EXHIBIT D

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE SECRETARY

DECLARATION OF JOHN C. HALEPASKA IN SUPPORT OF TEXANS FOR A SOUND ENERGY POLICY'S PETITION TO INTERVENE AND CONTENTIONS

I John C. Halepaska, declare pursuant to 28 U.S.C. § 1746, on personal knowledge and under penalty of perjury, that the following is true and correct:

This declaration is submitted in support of Texans for A Sound Energy Policy's ("TSEP") Petition to Intervene and Contentions.

1. I am a resident of Douglas County, Colorado. I am over 21 years of age and have never been convicted of a felony.

2. I am the president of JOHN C. HALEPASKA AND ASSOCIATES, INC.. My staff and I have reviewed Exelon Nuclear Texas Holdings, LLC's Early Site Permit Application for the Victoria County Station Site.

3. Attached are our two reports. Exhibit D-1 is a letter report entitled *A Summary of Contentions on Exelon's ESP Application for the proposed Victoria County Station Site* dated October 8, 2010, which was submitted to Mr. Jim Blackburn. Exhibit D-2 is entitled *Contested Issues Concerning Early Site Permit, Exelon's Victoria County Station*, dated January 2010.

4. A copy of my resume and the resumes of my staff accompanies this report as Exhibit D-3..

I, JOHN C. HALEPASKA, DECLARE UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE UNITED STATES OF AMERICA THAT THE FOREGOING IS TRUE AND CORRECT.

Executed this 19 day of January, 2011.

John C. Halepaska

EXHIBIT D-1

HALEPASKA AND ASSOCIATES

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October 8, 2010

Texans for Sound Energy Policy
106 West Juan Linn Street
Victoria, Texas 77901

Attn: Jim Blackburn Esq.

Subject: Summary of Contentions, Exelon's ESP Application for the proposed Victoria County Station Site

Project No. 5971

Dear Mr. Blackburn:

As requested by Texans for Sound Energy Policy (TSEP), John C. Halepaska and Associates, Inc. (JCHA) reviewed the Early Site Permit Application (ESP) for the Victoria County Station (VCS) Site. The permit was submitted by Exelon Nuclear Texas Holdings, LLC (Exelon) to the US Nuclear Regulatory Commission (NRC) on March 25, 2010, in accordance with 10CFR52 with a requested permit duration of 20 years. This application was submitted to replace the previously submitted combined license application (COLA) to construct, possess, use, and operate two Economic Simplified Boiling Water Reactor (ESBWR) units, referred to as Victoria County Station (VCS), units 1 and 2 which was previously submitted by Exelon on September 2, 2008.

History of Exelon's Submittals

Exelon officially submitted the COLA on September 2, 2008. The original application did not contain all of the information required under NRC regulations. Additional meteorological data were submitted on September 23, 2008. Additional geologic and environmental monitoring data (most of which was marked as confidential seismic data and was not released to the public) were submitted on October 16, 2008. On October 24, 2008, a Conceptual Temporary Dewatering plan was submitted. On October 30, 2009, NRC released a Letter of Acceptance for Docketing of the Exelon Application for a Combined License for VCS, Units 1 and 2 and published a notice in the Federal Register.

On November 24, 2008, Exelon notified NRC that it would not proceed with an initial plan to use the GE/Hitachi ESBWR because that design had not been certified by NRC. On December 18, 2008, NRC informed Exelon that they were suspending the review of the COLA for the VCS. NRC stated that it would conduct acceptance and technical reviews of the revised COLA after it has been submitted and then develop a schedule for the review of the application.

On February 4, 2009, Exelon notified NRC that it would be submitting the updated groundwater data and wildlife surveys with the revised COLA rather than as a separate document.

In late March 2009, Exelon announced that the company had signed an agreement with Hitachi to develop two 1,350-megawatt electric (MWe) Advanced Boiling Water Reactors (ABWR) for its project in Victoria County, Texas. Exelon must revise the reactor-specific parts of its COLA and submit them to the NRC. Exelon stated they hoped to have a revised COLA completed by the end of the third quarter 2009.

On June 30, 2009, Exelon informed the NRC that the company would not submit a revision to their COLA submitted on September 2, 2008, but would pursue an Early Site Permit (ESP) instead. The expected submittal date for the ESP was July 1, 2009.

On March 25, 2010, Exelon submitted an Early Site Permit for the VCS site. Under the ESP process, the Nuclear Regulatory Commission undertakes an evaluation of site safety, emergency planning and environmental impact regarding a proposed nuclear plant site. By issuing an ESP for a specific site, the NRC is certifying that the site satisfies the criteria in those evaluation areas. If the company later chooses to pursue construction, the ESP becomes part of the combined construction and operating license application, which requires a separate review and approval by the NRC. Issues resolved during the ESP review cannot be reopened.

Since submittal of the ESP application (referred to as Revision 0), Exelon has submitted additional data to complete and support the license. These include:

- May 4, 2010 Exelon submits meteorological data collected at the on-site station in support of the permit.
- May 6, 2010 Exelon submits additional information to clarify the accident analysis in support of the ESP.
- May 13, 2010 Exelon submits corrected notification regarding two issues affecting the license review.
- May 20, 2010 Exelon submits additional information relating to design parameters for minimum and dynamic bearing capacity.
- June 15, 2010 Exelon submits revised application pages correcting the Mmax used in the seismic evaluation section 2.5.2.
- June 15, 2010 Exelon transmits letter from the Texas Historical Commission which concur with the phase 1a and 1b investigation at the VCS site.
- June 24, 2010 Exelon submits Environmental Report Revisions incorporating additional supporting information.
- June 28, 2010 Exelon submits additional information regarding Site-related design parameters for maximum and dynamic bearing capacity.
- July 26, 2010 Exelon submits wetlands delineation materials.
- August 19, 2010 Conference among NRC, Exelon, and Exelon consultants regarding growth faults at the site.
- September 9, 2010 Exelon Letter to the US Army Corps of Engineers transmitting site wetlands data and requesting a preliminary jurisdictional determination (PJD) for aquatic resources on the VCS site.

The Federal Notice for docketing of the Exelon's ESP application for the VCS site was posted on July 14, 2010. The review schedule was published by NRC on August 31, 2010. The schedule contemplated completion of the Safety Review in April 2013, and the issuance of the final Environmental Statement in August 2013.

Proposed Facility

The VCS Site is comprised of approximately 11,500 acres in a rural area of Victoria County, Texas, approximately 13.3 miles south of the city of Victoria, Texas, the county seat. The site is approximately 4.2 miles west of the Guadalupe River. The site boundary runs through Linn Lake on the east and runs adjacent to US Highway 77 on the west and the Union Pacific Railway tracks on the southeast.

The ESP application is intended to demonstrate the suitability of the VCS site for construction and operation of a nuclear power generating facility. Exelon chose not to select a specific plant design. Instead, Exelon developed a set of plant design parameters thought to envelop future site development options. The reactor technologies used to develop this set of plant design parameters was based on the following reactor designs:

- Advanced Boiling Water Reactor (ABWR) designed by General Electric and Toshiba
- Advanced Passive Pressurized Water Reactor (AP1000) designed by Westinghouse
- Economic Simplified Boiling Reactor (ESBWR) designed by General Electric-Hitachi. This was the design originally proposed for the site.
- Advanced Pressurized Water Reactor (APWR) designed by Mitsubishi
- mPower designed by Babcock & Wilcox

Exelon estimates that the selected reactor or reactors will be capable of generating a combined core thermal power of up to 9000 MWt. The reactor actually selected to be used by Exelon at the VCS site will not be limited to those listed above. The final selected reactor will have design parameters that are bounded by the surrogate plant parameter envelope (PPE).

The VCS uses a 4,900 acre cooling basin to dissipate heat from the power cycle transferring heat from the main condenser via the circulating water system (CWS) and other non safety related heat exchangers of the plant to the environment. The cooling basin would also provide makeup water to the mechanical draft cooling towers associated with the service water cooling system for each unit.

The CWS operates in a closed loop as the cooling basin supplies cooling water at one end through a common pump intake structure and receives heated water at the other end via a common discharge structure. The cooling basin surface area provides the mechanism for dissipation of heat to the atmosphere.

The ultimate heat sink (UHS) is the source of cooling water necessary to safely operate, shutdown and cool down the plant. Potential plant designs for the VCS site currently employ both active and passive systems. The passive systems are based on using gravity to move water, and valves are typically actuated by safety-related dc power sources. The active systems rely on powered components, such as pumps, to move coolant to the needed locations. Some designs rely on a UHS to remove heat from safety related systems and discharge it to the atmosphere. If required, the design selected for the UHS at the VCS site is to use small mechanical draft cooling towers.

Makeup water, which compensates for evaporation, seepage and blowdown, is to be supplied by diversions from the Guadalupe River to the cooling basin by the raw water makeup (RWMU) system. The RWMU system includes a pump house located adjacent to the Guadalupe River and a water supply pipeline, which is capable of diverting up to 217 cfs (97,396 gpm). The RWMU intake canal would be located on the Guadalupe River approximately 500 feet upstream of the GBRA's Lower Guadalupe Diversion Dam and Saltwater Barrier.

Cooling basin blowdown and treated radwaste effluent is to be discharged to the Guadalupe River via a diffuser. Blowdown is conveyed to the diffuser by a subsurface pipeline that follows the route of the VCS heavy haul road to the boundary of the VCS site and then parallels the Victoria County Navigation District (VCND) transportation corridor to its intersection with the Guadalupe River.

American Electric Power (AEP) will be the transmission service provider and they will be responsible for construction of the new transmission circuits to be built in association with the proposed VCS project. The onsite substation will cover about 90 acres. A 345kV interconnection will be needed to tie the VCS into the AEP grid. Six 345 kV transmission lines will be needed to connect the VCS substation to Coleto Creek, Hillje, Blessing, White Point, Cholla, and South Texas Project substations. The lines from the VCS to Coleto Creek and Blessing will require new rights of way. In addition, six new or rerouted AEP 345 kV transmission lines remote from the VCS will be needed to fully integrate power from the VCS into the regional transmission grid.

Methodology

As demonstrated above, the facility and action to be reviewed has been a moving target. The September 3, 2008, COLA was initially reviewed. When the March 25, 2010, ESP application was submitted, it too was reviewed and compared with the original COL application. The contentions discussed in this letter deal strictly with those relative to the ESP.

An early site permit must include an evaluation of the site safety, emergency preparedness, and environmental impacts. An ESP application may refer to a reactor or reactors characteristics as described by a plant parameter envelope, which is a set postulated design parameters that bound the characteristics of a reactor or reactors that might be built at the target site, or alternatively, an ESP may refer to a detailed reactor design. In any event, the contents of an ESP must include:

1. Site Safety Review
    1. Seismology
    2. Geology
    3. Hydrology
    4. Meteorology
    5. Geography
    6. Demography (population distribution)
    7. Site hazards Evaluation

2. Emergency Preparedness Review
    1. Evaluate proposed emergency plan, or emergency preparedness information
    2. Evaluate physical impediments, population distribution and transportation routes
    3. Federal Emergency Management Agency (FEMA) review

3. Environmental Protection Review
    1. Surface water quality, hydrology, and use
    2. Aquatic ecology
    3. Groundwater use and quality
    4. Threatened or endangered species
    5. Air quality
    6. Land use
    7. Uranium fuel cycle and waste management
    8. Human health
    9. Socioeconomics
    10. Postulated accidents
    11. Decommissioning
    12. Environmental justice
    13. Alternative sites

Each of these items was addressed in the COLA originally submitted to NRC and in the Exelon's March 25, 2010 ESP.

Materials

JCHA reviewed all 5281 pages of Exelon's COLA. We have also reviewed the 3890 pages of the Site Safety Analysis Report (SSAR) and Environmental report contained in the ESP as well as over 4000 pages of site testing and design materials. The materials in the ESP were compared with the requirements found in NRC's regulations, guidance documents, and NUREG documents to determine if the ESP contained the required material. In addition, other Federal and State regulations applicable to the proposed action were reviewed to evaluate compliance.

JCHA acquired and reviewed numerous publications and public data describing the physical and socioeconomic characteristics of the site vicinity, including:

- groundwater hydrology of the region
- groundwater modeling
- groundwater availability
- surface water hydrology
- surface water availability
- surface water modeling
- presence and location of growth faults
- subsurface geology of the region
- oil and gas well data
- oil and gas pipeline data
- reports on the seismic activity of the area
- data on bays and estuaries
- modeling of bays and estuaries
- presence and range of endangered species
- Light Detection and Ranging (LIDAR) data
- Geographic information data sets for the five county area
- Census data for the five county area
- 3D seismic data covering the site and adjacent areas
- siting data for all active commercial reactor sites in the United States.

In addition, similar publicly available data was collected on the site in Matagorda County originally selected by Exelon as the best location to construct a nuclear power station. The JCHA approach was to compare the Victoria site to the Matagorda site. However JCHA also recognizes that there may be other sites in the area that could be evaluated for their potential to construct a nuclear power station.

Comparison of the ESP Application with the COL Application

Although the COL and ESP are for the same site, a number of changes were noted between the two documents as summarized below:

Site Safety Analyses Report

- Uses a Plant Parameter Envelope based on the requirements of ESBWR, ABWR, AP1000, APWR, and mPower reactor designs.
- The VCS site would accommodate one or two large reactor units or 12 modular units within the designated power block.
- Exelon updated the natural gas pipeline hazard analysis.
- The transportation hazard analysis was updated.
- Exelon deferred the hazard analysis of toxic gases until the submittal of a COL application for construction and operation of the specific reactor selected for the site.
- The site dispersion values used to evaluate transport of airborne contaminants were refined and updated based on two years of meteorological data collected on site.
- The site groundwater model was updated and refined based on additional data collected from old and new monitor wells installed at the site.
- A new section presenting the results of a study evaluating possible paleoliquifcation features on or near the site.
- A new section discussing the results of an analysis of the possible presence of salt diapirs beneath or near the site.
- The seismic evaluation was modified to include the consideration of a seismic sources in the Gulf of Mexico.
- Data collected from a 2009 supplemental subsurface investigation conducted to validate and refine the geology, hydrology, and bearing strength of near surface materials were added to the application.

- Exelon revised the calculated radiological impacts of liquid and gaseous effluent releases based on a composite bounding set of source terms developed by selecting the highest values from each of the considered reactor technologies.

- The safety analysis for specific technology was deferred to the COL application stage.

Environmental Report

- The discussion of severe accident mitigation alternatives was removed and is to be provided with a COL application.

- The discussion of the need for power was removed and is to be provided with a COL application.

- The discussion of alternative methods for meeting energy demand was removed and is to be provided with a COL application.

- The benefit-cost balance is to be provided with a COL application.

- A discussion of activities that would not be considered as construction and so could be performed prior to license approval was added in the ESP application. This activities include the following:

    - Installation of environmental controls
    - Clearing, grubbing, and grading
    - Road, rail, and barge facility construction
    - Construction of facilities required to implement site security.
    - Installation of temporary utilities
    - Construction of temporary facilities
    - Preparation of layout, fabrication, and shop areas
    - Construction of the cooling basin
    - Construction of the cooling basin intake and discharge structure
    - Installation of the cooling basin blow-down line
    - Installation of the RWMU system
    - Excavation of the power block area
    - Preparation of the modular assembly area

- A discussion of greenhouse gas emissions expected during construction, operation, and for the fuel cycle was added to the ESP.

- The Raw Water Intake Structure was relocated adjacent to the Guadalupe River.

- Reference to the 12/15/2007 reservation agreement between the GRBA and Exelon to supply water to the cooling basin was removed.

- Exelon added a discussion for obtaining legal rights to divert water by either leasing existing water rights, buying existing water rights, applying for new water rights, or some combination of these.

- Added a discussion of water availability using the Region L 2010 report in which the WAM runs indicated 38,000 feet of unused water rights in the Guadalupe-San Antonio River basin, and GBRA/UC excess rights of 115,000 feet.

- Exelon removed the discussion of the 35,000 ac-ft storage reservoir for GBRA originally proposed for the site. However, the pumping station still has excess capacity of 50 cfs to be used by "a Future Water Supply Agency", and an on-site storage reservoir in briefly mentioned in Section 2 of the ESP's Environmental report.

- The discussion regarding construction of a heavy haul road from VCND to the site by Exelon was removed and a new discussion regarding a proposed project by VCND to link US77 with the Port of Victoria by a route adjacent to the VCS.

- An additional 200 residents were added to the NE and ENE sectors included in the demographic and radiological analyses.

- The seismic data used to evaluate the growth faults on-site were included as Part 6—Propriety Information, which means the data are not available except to NRC personnel, so confirmation of Exelon's interpretation of this data could not be performed.

As a result of these changes between the COL and the ESP, the contentions prepared for the COL could not be used for the ESP without modification. Therefore, JCHA revised the contentions to make them applicable to the ESP.

Identification of Issues in the ESP

Site Safety Review

JCHA's review of the site safety analysis found major deficiencies in the evaluation of the site geology, cooling water availability, and site hazards as summarized below and as discussed in detail in the attached contentions.

Geologic Issues

There are at least two, and perhaps as many as four, growth faults which reach to the surface are present or adjacent to the VCS site. Additional growth faults which do not reach the surface are also present beneath and near the VCS site. These faults pass near the power block and cross the recirculating cooling pond. As summarized below and detailed in contention 7 attached, contrary to Exelon's evaluation in the ESP for the VCS there is evidence of significant historical as well as recent movement along some of these faults making this site unsuitable for a nuclear power station.

JCHA obtained 3D seismic data for the VCS and adjacent areas. These data immediately called into question the reliability of the interpretation's from Exelon's 2D seismic study as the data shows that movement across some growth faults in the area is as much as several hundreds of feet at depth, which is considerably higher than what was estimated by Exelon in the ESP. The critical question raised by comparisons of the two methods is not whether growth faults exist within the site, but how recent and how fast the movement along the faults has occurred. Exelon, using a standard NRC procedure to estimate the rate of growth fault movement based on the total throw of the growth fault divided by the age of the sediments resulting in an estimated rate of change across the fault of 0.0005 to 0.00005 In/year.

JCHA used LIDAR data obtained from the state of Texas to locate the surface expression of the growth faults on the proposed site and their offsite extension. Preliminary field trenching conducted by JCHA across the faults at locations near the site boundary indicates that the fault traversing the cooling pond area exhibits evidence of recent and continuing movement. This movement poses an immediate and substantial threat to the stability of the cooling pond.

The LIDAR data indicates that the fault known as "Growth Fault E" crosses McFaddin Road. Field observation indicates a dip in the road where the fault trace intersected the road. JCHA obtained the survey data from when the road was constructed in 1970, and found that the road was not built with a dip in it. A 2009 survey of the road's center line showed a dip of approximately 8 inches across the growth fault. Assuming that this activity happened at a uniform rate over the past 39 years, the resulting movement rate of this growth fault would be 0.2 inches per year, which is approximately 1,000 to 10,000 times larger than rates estimated in the FSAR (0.00005-0.0005 in/yr). Of course, it is unlikely that the rate of movement is uniform; so, the actual rate of movement during episodic events would be significantly higher.

Cesium 137 age dating is also a useful method to estimate growth fault movement. Fallout from the early 1960's era of atmospheric nuclear testing contained elevated concentrations of Cs-137. If samples collected from the same depth on different sides of the fault trace have

different Cs-137 concentrations, recent movement would be indicated. Samples at depths ranging from 0-56 cm were collected from each side of "Growth Fault E" near where it crosses the San Antonio River. Results of these analyses show a vertical movement of at least 13 inches since the test era (c. 1960). This would suggest a movement rate of 0.265 in/year, which is comparable to the estimate from the road survey.

The LIDAR data also indicated that the extension of a growth fault crossed the Union Pacific tracks. JCHA contacted the Union Pacific railroad regarding any repairs that may be related to growth faults. The railroad reported that they had to rebuild the bridge across the San Antonio River a few miles south of the VCS. This bridge is adjacent to one of the growth faults shown in the Exelon submittal. JCHA was not able to obtain documents that gave a history of the bridge, nor the degree of changes in elevation that resulted in the bridge being replaced. However it does add credence to the overall picture of growth fault movement in the vicinity of the VCS that was not considered in the submittal.

The LIDAR data also indicated that the trace of the growth fault crossed US Highway 77. A dip in the highway was also noted on Highway 77. Records of maintenance activities along highway 77 were obtained and reviewed. These records lacked sufficient detail to allow the calculation of a rate of movement of the growth fault.

Growth faults have been studied as a potential factor in the failure of levees around New Orleans during Hurricane Katrina. Such potential failure should be a consideration when designing any type of structure atop growth faults. Exelon does not adequately account for these growth faults on their property. In addition to instability introduced by the presence of growth faults, there is a potential for aftershock waves from distant earthquakes to activate movement along the growth faults damaging the cooling pond. There have been several instances in the past where distant earthquakes have caused shock waves with resulting movement along growth faults that have inflicted damage along the Gulf Coast. The March 27, 1964 Alaskan Earthquake (magnitude 9.2 on the Richter Scale), the New Madrid Quake of 1811-1812, the Charleston, South Carolina earthquake of 1886, and the November 3, 2002 Denali Alaska earthquake all generated significant shock waves causing movement along growth fault traces in the Gulf Coast, resulting in property damage.

The growth faults pose an unacceptable risk to the proposed facility's cooling pond, and the resulting impacts of these growth faults on the design and operation of the nuclear power station are ignored in the application.

Lack of Sufficient Cooling Water

Approximately 75,000 acre-feet/year of makeup water for the cooling basin is planned to be obtained from diversion of water from the Guadalupe River. According to the ESP, Exelon will

obtain the legal rights to divert this water by either leasing existing water rights, buying existing water rights, applying for new water rights, or some combination of these. As discussed in contentions 2, 3 and 8, JCHA's review indicates that Exelon has not shown there is sufficient water legally or actually available to consistently meet the VCS cooling requirements.

Permits for the use of surface water in Texas are based on the prior appropriation doctrine. When surface water supplies are insufficient, the oldest water right (the "senior" right) has first call on available supplies. The most likely source of leased water for Exelon would be from the GBRA. Exelon previously entered into an agreement with GBRA to reserve 75,000 acre-feet of water per year for use at the VCS. The South Coast Texas Regional Water Planning Group has concluded that flows in the Guadalupe sufficient to meet the 75,000 acre-feet per year requirement were available only 41% of the time. The Planning Group also concluded that the maximum annual diversion available to GBRA to fulfill the 75,000 acre-feet per year requirement was only 64,358 acre-feet per year.

Exelon has not demonstrated an understanding of the primitive, legal definition that surface and groundwater are not connected in Texas despite the reality that removal of groundwater will reduce the amount of water available for surface flows and so the amount of water available for diversion. Exelon fails to recognize that future droughts will result in increased groundwater use which will result in further decreases in available surface flows for diversion to the CWS. None of the water availability studies conducted by Region L, GBRA, or TDNR take into consideration these issues. In fact, the drought analysis used by Exelon assumes 70,000 acre-feet of return flows would be available from San Antonio. The San Antonio water supply is groundwater from the Edwards aquifer which may be unavailable in a drought, or San Antonio may reuse all or part of this amount to meet its demand, further reducing flows available for diversion by Exelon. As discussed in the comparison of the VCS with the Matagorda site, the use of sea water for cooling makes water reliability issues disappear.

The situation is further complicated by the fact that GBRA has committed a portion of the water rights underlying the Reservation Agreement to other water development projects. The Lower Guadalupe Water Supply Project was to deliver 70,000 acre-feet per year to the San Antonio Water System and the San Antonio River Authority. In addition, 60,000 acre-feet per year appears to have been promised by GBRA to the San Marcos/New Braunfels area and 30,000 acre-feet per year is to be diverted for use at the Coleto Creek power plant in order to make an equivalent quantity of water available from Canyon Dam for local water supplies.

Although Exelon can apply for new water rights, the availability of unappropriated water in the Guadalupe River is doubtful. Availability of new water would be influenced by the needs of the Aransas National Wildlife Refuge. On 31 December 1937, President Franklin D. Roosevelt issued Executive Order No. 7784 establishing what is now the Aransas National

Wildlife Refuge (the Refuge). In part, the Refuge was established to fulfill the requirements of both the Migratory Bird Treaty and the Migratory Bird Conservation Act. Under the Reserved Water Rights Doctrine, when land owned by the federal government is reserved for a specific federal purpose, the minimum quantity of unappropriated water needed to meet the primary purposes of the reservation is reserved by implication. The Reserved Water Rights Doctrine applies to land owned by the federal government irrespective of whether the land was once part of the public domain or was acquired by the federal government.

The best estimate of the minimum quantity of water needed to fulfill the primary purposes of the Refuge is 1,242,500 acre-feet per year. Assuming (1) that 1,242,500 acre-feet of water is the minimum quantity of water needed to fulfill the primary purposes of the Refuge and (2) that this quantity fulfills the needs of federal species protection statutes, historic records indicate that Exelon would have no water both physically and legally available between 28.4% and 79.7% of the time depending on month. The historic record also indicates that there are multiple months when actual flows only minimally exceeded the freshwater inflow requirements of the Refuge. In essence, based on both the historic record and existing surface water right priorities on the Guadalupe River, only a portion of the 75,000 acre-feet required by the plant would be both physically and legally available on a firm basis. The water that is available would be so only on an intermittent basis.

The federal reserved water right for the Refuge, having a priority date of 31 December 1937, would have priority over any new water rights and all of the GBRA's surface water rights on the Guadalupe River. Under Texas water law, a sufficient quantity of new or leased water is neither physically nor legally available to fulfill the requirements for cooling the VCS.

Exelon presented no data that existing water rights are for sale. In addition the project population growth over the next 50 years in the South Central Texas Region is 3 million people, which translates to a water demand increase of 420,000 acre-feet per year and increased competition for purchase water. Any purchase of existing water rights would come at the expense of existing users and could result in the discontinuance of agriculture operations, the shutdown of existing industrial uses, and shortages of municipal supplies dependent on surface water from the Guadalupe River.

This additional water required to meet the needs of population growth will likely be pumped from ground water as no additional surface water is available in the Guadalupe River Basin. The pumping of additional groundwater will impact the amount of base flow being supplied from the aquifers into the streams. The availability of leased or new water rights rests on the fallacious assumption that ground water will continue to be available to augment surface flows. Since Exelon cannot control the future use of ground water, it cannot estimate much less guarantee, that it will be able to supply enough water to meet the cooling requirements

for the VCS. Exelon's ESP failed to demonstrate that an adequate source of cooling water is available for the VCS Facility.

Site Hazards

As discussed in contention 4, Exelon's Site Safety Analysis Report (SSAR) fails to properly document and evaluate the threats of explosion and seepage of poisonous gas posed by the existence of hundreds of active and abandoned oil and gas wells and borings on and near the proposed facility. A review of records maintained by the Texas Railroad Commission demonstrated that many of the required records were either incomplete or missing.

While there also exists many natural pathways that could potentially act as conduits to poisonous or explosive gases, the major concern on the proposed VCS site is several man-made pathways. Of particular concern are the nearly 300 active and abandoned oil and gas wells and borings on and near the proposed facility. The majority of Texas wells or boreholes have historically been plugged with little or no regulatory oversight. Many of the abandoned wells on or near the proposed site were abandoned more than 20 years ago, when there were fewer requirements, and less sensitivity to environmental concerns. In addition, structural integrity of well components and seals is not permanent, and some of the oil and gas wells on the Exelon site haven been in the ground for nearly 100 years. Any deterioration of well integrity can lead to leaks. Because of the lack of dependable records, each borehole must be located and entered to determine its current condition.

The types of problems presented by the bore holes and wells on the site are:

- Explosion hazard due to seepage of explosive gases such as methane and natural gas from improperly abandoned wells.
- Hazard due to poisonous gas seepage, such as hydrogen sulfide which is known to be present in wells near the site.
- Upward migration of hydrocarbons and other contaminants seeping to the surface through a cracked well seal or other inadequate plugging.

These wells are present beneath areas where site facilities, including cooling basin dams, the cooling basin, and the power block. No plans to find and determine the status of these 300 wells was included in the ESP.

The growth fault planes also provide potential pathways for the migration of gas. On February 17, 2008, the Big Bottom #1 Well blew out. Investigation of the area after the blow out identified a number of craters formed along the surface expression of an adjacent growth fault.

Environmental Protection Review

Surface water quality, hydrology, and use

The diversion of water at the Salt Water Barrier will contribute to flooding of the Lower Guadalupe River. When the saltwater barrier is inflated, it causes the water in the river to lose velocity, and drop its sediment load. This constricts the channel, and eventually causes the water to flow over the river banks, flooding the surrounding areas.

Aquatic ecology

As discussed in contention 1, Exelon's Environmental Report fails to include a consistency determination issued by the Texas Coastal Zone Coordination Council as mandated by the Coastal Zone Management Act. The relevant language of the Coastal Zone Management Act leaves little room for interpretation: "[A]ny applicant for [a] required Federal license or permit to conduct an activity, in or outside of the coastal zone, affecting any land or water use or natural resource of the coastal zone of that state shall provide in the application to the licensing or permitting agency a certification that the proposed activity complies with the enforceable policies of the state's approved program[.]" This language is directly applicable to Exelon given that the Secretary of Commerce approved the Texas Coastal Management Program on 10 January 1997. This program is to be administered by the Texas Coastal Coordination Council.

As discussed in contention 6, Exelon's Environmental Report (ER) does not consider the reduced sediment load carried to the downstream estuary due to the diversion of 105,000 acre-feet of water per year (75,000 ac-ft for Exelon, and 30,000 ac-ft made possible by the over-sizing of the pumping station). The decrease in flow will result in a reduced capacity to transport sediment which is an important part of estuary health.

A study performed by the Texas Water Development Board in 1994 determined an empirical equation relating annual flow rates in the Guadalupe and San Antonio Rivers to sediment and nutrients transported into the Estuary. Using this equation, a reduction of inflow to the Estuary of 105,000 acre-feet per year would result in a reduction in sediment/nutrient inflow of approximately 56,000 metric tons per year. This loss of load will adversely impact the overall health of the Estuary.

Groundwater use and quality

The projected population growth over the next 50 years in the South Central Texas Region is 3 million people, which translates to a water demand increase of 420,000 acre-feet per year.

This additional water will likely be pumped from ground water as no additional surface water is available in the Guadalupe River Basin. Much of the groundwater in the area is brackish and the amount of fresh water in the groundwater aquifers is limited. The pumping of additional groundwater may activate or accelerate the growth faults in the area.

Exelon potentially underestimates seepage losses from their cooling pond, due to the presence of the oil gas wells of unknown status.

Threatened or endangered species

As discussed in contention 2, there are many species with important habitat downstream of the VCS site. Most importantly, the endangered whooping crane but also for a variety of species protected by the Migratory Bird Treaty, the Migratory Bird Treaty Act, the Endangered Species Act, the Bald and Golden Eagle Protection Act and the Marine Mammal Protection Act. Several studies were performed to examine the inflows required in order to maintain the health of the downstream estuary. Each of these studies show that under current conditions, the amount of inflow required to maintain estuary health, and protect the whooping crane's food supply is met only sporadically. To the extent that the inflow requirements into the estuary have been quantified, the freshwater inflow requirements for protected species appear to be roughly equivalent to the federal reserved water right for the Refuge (1,242,500 acre-feet per year). The impact of the anticipated diversion of 75.000 acre-feet per year was not adequately evaluated by the ESP.

There are eight species found in Comal Springs or San Marcos Spring that are either threatened or endangered. For several of these species, minimum discharges from either Comal Springs or San Marcos Spring (or both) have been established. In order to meet the prescribed discharges, many alternatives are being evaluated. These alternatives include ground water management, replacing the water supply of local large groundwater users with non-Edwards water, diversion of water from downstream areas, etc. Each of these alternatives has the potential to reduce downstream flows. There are so many different proposed solutions to this problem that it is impossible to determine the impacts that this issue may have on legal or physical availability of water to the VCS site. However, meeting these minimum flows is an additional strain on the basin's limited water resources, and will diminish the amount available for the VCS.

Eight power transmission lines would be required for the VCS site, using six right-of-ways. This would total approximately 180 miles of new lines, and would occupy approximately 4,700 acres. Transmission lines represent a major hazard to migrating birds such as the whooping cranes.

Socioeconomics

As discussed in contention 9, Exelon fails to address the value of operating oil and gas facilities on or near the VCS property, which would need to cease operation and be properly closed prior to opening the VCS. The evaluation was limited to the immediate vicinity of the VCS. However, depending on the extent and connectivity of the producing horizons, wells remote from the site may also need to be abandoned to manage the possible subsidence at the site.

The projected population growth over the next 50 years in the South Central Texas Region is estimated at 3 million people. To provide for this population, a water demand increase of 420,000 acre-feet per year is anticipated. However, there is currently insufficient surface water to meet this projected demand. The ER does not consider the socioeconomic impact of a single entity using essentially all of the remaining surface water available for municipal and industrial growth within the Guadalupe River Basin, or the effects of purchasing existing surface water rights will have on the industries which have historically used this water.

Comparison of VCS site to other US Commercial Reactor Sites

JCHA reviewed the siting information for the 64 sites which contain the 104 currently permitted and operating nuclear reactors in the United States. The results of the review are summarized on the attached table. Site data were reviewed for the cooling water source, the presence of oil and gas wells, the presence of oil pipelines, and the presence of active or inactive surface faulting. The data reviewed came primarily from the NRC ADAMS on-line document database. In addition, state records were searched for the location of oil and gas wells on or near the plant sites, state geologic survey data were reviewed for data on faulting in and near plant sites, and state water rights data were reviewed to determine legal diversion rights for plant cooling water.

All of the 104 commercial reactors currently licensed to operate in the United States are light water reactors. Sixty-nine are pressurized water reactors (PWRs) and 35 are boiling water reactors (BWRs).

Cooling Water Sources and Methods

The required amount and usage of water by PWRs and BWRs is essentially the same. Both types of nuclear reactors are about 33 percent efficient which means that for every three units of thermal energy generated by the reactor core, one unit of electrical energy goes out to the grid and two units of waste heat must be exchanged with the surrounding environment.. This heat can be removed by either once-through cooling or closed-cycle cooling.

If the power plant is next to the sea, a big river, or large inland water body, it may be cooled simply by running a large amount of water through the condensers in a single pass and discharging it back into the sea, lake or river a few degrees warmer and without much loss from the amount withdrawn. That is the simplest and most economical method. The water may be salt or fresh. Some small amount of evaporation will occur off site due to the water being a few degrees warmer.

If the power plant does not have access to abundant water, cooling may be done by passing the steam through the condenser and then using a cooling tower or an on-site pond or canal for cooling the water. Normally the cooling is chiefly through evaporation, with direct heat transfer to the air being of less significance. The cooling tower or cooling basin evaporates up to 5% of the flow and the cooled water is then returned to the power plant's condenser. The 3 to 5% or so is effectively consumed, and must be continually replaced. Water evaporating from the cooling towers or cooling basins leads to an increasing concentration of impurities in the remaining coolant. Some bleed - known as "blowdown" - is needed to maintain water quality. Replacement water required is thus about 50% more than actual evaporation replacement.

Of the 104 US nuclear reactors, 60 use once-through cooling, 35 use wet cooling towers or cooling basins, and 9 use dual systems, switching according to environmental conditions.

A review of the sources of cooling water indicates that 21 of the sites obtain water from either the ocean or the great lakes, 17 sites obtain water from large rivers (Mississippi, Ohio, etc), 11 obtain water from large reservoirs on large rivers, 3 from non-traditional sources (groundwater, municipal waste water, precipitation) and 12 from small rivers. Of the 12 obtaining water from small rivers, 8 have total thermal requirements less than 5000 MWt. Only 4 plants have thermal requirements in the 7000 MWt range. The projected VCS site will have a thermal capacity of 9000 MWt making it the largest plant on a small river.

Oil and Gas Wells

Of the 64 sites investigated, 63 of the sites had no oil and gas wells present on-site, and one (the South Texas Project) had 2 wells on-site which were plugged and abandoned. Four of the sites had wells in the area around the site, including Comanche Peak, 37 gas wells in the Barret Shale with the closet 1.2 miles from the site, River Bend with 1 plugged and abandoned well 0.75 miles from the site, South Texas Project with 7 oil plus 26 gas plus 9 oil and gas wells within 6 miles of the site, and Wolf Creek with one plugged and abandoned well 2 miles from the site and one producing oil well 3 miles away. The proposed VCS has over 100 wells on site and 300 wells in the site vicinity.

Pipelines

Fifty-nine of the sites have no pipelines on the site and 5 do have pipelines. Three of the sites with pipelines have co-located fossil fuel generating plants which have a natural gas supply line for the facility. Two other have pipelines which cross the site, but are located away from the power block. Thirteen pipelines are found on or near the VCS site. Exelon plans to move the pipelines close to the power block, but they may leave the pipelines in the vicinity of the cooling basin.

Surface Faulting

Understanding the geologic, seismic and geotechnical engineering characteristics of a proposed nuclear power plant site and its surrounding region is a basic requisite for siting a new nuclear reactor. U.S. Nuclear Regulatory Commission (NRC) requirements in Part 52 of Title 10 of the Code of Federal Regulations (10 CFR Part 52) specify the process for obtaining an Early Site Permit (ESP) or a Combined License (COL) to build and operate a proposed nuclear power plant at a site. 10 CFR Part 100.23 further defines specific geologic and seismic siting criteria that must be met for the design of safety-related facilities at a proposed site. An applicant presents technical information on geologic, seismic, and geotechnical engineering characteristics for a proposed site in an SSAR.

The review of the SSAR focuses on five primary topics related to regional and site-specific geology, which are (1) tectonic information; (2) seismic source characterization; (3) the potential for surface faulting; (4) non-tectonic deformation; and (5) conditions caused by human activities. Emphasis is placed on Quaternary geologic features and processes. Nuclear power plants are designed to withstand the credible earthquakes ("Operating Basis Earthquake" and "Safe Shutdown Earthquake") with no damage to safety-related equipment per 10CFR100's Appendix A "Seismic and Geologic Criteria for Nuclear Power Plants." The pattern of the Earth's motion is considered as well as the strength of the vibrations.

None of the site investigated contained competent faults on site or showed evidence of recent non-tectonic faults or folds. Those in known seismically active zones were required to design equipment to withstand higher ground accelerations.

None of the sites had active growth faults on site. Although site specific data was not found for all sites within the time allowed for the review, those plants with no data were not within the geologic environment associated with growth faults. The South Texas Project delineated 10 subsurface growth faults near the site, but 8 were buried under at least 5000 ft with an age greater than 5 million years. The other two were located at least 3 miles from the site and were buried at least 800 ft. No evidence of recent movement was found.

The VCS site is the only site with faults showing evidence of current fault movement at the surface.

Summary

The VCS site, compared with the 64 sites that host the currently operation commercial reactors, ranks at the bottom of the list. The presence of 100's of active and abandoned oil and gas wells of unknown condition, the presence of several currently active growth faults, and questionable water availability for cooling the reactor demonstrate that the site is not suitable for the construction of a nuclear power station.

Alternative sites

Exelon's Environmental Report claims "there is no significant difference in environmental impact among the five candidate sites". As discussed in Contention 5, the Environmental Report fails to consider the VCS impact on the whooping crane habitat downstream, and does not consider the difference between using an unlimited source of ocean water versus using the limited and highly contested freshwater flows of the Guadalupe River.

Victoria Site

Negative impacts of constructing a nuclear power station at the Victoria County Site include:

1. Nearly 300 active or inactive oil and gas wells in or immediately surrounding the property boundary and13 oil and gas pipelines cross the site.

2. The diversion of from 75,000 to 105,000 acre-feet scarce surface water will have a negative impact on the many species with important habitat downstream of the VCS site. Most importantly, the endangered whooping crane. Several studies were performed to examine the inflows required in order to maintain the health of the downstream estuary. Each of these studies show that under current conditions, the amount of inflow required to maintain estuary health, and protect the whooping crane's food supply is met only sporadically. This brings into question whether there is actually any water available for diversion.

3. Diversion of makeup water for the cooling basin reduces the inflow of sediment and nutrients to the estuary.

4. Eight power transmission lines would be required for the VCS site, using six right-of-ways. This would total approximately 180 miles of new lines, and would occupy

approximately 4,700 acres. Transmission lines represent a major hazard to migrating birds such as the whooping cranes.

5. Cooling water would be pumped 18.5 miles to the site from the GBRA pumping station.

6. There are at least two, and perhaps as many as four, growth faults present or adjacent to the VCS site which have had significant historic and recent movement. These faults pass near the power block and cross the recirculating cooling pond.

7. Blow down water from the circulating cooling pond containing high total dissolved solids, unspecified proprietary chemicals, radionuclide's, and high concentrations of various inorganic salts will be discharged into the Guadalupe River and then into the estuary.

8. The site occupies over 11,500 acres including water reservoir occupying over 6,200 acres.

9. Active gas and oil wells will need to be discontinued and the mineral estate condemned.

Matagorda Site

Characteristics of the Matagorda site are:

1. The Matagorda Site, as originally proposed, would use a once through cooling water system supplied by salt water, pumped from the Gulf Intercoastal Water Way.

2. Site occupies 1,480 acres.

3. There are 3 oil and gas wells in the immediate vicinity of the site.

4. No oil and gas pipelines in the vicinity.

5. Matagorda cooling water would be piped 4.5 miles to the site, then 2.7 miles for discharge.

6. No growth faults have been noted in any of the publicly available studies reviewed which contain information on the vicinity of the Matagorda Site.

7. The plant does not affect fresh water inflows to estuaries.

8. This site would need four additional transmission lines, with one new 400-foot-wide right-of-way, running 11.5 miles. This would require only 560 acres of land.

9. Site may be at an elevation below the projected storm surge.

Conclusions

Based on the review of the license, relevant documents, and limited field investigations, JCHA concludes that Exelon's Victoria County Site is not suitable for the construction of a nuclear power station. Further, the COLA fails to acknowledge many severe environmental impacts and proposes no mitigation operations. The originally selected site in Matagorda County is clearly superior to the VCS site.

The JCHA team was comprised of a variety of university and private consulting personnel including; Geohydrologic Inc, Ciruli and Associates, George Sherk, PhD LLB, and Michael R. Walls and Company. This summary was prepared by Mr. Steven Lange who was also the primary author of the contentions. This document was reviewed and approved by Dr. John C. Halepaska.

JCHA appreciates the opportunity to assist you in this matter. If you have any questions, please contact me at the phone number or address shown on the letterhead.

Sincerely,

John C. Halepaska, PhD, P.E.
President

Comparison of Victoria Site to Commerical Reactor Sites

Name	unit	Owner	capacity (MW(e)	Type	Date on line	License Expiration Date	Cooling Water Source	Site Size (acres)	Oil and Gas Wells	Oil and Gas Pipelines	Faults	State	Location	Comments
Arkansas Nuclear One	Unit 1	Entergy	843	PWR	12/19/1974	05/20/2034	Once through cooling 947 MGD Lake Dardanelle 486,000 acre-feet	1100	None	None	Nearest fault zone 2 miles north of site	Arkansas	Located in southwestern Pope County, Arkansas, about 57 mi nw of little rock and 68 mi east of Fort Smith on a peninsula formed by Lake Dardanelle on the Arkansas River. The town of London, Arkansas is 2 mi nw of the site	
	Unit 2		995	PWR	03/26/1980	07/17/2038	Cooling tower Evaporation 17.28 MGD Blowdown 4.112 MGD Dardanelle Lake 486,000 acre-feet							
Beaver Valley	Unit 1	FirstEnergy Nuclear	892	PWR	10/01/1976	01/29/2016	Circulating water system using cooling towers with make up water from the Ohio river and blowdown discharge to Ohio river.	453	None	Yes Several	Interior Stable location with the lowest estimated ground acceleration of any plant. No faults on site	Pennsylvania	Located on the South Bank of the Ohio River in Shippingport Borough, Beaver County, PA. Lat 40.6219 deg N and lon 80.4339 deg W	
	Unit 2		846	PWR	11/17/1987	05/27/2027								
Braidwood	Unit 1	Exelon	1178	PWR	07/29/1988	10/17/2026	Recirculating cooling pond 2536 acres approximately 22,500 acre-feet. Makeup water supplied from Kankakee River	4457	None	none on Site 10 within 5 miles	Flat lying stratigraphy, upper units are shale, sandstones and coal beds. No faults on or near site	Illinois	Located in Reed Township of Will County in ne Illinois approximately 50 mi from chicago. It is adjacent to the village of Godley. Approximatelya 3 miles from the Kankakee River	Tritium present in groundwater 247,000 pCi/L 1998, law suit filed by surrounding residents, NRC says not a health problem
	Unit 2		1152	PWR	10/17/1988	12/18/2027								
Brown's Ferry	Unit 1	TVA	1065	BWR	08/01/1974	12/20/2033	Once through cooling 3171 MGD Lake Wheeler 67,000 acre lake 326,484 acre-feet	850	None	None	Underlain by undeformed limestone of Mississippian age. The immediate site vicinity has experienced little structural deformation	Alabama	Located on the north shore of Wheeler Reservoir in Limestone County, Alabama, at Tennessee River Mile 294. The site is approximately 30 mi west of Huntsville, 10 mi nw of Decatur, and	
	Unit 2		1104	BWR	03/01/1975	06/28/2034								
	Unit 3		1105	BWR	03/01/1977	07/02/2036								
Brunswick	Unit 1	Progress Energy	938	BWR	03/18/1977	09/08/2036	Once through circulating water diverted from the Cape Fear River and returned to the Atlantic ocean at a rate of up to 1.05 million	1200 (130 acres for facilities)	None	None	Located in stable interior with few recorded earthquakes in the last 200 years. No capable	North Carolina	Located in Brunswick County in SE North Carolina, near the mouth of the Cape Fear River	Tritium present in groundwater 1,300,000 pCi/l in 2007
	Unit 2		937	BWR	11/03/1975	12/27/2034								
Byron	Unit 1	Exelon	1164	PWR	09/16/1985	10/13/2024	Recirculation using cooling towers, makeup water from the Rock River	1782	None	Nearest pipeline approximately 5 miles from the	Located north of the inactive Sandwich Fault Zone	Illinois	Located in Ogle County, Illinois, 2 m east of Rock River. Coord lat 42:4:27 and long -89:16:55	
	Unit 2		1136	PWR	08/02/1987	11/06/2026								
Calaway	Unit 1	Ameren	1190	PWR	12/19/1984	10/18/2024	Recirculating using cooling tower makeup water from Missouri River approximately 20,000 gpm composed of 15,000 gpm evap and 5,000 gpm blow down	5228	None	Nearest pipeline, which carries nat gas, located 7.7 miles from site	No faults on site, geophysics indicated no stratigraphic displacement in subsurface strata	Missouri	The Callaway Plant is a nuclear power plant located on a 5,228-acre (21 km²) site in Callaway County, Missouri, near Fulton, Missouri.	Tritium present in groundwater at 200,000 pCi/l 2006
Calvert Cliffs	Unit 1	Constellation Nuclear	873	PWR	05/08/1975	07/31/2034	Once through cooling Obtains 1.2 million gallons per minute of brakish water from the Chesapeake Bay and returns without cooling.	2300	None	One Natural Gas pipeline within 5 miles of the site	No faults or folds detected on site. Nearest lineament approximately 1 mile away	Maryland	The Calvert Cliffs Nuclear Power Plant (CCNPP) is a nuclear power plant located on the western shores of the Chesapeake Bay in Lusby, Calvert County, Maryland.	
	Unit 2		862	PWR	04/01/1977	08/13/2036								
Catawba	Unit 1	Duke Energy	1129	PWR	06/29/1985	12/05/2043	Recirculating cooling water with cooling towers. Makeup water supplied from Lake Wylie at a rate of 71000 gpm with blowdown of 42,000 gpm	391	None	Nearest pipeline 16 miles from the site	In the Piedmont Geologic Provence in the Charlotte belt. Complex metamorphic terrain with no faults near the site, on earth quake found 60	South Carolina	Located in York County in north central South Carolina adjacent to Lake Wylie at lat 35:3:5 and long -81:4:10	Tritium present in groundwater at 42,000 pCi/L 2007
	Unit 2		1129	PWR	08/19/1986	12/05/2043								
Clinton	Unit 1	Exelon	1043	BWR	11/24/1987	09/29/2026	cooling water obtained from Clinton Lake (5000 surface acres).	14300	None	5 pipelines cross site. Closest 1 mi from sit	No evidence of surface faults or folded strata found on site	Illinois	The site is located in DeWitt County in east-central Illinois, 6 miles east of Clinton in Harp township.	Submitted ESP for second reactor at the site using AP1000 reactor design

Comparison of Victoria Site to Commerical Reactor Sites

Name	unit	Owner	capacity (MW(e)	Type	Date on line	License Expiration Date	Cooling Water Source	Site Size (acres)	Oil and Gas Wells	Oil and Gas Pipelines	Faults	State	Location	Comments
Columbia Generating	Unit 2	Energy Northwest	1131	BWR	12/13/1984	12/20/2023	Closed cycle cooling system with mechanical draft cooling towers makeup from Columbia River avg. 25,000 gpm max 37,500 gpm.	1089	None	None Nearest nat gas pipeline is 15 miles away	No evidence of surface faulting on site or in site vicinity	Washington	Located in Benton county, WA, on the Hanford Nuclear Site. Lat 46:28:18 -119:19:58	
Comanche Peak	Unit 1	Luminant Generation	1150	PWR	08/13/1990	02/08/2030	Cooling water from 3,228 acre Squaw Creek Lake built for the plant	7950	None on site, 37 Gas wells completed in the Barret shale closest is 1.2 miles from site	8 pipelines within 5 miles of the site, none of these are on site	No tectonic or growth faults or folds detected on site. Nearest lineament approximately 1 mile away	Texas	Comanche Peak Nuclear Power Plant is located in Somervell County Texas. The nuclear power plant is located 40 miles (65 km) southwest of Ft. Worth and about 60 miles (100 km) southwest of Dallas.	COL submitted for Units 3 and 4 currently under review by NRC
	Unit 2		1150	PWR	08/03/1993	02/02/2033								
Cooper	Unit 1	Entergy Nuclear of NE	758	BWR	07/01/1974	01/18/2014	Once through cooling from the Missouri River, max cap 640,000 gpm.	1359, facilities on 55 acres	None	None	No faults in immediate vicinity of the site. 3.5 magnitude earth quake felt in Nemaha County Dec 2009. Source unkown	Nebraska	Located in Nemaha county NE on the West bank of the Missouri River. Closest town Nemaha NE	License Renewal submitted in 2008 and is undergoing review
Crystal River 3	Unit 3	Progress Energy	838	PWR	03/13/1977	12/03/2016	Once through cooling water 680,000 gpm from Crystal Bay an embayment of the Gulf of Mexico	4700	None	None	No evidence of faulting or folding on plant site. Some evidence of Karst features north of the plant	Florida	Located in Northwestern Citrus County, FL,	Site shared with 4 fossil fuel fired generators
D. C. Cook	Unit 1	American Electric Power	1009	PWR	08/28/1975	10/25/2034	Once through circulating water system 1,600,000 gpm from lake Michigan	650	None	None	located on edge of the Michigan basin, no capable faults on site	Michigan	Located in Lake Charter Township, Berrien County, Michigan, on the southeastern shoreline of Lake Michigan	
	Unit 2		1060	PWR	07/01/1978	12/23/2037								
Davis-Besse	Unit 1	First Energy Nuclear	879	PWR	07/31/1978	04/22/2017	Recirculating system with cooling towers approximately 10,000 gpm evap plus unknown amounts of blowdown. makeup water from Lake Erie	954 (733 acres wildlife preserve)	None	None	The Bowling Green and Maumee faults run about 50 miles west of the Davis-Besse plant in Port Clinton	Ohio	Located in Carroll Township of Ottawa County Ohio. 7 miles north of Oak Harbor.	Built in Marsh land on shore of Lake Erie. Plant hit by Tornado and shut down for a year because of cracks in reactor head. Tritium at 24,000 pCi/l in 1990
Diable Canyon	Unit 1	Pacific Gas and Electric	1122	PWR	05/07/1985	11/02/2024	Once through cooling system with water withdrawn from the Pacific Ocean. 867,000 gpm per unit	750	None	None	Located in a seismically active area. Shoreline fault located 0.6 miles	California	Located adjacent to the Pacific Ocean in San Luis Obispo County CA at Lat 35:12:42 Lon -120:51:14	15 year construction period due to proving ability to withstand seismic stress
	Unit 2		1118	PWR	03/13/1986	08/20/2025								
Dresden	Unit 2	Exelon	867	BWR	06/09/1970	12/22/2029	Water (max 940,000 gpm) is drawn from the Kankakee River and Discharge to the Illinois River. Once through June 15 – Sept 30 (70,000 gpm makeup water). Uses cooling pond Oct through	2500	None	None	Closest fault is the Sandwich fault in Will County. Last movement probably during Mesozoic Era	Illinois	Located on the South Bank of the Illinois River and the west bank of the Kankakee River in Grundy and Will County	Unit 1 was retired in 1978. 3,200,000 pCi/l in 2004
	Unit 3		867	BWR	11/16/1971	01/12/2031								
Duane Arnold	Unit 1	Florida Power and Light	580	BWR	02/01/1975	02/21/2014	Closed cycle cooling system with cooling towers avg 8100 gpm evap and 3100 gpm bd diverted from the Cedar River.	500	None	None	No major active fault lines exist in Iowa, and Iowa is one of the most seismically stable states in the US. Large earthquakes associated with the New Madrid Fault of far southern Illinois and Missouri can occasionally be felt in eastern Iowa. No structures on or near the site.	Iowa	Located in Linn County IA on the Western bank of the Cedar river	

