



**M** UNIVERSITY OF MICHIGAN

# Policy/Law Technical Report



HYDRAULIC FRACTURING IN THE STATE OF MICHIGAN

## ABOUT THIS REPORT

This document is one of the seven technical reports completed for the **Hydraulic Fracturing in Michigan Integrated Assessment** conducted by the University of Michigan. During the initial phase of the project, seven faculty-led and student-staffed teams focused on the following topics: **Technology, Geology/Hydrogeology, Environment/Ecology, Human Health, Policy/Law, Economics**, and **Public Perceptions**. These reports were prepared to provide a solid foundation of information on the topic for decision makers and stakeholders and to help inform the Integrated Assessment, which will focus on the analysis of policy options. The reports were informed by comments from (but do not necessarily reflect the views of) the **Integrated Assessment Steering Committee**, expert peer reviewers, and numerous public comments. Upon completion of the peer review process, final decisions regarding the content of the reports were determined by the faculty authors in consultation with the peer review editor. These reports should not be characterized or cited as final products of the Integrated Assessment.

The reports cover a broad range of topics related to hydraulic fracturing in Michigan. In some cases, the authors determined that a general discussion of oil and gas development is important to provide a framing for a more specific discussion of hydraulic fracturing. The reports address common hydraulic fracturing (HF) as meaning use of hydraulic fracturing methods regardless of well depth, fluid volume, or orientation of the well (whether vertical, directional, or horizontal). HF has been used in thousands of wells throughout Michigan over the past several decades. Most of those wells have been shallower, vertical wells using approximately 50,000 gallons of water; however, some have been deeper and some have been directional or horizontal wells. The reports also address the relatively newer high volume hydraulic fracturing (HVHF) methods typically used in conjunction with directional or horizontal drilling. An HVHF well is defined by the State of Michigan as one that is intended to use a total of more than 100,000 gallons of hydraulic fracturing fluid. The reports indicate if the text is addressing oil and gas development in general, HF, or HVHF.

Finally, material in the technical reports should be understood as providing a thorough hazard identification for hydraulic fracturing, and when appropriate, a prioritization according to likelihood of occurrence. The reports do not provide a scientific risk assessment for aspects of hydraulic fracturing.

### Participating University of Michigan Units

Graham Sustainability Institute

Erb Institute for Global Sustainable Enterprise

Risk Science Center

University of Michigan Energy Institute

HYDRAULIC FRACTURING IN THE STATE OF MICHIGAN

# Technical Report on Policy/Law

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## EXECUTIVE SUMMARY

**A**s high-volume hydraulic fracturing and public concern have grown in the last few years, governments have begun to make policies specifically addressing hydraulic fracturing, and in some cases high-volume hydraulic fracturing. The details of these policies may be presented in informal statements of policy or guidance, or may be made binding in law through legislative action or agency rulemaking. Courts have also been called upon to resolve disputes, creating an additional source of law. This report is designed to inform the integrated assessment by describing the existing policies and laws that apply to oil and gas wells utilizing high-volume hydraulic fracturing in Michigan, explaining trends in policy approaches across the United States, and identifying challenges and opportunities inherent in policymaking in this area. The report then offers five pathways for interdisciplinary assessment of policy options.

The report takes a broad view, examining high-volume hydraulically fractured wells in light of the overall policy and legal framework governing oil and gas wells. This is for two reasons. It is important to understand the ways in which the general framework, when applied to high-volume hydraulically fractured wells, addresses the increased scale of the wells. In addition, the policies and laws specific to high-volume hydraulic fracturing supplement the general framework, and thus cannot be fully understood without that context.

The first section of the report discusses the status of the policies and laws that govern high-volume hydraulically fractured wells in Michigan, and then examines recent policy trends in the United States. The section begins by describing the federal, state, and local policies and laws—both general and specific in nature—that are applicable to a high-volume hydraulically fractured well in Michigan. After presenting the law on mineral ownership and leasing and providing an overview of the primary state permitting program, the section follows the arc of a well: from spacing and pooling; to siting and natural resource use; to well construction; to high-volume hydraulic fracturing and chemical use; to production and plugging; and finally to waste management. The section then describes policy trends at the federal, regional, state, and local government levels. Five areas of state policymaking are examined in further detail—public participation, land use, water withdrawals, chemical disclosure, and special protections for landowners—together with Michigan’s current and proposed policies.

The second section of the report identifies three primary axes that must be considered in making policy on high-volume hydraulic fracturing: the level of government, the policy or legal actor, and the policy approach. The section also identifies the underlying

challenge of uncertainty—both about risk and the direction of policy and law. To inform the analysis of policy options, the section presents the opportunities and challenges of the points along each axis.

Based on the above sections, the third section offers five prioritized pathways for an analysis of policy options. The first pathway—and the one the authors suggest should be the highest priority—is an analysis of the policy options for addressing public concern about chemical use. The second pathway is an analysis of the policy options for public participation in governmental decisions on high-volume hydraulic fracturing. The third pathway is an analysis of the policy options for addressing contamination, both prospectively and retrospectively. The fourth pathway is an analysis of the policy options for water withdrawals and potential impacts. And the fifth pathway is an analysis of the policy options for land use, both at the state and local level.

The authors would like to thank the five anonymous peer reviewers for their very helpful comments.

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## STATUS AND TRENDS

**T**his section of the report presents the current status of the federal, state, and local policies and laws governing high-volume hydraulically fractured oil and gas wells in Michigan, and the trends at each level. Historically, the policy and legal framework did not distinguish between hydraulically fractured wells and non-hydraulically fractured wells, other than to require reporting of the completion method. Nor did the framework distinguish between high-volume hydraulically fractured wells and low-volume hydraulically fractured wells. But as high-volume hydraulic fracturing has increased, governments have begun to adopt specific policies and laws.<sup>1</sup>

### 1.1 Status of Policies and Laws

The legal system treats oil and gas development as a unique activity in many ways, treatment that begins with the nature of the property right in oil and gas. This part of the section begins with the scope of the right and the way in which the right is conveyed through leasing. The section then introduces the primary regulatory program, the state oil and gas well permitting program, and the 2011 state policy on high-volume hydraulically fractured wells. Building on this foundation, the section describes two sets of laws that determine the location of wells: the state conservation measures designed to efficiently “conserve” or drain the reservoir; and the federal, state, and local measures that seek to protect natural resources and other land uses. From there, the section reviews the policies and laws governing the life of the well itself: state

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well construction standards, the bulwark of the state regulatory program; state review and reporting requirements on high-volume hydraulic fracturing; and state production reporting requirements and well plugging standards. This part ends with a discussion of the federal and state laws governing the back end of the life cycle, wastewater management.

### 1.1.1 Mineral Rights and Leasing

A private or public landowner traditionally owns both the “surface” of the land and the “mineral interest” in the oil and gas beneath the land.<sup>2</sup> Mineral rights may be severed from the surface, however, resulting in what is known at law as a “split estate.” In this case, the surface owner is not the same as the mineral interest owner. When there is a split estate, the mineral interest is the “dominant” interest.<sup>3</sup> The mineral interest owner has the right to reasonably use the surface to extract the oil and gas underneath, even if the surface owner is opposed.<sup>4</sup> Under the Dormant Minerals Act, any oil or gas interest not developed for more than twenty years will be deemed abandoned and will revert to the surface owner, unless the mineral interest owner files a notice of intent to retain the rights.<sup>5</sup>

In Michigan, the state Department of Natural Resources (DNR) is the largest owner of mineral interests. The state owns both the surface and the mineral interests of just over 4 million acres of state land, and also holds in trust mineral interests under 25 million acres of Great Lakes bottomland.<sup>6</sup> In addition, the state owns mineral interests below 2.3 million acres of private lands.<sup>7</sup> These private-public split estates are primarily the result of a historical artifact: the state became the owner of the lands during the Great Depression, and reserved the mineral interest when it later sold the property.<sup>8</sup> In 1998, Michigan enacted a law that allows surface owners to petition the DNR to buy the underlying mineral interest at fair market value.<sup>9</sup> The DNR is prohibited from selling the interest when there is already oil and gas production, the interest is leased or permitted for production, or there are unusual or sensitive environmental features.<sup>10</sup>

Unlike other natural resources such as coal or timber, the right in oil and gas is limited. The mineral interest owner has the reasonable opportunity to extract oil and gas, not a right to the specific oil or gas underneath the property. According to the “rule of capture,” recognized by Michigan and other states, a person who “captures” oil or gas is entitled to the extracted minerals even if the well drains oil or gas from an adjoining property.<sup>11</sup> Confronted with drainage, the adjacent owner’s “remedy under such circumstances is that of self-help: ‘go and do likewise.’”<sup>12</sup> This rule is balanced by the “fair share” principle, which restricts the rights of those who access a common reservoir. An owner has a duty not to act negligently in extracting gas or oil, or to act in a way that injures the reservoir itself.<sup>13</sup> As discussed below, the rule of capture is also softened by

state conservation measures that promote efficient extraction by limiting the placement and production of wells.

The owner of oil and gas rights generally leases those rights to an oil and gas exploration and production company with the expertise to drill wells and manage production.<sup>14</sup> Leases are negotiated between the owner and a “landman” who represents the company. Some of the standard provisions in a mineral lease include a description of the property interest being conveyed; the primary term in which the operator must begin specified activities or potentially lose the lease; a royalty to the mineral owner on any produced minerals; and a bonus, paid to a mineral owner when a lease is signed.<sup>15</sup> While the lessee has the right to reasonable use of the surface, the lease may include a provision on compensation for damage to crops or trees.<sup>16</sup> Unlike some other states, Michigan does not require lessees to pay for surface damages by statute. Most leases also contain a provision giving lessees the right to consolidate leased premises with adjoining leased tracts to form a “pool” or “unit,” which may be necessary to meet the minimum acreage requirement for a well permit under the state regulatory program.<sup>17</sup>

The DNR has its own leasing program for state mineral interests, whether below state or private lands. As the owner of the interests held for the benefit of the public, the DNR faces a careful balancing act: it seeks to maximize revenue and ensure that the oil and gas is not being drained by wells on adjacent properties, and at the same time to protect the environmental, archaeological, and historical features on the surface.<sup>18</sup> The state primarily leases its interests through a public auction held twice a year; more rarely, the state enters into direct leases.<sup>19</sup> Before an auction, the state solicits nominations of specific parcels from oil and gas companies. The state then reviews the surface features of the properties and classifies them into four categories: leasable surface development, leasable surface development with restrictions, leasable non-surface development, and non-leasable.<sup>20</sup> The private surface owners and the broader public are given thirty days to comment on the proposed tracts, and the state then makes the final decision about which interests to auction.<sup>21</sup>

An oil and gas company may conduct exploration activities, such as seismic surveys, after it obtains a lease or through a separate agreement with the mineral owner. The DNR generally requires a company to enter into a state lease in order to survey state-owned minerals.<sup>22</sup> Under the terms of the general state lease, the company must request permission from the DNR for surveys on state land.<sup>23</sup> When there is a split estate, Michigan courts have not addressed whether a mineral owner has the right to use the surface to conduct seismic surveys. Other jurisdictions, however, have decided in favor of the mineral owner.<sup>24</sup> Neither state law nor the general

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state lease requires a company to notify a private surface owner of exploration activities.

A review of the general state lease and a form lease used by producers in Michigan reveals significant differences in their terms. For example, companies must pay the state one-sixth of the gross proceeds from the sale of the extracted oil and gas, while the producer lease offers private landowners one-eighth of the proceeds.<sup>25</sup> Companies must also pay a rental or “delay” payment to the state if no minerals are produced and no royalty payments are being made, while the producer lease offers private landowners a “paid-up” lease with no rental payments.<sup>26</sup> Companies must provide a lease performance bond of \$10,000 to \$50,000 to the state and pay for all damages or losses to the surface, while the producer lease offers private landowners compensation for certain damages, such as to crops.<sup>27</sup> Finally, the state lease requires companies to attempt to negotiate a surface use and damage agreement, while, not surprisingly, there is no similar provision for different surface owners in the producer lease.<sup>28</sup>

The final terms in a lease are dependent on the bargaining power and knowledge of the parties. Because of the state’s greater bargaining power, the final terms in a state lease obtained through auction will be the same as those offered by the state.<sup>29</sup> In contrast, the final terms in a private lease may vary significantly from those offered by the producer.<sup>30</sup> When there is a rush to lease and the owner has more bargaining power, one would expect the final terms to be more favorable to the owner; in contrast, when leasing activity is slow and owners have little bargaining power, one would expect the final terms to reflect the terms offered by the producer. At the same time, during periods of slow activity, knowledgeable owners may negotiate more environmental protections because the financial benefit of leasing is smaller.<sup>31</sup> A review of recorded leases in Michigan would be necessary to determine the specific differences in leases.

Disputes about leases are resolved through judge-made common law rather than by statute or regulation. To protect the owner of the mineral interests and encourage production, courts presume that the lessee has agreed to several “implied covenants” not present in the lease, such as the covenant to prevent drainage and the covenant to reasonably develop the minerals.<sup>32</sup> The Michigan Legislature has stepped in, however, to require lessees who drill gas wells to provide monthly revenue statements to lessors and to prohibit the deduction of certain costs from royalties unless there is a specific provision in the lease.<sup>33</sup>

Since 2010, when the Petoskey Pioneer well spurred interest in deep, directionally drilled, high-volume hydraulically fractured wells, nineteen such wells are known to have been completed.<sup>34</sup>

Of these, nine are on state land and were developed pursuant to state mineral leases, eight are on private land and were developed pursuant to private leases, and two are on private land and were developed pursuant to both state and private leases.<sup>35</sup> A review of recorded leases would be necessary to determine whether any of the private leases are for severed mineral interests.

While the increase in leasing due to high-volume hydraulic fracturing has received some attention, the nature of property rights and the means of conveyance are rarely discussed in the debate surrounding environmental impacts. But this private law plays an important role in driving development. The limited property interest in oil and gas incentivizes oil and gas leasing and extraction, as does the separate interests in a split estate. To the extent that high-volume hydraulic fracturing opens up areas in Michigan that have not historically seen oil and gas development, the legal framework encourages mineral interest owners to sign leases to gain the economic benefits and avoid drainage, and companies to lease and develop in the least-cost way.

Incentives to lease played out in the 2009-2010 rush to develop the Utica/Collingwood play in Michigan. The promising initial production of a high-volume hydraulically fractured well in Missaukee County drove record lease sales at the state auction in May 2010. The state received \$178 million in bonus payments, almost as much as the state had collected in the previous eighty-one years of auctions.<sup>36</sup> Meanwhile, many private owners signed leases, some with very favorable terms. At the height of the leasing rush, for example, owners negotiated leases with terms such as a bonus of \$3,000 per acre, a 25% royalty on gross proceeds, and greater protections for the surface.<sup>37</sup>

Since 2010, however, leasing activity has slowed due to disappointing production and low natural gas prices. This boom and bust in leasing resulted in allegations of anti-trust violations and extensive litigation. Chesapeake Energy Corporation and Encana Corporation, the two companies most interested in the Utica/Collingwood, are being investigated by the U.S. Department of Justice and the state Attorney General for alleged collusion to divide bidding and reduce the cost of leasing.<sup>38</sup> A private mineral owner sued the companies in February 2013, alleging similar collusion on a 2010 sale.<sup>39</sup> Private owners have also sued Chesapeake Energy for its decision not to go forward with many of its leases because of a mortgage on the property; these cases have been amicably resolved.<sup>40</sup>

### 1.1.2 The State Oil and Gas Well Permitting Program

In Michigan, Part 615 of the state Natural Resources and Environmental Protection Act (NREPA) governs oil and gas exploration, development, and production.<sup>41</sup> The statute gives broad

authority to the “Supervisor of Wells,” the director of the Michigan Department of Environmental Quality (DEQ), to prevent waste.<sup>42</sup> “Waste” includes physical loss of oil and gas through inefficient extraction and surface escape, damage to the environment and public health caused by underground or surface operations, and excess market supply caused by overproduction.<sup>43</sup> Using this statutory authority, the DEQ issues specific rules and guidance, sets permitting conditions, and enforces requirements on the location, construction, completion, operation, and plugging and abandonment of oil and gas wells, including high-volume hydraulically fractured wells.<sup>44</sup>

Once an oil and gas company obtains rights from mineral interest owners, the company is required to obtain a permit from the DEQ before drilling a well.<sup>45</sup> The well operator must submit a permit application, together with an organization report, a conformance bond or statement of financial responsibility, and a fee of \$300.<sup>46</sup> By rule, a bond of \$25,000-\$30,000 is required for an individual well that targets the Utica/Collingwood formation, or \$250,000 for a blanket bond for up to 100 wells.<sup>47</sup> If the operator chooses to submit a statement of financial responsibility, the operator must show net working capital, tangible net worth, and total assets of at least three times the bond amount.<sup>48</sup> For a horizontal well, the permit application must contain additional information about the depth at which deviation from vertical is planned, the angle and path of each deviation, the proposed horizontal distance and direction from the well location to the bottom hole, and the well’s measured and true vertical depths.<sup>49</sup>

The DEQ gives the public notice of permit applications for all oil and gas wells, including hydraulically fractured wells, through its website and an email list.<sup>50</sup> By statute, the notice must contain the name and address of the applicant, the location of the proposed well, the well name and number, the proposed depth of the well, the proposed formation, the surface owner, and whether hydrogen sulfide gas is expected.<sup>51</sup> Well data in the application is kept confidential.<sup>52</sup> Notice of permit applications must also be given to the surface owner; the county in which an oil or gas well is proposed to be located; and the city, village, or township in which the oil or gas well is proposed to be located if that city, village, or township has a population of 70,000 or more.<sup>53</sup> Any city, village, township or county in which an oil or gas well is proposed to be located may provide written comments and recommendations on the application to the DEQ, and the DEQ is required to consider these comments and recommendations.<sup>54</sup> There is no formal opportunity for the general public to review and comment on the applications, but the DEQ does informally consider comments submitted by members of the public.<sup>55</sup>

A permit is issued for the life of the well. In considering whether

to grant a permit, the DEQ determines whether the applicant will comply with conservation measures designed to ensure efficient extraction and with measures designed to protect the environment and public health. Once the permit is issued, the permittee is required to comply with the terms of the permit and with the applicable legal requirements. Historically, the same permitting requirements applied to hydraulically fractured wells and non-hydraulically fractured wells. The one exception is a reporting requirement: by rule, well operators are required to report “data on all perforating, acidizing, fracturing, shooting, and testing” within sixty days of completion.<sup>56</sup> In practice, the reported data included the date of hydraulic fracturing, the interval treated, and a general description of the materials and volumes used.<sup>57</sup>

In May 2011, the DEQ issued an administrative directive to operators, known as a “Supervisor of Wells Instruction,” to “clarify the requirements under Part 615 . . . for permitting, drilling, completing, and records reporting for all oil and gas wells that utilize high volume hydraulic fracture completion technology.”<sup>58</sup> “High volume hydraulic fracturing well completion” is defined as a “well completion operation that is intended to use a total of more than 100,000 gallons of hydraulic fracturing fluid.”<sup>59</sup> The instruction focuses on four areas: water use and storage on site; pressures during hydraulic fracturing; chemical use; and wastewater. Of these, substantive limitations are imposed on water use and storage, while monitoring and/or reporting requirements are imposed on the remaining activities. The specific requirements are discussed in the relevant subsections below.

