DRILLING DOWN NATURAL GAS WELL PERMITTING POLICY: EXAMINING THE EFFECTS OF INSTITUTIONAL ARRANGEMENTS ON CITIZEN PARTICIPATION AND POLICY OUTCOMES

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Over the past decade the movement of natural gas drilling operations toward more suburban and urban communities has created unique policy challenges for municipalities. Municipal response is manifest in a variety of institutional arrangements, some more enabling than others regarding citizen access to public hearings. This observation lead to the main research question, "How are variations in citizen participation affecting policy outcomes?" The argument is made that institutions affecting citizen participation, in turn affect policy outcomes. If the general public is given access to public hearings, their preferences for longer setbacks will be taken into account and the approved gas wells will have greater distances from neighboring residences – effectively providing for greater safety.

Given the paucity of research on the topic of natural gas drilling, the research first begins with the presentation of a theoretical framework to allow for analysis of the highly complex topic of gas well permitting, emphasizing the rule-ordered relationships between the various levels of decision making and provides a typology of collective action arenas currently used by Texas municipalities.

The research uses paired case studies of most similar design and employs a mixed methods process for the collection, analysis and interpretation of the municipal level gas well permitting process. The investigation includes a complete census of 185 approved gas wells from four North Texas cities between the years 2002-2012; 20 interviews comprised of city

officials and drilling operators; and archival records such as gas well site plans, ordinances, on-line government documents and other public information.

The findings reveal that zoning institutions are associated with a 15% longer gas well setback than siting institutions and institutions without waivers are associated with a 20% longer gas well setback than institutions with waiver rules. The practical implications suggest that citizen participation has a positive effect on public safety within gas well permitting decisions.

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CHAPTER 1

URBAN DRILLING

Over the past decade, the movement of natural gas drilling operations toward more suburban and urban communities has created unique policy challenges for municipalities. The core problem facing policy makers is determining how to best regulate the industry to protect their community's health, safety and welfare without overstepping their bounds of authority or unconstitutionally impeding the rights of the affected parties. The municipal response has been the adoption of new oil and gas drilling ordinances. However, little is known about the effects of the differing institutions that are being created, which leads to the purpose of this dissertation – to gain a better understanding of local oil and gas well permitting policy and obtain new insight as to how institutions affect citizen participation and ultimately policy outcomes.

This chapter begins the investigation by providing a brief history of oil and gas drilling operations within Texas and explains the recent changes leading to the current state of affairs. Emphasis is placed on the unique problems associated with urban drilling and the challenges that must be considered when creating policy solutions. The chapter then follows with the statement of the problem, presents specific goals and objectives of the research and concludes with the organization of this dissertation.

1.1 Background

Producing more oil and natural gas than any other state in the U.S., oil and gas drilling has played a large role in the Texas economy for years (Kim & Ruppel, 2005). The first Texas oil

well was drilled as early as 1866 and the 1901 discovery of the Spindletop oilfield in Beaumont, Texas lead the state's transformation from primarily an agricultural society to a major petroleum producer and industrial power (Ramos, 2000). Although oil and gas operations have been an active part of the Texas economy since the 20th century, historically, the extraction/production process was largely a rural activity; any negative externalities it produced such as increased risk to hazards, water pollution, air pollution and unsightliness of facilities, had relatively little impact on people (Cady, 2009). However, since the late 1990s new technological advances, coupled with economic conditions helped intensify the demand for natural gas drilling (Energy Information Agency, 2011). Natural gas exploration within shale deposits (geological formations containing natural gas) became not only possible, but economically feasible, moving drilling operations from primarily a rural activity to one occurring in more highly populated areas.

Conventional drilling operations extract oil and gas from reservoir rock. Reservoir rock is a porous geologic formation containing hydrocarbons. The pores of the rock are connected in such a way that the gas is considered permeable, able to flow through the rock for capture in a well. Historically, shale deposits were bypassed because its pores are extremely small and considered "relatively impermeable to gas flow" (Energy Information Agency, 2011, vii). However, following the basic economic theory of supply and demand, as conventional oil and gas reserves dwindle and the nation's energy policy emphasizes the need to develop energy independence (National Energy Policy Development Group, 2001; Bush, 2006; Energy Independence and Security Act, 2007), the drive to tap into "unconventional domestic resources" such as natural gas reserves within shale formations increases

(http://geology.com/research/barnett-shale-gas.shtml). Consequently, since much of the untapped shale beds lie under highly populated areas, over the past decade drilling has progressed from rural areas to more urban environments, resulting in the phenomenon known as "urban drilling."

"Urban drilling," extraction/production of natural gas within or near developed areas, is largely credited to the technological advances of hydraulic fracturing and horizontal drilling (Galbraith, 2011; Pless, 2012; Rogers, 2011). Hydraulic fracturing is a process by which millions of gallons of water are forced at high pressures into the well bore in order to crack the shale beds containing natural gas. The water used for "fracking" is infused with chemicals to facilitate the fracturing process and mixed with a propping agent such as sand, to hold the fissures open for maximum release of the gas. The resulting artificially induced fractures within the shale formations allow the trapped natural gas to flow freely up the well bore for capture. Each well typically requires a minimum of three million gallons of fresh water for drilling and completion (Galusky, 2007). Additionally, wells may be periodically re-fractured to stimulate production (approximately every 3-5 years over the lifespan of the well) requiring even more water usage. The practice of hydraulic fracturing coupled with horizontal drilling improves the economic feasibility of natural gas production.

Horizontal drilling was made possible by the invention of a specialized drill bit designed to redirect the well bore by 90^{o} allowing for the creation of horizontal wells. As a result, multiple wells could be drilled from a single pad site reaching over 1 ½ miles laterally from the traditional vertical well bore, greatly expanding the ability to extract larger amounts natural gas deposits within existing shale formations (Energy Information Agency, 1993). Horizontal drilling

also enabled access of the natural gas deposits under properties in which the surface had already been developed, thus reducing the dependence of vast undeveloped land for drilling operations and consequently bringing drilling operations closer to developed areas.

1.1.1 Urban Drilling Problems

As development moves toward more populated areas, the land becomes scarcer and the infrastructure strained. Accordingly, based on the threat to property rights, scholars attest that in the face of scarcity and overconsumption of resources, there is greater concern by the public over development and land use issues (Libecap, 1989; Alchian & Demsetz, 1973). The development of natural gas drilling activities is no exception, as the movement toward suburban and urban areas has created a heightened awareness about the negative impacts associated with the drilling and production activities. Homeowners are concerned with a variety of issues associated with having natural gas drilling operations within their communities and near their homes. Some of the negative impacts of the industry include excessive truck traffic (typically necessary for the transportation of water and production fluids), increased noise levels from drilling/production operations, increased air pollution from air compressor stations and other facilities, reduced aesthetics from unsightly industrial operations within residential or commercial developments, increased risk to fires/explosions or related technological hazards, potential reductions in property values and the general reduction in quality of life issues. While many of these problems have always existed in traditional drilling activities, the new urban nature of the drilling process has increased the numbers of people being exposed to drilling operations. The close proximity of drilling operations to residential

neighborhoods and other well developed properties has increased the saliency of the negative externalities.

In addition to the basic problems of drilling in an urban environment, the new technologies bring with them new concerns. For example, since each well requires a minimum of three million gallons of water for drilling and completions, the decision to allow hydraulic fracturing becomes an important societal cost/benefit dilemma over water usage. Most of the water used and later retrieved from the drilling process returns to the surface as extremely corrosive and toxic waste water that is typically disposed of in long-term injection wells (concrete encasements that store the waste underground, similarly to nuclear waste disposal). Balancing the interests of energy production and the preservation of water resources becomes particularly problematic in regions that are prone to drought. Further complicating the matter is the possibility of contamination of existing water supplies due to chemical exposures from the fracking fluids and leakage of methane into underground aquifers. The high salinity of the retrieved production fluids, also sterilizes soils upon exposure, creating yet another negative impact – soil contamination from production fluid spills.

Part of the concern over urban drilling lies in the uncertainty of its impacts. Being that the extraction and production of natural gas is highly technical; there is a dependence on the industry for information, giving the industry an unfair advantage during market transactions. While the United States' economic system is fundamentally based on the principles of a free market in which the prices of goods and services are established by the interchange of supply and demand (Wheelan, 2010), some exchanges such as determining where to locate gas wells through private leases, may not be in-line with societal equilibriums. Market failure is likely to

occur, due to the asymmetry of information within the market transaction. For example, when oil and gas representatives meet with potential lease holders, acting as rationale actors they may withhold information sharing only that which is necessary or will benefit the company. For instance, the industry may state that the drilling derrick will only be up for a 30 day period for the drilling of a well, but fail to mention that the lease allows for multiple wells per pad site which may reflect a 1-2 year period in which the land owner will have to deal with the drilling rig and its associated activities. Furthermore, the market assumes exchanges are voluntary, but land owners may feel compelled to sign leases, because the industry may reference Texas state law which recognizes the mineral estate as dominant over the surface estate (Getty Oil Co. v. Jones, 1971).

Market failure does not only occur from information asymmetries and confusion over property rights, but may also occur when physical effects brought about by the market exchange are born by person(s) not a part of the transaction. If negative externalities, such as those discussed earlier, are not accounted for within the market exchange, the market will not work efficiently for society. Consequently, scholars assert that government institutions are often necessary in settling land use issues to correct for the inefficiencies of the market (Matejczyk, 1997; Feiock, Tavares & Lubell, 2008), which explains why municipalities in the natural gas producing territories are actively creating/amending oil and gas drilling ordinances. Municipalities are tackling the very complex challenge of determining how to best address the land use conflicts and regulate the industry for the protection of their community's health, safety and welfare.

1.1.2 Challenges to Policy Solutions

Typically, municipalities address land use conflict through zoning laws and local ordinances (McCoy, 2010). The concept of zoning dates back to the first half of the 20th century, when city planners sought to separate the potentially hazardous industrial facilities from residential areas. The practice was to protect households from excessive noise, glare, unpleasant odors and eyesores, created by the facilities. In addition, the separation was to prevent potential dangers to households such as pollutants and explosions or fires (Burby, 1999). Planners such as Benjamin Marsh (1909) and John Nolen (1916) were some of the early advocates for the decentralization of factories to counter the pollution problems that emerged during the industrial revolution. By 1948, the American Public Health Association released a publication, *Planning the Neighborhood* which supported these early efforts by stating that strict separation was essential for public health (Burby, 1999). Within ten years, by 1958, the separation of industry from residential areas had become standard practice, with the planner's tool of choice being the zoning ordinance.

The traditional zoning ordinance essentially identifies the types of building structures and activities that may be permissible within designated areas, or zones (i.e., commercial, industrial, residential and agricultural). If municipalities choose to zone oil and gas drilling/production operations, they would be considered industrial activities. In addition to separating the industry from residential areas through zoning, municipalities may opt to regulate the location of the specific oil and gas drilling/production facilities through ordinances which place limits on how close the industrial facilities may be to other structures (i.e., residential buildings) or protected areas (i.e., water sources and environmentally sensitive

areas). Besides establishing zoning districts and setback standards, municipalities may also include other methods for mitigating the negative externalities within their local ordinances, such as setting noise limits, establishing traffic routes, and screening facilities. Ultimately, under the authority granted in the Local Government Code municipalities have the power to adopt ordinances, laws or regulations as deemed necessary for the interest of its community's health, safety and welfare (§211.001). Accordingly, they are granted some flexibility in the rules and procedures they may adopt, resulting in the possibility of varied institutional arrangements for local gas well permitting policy across municipalities.

While recognizing oil and gas operations through zoning districts is certainly a valid option for municipalities, it is not always chosen because in some instances it may increase the risk of litigation. Unlike most other industries, gas drilling operations are somewhat restricted in their mobility; as stated by an industry representative, "We need to drill where the minerals are." Consequently, if industrial zones which allow drilling operations do not contain the minerals underneath the surface or are too far from the mineral source to allow access through horizontal drilling, they may be placing the municipality at risk for a regulatory takings and/or due process lawsuit. For similar reasons, if the setback standard is so long it essentially prevents any likelihood of drilling from occurring within their boundaries, the municipality may again be giving rise to a regulatory takings lawsuit.

A regulatory takings, as is all land use conflicts, is based on the issue of protecting property rights. Written with the intent to prevent abuses from governmental authority, the issue of protecting property rights is first addressed within the US Constitution. The Fifth Amendment of the U.S. Constitution states "nor shall private property be taken for public use,

without just compensation." The Texas Constitution adopts a similar provision regarding private property such that, "[n]o person's property shall be taken, damaged or destroyed for or applied to public use without adequate compensation being made, unless by the consent of such person…" (Tex. Const. art. 1, § 17). Additionally, the Fourteenth Amendment includes the "due process" clause prohibiting state and local governments from depriving persons of "life, liberty or property without due process of the law." Accordingly, municipal ordinances typically include the ability to grant zoning exceptions, setback variances, or special use permits allowing for due process and reducing the risk of litigation.

The significance of the constitutional provisions is that they suggest a need for balance between public rights and private rights. Local governments are faced with the challenge of creating institutional arrangements and regulations that fulfill their duty to serve and protect the health, safety and welfare of their citizens (public rights), without overstepping their authority and denying persons (or entities) of their private rights.

The locational peculiarities and property rights issues associated with drilling operations are particularly evident within land use conflicts involving split-estates. A split-estate occurs when the land owner has severed his land and mineral estate. While initially the land and its minerals are joined under one ownership, the mineral estate and the surface estate may be severed "through the sale, reservation or execution of a lease" (Cady II, 2009). The significance of the split-estate issue pertains to the differing property rights recognized under state law. Texas state law recognizes the mineral estate as the dominant estate; essentially, granting the mineral owner and his lessee (the drilling operator) the "right to enter, dig and carry [the minerals] away, and all other such incidents thereto as are [deemed] necessary" (*Cowan*, 26

Tex. at 217) and "reasonable" (*Humble Oil and Ref. Co. v. Williams*, 1967). Thus, the issue of mineral right supremacy further complicates gas well permitting issues, because there is no longer an implied balance between property right owners. Mineral right owners are definitively given dominance over land owners, which is why even though municipalities have the authority to create ordinances regulating land use for the public's health, safety and welfare, "some attorneys and legal scholars argue that these ordinances give rise to compensatory takings challenges," (Riley, 207, p. 352).

The issue of determining a legally defensible setback is further complicated by the fact that there is little scientific study about the impacts of fracking and drilling within highly developed areas, such as the eventual effect on property values, not to mention the long term health effects of continued exposure to the additional air, water, and soil pollutants created by the industrial activities. Of the research that does exist, its generalizability is limited. For instance, a study by Flower and Ragas (1994) examined the influence of large-scale oil and gas refineries on residential properties. While it illustrated that property values are negatively correlated with facilities, today's natural gas well facilities are notably different than the analyzed oil refineries. A more recent study by Boxall and colleagues (2005) illustrated property values are negatively correlated with the number of gas wells and flaring of oil batteries within 4 km of the property, but these wells were "sour" gas wells located near rural properties in Alberta, Canada. Sour gas is a natural gas that contains hydrogen sulphide (H_2S), a colorless flammable compound with an unpleasant smell that is hazardous to humans and animals at relatively low concentrations. The natural gas produced in urban drilling communities of North Texas is largely considered "sweet" with less than 1% H_2S.

When considering safety in the determination of a gas well setback, one might look toward the state's regulatory commission which has established spacing requirements of 467 feet away from any property line, lease line, or subdivision line (Texas Administrative Code: Title 16, Part 1, Chapter 3, Rule §3.37). However, the setback distance is not firm as there is an ability to grant exceptions, because this provision was not necessarily designed for safety in mind, but primarily to prevent the waste and confiscation of property (to maximize the ability to extract the natural resource for use). Even if safety was a factor in the statewide spacing standards, determining an appropriate distance from human occupied properties is still in question, because state incident reports of evacuations have been within a half mile radius (i.e., Forest Hills suburb of Fort Worth, TX) with secondary fires occurring up to one mile from the incident site (i.e., Palo Pinto County, Fort Worth, TX) (http://www.rrc.state.tx.us/). Additionally, according to Boxall and colleagues (2005), energy experts have calculated probable maximum range for impacts extending from wells, pipelines or their associate facilities (tank batteries) to be 4km (2.49 miles). Unfortunately, given the lack of scientific study, there is not a simple calculation for determining appropriate setback distances from gas wells. The process is further complicated because setbacks are not just a technical matter, but a political one as well; influenced by the specific needs and desires of the community.

Part of what makes gas well setback and permitting decisions so challenging, is that they affect multiple stakeholders, each with his own interests guided by differing sets of norms, values, information, and costs/benefits. Even when interest group diversity is narrowed to its simplest form, categorized by two general positions on the permitting policy: (1) economic/energy interests, and (2) environmental interests (Smith, 1995; Katz, 2001), the

resolve to the land use conflict is not an easy one as it is complicated by differing concepts of risk. Those with economic and energy interests encompass commercial oil and gas production companies, waste water and natural gas pipeline companies, oil and gas utilities, professional associations, and land owners (predominantly land owners with lots of acreage) who hold mineral rights or leases with oil and gas production companies. As the category suggests, actors with economic/energy interests seek to use their property for personal or economic gain. Environmental interests would include local residents with smaller tracks of land (less than one acre) who do not stand to make as much monetarily on an oil and gas lease, or do not have the rights to the minerals underneath their surface ownership. However, larger environmental interests may also be evident at the local level, such local citizen activist groups (i.e. Flower Mound Citizens Against Urban Drilling) or national public interest organizations such as the Sierra Club and Natural Resources Defense Council (Katz, 2001). These actors with environmental interests perceive the industrial operations and facilities as bringing negative externalities, such as reduced property values (Barzel, 1997) and generally desire to mitigate or eliminate the negative effects.

The land use politics generally pits the narrow economic interests with the broader-based community interests (Lubell et al., 2009). Each actor or interest group is influenced by differing factors which generates differing concepts of risk, or willingness to accept risk (Shively, 2007). The concept of risk has different meanings to different people, in part because there is a disconnect between the technical and social understandings of the term (Renn, 1992). Industry analysts who rely heavily on mathematical risk assessments are likely to have a totally different perception of risk from the general public who relies more on the media, or personal

experiences. Although, lay persons can assess the number of probable fatalities, much like the technical experts, their judgments of risk are much different than those held by the experts, as the public includes other hazard characteristics, such as the possibility of catastrophic disaster and the potential threat to future generations (Slovic, 1987; Clarke 2006; Gouldson et al., 2007). Furthermore, there are differing costs/benefits imposed on each interest group. Persons with economic/energy interests stand to gain financially from proposed drilling activities, but residents without mineral interests living close to the industrial activities have little to gain other than the increased exposure to the negative externalities. The differing cost/benefit analyses play a role in how much risk a person is willing to accept – the greater the benefit, the greater the risk one will bear.

The classic psychometric study presented by Slovic (1987) uses a factor analysis to determine how one perceives the riskiness of various hazards by the degree of dread and uncertainty they possess. The dread factor is defined by "the perceived lack of control, dread, catastrophic potential, fatal consequences, and the inequitable distribution of risks and benefits;" whereas, the unknown factor judges hazards to be "unobservable, unknown, new, and delayed in their manifestation of harm" (Slovic, 1987, p. 283). If one considers recent press releases highlighting oil and gas accidents and their reported pollutants, then considers how relatively new technologies are being used to extract gas within communities of high population densities against their wishes, the analysis would suggest a high degree of perceived risk which explains what is known in the literature as the NIMBY response. NIMBY stands for "not-in-my-back-yard" and is often used to describe the phenomenon of persons actively protesting the approval of an unwanted land use located near their homes.

Extant literature is filled with commentary regarding the NIMBY syndrome, each with its own set of characteristics and theories concerning citizen behavior to locally unwanted land uses. While there is not research specific to oil and gas well permitting, much of the NIMBY literature suggests persons attending public hearings pertaining to natural gas well permitting will largely be opponents concerned with the negative impact on their primary asset, their home (Fischel, 2001). However, as noted above, there are at least two sides to every locally unwanted land use issue (Smith and Marquez, 2000). Citizens attending public hearings are not only those that oppose the siting of the noxious facility, there are also persons in support, such as the applicant or other parties with financial interests.

Since there are a variety of parties with differing perspectives as to what is the best location for the gas well (i.e., operators, landowners with mineral interests, landowners without mineral interests, citizens residing in high impact areas, citizens that may experience less direct impact from the drilling operations), some scholars assert the best way to meet the needs and desires of the community, would be to include the varied stakeholders within the decision making process (Innes 1990, 1998; Lindblom & Cohen, 1997; Schon, 1983). It is argued that when governments utilize public participation as a part of the decision making process, citizens are given the opportunity to inform, negotiate, meet their shared interests (Denhardt and Denhardt, 2000) and ultimately produce better decisions (Richards & Dalbey, 2006). On the other hand, while we are a society based on the normative belief in democratic values, there are still critics that question the usefulness of public participation (Roberts, 2008; Delli Carpini et al., 2004; Ryfe, 2005). Consequently, understanding how citizen participation affects the outcomes of oil and gas well permitting policy becomes a matter of practical importance

related to public health, safety and welfare. It is of particular importance for this policy issue as there is very limited research on the subject matter which is attempting to address wicked problems that have wide-reaching impacts.

1.2 Problem Statement

As noted above, in spite of Texas' long standing history of being a major U.S. producer of oil and gas, Texas municipalities are faced with a relatively new problem of dealing with oil and gas production within or near their residential communities. The application of hydraulic fracturing and horizontal drilling has enabled operators to tap into the more unconventional gas resources, such as shale source rock, much of which lies underneath developed areas. Since the North Texas region is located on top of the "core area" of the Newark East, Barnett Shale Field (one of the fastest growing natural plays in the nation (Railroad Commission of Texas, 2013), it is a prime location for analyzing the differing municipal approaches to dealing with urban drilling (see Figure 1.1). This particular area is highly desirable by oil and gas excavation companies, containing enough resources for it to "continue to be a major contributor to U.S. natural gas production through 2030" (University of Texas at Austin, 2013). In addition to being highly desirable for oil and gas development, it is also a desirable area for residential development. In fact, according to the North Central Texas Council of Government reports, the North Central Texas region is expected to grow to 10.5 million residents by the year 2040 (Coggeshall, 2012). The combination of projections for increased drilling and increased population growth suggest we will be witnessing unprecedented numbers of urban drilling related land use conflicts for years to come. For these reasons, gaining a better understanding

of how municipalities are addressing these land use issues and protecting their communities from the negative externalities is becoming increasingly salient. Given that "there are as many as 41 identified shale basins in the United States" (Cady II, 2009, p. 2; illustrated in Figure 1.2), the information gained from this research will benefit not only other shale producing municipalities within Texas, but offers far-reaching nationwide benefit for policy makers, public administrators, operators, citizens and scholars alike.

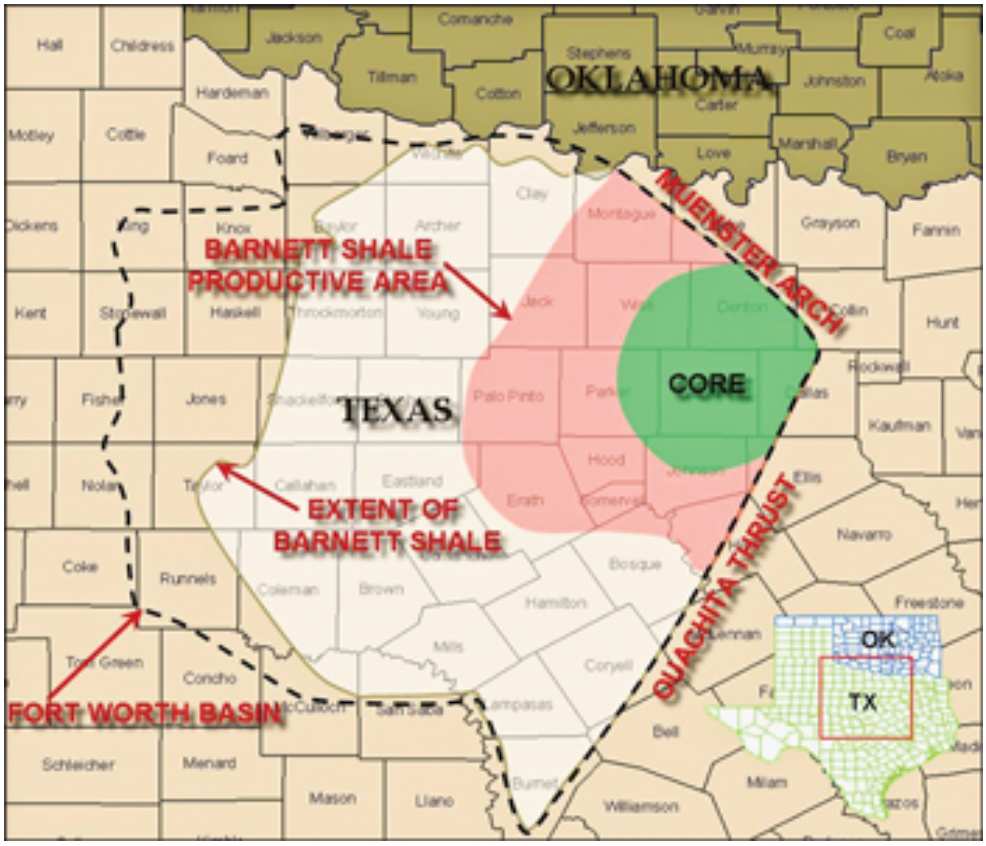


Figure 1.1. Barnett shale productive areas. Light tan indicates extent of Barnett shale, red indicates productive area within the Barnett, and green indicates where the shale is thicker providing highest likelihood of productivity. Image accessed from: http://www.worldoil.com.

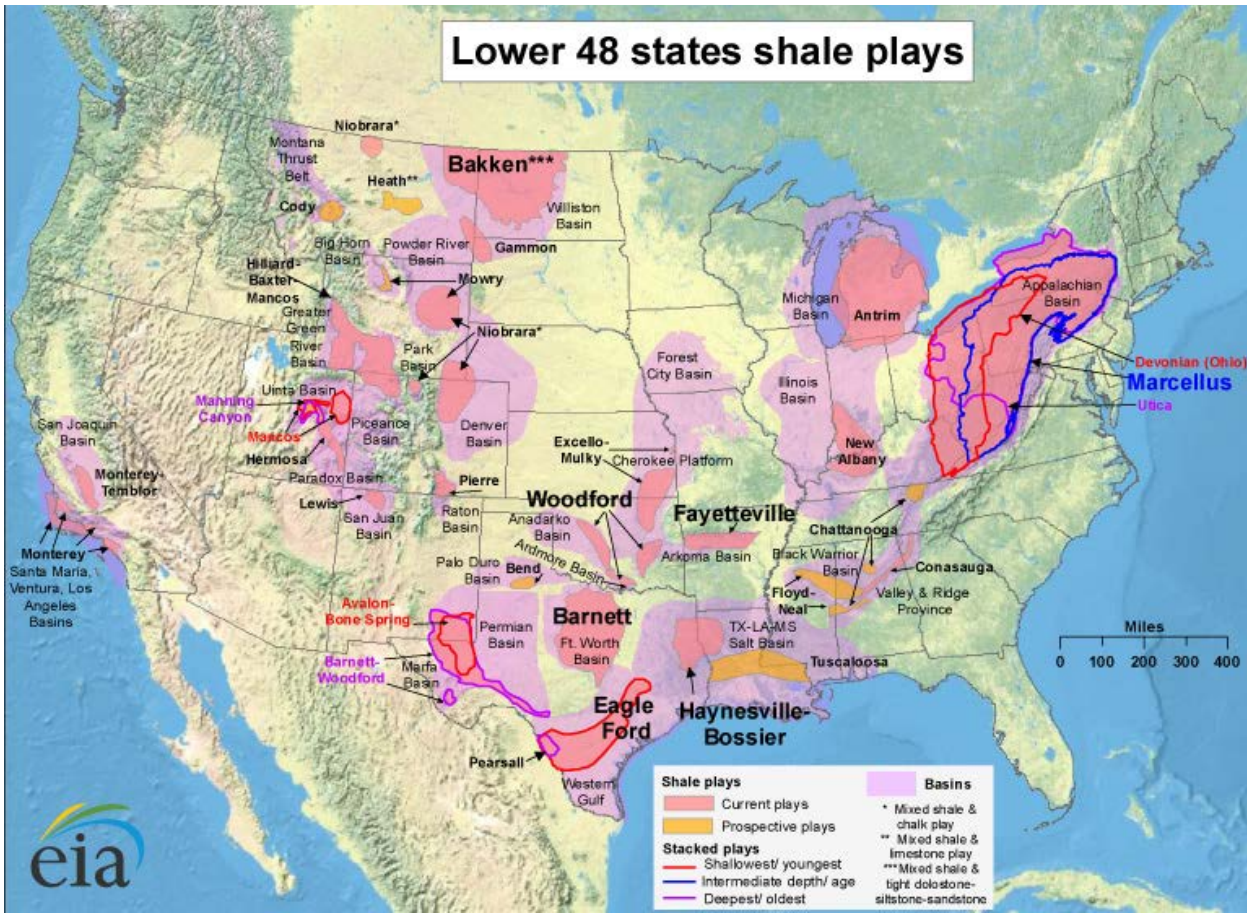


Figure 1.2. Map of US shale gas and shale oil plays (as of May 9, 2011). *Source:* U.S. Energy Information Association http://www.eia.gov/analysis/studies/usshalegas/ pdf/usshaleplays.pdf

The unique nature of natural gas drilling/production operations, including the limited mobility of the industry, the primacy of mineral rights, the diversity of stakeholders in land use conflicts, and the lack of scientific knowledge about the effects of its drilling/production operations on developed communities and their residents, present challenging policy making problems for local municipalities. The municipalities' core problem exists in determining which institutional arrangement best addresses the public health, safety and quality of life concerns of its citizens, without compromising due process or the property rights of the affected parties.

Based on an examination of the existing literature on urban drilling, there is a paucity of research that directly addresses the policy problem facing today's municipal policy makers and administrators. Much of the extant research tends to focus on gas resource assessment and its economic implications of energy policy (National Petroleum Council, 2007; ALL 2008; International Energy Agency, 2009; Rogers, 2011), or examines regulatory issues from a legal or case law perspective (Cady II, 2009; Vanham, 2011; Welch, 2012). There is little scholarly investigation specific to oil and gas permitting policy, particularly as it relates to the literatures on institutions and citizen participation. Given that natural gas well drilling policy is a relatively untapped research topic (Davis, 2012), this research is directed by the following questions: (1) What are the existing state level policies guiding municipal level decision making pertaining to natural gas drilling? (2) How are the various institutional arrangements, which have been adopted by municipalities, affecting citizen participation? (3) How are variations in citizen participation (access to public hearings) affecting policy outcomes, such as gas well setbacks?

1.3 Goals and Objectives

There are three objectives that are addressed within the body of this research for the purpose of advancing our knowledge in the topics of natural gas well permitting policy, institutions and citizen participation. The first objective is to provide a structured theoretical framework for analyzing oil and gas policy, which emphasizes the rule-ordered relationships between various levels of decision making. The second objective is to offer descriptive theory explaining how rules are a determinant of public hearings, suggesting that entry rules directly enable or impede citizen participation within formal institutional arrangements. The third

objective is to address the research question, “Does variation in the rules which affect access to public hearings (citizen participation) lead to a variation in outcomes such as, the length of gas well setbacks?”

The first objective is addressed by providing a descriptive analysis of the existing urban drilling polices in Texas, giving special attention to those that are unique to the state. The policies are identified across the three levels of decision making (constitutional, collective choice, and operational) using an institutional analysis and development framework. Emphasis will be placed on the interdependency of rules to decision making opportunities between the various levels. For instance, certain constitutional level decisions enable or inhibit the decision makers’ options at the municipal level of collective choice and in turn the collective choice decisions impact the driller’s operational level decisions.

The second objective is addressed by drilling down to one particular policy of interest, gas well setback policy. Following a review of the literature on citizen participation and institutions, it is noted that the institutions pertaining to citizen participation are essentially “black-boxed.” Thus, a theoretical framework is presented, explaining how rules are affecting citizen participation and how variation in citizen participation is ultimately affecting policy outcomes, specifically gas well setback distances from residential buildings. A typology of the varied collective choice arenas is also created to better illustrate how rules within local level decision making are affecting citizen access to public hearings.

The third and final objective is addressed by testing the proposed theory within two different sets of institutional arrangements. Using paired case studies of most similar design and employing a mixed methods process for the collection, analysis and interpretation of the

municipal level gas well permitting process, the first test examines how the variation in citizen access to public hearings between "zoning" institutions and "siting" institutions affect length of approved gas well setbacks. The second test examines how the variation in citizen access to public hearings between institutions with waiver rules and institutions without waiver rules affect length of approved gas well setbacks. The benefit of examining the length of gas well setbacks offers objective and practical implications about how rules which enable or impede citizen participation affect public safety.

1.4 Organization of Dissertation

This first chapter of the dissertation provides the background and rationale for the research. It includes a statement of the problem, goals and objectives and concludes with this section, the organization of the research. The next two chapters present descriptive theory on natural gas drilling. Chapter 2 provides the structured theoretical framework for analyzing oil and gas policy, emphasizing the rule-ordered relationships between various levels of implementation. Chapter 3 presents the literature review on institutions and citizen participation which leads to the descriptive theory as to how rules are a determinant of public hearings and concludes with a typology municipal level collection choice arenas. Chapters 4 and 5 are the substantive chapters of the study. Chapter 4 tests the first stated hypothesis, examining the theoretical implications of citizen participation as they compare "siting" v. "zoning," while Chapter 5 tests the second hypothesis, examining the theoretical implications of citizen participation through a comparison of institutions with waiver rules and those without. Chapter 6 presents qualitative data from interviews with city officials and drilling operators to

illustrate support for some of the underlying assumptions, for the purpose of strengthening the theoretical argument and internal validity of the research. Additional information obtained from the interview process is also shared to offer a more complete story of the oil and gas permitting process and guide future research. The final chapter, Chapter 7, concludes with a brief overview of the accomplished goals and objectives, discusses the limitations of the study and offers closing commentary about the implications for future research.

CHAPTER 2

AN IAD ANALYSIS OF URBAN DRILLING IN TEXAS

Before any meaningful analysis can begin about the effects of institutions, one first needs to know what they are, how and why they were created, as well as what possible consequences they may produce (Ostrom, 2005). As there is no known research on the varied institutional arrangements within local gas well permitting, the first step within this research is to establish a structured theoretical framework for analysis which includes all the critical attributes of the policy environment and how they interact. This chapter explains the theoretical framework that is considered necessary, and then applies it to natural gas well permitting policy for the state of Texas.

2.1 An Institutional Analysis and Development Framework

The day-to-day operations of urban drilling are manifest by the contracting of mineral leases and the development of new gas wells within and near residential neighborhoods. As operators are required to gain permits prior to developing their drill sites, assessing the outcomes of natural gas well permitting policy, such as the proximity of gas wells to residential buildings, becomes more salient to greater numbers of people. However, since natural gas well permitting within the state of Texas is regulated at various levels of government, it is integrally associated within arenas of choice outside of the operational level. Consequently, to gain a fuller understanding of natural gas well permitting policy, analysis should include the other decision making arenas as they affect the lower level choices. In light of this, the objective of the chapter is to illustrate the theoretical impact of how the rules created from upper level

action situations enable or constrain the actors and their choices within lower level action situations.

Considering, the complexity of natural gas drilling and the multiple layers of decision making, the discussion will apply the institutional analysis and development (IAD) framework created by Ostrom and colleagues (Kiser & Ostrom, 1982; Ostrom et al., 1984; Ostrom, 1986, 2005, 2010; McGinnis, 2000; Poteete, Janssen, & Ostrom, 2010) as it provides useful conceptions for defining the different decision making arenas, their component parts and how they are linked to lower level outcomes. As the action situation is considered the core component of the IAD framework, key action situations pertaining to gas well permitting will be discussed within each arena of choice, emphasizing its linkage to lower level choices.

Described as the "black box" where decision making occurs, the action situation is the social space where actors (persons acting on their own or as agents of organizations) gain information, interact with other participants, and select actions resulting in outcomes (McGinnis, 2011). While the action situation is influenced by different contextual factors, such as the nature of the biophysical world, the attributes of the community and rules-in-use, scholars attest its attention to rules to be one of the most critical aspects of the IAD framework (Koontz, 2005). Rules are critical because it is the rules (or absence of rules) structuring the action situation that provide individuals opportunities, constraints and information which impacts the decision maker's choice (Ostrom 2005; Koontz 2005).

The concept of rules carries multiple meanings. Ostrom defines rules as a set of instructions for creating a situation where choices are made within a particular environment, (2005, p. 17). Within the context of this report, rules denote an order prescribed by an

authority to control behavior of certain parties, by identifying what actions (or outcomes) are required, prohibited, or permitted (Ganz, 1971; V. Ostrom, 1980; Commons, 1968). Rules are created to govern the action situation; however, not all rules are meticulously applied. It is the mechanisms of monitoring and sanctioning that influence how rules are actually applied within society (Collins and Khan, 2004, p.44). The rules applied in governing action situations are known as the rules-in-use.

While the IAD framework recognizes that rules influence decision making, it also recognizes that there are multiple levels of decision making (nested arrangements of action situations at different levels of arenas of choice). Because there are multiple levels of decision making the rules take on two different roles depending upon the point of reference. Rules are not only inputs to action situations, enabling or constraining the actors' choices, but rules may also be outputs of action situations. Essentially, the rule outputs at one level of decision making combine with monitoring and sanctioning mechanisms to create the outcomes known as the rules-in-use. The rules-in-use then act as inputs for a lower level of decision making. This suggests that rules provide a definitive linking mechanism between the various arenas of choice, with the more upper level rules affecting the lower level choices. Figure 1 provides a conceptual map illustrating the three arenas of choice and how the rules are linked between the levels.

The three levels of decision making recognized within the IAD framework include constitutional choice, collective choice and operational choice. The constitutional level is the upper most level of decision making and may be thought of as the level of governance, determining "who can do what to whom and on whose authority" (McGinnis, 2011, p. 171).

