16. **394 Laboratory Equipment ($2,269.50)**

Monarch used this category to purchase an eyewash station in 2008 in its Holiday Village of Forks wastewater system.

17. **395 Power Operated Equipment ($9,721.21)**

This category includes costs for power operated equipment used in construction of repair work. Monarch has included in this category the cost for air compressors.

18. **396 Communication Equipment ($61,042.40)**

Communication equipment is used to monitor and control wastewater facilities such as lift stations and treatment plants. Monarch's wastewater communication equipment typically consists of a combination of auto dialers that use telecommunication company phone lines to transmit important information such as pump failures to remotely located operators. Monarch has used this category to record the cost of purchasing communication equipment required to replace equipment that has failed.

19. **397 Miscellaneous Equipment ($3,231.87)**

Monarch used this category to purchase a Gun Cart irrigation reel for its Lake Medina Shores wastewater system in 2014, and a 3hp Smoke Blower in its Tower Terrace wastewater system in 2015.

B. Water ($61,798,893.22) by NARUC Account

Q. WHAT WERE THE CAPITAL INVESTMENTS MADE IN MONARCH'S WATER SYSTEM?

A. Monarch spent $61,798,893.22 on capital improvements in the Water systems. These costs are categorized below according to NARUC asset classification.

1. 303 Land and Land Rights ($1,159,748.08)

Land and Land Rights such as easements are purchased to accommodate water production and distribution facilities such as wells, ground storage tanks, and pump stations. Further, easements are purchased to allow the legal installation of pipelines on private property and provide required buffer zones between residential customers and water treatment facilities. Monarch's larger capital investments in land and land rights are discussed below in more detail:

The following is a more detailed description of the major investments in this category:

- In 2010, Monarch entered into a Public Utilities Service Agreement with the City of Pottsboro where the City would provide Monarch with 300gpm of potable water and would accept 90,000 gallons of sewage per day. The initial term of the agreement is for 20 years with the option to extend. These services are required to meet TCEQ supply and discharge requirements for Monarch's Tanglewood service area. Pursuant to the agreement, and in exchange for reserving this capacity in the City's water system, Monarch constructed 12,100 feet of 12-inch water pipeline in 2013 at a cost of $648,411.27 and contributed it to the City. This pipeline is dedicated to only serve Monarch's Tanglewood service area, and the City is responsible for all future maintenance of the pipeline. This cost is considered to be a capacity fee and is accounted for as intangible plant with an indefinite useful life.
- This category includes $225,966.70 in CIAC/Advances for Land and Land Rights made by TECON and recorded in 2004.

2. 304 Structures and Improvements ($10,795,276.08)

This category captures the cost of structures and improvements that are used in connection with source of supply, pumping, water treatment, transmission and distribution, and general plant. Major cost items in this category are explained in greater detail, and minor cost items are grouped for more efficient discussion.

Building structures are used to protect pumping, electrical, chemical handling, and treatment equipment from the effects of weather (rain, extreme heat and cold, exposure to the sun). Like the other components of the water system, these facilities deteriorate over time and need to be rehabilitated or replaced. Monarch has used this category to capture capital costs for constructing replacement pump station buildings, well pump buildings, and chemical storage buildings. Also included in this category are costs for rehabilitating building electrical and lighting systems, replacing windows, replacing siding, roof replacement, and major repairs required as a result of Hurricane Rita. These facilities help ensure the reliable operation of water production and distribution equipment.

This category is also used to capture capital costs for yard piping and valves located within plant sites and for the structures required to provide access to them. Monarch has replaced rate of flow control valves and pump control valves, installed cycle stop valves, connections to tanks, other treatment processes (e.g. gravity filter backwash), air compressors, and meter vaults in order to connect new equipment, and replaced existing equipment that had reached the end of its useful life.

Also included in this category are capital costs for installing and replacing water treatment equipment such as turbidity meters, gravity filters, hand rails on catwalk and stairs, sand separators, a spectrophotometer at a surface water plant, chlorine storage tanks and containment vessels, and chlorine analyzers. These improvements were necessary to protect the safety of employees and to ensure that the quality of water produced, stored, and distributed meets the high standard required to ensure customer safety.

After terrorist attacks in 2001, the EPA had water utilities perform vulnerability assessments of their facilities. Simple fencing around plants sites was determined to be an effective method to detect, deter, and delay those looking to harm a water system. Damaged fencing provides an indication that someone has breached the secured perimeter of a plant and initiates facility inspections and water quality testing that could provide early detection of the introduction of undesirable compounds to the water system. Fences make it clear that facilities are secure and closely watched, and provide a physical barrier that delays entry, which provides time for operators or neighbors to observe the unauthorized access and report to law enforcement. Fences suffer damage from storms, vandalism, and deterioration with age and need to be replaced.

Finally, TCEQ rule 290 Subchapter D requires all weather access roads for water facilities that include wells, intakes, pump stations, ground storage tanks, etc. Monarch maintains access roads that are constructed from asphalt, concrete, and gravel depending on the road length and conditions. Gravel roads can be damaged by heavy rain events that cause ruts. The oil that holds the aggregate together on Asphalt roads evaporates overtime leaving the roadway brittle and subject to damage from vehicle traffic.

Monarch has constructed or rehabilitated all-weather roads to remediate violations raised in the TCEQ Compliance Agreement (Enforcement Case No. 37045). Specifically, the TCEQ requires the provision of an all-weather road to the raw water pump station, and to ensure that the facility is located at a site that is accessible by an all-weather road in accordance with 30 TAC § 290.41(a)4) and 30 TAC § 290.42(e)(3), respectively. The following is summary of the compliance locations:

GCA2	4.a.	Oak Trail Shores - Region 4	30 TAC § 290.41(a)4)	Provide an all-weather road to the raw water pump station.
GCA2	20.b.	Holiday Villages of Fork - Region 5	30 TAC § 290.42(e)(3)	Ensure that the Facility is located at a site that is accessible by an all-weather road.

The following is a more detailed description of the major investments in this category:

- In 2009, Monarch invested $1,743.851.31 in its Oak Trail Shores water system to construct a reverse osmosis treatment plant. The project included the construction of Reverse Osmosis equipment, a Clarifier, buildings, and miscellaneous process equipment. The Oak Trail Shores Surface Water Treatment Plant receives water from the Brazos River on Lake Granbury located near Thorp Springs, Hood County, Texas. The Brazos River raw water is characteristically very high in Total Dissolved Solids ("TDS") and chlorides. The water is first treated by a conventional surface water treatment plant and then conveyed through sand filters and into surge tanks. At this point, some of the water is treated by the Reverse Osmosis process for final water polishing to remove high chlorides and is then blended back with the main plant effluent to achieve required water quality standards.

Rigorous testing and process instrumentation are used to ensure that requirements are met.

- In 2007, Monarch invested $1,137,444.23 in its Oak Trail Shores water system to replace the existing clarifier that was severely corroded and had reached the end of its useful life. At the same time, Monarch also invested $213,361.33 to modify the existing Leopold underdrains on the gravity filters that had failed due to corrosion, and $161,991.54 to rehabilitate the filter vessels.

- In 2006, Monarch invested $698,986.68 (filter), and $423,523.66 (clarifier) in its Carolynn Estates water system to replace an existing surface water treatment plant that was in poor condition, that did not have adequate control over filter flow rates, that struggled to reliably meet treated discharge water requirements, and that was undersized to meet TCEQ capacity requirements. The replacement facilities were sized to meet contemporary customer demands that increased with the addition of the Pinnacle Club development.

- In 2007, Monarch invested $695,882.26 in its Oak Trail Shores water system to construct additional treatment facilities to improve the efficiency of an existing treatment plant and meet the TCEQ capacity requirements. The project included the construction of a Clarifier vessel to specifically treat backwash water to return to the head of the plant. Prior to this project, the plant's reverse osmosis treatment process wasted approximately 40% of the water entering the plant on backwashing. The project not only increased the efficiency of the plant, it also reduced the reject water stream minimizing the amount of water that has to be applied to evaporation ponds and achieving compliance with discharge permit requirements.

Additionally, Monarch invested $438,786.22 on other plant and yard piping modifications to connect the above-mentioned clarifier into the treatment process. In 2009, Monarch invested $234,818.28 in backwash skids, and $234,673.42 on building site renovations to accommodate the lab and control equipment required to operate the treatment plant, and complete the project.

