reams' Environmental Management class of graduate students. The students were excited about the project to save the drinking water and had several questions and suggestions. Several students sought to do their term papers on ground water.

On Wednesday the first of February, I gave my Baton Rouge Groundwater Presentation to the Kenilworth Subdivision Association. With over a hundred residents present, their reception was very good and they asked many pertinent questions. I also e-mailed our web site address to the Association Secretary so it could be viewed when it became available. On February 6, 2012, I gave the Presentation to the Board of the Southdown's Civic Association. On 7 February, 2012, I met with Patrick Kerr of BRWC again to discuss salt water intrusion and

possible remedies. On February 8, 2012, Mr. Jenkins and I met to discuss trying to acquire public involvement. Also on February 8 and 9, 2012, I had telephone interviews with Amy Wold about The Advocate article to be published on Monday, February 12th. On Friday afternoon I received, through Mike Walker's office, a letter e-mailed to the Councilman's office from Commissioner Welsh stating that they had an ongoing study to be completed in October. They also stated they would need about three months to study the report and then would be able to determine if calling a hearing was necessary. This occurred on the Friday before The Advocate was to publish a front page article on the salt water intrusion. I later learned from Ms. Wold that she had called the Commissioner on Wednesday before his Friday afternoon letter to Councilman Walker.

On February 28, 2012, Mr. Jenkins and I met with Scott Angell the Secretary of Natural Resources to discuss the threat of salt water intrusion. I gave my Baton Rouge Groundwater Presentation and the Secretary understood the problem and the necessity for the Commissioner to work to help solve the problem. On February 29, 2012, the Commissioner announced a hearing to be held on April 12, 2012. This is a technical hearing where testimony will be taken to help the Commissioner decide what, if any, action must be taken to protect the Southern Hills Aquifer drinking water.

On Thursday, March 1, 2012 accompanied by Dr. Butler Fuller, I gave my Baton Rouge Groundwater Presentation in Donaldsonville to the Ascension Parish Council. The Council voted to send a resolution asking the Commissioner to call a hearing. I advised the Council that on the previous day, the Commissioner had indeed called a hearing, but it was important for him to know that the people of Ascension were both interested and involved.

On Thursday, March 8, 2012, the Public Meeting was called by the Commissioner to replace the hearing asked for by the Baton Rouge Metro-Council and the Capital Area Legislative Delegation. At this meeting the Commissioner spoke first saying that he was very concerned about the salt water intrusion into the aquifer under Baton Rouge, and that he intended to take action to halt and reverse this intrusion. Then Mr. John Adams, attorney for the Commissioner, spoke describing the amount of drawdown of the hydraulic heads in the 2000 foot and 1500 foot sands under East Baton Rouge Parish. This has amounted to 300 and 200 feet respectively since 1945.

This is the same information Mike Walker and I had given to the Commissioner and his attorneys at their first meeting on June 18, 2011, eight months before. Also speaking at the meeting were Mr. Tony Duplechin of the CAGWCC, Mr. John Lovelace of the USGS, and Mr. William Fontenot, formerly with the Attorney General Office. Mr. Fontenot stated that the meeting was poorly managed, in that it was not properly advertised, there were no other State agencies represented, and this encroachment should have been addressed twenty years ago. Next, I spoke about BRCSWO. I thanked the Commissioner for saying that he was concerned about the salt water encroachment and he intended to stop this encroachment and actually reverse it. I then thanked Mr. Adams for recognizing the tremendous drops in the water tables in the 2000 and 1500 foot sands. I also spoke to a possible solution to try to gain sustainability for the fresh drinking water since industry located on the river could and should use Mississippi River water instead of the deep well drinking water.

Next Mr. Eugene Owen with the BRWC spoke. He described the history of BRWC and their efforts to divert salt water from their Lula pumping station. Then Mr. Graham, with Louisiana Chemical Association, attacked BRWC as being a private-for-profit company which

was causing the entire problem by locating some of their pumping stations too close to the Fault. He also stated that BRWC had been aware of this encroachment for some time and had stubbornly refused to move these stations as well as selling their water to commercial establishments and industry in the area.

The next speaker was Mrs. Kathy Wascom, Louisiana Environmental Action Network. She called for the Commissioner to take positive action to save the fresh drinking water. She also said it was past time for studies. Then Mr. Owen asked to rebut things that Mr. Graham had said and claimed that his company did not, to his knowledge, sell any water to companies that used it in processing (i.e. industrial uses).