Comparison of Victoria Site to Commerical Reactor Sites

Name	unit	Owner	capacity (MW(e)	Type	Date on line	License Expiration Date	Cooling Water Source	Site Size (acres)	Oil and Gas Wells	Oil and Gas Pipelines	Faults	State	Location	Comments
Joseph M Farley	Unit 1	Southern Nuclear Operating Company	851	PWR	12/01/1977	06/25/2037	Closed Cycle cooling with mechanical cooling towers. Makeup water 61,000 gpm	1850	None	No oil or gas production in Southeastern Alabama.	No quaternary (> 1.6 MY BP) surface faults. On or near the site	Alabama	Located in Houston County in SE Alabama adjacent to the Chattahoochee River	
	Unit 2		860	PWR	07/30/1981	03/31/2041	diverted from the Chattahoochee River. BD 32,000 gpm							
Enrico Fermi	Unit 2	Detroit Edison	1122	BWR	01/23/1988	03/20/2025	Recirculating cooling system with twin cooling towers. Source Lake Erie	1260	None closer than 5 miles	None, closest pipelines app 5 miles from the site	No faults or folds on site. Some evidence of Karst in the region closes fault 25 miles away. Some borings had vugs to 2 inch in diameter	Michigan	Located in Frenchtown Township, Monroe County in SE Michigan on the bank of Lake Erie	Unit 1 operated form 1963 – 1978 was offline for four years because of a partial core melt down in 1966 and is currently being decommissioned
Fitzpatrick	Unit 1	Entergy	852	BWR	07/28/1975	10/17/2034	Once through circulating water system 352,600 from Lake Ontario.	702	None	Closest Natural gas pipelines 2.2 miles from site	No growth faults of seismic events post Quaternary Two brittle zones (fractures without significant displacement on site	New York	Located on the south shore of lake Ontario in the town of Scriba, NY	Located on same site as nine mile point 1 & 2. >20,000 pCi tritium in 1991
Fort Calhoun	Unit 1	Omaha Public Power district	482	PWR	09/27/1973	08/09/2033	Once through circulating water diverted from the Missouri river at 371,000 gpm	660	None	None	No surface expressions of faults in or near the site	Nebraska	Located on the southwestern bank of the Missouri river 10 miles north of downtown Omaha	
R. E. Ginna	Unit 1	Constellation Nuclear	498	PWR	07/01/1977	09/18/2029	Once through circulating water diverted from lake Ontario at a rate of 354,600 gpm	488	None	None	No site data found	New York	Located in the town of Ontario, NY in nw Wayne county NY on the south shore of Lake ontrario	20,000 pCi/l Tritium found in groundwater
Grand Gulf	Unit 1	Entergy	1268	BWR	07/01/1985	11/01/2024	Circulating cooling water with a natural draft cooling tower. Water supplied by radial wells in the Mississippi River Alluvium	2100	None	Nearest pipeline, which carries nat gas is 4.7 miles from the site	No growth faults or other surface faults within 90 miles of the site	Mississippi	Located in Claiborne county in southwestern Mississippi on the East bank of the Mississippi River	Planned unit 2 never completed. COL in process for a unit 3 at the site
Shearon Harris	Unit 1	Progress Energy	900	PWR	05/02/1987	10/24/2046	Recirculating cooling pond with cooling tower with 26,000 gpm makeup water from Harris reservoir	10700	None	One LPG pipeline located 1.2 miles from the site	No evidence of surface faults on or near site. Nearest competent fault app 25 miles away	North Carolina	Located in extreme southwest corner of Wake County NC on a peninsula that extends into Harris Reservoir	
Hatch	Unit 1	Southern Nuclear Operating Company	876	BWR	12/31/1975	08/06/2034	Recirculating using cooling towers with makeup supplied by the Altamaha river avg 40,000 gpm	2244	None	Existing natural gas pipeline app 4.5 mi from site	Located on the stable georgia coastal plane no recent faulting or folding noted on site	Georgia	Located in Appling county Georgia, on the Altamaha River	4,000,000 pCi Tritium found in the groundwater in 2003
	Unit 2		883	BWR	09/05/1979	06/13/2038	makeup with 22,600 gpm lost to evap							
Hope Creek	Unit 1	PSEG	1061	BWR	12/20/1986	04/11/2026	Recirculating using cooling towers with 42,000 gpm makeup supplied by the Delaware River with 9000 gpm lost to evaporation	153	None located withing 5 miles of the site	None located within 5 miles of the site	No recent bedrock faults of folds on site.	New Jersey	Located on the southern end of Artificial Island in lower Alloways Creek township, Salem County, NJ in the Delware River	Salem Nuclear plant located on the same property adjacent to this site.
Indian Point	Unit 2	Entergy	1020	PWR	08/01/1974	09/28/2013	Once through circulating water system with water drawn and returned to the Hudson River	239	None	1 30 inch and 2 24 inch natural gas pipelines on site	Possible active seismic zone discovered in 2008 less than one mile from the site	New York	Located on the eastern bank of the Hudson River at Indian Point, in the village of Buchanan, in upper Westchester county, NY	Indian point unit 1 a 275 mw, Th core, reactor, operated from sept 1962 to oct 1976 is in safe storage at the site pending decommissioning. 600,000
	Unit 3		1025	PWR	08/30/1976	12/15/2015								pCi/l Tritium in 2006
Kewaunee	Unit 1	Dominion Generation	556	PWR	06/16/1974	12/21/2013	Once through cooling system which extract water from and returns water to Lake Michigan	908	None	No nat gas pipeline within 10 miles no haz pipeline within 5 miles	None faults or folds known on site. Closest known fault is the Dutchman Creek Fault located north and west of the site.	Wisconsin	located on the west-central shore of Lake Michigan in Kewaunee, Wis app. 30 mile ESE of Green Bay	>20,000 pCi/l Tritium in 2006
La Salle County	Unit 1	Exelon	1118	BWR	01/01/1984	04/17/2022	On-site 2058 acre cooling lake used for recycling cooling system.	3055	None	no data available	no data available	Illinois	Located in rural LaSalle County in northern Illinois 75 miles SW of	

Comparison of Victoria Site to Commerical Reactor Sites

Name	unit	Owner	capacity (MW(e)	Type	Date on line	License Expiration Date	Cooling Water Source	Site Size (acres)	Oil and Gas Wells	Oil and Gas Pipelines	Faults	State	Location	Comments
La Salle County	Unit 2	Exelon	1120	BWR	10/19/1984	12/16/2023	Makeup water source ??	3600	None	No data available	No data available	Illinois	Chicago	
Limrick	Unit 1	Exelon	1134	BWR	02/01/1986	10/26/2024	Circulating cooling water with two natural draft cooling towers with makeup water from the Schuykill River. Can use mine pool water during drought	600	None	None	No Data. Unlikely	Pennsylvania	Located in Montgomery county PA, 2 miles se of Pottstown, 21 miles northwest of Philadelphia	
	Unit 2		1134	BWR	01/08/1990	06/22/2029								
McGuire	Unit 1	Duke Energy	1100	PWR	12/01/1981	06/12/2041	Once through circulating water obtained from 32,500 acre Lake Norman and returned to the Lake	30000	None	Closest pipeline 2 miles from site	No recently active folds or faults noted on site	North Carolina	The site is located in nw Mecklenburg County, North Carolina 6 miles west of Huntersville. Lat 35:25:59 long -80:56:55.	
	Unit 2		1100	PWR	03/01/1984	03/03/2043								
Millstone	Unit 2	Dominion Generation	877	PWR	12/26/1975	07/31/2035	Once through circulating water system withdrawn from Niantic Bay (part of Long Island Sound) and discharges to the granite quarry. Flow through unit 2 is max 548,800 gpm and Unit 3 is	525	None	None	Although there are faults in Connecticut, none are known to be active and no recent faults or folds are found on the plant site	Connecticut	The plant is located in Waterford Connecticut on Millstone Point adjacent to a granite quarry	Unit 1 shutdown in 1995 and permanently closed in July 1998. 34,000 pCi/L Tritium
	Unit 3		1145	PWR	04/23/1986	11/25/2045								
Monticello	Unit 1	Xcel Energy	572	BWR	06/30/1971	09/08/2030	hybrid once though 280,000 gpm withdrawn and returned to Mississippi River. Can be operated in closed circuit mode using onsite cooling towers	2150	None	None	No site data found	Minnesota	Located in the City of Monticello, Wright County. MN on the southern bank of the Mississippi River 30 miles upstream from Minn/St Paul	21,300 pCi/L Tritium found 2009
Nine Mile Point	Unit 1	Constellation Nuclear	621	BWR	12/01/1969	09/22/2029	Once through circulating water diverted from lake Ontario	900	None	Closest Natural gas pipelines 2.2 miles from site	localized deformation zone caused by normal fault exposed in excavation at site for Unit 2	New York	Plant located on the SE shore of Lake Ontario in the Town of Scriba, Oswega County, NY	COL submitted for Unit 3 submitted to NRC. Review temporarily suspended as site not selected for loan guarantees
	Unit 2		1140	BWR	03/11/1988	10/31/2046	Closed Cycle cooling with a cooling tower							
North Anna	Unit 1	Dominion Generation	903	PWR	06/06/1978	04/01/2038	Once through circulating water diverted from Lake Anna. When both units operations 1,960,000 gpm diverted. Cooled in waste heart treatment facility prior to	1075	None	No nat gas pipeline within 10 miles no haz pipeline within 5 miles	Fault discovered in excavations for abandoned unit 3 & 4. Determined to be not capable by D&M (last	Virginia	Located in Louisa County in NE Virginia on a peninsula on the southern shore of Lake Anna. Lat 38:3:36 lon 77:47:23	Approved ESP for Unit 3, COL application submitted for unit 3. Original technology ESBWR change 5/2010 to US-APWR. COLA revised
	Unit 2		903	PWR	12/14/1980	08/21/2040								
Oconee	Unit 1 Unit 2 Unit 3	Duke Energy	846 846 846	PWR PWR PWR	07/15/1973 09/09/1974 12/16/1974	02/06/2033 10/06/2033 07/19/2034	Once through circulation water diverted from 952,000 ac-ft Lake Keowee	510	None	None	No surface expressions of faults in or near the site	South Carolina	Located in eastern Oconee County, South Carolina app 8 mile NE of Seneca, SC	Part of an integrated facility that incudes hydropower plants and an pump-storage plant. 24,500 pCi/l
Oyster Creek	Unit 1	Exelon	619	BWR	12/01/1969	04/09/2029	Once through circulation water diverted from Barnegat Bay at around 1 million gpm.	800	None	Closest natural gas pipeline app 2 miles from site	No site data found	New Jersey	Located adjacent to Barnegat Bay in Lacey and Ocean Townships, Ocean county, New Jersey	Oldest operating commercial nuclear power plant. 4,160,000 pCi/L Tritium in groundwater
Palisades	Unit 1	Entergy	778	PWR	12/21/1971	03/24/2031	Closed cycle cooling system with two cooling towers. Makeup at 98,000 gpm withdrawn from Lake Michigan with 12,000 gpm evaporation	432	None	Closest Natural gas pipeline 5 miles from site	No site data found	Michigan	Located on the eastern shore of Lake Michigan in Covert Township on the western side of Van Buren county	34,600 pci/L Tritium found in groundwater

Comparison of Victoria Site to Commerical Reactor Sites

Name	unit	Owner	capacity (MW(e)	Type	Date on line	License Expiration Date	Cooling Water Source	Site Size (acres)	Oil and Gas Wells	Oil and Gas Pipelines	Faults	State	Location	Comments
Palo Verde	Unit 1	Arizona Power Project	1311	PWR	01/28/1986	06/01/2025	Palo Verde is the only plant in the US that does not withdraw cooling water from a natural water body. Make water is supplied as reclaimed water from two Phoenix area sewage treatment plants and store in on-site 85 acre pond. (45 acre pond under constructions) Blowdown discharges to two	4280	None	None	No site data found	Arizona	Located in Maricopa county approximately 26 miles west of the nearest boundary of the Phoenix Metro Area	4,200,000 pCi/l Tritium found in the groundwater in 1993
	Unit 2		1314	PWR	09/19/1986	04/24/2026								
	Unit 3		1247	PWR	01/08/1988	11/25/2027								
Peach Bottom	Unit 2	Exelon	1112	BWR	07/05/1974	08/08/2033	Once through cooling system 1,500,000 gpm diverted from and returned to Conowingo Pond, a 9000 acre reservoir on the Susquehanna River. Originally cooled return flow with cooling towers, but discontinued in 1995	620	None	Transco gas line 3 miles from site	No site data found	Pennsylvania	Located in Peach Bottom Township, york County, Penn on the west side of Conowingo pond. Lat 39:75:89 lon -76:26:92	Unit 1 operated from 1966 to 1974. 123,000 pCi/L Tritium found in groundwater
	Unit 3		1112	BWR	12/12/1974	07/02/2034								
Perry	Unit 1	First Energy Nuclear	1245	BWR	11/18/1987	03/18/2026	Cooling tower with makeup water from lake erie	1100	None	none on site	The Middleburg fault is about 50 miles west. No evidence of on-site	Ohio	located on the south bank of lake erie. Lat 41:48:3 long -81:8:38	59,900 pCi/L found in 2006
Pilgrim	Unit 1	Entergy	685	BWR	12/01/1972	06/08/2012	Once through cooling water system diverted from Cape Cod Bay at 311,000 gpm	1600	None	Nearest pipeline 5.5 miles from site	No site data found	Massachusetts	located on the western shore of Cape Cod Bay in the Town of Plymouth, Plymouth County	
Point Beach	Unit 1	FPL Energy	512	PWR	12/21/1970	10/05/2030	Once through circulating water diverted from Lake Michigan at 350,000 gpm per condenser	1260	None	None indicated in data found	No site data found	Wisconsin	Located on the western shore of Lake Michigan in Manitowoc County Wisconsin app 30 miles se of Green bay	
	Unit 2		514	PWR	10/01/1972	03/08/2033								
Prairie Island	Unit 1	Xcel Energy	551	PWR	12/16/1973	08/09/2013	Cooling water is withdrawn from the Mississippi River limited to a max of 630,000 gpm. Hybrid system allows operation in once through, closed circuit with cooling towers and helper mods	578	None	Nearest pipeline approximately 5 miles	None	Minnesota	Prairie Island nuclear plant is locate on the west bank of the Mississippi River in Goodhue County within the city limits of Red Wing, Minnesota at -92:27.9 long and 44:37.3 lat	
	Unit 2		545	PWR	12/21/1974	10/29/2014								
Quad Cities	Unit 1	Exelon	867	BWR	02/18/1973	12/14/2032	Condenser cooling by once through system with water from the Mississippi River at 970,000 gpm	765	None	Unknown	No evidence of surface faulting on site or in site vicinity	Illinois	located in Rock Island County, Illinois on the east bank of pool 14 of the Mississippi River	3,000,000 pCi/l Tritium found in 2008
	Unit 2		867	BWR	03/10/1973	12/14/2032								
River Bend	Unit 1	Entergy	970	BWR	06/16/1986	08/29/2025	Cooling provided by circulating water system with cooling towers. Makeup water is supplied by and blowdown discharge to, the Mississippi River	3300	None on site, one plugged and abandoned well 0.75 miles west of site	Nearest pipelines, which carry natural gas, are approximately 2.1 miles from the site. Approximately 10 pipelines within 10 miles of the	There is no evidence for Quaternary tectonic surface faulting or fold deformation on the site. Additionally, within 5 miles, there is negligible potential of surface deformation associated with growth faults or salt	Louisiana	Located in the southeastern corner of West Feliciana parish, LA on the east bank of the Mississippi River.	Application for unit 3 submitted 9/25/2008. Unit 2 was permitted by cancelled. 129,000 pCi/l Tritium found in groundwater in 2008
H B Robinson	Unit 2	Progress Energy	710	PWR	03/07/1971	07/31/2030	Once through circulating water system with water supplied from Lake Robinson.	5000	None	Gas pipeline to the internal combustion plant located 1.4 miles from nuclear plant	No site specific data found	South Carolina	Located in northeastern South Carolina in Darlington County. Site includes CP&L Internal combustion turbine plant	Unit 1 is a fossil fuel fired plant (coal)
Saint Lucie	Unit 1	Florida Power and Light	839	PWR	12/21/1976	03/01/2036	Once through circulating water supplied from the Atlantic ocean	1130	None	None	No site specific data found	Florida	located on Hutchinson Island, a barrier Island in the Atlantic ocean, St Lucie County Florida	
	Unit 2		839	PWR	08/08/1983	04/06/2043								

Comparison of Victoria Site to Commerical Reactor Sites

Name	unit	Owner	capacity (MW(e)	Type	Date on line	License Expiration Date	Cooling Water Source	Site Size (acres)	Oil and Gas Wells	Oil and Gas Pipelines	Faults	State	Location	Comments
Salem	Unit 1	PSEG	1174	PWR	06/30/1977	08/13/2016	Once through circulating cooling water system that withdraws brackish water from the Delaware Estuary at a maximum of 2.1 million gallons per minute.	220	None located withing 5 miles of the site	None located within 5 miles of the site	None	New Jersey	Located in Lower Alloways Creek Township, Salem County, New Jersey on an artificial Island in the Delaware River.	Located on the same Island as Hope Creek
	Unit 2		1130	PWR	10/13/1981	04/18/2020								
San Onofre	Unit 2	Southern California Edison	1070	PWR	08/08/1983	02/16/2022	Once through circulating water from the pacific ocean	84	None	None	Designed for 7.0 earthquake 5 miles distant	California	located near camp pendleton in Northern San Diego County	Unit 1 operated for 25 years and was permanently closed in 1992
	Unit 3		1080	PWR	04/01/1984	11/15/2022								
Seabrook	Unit 1	FPL Energy	1245	PWR	09/19/1990	10/17/2026	Once through circulating water diverted from Atlantic ocean	889	None	none on Site	No site specific data found	New Hampshire	Located in the town of Seabrook, Rockingham County, New Hampshire, two miles west of the Atlantic ocean	Unit 2 was 25 percent complete when it was discontinued in 1984
Sequoyah	Unit 1	TVA	1148	PWR	07/01/1981	09/17/2020	Recirculating cooling system using cooling towers with water supplied by Lake Chickamauga	525	None	none on Site	No site specific data found	Tennessee	SQN is located in Hamilton County in southeast Tennessee near the cities of Soddy Daisy, Cleveland, and Chattanooga. abutting Chickamauga Lake, a lake created from the Tennessee River near	
	Unit 2		1126	PWR	06/01/1982	09/15/2021								
South Texas	Unit 1	South Texas Project Nuclear Operating Co	1280	PWR	08/25/1988	08/20/2027	7,000 acre-ft cooling pond, 45 feet deep. Certificate of adjudication for 102,000 ac-ft currently uses 37,084 ac-ft max div rate 540,000 gpm. Priority date June 1989	12220	TRRC files indicate 2 abandoned and plugged wells on site, and 7 oil, 26 gas, and 9 oil and gas	There are 14 pipelines and 5 gas/oil fields within 5 miles of the site.	10 growth faults in the site vicinity, 8 of which are buried by at least 5000 ft of sediment with an age greater than 5 million years. 2 faults within 800 to 1000 ft from surface and 3.8 and 3.0 miles from the site. No evidence of recent	Texas	Located in rural Matagordo County, Texas on the west bank of the Colorado River approximately 10 miles from Matagordo Bay and 70 miles from Houston, TX	COLA submitted for units 3 and 4 planned to be advanced boiling water reactors.
	Unit 2		1280	PWR	06/19/1989	12/15/2028								
Virgil C. Summer	Unit 1	South Carolina elec and gas	966	PWR	01/01/1984	08/06/2042	Cooling water is withdrawn from Monticello Reservoir (upper storage basin for pump storage unit) at a rate of 513,000 gpm, passed through the condensers, and returned to the reservoir.	2560	None	One gas line, which supplies the Parr combustion station located approximately 1.2 miles from the site	12 bedrock faults within 25 miles of the site (closest is 2 mi). No evidence of post Quaternary movement.	South Carolina	Located in Fairfield County, South Carolina approximately 15 miles from Winnsboro and 26 miles from Columbia	Site includes Parr Combustion turbine generating station and a pump-storage hydro unit. COLA submitted for units 2 and 3
Surry	Unit 1	Dominion Generation	799	PWR	12/22/1972	05/25/2032	Once through cooling system with 1,680,000 gpm water withdrawn directly from the James River and returned	840	None	Oil and gas pipelines provides fuel to the combustion turbines	No evidence of faulting at the site found during drilling and construction. Site not active since Cretaceous Perioc	Virginia	Located on the south side of the James River on a peninsula (Hog Island) at 37:9:58 -76:41:53	Site included the Gravel Neck Combustion Turbine Generating Station. Originally designed for 4 units but 3 and 4 were cancelled
	Unit 2		799	PWR	05/01/1973	01/19/2033								
Susquehanna	Unit 1	PPL Corp	1149	BWR	06/08/1983	07/17/2022	Closed cycle cooling with cooling towers. App 40,500 gpm Makeup water supplied from and blowdown sent to, the Susquehanna Rive	1173	None	Closest Natural gas pipeline approximately 2 miles from site	No site specific data found	Pennsylvania	Located in Salem township, Luzerne county, Penn on the west bank of the Susquehanna river	
	Unit 2		1140	BWR	02/12/1985	03/23/2024								
Three Mile Island	Unit 1	Exelon	786	PWR	09/02/1974	04/19/2014	Closed cycle cooling with cooling towers. Makeup water supplied from the Susquehanna River at 12,250 gpm (max 15,250 gpm). Blowdown at 3000 gpm (max 6000 gpm) returned to the river	814	None	Closest Natural gas pipeline 5 miles from site	No site specific data found	Pennsylvania	Located in Londonderry Township in Dauphin County on the northern end of three mile island near the eastern shore of the Susquehanna River.	Unit 2 permanently shut down March 28, 1982 after the most significant accident in US nuclear history in 1979
Turkey Point	Unit 3	FPL Energy	693	PWR	12/14/1972	07/19/2032	The site contains 168 miles of cooling water canals. No surface water or groundwater is diverted	3280	None	Closest Natural gas pipeline is 1 mile from site and	No evidence of faulting or folding is found on the site or in the site vicinity.	Florida	Located on the shore of Biscayne Bay in Miami-Dade County, FL 25 miles south of Miami. 25:26:04 -	Units 1 and 2 are fossil fuel fired plants and unit 5 is a natural gas combined cycle generating plant. COLA has

Comparison of Victoria Site to Commerical Reactor Sites

Name	unit	Owner	capacity (MW(e)	Type	Date on line	License Expiration Date	Cooling Water Source	Site Size (acres)	Oil and Gas Wells	Oil and Gas Pipelines	Faults	State	Location	Comments
Turkey Point		FPL Energy					for the cooling system. Rainfall	5300	None			Florida		
	Unit 4		693	PWR	09/07/1973	04/10/2033	provides makeup water. Water in canals has salinity 55 parts per thousand (bay is 35 parts to 35			supplies the combined cycle generation plant	Solution feature called potholes found in the limestones beneath the site area		80:19:52	been submitted for units 6 and 7,
Vermont Yankee	Unit 1	Entergy	620	BWR	11/30/1972	03/21/2012	Hybrid cooling system which can be operated in once through mode or recycle mode with or without use of onsite cooling towers. Water is diverted and blowdown returned to the Connecticut river.	125	None	No pipelines within 5 miles of the site	No site specific data found	Vermont	Located in the town of Vernon, Vermont in Windham County on the west shore of the Connecticut River immediately upstream of Vernon Hydroelectric plant	
Vogtle	Unit 1	Southern Operating Company	1109	PWR	06/01/1987	01/16/2027	Closed cycle cooling system with cooling toweres which diverts 22,000 to 44,000 gpm makeup water from and discharges blowdown water to, the Savannah River	3169	None	No pipelines within 10 miles of the site	4 bedrock faults within 5 miles of the site. Youngest strata penetrated is Eocene. No features indicating Quaternary movement	Georgia	Located on the Atlantic Coastal Plain on the southwest side of the Savannah River in eastern Burke County	ESP and Cola submitted to Units 3 and 4 AP1000 reactors
	Unit 2		1127	PWR	05/20/1989	02/09/2029								
Waterford	Unit 3	Entergy	1157	PWR	09/24/1985	12/18/2024	Once through circulating water diverted from the Mississippi River.	3000	two plugged and abandoned dry holes within 1 mile of site	Non on site, likely some in the site vicinity	none on Site. Located midway between the Frenier Growth fault and the Thibodaux growth fault zones	Louisiana	located in Saint Charles Parish, on the Mississippi River near Taft, LA	
Watts Bar	Unit 1	TVA	1123	PWR	05/27/1996	11/09/2035	Closed cycle cooling with cooling towers. Makeup water supplied from, and blow down discharged to, the Tennessee River 11,300 gpm evap loss.	1770	None	No pipelines are located in the vicinity of the nuclear plant	The foundation strata are folded, contorted, crumpled, sheared, and broken by small faults. These features are confined to the Middle Cambrian Conasauga Formation, a weaker shale and limestone unit lying between more massive sandstones on the Rome formation and the massive overlying dolomite of the Knox formation	Tennessee	Watts Bar Nuclear Plant is located in Rhea county, just south of Watts Bar Reservoir on the Tennessee River near Spring City in east Tennessee.	Unit 2 under construction. In 1988 TVA suspended construction of Unit 2 because of a reduction in the predicted growth of power demand. Submitted request to restart construction of unit 2 with FEIS dated 6/2007. Unit currently scheduled to begin operation in 2012
Wolf Creek	Unit 1	Wolf Creek Nuclear Operating	1166	PWR	09/03/1985	03/11/2045	Once through with cooling lake. Extracts 500,000 gpm from 5,090 acre Coffey County Lake, which has makeup water supplied from the Neosho River when needed (normally sufficient water provided by the watershed)	9818	None (one plugged and abandoned well 2 miles from the site one producing oil well 3.0 miles away)	None	No faults or folds in the site vicinity. Located in stable craton, nearest structure over 30 miles away	Kansas	Located in Coffey County, Kansas on the shores of Coffey County Lake (formerly known as Wolf Creek Cooling Pond), 75 miles southwest of Kansas City near Burlington	
Victoria County Station (proposed)	Unit 1	Exelon	<1325				Recirculating cooling pond with makeup at 75,000 acre-ft per year from the Guadalupe River	11500	Over 100 wells on site, 300 in the site vicinity	13 pipelines on site	Several growth faults on site	Texas	currently has a ESP application before the NRC	
	Unit 2		<1325											
Matagordo Location (site	Unit 1	Exelon					Once through circulating water using water from the Gulf of	1480	3 abandoned	none on Site	No growth faults	Texas	Original Exelon selected this site as the preferred location for the power	

Comparison of Victoria Site to Commerical Reactor Sites

Name	unit	Owner	capacity (MW(e)	Type	Date on line	License Expiration Date	Cooling Water Source	Site Size (acres)	Oil and Gas Wells	Oil and Gas Pipelines	Faults	State	Location	Comments
rejected)	Unit 2	Exelon					Mexico	1400	wells in the plant vicinity	None on site	indicated	Texas	plant	

EXHIBIT D-2

HALEPASKA AND ASSOCIATES

Texans for a Sound Energy Policy

Contested Issues Concerning Early Site Permit Exelon's Victoria County Station

Texas Parks & Wildlife

International Crane Foundation

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Project No. 5971
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Contested Issue 1

Contested Issue 1

Exelon's Environmental Report, contained in the ESP application, fails to include a Consistency Determination Issued by the Texas Coastal Coordination Council as Mandated by the Coastal Zone Management Act. The Environmental Report states that the site is not located within the Texas Coastal Management Zone. However, site impacts, such as those resulting from the withdrawal of cooling water from the Guadalupe River, do impact the Texas Coastal Management Zone.

Issue Statement

1. Requirements of the Coastal Zone Management Act (CZMA).

   A. The relevant language of the CZMA leaves little room for interpretation:

      After final approval by the Secretary of a state's management program, any applicant for required Federal license or permit to conduct an activity, *in or outside of the coastal zone, affecting any land or water use or natural resource of the coastal zone* of that state *shall* provide in the application to the licensing or permitting agency a certification that the proposed activity complies with the enforceable policies of the state's approved program and that such activity will be conducted in a manner consistent with the program. At the same time, the applicant *shall* furnish to the state or its designated agency a copy of the certification, with all necessary information and data.

      16 USC §1456(c)(3)(A) (emphasis added)

   B. This section of the CZMA also requires the applicant to provide the state agency with a copy of the applicant's certification statement and requires the state agency to notify the federal agency "at the earliest practicable time" whether the state agency concurs in or objects to the applicant's consistency certification.

   C. With regard to the requirement in the CZMA that the state's management program receive final approval by the Secretary of Commerce, the Texas Coastal Management Program (CMP), which is to be administered by the Coastal Coordination Council, received such approval on 10 January 1997. The CMP appears at Title 31, Part 16 of the Texas Administrative Code.

2. Requirements of regulations implementing the Coastal Zone Management Act.

   A. Regulations implementing the CZMA were issued by the National Oceanic and Atmospheric Administration, U.S. Department of Commerce. As with the

language of the CZMA, the language of the implementing regulations leaves little room for interpretation.

B. The term "federal license or permit" is defined in 15 CFR §930.51(a):

> The term "federal license or permit" means any authorization that an applicant is required by law to obtain in order to conduct activities affecting any land or water use or natural resource of the coastal zone and that any Federal agency is empowered to issue to an applicant.

C. Requirements regarding consistency certifications are included in 15 CFR §930.57(a)(emphasis added):

> Following appropriate coordination and cooperation with the State agency, all applicants for required federal licenses or permits subject to State agency review *shall* provide in the application to the federal licensing or permitting agency a certification that the proposed activity complies with and will be conducted in a manner consistent with the management program. At the same time, the applicant *shall* furnish to the State agency a copy of the certification and necessary data and information.

D. With regard to the "necessary data and information" requirement, 15 CFR §930.58(a)(3) provides: "Applicants *shall* demonstrate that the activity will be consistent with the enforceable policies of the management program." (emphasis added)

E. The requirement of state agency action regarding an applicant's consistency determination is addressed in 15 CFR §930.62(a): "At the earliest practicable time, the State agency shall notify the Federal agency and the applicant whether the State agency concurs with or objects to a consistency certification."

3. Exelon was aware of these statutory and regulatory requirements.

A. With regard to the relicensing of Exelon's Oyster Creek facility, Exelon acknowledged the need for a consistency determination by the New Jersey Department of Environmental Protection as a condition precedent to relicensing.

i. Part 1: General and Administrative Information (p. 5):

> "In July 2005, Generation applied for license renewal for Oyster Creek on a timeline consistent and integrated with the other planned license renewal filings for the Generation nuclear fleet. … [I]n January 2008,

Generation received a letter from the NJDEP concluding that Oyster Creek's continued operation is consistent with New Jersey's Coastal Management Program, and approving Oyster Creek's coastal land use plans for the next 20 years. This consistency determination is a necessary element for license renewal."

ii. Exelon Corporation and Subsidiary Companies, Exelon Generation Company, LLC and Subsidiary Companies, Commonwealth Edison Company and Subsidiary Companies, PECO Energy Company and Subsidiary Companies, Combined Notes to Consolidated Financial Statements (p. 237):

"Further, in January 2008, Generation received a letter from the NJDEP concluding that Oyster Creek's continued operation is consistent with New Jersey's Coastal Management Program, and approving Oyster Creek's coastal land use plans for the next 20 years. This consistency determination is a necessary element for license renewal."

iii. EXELON CORPORATION AND SUBSIDIARY COMPANIES, EXELON GENERATION COMPANY, LLC AND SUBSIDIARY COMPANIES, COMMONWEALTH EDISON COMPANY AND SUBSIDIARY COMPANIES, PECO ENERGY COMPANY AND SUBSIDIARY COMPANIES, COMBINED NOTES TO CONSOLIDATED FINANCIAL STATEMENTS (pp. 39-40):

"Further, in January 2008, AmerGen received a letter from the NJDEP concluding that Oyster Creek's continued operation is consistent with New Jersey's Coastal Management Program, and approving Oyster Creek's coastal land use plans for the next 20 years. This consistency determination is a necessary element for license renewal."

B. Consistency review is included in Table 1.2-1: Permits / Authorizations / Consultations Required for Preconstruction/Construction Activities. Part 3: Environmental Report (p. 1.2-3)

4. Exelon failed to fulfill these statutory and regulatory requirements:

A. Rather than comply with these requirements, Exelon stated in the ESP application that it the project was not located in the Texas Coastal Management Zone

B. Exelon apparently is not seeking consistency certification from the Texas Coastal Coordination Council.

C. In part, Exelon's failure to seek a consistency determination from the Texas Coastal Coordination Council may be based on the mistaken belief that the project needs to be located within the Texas coastal zone for the requirements of the CZMA to be applicable:

i. "The proposed VCS site is not located in the Texas Coastal Management Zone." (p. 2.2-1)

ii. If there is uncertainty regarding this issue, it may derive from the regulations of the Coastal Coordination Council.

a. In relevant part, Title 31, Part 16, Rule §506.12 of the Texas Administrative Code provides:

(a) For purposes of this section, the following federal actions within the CMP boundary may adversely affect coastal natural resource areas (CNRAs):

***

(2) Federal Agency Actions.

***

(F) Nuclear Regulatory Commission. Licenses under §103 of the Atomic Energy Act of 1954, 42 United States Code Annotated, §2133.

b. This language could be interpreted to mean that only federal agency activities within the CMP boundary are subject to the CZMA consistency determinations.

c. To the extent that such a reading would limit applicability of the CZMA, it would be subject to preemption by the federal law. As noted above, the CZMA requires a consistency determination if the federal agency action is located within the coastal zone *or* if the federal agency action would affect "any land or water use or natural resources of the coastal zone[.]"

6. Failure to fulfill these statutory and regulatory requirements renders the Exelon ESP application incomplete.

   A. The CZMA requires a determination by the Texas Coastal Coordination Council that issuance of the ESP by the Nuclear Regulatory Commission is consistent with the Texas Coastal Zone Management Program.

   B. Exelon is required to include such a consistency determination in its ESP application.

7. Fulfilling the CZMA statutory and regulatory requirements is material to the findings the NRC must make regarding Exelon's ESP application.

8. A genuine dispute exists with the applicant on a material issue of fact or law.

   A. Exelon appears to believe that as the plant is not located within the Texas Coastal Management Zone it is unnecessary to fulfill the requirements of the CZMA and its implementing regulations.

   B. Petitioners believe that the CZMA and its implementing regulations require issuance of a consistency determination by the Texas Coastal Coordination Council as a condition precedent to NRC action on the Exelon ESP application.

   C. Until the requisite consistency determination has been issued by Texas Coastal Coordination Council and filed by Exelon with the NRC, Exelon's ESP application will be incomplete.

Contested Issue 2

Contested Issue 2

Exelon's Environmental Report Fails to Document Both the Actual and the Legal Availability of the Quantity of Water Needed by Exelon to operate the VCS plant. According to the ESP, Exelon will obtain the legal rights to divert this water by either leasing existing water rights, buying existing water rights, applying for new water rights, or some combination of these. The only entity with enough water to lease is the Guadalupe-Blanco River Authority (GBRA) from whom Excelon had previously entered into an agreement to supply 75,000 acre-feet of water from the Guadalupe River to the project.

Issue Statement

1. Water Available from GRBA.

   A. Previously, Exelon and the Guadalupe-Blanco River Authority (GBRA) had entered into a *Reservation Agreement Between Guadalupe-Blanco River Authority and Exelon Generation Company, LLC* (the Reservation Agreement). This agreement has been allowed to lapse, but is the water purportedly available for lease.

   B. Exelon requires 75,000 acre-feet of water per year for use by Exelon at the proposed generating facility.

   C. GBRA has stated that it currently has a water supply of more than 75,000 acre-feet per year available … to the extent water is available under GBRA's interests in the Run-of-River Rights[.]"

      i. GBRA's Run-of-River Rights" are available from Certificates of Adjudication Nos. 18-5173, 18-5174, 18-5175, 18-5176, 18-5177, and 18-5178, each as amended."

      ii. Certificate of Adjudication No. 18-5178 with a priority date of 7 January 1952 is the most likely source of the leased water.

      iv. The 75,000 acre-feet would represent most of the remaining water supply that GBRA has available for commitment on a long-term basis within its ten-county statutory district."

      v. GBRA has also reserved an additional 5,000 acre-feet of water per year "to account for losses in the Canal System" that would deliver water to Exelon.

2. SubContested Issue 1: A Federal Reserved Water Right Mandating Freshwater Inflows for the Aransas National Wildlife Refuge Precludes Use of the Waters of the Guadalupe River as Anticipated by existing GBRA rights.

   A. Federal property: The Aransas National Wildlife Refuge.

      i. Federal authority is based on Article IV, Section 3, the Property Clause of the Constitution ("Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States").

      ii. Establishment of the Aransas National Wildlife Refuge:

         a. The Aransas Migratory Waterfowl Refuge (now the Aransas National Wildlife Refuge) was established by President Franklin D. Roosevelt on 31 December 1937 under Executive Order No. 7784

         b. Executive Order No. 7784 provides as follows:

            Executive Order Establishing the Aransas Migratory Waterfowl Refuge, Texas

            By virtue of and pursuant to the authority vested in me as President of the United States and in order to effectuate further the purposes of the Migratory Bird Conservation Act (45 Stat. 1222), it is ordered that the lands acquired, or to be acquired, by the United States within the following-described area, comprising approximately 47,215 acres, in Aransas and Refugio Counties, Texas, be, and they are hereby, reserved and set apart, subject to valid existing rights, for the use of the Department of Agriculture as a refuge and breeding ground for migratory birds and other wildlife: *Provided*, that any private lands within the area described shall become a part of the refuge hereby established upon the acquisition of title thereto or lease thereof by the United States:

            All that part of Blackjack Peninsula, including Bludworth Island, Cape Carlos, and the small island near the westernmost point of Cape Carlos, lying between St. Charles Bay and San Antonio Bay, south of the following-described line:

Beginning at a point at the head of St. Charles Bay, on the west bank and at the mouth of Twin (Willow) Creek, said point being marked with a U.S. Biological Survey standard concrete post;

Thence from said initial point, upstream with the west bank meanders of Twin (Willow) Creek, northwesterly, 122.304 chains, to a point;

Thence crossing Twin (Willow) Creek and Blackjack Peninsula N. 13°39′ E., 48.90 chains; N. 18°06′ E., 42.81 chains; N. 12°13′ E., 2.271 chains; S. 0°49′ E., 80.08 chains; N. 89°12′ E., 94.53 chains; N. 0°43′ W., 39.85 chains; N. 89°11′ E., 119.08 chains; N. 0°51′ W., 80.04 chains; N. 89°15′ E., 120.03 chains; N. 0°44′ W., 61.58 chains; N. 89°07′ E., 76.70 chains; S. 1°30′ E., 40.44 chains; S. 89°28′ E., 40.27 chains; South, 0.352 chain; East, 0.188 chain; S. 0°28′ E., 6.85 chains; N. 89°31′ E., 163.06 chains, to a point on Webb Point on the west shore of San Antonio Bay, said point being marked with a U.S. Biological Survey standard concrete post sent in a shell bank.

This reservation shall be known as the Aransas Migratory Waterfowl Refuge.

Franklin D. Roosevelt
The White House
December 31, 1937

c. The lands included in the Aransas Migratory Waterfowl Refuge were either then owned by the United States or were to be acquired by the United States. President Roosevelt made specific reference to the "lands acquired" *and* the "lands to be acquired" by the United States.

B. The Aransas National Wildlife Refuge federal reserved water right:

i. Establishment of the reserved water rights doctrine:

a. The reserved water rights doctrine emerged from the decision of the Supreme Court in *Winters v. United States*, 207 U.S. 564 (1908). At issue in *Winters* was the reservation of land from the public domain for the Indians of the Fort Belknap Reservation in Montana. The question before the Supreme Court was whether the reservation of land also reserved water as needed for the purposes of the reservation.

b. When it concluded that the reservation of water was a "necessary implication" of the reservation of land for the Indians of the Fort Belknap Reservation, the Supreme Court established the reserved water rights doctrine.

c. In essence, under the reserved water rights doctrine, when lands are reserved from the public domain for a specific federal purpose, the minimum quantity of water needed to fulfill the primary purpose(s) of the reservation is reserved by implication from water unappropriated as of the time of the reservation.

ii. Expansion of the reserved water rights doctrine:

a. The reserved water rights doctrine was expanded beyond Indian water rights when the Supreme Court ruled in *Cappaert v. United States*, 426 U.S. 128 (1976), that the reservation of land for the Devil's Hole National Monument included the reservation of sufficient water to preserve the habitat of the pupfish (a species mentioned in the declaration creating the monument).

b. In *Arizona v. California*, 373 U.S. 546 (1963), the Supreme Court ruled that the reserved water rights doctrine "was equally applicable to other federal establishments such as National Recreation Areas and National Forests." 373 U.S. at 601. This ruling led a federal district court in *Sierra Club v. Block*, 622 F. Supp. 842 (D.C. Colo. 1985), to observe that the *Arizona v. California* court based the reservations not on ownership of the water but on federal power to regulate navigable waters under the Commerce Clause and to regulate government lands under the Property Clause. The district court also spoke of this power in terms of federal supremacy: "We have no doubt about the power of the United States under these clauses to reserve water rights for its reservations and its property." 622 F. Supp. at 852 (*quoting Arizona v. California*, 373 U.S. at 598, other citations omitted), *vacated for lack of ripeness sub nom. Sierra Club v. Yeutter*, 911 F.2d 1405 (10th Cir. 1990).

c. The *Sierra Club v. Block* ruling also addressed the argument that the reserved water rights doctrine was only applicable when the land in question had been withdrawn from the public domain. The court concluded

that the argument "is without merit." 622 F. Supp. at 857. In explaining this conclusion, the court noted:

> There is nothing in those cases [*Cappaert v. United States*, 426 U.S. 128 (1976) and *United States v. New Mexico*, 438 U.S. 696 (1978)] which suggests that the doctrine applies *only* to lands *originally* withdrawn from the public domain. Moreover, there is some indication that the Supreme Court would imply reserved water rights where there has been a second withdrawal and reservation of lands. In *Arizona v. California*, the Supreme Court granted reserved water rights for the second withdrawal and reservation of Havasu Lake National Wildlife Refuge and Lake Mead National Recreation Area. [373 U.S. 546, 601 (1963); 376 U.S. 340, 345-46 (1964)]. Both of these reservations had been withdrawn first for a water project and a possible national monument and then a second time as natural preserves.

622 F. Supp. at 857 (emphasis in original).

d. The court's observations regarding the Havasu Lake National Wilderness [Wildlife] Refuge are of particular importance given the assertion of a federal reserved water right for the Aransas National Wildlife Refuge:

> Havasu Lake National Wilderness Refuge was withdrawn and reserved by executive order in 1941 "for the use of the Department of the Interior as a refuge and breeding ground for migratory birds and other wildlife", Exec. Order No. 8647, *reprinted in* 6 Fed. Reg. 593 (1941), but subject to the "purposes of the Parker Dam Project." *Id*. at 599.
>
> Additionally, with respect to Havasu Lake National Wildlife Refuge, the Solicitor for the Department of the Interior, noting that this area was "subject to use under earlier withdrawals," concluded that this area obtained
>
> > reserved water rights for refuge purposes (e.g., habitat, maintenance, watering needs, etc.), carrying a priority date as of the date of reservation for refuge purposes. Superimposed refuge reservations, such as the Havasu Lake National Wildlife Refuge, received reserved water rights in *Arizona v. California*, 373 U.S. 546, 601 [10 L. Ed. 2d 542, 83 S. Ct. 1468] (1963); 373 U.S.

> 340, 346 [84 S. Ct. 755, 11 L. Ed. 2d 757 (1964). *The fact that such refuges are subject to another withdrawal is a distinction without a difference.*
>
> Op. Solic. Dep't of Interior, 86 Im. Nat. Int. Dec. 553, 605 (1979) (emphasis added).

622 F. Supp. at 857 n. 12 (emphasis in original).

e. In fact, opinions issued by both the Solicitor of the Department of the Interior and an Assistant Attorney General of the Department of Justice support the assertion of a reserved water right for the Aransas National Wildlife Refuge.

- As noted above, support is found in the Opinion of Solicitor Leo Krulitz, 86 Interior Decisions 553 (Opinion M-36914, 25 June 1979):

  "A reserved water right may be created by an Act of Congress (*United States v. New Mexico*, *supra*), a Presidential Proclamation (*Cappaert v. United States*, *supra*), an executive order (*Arizona v. California*, *supra*), a treaty (*Winters v. United States*, *supra*), a Secretarial land order (*Arizona v. California*, *supra*), or other departmental action ultimately creating a reservation (*United States v. Walker River Irrigation Dist.*, 104 F.2d 334 (9th Cir. 1939))." 86 Interior Decisions at 572-573

  "Any legislation enacted by Congress to accomplish management objectives on federal lands preempts conflicting state regulations or laws as a result of the operation of the Property and Supremacy Clauses of the United States Constitution. *See Kleppe v. New Mexico*, *supra*. Any authority the states may have been given to regulate and administer federal property and/or programs by the Congress may only be exercised in a manner which is 'not inconsistent with clear congressional directives.' *See California v. United States*, *supra*, 438 U.S. 645 at 672." 86 Interior Decisions at 575-576

  "The Fish and Wildlife Service (FWS) administers a number of areas to which reserved water rights may properly be ascribed. *Arizona v. California*, *supra*, at 601. Most of these areas are now components of the National Wildlife Refuge System (hereinafter 'NWRS'), which

consists of: '[A]ll lands, waters, and interests therein administered by the Secretary as wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas[.]'" 86 Interior Decisions at 602, *quoting* the National Wildlife Refuge System Administration Act of 1966, 80 Stat. 927, 16 U.S.C. § 668dd (1970).

"Such reserved water rights include consumptive and non-consumptive water uses necessary for the conservation of migratory birds and other wildlife (e.g., watering needs, habitat protection, ecosystem food supply, fire protection, soil and erosion control) and attendant FWS personnel needs (e.g., refuge staff domestic needs)." 86 Interior Decisions at 602

"These reserved water rights carry the priority date of the establishing executive order." 86 Interior Decisions at 602

- Support is also found in the Opinion of Assistant Attorney General Theodore B. Olson, 6 Opinions of the Office of Legal Counsel 328 (16 June 1982):

  "It is now settled that when the federal government reserves land for a particular federal purpose, it also reserves, by implication, enough unappropriated water as is reasonably necessary to accomplish the purposes for which Congress authorized the land to be reserved, without regard to the limitations of state law. *The right to that water vests as of the date of the reservation*, whether or not the water is actually put to use, *and is superior to the rights of those who commence the use of water after the reservation date*. *See Cappaert* v. *United States,* 426 U.S. 128, 138 (1976); *United States* v. *New Mexico, supra,* 438 U.S. at 698." 6 Opinions of the Office of Legal Counsel at 346 (emphasis added)

  "The applicability of the reserved right doctrine to all federal reservations was confirmed in *Arizona* v. *California,* 373 U.S. 546 (1963). There, the Court upheld, with little discussion, a Master's award of reserved rights to the United States in several national wildlife refuges and the Gila National Forest:

> The Master ruled that the principle underlying the reservation of water rights for Indian Reservations was equally applicable to other federal establishments such as National Recreation Areas and National Forests. We agree with the conclusions of the Master that the United States intended to reserve water sufficient for the future requirements of the Lake Mead National Recreation Area, the Havasu Lake National Wildlife Refuge, the Imperial National Wildlife Refuge and the Gila National Forest.

"373 U.S. at 601." 6 Opinions of the Office of Legal Counsel at 348

"After *Cappaert* and *New Mexico,* it is safe to conclude that a federal agency may acquire unappropriated water on federal lands without regard to state substantive or procedural law, when that land has been reserved pursuant to congressional authorization for a specific federal purpose that requires the use of water. The right is based on implied congressional intent, and is limited in two crucial respects. First, federal rights will be implied only if necessary to accomplish the specific purposes for which Congress authorized reservation of the land, not for incidental, or 'secondary' uses that may be permitted by congressional authorization or acquiescence in agency practice. … Second, the amount of water reserved is only that minimally necessary to accomplish those primary purposes – *i.e.,* that water 'without [which] the purposes of the reservation would be entirely defeated.' *United States* v. *New Mexico, supra,* 438 U.S. at 700." Opinions of the Office of Legal Counsel at 350-351

iii. The Aransas Wildlife Refuge federal reserved water right:

a. Three things must be remembered:

- Reserved water rights are limited to the minimum quantity of water needed to fulfill the primary purpose(s) of the federal reservation.
- Under the prior appropriation doctrine, the priority date for reserved water rights usually is the date of the reservation.
- Reserved water rights are created by implication.

b. The priority date for the Aransas National Wildlife Refuge would be 31 December 1937, the date on which Executive Order No. 7784 was signed by President Franklin D. Roosevelt.

c. There are two critical issues regarding establishment of the Aransas National Wildlife Refuge:

- What was the primary purpose of the reservation?
- What is the minimum quantity of water needed to fulfill the primary purpose of the reservation?

d. Determination of the primary purpose of the reservation is relatively easy as this is included in Executive Order No. 7784.

