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Economic, Market
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September 30, 2011

Sent via e-mail: _____

Dear Client:

Thank you for the opportunity to talk with you about the hog facility, more commonly known as a concentrated animal operation (CAO) which has been developed near your home. As I understand it, you have asked me to comment on the likely impacts on the value of nearby real estate stemming from the development of this enterprise.

I also understand that this letter may be presented to local officials, the media, attorneys, and members of the general public. As such, it is important that I note two things at the onset – to aid these potential readers in understanding who I am, why I have been asked to write this, and what the limitations on this opinion are. First, although I am an Illinois State Certified (General) Real Estate Appraiser, this memorandum does not constitute an appraisal *per se* as normally defined by the Uniform Standards of Professional Appraisal Practice or, as I understand it, Illinois state law and regulation. It is simply a summary of my professional experience and training on matters such as this. However, given the breadth and depth of that experience, it is safe to say that the matters on which I opine in this letter represent those which an appraiser in Illinois, or any appraiser anywhere for that matter, would be well advised to consider when conducting an actual appraisal of a home or other property impacted by a CAO. I would also note that I've reviewed a recent appraisal of your home (dated 3/11/09, by Roger Jacobson, SRA). I have incorporated a "review" of this appraisal into this document, consistent with the Uniform Standards of Professional Appraisal Practice.

So, why is an appraiser from Seattle opining about Illinois real estate? Greenfield Advisors consults on projects throughout the U.S. and, occasionally, the rest of the world. We are best known for appraising properties which negative environmental impacts – and CAO's fall into that category. We also do many other things, and our Illinois clients in recent years have included the University of Chicago endowment (advising on the value of real estate holdings) and the Friends of the Chicago Art Museum (advising on "trophy" real estate acquisitions) as well as individual property owners and government entities impacted by contamination problems. We are frequently engaged in very complex, high-profile litigation matters – the Gulf Oil Spill, the Exxon Valdez Oil Spill, the Celebrity Cruise Lines Legionnaires' Disease case, post-Hurricane Katrina class actions, Chinese Drywall cases, and others. For example, I was the sole testifying expert for the impacted property owners in *Allison versus Exxon*, in which just last week a jury in Baltimore awarded 154 property owners \$1.5 Billion in damages resulting from environmental impacts. (A complete copy of my professional qualifications is attached to this letter).

More specifically, I wrote an article for *The Appraisal Journal* in 2001 titled "Concentrated Animal Feeding Operations and Proximate Property Values". This journal is published by the Appraisal Institute, and is widely read and often relied upon by practicing appraisers. This article is presented by the National Association of Realtors on their website, realtor.com, as authoritative guidance for real estate agents when transacting properties impacted by CAO's (they call hem "feedlots" on their website, a

generic term which is fully synonymous with CAO in this context.)¹ I understand that in the ensuing ten years, this article has gained a significant following as one of the more authoritative sources for appraisal guidance on the impact of concentrated animal operations (CAO) and is widely cited by appraisers in their work in this arena.

Since 2001, I have consulted on several projects, particularly litigation projects, in which a CAO was impacting surrounding property values. I've summarized those as follows. What do we know about the impacts of CAOs on surrounding property values? In short, it is clear from the broad array of empirical studies and case studies that diminished marketability, loss of use and enjoyment, and loss of exclusivity results in a diminishment which can range from 50% to nearly 90% of otherwise unimpaired value for homes which are adjacent to the facility. Negative impacts are noted at distances exceeding 3 miles, and in the case of a flood or other weather event, waste from the facility can be spread over far greater areas.

Overview Of The CAO Literature

Concentrated Animal Operations (CAOs) and Concentrated Animal Feeding Operations (CAFOs) are one in the same thing. They are often called "feedlots". They may include facilities in which animals are raised or facilities in which animals are brought for slaughter. The common denominator is a large perpetual inventory and density of animals². CAOs and CAFOs are a relatively new phenomenon. The genesis of the CAO is generally credited to Smithfield Slaughterhouses in North Carolina in the late 1980's. Large numbers of genetically enhanced hogs were kept in pens and dosed with antibiotics, then fed growth enhancers. Waste run-off was discharged onto adjacent landscapes and waterways³.

Recent data from the USDA and the EPA estimate that livestock in the U.S. produce 130 times the total amount of manure as the entire human population of the country. One hog excretes nearly 3 gallons of waste per day, or 2.5 times the average human's daily total. A 3,000-sow hog factory will produce about 25 tons of raw manure a day⁴.