A letter to permitting staff also accompanied the instruction. The letter directs DEQ staff to review recorded wells within 1,320 feet of the proposed high-volume hydraulically fractured well to ensure that other wells do not provide a conduit for movement of fracturing fluids or produced fluids into freshwater strata.<sup>60</sup> This requirement is similar to the “area of review” analysis for injection (disposal) wells. In other respects, however, hydraulically fractured wells are not treated the same as disposal wells. Thus, for example, applicants are not required to submit injection rates and pressures, the types of fluids to be injected, and a qualitative and quantitative analysis of a representative sample of fluids to be injected.<sup>61</sup> In 2012, two landowners and a Michigan organization, Ban Michigan Fracking, petitioned the DEQ to declare that hydraulically fractured production wells are injection wells under state law.<sup>62</sup> The DEQ denied the petition, and the case is currently in front of the Michigan Court of Appeals.<sup>63</sup>

Since 2010, the DEQ has issued permits for forty wells that operators intended to complete using high-volume hydraulic fracturing.<sup>64</sup> The majority of the permits are for wells targeting the Utica/Collingwood formation. Of these wells, nineteen wells have been

completed using high-volume hydraulic fracturing according to publicly available information. Seven wells were completed by means other than high-volume hydraulic fracturing. Four wells have not been completed yet. And ten wells are on confidential status; there is no information available to the public about whether the wells have been completed, or by what means. As of August 15, 2013, the DEQ is currently reviewing an additional ten permit applications for wells that operators intend to complete using high-volume hydraulic fracturing.<sup>65</sup>

Unlike the detailed regulatory framework for oil and gas wells, there is very little regulation of exploration for oil and gas. The DEQ does not use its authority under Part 615 to regulate surface exploration activities, such as seismic surveys by “vibroseis” or “thumper” trucks. Permits are required for test wells under a separate statute, Part 625 of NREPA.<sup>66</sup> But most seismic test holes for oil and gas are not drilled deep enough to require a permit.<sup>67</sup>

### 1.1.3 Conservation, Spacing, and Pooling

In enacting the statute that is now Part 615 in 1939, the Michigan Legislature declared the following state policy on oil and gas conservation:

It has long been the declared policy of this state to foster conservation of natural resources so that our citizens may continue to enjoy the fruits and profits of those resources. Failure to adopt such a policy in the pioneer days of the state permitted the unwarranted slaughter and removal of magnificent timber abounding in the state, which resulted in an immeasurable loss and waste. . . . In past years extensive deposits of oil and gas have been discovered that have added greatly to the natural wealth of the state and if properly conserved can bring added prosperity for many years in the future to our farmers and landowners, as well as to those engaged in the exploration and development of this great natural resource. The interests of the people demand that exploitation and waste of oil and gas be prevented so that the history of the loss of timber may not be repeated. It is accordingly the declared policy of the state to protect the interests of its citizens and landowners from unwarranted waste of gas and oil and to foster the development of the industry along the most favorable conditions and with a view to the ultimate recovery of the maximum production of these natural products.<sup>68</sup>

In this meaning of conservation, the DEQ conserves oil and gas by preventing inefficient extraction through excessive drilling and by promoting the “fair share” of the resource. To obtain a permit, the operator must create a drilling unit of a certain size and site the well a specific distance from the unit boundary and other wells.<sup>69</sup>

The DEQ may also set an “allowable” production rate.<sup>70</sup> Lessees or lessors of separate tracts or interests may pool the tracts or interests to form full drilling units.<sup>71</sup> Those wishing to pool the tracts or interests must submit an application to the DEQ.<sup>72</sup> The application must include a certified copy of the pooling agreement and the plans for exploration or development, which the DEQ may approve if waste is prevented, among other considerations.<sup>73</sup>

If the well operator is not the lessee of all of the interests within a unit and has not been able to create a unit through voluntary pooling with other operators or owners, the operator can request compulsory pooling. The purpose of compulsory pooling is to ensure that owners will receive a just and equitable share of the production from the unit.<sup>74</sup> The petitioner must submit sworn statements that indicate, in detail, what action the petitioner has taken to obtain a voluntary unit and a recommendation as to the arrangements that are just and equitable.<sup>75</sup> After a hearing on the petition, the DEQ determines whether compulsory pooling is necessary.<sup>76</sup> Most compulsory pooling requests are granted.<sup>77</sup> A pooled owner must then elect to be either a “participating” owner and pay a share of the costs of the well, or a “carried” owner and pay a risk premium from any royalties.<sup>78</sup> The state Court of Appeals has expressed concern about whether the DEQ has authority to impose the latter penalty, but no court has directly reached the issue.<sup>79</sup>

The greater the size of the drilling unit, the lower the well density and the more concentrated the drilling activity on a well pad. Wells drilled into the Utica/Collingwood formation are currently required to comply with the 80-acre spacing order developed for wells in the Niagaran and deeper formations.<sup>80</sup> In 2010, the DEQ convened a hearing to consider a Utica/Collingwood spacing order of up to 640 acres; the agency ultimately decided not to pursue the order until more data is available on production.<sup>81</sup> In practice, operators of high-volume hydraulically fractured wells may seek an individual exception to the 80-acre spacing to form units of 320 to 640 acres.<sup>82</sup> The DEQ has decided only one compulsory pooling case involving the Utica/Collingwood, a 2012 case involving Devon Energy Corporation’s proposed Yonkman 1-29 HD1 well in Richfield Township, Missaukee County.<sup>83</sup> Devon Energy owned or controlled mineral interests in 617.85 acres of the total proposed 640-acre unit; the remaining mineral interests were owned by four other entities, including individual landowners and oil and gas companies.<sup>84</sup> The DEQ determined that compulsory pooling is appropriate, and in comparison to other units, estimated significantly higher well costs and assessed higher risk premiums based on the risks of drilling and completion.<sup>85</sup> Because of the greater acreage required for such high-volume hydraulically fractured wells, it seems likely that the DEQ will need to decide more compulsory pooling cases and that the appropriate risk premiums will be a source of contention.

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### 1.1.4 Natural Resources and Land Use

The DEQ has broad authority under Part 615 to prevent waste, including “unnecessary damage to or destruction of the surface; soils; animal, fish, or aquatic life; property; or other environmental values,” and “unnecessary endangerment of public health, safety, or welfare” from oil and gas operations.<sup>86</sup> Traditionally, federal and state environmental agencies regulate the impacts of an activity on natural resources, while local units of government regulate the location of land uses through zoning and planning. In the context of oil and gas wells, the state uses its authority to regulate both the well location and the impacts of well sites, and the authority of localities is constrained.

In addition to the spacing requirements described above, the state directly regulates the location of oil and gas wells through minimum setback distances from certain natural resources. These setback distances are the same for all types of wells. The DEQ requires that an oil or gas well be sited 300 feet from freshwater wells utilized for human consumption,<sup>87</sup> and that surface facility equipment be sited 2,000 feet from larger public water supply wells and 800 feet from smaller public water supply wells.<sup>88</sup> Moreover, operators who develop state mineral interests are required by the lease to site the well 1,320 feet from any lake or stream.<sup>89</sup> Drilling in or underneath the Great Lakes is prohibited by state<sup>90</sup> and federal law,<sup>91</sup> an operator that has leased state mineral interests is also prohibited from surface development within 1,500 feet of the shoreline.<sup>92</sup>

The DEQ considers the natural resource impacts of site preparation as part of the permit application review. In an application, the operator of an oil and gas well must submit an environmental impact assessment to the DEQ that identifies nearby natural resource features and describes the impacts of the access road, well site, surface facilities, and flow lines.<sup>93</sup> Applicants for an Antrim well permit must submit an additional environmental impact assessment showing the locations of all project wells, flow lines, and surface facilities.<sup>94</sup> There is no similar requirement for high-volume hydraulically fractured wells in the Utica/Collingwood. The assessment forms ask the operator to explain how impacts will be mitigated, but there are no specific mitigation standards in Part 615 or the rules.<sup>95</sup>

The impacts of site preparation are therefore primarily regulated under generally applicable state laws designed to protect natural resources. These include laws governing natural rivers and related resources,<sup>96</sup> critical dune areas,<sup>97</sup> threatened and endangered species,<sup>98</sup> inland lakes and streams,<sup>99</sup> and wetlands.<sup>100</sup> The laws focus on the degree of impact rather than on the type of activity. The one exception is the law governing natural rivers; drilling for oil and gas may be prohibited or limited if it is within 300 feet from the river’s edge.<sup>101</sup> Under the federal Clean Water Act (CWA), operators must

comply with stormwater permitting requirements for construction of well pads and access roads if the land disturbance is one acre or greater;<sup>102</sup> site operations are exempt unless the stormwater is contaminated with sediment or other pollutants.<sup>103</sup> The state also requires soil erosion and sedimentation measures for earth changes associated with construction of well locations, surface facilities, flow lines, or access roads.<sup>104</sup> Direct federal regulation of the impacts of siting on natural resources is otherwise limited to the Endangered Species Act and the Migratory Bird Treaty Act.<sup>105</sup>

If the mineral interest is leased from the state, there are additional resource protection requirements in the lease. No oil or gas operations may take place in a wetland, critical habitat of an endangered species, or a designated historical or archaeological site unless there is a plan to substantially eliminate negative impacts.<sup>106</sup> If the surface is owned by the state or the area has special wildlife, environmental, or recreational significance, the operator is required to submit a development plan to the DNR that minimizes negative impacts.<sup>107</sup> Restoration activities must be conducted within nine months of surface disturbance.<sup>108</sup>

Part 327 of NREPA prohibits a new or increased “large quantity” water withdrawal from causing an adverse resource impact.<sup>109</sup> Withdrawals for oil and gas well activities are exempt from all Part 327 requirements.<sup>110</sup> The DEQ’s instruction on high-volume hydraulic fracturing, however, requires a permit applicant who makes an on-site groundwater withdrawal to follow a similar process.<sup>111</sup> The applicant must use the internet-based assessment tool designed for Part 327, and if the tool predicts an adverse resource impact, the well operator may request a site-specific review by the DEQ. Adverse resource impacts are not directly prohibited, but the instruction warns that “the ability to utilize an on-site water supply well(s) may be impacted.”<sup>112</sup> To protect freshwater wells within 1,320 feet of the supply well, the DEQ also requires the operator to install a monitor well between the supply well and the nearest freshwater well and to record the water levels.<sup>113</sup> In addition, freshwater pits must be constructed so as not to create a site hazard, and operators may be required to take measures to protect against soil erosion, including fencing.<sup>114</sup>

The authority of local units of government over oil and gas wells is limited. Localities may exercise authority in two ways: through zoning ordinances, which focus on the location of land uses, and through regulatory ordinances, which focus on the activity itself.<sup>115</sup> Counties and townships are prohibited by the state’s Zoning Enabling Act from specifying the location or regulating the activities of drilling, completion, operation, or abandonment of wells,<sup>116</sup> but not other aspects of oil and gas production, such as processing plants and small pipelines.<sup>117</sup> There is no similar provision prohibiting cities and villages from prescribing the location of wells or

regulating well activities. These entities must act in accordance with the powers in their charters and may not adopt ordinances that are preempted by state law. No Michigan court has decided whether the DEQ's oil and gas well permitting program occupies the field so as to preempt cities and villages from exercising their zoning or regulatory authority over wells.

If cities and villages may use their zoning authority to limit the location of wells, it is unclear whether they could ban hydraulically fractured wells. The state prohibits local units of government from banning a use unless there is no demonstrated need for the land use within the locality or the surrounding area and a location does not exist within the locality where the activity could be conducted.<sup>118</sup> All decisions by local units of government must also advance a reasonable governmental interest beyond one that is purely arbitrary, capricious, or unfounded.<sup>119</sup> Since 2011, ten Michigan localities have passed resolutions urging state and federal bans of hydraulic fracturing, and one has passed a resolution urging state and federal moratoria.<sup>120</sup> No local units of government have themselves banned hydraulic fracturing; the townships of Cannon, Courtland, and West Bloomfield came the closest by adopting six-month moratoria on township approvals.<sup>121</sup> An environmental organization, For Love of Water (FLOW), has been encouraging local regulation of hydraulic fracturing and has prepared model ordinances for townships.<sup>122</sup> If these ordinances are adopted, the state courts will have the opportunity to rule on the extent of local authority.<sup>123</sup>

### 1.1.5 Well Construction

After an operator obtains a well permit from the DEQ and complies with other natural resource laws, well construction begins. Part 615 grants the DEQ the authority to require that wells are constructed and operated "to prevent the escape of oil or gas out of 1 stratum into another, or of water or brines into oil or gas strata" and "to prevent pollution of, damage to, or destruction of fresh water supplies, including inland lakes and streams and the Great Lakes and connecting waters."<sup>124</sup>

Not less than five days before preparing the location and not less than forty-eight hours before moving drilling equipment on location, the operator of an oil and gas well is required to notify the DEQ and the surface owner when well construction will begin.<sup>125</sup> All oil and gas wells are required to install casing from the surface to 100 feet below the deepest freshwater.<sup>126</sup> This "surface casing" must be completely cemented to the formation from the base of the casing to the ground surface, with all open annulus spaces filled with cement before drilling.<sup>127</sup> Other casing "strings" are required on a case-by-case basis by permit.

There are no specific construction requirements for high-volume hydraulically fractured wells. But all casing must be of sufficient

weight, grade, and condition to have a minimum strength of 1.2 times the greatest expected wellbore pressure to be encountered.<sup>128</sup> The DEQ must approve of the cement mixture composition and volume, and the casing must be pressure tested before the cement plugs are drilled or the casing perforated for hydraulic fracturing.<sup>129</sup> In addition, all permittees must take "proper measures" to avoid uncontrolled releases from the well.<sup>130</sup> Blowout preventers and aboveground blowout equipment that is designed to handle at least the maximum anticipated surface pressure of the well must be installed and kept in "good working condition at all times."<sup>131</sup> Blowout preventers, accumulators, and pumps are required to be certified as operable under the product manufacturer's minimum operational specifications.<sup>132</sup>

### 1.1.6 Hydraulic Fracturing and Chemical Use

The federal government is responsible for regulating hydraulically fractured oil and gas production wells that use diesel fluids in the hydraulic fracturing fluid.<sup>133</sup> Operators of these wells are required to obtain a permit from the federal Environmental Protection Agency (EPA) as part of the Underground Injection Control Program of the Safe Drinking Water Act (SDWA).<sup>134</sup> In response to a request from Democratic members of the U.S. Senate Committee on Energy and Commerce, service companies reported using diesel fuels in hydraulic fracturing fluid in wells in Michigan during the period of 2005 to 2009.<sup>135</sup> In May 2012, the EPA released draft guidance on how to apply its construction and operating standards to such wells, but the guidance has not been finalized.<sup>136</sup> According to EPA's Region 5 office, no production well operators in Michigan have applied to the EPA for a SDWA permit.<sup>137</sup>

Production wells that do not use diesel fuels in hydraulic fracturing fluid are regulated by the state. The DEQ is generally authorized to "regulate the mechanical, physical, and chemical treatment of wells."<sup>138</sup> This regulation occurs through monitoring and reporting requirements. During high-volume hydraulic fracturing, operators are required to monitor and record the injection pressure at the surface and the pressure in the annulus between the injection casing and the next casing string.<sup>139</sup> Within sixty days after the well is completed, an operator must submit to the DEQ the service company fracturing records and associated charts showing fracturing volumes, rates, and pressures, and the pressures recorded during fracturing.<sup>140</sup>

The transportation of hazardous chemicals to the well site is regulated both by Michigan<sup>141</sup> and by the federal Department of Transportation.<sup>142</sup> Once the chemicals are on site, there are no federal or state restrictions on the chemical substances to be used in hydraulic fracturing fluid. Instead, the operator of a high-volume hydraulically fractured well must disclose the hazardous constituents of chemical additives by providing the DEQ with copies

of Material Safety Data Sheets (MSDSs) for each additive within sixty days of well completion.<sup>143</sup> The operator must also provide the volume of each additive used.<sup>144</sup> A MSDS is designed to educate workers about the properties and health effects of hazardous chemicals; for each chemical additive that the manufacturer determines is hazardous, the MSDS lists the hazardous constituents and the known health effects. The DEQ posts the MSDSs on its website for public review as they are received.<sup>145</sup> As of August 22, 2013, the MSDSs for fifteen wells are available.<sup>146</sup>

Under Title III of the federal Emergency Planning, Control, and Right-to-Know Act, an operator of a facility must disclose the identity and amount of hazardous chemicals present on the site to state and local emergency authorities. The public may then request the information. The general threshold for reporting is 10,000 pounds of a chemical substance;<sup>147</sup> extremely hazardous substances have lower thresholds.<sup>148</sup> Most well sites will not have chemicals present in amounts great enough to meet the threshold for reporting. Of the ten wells for which the DEQ posted MSDSs as of January 2013, only Encana Corporation's State Wilmot 1-21 had a Title III report. The substances listed on the report were silica, the propant; diesel, presumably fuel; barium sulfate, an agent to increase the density of drilling muds; and "drilling muds and associated additives."<sup>149</sup>

### 1.1.7 Production and Plugging

After a natural gas well is hydraulically fractured, the injected fluid returns to the surface as flowback mixed with methane and other volatile organic compounds (VOCs). The state requires an operator to burn, process, or dispose of gas from operations if it will not be utilized.<sup>150</sup> In practice, operators choose to burn the gas emitted during the flowback period by sending it to a flare stack.<sup>151</sup> The EPA also recently promulgated rules under the federal Clean Air Act (CAA) to control these VOC emissions.<sup>152</sup> Initially, operators must reduce emissions either by flaring or by capturing the VOCs using green completions.<sup>153</sup> Beginning January 1, 2015, operators must use green completions.<sup>154</sup> Green completions are not required for new exploratory/delineation ("wildcat") wells or low-pressure wells, where natural gas cannot be routed to the gathering line.<sup>155</sup> Operators of these wells must still, however, use combustion.<sup>156</sup> In addition to reducing smog, these requirements have the benefit of reducing emissions of methane, a potent greenhouse gas.