- The primary purpose of the reservation was "to effectuate further the purposes of the Migratory Bird Conservation Act[.]"
- The primary purpose included use of the lands reserved "as a refuge and breeding ground for migratory birds and other wildlife[.]"

e. A more difficult question is the minimum quantity of water needed to allow the lands reserved to be used "as a refuge and breeding ground for migratory birds and other wildlife[.]"

f. The best estimate of the minimum quantity of water needed to fulfill the primary purposes of the reservation is contained in Texas Department of Water Resources, *Guadalupe Estuary: A Study of the Influence of Freshwater Inflows*. 1980, Texas Department of Water Resources: Austin, TX:

- This study was one of a series of studies mandated by SB 137 enacted by the 64th Texas legislature in 1975.
- The study noted that freshwater inflows were needed for salinity gradient control, to transport sedimentary and nutritive building blocks and to inundate deltaic marshes. (pp. II-13, IX-1)
- The report also noted that inflows needed to occur at specific times during the year. (p. II-13) Specifically, five inundation events of at least 125,000 acre-feet needed to occur annually with at least one occurring during both the spring and the fall. (pp. I-5, IX-10)

- The report addressed these requirements based on three alternative scenarios:

    - The Subsistence Alternative: "[M]inimization of annual combined inflow while meeting salinity viability limits and marsh inundation needs[.]" (pp. I-5, IX-12)
    - The Maintenance of Fisheries Harvests Alternative: "[M]inimization of annual combined inflow while providing freshwater inflows sufficient to supply predicted annual estuarine commercial bay harvests of red drum, seatrout, shrimp, and all shellfish at levels no less than their mean historical (1962-1976) values, satisfying marsh inundation needs, and meeting viability limits for salinity[.]" (pp. I-5, IX-12)
    - The Shrimp Harvest Enhancement Alternative: "[M]aximization of the total annual estuarine commercial harvest of shrimp while observing salinity limits, satisfying march inundation needs, and utilizing an annual combined inflow no greater than the average historical (1941-1976) combined inflow. In addition, it is required that the combined commercial bay harvests of all shellfish be no less than the average historical (1962-1976) harvest." (pp I-6, IX-12 – IX-13)

- Of the three alternatives studied, the Subsistence Alternative mirrors the purposes for which the Aransas National Wildlife Refuge was established. Maintenance of the Subsistence Alternative inflows, particularly with regard to salinity viability limits and marsh inundation needs, appears to be the best available estimate of the minimum quantity of water needed to fulfill the primary purpose of the Aransas National Wildlife Refuge, specifically to serve "as a refuge and breeding ground for migratory birds and other wildlife[.]"The freshwater inflows under the Subsistence Alternative (Alternative I) are depicted in the following table (p. IX-15). Note, however, that the total expressed as "Estuary Inflow Need from Gaged Portion of the Basin" (1,240.7) contains a mathematical error. The correct total is 1,242.5.

Table 9-6. Freshwater Inflow Needs of the Guadalupe Estuary under Alternative I a/

Period	Guadalupe River Basin		Total Inflow From Coastal Basins	Combined Inflow c/
	Estuary Inflow Need from the Basin	Estuary Inflow Need from Gaged Portion of the Basin b/		
	Thousands of Acre-Feet			
January	102.2	86.4	4.0	106.2
February	115.8	96.2	6.0	121.8
March	97.0	80.3	3.0	100.0
April	160.4	134.1	6.0	166.4
May	165.1	138.1	8.0	173.1
June	125.0	104.0	8.0	133.0
July	70.4	57.6	6.0	76.4
August	97.5	80.6	7.0	104.5
September	247.1	207.8	14.0	261.1
October	125.0	104.0	10.0	135.0
November	93.1	76.9	5.0	98.1
December	92.6	76.5	6.0	98.6
Annual	1,491.2	1,240.7	83.0	1,574.2

a/ All inflows are mean monthly values.
b/ These values computed using regression equations relating monthly river basin inflow to the estuary with monthly gaged flows at USGS Stations at Goliad and Victoria on the Guadalupe River, and Coleto Creek near Schroeder.
c/ Includes all freshwater inflow to the estuary except direct precipitation on the estuary's surface (see Chapter IV for definition).

- Maintenance of these inflows would result in the following monthly salinity averages (p. IX-16):

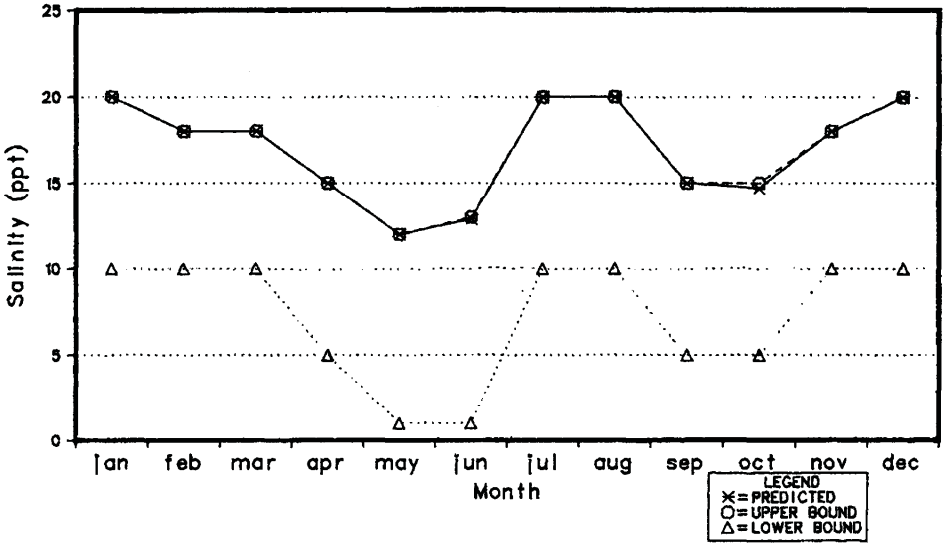


Figure 9-2. Average Monthly Salinities in Upper San Antonio Bay Under Alternative I

- With only one relatively minor exception (September), the recommended freshwater inflows under the Subsistence Alternative are less than historic freshwater inflows (p. IX-16):

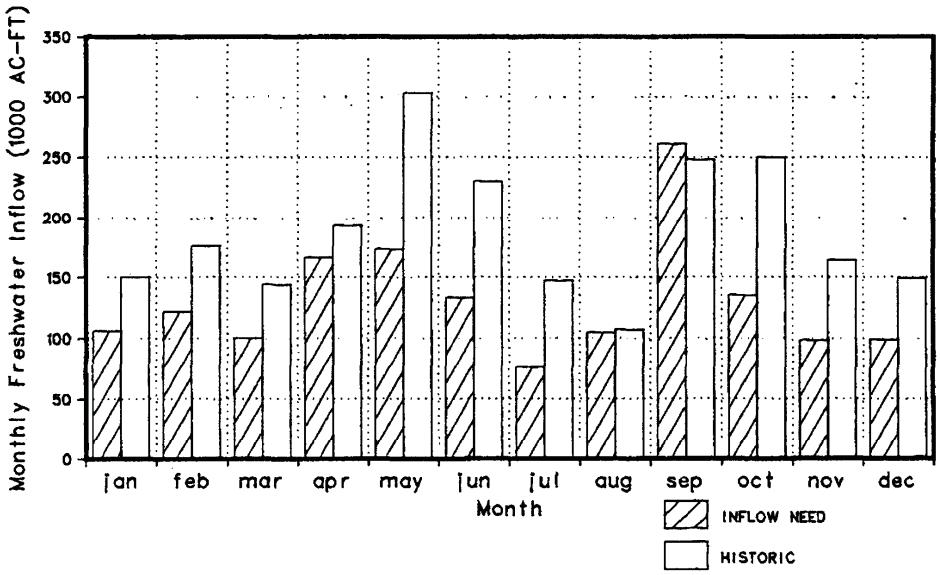


Figure 9-3. Comparison Between Mean Historical Freshwater Inflow and Inflow Needs Under Alternative I From the Guadalupe River Basin for the Guadalupe Estuary

e. The results of this study were confirmed in Texas Department of Water Resources, *The Influence of Freshwater Inflows Upon the Major Bays and Estuaries of the Texas Gulf Coast*. 1982, Texas Department of Water Resources: Austin, TX.

- The Subsistence Alternative was described as establishing "minimum monthly inflows for the basic purposes of nutrient transport, habitat maintenance, and salinity control." (pp. 3, 21-22)
- Maintenance of these inflows would result in the following monthly salinity averages (p. 35):

	Subsistence Alternative	
Month:	Gauged inflow (1000 ac-ft):	Salinity (ppt):
January	86.4	20.0
February	96.2	18.0
March	80.3	18.0
April	134.1	15.0
May	138.1	12.0
June	104.0	12.9
July	57.6	20.0

August	80.6	20.0
September	207.8	15.0
October	104.0	14.7
November	76.9	18.0
December	76.5	20.0
Annual total from gauged inflow:	1,242.5*	
*The total expressed on p. 35 of the report (1,240.7) contains a mathematical error. The correct total is 1,242.5.		

- These inflows were expressed in terms of monthly averages and probability of exceedance (p. III-10).

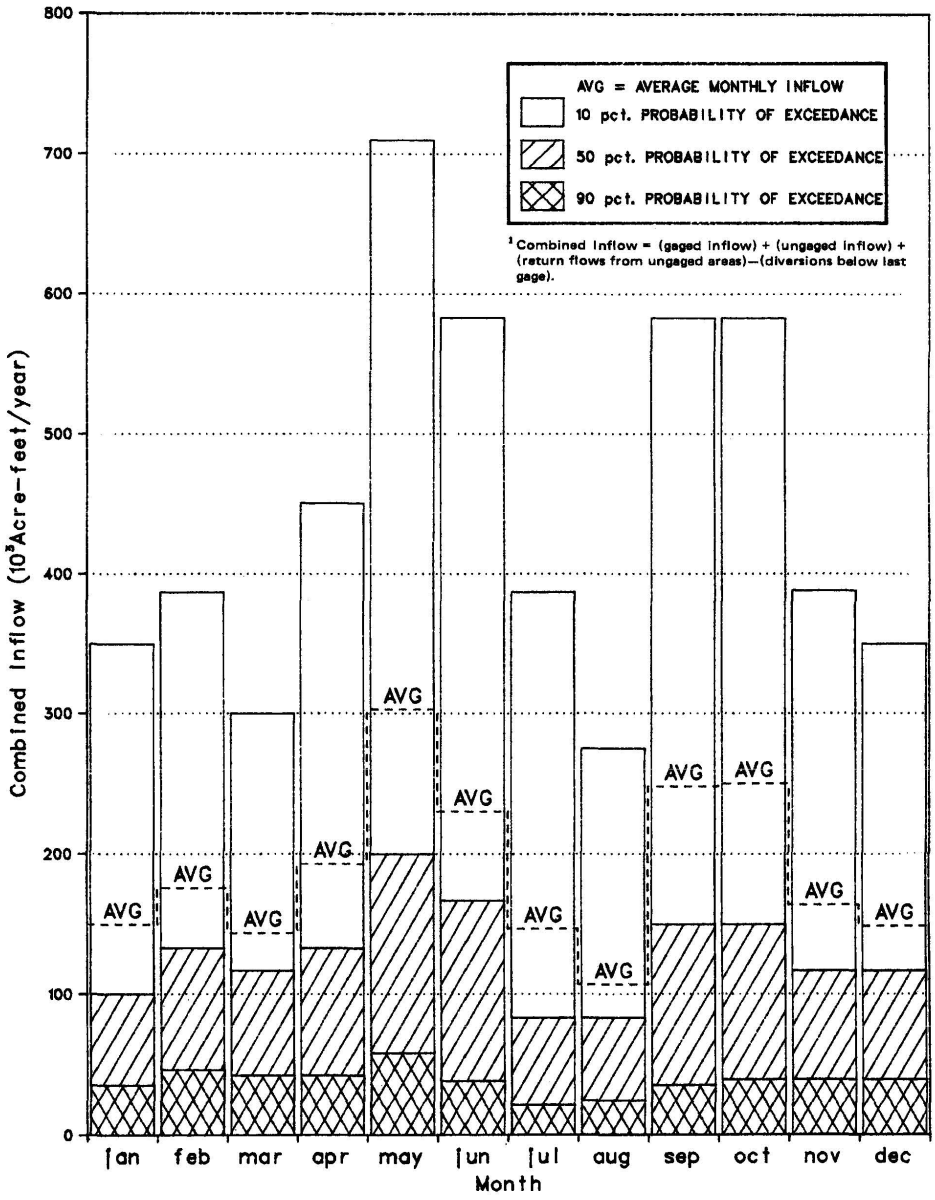


Figure III-8. Monthly Distribution of Combined Inflow,[1] Guadalupe Estuary, 1941-1976

- A comparison of Figure III-8 with Table 9.6 (above) demonstrates that the Subsistence Alternative inflows are less than historic inflows in every month except September.

- In fact, inflows required under the Subsistence Alternative would constitute 69% of mean annual gauged inflows during the 1941-1976 period. (p. 36).

h. In a subsequent study, Pulich, W., Jr., *et al*., *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas*. 1998, Resource Protection Division, Coastal Studies Program, Texas Parks and Wildlife Department: Austin, TX, a freshwater inflow of 1.15 million acre-feet per year was recommended. (pp. 2, 5, 38)

- This recommendation was based in an analysis of inflows needed to maintain salinity gradients for optimal fish harvest (MaxH). (p. 5):

  TPWD staff recommends MaxH (1.15 million ac-ft per yr) inflows as the lowest target value to fulfill the biological needs of the Guadalupe Estuary System on a seasonal basis. TPWD prefers this conservative value of MaxH since it was shown to produce conditions closer to many of the peak density salinity zones of the target species and wetlands examined in this analysis. This is in contrast to the MinQ case (1.03 million ac-ft per year). The distribution of flows approximating the historical monthly median pattern provides the most adequate salinity conditions during the critical spring months of May and June. Dryer conditions during summer months (July and August) are expected naturally and can be tolerated if the estuary is prepared by earlier flows.

- Salinity was used as a proxy in order to measure the response of the bay fishery communities to freshwater inflows.

- This study recognized both the importance of natural variability and the need to protect the estuary from "human-induced increases in the magnitude and duration of naturally occurring droughts[.]" (p. 7, emphasis in original)

  Under reduced riverflow management conditions, however, the <u>frequency of reduced bay inflow levels</u> should not be increased beyond historical occurrences. Watershed management programs should provide target and lower flows <u>at almost the same frequency at which they occurred in the past</u> and retain as much historical variability at higher flows as possible. Although drought cannot be avoided in many

cases, the adverse environmental effects due to human-induced increases in the magnitude and duration of naturally occurring droughts should be minimized.

- This study also acknowledged that estuaries need "proper salinity regimes, nutrient loadings, and sediment input that in proper combination support unique, historical levels of biological productivity," (p. 8)

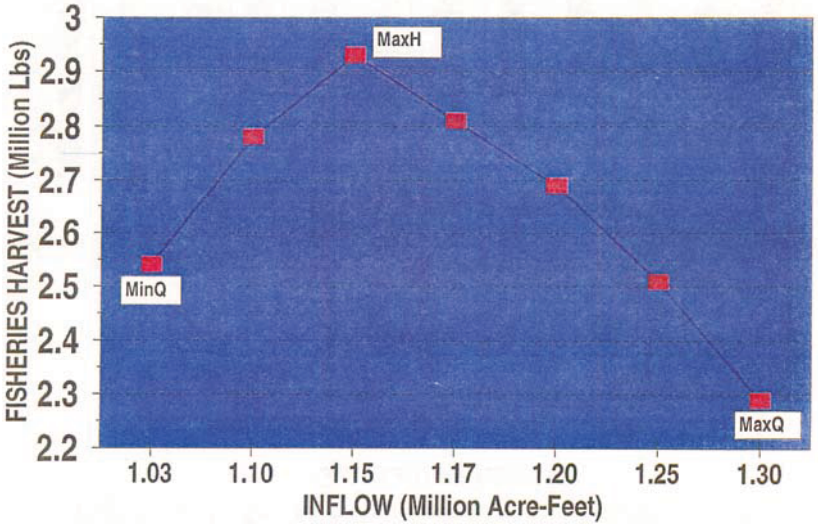
- However, the study focused on ways "to optimize for flows producing maximum fisheries harvest (MaxH) within the range of inflows between MinQ and MaxQ." The MaxH and MinQ inflows on a monthly basis are depicted in the following table: (p. 15)

Table 2.1. Monthly Inflow Needs (in thousands of acre-feet) of Guadalupe Estuary for Two Simulations.

Month	Min Q	Max H
Jan	111.2	111.2
Feb	124.2	124.2
Mar	52.4	52.4
Apr	52.4	52.4
May	186.0	222.6
Jun	136.0	162.7
July	60.8	88.6
Aug	60.8	88.3
Sep	52.4	52.4
Oct	52.4	52.4
Nov	73.8	73.8
Dec	66.2	66.2
Total	1028.8	1147.4

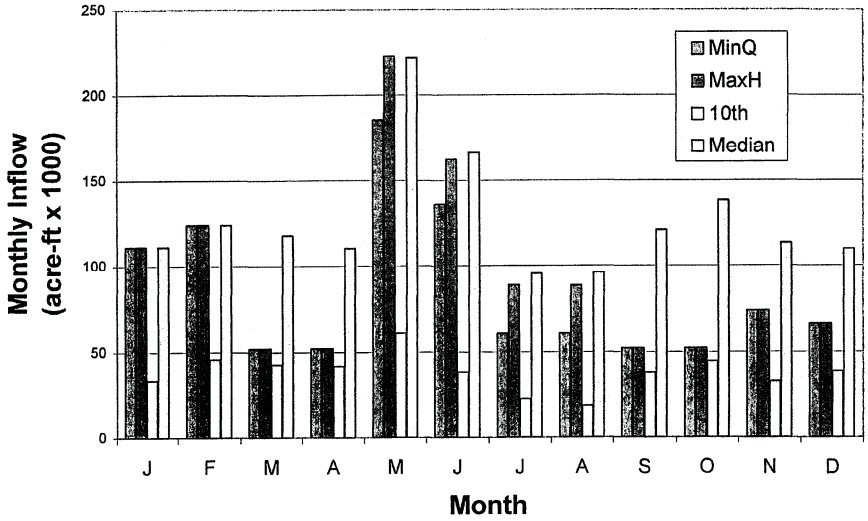
- The relationship of these monthly inflows to MaxH can be seen in the following figure:

Figure 2.1. TxEMP MODEL SOLUTIONS FOR GUADALUPE ESTUARY



- The relationship of MaxH and MinQ inflows to historic inflows is depicted in the following table:

Figure 2.2. TxEMP Monthly Inflow Distribution for Guadalupe Estuary

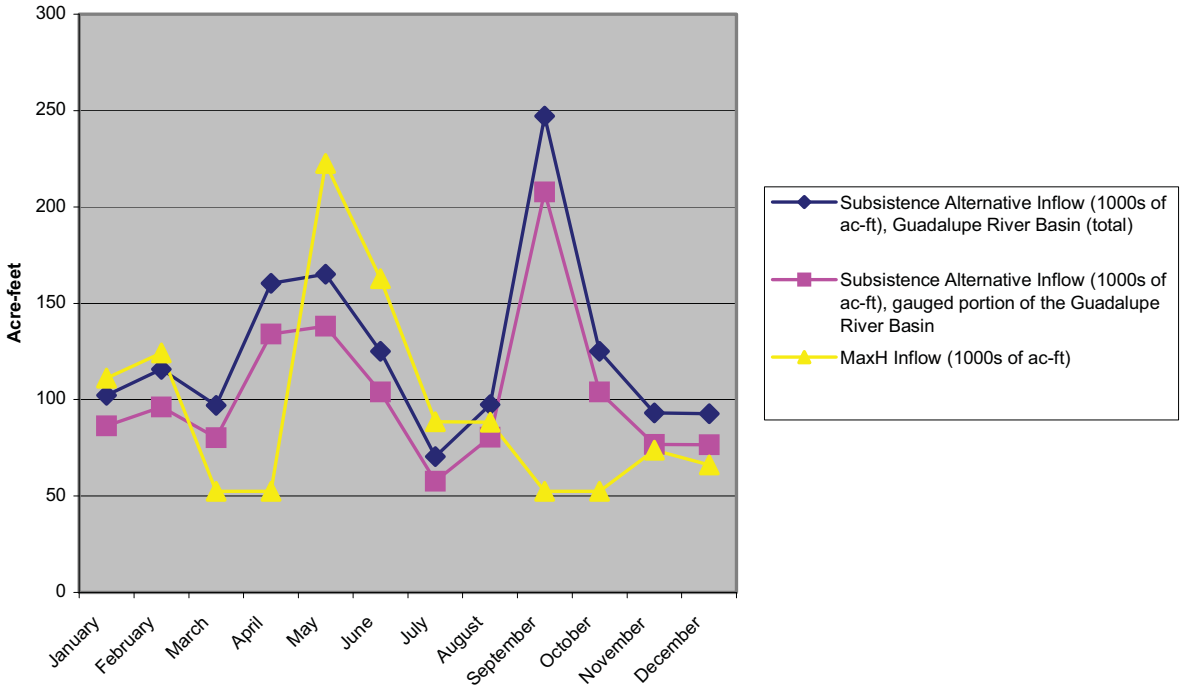


- The results of this study were confirmed and refined in South Coast Texas Regional Water Planning Group, *2011 Regional Water Plan, Study 4, Part A: Environmental Studies (draft)*. 2008, San Antonio River Authority: San Antonio, TX.

i. The freshwater inflows recommended in *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas* are not an adequate quantification of the federal reserved water right.

- As noted above, the focus of *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas* was the maximization of fishery harvests. This is not one of the purposes for which the Aransas National Wildlife Refuge was established.
- By focusing on inflows needed for MaxH, *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas* does not include all the freshwater inflows needed for the purposes of the Aransas National Wildlife Refuge.
- For example, the Subsistence Alternative contained in *Guadalupe Estuary: A Study of the Influence of Freshwater Inflows* included inflows for salinity gradient control, to transport sedimentary and nutritive building blocks and to inundate deltaic marshes. (pp. II-13, IX-1)
    - Five inundation events consisting of an inflow of no less that 125,000 acre-feet needed to occur annually with at least one occurring during both the spring and the fall. (pp. I-5, IX-10)
    - These events were recommended for the months of April, May, June, September and October. (p. I-5)
    - However, the MaxH monthly inflows contained in *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas* do not include inundation flows for the months of May, September and October. (Table 2.1 and Figure 2.2, above)
    - This is illustrated in the following figure:

Subsistence Alternative v. MaxH Inflows



- Furthermore, the MaxH inflows contained in *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas* could result in salinity levels that adversely affect species inhabiting the Aransas National Wildlife Refuge:
    - "During September, salinity for the MaxH case ranged from 0–14.9 ppt in the Upper Bay/Delta region, to 15–24.9 ppt in Mid Bay, to 20–29.9 ppt in the Lower Bay … while salinity for the MinQ case ranged from 5–14.9 ppt in the Upper Bay/Delta, to 15–24.9 ppt in the Middle bay, to 25–30+ ppt in the lower bay." (p. 18)
    - One of the species protected at the Aransas National Wildlife Refuge is the Whooping Crane.
    - When salinity levels exceed 23 ppt, Whooping Cranes are forced to seek other sources of freshwater. HARC, *The Role of Freshwater Inflows in Sustaining Estuarine Ecosystem Health in the San Antonio Bay Region*. 15 September 2006; White, J.A., C.M. Giggleman, and P.J.

Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX; Stehn, T., *Fresh Water for ALL Texans: Enough for Both Humans and Wildlife? New Laws Debated*. Journey North, 2002; Stehn, T., *Relationship between inflows, crabs, salinities, and whooping cranes*. Journey North, 26 November 2001.

- "These flights use up energy, reduce time available for foraging or resting, and could potentially make the cranes more vulnerable to predation in the uplands." HARC, *The Role of Freshwater Inflows in Sustaining Estuarine Ecosystem Health in the San Antonio Bay Region*. 15 September 2006; *accord*, White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX.

j. Consequently, given the similarity between the Subsistence Alternative contained in *Guadalupe Estuary: A Study of the Influence of Freshwater Inflows* and the requirement that a federal reserved water right be the minimum quantity of water needed to fulfill the primary purpose of the reservation, the following conclusions may be drawn:

- The Aransas National Wildlife Refuge could assert a federal reserved water right with a priority date of 31 December 1937.
- The total quantity of that right would be 1,572,200 acre-feet per year. Of this quantity:
  - 1,491,200 acre-feet of inflow would be required from the Guadalupe River Basin (including the San Antonio River Basin).
  - Of this amount, 1,242,500 acre-feet per year would be required from the gauged portion of the Guadalupe River Basin.
  - The remaining 83,000 acre-feet per year would be required from coastal basins.

k. Other studies of freshwater inflow requirements for the Guadalupe Estuary have reached similar conclusions:

- Bureau of Reclamation, *Summary of Special Report, San Antonio - Guadalupe River Basins Study, Texas Basin Project*. 1978, U.S. Department of the Interior: Amarillo, TX:
    - "The water quality and biological characteristics of the estuary are related to changes in freshwater inflow." (pp. 5, 13)
    - "The Texas Parks and Wildlife Department (TP&W) recommends total annual freshwater inflow into the estuary system of about 1.6 to 2.5 million acre-feet (with a minimum of 1.3 million acre-feet), with about 34 percent (429,000 to 729,000 acre-feet) of the annual inflow in May and June. Also, assuming that one of the keys to maintaining a nursery area within the estuary system is the flooding and freshening of its marshes, then a means of periodically flooding the marshes would be desirable. According to Texas Water Development Board (TWDP) figures, an annual flow during the spring of about 10,300 cubic feet per second totaling 130,000 acre-feet would be required to flood the marshes." (p. 26)
    - As noted above, the calculation of inflow requirements for the Subsistence Alternative assumed 125,000 acre-feet would be required to flood the marshes during the months of January, May, June, September and October. Texas Department of Water Resources, *Guadalupe Estuary: A Study of the Influence of Freshwater Inflows*. 1980, Texas Department of Water Resources: Austin, TX (p. I-5)
- Guadalupe-Blanco River Authority and HDR Engineering, *Regional Water Plan for the Guadalupe River Basin*. 1991, Guadalupe-Blanco River Authority: Seguin, TX:
    - "Established rights for municipal, industrial, and agricultural uses make new diversions possible only during extreme high flow conditions." (p. 1-8)
    - "Previous studies have estimated that 1.57 million acre-feet of fresh water inflows to Guadalupe Estuary are needed annually for subsistence levels of fishery reproduction and growth, and that 2.02 million acre-feet

are needed annually to maintain average historic levels of fishery productivities." (p. 1-9)

- "In a 1984, 1985, and 1986 water supply study of the Guadalupe and San Antonio River Basins by Espey, Huston and Associates, Inc. (EH&A) for the Guadalupe-Blanco River Authority (GBRA), the City of San Antonio (CSA), and the San Antonio River Authority (SARA), an assessment was made of the needs of Guadalupe Bay and Estuary regarding fresh water inflow requirements. [*Water Availability Study for the Guadalupe and San Antonio River Systems; Volume I*. 1986, Espey, Huston & Associates: Austin, TX, p. 5-2.] This study considered: (1) salinity versus inflow, and (2) selection of highest desirable salinity levels. The study presented recommendations of monthly inflow requirements necessary to maintain viable habitat, and assessed the effects of recommended monthly inflow requirements upon estimates of fisheries catch and reservoir yields. The EH&A study showed that species viability requirements for fresh water inflow to Guadalupe Bay were 40 percent less, on an annual basis, than was computed in the Texas Department of Water Resources (TDWR) studies referenced above. In quantitative terms, this is 600,000 acre-feet per year versus 1.0 million acre-feet per year. However, the EH&A study concludes that this level of difference does not necessarily exist for the other inflow/fish catch alternatives studied by TDWR (subsistence, 1.57 million acre-feet annually; maintenance, 2.02 million acre-feet annually; and shrimp enhancement, 2.26 million acre-feet annually), and recommended further study." (p. 2-25)

- Longley, W.L., ed. *Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determination of Needs*. 1994, Texas Water Development Board: Austin, TX:
  - "An extensive study was conducted on the Guadalupe Estuary by Childress [Childress, R., *et al*., *The Effects of Freshwater Inflows on Hydrological and Biological Parameters in the San Antonio Bay System*. 1975, Coastal Fisheries Branch, Texas Parks and Wildlife

Department: Austin, TX] for the period 1971 to 1974; this estuary is influenced by inflows from the Guadalupe and San Antonio rivers. While the study dealt primarily with abundance of fishery species and relationships to freshwater inflow parameters such as salinity, turbidity, and nutrient loadings, some information was provided on seasonal status of vegetated habitats and potential contribution of freshwater inflow to plant productivity. Significant observations included the widespread dominance of two classical higher salinity species, smooth cordgrass and shoal grass, around much of the San Antonio Bay shoreline, and the common reed (*Phragmites austalis*) in the brackish river delta. During the study period, the overall bay environment showed an average annual salinity in the range of 1.6 to $9.5^{0}/00$. for the upper bay, 4.1 to $13.0^{0}/00$ for the middle bay, and 7.4 to $19.1^{0}/00$ for the lower bay. Childress *et al*. inferred from their data that a major decrease in the quantity or timing of freshwater inflows from an annual gaged minimum of 1.6 million acre-ft would cause major alteration in the estuary's ecology."

- Two other specific freshwater inflow requirements were also noted in *Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determination of Needs*:

- 286,000 acre-feet per year was needed "to replace all nitrogen lost to the system each year." This was characterized as "an absolute minimum". (p. 274)
- 355,235 acre-feet per year was needed to bring sufficient sediment into the Estuary. (pp. ix, 275)

- The San Marcos River Foundation (SMRF) sought 1.3 million acre-feet, as the "minimum flow needed to sustain the bay ecosystem and keep the bays productive." Stehn, T., *Relationship between inflows, crabs, salinities, and whooping cranes*. Journey North, 26 November 2001.
  - At the time of the SMRF's filing for instream flow water rights, the U.S. Fish & Wildlife Service wrote a letter in support, arguing that 1.3 million acre-feet was needed as "a crucial first step in guaranteeing that the bays would continue to function ecologically for all users to enjoy."

Stehn, T., *Relationship between inflows, crabs, salinities, and whooping cranes*. Journey North, 26 November 2001.

- The Texas Water Development Board appeared to be in agreement. Gary Powell, Director of the Board's Bays and Estuaries Program, was quoted as concluding that "[t]he bay needs between 1 and 2 million acre-feet of water per year to maintain a productive life." Stehn, T., *Fresh Water for ALL Texans: Enough for Both Humans and Wildlife? New Laws Debated*. Journey North, 2002.
- The political aspects of the SMRF filing are of note, particularly the dismissal of the filing by TCEQ:

> TCEQ commissioners took the unusual step of dismissing the SMRF permit outright, rather than the customary administrative judicial review process. The vote was unanimous (3-0). The commissioners stated that current law did not authorize TCEQ to provide for new permits for instream river flows. The Los Angeles Times noted another reason that the permit may have been quashed from the agenda: "Andy Saenz, a spokesman for the Texas Commission on Environmental Quality, acknowledged [that] when the item was placed on the commission's agenda, Texas Lt. Gov. David Dewhurst passed along a message, Saenz said: 'Don't vote on this issue.' " Jacoby, A.K., *Water Pressure: The Eightieth Texas Legislature Attempts To Protect Instream Flows of Rivers and Streams, and Freshwater Inflows to Bays and Estuaries*. Tulane Environmental Law Journal, 2007. 20: p. 381-405, citing, Gold, S., *Water Pressures Inspire Creative Conservationism* in *The Los Angeles Times*. July 28, 2003: Los Angeles, CA. p. A1.

3. SubContested Issue 2: The Freshwater Inflow Requirements for the Aransas National Wildlife Refuge Mandated by Federal and State Species Protection Statutes Preclude Use of the Waters of the Guadalupe River as Anticipated in the ESP.

   A. Species protected under federal law.

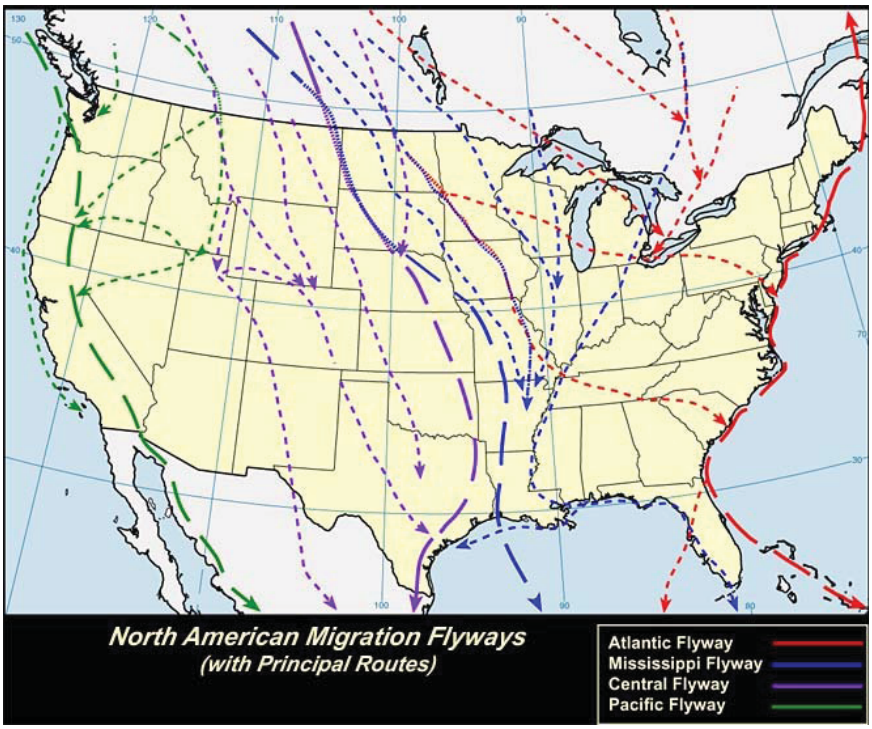
      i. The Migratory Bird Conservation Act.

         a. The Migratory Bird Conservation Act, 16 U.S.C. §§715-715r (18 February 1929) was enacted to fulfill the requirements of the 1916 Convention Between

the United States and Great Britain (for Canada) for the Protection of Migratory Birds, 39 Stat. 1702; TS 628 (the Migratory Bird Treaty).

b. As seen in Executive Order No. 7784, President Roosevelt exercised his authority under the Migratory Bird Conservation Act when he "reserved and set-apart" the Aransas Migratory Waterfowl Refuge.

c. As depicted in the following map, the Aransas National Wildlife Refuge is located at the terminus of both the Central Flyway and the Mississippi Flyway:



d. The Refuge provides essential habitat for numerous species protected by a variety of federal and state species protection statutes including both the Endangered Species Act and the Migratory Bird Treaty Act. Guadalupe-Blanco River Trust, *Whitmire Unit/Calhoun Canal System Project*. undated.

ii. The Migratory Bird Treaty Act.

a. The Migratory Bird Treaty Act, 16 U.S.C. §§703-712 (3 July 1918) was also enacted to fulfill the requirements of the Migratory Bird Treaty.

b. In relevant part, the Migratory Bird Treaty Act provides that, in the absence of permits as permitted by regulation, "it shall be unlawful at any time, by any means or in any manner, to ... take, ... kill, attempt to take ... or kill ... any migratory bird." 16 U.S.C. §703.

c. The term "take" is defined in the regulations implementing the Migratory Bird Treaty Act as meaning "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." 50 C.F.R. §10.12.

iii. The Endangered Species Act.

a. The purposes of the Endangered Species Act, , 16 U.S.C. §§1531-1544, are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such endangered species and threatened species." 16 U.S.C. §1531(b).

b. The Endangered Species Act prohibits any federal agency from taking any action (including destruction of "critical habitat") that would jeopardize the continued existence of a threatened or endangered plant or animal species.

c. The Endangered Species Act also prohibits all parties (both public and private) from undertaking actions that would result in the "taking" of a threatened or endangered species. 16 U.S.C. §1538(a)(1).

d. Endangered species are defined as "any species which is in danger of extinction throughout all or a significant portion of its range[.]"16 U.S.C. §1532(6).

e. U.S. Fish & Wildlife Service regulations extended these provisions to "threatened" species, defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. §1532(20). This regulation was sustained as a reasonable and permissible interpretation of the

Endangered Species Act in *Sweet Home Chapter of Communities for a Great Oregon v. Lujan*, 806 F. Supp. 279 (D.D.C. 1992), *aff'd sub nom Sweet Home Chapter of Communities for a Great Oregon v. Babbitt*, 1 F.3d 1 (D.C. Cir. 1993), *modified*, 17 F.3d 1463 (D.C. Cir. 1994), *rev'd*, 515 U.S. 687 (1995).

f. The Endangered Species Act provides that "with respect to any endangered species of fish or wildlife listed pursuant to ... this title it is unlawful for any person subject to the jurisdiction of the United States to ... (B) take any such species within the United States or the territorial sea of the United States ... or (G) violate any regulation pertaining to such species or to any threatened species of fish or wildlife listed pursuant to ... this title." 16 U.S.C. §1538(a)(1).

g. Furthermore, "with respect to any endangered species of plants listed pursuant to ... this title, it is unlawful for any person subject to the jurisdiction of the United States to ... (B) remove and reduce to possession any such species from areas under Federal jurisdiction; maliciously damage or destroy any such species on any such area; or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law ... or (E) violate any regulation pertaining to such species or to any threatened species of plants listed pursuant to ... this title. 16 U.S.C. §1538(a)(2).

h. Concurrent with the determination that a species is endangered or threatened, the Secretary of the Interior must designate critical habitat. 16 U.S.C. §1533(b)(2). In making a determination regarding the designation of critical habitat, the Secretary:

[S]hall designate critical habitat ... on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned.

i. The term "take" is broadly defined to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. §1532(19).

iv. The Bald and Golden Eagle Protection Act.

a. In relevant part, the Bald and Golden Eagle Protection Act provides that "[w]hoever, within the United States or any place subject to the jurisdiction thereof, without being permitted to do so as provided in this subchapter, shall knowingly, or with wanton disregard for the consequences of his act take ... at any time or in any manner, any bald eagle commonly known as the American eagle, or any golden eagle, alive or dead, or any part, nest, or egg thereof of the foregoing eagles, or whoever violates any permit or regulation issued pursuant to this subchapter, shall be fined not more than $5,000 or imprisoned not more than one year or both. 16 U.S.C. §668(a). The act also provides for civil penalties. 16 U.S.C. §668(b).

b. The definition of the term "take" reflects the definition contained in the Endangered Species Act and "includes ... pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb." 16 U.S.C. §668c.

v. The Marine Mammal Protection Act.

a. A declaration of congressional findings and policy, 16 U.S.C. §1361(6), accompanied enactment of the Marine Mammal Protection Act:

[M]arine mammals have proven themselves to be resources of great international significance, esthetic and recreational as well as economic, and it is the sense of the Congress that they should be protected and encouraged to develop to the greatest extent feasible commensurate with sound policies of resource management and that the primary objective of their management should be to maintain the health and stability of the marine ecosystem. Whenever consistent with this primary objective, it should be the goal to obtain an optimum

sustainable population keeping in mind the carrying capacity of the habitat.

b. Reflecting the requirements of the Endangered Species Act, the Marine Mammal Protection Act makes it unlawful for "any person ... to take any marine mammal in waters or on lands under the jurisdiction of the United States." 16 U.S.C. §1372(a)(2)(A).

c. "Marine mammal" is defined as "any mammal which (A) is morphologically adapted to the marine environment (including sea otters and members of the orders *Sirenia*, *Pinnipedia* and *Cetacea*), or (B) primarily inhabits the marine environment (such as the polar bear)." 16 U.S.C. §1362(6).

d. "Take" is defined as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." 16 U.S.C. §1362(13).

e. "Person" is defined to include "(A) any private person or entity, and (B) any officer, employee, agent, department, or instrumentality of the Federal Government, of any State or political subdivision thereof." 16 U.S.C. §1362(10).

f. It is permissible to take a marine mammal upon issuance of the requisite permit. 16 U.S.C. §1373 & §1374.

g. Violation of the Marine Mammal Protection Act carries both civil and criminal penalties. 16 U.S.C. §1375.

h. In *Committee for Humane Legislation v. Richardson*, 540 F.2d 1141 (D.C. Cir. 1976), one of the leading decisions interpreting the requirements of both the Marine Mammal Protection Act and the implementing regulations, the Court of Appeals for the District of Columbia concluded that the Marine Mammal Protection Act "was to be administered for the benefit of the protected species." 540 F.2d at 1141.After noting that the "specific requirements of the Act are so clear as to require little discussion," the court concluded that the Marine Mammal Protection Act "was deliberately designed to permit takings of

marine mammals only when it was known that that taking would not be to the disadvantage of the species." 540 F.2d at 1150.

B. Species protected under Texas law.

i. Chapter 68 of the Texas Parks and Wildlife Code contains provisions similar to the federal Endangered Species Act.

ii. Under §68.003(a), the Director of the Parks and Wildlife Department is to develop a "list of fish or wildlife threatened with statewide extinction" and file that list with the Texas Secretary of State.

iii. §68.003(b), provides that "[f]ish or wildlife [defined in §68.001(1) as 'any wild mammal, aquatic animal, wild bird, amphibian, reptile, mollusk, or crustacean, or any part, product, egg, or offspring, of any of these, dead or alive'] may be classified by the director as threatened with statewide extinction if the department finds that the continued existence of the fish or wildlife is endangered due to: (1) the destruction, drastic modification, or severe curtailment of its habitat; (2) its overutilization for commercial or sporting purposes; (3) disease or predation; or (4) other natural or man-made factors.

iv. Chapter 88 of the Parks and Wildlife Code extends similar authority to the Director regarding Endangered Plants. Parks and Wildlife Code, §88.003.

v. Fish, wildlife and plants listed as threatened or endangered by the federal government are to be included on the state list. Parks and Wildlife Code, §68.002(1) and §88.002(1).

vi. Once a species has been listed as threatened or endangered, "[n]o person may capture, trap, take, or kill, or attempt to capture, trap, take, or kill, endangered fish or wildlife." Parks and Wildlife Code, §68.015(a). For threatened or endangered plants, *see* Parks and Wildlife Code, §88.008(a).

vii. It is permissible to "possess, take, or transport endangered fish or wildlife for zoological gardens or scientific purposes or to take or transport endangered fish or wildlife from their natural habitat for propagation for commercial purposes" upon issuance of a permit pursuant to §43.002 of the Parks and Wildlife Code. Parks and Wildlife Code, §68.006. For threatened or endangered plants, *see* Parks and Wildlife Code, §88.0081.

viii. The Parks and Wildlife Department is authorized to establish "procedures for identifying endangered fish and wildlife or goods made from endangered fish or wildlife which may be possessed, propagated, or sold under this chapter[.]" Parks and Wildlife Code, §68.014(3). For threatened or endangered plants, *see* Parks and Wildlife Code, §88.006(3).

ix. The Parks and Wildlife Department is also authorized to set "limitations on the capture, trapping, taking, or killing, or attempting to capture, trap, take, or kill, and the possession, transportation, exportation, sale, and offering for sale of endangered species." Parks and Wildlife Code, §68.014(5).

ix. Section 68.021 establishes specific penalties for a violation of this chapter. For threatened or endangered plants, *see* Parks and Wildlife Code, §88.011.

C. Protected species

i. At the present time, 186 plant and animal species located in Texas have been listed as threatened or endangered by either the federal government or the Texas Parks and Wildlife Department (discussed below).

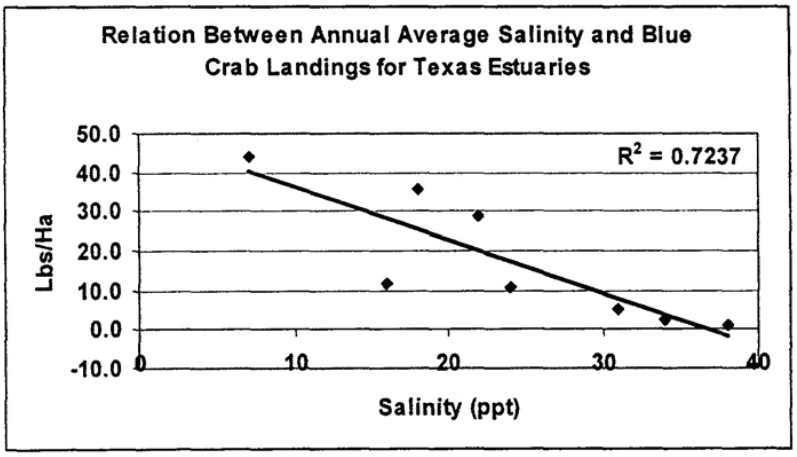
a. A total of 127 species are protected by the Migratory Bird Treaty Act, including both species also protected by the Bald and Golden Eagle Protection Act.

b. The West Indian Manatee, listed as endangered by both the State of Texas and the federal government, is also protected by the Marine Mammal Protection Act.

ii. Given the location of the proposed Exelon development, of particular concern are the threatened and endangered species for whom the Guadalupe Estuary provides critical habitat. Stehn, T., *Fresh Water for ALL Texans: Enough for Both Humans and Wildlife? New Laws Debated*. Journey North, 2002. These species include:

a. The Whooping Crane (*Grus Americana*) is listed as endangered by both the State of Texas and the federal government.

- The Aransas National Wildlife Refuge is the only remaining over-wintering habitat for the Whooping Crane. Wassenich, T., *The State of the Protection of Freshwater Inflow to the Bays and Estuaries of Texas*. 2005, River Systems Institute, Texas State University: San Marcos, TX, p. 302.
- Critical habitat for the Whooping Crane includes designated areas of land and water around Aransas National Wildlife Refuge, specifically San Antonio Bay, Espiritu Santo Bay, Cedar Bayou and St. Charles Bay in Aransas, Calhoun and Refugio counties. White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX.
- Identified threats to the Whooping Crane include both habitat dewatering and salinity. White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX.
- To ensure survival of the whooping crane, freshwater inflows into critical habitat must be sufficient to maintain the blue crab (*Callinectes sapidus*) population which "can make up 80-90% of the diet of whooping cranes." HARC, *The Role of Freshwater Inflows in Sustaining Estuarine Ecosystem Health in the San Antonio Bay Region*. 15 September 2006; White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX; Stehn, T., *Fresh Water for ALL Texans: Enough for Both Humans and Wildlife? New Laws Debated*. Journey North, 2002; Stehn, T., *Relationship between inflows, crabs, salinities, and whooping cranes*. Journey North, 26 November 2001.
- "Adult blue crabs are most prevalent in mesohaline areas (5 to 20 ppt) of the Guadalupe estuary along the Texas Gulf Coast." White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX.
- A reduction in freshwater inflows may result in an increase in salinity which, in turn, may result in a decrease in the blue crab population. McFarlane provides figures depicting a statistically significant relationship between salinity and the production of blue crabs. McFarlane, R.W., *Freshwater Inflow, Bay Salinity and Blue Crabs (draft)*. 2004, McFarlane & Associates: Houston, TX:



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b. The "Eastern" Brown Pelican (*Pelecanus occidentalis*) is listed as endangered by both the State of Texas and the federal government.

- Although its numbers are increasing, the "Eastern" Brown Pelican remains listed as endangered in both Texas and Louisiana. White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX.
- It Texas, it is "found along the Texas coast from Chambers County on the upper coast to Cameron County on the lower coast." Campbell, J., *Endangered and Threatened Animals of Texas: Their Life History and Management*. 2003, Wildlife Division, Texas Parks and Wildlife Department: Austin, TX.
- Specific threats include "human disturbance and loss of nesting habitat." Campbell, J., *Endangered and Threatened Animals of Texas: Their Life History and Management*. 2003, Wildlife Division, Texas Parks and Wildlife Department: Austin, TX.

c. The Reddish Egret (*Egretta rufescens*) is listed as threatened by the State of Texas and is also protected by the Migratory Bird Treaty Act.

- The Reddish Egret is "a permanent resident of the Texas coast." White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water*

Quality for Federally Listed Species in Texas. 2006, U.S. Fish and Wildlife Service: Austin, TX

- White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX note the recovery history of the Reddish Egret:

- Until the late 1800s, reddish egrets were hunted for their feathers, which were used to decorate ladies' hats and clothing. The entire United States population of reddish egrets was nearly exterminated by hunters. The reddish egret completely disappeared from Florida. In 1918, the Migratory Bird Treaty Act was passed, finally protecting reddish egrets and other birds from plumage hunters.

d. The Piping Plover (*Charadrius melodus*) is listed as threatened by both the State of Texas and the federal government and is also protected by the Migratory Bird Treaty Act.

- Critical habitat for the Piping Plover includes coastal areas in the counties of Aransas, Brazoria, Calhoun, Cameron, Galveston, Kenedy, Kleberg, Matagorda, Nueces, San Patricio and Willacy. White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX.
- Specific threats to the Piping Plover include alteration or destruction of habitat, disturbance of natural salinity levels and either excess or continuous inundation with freshwater effluents. White, J.A., C.M. Giggleman, and P.J. Connor, *Recommended Water Quality for Federally Listed Species in Texas*. 2006, U.S. Fish and Wildlife Service: Austin, TX; Campbell, J., *Endangered and Threatened Animals of Texas: Their Life History and Management*. 2003, Wildlife Division, Texas Parks and Wildlife Department: Austin, TX.

e. The Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) is listed as endangered by both the State of Texas and the federal government.

- Adult Kemp's Ridley Sea Turtles are normally found only in the Gulf of Mexico. Campbell, J., *Endangered and Threatened Animals of*

Texas: Their Life History and Management. 2003, Wildlife Division, Texas Parks and Wildlife Department: Austin, TX.

- With regard to critical habitat, the Kemp's Ridley Sea Turtle prefers shallow waters and extensive seagrass beds. Campbell, J., *Endangered and Threatened Animals of Texas: Their Life History and Management*. 2003, Wildlife Division, Texas Parks and Wildlife Department: Austin, TX.
- In terms of the relationship between freshwater inflows, salinity levels and the abundance of blue crabs, the observations of Campbell, J., *Endangered and Threatened Animals of Texas: Their Life History and Management*. 2003, Wildlife Division, Texas Parks and Wildlife Department: Austin, TX are of note: "In Texas, Kemp's ridley and loggerhead sea turtles are thought to partition food resources: the ridleys forage on relatively fast blue and spotted crabs, whereas the loggerheads feed on seapens and slow-moving crabs."

iii. To the extent that they have been quantified, the freshwater inflow requirements for protected species appear to be roughly equivalent to the federal reserved water right for the Aransas National Wildlife Refuge. Stehn, T., *Fresh Water for ALL Texans: Enough for Both Humans and Wildlife? New Laws Debated*. Journey North, 2002; Stehn, T., *Relationship between inflows, crabs, salinities, and whooping cranes*. Journey North, 26 November 2001; Longley, W.L., ed. *Freshwater Inflows to Texas Bays and Estuaries: Ecological Relationships and Methods for Determination of Needs*. 1994, Texas Water Development Board: Austin, TX.

iv. Assuming *arguendo* that there is no federal reserved water right for the Refuge, then roughly equivalent quantities of water could be protected under the species protection statutes listed above.

a. States may exercise primacy over the management and allocation of water resources only to the extent that such resources are not needed to fulfill the requirements of federal statutes and regulations.

b. These statutes and regulations include the species protection statutes noted above.

c. In part, this rule is based on Article VI of the Constitution, the Supremacy Clause:

This Constitution, and the Laws of the United States which shall be made in Pursuance thereof; and all Treaties made, or which shall be made, under the Authority of the United States, shall be the supreme Law of the Land; and the Judges in every State shall be bound thereby, any Thing in the Constitution or Laws of any state to the Contrary notwithstanding.

d. Additional authority is found in the Property Clause (noted above) and Article II, Section 2, the Treaty Clause of the Constitution (the President "shall have Power, by and with the Advice and Consent of the Senate, to make Treaties, provided two thirds of the Senators present concur").

e. Consequently, the water requirements of the species protection statutes noted above will preempt the requirements of conflicting state laws and regulations.

f. As Justice Douglas noted in *Oklahoma ex rel Phillips v. Guy F. Atkinson Co.*, 313 U.S. 508, 534-535 (1941)(additional citations omitted):

"Whenever the constitutional powers of the federal government and those of the state come into conflict, the latter must yield." *Florida v. Mellon*, 273 U.S. 12, 17, 47 S.Ct. 265, 266, 71 L.Ed. 511. ... [T]he suggestion that this project interferes with the state's own program for water development and conservation is likewise of no avail. That program must bow before the "superior power" of Congress.

g. Of particular relevance to the proposed Exelon development, one of the clearest examples of the relationship between federal and state laws regarding the allocation of water is *Sierra Club v. Lujan*, Case No. MO-91-CA-069 (W.D. Texas, filed 1 February 1993), *sub now. Sierra Club v. Babbitt*, 995 F.2d 571 (5th Cir. 1993).