Spills from CAOs have killed fish in several states; phosphorus in land and water have been correlated with livestock density; and manure has caused eutrophication and degradation of U.S. waterways⁵. CAOs are generally recognized to impact the surrounding environment in several key ways: air quality and odors (ammonia, hydrogen sulfide, methane, and particulate matter), greenhouse gas and climate change, insect vectors (often carrying resistant strains of pathogens), groundwater and surface water contamination, and a variety of pathogens⁶.

For example, On Sept. 15, 2006, the FDA issued a press release informing consumers of an outbreak of E. coli O157:H7 that began between Aug. 26 and Sept. 12, and was associated with the consumption of

¹ <http://www.realtor.org/library/library/fg508>

² Quite a few documents were reviewed to develop this section – see subsequent footnotes for details. However, much of the nomenclature comes from Kershen, Drew L. and Chuck Barlow, "Concentrated Animal Feeding Operations and Water, Air, Land, and Welfare", a report on the ABA's Special Committee on Agricultural Management Roundtable II on Environmental Challenges in Animal Feeding Operations, dated September 23, 1999. Mr. Kershen is a professor of law at the University of Oklahoma, and Mr. Barlow is an adjunct professor of law at Mississippi College. The two professors co-chaired the ABA's roundtable, which is the subject of their report.

³ Dines, R.E., D. Henderson, and L. Rock, "The Case Against Intensive Hog Operations", unpublished working paper.

⁴ Hopey, Don, "Study Finds Large Hog Farms Lower Property Values", Post Gazette, 6/7/2003.

⁵ Jann, Stephen, "Recent Developments in Water Pollution Control Strategies and Regulations", a talk presented at the ABA's Special Committee on Agricultural Management Roundtable II on Environmental Challenges in Animal Feeding Operations, Minneapolis, MN, May 12, 1999.

⁶ Hribar, Carrie, Understanding Concentrated Animal Feeding Operations and Their Impact on Communities, National Association of Local Boards of Health, 2010

fresh spinach. As of Oct. 10, there have been 199 reported cases of infection related to this outbreak in 26 states including 31 case of Hemolytic Uremic Syndrome, 102 hospitalizations and 3 deaths. Since the notification of the public, there have been national recalls of fresh-bagged spinach for products either bagged by or purchased from Natural Selection Foods, LLC of San Juan Batista, CA. The spinach, sold by Natural Selection Foods, implicated in the outbreak was grown in the Salinas Valley region of California, which is located 100 miles south of San Francisco Bay Area.⁷

The FDA released a guide to minimizing Microbial Hazards in 1998, and lists potential sources of this type of contamination including: agricultural water, wild or domestic animals, worker hygiene, production environment (use of manure, previous or adjacent land use), and sanitation of facilities and equipment.⁸ A L.A. Times article concerning the outbreak states that while growers do not draw water from the local surface water source for agriculture use because they are known to be contaminated from concentrated livestock operations. The Centers for Disease Control, the California Department of Health Services, and the FDA finally traced the source of the contamination to cattle feces⁹.

One of the leading causes of food and waterborne illness in the United States is this E. coli O157:H7 organism. The E. coli O157:H7 is a specific strain of the Escherichia Coli bacteria, and can commonly be found in the intestines of healthy cattle. One of the common means of transfer to humans is when untreated manure is able to enter water sources or used for fertilization.¹⁰ CAOs are regarded as potential sources for contamination because of the large amounts of manure that they produce, and the proximity in which the animals are confined allows for disease to be easily transferred.¹¹ The reduction in space that the animals inhabit requires that the facility must collect and process the waste instead of letting it lay where it falls.¹² It was because of their potential to spill that EPA acting under the Clean Water Act designated CAOs as point sources of pollution requiring that they have zero discharge, or apply for a permit which requires an extensive Waste Management Plan. Even with these regulations spillage will typically occur when manure storage locations are allowed to spill due to flooding, leeching into the soil, or through disregard of regulations. The EPA's data from the 2000 Inventory lists agriculture as the fifth leading contributor to general water quality impairments. The data did not explicitly review contamination because of AFO/CAOs, water quality concerns were greatest in regions that were intensively cultivated and where livestock operations were concentrated.¹³

Because the trend toward CAOs has been so rapid and pronounced in the US, federal and state laws are generally considered to have some gaps. In addition to water quality issues resulting from manure and waste run-off, these facilities attract flies and other insects and then other pests which parasitize the insects¹⁴.