The rules created within the constitutional choice arena determine who constitutes the decision making body in collective choice arena and define the rules that will govern the collective choice process. The constitutional rules also indicate what rules may or may not be created by the authorized body of decision makers. The level of collective choice involves the processes through which institutions and policies are created. The actors authorized to participate in the collective choice decision making are those that have been granted the authority through the constitutional rules and they can only act according to the procedures established by the constitutional choice processes. Finally, the lowest level of decision making is the level of operational choice. The operational level is where the implementation of practical day-to-day decisions are made by the parties "on the ground," those authorized to take action as a consequence of the collective choice process (McGinnis, 2011). Unlike constitutional and collective choice arenas, the outcomes of the action situation are not the rules-in-use governing the lower level decision making. Being the lowest level decision making, the outcomes of operational choice decisions affect the variables in the physical world. The changes to the physical world can then be used as feedback for each of the action situations within each arena of choice. An illustration of this IAD conceptual map for natural gas well permitting is located in Figure 2.1. Simply stated, each level of decision making is linked to the other. Constitutional choice affects, collective choice, which in turn affects operational choice, which ultimately provides feedback to the other levels for future decision making.

While policy analysis within one arena of choice is beneficial, analysis that takes into account the rule-ordered decision making provides a more complete picture of the policy making process and its linkage to societal outcomes (Kiser & Ostrom, 1982). To gain a better

understanding of this theoretical framework, the following passages discuss its practical application to natural gas well permitting decisions within Texas. Basically, there are three areas of discussion that must be addressed when considering the regulation of gas well drilling operations within the state of Texas. They are associated with the Railroad Commission of Texas, local governments, and property rights. Discussion in each topic area includes the relevant constitutional and collective choice rules, followed by monitoring and sanctioning issues for the determination of the rules-in-use. The final passages conclude with discussions on the two primary action situations occurring within the operational arena as they relate to the upper level rules.

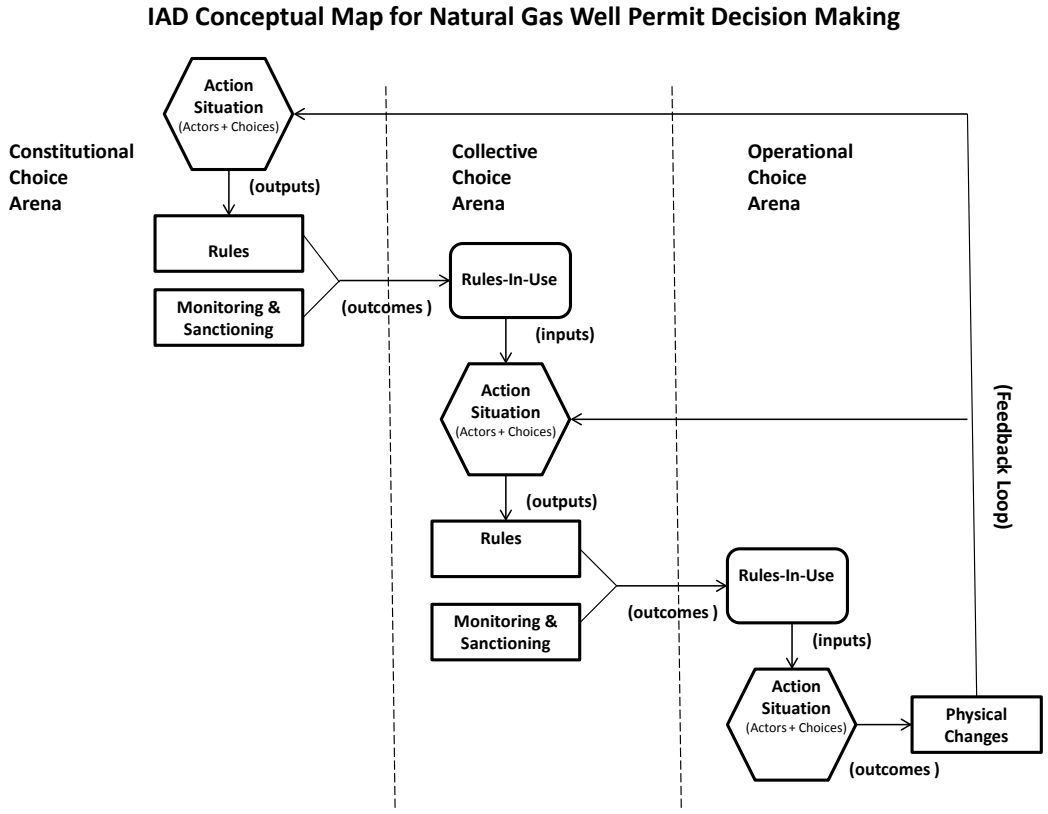


Figure 2.1. An IAD conceptual map for natural gas well permit decision making. Source: Adapted from Collins and Kahn, 2004, which was originally adapted from Ostrom, Gardner and Walker, 1994.

2.2 Railroad Commission of Texas

2.2.1 Constitutional Choice Arena

One of the action situations within the constitutional arena of choice seeks to answer the question, "Who should regulate oil and gas drilling within the state of Texas?" Though its name is not reflective of its current jurisdictional powers, constitutionally, the state of Texas recognizes the Railroad Commission of Texas (RRC) as the state agency with primary regulatory authority over the oil and gas industry. Created in 1891 by the state legislature, the Railroad Commission was originally established to regulate rates and operations of railroads, terminals, wharves and express companies (1891 Tex. Gen. Laws, ch.51). The first act to designate the Railroad Commission as an agency over laws relating to oil and gas did not come about until 1917, when the legislature declared pipelines to be common carriers, giving the RRC jurisdiction over them (1917 Tex. Gen. Laws, ch. 30, Tex. Rev. Civ. Stat. art. 6019). Over the years the legislature continued to enact statutes expanding the jurisdiction of RRC over the oil and gas industry, while gradually reducing its relevance over railroads. In 1984, the federal government took over the regulation of railroads, trucking and buses, and by 2005 the last of RRCs state authority over the railroads moved to the Texas Department of Transportation (www.rrc.state.tx.us).

Presently, RRC is the primary regulatory agency responsible for ensuring effective use of the state's energy resources through the regulation of almost all phases of the oil and gas exploration and production; from the initial permitting to drill a well to its final plugging of inactive wells. RRC's principal responsibilities as designated by the legislature within the Texas Natural Resources Code include: preventing waste of oil and gas resources; protection of

surface and subsurface water; issuance of permits and collection of financial assurances and, ensuring all mineral interest owners have an opportunity to develop their fair share of the minerals underlying their property (www.rrc.state.tx.us/barnettshale/index.php). In addition, RRC regulates natural gas utilities, pipeline safety, the natural gas and hazardous liquid pipeline industry and surface coal and uranium mining in Texas. Based on how the regulatory authority granted RRC has evolved over the years, a more appropriate name is likely to be adopted in future legislative sessions. As of the January 2013 submission of the Sunset Advisory Commission Staff Report, the Sunset Commission is recommending the agency be renamed Texas Energy Resources Commission. Until such a name change occurs, the Railroad Commission of Texas remains the current name of the agency given state regulatory authority over the oil and gas industry.

2.2.2 Collective Choice Arena

The Texas Natural Resources Code, provides the Railroad Commission broad authority to "make and enforce rules and orders for the conservation…and prevention of waste of oil and gas" (§85.201) and for "ensuring that all mineral interest owners have an opportunity to develop their fair share of minerals underlying their property" http://www.rrc.state.tx.us/barnettshale/ index.php). This rule making authority granted to the Railroad Commission by the state legislature is the outcome of the constitutional arena of choice and now becomes the input for the collective choice arena. The Railroad Commission has adopted many rules under Title 16, Part 1 of the Texas Administrative Code, to assist with the implementation of its assigned responsibilities. The first rule adopted by RRC pertinent to

the setback of gas wells was the Statewide Spacing Rule, adopted in 1919 commonly referred to as “Rule 37” (Tex. Admin. Code, Title 16, Part 1, Chapter 3, Rule §3.37). Based upon the need for conserving our natural resources of oil and gas, Texas was the first state to adopt a well spacing rule. Rule 37 was promulgated to reduce fire hazards and waste of the oil/gas which occurred from the production practices of drilling wells in too great a number or in too close proximity (Tex. Gen. Laws ch. 155, 1919, Tex. Gen. Civ. Stat. art. 6023, Vernon 1962). In accordance to Rule 37, no well shall be drilled nearer than 1,200 feet to any other well on the same tract, nor shall a well be drilled nearer than 467 feet to any property line, lease line, or subdivision line. However, exceptions may be granted by RRC, if RRC deems shorter setbacks necessary for the prevention of waste or confiscation of property. Cases requiring exceptions are presented at a public hearing after a minimum of 10 days notice is given to all affected parties.

There have since been additional rules created that are closely related to spacing issues. For instance, exceptions to Rule 37 must also abide by field rules governed by Rule 43. Within the Barnett Shale fields the driller is allowed as close as 330 feet from the property line of unleased properties. With the onset of horizontal wells, Rule 86 explains why the surface location for horizontal wells can be located on a lease closer to a lease line than the field rules or Rule 37 require. One reason is related to the “horizontal drainhole,” defined by Rule 86 as the “portion of the wellbore drilled in the correlative interval, between the penetration point and the terminus.” Since the surface location is not considered part of the horizontal drainhole where production may occur, the surface location may be anywhere on the lease. Additionally, with regards to permitting, Rule §3.5 stipulates the application to drill, deepen, reenter or plug

back wells must be made under provisions of §3.37 as well as other rules relating to well densities, proration, and pooled development (see §3.38, §3.39, and/or §3.40).

Since this research is interested in the analysis of natural gas well permitting policy, one additional rule that cannot go unmentioned is Rule §1.201 which defines the well permitting process. Applications are essentially granted administratively by the Commission if the operator submits all required materials to the Commission. If application is deemed incomplete, notice will be given to the applicant indicating the specific information needed to complete the application. There may be two supplemental filings before the application is officially denied due to incompleteness. The final review period ends when the Commission makes the final determination of administratively approved, administratively denied or docketed as a contested case. Contested cases require a public hearing prior to their determination.

While the Texas Natural Resources Code provides the Railroad Commission broad authority to "make and enforce rules" for regulating the oil and gas industry, RRC's authority is not absolute. The constitutional choice rules affect the collective choice actions. For instance, constitutionally RRC does not have jurisdiction over roads, traffic, noise, odors, leases, pipeline easements, or royalty payments. These limitations in regulatory authority are relevant when it comes to permitting and siting issues. For example, while RRC issues permits for oil and gas exploration, production, and waste disposal, The Texas Department of Transportation (TXDOT) is responsible for issuing access permits to well sites from a roadway on the state highway system.

2.2.3 Monitoring and Sanctioning Issues

The Railroad Commission is one of the many government agencies that must undergo a regular review by the Sunset Advisory Commission (Chapter 325 of the Texas Government Code). Established in 1977 by the state legislature to eliminate waste and inefficiency in government agencies, the Sunset Commission makes recommendations to the state legislature about the policies and programs of government agencies (http://www.sunset.state.tx.us/). Recommendations may include: to continue the agency as is, continue with modifications (including reducing responsibilities or merging with other agencies) or terminate. Although the constitutional choice rule may include recommendation for termination, the reality of the primary regulatory agency for oil and gas operations ever being shut down is highly unlikely given our nation's dependence on oil and gas. Furthermore, the Sunset Advisory Commission has formally recognized that "unregulated production of oil and natural gas can detrimentally affect the environment and significantly hinder future product recovery efforts" (2011, p. 12). Consequently, the rules-in-use are essentially to continue as is or with some form of modification (i.e., recommend changing the agency name). This limited threat of closure, may affect the Commission's behaviors regarding the implementation of their regulatory powers. In fact, enforcement issues are noted to be one of the areas requiring improvement within Sunset Advisory Commission Staff Reports (Sunset Advisory Commission, 2013).

Within the collective choice arena the Railroad Commission provides inspections for gas wells to ensure compliance. However, as reported by the State Auditor's Office, it is known that many gas wells go uninspected and have untimely follow-up inspections to determine whether operators have resolved problems (Keel, 2007). The lack of sufficient and timely

inspections suggests many oil and gas facilities operate with little oversight. The table in Appendix A confirms this, as the annual number of inspections consistently falls below the total number of active wells. Consequently, although the rule indicates that facilities will be inspected, the rule-in-use is facilities are inspected following complaints (reactively, not always proactively). Furthermore, as noted within the Sunset Commission's 2011 review, "…the Commission takes relatively few enforcement actions, resulting in a lack of deterrence for future noncompliance. While there is no standard for how many violations should result in a monetary sanction, action should be frequent enough to deter future violation" (Sunset Advisory Commission, 2011, p. 33). In addition to the limited application of monitory sanctions for violators, particularly repeat violators, the sanctions may not be at levels sufficient enough to deter violations. In order for sanctions to deter unwanted actions, they should be at a level that results in a cost that outweighs the benefit of performing the violation. Fines of only a few thousand dollars are not likely to act as a deterrent for such a lucrative industry. Finally, it is often pointed out by critics of the Railroad Commission that conflict of interest may play a role in reducing the Commission's effectiveness as a regulatory agency since commissioners are regulating the same industry players they depend on for campaign money (Trovall, 2012). All of these aforementioned enforcement issues suggest the rules-in-use are more lax than the written rules, giving the operators more freedoms than reflected in the Texas Administrative Codes.

2.3 Local Governments

2.3.1 Constitutional Choice Arena

While the state legislature of Texas has authorized RRC to regulate the oil and gas industry, constitutionally the state has also granted authority to local governments through its police powers. The term "police powers" describes the authority to regulate private property in the interest of public health, safety and welfare. This authority to regulate is reserved by the U.S. Constitution to the states and delegated by the state governments to their local governments. However, the extent of regulatory authority granted to local governments is not uniform within the state of Texas and is based on what is known as "Dillon's rule" versus "home rule." Texas counties are considered creatures of the state implying that they must follow Dillon's rule also known as general law; and therefore, may not exercise any power unless specifically granted to them by the legislature (Capital Area Council of Governments, 2009). Dillon's rule also applies to Texas cities with a population less than 5000 that have not been granted a home rule charter. Although greatly limited, all unincorporated areas are not necessarily powerless. Chapter 231 of the Local Government Code entitled "County Zoning Authority," provides zoning authority to a few special areas deemed unique enough in nature that the legislature granted them enhanced land use control to protect their special features (i.e., Padre Island, near Amistad Recreation Area, military zones, and historical areas such as El Paso Mission Trail and zoning around certain lakes, the areas surrounding Lake Ray Roberts and the El Paso Mission Trail). Additionally, Chapter 241 provides for county zoning authority (as well as municipal authority) around airports to prevent the creation of an airport hazard (§241.011). According to the code, the zoning regulations may specify land uses permitted,

regulate the type and height of structures, and require permits prior to construction or alteration of structures.

In contrast to the severe limitations on rulemaking under Dillon's rule, home rule is generally understood to be the capacity of local governments to initiate policies without prior approval of the state legislature to the extent that they are not expressly forbidden by the Texas Constitution or the legislature (Hawkins, 2011, p. 682; Vanham, 2011, p. 248). In addition, a home rule city "may adopt" ordinances, laws or regulations "necessary for the government, interest, welfare, or good order of the municipality as a body politic" and the courts recognize this local power as equivalent to the state legislature's powers (Local Government Code, Title 2, Subtitle D, Chapter 51, §51.012; Riley, 2007, p. 365-366). Furthermore, Title 7 of the Local Government Code authorizes municipalities to enact general land use ordinances that specify where certain structures and land uses may occur (Local Government Code, Title 7, Subtitle A, Chapter 211, §211.003). Consequently, even though RRC is the primary regulatory authority over the oil and gas industry, the authority granted municipalities enables municipalities to regulate the land use operations associated with the oil and gas industry, which in turn gives municipalities the ability to influence whether and where natural gas drilling may occur within its city's boundaries.

Ever since it was founded as a regulatory institution in the early part of the 20th century, zoning has become the municipality's main tool for regulating land use in the US. The intent of zoning is to geographically separate different types of land uses and regulate property characteristics to protect "public health, safety and welfare" (Levy, 1996; McDonald, 1995). The local government code not only identifies who has the authority for creating policy and the

range of policy they may create, it also specifies the procedures governing the adoption of zoning regulations and district boundaries as well as the process for proposed changes to a regulation or boundary protest. For example, Section 211.003 identifies the governing body of the municipality as having the authority to regulate height, size, location and use of buildings and other structures as well as the land for business, industrial, residential, or other purposes. Whereas, Section 211.006 specifies the procedures for adopting new (or modified) zoning regulations, such as the requirement of a 30 day public notice, a public hearing and the affirmative vote of at least three-fourths of all members of the governing body. Additionally, Section 211.008 specifies requirements if boards of adjustments and appeals are created. Deemed a quasi-judicial board, zoning boards of adjustments/appeals may be created by the governing body to hear appeals to the staff's administration of the zoning ordinance, conduct hearings on special exceptions to the ordinance, or grant variances to the terms of a zoning ordinance (§211.009).

2.3.2 Collective Choice Arena

Although seemingly detailed in what municipalities can and cannot regulate, the rules are broad enough to provide some flexibility in how municipalities may choose to implement these laws, as seen in the diversity of institutional arrangements at the level of collective choice. In the area of gas well permitting, a bifurcation of possible decision making processes has occurred. There are effectively two distinctive institutional worlds which I call the "zoning process" and the "siting process." The "zoning process" requires all permitting requests to undergo at least one public hearing prior to the determination of the permit request while the

"siting process" allows for some permitting approvals without incorporating public hearings. Traditionally, zoning works to limit the conflicting uses by creating development districts which separate land uses. Through zoning laws, only certain types of activities or developments are permitted within the stated zoning districts. Cities adopting a "zoning" approach do not recognize oil and gas drilling as a permissible use by right and therefore, require a zoning process such as a classification change, a specific use permit (also called special use permits or conditional use permits) or a special exception granted prior to allowing such a use within their territory.

Rezonings change the legal designation for a plot of land to allow for a different class of land use to be occupied on the property. Specific use permits, allow an otherwise unapproved type of land use to be sited within a particular zoning district if specific conditions are met (i.e., allow for drilling operations if structures have facades that aesthetically match the other buildings within the zoning district). Thus, in accordance to Texas Local Government Code (§211.006), all application requests requiring rezoning or specific use permits would then be subject to public notice provisions, require a public hearing before a planning and zoning commission which makes recommendations to the council, and require a second public hearing before the council prior to the granting of any drilling permit. Permitting by special exception is very similar to permitting by special use as it requires adherence to special criteria. However, special exceptions are recognized in Sections 211.008 and 211.009 of the Local Government Code such that the governing body of a municipality "may provide for the appointment of a board of adjustment…(and) authorize the board…to make special exceptions to the terms of the zoning ordinance that are consistent with the general purpose and intent of the ordinance

and in accordance with any applicable rules contained in the ordinance." Consequently, under this provision, the permitting applications may be reviewed by a board of adjustment not the city council and require only one public hearing before the board of adjustment (following the appropriate public notice).

In contrast to the "zoning" approach, municipalities that opt for a "siting" approach permit gas well drilling by right. This means drilling is not restricted by its use and may be permitted anywhere within the city's boundaries through an administrative approval process. However, this is not to say that the "siting" process results in an automatic approval or never requires a public hearing. Drilling is permitted by right, but it still has to follow the locally adopted oil and gas ordinances which define the permitting process and regulate drilling activities such as restricting their location by length of setback from protected uses (i.e., residences, public buildings, habitable structures, property lines, public parks, and environmentally sensitive areas (i.e, flood plains, waters of the state). Consequently, if the applicant wishes to locate a gas well closer than the specified setbacks he would then have to ask for an appeal to request a variance which would then require public notice, a public hearing and a formal review by the board of appeals as stipulated in the Local Government Code (§211.008 and §211.009).

Although there is no uniform municipal ordinance governing oil and gas well drilling, it is assumed the cities are basically seeking the same rights and interests – to protect the public health, safety and welfare. Furthermore, since RRC does not have authority to regulate roads, traffic, noise, odors and other nuisances, it is logical that most local oil and gas ordinances would have provisions to address these issues under their policing power. Accordingly, the

ordinances do have some similarities in form. For instance, it is very common to see a provision in the ordinance that requires oil and gas operators to enter road repair agreements or contracts (Vanham, 2011). Similarly, local ordinances may have provisions to restrict noise levels and minimize other nuisances that are associated with drilling activities and their facilities. For a listing of some of the regulatory conditions mentioned in local ordinances see Appendix 3. Moreover, given that zoning ordinance is the regulatory tool to separate the negative effects of industry from other land uses and to regulate the property characteristic for the protection of a community's health, safety and welfare, it is observed that all cities have some setback distance requirements within their ordinances. In fact, Vanham (2011) states that there is always a setback distance requirement precluding operations from drilling within a specified distance of residences or public places. Appendix 4 provides a listing of some typical setbacks from designated protected uses. However, as communities may vary in their needs and preferences, the required minimum setback distances are not consistent from municipality to municipality. Guidance for establishing a minimum setback distance from residential buildings does not come from existing Railroad Commission standards, as their setbacks pertain to well spacing and leas line issues, not residential buildings. The only formal rule giving some direction for municipalities is found in an old law in the Municipal Code. Section 253.005 (c) of the Municipal Code states, "A well may not be drilled in the thickly settled part of the municipality or within 200 feet of a private residence."

2.3.3 Monitoring and Sanctioning Issues

Just as the constitutional rules established within the Local Government Code result in

major differences in the ability to govern and create policy between general law counties and home rule cities, there are significant differences in their monitoring and sanctioning. On a very fundamental level, because counties cannot create ordinances that govern land use in the same manner that cities can, they cannot establish sanctions for violations of laws that do not exist. This difference in governance creates a more preferable drilling environment for operators – less laws result in less restrictions as well as less upfront fees and potential fines. Moreover, given that cities have the authority to include specifications for land use operations for the protection of public health, safety and welfare, the equipment/materials required by cities for drilling operations may be more costly than those allowable within counties. For example, city ordinances can require a closed-loop system for the temporary storage of drilling waste (storage of used fracking fluids in steel bins) as opposed to the cheaper open reserve pit. Additional material such as sound walls, visible screening devices, air filtration systems may also be requirements within city ordinances to reduce the negative impacts of drilling which further increase the costs to the driller. The very nature of the increased populous within cities as compared to counties also results in closer monitoring by residents regarding the violation of state (Railroad Commission) or local ordinances. In light of the differences between counties and cities, the rules-in-use for operational choice decisions will likely include prioritizing drilling sites within counties over cities when all else is equal. Similarly, the difference in institutional arrangements for permitting decisions between cities may affect the decision making at the level of operational choice – operators are likely to prioritize communities that result in the best cost/benefit ratio for the company, all else equal.

2.4 Property Right Issues

2.4.1 Constitutional Choice Arena

While seemingly different in their regulatory powers, the concurrent authority for municipalities to regulate oil and gas activities alongside RRC, unfortunately creates confusion for municipal policy makers when considering what they can and cannot regulate. Though the dual power of authority created by our federalist system has been recognized in common law since the 1930s (*Tysco Oil Co. v. Railroad Commission*, 1935; *Klepak v. Humble Oil & Refining Co,* 1944), the extent to which a municipality can use its policing powers to regulate is up for debate. Differing interpretations of state law are addressed through legal proceedings. Frequently the major components of legal contention are the issues pertaining to property rights, the third area warranting discussion under constitutional choice issues.

Written with the intent to prevent abuses from governmental authority, the issue of protecting property rights is first addressed within the U.S. Constitution. The Fifth Amendment states "nor shall private property be taken for public use, without just compensation." Additionally, the Fourteenth Amendment includes the "due process" clause prohibiting state and local governments from depriving persons of "life, liberty or property without due process of the law."

The Texas Constitution adopts a similar provision regarding private property such that, "[n]o person's property shall be taken, damaged or destroyed for or applied to public use without adequate compensation being made, unless by the consent of such person…" (Tex. Const. art. 1, § 17). The significance of these provisions is that they suggest a need for balance. When creating and enforcing policies, states and local governments must work to find a balance

between their duty to serve and protect the safety and welfare of their citizens without overstepping their authority and denying persons (or entities) of their rights. Because there are various interests involved in the decision making of gas well permitting (RRC, municipality, land owner, mineral owner, drilling operator etc.), the proper level of regulatory authority is often in question and tested within legal proceedings under either regulatory takings or due process challenges.

While this paper is primarily interested in the cases pertaining to Texas, some mention of federal and non-Texas cases is warranted as a means of providing a more complete understanding of the issues. The first case signifying the birth of the regulatory takings doctrine occurred in 1922, with *Pennsylvania Coal v. Mahon* (260 U.S. 393). Since then, the U.S. Supreme Court has recognized a regulatory taking by the categorical rule where the regulation itself "denies all economic beneficial or productive use of land…" (*Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1015-16, 1992). Also referred to as a compensatory taking, the Texas Supreme Court has held that a taking occurs when the regulatory restriction "denies the landowner all economically viable use of the property or totally destroys the value of the property…" (*Mayhew v. Town of Sunnyvale*, 964 S.W.2d 922, 933, Texas, 1996).

Although there are many cases that examine the constitutionality of regulations that prohibit or restrict mining and mineral extraction, most of them predate the 1978 *Penn Central Transportation Co. v. City of New York* case (438 U.S. 104) which promulgated the three factors now considered in regulatory takings cases. These factors are "(1) the character of the governmental action, (2) the economic impact of the regulation upon the claimant, and (3) the extent to which the regulation has interfered with distinct investment-backed expectations"

(Welch, 2012, p. 3; Kramer, 1996). Moreover, findings reflect contrary rulings, leaving uncertainty as to what delineates the tipping point on the scale, demarking when regulatory authority has overstepped its boundaries. For instance, in 1905, a California case involving a challenge to a San Francisco ordinance which directly prohibited quarry operations within a portion of the city found the regulation a taking of private property without due process (*Ex parte Kelso*, 82 P. 241). Even though it recognized all property interests are held subject to the police power of the municipality, it maintained it was unlawful to place a total ban on quarrying activities. Alternately, while still using a substantive due process approach, the ruling in the case of *Hadachek v. Sebastian*, 132, 584 (Cal. 1913) found that the use of police power was valid as the ordinance was protecting the public from the noxious effects of the industry's operations. Perhaps what caused the divergence between these findings and those of similar cases is that the *Kelso* case emphasized the locational dependence of mining, whereas the *Hadacheck* case did not treat mining operations differently from any other industry.

The more modern approach to dealing with zoning and rezoning decisions includes the consideration of the three factors promulgated in the *Penn Central* case of 1978. One important case emphasizing the economic impact of the regulation is *Keystone Bituminous Coal Association v. DeBenedictis*, 480 U.S. 470 (1987). Although the regulation required 50% of coal beneath certain structures to remain in place for surface support, the findings stated that the ordinance did not result in a regulatory taking, because the coal that was to remain was only 2% of the total petitioner's estate. Citing *Penn Central*, the Court stated it focused on "the character of the action and on the nature of the interference with rights *in the parcel as a whole."* The parcel as a whole rule, was also applied in *Bernardsville Quarry, Inc. v. Borough of*

Bernardsville, 608 A.2d 1377 (NJ 1992); a NJ Supreme Court case which upheld an ordinance as constitutionally valid in restricting the depth of quarrying as the property could generate other "significant revenue."

Thus far, while additional rules gained through common law assist in the determination of a taking, there is not definitive consistency among the rulings. Additionally, while the parcel as a whole rule assists in justifying some limitation on mineral extraction, the extent of limitation remains undefined. Moreover, while some cases recognize the locational peculiarities of minerals, the cases referenced thus far have recognized both the land and the minerals beneath the surface as property under one ownership. However, the minerals underneath a plot of land do not necessarily belong to the land-owner. While initially the land and its minerals are joined under one ownership, the mineral estate and the surface estate may be severed "through the sale, reservation or execution of a lease" (Cady II, 2009).

The concept of the severed or "split-estate" dates back to as early as 800 B.C., where there is evidence that mines were owned collectively by the citizens of Greece (Lacy, 1995). The first occurrence of the severed estate in English history dates back to the late 1300's when King Edward III by royal decree claimed ownership in the gold and silver deposits under the land (Stratton, 2005). The first disputed case on record occurred in 1567 between the Earl of Northumberland and Queen Elizabeth (*Queen Elizabeth v. The Earl of Northumberland*; The Case of Mines, 75 Eng. Rep. 472, Exch. Div. 1567). Known as "The Case of Mines" it was argued that all gold and silver belonged to the King so that he could meet his responsibility of providing coins and money. In the 1300s the Spanish Crown also influenced American mining laws by claiming ownership of all minerals in Spain and her settlements abroad, including Mexico,

California and Texas (Lacy, 1995). Upon joining the Union in 1846, Texas maintained the Spanish law that all minerals under the surface belonged to the government. Consequently, a grantee of land had no interest in the minerals. While this practice was abandoned by a provision in the 1866 state constitution, which returned the mineral interests back to the land owner, the ability to severe the estates remained (Tex. Const. art. VII, § 39, 1866). As a matter of fact, through a series of Acts passed by Congress, the U.S. Government was given the ability to reserve minerals from the sale or transfer of federal lands, making it the largest owner of severed mineral rights in the U.S (http://www.blm.gov/wo/st/en/prog/energy.html). The following are some examples of the enabling legislation: Coal Lands Act of March 3, 1909; Coal Lands Act of June 22, 1910; Agricultural Entry Act of July 17, 1914; Stock-Raising Homestead Act of Dec. 29, 1916; Mineral Lands Leasing Act of Feb. 25, 1920. In spite of the established legislation recognizing severed estates, and the creation of the Bureau of Land Management which manages federally owned properties (both land and mineral estates), there is no legislation that provides the constitutional choice rules defining which estate (mineral or surface) is granted dominance. As a result, the right of dominance has been determined through common law.

The first case regarding the rights of mineral owners was the Texas case of *Cowan v. Hardeman* in 1862. Citing to early English cases and to Spanish and Mexican law as the precedent, the Texas Court recognized that "it is a well established doctrine from the earliest days of the common law, that the right to the minerals thus reserved carries with it the right to enter, dig and carry them away, and all other such incidents thereto as are necessary to be used for getting and enjoying them" (*Cowan*, 26 Tex. at 217). Noted as early as 1893, in *Chartiers*

Block Coal v. Mellon, the mineral estate as dominant estate became an accepted doctrine of common law. The courts gave the mineral estate an unquestioned right to access making the surface rights subservient to the minerals, reasoning that it was a necessary rule of law because the estate would be worthless without the right to access the minerals beneath the surface (*Harris v. Currie*, 1944; *Moser v. U.S. Steel Corp.,* Texas 1984). However, by the 1960's and 70's the level of dominance of the mineral estate began to be called into question. Although the mineral estate owner was being given implied rights to use the surface in order to access his minerals below, these rights were no longer considered absolute. Within Texas, common law evolved such that the mineral estate owner must use only that surface which is deemed "reasonable" and necessary and must exercise with "due regard for the rights of the owner of the subservient estate" (*Humble Oil and Ref. Co. v. Williams,* 1967) such as accommodating existing uses when alternatives are practical (*Getty Oil v. Jones*, 1971). *Getty Oil* (1971) marked the start of what is commonly referred to as the "accommodation doctrine."

While legal doctrine adopted by the Texas courts recognizes the dominant mineral estate must exercise his rights with due regard for the surface estate, the restrictions placed on the mineral estate are very limited within the state legislation. For example, the King's Common Courtesy Act of 2007 (Texas Natural Resource Code § 91.701 et seq.), hailed as a legislative act to "protect the rights of land owners" (http://weatherforddemocrat.com/local/x1472024417/ Legislature-passes-King-s-Common-Courtesy-Act), does little more than require a 15 day notice to the affected surface owners, *after* RRC has granted the permit to drill a new well or reenter a plugged or abandoned well (§ 91.753). Additionally, there is little consequence for lack of action since failure to give notice

does not affect permit or otherwise restrict, limit, or terminate right to develop (§ 91.755). Furthermore, within the state of Texas, there is no liability or required compensation for surface damage, as the provision expressly states that the State does not affect status of dominance of mineral estate over surface estate (§ 91.755).

On the other hand, Texas legislature in its attempt to balance the rights of the surface estate and mineral estate is one of only two states (Colorado is the 2nd) that allow real estate development to restrict gas well operations (Stickley, 2009). The Mineral Use of Subdivided Land Act of 1983 (Tex. Nat. Res. Code §92.001 et seq.) and the subsequent rules adopted by RRC in Texas Administrative Code, currently "Rule 76" (§3.76) allow the surface owner of a qualified subdivision to request a hearing to restrict the mineral owner's development activities. To be considered a "qualified subdivision," it "must be in a county with a population over 400,000," the tract of land must not be "more than 640 acres," and it must have been "subdivided in a manner authorized by law by the surface owners for residential, commercial, or industrial use." Additionally, there are limits as to how much the surface may be limited as the operation site must be contain a "surface area of two or more acres" for "each separate 80 acres in the qualified subdivision. Furthermore, the burden of proof is placed on the surface owner, not the mineral owner.

2.4.2 Collective Choice Arena

For all intents and purposes, the rules set at the level of constitutional choice do not grant decision making authority for determination of property rights at the level of collective

choice. Mineral right owners have been granted supremacy over surface right owners. There is not a choice on this matter.

2.4.3 Monitoring and Sanctioning

While there is an absolute primacy of mineral rights over surface rights, monitoring and sanctioning of abuse of rights does occur at the level of operations. As noted in the legal proceedings discussed above, if a surface owner feels his land use has been unreasonably destroyed by drilling operations, he/she may file suit against the operator under the accommodation doctrine. Drilling operators may also file suit against municipalities if they believe the local regulations have overstepped their authority with their rulemaking by blocking the right of access and causing a regulatory taking of property. Although there is no certainty in the outcomes of these proceedings, the threat of potential lawsuits may deter any abuses. Thus, the rules-in-use for municipalities generally include processes that enable drilling operations (noted by the very few denials in practice) and operators generally attempt to provide "reasonable" accommodations for the land owner. During an interview with a representative from a drilling company, it was mentioned that they regularly enter into surface lease agreements with land owners regardless if they have mineral interests or not (March 25, 2013, Phone Interview). Although this practice is not required within Texas (http://www.rrc.state.tx.us/about/faqs/SurfaceOwnerInfo.pdf), the interviewee reported it to be a common practice among drilling companies.

2.5 Constitutional Choice/Collective Choice Summary

In summary, there are constitutional choice rules delineating who has the authority to regulate natural gas drilling operations. Within the state of Texas, both the Railroad Commission and local municipalities have dual authority to regulate granted to them by the State. Within the constitutional arena, the Natural Resource Code recognizes the Railroad Commission as the primary regulatory agency, giving it rule making authority. Subsequently, RRC has developed collective choice rules listed under the Texas Administrative Code describing the system of procedures for implementing its regulatory authority, with the purpose of providing "just disposition of proceedings and public participation in the decision-making process" (§ 1.1). Alternately, the Local Government Code provides authority to home rule municipalities to adopt ordinances, laws or regulations as deemed necessary for interest of its community's health, safety and welfare (§ 211.001). Accordingly, at the level of collective choice authorized municipalities enact their own local ordinances, specifying procedures for implementing their regulatory authority, including the process of decision making for natural gas well permitting and the disposition of public participation within the process, creating some degree of variance for collective choice rules between municipalities, as noted in the differences between the process of "zoning" and "siting." Specifically, "zoning" requires all gas well permitting requests to undergo at least one public hearing before final determination may be made, while "siting" allows for some permitting approvals without incorporating public hearings.

In spite of the many rules governing the collective choice action situations and the differing configurations of governance institutions municipalities have to choose from, there

are essentially two basic choices municipalities have to make at the collective choice level of decision making: (1) to grant permit or deny permit request and (2) to determine what, if any additional conditions and variances will be applied. While an "either/or" decision (to grant or deny permit request) may seem to be a relatively simple choice, it is packed with tons of confounding information particularly related to property rights, that leaves decision makers reticent to deny requests for gas well permits. As mentioned earlier, although municipalities may be given authority through home rule charters to regulate land uses for the protection of its citizens against the negative externalities associated with natural gas drilling/production operations, dominance of mineral rights over surface rights granted by the state creates a threat of "regulatory takings" lawsuits if drilling is denied or excessive conditions are placed on the land use operations associated with drilling. Consequently, very few denials are observed in practice.

Given that the practicality of denial is limited, the only other options municipalities have at their discretion for reducing exposure to negative externalities is to determine what, if any additional conditions may be applied to drilling/production operations within their local ordinances. Careful consideration must be given to the types of conditions that may be placed on drilling companies. Municipalities cannot regulate any industry operations under RRC's jurisdiction, thus municipal regulations are constrained to land-use considerations. Consequently local ordinances regulating the proximity of gas drilling operations to dwellings or other structures is one of the top regulatory conditions placed on operators.

2.6 Operational Choice Arena

In light of the above constitutional choice rules, collective choice rules and the associated monitoring and sanctioning, the actors at the operational level are given a limited set of choices, with some actors more enabled or constrained than others. Since the actions taken at the level of operational choice affect variables in the physical world, examination of the actors and their choices within the most predominant action situations of the operational choice arena may provide new information to help explain the societal outcomes of gas well permitting policy, such as the proximity of gas wells to residential buildings. For oil and gas well drilling there are essentially two action situations dominating the operational choice arena: (1) drilling operators, land owners and mineral rights owners buying/selling/leasing property rights and (2) drilling operators developing gas wells within close proximity to homes (i.e., less than 1000') or at farther distances.

2.6.1 Buying/Selling/Leasing Properties

Much of the conflict surrounding natural gas well permitting is based on differing rights given to the mineral estate owner and the surface estate owner. However, since the state has not provided a process to resolve the conflict within a collective choice arena, market exchanges occur within the operational choice arena as a method of conflict resolution. For this reason, the operational level may be viewed as the market for property rights. The primary actors within the market transactions are drilling operators, mineral owners and surface owners. The basic choices within the action situation include retaining, selling or leasing property rights (mineral rights and surface rights). Given that drilling operators have the desire

to extract and produce the minerals beneath the surface, it is assumed they would retain any mineral rights they have (unless the company was failing financially or merging with another company). For the same reason, in cases where the operators do not own the mineral rights, drilling companies make concerted efforts to either purchase or lease the mineral rights from the existing owners.