- At issue in the case was the relationship between the pumping of ground water from the Edwards Aquifer (pursuant to Texas law) and the need to provide flows from Comal and San Marco Springs in order not to adversely affect species protected by the federal Endangered Species Act.

- Judge Bunton's decision on this issue was succinct: "Priority is to be given to species whose survival is in conflict with economic activities, such as withdrawal of water from the Edwards." Slip opinion at 32.

h. The decision in *Sierra Club v. Lujan* is consistent with an earlier decision in *Riverside Irrigation District v. Stipo*, 658 F.2d 762 (10th Cir. 1981), *sub nom*. *Riverside Irrigation District v. Andrews*, 568 F. Supp. 583 (D. Colo. 1983), *aff'd* 758 F.2d 508 (10th Cir. 1985). In this case arising in Colorado, the court concluded that the requirements of federal law, specifically the Clean Water Act and the Endangered Species Act, may restrict the exercise of otherwise valid state water rights.

4. SubContested Issue 3: Under the Texas Prior Appropriation Doctrine, a Sufficient Quantity of Water is Neither Physically Nor Legally Available to Fulfill the Requirements of the Water Supply for the Plant.

A. The Texas prior appropriation doctrine.

i. Water resources in Texas are divided into three categories: Surface water, ground water and diffused water. Despite the fact that these resources are connected hydrologically, they are legally independent.

ii. State surface water is defined as the "water of the ordinary flow, underflow, and tides of every flowing river, natural stream, and lake, and of every bay or arm of the Gulf of Mexico, and the storm water, floodwater, and rainwater of every river, natural stream, canyon, ravine, depression, and watershed in the state[.]" Water Code, §11.027. In order to use such waters, a permit is required from the Texas Commission on Environmental Quality (TCEQ).

iii. Unlike surface water, ground water is considered the property of the surface landowner and is subject to the rule of capture.

a. As the Texas Supreme Court ruled in *Houston and Texas Central Railway Co. v East*, 81 S.W. 279, 281 (1904), underground waters "are so secret, occult, and concealed that an attempt to administer any set of legal rules in respect to them would be involved in hopeless uncertainty, and would be, therefore, practically impossible."

b. Though there are several exceptions, the general rule is that the landowner may pump ground water irrespective of adverse impacts on neighboring wells. *Texas Co. v. Buarkett*, 296 S.W. 273 (Texas, 1927).

iv. Permits for the use of surface water are based on the prior appropriation doctrine. Water Code, §11.021(a).

a. When surface water supplies are insufficient, the oldest water right (the "senior" right) has first call on available supplies.

b. Hence the rule: First-in-Time is First-in-Right.

c. Consequently, the federal reserved water right for the Aransas National Wildlife Refuge, having a priority date of 31 December 1937, would have priority over all the GBRA's surface water rights on the Guadalupe River. This would include Certificate of Adjudication No. 18-5178.

GBRA WATER RIGHTS		
Certificate:	Acre-feet per year:	Priority date:
5173	2,500	3 February 1941
5177	32,615	3 January 1944*
5174	1,870	15 June 1944
5177	8,632	26 January 1948
3863	3,000	1 March 1951
5175	940	13 February 1951
5176	9,944	21 June 1951
5178	106,000	7 January 1952
* If the diversion rate exceeds 370 cubic feet per second, the priority date for this water right becomes 26 January 1948.		

v. Even without considering the federal reserved water right for the Aransas National Wildlife Refuge or the freshwater inflow requirements of protected species, a sufficient quantity of GBRA water is neither physically not legally available to fulfill the requirements for cooling the VCS plant.

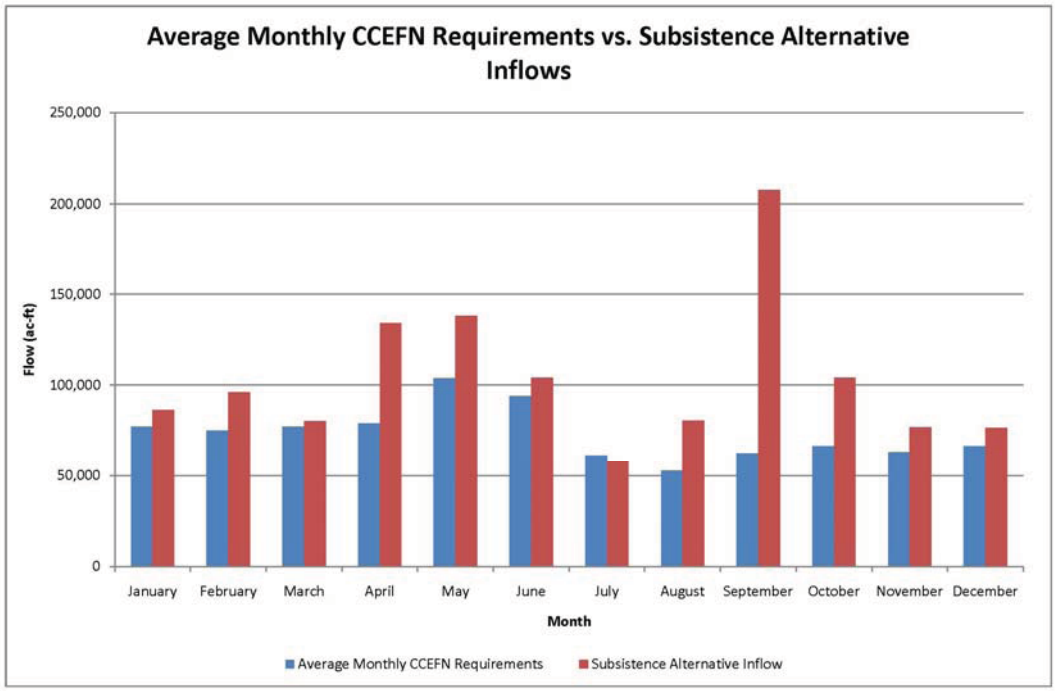
a. As noted above, the GBRA water available for lease by Exelon would be junior (have lower priority) than all of the other water rights held by GBRA.

b. The availability of 75,000 acre-feet of water per year under Certificate of Adjudication No. 18-5178 was addressed in South Coast Texas Regional Water Planning Group, *2011 Regional Water Plan, Study 1: Lower Guadalupe Water Supply Project for GBRA Needs (draft)*. 2008 (August), San Antonio River Authority: San Antonio, TX.

- To determine the availability of water under Certificate of Adjudication No. 18-5178, the South Coast Texas Regional Water Planning Group applied the Consensus Criteria for Environmental Flow Needs (CCEFN).
    - The CCEFN determinations were based on "consideration of the recommended monthly inflow needs of the Guadalupe Estuary" based on the MaxH values contained in Pulich, W., Jr.,, et al., *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas*. 1998, Resource Protection Division, Coastal Studies Program, Texas Parks and Wildlife Department: Austin, TX.
    - The CCEFN method was summarized by Roman in *Systematization of Water Allocation Systems: An Engineering Approach*. 2006, Texas A&M University: College Station, TX, p. 188 (*citing* guidance documents prepared by the Texas Water Development Board in 2002, specifically "Exhibit B: Guidelines for regional water plan development"):

      The CCEFN method defines three zones for pass-through flows in reservoirs and for direct diversions from freeflowing streams and rivers. The first zone minimum benchmark value is the monthly median flow. If the flow at the measured location is equal or greater than the monthly median, the pass-through flow is set equal to the monthly median flow. Zone 2, is defined between the monthly median flow (upper limit) and the monthly 25th percentile flow. The pass-through flow is set equal to the 25th percentile. In zone 3, which is the lowest flow category zone, minimum flows will be the larger of the flow necessary to maintain acceptable water quality standards or some site-specific minimum flow determined by TCEQ's planning staff.

- As displayed in the following table, the CCEFN inflows fall short of the amount required and would restrict the amount available to lease:

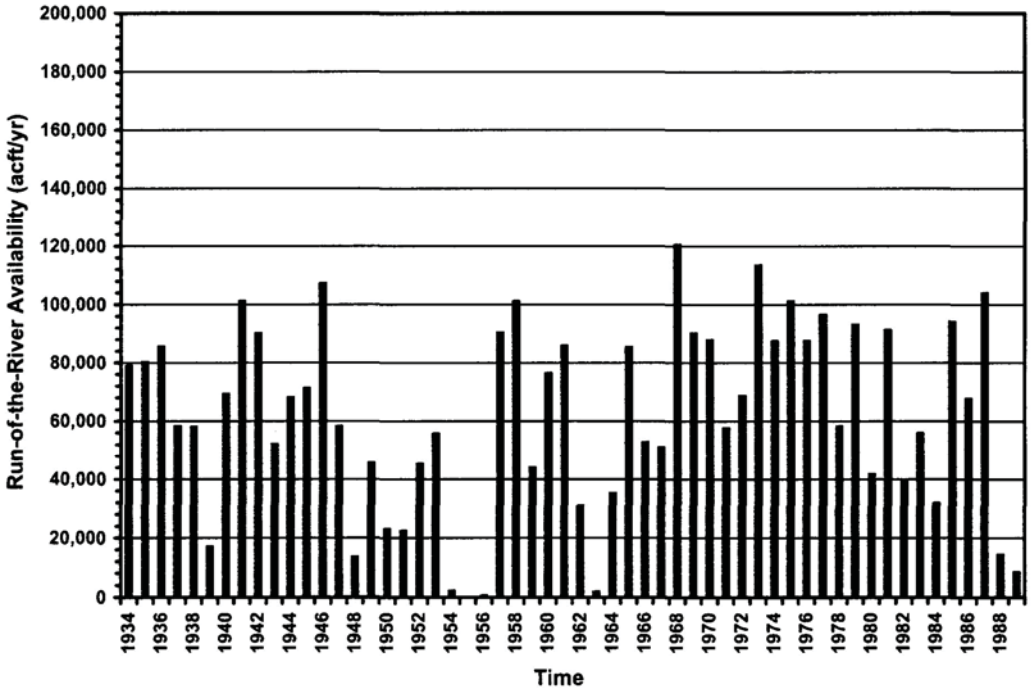


- As previously discussed, the Subsistence Alternative Inflows are the best quantification to date of the federal reserved water right.
- The Average Monthly CCEFN Requirements were determined using combined historic streamflow data for the Guadalupe River near Victoria, Coleto Creek and San Antonio River at Goliad and comparing the monthly data to the Median, 25th percentile and 15th percentile flows derived from the historic data.

- The South Coast Texas Regional Water Planning Group concluded:
  - Flows in the Guadalupe sufficient to meet the 75,000 acre-feet per year requirement were available in only 41% of the months simulated in the study. (*2011 Regional Water Plan, Study 1: Lower Guadalupe Water Supply Project for GBRA Needs (draft)*, p. 8.)
  - "The maximum annual diversion under CA# 18-5178 is 64,358 acft/yr[.]" (*2011 Regional Water Plan, Study 1:*

Lower Guadalupe Water Supply Project for GBRA Needs (draft), p. 9.)

- These conclusions were illustrated in Figure 2-2, Scenario 2 – "Availability from Guadalupe River under Junior Portion of CA# 18-5178 Subject to CCEFN, Limited by Maximum Diversion Rate of 187 cfs" (*2011 Regional Water Plan, Study 1: Lower Guadalupe Water Supply Project for GBRA Needs (draft)*, p. 9.):



c. To further complicate the situation, it appears that GBRA has also committed a portion of Certificate of Adjudication No. 18-5178 to other water development projects:

- The Lower Guadalupe Water Supply Project was to deliver 70,000 acre-feet per year to the San Antonio Water System and the San Antonio River Authority.
- 60,000 acre-feet per year appears to have been promised by GBRA to the San Marcos/New Braunfels area.
- 30,000 acre-feet per year is to be diverted for use at the Coleto Creek power plant in order to make an equivalent quantity of water available from Canyon Dam for local water supplies.

vi. Given the conclusions of the South Coast Texas Regional Water Planning Group noted above, it would be useless of Exelon to attempt to obtain a new water right for the Exelon project. In order to obtain a permit, an applicant must demonstrate to TCEQ:

a. That unappropriated water is available, Water Code, §11.134(b)(2).

- "For the approval of an application for a direct diversion from a stream without sufficient on or off channel water storage facilities for irrigation, approximately 75% of the water requested must be available approximately 75% of the time when distributed on a monthly basis and based upon the available historic stream flow record. Lower availability percentages may be acceptable if the applicant can demonstrate that a long-term, reliable, alternative source or sources of water of sufficient quantity and quality are economically available to the applicant to make the proposed project viable and ensure the beneficial use of state water without waste." 30 Texas Administrative Code, Chapter 297, §297.42(c)

b. That the proposed appropriation is intended for a beneficial use, Water Code, §11.134(b)(3)(A).

- Even though water permits are for a quantified amount of water, the actual water right is limited to the quantity of water put to beneficial use. Water Code, §11.025.
- "Beneficial use" is defined as "the amount of water which is economically necessary for a purpose authorized by this chapter, when reasonable intelligence and reasonable diligence are used in applying the water to that purpose and shall include conserved water." Water Code, §11.002(4).

c. That the proposed diversion will impair neither existing water rights nor vested riparian rights, Water Code, §11.134(b)(3)(B).

d. That the proposed diversion is not detrimental to the public welfare. Water Code, §11.134(b)(3)(C).

vii. The proposed diversion must also "consider" environmental flows established under Texas law, Water Code, §11.134(b)(3)(D). These include "any applicable environmental flow standards established under Section 11.1471 and, if applicable, the assessments performed under Sections 11.147(d) and (e) and Sections 11.150, 11.151, and 11.152[.]"

viii. Of particular relevance is the fact that the Region L water plan has not been approved. Unless an exception has been granted by TCEQ, the permit applicant must "addresses a water supply need in a manner that is *consistent with* the state water plan and *the relevant approved regional water plan* for any area in which the proposed appropriation is located[.]" Water Code, §11.134(b)(3)(E) (emphasis added).

ix. Finally, the applicant must provide evidence that "reasonable diligence will be used to avoid waste and achieve water conservation as defined by Section 11.002(8)(B)." Water Code, §11.134(b)(4). Section 11.002(8)(B) defines water conservation to include both "the development of water resources" and "those practices, techniques, and technologies that will 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."

x. With regard to the proposed Exelon project, the environmental flow requirements noted above are particularly relevant.

    a. Whenever TCEQ considers "an application for a permit to store, take, or divert water, the commission *shall* assess the effects, if any, of the issuance of the permit on the bays and estuaries of Texas." Water Code, §11.147(b) (emphasis added).

    b. Furthermore, with regard to permits "issued within an area that is 200 river miles of the coast, to commence from the mouth of the river thence inland, the commission *shall* include in the permit any conditions considered necessary to maintain beneficial inflows to any affected bay and estuary system, to the extent practicable when considering all public interests and the studies mandated by Section 16.058 [studies conducted on bays and estuaries by the Texas Parks and Wildlife Department] as evaluated under Section 11.1491." Water Code, §11.147(b) (emphasis added).

c. Under §11.1491 of the Water Code, TCEQ and the Texas Parks and Wildlife Department are required "to review the studies prepared under Section 16.058, to determine inflow conditions necessary for the bays and estuaries, and to provide information necessary for water resources management." Water Code, §1.1491(a).

d. With regard to the effect of the proposed appropriation on bays, estuaries and instream uses, the term "beneficial inflows" noted above means "a salinity, nutrient, and sediment loading regime adequate to maintain an ecologically sound environment in the receiving bay and estuary system that is necessary for the maintenance of productivity of economically important and ecologically characteristic sport or commercial fish and shellfish species and estuarine life upon which such fish and shellfish are dependent." Water Code, §11.147(a).

e. In order to assess the effects of permit issuance on Texas' bays and estuaries, TCEQ "*shall* consider *among other factors*", Water Code, §11.147(c) (emphasis added):

- The need for freshwater inflows, Water Code, §11.147(c)(1). Specifically, TCEQ must address "the need for periodic freshwater inflows to supply nutrients and modify salinity to preserve the sound environment of the bay or estuary, using any available information, including studies and plans specified in Section 11.1491 of this code and other studies considered by the commission to be reliable; together with existing circumstances, natural or otherwise, that might prevent the conditions imposed from producing benefits[.]"
- The "ecology and productivity of the affected bay and estuary system," Water Code, §11.147(c)(2).
- The impact on public welfare of not maintaining beneficial inflows, Water Code, §11.147(c)(3). TCEQ is required to address "the expected effects on the public welfare of not including in the permit some or all of the conditions considered necessary to maintain the beneficial inflows to the affected bay or estuary system[.]"
- The applicant's proposed use and quantity of water requested, Water Code, §11.147(c)(4).
- The "needs of those who would be served by the applicant," Water Code, §11.147(c)(4).

- "[T]he expected effects on the public welfare of the failure to issue all or part of the permit being considered[.]" Water Code, §11.147(c)(5).

xi. Finally, Water Code, §11.147(c)(6) requires TCEQ to consider both "the declarations as to preferences for competing uses of water as found in Sections 11.024 and 11.033" of the Water Code and "the public policy statement in Section 1.003" of the Water Code.

a. The following preferences are established in § 11.024.

In order to conserve and properly utilize state water, the public welfare requires not only recognition of beneficial uses but also a constructive public policy regarding the preferences between these uses, and it is therefore declared to be the public policy of this state that in appropriating state water preference shall be given to the following uses in the order named:

(1) domestic and municipal uses, including water for sustaining human life and the life of domestic animals, it being the public policy of the state and for the benefit of the greatest number of people that in the appropriation of water as herein defined, the appropriation of water for domestic and municipal uses shall be and remain superior to the rights of the state to appropriate the same for all other purposes;
(2) agricultural uses and industrial uses, which means processes designed to convert materials of a lower order of value into forms having greater usability and commercial value, including the development of power by means other than hydroelectric;
(3) mining and recovery of minerals;
(4) hydroelectric power;
(5) navigation;
(6) recreation and pleasure; and
(7) other beneficial uses.

b. Section 11.033 addresses the use of eminent domain authority:

The right to take water necessary for domestic and municipal supply purposes is primary and fundamental, and the right to recover from other uses water which is essential to domestic and municipal supply purposes is

paramount and unquestioned in the policy of the state. All political subdivisions of the state and constitutional governmental agencies exercising delegated legislative powers have the power of eminent domain to be exercised as provided by law for domestic, municipal, and manufacturing uses and for other purposes authorized by this code, including the irrigation of land for all requirements of agricultural employment.

c. The public policy statement contained in §1.003 provides that "[t]his chapter [Chapter 11: Water Rights] applies to all streams or other sources of water supply lying upon or forming a part of the boundaries of this state."

xii. TCEQ is required to include in the permit, to the extent practicable when considering all public interests, "those conditions considered by the commission necessary to maintain existing instream uses and water quality of the stream or river to which the application applies," Water Code, §11.147(d), as well as "those conditions considered by the commission necessary to maintain fish and wildlife habitats." Water Code, §11.147(e).

xiii. The requirements of §1147 of the Water Code apply both to new permit applications and to applications to amend existing permits. However, the statutory requirements are not to "affect an appropriation of or an authorization to store, take, or divert water under a permit or amendment to a water right issued before September 1, 2007." Water Code, §11.147(e-1).

5. Conclusions regarding the physical and legal availability of water.

A. As noted above, the best available quantification of the federal reserved water right for the Aransas National Wildlife Refuge indicates demonstrates a right to 1,572,200 acre-feet of water per year with a priority date of 31 December 1937. Texas Department of Water Resources, *Guadalupe Estuary: A Study of the Influence of Freshwater Inflows*. 1980, Texas Department of Water Resources: Austin, TX: Of this quantity:

i. 1,491,200 acre-feet of inflow would be required from the Guadalupe River Basin (including the San Antonio River Basin).

ii. Of this amount, 1,242,500 acre-feet per year would be required from the gauged portion of the Guadalupe River Basin.

iii. The remaining 83,000 acre-feet per year would be required from coastal basins.

B. In a subsequent study focusing primarily on salinity gradients in the Estuary, Pulich, W., Jr., *et al*., *Freshwater Inflow Recommendation for the Guadalupe Estuary of Texas*. 1998, Resource Protection Division, Coastal Studies Program, Texas Parks and Wildlife Department: Austin, TX, a freshwater inflow of 1.15 million acre-feet per year was recommended.

C. These freshwater inflow requirements, both annually and on a monthly basis, are depicted in the following table:

MONTH	Subsistence Alternative Inflow (1000s of ac-ft), Guadalupe River Basin (total)	Subsistence Alternative Inflow (1000s of ac-ft), gauged portion of the Guadalupe River Basin	MaxH Inflow (1000s of ac-ft)
January	102.2	86.4	111.2
February	115.8	96.2	124.2
March	97.0	80.3	52.4
April	160.4	134.1	52.4
May	165.1	138.1	222.6
June	125.0	104.0	162.7
July	70.4	57.6	88.6
August	97.5	80.6	88.3
September	247.1	207.8	52.4
October	125.0	104.0	52.4
November	93.1	76.9	73.8
December	92.6	76.5	66.2
Annual inflow requirement:	1491.2	1242.5	1147.2

D. As noted above, the assumption is made that these monthly inflows are sufficient to meet the needs of species protected by the aforementioned species protection statutes. If these monthly inflows are not sufficient to meet the needs of protected species, then both the annual and the monthly inflow requirements could increase.

E. Only after the requirements of federal law have been satisfied may the TCEQ issue permits for the use of surface water. At that point, the requirements of state law discussed in SubContested Issue 3, above, become applicable.

F. In essence, water that is actually available is not legally available for allocation and management by TCEQ until the requirements of federal law have been satisfied.

6. Exelon did not address any of these requirements, preferring simply to assert that water supply for the Exelon facility would be obtained from the Guadalupe River by either leasing, new water right, purchase of existing water rights or some combination.

A. Given the 1,242,500 acre-feet per year Subsistence Alternative Inflow requirement from the gauged portion of the Guadalupe River Basin, historic records indicate that Exelon would have *no* water both physically and legally available between 28.4% and 79.7% of the time depending on month.

B. The percentage of time during which Exelon would have *no* water both physically and legally available would increase if the Subsistence Alternative Inflow requirement is based on the aforementioned 1,491,200 acre-feet per year requirement for the Guadalupe River Basin rather than on the 1,242,500 acre-feet per year requirement from the gauged portion of the Basin.

C. The historic records and months during which the Subsistence Alternative Inflow requirements have not been met (in yellow) are depicted in the following table.

Combined Streamflow at Diversion Point (Coleto Creek+Guadalupe at Victoria+San Antonio River at Goliad)

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total Flow (AF)
1934	-	-	-	-	-	-	-	-	-	-	-	102,913	102,913
1935	48,498	107,820	46,890	66,653	483,673	537,743	114,348	71,941	273,392	121,826	64,320	126,483	2,063,586
1936	86,797	59,703	64,908	48,629	296,279	138,546	1,133,304	80,609	193,140	266,918	105,125	95,187	2,569,144
1937	86,321	75,253	174,249	81,224	59,005	162,620	57,561	42,137	38,845	49,805	39,253	70,959	937,232
1938	161,852	95,663	89,316	311,074	302,521	81,363	58,588	47,465	41,812	37,097	38,156	41,135	1,306,043
1939	43,809	36,326	48,198	44,052	52,387	53,052	72,921	37,813	32,245	37,639	32,656	38,821	529,918
1940	39,885	59,235	47,476	79,992	61,060	140,897	506,253	60,412	35,759	65,427	594,604	471,697	2,162,696
1941	197,364	282,123	324,531	392,586	1,071,733	395,764	229,858	116,204	124,299	118,425	100,458	77,486	3,430,832
1942	71,334	64,327	64,534	187,710	124,955	71,213	701,622	83,383	551,390	301,901	144,990	121,072	2,488,430
1943	116,943	84,648	101,937	85,284	86,837	138,174	88,188	56,625	65,339	56,277	58,003	63,511	1,001,765
1944	113,599	116,876	224,281	108,523	339,446	213,365	91,385	84,344	141,918	69,776	91,374	160,276	1,755,163
1945	242,885	229,039	203,880	410,562	118,268	110,013	72,432	58,389	51,031	104,721	62,698	79,893	1,743,810
1946	98,895	128,058	220,596	135,549	233,911	217,325	66,312	123,021	545,709	708,972	281,834	174,007	2,934,187
1947	273,889	148,808	167,970	158,249	215,448	91,175	71,784	104,628	57,375	49,603	54,312	62,037	1,455,277
1948	57,492	65,910	63,596	47,365	109,751	41,676	70,431	79,933	40,474	48,640	33,532	36,226	695,026
1949	41,524	72,422	112,747	385,450	217,366	130,408	105,282	59,457	46,839	248,146	69,997	90,347	1,579,986
1950	60,656	62,619	55,913	92,904	70,008	175,539	47,686	35,562	33,233	29,759	28,461	33,196	725,535
1951	31,783	34,491	37,026	38,629	66,417	205,658	26,682	16,885	84,882	24,163	28,407	29,371	624,394
1952	29,135	35,584	31,902	57,488	132,646	93,459	39,254	15,801	463,160	53,000	81,386	134,361	1,167,177
1953	118,556	55,784	50,759	55,873	226,489	25,425	27,142	71,350	188,192	118,881	50,770	66,564	1,055,786
1954	45,101	34,979	32,334	38,318	60,256	22,041	13,997	9,650	10,283	14,975	19,709	20,080	321,724
1955	23,554	71,994	30,949	22,498	66,395	57,180	17,332	22,935	23,590	10,692	10,819	18,180	376,117
1956	18,263	20,713	14,793	14,432	25,412	5,085	6,481	5,975	14,779	32,310	12,647	53,003	223,893
1957	13,909	31,887	101,409	393,904	603,127	451,882	51,517	28,426	348,113	546,066	302,852	140,223	3,013,317
1958	349,483	637,573	279,748	141,338	388,818	131,537	107,269	57,528	174,328	186,543	226,690	124,382	2,805,236
1959	106,228	137,434	104,126	233,927	140,564	87,849	99,947	64,447	56,932	195,027	100,510	88,784	1,415,776
1960	111,796	108,364	97,830	97,822	166,306	203,317	193,368	144,410	79,428	719,083	565,305	259,275	2,746,304
1961	288,126	331,841	192,593	121,041	86,896	487,930	223,344	95,364	134,354	97,152	179,745	81,980	2,320,365
1962	75,704	67,880	62,809	75,322	61,074	93,162	41,456	29,254	62,373	49,274	54,639	72,350	745,297
1963	55,880	78,977	52,771	56,165	39,380	29,269	25,543	13,490	20,726	30,933	66,266	43,954	513,352
1964	40,606	76,817	100,636	51,649	36,681	50,195	21,336	45,224	54,731	70,366	92,502	46,184	686,928
1965	132,609	360,097	97,734	99,592	423,540	281,946	82,579	53,405	52,407	114,446	131,181	204,015	2,033,550
1966	93,558	112,361	117,154	150,518	196,281	87,098	66,188	53,925	73,788	66,504	51,335	47,749	1,116,458
1967	48,400	39,591	42,112	39,110	34,336	20,860	23,432	42,421	1,260,226	203,204	188,340	91,738	2,033,770
1968	698,887	192,404	154,053	212,636	431,596	416,960	135,174	76,805	148,064	70,569	74,681	161,235	2,773,064
1969	79,159	238,767	218,240	259,937	280,735	124,922	63,269	57,574	69,636	106,358	87,469	115,684	1,701,749
1970	138,232	129,247	215,066	134,772	279,625	239,887	88,131	66,597	60,407	81,108	55,438	54,988	1,543,498
1971	55,583	45,399	47,562	35,758	30,846	35,669	28,464	174,195	229,659	174,072	139,588	172,600	1,169,396
1972	121,329	116,576	86,331	77,499	1,007,973	228,754	132,586	114,074	88,048	94,214	79,402	75,379	2,222,164
1973	96,076	124,539	187,139	412,674	174,628	695,763	548,497	251,932	261,556	1,076,869	297,182	188,801	4,315,657
1974	274,185	141,983	125,448	100,903	183,085	133,023	68,355	123,965	330,850	128,438	342,475	218,325	2,171,036
1975	175,557	368,884	193,356	178,759	696,376	516,223	262,650	158,384	116,750	98,302	82,060	103,192	2,950,493
1976	82,644	70,458	78,464	392,764	551,747	240,800	207,691	139,563	145,831	360,690	444,151	528,243	3,243,047
1977	271,196	346,658	200,995	868,771	433,046	228,148	148,715	100,073	109,469	88,074	171,725	92,005	3,058,875
1978	87,725	88,736	88,499	97,950	75,040	140,577	51,208	334,749	375,720	134,452	174,903	99,262	1,748,822
1979	415,775	291,553	314,695	490,716	653,064	542,909	209,016	167,399	146,769	80,527	76,398	81,990	3,470,812
1980	110,749	82,447	69,131	66,316	244,292	87,079	49,981	69,876	135,431	77,401	73,084	75,905	1,141,691
1981	78,294	73,796	103,519	126,643	212,257	939,231	332,891	158,038	832,091	259,929	341,789	141,117	3,599,593
1982	109,055	161,862	101,477	83,941	423,873	105,383	65,029	48,397	43,655	69,398	112,176	68,803	1,393,048
1983	68,879	117,354	182,164	101,458	115,175	97,881	121,099	61,212	93,685	78,226	90,093	50,632	1,177,858
1984	72,301	58,149	84,871	42,310	38,033	29,381	16,586	17,442	16,229	104,676	76,823	80,978	637,779
1985	166,491	112,050	209,422	219,307	125,418	213,699	219,485	78,102	68,526	160,606	287,661	232,603	2,093,370
1986	136,379	122,684	93,682	72,746	122,630	362,635	104,490	56,894	102,771	215,243	186,541	487,943	2,064,638
1987	371,052	272,117	379,366	173,878	234,079	2,380,406	523,418	324,859	183,089	133,412	118,120	112,612	5,206,409
1988	93,335	79,708	96,500	72,880	70,782	82,491	82,362	81,849	54,178	48,542	44,367	49,471	856,464
1989	65,952	63,346	67,366	68,871	108,539	59,744	28,479	22,655	16,830	28,117	47,393	46,932	624,225
1990	40,646	43,221	69,617	103,647	116,519	52,827	168,639	74,266	83,864	52,740	57,278	51,800	915,065
1991	230,332	203,074	105,893	383,289	209,598	123,115	123,943	60,467	83,234	69,557	73,341	905,695	2,571,538
1992	849,006	1,480,914	918,186	902,875	938,137	867,549	279,159	189,206	141,679	116,641	181,252	155,430	7,020,035
1993	165,389	193,102	256,309	148,433	622,267	586,730	191,299	82,226	66,951	84,399	83,070	78,501	2,558,676
1994	79,163	72,476	118,189	93,027	412,558	118,253	60,632	52,327	66,185	371,764	96,406	147,398	1,688,377
1995	161,730	83,296	199,499	148,425	85,123	230,119	120,252	61,138	62,824	53,648	55,955	64,876	1,326,887
1996	56,522	48,162	47,865	40,210	34,789	30,709	19,776	29,481	160,679	37,105	40,341	54,512	600,149
1997	77,191	59,047	212,756	566,960	288,518	869,787	473,716	185,109	92,740	255,679	89,976	103,722	3,275,221
1998	123,054	259,518	268,460	151,372	76,191	54,053	46,224	122,907	277,222	2,407,349	737,215	354,260	4,897,824
1999	182,492	121,236	133,046	111,074	125,752	173,356	99,674	59,826	44,538	45,786	49,791	52,199	1,198,770
2000	63,367	60,148	65,360	63,761	85,710	136,487	38,647	26,299	28,549	74,582	480,078	190,311	1,313,297
2001	221,695	160,946	254,025	162,866	172,235	88,900	60,891	117,660	873,791	135,091	309,983	434,101	2,992,185
2002	168,762	114,001	105,767	189,145	78,083	62,213	1,995,928	375,747	514,942	686,243	845,391	499,818	5,638,040
2003	332,233	358,654	295,389	161,464	125,883	123,139	148,940	92,025	200,578	140,183	116,754	96,201	2,191,441
2004	129,568	118,859	139,795	360,785	413,727	559,985	496,406	170,461	140,759	289,367	1,456,936	576,297	4,852,945
2005	278,023	366,230	522,559	187,231	226,483	143,109	105,986	91,109	84,651	75,250	64,053	73,263	2,217,948
2006	71,528	57,299	68,379	54,292	69,873	48,801	51,788	26,763	52,555	44,669	40,790	50,602	637,340
2007	162,627	65,569	484,884	341,435	403,149	297,053	1,269,605	805,853	448,394	192,570	158,984	120,323	4,750,445
2008	109,851	94,351	95,328	81,583	65,842	47,235	59,388	74,212	53,247	42,150	38,651	42,202	804,040
Subsistence Alternative Inflow	**86,400**	**96,200**	**80,300**	**134,100**	**138,100**	**104,000**	**57,600**	**80,600**	**207,800**	**104,000**	**76,900**	**76,500**	**1,242,500**
# of Years SAI Not Met	31	37	24	41	36	29	21	44	59	40	33	30	
% of Years SAI Not Met	**41.9%**	**50.0%**	**32.4%**	**55.4%**	**48.6%**	**39.2%**	**28.4%**	**59.5%**	**79.7%**	**54.1%**	**44.6%**	**40.5%**	

Guadalupe River near Victoria records started in December, 1934
San Antonio River at Goliad records started in March, 1939
Coleto Creek records started in July 1939
No Records for Coleto Creek from October 1954 - June 1978

# of Years Below SAI: 26
% of years below minimum: 35.1

D. Given the priority date of the Aransas federal reserved water right as well as the preemptive effect of federal species protection statutes, surface flows would not be legally available to satisfy the GBRA Salt Barrier Water Rights in those months when the Subsistence Alternative Inflow requirement has not been met.

E. In essence, the Subsistence Alternative Inflow requirement must be met *before* surface flows become legally available for other uses.

F. Furthermore, the historic record indicates that there are multiple months when actual flows only minimally exceeded the Subsistence Alternative Inflow requirements. During these months, it is possible that water *might* be available to Exelon depending on the relative priorities of the GBRA Run-of-River Rights.

H. As noted above, "Certificate of Adjudication No. 18-5178 has a time priority that is junior to all other Certificates of Adjudication comprising the Run-of-River Rights and, therefore, the water supply available under Certificate of Adjudication No. 18-5178 is the least firm of the water supplies available under any of such rights.

I. In essence, based on both the historic record and existing surface water right priorities on the Guadalupe River, only a portion of the water required to cool the VCS plant would be both physically and legally available. The portion that is available would be so only on an intermittent basis.

7. Failure to document a water supply that is both physically and legally available renders the Exelon ESP application incomplete.

8. Determining that the water supply for the Exelon facility is both physically and legally available is material to the findings the NRC must make regarding Exelon's ESP application.

9. A genuine dispute exists with the applicant on a material issue of fact or law.

A. Exelon appears to believe that both the actual and the legally available water in the Guadalupe River is sufficient to cool the Exelon facility.

B. Petitioners believe that the requirements of both federal and state law place significant limitations on the quantity of water that is available for leasing or new allocation.
C. These limitations, when combined with climatic variability, result in substantially less water being both physically and legally available.

Contested Issue 3

Contested Issue 3

Exelon is relying on a Flawed Water Supply Analysis conducted by Guadalupe Blanco River Authority to assert that sufficient water to cool the VCS plant is available for leasing.

Issue Statement

1. The GBRA Water:

   Exelon appears to rely on the Guadalupe Blanco River Authority (GBRA) to lease water to cool the proposed Victoria county nuclear facility. As discussed in Contested Issue Two, the GBRA's surface water rights near the location of the proposed facility are junior to the federal reserved water right for the Aransas National Wildlife Refuge and may also be superceded by federal species protection statutes.

2. The Inadequacy of the Water Availability Model:

   In an attempt to determine the quantity of water physically available for diversion and use, GBRA modeled the Guadalupe and San Antonio river systems using a Water Availability Model (WAM) based on historical surface water flow statistics. However, since Texas water law doesn't recognize that surface and ground water are part of the same hydrologic system, the WAM model also assumes no hydrologic connection. Therefore, the WAM model by definition over predicts the availability of surface water simply because it ignores past, present and future ground water production, which will directly reduce future surface water flow.

   The Guadalupe-San Antonio drainage basins are a source of both surface and groundwater. How this system and adjacent systems of aquifers interacts and contributes to surface flow in the rivers, streams and ultimately to the Gulf of Mexico has been studied by the Texas Water Development Board (TWDB) in a report titled "Groundwater Availability Model of the Central Gulf Coast Aquifer System: Numerical Simulations through 1999", dated September 27, 2004. This report states; "Of the annual flow of about 620,000 acre-ft, about 84 percent discharges into the streams, and 16 percent discharges through the general head boundary into the Gulf of Mexico." Therefore, one estimate is approximately 520,000 acre-ft per year of surface flow is direct base flow from the groundwater aquifers to the streams. The study area is shown in Figure 1 from the TWDB report (below).

Figure 1

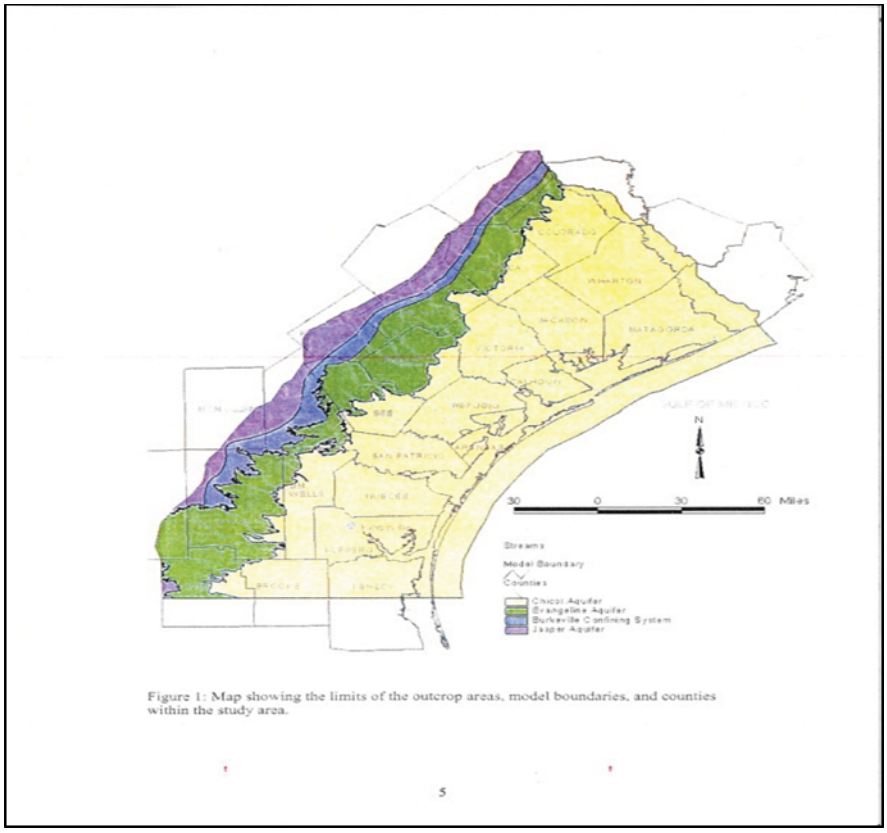


Figure 1: Map showing the limits of the outcrop areas, model boundaries, and counties within the study area.

5

3. The Effects of Population Growth Ignored:

Future water needs for population growth in the Guadalupe-San Antonio river basins are projected in extensive "Region L" studies to approximately double between the years 2010 and 2060, "2006 South Central Regional Water Plan Volume I, June 2005, HDR". Attached is the HDR population projection, figure 2-1 for the South Central Texas Region's Projected Population (below), estimated Region L population to rise from about 1.7 million to 4.3 million in 2060.

Figure 2-1

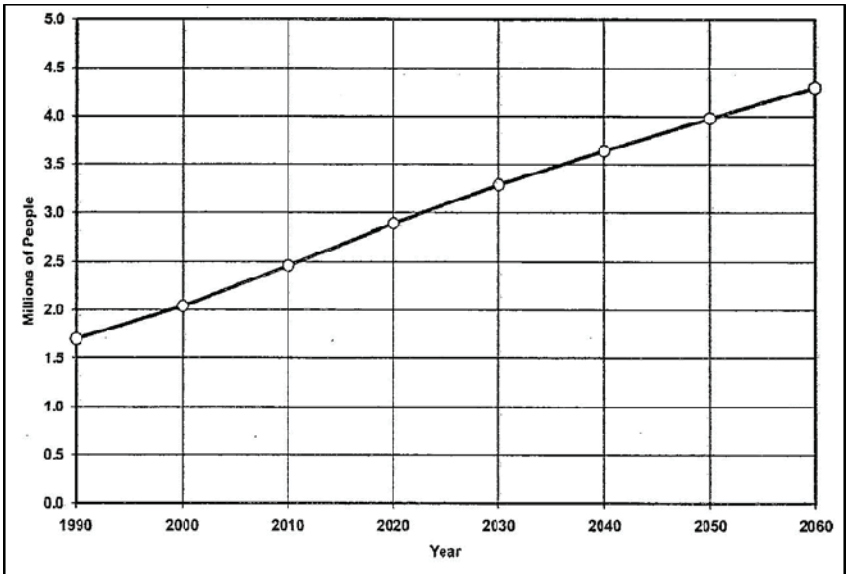


Figure 2-1. Summary of South Central Texas Region's Projected Population

Also attached from the same publication is Figure 2-2, the HDR study also included data on "Projected Per Capita Water Use and Municipal Water Demand South Central Texas Region – 1990 to 2060" (figure 2-2, below). This study estimates that due to population and industrial growth, water demand will rise from about 325,000 acre-ft/year to 650,000 acre-ft/year. However in order to service an additional 3 million people, Region L speculates that a significant drop in irrigation water demand will take place and per capita water use will significantly drop. Since surface water rights are virtually unavailable that are "Senior" enough to provide a reliable future water supply, groundwater is expected to make up much of the shortfall.

Figure 2-2

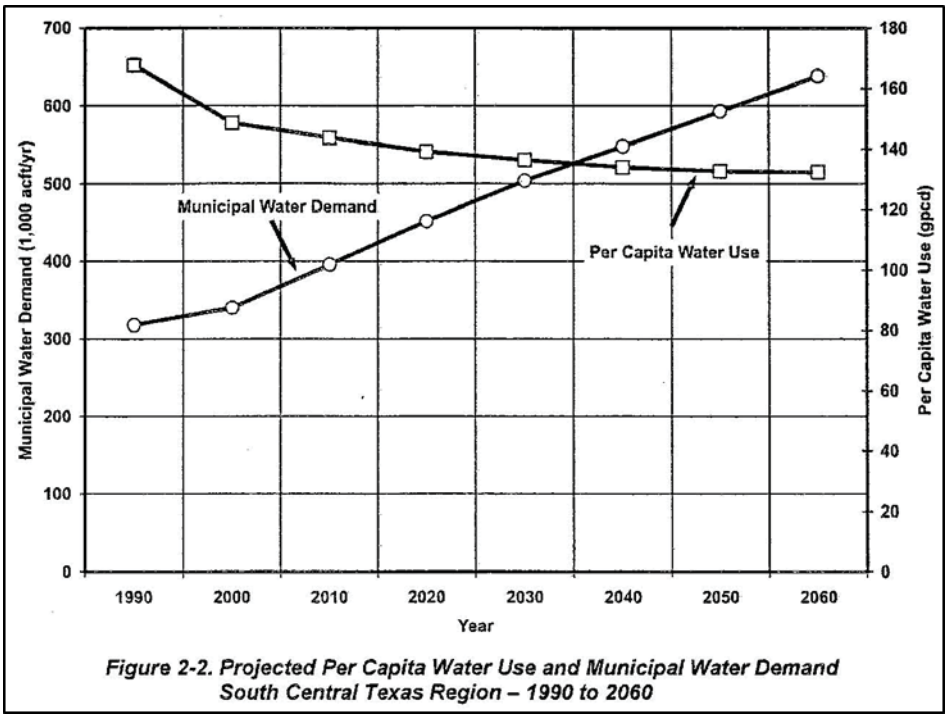


Figure 2-2. Projected Per Capita Water Use and Municipal Water Demand South Central Texas Region – 1990 to 2060

Since base flow from the TWDB model is only 520,000 acre-ft over the entire study area as shown on TWDB figure 1 (above) the base flow in the Guadalupe, San Antonio drainage portion must be significantly less, herein assumed to be conservatively one half of the total base flow or 260,000 acre-ft per year. Assuming 125 gallons per person per day and a population growth of 3 million people translates to an increase in future demand of 420,000 acre-ft per year. This simple calculation ignores all other increases or decreases in demand but clearly indicates that potentially GBRA has more legal water than real water to sell. It is highly unlikely that the water supply purported to be available to the GBRA will be physically available.

4. Cumulative Effects of Drought Ignored:

Assuming that a drought and the impact of future ground water demand are either individually or cumulatively possible, any model based on historical surface water

statistics could be inaccurate in the range of 420,000 to 1,400,000 acre-ft/year. Given the magnitude of the potential impact of defining the hydrologic system incorrectly, sufficient water is not available to cool the VCS plant.

5. The GBRA Analysis Rests on the Fallacious Assumption that Ground Water Will Continue to be Available to Augment Surface Flows:

   In summary, ignoring all other issues, the paradox for water planners, centers of water demand, GBRA and therefore EXELON, is to determine the future impact of groundwater production on the reliability of surface water, since the historical statistics are flawed by definition. Surface and groundwater are not legally interconnected but are physically connected by all measures. Exelon therefore finds itself in a position of proposing to build a nuclear reactor facility where the legal and physical availability of the water in question lacks legal and scientific definition. There is no legal or scientific basis for Exelon to assume future water will be available where the fundamental assumptions of the projected availability of this water are flawed. The fundamental flaw is that the availability of GBRA water appears to be predicated on the assumption that GBRA can control the future use of ground water. Under current Texas law, this is something that the GBRA cannot do.

6. Exelon did not adequately address these issues, preferring simply to assert that the water supply for the Exelon facility could be met by leasing, new sources, buying existing rights or some combination.

7. Failure to document a water supply that is both physically and legally available renders the Exelon ESP application incomplete.

8. A genuine dispute exists with the applicant on a materials issue of both fact and law.

   Exelon appears to believe that there is actual and the legally available water for the VCS facility. Petitioners believe that future development of ground water under Texas law will result in surface water being unavailable for use by Exelon in the quantities required for plant operation.

Contested Issue 4

Contested Issue 4

Exelon's ESP for the Victory County Site (VCS) Fails to Properly Document and Evaluate the Threats Posed by the Existence of Hundreds of Active and Abandoned Oil and Gas Wells and Borings On and Near the Facility.

Background

The ESP notes the existence of many active and abandoned oil and gas wells on and near the site selected for the Victoria County Nuclear Station, but then dismisses any further evaluation on the stated basis that the gas pipelines present a greater hazard. This analysis fails to consider the numerous potential hazards posed by the existence of active and abandoned wells on site.

The migration of gas from oil and gas formations to the surface is a problem that greatly affects those surface areas where human activity exists. Gas fields, underground gas storage facilities, and oil fields have demonstrated a long history of gas migration problems. Experience has shown that the migration of gas to the surface through natural and manmade pathways creates a serious potential risk of explosion, fires, noxious odors and potential emissions of poisonous or carcinogenic chemicals. These risks must be seriously examined for all human activities located near oil and gas operations.

Natural Pathways

Gas can reach the surface through natural geologic features, which may facilitate vertical or lateral migration. The geologic features most likely to serve as potential pathways include:

- Surficial Alluvial Deposits
- Aquifers
- Fracture Systems
- Fault Planes
- Bedrock contacts (unconformities)

In general, geologic pathways tend to be relatively tight except near the surface. The main exception is fault planes which can provide open conduits over long distances. Several of these pathways are present at the VCS.

Manmade Pathways

A list of common man-made structures that could serve as vertical conduits of gas from the subsurface to the surface include:

- Old abandoned oil and gas wells or dry holes (prior to current TRRC abandonment regulations)
- Previously undocumented wells and dry holes
- Existing water extraction or injection wells
- Old abandoned water wells
- Monitoring wells
- Recently plugged and abandoned oil and gas wells (after current TRCC abandonment regulations)

Each year many wells are plugged and abandoned throughout the United States. These include water wells, mineral exploration wells, and oil and gas production wells. Many wells penetrate one or more aquifers, i.e., layers of sand, gravel, or permeable rock containing potable subsurface water. The wells also pierce formations containing oil and gas reservoirs, mineral deposits such as uranium and lead, and water contaminated with concentrations of salts and other dissolved solids.

The borehole provides a mechanism for communication of fluids and gases between formations and the surface. Therefore these boreholes pose a threat to fresh water aquifers and surface structures. For example, if the borehole passes through both an aquifer and a brine-bearing formation, the brine can invade the aquifer and compromise the quality and purity of the water. Aquifers are typically isolated by non-permeable formations above and below the water-bearing material, confining the water and protecting it from contamination. Improperly plugged wells compromise aquifer integrity by destroying its natural isolation, and exposing it to potentially toxic materials from nearby formations.

Responsibility for proper plugging and abandonment of wells usually belongs to the well operator or owner. Depending on the type of well, oversight of abandonment procedures falls under several jurisdictions. The laws governing plugging and abandonment with regards to oil and gas wells in Texas are covered in the Texas Administrative Code (TAC) Title 16 Part 1 Chapter 3 Rule 14 and are administered by the Texas Railroad Commission.

Enforcement of proper abandonment procedures is problematic due to the limited resources available in the past and currently. Limited resources mean that it is seldom possible for an inspector to be present to ensure proper plugging practices are followed, and the majority of abandoned wells are plugged without any oversight.

Unfortunately, considering the high cost, limited inspection, complicated jurisdiction, and conflicting abandonment procedures, there is temptation to abandon the well with nothing more than a

surface plug. Wells abandoned 20 or more years ago are even more likely candidates for improper abandonment due to fewer requirements and less sensitivity to environmental concerns.

Well construction, redevelopment, and abandonment deficiencies can contribute to gas migration problems. If cement bonds between the casing and surrounding natural formation do not form adequate seals, pressurized leakage is possible. Leakage through the annular space between casing and formation can occur due to lack of proper seals, inadequate or poor cement bonds with bore hole walls, channel within cement, deterioration of annular seals over time, and fracturing or cavitation of enclosing walls.