⁷ "FDA Announces Findings from Investigation of Foodborne E. coli O157:H7 Outbreak in Spinach U.S. Food & Drug Administration. 2 Oct. 2006 <<http://www.fda.gov/bbs/topics/NEWS/2006/NEW01474.html>>.

⁸ "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables." U.S. Food & Drug Administration 28 Sept. 2006 <<http://www.cfsan.fda.gov/~dms/prodguid.html>>

⁹ "Tainted spinach tied to cattle ranch," Los Angeles times, March 24, 2007

¹⁰ "Disease Listing, Escherichia Coli O157:H7, Gen Info" Center for Disease Control & Prevention 2 Oct. 2006 <http://www.cdc.gov/ncidod/dbmd/diseaseinfo/escherichiacoli_g.htm>

¹¹ "National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal feeding Operations (CAFOs); Final Rule" Federal Register 68 (12 February 2003)

¹² Ikerd, John "Social, Economic, and Cultural Impacts of Large-Scale, Confinement Animal Feeding Operations." Working Paper, University of Missouri (Viewed Oct. 2, 2006)

¹³ "National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitation Guidelines and Standards for Concentrated Animal feeding Operations (CAFOs); Final Rule" Federal Register 68 (12 February 2003)

¹⁴ "Concentrated Animal Feeding Operations – Resources for Environmental Responsibility", working paper prepared by Smith-Comeskey Ground Water Sciences, April 1, 2000. See <http://www.groundwatersystems.com/agwaste.html> for more details.

Prof. John Ikerd, an agricultural economist with the U. of Missouri, Columbia, sums up the problems quite succinctly in a recent working paper, when he says, “Piling up too much ‘stuff’ in one place causes problems.” Writing specifically about swine CAOs, he goes on to comment, “If you spread out the hogs and let hog manure lay where it falls in a pasture, it doesn’t bother anyone very much. But if you start collecting it, flushing it, spreading and spraying it around – all normal practices in confinement hog operations – it becomes air pollution.”¹⁵

According to reports, the principle odor constituents of hog manure are hydrogen sulfide and ammonia, and methane is also a major constituent. The most noticeable sign of hydrogen sulfide is a “rotten egg smell”, similar to what is produced by paper mills. It is generally regulated in industrial operations due to known toxicity. It is colorless and denser than air, and thus tends to collect in low-lying areas rather than dissipate in the atmosphere. It can be noticed at concentrations as low as 1.1 parts per billion (ppb). It is toxic at concentrations below that which has been measured near liquefied hog manure, and is both an irritant and an asphyxiate. Exposure to levels as low as 5 parts per million (ppm) has been reportedly linked to accelerated neurobehavioral function deterioration. Even at higher concentrations of 100 – 400 ppm, it reportedly produces rhinitis, cough, dyspnea, tracheobronchitis, and possibly pulmonary edema. According to recent Canadian studies, health effects have been reported by residents who live within five kilometers (three miles) of CAOs¹⁶.

As a result of the noxious and obvious problems associated with CAOs, many states have enacted severe restrictions on permitting. For example, in 1997 the legislature of typically livestock-friendly Oklahoma mandated setbacks and other pollution controls, and in 1998 that legislature enacted a moratorium on new livestock permits¹⁷. Kansas is another typically agriculture-friendly state which has recently enacted a moratorium on CAOs and is considering legislation to end CAOs¹⁸. In 1998, the North Carolina legislature – the home of CAOs and faced with unregulated establishment of CAOs in that state -- enacted House Bill 1480, which mandated the registration of growers for integrators, extended a moratorium, and mandated substantial elimination of both atmospheric emission of ammonia as well as odor beyond the boundary of existing CAOs¹⁹. Minnesota had enacted similar odor control legislation in 1997, and established both a complaint control protocol and an enforcement response protocol specific to CAOs²⁰.

In 2000 – 2001, the U.S. Environmental Protection Agency began levying fines against concentrated beef production facilities in the Northwestern U.S. which met two criteria: the facility confined animals for at least 45 non-consecutive days per year and the confinement area was devoid of vegetation. The rules

¹⁵ Ikerd, John, “Social, Economic, and Cultural Impacts of Large-scale, Confinement Animal Feeding Operations”, U. of Missouri unpublished working paper.