Once a well begins producing, the operator must submit monthly reports on production to the DEQ<sup>157</sup> and pay royalties to the mineral interest owner in accordance with the lease. In addition, as discussed in Zullo (this series), the state collects a privilege tax for administration of Part 615 and a severance tax. The Part 615 fee is levied upon the gross cash market value of oil and gas produced in the state and is collected by the Department of Treasury.<sup>158</sup> The

severance tax is levied upon each producer engaged in the business of severing oil or gas from the soil.<sup>159</sup> Excepted are producers that receive income pursuant to a royalty interest bought from the state on production from hydraulically fractured wells that target the Devonian or Antrim shale and that qualifies for the nonconventional fuel credit in the federal Internal Revenue Code.<sup>160</sup> This exception would not, however, apply to income on production from high-volume hydraulically fractured wells in the Utica/Collingwood formation.

The operator of a well is required to plug a well "within 90 days after drilling completion or well completion as a dry hole, when the well has not economically produced or has not been utilized for its permitted use for more than 12 consecutive months, when a change of well status has not been granted, or when the permitted use has been suspended for more than 12 consecutive months." An operator may petition the DEQ for a hearing to show cause why the well should not be plugged.<sup>161</sup> In accordance with DEQ instructions, the operator "plugs" the well by removing equipment in the wellbore, leaving the cemented casing, and then filling the wellbore with cement.<sup>162</sup> The operator must restore the well site within six months of plugging.<sup>163</sup> If the operator abandons the well without plugging it, the DEQ is authorized to plug the well and recover the costs from the operator and any surety.<sup>164</sup> The DEQ may draw upon the "orphan well" fund to plug the well when the operator is insolvent.<sup>165</sup> Failure to plug a well is a misdemeanor punishable by imprisonment for not more than 90 days, or a fine of not more than \$1,000 and costs of prosecution, or both.<sup>166</sup>

### 1.1.8 Waste Management

Irrespective of its hazardous characteristics, waste from the exploration, development, and production of oil and gas is exempted from the "cradle to grave" provisions governing generation, transportation, treatment, storage, and disposal of hazardous waste in the federal Resource Conservation, and Recovery Act.<sup>167</sup> This exemption includes drilling fluids, drilling muds, drill cuttings, flowback, and produced water from high-volume hydraulically fractured wells. States thus regulate the waste through both solid waste and oil and gas programs.

Under Part 615, the storage, transportation, or disposal of brine, crude oil, or oil or gas field waste that results or may result in pollution is prohibited.<sup>168</sup> Brine is defined broadly to include "all nonpotable water resulting, obtained, or produced from the exploration, drilling, or production of oil or gas, or both," a definition that encompasses both flowback and produced water.<sup>169</sup> The operator of a well must ensure that wastes are stored, transported, and disposed of in a manner approved by the DEQ and consistent with all applicable state and federal laws and rules.<sup>170</sup> The operator of a high-volume hydraulically fractured well must report the total

volume of wastewater from the well at the time that the operator submits a well completion report.<sup>171</sup>

Drilling fluids, water-based muds, and drill cuttings may be placed in a lined pit on site; free fluids must be removed and the pit must be encapsulated and buried within six months of well completion.<sup>172</sup> Flowback and produced water must be placed in steel tanks; operators are not allowed to use pits to store the wastewater.<sup>173</sup> Spills of hydraulic fracturing additives must be reported to the DEQ within eight hours.<sup>174</sup> Spills of flowback, produced water, or other oil and gas field waste must also be reported to the DEQ within eight hours if they are forty-two gallons or greater; contact surface waters, groundwater, or other environmentally sensitive resources; or are not completely contained and cleaned up within forty-eight hours.<sup>175</sup> If the spill does not meet one of these criteria, the operator must submit a written notification within ten days.<sup>176</sup> Cleanup of spills is required by state<sup>177</sup> and in some cases federal law.<sup>178</sup>

Unlike other states that allow wastewater from well operations to be treated and discharged into surface waters, Michigan requires that brines—including fluid from drilling muds, flowback, and produced water—be disposed of in underground injection wells or in a manner approved by the DEQ.<sup>179</sup> Injection wells are regulated by the federal EPA under its Class II program for brine disposal wells,<sup>180</sup> and by the DEQ under its oil and gas well permitting program.<sup>181</sup> The permitting requirements are similar. Both programs require a well operator to submit a corrective action plan for nearby wells that may act as conduits because they are improperly sealed, completed, or abandoned.<sup>182</sup> In addition, both programs require the well operator to monitor the injection pressure, flow rate, and cumulative volume of the injected fluid on a weekly basis.<sup>183</sup> In some cases, Michigan's requirements go beyond the federal requirements. For example, the EPA requires that a Class II well "inject into a formation which is separated from any [source of drinking water] by a confining zone that is free of known open faults or fractures within the area of review;" Part 615 requires that the well must inject into a formation that is isolated from freshwater strata by an impervious confining formation.<sup>184</sup> Neither program requires the operator to assess the potential for induced earthquakes or to continuously monitor surface pressures.<sup>185</sup> For a further discussion of seismicity, see Ellis (this series).

Upon approval of the DEQ, brine may be used for ice and dust control and road stabilization.<sup>186</sup> The brine must meet certain concentration requirements for calcium, hydrogen sulfide, and benzene, ethylbenzene, toluene, and xylene.<sup>187</sup> Brines produced during drilling and placed in pits cannot be used for these purposes even if they meet the concentration limits; however, there is no similar prohibition for brines produced during and after completion.<sup>188</sup>

After flowback from a high-volume hydraulically fractured well was used on Northern Michigan roads in the summer of 2012,<sup>189</sup> The DEQ clarified its internal policy that flowback from hydraulically fractured wells should not be approved for use.<sup>190</sup>

Fluid from drilling muds, flowback, and produced water intended for disposal are considered liquid industrial wastes, and require a transporter credential when not being disposed of on site.<sup>191</sup> The well operator may complete a single manifest per transporter, per disposal well, each month.<sup>192</sup> Brine approved for ice and dust control is not considered liquid industrial waste.<sup>193</sup>

## 1.2 Trends in Policies and Laws

In the last few years, federal, state, regional, and local governments have adopted a variety of policies and laws to respond to the increase in high-volume hydraulic fracturing. The states have been the most active, but federal agencies are increasingly using their existing authority to regulate human health and environmental impacts. Meanwhile, local governments are testing the boundaries of their zoning and regulatory powers, leading to litigation over their proper role.

### 1.2.1 Federal Trends

The federal government has responded to public concern about high-volume hydraulic fracturing in two primary ways: by gathering more information, and by taking administrative action. Bills have also been introduced in the U.S. Congress to repeal the SDWA exemption<sup>194</sup> and the CWA stormwater exemption,<sup>195</sup> but the prospects for enactment are unclear.

Initially, the federal government turned to expert agencies to study the problem. In 2009, the U.S. Congress directed the EPA to "carry out a study on the relationship between hydraulic fracturing and drinking water, using a credible approach that relies on the best available science, as well as independent sources of information."<sup>196</sup> The study is ongoing; the EPA has released a progress report and has promised a draft of the report by the end of 2014, which will then be subject to peer review and public comment.<sup>197</sup> Meanwhile, in March 2011, President Obama directed the Department of Energy to identify "any immediate steps that can be taken to improve the safety and environmental performance of fracking" and to develop "consensus recommended advice to the agencies on practices for shale extraction to ensure the protection of public health and the environment."<sup>198</sup> A subcommittee made twenty recommendations in its initial report in August 2011,<sup>199</sup> and critically assessed implementation in its final report in November 2011.<sup>200</sup>

More recently, federal agencies have employed their existing administrative authority to directly regulate aspects of the life cycle

of a hydraulically fractured well. As discussed above, in 2012 the EPA issued draft guidance to apply the SDWA to wells that use diesel fuels in hydraulic fracturing fluid, and also issued a rule under the CAA to limit air pollution caused by hydraulically fractured natural gas wells. The EPA has signaled its intent to issue a rule under the Toxic Substances Control Act to require reporting on chemicals used in exploration and production,<sup>201</sup> and under the CWA to impose treatment standards for wastewater from unconventional natural gas wells.<sup>202</sup> In addition, the Bureau of Land Management (BLM), which oversees federal and Indian mineral interests, has proposed a rule to regulate the hydraulically fractured wells that develop these mineral interests.<sup>203</sup> The results of the EPA study are likely to influence the direction and pace of further regulatory action.<sup>204</sup>

### 1.2.2 State and Regional Trends

Almost all of the states in which high-volume hydraulic fracturing is or could be occurring have taken some action in response. The issue has also been taken up by two regional entities that regulate water use, the Susquehanna River Basin Commission (SRBC)<sup>205</sup> and the Delaware River Basin Commission.<sup>206</sup> The response varies, however, in scale, focus, and means.<sup>207</sup> Some states have significantly revised their programs, while others have made more limited changes. Some states have focused primarily on high-volume hydraulically fractured wells, while others have focused on hydraulically fractured wells or all oil and gas wells. And some states have enacted statutes through their legislatures, while others have issued rules or policies through administrative agencies.

State legislatures have commissioned studies, created new requirements, increased agency budgets, and even adopted moratoria or bans. The legislatures have also sought to cement state jurisdiction by urging the federal government to recognize the authority of the states, authorizing state agencies to regulate, and restricting local authority. In the 2012 legislative session alone, twenty-nine states introduced more than 170 bills and resolutions.<sup>208</sup> Ten states enacted laws: Kansas and North Carolina authorized state agencies to regulate; Idaho prohibited localities from banning oil and gas extraction; Indiana and Louisiana required chemical disclosure; Idaho and Oklahoma added taxes; Maryland established landowner protections; Ohio and Pennsylvania significantly revised their state programs; and Vermont banned hydraulic fracturing and disposal of wastewater.<sup>209</sup> Four states passed resolutions: North Dakota, South Dakota, and Utah urged the U.S. Congress to clearly delegate regulatory authority to the states; and Tennessee encouraged stakeholders to collaborate on regulations.<sup>210</sup> More recently, Illinois enacted a comprehensive law on high-volume hydraulically fractured wells.<sup>211</sup>

State agencies have also responded by providing the public with

information about hydraulic fracturing and using their new or existing authority to create additional requirements. Since 2010, eighteen state agencies have issued rules: Arkansas, Colorado, Idaho, Indiana, Louisiana, Mississippi, Montana, Nevada, New Mexico, South Dakota, North Dakota, Oklahoma, Pennsylvania, Tennessee, Texas, Utah, West Virginia, and Wyoming.<sup>212</sup> As discussed above, Michigan has issued a directive. Six more states—Alaska,<sup>213</sup> California,<sup>214</sup> Kansas,<sup>215</sup> Nebraska,<sup>216</sup> New York,<sup>217</sup> and North Carolina<sup>218</sup>—are considering rules. The rules address many different topics. They include well construction, such as blowout preventers and enhanced casing and cementing standards; surface use, such as closed-loop drilling systems and limitations on pits; hydraulic fracturing, such as notification, disclosure, and reporting; and wastewater management, such as reuse plans.

Rather than attempt to describe all of the state statutes and regulations, the authors have chosen to examine five topics that are the focus of significant attention in Michigan and elsewhere: public participation; land use; water withdrawals; chemical disclosure; and special protections for landowners. For each topic, the report presents examples of policies to demonstrate the range of options. Most of the policies are already in law; the remaining policies are likely to be adopted. It should be noted that these examples were chosen for the variation in policy approach, not for prevalence. Michigan's current or proposed policies on the topics are also included.

First, some states have responded by giving members of the public the opportunity to participate in permitting decisions. In Table 1, the report presents avenues for public participation in six states, including Michigan. Oklahoma's program follows the traditional oil and gas model of limited participation; the state notifies surface owners of applications but does not invite comments. Alaska's proposed rule would go further and require operators to send a copy of the hydraulic fracturing application to nearby landowners. Indiana's program incorporates public comment, but limits the opportunity to persons with a financial interest in the resource (coal). New York's proposed program gives the public an opportunity to comment but not to request a hearing. Finally, Illinois's program adopts the environmental permitting model by giving the public both an opportunity to comment on the application and to request a formal hearing on objections.<sup>219</sup> Michigan currently notifies interested persons and provides an indirect opportunity for comment through local units of government.

Second, some states have responded by limiting the impact of wells on other land uses through setback requirements. The setbacks can be divided into two categories: minimum distances from human uses such as residences, other structures, or activity areas; and minimum distances from natural "uses" such as water

**TABLE 1: Public Participation in Permit Decisions**

	<b>Alaska (proposed)<sup>220</sup></b>	<b>Indiana<sup>221</sup></b>	<b>Illinois<sup>222</sup></b>	<b>Michigan</b>	<b>New York (proposed)<sup>223</sup></b>	<b>Oklahoma<sup>224</sup></b>
<b>Oil and gas well type</b>	Hydraulically fractured	Coalbed methane	High-volume horizontal	All	High-volume	All
<b>Notice of permit application</b>	Copy of HF application to all owners and operators within 1/2 mile of wellbore trajectory	State website; written notice to list of persons below	State website; nearby landowners, newspaper in general circulation in county; municipality, county	State website, email list; county; large city, village, or township	State website; environmental bulletin; town, village; nearby Indian nation	Surface owners; permit must be posted at well site
<b>Who may comment</b>	N/A	Persons with experience, interest in mining commercially minable coal resources	Unlimited	County, city, village, township	Unlimited	N/A
<b>Comment period</b>	None	At least 30 days	30 days	None specified	15 days	None
<b>Permit challenge</b>	No specific provision	No specific provision	Hearing if non-frivolous request by adversely affected person	No specific provision	No specific provision	No specific provision

**TABLE 2: Setback Requirements for Well Location**

	<b>Colorado<sup>225</sup></b>	<b>Illinois<sup>226</sup></b>	<b>Michigan<sup>227</sup></b>	<b>Ohio<sup>228</sup></b>	<b>Pennsylvania<sup>229</sup></b>	<b>Texas<sup>230</sup></b>
<b>Oil and gas well type</b>	All	High-volume horizontal	All	All	Unconventional natural gas	All
<b>Residences</b>	500 feet	500 feet	300 feet; 450 feet in large cities and townships	100 feet in non-urbanized areas; 150 feet in urbanized areas	500 feet	200 feet
<b>Other Structures/ Areas</b>	1,000 feet from "high occupancy building;" 350 feet from "outside activity area"	500 feet from school, hospital, nursing home, place of worship	300 feet from structure used for public or private occupancy	100 feet from "public building" in non-urbanized areas	500 feet from building	None
<b>Water supplies</b>	0–300 feet from designated public water supply stream segment	500 feet from water well or spring; 1,500 feet from public water supply intake	300 feet from freshwater well	None	500 feet from water well; 1,000 from water supply	None
<b>Natural resources</b>	300 feet from gold medal stream, cutthroat trout habitat	300 feet from water body; 750 feet from nature preserve	300 feet from natural river; if state lease, 1,320 feet from lake or stream	50 feet from water body	300 feet from water body, wetland greater than 1 acre	None

supplies and natural resources. In Table 2, the report presents the approaches of six states, including Michigan. Texas follows the traditional approach of maximizing mineral interest ownership rights through minimal location restrictions; the state's only setback requirement, enacted in 1987, is to protect residences. The remaining states require more setbacks, but the number and degree of protection varies. Ohio's program includes a few setbacks that are primarily based on the urbanization of an area. In contrast, Pennsylvania has setbacks to protect buildings, water supplies, and water bodies, and Illinois has similar requirements. Colorado's recent setback rule goes further and includes "outside activity areas," such as recreational fields and entertainment venues. In Michigan, operators must site wells away from private and public residences, freshwater wells, and natural rivers. Operators who lease state mineral interests must also site wells away from lakes and streams.

