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Comparing Subsurface Trespass Jurisprudence—Geophysical Surveying and Hydraulic Fracturing

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COMPARING SUBSURFACE TRESPASS JURISPRUDENCE—GEOPHYSICAL SURVEYING AND HYDRAULIC FRACTURING[1]

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INTRODUCTION

The physical and practical realities of scientific and commercial processes that take place beneath the surface of the earth often give rise to complex legal issues that would be much simpler in other contexts. Activities that are conducted under the cover of a blanket of strata vary mechanically, ranging from making cracks in the rock with fluid containing particulates to introducing various types of seismic waves into the strata and then recording the reflections to storing natural gas underground to disposing enormous volumes of waste fluid down injection wells. These processes are diverse; conducted with different motivations by different parties with different measures of control, constraint, and success.

As such, these processes may give rise to claims of subsurface trespass and such claims are more difficult to adjudicate than surface trespasses, and not just because the earth is opaque. The complexity of mineral *and* surface property interests, combined with their speculative and actual values, can create doubt and dispute over "who" owns "what" property right in a particular property. When the existence or scope of a person's mineral property rights is disputed, trespass will frequently be the underlying theory used to litigate and define the parties' correlative rights. The lessor purporting to grant lease rights may not have title to the underlying minerals. The parties to an oil and gas lease may disagree concerning the scope of the rights granted. A lessee's activities on the premises may give rise to a trespass claim. A party may try to seek damages for slander of title when denied the rights of the other party. Once trespass is found, the unauthorized production of oil and gas will generate conversion claims. All of these are examples of competing claims in the mineral realm, and many involve trespass alongside other causes of action.

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1. Portions of this paper, updated as necessary, appear in: (1) Thomas E. Kurth et al., *American Law and Jurisprudence on Fracing*, 58 ROCKY MTN. MIN. L. INST. § 4 (2012); (2) JOHN S. LOWE et al., CASES AND MATERIALS ON OIL AND GAS LAW (6th ed. 2013); and (3) Joel Watkins & Chris Kulander, INTRODUCTION TO SEISMIC REFLECTION INTERPRETATION, Texas A&M University and U.S. Geological Survey, 103 pages, (2001) (unpublished lecture manual). The authors wish to thank Owen Anderson, Jim Cox, Kraig Grahmann and Ellen Desrochers, Keith Hall, Bill Huck, Marcus Miller, Byron Kulander, Curtis Leonard, Glynn Starling, Natalie Terenko, Chris Tucker, Leslyn Wallace, and (of course) Professor Emeritus of Geophysics, Dr. Joel Scott Watkins, Texas A&M, to whom this article is dedicated.

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Third parties may raise claims when an exploration or development activity interferes with their property interests. For example, a lessee's geophysical activities may collect information concerning the mineral potential of surrounding lands. The drilling process may cause a well bore to penetrate adjacent lands. A fee owner of one tract may have evidence that the fractures induced by a hydraulic fracturing survey on an adjacent tract are creating fissures in the productive formation that extends into his tract. Injected produced water or natural gas may migrate to adjacent lands.

The threshold question in these cases is usually a determination of title to the interests in dispute. Once the title issue is resolved, the next problem is determining factually what has transpired regarding the property. If you cannot "see" the property interest, it will be easier to interfere with it, either by accident or surreptitious design. What goes on at considerable depths below the surface of the earth is, by necessity, a matter of technical expertise and opinion. Once the facts are ascertained, the relative rights and obligations of the parties arising out of their respective ownership interests must be defined and potential remedies identified.

This article examines the basics of two types of subsurface activity—geophysical prospecting (and the myriad of different surveys that comprise same) and hydraulic fracturing (or "fracing" sometimes herein)[4]—describing the purpose of both, comparing the physical science background, field activities necessary, and data gathered in both, and analysis of the motivations of the parties conducting the activities. The article also contains an examination of selected germane subsurface trespass jurisprudence from New Mexico, Texas, and beyond. The article ends with thoughts and about what ought to be the state of subsurface trespass jurisprudence related to geophysical surveying and fracing and whether any uniformity exists between the two that could be applied to other activities. Ultimately, this article concludes that regulated fracing, which is currently less controllable than similar subsurface activities such as seismic reflection surveys, should not be liable for common law trespass claims in order to strengthen domestic energy security, prevent waste, and promote responsible self-development by mineral owners.[5]

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4. Fracing," "frac'ing," and "fracing"—all pronounced the same—have all been used in various outlets as a substitute for "hydraulic fracturing." Because the words "hydraulic fracturing" do not contain the letter 'k,' and because industry has generally used the spelling "fracing" since the inception of the technology, this article uses "fracing." Similarly, a "fraced well" is a well that has undergone hydraulic fracturing.

5. While this article focuses on vertical property boundaries, most of the issues stated herein are applicable if the property boundary is horizontal or sub-horizontal, as happens when a boundary is defined by a particular depth or formation horizon with the adjacent unpermitted tract immediately above or below the permitted strata. If fractures caused by fracing were to enter the unpermitted strata above or below the permitted strata, the result would likely be the same as the divide of ownership based on a vertical plain. For discussion on division of estates, see generally Thomas E. Kurth et al., *American Law and Jurisprudence on Fracing*, 58 ROCKY MTN. MIN. L. INST. § 4.09 (2012). For the purpose of this article, a permitted tract refers to a tract of land where the drilling party has properly secured the authorization or consent of the mineral estate owner to conduct drilling operations upon his or her land. An unpermitted tract is land where the drilling party has not secured the authorization or consent of the mineral estate owner and thus has no legal rights to enter upon that land in any manner. Meanwhile, an adjacent tract is a neighboring mineral estate owner's property based upon a vertical divide in ownership.

First, the fundamentals of trespass jurisprudence are taken up and the tort of trespass and the common law dimensional test are examined over their evolution and their adaptation to modern uses. Analysis of the *ad cœlum* doctrine follows, starting with the strict common law application of the doctrine followed by its attenuation over time in a number of contexts—groundwater, oil and gas, and various above-ground activities—that saw strict application of the doctrine constrained.

Of the two processes that touch upon trespass discussed in this article, geophysical surveying is described first, defining remote sensing and comparing active and passive surveys before turning to geophysical trespass and trespass-related claims. The article then responds to calls for a seismic "rule of capture" and questions related to the acquisition of permission to conduct seismic operations.

Next the technical side of the fracing issue is described, starting with some fundamentals of petroleum geology followed by an explanation of the differences between vertical and horizontal drilling techniques. Then the process of fracing and how the technique is used in conjunction with the different drilling techniques is considered in order to furnish a basic understanding of the process of fracing.

Following a description of how groundwater law has served as the basis for the rule of capture and how it has been applied to oil and gas law, the article concludes with an examination of prior Texas case law in the area of subsurface trespass occurring as a result of oil and gas operations. Since Texas provides a vast amount of oil and gas jurisprudence, it often serves as the foundation for the legal framework in oil and gas law nationwide. This analysis culminates with discussion and comparisons of West Virginia's recent *Stone v. Chesapeake Appalachia, LLC* (hereafter "*Stone*") decision to the ballyhooed but fractured Texas Supreme Court opinion of *Coastal Oil & Gas Corp. v. Garza Energy Trust* (hereafter, "*Garza*") and some suggestions about how other oil and gas jurisdictions should treat hydraulic fractures that cross onto an unpermitted tract, considering the *ad cœlum* doctrine, the dimensional test, the negative rule of capture, and a look at how the fugaciousness of minerals should be analyzed when considering the application of trespass to fracing.

I. UNDERGROUND TRESPASS FUNDAMENTALS

A. Trespass to Real Property

At common law, a landowner held a virtually absolute right to exclude others from his land. Even today the right to exclude is "one of the most essential sticks in the bundle of rights that are commonly characterized as property."[6] Trespass upon real property is commonly defined as a violation of an owner's exclusive right of unique possession.[7] The right to exclude others was seen as a mechanism to maximize the productive use of land.[8] The tort of trespass is used to protect the

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6. John G. Sprankling, *Owning the Center of the Earth*, 55 UCLA L. REV. 979, 1016 (2008) (quoting Kaiser Aetna v. United States, 444 U.S. 164, 176 (1979)).

7. *See, e.g.*, Team Enter. v. Western Inv. Real Est. Tr., 647 F.3d 901, 912 (9th Cir. 2011); Minch Family LLLP v. Buffalo-Red River Watershed Dist., 628 F.3d 960, 968 (8th Cir. 2010) (applying Minnesota law); W. PAGE KEETON et al., PROSSER AND KEETON ON TORTS § 13, at 77 (5th ed. 1984).

8. Sprankling, *supra* note 6, at 1017; *see generally* RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 32–34 (6th ed. 2003).

possessor's interests in exclusive possession—and through that, his development rights—of the property.[9] In order to bring the action successfully, however, an owner must have the right of possession.[10] Non-possessing owners of real property can still bring a trespass action, however, if an interloper has not established possession through adverse possession or other legal mechanism.[11]

Recognized schemes of common law trespass, as applied to minerals, vary across the states. In New Mexico, "trespassing . . . is the entry onto another's property without permission of the owner."[12] In Texas, a plaintiff must adequately show that: (1) the plaintiff owns or has a lawful right to possess the real property, (2) the defendant entered the plaintiff's land, (3) the entry was physical, intentional, and voluntary, and (4) the defendant's trespass caused injury to the plaintiff.[13] Traditionally, in order for something to be deemed a trespass the invasion had to be a direct physical, rather than indirect, invasion.[14] This determination was made through use of the "dimensional test.[15]" Under the test, "[i]f the intruding agent could be seen by the naked eye, the intrusion was considered a trespass. If the agent could not be seen, it was considered indirect and less substantial, hence, a nuisance."[16] Direct invasions brought strict liability—damages were presumed.[17] Indirect invasions required proof of "1) an invasion affecting an interest in the exclusive possession of one's property; 2) an intentional act resulting in the invasion; 3) reasonable forethought given to the action culminating in an invasion of plaintiff's possessory interest; and 4) as a result of the action taken, substantial damages sustained to the Res."[18] In New Mexico, the court has stated that "where there is no physical invasion of property, as with intangible intrusions such as noise and odor, the cause of action is for nuisance rather than for trespass." [19]

Most jurisdictions have rejected the division between trespass and nuisance embodied in Texas' dimensional test. In the Oregon Supreme Court case of *Martin v. Reynolds Metals Co.*,[20] the defendant operated an aluminum reduction plant that caused "certain fluoride compounds in the form of gases and particulates to become airborne and settle upon the plaintiff's land rendering it unfit for raising livestock."[21]

9. Borland v. Sanders Lead Co., 369 So. 2d 523, 527 (Ala. 1979).

10. Johnson v. Paynesville Farmers Union Co-Op. Oil Co., 817 N.W.2d 693, 701 (Minn. 2012). *See* Babb v. Lee Cty. Landfill SC, LLC, 747 S.E.2d 468, 473 (S.C. 2013).

11. KEETON et al., *supra* note, 7.

12. State v. Tower, 2002-NMCA-109, ¶ 7, 133 N.M. 32, 34, 59 P.3d 1264, 1266 *overruled by* State v. Archuleta, 2015-NMCA-037, 346 P.3d 390.

13. Stone Res., Inc. v. Barnett, 661 S.W.2d 148, 151 (Tex. App. 1983) *abrogated by* Envtl. Processing Sys., L.C. v. FPL Farming Ltd., 457 S.W.3d 414 (Tex. 2015); *see also* Wilen v. Falkenstein, 191 S.W.3d 791, 798 (Tex. App. 2006).

14. Frona M. Powell, *Trespass, Nuisance, and the Evolution of Common Law in Modern Pollution Cases*, 21 REAL EST. L.J. 182, 187 (1992).

15. Borland v. Sanders Lead Co., 369 So. 2d 523, 527 (Ala. 1979).

16. *Id.* at 527.

17. Robert H. Cutting, *"One Man's Ceilin' Is Another Man's Floor": Property Rights as the Double-Edged Sword*, 31 ENVTL. L. 819, 865 (2001).

18. *Borland*, 369 So. 2d 523, 529 (Ala. 1979).

19. Padilla v. Lawrence, 1984-NMCA-064, ¶ 26, 101 N.M. 556, 563, 685 P.2d 964, 971.

20. 221 Or. 86, 342 P.2d 790 (1959).

21. *Id.* at 791.

The plaintiff claimed this constituted a trespass. The defendant argued that "a trespass arises only when there has been a 'breaking and entering upon real property,' constituting a direct . . . invasion of the possessor's interest in land,"[22] that can be seen by the naked eye.[23] Fluoride, in its gaseous state, cannot be seen with the naked eye. Therefore, the defendant argued the only claim that the plaintiff could assert was nuisance since the character of the invasion could not be seen by the naked eye.[24] According to the Court, the dimensional test was likely adopted before "science had . . . peered into the molecular and atomic world of small particles"[25] and, therefore, the real focus of the court should be on "the object's energy or force rather than its size. Viewed in this way, trespass can be defined as any intrusion that invades the possessor's protected interest in exclusive possession, whether that intrusion is by visible or invisible pieces of matter.[26]

Similar cases gradually brought about the adoption of what has been called modern trespass. The Restatement (Second) of Torts states that a "trespass" occurs when a person "intentionally enters land in the possession of the other, or causes a thing . . . to do so [.]"[27] A trespass is not just limited to the surface of the res but can also be committed "beneath, or above the surface of the earth."[28] Under the modern theory, a trespass can now result from both a direct and indirect intrusion, with the elements remaining the same as under the common law theory.

1. Ad Cœlum / Ad Inferos

Cujus est solum, ejus est usque ad cœlum et ad inferos is the Latin term used to define the extension of surface property ownership upward to the heavens (*ad cœlum*) and downward to the center of the earth (*ad inferos*).[29] The *ad cœlum* doctrine can trace its beginnings back to mid-eighteenth century England with its initial proponent, Lord Coke.[30] It was at this point that William Blackstone is believed to have added the "*ad inferos*" to Lord Coke's *ad cœlum* maxim,[31] combining both in his treatise called the Commentaries on the Law of England.[32] In his treatise, Blackstone defined the term "land" as:

> Whatever is in a direct line between the surface of any land and the center of the earth, belongs to the owner of the surface; as is every day's experience in the mining countries. So that the word

22. *Id*.
23. *Id.* at 792.
24. *Id*. at 791.
25. *Id*. at 793.
26. *Id*. at 794.
27. RESTATEMENT (SECOND) OF TORTS § 158 (1965); *see generally*, Railroad Comm'n of Texas v. Manziel, 361 S.W.2d 560, 567 (Tex. 1962); Crow v. TRW, Inc., 893 S.W.2d 72, 77 (Tex. App. 1994).
28. RESTATEMENT (SECOND) OF TORTS § 159 (1965).
29. *See* Sprankling, *supra* note 6, at 981.
30. *Id.* at 984.
31. *Id.* at 988.
32. *Id.* at 986; *see* 2 WILLIAM BLACKSTONE, COMMENTARIES *18.

> 'land', includes not only the face of the earth, but everything under it, or over it.[33]

The colonists adopted English common-law in most of the U.S. states, either by reception statutes or judicial opinion,[34] thus adopting the *ad cœlum* doctrine.[35] The significance of this doctrine is "that the ownership of the surface of the earth carries with it the right to the minerals beneath[.]"[36] This was the subject of *Lincoln-Lucky & Lee Min. Co. v. Hendry*,[37] wherein the plaintiff was the owner of the surface and the defendant entered beneath the plaintiff's surface through a tunnel and mined while therein.[38] The defendant discovered the plaintiff's entry beneath his surface only when the defendant attempted to sink a shaft to mine beneath his own property.[39] The defendant raised the defense that the plaintiff, by occupying only the surface, did not have actual possession of the subsurface; thus the defendant's actions by mining only the subsurface beneath the plaintiff did not constitute a trespass.[40] The court disagreed with the defendant, ruling that "if the entry was made upon the surface, and the ouster was there committed. Is the rule different because the entry was below the surface and by way of a tunnel? Surely not, '*Cujus est solum est usque ad cœlum*.'"[41]

The *ad cœlum* doctrine met one of its most visible limitations with the advent of flight by the Wright brothers of Dayton, Ohio. The Restatement of Torts[42] and the U.S. Supreme Court[43] have recognized that some limit to the ownership rights of a surface owner to the airspace over his tract must be recognized. Courts have unanimously found the *ad cœlum* had no place to stop the modern advance of flights high over tracts where no actual injury or damages could be proven, consistently finding actual damages must be shown, and that the march of progress would be disrupted otherwise.[44]

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33. *Id.* (quoting 2 WILLIAM BLACKSTONE, COMMENTARIES *18).

34. *See* Kenneth J. Vandevelde, THINKING LIKE A LAWYER: AN INTRODUCTION TO LEGAL REASONING 10 (1996) ("English common-law was not adopted in Louisiana.").

35. *See, e.g.*, 29 N.J. PRAC., LAW OF MORTGAGES § 5.12 (2d ed. 2014) ("[T]he English common law doctrine *cujus est usque ad cœlum et ad inferos*, the owner of land was considered to own everything beneath the surface to the center of the earth, except for the right of the sovereign to 'royal minerals,' gold and silver, and to treasure trove.").

36. De Moss v. Sample, 78 So. 482, 485 (La. 1918).

37. 1897-NMSC-019, 9 N.M. 149, 50 P. 330 (1897).

38. *Id.*

39. *Id.*

40. *Id.* at 332.

41. *Id.* (quoting BROWN'S LEG. MAX. 395).

42. *See* RESTATEMENT (SECOND) OF TORTS § 159 cmt. g (AM. LAW INST. 1965) ("There must, in the public interest, and to avoid confusion and hindrances, be limits to the upward ownership of air space.").

43. *See* U.S. v. Causby, 328 U.S. 256, 261 (1946) (noting that the doctrine *cujus est solum ejus est usque ad coelum* has no place in the modern world and that transcontinental flights would face countless trespass suits if the doctrine applied without limits).

44. *See, e.g.*, Svetland v. Curtiss Airports Corp., 55 F.2d 201, 203 (6th Cir. 1932); Hinman v. Pac. Air Transp. Corp., 84 F.2d 755, 758–759 (9th Cir. 1936); *see also* Owen L. Anderson, *Lord Coke, the Restatement, and Modern Subsurface Trespass Law*, 57 ANN. INST. ON MIN. L. 22 (2010) ("Subsurface trespass should not be actionable whenever the trespasser's subsurface intrusion accomplishes an

At the same time, with the advent of modern drilling, injection disposal, natural gas storage in sandstone and salt, and geophysical surveying, possible trespass underground was more closely scrutinized. Independent of mineral development, common law recognizes the utility of a surface owner having some measure of control of the subsurface. Surface possession and use requires some right to use and possess the subsurface (and the airspace above) for the construction of buildings and associated foundations, basements, and support apparatus such as pipelines, drains, and septic tanks.[45] Correlatively, , with regards to surface ownership, the owner of the surface is granted a right of lateral support so that his surface and structures thereon are not affected by removal of strata and soil from a neighboring tract.[46]

Although the owner of the mineral estate hypothetically owns to the deepest depths of the earth, horizontally the *ad cœlum* doctrine is limited to the interior of the surface boundaries from which the mineral estate is derived. This surface boundary limitation to the *ad cœlum* doctrine was famously expressed in *Del Monte Min. & Mill. Co. v. Last Chance Min. & Mill. Co.*[47] This hoary case of yore considered whether side line boundaries of the patent limited the defendant's ability to mine a lode or vein extralaterally under an adjacent property owned by another. The court stated that "patents for land containing minerals would, except in cases affected by local customs and rules of miners, be subject to the ordinary rules of the common law, and would convey title to only such minerals as were found beneath the surface."[48]

While the doctrine of *ad cœlum* is easily applied to "hard" (*e.g.* solid) minerals because they stay in place, when the mineral is transitory/fugacious in nature such as groundwater, oil, and gas, the strict application of the *ad cœlum* doctrine has been found to be impracticable.[49] In the oil and gas realm, the most obvious example of trespass is drilling into an unpermitted (by either the surface or mineral owner, as state laws make necessary) tract that is not included in the drilling unit for that well. Such drilling can be done either with directional drilling or with old-fashioned "slant drilling"—a straight well that enters the earth at a non-vertical direction and that eventually crosses the vertical boundary into another, unpermitted tract in another drilling unit. Both constitute unquestionable underground trespass by

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important societal need (including private commercial needs), if the subsurface owner suffers no actual and substantial harm.").

45. *See, e.g.*, Faith United Methodist Church v. Morgan, 231 W. Va. 423, 442-443 (W. Va. 2013) ("We hold that the word 'surface,' when used in an instrument of conveyance, generally means the exposed area of land, improvements on the land, and any part of the underground actually used by a surface owner as an adjunct to surface use (for example, medium for the roots of growing plants, groundwater, water wells, roads, basements, or construction footings))."