¹⁶ Dines, op. cit., also University of Iowa CAFO Guide, September, 2002; also Industrial Swine Operations and Community Health Effects, Eastern Ontario Health Unit, October 27, 2003.

¹⁷ Stephens, Michelle, “NGO and Grassroots Perspectives and Action”, a talk presented at the ABA’s Special Committee on Agricultural Management Roundtable II on Environmental Challenges in Animal Feeding Operations, Minneapolis, MN, May 12, 1999.

¹⁸ Myers, Roger, “Graves May Lift Licensing Ban on Large-Scale Hog Farming”, The Topeka Kansas Journal, Saturday, January 24, 1998.

¹⁹ Williams, C. Mike, “CAFO Odor Control Options”, North Carolina State University unpublished working paper presented at the ABA’s Special Committee on Agricultural Management Roundtable II on Environmental Challenges in Animal Feeding Operations, dated September 23, 1999.

²⁰ Sullivan, Mike, “Minnesota’s Program Regarding Hydrogen Sulfide Emissions from CAFOs”, Minnesota Pollution Control Agency unpublished working paper presented at the ABA’s Special Committee on Agricultural Management Roundtable II on Environmental Challenges in Animal Feeding Operations, dated September 23, 1999.

generally applied to any operation with 300 head of cattle or more. At the time of the regulations, the EPA estimated that this would affect between 26,000 and 39,000 CAOs in the U.S.²¹.

A CAO impacts the value of proximate properties in two ways. First, the CAO is viewed by market participants as a negative externality²². As an externality, it is not typically considered to be economically “curable” under generally accepted appraisal theory and practice^{23,24}. Hence, the value diminution of a property attributable to proximate location of a CAO can be attributed to stigma.

Second, as Gomez and Zhang (2000) have substantiated, CAOs have a substantial indirect negative impact on surrounding communities, which would include property values in those communities, via shifts in sources of purchases and other inputs in the factors of production. Gomez and Zhang studied 1106 rural communities and concluded that economic growth rates in communities with conventional farming were 55% higher than in those with CAOs. They note that conventional farmers buy most or all of their supplies locally, thus stimulating the local community and, by extension, stimulating the local real estate market. On the other hand, CAOs bypass local retailers and import the factors of production. CAOs exacerbate the economic negative impact by “importing” large quantities of pollution and the attendant costs. Hence, local communities suffer the negative economic byproducts without the attendant economic benefits.

For example, Greenfield Advisors was engaged by the owners of a closed CAO in eastern Washington (the Shaake Feedlot, Ellensburg, Washington) to advise on adaptive re-use of the facility. The livestock slaughter business had been purchased by a consolidating firm which did not want to buy the real estate itself. The business was consolidated to another facility in distant town, leaving the host town with an abandoned, contaminated site. The business, which had originally been promised as an economic boon to the town, now employed no one. In addition, the real estate was no contaminated and value-less, and thus no longer producing local tax revenues. As a final insult to the local economy, the contaminated CAO site was a blight on surrounding development²⁵.

In 2008, the EPA published revised regulations which addressed the Federal 2nd Circuit’s ruling in *Waterkeeper Alliance v. EPA*. Some aspects (particularly certain requirements for NPDES permitting for water runoff) were struck down by the 5th Circuit in 2011 (*National Pork Producer’s Council v. EPA*), but the remainder of the regulations stand in force, recognizing the significant environmental impact of a CAO.

Impairment and Value – an Overview

From an economic perspective, the rights enjoyed by a fee-simple owner fall into three categories:

1. Right of use
2. Right of exclusion, and

²¹ Steward, Peggy, “Cattlemen Find CAFO Rules Confusing”, *Capital Press Agricultural Weekly*, 3/9/2001, page 9. Also, www.epa.gov/owm/afo.htm. Also, Hansen, Alice Sherman, “CAFO Rules May Prompt Need for Farm Consultants,” *Capital Press Agricultural Weekly*, 2/9/2001. Also, Steward, Peggy, “EPA Fines Toppenish Feedlot,” *Capital Press Agricultural Weekly*, 3/2/2001, page 12.

²² For a thorough discussion in this context, see *The Appraisal of Real Estate* 11th ed, and specifically pages 46-48, 336-337, and 398.

²³ *The Appraisal of Real Estate*, op. cit, pgs. 336-337.