Third, some states have responded by directly regulating the environmental impacts of water withdrawals and the associated consumptive use (water loss). In Table 3, the report presents the approaches of five states, including Michigan. Also included is the regional SRBC, composed of representatives from Maryland, New York, Pennsylvania, and the federal government. Of these entities, Texas has the most permissive water use system.<sup>231</sup> Operators need not obtain a permit from local groundwater conservation districts if a freshwater well supplies rigs "actively engaged in drilling or exploration operations."<sup>232</sup> Oklahoma grants an immediate provisional permit for short-term withdrawals that is primarily intended for oil and gas well operators. In contrast, New York requires registration, reporting, and environmental review of all but the smallest withdrawals. Ohio requires registration and reporting, as operators are unlikely to trigger permitting thresholds. The SRBC has the most restrictive system. The commission not only regulates all withdrawals, but it also regulates the consumptive use associated with other sources of water. In Michigan, withdrawals for oil and gas wells are exempt from the state's water use program; however, the DEQ assesses the environmental impact of high-volume groundwater withdrawals using a similar standard. A bill was introduced in the state House in November 2011 to repeal the statutory exemption.<sup>233</sup> More recently, a House bill was introduced that would put the requirements of the DEQ instruction in statute.<sup>234</sup>

Fourth, almost all states have responded by requiring operators to disclose the chemicals in hydraulic fracturing fluid. In Table 4, the report presents the approaches of six states, including Michigan. Michigan requires the operator of a high-volume hydraulically fractured well to submit a MSDS for a chemical additive, if there is one available, and the volume of the additive used. The MSDS generally includes the trade name of the additive, the vendor, the function, the hazardous ingredients, and the maximum concentration

of the hazardous ingredients in the product.<sup>241</sup> Each ingredient is usually identified by the constituent's unique Chemical Abstracts Service (CAS) number.<sup>242</sup> The form of the remaining state disclosure policies is different—the states specify the information by category—but the ultimate effect is the same if the MSDS is complete.<sup>243</sup> In some cases, Michigan's policy may provide more information; for example, New York and Wyoming do not require the vendor, and Colorado, New York, Texas, and Wyoming do not require the maximum concentration of ingredients in the product. In other cases, Michigan's policy provides less information. The rest of the states require the operator to disclose the maximum concentration of each hazardous ingredient in the hydraulic fracturing fluid. Colorado, New York, Texas, and Wyoming also require disclosure of non-hazardous ingredients.

The timing and means of disclosure vary. Most of the states require disclosure after the well is hydraulically fractured; only New York and Wyoming require operators to submit information beforehand. Colorado, Louisiana, New York, and Texas require disclosure through a website known as "FracFocus," which is operated by the Interstate Oil and Gas Compact Commission and the Groundwater Protection Council.<sup>244</sup> Members of the public can use the Google map-based interface to find a well and view the chemical information sheet.<sup>245</sup> The wells may also be searched by ingredient, CAS number, and date.<sup>246</sup> In contrast, both Michigan and Wyoming require operators to submit information to the state. Michigan posts the MSDSs for each well on the state's website.<sup>247</sup> Members of the public in Wyoming must find the records through the state's online well database. Although operators in Michigan and Wyoming are not required to use FracFocus, many have chosen to submit well information. As of August 22, 2013, there is information for sixteen Michigan wells on FracFocus.<sup>248</sup>

All of the states protect the specific identity of a chemical ingredient if it is a trade secret. Operators in Michigan need not take any action; the state relies on the manufacturer to withhold the identity of a trade secret chemical from the MSDS. In Louisiana and Texas, the operator must state on the FracFocus form that the chemical identity is being withheld as a trade secret and provide the chemical family of the ingredient. Texas also allows the surface owner and adjoining landowners to challenge the trade secret designation. In Colorado, the operator must submit a written claim of entitlement and disclose the chemical family, while in New York and Wyoming, the operator must submit the identity and justification to the state for review. Colorado, Louisiana, and Texas provide a medical exception to trade secret protection upon a written request from a health care professional and a signed confidentiality agreement. Michigan, New York, and Wyoming do not provide such an exception; however, it should be noted that the states of New York and Wyoming already have the information.<sup>249</sup>

**TABLE 3: Water Withdrawal Requirements**

	Michigan <sup>235</sup>	New York (proposed) <sup>236</sup>	Ohio <sup>237</sup>	Oklahoma <sup>238</sup>	SRBC <sup>239</sup>	Texas <sup>240</sup>
<b>Oil and gas well type</b>	High-volume	All	All	All	Marcellus and Utica shale natural gas	All
<b>Water source</b>	Groundwater	Groundwater and surface water	Groundwater and surface water	Groundwater and surface water	Groundwater and surface water	Surface water
<b>Threshold</b>	> 100,000 gpd averaged over 30-day period	> 100,000 gpd	Varies	Withdrawals < than 90 days	None	< 10 acre-feet in one year
<b>Registration</b>	No	Through permit	If > 100,000 gpd averaged over 30-day period	Through provisional permit	Through approval	Through temporary permit
<b>Reporting</b>	No	Yes	Yes	No	Yes	No
<b>Environmental Assessment</b>	Exempted by statute, but required to use water withdrawal assessment process	May not adversely affect water resources	If consumptive use > 2 mgd averaged over 30-day period; separate permit in Great Lakes Basin	May not affect existing fish and wildlife use or cause pollution	May not adversely affect water resources	May not affect environmental flow
<b>Other requirements</b>	Monitor well if freshwater well within 1,320 feet	Water conservation	Water conservation	None	Consumptive use approval; metering; stream protections	None

*gpd=gallons per day; mgd=million gallons per day*

**TABLE 4: Chemical Disclosure Requirements**

	Colorado <sup>255</sup>	Louisiana <sup>256</sup>	Michigan <sup>257</sup>	New York (proposed) <sup>258</sup>	Texas <sup>259</sup>	Wyoming <sup>260</sup>
<b>Oil and gas well type</b>	All	All	High-volume	High-volume	All	All
<b>Additive disclosure</b>	Trade name, vendor, function	Trade name, supplier, type	MSDS for additives; volume of each additive	Trade name, type, function, concentration; MSDS	Trade name, supplier, function	Trade name, type, rate or concentration
<b>Ingredient disclosure</b>	All constituents by CAS number, maximum concentration in fluid	Hazardous constituents by CAS number, maximum concentration in additive and fluid	Hazardous constituents by product, concentration in additive and CAS if in MSDS	All constituents by chemical name, CAS number, actual or maximum concentration in fluid	Hazardous constituents by CAS number, actual or maximum concentration in fluid; non-hazardous constituents by CAS number	All constituents by CAS number
<b>Timing</b>	After	After	After	Before and after	After	Before and after
<b>Means</b>	FracFocus	FracFocus or state	State; placed on state website	State and FracFocus	FracFocus	State; no public disclosure
<b>Trade secret claims</b>	Written claim of entitlement to state	Statement on FracFocus	By manufacturer under worker safety law	Upon state approval	Statement on FracFocus; nearby owners and state agencies may challenge	Upon state approval
<b>Replacement information</b>	Chemical family	Chemical family	None	Chemical family	Chemical family	None
<b>Trade secret exceptions</b>	Health care professional; state if necessary to respond to spill or release	Health care professional	No provision	No provision	Health professional or emergency responder	No provision

**TABLE 5: Special Protection Measures for Groundwater Supplies**

	Colorado <sup>262</sup>	Maryland <sup>263</sup>	Michigan (proposed 2011, 2013) <sup>264</sup>	Ohio <sup>265</sup>	Pennsylvania <sup>266</sup>	West Virginia <sup>267</sup>
<b>Oil and gas well type</b>	All	Deep shale gas	Hydraulically fractured	Varies	Varies	Horizontal well
<b>Baseline testing</b>	Up to four water wells within ½ mile; subsequent testing within 6-12 months and 5-6 years	No presumption if testing shows no contamination or property owner refuses to allow testing	Unclear if could rebut presumption	Water wells within 1,500 feet of horizontal well, or 300 feet of all wells in urban areas; operator must provide a list of water wells where owner refuses to allow testing	Presumption rebutted if testing shows no contamination or property owner refuses to allow testing	Presumption rebutted if testing shows no contamination or property owner refuses to allow testing
<b>Presumption</b>	Testing does not create presumption	Within 2,500 feet of a well for one year after completion	Within the vicinity when one or more hazardous constituents used in hydraulic fracturing is present	None	Within 1,000 feet of any well for six months after completion; within 2,500 feet of an unconventional well for one year after completion	Within 1,500 feet for six months after completion
<b>Remedy</b>	None	Replace or compensate	Remediate under cleanup statute	Replace or compensate if has been substantially disrupted	Restore or replace	Replace

Three bills on chemical disclosure have been introduced in Michigan. The first and second, introduced in 2012 and 2013, would require an operator to submit chemical information to the state as part of a well permit application and to annually report on the substances used in hydraulic fracturing.<sup>250</sup> To withhold the identity of a chemical as a trade secret, the operator would be required to submit the identity and a written claim to the state.<sup>251</sup> Any person could challenge the claim.<sup>252</sup> The chemical identity could be disclosed as part of an investigation of contamination or to a health professional upon a statement of need.<sup>253</sup> The third, introduced in 2013, would require an operator to submit MSDSs to the state prior to hydraulic fracturing and would require disclosure of trade secret information in the case of an environmental or medical emergency.<sup>254</sup>

Fifth and finally, some states have responded by creating special mechanisms to protect landowners from groundwater contamination. These protections take three, often interrelated forms: baseline testing of nearby water wells; a presumption that an oil or gas well is the cause of nearby groundwater contamination; and a statutory requirement that an operator remedy the contamination. In Table 5, the report presents the approaches of six states, including a 2011 legislative proposal in Michigan. Maryland, Pennsylvania, and West Virginia have the most comprehensive protections for landowners. In each state, the operator of an unconventional well is presumed to have contaminated the groundwater supply of landowners within an impact area around the well. To rebut or nullify the presumption, the operator must conduct baseline testing of the water wells in the impact area. If the operator is found to have caused contamination, the operator is required to

remedy the harm by replacing the water supply. In Maryland, the operator may also compensate the landowner; in West Virginia, the operator may also restore the supply. Ohio mandates baseline testing and either replacement of the supply or compensation for substantial disruption caused by contamination, but does not link the testing to the remedy through a presumption. Colorado requires only baseline testing, and specifically prohibits the results of the testing from being used to create a presumption of liability. Michigan does not require any of the three mechanisms. A House bill introduced in 2011 and a similar bill introduced in 2013 would create a presumption of contamination under Part 201 of NREPA, the state’s environmental remediation statute. It is unclear how the presumption could be rebutted. If the operator were found responsible for the contamination, Part 201 would require cleanup of hazardous substances. Another 2013 House bill would require baseline testing in accordance with DEQ requirements.<sup>261</sup>

### 1.2.3 Local Trends

Local governments have responded to public concern about high-volume hydraulic fracturing in three ways. The first is through non-binding statements of policy, such as passing resolutions opposing hydraulic fracturing. The second is through control of the location of wells and associated facilities, such as limiting development to certain areas or requiring setbacks. And the third is through regulations governing the manner of development, such as restricting the “nuisance” impacts of noise, light, and increased traffic; specifying technical standards; or even banning hydraulic fracturing. By one count, local governments have adopted 360 measures that ban hydraulic fracturing or encourage state and federal governments to do so.<sup>268</sup>

Some cities have adopted stringent controls on the location of wells. Coppel, a city in Texas that overlies the Barnett Shale, requires that oil and gas wells be sited in areas zoned light industrial or agricultural, and set back 1,000 feet from habitable structures, 300 feet from water wells, and 500 feet from water conveyances.<sup>269</sup> Arlington and Fort Worth, which also overlie the Barnett Shale, require gas wells to be sited 600 feet from protected uses such as residences, religious institutions, hospitals, schools, and public parks, and 200 feet from water wells.<sup>270</sup> In Colorado, the city of Longmont bans surface development in residential areas and classifies disposal facilities as heavy industrial uses that must be sited in industrial zoning districts.<sup>271</sup>

These cities have also adopted stringent regulations on the manner of development. Fort Worth, for example, requires gas well operators to meet forty-one technical standards for on-site activities; the standards include notifying the city gas inspector and posting a sign at the well site at least forty-eight hours before hydraulic fracturing operations begin.<sup>272</sup> Other standards govern noise, fencing and landscaping, clean up and maintenance, and plugging and abandonment of wells.<sup>273</sup> Operators must maintain insurance, including environmental pollution liability coverage of \$5 million per incident and well control liability coverage of \$5 million per incident, and demonstrate proof of financial responsibility through a bond or letter of credit.<sup>274</sup>

The extent of local authority is contested in many states.<sup>275</sup> Two lawsuits are underway in Colorado to challenge Longmont's authority to regulate wells and ban hydraulic fracturing.<sup>276</sup> A decision is pending in the Pennsylvania Supreme Court in a case concerning Act 13, which requires that all local ordinances regulating oil and gas operations allow for the "reasonable development" of oil and gas resources.<sup>277</sup> The New York Supreme Court's Appellate Division recently upheld two city ordinances banning hydraulic fracturing,<sup>278</sup> and an Illinois appellate court ruled that even a non-home-rule unit of government may prohibit the drilling or operation of an oil or gas well within its limits.<sup>279</sup> But in Ohio, the state Appellate Court recently struck down a city ordinance on oil and gas drilling because it conflicted with the state regulatory program,<sup>280</sup> and in West Virginia, a trial court held that the state regulatory program preempted a town ordinance that banned hydraulic fracturing.<sup>281</sup>

## CHALLENGES AND OPPORTUNITIES

**T**here are three primary axes to consider when analyzing the policy and law of high-volume hydraulic fracturing: the level of government, the policy/legal actor, and the policy approach. Different types of uncertainty affect all of these axes: scientific uncertainty, public

uncertainty, and uncertainty about the direction of policy and law. The latter type of uncertainty stems from the rapid creation of law by federal, regional, state, and local governments; the unsettled balance between different levels of government; and ongoing litigation on key issues.

### 2.1 The Division of Governmental Power

There are four levels of government that could make policies and laws governing a high-volume hydraulically fractured oil and gas well: federal, regional, state, and local. As discussed in the Status and Trends section, the state is the primary regulator of oil and gas development and its environmental impacts in Michigan. Some activities are governed by federal laws, but there are also several federal exemptions. Regional entities, such as those created by the Great Lakes Compact and Agreement, have not entered the fray.<sup>282</sup> And localities in Michigan are only beginning to assert a role.

Our governmental system divides powers between the levels of government in such a way as to match the scope and nature of the particular problem. Federal authority to enact laws rests in specific powers relating to national concerns, such as the power to regulate interstate commerce.<sup>283</sup> In contrast, states retain broad police power to protect their residents' public health, safety, and welfare.<sup>284</sup> Regional bodies exercise authority over a region as defined by state members and approved by the U.S. Congress.<sup>285</sup> Local governments regulate land uses within their own localities through powers granted by the state.<sup>286</sup> Thus, there is an opportunity to separate activities related to high-volume hydraulic fracturing and "match" them to national, regional, state, and local powers.

Yet the division of power is not, in fact, so neat. Most federal environmental laws, for example, take a cooperative federalist approach that sets a federal floor for standards but delegates programs to the states.<sup>287</sup> Beyond these specific divisions of authority, the reality is that federal, regional, state, and local governments act within substantially overlapping spheres. Courts generally uphold federal regulation of intrastate commercial activities and their environmental effects when the activities in aggregate substantially affect interstate commerce, thus allowing both federal and state environmental regulation of most activities.<sup>288</sup> Regional entities employ state authority and may act under federal law.<sup>289</sup> States have the authority to regulate land uses through zoning, thus allowing both state and local regulation of such uses.<sup>290</sup>

Beyond questions of legal authority, there is an ongoing debate among legal scholars on the justifications for federal, regional, state, and local government regulation of hydraulic fracturing and its environmental effects.<sup>291</sup> Among the justifications for federalization are "spillover" effects on other states; a "race to the bottom"

between states; the importance of uniform standards to industry; the benefits of pooling technical, scientific, and legal resources; diverse interest group participation; and a national interest or moral imperative.<sup>292</sup> Among the justifications for decentralization are improvements in democratic participation; better responses to community preferences; the importance of local conditions; the benefits of experimenting with different policy approaches through the laboratories of many jurisdictions; and the spurring of competition among states to create economically efficient policies.<sup>293</sup>

## 2.2 The Policy and Legal Actors

There are three actors who could make policies and laws governing a high-volume hydraulically fractured oil and gas well: legislative bodies, which create statutes, resolutions, and ordinances; administrative agencies, which create regulations, guidance, and statements of policy; and judges, who create common law through cases. As discussed in the Status and Trends section, the primary actors creating policy and law in Michigan are administrative agencies, the DEQ and the federal EPA. While legislative bodies have passed many statutes relating to oil and gas wells and environmental impacts, there are few provisions on hydraulic fracturing. The U.S. Congress has exempted hydraulic fracturing in the SDWA and considered new requirements in two bills; the Michigan Legislature has considered several bills but not acted on them; and some local governments have passed resolutions or ordinances. No state or federal courts have applied Michigan common law to disputes specifically involving hydraulic fracturing.

Given the high level of public interest in high-volume hydraulic fracturing, one consideration is whether the actors are more or less likely to create policies and laws reflecting majoritarian preferences. From a traditional point of view, legislative bodies should be most responsive to public concern—and thus make more legitimate decisions—because the bodies are composed of elected representatives.<sup>294</sup> Administrative agencies are directed by political appointees who answer to the elected President or Governor and execute laws created by elected legislatures. But the agencies are primarily composed of civil servants who are less directly responsive to the voters, by virtue of not having to stand for reelection.<sup>295</sup> Particularly if administrative decisions are made without public review, the decisions may lack legitimacy. By the same logic, elected judges such as those in Michigan should also be responsive to the public, although they act within a more constrained environment than do legislators.<sup>296</sup> Deference to legal precedent, for example, is designed to make significant changes in law more difficult.

Among others, U.S. Supreme Court Justice Breyer has argued that the larger the public concern, the more that the very responsiveness of decision-makers may result in irrational policies that spend

significant resources on insignificant risks.<sup>297</sup> In this view, legislative bodies are most likely to focus on the latest crisis rather than carefully consider how to address risk more generally.<sup>298</sup> Administrative agencies, if they are insulated from the political agenda of the elected executive and able to prioritize, can make more rational decisions based on their scientific and technical expertise.<sup>299</sup> And appointed judges, unlike elected ones, will be more likely to use their judicial expertise to resolve controversial disputes in a neutral, fair manner, and to appropriately defer to the expertise of agencies.<sup>300</sup> Thus, administrative decisions that rely on technical and scientific expertise to prioritize risk may be preferable to unconstrained decisions by legislators or elected judges.