Structural integrity of well components and seals is not permanent. Some of the oil and gas wells on the Exelon site have been in the ground for nearly a hundred years. The Texas Land and Mineral Owners Association stated, on their website, that the average life expectancy of a well in the ground with normal acidity is 20 years. The FSAR states that the pH of the soil around the Exelon property is 5.7 which is "mildly corrosive towards buried steel" (FSAR 2.5.4-24). Potential exists for many of the oil and gas wells on the VCS site to be deteriorated and these wells could be used as conduits for seepage through otherwise disconnected layers in the ground. Some of the oil and gas wells in the vicinity of the VCS site have been in the ground for nearly 100 years. Over extended periods of time, they eventually deteriorate. Both casings and seals are subject to corrosion caused by exposure to chemical attack, high and fluctuating pressures, high temperatures, and ground movement. Steel casing is susceptible to rusting from saline and sour/sulfurous water produced along with the oil. Hydrogen sulfide of sour water and sour gas can corrode both steel and cement. Differential earth stresses (e.g., movement along growth faults) can affect well integrity, even causing casing to collapse. Any deterioration of well integrity can lead to leaks.

Several of these manmade pathways are present at the VCS site and could be activated by site construction activities.

Known Oil and Gas Wells in Vicinity of the VCS Site

Although the ESP recognizes that numerous active and abandoned oil and gas wells are located on the property, the only hazard considered in the ESP is the possibility of land subsidence caused by production of oil and gas from beneath the site. No mention of any other potential hazard, such as, from gas leaking from the wells, potentially accumulating in site structures or moving along known on-site fault systems, wells disturbed by the construction leaking into building foundations or the cooling pond dikes, or the seepage of toxic gases from the wells is found in the ESP Application. The ESP apparently assumes that all wells are known and that the unused wells have been properly abandoned. However, this is far from the case.

Based on JCHA's investigation using the TRRC database, there are nearly 300 oil and gas wells within the Exelon property boundary and the immediate vicinity. Production from the site began before 1960. From the information gathered by JCHA, 133 of those wells have been abandoned and 70 wells have an unknown status. Of the "active wells", approximately 27 are currently

producing and the remainder appear to be shut in. Given the past plugging and abandoning methods for oil and gas wells in Texas, there is no way of knowing which of these wells are leaking potentially hazardous gases or liquids. However, it is likely that some of the wells could be leaking. Exelon's method of simply referring to published or unpublished data sources is not sufficient to evaluate the condition of the 100's of wells on and adjacent to the site.

The Texas Railroad Commission's (TRRC) online database was consulted to review nearly 300 wells in or immediately surrounding the Exelon property in Victoria County Texas. The information indicates the data are not complete.

- API numbers were not available for 20% of the wells,
- Total depth was not available for 40% of the wells,
- Current status (active or abandoned) was not available for 25% of the wells,
- The date and method for abandonment was not available for 50% of the wells,
- The type of well was not available for 15% of the wells,
- Nearly 60% of the wells did not have completion data on file,
- None of the wells had data for surface casing length, long string length, or cementing schedule for any of the wells, and
- None of the wells had data for H_2S occurrence.

The Texas Land and Mineral Owner's Association (TLMA) states on their website, that "A casing job in an area of average acidity is estimated to be effective for 20 years, after which time it must be tended to and plugged". According to the ESP, the soil around the Exelon property has an average pH of 5.7 s.u. which is "mildly corrosive towards buried steel". Therefore, it is extremely important to know when wells were installed so that they are plugged and abandoned in a timely manner. Only 41% of the well records that were examined had completion data on file with the TRRC. Of the wells that did have completion data on file, 62 or 51%, have been in the ground for 20 years or more. The wells without completion data tended to be the older wells. Therefore, as many as 80% of the 300 wells investigated could be over 20 years old.

In order to evaluate the hazards posed by the abandoned wells on the property, it is necessary to know whether the wells on and near the Exelon site have been properly constructed and abandoned, or if mitigation is needed to prevent surface migration of gas or to protect local aquifers and structures constructed on the site. The only practical way to confirm whether a well has been properly plugged is to locate it on the ground and re-drill it. Given the age of the original drilling at the site and the incompleteness of the official records, it is questionable that all of the drill holes on the site can be located simply by using the existing records.

Oil and Gas Wells at Other Nuclear Plant Sites

JCHA reviewed the site conditions at 65 sites containing 104 licensed, operating, commercial reactors. Of these 65 sites, only the South Texas Project Site, with two on-site wells, reported any

oil and gas wells on its site. By comparison, the VCS site has 27 operating wells and over 100 inactive wells within it's site boundaries. A few of the existing nuclear plant sites have wells nearby their site boundaries, but none of the sites have the hundreds of wells as close as the VCS site does. Since no nuclear plant has been built on a site with so many active and hundreds of abandoned oil and gas wells, the safety and environmental consequences of these wells must be carefully and thoroughly evaluated.

Sub-Contested Issue 4.1

The ESP fails to properly document and evaluate the threats of explosion posed by hundreds of active and abandoned oil and gas wells and exploration boreholes on and near the proposed facility.

Issue Statement

According to 10CFR100.21(e) "Potential hazards associated with nearby transportation routes, industrial and military facilities must be evaluated and site property established such that potential hazards from such routes and facilities will pose no undue risk to the type of facility proposed to be located at the site." In addition, Regulatory Guide 1.70 Section 2.2.1 states that these include "Oil and gas pipelines, drilling operations, and wells".

Basis

Natural gas has been detected at the surface in many areas overlying oil and gas fields. When this occurs, it often makes the news. For example, according to the July 30, 1999, Los Angeles Times, "One witness thought it was raining fire. The earth was belching flames through cracks in the pavement, tongues of fire marching in a steady progression across a shopping center parking lot on 3rd Street near Fairfax Avenue in West Los Angeles. The methane explosion that ripped through the Ross Dress for Less Store in March 1985 left 24 people injured and forced closure of stores in the center for several days". The shopping center was built over a series of abandoned oil and gas wells.

In another case, drillers knew they had a problem with the Telesis-Ritchie-37 Well #2 west of Palo Pinto, Texas, but what they weren't expecting was the massive 1:45 a.m. explosion on Dec. 16 that blew chunks of rock the size of pickups out of the ground, and left a half-acre crater. The six workers, along with a representative from the Texas Railroad Commission, fled for their lives. One worker received minor burns, but the others escaped injury-free. According to the Texas Railroad Commission, high-pressure natural gas migrated to the surrounding subsurface and formed pockets. As the higher pressure gas vented to the surface, something ignited it, creating an explosion. A one-mile radius around the well site displayed evidence of natural gas within the substrate. In that area, plugged, abandoned wells and ground fractures experienced gas venting from the ground.

On April 17, 2007, a house, that was being built for Stephen and Audrey Bouvier in Las Animas County, Colorado, by Cornerstone Construction, exploded, injuring three workers and destroying the Bouvier house. There was not a gas hook up or other source of explosive materials on site. Three wells, which were plugged and abandoned in the 1980s, are located near the explosion site. One well appeared to be located adjacent to or possibly underneath the Bouvier house. Methane seeping from these wells was the cause of the explosion.

Methane is a component of thermogenic gas found in oil and gas deposits. Thermogenic gas is generated at depth, when increased pressure and temperature alter organic material. It includes a broad range of gas components (methane, propane, butane, ethane, etc). Thermogenic gas can reach the surface through various natural and/or man-made pathways. Methane presents a risk of explosion when it accumulates in an enclosed space. Mixtures of methane and air with the methane content between 5% and 15% by volume are explosive.

Natural Pathways

The most likely potential natural pathway to conduct gas from the subsurface to the surface is along the growth fault planes known to exist at the site. On February 17, 2008, at 4:45 am, the Big Bottom #1 well blew out. The well is located just south and east of the site across the San Antonio River. The well crossed the trace of the subsurface plane of the growth fault that crosses the site. When the well blew out, a number of explosion craters formed along the surface expression of the growth fault indicating that gas from the well was moving along the plane of the growth fault.

Summary

The ESP dismissed any evaluation of the hazard posed by on-site oil and gas wells based on the unproven assumption that the gas pipelines present a greater hazard. This analysis fails to consider the numerous potential hazards posed by the existence of active and abandoned oil and gas wells on and adjacent to the site.

Sub-Contested Issue 4.2

The ESP fails to properly document and evaluate the threats of poisonous gas posed by hundreds of active and abandoned oil and gas wells and test holes on and near the proposed facility.

In addition to methane, poisonous gases may also be released from oil and gas wells. The most common poisonous gas associated with gas and oil fields is hydrogen sulfide (H_2S). Based on reviewing the available literature and the records of agencies to which accidental releases of hydrogen sulfide might be reported, the EPA states that well blowouts, line releases, extinguished flares, collection of sour gas in low-lying areas, line leakage, and leakage from idle or abandoned wells are sources of documented accidental releases that have impacted the public, not just workers at oil and gas extraction sites.[1]

Issue Statement

According to 10CFR100.21(e) "Potential hazards associated with nearby transportation routes, industrial and military facilities must be evaluated and site property established such that potential hazards from such routes and facilities will pose no undue risk to the type of facility proposed to be located at the site." In addition, Regulatory Guide 1.70 Section 2.2.1 states that these include "Oil and gas pipelines, drilling operations, and wells".

What is Hydrogen Sulfide

You can't see it but you can certainly smell its rotten egg odor. The effects of exposure depend on the dose and the duration of exposure, along with personal traits and habits and whether other chemicals are present. Even low levels of H_2S can irritate the eyes, nose or throat, and asthmatics can have difficulty breathing. At 140 parts per million, the nose can't smell anymore. At 300 parts per million, the gas is immediately toxic. Brief exposure to high concentrations -- 500 parts per million and higher -- causes a loss of consciousness and death within a half-hour. Those who regain consciousness might suffer permanent or long-term effects such as headaches, poor attention span, poor memory and motor function. What is really unsettling is that scientists have little information about the effects of ingesting H_2S, skin exposure to it or its effects on children.

The current OSHA workplace standard for H_2S exposure is 10 parts per million (ppm). In more detail, according to OSHA, "Exposures shall not exceed 20 ppm (ceiling) with the following exception: if no other measurable exposure occurs during the 8-hour work shift, exposures may exceed 20 ppm, but not more than 50 ppm (peak), for a single time period up to 10 minutes." The OSHA regulations do not specify an 8-hour time weighted average (TWA) for H2S. Exposure to these concentrations even for the seemingly short duration of 10 minutes can nevertheless result in

1 State agencies, emergency response organizations, industry officials. EPA, "Report to Congress on Hydrogen Sulfide Emissions,"

eye and respiratory irritation, according to several sources. The NIOSH recommended exposure limit to the OSHA 10 ppm standard is 10 minutes, and its Immediately Dangerous to Life or Health (IDLH) H_2S concentration is 100 ppm.

Site Evaluation

Most of the wells located on and near the site were not tested for hydrogen sulfide when they were completed. The data contained in the TRRC online database did indicate that 6 active wells within Victoria county (two at the Kay Creek oil field, two at the Mcfaddin oil field, and two at the Richard Adcock oil field) showed signs of elevated hydrogen sulfide (H_2S) levels with average concentrations being between 38-650 ppm. One well (Mcfaddin 1900) showed a peak level of 1,035 ppm (Table 3).

The ESP deferred the evaluation of poisonous gas until the COL stage. However, it appears that this deferred discussion would consider transportation of materials and not seepage from abandoned wells. The ESP does not mentioned toxic gasses from oil and gas wells on or near the Exelon property, even though two of the oil fields containing wells with elevated concentrations of H_2S are directly adjacent to the property boundaries.

Table 3: Active and non-active oil fields showing elevated hydrogen sulfide concentrations

Status	Field Number	Field name	Maximum Concentration (ppm)	Average concentration (ppm)	H2S injection
Active	4835220	Kay Creek (2200)	600	38	No
Active	4835252	Kay Creek (3500)	650	650	No
Active	5937113	Mcfaddin (1900)	1035	95	No
Active	5937110	Mcfaddin (2000)	400	205	No
Inactive	7639610	Richard Adcock (800)	600	600	No
Inactive	7639620	Richard Adcock (5056)	636	636	No

Source: TRRC online database.

Contested Issue 4.3

Exelon's ESP fails to properly address the potential for upward migration of liquid hydrocarbons and other contaminants through abandoned oil and gas wells present within or adjacent to the VCS site.

Issue Statement

According to 10CFR100.21(e) "Potential hazards associated with nearby transportation routes, industrial and military facilities must be evaluated and site property established such that potential hazards from such routes and facilities will pose no undue risk to the type of facility proposed to be located at the site." In addition, Regulatory Guide 1.70 Section 2.2.1 states that these include "Oil and gas pipelines, drilling operations, and wells."

Basis

In 1973, a retired sea captain's Newport Beach cottage began rapidly filling up with crude oil. The cause was an abandoned oil well directly below the house. The force of the improperly sealed well cracked the concrete foundation and flooded the kitchen. The well had been previously abandoned and no longer produced oil. However, after the field was abandoned, the reservoir refilled with oil which was pushed up the well and past the plug.

Site Evaluation

Although the majority of the wells completed on the site produced gas, some of the wells are oil wells. These wells, if improperly abandoned, could provide a pathway for liquid petroleum to move to the surface. Even if the wells were properly abandoned, the construction activities at the site could compromise the well seal.

Oil moving up a well could pose a danger to the stability of the cooling dam, and the structural integrity of the reactor building. Of course, the crude can burn so fire is also a risk. Since the location of all wells at the site are unknown, and Exelon has no plans to locate all of the wells at the site, the possible movement of crude oil through a well is a potential and unquantified risk to the plant and cooling pond dikes.

Summary

The existence of wells that have produced oil within the site boundaries at unknown locations present a hazard to the facilities to be constructed at the site that was not adequately addressed in the application for a ESP.

Contested Issue 4.4

Exelon's ESP fails to properly address the enhanced seepage through abandoned oil and gas wells located within the plants cooling basin. Exelon has deferred considering the environmental impact of the potential contaminants as they have not identified many of the water treatment chemicals to be used at the plant.

Issue Statement

According to 10CFR100.20(b) "The nature and proximity of man-related hazards must be evaluated to establish site parameters for use in determining whether a plant design can accommodate commonly occurring hazards."

Basis

In the ESP, Exelon estimates that there will be seepage losses of 3,900 gpm from the bottom of the cooling basin. Exelon potentially underestimates the amount of seepage that will occur from the cooling basin. There is no mention in the ESP of the possibility of increased seepage and movement of water due to the large number of plugged and active oil and gas wells in and near the VCS site. Laws governing oil and gas well plugging and abandonment were not heavily enforced or documented prior to the mid 1960's. Because of this, it is likely that there are oil and gas wells within the footprint of the proposed cooling basin that are not documented, or were not properly abandoned in the first place. These wells could become conduits for contaminated water to seep out of the cooling basin.

Contaminants and Groundwater Quality

Tritium is a known by-product of nuclear fission, and is in cooling basins at nuclear facilities. Leaking of tritium into the groundwater has occurred at many currently operating plants and can affect drinking water quality and overall ecosystem health. Improperly abandoned oil and gas wells on the Exelon property provide additional seepage pathways for tritiated water to escape the cooling basin and enter the surrounding freshwater aquifers. Exelon has not sufficiently investigated the number or scope of oil and gas wells within the footprint of the cooling basin.

Exelon estimated that there would be 3,900 gpm loss of water from the cooling basin. So almost 6 million gallons of water would be escaping from the cooling basin through seepage every day. This increased infiltration may be transported to Linn Lake and the Guadalupe River causing environmental impacts downstream as a result of potentially harmful chemicals in the seepage.

Although the ESP did mention that the water and inactive oil and gas wells found within the footprint of the cooling basin would be plugged, it did not properly state the laws that govern oil and gas well abandonment. They also did not address what would be done with active oil and gas wells within the footprint of the basin nor what methods would be used to find these wells. The ESP

referenced Sections 1901.255 and 1901.256 which apply only to water wells, and have no bearing on oil and gas wells. Exelon should be required to cap all oil and gas wells, active and abandoned, within the footprint of the cooling basin and its embankments in accordance with the Texas Administrative Code, Title 16, Part 1, Chapter 3, rule 14.

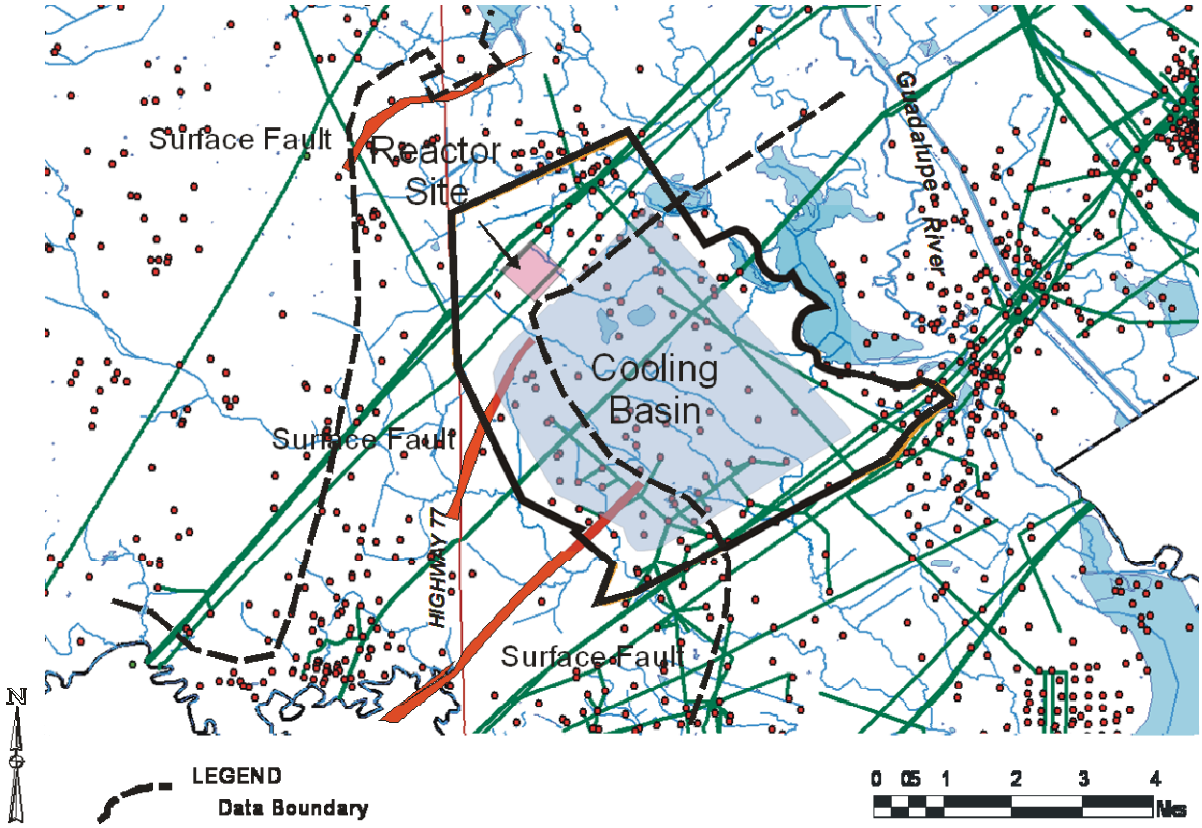
Chemicals Used In Water Treatment

The potential chemicals to be found in the cooling basin were not listed in the ESP. Rather, the identification and listing of chemicals is deferred to the COL Application stage.

Growth Faulting as a Pathway for Increased Seepage

Growth faulting is prevalent in the Texas gulf coast region of the United Sates. There was no mention in the ESP of a link between growth faulting and the potential for increased seepage from surface waters. Studies by Losh et al and Zeng et al suggest that fluid migration along growth faults is common. These faults could add to the already high seepage rates expected from the VCS site, and help to aid in the distribution of toxic chemicals to the surrounding environment. It is known that surface faults are present in and around the VCS site (Figure 1). Exelon should be required to investigate growth faulting in the vicinity of the VCS site, as well as investigate the relationship between growth fault propagation and seepage loss from the cooling basin impoundment.

Figure 1: Known surface faults as well as know oil and gas wells on VCS site and vicinity.



Alternate Site

Because of the aforementioned reasons, Exelon should consider one of the alternate sites for their power production. The dangers associated with seepage loss, groundwater contamination, and use of potentially harmful water treatment chemicals could potentially be better controlled at another location. Also, there is no guarantee, even if all wells on the site are properly plugged and abandoned, that toxic chemicals would not leak out of the cooling basin through normal and anticipated seepage. The Matagorda County site situated in western Matagorda County, Texas would be a good option to alleviate these potential risks. This proposed site includes the use of cooling towers, which would be better suited to contain cooling water since seepage would be a non-issue. This would also alleviate the potential problem of chemicals escaping from the cooling water system and impacting the environment.

Sub-Contested Issue 4.5

Exelon is attempting to Construct a nuclear power facility in Victoria County, Texas. The site is littered with oil and gas wells, some active, some shut-in, some abandoned, and some plugged. The cost of plugging and properly abandoning all of the wells on site was not thoroughly discussed in the ESP.

Issue statement

All oil and gas wells must be plugged and abandoned in accordance with the Texas Administrative Code (TAC) Title 16 Part 1 Chapter 3 Rule 14. Among other specific rules, all oil and gas wells must be plugged to ensure that all formations bearing usable quality water, oil, gas, or geothermal resources are protected.

Basis

Before an estimate for plugging and abandoning multiple wells within a given area can be established, there are a few factors that need to be considered. Site location, accessibility, status of wells, distance between wells, and size of plugging area are all issues that need to be considered. Also, there are some site specific problems that need to be addressed to be able to make a good estimation in the gulf coast region of Texas. These include the age of the well, status of surface completion, the location of buried wells, improperly plugged wells, wells decommissioned prior to plugging laws, and locating wells that are not listed with the Texas railroad commission (TRRC).

The Victoria County Station (VCS) site consists of approximately 1,100 acres of fairly flat land in Victoria County, Texas. Through data found on the TRRC website, 130 oil and gas wells were found within the VCS property boundary. This site would be conducive to easy movement of drilling equipment and haul trucks (for mud and waste) between different wells. Most of the wells on site are non-producing and are in an idle or abandoned state with varying levels of plugging. These wells will need to be examined individually to see exactly how much effort will be needed to properly plug and abandon them.

Well drilling in the region has been going on for over a hundred years, and there were no laws or regulations in place prior to the 1930's that required an operator to keep a record of where the well was located, or record it's depth and how it was abandoned. Even with an unlimited budget for plugging operations, it would be nearly impossible to find and plug every well within the property boundaries of the VCS site. Any well left un-plugged or improperly plugged could pose an environmental hazard in the future and should be a reason for the NRC to not allow Exelon to move forward with their attempts to build on the VCS site.

In addition to the problems associated with wells that were not registered, some wells that were registered with the TRRC have been tampered with and surface casings have been removed for their value as scrap metal. This poses a similar problem as mentioned before, where it could be, even

with an unlimited budget, impossible to find and properly plug these wells. Even though their location is known, there is no way of knowing how deep the surface casings went (there is no data on file with the TRRC for surface casing length), so finding the actual well could be extremely difficult.

Another problem that could occur during plugging operations is that there could be wells that have been in the ground for some time that have had full or partial cave-ins around the well casing. This would cause the price of plugging to go up since the hole would have to be re-drilled to be properly and effectively plugged.

All of the aforementioned problems make it difficult to make an accurate estimate for the cost of plugging and abandoning all of the wells within the property boundary. JCHA consulted Layne Christensen of Denver Colorado to help break down the costs that are, and could be, associated with plugging wells on the VCS site and an estimate for how much it could potentially cost to overcome the unique problems associated with this region of Texas.

The most basic estimate for this operation put the cost of plugging in the 60 million dollar range. This number assumes that:

- We do not know where any of the wells are, and puts the average cost of locating each well at $2,500.00.
- It also assumes that the top casings have been taken from every well on site which would cost $3,700.00 per well to fabricate a new casing.
- That each well is at or near 5,000 feet deep.
- A lump sum of $150,000.00 for mobilization of drilling rig, crews, mud tanks, pumps, support equipment for drilling operations, and cementing operations.

It is difficult to get a more accurate estimate because of all of the unknown factors in the region. Based on the information that JCHA was able to take from the TRRC's website and IHS Energy's online database, there are 130 wells within the property boundary with varying levels of decay and abandonment status. Many of the wells that are listed on the sites claim to be plugged, but plugging laws and regulations have changed over the 70 plus years that these wells have been considered "Plugged". The only way to know if they have been properly plugged is to dig up every well regardless of status and examine each one individually.

Layne Christensen states that an "estimated cost for plugging and abandoning operations is $455,000.00 per well". According to this, if we know where every one of the 130 wells are, and all wellheads are intact, and assume that there are only 130 wells on the site, the cost would be approximately 59 million dollars. Thirty eight of the wells within the property boundary were documented as being plugged since the last set of regulations on plugging was enacted in 1984. Assuming that there would be nothing more needed to be done to these thirty eight wells, the cost for the entire operation would drop down to approximately 42 million dollars.

Keeping that number in mind, we do not know where all of the 130 wells are on site, nor do we know if there are only 130 wells total on the site. Also, we do not know how intact the surface casings are for all of the wells either. Layne Christensen recommends that to find every well on the site, the entire area needs to be excavated with a dozer to make sure there are no wells that have been covered up over the hundred plus years that prospecting has been occurring in the region. Also, any of the wells that have been buried, most likely, will not have surface casings that are up to standards, so they will need to be re-fabricated.

Using this information, we would assume that no work at all would need to be performed on the thirty eight wells that were plugged post 1984. Of the remaining ninety two wells that are known to be on the property, sixty four do not have any information on plugging at all and it would be assumed that those wells would need to be located, surface casings attached, and plugged at a rate of $ 461,200.00 per well. Sixteen of the wells within the property are listed as active, which means their locations would be known, and they would have intact surface casings. These wells would be plugged at a rate of $ 25,000.00 per well. The remaining twelve wells are listed as being plugged, but were plugged prior to 1984. These wells would have to be examined to determine the quality and effectiveness of the plugging that was previously performed. Since some of these wells would not need any work and some could need extensive work, a rate of $ 230,000.00 (half of the cost of normal plugging costs) has been assigned to them for the purpose of this study. Using these numbers, the total for plugging all known wells on the site comes to approximately 33 million dollars.

Conservative cost estimates for plugging and abandoning all of the wells on the VCS site range from 30-60 million dollars. However, there are a couple of issues that could arise during plugging operations that could exponentially raise the cost. One of these issues could be the fact that not all known wells are found. If there is a record of a well on site that cannot be located, a potential for an environmental hazard would exist. Also, there is a possibility that not all wells within the VCS property boundaries are known. As with known wells that cannot be found, this would be another potential environmental hazard. When dealing with nuclear power, any potential environmental hazard would be too grave to accept. For these reasons, Exelon should be forced to find another site for their plant.

Some things that should be noted about the cost estimate are that most other sources examined for pricing estimates of plugging and abandoning oil and gas wells in the Victoria region were much lower than Layne Christensen's estimate. The highest found estimate put costs as high as $250,000 a well, but no estimates put the cost in the $400-500,000 ranges. Each site is unique and until a thorough in person investigation is performed, there will be considerable uncertainty.

Summary

The presence of 100s of active and abandoned oil and gas wells on and near the property that Exelon plans to use for the construction of a nuclear power station and massive cooling pond is unique among the sites approved for construction of nuclear power stations. The existence of the wells poses a real and unanalyzed threat to the safety of the construction and operation of the power station. Exelon's ESP Fails to Properly Document and Evaluate the Threats Posed by the Existence of Hundreds of Active and Abandoned Oil and Gas Wells and Borings On and Near the Facility.

References

Accepta Biodispersant biocide Material Safety Data Sheet. Issued 1-06-2004. Product Name: ACCEPTA 2075. Last Accessed 2-19-2009.

Albenesius E.L., Ondrejoin R.S. (1960). Nuclear Fission Produces Tritium. Nucleonics. Volume: 18-9

BioGuard Scale Inhibitor Material Safety Data Sheet. Issued 6-30-1997 MSDS Reference Number: BBIO23470. Last accessed 2-20-2009.

Berg R.R., Avery A.H. (1995) Sealing properties of tertiary growth faults, Texas Gulf Coast. AAPG. Volume 79:3 pp 375-393.

Cartwright J., Bouroullec R., James D., Johnson H. (1997) Polycyclic motion history of some Gulf Coast growth faults from high-resolution displacement analysis. Geology. Volume 26:9 pp 819-822.

ChemLogic Scale Inhibitor Material Safety Data Sheet. Issued 6-28-2006. Trade Name: DC-788. Last Accessed 2-20-2009.

Clearon Bromide Plus Material Safety Data Sheet. Issued 9-08-2006. Product ID: 2270SLB. Last Accessed 2-21-2009.

Department of the Environment, Water, Heritage, and the arts. GPO Box 787 Parks ACT 2600 Australia website: www.npi.gov.au

Exelon Generation. Victoria County Station, ESP Application.

Howlett Associates Water Treatment Biodispersant Material Safety Data Sheet. Issued 6-07-2003. Product Name: HA56. Last Accessed 2-20-2009.

Losh S., Eglinton L.B., Schoell M., Wood J.R. (1999) Vertical and lateral fluid flow related to a large growth fault, South Eugene Island Block 330 Field, offshore Louisiana. AAPG. Volume 83:2 pp 244-276

Nicot J.P. (2008) A survey of oil and gas wells in the Texas Gulf Coast, U.S.A. and implications for geological sequestration of CO_2. Journal of Environmental Geology. DOI 10.1007/s00254-008-1444-4.

Nu-Calgon Scale Inhibitor Material Safety Data Sheet. 2-08-2007. Product Name: Scale Inhibitor No. 340

Nuclear Regulatory Committee (NRC) website located at www.nrc.gov. accessed last on 1-20-2009.

Operational Safety and Health Administration website located at www.osha.gov

Smith DK (1993) Handbook on well plugging and abandonment. Pennwell Publishing Company, Tulsa, 399p

Suro, Roberto (1992) Abandoned Oil and Gas Wells become Pollution Portals. New York Times. Published May 3rd.

Sustainable Energy and Economic Development collation report on Exelon's history of radiation leaks and hiding it from the public. Located at: http://www.nukefreetexas.org/downloads/exelons_history_of_leaks.pdf accessed on 1-9-09

Tech Cominco Sodium Bisulfite material safety data sheet. Dec 2006. pdf file located at: *teck.com/DocumentViewer.aspx?elementId=115498&portalName=tc. Last accessed on 1-20-2009.*

Texas Land and Mineral Owners Association website located at http://www.tlma.org/

Texas Railroad Commission online database located at http://gis2.rrc.state.tx.us/public/startit.htm

Texas Railroad Commission: An informal History compiled for its centennial (April, 1991) located at: http://www.rrc.state.tx.us/about/history/centennial/centennial05.php

Texas Water Development Board (TWDB). Website accessed at http://www.twdb.state.tx.us/home/index.asp

Warner D.L., Koederitz L.F., Laudon R.C. (1998) An Area-Of-Review Variance study for Texas Gulf Coast Frio Formation Oil Fields. Gulf Coast Association of Geological Societies Transactions Vol. 48 pp 475-485

Zeng J., Yu C., (2005) Hydrocarbon migration along the Shengbei fault zone in the Bohai Bay basin, China: The evidence from geochemistry and fluid inclusions. Journal of Geochemical Exploration. Volume 89:1 pp455-459.

Contested Issue 5

Contested Issue 5

Exelon's Environmental Report claims "there is no significant difference in environmental impact among the five candidate sites." The Environmental Report fails to consider the 100's of gas and oil wells near and adjacent to the VCS site relative to none at the Matagorda site, the VCS impact on the whooping crane habitat downstream vs. no impact by the Matagorda site, and does not consider the difference between using an unlimited source of ocean water versus the limited and highly contested freshwater flows of the Guadeloupe river.

Issue Statement

Surface Water Use

Victoria Site

The proposed water supply for the makeup water to the VCS closed loop circulating water system is fresh water obtained from the Guadalupe River. The average estimated makeup flow is 95 cfs (42,809 gpm). (3.3-8) The maximum estimated makeup flow is 217 cfs (97,500 gpm). The maximum annual amount of surface water to be diverted to VCS is 75,000 ac-ft, which is equivalent to approximately 104 cfs (46,500 gpm) if pumped continually throughout the year. The proposed intake is on the GRBA main canal, which diverts its water just upstream of the Guadalupe River saltwater barrier. The actual intake for the VCS is located downstream of the GBRA pump station in Calhoun County, approximately 15 miles southeast of VCS. (3.3-3).

The diversion of this amount of water from the Guadalupe River, which is already over appropriated, will result in no water being available for population growth or to provide for new industrial growth in the Guadalupe River basin using surface water. In addition, the Aransas Wildlife Refuge, and the wildlife living there rely on inflows from the Guadalupe River, and there are signs that inflows are insufficient. Given that there exists a Federal Reserve Water Right for the refuge, it is not clear that any water is legally available for this diversion. It will also result in a reduction in transported sediment and nutrients into San Antonio Bay, which is a vital part of estuary health.

Matagorda Site

The proposed cooling water supply for the Matagorda site would be salt water pumped from the Gulf Intercoastal Water Way. Merely the fact that this site would be using seawater as its makeup water already makes this a preferable alternative. Ocean water is abundant, and is not dependent on day-to-day precipitation and the resulting runoff, which is unpredictable. Provided that the intake design is such that flow velocities do not cause significant impingement or entrapment of ocean life, there are very few restrictions placed on the amount of water used.

The use of Salt water leaves additional scarce surface water in the Guadalupe River which can then be used for population growth or for new industries.

Oil and Gas Wells

Victoria Site

A review of the Texas Railroad Commission's (TRRC) online database indicates there are nearly 300 wells in or immediately surrounding the Exelon property in Victoria County Texas. The records regarding these wells in the TRCC database are incomplete regarding the method of construction and the method of abandonment. Improperly abandoned oil and gas wells pose a risk of explosion, poisonous gas, and aquifer contamination.

Matagorda Site

A review of the Texas Railroad Commission's (TRRC) online database indicates there are 3 wells (two are dry holes) in the immediate vicinity of the Matagorda Site investigated by Exelon. This is in stark contrast to the hundreds of wells on and adjacent to the Victoria County site. Clearly the Matagorda site poses a much lower hazard for explosion, poisonous gas and aquifer contamination from improperly abandoned oil and gas wells.

Oil and Gas Pipelines

Victoria Site

There are 13 pipelines which cross the site. The pipelines primarily carry natural gas, although gasoline and diesel fuel are transported in one of the pipelines. Three of the pipelines are gathering lines for local wells and are 4.5 inches in diameter. The other pipelines are part of intercontinental and trans-Texas system and range from 24 inches to 30 inches in diameter. Many of these pipelines cross the areas designated for the cooling pond. Exelon plans to relocate pipelines passing through the power block area, but they plan to leave the pipelines under the cooling pond in place.

Matagorda Site

There are no pipelines in the vicinity of the Matagorda site. Clearly, this is a much safer condition.

Endangered Species

Victoria Site

The ESP contains a discussion of the studies performed by the Texas Parks and Wildlife Department (TPWD) and the Texas Water Development Board (TWDB) regarding the annual amount of water recommended for inflow into Guadalupe Estuary in order to maintain fisheries harvest of greater than 80% of mean historical harvest of seven selected species: blue crab, eastern oyster, red drum, black drum, spotted sea trout, brown shrimp, and white shrimp. The

inflow rate required to maintain this level for the fisheries was 1.15 million acre-feet per year. The study looked at a period from 1941 to 1987, and found that 11 years within that period did not reach the target volume of inflows to the Estuary. The ramifications of these findings, as they relate to the increase in water demand by VCS, are not discussed in the license. The ramifications of these findings on the studied species, and also on the species that prey on the studied species were not discussed. This is a glaring deficiency, particularly in the case of the blue crab, which is a major food source of the whooping crane, an endangered species. In all of the discussion of the environmental impacts, there is no consideration or discussion given to the impacts of the fresh water diversion on the downstream estuary/bay. This is where the most significant impact will be.

In 1980, the Texas Department of Water Resources issued a report entitled "Guadalupe Estuary: A Study of the Influence of Freshwater Inflows". In this report, three different flow calculations were made for inflow requirements to the Estuary. Of the three, the Subsistence Alternative Flow appears to be the most consistent with the requirements for which the Aransas National Wildlife Refuge was established. This requires a total of 1.24 million acre-feet of inflow from the gauged portions of the Guadalupe River, Coleto Creek, and San Antonio Rivers, also with monthly minimum requirements. Historic stream flow records indicate that 48% of the months evaluated provided an inadequate amount of inflow to the Estuary. Diversion of additional water from this river system for cooling of the Exelon plant would further endanger the wildlife reliant upon the Estuary.

The TWDB, the Texas Natural Resource Conservation Commission (TNRCC), and the TPWD compiled criteria for determining volume of water available for water supply needs against volume of water needed to sustain environmental conditions downstream. These criteria are ignored in the VCS Environmental Report. Use of these criteria place further limitations on the water available for diversion by the VCS, and further suggest that diversion of the water needed for the operation of the VCS would have a significant impact on the estuary downstream. The recommended criteria would be based on stream flow conditions just upstream of the diversion point, and would be divided into three zones as follows (CCEFN):

Zone 1 – when actual streamflow is greater than monthly medians calculated with naturalized daily streamflow estimates, minimum flows passed will be the calculated monthly medians.

Zone 2 – when actual streamflow is less than or equal to medians, but greater than monthly 25th percentile values, minimum flows passed will be the monthly 25th percentile values.

Zone 3 – when actual streamflow is less than or equal to monthly 25th percentile values, minimum flows passed will be the larger of either the value necessary to maintain

downstream water quality or a continuous flow threshold to be determined by consensus planning staff that will not allow the diversion by itself to dry up the stream.

When these three Zones are applied to the cumulative measured flows of the Guadalupe River, Goliad, and Coleto Creek, the result is many months in which there is no available flow for diversion in the river. There are also many prolonged periods of up to 10 months in which there is no available water for diversion. Use of the Guadalupe River as the main source of cooling water is a completely unpredictable choice, and historic measurements show that this choice would have been problematic in many of the years since 1980.

All of these imposed limitations on the available surface water in the Guadalupe River cast a significant shadow of doubt over the project's requirements for cooling water. When faced with less available water than what is needed, the power plant is frequently going to be faced with having to break regulations in order to adequately cool the plant. This would place many species living downstream of the plant in peril – most importantly, the whooping crane. There would be no alternative given that, without adequate water, the plant would have to shut down.

Matagorda Site

Because the Matagorda site will be using Salt water from the Gulf Intercoastal Waterway (GIWW), the operation of the plant does not affect fresh water inflows into the estuaries. The water being returned to Tres Palacios Bay will be cooled in natural draft cooling towers prior to release minimizing the impact of temperature rise. Many of the plants using salt water and once through cooling systems find that the slight rise in temperature of the receiving water has improved the aquatic productivity in the vicinity of the discharges.

Power Transmission Lines

Victoria Site

According to the ESP, eight 345 kV transmission lines would be required for the VCS site. Six right-of-ways would be used, which are:

- VCS to Hillje (two lines on double-circuit towers
- VCS to Coleto Creek (two lines on double-circuit towers)
- VCS to Blessing
- VCS to Whitepoint
- VCS to South Texas Project
- VCS to Cholla

Four of these lines would be new, totaling approximately 180 miles of new power transmission lines. The line to the South Texas Project and to Whitepoint would only require short connections from the VCS to the existing STP-Whitepoint line.

The two new installations with double circuit towers will require a right-of-way 300 feet wide for the entire length of the lines. The other lines will require 150 feet width rights-of-way. In total, these new installations will occupy 4,700 acres. Transmission lines represent a major hazard to migrating birds such as the whooping cranes. The proximity of this site to the Aransas National Wildlife Refuge is cause for further concern.

Matagorda Site

According to the ESP, Exelon would need four additional 345 kV transmission lines for this site. One new 400-foot-wide transmission right-of-way containing all four lines would run from the Matagorda County Site to the STP nuclear plant about 11.5 miles to the northeast. Rights-of-way from the STP would be utilized for the rest of the additional lines from that point. This single new right-of-way would require approximately 560 acres of land. Given that this site would require less than one tenth of the new power line construction required by the VCS, this represents a much lower danger to the migrating birds.

Water Supply Lines

Victoria Site

The cooling water supply for the Victoria site will be piped approximately 18.5 miles from the GBRA pumping station to the site. The discharge lines for cooling pond blow down will be approximately 4 miles long.

Matagorda Site

The matagorda cooling water will be pumped 4.5 miles from the GIWW to the site. The discharge of the cooling water, after having its temperature lowered in cooling towers, will be discharged into Tres Palacios Bay through a 2.7 mile discharge line.

Growth Faults

Victoria Site

There are at least two, and perhaps as many as four, growth faults present or adjacent to the Victoria site. These growth faults pass near the power block and cross the recirculating cooling pond. Although these faults do not pose a seismic risk resulting from tectonic activity, they do pose a risk of movement which could result in instability and failure of the cooling dam.

Matagorda Site

No growth faults have been noted in any of the publicly available studies reviewed which contain information on the vicinity of the Matagorda site.

Conclusion

There are a number of clear differences between the Victoria County site as compared with the Matagorda site which make the Matagorda site clearly superior from both a safety and an environmental view point.

Due to the proposed diversion of surface water from the Guadalupe River, the VCS site is likely to have the most significant environmental impact of any of the five sites considered in Exelon's environmental report. The presence of the whooping crane directly downstream of the proposed site, and the crane's reliance on the blue crab for its food supply make the VCS site an undesirable place to build a power plant. In addition, there exists ample reason to question the availability of diverted Guadalupe River water for the purpose of cooling the power plant due to the restrictions imposed on available water by various state agencies. There will be many months in the future, as there have been in the past, in which there is not enough water available for cooling the power plant. As opposed to the Matagorda site which would obtain water from an essentially unlimited salt water supply.

There have been recent news articles about the possibility that Exelon would decide to abandon the use of river water for cooling, and use salt water from the Gulf of Mexico. While doing this would avoid the problems associated with the diversion of water from the Guadalupe River, there would still be several reasons that the VCS site would not be as viable a site as the Matagorda site.

1. All of the hazards and uncertainty presented by the presence of abandoned oil and gas wells on the VCS site.
2. There are 13 oil and gas pipelines crossing the Victoria County Site, and there are none crossing the Matagorda site.
3. According to the ESP, 8 transmission lines are required, with a total right-of-way length of approximately 100 miles.
4. The need for construction of two pipelines approximately 50 miles in length from and back out to the Gulf of Mexico. The locations of these pipelines would be met with a lot of resistance, due to their proximity to critical habitat for endangered species. Given that the pipelines required to supply water for the Matagorda site would only be approximately 4.5 miles each way, the Matagorda site is clearly preferable.
5. There are two to four growth faults that cross proposed cooling basin part of the VCS property. These growth faults have shown recent movement about 1,000 greater than that estimated by Exelon. No such faults are documented at the Matagorda site.

Further, the presence of hundreds of active and abandoned oil a gas wells as well as multiple pipelines on and near the Victoria County property that Exelon plans to use for the construction of a nuclear power station and massive cooling pond poses a real and unanalyzed threat to the safety of the construction and operation of the power station. Exelon's Final Safety Analysis Report (FSAR) fails to properly document and evaluate the threats of explosion and seepage of poisonous gas

posed by these active and abandoned oil and gas wells and borings on and near the facility. The proposed Matagorda site has no pipelines and only 3 wells in its vicinity.

In addition, the environmental impact of the Victoria site includes the construction of a 180 miles of transmission lines, 18.5 miles of water supply lines, and the construction of a massive 6,500 acre cooling pond. The Matagorda site would only disturb an 11.5 mile corridor for transmission lines, 4.5 miles for intake water pipelines and 0 acres for the cooling pond.

References

Texas Department of Water Resources, August 1980, Guadalupe Estuary: A Study of the Influence of Freshwater Inflows, Austin, Texas.

Longley, W.L., ed. 1994. Freshwater Inflows to Texas bays and estuaries: ecological relationships and methods for determination of needs. Texas Water Development Board and Texas Parks and Wildlife Department, Austin, Texas.

Contested Issue 6

Contested Issue 6

Exelon's Environmental Report (ER) does not consider the reduced sediment and nutrient load carried to the estuary due to the diversion of 105,000 acre-feet of water per year (75,000 ac-ft for Exelon, and 30,000 ac-ft made possible by the capacity reserved for a regional water organization installed in the RWMU system). The decrease in flow will result in a reduced capacity to transport sediment and nutrients which are an important part of estuary health.

Issue Statement

1. The diversion of 105,000 acre-feet per year will have a significant impact on the sediment transport capacity of the river.

   The Guadalupe-Blanco River Authority (GBRA) operates an inflatable saltwater barrier structure consisting of two neoprene fabric inflatable dams, known as fabridams. When fully inflated, each fabridam is 10 feet in height by 50 feet in base length. The fabridams are bolted to the concrete base of a bridge structure at -6.0 feet below mean sea level (ft, MSL). When the fabridams are inflated with river water, the tops of the dams raise in height to an approximate elevation of 4 ft., MSL. When inflated, the fabridams cause the water level upstream of the barrier to rise, and water spills over at a head gate on the east bank. This head gate leads to the GBRA canal, which guides the water to a pumping station on Goff Bayou. This is where the 105,000 acre-feet of water will be diverted for use in the VCS.

   A study performed by the Texas Water Development Board in 1994 determined an equation relating annual flow rates in the Guadalupe and San Antonio Rivers to sediment and nutrients transported into the Estuary. This equation was derived empirically, based on measured flows and sediment content.

   $$S = 0.78742 * Q^{0.96655}$$

   Where: S = Sediment Load, in metric tons/year, and
   Q = Streamflow, in acre-feet/year

   Using this equation, a reduction of inflow to the Estuary of 105,000 acre-feet per year would result in a reduction in sediment/nutrient inflow of approximately 56,000 metric tons per year. This loss of sediment/nutrient load being carried into the Estuary will adversely impact the overall health of the Estuary.

   Table 1 and Figure 1 show a summary of the historical flows in the Guadalupe River at the Saltwater Barrier Diversion point. These numbers are attained by addition of the measured flow at the Guadalupe River near Victoria, Coleto Creek, and San Antonio River at Goliad gauging stations.

Table 2 and Figure 2 show a combination of the monthly historic GBRA diversions from 1991 through 2008, and the proposed diversion rates for the VCS, in acre-feet. Table 3 and Figure 3 compare the proposed diversion rates listed in Table 2 to the measured streamflows at the Saltwater Barrier. In summary, the proposed diversion rates will result in a 14% average reduction in streamflow to the Estuary.

2. The diversion of water will also contribute to flooding of the Lower Guadalupe River at the saltwater barrier.

   When the saltwater barrier is inflated, the flowing water will lose velocity, causing it to drop its sediment and nutrient load. In addition, the nature of the diversion effectively takes water that flows over the top of the channel walls. Since water at the river surface typically does not carry as much sediment and nutrients as water close to the streambed, most of the sediment/nutrient load is left behind in the Guadalupe River Channel. The dropped sediment builds up on the river bottom behind the barrier, which constricts the channel, and eventually causes the water to flow over the river banks, flooding the surrounding areas. The water simply has nowhere else to go.

Conclusion

The diversion of water from the Guadalupe River will reduce the amount of sediment and nutrients transported to the Guadalupe Estuary, and have a significant impact on the wildlife that reside there. This diversion will also contribute to increased flooding upstream of the saltwater barrier.

References

JCHA, August 2005. Review of Guadalupe-Blanco River Authority and the Lower Guadalupe Water Supply Project. Prepared for Blackburn and Carter, Houston Texas.

