In the United States Court of Federal Claims

Nos. 02-30C, 04-1822C, & 05-249C (consolidated)
(Originally Issued: February 25, 2009)
(Reissued: March 11, 2009)[1]

* *
AMBER RESOURCES CO.,
et al.,

Plaintiffs,

v.

THE UNITED STATES,

Defendant.
* *
ANADARKO E&P CO. LP,
et al.,

Plaintiffs,

v.

THE UNITED STATES,

Defendant.
* *
NYCAL OFFSHORE DEVELOPMENT
CORP.,

Plaintiff,

v.

THE UNITED STATES,

Defendant.

RCFC 59(a)(1) Motion for Reconsideration; Restitution and Rescission; Duty to Return Property in Substantially the Same Condition; Offset for damage to property; Election of Remedies; Offshore Oil and Gas Leases

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[1] The opinion was originally issued on February, 25, 2009, under seal. The parties were given an opportunity to make redactions; none were requested.

* *

Steven J. Rosenbaum, Covington & Burling, Washington, D.C., with whom was *Thomas J. Cosgrove*, also of Washington, D.C., for plaintiff.

Gregg M. Schwind, Trial Attorney, Commercial Litigation Branch, Civil Division, United Stated Department of Justice, Washington, D.C., with whom was *Allison Kidd-Miller*, Trial Attorney, Director *Jeanne E. Davidson*, and Assistant Attorney General *Peter D. Keisler*, for defendant.

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OPINION AND ORDER

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BRUGGINK, *Judge*.

Pending in this breach of contract action are defendant's January 19, 2006 motion for reconsideration of our ruling of December 20, 2005, in which we held that the government had breached its contract with plaintiffs, and defendant's June 6 and October 1, 2008 motions that we take judicial notice of certain recent legislative activity, as well as current fluctuations in the price of oil. After inviting briefing, we denied the motion for reconsideration in part on September 12, 2007, and deferred ruling on the balance pending trial on two issues. Trial took place over a two week period in December 2007 and January 2008. After extensive post-trial briefing, the matter is ready for ruling. This opinion addresses the remainder of the motion for reconsideration and the motions for judicial notice.

PROCEDURAL BACKGROUND

Although we assume the reader's familiarity with our three previous opinions, a brief recital of the procedural history is useful. This breach of contract action was brought by holders of offshore oil and gas leases to remedy the government's anticipatory repudiation that resulted from a 1990 amendment to the Coastal Zone Management Act ("CZMA"), 16 U.S.C. §§ 1451-65 (2006). That amendment ultimately caused the government to cancel previously granted lease suspensions. We held that the leaseholders could treat the cancellation as a total breach, giving them the right of rescission and restitution. *Amber Resources Co. v. United States*, 68 Fed. Cl. 535 (2005) ("*Amber I*"). Thus plaintiffs were entitled to a return of approximately $1.1

billion in up-front "bonus" payments that they, or their predecessors in interest, had paid for the leasehold rights. *Id*. at 560.

Plaintiffs then moved to establish their entitlement to add the cost of their exploratory activities to that restitutionary award and to establish the absence of any benefit to be offset against it. We held that the inclusion of "sunk costs" would be in inconsistent with an award of restitution and rescission. *Amber Resources Co. v. United States*, 73 Fed. Cl. 738, 748 (2006) ("*Amber II*"). We also held that the government was not entitled to any offset for the "benefit" of the opportunity to explore for oil and gas or for damage to the speculative value of the leaseholds. *Id*. at 754-57. With liability and the issue of "sunk costs" resolved, plaintiffs elected to forgo reliance damages and limited their claim to restitution and rescission. The opinions in *Amber I* and *II* have been affirmed in full. *See Amber Resources, Inc. v. United States*, 538 F.3d 1358 (Fed. Cir. 2008) ("*Amber IV*").[2]

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[2]Although not raised by either party, we note that language in the decision of the Federal Circuit on appeal has potential application to the question of whether plaintiffs' actions have compromised the integrity of the lease. On appeal, plaintiffs argued that we erred in not including plaintiffs' sunk costs as part of the restitution remedy. We declined to do so because it only would be clear whether the government benefitted from the investment if plaintiffs could establish that the leases were profitable, yet plaintiffs specifically chose not to pursue an alternative lost profits remedy. The Federal Circuit agreed:

> [B]oth the government and the lessees invested a significant amount of time and resources in developing the leases before the implications of the 1990 CZMA amendments became clear. Under these circumstances, where both parties have participated in apparent good faith for the better part of 20 years, the purpose of restitution is adequately served by having the government return the initial payments; it is not clear that the net effect of the parties' performance during the pendency of the leases has been to confer a benefit on the government at the expense of the lessees.

Amber IV, 538 F.3d at 1381.

In affirming our limitation of the restitution remedy to a return of the (continued...)

On January 11, 2007, we ordered entry of final judgment under Rule 54(b) of the Rules of the Court of Federal Claims ("RCFC") as to nearly all of the leases.[3] Lease OCS P-0452 ("lease 452"), the subject of this opinion, was excluded because the government previously had filed a motion for reconsideration of the court's rescission of that lease. We opened consideration of that motion because it is apparent that, if defendant's allegations are true, lease 452 could not be returned in substantially the same condition as when Delta Petroleum Corporation ("Delta" or "plaintiff") received it and plaintiff elected to continue performance by taking actions inconsistent with a total breach.[4] We concluded that trial was necessary to resolve questions of: (1) whether lease 452 can be returned in substantially the same condition; and (2) whether plaintiff elected to continue performance on lease 452. *Amber Resources Co. v. United States*, 78 Fed. Cl. 508, 518 (2007) ("*Amber III*"). We also denied defendant's motion as to its entitlement to an offset for loss of speculative value or the benefit of explorative opportunity. *Id*.

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[2](...continued)
initial payment, however, the Federal Circuit also suggested that our holding was predicated on a finding that "a return to the status quo ante in this case is impossible given that the lessees cannot return the leases to the government in the same condition in which they received them." *Id*. at 1380. We do not take this statement as conclusive of defendant's argument here. The context for the statement was plaintiffs' assertion on appeal that they should be credited with having invested hundreds of millions of dollars in oil exploration. The Federal Circuit refused to assume that the investment benefitted the government. The reverse should also be true: the mere fact of what the government characterizes as unsuccessful exploration should not be assumed to be detrimental to the government's interests. The most objective measure of whether the lease has been impacted is the extent of drainage. Only in that respect, would the defendant have suffered a tangible injury.

[3] The excluded leases are all leases owned by plaintiff NYCAL Offshore Development Corp., four leases still subject to administrative appeal, and lease OCS P-452.

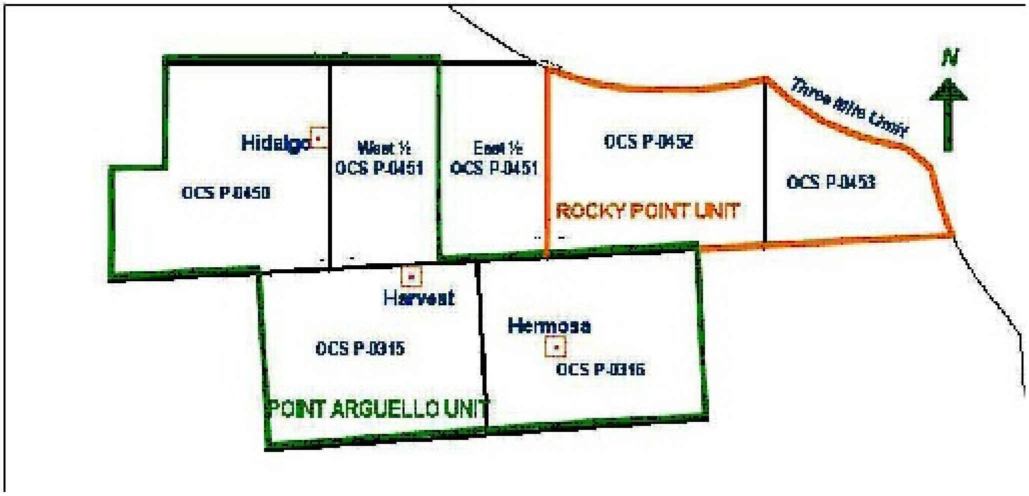
[4]Delta is the only relevant plaintiff in this opinion, so despite the numerous other plaintiffs, we refer to Delta as the singular plaintiff for purposes of this opinion.

Trial was held on December 3-6, 2007, and January 7-11, 2008. For the reasons explained herein, the motion for reconsideration is granted in part and denied in part. We deny defendant's motion for reconsideration as to the rescission of lease 452. The motion is granted as to the government's entitlement to an offset to reimburse it for drainage from lease 452 via production from the eastern half of lease OCS P-451 ("451").

Also pending are defendant's motions suggesting that the court take judicial notice of three things: the July 14, 2008 action by the President to rescind the executive prohibition on federal offshore leasing; the September 24, 2008 vote of the House of Representatives in favor of an appropriations bill that did not extend the Congressional moratorium on spending on off-shore oil leasing, along with the Senate's approval of the same bill and the President's signature into law of the same on September 30, 2008; and fluctuations of the price of oil between early 2004 and September 16, 2008 from as low as $40 to as high as $145 per barrel. Because these facts are not reasonably subject to dispute and involve matters of public record, we grant the motions to take judicial notice. Whether these facts have significance to the outcome is discussed, as appropriate, below.

FACTUAL BACKGROUND

The leases involved in this suit are located in federal waters on the outer continental shelf in the Santa Barbara channel off the coast of southern California. Lease 451 lies directly adjacent to the west side of lease 452. Lease 453 adjoins lease 452 to the east. To the west of least 451 lies lease 450. The leases are organized into operating units to facilitate development and exploitation. Each unit is governed by a unit agreement by which the leaseholders agree to share costs and profits and designate a unit operator.



Pl.'s Ex. 79 at 3.[5]

Lease 452 was issued by the United States in 1982 to Chevron USA ("Chevron") and Phillips Petroleum Company ("Phillips") in equal shares. Chevron and Phillips paid $91,986,800 to acquire the lease (the bonus payment). In 1985, lease 452 became one of the constituent leases of the then-formed Rocky Point Unit. A unit is an administrative concept enforced by the Minerals Management Service ("MMS"), the federal agency responsible for the administration of federal oil and gas leases throughout the United States, both on and offshore.

The Rocky Point Unit and Field

As of 1999, the Rocky Point Unit consisted of the eastern half of lease 451, lease 452, and lease 453. There are two known fields within the Rocky Point Unit–Rocky Point and Jalama. The Rocky Point field underlies the eastern half of lease 451 and parts of lease 452. The Jalama field underlies parts of leases 452 and 453. All of the wells on the eastern half of lease 451 are drilled into the Rocky Point field. Jalama remains untapped.

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[5] The page citations to exhibits will refer first, if available, to the bates page number, or, if unavailable, to the sequential page number of the specific page within the exhibit.

Whiting Petroleum Company ("Whiting") was the operator of the unit. Arguello, Inc., a wholly owned subsidiary of Plains Exploration & Production ("Plains"), succeeded Whiting as the operator of the Rocky Point Unit on November 15, 2000. The western half of lease 451 is part of the adjacent Point Arguello Unit, which also contains leases 450, 315, and 316. Point Arguello is operated by Arguello. The Point Arguello Unit has been producing oil and gas since 1991. In 1999, Delta acquired Whiting's 6.06% working interest in Point Arguello and Whiting's record title interests in the Rocky Point leases.[6] Delta thus acquired an 11.11% interest in the east half of lease 451 and 100% record title to leases 452 and 453.

The oil productive formations within the Rocky Point and Jalama fields are within the Monterey and Sisquoc rock layers, the Sisquoc layer sitting above the Monterey. There has been substantial oil production off the coast of California from other fields containing these same formations. For example, the Point Arguello Unit, to the west and south of lease 451, has produced over 170 million barrels of oil equivalent[7] through June 2007.

Exploration for offshore oil involves several scientific methods. The principal one is the use of seismic readings, obtained by recording the results of shockwaves fired from vessels on the surface of the ocean. These waves penetrate deep into the earth's mantle and are reflected up and recorded, leaving a cross-sectional image of the various layers of rock formation. The seismic data used in this case was obtained in the early 1980's, although it was reprocessed in 2002.

Other data is obtained by drilling. Not only are wells intended to test the production from different zones, but various devices can be used within the well bore to assess the likelihood of finding productive zones. For example, electronic well logs ("SONDE logs") subject rock along the well bore to electric stimulation as a means of determining the conductivity of the rock. Drill stem tests ("DSTs") isolate specific intervals of a well to measure fluid inflow, thereby establishing whether and at what depth oil and water are

[6] Working interests are distinct from record title interests. Working interests are established by contract among the lessees and correspond to their respective shares in costs and returns.

[7] Barrels of oil equivalent means both barrels of oil and the volume of natural gas produced equivalent to a barrel of oil.

encountered as well as the rate of fluid flow. Mud logs analyze the slurry coming out of the well bore to determine the composition of the material being drilled.

Two other related types of data figured prominently in the testimony at trial: dipmeter data and FMI logs. Both record the inclination of sedimentary rock beds which then gives an indication of the presence of fracturing and faults.

A great deal of information was generated during the 1980's and 1990's about the Rocky Point Unit. Scott Haberman, one of plaintiff's experts, notes in his report that there is "far more reliable data available to perform a geological interpretation for the Rocky Point and Jalama fields than is typical for most reservoirs in the United States." Pl.'s Ex. 114 at 40. Based on this information, which will be examined in greater detail below, the entities which owned the Rocky Point Unit leases concluded that there were significant quantities of recoverable oil and gas within the Sisquoc and Monterey formations on the Rocky Point and Jalama fields.

Multiple DST tests were conducted in the exploratory wells in the Rocky Point field during the early stages of exploration before any production wells were drilled. DST tests for the first exploratory well, 451-1[8], encountered water in the PA22 zone, approximately 7100 to 7200 feet of vertical distance from the sea floor. Oil flow rates in various zones ranged from, at best, 1629 barrels of oil per day ("BOPD") to, at worst, 150 BOPD. The 451-1 well is located in the "Main Pool"[9] in the northern most area of the Rocky Point formation on lease 451 and is located very near the lease 452 line.

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[8] The naming convention used for some of the exploratory wells, e.g. 451-1, informs the reader that the well was exploratory, was the first drilled on Rocky Point, and that it was drilled on lease 451.

[9] The term "pool" refers to a section of an oil field that is geologically separate from other areas of the same field. The names of the pools described here were provided by plaintiff's experts. Although there is disagreement as to the existence and names of the particular pools, about which much more will be discussed later, we find plaintiff's designations of the various pools to be useful and reliable.

The 451-2 exploratory well is located to the southwest of the 451-1 well in the "Central Pool." It is significantly west of the lease line. The DST tests for the 451-2 well encountered water at a depth of 7118 feet. The highest known oil was found at 7023 feet. Three separate DSTs conducted in different intervals found flow rates of approximately 600 BOPD.

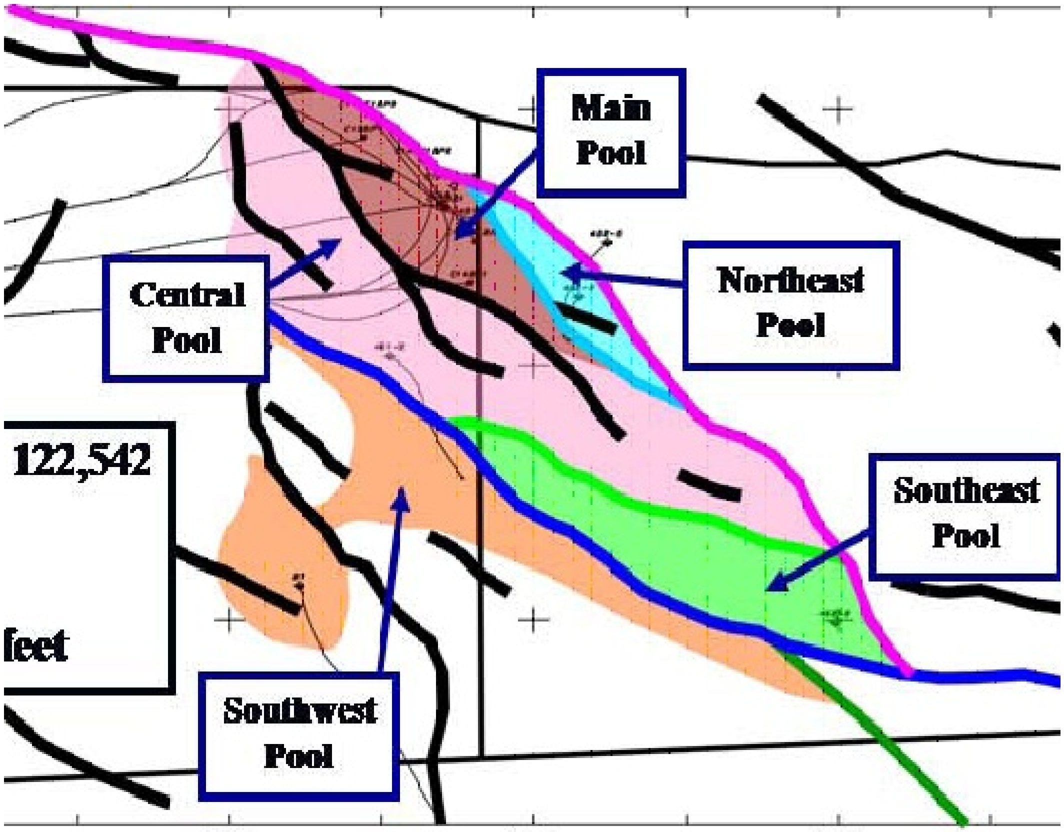
The 452-3 exploratory well is located in the "Northeast Pool" on lease 452. It encountered its highest known water at 6810 feet and lowest known oil at a depth of 6637 feet. Flow rates were initially low, but additional tests run after the well was acidized established rates in various zones from 839 to 1100 BOPD. The lowest zone tested, 6346-6637 feet, flowed 537 barrels of water per day.

The 452-5 well, also located in the Northeast Pool on lease 452, hit water at a depth of 6617 feet. One DST, performed between 5792 and 6187 feet, showed a 3500 BOPD oil flow rate. In contrast, a DST performed between 5430 and 5704 feet was almost entirely dry of any fluid. The total rate for all productive zones tested by the 452-5 well was approximately 4200 BOPD. The oil encountered was also of a higher gravity (lighter oil), marking a greater potential for recovery.[10]

The B-7 exploratory well was the lone well drilled in a separate area of the Rocky Point field on lease 451 known as the "Southwest Pool." It was performance tested for one day along the entire perforated interval. The interval began at 7008 feet of depth and ended at 7930 feet. The test resulted in 250 BOPD and 103 barrels of water.

The following map view of the Rocky Point field, as interpreted by plaintiff, is useful to visualize the location of the pools and wells described above. The vertical central line marks the border between lease 451 (on the left) and lease 452.

[10]There is a relationship between recovery and oil gravity. The heavier the oil, the more viscous it becomes and the harder to produce.



Pl.'s Ex. 116 at 41.

The Norton Litigation and Its Impact on Rocky Point

OCS leases are issued for a primary term of five years and then continue for the duration of oil and gas production or drilling operations. By statute, the running of the primary term is suspended while exploration or development is taking place.[11] Leases 452 and 453 were subject to suspensions issued by MMS from January 1, 1993 through November 1999, during which time the California Offshore Oil and Gas Energy Resources ("COOGER") study was performed.[12] Lease 451 was not suspended because

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[11] 43 U.S.C. sections 1337(b)(5) and 1344 require the Secretary to adopt regulations for the suspension of OCS leases during exploratory and developmental activity.

[12] Numerous other leases were similarly suspended during the pendency of the COOGER study as well.

its western half was part of the producing Point Arguello Unit. The whole of lease 451 was thus considered to be in production.

As the COOGER study neared completion, lease owners and MMS began working to issue new suspensions to allow for further exploration and development. During November 1999, MMS approved suspension requests for leases 452 and 453. These suspensions were challenged by the state of California in federal district court. *See California v. Norton*, 150 F. Supp. 2d 1046 (N.D. Cal. 2001) ("*Norton I*"), *aff'd*, 311 F.3d 1162 (9th Cir. 2002). Despite the pendency of the *Norton* suit, the Point Arguello and Rocky Point owners continued with their plans for development of Rocky Point.

Whiting submitted the Rocky Point Unit Development Project Description to MMS on May 24, 2000. The May 2000 development plan called for between 14 and 20 wells targeted at the Rocky Point Field. None were planned for the Jalama field. A chart in the project proposal shows the bottom hole locations of ten of the projected production wells. Most were located on lease 452. Only one of the wells projected for lease 451 had a bottom hole location within 500 feet of the 452 lease line.

In September 2000, the Point Arguello and Rocky Point owners entered into the Rocky Point Agreement, whereby they agreed to use the existing Point Arguello platforms to drill for production from the Rocky Point field.[13] In return for the use of the Point Arguello platforms, the Point Arguello owners were given the right to participate in any wells that were drilled on Rocky Point in the same percentage working interests as they held in Point Arguello. Delta thus had a 6.06% working interest (its share of net profits) in the wells drilled on the eastern half of lease 451.

In May 2001, Plains/Arguello, now the operator of Rocky Point, submitted "Revisions to the Point Arguello Field Development and Production Plans to Include the Rocky Point Unit Development to MMS." The 2001 revisions once again planned fourteen to twenty wells to be drilled in three

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[13] Three production platforms are located in Point Arguello: Platforms Hermosa, Hidalgo, and Harvest. There are no platforms on the Rocky Point leases. Exploratory and production wells on all of the involved leases are drilled via extended reach technology from the Point Arguello platforms.

phases. The first two phases would cover fourteen initial wells to be drilled on leases 451 and 452. The six Phase III wells were conditional upon the success of the initial wells. The Project Description included bottom hole locations for all fourteen of the Phase I and II wells. Five of the fourteen were to be drilled on lease 451. Consistent with the 2000 Project Description, only one of the five 451 wells was to end within 500 feet of the lease line. Both the 2000 and 2001 plans were developed on the assumption that drilling could take place on lease 452.

On June 21, 2001, the United States District Court for the District of Northern California ordered MMS to end previously-granted suspensions of numerous undeveloped leases off the coast of California, including the Rocky Point Unit. *Norton*, 150 F. Supp. 2d at 1057. MMS complied and ordered suspension of all physical activities on the leases. As a result, the owners filed complaints in this court on January 9, 2002, alleging anticipatory breach.

With the original plan for Rocky Point development effectively blocked by the *Norton* order, Plains, its partners, and MMS developed a scaled-down plan to develop the eastern half of 451 separate from the litigation-encumbered 452 and 453 leases. Lease 451 remained open for production because its western half was part of the producing Point Arguello Unit and was not subject to the *Norton* suit.

The plan originated internally at Plains and was kept confidential for a time. Plains began referring to the project as the "451 only" plan as early as the beginning of 2002. *See* Def.'s Ex. 84 (e-mail from Thomas Gladney to Bob Wilson[14], Jan. 16, 2002). The title, "451 only," reflected Plains' recognition that it was quite possible that the eastern half of 451 might be the only area of Rocky Point ever developed. *Id.* at ARGUELLO-00104 ("[lease 451] might be the only developable area for some time or forever."). Thus, it was important from the beginning of the project planning that the project be economically viable with wells located on lease 451 alone. From Plains' perspective, this meant that cross-lease drainage had to considered as a factor in improving the economics. Project manager Gladney made clear in the same January 2002 e-mail that wells should be considered with a "bias to lease line"

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[14] Thomas Gladney was Plains' project manager at that time and eventually was promoted to vice president. Bob Wilson served as Plains' exploitation manager on the project.

and the "possibility of greater recovery from cross lease drainage." *Id*. at ARGUELLO-00103. Plains, as operator, was chiefly responsible for the initial supporting geological work and selection of well locations. These emails were sent only to and by Plains employees, and there is no evidence that they were seen by anyone from Delta.

During this time, Plains received the results of a reprocessing of seismic data. The new data allowed for an improved interpretation of that data and a better understanding of the subsurface geology. As a result of this re-analysis, wells which had been planned for a portion of the Rocky Point field known as the "southeast pool," which is located completely on lease 452, were determined to be less promising than earlier thought.