There are other theorists who contend that the responsiveness of decision-makers to public concern is itself subject to question, particularly when there are significant private interests at stake. Public choice theorists view legislative bodies as marketplaces in which laws reflect the deals of private, well organized interests.<sup>301</sup> Legislators will respond to the intensity of preferences by making deals with small groups who will be directly impacted by regulation.<sup>302</sup> Through a process known as “logrolling,” legislators trade off votes with other legislators who have made their own deals.<sup>303</sup> Similarly, some administrative law theorists argue that agencies are naturally subject to “capture” by private regulated interests.<sup>304</sup> The constant interaction between agency staff and the regulated community is likely to lead the agency over time to privilege private interests over diffuse public welfare.<sup>305</sup> If administrative decision-making is opaque, subject to discretion, and without public review, it may more easily result in decisions influenced by private interests.<sup>306</sup> Some of the EPA’s decisions on hydraulic fracturing, for example, have been attributed to agency capture.<sup>307</sup> While there has been less focus on the judiciary, the same arguments apply to dealmaking and a form of capture when judges are elected.<sup>308</sup>

## 2.3 The Policy Approaches

Finally, there are four primary policy approaches that could be used to govern a high-volume hydraulically fractured oil and gas well: “command-and-control” requirements, market-based initiatives, “informational” regulation, and deterrence through court decisions. As discussed in the Status and Trends section, the primary means of regulating a high-volume hydraulically fractured well in Michigan is through command-and-control requirements—either prescriptive- or performance-based. For example, the state oil and gas permitting program prescribes a set distance between a production well and a freshwater well, and also mandates that an operator use every reasonable precaution to prevent waste. The practice of hydraulic fracturing itself, however, is regulated through information provided to the state agency and to the public.

Command-and-control policies require the regulated actor to take

prescribed actions or to meet a certain level of performance.<sup>309</sup> The policies are usually based on substantive standards that employ environmental, health, or technology criteria. Market-based policies seek to internalize environmental externalities and compensate the affected public through taxes or trading schemes.<sup>310</sup> In a looser sense, market-based policies may encourage private bargaining that results in more efficient outcomes. Informational policies require disclosure of private information to government and to the public, with the goal of reducing risk.<sup>311</sup> Finally, court decisions not only resolve a particular dispute, but “regulate” by setting a standard of liability that deters other actors from the unlawful activity.<sup>312</sup>

There is an extensive literature on the benefits and detriments of each approach. Command-and-control policies are designed to reach a particular environmental and/or public health outcome, but do so through sometimes rigid mandates that can be paralyzed by contested rulemaking and judicial challenges.<sup>313</sup> Market-based policies are economically efficient if the market participants have the right incentives, but may not adequately protect health and the environment.<sup>314</sup> The policies also are not free from politics: there must be politically unappealing decisions about the imposition of direct costs. Informational policies can harness public pressure to reduce health and environmental effects in a cost-effective manner, but like market-based policies, they may not provide adequate protection.<sup>315</sup> In addition, it is unclear how to best structure these policies so they inform the public. And court decisions set morally acceptable standards through tort law, but the standards may not result in changes in private behavior if the expected costs posed by lawsuits are less than the benefits of the activity.<sup>316</sup>

The discussion of how to apply the policy approaches to the issue of high-volume hydraulic fracturing is just beginning.<sup>317</sup> In theory, each risk-creating activity could be matched to the best policy. Thus, activities with health and environmental risks that can be controlled through standards could be addressed through command-and-control policies. Activities with clearly understood costs and sophisticated participants could be addressed through market-based policies. Activities that cause risks which can be characterized through privately held data and communicated to the public could be addressed through informational policies. And activities that are difficult to control through regulation but cause morally unacceptable, expensive injuries could be addressed by the deterrence effect of court decisions. As an example, two scholars have proposed addressing the risk of water contamination through a combination of command-and-control policy and changes to the liability rules of tort law, with information disclosure in a secondary role.<sup>318</sup>

## PRIORITIZED PATHWAYS FOR PHASE 2

**B**ased on the above sections, the authors offer five pathways for an analysis of policy options in Phase 2 of the Integrated Assessment. The first prioritized pathway—and the one the authors believe should be the highest priority—is an analysis of the policy options for addressing public concern about chemical use. The second pathway is an analysis of the policy options for public participation in governmental decisions on hydraulic fracturing. The third pathway is an analysis of the policy options for addressing contamination, including both prospective and retrospective responses. The fourth pathway is an analysis of the policy options for addressing the impacts of water withdrawals. And the fifth pathway is an analysis of the policy options for addressing land use, both at the state and local level. For each pathway, the analysis should weave the expertise of the participating disciplines together with the challenges and opportunities posed by governmental levels, policy actors, policy approaches, and uncertainty.

### 3.1 Chemical Use

One of the most contentious issues in the debate surrounding high-volume hydraulic fracturing is the scale of chemical use. The precise risk to human health and the environment of this chemical use has not been quantified, and there is disagreement about whether the risk may be lower or higher than other activities associated with high-volume hydraulic fracturing. The report of Basu (this series) covers the issue in detail. But because the topic generates significant public concern, see Hoffman and Wolske (this series), it is an important subject of analysis in Phase 2.

As discussed above, Michigan is one of many states that have chosen to address chemical use through the policy approach of disclosure. In the last three years, twenty-one states have adopted policies requiring disclosure of the constituents in hydraulic fracturing fluid. The federal government has also proposed disclosure in the federal FRAC Act and the BLM’s rule. The specific information required of well operators and the means of disclosure vary, but an increasingly common state vehicle for disclosure is a website called FracFocus.

The model for informational regulation in the context of chemical use is the Toxics Release Inventory (TRI), created in 1986 as part of the federal Emergency Planning, Control, and Right-to-Know Act. Under the act, certain facilities are required to report releases of toxic chemicals into the environment each year.<sup>319</sup> The EPA then places the information online so that members of the public can learn about toxic releases in their community.<sup>320</sup> Following the surprising success of the TRI, legal scholars have debated the value of informational regulation. But the literature on disclosure in the

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context of chemical use in hydraulic fracturing is in its infancy.

Phase 2 should seek to establish a range of options for addressing public concern about chemical use, including a comparison of disclosure to other policy options. In considering disclosure, Phase 2 should assess what information could be disclosed, to whom it could be disclosed, when it could be disclosed, how it could be disclosed, and how it could be used. The analysis should also examine the issue of trade secrets and the options for balancing the protection of intellectual property with environmental transparency. Cross-disciplinary inquiry is essential to this study. It is important to understand the environmental and human health hazards of the various chemicals, and the areas of scientific uncertainty. It is also important to understand the perceptions of risk among the public and the ways in which risk could be communicated to inform decision-making. Finally, it is important to understand the economic value of trade secrets so as to weigh the harms from varying levels of disclosure. This analysis would benefit from additional empirical studies on the effectiveness of different disclosure models.

### 3.2 Public Participation and Trust

As discussed in detail in Hoffman and Wolske (this series), there is a wide gulf between the public perception of the risks of high-volume hydraulic fracturing and that of the oil and gas industry and some regulators. The gulf is fueled by mistrust and conflicting information. The authors suggest that Phase 2 include an analysis of the policy options available to address this issue, including options for public participation.

Unlike many environmental permitting programs, oil and gas well programs do not historically give the general public the formal opportunity to review and comment on permit applications, or require agencies to respond to comments. As discussed above, Michigan law gives local governments the opportunity to comment, but not the general public. Moreover, the DEQ has used its statutory authority to respond quickly to public concern, but in a primarily informal manner and without formal public input.

In analyzing the policy options, it is important to distinguish between public access to and review of information that pertains to the environment, public health, and safety, and information that pertains to the productiveness of the resource. Because of the competitive nature of the industry, oil and gas well permitting programs often include protections for well data. Michigan's program, for example, requires that all well data and samples provided to the DEQ can be held confidential for 90 days after well completion at the request of the operator.<sup>321</sup>

There is a fairly well developed legal literature on public participation and transparency in the context of environmental law. This

includes the conflicting incentives of administrative agencies to both involve the public and to avoid difficult formal processes. There is, however, very little literature that focuses on public participation or collaborative governance as it relates to oil and gas law. Given the intense public concern, this topic would benefit from an interdisciplinary approach. It is important to understand how members of the public think about the risks of high-volume hydraulic fracturing and the ways in which public participation could help or hinder communication between the public and decision-makers. It is also important to understand the technical information gathered by oil and gas companies in exploration and development.

### 3.3 Contamination and Response

There have been high profile incidents of environmental contamination from undiluted chemical additives, hydraulic fracturing fluids, flowback, and methane, but the extent to which such contamination is a significant problem is contested. See Basu (this series). If contamination occurs, the people who are most likely to be affected by the incidents—at least in the short term—are surface owners or nearby landowners. The traditional remedy for harm caused by environmental contamination is a tort claim. Claims include trespass, nuisance, negligence and negligence per se, and strict liability claims for an abnormally dangerous activity. In the context of hydraulic fracturing, reported decisions have generally found against the plaintiffs.<sup>322</sup> One reason—although certainly not the only one—is that scientific uncertainty makes proving causation very difficult.

The authors suggest that Phase 2 include an analysis of policy options to address contamination. The cross-disciplinary inquiry would combine contamination incidents and likely pathways, the technologies that could be employed, and the policy and legal tools. As discussed above, one way of responding to the challenge of causation is to reduce the burden by creating a presumption of liability and by requiring baseline testing of water wells. Another way is to examine methods of fingerprinting hydraulic fracturing fluids so as to trace the source of contamination. See Ellis (this series). And yet another way is to look to leases and lease terms. Landowners can bargain for environmental protections that go beyond federal and state requirements, or the state can require specific provisions be included in the lease.

Ideally, the analysis would be informed by research on leases signed in Michigan and the ways in which they create a private standard addressing contamination and hydraulic fracturing. There is no comprehensive analysis of Northern Michigan leases and their environmental terms. The producer form discussed above requires the company to pay only for damages to growing crops,<sup>323</sup> but this term does not necessarily reflect what is in the final lease. In 2011, the New York Times reviewed more than 111,000 leases in other

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states and found that they varied significantly in the protections they offered for water supplies, crops, and livestock.<sup>324</sup>

The analysis could also consider educational efforts. Michigan State University Extension has a program devoted to educating landowners—particularly farmers—about oil and gas leasing.<sup>325</sup> Starting in 2010, the program has held meetings at which Extension educators, attorneys, oil and gas companies, and state officials explain oil and gas development, state regulation, and the leasing process. The Extension website includes fact sheets and other materials, including a 2010 lease addendum with provisions on water use, location of equipment, damages, and disposal wells.<sup>326</sup> Owners may submit a question online, through “Ask a Expert.”<sup>327</sup>

### 3.4 Water Use and Regulation

The scale of water use for high-volume hydraulic fracturing is an important issue, and one that generates public concern. See Hoffman and Wolske (this series). As discussed above, water withdrawals for oil and gas operations are exempt from regulation under Michigan’s water management law. The DEQ requires operators of high-volume hydraulically fractured wells to use the state water withdrawal assessment tool, which may not fully address the impacts of withdrawals on sensitive resources. See Burton and Nadelhoffer (this series).

Phase 2 should include an analysis of the policy options to address water use. High-volume hydraulic fracturing poses a challenge to the traditional model of water quantity regulation, which focuses on long-term, continuous withdrawals rather than on short-term, one-time withdrawals. The interdisciplinary analysis would bring together information on the amounts of water used, the potential environmental impacts, the availability and cost of technology to minimize water use and reuse flowback, and regulatory mechanisms.

### 3.5 Land Use Impacts

Finally, Phase 2 should examine the siting of high-volume hydraulically fractured wells and the policy options available to address nuisance impacts such as noise, light pollution, truck traffic, and dust. These are discussed in Basu (this series) and Burton and Nadelhoffer (this series). As discussed above, the DEQ regulates the siting of wells through conservation requirements and setbacks. The cross-disciplinary analysis would include information on the source and extent of nuisance impacts, the concerns of residents, and the authority of both the state and local governments to address these impacts. Ideally, the analysis would include a survey of local units of government and residents to determine the issues of greatest concern.

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<sup>1</sup> For other discussions of the policy and legal framework, see Michael Goldman, *Drilling into Hydraulic Fracturing and Shale Gas Development: A Texas and Federal Environmental Perspective*, 19 TEX. WESLEYAN L. REV. 185 (2012); William J. Brady & James P. Crannell, *Hydraulic Fracturing Regulation in the United States: The Laissez-Faire Approach of the Federal Government and Varying State Regulations*, 14 VT. J. ENVTL. L. 39 (2012). See also Stephanie Karisny, Note, *Hydraulic Fracturing In Michigan: Reassessing State Regulations in Light of New Drilling in the Collingwood and Utica Shales*, 57 WAYNE L. REV. 627 (2011) (reviewing the Michigan framework).

<sup>2</sup> Under the “ownership-in-place” theory followed in Michigan, “the nature of the interest of the landowner in oil and gas contained in his land is the same as his interest in solid minerals;” minerals are a part of the land in or beneath which they are located, so the owner of land is also the owner of the oil and gas in or beneath it. *Wronski v. Sun Oil Co.*, 279 N.W.2d 564, 569 (Mich. 1979) (citing WILLIAM & MEYERS, OIL AND GAS LAW § 203.3); *Mark v. Bradford*, 23 N.W.2d 201 (Mich. 1946).

<sup>3</sup> MICHIGAN ENVIRONMENTAL LAW DESKBOOK §§ 20.10-11 (2d ed. 2012).

<sup>4</sup> *Id.*

<sup>5</sup> MICH. COMP. LAWS ANN. §§ 554.291-.294 (West 2013). The purpose of the Dormant Minerals Act is to promote the development of mineral interests.

<sup>6</sup> Telephone Interview with Staff, Minerals Management Section, DNR (Mar. 18, 2013); DNR, DNR DEP’T PROCEDURE 27.23-14, OIL AND GAS LEASING PROCEDURE (2005).

<sup>7</sup> Telephone Interview with Staff, *supra* note 6. The state also owns approximately 530,000 acres of surface lands. *Id.*

<sup>8</sup> Interview with Staff, Minerals Management Section, DNR, in Lansing, MI (Mar. 13, 2013). When the DNR sells land now, it may reserve mineral rights to oil and gas “when the land is in production or is leased or permitted for production, or when the department determines that the land has unusual or sensitive environmental features or that it is in the best interest of this state to reserve those rights.” MICH. COMP. LAWS ANN. § 324.503(15).

<sup>9</sup> *Id.* §§ 324.61001-.61004.

<sup>10</sup> *Id.* § 324.61003(1).

