



RAILROAD COMMISSION OF TEXAS

HEARINGS DIVISION

OIL AND GAS DOCKET NO. 01-0295061

THE APPLICATION OF SEAWATER PRODUCTION, LLC PURSUANT TO STATEWIDE RULE 9 FOR A COMMERCIAL PERMIT TO DISPOSE OF OIL AND GAS WASTE BY INJECTION INTO A POROUS FORMATION NOT PRODUCTIVE OF OIL OR GAS, FOR THE BALLER SWD LEASE, WELL NO. 1, EAGLEVILLE (EAGLE FORD-1) FIELD, ATASCOSA COUNTY, TEXAS

HEARD BY: Karl Caldwell – Technical Examiner
John Dodson – Administrative Law Judge

PROCEDURAL HISTORY:

Application Filed:	August 15, 2014
Protest Received:	August 21, 2014
Request for Hearing:	December 15, 2014
Notice of Hearing:	May 19, 2015
Hearing Held:	June 10, 2015 & August 26, 2015
Transcript Received:	June 22, 2015 & September 15, 2015
Proposal for Decision Issued:	April 7, 2016

APPEARANCES:

REPRESENTING:

APPLICANT:

Seawater Production, LLC

Michael McElroy, Esq.
Michael Choate, Esq.
Carter Davis
Todd Reynolds

PROTESTANT:

Cabot Oil & Gas Corporation

John Hicks, Esq.
Kim Dillard
Triniti Brown
Dale Miller

CASE SUMMARY

Seawater Production, LLC requests to drill a new well for commercial disposal on the Baller SWD Lease, located in Atascosa County, approximately ten miles southwest of Charlotte, Texas. The Applicant requests to inject 30,000 barrels per day (bpd) of salt water and RCRA-exempt waste¹ into the Edwards and Glen Rose Formations in the depth interval between 8,130 feet and 10,300 feet. The application is protested by Cabot Oil & Gas Corporation, an operator within a half-mile of the proposed disposal well. Cabot Oil & Gas Corporation's position is that this is an area of faulting, not a good location for a disposal well, and that there is not a need for a disposal well in this location. Cabot Oil & Gas Corporation is also concerned that the proposed disposal well will endanger their production from the Eagleford and Buda Formations. Having reviewed and considered all admitted evidence, the Examiners recommend the application be denied.

APPLICABLE LAW

Any person who disposes of saltwater or other oil and gas waste by injection into a porous formation not productive of oil, gas, or geothermal resources shall be responsible for complying with 16 Tex. Admin. Code §3.9, Texas Water Code, Chapter 27, and Title 3 of the Natural Resources Code. Pursuant to Texas Water Code § 27.051(b), the Railroad Commission of Texas (Commission) has authority to permit disposal wells if it finds all of the following:

- (1) that the use or installation of the injection well is in the public interest;
- (2) that the use or installation of the injection well will not endanger or injure any oil, gas, or other mineral formation;
- (3) that, with proper safeguards, both ground and surface fresh water can be adequately protected from pollution; and
- (4) that the applicant has made a satisfactory showing of financial responsibility if required by § 27.073 of this code.

¹ Resource Conservation and Recovery Act: Examples of RCRA exempt oil and gas waste includes produced water, drilling fluids, hydraulic fracturing flow back fluids, rig wash and workover wastes.

DISCUSSION OF THE EVIDENCE

Applicant's Evidence (Seawater Production, LLC)

Application

Seawater Production, LLC ("Seawater" or "Applicant") requests commercial disposal authority pursuant to Statewide Rule 9² for the Baller SWD Lease, Well No. 1, ("Baller SWD No. 1") Eagleville (Eagle Ford-1) Field, Atascosa County, Texas. The Baller SWD Lease is a ten-acre lease located in close proximity to State Highway 97, approximately ten miles southwest of the town of Charlotte. Notice of the application was published in the *Pleasanton Express*, a newspaper of general circulation in Atascosa County on September 10, 2014. Notice of the application was mailed to the surface owner of the Baller SWD Lease, to adjacent surface owners of the Baller SWD Lease, to all operators within a half-mile radius of the proposed well location, and to the Atascosa County Clerk.³ The application is protested by Cabot Oil & Gas Corporation ("Cabot" or "Protestant"), an operator within a half-mile radius of the proposed disposal well.

Injection Interval

The proposed disposal interval is between 8,130 feet and 10,300 feet in the Edwards and Glen Rose Formations. The requested maximum injection volume is 30,000 bpd, at a maximum surface injection pressure of 4,065 feet. Carter Davis, Applicant's engineering witness, stated that Applicant does not want to be bound by a maximum injection volume on the permit that is not representative of the geology of the injection interval after the well has been drilled, and therefore requests a maximum injection volume of 30,000 bpd.

Confining Intervals

According to Mr. Davis, there have not been many wells that have penetrated through the injection interval in the immediate area. As a result, Applicant used the Mabel Wilson, Well No. 1, API No. 42-283-00037 ("Mabel Wilson No. 1"), as the type log to identify the disposal interval and confining intervals. The Mabel Wilson No. 1 is located approximately 11.5 miles to the southwest of the proposed disposal well location. In Mr. Davis' opinion, "...using this as a type log to indicate the formations in which we propose to inject, we basically showed that the tight formation in the base of the Georgetown will be an upper seal for our injected fluids. And then the tight formation at the base of the Glen Rose would prevent injected fluids from going down into underlying formations."⁴ The Del Rio Formation is located between the Georgetown and Buda Formations and will act as an additional upper confining interval between the injection interval and productive and fresh water formations. Mr. Davis considers the Del Rio Formation

² 16 Tex. Admin. Code § 3.9 (Disposal Wells).