Longley, W.L., ed. 1994. Freshwater Inflows to Texas bays and estuaries: ecological relationships and methods for determination of needs. Texas Water Development Board and Texas Parks and Wildlife Department, Austin, TX

TABLES

Table 1
Combined Streamflow at Diversion Point (Coleto+Guadalupe+Goliad)

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total Flow
1934	-	-	-	-	-	-	-	-	-	-	-	102,913	102,913
1935	48,498	107,820	46,890	66,653	483,673	537,743	114,348	71,941	273,392	121,826	64,320	126,483	2,063,586
1936	86,797	59,703	64,908	48,629	296,279	138,546	1,133,304	80,609	193,140	266,918	105,125	95,187	2,569,144
1937	86,321	75,253	174,249	81,224	59,005	162,620	57,561	42,137	38,845	49,805	39,253	70,959	937,232
1938	161,852	95,663	89,316	311,074	302,521	81,363	58,588	47,465	41,812	37,097	38,156	41,135	1,306,043
1939	43,809	36,326	48,198	44,052	52,387	53,052	72,921	37,813	32,245	37,639	32,656	38,821	529,918
1940	39,885	59,235	47,476	79,992	61,060	140,897	506,253	60,412	35,759	65,427	594,604	471,697	2,162,696
1941	197,364	282,123	324,531	392,586	1,071,733	395,764	229,858	116,204	124,299	118,425	100,458	77,486	3,430,832
1942	71,334	64,327	64,534	187,710	124,955	71,213	701,622	83,383	551,390	301,901	144,990	121,072	2,488,430
1943	116,943	84,648	101,937	85,284	86,837	138,174	88,188	56,625	65,339	56,277	58,003	63,511	1,001,765
1944	113,599	116,876	224,281	108,523	339,446	213,365	91,385	84,344	141,918	69,776	91,374	160,276	1,755,163
1945	242,885	229,039	203,880	410,562	118,268	110,013	72,432	58,389	51,031	104,721	62,698	79,893	1,743,810
1946	98,895	128,058	220,596	135,549	233,911	217,325	66,312	123,021	545,709	708,972	281,834	174,007	2,934,187
1947	273,889	148,808	167,970	158,249	215,448	91,175	71,784	104,628	57,375	49,603	54,312	62,037	1,455,277
1948	57,492	65,910	63,596	47,365	109,751	41,676	70,431	79,933	40,474	48,640	33,532	36,226	695,026
1949	41,524	72,422	112,747	385,450	217,366	130,408	105,282	59,457	46,839	248,146	69,997	90,347	1,579,986
1950	60,656	62,619	55,913	92,904	70,008	175,539	47,686	35,562	33,233	29,759	28,461	33,196	725,535
1951	31,783	34,491	37,026	38,629	66,417	205,658	26,682	16,885	84,882	24,163	28,407	29,371	624,394
1952	29,135	35,584	31,902	57,488	132,646	93,459	39,254	15,801	463,160	53,000	81,386	134,361	1,167,177
1953	118,556	55,784	50,759	55,873	226,489	25,425	27,142	71,350	188,192	118,881	50,770	66,564	1,055,786
1954	45,101	34,979	32,334	38,318	60,256	22,041	13,997	9,650	10,283	14,975	19,709	20,080	321,724
1955	23,554	71,994	30,949	22,498	66,395	57,180	17,332	22,935	23,590	10,692	10,819	18,180	376,117
1956	18,263	20,713	14,793	14,432	25,412	5,085	6,481	5,975	14,779	32,310	12,647	53,003	223,893
1957	13,909	31,887	101,409	393,904	603,127	451,882	51,517	28,426	348,113	546,066	302,852	140,223	3,013,317
1958	349,483	637,573	279,748	141,338	388,818	131,537	107,269	57,528	174,328	186,543	226,690	124,382	2,805,236
1959	106,228	137,434	104,126	233,927	140,564	87,849	99,947	64,447	56,932	195,027	100,510	88,784	1,415,776
1960	111,796	108,364	97,830	97,822	166,306	203,317	193,368	144,410	79,428	719,083	565,305	259,275	2,746,304
1961	288,126	331,841	192,593	121,041	86,896	487,930	223,344	95,364	134,354	97,152	179,745	81,980	2,320,365
1962	75,704	67,880	62,809	75,322	61,074	93,162	41,456	29,254	62,373	49,274	54,639	72,350	745,297
1963	55,880	78,977	52,771	56,165	39,380	29,269	25,543	13,490	20,726	30,933	66,266	43,954	513,352
1964	40,606	76,817	100,636	51,649	36,681	50,195	21,336	45,224	54,731	70,366	92,502	46,184	686,928
1965	132,609	360,097	97,734	99,592	423,540	281,946	82,579	53,405	52,407	114,446	131,181	204,015	2,033,550
1966	93,558	112,361	117,154	150,518	196,281	87,098	66,188	53,925	73,788	66,504	51,335	47,749	1,116,458
1967	48,400	39,591	42,112	39,110	34,336	20,860	23,432	42,421	1,260,226	203,204	188,340	91,738	2,033,770
1968	698,887	192,404	154,053	212,636	431,596	416,960	135,174	76,805	148,064	70,569	74,681	161,235	2,773,064
1969	79,159	238,767	218,240	259,937	280,735	124,922	63,269	57,574	69,636	106,358	87,469	115,684	1,701,749
1970	138,232	129,247	215,066	134,772	279,625	239,887	88,131	66,597	60,407	81,108	55,438	54,988	1,543,498
1971	55,583	45,399	47,562	35,758	30,846	35,669	28,464	174,195	229,659	174,072	139,588	172,600	1,169,396
1972	121,329	116,576	86,331	77,499	1,007,973	228,754	132,586	114,074	88,048	94,214	79,402	75,379	2,222,164
1973	96,076	124,539	187,139	412,674	174,628	695,763	548,497	251,932	261,556	1,076,869	297,182	188,801	4,315,657
1974	274,185	141,983	125,448	100,903	183,085	133,023	68,355	123,965	330,850	128,438	342,475	218,325	2,171,036
1975	175,557	368,884	193,356	178,759	696,376	516,223	262,650	158,384	116,750	98,302	82,060	103,192	2,950,493
1976	82,644	70,458	78,464	392,764	551,747	240,800	207,691	139,563	145,831	360,690	444,151	528,243	3,243,047
1977	271,196	346,658	200,995	868,771	433,046	228,148	148,715	100,073	109,469	88,074	171,725	92,005	3,058,875
1978	87,725	88,736	88,499	97,950	75,040	140,577	51,208	334,749	375,720	134,452	174,903	99,262	1,748,822
1979	415,775	291,553	314,695	490,716	653,064	542,909	209,016	167,399	146,769	80,527	76,398	81,990	3,470,812
1980	110,749	82,447	69,131	66,316	244,292	87,079	49,981	69,876	135,431	77,401	73,084	75,905	1,141,691
1981	78,294	73,796	103,519	126,643	212,257	939,231	332,891	158,038	832,091	259,929	341,789	141,117	3,599,593
1982	109,055	161,862	101,477	83,941	423,873	105,383	65,029	48,397	43,655	69,398	112,176	68,803	1,393,048
1983	68,879	117,354	182,164	101,458	115,175	97,881	121,099	61,212	93,685	78,226	90,093	50,632	1,177,858
1984	72,301	58,149	84,871	42,310	38,033	29,381	16,586	17,442	16,229	104,676	76,823	80,978	637,779
1985	166,491	112,050	209,422	219,307	125,418	213,699	219,485	78,102	68,526	160,606	287,661	232,603	2,093,370
1986	136,379	122,684	93,682	72,746	122,630	362,635	104,490	56,894	102,771	215,243	186,541	487,943	2,064,638
1987	371,052	272,117	379,366	173,878	234,079	2,380,406	523,418	324,859	183,089	133,412	118,120	112,612	5,206,409
1988	93,335	79,708	96,500	72,880	70,782	82,491	82,362	81,849	54,178	48,542	44,367	49,471	856,464
1989	65,952	63,346	67,366	68,871	108,539	59,744	28,479	22,655	16,830	28,117	47,393	46,932	624,225
1990	40,646	43,221	69,617	103,647	116,519	52,827	168,639	74,266	83,864	52,740	57,278	51,800	915,065
1991	230,332	203,074	105,893	383,289	209,598	123,115	123,943	60,467	83,234	69,557	73,341	905,695	2,571,538
1992	849,006	1,480,914	918,186	902,875	938,137	867,549	279,159	189,206	141,679	116,641	181,252	155,430	7,020,035
1993	165,389	193,102	256,309	148,433	622,267	586,730	191,299	82,226	66,951	84,399	83,070	78,501	2,558,676
1994	79,163	72,476	118,189	93,027	412,558	118,253	60,632	52,327	66,185	371,764	96,406	147,398	1,688,377
1995	161,730	83,296	199,499	148,425	85,123	230,119	120,252	61,138	62,824	53,648	55,955	64,876	1,326,887
1996	56,522	48,162	47,865	40,210	34,789	30,709	19,776	29,481	160,679	37,105	40,341	54,512	600,149
1997	77,191	59,047	212,756	566,980	288,518	869,787	473,716	185,109	92,740	255,679	89,976	103,722	3,275,221
1998	123,054	259,518	288,460	151,372	76,191	54,053	46,224	122,907	277,222	2,407,349	737,215	354,260	4,897,824
1999	182,492	121,236	133,046	111,074	125,752	173,356	99,674	59,826	44,538	45,786	49,791	52,199	1,198,770
2000	63,367	60,148	65,360	63,761	85,710	136,487	38,647	26,299	28,549	74,582	480,078	190,311	1,313,297
2001	221,695	160,946	254,025	162,866	172,235	88,900	60,891	117,660	873,791	135,091	309,983	434,101	2,992,185
2002	168,762	114,001	105,767	189,145	78,083	62,213	1,995,928	375,747	514,942	688,243	845,391	499,818	5,638,040
2003	332,233	358,654	295,389	161,464	125,883	123,139	148,940	92,025	200,578	140,183	116,754	96,201	2,191,441
2004	129,568	118,859	139,795	360,785	413,727	559,985	496,406	170,461	140,759	289,367	1,456,936	576,297	4,852,945
2005	278,023	366,230	522,559	187,231	226,483	143,109	105,986	91,109	84,651	75,250	64,053	73,263	2,217,948
2006	71,528	57,299	68,379	54,292	69,873	48,801	51,788	26,763	52,555	44,669	40,790	50,602	637,340
2007	162,627	65,569	484,884	341,435	403,149	297,053	1,269,605	805,853	448,394	192,570	158,984	120,323	4,750,445
2008	109,851	94,351	95,328	81,583	65,842	47,235	59,388	74,212	53,247	42,150	38,651	42,202	804,040
Average	164,678	175,987	198,924	182,077	215,362	309,357	253,611	124,704	173,237	219,045	219,114	186,155	2,422,252
Median	102,561	95,007	102,728	106,085	153,435	132,280	85,355	70,613	84,767	91,144	85,270	90,347	1,743,810
25th Perc	64,013	63,591	65,861	67,208	75,328	73,750	51,285	47,698	52,728	52,805	54,839	54,631	
15th Perc	48,235	57,223	50,631	51,498	61,074	50,125	28,478	29,212	40,393	44,543	40,768	47,708	

Guadalupe River near Victoria records started in December, 1934
San Antonio River at Goliad records started in March, 1939
Coleto Creek records started in July 1939
No Records for Coleto Creek from October 1954 - June 1978

Table 2
GBRA Historical Diversion Rates Plus Estimated Exelon Diversion Rates

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1991	10,050	10,101	10,288	10,845	13,195	15,671	16,956	16,965	14,178	13,333	10,206	10,225	152,014
1992	8,750	9,369	11,260	9,573	13,050	16,100	19,004	23,172	16,308	12,576	11,382	10,395	160,939
1993	11,169	9,937	10,210	10,887	12,423	14,914	27,173	16,559	13,005	12,201	10,913	10,374	159,766
1994	11,953	11,784	12,814	17,332	21,293	27,594	30,958	17,992	22,912	20,257	12,724	13,353	220,966
1995	10,547	10,201	10,499	10,611	14,712	16,469	17,829	14,260	13,750	8,901	10,732	10,847	149,356
1996	10,620	10,627	12,052	15,379	19,358	19,270	17,566	12,697	12,999	12,048	11,179	10,937	164,732
1997	10,240	10,185	10,753	10,253	11,458	13,853	16,885	14,226	13,401	11,200	10,869	10,684	144,007
1998	11,281	10,237	11,045	14,136	18,273	20,611	17,907	14,520	11,221	10,866	11,753	10,907	162,758
1999	10,713	10,875	10,598	13,490	16,467	16,124	16,059	13,339	19,182	14,155	13,561	11,878	166,443
2000	14,328	12,938	13,898	12,993	16,028	16,908	16,910	15,428	14,716	14,953	13,488	12,955	175,544
2001	13,181	12,573	14,359	18,879	19,790	26,485	18,364	19,560	16,729	13,569	11,808	11,752	197,049
2002	11,007	10,407	12,078	13,115	15,793	17,142	13,177	16,381	14,272	11,979	11,570	9,308	156,229
2003	10,989	10,403	11,291	11,799	15,018	14,970	14,369	13,307	13,120	11,926	11,184	11,539	149,914
2004	11,343	10,281	11,000	10,619	12,037	14,334	16,362	15,291	13,639	13,069	11,879	12,642	152,496
2005	12,633	11,228	10,348	11,582	14,471	15,813	17,379	8,750	11,228	8,750	8,750	8,750	139,682
2006	8,750	10,989	11,083	13,532	15,348	14,522	15,501	11,871	10,398	9,821	9,767	8,750	140,333
2007	10,722	10,543	10,725	10,321	10,659	13,924	13,194	13,018	11,567	10,484	10,282	9,688	135,127
2008	11,270	10,544	10,831	13,309	16,061	17,894	17,065	13,581	11,799	13,658	11,887	10,277	158,176
Average	11,086	10,735	11,396	12,703	15,302	17,367	17,925	15,051	14,135	12,430	11,330	10,848	160,307

Notes:

Data obtained from the Texas Water Master

Assumed total diversion rate of 105,000 ac-ft/year

Table 3
Comparison of Proposed Diverted Flow to Total Streamflow

YEAR	January	February	March	April	May	June	July	August	September	October	November	December	Year Average
1991	4%	5%	10%	3%	6%	13%	14%	28%	17%	19%	14%	1%	11%
1992	1%	1%	1%	1%	1%	2%	7%	12%	12%	11%	6%	7%	5%
1993	7%	5%	4%	7%	2%	3%	14%	20%	19%	14%	13%	13%	10%
1994	15%	16%	11%	19%	5%	23%	51%	34%	35%	5%	13%	9%	20%
1995	7%	12%	5%	7%	17%	7%	15%	23%	22%	17%	19%	17%	14%
1996	19%	22%	25%	38%	56%	63%	89%	43%	8%	32%	28%	20%	37%
1997	13%	17%	5%	2%	4%	2%	4%	8%	14%	4%	12%	10%	8%
1998	9%	4%	4%	9%	24%	38%	39%	12%	4%	0%	2%	3%	12%
1999	6%	9%	8%	12%	13%	9%	16%	22%	43%	31%	27%	23%	18%
2000	23%	22%	21%	20%	19%	12%	44%	59%	52%	20%	3%	7%	25%
2001	6%	8%	6%	12%	11%	30%	30%	17%	2%	10%	4%	3%	11%
2002	7%	9%	11%	7%	20%	28%	1%	4%	3%	2%	1%	2%	8%
2003	3%	3%	4%	7%	12%	12%	10%	14%	7%	9%	10%	12%	9%
2004	9%	9%	8%	3%	3%	3%	3%	9%	10%	5%	1%	2%	5%
2005	5%	3%	2%	6%	6%	11%	16%	10%	13%	12%	14%	12%	9%
2006	12%	19%	16%	25%	22%	30%	30%	44%	20%	22%	24%	17%	23%
2007	7%	16%	2%	3%	3%	5%	1%	2%	3%	5%	6%	8%	5%
2008	10%	11%	11%	16%	24%	38%	29%	18%	22%	32%	31%	24%	22%
AVERAGE	9%	11%	9%	11%	14%	18%	23%	21%	17%	14%	13%	11%	14%
					Average	14%							

FIGURES

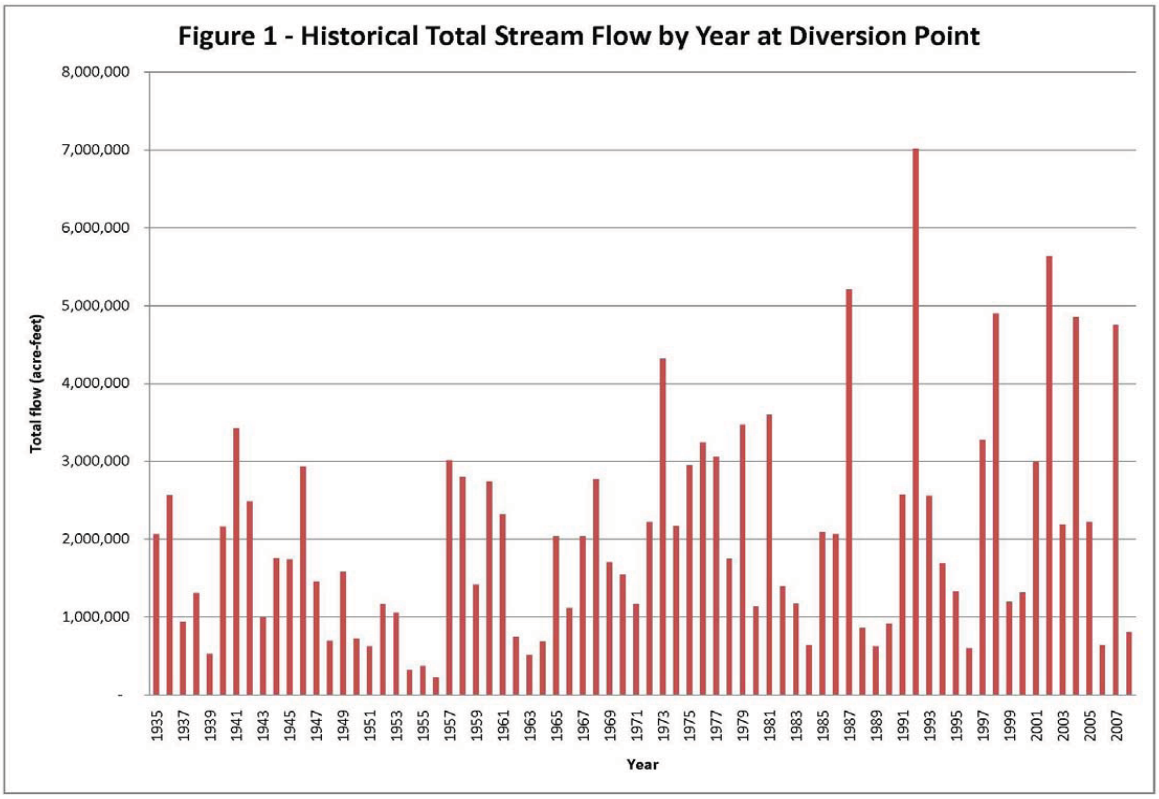


Figure 1 - Historical Total Stream Flow by Year at Diversion Point
Total flow (acre-feet)
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
-
1935
1937
1939
1941
1943
1945
1947
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
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2005
2007
Year

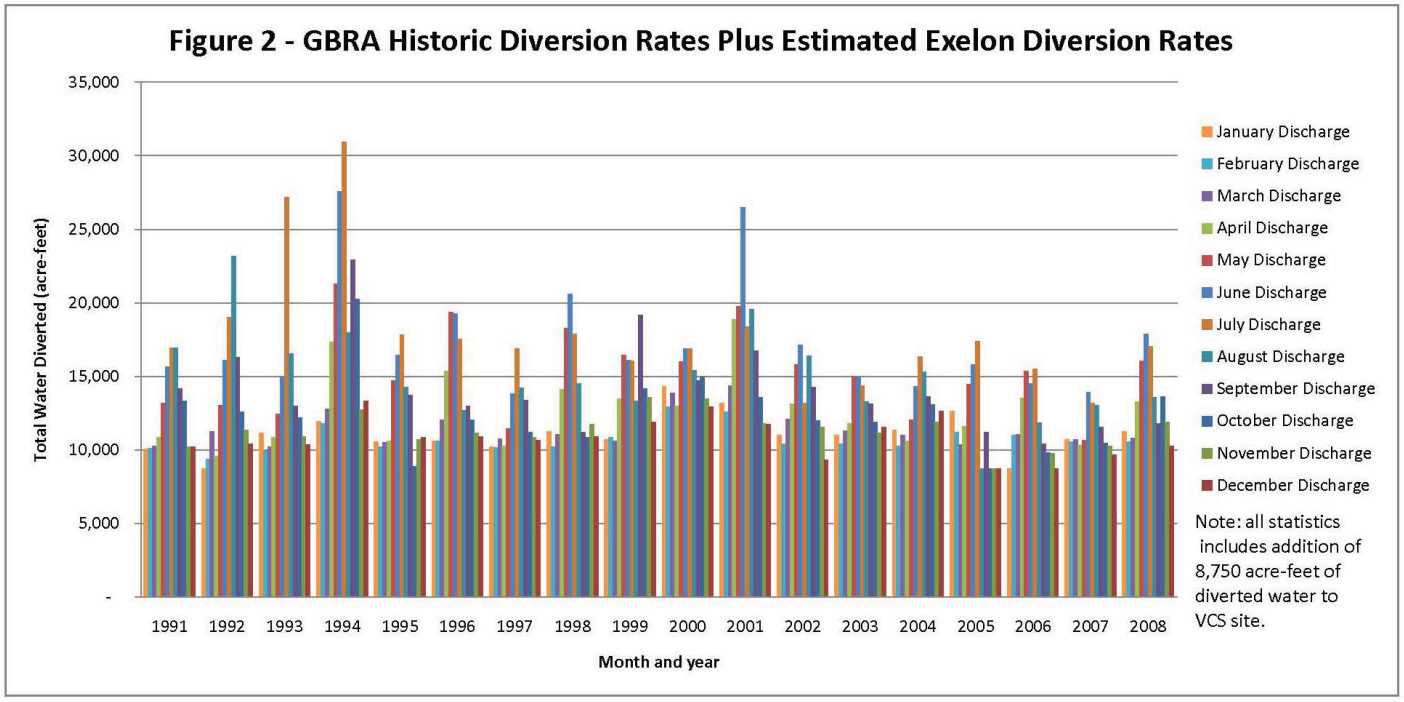
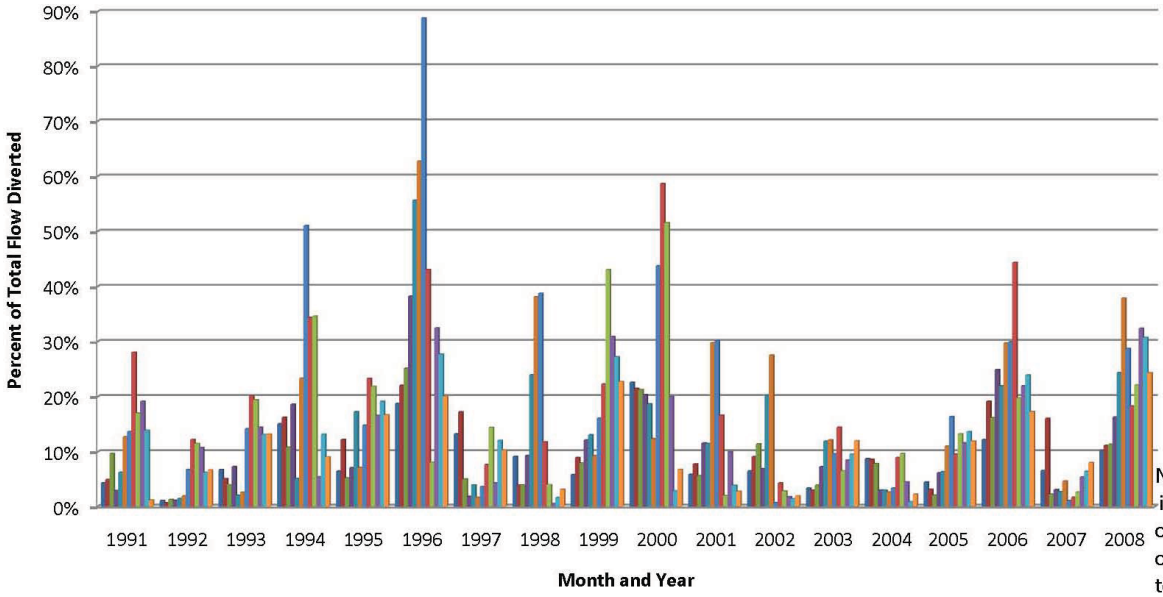


Figure 2 - GBRA Historic Diversion Rates Plus Estimated Exelon Diversion Rates
Total Water Diverted (acre-feet)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
-
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Month and year
January Discharge
February Discharge
March Discharge
April Discharge
May Discharge
June Discharge
July Discharge
August Discharge
September Discharge
October Discharge
November Discharge
December Discharge
Note: all statistics includes addition of 8,750 acre-feet of diverted water to VCS site.

Figure 3 - Comparison of Proposed Diverted Flow to Total Streamflow



Note: All statistics include addition of 8,750 acre-feet of diverted water to VCS site.

Contested Issue 7

Contested Issue 7

The Exelon Site Safety and Analysis Report (SSAR) does not properly evaluate the nature of the growth faults on the property. Data from 3D seismic interpretation indicates that the movement along the faults (hundreds of feet) is considerably more than estimated in the SSAR for the project. Preliminary field investigation of the faults at locations near the site boundary indicates that the fault traversing the cooling pond area exhibits evidence of recent and continuing movement. This movement poses an immediate and substantial threat to the stability of the cooling pond. Further, the SSAR does not evaluate the possibility that seepage from the pond into the fault zone could cause activation of the fault, resulting in dam failure. Although the SSAR maintains that the cooling ponds are not a safety feature, and that a release of water from the ponds would not flood the reactors, total loss of normal load cooling water and the resulting water levels would pose significant safety-related operational difficulties.

Issue Statement

1. Data from 3D seismic interpretation indicates that movement along the faults is as much as several hundreds of feet, which is considerably higher than what is estimated in the SSAR for the project.

   The SSAR examines only four two-dimensional reflection profiles. Exelon uses them to establish that there has been little Quaternary growth fault movement in the area of the proposed VCS. The SSAR describes "Growth Fault D" as having evidence of Quaternary deformation. The top of the Beaumont Formation (350,000 to 100,000 years ago) across "Growth Fault D" is said to be offset by 1.5-4.5 feet. "Growth Fault E" was not detected in the four lines examined by Exelon. Only one of the four lines even crossed the approximate location of "Growth Fault E", and the one that did cross the fault area did so near the end of the survey line, so the quality and resolution of the survey was compromised in the area of the fault.

   The seismic data used by Exelon went to greater depths (>18,000 feet) than the data used by JCHA (>5,000 feet). However, the 3D seismic data provides a much more complete picture for the area covered than the 2-dimensional lines examined by Exelon. Examination of Seismic Exchange, Inc's 3D seismic data shot by Sanchez Oil show several features of interest. Cross section 335 of the 3D seismic data shows several offsets across faults in the area. The depths of these offsets are approximately 1,500-2,000 ft below ground surface (bgs). These offsets appear to be approximately 0.06 seconds, which, if multiplied by an assumed velocity of 3,500 feet/second, correspond to approximately 210 feet. Additional offsets exist in the area of approximately 280 feet.

2. The activity rates associated with the growth faults are grossly underestimated.

Figure 1 shows the proposed VCS site, and documented surrounding growth faults. JCHA has observed the growth fault named in the SSAR as "Growth Fault E" where it crosses McFaddin Road (FM 445). There is a noticeable dip in the road at this point.

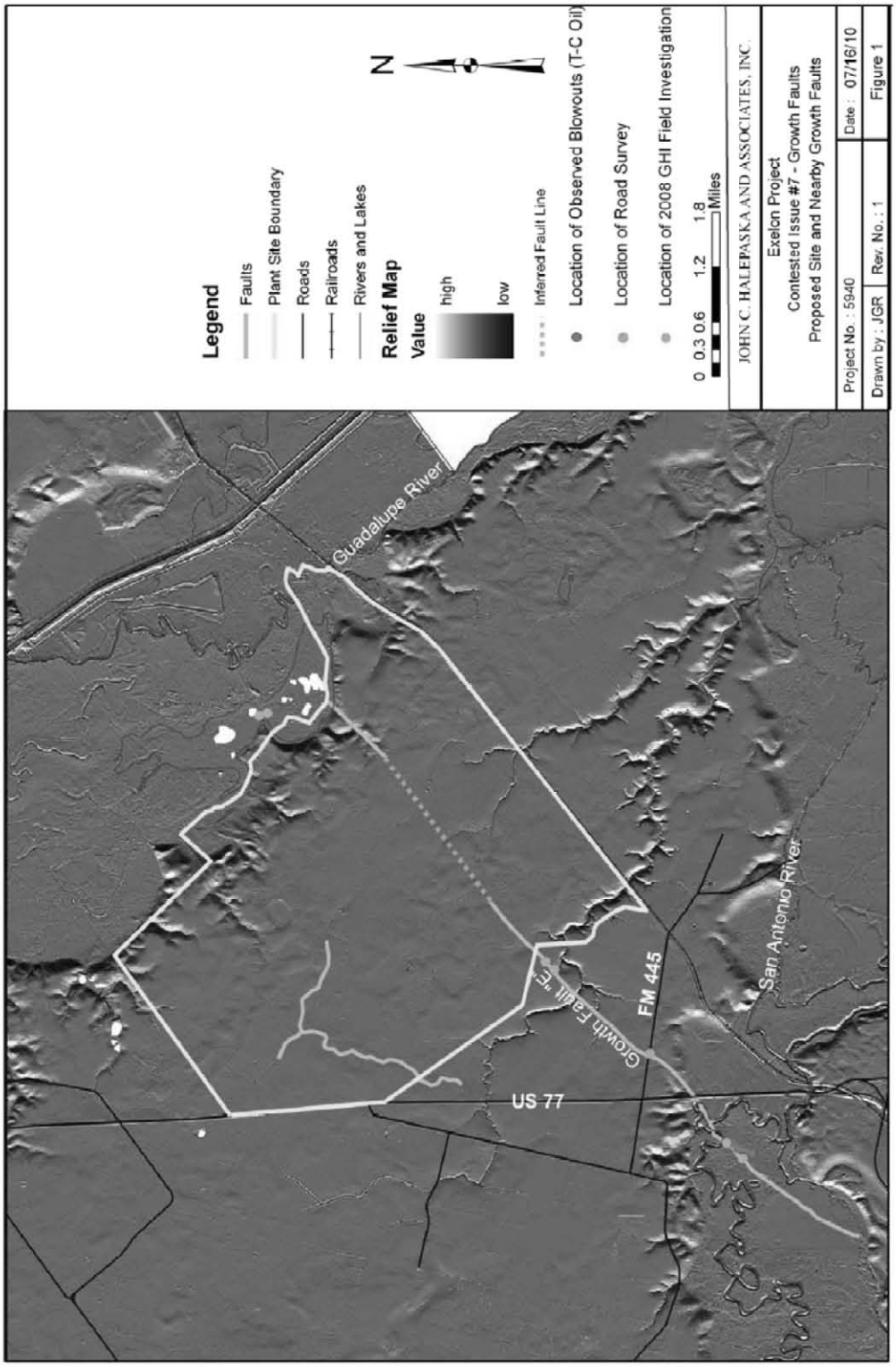


Figure 2 shows a photograph of the growth fault where it crosses the road. JCHA obtained the survey data from when the road was constructed in 1970, and found that the road was not built with a dip in it. It then stands to reason that the dip has occurred since 1970, and any measurable offset could be primarily attributed to growth fault movement. JCHA hired a local surveyor, CivilCorp, LLC, to resurvey the road using the same survey points as those used from the road survey in 1970, and some additional points across the area of the growth fault. This survey was performed on March 10, 2009.

Figure 2 - McFaddin Road (FM 445) Looking ENE at Growth Fault

The results of the survey (Figure 3) show a dip of approximately eight inches, or 0.67 feet. Assuming that this activity happened at a uniform rate over the course of the last 39 years, the resulting movement rate of this growth fault would be 0.2 inches per year, which is approximately 1,000 times larger than the rates estimated in the SSAR (0.00005-0.0005 in/yr).

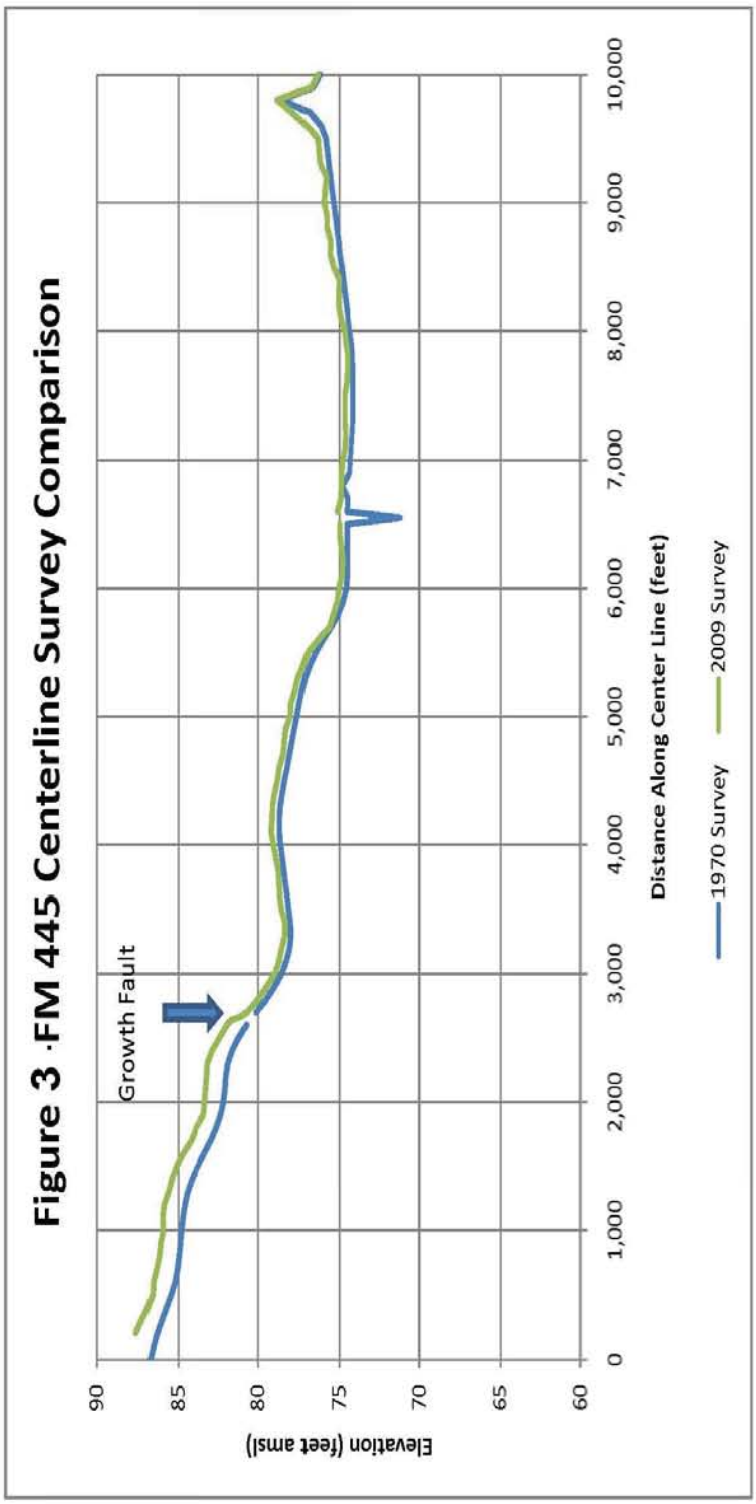


Figure 3 -FM 445 Centerline Survey Comparison
Growth Fault
Elevation (feet amsl)
90
85
80
75
70
65
60
0
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
9,000
10,000
Distance Along Center Line (feet)
1970 Survey
2009 Survey

Another method used to estimate recent growth fault movement was cesium 137 age dating. The atmospheric nuclear testing performed in the early 1960's left a global marker of that era. The stratigraphic horizon that represents the period of nuclear testing can be determined by analysis for radioactive isotopes associated with bomb fallout. JCHA contracted Geo-Hydro, Inc. (GHI) to take samples of depths varying from 0-56 cm from each side of "Growth Fault E" near where it crosses the San Antonio River. Results of analysis of these samples show an offset of at least 13 inches since the test era (c.1960). This would suggest a rate of movement of 0.265 in/year, which is comparable to the estimate derived from the road survey above.

On October 19, 2010, JCHA collected samples from 4 boreholes spaced 75 feet apart straddling the anticipated trace of growth fault A near where it crossed the southern property boundary. The borings were drilled to a depth of 8 feet. Samples were collected at 3 inch intervals from the continuous cores and submitted for analysis of cesium 137. The results were consistent with possible recent movement of 7 inches across this fault.

JCHA contracted GHI to observe the excavation of a series of trenches just North of the San Antonio River in the vicinity of the VCS site (2008, Geo-Hydro, Inc.). These trenches showed a visible offset in near surface stratigraphy of at least 6 inches (Figure 4). Although dating of the offset was not performed, this corroborates that there has been movement across faults in the VCS area.

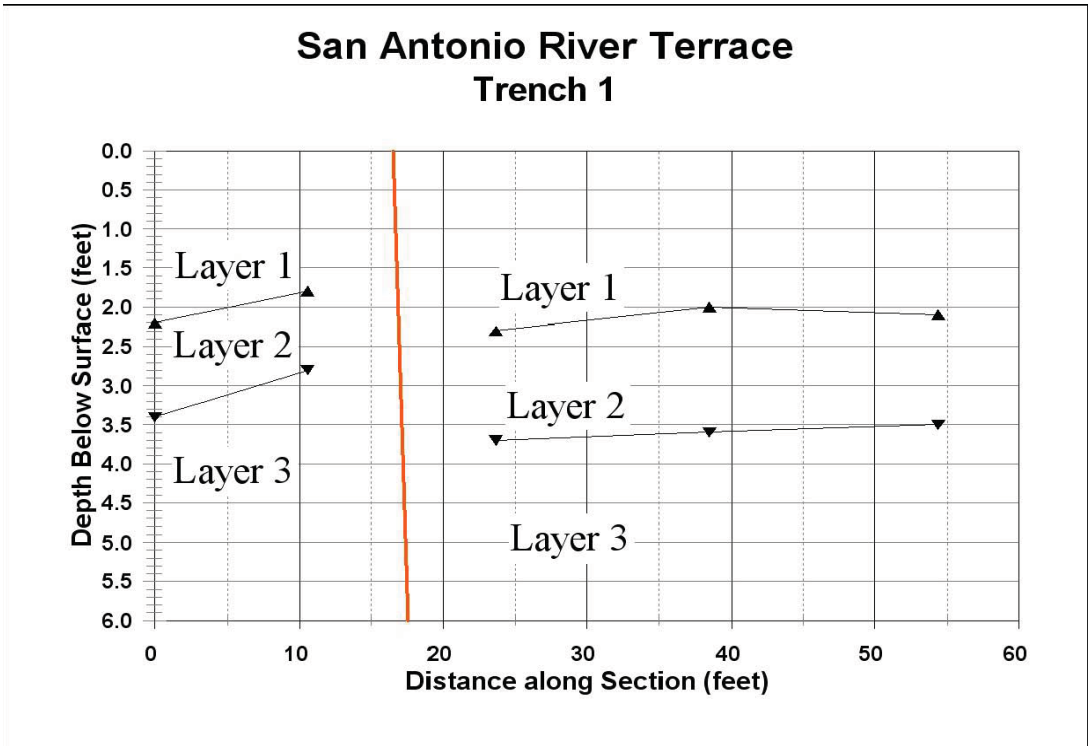


Figure 4 - Trench Cross Sectional View

JCHA contacted the Texas Department of transportation (TxDOT), in order to determine whether growth faults were a documented problem, and to find if there were records of road maintenance

attributed to growth fault movement. JCHA found that TxDOT did not have an adequate level of individual job description to determine what road maintenance activities were attributable to growth fault movement.

JCHA also did some investigation on the railroads in the area, and whether they had observed similar problems due to growth fault movement. Union Pacific Railroad (UPR) maintains the railroad lines in Refugio and Victoria counties. UPR apparently was not aware of the presence of growth faults in the area. However, they did observe a substantial amount of differential settling when working on the bridge over the San Antonio River, just East of US 77. The location of this bridge is about four miles South of FM 445 along US Route 77. Upon hearing of the growth faults in the area, UPR suspected that may be some of what was causing the structural problems at the bridge. However, it was clear that UPR's main concern was fixing the problem, not determining the cause.

3. The growth faults of the Gulf Coast have been studied as a potential factor in the failure of levees around New Orleans during Hurricane Katrina. Such potential failure should be a consideration when designing any type of structure atop growth faults. Exelon does not adequately account for the presence of these growth faults through their property.

   Faults, especially growth faults, are a largely overlooked natural hazard. There is evidence that would suggest that some levees constructed across growth faults failed where they overlay them. A similar scenario would occur at the VCS site, where a growth fault transects the property, and where the cooling pond would be built. Design of the cooling pond and the adjacent GBRA pond needs to be done with consideration for the presence of these faults, and the potential structural weakness caused by them.

4. In addition to the relative weakness introduced by the presence of the growth faults, there is also potential for aftershock waves from distant earthquakes to damage the cooling pond.

   There have been several instances in the past where distant earthquakes have caused shockwaves that have inflicted damage on the Gulf Coast. For instance, the March 27, 1964 Alaskan Earthquake (magnitude 9.2 on Richter scale) caused a series of large waves (6-7 feet in magnitude) in the vicinity of several different growth faults along the Gulf Coast. These large waves were indicative of movement along the growth faults in the area. These events damaged boat docks, and broke small boats from their moorings. There was also structural damage due to fault movement which caused cracks in public swimming pools in Baton Rouge, and collapsed the concrete walls of a New Orleans water treatment plant. Other earthquakes that generated the same type of phenomenon was the New Madrid Quake of 1811-1812, the Charleston South Carolina earthquake of 1886, and the November 3, 2002 Denali Alaska earthquake. It is only a matter of time before another earthquake happens. The growth faults underlying the site make it vulnerable to aftershocks, regardless of the site's distance from or proximity to, the primary earthquake.

5. The growth faults in the area of the proposed site have a proven history of acting as conduits for fluid transport. This poses a significant risk to the proposed facility's cooling pond, which would overlie at least one of these growth faults. The physical and chemical impacts of these growth faults are ignored in the application.

   The area has experienced blowouts in early 2008 on the San Antonio River terraces West of US Route 77. These blowouts occurred as a result of water and gas moving upward along the fault until they reached sufficiently shallow depth that they broke vertically upward to the surface in a series of secondary blowouts parallel to, but Gulf-ward of, the surface projection of the fault.

   It is clear that these faults have acted as pathways for fluids in the past, and are likely to do so in the future. Whether they act to drain the overlying cooling pond water, or allow hydrogen sulfide gases to reach the surface, they are a hazard to this project, and must be considered as such in the application.

Conclusion

The results of the survey of Farm-to-Market Road 445 across "Growth Fault E" show an offset of 8 inches, or 0.67 feet, likely over the past 39 years, possibly less. Cesium 137 age dating from another location adjacent to Exelon property boundary showed a rate movement (0.265 in/year) similar to that shown in the road survey (0.2 in/year). This represents a fault movement rate of approximately 1,000 times greater than that used in the SSAR.

References

Geo-Hydro, Inc., February 2009, Growth Fault Evaluation Report, Victoria County, Texas.

Contested Issue 8

Contested Issue 8

Uncertainty Regarding Alternatives for Fulfilling Water Supply Requirements for Protected Species Located in Comal and San Marcos Springs Precludes Any Long-term Commitment of Water Resources to Fulfill the Cooling Requirements of the VCS station.

Issue Statement

1. The requirements of the Endangered Species Act:

   A. The purposes of the Endangered Species Act, , 16 U.S.C. §§1531-1544, are "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such endangered species and threatened species." 16 U.S.C. §1531(b).

   B. The Endangered Species Act prohibits any federal agency from taking any action (including destruction of "critical habitat") that would jeopardize the continued existence of a threatened or endangered plant or animal species.

   C. The Endangered Species Act also prohibits all parties (both public and private) from undertaking actions that would result in the "taking" of a threatened or endangered species. 16 U.S.C. §1538(a)(1).

   D. Endangered species are defined as "any species which is in danger of extinction throughout all or a significant portion of its range[.]"16 U.S.C. §1532(6).

   E. U.S. Fish & Wildlife Service regulations extended these provisions to "threatened" species, defined as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. §1532(20). This regulation was sustained as a reasonable and permissible interpretation of the Endangered Species Act in *Sweet Home Chapter of Communities for a Great Oregon v. Lujan*, 806 F. Supp. 279 (D.D.C. 1992), *aff'd sub nom Sweet Home Chapter of Communities for a Great Oregon v. Babbitt*, 1 F.3d 1 (D.C. Cir. 1993), *modified*, 17 F.3d 1463 (D.C. Cir. 1994), *rev'd*, 515 U.S. 687 (1995).

   F. The Endangered Species Act provides that "with respect to any endangered species of fish or wildlife listed pursuant to ... this title it is unlawful for any person subject to the jurisdiction of the United States to ... (B) take any such species within the United States or the territorial sea of the United States ... or (G) violate any regulation pertaining to such species or to any threatened species of fish or wildlife listed pursuant to ... this title." 16 U.S.C. §1538(a)(1).

G. Furthermore, "with respect to any endangered species of plants listed pursuant to ... this title, it is unlawful for any person subject to the jurisdiction of the United States to ... (B) remove and reduce to possession any such species from areas under Federal jurisdiction; maliciously damage or destroy any such species on any such area; or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law ... or (E) violate any regulation pertaining to such species or to any threatened species of plants listed pursuant to ... this title. 16 U.S.C. §1538(a)(2).

H. Concurrent with the determination that a species is endangered or threatened, the Secretary of the Interior must designate critical habitat. 16 U.S.C. §1533(b)(2). In making a determination regarding the designation of critical habitat, the Secretary:

> [S]hall designate critical habitat ... on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned.

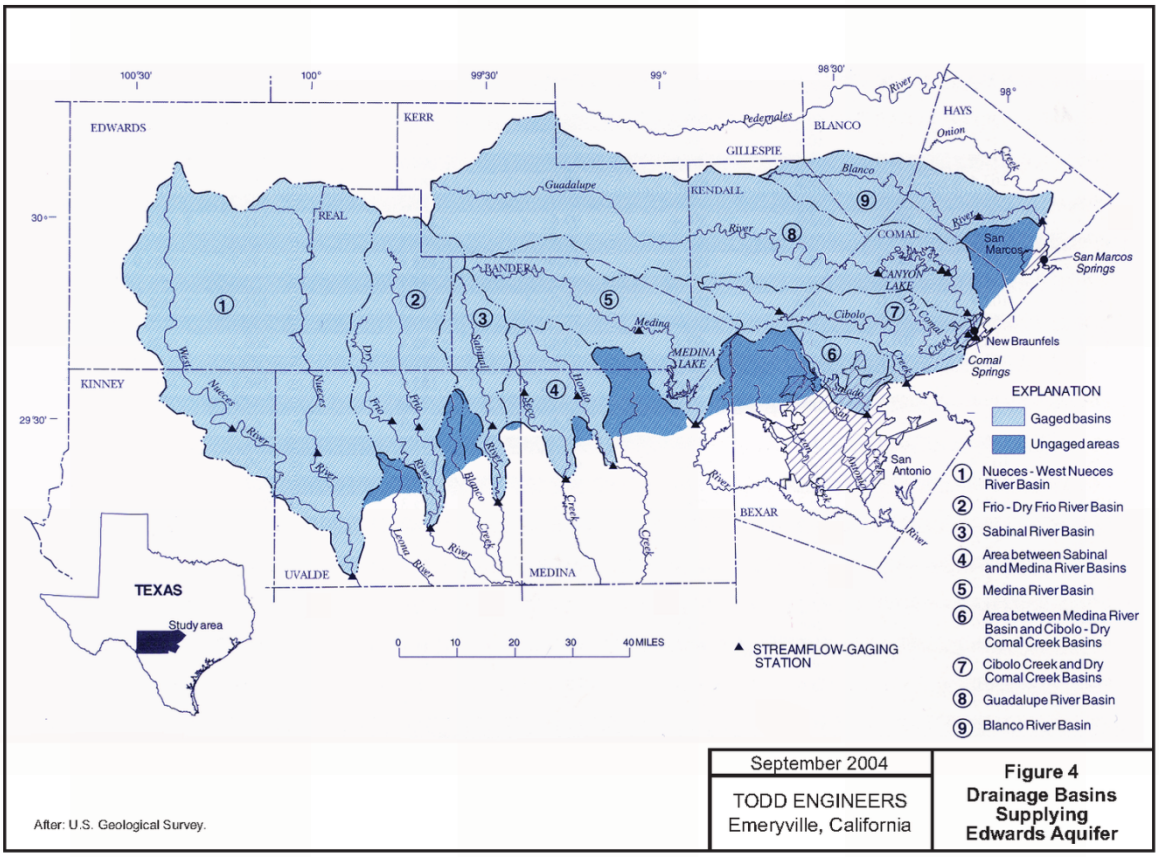
I. The term "take" is broadly defined to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. §1532(19).

2. Comal and San Marcos Springs:

A. Both springs derive their water supplies from the Edwards Aquifer.

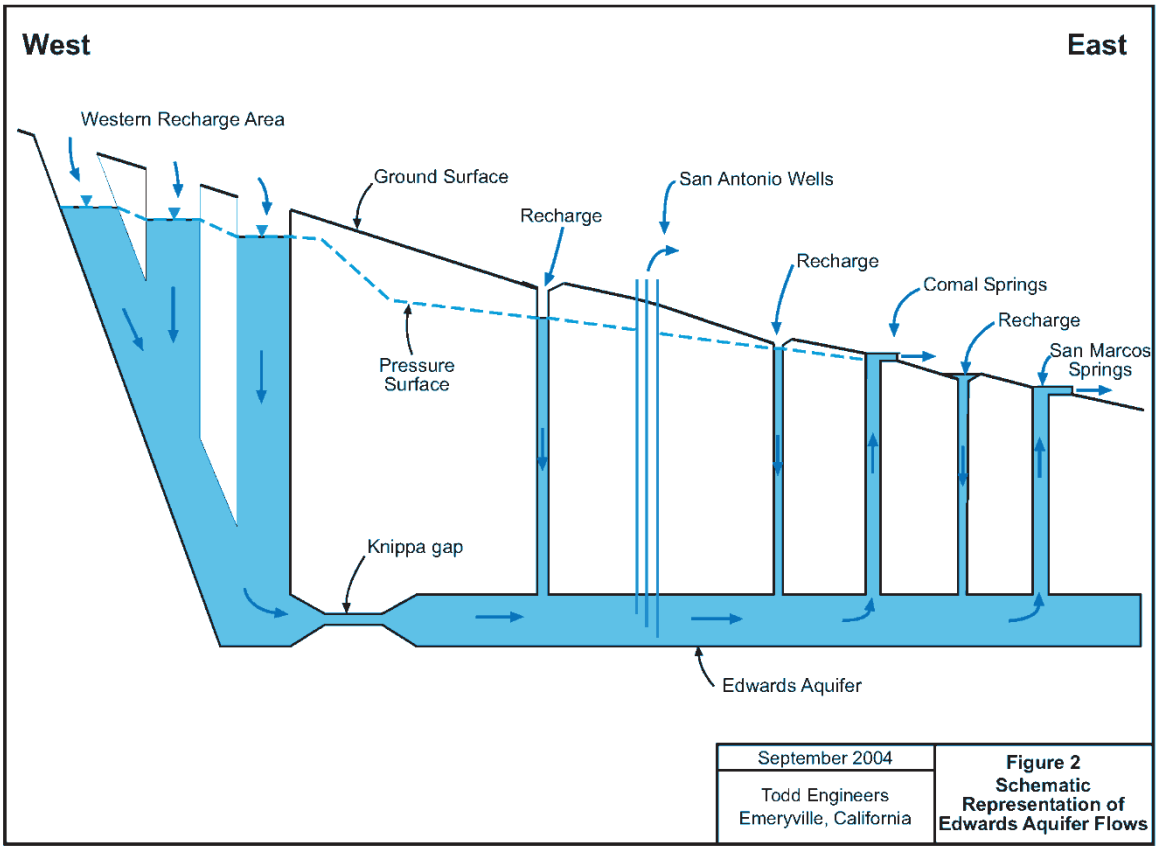
B. "The Edwards Aquifer is a karst aquifer that is characterized by the presence of sinkholes, sinking streams, caves, springs, and a well-integrated subsurface drainage system. It is one of the most productive groundwater systems in the United States, characterized by extremely productive water wells and high spring discharges. The aquifer exhibits extremely high (cavernous) porosity and permeability which are typical of many karst aquifers and enables groundwater levels to respond quickly to rainfall (recharge) events." Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, page 4.

C. Comal Springs is located in the downstream section of the Guadalupe River Basin. San Marcos Springs is located further east in the San Marcos River Basin:



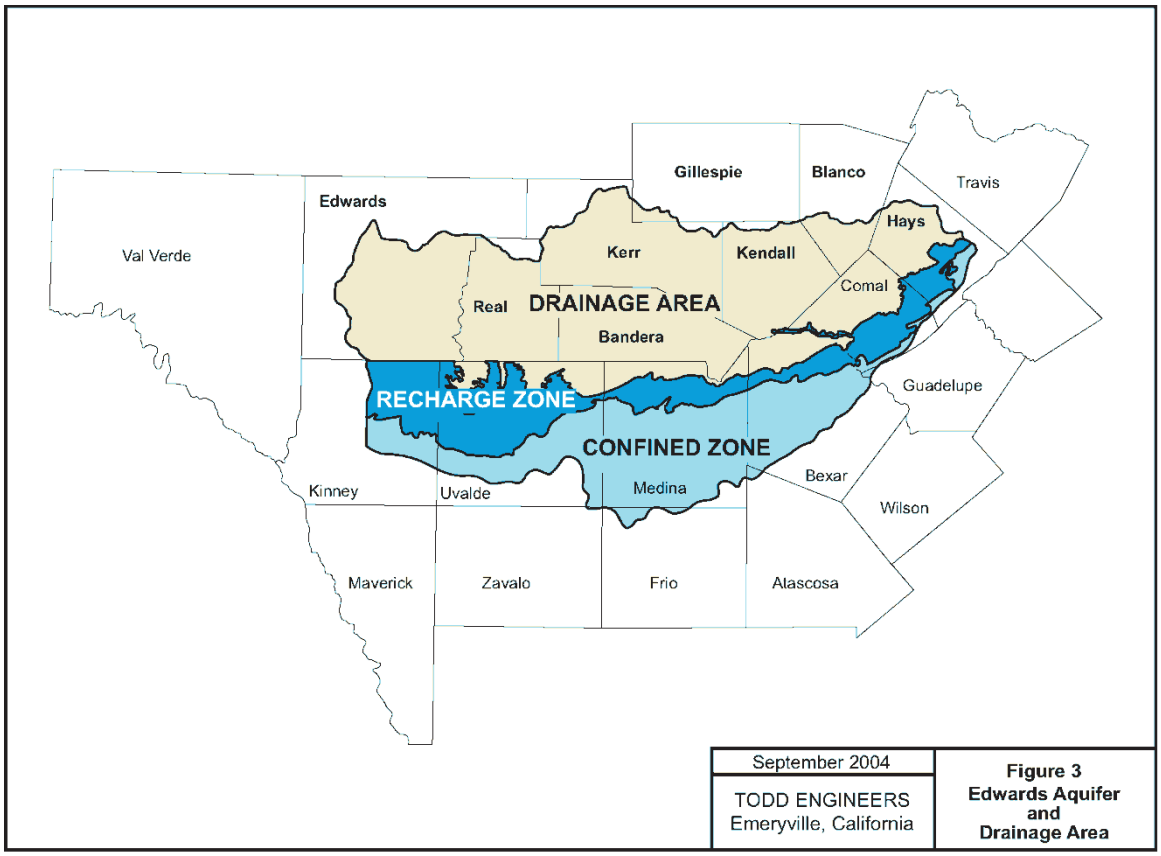
Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, Figure 4: Drainage Basins Supplying the Edwards Aquifer.

