REGION C WATER PLANNING GROUP

MODEL WATER CONSERVATION PLAN FOR STEAM ELECTRIC POWER GENERATORS

FEBRUARY 2005

Prepared for:

REGION C WATER PLANNING GROUP

Brian K. McDonald, P.E.
Alan Plummer Associates, Inc.

Thomas C. Gooch, P.E.
Freese and Nichols, Inc.

Stephanie W. Griffin, P.E.
Freese and Nichols, Inc.

Prepared by:

Alan Plummer Associates, Inc.
7524 Mosier View Court,
Suite 200
Fort Worth, TX 76118
817/806-1700

Freese and Nichols, Inc.
4055 International Plaza
Suite 200
Fort Worth, TX 76109
817/735-7300

Chiang, Patel, and Yerby, Inc.
1820 Regal Row, Suite 200
Dallas, Texas 75235
214/638-0500

ACKNOWLEDGEMENTS

This model water conservation plan for the fictional Poca Agua Steam Electric Power Station was prepared by Alan Plummer Associates, Freese and Nichols, and Chiang, Patel and Yerby for the Region C Water Planning Group. It is a template for steam electric power generators to use as they develop their own water conservation plans. Each steam electric power generator should customize the details to match their unique situation. The model plan was prepared pursuant to Texas Commission on Environmental Quality rules. The rules do not require a drought contingency plan for steam electric power generators. Much of the material in this model plan is patterned after the TXU water conservation plan for the Big Brown Steam Electric Station[1].

Questions regarding this model water conservation plan should be addressed to the following:

Brian McDonald, P.E.
Alan Plummer Associates, Inc.
(817) 806-1700
bmcdonald@apaienv.com

Tom Gooch, P.E.
Freese and Nichols, Inc.
(817) 735-7300
tcg@freese.com

Stephanie Griffin, P.E.
Freese and Nichols, Inc.
(817) 735-7300
swg@freese.com

[1] Superscripted numbers match references listed in Appendix A.

POCA AGUA STEAM ELECTRIC POWER STATION

WATER CONSERVATION PLAN

FEBRUARY 2005

Prepared by:

EFICIENTE ENGINEERS, INC.
123 MAIN STREET
POCA AGUA, TX 76026

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Water Conservation Plan

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1. INTRODUCTION AND OBJECTIVES

Water supply has always been a key issue in the development of Texas. In recent years, the increasing population and economic development in Region C have led to growing demands for water supplies. At the same time, local and less expensive sources of water supply are largely developed. Additional supplies to meet higher demands will be expensive and difficult to develop. It is therefore important that we make efficient use of our existing supplies and make them last as long as possible. This will delay the need for new supplies, minimize the environmental impacts associated with developing new supplies, and delay the high cost of additional water supply development.

Recognizing the need for efficient use of existing water supplies, the Texas Commission on Environmental Quality (TCEQ) has developed rules governing the development of water conservation plans for industrial and mining water use (Appendix B). The Poca Agua Steam Electric Power Station has adopted this water conservation plan pursuant to TCEQ rules.

The plan lists the TCEQ rules; describes the power generation process at the Poca Agua Steam Electric Power Station and associated water uses; sets a water conservation goal; describes water measurement devices and methods; discusses leak detection, repair, and water loss accounting; and reports existing and future water use efficiency practices.

2. TEXAS COMMISSION ON ENVIRONMENTAL QUALITY RULES

The TCEQ rules governing development of water conservation plans for industrial or mining use are contained in Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.3 of the Texas Administrative Code (TAC), which is included in Appendix B.

A water conservation plan is defined as "a strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water. A water conservation plan may be a separate document identified as such or may be contained within another water management document(s)[2]." The minimum requirements for water conservation plans for industrial or mining use are as follows:

TAC Reference	Subject	Plan Location
30 TAC §288.3(a)(1)	Production Process	Section 3, Appendix C
30 TAC §288.3(a)(2)	Water Conservation Goals Before May 1, 2005	Section 4
30 TAC §288.3(a)(3)	Water Conservation Goals After May 1, 2005	Section 4
30 TAC §288.3(a)(4)	Accurate Metering	Section 5
30 TAC §288.3(a)(5)	Leak Detection, Repair, and Water Loss Accounting	Section 6
30 TAC §288.3(a)(6)	Water Use Efficiency Process and/or Equipment Upgrades	Section 7
30 TAC §288.3(a)(7)	Other Conservation Practices	Section 8
30 TAC §288.3(b)	Review and Update of Plan	Section 9

[TCEQ rules do not require a drought contingency plan for industrial or mining water users.]