Once approached by the drilling company, the mineral owner has a choice to retain, sell or lease his mineral rights. If the owner desires financial gain from his mineral asset, he/she would have to access, extract, produce and sell the minerals. As private individuals would not typically be able to conduct such activities, sale or lease of the mineral rights would likely occur. Full sale of the mineral rights only provides a one-shot financial benefit. There would be no continued royalty payments throughout the life of the well. Plus negotiating power for minimizing surface damage would be lost. Consequently, leasing of the mineral rights tends to be the most common option chosen. Through negotiations, the lease may provide multiple payment opportunities such as a sign-on bonus payment, long-term royalties and free use of produced gas, as well as surface use provisions.

On the other hand, if the mineral owner is not motivated by financial gain of his asset, but more concerned about preventing the negative impacts of drilling, retaining the minerals might be an option he/she considers, because he/she may believe it will prevent drilling near his residence. However, even in this scenario leasing would be the most likely choice, because unless the mineral owner has an extremely large portion of the total pooled unit (combined leases of the mineral reserve to be drilled), the well site might still be financially viable and drilled anyway. Plus, within transaction cost economics, scholars such as Williamson (1985)

assert that actors are “self-interest seeking with guile” and will behave opportunistically, taking selfish advantage of circumstances particularly when information is asymmetric. This suggests that unethical operators (or landmen – persons that gather leases for an operator or work independently with the goal of selling the obtained contracts to an operator for a profit) are likely to tell mineral owners that the majority of leases have already been obtained and drilling will occur whether he/she signs the leasing contract or not, even if they do not know this to be true. Reports of landmen minimizing the negative impacts of drilling operations, over estimating the projections for financial gains etc. have also been noted in the media (NCPR News, 2011; MIT News, 2010). Thus, the mineral owner not wanting drilling to occur, would still be likely to sign the lease, because he/she might believe refusal to sign would not inhibit the drilling operations from occurring and being a rational person would opt to get some kind of financial benefit versus no benefit at all.

The savvy mineral estate owner who owns the corresponding surface estate would include surface provisions in his/her lease, or contract a separate surface lease. Since mineral leases provide the operator the right of use of the surface estate so they may gain access to the minerals beneath it, it is in the mineral owner’s best interest to sign a surface lease stipulating specific rights to surface use beyond what might be considered “reasonable” under the accommodation doctrine. Specific enclosures around the equipment, location of egress and ingress of truck traffic, and detailed restoration requirements following the completion of drilling are just a few examples of what might be included in a surface lease. While it is possible the surface estate owner without mineral interests, may be approached by the drilling company

to sign a surface lease, there are no real negotiation powers for the split-estate surface owner; therefore, the lease would likely be written in the operator's best interest.

Considering all the possible scenarios, the rules influencing the operational choice arena lead to a "lessee's market." By this I mean the market for exchange of property rights is highly swayed in favor of the operator, the lessee. The mineral owner, the lessor, while having some negotiating power is highly dependent on the technical knowledge of the operator and lacks the level of experience for interpreting or negotiating lease contracts that the operator holds. This information asymmetry puts the lessor at a disadvantage during the market transactions.

Although the contracts are considered leases, one might also describe the market by the more familiar phrase a "buyer's market," because the leasing agreement may be viewed as a sale of part of a property. Plus the general definition of buyer's market still holds, since there are more sellers than buyers, giving the advantage to the buyer.

2.6.2 Deciding Where to Drill

When considering the actors involved in the various stages of decision making for the determination of gas well locations, ultimately the process begins and ends with the operator; the regulatory process does not begin unless the operator first chooses to drill. During the initial phase of decision making, the operator (working with a team of exploration geologists and geophysicists) identifies land masses that have the geological conditions consistent with a high probability of a productive well site and contain the open space necessary for drilling operations. Comprehensive analysis examines many factors of the subsurface geology, including the expected mineral concentration within the shale, the permeability of the shale,

the depth and size of the deposit, and other characteristics of the nature of the potential formation (http://www.naturalgas.org/naturalgas/extraction.asp).

After the geophysical team identifies the optimal location for a well, the final consideration on whether or not to drill a well depends on the economic potential of the well site. Assuming good business practices, many factors will be taken into consideration when determining the specific location of the gas well in addition to the estimated size, depth and productivity of the potential reserve. Considerations such as, cost of obtaining leases, length of time in the permitting process, persons involved in the decision making process, extent of restrictions placed on drilling activities, cost of additional fees/equipment etc. may all be factored in the company's cost/benefit analysis. Once determined to be a financially viable site, the company begins the process to ensure legal compliance for drilling in the identified location. This involves securing the rights to access/extract/produce the minerals through purchasing and leasing contracts, as well as securing all necessary permits for the drilling operations.

As noted in the previous section, because the state grants mineral owners' primacy over surface owners and non-industry mineral owners require industry resources and expertise to access the minerals in order to financially benefit from their ownership, the industry has little difficulty in securing the rights to access/extract/produce the minerals. Given the industry's advantage in the market place, well locations are not likely altered because of property rights issues. On the other hand, the regulatory process for gas well permitting does have some affect on gas well locations. According to Fambraugh (2002), "beyond a 1,200 foot horizontal drainhole, the added costs may cause an unsatisfactory return on investment" (p. 10). Thus,

the extent of regulatory restrictions imposed on location is important to oil and gas companies, because profit margins may be negatively impacted.

Considering the state level rules for oil and gas well permitting, the industry enjoys substantial latitude in their pursuit of drilling opportunities. Even though the Railroad Commission is the primary regulatory agency for oil and gas operations within the state of Texas, its permitting policy is largely administrative and does not restrict the location of gas wells based on the proximity to neighboring land uses, such as residential buildings. However, since there are noted differences in regulatory authority granted and adopted by local governments, drilling operators may choose gas well locations based on local ordinances and permitting processes that best meet their internal calculus.

Drilling operators have the choice to try and locate wells in counties or home-rule cities. Given a choice between an unincorporated area, with limited regulatory authority and an incorporated municipality with restrictive drilling ordinances (all else being equal), the driller is likely to opt to develop in the unincorporated area, because of the lower transaction costs (www.barnettshalenews.com). For instance, the permitting fee would be limited to that of RRC's and there would be no uncertainty of outcomes associated with local public hearings. Although driller's may prefer to development gas wells in counties over cities when all else is equal, the geological characteristics of the shale are not a constant variable. Much of the core productive areas are located beneath developed lands (see figures in Appendices D and E), which is why development has progressed to urban areas.

As was discussed under the Local Governments section, home-rule cities have the authority to regulate land use operations. This is particularly good news for the surface owner

without mineral interests who does not wish to have natural gas drilling close to his home, because the municipality can create ordinances in an attempt to correct for market failures that are not addressed at the state level. For example, it has been noted that municipal ordinances include a minimum setback rule, requiring well sites to maintain a minimum distance from residences for the protection of public health, safety and welfare. The required setback is an attempt to correct for the lessee's opportunism when a gas well location is preferred closer to an existing structure, because it would be less costly to the drilling company. Because municipalities have some flexibility in their rulemaking authority, minimum required setback distances may differ between municipalities. Municipalities that require stricter setback standards (greater distances from residences and other protected uses) will be imposing greater costs on the drilling company as compared to cities with shorter setbacks, so it would be logical to assume drilling companies would opt to locate in less restrictive areas, all else being equal.

In addition to the variations in rules placed on the land use operations (i.e. setback standards, maximum noise levels, screening of facilities), there are distinctive differences in the collective choice rules governing the decision making processes for permitting gas wells. One notable difference is whether or not the process requires a public hearing. If a public hearing is required as part of the permitting decision making process, the surface owner gains some negotiating power, not previously granted under state law. He/she now has a choice to participate in a public hearing as a means of influencing the decision makers to approve, deny or modify the permit request according to his/her self-interest. The requirement of a public hearing enables different actors to be involved in the decision making process. The choice of

gas well location is no longer solely based on the driller's optimum choice; the driller may now have to consider how the information shared by other parties during a public hearing may affect the decision making outcome. Since there is greater uncertainty of the outcome being in favor of the driller's optimum choice, the driller may choose a less than optimum choice for locating the gas well to better accommodate the needs of others (the surface owners) and increase his chances for gaining an approved permit.

The value of the public hearing is that it serves not only the surface owner who is directly affected (owner with property in close proximity of where the proposed drilling will occur), but those who own land further removed from the drill site location, but may also be exposed to potential negative externalities (i.e., increased noise, increased traffic, risk of hazard, exposure to pollutants, reduced property values and community aesthetics). The public hearing provides an opportunity to inform the decision makers about the unique circumstances pertaining to the drilling permit request. The open forum provides equal opportunity for all parties to speak (i.e., directly affected surface owners, indirectly affected citizens, mineral owners, and drilling operators) with the goal of creating a more well-informed decision and balanced outcome. Given that our society places a value on citizen participation, the inclusion or exclusion of a public hearing becomes extremely relevant. If public hearings are a required part of the decision making process then citizen participation is enabled, but if public hearings are not included within the decision making process citizen participation is restricted. Accordingly, it is anticipated that a variation in rules pertaining to public hearing requirements leads to a variation in citizen participation, which in turn leads to a variation in outcomes, such as the location of approved gas wells.

While the location of gas wells is the outcome of interest within the operational choice arena, the operator choices at this point are either drill the permitted well or don't drill the permitted well. Analysis at the operational level provides little value to the effectiveness of policy unless it includes the rules of the permitting policy at the level of collective choice. Analysis of the collective choice arena is considered critical, because it is at this level that the greatest variation in rulemaking occurs. With this in mind, the following chapter will take a closer look at the various institutional arrangements adopted by municipalities. Particular attention will be given to rules that affect the actors involved in the decision making process, with the goal of illustrating the theoretical premise of how rules affect citizen participation and how citizen participation in turn affects outcomes, such as average gas well setbacks from residential buildings.

CHAPTER 3

MUNICIPAL COLLECTIVE CHOICE ARENAS FOR OIL AND GAS WELL PERMITTING

As noted in the previous chapter, the greatest potential for influencing operator choice for gas well locations comes from the collective choice arena. Although the Railroad Commission (RRC) provides some restrictions to gas well location, such as proximity to other gas wells and gas leases, it does not have jurisdiction over roads, traffic, noise, odors and other issues that are relevant to neighboring land owners. Municipalities, on the other hand, are granted the authority to govern land uses for the purposes of protecting public health, safety and welfare (Local Government Code §211.01). Accordingly, specific ordinances are created to minimize the associated negative externalities. One of the most common policies adopted by municipalities is requiring a minimum distance (setback) between gas wells and specific land uses (Vanham, 2011). This chapter drills down to this one particular policy of interest, gas well setback policy at the municipal level of decision making, to illustrate the theoretical framework describing how rules are affecting citizen participation and how variation in citizen participation is ultimately affecting the policy outcomes (approved setback distances from residential buildings). The basic framework is conceptualized below.

Figure 3.1. Theoretical framework: Rules affect citizen participation, which in turn affects outcomes.

3.1 Dependent Variable: Setbacks

Gaining a better understanding of setback policy is important not only because it is widely used among municipalities, but because the resulting outcomes of the policy impact many actors within the community. Within the oil and gas arena, when local governments impose gas well setbacks, they affect not only the operator and those land owners where the well site will be located, but the rules also affect the mineral owners of the identified reservoir, as well as the land owners and residents that are indirectly affected by the industrial activities. Gas well setbacks are essentially building restrictions imposed on the industry. By establishing a minimum distance from the gas well to another fixed point, such as a property line or nearest residential building, boundaries are formed identifying locations where gas well development is restricted. Accordingly, setbacks may be viewed as legislatively defined buffer zones. The boundary lines create a buffer or additional level of protection against potential negative externalities of the industry. Typically, there are two areas that are created within the local gas well setback ordinances which I refer to as the "protected use area" and the "no-build area." Figure 3.2 provides an illustration of the two areas created by the setback ordinances.

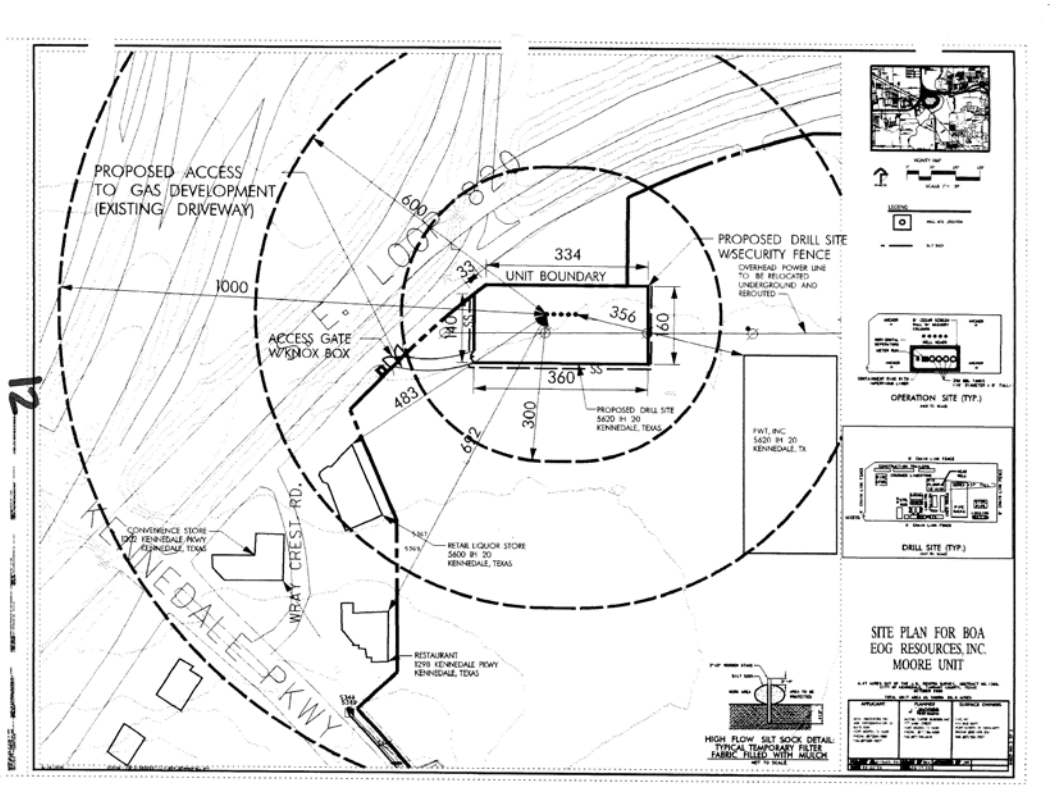


Figure 3.2. Protected use area and no-build area.

Notes:

1. The rectangle in the center of the figure represents the gas well site. The dashed circles indicate either the boundary for the protected use area or the no-build area, depending upon the designated setback standards.
2. Each city may designate its own specific setback standard. For instance, some may identify protected uses to have a 1000' setback standard, while others may only require a setback standard of 600'. If the city states gas wells must be 1000' from its protected use, then the area formed by the 1000' radius from the gas well would be the "protected use area." Alternately, if the city states gas wells need only be 600' from its protected use, then the area formed by the 600' radius from the gas well would be the "protected use area."
3. Most cities have identified that some protected uses have a minimum setback standard. Meaning, exceptions or variances cannot be granted below the specified distance; a minimum setback distance must be maintained. For instance, most cities state 300' as a minimum gas well setback from residential buildings, thus the area formed by the 300' radius from the gas well would be considered the "no-build area."
4. Legislatively, the area outside of the "protected use area" is essentially considered low risk, the "protected use area" high risk, and the "no-build area" highest risk.

The protected use area is the area that lies between the gas well and the city's stated setback standard from a specified use (protected use). Cities may establish gas well setbacks from a variety of uses, such as residential buildings, human occupied buildings, schools, public places, roadways, and environmentally sensitive areas, such as wetlands or waterways (see Appendix C for examples). Furthermore, each city may designate its own specific setback standard for each identified use. For instance, some municipalities may identify residential buildings as a protected use requiring a 1000' setback standard, while other municipalities may only require a setback standard of 600' for the same protected use. Accordingly, if the city states gas wells must be 1000' from its protected use, then the area formed by the 1000' radius from the gas well would be the "protected use area." Alternately, if the city states gas wells need only be 600' from its protected use, then the area formed by the 600' radius from the gas well would be the "protected use area." The figure below illustrates the variation in "protected use area" created by these differing setback standards.

Most cities have identified that some protected uses have a minimum setback standard. Meaning, exceptions or variances cannot be granted below a specified distance; a minimum setback distance must be maintained. For instance, most cities state 300' as a minimum gas well setback from residential buildings, thus the area formed by the 300' radius from the gas well would be considered the "no-build area." The no-build area is a subset of the protected use area. It is the area formed by the minimum required setback of a gas well from the protected use. The minimum required setback places a limitation as to how much variation may be granted to the standard setback. Meaning, exceptions or variances to setback standards cannot be granted below the minimum setback, thus guaranteeing a minimum distance between the gas well and the protected use. In effect, the "no-build area" is the legislatively recognized area of highest impact or risk, justifying the prohibition of gas well

development. Similarly, the area within the protected use boundary and the minimum boundary is legislatively recognized as high impact or risk, justifying additional regulation as noted in the setback standards. Finally, the area outside of the protected use area is legislatively recognized as the low impact area, thus having fewer restrictions placed upon the builder. Table 3.1 lists the differences in the legislatively defined impact areas based on a 600' or 1000' setback standard, which corresponds to the descriptions and illustration provided in Figure 3.2.

Just as each protected use may have its own specified setback standard, each standard may have its own designated minimum as defined within the ordinance. The variation in setback distances suggests that setbacks are not just a technical matter, but political as well; varied to meet the specific needs and desires of its community. It is for this reason that citizen participation is considered important. Scholars assert to best meet the needs and desires of the community, one must include the community within the decision making process (Innes 1990, 1998; Lindblom & Cohen, 1997; Schon, 1983). Since there are a variety of parties interested in the location of gas wells (i.e., operators, landowners with mineral rights, landowners without mineral rights, citizens residing in high impact areas and citizens that may experience indirect impact from drilling operations), the fundamental questions are whether or not who participates in the decision making process matters and whether or not the rules prevent some of the affected parties from participating.

Table 3.1

Legislatively Defined Levels of Impact

	Legislatively Low Impact	Legislatively High Impact	Legislatively Highest Impact
600' Setback Standard	The area outside the 600' radius from the gas well.	The area within a 600' radius from the gas well, also known as the "protected use area."	The area within the minimum setback boundary, also known as the "no build area."
1000' Setback Standard	The area outside the 1000' radius from the gas well.	The area within a 1000' radius from the gas well, also known as the "protected use area."	The area within the minimum setback boundary, also known as the "no build area."

3.2 Independent Variable (Intermediate): Citizen Participation

The question as to whether or not who participates matters, is directly related to our societal belief in the benefits of citizen participation. Citizen participation is a longstanding fundamental element of our governmental processes within the United States. The overriding belief is that public participation empowers citizens to influence government actions. From a normative sense, enabling people to have a voice in decisions that affect them is considered vital to the functioning of a healthy democracy (Fiorino, 1990). When governments utilize public participation as a part of the decision making process, citizens are given the opportunity to inform, negotiate and meet their shared interests (Denhardt & Denhardt, 2000). From a substantive sense, citizen involvement can "generate information, understanding, and agreement on problems" (Burby, 2003, p. 35) and ultimately produce better decisions (Richards & Dalbey, 2006). Advocates of public participation see great value in citizen involvement from both normative and instrumental perspectives. Scholars suggest public participation assists

with fostering citizenship values, enhancing accountability, improving trust in government, achieving better decisions, and building consensus (Barber, 1984; King et al., 1998; Thomas, 1995; Matejczyk, 2001). Conversely, its critics state that public participation can be costly, time-consuming, exacerbate conflicts, disappoint participants and lead to greater distrust (see Roberts, 2008; Delli Carpini et al., 2004; Ryfe, 2005). Consequently, while there may be belief in the normative values, further assessment of the effects of citizen participation is warranted, especially within the context of solving wicked problems such as, the resolution of gas well policy.

3.2.1 Defining Citizen Participation

Part of the challenge in understanding how citizen participation affects policy outcomes is that the research produces a complex literature inundated with definitional problems (Kweit & Kweit, 1981; Roberts, 2004; Schachter & Yang, 2012). Broadly defined citizen participation may be viewed as "any form of involvement in community affairs that has the potential to shape the allocation of public resources or the resolution of public issues" (Sharp, 2012, p. 102). While there is a general understanding of the concept of citizen participation, the concept is extremely broad as it may be formal or informal, direct or indirect and is found at all levels of government. The extreme diversity of the concept creates confusion as to what citizen participation actually looks like in practice and makes it difficult to evaluate and compare empirical findings, because the independent variables may be vastly different (Kweit & Kweit, 1981; Day, 1997). Thus, if we wish to examine how formal citizen participation affects policy making, citizen participation must be clearly defined in order to develop meaningful inferences

from the findings. For instance, while voting is a formal act of citizen participation, it is considered indirect to the decision making process and very different from the act of citizens sharing information with decision makers within formal meetings such as public hearings. Therefore, for the purposes of this research project, the concept of citizen participation is limited to direct citizen participation within formal institutional settings. However, since there are several methods for direct, formal public participation in land-use or environmental decision making ranging from answering public surveys, speaking at public meetings, serving on advisory boards and collaborative decision making bodies (Daley, 2008), further narrowing of the concept is necessary. As the public hearing remains the most prevalent mechanism to provide for public input (Baker, Addams & Davis, 2005; Fiorino, 1990), this research will focus on the public hearing process as an entry point for public participation, specifically public hearings at the local level of governance. Within this context, citizen participation may then be identified not just by attendance at public hearings, but by the sharing of information with decision makers, noted by publically speaking at the hearing process or submitting a written comment for consideration.

3.2.2 Determinants of Public Participation and its Effect on Policy

The majority of existing research on citizen participation stems from democratic theory exploring the determinants and impacts of pluralism on formal democratic institutions (Dryzek, 1990; Williams & Matheny, 1994). Concerning local level participation within formal institutions, many scholars attribute socioeconomic status and mobility as predictors of attendance (McComas, Besley and Trumbo, 2006; Almond and Verba 1989; Rosenstone and

Hansen, 1993; Verba, Scholozman, & Brady, 1995) with Verba and colleagues also noting political efficacy as a key factor (i.e., having the education and linguistic ability to communicate effectively and influence decision makers within formal governmental meetings). In general, the research suggests that those with the higher levels of education, relevant political experience and a belief that they can make a difference have the greatest likelihood of participation due to their high levels of capacity.

One of the limitations in above research is that while it examines some of the factors influencing citizen participation at public hearings, it assumes that all the public has access. Any observed variance in participation is credited to self-selection issues, not necessarily barriers of access within the rules. For instance, while socioeconomic status, mobility and political efficacy have been identified as predictors of public participation (McComas, Besley & Trumbo, 2006; Almond & Verba, 1989; Rosenstone & Hansen, 1993; Verba, Scholozman, & Brady, 1995) it is still assumed the decision to participate or not is left up to the individual. The literature offers limited discussion on how the institutions themselves may act as barriers of entry, specifically concerning a citizen's ability or inability to participate in formal deliberative decision making arenas. While some scholars argue there are possible barriers to citizen participation, such as administrative preferences (Yang & Callahan, 2007), the research does not investigate the policy rules which enable or inhibit citizen participation from the decision making process; rather it addresses factors that influence the administrator's preference to use or not use citizen stakeholders within their strategic decision making processes.

Assuming citizens and their interest groups exhibit various degrees of participation within formal deliberative institutions, the question of interest then becomes, "How does the

variation in the extent of citizen participation affect policy outcomes?" Empirically, there are mixed results regarding the importance of citizen participation on land-use policy (Burby, 2003; Richards & Dalbey 2006; Delli Carpini et al., 2004; Ryfe, 2005). Some scholars find that input from neighborhood organizations matters in the decision making process (Altshuler, 1965; Babcock, 1966; Allensworth, 1975; Berry et al., 1993; Matejcyzk, 2001). For example, Matecjcyzk (2001) argues neighborhood associations that have reputations for working towards consensus with proposed developers increase the probability of having an effective voice within public hearings when facing future zoning exceptions. Still other scholars argue that local interest groups have little influence on municipal policy making (Peterson, 1981) or rezoning outcomes (Fleischmann, 1989). Much of the existing research addressing the impacts of pluralism essentially mirrors the aforementioned literature on the determinants of citizen participation, as it largely recognizes variation in socioeconomic characteristics as predictors of outcomes (King, Feltey & Susel, 1998; Kweit & Kweit, 1981; Thomas, 1995; Yang & Pandey, 2011). Race, education and income are viewed as determinants of interest group power which in turn affect the motivations of decision makers, thus influencing outcomes such as zoning decisions (Polsby, 1980; Neiman & Loveridge, 1981; Navarro & Carson, 1991; Hamilton, 1995; Lewis & Neiman, 2002).

The existing research suggests socioeconomic indicators as the primary factors associated with policy outcomes, but this goes against one of the guiding principles of representative government – to provide a wide range of involvement to represent the diverse socioeconomic groups that may be affected (Moynihan, 2003). This leads to the next question of concern, "What is influencing the range of citizen involvement?" According to the IAD

framework, rules are considered a primary factor in determining the actors involved in the decision making arena (Ostrom, 2005), thus a closer examination of the institutional arrangements is warranted.

3.3 Linking Rules to Citizen Participation to Outcomes

In spite of the long standing interest in citizen participation issues, there is surprisingly little research on the relationship between how institutional factors affect citizen participation and how variation in citizen participation in turn affects the policy outcomes. The extant research that comes closest to this includes studies that offer a political market framework to explain the choice of land-use practices. The political market framework argues that the structure of local political institutions mediate the interest groups, thereby shaping incentives for public officials resulting in the filtering of growth management preferences and influencing the distributive effects on specific constituencies (Feiock et al., 2008). That is to say, it is the institutional structure that determines which groups will have their preferences met in land-use development patterns. The political market framework is basically an attempt at integrating the property rights model and the interest group model for explaining policy outcomes. The property rights model (Alchian & Demsetz, 1973; Libecap, 1989) argues that "land-use policy will become more restrictive as land becomes scarce, population increases, and infrastructure becomes strained" (Lubell et al. 2009, p. 649). Interest group models, on the other hand, argue that local elected officials have a greater tendency to adopt policy that matches the preferences of those interests groups (typically developer interests) who are better able to

provide political resources that will aid in their re-election, (Logan & Molotch, 1987: Molotch, 1976; Elkins, 1995; Goetz, 1994).

Feiock and colleagues (2008) use the political market framework to structure their argument that different institutional arrangements influence policy creation. Their research findings suggest that county government structure (i.e., commission v. commission-administrator) and election rules (i.e., district b. at-large districts) play critical roles in the adoption of local land-use policies. In 2009, Lubell and colleagues conducted a similar study, but this time the structure of local institutions included variations in forms of municipal governments, mayoral powers, council representation (district v. at-large) and charter powers. Results indicate as mayoral power increases, the strong connections with higher socioeconomic status interests yields a greater likelihood for pro-environmental policies, while city managers tend to be driven more consistently by economic development interests yielding a greater likelihood for pro-development policies.

Although the aforementioned research examines the affect of institutional arrangements on local policy making, the focus is generally limited to a high level of institutional differentiation within the executive branch (i.e., county form of government defined by county commission vs. commission-administration or elected at-large representation vs. district elected; municipal form of government defined as mayor-council, manager-council or commission only) and does not drill down to a lower level institutional differentiation. The research fails to address the differentiation of the rules that affect the citizens' ability or inability to participate in the decision making arena, or how the resulting variation of citizen involvement affects the outcomes. Consequently, the rules affecting citizen

participation and the various publics who participate, or more importantly who do not participate within public hearings, are essentially "black boxed." This oversight is a severe limitation, because, the rules (or absence of rules) structuring the decision making arena are important predictors of outcomes (Ostrom, 2005). The rules act as explanatory variables of outcomes, because the rules determine the actors involved in the decision making arena (action arena) thereby affecting the information that may or may not be made available to the decision makers which ultimately influences their reasoning and outcomes of decision making. In light of this, citizen participation is an intermediate explanatory variable for outcomes. Thus, the theoretical framework that must be examined is the relationship between rules, citizen participation and setbacks. As indicated in Figure 3.1, it is anticipated that the variation in rules, leads to a variation in citizen participation, which leads to a variation in outcomes.

3.4 Independent Variable: Rules

Using the established theoretical framework, it is evident that before examining citizen participation effects on policy outcomes, the institutional effects on citizen participation must first be examined. As discussed in the previous chapter, the local level of governance has created two distinctive institutional worlds for determining gas well permits: (1) the "zoning process" and the "siting process." The "zoning process" requires all permitting requests to undergo at least one public hearing prior to the determination of the permit request, while the "siting process" allows for some permitting approvals without incorporating public hearings. The main distinction is whether or not the general public is allowed to participate in the decision making process prior to a permit approval by being given access to a public hearing.

Providing access to public hearings is important because citizen participation is considered a "channel for direct democratic voice in decision making, calling for decisions that affect citizens to be made by direct and open involvement of those citizens" (Moynihan, 2003, p. 169).

Applications going through a "zoning" process will *always* allow participation by the general public prior to any approvals (100% correlation with public hearings), whereas the "siting" process provides access to the general public only *sometimes*. There is not a perfect correlation to public hearings within the siting process, because it is a hybrid of both a public deliberation process and a rule driven administrative approval process. Siting allows for administrative approvals if proposed setbacks meet city standards and only requires public hearings in order to gain approvals when proposed setbacks are below standards. Consequently, the general public is only *sometimes* provided access to the decision making process (<100% correlation with public hearings). Thus, it is argued that since public hearings are a common mechanism enabling citizen participation, the rules affecting public hearings fundamentally affect citizen participation. Case in point, any rules that provide access to public hearings enable citizen participation and any rules that deny access to public hearings impede citizen participation. Given this rationale, rules may be viewed as determinants of citizen participation based on the presence or absence of a public hearing.

Drilling down within both the "siting" and "zoning" processes, there are two rules affecting which publics are allowed or disallowed from participating within the decision making process of gas well permitting: (1) the setback rule and (2) the waiver rule. The setback rule recognizes a legislatively defined boundary line, commonly referenced within local ordinances as the "setback standard." The setback standard essentially identifies an area of high risk or

high impact; frequently called the “protected use area.” Given the increased likelihood of risk/impact, the setback rule acts as a trigger for a higher degree of discernment during the permitting process. This means, careful consideration must be given prior to the granting of any gas well permits that are requested within the protected use area. Within siting and zoning processes this is noted in the rules that restrict the amount of discretion given the decision making bodies to grant variances to setback standards by including “minimum setbacks” to the established standards. Minimum setbacks limit the degree of variation that may be granted to the setback standard. While exceptions or variances may be granted, they can only vary to the point of the minimum standard. Within the siting world, additional discernment is also reflected in the additional requirement of a public hearing whenever the setback request is less than the stated standard.

As well as delineating the area requiring greater discernment, setback standards fundamentally act as a demarcation of two types of publics (the general public and the affected public) that may or may not be allowed to participate in the decision making of permit requests. For the purposes of this research, the general public is defined as all actors working or residing within the city limits, but outside the protected use area, whereas the affected public is a more narrowly defined public. The affected public is limited to those actors who own property within the radius of the wellbore that is below the setback standard; they reside in the protected use area. This distinction between publics becomes particularly critical when an additional rule is applied, the waiver rule.

The waiver rule referenced within this body of research requires the drilling operator to obtain signed releases, “waivers,” from the affected parties whenever the permit request for a

well site is within the protected use area. It is separate and distinct from the rule which gives the City Council or Board of Appeals/Adjustment the authority to grant exceptions to the setback standards, which may also be interpreted as the granting of waivers. To reduce confusion, this document uses the term "exceptions" (or variances) when referring to the authority granted to the Council or a Board to allow gas wells to be located less than the city's setback standards, and reserves the term "waivers" for the authority granted to the affected property owners to give permission to locate gas wells within protected use areas (within setback distances that are less than the city standards). Fundamentally, the "waiver rule" provides the more narrow public, greater rights than the general public, by allowing them access to the decision making process prior to and, in some cases, in lieu of participation by the general public. Just as the siting process does not provide for citizen participation through public hearings when the setback standards are met, the waiver rule places an additional barrier to public hearings when applied within the siting and zoning processes.

Since the siting and zoning processes differ, there are two resulting configurations of the waiver rule. One exists within the zoning world and the other exists within the siting world. In the zoning world, successfully obtained waivers lead to approval through public hearings, with unsuccessfully obtained waivers leading to an incomplete application. The additional rule prioritizes the rights of those persons within the protected use area, giving them the ability to determine if the gas well request should be considered for approval. If there is not the specified percentage of waivers obtained, the general public is not given the opportunity to speak at a public hearing whether in favor or against the permit request. Depending upon the specific rule (i.e., 100% of affected parties must have signed waivers vs. 80%) one individual

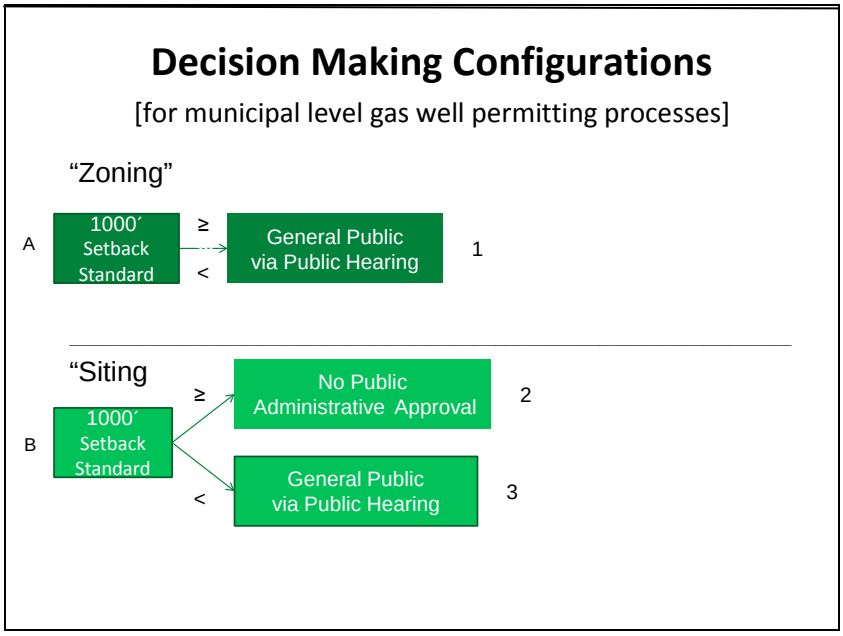
may have the ability to stop the drilling application from moving forward which brings about interesting normative and theoretical questions about the rights of the individual over the rights of the majority.

In the siting world, successfully obtained waivers lead to an administrative approval, with unsuccessfully obtained waivers resulting in the option for approval through a public hearing. Given that all siting processes make public hearings optional when certain conditions are met, it is important to explore the question of how the waiver rule further impacts the likelihood of public hearings. It is argued that that incorporation of a waiver rule is essentially the inclusion of another boundary rule, limiting the public involved in the decision making process for the approval/denial of the requested permit. Basically, the inclusion of a waiver rule adds a step in the decision making process that excludes the general public. For instance, normally within the siting world if a permit application is for a gas well to be located at a shorter distance than the setback standard to a protected use, it would require a public hearing to gain approval. However, if a waiver rule is a part of the decision making process, and the waivers are successfully obtained, then the operator can gain an administrative approval without having to go through the public hearing process. Thus, the waiver rule acts as an entry barrier to the general public, removing their right to participate in the decision making process for gas well permitting. The rights to decision making are given solely to the "affected public" and the operator.

3.5 Configurations of the Permitting Process

Recognizing the fact that there are several rules within natural gas permitting policy that impact public access to the decision making process, it is important that the policy analysis drills down to those specific rules to ascertain how the rules affecting citizen participation may be influencing the policy outcomes. This is particularly important given the level of controversy surrounding the siting of natural gas drilling operations. Land use decisions, such as deciding on where to drill, require a bargaining over property rights. Typically land use politics pits narrow economic interests with the broader-based citizen interests (Lubell et al., 2009). In the arena of natural gas well development, the developers and persons with mineral interests would be viewed as having the narrow economic interests, wishing to use their property for personal or economic gain. Alternately, others in the community, such as neighboring residents, may perceive the development as bringing negative externalities that reduce property values (Barzel, 1997) and the overall health and quality of life. There are definitely competing interests at work, but we currently don't have a full understanding as to how the rules are affecting each public's involvement in the decision making process. In order to illustrate the relationship between the rules, access to public hearings and the type of public involved in the local gas well permit approval decisions, a typology of the various decision making configurations is provided in Figure 3.3. "A" represents the zoning process without the waiver rule; "B" represents the siting process without the waiver rule; "C" represents the zoning process with the waiver rule, and "D" represents the siting process with the waiver rule. It is important to note that there are eight possible decision making configurations created from the four institutional arrangements. The explanation as to why this occurs is provided in

the following passages, along with a discussion as to how the institutional arrangements either block or enable different publics from participating in the gas well permitting decisions.



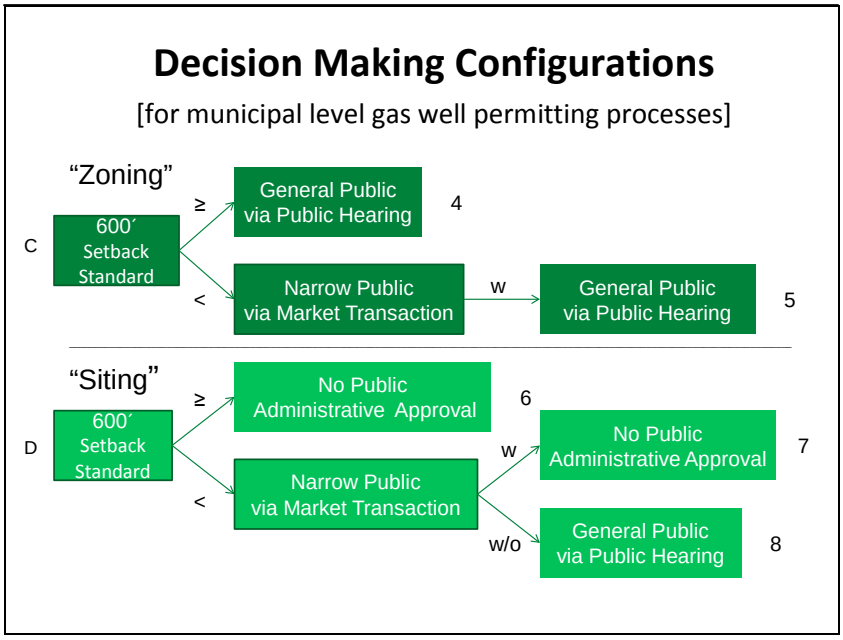


Figure 3.3. Decision making configurations. A = Zoning without the waiver rule; B = Siting without the waiver rule; C = Zoning with the waiver rule; Siting with the waiver rule; w = with successfully obtained waivers; w/o = without successfully obtaining waivers; < = gas well setback is less than city's setback standard; ≥ = gas well setback is greater than or equal to city's setback standard.