D. As illustrated below, flows from Comal and San Marcos Springs result from aquifer recharge occurring primarily to the west of the Springs:



Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, Figure 2: Schematic Representation of Edwards Aquifer Flows.

E. The recharge areas noted above extend from Kinney County in the west to Hayes County in the east:



Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, Figure 3: Edwards Aquifer and Drainage Area.

3. Eight species found in the Comal and San Marcos Springs ecosystems are listed as threatened or endangered by the U.S. Fish and Wildlife Service. For several of these species, minimum discharges from either Comal Spring or San Marcos Spring (or both) have been established:

   A. Endangered species:

      i. Fountain darter (*Etheostoma fonticola*)

         - Comal Spring: "Take" threshold – minimum discharge of 200 cfs in the Comal River measured at the U.S.G.S. gauge at Torrey Mill dam. "Jeopardy" threshold – minimum discharge of 150 cfs in the Comal River measured at the U.S.G.S. gauge at Torrey Mill dam. U.S. Fish and Wildlife Service. (1996). *San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan*. Washington, DC: U.S. Fish and Wildlife Service, *cited in* LBG-Guyton

Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages C-1, C-6 to C-7, *accord*, Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 1-3.

- San Marcos Spring: "Take" and "jeopardy" thresholds – minimum discharge of 100 cfs in the San Marcos River measured at the U.S.G.S. gauge at University Drive Bridge. U.S. Fish and Wildlife Service. (1996). *San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan*. Washington, DC: U.S. Fish and Wildlife Service, *cited in* LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages C-1, C-17, *accord*, Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 1-3.

ii. Texas blind salamander (*Eurycea rathbuni*)

- San Marcos Spring: "Take" and "jeopardy" thresholds – minimum discharge of 50 cfs. U.S. Fish and Wildlife Service. (1996). *San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan*. Washington, DC: U.S. Fish and Wildlife Service, *cited in* LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, page C-1.

iii. Texas wild-rice (*Zizania texana*)

- San Marcos Spring: "Take" and "jeopardy" thresholds – minimum discharge of 100 cfs in the San Marcos River measured at the U.S.G.S. gauge at University Drive Bridge. U.S. Fish and Wildlife Service. (1996). *San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan*. Washington, DC: U.S. Fish and Wildlife Service, *cited in* LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages C-1, C-18, *accord*, Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 1-3.

B. Threatened species: San Marcos salamander (*Eurycea nana*). San Marcos Spring: "Take" and "jeopardy" thresholds: minimum discharge of 60 cfs. U.S. Fish and Wildlife Service. (1996). *San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan*. Washington, DC: U.S. Fish and Wildlife Service, *cited in* LBG-

Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages C-1, C-18.

C. Neither "take" nor "jeopardy" levels have been established for the endangered Comal Springs dryopid beetle (*Stygoparnus comalensis*), the Comal Springs riffle beetle (*Heterelmis comalensis*) and the Peck's Cave amphipod (*Stygobromus pecki*). Such levels could not be set due to "limited available life-history information, including distribution and habitat requirements[.]" LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages C-1 to C-2.

D. Though listed as an endangered species, the San Marcos gambusia (*Gambusia georgei*) is considered extinct. It previously existed in the upper reaches of the San Marcos River. LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages C-1, C-13, C-14 to C-15.

E. With regard to the springflow requirements noted above:

i. "[I]t may be possible for flows to fall below these levels for short periods of time, but not for extended periods." U.S. Fish and Wildlife Service. (1996). *San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan*. Washington, DC: U.S. Fish and Wildlife Service, *cited in* Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 1-3.

ii. "Additional studies are ongoing, and minimum springflows are subject to revision in the future." Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 1-3.

4. Multiple alternatives have been suggested to maintain springflows as needed to protect the species listed above.

A. "Regional groundwater management to maintain water levels as high as possible during drought periods." LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, page D-1.

B. "Importing water to the spring complex and augmenting flow by injecting the water directly into the aquifer, importing the water into Landa Lake or Spring Lake or in the specific case of Comal Springs discharging the water into the Old Channel where there is a large population of endangered species. A variety of different water sources are also considered." LBG-Guyton Associates. (2004). *Evaluation of Augmentation*

Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas, page D-1. At San Marcos Spring, supplemental water "should probably come from an outside source[.]" *Id*. at C-20.

i. In terms of the "different water sources" noted above, a number of surface water supplies are being considered:

   a. One option is to import water from Canyon Reservoir on the Guadalupe River. Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, pages ES-31 to ES-32; LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages C-8, D-14 to D-16.

      - "The diversion at Lake Dunlap … is the farthest downstream of the three Guadalupe River diversion sites and has the advantage of also being downstream of Comal Springs. This location would also be capable of recirculating excess springflow in addition to the WAM□derived estimates of source water at Lake Dunlap. The analysis examines conveyance of this water to the Cibolo Dam site … and the San Geronimo Type 2 site[.]" Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 6-5.
      - With regard to water potentially available for aquifer recharge, Canyon Lake has an average of 78,249 acre-feet of unappropriated water and an average of 64,796 acre-feet of "marketable" water. Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, pages 5-13, 5-14.
      - "Marketable" water is defined as "the portion of the appropriated (or permitted) water at a particular location on a stream that has not been used historically and is not anticipated to be needed and used for some period of time in the future, i.e., several years." Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 5-4.

   b. Lake Dunlap has also been suggested as a source of supply. Todd Engineers. (2008). Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report. Emeryville, CA: Todd Engineers, pages ES-31 to ES-32; Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, pages 1, 7.

      - "[The study analyzed] the benefits of conveying unappropriated amounts of source water from Canyon Lake to the recharge zone. Previously-

determined routes of conveyance were used to transmit this water to Medina County Type 2 sites. … Water is diverted from the flood storage pool at Canyon Lake, conveyed to a tributary of Cibolo Creek via pipeline, and allowed to flow downstream to the Type 2 site for retention and infiltration. Although the projected capacity of the proposed Cibolo Dam project had limited the amount of recharge in past evaluations, all unappropriated water was simulated for the purposes of initial analysis." Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 6-5.

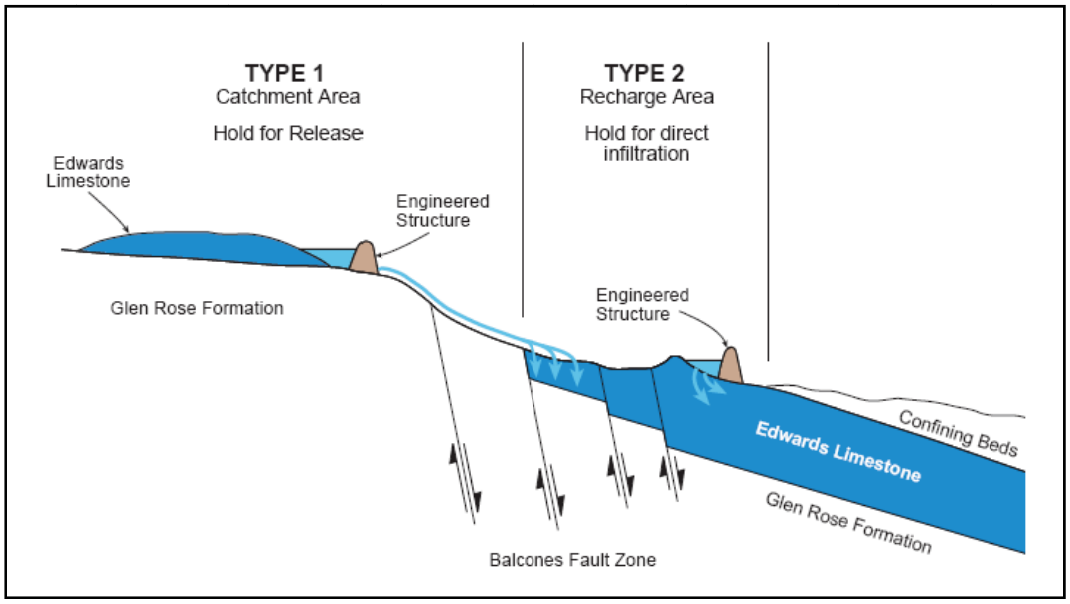
- With regard to water potentially available for aquifer recharge, Lake Dunlap has an average of 81,343 acre-feet of unappropriated water and an average of 71,355 acre-feet of "marketable" water. Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, pages 5-13, 5-14.

c. Another source of supply could be Medina Lake. Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, pages 1, 7.

- [The study examined] the diversion of unappropriated water near the town of Comfort and conveyance to a tributary of the Medina River. From there, water would flow downstream into Medina Lake and could be re-captured and conveyed via pipeline to a Type 2 recharge site. Because unappropriated water may be available on the Medina River, along the conveyance route, this additional source water is incorporated into the analysis." Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 6-5.
- With regard to water potentially available for aquifer recharge, Medina Lake has an average of 21,349 acre-feet of unappropriated water and an average of 5,823 acre-feet of "marketable" water. Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, pages 5-13, 5-14.

d. Construction of Type 1 catchment dams has also been proposed. Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, page 1. These structures are planned for "streams outside of the Edwards Aquifer where water cannot be recharged directly into the aquifer." Todd Engineers. (2005). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 2*. Emeryville, CA: Todd Engineers, page 2. Type 1 and Type 2 retention structures are depicted in the following illustration. As more fully discussed in Type 2 retention structures, which capture

water for direct infiltration, are located on the recharge zone. Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page ES-3.



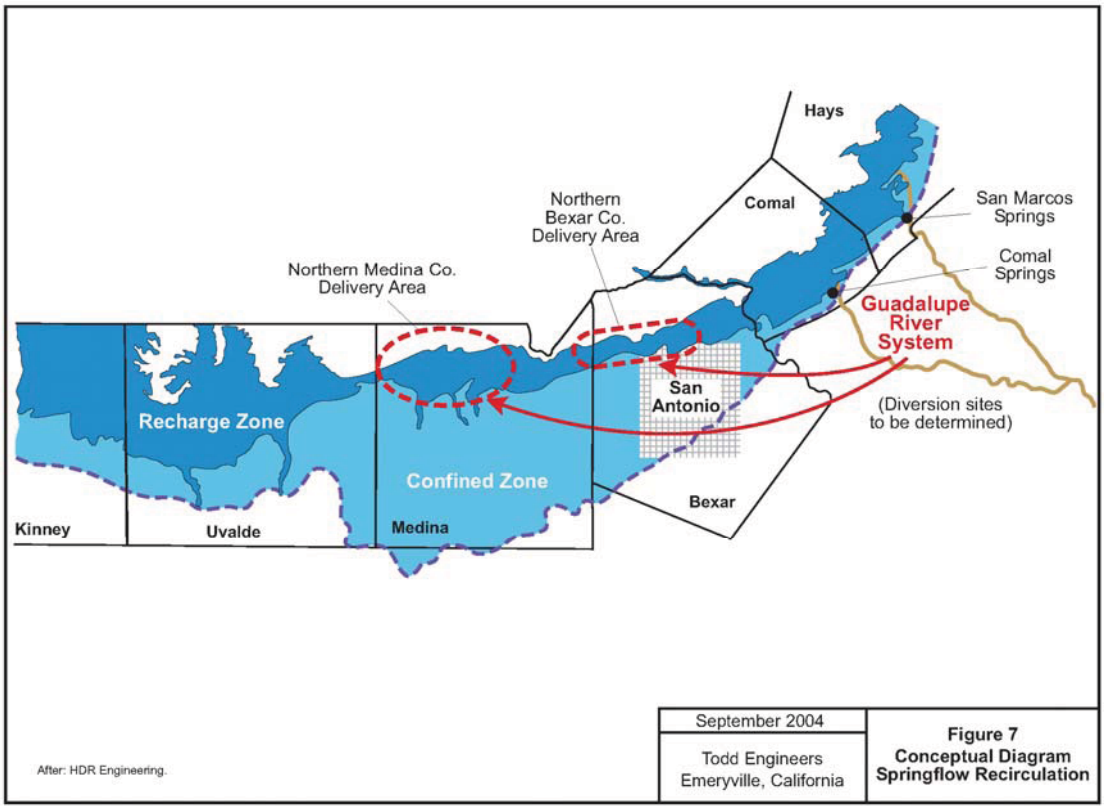
Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, Illustration ES-2: Types of Enhanced Recharge Structures.

e. It has also been suggested that "unused Edwards Aquifer withdrawal permits" could provide be a water supply source, particularly during wet periods. Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page ES-32. This could provide a substantial quantity of water for recharge:

Pool	County	Average Unused Permits 1999-2006		
		Irrigation (AFY)	Muni/Ind. (AFY)	TOTAL (AFY)
Uvalde Pool				
	Uvalde	66,631	1,241	67,872
San Antonio Pool				
	Medina	54,478	2,840	57,318
	Bexar	25,717	22,044	47,761
	Comal	951	6,993	7,944
	Hays	867	4,243	5,110
	Subtotal	82,013	36,120	118,133
TOTAL		148,644	37,361	186,005

Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, Table 5-8: Average Amounts of Unused Pumping Permits by County and Water Use.

ii. "Another possibility is that of intercepting water from the Guadalupe River Basin downstream from Comal and San Marcos Springs and recirculating it to the recharge zone of the aquifer[.]" Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, page 1. This possibility is depicted below. In terms of the reference to "diversion sites to be determined", subsequent studies concluded that a "diversion point at Lake Dunlap was considered optimal over the diversion points at Canyon or Comal River because Dunlap provided more unappropriated water and greater flexibility to capture excess springflow." Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page ES-32.



Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, Figure 7: Conceptual Diagram, Springflow Recirculation.

iii. Yet another groundwater transfer option would be to import water to be pumped from the Carrizo Aquifer south and east of Comal and San Marcos Springs. LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages D-10 to D-13.

iv. In 1995, it was suggested that "a production wellfield in Western Bexar County" should be developed to provide water supplies for the protected species. This

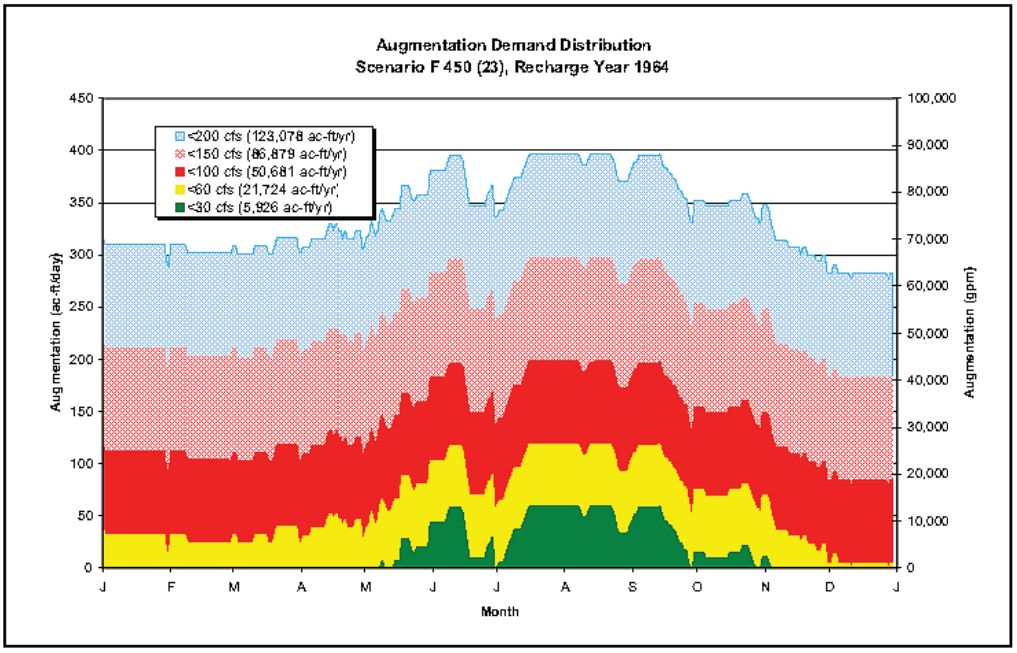
wellfield was intended to produce between 200 and 300 cfs. Following production, the water would have been transported by pipeline to the springs. Pumping of groundwater was seen as preferable to the use of surface water to meet water supply needs because the chemistry of the groundwater more nearly matched the chemistry of Comal and San Marcos Springs. McKinney, D. C. & Sharp, J. M. (1995). *Springflow Augmentation of Comal Springs and San Marcos Springs, Texas: Phase I - Feasibility Study* (Technical Report No. CRWR 247). Austin, TX: Center for Research in Water Resources, *cited in* LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, page A-1.

v. Use treated effluent from San Marcos and New Braunfels to maintain springflows has also been suggested. LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages D-16 to D-17.

vi. Irrespective of the source, substantial quantities of water may be needed to maintain the flows noted above in Comal and San Marcos Springs.

a. The quantity of water that might need to be imported to fulfill either the 150 cfs or the 200 cfs requirement during a serious drought was addressed in LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*.

- Given the following assumptions:
  - The drought of 1964, "the most severe drought outside of the drought of record." *Id*. at page D-5.
  - The level of monitoring well J-17 located in San Antonio at or below 627 feet. *Id*. at page D-2.
  - Triggering of Stage IV of the Edwards Aquifer Authority's Demand Management Plan requiring groundwater users to reduce production by 23%. *Id*. at pages D-1 to D-2.
  - Groundwater production from the Edwards Aquifer of 450,000 acre-feet per year. *Id*. at page D-5.
- Maintaining a minimum discharge of 150 cfs would require the importation of 86,879 acre-feet of water. *Id*. at pages D-5, D-7.
- Maintaining a minimum discharge of 200 cfs would require the importation of 123,078 acre-feet of water. *Id*. at page D-7.
- The timing of these importation requirements is illustrated below:



LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, Figure D-1: Augmentation Demand Distribution for Comal Springs.

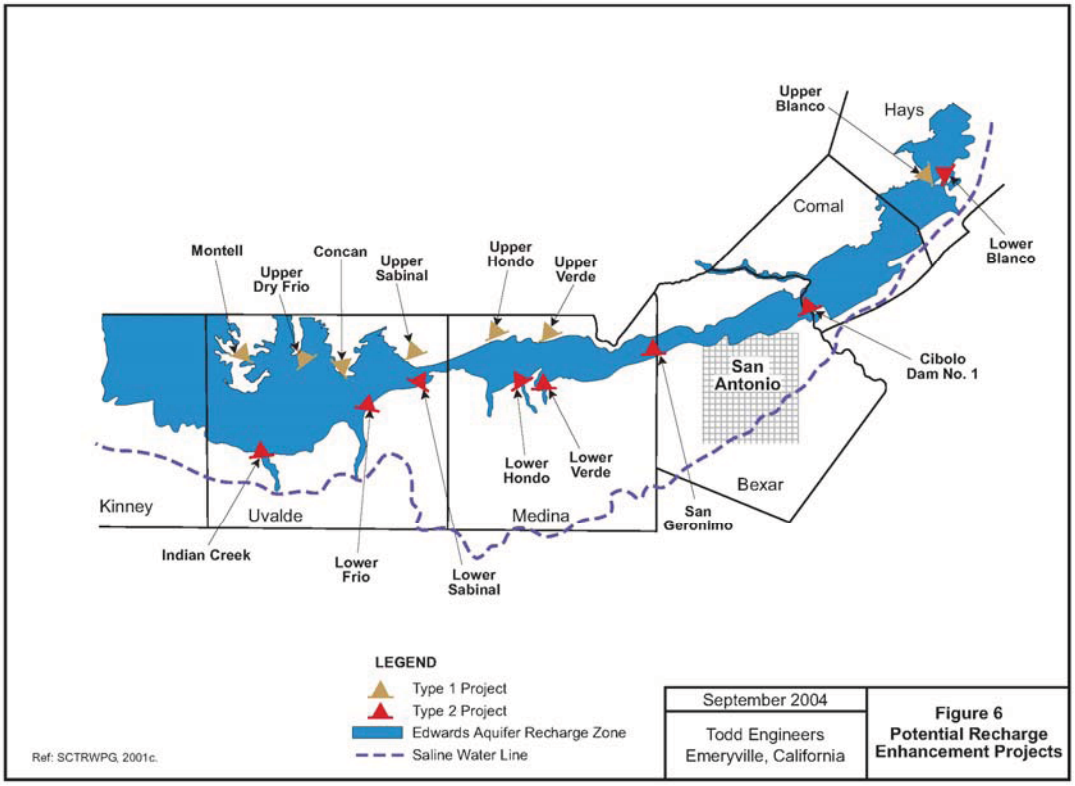
b. As indicated below, current Critical Period Management rules mandate progressively more significant restrictions on pumping as flows from Comal and San Marcos Springs decline:

Critical Period Stage	San Antonio Pool				Uvalde Pool	
	Comal Springs (cfs)	San Marcos Springs (cfs)	Index Well J-17 (ft, msl)	Withdrawal Reduction (%)	Index Well J-27 (ft, msl)	Withdrawal Reduction (%)
I	<225	<96	<660	20%	NA	NA
II	<200	<80	<650	30%	<850	5%
III	<150	NA	<640	35%	<845	20%
IV	<100	NA	<630	40%	<842	35%

Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page 2-10.

c. Utilizing recharge sites proximate to Comal Springs (Lower Sabinal, Lower Hondo, Lower Verde, San Geronino and Cibolo, depicted below), Todd Engineers concluded that the flow of Comal Springs increased from 0.9 to 1.1 cfs for every 1,000 acre-feet of recharge. Todd Engineers. (2005). *Analysis of*

Recharge and Recirculation, Edwards Aquifer, Phase 2. Emeryville, CA: Todd Engineers, pages ES-4, 6, 3, 7, 19.



Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, Figure 6: Potential Recharge Enhancement Projects.

d. With regard to the Lower Sabinal, Lower Hondo, Lower Verde, San Geronino and Cibolo recharge sites, it must be noted that substantially different quantities of water would have to be recharged in order to maintain a springflow of 150 cfs at Comal Spring. As indicated below, during dry conditions (the period between 1947 and 1956), the recharge requirement could range between 260,000 acre-feet per year (San Geronino) to 350,000 acre-feet per year (Lower Verde).

Type 2 Recharge Site	Dry Conditions (1947-1956) (AFY)		Average Conditions (1976-1983) (AFY)	
	40 cfs	150 cfs	40 cfs	150 cfs
Indian Creek	575,000	1,850,000	-	150,000
Lower Frio	400,000	750,000	-	80,000
Lower Sabinal	150,000	325,000	-	33,000
Seco Creek	155,000	315,000	-	35,000
Lower Hondo	160,000	325,000	-	35,000
Lower Verde	165,000	350,000	-	40,000
San Geronimo	117,000	260,000	-	25,000
Cibolo	160,000	340,000	-	27,000
Lower Blanco	5,000,000	> 10,000,000	-	300,000

Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers. Tables ES-2, 4-11: Annual Enhanced Recharge (in AFY) to Maintain Comal Springs Flow for Dry and Average Conditions.

C. "Pumping Edwards water locally to augment surface waters either in Landa Lake or Spring Lake." LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, pages D-1, D-7 to D-10.

D. "Replacing current local large groundwater users with non-Edwards water." LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, page D-1.

E. "Construction of engineered structures to focus flow to specific habitats." LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, page D-1.

i. At Comal Spring, this could include:

a. Recirculating water from Landa Lake back into upstream habitats through a series of underground pipes. *Id*. at page C-9.

b. Lowering the water level of Landa Lake in areas not providing critical habitat. *Id*. at C-10.

c. Use of temporary dams downstream to provide a source of water to be recirculated. *Id*. at C-10.

d. Intensive management of a portion of the Old Channel as a refugia. *Id*. at pages C-10 to C-11.

ii. At San Marcos Spring, this could include:

a. Utilization of a recapture and recirculation system similar to the system proposed for Comal Spring. *Id*. at page C-20.

b. Implementation of such a system, however, would result in a net decrease in downstream flows. *Id*. at page C-20.

F. Construction of Type 2 recharge dams has also been proposed. Todd Engineers. (2004). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 1*. Emeryville, CA: Todd Engineers, page 1.

i. "Type 2 structures are defined as structures located on the recharge zone, consisting of the unconfined portion of the aquifer, and are designed to retain storm runoff allowing for direct infiltration." Todd Engineers. (2005). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 2*. Emeryville, CA: Todd Engineers, page 2.

ii. "Type 2 structures provide for direct recharge and are normally dry, impounding water for only a few days or weeks following storm events." Consequently, "the recharge associated with Type 2 projects may not be available year round[.]"Todd Engineers. (2005). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 2*. Emeryville, CA: Todd Engineers, page 2.

G. A combination of alternatives will be required to provide the required springflows at Comal and San Marcos Springs. Todd Engineers. (2005). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 2*. Emeryville, CA: Todd Engineers, page 18. As noted in the most recent study:

> [With regard to combinations of alternatives expressed as different scenarios], no one scenario stands out as the most optimal. Several scenarios meet individual potential objectives. The optimal program would combine components of scenarios to meet specific objectives.

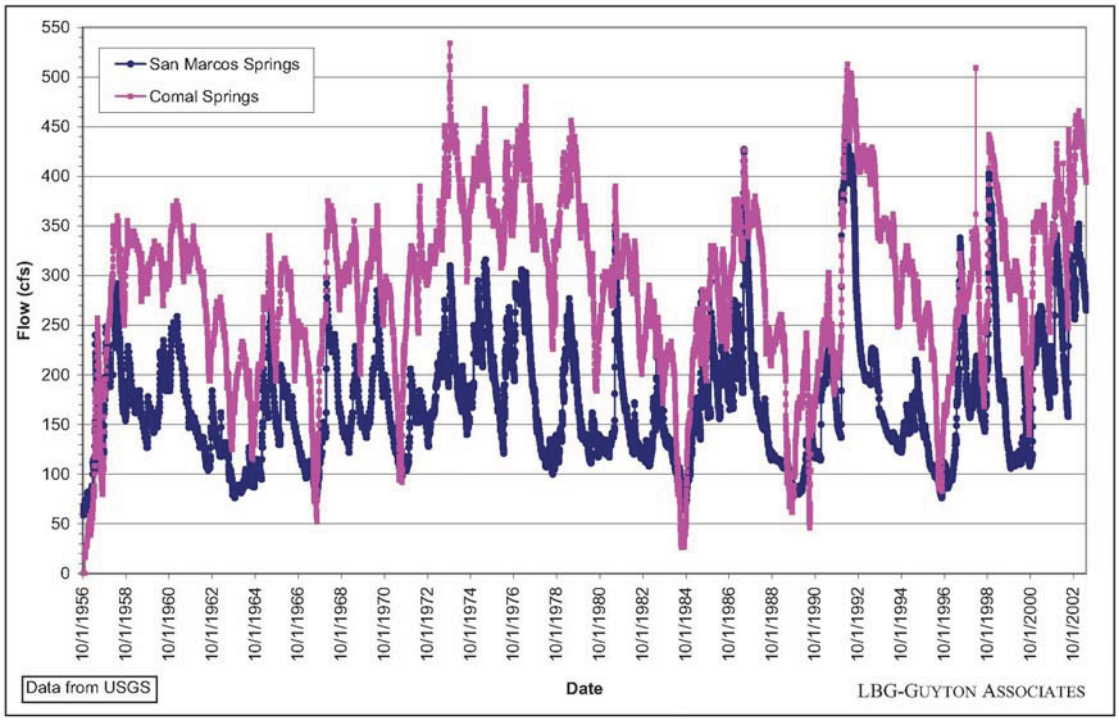
Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page ES-33.

H. Each of these alternatives has the potential to reduce downstream flows. In reality, the relevant question is not *whether* downstream impacts will occur, it is the *extent* of the

impacts. Unfortunately, given climatic variability, these impacts cannot be determined in the abstract.

I. Selection of an appropriate combination of alternatives is complicated by the fact that the flows from Comal and San Marcos Springs are highly variable:

i. For example, between 1956 and 2001, flows from Comal Springs ranged from zero to in nearly 550 cfs:



LBG-Guyton Associates. (2004). *Evaluation of Augmentation Methodologies in Support of In-Situ Refugia at Comal and San Marcos Springs, Texas*, Figure B-22: Comal and San Marcos Springs Flow 1956 to 2001.

ii. The average flow from Comal Springs is approximately 260 cfs. Todd Engineers. (2005). *Analysis of Recharge and Recirculation, Edwards Aquifer, Phase 2*. Emeryville, CA: Todd Engineers, page 8.

iii. This variability is caused by both climatic dynamics and increased pumping from the Edwards Aquifer.

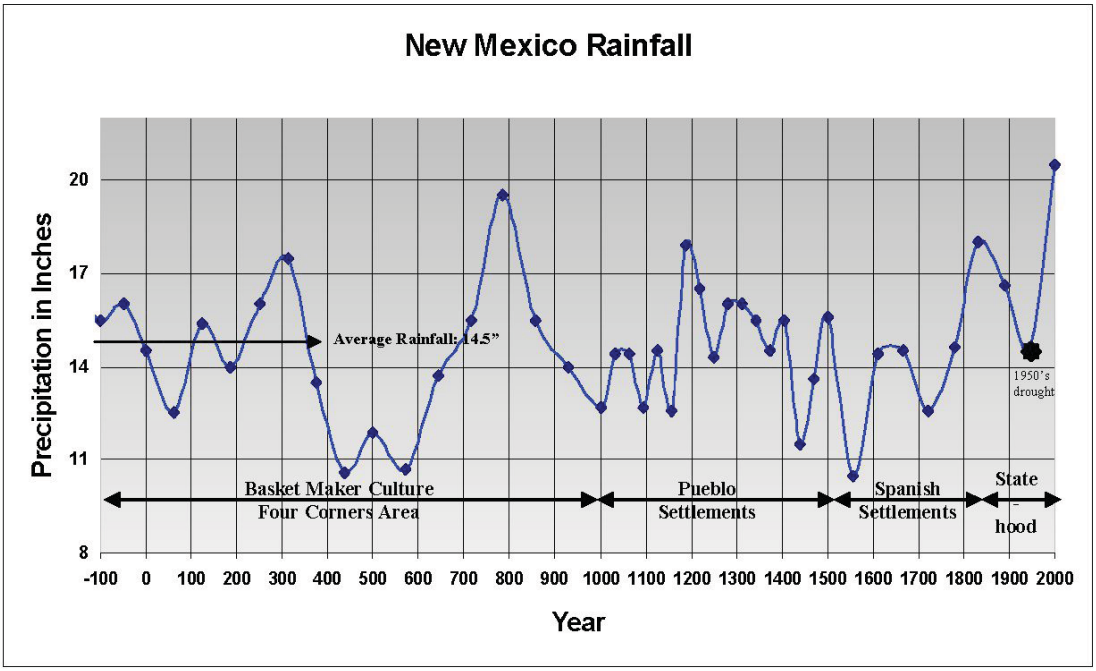
J. Potentially invalid planning assumptions may also have created uncertainty regarding the selection of an appropriate combination of alternatives to provide flows from both Comal and San Marcos Springs.

i. The State of Texas has assumed that the period from 1947 through 1956 (particularly the year 1956) was the "drought of record". Todd Engineers. (2008). *Recharge and Recirculation, Edwards Aquifer Optimization Program, Phase III/IV Report*. Emeryville, CA: Todd Engineers, page ES-30.

ii. The State of New Mexico also assumed that the drought of the 1950s was the "drought of record".

   a. Dendrochronological studies in New Mexico question the validity of this assumption.

   b. In fact, a study of tree rings covering 2,129 suggests that the "drought of record" in actually the historic norm. The period of Northern European colonization of New Mexico beginning in the late 18th century happened to coincide with a "wet" period.



Grissino-Mayer, H. (1996). A 2129-year Reconstruction of Precipitation for Northwestern New Mexico, U.S.A. In J. S. Dean, D. M. Meko & T. W. Swetnam (Eds.), *Tree Rings, Environment and Humanity* (pp. 191-204). Tucson, AZ: Radiocarbon, *accord*, Office of the State Engineer and the Interstate Stream Commission. (2003). *New Mexico State Water Plan: Working Together Towards Our Water Future*. Santa Fe, New Mexico: New Mexico State Engineer, page 30 and Office of the State Engineer and the Interstate Stream Commission. (2001). *White Paper and Strategic Plan: New Mexico's Water Supply and Active Water Resource Management*. Santa Fe, New Mexico: New Mexico State Engineer, page 9.

iii. The applicability of these dendrochronological studies to Texas is open to question, of course. It must be remembered, however, that New Mexico is directly west of Texas and that the two states are located on approximately the same latitude.

5. Irrespective of which combination of alternatives is chosen to maintain springflows to protect the species listed above, providing such flows may preclude the use of water as anticipated by Exelon in the ESP.

   A. The Reservation Agreement.

      i On 15 December 2007, Exelon and the Guadalupe-Blanco River Authority (GBRA) entered into a *Reservation Agreement Between Guadalupe-Blanco River Authority and Exelon Generation Company, LLC* (the Reservation Agreement).

      ii. The Reservation Agreement purports to reserve 75,000 acre-feet of water per year for use by Exelon at the proposed generating facility. (Reservation Agreement, §2(a).)

      iii. GBRA states in the Reservation Agreement that it "currently has a water supply of more than 75,000 acre-feet per year available … to the extent water is available under GBRA's interests in the Run-of-River Rights[.]" (Reservation Agreement, Recital E.)

      iv. GBRA has also reserved an additional 5,000 acre-feet of water per year "to account for losses in the Canal System" that would deliver water to Exelon. (Reservation Agreement, §2(c).)

   B. Fulfilling the water requirements of the protected species located in Comal and San Marcos Springs takes precedence over the Exelon's needs.

      i. When there is a conflict between water uses required by federal law and water uses authorized by state law, federal law controls. *See*, for example, *Riverside Irrigation District v. Stipo*, 658 F.2d 762 (10th Cir. 1981), *sub nom*. *Riverside Irrigation District v. Andrews*, 568 F. Supp. 583 (D. Colo. 1983), *aff'd* 758 F.2d 508 (10th Cir. 1985) (the requirements of federal law, specifically the Clean Water Act and the Endangered Species Act, may restrict the exercise of otherwise valid state water rights).

      ii. Subsequent litigation, *Sierra Club v. Lujan*, Case No. MO-91-CA-069 (W.D. Texas, filed 1 February 1993), *sub now. Sierra Club v. Babbitt*, 995 F.2d 571 (5th Cir. 1993), addressed this federal/state relationship in terms of the water supplies for Comal and San Marcos Springs.

a. At issue in the case was the relationship between the pumping of ground water from the Edwards Aquifer (pursuant to Texas law) and the need to provide flows from Comal and San Marco Springs in order not to adversely affect the protected species listed above.

b. Judge Bunton's decision on this issue was succinct: "Priority is to be given to species whose survival is in conflict with economic activities, such as withdrawal of water from the Edwards." Slip opinion at 32.

6. It is not possible to determine the quantity of water that will be required for the protection of threatened or endangered species during implementation of the Fish & Wildlife Service Recovery Plan for these species.

A. Though the quantity of water required has been determined, climatic variability makes it impossible to determine in advance how much additional water will have to be provided to fulfill the requirements of the Recovery Plan. This is true irrespective of the water supply alternative discussed in §2.D.

B. As a result, there is great uncertainty as to the long-term implications of fulfilling the water supply requirements of the Recovery Plan.

C. Because the requirements of federal law supersede the requirements of state law, the flow requirements contained in the Recovery Plan take precedence over the exercise of state water rights, including those contemplated to be leased, purchased, or applied for by Exelon.

D. Consequently, as there is uncertainty regarding water supplies needed to meet the flow requirements of protected species, there is equal uncertainty regarding the legal ability to fulfill the delivery requirements of the VCS site.

7. Inability to determine that the water supply to be provided pursuant to new or existing water rights that will in fact be both physically and legally available throughout the anticipated lifetime of the Exelon Project renders the Exelon ESP application incomplete.

8. Determining that the water supply for the Exelon facility is both physically and legally available is material to the findings the NRC must make regarding Exelon's ESP application.

9. A genuine dispute exists with the applicant on a material issue of fact or law.

A. Exelon appears to believe there is sufficient long-term physical and legally available water for the Exelon facility.

B. Petitioners believe that the requirements of the Endangered Species Act and the Fish & Wildlife Service Recovery Plan for the threatened and endangered species located in Comal and San Marcos Springs impose significant limitations on the quantity of water available to Exelon for use at the VCS site.

C. These requirements, when combined with climatic variability, make it impossible to determine that the long-term water supply ostensibly available will be both physically and legally available through the anticipated lifetime of the Exelon facility.

Contested Issue 9

Contested Issue 9

Exelon fails to address the value of operating oil and gas facilities on or near the VCS property, which would need to cease operation and be properly closed prior to opening the VCS.

Issue Statement

Due to the current oil and gas activity on and around the VCS site, Exelon would have to come to an agreement with the operators and owners of the oil and gas interests in order to proceed with their construction. Exelon has not addressed this issue in their SSAR or ER.

JCHA contracted Michael R. Walls and Company to perform a valuation of the Katy Creek and McFaddin Fields. A copy of the valuation report is included as Attachment A. The preliminary estimate of the net present value of the operations is approximately $7 million. The information from this report is intended for informational purposes only, and is not for use with respect to any sale or purchase of the assets, or for tax computation or liabilities, or any other legal interpretation.

Conclusion

The operation of oil and gas facilities would need to cease in order for the VCS to operate. Exelon must consider the steps that need to be taken in order to halt these operations.

Attachment A

Preliminary Report

McFaddin and Kay Creek Reserve Valuation

Victoria County, Texas

Disclaimer

The information contained in this report is provided by Michael R. Walls & Company in good faith. The information is derived from sources believed to be accurate and current as of the dates indicated, subject to the assumptions stated in this report. Neither Michael R. Walls & Company nor any of its employees give any representation or warranty as to the reliability, accuracy or completeness of the information, nor do they accept any responsibility arising in any way (including by negligence) for errors in, or omissions from, the information. This analysis is intended for informational purposes only and is not for use with respect to any sale or purchase of the subject assets, nor for tax computation or liabilities, or any other legal interpretation. While the resource estimates presented herein are believed to be reasonable, they should be viewed with the understanding that additional analysis or new data may justify their revision and we reserve the right to make such revision.

Overview

This report provides a preliminary estimate of the reserves, future production and income attributable to the gross (100%) mineral interests as of September 1, 2009 for certain mineral assets located within a Halepaska-specified area of interest in the McFaddin and Kay Creek Fields, Victoria County, Texas. The estimates of reserves and future income presented herein are based upon a preliminary study of the Proved Producing assets located in the referenced fields. Valuations are presented on a gross Before Federal Income Tax basis as the tax implications to individual mineral holders are unknown.

Reserve estimations are based primarily on interpretation of historical and current production and operating data made available to Michael R. Walls & Company during the period of the study. Estimates of income attributable to the mineral interests are based on a set of product prices, operating costs, capital expenditures, field development and operating assumptions described below. The discounted future net income is calculated based on a 10.0% discount rate. Additional discounted net present value profiles are presented in the Grand Summary, as well as the individual asset analyses. Individual asset summaries and a Grand Summary of the analysis are presented in the Appendix, Tables 1 through 15. A map of the area of interest is also included in the Appendix as A-16.

Reserve and Income Analysis

Michael R. Walls & Company performed a preliminary analysis of all available historical and current production data with regard to the McFaddin and Kay Creek Fields. Well production data

acquired from IHS, Inc. were examined with base map information and well locations provided by Tobin map services. A major focus of our efforts were directed towards a close examination of the decline curve analysis and historical production declines associated with currently producing wells, as well as analog wells in the McFaddin and Kay Creek Fields that are no longer producing. A major approach utilized in our reserve and economic valuation was an estimation of the forecasted production rates and decline curve analysis for multiple zone Frio reservoirs in the two subject fields. Currently, there are 13 producing wells in the Kay Creek and McFaddin Fields located in the Halepaska-specified area of interest. Economic runs were undertaken in a proprietary valuation model in order to estimate the projected reserves and income analysis over the life of the proved producing wells. Economic and operating assumptions discussed in this preliminary report were utilized in the proprietary model to compute the cash flows and net present values associated with the subject assets.

Walls & Company has undertaken a detailed examination of the relevant production and well data from the Texas Railroad Commission and IHS, Inc. A list of those wells is provided below:

Proved Producing Wells
Kay Creek and McFaddin Fields

Well Number	API Number	Operator	Lease	Field	Total Depth
223	424693268100	APACHE CORPORATION	MCFADDIN, J.A.	KAY CREEK	5500
204	424693235500	APACHE CORPORATION	MCFADDIN, J.A.	KAY CREEK	4000
12	424690154500	CHAMPLIN O&G	MCFADDIN, J.A.	KAY CREEK	5300
188	424693200200	APACHE CORP.	MCFADDIN, J.A.	KAY CREEK	6697
261	424693371900	APACHE CORPORATION	MCFADDIN, J.A.	MCFADDIN	3751
259	424693358800	APACHE CORPORATION	MCFADDIN	KAY CREEK	3900
191	424693201900	UNION PACIFIC RESOURCES CO.	MCFADDIN	MCFADDIN	5500
240	424693295900	ANAQUA O&G, INC.	MCFADDIN	MCFADDIN, N.W.	5260
270	424693400100	TEXCOM OPERATING, LLC	MCCAN	MCFADDIN NORTH	6225
267	424693397000	TEXCOM OPERATING LLC	MCCAN	MCFADDIN NORTH	6320
257	424693344700	CARRIZO OIL & GAS INC	CARRIZO MCCANN	MCFADDIN NORTH	6480
266	424693395000	TEXCOM OPERATING LLC	MCCAN	MCFADDIN NORTH	6450
268	424693398000	TEXCOM OPERATING, LLC	MCCAN	MCFADDIN NORTH	6387
269	424693398700	TEXCOM OPERATING, LLC	MCCAN	MCFADDIN NORTH	6390

The estimate of reserves herein are based on these and other professional assessments which are part of this preliminary study of the producing assets in the McFaddin and Kay Creek Fields. The reserve summaries for the Proved Producing category which are provided in this report conform generally to the definitions approved by the Society of Petroleum Engineers (SPE) and the Society of Petroleum Evaluation Engineers (SPEE), except that they are based on price and cost parameters which allow for future changes in current economic conditions, whereas the definition approved by the SPE

and SPEE assumes that no change in current economic conditions will occur in the future. In this technical report, reserves and cash flows evaluated are based on 100% ownership and on a before Federal Income Tax basis. This 100% ownership analysis includes the mineral interests of the working interest owner as well as the mineral rights owner.

According to commercial practices, the Income Approach represents the petroleum industry-standard used to value oil and gas properties. Expected cash flows are developed based on an estimation of future reserves and production and an estimation of future costs. Reserves are defined as "quantities of petroleum anticipated to be commercially recoverable from a known accumulation form a given date forward."[1] Commercially recoverable reserves are usually less than the estimated physical volume of oil and gas because they are calculated as the production that would be obtained between the valuation date and the economic limit of production. The economic limit is reached when the unit costs of production are equal to the unit revenue. Consequently, estimated recoverable reserves can change based on changes in projected oil prices and estimated operating costs. Future costs of production include capital costs, such as drilling and facilities, and operating costs, such as labor, allocated overhead, supplies, and maintenance. Abandonment costs are also included in the cash flow calculations.

Economic Assumptions

Our valuation includes a number of important assumptions regarding the economic environment during the life of the McFaddin and Kay Creek fields. In the context of product prices, we utilize the NYMEX futures market as an estimator of future natural gas prices over the term of the analysis. Natural gas prices are based on delivery at the Henry Hub in Louisiana, the nexus of 16 intra- and interstate natural gas pipeline systems that draw supplies from the region's gas deposits. The pipelines serve markets throughout the U.S. East Coast, the Gulf Coast, the Midwest, and up to the Canadian border. Pricing contracts and the resultant natural gas price deck utilized in our analysis are as of closing of trading of futures contracts on September 16, 2009. Note that these price contracts change on a daily basis, which may result in a variation in the overall valuation of the two subject fields.

The annual inflation rate utilized in this analysis is 3.0% and applies to all operating costs over the life of the fields. The discount rate applied to all future cash flows is 10.0%. All discounted cash flow summaries provided in the Grand Summary and Asset Summary are based on this discount rate. A profile of present worth values based on alternative discount rates (0%, 5%, 10%, 15%, 20%, 25%, 30%) is also provided for each asset and at the summary level. These present worth summaries are provided only as a basis for comparison at alternative discount rates. Severance and ad valorem taxes on all future production are included as part of the economic analysis. Federal and state income taxes, however, are not included in this analysis.

1 Ryder Scott Company, presentation by Ronald Harrell at the ASA 1997 International Appraisal Conference, Houston, Texas.

Operating Assumptions

In the reserve and income analysis, we do not assume any exploratory drilling or additional development drilling. A preliminary check of the Texas Railroad Commission records indicates that there are no pending drilling permits on any of the properties within the Halepaska area of interest. Operating costs for a typical well in this area is approximately $50,000 per year, as provided by Halepaska and Associates. This assumes approximately $20,000 per year before compression and $75,000 per year after compression. In our analysis, we assume fixed operating costs of $2,000 per month and variable costs of $0.10 per MCF of production. Plug and abandonment costs for each well are assumed to be offset by the salvage value of well and production equipment; as a result, we do not include any abandonment costs for each well. In order to achieve a better estimate of the actual operating costs, information should be acquired from area operators specific to each well type. Capital costs include normal workover operations associated with optimizing production in these multi-reservoir wells. We assume a capital cost of $20,000 per workover operation. Workovers are scheduled every 24-36 months depending on the remaining recoverable reserve estimate associated with each well in the field.

Reserve and Income Summary

The preliminary results of our study of the reserves and income attributable to certain mineral interests in the Kay Creek and McFaddin fields are summarized in Table 1. All gas volumes are sales gas expressed in millions of cubic feet (Mmcf) at the official temperature of 60 degrees Farenheit and pressure base of 14.73 psia. It is important to note that these data are presented on an unrisked basis. All reserve and income data included in this analysis conform to the definitions approved by SPE and SPEE and do not account for uncertainty associated with reserve and cash flow outcomes. Unproved reserves, including probable and possible categories are not included in this analysis. Significant additional work regarding geologic and reservoir interpretations are required to make estimates of unproved reserves. In any case, these additional reserves would be significantly discounted as a result of the uncertainty associated with estimations.

TABLE 1	
Net Remaining Reserves	
Natural Gas (MMCF)	2,099.9
Oil/Condensate (BBL)	0.0
Income Data (M$)	
Future Gross Revenues	$ 13,302.2
Operating Costs	2,083.3
Production Tax	1,011.0
Capital Costs	320.0
BTAX Net Cashflow	$9,887.9
Net Present Value @10% (M$)	**$6,997.0**

The tables in the Appendix of this report provide additional detail regarding the economic and reserve analysis on the subject assets. Tables A-1 and A-2 show a Grand Summary on an "annual" and "asset" basis. In addition, Tables A-3 through A-15 show the individual asset analysis for each well, including reserves and economic projections. The economic and operating assumptions discussed earlier in this report are reflected in these analyses.

Additional Comments

It is important to recognize that this valuation represents a preliminary analysis of the Kay Creek and McFaddin field assets within the designated area of interest shown on the attached map (Appendix-

16). The focus of this analysis is the Proved Developed Producing category of reserves. Our analysis includes a comprehensive valuation as it relates to the producing wells in the designated area, under the assumptions stated above. This analysis does not include any probable or possible reserve designations as we have insufficient data at this time to conduct that analysis. As noted earlier, however, based on SPE and SPEE guidelines, probable and possible reserve categorizations and their associated valuations would be significantly discounted due to their inherent uncertainty. Additional data and further geologic and reservoir analysis is necessary in order to provide a comprehensive reserve and economic valuation for the entire area of interest. This preliminary analysis, however, provides a first approximation of the net worth of the remaining recoverable reserves associated with the proved producing category of assets.