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- <sup>11</sup> Wronski, 279 N.W.2d at 569 (citing WILLIAM & MEYERS, *supra* note 1, § 204.4) (“The owner of a tract of land acquires title to the oil and gas which he produces from wells drilled thereon, though it may be proved that part of such oil or gas migrated from adjoining lands.”).
- <sup>12</sup> Wronski, 279 N.W.2d at 569 (citing WILLIAM & MEYERS, *supra* note 1, § 204.4).
- <sup>13</sup> Wronski, 279 N.W.2d at 570.
- <sup>14</sup> See Mable Cleary Trust v. Edward-Marlah Muzyl Trust, 686 N.W.2d 770 (Mich. 2004); Southwestern Oil Co. v. Wolverine Gas & Oil Co., 450 N.W.2d 1 (Mich. 1989).
- <sup>15</sup> DEQ, MINERAL RIGHTS (undated), available at [http://www.michigan.gov/documents/deq/ogs-oilandgas-mineral-rights\\_257977\\_7.pdf](http://www.michigan.gov/documents/deq/ogs-oilandgas-mineral-rights_257977_7.pdf).
- <sup>16</sup> *Id.* Other common surface use provisions are setbacks from houses or barns and burial of any pipelines below plough depth.
- <sup>17</sup> MICH. STATE UNIV. EXTENSION, LANDOWNER INFORMATION FOR OIL/GAS/MINERAL LEASES 8 (2010), available at [http://www.portal.msue.msu.edu/objects/content\\_revision/download.cfm/revision\\_id.576752/workspace\\_id.28369/Landowner%20Information%20for%20Oil%20&%20Gas%20Leasing.pdf](http://www.portal.msue.msu.edu/objects/content_revision/download.cfm/revision_id.576752/workspace_id.28369/Landowner%20Information%20for%20Oil%20&%20Gas%20Leasing.pdf). For more information on pooling and “Pugh” clauses, see Randy M. Awdish, *Wolverine Gold Rush? A Primer on the Utica/Collingwood Shale and Gas Lease Issues*, 38 MICH. REAL PROP. REV. 64 (2011).
- <sup>18</sup> See, e.g., DNR, DNR DEP’T PROCEDURE 2315.15, OIL AND GAS LEASING PROCEDURE (2001) (“It shall be the policy of the Natural Resources Commission (NRC) to manage State-owned minerals in a manner that protects and enhances the public trust. . . . Minerals shall be developed in an orderly manner to optimize revenue consistent with other public interest and natural resource values.”).
- <sup>19</sup> DNR, DNR DEP’T PROCEDURE 27.23-14, *supra* note 6. The amount of direct leasing is quite small in relation to leasing through auction. Since 2004, the number of direct leases has ranged from 11 (in 2012) to 50 (in 2008), while the number of auction leases has ranged from 566 (in 2004) to 3,302 (in 2011). Minerals Management Section, DNR, Oil and Gas Leases Issued - FY2004 through FY2012 (Mar. 18, 2013) (on file with author). During the height of the Utica/Collingwood leasing activity in 2010, the DNR issued 42 direct leases. *Id.*
- <sup>20</sup> DNR, DNR DEP’T PROCEDURE 2315.15, *supra* note 18.
- <sup>21</sup> *Id.*
- <sup>22</sup> Email from Thomas Hoane, Geologist, Minerals Management Section, DNR, to author (May 29, 2013).
- <sup>23</sup> DNR, PR4305, OIL AND GAS LEASE para. 1.1 (2012).
- <sup>24</sup> WILLIAM & MEYERS, *supra* note 1, § 218.5 (collecting cases).
- <sup>25</sup> Compare DNR, PR4305, OIL AND GAS LEASE, *supra* note 23, para. C.2, with OIL AND GAS LEASE (PAID UP) FORM para. 3 (on file with author).
- <sup>26</sup> Compare DNR, PR4305, OIL AND GAS LEASE, *supra* note 23, para. C.1, with OIL AND GAS LEASE (PAID UP) FORM, *supra* note 25.
- <sup>27</sup> Compare DNR, PR4305, OIL AND GAS LEASE, *supra* note 23, para. G.1, and DNR, DNR DEP’T PROCEDURE 27.23-14, *supra* note 6, para. 28.D.4, with OIL AND GAS LEASE (PAID UP) FORM, *supra* note 25, para. 7.
- <sup>28</sup> Compare DNR, PR4305, OIL AND GAS LEASE, *supra* note 23, para. G.2-.3, with OIL AND GAS LEASE (PAID UP) FORM, *supra* note 25. If the two sides are not able to reach an agreement, the state allows oil and gas development to proceed.
- <sup>29</sup> For mineral interests leased through auction, the state always uses its standard lease. Telephone Interview with Thomas Hoane, Geologist, Minerals Management Section, DNR (June 5, 2013). For mineral interests leased directly, the state also uses its standard lease, but the royalty is increased to 3/16 and the bonus and primary term vary. *Id.*
- <sup>30</sup> An important exception to this conclusion is that almost all private leases in Michigan are paid-up leases. Telephone Interview with Curtis Talley, Farm Mgmt. Educator, Mich. State Univ. Extension (June 5, 2013).
- <sup>31</sup> *Id.* For example, owners in Michigan are now negotiating leases that prohibit surface development or specify the location and manner of such development. *Id.*
- <sup>32</sup> See, e.g., Compton v. Fisher-McCall, Inc., 299 N.W. 750 (Mich. 1941).
- <sup>33</sup> MICH. COMP. LAWS ANN. §§ 324.61503a, .61503b (West 2013). The general rule is that royalties should be paid on the value of the gas at the wellhead. To ensure that owners will receive the benefit of this rule, the statute provides that the deduction of post-production costs must be clearly spelled out in the lease.
- <sup>34</sup> See Office of Oil, Gas, and Minerals, DEQ, [http://www.michigan.gov/deq/0,4561,7-135-3306\\_57064---,00.html](http://www.michigan.gov/deq/0,4561,7-135-3306_57064---,00.html) (last visited Aug. 22, 2013) (follow the “List of high volume Hydraulic Fracturing active permits and applications” hyperlink under “Maps showing the distribution of hydraulically fractured wells in Michigan”).
- <sup>35</sup> *Id.*; Email from Rick Henderson, Field Operations Supervisor, Office of Oil, Gas, and Minerals, DEQ, to author (Aug. 19, 2013).
- <sup>36</sup> Press Release, DNR, State Oil and Gas Lease Auction Sets Historic Record for Revenue (May 6, 2010).

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- <sup>37</sup> Telephone Interview with Curtis Talley, *supra* note 30. See also *Oil and Gas*, MICH. STATE UNIV. EXTENSION, [http://msue.anr.msu.edu/program/info/oil\\_and\\_gas](http://msue.anr.msu.edu/program/info/oil_and_gas) (last updated Apr. 17, 2013) (follow “Oil and Gas Lease Addendum” hyperlink under “Fact sheets and publications,” “From MSU Extension” for an actual 2010 addendum).
- <sup>38</sup> See, e.g., Brian Grow & Joshua Schneyer, *Chesapeake, Encana Sued in Civil Antitrust Action*, REUTERS (Feb. 25, 2013).
- <sup>39</sup> *Id.*
- <sup>40</sup> Joshua Schneyer & Brian Grow, *Special Report: Energy Giant Hid Behind Shells in “Land Grab”*, REUTERS (Dec. 28, 2011); Telephone Interview with Susan Topp, Attorney (Aug. 21, 2013).
- <sup>41</sup> MICH. COMP. LAWS ANN. § 324.61501-61527 (West 2013).
- <sup>42</sup> *Id.* §§ 324.61504-.61505. The Office of Oil, Gas, and Minerals in the DEQ administers the program, led by the chief or assistant supervisor of wells.
- <sup>43</sup> *Id.* §§ 324.61501(q). In the statute, “waste” is defined as “underground waste,” “surface waste,” and “market waste.”
- <sup>44</sup> In the interests of space, this report focuses on the text of laws and policies, not on the extent of compliance and enforcement. One recent study compared the violations of hydraulically fractured Antrim wells in Michigan to violations of unconventional wells in Louisiana, Mexico, and Texas. Hannah Wiseman, *Fracturing Regulation Applied*, 22 DUKE ENVTL. L. & POL’Y F. 361 (2012). Almost all of the Michigan violations were minor, involving signs and labeling, site maintenance, and surface spills of non-produced water. *Id.* at 374-75. In other states, violations were more likely to involve permitting, reporting, pits, and surface spills of produced water. *Id.* The authors theorize that “all of the most common violations are readily identifiable via a quick survey of the site. Although other incidents, such as groundwater contamination and air quality impacts, may in fact occur less often, these violations’ lower frequencies may also be a function of their difficulty to detect.” *Id.* at 377. One area of further research thus could be a comparison of the compliance of high-volume hydraulically fractured wells in Michigan with Antrim wells and with wells in other states.
- <sup>45</sup> MICH. COMP. LAWS ANN. § 324.61525 (prohibiting a person from drilling or operating an oil and gas well without a permit).
- <sup>46</sup> *Id.*
- <sup>47</sup> MICH. ADMIN. CODE r. 324.212 (2013).
- <sup>48</sup> *Id.* at r. 324.210(3)(a)(ii)-(iii).
- <sup>49</sup> *Id.* at r. 324.201(3).
- <sup>50</sup> A weekly list of oil and gas permits applied for, issued, and updated is available at *Weekly Oil & Gas Permit List*, DEQ, [http://www.michigan.gov/deq/0,4561,7-135-3311\\_4111\\_4231-121842--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3311_4111_4231-121842--,00.html) (last visited Aug. 22, 2013).
- <sup>51</sup> MICH. COMP. LAWS ANN. § 324.61525.
- <sup>52</sup> The statute requires all well data and samples provided to the DEQ be held confidential for 90 days after well completion if requested by the operator. *Id.* § 324.61506(d). Presumably, the DEQ considers information in the permit application subject to this confidentiality provision.
- <sup>53</sup> *Id.* § 324.61525; MICH. ADMIN. CODE r. 324.201(d).
- <sup>54</sup> MICH. COMP. LAWS ANN. § 324.61525.
- <sup>55</sup> Interview with Hal Fitch, Chief, Office of Oil, Gas & Minerals, DEQ (May 20, 2013).
- <sup>56</sup> MICH. ADMIN. CODE r. 324.418(b).
- <sup>57</sup> See *OOGM Forms for Oil & Gas Permits and Operations*, DEQ, [http://www.michigan.gov/deq/0,4561,7-135-3311\\_4111\\_4231-9207--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3311_4111_4231-9207--,00.html) (follow “EQP 7130” hyperlink next to “Record of Well Completion” for completion report form).
- <sup>58</sup> DEQ, Supervisor of Wells Instruction 1-2011, High Volume Hydraulic Fracturing Completions (2011).
- <sup>59</sup> *Id.*
- <sup>60</sup> *Id.*
- <sup>61</sup> MICH. ADMIN. CODE r. 324.201(2) (2013).
- <sup>62</sup> Deanna Hughes, Heather Schiele, and Ban Michigan Fracking, Petition for Declaratory Ruling as to Application of R 324.102(x) and 324.201(2)(j)(v) and (vi) to Fracking Permit Applications and Operations (Apr. 27, 2012).
- <sup>63</sup> Declaratory Ruling, Deanna Hughes, Heather Schiele, and Ban Michigan Fracking (DEQ June 28, 2012) (denying petition); Hughes v. DEQ, No. 12-497-CE (Ingham Cnty. Mich. Cir. Ct. 2012) (upholding DEQ decision); Hughes v. DEQ, No. 312902 (Mich. Ct. App. May 24, 2013) (denying DEQ’s motion to dismiss).
- <sup>64</sup> *Office of Oil, Gas, and Minerals*, DEQ, *supra* note 34; Email from Rick Henderson, Field Operations Supervisor, Office of Oil, Gas, and Minerals, DEQ, to author (Aug. 22, 2013). Twenty-two vertical wells have been permitted, of which twenty are associated with a horizontal well.
- <sup>65</sup> *Id.*
- <sup>66</sup> MICH. COMP. LAWS ANN. §§ 324.62501(o), .62508(b) (West 2013).

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- <sup>67</sup> *Id.* § 324.62509(2) (requiring permits for test wells only if they are drilled fifty feet or greater into bedrock or below the deepest freshwater strata); Email from Hal Fitch, Chief, Office of Oil, Gas & Minerals, DEQ (May 29, 2013).
- <sup>68</sup> MICH. COMP. LAWS ANN. § 324.61502 (originally enacted as 1939 Mich. Pub. Acts 61).
- <sup>69</sup> *Id.* § 324.61513; MICH. ADMIN. CODE r. 324.301 (2013).
- <sup>70</sup> MICH. COMP. LAWS ANN. §§ 324.61512, .61513; MICH. ADMIN. CODE r. 324.601.
- <sup>71</sup> MICH. COMP. LAWS ANN. § 324.61513; MICH. ADMIN. CODE r. 324.303(1).
- <sup>72</sup> MICH. COMP. LAWS ANN. § 324.61513; MICH. ADMIN. CODE r. 324.303(2).
- <sup>73</sup> MICH. COMP. LAWS ANN. § 324.61513; MICH. ADMIN. CODE r. 324.303(2).
- <sup>74</sup> MICH. COMP. LAWS ANN. § 324.61513; MICH. ADMIN. CODE r. 324.304. Established practices and industry standards suggest that actual well costs and production from the well be allocated based upon the ratio of the number of surface acres in the tracts of various owners to the total number of surface acres in the drilling unit. See Savoy Energy, No. 03-2012, 2012 Mich. ENV LEXIS 4, at \*10-11 (May 23, 2012); Jordan Dev. Co., No. 01-2012, 2012 Mich. ENV LEXIS 2, at \*9-10 (Mar. 12, 2012).
- <sup>75</sup> MICH. ADMIN. CODE r. 324.1206(1).
- <sup>76</sup> *Id.* at r. 324.1206(4).
- <sup>77</sup> Telephone Interview with Hal Fitch, Chief, Office of Oil, Gas & Minerals.
- <sup>78</sup> MICH. ADMIN. CODE r. 324.1206(4)(b).
- <sup>79</sup> *Traverse Oil Co. v. Hoeter*, 396 N.W.2d 498, 504-05 (Mich. Ct. App. 1986).
- <sup>80</sup> DEQ, Special Order No. 1-73, amended (June 23, 1975), available at [http://www.michigan.gov/documents/deq/ogs-oilandgas-spacing-1-73-amended\\_258024\\_7.pdf](http://www.michigan.gov/documents/deq/ogs-oilandgas-spacing-1-73-amended_258024_7.pdf).
- <sup>81</sup> The Initiative of the Supervisor of Wells for an Order to Fix the Spacing of Gas Wells in the Utica Shale Formation and the Collingwood Shale Formation, Order No. 12-2010 (Supervisor of Wells 2012).
- <sup>82</sup> See, e.g., *Devon Energy Prod. Co.*, No. 08-2012 (Supervisor of Wells Sept. 7, 2012).
- <sup>83</sup> *Id.*
- <sup>84</sup> *Id.* at 4-5.
- <sup>85</sup> Compare *id.* at 11-12 (estimating costs of Utica/Collingwood well at \$11 million and setting risk premiums at 400% of actual drilling costs and 300% of actual completion costs), with *Savoy Energy*, *supra* note 74, at \*17-18 (estimating costs of Trenton well at \$1.5 million and setting risk premiums at 300% of actual drilling costs and 200% of actual completion costs).
- <sup>86</sup> MICH. COMP. LAWS ANN. § 324.61506 (West 2013).
- <sup>87</sup> MICH. ADMIN. CODE r. 324.301(1)(b)(v) (2013).
- <sup>88</sup> *Id.* at r. 324.301(1)(b)(vi).
- <sup>89</sup> DNR, PR4305, OIL AND GAS LEASE, *supra* note 23, para. I.4.
- <sup>90</sup> MICH. COMP. LAWS ANN. § 324.61505a.
- <sup>91</sup> 42 U.S.C. § 15941 (2006) (“No Federal or State permit or lease shall be issued for new oil and gas slant, directional, or offshore drilling in or under one or more of the Great Lakes.”).
- <sup>92</sup> DNR, PR4305, OIL AND GAS LEASE, *supra* note 23, para. I.4.
- <sup>93</sup> See *OOGM Forms for Oil & Gas Permits and Operations*, *supra* note 57 (follow “EQP 7200-19” hyperlink next to “Environmental Impact Assessment” for form).
- <sup>94</sup> *Id.* (follow “EQP 7200-21” hyperlink next to “Antrim Project Environmental Impact Assessment” for form).
- <sup>95</sup> See MICH. ADMIN. CODE r. 324.201(2)(f) (requiring only the filing of an environmental impact assessment form).
- <sup>96</sup> MICH. COMP. LAWS ANN. § 324.30508 (West 2013).
- <sup>97</sup> *Id.* § 324.35304.
- <sup>98</sup> *Id.* § 324.36502. Information developed regarding T&E species is identified in or attached to the Environmental Impact Assessment. Environmental Impact Assessment, Form EQP 7200-19, available at [http://www.michigan.gov/deq/0,4561,7-135-3311\\_4111\\_4231-9207--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3311_4111_4231-9207--,00.html).
- <sup>99</sup> MICH. COMP. LAWS ANN. § 324.30102.
- <sup>100</sup> *Id.* § 324.30304. Michigan administers the federal wetlands program through its state wetlands law. See 40 C.F.R. § 233.70 (2013).

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<sup>101</sup> MICH. COMP. LAWS ANN. § 324.30509.

<sup>102</sup> 40 C.F.R. §§ 122.21(c)(1), 122.26(b)(15)(i), (e)(8) (2013).

<sup>103</sup> 33 U.S.C. § 1342(l)(2) (2006) (exempting “discharges of stormwater runoff from . . . oil and gas exploration, production, processing, or treatment operations or transmission facilities . . . which are not contaminated by contact with, or do not come into contact with, any overburden, raw material, intermediate products, finished product, byproduct, or waste products located on the site of such operations”). For a helpful discussion of the applicable requirements, see Hannah Wiseman & Francis Gradijan, Regulation of Shale Gas Development, Including Hydraulic Fracturing 22 (June 15, 2012) (unpublished manuscript), [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=1953547](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1953547).

<sup>104</sup> Under Part 91 of NREPA, which governs soil erosion and sedimentation, the authority to issue a construction permit is given to the Supervisor of Wells, not to county or municipal enforcing agencies. MICH. COMP. LAWS ANN. § 324.9115(3). But the standards for a soil erosion and sedimentation plan remain the same. *Id.*

<sup>105</sup> See 16 U.S.C. § 1531(a)(1)-(2) (declaring it unlawful for “any person” to “take” endangered fish or wildlife or “remove, cut, dig up, or damage or destroy [endangered plants] . . . in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law”); 16 U.S.C. § 703 (declaring it unlawful to “take” a migratory bird, which the Fish and Wildlife Service has interpreted to include effects on habitat). Whether the Migratory Bird Treaty Act requires intent or purpose to take a migratory bird is disputed. One federal district court recently ruled that maintaining a pit at a well site that attracts and kills migratory birds is not a violation of the act, but other courts have found unintentional activity to be a “taking.” See *United States v. Brigham Oil & Gas*, 840 F. Supp. 2d 1202, 1211 (D.N.D. 2012).

<sup>106</sup> DNR, PR4305, OIL AND GAS LEASE, *supra* note 23, para. I.2.

<sup>107</sup> *Id.* para. I.3.

<sup>108</sup> *Id.* para. I.6.

<sup>109</sup> MICH. COMP. LAWS ANN. §§ 324.32701(aa), 324.32721 (West 2013). A large quantity withdrawal is defined as “1 or more cumulative total withdrawals exceeding 100,000 gallons of water per day average in any consecutive 30-day period that supply a common distribution system.”

<sup>110</sup> *Id.* § 324.32727 (exemption for “withdrawal undertaken as part of an activity authorized by the department” under Part 615, which governs oil and gas wells).

<sup>111</sup> DEQ, Supervisor of Wells Instruction 1-2011, *supra* note 58. By its terms, the instruction only addresses groundwater withdrawals. The rules prohibit operators from using surface waters for drilling fluids, but do not address the use of surface water for hydraulic fracturing fluids. See MICH. ADMIN. CODE r. 324.404 (2013).

<sup>112</sup> DEQ, Supervisor of Wells Instruction 1-2011, *supra* note 58.

<sup>113</sup> *Id.*

<sup>114</sup> *Id.*

<sup>115</sup> *Natural Aggregates Corp. v. Twp. of Brighton*, 539 N.W.2d 761, 767-68 (Mich. Ct. App. 1995).

<sup>116</sup> MICH. COMP. LAWS ANN. § 125.3205(2) (West 2013).

<sup>117</sup> *Addison Twp. v. Gout*, 460 N.W.2d 215, 216 (Mich. 1990).

<sup>118</sup> MICH. COMP. LAWS ANN. § 125.3207.

<sup>119</sup> *Risko v. Grand Haven Charter Twp. Zoning Bd. of Appeals*, 773 N.W.2d 730 (Mich. 2009).