On Friday March 9, 2012, Mr. Jenkins and I drove to West Monroe, Louisiana to meet with Mayor Dave Morris, Mr. Jack Smith and Mr. John Stamberg with Energy Ventures Analysis, Inc. The Mayor and Mr. Stamberg explained the genesis of the West Monroe's new water purification plant. They talked about the cost, financial aid and operation of the plant. Its purpose was to purify water from the city sewage plant to be used by the local paper manufacturer. The new plant is an experiment in the use of previously manufactured units, situated to convert ten million gallons of treated sewer water per day to water pure enough to replace the well water used by the local paper manufacturer. Mr. Jenkins and I are considering recommending this type of system to the state authorities to replace fresh deep well water presently used by industries in the East Baton Rouge Parish area.

On March 14, 2012, I attended a Technical Committee meeting of the CAGWCC. The meeting was held at the BRWC and a presentation was made by Dr. Jack Wittman of Layne Hydro. Dr. Wittman gave an excellent presentation of his company's recent study of salt water intrusion into the 1500 foot sand, specifically its advance to the Lula pumping station. After

talking with Dr. Wittman, Mr. Owen of BRWC and Mr. John of Lovelace of USGS, it became apparent that hydrologists worry about stopping the immediate threat as opposed to striving for sustainability as if the word sustainability is not in their thought process. I am presently looking for a hydrologist who understands and desires sustainability for future generations and not just for 20 or 50 years.

Friday, March 16, 2012, the Secretary of the Department of Natural Resources presented to the Louisiana Legislature an interim report, "Managing Louisiana's Ground Water Resources", composed by Louisiana Ground Water Resources Commission. The report claims that they understand and are concerned about the lowering of the ground water table and the salt water intrusion in the Southern Hills Aquifer System. The question is if they know so much about this problem, why haven't they taken any action before now?

Sunday, March 18, 2012, I spoke to the Magnolia Woods Subdivision Association. Councilman Bourgeois was present and also addressed the gathering.

Monday March 19, 2012, I was interviewed by Mr. Brian Halding of 107.3 talk radio. I had gone to the station the previous Friday and presented my Baton Rouge Ground Water Presentation to Mr. Halding and the Manager, Mr. Gauthier. They were extremely taken by the seriousness of the threat to the fresh water aquifer and the questions during the interview brought this point across to the audience. The next day we arranged for a newspaper ad to run three times to advertise the website.

Friday the twenty-third, I spoke to Dr. Kristine Delong's LSU Geography Class. Monday the twenty-sixth, I met with state senator Rickey Ward to solicit his help involving the Commissioner of Conservation. The next day at noon I spoke to a meeting of the Baton Rouge

Area Military Officers Association of America and afterwards emailed their secretary the web address and the date of the Public Hearing on the aquifer.

In September, 2012, we launched a television campaign to influence the Commissioner of Conservation to take action to save the Baton Rouge aquifer. This campaign was in the form of an advertising blitz funded by the Citizens for Clean Land and Water PAC. Two commercials were shot, one 30-second and one 60-second, and aired approximately 300 times over the course of one month.



FIGURE 14: Screenshot from Television Advertisement, September 2012.

Release of the transcript of the December 5, 2012 meeting of the Water Resource Commission, took place December 19, 2012. The meeting began with a discussion of the creation of the Water Resources Commission, which replaced the Ground Water Resource Commission, by the recent legislative session. This change was made to include surface water

under this new Commission. Next was a discussion of additional monitoring wells for a state-wide system to provide more information to regulate wells and pumpage.

There was an extensive discussion of an education program for the public by the Conservation Commission. In a survey by DNR in December 2012, it was found that only half of respondents were aware that their drinking water came from underground aquifers. This demonstrates an immediate need to create a new program (Water-wise in BR). This education would be done through the public schools. Planners should also develop educational programs to alert adults as well as children to groundwater issues. The curriculum should address the real and perceived problems about groundwater and make all citizens aware of the danger of contamination of groundwater, (Suvedi, et.al.2000).

John Lovelace, USGS, gave his testimony as to the use of the new monitoring wells to be paid by the Office of Conservation Commissioner. He was questioned as to the completion date of the ongoing study of 2000 and 1500 foot sands under East Baton Rouge Parish (the study was originally commissioned to be finished in 2011.) Mr. Lovelace reported that they (USGS) had gathered all of the necessary information, but that it had to be reviewed and corrected before being released to the public. He expects it happen in February 2013.