- In 2007, Monarch invested $519,922.68 in its Plum Creek water system to construct foundations and buildings to support reservoirs and pumping equipment. These structures were constructed in conjunction with the storage tanks, which is discussed later in my testimony in the "Distribution Reservoirs and Standpipe" section, to remedy poor pressure experienced by customers in this water system due to increased customer demand from system growth at the end of the system opposite to the water source. These facilities have stabilized pressure for the entire zone improving the quality of service for customers.

- In 2011, Monarch invested $373,551.04 in its Cherokee Shores water system to replace Clarifier #2 that had reached the end of its useful life. The failed clarifier was a bolted steel tank that had severe corrosion damage.

- In 2007, Monarch invested $369,174.60 in its Lake Medina Shores water system to construct a new pump station. The pump station was required because the number of customers in this system exceeded the TCEQ maximum of 50 connections without a storage tank and booster pumps after the Lake Medina Shores and Holiday Villages of Medina water systems were merged to improve the reliability of both systems.

3. <u>307 Wells and Springs ($7,497,768.61)</u>

This account was used to capture capital cost of wells and lake intakes used for the production of water to supply water systems. Major cost items in this category are explained in greater detail and minor cost items are grouped for more efficient discussion.

Groundwater wells are constructed by drilling a hole in the ground that extends down hundreds of feet. A steel or PVC casing pipe is installed in the hole to keep it from collapsing. Groundwater wells must be designed by a licensed engineer to the TECQ's public drinking water specifications and installed by a licensed well driller. Screens are openings in the casing that permit water from the surrounding geologic formation to enter the well. Over time, the well casing fails due to corrosion and to plugging of the screens, and the well loses its production efficiency and can no longer supply the water required. To maintain a reliable supply for customers, wells need to be replaced or rehabilitated. Monarch has used this category to capture the cost of designing, drilling, and constructing replacement wells, and for well redevelopment processes that extend the life of the asset.

Also, this category was used by Monarch to capture the capital cost of other items associated with wells such as pipes to connect wells to the distribution system, protective coating, fencing, hydro pneumatic tanks, sand separators, gate valves, and check valves.

The following is a more detailed description of the major investments in this category:

- In 2010, Monarch invested $973,349.33 in its Westside water system to construct a new groundwater production well to remediate violations raised in the TCEQ Compliance Agreement (Enforcement Case No. 37045) item 13.a that required Monarch to provide a well capacity of 0.6 gallons per minute per connection, per 30 TAC § 290.45(b)(1)(C)(i).

- In 2006, Monarch invested $658,161.30 in its Falcon Crest Addition water system to construct a groundwater production well to replace older wells that no longer were capable of producing required capacity to meet customer demand.

- In 2010, Monarch invested $509,892.64 in its Sherwood Shores water system to construct a groundwater production well to meet minimum TCEQ supply requirements.

- In 2005, Monarch invested $507,239.45 in its Plum Creek water system to construct groundwater production well W-4 to provide additional production capacity because existing wells could not meet minimum TCEQ supply requirements. In 2007, Monarch invested $410,225.48 to rehabilitate W-1, W-2, and W-3 to provide additional capacity.

4. <u>**309 Supply Mains ($26,780.50)**</u>

Supply mains are pipes that take raw water from a source of supply to a treatment plant. Monarch invested $16,230.50 in 2012 in its Plum Creek water system to redesign a supply pipeline, and $10,550.00 in 2013 in its Oak Trail Shores water system to replace a 6-inch control valve on the intake at the Reverse Osmosis plant.

5. <u>**310 Power Generation Equipment ($3,640,554.13)**</u>

Monarch has used this category to account for capital costs associated with the construction and replacement of electrical equipment. Electrical control equipment is used to obtain power from the electricity utility system to drive pumps and to control the water system operations. This equipment is primarily installed at unmanned facilities that operate autonomously and to achieve water system objectives such as maintaining system pressure; however, this equipment also operates such that it protects electrical components from damage.

A major portion of this category consists of the installation of auxiliary generators. These generators supply electricity to well and booster pumps in the event of an electricity outage. This continuation of electricity supply ensures that the water systems continue to supply water to customers.

Monarch has installed generators to remediate violations raised in the TCEQ Compliance Agreement dated September 25, 2006. Specifically, the TCEQ requires the provision of sufficient emergency power to deliver a minimum of 0.35 gpm per connection to the distribution system in the event of the loss of normal power supply in accordance with 30 TAC § 290.45(b)(1)(D)(v) and 30 TAC § 290.45(b)(2)(H). The following is summary of the locations where generators were installed for compliance:

Year	System	$ Amount	Doc	No.	Violation Citation
2008	Oak Trail Shores	395,478.83	GCA1	17b	30 TAC § 290.45(b)(2)(H)
2007	Carolynn Estates	145,538.68	GCA1	4a	30 TAC § 290.45(b)(2)(H)
2006	Ivanhoe	141,981.64	GCA1	11c	30 TAC § 290.45(b)(1)(D)(v)
2007	Oak Trail Shores	138,409.65	GCA1	17b	30 TAC § 290.45(b)(2)(H)
2007	Decker Hills	114,576.83	GCA1	7	30 TAC § 290.45(b)(1)(D)(v)
2008	Western Hills Harbor	107,562.96	GCA1	27d	30 TAC § 290.45(b)(1)(D)(v)
2008	Highsaw Water	106,556.60	GCA1	10c	30 TAC § 290.45(b)(1)(D)(v)
2007	Lakeway Harbor	103,857.34	GCA1	12a	30 TAC § 290.45(b)(2)(H)
2008	Tanglewood	97,498.24	GCA1	25c	30 TAC § 290.45(b)(1)(D)(v)
2008	Callendar Lake	90,876.11	GCA1	3b	30 TAC § 290.45(b)(1)(D)(v)
2008	Pine Harbor	83,226.88	GCA1	18b	30 TAC § 290.45(b)(1)(D)(v)
2008	Pine Trail Shores	83,166.85	GCA1	19	30 TAC § 290.45(b)(1)(D)(v)
2008	Metroplex Homesteads	82,766.26	GCA1	14b	30 TAC § 290.45(b)(1)(D)(v)
2008	Tower Terrace	81,673.67	GCA1	26	30 TAC § 290.45(b)(1)(D)(v)

Monarch also made investments in generators at the following rural water systems to provide back-up power to prevent water outages in utility power outage events and improve the reliability of service and safety of water quality to customers:

2008	Lake Medina Shores	$116,348.45
2008	Plum Creek	$67,115.78
2009	Ridgecrest Grayson County	$65,952.76
2010	Ridgecrest Grayson County	$63,112.18

In addition to generators, other major equipment included in this category is variable frequency drives, propane tanks that store fuel for generators, major motor rewinds and replacements, motor heaters, and a programmable flush valve. These items were installed for new installations such as new wells, but also installed to replace existing equipment that had reached the end of its useful life.

Wiring is the important component of the electrical system that connects the electrical equipment. There is high voltage wiring that transmits the electricity for driving motors, and there is control wiring that is used to communicate with and control equipment. Wiring improvements are required when new equipment is installed, and it is also required whenever existing equipment is replaced because the National Electrical Code is always evolving to improve worker safety and older installations do not always meet current requirements. In this category, Monarch has included costs for treatment plant electrical systems, pump station and well wiring, electrical poles, circuit breakers and generator disconnects, conduit, weather head, fuse box, and connections to the electrical utility.

Another area covered in this category is electrical controls. Control systems use information measured by field instruments to adjust the equipment operation; also, control systems ensure that equipment does not operate if conditions would cause them damage. Monarch has installed pressure transducers and ground storage tank level probes that measure the system pressure and the amount of water stored in reservoirs, pressure switches that start or stop equipment, pressure switches that prevent over pressurization by shutting off equipment, and power phase monitors that monitor the quality of power from the electrical utility to ensure that phase voltages do not damage equipment. Also included are pump control panels, communication modules, warning lights, timer delays, relay switches, starter relays, and auto dialers. Monarch also uses electrical controls to operate control valves, and radio equipment is used to communicate between remote sites.