46. *See* JOSEPH SINGER, PROPERTY, § 3.5.1 (Aspen, 3rd Ed., 2010).

47. 171 U.S. 55 (1898).

48. *Id.* at 66.

49. *See* Colleen E. Lamarre, *Owning the Center of the Earth: Hydraulic Fracturing and Subsurface Trespass in the Marcellus Shale Region*, 21 CORNELL J.L. & PUB. POL'Y 457, 462 (2011); *see also* JOHN S. LOWE, OIL AND GAS LAW IN A NUTSHELL 9 (4th ed. 2003) ("Oil and gas are fugacious; they move from place to place within sedimentary rock. In addition, oil and gas are fungible; it is difficult to determine whether a given MCF [metric cubic foot] of gas or barrel of oil produced has been drawn from under one tract of land or another.").

the drilling stem.[50] A claim of trespass in such an instance may take a backseat to an action for conversion as conversion damages are valued on the drainage volume multiplied by the price per unit of hydrocarbons, a potentially more lucrative award than a trespass claim.[51] Such an award for conversion typically either includes or nets out production expenses depending on whether the trespass was "good faith" or "bad faith." A good faith trespasser is one that reasonably believed it was not trespassing, often times though color of title from an ineffective deed.[52] Such a trespasser may deduct drilling and production costs. A bad faith trespasser may not deduct drilling and production costs.[53]

Horizontal wells may seem to potentially throw the easier analysis of trespass for a vertical well into doubt. So long as the actual wellbore does not cross over the vertical plane into an unpermitted or unpooled tract, at least one commentator—citing *Garza*—believes that the Texas Supreme Court would not find trespass in the intrusions of fractures, proppant, and fracing fluid into the unpermitted/unpooled tract even in the instance such entrance can be proven.[54] Furthermore, the federal court's decision in *Stone*, described below, would likewise not find a distinction between vertical and horizontal wells and trespass in its analysis as applied to fracing.

B. Exceptions to *Ad Cœlum*

A strict application of the *ad cœlum* doctrine to fracing could mean that fractures that cross into an unpermitted tract result in a direct trespass. In the case of mineral development and trespass, however, when the mineral is fugacious, courts have granted exceptions to the strict application of *ad cœlum*.

1. Rule of Capture

Groundwater was the subject of the first one of these exceptions to strict application of *ad cœlum*. English common law stated that groundwater was subject to the absolute ownership doctrine. This doctrine was expressed in the English case of *Acton v. Blundell*, wherein the court opined:

> That the person who owns the surface may dig therein and apply all that is there found to his own purposes, at his free will and pleasure; and that if, in the exercise of such right, he intercepts or drains off the water collected from the underground springs in his neighbor's well, this inconvenience to his neighbor falls within the

50. *See, e.g.*, Alphonzo E. Bell Corp. v. Bell View Oil Syndicate, 76 P.2d 167, 171–72 (Cal. Ct. App. 1938); Gliptis v. Fifteen Oil Co., 16 So. 2d 471, 474 (La. 1943).

51. *See, e.g.*, Pan Am. Petroleum Corp. v. Long, 340 F.2d 211, 220 (5th Cir. 1964).

52. *See, e.g.*, Rudy v. Ellis, 236 S.W.2d 466, 468 (Ky. 1951).

53. *See, e.g.*, Mayfield v. Benavides, 693 S.W.2d 500, 506 (Tex. App. 1985) (explaining that in addition to a bad faith trespasser, a trespasser whose improvements were unnecessary to the drained party to produce the converted oil and gas (*i.e.* the drained party already had wells that could have drained the converted hydrocarbons) cannot deduct exploration and development costs).

54. Anderson, *supra* note, 44 at 36.

> description of *damnum absque injuria*, which cannot become the ground of an action.[55]

Thus, ownership of the surface came freighted with the right to drill upon the surface estate and capture the groundwater below, from wherever it came. The rationale for the departure from the strict adherence to the *ad cœlum* doctrine is probably due, as a more modern court has speculated, to "the inability of courts to determine the source of a well's production."[56] The rule of capture was upon us.

As many first-year law students learn,[57] the rule of capture was applied early to ownership of game animals in *Pierson v. Post*,[58] where Post had been in pursuit of a fox with his dogs and Pierson happened to come across the fox and killed it. Post claimed to have an ownership interest in the fox since he was the one in pursuit of it but the court ruled, "That mere pursuit gave *Post* no legal right to the fox,[59] but that he became the property of Pierson, who intercepted and killed him."[60] The case of *Westmoreland & Cambria Nat. Gas Co. v. De Witt*,[61] made the connection between wild animals and fugacious substances when Justice Mitchell of Pennsylvania stated that "[water and oil], and still more strongly gas, may be classed by themselves, if the analogy be not too fanciful, as minerals *feroe naturoe*. In common with animals, and unlike other minerals, they have the power and the tendency to escape without the volition of the owner."[62] The Justice then went on to clarify how title to these substances could be acquired when he wrote:

> They [water, oil and gas] belong to the owner of the land, and are part of it, so long as they are on or in it, and are subject to his control; but when they escape, and go into other land, or come under another's control, the title of the former owner is gone. Possession of the land, therefore, is not necessarily possession of the gas. If an adjoining, or even a distant, owner, drills his own land, and taps your gas, so that it comes into his well and under his control, it is no longer yours, but his.[63]

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55. Houst. & T.C. Ry. Co. v. East, 81 S.W. 279, 280 (Tex. 1904) (quoting Acton v. Blundell, (1843) 152 Eng. Rep. 1223, 1235 (Exchequer Ct.)).

56. City of Del Rio v. Clayton Sam Colt Hamilton Tr., 269 S.W.3d 613, 618 (Tex. App. 2008).

57. The most popular casebook for first-year property courses is DUKEMINIER ET AL., PROPERTY 18–38 (Vicki Been et al. eds, 8th ed., 2014). Currently in its eighth edition, the second case in the book is an excerpt from *Pierson v. Post*, 3 Cai. R. 175, 2 Am. Dec., 264 (N.Y. Sup. Ct. 1805). The notes thereafter speak towards the case's ramifications on oil and gas law.

58. 3 Cai. R. 175, 178, 2 Am. Dec., 264 (N.Y. Sup. Ct. 1805).

59. The fox is ferae naturae which is defined as "wild by nature and not usually tamed" essentially a wild animal. *See* Merriam-Webster, http://www.meriam-webster.com/dictionary/ferae%20naturae (last visited Sept. 8, 2015).

60. 3 Cai. R. 175, at *178, 2 Am. Dec., 264 (N.Y. Sup. Ct. 1805).

61. Westmoreland & Cambria Nat. Gas Co. v. De Witt, 18 A. 724 (Pa. 1889).

62. *Id*. at 725.

63. *Id*.

Thus to achieve title to "fugacious"[64] minerals, one must capture them. This requires reducing the substance to actual possession via severance from the estate, with no regard for the origin of its migration. This notion was succinctly stated in *Ellif v. Texon Drilling Co.*,[65] where the Supreme Court of Texas opinion stated "that the owner of a tract of land acquires title to the oil or gas which he produces from wells on his land, though part of the oil or gas may have migrated from adjoining lands."[66]

Eventually science progressed and courts came to understand that oil and gas are not migratory in the sense of a wandering animal but are, in fact, "commonly found in underground reservoirs, [that] are securely entrapped in a static condition in the original pool, and, ordinarily, so remain until disturbed by penetrations from the surface."[67] Once the reservoir is penetrated, then oil and gas "will migrate across property lines towards any low pressure area created by production from the common pool."[68] Even as science advanced to better understand the relationship of the mineral estate to fugacious substances, the rule of capture has remained vibrant, rooted in the belief that if the courts were to rigidly apply the *ad cœlum* doctrine, drainage from the adjoining lands "would . . . expose the landowner . . . to liability for wrongful taking of oil and gas."[69] Thus, "[the] rule [of capture] encourage[s] the development and exploitation of natural resources in the U.S. by modifying the potential obstacles of the *ad cœlum* doctrine and traditional trespass liability."[70] The only caveat to the rule of capture as it applies to oil and gas law is that it "is based on the fugitive nature of oil and gas."[71]

2. *Regulatory Immunity*

Generally, the mere permitting of exploration and production operations by state oil and gas conservation agencies that may result in a trespass do not release the operator from liability for trespass or other torts.[72] Exceptions to this rule, however, have been carved out by some courts for alleged subsurface trespass resulting from operation of waste injection wells. This exception is often founded in recognition that public policy is served by insulating some actors, such as waste injectors, from trespass liability if their operations are approved by state regulatory agencies as they provide a needed service to the public.[73]

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64. Fugacious has been defined as "tending to disappear; fleeting." *See* OxfordDictionaries.com, http://www.oxforddictionaries.com/us/definition/american_english/fugacious (last visited Sept. 8, 2015).

65. 210 S.W.2d 558 (Tex. 1948).

66. *Id.* at 561–62.

67. *Id.* at 561.

68. *Id.*

69. Knighton v. Texaco Producing, Inc., 762 F. Supp. 686, 689 (W.D. La. 1991), *aff'd*, 988 F.2d 1209 (5th Cir. 1993).

70. Aaron Stemplewicz, *The Known "Unknowns" of Hydraulic Fracturing: A Case for a Traditional Subsurface Trespass Regime in Pennsylvania*, 13 DUQ. BUS. L.J. 219, 226 (2011).

71. *See, e.g.*, ANR Pipeline Co. v. 60 Acres of Land, 418 F. Supp.2d 933, 939 (W.D. Mich. 2006).

72. *See, e.g.*, Berkley v. R.R. Comm'n, 282 S.W.3d 240, 243 (Tex. App. 2009).

73. *See, e.g.*, Hanson v. Carroll, 52 A.2d 700, 701 (Conn. 1947); Proctor v. Adams, 113 Mass. 376, 377–78 (1873).

Waste disposal wells involve pumping thousands of gallons of various types of waste, such as industrial waste, CO_2, saltwater, and drilling and production waste, many thousands of feet underground, far below freshwater aquifers. One commentator has described waste injection as the simplest of subsurface trespasses as it only requires a court to consider intruding waste.[74] Courts considering waste injection trespass cases seem reluctant to allow liability unless actual damages are shown provided the injector has gotten approval from whatever regulatory authority permits injection wells.[75]

Modern courts from different states have grappled with subsurface trespass claims arising from waste injection with varying results. In Ohio, BP Chemicals, Inc. was faced with a class action suit, accusing the company of subsurface trespass caused by injected fluid crossing into unpermitted tracts.[76] The Supreme Court of Ohio rejected the property owners' contention that they were entitled to recognition of "absolute ownership of everything below the surface of their properties."[77] The Court equated the attenuation of absolute property ownership rights—the right to exclude—from the airspace overhead the unpermitted tract, allowing air and space travel, to the subsurface realm.[78] Ohio surface owners must therefore show *actual damages* that negatively affect their reasonably foreseeable use of the subsurface, not just the presence of trespassing fluid.[79] The Court held that only one tract owner among the plaintiff class members possibly had a legitimate claim for damages because that owner had allegedly been forced by the intrusion to abandon plans to complete a gas well.[80] Thus, only that owner could show actual and thus actionable harm caused by the unpermitted intrusion.

The Court also affirmed disallowance of consideration of evidence concerning whether the intruded land had lost value due to the market's negative perception of the potential presence of injected fluid.[81] This would appear to eliminate damages for the loss of speculative value regarding perceived intrusion by injected fluid. However, a difference between the loss of market value as seen in *Chance* from the loss of leasing value of a tract caused by seismic trespass, as described below, that reveals that tract to be unprospective for oil and gas development exists: the latter is a result of actual scientific evidence causing actual damage to the speculative value of the captioned land.

More recently, Texas case law regarding waste disposal was made when an applicant was required to estimate by the state authorities how far a contaminate plume might go before a project was approved.[82] After the permit was issued, nearby landowners noted that the estimates projected that waste would enter their tracts and

74. Anderson, *supra* note 44, at 46.
75. *Id*.
76. Chance v. BP Chemicals, Inc., 670 N.E.2d 985 (Ohio 1996).
77. *Id*. at 992.
78. *Id*.
79. *Id*.
80. *Id*. at 994 n.1.
81. *Id*. at 993.
82. FPL Farming, Ltd. v. Tex. Nat. Res. Conservation Comm'n, 2003 WL 247183 at *1 (Tex. App. Feb. 6, 2003) (mem. op.).

brought suit against the permitting state agency.[83] In a memorandum opinion, the Austin Court of Appeals rejected that liability lay with mere intrusion by the waste plume but rather required that "some measure of harm must accompany the migration."[84] The court noted the trend away from application of strict liability traditional trespass and instead chose to respect the scientific acumen of the state agency that issued the injection permit.[85] Later, the same plaintiff sued the injecting operator for a panoply of actions including trespass.[86] The court of appeals held that, absent actual damages, a deep injection well did not result in trespass liability if the contaminate plume migrates into an unpermitted tract if a state agency had first authorized the injection.[87]

Louisiana earlier reached a similar result in *Raymond v. Union Texas Petroleum Corp*. wherein a state-permitted saltwater injection project resulted in a plume migrating into an unpermitted tract.[88] The federal district court held that the intrusion from the permitted operation did not constitute an actionable trespass.[89] The court later opined that actual damages may have resulted in liability, state-issued permit or no.[90]

The Fifth Circuit Court of Appeals also considered a migrating waste plume in *Mongrue v. Monsanto*, wherein a state-permitted operation was found to not constitute a regulatory takings.[91] While the decision did not consider actual trespass, the court seemed to allow for trespass if actual damages were shown, regardless of permitting.[92] Later in the year, the same court affirmed *Raymond* as to the fact that migration of a waste plume was not actionable if permitted.[93]

A New Mexican case, however, unsurprisingly suggests that not all courts are ready to dispense with the idea of strict liability traditional trespass. In *Snyder Ranches, Inc. v. Oil Conservation Commission*,[94] the Supreme Court of New Mexico affirmed a finding by the state conservation agency that saltwater injected into a permitted tract would not migrate to the plaintiff's tract but opined in dicta that:

> The State of New Mexico may be said to have licensed the injection of saltwater into the disposal well; however, such license does not authorize trespass . . . or other tortious conduct by the licensee, nor does such license immunize the licensee from liability for negligence or nuisance which flows from the licensed activity . . . .In the event that an actual trespass occurs by Mobil in its injection operation, neither the Commission's decision, the

83. *Id*. at *1-2.
84. *Id*. at *4.
85. *See id*. at *5.
86. FPL Farming, Ltd. v. Envtl. Processing Sys., 305 S.W.3d 739 (Tex. App. 2009) *rev'd*, 351 S.W.3d 306 (Tex. 2011).
87. *Id*. at 744–45.
88. 697 F. Supp. 270, 271 (E.D. La. 1988).
89. *Id*. at 274.
90. *Id*. at 274–75.
91. 249 F.3d 422 (5th Cir. 2001).
92. *Id*. at 432 n.17.
93. Boudreaux v. Jefferson Island Storage & Hub, LLC, 255 F.3d 271, 274 (5th Cir. 2001).
94. 1990-NMSC-090, 110 N.M. 637, 798 P.2d 587.

> district court's decision, nor this opinion would in any way prevent Snyder Ranches from seeking redress for such trespass.[95]

Professor Owen Anderson notes that this passage makes it sounds as if actual damages need not be proven in New Mexico but rather that strict liability traditional trespass would be applied in the state.[96]

3. *Gas and Oil Storage*

Storage of oil and/or gas in strata or salt is another example of injection of material that might subsequently cross over to into an unpermitted tract, potentially raising trespass issues. Historically, the main issue in gas storage cases has not usually been trespass, however, but rather whether the injector has retained ownership of gas that migrates off the permitted tract.[97] In a number of states, the injecting/storing entity can acquire storage rights though condemnation of the reservoir via exercise of its private eminent domain power.[98] Back when gas storage began in the first half of the 20th Century, at least one court (in Kentucky) determined that the injected gas had been released back into nature and that the injector did not retain any ownership rights.[99]

Since the early gas storage days, courts have largely acknowledged that the title to injected natural gas remains with the injector.[100] Of course, since title to stored gas is now retained by the injector, trespass becomes an issue when the stored gas migrates to an unpermitted tract, and little case law yet definitively examines this issue.[101] Little case law also considers the implication of evidence of actual damage caused by gas storage.[102]

One Texas case, however, is perhaps on the cusp of providing some guidance. The Texas Supreme Court is currently considering an opinion by the Beaumont Court of Appeals that holds an actionable common law trespass may occur when injected waste migrates into the substrata of a neighboring property.[103]

II. GEOPHYSICAL SURVEYING AND TRESPASS

A. Remote Sensing—Generally

The search for oil, gas, and other minerals typically begins with geologists conducting surface and subsurface geological studies in an effort to identify

95. *Id*. at ¶ 8.

96. Anderson, *supra* note 72, at 229.

97. *Id.* at 236.

98. *Id.*

99. Hammonds v. Cent. Ky. Nat. Gas Co., 75 S.W.2d 204, 206 (Ky. Ct. App. 1934), *partially overruled by* Tex. Am. Energy Corp. v. Citizens Fid. Bank & Tr., 736 S.W.2d 25, 28 (Ky. 1987).

100. *See, e.g.*, Okla. Nat. Gas Co. v. Mahan & Rowsey, Inc., 786 F.2d 1004, 1006–7 (10th Cir. 1986); Lone Star Gas Co. v. Murchison, 353 S.W.2d 870, 879–80 (Tex. App. 1962); White v. N.Y. State Nat. Gas Corp., 190 F. Supp. 342, 347–49 (W.D. Pa. 1960).

101. Anderson, *supra* note 72, at 238.

102. *Id.*

103. FPL Farming Ltd. v. Envtl. Processing Sys., L.C., 383 S.W.3d 274, 282 (Tex. App. 2012), *rev'd*, 457 S.W.3d 414, 425–26 (Tex. 2015).

reservoirs suitable for the accumulation of oil and gas. While geologists mapping the surface on foot or with the assistance of aerial photography can accurately describe what rocks are outcropping where, and while logs taken from wells can provide a look at the rocks at depth at one point, neither can accurately describe the subsurface structural configuration. Therefore, it is necessary to employ devices and techniques that can remotely sense the subsurface geology and provide the geologist with useful subsurface information.

The biggest limitation on petroleum exploration is that the mineral wealth sought is often located in rock layers miles beneath the surface where no one can personally observe and look for hydrocarbons. A geophysicist will typically never be able to personally visit the target of his interest. Geophysics is the study and measurement of the physical properties of the earth by either recording the earth's response to various stimuli (explosive compressive force or electricity) or merely measuring forces that already exist but that vary by location (gravity or magnetic forces) and using that data to remotely detect and image buried features. The first type of survey is said to have an "active source" because it relies on some form of energy being applied to the earth that yields a response by the earth that the geophysicist records, processes using mathematical and spatial geometric methods assisted with very specialized computer software. The response is then interpreted by the geophysicist, again assisted with very specialized computer programs. The second type of survey does not involve any energy impulse being inserted into the earth and the response recorded, but rather a recording of an existing physical property or field of the earth, such as the background magnetic or gravity field of the earth or the bathometry of the ocean floor.

B. Active Geophysical Methods

A geophysical survey with an "active" source is one where the surveyors record the earth's response to an energy source such as dynamite (for a seismic reflection survey), radio waves (for a ground penetrating radar (GPR) survey), or the strike of a sledgehammer on a plate lain on the ground (for a seismic refraction survey). The energy source is typically triggered by the same party that is recording the response. Depending on the type of source, the direction that the inputted energy takes is often difficult to control with energy in the form of seismic waves (described below), radar waves, and various surface waves traveling away from the source in all directions.

Other active-source geophysical methods include techniques designed to measure and describe near-surface phenomena. One example is GPR surveys that are conducted using ground-penetrating radar antenna arrays commonly deployed in hand-operated devices pushed along the surface like a lawnmower. These devices send high-frequency radio waves into the ground, and in the best geologic conditions, can image objects down to 50 feet of depth.

Most of these near-surface or "environmental" geophysical techniques focus on the zone from the surface down to a depth of approximately 250 feet or less, coincidently the same rough depth interval often associated with the "surface destruction" test used by some states at varying times to determine whether the surface owner or the mineral owner owns a certain mineral. In addition, such near-surface techniques are rarely used for prospecting purposes, but rather are used for such tasks as finding the depth to the water table. Therefore, they are usually the exclusive province of the surface owner unless the mineral owner is using the technique for non-prospecting purposes such as examining the result of completed operations. Limiting these techniques to mineral owners or their lessees would make little sense.

