Supreme Court of Louisiana

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FROM: CLERK OF SUPREME COURT OF LOUISIANA

The Opinions handed down on the **8th day of December, 2015**, are as follows:

BY KNOLL, J.:

2014-C -2592 HAYES FUND FOR THE FIRST UNITED METHODIST CHURCH OF WELSH, LLC, ET AL. v. KERR-MCGEE ROCKY MOUNTAIN, LLC, ET AL. (Parish of Jefferson Davis)

Accordingly, for these reasons, we reverse the judgment of the Court of Appeal and hereby reinstate the judgment of the District Court.
REVERSED; JUDGMENT OF THE DISTRICT COURT REINSTATED.

12/08/15

SUPREME COURT OF LOUISIANA

NO. 2014-C-2592

HAYES FUND FOR THE FIRST UNITED METHODIST CHURCH OF WELSH, LLC, ET AL.

VERSUS

KERR-MCGEE ROCKY MOUNTAIN, LLC, ET AL.

ON WRIT OF CERTIORARI TO THE COURT OF APPEAL, THIRD CIRCUIT, PARISH OF JEFFERSON DAVIS

KNOLL, JUSTICE

This mineral case presents a classic battle of experts, which was resolved through factual findings and credibility determinations by the trier of fact. In its simplest terms, this case was brought by the plaintiffs, mineral royalty owners, against defendants, mineral lessees and working interest owners, for unrecovered hydrocarbons after two wells ceased production. Following a lengthy bench trial, the District Court concluded plaintiffs had not proven the operators caused any loss of hydrocarbons and dismissed their claims with prejudice.

The single issue before us is whether the District Court committed manifest error in ruling in favor of defendants, finding their experts more credible than plaintiffs' expert. The Court of Appeal, Third Circuit, reversed. We granted writ to determine the correctness *vel non* of the appellate court's manifest error review. *Hayes Fund for the First United Methodist Church of Welsh, LLC, v. Kerr-McGee Rocky Mountain, LLC,* 14-2592 (La. 4/17/15), 168 So.3d 389.

Manifest error review is not a *res nova* issue. Indeed, this doctrine and its proper application and analysis are spelled out in our jurisprudence extensively. This case will only add yet one more to the many cases through the many years repeating that which we have already said in-depth to reviewing courts. We recognize an able counsel can make a persuasive argument to the reviewing court pleading for a reversal of the lower court, claiming the trial court committed manifest error. However persuasive the argument, the appellate court does not function as a choice-making court; the appellate court functions as an errors-correcting court. With this lengthy opinion we have meticulously analyzed this case employing the manifest error doctrine to further demonstrate, as guidance, the proper analysis the reviewing court should employ.

For the following reasons, we find the appellate court was incorrect in its analysis of the manifest error review standard. After reviewing the entirety of the record evidence, we find a reasonable basis did exist for the District Court's conclusion on causation, and therefore, its conclusion was not clearly erroneous. Accordingly, we reverse the judgment of the Court of Appeal and reinstate the District Court's judgment of dismissal.[1]

FACTS

Plaintiffs herein seek to recover damages for monetary losses they allegedly sustained when defendants mismanaged, or imprudently operated, two oil and gas wells in which plaintiffs had interests—Rice Acres No. 1 ("Rice Acres well") and Hayes Lumber No. 11-1 ("Hayes Lumber well"). Both wells were located in Jefferson Davis Parish.

Rice Acres, Inc., owned the property on which the wells were located and leased to HS Resources the exclusive right to explore for and produce the minerals from the property in 1999. The Hayes Fund for the First United Methodist Church

[1] Defendants along with amici curiae—former Commissioners of Conservation Warren A. Fleet and Philip N. Asprodites, Louisiana Mid-Continent Oil and Gas Association and Louisiana Association of Business and Industry, and Louisiana Oil & Gas Association—present three other assignments of error involving the collateral attack doctrine, lease interpretation, and windfall damages. As we find the District Court's causation determination is both reasonable and dispositive of plaintiffs' case in its entirety, we pretermit discussion of the remaining assignments of error. We note our reversal of the Court of Appeal's judgment effectively vacates its rulings on these issues.

of Welsh, L.L.C., Hollis Kay Hayes Hassien, Terry Glen Hayes, Cody William Hayes, Jodi Lee Hayes Oliver, and Lori Beth Hayes Lemons, owned royalty interests in the two wells. Named as defendants are Aspect Resources, LLC, Noble Energy, Inc., Crimson Exploration Operating, Inc., Southern G. Holdings, L.L.C., Anadarko Petroleum Corporation, Kerr-McGee Oil & Gas Onshore, LP, and Kerr-McGee Rocky Mountain, LLC (hereinafter "Kerr-McGee" or collectively "defendants").[2]

In their suit, Rice Acres, Inc. along with the other plaintiffs (hereinafter "Hayes Fund" or collectively "plaintiffs") alleged defendants failed to follow the proper, customary, and industry-wide accepted protocol for drilling the two oil and gas wells at issue:

> The defendants operated two wells on the plaintiffs' property (the Rice Acres No. 1 well and the Hayes Lumber No. 11-1 well) in an imprudent manner in violation of La. R.S. 31:122 (Mineral Code article 122). This caused damage to the reservoirs beneath the two wells, which in turn caused significant losses of royalty income the plaintiffs otherwise would have received. Under the leases between the parties, the defendants are liable for the plaintiffs' losses, even without a showing of fault.

HS Resources, the original operator and lessee, drilled the Rice Acres well in 1999 and produced hydrocarbons from the Hackberry formation reservoir (9443'-9522') until the well ceased production in 2004. In defendants' first attempt

[2] HS Resources assigned a fifty percent working interest ownership in the leases to Aspect Resources, LLC. In 2001, Aspect assigned its working interest ownership to Samedan Oil Corporation, which ultimately merged with Noble Energy in 2008. Kerr-McGee was acquired by Anadarko Petroleum Corporation, which eventually sold its rights to the leases to Exco Resources, Inc., in 2007. That same year, a sale was executed between Exco, Southern G. Holdings Company, and Crimson Exploration Operating, Inc. Southern G then merged with Crimson. At the time of suit, HS Resources had merged into or was acquired by Kerr-McGee and Anadarko.

to drill the well, they encountered differential pressure,[3] which plaintiffs claimed should have warned them the drill pipe would get stuck in the hole. Despite this, defendants continued to drill without installing intermediate or protection casing, which plaintiffs claimed would have eliminated the risk of differential sticking.[4]

As plaintiffs anticipated, the drill pipe became differentially stuck and could not be moved or removed, forcing the operator to abandon the drill pipe in the hole and drill a sidetrack well just 132 feet away. However, plaintiffs claim the stuck drill pipe prevented defendants from adequately cementing the hole, thus in turn, allowing extraneous water to enter the annulus of the original wellbore (the area outside the pipe) and eventually channel into the unprotected gas zone later produced by the sidetrack well. “This extraneous water caused the reservoir to ‘water out,’ causing the loss of millions of dollars’ worth of production—and, of course, the loss of substantial royalties to the plaintiffs.” Plaintiffs calculated their share of lost royalties from this well at $6.5 million.

HS Resources drilled the Hayes Lumber well in 1999 as well. It produced from the lower zones in the Nodosaria formation (9890’-9995’) from January 2000 until May 2007. Thereafter, HS Resources performed a workover of the well from May 2007 until January 2008, enabling production from a different location, the upper zone of the Nodosaria formation (9718’-9742’), from March 2008 until production ceased on November 30, 2008.

Regarding this well, plaintiffs asserted defendants’ use of a triple permanent packer resulted in the sanding up of the well and loss of the lower zones.

[3] As explained in plaintiffs’ post-trial brief, “differential pressure is the difference in the normal formation pressure (also called pore pressure) and the hydrostatic pressure exerted by the mud in the wellbore.”

[4] Plaintiffs also explained in their post-trial brief “differential sticking is where the pipe sits still against the borehole wall, and the differential pressure between the hydrostatic pressure of the mud column and the formation pressure in the adjacent formation is such that the pipe is pulled against the wall and stuck in the mud cake.”

Moreover, the use of this packer configuration was, according to plaintiffs, clearly imprudent because defendants knew or should have known the well was likely to sand in, and installation of the recognized method to control sanding—a gravel pack—was not feasible with the use of a permanent packer.

After the sanding issue, the operator moved back up the hole and perforated at a shallower depth, but plaintiffs alleged the defendants were aware the sand produced by the well had sandblasted holes in both the tubing and the well's protective casing—compromising the integrity of the entire casing. Defendants' attempt to repair the damage—by installing a 3½-inch liner—came too late, thus exposing the gas formation in the upper zone to shallower water sands. This resulted, according to plaintiffs, in the premature termination of production from the upper perforations and the permanent destruction of the upper zone from vertical communication with the shallower water sands. Plaintiffs calculated their share of lost royalties from this well at $6.9 million ($1.2 million for the lower zone and $5.7 million for the upper zone).

To prove their claims, plaintiffs relied exclusively on the testimony and exhibits of their expert, William Griffin, who was accepted as an expert in the field of petroleum engineering with a subspecialty of drilling, reservoir production, marketing, and economic evaluation and safety, but not as a geologist or geophysicist. His theories of destruction were premised on his belief all three reservoirs were volumetric or depletion driven,[5] the unitized size of the reservoirs

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[5] A reservoir is a subsurface body of rock having sufficient porosity and permeability to store and transmit hydrocarbons and/or water. The natural energy of a reservoir can be used to move the hydrocarbons as well as water towards the wellbore, and when used in such a fashion, these energy sources become known as driving mechanisms. In footnote 5, the Court of Appeal described the two possible driving mechanisms at issue in this case:

> Water drive is "the reservoir drive mechanism in which oil is produced by the expansion of the underlying water and rock,

as depicted in the unit orders, and his reading of the production summaries. As the record shows, volumetric reservoirs are not in communication with an aquifer and so have no gas-water contact. Therefore, Griffin opined the presence of water in the production of such reservoirs establishes the communication of the hydrocarbons contained within the reservoir with water from outside the reservoir, *i.e.*, extraneous water, caused more probably than not by defendants' drilling activity. Nevertheless, even if the reservoirs, or more specifically Rice Acres, had a water-drive component, Griffin opined the sudden onset of the water in production was still indicative the water was extraneous and not formation water, which would have taken years to show up and would have been preceded by an increase in oil shortly before it hit.

Following their extensive cross-examination of Griffin, defendants called nine witnesses—four lay and five experts—in their efforts to establish their drilling practices were not unreasonable or imprudent and the water in both the Rice Acres and the Hayes Lumber upper zone was formation water as both reservoirs were water-driven. The record evidence reveals in a water-driven reservoir the hydrocarbon-bearing portion of the reservoir is in direct communication with the

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> which forces the oil into the wellbore. In general, there are two types of water drive: bottom-water drive, in which the oil is totally underlain by water; and edgewater drive, in which only a portion of the oil is in contact with the water." Occupational Safety & Health Administration, U.S. Department of Labor. Dictionary of Petroleum Terms provided by Petex and the University of Texas (last visited August 5, 2014)…. Depletion drive, also called gas drive, is "the use of the energy that arises from the expansion of compressed gas in a reservoir to move crude oil to a wellbore."

Hayes Fund for the First United Methodist Church of Welsh, LLC, v. Kerr-McGee Rocky Mountain, LLC, 13-1374, p. 14, n. 5 (La. App. 3 Cir. 10/1/14), 149 So.3d 280, 290, n. 5. As will be discussed more thoroughly herein, though plaintiffs argue the driving mechanism is not important, it is clear from the transcript the driving mechanism is essential to ultimately answer the question from where did the water come: if water-driven, the reservoir is a potential source of the water; but if volumetric or depletion-driven, the water has to be extraneous because such reservoirs contain no water and so the hydrocarbons should have no contact with water.

water-bearing portion of the same rock body. Once enough hydrocarbons are removed, the water expands up to the wellbore and is produced with the oil and gas, in this case gas condensate. Because the water came from the water-driven reservoirs, defendants' witnesses opined based on the rules of nature and the laws of geophysics defendants more probably than not were not at fault. Defendants through their experts further sought to demonstrate how plaintiffs failed to prove the hydrocarbons allegedly remaining in the lower zones of the Hayes Lumber well were unattainable.

After hearing twenty-five days of testimony conducted over an eleven-month period and receiving hundreds of pages in post-trial memoranda, the District Court ultimately credited defendants' experts over plaintiffs' expert, concluding plaintiffs failed to prove defendants' actions caused the loss of hydrocarbons. Accordingly, the District Court rendered judgment in favor of defendants, dismissing plaintiffs' claims. On appeal, the Court of Appeal, Third Circuit, reversed the District Court's factual findings as manifestly erroneous and rendered a judgment of $13,437,895 for plaintiffs. *Hayes Fund for the First United Methodist Church of Welsh, LLC, v. Kerr-McGee Rocky Mountain, LLC*, 13-1374 (La. App. 3 Cir. 10/1/14), 149 So.3d 280.

DISCUSSION

At its core, this case involves the alleged breach of a mineral lease. As the aggrieved party, plaintiffs bore the burden of proof on each element of their breach of contract claim. Thus, they had to prove by a preponderance of the evidence (1) defendants owed them an obligation; (2) defendants failed to perform that obligation; and (3) defendants' failure resulted in damages to the plaintiffs. *See* 2 Saul Litvinoff, *La. Civ. Law Treatise: The Law of Obligations* 378-87 (1975); La. C.C. art. 1994; *Favrot v. Favrot*, 10-986, pp. 14-15 (La. App. 4 Cir. 2/9/11), 68

So.3d 1099, 1108-09. Whether defendants' actions caused plaintiffs' damages is a question of fact, which should not be reversed on appeal absent manifest error. *Detraz v. Lee*, 05-1263, p. 7 (La. 1/17/07), 950 So.2d 557, 561; *Housley v. Cerise*, 579 So.2d 973, 979 (La. 1991). The proper application of the manifest error standard is central to our resolution of this case, thus a brief overview of this standard is clearly warranted herein.