6. <u>311 Pumping Equipment ($7,056,054.23)</u>

This category includes capital costs for items related to water pumps including vertical turbine pumps, electric motors (vertical hollow-shaft or submersible), and the electrical cables and control equipment (soft starters, circuit breakers, etc.) used to deliver power from the electric utility to pumps. Water pumps are the vital component of the water system that lift groundwater from underground aquifers, admit water from at intakes from lakes, and boost pressure to provide service to customers that meets TCEQ minimum pressure and flow requirements. Pumps are mechanical devices that have moving parts that operate under harsh high pressure conditions and handle product water that is corrosive to its metallic components and can also contain grit (sand) that wears away at the surfaces that need to operate in close tolerances. This equipment usually operates 24 hours a day 7 days a week. Also, the continuous operation of electrical motors can cause the insulation in its windings to fail, causing the motor to short out and require replacement. The reliability of a water system is directly related to condition of its pumps. To ensure reliability, Monarch replaces water pumps when they fail. Failure is eminent when their output declines or their energy requirement increases.

In addition to pumps, this category also includes costs associated with the refurbishment of water wells. The water level in a well drops from the standing water level to the pumping water level when a well pump is started. The amount of this drop is referred to as the drawdown. The Specific Capacity of a well is a measure of its production efficiency and is calculated by dividing the production flow rate (gallons per minute - gpm) by the draw down, resulting in value of gpm per feet of drawdown. Declining well production is an indicator that the well's specific capacity is dropping. This will prevent the well, which is often the primary water source of a water system, from providing the TCEQ required production flow rate. The cause of declining well production efficiency is often plugging of the well's screens that allow water from the surrounding aquifer formation to enter the well casing. Monarch has used mechanical (brushes) and chemical treatment (acid) methods to refurbish the wells and restore its production efficiency and capacity. To perform this treatment, the well pump must be removed, which causes an interruption to supply and requires a significant effort from outside vendors. For cost efficiency, and to minimize interruptions, well refurbishing work usually coincides with the replacement of a well pump.

Electric motors are the primary driver for powering water pumps. For larger pumps, the motor shaft that transfers power to the pump is connected to the pump shaft with a coupling. This coupling allows for the relatively simple process of removing the motor for replacement or rewiring should it fail. For smaller pumps the pump and motor share a shaft. A failure of the pump or the motor usually necessitates the replacement of the entire unit. For wells installed in close proximity to residences where motor noise is a concern, submersible motors are installed underground adjacent to the pump. This electric equipment works submerged in water. For that reason, the seals and the cables must prevent water from shorting out the motor. Monarch replaces motors and cables when pumps and motors fail.

This electrical equipment must be wired into the pump control system that includes soft starters and variable frequency drives ("VFD's"). The mechanical/electrical devices are under operating load 24 hours a day 7 days week and eventually wear out with continued use. Monarch replaces these components as they wear out, and often this work coincides with a pump replacement to minimize interruption of service and to leverage vendors that are already at the site wiring replacement motors into the electrical system.

Monarch has reviewed and upgraded some pumps to remediate violations raised in the TCEQ Compliance Agreement (Enforcement Case No. 37045). Specifically, the TCEQ requires the provision of two or more pumps having a total capacity of 2.0 gpm per connection at each pump station or pressure plane in accordance with 30 TAC § 290.45(b)(1)(D)(iii), 30 TAC § 290.45(b)(2)(F), and 30 TAC § 291.93(3) and Tex Water Code § 13.139(d).

The following is summary of the compliance locations:

Doc	No.	System	Violation Citation
GCA1	3c	Callendar Lake - Region 5	30 TAC § 290.45(b)(1)(D)(iii)
GCA1	11d	Ivanhoe (RN102316700) - Region 10	30 TAC § 290.45(b)(1)(D)(iii)
GCA1	12e	Lakeway Harbor (RN101281004) - Region 5	30 TAC § 290.45(b)(2)(F)
GCA1	14c	Metroplex Homesteads (RN101376283) - Region 4	30 TAC § 290.45(b)(1)(D)(iii)
GCA1	17d	Oak Trail Shores (RN101380848) - Region 4	30 TAC § 290.45(b)(2)(F)
GCA1	18c	Pine Harbor (RN102322385) - Region 5	30 TAC § 290.45(b)(1)(D)(iii)
GCA1	23b	Serenity Woods (RN101376416) - Region 12	30 TAC § 290.45(b)(1)(C)(iii)
GCA2	1.a.	Denton Creek Estates - Region 4	30 TAC § 291.93(3) and TWC § 13.139(d)

GCA2	5.a.	Ridgecrest Estates - Johnson City - Region 4	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	9.b.	Stonecrest Estates - Region 4	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	12.b.	Western Lake Estates - Region 4	30 TAC § 290.45(b)(1)(D)(iii)
GCA2	13.c.	Westside - Region 4	30 TAC § 290.45(b)(1)(C)(iii)
GCA2	15.b.	Beachwood Estates - Region 5	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	17.b.	Callendar Lake - Region 5	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	19.b.	Highsaw - Region 5	30 TAC § 290.45(b)(1)(D)(iii)
GCA2	21.a.	Indian Hills Harbor - Region 5	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	23.a.	Pine Harbor - Region 5	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	24.a.	Decker Hills / Champions Glenn - Region 12	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	25.a.	Holiday Shores - Region 12	30 TAC § 291.93(3) and TWC § 13.139(d)

7. 320 Water Treatment Equipment ($2,911,323.96)

This account was used to capture capital cost of apparatus, equipment, and other facilities used for the treatment of water. Major cost items in this category are explained in greater detail and minor cost items are grouped for more efficient discussion.

Water treatment is the application of physical and chemical processes to remove undesirable constituents and produce a product of quality that meets TCEQ requirements. This is of the highest level of importance for water utilities because undesirable water quality can affect the safety of customers. Monarch has treatment equipment at the sources of all of its water systems. This equipment operates 24 hours a day 7 days a week and deteriorates over time with age and exposure to corrosive chemicals, product water, and the harsh weather conditions. Monarch has used this category to rehabilitate filter systems, rehabilitate hydro pneumatic tanks, replace the bottom bearing and gear box of clarifiers, and replace pressure valves, flow control valves, grating and lights, and plant piping. This category has also been used to install static mixers and reverse osmosis unit membranes and to perform hydro tanks tests.

Water system operators rely on monitoring equipment to measure water characteristics to determine treatment requirements and effectiveness and to confirm that effluent water quality leaving the plant complies with TCEQ requirements. Monarch has used this category to purchase chlorine analyzers, turbidity meters, colorimeters, and scales for measuring chemicals.

Disinfection is the process of adding a chemical to inactive any harmful bacteria from a water source to ensure that water produced, stored, and distributed in the water system is safe for the customers to consume. Disinfection usually takes place at the treatment plant or well head. Chlorine is a very effective disinfectant; historically chlorine gas was injected as an inexpensive treatment method. The problem with chlorine gas is that it is very harmful to inhale, ingest, or even have contact with skin. Leaking chlorine gas creates a very hazardous situation for both water system operators and the customers that live near water treatment plants. An alternative to chlorine gas is the injection of Sodium Hypochlorite solution (12.5%), which is similar in strength to domestic cleaning bleach. This chemical is significantly less hazardous than gaseous chlorine, does not pose a hazard to surrounding neighbors, and is much less hazardous to water system operators. This category captures the investment that Monarch made in 2005 to replace its gas chlorine systems with Sodium Hypochlorite systems at all of its well heads and treatment plants. This investment included injection pumps and chemical storage tanks. A drawback to solution feed chlorination is that the small chemical pumps have a relatively short life. Included in this category are the costs of replacing the disinfection pumps and related equipment.

8. <u>330 Distribution Reservoirs and Standpipes ($8,906,160.64)</u>

To maintain a constant pressure in a water distribution system, supply must be balanced with demand. Storage reservoirs are used in water systems to balance supply and demand. When supply exceeds demand, reservoirs receive surplus water and fill up. When demand exceeds supply, water from the reservoir makes up for the shortage.