Mr. Robert Huguenard testified. He was Plains' operations manager in 2000, and in 2002 became vice president of Arguello for the Pacific Development Unit and Plains' project manager for Plains' Point Arguello and Rocky Point operations. Once he assumed the position of project manager, he was the highest-ranking Plains representative in California. He recalled internal Plains' discussions regarding the maximization of cross-lease drainage. He testified that Gladney's instruction, first as project manager and then after that as a vice president, was taken as a "directive" and was followed by the geoscientists and engineers. Trial transcript (hereinafter "Tr.") at 1420. "[I]t was clear that [lease 452] was out of play . . . . So, I think the well placement was strategically placed on the structure with the concept of maximizing recovery from the structure without regard to lease lines . . . ." *Id*. at 1421. Mr. Huegenard later testified that this cross-lease directive was never "rescinded or countermanded" and thus remained in place throughout the planning of the project. *Id*. at 2521-22.

A two-phased approach was settled upon. The first phase would include eight wells to be drilled on the eastern half of lease 451. The second phase would continue after resolution of the *Norton* litigation with additional wells to be drilled on lease 452 and possibly 453. The focus of the plan was, however, the 451 development. In May of 2002, in a letter from Mr. Huegenard[15] to MMS discussing the two phased approach of the August 2002 DPP Revisions, he stated that quick action on the first phase was critical because it appeared that, based upon the "geo-technical" work conducted by

[15] Mr. Huguenard had by this point assumed the position of project manager.

Plains, "a substantial majority of the economically recoverable reserves from [Rocky Point] can be produced from [lease 451]." Def.'s Ex.17. The new plan was submitted to MMS on August 9, 2002. Pl.'s Ex. 5 (Revisions to the Point Arguello Field Development and Production Plans to Include the Rocky Point Unit Lease OCS-P 0451 Development) ("August 2002 DPP Revisions").

A comparison between the May 2001 and August 2002 project descriptions reflects an increase in the number of wells on lease 451 (eight as opposed to five) and a decrease in the number proposed on lease 452 (three as opposed to nine). The latter number was, in addition, contingent on removal of the development ban. None of the wells planned for lease 452 in the new DPP were within the southeast pool. The locations and numbering of the wells also changed. The number of wells proposed for lease 451 with bottom hole locations within 500 feet of lease 452 remained at only one, however, despite the *Norton* bar to development of lease 452.

What these changes do not reflect is evidence of a change in strategy to drain lease 452 through a shifting of wells on lease 451. The number of wells "biased" towards the lease line did not increase. This is in agreement with the testimony of Mr. Huguenard. When asked by the court what effect the inability to drill on lease 452 had on the well locations for lease 451, he answered: "I would say that the wells that were proposed on [lease 451] after [leases 452 and 453] became unavailable were only adjusted in a very minor fashion. I would say little or no influence. I would say there was more influence by the seismic reinterpretation than by the [leases 452 and 453] coming out of play." Tr. 1266.[16]

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[16] Mr. Huguenard similarly testified later on cross-examination that, "Well certainly the intent was to make all the oil and gas that was possible to make. And to the extent that there was oil available on [452], which could migrate in the time that we were there, it's not that we intended to exclude or reject those barrels. We would have taken them had they come. Was the intent to, in any well location or any well plan, to specifically go after [452] barrels, I would say no. The plan was always to get the well location[s] in such a way that we would get the most barrels from the available rock, period." Tr. 2561.

The development revision was sent to the California Coastal Commission ("CCC") and to Santa Barbara County for approval.[17] The state and county immediately raised two concerns. First, there was concern that any development and drainage on the eastern half of lease 451 would mean that all of the Rocky Point Unit was "in development," including lease 452. Pl.'s Ex. 15 (Letter from the County of Santa Barbara to Arguello, September 12, 2002). Second, the agencies were alarmed by the potential for Delta to argue an entitlement to develop lease 452 due to development on lease 451, especially with the possibility of cross-lease drainage. *Id*.

Discussions regarding the state and county's concerns took place both among the leaseholders and between MMS and Plains for several months. The discussions with MMS resulted in the idea of an adjustment to the Rocky Point Unit. In a presentation dated September 25, 2002, Plains informed the Point Arguello Reservoir Management Team that MMS had "suggested dissolving the Rocky Point unit or removing 451 from the RPU . . . ." Def.'s Ex. 23 at DELTA-00686. *See also* Def.'s Ex. 24 at ARGUELLO-00606 (September 26, 2002 Point Arguello Project: Annual Unit and Partnership Management Meeting presentation); Pl.'s Ex. 29 at ARGUELLO-00116 (e-mail from CCC to John Pierson[18], October 21, 2002). The adjustment eventually settled upon was the contraction of the eastern half of lease 451 out of the Rocky Point Unit. The record is uncontradicted that the contraction solution originated with MMS.

In order to effectuate a contraction, the original Rocky Point Agreement had to be modified. Amendment No. 1 was executed in February and March 2003 by the Point Arguello and Rocky Point owners. The Amendment detailed the following: Delta agreed to allow Plains to request that MMS contract the eastern half of lease 451 from the Rocky Point Unit; if MMS approved the contraction, the owners would treat the eastern half as subject to the Rocky Point Agreement; and Delta agreed to pay 20% of its net share of damages in the present suit to the Point Arguello owners. Plains and Delta entered into a supplemental agreement whereby Delta agreed to provide cooperation "in regard to Arguello's efforts to obtain all necessary governmental permits," including support for plans to place wells closer than

[17] This was required by the CZMA. *See* 16 U.S.C. § 1456(c)(3)(B) (2006).

[18] John Pierson was a consultant hired by Plains to assist in the permitting process for the Rocky Point development.

500 feet from the lease line and to provide a letter of support to the state and county agencies. Def.'s Ex.31 at PLAINS-02048 (Agreement Concerning the Conditional Withdrawal of the Eastern Half of Lease OCS-P 451 from the Rocky Point Unit). The referenced letter would inform the agencies that Delta had agreed to waive any right to develop leases 452 and 453 that might otherwise be argued due to oil drainage from lease 452 resulting from drilling on 451.

Plains submitted a letter to MMS requesting contraction on February 20, 2003. That request was followed by MMS's affirmative demand that the eastern half of lease 451 be contracted. MMS had the right to demand contraction of any part of the Rocky Point Unit under Article 10 of the Rocky Point Unit Agreement whenever it was necessary to "conform with the purposes of this Agreement." Def.'s Ex.3 at ARGUELLO-00051. As is made clear in these documents, the effort to contract out the eastern half of lease 451 was, at the very least, a joint effort between the leaseholders and MMS. Both stood to gain from the proposed development. As explained by Dr. Lisle Reed, MMS Regional Director, the United States benefitted both from the additional oil production available to its citizens and in the receipt of royalties[19] by the government.

The second concern raised by the state and county during the permitting and contraction process was that of the potential for Delta to claim entitlement to develop leases 452 and 453 due to cross-lease drainage from lease 451. The state proposed that Delta waive any rights it held in this regard. Mr. Huguenard made an inquiry to Plains' exploitation manager, Bob Wilson, and Plains' staff geologist, Greg Yvarra, concerning the drainage issue. In an e-mail dated September 17, 2002, Huguenard asked: "1) What is the distance for each of the eight phase 1 wells from the P-0452 line[?] . . . . 2) How many of those wells would drain [lease 452]? Best professional estimate." Def.'s Ex.77. Mr. Yvarra replied late that same day and identified three wells, based on a 60-acre drainage area, that would drain from lease 452. *Id*. (e-mail from Yvarra to Huguenard). The wells were RP3 (131 feet from lease line), RP10 (564 feet), and RP14 (541 feet). *Id*. Mr. Wilson also responded by e-mail on September 17, identifying the same three wells. Wilson attached drainage calculations for those wells with the disclaimer that the numbers were based

[19] The United States receives a one-sixth or 16.67% royalty on all oil and gas produced.

on factually incorrect "vertical well bores, symmetrical drainage, etc." Pl.'s Ex.69. He stated, however, that this sort of calculation reflects "the kind of simplistic view that we may have to defend against if the County/CCC makes it an issue." *Id*. Based on those assumptions, Wilson estimated that RP3 would recover approximately 41% of reserves from lease 452. RP10 and RP14 were approximated at 14% recovery from lease 452. Mr. Wilson attached a graph and vertical well bore schematic further explaining these simplistic calculations.

Wilson also sent an e-mail to Tom Gladney summarizing the discussion between himself, Mr. Yvarra and Mr. Huguenard. In it, he stated that there was obvious potential for cross-lease drainage from RP3 and that "in theory it could be 41% of recovery." Pl.'s Ex.28. He qualified that estimate by stating that that potential was mitigated by "the probability that the drainage area will not be circular, but elliptical or oval with the major axis aligned with the regional fracture trend." *Id*. Additionally, he pointed out that the reservoir penetration would be west to east, meaning that only the far end of the well bore would come within 131 feet of the line.[20] Wilson concluded by recommending that Plains not pursue a scientific debate on the likelihood and estimates of cross-lease drainage as it would "lead to an esoteric debate with near-zero potential for a solid conclusion." *Id*. This was an effort, in short, to develop a worst case scenario in anticipation of the state's argument in the event it was based on what Plains viewed as a simplistic, i.e., unscientific, approach.

A waiver was agreed to as the best solution. Consistent with its supplemental agreement with Plains, Delta provided a waiver letter concurrent with the contraction request on February 20, 2003. The letter was signed by the president and CEO of Delta, Roger Parker, and was sent to MMS, CCC, and the Santa Barbara County Energy Division. Mr. Parker testified that Delta agreed to the waiver letter, in part, because it was unconcerned with any potential cross-lease drainage. Tr. 1653.[21]

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[20] As other witnesses further explained, the well bore is neither vertical nor horizontal. It runs at an angle, and the well casing is perforated over hundreds of feet of its length, away from the bottom of the hole.

[21] Delta's cooperation in efforts to obtain permitting for the new 451 development proved important for an additional reason. MMS is required to (continued...)

Plains also submitted a further revision to its development proposal. The February 2003 plan, like the 2002 DPP Revision, called for the same eight wells to be drilled on lease 451, one of which was to be drilled within 500 feet of the boundary line. The principal difference was that the three wells on lease 452 were dropped altogether. With the unitization and drainage issues resolved, the state, county, and MMS provided their approvals in August 2003.

Drilling on Lease 451

Shortly after Plains acquired the necessary approvals, it gave a presentation to the Point Arguello Unit Reservoir Management Team. The presentation proposed drilling at least eight production wells. Geologic information was furnished along with the estimated volume of productive rock and oil reserves. The reserves estimated for the portion of the eastern half of 451 where the field is located were 19,348,571 barrels of oil. This was based on a recovery factor of fifty barrels per acre feet of productive rock. Because the presentation was an effort to solicit participation in the development of those wells, data was provided as to cost and expected return. Included as a footnote on one page of the presentation was a reference to the possibility of cross-lease drainage from the portion of the Rocky Point field on lease 452: "A conservative 1 to 2 [million barrels] of tract 452 reserves could be recovered by 451 wells." Def.'s Ex. 48 at PLAINS-03515.

This information, which took the form of a Power Point presentation, was made in person to some of the Point Arguello and Rocky Point owners. As Delta was not a member of the Point Arguello Unit Reservoir Management Team, it was not represented at the meeting. A digital copy of the presentation was sent to it, however. Kent Lina, who was at that time Senior Vice President of Engineering at Delta, received Delta's copy of the CD but testified that, although he opened it, he did not see the volume estimates and was unaware

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[21](...continued)
consider and protect the correlative rights of neighboring leaseholders when in the process of approving new development plans. This is particularly relevant when a development calls for the drilling of a well within 500 feet of a lease that is not part of the proposed development. MMS is required to take into consideration the assent or not of the neighboring lease holders in such an instance. *See* 30 C.F.R. § 250.1101(b) (2007). Delta's waiver letter eliminated any possible concern on the part of MMS in this regard.

of the estimates of cross-lease drainage.[22] Mr. Lina testified that he recalled opening the presentation one time in connection with a conversation he was having with Roger Parker, Delta's president and CEO, but that it was for the purpose of extracting one page of figures for a typical Rocky Point well.

Mr. Parker testified concerning the analysis done by him and Kent Lina regarding cross-lease drainage. He testified that Delta's acquiescence to the 451 development through the supplemental agreement with Plains and the waiver letter made sense given the geological and geophysical realities present in the Monterey formation. The Monterey oil fields are fractured reservoirs that produce oil and gas through a heterogeneous fracture and fault matrix. As we discuss below, there is a directional bias to fluid flow. For that and other reasons, single wells cannot be assumed to drain large volumes of rock. Mr. Parker testified that the extent of the drainage area of any one well is and was limited by the geological properties of the Monterey formations and especially by the presence of frequent large and small faulting throughout the reservoir. Based on their twenty years of experience operating in fractured reservoirs,[23] Mr. Parker concluded that the likelihood of cross-lease drainage from the proposed bore paths on the east half of lease 451 was virtually nil. Tr. 1641-42 ("We concluded that there would be none."). Mr. Lina recommended Delta's involvement with the project and the company ultimately agreed to contribute to each of the wells drilled on the eastern half of lease 451.[24]

Likewise, Steven Renke, a reservoir engineer for Devon Energy ("Devon"), one of the other participants in the 451 project, testified that it was Devon's belief that once the development of lease 452 "went off the table, to me, drainage wasn't much of an issue." Tr. 1506. He testified that it was his belief that drainage from lease 452 was not going to be significant. Devon

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[22]We found him to be a credible witness and have no reason to doubt his recollection or the accuracy of his recall.

[23] *See* Tr. 1638-39, 1685.

[24]The government relies on Mr. Huguenard's testimony to make its point that "Delta expressed 'no concerns' . . . about the possibility that lease 452 would be drained by the wells proposed on lease 451." Def.'s Post-Trial Br. 24. We note that the context of the questioning to Mr. Huguenard involved cross-lease drainage. We do not view his response as affirmation by Delta that lease 452 would be "drained."

holds the second largest interest in the Point Arguello Unit and in the wells drilled on the eastern half of lease 451. Mr. Renke was the principal person at Devon in charge of preparing internal Devon authorizations for expenditure ("AFEs") for proposed wells and making economic recommendations concerning those wells. *Id*. at 1477-79. Mr. Renke recommended, and Devon ultimately approved, each of the AFEs for the wells on the eastern half of lease 451. In making his economic recommendations, Mr. Renke testified that he did not assume that reserves underlying lease 452 would be recovered. *Id*. at 1505-06 ("when we couldn't drill on 452, we didn't make that $50 million investment . . . , then we weren't going [to] get those reserves").

MMS held a similar view of the physical realities and likelihood of cross-lease drainage. Lisle Reed, MMS Regional Director, stated that his staff informed him that cross-lease drainage would be "very minimal, an insignificant quantity." Jt. Ex. 1 (Reed Dep.) 65-66. He testified that maximizing cross-lease drainage was not the aim of the staff at MMS. *Id*. at 66 ("I contended that was not the objective here, and my staff contended that where wells were placed, this was going to be a minimal amount of drainage."). Mr. Huguenard preserved a record of a discussion he had with MMS Director Lisle Reed concerning a meeting that MMS had with state officials regarding Rocky Point. Mr. Huguenard reported that, when asked about drainage by the state, Reed answered: "all production which comes from the proposed development of 0451 will be treated as 0451 production and this will have no impact . . . on the adjacent block." Def.'s Ex. 25 at PLAINS-03517. Reed further explained that, although the wells should be placed as if leases 452 and 453 would not ever come into production, cross-lease drainage "would not in any way be president [sic] setting since there is ongoing drainage from adjacent non producing blocks in many locations in OCS waters. There would likewise be no effect on any ongoing litigation or future development possibilities for the adjacent blocks with or without drainage." *Id*. at PLAINS-03518.

Plains, as operator, sent AFEs for each well drilled on lease 451 to all of its partners to solicit their involvement in both the costs and returns from the wells. Ultimately, all of the partners agreed to participate in all of the wells, with the exception of the sixth well, in which Kerr McGee declined to participate.

The AFEs all contained detailed cost estimates, a timeline for completion, and a planned path of the well bore. The first AFE, for the C-12 well, was dated October 6, 2003. It contained a timeline of pre-drilling and drilling processes, a detailed description of the anticipated progress, a trajectory of the drilling, and a cost breakdown. It did not include any information with regard to the structural geology or the anticipated recovery.

The next AFE, for the C-13 well, dated July 22, 2004, contained the same type of information. It included additional attachments: a geological contour map of the PA-17 layer with the paths of the C-12 and C-13 wells transposed upon it; a cross-sectional schematic of the well path, focusing on the productive interval; and a map-view of the entire distance of the C-12 and C-13 wells.

The C-14 AFE, dated October 26, 2004, contained the same type of information as the previous three. The C-14 well was the final production version of the RP-3 well, which ended only 131 feet from the lease line. The three attached schematic illustrations each show the path of the well ending almost directly on the lease line. None of the illustrations show any apparent barrier to fluid migration across the boundary.

The C-14 well was a failure and never went into full production. Instead, the next well drilled was a sidetrack from the original C-14 path. The AFE for the C-14 sidetrack ("C-14ST") was dated July 11, 2006. The choice was also made to use the C-14ST as a replacement for the originally-proposed and subsequently-approved B-19 well. The cover letter indicated that the well would traverse two faults, "which we expect to add to the fracture network so necessary for good production." Def.'s Ex. 89 at ARGUELLO-00294. A small map view provided on the next page of the AFE showed that the two faults were located near the northeastern corner of lease 451. The well, as drilled however, never actually crossed the second, more northern fault.

The C-14ST well, unlike the previous three wells, was not drilled in a straight line trending west to east. As made clear from the diagrams in the AFE, it made a dramatic curve in a northwesterly direction. As a result, the productive interval was oriented almost perpendicular to that of the earlier straight-line wells. Another map view diagram, included later in the AFE, showed the curving well path actually trespassing onto lease 452 before ending back on lease 451. This is in contrast to the illustration on the second page of the AFE. Plains' operations manager, Tom Goeres, testified that initially "the drilling engineer erroneously plotted a path through the offsetting lease, not realizing that . . . that was not acceptable." Tr. 2490. Mr. Goeres further testified that, at some point, the mistake was identified and the well trajectory corrected. The well, as drilled, did not cross the line.

The fifth well drilled was a sidetrack of the C-13 well. Its AFE is dated November 1, 2005. It was planned to "complete the drainage of reserves from the PA-17 to the oil water contact on the west side of the sealing fault, within the Northeast corner of OCS P-0451." Def.'s Ex. 88 at ARGUELLO-00207. It was also a curved well but trended northwest to southeast ending near the 452 line. Despite the proximity to the lease line, the above quoted AFE language makes clear that the well was primarily intended to drain reserves located on lease 451.

The sixth and final well, C-15, was preceded by an AFE dated January 26, 2006. It was aimed at the same area of rock as C-13ST and C-14ST: "The C-15 well will allow us to recover additional reserves below and to the west of the intersection of the C-13ST and C-14ST well paths. C-15 will establish production both inside and outside of the wedge shaped fault block from which C-13ST and C-14ST are both currently producing." Def.'s Ex. 90 at ARGUELLO-00345. The well path is quite similar to that of the C-13ST but is less angled as it travels northwest to southeast.

Two wells, B-19 and B-20, originally planned to have been drilled from Platform Hermosa were dropped due to the poor performance of the prior wells and the overlap, at least in the case of the B-19, with the area drained by the C-14ST well. The area to the south of the current production wells was left undeveloped because it posed "too high a risk." Tr. 1454.

The six production wells were drilled between June 2004 and the end of 2006. Four of these wells are still in production today: C-12, C-13ST, C-14ST, and C-15. Three, C-12, C-13, C-14,[25] were drilled between June 2004 and January 2005. These wells terminated 600, 1900 and 115 feet from the lease line. The C-13 and C-14 sidetracks were completed between the fall of 2005 and winter of 2006, resulting in the new wells C-13ST and C-14ST. C-13ST terminated more than 500 feet from the 452 lease line, but part of the productive interval was within 500 feet. C-14ST terminated 550 feet from the

[25]The designation "C" reflects wells drilled from Platform Hidalgo. The "B" designation for later wells reflects those drilled from Platform Hermosa. "A" represents wells drilled from the Harvest Platform.

lease line. The results on these two re-drills were better than their predecessors but still not what was hoped for. The final well, C-15, was drilled in spring 2006. It terminated 500 feet from the lease line. It was also a poor producer. The average daily production from the wells was as follows:

C-12	3390 BOPD
C-13	2081 BOPD
C-14	23 BOPD
C-14ST	1861 BOPD
C-13ST	1579 BOPD
C-15	253 BOPD

The parties' experts basically agree that the wells on lease 451 will ultimately produce between 2.5 and 2.6 million barrels of oil, considerably less than the nearly twenty million barrels anticipated. They disagree, however, on two key variables: how much of this production will come from lease 452, and how large the reserves are on lease 452. Once there is more certainty as to these two variables, the court will know what proportion of the reserves on lease 452 will likely be removed via the wells on lease 451. Once that proportion is better understood, the court will be a better position to assess whether that ratio represents a significant diminution in the value of lease 452. The parties' presentations with respect to those two issues were mediated through their respective experts. Although those presentations fundamentally pose fact questions, we deal with them below in the discussion section.

DISCUSSION

We granted reconsideration to hear evidence on two possible theories: first, that Delta will be unable to return lease 451 in substantially the same condition as when it was acquired; and second, that Delta elected to treat defendant's breach as partial, thereby foregoing the remedy of rescission. Defendant's briefing on the motion for reconsideration, its pre-trial briefing, and the evidence at trial focused on the first of these defenses. Because defendant's post-trial briefing now emphasizes the election defense, we begin with that argument.

I. Did Delta Waive its Right to Pursue Rescission by Electing to Continue Performance?

As plaintiff points out in its post-trial reply brief, the election argument as originally posed by defendant contained within it the suggestion that Delta chose to use its position as part owner of lease 451 to exploit the reserves on 452. We accepted the relevance of that possibility in granting the motion:

> [p]laintiff's motivations are relevant and disputed with respect to its participation in the development of lease 451. . . . Although it is true Delta certainly knew that oil would be extracted from lease 452 via the wells on 451, . . . the court cannot determine if its actions were, in meaningful part, motivated by a desire or willingness to exploit lease 452.

Amber III, 78 Fed. Cl. at 518.

Defendant poses the election argument in a different way in its post-trial brief. It now contends that, "Delta's intent to drain, or allow the drainage of, Lease 452 simply is not relevant for purposes of our election defense." Def.'s Post-trial Br. at 33. It contends that the actions Delta took as owner of lease 452 after the date of breach (June 2001) amounted to an election to continue partial performance of the lease contracts irrespective of intent to maximize oil production. It points to three specific actions: 1) Delta agreed, pursuant to Article X of the Rocky Point Agreement, to Plains' request to withdraw (contract) from the unit the eastern half of lease 451; 2) Delta waived its correlative rights to develop lease 452 in order to facilitate development of lease 451; and 3) Delta agreed to Plains' plan to drill within 500 feet of the 452 lease boundary.

That Delta took these actions is undisputed. Contrary to the order granting reconsideration, however, defendant now argues that Delta's motivations in doing so are irrelevant; the mere fact that Delta took any legal act as owner of lease 452 is sufficient, according to defendant, to demonstrate an election to continue partial performance.

The three actions cited were indeed taken by Delta, at least in part, in its capacity as owner of lease 452. As defendant points out, Delta's consent was necessary to achieve unit contraction. The contraction, however, as plaintiff points out, and as defendant concedes, was done at the suggestion of

MMS. Similarly, Delta's February 2003 agreement to waive its right to argue that lease 452 was held by incidental production via lease 451, although done in furtherance of its obligation to the other owners of the Rocky Point Unit to cooperate in development of lease 451, was necessitated by its ownership of lease 452. Finally, Delta's agreement in October 2005 to placement of well C-13ST within 500 feet of the 452 lease line, while not strictly necessary to that well placement,[26] was admittedly triggered by its ownership of lease 452.