Manifest Error Review

In all civil cases, the appropriate standard for appellate review of factual determinations is the manifest error-clearly wrong standard, which precludes the setting aside of a trial court's finding of fact unless that finding is clearly wrong in light of the record reviewed in its entirety. *Cenac v. Public Access Water Rights Ass'n*, 02-2660, p. 9 (La. 6/27/03), 851 So.2d 1006, 1023. Thus, a reviewing court may not merely decide if it would have found the facts of the case differently. *Hall v. Folger Coffee Co.*, 03-1734, p. 9 (La. 4/14/04), 874 So.2d 90, 98. Rather in reversing a trial court's factual conclusions with regard to causation, the appellate court must satisfy a two-step process based on the record as a whole: there must be no reasonable factual basis for the trial court's conclusion, and the finding must be clearly wrong. *Stobart v. State through Dept. of Transp. and Development*, 617 So.2d 880, 882 (La. 1993).

This test requires a reviewing court to do more than simply review the record for some evidence, which supports or controverts the trial court's findings. The court must review the entire record to determine whether the trial court's finding was clearly wrong or manifestly erroneous. *Parish Nat. Bank v. Ott*, 02-1562, pp. 7-8 (La. 2/25/03), 841 So.2d 749, 753-54. The issue to be resolved on review is not whether the judge or jury was right or wrong, but whether the judge's or jury's factfinding conclusion was a reasonable one. *Rosell v. ESCO*, 549 So.2d 840, 844 (La. 1989); *Canter v. Koehring Co.*, 283 So.2d 716, 724 (La. 1973).

Notably, reasonable persons frequently can and do disagree regarding causation in particular cases. But where there are two permissible views of the evidence, the factfinder's choice between them cannot be manifestly erroneous or clearly wrong. *Rosell*, 549 So.2d at 844. In this regard,

> … the reviewing court must give great weight to factual conclusions of the trier of fact; where there is conflict in the testimony, reasonable evaluations of credibility and reasonable inferences of fact should not be disturbed upon review, even though the appellate court may feel that its own evaluations and inferences are as reasonable. The reason for this well-settled principle of review is based not only upon the trial court's better capacity to evaluate live witnesses (as compared with the appellate court's access only to a cold record), but also upon the proper allocation of trial and appellate functions between the respective courts.

Perkins v. Entergy Corp., 00-1372, p. 10 (La. 3/23/01), 782 So.2d 606, 612-13.

Accordingly, an appellate court on review must be cautious not to re-weigh the evidence or to substitute its own factual findings just because it would have decided the case differently:

> [w]hen findings are based on determinations regarding the credibility of witnesses, the manifest error-clearly wrong standard demands great deference to the trier of fact's findings; for only the factfinder can be aware of the variations in demeanor and tone of voice that bear so heavily on the listener's understanding and belief in what is said. Where documents or objective evidence so contradict the witness's story, or the story itself is so internally inconsistent or implausible on its face, that a reasonable fact finder would not credit the witness's story, the court of appeal may well find manifest error or clear wrongness even in a finding purportedly based upon a credibility determination. But where such factors are not present, and a factfinder's finding is based on its decision to credit the testimony of one of two or more witnesses, that finding can virtually never be manifestly erroneous or clearly wrong.

Rosell, 549 So.2d at 844-45 (citations omitted).

While we understand and appreciate the reality that many times we would have judged the case differently had we been the trier of fact, this is not our function as a reviewing court. *Menard v. Lafayette Ins. Co.*, 09-1869, p. 21 (La. 3/16/10), 31 So.3d 996, 1011. We give great deference to the trial court because it observes and participates in the live presentation, while the appellate court merely reviews the cold transcript. This is why we have said:

> The manifest error doctrine is not so easily broached. Rarely do we find a reasonable basis does not exist in cases with opposing views. We note it is not hard to prove a reasonable basis for a finding, which makes the manifest error doctrine so very difficult to breach, and this is precisely the function of the manifest error review. A reviewing court only has the "cold record" for its consideration while the trier of fact has the "warm blood" of all the litigants before it. This is why the trier of fact's findings are accorded the great deference inherently embodied in the manifest error doctrine. So once again we say it should be a rare day finding a manifest error breach when two opposing views are presented to the trier of fact.

Menard, 09-1869 at pp. 21-22, 31 So.3d at 1011.

The present case consists of twenty-five days of live testimony and in-time slide and exhibit presentations in which the record undisputedly shows the trial court was actively involved and participated. In our review, we are faced with a cold transcript consisting of thirty-five record volumes and fourteen volumes of exhibits. We are tasked with reviewing the District Court's factual findings for error, all the while paying heed to the factfinder's broad discretion in credibility determinations.

With these principles in mind, we must review the evidence of record and determine if the District Court's finding on causation was unreasonable and clearly contrary to the evidence in order to answer the question presently before us of whether "our intermediate brethren erred in failing to apply in the instant case th[ese] principle[s] of appellate review of facts." *Canter*, 283 So.2d at 724. To do so, we find it helpful to examine the record evidence and factual conclusions of the lower courts as to each well and reservoir individually. We begin with Rice Acres.

Rice Acres Well

As the record shows, it was undisputed the Rice Acres well produced water and essentially watered out. What was disputed was the source of the water. Plaintiffs through their expert Griffin claimed the water was extraneous channeling through the original wellbore. Defendants through their experts and exhibits claimed the water was formation water as the Rice Acres well had a strong water drive.

The District Court clearly credited defendants' experts over Griffin. And though finding defendants did act imprudently in allowing the original drill pipe to get stuck, the District Court ultimately concluded:

> … despite the defendants' imprudence, HAYES FUND has not demonstrated that there were any damages to the remaining hydrocarbons that could be produced from a replacement well. The plaintiffs' expert, William Griffin, stated at trial that there was an absence of adequate zonal isolation in the Rice Acres wellbore. To support his contentions, Mr. Griffin offered several articles from different authorities and snippets from the depositions of the defendants' experts. None of the articles or snippets, however, applied to setting a cement plug around a stuck drill pipe. The evidence presented at trial demonstrated that the drill pipe was centralized at certain points and that the amount of vertical cement in the wellbore necessary to form a barrier to fluid migration was in place. Mr. Griffin did not dispute these facts.
>
> In addition, the testimony of the defendants' experts demonstrated to the Court that the Rice Acres well was a strong water drive. Defense expert Michael McKenzie provided detailed testimony with supporting studies and peer-reviewed articles that the Rice Acres Hackberry reservoir was water driven and was not subject to extraneous water from other zones. The water that was produced had chloride counts that were consistent with the counts of the water in the reservoir, further supporting the argument that the water was from the reservoir, not migrating from a higher or lower zone. With the amount of water being produced through the sidetrack well (200-550 barrels per day), it is not possible for that amount of water to have moved there from the original

> wellbore. In sum, the water produced in the sidetrack well came from the Hackberry reservoir and [] this event was expected given the structure of the reservoir.

On appeal, the Third Circuit found the District Court manifestly erred in finding:

> (1) the cement pumped into the original Rice Acres wellbore provided adequate zonal isolation and the industry standards for centralization and pipe movement did not apply to the cementing of pipe, *Haynes Fund*, 13-1374 at pp. 8-9, 149 So.3d at 286-87.
>
> (2) Griffin failed to dispute the pipe was centralized at certain points and the amount of vertical cement in the wellbore necessary to form a barrier to fluid migration was in place because Griffin explained the stabilizers on the drill pipe were not in the proper position to centralize the pipe across the reservoir and were not located where they could be effective in isolating the reservoir, *Haynes Fund,* 13-1374 at p. 10, 149 So.3d at 287-88; and
>
> (3) the chloride levels, which measure salinity, in the water produced from the Rice Acres well supported a finding that the water was not extraneous in nature because "[t]estimony received at trial from experts of both parties established there was no significant difference between the salinity of the water inside and outside of the reservoir," *Haynes Fund*, 13-1374 at p. 11, 149 So.3d at 288.

Significantly, in reaching its conclusions, the appellate court focused on Griffin's testimony and the evidence in support thereof to *disprove* the District Court's factual findings. This is where the appellate court fell into error in its analysis under a manifest error review. It did not review the record to see if there was a *reasonable basis* for the District Court's factual conclusions in the opposing view of plaintiffs' expert.

Our review of the entire record clearly reveals more than a reasonable basis for the District Court's factual findings. First, defendants' expert, Donald Bazer, a consulting petroleum engineer accepted as an expert witness in the field of petroleum engineering and log analysis, testified the cement pumped into the original wellbore provided adequate zonal isolation and the amount of vertical cement in the wellbore necessary to form a barrier was in place:

> A. … 8 feet of continuous cement all the way around the pipe would … adequately prevent vertical migration.
>
> …
>
> Q.… would it be fair to say that you would have numerous intervals that you had 8 feet or more of cement within that Rice Acres wellbore?
>
> A. That's right.
>
> Q. … would it also be fair to say, then, because you have multiple areas of that 8 foot or more isolation, that that would not allow vertical migration of water within the original Rice Acres hole?
>
> A. That's correct.

His testimony was supported by the Cement Evaluation Guidelines issued by Western Atlas. Adam Blum, the drilling and completion supervisor for both the Rice Acres and Hayes Lumber wells, also testified: "But remember, just because it's laying against the wall here, doesn't mean it's laying against the wall 4, 5, 10, feet up above." And it was evident from Blum's testimony defendants, in their attempt to set a "balanced" plug, put in "15 to 20 percent excess" cement as approved by the Office of Conservation. This procedure was, according to Bazer, in keeping with industry requirements that cement plugs "**shall** be installed and verified as required by regulations":

> Q. … you're familiar with articles published by the API [American Petroleum Institute] for engineers that drill oil and gas wells, are you not?
>
> A. Yeah, I am.
>
> Q. Where did you get this article?
>
> A. We have some of the API standards in the library at DOR. This is one of them that we have in the library.

Q. Okay. And it's considered an industry guide, would you say?

A. It is, yes.

Q. Okay. And this article discussed cementing in wellbores during wellbore construction, correct?

A. Yes.

Q. Okay. Did this article also reference scenarios in which cement plugs would be installed in a wellbore?

A. There is an excerpt in here about that, that's right.

Q. Okay. Let's go to Page 5 of 148C.

…

Q. And can you identify what you have up here on the screen?

A. Yeah. This is the … section that deals with "Special Operational Considerations." And at the very bottom, this is the only reference in this API recommendation about cement plugs for abandonment. And it states that "Cement plugs shall be installed and verified as required by regulations."

Q. "Shall be installed and verified as required by –

A. That's what it says.

Q. –regulations," correct?

A. Yes, sir.

Q. Okay. So would it be fair to say, then, that – that 148C, while it provides guidance on cementing during well construction, that when you're actually plugging a hole, the only thing the API requires or recommends for – for putting a cement plug is that the operator shall follow the requirements of the applicable regulations; is that right?

A. Right, the regulatory body in charge. The … Office of Conservation in Louisiana or the Bomar offshore.

Q. Okay. And in this case, HS Resources followed the instructions of the Office of Conservation when they plugged the hole, did they not?

A. They did.

Second, Griffin conceded the pipe was centralized at the "industry [minimum] standard 70 percent … at 9,515 feet" and could not dispute the cement in the bottom 150 feet of the wellbore successfully isolated multiple water zones he had earlier considered as possible sources of extraneous water. Further, none of the articles or snippets mentioned and relied upon by Griffin concern the cementing of stuck pipe or support a conclusion a mud channel creating a pathway between the extraneous water zones and the Hackberry gas zone even occurred. Rather they discuss the proper procedure for cementing the space between movable casing or pipe and the wall of the well in the construction of the wellbore and, as defendants noted in their post-trial memorandum, reveal a lack of centralization does not eliminate the flow of cement on the narrow side, but only reduces the cement column size relative to the cement column on the wide side at both 75% and 50%:

> **9.5 Hole Preparation**
>
> …If casing is close to the wall of the hole, it may not be possible to pump the cement at a rate high enough to develop uniform flow throughout the entire annulus….
>
> **9.5.1 Standoff.** ***100% Standoff***. This shows a hole with casing that is exactly centralized in the hole. The shaded areas are the cement and it shows the cement level is the same on both sides of the casing.
>
> ***75% Standoff***. This shows a hole with the casing decentralized to a 75% standoff, and it shows that as you decentralize the casing the flow is higher up the wide side of the hole compared to the narrow side.
>
> ***50% Standoff***. Same as the 75% standoff only more pronounced with the cement height.[6]

The District Court, however, accurately recognized Rice Acres involved stuck immovable pipe. While arguably supportive of the District Court's finding defendants were not prudent in the drilling of the well, including centralizing the

[6] Ex. P 27, pp. 9-10. Figure 9.2, p. 10, shows, even at 50% standoff, cement will flow into the narrow side, just not as high as on the wide side.

pipe and placement of stabilizers, plaintiffs' articles did not speak to the proper or improper cementing of the original pipe after the pipe became stuck in the well and had to be abandoned as defendants pointed out at trial and in brief to this Court. We note plaintiffs cite Bazer's testimony for support of their position that "casing's just a type of pipe." Though his testimony does affirm Griffin's testimony regarding the proper cementing of casing in wellbore construction "[a]s long as [a prudent operator] could do it," his overall testimony reveals plaintiffs' articles do not address proper cementing after the pipe becomes stuck as occurred in this case. Regardless, Griffin's testimony directly conflicted repeatedly throughout trial with defendants' experts, bringing the resolution of the factual issues throughout this case, including this one on proper cementing, down to a credibility call.