<sup>120</sup> The localities that support bans are the townships of Cross Village, Orangeville, Reno, Thornapple, and Yankee Springs; the cities of Dearborn Heights, Detroit, Ferndale; and the counties of Ingham and Wayne. The township of Burleigh supports moratoria. The City of Southfield and Waterford Township have passed resolutions urging further federal regulation and analysis. See *Local Actions against Fracking*, FOOD & WATER WATCH, <http://foodandwaterwatch.org/water/fracking/fracking-action-center/local-action-documents/> (last visited Aug. 22, 2013).

<sup>121</sup> Township of Courtland, Resolution No. 2013-08, Moratorium on Issuance of Permits for Oil and Gas Related Activities (June 5, 2013); Township of West Bloomfield, Moratorium Resolution (Aug. 20, 2012) (imposing moratorium on any township actions related to drilling operations from September 1, 2012, to February 28, 2013); Jim Harger, *Fearful of ‘Fracking,’ Kent County Township Adopts Moratorium on Oil and Gas Drilling*, MLIVE (May 16, 2013), [http://www.mlive.com/business/west-michigan/index.ssf/2013/05/fearful\\_of\\_fracking\\_kent\\_count.html](http://www.mlive.com/business/west-michigan/index.ssf/2013/05/fearful_of_fracking_kent_count.html).

<sup>122</sup> See, e.g., Press Release, FLOW, FLOW Local Ordinance Program Brings Fracking Protection to Two Michigan Townships (May 23, 2013); OLSON & KIRKWOOD, HORIZONTAL FRACTURING FOR OIL AND GAS IN MICHIGAN: LEGAL STRATEGIES AND TOOLS FOR COMMUNITIES AND CITIZENS (2012).

<sup>123</sup> For a pessimistic view of the extent of local authority, see Ford J.H. Turrell, *Frack Off! Is Municipal Zoning a Significant Threat to Hydraulic Fracturing in Michigan?*, 58 WAYNE L. REV. 279 (2012).

<sup>124</sup> MICH. COMP. LAWS ANN. § 324.61506(c) (West 2013).

<sup>125</sup> MICH. ADMIN. CODE r. 324.402 (2013).

<sup>126</sup> *Id.* at r. 324.408(1).

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- <sup>127</sup> *Id.*
- <sup>128</sup> *Id.* at r. 324.410-.411.
- <sup>129</sup> *Id.* at r. 324.411.
- <sup>130</sup> *Id.* at r. 324.503.
- <sup>131</sup> *Id.* at r. 324.406.
- <sup>132</sup> *Id.*
- <sup>133</sup> 42 U.S.C. § 300h(d)(B)(ii) (2006).
- <sup>134</sup> *Id.*
- <sup>135</sup> See Letter from Henry A. Waxman, Ranking Member, S. Comm. on Energy & Commerce, to Lisa Jackson, Adm'r, U.S. EPA (Jan. 31, 2011).
- <sup>136</sup> Permitting Guidance for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels--Draft: Underground Injection Control Program Guidance #84, 77 Fed. Reg. 27,451 (proposed May 10, 2012).
- <sup>137</sup> Telephone Interview with Lisa Perenchio, Section Chief, Direct Implementation UIC Program, EPA Region 5 (Mar. 18, 2013).
- <sup>138</sup> MICH. COMP. LAWS ANN. § 324.61506(h) (West 2013).
- <sup>139</sup> DEQ, Supervisor of Wells Instruction 1-2011, *supra* note 58.
- <sup>140</sup> *Id.*
- <sup>141</sup> MICH. COMP. LAWS ANN. § 29.473.
- <sup>142</sup> 49 C.F.R. §§ 171-80 (2013).
- <sup>143</sup> DEQ, Supervisor of Wells Instruction 1-2011, *supra* note 58. In March 2012, the U.S. Occupational Safety and Health Administration amended the Hazard Communication Standard that governs MSDSs and renamed the document a "Safety Data Sheet," or SDS. 29 C.F.R. § 1910.1200(g).
- <sup>144</sup> *Id.*
- <sup>145</sup> *Hydraulic Fracturing in Michigan*, MICH. DEP'T OF ENVTL. QUALITY, [http://www.michigan.gov/deq/0,4561,7-135-3311\\_4111\\_4231-262172--,00.html](http://www.michigan.gov/deq/0,4561,7-135-3311_4111_4231-262172--,00.html) (last visited Aug. 22, 2013).
- <sup>146</sup> *Id.*
- <sup>147</sup> 42 U.S.C. §§ 11021(b), 11022(b) (2011); 40 C.F.R. § 370.10(a)(2)(i).
- <sup>148</sup> See 40 C.F.R. § 370.10(a)(1) (requiring reporting for extremely hazardous substances if they are present at the facility in amounts greater than 500 pounds or the threshold planning quantity, whichever is less).
- <sup>149</sup> Encana Oil & Gas (USA) Corp., Tier II Emergency and Hazardous Chemical Inventory, State Wilmot 1-21 (2011) (on file with author). Because the MSDSs that Encana submitted to DEQ for the hydraulic fracturing fluid additives used in the well do not list diesel, the diesel on the inventory was presumably used for fuel. See *Hydraulic Fracturing in Michigan*, *supra* note 145 (follow "State Wilmot 1-21" hyperlink under "Additional well specific information").
- <sup>150</sup> MICH. ADMIN. CODE r. 324.1010 (2013).
- <sup>151</sup> Email from Hal Fitch, Chief, Office of Oil, Gas & Minerals, to author (May 30, 2013).
- <sup>152</sup> Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews; Final Rule, 77 Fed. Reg. 49,490 (Aug. 16, 2012) (to be codified at 40 C.F.R. pts. 60, 63).
- <sup>153</sup> 40 C.F.R. § 60.5375(a).
- <sup>154</sup> *Id.*
- <sup>155</sup> *Id.* § 60.5375(f).
- <sup>156</sup> *Id.*
- <sup>157</sup> MICH. ADMIN. CODE r. 324.610 (2013).
- <sup>158</sup> MICH. COMP. LAWS ANN. § 324.61524 (West 2013).
- <sup>159</sup> *Id.* § 205.301.
- <sup>160</sup> *Id.* §§ 205.303(3), 324.503(4).
- <sup>161</sup> MICH. ADMIN. CODE r. 324.903.
- <sup>162</sup> *Id.* at r. 324.902.
- <sup>163</sup> *Id.* at r. 324.1003.

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- <sup>164</sup> MICH. COMP. LAWS ANN. § 324.61519.
- <sup>165</sup> *Id.* § 324.61603.
- <sup>166</sup> *Id.* § 324.61520.
- <sup>167</sup> 40 C.F.R. § 261.4(b)(5) (2013). *See also* 42 U.S.C. §§ 6921(b)(2), 6982(m) (2006).
- <sup>168</sup> MICH. ADMIN. CODE r. 324.701.
- <sup>169</sup> *Id.* at r. 324.102(f).
- <sup>170</sup> *Id.* at r. 324.701.
- <sup>171</sup> DEQ, Supervisor of Wells Instruction 1-2011, *supra* note 58.
- <sup>172</sup> MICH. ADMIN. CODE r. 324.407. Below the base of the Detroit River Anhydrite, only cuttings and the solid fraction of drilling muds may be placed in the pit. *Id.* at r. 324.407(7)(b)(4).
- <sup>173</sup> *Id.* at r. 324.503.
- <sup>174</sup> *Id.* at r. 324.1008(7).
- <sup>175</sup> *Id.* at r. 324.1008(2), (5).
- <sup>176</sup> *Id.* at r. 324.1008(4). Spills of flowback, produced water, and other wastes of less than 42 gallons are excepted from reporting if the permittee is on site and the spill is completely contained and cleaned up within an hour. *Id.* at r. 324.1008(6).
- <sup>177</sup> *Id.* at r. 324.1006 (requiring clean up of brine but not chemical additives); MICH. COMP. LAWS ANN. § 324.20126 (imposing liability for releases of hazardous substances and exempting severed mineral interest owners from liability if they did not cause release).
- <sup>178</sup> 42 U.S.C. § 9607 (2006) (imposing liability under Comprehensive Environmental Response, Compensation, and Liability Act, known as “Superfund,” for designated sites).
- <sup>179</sup> MICH. ADMIN. CODE r. 324.702-.703, .705. The CWA prohibits operators from discharging wastewater into surface waters east of the 98th meridian, but operators are allowed to send the wastewater to publicly owned treatment works or centralized waste treatment plants for treatment and discharge. 40 C.F.R. §§ 435.32, .50, 52 (2013).
- <sup>180</sup> 40 C.F.R. § 144.6(b) (2013).
- <sup>181</sup> MICH. ADMIN. CODE r. 324.201(1)(c).
- <sup>182</sup> 40 C.F.R. §§ 146.24(a)(2)-(3), 144.55; MICH. ADMIN. CODE r. 324.201(2)(j).
- <sup>183</sup> 40 C.F.R. § 146.23(b); MICH. ADMIN. CODE r. 806.
- <sup>184</sup> *Compare* 40 C.F.R. § 146.22(a), *with* MICH. ADMIN. CODE r. 324.703, .705(3).
- <sup>185</sup> *Compare* OHIO ADMIN. CODE 1501:9-3-06(C) (granting authority to require geological investigations, including seismic surveys, and monitoring plan for seismic activity), 9-3-077(F)-(G) (requiring continuous monitoring), *with* MICH. ADMIN. CODE r. 324.201(2)(j) (describing application requirements, which do not include investigations of the potential for seismic activity), .806 (requiring weekly monitoring), *and* 40 C.F.R. § 146.23(b)(2)(i) (requiring weekly monitoring), .24 (describing considerations for authorization, which do not include investigations of the potential for seismic activity).
- <sup>186</sup> MICH. ADMIN. CODE r. 324.705(3).
- <sup>187</sup> *Id.*
- <sup>188</sup> *Id.* at r. 324.705(2).
- <sup>189</sup> *See* Shawna Jankoviak, *Frack Flowback Used on County Roads*, CheboyganNews.com (Jan. 16, 2013), <http://www.cheboygannews.com/article/20130116/NEWS/130119634>.
- <sup>190</sup> Email from Hal Fitch, Chief, Office of Oil, Gas & Minerals, to author (Jan. 9, 2013).
- <sup>191</sup> MICH. COMP. LAWS ANN. § 324.12107 (West 2013).
- <sup>192</sup> *Id.* § 324.12103(1)(d).
- <sup>193</sup> *Id.* § 324.12102a(m).
- <sup>194</sup> Fracturing Responsibility and Awareness of Chemicals (FRAC) Act, H.R. 2766, 111th Cong. (2009); Fracturing Responsibility and Awareness of Chemicals (FRAC) Act, S. 1215, 111th Cong. (2009); Fracturing Responsibility and Awareness of Chemicals (FRAC) Act, H.R. 1084, 112th Cong. (2011); Fracturing Responsibility and Awareness of Chemicals (FRAC) Act, S. 587, 112th Cong. (2011).
- <sup>195</sup> Focused Reduction of Effluence and Stormwater Runoff through Hydrofracking Environmental Regulation (FRESHER) Act of 2013, H. R. 1175, 113th Cong. (2013).
- <sup>196</sup> EPA, PLAN TO STUDY THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES 1 (2011).

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- <sup>197</sup> EPA, STUDY OF THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES: PROGRESS REPORT 4 (2012).
- <sup>198</sup> THE WHITE HOUSE, BLUEPRINT FOR A SECURE ENERGY FUTURE 13 (2011).
- <sup>199</sup> SHALE GAS PRODUCTION SUBCOMMITTEE, SEC'Y OF ENERGY ADVISORY BD., 90-DAY REPORT (2011).
- <sup>200</sup> SHALE GAS PRODUCTION SUBCOMMITTEE, SEC'Y OF ENERGY ADVISORY BD., SECOND NINETY DAY REPORT (2011).
- <sup>201</sup> Letter, Stephen A. Owens, Assistant Adm'r, EPA, to Deborah Goldberg, Earthjustice (Nov. 23, 3011).
- <sup>202</sup> Press Release, EPA, *EPA Announces Schedule to Develop Natural Gas Wastewater Standards* (Oct. 20, 2011).
- <sup>203</sup> See Oil and Gas; Well Stimulation, Including Hydraulic Fracturing, on Federal and Indian Lands, 77 Fed. Reg. 27,691 (proposed May 11, 2012) (to be codified at 43 C.F.R. pt. 31) (original proposal); Oil and Gas; Hydraulic Fracturing on Federal and Indian Lands, 78 Fed. Reg. 31,635 (May 24, 2013) (to be codified at 43 C.F.R. pt. 31) (revised proposal).
- <sup>204</sup> JEFFREY LOGAN ET AL., JOINT INSTITUTE FOR STRATEGIC ENERGY ANALYSIS, NREL/TP-6A50-55538, NATURAL GAS AND THE TRANSFORMATION OF THE U.S. ENERGY SECTOR: ELECTRICITY 43-44 (2012).
- <sup>205</sup> Review and Approval of Projects, 73 Fed. Reg. 78,618 (Dec. 23, 2008) (to be codified at 18 C.F.R. pt. 806).
- <sup>206</sup> *Natural Gas Drilling Index Page*, DEL. RIVER BASIN COMM'N (Oct. 24, 2012), <http://www.state.nj.us/drbc/programs/natural/> (describing history of draft regulations).
- <sup>207</sup> For a review of state policies, see Sarah K. Adair, *Considering Shale Gas Extraction in North Carolina: Lessons from Other States*, 22 DUKE ENVTL. L. & POL'Y F. 257 (2012). For a general overview of state policies, see Hannah Wiseman, *Untested Waters: The Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation*, 20 FORDHAM ENVTL. LAW REV. 115 (2009).
- <sup>208</sup> JACQUELYN PLESS, NAT'L CONFERENCE OF STATE LEGISLATURES, STATES TAKE THE LEAD ON REGULATING HYDRAULIC FRACTURING 1 (2013).
- <sup>209</sup> *Id.* at 17-18.
- <sup>210</sup> *Id.*
- <sup>211</sup> 30 ILL. COMP. STAT. 105/5.826 (2013).
- <sup>212</sup> The landscape is changing so quickly that there is no one up-to-the-minute compilation of state rules. The sources include: Wiseman & Francis Gradijan, *supra* note 103 (as of June 15, 2012); JEFFREY LOGAN ET AL., *supra* note 204 (as of November 2012); NATHAN RICHARDSON ET. AL, RES. FOR THE FUTURE, THE STATE OF STATE SHALE GAS REGULATION (2013); *Hydraulic Fracturing Regulations*, INTERSTATE OIL & GAS COMPACT COMM'N, <http://groundwork.iogcc.org/topics-index/hydraulic-fracturing/hydraulic-fracturing-regulations>.
- <sup>213</sup> *Notice of Proposed Changes in the Regulations*, ALASKA OIL & GAS CONSERVATION COMM'N (Dec. 20, 2012), <http://doa.alaska.gov/ogc/hear/HydraulicFrac.pdf> (original proposal); *Notice of Proposed Changes in the Regulations*, ALASKA OIL & GAS CONSERVATION COMM'N (June 19, 2013), [http://doa.alaska.gov/ogc/frac/02\\_01\\_Hydraulic%20Fracturing%20Public%20Notice%20and%20Additional%20Info.pdf](http://doa.alaska.gov/ogc/frac/02_01_Hydraulic%20Fracturing%20Public%20Notice%20and%20Additional%20Info.pdf) (revised proposal).
- <sup>214</sup> *Pre-Rulemaking Discussion Draft*, DIV. OF OIL, GAS & GEOTHERMAL RES., CAL. DEP'T OF CONSERVATION (Dec. 17, 2012), [http://www.conservation.ca.gov/dog/general\\_information/Documents/121712DiscussionDraftofHFRregs.pdf](http://www.conservation.ca.gov/dog/general_information/Documents/121712DiscussionDraftofHFRregs.pdf).
- <sup>215</sup> Notice of Hearing on Proposed Administrative Regulations, 32 Kan. Reg. 543 (May 30, 2013).
- <sup>216</sup> *Second Amended Application*, Case No. 12-02, NEB. OIL & GAS CONSERVATION COMM'N (Apr. 3, 2013), [http://www.nogcc.ne.gov/Publications/NE\\_RulesRegsChangesAmend2.pdf](http://www.nogcc.ne.gov/Publications/NE_RulesRegsChangesAmend2.pdf).
- <sup>217</sup> 34 N.Y. Reg. 3 (Dec. 12, 2012). See also *High Volume Hydraulic Fracturing Proposed Regulations*, N.Y. DEP'T ENV. CONSERV., <http://www.dec.ny.gov/regulations/77353.html>.
- <sup>218</sup> *Draft Rules*, N.C. MINING & ENERGY COMM'N, <http://portal.ncdenr.org/web/mining-and-energy-commission/draft-rules> (last visited Aug. 22, 2013).
- <sup>219</sup> The law also grants aggrieved persons the right to bring a citizen suit against both companies and the state to compel compliance. 30 ILL. COMP. STAT. 105/5.826 §1-102 (2013).
- <sup>220</sup> *Notice of Proposed Changes in the Regulations*, ALASKA OIL & GAS CONSERVATION COMM'N (June 19, 2013), *supra* note 213.
- <sup>221</sup> IND. CODE § 14-37-4-8 (2012).
- <sup>222</sup> 30 ILL. COMP. STAT. 105/5.826 §§ 1-40, -45, -50 (2013).
- <sup>223</sup> N.Y. DEP'T ENVTL. CONSERVATION, REVISED EXPRESS TERMS 6 NYCRR PARTS 550 THROUGH 556 AND 560, at 34-35 (2012) (proposing to create N.Y. COMP. CODES R. & REGS. tit. x, § 560.3(e)).
- <sup>224</sup> OKLA. ADMIN. CODE § 165:10-1-7(b)(1) (2013).
- <sup>225</sup> 2 COL. ADMIN. CODE § 404 (2013).
- <sup>226</sup> 30 ILL. COMP. STAT. 105/5.826 § 1-25.