1. Seismic Surveys

The most widely used active geophysical technique is seismic reflection. Significant advances have been made in seismic technology during the past three decades or so. Extensive geophysical research and improved computer technology have aided the progression of seismic technology from its original—and frequently unreliable—two-dimensional ("2D seismic") mode to three-dimensional ("3D seismic") status.[104] 3D seismic can provide a much more accurate geometrical representation of the rock structure, rock material, and their probable contents. For developed oil and gas fields, 3D seismic gathered through time can be used to map the actual movement of oil and gas within the reservoir. This time-lapse 3D seismic, sometimes called "4D seismic," can help maximize the recovery of hydrocarbons from a reservoir.

Seismic imaging of the subsurface is the most widely used geophysical technique for analyzing the interior of the earth and is used much more commonly by the petroleum industry than all the other techniques combined. The search for minerals and hydrocarbons was limited to those exhibiting surface expressions, such as oil slicks or rock outcrops with "oil shows" (*i.e.* traces of oil) until after World War I. Seismic reflection data provided the crucial link that tied data taken from individual wells, well logs, and surface mapping together so that the extent and thickness of various strata could be imaged and mapped over long distances. Modern geophysicists can model strata at depth without anyone's direct observation. They can remotely sense the geometry of strata no one will ever personally encounter. Geophysicists involved in petroleum seismology use many techniques to remotely sense and image the shapes and patterns of various rocks far beneath the surface in their quest to find oil and gas.

In the decades since the inter-World War period, the petroleum industry has invested significant resources in improving the resolution of seismic reflection data. Although petroleum exploration and development focuses on the upper portion of the earth's crust from which most commercial oil and gas accumulations are developed—a zone of depths from approximately one to twenty thousand feet—seismic reflection technology has been applied to both greater and shallower depths. For example, surveys designed to image very shallow coalbed methane layers have been popular in the last twenty years.

a. Types of Waves

Seismologists recognize a number of different types of seismic waves. The two principal categories are called body and surface waves. Body waves travel

104. For a comprehensive discussion of 3D seismic data, and its potential legal implications, see Owen L. Anderson & John D. Pigott, *3D Seismic Technology: Its Uses, Limits, & Legal Ramifications*, 42 ROCKY MTN. MIN. L. INST. § 16.01, at 16-1 (1996).

through an elastic body while surface waves travel along the surface of the earth. Body waves typically travel faster (higher velocities) than do surface waves. In seismic exploration, surface waves interfere with body waves reflected from subsurface interfaces and are consequently undesirable. They are usually "muted" or cut out from the seismic data prior to imaging.

Two classes of body waves interest seismologists—compressional waves (also known as "P-waves") and shear waves (also known as "S-waves"). The energy comprising a P-wave causes the molecules of the strata receiving the energy—perhaps from an explosive source—to press against the adjacent molecules in the opposite direction, and those molecules in turn abut the next, and so on through the matrix of rock, like a break in billiards when the cue ball strikes the triangle and the energy travels through the mass of balls causing the ones in the back to scatter. Compressional waves are easily generated by an explosion of dynamite buried a few tens of feet below the earth's surface. S-waves, also possibly generated by a dynamite explosion, travel more slowly than P-waves and cause the molecules to move perpendicularly to the direction of stress. Compressional waves travel through liquids whereas shear waves do not.[105] Finally, because shear waves 'decay' or attenuate more quickly with depth than compressional waves and compressional waves are much easier to detect and record than shear waves, petroleum exploration utilizes compressional waves for the most part.

In contrast to body waves like P- and S-waves, surface waves radiate from the source much like ripples from a disturbance in a pool of water. These waves differ from body waves in that they do not travel through the propagating medium but instead remain on the surface.[106] In seismic acquisition, surface waves come in several varieties and are usually seen as a nuisance because they can mask the arrival of compressional waves from deep reflectors. In this way, surface waves introduce interfering 'noise' into the signal the acquisition seismologist is trying to record. Examples of surface waves include Rayleigh waves and Love waves.[107]

b. Relating Rock Properties to Seismic Waves

Seismic surveys involve recording energy returning to the surface after being inputted into the earth and reflected back to the surface. This energy is generated by a source and is comprised of various types of waves. The most common onshore sources are explosive, often TNT, dynamite, or Kinestik explosives. Placing such charges usually involves the drilling of shallow holes, called "shot holes," in which the "shot" is detonated. In addition, truck-mounted vibration devices called

105. This difference is what allowed geophysicists to determine that the center of the earth was liquid. Sensors placed on the opposite side of the globe from an earthquake picked up P-waves generated by the earthquake while S-waves went missing, having been absorbed by the molten core.

106. For example, the damage caused by earthquakes is a result of surface waves which arrive after the faster P- and S-waves have already passed. Tsunamis caused by earthquakes are another example of a surface wave.

107. Rayleigh waves are propagated on the free surface of a solid material. The molecules of the strata moves in an ellipse much like water molecules in an ocean wave. Love waves, named for the English mathematician A. H. Love, are detected when a low-velocity layer overlies a high-velocity substratum. Luckily, Love waves rarely interfere with seismic prospecting because the waves cause the rock molecules to move horizontally, perpendicular to the direction of detection for geophones. However, they are useful to deep earth and hazards seismologists.

VibroSeis or "thumper" trucks can generate waves of a certain range of frequencies. Compressive airguns are commonly used offshore for marine geophysical surveys.

Once generated, P-waves travel down through the rock until the energy encounters a reflector, whereupon a portion of the energy comprising the P-wave is reflected back towards the surface. Typical reflectors are caused by changes in density within a rock formation or the boundary between one rock type and another. P-waves travel through different kinds of rock at different speeds and this difference in travel time allows geophysical interpreters to model and identify different kinds of buried strata. Depth also plays an important role. An increase in velocity of sediments with depth results mainly from increasing cementation, decreasing porosity and the closing of cracks in the rocks due to increased pressure. The effective pressure (overburden pressure minus pore pressure) has a lesser effect. Returning P-waves are recorded by sensors called "geophones" onshore and "hydrophones" offshore, which are placed at specified locations and intervals on land or dragged behind a boat in long arrays at sea, respectively.[108]

After the data is recorded in the field, this raw seismic data is passed along to the seismic processor. The processor uses advanced methods of computer assisted signal processing and wave-theory to render the raw data into a recognizable format so that interpretation and presentation can be made. Typically, the largest obstacle in seismic processing is "noise"—unwanted return multiples from indirect reflections or random events in the data that hide the true signal. In addition, objects seen on seismic records sometime need to be moved within the data so that they are represented as being in the same space in the data as in nature. The ultimate goal of seismic processing is to construct a data set that represents, as closely as possible, an accurate picture of subsurface rock structures.

Once seismic data has been processed so that it can be presented in a recognizable form, seismic interpretation can begin. A seismic reflection data section appears like a cross section of the earth, similar to a giant-scale roadcut of rock beside a highway, whereon various structures and strata are clearly evident. Because seismic reflection data consists of echoes, however, the vertical axis does not reflect *depth* but rather *time*—the time it takes for the seismic waves generated on the surface to travel through the rock, encounter a reflector, and return to the surface. The ultimate goal of seismic interpretation is to identify subsurface rocks, reservoirs, and the hydrocarbons themselves. This information will be used, along with other available geological data, to make drilling and development decisions.

Drilling costs increase dramatically with increased depth, so the time scale on the vertical axis must be converted to depth. To do this, the velocity of the seismic waves as they travel through the rock layers must be determined. This is usually done by taking well logs in the area and modeling the various types of rocks encountered. Accuracy can be a problem: even with good well control, a depth value estimated from a converted time scale may be five percent (5.0%) or more off of the real depth in the depth range of two to four (2-4) miles. Errors increase dramatically below

108. Geophones consist of a mass hanging on a spring that is housed inside a small metal casing. When the reflected P-waves return to the surface, the ground and the geophone are vibrated. These vibrations are recorded as data by an operator in a nearby recording truck, sometimes called a "doghouse."

those depths or where poor well control and/or deficient modeling take place. Seismic interpretation relies heavily on integration of other data and experience.

In total, seismic surveys may involve a significant number of workers, extensive surface use with small drill rigs and trucks, and potentially the use of small explosive charges. 3D seismic surveys require a field technician to place geophones along parallel lines only dozens of feet apart. Displeasure by surface owners at these intrusions and use represent a growing source of litigation and of action by state legislatures—actions that may include trespass claims as a component.

C. Passive Geophysical Methods

In contrast to "active" geophysical methods, passive remote sensing either listens for distinct naturally-occurring phenomena such as volcanoes and tectonic plate movement or constantly existing fields such as the earth's gravity or magnetic field. These phenomena are measured and recorded by equipment that merely "listens" to the targeted event or field. In some instances, such "passive" geophysical information may be obtained from overflights or from data relayed from space satellites.

The density of subsurface rocks can be measured with a gravity meter, sometimes called a "gravimeter," which measures changes in the earth's gravitational pull caused by variations in density of objects in the earth crust. This information may assist the geologist in determining generally whether the predominant regional rock material is of a type commonly associated with oil and gas deposits. The "magnetometer" measures the intensity of the earth's magnetic field and can also be used to predict the type of rock being measured. The "magnetometer" measures the intensity of the earth's magnetic field in a certain spot and can also be used to predict the type of rock being measured. The presence of the mineral magnetite is the primary driver of localized variations in the general magnetic field of the earth. Magnetite is a commercial grade iron ore, meaning its presence as read by a magnetometer can heighten the interest of a potential prospector.

Since these passive techniques involve merely "listening" for and measuring the magnitude and rate of change of background phenomena and fields already existing in or related to the earth, such surveys are clearly distinguishable from active-sourced surveys the conduction of which are typically only the province of the mineral owner or its lessee. Anybody with a right to physically conduct the survey without trespassing should not face liability under any of the causes of action commonly associated with seismic trespass.

D. Passively Listening to Another's Active Source—A Legal Wrinkle

One type of remote sensing can be thought as having both passive and active aspects—that is, passively monitoring an active source triggered by an unrelated second party. This would be an active-sourced geophysical survey in that receivers have been placed to record an anticipated active source, such as an explosion, triggered by another party. Legally, this could be considered a type of passive remote sensing in that the party recording is not controlling the source and that the data gathered is probably not being used for prospecting purposes.

This distinction is important when one considers that, generally, only the mineral owner or his lessee can prospect for the particular type of mineral owned. Typically, the mineral owner passes on the prospecting right to his lessee when he leases for the development of the mineral(s) he owns. Uncertainty exists in situations where a mineral owner leases for the development of Mineral A, retains the rights to Mineral B, and then prospects for Mineral B in such a way that may also identify the presence or absence of Mineral A—is the mineral owner infringing on the lessee's rights? Similarly, if Adam owns Mineral A and Bob owns Mineral B within the same tract, and Adam's remote sensing to detect Mineral A proves that Mineral B is largely absent (thus possibly eliminating leasing opportunities for Bob if news spreads), are Adam's activities actionable, perhaps in trespass?

Germane to the question of trespass, what if a mineral owner uses remote sensing techniques to detect the extent that fractures induced by fracing techniques conducted on a neighboring tract cross into his property? If remote sensing methods—perhaps microseismicity, a process described below—are conducted on a tract already leased to a mineral developer, conventional common law generally holds that the right to prospect with geophysical methods has passed to the lessee and the conductor of the remote sensing may be exposed to liability. Recording seismic events is not always for prospecting purposes, however, so that use of microseismicity surveys for the purposes of detecting intrusion by fractures may not be considered prospecting even though the lessee of the tract being surveyed for intrusion is opposed to such activity. Such an imbroglio might occur in the common lessee scenario where one oil company has leased both Leftacre and adjoining Rightacre, and has chosen to develop one of the tracts but not the other. Hearing of this development, the mineral owner of the other tract—who is perhaps owed a larger lessor's royalty fraction than that owed a different owner on the drilled tract—wants to discover whether the fracing has induced fractures on his tracts.[109] The common lessee may want to block this activity by the mineral owner.

E. Geophysical Trespass and Trespass-Related Claims

In *Kennedy v. General Geophysical Co.*,[110] General Geophysical, a seismic surveying company, asked landowner Kennedy for permission to conduct a seismic survey on Kennedy's land. Kennedy refused, and General set up its shot points on a public road near (but not on) Kennedy's land, but did not seek to obtain information, nor did it obtain any useful information, concerning Kennedy's land. Kennedy sued for trespass, asserting the vibrations associated with General's seismic activities entered his property. The court held that vibrations alone would not constitute a trespass unless they caused physical damage. However, the court deemed it important that General did not seek, nor obtain, any reliable information concerning Kennedy's land.

109. Such a scenario would be rare as the recording surface owner would have to be operating the recording operation at the exact same time the targeted fracing operation was being conducted. Fracing operations do not leave a "fingerprint" that can be recorded later; a microseismic recording would have to be conducted during fracing operations, or any record of the event would be lost.

110. 213 S.W.2d 707 (Tex. App. 1948).

Geophysical operators across Texas and beyond have relied upon *Kennedy* where they cannot obtain permission from the mineral owner of a given tract. Geophysical "lines" are "shot" as close as possible to the property to which access is denied, but information as to the geophysical structures under that property is not recorded, but rather is "muted" so that the human seismic interpreter never sees it.[111]

1. Ownership of Seismic Reflection Data

Who owns geophysical information acquired by an oil and gas lessee in the process of exploring the leased land? *Musser Davis Land Co. v. Union Pacific Resources*[112] offers one answer to this question, with the court opining that the lessee was "entitled to the ownership of the seismic data it develops pursuant to its prudent and reasonable geophysical operations incidental to its exercise of the exclusive right to explore and produce oil and gas under the lease." Lessors seldom demand access to the information, and the industry custom and usage has been to treat it as the property of the lessee. Therefore, if lessees have the authority to collect the information, they will "own" the information. Presumably lessors could obtain their own geophysical information, in which case it would be the lessor's sole property. The issue in those cases would be whether the lessor retained the right to collect the information.

If the lessee is acting pursuant to an oil and gas lease from less than all of the mineral interest cotenants, the lessee is typically still able to conduct geophysical operations without the consent of all cotenants in Texas and in at least a majority of states where the consent of all cotenants is not required to develop the mineral estate.[113] Of course, the lessee will run the risk that the unleased cotenants would be free to grant geophysical rights to the lessee's competitors.[114] The company acquiring the seismic information can also obtain permission from a cotenant through a seismic permit instead of an oil and gas lease.[115]

2. Permission for Acquisition

3D seismic, due to its greater accuracy, can present even greater problems when it is acquired without the consent of all interest owners. A big worry for a seismic operator is to obtain permission from the correct owner of the seismic right in order to avoid geophysical trespass. Concerns about trespass are often greater for gatherers of 3D seismic data because such surveys are much more detailed than 2D

111. Interestingly, and in contrast to the facts of *Kennedy*, *id.*, the land beneath public highways may be owned by the adjoining property owners, subject to an easement or right of way. If the road was not owned by the public in fee, then the issue would be whether the scope of the easement granted to the public for road purposes would encompass granting exploration rights—an unlikely scenario that would place the parties in a more traditional trespass context: a geophysical company entering onto the landowner's possessory interest in real property without authorization.

112. 201 F.3d 561, 570 (5th Cir. 2000).

113. *See* JOHN S. LOWE ET AL., CASES AND MATERIALS ON OIL AND GAS LAW 120 (6th ed. 2013).

114. *Id.*

115. *See* Enron Oil & Gas Co. v. Worth, 947 P.2d 610, 613–14.

seismic data and involve far more intensive surface use.[116] In addition, the gathering of 3D seismic data often requires entrance upon neighboring tracts and/or the gathering of data from those contiguous tracts—if these tracts are unpermitted, such gathering and/or entrance may be actionable.[117] Most of all, because 3D seismic is typically much more detailed and useful (and expensive) than 2D seismic data, 3D seismic data can potentially greatly affect the value of a tract for prospective purposes. Consequently, geophysical trespass can be very expensive for a guilty prospector.[118]

When an action is brought on the theory of assumpsit, tortious actions are commonly, but not always present.[119] For example, recovery in assumpsit may be available for photographing and other aerial reconnaissance even if no actionable trespass takes place and if the aerial remote sensing includes landing on the unpermitted tract, the resultant trespass may be traded for an assumpsit action for the value of the right of exploration—what the trespasser would have paid for the right.[120] If that value cannot be established or no actionable trespass has occurred, one commentator has suggested that the law relating to improper means of obtaining trade secrets might be considered.[121] As a practical matter, a mineral owner is often not likely to know that geophysical information has been gathered from under his lands unless the searcher comes onto the surface or nearby.

F. Seismic "Rule of Capture"

The rule of capture backdrops modern oil and gas development, allowing a producer not otherwise restrained by conservation laws to produce without regard to the ownership rights of neighboring mineral owners from which the developed oil or gas may have migrated before being produced at the wellhead. Courts, uninterested in wrestling with difficult, expensive, and case-specific questions about what tract produced hydrocarbons might have come from before being produced, have put the remedy for such drainage in the hands of the aggrieved—go and drill yourself. This rule recognizes that producers often have no control over what direction their production comes from or from under what tract their produced hydrocarbons originated before being driven to the annulus. This is not to suggest that producers have no control at all over the direction from which the produced hydrocarbons come, but structural and stratigraphic features in the local geology around the borehole such as faults, folds, and porosity/permeability changes, as well as secondary and tertiary recovery efforts such as water flooding,[122] can direct and

116. Anderson & Pigott, *supra* note, 102, § 16.04, at 16-67 to 16-69 (footnotes omitted). *See also* Harry L. Blomquist III, *Geophysical Trespass? The Guessing Game Created by the Awkward Combination of Outmoded Laws and Soaring Technology*, 48 BAYLOR L. REV. 21 (1996).

117. *See* Anderson & Pigott, *supra* note, 102, § 16.04, at 16-67 to 16-69.

118. *Id.* § 16.04, at 16-68 to 16-69.

119. *See* EUGENE KUNTZ, A TREATISE ON THE LAW OF OIL AND GAS § 12.7, at 349 (1987).

120. *Id.* at 349–50.

121. *Id*.

122. Secondary recovery involves the injection of gas or water that displaces the oil in-place and drives it toward another borehole and thereafter to the surface. Tertiary (or "enhanced") oil recovery actually alters the physical properties of the in-place oil to make it more conducive to extraction. Tertiary recovery techniques include thermal recovery and gas/chemical injection. *See What is the Difference between*

determine what hydrocarbons are produced. The measure of control that a producer has over where produced hydrocarbons come from before production, however, is often beyond any significant control that can be exercised by the producer.

Following an exhaustive study of geophysical trespass, and 3D seismic technology, two Oklahoma commentators proposed applying a "rule of capture" analysis to the acquisition of geophysical information, holding forth that:

> [W]e agree that the right to explore for minerals is a valuable property right and that a mineral owner should have the right to control geophysical oil and gas operations that involve direct entry onto or beneath such owner's parcel; however, we submit that the mineral owner of a target parcel should have no cause of action when seismic data are gathered from the target parcel solely through the use and occupancy of nearby parcels. In short, we reject the argument that the intentional gathering of seismic data from a target parcel solely by geophysical operations conducted on nearby parcels is wrongful, immoral, unethical, and unreasonable (and thereby constituting "geophysical trespass") if permission is not secured from a mineral owner of the target parcel. We reach these conclusions even though we concede that the use of 3D seismic techniques may often result in the gathering of information that geophysicists and their principals would regard as valuable, useful, and reliable. Nevertheless, we submit that this manner of gathering seismic data should fall within the venerable rule of capture.
>
> * * * Accordingly, we submit that the gathering of seismic data by a mineral owner (or such owner's seismic permittee) by geophysical operations conducted on such owner's parcel and concerning the possible presence of oil or gas beneath a neighbor's parcel should be treated no more restrictively than the drilling of a producing well on such owner's parcel that drains oil or gas from a neighbor's parcel or than the drilling of a dry hole on such owner's parcel which results in the loss of speculative value to a neighbor's parcel.[123]

This analysis seems to rely on a notion that control of what geophysical data is recovered, recorded, processed, and eventually interpreted is as difficult to control as where hydrocarbons come from before going up the borehole. While it is true that the seismic sources—explosives and VibroSeis—send P- and S-waves off in all directions down through the earth, only those that return and are not eliminated though recording and processing techniques as necessary to eliminate noise ever have the potential to be interpreted. Surviving data that is gathered from unpermitted tracts is simply removed from the package of data before it reaches the eyes of a seismic interpreter. Thus, while seismic energy does go through the strata of

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Primary, Secondary & Enhanced Recovery for Oil Extraction?, PETRO INDUSTRY NEWS: FUEL FOR THOUGHT (Aug. 26, 2014, 9:04 AM), http://www.petro-online.com/news/fuel-for-thought/13/breaking_news/what_is_the_difference_between_primary_secondary_enhanced_recovery_for_oil_extraction/31405/.