And third, Michael McKenzie who was tendered as an expert in the field of petroleum engineering, reservoir engineering, and drilling operations, did testify the chloride and salinity levels are like "a fingerprint of where the water came from within the well," and his in-depth evaluation of the chloride and salinity levels in the various sands and the water logs from the Rice Acres well led him to conclude:

> Suffice to say, the salinity level from the Hackberry zone that was tested in September is very similar to the chlorides reported during the life of the producing history of the Rice Acres #1 from the main Hackberry reservoir. I would conclude[] that the water that was tested from this interval is identical, if not similar to the water that was produced during the life of the Rice #1 Well, which would tell me that the source of the produced water in the Rice Acres #1 was the Hackberry aquifer in communication with the reservoir. If one considers the chloride measurements and the remaining evidence, the PRAL log,[7] the open hole log, offset records,

[7] PRAL is a brand name for a production analysis log, which, according to Bazer, "is a series of measurements that are made on a wireline tool that's run in the hole. You measure the velocity of the flowing fluid, you measure the resistivity of the flowing fluid, you measure the gravity of the flowing fluid, and you measure the temperature of the flowing fluid."

> hit all points to a lack of extraneous water being produced from the Hackberry completion in the Rice Acres.

In investigating the allegations Rice Acres was producing extraneous water, McKenzie reviewed the offset well records "to get a handle on the intervals being produced that were making saltwater in the vicinity of the Rice Acres Well":

> Q. Now, typically in wells outside the Hackberry, does it usually tend to get more or a greater salinity as you go deeper?
>
> …
>
> A. No. In other areas of the state, you can go deeper and find a higher salinity.
>
> Q. Okay. But in this case, that's what tends to happen[] from what you've observed; it goes from a greater salinity to a fresher or less salinity?
>
> A. In this area, yes. That's correct.
>
> Q. Let's go to Exhibit 64 for a moment. Now, can you tell the Court what this chart represents, Mr. McKenzie?
>
> A. This is just a summary of the prior water analyses samples that we looked at. Across the top of the exhibit, it's labeled Water Analysis, Rice Acres #1; but it also includes some offset well information. This center set of exhibit information here, Your Honor, are the three zones that were tested in the Rice Acres Well; and the upper left, you can see the Nodosaria was tested 20,500 parts per million. And then Zones 2 and 3 of the Hackberry ran from 30 to 32,000, 34,000 parts per million through here. And then below that, we have information from the offset fields of Turps and Woodlawn[]. Hackberry test at Turps was 35,000 parts per million. Hackberry at Woodlawn, 35,000 to 34.7. And the Showers sand at Woodland of 50,000 parts per million.
>
> Q. So in terms of what this leads you to conclude about the fingerprints you were talking about before, what can you conclude about these salinities that you can expect as you go deeper?
>
> A. Well, below the Hackberry interval in the vicinity of the West Fenton Field, one would expect to see a decrease in salinity from the produced water; and above it, above the Hackberry in the shallower Massie sands a much higher salinity. The point being if there was extraneous water being produced from the Rice Acres, you would see something other

than 30,000 parts per million being chlorides. You would see either a dilution effect from the more brackish Nodosaria; or if it was coming from the Massie sands, you would see a mixture of Hackberry and shallow … sands, it would be – the resulting mixture would be a higher chloride measurement than the 30,000 reported from the Rice Acres Well.

Q. So, in other words, if it was coming from a zone up above the Rice Acres producing zone, there was some other higher sand that had water in it that the extraneous water was coming down, then you would expect to see the chloride count increase in the producing zone of the Rice Acres?

A. Yes. It would be – it's just a simple mixture of high salinity water, a more brackish water; and you end up with an average of the two. So maybe 40 or 50,000 parts per million.

Q. Okay.

A. If it was being contaminated, say.

Q. And similarly, if there was some water coming up from the original well bore of this Rice Acres Well from below the Hackberry producing formation that we've been talking about in Zone 2 and Zone 3, you would expect it to be less saline or less salty; and therefore, it would dilute the chloride count in the producing Rice Acres zone?

A. That's correct. You would see a dilution effect.

Q. And that didn't happen in this case, did it?

A. It did not.

Q. And what does that lead you to conclude?

A. That there was no extraneous water being produced from the Rice Acres Well.[8]

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[8] As exhibit DF-64 depicts:

Zone 1 of Rice Acres No. 1 Well (West Fenton Field) was in the Nodosaria formation perforated at 9892'-9904'. On 9/24/99, it had 20,500 chlorides, and on 9/23/99, it had 23,000 chlorides.

Zone 2 was in the Hackberry formation at 9487'-9491' and testing showed 31,000-34,000 chlorides on 9/27-29/99 and then 28,700 chlorides on 9/29/99.

Zone 3 was also in the Hackberry formation at 9444'-9448' and testing revealed chloride levels of 30,000 on 11/14/00, 1/30/01, 3/27/03, and levels of 32,500 on 9/17/01.

In the offset field of Turps, the Hackberry formation at 7497'-7518' produced 35,000 chlorides on 4/3/03.

Although plaintiffs claim Bazer concluded "there was no significant difference in the salinity of the water found naturally in the Hackberry reservoir and several zones located above and below," Bazer's testimony on salinity not only agreed with but also validated McKenzie's testimony above:

> Q. …Mr. Bazer, based on your review of the evidence in this case, is it – is it more probable than not that the water that was produced in the Rice Acres sidetrack was formation water and not extraneous water migrating from the original hole?
>
> A. That's correct. More probable than not.
>
> ...
>
> Q. Mr. Bazer, does salinity give you any guidance as to whether water is extraneous or from – from the formation itself?
>
> A. It – it can, yeah. You can – if you've got much difference in salinity of the water from what you expected in the reservoir, it can be a flag for you.
>
> Q. Okay. Was there any testing done that would indicate the salinity of the water in the Rice Acres well?
>
> A. Yeah. The water when it – right after it hit was measured at 30,000 parts per million chlorides.
>
> …
>
> … they took a test down here at one of these suspicious-looking zones, and it – it flowed saltwater at 23,000 parts per million chlorides. And then they tested up here just below the Hackberry, and it flowed at 27,000 parts per million chlorides. And then the Hackberry sands itself, when it started making water, was 30,000 parts per million chlorides.

Concluding his testimony, Bazer opined there is no "evidence indicating any extraneous water has damaged any zones within the Rice Acres well… all the … evidence we have is to the contrary."

In the offset field of Woodlawn, the Hackberry formation at 10,762'-774' produced 34,705 chlorides on 7/23/82 and the formation at 6414'-6422' produced 50,000 chlorides on 6/8/88.

But more fatally, the appellate court did not address, nor did the plaintiffs appeal, the District Court's two outcome-determinative findings: (1) the Hackberry reservoir was water-driven, and (2) it was not possible for the amount of water produced by the sidetrack well to have migrated from the original wellbore. Both findings were likewise clearly supported by the record evidence in opposition to plaintiffs' evidence.

Dean Beccue, a reservoir petroleum engineer, testified Rice Acres was a "stronger water drive," as depicted on the 2001 reserve estimate provided by HS Resources, and the production of water "wasn't surprising because a lot of other … Hackberry wells in the area had produced water." James Hardwick, accepted as an expert in the field of petroleum geology and unitization geology, testified the Rice Acres reservoir "was water-bearing." Likewise, Bazer opined Rice Acres was predominantly a water-drive reservoir:

> A. Well, you can … pretty well bet that this is going to be a water-drive reservoir if you've got – predominantly a water-drive reservoir if you've got that much water in the wellbore. And … you would expect that you would make water … early in the life of the production of this well.
>
> Q. Okay. And you've reviewed all the drilling and production reports produced by the defendants in this case, right?
> A. Yes.
>
> Q. And … based on your review of those documents, the Rice Acres well did, in fact, produce a significant amount of water throughout its life, correct?
>
> A. After the first five months, it … started making water, and then it produced substantial amounts of water, right.

According to McKenzie's testimony, the Rice Acres well behaved like a water-drive well "consistent with the surrounding Hackberry and wells in that area of the state":

> Q. … you have knowledge going into this that – that it's common for wells in this part of Southwest Louisiana in these formations to be water drive; is that correct?
>
> A. I would say it's very unusual to have a pure depletion drive or a nonwater-drive component in any reservoir in South Louisiana.
>
> Q. So it's not only common; it's unusual if it isn't?
>
> A. That's correct.
>
> Q. To the point that you're going to start with the assumption that there's some component of water drive when you're … analyzing?
>
> A. For reservoirs in South Louisiana, we always start with the assumption that it'll be a partial water drive.
>
> Q. Okay. Now, do the logs provide you with any information as to the nature of the … water drive?
>
> A. It's no surprise that the well started producing water because there is a gas or oil water contact in the well at the base of the sand in communication with the reservoir.
>
> Q. Okay.
>
> A. So you … would expect the well to – at some point to start producing formation water.
>
> Q. Okay. And in this case, the Rice Acres well behaved like a water-drive well, didn't it?
>
> A. That's correct. It's consistent with the surrounding Hackberry and wells in that area of the state.

Notably, Griffin admittedly never investigated the correlative zones in the surrounding Hackberry or Nodosaria producing wells to see if there was water produced from those reservoirs. He never conducted a traditional geological reservoir study. He never investigated or reviewed any published articles on the Hackberry or Nodosaria formations. And the information utilized in his calculations and theories was gleaned from well summaries published on the Office of Conservation's public website—drillinginfo.com—not the actual logs maintained by the operators, though he did claim his interpretation of the logs supported his position.

Moreover, regarding the possibility of communication between the productive sands and the water-bearing sands, Griffin did concede:

> Q. … it's entirely possible that the entire Hackberry Reservoir A from the top at 9,443 down to the bottom at 9,522 is in communication at some point within the reservoir?...
>
> A. That's correct.
>
> …
>
> Q. … So if it's in communication somewhere in the reservoir, then that water down in that lower sand zone is going to eventually find its way to the perfs – the upper perfs at No. 1 and No. 2 up there?
>
> A. And it did.
>
> Q. All right. And it's going to find its way through the perfs through the formation because they're in communication?
>
> A. That's not an assumption I'd make. I'm just saying it did because it made it up through that original wellbore on there.
>
> Q. All right. But if there is no barrier somewhere in the reservoir, then that pressure sink caused by that is going to have the water migrate up from the lower sand zone into the upper sand zone, is it not?
>
> A. That's correct.
>
> Q. All right. So even if there were no communication in the annulus of that straight hole, if there is no barrier, then that – this well is going to eventually start making water out of those perforations?
>
> A. That's correct.

Griffin's overall theory, though, was the reservoir was water sealed by impermeable shale directly below the productive sands, and given its geopressure, the reservoir was volumetric. Even if the shale was discontinuous, as defendants argued, Griffin still essentially maintained the shale directly below the drilled hole was continuous and the discontinuous sections were so far out that it would have taken a much longer time, *i.e.*, seven years, for the well to produce water as it did.[9]

---

[9] On this point, plaintiffs go to great lengths to attack Hardwick's exhibits and testimony. However, as the above-quoted testimony from their expert shows, it was entirely possible the shale was discontinuous within the 220-acre unit as the well closest to Rice Acres, the Powell Lumber Company well, would have encountered 100% water-bearings sands. And although plaintiffs sought a concession from Hardwick that HS Resources did not share his opinion regarding the discontinuation of the shale, Hardwick made no such concession, even though plaintiffs state to this Court such a concession was made in footnote 16 of their brief. The following is Hardwick's testimony in this regard:

> Q. … Okay. So your theory that you … testified to before in response to [defense counsel]'s questions was that the Rice Acres gas was a single reservoir. It was not separated by shale. The shale was discontinuous, correct?
>
> A. I did testify to that, yes.
>
> Q. Yes. That's not what HS Resources believed, though, is it?
>
> A. They're certainly entitled to their opinion.
>
> Q. Based on all of the information HS had as an operator, they believed there were three producing intervals all separated by continuous shale, didn't they?
>
> > [Defense counsel]: Objection, Your Honor.
> >
> > THE COURT: All right. We've got an objection.
> >
> > [Defense counsel]: It calls for speculation about what HS Resources –
> >
> > [Plaintiffs' counsel]: He's an expert under cross.
> >
> > THE COURT: All right. He's an expert. He can give his opinion. How can he give what HRS' (sic) opinion was?
> >
> > [Plaintiffs' counsel]: He can't give an opinion, then, on discontinuous shale. I'm showing that he's wrong and that others were right, and the people who had the money on it believed differently, and I'm about to use his exhibit to prove it. That's – that –
> >
> > THE COURT: I've already – I've –
> >
> > [Plaintiffs' counsel]: If I could just tie it in, Your Honor.

This forms the basis of plaintiffs' position that whether the reservoir was volumetric or water-driven is immaterial as it was subject to extraneous water regardless, and the driving mechanism "is only relevant to calculate the amount of hydrocarbons lost in a reservoir." Moreover, Griffin's gas-to-liquid ratios based on the production summaries showed the absence of an increase in the amount of oil produced shortly before the water hit, which would, according to Griffin, prove the water was not naturally produced from the formation as in nature oil sits on top of water.