3. DESCRIPTION OF THE WATER USES IN THE ELECTRIC GENERATION PROCESS

[This section must include a description of the use of the water in the production process, including how the water is diverted and transported from the source(s) of supply, how the water is utilized in the production process, and the estimated quantity of water consumed in the production process and therefore unavailable for reuse, discharge, or other means of disposal. If your facility uses other cooling methods, such as once-through cooling or dry-type cooling, please amend the process description below. Also modify the water sources and water uses to match those at your facility.]

The Poca Agua Steam Electric Power Station is a natural gas-fired electric generating facility located at 4220 Poca Agua Road in the City of Poca Agua, Texas, on the south shore of Poca Agua Reservoir. The facility consists of one natural gas-fired, 150 megawatt (MW) steam electric generating unit that has been in service since 1972.

Water used for cooling, domestic uses, and most industrial uses is supplied with groundwater from four onsite wells installed in the Trinity Aquifer. The remainder of the industrial water demand is met with stormwater runoff from the facility. Water is used for cooling, boiler feed, fire protection, drinking, sanitary, and miscellaneous purposes. A water use diagram for the Poca Agua Steam Electric Power Station is presented in Appendix C.

Groundwater from the four onsite wells is pumped to the cooling tower basin for cooling makeup water and is pumped to an onsite potable water system where it is treated using a reverse osmosis (RO) process. The treated water is used for boiler feed and makeup and for drinking water and sanitary purposes. Wastewater from the potable water system is treated by an onsite septic system. RO reject water and boiler blowdown are commingled with recirculating cooling water and cooling makeup water in the cooling tower basin and cycled through the condenser and the cooling tower an average of three times. Cooling tower blowdown flows by gravity to the cooling tower blowdown sump, where it is pumped for discharge into the Poca Agua River downstream of Poca Agua Reservoir.

Other water uses supplied from groundwater include fly ash handling, equipment washdown, dust control, and fire protection. The amount of miscellaneous surface water use is estimated by multiplying the capacity of the service water pumps by their run times. Average flowrates under normal operating conditions are shown on the water use diagram in Appendix C.

Stormwater from the facility is collected in the stormwater retention pond. Water from the stormwater retention pond is also used for fly ash handling, equipment washdown, and dust control.

The largest consumptive water use at the Poca Agua Steam Electric Power Station is forced evaporation in the cooling tower. This is estimated to be 0.6 gallons per kilowatt-hour (kWh) of generation. The exact amount varies from year to year depending on the amount of power generated at the facility and climatic conditions. With a 90 percent capacity factor

and three cycles through the cooling tower, approximately 3,269 acre-feet per year (ac-ft/yr) of cooling makeup water is required.

Fly ash handling, equipment washdown, and dust control consumes approximately 7 ac-ft/yr, and domestic uses consume an average of approximately 2 ac-ft/yr. Because water is used for fire protection on a very infrequent, as-needed basis, no average annual quantity has been estimated.

4. SPECIFICATION OF WATER CONSERVATION GOALS

[This section must include specification of 5-year and 10-year water conservation goals and the basis for development of such goals. Please amend the water conservation goals, basis, and time frame to match those at your facility. Examples of methods that could be used to conserve water include expansion to a combined cycle generating facility, conversion to a dry-type cooling tower, switching to a higher quality source water for cooling tower makeup water, switching to reclaimed water as a source for most uses, water wise landscaping, retrofit of domestic plumbing fixtures with water-efficient fixtures, and employee education.]

The Poca Agua Steam Electric Power Station has set a five-year water conservation goal of reducing total water usage by 20 percent (from 3,278 ac-ft/yr to 2,624 ac-ft/yr) by _____ *[five years from date of plan]*. The ten-year goal is the same as the five-year goal. This will be achieved by switching to a higher quality source for cooling makeup water, which will allow more cooling cycles prior to blowdown.

Currently groundwater from the four onsite wells is used for cooling makeup water. This groundwater has a total dissolved solids (TDS) concentration of 1,000 milligrams per liter (mg/L). Blowdown from the cooling tower is discharged to the Poca Agua River with a TDS discharge limit of 3,000 mg/L, limiting the cooling tower operation to three cycles.