The first decision making pathway in Figure 3.3 listed as “A,” representing the zoning process without a waiver rule, provides the simplest configuration as it consistently provides equal opportunity for all parties to participate in a public hearing. Based on the Local Government Code, this would occur if a zoning process is adopted which requires the applicant to obtain a Specific Use Permit (SUP) as a mandatory step in the gas well permitting process. Ordinances using SUPs are treated similarly to rezoning applications; therefore, they are required to follow state mandated public notice and public hearing requirements. Consequently, even when an application request is for a gas well located outside a protected use area (i.e., if the well is 1200' from a residential building when the standard setback is 1000') the decision making process will always require a public hearing by the city council. Similarly, some cities adopting a zoning process may require all gas well permitting cases to undergo a public hearing using an oil and gas board of adjustments as opposed to city council. The critical factor defining all zoning cases is that all gas well approvals must have undergone at least one public hearing.

A key variation in access to public hearings with zoning processes occurs when a waiver rule is incorporated as a part of the decision making process. The incorporation of a waiver rule adds another step in the decision making process that only occurs when variances or special exceptions to setback standards are being requested. “C” in Figure 3.3 illustrates a bifurcation in decision making when a zoning process uses a waiver rule. While all cases under consideration for approval must undergo a public hearing (illustrated in configurations 4 and 5), the waiver rule requires those cases in need of exceptions to the setback standards to first gain signed waivers from the affected parties residing in the protected use area. The signed waivers

are a means of providing evidence to the decision making body that the affected parties are okay with the shorter setback distance. The waiver rule places limits on public approval. Only when the waivers are obtained, may the application move onto the public hearing for approval (illustrated in configuration 5); if signed waivers are not obtained the application is considered incomplete and cannot move forward for approval. While this process seems logical, if the rule requires 100% of the waivers to first be obtained before the application may move to a public hearings, then one person refusing to sign the waiver for whatever reason is essentially given veto power, blocking access to a public hearing even if all other affected parties and the general public may desire approval. In this scenario, a private individual is granted decision making authority prior to the general public and is essentially given the power of denial. This veto power given to the private individual may be reduced if the aggregation of the waiver rule is reduced to some degree less than 100%, such as 80%. An 80% waiver rule would only require waivers be obtained from 80% of the affected parties in order to move the case forward to a public hearing process, thus providing for greater opportunity for the general public to participate in the decision making process.

Although the inclusion of the waiver rule provides the narrow, affected public with some power for permitting denials, both processes still allow for public hearings prior to any approvals and it is the approval process for new land uses that typically generates public concern. On the other hand, the siting processes are quite different from the zoning processes, because they do *no*t always provide for public hearings prior to an approval. Siting processes use the setback standards as a trigger point, determining the need for a public hearing. The example listed under “B” in Figure 3.3 indicates a setback standard of 1000'. Assuming the

standard is for the protected use of residential buildings, the configuration indicates that all gas well applications with proposed well sites setback ≥ 1000' from a residence would be administratively approved, if all other application and setback standards were also met. However, all gas well applications requesting well sites <1000' from a residence would require a public hearing prior to a citizen review board approval as noted in configuration 3. The illustration, clearly depicts how access to public hearings are blocked within siting processes when gas wells either meet or exceed the city's setback standards.

The final institutional arrangement "D," representing a siting process with a waiver rule provides three different approval pathways (configurations 6-8). While it creates the most decision making pathways, it is the most limiting in terms of access to public hearings. Like example "B," example "D" uses a siting process, meaning cases that meet or exceed the setback standards will be administratively approved, if all other application conditions are met, thus restricting access to public hearings on some cases. However, as "D" is a siting process which also incorporates a waiver rule, the provision for public hearings is further restricted. Only if waivers cannot be successfully obtained will a public hearing be required. If the operator successfully obtains waivers from the affected parties (in this case example, those residing within the 600' setback standard) then the application will be administratively approved, given that all other provisions are met. As configuration 7 illustrates, the operator has two opportunities to avoid having to go through a public hearing. He may choose a site greater than the setback standard or if the shorter site is preferred he can then gain administrative approval via waivers. The use of the waiver rule within siting processes gives the driller and the affected parties within the protected use area the authority to conduct private market

transactions to resolve the land use conflict. Consequently, if these private negotiations are successful (waivers are obtained), the waiver rule within the siting process essentially grants the narrower public the power of approval, blocking the general public's access to the decision making process, by waiving the requirement of the public hearing.

Given our normative belief in the democratic process, scholars see great value in public participation such as assisting with creating better decisions, improving responsiveness and building a shared conception of the common good (Barber, 1984; King et al., 1998; Thomas, 1995; Rosener, 2008; Levine, 2008). However, not all rules provide equal opportunity for public participation as my typology has illustrated. The decision making processes for natural gas well permitting vary by "who" is allowed to participate (general public, narrow public, no public), "how" the actors are allowed to participate (within public hearing, through market transaction, by administrative action) and "when" they are allowed to participate (prior to a public hearing, during a public hearing). I anticipate that the variation in rules which affect citizen participation ultimately affect outcomes. To test this theoretical premise, the following two chapters will examine the outcomes from two different pairs of institutional arrangements affecting the access to public hearings for gas well permitting decisions. Chapter 4 will compare outcomes between siting and zoning processes and Chapter 5 will make comparisons when waiver rules exist or do not exist within the decision making process.

CHAPTER 4

IMPLICATIONS OF CITIZEN PARTICIPATION PART I:

"ZONING" V. "SITING"

4.1 Introduction

As illustrated in the prior chapter, the institutional arrangements of siting and zoning have differing effects on citizen participation. Zoning processes always provide for public hearings, while siting processes allow for some cases to be approved without a public hearing. This chapter examines how the institutional arrangements which enable or limit access to public hearings are affecting the decisions on gas well approvals within the local level of governance. Specifically, the analysis investigates variation in the approved gas well setbacks from the nearest residential building between siting and zoning decision making processes.

First, the basic theoretical foundation is presented, which leads to the statement of the hypothesis. Next, an explanation of the methodology employed is provided, including justification for the design, case selection, unit of analysis and measurement of variables. Finally, the data analysis section is presented with qualitative data augmenting quantitative results, followed by concluding statements.

4.2 Theoretical Foundation

The empirical evidence provided in the previous chapter illustrates that zoning and siting processes distinctively differ with regard to access to public hearings. The zoning process, designed as a public deliberation process, provides perfect correlation to public hearings such that anyone within the jurisdiction of the city is given access to participate within

formal public hearings for the determination of gas well permitting decisions. On the other hand, the siting process does not provide a perfect correlation to public hearings, because it is a hybrid of both a public deliberation process and a rule driven approval process, such that the public will be either partially or completely excluded from decision making when the applicant meets setback standards that allow for an administrative approval. For example, if a city which adopts the siting process has a gas well setback standard of 1000' from a protected use (i.e., residential building), then the application for permit must go to a public hearing if the proposed well is <1000', but will be granted administrative approval if ≥1000'. Whereas, if a city with the same setback standard adopts a zoning process, the application will have to undergo a public hearing in order to gain an approved permit, regardless of the proposed setback. Consequently, the institutional rules are such that the siting process results in a lower percentage of public hearings (citizen participation) per total permit applications received as compared to the zoning process. Fundamentally, the setback rule within a siting process, acts a barrier to citizen participation when setback standards are met, whereas even if standards are met within the zoning process, the public is still granted the right to participate in the decision making process.

Noting the differences in public access between siting and zoning, the theoretical question remains, “To what extent does the particular institution drive policy outcomes?” Continuing the initial theoretical premise that any administratively approved process excludes a segment of the public, it is logical to assume that it also reduces the likelihood of those site specific preferences being communicated to the decision making body; less information is made available to the decision maker. Consequently, it is likely that the outcomes of decision

making may differ between the siting cases that are administratively approved and the zoning cases that have more complete information from the public hearing process. It is posited that since the administratively approved siting cases include the applicant (also known as the driller or operator), but exclude the remaining public within the community, the preferences of the driller will have a greater likelihood of predominance in siting as compared to zoning. Given this understanding, what is the preference of the operator with regard to setback distances? In accordance to rational choice theory, the operator would attempt to maximize profits by minimizing the costs of production. Since one method of reducing production costs is to minimize the distance of the well site from the location of the shale deposits, the operator's preference would be for shorter setbacks as opposed to longer ones. This assumption of operator preference for shorter setbacks was confirmed during the interview process with operator representatives; specific details are noted in Chapter 6.

Continuing this theoretical premise, when considering the zoning process as compared to the siting process, zoning provides an opportunity for a broader range of preferences to be considered within the decision making process. Not only are the operator's preferences considered, as well as other lease holders or persons standing to gain financially from the most profitable location for the well site, but citizens who do not have financial gain are also given an opportunity to share their preferences for the gas well location. Given the potential for increased risk of technological hazards, health and environmental concerns, reduced property values and overall quality of life issues, the NIMBY (not-in-my-backyard) literature states there will likely be a segment of society that will actively oppose the locally unwanted land use (Schively, 2007; Fischel, 2001; Hunter & Leyden, 1995), especially when there is no financial

gain or method of compensation for the negative externalities. Opening up the decision making process to the general public brings two sides of the land use debate to the table for consideration; the NIMBY side and the BIMBY (build-in-my-backyard) side (Smith & Marques, 2000). Consequently, there is an increased likelihood to find a common ground between the two. It is posited that within zoning processes, setbacks will no longer be driven primarily by the operator, but the operator will present a compromise from the ideal location to one with a longer setback. The longer setback provides a balance between the two sides of the land use conflict; it meets the interests of the mineral owners by allowing a site for accessing minerals, and it meets the interests of the land owners by reducing the exposure to negative externalities. Given the stated arguments for considered preferences within siting and zoning institutions, it is anticipated that zoning institutions will result in greater setback distances from neighboring residences than siting. Accordingly, the following hypothesis is presented:

H_1: On average, zoning institutions will approve greater setback distances as compared to siting institutions, all else equal.

4.3 Methodology

Since case studies are well suited to understanding complex phenomena in real-world settings (Yin, 2003), this research utilizes the case study approach. Specifically, there is an examination of two sets of comparative case studies investigating how entry rules affect citizen participation by enabling or blocking access to public hearings and how the variation in citizen participation in turn affects policy outcomes (gas well setbacks). This research employs a mixed methods process for the collection, analysis and interpretation of the municipal level gas well

permitting process. Both quantitative and qualitative data is obtained from archival information obtained from public records located on the internet (i.e., gas well site plans, permit approval documents and other information from the Texas Railroad Commission website) and from documents obtained from formal public information requests (i.e., gas well site plans, city permits, gas well activity reports, and city ordinances). Additional qualitative data is obtained from 20 semi-structured interviews with city officials and oil and gas representatives. Given that the primary focus of this chapter centers on analysis of the quantitative data, the following passages only explain the methodology and measurement techniques employed for the analysis of the quantitative data. The methodology employed for collecting and recording the supplemental qualitative data may be found in Appendices F - J. Specifically, Appendix F provides the completed Internal Review Board packet; Appendix G is the protocol for the collection of data for human participants; Appendix H contains the recruitment materials; and Appendix I and J include the informed consent form and notice (respectively). A copy of the survey instrument, including the scripts and list of semi-structured questions, may be obtained by contacting the Department of Public Administration at the University of North Texas.

The approved gas well sites are the unit of analysis, with the research population coming from North Texas municipalities. The North Texas area was chosen because much of it resides over the Barnett Shale field, one of the most active natural gas plays within the United States (http://www.rrc.state.tx.us/barnettshale/index.php). Appendices D and E illustrate the positive geological conditions and productive areas within the Barnett Shale, while appendices L and M illustrate the gas well permitting activity and productivity of wells since 1993. Since

natural gas drilling began to move into the more urban areas in the early 2000s as noted by the peak in productivity, the temporal domain includes the ten year period between 2002 and 2012.

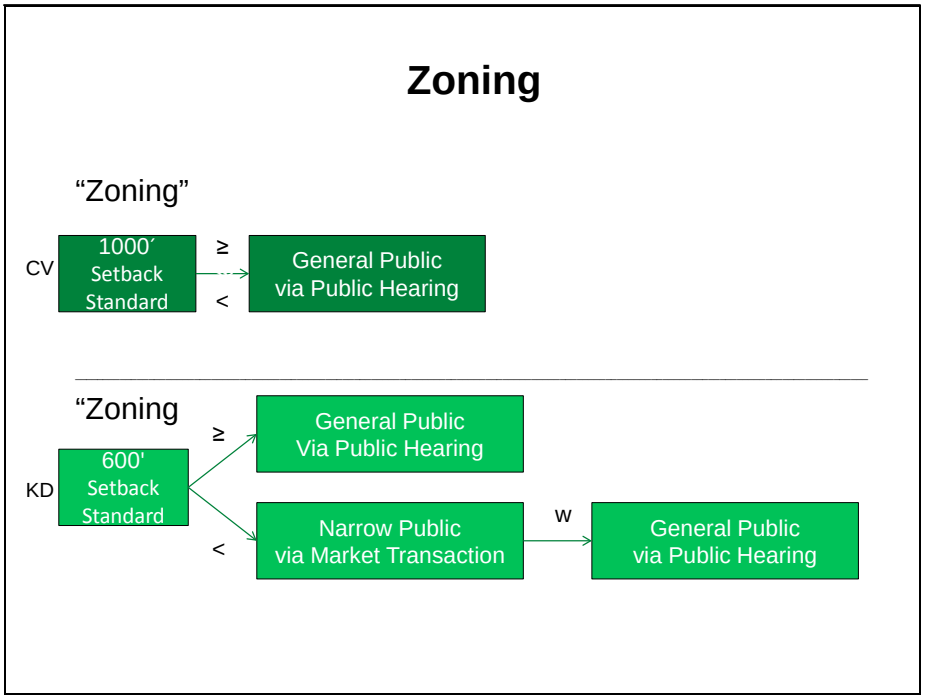
Following the predominant view among social scientists that systems which are as similar as possible constitute an optimal sample for comparative study (Przeworski & Tweune, 1970), the case cities of Benbrook, Kennedale, Flower Mound and Colleyville have been purposefully selected to accommodate for a most similar design with the exception of variation on the independent variable of interest (King, Keohane & Verba, 1994). As illustrated in Table 4.1, each of the four cities is similar in both the attributes of the biophysical world and characteristics of the general community. For example, each city is a suburb of North Texas with similar geological conditions, available open space for drilling operations, approved gas wells and socioeconomic characteristics, but differ in the institutional rules governing natural gas well permitting. Since this chapter tests how the institutional variation of zoning versus siting affects length of approved gas well setbacks, the zoning cities of Colleyville and Kennedale will be compared to the siting cities of Flower Mound and Benbrook. The variation in access to public hearings discussed in Chapter 3 is illustrated in Figure 4.1 with the four case cities. The investigation includes a complete census of the total population of approved gas wells (185) for each of the identified cities, between the years 2002 and 2012 and uses the t-test as the statistical test of significance when comparing means.

Table 4.1

Most Similar Design Considerations: Demographics, Geology, and Topography

	Benbrook	**Colleyville**	**Flower Mound**	**Kennedale**
Always public hearing	No	Yes	No	Yes
Waiver rule	Yes	No	No	Yes
Barnett shale	Yes	Yes	Yes	Yes
Approved Wells	Yes	Yes	Yes	Yes
≥ 25 % undeveloped land	Yes	Yes	Yes	Yes
Population 5,000 – 65,000	Yes (21,234)	Yes (22,807)	Yes (64,669)	Yes (6,763)
≥ 80% white	Yes (86.8)	Yes (88.9)	Yes (83.9)	Yes (81.7)
Median age 35-49 years	Yes (42.7)	Yes (45.5)	Yes (38.1)	Yes (38.7)
≥ 80% high school or higher (for persons ≥ 25 years)	Yes (94.9)	Yes (98.3)	Yes (80.4)	Yes (85)
Occupied households 2,000-25,000	Yes (9,408)	Yes (7,913)	Yes (21,011)	Yes (2,453)
Median income ≥ TX median (TX = $50,920)	Yes (62,708)	Yes (159.982)	Yes (118,143)	Yes (59,726)

Note: Demographic data from 2010 US Census (factfinder2.census.gov), Barnett Shale data from Texas Railroad Commission. Land use data based on city staff reported estimates.



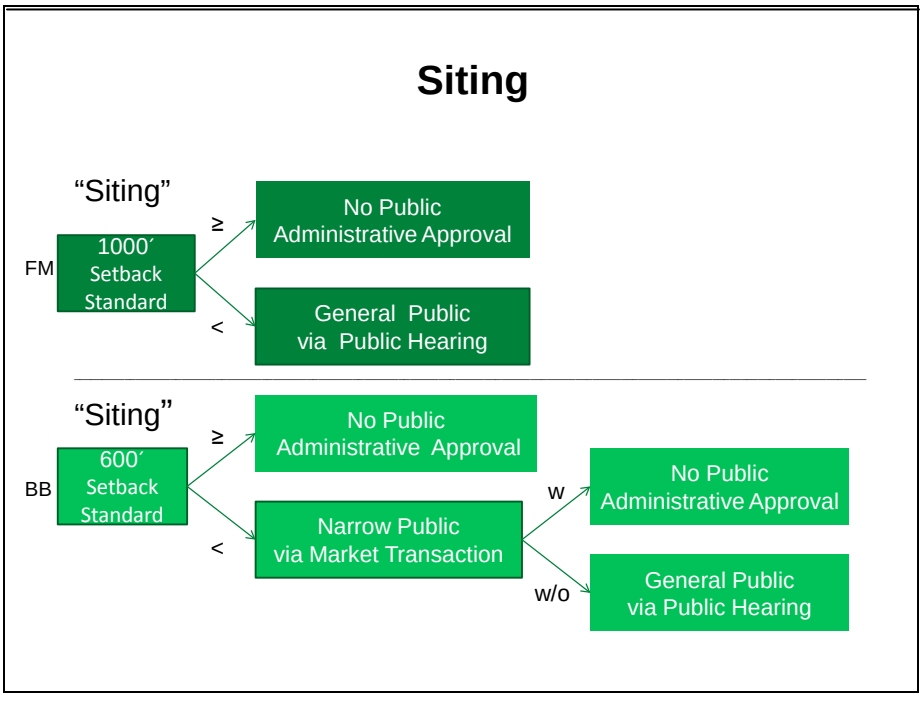


Figure 4.1. Decision making configurations for zoning v. siting. CV = Colleyville; KD = Kennedale; FM = Flower Mound; BB = Benbrook; w = with successfully obtained waivers; w/o = without successfully obtaining waivers; < = gas well setback is less than city's setback standard; ≥ = gas well setback is greater than or equal to city's setback standard.

4.3.1 Operationalizing Variables

The dependent variable, length of gas well setback from the nearest residential building, is measured in two manners: (1) absolutely, by actual distance in linear feet from the approved well head to the nearest residence and (2) as a percentage variation from the setback standard, calculated by subtracting the setback standard from the actual distance from nearest residence, then dividing that number by the setback standard. Using this calculation for percentage variation, if the nearest residence is greater than the standard, the percent variation will indicate a positive direction (implying a safer distance than the standard), but if it is shorter than the standard, the percentage variation will indicate a negative direction (implying a less safe distance than the standard).

$$\%\Delta \text{ standard} = (\text{actual distance} - \text{setback standard}) / \text{setback standard}$$

The value of measuring the dependent variable by percentage variation from the setback standard in addition to just the absolute length of approved setback is to normalize the data when setback standards between cities are not the same. For instance, while Colleyville and Flower Mound have setback standards of 1000', Kennedale and Benbrook established 600' setback standards. Since Kennedale and Benbrook have identified standards which are 400' shorter in length, analysis that just examines absolute lengths may be misleading, because the paired cities differ not only in access to public hearings, but in the length of setback standards. Thus, it is necessary to include an analysis which normalizes the data set. Calculating the percentage variation from the setback standard does just that; it takes into account each city's institutionally recognized buffer zone established by the setback standard and creates a common point of reference for comparison.

The primary independent variable, type of decision making process (zoning v. siting), is coded "1" if zoning and "0" if siting. Other independent variables are taken into consideration and controlled for within the analysis such as, the setback rule, the need for an exception to the setback standard and the waiver rule. The setback rule is coded "1000" for setback standards of 1000 feet and "600" for

setback standards of 600 feet. The need for exceptions to setback standard is coded "1" if gas well meets or exceeds ($\geq$) the city standard and "0" if the setback is less than (<) the city setback standard.

Comparison between the independent variables of zoning and siting is conducted first between all gas well permitting cases, next between only those cases that meet or exceed standards, and then between those cases that are below the standard. Additionally, each scenario makes comparisons while controlling for the differences in setback standard. The purpose of the multiple analyses is to gain a more complete understanding of when public participation may offer the greatest influence on outcomes (gas well setbacks) by controlling for other factors.

Table 4.2 illustrates each set of comparisons by identifying the specific cities and cases used within each examination. For example, within the first column, under the heading "mean lengths of gas well setbacks total cases," the first bulleted item is "all cases." This indicates that all zoning cases will be compared to all siting cases. Since the zoning cities consist of Colleyville (CV) and Kennedale (KD), and the siting cities consist of Flower Mound (FM) and Benbrook (BB), all cases within Colleyville and Kennedale (CV+KD) will be compared to all the cases with Flower Mound and Benbrook (FM+BB), as indicated in the second column by the equation (CV + KD) v. (FM + BB).

Table 4.2

Descriptions for Comparing Means: Zoning v. Siting

	Zoning cities v. siting cities
Mean lengths of gas well setbacks total cases	
• all cases	(CV + KD) v. (FM + BB)
• controlling for 1000' setback standards	CV v. FM
• controlling for 600' setback standards	KD v. BB
Mean lengths of gas well setbacks $\geq$ setback standard	
• all cases in subset	($CV_{\geq}$ + $KD_{\geq}$) v. ($FM_{\geq}$ + $BB_{\geq}$)
• controlling for 1000' setback standards	$CV_{\geq}$ v. $FM_{\geq}$
• controlling for 600' setback standards	$KD_{\geq}$ v. $BB_{\geq}$
Mean lengths of gas well setbacks < setback standard	
• all cases in subset	($CV_{<}$ + $KD_{<}$) v. ($FM_{<}$ + $BB_{<}$)
• controlling for 1000' setback standards	$CV_{<}$ v. $FM_{<}$
• controlling for 600' setback standards	$KD_{<}$ v. $BB_{<}$

Notes: CV indicates Colleyville; KD indicates Kennedale; FM indicates Flower Mound; BB indicates Benbrook.

The next two bulleted items, “controlling for 1000' setback standards,” and “controlling for 600' setback standards” identify the next set of comparisons for examination. While they too are comparing average length of setbacks for all approved cases between zoning and siting cities, this time the identified pairs are controlling for variation in setback standards. As illustrated in the second column, the average setback lengths of all the Colleyville cases will be compared to the average setback lengths of all the Flower Mound Cases (CV v. FM), as they both have 1000' setback standards. Similarly, Kennedale and Benbrook are paired for comparison (KD v. BB), because they both have the same setback standard of 600'. The benefit of conducting the additional comparisons is that they control for the variation in setback standards, which may also be influencing outcomes.

The second grouping of comparisons listed, “mean lengths of gas well setbacks $\geq$ setback standard,” limits the comparison from all cases within each city to only those cases with setbacks equal to or exceeding the setback standard. The value of this demarcation is that it isolates the comparisons to those cases that have the greatest variation in the institutionally mediated variable, citizen participation. This occurs because zoning requires public hearings, but siting cases that are equal to or greater than the setback standard do not require public hearings.

As was conducted previously, the comparisons will be done in three phases. In this scenario, the first comparison will include all zoning cases with average length setbacks equal to or exceeding the standard, to all siting cases with setbacks equal to or exceeding the standard. Since the zoning and siting cities are the same as before (Colleyville and Kennedale are zoning cities; Flower Mound and Benbrook are siting cities), the references of CV + KD for zoning cities and FM + BB for siting cities are the same. However, to illustrate the subset of cases under comparison as only including cases with approved setbacks equal to or exceeding the city’s

setback standard, the subscript "$_{\geq}$" is now included in the equation ($CV_{\geq} + KD_{\geq}$) v. ($FM_{\geq} + BB_{\geq}$) located in column two.

Following the established pattern, additional comparisons will be examined to control for variations in setback standards. Once again, Colleyville will be compared to Flower Mound and Kennedale will be compared to Benbrook, as both Colleyville and Flower Mound have 1000' setback standards, and Kennedale and Benbrook have 600' setback standards. However, in this scenario the comparisons will only include those cases equal to or exceeding the setback standard, thus the noted equations for comparison are $CV_{\geq}$ v. $FM_{\geq}$ and $KD_{\geq}$ v. $BB_{\geq}$ as illustrated in column two.

The final set of comparisons is identified under the heading, "mean lengths of gas well setbacks < setback standard." This particular subset will make comparisons between zoning and siting cases that are less than the setback standard. As was noted in the passages above, there will be three sets of comparisons for this given subset of cases. First, comparisons will be made by all cases within the identified subset, then two more comparisons will be made to control for the variation in setbacks. The equations are similar to those above, differing only in the inclusion of the subscript "$_{<}$" to symbolize the delimited subset of cases under comparison.

4.3.2 Measurement Issues

The first step in collecting the data necessary for calculating the length of gas well setback from nearest residence (regardless of the type of measurement), required gathering the surface location coordinates for each of the approved gas wells within the case study cities. This process proved more laborious than initially anticipated, as the archival documents obtained through public information requests did not always include the surface location

coordinates within the cities' gas well site plans or application records. Additionally, even when coordinates were included, there was not a common coordinate system used between or within cities. Some site plans used the seven digit x, y coordinate system (e.g., 2393962, 7053914), while others used latitude and longitudinal coordinates (e.g., 33.0119726, -97.1171422) and still others were recorded as degrees (e.g., 33°02'31.709", 97°07'01.339"). Further complicating the matter, the coordinates used different points of reference; either NAD 27 or NAD 83. NAD is the acronym used for the Northern American Datum, a point of reference for making projections from a curved surface (global) to a linear surface (map). NAD 27 was adopted in 1927 and uses the center of the United States as its point of reference, while NAD 83, the system adopted in 1983, uses the center of the earth as its point of reference. According to a geographic information systems specialist from the Texas Railroad Commission, although NAD 83 is considered more accurate for making projections, when coordinates have unknown point of origin (an additional factor experienced during the data collection process) NAD 27 is typically used as the default. The problem created from using different points of reference is the latitude and longitude of a point on the ground is different in each datum, thus the accuracy in measuring a linear point from a wellbore to residence will be distorted.

In an effort to simplify the data collection process and utilize a common point of reference to reduce distortions within the projections, an attempt was made to use the Texas Railroad Commission's online Geographic Information System (GIS) map viewer. The representative assured me that inputting the Railroad Commission's API number (a unique numeric identifier for gas wellbores) while utilizing the map tool, "identify wells," would lead to the well's surface hole locations (both NAD 27 and NAD 83 options would be provided). Since

NAD 27 is considered the default, the representative recommended using NAD 27 for the project data set. Following this instruction, all API numbers were gathered from city gas well applications/approved gas well documents and inputted into the GIS map viewer one at a time. Once all coordinates were obtained they were inputted into ArcGIS data files to allow for spatial analysis. Unfortunately, when the data files were layered with satellite photos from Bing Maps and shape files identifying city boundaries obtained from UNT's Department of Geology, the resulting images revealed wells in locations incongruent with expectations. Wells were on top of houses, outside of city limits and generally not on the gas well pad sites as seen in the aerial photographs.

Upon further inquiry with the Railroad Commission, another staff representative stated I was misinformed. The coordinates listed under wellbore attributes are associated with *bottom hole* locations, not *surface hole* locations. This is important to mention, as researchers depend on the accuracy of their data in order to develop meaningful inferences. Had this analysis not required multiple layering of data sets, this misinformation may have not been revealed and inferences would have been made based on the wrong data set. This being said, researchers (and representatives assigned to educate the public, such as Texas Railroad Commission staff) need to understand the differences in the types of coordinates they may find within archival data pertaining to wellbores. Below is a listing of the commonly used labels associated with the well bores as illustrated within gas well site plans within this research data set:

SH = surface hole – location as seen on the ground at well site
BH = bottom hole – location at the end of the wellbore, includes the filler past the LTP
PP = penetration point – location where the wellbore enters the shale formation
FTP = first take point – first point of perforation or production
LTP = last take point – last point of perforation or production

Obviously, once the initial error in the data input was identified, new data was obtained for each of the approved wells within the case study cities. Unfortunately, it had to be obtained from individual review of site plans and resulted in a collection of data with multiple coordinate systems between and within cities, as previously mentioned. To reduce distortions within the projections a common coordinate system had to be created across all wells within the data set, thus coordinate converter websites were accessed and utilized. The Federal Communication System (http://transition.fcc.gov/mb/audio/bickel/DDDMMSS-decimal.html) permits the user to convert latitude and longitude between decimal degrees and degrees, minutes, and seconds and the National Geodetic Survey's NADCON program (http://www.ngs.noaa.gov/cgi-bin/nadcon.prl)allows provides for conversion between the NAD83 coordinate system and the older NAD27 coordinate system.

Following the conversion of all surface coordinates into a compatible data set, a single layer of well data was then inputted into the GIS system, resulting in all wells being projected on or near the appropriate pad sites. To minimize the level of error in linear measurement from actual well site to nearest residential unit, the projected well sites were then moved using the GIS editor tool to the visible well location identified within the satellite photograph. The figure below illustrates the localized wells within a pad site. Following this protocol, all well setbacks could then be measured (using the GIS measurement tool) from the well site to the nearest residence.

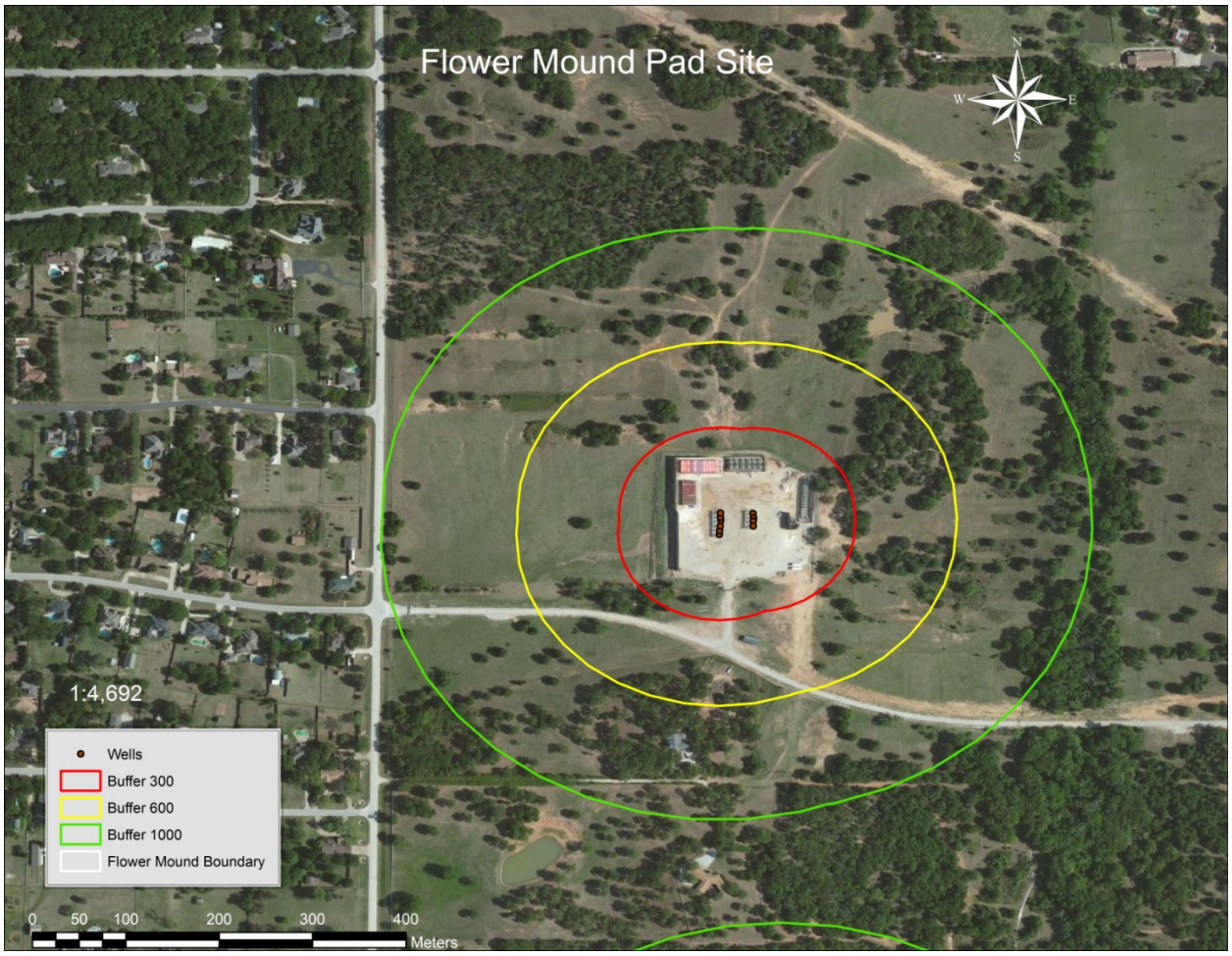


Figure 4.2. Example of projected wells located on gas well pad. Illustrates clustering of wells as well as relative location to residential units.

4.4 Statistical and Substantive Results

Using the raw numbers obtained with the GIS program, the information is placed into SPSS for analysis. First, a series of descriptive statistics are obtained to help identify overall sample size, sample size of subgroups, skewness as well as other characteristics of the case study data such as, measures of central tendency and measures of dispersion. To offer compatible information for assisting in the interpretation of t-test results, the descriptive statistics are organized in a similar format to the t-testing. There are a total of six descriptive statistics tables

provided. The first three tables offer mean length of setback for nearest resident for all cases, cases ≥ setback standards, and cases < setback standards. The remaining three tables provide the mean percentage variation of permitted setback from the city's setback standard, under the same conditions.

Table 4.3

Descriptive Statistics: Mean Length of Setback from Nearest Resident (all cases)

	N	Mean	Median	Min	Max	SD	Skewness	
							Stat.	Std.Error
Colleyville (zoning + no waiver; 1000')	7 (3.8)	541.67	548.54	507.57	556.01	16.52	-1.80	.79
Flower Mound (siting + no waiver; 1000')	73 (39.5)	1211.40	979.61	563.85	3127.50	713.83	1.73	.28
Kennedale (zoning + waiver; 600')	57 (30.8)	798.13	659.12	394.25	1740.81	360.15	1.75	.32
Benbrook (siting + waiver; 600')	48 (25.9)	751.98	793.74	326.49	1041.94	207.18	-.55	.34
All cities	185 (100)	939.53	788.90	326.49	3172.50	548.23	2.48	.18

Note: Percent is in parentheses.

Table 4.4

Descriptive Statistics: Mean Length of Setback from Nearest Resident for Cases ≥ Standard

	N	Mean	Median	Min	Max	SD	Skewness	
							Stat.	Std.Error
Colleyville (zoning + no waiver; 1000')	0	NA	NA	NA	NA	NA	NA	NA
Flower Mound (siting + no waiver; 1000')	33	1715.02	1386.96	1000.00	3127.50	800.89	.82	.34
Kennedale (zoning + waiver; 600')	49	856.25	679.96	600.00	1740.81	355.60	1.79	.41
Benbrook (siting + waiver; 600')	42	809.06	822.24	600.64	1040.94	149.82	-.01	.37
All cities	124	1068.81	887.35	600.00	3127.50	613.82	2.12	.22

Table 4.5

Descriptive Statistics: Mean Length of Setback from Nearest Resident for Cases < Standard

	N	Mean	Median	Min	Max	SD	Skewness	
							Stat.	Std.Error
Colleyville (zoning + no waiver; 1000')	7	541.67	548.54	507.57	556.01	16.52	-1.8	.79
Flower Mound (siting + no waiver; 1000')	40	795.91	766.59	563.85	995.67	150.79	.05	.37
Kennedale (zoning + waiver; 600')	7	447.18	473.17	394.25	493.58	46.78	-.29	.79
Benbrook (siting + waiver; 600')	6	352.43	358.90	326.49	378.82	21.79	-.07	.85
All cities	60	671.40	644.61	326.49	990.63	208.67	.12	.31

Table 4.6

Descriptive Statistics: Mean Percentage Change of Permitted Setback from Setback Standard (all cases)

	N	Mean	Median	Min	Max	SD	Skewness	
							Stat.	Std.Error
Colleyville (zoning + no waiver; 1000')	7 (3.8)	-.46	-.45	-.49	-.44	.02	-1.72	.79
Flower Mound (siting + no waiver; 1000')	73 (39.5)	.21	-.02	-.44	2.13	.71	1.73	.28
Kennedale (zoning + waiver; 600')	57 (30.8)	.33	.10	-.34	1.90	.60	1.75	.32
Benbrook (siting + waiver; 600')	48 (25.9)	.25	.32	-.46	.74	.35	-.55	.34
All cities	185 (100)	.23	.06	-.49	2.13	.60	1.64	.18

Note: Percent is in parentheses.