Rather, Griffin opined there was a substantial flow of fluids from the higher-pressured zones deep in the original wellbore, up the wellbore, and across shallower formations to the sidetrack wellbore drilled 132 feet away. This occurred just two weeks after the defendants stuck the pipe in the original wellbore, when the sands beginning at approximately 8,130 feet were charged up by fluids entering the bottom of the original wellbore, traveling up the wellbore, and entering the shallower formations. The charge up in pressure was even noted when the sidetrack was drilled at 8,100 feet. As gas was produced during the initial months, the pressure of the gas reservoir decreased relative to the nearby water zones. Channels in the cement in the original wellbore created a pathway between the adjacent water zones and the gas reservoir. The higher-pressured extraneous water followed this pathway to reach the lower-pressured gas zone, and thus began the flow of extraneous water in the reservoir.

Contrarily, defendants' expert, Bazer, opined the cement, the drilling fluid, and mud cake would have constituted sufficient barrier to any water coming through the original wellbore:

THE COURT: I've sustained the objection.

> Q. … And just so the Court is clear, Mr. Bazer, that when Mr. Griffin testified that water would be able to migrate vertically in a straight hole because the pipe was not centralized when it was cemented, you disagree with that opinion, correct?
>
> A. I do.
>
> Q. Okay. And can you tell the Court why that is?
>
> A. Well, in the first place, our well is cemented, an excellent cement job. There may be in some parts of the wellbore up higher some uncemented intervals. There probably are. But these would be full of drilling mud, or drilling mud cake, or settled drilling mud in which the – the vertical permeability would be greatly reduced.
>
> Q. Okay. And … was there anything unusual about how HS Resources plugged that original wellbore?
>
> A. No. They pumped more … cement than is required by a long shot, but it was – that's typical.
>
> Q. Okay. And in your opinion, HS Resources effectively plugged that well?
>
> A. They did.
>
> Q. Okay. And … tell the Court why you believe that to be the case.
>
> A. Well, they … pumped 1,100 feet of cement plug on the bottom inside and outside the drill pipe, the drill string, and they put – placed a plug on top of it. So it was … abandoned in a very effective manner. It was abandoned exactly what the Office of Conservation required.
>
> Q. Okay. And in your opinion and based on your review of the cement job in the Rice Acres, is there any evidence that there was any extraneous water flowing within the original Rice Acres hole?
>
> A. No, there's none.

Bazer further opined the migration postulated by Griffin defied the laws of physics:

> Q. Okay. So the significance of this is that when … we looked at the PRAL earlier and confirmed that the water was entering the sidetrack through the bottom 1 foot of this lower perforation, isn't that scientific evidence that directly refutes

Mr. Griffin's testimony that the water was coming down from right about 8,130 and below and migrating across the sidetrack?

A. Yes. This is not possible.

Q. Okay. And even if the cement in the original hole – even if it weren't completely around the drill collars, which you … say it is, there would be 14.1 per gallon mud present that would prevent that flow of water anyway, right?

A. Right. The … mud in the hole itself. Water would definitely not go down through the liquid mud if the mud was still in a liquid state because it … can't fracture it away. It's got to push the mud out of its way in order to go down the hole, and it just cannot do that. It … would have to fracture the formation and put that hole mud away into some formation core space and it can't do that. There's not – insufficient fracture gradient anywhere in this wellbore, especially not up shallow in the normal pressured formations at 8,130.

…

Q. Okay. And to remind the Court, if water's going to flow, it's going to flow from higher pressure to lower pressure, right?

A. That's right.

Q. So because the pressure in the Rice Acres sidetrack is greater than the pressure in the original wellbore at 8,130, any water flow would have gone from the sidetrack to the original hole and not from the original hole to the sidetrack as Mr. Griffin claims, right?

A. That's exactly right.

Q. Because basically Mr. Griffin's theory is contrary to the law of physics, is it not?

A. Yes. Yes, it is. Yes, it doesn't match physics.

Q. Okay. Wouldn't it be more probable that any water entering the Rice Acres sidetrack was entering the lower perforation from the formation itself as opposed to Mr. Griffin's theory that water was flowing through cement, drilling mud, et cetera, and going through 132 feet to enter the sidetrack?

A. That's the most likely thing, right.

Q. It's certainly the simplest explanation, is it not?

A. It is.[10]

---

[10] Note, plaintiffs attack Bazer's reliance on Darcy's Law, which calculates the flow of fluids through porous media, because drilling fluid is not a porous medium. Bazer testimony quoted above, however, is not based on Darcy's equation. Nevertheless, defendants postulate and the evidence does reasonably support that more than just drilling fluid is more likely than not in the annulus—namely, drilling mud, shale, and cement. Plaintiffs simply disregard this postulation, and Griffin admittedly performed no calculations to even determine the permeability—"the ability of the media to allow fluid to flow through it"—of the porous media in the annulus:

> Q. …Now, if, in fact, an annulus contains porous media, this equation will apply to fluid flow in the annulus as well as it will in the reservoir, will it not?
>
> A. I'm not sure if this equation would.
>
> Q. What equation would?
>
> A. There is Darcy's linear equation. But this thing right here, I don't know anybody that would perform calculations using this equation.
>
> Q. Okay. But you agree that there is a method, there's a scientific, generally accepted method of calculating the ability of fluid to flow in an annulus that is filled with porous material?
>
> A. And it is possible; but in this case impossible.
>
> Q. When you say it's "impossible," why is that?
>
> A. Because you have to know – for the linear equation, you have to know the area through which it's flowing, you have to know the permeability of the material that you're flowing through, and there, if the mud's already been displaced as your – as water's moving from the original hole over to the sidetrack. There are too many unknowns to be able to perform that calculation.
>
> Q. But you haven't done any calculations, even making assumptions, on what the permeability is?
>
> A. I have absolutely no reason to do it, and I didn't.
>
> Q. Okay. Now, let's talk about the permeability in the annulus. Have you done any kind of research at all to determine whether or not there have been any studies made to determine what the permeability is of mud, of slough shale, of cement in a wellbore annulus?
>
> A. No.

On cross-examination of his rebuttal testimony, Griffin did concede Darcy's Law "can be used in wellbores, but not under the circumstances of this wellbore" and cement

Calvin Barnhill, accepted as an expert in the field of petroleum engineering with a subspecialty of drilling engineering, agreed with Bazer on the physics of migration:

> A. … Typically, if you do not have standoff where the pipe is laying against the side of the hole, you have a contact point, then there will be an area of some amount. You know, first off, you will have some – if it's a permeable and porous formation you will have wall cake that has built up on the side, so the pipe will be laying in the wall cake.
>
> And so there will be a small area here on each side where you just get no flow velocity. You get flow velocity around this area, but you would not get flow velocity in this

---

"probably has porosity." For support, Griffin relied upon his own interpretation of language found in Craft, Hawkins, & Terry, *Applied Petroleum Reservoir Engineering* (2nd ed. 1991), that Darcy's law only applies to "porous media":

> Q. … Do you have any literature, peer-reviewed articles, published studies or anything that says that Darcy's Law is not applicable to defining media flow in cement or in mud or in slough shales in a wellbore?
>
> A. Yes.
>
> Q. What is that?
>
> A. What this particular slide shows [the porous media excerpt from *Applied Petroleum Engineering*], it only applies to porous media.
>
> Q. All right. And it's your position that cement and drilling mud and slough shales in a wellbore are not porous media?
>
> A. Well, cement – well, it means porous, and you have – have to have permeability for it to flow, because permeability is this K in the equation. Cement generally doesn't have permeability. Mud – a liquid mud system is not a porous medium, it's a liquid. So it wouldn't apply, and that's my authority right there.
>
> Q. And that's the only authority you address?
>
> A. No. That's the only – I – the question just came up. I mean, I don't carry around authorities in my – you know, with me. So – but –so I don't have an authority with me today, other than that.
>
> Q. And it's based on your interpretation of that language right there?
>
> A. It's based on my reading of that language.

area. So basically, whatever is in this area, since you have no flow velocity, has the potential to be isolated.

Q. And that will include mud and what we call “mud cake;” is that correct?

A. Whatever’s in that area if you can’t move it, then it’s going to stay there.

Q. All right.

A. And when it gets locked in, then there’s really no place for it to go.

Q. All right. That’s what I want to talk about. The fact that there is mud remaining in some portion of the wellbore after a cement plug is created, that does not mean that there is a pathway for influx of water, does it?

A. No. I mean to have migration you could – there are two components of migration you have to have, and there’s been a lot written on fluid migrations. But it really boils down to two components. You have to have a pressure differential in favor of a fluid coming out of a formation and moving something out here, and you have to have a flow path. This, you know, this material is essentially an incompressible fluid, so there has to be someplace for it to go.

If you don’t have a pressure differential in favor of the formation, or there is no place for this fluid to go, you can’t have anything to take its place.

Q. Could you … demonstrate to the Court, if you have a situation like this, why water is not going to displace that mud should water try and come into that wellbore?

A. Well, again, there are two things that work here: One, do you have a pressure differential in your favor? You know, typically, when we run cement jobs, the cement is heavier than the mud column. If we looked at the Rice Acres in particular, what we saw was they had a well-control event when stuff came into the well. They circulated that stuff out. In fact, they circulated many times. They increased their mud weight. They got the well back in balance, and then they added some additional mud weight, that’s why it got stuck.

But the well was under control. So that meant that the hydrostatic pressure in the well was higher than the pressure in the formations on the outside, so nothing can come in. Then they came back and they pumped the cement that was even higher weight than that. The mud they circulated around was roughly a 13-pound. The cement was 16.4. So it’s 2.4 pounds

> per gallon heavier than cement, so it's going to exert even more pressure.
>
> So we have a hydrostatic pressure situation where there's a hydrostatic overbalance in favor of the wellbore. You got several hundred psi of pressure greater in here than out here. So water is not going to come in. There's no moving mechanism. So there's nothing moving to push this out.
>
> Plus we know they pumped about 1,200 foot balanced plug inside and out. We know that the hole is helix-shaped. We also know they have stabilizers. So there's going to be portions of the hole – we have got cement all around. There's going to be portions where you do have contact area, and then there are going to be other portions where you have more cement around. So any channel or pathway that may have mud in it was going to be contained within that cement.
>
> So the question No. 1 is: How do you get past the pressure to get in there? And then once you get past the pressure, which there is no indication it did, but if it does, how does it then force the stuff out? Where does it go? You know, so if you can't get the pressure in here to push it out, it doesn't go. If there's no place for it to go, it doesn't go.

On cross-examination, Griffin conceded he had no peer review article or study to show 200 to 500 barrels could flow through cased annulus into the wellbore, explaining: "I didn't know what questions you were going to ask. If I knew you were going to ask, I would have looked for studies; therefore, I haven't." Later, when asked again for studies supporting his theories, Griffin likewise replied, "No, sir. I wasn't prepared to address that issue on cross-examination."[11] And as evidence the fluid flow occurred after the top plug was set, Griffin testified:

> Q. …what evidence do you have that fluid began to occur after that top plug was set?
>
> A. Because it showed up on the sidetrack well.
>
> Q. That's the only proof you have, the only evidence you have?
>
> A. That I can think of right now.

---

[11] Concerning this lack of authorities, the District Court stated on the last day of trial: "with this case going on as long as it has, he should have his authorities by now." This comment was made in response to defendants' objection to plaintiffs' attempt to introduce in Griffin's rebuttal redirect examination an article they claimed supported Griffin's migration theory.

…

Q. Do you recall any evidence of any water entering the formation at 8,100 and going from the original hole over to the sidetrack?

A. I have no direct evidence.

Interestingly, plaintiffs cite Bazer's statement the pattern of production water-free for months was "highly unusual" for a water-driven well as support for Griffin's theory the water production itself proves its extraneous nature. However, examining his testimony in context reveals his opinion the pattern of production was really indicative of the discontinuous nature of the shale, which allowed for production water-free for a few months until production drew the water around the edges of the shale:

Q. [Defense counsel] asked you, Question: Now, would that shale act as a barrier to the water? Answer: It would act as a barrier as far as making water in this wellbore. I don't think it would restrict this reservoir from making water.
Was that your testimony?

A. That's exactly what I believe, and that's what I said, yes.

Q. That's not what you[] said in your deposition, though?

A. I said it would act as a barrier to vertical flow.

Q. That's not what you said in your deposition, is it?

A. That's exactly what I said in that last line we just read, a barrier to vertical flow.

Q. And where did you say, in your deposition, that it would form a barrier to making water in the wellbore, but not in the reservoir?

A. I didn't say that in the deposition. You didn't ask me that. You asked me if it was a barrier to vertical flow, and I said, yes, it would act as a barrier to vertical flow. I do believe that.

> Q. In the reservoir, you said?
>
> A. Well, in the reservoir and at this wellbore.
>
> Q. Okay. So when we were talking here, we were asking specifically about the reservoir, correct?
>
> A. Well, it – I didn't – you didn't ask me whether water could go around the end of the shale barrier, which it can. But it did act as a vertical flow – barrier to vertical flow at the wellbore and in the reservoir, because, recall, this well produced five months water-free. Highly unusual for a well with a gas-water contact in it to do that.

Moreover, his testimony actually contradicts Griffin's theory of migration and water production under Darcy's Law:

> Q. … So basically what you're assuming is, if Mr. Griffin is – is correct, that there was water flowing from the original Rice Acres wellbore to the sidetrack, you calculate that only .044 barrels per day would physically be able to flow between those wellbores, correct?
>
> A. Based on the science that we know, yes.
>
> Q. Okay. And if you remember, we were looking at … the daily production – do you recall how much water was flowing per day in the beginning of March of … 2000?
>
> A. Five barrels a day.
>
> Q. And then it increased drastically to how much?
>
> A. It finally reached in excess of 300 barrels per day.
>
> Q. Okay. So that's significantly more than .044 barrels per day that you calculated, is it not?
>
> A. Right, it is.
>
> Q. Okay. Now, the … increase in the water production in the Rice Acres when it was at 5 barrels per day and it jumped up to 50 and it quickly escalated from there, that … was a sudden increase in … water production, was it not?
>
> A. It was.
>
> Q. Okay. And that's not unusual in a water-drive reservoir, is it?
>
> A. No. That's exactly how it happens.