The Poca Agua Steam Electric Power Station has a contract with the Poca Agua Water Supply Corporation to purchase surface water from the Poca Agua Reservoir, and it is expected that the pipeline and pumping facilities will be constructed and placed into service by _____ *[five years from date of plan]*. The TDS concentration of this surface water is 500 mg/L. With this higher quality source water, cooling water can be cycled six times before it meets the blowdown TDS discharge limit. With six cycles and a 90 percent load factor, the estimated cooling makeup water demand is 2,615 ac-ft/yr. Other water demands will remain unchanged.

5. ACCURATE METERING TO MEASURE AND ACCOUNT FOR WATER

[This section must include a description of the device(s) and/or method(s) within an accuracy of plus or minus five percent to be used to measure and account for the amount of water diverted from the source of supply. Please amend the metering description to match those at your facility.]

The Poca Agua Steam Electric Power Station uses a totalizing meter on each of the four onsite wells that is calibrated on an annual basis to within two percent accuracy. Meter readings are logged each day.

Within the process itself, magnetic flow meters measure the following flows:

- Water entering the RO treatment process
- Boiler blowdown
- Recirculating cooling flow through the condenser
- Cooling tower blowdown

Each of the magnetic flow meters is calibrated on an annual basis to within two percent accuracy.

Meter readings from all of the above meters are transmitted via the plant SCADA system to the plant control center where they are monitored as necessary for plant operations.

Other small, miscellaneous water uses are estimated by a flow balance using readings from the meters described above and/or by multiplying the capacity of service water pumps by their run times.

The future water supply from the Poca Agua Water Supply Corporation will also be metered with a totalizing meter that will be calibrated to within one percent accuracy on an annual basis.

6. LEAK DETECTION, REPAIR, AND WATER LOSS ACCOUNTING

[This section must include a description of leak-detection, repair, and water loss accounting in the water distribution system. Please amend the description below to match operations at your facility. Examples of methods that may be used to conserve water include combined cycle generation, dry-type cooling tower(s), high quality source water for cooling tower makeup, reclaimed water as a source for most uses, water wise landscaping, water-efficient plumbing fixtures, and an employee education program.]

At the Poca Agua Steam Electric Power Station, leaks are identified through the following methods:

- Plant personnel observe, operate, and maintain facilities throughout the day. Inspection of aboveground piping and pump packing is a normal part of employee duties.

- Operators log and aggregate meter readings from the plant SCADA system and run times of circulating and service water pumps on a daily basis. Abnormal values can signify a water leak.

- Plant personnel collect water samples from various points in the process and have them analyzed for key water quality parameters. Water quality problems can be indicative of water leaks.

- Operators monitor the water level in the cooling tower storage basin and in the stormwater retention pond. A large change in water level can also signify a water leak

If a water leak is indicated by any of the above means, the source of the leak is investigated and a work order for repairs is issued as necessary.

7. WATER USE EFFICIENCY PROCESS AND/OR EQUIPMENT UPGRADES

[This section must include a description of equipment and/or process modifications to improve water use efficiency. Please amend the description below to match operations at your facility.]

Several water conservation methods are already in use at the Poca Agua Steam Electric Power Station, including the following:

- Cooling water is circulated through the condenser and cooling tower multiple times to reduce water usage.
- Cooling water blowdown is discharged on a continuous, rather than a batched, basis.
- Water/steam is circulated through the boiler-turbine process multiple times to reduce water usage.
- Chemical dosages and concentrations are closely monitored to allow maximum cycling of cooling water and boiler water/steam without scaling or corrosion.
- Floor/equipment drainage and other miscellaneous low-volume wastes are passed through oil-water separators and routed to the stormwater retention pond for reuse. Water from the stormwater retention pond is also used for fly ash handling, equipment washdown, and dust control.
- Landscape areas around the generating station are not irrigated.

8. OTHER CONSERVATION PRACTICES, METHODS, OR TECHNIQUES

[This section must include any other water conservation practice, method, or technique which the user shows to be appropriate for achieving the stated goal(s) of the water conservation plan. Please amend the description below to match operations at your facility.]

No other water conservation methods are necessary to achieve the water conservation goals for the Poca Agua Steam Electric Power Station.

9. IMPLEMENTATION OF THE WATER CONSERVATION PLAN

Appendix D contains a copy of the resolution of the Board of Directors of the Poca Agua Power Company adopting this water conservation plan. The resolution designates responsible officials to implement and enforce the water conservation plan.