³ 16 Tex. Admin. Code § 3.9(5) (Notice and Opportunity for Hearing).

⁴ Tr. Vol. I, pg. 20, ln 14-20.

to be a regional shale, and a good seal, which is estimated to be approximately 50 feet in thickness. On cross-examination, Mr. Davis stated that the base of the Georgetown Formation appears to be tight, based on the low conductivity reading shown on the type log, indicating very little pore space.

Fresh Water Formations

The Groundwater Advisory Unit (“GAU”) estimates the base of usable-quality water (“BUQW”) to occur at a depth of 4,100 feet at the proposed disposal well location. The base of underground sources of drinking water (“USDW”) is estimated to occur at a depth of 4,200 feet. The GAU has determined that geologic isolation occurs at a depth of 5,500 feet, and that the proposed injection operations into the subsurface strata depth interval from 7,900 feet to 11,000 feet will not endanger the freshwater strata in the area.⁵

Well Construction

In Mr. Davis’s opinion, the proposed well construction will protect the BUQW. 10-3/4 inch surface casing will be set at a depth of 4,200 feet and cemented with cement circulated to surface. The well will be drilled to a total depth (TD) of 10,350 feet. 7-5/8 inch long string casing will be set at a depth of 10,300 feet. The proposed zonal isolation plan on the long string casing is to bring the top of cement to 3,700 feet from surface, which would be 500 feet above the setting depth of the surface casing.

Mr. Davis would not consider a permit condition that a cement bond log be run to be adverse, and considers running a cement bond log to be prudent. However, Mr. Davis stated, “I don’t know that it needs to be put on as a permit requirement.”⁶

Nearby Wellbores

No wellbores penetrate the disposal formations within a 1.5-mile radius. The estimated top of the injection interval is 7,695 feet subsea. There is one well located within a quarter mile radius, the Bowman West 1H (API No. 42-013-34804), operated by EOG Resources. The maximum true vertical depth (“TVD”) of this well is 7,370 feet subsea. There are two additional wells located between a quarter-mile and a half-mile radius from the proposed disposal well location: the R. H Pickens, et. al “B” No. 29H, (API No. 42-013-34891), drilled to a maximum TVD of 7,370 feet subsea, and the R. H Pickens, et. al “B” No. 16H, (API No. 42-013-34638), drilled to a maximum TVD of 7,323 feet subsea. According to Mr. Davis, none of these wellbores are deep enough to act as a possible conduit for fluids to escape the proposed injection interval.

⁵ The Applicant has since reduced the disposal interval from the original 7,900 to 11,000 feet to the depth interval between 8,130 and 10,300 feet, which was adjusted with additional well log information.

⁶ Tr. Vol. I, pg. 67, ln 21-22.

Oil and Gas Activity in the Area

The proposed Baller SWD No. 1 will be located in southwestern Atascosa County. The number of drilling permits issued in Atascosa County has increased between 2009 and 2014, which is the last full year with data. In 2014, approximately 445 drilling permits were issued in Atascosa County. Collectively, the four counties of Atascosa, Frio, La Salle, and McMullen have seen an increase in the number of wells drilled and completed over the past several years. In 2014, a combined total of 2,444 drilling permits were issued for these four counties. The majority of wells that have been drilled in the last few years are associated with Eagle Ford development in the area.

In Mr. Davis's opinion, saltwater disposal in Atascosa, Frio, La Salle, and McMullen Counties is somewhat interrelated. Mr. Davis reviewed the producing leases within three miles of the proposed Baller SWD to determine where some of that water has been disposed. Mr. Davis stated "You can see there are a number of wells literally right across the highway from the proposed Baller SWD location...many of those wells are currently shipping their water down to some wells in McMullen and La Salle Counties."⁷ Mr. Davis has reviewed the P-18 forms for the Herrman No. 1 disposal well in La Salle County, and the Provechoso No. 1 in McMullen County. Mr. Davis determined that in April 2015, 68,000 barrels of water from leases within a three-mile radius of the proposed saltwater disposal well were trucked to McMullen and LaSalle Counties for disposal. In Mr. Davis's opinion, if the Baller SWD application were approved, there would be a closer disposal location for wells completed in this area.

Seismic Survey

USGS records show no seismic events reported within 100 square miles of the proposed disposal well location between May 26, 1900, and June 2, 2015.⁸

Protestant's Evidence (Cabot)

The application is protested by Cabot. Cabot's position is that this is an area of faulting, and is not a good location for a disposal well. Further, Cabot alleges that the proposed disposal well will endanger Cabot's Eagle Ford production, and that there is no need for a disposal well in this location. There are a number of active commercial disposal wells within a 20-mile radius, and a number of disposal wells that are permitted and not yet drilled. These disposal wells are ready to be drilled and provide additional capacity in the area.

Endangerment to Productive Formations

Triniti Brown is Cabot's team lead on the Eagle Ford program, and the principal geologist of operations and development, responsible for drilling Eagle Ford wells. Two recent,

⁷ Tr. Vol. I, pg. 41, ln 5-10.

⁸ Applicant Exhibit No. 11: Latitude: 28.731658, Longitude: -98.782490.

peer-reviewed journal papers, with separate authors, have produced the location and verified the authenticity of a large-scale, regional fault zone, the Charlotte-Jourdanton Fault Zone (“CJFZ”). According to Ms. Brown, the CJFZ is also referred to as the Charlotte-Jourdanton Graben Zone (“CJGZ”) because the fault zone is a graben. The graben straddles the Frio – Atascosa County line, slightly to the west of the Frio – Atascosa County line. The graben travels north-northeast, crossing the Frio – Atascosa County line, and then makes a turn northeasterly.