> Q. And … the Rice Acres, despite that water production, continued to produce for a few more years after that initial water hit in March of 2000, right?
>
> A. That's right.
>
> Q. And that's also not unusual in a water-drive reservoir that even after a water hit the well could still be produced, correct?
>
> A. That's … typical, right.
>
> Q. All right. But if … the Rice Acres were volumetric, once there was that water hit, wouldn't the well no longer be able to be produced almost immediately?
>
> A. Well, if it's a volumetric reservoir, the bottom-hole pressure would have been drawn way down to the point that when water hit it would have probably tended to kill the well. In other words, it couldn't flow the column of water and gas because of the reduced bottom-hole pressure.
>
> Q. Right. But that's not what happened in this case, right?
>
> A. No. This …well had a strong water drive and had, as we know, 5,120 psi flow in the bottom-hole pressure at the end of life.
>
> Q. Okay. So would it be fair to say that even if Mr. Griffin is correct that water flowed from the original hole to the sidetrack it simply was not enough to make a significant difference in the amount of water that was actually being produced by the Rice Acres well, correct?
>
> A. You … couldn't notice this volume of water, no.

Therefore, even if the cement plug was not a complete barrier to hypothetical water from another zone, the District Court *could reasonably have concluded* plaintiffs failed to prove by a preponderance of the evidence that the produced water penetrated the plug and migrated to the sidetrack destroying the reservoir.

As the above evidence more than demonstrates, the District Court was presented with two theories: either the water was formation water or extraneous. In its vast discretion, the District Court credited the testimony of defendants' experts, finding Griffin's testimony unreliable and his corresponding exhibits not supportive of his theory. The District Court's conclusion the water produced in the Rice Acres well was formation water because the Hackberry reservoir "was water driven and not subject to extraneous water from other zones" was clearly supported by the record evidence. We note the District Court did not as plaintiffs argued to this Court find a water drive cannot be subject to extraneous water, but rather it found the Rice Acres reservoir, based on the evidence presented, was not subject to extraneous water. As the record evidence clearly and reasonably supports this conclusion, we find the District Court's factual finding in this regard was not manifestly erroneous.

Hayes Lumber Well (Lower Zones)

Regarding the Hayes Lumber well, the initial triple packer configuration allowed defendants to produce three sand intervals simultaneously and gave them the ability to shut off each interval as it watered out. Significantly, however, there was no evidence water ever appeared or that the reservoir was destroyed, but rather the allegation the well was lost due to sanding. And as the transcript of defendants' motion for involuntary dismissal reflects, the District Court understood the destruction claim in this regard involved a failure to attain the reservoir, not a true destruction:

> THE COURT: … How is that reservoir there destroyed?
>
> [Plaintiffs' counsel]: Well, there's no evidence anybody can go back into it.
>
> THE COURT: What is that evidence that nobody can go back into it? That's the Court's issue.
>
> [Plaintiffs' counsel]: Has anybody suggested they can or that they want to? Has anybody presented evidence that it's feasible?

> THE COURT: But I feel that the plaintiffs have to show me by a preponderance of the evidence that that reservoir cannot be attained.

Although the District Court denied defendants' motion for dismissal after briefing by the parties, he ultimately concluded plaintiffs:

> …failed to prove the claim regarding the [lower zones]. After reviewing the testimony and memoranda, it is evident that the plaintiffs have not only neglected to demonstrate that the multiple packer configuration resulted in reservoir damage, they also failed to offer any evidence that the design was unreasonable in the first place.

On appeal, the appellate court again reviewed the record, focusing not on evidence supporting the District Court's holding, but on evidence in conflict with it, and never addressed the issue of whether the reservoir was in fact unattainable. In its reversal, the appellate court focused on a snippet from Blum's deposition taken eleven years after the well was completed that he initially did not recall the reasons for the simultaneous packers, and therefore, the packer design was not planned ahead of time with certain production advantages in mind. *Hayes Fund*, 13-1374 at pp. 12-13, 149 So.3d at 289-90. The appellate court did not acknowledge (1) Blum's statement "[i]t's been a long time, and I don't remember that much," (2) his admitted need to look at the completion reports to refresh his memory, or (3) his further testimony:

> A. … if I remember correctly, on this – I was thinking about that last night, that very same thing, is – when they – when we sat down with our geologist and looked at this, they were under the assumption and they planned upon that it would start losing our zones from the bottom up. We'd start watering out from the bottom up. And that's why – I think that's one reason we did this, to the best of my – that I can remember.
>
> Q. Okay. But it took into – or I assume that the lowest zone would water out first, correct?
>
> A. Yes, because if – if not – you know, if – if there hadn't been some thinking there, they would never have shot

> three zones to start with. They'd only perforated one zone and produced it and see what it did. For some reason I think that's the reason that they looked at the logs and were under the assumption that it was going to water out as it came up hole.
>
> Q. Okay. As far as having to – or as far as avoiding the situation where the shallowest zone may have watered out first based on this packer configuration, would you have avoided this problem by simply producing the lowest zone first at one time as opposed to having the other two zones producing above it?
>
> A. Yes, and that's just what I was saying. Again, what I'm going back to is when this well was planned, there were a number of different people in on this, and what they were looking at is – they wanted – the best I can remember, they were thinking that it would water out from the bottom up. And at that time – and I think if there had been any doubt about the top one watering out before the other two, they wouldn't have done this.

Read in its *entirety*, Blum's testimony clearly established he remembered defendants utilized the triple packer configuration because they believed the lower zones would water out from the bottom up, and the completion prognosis report supports his testimony.

Although the appellate court acknowledged Cabrera's testimony and the list of other wells employing the multiple packer design, it focused on Cabrera's inability to say whether those packers produced out of multiple formations simultaneously. The appellate court then questioned whether there was evidence defendants believed the reservoir was water-driven, focusing only on an evaluation from 2001 by Aspect, a non-operator who wanted to sell its working interest, treating the zone as a depletion drive. *Hayes Fund*, 13-1374 at p. 11-15, 149 So.3d at 288-90. We note McKenzie criticized this evaluation because it "only used a few months worth of production":

> Q. … And in this case, [it], Aspect, determining that this Hayes well was a depletion-drive mechanism directly contradicts your opinion that the Hayes well was a partial water-drive well, correct?

A. Yes. We have a difference of opinion there.

Q. Okay. And Aspect's study of this well, this Hayes well, reached the same conclusion that Mr. Griffin did in his study, and that is the Hayes well was producing a depletion-drive reservoir, correct?

A. Yes. If you – I think you need to point out that the work was done a decade – probably 10, 12 years between the two work products. And Aspect, in 2001, didn't have the benefit of a long production history when they made their calculations. Otherwise, you would have seen a decline curve analysis.

Q. But Mr. Griffin had the benefit of a long production history, did he not?

A. He did. But he failed to use the correct decline rate.

Q. And at the end of the day, both he and Aspect had the same opinion as to the drive mechanism of this Hayes well in that it was depletion, correct?

A. That's correct. But they're both wrong.

Q. Okay. Your own client is wrong; is that right?

A. Well, they had – well, let's talk about when they did the work, 2001. At that time, the well had only been producing for, what, less than two years. So they were optimistic when they made that calculation.

Q. Have you gone back recently and spoke to any of the engineers, or geologists, or any experts to tell them that they were wrong in determining that the Hayes well was a depletion drive?

A. No. If I did something like that ten years after they had done this work for a sales package, they'd think I'm nuts.

…

Q. But when Aspect in – on October 1st, 2001, they didn't use a hypothet; they had actual production of 21 months, and they characterized it as a depletion drive, correct?

A. That's what they did. But you … need to keep in perspective: It was part of a sales package.

Q. So if … it's a sale package, that means you don't have to be truthful and honest and accurate?

> A. No. But I've seen a lot of sales packages, and they typically present the most optimistic evaluation of the reserves. But –
>
> Q. And that's – I'm sorry.
>
> A. They're just trying to get the most money they can if somebody's willing to pay for it.

Moreover, as the 2001 assessment was not prepared by the driller or operator, it could not speak to defendants' understanding at the time the well was drilled as Blum's testimony did. Yet in reaching its conclusion, the appellate court once again ignored Blum's and Cabrera's testimony regarding defendants' expectation the zones would water out from the bottom up, indicating a water drive component. But at trial, Cabrera reaffirmed Blum's reasons for defendants' utilization of the triple packer:

> Those packers were intended – when the well was originally completed, there were three different – three different lobes of the – or three different parts of the Hackberry or the Nodosaria that were completed. The intention was as water moved up through the reservoir, you could set a plug in here and shut off this lower zone while still continuing to produce the upper two. The same thing when the water encroached up, you'd set a plug in here, and eventually you'd set a plug in the top – in the topmost packer, and then you could perforate your casing for your next – you know, for the next recompletion.
>
> …
>
> Again, it's to allow for … successively shutting off the lower production – the lower zones as they produce water. You know, … these Hackberry zones are … notoriously water driven, and you would want to basically work your way from the bottom up.

The appellate court also ignored the abundant testimony that the majority of wells in southwest Louisiana have a water-drive component and the peer review and industry understanding that even those which initially produced as depletion, ultimately produced water in the end and, thus, have a water-drive component as well. Through McKenzie, defendants introduced a Society for Petroleum Engineers

(SPE) paper published by Dr. William J. Bernard, then professor at Louisiana State University, entitled *Gulf Coast Geopressured Gas Reservoirs, Drive Mechanism and Performance Prediction*, in which he opined, based on his study of about 100 abnormally pressured/geopressured reservoirs on the Gulf Coast, most of the studied geopressured wells were predominantly water-driven. Even those that originally presented as volumetric or depletion ultimately demonstrated a water-drive component. McKenzie further extrapolated:

> A. …. Most of the reservoir engineers and appraisal firms that I have dealt with over the past few decades, frankly, I can't remember anybody – any reservoir engineer, practicing consulting engineer that didn't recognize that geopressured reservoirs along the Gulf Coast are typically water drive.
>
> Q. And that's also reflected in Craft, Terry, & Hawkins' book on the subject [*Applied Petroleum Engineering*]; correct?
>
> A. That's correct. They reference this paper in the text itself.

Regarding his own investigation of other Hackberry and Nodosaria formation wells in the vicinity, Hardwick testified:

> Q. … based on this investigation, what conclusions did you draw or come to with regard to the drive mechanism of Hackberry and Nodosaria reservoirs in the vicinity of the Rice Acres and the Hayes Lumber Company wells?
>
> A. Well, as [Ex. DF-34A] will … bear out, … the units that we looked at, the wells that we looked at, and without exception, all of them made significant water production, either increasing or originally. So there was some – component of water drive appears to be very common; either that, or all the wells had mechanical problems.

Likewise, McKenzie explained his study of around sixty wells in Allen, Beauregard, and Jefferson Davis Parishes, of Hackberry and Nodosaria completions. Within that study was a smaller fourteen-well study of completions in those sands within a six-mile radius of the Rice Acres and Hayes Lumber wells. Of the sixty wells, only three or four were pure depletion.

The appellate court then concluded the District Court manifestly erred in also finding: "Griffin offered no testimony that the defendants should have known that the well would sand up eventually nor did he offer any authority and/or support for his position that [defendants] should have predicted the sanding of the well." On this issue, Blum testified, prior to drilling the Rice Acres and Hayes Lumber wells, he had drilled about twenty-four wells in these formations with no sanding problems:

> Q. … In your prior experience in this area prior to completing the Hayes Lumber Company well, what, if any, experiences did you have with sand coming out of the reservoir?
>
> A. Up until this point we hadn't had any. We had some wells that had watered out, but we hadn't seen any sand production.
>
> Q. What, if any, experience, prior to this Hayes Lumber Company well being completed, did you have in casing leaks or sand piercing casing and causing erosion, or not only casing but also tubing?
>
> A. Well, I've seen a lot of casing leaks, but most of that has been from corrosion. But I don't remember any casing leaks from sand erosion.
>
> …
>
> Anywhere, anywhere. What I'm saying is, anywhere I've ever worked, I don't remember any wells where we've had sand erosion pert to casing.

Regarding Blum's testimony above, Griffin explained:

> Q. Now, Mr. Griffin, having listened to Mr. Blum's testimony, do you recall that he testified that, prior to completing this well, that HS Resources had never encountered a sand problem?
>
> A. I just heard what he said.
>
> Q. All right. And do you have any evidence that HS Resources had any knowledge of the potential or the existence of the potential that this well would sand up in the way that it did?

> A. Yes, sir. Oh, you mean at – when they drilled it and completed it?
>
> Q. Yes, sir. That's correct.
>
> A. I don't know what was floating around in their mind back then.
>
> Q. Well, do you have any evidence, have you seen any evidence that HS Resources should have known that one or more of these zones was going to sand up prior to the actual occurrence?
>
> A. If you have any experience – any evidence?
>
> Q. Yes, sir.
>
> A. Like a document or something?
>
> Q. Yes, sir, or testimony or any – any evidence.
>
> A. Well, I disagree with what Mr. Blum said, if that will help.
>
> Q. No, sir, that's not responsive to the question.
>
> A. Okay.
>
> …
>
> Q. The question is: Do you have any evidence to indicate that HS Resources should have known that one or more of these zones was going to sand up prior to the actual occurrence in May of 2007?
>
> …
>
> A. Okay. I have no documentation. I have seen nothing in the files that have been produced by the defendants that indicated that HS Resources even considered the potential for sand production. I have seen no testimony, other than Mr. Barnhill's – y'all's expert, Mr. Barnhill, that addressed … sand production, the probability of sand production, other than what just Mr. Blum has said.