Defendant argues that these exercises of Delta's status as owner of lease 452 are sufficient, independent of any consideration of what motivated them or their significance to Delta's contractual rights, to constitute an election. This is so, defendant contends, because Delta acted with the knowledge that doing so was inconsistent with the remedy of declaring total breach and seeking rescission.

This per se approach to an election defense ignores the fact that the lawsuit is not at an end. Delta has tendered lease 452 to the government, but the government has not accepted that tender and final judgment has not been entered. In the interim, Delta is still record owner of the lease and the mere fact that it *wants* to declare a total breach and get its money back does not mean it has accomplished that end. If a purchaser of a horse brought suit to rescind the contract of sale, should it stop feeding the horse for fear of losing a cause of action? Or, if a disgruntled home buyer has pending a claim of total breach due to violation of a warranty of habitability, does it waive the remedy of rescission if it pays its mortgage and taxes? Plainly not everything that a contracting party does in connection with exercising its rights as owner by purchase can put in jeopardy a pending claim of total breach.

This should be a familiar principle in these cases. In *Amber I*, we rejected the government's argument that plaintiffs' pursuit of suspensions amounted to partial performance that precluded a right to rescission. 68 Fed. Cl. at 558. In that case, we relied on the Supreme Court's decision in *Mobil Oil Co. v. United States*, 530 U.S. 604, 622 (2000), which also involved offshore oil and gas leases. The Court held that the waiver analysis is not dependent just on what "the oil companies did or requested, but also about

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[26]It is important to note that MMS need only consider the correlative rights of neighboring leaseholders in renewing a development plan.

what they actually received from the Government." *Id*. at 623. Performance had to be "significant." *Id*.

Later, the government raised the waiver issue again, on the same facts, only now arguing an election of remedies. This prompted our holding in *Amber II*, rejecting the election defense with respect to the suspension requests: "the asserted additional performance–the lessees' submission of updated suspension requests–was not the consideration bargained for under the contract. As the Court held in *Mobil*, the nature of the asserted benefit matters." 73 Fed. Cl. at 749.

In *First Nationwide Bank v. United States*, 431 F.3d 1342 (Fed. Cir. 2005), the Federal Circuit noted the government's similar argument there that:

> restitution is not an available remedy unless there was a 'total breach' or repudiation of the entire contract, requiring termination of all performance by both parties. The government argues that because Nationwide continued to perform its contractual obligations after enactment of the Guarini Legislation, and continued to accept payment . . . Nationwide waived recovery of the lost tax benefits.

Id. at 1352. It rejected that all or nothing approach: "[A] non-breaching party is not required to create an even worse situation by abandoning all performance in order to preserve access to remedy." *Id.* (citing Restatement (First) of Restitution § 68, comment b (1937)).

We conclude, therefore, that to prove an election, defendant has the burden of proving that Delta's actions were taken for the purpose of obtaining a benefit from lease 452 in terms of oil production. There is no such evidence. Neither Kent Lina nor anyone else from Delta attended the Reservoir Management Team meeting at which Plains presented the Power Point presentation with one slide indicating Plains' expectation that there would be significant drainage from 452. Although he later received a CD with the same information, he gave it cursory consideration, focusing on one sheet with figures for well productivity. Delta's motivations therefore, could not have been based on what Plains assumed concerning drainage from 452.

This is fully consistent with the deposition testimony of Lisle Reed, former Regional Director of the MMS for the Pacific Outer Continental Shelf.

He held that position during the times relevant to this suit. One cannot read his deposition without sensing that MMS was a prime mover in the effort to enlist Delta's cooperation. His assessment of Delta's motivation was that it was primarily reactive – it did not want to be a bottleneck to the Rocky Point owner's plans for developing lease 451. To the extent it had an affirmative motivation it was to take advantage of the production from 451.

Defendant also argues, however, that Plains, or at least some of its officers or employees, fully intended to exploit cross-lease drainage, and that that intent should be attributed to Delta because Plains was Delta's agent. We find that defendant's characterization of Plains' intent is dramatically overstated: "Plains crafted a plan and carried out a development plan with the specific intent . . . to drain reserves from Lease 452." Def.'s Post-Trial Br. at 61. Plains' intent was far less Machiavellian. It was to develop lease 451. Its hope was that there would be significant drainage from lease 452.

Nor do we agree with defendant's conclusion that the spacing and density of wells on lease 451 before and after the *Norton* decision reflect an attempt to thwart the injunction. Defendant attaches far too much significance to the dots on Plaintiffs' Exhibit 5, the August 2002 well plan. The end locations of the wells, which are loosely depicted on such plans, do not reflect the fact that the wells are thousands of feet in length and do not run straight down. In fact they trend away from the end points toward the drilling platforms, which are further away from the lease line.

In addition, defendant's attempt to enlist Mr. Huguenard in support of the proposition that "the well locations must have been . . . proposed in conformance with directive" to move the wells closer to the lease line, *id.* at 66, misrepresents his testimony. He specifically stated that "the locations were adjusted slightly, due to the seismic reprocessing." Tr. 1263. He also testified to the contrary in the following questions and answers:

> Q What effect, if any, did . . . [t]he inability to drill on 452 . . . have . . . on the location of wells on 451?
>
> A I would say the wells that were proposed on 451 after 452 and 453 became unavailable were only adjusted in a very minor fashion. So I would say little or no influence. I would say there was more influence by the seismic reinterpretation than by the 452 and 453 coming out of play.

Id. at 1266.

Q . . . [I]n point of fact, did, as Plains moved forward, have more of a bias to lease line wells?
A No, no. The number of lease line wells remained the same.

Id. at 1269.

Q Mr. Huguenard, it's clear from a number of documents this morning, would you agree, that your company anticipated a certain amount of drainage of lease 452 via the development of lease 451, correct?
A I don't know that we anticipated there would be drainage, but we discussed or contemplated the possibility of drainage. Certainly, economics were based on the fact that there was no drainage.

Id. at 1452. There is no way to read Huguenard's testimony fairly to support defendant's over-heated view of the evolution of the well plan for lease 451.

Finally, Plains' drainage estimates derived from the 2002/2003 revisions were simplistic and must be understood in their context, namely as a worst case scenario in anticipation of state and county concerns. They were not intended to reflect Plains' true opinion about drainage from lease 452 and were not, in any event, seen by Delta employees. The estimates do not, as defendant argues, reflect Delta's state of mind.

Defendant reads too much into the documents that Delta did see, the AFE's for the various production wells. It concedes that Plains did not "state expressly in its AFEs that the proposed wells were intended to recover reserves from Lease 452." Def.'s Post-Trial Br. at 76. Indeed there is no mention in the AFEs of presumed drainage from lease 452. The production numbers utilized were all based on reserves on lease 451. But defendant then asserts that "this intent . . . i[s] nonetheless plain in several AFE enclosures." *Id*. What is plain to defendant is that "[n]one of these materials show a structural barrier that would hinder flow of oil from Lease 452 to the wellbore. It is as if Plains proposed placing the open end of straw directly up against Lease 452 . . . ." *Id.* Elsewhere, it concludes that "the proposed well [C-13ST] is pointed directly and unmistakably at Lease 452." *Id.* at 78. Later it refers to well C-15 as "aimed" at lease 452. *Id.* at 80. These unscientific characterizations, however, bear little connection to the realities of well bores or the mechanics of drainage.

As Steve Renke, a reservoir engineer for Devon Energy, one of the other owners of lease 451, explained, the "dot" on a map representing a well is the end point of an angled line. In addition, the drainage from a well in a fractured reservoir is not circular, it is elliptical. Renke's responsibilities included Rocky Point. He evaluated the AFEs sent by Plains and, in turn, produced revised, internal AFEs for use by Devon. In response to a question about one Plains' estimate he saw, suggesting that 41 of the recovery from well C-14 would come from lease 452, he testified as follows: "that particular estimate is explained on the next page and any engineer that would look at it would say that doesn't depict at all what is happening in the reservoir. So, just by inspection, I guess, I would look at it and say I'm going to dismiss it." Tr. 1514-15.

Renke testified that in his reading of the AFEs, there was no indication that production was expected from lease 452. Roger Parker, President of Delta, also testified that he was unconcerned about drainage from lease 452: "At the time that we signed the agreement we did not think that a well that would stop 500 feet or within 500 feet from the boundary would drain any oil from Lease 452." Tr. 1754.

Even if Plains' intent was meaningfully to exploit lease 452, however, Plains is not the relevant litigant, and there is no credible evidence that Plains' expectation of significant drainage across the lease line actually was known to Delta employees. The government contends, however, that Plains' intent to draw oil from lease 452 can be attributed, as a matter of law, to Delta. It sets a low threshold for itself, however.

Plaintiff contends, and we agree, that election requires full knowledge of the facts, citing *Banner Mfg. Co. v. United States*, 112 F. Supp. 365, 367 (Ct. Cl. 1953) ("[W]e are aware of no application of the rule which does not include the requirement that the litigant have full knowledge of the facts when the election was made."). As the court in *Banner* explains, the doctrine of election is not a rule of substantive law, but rather one of court administration, and one which should be cautiously applied. *Id.* Delta knew, at most, that there might be incidental drainage from lease 452. It did not know of Plains' initial intent to place wells in such a way as to maximize drainage from lease 452.

Defendant suggests, however, that full knowledge of the facts "refers not to knowledge of the sort Delta is claiming it lacked, but to knowledge of the *existence* and *inconsistency* of available *remedies*–here, the options of claiming partial or total breach, and the knowledge that those claims are inconsistent with each other." Def.'s Post-Trial Br. at 34 (emphasis in original). In other words, defendant does not dispute the lack of evidence of actual intent on Delta's part to drain lease 452. Rather, it is reverting to its basic contention that *any* intentional action that can be attributed to plaintiffs' ownership of lease 452 constitutes partial performance. We have rejected this position earlier and see no reason to revisit it in this context. The court was willing to entertain proof either that 452 was materially damaged (an issue we address below), or, even if it was not materially affected by drainage through wells on lease 451, that Delta deliberately chose to use its ownership of lease 452 and its interest in lease 451 to *attempt* to reap the benefits of the lease. The latter intent we would view as sufficient to trigger an election inconsistent with rescission and restitution. The type of conduct defendant points to, however, constitutes merely the nominal exercise of rights and does not amount to the significant exercise required by *Mobil Oil*.

In the absence of actual knowledge, defendant then suggests that Delta is accountable for what it *should* have known. As plaintiffs point out, the argument can only be telling with respect to the Wilson presentation. We certainly cannot agree that Delta was on notice of Plains' internal memoranda and emails. As to the one slide within the lengthy Point Arguello Reservoir Management Team presentation, which showed potential drainage from lease 452, there is no proof of actual knowledge, and we agree with plaintiff that constructive knowledge is insufficient for a knowing election.

Defendant also argues that Plains, as operator, is an agent for purposes of making a legally binding election on behalf of Delta. We disagree. Plains could bind Delta with respect to operational decisions concerning those leases for which it had an executed a "designation of operator"[27] form, but that limited authority would be insufficient for purposes of making an election of remedies in a litigation context. Election is a disfavored defense, and it would

[27]Even though there is no such form in evidence for lease 452, Delta does not dispute that Plains was authorized to act as its operator with respect to that lease.

require something in the nature of an attorney-in-fact agency relationship, to permit second hand waiver. No such agency relationship existed.

Although what we have said is sufficient to reject defendant's election argument, we note that, under one possible formulation of the test in this circuit, defendant would also have to show a benefit to Delta and detrimental reliance by the government.[28] Both these elements of a defense share a common set of facts with the discussion below concerning the extent of actual drainage. We find there that there was insufficient drainage in fact to materially alter lease 452. Consequently there was no benefit to plaintiff or detrimental reliance by the government. We note another reason, however, that there could not have been detrimental reliance by the government. The actions which defendant points to as contract performance were all aimed at liberating lease 452 from the Rocky Point Unit so that development could proceed on lease 451. Plaintiff is correct that they amounted to Delta giving up rights in lease 452, indeed, at the government's strong urging. MMS wanted to develop lease 451 and, despite the fact that production was disappointing, the government received its royalties from that production.

In sum, we understand defendant does not agree with our formulation of the relevant test, but we believe its argument concedes that, if the test is as the court has stated it, Delta is not barred from seeking restitution. There is no proof of a knowing election of an inconsistent remedy.

II. Does Lease 452 Remain in Substantially as Good a Condition as When it Was Leased?

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[28]In *Old Stone Corp. v. United States*, 450 F.3d 1360, 1371 (Fed. Cir. 2006), the Federal Circuit laid out two possible tests for election: (1) mere continued performance or acceptance of performance constitutes a bar to restitution; or more strictly, (2) that there must be either detrimental reliance on the part of the breaching party or a benefit to the non-breaching party as a result of continued performance. *Id*. at 1372. The court declined to rule which was the proper test because it held that both prongs of the stricter test were met in that case. *Id*. (holding that there was both detrimental reliance on the part of the government in continuing to demand payment from plaintiff and that the plaintiff continued to accept benefits by operating its thrift).

The second issue upon which we heard evidence at trial concerned the physical condition of lease 452 after the development on lease 451. There is no question that there has been some drainage from lease 452 to lease 451 due to the presence of wells on lease 452. Plaintiff contends it will amount to no more than 85,000 barrels out of a total agreed-on production of approximately 2.6 million barrels. Defendant contends that the amount is over one million barrels. The central question is whether the oil reserves underlying lease 452 nevertheless remain in substantially the same condition as when the lease was executed. If not, Delta will be unable to tender the lease back and ask for restitution, or at least full restitution.

The question of where the line should be drawn between "substantial" and "insubstantial" alteration in the condition of the reserves we defer for the moment. We note, however, that we view the question of "substantiality" in terms of proportion, i.e., the ratio between what was taken via lease 451 versus what was originally in place. Even though the absolute numbers of barrels removed might be small, if they represent a significant portion of total reserves, then the impact would probably be substantial. Conversely, even if the absolute numbers are large, they might represent a very small proportion of total reserves.[29] In short, it is necessary to know not only how much oil likely was drained, but also the beginning and ending reserves.

Additionally, without abandoning the pursuit of certainty, we note that the one absolute certainty emerging from trial was that the business of exploring for oil and gas is highly unpredictable. While it involves the use of scientific data, that data is incomplete and requires interpretation. The best we can hope for is sufficient confidence to project ranges which probably bracket the correct numbers.

Defendant bears the burden of proving that the amount of cross-lease drainage is substantial. What it argues is that wells drilled on lease 451 will drain substantial amounts of the Rocky Point Field lying within lease 452. This is true, according to defendant, for two reasons: first, because there are no meaningful impediments to drainage across the lease line to the furthest extent of the reserves on 452; and second, because the reserves on all of lease

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[29]We also preserve, however, the possibility that, even though the proportion is small, it might be appropriate to require an offset by plaintiff before permitting it to tender back the lease.

452 (whether or not limited to the Rocky Point Field) are smaller than claimed by plaintiff (and therefore any drainage to lease 451 constitutes a larger proportion of 452 reserves). For its part, Delta attempted at trial to rebut this presentation by showing the converse: first, that there are numerous impediments to the drainage of oil from lease 452 to 451; and second, that the reserves on 452 are larger than as posited by defendant.

A. Drainage From Lease 452 Via The Wells On Lease 451

We begin with the issue of drainage. That issue, in turn, will be broken into three groups of related topics: 1) fracture matrix/directionality/heterogeneity; 2) sealing faults/compartmentalization; and 3) drainage distance. These three groups of topics all bear on the question of how much oil will be drained from lease 452 via the existing wells on lease 451. Separating the topics is somewhat artificial. While they are distinct, the three topics are plainly inter-related, and the findings in one area have implications in the others.

1. The Fracture Matrix

The rock formations involved in this case present a formidable challenge to the exploitation of oil and gas reserves located therein. There is no dispute that this is due primarily to the fact that the oil and gas are trapped in fractured reservoirs. As explained by plaintiff's expert, Mr. Scott Haberman, the oil is not contained within the rock itself. Rather, it is trapped in a matrix of fractures and faults.[30] In order for a well to extract a given pocket of oil or gas, it must intersect fractures that are in "fluid connection" with those reserves. A given pocket of oil and gas that is not in fluid connection with the fracturing intersected by the well will not be produced by that well, irrespective of proximity.

MMS director, Dr. Reed, expounded upon this subject at his deposition when he was asked whether drainage estimates across a lease line were a matter of interpretation:

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[30] A conventional reservoir, by contrast, is in rock material that is porous. The oil and gas are stored and transported through the rock itself. A well can drain fluid from all directions.

> [T]extbook petroleum engineering is generally based on a classic sandstone reservoir, with even porosity, even permeability, and flows are all according to simple physics and things like that.
>
> The Monterey formation – well, first of all, just sandstone reservoirs have been found to be very misleading in various parts of the country, and a lot of companies have found, going back in and drilling additional wells in certain places, have increased reserves substantially, and production out of the fields that by textbook calculations, should have been produced in the wells that were already there.
>
> In the Monterey formation, triple it, at the very least. There are so many weird phenomena that take place in the Monterey formation because of its characteristics, its matrix and crystalline structure, that figuring how much oil is moving from one place to another, can only be done with reasonable accuracy if you're able to place wells on both sides of the area you're trying to determine whether it's moving or not. You have to get pressure drops and flows and stuff like that from various points to ever be able to tell what, in general, is going on.

Jt. Ex. 1 at 81.

The particular characteristics of the fracture matrix present in the offshore Monterey and Sisquoc formations become very relevant to the question of cross-lease drainage. As we explain below, we find that the heterogenous nature of the fracture matrix, when acted upon by the tectonic forces in that location, creates a bias towards drainage in a direction ninety degrees opposite to the lease boundary line. That is to say, in a northeast to southwest direction.

The orientation, or shape, of the drainage area matters because the wells in question are located close to the northern extent of the Rocky Point field and on its western half. Drainage to the northeast of the wells stops at the edge of the field and is blocked by the presence of a sealing fault. Drainage to the southwest is in a direction away from the lease line and is entirely within lease 451. The preferential drainage in a northeast-southwest direction thus reduces the extent of drainage from lease 452, which lies to the southeast of the wells on lease 451.

Plaintiff presented the testimony of Mr. Herman Homann and Dr. William Dershowitz to explain the directional bias to fluid flow in the Monterey and Sisquoc formations. Dr. Derschowitz employed the term "anisotropy" to describe the directional bias to flow:

> We're saying typically fractured reservoirs are anisotropic, and anisotropy means there's more flow, there's greater flow, greater capacity to flow, greater drainage, in one direction than another direction.
>
> For example, if you only had fractures in one direction clearly you'd have strong anisotropy. Fractures increase permeability in certain directions, and the higher the permeability means more flow and more drainage in those directions.

Tr. 901. We begin with the testimony and opinions of Mr. Homann, upon which Dr. Derschowitz built his conclusions.

Mr. Homann is a geologist and an expert in the interpretation of formation images and dipmeter data for structural and stratigraphic purposes. He has been chiefly involved in the interpretation of dipmeter and image logs since 1980 in both the coal and petroleum producing industries. He conducted an interpretation of the FMI log generated from the C-13 production well. By examining the log data, Mr. Homann "identif[ies] distinct fracture sets that may be important as conductors or as barriers, both [are] possible." *Id.* at 564. The critical aspect is the identification of open fractures. If the fracture is open, it is available for fluid flow.[31] Mr. Homann also identified closed and cemented fractures, which he testified are not open for fluid flow.[32] An FMI log makes possible the identification of these features by recording the electrical resistivity of the rock surface. An open fracture is readily identifiable because it is invaded during the drilling process by a viscous fluid

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[31] That is not to say that all open fractures are fluid conduits. Mr. Homann specifically stated that not all open fractures are conduits, only that if a fracture is conducive to fluid flow, it will be open or partially open.

[32] A closed fracture represents a crack in the rock without any separation. A cemented fracture is a fracture that is filled in with other minerals and effectively sealed.

known as "drilling mud," which shows up on an FMI log as a dark space. *Id*. at 593. Dr. Derschowitz testified to the same effect.

In addition to the simple identification of open, closed, and cemented fractures, Mr. Homann is able to use the FMI log to record the "dip" and "strike" direction of the fractures that he encounters. "The dip angle . . . of a fracture or a bedding plane would be the maximum angular deviation between the dipping plane and the horizontal . . . ." Tr. 602. The strike direction is perpendicular to the dip direction. "It's the map orientation of fault lines and fractures," *id*., or the "[a]ngle on a compass." *Id*. at 603. A computer is used to record the dip and strike orientation of an identified fracture by using a trigonometric calculation using data points generated by encountering a feature at two different points along the well bore.

The third piece of information that the FMI log can provide is information as to how the fracture was formed. If the image log shows displacement on either side of the fracture, then "it has been the result of a fault movement." *Id*. at 617. If a fracture is encountered without displacement, it is an "extension" or "joint." Some fractures are "closely related to the existence of faults while the others . . . , the joints, may be fairly evenly distributed across a reservoir over wider areas." *Id*. This information is useful to the question of drainage because Mr. Homann can identify whether the extensional fractures tend to be open. Because extensional fractures tend to be evenly distributed across the field, the interpreter can use that information in determining the direction of fluid flow across the field. *Id*. at 618.

With these three types of information in hand, Mr. Homann testified that he observed that the open and partially open fractures trended in a southwest-northeast direction. The closed and cemented fractures struck "clearly northwest, southeast." *Id*. at 619. He also identified the closed fractures as "predominantly fault related" and the open fractures as joints. *Id*. at 620.

Dr. Derschowitz based his report, in part, on the work conducted by Mr. Homann. Dr. Derschowitz is an expert in the field of "[r]ock mechanics, specializing in [fluid] flow, transfer and geomechanics in fracture controlled systems." Tr. 892. As a specialist in "rock mechanics," he is primarily interested in the "geometry and properties" of the fractures. *Id*. at 881. By studying the geometry of the fractures, he can make predictions as to the direction of flow through those fractures. In this case, Dr. Derschowitz calculated the anisotropy of the Rocky Point Field.

Although the fractures in a fractured reservoir are oriented in all directions, they tend to be grouped in directional “sets”. *Id.* at 910-11. One or more of the sets will be identified as preferential for fluid flow because it contains a higher concentration of open fractures. There may be some flow in another set, but the dominant fracture set will provide the preferential direction of fluid flow. Dr. Derschowitz specifically mentioned the very high importance of a skilled FMI interpreter in order to identify the open, closed, and cemented fractures. “We need to be able to rely on the FMI analyst to identify those open fractures that are most likely to be permeable.” *Id.* at 914. He testified that Mr. Homann is “one of the best.” *Id.*

Dr. Derschowitz walked the court through the process by which he calculated the anisotropy for the Rocky Point Field. He began by using the image log from the C-13 well to find all of the open and partially open fractures[33] and then to measure the fracture intensity in fractures per meter. This is then converted into a three dimensional image. Using this information, Dr. Derschowitz created a hypothetical three dimensional representation of a cube of rock populated by fractures “matching the orientation distribution of the open and partially open fractures from the FMI log.” *Id.* at 920.

The next step is the application of the “critical stress” analysis to the open and partially open fracture set. The key part of that analysis is the identification of which fractures are critically stressed. Those fractures are assumed to be 100 times more permeable and likely for fluid flow. Dr. Derschowitz testified that, “there [are] studies dating back to the [1980s] indicating that critically stressed fractures are those that would have the highest transmissivity . . . .” *Id.* at 924. The identification of critically stressed fractures is a process in which you apply the direction of maximum horizontal stress and find those fractures which are oriented roughly thirty to forty degrees to that direction: “there is a shear on that fracture, and it’s that shear failure that we refer to as critically stressed fractures.” *Id.* at 929. Additionally, a fracture that is parallel to the direction of maximum horizontal stress, while not “critically stressed,” will be “in tension popping open” and conducive to flow. *Id.*

[33] As identified by Mr. Homann.