- <sup>227</sup> MICH. COMP. LAWS ANN. § 324.61506b(1) (West 2013); MICH. ADMIN. CODE r. 324.301(1)(b)(v) (2013). Surface facilities associated with oil and gas production must also be set back from public water supplies. *Id.* r. 324.301(1)(b)(vi).
- <sup>228</sup> OHIO REV. CODE ANN. § 1509.021 (West 2013).
- <sup>229</sup> 58 PA. CONS. STAT. ANN. § 3215 (West 2013).
- <sup>230</sup> TEX. LOCAL GOV'T CODE ANN. § 253.005(c) (West 2013).
- <sup>231</sup> See Edmond R. McCarthy, Jr., *Environmental Impacts of Oil and Gas: Mixing Oil and Gas with Texas Water Law*, 44 TEX. TECH L. REV. 883 (2012) (explaining the relationship of oil and gas production to water law in Texas); Mark McPherson, *Environmental Impacts of Oil and Gas: Water Use and Water Law in Texas from an Oil and Gas Perspective*, 44 TEX. TECH L. REV. 939 (2012) (same).
- <sup>232</sup> In the 2013 session, the Texas legislature considered a bill that would give groundwater conservation districts the authority to regulate water wells. S.B. 873, 83d Session (Tex. 2013). The bill passed the Senate but was left in committee in the House.
- <sup>233</sup> H.B. 5149, 95th Leg., 2010-2011 Sess. (Mich. 2011).
- <sup>234</sup> H.B. 4070, 97th Leg., 2013-2014 Sess. (Mich. 2013).
- <sup>235</sup> DEQ, Supervisor of Wells Instruction 1-2011, *supra* note 58; MICH. COMP. LAWS ANN. § 324.32727(1)(a) (West 2013).
- <sup>236</sup> N.Y. ENVTL. CONSERV. LAW §§ 15-1501, -1503 (2013).
- <sup>237</sup> OHIO REV. CODE ANN. §§ 1501.33, 1521.16, 1522.12 (West 2013).
- <sup>238</sup> OKLA. ADMIN. CODE §§ 785:20–30 (2013); OKLA. STAT. tit. 82, §§ 105.1-19, 1020.1-11 (2013).
- <sup>239</sup> Review and Approval of Projects, 73 Fed. Reg. 78,618 (Dec. 23, 2008) (to be codified at 18 C.F.R. pt. 806).
- <sup>240</sup> TEX. WATER CODE ANN. §§ 11.138, 11.1471, 36.117(b)(2) (West 2013).
- <sup>241</sup> See *Hydraulic Fracturing in Michigan*, *supra* note 145.
- <sup>242</sup> See CAS REGISTRY--*The Gold Standard for Chemical Substance Information*, CHEMICAL ABSTRACTS SERVICE, <http://www.cas.org/content/chemical-substances>.
- <sup>243</sup> The extent to which manufacturers comply with the governing federal worker safety law is disputed. See, e.g., Susan D. Carle, Note, *A Hazardous Mix: Discretion to Disclose and Incentives to Suppress under OSHA's Hazard Communication Standard*, 97 YALE L.J. 581 (1988).
- <sup>244</sup> *FracFocus Chemical Disclosure Registry*, FRACFOCUS, <http://fracfocus.org/>.
- <sup>245</sup> See *Find a Well*, FRACFOCUS, <http://www.fracfocusdata.org/fracfocusfind/>.
- <sup>246</sup> *Id.*
- <sup>247</sup> Under both federal and state worker safety law, copies of MSDSs must be maintained in the workplace and made readily accessible to employees. 29 C.F.R. § 1910.1200(g)(8) (2013); MICH. COMP. LAWS ANN. § 408.1014(a) (West 2013). But these provisions do not disclose the MSDSs to the general public.
- <sup>248</sup> See *Find a Well*, *supra* note 245 (from the drop down menus, choose the state of Michigan).
- <sup>249</sup> Federal worker safety law requires the manufacturer of an additive to disclose the chemical identity when there is a medical emergency in the workplace or there is an occupational health purpose to treat an exposed employee. 29 C.F.R. § 1910.1200(i)(iv). Neither of these exceptions applies, however, to other incidents involving members of the general public.
- <sup>250</sup> H.B. 5565, 96th Leg., 2011-2012 Sess. §§ 61532-33 (Mich. 2012); H.B. 4061, 97th Leg., 2013-2014 Sess. §§ 61532-33 (Mich. 2013).
- <sup>251</sup> H.B. 5565 § 61534; H.B. 4061 § 61534.
- <sup>252</sup> H.B. 5565 § 61534; H.B. 4061 § 61534.
- <sup>253</sup> H.B. 5565 §§ 61534, 61536-37; H.B. 4061 § 61534, 61536-37.
- <sup>254</sup> H.B. 4070, 97th Leg., 2013-2014 Sess. § 61525C(1)(f) (Mich. 2013).
- <sup>255</sup> COLO. CODE REGS. § 404-1:205A (2013).
- <sup>256</sup> LA. ADMIN. CODE tit. 43, § 118 (2013).
- <sup>257</sup> DEQ, Supervisor of Wells Instruction 1-2011, *supra* note 58.
- <sup>258</sup> N.Y. DEP'T ENVTL. CONSERVATION, *supra* note 223, at 33-34, 42-44 (proposing to create N.Y. COMP. CODES R. & REGS. tit. x, § 560.3(d), .5(h)).
- <sup>259</sup> 16 TEX. ADMIN. CODE § 3.29 (West 2013).
- <sup>260</sup> Tit. 55, Ch. 3, WYO. CODE R. § 45(d) (LexisNexis 2013).
- <sup>261</sup> H.B. 4070, 97th Leg., 2013-2014 Sess. § 61525C(1)(B) (Mich. 2013).
- <sup>262</sup> COLO. CODE REGS. § 404-1:609 (2013) (effective May 1, 2013).

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- <sup>263</sup> MD. CODE ANN., ENVIR. § 14-110.1 (West 2013).
- <sup>264</sup> H.B. 4736, 96th Leg., 2011-2012 Sess. (Mich. 2011); H.B. 4902, 97th Leg., 2013-2014 Sess. (Mich. 2013).
- <sup>265</sup> OHIO REV. CODE ANN. § 1509.06(A)(8), 1509.22(F) (West 2013).
- <sup>266</sup> 58 PA. CONS. STAT. ANN. § 3218 (West 2013); 25 PA. CODE § 78.51 (2013).
- <sup>267</sup> W. VA. CODE ANN. § 22-6B-3 (West 2013).
- <sup>268</sup> *Mapping the Movement*, FOOD & WATER WATCH, <http://foodandwaterwatch.org/water/fracking/fracking-action-center/map/> (last visited Aug. 22, 2013).
- <sup>269</sup> City of Coppell, Texas, Code of Ordinances §§ 9-26-7(A)(4), -14(B)(oo) (2013).
- <sup>270</sup> City of Arlington, Texas, Code of Ordinances, Gas Drilling and Production Chapter § 7.01(B) (2013); City of Fort Worth, Texas, Code of Ordinances § 15-42(C) (2013).
- <sup>271</sup> City of Longmont, Colorado, Ordinance O-2012-25 § 15.04.020(B)(32)(c)(iii) (2013). In November 2012, Longmont residents amended the city charter to ban hydraulic fracturing and storage or disposal of associated wastes. City of Longmont, Colorado, Home Rule Charter art. XVI (2013).
- <sup>272</sup> City of Fort Worth, Texas, Code of Ordinances § 15-42(A).
- <sup>273</sup> *Id.* §§ 15-42(B) to -45.
- <sup>274</sup> *Id.* § 15-41. Santa Fe County, New Mexico, also has very stringent requirements, including a prohibition on siting oil and gas facilities in traditional communities. County of Santa Fe, New Mexico, Ordinance 2008-19 (2013).
- <sup>275</sup> See Shaun A. Goho, *Municipalities and Hydraulic Fracturing: Trends in State Preemption*, PLAN. & ENVT. L., July 2012, at 3.
- <sup>276</sup> Colo. Oil & Gas Conservation Comm'n v. Longmont, No. 2012CV702 (Boulder Co. Dist. Ct.); Colo. Oil & Gas Ass'n v. Longmont, No. 2012CV960 (Weld Co. Dist. Ct.).
- <sup>277</sup> 58 PA. CONS. STAT. ANN. § 3304 (West 2013).
- <sup>278</sup> Norse Energy Corp. v. Dryden, 964 N.Y.S.2d 714 (N.Y. App. Div. 2013); Cooperstown Holstein Corp. v. Middlefield, 964 N.Y.S.2d 431 (N.Y. App. Div. 2013). The plaintiffs in both cases have requested review by the state's highest court, the Court of Appeals.
- <sup>279</sup> Tri-Power Res., Inc. v. City of Carlyle, 967 N.E.2d 811, 817 (Ill. App. Ct. 2012).
- <sup>280</sup> State v. Beck Energy Corp., 989 N.E.2d 85 (Ohio Ct. App. 2013). The Ohio Supreme Court has accepted the appeal for review.
- <sup>281</sup> Ne. Natural Energy, LLC v. City of Morgantown, No. 11-C-411, slip op. 6285 (W. Va. Cir. Ct. Aug. 12, 2011).
- <sup>282</sup> *But see* Nicholas Schroeck & Stephanie Karisny, *Hydraulic Fracturing and Water Management in the Great Lakes*, 63 CASE W. RES. L. REV. 1167 (2013) (arguing that the Great Lakes Council and Regional Body should regulate the withdrawal and use of water for hydraulic fracturing).
- <sup>283</sup> See U.S. CONST. art. I, § 8, cl. 3.
- <sup>284</sup> *Id.* amend. X. See also MICH. CONST. art. IV §§ 51-52 (providing that the "public health and general welfare of the people of the state are . . . matters of primary public concern," and the "conservation and development of the natural resources of the state are . . . of paramount public concern in the interest of the health, safety and general welfare of the people").
- <sup>285</sup> U.S. CONST. art. I, § 10, cl. 3 (providing that "[n]o State shall, without the Consent of Congress . . . enter into any Agreement or Compact with another State").
- <sup>286</sup> See, e.g., MICH. CONST. art. VII §§ 2 (counties), 18 (townships), 22 (cities and villages).
- <sup>287</sup> See Robert L. Fischman, *Cooperative Federalism and Natural Resources Law*, 14 N.Y.U. ENVT. L.J. 179 (2005) (describing cooperative federalism).
- <sup>288</sup> See, e.g., Bradford C. Mank, *After Gonzales v. Raich: Is the Endangered Species Act Constitutional under the Commerce Clause?*, 78 U. COLO. L. REV. 375 (2007).
- <sup>289</sup> Matthew S. Tripolitsiotis, *Bridge Over Troubled Waters: The Application of State Law to Compact Clause Entities*, 23 YALE L. & POL'Y REV. 163, 173-78 (2005) (describing state and federal interests).
- <sup>290</sup> Richard Briffault, *Our Localism: Part I--The Structure of Local Government Law*, 90 COLUM. L. REV. 1, 6-11 (1990) (explaining that local governments with "home rule" powers have broad authority to regulate land uses, while local governments without such powers regulate only those uses allowed by the state).
- <sup>291</sup> Compare David P. Spence, *Federalism, Regulatory Lags, and the Political Economy of Energy Production*, 161 U. PA. L. REV. 431 (2013), with Michael Burger, Response, *Fracking and Federalism Choice*, 161 U. PA. L. REV. ONLINE 150 (2013), and Emily C. Powers, Note and Comment, *Fracking and Federalism: Support for an Adaptive Approach That Avoids the Tragedy of the Regulatory Commons*, 19 J.L. & POL'Y 913 (2011). See also Gianna Cricco-Lizza, *Hydraulic Fracturing and Cooperative Federalism: Injecting Reality into Policy Formation*, 42 SETON HALL L. REV. 703 (2012); Elizabeth Burleson, *Cooperative Federalism and Hydraulic Fracturing: A Human Right to a Clean Environment*, 22 CORNELL J. L. & PUB. POL'Y 289 (2012) (arguing for a "collaborative governance" model).
- <sup>292</sup> See Burger, *supra* note 291, at 158; Spence, *supra* note 291, at 461-65.

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<sup>293</sup> See Burger, *supra* note 291, at 158-59. See also Gregory D. Russell & Robert J. Krummen, *Ohio's Experience with Preempting Local Regulation of Oil and Gas Development*, 19 TEX. WESLEYAN L. REV. 37, 45 (2012) (contending that the state has the "resources and extensive scientific and technical expertise necessary to regulate and permit the industry" and that local regulation would result in "conflict between local and state authorities" and would likely "suppress[] needed economic and resource development").

<sup>294</sup> See, e.g., Eric Berger, *Individual Rights, Judicial Deference, and Administrative Law Norms in Constitutional Decision Making*, 91 B.U.L. REV. 2029 (2011); Matthew C. Stephenson, *Optimal Political Control of the Bureaucracy*, 107 MICH. L. REV. 53 (2008).

<sup>295</sup> See Stephenson, *supra* note 294 (explaining theory and arguing that insulated agencies will in fact moderate policy outcomes, thus reflecting majority preferences).

<sup>296</sup> See Steven P. Croley, *The Majoritarian Difficulty: Elective Judiciaries and the Rule of Law*, 62 U. CHI. L. REV. 689 (1995) (explaining theory and examining the protection of minorities).

<sup>297</sup> STEPHEN BREYER, *BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION* (1993).

<sup>298</sup> *Id.* at 39-42.

<sup>299</sup> *Id.* at 60-61.

<sup>300</sup> Cf. Aaron-Andrew P. Bruhl & Ethan J. Leib, *Elected Judges and Statutory Interpretation*, 79 U. CHI. L. REV. 1215, 1280 (2012) (evaluating whether elected judges should defer to agencies in the state context).

<sup>301</sup> See generally DANIEL FARBER & PHILIP FRICKEY, *LAW AND PUBLIC CHOICE: A CRITICAL INTRODUCTION* (1991).

<sup>302</sup> See Blake A. Watson, *Liberal Construction of CERCLA Under the Remedial Purpose Canon: Have the Lower Courts Taken a Good Thing Too Far?*, 20 HARV. ENVTL. L. REV. 199, 216 (1996) (describing theory).

<sup>303</sup> *Id.*

<sup>304</sup> For a summary of the theory, see Mark C. Niles, *On the Hijacking of Agencies (And Airplanes): The Federal Aviation Administration, "Agency Capture," and Airline Security*, 10 AM. U.J. GENDER SOC. POL'Y & L. 381, 385-400 (2002). See also Spence, *supra* note 291, at 465-67.

<sup>305</sup> Niles, *supra* note 304, at 394-95.

<sup>306</sup> *Id.* at 415 (describing decision by Federal Aviation Administration).

<sup>307</sup> Burger, *supra* note 291, at 157; Wiseman, *supra* note 207, at 180-81.

<sup>308</sup> See Richard L. Hasen, *"High Court Wrongly Elected": A Public Choice Model of Judging and Its Implications for the Voting Rights Act*, 75 N.C.L. REV. 1305 (1997).

<sup>309</sup> See Michael P. Vandenbergh, *From Smokestack to SUV: The Individual as Regulated Entity in the New Era of Environmental Law*, 57 VAND. L. REV. 515, 526-27 (2004).

<sup>310</sup> See *id.* at 527-29.

<sup>311</sup> See *id.* at 529-33.

<sup>312</sup> See Kyle D. Logue, *Coordinating Sanctions in Tort*, 31 CARDOZO L. REV. 2313, 2314-15 (2010).

<sup>313</sup> See Vandenbergh, *supra* note 309, at 527.

<sup>314</sup> *Id.* at 528-29.

<sup>315</sup> *Id.* at 530-33.

<sup>316</sup> See Logue, *supra* note 312, at 2320 (describing conflict between corrective justice and deterrence visions of tort law).

<sup>317</sup> See, e.g., John D. Furlow & John R. Hays, Jr., *Disclosure with Protection of Trade Secrets Comes to the Hydraulic Fracturing Revolution*, 7 TEX. J. OIL GAS & ENERGY L. 289 (2012) (arguing for disclosure as a policy approach); Hannah J. Wiseman, *The Private Role in Public Fracturing Disclosure and Regulation*, HARV. BUS. L. REV. ONLINE (2013) (examining public-private partnerships, including disclosure).

<sup>318</sup> Thomas W. Merrill & David M. Schizer, *The Shale Oil and Gas Revolution, Hydraulic Fracturing, and Water Contamination: A Regulatory Strategy* 48-50 (March 13, 2013) (unpublished manuscript), [http://www7.gsb.columbia.edu/richman/sites/default/files/files/Fracturing3\\_13.doc.pdf](http://www7.gsb.columbia.edu/richman/sites/default/files/files/Fracturing3_13.doc.pdf). The authors also propose a prohibition on hydraulic fracturing when there are significant risks. *Id.* at 49.

<sup>319</sup> 42 U.S.C. § 11023(a) (2006).

<sup>320</sup> *Toxics Release Inventory (TRI) Program*, EPA, <http://www.epa.gov/tri/>.

<sup>321</sup> MICH. ADMIN. CODE r. 324.416(3) (2013).

<sup>322</sup> This does not include settlements, which are unreported and may be favorable to plaintiffs.

<sup>323</sup> Oil and Gas Lease (Paid Up) Form, *supra* note 25, para. 7.

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<sup>324</sup> Ian Urbina & Jo Craven McGinty, *Learning Too Late of the Perils in Gas Well Leases*, N.Y. TIMES A-1 (Dec. 1, 2011).

<sup>325</sup> See *Oil and Gas*, MICH. STATE UNIV. EXTENSION, *supra* note 37.

<sup>326</sup> *Id.* (follow “Oil and Gas Lease Addendum” hyperlink under “Fact sheets and publications,” “From MSU Extension”).

<sup>327</sup> *Id.*



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