Both the appellate court and plaintiffs put great stock in Barnhill's testimony as establishing defendants should have known of the potential of sanding. However, his testimony taken as a whole reveals, while sanding is an issue in south

Louisiana, the focus should be on what the operators knew or should have known at the time of completion:

> Q. You … read the completion prognosis that HS Resources prepared, didn't you?
>
> A. I did.
>
> Q. And didn't that set forth what they intended to do?
>
> A. It … laid out what they were doing. And I also read the testimony of – I think of Mr. Blum and Mr. Cabrera, and I think they discussed this.
>
> Q. Okay. Let's go back, then, to Exhibit 87B [Completion Prognosis].
>
> A. But I'll talk … about it in generic terms.
>
> Q. Sure.
>
> A. Basically, the purpose for doing this would be to allow you to have a situation where if the State permitted it, you could come in and you could produce these three zones together, with the assumption being that the thinner, less – poor-quality zones were going to be the first ones that were going to go out or give you trouble. So you would flow the fluid with the expectation that the bottom zone could potentially water out on you, or could potentially have a problem. If that started giving you a problem, you could plug it off with a wireline unit, again, not have to do a full-blown workover, still have the production capability out of the next one or out of the main; or you could plug off the bottom two. If they started giving you some kind of problem, you could plug it off and flow out of the main.
>
> If you wanted to do diagnostics to see whether it was the main giving you an issue or the bottom two, you could set a plug in here and flow the main and see if it was what was giving you a problem, or if the bottom tube was what was giving you a problem.
>
> But it gives you this flexibility without having to put a rig on there and go in and start working in that well, tearing – you know, burning over things, tearing things up and, you know, doing major work in that well.
>
> Q. In your opinion, was the setting of three isolation packers by HS Resources a reasonable way to approach the production of these three different zones?

> A. Again, when I looked at what they were doing and their rationale for doing it, I understood it, and it was okay with me.
>
> Q. Okay. And there were no significant sand issues noted at the time that this well was completed in any of the completion reports or anything that you reviewed which would have suggested any problems with using this arrangement, were there?
>
> A. Correct. You know, again, if … you had had an idea on the initial completion that you were going to have a sanding problem from any of these zones, then you would not have utilized this particular type of completion. You would have looked at potentially gravel packing. We do see – we do have gravel packs on multiple zones. But you would have either looked at it as a single zone gravel pack with a selective or … if you believe you were going to have a sanding problem, your completion would have looked different.

On cross-examination, Barnhill further explained:

> Q. … On your direct, you indicated, in so many words, that you are familiar with wells sanding in?
>
> A. I am.
>
> Q. That's not an uncommon thing in south Louisiana, correct?
>
> A. It is not.
>
> …
>
> Q. Therefore, a prudent operator should recognize that that is one of the more common risks of attempting to drill a well in south Louisiana, correct?
>
> A. It is.
> … I was going to say, again, that's one of the things that you kind of look to the – at the offset wells for. To see if they were gravel-packed or whatever, you look at your sand analysis. But there is a recognition, if you're in south Louisiana within a certain interval, sand can be an issue.
>
> Q. Now, a prudent operator contemplates and recognizes the most common risks that could damage his well and plans for them, correct?
>
> A. My opinion you do, yes.

> Q. Okay. And when you're in an area where it is not uncommon to have sanding, you should plan for the possibility of having to control the sanding, correct?
>
> A. I think if you're in an area where the offset – if you've got offset well control in close proximity to you and they indicate a sanding problem and your core analysis indicate a sanding problem, or your core analysis standalone indicates a sanding problem, then you should consider it.
>
> …
>
> Q. … do you know of any documents or records in this case indicating that the operators of this well decided there was no risk of sanding in because they looked at records of other wells in the area?
>
> A. No, I haven't seen documents to that effect.
>
> Q. Okay. So when you say they saw the wells and there was no danger, you're – that's your supposition or your speculation?
>
> A. No. I thought you were asking me – I was answering from my standpoint –
>
> …
>
> Well, let me back up and say one thing. Other than Blum said he looked at the offset wells, whatever that implies. He did say that.
>
> …
>
> Q. Well, did Mr. Blum ever testify: We thought there was no danger of sanding in because we looked at other wells?
>
> A. No. Again, my memory is he said he … looked at the – he considered the offset wells and looked at the offset wells.
>
> Q. Okay.
>
> A. That's my memory of the extent of his testimony.
>
> Q. For what purpose?
>
> A. To design the well.

Therefore even on cross, Barnhill maintained his position that the reasonableness of an operator in anticipating sanding issues should be examined based upon what the operator knew at completion. Consequently, his focus was on Blum's testimony, which revealed defendants did not have reason to anticipate sanding based on the other wells in this formation and vicinity Blum had previously drilled and completed. Overall, Barnhill opined there was no indication defendants were going to have a sanding problem at the time the well was designed and completed:

> … I think you look at information you have, and you configured the well based on what you think it's going to be best. I mean, there's a risk both ways, anytime you put a rig on and start doing things. So I can tell you, if you ask me if I looked at the completion design of this well with retrievable packers versus the way they did it, I would come down on the side of the way they did it. I think there are fewer tricks associated with that.
>
> …
>
> … There w[as] no information ahead of time that gave them an indication that that was going to happen [the sanding in]. And, again, we are talking, you know, a vacuum. We don't know what would've happened if they would have gone the other way.

Moreover, Griffin failed to present any evidence defendants, based on what was in the completion reports and Blum's hands-on testimony, believed or should have believed at the time of completion the well would eventually sand up. Notably the well performed above expectation for years until its sanding in 2007.

In an effort to prove defendants should have anticipated in year 2000 the well would eventually sand up, Griffin on rebuttal produced an excerpt from the 2007 edition of the Petroleum Engineering Handbook that used porosity information to determine the likelihood of needing sand control:

> **5.3.5. Porosity.** The porosity of a formation can be used as a guideline as to whether sand control is needed. If the formation porosity is greater than 30%, the probability of the need for sand control is high because of the lack of cementation. Conversely, if the porosity is less than 20%, the need for sand control will probably be minimal because the sand has some consolidation. The porosity range between 20 to 30% is where uncertainty usually exists. In natural media, porosity is related to the degree of cementation present in a formation; thus, the basis for this technique is understandable. Porosity information can be derived from well logs or laboratory core analysis.

Interestingly, both plaintiffs and the appellate court claim this 2007 article proves Griffin's postulation defendants should have known in 2000 sand control measures would eventually be needed, but on cross-examination, Griffin conceded the 2007 handbook was not in publication in 2000, and the cited language on porosity as an indicator of sand production was not in the 1987 predecessor handbook:

> Q. Now, somebody completing a well in 2000 is not going to have access to this authority [SPE Petroleum Engineering Handbook of 2007], are they?
>
> A. That's correct.
>
> Q. Did you do any investigation to see whether or not the predecessor to this handbook had any reference or made any statement comparable to what you've just produced to this Court?
>
> A. No. I don't know which predecessor you're talking about, but I didn't check any of them.
>
> …
>
> Q. Go to the first page, the Foreword.
>
> …
>
> A. You want me to read the yellow or something?
>
> Q. Yes, sir, I want you to read the yellow.
>
> A. Okay. "The handbook is a continuation of SPE's primary mission of technology transfer. Its direct descendants are the Frick" – F-R-I-C-K – "handbook published in 1952, and the Bradley handbook published in 1987."
>
> Q. All right. So you would agree that the Petroleum Engineering Handbook that any engineer attempting to design a completion of a well in 2000 would be that 1987 version.
>
> A. Not necessarily. In my opinion, I wouldn't … go to a handbook to … select packers, temporary versus permanent.
>
> Q. But you used this as an authority, as a basis for your conclusion?

A. Correct, because you're always asking me what authority supports my opinion.

…

Q. … Let's go to porosity. Is the quote that you presented to the Court last week in Exhibit 148-NN, which is the '87 version of the handbook?

A. No, sir.

Q. Is there any reference to a porosity standard in the '87 handbook?

A. Essentially.

Q. When you say "essentially," what are you referring to?

A. They don't give numbers exactly, but right there in that first paragraph under Sand Control –

Q. All right.

A. – it says: Sand Formation Properties and Geology. It says: Marine-deposited sands, where most of the hydrocarbons are found, were often cemented with calcareous or salacious materials and may be strongly consolidated, glued together good. In contrast, Miocene and younger sands are often unconsolidated or only partially consolidated with soft clay or silt. These structurally weak formations may not restrain grain movement. When produced at high flow rates, they may produce sand along with the fluids.

Now, even though they didn't put a percent – a porosity number to differentiate between consolidated and unconsolidated, that's the best measurement of consolidated and unconsolidated unless you have core analysis.

Q. Did you look at the core analysis on the Hayes Lumber Company to determine whether or not the sands were consolidated or unconsolidated?

A. Yes, sir, and it doesn't say, one way or another.[12]

---

[12] Note, 148NN was not admitted into evidence:

> [Defense counsel]: We would also introduce into evidence Exhibit 148-NN, being the 1987 version of the SPE petroleum handbook pertaining to sand control, and which Mr. Griffin just read out.

This testimony reasonably and clearly demonstrates Griffin did not, as the District Court reasonably found, present any treatises or other reliable sources in existence when the well was completed stating or opining defendants should have known the well could or would sand up or indicating the need for sand control measures. Furthermore, the excerpt relied upon by plaintiffs on porosity is actually just a subpart—5.3.5—of the 2007 handbook's "Predicting Sand Protection" section—5.3—, which provides as emphasized by defendants:

> **5.3 Predicting Sand Protection**
> Predicting whether a well will produce fluids without producing sand has been the goal of many completion engineers and research projects. There are a number of analytical techniques and guidelines to assist in determining if sand control is necessary, but no technique has proven to be universally acceptable or completely accurate…. Until better prediction techniques are available, the best way of determining the need for sand control in a particular well is to perform an extended production test with a conventional completion and observe whether sand production occurs. Normally, it is not necessary to predict sand production on a well-by-well basis because wells in the same reservoir tend to behave similarly. The prediction required is on a reservoir-by-reservoir basis. However, initial good results may prove misleading, as reservoir and flow conditions change.

Notably, Blum testified he considered the offset wells in the formation and vicinity of which the above quoted guidelines would seemingly approve.

Regardless, the real issue herein is not the reasonableness of the packer configuration, but whether defendants' actions rendered the lower zones

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> [Plaintiffs' counsel]: Your Honor, again, the portions that were brought to his attention, we have no objection to.
>
> THE COURT: You see, that's the situation we have here, [Defense counsel]. You're giving him a blanket, asking him to review it, and then to – and if there's nothing that he can point to, then what's being introduced?
>
> [Defense counsel]: Well, if he stipulates that it is not in there, then we –
>
> THE COURT: He's already testified it was not in there.

unattainable. As to this alleged "unattainability," our review reveals Griffin testified drilling a replacement well would be a "risky venture, since you would be communicating with potential water zones or probable water zones in this wellbore they could enter any gas zone you're producing by an offset well." He further explained: "Plus, the reserves are probably too low to drill another new well in that lower stuff." And defendants were "working on the well, they had all this information and they didn't do it, so I assume you can't." This "they didn't, therefore, no one could" argument again reappeared in plaintiffs' opposition to defendants' motion for involuntary dismissal:

> …Simply put, the defendants have destroyed the plaintiffs' access to the minerals beneath their property. And that is clear because no one—including the defendants themselves—believes it is economical to drill a new well or otherwise attempt to produce the remaining recoverable reserves in the lower three zones…
>
> …
>
> …Simply put, if the remaining reserves in the lower three zones of the Lower Nod B could be produced despite the defendants' destruction of the original well bore, why haven't the defendants—or anyone else—made any effort to produce them?

In support of their position, plaintiffs quoted McKenzie's report and opinion testimony it was not economical for defendants to drill a replacement well. However, plaintiffs clearly took McKenzie's testimony out of context in that McKenzie's opinion was based on his understanding of the size of the reservoir, which was less than half the size contemplated by Griffin.[13]

Nevertheless, plaintiffs had to prove by a preponderance of the evidence the reservoir was unattainable, *i.e.*, they were damaged because no one could access

---

[13] As advanced by defendants, employing simple math and logic, if Griffin's numbers are correct, McKenzie's economic analysis would not be. According to Griffin, even after all royalties were paid, $5,470,000 of reserves remained. McKenzie testified a replacement well would have cost around $3.5 million, and Barnhill's overall testimony on this issue established it would be reasonable and worth such an investment to recover over $5 million.

the reserves, and Griffin's vague and unsupported statements "fall far short" of proving no further hydrocarbons could be economically produced. The following colloquy occurred when Griffin was specifically asked about the possibility of further production from the lower zones:

> Q. Did you ever try to think of ways that a operator could come in and economically obtain additional production from that lower Nodosaria reservoir?
>
> A. Not the way it was originally configured.
>
> Q. Well, today, an[] operator could go perform a block squeeze in the existing Hayes Lumber wellbore at the point just about the top perforations at 9,718, right?
>
> A. You know, I'm not sure they could.
>
> Q. More likely than not, they could go down and perform a block squeeze right about 9,718 today, correct?
>
> A. Well –
>
>> [Plaintiffs' Counsel]: Your Honor, are the defendants offering to drill a well?
>>
>> [Defense Counsel]: This is –
>>
>> THE COURT: That's not an objection.
>>
>> [Plaintiffs' Counsel]: It's our objection to relevance.
>>
>> THE COURT: What is your objection? That is not an objection.
>>
>> [Plaintiffs' Counsel]: All right. Our objection is, again, as to relevance. It's not a mitigation of damages issue.
>>
>> THE COURT: All right. I'm going to overrule the objection. Thank you.
>
> A. You know, I don't have sufficient information about the condition of that wellbore. I would say, based on the information I have, the answer would be, no, they couldn't. And since [defendant] was working on the well, they had all this information and they didn't do it, so I assume you can't.