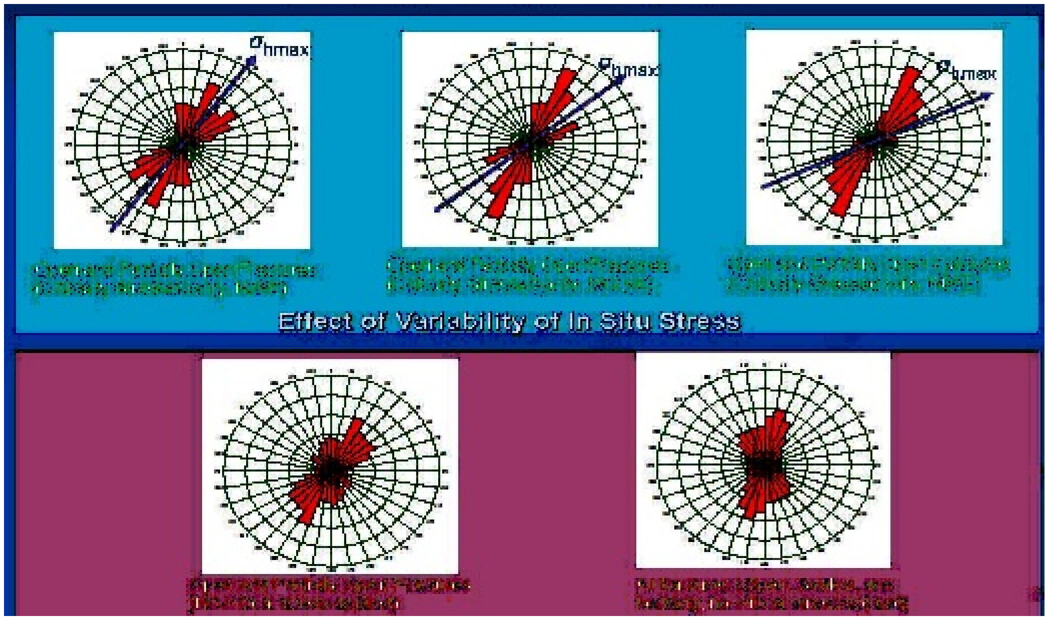
Dr. Derschowitz testified, "in this case you've got a compressive stress from approximately the northeast/southwest direction." *Id.* at 926. The direction of maximum horizontal stress, or "in situ" stress state, was borrowed from the work of defendant's expert, Dr. Colleen Barton.[34] With this information in hand, Dr. Derschowitz calculated the anisotropy of the Rocky Point Field through an "equation derived by Professor Oda in Japan back in the early to mid 1980s." *Id.* at 930. As Dr. Derschowitz summarized:

> So we applied this Oda equation to calculate the reservoir and anisotropy as a permeability ellipse using all the open and partially open fractures and assuming that the critically stressed open and partially open fractures have a transmissivity 100 times greater than those that were not critically stressed.
>
> And then in order to solve the direction of maximum permeability we used something called an Eigenvector analysis.

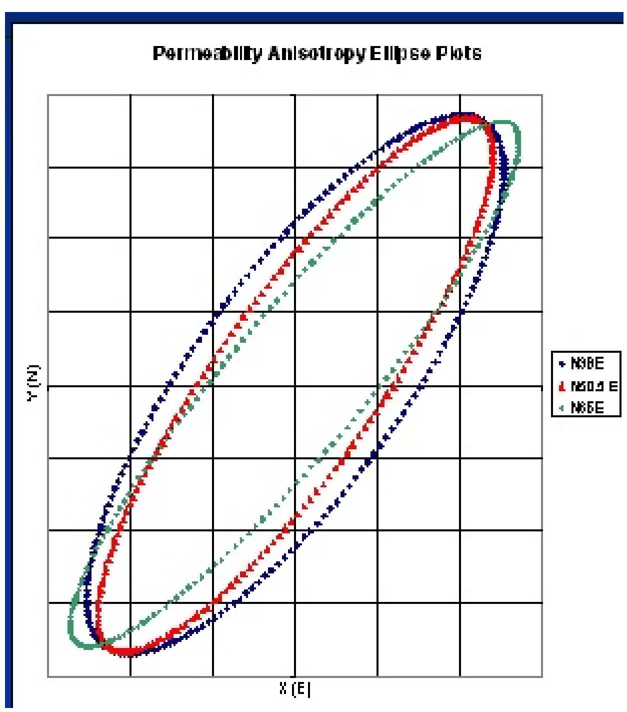
Id. He further testified that this type of procedure has been used by the industry since the late 1980s.

Applying the method above and allowing for fifteen degrees of variability in both directions of the maximum horizontal stress, Dr. Derschowitz produced the following five diagrams depicting the anisotropy in the Rocky Point Field:

[34] "We double checked her in situ stress state, and it's consistent with the published data for the offshore Monterey formation. There's a lot of data. Hers is consistent, so we were able to rely upon that in situ stress states." Tr. 925.



Pl.’s Ex. 15 at 9 (Derschowitz Trial Presentation). Another slide presents the same analysis in the form of three colored ellipsis:



Id. at 10. The result is obvious – a distinct bias for drainage in a northeast-southwest orientation. Even taking away the critical stress factor, a bias in that orientation remains. The significance of this evidence is that drainage from the lease 452 portion of the Main Pool is minimized, at least over a finite period.

Defendant fought hard at trial against this view of drainage, assembling a case in favor of drainage in a perfect circular pattern. We ultimately find plaintiff's modeling more plausible, for reasons we set out below. What we find odd, however, is that defendant's primary argument on drainage made this dispute irrelevant. Its primary contention is that, even in Monterey fields, any single well would drain to the outer extent of the field, irrespective of distance. In other words, any well within the Rocky Point field on lease 451 would eventually drain all recoverable oil within the field on lease 452. Because this contention, if true, would moot much of the trial presentations, we pause briefly to address it first, at least in general terms.

This assertion was made only by Dr. Richard Strickland, defendant's chief expert. When asked to explain, he admitted that this notion of unlimited drainage was only true if one assumes an infinite amount of time. The critique thus bears no correspondence to the reality that the economics of oil and gas production must be measured in something considerably less than geologic ages. Dr. Strickland's suggestion has no application in assessing recoverable reserves because wells and drilling platforms have finite economic lifespans. In addition, it does not account for the unique characteristics of formations in the Monterey fields, which are much more fractured and unpredictable than fields in more uniform rock formations. In short, we do not view this as a serious criticism of plaintiff's drainage model.

Dr. Strickland also took issue more directly with plaintiffs' view of the directionality of drainage. He asserts that drainage will occur in a circular pattern from the well, thus increasing the likelihood of drainage from the direction of lease 452. He was joined by Dr. Colleen Barton. We begin with Dr. Barton as her testimony and report were more directly in contradiction to the views and work presented by Mr. Homann and Dr. Derschowitz.

Dr. Barton is a "geomechanic specialist" studying the forces and stresses "in the crust of the earth, and the implications of those stresses to oil and gas production." Tr. 2919. She currently holds the position of senior technical advisor to a firm called Geomechanics International, which she founded in 1997. Dr. Derschowitz confirmed that her work in the area of critical stress is widely used in fractured reservoirs. Her work in the case at bar was to "provide an analysis of critically stressed fractures at the Rocky Point Field and how they related to . . . fluid flow through the field." *Id*. at 2920. Part of that work was to analyze the FMI data and provide her conclusions to Dr. Strickland.

Dr. Barton confirmed that "critically stressed fractures within a reservoir are the fractures that can maintain the permeability. They are dilated and sheer, and therefore provide the preferential paths of fluid migration." *Id*. at 2944. Dr. Barton co-authored and published a paper in 1995, which introduced her critical stress fracture concept. She testified that it has been cited over 100 times in other works since then. Dr. Barton summarized her approach:

> Well, what we have to determine is the stress state. You determine the orientations and magnitude of the stresses in the reservoir, and then you also need to measure fractures, all of the fractures in the reservoir, and then you can computer which fractures are open and dilated within that population of the full set of fractures.

Id. at 2947. The use of the phrase "population of the full set of fractures" is where we encounter her first major disagreement with plaintiffs.

Dr. Barton examined the interpretation of Mr. Homann of the FMI log from the C-13 well. She testified that although he "did a good job of determining the depth and orientation of the fractures in space," he failed to identify or interpret many fractures. *Id*. at 2967. "So my general sense of his interpretation is that he underinterpreted the data." *Id*. at 2968. Dr. Barton presented the court with a slide showing fractures as interpreted by Mr. Homann and then pointed out additional ones that she would have identified. She testified that this was a problem throughout Mr. Homann's interpretation but particularly towards the end of the well bore.[35]

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[35] Dr. Barton also later added that FMI logs themselves present a further factor contributing to the under-representation of the fractures actually encountered in the well bore. She testified that the FMI tool cannot, in effect, see the (continued...)

Second, and more critically, Dr. Barton disagreed with Mr. Homann's classification of open and partially open fractures as "hydraulically conducive." Tr. 2970. She testified that it is not possible to know from an FMI log whether a fracture is "hydraulically connected to the reservoir." *Id.* Additionally, electric conductivity cannot be equated with hydraulic conductivity. This is partially due, according to Barton, to the "borehole hoop stress" which tends to "open fractures at its intersection of the wellbore." *Id*. Away from the wellbore, those fractures may be indeed be closed. Dr. Barton admitted, however, that it remains common practice in the oil service industry to use well logs to identify open fractures and to assume that they are conducive to fluid flow.[36] Dr. Barton also testified that although she did not have a per se problem with identifying cemented fractures from an FMI log, she did not believe that they should be excluded from the universe of fractures included in the critical stress analysis. This is due to the high amount of tectonic activity in the Monterey area. This tectonic activity has a tendency, in Dr. Barton's view, to either keep open or re-open cemented fractures. In fact, in her view, partially cemented faults might actually serve to enhance fluid flow because "the partial cementation serves to prop the crack open and keep it open." *Id*. at 2990.

In order to determine the hydraulically conductive fractures, Dr. Barton applied her critical stress analysis. The difference in approach between Barton and Derschowitz is that Dr. Barton applied the critical stress theory to all of the

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[35](...continued)
fractures with an aperture under "two-tenths of an inch." Tr. 2985. This is a problem in her view because "those small fractures can actually contribute significantly to storativity and transmissivity of fluids in the reservoir . . . ." *Id*.

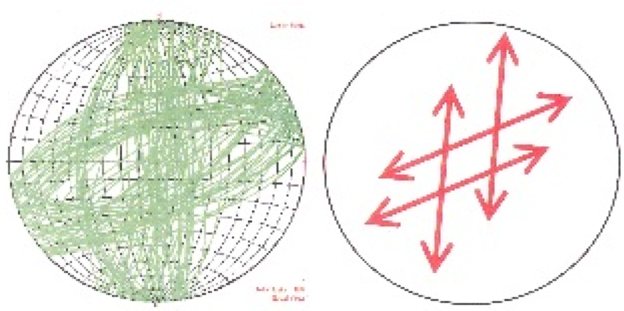
[36] The court asked Dr. Barton why then the practice had not died out:

> A. Well, no, there is just, unfortunately energy behind it as it were, and there is a lot of people who are, I believe, misled by the industry, by the service providers that there is a direct correlation between electrical and hydraulic conductivity.
>
> Q. You're saying it has no predictive character or limited?
>
> A. I would say that in my experience it doesn't represent which fractures are really flowing. You need a flow test.

Tr. 2974.

fractures identified from the log. The earlier winnowing out of closed and cemented fractures from the FMI log is not a part of Dr. Barton's analysis of reservoir flow. "I believe the classification as [Homann has] done it here just adds a lot of uncertainty." *Id*.

The result, as depicted on a stereographic projection in Dr. Barton's presentation, was the identification of two distinct sets of critically stressed fractures, one trending north-south and one trending in a northeasterly direction:



Pl.'s Ex. 133A at 7. Although she performed no actual calculation of anisotropy, Dr. Barton concluded, based upon her cris-crossed matrix of open fractures, that fluid flow in the Rocky Point would be in all directions. If a well intersects this interconnected network of open fractures at any point, no area of the reservoir would be "immune to drainage." Tr. 3001.

Dr. Barton's conclusion was also based in part upon her view that faults can be "superhighways for fluid flow." *Id*. at 3009. She testified that drainage can be both through and along the path of a fault. This is due, at least in part, to the development of breccia zones along the path of the fault.

> A breccia zone in my parlance is essentially a fault. A breccia zone is a mature fault . . . . [T]hrough time they evolve and are more and more crushed. The faults get wider . . . and at some

> point they become a breccia zone, and within that zone . . . the rock is very fractured."[37] *Id*. at 3009-10. The rock fractures in all directions and is very permeable to flow, according to Dr. Barton.

Dr. Barton believes that the faults encountered in the Rocky Point formation provide extremely permeable conduits to flow throughout the reservoir.

Dr. Strickland came to the same conclusion that the fracture network in the main structure of the Rocky Point field is multi-directional, allowing oil to flow from all directions, i.e., in a circular pattern. Aside from relying upon the work of Dr. Barton, Dr. Strickland also presented the results of two studies. The first study was conducted in 1998 by Iraj Ershaghi ("Ershaghi Study"). It detailed the results of a pressure interference test conducted in the Point Arguello unit. *See* Def.'s Ex. 177 (excerpts of Ershaghi Study). The second was a 2001 study of the well cores drilled in five of the exploratory wells on Rocky Point performed at the request of Plains. *See* Def.'s Ex. 126 ("GeoSystems Study").

Dr. Strickland is a petroleum engineer specializing in reservoir engineering. During his thirty two years of reservoir engineering, Dr. Strickland has been primarily employed to do one or both of two things: field studies and appraising of oil and gas properties, both of which are relevant to this case. A field study is a study of a reservoir to figure out how the producer can improve its production. He is currently the president of the petroleum consulting firm, the Strickland Group.

The Ershaghi study presented the results of a pressure interference test conducted by the unit operator on five wells in the Point Arguello Unit. Although not cited in his expert report, Dr. Strickland testified that the Ershaghi Study is the "most definitive thing we have" in regard to the question of the multi-directionality of fluid flow. Tr. 3272. The report was also cited in the September 2005 report of plaintiff's expert Dr. Robert Mannon. As Dr. Mannon explained on cross-examination, a pressure interference test is used

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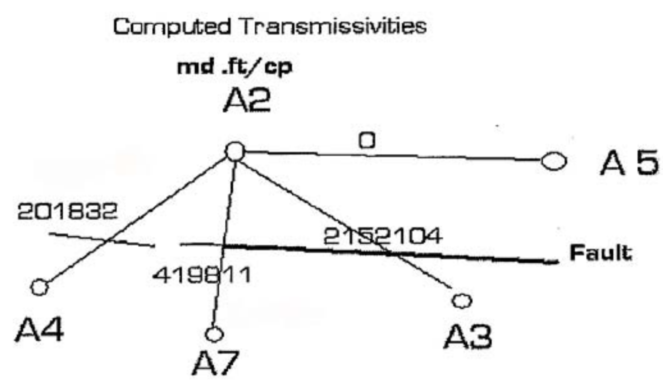
[37] Brecciation refers to the grinding up of the rock around large scale faulting, resulting in areas of intense fracturing in and around the fault zone. The rock is so intensely fractured that a gross visual representation can be likened to a glass jar filled with gravel.

to measure pressure communication between wells in the same reservoir. This is done by using "a production well, and you produce that well, and then the other wells are shut in as an example. You determine any possible drawdown on those surrounding wells as a result of producing that one well that's maintained on production." *Id.* at 2167. A pressure drop recorded in a shut-in well indicates pressure communication between the producing wells. The strength of the pressure drop also indicates the relative transmissivity of the fracture network between the wells.

The following graphic from the excerpt of the Ershaghi Study depicts the results of the test:



Def.'s Ex. 177 at 14. "A2 ", "A4 ", "A7 ", "A3 " and "A5 " represent the five wells drilled from Platform Harvest used in the test. All of the wells depicted are located in the Point Arguello Unit, none are in the Rocky Point field. The A2 well was the well left on production while the others were shut-in. The numbers appearing between the wells inform the reader that all of the wells save A5 showed a pressure response from the production in A2. The higher the number, the greater the pressure response and the greater transmissivity as computed by the author. Dr. Strickland testified that the distance between the A2 well and the other wells ranged from 3000 to 4000 feet approximately.

Dr. Strickland explained the mechanics of the pressure response:

> This is a pressure wave. You put the well on production, just like you throw a pebble in a pond, and the ripples go out . . . .

> And so the ripples are traveling through the pore spaces in the rock through the fluid. The pressure wave doesn't go through the rock. It goes through the fluid, the oil, water, and gas.
>
> So if the A-4 senses that the A-2 is on production, we say that the A-2 and the A-4 are in communication with each other. . . . . You could inject in A-4, and it would show up in A-2.

Tr. 3261-62. He further explained that the pressure wave travels much faster than fluid would. The important point to Dr. Strickland, however, was that the "pressure wave moves over that distance, and then oil moves over that distance." *Id*. at 3262.

Defendant also makes much in its post-trial briefing of additional information from the excerpt of the study now in evidence. First, according to Ershaghi, the lack of pressure response between A2 and A5 is not likely due to the presence of any sealing fault but rather due to "the tightness of the matrix and the non-existence of any fractures for establishing communication." Def.'s Ex. 177 at 14. The second point is that the faults encountered between the wells that did show a pressure response "do not seem to be sealing." *Id*. Further, the "intensity of fracturing in the drainage areas of wells A4, A3 and A7 points out the role of highly brecciated intervals in establishing high productivity for the wells." *Id*.

Dr. Strickland also presented the GeoSystems Study in support of his conclusions. He testified that the study came to three conclusions. First, the productive zones are the same in both the Point Arguello and Rocky Point fields. The second was that the fracture types are similar between the two. The third was that "the fractures are multi-directional." *Id*. at 3269. According to Dr. Strickland, this confirms the results of the Ershaghi Study that the nature of the fractures in the area lead to a fluid flow in all directions. The "significance to drainage then is that it gives that pressure wave the opportunity to go in all directions, which means cross all parts of the lease line, and go out to the reservoir boundaries." *Id*. at 3271.

Defendant cites the GeoSystems Study in its post-trial briefing for a number of additional conclusions. The first is that the cores studied showed extensive fracturing on both the micro and macroscale. The most likely productive fracturing was found in the PA-17 to PA-21 zones. These fractures are primarily characterized as splay fractures and brecciation. The fracture networks necessary for fluid storage and production were encountered throughout the cores studied from the Rocky Point. Defendant further draws from the study that the "'splay fractures/breccias' are expected to be oriented northwest-southeast (perpendicular to the direction of compression/folding) in the Rocky Point structure." Def.'s Post-Trial Br. at 122 (quoting Def.'s Ex. 177 at 15). "These splay faulted and brecciated zones are considered to form the bulk of the productive sections in the PA-14 to PA-22 sequence." Def.'s Ex. 77 at 17.

The parties thus present the court with two very different explanations for what is occurring in the Rocky Point field in terms of the flow of fluid from the wells on lease 451. For the reasons we explain below, we cannot agree with Dr. Strickland's conclusions drawn from the work of Dr. Barton and the two above referenced studies or defendant's additional arguments based on those documents. We find that the fracture network present in Rocky Point is heterogenous with a distinct anisotropic bias in the northeast-southwest direction. Although it is undeniable that some limited drainage occurs from all directions, the directional bias limits cross-lease drainage.

Both Dr. Derschowitz and Dr. Barton are in agreement as to the tectonic forces at play in the area and how those forces effect the fractures upon which they play. The difference between them is the discerning of those fractures that should be included in this critical stress analysis. We find that the differentiation of open and closed fractures performed by Mr. Homann from the FMI log to be a reliable basis on which Dr. Derschowitz could apply his critical stress analysis. Both Mr. Homann and Dr. Derschowitz were unequivocal in their testimony that log images could be used to pick open and closed fractures. They also both agreed that this was useful because it was highly likely that if a fracture was identified in an FMI log as having taken mud, it would also be likely to be conducive to oil flow. Dr. Barton admitted that it was standard in the oil and gas industry to do so. It is important to understand that Dr. Barton's criticism is not in the actual identification of an open fracture at the point of the well bore. Rather she disagrees that anything can be said about that fracture away from the well bore. That is to say that Dr. Barton disagrees with the underlying premise that an open fracture, as identified in an FMI log, is any more likely to be hydraulically conductive or connected to the reservoir.

As noted previously, this was partly, in Dr. Barton's opinion, due to the phenomenon she called "borehole hoop strees," which she testified,"if it is in tension, tends to open fractures at its intersection of the wellbore." Tr. 2971. Dr. Barton argues that those fractures may not be open away from the wellbore. This is far from conclusive, and, even if relevant, Dr. Barton did not say that this phenomenon would disqualify all, or even a majority, of the open fractures. Additionally, her testimony was qualified with the phrase "if it is in tension." Our understanding is that many fractures, if not the majority of fractures, are not actually in tension. The slide depicting the borehole hoop stress even indicated fractures not in tension. Dr. Barton did not testify as to the number or percentage of fractures likely to be "in tension."

We find that, even if some of the fractures identified as open are not in fact conducive to flow, it would not moot the entire exercise of the critical stress analysis and calculation of anisotropy. The fractures likely to flow oil will be those that are identified as open, or some subset of them. What is critical is whether the open fractures are predominately in one direction. Further, Dr. Barton could not explain why Mr. Homann would be unable to pick out closed fractures and why those fractures should not be excluded from the critical stress analysis. If the fracture takes mud, as observed from the FMI image, it is more likely to flow oil. The converse is also true.

As to Dr. Barton's criticism of Mr. Homann's apparent under-interpretation of fractures, she provided no reason why this would bias Dr. Derschowitz's application of the critical stress analysis. Even if Mr. Homann failed to identify all of the fractures, we find that those he did identify were sufficient for the purpose of the calculation of anisotropy. It is important to remember that the anisotropy calculation is not dependent upon a perfect understanding of the actual physical state of any particular fracture in the ground. It is instead a calculation of a ratio of drainage from different directions. It does not depend upon a perfect sampling of the fractures or the perfect identification of open or closed fractures. It also does not matter that the FMI image does not show the interpreter anything outside of the actual well bore or the fact that there is only a FMI log from one well. As stated by Dr. Barton, "it would be my judgment that . . . similar fracture patterns would exist throughout the structure, and they're all feeling today's stress field . . . ." Tr. 3000. It is enough that the FMI analyst provide a strong enough survey of the fractures and their orientation in the earth (dip and strike direction).[38] Mr. Homann's interpretation is exactly that. We similarly find that the assumption that FMI-identified open fractures are those that are the most likely to be conducive to flow to be entirely reasonable and useful in the calculation of drainage anisotropy.

We turn now to the two studies presented by Dr. Strickland, both of which are inconclusive on the question of the directionality of drainage. The Ershaghi Study is inconclusive because the author specifically states that the results of the pressure interference test cannot be used to predict the directionality of drainage. "Because of the heterogeneous nature of the fractures, additional cross hole interference data are necessary to estimate directional trends in fracture conductivity and storativity." Def.'s Ex. 177 at 15. That statement is in agreement with the respective testimony of Dr. Derschowitz and Dr. Mannon that a pressure response cannot be equated to the movement of oil. In other words, the further the pressure wave travels, the lower the drop in pressure. This means that the further oil is from a pressure drop, the less oil will be moved by that change in pressure. *See* Tr. 1970-73. On rebuttal, Dr. Derschowitz testified that the Ershaghi study actually confirmed his conclusions as to the heterogeneity of fractures because it showed that, among wells in the same reservoir, some were in hydraulic connection and another was not. Dr. Derschowitz also informed the court that the various wells that were hydraulically connected had very different estimated ultimate recoveries. "So they clearly are not draining the same rock volume, and if you pump the A2 as hard as you could, ultimately you would be producing some water, but you wouldn't be draining the oil from the location of the A4." Tr. 3355. He explained: "You can transmit a pressure wave much further and much faster, and you can transmit a pressure wave without moving any fluid at all. . . . [T]he pressure response is and can be much stronger, and extend over much further distances than the actual movement of mass." Id. at 3355-56.