²⁴ Smith, Hal, and John Corgel, *Real Estate Perspectives* 2nd, (Boston: Irwin, 1992), pg. 524 specifically deals with the incurability of external obsolescence.

²⁵ Source: Greenfield Advisors LLC files and personal inspections

3. Right of transfer²⁶

It is important to note that in the United States, property itself is not “owned,” but rather the rights of the property are owned²⁷. The ability to delineate these rights, and the ability of owners to transfer some or all of these rights voluntarily is an necessary condition for property valuation.

The first of these rights, that of use, is generally interpreted to mean that the owner may determine how property will be used, or if it is to be used at all. The right of use is traditionally limited in western culture by both public restrictions (e.g. -- eminent domain, police power) and private restrictions (e.g. -- liens, mortgages). Private restrictions are generally voluntary, and property owners willingly submit to the disutility of such restrictions in trade for some other economic benefit. For example, a property owner will issue a mortgage to a lender in trade for leverage in the purchase. Also, a homeowner will purchase in a subdivision with covenants and restrictions in trade for the assurance of uniform property use within the neighborhood. It is noteworthy to stress that the voluntary acceptance of private restrictions is always in trade for some economic compensation. An impairment places a restriction on the right of use without some economic compensation. This is illustrated in potential restrictions which may be placed on the use of real estate due to a physical impairment and which can thus limit the property to something less than its highest and best use.

The right of exclusion -- often called the right of exclusive use or right of exclusive enjoyment -- provides that those who have no claim on property should not gain economic benefit from enjoyment of the property. In other words, the right of use is exclusive to the property owner, and any violation of the right of exclusive use typically carries either payment of compensation to the rightful owner or assessment of a penalty. For example, if “A” trespasses on land owned by “B,” then “A” will be guilty of a crime and a possible criminal penalty may be in order, as well as civil damages. Physical impairment by a third party is, in effect, a trespass on property rights, violating the right of exclusion.

Society places a high value on the right of exclusion, for justifiable reasons. Exclusion provides that both the current benefits of ownership as well as future benefits accrue only to the rightful owner, and his/her successors and assigns. In the absence of exclusion, the right of use is under constant threat of nullification without just compensation. In an economy without the right of exclusion, property owners would adopt short-term strategies for use, rather than long-term strategies. In an economic sense, this would lead to widespread inefficiency in the allocation of resources. Hence, the right of exclusion carries with it a significant societal good²⁸, and thus a significant societally-recognized value.²⁹

Finally, the right of transfer provides the owner with the ability to swap one resource for another. An impairment restricts the right of transfer, and may in fact destroy the right of transfer altogether.

Effects of Proximate Contamination on Property Values

²⁶ While delineated in one fashion or another in many texts, this specific wording derives from Jaffee, Austin J. and Demetrios Louziotis, Jr., “Property Rights and Economic Efficiency”, Journal of Real Estate Literature 4, July, 1996, pg. 137-162.

²⁷ Alchian, Armen A. and Harold Demsetz, "The Property Rights Paradigm", Journal of Economic History 53, March 1973, pg. 16-27. Also, see Demsetz, Harold, "Toward a Theory of Property Rights", American Economic Review 57, May, 1967, pg. 347-373.

²⁸ See, for example, Snare, Frank, "The Concept of Property", American Philosophical Quarterly 9, April 1992.

²⁹ Stigler, George, "Law or Economics?", Journal of Law and Economics 35, October, 1992, pg. 455-469.

Real estate economics – and appraisal practice – uniformly recognizes that contamination has a negative impact on property values. Indeed, appraisers are required by the Uniform Standards of Professional Appraisal Practice to consider the impacts of such contamination in the value estimation process³⁰.

Fitchen (1989)³¹ was one of the first to look at the value of the rights of a property owner in the face of impairment – in this case, a toxic chemical pollution. As an anthropologist and a Professor of Anthropology at Ithaca College, she looks principally at residential values, not only at the real aspects of “violation of the home” by contamination (e.g. – carcinogenic effects of polluting chemicals) but also about the symbolic interference on what she calls “...a threat to the assumptions people have about themselves and the way life is supposed to be³².” She continues, “Toxic contamination also attacks the valued institution of homeownership, violating many of the rights that are assumed to flow from the ownership of ones home, including the assumed right to control entry to it....chemical contamination may affect homeowners more seriously than renters, not only in terms of potential financial loss, but also in terms of devaluation of the achieved status of homeowners.”