A mere assumption based upon insufficient information is not sufficient proof by a preponderance of the evidence.

Moreover, defendants disputed his claims. Regarding the extraneous water, Barnhill testified the sand that blocked the gas from entering the wellbore would form a barrier and block any water leaks:

> Q. The lower zone of the Hayes Lumber well, that's the 9,890 to 9,995 zone, stopped producing because it sanded up; is that right?
>
> A. That's correct, in my opinion.
>
> Q. And the term … "sanded up" means that the sand is physically blocking and clogging up the area where the gas has been entering the Hayes Lumber well; is that right?
>
> A. It … could not produce through whatever the restriction was.
>
> Q. All right. Assume that Mr. Griffin has testified that there are casing leaks in the Hayes Lumber wellbore that can leak water, but that all of those leaks are above the two intervals that were produced, meaning they were above a depth of 9,718.
>
> A. Okay.
>
> Q. Also assume that Mr. Griffin has voiced a concern that if a replacement well were drilled to produce the remaining hydrocarbons from the 9,890 to 9,995 interval, that new well might some day water out because water from the original wellbore might enter the reservoir and migrate over to the new well. All right?
>
> A. Okay.
>
> Q. Now, since there is sand that is preventing the gas in the reservoir from entering the wellbore from the 9,890 to 9,995 interval, will that sand also act as a barrier and prevent any water inside the wellbore from entering the reservoir?
>
> A. In my opinion, if that sand plug was sufficient enough that it was blocking gas production out of that zone, then water would not go – flow backwards through that plug.

Q. So in this case here, where the well sanded up, that's not just possible, that's probable, right?

A. In my opinion, it's likely. I mean, I think it's probable, yes. If gas doesn't go through the plug, water's not going to go through the plug.

…

Q. So my last question, I believe, Mr. Barnhill, is: So if a replacement well were drilled to produce whatever remaining hydrocarbons there may be in the 9,890 to 9,995 interval, then even if Mr. Griffin is correct, that water can enter the original wellbore through the casing leaks, that water could not move past the sand plug and into the reservoir; is that right?

A. If there was a sand plug in place that was preventing gas flow out of the zone, then, in my opinion, the water flow would not go through the plug.

Q. And in this case, we did have that sand plug, right?

A. There was an indication, like I said, when they cleaned out through the 9,890 interval with the original workover, they left the well open, and there was no flow coming out of the well, is my memory from the reports.

Q. If the water can't enter the reservoir, it can't interfere with the replacement well; is that right?

A. If it doesn't enter the reservoir, no, it won't interfere.

Notably, Griffin tentatively agreed:

Q. … Since the deeper zone sanded up, water from casing leaks higher up the wellbore and would not be able to get through the sand plugs and into the productive gas zones at 9,890 to 9,995, would it?

A. If the sand plugs formed a total barrier, that would be correct.

Q. And do you have any indication that they did not?

A. I'm just telling you, I wouldn't risk it. Sand plugs should form a barrier, but they may not. Plus, this casing in this entire wellbore was very deteriorated. I frankly would not risk – I personally would not risk drilling to those lower zones because of the potential communication within this wellbore

> and the small amount of reserves that's left in the lower zones, and that's what I presented to the Court.
>
> Q. You didn't run any calculations to estimate how long it would take for a new Hayes Lumber well to water out, correct?
>
> A. That's correct.
>
> Q. All right. And you don't know how much additional production you could get from a new well before it watered out, right?
>
> A. That's correct, but nobody's – the operator, Crimson or nobody else has drilling a well out there, so I assume they subscribe to the same –
>
> …
>
> Q. All you're saying is that water from the casing holes higher up the wellbore could migrate down and exit through the perforations into the reservoir, right?
>
> A. Correct.

As to the economic feasibility of replacement wells, Barnhill testified wells could economically be drilled into both the lower and upper zones, packers can be retrieved even though defendants were not successful in doing so, and if a well was drilled to produce from the recompleted upper zone, then the incremental cost of drilling to the lower zone would easily be justified by the amount of hydrocarbons Griffin claims are still there:

> Q. Assume for this next question … that Mr. Griffin is correct, that there's about $40 million worth of remaining hydrocarbons in the two lower Nodosaria intervals at issue in this case, and that a replacement well is drilled to produce those intervals. If an operator cemented the original Hayes Lumber wellbore, as you've just discussed, then you would have successfully resolved Mr. Griffin's concern that water from the original wellbore might migrate over to the new well and water it out; is that right?
>
> A. That would be my expectation.

> Q. Okay. Assume that Mr. Griffin has said that it is not economically worthwhile to drill a well just to produce the remaining hydrocarbons in the 9,890 to 9,995 interval.
>
> A. So it is not economical?
>
> Q. Assume that fact, that Mr. Griffin has said that.
>
> A. Okay.
>
> Q. If an operator is already drilling a well to produce from the upper 9,718 to 9,742 interval, what is a reasonable estimate of the incremental cost of drilling an additional 160 feet or so to the lower interval?
>
> A. If I have already drilled down to the 9,718 interval, if I've drilled that interval, I'm going to drill a couple of hundred feet of rat hole anyway, just to be able to do a normal conventional operation. So you would really only be talking about maybe adding another hundred foot of rat hole below that, because that would – the initial rat hole should have covered that zone. So I think you'd be looking at very little incremental cost, maybe 50, 60,000 bucks, something like that.
>
> Q. If an operator is already drilling a replacement well to reach that 9,718 to 9,742 interval, then would a reasonable operator spend that additional cost to drill that – those additional feet to the lower interval if there were about 7 million in hydrocarbons remaining in that lower zone?
>
> …
>
> A. In my opinion, if I could get another $7 million for a 50, $60,000 expenditure, yes, I'd do it.

Griffin even conceded replacement wells could be drilled at a great distance from the existing wells:

> Q. Even if you didn't do a single thing to the existing Hayes Lumber wellbore, don't you agree that based on your assumptions as to the size of the reservoir, you can drill a replacement well over 2,500 feet from the existing wellbore and still tap into the reservoir?
>
> A. Sure. Because it sticks out there that far, I think. I mean, there's distance between the well and the boundaries of the unit.
>
> Q. Right. So if your replacement well is over 2,500 feet away from the existing Hayes Lumber well, and even if you

are correct that the water can migrate from casing leaks to the productive gas zones in the original wellbore, that water is too far away to interfere with production from a new well, correct?

A. To get over there is the only thing I can say.

Q. It could get over there?

A. Yes, sir, and nobody's drilled it. So in – that kind of confirms my opinion, nobody has drilled a replacement well.

Q. [B]ut you have done no calculations whatsoever to determine whether it's physically possible for that water to get that far over before the replacement well had produced the reserves?

A. That's correct. And, in fact, the drilling of –the position of drilling a replacement well, could also be considered a collateral attack on the Commissioner's order. Because the order says that the existing unit well will drain the entire reservoir. In order to drill a second well, you've got to go back to the hearing process or make application with the Commissioner.

Q. You've testified under oath that if you have an existing wellbore that contained extraneous water capable of entering a productive zone, that drilling a replacement well a thousand feet away would prevent communication of extraneous water between those wellbore, haven't you?

A. It would minimize – in other words, if I've got a problem well that's forcing water into my reservoir, such as the original wellbore in Rice Acres well, and I drill a replacement well – if I have the option of drilling a replacement well a hundred feet or a thousand feet away, I should elect to drill one a thousand feet away because it's going to take a lot longer for that water to get over there.

Q. It's going to minimize the water problem, right?

A. It's not going to minimize it. It's going to – you'll be able to produce more gas before you get hit by water if you are further away.

Q. You don't remember in the answer to my last question you said it would minimize the water?

A. No. Well, I mean, I may have.

Q. Well, that's actually the same. It will minimize the amount of water if you're drilling 100 feet away as compared to a thousand feet away, it will minimize – the amount of water you produced based on those two distances.

A. Right.

Q. And if you can go one and a half times further, not a thousand feet away but 2,500 feet away, you're really minimized the water impact if there would ever be any, right?

A. It would take longer for that water to get over there, that's correct.

Barnhill in his testimony also presented other measures besides cementing a reasonable operator could employ to successfully produce the remaining reserves, namely an operator could "start producing from the original wellbore so that the extraneous water would be drawn up the original well rather than migrate over to the new well." Simply put, defendants through Barnhill presented evidence the reservoir was still attainable, and if the reservoir was as vast as plaintiffs claimed, a reasonable operator would be willing to drill to recover those reserves. Further, Griffin agreed:

Q. Do you know how much it would cost to drill a replacement well for the Hayes Lumber well?

A. No. I mean, I know but don't know today. That's easily ascertainable.

Q. If you had over $80 million or [$]40 million or $80 million of hydrocarbons capable of being produced, there's no question it would be worth spending several million dollars to drill the replacement well, if you could obtain the production, right?

A. If you could obtain the production, that's correct.

Q. And, again, the cost of the replacement well would be borne by the operator, not the mineral royalty interest owner, correct?

A. That's correct.

This evidence *reasonably supports* the District Court's conclusion plaintiffs failed to prove reservoir destruction as to the lower zones.[14] Accordingly, we likewise find no manifest error in the District Court's factual findings in this regard.

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[14] Almost as an aside, plaintiffs attempted to advance as a damage claim one for delay in recovery, *i.e.*, plaintiffs were deprived of the present worth of minerals through defendants' failure to produce them expeditiously. La. Rev. Stat. § 31:122, Official Comments. This theory finds its basis in the Official Comments to Article 122 of the Mineral Code, which article sets forth the reasonably prudent operator duty imposed on all mineral lessees under our code. The comment at issue specifically provides:

> No Louisiana court has ever awarded damages for breach of the obligation of reasonable development. The remedy of damages should, however, be regarded as available if proper proof is made. See 5 Williams and Meyers, Oil and Gas Law § 834 (1969). Damage might result from permanent loss of recoverable minerals or from deprivation of present worth of minerals through failure to produce them expeditiously. From a practical standpoint it seems that little in the way of damages can be shown in most cases unless the premises are being drained by wells on adjoining land. In that case, the dispute will be dealt with as a failure to exercise reasonable diligence to protect the property against drainage and damages could be awarded. In this regard see the discussion below of the obligation to protect against drainage.

During plaintiffs' opening statement, their counsel explained:

> … we felt the need to go ahead and put it in the record that there's abundant … law supporting damages. This is straight out of Article 122, the official comment. Anyone who – who doesn't understand this could simply read the mineral code. And it says, damage, again, from imprudent operations, might result from permanent loss of recoverable minerals or from deprivation of present worth of minerals through failure to produce them expeditiously.
>
> Now, that second part means you could even be damaged if they should have produced the minerals earlier and they waited years to do so. But we're concerned here with the first. And that is that damage in this case resulted from the permanent loss of recoverable minerals….

This theory of delayed recovery was advanced in a footnote in plaintiffs' opposition to defendants' motion for involuntary dismissal: "Even then, the plaintiffs' clients would still have sustained damages because they have been delayed in receiving their just royalties." Thus, it appears that when the District Court questioned the "unattainability" of the lower zones, this theory was advanced almost as an afterthought with no proof presented at trial.

Hayes Lumber Well (Upper Zone)

After the sanding issue in the lower zones, the defendants pulled back up the hole and perforated at a shallower depth to produce the upper zone reservoir. Plaintiffs then claimed the gas formation was exposed to the shallower water sands as a result of holes in both the tubing and the well's protective casing due to years of sandblasting. This resulted, according to plaintiffs, in the premature termination of production from the upper perforations and the permanent destruction of the upper zone from vertical communication with the shallower water sands. Defendants once again advanced the defense the reservoir was water-driven and always expected to produce water; therefore, the water was more probably than not formation water.

Again crediting the defendants' experts and their abundance of supporting evidence, the District Court concluded:

> With regard to the Hayes Lumber recompletion zone…, the evidence demonstrated that the upper reservoir was a water drive which made it similar to other wells in the area. Mr. Cabrera testified that the defendants perforated the tubing from 9718' to 9730' because the log showed that the zone was condensate on top of water and that the goal was to put the perforations as high as possible to stay away from the water. Mr. McKenzie stated in his testimony that the perforations were very close to the gas/water contact. Mr. Cabrera further testified that he fully expected to see water in the production due to his review of the log and the resistivity curves which clearly showed the water. In contrast, Mr. Griffin based his opinion after looking at the log and his own worksheets. His opinion, the defendants argue, was not based on any scientific study using a generally accepted methodology and is therefore unreliable.
>
> At trial, Mr. Griffin was asked directly if he had any evidence that the water was migrating down the annulus from the casing leaks into the perforations. His response was that the only evidence he had was the fact that the water appeared. The Court finds that Mr. Griffin had no evidence to prove the existence or location of leaks below the packer and that it was entirely speculation on his part.