He went on to give an example in which tracers were used to track the production of certain oil by wells that were known to be in hydraulic connection. That test confirmed that the wells were still producing different volumes of oil. The oil that drained to the well was different. "There is no --

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[38] Dr. Barton did not criticize Mr. Homann's identification of the fracture orientations and testified that he had done a good job in that respect.

what we call -- reciprocity. Reciprocity would be if A2 and A4 were really part of the same drainage volume, and we were draining the same oil, well, then they would be producing the same." *Id*. at 3356. Instead, Dr. Derschowitz posited that the production figures from the Arguello field confirm that, "[y]ou can have A2 and if you add A4, if A2 is producing a hundred barrels a day, you could put A4 on and it is producing a thousand barrels a day without diminishing the production in A2." *Id*. at 3356-57. Thus confirming that a pressure response does not necessarily equate to the drainage of the same reserves between hydraulically connected wells in the Ershaghi Study.

Even if one were to assume that a pressure response did equate to significant drainage, the results of the Ershaghi Study would not change our view as to the directionality of drainage in the Rocky Point Field. The pressure response from A4 and A7 are both consistent with the northeast-southwest directionality of the Rocky Point fracture network. The Rocky Field is subdivided into pools caused by sealing faults, which interrupt any drainage of reserves on the other side of the sealing fault. We treat this subject in more depth in the next section. Any drainage in the direction of the A2 to A3 connection would be limited in the area drained by the production wells on lease 451 due to the presence of several sealing faults. It is sufficient to say that in the pool drained by the wells on lease 451, several sealing faults effectively halt the possibility of any significant drainage across the lease line.

We turn next to the GeoSystems Study referenced by Dr. Strickland and heavily relied upon in defendant's post-trial briefing. We find that it does not support the conclusions for which it was cited by Dr. Strickland in his testimony or by defendant in its brief. Most of the conclusions drawn by defendant are uncontroversial. It is defendant's citation of the paper for the proposition that the highly productive "splay fractures/breccias" are "expected to be oriented northwest-southeast," Def.'s Post-Trial Br. at 122, that is highly disputed. The GeoSystems Study does not go so far.

As stated in the study, "[s]play fractures . . . associated with slip along bedding plane discontinuities . . . are expected to have strikes perpendicular, or somewhat oblique to, the slip direction (inferred to be the direction of compression and folding)." Def.'s Ex. 126 at 24. Defendant, however, has not cited evidence, nor presented testimony, of the necessary predicate for its conclusion: the slip direction and/or direction of compression. In contrast, plaintiff's expert, Mr. Homann, testified in detail concerning the quoted language and the tectonic forces at play. Mr. Homann compared the results of his fracture-selection from the FMI log with the GeoSystems Study's conclusions; he concluded that they were the same. The direction of compression and folding was northeast-southwest. That direction, as quoted above, is inferred by the GeoSystems Study to be perpendicular to the slip direction. The direction of the most productive fractures is oblique or perpendicular to the slip direction and thus roughly parallel to the direction of compression and folding: northeast-southwest.[39] Thus, the cited study actually confirms plaintiff's experts opinion of the direction of drainage.

In summary, because there is general agreement as to the in-situ stress state and the usefulness of the application of the critical stress analysis, it is only the question of which fractures should be included in the analysis that is critical. As stated above, we find plaintiff's distinction between open and closed fractures to be reasonable and the best predictor of the directionality of flow after the critical stress analysis is applied to those that are open. Defendant failed to show why Dr. Barton's other criticisms of Mr. Homann's fracture-selection make a meaningful difference to his and Dr. Derschowitz's conclusions. Additionally, neither of the cited studies provides a reason for rejecting our findings. As a result, we find that plaintiff has proven that there is a strong northeast-southwest bias in the direction of drainage in the Rocky Point field. The implication is that, for any fixed period of time, disproportionately more oil is flowing toward any particular well on lease 451 from directions other than the Rocky Point reserves on lease 452, which lie to the southeast of the wells on lease 451.

2. Sealing Faults/Compartmentalization

The second major factor limiting cross-lease drainage is the presence of sealing faults which create separate pools of reservoir rock within the Rocky Point formation. Because the faults are sealing, the pools are not in fluid communication. Drainage in one pool thus has no effect on the reserves in another pool. The parties and their experts disagree both as to the location and character of the faults as sealing. The disagreement matters because the existence of sealing faults, especially as mapped by plaintiff, would partition

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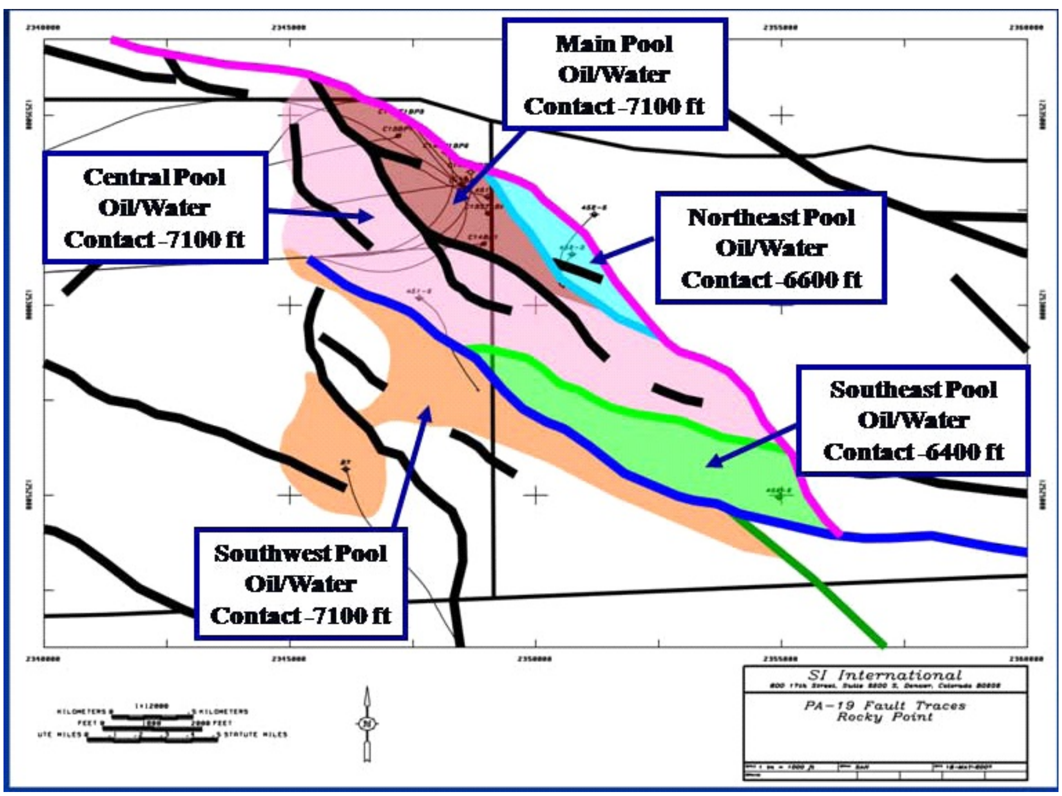
[39] "The direction of compression and folding is somewhat oblique [to the slip direction] . . . so the splay fractures then have strikes perpendicular to the movement along those slip surfaces . . . . If I use that, it will result in an orientation of these fractures of roughly northeast/southwest." Tr. 856-57.

large areas of oil bearing rock on lease 452 from any drainage from the wells on lease 451.

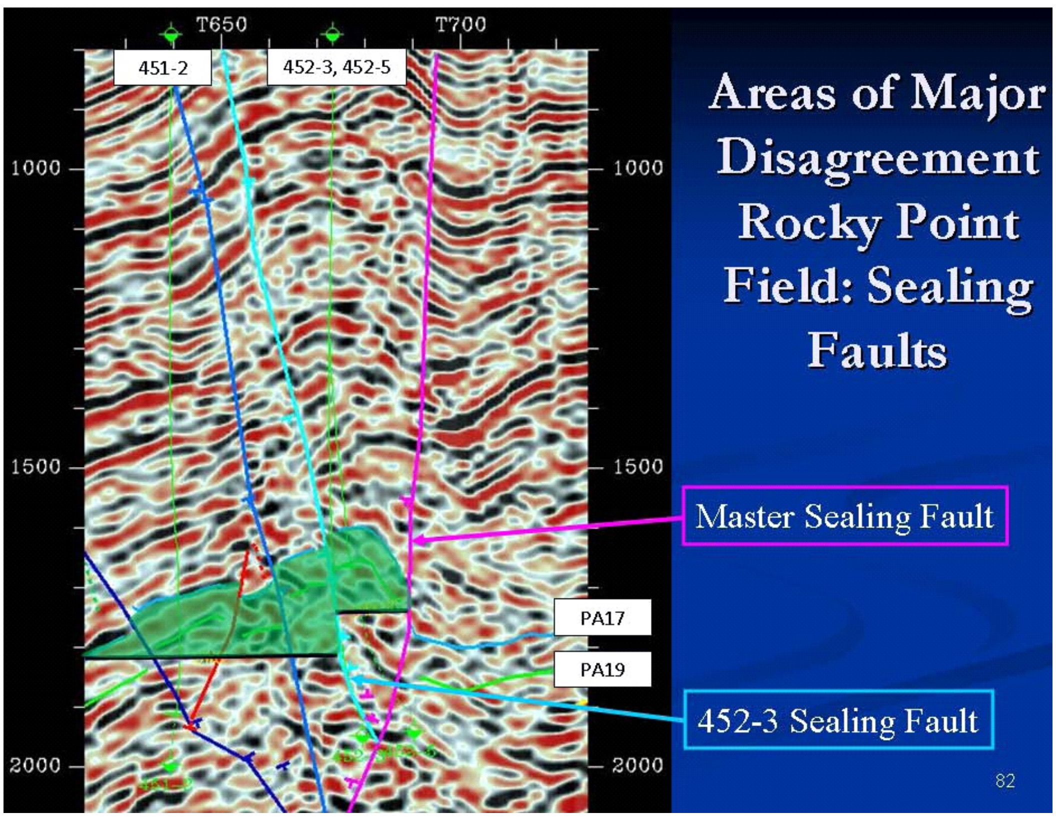
Plaintiff chiefly relied on the testimony of Mr. Scott Haberman on the question of sealing faults in Rocky Point, although the testimony of other witnesses also corroborates his testimony. Mr. Haberman is an oil and gas consultant, providing "geological and geophysical consulting." Tr. 19. As described by Mr. Haberman, he uses "physical means to remotely understand the geology under the surface." *Id.* at 20. His particular emphasis is "in the interpretation of 2-D and 3-D seismic data and in the integration of seismic data with geological, petrophysical and engineering data and specifically in structurally complex regimes." *Id.* at 32-33. Mr. Haberman has been providing these types of services to the oil and gas industry since 1983.

For his work in this case, Mr. Haberman conducted an interpretation of the Rocky Point Field using all of the seismic and well data available as well as previous Rocky Point interpretations conducted by others. The following map view slide of the Rocky Point formation is a useful summary of his findings:



Pl.'s Ex. 114 at 51 (Haberman Trial Presentation). The magenta colored fault running across the top of the formation is known as the "master sealing fault." It forms the northern boundary of the formation. The parties basically agree as to its existence, although not as to whether it is sealing. The other colored lines represent several other major faults that are interpreted by plaintiff to be barriers to fluid flow. It is exact location of the other faults and, most importantly, their characterization as sealing that creates the dispute.

Mr. Haberman explained during his testimony that the mapping of faults is a process conducted by examining the seismic survey data and looking for locations and patterns of displacement along a line through the rock beds. This displacement is an indicator of fracturing and faulting. Major displacement is the result of a fault. The following slide from his presentation is an example of this mapping:



Id. at 82. The black and red bands represents layers of rock. The alternating colored bands reflect the layers of rock. Only two bands, PA 17 and 19 have been identified as productive of oil. It is clear from this example that such interpretation is certainly imperfect and is a matter of judgment. It is, however, a common practice in the petroleum industry.

The inference that faults are sealing is primarily a result of differing oil/water contacts between pools. Mr. Haberman identified five separate pools of oil with three differing oil/water contact levels:

> [Y]ou can see as shown previously in 3-D geologic model, if you look at the southwest pool, the contact of minus 7,100 feet, southeast pool with minus 6,400 feet, the central and main pools at minus 7,100 feet, the northeast pool the contact of minus 6,600 feet you can see that there are several sealing faults that must be in play here in order to segregate the reservoir in this fashion.

Tr. 167-68. The following exchange between counsel and Mr. Haberman is useful to clarify the above quoted testimony:

> Q. And the question then becomes what is the necessary implication at least from your perspective of the fact that you have different oil/water contacts?
>
> A. Right. That's right. I mean, there's a structural mechanism here for segregating those different compartments and causing these oil/water contacts to be so different.
>
> Q. What is that mechanism?
>
> A. That would be sealing faults.

Id. at 169. Dr. Mannon also agreed that the "only way that you can possibly have a difference in oil/water contacts is by having some kind of barrier which would prevent fluid migration across the fault." Tr. 1866.

Mr. Haberman and Dr. Mannon drew their oil/water contacts from the exploratory wells drilled throughout the Rocky Point structure.[40] Dr. Mannon

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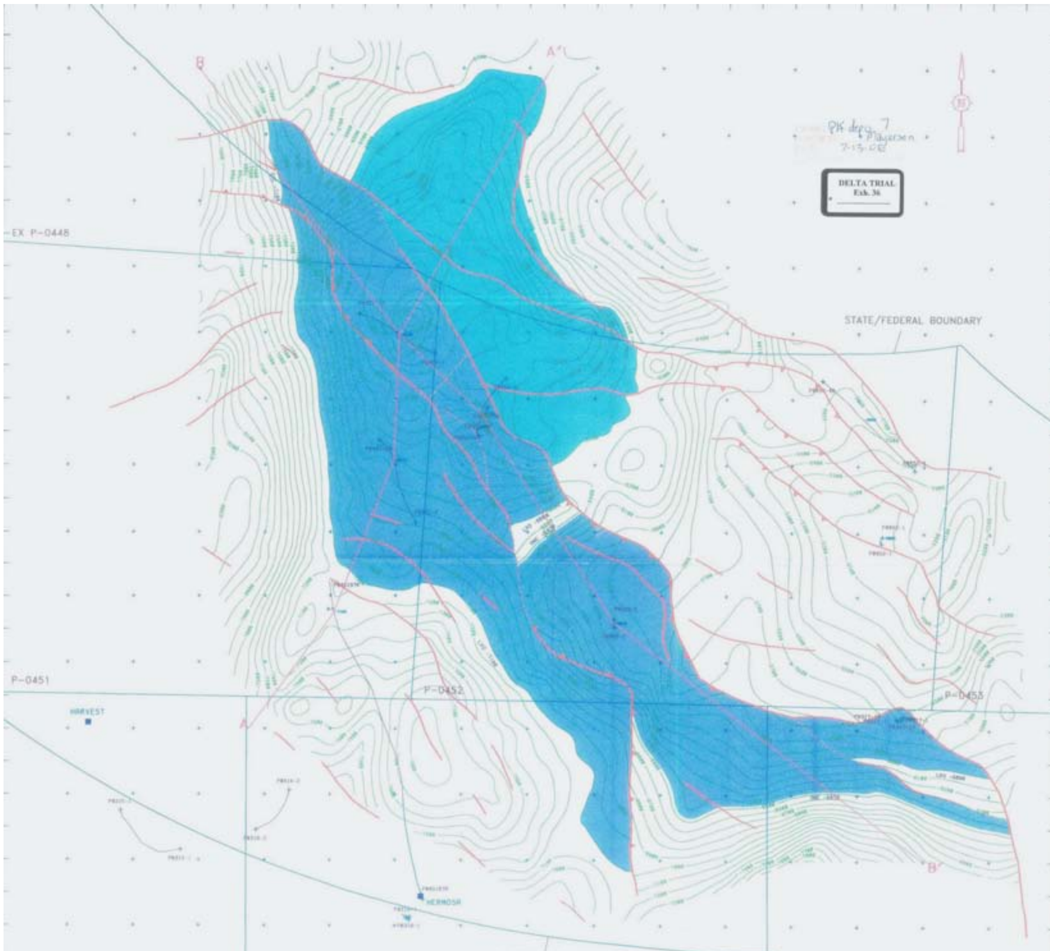
[40] A brief recap of the exploratory well DSTs is useful: the 451-1 well, located (continued...)

testified that, in his experience, the DST tests from exploratory wells are virtually the only way to determine oil/water contact levels. "Without exception, all the projects I've worked on, which is quite a number, six or seven units in the offshore, invariably we have determined the oil/water contact by DST information." *Id*. at 1885. He went on to state that it is not possible to reliably measure the oil/water contact after a field is in production because of the nature of the fracture matrix. Water moves up the structure very rapidly once the field goes on production.[41]

MMS and the state also conducted their own jointly-sponsored interpretation of the Rocky Point field. The joint interpretation divided the field into nine separate blocks or pools. Mr. Drew Mayerson, the Chief of the Office of Reservoir Evaluation and Production for the Pacific OCS Region, spent four to six weeks developing a structural interpretation. A map-view of that interpretation appears below:

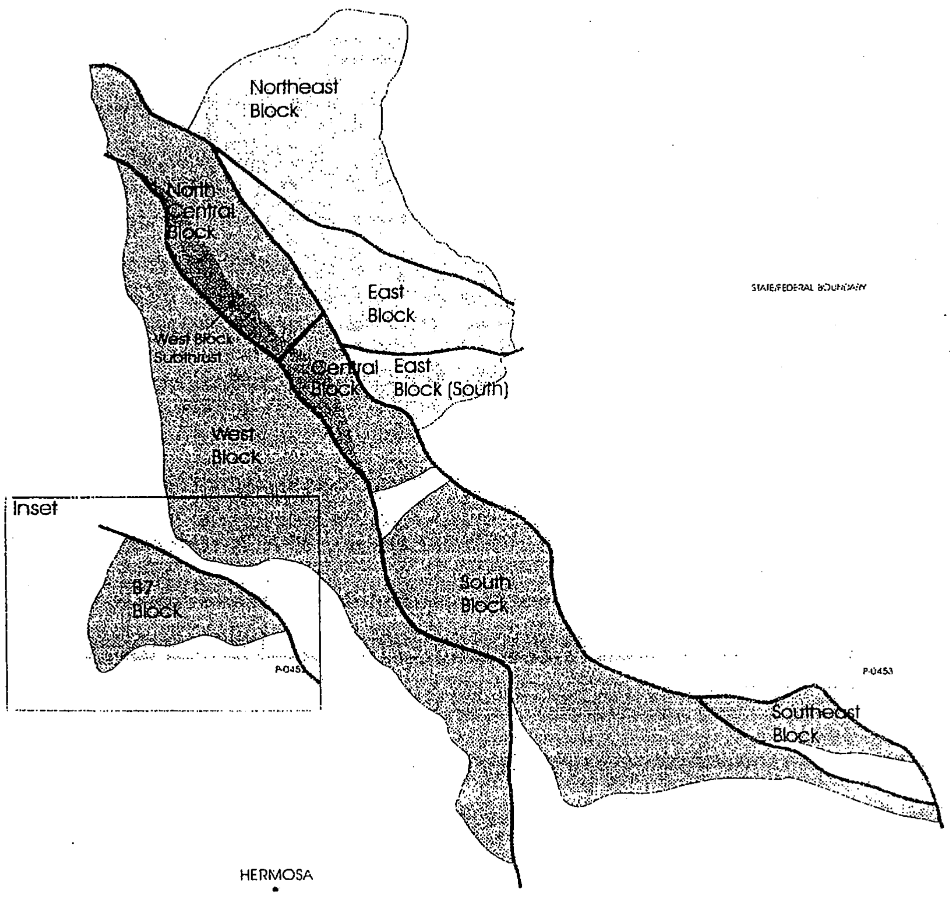
[40](...continued)
in the Main Pool, encountered water between 7100 and 7200 feet sub-sea; the 451-2 well, located in the Central Pool, encountered water at a approximately 7100 feet of depth; the 452-3 well, located in the Northeast Pool, found water at a depth of 6810 feet; the 452-5 well, also in the Northeast Pool, showed water at 6617 feet sub-sea; the B-7 well, drilled in the Southwest Pool, showed results consistent with a oil/water contact of approximately 7100 feet; the 452-2 well, located in the Southeast pool, established an oil/water contact at around minus 6400 feet.

[41] Dr. Mannon also presented testimony explaining one of the phenomena in the rock that leads to this rapid influx of water. He informed the court of a paper presented to the Society of Petroleum Engineers by Iraj Ershaghi and Armen Voskanian, of MMS, which posited that certain vertically oriented fractures and breccia zones create a "chimney" or "bundle of straws" that allow for the rapid movement of water up the formation after it has been begun to be produced. *See* Pl.'s Ex. 116 at 53 (excerpts from paper by Ershaghi and Voskanian) (Mannon Trial Presentation).



Pl.'s Ex. 36. The blue colors represent oil reserves. The red lines are interpreted faults.

The following cartoon version makes it is easier to see the pools as discerned by MMS and the state:



Pl.'s Ex. 33.

Mr. Mayerson testified that he determined what he believed to be the oil/water contact levels for the various pools. He identified the North Central Block as having a minus 7100 feet contact level. This was based upon the results of the DSTs from the 451-1 exploratory well. The West Block was also found to have a minus 7100 level from the results of the 451-2 well. The oil/water contact for the Central Block was established at or below negative 6600 feet based upon the lowest known oil encountered by the 452-3 and 452-5 DSTs.

When asked on cross-examination what could account for the difference between the levels in the North Central and Central Blocks, Mr. Mayerson answered that it was either due to a sealing fault or a tilted oil/water contact. He testified that generally this would be due to a fault. He was, however, unable to find the fault in the seismic data that he examined. After consultation with Chevron, then the owner of the Rocky Point leases, he settled upon the inclusion of a fault. "It was used as a tool to explain the difference in the oil/water contact . . ." Tr. 2436.

In addition to the differing oil/water contact levels, Mr. Haberman relied on the work of Mr. Homann and Dr. Derschowitz and he drew upon his "experience . . . hav[ing] work[ed] for years in these types of transpressional systems in other parts of the world and in onshore and offshore California" to confirm his analysis. *Id*. at 170. His experience working in transpressional systems is particularly relevant here because, "[w]e know that in a transpressional system, the likelihood of having fault seals is quite high because of cataclasis that occurs through shearing on strike slip deformation and also because of the pressure that exists on the fault because of the compression components of the stress field . . . ." *Id*. The general orientation of the sealing faults was northwest to southeast. The direction of open fractures, in contrast, he concluded was northeast to southwest.[42]

Coming to the same conclusion, Mr. Homann testified that in his FMI log analysis from the C-13 well, he encountered several major faults, including the fault separating the Main Pool from the Central Pool.[43] Mr. Homann concluded that these faults were sealing: "Based on the observation that all the closed and cemented fractures strike somewhat parallel to these microfaults, these large faults, I made the assumption that these faults are barriers to flow." *Id*. 651. He testified that he observed the presence of fault gouge in the fault zones, which causes the faults to seal.[44]

Fault gouge is a relatively fine material comprised of ground up rock and shale pebbles, "which is the result of grinding down the rock as the walls of the fault move against each other." *Id*. at 653. Mr. Homann explained this process when asked if the fault zone can have fractures of its own:

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[42]He testified that "what I call closed and cemented fractures, which would be flow barriers, appear to strike fairly clearly northwest, southeast, in general while the majority of my open and partially open fractures strike northeast, southwest." Tr. 456.

[43] This fault is represented by the black line trending northwest to southeast directly below the magenta-colored master sealing fault in Mr. Haberman's fault map of the field.

[44] A fault zone is a term synonymous with a breccia zone.

> It has originally because every time the fault moves it creates again little fractures. Those will be then during further processes ground down again. So it's an ongoing process as long as the fault is alive. They will not be preserved as open fractures for sure or not. At best they end up as fault-filled fractures, cement-filled fractures, gouge-filled fractures.

Id. at 653-54. Mr. Homann agreed with Mr. Haberman that in a transpressional tectonic regime, the forces at play create a cementation of the fault zone. "That means the faults and the body of rock that we are looking at in the Rocky Point structure is subject to considerable compression and lateral displacement, so it's a movement that squeezes everything together." *Id*. at 655.