Table 4.7

Descriptive Statistics: Mean Percentage Change of Permitted Setback from Setback Standard for Cases ≥ Standard

	N	Mean	Median	Min	Max	SD	Skewness	
							Stat.	Std.Error
Colleyville (zoning + no waiver; 1000')	0	NA	NA	NA	NA	NA	NA	NA
Flower Mound (siting + no waiver; 1000')	34	.69	.38	.00	2.13	.80	.86	.40
Kennedale (zoning + waiver; 600')	49	.43	.13	.00	1.90	.59	1.80	.34
Benbrook (siting + waiver; 600')	42	.35	.37	.00	.74	.25	-.01	.37
All cities	125	.47	.28	.00	2.13	.59	1.69	.22

Table 4.8

Descriptive Statistics: Mean Percentage Change of Permitted Setback from Setback Standard for Cases < Standard

	N	Mean	Median	Min	Max	SD	Skewness	
							Stat.	Std.Error
Colleyville (zoning + no waiver; 1000')	7	-.46	-.45	-.49	-.44	.02	-1.72	.79
Flower Mound (siting + no waiver; 1000')	39	-.21	-.24	-.44	-.01	.15	.09	.38
Kennedale (zoning + waiver; 600')	8	-.26	-.27	-.34	-.18	.08	.05	.75
Benbrook (siting + waiver; 600')	6	-.41	-.41	-.46	-.37	.04	-.07	.85
All cities	60	-.27	-.30	-.49	-.01	.15	.42	.31

One of the most prominent pieces of information noted within the descriptive statistics is the uniqueness of Colleyville compared to the other three cities. For instance, Table 4.3

provides information on the number of approved gas wells for each city. Colleyville has a very small *N* in comparison (7 compared to a range of 48-73). Not only are there a limited amount of cases within Colleyville, GIS mapping shows all wells clustered on one pad site, while all other case cities within the study have approved wells on multiple sites. The difference in dispersion of gas wells within the case cities is clearly illustrated in the four figures below. In addition to illustrating the limited *N* and singular clustering of wells, GIS mapping also reveals that Colleyville is more built out than the other case cities and its percentage of undeveloped surface area may be less than the approximated percent shared by city officials (≥ 25%). At the very least, even if the total area of open space equals 25%, the map reveals it is piecemealed; comprised of pockets of smaller land areas in comparison to the other study cities with more contiguous open space. This may explain Colleyville's limited number of wells in comparison to the other test cities, as it has a more limited opportunity for well development. One final characteristic which is unique to Colleyville, as noted in Tables 4.4 and 4.7 is its empty data set for number of wells greater than or equal to the setback standard. Based on these aforementioned characteristics, Colleyville is considered an outlier in the sense that its data differs from the other case samples within this study. For this reason, the interpretation of quantitative analyses relies more heavily on the comparisons which exclude Colleyville.

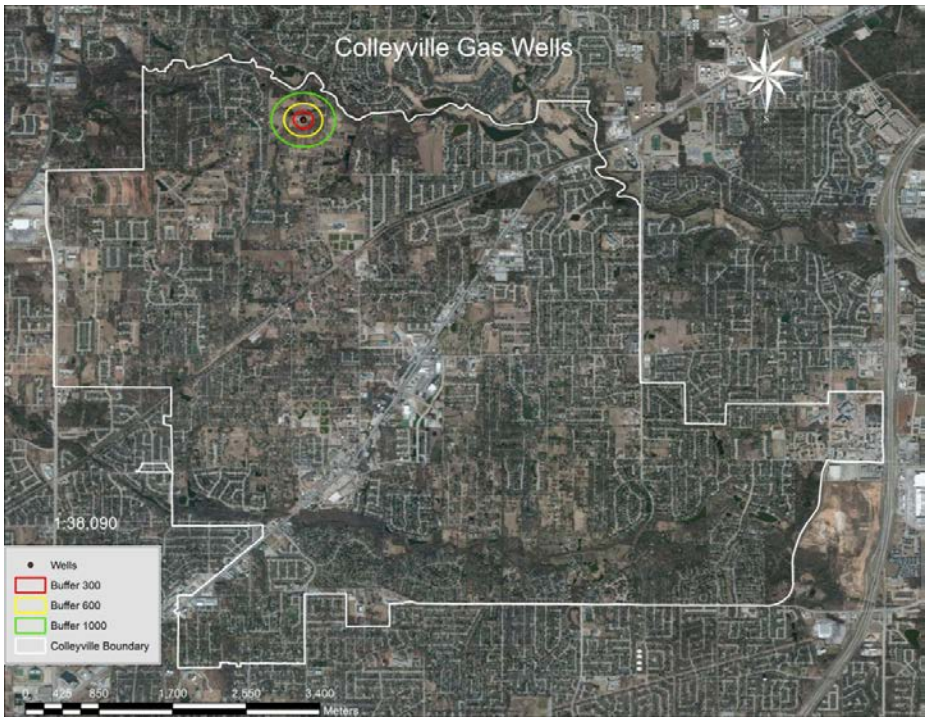


Figure 4.3. GIS mapping of Colleyville pad sites containing gas wells.

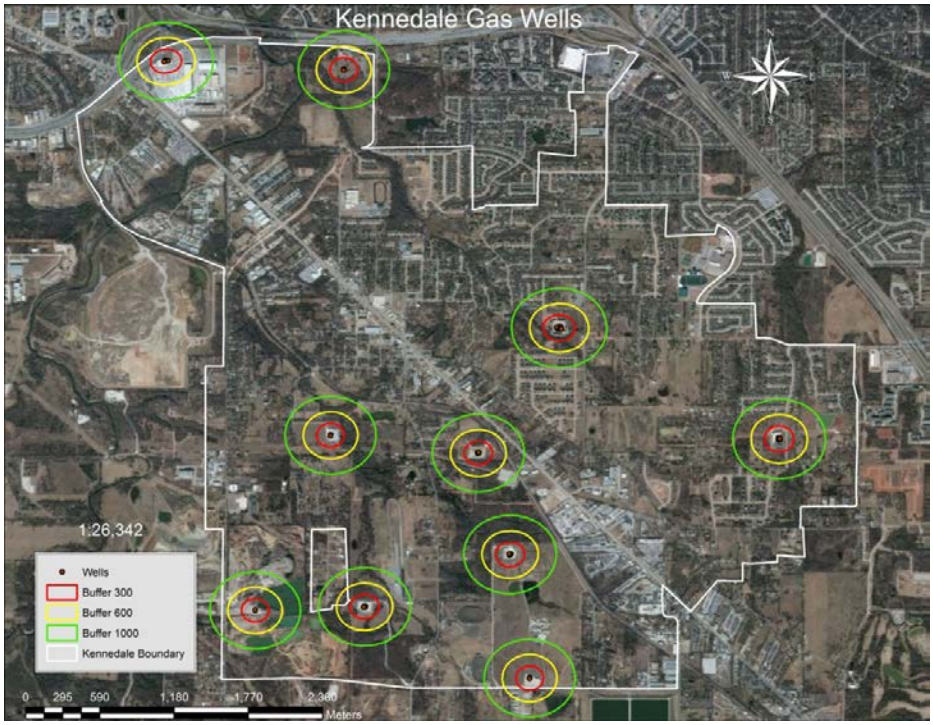


Figure 4.4. GIS mapping of Kennedale pad sites containing gas wells.

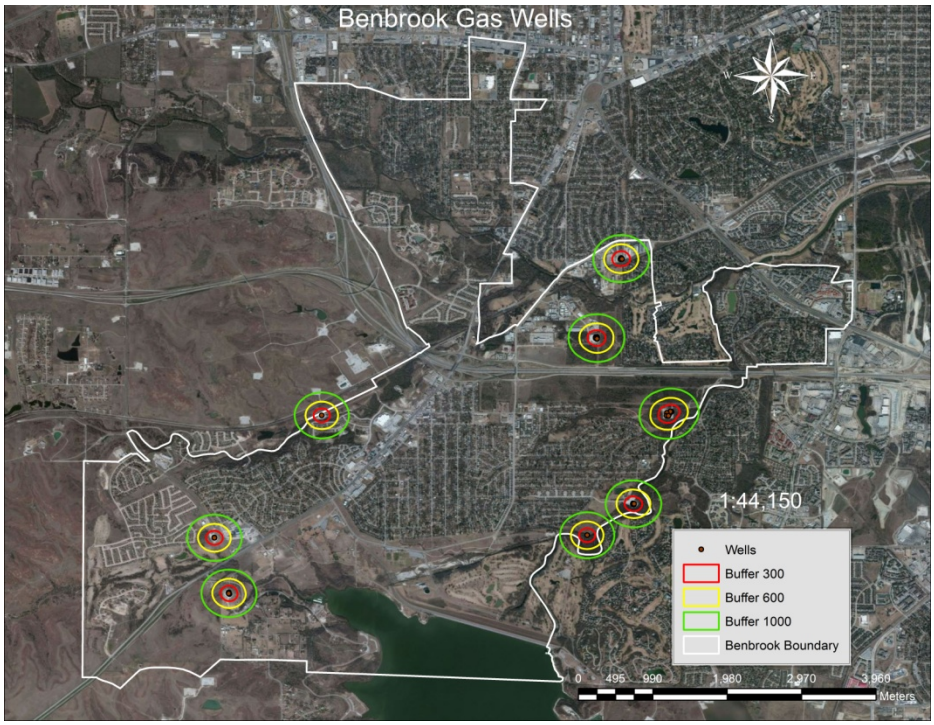


Figure 4.5. GIS mapping of Benbrook pad sites containing gas wells.

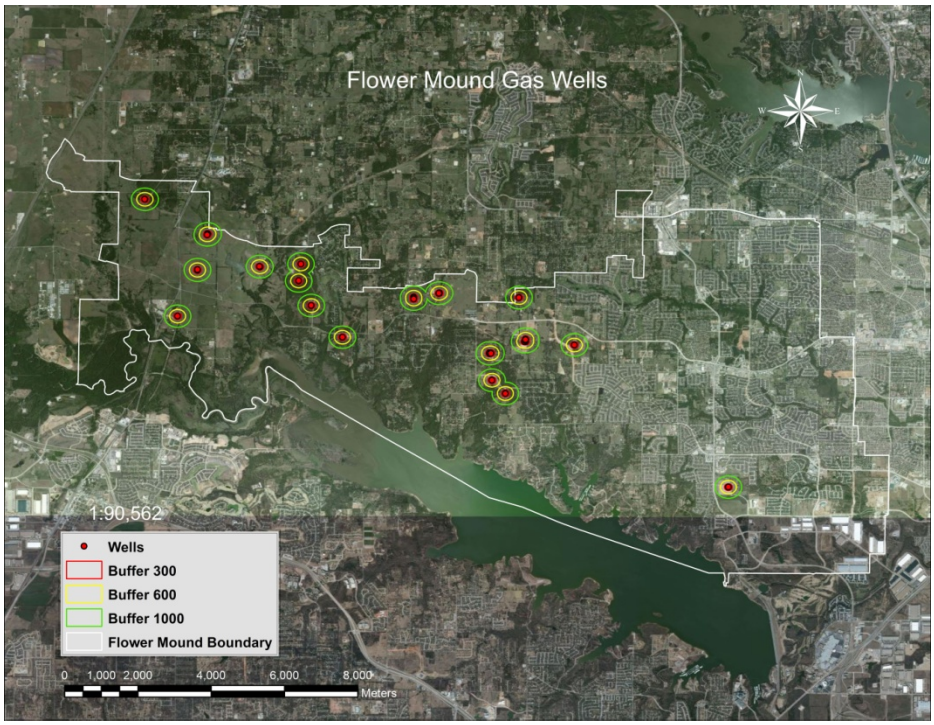


Figure 4.6. GIS mapping of Flower Mound pad sites containing gas wells.

Then again, Colleyville is not excluded from the analysis all together, because within the preliminary case study search it offered the only known example of a zoning city, without waiver rules which fulfilled the most similar design characteristics. Additionally, Colleyville's *N* of 7 is very similar to Kennedale's and Benbrook's (7 and 6 respectively on Table 4.5) when examining the mean length of setbacks for only those cases < the city setback standard. Within this subset, Flower Mound stands out with an *N* of 40 cases. At this point in time, it is relevant to point out what may look like a discrepancy in data results, is merely a result of statistical calculations. By this I am referring to the difference in the *N* from mean length of setback to mean percentage variation from the standard. Table 4.5 lists an *N* of 40 for Flower Mound, but Table 4.8 lists an *N* of 39. This is not an error, while there are 40 cases below setback standards, one Flower Mound case is so close to the standard, SPSS calculated it as a 0% variation from the standard, resulting in only 39 cases below the setback standard.

In addition to allowing for comparisons in sample size, the descriptive statistics reveal the mean lengths of setbacks and mean percentage variation from setback standards for each city within the study. Examining the total cases within each city, the mean lengths of setbacks are greater than the city setback standards, barring the Colleyville outlier. This suggests, for the most part, approved gas wells are meeting or exceeding the setback standards. It also suggests that most approved gas wells are located in what is legislatively considered low impact areas, at least pertaining to the nearest residence. This is verified in tables 4.5 and 4.8 by the relatively small number of cases (≈32% of total cases) identified with setbacks < standard (60 cases < standard as compared to 185 total cases, with 3 of the 4 cities having 7 or less cases).

One final point of observation, of all the siting and zoning cases, the cities with 1000' setback standards had the greatest percentage of cases requiring exceptions to standards (cases < standard). Since this occurred for both siting and zoning cases, it is likely due to the fact that 1000' setback standards are 400' more restrictive than 600' setback standards; thereby, requiring a greater need for exceptions. This observation may be particularly important for policy makers who believe siting institutions will reduce political conflict by allowing for the possibility of administrative approvals. As the comparison between siting cities of Flower Mound and Benbrook indicates, the greater length in setback is positively associated with greater likelihood of a public hearing. Thus, if reduced political conflict, defined by the percentage of public hearings, is an objective of the siting process, the city may opt to create shorter setback standards. On the other hand, if maximizing public safety is prioritized, the city may prefer longer setback standards, but the municipality should also expect to conduct a larger percentage of public hearings to allow for exceptions.

Moving onto the primary set of analyses, independent sample t-tests, a cursory look at the findings suggests mixed results. However, upon deeper examination, a much clearer picture is revealed. Accordingly, the following explanation of the results will first review the broadest level of analysis, then drill down to more controlled scenarios (paired subsets), free of case study outliers. Table 4.9 details the results for each phase of the analysis.

Table 4.9

Comprehensive t-table: Siting v. Zoning: Average Length of Permitted Gas Wells from Nearest Residence

	Zoning v. Siting		***T***	***df***
	Zoning	**Siting**		
Total cases = all levels of impact (CV+KD) v. (FM+BB)	770.08 (349.04)	1029.15 (611.13)	-3.13**	183
• 1000' standard • CV v. FM	541.67 (16.52)	1211.40 (713.83)	-2.47*	78
• 600' standard • KD v. BB	798.13 (360.15)	751.98 (207.18)	.79	103
All cases without need of exceptions = low impact (≥ standard) ($CV_{\geq}$ + $KD_{\geq}$) v. ($FM_{\geq}$ + $BB_{\geq}$)	856.25 (355.60)	1207.69 (703.41)	-3.24**	122
• 1000' standard • $CV_{\geq}$ v. $FM_{\geq}$	Insufficient data (no CV cases)	Insufficient data (no CV cases)	Insufficient data (no CV cases)	Insufficient data (no CV cases)
• 600' standard • $KD_{\geq}$ v. $BB_{\geq}$	856.25 (355.60)	809.06 (149.82)	.80	89
All cases needing exceptions = **high impact (≤ standard)** ($CV_{<}$+$KD_{<}$) v. ($FM_{<}$+$BB_{<}$)	488.59 (61.62)	732.34 (204.91)	-4.25***	58
• 1000' standard • $CV_{\leq}$ v. $FM_{\leq}$	541.67 (16.52)	795.91 (150.79)	4.42***	45
• 600' standard • $KD_{\leq}$ v. $BB_{\leq}$	442.15 (45.58)	352.43 (21.79)	4.43***	12

Notes: * = $p \leq .1$, ** = $p \leq .01$, *** = $p \leq 001$. Standard deviations appear in parentheses below means. CV indicates Colleyville; KD indicates Kennedale; FM indicates Flower Mound; BB indicates Benbrook

When comparing all zoning cases to all siting cases, there is an observable difference in mean lengths of setbacks of approved gas wells; however, the direction of influence is opposite than anticipated within the stated hypothesis. As noted in the first listing in table 4.9, the case study indicates a greater length in gas well setback within siting cities (*M* = 1029.15, SD 611.13)

than with zoning cities (M = 779.08, SD SD 349.04), t (183) = -3.13, p = .002. Controlling for the variation in setback rules and removing the noted outlier of Colleyville, changes the direction of influence in support the hypothesis (zoning M = 798.13 with siting M = 751.98), but now the observable difference is no longer considered statistically significant. One possibility for the lack of statistically significant variation may be due to the limited variation in access to public hearings. In other words, since the variation in public hearing access is from 100% to some percentage less than 100% (zoning v. siting respectively), perhaps the variation in access is too small to indicate a statistically significant difference in outcomes. This leads to the next set of scenarios, cases without need of exceptions to the setback standard.

The cases that do not require exceptions are those that have gas wells greater than or equal to the setback standard. Given this scenario, a 100% variation in access to public hearings between zoning and siting cases is triggered, because zoning rules require 100% access to public hearings, while siting rules do not require a public hearing (0% access). In accordance to the theory on citizen participation, a difference in outcomes is anticipated. Counter to what is expected; the results are essentially the same. The length of setback for all cases with gas wells greater than or equal to the setback standard are longer for siting than for zoning. Again, controlling for setback standards and removing the outlier (in this case Colleyville, was automatically eliminated due to lack of data) the direction of influence is inverted, following the same direction as that stated within the hypothesis, but once more the observed variation in outcomes is statistically insignificant.

While the results for cases with setbacks greater than or equal to the city setback standard do not indicate support for the stated hypothesis, the characteristics of the subset

may be influencing the outcomes. Setback standards are essentially written to create safety buffers. They distinguish high impact areas from low impact areas to indicate when greater discernment is necessary for the preservation of community safety. This understanding of the legislative intent is supported by the commentary shared by city officials in response to questions 3-6 of the city official interview scripts.

> The purpose of the chosen process is to establish health, safety and welfare of the community.
>
> We (municipality) regulate the placement of gas wells to protect the quality of life for our residents.
>
> Ultimate goal is to preserve the neighborhood integrity and quality of life.
>
> The regulations are a way of balancing property rights…allowing the oil and gas companies and mineral owners the right to drill while maintaining community safety and quality of life.

Without exception, as noted in the examples above, every official mentioned the priority of maintaining community safety and quality of life as a reason for choosing their gas well permitting process and setback standard. Given this understanding of the legislative intent and the underlying assumption expressed within the NIMBY literature which states persons likely to experience negative impact (net costs) are the ones who are most likely to attend public hearings (Lober, 2005; O'Hare, 1977), the statistically similar outcomes for cases outside of the high impact area may be logical. For example, since the gas wells with setbacks greater than or equal to the setback standards are located in legislatively defined low impact areas, they would not present a high degree of threat of negative impact on the general public. The lower the threat of impact, the less likelihood of public opposition (attendance); thus, the less relevant the access to public hearings becomes. This implication of inverse relationship

between distance and attendance is supported within the NIMBY literature (Lindell & Earle, 1983) and offers practical implications for policy makers. For instance, if policy makers create setback standards that successfully take into account the community's perspectives, there would be no anticipated difference in outcomes for low impact cases (those greater than or equal to the standard) whether or not the policy makers chose a siting or zoning process. Since the results of this study indicate statistically similar outcomes between the zoning and siting cases for this subset (≥ standard), it could be argued that the cities within this study have successfully created setback standards that are meeting the needs of their communities.

Coming from the perspective of the operator, if the proposed gas well is located in an area of low impact, outside the protected use areas, the operator could then expect a low risk of citizen opposition within the public hearing process. Being a rational actor, the operator would choose the best site to meet his interests, without need of compromising setback length. Accordingly, the resulting mean variation in length of setbacks would not be different based on siting and zoning, but equivalent to chance (all else equal).

Extending this line of logic to gas well permitting cases of high impact, cases where there is a greater likelihood of citizen opposition, differences in access to public hearings may now prove to be a significant factor in influencing policy outcomes. It is precisely within this scenario that the test results provide strong support for the stated hypothesis. Although the analysis initially follows suit with the previous results, statistical significance is noted when controlling for setbacks and removing the case outlier. For example, in the case of Kennedale to Benbrook, the mean length of setbacks are significantly longer for zoning cases (M = 442.15, SD = 45.58) as compared to siting cases (M = 352.43, SD = 21.79), $t(12)$, p = .001.

The differing outcomes between the presented case comparisons, particularly between cases needing exceptions to standards and those not needing exceptions, suggest a general comparison between zoning and siting is insufficient and may be misleading. Instead, variation in gas well impact on residents must be taken into consideration as an influential factor when investigating the influence of public access (citizen participation). It is not simply a question of differing access between zoning v. siting, but it is about when the differences in access between zoning and siting are most relevant to citizens. Since this research conducted its analyses in multiple phases and provides additional theory about the likelihood of citizen participation in unwanted land use cases (Lober, 2005; O'Hare, 1977; Lindell & Earle, 1983), the results provide support for the hypothesis in cases when gas well impact on citizens is greatest. This implies that the level of influence from citizen participation is greatest when cases have high impact on residents; alternately, the level of influence from citizen participation is likely to dissipate as the negative impact on residents reduces to lower levels.

Table 4.10

Comprehensive t-table: Siting v. Zoning: Mean Percentage Variation of Permitted Gas Wells from Setback Standards

	Zoning v. Siting		***T***	***df***
	Zoning	**Siting**		
Total cases = all levels of impact (CV+KD) v. (FM+BB)	.24 (.62)	.23 (.59)	.17	183
• 1000' standard • CV v. FM	-.46 (.02)	.21 (.71)	-2.47*	78
• 600' standard • KD v. BB	.33 (.60)	.25 (.35)	.79	103

(*continues*)

Table 4.10 *(continued)*

All cases without need of exceptions = low impact (≥ standard) ($CV_{\geq}$ + $KD_{\geq}$) v. ($FM_{\geq}$ + $BB_{\geq}$)	.43 (.59)	.50 (.59)	-.70	123
• 1000' standard • $CV_{\geq}$ v. $FM_{\geq}$	Insufficient data (no CV cases)	Insufficient data (no CV cases)	Insufficient data (no CV cases)	Insufficient data (no CV cases)
• 600' standrd • $KD_{\geq}$ v. $BB_{\geq}$	.43 (.59)	.35 (.25)	.80	89
All cases needing exceptions = high impact (≤ standard) ($CV_{\leq}$+$KD_{\leq}$ v. ($FM_{\leq}$+$BB_{\leq}$)	-35 (.11)	-.24 (.16)	-2.69**	58
• 1000' standard • $CV_{\leq}$ v. $FM_{\leq}$	-.46 (.02)	-.21 (.15)	-4.37***	44
• 600' standard • $KD_{\leq}$ v. $BB_{\leq}$	-.26 (.08)	-.41 (.04)	4.43***	12

Notes: * = $p \leq .1$, ** = $p \leq .01$, *** = $p \leq 001$. Standard deviations appear in parentheses below means. CV indicates Colleyville; KD indicates Kennedale; FM indicates Flower Mound; BB indicates Benbrook

Continuing the investigation on zoning and siting, the same sets of comparative case studies are examined, but this time comparisons are between mean percentages in the gas well variations from setback standards (refer to Table 4.10). As mentioned under the methodology section, the rationale for conducting this set of analyses is to normalize the different setback standards. Consequently, the resulting findings are congruent with the above findings when the controls for setbacks were implemented. Moreover, there is now consistency within all of the total case comparison results (barring one comparison containing the outlier) as well as greater consistency for all cases that do not require exceptions to standards. Within all the aforementioned comparisons (barring the outlier), the results do not reveal statistically significant variations from the setback standards. On the other hand, what remain statistically

significant are the differences in findings when cases do require exceptions to the setback standard.

Again, focusing on the case comparison which does not contain the outlier (KD v. BB), the findings indicate strong support for the stated hypothesis. In addition, new information has been gained. On average, siting processes approve gas wells with a 41% (SD = .04) reduction in the setback standard as compared to zoning cities which approve only a 26% (SD = .08) reduction. This suggests siting processes result in a 15% greater reduction in setbacks from the city standards, then zoning processes. The key implication from this finding is that the institution's effect on participation affects public safety.

While results offer new insight about zoning and siting institutions, they are not the only institutional variations affecting citizen participation within gas well permitting processes. Waiver rules are embedded within some zoning and siting institutions, further impeding citizen participation by barring access to public hearings. Consequently, not all zoning and siting processes are created equal; some have waiver rules, while others do not. The following chapter extends the investigation by examining the effects of institutionally mediated citizen participation, by comparing the outcomes of oil and gas permitting institutions with waiver rules to those without waiver rules.

CHAPTER 5

IMPLICATIONS OF CITIZEN PARTICIPATION PART II:

WAVIER RULE V. NO WAIVER RULE

5.1 Introduction

Just as the institutional arrangements of siting and zoning have differing effects on citizen participation, so too does the inclusion or exclusion of a waiver rule. As explained within Chapter 3, waiver rules within the context of this research are those rules which require the drilling operator to obtain signed releases from the affected parties within a protected use area whenever the permit request for a well site resides within the protected use area. Fundamentally, this rule provides the more narrow public, greater rights than the general public, by allowing them access to the decision making process prior to and, in some cases, in lieu of participation by the general public.

While Chapter 4 examines how the differences in access to public hearings, created by zoning and siting institutions, affect gas well setback distances, this chapter examines a second vector of influence. Specifically, this chapter investigates how the differences in access to public hearings, created by the existence or nonexistence of waiver rules, affect gas well setback distances. The analysis compares the variation in the approved gas well setbacks from the nearest residential building between cases having waiver rules and those that do not. First, the basic theoretical foundation is presented with discussions leading to the statement of the hypothesis. Next, an explanation of the methodology employed is provided. Finally, the chapter concludes with discussion on the statistical and substantive results.

5.2 Theoretical Foundation

This section presents an argument explaining why the incorporation of a waiver rule is essentially the inclusion of a boundary rule, limiting the public involved in the decision making process for the approval/denial of the requested permit. Within land use transactions, such as the determination of natural gas drilling operations, there is often discrepancy in interpreting property rights, errors in accounting for externalities and asymmetries of information available to homeowners and developers (Barzel, 1997). Consequently, scholars assert that government institutions are often necessary in settling land use issues, because of poorly defined property rights and high costs of transactions (Feiock, Tavares & Lubell, 2008). I assert the inclusion of a waiver rule uses a market-centered approach to solving conflict resolution by clarifying property rights and reducing transaction costs (Coase, 1960).

Written within the provisions of the gas well permitting process, waiver rules require the driller to obtain signed documents from property owners within the protected use area stating that they give permission for the setback standard to be waived. As a result, the waiver rule requirement effectively gives private individuals the capability to control whether or not the application will move forward to a public hearing, by their signing or not signing of the waiver. The inclusion of a waiver rule adds a step in the decision making process that excludes the general public. Fundamentally, the waiver rule prioritizes the rights of each private individual residing in the protected use area over the rights of the general public.

Within the zoning process, the obtained waivers allow the application to move forward to a public hearing for consideration of approval, but if waivers are not obtained, the general public has no decision in the matter, because the application is considered incomplete. On the

other hand, if there is no waiver rule, the application will move forward to the public hearing process (with or without obtained waivers) assuming all other requirements have been met. In this latter institutional arrangement, all parties are given equal access to participate in the decision making process.

Within the siting world, if the gas well application is for a well to be located at a shorter distance than the setback standard to a protected use, it would require a public hearing to gain approval. This is true for siting processes with or without waiver rules. However, if the decision making process includes a waiver rule provision, and the waivers are successfully obtained, then the operator can gain an administrative approval without having to go through the public hearing process. Essentially, the waiver rule acts as an entry barrier to the general public, removing their right to participate in the decision making process for gas well permitting. The rights to decision making are given solely to the property owners within the protected use area and the operator.

In addition to clarifying property rights, the waiver rule reduces transaction costs for the operator, because the numbers of persons involved in negotiations is drastically reduced from all of the general public, to the few property owners within the protected use area. What's more, the time, financial costs, and uncertainty of a public hearing process are eliminated if waivers are obtained. Considering the costs of drilling and casing a wellbore, the cost of production is also reduced when the length of wellbores are shorter. Based on the potential cost savings realized by the operator, it is assumed the rational operator will work towards successfully obtaining waivers; it would be rare for a case not to be resolved within the private market transaction.

When considering the municipality's perspective within the market transaction, the waiver rule also has the potential of reducing the municipality's transaction costs associated with permitting decisions, since the inclusion of the rule provides an opportunity for the private market to resolve the conflict without expending the time and staffing costs of conducting public meetings.

The incorporation of the waiver rule presents interesting theoretical and normative questions pertaining to a market-centered approach to conflict resolution versus the more democratic approach which uses open public deliberation as a part of the decision making process. For instance, although economic theory suggests a market-centered approach is an efficient method for addressing conflicts, it may also create a fundamental policy concern, as the negative externalities experienced by third party actors (i.e., the general public residing outside of the protected use area) may not be addressed within the market transaction.

In the case of a successfully negotiated waiver process, the only public allowed to participate in the determination of the permit is the driller and the few land owners who reside in the protected use area. The remaining public within the community is not given similar access to a decision making arena where they may express their preferences for longer setbacks as a means for reducing the impact of the negative externalities. Therefore, logic suggests the only interests being accounted for are those pertaining to the actors within the transaction; modifications to address negative externalities by third parties would not be a consideration. Consequently, one would expect to see a different outcome between decisions made with a market-centered approach vs. a more public deliberation approach. Specifically, it is anticipated that the inclusion of a waiver rule will typically result in shorter setbacks, as

compared to processes without waiver rules, because the affected parties will likely have negotiated an agreed upon compensation for the shorter, preferred setbacks of the drillers. Furthermore, when waivers are not incorporated, there is a larger public being given an opportunity to share information with decision makers about their concern over the industrial use within/near residential areas, making known their preference for longer setbacks as a method of reducing the impacts of the negative externalities. Given this logic the following hypothesis is presented:

> H_2: On average, permitting processes with waiver rules will approve shorter setback distances as compared to permitting processes without waiver rules, all else equal.

5.3 Methodology

As discussed within Chapter 3, this research uses a case study approach, because it is considered by scholars as well suited to gain better understanding of complex, real-world phenomena (Yin, 2003). Again, the same four North Texas cities under comparison are purposefully chosen to accommodate a most similar design as it is the preferred sampling for comparative case studies within the social sciences (Przeworski & Tweune, 1970). However, the paired case studies under comparison within this chapter vary from the previous chapter, because each test hypothesis is investigating a different independent variable of interest. For instance, Chapter 4 examines the variation in outcomes between the decision making processes of zoning and siting, while Chapter 5 examines the variation in outcomes between processes with waiver rules and ones without waiver rules. Therefore, rather than comparing Colleyville and Kennedale to Flower Mound and Benbrook (zoning v. siting), this chapter makes comparisons between Kennedale and Benbrook to Colleyville and Flower Mound (waiver rule v.

no waiver rule). The illustration of the varied effects on citizen participation is illustrated in Figure 5.1. As with the previous chapter's investigation, this investigation includes a complete census of the total population of approved gas well sites for each of the identified cities, between the years 2002 and 2012 and uses the t-test as the statistical test of significance when comparing means.

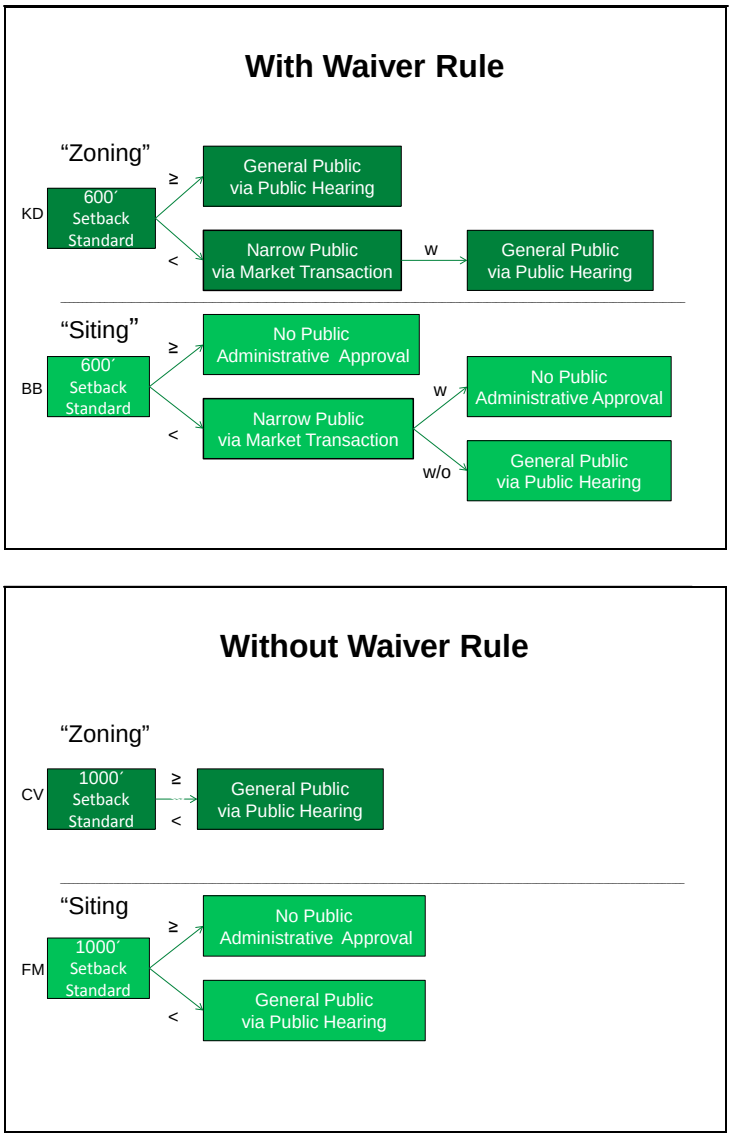


Figure 5.1. Decision making configurations with waiver rule v. without waiver rule. KD = Kennedale; BB = Benbrook; CV = Colleyville; FM = Flower Mound; w = with successfully obtained waivers; w/o = without successfully obtaining waivers; < = gas well setback is less than city's setback standard; ≥ = gas well setback is greater than or equal to city's setback standard.

The quantitative data collected for this research comes from the same archival sources mentioned in the previous chapter (e.g., city ordinances, gas well site plans, and gas well permit applications). Since the primary data set for Chapters 4 and 5 are essentially the same, the protocol for obtaining the gas well coordinates, correcting for differing coordinate systems and calculating gas well setbacks through GIS measurement tools are also the same. For persons wanting detailed explanations, they may refer back to Chapter 4. The only differences in the data exist the pairing of the cases and the operationalization of the variables, which is explained under the upcoming section, Operationalizing Variables

In a similar fashion to Chapter 4, this chapter makes reference to some qualitative data obtained from semi-structured interviews, but its purpose is largely supplemental. Thus, the detailed review of the data collection process is reserved in Appendices F - J. The measurement issues requiring the most explanation are those that are unique from Chapter 4, thus, the following passages provide the operationalization of the variables for H_2 and include a description for this chapter's specific comparison of means.

5.3.1 Operationalizing Variables

The dependent variable, length of gas well setback from the nearest residential building, is measured absolutely by linear feet and as a percentage variation from the setback standard. The absolute measurement is obtained using the GIS mapping tool. The percentage variation from the setback standard is calculated by the following equation:

$$\%\Delta \text{ standard} = (\text{actual distance} - \text{setback standard}) / \text{setback standard}$$

The value of measuring the dependent variable by percentage variation from the setback standard in addition to just the absolute length of approved setback is to normalize the data when setback standards between cities are not the same. In other words, it takes into account each city's institutionally recognized buffer zone established by the setback standard (specifically 600' or 1000' within this study) and creates a common point of reference for comparison. This common point of reference allows for greater validity when interpreting results.

The primary independent variable, type of decision making process (with waiver rule v. without waiver rule), is coded "1" if waiver rule exists within the city ordinance and "0" if there is no waiver rule written into the city ordinance. Other independent variables are taken into consideration and controlled for within the analysis such as, the setback rule, the need for an exception to the setback standard, and the decision making process of zoning versus siting. The setback rule is coded "1000" for setback standards of 1000 feet and "600" for setback standards of 600 feet. The need for exceptions to setback standard is coded "1" if gas well meets or exceeds ($\geq$) the city standard and "0" if the setback is less than ($<$) the city setback standard.

Comparison between the independent variables of with waiver rule and without waiver rule is conducted in three phases. First, all gas well permitting cases are analyzed, then only those cases that meet or exceed standards are examined, and finally only those cases that are below the standard are investigated. Additionally, within each phases of analysis, there are analyses between individually paired cities to control for siting versus zoning. Table 5.1 below provides the specific examples for each of the case cities and their collective choice arenas that

are used for each phase in the comparative analysis. The same step by step comparison discussed in Chapter 4 is used again within this chapter, but rather than making comparisons between zoning and siting institutions, the comparisons are between institutions with waiver rules and those without. The purpose of the multiple analyses is to gain a more complete understanding of when public participation may offer the greatest influence on outcomes (gas well setbacks) by controlling for other factors.

Table 5.1

Descriptions for Comparing Means: Waiver Rule v. Ø Waiver Rule

	Waiver rule v. Ø waiver rule
Mean lengths of gas well setbacks total cases	
• all cases	(KD+ BB) v. (CV +FM)
• controlling for zoning	KD v. CV
• controlling for siting	BB v. FM
Mean lengths of gas well setbacks $\geq$ setback standard	
• all cases in subset	($KD_{\geq}$ + $BB_{\geq}$) v. ($CV_{\geq}$ + $FM_{\geq}$)
• controlling for zoning	$KD_{\geq}$ v. $CV_{\geq}$
• controlling for siting	$BB_{\geq}$ v. $FM_{\geq}$
Mean lengths of gas well setbacks < setback standard	
• all cases in subset	($KD_{<}$ + $BB_{<}$) v. ($CV_{<}$ + $FM_{<}$)
• controlling for zoning	$KD_{<}$ v. $CV_{<}$
• controlling for siting	$BB_{<}$ v. $FM_{<}$

Notes: CV indicates Colleyville; KD indicates Kennedale; FM indicates Flower Mound; BB indicates Benbrook

5.4 Statistical and Substantive Results

For the sake of eliminating unnecessary redundancy, this chapter does not provide a discussion on the descriptive statistics, as its content would be identical to that provided in

Chapter 4. However, it is important to note the information obtained from the descriptive analysis still plays a critical role within the interpretation of this chapter's results. For instance, the recognition of Colleyville as an outlier, due to its small *N*, clustering of cases on one pad site and empty data set for cases ≥ setback standard, clarifies why case comparisons containing Colleyville may result in conflicting findings.