123. Anderson & Pigott, *supra* note, 102, § 16.04, at 16-113.

unpermitted tracts, and while geophones do recover raw, unprocessed data from unpermitted tracts, seismic companies ultimately do control what data is finally processed and interpreted.

Selectivity in what seismic data is subject to interpretation is in contrast to what occurs in oil and gas production, where the rule of capture recognizes that produced hydrocarbons potentially come from all directions through the strata to the borehole.[124] Conversely, in a case involving alleged seismic trespass, a fact finder supplied with recorded and processed seismic data that is correctly placed in the context of property boundaries can easily see whether interpretable seismic data has been acquired from an unpermitted tract. The relative ease of determining such a seismic trespass is starkly contrasted from the more difficult questions facing a fact finder asked to determine from what tract separated hydrocarbons originated from before being produced—an expensive and difficult exercise that the rule of capture was crafted to avoid.

III. HYDRAULIC FRACTURING AND TRESPASS

A. Setting the Stage for Fracing: Petroleum Geology & Drilling

1. Reservoirs and Hydrocarbons

Understanding porosity and permeability is crucial to understanding why fracing works. Porosity refers to the pore space in a rock that is capable of holding liquid or gas,[125] while permeability refers to the level of resistance to the migration of the liquid or gas through a volume of rock.[126] If the substance can move easily through a volume of rock, that rock is referred to as having high permeability; the opposite indicates low permeability.[127] Generally, rocks can be placed in one of three categories: source rocks, reservoir rocks, and sealing rocks.[128]

Oil and gas originate in source rocks.[129] Source rocks are typically found within sedimentary basins.[130] A common type of sedimentary rock is shale that is formed by the simultaneous deposition of sediments together with organic debris,

124. Local structural and stratigraphic features in the producing reservoir can, however, alter and limit the direction and amount of production. *See e.g.* Christopher Kulander, Geologic Evolution and Structural Controls on Hydrocarbon Flow in the Ship Shoal Block 274/293 Field, Offshore Louisiana, Gulf of Mexico (May 1999) (unpublished Ph.D. dissertation, Texas A&M University) (on file with Texas A&M University Library).

125. *See Porosity*, SCHLUMBERGER'S OILFIELD GLOSSARY, http://www.glossary.oilfield.slb.com/en/Terms/p/porosity.aspx (last visited Sept. 5, 2015).

126. *See Permeability*, SCHLUMBERGER'S OILFIELD GLOSSARY, http://www.glossary.oilfield.slb.com/en/Terms/p/permeability.aspx (last visited Sept. 5, 2015).

127. *See id*.

128. *See* Renato Tadeu Bertani, *Geologic Characterization and Exploration Concepts Applied to Conventional and Resource Base Exploration Plays*, OIL & GAS AGREEMENTS: THE EXPLORATION PHASE, ROCKY MTN. MIN .L. INST. 1-7 (Special Inst. Mar. 2010).

129. Press Release, U.S. Geological Survey., USGS Releases First Assessment of Shale Gas Resources in the Utica Shale: 38 Trillion Cubic Feet, (Oct. 4, 2012) http://www.usgs.gov/newsroom/article.asp?ID=3419&from=rss_home (last visited Sept. 5, 2015).

130. *See* Bertani, *supra* note 126, at 1–6.

algae, plants, and other organic matter.[131] Over time, hydrocarbons are produced as a result of the mixture of organic matter, heat, and high compressive stress.[132] As a result of being highly compacted, shale usually has very low permeability.[133] Even though hydrocarbons are derived from source rocks like shale, the low permeability of some source rocks like shale makes it uneconomic to extract oil and gas unless the permeability is artificially enhanced—a process usually done today by inducing fractures into the reservoir strata.[134] This enhancement to permeability has created what are now called "unconventional" reservoirs, named such because they have not been the traditional source of oil and gas until recently.[135]

Reservoir rocks such as sandstone,[136] on the other hand, are also porous but have higher permeability.[137] Reservoir rocks only become oil and gas reservoirs if, over a period of sometimes millions of years, the oil and gas have migrated from source rocks via one or more migration paths to an oil and gas reservoir before being halted or "trapped." This stoppage typically requires a sealing rock or "seal" above the reservoir that is comprised by an impenetrable barrier that stops further upward migration of the oil and gas beyond the reservoir rock.[138] After encountering the seal, the upwardly migrating oil and gas then remains in the permeable layer below the seal forming a "conventional" reservoir that can be exploited by allowing reservoir pressure to push hydrocarbons in the reservoir to and through the production cased-portion of the well annulus and then to the surface.[139]

2. *Drilling*

Before fracing can occur, a well must first be drilled. A well can be either vertical or horizontal. Well geometry will usually depend upon the type of reservoir targeted, and a horizontal well can cost up to three hundred percent (300%) more than a vertical well drilled into the same formation at the same depth.[140] Vertical

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131. *See* Volcano World Earth Science Lessons, *Sedimentary Rocks Lesson #13*, OREGON STATE UNIVERSITY, http://volcano.oregonstate.edu/sedimentary-rocks-lesson-13 (last visited Sept. 5, 2015).

132. *See Hydrocarbon Systems, Step 3: Sediment Maturation*, THE PALEONTOLOGICAL RESEARCH INSTITUTION: PETROLEUM EDUCATION, http://www.priweb.org/ed/pgws/systems/maturation/maturation.html (last visited Sept. 5, 2015).

133. *See Permeability*, SCHLUMBERGER'S OILFIELD GLOSSARY, http://www.glossary.oilfield.slb.com/en/Terms/p/permeability.aspx (last visited Sept. 5, 2015).

134. *See* Bertani, *supra* note 126, at 1–11.

135. *See Geologic Terms and Concepts: What's the Difference Between a "Conventional" and "Unconventional" Reservoir?*, PENNSYLVANIA DEP'T OF CONSERVATION AND NAT. RES., http://www.dcnr.state.pa.us/topogeo/econresource/oilandgas/marcellus/marcellus_faq/geologic_terms/index.htm (last visited Sept. 5, 2015).

136. *See Hydrocarbon Systems, Step 4: Reservoir Rock*, THE PALEONTOLOGICAL RESEARCH INSTITUTION: PETROLEUM EDUCATION, http://www.priweb.org/ed/pgws/systems/reservoir/reservoir.html (last visited Sept. 5, 2015).

137. *See* Bertani, *supra* note 126, at 1-6.

138. *Id*.

139. *See Geologic Terms and Concepts: What's the Difference Between a "Conventional" and "Unconventional" Reservoir?*, PENNSYLVANIA DEP'T OF CONSERVATION AND NAT. RES., http://www.dcnr.state.pa.us/topogeo/econresource/oilandgas/marcellus/marcellus_faq/geologic_terms/index.htm (last visited Sept. 5, 2015).

140. *See* Lamont C. Larsen, *Horizontal Drafting: Why Your Form JOA May Not Be Adequate for Your Company's Horizontal Drilling Program*, 48 ROCKY MTN. MIN. L. FOUND. J., 51, 52–53 (2011).

wells are highly effective at draining rocks that have high permeability allowing for the hydrocarbons to travel a long distance to the wellbore due to reservoir pressure or secondary recovery efforts like water-flood operation.[141] When the reservoir has low permeability, however, the cost effectiveness of a vertical well decreases because the hydrocarbons have trouble moving towards the wellbore.[142] In addition, the "pay zone" for a vertical well is limited to the thickness of the reservoir at the location the operator drilled the well.[143] This is how the horizontal well makes fracing economical.

A horizontal well is spudded in the same manner as a vertical well and descends vertically until it reaches a point just above the target reservoir called the "kick off point."[144] The kick off point is the predetermined location where the well starts to deviate from vertical and will eventually end up horizontal within the target reservoir, and extending laterally until the desired bottom hole location has been reached.[145] The largest advantage to a horizontal well is that it creates a large contact area between the reservoir and the productive casing of the well.[146] Depending upon the type of reservoir, naturally occurring pre-existing fractures may exist, and thus a horizontal well can be aimed to pass through a number of factures, thus enhancing ultimate recovery.[147] This deviation of the direction of the annulus's orientation away from vertical means the "pay zone" of a horizontal well is not limited to the vertical thickness of the reservoir but rather how far the horizontal portion of the well can extend, making it economic to drill in thinner reservoirs.[148] In addition, horizontal wells reduce surface disturbance because several horizontal wells can be drilled from the same surface location, or "pad."[149] All this means more fields have become economic and a higher rate of return per horizontal well can be generated when compared to a vertical well in the same play.[150]

Modern horizontal drilling allows a developer to place production casing both parallel to a tract boundary and within tens of feet of that boundary, both over a long horizontal distance—thousands of feet. This allows fractures to cross over the boundary during hydraulic fracturing operations, sometimes hundreds of feet into the unpermitted tract. A small unpermitted tract can experience significant drainage if it is surrounded by production casing and then targeted by fracing, even if none of the

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141. *See Directional and Horizontal Drilling in Oil and Gas Wells: Methods Used to Increase Production and Hit Targets that Cannot be Reached with a Vertical Well*, GEOLOGY.COM, http://geology.com/articles/horizontal-drilling/ (last visited Sept. 5, 2015).

142. *Id*.

143. *Id*.

144. *See Directional Drilling Technology*, ENVTL. PROT. AGENCY, 1, http://www.epa.gov/cmop/docs/dir-drilling.pdf (last visited Sept. 5, 2015).

145. Michael J. Wozniak & Jamie L. Jost, *Horizontal Drilling: Why It's Much Better to "Lay Down" Than to "Stand Up" and What Is an "18° Azimuth" Anyway?*, 57 ROCKY MTN. MIN. L. INST § 11.01, 11.02[1], at 2 (2011).

146. *Id*. at § 11.02[3], at 8.

147. *Id*.

148. *See* SCHLUMBERGER, HORIZONTAL HIGHLIGHTS, 7, 8–9 (Nov. 16, 1995), http://www.slb.com/~/media/Files/ resources/mearr/wer16/rel_pub_mewer16_1.pdf.

149. Jason A. Proctor, Note, *The Legality of Drilling Sideways: Horizontal Drilling and Its Future in West Virginia*, 115 W. VA. L. REV. 491, 497–98 (2012).

150. *Id*.

casing actually enters the volume of strata comprising the unpermitted tract. In addition, laboratory and both controlled field and empirical evidence suggest production from wells located on unpermitted tracts is subject to significant effects from neighboring fracing operations.[151]

3. *The Process of Fracing*

Fracing can be used as either a well completion method[152] or a secondary/tertiary stimulation method and can be employed in conjunction with either vertical or horizontal wells.[153] The fracing process can begin only after the well has been drilled and the casing set. The first step is to perforate the casing at the target zones.[154] Perforation is performed by a perforation gun that punches holes through the casing and into the formation.[155] The next step is to inject fluids comprised of water and chemicals into the formation at a rate of pressure that exceeds the given rock's compressive strength.[156] This step takes the fractures that were initially made by the perforation gun and extends them several hundred feet—sometimes well over a thousand feet—away from the well,[157] creating fissures in the reservoir.[158] At the depths drilled to extract most hydrocarbons, fissures will remain open only for a short period after the fracing fluid is removed due to the overlying weight of the earth.[159] In order to avoid having the fracture reseal under the pressure, "proppants," consisting primarily of sand or ceramic beads, are pumped into the fissures prior to removal of the pressure.[160] Once the pressure is removed, a portion of the fracing fluids return to the surface due to the underground pore pressure, completing one iteration of the fracing process.[161]

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151. *See, e.g.*, F. Zhang et al., *Fracture Network Connectivity – A Key to Hydraulic Fracturing Effectiveness and Microseismicity Generation*, *in* EFFECTIVE AND SUSTAINABLE HYDRAULIC FRACTURING 591, 600 (Andrew Bunger et al. eds., 2013), http://cdn.intechopen.com/pdfs/44146/InTech-Fracture_network_connectivity_a_key_to_hydraulic_fracturing_effectiveness_and_microseismicity_generation.pdf. Additionally, both authors have spent significant time in the field at production sites, and many engineers and other production personnel have, off the record, relayed to the authors accounts of significant effects on production from existing nearby wells when a fracing operation is conducted on a new well.

152. *See The Facts about Hydraulic Fracturing and Seismic Activity*, AM. PETROLEUM INST., at 1 (2015), http://www.api.org/~/media/files/policy/hydraulic_fracturing/hf-and-seismic-activity-report-2015.pdf.

153. *See What is Hydraulic Fracturing?*, ENVTL. PROT. AGENCY, http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_hydrowhat.cfm (last updated May 9, 2012).

154. *See Hydraulic Fracturing 101*, EARTH WORKS, http://www.earthworksaction.org/issues/detail/hydraulic_fracturing_101 (last visited Sept. 8, 2015).

155. *See* Brad Hansen, *Casing Perforating Overview*, ENVTL. PROT. AGENCY, http://www2.epa.gov/sites/production/files/documents/casingperforatedoverview.pdf (last visited Sept. 8, 2015).

156. *See What is Hydraulic Fracturing?*, *supra* note, 151.

157. *See id.*

158. *See* Travis Zeik, Note, *Hydraulic Fracturing Goes to Court: How Texas Jurisprudence on Subsurface Trespass Will Influence West Virginia Oil & Gas Law*, 112 W. VA. L. REV. 599, 603 (2010).

159. *See What is Hydraulic Fracturing?*, *supra* note, 151.

160. *See id.*

161. *See id.*

Fracing has allowed oil and gas operators to tap shale formations which contain a multitude of tiny pores that, in the aggregate, have the ability to store and then produce substantial amounts of oil and/or gas.[162] Prior to fracturing these shale formations, the oil and gas in those pores essentially remain in place. When oil and gas is located in shale formations, since shale formations typically have low permeability in order for production to occur at commercially viable quantities, either the shale must have natural fractures, or alternatively, fracing must be employed to create artificial fractures in the rock.[163] Thus there is no migration prior to conducting fracing operations.

B. Hydraulic Fracturing and Trespass Jurisprudence

Because the fracing process may be imprecise and lead to migration of fluids, proppant, and/or fissures across boundaries, plaintiffs may assert claims for trespass. In jurisdictions that have not faced trespass litigation related to fracing, cases involving similar operations, such as enhanced recovery operations, may be instructive. First, this article summarizes litigation surrounding such operations nationally. Then Texas case law leading to the decision in *Coastal Oil & Gas Corp. v. Garza Energy Trust* in which the Texas Supreme Court held that fracing is not a trespass is discussed. Finally, *Garza* is compared with the decision made in *Stone v. Chesapeake, Appalachia, LLC*, in which the Federal Court of the Northern District of West Virginia held that fracing constitutes a trespass.

1. Enhanced Recovery Operations & Trespass, Nationally

Two underground operations that resemble fracing are enhanced recovery operations and natural gas storage. Fracing, a completion technique itself, is similar to water or CO_2 flooding in that all such operations are conducted downhole to allow a higher ultimate recovery past what can be produced from just primary recovery attributable to natural reservoir pressure. Such secondary recovery operations can affect neighboring unleased tracts, potentially lowering recovery on these tracts by sweeping out hydrocarbons from below the unpermitted tracts. Aggrieved neighboring tract owners have fought these alleged invasions with trespass actions. While the results have been mixed, one commentator believes a strong general trend exists in the favor of operator/defendants if the enhanced recovery operation at issue has been approved by the appropriate state agency.[164]

For example, the Kansas Supreme Court ruled against trespass liability for a permitted waterflood operation after claimants predicted that their mineral estate would somehow be harmed by migrating wastewater.[165] The Court cited case law from other states in holding that traditional strict-liability surface trespass rules did not apply to subsurface trespass generally and, specific to the case before it, were not

162. Aaron Stemplewicz, Note, *The Known "Unknowns" of Hydraulic Fracturing: A Case for A Traditional Subsurface Trespass Regime in Pennsylvania*, 13 DUQ. BUS. L.J. 219, 222 (2011).

163. *Id*. at 223.

164. Owen L. Anderson, *supra* note, 44, at 51 (This paper provides an excellent in-depth survey of case law for a multitude of state regarding enhanced oil and gas recovery operations. What follows in this article is merely a summary.).

165. Crawford v. Hrabe, 44 P.3d 442, 446, 449, 453 (Kan. 2002).

applicable to migrating wastewater.[166] Likewise, the Fifth Circuit held that displacement of wet gas by injected (less expensive) dry gas that had migrated into the unpermitted tract during a secondary recovery operation was not actionable trespass, in part because the claimants had declined to include their tracts in the operations.[167] The North Dakota Supreme Court sided with operators conducting secondary recovery operations over leaseholders who had previously declined to join in the operations, noting that such operations were beneficial to the state's energy policy and that the claimants had failed to show actual damages caused by the enhanced recovery operations.[168] Oklahoma courts have provided for a private nuisance cause of action if the claimant can show actual damages stemming from waterflooding or similar processes if the operation results in the migration of fluid onto an unpermitted tract even if the operation was approved by state authorities.[169]

In *Tidewater Oil Co. v. Jackson,*[170] the U.S. Circuit Court of Appeals for the Tenth Circuit, applying Kansas law, sustained a verdict awarding actual damages for injury caused by water flooding conducted pursuant to a voluntary unitization that had been approved by the conservation agency but reversed the award of punitive damages. Although the defendants argued that plaintiff had received a fair offer to unitize, the court did not regard this fact as germane.[171] The court also reasoned that conservation-agency approval of the unit operations was also not germane because the agency lacked authority to resolve private tort claims.[172] The court, however, limited its decision to voluntary unitization.[173]

The Nebraska Supreme Court considered the secondary recovery trespass question in *Baumgartner v. Gulf Oil Corp*.[174] In the case, the Nebraska conservation commission entered an order unitizing a field for the secondary recovery of oil by water flooding.[175] The defendant—the unit operator—and all the working-interest owners in the captioned area executed a unit agreement except the plaintiff—the lessee of a state-owned tract located near the edge of the field.[176] The operator's water flooding operations then allegedly pushed some of the oil from beneath the plaintiff's leasehold to production wells located on unitized lands, leading to a suit for willful trespass and conversion.[177] When the state district court entered judgment against the operator for willful trespass, the Nebraska Supreme Court reversed.[178] That Court held that, where a secondary recovery project has been authorized by the

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166. *Id*. at 448–53.

167. Tide Water Associated Oil Co. v. Stott, 159 F.2d 174, 176, 179–80 (5th Cir. 1947).

168. Syverson v. N.D. Indus. Comm'n, 111 N.W.2d 128 (N.D. 1961).

169. Boyce v. Dundee Healdton Sand Unit, 560 P.2d 234 (Okla. Civ. App. 1975); West Edmond Salt Water Disposal Ass'n v. Rosecrans, 226 P.2d 970 (Okla. 1950) (finding no trespass on unpermitted tract for saltwater injection on adjacent tract for wont of proven actual damages).

170. Tidewater Oil Co. v. Jackson, 320 F.2d 157 (10th Cir. 1963).

171. *Id.* at 162.

172. *Id.* at 160.

173. *Id.* at 162.

174. Baumgartner v. Gulf Oil Corp., 168 N.W.2d 510 (Neb. 1969).

175. *Id.* at 386.

176. *Id.*

177. *Id.* at 388–389.

178. *Id.* at 389–390.

conservation commission, the operator is not liable to owners who refuse a fair opportunity to participate in the project even though the injected substance displaces oil from beneath those owners' property.[179] The Court did, however, state that the plaintiff could recover any profits that he can prove he would have obtained from his own primary recovery efforts in the absence of unitization—of course, there may be none or at least none that can be proved by a preponderance of the evidence.[180] The decision appeared to be driven by a desire to encourage a public policy of unitization and to prevent underground waste.

In contrast to the majority, some courts have found trespass liability exists stemming from enhanced recovery operations even if conducted with state regulatory approval. This could be a hint as to states that may see trespass liability for fracing operations in the future. For example, in California, a state court of appeals found that secondary recovery wastewater injection had impeded production on adjacent unpermitted tracts, thus allowing for a trespass claim.[181]

Similarly, in *Snyder Ranches, Inc. v. Oil Conservation Commission*—a case involving brine injection and resultant trespass allegations—the New Mexico Supreme Court suggested that actual damages need not be shown for traditional trespass to apply, raising the question of whether or not disposal of salt water is legally distinguishable from water flooding.[182] As a result, it is likely an operator would be held liable for any actual damages caused by either operation. Both water flooding and salt water disposal involve the injection of salt water into the ground. Both operations could cause pollution, especially if the brine were allowed to contaminate fresh-water formations due to lacking well completion techniques. Such operations are, however, distinguishable. Water flooding enhances the recovery of hydrocarbons from beneath flooded tracts through the injection of saltwater into the same formation that is being produced.[183] The disposal of salt water is simply the injection of waste, frequently into a different formation from which it was originally drawn, with the salt water frequently coming from other lands.