Ground storage tanks are used to balance the differences in constant supply from a well with the demand of customers that varies at different times of the day. Due to hydrogeological and equipment limitations, most wells cannot meet peak hour demands. Instead, wells run continuously at a constant rate to fill ground storage tanks. Water is then pumped out of the ground storage tanks as required to meet the demand of the customers. These tanks are typically constructed from steel or concrete and are subject to corrosion and cracking from both the external environment and product water that they store. Monarch has used this category to capture the cost or rehabilitating (welding, sand blasting, and recoating) and replacing ground storage tanks that were found to have been damaged or had reached the end of their useful life, resulting in concern that they would not be able to reliably supply water to customers.

Almost none of Monarch's smaller rural water systems have elevated storage pressure tanks to maintain pressure. Mechanical devices are required to maintain a stable pressure in these distribution systems. In these systems, pumps and pressure tanks (also called hydro-pneumatic tanks) are used to boost water to the required pressures and maintain pressure at operating levels.

The challenge for these pumps is matching supply and demand. Booster pumps and their electrical control systems are typically constructed to operate at a constant speed, but the demand from customers changes throughout the day. To balance flow, a relief valve can bleed surplus water supplied by the pumps. This is an inefficient use of electricity because energy is added to the water by the pump and then removed by the valve. An alternative to this approach to matching supply to demand is the use of pressure tanks and air compressors. Boosters pump water into a hydro-pneumatic pressure vessel (tank) and shut off when the tank is full. As the customers draw water from the tank, air compressors supply air to maintain a constant pressure inside the vessel. This often results in the boosters being off during periods of low demand, which is a more efficient use of electricity. In the absence of elevated storage, TCEQ Rule 290.45 requires that water systems have 20 gallons of pressure tank storage per connection or 50 gallons per connection if there is no storage.

These tanks are pressure vessels that are subject to the forces of the pressurized water. They are also subject to the harsh and corrosive environments of direct sunlight and rainfall. With this exposure and the passing of time, the steel pressure tanks can corrode, which leads to leaks or dangerous structural failures. Since 1993, new pressure vessels have been required to be designed according to American Society of Mechanical Engineers ("ASME") requirements and stamped by an engineer. Further, the external parts of the pressure tank is to be inspected annually, and the internal parts to be visually inspected every five years. Monarch has used this category to capture the capital costs of performing tests on these tanks to determine if they have the structural integrity to safely and reliably perform their function. Monarch has also used this category for the cost to replace and rehabilitate (welding, sand blasting, and recoating) pressure tanks to ensure reliable service to customers.

Monarch has used this category to capture the cost of pressure tanks installed to remediate violations raised in the TCEQ Compliance Agreements dated September 25, 2006, and February 25, 2009. Specifically, the TCEQ required the provision of 20 gallons of pressure tank storage per connection in accordance with TAC rules 290 and 291.

Doc	**No.**	**System**	**Violation Citation**
GCA1	8c	Green Acres (RN101379733) - Region 4	30 TAC § 290.45(b)(1)(B)(iv)
GCA1	12f	Lakeway Harbor (RN101281004) - Region 5	30 TAC § 290.45(b)(2)(G)
GCA1	13b	Markum Estates (RN101376135) - Region 4	30 TAC § 290.45(b)(1)(C)(iv)
GCA1	24b	Stonecrest (RN101377810) - Region 4	30 TAC § 290.45(b)(1)(C)(iv)
GCA1	25b	Tanglewood (RN101376986) - Region 4	30 TAC § 290.45(b)(1)(D)(iv)
GCA1	29a	Westview (RN101377166) - Region 4	30 TAC § 290.45(b)(1)(D)(iv)

GCA2	1.a.	Denton Creek Estates - Region 4	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	9.a.	Stonecrest Estates - Region 4	30 TAC § 290.45(b)(1)(C)(iv)
GCA2	11.a.	Twin Creeks Addition - Region 4	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	17.b.	Callendar Lake - Region 5	30 TAC § 291.93(3) and TWC § 13.139(d)
GCA2	24.a.	Decker Hills / Champions Glenn - Region 12	30 TAC § 291.93(3) and TWC § 13.139(d)

The following major cost items in this category are explained in greater detail:

- Monarch invested $1,199,852.72 in 2008 to construct a spheroidal elevated storage tank and $203,946.95 in 2007 to construct a ground storage tank in its Plum Creek water system. The reservoirs were installed as part of a larger project to remedy poor pressure experienced by customers in this water system because of increased customer demand from system growth at the ends of the system opposite to the water source. The reservoirs were installed towards the center of the water system. The elevated storage reservoir provides the storage required to meet the TCEQ's 200 gallons of storage per connection requirement, and has stabilized pressure for the entire zone improving the quality of service for customers. In 2014, Monarch invested $54,025.28 to rehabilitate the #2 ground water storage tank to remedy a TCEQ notice of violation that resulted from a TCEQ inspection.

- In 2006, Monarch invested $390,380.45 in a new ground storage tank at its Ivanhoe water system. This reservoir was constructed as part of larger project to increase the existing production, storage, and booster facilitates to improve the reliability and consistency of service to customers. The new tank meets the TCEQ's 200 gallon of storage per customer requirement.

9. <u>331 Transmission and Distribution Mains ($12,474,340.26)</u>

This category captures the costs of pipeline and pipeline appurtenance projects for transmission and distribution mains. Major cost items in this category are explained in greater detail, and minor cost items are grouped for more efficient discussion.

Distribution and Transmission pipelines are used to deliver water to customers. Monarch extends existing distribution systems by constructing new pipelines to serve new customers in compliance with TCEQ requirements.

Pipelines are subject to deterioration due to corrosion and damage from tree roots and ground movement. This damage results in pipe failures and leaks that cause damage to surface improvements, waste water, and require shut downs for repairs that interrupt service to customers. Major capital repairs are required to replace significant sections of pipeline that are damaged. Some of these repairs were necessitated by damage caused by Hurricane Rita in 2005. Monarch replaces major sections of pipeline if these sections are observed to have reached the end of their useful life.

Distribution and Transmission pipelines include interconnections that provide primary and emergency sources of supply to Monarch's water systems. These connections are critical to the utility's ability to provide reliable service to customers.

Monarch has also included capital costs for some piping at plant sites required to replace existing pipes that had reached the end of their useful life and also to connect new wells and treatment processes.

The flow of water in pipes create friction between the pipe wall and the water itself. This friction consumes the energy from the water resulting in pressure drops. If a pipeline is undersized (diameter is too small) because customer demand has grown, then the pressure drop can become unacceptably high resulting in difficulty maintaining the TCEQ required minimum pressure. To alleviate this situation, Monarch as replaced some sections of pipe with larger diameter pipe.

Valves are mechanical devices that allow operators to isolate sections of pipe (take them out service). Over time, the mechanical components can seize up or get damaged resulting in a need to replace the valve. Monarch has used this category to track capital costs associated with the valves and equipment that are required to operate the water systems to provide reliable and efficient service. In addition to isolation valves, this category also includes check valves, cycle stop valves, motor operator valves, pressure control valves (Cla-Val), air relief valves, and blow off/flush valves that were replaced because they reached the end of their useful life.

This category has been used to capture engineering costs associated with the design and operation of the system. These include water distribution maps that show the location of pipes and valves. The maps are important because most of the assets in a water utility are buried, and operators need to know their location so they can adjust the system (shut downs, flushing, etc.) to perform maintenance required to minimize water loss through leaks and maintain safe drinking water quality for customers. These costs also include the engineering design for the surface water plant at Lakeway Harbor to replace the clarifier that was leaking due to age related deterioration, the development of a hydraulic model for the system at Carolynn Estates, and down hole video inspection of water wells required to determine the condition and a the remediation required to improve its production efficiency and the reliability of the system for the customers.

The following is a more detailed description of the major investments in this category:

- This category includes $1,363,038.11 in CIAC/Advances for Transmission and Distribution Mains made by TECON and recorded in 2004.
- In 2007, Monarch invested in its Plum Creek water system $560,391.65 to construct a water main from Pump Station 2 to the elevated storage tanks, $481,679.49 to construct a water main from the elevated storage tanks to Pump Station 4, and $135,435.86 to construction a 16-inch pipe to connect Pump Station 3 and Pump Station 4. In 2008, Monarch invested $321,277.57 to construct pipelines to Plants 1 and 2. These pipelines were constructed in conjunction with the storage tanks discussed in the section above to remedy poor pressure experienced by customers in this water system due to increased customer demand from system growth at the end of the system opposite to the water source. These facilities have stabilized pressure for the entire zone improving the quality of service for customers.
- In 2010, Monarch invested $375,300.18 in its Crowley water system to construct a pipeline to provide service to the Bluegrass Development.