The CJGZ is a large –scale system. The bounding faults in this graben may extend a total of 15,000 feet of TVD vertical extension, from the Louann Salt, at approximately 18,000 to 19,000 feet of measured depth, up almost to the Cretaceous-Tertiary Boundary, at about 3,000 to 4,000 feet. Cabot identified two generations of faulting in the CJGZ. The first generation of faulting occurred in the early Cretaceous, which is the Sligo horizon faulting. Several of those faults were reactivated in the second generation of faulting in the late Cretaceous, which is at the Buda horizon. According to Ms. Brown, these are huge faults that have been identified in literature.⁹ Cabot identified these faults in nearby well log cross sections, as well as in Cabot’s proprietary data.¹⁰

Cabot’s Well Completions in the Area

Cabot’s wells produce from the Eagleford and Buda Formations in the vicinity of the proposed Baller SWD No. 1. Cabot has blanket Statewide Rule 10 exceptions in the Olmos, Buda, and two Eagle Ford fields. Ms. Brown stated, “When we drill our horizontal wells, sometimes we end up in the Buda; sometimes we purposely hit the Buda in faults of increased fracturing, so, we’ve been able to basically commingle both of those formations, so in wellbores, we do have Buda penetrations and we do complete in the Buda, so it’s considered a hydrocarbon-bearing formation so both the lower Eagle Ford and the Buda are formations that we extract hydrocarbons from.”¹¹ Ms. Brown also stated that Cabot purposely leased in this area due to the faulting “...because we want that secondary permeability, so we are aware of the risk and we work to mitigate that in a group environment.”¹²

The perforated interval in Cabot’s horizontal wells varies from 4,000 to 5,000 feet in shorter laterals, and 7,000 to 8,000 feet in the longer laterals. If a geologist sees a fault that was not identified in seismic data while geosteering a well, the geologist communicates this information to the completion engineers. In these instances, the perforations, and subsequently, the frac stages, will be located at a fixed distance from that fault. According to Ms. Brown, “we may take two stages out in that instance to remain a fixed distance from any type of geologic hazard that we may see...each well is not a cookie cutter plan. It is a specially designed completion scheme.”¹³

⁹ Cabot Exhibit No. 7.

¹⁰ Cabot Exhibit Nos. 8, 11, and 13.

¹¹ Tr. Vol. II, pg. 16, ln 11-19.

¹² Tr. Vol. II, pg. 46, ln 22.24.

¹³ Tr. Vol. II, pg. 45, ln 16-20.

Cabot has conservatively estimated that a total 16 wells are of primary concern with this disposal well application. This estimate is only considering the 16 Cabot wells that are within a couple of hundred feet of the larger bounding graben faults and does not take into account the sub-seismic faults. Ms. Brown believes the proposed disposal well would pose a risk to Cabot's current hydrocarbon production and to the hydrocarbon resources of these formations. The placement of the Baller SWD No. 1 in this heavily faulted regime is of great concern to Cabot. Cabot's concern is due to the proposed disposal well injecting fluids in the vicinity of the CJGZ, as well as injecting fluid in close proximity to sub-seismic faults in Cabot's laterals, as identified in the geosteering panels.

The proposed disposal interval includes the Edwards Formation. In Ms. Brown's opinion, if the Edwards Formation were to be pressured up from injected water, faults could be a potential conduit for fluids to migrate and reduce production in the hydrocarbon-bearing Buda and Eagleford Formations. According to Ms. Brown, there is a highly faulted area associated with this graben, which is very risky to Cabot's hydrocarbon production, and the resources in general in this area, because there are potentially many conduits for produced saltwater to flow up into the hydrocarbon-bearing formations. If one were to pressure up the Edwards Formation, which is only approximately 170 feet deeper than Cabot's lowest producing horizon in this area, there is a risk that any pressure increase in the Edwards Formation will not be confined to the Edwards Formation. According to Ms. Brown, Cabot's concern is that knowing the sub-seismic faults, and knowing the large-scale faults are there, "... you start to pressure up the Edwards, and you have created a super easy conduit for that water that has been disposed, produced water from the (proposed) Baller (SWD) well, to now flood out a minimum of 16, actually more, of the Cabot Eagle Ford wells."¹⁴

According to Ms. Brown, there is a small confining zone, the Del Rio Formation, below the producing horizons. The Del Rio Shale is about 50 feet in thickness. Directly below the Del Rio formation is the Georgetown Formation, which Ms. Brown describes as porous on the order of a hundred feet. Directly below the Georgetown Formation is the Edwards Formation, which is the top of the proposed injection interval. Ms. Brown states, "...which I do not believe will be enough thickness for confining the injected water...Not only do we have this smaller confining interval, but we also have a large scale mass failure of rock that is not only expressed with these large grabens, but you also see in well logs and you can correlate smaller subseismic features in your geosteered horizon(tal) wells."¹⁵

Ms. Brown stated that the vertical extent, from where one first sees the rock break and then where one last sees the rock break in these graben faults, are thousands of feet, regardless of the throw. The throw of the fault is the displacement between the formations. For the CJGZ, the throw varies. Ms. Brown has observed throws of 700 feet, 200 feet, and 40 feet, whereas the vertical extent of the fault may vary from 5,000 feet to 17,000 feet. Ms. Brown stated, "In some

¹⁴ Tr. Vol. I, pg. 175, ln 2-6.