2. Enhanced Recovery Operations & Trespass in Texas

Since Texas provides a vast amount of oil and gas jurisprudence, it often serves as the foundation for the legal framework in oil and gas law nationwide. While each case addressed in this section does not directly deal with fracing, each does add to the discussion of how the Texas Supreme Court eventually reached its conclusion in *Garza*.[184]

As a beginning point, actual intrusion by a borehole falls within the *ad cœlum* doctrine. In *Hastings Oil Co. v. Texas Co*,[185] the defendant, Hastings, drilled a directional well from the permitted leased premises that had so deviated from

179. *Id.* at 394.

180. *Id.* at 399–400.

181. Cassinos v. Union Oil Co., 18 Cal. Rptr. 2d 574 (Ct. App. 1993).

182. *See* Snyder Ranches, Inc. v. Oil Conservation Comm'n, 1990-NMSC-090, 110 N.M. 637, 798 P.2d 587 (1990).

183. Often times, the same saltwater that is produced with oil is separated out at the well head and reinjected, along with additional saltwater, into the same formation for pressure maintenance.

184. Coastal Oil & Gas Corp. v. Garza Energy Trust, 268 S.W.3d 1 (Tex. 2008).

185. Hastings Oil Co. v. Texas Co., 234 S.W.2d 389 (Tex. 1950).

vertical that it bottomed out approximately 250 feet into the subsurface of the adjoining, unpermitted tract.[186] The Supreme Court of Texas eventually took up the case for procedural reasons but affirmed the appellate court ruling that said:

"Appellants could, of course, have no more right to bore a well with its top on the surface of their lease, and slant the bore hole so as to trespass upon appellees' subsurface, and produce oil from appellees' oil sands, than they would have to move upon the surface of appellee' surface to appellees' said oil bearing sands. Nor do appellants deny this."[187]

While the rule of capture existed at this time, the court affirmed the principle of *ad cœlum,* by saying that Hastings did have a right to drill into and capture oil and gas in the common reservoir but did not have the right to do so through actual entry on the unpermitted tract. Thus a subsurface trespass would result if the wellbore breaks the plane between the permitted property and unpermitted property.

Eleven years later, in 1961, the same court indirectly dealt with a variation of Hastings, focusing on whether fractures caused by fracing constituted a subsurface trespass when the resulting fractures crossed into the unpermitted tract. In the companion cases of Delhi-Taylor Oil Corp. v. Holmes[188] and Gregg v. Delhi-Taylor Oil Corp.,[189] the defendants each sought to drill wells on their respective tracts and employ fracing as a means to enhance production from the formation. The common plaintiff in both cases, Delhi-Taylor Oil Corporation, brought both suits to enjoin the defendants from fracing their wells by using the theory of subsurface trespass.[190]

The purposed location of the wells concerned the plaintiff because the Gregg lease was only approximately 75 feet wide and the well was to be drilled 37.5 feet from the Delhi-Taylor lease.[191] On the Holmes tract, the well was located on a tract just 30 feet in width and was surrounded by the Delhi-Taylor lease.[192] In *Holmes*, the trial court considered evidence presented by Delhi-Taylor's expert that, based upon the proposed amount of hydraulic pressure, the physical fractures could possibly travel "550 feet from the well bore." Conversely, the Holmes expert stated that the fractures would not travel more than five feet.[193] The Court agreed with the plaintiff oil company, stating:

> We think the allegations are sufficient to raise an issue as to whether there is a trespass. The invasion alleged is direct and the action taken is intentional. Gregg's well would be, for practical purposes, extended to and partially completed in Delhi-Taylor's land. The pleadings allege a physical entrance into Delhi-Taylor's leasehold. While the drilling bit of Gregg's well is not alleged to have extended into Delhi-Taylor's land, the same result is reached

186. *Id.* at 390–391.

187. Hastings Oil Co. v. Texas Co., 227 S.W.2d 317, 321 (Tex. App. 1950), *aff'd*, 234 S.W.2d 389 (Tex. 1950).

188. Delhi-Taylor Oil Corp. v. Holmes, 344 S.W.2d 420 (Tex. 1961).

189. Gregg v. Delhi-Taylor Oil Corp, 344 S.W.2d 411 (Tex. 1961).

190. Delhi-Taylor Oil Corp., 344 S.W.2d at 420; Gregg, 344 S.W.2d at 412.

191. *Gregg*, 344 S.W.2d at 412.

192. *Holmes*, 344 S.W.2d at 420.

193. *Id.* at 421.

> if in fact the cracks or veins extend into its land and gas is produced therefrom by Gregg. To constitute a trespass, "entry upon another's land need not be in person, but may be made by causing or permitting a thing to cross the boundary of the premises."[194]

Put simply, *Gregg* holds that if a wellbore remains within the vertical boundaries of the permitted tract but its resulting fractures cross into the unpermitted tract, it is no different than the situation presented in *Hastings*,[195] which resulted in a subsurface trespass. This, however, was not the main issue taken up by the court and so this statement appeared only as dictum in the case.

In these companion cases, the Supreme Court of Texas focused its attention on whether the Texas oil and gas regulatory agency, the Railroad Commission ("RRC"), had primary jurisdiction over cases where it was suspected that a subsurface trespass had resulted from fracing. The Court ruled that the issue of trespass resided with the courts. It stated "[w]here the issue is one inherently judicial in nature (as we think the question of trespass is), the courts are not ousted from jurisdiction unless the Legislature, by a valid statute, has explicitly granted exclusive jurisdiction to the administrative body" and that body had promulgated rules regulating that issue.[196] Delhi-Taylor pointed out and the Court agreed that, as of the date of these cases in 1961, the Texas "Legislature ha[d] not specifically delegated to the Commission the question of subsurface trespass or sand fracturing; that the Commission itself asserts no such power; that it has made no rules regarding the subject though requested to do so by Gregg. . . . "[197] The court ended its opinion stating:

> Our attention is called to secondary recovery operations involving water or gas injection, waterflooding, the injection and storage of salt water, and the recycling of gas. . . . The validity and reasonableness of the rules and orders involved in those operations may be passed upon when and if they reach this Court.[198]

It did not take long for the Court to hear such a case. In 1962, the Court heard *R.R. Comm'n of Tex. v. Manziel*,[199] which explored whether waterflooding in a common reservoir constituted a subsurface trespass even if authorized by the rules promulgated by the RRC.[200] The RRC granted a Rule 37 exception permit that authorized the co-defendants, the Whelan Brothers, to have an injection well located just 206 feet from the Manziel lease.

The Court first looked at whether an authorized secondary recovery project is capable of committing a subsurface trespass when the waters from said project cross lease lines. The Court noted that "[t]o constitute trespass there must be some

194. *Gregg*, 344 S.W.2d at 416 (quoting Glade v. Dietert, 295 S.W.2d 642, 645 (Tex. 1956) (quoting 87 C.J.S. *Trespass* § 13 (1954))).

195. Hastings Oil Co. v. Texas Co., 234 S.W.2d 389, 389 (Tex. 1950).

196. *Gregg*, 344 S.W.2d at 415.

197. *Id.* at 414–15.

198. *Id.* at 419.

199. 361 S.W.2d 560 (Tex. 1962).

200. *Id.* at 565.

physical entry upon the land by some 'thing,' but is injected water that crosses lease lines from an authorized secondary project the type of 'thing' that may be said to render the adjoining operator guilty of trespass?"[201] The Court further noted that "[w]ater injected into an oil reservoir generally spreads out radially from the injection well bore, and it is impossible to restrict the advance of the water to lease lines."[202] It is this element of unpredictability that allowed the Court justification to rule that secondary recovery by injection[203] did not constitute a trespass, when just a year prior, using the same law on trespass, the Court stated in dictum that fracing constituted a subsurface trespass because the fractures physically crossed into the unpermitted tract.

After *Manziel*, almost thirty years passed with little case law appearing in Texas courts regarding the issue of subsurface trespass caused by fracing. The issue eventually made a return to the high court in *Geo Viking, Inc. v. Tex-Lee Operating Co.*,[204] which involved a well that was drilled into the Austin Chalk formation.[205] Geo Viking, as per the contract, was "to frac the well in a 'good and workman-like manner. . . . '"[206] It allegedly failed, however, to meet this standard of care by the "intentional furnishing of equipment that was nonfunctional"[207] and Geo Viking's substandard performance was ultimately found to be the cause for Tex-Lee to plug and abandon its well.

The trial court, in its calculations of damages, included not only the oil and gas that was recoverable by the well within the 80 acre permitted tract but also allowed the jury to consider the oil and gas that the well *would* have recovered from under the adjacent unpermitted tract by the use of fracing techniques. Geo Viking "requested [a jury] instruction which would have told the jury not to consider or include the value of any oil and gas reserves outside the actual eighty-acre unit"[208] because the factures, by entering into the unpermitted tract, constituted a subsurface trespass. The illegality of a subsurface trespass would, then, have ruled out the need for compensation. The trial court did not allow the limiting instruction on damages, and the case was appealed to the Court of Appeals of Texas, Texarkana. The appellate court upheld the trial court decision by not allowing such a limiting instruction. In so doing, the court stated that Geo Viking's argument was in direct opposition to the rule of capture. The rule of capture allows owners to drill a well on their land and avoid liability to adjacent land owners for drainage that results from operations on their own land. The adjacent landowner's remedy in this instance is to resort to self-help.[209]

201. *Id.* at 567 (citing *Gregg*, 344 S.W.2d at 411).

202. *Id.* at 564.

203. *Id.* at 567 ("Our attention is called to secondary recovery operations involving water or gas injection, water flooding, the injection and storage of salt water, and the recycling of gas.").

204. 817 S.W.2d 357 (Tex. App. 1991), *writ granted* (Apr. 22, 1992), *writ withdrawn* (Oct. 28, 1992), *writ denied*, 839 S.W.2d 797 (Tex. 1992).

205. *Id.* at 359 ("This formation is characterized as an extremely tight formation containing intermittent fractures which must be tapped in order to obtain oil.").

206. *Id.* at 362.

207. *Id.* at 363.

208. *Id.*

209. *Id.* at 364 (citing Brown v. Humble Oil & Ref. Co., 83 S.W.2d 935, 940 (Tex. 1935)).

Thus, the majority in *Geo Viking* was in direct opposition to the dictum contained in *Gregg*. Interestingly, Justice Grant, the writer of the first *Geo Viking* opinion, reheard the case in the Texas Court of Appeals and became the sole dissenter the second time around.[210] Justice Grant, embracing the *Gregg* dictum, opined that:

> The Court in *Gregg* pointed out that fracing under another person's lands had all the necessary elements to be a trespass and found that it was comparable to slant-well drilling that bottomed on a neighboring tract, which the court had found to be a trespass and subject to injunctive relief in *Hastings*. . . . We agree that Tex–Lee could not claim as damages loss of oil and gas to which it was not entitled.[211]

Geo Viking eventually made its way up to the Texas Supreme Court, which initially reversed the Court of Appeals, stating that "[t]he court of appeals' reliance on the rule of capture is misplaced,"[212] and further that "[f]racing under the surface of another's land constitutes a subsurface trespass"[213] to which "the rule of capture would not permit Tex-Lee to recover for a loss of oil and gas that might have been produced as the result of fracing beyond the boundaries of its tract."[214] The Court of Texas reversed and remanded the case for a new trial on the issue of actual damages.[215]

Several months after *Geo Viking* was decided, the Federal District Court for the North District of Texas heard *Gifford Operating Co. v. Indrex, Inc.*[216] The court found that the defendants, Gifford and DSI, had purposely designed the survey so that the fractures crossed the lease line and entered the unpermitted contiguous Indrex lease that was approximately 1340 feet away from the Gifford well.[217] Almost immediately after the defendants fraced their well, Indrex noticed that production from a well on its lease had decreased, and, within a day, Indrex was producing only frac fluids.[218] Production of frac fluids lasted several months and afterward the production of MFC and oil stabilized at a rate of slightly more than 1/8th of what it had prior to the defendants' fracing operation.[219] The district court ruled that "[u]nder Texas case law, fracing across lease lines constitutes a subsurface trespass."[220] In support for its holding, the court first cited *Gregg* for the proposition that hydraulic fracturing was tantamount to having a drill stem extend beyond the leased tract into the unleased tract when the fractures crossed the vertical horizon between the

210. *Id.* at 364–66 (Grant, J., dissenting).
211. *Id.* at 365.
212. Geo Viking, Inc. v. Tex-Lee Operating Co., No. D-1678, 1992 WL 80263, at *2 (Tex. Apr. 22, 1992), *opinion withdrawn and superseded on overruling of reh'g*, 839 S.W.2d 797 (Tex. 1992).
213. *Id.*
214. *Id.*
215. *Id.*
216. No. 2:89-CV-0189, 1992 U.S. Dist. LEXIS 22505 (N.D. Tex. Aug. 7, 1992).
217. *Id.* at *12.
218. *Id.* at *9–11.
219. *Id.* at *10–11.
220. *Id.* at *13.

tracts.[221] The district court next looked to *Geo Viking* to find further support in that "fracturing across lease lines amounts to subsurface trespass"[222] and that the rule of capture did not permit recovery of oil and gas that would be produced as a result of fracing beyond the permitted boundaries.[223]

By the end of August 1992, Texas case law on the issue of subsurface trespass had established a degree of clarity. If fractures crossed into an unpermitted tract, a somewhat rickety framework of case law suggested, this act would constitute a subsurface trespass. On the other hand, if fracing fluid was shown to transgress property lines, and the fracing itself was authorized by the RRC, then no actionable trespass had occurred.

Just a mere six months after issuing its opinion on the case of *Geo Viking*, however, the Supreme Court of Texas issued a *per curiam* opinion withdrawing its earlier opinion. The Court stated that "we should not be understood as approving or disapproving the opinions of the court of appeals analyzing the rule of capture or trespass as they apply to hydraulic fracturing."[224] This had the effect of essentially casting back into doubt whether the rule of capture would shield from trespass liability operators who caused fractures to cross into the unpermitted tract. This degree of doubt remained in effect until 2008, when the Supreme Court of Texas took up *Garza*.

3. *Fracing Is Not a Trespass: Coastal Oil & Gas Corp. v. Garza Energy Trust*

Garza was initially filed in the 332 District Court, in Hidalgo County, Texas[225] between the plaintiffs, the Garza and Salinas families, and the defendants, Coastal Oil & Gas Corporation, USA L.P., Bellwether Exploration Company, and El Paso.[226] The Garzas and Salinas executed a lease with Coastal on a tract called Share 13[227] with the plaintiffs, as part of their consideration for executing the lease, obtaining "a royalty interest in the Share 13 mineral estate."[228] Coastal, in addition to having an interest in the mineral estate of Share 13, also owned both the surface and mineral estates of Share 12, a neighboring tract.[229] In 1996, Coastal drilled and hydraulically fractured the Coastal Fee No. 1 well (the "Coastal #1"), a well located in the northeast corner of Share 12, just 467 feet from the boundary of the Share 12 northeast, Share 13 southwest boundary line.[230] Although this location was quite close to the property boundary—a proximity concerning to the plaintiffs—it was

221. *Id.* at *14.
222. *Id.* at *15–16.
223. *Id.* at *16.
224. Geo Viking, Inc. v. Tex-Lee Operating Co., 839 S.W.2d 797, 798 (Tex. 1992).
225. Garza Energy Tr. v. Coastal Oil & Gas Corp., No. C-1313-97-F, 2001 WL 35832908 (332 Tex. Jud. Dist.), *aff'd and rev'd sub nom.* Mission Res., Inc. v. Garza Energy Tr., 166 S.W.3d 301 (Tex. Ct. App. 2005), *rev'd sub nom.* Coastal Oil & Gas Corp. v. Garza Energy Tr., 268 S.W.3d 1 (Tex. 2008).
226. Mission Res., Inc. v. Garza Energy Tr., 166 S.W.3d 301, 301, 309 (Tex. Ct. App. 2005), *rev'd sub nom.* Coastal Oil & Gas Corp. v. Garza Energy Tr., 268 S.W.3d 1 (Tex. 2008).
227. *Id.* at 309.
228. *Id.* at 310.
229. *Id.*
230. *Coastal Oil & Gas Corp.*, 268 S.W.3d at 6.

squarely in accordance with the Railroad Commission's Rule 37 property boundary set back requirements.[231]

At trial, the plaintiff's expert testified that the length of the fractures was designed to reach between 1,100 to 1,500 feet from the Coastal #1. The defendant's expert disagreed, stating that the fractures were designed to extend only one thousand feet from the well.[232] The trial court also heard evidence that the amount of proppant that was used in the fracing process of the Coastal #1 was "massive" in comparison with that used in the well Coastal drilled on Share 13.[233] The plaintiff agreed that, since the Coastal #1 well required more proppant, the fractures were probably longer, suggesting the fractures extended across the boundary and far into Share 13.[234] The plaintiff, however, could not definitively state the direction the fractures traveled, the extent they traveled into Share 13, and whether the geology of the reservoir in Share 12 was similar to that of Share 13.[235] The jury focused on the issue of subsurface trespass and returned a verdict in favor of the plaintiffs for one million dollars. This was later reduced by the trial court to an award of $543,776.[236]

Coastal appealed to the Court of Appeals of Texas, Corpus Christi,[237] arguing for reversal on the grounds that Texas did not recognize a cause of action for subsurface trespass based on the hydraulic fracture stimulation treatment of a well and that no Texas court had ever held that fracing can support a cause of action for trespass damages.[238] Coastal noted there have only been two Texas cases that even discussed "fracture treatments" and then only indirectly. Coastal dismissed G*regg*,[239] where the Supreme Court's statement that allegations about a subsurface intrusion caused by fracing were "sufficient to raise an issue of whether there is a trespass[,]" as mere dicta evidencing no intention to hold that fracing trespass exists.[240] Regarding the second, *Geo Viking*,[241] Coastal noted that the rule of capture and self-help precluded any claim that fracing caused a subsurface trespass.[242] Coastal further argued that since the question of whether fracing across a property boundary into an unpermitted tract constituted a trespass was only collateral to the main issue as it had

231. *Id.*

232. *See id.* at 7. (The reach of the fractures, however disputed, was nevertheless enhanced by the fact the target formation was a well-cemented sandstone accessed by a vertical well; a horizontal well in a share target formation would likely have resulted in shorter fracture lengths.)

233. *Id.*

234. *See id.*

235. *Id.* at 8.

236. Mission Res., Inc. v. Garza Energy Tr., 166 S.W.3d 301, 310 (Tex. App. 2005), *rev'd sub nom.* Coastal Oil & Gas Corp. v. Garza Energy Tr., 268 S.W.3d 1 (Tex. 2008).

237. *Id.* at 1, 9.

238. *Id.* at 10.

239. Gregg v. Delhi-Taylor Oil Corp., 344 S.W.2d 411, 416 (Tex. 1961).

240. *Mission Res., Inc.*, 166 S.W.3d at 310 (Tex. App. 2005), *rev'd sub nom. Garza*, 268 S.W.3d 1 (Tex. 2008).

241. Geo Viking, Inc. v. Tex-Lee Operating Co., 817 S.W.2d 357 (Tex. App. 1991), *writ denied per curiam*, 839 S.W.2d 797 (Tex. 1992).