10. 333 Services ($294,606.81)

Services are the relatively smaller diameter pipes that connect the main water pipes to the water meter, which is the point of service to the customer's private water system. Each of Monarch's customers have a water service. The cost of services installed for new customers is covered by tap fees and is not included in the capital testimony. When a pipeline is replaced because it has reached the end of its useful life, the other appurtenances (valves, services, etc.) are also replaced. This category captures the cost of services that were replaced as part of pipeline replacement projects. The individual service can also develop a crack or split, which results in a leak. A failure of this type is usually indicative of the condition of the rest of the service lateral suggesting that subsequent leaks will occur in short order. The major cost required in repairing a service is excavating, and this effort is similar to that required to replace the service. For these reasons, leaking services are often replaced. Monarch captures the capital service replacements in this category.

11. 334 Meters and Meter Installations ($6,005,430.07)

This category is used to track the purchase of replacement production and distribution and customer meters.

From the time of system installation to 2011, Monarch's water systems have not systematically replaced customer meters. With time and use, the mechanical components of water meters deteriorate resulting in a continual decline in poor meter accuracy and under registering. Water not registered is considered water loss, and the cost to produce and distribute this water is included in the water rates charged to all water customers. This results in inequitable billing for customers who use less water or who have more accurate meters. Further, accurate meter reading and billing is required to send price signals to customers to encourage water conservation that is so important to Monarch's ability to meet customer demands during periods of extended drought, which is often experienced throughout Texas.

In 2011, Monarch replaced all of its customer meters. The existing manual read customer meters were replaced with Automatic Meter Reading ("AMR") units that are widely accepted as contemporary meter technology. AMR meters are read remotely and en masse resulting in improved operating efficiency by allowing faster meter reading. Amounts saved through efficiencies were redirected to meet the ever increasing need to perform distribution system activities such as leak repair and equipment maintenance and reducing the need for costly overtime and additional personnel. Further, the remote reading capability of these meters significantly increases the safety of employees by reducing the risk of dog, bug, and snake bites that employees are exposed to when they are in the field looking for and opening meter boxes. The remote read also reduces need for employees to be on or near private property that sometimes raises privacy concerns by residents. Other benefits of AMR are the leak detection feature that flags accounts that have continuous use for 24 hours indicating the presence of a leak, and the storage of historic use data that can be downloaded and used to verify periodic usage.

Also, this category also includes the replacement of well production and pump station distribution meters that are required to measure the water produced from wells (30 TAC § 290.41(c)(3)(N)) and delivered to water customers. Like customer meters, these meters also deteriorate over time and lose accuracy and need to be replaced.

12. 335 Hydrants ($197,907.26)

The hydrants installed on Monarch's potable water systems are not intended for fire protection supply, and instead serve as access locations for flushing water lines. Flushing is an important activity required to replace water in dead end pipes, maintain disinfectant residuals, and remove sediment that accumulates in the water distribution system. Hydrants are replaced when they are found to be damaged or otherwise inoperable.

This category includes $103,959.99 in CIAC/Advances for Hydrants made by TECON and recorded in 2004.

13. 340 Office Furniture and Equipment ($186,015.80)

Monarch has used this category to capture the capitalized cost of software for Asset management planning, Geographical Information System ("GIS"), Computer Aided Drafting ("CAD"), fixed asset tracking, and accounting that are required to plan and manage the utilities assets.

This category includes capital costs associated with the purchase of technology items required to read the Monarch's customer meters. This information is then uploaded to the billing system and used to generate customer invoices. The installation of AMR technology required the acquisition of laptop computers and software that are used to communicate with the meters and collect their reads. Finally, software was acquired to upload and manage the meter reading data.

This category also includes office furniture purchases that include desks, drawers, chairs, tables, a conference room table, a dry erase board, shelving, and modular furniture purchased by Monarch for the field offices to ensure a safe and productive environment for employees. Additionally, there are costs to purchase computer equipment that includes server, laptops, telephones, monitors, and printers for use in the field offices and at a treatment plants.

This category was also used for some minor leasehold improvement items such as conference room construction, installation of a security system, hot water heater, and air conditioner.

14. <u>341 Transportation Equipment ($23,482.47)</u>

This category includes costs for equipment used in construction of repair work. Monarch has included in this category the cost for a backhoe, lawn mowers, and various trailers for transporting equipment.

15. <u>344 Laboratory Equipment ($31,452.61)</u>

Laboratory equipment is used to test raw and product water to ensure treatment process equipment is working correctly and providing desired water quality. This category includes the purchase of a meter testing kit to determine meter measuring accuracy, a turbidity meter to measure the turbidity of product water leaving a surface water treatment plan, and a chlorine analyzer to measure chlorine residuals.

16. <u>345 Power Operated Equipment ($71,999.16)</u>

This category includes costs for power operated equipment used in construction of repair work. Monarch has included in this category the cost for a backhoe, a trencher machine, a loader tractor, lawn mowers, air conditioners, air compressors, smoke blower, various trailers for transporting equipment, a compacting machine, 500gal water trailer, and concrete saw.

17. <u>346 Communication Equipment ($451,480.27)</u>

Communication equipment is used to monitor and control water production and distribution facilities such as wells, pump stations, treatment plants, and storage tanks.

Supervisory Control and Data Acquisition ("SCADA") is an electronic system for monitoring and controlling water facilities. SCADA consists of three components namely 1) a Remote Terminal Units ("RTU") and instruments that are the brains, eyes and ears of the system, 2) communication networks that permit remote control and monitoring, and 3) software that are the algorithms that decipher and encode the information. Monarch has installed SCADA systems to monitor and control critical functions at some of its critical facilities including an elevated tank, a reverse osmosis treatment plant, and several wells and pump stations.

Monarch SCADA system's communication network typically consists of a combination of auto dialers that use telecommunication company phone lines to transmit important information such as pump failures to remotely located operators. Further, the communication network also uses radio transmitters and receivers to communicate data to remotely located operators. Monarch invests in replacement radio equipment as existing equipment fails.

Pumping equipment controls are electro-mechanical logic devices that control the sequence and timing of plant equipment. They are required to achieve an order of events, such as well flush cycle, or to protect equipment from damage. Being that these devices are mechanical in nature they wear out with the passing of time and Monarch replaces these as required to maintain reliable operations. Variable frequency drives are a sophisticated pump control device that varies that frequency of electricity entering the motor to change the speed of a pump and resulting flow and head performance to achieve objectives such as pressure and energy conservation management. Monarch has installed VFD's at a number of pumping plants to optimize their operation.

18. 347 Miscellaneous Equipment ($4,450.34)

This category was used to record costs for handheld analysis devices (gas detector device, and Ultrameter, etc.), and warning signs.

19. 348 Other Tangible Plant ($63,701.94)

This category was used to record costs for consulting engineering to prepare master plans $62,290.81 in 2011 for the Plum Creek water system. The master plans are used to determine how many LUE's would be required at build out based on land use zoning. From the Master Plan, Monarch was able to determine what water rights and additions or improvements to plant and backbone were needed at build out, and the plan recommends cost effective phasing of the needed upgrades and improvements. This category was also used for the purchase of signage in 2008 for the Holiday Villages of Livingston water system.

C. Shared Assets ($334,056.07) by NARCU Account

Q. WHAT WERE THE CAPITAL INVESTMENTS MADE IN MONARCH'S SHARED ASSETS FOR USE IN BOTH THE WATER AND WASTEWATER SYSTEMS?

A. Monarch spent $334,056.07 on capital investments in shared assets used by operations in both the Water and Wastewater systems. These costs are categorized below according to NARUC asset classification.

1. **310 Power Generation Equipment ($9,240.24)**

In 2015, Monarch used this category to purchase four (4) 500 gallon double walled tanks with 12volt pumps for its Tower Terrance, Holiday Villages of Livingston, and Decker Hills wastewater systems.