On appeal, the appellate court sought again to disprove the District Court's finding by directly quoting Cabrera's testimony in which he stated there were suspected casing holes and/or leaks both above and below the packer (though he could not say whether the holes were communicative with water zones) to prove the District Court erred in finding Griffin had no evidence of leaks. The appellate court then explained:

> Furthermore, it is immaterial whether the extraneous water entered the well above or below the packer since the damage was the result of Kerr-McGee's imprudent operations. By finding that Hayes Fund had to prove the existence or location of leaks below the packers, the trial court imposed an additionally element of proof on Hayes Fund that was not warranted. The trial court rejected Hayes Fund's claims based upon its erroneous conclusion that this extra element of proof, i.e., location of leaks, was not satisfied. Moreover, the trial court failed to recognize that Cabrera's testimony showed that this additional and unwarranted element, i.e., location of leaks, was also satisfied. *Hayes Fund*, 13-1374 at p. 19, 149 So.3d at 292.

In this reasoning, the appellate court simply ignored the District Court's finding the reservoir was water-driven, the evidence in support of this finding, and the absence of evidence beyond Griffin's speculation the potential casing leaks were in fact in communication with water-producing sands. Rather Griffin merely stated there were "ample sources of water in these sands at the depths of the suspected casing leaks," without establishing more probably than not an actual communicative link between the potential casing holes and any corresponding water sands. He even admitted the uncertainty regarding the location of the casing holes: "They did test and found there were casing leaks; they just didn't narrow them down to any further than that 1,800-foot interval." The appellate court further reasoned Cabrera, not plaintiffs, established the leaks below the packer set at 8,841 feet. This reasoning, however, does not credit the entirety of Cabrera's testimony or even Griffin's rebuttal testimony that the casing holes below the packer were merely suspected not proven. Neither could they show with any certainty the location of the suspected holes or prove the suspected holes existed in water-bearing sands or were in communication therewith. Simply put, while Cabrera did concede the multiple casing holes were "sources of communication from whatever formation is outside into the wellbore," he could not say whether more probably than not those formations actually in communication with the casing holes contained water. And despite his extrapolations and speculation, neither could Griffin.

The appellate court also did not address the District Court's finding plaintiffs failed to prove the water was extraneous and not formation water; rather, it just seemed to accept as proven the water was extraneous. However, this was a highly contested fact, and the District Court clearly did not credit Griffin's characterization of the water as extraneous, which was based primarily upon his first assumption that the geopressured reservoir was volumetric/depletion driven, leading to his ultimate conclusion that any water had to be extraneous because "it showed up."

Moreover, the entirety of Cabrera's testimony reveals the steps defendants took to address the casing issues before perforating the upper zone—namely, the 3½-inch liner and the packer installed at 8,841 feet. In response, Griffin again opined defendants' failure in cementing the casing allowed water to migrate down the annulus and enter the reservoir, but when asked what evidence he had of this migration, he again relied upon the water's appearance as proof:

> A…. I would think that that source of water's [sic] from the casing leaks.
>
> Q. All right. When you say "that source of water," the … water that is coming from the recompleted zones?
>
> A. That's correct.

> Q. All right. And the only evidence that you have to base that on is the existence of water in the production?
>
> A. That's correct.
>
> Q. You don't have any evidence that the water was migrating down that annulus from the casing leaks into the perforations?
>
> A. It showed up. That's the only evidence I have.
>
> Q. All right. It showed up in the production at the surface.
>
> A. That's correct.

When questioned regarding his evidence the water was from an extraneous source, Griffin stated:

> Q. What evidence do you have to indicate that in June – on June 25th, 2008, 135 barrels of water is coming from an extraneous source, most likely a casing leak, and into the perforations where – where prior to that time there's no evidence of any water coming from an extraneous source?
>
> A. Well, I can answer that two ways. I can first say, I know the evidence that I really needed or – to support my …opinion, it didn't exist, and therefore, the only evidence that I have is the fact that, in my opinion, that is extraneous water based on my evaluation of the log, as well as the size of the reservoir.
>
> Q. All right. But you haven't seen any evidence to indicate – to indicate a change of condition in the wellbore, a change of condition in the formation, where these casing leaks are supposed to exist, to indicate why water was producing in June 2008 when it wasn't producing prior to that time?
>
> A. That's correct.

Along with Griffin's "indirect measurements," which plaintiffs claim "made it more probable than not that the water produced from the well was extraneous," plaintiffs also cite (1) McKenzie's admission he participated in an engineering study in 2000 that concluded the upper zone was depletion-driven and (2) his statement that "if you want to make that hypothetical assumption that it's a depletion-drive well, then, yes, you could conclude the water is extraneous." Yet, when examined in whole, McKenzie's testimony refutes Griffin's theory of depletion:

> Q. And so you don't want the Hayes well to be a depletion-drive well because that leaves you with no other explanation for the water other than it's coming from an extraneous source, correct?
>
> A. No. The water is coming from the aquifer in communication with the reservoir.
>
> Q. I'm going to ask you again. Despite all that, you don't want the Hayes well to be a depletion-drive well because that leaves you with no other explanation for the water other than it's coming from an extraneous source if it's a depletion-drive well, correct?
>
> A. If you want to make that hypothetical assumption that it's a depletion-drive well, then, yes, you could conclude the water is extraneous. But you would be ignoring the statistical production records for dozens of wells in the vicinity that all produced formation water at one degree or another.

Regarding the 2000 review, McKenzie's testimony in its entirety demonstrated how estimates are just that—guesstimates—and production is the true indicator of the driving mechanism:

> Q. Okay. Now, based on all of the information available in 2000, isn't it true you estimated that the Upper NOD B zone, which I think we referred to as the recompletion zone, which was from 9,718 to 9,730 feet was a depletion drive?
>
> …
>
> A. That's correct.
>
> Q. Okay. And certainly that wasn't just a guess, was it?
>
> A. I don't think so. I believe the – the geologist and the reservoir engineer that performed this work would have combined their knowledge of the – the geology and reservoir mechanics to make this estimate.
>
> Q. So can we assume that your estimate in 2000 for this Upper NOD B zone was based on objective studies, such as

well logs, sidewall core analysis, isopach maps, and other data?

A. Yes. I believe we prepared our own net pay isopach map using the available well log information and the 3-D seismic data.

Q. And so based on all this information and data, you determined – or estimated that that zone was a depletion drive, correct?

A. That was our estimate at the time, yes.

Q. Okay. And so based on that estimate, that it was a depletion drive, you would certainly agree that any water that – that was produced was extraneous water, correct?

A. No.

Q. Depletion-drive reservoirs don't produce water, do they?

A. No.

Q. Okay. So if you characterized it – estimated it as a depletion drive and it ultimately produced water, then that water would have to be extraneous, would it not?

A. No.

Q. Okay. That's your testimony?

A. That's correct.

…

Q. This Upper NOD B zone that you originally estimated as a depletion drive, you're aware that is ultimately watered out because of water, correct?

A. That's correct.

Q. Okay. And certainly back in 2000 when you made this estimation for your client, Nexen, if you had seen any indication that the hydrocarbons in that reservoir were in communication with any water, that would have been critical information for your client, wouldn't it have been?

A. It would have been, but I don't know how you would know that type of information at that time period. The geologist, in all likelihood – and I have not gone back and

> revisited this with him, but in all likelihood would have interpreted the sand of the reservoir to pinch out in the vicinity of the Hayes well, hence the communication with the geologist and the engineer, it would have been reasonable that if the geologist interpreted that the sand pinched out through seismic and well control interpretation, that the engineer would have assumed that it would have been depletion drive. In retrospect, apparently … there's a … larger aquifer in communication with the reservoir that was not seen in the 2000 study.

Based upon production, McKenzie ultimately opined the upper zone was a hydrocarbon reservoir overlying an active aquifer:

> Q. … Now, Mr. Griffin also claimed that the recompletion zone in the Hayes Well, but not the one at 9,718 feet, watered out as well due to extraneous water. Do you agree or do you disagree with that statement?
>
> A. I disagree.
>
> Q. What, in your expert opinion, happened to the recompletion zone in the Hayes Well?
>
> A. We have touched on that earlier in my testimony, but I believe the hydrocarbon bearing portion of the upper zone was in communication with a water bearing zone that, as the well was produced, the water migrated from the lower portion of the Nodosaria sand into the reservoir and into the well bore and up through the perforations – through the perforations and up the tubing with the hydrocarbons.
>
> …
>
> Q. The fact that it produced water-free for a couple of months and then it spiked up after that, what is that characteristic of in your experience?
>
> A. Hydrocarbon reservoir overlying an active aquifer.
>
> Q. Okay. Again, Mr. Griffin comes up with the idea that there's extraneous water, primarily on the basis that he calculates this as a depletion drive reservoir and not a water drive reservoir, correct?
>
> A. Well, that in conjunction with using the unit size for his volumetric calculation.

Bazer in his testimony "definitely" agreed "the upper hydrocarbon zone in the Hayes Lumber is sitting right on top of water, [and] that … the Hayes Lumber well would also produce water fairly quickly." And Cabrera likewise explained the oil and gas in that sand zone was condensate—sitting right on top of water:

> … So the decision was to come up to this primarily condensate-bearing zone at around 9,720 feet and complete there…
>
> …we perforated that from 9,718 to 9,730… [t]he topmost part of that sand. What we saw in the log analysis was that the zone looked like it was condensate on water, so we chose to put our perforations at the very top of the sand basically to stay away from – to s[t]ay away from any potential water.
>
> …
>
> Oil … gas, and water exist in … phases in … the reservoir. Water is the heaviest element, so it sits on bottom. Condensate or – or oil would sit above that. Natural gas would … basically exist at … the top.
>
> …
>
> All in one sand.

Hardwick also testified:

> Q. Again, with respect to [t]his particular zone and this is what we call the recompletion zone in the Hayes Lumber Company. You're showing that this has an associated aquifer with the hydrocarbons; is that right?
>
> A. That is correct. I mean, the resistivity does drop down toward the base of the sand, and I believe that performance also at the ends of its life did produce some water.

Therefore, despite plaintiffs' reliance upon his earlier estimate, McKenzie, along with defendants' other experts, ultimately classified the upper zone as "a moderate water drive" based upon its production: "It did produce a good bit of water…." The peer review literature, namely Dr. Bernard's SPE paper and Craft, Hawkins, & Terry's textbook that cites it as authority, lends further support for his ultimate classification of the upper zone as a water drive, even given his initial estimate, as do the surveys conducted of the other Nodosaria wells in the vicinity.

Thus, our review of the record demonstrates the water drive aspect of the upper Hayes Lumber reservoir as well as the District Court's finding the water was formation water are well supported by the defendants' experts and their various exhibits. We likewise find all this evidence clearly and reasonably supports the District Court's factual determination regarding the source of the water in the Hayes Lumber upper zone.

In conclusion, the District Court found:

> …the plaintiffs had the burden of proof by a preponderance of the evidence. The plaintiffs fell short of meeting their burden on every element because they relied exclusively on one expert, William Griffin, without offering any supporting evidence or authorities to back up their claims. As the plaintiffs have failed to prove every element of their case by a preponderance of the evidence, the Court hereby enters judgment in favor of the defendants…on all claims.

As explained in detail above, we find the District Court's factual conclusions on causation are clearly and reasonably supported by the record, and therefore, the Court of Appeal erred in its analysis of manifest error review and its reversal of the District Court's dismissal of all the plaintiffs' claims.

Throughout the appellate review process, plaintiffs have focused on phrases inartfully employed by the District Court to undermine its factual findings. Namely, plaintiffs emphasize the District Court's statements plaintiffs failed to produce or offer "any supporting evidence." Plaintiffs then list the snippets of testimony and the various exhibits they claim support their theory of the case. However, although this matter was tried over an eleven-month period and consisted of twenty-five days of live testimony, it ultimately came down to two competing expert views or theories: (1) the water was extraneous or (2) the water was from the formation and produced as expected. The resolution of this dispute rested within the sound discretion of the factfinder. The District Court found in favor of defendants and clearly did not find Griffin credible nor did it find his exhibits supportive.

Simply put, the District Court concluded as a finding of fact plaintiffs failed to prove their case. As demonstrated in this opinion, the District Court did not commit manifest error notwithstanding able counsel's persuasive argument to the contrary.

CONCLUSION

We find after our thorough manifest error review, the record more than reasonably supports the District Court's factual findings and determinations. The function of the Court of Appeal is to correct errors, not make choices it prefers over the District Court when there are two or more permissible views of the evidence. We do not discern nor does the record support any clear error by the District Court's choice of defendants' experts as more credible than plaintiffs' expert. Under a proper manifest error review, the analysis by the reviewing court should focus on whether there was clear error for lack of a reasonable basis in the conclusions of the factfinder. *Rarely* should a District Court's choice of expert(s) be found clearly wrong because it is so difficult to find a reasonable basis does not exist for the expert's opinion relied upon by the District Court. It is destructive to the manifest error analysis for a reviewing court to make its choice of the evidence rather than look for clear error in the reasonable basis found by the trier of fact. We have tortuously studied this scientific and voluminous record to demonstrate a proper manifest error review. This opinion carefully sets out the gist of the scientific evidence of the experts for both sides in our analysis of manifest error in discerning whether clear error existed in the conclusions found by the District Court. As demonstrated above, because the record clearly shows a reasonable basis for the District Court's conclusions, it did not manifestly err. We set forth this manifest error analysis at length in this opinion to give guidance to the appellate courts in analyzing evidence under the manifest error doctrine when there are two or more permissible views of the evidence.

Therefore, as the record does not support the District Court committed manifest error, we reverse the judgment of the Court of Appeal and reinstate the District Court's judgment dismissing plaintiffs' case.

DECREE

Accordingly, for these reasons, we reverse the judgment of the Court of Appeal and hereby reinstate the judgment of the District Court.

REVERSED; JUDGMENT OF THE DISTRICT COURT REINSTATED.