242. *See Mission Res., Inc.*, 166 S.W.3d at 311 (Tex. App. 2005), *rev'd sub nom. Garza*, 268 S.W.3d 1 (Tex. 2008).

arisen only in the context of a jury instruction, nothing in the case should be treated as authority establishing trespass for fracing.[243]

The appellate court disagreed with Coastal, stating that the Texas Supreme Court's comments in *Gregg* "cannot be discounted entirely as dictum, if it is dictum at all," and that if fracing could not amount to a trespass, the Court would have simply dismissed the case and allowed the Railroad Commission to resolve the dispute.[244] Instead, the Court had held that the trial court had jurisdiction—and that the RCC did not—because the case involved a tort (*i.e.*, trespass).[245]

The court of appeals also contrasted *Geo Viking*,[246] stating that since the two cases conflict with one another, "[t]his Court will not endeavor to reconcile the conflict. Instead, we follow *Gregg* as it is not for this Court to declare it devoid of precedential value, as *Gregg* remains the law. Coastal's first issue is overruled."[247]

The Texas Supreme Court agreed to hear Coastal's appeal.[248] The majority initially addressed the *ad cœlum/ad inferos* doctrine, quoting the U.S. Supreme Court that the maxim *cujus est solum ejus est usque ad cœlum et ad inferos* "has no place in the modern world."[249] Addressing the trespass issue, the majority held that the rule of capture precluded the plaintiff from claiming that a trespass occurred when fractures extend beyond the permitted tract into the adjacent unpermitted tract, stating "[w]e need not decide the broader issue here. In this case, actionable trespass requires injury, and Salinas's only claim of injury—that Coastal's fracing operation made it possible for gas to flow from beneath Share 13 to the Share 12 wells—is precluded by the rule of capture."[250] In other words, the Court squelched the idea that the issue of subsurface trespass was even before it because the only injury claimed by the plaintiff was drainage due to migration of hydrocarbons from Share 13 to Share 12—the exact type of liability question the rule of capture was designed to avoid. The majority then listed four reasons why there should be no exception to the rule of capture when drainage is caused by fractures extending into unpermitted tracts.[251]

First, the owner of the property has a wide array of self-help options available to stop drainage generally. The extent a person is free from liability for capturing drainage from a neighboring tract is one of the primary differences between the majority and the dissent in *Garza*. The majority approached the trespass issue from the view that the rule of capture will protect a person from liability so long as the "landowner can protect himself from drainage by drilling his own well, thereby avoiding the uncertainties of determining how gas is migrating through a reservoir."[252] The dissent focused instead on the "fugitive nature" of

243. *See id.* at 311.
244. *Id.* at 310.
245. *Id.* at 310–11.
246. *Id*. at 310.
247. *Id.* at 311.
248. Coastal Oil & Gas Corp. v. Garza Energy Tr., 268 S.W.3d 1 (Tex. 2008).
249. *Id.* at 11 (quoting United States v. Causby, 328 U.S. 256, 260–261, n.5 (1946)).
250. *Id.* at 11–13.
251. *Id.* at 14–17.
252. *Id.* at 14.

hydrocarbons,[253] and would apply the rule of capture only "whenever [hydrocarbon] flow occurs solely through the operation of natural agencies in a normal manner, as distinguished from artificial means applied to stimulate such a flow."[254] The dissent also believed that self-help remedies are not helpful to most individuals because the aggrieved party would either not know of the existence of the drainage or would not have the resources to implement the remedy.

The majority's second reason for promoting the rule of capture was to better ensure that the Texas RCC—and not courts and juries—had the power to regulate fracing.[255] The Court worried that if the rule of capture did not apply, the RRC could not adequately regulate oil and gas exploration and production because each time a permit allowed any drainage, this could be deemed a regulatory taking.[256] The majority observed that "only . . . the rule of capture leaves the [RCC]'s historical role unimpeded"[257] and thus "should not be supplanted by the law of trespass."[258]

The third reason cited by the majority supporting application of the rule of capture to fracing was to prevent a litigation system that is poorly equipped to handle valuation of oil and gas drainage from having to make difficult, lengthy, expensive—and very likely erroneous—decisions about who was getting drained and by how much.[259] The *Garza* majority believed that most of the information necessary to determine fracing-induced drainage "[is] hidden below miles of rock, making it difficult to ascertain what might have happened."[260]

Finally, the majority and (especially) concurrence note public policy reasons for applying the rule of capture to fracing trespass, particularly stressing the importance of a vital and dynamic oil and gas industry unfettered by trespass claims rooted in fracing, citing the usual arguments—oil and gas jobs, energy security, and lower energy costs—for why it is best to not have common law liability mixed in with a practice that is essential to the industry.[261] For these four reasons the majority and concurrence came to the determination that in Texas oil and gas production is best served with fracing protected from trespass by the shield of the rule of capture.

4. Fracing is a Trespass: Stone v. Chesapeake Appalachia, LLC

On Apr. 10, 2013, the Federal Court of the Northern District of West Virginia, Wheeling, denied a motion for summary judgment made by the energy company defendant in the case of *Stone v. Chesapeake Appalachia, LLC*.[262] Since the issue of whether a subsurface trespass could result from fracing was a matter of

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253. *Id.* at 42 (Johnson, J., dissenting) (quoting Halbouty v. R.R. Comm'n, 357 S.W.2d 364, 375 (Tex. 1962)).

254. *Id.* (Johnson J. dissenting) (quoting Peterson v. Grayce Oil Co., 37 S.W.2d 367, 370–71 (Tex. Civ. App. 1931), *aff'd,* 98 S.W.2d 781 (Tex. 1936)).

255. *Id.* at 14–16 (majority opinion).

256. *Id.*

257. *Id.* at 15.

258. *Id.* at 16.

259. *See id.*

260. *Id.*

261. *Id.* at 16–17 n.56; *id.* at 26–35, 41 (Willett, J., concurring).

262. Stone v. Chesapeake Appalachia, LLC, No. 5:12-CV-102, 2013 WL 2097397 (N.D. W. Va. Apr. 10, 2013), *vacated,* No. 5:12-CV-102, 2013 WL 7863861 (N.D. W. Va. July 30, 2013).

first impression in West Virginia, the defendant's motion for summary judgment leaned heavily upon the majority decision in *Garza.*[263]

In *Stone*, Chesapeake Appalachia spudded a Marcellus Shale well approximately 200 feet from the boundary with Stone's mineral property with a horizontal drainhole that came within "tens of feet" of the plaintiffs' property. Although Chesapeake was a common lessee across both tracts, Stone's lease did not authorize pooling or unitization of the Marcellus formation. Chesapeake then conducted fracing operations, causing fractures to almost certainly extend beyond the permitted tract and onto the contiguous Stone property. Stone sued, and in response, Chesapeake removed and filed a motion in federal court for summary judgment on the basis that even though fractures from its well likely did cross into Stone's tract, Stone's claim of trespass was barred by the rule of capture, per *Garza*.

Attempting to interpret West Virginia law, the federal court expressed its belief that the West Virginia Supreme Court would be unlikely to support the four propositions that laid the foundation for the Texas Supreme Court majority concurrence in *Garza*.[264] Instead, while acknowledging that West Virginia jurisprudence had adopted the rule of capture, the federal court believed that the high court of West Virginia would side with the dissenting justices in *Garza* that seemed to believe the rule of capture is essentially limited to conventional reservoirs from which migration from the unpermitted tract occurs only due to "natural" flow.[265]

In denying the defendant's motion for summary judgment, opinion author Justice Bailey held that under the rule of *Garza*, oil and gas companies could either demand mineral owners sign leases with draconian terms or the producer would simply drill a neighboring tract and drain the unpermitted tract via fracing. The federal court speculated that the West Virginia Supreme Court would find that, since trespass in West Virginia is defined as an entry onto the real property of another without lawful authority combined with some measure of damage— however small—being inflicted on (or under) the tract, the Court would hold that fracing into an unpermitted tract was trespass not permitted by the rule of capture.

The federal court also believed that not all property owners are sophisticated enough or have the resources to engage in self-help methods like drilling their own well or conducting their own fracing operation. The federal court further distinguished *Garza* by recognizing that the RRC in Texas has much more resources and regulatory power at its disposal to protect correlative rights than West Virginia's regulatory authority and that problems of providing evidence for fracing trespass were surmountable. In addition, seeming to specifically target Justice Willett's concurrence in *Garza*, Justice Bailey opined that the concerns of the energy industry should not trump the property rights of small landowners. Justice Bailey noted that the West Virginia Supreme Court had recently reaffirmed the strict application of the *ad cœlum* doctrine, furthering bolstering Stone's claim of trespass.

The federal court also denied Chesapeake's motion to dismiss Stone's claim for breach of the implied covenant to protect against drainage. In its motion to dismiss, Chesapeake cited West Virginia precedent that a good faith offer by a

263. *Id.* at *4 (citing *Garza,* 268 S.W.3d 1 (Tex. 2008)).
264. *Id.* at *6.
265. *Id.* at *6 (quoting *Garza*, 268 S.W.3d at 42).

common lessee to join a pool when made to a party claiming drainage is enough to avoid violation of the implied covenant against drainage.[266] In *Stone*, the court noted that no evidence had been presented by Chesapeake that the lease offered to Stone was comparable to the leases executed by other lessors in the pool.

C. Analysis—Fracing vs. Trespass

1. Stone *Cold Crazy*

The court in *Stone* placed a great deal of importance on the *Garza* dissent in reaching its conclusion, but the court's four arguments lack merit and fail to credit conservation agencies with the ability to protect the correlative rights of all property owners while preventing the waste of leaving oil and gas in place due to fear of liability for fracing trespass

The first argument made by the *Stone* court referred to the idea that not all property owners are sophisticated enough or have enough resources to drill their own well, and thus are incapable of resorting to self-help. However, this argument simply lacks merit. Legislatures and the courts at times form the belief that their subjects are entirely incapable of solving their own problems. Although the likelihood of an individual financing his or her own horizontal well completion may not be realistic, other options are available to the landowner. The most common choice would be execution of an oil and gas lease and getting into a pool. When given a little thought, if a well is completed as a producer on an adjacent property "within tens of feet of the property line" the landowner may have little trouble finding a competing company that would be prepared to drill a well on his property, especially if upfront exploration costs can be attenuated due to the success of a well so close to the subject property.[267]

The next argument offered by the *Stone* court was that the Texas RRC has far more regulatory authority vested in it than does the West Virginia regulatory authority, the Department of Environmental Protection, Office of Oil and Gas (the "DEP").[268] The DEP has been delegated the power by the West Virginia Legislature to "(12) [p]erform all duties as the permit issuing authority for the state in all matters pertaining to the exploration, development, production, storage and recovery of this state's oil and gas."[269] This delegation appears to vest the DEP with broad authority in regulating all facets of the oil and gas industry. Whether a broad delegation has been made and what is encompassed by it was the subject of the case of *State v. West Virginia Racing Commission*.[270] In this case, the West Virginia Legislature delegated to the West Virginia Racing Commission that it "shall have all the powers necessary to carry out fully and effectively all the purposes of this act and shall have full power

266. *Id.* at *8 (citing Croston v. Emax Oil Co., 464 S.E.2d 728 (W. Va. 1995)).

267. This article does not take into account "communication" between wells that may reduce production in both wells or one over the other. In any event, the issue of "communication" should be left to the state oil and gas regulatory agency when considering the correlative rights within a given reservoir.

268. *Stone,* 2013 WL 2097397, at *7. *See* W. VA. CODE ANN. § 22-1-7(4) (West) ("The Office of Oil and Gas, which is charged, at a minimum, with administering and enforcing, under the supervision of the director, the provisions of articles six, seven, eight, nine and ten of this chapter[.]").

269. W. VA. CODE ANN. § 22-6-2(12) (West 2015).

270. 55 S.E.2d 263 (W. Va. 1949).

to prescribe rules, regulations and conditions under which all races shall be conducted within the state of West Virginia."[271] This delegation was characterized by the Court as being "very broad and comprehensive, and presumably covered every feature of horse racing permitted under the act."[272] There is no reason to believe that the DEP delegation is also anything less than a broad delegation of presumably every feature of oil and gas exploration, development, production, storage, and recovery of the state's oil and gas. Therefore, the DEP has been granted with as much regulatory authority as the RRC. Thus the DEP, just like the RRC, has the "power [to] invade the right of the owner of the land to the oil in place under his land as long as it is based on some justifying occasion, and is not exercised in an unreasonable or arbitrary manner."[273]

The third suggestion of the *Stone* court was the notion that trial lawyers have solved the issue of proving difficult matters like fracing drainage. While civil litigation can always provide some sort of determination, one of the justifications for the rule of capture is to avoid this expensive and often erroneous errand being left to the courts as a first resort. Allowing an adjacent property owner to wait for another to drill a well and then sue for damages to exact a profit without taking any risk is exactly what the *Garza* majority was attempting to avoid.[274] If the regulatory authority of a state's oil and gas conservation agency, backstopped by the rule of capture, were to govern the placement of fractured wells close to the property line, the incentive to hinder production by somebody else then switches to a desire to share in the proceeds.

The fourth rationale of the *Stone* court was that the concerns of industry should not overcome the property rights of small landowners. Smacking of campaign rhetoric instead of reasoned jurisprudence, this view fails to credit state conservation agencies with the ability to protect the correlative rights of all property owners while preventing the waste of leaving oil and gas in place due to fear of liability for fracing trespass. Consider also the response of different sized landholders to the threat of fracing trespass liability. Large landowners could more easily avoid such liability by simply moving the well pad farther away from the neighboring property line. Smaller landowners, on the other hand, may not have this option. By not allowing the rule of capture to shield proactive landowners and their lessees while encouraging neighbors to either develop themselves or get into a pool or unit, *Stone's* jurisprudence could deprive small landowners of their motivation to develop unconventional reservoirs.

Finally, the *Stone* court's invocation of the *ad cœlum* doctrine as support for its finding of trespass causes concern.[275] Contrasting the quote used in the *Garza* opinion (taken from *Causby*)—that the *ad cœlum* doctrine "has no place in the modern world" with a quote from 2003 when the West Virginia Supreme Court "reaffirmed the maxim,"[276] the federal court seems to imply that the *ad cœlum*

271. *Id*. at 264–65.

272. *Id.* at 265.

273. R.R. Comm'n of Tex. v. Manziel, 361 S.W.2d 560, 572 (Tex. 1962) (citing Brown v. Humble Oil and Refining Co., 83 S.W.2d 935 (Tex. 1935)).

274. Coastal Oil & Gas Corp. v. Garza Energy Trust, 268 S.W.3d 1, 41 (Tex. 2008).

275. Stone v. Chesapeake Appalachia, LLC, 2013 WL 2097397, at *7 (N.D.W. Va. Apr. 10, 2013) *vacated*, 2013 WL 7863861 (N.D.W. Va. July 30, 2013).

276. *Id.* (citing Energy Development Corp. v. Moss, 591 S.E.2d 135, 143 n.14 (2003)).

doctrine applies literally and at all times in West Virginia jurisprudence. As Professor Keith Hall has noted, neither the West Virginia Supreme Court nor any modern court known to him (or the authors) has ever applied the rule of capture literally and at all times[277] and, furthermore, the 2003 West Virginia case quoted by the federal court did not involve either trespass or fracing but rather dealt with a dispute on whether the terms of an oil and gas lease assigned to the lessee the right to produce coalbed methane.[278] Ultimately, as Professor Hall suggests, courts and commentators have construed the *ad cœlum* doctrine as dicta not to be applied literally – at all times in all instances.[279]

2. Common Law Trespass as Remedy for Alleged Contamination

Although, fracing operations, if conducted correctly, are environmentally sound and have been successfully conducted over a million times, at least one commentator has called for the application of common law rules to trespass for environmental reasons.[280] Under this view, any unauthorized entry, any intrusion of fracing materials over the boundary into an unpermitted tract, is actionable, and this application of strict liability is seen as eliminating the need for proving damages.[281] In addition, if it can be proven that a planned fracing survey will result in an entrance into an unpermitted tract, an injunction can stop it from occurring.[282] Furthermore, under this view, application of strict liability common law trespass is promoted so that the perceived environmental ills of fracing can be avoided.[283] More specifically, application of strict liability common law trespass would, it is believed, eliminate the need for the plaintiff to prove the fracing defendant was the single cause of harm in an action involving alleged groundwater contamination.[284]

Under the strict liability theory, the question therefore is whether fracing causes discernable and measurable damage. The environmental effects of fracing on groundwater and surface water have been hotly debated. Some states and provinces have effectively outlawed fracing while a majority of states with prospective shale formations have embraced fracing, albeit with contention and the promulgation of significant state regulatory schemes.[285] Any effect, if detrimental, discernable, and measureable, could count as the "damages" by which an award may be made to remedy.

277. Keith B. Hall, *Hydraulic Fracturing: If Fractures Cross Property Lines Is There An Actionable Trespass?*, 54 NAT. RESOURCES J. 361, 399 (2014) (first citing Thrasher v. City of Atlanta, 173 S.E. 817, 825 (Ga. 1934); then citing Swetland v. Curtiss Airports Corp., 41 F.2d 929, 936–38 (N.D. Ohio 1930); and then citing Sprankling, *supra* note 6, at 999–1003).

278. *Moss*, 591 S.E.2d at 143.

279. Hall, *supra* note 275, at 399.

280. Aaron Stemplewicz, *The Known "Unknowns" of Hydraulic Fracturing: A Case for A Traditional Subsurface Trespass Regime in Pennsylvania*, 13 DUQ. BUS. L. J. 219, 265 (2011).

281. *Id.*

282. *Id.*

283. *Id.*

284. *Id.*

285. *See* Thomas E. Kurth et al., *American Law and Jurisprudence on Fracing*, 47 ROCKY MTN. MIN. L. INST. 277 (2010).

Although an in-depth environmental investigation into the environmental soundness and safety of fracing is beyond the scope of this paper, fracing appears safe when sound drilling and completion methods are used and when the subsequent fracing operations are conducted with adequate borehole pressure monitoring so as to immediately identify and halt potential aquifer intrusion. No evidence directly connects injection of fracking fluid into shale with widespread aquifer contamination.[286] In 2004, the Environmental Protection Agency ("EPA") released a study finding no confirmed instances of drinking water contamination by fracking fluids in the ground on a study focused on coalbed methane wells.[287] Eight years later, Lisa Jackson, then head of the EPA, told a reporter, "In no case have we made a definitive determination that the fracking [sic] process has caused chemicals to enter groundwater."[288] These revelations are not surprising as fracing fluid is pumped through a concrete-lined borehole to formations thousands of feet below potable aquifers.

Nor does fracing cause significant earthquake activity. State and federal regulators and scientists have looked for a direct causal connection between fracing and seismic activity. Although none of the resulting state or federal studies has causally linked fracing to earthquakes of perceptible scale, the findings of these studies have often subsequently been misconstrued.[289] For example, a recent U.S.

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286. *See* RICHARD W. HAMMACK ET AL., AN EVALUATION OF FRACTURE GROWTH AND GAS/FLUID MIGRATION AS HORIZONTAL MARCELLUS SHALE GAS WELLS ARE HYDRAULICALLY FRACTURED IN GREENE COUNTY, PENNSYLVANIA 1, 2 (Nat'l Energy Tech. Lab., U.S. Dep't of Energy eds., 2014), http://www.achd.net/shale/pubs/NETL-TRS-3-2014_Greene-County-Site_20140915_1_1.pdf ("Current findings are: 1) no evidence of gas migration from the Marcellus Shale; and 2) no evidence of brine migration from the Marcellus Shale. . . . Conclusions of this study are: 1) the impact of hydraulic fracturing on the rock mass did not extend to the Upper Devonian/Lower Mississippian gas field; and 2) there has been no detectable migration of gas or aqueous fluids to the Upper Devonian/Lower Mississippian gas field during the monitored period after hydraulic fracturing."); MD. DEP'T OF NAT. RES., MD. DEP'T OF THE ENV'T, ASSESSMENT OF RISKS FROM UNCONVENTIONAL GAS WELL DEVELOPMENT IN THE MARCELLUS SHALE OF WESTERN MARYLAND 3 (2015), http://www.mde.state.md.us/programs/Land/mining/marcellus/Documents/A_Final_Draft_Cover_Ex_Sum_and_RA.pdf ("One of the greatest concerns regarding [unconventional gas well development] is the contamination of water supplies, both ground and surface waters, which may provide sources of drinking water or support ecologically valuable and sensitive aquatic communities. Risks associated with water contamination were rated most commonly as low, and in some cases, moderate, depending on the sensitivity of the receptor."); GRAHAM GAGNON ET AL., WHAT ARE THE INTERACTIONS BETWEEN UNCONVENTIONAL GAS RESOURCES AND WATER RESOURCES? INPUT QUALITY AND QUANTITY REQUIREMENTS AND WATER TREATMENT NEEDS AND IMPACTS 10 (Verschuren Centre, Cape Breton Univ., eds., 2014), http://nlhfrp.ca/wp-content/uploads/2015/01/Discussion-Paper-Water.pdf ("Due to the distance between the targeted formation and the aquifer, it is anticipated that fractures would not extend from the shale to the aquifer, and thus direct contamination from hydraulic fracturing fluids would appear unlikely.").

287. DRINKING WATER PROT. DIV., OFFICE OF GROUND WATER AND DRINKING WATER, OFFICE OF WATER, U.S. ENV'T PROTECTION AGENCY, EVALUATION OF IMPACTS TO UNDERGROUND SOURCES OF DRINKING WATER BY HYDRAULIC FRACTURING OF COALBED METHANE RESERVOIRS, at ES-16 (2004), EPA 816-R-04-003, http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/wells_coalbedmethanestudy.cfm.

288. EnergyInDepth, *EPA's Lisa Jackson on Safe Hydraulic Fracturing*, YOUTUBE 0:59–1:07 (Apr. 30, 2012), https://www.youtube.com/watch?v=_tBUTHB_7Cs.