2. **311 Pumping Equipment ($956.70)**

In 2015, Monarch used this category to purchase a 3.5 engine driven semi-trash pump for its Conroe Operations.

3. **340 & 390 Office Furniture and Equipment ($205,508.27)**

Monarch has used this category to capture the cost of rehabilitating a conference room at the office located at the Holiday Villages of Livingston Wastewater Operation.

4. **341 Transportation Equipment ($2,280.93)**

Monarch has used this category to capture the cost of purchasing two trailers to transport equipment required to maintain the wastewater system.

5. **343 Transmission & Distribution Plant - Transmission & Distribution Mains ($2,747.87)**

Monarch used this category to record costs for the purchase of a chop saw and horizontal air compressor for its Conroe Operations, and for Water Shop Tools for its Decker Hills operation.

6. **344 Laboratory Equipment ($6,056.42)**

This category was used to record costs for the purchase of ice machines to produce ice that is required to preserve water samples for transportation to the lab for testing.

7. **345 & 395 Power Operated Equipment ($49,695.55)**

This category includes costs for power operated equipment used in construction of repair work. Monarch has included in this category the cost of purchasing backhoes, lawn mowers, trailers, and a trenching machine.

8. **347 Miscellaneous Equipment ($9,600.00)**

In 2015, Monarch invested $9,600 to remodel its Benbrook office to accommodate current staffing structure.

9. **381 Plant Sewers ($47,927.69)**

In 2012, Monarch used this category to capture the cost of the purchase of a Trailer Mounted Sludge mate for $47,927.69 for its Mabank operations.

IV. CONCLUSION

Q. PLEASE SUMMARIZE YOUR TESTIMONY.

A. SouthWest is committed to maintain Monarch's water and wastewater systems to provide safe and reliable service to customers in 77 water, and 11 wastewater systems in 24 counties across Texas. Further, SouthWest is acutely aware of its responsibilities to provide a safe work environment for its employees, to protect the environment, and to comply with the regulation of the TCEQ. This commitment and awareness represent the guiding principles that SouthWest uses when making decisions regarding the investment in its water and wastewater infrastructure.

My testimony demonstrates that Monarch's post-October 15, 2002 recorded gross plant additions through June 30, 2015 of $74.47 million represents reasonable and necessary costs to provide service to Monarch's customers and should therefore be included in the Company's cost of service.

Schedules Sponsored

Schedule II-B-1 Original Cost of Utility Plant - Total Company

Schedule II-B-1 (W) Original Cost of Utility Plant - Water Operations

Schedule II-B-1 (S) Original Cost of Utility Plant - Wastewater Operations

Schedule II-B-1 (SH) Original Cost of Utility Plant - Shared Plant

Schedule II-B-1.1 Original Cost of Utility Plant for Water/Sewer

Schedule II-B-1.2 Adjusted Test Year Plant

Schedule II-B-1.3 Assets Used for Purposes Other than Utility

PUC DOCKET NO. 45570

APPLICATION OF MONARCH	§	PUBLIC UTILITY COMMISSION
UTILITIES I, L.P. TO CHANGE RATES	§	
FOR WATER AND SEWER SERVICE	§	OF TEXAS

DIRECT TESTIMONY

OF

THOMAS C. GOOCH, P.E.

ON BEHALF OF

MONARCH UTILITIES I, L.P.

FEBRUARY 29, 2016

DIRECT TESTIMONY OF
THOMAS C. GOOCH, P.E.

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ATTACHMENTS:

PUC DOCKET NO. 45570

APPLICATION OF MONARCH UTILITIES I, L.P. TO CHANGE RATES FOR WATER AND SEWER SERVICE	§ § §	PUBLIC UTILITY COMMISSION OF TEXAS

DIRECT TESTIMONY OF THOMAS C. GOOCH, P.E.

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME FOR THE RECORD.

A. My name is Thomas C. Gooch.

Q. WHAT IS YOUR OCCUPATION?

A. I am a licensed Civil Engineer in the State of Texas.

Q. WHAT IS YOUR EDUCATIONAL BACKGROUND?

A. I received a Bachelor of Science degree in Civil Engineering and a Bachelor of Science degree in Humanities and Science concentrating in Literature from the Massachusetts Institute of Technology in 1977. I received a Master of Science degree in Civil Engineering from Stanford University in 1978.

Q. ON WHOSE BEHALF ARE YOU SUBMITTING THIS TESTIMONY?

A. I am submitting testimony on behalf of Monarch Utilities I, L.P. ("Monarch").

Q. HOW ARE YOU CURRENTLY EMPLOYED?

A. I am a vice president with Freese and Nichols, Inc., in Fort Worth, Texas.

Q. WHAT IS THE NATURE OF YOUR WORK?

A. Freese and Nichols is a consulting engineering firm, and I am in charge of the firm's Water Resource Planning Group. In that capacity, I assist clients with analysis, planning, permitting, and development of water supplies.

Q. WHAT IS YOUR PRIOR WORK EXPERIENCE?

A. I have been with Freese and Nichols since 1980. In the summer of 1977, I was an engineer in training with Turner, Collie and Braden, a Houston-based engineering firm. From 1978 to 1980, I was an engineer in training with Resource Analysis and Camp, Dresser and McKee in Waltham, Massachusetts. I did water resource planning in those prior positions.

Q. PLEASE IDENTIFY THE DOCUMENT MARKED ATTACHMENT TCG-1.

A. Attachment TCG-1 is a true and correct copy of my resume.

Q. DID YOU PREPARE THIS RESUME?

A. Yes.

Q. DOES ATTACHMENT TCG-1 ACCURATELY REFLECT YOUR ACTIVITIES AND EXPERIENCE?

A. Yes.

Q. WHAT ARE YOUR AREAS OF EXPERTISE OR SPECIALIZATION?

A. I am a civil engineer and a hydrologist, and my areas of expertise include water right permitting, analyses of water rights and water supply strategies, water supply planning, water conservation and drought response planning, reservoir operation studies, water quality evaluations, analyses of flooding, preliminary design and cost estimates for water supply projects and transmission systems, economic analyses, and water and sewer rate studies.

Q. PLEASE DESCRIBE YOUR EXPERIENCE IN PLANNING FOR FUTURE WATER SUPPLIES.

A. That experience is summarized in Attachment TCG-1. I have assisted clients, including cities, river authorities, water districts and industries, with the development of long-range water supply plans. I have also worked on regional water supply plans as part of Texas' water planning process.

Q. ARE YOU FAMILIAR WITH THE STATE'S APPROACH TO WATER PLANNING?

A. Yes. Long-range planning is particularly critical for developing future water supplies because of the time required to permit and develop a new supply and the regulatory and permitting challenges. In light of these considerations, and concerns with the State's long term water supply needs, the Texas Legislature passed Senate Bill 1 in 1997, addressing a variety of water-related matters. One significant part of Senate Bill 1 was the Legislature's directive to change the manner in which water supply planning was conducted in Texas.

Q. HAVE YOU HAD PERSONAL EXPERIENCE WITH THE REGIONAL WATER SUPPLY PLANNING PROCESS ESTABLISHED BY SENATE BILL 1?

A. Yes, I have had extensive experience with this process as the leader of the consultant team for Region C. Region C includes the Dallas-Fort Worth area, and our team has assisted the Region C Water Planning Group with development of regional water plans for Region C since the Senate Bill 1 planning process started. I have also worked on regional water plans in other regions. In addition to my work on regional water planning for Region C, I have participated in the development of other Senate Bill 1 regional water plans, including Region A for the northern Panhandle, Region B along the Red River in northwest Texas, Region E in El Paso County and surrounding Counties, Region F in the Upper Colorado River Basin, Region G in the Brazos River Basin, Region I in southeast Texas, and Region J in the Edwards Plateau area.

Q. WHAT HAS YOUR WORK FOR THE REGION C WATER PLANNING GROUP ENTAILED?

A. Since the regional planning process began in 1998, I have led the consulting team providing technical support to the Region C Water Planning Group in developing long-range water plans for the region. Region C is one of the 16 water supply planning regions in the state, and it includes the Dallas-Fort Worth area and surrounding counties. Region C is the most populous of the Senate Bill 1 regional water planning areas, with over 25 percent of Texas' population. Our planning efforts in Region C have included development of population and water use projections, analysis of currently available water supplies using water availability models and other tools, and analysis and selection of potential water management strategies to meet projected needs. The Region C consultant team works closely with the Region C Water Planning Group and with water suppliers in Region C. The planning process also includes considerable interaction with members of the general public.