Dr. Derschowitz concurred, adding that, in his experience and in the documentation relating to the Monterey area, the faults trending in the northwesterly direction tend to be sealing because of the strike-slip, or transpressional, offset that occurs. As he explained:

> It's very common in the fault core for the fault to grind the material so fine that it is clay-size particles. Clay-size particles form an impermeable barrier. So it's classic in a lot of reservoirs to have faults, particularly strike slip faults that contain this clay type material that makes the fault into a barrier, and then compartmentalizes the reservoir.

Id. at 958-59.

Defendant countered mainly with the testimony of Dr. James Robertson. Dr. Robertson is an oil and gas consultant, specializing in “geology and geophysics associated with oil and gas exploration and development.” *Id*. at 2581. He has worked in that field for thirty eight years, the majority of which were spent doing work in connection with oil and gas exploration, including seismic interpretation.

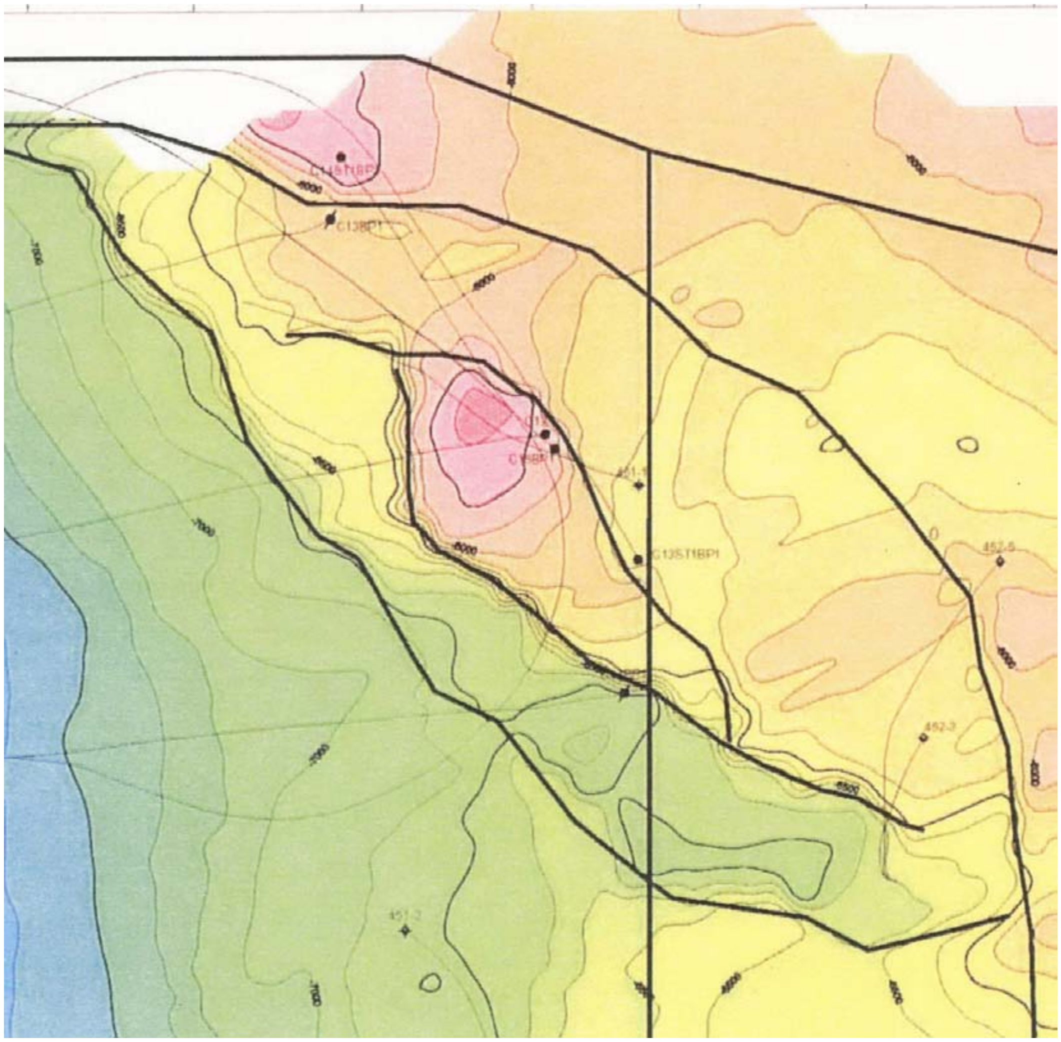
Dr. Robertson was asked to perform his own interpretation of the Rocky Point field and make a calculation of reserves in Rocky Point and the Jalama field. In his interpretation, Dr. Robertson used the same seismic information as Mr. Haberman along with the various well information, four expert reports

(Haberman, Homann, Mannon, and Wright), and a database of technical papers about the Monterey.

Dr. Robertson walked the court through his process and presented several images of cross-sections of seismic data, showing the court where they were located in map view. He also presented several slides with faults, as interpreted by Mr. Haberman, superimposed upon them. Dr. Robertson concluded, however, that the majority of the seismic and well data was poor in quality.[45] He presented a visual comparison of seismic images, contrasting how he viewed the seismic data in the software and how Mr. Haberman had viewed it. He testified that "interpreters do have some control over the scales of color and the scales of the amplitude at which seismic traces are displayed in the interpretation software that they use." *Id*. at 2604-05. He showed the court an example of "modern 3D seismic data" to illustrate the detail that is available in contrast to the data from Rocky Point.

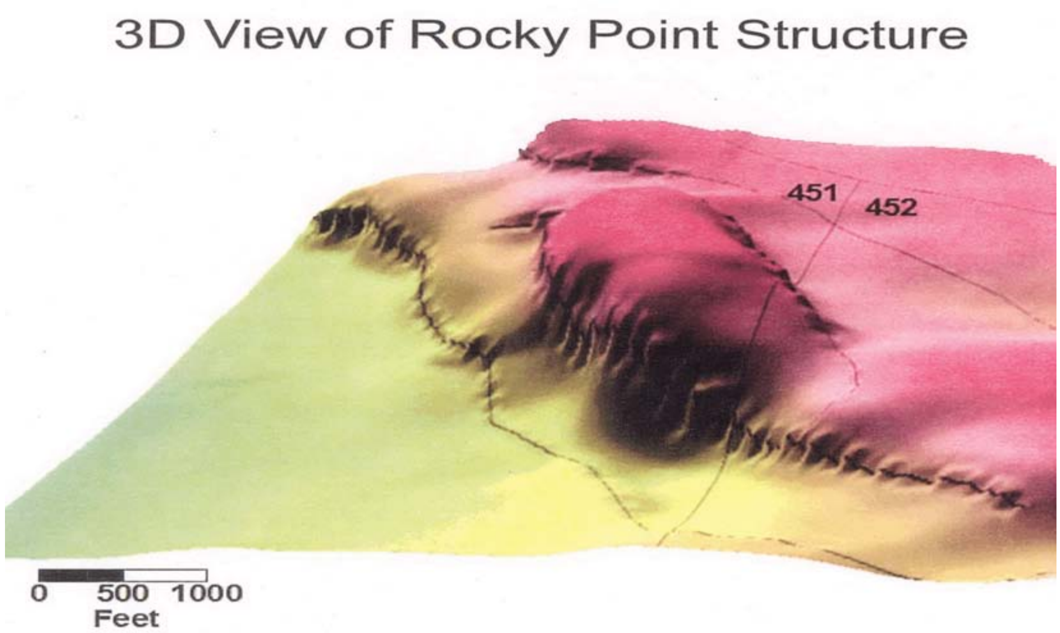
As a result of this poor data, Dr. Robertson testified that he could not create a reliable structural interpretation of most of the faults in the Rocky Point structure, especially those inside of his structure-bounding faults. The following image is a map view of Dr. Robertson's interpretation at the PA-19 level:

[45] He also testified that wells logs taken throughout the Monterey are generally regarded as providing poor quality data: "one cannot use the data to look at the properties of the rocks in the section, at any of the characteristics that are associated with lithology, or at parameters that are red to reservoir engineering calculations like porosity, location of oil/water contact, and so on." Tr. 2601.



Def.'s Ex. 127 Attachment 2. As stated in Dr. Strickland's expert report, "Dr. Robertson concludes that the quality of the seismic image in the area of interest is so poor that it is not possible to create an unambiguous structural interpretation of the area." Def.'s Ex. 127 at 12. According to Dr. Robertson, his field occupies roughly the same space as plaintiff's Main Pool and Northeast Pool. A little less than half of Dr. Robertson's formation is on lease

452.[46] He also presented a 3D view of the Rocky Point field, which is useful to gain a general understanding of the shape of the field throughout all of the productive zones:



Def.'s Ex. 132A at 10. It was, however, the mapping of faults within the structure that proved too difficult for Dr. Robertson.

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46 Dr. Robertson later testified that 44% of the bulk rock volume lies on lease 452.

After his testimony concerning his structural interpretation, Dr. Robertson turned his focus to a quantitative computation of the bulk rock volume of productive rock in the Rocky Point and Jalama fields. A major factor contributing to that computation is the oil/water contact level. The oil/water contact level, as explained above, is critical to the question of whether the faults, as mapped by Mr. Haberman, are sealing.

Dr. Robertson testified that, after reviewing all of the well data from the production and exploratory wells, he came to the conclusion that eight of the wells supported a minus 6500 feet oil/water contact and only one exploratory well, the 451-1 supported a 7100 level, which he concluded was an anomalous reading.[47] He presented his conclusions broken down well by well, supported by information from the DSTs conducted on those wells.[48]

Dr. Robertson based his conclusions on DSTs performed in the production wells on the Rocky Point field. He put the oil/water contacts for each of the production wells between 6300 to 6600 feet deep. As identified by Dr. Robertson in his summary of Rocky Point well tests:[49] the C-12 well, tested in February of 2005, flowed oil from the PA-17 through the PA-20. The PA-21 did not flow oil and was interpreted to be a "tight zone." The lowest perforation was at 6937 feet sub sea. The lowest perforation in the productive zone was at 6698 feet. The lowest productive zone (PA-20) produced around 45 water. From these figures, Dr. Robertson calculated an oil/water contact at between 6500-6600 feet.

For the C-13 well, tested in July through September 2005, Dr. Robertson deduced an oil/water contact between 6400 and 6600 feet deep. The well flowed oil from the PA-17 through the PA-20. The third zone, PA-

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[47] As defendant concedes, Dr. Robertson did not review any information from the B-7 exploratory well, which is located in the Southwest Pool and had an oil water contact level of approximately minus 7,100 feet.

[48] Contrary to his testimony, Dr. Robertson's well summary and an earlier version of it confirm that two of the wells he examined – 451-1 and 451-2 – in fact, support a minus 7100 foot oil/water contact. *See* Pl.'s Ex. 50 at 3-4; Pl.'s Ex. 59 at 3-4, 8.

[49] The information is drawn from plaintiff's exhibit 50, most of which was testified to by Dr. Robertson on direct or cross-examination.

21, was not individually tested. The PA-21 was, however, tested in conjunction with the PA-17, PA-18, and PA-19 levels and the well as a whole. Dr. Robertson concluded that it was a water zone based on the high levels of water flowing in those tests and in a test that examined the PA-17 through PA-20. The lowest perforation in the well was at minus 6921 feet. The DST in the PA-20 alone flowed 84% water. The perforations in that zone were from minus 6305 to 6706 feet. The high water cut in that zone led Dr. Robertson to conclude that the oil/water contact must be in that zone.

The C-13 re-drill (C-13ST) was tested in February 2006, only one month after going into production. The C-13ST had perforations ranging from negative 5815 feet through negative 6552 feet, in the PA-18 through PA-20. The PA-20 zone was shut-in during January of 2006, due to immediate high water production. The other zones tested together flowed between 25-30% water. Dr. Robertson concluded that the PA-20, with perforations between 6374 and 6552 feet sub sea must be the oil/water contact.

The C-14 was tested in its first month of production in June 2005. The well flowed almost entirely water from the very first day. The perforations began at 6519 feet of depth and ran all the way down to 6982 feet below sea. Due to the immediate invasion of water, Dr. Robertson calculated the oil/water level at between 6500-6600 feet sub sea.

The C-14 sidetrack was tested in November 2005. It was tested only as a whole well. Its had perforations starting at 5334 feet deep and its lowest were at 6437 feet of depth. The well flowed between 20-25% water. Dr. Robertson believed these results to be consistent with an oil/water level of between 6500 and 6600 feet sub sea.

The final production well, the C-15, was tested in June and then in July of 2006. The C-15 had perforations starting at 6066 feet deep and its lowest was at negative 6678 feet. It was drilled from the PA -19 through the PA-21. During the June 2006 tests, the PA-19 test alone flowed 53% water. All three zones together flowed 60-80% water. Zones one and three tested together flowed 80-90% water. In the July 2006 tests, all three zones tested simultaneously flowed almost entirely water. When zone two was left out, the well flowed only 60-75% water. The higher cut of water from the inclusion of zone two led Dr. Robertson to conclude that the oil/water contact was in that zone, somewhere between 6300 and 6500 feet below the seabed.

Dr. Robertson also testified concerning the result of the DSTs in the 451-1 well, which establish an alternate oil/water contact. With regard to the difference between the 451-1 well and the 452-2, the two wells that caused Mr. Mayerson to infer a sealing fault on his MMS sponsored interpretation, Dr. Robertson concluded otherwise. He testified that despite his careful searching, the poor quality of the seismic data prevented him from finding a reliable fault that would serve as a barrier between them. Instead, he posited two alternate explanations. The first was the tilted oil/water contact offered by Mr. Mayerson. He dismissed this possibility summarily as not physically possible due to the angles and distances involved. The explanation Dr. Robertson offered was that the 451-1 well was drilled into an "impermeable layer of rock, or combination of impermeable layers, that in essence is isolating a small compartment of oil here with a low oil/water contact from a higher oil/water contact over here." Tr. 2614. He analogized this situation to a thimble in an upside down mixing bowl. He agreed it was akin to "an anomalous vacuole of both oil and water on some column below this larger dome." *Id*. at 2615.

On cross-examination, Dr. Robertson was asked whether the results of the 451-2 well, which also showed a minus 7100 foot oil/water contact, might be another example of the "anomalous vacuole," or "thimble" theory. He stated that he had no information that might suggest a repeating anomaly. Nevertheless, based on the six production wells, he cast aside the possibility of any pool or reservoir wide oil/water contacts at the negative 7100 foot level.

We agree with plaintiffs that the weight of the evidence establishes five separate pools with three different oil/water contact levels, confirming the existence of sealing faults. Defendant's proposed oil/water contacts, based on the six production wells and the thimble theory, do not, as it were, hold water.

We start with the obvious. Putting aside the anomalous thimble and the 451-1 well, Dr. Robertson simply failed to account for the 451-2 and B-7 wells in his analysis. The B-7, located in the southwestern extremity of the Rocky Point field, established an oil/water contact of around 7100 feet sub sea. Although located a substantial distance from Robertson's reservoir,[50] without

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[50] Dr. Robertson testified that his reservoir was roughly the same area occupied by Mr. Haberman's Main and Northeast Pools. Dr. Robertson did not deny that oil resided outside of this reservoir, but did not include those areas (continued...)

an intervening sealing fault, or one of the other less likely explanations, it ought to have established a contact level at the negative 6600 foot mark. It did not. Likewise, because Dr. Robertson does not assume any of his faults to be sealing, the 451-2 well, although located in plaintiff's Central Pool, outside of Dr. Robertson's reservoir, ought to have found an oil/water contact consistent with his field-wide level. It did not. Both parties' experts were in agreement that absent some barrier, the oil/water contact level should be uniform across wells.

We find that the exploratory wells are the best evidence of the oil/water contacts at their respective positions in the field. Dr. Mannon was unequivocal in his testimony that in every oil field[51] he has worked in, the oil/water contact levels were established by use of tests from exploratory wells. Dr. Mannon explained that production wells are unreliable indicators of original oil/water contact levels in the Monterey because of the rapid movement of water up the well bore after production. He cited a study by Iraj Ershaghi, in which Ershaghi presented a scientific explanation of this phenomenon, involving vertically oriented brecciated intervals that allowed water to move rapidly up the formation once oil was displaced. *See* Pl.'s Ex. 116 at 53 (excerpts from Iraj Ershaghi, *A Conceptual Model for Reservoirs Producing in the Monterey Fields, Offshore California*, Society of Professional Engineers (1999)). Dr. Mannon also testified of his experience in the Monterey when an operator attempted to create an oil/water contact map using data from production wells. He stated that the levels varied so greatly between wells that Chevron abandoned this attempt completely. Dr. Mannon's testimony concerning the exclusive use of exploratory wells was not meaningfully addressed by any of defendant's witnesses. We find Dr. Mannon's testimony in this regard to be compelling.

In addition to Dr. Mannon's testimony, there are several reasons why Dr. Robertson's calculation of the oil/water level is unreliable. Chiefly, the production wells are the only ones with productive intervals (perforations) at or below the minus 7100 foot level. None of the production wells have

[50](...continued)
because of his view of their low prospectivity.

[51] Dr. Mannon testified that he has worked in six or seven of the units in the offshore Monterey formation, which would encompass nearly all of the Monterey oil fields.

perforations below the minus 6900 foot level. They are thus less probative to the question of the oil/water contact. We examine each well below.

The C-12 well, located inside of Dr. Robertson's reservoir and in plaintiff's Main Pool, is in direct competition with the 451-1 well for establishing the oil/water level in that area. The issue, however, is not simply picking between them. We find that the C-12 well does not establish an oil/water contact around the 6500-6600 feet sub sea level. First, C-12's lowest perforation is at 6937 feet. Although the lowest zone produced no oil, no perforations exist below that zone that would allow us to test the question conclusively. Dr. Robertson drew his conclusion of the oil/water level from the water cut established when the three higher productive zones were tested in conjunction with one another. The cut was approximately 40% water from zones ranging from negative 6029 feet to 6698 feet sub sea. He also relied upon the test of zone 2 alone, which produced a 45% water cut in the perforations between 6203 and 6698 feet sub sea.

The problem with Dr. Robertson's reliance on these tests is that they were conducted in February of 2005. The C-12 went into production in October of 2004. Dr. Strickland testified that when the C-12 first when into production, it flowed only 15% water. That fact, in conjunction with both Dr. Mannon's and Dr. Derschowitz's testimony that water moves up the wells very rapidly in the Monterrey, makes Dr. Robertson's calculation unreliable as to the original oil/water contact. Given that Dr. Robertson relied on a 44% water cut five months after a well went into production to find an oil/water contact at minus 6500 feet, we assume that a 15% water cut immediately upon the start of production leads to the conclusion that the original oil/water contact was at a level lower than that. Because the C-12 did not test below 6900 feet sub sea, we find it more reasonable to rely on the 451-1 well, which did test below 6900 feet and established an oil/water contact at minus 7100 feet. As we explain further below, we find that in the Main Pool, the oil/water contact level was at minus 7100 feet.

Dr. Robertson's conclusion based on the C-13 well fails for a much more fundamental reason. Several witnesses testified at trial that the C-13 well suffered from a faulty cement job. This means that the cement casing of the well bore failed to seal, which lead to an inability to establish at what level in the well fluid was being produced. Dr. Robertson admitted on cross-examination that he was aware that Plains had concluded that the cement job was faulty. He was asked: "And a busted cement job means that water can come up into any zone from the depths of the well or below, correct?" *Id*. at 2806-807. He answered: "correct." *Id*. at 2807. He also stated that he was aware that Plains attempted to fix the cementing before the DSTs were conducted. He was, however, unaware whether that attempt was successful. Dr. Mannon testified that the well records he examined prior to trial indicated that the cement fix was not successful. Thus, according to Dr. Mannon, there was never any zone isolation in the C-13 well, meaning that Plains could not tell specifically from which level the fluid produced by the well came. The faulty cementing, in combination with the fact that the DSTs were conducted at least seven months after the C-13 went into production and the very high percentage of water production, makes an oil/water contact conclusion impossible based on the C-13 well.

The C-13 sidetrack (C-13ST), also located in the Main Pool, is similarly not probative on the question of the oil water contact. Although the lowest zone was almost immediately shut in due to the high water cut, we cannot rely upon the C-13ST results because the lowest perforations are at only 6552 feet sub sea, almost 600 feet above the 7100 foot level. Given the testimonies of Dr. Derschowitz and Dr. Mannon, we cannot draw a solid conclusion from the C-13ST when alternate explanations for the water cut are consistent with a lower oil/water contact. Instead, we rely upon the exploration wells that did have perforations low enough to definitively establish the oil/water contact level.

Nor can we draw any conclusion based on the C-14 well because it produced almost exclusively water, even when tested in separate zones. It therefore cannot provide even a range of where the oil/water contact might have been.

The C-14 sidetrack (C-14ST) was tested only as a whole unit; all three zones were tested at once. It produced between 20 and 25 water. The lowest perforations in the C-14ST are at minus 6437 feet. Dr. Robertson testified on cross-examination that a definitive conclusion could not be drawn: "since they didn't test any of these zones individually, and particularly since there is no zone of open [perforations] . . . below 6,500 feet, all you can do is say that this well produced mostly oil with 20-25 water, so it's up in the oil zone." *Id*. at 2808. For these reasons we find the C-14ST well tests to be an unreliable indicator of the oil/water contact level.

The final production well, C-15, has its lowest perforations at 6678 feet below the sea bed. The lowest production zone, 6591 through 6678 feet sub sea, was found to be "mostly tight," flowing very little fluid. In the second round of testing, one month after the first DSTs, all three zones tested together flowed overwhelming percentages of water. When zone two was left out, the water cut was reduced to between 60 and 75 . This does not, however, lead us to the conclusion that the oil/water contact must be in that zone. Rather, like several wells discussed above, we cannot rely upon the C-15 results due to the high level of water production throughout the well, combined with the fact that the perforations ended at only minus 6678 feet.[52]

In sum, the Rocky Point exploratory wells provide the only reliable basis on which to draw a conclusion as to the oil/water contact level. We find that the oil/water contact levels are as follows: the 451-1, 451-2, and B-7 wells establish oil/water contact level of minus 7100 feet in the Main, Central, and Southwest Pools respectively. The 452-3 well establishes a negative 6600 foot oil/water contact for the Northeast Pool. The 452-2 well establishes a minus 6400 foot oil/water contact in the Southeast Pool.

With regard to the specific location of the of the faults within the reservoir, we find that plaintiff's interpretation, as performed by Mr. Haberman, represents the picture closest to the state of the rock under the sea floor. As a preliminary matter, we note that there is much agreement between the competing interpretations. To the extent that Dr. Robertson performed a seismic interpretation, his reservoir-bounding faults are roughly equivalent to the faults bounding Mr. Haberman's Main and Northeast Pools. Dr. Robertson's faults are also oriented in the same direction as Mr. Haberman's and the MMS's interpretations. The main difference between Dr. Robertson's interpretation and that of Mr. Haberman is that Dr. Robertson declined to perform as detailed an interpretation due to his belief that the seismic information available was insufficient.