Tables 5.2 and 5.3 provide the results for this chapter's comparison of means. The presentation of results mirror the format described above: analysis progresses from all cases, to cases ≥ standard, then concludes with cases < standard. Focusing on the results listed within the first table, every phase of this analysis (excluding the empty data set) provides observations with significant findings. All observations, with the exception of the Kennedale v. Colleyville comparison for total cases, have shorter setback distances when waiver rules exist compared to when waiver rules do not exist. Not only are these results significant, but they are highly significant with all *p* values at .000 (t [ranges from -9.12 to -4.90], indicating strong support for the stated hypothesis. Alternately, the Kennedale v. Colleyville case comparison provides only a mildly significant result (*t* [1.87], *p =.006*) and has a shorter average setback for cases without the waiver rule, offering a direction of influence contrary to the stated hypothesis. There are few possible reasons for what appears to be mixed results. First, because the waiver rule is applied differently within the zoning and siting processes, there may be some indication for differing directions of influence. Second, there may be some additional factor associated with the zoning process creating the differing results, such as the higher levels of discretionary decision making. However, the most likely reason for the differing direction of influence is that Colleyville is considered an outlier with a very limited number of cases, all with setback lengths

less than the city standard. Once the identified outlier is removed from the analysis, all observations find consistent support for the stated hypothesis.

Table 5.2

Comprehensive t-table: Waiver v. No Waiver: Average Length of Permitted Gas Wells from Nearest Residence

	Waiver v. No waiver		***T***	***df***
	Waiver	No waiver		
Total cases (KD+BB) v. (CV+FM)	777.04 (299.62)	1152.80 (707.59)	-4.90***	183
• zoning KD v. CV	798.13 (360.15)	541.67 (16.52)	1.87*	62
• siting BB v. FM	751.98 (207.18)	1211.40 (713.83)	-4.33***	119
All cases without need of waivers (≥ standard) ($KD_{\geq}$ + $BB_{\geq}$) v. ($CV_{\geq}$ + $FM_{\geq}$)	834.47 (279.69)	1715.02 (800.89)	-9.12***	122
• zoning $KD_{\geq}$ v. $CV_{\geq}$	Insufficient data (no CV cases)	Insufficient data (no CV cases)	Insufficient data (no CV cases)	Insufficient data (no CV cases)
• siting $BB_{\geq}$ v. $FM_{\geq}$	809.06 (149.82)	1715.02 (800.89)	-7.19***	73
All cases needing waivers (<standard) ($KD_{<}$+$BB_{<}$) v. ($CV_{<}$+$FM_{<}$)	403.70 (58.52)	758.05 (166.39)	-7.79***	59
• zoning $KD_{<}$ v. $CV_{<}$	442.15 (45.58)	541.67 (16.52)	-5.45***	13
• siting $BB_{<}$ v. $FM_{<}$	352.43 (21.79)	795.91 (150.79)	-7.12***	44

Notes: * = $p \leq .1$, ** = $p \leq .01$, *** = $p \leq 001$. Standard deviations appear in parentheses below means. CV indicates Colleyville; KD indicates Kennedale; FM indicates Flower Mound; BB indicates Benbrook.

Unfortunately, in spite of the supportive findings, the association between wavier rules and length of approved setback cannot be inferred with great confidence, because there is a compounding factor – there is a 100% correlation between setback rules and waiver rules

within the chosen case studies. Specifically, all cases with waiver rules have setback standards of 600', while all cases without waiver rules have setback standards of 1000'. Therefore, the shorter average length of approved setbacks associated with the existence of waiver rules are just as likely influenced by the shorter setback standards as they are the waiver rule itself. There may also be some mixture of influence associated with the setback standards and the waiver rules. Consequently, in order to gain a more meaningful interpretation of the findings, additional analysis is necessary to control for the confounding factor of setback rules. By calculating each gas well's percentage variation from the setback standard, the differing setback standards between waiver rule and non-waiver rule cases will no longer be an issue of concern, because the data sets will be effectively standardized. For this reason, the following set of analyses compares cases with and without waiver rules by examining the average percentage variation of their approved gas wells from their city's setback standards. Table 5.3 presents this next set of observations.

Table 5.3

Comprehensive t-table: Waiver v. No Waiver: Mean Percentage Variation of Permitted Gas Wells from Setback Standards

	Waiver v. No waiver		***t***	***Df***
	Waiver	**No waiver**		
Total cases (KD+BB) v. (CV+FM)	.30 (.50)	.15 (.71)	1.6	183
• Zoning KD v. CV	.33 (.60)	-.46 (.02)	-3.45***	62
• siting BB v. FM	.25 (.34)	.21 (.71)	.38	119

(continues)

Table 5.3 *(continued)*

All cases without need of waivers (≥ standard) ($KD_{\geq}$ + $BB_{\geq}$) v. ($CV_{\geq}$ + $FM_{\geq}$)	.39 (.47)	.69 (.80)	-2.63**	123
• zoning $KD_{\geq}$ v. $CV_{\geq}$	Insufficient data (no CV cases)	Insufficient data (no CV cases)	Insufficient data (no CV cases)	Insufficient data (no CV cases)
• siting $BB_{\geq}$ v. $FM_{\geq}$	.35 (.25)	.69 (.80)	-2.65**	74
All cases needing waivers (<standard) ($KD_{<}$+$BB_{<}$) v. ($CV_{<}$+$FM_{<}$)	-.33 (.10)	-.25 (.16)	-1.73*	58
• zoning $KD_{<}$ v. $CV_{<}$	-.26 (.08)	-.46 (.02)	6.63***	13
• siting $BB_{<}$ v. $FM_{<}$	-.41 (.04)	-.21 (.15)	-3.29**	43

Notes: * = $p \leq .1$, ** = $p \leq .01$, *** = $p \leq 001$. Standard deviations appear in parentheses below means. CV indicates Colleyville; KD indicates Kennedale; FM indicates Flower Mound; BB indicates Benbrook

The application of the standardized measurement for gas well setbacks does in fact appear to correct for the correlative problem, as evidenced in the modification of significance throughout all phases of the analysis. In fact, when comparing all waiver rule cases (KD+BB) to all cases without waiver rules (CV+FM) the previously noted level of significance (*t*[-4.90], *p*=.000) is eliminated, suggesting the observed difference within the first analysis was associated with the setback standard, not the waiver rule. When controlling for siting, the results once again indicate the observed differences are associated with the setback standards, as the previously identified level of significance (*t*[-4.33], *p*=.000) is again eliminated. This suggests setback standards play a significant role in the length of approved gas well setbacks. Persons desiring to have a strong influence on gas well permitting outcomes may not only need

to consider participation within public hearings, but participation within the policy creation process which establishes/modifies setback standards within the local ordinances.

Continuing with the comparison of means between total cases, the standardization for setback standards did not eliminate the significance levels when controlling for zoning (KD v. CV). Instead, the level of statistical significance increased from $t(1.87)$, $p=.066$ for absolute values to $t(-3.45)$, $p=.001$ for percentage variation from standards. Knowing that the analysis contained the outlier Colleyville, with its data set consisting only of setbacks below city standards, the finding of increased negative direction of influence is readily explainable. However, what remains unclear is why Colleyville's data set is so different from the other case study examples. Is it Colleyville specific? Other than the piecemealed undeveloped surface area, what other factors might explain the limited number of applications that have gone through its permitting process? As with many things in life, timing may have played a role. According to a timeline of permitting activity created from archival data, as noted in Figure 5.2, Colleyville's drilling related activities (ordinance creation and permitting approvals) are relatively recent compared with the other case cities within the study. Colleyville's ordinance was adopted in 2008 in anticipation of drilling applications, while every other city within the study adopted ordinances at least two years earlier: Benbrook in 2006, Kennedale in 2004 and Flower Mound as early as 2002. Colleyville's manager also stated that their urban drilling development came into play during the time the city of Dish, Texas starting reporting environmental issues in the media. The heightened public concern over urban drilling that was noted within the media (http://www.npr.org/templates/story/story.php?storyId= 120043996) along with the drop in gas prices (Appendix M provides liner graph of gas well head prices

illustrating marked drop between 2005 and 2010) coincided with the time drilling was entering the Colleyville area. With prices down, public anxiety up and drilling companies slowing production of new wells (illustrated in Appendix K), Colleyville's subsequent experience with urban drilling was more limited in comparison to the other test cities.

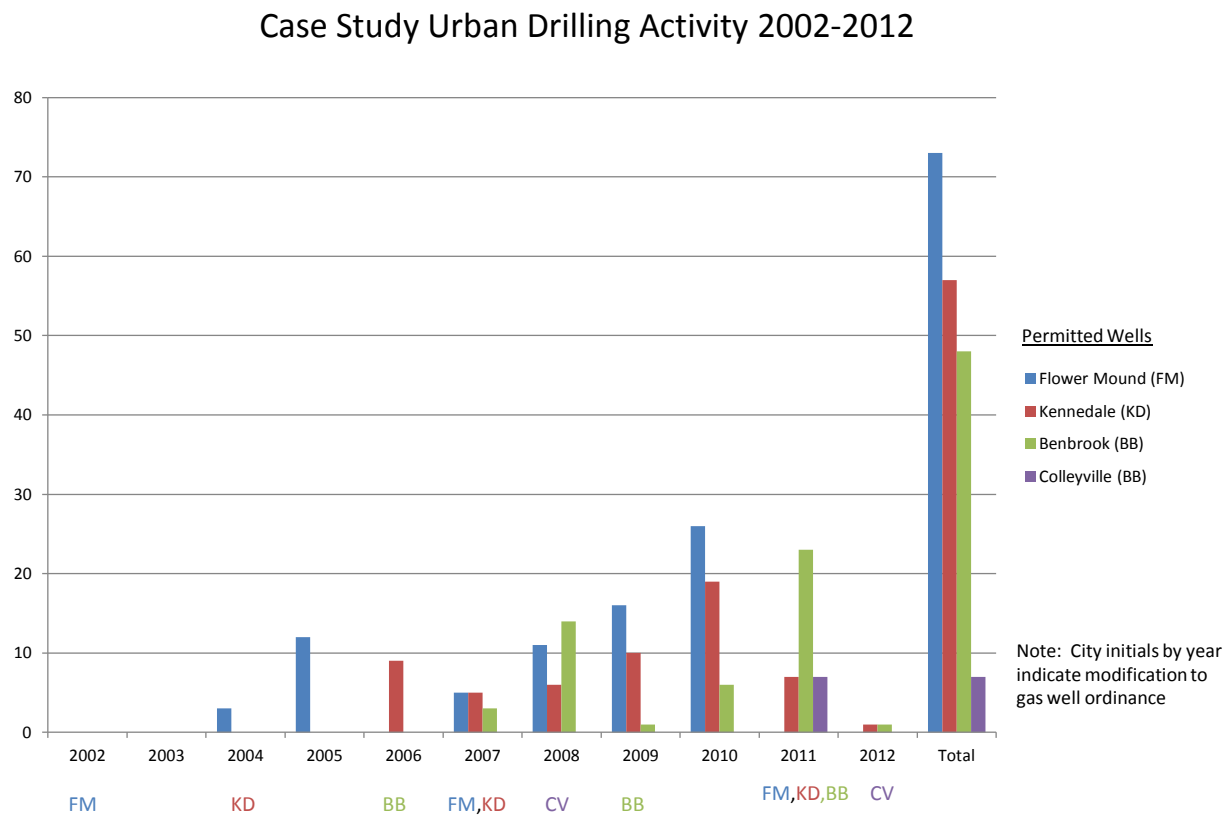


Figure 5.2. Case study urban drilling activity 2002-2012.

An alternate theory explaining the outlier is that there is something within the institutional arrangement of zoning without a waiver rule that is unique. This is suspect because during the search for most similar case study cities within the North Texas area, differing primarily by their institutional rules of zoning/siting and waiver rule/no waiver rule, Colleyville was the only case identified that fulfilled the zoning without waiver rule quadrant

within the 2 x 2 factorial design. Granted, the search was not comprehensive, but it begs to ask the question, why was the zoning without waiver rule quadrant so difficult to fill? Future research which assesses the percentage of cities that use the varied institutional arrangements may provide new insight as to which institutional arrangements are most common and why.

Moving onto the comparison of means between cases that are greater than or equal to setback standards, the level of significance decreases slightly for all comparisons containing the sufficient data for analysis. For example, while the absolute measure for length of setback reveals a *p*-value of .000, the results of analysis with the length of setback measured as percentage change resulted in a reduced level of significance ($p = .010$). This pattern suggests the setback standard may have partial influence over the length of approved setbacks, with waiver rules also offering partial influence.

The most relevant subset for comparative analysis between cases with waiver rules and cases without waiver rules is the one containing cases with setbacks less than the setback standard. The reason this subset is the most relevant is because only the cases below the setback standard would require waivers in order to receive a drilling permit. The findings within this subset are similar to those just mentioned (with the exception of KD v. CV). Specifically, the level of significance is reduced when normalizing data sets, but statistical significance is not completely eliminated, suggesting both the setback rule and the waiver rule may have a role in influencing the length of approved gas well setbacks. As with most of the previously mentioned analyses containing Colleyville, the results do not provide supportive evidence for the stated hypothesis, because Colleyville's data set is indicative of an outlier, skewing the results. However, once the outlier is removed from the analysis, the findings show

support for the hypothesis. For example, results of the Benbrook v. Flower Mound comparison indicate gas well permitting institutions with waiver rules are associated with a 20% greater reduction from the setback standards (M = -.41, SD = .04), than institutions without waiver rules (M = -.21, SD = .15), t(-3.29), p = .002. For the policy maker, the substantive value is in recognizing the connection between the institutionally mediated citizen participation and the critical outcomes of the regulatory process, such as length of setbacks. When the general public's participation is reduced through the waiver rule process, the setback lengths have a greater likelihood of being reduced an additional 20%. Referring to the average means for siting cities, if the setback standard is 1000' and the request is for less than the standard, the average approved length for the non waiver rule city would be 790', but for the waiver rule city it would be 590'. This difference of 200' is not only statistically significant, but offers substantive differences. For instance, in the case of an accidental explosion, the additional 200' could prevent physical harm. The noxious air emissions would have 200' more distance to dissipate. Fundamentally, from a safety and quality of life perspective, the neighboring homeowners would be safer and less negatively impacted by the drilling activity. The practical implications suggest rules enabling participation from the general public have a positive effect on public safety. An expanded discussion about the implications of this research, as well as other concluding statements, will be provided in the final chapter.

CHAPTER 6

VALIDATING ASSUMPTIONS FROM QUALITATIVE DATA

The main theoretical premise under examination states that rules affect citizen participation, which in turn affects outcomes, specifically length of gas well setbacks. This has implications regarding local policy makers' intents, such that policy makers who create institutional arrangements that provide access to public hearings may have differing objectives or intended outcomes from policy makers who block access to public hearings. However, this research assumes municipalities, regardless of their chosen institutional arrangement, maintain similar objectives as dictated by their constitutional level rules. For instance, ensuring public safety is considered a priority for all municipalities since the Local Government Code of Texas grants municipalities regulatory authority for the purpose of "promoting the public health, safety, morals, or general welfare and protecting and preserving places and areas of historical, cultural, or architectural importance and significance" (Sec. 211.001). Gaining a better understanding of each city's intended purpose for adopting its gas well permitting ordinance will help validate the assumption of the common priority for ensuring public safety.

Furthermore, since the research makes the implicit association that proximity of gas wells to residential buildings is a reflection of safety (farther distances reflecting greater safety than closer distances), it is equally important to ascertain if each city has established its setback standard with the intent of preserving residential safety. For these reasons, as well as to gain supplemental information to offer a more complete story of the oil and gas permitting process, this research includes information obtained from 20 semi-structured interviews. Semi-structured interviews are preferred over close-ended surveys, because they provide greater

flexibility of responses, allowing for richer, more detailed information to be collected (Yin, 2012).

The interviews were conducted either in person or over the phone, depending on the interviewee's preference. Participants were purposively selected for their knowledge of and experience with their community's local gas well permitting process. Respondents included city officials for the case study cities of Colleyville, Flower Mound, Kennedale and Benbrook (i.e., mayors, city managers, board members, legal counsel and other staff associated with the oil and gas permitting process). In addition to the city officials, two representatives from oil and gas companies also participated in the study. The particular oil and gas companies were chosen because of their drilling activity within the study area. Although gaining information from one operator per city was attempted, only two drilling companies were ultimately cooperative. Six other oil and gas drilling companies were contacted via phone and email, but their representatives ultimately refused to participate in the interview process, claiming they had too many prior experiences in which interviews resulted in unfair public criticism of the industry. For a more detailed discussion on the procedures and protocols used for the qualitative data collection phase of this research the reader may refer to Appendices F-J. A copy of the survey instrument including scripts for interviews and list of semi-structured questions may be obtained by request, by contacting the Department of Public Administration at the University of North Texas.

6.1 Support for Typology/Classification of City Ordinance

Interviews with city officials began with a set of two basic questions essentially asking them to match their oil and gas well permitting process by the independent variables within this study (zoning v. siting; with waiver rule v. without waiver rule). Subsequent questions also addressed amendments within the ordinances that occurred during the study period (2002-2012). The basic purpose for these questions was to ensure that the topology identified within Chapter 3 represented an accurate interpretation of each city's decision making process for gas well permitting.

Without exception each official placed his/her city ordinance within the same classification as noted within this study. Respondents from Colleyville recognized their ordinance as being zoning without waiver rule; Kennedale is zoning with waiver rule; Flower Mound is siting without waiver rule; and Benbrook is siting with waiver rule. While responses to Questions 8 and 9 indicated each city's ordinance had been amended at least once during the ten year period (3/4 are on their 3rd rendition), city officials confirmed the primary institutional arrangements for this research remained constant for the 185 gas well permits investigated throughout the ten year study period.

6.2 Support for Common Goal Across Institutional Arrangements

As mentioned above, one of the objectives for including interviews within this research was to gain additional information about the validity of the underlying assumptions. The assumption of a common goal across institutional arrangements was addressed through several questions. Question 3 listed seven possible reasons for adopting the chosen institutional

arrangement: modeled after existing city, allows for site specificity, considered most effective, considered most efficient, reduces political conflict, allows for due process and perceived as most fair. Respondents were asked to indicate all that were applicable. Two of the city officials interviewed felt they could not address the question as they were not involved in the initial creation of the ordinance. All but one of the remaining respondents indicated each of the reasons listed were considerations within the decision making process, illustrating consistency of purpose. Moreover, the majority of respondents (75%) felt the need to clarify their answer with regard to efficiency and effectiveness. They explained it wasn't necessarily a question of identifying a process that was most efficient or most effective, but it was a matter of balancing efficiency with effectiveness. This desire to balance efficiency with effectiveness was expressed by respondents across all institutional arrangements, regardless of zoning, siting, with waiver rules or without waiver rules.

Consistency of responses across institutional arrangements was also observed within descriptions of their ordinance's primary intent. Officials were quoted as saying they felt "state standards were too lax," and "the local government code provided them the authority to protect their community's health, safety and welfare." Furthermore, the responses to Questions 4 and 5 always contained some statement indicating their primary purpose was the preservation of neighborhood safety and quality of life, while balancing the rights of all stakeholders.

6.3 Support for Use of Gas Well Setbacks as an Indicator of Public Safety

Providing support for the use of gas well setback distances as an indicator of public safety, “fire safety buffer zone” was the only choice in Question 6 that was consistently mentioned by all respondents as a factor for determining setback standards. Further support is found within the statements of city officials:

> We used the fire codes to set the minimum standards and we wanted our standards to meet or exceed the minimum, based on the nature of the protected use. For example, with residential uses, since fire codes indentify a 300' minimum radius for evacuations, we made our standard twice the minimum (600') to provide greater protection against the potential hazard.

> Initially, minimum setbacks were established by evacuation zones…considered blow-outs, fires, dissipation of noxious air emissions….later, a property value impact study by Integra Realty was used to justify the longer 1500' setback. [Note: while this city indicated a change in setback distance, it does not come into play within this analysis as no wells were approved during the study period with this longer setback standard.]

The municipal preference of longer setbacks is also exemplified within these city official responses:

> Gas well development is not like putting in a Tom Thumb grocery store. We’re not sure of all the implications. For instance, there are a lot of unknowns about the health implications. Our philosophy is when in doubt error on the side of public safety. If you find out later that it (drill site) is too close, you can’t change it, but if it (drill site) is too far, you can always change in the future.

> There is still no real body of evidence for setback. There is a lack of scientific evidence telling us what standard is right. But have to put a stake in the ground somewhere, so better to error on the side of caution; the farther away from residence the safer it is. Residential areas were never zoned to be industrial. Therefore, distance protects residential from the heavy industry activity.

6.4 Support for Operator's Preference for Shorter Setbacks

Not only is support found indicating that municipalities prefer longer setbacks as a means of improving public safety, interviews with the operators provide support for the operators' preference for shorter setbacks. Specifically, both operator respondents stated the industry would prefer statewide setback standards of 300', because they perceive the longer setbacks established by the city standards as unnecessary, in terms of safety. However, one of the two operators did acknowledge "a sliding scale might need to be established to accommodate the need for longer setbacks based on the number of wells and equipment located on the pad site." Nevertheless, the major emphasis stressed by both respondents was that "safety is a technical matter" and "should be determined by the industry or the state." The interviews with the city lawyers reiterated the industry's desire for shorter, more uniform setback standards, as they mentioned there are many proposed bills at the legislature attempting to give the Railroad Commission sole authority for permitting gas well locations.

6. 5 Support for Upper Level Rules Limiting Municipal Decision Making

While responses provide support indicating the city's preference for longer setbacks and the operator's preference for shorter setbacks, city official responses to questions 4 and 5 also suggest that public safety is not an absolute priority, but considered in relation to balancing the rights of all stakeholders. As one councilman explained, "You want to make sure there are protections for the homeowners, but once you start getting legal opinions, you realize mineral owners also have rights." It is evident that although local policy makers believe longer setbacks provide greater safety, they also believe if they go beyond what is reasonable, they increase

their risk of lawsuit by the industry. The overshadowing threat of regulatory takings is illuminated in the commentary below:

> Safety is a priority, but the question really is "What is safe enough?" because setback standards that are too stringent (too long) may create unintended consequences. They may in effect zone out drilling, creating a regulatory takings
>
> The takings issue is really the one that keeps bubbling up and coming back.
>
> The stronger we make our ordinances, the more we get push-back from the industry. Lawyers are getting more involved. (One company) actually brought a lawyer to come and tell us our pipeline ordinance was outside of our regulatory authority.

Based on the above statements, it is clear municipalities recognize their regulatory authority has its limits. The constitutional rule giving mineral rights dominance over surface rights places restrictions on the rules that local municipalities may impose on drilling operations. Furthermore, the influence of constitutional rules was not just implied within responses, but throughout the interview process legal counsel respondents made direct references to the Railroad Commission authority, state law, property rights and local government codes, indicating how they guide municipal choices for natural gas permitting policy. As expected, responses provided support for the underlying framework which states upper level rules influence lower level decisions.

6.6 Perceived Benefits of Zoning v. Siting

While responses from city officials indicated a common goal across institutional arrangements for protecting public health, safety and welfare, particularly by establishing standards for gas well setbacks, there is some indication that city officials perceive different benefits between siting and zoning institutions. For instance, one representative from each

siting institution (one with waiver rules and one without waiver rules) specifically expressed reduced political conflict as a potential benefit of siting, based on the reduced need of public hearings. This being said, all formal institutional arrangements are essentially methods of resolving conflict, and thus may be perceived as reducing conflict, which might explain why, 30% of all respondents modified the choice in Question 3 from "it *reduces* political conflict" to "it a*ddresses* political conflict" as one of the reasons for adopting their particular institutional arrangement for gas well permitting decisions. This may also explain why an official from a zoning institution was also quoted as saying their process "reduces political conflict; it is vetted out through the public hearing process."

More often than not, when discussing why their particular institutional arrangement was chosen, city officials related the benefits of objectivity or flexibility. Greater objectivity was credited as a benefit within siting institutions, while greater flexibility was credited as a benefit within zoning institutions. City officials of siting institutions shared statements such as:

> The siting process was considered appropriate for our community, because it historically fluctuated from one political extreme to the other (pro development v. pro environmental preservation). The process would provide for greater objectivity, consistency and fairness in outcomes.
>
> The siting institution by way of its greater objectivity provides a system that is more litigation stable. Denials are more defensible in court…[Furthermore] our process requires two court rulings, but zoning can go right into a takings case.
>
> While zoning offers a method for addressing site specific issues, variances are allowed through public hearings within the siting process; therefore, site specific issues are also being addressed.

In contrast, the city officials of zoning institutions offered these types of justifications:

> Siting is limited to a set of standards and does not recognize site specific issues; it forces you to have a one size fits all requirement. If the applicant does not fit the requirement, it flat can't go. However, if the relief mechanism for that is to send them to a board of

> adjustment or appeals, then you are saying that they should be entitled to some sort of discretion also. So, if you are going to provide for some sort of discretion, why not give that discretion exercising body the best prerogative that can be provided? We believe sending people through the zoning process provides exactly that, without any unnecessary limitations of a one size fits all process, nor the limitations of strictly a variance based consideration.
>
> Zoning is better able to address issues on a case by case basis

The above observations suggest that municipalities make purposeful choices as to which is preferable for their community, greater objectivity or greater flexibility within decision making. Within practice, this implies that policy makers consider the level of discretion given the decision making body as an important factor when determining policy design. While this research is primarily interested in examining the rules affecting public participation and how they in turn affect outcomes, future research examining the variation in discretionary decision making (i.e., who is given discretion, what is the extent of discretion given) may provide new insight regarding institutional design and its impacts on gas well permitting outcomes.

The benefit of gaining a more socially acceptable outcome was also implied with zoning institutions, particularly in comparison to a pure market approach.

> While the most efficient way would be to have individuals negotiate through the market, there would be a likelihood of abuse by the oil and gas industry, or mineral owners with less regard for the community as a whole, which is why the public hearing process is considered a better, more effective choice.

The above response lends support to the theoretical discussion within Chapter 5 which posits different policy outcomes between a market-centered approach vs. a more public deliberation approach.

In addition to providing support for the underlying framework and theoretical assumptions for this research, the information obtained within the semi-structured interviews

also allowed for grounded theory leading to implications for future research (Glaser, B.G. & Strauss, A.L., 1967; Thornberg, R., & Charmaz, K., 2012). The discussion on these and other future research implications is reserved for the upcoming, final chapter of this dissertation.

CHAPTER 7

CONCLUSIONS

7.1 Summary

Prior to this research there has been little scholarly investigation specific to oil and gas permitting policy. Thus the progressions from framework to theory to measurable outcomes are important contributions of this research. Since the investigation was directed by three questions, concluding statements will address to what extent this research met its objectives in answering the questions, then follow with commentary about the limitations of the research and the subsequent implications for future research.

7.1.1 Objective 1: Provide Theoretical Framework

Fulfilling the first objective, this research developed a structured theoretical framework for addressing the complex policy issue of gas well permitting, emphasizing the rule-ordered relationships between various levels of decision making. Applied to urban drilling polices in Texas, it helped identify the key constitutional level rules guiding municipal choices noting the interaction effects of the various levels of decision making and the possible consequences of chosen actions. For instance, while municipalities are given authority to regulate land use operations, they cannot regulate the technical aspects of the operations, as that authority is given to the Railroad Commission, and if they overstep their bounds of authority, they set themselves up for possible litigation. Other upper level rules were also identified within the U.S. Constitution and common law which further limit regulatory authority based on property right issues. Rules such as these help explain why municipalities faced with the choice of

approving or denying permit requests typically approve requests, but create permitting ordinances that regulate its location as a means of mitigating the negative effects of the industry.

The framework is not only beneficial for the purposes of this research, but the demonstrated application of the framework provides a very necessary tool for future research on the subject matter. For instance, while this research focused on the collective choice arena for municipalities in the decision making of well permits, future research may investigate the collective choice arena for Railroad Commission permitting decisions pertaining to Rule 37. Rule 37, the spacing rule promulgated by the Railroad Commission places limits on well spacing to other wells, property lines, lease lines or subdivision lines offers another institutional arrangement. If an operator desires closer spacing exceptions may be requested. Following the mandatory 10 day notice, citizens may participate within the hearings. Research examining the deliberations and outcomes of these meetings may be further our understanding on how institutions affect citizen participation and ultimately the policy outcomes. Given my current understanding about the decision making process I would anticipate the variation in setbacks to be quite different than observed within the local level collective choice arenas. The reason being there may be some inherent entry barriers to citizen participation even when access is being provided. For instance, the hearings are held in Austin, not in the communities where the well will be drilled. The distance and time factor may preclude citizens from attending the hearings even though there may be a preference to oppose the request for exception. On the other hand, drilling companies would obviously attend the meetings as they are the ones making the variance request. As a matter of practice, the Railroad Commission would likely be

holding a very one-sided argument. In addition to the cost in time and inconvenience caused by distance, there are very real financial costs as well. I know of a citizen who was involved in a Rule 37 case who said legal counsel essentially had to be retained to present his argument against the request for the exception. Thousands of dollars were spent on legal fees with no certainty of benefit. The rule-in-use about requiring legal representation also acts as a barrier of entry for most citizens. Research on Rule 37 cases would further our knowledge of how institutionally mitigated citizen participation affects oil and gas permitting policy outcomes.

The knowledge of state level policies guiding municipal decision making within Texas will also provide a source of information for comparative research across U.S. states. A comparative study between Texas, a state with municipal level permitting authority, and another state which only authorizes state level control over gas well permitting may provide valuable new insight regarding the appropriate level of governance for gas well permitting.

"Land use has generally been considered a local environmental issue" (Foley, 2005, p. 570), the rationale for the inclusion of local input is to best meet the needs of the affected community. However, land use problems are complicated when the use creates negative externalities that cross jurisdictional boundaries. Air pollution and water pollution are not confined to invisible boundary lines and the excessive water usage (not returned to the watershed) depletes available drinking water for all of society, not just those nearest the well site. Consequently, some might argue for a broader approach to governance. Examining the effects of the differing levels of governance may reveal which level results not only in the least amount of negative impact on the neighboring community, but on society as a whole. Measuring the effects such as, average setback distances, average noise levels, and change in

neighboring property values, can address the neighboring community, while comparison of sustainability policies such as restrictions on water usage, mandates for water re-use, and air filtration systems can address the cross jurisdictional and greater societal issues. Use of an institutional analysis and development framework provides a necessary tool for this type of comparison.

Currently, within the state of Texas the level of intervention is currently limited to individual municipalities or state level regulatory agencies (when drilling within unincorporated areas). Unfortunately, left at the municipal level, there is the potential of social inequities as incorporated communities may be pushing drilling out of their borders into unincorporated areas. On the other hand, restricting regulation to the state limits the ability to address the unique needs of each community. It is possible that a comparative analysis between municipal level and state level governance structures (within Texas and across U.S. states) may show indications for the need for a more regional approach, one that is not as removed from the source of the problem as state governance, but offering greater attention to the broader societal concerns than may be given at the local level. This premise is supported by a study conducted by Schneider and colleagues (2003) which suggests there are benefits to regional governance structures: they span more levels of government, integrate more experts, nurture stronger interpersonal ties between stakeholders, and create greater faith in procedural fairness of local policy.

In a study investigating the emergence of large-scale collaborative institutional arrangements, Heikkila and Gerlak (2005) find that institutional formation follows widespread awareness of a problem. A quick glance at the news and legislative proposals indicates the

problems associated with oil and gas drilling/production in urban areas is a main issue of concern. It is likely an examination of the policy making arenas across the U.S. may reveal the emergence of voluntary collaborative regional governance structures as a means of addressing the collective action problems and correcting for the societal inefficiencies and inequities.

7.1.2 Objective 2: Develop Descriptive Theory

Analysis of four case studies of oil and gas permitting policy revealed two key variables affecting access to public hearings, the institutional variations of (1) siting v. zoning and (2) waiver rule v. no waiver rule. Identification of the institutional variations lead to the creation of a typology of eight possible collective choice arenas for oil and gas permitting within Texas municipalities each illustrating how institutions acting as entry barriers to public hearings are in effect determinants of citizen participation.

The development of the typology also revealed important distinctions in the types of public's being given depository decision making or removed from the decision making process because of the established institutions. It was illustrated that the use of the waiver rule diminishes the decision making role of the broad, general public (parties residing outside the protected use area) and empowers the more narrow, affected public (parties residing within the protected use area). This is accomplished by requiring signed waivers. Zoning waiver rules require signed waivers as a part of the application. Thus if waivers are not obtained the application cannot move forward to a public hearing for consideration of approval. In this sense, zoning waiver rules give narrow publics first bite at the apple. If 100% of the waivers are required and a person in the narrow public decides not to sign, in his veto power has blocked

the general public from being able to participate in the decision making process. In essence, if the affected parties do not provide signed waivers, they determined the fate of the application – it is deemed incomplete and cannot gain approval. On the other hand, waiver rules in siting cases allow affected parties, through their signing of waivers, to eliminate the need of a public hearing to gain approval. If all necessary waivers are obtained, the application can gain administrative approval – the general public has no say in the matter. However, if waivers are not obtained, it may still progress to a public hearing for consideration of approval, denial or modification. The practical implications gained from the typology suggests that in order to keep decision making a more public endeavor, waiver rules should not be included. Furthermore, the illustrated decision making configurations demonstrate that waiver rules not only affect access to public hearings and act as determinants of citizen participation, but when sufficient waivers are obtained in siting cases or not obtained in zoning cases they are also determinants of policy outcomes. This is a very significant piece of information for policymakers as the connection between rules and outcomes must be clearly understood in order affect the targeted behaviors. Given the understanding that the purpose of all public policy is to change a behavior in accordance to some societal goal (Bobrow & Dryzek, 1987; Schneider & Ingram, 1990) this research extended the literature on institutions and citizen participation, and developed the theoretical argument that institutions affecting citizen participation will in turn affect policy outcomes.

Just as the prior application of an institutional analysis and development framework provides a valuable tool for future research. The developed typology and its theoretical implications should also prove beneficial for future research on this under examined subject

matter. For instance, the developed typology provides a visual mapping of decision making with distinctive differences and similarities among the varied collective choice arenas which can assist the researcher in determining appropriate pathways for comparative analysis.

7.1.3 Objective 3: Address Research Question

The third objective of this research was addressed by testing the proposed theory within two different sets of institutional arrangements. Using paired case studies of most similar design, empirical evidence was found in support of the two stated hypotheses suggesting that institutionally mediated citizen participation does in fact affect outcomes. When greater access to public hearings are provided within high impact cases, the outcomes of the decision making process show increased safety precautions by means of longer setbacks. Specifically, zoning institutions offer a 15% longer setback than siting institutions and institutions without waiver rules offer a 20% longer setback than institutions with waiver rules. The substantive implication is that citizen participation has a statistically significant positive effect on public safety. These results offer valuable information for municipal policy makers who have regulatory power over land use operations pertaining to gas drilling. If maximizing safety is a priority, results indicate the zoning process will afford the community a better opportunity to gain longer gas well setback approvals as compared to the siting process. Similarly, a siting process without waiver rules would be preferred over one with waiver rules, because of the greater likelihood for longer gas well setbacks. Longer setbacks are important for the general public as they reflect greater public safety due to the reduced levels of exposure to the negative impacts associated with the drilling operations. Fundamentally, regulators need to be aware that the manner in

which they structure their decision making process and the degree to which institutions mediate citizen participation, will ultimately affect critical outcomes of the decision making process, such as gas well distances from residential buildings.

This new insight regarding the institutionally mediated effects of citizen participation on policy outcomes is important not just for municipal policy makers of North Texas, but for other municipalities across Texas and across the United States. Given our growing population and ongoing need to meet our nation's energy needs, drilling will undoubtedly continue to move from rural areas to more populated territories. Other local governments will soon follow suit, creating/updating their oil and gas drilling ordinances to better protect their community's health, safety and welfare against the negative impacts of drilling operations. Understanding how institutional arrangements affect the participation of differing stakeholders will help policy makers make better decisions as to how to structure their ordinances so they have the greatest likelihood of producing the intended results.

The process of conducting the analyses in phases (all cases, cases $\geq$ standard, cases < standard) also provided opportunities for new theory building. For instance, while it was expected that cases $\geq$ the setback standard would reveal varied outcomes between siting and zoning cases, the approved setbacks were statistically similar with this subset. This can be explained using the NIMBY literature which states there is an inverse relationship between public hearing attendance and distance of the unwanted land use – the shorter the distance, the more likely the attendance (Lindell & Earle, 1983). While attendance was not measured directly in this research, the implications of participation are similar because high impact cases (wells closer to residence within the protected use area) revealed positive effect from citizen

participation; whereas low impact cases (wells farther from residence outside protected use area) appeared to have no statistically significant effect. The value added for the policy maker is that if setback standards successfully represent community preferences, one should not expect to see a discernible difference between siting and zoning outcomes in low impact cases.

Establishing setback standards that are in-line with the community's preferences are not only important in minimizing the differences in outcomes between siting and zoning, but based on the results of this study, the setback standard itself is also associated with the length of approved gas well setback. For instance if the average reduction from a gas well setback is 20%, then a setback standard of 1000' may result in an approved setback of 800', while 20% of 600' would result in an approved setback of 480'. If applicants tend to limit the variance requests by percentage variation from the standard, then the standard plays an important role in outcomes. Based on the theory that citizen participation does affect outcomes, citizens desiring longer setbacks should not just participate in the public hearing process, but should consider being an active participant in the policy creation process for establishing setback standards.