Edelstein (1986) also deals with this "home" theme, and calls impairment to or near a residence a “...inversion of home...” when “...the previous locus of family security and identity becomes instead a place of danger and defilement.³³” He builds on previous works, such as Perin (1977)³⁴ and Altman and Chemers (1980)³⁵, who show the very special place the home has in American society, culture, and economics. To quote Perin (1977): “Not being a nation of shopkeepers, America is one of homeowners, busily investing in plant maintenance and expansion with both money and time, keeping the product attractive for both use and sale.³⁶”

Edelstein (1986) specifically stresses the investment diminution aspect of the inversion of home principle. In citing case studies of experiences following neighborhood-wide impairment in the Legler section of Jackson Township in southern New Jersey, he shows that residents could not separate the psychological pride in home ownership from the question of economic value. Surveys of the population found uniformity of opinion that property values had diminished as a result of the problem. While previous studies had focused on the diminution of value from exiting homes, Edelstein (1986) was one of the first to focus on the opportunity costs stemming from the inability to move. In short, homeowners were stuck holding unsellable homes with stagnant prices, while homes in other neighborhoods were soaring in value. Thus, the owners were harmed not only by the diminution of value in the existing residences, but by the opportunity costs inherent in lost gains from alternative home investments.

Value Loss: Stigma Issues

³⁰ This is specifically covered under USPAP Rule 1-2(e). This is one of the rules from which departure is specifically not permitted. In other words, an appraiser may not fail to take physical disutility into account EVEN IF s/he discloses such departure from the rules. A thorough discussion of the appraiser’s responsibility is also contained in Eaton, J.D., Real Estate Valuation in Litigation (Chicago: The Appraisal Institute, 1995). For specific references, see pages 128, 129, 149-54, and 235-37. It is clear that an appraisal of a residence which fails to account for a physical deficiency such as a failure in the siding would violate the Uniform Standards. As of this writing, all 50 states have adopted these standards as a matter of law. In addition, adherence to these standards is mandatory for all federally-insured mortgage transactions.

³¹ Fitchen, Janet M., “When Toxic Chemicals Pollute Residential Environments: The Cultural Meanings of Home and Homeownership,” Human Organization 48, Winter, 1989, pgs. 313-324.

³² Ibid, pg. 320.

³³ Edelstein, Michael R., “Toxic Exposure and the Inversion of the Home”, Journal of Architecture Planning and Research 3, 1986, pgs. 237-251.

³⁴ Perin, Constance, Everything in its Place: Social Order and Land Use in America (Princeton: Princeton University Press, 1977)

³⁵ Altman, I, and M. Chemers, Culture and Environment (Monterey: Brooks/Cole Publishing, 1980)

³⁶ Perin, op, cit., pg. 120.

Edelstein (1986) refers in a general sense to the issue of stigma as a mechanism for manifestation of value diminution in residential property. Stigma is an increasingly common term in the appraisal and real estate economics literature, and refers in fact to a very specific quantitative mechanism by which value is impacted by proximate contamination or negative externalities.

The earliest references to stigma as a quantitative concept in real estate economics appears to be in the writings of Patchin (1991)³⁷ and Mundy (1992)³⁸. This latter study differentiated between the costs to cure and stigma. The former is an out-of-pocket expense born either by the property owner or some other responsible party, while the latter manifests in property value diminution even in the absence of a cost to cure. For example, a property which is completely cured may continue to suffer a diminution in value, and hence damages, as a result of stigma.

Kilpatrick (1999) outlines the quantitative model by which the value of income producing property is reduced by stigma effects, which are manifested via increases in market driven capitalization rates³⁹. He outlines four components of income producing property value impacts: Net Operating Income, actual Cost-to-Cure, Ongoing Increases in Maintenance, and Stigma. In his model, the stigma losses actually overwhelm the other three factors as a component of value diminution. He concludes that, under many circumstances, the stigma impacts are actually the greater portion of value losses to property owners.

Overview of the Air Quality Literature

The valuation literature on the impact of air quality on residential property values traces its origins to Ridker and Henning (1967)⁴⁰, who used 1960 census information in St. Louis and measures of both sulfation and suspended particulates to show a direct correlation between poor air quality and property value diminution. In the wake of their groundbreaking hedonic study, the consensus of studies has shown this causal relationship.