Q. **WHAT OTHER EXPERIENCE HAVE YOU HAD WITH THE ANALYSIS AND DEVELOPMENT OF WATER DEMANDS AND SUPPLIES?**

A. In addition to the Senate Bill 1 regional water planning process, I have also been involved in other planning efforts for river authorities, water districts, municipalities, and industrial customers. For example, I have worked with the North Texas Municipal Water District on planning and developing new water supplies since the mid-1980s. I have developed long-range water supply plans for the City of Cleburne, the Sabine River Authority, the City of Saltillo, Coahuila, Mexico, and others. All of those plans have required the development of projections of future water needs. My resume includes other examples of my work experience in the analysis, planning, permitting and development of new water supplies.

Q. **HAVE YOU HAD EXPERIENCE IN ANALYZING THE IMPACT OF WEATHER CONDITIONS ON MUNICIPAL WATER DEMANDS?**

A. Yes. In general terms, I have reviewed historical water use patterns for hundreds of water suppliers in my career. The impact of weather on municipal demands in Texas is clear in historical use data. In the absence of drought response measures designed to limit water use, municipal water use tends to be higher when the weather is hot and dry and lower when it is cool and wet. I have also worked on detailed statistical analyses of the impact of weather on water demands for the North Texas Municipal Water District and reviewed similar analyses for other water suppliers.

Q. PLEASE DESCRIBE YOUR EXPERIENCE WITH DEVELOPING AND IMPLEMENTING WATER CONSERVATION AND DROUGHT CONTINGENCY PLANS.

A. I have developed water conservation and drought contingency plans for many water suppliers, including the Brazos River Authority, the Lower Neches Valley Authority, the North Texas Municipal Water District, the Sabine River Authority, Somervell County Water District, the City of Cleburne, the City of Lancaster, and the City of Pearland. I have also developed model water conservation and drought contingency plans for the North Texas Municipal Water District. These model plans are designed to be used by the District's customers in developing their own conservation and drought contingency plans.

In the course of my water planning and water right permitting efforts, I have reviewed numerous water conservation and drought contingency plans developed by others. I have also spent a great deal of time helping the North Texas Municipal Water District and its customers implement the District's drought contingency plan in response to significant droughts in 2005-06 and 2010-2015.

II. PURPOSE OF TESTIMONY

Q. WHAT SUBJECTS ARE YOU TESTIFYING ABOUT TODAY?

A. I testify about conservation and drought contingency requirements in Texas, recent trends in municipal water use in Texas, the projected reduction in per capita municipal water use in Texas over time, and the reasonableness of the demand projections used by Monarch Utilities I, L.P. ("Monarch") in this rate case.

Q. **DO YOU BELIEVE THAT YOUR EXPERTISE AND EDUCATION MAKE YOU AN EXPERT WITH RESPECT TO THESE SUBJECTS?**

A. Yes, I do. In my previous work on water supply planning, water conservation planning and drought contingency planning I have developed considerable expertise in each of the areas that I will cover in my testimony.

III. WATER CONSERVATION AND DROUGHT CONTINGENCY PLANNING REQUIREMENTS

Q. **CAN YOU EXPLAIN WHAT YOU UNDERSTAND THE WORD CONSERVATION TO MEAN IN THE CONTEXT OF WATER SUPPLY MANAGEMENT AND PLANNING IN TEXAS?**

A. Water conservation means efforts to improve efficiency and reduce waste in the use of water resources. The Texas Legislature has defined conservation in Section 11.002(8)(B) of the Texas Water Code to mean those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses. In section 288.1(4) of its rules, the Texas Commission on Environmental Quality ("TCEQ") uses the same definition of conservation for purposes of its regulations.

Q. THROUGH YOUR WORK IN WATER CONSERVATION PLANNING THAT YOU DISCUSSED EARLIER, HAVE YOU DEVELOPED A FAMILIARITY WITH AND UNDERSTANDING OF STATUTORY AND REGULATORY REQUIREMENTS APPLICABLE TO WATER CONSERVATION PLANS?

A. Yes, I have. Texas Water Code §11.1271 requires the completion and implementation of water conservation plans. TCEQ has adopted Chapter 288 of Title 30 of the Texas Administrative Code to implement this statutory requirement.

Q. HAVE THERE BEEN WATER CONSERVATION MEASURES THAT HAVE SERVED TO REDUCE MUNICIPAL WATER DEMAND IN TEXAS?

A. Yes. In recent years, the state and Federal governments have implemented requirements for the use of water-efficient plumbing fixtures and appliances. In Texas, this started with the State Water-Efficient Plumbing Act, passed in 1991, which mandated the use of water-efficient toilets (1.60 gallons per flush) and showerheads. Subsequent state and federal laws and regulations have mandated additional water use savings for toilets and reduced water use for dishwashers and clothes washers. In 2009, the Texas Legislature reduced the allowable water use for toilets to 1.28 gallons per flush, effective January 1, 2014. Regulations developed under the Federal Energy Independence and Security Act of 2007 have mandated water-efficient dishwashers and clothes washers. The use of water-efficient appliances and fixtures has significantly reduced water use in the state, compared to what the use would have been without these laws and regulations. In addition, other water conservation measures implemented by water suppliers have also served to reduce municipal water demand.

Q. WHAT IS A DROUGHT CONTINGENCY PLAN?

A. A drought contingency plan develops a program of temporary measures designed to reduce water use during a drought or other emergency.

Q. DOES MONARCH HAVE A DROUGHT CONTINGENCY PLAN?

A. Yes. Monarch's current Drought Contingency Plan was submitted to the Texas Commission on Environmental Quality on June 5, 2013.

Q. WHAT ARE THE REQUIREMENTS FOR DROUGHT CONTINGENCY PLANNING IN TEXAS?

A. Subchapter B of Chapter 288 of Title 30 of the Texas Administrative Code lays out the requirements for the development of drought contingency plans in Texas. As described in 30 TAC Section 288.20, drought contingency plans for public water suppliers are required to include provisions to inform the public and allow for public input in plan preparation; provisions for continuing public education and information regarding the drought plan; documentation of coordination with regional water planning groups; criteria for initiation and termination of drought stages; specific, quantified targets for water use reduction for each stage; management measures to be implemented at each stage; procedures for the initiation and termination of drought stages; procedures for granting variances; and procedures for enforcement of mandatory measures. The rules require that the plans be updated every five years.

Q: BASED ON YOUR EXPERIENCE, HOW HAS THE DEVELOPMENT AND IMPLEMENTATION OF WATER CONSERVATION PLANS INFLUENCED WATER USE IN TEXAS?

A: Based on my experience in developing and reviewing water conservation plans, they have tended to reduce water use in the state. Many of the large water suppliers have adopted increasingly aggressive approaches to conservation as they revise their plans every five years. Examples of this pattern that I am personally familiar with include Dallas Water Utilities, Tarrant Regional Water District, Fort Worth, North Texas Municipal Water District, Lower Colorado River Authority, Austin, San Antonio, and El Paso. Since each of these water suppliers is also a wholesale water supplier, the requirements in their conservation plans are passed on to their customers as well.

IV. <u>PAST TRENDS IN MUNICIPAL WATER USE</u>

Q. ARE THERE DATA AVAILABLE ON HISTORICAL TRENDS IN MUNICIPAL WATER USE IN TEXAS?

A. Yes, there are. The Texas Water Development Board maintains records of water use in Texas, including records of municipal use.

Q. CAN THOSE RECORDS BE USED TO LOOK AT HISTORICAL PER CAPITA MUNICIPAL WATER USE?

A. Yes, they can. The total state municipal water use can be divided by the state population to determine the historic statewide per capita municipal water use. In fact, the Texas Water Development Board has developed this data for 2000 through 2013. Prior to 2000, the data required to do this computation are readily available and can be calculated.