¹⁵ Tr. Vol. II, pg. 35, ln 3-11.

instances, there's 17,000 foot of vertical extent for a single fault that may have been reactivated, so these are very large vertical extent faults."¹⁶

Evidence of Faulting in Well Logs

Ms. Brown prepared a stratigraphic cross section using the same well logs identified by Applicant in its cross-section. Ms. Brown does not agree with some of Applicant's picks for formation tops. Ms. Brown also identified faults in the well logs by identifying missing sections in several wellbores as compared to its offset wellbore in the cross-section:

- 1) There are missing sections within the Glen Rose Formation as shown on the Skelly Oil, La Salle No. 1A, API No. 42-283-00673, ("Skelly LaSalle") and within the Pearsall Formation as shown on the Irvin Family Lease, Well No. 1, API No. 42-283-32176, ("Irvin Family") which fit the orientation of the regional scale faulting in the area. Ms. Brown estimates the fault shown on the Irvin Family well log to be a 40-foot throw. The Skelly La Salle log appears to show a deeper fault, estimated to be a throw of 40 feet, and a shallower fault of approximately 60 to 70 feet, that may be a synthetic fault off of the main fault. Ms. Brown deduced that the lower fault cutting the Skelly La Salle is the same fault cutting the Irvin Family wellbore.
- 2) The Humble Pruitt, E.J. Lease, Well No. 46, API No. 42-013-02361 ("Pruitt E.J. 46") is close to one of the main graben faults at the Buda horizon. This well is downthrown from the fault, and therefore a fault should cut this wellbore in a formation deeper than the Buda Formation. Ms. Brown estimates that a fault caused approximately 180 feet to be cut-out of the Edwards Formation in this wellbore.
- 3) The Marrs McLean Lease, Well No. 1, API No. 42-163-01552, ("Marrs McLean") is upthrown to a fault that has been mapped at the Buda horizon and therefore, a fault would be expected to be higher in this well log, and as expected, a fault was identified higher than the Buda formation. A fault was identified above the Olmos Formation. Ms. Brown states, "So that does indicate the validity of these faults and that they are, in fact, far reaching, because you can see them from Olmos to - down through Pearsall, which is 8,000, 9,000 feet."¹⁷

Based on the evidence of faulting in these well logs, Ms. Brown concludes " [W]hat we're seeing here is consistent to what we're seeing in the main...publications about the shape of the Charlotte-Jourdanton Fault Zone."¹⁸

¹⁶ Tr. Vol. II, pg. 15, ln 15 – pg. 16, ln 1.

¹⁷ Tr. Vol. I, pg. 157, ln 3-7.

¹⁸ Tr. Vol. I, pg. 158, ln 21-24.

Cabot's Seismic Evidence of Faulting in the Area

Fault polygons are surficial representations, or a flat map view of a fault's throw at depth. Cabot's seismic information shows that fault polygons at both the Buda horizon and Sligo horizon, which is several thousand feet deeper than the Buda horizon, is consistent with literature's location of the CJGZ.¹⁹ Using seismic information, Cabot has estimated the measured distance from the proposed Baller SWD No. 1 to the Buda horizon faulting to be approximately 11,000 feet, and approximately 14,800 feet to the Sligo horizon faulting. Cabot is also concerned with "...smaller sub-seismic resolution faults that exist in this type of system that you're unable to uniquely image in a 3D volume, and the only way you can identify those types of sub-seismic faults are in well logs. In this case... gamma ray log."²⁰

Ms. Brown describes a synthetic fault as a smaller fault that offsets the larger fault. According to Ms. Brown, in this case there are larger graben faults, and there is a massive failure of the rock, and everything slides down along the fault plane. As a result, there is a massive failure along the fault plane as well as additional smaller failures both upthrown and downthrown to that larger graben system. Those failures are termed synthetic if they are parallel to the fault plane or antithetic if they are perpendicular to the fault plane. Ms. Brown has identified antithetic and synthetic faults, both upthrown and downthrown of the larger graben.

Forensic Geosteering Evidence of Faults

Ms. Brown does geosteering on a daily basis as an operations geologist. Geosteering is defined as using a well log, logged while drilling, to keep the horizontal section of the wellbore in zone. Forensic geosteering is a post-drill analysis. Ms. Brown is able to use forensic geosteering to identify faults that the wellbore has crossed. Ms. Brown considers these faults to be sub-seismic resolution faults in the horizontal wellbores.

The two closest Cabot wells that have been drilled in the direction of minimum stress to the proposed Baller SWD are the Pickens B 16H (API No. 42-013-34638) and the Pickens B 27H (API No. 42-013-34856). Ms. Brown identified two sets of faults -four faults in total- in both the Pickens B 16H and the Pickens B 27H. The closest sub-seismic fault to the proposed Baller SWD identified by Ms. Brown is in the Pickens B 16H lateral, estimated to be approximately 3,500 feet away. According to Ms. Brown, "this tells you yes, you have major graben faults. But you also have sub-seismic faults that are a smaller throw, which you cannot uniquely image on seismic data that you can only see in geosteering panels. So you not only have the large faults, but you have the sub-seismic faults to contend with also in this region."²¹ The faults identified by Ms. Brown using forensic geosteering are between 5 and 12 feet in throw, which, in Ms. Brown's opinion, are below the sensitivity of seismic data to uniquely image them (sub-seismic).

¹⁹ Cabot Exhibit Nos. 8 and 9.

²⁰ Tr. Vol. II, pg. 28, ln 1-5.

²¹ Tr. Vol. I, pg. 170, ln 23 – pg. 171, ln 4.