The following quotes are from the same meeting, Commission Chairman Angelle stated “from the data that you have seen and your historic knowledge of the area, are you prepared to say that the current volume, regardless of where it comes from – this is not about the user, this is about a group of users.- that the current pumpage is not sustainable relative to salt water intrusion? Are we going to have to reduce pumpage to solve the salt water intrusion issue?”

Mr. Lovelace: “Yes, there will have to be changes to the pumping to solve the salt water intrusion issue. There is no doubt about that.”

“Salt water has been moving since – was first noted in the late 1940’s in the 600 foot sands, and since then has been showing up in other sands. So, there is really no questions that there will have to be some changes, reductions, the reductions in the pumping, or movement of wells further from the fault to address the issue, or use scavenger to pump the salt out.”

Mr. Lovelace has on several occasions said to me that he believes that Baton Rouge Water Company has positioned the wells too close to the fault and this is the root cause of the salt water intrusion towards their pump stations. This statement does not reflect the accelerating salt water movement towards the wells at Exxon Mobile refinery. I believe that the new study, in the 2000 foot sands, will show that if the refinery does not curtail the pumping that the intrusion will reach refinery wells in the near future.

Chairman Angell- “I am going to offer myself in the leadership role to try to work with the impacted users as we move forward in, you know, receiving this information. But none of us want to be a generation that says, we had the information and we didn’t demand change. We are going to have to be part of that.” One of the main problems is that Commissioner of Conservation (State Government,) the Capitol Area Ground Water Conservation and the Greater Baton Rouge Chamber of Commerce do not consider the people of East Baton Rouge and surrounding Parishes as stakeholders in the need to divide up the water resources.

December 21 2012: Release of survey results taken by Department of Natural Resources as to knowledge of the Southern hills Aquifer serving the people of East Baton Rouge Parish. The survey showed only fifty two percent were aware that the drinking water came from the aquifer and only twenty two percent thought that the state government was in charge of the pumping from the aquifer and is responsible to maintain the sustainability of our drinking water.

The survey showed a definite need for the education of the citizens in regards to the aquifer and the need for conservation of this natural resource.

January 14, 2013 Commissioner of Conservation, Mr. Jim Welsh, wrote a letter to Mr. Anthony Duplechin, Director of the Capital Area Groundwater Conservation Commission basically stating that the 1500 and 2000 ft. sands of the Southern Hills Aquifer are not being used in a manner that can continue indefinitely without causing unacceptable environmental, economic, social, or health consequences. He then states that the record contains sufficient data to affirmatively state that the ground water withdrawal fails to meet the statutory definition of sustainable (Welsh, 2013). He then request the Capital Area Groundwater Conservation Committee to take up two items at their next, March 19th,2013 meeting, first recognizing that the pumping centers at Lula Street Pumping station and the Industrial District require action. Then secondly what solutions the Capital Area Ground Water Commission propose to resolve the issue.

On January 29, 2013 Amy Wold of the Advocate wrote an article, page B1, ' Conservation Office Wants B R Aquifer Declared Unsustainable.' From that article, Director of the CAGWCC Tony Duplechin is quoted as saying, "This has taken decades to unfold and we're not going to get it back in the bag next year." I was very disappointed in the reaction of the Director of the CAGWCC. The problem is that the CAGWCC has been tracking the advance of salt water intrusion for thirty seven years and has done nothing to reduce or contain the advancing intrusion of salt water into the fresh water aquifer under Baton Rouge.

APPENDIX 2

The CAGWCC releases a quarterly newsletter concerning the aquifer under Baton Rouge. The following are excerpts from the newsletter expressing their concerns for the freshwater supply of Baton Rouge.