Appendix E contains a copy of a letter to the chairman of the Region C Water Planning Group to inform the planning group of this water conservation plan.

This plan will be reviewed and updated every five years.

Appendix A
List of References

List of References

1. TXU Electric: *Water Conservation Plan for Industrial Use*, prepared for the Big Brown Steam Electric Station, Revision 0, August 1999.
2. Texas Commission on Environmental Quality: "Water Conservation Plans for Industrial or Mining Use," *Texas Administrative Code* Title 30 Part I Subchapter A §288.3, effective October 7, 2004.
3. *Power Generation Water Use in Texas for the Years 2000 Through 2060*, prepared for the Texas Water Development Board by representatives of investor-owned utility companies of Texas, January 2003.
4. New Mexico Office of the State Engineer: *A Water Conservation Guide for Commercial, Institutional, and Industrial Users*, July 1999.
5. Texas Water Development Board: *Report 362 Water Conservation Best Management Practices Guide*, prepared for the Water Conservation Implementation Task Force, Austin, November 2004.

Appendix B

Texas Commission on Environmental Quality Rules on Water Conservation Plans for Industrial or Mining Water Use

TITLE 30 ENVIRONMENTAL QUALITY

PART 1 TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

CHAPTER 288 WATER CONSERVATION PLANS, DROUGHT CONTINGENCY PLANS, GUIDELINES AND REQUIREMENTS

SUBCHAPTER A WATER CONSERVATION PLANS

RULE §288.1 Definitions

The following words and terms, when used in this chapter, shall have the following meanings, unless the context clearly indicates otherwise.

(1) Agricultural or Agriculture--Any of the following activities:

(A) cultivating the soil to produce crops for human food, animal feed, or planting seed or for the production of fibers;

(B) the practice of floriculture, viticulture, silviculture, and horticulture, including the cultivation of plants in containers or non-soil media by a nursery grower;

(C) raising, feeding, or keeping animals for breeding purposes or for the production of food or fiber, leather, pelts, or other tangible products having a commercial value;

(D) raising or keeping equine animals;

(E) wildlife management; and

(F) planting cover crops, including cover crops cultivated for transplantation, or leaving land idle for the purpose of participating in any governmental program or normal crop or livestock rotation procedure.

(2) Agricultural use--Any use or activity involving agriculture, including irrigation.

(3) Conservation--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.

(4) Drought contingency plan--A strategy or combination of strategies for temporary supply and demand management responses to temporary and potentially recurring water supply shortages and other water supply emergencies. A drought contingency plan may be a separate

document identified as such or may be contained within another water management document(s).

(5) Industrial use--The use of water in processes designed to convert materials of a lower order of value into forms having greater usability and commercial value, commercial fish production, and the development of power by means other than hydroelectric, but does not include agricultural use.

(6) Irrigation--The agricultural use of water for the irrigation of crops, trees, and pastureland, including, but not limited to, golf courses and parks which do not receive water through a municipal distribution system.

(7) Irrigation water use efficiency--The percentage of that amount of irrigation water which is beneficially used by agriculture crops or other vegetation relative to the amount of water diverted from the source(s) of supply. Beneficial uses of water for irrigation purposes include, but are not limited to, evapotranspiration needs for vegetative maintenance and growth, salinity management, and leaching requirements associated with irrigation.

(8) Mining use--The use of water for mining processes including hydraulic use, drilling, washing sand and gravel, and oil field repressuring.

(9) Municipal per capita water use--The sum total of water diverted into a water supply system for residential, commercial, and public and institutional uses divided by actual population served.

(10) Municipal use--The use of potable water within or outside a municipality and its environs whether supplied by a person, privately owned utility, political subdivision, or other entity as well as the use of sewage effluent for certain purposes, including the use of treated water for domestic purposes, fighting fires, sprinkling streets, flushing sewers and drains, watering parks and parkways, and recreational purposes, including public and private swimming pools, the use of potable water in industrial and commercial enterprises supplied by a municipal distribution system without special construction to meet its demands, and for the watering of lawns and family gardens.

(11) Municipal use in gallons per capita per day--The total average daily amount of water diverted or pumped for treatment for potable use by a public water supply system. The calculation is made by dividing the water diverted or pumped for treatment for potable use by population served. Indirect reuse volumes shall be credited against total diversion volumes for the purpose of calculating gallons per capita per day for targets and goals.