Overall, this research provides valuable information for advancing the understanding of oil and gas policy as well as extending the literatures on institutions and citizen participation. The application of the institutional analysis and development framework offers a new tool for the policy maker's tool box. The developed theory offers new opportunities for further research. The observed relationships between rules, citizen participation and outcomes provide new information to guide decision making on how to create policy to best address matters of public safety. While centered on urban drilling policy within the North Texas region,

the information gained offers valuable insight that may be used for research in other areas of Texas and for comparative studies across the U.S.

7.2 Limitations and Their Implications for Future Research

Although this research provides valuable information for advancing the field's knowledge base, it is not without its limitations. For instance, the unique characteristics of Colleyville resulted in conflicting findings and incomplete analyses due to empty data sets. The primary explanation was that Colleyville was an outlier, too new in its urban drilling experience to provide sufficient data for comparison. However, review of the documents submitted within the public hearing process, provides yet another alternate explanation – the existence of a waiver rule-in-use. Although there are no formal rules mandating the obtaining of waivers prior to permit approval, the applicant submitted signed waivers as a part of the justification for approval. This suggests a waiver rule-in-use, despite the lack of a documented waiver rule. Noting this, future research not only needs to examine formal ordinances and their effects on outcomes, but examination must include the implementation process in detail to ensure rules-in-use are not in conflict with the formal written rules. Placing Colleyville in the category of "waiver rule-in-use" eliminates the conflicting results and shows further support for the hypotheses. It also brings to light the question as to why it is difficult to find a test city which uses a zoning approach without a waiver rule. Are waiver rules considered important for the dispositive body to justify greater reductions to setback standards? Further research examining the percentage of cities using the different institutional arrangements (zoning with waiver rule, zoning without waiver rule, siting with waiver rule, siting without waiver rule) and why policy

makers adopted such arrangements might shed light on an important principle allowing for a more complete understanding of the municipal policy making process for oil and gas well permitting.

To fill the gap in research associated with Colleyville's empty data set (zero cases greater than or equal to the setback standard), the first step would be to conduct an extended survey of all administrators within the North Texas Region whose cities contain Barnett Shale. Explicit questions should be devised to gain information about both the formal and informal rules used by the city within their gas well permitting policies to determine if there are any rules-in-use that would not be noted as part of the formal ordinance. Once all information is obtained, the most similar cities can then be identified for each institutional arrangement, ultimately allowing for a better case city example for the zoning without waiver rule category (naturally the other example cities may also be replaced in the future study in order to provide for the best set of comparative cities to fulfill the most similar design system).

As with all small N case studies, because this research only reviewed four cities with a total of 185 wells, this research is also limited in its generalizability, has inference problems, and did not make use of more advanced statistical methods. Expanding the research area to all of the cities within the Barnett Shale, helps correct for the small N and may enable the possibility of multiple regression modeling to provide for stronger inferences. Other institutional variations might also be considered, such as elected v. appointed body of decision makers to determine how variation in discretionary decision making (e.g., who is given discretion and what is the extent of discretion given), might also be affecting policy outcomes.

Conducting a more expansive study will help fill the gaps in this research, improve causal inference and help extend theory.

7.3 Additional Implications for Future Research

7.3.1 Examining Interactive Effects

Although not necessarily considered a limitation of the research, the analysis stopped short of examining the interactive effects of the differing institutional arrangements. While this research provides new information about siting v. zoning and waiver rule v. no waiver rule, the analysis was conducted separately (within Chapters 4 and 5 respectively). The interactive effects were not investigated. Therefore, it is unknown if the waiver rule amplifies the observed differences in outcomes between siting and zoning cases or if there is a counteractive effect, resulting in more similar outcomes between siting and zoning cases. Future research examining the interactive effects of these independent variables will provide additional insight about the institutions and their resulting outcomes. Since siting is associated with shorter setbacks than zoning and siting with waiver rule is associated with shorter setbacks than siting without waiver rule, it is posited that siting institutions with successfully obtained waivers will result in the shortest gas well setbacks of all institutional configurations. However, due to the problems associated with Colleyville, the directional influences of zoning with waiver and zoning without waiver rules could not be tested, so the full interactive effects could not be examined. Finding a better example for the zoning without waiver rule, as discussed above, will also allow for extended examination of the interactive effects.

Interactive effects may also be examined with the differing mitigation techniques presented in the oil and gas ordinances. For instance, this research examines safety from one critical factor, distance. However, safety may be heightened by other means as well. Oil and gas ordinances do not just address setback distances, but many require air quality monitoring, air filtration systems, automated shut off valves, and a host of other techniques which may improve the safety of the neighboring public. Additionally, improving other quality of life issues through the mandate of sound walls, minimum noise requirements, traffic flow patterns, facility facades and screening mechanisms all mitigate the negative effects of the industry. Future research which examines the variation of these techniques in conjunction with the variation in institutional arrangements may reveal interactive effects. While average setbacks may be shorter for siting institutions, there may be other mitigation techniques within the drilling ordinances compensating for the difference in setbacks. Interdisciplinary research with engineering, public management and public policy experts may provide a clearer understanding as to how the interactive effects of the static guidelines and varied levels of citizen participation within public hearings affect overall safety and quality of life issues.

7.3.2 Measuring Citizen Participation

While this research presents a theory linking rules to citizen participation to outcomes, direct measurements are only provided for the rules and outcomes. Chapter 3 illustrates that rules are determinants of citizen participation and Chapters 4 and 5 test how the variation in rules leads to a variation in outcomes, but this research does not directly measure citizen participation; it is "black-boxed." Further research can provide a more direct examination of

the theoretical link between rules, citizen participation and outcomes, by measuring all components of the theoretical equation (rules, citizen participation and outcomes). Examining the minutes of public hearings can provide valuable information about how the rules (zoning v. siting and waiver rule v. no waiver rule) may be affecting the numbers of people involved in decision making, the characteristics of the actors participating in the decision making process (both at meetings and via emails) and the type of information being shared and incorporated within the final permitting outcomes, such as length of setbacks and other mitigation techniques. Completing this analytical process will provide a more complete understanding of the practical implications of why rules affecting citizen participation may be ultimately affecting public safety and quality of life issues.

7.3.3 Modifying Variables under Investigation

Another analysis modification that may be considered for future research is changing the dependent variable from length of setback from nearest resident to length of setback from nearest residential subdivision. Future research may consider investigating this variation in the dependent variable as it may provide a better indication of "public "interest. This distinction from nearest resident to nearest residential development or subdivision may be more challenging to measure as one would have to determine density and/or number of what constitutes a "subdivision;" but it may prove to be a more valid indicator of "public" safety since more public would be involved. The use of nearest residential subdivision v. nearest resident will also reduce the possibility of other influential factors of the decision making process. For instance, this research did not investigate the different characteristics of the

nearest resident. While reviewing gas well applications and their site plans it was noted that many of the nearest residents were large land owners and lease holders, the percentages were not calculated or analyzed. Future research may need to investigate these types of variables (lease holders or not, amount of property with lease, royalty fees offered, etc.) to determine how they are affecting setback distances. It is possible, because of the market exchange, that lease holdings would have the same effect as waiver rules on outcomes.

Some consideration might also be given to researching the cumulative effects of multiple wells per pad site. Do citizen surveys reveal greater levels of negative impacts when pad sites house multiple wells and their associated facilities versus single wells? Are the average distances from residential buildings greater with pad sites housing multiple wells versus single wells? Is the distance variation linear or exponential in nature? This research revealed that some industry professionals may believe a sliding scale for setbacks might be appropriate when regulating distances, but little research has been conducted examining the cumulative effects of multiple wells (i.e., noise levels, pollutants, traffic issues). Engineers and public policy specialists should consider interdisciplinary research to help identify more scientifically based standards to help address drilling related public health, safety and quality of life concerns.

Additionally, this research focuses its attention on measuring the distances of approved gas wells from neighboring residences as a means of determining the institutional effects on public safety. However, a public safety risk is automatically imposed with any well approval; therefore, examining the denials, may also provide new insight about how differing institutional arrangements may be affecting public safety. The denials, because of the infrequency of their

occurrence may be overlooked in analyses, but while they may be few in numbers, they offer legitimate data and should be an inspiration for inquiry (Osborne & Overbay, 2004). Why were these cases denied; what makes them so unique? Is there a greater tendency for denials with siting than zoning or without waiver rule than with waiver rule? Are there cases that never enter the system because of the drillers' self-selection process and expectation of denials? There are many unanswered questions that still need to be explored to gain a fuller understanding of institutions, citizen participation and their impacts on policy outcomes.

7.3.4 Examining the Effects of Institutional Arrangements on Drilling Intensity

Within both the qualitative and quantitative data of this research, there is some indication that institutional design is not just affecting length of gas well setbacks, but that the intensity of drilling activity may vary from city to city because of the variation in institutional arrangements. One of the perceived benefits of siting revealed within the responses of city officials was its objectivity and consistency of outcomes. Greater objectivity was described as a benefit because it reduces the likelihood of arbitrary and capricious denials which could result in takings lawsuits. However, increasing the objectivity of outcomes also reduces the uncertainty of denials and additional costs associated with public hearings, which may have the unintended consequence of attracting oil and gas development within their city boundaries.

Depending upon the city's desire for drilling within the community, this unintended consequence of the gas well permitting design may be perceived as positive or negative effect. City administrators and policy makers need to understand how some institutions may result in

higher levels of drilling activity for their community, because of the lower transaction costs for the operators.

The logic behind the operator's preference for siting institutions is founded in rational choice theory. Simply put, operators, being rational actors, would prioritize development in siting cities over zoning cities (all else equal), as they offer the opportunity of guaranteed approval; fewer net losses. Evidence of operator preference for siting institutions may be inferred from interview responses:

> While all cities have gas well ordinances, an operator faces an uncertain regulatory environment in the zoning or specific use permit process since a staff member or council can make recommendations outside of the ordinance provisions. An administrative process (siting) holds an operator, homeowner, builder or any other applicant to strict standards set forth in the municipal code and is better suited to regulate a process such as drilling.

> It (siting) provides some certainty and consistency in outcomes. You (operator) meet the rules, you get granted. Specific use permits (zoning) results in more variations in outcomes. You (operator) negotiate as you go and still may not get approval.

A comparison of the total number of permitted wells between siting and zoning institutions also indicates higher levels of drilling activity within siting institutions as compared to zoning institutions (65% compared to 35% respectively). However, because this data set is extremely limited in its sample size, further research about how institutional arrangements may affect drilling intensity levels is warranted. In theory, I would expect to see drilling activity be initially higher for siting institutions than for zoning institutions (all else equal), but as resource scarcity increases, it is anticipated that the activity levels would equalize overtime as exceptions to setback standards (and the associated public hearings) would become increasingly necessary, making the decision making processes more similar across institutional arrangements.

7.3.5 Studies on Policy Change

This research essentially focused on the implementation phase of gas well permitting policy. The institutional arrangements for approving gas well permits were established within each test city and their outcomes of decision making examined. However, the propensity for adopting new gas well permitting policies within local governments has also created an opportunity for researchers to examine the explanatory power of policy adoption models within a new area of study. According to Berry and Berry (1999), "despite the extensive number of studies there are two principle forms of explanation for the adoption of a new (policy)," they are diffusion models and internal determinants (p. 170). Diffusion models assume innovation is created through channels of communication between intergovernmental systems, while internal determinant models assume there are political, economic and social characteristics specific to the level of government which are influencing the adoption of policy. Although, their research largely refers to state level policy, it can be easily translated to other levels of government, such as municipal policymaking.

Diffusion models argue that there are three primary reasons why newly adopted policy may emulate another existing policy. First, it is perceived as successful and a short cut. As mentioned by one city official "Why reinvent the wheel? If someone else has done the majority of the work for you, there is no need to start from scratch." Using an existing model presents an efficient method of accomplishing your objective. Second, there is a sense of competition and the adoption of policy may be to build advantage or avoid disadvantage. Finally, there is pressure to conform to a larger scope of acceptable standards. In other words, if you fall below bench mark comparisons, there is pressure to meet the societal standard.

While not a focus of this study, this research obtained evidence supporting the existence of diffusion within oil and gas permitting policy. For instance, diffusion models assume intergovernmental communication and statements obtained from city officials confirm its occurrence. Access of public documents, shared legal counsel and participation in regional oil and gas meetings are just a few examples of how information was communicated across government entities. Specific documents such as bench mark comparison charts, provided evidence suggestive of the desire to conform to acceptable standards. The tendency to focus on other North Texas city policies lends support for geographic proximity as a critical factor in policy adoption, which is specifically indicative of a regional interaction model of diffusion.

Support for other diffusion models was also found. For instance a leader-laggard model was implicated when city officials identified Denton and Fort Worth as two of the earliest innovators of urban drilling policy for North Texas, providing a model for other cities to follow. Additionally, since city officials expressed an attempt to make comparisons with other cities that were most similar (i.e., similar demographics, budgets, political and cultural characteristics), there is also support for the isomorphism model of diffusion. Expanding the research across all of the Barnett Shale, across differing geographic regions within Texas, as well as across the states, may help determine if there is one predominant model explaining the adoption of gas well permitting or if diffusion is largely multifactorial in nature.

Distinct from the diffusion models, the internal determinant models assume the unique political, economic and social characteristics internal to the organization influence the adoption of policy. Several hypotheses are generated from internal determinant models. For example, Walker (1969) hypothesizes that states of greater size and resources will be more innovative

than smaller organizations with fewer resources. Extending this hypothesis to municipalities, it might explain why Fort Worth and Denton were mentioned as one of the earliest innovators of oil and gas well permitting policy with the smaller case study cities adopting their policies later. Similarly, Mohr (1969) proposes that there is direct correlation between the motivation to innovate and the probability of innovation. Again, responses from city officials indicate that internal determinants for policy adoption exist. City officials implied they were motivated to adopt their initial urban drilling policies as evidenced within the following statements:

> We knew they (drilling companies) were coming and wanted to put in place a more protective ordinance. If there was no ordinance specific to gas drilling, approvals might default to the state regulations.
>
> We had operators come to us, letting us know they were thinking about drilling in our city. We needed to create policy that protected our community's health safety and welfare.
>
> The Railroad Commission regulates, but there is a conflict of interest secondary to campaign funding. The best level of governance is the local level, because we know the needs of our community.

Based on the observations obtained within this research, local government innovation reflects both diffusion and internal determinants. Policy adoption cannot be explained by either diffusion or internal determinants alone; an interactive model is required. A better understanding of gas well permitting policy adoption may be gained from testing their explanatory power simultaneously within a combined model, rather than in isolation.

Longitudinal studies examining policy change are also ideal for oil and gas well permitting since the observations of multiple amendments is highly suggestive of a policy learning phase. According to Baumgartner, Jones and Wilkerson (2011), information is the key determinant for understanding policy change. Consequently, there is an extensive literature

about the role of information in a variety of policymaking contexts (Henry & Dietz, 2011; James & Jorgensen, 2009; Weible, 2008; Ostrom, 2007; Leach & Sabatier, 2005; Dunn, 2004; Lubell 2003; Fischer, 2000; Jenkins-Smith, 1990; Sabatier, 1987; Weiss, 1977; Knorr, 1977). However, little is known about policy change within the context of oil and gas permitting. Future research may provide new light as to how information is used within this policy issue. It may play an instrumental role in the determination of policy (Dunn, 2004), or be used for political purposes to argue against an opponent (Knorr, 1977). The time is ripe to begin investigations with policy makers, citizens, operators and other stakeholders to gain new insight about the new information that is entering the policy making arena, what type of information is prevalent, who are the actors providing the information, and how is it used to effect policy change.

As is evident by the numerous implications for future research, in spite of having gained valuable information contributing to our knowledge of gas well permitting policy, citizen participation and institutions, the well of information has barely been tapped. Given our nation's dependence on energy sources like shale, the estimated population growths, and the numerous untapped reserves all across the U.S. continued research is necessary as there is still much to learn about this highly complex subject matter.

APPENDIX A

TEXAS OIL & GAS INSPECTION & WELL DATA

Texas oil and gas inspection and well data

	Inspectors	Inspections[1]	Inspections per Inspector	Wells Drilled[2]	Active oil and gas wells[3]	Active wells per inspector
1993	117	115,000	983	9,969	237,136	2,027
2002		106,462		9,877	221,551	
2003	81.5[4]	115,474	1,417	10,420	221,949	2,723
2004		110,624		11,587	223,442	
2005		115,393		12,664	227,796	
2006	87[5]	118,109	1,358	13,854	235,050	2,701
2007		119,131		20,619	241,534	
2008	83[6]	120,866	1,456	22,615	253,090	3,049
2009	87[7]	128,270	1,474	20,956	258,904	2,976
2010	88[8]	121,123	1,376	9,477	260,104	2,956
2011	97[9]	114,878[10]	1,184	8,391	270,233	2,786

[1] Statistics from 2002 – 2006 from: State Auditor's Office, Texas. August 2007. *An Audit Report on Inspections and Enforcement Activities in the Field Operations Section of the Railroad Commission.* SAO Report No. 07-046. p. 1. http://www.sao.state.tx.us/Reports/report.cfm/report/07-046 Statistics from 2007 – 2011 from: Texas Legislative Budget Board. Agency Budget and Performance Measures for Fiscal Years 2007-2011. Search: "Railroad Commission." http://bapm.lbb.state.tx.us/main.aspx?FiscalYear=2011
[2] Railroad Commission of Texas (**hereafter RRC**) web site: "Texas Drilling Statistics." Accessed May 23, 2012. http://www.rrc.state.tx.us/data/drilling/txdrillingstat.pdf
[3] Texas has data for active wells, (see RRC Well Distribution Tables http://www.rrc.state.tx.us/data/wells/welldistribution/index.php) but the number includes wells not used for oil and gas extraction (e.g., hydrocarbon storage, withdrawal, brine mining, injection disposal and other. So we used the number of producing oil and natural wells to represent active oil and gas wells(Source: RRC "Natural Gas Production and Well Counts (1935-2011)" and "Oil Production and Well Counts (1935-2011)" found at: http://www.rrc.state.tx.us/data/production/index.php)
[4] State Review of Oil and Natural Gas Environmental Regulations, Inc. August 2003. *Texas State Review.* p. 28. http://www.strongerinc.org/documents/Texas%20Follow-up%20Review%208-2003.pdf
[5] State Auditor's Office. August 2007. p. i. See endnote 1.
[6] RRC Oct. 14, 2008. Oil and Gas Division Presentation. p. 4. http://www.fortworthgov.org/uploadedFiles/Gas_Wells/RRC%20-%20Oil%20and%20Gas%20Division.pdf
[7] Sunset Commission. January 2011. Sunset Commission Decision - Railroad Commission of Texas. p. 12. http://www.sunset.state.tx.us/82ndreports/rct/rct_dec.pdf
[8] RRC presentation. July 2011. Slide 8. http://www.dallascityhall.com/pdf/GasDrilling/RRC_July2011.pdf
[9] A January 2012 press release from the Railroad Commission said that "As a result of an increased appropriation from the 82nd Legislature, the Commission increased the number of oil and gas inspectors from 88 to 153." (Source: RRC. Jan. 18, 2012. "2011: Year of Railroad Commission Accomplishments." News Release. http://www.rrc.state.tx.us/pressreleases/2012/011812.php) An email from RRC clarified that RRC "provided for an additional 21+ full time inspector positions in the past year." And that the RRC has "97 Full-time inspectors" but that lead techs, state pluggers, and cleanup coordinators "also spend a relatively large percentage of their time in the field." When the latter positions are added in, there are 153 employees who carry out some inspection duties. (Source: Email from Leslie Savage, Railroad Commission of Texas to Bruce Baizel, Earthworks. April 10, 2012.)
[10] ibid.

Note: Above data obtained from
http://www.earthworksaction.org/images/uploads/Texas_inspection_data_footnotes.gif

APPENDIX B

COMMON REGULATORY CONDITIONS PLACED ON DRILLING COMPANIES BY MUNICIPALITIES:

EXAMPLES OF TECHNICAL REGUATIONS

Topic of Concern	Examples of Details
Protection Water Quality	
• Drilling system	Closed loop mud system for temporary storage of waste
• Water fracture pond/pit	No waste allowed
• Pond/pit	Not allowed in FEMA floodplain or existing city ROW's
• Testing of pond/pit	Periodic tests may be required at cost of operator
• Salt water wells	No salt water disposal wells shall be located within the city limits.
• Fresh water well	No closer than 200' from gas well bore, without permission of owner
Protecting Air Quality	
• Emission control	Shall employ appropriate equipment
Reducing Noise Nuisance:	
• Work days/hours	No production activities on Sunday other than mobilization and demobilization and advancing bore hole. M-F 7 a.m.-7 p.m. Saturday 9 a.m. – 5 p.m. (may request variance)
• Levels	Shall not exceed 70db measured 300' from drilling/operation 56dB measured to nearest residence, public building, human occupied building at nighttime ≤ 5dB above ambient sound in day; ≤ 3 dB at night when measured at protected use
• Mitigation	Acoustical blankets, sound walls, mufflers may be used to ensure compliance
Reducing Lighting Nuisance:	
• Direction	Shall not shine directly on public roads or neighboring property; directed downward if <300 of well
Safety:	
• Automatic valve	Each storage tank will be equipped with automatic shutoff valve in case of leak Each well will have automatic shut off
• Tank setbacks	Must be ≥ 200' from protected use, public building or habitable structure Must be ≥ 100'from property line
• Perimeter fencing	Shall provide 6'chain link fencing or compatible 8'masonry fencing for perimeter of drill site, or discretion of City Engineer
Aesthetics	
• Permanent sound mitigation of compressors	No sound blankets. Must use permanent material (metal, masonry or other approved material by City Engineer) painted to match nearby surroundings
• Landscaping	Installed no later than 210 days from commencement of drilling of first well, unless otherwise permitted

APPENDIX C

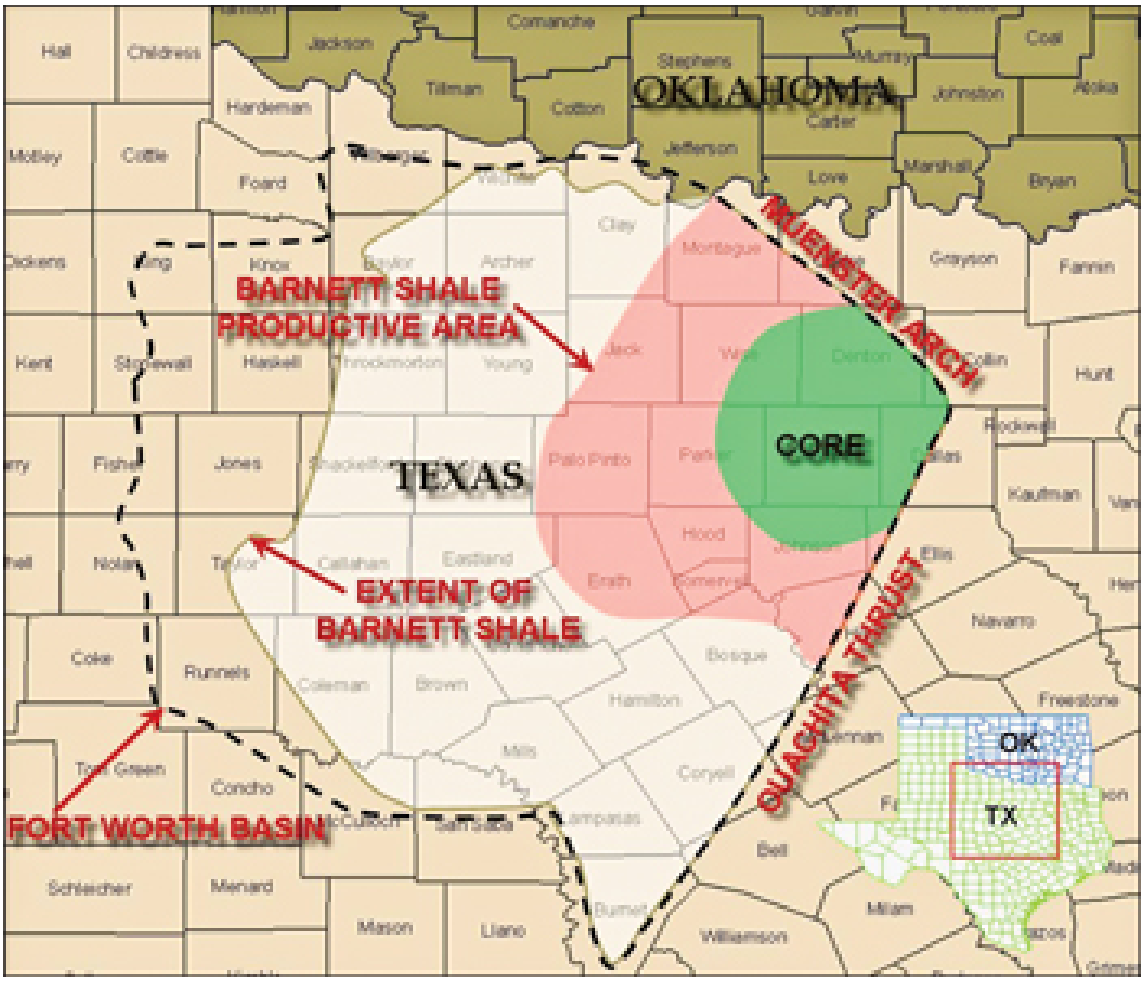
COMMON REGULATORY CONDITIONS PLACED ON DRILLING COMPANIES BY MUNICIPAILITIES:

EXAMPLES OF GAS WELL SETBACK BOUNDARIES

Topic of Concern	Examples of Details
Well setback boundaries	
• Protected use (i.e., residential building) • Min allowable variance	1000’ 300’
• Public building (institution, school or commercial building)	1000’ variance to 500’
• Property line	500’ no variance min
• Building accessory, not necessary for the well operation	100’ no variance min
• Fresh water well	1000’ w/o mineral interest 500’ w/ mineral interest No min variance
• Public road, ROW, rail etc.	500’ no variance min
• Storage tank	500’ no variance min
• tank batteries, compression facilities, other equip	1000’ from residence park, church, public building or school variance to 500’; 300’setback to residential w/ mineral interest
• Floodplain	500’ no min variance
• Existing drill site	1000’
• New construction	500’ variance to 300’

APPENDIX D

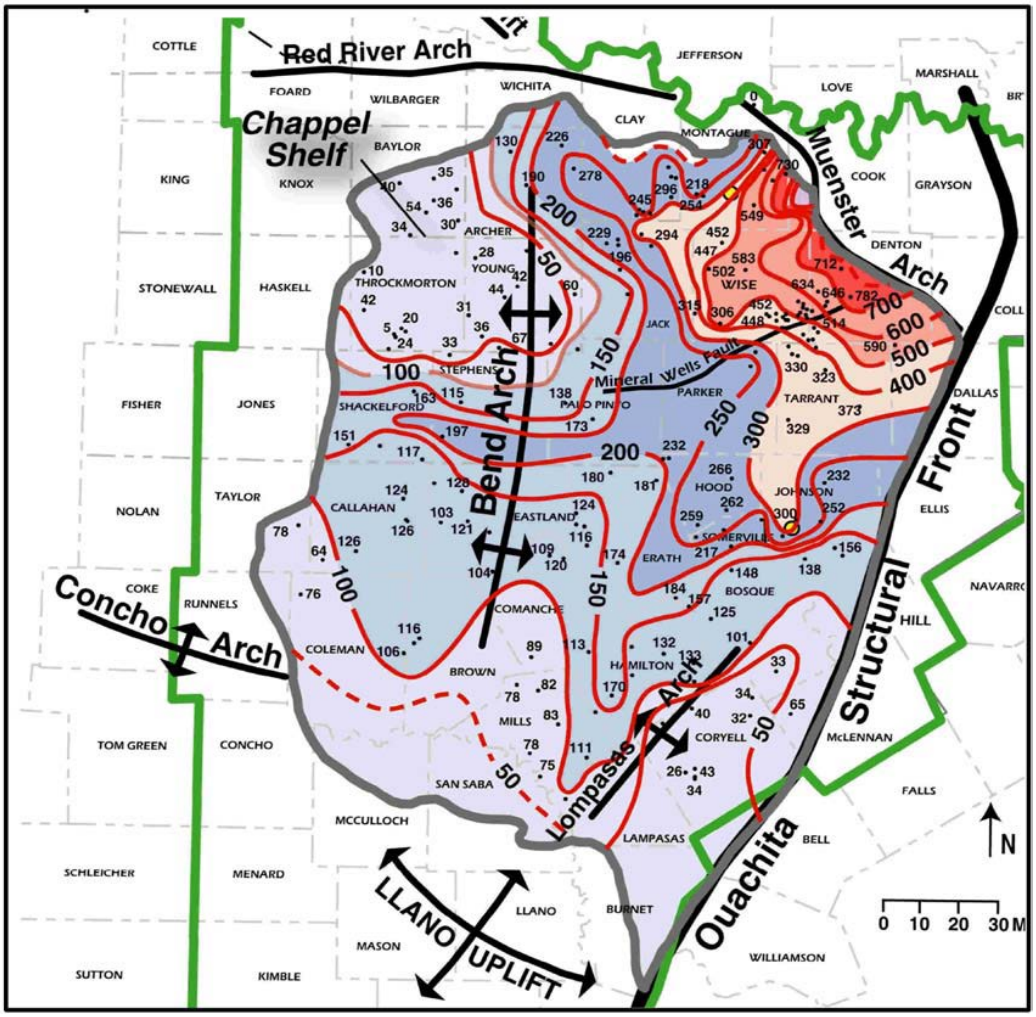
BASIC MAPPING OUTLING DIFFERENCES IN PRODUCTIVE AREAS WITHIN BARNETT SHALE



Note: Image retrieved from: http://www.worldoil.com.

APPENDIX E

BARNETT SHALE GEOLOGICAL THICKNESS



Note: Image retrieved from: www.barnettshalenews.com

APPENDIX F

INTERNAL REVIEW BOARD PACKET

Expedited or Full Board Review Application

For IRB Use Only	
File Number:	
Approval:	

University of North Texas Institutional Review Board
OHRP Federalwide Assurance: FWA00007479

Please use Adobe Acrobat to fill out this form and submit it along with all supplemental documents to the IRB Office as described in the Electronic Submission Checklist on page 7.

If you do not have Adobe Acrobat, please use Adobe Reader to fill out the form. To save your changes, go to "File" in the top tool bar and choose "Save As...PDF." To save future changes, follow the steps above and replace your existing document with the current changes.

For Mac users, right click the web link of the application you would like to open. Click "download linked file." After the file has downloaded, drag the file from your bottom toolbar to your desktop to save. Right click the file and click "Open with" and select Adobe Acrobat Pro.

1. Title of Study (Must be identical to the title of any related internal or external grant proposal)

Drilling down natural gas well permitting policy: Examining the Effects of Institutional Arrangements on Citizen Participation and Policy Outcomes

2. Investigator (or Supervising Investigator for Student Studies)
Must be a full-time UNT faculty member or a full-time UNT staff employee whose job responsibilities include conducting human subjects research. A faculty **Supervising Investigator** is required for all student studies which require IRB review, including theses and dissertations. Student Investigator information is entered in Section 4.

First Name	Last Name	Email Address
Brian	Collins	brian.collins@unt.edu
UNT Department	**UNT Building & Room Number**	**Office Phone Number**
Public Administration	Chilton Hall, 204 C	(940) 565-2318

3. Co-Investigator (if applicable)

First Name	Last Name	Email Address
UNT Department or University		**Title**

4. Student Investigator (if applicable, for student studies such as theses and dissertations)

First Name	Last Name	Email Address
Laurie	Long	laurieclong@verizon.net
UNT Department		**Degree Program**
Public Administration		PhD Public Administration & Management

5. Key Personnel

(List the name of all other Key Personnel (including students) who are responsible for the design, conduct, or reporting of the study (including recruitment or data collection).

NIH or CITI IRB Training

Have you, any Co-Investigator, any Student Investigator, and all Key Personnel completed the required NIH IRB training course ("Protecting Human Research Participants") or the CITI IRB training course ("Human Subjects Research") and electronically submitted a copy of the completion certificate to untirb@unt.edu? YES ☑ NO ☐

If you answered "No," this training is required for all Key Personnel before your study can be approved. The NIH IRB course may be accessed by visiting: http://phrp.nihtraining.com. The CITI IRB course may be accessed by visiting: https://www.citiprogram.org/.

6. Funding Information (if applicable) YES ☐ NO ☑

Has funding been proposed or awarded for this project?

If yes, please submit the statement of work or a project summary and provide the proposal number or project ID number for any external funding or the account number for any internal funding for this project.

7. Purpose of Study

In the space provided, briefly state the purpose of your study in lay language, including the research question(s) you intend to answer. A brief summary of what you write here should be included in the Informed Consent Form.

The purpose of this research is to provide a descriptive analysis explaining how local governments are resolving the land use conflicts pertaining to natural gas drilling, giving specific attention to the policies that are unique to Texas. First, it will provide a descriptive analysis illustrating the underlying theory that institutional arrangements which affect public hearings directly affect the types of publics able to participate in the decision making process. Then, it will address the theoretical question, "Does variation in the rules affecting public hearings (citizen participation) lead to a variation in outcomes such as, the length of gas well setbacks from protected uses (residential buildings)?"

8. Previous Research

In the space provided, summarize previous research leading to the formulation of this study, including any past or current research conducted by the Investigator that leads directly to the formulation of this study (including citations and references.)

As natural gas drilling within urban environments is a relatively new activity within Texas communities, local governments have had to decide how they will balance the growing demand for natural gas drilling operations and the desire to preserve the quality of life within their communities. While municipalities have a variety of institutional arrangements to choose from to the address gas well permitting issue, there is a scarcity of literature that discusses how the different institutional arrangements may impact the public's participation in the decision making process for natural gas well permitting and how in turn the variation in citizen participation may affect outcomes, such as gas well setbacks. However, there is a substantial amount of research outside the oil and gas policy arena that addresses the concepts of citizen participation, public hearings and institutions which may inform us about the potential effects of institutions on citizen participation and the determination of gas well setbacks.

Research on citizen participation produces a complex literature inundated with definitional problems (Kweit & Kweit, 1981; Roberts, 2004; Schachter and Yang, 2012). Broadly defined it may be seen as "any form of involvement in community affairs that has the potential to shape the allocation of public resources or the resolution of public issues" (Sharp, 2012, p. 102). Citizen participation is a longstanding fundamental element of our governmental processes within the United States. The overriding belief is that public participation empowers citizens to influence government actions. From normative sense, enabling people to have a voice in decisions that affect them is considered vital to the functioning of a healthy democracy. (Florino, 1990). From a

9. Recruitment of Participants

Describe the projected number of subjects.

I will conduct at least 10 interviews per city, totaling 40 interviews with local policy elites.

Describe the population from which subjects will be recruited (including gender, racial/ethnic composition, and age range).

The population will consist solely of adults (persons 18 years of age or older). Subjects will include both male and female adults. It is anticipated that the population will be approximately 80% white, based on the reported demographic information.

Describe how you will recruit the subjects.

The subjects will be identified through public records based on their participation as decision makers and participants within natural gas well permitting decision making arenas. I will obtain names and addresses then knock on their doors (or call on the phone if numbers available) and ask them if they will be willing to participate in the interview process.

Have you attached a copy of all recruitment materials including flyers, e-mails, and scripts for classroom announcements?

YES ☑ NO ☐

Page 3 of 7

10. Vulnerable Populations
Please identify any vulnerable populations who will be participants in this study:

- ☐ Children (under 18 years of age)
- ☐ Pregnant Women
- ☐ Prisoners
- ☐ Mentally Impaired or Mentally Retarded

If any boxes are checked, describe any special precautions to be taken in your study due to the inclusion of these populations.

11. Location of Study
Identify all locations where the study will be conducted.
Within the city of Bentbrook, Flower Mound, Kennedale, and Colleyville at the doorstep of the individual property owners' locations and/or on the telephone.

For data collection sites other than UNT, have you attached a signed and dated letter on the cooperating institution's letterhead giving approval for data collection at that site?

YES ☐ NO ☑

12. Informed Consent
Describe the steps for obtaining the subjects' informed consent (by whom, where, when, etc.).
After I introduce my self to the individual, I will present the individual with a brief summary of the purpose of my research on the informed consent form. I will read it aloud and also permit the individual to read it. I will not begin the interview until the individual expresses an understanding of the intent of my visit and provides both oral and written consent form me to conduct the interview. After the consent form is signed, I will provide a copy for the individual and keep the original for my records.

13. Informed Consent Forms
Written Informed Consent Forms to be signed by the subject after IRB approval are required for most research projects with human participants (exceptions include telephone surveys, internet surveys, and other circumstances where the subject is not present; an Informed Consent Notice may be substituted). Templates for creating informed consent forms and notices are located on the IRB website at **http://research.unt.edu/faculty-resources/research-integrity-and-compliance/use-of-humans-in-research. Final drafts of all informed consent documents you plan to use must be submitted before IRB review can begin.**

14. Foreign Languages

Will your study involve the use of any language other than English for Informed Consent forms, data collection instruments, or recruitment materials?

YES ☐ NO ☑

If "Yes," after the IRB has notified you of the approval of the English version of your forms, you must then submit the foreign language versions along with a back-translation for each. Specify **all** foreign languages below:

15. Data Collection

Which methods will you use to collect data?

- ☑ Interviews
- ☐ Surveys
- ☐ Focus Groups
- ☐ Assessment Instruments
- ☐ Internet Surveys
- ☑ Review of Existing Records
- ☐ Observation
- ☐ Other (Please list below)

If "Review of Existing Records" and/or "Observation" are checked above, please describe below the records you plan to review and/or the observations you plan to make for your study.

The records I plan to review will be public access documents that will be made available either by the Internet or formal public record requests. Documents will include natural gas well applications including site plans illustrating the location of the proposed gas wells, and minutes of public hearings.

Will your study involve audio-recording or video-recording the participants?

YES ☐ NO ☑

Have you attached a copy of all data collection instruments, interview scripts, and intervention protocols to be used?

YES ☑ NO ☐

What is the estimated time for a subject's participation in each study activity (including time per session and total number of sessions)?

Only one session is anticipated for each participant. The sessions are estimated to last between 15 and 30 minutes.

16. Compensation

Describe any compensation subjects will receive for participating in the study. Include the timing for payment and any conditions for receipt of such compensation. If extra credit for a course is offered, an alternative non-research activity with equivalent time and effort must also be offered.