The Proposed Baller SWD No. 1 Would be in a Poor Location

The majority of producing leases within three miles of the proposed Baller SWD No. 1 are Cabot leases. Ms. Brown does not agree with the conclusion of Applicant's witness that any water produced in close proximity to the Baller SWD No. 1 would go to the Baller SWD No. 1. On the contrary, Ms. Brown testified that Cabot would not take any water from their leases to the proposed Baller SWD No. 1, "Cabot is not going to take the risk to inject water into this proposed Baller saltwater disposal well. Even if it is a little bit cheaper than trucking it further down, we're not going to risk flooding out all of our production from several tens of wells."²²

Existing Commercial Disposal Capacity in the Area

There are three existing commercial disposal wells within a ten-mile radius of the proposed Baller SWD No. 1 location. In addition, there are three pending commercial disposal well applications within a ten-mile radius, including the subject application. Between ten and twenty miles there are twelve additional active commercial disposal wells and an additional nineteen commercial disposal wells that either have an approved permit and not yet drilled, or no H-10 report yet, or are pending applications.

Of the fifteen total active commercial disposal wells within a twenty-mile radius, the cumulative permitted daily injection volume of these active wells is approximately 290,000 bpd. In addition to the active commercial disposal wells within a twenty-mile radius, there are a number of additional wells that are permitted but not yet taking water, which would provide approximately an additional 200,000 bpd.

For the calendar year 2014, the summation of the reported daily injection volume per day for the active commercial disposal wells is approximately 95,000 to 96,000 bpd. Therefore, these fifteen active commercial disposal wells were injecting less than 33 percent of their permitted capacity when there was much greater activity than at the present time. There have been 66 drilling permits approved in Atascosa County between January 1, 2015, and June 9, 2015. Projecting this number over the full year of 2015 results in approximately 150 drilling permits, which is several hundred fewer than in 2014. For the four county area of Atascosa, Frio, LaSalle and McMullen, a total of 569 drilling permits were issued between January 1, 2015 and June 9, 2015. Projecting this number over a full year results in a drop off of several hundred permits as compared to 2014. In addition, the greatest volume of water produced during a well's lifecycle is at the very beginning, when the well is flowing back and cleaning up after hydraulic fracture stimulation of the well.

In Ms. Brown's opinion, "The big takeaway from this is that when we were operating at more capacity for injection in 2014, we were still only injecting at 33 percent of maximum injection volume per day...in 2015, if you look at these numbers, for the most part is less.

²² Tr. Vol. I, pg 178, ln 9-14.

So...there's greater than 66 percent capacity that's not being utilized of existing wells within a 20-mile radius, so there does not appear to be a need for any additional (disposal) wells."²³

Cabot uses the Donnell SWD No. 1 (API No. 311-34723), and the Herrmann SWD No. 1 (API No. 283-33963) to dispose of its water. Each well is permitted to dispose of 25,000 bpd. The average daily volume for 2014 as reported on Form H-10 was 9,791 bpd for the Donnell SWD No. 1 and 8,582 bpd for the Herrmann SWD No. 1. The Donnell SWD No. 1 and the Herrmann SWD No. 1 are located in McMullen and LaSalle Counties. According to Ms. Brown, the CJFZ system begins to dissipate in LaSalle County. Therefore, the locations of the Donnell SWD No. 1 and the Herrmann SWD No. 1 are a greater distance away from the Charlotte-Jourdanton graben than the proposed Baller SWD No. 1. In addition, the disposal intervals for both the Donnell SWD No. 1 and the Herrmann SWD No. 1 are deeper than the proposed Baller SWD No. 1 disposal interval. The Donnell SWD No. 1 is permitted from 10,000 feet to 11,000 feet, and only injecting from 10,100 feet to 10,610 feet, which corresponds to the middle to lower Glen Rose Formation. Although the Herrmann SWD No. 1 is permitted from 8,600 to 10,500, the well is perforated and injecting into an interval from approximately 10,100 feet to 10,370 feet. Ms. Brown does not consider the Herrmann SWD No. 1 or the Donnell SWD No. 1 to be disposal wells that may impact productive intervals since these wells are further away from the fault zone.

Seawater's Rebuttal Evidence

Cabot's Well Completions in the Area

Todd Reynolds, Applicant's geology and geophysics witness, estimates the distance from the proposed Baller SWD No. 1 to the closet fault ("F1 Fault") at the Buda horizon identified by seismic data to be 11,116 feet.²⁴ The distance would be greater than 11,116 feet to the Edwards Formation. Applicant has not performed any calculations to estimate the migration distance of fluids injected into the proposed Baller SWD No. 1 at the requested rate of 30,000 bpd.

Mr. Reynolds estimates the thickness of the Del Rio Formation to be approximately 60 feet. This estimate is based on the well log of the R.H. Pickens, et. al 'A' 101H (API No. 42-013-34751), located approximately 7,966 feet from the proposed Baller SWD No. 1. In Mr. Reynolds's opinion, from the base of the Eagleford formation, which is also the top of the Buda Formation, there are approximately 300 feet of either tight limestone or impervious shale intervals to the top of the disposal interval.

Mr. Reynolds states that the extent of the F1 Fault is probably at a maximum extent of 100 feet at the proposed Baller SWD No. 1. In the event the displacement is greater, for example 300 feet of displacement, it may pose a situation where the Edwards Formation has moved up and is juxtaposed adjacent to the Eagleford Formation. This would result in a situation where

²³ Tr. Vol. I, pg. 186, ln 1-9.

²⁴ Seawater Exhibit No. 17.