(12) Nursery grower--A person engaged in the practice of floriculture, viticulture, silviculture, and horticulture, including the cultivation of plants in containers or nonsoil media, who grows more than 50% of the products that the person either sells or leases, regardless of the variety sold, leased, or grown. For the purpose of this definition, grow means the actual cultivation or propagation of the product beyond the mere holding or maintaining of the item prior to sale or lease, and typically includes activities associated with the

production or multiplying of stock such as the development of new plants from cuttings, grafts, plugs, or seedlings.

(13) Pollution--The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to the public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

(14) Public water supplier--An individual or entity that supplies water to the public for human consumption.

(15) Regional water planning group--A group established by the Texas Water Development Board to prepare a regional water plan under Texas Water Code, §16.053.

(16) Retail public water supplier--An individual or entity that for compensation supplies water to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants when that water is not resold to or used by others.

(17) Reuse--The authorized use for one or more beneficial purposes of use of water that remains unconsumed after the water is used for the original purpose of use and before that water is either disposed of or discharged or otherwise allowed to flow into a watercourse, lake, or other body of state-owned water.

(18) Water conservation plan--A strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water. A water conservation plan may be a separate document identified as such or may be contained within another water management document(s).

(19) Wholesale public water supplier--An individual or entity that for compensation supplies water to another for resale to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants as an incident of that employee service or tenancy when that water is not resold to or used by others, or an individual or entity that conveys water to another individual or entity, but does not own the right to the water which is conveyed, whether or not for a delivery fee.

Source Note: The provisions of this §288.1 adopted to be effective May 3, 1993, 18 TexReg 2558; amended to be effective February 21, 1999, 24 TexReg 949; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective August 15, 2002, 27 TexReg 7146; amended to be effective October 7, 2004, 29 TexReg 9384

TITLE 30 ENVIRONMENTAL QUALITY

PART 1 TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

CHAPTER 288 WATER CONSERVATION PLANS, DROUGHT CONTINGENCY PLANS, GUIDELINES AND REQUIREMENTS

SUBCHAPTER A WATER CONSERVATION PLANS

RULE §288.3 Water Conservation Plans for Industrial or Mining Use

(a) A water conservation plan for industrial or mining uses of water must provide information in response to each of the following elements. If the plan does not provide information for each requirement, the industrial or mining water user shall include in the plan an explanation of why the requirement is not applicable.

(1) a description of the use of the water in the production process, including how the water is diverted and transported from the source(s) of supply, how the water is utilized in the production process, and the estimated quantity of water consumed in the production process and therefore unavailable for reuse, discharge, or other means of disposal;

(2) until May 1, 2005, specification of conservation goals, the basis for the development of such goals, and a time frame for achieving the specified goals;

(3) beginning May 1, 2005, specific, quantified five-year and ten-year targets for water savings and the basis for the development of such goals. The goals established by industrial or mining water users under this paragraph are not enforceable;

(4) a description of the device(s) and/or method(s) within an accuracy of plus or minus 5.0% to be used in order to measure and account for the amount of water diverted from the source of supply;

(5) leak-detection, repair, and accounting for water loss in the water distribution system;

(6) application of state-of-the-art equipment and/or process modifications to improve water use efficiency; and

(7) any other water conservation practice, method, or technique which the user shows to be appropriate for achieving the stated goal or goals of the water conservation plan.

(b) Beginning May 1, 2005, an industrial or mining water user shall review and update its water conservation plan, as appropriate, based on an assessment of previous five-year and

ten-year targets and any other new or updated information. The industrial or mining water user shall review and update the next revision of its water conservation plan not later than May 1, 2009, and every five years after that date to coincide with the regional water planning group.

Source Note: The provisions of this §288.3 adopted to be effective May 3, 1993, 18 TexReg 2558; amended to be effective April 27, 2000, 25 TexReg 3544; amended to be effective October 7, 2004, 29 TexReg 9384

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Appendix C
Water Use Diagram

Water Use Diagram
Poca Agua Steam Electric Power Station

[Insert water use diagram here. Show all water uses, sources, and flowrates.]

Appendix D
Board Resolution Adopting the Water Conservation Plan

[Insert Board resolution adopting the water conservation plan.]

Appendix E
Letter to the Region C Water Planning Group

[Insert letter to the Region C Water Planning Group.]