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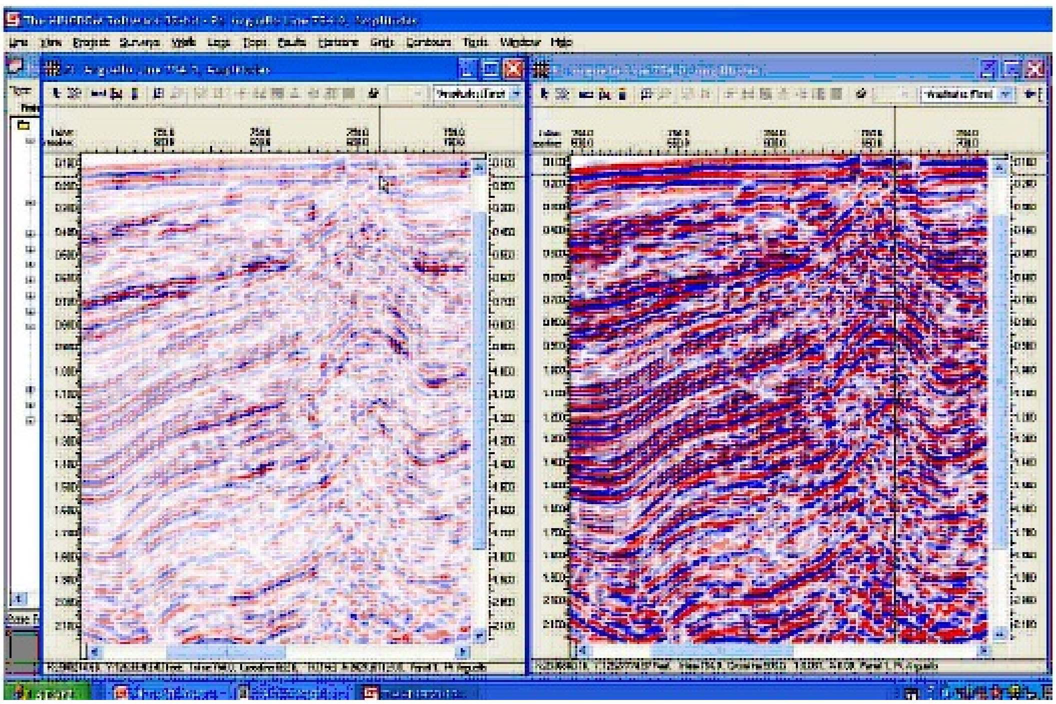
[52] We note also that the significant increase in water cut between the June 2006 and July 2006 tests provides validation for criticism against using production wells to indicate oil/water contact levels. We see frequently in Dr. Robertson's methodology that, the higher the water cut in any given zone or in the well as a whole, the higher the oil/water contact level. This does not appear to be a reliable method, however, as shown by these test results because the longer a well is on production, the higher the water cut.

Dr. Robertson's criticism of the quality of the seismic data is unconvincing, however. Dr. Robertson was cross-examined extensively on his use of the software used to view the seismic data. It became apparent during his testimony that Dr. Robertson was unfamiliar with the software he used and hired an outside contractor to run it for him. It was also clear that Dr. Robertson's comparisons of new seismic date to old data were strongly affected by his user-controlled selections in the software interface program. Plaintiff's counsel led Mr. Robertson through an exercise of color amplitude and raster manipulation in the software. As a result of this exercise, the following demonstrative was produced:



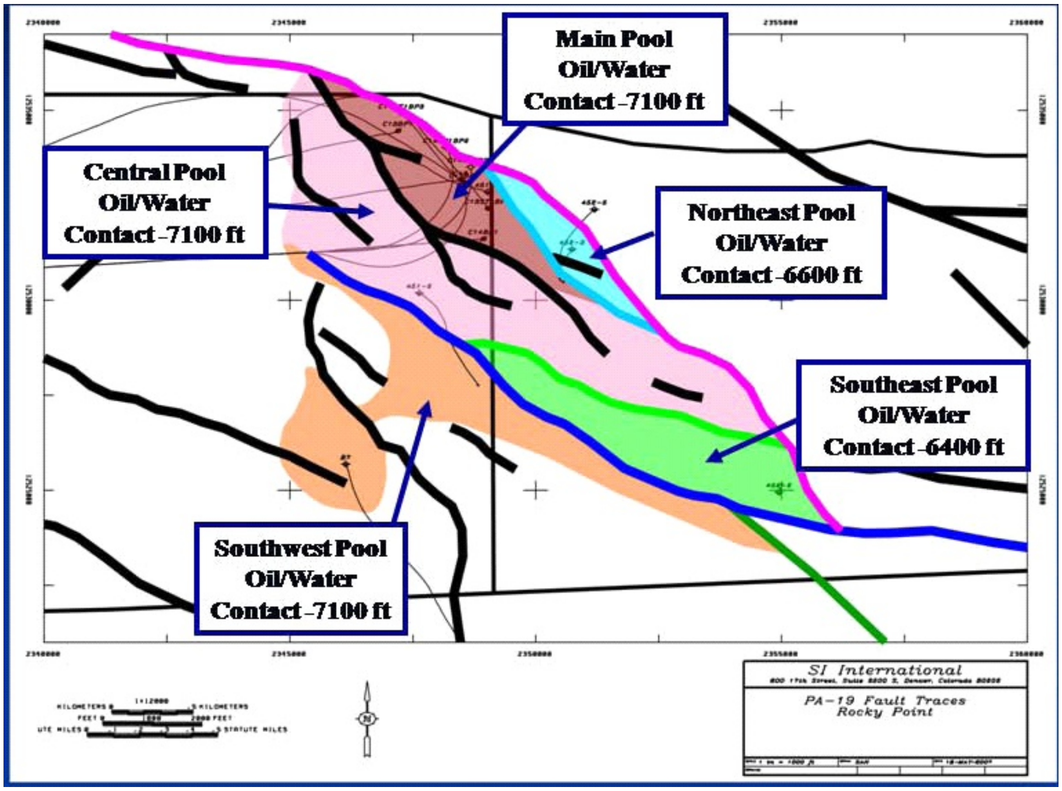
Pl.'s Ex. 186. The image on the left was presented by Dr. Robertson. Mr. Haberman's is on the right. The exhibit shows clearly that the image could be readily distorted or improved as the result of a few keystrokes.

Even putting aside his low-amplitude viewing of the data, Dr. Robertson's criticism is not credible because all of the previous and contemporary interpretations, not only on Rocky Point but also throughout the Monterey, were performed using the same seismic data collected in the early 1980s. Over a billion barrels of oil have been produced from the federal offshore California leases using the same era seismic data as that used here.

Many of the previous interpretations were produced without the benefit of the 2000-2001 reprocessing, including the interpretation performed by MMS's own Drew Mayerson. Mr. Mayerson testified that the quality and quantity of the data available for Rocky Point were "average" for the time in which it was collected. It was obviously sufficient for him to have performed his interpretation. Mr. Mayerson also testified that the reprocessing of data greatly improves its quality. It was the reprocessed data upon which Mr. Haberman relied in performing his interpretation. He concluded that there is far more reliable data available to perform a geological interpretation for the Rocky Point and Jalama fields than is typical for most reservoirs in the United States.

Although we recognize that seismic data and interpretations are far from perfect, the data here was sufficient to perform an interpretation with far more detail than that produced by Dr. Robertson. In the absence of a truly competing interpretation from defendant, we rely on plaintiff's interpretation as presented by Mr. Haberman. We find the methodology he used and the underlying data to be reliable. The oil/water contact levels, as established by the exploratory wells, lead to the conclusion that the faults separating those wells must be sealing.[53] In sum, we find the following map view graphic to be the best representation of the Rocky Point field:

[53] Additionally, in the case of the Southeast pool, we heard uncontroverted testimony that the oil weight was lighter in that pool, conclusively proving that it must be separated from the rest of the reservoir.



Id. at Ex. 114, at 51. The various colored lines separating the pools are sealing.

The implication of what we have found is that there is microscopic and macroscopic compartmentalization within the Rocky Point formation. On a small scale, the diversity of the fracturing and, as we found earlier, its directional bias due to stressing, mean that oil does not necessarily flow uninterrupted from point A to point B within the Rocky Point formation. The flow is directionally preferential and anomalous, in that there can be interruptions. On a macro level, what we have found means that there are sealing faults, which create distinct pools within the field, so that, for all practical purposes, a well within one chamber will not draw oil from an adjacent pool, no matter how close the oil is to the well.

3. *Drainage Distance*

As we explained, we reject the assumption that any one well, over time, will eventually drain all available reserves. This has clear implications for the question of the ability of any particular well to drain at great distances. Nevertheless, we treat the question of drainage distance separately because so much of defendant's experts' analysis depends on assumptions about the ability of wells to drain extensive areas. Defendant's theory of the case assumes that any well within the Rocky Point field, delineated by its more limited "blue polygon," simultaneously creates a draw down within that entire reservoir.

The thrust of defendant's argument is that the four production wells on lease 451 will drain the entire area within the "blue polygon" that makes up Dr. Strickland's reservoir. The reasons for that conclusion are as discussed above. The parties argue in the post-trial briefing whether Dr. Strickland's position is that one well would effectively drain a circular area with a 3000 foot radius. Dr. Strickland testified that he believes that a well placed in a "well connected fracture network" would drain oil from rock 3000 feet away, absent an intervening barrier to flow. *See* Tr. 3425. That radius would equate to a 738-acre circular drainage area.[54] Defendant ignores this testimony and instead focuses on the fact that Dr. Strickland's reservoir is only 350 acres large. Because there are four wells located in that "blue polygon," defendant suggests that this means Dr. Strickland is really only claiming that each well can drain an 87-acre area. Dr. Strickland did not design the well grid, however. He was merely confronted with what Plains had done.

Plaintiff's witnesses established beyond doubt, in any event, that a reservoir in the Monterey formation can only be exploited by multiple wells. If this were not the case, it would not have been necessary for Plains to drill from four to eight wells in an effort to exploit the Rocky Point reserves on lease 451. This is further confirmed by the testimonies of Dr. Mannon and Dr. Derschowitz that a pressure wave dissipates across distance, meaning that the farther oil is located from the well, the less likely it is to be produced by the well because the lower pressure differential farther from the well is insufficient to move significant amounts of oil.

Even defendant's reduced claim of only 87 acres per well rings hollow, given that the actual wells on lease 451 are located so closely together. They are not spaced uniformly throughout defendant's drainage area, and none are located on lease 452. In fact, given defendant's position regarding the well-connected network of fractures, and, under Dr. Strickland's view, one well

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[54] Dr. Mannon testified that 3000 foot drainage radius would equate to a 738-acre area.

should be able theoretically to drain the entire 350 acre polygon.[55] Plaintiff's counsel clearly demonstrated on cross-examination of Dr. Strickland that a 3000 foot drainage radius would make dozens, if not hundreds, of wells entirely superfluous throughout the offshore Monterrey. When superimposing a circular area with a 3000 foot radius on to a well map of the analogous South Ellwood field, Dr. Strickland counted fifteen or sixteen wells within the area he testified could be drained by one well.

The nature of the heterogenous fracture matrix and compartmentalization create a geophysical state in which the distance that oil will migrate to a well is highly limited. This is confirmed both by the evidence concerning the geophysical properties of the rock and by the placement of wells throughout the various fields in the Monterey. We therefore reject defendant's position that the distance of drainage to the wells on lease 451 is, for all practical purposes, unlimited.

The result of our findings on these three factors–fracture matrix/directionality/heterogeneity, sealing faults/compartmentalization, and drainage distance–is that all three mitigate against defendant's view that oil flows freely from reserves on lease 452 toward production wells on lease 451. They combine to suggest that a considerably more conservative estimate than defendant's figure on drainage from lease 452 (over 1.1 million barrels of oil) is correct.

In addition, while the central and main pools are probably connected, they are, for all practical purposes, separate pools, despite the common water table, because a significant fault separates them at most points. This means that, for oil in the central pool to migrate to wells on lease 451 in the main pool, distance and directional bias become major impediments.

One additional significant factor mitigating against defendant's figure is that defendant assumes that there is no sealing fault between the Northeast and Main pools. The Northeast pool is located completely on lease 452. This means that, even assuming defendant's other analysis is correct, the actual drainage figure would be approximately half as large as defendant suggests.

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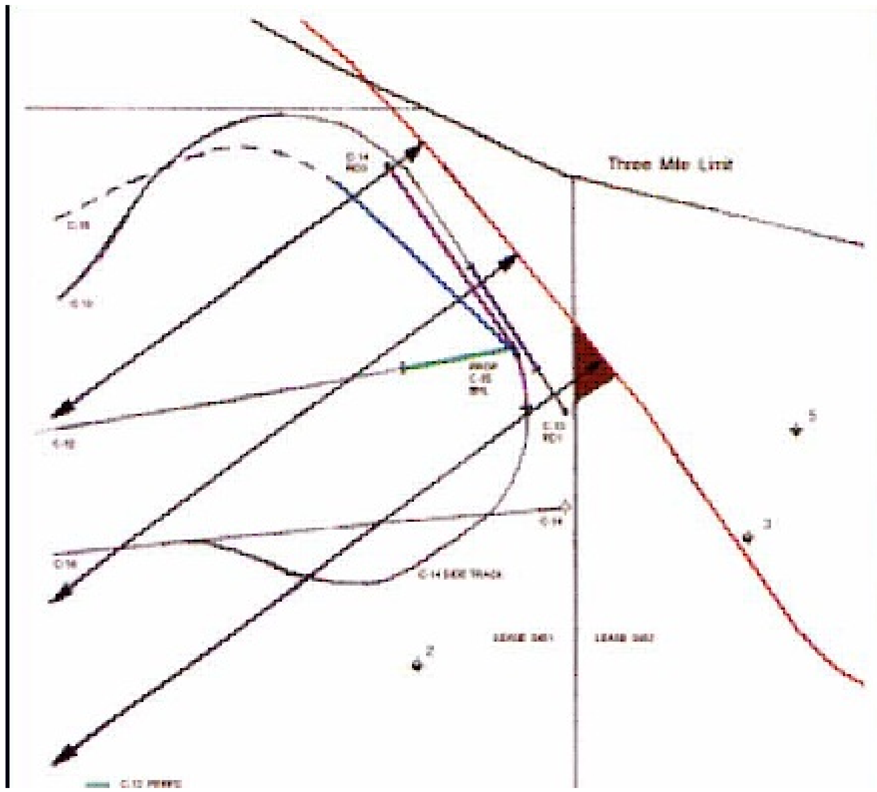
[55] It is unclear why, given Dr. Strickland's beliefs regarding a 3000 foot drainage radius and the lack of impediments to flow, his blue polygon was not larger.

B. Total Lease 452 Drainage

The factors discussed above lead the parties to present drastically different views as to the total amount of oil drained from lease 452 by the wells on lease 451. Defendant offered Dr. Strickland's static calculation, which he characterized as not being able to "account for flow versus time." *Id.* at 3238. He testified that the preferred method would be a dynamic calculation that measured the movement of oil over time, but that the data from the Rocky Point Field was insufficient to do so. Instead, his static method used "the existing production from the wells[, which] is then allocated attributable to each side of the area that you are using." *Id.* As he characterized it, it is "fundamentally a volumetric calculation." *Id.*

Dr. Strickland's description of the calculation as "volumetric" is telling. He presented two sets of numbers based on differing oil/water contact levels. We have previously rejected defendant's argument on that issue and therefore use only Dr. Strickland's figures for the deeper water table. He started with his ultimate estimated recovery (EUR) of 2.5 million barrels of oil. His figure for drainage from lease 452 is approximately 1.1 million barrels, representing approximately 44% of the EUR. The 44% figure also represents the percentage of the reservoir that defendant asserts is located on lease 452. Thus, Dr. Strickland has calculated the percentage of volume of rock on lease 452 and then applied that percentage to the EUR to produce his drainage figure for lease 452. His calculation simply assumes that all available reserves will migrate to lease 451 wells.

Plaintiff countered with the calculation performed by Dr. Mannon. Dr. Mannon offered a figure of 85,000 barrels migrating across the lease line to be produced by the wells on lease 451. It is apparent from Dr. Mannon's testimony that he, in effect, used the same static method as Dr. Strickland. The principal difference between the two figures is that Dr. Mannon's estimate for drainage from lease 452 is quite small because it is not coextensive with the whole of the area of the reservoir on lease 452. The following graphical depiction gives an idea of the lease 452 area Dr Mannon assumes will be drained by the lease 451 wells:



Pl.'s Ex. 116 at 73. The red triangle represents the lease 452 area he believes will be drained.[56] It is bounded on the northeast by the fault line between the main and northeast pools and on the southwest by what Dr. Mannon assumes to be the limits of southeast to northwest drainage.

In choosing between these competing figures, the first and most obvious problem for defendant is that the Northeast Pool is separated from the rest of lease 452 by a sealing fault. Although no expert testified to the exact extent of defendant's reservoir occupied by the Northeast Pool – defendant does not believe there are any separate pools in the Rocky Point Field – a visual depiction of defendant's polygon superimposed on one of plaintiff's maps shows that the *potential reservoir* area is approximately half of defendant's "blue polygon":

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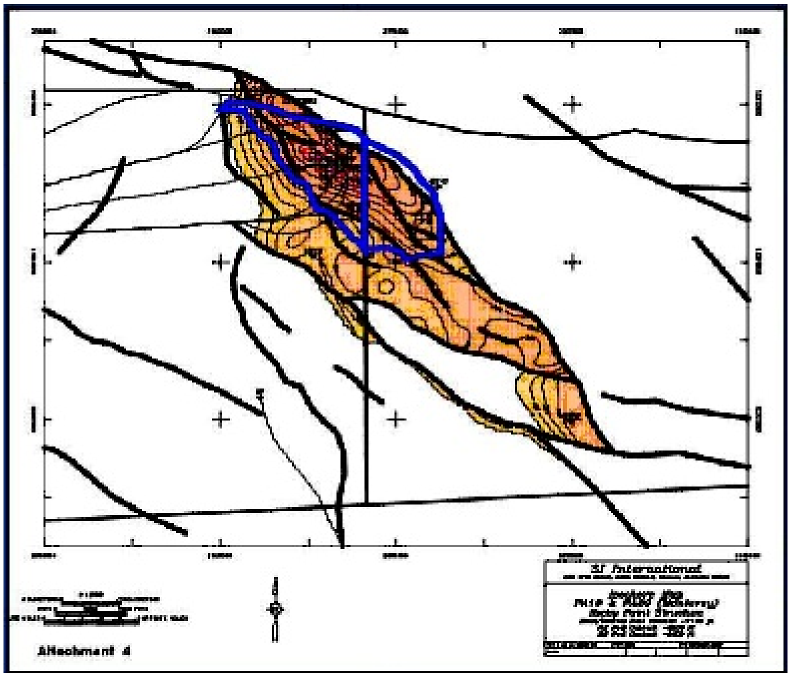
[56] The long red line represents the sealing fault that Mr. Haberman interpreted, and we accepted, to be a sealing fault separating the Northeast and Main Pools from one another.



Id. at Ex. 114 at 65.

The defendant's estimate therefore needs to be reduced by at least 50%, leaving approximately 500,000 barrels.[57] This contrasts with plaintiff's estimate of 85,000 barrels. While we agree with much of plaintiff's analysis as to the factors limiting flow, this estimate, at bottom, is based on a somewhat arbitrary limit to the reach of flow from the southeast. Nevertheless, given our prior findings regarding the fracture matrix, the directional bias of flow, sealing faults, and limited drainage distance, we find that, of the two figures, defendant's must be the most heavily adjusted. Ultimately we can do no better than select as narrow a range as possible of the most likely amount of total drainage from lease 452. Based on the analysis reflected above we believe that

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[57] We recognize that fault between the Main and Central pools does not, even in plaintiff's mapping, completely separate the two pools. It does, however, run a great distance away from the lease line, thus segregating much of those reserves from cross-lease drainage due to the limited distance of drainage. Dr. Mannon testified that oil from the Central Pool could theoretically be reached by the lease 451 wells, but that this could only happen over geological time and certainly not over the economic life span of the Rocky Point development.

the actual amount of ultimate drainage is within a range of between 150,000 and 200,000 barrels.

C. The Size Of The Reserves On Lease 452

Having established the amount of drainage from lease 452, we turn to the question of the size of the reserves on lease 452. These two numbers will form a fraction that represents the impact of the lease 451 development on the physical condition of lease 452 (depletion of reserves). The numerator is the drainage from lease 452; the denominator is the size of the reserves underlying any portion of lease 452, not just the reserves in Rocky Point Field. The smaller the fraction, the greater the likelihood that plaintiff can return lease 452 in substantially as good condition as it received it.

The calculation of the recoverable reserves, the denominator in the fraction, consists of the total bulk rock volume of oil bearing rock divided by a recovery factor.[58] The parties differ greatly as to both of those inputs.

1. Bulk Rock Volume In Rocky Point

One basic difference between the parties is that plaintiff includes volumes in reserves on the other field on lease 452, the Jalama Field. Defendant contends that Jalama should not be included. For the moment, we will limit ourselves to the parties' differences regarding the larger Rocky Point Field.

Bulk rock volume is product of two inputs: the depth of the oil bearing formation and the area of the formation to be included. The depth of the oil bearing area, in turn, is determined by the oil/water contact level. The oil/water contact level establishes the bottom of the oil bearing formation; the top of the formation is basically undisputed. We have previously accepted plaintiff's view of the facts relative to the the oil/water contacts, which has the effect of substantially increasing the volume number.

The next variable in calculating bulk rock volume is the area of oil-bearing rock formations. The parties are in basic agreement as to the size of

[58] The recovery factor is an estimate of the barrels of oil to be recovered per acre-foot.

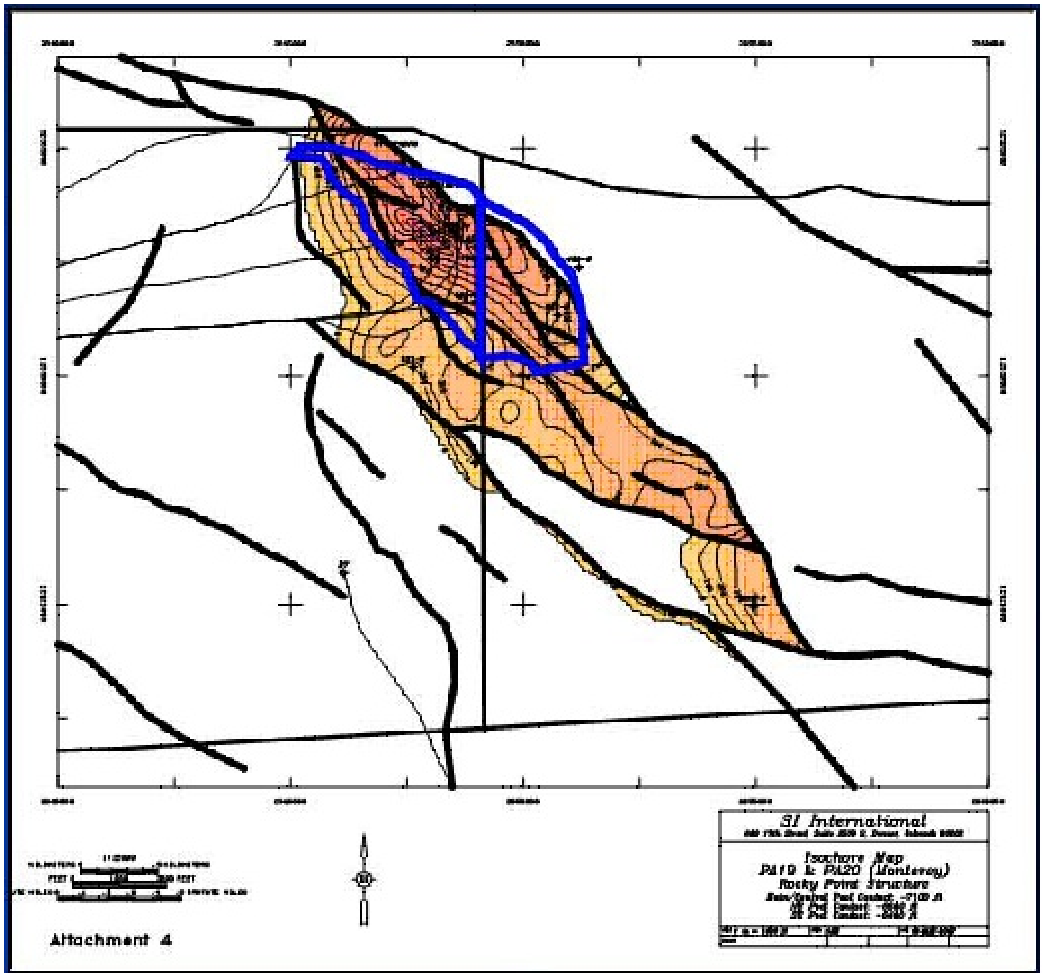
the Rocky Point field as a whole. They disagree, however, on the question of what specific areas need to be included in the reservoir. That involves an estimate of the prospectivity of the area to be included. The parties agree that despite the presence of oil, if an area of rock is not a good candidate for production, it should be left out of the reserves. As stated previously, defendant limits its reservoir in the Rocky Point field to roughly the equivalent of the combination of plaintiff's Main and Northeast Pools. The exclusion of plaintiff's Central Pool is the largest factor in the difference between the parties.