Edwards Formation water could migrate into the Eagleford Formation naturally, and not as a result of any saltwater injection into the Edwards Formation. Mr. Reynolds believes communication between the Edwards Formation and one of Cabot's producing wells in the area, the Chillipitin 4H well, may be evidence of this situation. In Mr. Reynolds's opinion, the Chillipitin 4H was drilled in close proximity to a large fault. Cabot provided a water analysis in discovery that was "very high H₂S; very high chlorides; very high total solids. All things that are typically found in Edwards water."²⁵

On cross-examination, Mr. Reynolds was questioned whether the water analysis for the Chilliptin 4H was an indication that water crossed a fault. Mr. Reynolds stated "Well, as I show with D-D' (Seawater Exhibit No. 17), you have a situation there where the Edwards is juxtaposed on the opposite side of the fault from the Eagle Ford, and, it appears that they may have fracture stimulated into that water."²⁶ According to Mr. Reynolds, the standard procedure for completing horizontal Eagle Ford wells in this area is to hydraulically fracture-stimulate ("frac") the lateral in multiple stages. Many of Cabot's wells are drilled very close and right up to the F1 Fault. For example, the Chillipitin 4H (API No. 42-163-33693) to the north, is drilled in close proximity to a large fault.

Mr. Reynolds expects the frac pressures required to hydraulically-fracture stimulate Cabot's wells to be greater than Seawater's maximum requested injection pressure for the proposed Baller SWD No. 1. Mr. Reynolds expects the fracture stimulation pressure to be "considerably greater to be able to create the fracture which is what they are trying to do is propagate a fracture in a shale. I would expect those pressures are going to be several orders of magnitude higher than the pressures that would be encountered on the injection of the saltwater disposal well."²⁷ In completing wells, Cabot injects large volumes of fluid at higher pressures up against a fault than the Applicant proposes with the Baller SWD No. 1 disposal well. Mr. Reynolds stated "Seven times...the frac job has occurred right there in close proximity of the fault with large volumes of sand and water and pressures, and that probably presents a greater risk of communicating with the Edwards at this fault than this (proposed) saltwater disposal well over two miles away from the fault, so, potentially Cabot could create their own saltwater problems with these fracs in close proximity to the fault."²⁸

In Mr. Reynolds's opinion, there is evidence that the large Charlotte fault to the north of the proposed disposal well is sealing because of hydrocarbon accumulations in the Edwards and Olmos Formations. With the F1 Fault, Mr. Reynolds stated "Down here we don't have close contours to be able to say one way or another whether a trap would be created and sealed there."²⁹ In Mr. Reynolds's opinion, the absence of a trap does not mean it's not a sealing fault, and it does not mean it is a sealing fault - it does not indicate one way or the other.

²⁵ Tr. Vol. II, pg. 77, ln 9-11.

²⁶ Tr. Vol. II, pg 103, ln 4-8.

²⁷ Tr. Vol. II, pg. 87 ln 22 – pg. 88, ln 2.

²⁸ Tr. Vol. II, pg. 88, ln 23 – pg 89, ln 6.

²⁹ Tr. Vol. II, pg. 103, ln 19 – 21.

The Need for Additional Disposal in this Area

The Reese SWD Lease, Well No. 1, API No. 42-013-34459, (“Reese SWD”) is located northeast of the proposed Baller SWD No. 1. Mr. Reynolds estimates the Reese SWD is approximately 8,600 feet away from a fault at the Buda horizon, and therefore closer to the F1 Fault than the proposed Baller SWD No. 1. The Reese SWD disposal interval is in the Edwards Formation, perforated from 8,075 feet to 8,010 feet.

The Form P-18 for the Reese SWD shows 15,461 barrels (bbl) were disposed of in March 2015. All fluid was from Cabot leases. In April 2015, 48,036 bbl of fluid were injected into the Reese SWD, and again, all fluid was from Cabot. No injection was reported for the Reese SWD in May or June 2015. On cross-examination, Mr. Reynolds stated that according to the P-18 records for the Reese SWD, zero water has been reported for May and June 2015. Mr. Reynolds does not know if any water has been disposed of for the months of July or August 2015. Mr. Reynolds estimates that approximately 99% of the volume of water reported for the Reese SWD was from Cabot. Mr. Reynolds does not know if Cabot is ever going to send any water to the Reese SWD again. Mr. Reynolds is unaware of why the Reese SWD is not currently disposing of any water, and whether it is mechanically-related or demand-related.

Cabot has recently acquired wells in close proximity to the Reese SWD. Drilling permits have also recently been issued to Cabot in the vicinity of the Reese SWD. In Mr. Reynolds’s opinion, this shows that there is an existing, active salt water disposal (SWD) well in the area and Cabot is active around that SWD well. The evidence also shows that the Reese SWD is closer to the faulting in this area than the proposed Baller SWD well would be. On cross-examination, Mr. Reynolds stated that he believes that Cabot’s wells are to the south of the Reese SWD and also to the northeast and east, and not between the Reese SWD and the F1 fault. Mr. Reynolds stated that the 16 wells in which Cabot expressed concern are located between the proposed Baller SWD and the F1 Fault. In Mr. Reynolds’s opinion, any synthetic faults associated with the F1 Fault will tend to be parallel to the primary fault.

EXAMINERS’ ANALYSIS OF THE EVIDENCE**Public Interest**

The Examiners conclude that Applicant failed to meet its burden to show that there is a need for additional disposal capacity at this location at this time. Therefore, the proposed Baller SWD No. 1 commercial disposal well is not in the public interest. Applicant’s assertion that there is a need for a commercial disposal well at the Baller SWD No. 1 location is not supported by the evidence. Applicant’s engineering witness concluded that, since water from leases within three miles of the proposed Baller SWD No. 1 is being disposed of in McMullen and La Salle Counties, there was a need for the Baller SWD No. 1. However, the majority of the producing leases within three miles are Cabot leases. Cabot’s witness stated that Cabot currently uses disposal wells in McMullen and La Salle Counties and would not use the proposed Baller SWD

even if it were closer and possibly less expensive, due to the potential risk to hydrocarbons in the Buda and Eagleford Formations.