289. *See* Juan Carlos Rodriguez, *NY Bill Calls for Earthquake-Fracking Link Study,* LAW360 (Apr. 9, 2012), http://www.law360.com/energy/articles/328204/ny-bill-calls-for-earthquake-fracking-link-study;

Geological Survey ("USGS") study lead to the conclusion that, "We don't see any connection between fracking [sic] and earthquakes of any concern to society."[290] The USGS study does, however, reinforce earlier science identifying a correlative link between wastewater disposal wells and earthquakes.[291]

Therefore, the discussion of jurisprudence of subsurface trespass is qualified by the suspicion that evidence for actual damage, as a result of fracing, is arguably suspect,. Outside of *Stone* and the minority of cases described in Section III above, it appears that in most jurisdictions that have considered subsurface trespass claims arising from an alleged lateral invasion of material in the briny deep—below any use of the claimant—courts have held that either (1) actual harm must be shown or (2) some interference exists with the reasonable expectations of the claimant's as to his use of the property.[292] These majority-view states recognize a claim for subsurface trespass provided the landowner adequately shows (1) entry on the property without the landowner's consent and (2) the trespass caused actual damages or interference with the use of property.[293] For example, the Ohio Supreme Court has ruled that a claimant could only exclude subsurface invasions that actually interfered with his "reasonable and foreseeable" use of the subsurface.[294] The Oklahoma Supreme Court noted that injection wells would not exist if an adjacent tract owner could succeed with a trespass claim without showing actual interference with his use.[295] In Louisiana, the Supreme Court ruled that subsurface migration of fluids did not constitute a trespass unless the property owner could prove actual and measurable damages.[296] And, again, the Nebraska Supreme Court noted that a trespass did not occur if injected material crossed vertical lease lines during secondary recovery projects.[297]

This jurisprudence rejects the application of strict liability traditional trespass for the sole purpose of protecting aquifers where contamination, by and large, has not manifested itself as a problem is not sound jurisprudence. Given the disputed nature of fracing's effect on the environment, particularly regarding alleged intrusions thousands of feet below the surface, and its clean record regarding widespread aquifer contamination given the million plus wells that have undergone fracing operations, showing actual contamination should remain a requirement for liability.

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see also Greg Ryan, *New US Study Links Soaring Earthquake Totals To Fracking*, LAW360 (Apr. 6, 2012), http://www.law360.com/articles/327659/new-us-study-links-soaring-earthquake-totals-to-fracking.

290. Mike Soraghan, *Earthquakes: Disconnects in Public Discourse Around 'Fracking' Cloud Earthquake Issue*, ENERGYWIRE (Apr. 23, 2012), http://www.eenews.net/public/energywire/2012/04/23/3.

291. *Id.*

292. Kraig Grahmann, *Subsurface Trespass at a Crossroads: Environmental Processing Systems,* L.C. v. FPL Farming Ltd, 27TH ANNUAL LAW INSTITUTE FOR ATTORNEYS AND LANDMEN, at H-7 (S. Tex. Col. of Law ed., 2014).

293. *Id.*

294. Chance v. BP Chems., Inc., 670 N.E.2d 985, 993 (Ohio 1996).

295. West Edmond Salt Water Disposal Ass'n v. Rosecrans, 226 P.2d 965, 969–70 (Okla. 1951).

296. Boudreaux v. Jefferson Island Storage and Hub, LLC, 255 F.3d 271, 271–272, 275 (5th Cir. 2001).

297. Baumgartner v. Gulf Oil Corp., 168 N.W.2d 510, 516–17 (Neb. 1969).

This is particularly true for an activity that arguably cannot be accurately described as "ultrahazardous." Of all underground activities, injection of fluids through waste disposal wells is probably the closest analog to fracing. "Underground injection" is defined as the "subsurface emplacement of fluids by well injection."[298] Far from being an "ultrahazardous" activity, waste disposal wells are commonplace and are regulated by the Safe Drinking Water Act ("SDWA") through the Underground Injection Control ("UIC") program. The SDWA establishes six (6) classes of wells with class II wells and states can obtain primacy over their own UIC program if they submit a proposed UIC program to the EPA for approval and the EPA does not determine that the state's UIC program fails to meet the SDWA's standards. If approved, the state[299] has primacy, administers the program, and has responsibility for regulation and enforcement. Under the SDWA and the EPA's associated rules, for a state program to be approved, states must prohibit underground injection unless it is authorized.[300] As discussed above in Section I, approved waste disposal operations are largely exempted from application of the common law rules to trespass without evidence of actual damage. Similarly, the common law definition of an "ultrahazardous activity" has not hitherto successfully been latched onto waste disposal through injection wells in modern times.[301] Likewise, fracing operations, like the exploration and drilling activities of which they are a part, are governed by the states on state and private lands, and would hardly qualify as an "ultrahazardous" activity.

3. The Negative Rule of Capture

Courts have come up with three separate justifications for applying the rule of capture to secondary and tertiary stimulation methods. The first was the power of the state energy regulatory agency to sanction such conduct, using the police powers delegated to it by the state legislature.[302] The second justification is that the *ad cœlum* doctrine below ground is not applied as strictly as it is to surface invasions allowing the rule of capture to govern.[303] The third is what courts have called the negative rule of capture.[304] It states that since a landowner is capable of capturing oil and gas that has migrated from an adjoining property, the landowner is also allowed to inject into the formation substances, which can displace valuable hydrocarbons and replace them with less valuable substances.[305] Secondary and tertiary recovery methods operate under the negative rule of capture largely because they do not strip the

298. 42 U.S.C. § 300h(d)(1) (2013).

299. *See UIC Program Primacy*, U.S. ENVTL. PROTECTION AGENCY, http://water.epa.gov/type/groundwater/uic/Primacy.cfm (last updated May 13, 2015) (containing the EPA maintained website that tracks which states (and tribes) have state-only, dual state/EPA (or dual tribal/EPA), or EPA-only primacy programs for all covered injection well categories).

300. *See* 40 C.F.R. § 145.11(a)(5) (2014).

301. The authors speculate this may change if significant earthquake activity can be traced to waste injection wells.

302. Clifton A. Squibb, *The Age of Allocation: The End of Pooling As We Know It?*, 45 TEX. TECH L. REV. 929, 938 (2013).

303. Pierson v. Post, 3 Cai. 175, 179 (N.Y. Sup. Ct. 1805).

304. R.R. Comm'n of Tex. v. Manziel, 361 S.W.2d 560, 568 (Tex. 1962).

305. *Id.*

adjacent property owner of his or her remedy, which is the ability to resort to self-help.

If the rule of capture does not shelter a party from trespass liability then it could have the effect of transforming wells drilled in conventional reservoirs that previously operated under the rule of capture, to later being subject to trespass liability. This would occur when a well was originally drilled using the natural pressure of the reservoir as the means of production, and then later utilizing fracing to produce the remaining hydrocarbons in that reservoir. The *Stone* case referenced *Peterson v. Grayce Oil Co.*, making it appear as if *Peterson* stood for the proposition that the rule of capture only applies whenever oil and gas flows across property lines through the use of "solely through the operation of natural agencies in a normal manner, as distinguished from artificial means applied to stimulate such a flow."[306] Although the 1936 *Peterson* case did state this in dictum, the case in whole and subsequent decisions by courts in Texas and around the country that this just is not the case.[307]

This difference in perspective is supported by the development of the negative rule of capture, formally defined in Texas case law as:

> Just as under the rule of capture a land owner may capture such oil or gas as will migrate from adjoining premises to a well bottomed on his own land, so also may he inject into a formation substances which may migrate through the structure to the land of others, even if it thus results in the displacement under such land of more valuable with less valuable substances (*e.g.*, the displacement of wet gas by dry gas).[308]

The *Manziel* Court ended its discussion on subsurface trespass by holding "[t]he orthodox rules and principles applied by the courts as regards surface invasions of land may not be appropriately applied to subsurface invasions as arise out of the secondary recovery of natural resources"[309] thus stating that secondary recovery methods do not constitute a subsurface trespass.

The attention of the Court in *Manziel* then turned to whether the RRC "in the valid exercise of its authority to prevent waste, protect correlative rights, or in the exercise of other powers within its jurisdiction"[310] could license activity that otherwise would constitute a subsurface trespass. Here the Court bluntly stated that "[t]he technical rules of trespass have no place in the consideration of the validity of the orders of the Commission."[311] The Legislature, by delegating to the RRC the power to regulate oil and gas development, has extended the force of the state's police powers to such decrees within the RRC's jurisdiction, giving the RRC the

306. 37 S.W.2d 367, 371 (Tex. Civ. App. 1931), *aff'd*, 98 S.W.2d 781 (Tex. 1936).

307. Peterson v. Grayce Oil Co., 37 S.W.2d 367, 370 (Tex. Civ. App. 1931), *aff'd*, 98 S.W.2d 781 (Tex. 1936) (noting that the jury appeared to in fact decide this case on the belief that Rule 40 allowed the RRC to order the discontinuing use of an otherwise grandfathered vacuum pump when it found that the use was "injurious to the producing formations or in conflict with the Conservation laws of this State").

308. *Manziel*, 361 S.W.2d at 568.

309. *Id.* at 568.

310. *Id.*

311. *Id.* at 568–69.

"power [to] invade the right of the owner of the land to the oil in place under his land as long as it is based on some justifying occasion, and is not exercised in an unreasonable or arbitrary manner."[312] This recognition of the delegation of power to the state oil and gas regulatory agency answers the issue originally raised in *Gregg*, wherein the Court said "we do not regard the holding as authority for the proposition that the type of deliberate action here involved for the purpose of increasing production even across property lines would not be a trespass, or as authorizing the [RRC] to license such action [referring to fracing]."[313] By the Court's recognition that "[t]he orthodox rules and principles applied by the courts as regards surface invasions of land may not be appropriately applied to subsurface invasions as arise out of the secondary recovery of natural resources" in *Manziel*, [314] the Court seems to make clear that as long as the Legislature grants the RRC the authority to regulate fracing, the RRC's power trumps any underlying subsurface trespass claim, thus giving the RRC the power to sanction such activity.

Fracing is no more invasive than other secondary and tertiary recovery methods of extraction over which the rule of capture casts its protective wing.[315] While fracing may result in the permanent placement of material within the pore space of an unpermitted tract (proppant and fracing fluid, approximately half of which appears to stay in the formation),[316] this is no different than material left in unpermitted tracts after CO_2 flooding or other intrusive enhanced oil recovery process. Since the dynamics in the reservoir and the remedies available to the adjacent landowner appear no different when fracing is employed than when other secondary and tertiary methods are used, the rule of capture should shelter the capturing party from trespass liability just as it does with other secondary and tertiary recovery methods.

4. *The "Traditional" Trespass Model*

While the length of the fractures resulting from an episode of hydraulic fracturing can be measured by microseismicity surveys as the fractures propagate into the strata, actually predicting the length of the fractures of planned surveys is a function of the lithology present, the survey pressure used, the formation pressure encountered at depth, the type of fracing fluid and proppant, and (possibly) other factors and is an inexact process.[317] Often times, a geologist's prediction of average

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312. *Id.* at 572.

313. Gregg v. Delhi-Taylor Oil Corp., 344 S.W.2d 411, 417 (Tex. 1961).

314. R.R. Comm'n of Tex. v. Manziel, 361 S.W.2d 560, 568 (Tex. 1962).

315. For example, water- or CO_2-flooding.

316. Terry Engelder, et al., *The Fate of Residual Treatment Water in Gas Shale*, Journal of Unconventional Oil & Gas Resources, May 20, 2014, Vol. 7 at 45–46 (Noting that when capillary and osmotic forces are considered, no forces exist to cause material injected into a prospective shale formation during fracing operations to migrate from gas shale along natural pathways. In fact, the authors state, the risk of fracing fluid migration could actually be *reduced* by the reduction in gas pressure by gas production, not increased, but that either migration scenario is unlikely because the capillary seals surrounding the prospective formation will be as effective in preserving its underpressured state as they have been in protecting its overpressured state prior to hydrocarbon production).

317. *See generally* Les Bennett et al., *The Source for Hydraulic Fracture Characterization*, OILFIELD REV. (Winter 2005/2006), http://www.slb.com/~/media/Files/resources/oilfield_review/ors05/win05/04_the_source_for_hydraulic.pdf.

fracture length involves a mere estimate derived from prior observations, such as "up to 6 ft (1.8 m) in length, plus or minus 1 ft. (0.3 m)" with the approximating language indicating the length of a typical fracture uncertainty.[318] If trespass jurisprudence considers it a trespass if any significant number of fractures cross the barrier between properties and enter an unpermitted tract, a company operating in such a regime and faced with a "plus or minus 500 feet" engineer's report regarding a planned fracing operation would likely design their fracing operation so that the fractures would be estimated to end 500 feet from the vertical boundary with the unpermitted tract. Assuming the accuracy of such petroleum engineering estimates, this would, in most instances, leave a zone of unrecovered petroleum between 0 and 1000' feet in thickness. Such zones of unrecovered hydrocarbons would, in the aggregate, constitute mass waste.

Professor Keith Hall has promoted one possible solution to the fracing trespass issue he called the "Traditional" model to hydraulic fracturing intrusion.[319] This idea acknowledges the inexactitude of fracture length prediction and is rooted in the traditional concept of trespass as a claim to protect and promote a mineral owner's right to exclusive possession and control of his mineral estate while being consistent with the rule that injected waste that travels across a property boundary is typically not a trespass.[320] Professor Hall applied this model to both "near border" intrusions and intrusions further into the unpermitted tract past the "near border" zone measured with regards to the length of typical fracture uncertainty.

Generally, this model allows for trespass liability for fractures only if the operator either designed the fractures to reach beyond the boundary with the unpermitted tract or negligently caused the fractures to cross the boundary with the unpermitted tract. By "designed," it is meant that if the planned fracing operations are predicted by the petroleum engineers on the project to produce fractures that, on average, will cross the boundary into the unpermitted tract, the survey is designed to intrude over the boundary, and a trespass has occurred. The model's focus, however, is on reciprocity regarding the exclusive zone of control. As Professor Hall puts it, "a person would not have a claim for subsurface trespass unless there was an intrusion into an area where he could exercise exclusive use without risking that he will intrude into another person's subsurface." For example, if both parties (or their lessees) on either side of a tract boundary have fracing surveys that result in fractures that are predicted by their respective engineers to extend 3000 feet on average, plus or minus 500 feet, then neither party (or their lessees) would have a trespass claim for fractures that extend 500 feet or less into the other party's tract.

The "Traditional" trespass model elegantly blends petroleum engineering and oil and gas trespass jurisprudence in a number of ways. First, focus remains on a mineral owner's right to exclusive possession and control of his mineral estate so that his correlative rights are protected and waste caused by overzealous observance

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318. *See* BYRON R. KULANDER ET AL., FRACTURED CORE ANALYSIS: INTERPRETATION, LOGGING, AND USE OF NATURAL AND INDUCED FRACTURES IN CORE (Am. Ass'n of Petroleum Geologists, Methods in Exploration Ser. No. 8, 1990).

319. *See* Hall, *supra* note 275.

320. *Id.* at 400–402 (noting that liquid waste that is deposited in deep formations via an injection well that thereafter flows across a property boundary is not a trespass unless it inhibits the mineral owner of the unpermitted tract from realizing the full possible value of his minerals).

of common law trespass that leaves reserves along tract boundaries is prevented. This is done without crafting rules and exceptions that focus instead on whether material is intruding into and being deposited within an unpermitted tract, as in the case of waste disposal wells that do not affect mineral development and the exception to trespass that had to be carved out of the traditional trespass and trespass on the case common law jurisprudence. Second, and on a related note, the model would seem to encourage developers on neighboring tracts to work together to avoid overlapping fracture zones and ensure optimal spacing of fracture operations.

Fact questions, however, will present trial courts applying the "Traditional" trespass model with a multitude of practical problems. The first is heterogeneity in the mechanical qualities or structural aspects of the target strata that may give rise to a small number of fractures that extend well beyond the estimated range of error. The current technique to record the actual lateral extent of fractures is microseismicity. As described above, this technique presents a multitude of data points. Out of thousands of data points, some scattered outliers, representing extra-long fractures, will seemingly always extend past the range of the "plus or minus" footage. Courts, if they are satisfied with the concept of the "Traditional" model and the predicted "average" lengths to a fracture need to recognize that such isolated fractures crossing the boundary into an unpermitted tract do not necessarily mean that the "Traditional" model has somehow failed and that a trespass has, in fact, occurred.

Second, if the "Traditional" trespass model is used, certain evidentiary problems could surface. Courts should expect cases where each party presents different accounts on what the estimated average length of the fracing surveys and the margin for error should have been, with the plaintiff alleging trespass arguing that the average fracture length estimation of the defendant was too small and that its own longer average fracture length estimation was correct. This would have the effect of a claim for subsurface trespass where the defendant, perhaps mistakenly, intruded with his fractures into an area where only the plaintiff could exercise exclusive use without risking that he, in turn, would intrude into the defendant's subsurface.

5. The Dimension Test: Nuisance v. Trespass

Is fracing a nuisance or a trespass? Is it both or neither? Such a determination has been made in mineral jurisprudence through use of the "dimensional test" which avoided the necessity of determining whether the intrusion was "direct" and "substantial."[321] Generally, the dimensional test provided that if the intruding substance could be seen by the naked eye, the intrusion was a categorized as a trespass, but otherwise the intrusion was classified a nuisance.[322] Direct invasions brought strict liability—damages were presumed.[323] Successful actions for indirect invasions, however, required proof of substantial damage to an "exclusively

321. *See, e. g.*, 1 HARPER & JAMES, TORTS, § 1.23 (1946) (where the "dimensional" or the "tangible/intangible" test is included in an earlier definition of trespass and nuisance); *see also* Borland v. Sanders Lead Co., Inc., 369 So. 2d 523, 527 (Ala. 1979).

322. *Borland*, 369 So. 2d at 527.

323. Babb v. Lee Cty. Landfill S.C., LLC, 747 S.E.2d 468, 478 (2013).

possessed" interest in the intruded tract arising from an intentional act with knowledge that such damage was reasonably likely.[324]

While it seems most jurisdictions have rejected the division between trespass and nuisance embodied in the dimensional test, can fracing be considered a nuisance and not a trespass as fracing takes place thousands of feet below the surface and cannot be seen by the naked eye? The responsibility would, therefore, fall to the owner of the unpermitted tract to bring the more difficult action for an indirect invasion. The question might then become the following: can the oil and gas removed through fracing from an unpermitted tract be considered "exclusively possessed" when it is subject to the rule of capture and has not been reduced to the personal property of the owner of the unpermitted minerals by the drilling of a well on the unpermitted tract itself? Most likely not.

6. Fugaciousness—the Only Criteria?

Just as Justice Bailey recognized in *Stone*,[325] reservoir geology is an important factor that must be taken into consideration. Prior to fracing a well drilled into an unconventional 'tight' reservoir, the oil and or gas are held in place by low permeability.[326] The *Stone* decision suggested that since the oil and gas in tight reservoirs are not fugacious prior to fracing being conducted, oil and gas in unconventional reservoirs should be treated like non-fugacious minerals under the *ad cœlum* doctrine. Treating oil and gas this way would mean the owner of the estate the hydrocarbons exist in would have a possessory interest in said minerals without the qualified need to reduce them to possession.[327] One problem with this argument is that oil and gas in all reservoirs, given a large enough scope, can be described as non-fugacious. For instance, prior to penetrating the caprock in a conventional reservoir, the oil and gas due the pressure in these reservoirs are not fugacious. It is not until the caprock is penetrated that a low pressure gradient around the annulus is created, allowing the oil and or gas to become capable of migration.[328]

Questions, then, are raised about whether the degree to which a substance is or becomes fugacious should be the sole basis for determining whether the rule of capture should be applied or not. If a substance is capable of becoming fugacious solely through a drilling and completion method without the use of chemicals to change significantly the form of the mineral itself in its natural state,[329] the rule of

324. *Borland*, 369 So. 2d at 529.

325. *See generally* Stone v. Chesapeake Appalachia, LLC, No. 5:12-CV-102, 2013 WL 2097397, at *6–7 (N.D. W.Va. Apr. 10, 2013).

326. *See e.g.*, *Unconventional Resources*, CGG.COM, http://www.cgg.com/default.aspx?cid=3501 (last visited Sept. 6, 2015).

327. *See* Del Monte Mining & Milling Co. v. Last Chance Mining & Milling Co., 171 U.S. 55, 91 (1898).

328. Elliff v. Texon Drilling Co., 210 S.W.2d 558, 561 (1948) ("[C]ourts generally have come to recognize that oil and gas, as commonly found in underground reservoirs, are securely entrapped in a static condition in the original pool, and, ordinarily, so remain until disturbed by penetrations from the surface. It is further established, nevertheless, that these minerals will migrate across property lines towards any low pressure area created by production from the common pool.").