Plaintiff's expert, Mr. Haberman, calculated a bulk rock volume on Lease 452 of five Rocky Point pools containing a total of 373,503 acre-feet of oil-bearing rock. He assigns 231,215 acre-feet to the Main, Central and Southwest Pools, which have a uniform oil/water contact. For the remaining pools, he calculated 118,521 acre-feet in the Northeast Pool, and 23,767 acre-feet in the Southeast Pool. Dr. Mannon presented a smaller figure of 360,476 acre-feet of oil-bearing rock on lease 452 by omitting small areas of rock that he determined were not promising, including all of the Southwest Pool. No reserves for the geologically isolated Jalama Field are included in that number.

Defendant's expert, Dr. Strickland, presents a much smaller number. Drawn from the work of Dr. Robertson, Dr. Strickland calculated a bulk rock volume for the Rocky Point Field on lease 452 of 170,823 acre-feet of oil-bearing rock if a field-wide oil/water contact of minus 7100 feet is used.[59] Dr. Strickland's figure represents 44% of the total oil-bearing rock in the Rocky Point Field as a whole.

The following graphic from Mr. Haberman's trial presentation shows a blue polygon representing the area included in defendant's reserves, superimposed upon the area included in plaintiff's calculation:

[59] Dr. Strickland also presented a figure of 91,016 acre-feet using a 6500 foot sub sea oil/water contact. We decline to use that figure in light of our prior finding of oil/water contacts as established by the exploratory wells.



Pl.'s Ex. 114 at 65; *see also* Pl.'s Ex. 76. The main reason for the stark contrast[60] is, in short, that defendant views the performance of the wells on lease 451 to be so poor that any future development on lease 452 outside its proposed polygon is not worth considering. It contends that, even if the oil is there, it is not economical to recover. Areas of rock outside those already being drained by the wells on lease 451 are therefore excluded from defendant's reserves.

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[60]This diagram is not an ideal depiction of the differences because it only shows the reserves at the PA 19 and 20 levels. This causes much of the Southeast Pool, which plaintiff includes in its calculations, to show up as blank.

Defendant's approach, basing reserve calculations on recoverability, and then basing recoverability on circumstantial economic factors, such as the likelihood that wells will be placed in lease 452 (assuming it could legally be explored), adds an almost intolerable level of subjectivity and hence uncertainty to the inquiry. That likelihood, of course, depends on such variables as the price of oil and the results achieved on lease 451 or comparable Monterey fields. Defendant's figures for reserves, in other words, are artificially reduced because Dr. Strickland, *ipse dixit*, says no further wells will be drilled on 452.

This can be seen readily by his figures for the percentages of drainage from lease 452. On the assumption that no further wells will be drilled, then, by definition, 100% of the Rocky Point reserves on lease 452 will be extracted through existing wells on lease 451. In other words, because likely there will never be additional wells drilled on lease 452, according to Dr. Strickland, the wells on lease 451 will take all they can take, fixing the reserves. If, however, one additional well is drilled on lease 452, then Dr. Strickland projects that only 50% of the reserves on lease 452 are taken via 451, and so on. As the number of wells increases, the size of the reserves taken via lease 451 decreases. The circularity of this reasoning is apparent and makes it useless.

Moreover, the reason Dr. Strickland believes no wells will be drilled is due to what he characterizes as the poor results of the wells on lease 451, which prompted Plains to drop plans for future wells. There is no question, however, that the wells on lease 451, at the prices of oil prevailing at trial, will not only at least break even, they will be profitable. It is unfair, moreover, for defendant to speculate on why Delta will not drill wells on lease 452, when the only known reason prior plans for drilling were aborted is the government's breach.

Defendant' approach, in short, is inappropriate. Instead, we agree with Mr. Haberman's observation that "you do what is required to understand how much oil is residing in the rock before you simply cast off an area as being either not worthy or uneconomic. . . . [Y]ou can't declare it uneconomic if you don't know how much oil is there." Tr. 167. There is good reason to believe that the Rocky Point Field goes well beyond Dr. Strickland's polygon. The MMS maps introduced at trial support Dr. Mannon's view that there are substantial quantities of oil-bearing rock within the Rocky Point Field on lease 452 beyond the likely drainage area of existing wells on lease 451.

We begin, therefore, with plaintiff's numbers with respect to oil-bearing volume of rock on lease 452, reserving the application of defendant's criticism of recoverability to the separate issue of the correct recovery factor to apply. If we begin with Dr. Mannon's more conservative number of 360,000 acre-feet for the Rocky Point Field, we face the questions of whether to exclude from this figure the Southeast Pool, which is geologically isolated from the rest of the field, and whether to add to the Rocky Point numbers the Jalama Field, which is geologically separate.

Dr. Mannon testified that he excluded several zones of rock from the Southeast Pool due to their low prospectivity, leaving only the PA 19 and 20 zones in his bulk rock volume for that pool. Although we recognize that these are generally the most productive zones in the region, in light of the testimony and evidence presented throughout trial regarding the overall poor returns from the east half lease 451 development, we find that the thinner oil column in the Southeast Pool suggests that a more conservative approach dictates its exclusion from the total reserve calculation.[61] Therefore an additional 21,839 acre-feet of rock is removed excluded from Dr. Mannon's figures, resulting in a Rocky Point Field bulk rock volume of 338,637 acre-feet.

This leaves us with the question of the Jalama field. The parties are in basic agreement as to the bulk rock volume numbers for Jalama. Both Dr. Robertson, for defendant, and Mr. Haberman, for plaintiff, estimated approximately 120,000 acre feet of oil bearing rock. Using a high recovery factor of ninety barrels/acre-foot, plaintiff contends that there are approximately 10.6 million barrels of oil reserves on Jalama. Defendant contends that whatever oil is there should not be included in the reserve figure

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[61] Defendant urges that this same criticism applies to whole of the reserves on lease 452 and especially those outside of Dr. Robertson's reservoir (the blue polygon shown above). We decline to apply the same criticism across the whole of lease 452. It is that criticism in combination with the thinner zone of productive rock that causes us to exclude the Southeast Pool. As to the rest of lease 452, as defendant has implicitly recognized in its motions for judicial notice, a shift upwards in the price of oil can quickly make previously unattractive areas subject to renewed interest in production. Additionally, Dr. Mannon presented the court with a variety of economic scenarios for the future development of lease 452. In his scenario, with a price per barrel of $55, future development on lease 452 was nominally profitable.

at all because it is unlikely to economically viable. To the extent there is recoverable oil present, defendant, because it uses a much lower recovery factor of thirty-one barrels/acre-foot, asserts that there are no more than 4.3 million barrels.

Two exploratory wells were drilled in the Jalama field, 452-1 and 452-4. The first was successful, producing at a rate of over 2000 barrels per day. The second was a dry hole, which Dr. Strickland suggests would discourage buyers from making any assumptions about available reserves. The seismic and lithological data, however, as plaintiff points out, is very promising. The productive layers in Jalama have proportionately more chert, which fractures more easily and thus is generally more productive. MMS's most recent reserves estimates for Jalama are that there are 9.7 million barrels of oil on the portion of the field in lease 452.

There is no question, in other words, that there are significant volumes of oil-bearing rock in the Jalama field, and that the field is probably more productive than the Rocky Point field. Defendant's real reason for discounting it to zero is that Dr. Strickland does not think that potential future buyers would be attracted to the field because it would require long-reach drilling from remote platforms. We view that as an inappropriate variable to introduce, at least into the court's inquiry into whether plaintiff can return lease 452 in substantially the same condition. There are significant quantities of oil present in the Jalama field and nothing the plaintiff has done diminishes their value. It would be highly unfair, in a restitution inquiry, to ignore the relative importance of the unaffected fields. The attractiveness *vel non* of Jalama to unknown bidders in the future, when oil prices may be higher, and other means of access may present themselves, we view to be an inappropriate consideration. Even using defendant's number, and if oil is at $50 per barrrel, Jalama contains over $200 million in oil reserves. At least 4.3 million barrels of reserve must be included, and perhaps more, depending on the question of recovery factors, which we address next.

2. Recovery Factors

The appropriate recovery factor is applied as a multiple against the acre-feet total. Dr. Mannon presented the following recovery factors for the Rocky Point productive zones in the Northeast, Main, and Central Pools:

	Northeast	Main	Central
PA-17 & 18	60	40	40
PA-19 & 20	60	60	60
PA-20 & 21	0	65	0

Pl.'s Ex. 116 at 9. This would result, excluding the Jalama Field, in total lease 452 reserves of approximately 19.225 million barrels of oil.

MMS maintains its own reserves figures for Rocky Point Field. The most recent figures for the "tested" reserves is 26,000,000 barrels of oil, based on a somewhat different footprint than plaintiff utilized, and a recovery factor forty barrels/acre-foot. MMS generally uses a recovery factor range of forty to sixty barrels for the Monterey.

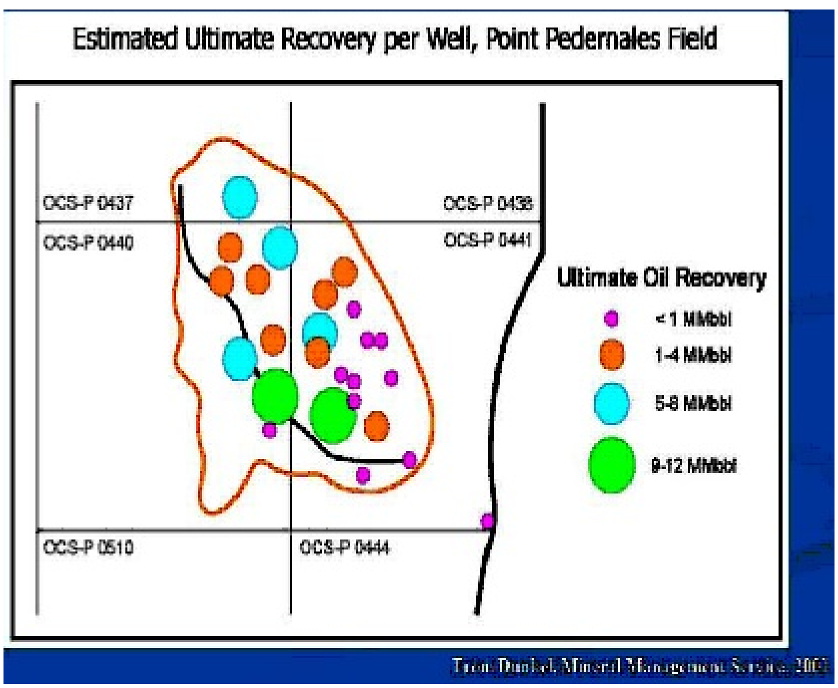
Dr. Mannon applied a range of recovery factors, depending on the pool and depending on the zone within the pool. The lowest factor he applied was forty barrels/acre-foot. The highest within Rocky Point, for PA 21 and 22 in the Central and Main pools, was sixty-five. For Jalama, he applied a figure of 95.7 barrels/acre-foot. For Rocky Point, Dr. Mannon drew comparisons to what he believed were the closest analog fields in the Monterrey, which actually produced in the forty to sixty-three barrel range.

Defendant does not offer specific recovery factors for its Rocky Point field bulk rock volume on lease 452. We have to infer them from Dr. Strickland's figures for lease 452 reserves. Those figures, however, turn out to be variable, depending on the estimated ultimate production from lease 452 via lease 451 wells, a factor which we view to be irrelevant. Defendant's overall critique of plaintiff's assumption of productivity in the fifty barrel range is that the results from the production wells on 451 are too poor to warrant that level of optimism.

Thus, as we explained above, Dr. Strickland's estimate of 1.1 million barrels of oil coincides 100% with his reserve figure for the Rocky Point Field on lease 452. He also presented three alternative figures, however, based on possible future lease 452 development. The first was a reserve total of 2.1 million barrels based on the one new, minimally economic well drilled in the Rocky Point Field on lease 452, producing an additional one million barrels of oil. The second alternative proposed 5.4 million barrels of reserves based on the oil produced via lease 451 and two additional wells in the Jalama Field (4.3 million barrels). The third scenario was the oil already produced via lease 451, one additional Rocky Point well, and two wells in Jalama, for a total reserve figure of 6.4 million barrels.

This approach is a result of defendant's position that the disappointing results of the development on lease 451 significantly limits the likelihood of the possibility of the future development of lease 452. We find this approach to be unreliable. The risk-reward analysis implicit in defendant's economic criticism is entirely dependent upon the price of oil. A dramatic increase in the price per barrel would drastically increase the likelihood of future development. Defendant's reserve totals, however, are completely dependent upon the notion that no new lease 452 development will ever take place. Under Dr. Strickland's scenarios, if future development does occur, the size of the reserve increases.

Defendant's reliance on the mediocre performance of the lease 451 wells goes too far. First, it ignores the established phenomenon of the wide variability of wells in the Monterey formation. The following graphic drawn from Dr. Mannon's trial presentation is emblematic of just how variable wells in the Monterey are:



Id. at Ex.116 at 18; *see also* Tr. 1842.

Dr. Mannon testified as to the danger of making overly broad conclusions about a field based on a limited number of wells. He also testified that the Point Pedernales Field is roughly equivalent in size to the Rocky Point Field and that twenty eight wells have been drilled in to Point Pedernales. Only six wells, including two re-drills, were drilled in to Rocky Point and only four remain on production today. Rocky Point is not a fully developed field. As Dr. Derschowitz stated, "[t]his means there's very few wells . . . that are producing most of the oil. The best 10% of the wells in the fractured reservoir are producing almost 50% of the oil." Tr. 1017. Overly broad conclusions about the prospectivity of the entire rest of the field ought not be made based on four wells grouped together in one small area of the field.

It is also important to remember that the disappointing lease 451 results are not tantamount to a net loss. Dr. Strickland conceded that, based on the price of oil at the time of trial, the lease 451 wells would at least come close to breaking even.[62] Plaintiffs' counsel then proceeded to lead Dr. Strickland through an exercise of mathematics to estimate the necessary ultimate recovery of additional wells drilled on lease 452 in order for them to at least break even. The result of that exercise was that, if four wells were drilled on lease 452 via existing platforms, they would need to produce 594,000 barrels each to break even, a number slightly less than the average production of the lease 451 wells. The calculations even included a substantial increase in operating expenses. That testimony, combined with the inherent variability in the Monterey fields, and the speculative nature of reliance on the price of oil as the determinative factor, make defendant's argument regarding the future development of lease 452 an unreliable basis for excluding significant portions of reserves on lease 452.[63]

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[62]Dr. Mannon characterized the results as disappointing based on an assumed price of $55 per barrel of oil, versus the price of $95 at the time of trial.

[63] Defendant's hypothesis is also problematic because it is rendered untestable primarily due to defendant's breach. We know from Plain's pre-*Norton* development plans that drilling on lease 452 was planned. It was only after it became apparent that the *Norton* impediment would not be quickly resolved that lease 452 development was dropped. The fact now that relatively poor production from the lease 451 wells casts a cloud on the development of lease 452 should not be charged against plaintiff.

In short, defendant does not offer a specific counter to plaintiff's productivity figures. We accept, however, the general observation that the results on Rocky Point were disappointing, and hence that the recovery factor should be lower than the average for the Monterrey. In an effort to be conservative, we will assign to Rocky Point a uniform figure of 35 barrels/acre-foot and to Jalama a figure of fifty barrels. Using those numbers, rounded, yields the following results:

	Bulk Rock Vol.	Prod. Fac.	Total Reserves
Rocky Point	340,000 acre-ft	35	11,900,000
Jalama	120,000 acre-ft	50	6,000,000
Total			17,900,000

This figure is at the low end of what should really be a range. We use it, however, to test defendant's argument in its most favorable light. Applying the high end of the previously derived range for production from lease 452 via lease 451 wells, 200,000 barrels, we arrive at the following fraction:

$$\frac{200,000}{17,900,000}$$

In other words, we can say with some certainty that no more than one barrel of oil out of ninety has been removed, and the actual amount and ratio are probably less favorable to the government.

III. Remedy

Before addressing the effects of the figures we have now derived, one additional independent reason offered by the government for rejecting rescission and restitution must be addressed, namely, that plaintiffs' exploration activities have made the lease unmarketable by demonstrating its lack of economic viability. We rejected this argument once before, *see Amber I*, 68 Fed. Cl. at 539-42; *Amber II*, 73 Fed. Cl. 738, 744-48 (also citing the Supreme Court's holding in *Mobil*, which made clear that the question of whether the aggrieved party's bet was a good one was irrelevant).

We note, as well, that the Federal Circuit affirmed "the trial court's judgment in all respects." *Amber IV*, 538 F.3d at 1362. We thus can assume the court endorsed our ruling in *Amber II.* In that opinion, we dealt with defendant's assertion that plaintiff's exploration activities, because they were, according to defendant, unsuccessful, will make it more difficult for defendant to market the returned leases. We rejected that argument: "Here, with the exception of a few stray holes poked into the mantle, the resource exists precisely as initially tendered by the United States." *Amber II*, 73 Fed. Cl. at 757. Although this was before defendant's current motion for reconsideration, we take it that the Federal Circuit did not disagree with the principle that mere exploration, and very limited exploration,[64] was not sufficient to preclude the rescission remedy.

Nevertheless, the government renews its argument in connection with the pending motion for reconsideration, using the facts associated with its current motions seeking judicial notice. It suggests that, because the federal moratoria on new off shore leasing have been lifted, the court's prior rulings are incorrect. It has a basis for making this argument because, in *Amber III*, an alternative reason we offered for rejecting the government's argument that it would not be in a position to re-market the lease, and thus that restitution was inappropriate, was that, as things stood at that time, there were a number of legal impediments to offering the lease for sale. *See* 78 Fed. Cl. at 517.

Defendant is correct that two of those impediments are now gone. And we grant the motion to take judicial notice to that extent.[65] We deemed those impediments to be relevant at the time and their removal must, perforce, be equally relevant. Our analysis as to the correctness of restitution is unaltered, however, for two reasons. First, California still has the right under Section 307(c)(1) of the CZMA, 16 U.S.C. § 1456(c)(1), the very source of the finding of a breach, to oppose re-leasing. And, as plaintiff points out, it has shown

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[64]We recognize that, in the event there had been extensive exploration, and that such exploration demonstrated the absence of any commercial quantities of oil and gas, we would be faced with a different question. Although even in that circumstance, it is not clear that *Mobil* would suggest a different result.

[65]We also take judicial notice that, at the time of the motion, the price of oil, per barrel, was $96. As we explain below, however, we are reluctant to treat that fact as anything other than an indication that the price of oil has fluctuated dramatically between the time the leases were executed, the time they were breached, the time the suit was filed, the time the trial was held, and until now. Making the liability determination or the remedy contingent on the then-current price of oil would be folly.

every intention to do so. There is thus no reason to think that plaintiffs' activities on lease 452 would be prejudicial to the government.

Second, as plaintiff correctly point out, the primary reason we rejected this line of argument in the past is that "the assumption behind an offset for 'diminished marketability' would be fundamentally inconsistent with the finding of breach. The government, in other words, bears the risk that plaintiff made a bad bargain if it commits a total breach prior to plaintiff's ability to fully exploit the leases." *Amber III*, 78 Fed. Cl. at 517. It is not unfair, therefore, for the government to get back the lease in substantially the same physical condition it was in prior to breach.

Imagine a contract to purchase a building "as is," but conditioned on the seller being able to produce clear title by a date certain. If that date arrives and the seller cannot furnish clear title because of a lien, the buyer is entitled to return of her down payment, despite the fact that it may turn out that her own preliminary inspection revealed a heavy termite infestation. The buyer may have avoided a bad investment, but the seller has nothing to complain about. The house, or, in this case, the leasehold, is in no different physical condition. What the buyers discovered in both instances was merely the true condition of the property. The new information may, in any event, be immaterial to other buyers. Someone interested in demolition of the building would not be deterred. Likewise, the attractiveness of the leasehold for oil and gas production would also be affected heavily by the price of oil. As plaintiff points out, the price per barrel tripled between the time of the leases and the time of defendant's motion for judicial notice.

We finally arrive at the question of whether the amount of drainage, 200,000 barrels or less, and the percentage of loss, approximately 1%, precludes restitution. We think plainly not. As we wrote in *Amber III*, we are unaware of any objective standard for assessing substantiality. *Id.* at 515. We noted, however, that, in the context of a fungible substance, like oil, a 17% loss should be considered substantial. *Id.* It would probably preclude restitution, or, at a minimum, would require an offset. The actual numbers turn out to be very much lower. Any objective assessment of the before and after condition of lease 452 would have to result in the conclusion that future bidders would not be deterred and would not adjust their bids to account for a *de minimis* loss of oil. There is always the inherent risk that adjoining lease-holders will poach oil to the extent of the legal limit, even if the adjoining leases are then undeveloped. What happened here must be viewed as comparable to this type of leakage.

At $55 per barrel, the then-current price of oil used by Dr. Mannon in his calculations, the current value of the reserves we have estimated is $984,500,000. If the 200,000 barrels that will be removed via lease 451 were included, the total value would only go up by $11,000,000. If the price of oil were to return to the $150 per barrel range, obviously the value of the drainage would nearly triple, but the value of the remainder would become so vast as to make the loss negligible. Restitution, in sum, is permissible.

Although the property can be returned in substantially the same condition, the mathematical ease of calculating a value for the loss of a fungible substance, assuming a known quantity and a known price, dictates that we consider an offset. Defendant argues that an offset is inappropriate and not feasible. We presume it would have found a way to calculate an offset if it could have predicted the outcome here.

Plaintiff is comfortable with an offset, so long as it is calculated based on benefit to Delta, as opposed to loss to the government. There are a number of ways to approach the question of offset, assuming one is appropriate. Delta's gross return on all the oil that will be produced from lease 451 including drainage from 452, is based on a 5.05% share (6.06% adjusted for the 16.67% government royalty). At $55 per barrel, Delta will receive approximately $7 million. If the calculation is done based only on oil that is probably attributable to lease 452, the figure drops dramatically, to approximately $555,500.

Plaintiff urges the court, if it applies an offset, to measure it by net gain to plaintiff. If oil is $55 per barrel, plaintiff will merely break even, and hence, it argues, no offset should be assessed.

If the court takes the approach of calculating loss to the government, as opposed to gain to plaintiff, 200,000 barrels at $55 per barrel yields $11,000,000, a figure which would have to be discounted by the government's royalty rate of 16.67%, to $9.1 million.

We agree with plaintiff that, as between benefit to the innocent victim of a breach and loss to the breaching party, the appropriate perspective is benefit to the non-breaching party. While perhaps typically the measure would be the same, here, it is not because plaintiff only owned a fractional interest in lease 451. Nor is that result unfair; plaintiff's motivation in cooperating with the other owners of lease 451 was limited to its share in proceeds, and those other owners could have attempted to obtain permits for drilling in proximity to lease 452 even if plaintiff had objected.

We do not, however, believe that the net profitability of the wells on lease 451 matters. Whatever the impact of external factors, such as the price of oil, plaintiff's economic position will benefit by every dollar it receives. This militates in favor of measuring any offset by the projected return (net of government royalties) that plaintiff will receive for the 200,000 barrels flowing from lease 452. At $55 a barrel, the offset would be $555,500.

We are comfortable with using $55 a barrel for two reasons. First, the vast bulk of production from the 451 wells has taken place. The court requested the parties to update these figures on the last day of trial. In round numbers, approximately 1.9 million of the projected total production of 2.5 million barrels has already occurred. While the price of oil rose dramatically at the time of trial and spiked at nearly $150 per barrel after trial, it has returned to approximately the $40 per barrel level as of the time of the writing of this opinion. The bulk of production, in other words, will have been in that range.

CONCLUSION

Plaintiff is entitled to maintain its claim for rescission and restitution. Defendant's motion for reconsideration is granted only in this one limited respect: it is entitled to an offset of $555,500 from the prior recovery of $91,986,800. The motion is otherwise denied. Defendant's motions to take judicial notice are granted. Accordingly, there being no further cause for delay of entry of judgment, the Clerk is directed to enter judgment for plaintiff Delta Petroleum Corp. in the amount of $91,431,300. Costs to plaintiff.

s/ Eric G. Bruggink
ERIC G. BRUGGINK
Judge