Applicant's evidence to show a need for additional disposal capacity consisting of the number of drilling permits in 2014 in Atascosa County, as well as the surrounding counties, was not persuasive. Protestant's evidence showed that there are three commercial disposal wells within a 10-mile radius of the proposed Baller SWD No. 1 location, and a total of 15 commercial disposal wells within a 20-mile radius. The total permitted disposal capacity of these 15 wells is 290,000 bpd. In 2014, the actual disposal volume was less than 33% of these wells' permitted capacity. In addition, there are a total of 21 disposal wells within a 20-mile radius - excluding the proposed Baller SWD No. 1 - where either a permit has been granted but no H-10 has been filed to date, where applicants have been issued a permit but the well is not yet drilled, or where applicants have submitted an application for a disposal well permit.

The evidence that the Reese SWD No. 1 is closer to the F1 Fault at the Buda horizon than the proposed Baller SWD No. 1, and that Cabot has previously used the Reese SWD No. 1 disposal well, fails to justify the need for the Baller SWD No. 1. Cabot does not have any producing wells between the F1 Fault and the Reese SWD No. 1, whereas Cabot identified 16 producing wells between the F1 Fault and the proposed Baller SWD No. 1. In addition, any faults associated with the F1 Fault would tend to be parallel to the main F1 fault. Furthermore, the evidence shows that 99% of the water disposed at the Reese SWD originated from Cabot leases prior to May 2015. No water was reported on Form P-18 for either May or June 2015, either due to lack of water to be disposed, or a well issue. Therefore, the evidence does not show that there is a need for additional water disposal capacity in the immediate area.

Injury to Any Oil, Gas, or Other Mineral Formation

The Examiners conclude that Applicant failed to meet its burden that the proposed disposal well will not injure any oil or gas formation. This is due to the cumulative effect of the nature and degree of faulting in this area, and the type of completions required to recover hydrocarbons from the productive Eagleford and Buda Formations. Evidence of faulting in this area is supported by well logs, seismic data, and peer-reviewed papers. The proposed Baller SWD is estimated to be approximately 11,000 to 11,116 feet from a major fault (F1 Fault) associated with the CJFZ. Cabot has drilled and completed 16 horizontal wells in the Buda and Eagleford Formations between the CJFZ and the proposed Baller SWD. Cabot has identified sub-seismic faults in the Eagleford and Buda Formations when drilling and logging the laterals. The closest sub-seismic fault to the proposed Baller SWD is in the Pickens B 16H lateral, approximately 3,500 feet away. Cabot adjusts the perforated intervals and frac stages to be a fixed distance away from the sub-seismic faults in the productive formations in an effort to minimize their potential impact during hydraulic fracture stimulation.

There is evidence in the record that one of the Protestant's productive wells is also producing water from the Edwards Formation. Several possible scenarios have been presented. One scenario is that due to faulting, the Edwards Formation is juxtaposed to either the Buda and/or Eagleford Formations such that communication of formation fluids is occurring. A

second scenario is that the existing faults in the area are a conductive pathway for fluids to migrate from the Edwards Formation to the productive formations. Another possible scenario is the bottomhole treating pressure required to create fractures in the Eagleford and Buda Formations is great enough such that fractures are either: 1) extending to a depth and are sufficiently propped open to create a conductive pathway between the Edwards Formation and the productive formations; and/or 2) the bottomhole treating pressure during the well completion is greater than the fissure opening pressure of natural fractures in the productive formations.

The evidence that Edwards Formation water is being produced with hydrocarbons from one of the Protestant's wells shows that the proposed injection operations pose a risk to productive formations. Injecting produced water into the Edwards Formation would increase the amount of water and pressure that naturally exists in the Edwards Formation. Increasing the volume of water in the Edwards Formation has the potential to water out the productive formations. At a minimum, injecting water in the Edwards Formation has the potential to increase the amount of water produced in recovering hydrocarbons contained within the Eagleford and Buda Formations as a result of the hydraulic fracture stimulation required to recover these reserves. If realized, this would increase production costs and potentially decrease the economic life of wells in the area.

Adequate Protection of Fresh Water

The Examiners conclude that the proposed well construction of the Baller SWD No. 1 would adequately protect both ground and surface fresh water. The BUQW occurs at a depth of 4,100 feet at the proposed disposal well location. The base of USDW occurs at a depth of 4,200 feet. The proposed well construction plan would set 10-3/4 inch surface casing at a depth of 4,200 feet. The surface casing would be cemented with cement circulated to surface. The well would be drilled to a total depth (TD) of 10,350 feet. 7-5/8 inch long string casing would be set at a depth of 10,300 feet. The top of cement behind the long string casing would be 3,700 feet from surface, which is 500 feet above the setting depth of the surface casing. No wellbores penetrate the disposal formations within a 1.5 mile radius to act as conduits.

Financial Assurance

There is no evidence in the record for the Examiners to make a determination as to whether the Applicant has an active P-5, or any financial assurance.

Additional Information

USGS data shows no seismic events have been reported within 100 square miles of the proposed disposal well location between May 26, 1900 and June 2, 2015.