- July 1997- Retired Professor Raphael Kazmann was the speaker and recommended to take a long term perspective looking ahead 100 years instead of 15 to 20 years.
- July 2000- An unlimited supply of water is available from the Mississippi River that could be used as a last resort. Public-supply water from that source would require extensive treatment. A better choice would be the Amite River which has much better quality with low dissolved solids and hardness.
- January 2001- Louisiana is one of the last states to develop a policy. Actually a study commission presented some recommendations regarding the water policy for the state. Nothing was done by the legislature and the document was largely forgotten.
- October 2001- Discusses the meaning of sustainability. No resolution arrived.
- January 2003- Discuss the use of grey water by industrial plants as well as treated Mississippi River water.
- April 2003- Letter sites: included pumping from some aquifers will create problems such as declining water levels and water- quality deterioration because of the salt water encroachment. These problems will stimulate interest in research aimed at the development of alternative water sources.
- January 2004- Fortunately the slow movement of salt water allows ample time for contingency plans to be developed before a problem occurs.
- October 2004- Says, leakage across the fault was aided by development for the public, water supply, and industrial uses that increase the head differences across the fault. Consequently, salt water encroachment became a problem in some sands as salty water moved north of the fault.
- April 2005- Discussed supplying industry with water from the Mississippi and Amite Rivers, and the Comite Diversion Canal.
- October 2006- Discusses a 2004 study of possible use of grey water for industrial purposes. Second phase of the study was never completed, discussed the possibility of reclamation of used water for Baton Rouge. It also, discussed looking 20 to 30 years ahead to the probable use of desalination as an alternative to fresh water ground water where aquifers contain brackish water.
- January 2007- Discussed a proposal by USGS to make a model that would be used to manage the future use of the 1500 foot sand and the 2000 foot sand.
- January 2007- Shows the drop in water levels in six wells, each dropping between 1.5 to 4.0 feet per year over a ten year period.

- April 2007- Discussed a chloride monitoring project and the present quality of the Baton Rouge drinking water.
- January 2008- Refers to the publication “Chloride Concentration in ground water in East and West Baton Rouge Parishes, Lovelace, J.K. 2007, USGS Scientific Investigation Report 2007-5069.
- April 2008- USGS Fact Sheet 075-03. In the Capital area two of our concerns are water-level declines and saltwater encroachment. In the foreseeable future, we may want to investigate supplemental sources to augment the fresh ground water for industrial and public-supply use.
- July 2008- Discussed desalination of the salt water, and reuse of sewer water.
- April 2009- Discussed water reclamation. In 2003, the Commission and East Baton Rouge City-Parish signed a contract to retain URS Corporation to do a study involving alternate sources of water for industrial use. One conclusion was that, in the long term, reclaimed water use will probably become more common as the perception of the water quality issues change.
- July 2009- The commission passed a resolution in 1991 to restrict future development in the industrial area for the 2000 foot sand and industries have cooperated in an effort to limit production in this important aquifer.
- April 2010- Fresh water flushing across the 1800 foot sand was incomplete, resulting in a zone of salty water that extends west to east on the north side of the Baton Rouge fault.
- July 2010- Well in Port Allen in the 1200 ft. sand, directly across the river from the industrial area, had a water table drop of 45 feet in twelve years.
- October 2010- Discussed alternate sources of water for Baton Rouge to include the Amite River, ground water of inferior quality, reverse osmosis, and scavenger wells.

APPENDIX 3

Capital Area Ground Water Conservation Commission Membership

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|------------------------|---|
| Mr. John Adams | Louisiana Department of Natural Resources |
| Mr. Dale Aucion | Industry EXXON MOBIL |
| Mr. Brian Chustz | Industry Entergy |
| Mr. John Hashagen | West Baton Rouge Parish |
| Mr. John Jennings | Louisiana D E Q |
| Mr. Dennis McGehee | Public Supply B R W C |
| Ms. Rosemary Rummler | Pointe Coupee Parish |
| Dr. John Westra | E B R Parish |
| Mr. Melvin Argrave III | Public Supply B R W C |
| Mr. John Cadenhead | East Feliciana Parish |
| Mr. Joey Hebert | Industry Georgia Pacific |
| Ms. Amelia Kent | La Farm Bureau & Cattleman's Assn. |
| Mr. James Rills | West B R Parish |
| Mr. Mark Walton | Board Nominee EXXON MOBIL |

VITA

A. Hays Town, Jr. was born in Jackson, Mississippi in 1935. At the age of four, his family moved to Baton Rouge, Louisiana and he has resided here ever since, with the exception of a short time serving as a Reserve Infantry Officer in the United States Army.

Town married the former Marguerite Gay May in 1956. They have six children, twenty grandchildren and seven great grandchildren to date.

He graduated from Louisiana State University in 1958. In 1959, Town started his own construction company which he owned and managed until retirement in 2007.

Town was the founding president of the Baton Rouge Chapter of the Associated Builders and Contractors and later received the first national award, Beam Club Man of the Year. He has served as Chairman of the State Licensing Board for Contractors.

In 1988, Town founded St. Elizabeth Foundation and remains President of the Foundation today. He received the first Angel of Adoption Award from the United States Congress. He has also served as Chairman of Louisiana State Child Care Committee.

Town founded Baton Rouge Citizens to Save Our Water, Inc. in 2012 and presently serves as President.

Town is expected to receive his Master of Science degree with a major in Geography in May, 2013