Q. YOU USE THE TERM "PER CAPITA MUNICIPAL WATER USE." COULD YOU EXPLAIN WHAT THIS IS?

A. Per capita water use means per person water use, and is usually expressed in gallons per capita per day, or "gpcd". The gallons per capita per day represent the average number of gallons a person uses each day during a year. In particular, per capita municipal water use represents the average use per person per day for municipal purposes. Use for municipal purposes includes residential water use and water use by commercial, governmental, and institutional users. Municipal use does not include agricultural use, mining use, or industrial use. Per capita municipal use figures are often computed for water suppliers or for geographical areas, like the state of Texas.

Q. WHY IS PER CAPITA MUNICIPAL WATER USE DATA SIGNIFICANT?

A. There are two reasons. Trends in municipal per capita use data over time can be used to get a feeling for changes in municipal demand patterns and the effectiveness of conservation programs. In addition, projections of municipal demand for water are often based on projections of population and per capita municipal demand. An understanding of historical per capita demands can help a planner to project future per capita demands.

Q. HAVE YOU LOOKED AT TRENDS IN PER CAPITA MUNICIPAL WATER USE IN TEXAS?

A. Yes, I have.

Q. PLEASE IDENTIFY FIGURE 1.

A. Figure 1 is a figure that I developed showing historical statewide per capita municipal use for 1999 through 2013, the last 15 years for which data are available.

Q. DID YOU PREPARE THIS FIGURE?

A. Yes, I did.

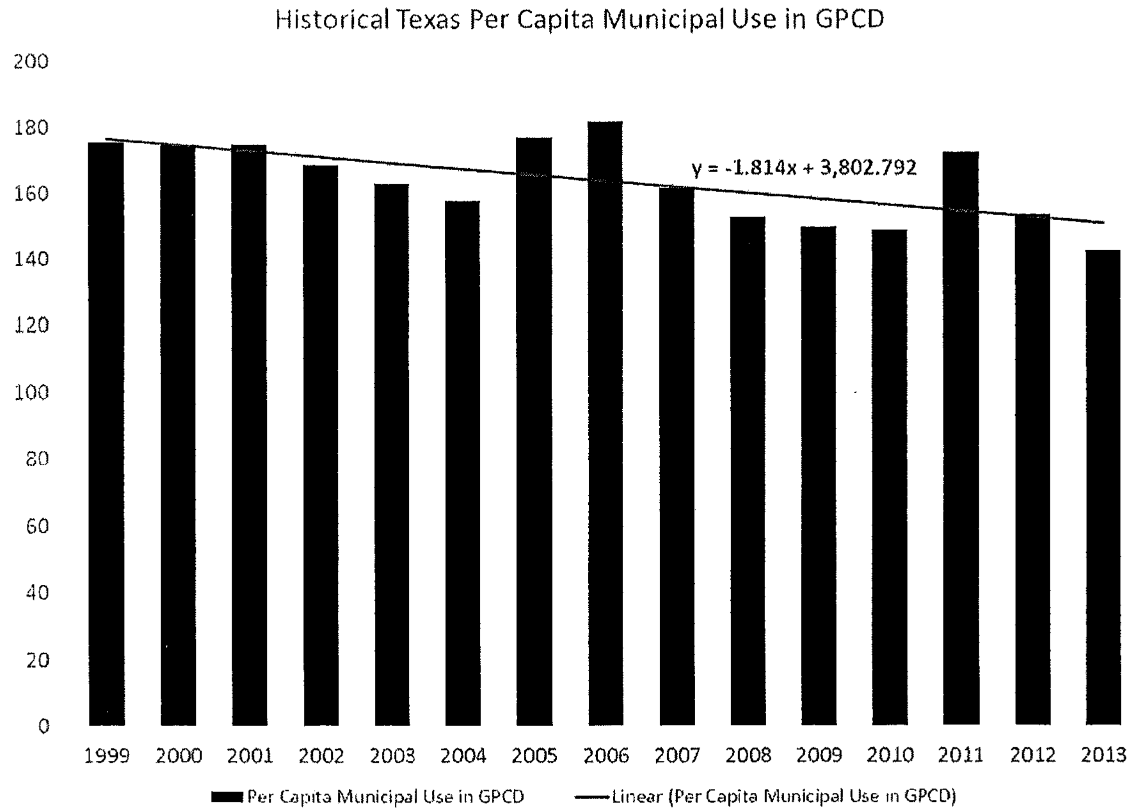
Q. DOES FIGURE 1 ACCURATELY REFLECT TEXAS WATER DEVELOPMENT BOARD DATA ON PER CAPITA MUNICIPAL WATER USE?

A. Yes, it does.

Q. IS TEXAS WATER DEVELOPMENT BOARD DATA LIKE THAT SHOWN IN FIGURE 1 REGULARLY USED BY PROFESSIONALS LIKE YOURSELF?

A. Yes. The Texas Water Development Board collects and disseminates water use data. Those data are important and are regularly used by water planners like myself.

Figure 1



Q. PLEASE DESCRIBE WHAT FIGURE 1 SHOWS.

A. The blue bars in the figure give the annual per capita municipal water use in Texas for each year from 1999 through 2013. The red line on the figure is the linear trend of those data based on a least squares fit to the annual data. The equation in the figure is a mathematical description of the line. As is visible to the eye and shown by the red line, per capita water use in Texas has been trending down for the last 15 years. The slope of the line indicates the downward trend of the data. In this case the slope is negative 1.814, indicating that overall trend of per capita municipal water use in Texas from 1999 through 2014 was a decrease of 1.814 gallons per person per day each year. This represents a reduction in per capita use of slightly over one percent per year over this period.

Q. CAN YOU EXPLAIN WHY PER CAPITA WATER USE VARIES FROM YEAR TO YEAR, WITH SOME YEARS, LIKE 2006 AND 2011, HIGHER THAN SURROUNDING YEARS?

A. Yes. Per capita municipal water use is influenced by the weather. In most of Texas, a substantial part of municipal water use is for landscape irrigation – watering lawns and landscaping. In hot, dry years, more water is needed to maintain healthy lawns, and municipal water use (and thus per capita municipal use) tends to go up. In cooler, wet years, municipal water use tends to go down. Summer temperatures and rainfall have the greatest impact on water use, since the majority of lawn and landscape irrigation occurs in the summer. High-use years like 2006 and 2011 tend to be years in which hot, dry conditions prevailed in the summer over a large part of Texas.

Q. ARE YOUR CONCLUSIONS ABOUT THE SEASONAL INFLUENCES OF WEATHER ON STATEWIDE WATER DEMAND CONSISTENT WITH THE TESTIMONY OF ANOTHER WITNESS IN THIS PROCEEDING, MR. JOHN HUTTS?

A. Yes. In his analysis of historical water use by Monarch systems in Texas, Mr. Hutts determined that temperature and rainfall have the most impact on water demands during summer. Temperature and rainfall have less impact on use in other months.

Q. BASED ON YOUR EXPERIENCE, WHAT ARE SOME POSSIBLE EXPLANATIONS FOR THE DECREASING TREND OF PER CAPITA MUNICIPAL WATER USE IN TEXAS?

A. State and federal laws and regulations now mandate the use of water-efficient appliances and plumbing fixtures. As I discussed previously, the 1991 State Water-Efficient Plumbing Act required the use of water-efficient toilets and low flow showerheads in fixture replacement and new construction. The requirements of the act did not take effect immediately. Subsequent federal and state laws and regulations have imposed more stringent requirements and required water-efficient clothes washers and dishwashers. The Texas Water Development Board has analyzed the impact of these laws and regulations on water use. That work shows a substantial reduction in municipal per capita water use as a result of these measures.

Q. MOVING AWAY FROM STATEWIDE MUNICIPAL WATER USE, HAVE YOU SEEN ANY INFORMATION ON TRENDS IN PER CAPITA USE FOR MONARCH?

A. Yes, I have seen the results of some statistical analysis conducted by John Hutts of GDS Associates for Monarch. His work is expressed in gallons used per month per connection rather than gallons per capita per day, but the results are related. (Like gallons per capita per day, gallons per month per connection is a measure of the amount used per user per time. If gpcd is trending down, gallons per month per connection will also trend down.) Mr. Hutts' work covered July of 2005 through June of 2015 (10 years). With adjustments for the effect of weather, Mr. Hutt's work showed an annual decrease in water use of about 103 gallons per connection per