Glossary of Terms

Mcf	**A standard measurement unit for volumes of natural gas that equals one thousand cubic feet. Six Mcf of natural gas is approximately the energy equivalent of one barrel of oil.**
MMcf	**Million cubic feet**
BCF	**Billion cubic feet**
Bbl	**Barrel of oil**
MBbl	**One thousand barrels**
MMBbl	**Million barrels**
STB	**Stock barrel - a standard measurement unit for volumes for crude oil and oil products that is equal to 42 U.S. gallons.**
Development Well	**A well drilled in the area of an oil or gas reservoir known to be productive. These wells are generally low-risk.**
Dry Hole	**A well that does not provide oil or gas in sufficient quantities to justify completion.**
Exploratory Well	**A well drilled in an unproved area, sometimes referred to as a wildcat.**
Field Formation	**A geographical area with one or more oil and gas reservoirs. An identifiable layer of rocks named after its geographical location and dominant rock type.**
Lease	**A legal contract that specifies the terms of the business relationship between an energy company and a landowner or mineral rights holder on a specific tract.**

Production	**Total production refers to all the oil and gas produced from a property. Gross Production: Total production before deducting royalties. Net Production: Gross production, minus royalties, multiplied by the company's fractional working interest.**
Working Interest (W.I.)	**The operating interest under and oil and gas lease subject to all the costs of drilling, completion, and operation of the lease.**
Net Revenue Interest (NRI)	**Ownership interest in the produced reserves from a petroleum asset; net revenue interest is the difference between the working interest and the royalty and overriding royalty interests on the property.**
Proved Developed	**Characterization of reserves that are nearly certain and available to be extracted. The highest classification.**
Reserves	**Oil or gas contained in underground rock formations called reservoirs. Proved reserves are the estimated quantities that geologic and engineering data demonstrate can be produced with reasonable certainty from known reservoirs under existing economic and operating conditions. Recoverable reserves are those that can be produced using all known primary and enhanced recovery methods.**
Royalty Interest	**An interest in an oil and gas property entitling the owner to a share of oil and gas production free of costs of exploration, development and production.**
Production Tax	**Serverance and advalorem taxes paid by the mineral interest owners as defined by the state or local governing body.**
BTAX	**Before federal income tax**
ATAX	**After federal income tax**

GRAND SUMMARY
Reserves and Economics Analysis
Kay Creek and McFaddin Fields
Victoria County, Texas

ANNUAL SUMMARY

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Dec-09	149.8	149.8	0.0	0.0	3.20	0.00	539.4	(41.0)	(112.8)	0.0	385.6
Dec-10	419.4	419.4	0.0	0.0	5.42	0.00	2,268.3	(172.4)	(329.0)	(60.0)	1,706.8
Dec-11	381.4	381.4	0.0	0.0	6.65	0.00	2,433.9	(185.0)	(335.3)	(100.0)	1,813.7
Dec-12	347.0	347.0	0.0	0.0	7.06	0.00	2,448.5	(186.1)	(342.0)	(40.0)	1,880.5
Dec-13	301.9	301.9	0.0	0.0	7.12	0.00	2,149.3	(163.3)	(320.6)	(60.0)	1,605.3
Dec-14	262.5	262.5	0.0	0.0	7.30	0.00	1,916.5	(145.7)	(301.8)	(40.0)	1,429.0
Dec-15	213.7	213.7	0.0	0.0	6.50	0.00	1,389.3	(105.6)	(246.1)	(20.0)	1,017.6
Dec-16	12.7	12.7	0.0	0.0	6.50	0.00	82.8	(6.3)	(47.2)	0.0	29.3
Dec-17	11.4	11.4	0.0	0.0	6.50	0.00	74.2	(5.6)	(48.5)	0.0	20.1
Dec-18	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Dec-19	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Dec-20	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Dec-21	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Dec-22	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Dec-23	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.0
Subtotal	2,099.9	2,099.9	0.0	0.0			13,302.2	(1,011.0)	(2,083.3)	(320.0)	9,887.9
After	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
TOTAL	**2,099.9**	**2,099.9**	**0.0**	**0.0**			**13,302.2**	**(1,011.0)**	**(2,083.3)**	**(320.0)**	**9,887.9**

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	6,997
0.0%	9,888
5.0%	8,251
10.0%	6,997
15.0%	6,017
20.0%	5,238
25.0%	4,609
30.0%	4,094

BFIT NPV $000 6,997
BFIT IRR 0.0%

ASSET SUMMARY
Reserves and Economics Analysis
Kay Creek and McFaddin Fields
Victoria County, Texas

◉ Sort by Name

ASSET SUMMARY

Well Name	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Apache 188	32.2	32.2	0.0	0.0	5.95	0.00	192	(15)	(89)	0	88
UPR 191	156.9	156.9	0.0	0.0	6.25	0.00	981	(75)	(374)	0	533
Apache 204	44.0	44.0	0.0	0.0	6.31	0.00	277	(21)	(118)	0	138
Apache 223	82.4	82.4	0.0	0.0	6.38	0.00	526	(40)	(181)	0	305
Anaqua 240	56.0	56.0	0.0	0.0	6.36	0.00	356	(27)	(148)	(20)	161
Apache 259	203.7	203.7	0.0	0.0	6.33	0.00	1,289	(98)	(194)	(40)	957
Apache 261	126.3	126.3	0.0	0.0	6.35	0.00	802	(61)	0	(60)	681
Texcom 266	24.2	24.2	0.0	0.0	5.91	0.00	143	(11)	0	0	132
Texcom 267	819.9	819.9	0.0	0.0	6.35	0.00	5,210	(396)	(263)	(60)	4,491
Texcom 268	256.4	256.4	0.0	0.0	6.38	0.00	1,636	(124)	(200)	(40)	1,271
Texcom 269	99.0	99.0	0.0	0.0	6.29	0.00	623	(47)	(153)	(20)	403
Texcom 270	117.3	117.3	0.0	0.0	6.33	0.00	742	(56)	(185)	(40)	461
Champlin 12	81.5	81.5	0.0	0.0	6.44	0.00	525	(40)	(179)	(40)	266
TOTAL	2,099.9	2,099.9	0.0	0.0			13,302	(1,011)	(2,083)	(320)	9,888

188

Company	**Apache Corp.**
Well Number	**Apache 188**
API	**424693200200**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	3.6	3.6	0.0	0.0	3.20	68.71	13	(1)	(9)	0	3
Dec-10	10.2	10.2	0.0	0.0	5.42	74.90	55	(4)	(26)	0	25
Dec-11	9.5	9.5	0.0	0.0	6.65	76.73	61	(5)	(27)	0	29
Dec-12	8.9	8.9	0.0	0.0	7.06	78.25	63	(5)	(28)	0	30
Dec-13	0.0	0.0	0.0	0.0	7.12	79.70	0	0	0	0	0
Dec-14	0.0	0.0	0.0	0.0	7.30	79.70	0	0	0	0	0
Dec-15	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	32.2	32.2	0.0	0.0			192	(15)	(89)	0	88
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**32.2**	**32.2**	**0.0**	**0.0**			192	(15)	(89)	0	88

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	69
0.0%	88
5.0%	78
10.0%	69
15.0%	62
20.0%	56
25.0%	51
30.0%	46

BFIT NPV $000	**69**
BFIT IRR	**N/A**

Company	**Union Pacific Resources**
Well Number	**UPR 191**
API	**424693201900**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	14.1	14.1	0.0	0.0	3.20	68.71	48	(4)	(20)	0	24
Dec-10	25.9	25.9	0.0	0.0	5.42	74.90	140	(11)	(40)	0	89
Dec-11	23.2	23.2	0.0	0.0	6.65	76.73	148	(11)	(41)	0	96
Dec-12	20.8	20.8	0.0	0.0	7.06	78.25	147	(11)	(42)	0	93
Dec-13	18.6	18.6	0.0	0.0	7.12	79.70	133	(10)	(43)	0	79
Dec-14	15.9	15.9	0.0	0.0	7.30	79.70	116	(9)	(45)	0	62
Dec-15	14.2	14.2	0.0	0.0	6.50	79.70	92	(7)	(46)	0	39
Dec-16	12.7	12.7	0.0	0.0	6.50	79.70	83	(6)	(47)	0	29
Dec-17	11.4	11.4	0.0	0.0	6.50	79.70	74	(6)	(48)	0	20
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	156.9	156.9	0.0	0.0			981	(75)	(374)	0	533
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**156.9**	**156.9**	**0.0**	**0.0**			981	(75)	(374)	0	533

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Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	370
0.0%	533
5.0%	440
10.0%	370
15.0%	317
20.0%	275
25.0%	242
30.0%	215

BFIT NPV $000	**370**
BFIT IRR	**N/A**

Company	**Apache Corp**
Well Number	**Apache 204**
API	**424693235500**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	3.6	3.6	0.0	0.0	3.20	68.71	13	(1)	(9)	0	3
Dec-10	10.0	10.0	0.0	0.0	5.42	74.90	54	(4)	(26)	0	24
Dec-11	9.0	9.0	0.0	0.0	6.65	76.73	58	(4)	(27)	0	26
Dec-12	8.2	8.2	0.0	0.0	7.06	78.25	58	(4)	(28)	0	26
Dec-13	7.4	7.4	0.0	0.0	7.12	79.70	53	(4)	(28)	0	20
Dec-14	5.9	5.9	0.0	0.0	7.30	79.70	43	(3)	(1)	0	39
Dec-15	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	44.0	44.0	0.0	0.0			277	(21)	(118)	0	138
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**44.0**	**44.0**	**0.0**	**0.0**			277	(21)	(118)	0	138

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
0.0%	138
5.0%	115
10.0%	98
15.0%	84
20.0%	73
25.0%	64
30.0%	57

BFIT NPV $000	**98**
BFIT IRR	**N/A**

151

Company	**Apache Corp**
Well Number	**Apache 223**
API	**424693268100**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	5.4	5.4	0.0	0.0	3.20	68.71	19	(1)	(9)	0	9
Dec-10	15.3	15.3	0.0	0.0	5.42	74.90	83	(6)	(27)	0	50
Dec-11	14.3	14.3	0.0	0.0	6.65	76.73	91	(7)	(27)	0	57
Dec-12	13.3	13.3	0.0	0.0	7.06	78.25	94	(7)	(28)	0	59
Dec-13	12.4	12.4	0.0	0.0	7.12	79.70	88	(7)	(29)	0	53
Dec-14	11.2	11.2	0.0	0.0	7.30	79.70	82	(6)	(30)	0	46
Dec-15	10.5	10.5	0.0	0.0	6.50	79.70	68	(5)	(31)	0	32
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	82.4	82.4	0.0	0.0			526	(40)	(181)	0	305
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**82.4**	**82.4**	**0.0**	**0.0**			526	(40)	(181)	0	305

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	215
0.0%	305
5.0%	254
10.0%	215
15.0%	184
20.0%	160
25.0%	140
30.0%	124

BFIT NPV $000	215
BFIT IRR	N/A

Company	**Anaqua O&G**
Well Number	**Anaqua 240**
API	**424693295900**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	4.2	4.2	0.0	0.0	3.20	68.71	15	(1)	(9)	0	5
Dec-10	11.9	11.9	0.0	0.0	5.42	74.90	65	(5)	(26)	0	33
Dec-11	11.1	11.1	0.0	0.0	6.65	76.73	71	(5)	(27)	(20)	18
Dec-12	10.4	10.4	0.0	0.0	7.06	78.25	73	(6)	(28)	0	40
Dec-13	9.7	9.7	0.0	0.0	7.12	79.70	69	(5)	(29)	0	35
Dec-14	8.7	8.7	0.0	0.0	7.30	79.70	64	(5)	(30)	0	29
Dec-15	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	56.0	56.0	0.0	0.0			356	(27)	(148)	(20)	161
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**56.0**	**56.0**	**0.0**	**0.0**			356	(27)	(148)	(20)	161

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Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	116
0.0%	161
5.0%	136
10.0%	116
15.0%	101
20.0%	88
25.0%	78
30.0%	70

BFIT NPV $000	**116**
BFIT IRR	**N/A**

Company	**Apache Corp**
Well Number	**Apache 259**
API	**424693358800**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	14.8	14.8	0.0	0.0	3.20	68.71	53	(4)	(10)	0	40
Dec-10	41.3	41.3	0.0	0.0	5.42	74.90	223	(17)	(29)	0	177
Dec-11	37.0	37.0	0.0	0.0	6.65	76.73	236	(18)	(30)	(20)	168
Dec-12	33.1	33.1	0.0	0.0	7.06	78.25	234	(18)	(30)	0	186
Dec-13	29.7	29.7	0.0	0.0	7.12	79.70	211	(16)	(31)	0	164
Dec-14	25.3	25.3	0.0	0.0	7.30	79.70	184	(14)	(32)	(20)	119
Dec-15	22.6	22.6	0.0	0.0	6.50	79.70	147	(11)	(32)	0	104
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	203.7	203.7	0.0	0.0			1,289	(98)	(194)	(40)	957
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**203.7**	**203.7**	**0.0**	**0.0**			1,289	(98)	(194)	(40)	957

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	681
0.0%	**957**
5.0%	**801**
10.0%	**681**
15.0%	**588**
20.0%	**513**
25.0%	**452**
30.0%	**403**

BFIT NPV $000	**681**
BFIT IRR	**N/A**

Company	**Apache Corp**
Well Number	**Apache 261**
API	**424693371900**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	7.6	7.6	0.0	0.0	3.20	68.71	29	(2)	0	0	27
Dec-10	27.7	27.7	0.0	0.0	5.42	74.90	150	(11)	0	(20)	118
Dec-11	24.1	24.1	0.0	0.0	6.65	76.73	154	(12)	0	0	142
Dec-12	21.0	21.0	0.0	0.0	7.06	78.25	148	(11)	0	(20)	117
Dec-13	18.2	18.2	0.0	0.0	7.12	79.70	130	(10)	0	0	120
Dec-14	14.8	14.8	0.0	0.0	7.30	79.70	108	(8)	0	(20)	80
Dec-15	12.9	12.9	0.0	0.0	6.50	79.70	84	(6)	0	0	78
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	126.3	126.3	0.0	0.0			802	(61)	0	(60)	681
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**126.3**	**126.3**	**0.0**	**0.0**			802	(61)	0	(60)	681

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	486
0.0%	681
5.0%	571
10.0%	486
15.0%	419
20.0%	366
25.0%	323
30.0%	288

BFIT NPV $000	**486**
BFIT IRR	**N/A**

Company TexCom Operating
Well Number Texcom 266
API 424693393000

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	2.8	2.8	0.0	0.0	3.20	68.71	10	(1)	0	0	9
Dec-10	7.9	7.9	0.0	0.0	5.42	74.90	43	(3)	0	0	40
Dec-11	7.1	7.1	0.0	0.0	6.65	76.73	45	(3)	0	0	42
Dec-12	6.4	6.4	0.0	0.0	7.06	78.25	45	(3)	0	0	41
Dec-13	0.0	0.0	0.0	0.0	7.12	79.70	0	0	0	0	0
Dec-14	0.0	0.0	0.0	0.0	7.30	79.70	0	0	0	0	0
Dec-15	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	24.2	24.2	0.0	0.0			143	(11)	0	0	132
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**24.2**	**24.2**	**0.0**	**0.0**			143	(11)	0	0	132

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Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	105
0.0%	132
5.0%	118
10.0%	105
15.0%	95
20.0%	86
25.0%	79
30.0%	72

BFIT NPV $000 105
BFIT IRR N/A

Company	**TexCom Operating**
Well Number	**Texcom 267**
API	**424693397000**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	56.4	56.4	0.0	0.0	3.20	68.71	203	(15)	(14)	0	174
Dec-10	159.3	159.3	0.0	0.0	5.42	74.90	862	(65)	(42)	(20)	734
Dec-11	145.6	145.6	0.0	0.0	6.65	76.73	929	(71)	(42)	0	817
Dec-12	133.1	133.1	0.0	0.0	7.06	78.25	939	(71)	(41)	(20)	806
Dec-13	121.6	121.6	0.0	0.0	7.12	79.70	866	(66)	(41)	0	759
Dec-14	106.6	106.6	0.0	0.0	7.30	79.70	778	(59)	(41)	0	678
Dec-15	97.4	97.4	0.0	0.0	6.50	79.70	633	(48)	(41)	(20)	524
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	819.9	819.9	0.0	0.0			5,210	(396)	(263)	(60)	4,491
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**819.9**	**819.9**	**0.0**	**0.0**			5,210	(396)	(263)	(60)	4,491

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	3,157
0.0%	**4,491**
5.0%	**3,735**
10.0%	**3,157**
15.0%	**2,706**
20.0%	**2,350**
25.0%	**2,062**
30.0%	**1,828**

BFIT NPV $000	**3,157**
BFIT IRR	**N/A**

Company	**TexCom Operating**
Well Number	**Texcom 268**
API	**424693398000**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	16.7	16.7	0.0	0.0	3.20	68.71	60	(5)	(10)	0	46
Dec-10	47.7	47.7	0.0	0.0	5.42	74.90	258	(20)	(30)	0	208
Dec-11	44.5	44.5	0.0	0.0	6.65	76.73	284	(22)	(31)	(20)	211
Dec-12	41.5	41.5	0.0	0.0	7.06	78.25	293	(22)	(31)	0	239
Dec-13	38.7	38.7	0.0	0.0	7.12	79.70	275	(21)	(32)	(20)	202
Dec-14	34.9	34.9	0.0	0.0	7.30	79.70	255	(19)	(33)	0	203
Dec-15	32.5	32.5	0.0	0.0	6.50	79.70	212	(16)	(34)	0	162
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	256.4	256.4	0.0	0.0			1,636	(124)	(200)	(40)	1,271
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**256.4**	**256.4**	**0.0**	**0.0**			1,636	(124)	(200)	(40)	1,271

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	888
0.0%	1,271
5.0%	1,054
10.0%	888
15.0%	759
20.0%	657
25.0%	575
30.0%	509

BFIT NPV $000	888
BFIT IRR	N/A

Company	**TexCom Operating**
Well Number	**Texcom 269**
API	**424693398700**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	8.3	8.3	0.0	0.0	3.20	68.71	30	(2)	(9)	0	18
Dec-10	22.9	22.9	0.0	0.0	5.42	74.90	124	(9)	(28)	0	87
Dec-11	20.3	20.3	0.0	0.0	6.65	76.73	130	(10)	(28)	(20)	72
Dec-12	18.0	18.0	0.0	0.0	7.06	78.25	127	(10)	(29)	0	89
Dec-13	16.0	16.0	0.0	0.0	7.12	79.70	114	(9)	(29)	0	76
Dec-14	13.4	13.4	0.0	0.0	7.30	79.70	98	(7)	(30)	0	60
Dec-15	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	99.0	99.0	0.0	0.0			623	(47)	(153)	(20)	403
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**99.0**	**99.0**	**0.0**	**0.0**			623	(47)	(153)	(20)	403

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	296
0.0%	**403**
5.0%	**343**
10.0%	**296**
15.0%	**258**
20.0%	**227**
25.0%	**202**
30.0%	**181**

BFIT NPV $000	**296**
BFIT IRR	**N/A**

Company	**TexCom Operating**
Well Number	**Texcom 270**
API	**424693400100**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	8.5	8.5	0.0	0.0	3.20	68.71	31	(2)	(9)	0	19
Dec-10	23.8	23.8	0.0	0.0	5.42	74.90	129	(10)	(28)	0	91
Dec-11	21.3	21.3	0.0	0.0	6.65	76.73	136	(10)	(28)	(20)	77
Dec-12	19.1	19.1	0.0	0.0	7.06	78.25	135	(10)	(29)	0	96
Dec-13	17.1	17.1	0.0	0.0	7.12	79.70	122	(9)	(29)	(20)	63
Dec-14	14.5	14.5	0.0	0.0	7.30	79.70	106	(8)	(30)	0	68
Dec-15	13.0	13.0	0.0	0.0	6.50	79.70	85	(6)	(31)	0	47
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	117.3	117.3	0.0	0.0			742	(56)	(185)	(40)	461
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**117.3**	**117.3**	**0.0**	**0.0**			742	(56)	(185)	(40)	461

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Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	330
0.0%	461
5.0%	387
10.0%	330
15.0%	285
20.0%	250
25.0%	221
30.0%	197

BFIT NPV $000	**330**
BFIT IRR	**N/A**

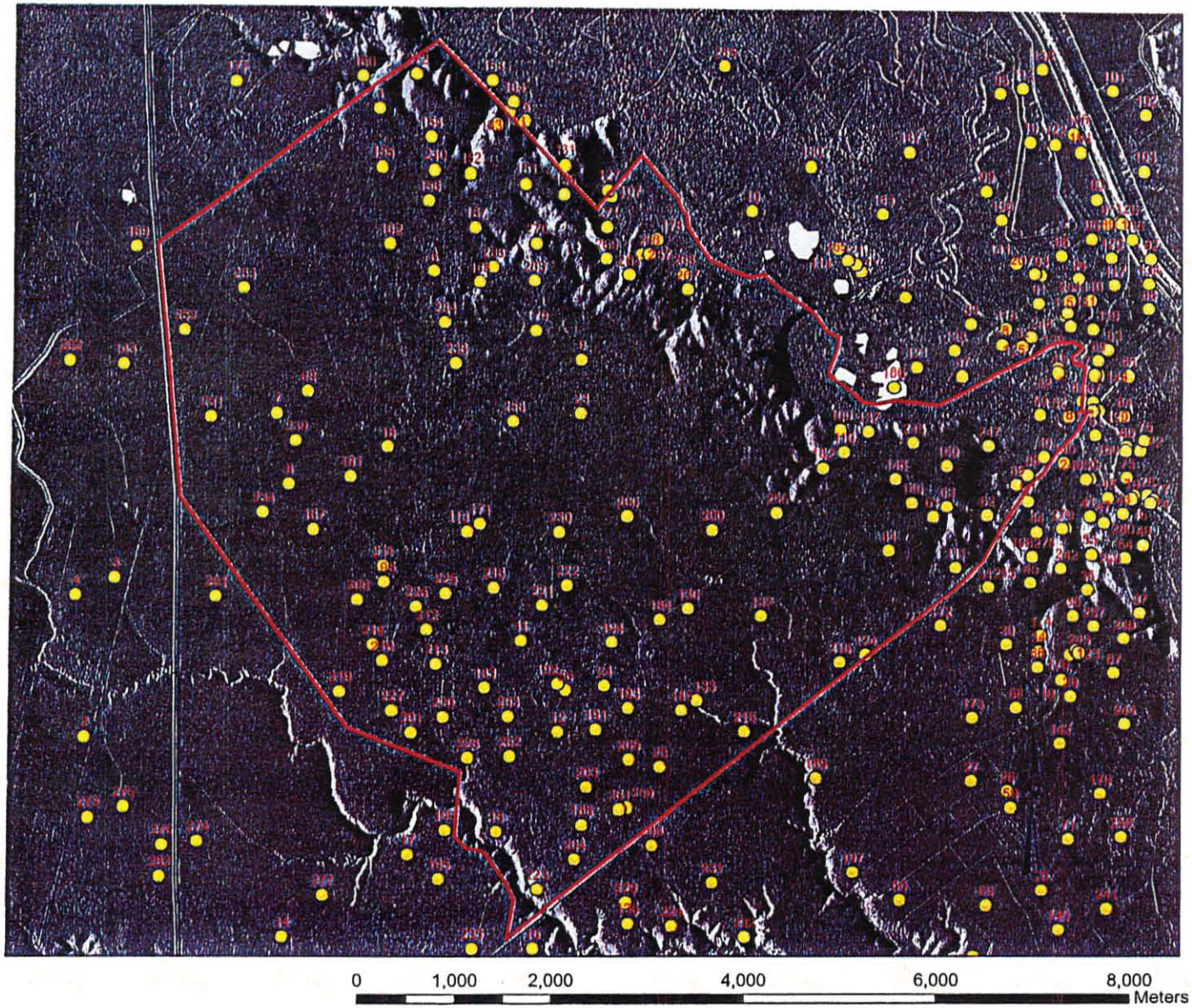
Company	**Champlin O&G**
Well Number	**Champlin 12**
API	**424690154500**

End Mo/Yr	Gross Gas Production MMCF	Net Gas Production MMCF	Gross Oil/Cond. Production MSTB	Net Oil/Cond. Production MSTB	Gas Price $/MCF	Oil Price $/BBL	Net Revenue $000	Production Tax $000	Net Operating Expense $000	Net Capital Expenditure $000	BTAX Net Cashflow $000
Dec-09	0.0	0.0	0.0	0.0	0.00	0.00	0	0	0	0	0
Dec-09	4.0	4.0	0.0	0.0	3.20	68.71	15	(1)	(7)	0	8
Dec-10	15.4	15.4	0.0	0.0	5.42	74.90	83	(6)	(27)	(20)	30
Dec-11	14.4	14.4	0.0	0.0	6.65	76.73	92	(7)	(27)	0	57
Dec-12	13.4	13.4	0.0	0.0	7.06	78.25	95	(7)	(28)	0	59
Dec-13	12.5	12.5	0.0	0.0	7.12	79.70	89	(7)	(29)	(20)	33
Dec-14	11.3	11.3	0.0	0.0	7.30	79.70	82	(6)	(30)	0	46
Dec-15	10.5	10.5	0.0	0.0	6.50	79.70	68	(5)	(31)	0	32
Dec-16	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-17	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-18	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-19	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-20	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-21	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-22	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Dec-23	0.0	0.0	0.0	0.0	6.50	79.70	0	0	0	0	0
Subtotal	81.5	81.5	0.0	0.0			525	(40)	(179)	(40)	266
After	0.0	0.0	0.0	0.0			0	0	0	0	0
TOTAL	**81.5**	**81.5**	**0.0**	**0.0**			525	(40)	(179)	(40)	266

Before Federal Income Tax
Present Value Analysis

Disc. Rate	NPV $000
	186
0.0%	**266**
5.0%	**221**
10.0%	**186**
15.0%	**158**
20.0%	**137**
25.0%	**120**
30.0%	**106**

BFIT NPV $000	**186**
BFIT IRR	**N/A**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John C. Halepaska & Associates, Inc.
VICTORIA COUNTY
EXELON FACILITY
File Name: Mosaic2
Date: 11/12/08
Project No: 5944
Drawn By: SL/JC
Fig. No: 1

EXHIBIT D-3

RESUMES OF KEY PERSONNEL

John C. Halepaska, Ph.D., P.E.
President

Education

B.S., Geology, St. Mary's University, San Antonio, Texas, 1963

M.S., Groundwater Hydrology, New Mexico Institute of Mining and Technology, Socorro, New Mexico, 1966

Ph.D., Geoscience (Groundwater Hydrology) New Mexico Institute of Mining and Technology, Socorro, New Mexico, 1970

Professional Registration and Memberships

Registered Professional Engineer: Colorado #19177, Indiana #20144
Member: Society of Mining Engineers of AIME, Colorado Mining Association, and National Groundwater Association

Professional Affiliations

PRESIDENT, John C. Halepaska and Associates, Inc. Littleton, Colorado: June 1985 to present

VICE PRESIDENT, In-Situ, Inc., Engineering and Environmental Science Division, Lakewood, Colorado: August 1983 to June 1985

VICE PRESIDENT AND CHIEF, Woodward-Clyde Consultants, Water Resources Division, Englewood, Colorado: March 1977 to August 1983

Woodward-Clyde Consultants, Tampa, Florida: August 1975 to March 1977

Kansas Geological Survey, Chief Ground Water Section, December 1969 to August 1975

Professional Experience

Dr. Halepaska has been involved in the project management of a large number of complex water resource projects. These projects have included the definition, management, and use of both surface water and ground water. They have also included the definition, design, and remediation of contamination projects. In addition, baseline conditions for environmental impacts were frequently conducted within the project frameworks of various client projects.

Dr. Halepaska recently completed the project management for the Rueter-Hess Reservoir Environmental Impact Statement, a proposed off-stream reservoir that will provide water management of available water resources for a community in the southeastern Denver Metropolitan area. Dr. Halepaska has coordinated all of the surface water and ground water modeling and the supplemental studies required for the Environmental Impact Statement.

Recently, Dr. Halepaska was in charge of developing the surface water supply for a proposed gold mine near Fairbanks, Alaska. Studies included the evaluation of the watershed run-off characteristics, development of alternative reservoir sites, selection of the preferred reservoir site, and operational studies to evaluate expected yields from the reservoir, including analyses to account for thick ice cover during the wintertime months.

Dr. Halepaska has managed projects that defined and implement water supplies for mines, towns, water districts, and for irrigation. These projects frequently involved field drilling analysis, preparation of plan specifications and bid documents, and the monitoring of installation activities.

Dr. Halepaska has managed projects that require the definition of contamination, remediation design, and subsequent implementation of the remediation design plan. These projects have included the remediation of fertilizer products, soluble metals, and both organic and inorganic contaminants.

Dr. Halepaska has been involved in the preparation of numerous environmental investigations. These investigations have included impact statement for mines (uranium, coal, molybdenum, gold, silver, and phosphate). He has also been involved in the hearing and litigation processes associated with these studies, which require analyses to be conducted within an institutional framework. Dr. Halepaska has also had extensive involvement in water and contamination litigation, including, but not limited to, field investigations, review of studies by others, and depositions and expert testimony within the litigation arena.

Select Publications

"Drawdown Distribution Around a Well Partially Penetrating a Thick Leaky Aquifer," M.S. Thesis, New Mexico Institute of Mining and Technology, 1966.

"Numerical Analysis of Air Injection Into an Aquifer," Ph.D. Dissertation, New Mexico Institute of Mining and Technology, 1970.

"Computer Program to Solve 3-Dimensional Equation of Heat Flow," Kansas Geological Survey Open-File Report," co-authored with Fred W. Hartman, September 1971.

"Numerical Solution of the 3-Dimensional Heat Flow Equation, "Short Papers on Research in 1971, Bulletin 204, Part 1, Kansas Geological Survey, March 1972.

"Drawdown Distribution Around Wells Partially Penetrating Thick Leaky Artesian Aquifers," Water Resources Research, Vol. 8, No. 5, October 1972.

"A Numerical Study of Confined-Unconfined Aquifers Including Effects of Delayed Yield and Leakage," co-authored with Christine Ehlig, Water Resources Research, Vol. 12, No. 6, December 1976.

"A Manager's Monitoring Model," Ground Water Monitoring Review, January 1983.

"Artificial Recharge Demonstration Project, Denver Basin, Colorado," co-authored K. Le and B. Lytle, Proceedings of the International Symposium on Class V Injection Well Technology, Las Vegas, Nevada, September 1988.

"Artificial Recharge: Willows Experience, Willows Water District, Arapahoe Aquifer Recharge Project," co-authored with K. Le and B. Lytle, Proceedings of Groundwater Engineering and Management Conference, Denver, Colorado, February 1990.

Steven L. Lange
Senior Geochemist

Education

B.S., Geology, Kansas State University, Manhattan, Kansas, 1970

M.S., Geochemistry, Kansas State University, Manhattan, Kansas, 1980

Professional Certifications

OSHA 40-Hour Certification
OSHA 8-Hour Refresher

Professional Affiliations

SENIOR GEOCHEMIST/ASSOCIATE, John C. Halepaska and Associates, Inc. Littleton, Colorado: October 2004 to present.

SENIOR TECHNICAL MANAGER, Terranext LLC, Denver, Colorado: October 1999 to March 2004

CHIEF OPERATING OFFICER AND VICE PRESIDENT TECHNOLOGY, Terranext, Inc., Denver, Colorado: July 1992 to October 1999

MIDWEST REGIONAL MANAGER, Industrial Compliance, Overland Park, Kansas: March 1989 to July 1992

EXECUTIVE VICE PRESIDENT, Deuel and Associates, Albuquerque, New Mexico, March 1982 to March 1989

ENVIRONMENTAL MANAGER, Pioneer Corporation, Amarillo, Texas: April 1978 to February 1982

ENVIRONMENTAL COORDINATOR, CONOCO Minerals, Albuquerque, New Mexico: June 1976 to April 1978

Professional Experience

Mr. Lange has been using his knowledge of geochemical and hydrologic modeling to solve complex environmental and water resource problems for clients in the public and private sectors for 30 years. He uses the results of the geochemical and hydrologic models to negotiate risk-based corrective action goals with Federal and State regulatory agencies for clients. In addition, he consults with clients on hazardous waste

management methods and regulatory compliance, development and implementation of sampling programs, and assists in the development of programs to define and minimize environmental liability.

Mr. Lange provides guidance to clients concerning regulatory issues related to NRC, RCRA, TSCA, CERCLA, CWA, DOT, and OSHA legislation. He provides Quality Assurance/Quality Control of project work and deliverables. He has conducted over 30 seminars on hazardous waste management and regulatory procedures. Mr. Lange has assisted in providing information to Congress and state legislatures and was appointed to a water pollution and management oversight committee by the Governor of New Mexico.

Mr. Lange has designed and conducted numerous environmental investigations of mining properties throughout the west. In conjunction with legal counsel, he has identified the permits required for projects, developed the permitting schedule, designed the environmental studies, prepared the permits, presented results at public hearings, and managed the operational environmental monitoring programs at existing and proposed mining sites. Projects have included surface mines, underground mines, and solution mines for uranium, precious metals, base metals, and industrial minerals. The attached matrix summarizes Mr. Lange's experience in mining.

Mr. Lange has applied his knowledge of geochemistry to predicting the impacts of proposed mining operations on the environment, to evaluate the efficacy of solution mining systems using a variety of solution compositions, evaluated the impact of seepage from tailings impoundments on ground water, and assisted in the design of systems to treat mine water from active and inactive mines using passive (engineered wetlands) and active (addition of chemicals with precipitation of metals) methods.

Mr. Lange has managed projects requiring the definition of the horizontal and vertical extent of contamination, evaluation of remedial alternatives, feasibility studies, remedial design, and implementation of the remedial design. These projects have included the remediation of byproduct materials (radium and progeny), source materials (uranium), metals (Cr, Cu, Pb, Co, As), chlorinated solvents, and petroleum hydrocarbons.

Mr. Lange has designed field, bench scale, and laboratory testing programs to investigate the geochemical interactions between solid and liquid phases for projects ranging from transport of metals in seepage from tailing impoundments to developing remedies for cleanup of contaminated aquifers. He conducted an investigation of an aquifer with As concentrations up to 1,070,000 μg/l. The program included conducting bottle roll tests to establish distribution coefficients and column test to evaluate the elution of As from the aquifer matrix. The data were used in a geochemical model to evaluate possible remedies. Ultimately, the model was used to support a finding of technical impracticability by the USEPA.

Mr. Lange has recently completed the development of a groundwater fate and transport model and preparation of a Ground Water Corrective Measures Plan for a Ni-Cd Battery Manufacturing Facility in Colorado Springs, Colorado. He modeled the flow and chemical transport of nitrate in a near surface alluvial aquifer connected to the Widefield aquifer that is used for municipal water supply. He developed the program to collect and evaluate publicly available data, and then implemented a site investigation that included the installation of monitoring wells and the conduct of short-term and long-term pumping test to provide site-specific geohydrologic data.

Based on the results of the field and literature studies, Mr. Lange developed the conceptual site model and then implemented the model using MODFLOW for the hydrodynamic modeling and MT3D for the transport modeling. The calibrated model was used in transient mode to evaluate alternatives and to design the selected groundwater remediation system consisting of source control and natural attenuation. The system was approved by CDPHE, installed and is operating successfully.

Mr. Lange has personally completed dozens of Site Characterizations for sites impacted by petroleum hydrocarbons in Missouri, Kansas, Nebraska, Illinois, Florida, Colorado, Arizona, California, New Mexico, Iowa, Michigan, Oklahoma, and Texas. Work has included development of proposals, work plans, and project budgets, subcontractor selection and oversight, performance of field investigations, interpretation and presentation of data in technical reports, design of systems for remediation of soil and ground water, installation of these systems, and operational monitoring for both private and public clients.

Representative Projects

Lower Guadalupe Water Supply Project, San Antonio, TX. Evaluated the impact of diverting as much as 400,000 ac-ft of water from the Guadalupe and San Antonio Rivers on current water users and freshwater inflows to bays and estuaries. Collected, reviewed, and managed information including gauged flows for both rivers, current and historic diversions, permitted diversions, and current and historic inflows to Mission lake,Gaudalupe Bay, and San Antonio Bay. The data were maintained in a GIS database. The impact of the proposed diversions were evaluated using the Texas Water Availability Model (WAM) to model the surface water flows.

Modeling the Operations of the Rueter-Hess Reservoir. Developed and programmed a model of the operational rules for the Rueter-Hess reservoir. Model incorporated the operation of the water treatment and delivery system, diversions from Cherry Creek, groundwater pumping from the Denver Basin aquifers, and pumping from the Cherry Creek Alluvium. The interactive model provided the platform to evaluate and plan for the future water availability for the Parker Water and Sanitation District's needs under a variety of possible future growth and changing water availability. The model included estimating the water quality in the reservoir as water sources and reservoir storage levels changed.

Water Availability for a Nuclear Power Plant, Victoria, TX. Evaluated the impact of diverting 75,000 ac-ft per year on current and future water users of the Guadalupe River. Used the Texas Water Availability Model to model the impact of the diversions on the river flow and on the flows into associated Bays and Estuaries including impacts on the wintering population of Whooping Cranes. Evaluation included impacts of changing flow on flooding and sediment flows in the river.

Managed and Conducted Ground Water Modeling and Preparation of a Ground Water Corrective Measures Plan for a Ni-Cd Battery Manufacturing Facility, Colorado Springs, Colorado. Modeled the flow and chemical transport of nitrate in a near surface alluvial aquifer used as a municipal water supply.

Tasks included collection and evaluation of publicly available data, design and implementation of a site investigation to determine site-specific geohydrology that included installation of monitor wells and the conduct of short-term and long-term pumping test. The conceptual site model was developed and implemented using MODFLOW for the hydrodynamic modeling and MT3D for the transport modeling. The calibrated model was used in transient mode to design the ground water remediation system. The system was approved by CDPHE, installed and is successfully operating.

Ground Water Modeling and Capture Zone Analysis, Hutchinson, Kansas. The purpose of this modeling effort was to determine minimum pumping rates for three selected public supply wells (PSW9, PSW12, PSW8) and two proposed recovery wells (RW-1 and RW-2) to capture and remediate the two large PCE plumes in Hutchinson, Kansas. The Hydrogeologic system is characterized by the extensive and permeable Equus bed aquifer, which has a high degree of interaction with surface water, specifically the Arkansas River. After model calibration, simulations were then run with the five pumping wells (PSW8, PSW9, PSW12, RW-1, RW-2) active and pumping at various rates. The difference in the predicted water levels between the baseline and pumping simulations illustrates the zone of influence of these pumping wells. A final design to control the PCE plum was then completed.

Ground Water Transport Modeling of a TCE release, Lincoln Nebraska. A generalized flow model was developed using water-level measurements, geologic observations, and plume geometry collected during investigation of the distribution of TCE and its degradation products. This information was used to establish reasonable ranges of aquifer properties that were then adjusted during calibration based on the difference between calculated heads and monitoring head values at monitoring wells within and near the TCE plume. The calibrated MODFLOW model was then coupled with the MTD3 code to evaluate the concentration of TCE and its degradation products in the alluvial aquifer and in Salt Creek. Based on the results of the model, permit limits, to be set at the source of the plume, were proposed to EPA. EPA approved the proposed limits for both ground water and surface water.

Ground Water Flow and Arsenic Transport, Houston, Texas. The effort included the evaluation of all data collected during the previous investigations, installation of monitor wells, soil borings, hydropunch[tm] testing and conduct of pumping tests. In addition, specialized laboratory testing was performed to evaluate sorption and release of arsenic from sediment collected from the borings. The testing included static and dynamic adsorption/desorption measurements and dynamic leaching tests.

Detailed hydrologic models and separate geochemical models were constructed and used to design the optimum ground water extraction system and then to evaluate the expected performance of the system.

Based on the results of the remedial design studies and associated modeling, we concluded that the ROD-mandated 50 mg/l concentration of arsenic in the ground water could not be achieved within a practicable period of time and that the EPA mandated system should not be installed because it is technically impracticable to remedy the ground water by pumping and treating the arsenic bearing groundwater.

Managed the Data Collection, Permit Preparation and Design of Best Management Practices at Madison Mine, Fredricktown, Missouri. Prepared the site-monitoring plan to evaluate discharges from a 160 year old mine that produced copper, lead, cobalt, nickel, iron and zinc leaving behind 6 million tons of tailings. Activities included characterizing storm water leaving the site and any impacts on water quality in surrounding streams. These data were then used to evaluate and select best management practices to reduce the concentrations of metals in discharged storm water. A storm water permit was issued by MDNR

Removal of By-Product Material from Recovery of Uranium, Thorium, and Yttrium. Planned and performed site investigation to characterize a site used for disposal of materials containing up to 20,000 pCi/g of radium. Developed work plan for excavation, transport, and disposal of material by reprocessing at a Uranium mill. Project included reporting to two PRP groups with approximately seven members each. Required permitting and license amendment approval by Colorado Department of Health and Environment.

Oversee Closure of Uranium Heap Leach Processing site, Uravan, Colorado. Prepared the closure plan and provided oversight for the closure of a uranium tailings heap leach recovery plant in southern Colorado. Included decommission of the processing plant, cleanup of evaporation ponds, and the stabilization of the tailings. Designed and conducted the post-closure ground water monitoring program for the verification of successful site closure.

Management and Preparation of All Permits for a 2500 tpd Uranium Mill, Natarita, Colorado. Designed and implemented programs to collect data for an EIS and other permit documents. Data gathered included meteorology, biota, ground water, surface water, air quality, land use, and demographics. Prepared the required permit applications. Received approval of all permits including radioactive source materials license approved by CDPHE and NRC.

Managed the Environmental Investigations and Permit Preparation for the Construction of Three Deep (>1500 ft) Mine Shafts in Northwestern New Mexico. The shafts were located on lands owned by Native Americans and managed by the USGS (Minerals Management service). Permits included water rights for dewatering the mines at up to 2,000 gpm per shaft, mining permit from USGS, air permits for mine exhaust, and discharge permits for treated ground water.

Prepared Permits for In-Situ Uranium Mine, Pumpkin Buttes, Wyoming. Managed and performed the ground water studies for a pilot in-situ mine in Wyoming. Included a mining permit, water rights, Restoration Permit and closure plan for the project. Pilot plant was operated and the mine zone successfully reclaimed. After stabilization period, the mine was closed.

Design and Permit a Regional Solid Waste Landfill in Johnson County, Missouri. Assisted in the design and permitting efforts for a composite lined regional landfill near Warrensburg, Missouri. Mr. Lange oversaw all field characterization and design efforts, and presented the proposal to the Missouri Department of Natural Resources. The landfill includes a composite lined leachate collection pond where leachate is automatically pumped to the pond for holding when it reaches a certain level within the landfill cell.

Hydrogeologic Assessment of a Municipal Solid Waste Landfill in Missouri. Mr. Lange planned and conducted a detailed hydrogeologic assessment and due diligence of a landfill in southern Missouri as part of a compliance order issued by the Missouri Department of Natural Resources (MDNR). The MDNR believed leachate was impacting the local ground water and surface water resources. The project was complex due to the Karst type terrain and subsurface conditions at the landfill, which included solution cavities, fracture flow, and disappearing streams.

Siting Study for a Regional Municipal Solid Waste Landfill in Yavapi County, Arizona. Mr. Lange managed and performed an analysis to identify and select the most appropriate locations for a new regional landfill for Yavapi County, AZ. Available data on geology, surface and ground water hydrology, topography, land use, land ownership, access, and routing were placed in a GIS database. Rules were developed and ratings produced to identify the optimal locations for a new landfill. Assisted in the public presentation of the top five identified sites.

Groundwater Monitoring and Statistical Reporting, Conservation Services, Inc. Adams County, Colorado. Mr. Lange developed a database management system and an early statistical model in compliance with the regulations for solid waste facilities. Since that time, two additional commercial software packages have been used to statistically analyze the data. Mr. Lange assisted in the completion of the required statistical and interpretation report for submittal to the CDPHE and Adams County.

Management and Preparation of the RFI, FS, RA, and CAP for a TCE Release, Brunswick Corporation, Lincoln Nebraska. During the SWMU investigation, up to 320,000 μg/l TCE was discovered in the ground water beneath this facility. Mr. Lange managed the fieldwork, and prepared the RFI, Corrective Measures Study Work Plan, Corrective Measures Report, the Feasibility Study, the Risk Assessment, and the Corrective Action Plan as well as the associated Sampling and Analysis Plans and Quality Assurance Project Plans. The EPA approved correction action consists of soil remediation by passive soil bio-venting, Source removal by ground water pumping from a single well, treatment in a shallow tray air stripper, and monitored natural attenuation. Based on the site-specific risk assessment, the permitted cleanup level is 8600 mg/l TCE.

Investigation of PCE Found in Ground Water Beneath Southern Pacific Intermodal Railyard, City of Industry, California. Investigation of a release of diesel from an underground storage tank discovered PCE in the ground water beneath the site. A site investigation, using soil gas survey techniques with an on site laboratory followed by targeted installation of monitor wells was conducted to determine the distribution of PCE beneath the site. Analysis of the data indicated a likely off site source for the majority of the PCE. Additional investigation discovered several off site releases of PCE, including one of more than 10,000 gallons. As a result, others were responsible for remediating the PCE.

TCA Release Investigation, Colorado Department of Transportation, Pueblo, Colorado. Assisted in the designed of a site assessment for TCA contamination at a vehicle maintenance facility. Work included soil vapor, soil, and ground-water sampling and analysis using on-site mobile laboratory. Prepared report presenting results of investigation and proposing a site-monitoring plan. This project was conducted under close regulatory scrutiny requiring daily contact with agency personnel during field investigation work. Prepared a corrective action plan consisting of monitored natural attenuation, which was approved by the CDPHE.

Investigation of TCE Releases, Locomotive Repair Facility. Los Angeles, California. Designed a phased investigation of a locomotive repair facility which had operated continuously for over 80 years. Initial phase consisted of a soil vapor survey using an on-site lab for real time data analysis allowing program modifications to be made in the field. A second phase of limited scope followed, consisting of targeted monitoring well installation. All site data was analyzed and managed in a GIS database system.

Management and Preparation of a RCRA Facility Investigation of a Wood Treatment Plant, Houston, Texas. Designed and performed a Facility investigation of a wood treatment facility established in 1892. Used CPT/MIPS to determine stratigraphy, approximate groundwater levels and distribution of contaminants on and off site. The data from this reconnaissance study allowed for the design of a highly optimized monitor well network. All data were analyzed using GIS techniques.

Management of the Preparation of a Remedial Design for the Soil Remedial Action at a Superfund site, Houston, Texas. The remedial design plan required the consolidation of approximately 40,000 cubic yards of arsenic impacted soil from off-site areas, including an adjacent flood control channel, onto the former chemical plant site and capping with a multi-layer cap. The Preliminary Design, Intermediate Design, Pre-Final Design, and Final Design submittals were prepared during a ten-month period. EPA approval of the Final Design was received within ten months of completion of the site characterization.

Groundwater Investigation and Remediation, Particle Board Manufacturing Facility, Albuquerque, New Mexico. Investigated groundwater impacted by releases of heat setting resins (primarily urea formaldehyde) from sumps at a particleboard plant. Designed a remediation system consisting of pumping ground water for hydraulic control and using the pumped ground water as processes water for the plant. Well configuration and pumping schedule was controlled to account for periodic reversals of the ground water flow direction in response to transient storm events and seasonal runoff.

Design and Management of a Soil Characterization Program for a Superfund Site, Houston, Texas. Mr. Lange managed preparation of project work plans including the Sampling and Analysis Plan, Quality Assurance Project Plan, Contingency Plan and Remedial Design Work Plan. Sampling crews collected over 1015 samples from the 24-acre arsenic impacted area during a seven-week period. The EPA approved soil characterization report was used as the basis for the remedial design.

Data Management and Analysis. Database development and application of graphical problem solving techniques for analysis of soil and ground water contamination using UNIX based GIS database (PM DIAMOND). Installed systems and provided instruction to other office locations within BE&K/Terranext. Duties include code maintenance, code development, and system updates.

Site Investigation and Remediation of Petroleum Contaminated Sites. Mr. Lange has personally completed dozens of Site Characterizations for petroleum hydrocarbon sites in Missouri, Kansas, Nebraska, Illinois, Florida, Colorado, Arizona, California, New Mexico, Iowa, Michigan, Texas, Oklahoma, Illinois, and California. Work included development of proposals, work plans, and project budgets, subcontractor selection and oversight, performance of field activities, and interpretation and presentation of data in technical reports, design of systems for remediation of soil and ground water, and installation of these systems for both private and governmental clients.

Jason G. Rose, P.E.
Senior Project Hydrogeologist

Education

B.S., Geo-Environmental Engineering, Michigan Technological University, Houghton, Michigan, 1997.

Professional Registrations and Certifications

Registered Professional Engineer:
Colorado #38957
Wyoming #10790
Nevada #18614
OSHA 40-Hour Certification
OSHA 8-Hour Refresher
MSHA 24-Hour Certification

Professional Affiliations

SENIOR PROJECT HYDROGEOLOGIST, John C. Halepaska and Associates, Inc., Littleton Colorado: June 2008 to present.

PROJECT HYDROGEOLOGIST, John C. Halepaska and Associates, Inc., Littleton, Colorado: January 2007 to June 2008.

SENIOR HYDROGEOLOGIST, John C. Halepaska and Associates, Inc., Littleton, Colorado: January 2006 to January 2007.

PROJECT ENGINEER, TRC Environmental Corporation, Littleton, Colorado: January 2000 to December 2005.

PROJECT HYDROGEOLOGIST, TRC Hydro-Geo Consultants, Littleton, Colorado: May 1998 to January 2000.

PROJECT HYDROGEOLOGIST, Hydro-Geo Consultants, Lakewood, Colorado: August 1997 to May 1998.

Professional Experience

Mr. Rose has a broad range of experience in applying the principles of civil engineering, environmental engineering, hydrology, and hydrogeology to a wide variety of projects for clients in the public and private sectors. He has designed and conducted site characterization studies, completed design and evaluation of facilities ranging from mine

tailings impoundments to landfills, and has used current state-of-the-art modeling programs to estimate the future performance of mine facilities, water supply facilities, and environmental remedies.

Mr. Rose has experience in design, drilling, and completion of water supply wells, for water districts, mines, and oil and gas plants in Colorado, Alaska, and Wyoming.

Mr. Rose has experience in the evaluation and permitting of mines in Alaska, Nevada, California, Arizona, Colorado, Washington, Idaho, Indiana, and Michigan, as well as international locations in Argentina, Peru, Indonesia, and Mexico. His mining experience includes: pit dewatering studies; wastewater injection systems; pit filling studies; underground flooding studies; underground seepage analysis; water quality monitoring; tailings containment and disposal; exploration drilling; watershed evaluations; and numerical modeling of water supply well fields, tailings impoundments, and underground mine inflows with dewatering.

Mr. Rose also has experience conducting studies of oil and gas processing and transportation sites in Michigan, California, Colorado, Louisiana, New Mexico, Texas, and Wyoming. This experience includes geotechnical drilling using a Cone Penetrometer Rig, drilling and completion of monitoring wells, construction oversight, site characterization, remedial alternatives analysis, quality analysis of laboratory data, field sampling program development, soil sampling, ground water sampling, and surface water sampling.

In addition, Mr. Rose has experience supervising slurry wall construction, designing landfills using AutoCAD and Land Desktop, and preparing large-scale computer models using MODFLOW, MODFLOW-SURFACT, MT3D, MODPATH, PHREEQCi, and HELP.

Representative Projects

Holly Ridge Mutual Water Association, Greenwood Village, Colorado. Mr. Rose served as a project manager for this project, which involved drilling and completion of a replacement water supply well for a small water association. Duties performed included drilling bid solicitation, contract negotiations, drilling supervision, geologic logging of drilling chips, and well completion supervision.

Rock Creek Mine, Nome, Alaska. Mr. Rose has served as project manager for this project, which has involved drilling and installation of dewatering wells, performing long-term pumping tests on dewatering wells surrounding the proposed pit, and using resulting water level and pumping data to create a non linear model of the pit area, and estimate dewatering requirements for the life of the mine. Another major aspect of this project was drilling and testing of wells for use in an underground wastewater injection system.

Parker Water and Sanitation District, Parker, Colorado. Mr. Rose supervised the drilling and installation of eight water supply wells completed in the Cherry Creek Alluvium, the Dawson Aquifer, the Denver Aquifer, the Arapahoe Aquifer, and the Laramie-Fox Hills Aquifer. This included supervision of the drilling, screen and casing installation, and geologic logging of the drilling chips.

Castle Pines North Metropolitan District, Castle Pines, Colorado.
Mr. Rose supervised the rehabilitation of three water supply wells completed in the Denver and Arapahoe Formations.

Chapparal Metropolitan District, Aurora, Colorado. Mr. Rose supervised the rehabilitation of two water supply wells, and the drilling and completion of two other water supply wells.

Alumbrera Mine, Baja De La Alumbrera, Argentina. Mr. Rose supervised the drilling and installation of wells and piezometers as part of the tailings containment and pumpback system. He also performed pump tests and logged chip samples.

Batu Hijau Mine, Sumbawa, Indonesia. Mr. Rose used MODFLOW to model expected pumping rates, and effects of pumping wells on the ground water supply of three river valleys, and to verify avoidance of saltwater intrusion.

La Choya Mine, Sonora, Mexico. Mr. Rose analyzed Acid-Base Accounting and Meteoric Water Mobility test results and used them with results from the HELP model to determine quality and volume of seepage through waste rock dumps. He also determined inflow contributions from surrounding watershed, ground water, and direct precipitation in order to estimate rate of pit filling, and final pit lake level.

Henderson Mine, Summit County, Colorado. Mr. Rose determined watershed area and estimated runoff from an area contributing to the tailings impoundment area, estimated flow of river, and estimated seepage under the tailings impoundment dam, as part of a study to determine the water quality of Williams Fork River after the mine closure.

Mountain Pass Mine/Ivanpah Valley, San Bernardino, California. Mr. Rose used USGS topographic maps to delineate the Ivanpah Valley watershed, and calculated an estimated precipitation and runoff. He also supervised the completion and development of monitoring wells in the Ivanpah Basin.

Beartrack Mine, Leesburg, Idaho. Mr. Rose determined inflow contributions from the surrounding watershed, ground water, and direct precipitation in order to estate the rate of pit filling, and final pit lake levels for the North and South pits.

Getchell Mine, Golconda, Nevada. Mr. Rose used MODFLOW-SURFACT to simulate mine water inflows in heavily fractured bedrock to assist the mine in the development of a mine dewatering program ahead of mine development.

White Pine Copper Mine, White Pine, Michigan. Mr. Rose supervised the drilling of diamond drill holes as part of an exploration program, as well as performed a chip sampling program to assess the quality of copper ore, and cut and prepared core for logging.

Select Publications

"Simulating Underground Mine Inflows and Dewatering with MODFLOW-SURFACT", co-authored with David E. Hay and Jeff Wright, Proceedings at MODFLOW and MORE 2003: Understanding Through Modeling, International Groundwater Modeling Center, Golden, Colorado.