FINDINGS OF FACT

1. Seawater Production, LLC seeks a permit authorizing commercial disposal operations pursuant to 16 TEX. ADMIN. CODE § 3.9 for the Baller SWD Lease, Well No. 1, Eagleville (Eagle Ford-1) Field, Atascosa County, Texas.
2. The application for the Baller SWD Lease, Well No. 1, was mailed to the owner of the surface tract, to adjacent surface owners, to the Atascosa County Clerk, and to all operators within a half-mile radius of the proposed well location. 16 TEX. ADMIN. CODE § 3.9(5)(A), (B).
3. Notice of the the Baller SWD Lease, Well No. 1, commercial disposal well application was published in the *Pleasanton Express*, a newspaper of general circulation in Atascosa County on September 10, 2014. 16 TEX. ADMIN. CODE § 3.9(5)(D).
4. The application is protested by Cabot Oil & Gas Corporation, an operator within a half-mile of the proposed disposal well.
5. At least 10 days' notice of the hearing was provided to the owner of the surface tract, to adjacent surface owners, to the Atascosa County Clerk, and to operators within a half-mile of the proposed disposal well. 16 TEX. ADMIN. CODE § 3.9(5)(E)(i).
6. The use or installation of the Baller SWD Lease, Well No. 1, is not in the public interest in terms of a need for additional disposal capacity in this area.
 - a. There are a total of 15 commercial disposal wells within a 20-mile radius of the proposed Baller SWD location;
 - b. The permitted capacity of the 15 commercial disposal wells within a 20-mile radius of the proposed Baller SWD location is 290,000 bpd;
 - c. In 2014, the actual disposal volume of these 15 active commercial disposal wells was less than 33% of the permitted capacity;
 - d. There are potentially an additional 21 disposal wells within a twenty-mile radius in which either a permit has been granted but no H-10 has been filed to date, in which applicants have been issued a permit but the well is not yet drilled, or where applicants have submitted an application for a disposal permit;
 - e. The majority of the producing leases within three miles of the proposed disposal well are Cabot leases; and
 - f. Cabot currently uses disposal wells in McMullen and La Salle Counties and would not use the proposed Baller SWD even if it were closer and possibly less

expensive, due to the potential risk to hydrocarbons in the Buda and Eagleford Formations.

7. The Applicant failed to show that the use or installation of the Baller SWD Lease, Well No. 1 will not endanger or injure oil, gas, or other mineral formations.
 - a. The Applicant proposes to inject a maximum volume of 30,000 bpd into the Edwards and Glen Rose Formations between 8,130 feet and 10,300 feet;
 - b. The proposed Baller SWD Lease, Well No. 1 is approximately 11,000 to 11,116 feet from a major fault at the Buda horizon associated with the Charlotte Jourdanton Fault Zone;
 - c. Cabot has drilled and completed 16 horizontal wells in the Buda and Eagleford Formations between faults associated with the Charlotte Jourdanton Fault Zone and the proposed Baller SWD Lease, Well No. 1;
 - d. Sub-seismic faults have been identified in the Eagleford and Buda Formations of Cabot's wells between the proposed Baller SWD Lease, Well No. 1 and faults associated with the Charlotte Jourdanton Fault Zone;
 - e. The closest sub-seismic fault in a productive formation to the proposed Baller SWD Lease, Well No. 1 is in the Pickens B 16H lateral, approximately 3,500 feet away;
 - f. Cabot's 16 wells located between the proposed Baller SWD Lease, Well No. 1 and faults associated with the Charlotte Jourdanton Fault Zone are hydraulically fracture stimulated; and
 - g. One of Cabot's wells producing oil and gas is also producing water from the Edwards Formation.
8. With proper safeguards, both ground and surface fresh water can be adequately protected from pollution.
 - a. The BUQW occurs at a depth of 4,100 feet at the proposed disposal well location;
 - b. The proposed well construction plan would set 10-3/4 inch surface casing at a depth of 4,200 feet and would be cemented with cement circulated to surface;
 - c. The well would be drilled to a total depth (TD) of 10,350 feet;
 - d. 7-5/8 inch long string casing would be set at a depth of 10,300 feet;

- e. Cement would be pumped behind the long string casing to reach a height of 3,700 feet from surface, 500 feet above the setting depth of the surface casing; and
 - f. No wellbores penetrate the disposal formations within a 1.5 mile radius to act as conduits.
9. No seismic events have been reported within 100 square miles of the proposed disposal well location between May 26, 1900 and June 2, 2015.

CONCLUSIONS OF LAW

1. Resolution of the subject application is a matter committed to the jurisdiction of the Railroad Commission of Texas. TEX. NAT. RES. CODE § 81.051.
2. The form of decision of the subject application meets the requirements of TEX. GOV'T CODE §2001.141.
3. The installation and use of the proposed commercial disposal well is not in the public interest. TEXAS WATER CODE § 27.051(b)(1).
4. The proposed fluid disposal operations may endanger oil, gas or geothermal resources. TEXAS WATER CODE § 27.051(b)(2).
5. The proposed fluid disposal operations will not cause the pollution of freshwater strata. TEXAS WATER CODE § 27.051(b)(3).
6. Seawater Production, LLC has not met its burden of proof, and the application for the Baller SWD Lease, Well No. 1 does not satisfy the requirements of Chapter 27 of the Texas Water Code and the Railroad Commission's Statewide Rule 9.

EXAMINERS' RECOMMENDATION

Based on the above findings of fact and conclusions of law, the Examiners recommend that the application of Seawater Production, LLC for commercial disposal authority pursuant to Statewide Rule 9 for the Baller SWD Lease, Well No. 1, Eagleville (Eagle Ford-1) Field, Atascosa County, Texas, be denied, as set out in the attached Final Order.

Respectfully submitted,



Karl Caldwell
Technical Examiner



John Dodson
Administrative Law Judge