No compensation will be provided.

17. Risks and Benefits

Describe any foreseeable risks to subjects presented by the proposed study and the precautions you will take to minimize such risks.

There are no foreseeable risks to the subjects, however, I will maintain their anonymity within the report to minimize the possibility of risks.

Describe the anticipated benefits to subjects or others (including your field of study).

As this study provides information pertaining to citizen participation within formal deliberative institutions at the local level of governance, it will benefit citizens who are interested in participating within local level decision making institutions. It also provides a specific benefit to citizens who live in communities that have the capacity to provide natural gas well sites.

18. Confidentiality

Describe the procedures you will use to maintain the confidentiality of any personally identifiable data.

I will assign a number to personally identifiable data to maintain confidentiality within the data analysis process and will not refer to any personal names within the body of my report. All information containing personal identifiers will be locked in a filing cabinet when not in use. Any files that contain personal identifiers that I discard, will be shredded prior to disposal.

Please specify where your research records will be maintained on the UNT campus, any coding or other steps you will take to separate participants' names/identities from research data, and how long you will retain personally identifiable data in your research records. Federal IRB regulations require that the investigator's research records (including signed Informed Consent Forms) be maintained for at least 3 years following the end of the study.

The records will be maintained in Chilton, 242. All participants names will be removed from the research data and replaced with a numerical reference. Following the end of the study, the records will be maintained for at least three years, in accordance to the Federal IRB regulations.

16. Compensation

Describe any compensation subjects will receive for participating in the study. Include the timing for payment and any conditions for receipt of such compensation. If extra credit for a course is offered, an alternative non-research activity with equivalent time and effort must also be offered.

No compensation will be provided.

17. Risks and Benefits

Describe any foreseeable risks to subjects presented by the proposed study and the precautions you will take to minimize such risks.

There are no foreseeable risks to the subjects; however, I will maintain their anonymity within the report to minimize the possibility of risks.

Describe the anticipated benefits to subjects or others (including your field of study).

As this study provides information pertaining to citizen participation within formal deliberative institutions at the local level of governance, it will benefit citizens who are interested in participating within local level decision making institutions. It also provides a specific benefit to citizens who live in communities that have the capacity to provide natural gas well sites.

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Describe the procedures you will use to maintain the confidentiality of any personally identifiable data.

I will assign a number to personally identifiable data to maintain confidentiality within the data analysis process and will not refer to any personal names within the body of my report. All information containing personal identifiers will be locked in a filing cabinet when not in use. Any files that contain personal identifiers that I discard, will be shredded prior to disposal.

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The records will be maintained in Chilton, 242. All participants names will be removed from the research data and replaced with a numerical reference. Following the end of the study, the records will be maintained for at least three years, in accordance to the Federal IRB regulations.

19. Publication of Results

Please identify all methods in which you may publicly disseminate the results of your study.

- [x] Academic Journal
- [x] Academic conference paper or public poster session
- [x] Book or chapter
- [x] A thesis or dissertation for one of your students
- [x] UNT Scholarly Works Repository
- [ ] Other (Please list below; e.g. Website or blog)

Investigator or Supervising Investigator Certification

- [x] By checking this box and e-mailing this application to the UNT IRB **from my UNT e-mail account**, I am certifying that the information in this application is complete and accurate. I agree that this study will be conducted in accordance with the UNT IRB Guidelines and the study procedures and forms approved by the UNT IRB.

Electronic Submission Checklist

1. Attach all supplementary documents, including:

   a. Copies of all NIH or CITI IRB Training completion certificates not previously submitted to the IRB Office;
   b. A copy of the statement of work or project summary for any internal or external funding for this study;
   c. A copy of all recruitment materials;
   d. A copy of the approval letter from each data collection site (other than UNT);
   e. A copy of all Informed Consent forms or notices; and
   f. A copy of all data collection instruments, interview scripts and intervention protocols.

2. The application and all supplementary documents must be **e-mailed from the Investigator's or Supervising Investigator's UNT e-mail account to** untirb@unt.edu. Please insert **"Expedited or Full Board Review"** in the subject line of your e-mail.

Contact **Sheila Bourns** at Sheila.Bourns@unt.edu for any questions about completion of your application.

Entire entry for Question 8 Previous Research in IRB Application

As natural gas drilling within urban environments is a relatively new activity within Texas communities, local governments have had to decide how they will balance the growing demand for natural gas drilling operations and the desire to preserve the quality of life within their communities. While municipalities have a variety of institutional arrangements to choose from to the address gas well permitting issue, there is a scarcity of literature that discusses how the different institutional arrangements may impact the public's participation in the decision making process for natural gas well permitting and how in turn the variation in citizen participation may affect outcomes, such as gas well setbacks. However, there is a substantial amount of research outside the oil and gas policy arena that addresses the concepts of citizen participation, public hearings and institutions which may inform us about the potential effects of institutions on citizen participation and the determination of gas well setbacks.

Research on citizen participation produces a complex literature inundated with definitional problems (Kweit & Kweit, 1981; Roberts, 2004; Schachter and Yang, 2012). Broadly defined it may be seen as "any form of involvement in community affairs that has the potential to shape the allocation of public resources or the resolution of public issues" (Sharp, 2012, p. 102). Citizen participation is a longstanding fundamental element of our governmental processes within the United States. The overriding belief is that public participation empowers citizens to influence government actions. From normative sense, enabling people to have a voice in decisions that affect them is considered vital to the functioning of a healthy democracy, (Fiorino, 1990). From a substantive sense, citizen involvement can "generate information, understanding, and agreement on problems" (Burby, 2003, p. 35) and ultimately produce better decisions (Richards and Dalbey 2006). Advocates of public participation see great value in citizen involvement from both normative and instrumental perspectives. Scholars suggest public participation assists with fostering citizenship values, enhancing accountability, improving trust in government, achieving better decisions, and building consensus (Barber, 1984; King et al., 1998; Thomas, 1995; Matejczyk , 2001). Conversely, its critics state that public participation can be costly, time-consuming, exacerbate conflicts, disappoint participants and lead to greater distrust (see Roberts, 2008; Delli Carpini et al., 2004; Ryfe, 2005). Consequently, while there may be belief in the normative values, further assessment of the effects of citizen participation is warranted, especially within the context of solving wicked problems such as, the resolution of gas well policy.

How do formal institutions affect citizen participation?

While there is a general understanding of the concept of citizen participation, the concept is extremely broad as it may be formal or informal, direct or indirect and is found at all levels of government. The extreme diversity of the concept creates confusion as to what citizen participation actually looks like in practice and makes it difficult to evaluate and compare empirical findings, because the independent variables may be vastly different (Kweit and Kweit, 1981; Day, 1997). In other words, if we wish to examine how formal citizen participation affects policy making, citizen participation must be clearly defined in order to develop meaningful inferences from the findings. For instance, while voting is a formal act of citizen participation, it is considered indirect to the decision making process and very different from the act of citizens sharing information with decision makers within formal meetings such

as public hearings. Therefore, for the purposes of this research project, the concept of citizen participation is limited to direct citizen participation within formal institutional settings. However, since there are several methods for direct, formal public participation in land-use or environmental decision making ranging from answering public surveys, speaking at public meetings, serving on advisory boards and collaborative decision making bodies (Daley 2008), further narrowing of the concept is necessary. As the public hearing remains the most prevalent mechanism to provide for public input (Baker, Addams and Davis, 2005; Fiorino, 1990), my research will focus on the public hearing process as an entry point for public participation, specifically public hearings at the local level of governance. Within this context, citizen participation may then be identified not just by attendance at public hearings, but by the sharing of information with decision makers, noted by publically speaking at the hearing process or submitting a written comment for consideration .

The majority of existing research on citizen participation stems from democratic theory exploring the determinants and impacts of pluralism on formal democratic institutions (Dryzek, 1990; Williams & Matheny, 1994). Concerning local level participation within formal institutions, many scholars attribute socioeconomic status and mobility as predictors of attendance (McComas, Besley and Trumbo, 2006; Almond and Verba 1989; Rosenstone and Hansen, 1993; Verba, Scholozman, & Brady, 1995) with Verba and colleagues also noting political efficacy as a key factor (i.e., having the education and linguistic ability to communicate effectively and influence decision makers within formal governmental meetings). In general, the research suggests that those with the higher levels of education, relevant political experience and a belief that they can make a difference have the greatest likelihood of participation due to their high levels of capacity. The theoretical problem noted by scholars is that "under most citizen participation processes, only a small portion of the community engages in decision making because of these socioeconomic, linguistic or educational class barriers" (Richards and Dalbey, 200, p. 18). The implications of these findings are that the representative nature of the public meeting is being compromised which may in turn affect the distributive outcomes.

How does citizen participation affect policy outcomes?

One way to conceptualize citizen participation is through interest groups. Assuming interest groups exhibit various levels of participation within formal deliberative institutions, the question of interest becomes how the various levels of citizen participation in turn affect policy outcomes? Much of the existing research addressing the impacts of pluralism essentially mirrors the aforementioned findings as it focuses on environmental and socioeconomic explanations for zoning decisions, suggesting income, education and race are useful predictors of policy outcomes (Pobby, 1980; Neiman & Loveridge, 1981; Navarro & Carson, 1991; Hamilton, 1995; Lewis & Neiman, 2002). However, the importance of citizen participation in urban land-use policy making varies within the literature. Some scholars find that input from neighborhood organizations matters in the decision making process (Altshuler, 1965; Babcock, 1966; Allensworth, 1975; Berry et al., 1993; Matejcyzk, 2001), while others argue that local interest groups have little influence on municipal policy making (Peterson, 1981) or rezoning outcomes (Fleischmann, 1989).

In spite of the long standing interest in citizen participation issues, there is surprisingly little research on how institutional factors affect citizen participation and how variation in citizen participation in turn affects the policy outcomes. The extant research that comes closest to this includes studies that offer a political market framework to explain the choice of land-use practices. The political market framework argues that the structure of local political institutions mediate the interest groups, thereby shaping incentives for public officials resulting in the filtering of growth management preferences and influencing the distributive effects on specific constituencies. In other words, it is the institutional structure that determines which groups will have their preferences met in land-use development patterns. The political market framework is basically an attempt at integrating the property rights model and the interest group model for explaining policy outcomes. The property rights model (Alchian and Demsetz 1973; Libecap 1989) argues that "land-use policy will become more restrictive as land becomes scarce, population increases, and infrastructure becomes strained" (Lubell et al. 2009, p. 649). Interest group models, on the other hand, argue that local elected officials have a greater tendency to adopt policy that matches the preferences of those interests groups (typically developer interests) who are better able to provide political resources that will aid in their re-election, (Logan and Molotch 1987: Molotch 1976; Elkins 1995; Goetz 1994).

Feiock and colleagues (2008) use the political market framework to structure their argument that different institutional arrangements influence policy creation. Their research findings suggested that county government structure (i.e, commission v. commission-administrator) and election rules (i.e., district b. at-large districts) play critical roles in the adoption of local land-use policies. In 2009, Lubell and colleagues conducted a similar study, but this time the structure of local institutions included variations in forms of municipal governments, mayoral powers, council representation (district v. at-large) and charter powers. Results indicate as mayoral power increases, the strong connections with higher socioeconomic status interests yields a greater likelihood for pro-environmental policies, while city managers tend to be driven more consistently by economic development interests yielding a greater likelihood for pro-development policies.

Gaps in the literature

Although scholars have examined some of the factors influencing citizen participation at public hearings it is assumed that all the public has access. Any observed variance in participation is credited to self-selection issues, not necessarily barriers of access. For instance, while socioeconomic status, mobility and political efficacy have been identified as predictors of public participation (McComas, Besley and Trumbo, 2006; Almond and Verba 1989; Rosenstone and Hansen, 1993; Verba, Scholozman, & Brady, 19995) it is still assumed the decision to participate or not is left up to the individual. The literature offers limited discussion on how the institutions themselves may act as barriers of entry, specifically concerning a citizen's ability or inability to participate in formal deliberative decision making arenas. While there are some scholars such as Yang and Callahan (2007) who argue that administrative preferences may act as possible barriers to citizen participation, stating they may ultimately guide the municipality's chosen decision making arenas, the details as to who participates and the rules enabling or inhibiting participation are not discussed.

Addressing the issue of how variation of citizen participation affects policy outcomes, the research again largely recognizes variation in socioeconomic characteristics as determinants of interest group power which in turn affects the motivations of decision makers, thus ultimately influencing outcomes (King, Feltey and Susel, 1998; Kweit and Kweit, 1981; Thomas, 1995; Yang and Pandey, 2011). However, the variation in the types of publics allowed or disallowed to participate in public hearings due to institutional arrangements has largely been ignored. Typically, it is the variation of institutional arrangements affecting the decision making body that is examined (Lubell et al., 2005; Feiock et al., 2008; Lubell et al. 2009), not necessarily the differentiation of the rules that affect the citizens ability or inability to participate in the decision making arena, or how the resulting variation of citizen involvement affects outcomes. Furthermore, the local government research is generally limited to a high level of institutional differentiation within the executive branch (i.e., county form of government defined by county commission vs. commission-administration or elected at-large representation vs. district elected; municipal form of government defined as *mayor-council*, *manager-council* or commission only) and does not drill down to a lower level institutional differentiation. Additionally, the emphasis is placed on the interaction effects between the structure of the executive branch institutions and interest group variables. The rules affecting citizen participation and the various publics who participate, or more importantly who do not participate within public hearings, are essentially "black boxed." This oversight is a severe limitation, because according to Ostrom, "rules affect the actions and outcomes in a particular ecological environment" (2005, p. 3). In other words, the rules (or absence of rules) structuring the decision making arena are important predictors of outcomes, because they determine the actors involved in the decision making arena (action arena) thereby affecting the information that may or may not be made available to the decision makers which ultimately influences their reasoning and decision making outcomes.

Literature contribution

Given our normative belief that citizens should be included in the decision making process for the functioning of a healthy democracy (Fiorino, 1990; Denhardt and Denhardt, 2000), variation in citizen participation at public hearings assumes there may be variation in outcomes. Empirically, however, there are mixed results regarding the importance of citizen participation on land-use policy (Burby, 2003; Richards and Dalbey 2006; Delli Carpini et al., 2004; Ryfe, 2005), warranting further research on the matter. Although existing research is developing an understanding of the mediating role of local political institutions on the provision of local land-use policies, the institutions pertaining to citizen participation are essentially "black-boxed." This research aims to open up the "box" and take a closer look at what's inside.

Working within the highly complex and relatively unexplored arena of natural gas policy, analysis will begin with the identification of specific entry rules that may enable or inhibit public participation in the natural gas permitting process. Research will examine two theoretical premises: (1) entry rules affect a citizen's ability to participate in public hearings and (2) variance in the publics participating within the decision making process affect policy outcomes. In other words, this research will provide new insight as to how institutions filter the actors involved in the decision making, thus affecting the outcomes of the decision making process.

APPENDIX G

PROTOCOL FOR DATA COLLECTION

DRILLING DOWN NATURAL GAS WELL POLICY:
EXAMINING THE EFFECTS OF INSTITUTIONAL ARRANGEMENTS ON
CITIZEN PARTICIPAITON AND POLICY OUTOOMES

Principal Investigator: Laurie Long
Supervising Investigator: Dr. Brian Collins
Institution: University of North Texas

PROTOCOL FOR THE COLLECTION OF DATA FROM HUMAN PARTICIPANTS

Study population: The participants in the study will consist mainly of public officials from each of the four cities identified for the comparative case studies (Flower Mound, Benbrook, Colleyville and Kennedale). One person from each of the five identified categories for public officials (a city manager, city lawyer, mayor, council member and board of adjustments/appeals member) will be included, totaling 20 officials. An additional four subjects, one drilling operator from each city, will also be included in the study. Finally, an additional two subjects will be accounted for because of the snowball sampling technique that will be used, generating a projected total of 26 subjects participating in this study.

Recruitment of study participants: The public officials will be recruited by email and/or phone contacts as identified by their city websites and public records. The drilling operator contacts will also be recruited via email and/or phone. The operator contact information will be obtained within the public records of each city's gas well drilling permit applications. The order of recruitment for city officials will first begin with the city manager as he/she helps to identify the appropriate points of contact for city council member and board of adjustment/appeals member. Once appropriate contacts have been identified by the city manager (as noted in the interview script), the remaining order of interviews will be guided by the available schedules of each participant.

Location of Study and Data Collection: The case study locations include the North Texas cities of Flower Mound, Colleyville, Benbrook and Kennedale. Information obtained from archival data will include public access materials. The records will include documents and information pertaining to oil and gas drilling that are made readily via the internet, such as information gathered from federal, state and city websites. Additionally, any specific oil and gas drilling documents for each city that cannot be obtained via the internet will be obtained through formal public information requests. The documents of interest include completed natural gas drilling permit applications (including site plans and survey documents), natural gas well permitting decisions, minutes of public hearings related to the permitting of gas wells, and Railroad Commission of Texas drilling permits.

The identified interview subjects within this study will be given an opportunity to participate in either a phone interview or a face-to-face interview. Anyone wishing to participate in a face-to-face interview will be given the opportunity to do so. These face-to-face interviews will be scheduled within the public access meeting rooms of each respective city for the convenience of the participant's involved. The scheduling of the rooms will follow the standard operating procedures for each city. A signed and dated letter of cooperation on the official cooperating institution's letterhead is not necessary, as the public meeting rooms are already made available for public use.

Provision of Informed Consent: Prior to the start of the interviews, each subject will be provided either an informed consent notice or form (documents included as attachments to IRB application). Persons being interviewed over the phone will be emailed an informed consent notice that they will read (or will have been read to) and may print for their records. The interview will only proceed once the participant has verbally stated he/she has understood the information within the notice and has agreed to be a participant in the study. Persons agreeing to participate in the face-to-face interviews will be handed an informed consent form prior to the start of the interview process. Once the form has been signed indicating the person has read and understood the information contained in the form, the interview process may proceed. A signed copy of the form will be provided to the participant.

Data Collection Instruments/Scripts: The script for recruiting the study participants is included as an attachment to the IRB application. When contacting potential interviews either by email or phone, the person making the contact will follow the attached script. Whether or not subjects choose to participate in the phone interview or face-to-face interview, the duration for completion of the interview is estimated to be between 30-45 minutes. Only one session is anticipated as there are a limited number of questions and clarification of responses may be provided for immediately. The specific questions for city officials and drilling operators are provided as attachments to the IRB application and will act as scripts for the person conducting the interview.

It is critical that all IRB standards are followed; therefore, in accordance to the standards, the notice of informed consent must precede the initiation of the interview. While consent may be provided orally prior to phone interviews, following the reading of the informed consent notice; a signed and dated copy of an informed consent form must be obtained from the subjects of face-to-face interviews, following the reading of the form. Both the informed consent form and the informed consent notice are attachments to the IRB application.

Data Storage:

Although there are no foreseeable risks to the human subjects presented by the proposed study, precautionary measures will be conducted to ensure the confidentiality of the individuals participating in the study. For instance, the names of each participant will remain confidential and references will only be made by their title or aggregated grouping within any published reports, unless the subject specifically states their personal name may be referenced along with their title. Additionally, any hard copies of collected data that cannot be obtained via the internet or public information requests will be transferred into an electronic form (digitized) as soon as possible for ease of storage and security purposes; this includes paper documents and audio tapes from interviews.

The electronically stored files will be maintained within the University of North Texas' computer communications system, such that only the student researcher and her dissertation committee will have password access to the files. The participant's names will be removed from the research data and in accordance to federal IRB regulation, the research records (including signed Consent Forms) will be maintained for at least three years following the end of the study, when at such time under the approval of the supervising professor or department chair, the original data will be destroyed.

APPENDIX H

RECRUITMENT MATERIALS

DRILLING DOWN NATURAL GAS WELL POLICY:
EXAMINING THE EFFECTS OF INSTITUTIONAL ARRANGEMENTS
ON CITIZEN PARTICIPAITON AND POLICY OUTOOMES

Principal Investigator: Laurie Long
Supervising Investigator: Dr. Brian Collins
Institution: University of North Texas

RECRUITMENT EMAIL/PHONE INQUIRY SCRIPT

Dear (Name/Title of City Official or Drilling Operator)

Hello. My name is Laurie Long. I am a student with the University of North Texas, conducting research under the supervision of Dr. Brian Collins. The purpose of this research project is to gain a better understanding of natural gas well drilling process and how the differing institutional arrangements adopted at the local level affect outcomes such as, the setback distances of gas wells from protected uses.

I am currently in the process of scheduling interviews with public officials and drilling operators working in the North Texas area. You are being invited to participate in an interview for this research study, because (name of organization) has been identified for having natural gas well activity in the Newark East Field of the Barnett Shale. You have been specifically selected to participate in this interview because of your knowledge of, and experience with, the local level governance issues associated with natural gas drilling.

The interview process should only take 30-45 minutes. We can conduct the interview over the phone, or schedule a face-to-face interview at one of (city's name) public meeting rooms. There are no foreseeable risks associated with participating in the interview process. However, as a standard precautionary procedure, you are being provided an informed consent notice to review prior to the start of the interview process (see attached). While you will be provided no monetary compensation for participating in this project, public managers, policy makers, drilling operators and other persons interested in natural gas well drilling policy will benefit from the new information gained from this research.

Participation in the study is completely voluntary. If you decide to participate, you may contact me to schedule an interview (or during phone contacts – If you decide to participate, we can schedule an interview at this time.) If a phone interview is scheduled, you may print the attached informed consent notice for your records. When an in-person interview is scheduled, I will provide you a copy of the signed consent form. While your name will not be reported in any published documents without your expressed consent, your title may be referenced. The research records will be kept as confidential as possible under current local, state and federal law. However, the Office for Human Research Protection, possibly other federal regulatory agencies, and Institutional Review Board may examine the records.

If at any time during the interview process you no longer wish to participate, you may withdraw without any consequence. If you have any questions regarding this research project, I may be contacted at (940) 565-2165 or you may contact my supervising processor, Dr. Brian Collins at (940) 565-2318. If you have any questions about your rights as a research subject, please contact the UNT Health Science Center Institutional Review Board at (817) 735-0409.

Thank you for considering being an interview participant in this study.

(The closure below is to be used for emailed recruitments, not necessary for telephone contacts)

Sincerely,

Laurie Long
PhD Student
Department of Public Administration
University of North Texas

APPENDIX I

INFORMED CONSENT FORM

University of North Texas Institutional Review Board

Informed Consent Form for Face-to-Face Interviews

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted.

Title of Study: Drilling down natural gas well policy: Examining the effects of institutional arrangements on citizen participation and policy outcomes.

Student Investigator: Laurie Long, University of North Texas (UNT) Department of Public Administration.

Supervising Investigator: Dr. Brian Collins, University of North Texas Department of Public Administration.

Purpose of the Study: You are being asked to participate in this research study which involves the examination of state and local level legislative and regulatory matters pertaining to natural gas well drilling operations. The focus of the study will be to investigate natural gas well permitting policy at the local level of implementation. Your organization or agency has been identified for its involvement in local level natural gas well policy making and implementation processes. You have been specifically selected to participate in this interview because of your knowledge of your organization's activities. You may have also been an active participant in one or more of the phases of decision making for the permitting of gas wells within an urban environment. We will be gathering information about the natural gas well permitting process from approximately 26 participants comprised of public officials and drilling operators within the North Texas area.

The purpose of this research is to gain a better understanding of how the various natural gas drilling permit processes adopted by municipalities affect outcomes such as, the approved setback distances of gas wells from protected uses.

Study Procedures: You will be asked to participate in a brief interview. It is anticipated that the interview will last between 30-45 minutes. If you provide permission to do so, the interview will be digitally recorded and transcribed.

Foreseeable Risks: No foreseeable risks are involved in this study.

Benefits to the Subjects or Others: The research will provide an overview of existing rules and regulations pertaining to urban gas well drilling, emphasizing the variation in institutional arrangements adopted by municipalities. It is anticipated that the analysis will demonstrate how variation in rules affecting access to public hearings lead to variation in outcomes, such as

the length of gas well setbacks from protected uses (residential buildings). Gaining a better understanding of how rules affect actors and outcomes of decision making will benefit public managers, policy makers, drilling operators, academics and anyone interested in the permitting process for natural gas wells. Finally, the structured theoretical framework used within this research may be adopted for further analysis of oil and gas policy.

Procedures for Maintaining Confidentiality of Research Records: While the names of individual participants will not be disclosed, total anonymity is not possible, because position titles may be referenced within publications and presentations regarding this study. However, confidentiality of your personal information will be strictly maintained. Any personal identifying information will be coded and stored in a separate location from the main data storage. The collected data will be encrypted and will be stored electronically in password protected files of University maintained servers for a period of three years at the University of North Texas. Data may be shared with authorized researchers for other research purposes with the approval of the study's supervising investigator.

Questions about the Study: If you have any questions about the study, you may contact Laurie Long at (940) 565-2165 or Brian Collins at (940) 565-2318.

Review for the Protection of Participants: This research study has been reviewed and approved by the University of North Texas Institutional Review Boards (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Research Participants' Rights: Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- Laurie Long, has explained the study to you and answered all of your questions. You have been told the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to take part in this study, and your refusal to participate or your decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as a research participant and you voluntarily consent to participate in this study.
- You have been told you will receive a copy of this form.

_____
Printed Name of Participant

_____ _____
Signature of Participant Date

For the Student Investigator or Designee: I certify that I have reviewed the contents of this form with the subject signing above. I have explained the possible benefits and the potential risks and/or discomforts of the study. It is my opinion that the participant understood the explanation.

_____ _____
Signature of Student Investigator or Designee Date

APPENDIX J

INFORMED CONSENT NOTICE

University of North Texas Institutional Review Board

Informed Consent Notice for Phone Interviews

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted.

Title of Study: Drilling down natural gas well policy: Examining the effects of institutional arrangements on citizen participation and policy outcomes.

Student Investigator: Laurie Long, University of North Texas (UNT) Department of Public Administration.

Supervising Investigator: Dr. Brian Collins, University of North Texas Department of Public Administration.

Purpose of the Study: You are being asked to participate in this research study which involves the examination of state and local level legislative and regulatory matters pertaining to natural gas well drilling operations. The focus of the study will be to investigate natural gas well permitting policy at the local level of implementation. Your organization or agency has been identified for its involvement in local level natural gas well policy making and implementation processes. You have been specifically selected to participate in this interview because of your knowledge of your organization's activities. You may have also been an active participant in one or more of the phases of decision making for the permitting of gas wells within an urban environment. We will be gathering information about the natural gas well permitting process from approximately 26 participants comprised of public officials and drilling operators within the North Texas area.

The purpose of this research is to gain a better understanding of how the various natural gas drilling permit processes adopted by municipalities affect outcomes such as, the approved setback distances of gas wells from protected uses.

Study Procedures: You will be asked to participate in a brief interview. It is anticipated that the interview will last between 30-45 minutes. If you provide permission to do so, the interview will be digitally recorded and transcribed.

Foreseeable Risks: No foreseeable risks are involved in this study.

Benefits to the Subjects or Others: The research will provide an overview of existing rules and regulations pertaining to urban gas well drilling, emphasizing the variation in institutional arrangements adopted by municipalities. It is anticipated that the analysis will demonstrate how variation in rules affecting access to public hearings lead to variation in outcomes, such as

the length of gas well setbacks from protected uses (residential buildings). Gaining a better understanding of how rules affect actors and outcomes of decision making will benefit public managers, policy makers, drilling operators, academics and anyone interested in the permitting process for natural gas wells. Finally, the structured theoretical framework used within this research may be adopted for further analysis of oil and gas policy.

Compensation for Participants: None.

Procedures for Maintaining Confidentiality of Research Records: While the names of individual participants will not be disclosed, total anonymity is not possible, because position titles may be referenced within publications and presentations regarding this study. However, confidentiality of your personal information will be strictly maintained. Any personal identifying information will be coded and stored in a separate location from the main data storage. The collected data will be encrypted and will be stored electronically in password protected files of University maintained servers for a period of three years at the University of North Texas. Data may be shared with authorized researchers for other research purposes with the approval of the study's supervising investigator.

Questions about the Study: If you have any questions about the study, you may contact Laurie Long at (940) 565-2165 or Brian Collins at (940) 565-2318.

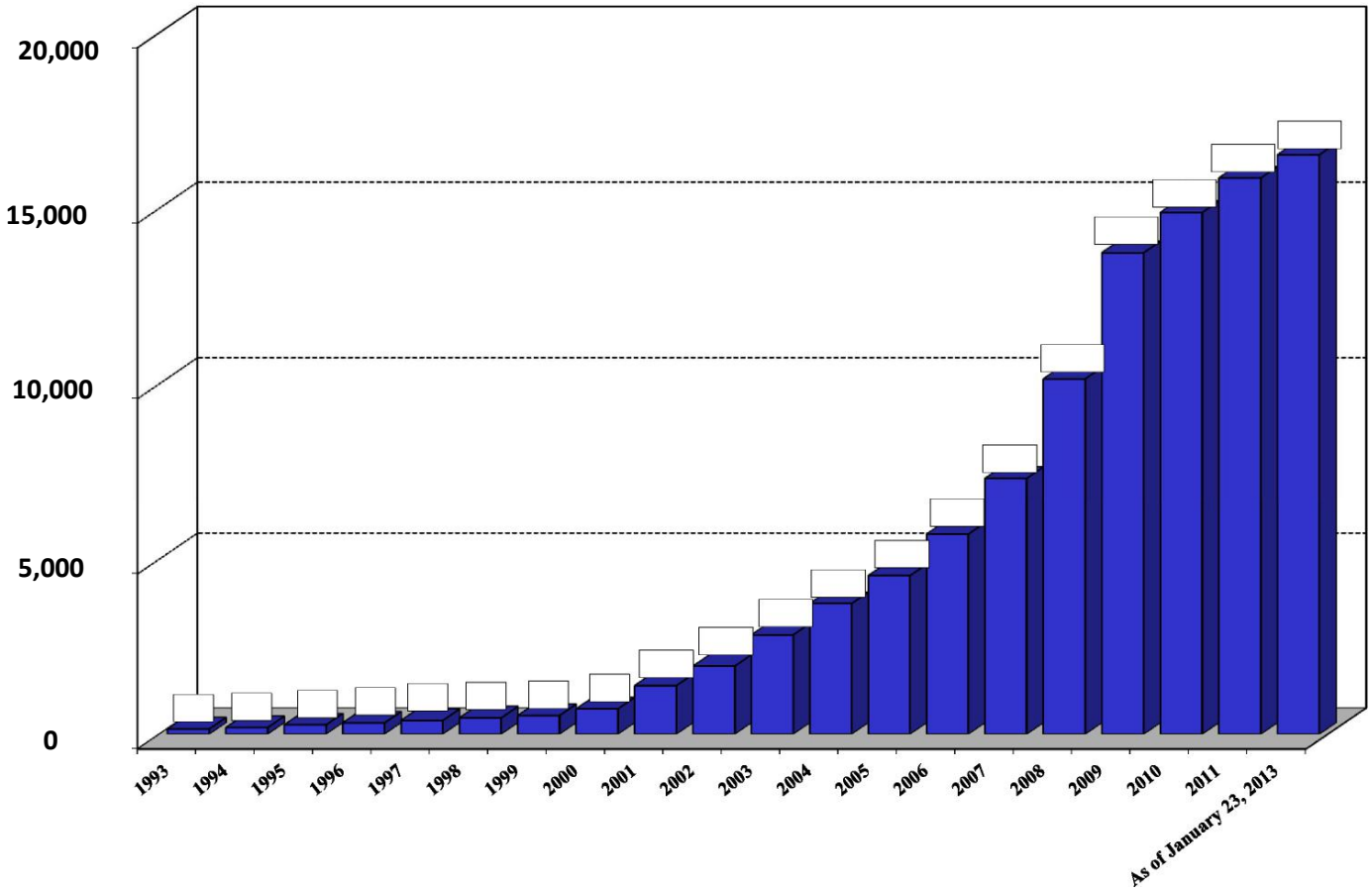
Review for the Protection of Participants: This research study has been reviewed and approved by the University of North Texas Institutional Review Boards (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Research Participants' Rights: Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- Laurie Long, has explained the study to you and answered all of your questions. You have been told the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to take part in this study, and your refusal to participate or your decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as a research participant and you voluntarily consent to participate in this study.
    - You understand you may print a copy of this form for your records.

APPENDIX K

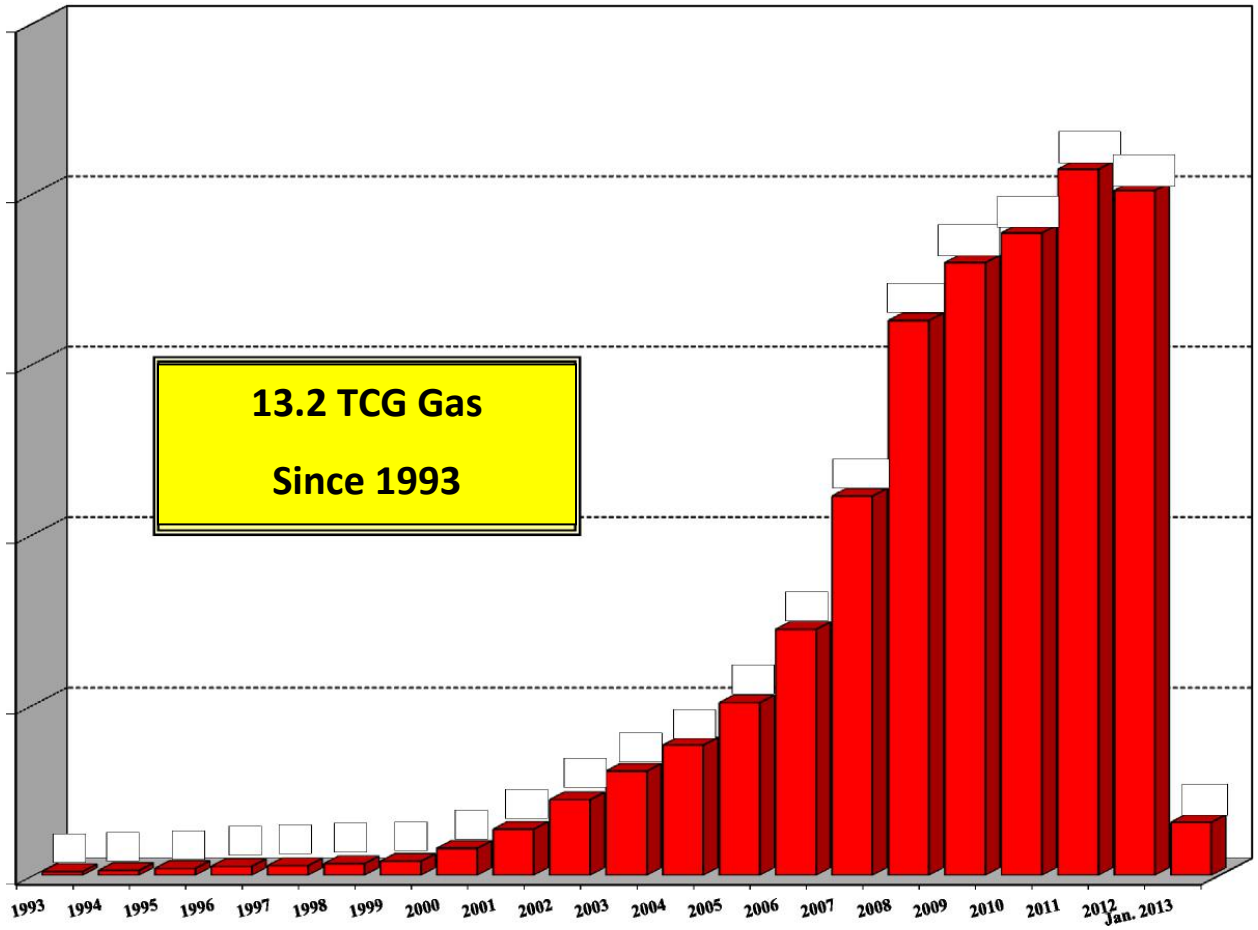
NEWARK EAST (BARNETT SHALE) WELL COUNT 1993- 1/23/2013



Source: Texas Railroad Commission Production Data Query System 3/22/2013

APPENDIX L

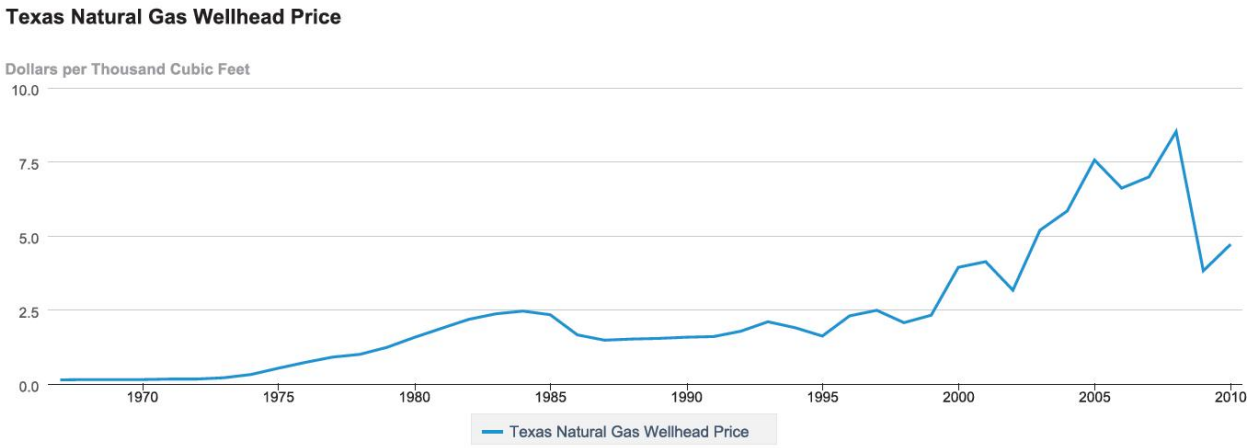
NEWARK EAST (BARNETT SHALE) WELL PRODUCTIVITY 1993-2012



Source: Texas Railroad Commission Production Data Query System 3/22/2013

APPENDIX M

NATURAL GAS WELL HEAD PRICES 1970-2010



Source: U.S. Energy Information Administration

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