329. In contrast to uranium mining techniques that liquefy the ore targeted for yellow cake extraction, bringing it to the surface as "pregnant liquor."

capture, reined in by conservation regulations and the laws of negligence, should perhaps apply. Thus, if the practice—like fracing—merely enhances permeability and frees up the mineral so that it can now travel to the annulus, the rule of capture should still apply. The rule of capture should not apply in situations such as *in situ* mining and other like processes.[330] Non-hydrocarbon minerals such as uranium, which are found in place but are capable of being made fugacious through the use of a chemical process, should remain under application of *ad cœlum* and the laws of trespass.

7. Modernizing *Ad Cœlum*

The *ad cœlum* doctrine still has its place in the theory of real property law. The estate owner has a qualified ownership interest in the oil and gas (and now in Texas, groundwater[331]) within the boundaries of its estate. As the *Stone* court pointed out, "[u]nder West Virginia law, to constitute a trespass, the defendant's conduct must result in an actual, nonconsensual invasion of the plaintiff's property, which interferes with the plaintiff's possession and use of that property."[332] Trespass has also been defined by West Virginia courts as "an entry on another man's ground without lawful authority, and doing some damage, however inconsiderable, to his real property."[333] When proppant and fracing fluid are lodged within fractures extending into the subsurface of an unpermitted tract, there is little doubt that some kind of *de minimus* intrusion and potential interference with that tract owner's possessory interest is occurring.

Coming to the conclusion that a trespass has occurred should not be the end of the analysis, however, as it seemed to be in *Stone*. Strict adherence to the *ad cœlum* doctrine has over time been abrogated by the courts in certain circumstances. Technological improvements have made it increasingly difficult to allow for absolute protection of one's property interest from the heavens to the earth's core in every instance. The U.S. Supreme Court has stated rather bluntly that the *ad cœlum* doctrine "is [an] ancient doctrine that at common law ownership of the land extended to the periphery of the universe . . . But that doctrine has no place in the modern world."[334] While the *ad cœlum* doctrine is not homeless in the modern world, the doctrine should be relaxed when a competing theory or doctrine causes less economic harm to all than would be the case if *ad cœlum* were strictly applied.

330. *See generally*, *In Situ Leach (ISL) Mining of Uranium*, WORLD NUCLEAR ASSOCIATION, http://www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Mining-of-Uranium/In-Situ-Leach-Mining-of-Uranium/ (last visited Sept. 6, 2015) (noting that *in situ* mining involves the use acid or alkali which is "pumped into the aquifer via a series of injection wells where it slowly migrates through the aquifer leaching the uranium bearing host sand on its way to strategically placed extraction wells where submersible pumps pump the liquid to the surface for processing").

331. Edwards Aquifer Auth. v. Day, 369 S.W.3d 814, 829 (Tex. 2012).

332. Stone v. Chesapeake Appalachia, LLC, No. 5:12-CV-102, 2013 WL 2097397, at *7 (N.D. W.Va. Apr. 10, 2013); Rhodes v. E.I. DuPont De Nemours & Co., 636 F.3d 88, 96 (4th Cir. 2011).

333. Patrick v. PHH Mortgage Corp., 937 F. Supp. 2d 773, 793 (N.D.W. Va. 2013); *see also* Hark v. Mountain Fork Lumber, 34 S.E.2d 348, 352 (W. Va. 1945); Perrine v. E.I. du Pont de Nemours & Co., 694 S.E.2d 815, 846 (W. Va. 2010) (quoting RESTATEMENT (SECOND) OF TORTS § 892A (1) (1979)).

334. United States v. Causby, 328 U.S. 256, 260–61 (1946) (This case is commonly cited for the proposition that a Congress can create laws that encroach upon a person's possessory interest in land without such act resulting in a regulatory taking.).

Allowing the strict application of *ad cœlum* would likely make many producers reluctant to drill wells in unconventional reservoirs near opposing property lines due the possibility of increased transactional costs and reduction in production as a result of conversion liability. This reluctance ultimately results in waste because producers would rather apply their capital to less potentially litigious ventures.

The *Stone* case referenced *Young v. Ethyl Corp.*,[335] which stated that the rule of capture was created "primarily" due to the difficulty of determining the original location of oil and gas migrating through a common reservoir.[336] Although courts and commentators[337] have cited this difficulty as support for the application of the rule of capture, it is not the only—or even the primary—justification. The rule of capture originally derived from hoary cases of yore like *Pierson v. Post*[338] wherein the court majority wanted to establish a motivation to eradicate "noxious" foxes in addition to the more mundane task of determining the ownership of one fox pelt. Nothing in *Post* suggests that the rule of capture came into existence due to the difficulty of determining the location from which the fox migrated in order to establish which party was the first in pursuit. The court certainly did not want to reward hunters for simply making desultory efforts to start a lackluster pursuit but instead, wanted to reward the party who took the affirmative act of reducing the fox to possession at a time when eliminating such "noxious beasts" was seen as a public good. In adopting the rule of capture for fugacious substances, American courts embraced the premise that it is was not merely enough that your land contains fugacious substances, you must exercise your rights to reduce them to possession.[339] Courts have acknowledged that while modern geologic techniques have improved to the point where one can determine the amount of migration that occurs within a single common reservoir, the doctrine has been largely left undisturbed.[340] Additionally, the need to vigorously exercise one's rights to actually reduce hydrocarbons to possession, subject to state's conservation laws, is an equally persuasive and independent justification for the continued use of the rule of capture, as is the desire to avoid having to determine from whence produced hydrocarbons migrated.

IV. SEISMIC EXPLORATION AND FRACING—A TRESPASS COMPARISON

Can—and should—a single body of trespass jurisprudential principles apply to seismic reflection surveys and fracing? Should it be extended to other underground activities such as waste injection wells and underground gas storage that arguable result in a potential trespass? Fracing and seismic reflection exploration

335. 521 F.2d 771 (8th Cir. 1975).

336. *See id.* at 774 (concluding that the rule of capture should not apply in the instance in the production of commercial-grade brine using a process similar to waterflooding where water is injected in some wells in order to displace the desired brine toward a producing well).

337. *See* Brown v. Humble Oil & Ref. Co., 83 S.W.2d 935, 940 (1935); *see also* 1 W.L. SUMMERS, THE LAW OF OIL AND GAS, 174–76 n.37 (1954).

338. 3 Cai. R. 175, 179 (N.Y. Sup. Ct. 1805).

339. Knighton v. Texaco Producing, Inc., 762 F. Supp. 686, 689 (W.D. La. 1991), *aff'd*, *sub nom.* Knighton v. Texaco Producing Inc., 988 F.2d 1209 (5th Cir. 1993).

340. *Id.*

are two fundamentally different types of operations conducted for different reasons at different times in the exploration and production history of any prospect and as a result, traditional trespass jurisprudence should not be applied uniformly to both. Ultimately, fracing should have protection from trespass claims if approved by conservation commissions so as to promote enhanced recovery operations and prevent waste.

Fracing is a completion process (or an enhanced recovery operation when done on an existing well) that essentially draws hydrocarbons from much further and in much greater quantities than would be possible without it. Concern about fractures crossing into an unpermitted tract, where microseismicity (or similar) can accurately image the length and geometry of the fractures, and within a jurisprudential regime that applies traditional strict liability trespass will undoubtedly cause operators to be cautious and to probably err on the side of avoiding trespass. This will then likely result in waste as reserves are left undeveloped.

In contrast, seismic reflection data involves no production and is not an activity that triggers much concern among conservation agencies about preventing waste and protecting correlative rights.[341] In addition, compared to currently practiced fracing techniques, the extent of the area covered by a seismic reflection survey is easily controlled, both in the field during data collection and later when data is "blacked out" during processing.[342] An errant fracture, perhaps just one of thousands, that exceeds the estimated fracture length for the survey and enters an unpermitted tract because of undetectable geologic heterogeneities cannot be "blacked out" during a processing step. Courts must recognize this difference before holding *any* entrance by *any* isolated fracture into an unpermitted tract is trespass.

Another conceptual difference between fracing and seismic reflection lies in the point source of the alleged trespass. Fractures generated by a fracing operation crossing into an unpermitted tract necessarily are sourced from a neighboring (presumably leased) mineral estate. Seismic reflection data is typically gathered from the surface.[343] Fracing that affects an unpermitted tract's mineral estate therefore typically does not affect an interest in the severed surface estate of the unpermitted tract unless a surface owner's use of the pore space below is harmed—provided the surface owner owned the pore space in the particular jurisdiction.

Because fracing and seismic reflection are different operations, conducted with different motivations, the allure of a common application (or non-application) of trespass fundamentals to both methods may be ill-advised. Differences between the two methods are multitudinous. Fracing involves invoking a change in the structure of the strata so targeted—the actual fractures—as well as possibly detecting

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341. Seismic surveys do affect the surface, of course, as establishment of sources and receivers require traversing the surface with personnel and vehicles. This use damages the surface—another type of waste.

342. Although seismic reflection data from unpermitted tracts is sometimes collected during seismic surveys, the computers that collect and store the received signals can delete the stored data attributable to the unpermitted tract before it is seen by an interpreter.

343. Check-shot surveys and similar processes are an exception to this as they involve lowering receivers downhole. *See* Definition of Check-Shot Survey, *Oilfield Glossary*, SCHLUMBERGER.COM, http://www.glossary.oilfield.slb.com/en/Terms/c/check-shot_survey.aspx (last visited Sept. 22, 2015) (noting that check-shot surveys and similar processes are an exception to this as they involve lowering receivers downhole).

and even causing changes to the stress fields of the affected rock formations.[344] Seismic reflection causes no such changes unless the seismic charges themselves disturb the unpermitted tract—a rare scenario. Fracing involves the physical invasion and deposition of fracing fluid and proppant into the unpermitted tract, raising a classic scenario of trespass by both the entrance and the act of leaving something on the trespassed land.[345] Again, seismic reflection does nothing of the sort.

On the other hand, seismic reflection data is just that—data that itself can be a trade secret, even at common law.[346] While the process of how a particular type of fracing operation is conducted is typically a closely held industry secret,[347] and while fracing does provide information about the strata being fractured, such as confirmation of the lithology predicted from wells logs and seismic data, processed and interpreted seismic data is more helpful in identifying desirable exploration targets or in condemning entire tracts as less viable for exploration purposes. Fracing is primarily a development tool used once a target stratum has been identified. Seismic reflection data can help find the target itself.

As described above, several cases in various states have found damages even though the conservation commission has approved unit operations, with the cause of action resting in trespass as well as nuisance, strict liability, or even confiscation.[348] Ultimately, however, while fracing into an unpermitted tract constitutes a technical trespass under the strict liability trespass jurisprudence of antiquity, the combination of: (a) reserve waste (in the form of reserves left in the target formation due to fracing operations that have their possible extent curtailed due to concern over liability), (b) surface waste (in the form of extra drilling and fracing over what would have been necessary sans fracing trespass worries), (c) the similarity of fracing to other processes, such as CO_2 or waterflooding, as an enhanced recovery process, (d) the desire to avoid difficult and fact-intensive litigation rife with expert witness testimony, and (e) the importance of maintaining the momentum of increasing domestic production, all auger in favor of placing fracing in the same category of unactionable trespass as other state-permitted completion and enhanced recovery operations.

The application of such strict liability trespass jurisprudence should only be supported where (a) a particular fracing operation has not been authorized by the state conservation commission, (b) the mineral owner making the trespass claim was not given an opportunity to join in the pool or unit upon the determination by the

344. *See, e.g.*, John D. Bredehoeft et al., *Hydraulic Fracturing to Determine the Regional in Situ Stress Field, Piceance Basin, Colorado*, 87 GEOLOGICAL SOC'Y AM. BULL., 250, 250 (1976).

345. *See, e.g.*, Lawrence Cathles, American Geophysical Union Fall Meeting, The Complex Physical-Chemical Interaction of Fracking Fluids with Gas Shale, NG21B-01, Dec. 16, 2014 ([I]t is possible to recover only about 20% of the injected water.") https://agu.confex.com/agu/fm14/meetingapp.cgi#Paper/10549 (last visited Sept. 4, 2015).

346. *See generally In re* Bass, 113 S.W.3d 735, 737 (Tex. 2003). For case law describing seismic data as being covered by common law trade secret jurisprudence, see *Lamont v. Vaquillas Energy Lopeno Ltd., LLP*, 421 S.W.3d 198, 211 (Tex. App. 2013) (citing Reliant Hospital Partners, LLC v. Cornerstone Healthcare Group Holdings, Inc., 374 S.W.3d 488, 499 (Tex. App. 2012)).

347. Interview with Curtis Leonard, CEO of ICA Energy, Inc., in Midland, Texas (July 22, 2013).

348. *See* Hartman v. Texaco Inc., 1997-NMCA-032, 937 P.2d 979; Greyhound Leasing & Fin. Corp. v. Joiner City Unit, 444 F.2d 439 (10th Cir. Okla.1971); Mowrer v. Ashland Oil & Ref. Co., 518 F.2d 659 (7th Cir. Ind. 1975).

conservation commission that drainage was imminent, *and* (c) actual trespass can be satisfactorily proven with data supplied by a microseismicity survey or other evidence that either shows (i) the fractures' actual entrance into the unpermitted tract *or* (ii) the fracing survey causing the alleged trespass was designed such that the fractures were likely to enter into the unpermitted tract. Since the primary two missions of any conservation commission is to prevent waste and to protect correlative rights,[349] authorizing fracing operations and regulating the formation of pools that equitably divide the production between all tracts undergoing drainage should alleviate the worry for producers of common law trespass actions.

To make an accurate determination that drainage was imminent in an unpermitted tract, the conservation commission could require presentation of data by fracing permit seekers describing the best estimate of the drainage area caused by the proposed fracing operations, but only if collection of such data was feasible and the drainage area interpretations reliable. If this data was available and reliable, then the conservation commission can certainly better establish a pooling, spacing, and density scheme that prevents waste and protects correlative rights than a trial court responding to an unpermitted tract owner's claim for alleged fracing trespass. Operators under this scheme of expanded conservation commission power would not be liable to mineral owners of unpermitted tracts who refuse a fair opportunity to participate in the project even though the fracing drained fluid from the unpermitted non-joiner's tract.

Fracing, like other secondary and tertiary recovery processes, should have protection from trespass claims if approved by conservation commissions so as to promote enhanced recovery operations, which are conducted to prevent underground, surface, and economic waste. Such an approved plan must give a mineral owner (or his lessee) that declines to join the operation a fair share of secondary recovery oil and gas from his tract. Determining each mineral owner's fair share of expenses, however, can stand in the way of realizing voluntary participation in a unitization plan. Given the nascent ability of operators to predict or measure the boundary of strata affected by a particular fracing operation, plus the typical problems related to achieving voluntary unitization, it may be some time until state agencies feel confident determining the extent of a fracing operation.

CONCLUSION

Seismic reflection surveys are much different than fracing operations, and are conducted for different reasons at different points in the production and exploration cycle. The geographical extent over which seismic reflection data is acquired is currently much more easily controlled than the extent of the fractures caused by a fracing operation. Until the extent of fracing operations can be shown to be as consistently controllable as the extent of seismic reflection surveys, trespass claims arising from fracing operations allegedly crossing into an unpermitted tract should not be compared to seismic trespass claims. In addition, seismic reflection data that happens to be gathered over an unpermitted tract can be eliminated in the

349. *See, e.g.*, *Regulation Under the Oil and Gas Division*, TEX. RAILROAD COMMISSION, http://www.rrc.state.tx.us/about-us/organization-activities/divisions-of-the-rrc/oil-gas-division/ (last visited Sept. 4, 2015).

processing stage before an interpreter ever sees it. The ultimate extent of a fracing operation cannot be culled in a similar way—an actual change in the strata has been made that cannot be undone.

More broadly, is fracing that affects an unpermitted tract even a trespass? Classic trespass—trespass *quare clausum fregit*—is defined as a tort consisting of doing one of the following on an unpermitted tract: entering upon the unpermitted tract; remaining on the unpermitted tracts; and placing or projecting any object upon the unpermitted tract.[350]

It could be argued that fracing falls within the definition of common law trespass as fracing is necessarily conducted intentionally, and the fracing proppant and water enter into the unpermitted tract and a portion remains after the process is complete. Dicta to this effect is found in *Gregg*,[351] but was overturned in *Garza*, the decision of which turned directly on the issue of subsurface trespass caused by fracing.[352] Under the modern approach, as seemingly endorsed by *Garza,* and definitely by this article, strict liability, formerly associated with trespass, now requires proof of negligence unless the defendant is engaged in an activity that is classified as being "ultrahazardous."[353] Although "Texas does not recognize a cause of action of strict liability for 'ultrahazardous' or 'abnormally dangerous' activities,"[354] other jurisdictions do recognize such a cause of action, so it still remains unclear how courts will rule on this issue.[355]

At some point, New Mexico courts will be presented with a case with facts similar to *Garza* and *Stone* that will ask what the law in New Mexico is regarding the fracing trespass. Perhaps this case will come freighted with microseismicity data that provides evidence that some of the defendant's fractures actually crossed the boundary into the plaintiff's unpermitted tract, carrying with them proppant and fracing fluid or gel. As the *Snyder* case suggests, while New Mexico appears to have given judicial approval of the injection of saltwater into the disposal well, it certainly has not approved "tortious conduct" or "negligence or nuisance which flows from the licensed activity [saltwater injection]." This is an expected result from a state with long experience in dealing with oil and gas law, especially when considering that not only saltwater injection but also seismic acquisition[356] and natural gas storage[357] have been commonly excused from the realm of common law nuisance and trespass.

350. *Trespass quare clausum fregit*, BLACK'S LAW DICTIONARY 732 (3d pocket ed. 2006).

351. Gregg v. Delhi-Taylor Oil Corp., 344 S.W.2d 411, 416 (Tex. 1961).

352. Coastal Oil & Gas Corp. v. Garza Energy Trust, 268 S.W.3d 1, 9 (Tex. 2008).

353. Frona M. Powell, *Trespass, Nuisance, and the Evolution of Common Law in Modern Pollution Cases*, 21 REAL EST. L.J. 182, 187 (1992).

354. Prather v. Brandt, 981 S.W.2d 801, 804 (Tex.App. 1998) ("[E]xception is for products liability or dangerous animals.").

355. *See* Tucker v. Sw. Energy Co., No. 1:11-CV-44-DPM, 2012 WL 528253, at *3 (E.D. Ark. Feb. 17, 2012); Fiorentino v. Cabot Oil & Gas Corp*.,* 750 F. Supp.2d 506, 511–12 (M.D. Pa. 2010); Berish v. Southwestern Energy Prod. Co.*,* 763 F. Supp.2d 702, 705 (M.D. Pa. 2011).

356. *See e.g.* Hunt Oil Co. v. Kerbaugh, 283 N.W.2d 131 (N.D. 1979).

357. *See e.g*. Texas American Energy Corporation v. Citizens Fidelity Bank & Trust Company, 736 S.W. 2d 25 (Ky. 1987).

The sting for producers lurking in the dicta of *Snyder* is the phrase " . . . however, such license does not authorize trespass . . . or other tortious conduct . . . ." If mere "trespass" in this context is defined as any entrance by fracing materials (fluid, gel, proppant) across the boundary of an unpermitted tract, and such a trespass is deemed an actionable transgression on the same level as "tortious conduct," then the *Snyder* court's subsequent observation that Snyder Ranches could seek redress for trespass does indeed suggest that an action could lie in strict liability traditional trespass for such an entry.

Another sting for producers, this time noteworthy by the absence of words, is the lack of any mention of any requirement for actual damages to be established for an actionable trespass claim.

For New Mexico courts to ensnare fracing within strict liability traditional trespass and, further, to equate it to negligence, nuisance, or other tortious activities would be double folly. First, for the reasons discussed above, the technologies of frac survey design and fracture length measurement are still undeveloped enough that fears of strict liability trespass would likely result in significant economic waste as producers erred on the side of caution by designing frac surveys that would leave behind considerable reserves near property boundaries. If state courts allow this expansion of the coverage of trespass jurisprudence, one the crucial missions of the New Mexico Oil Conservation Division—that of preventing waste—would be compromised.

Second, no evidence directly connects injection of fracing fluid into shale with significant and widespread contamination of potable water aquifers.[358] Since the potential for water contamination comes after fracing has occurred, and methods are being further developed to reuse, treat or contain used fracing fluid, fracing is best regulated as any other typical industrial process and not as an ultra-hazardous activity.

We hope for jurisprudence that lessens fears of difficult and expensive expert witness-laden fracing trespass litigation, strengthens domestic energy security, prevents the waste of reserves orphaned by fears of fracing trespass, and promotes responsible self-development by mineral owners.[359]

358. Environmental Protection Agency, *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources* at ES-6 ("We did not find evidence that [fracing operations] have led to widespread, systemic impacts on drinking water resources in the United States.") *Available at* http://www2.epa.gov/sites/production/files/2015-06/documents/hf_es_erd_jun2015.pdf

359. This article was edited by New Mexico Law Review Manuscript Editor Brenna Gaytan.