In 1974, Deyek and Smith studied one-hundred metropolitan areas using 1970 census data and compared housing values with air pollution⁴¹. They found a statistically significant relationship between housing values and air pollution across the U.S. Harrison and Rubinfeld (1978) examined owner-specific house values in Boston against NO₂ levels and found highly statistically significant value diminution⁴². Nelson (1978) examined median property values by census tract in Washington, DC, against particulate and oxidant concentration, again finding statistically significant value diminution⁴³.

Li and Brown (1980) examined sales prices in suburban Boston towns relative to sulfur dioxide and total suspended particles, and found statistically significant diminution. Murdoch and Thayer (1988) used 1979 sales data from California and found property value diminution from a variety of air quality issues⁴⁴. Zabel and Kiel (2000) studied nitrogen dioxide and sulfur dioxide in four different urban areas, and consistently found negative property value diminution⁴⁵.

³⁷ Patchin, Peter, "Contaminated Properties – Stigma Revisited", Appraisal Journal, April, 1991, pgs. 162-172.

³⁸ Mundy, Bill, "Stigma and Values", Appraisal Journal, January, 1992, pgs. 7-13.

³⁹ Kilpatrick, John, "Appraisal of Contaminated Property", presentation to the IAAO, 1999.

⁴⁰ Ridker, R.G., and J.A. Henning, "The Determinant of Residential Property Values with Special Reference to Air Pollution", Review of Economics and Statistics 49-2, 1967, 246-57.

⁴¹ Deyek, T.A., and V.K. Smith, "Residential Property Values and Air Pollution: Some New Evidence", Quarterly Review of Economics and Business 14-4, 1974, 93-100.

⁴² Harrison, D., and D.L. Rubinfeld, "Hedonic Housing Prices and the Demand for Clean Air", Journal of Environmental Economics and Management 5, 1978, 81-102.

⁴³ Nelson, J.P., "Residential Choice, Hedonic Prices, and the Demand for Urban Air Quality", Journal of Urban Economics 5-3, 1978, 357-69.

⁴⁴ Murdoch, J.C., and M.A. Thayer, "Hedonic Price Estimation of Variable Urban Air Quality", Journal of Environmental Economics and Management 15-2, 1988, 143-46.

⁴⁵ Zabel, J.E., and K. Kiel, "Estimating the Demand for Air Quality in Four U.S. Cities", Land Economics 76-2, 2000, 174-94.

Kiel and Boyle (2001)⁴⁶ note that the most significant air quality studies are those which measure impacts which are important to homeowners. In other words, air quality issues which directly impact homeowners' enjoyment of their property will have a measurable, direct, and statistically significant impact on property values.

Case Studies, Surveys, and Comparable Properties

North Carolina Statewide Study⁴⁷

Palmquist, et. Al, were the first to quantitatively determine that CAOs depressed nearby home values and to determine a model for spatial impacts of CAOs. They were able to measure differential impacts at 0.5, 1.0, and 2.0 miles.

Minnesota Study⁴⁸

In 1996, the Minnesota Department of Agriculture commissioned a study to be done by researchers at the U. of Minnesota on the topic of value diminution resulting from proximate CAOs. In addition to substantial secondary research in the area, the study authors also conducted primary research into value impacts in that state. Specifically, they conducted a hedonic price analysis on 292 rural residences which sold in 1993-94 in two Minnesota counties. They find a statistically significant pricing impact related both to the existence of a CAO as well as the distance to the CAO. In other words, not only is a CAO a significant impact on house price, but the nearer the CAO, the more of an impact it is. However, they also find that CAO's tend to be located near older or lower valued homes. Hence, the pricing impacts in a simple empirical study may be muted by other negative impacts to value. Hence, otherwise high-valued residences may be impacted to a greater degree by CAOs than would be suggested by their findings.

Missouri Study⁴⁹

Following the methodology of the Minnesota study, researchers at U. Missouri were able to quantify both the average value impact of a CAO as well as the impact by distance with a study of 99 rural, non-family real estate transactions of more than one acre near a CAO. Thirty-nine of the properties in the study included a residence. An average residential parcel within 3 miles of a CAO experienced a loss of about 6.6%. However, if that parcel was located within one-tenth of a mile of the CAO (the minimum unit of measure in their study), then the loss in value was estimated at about 88.3%. Based on an average land value of \$1,709 per acre, the approximate aggregate loss in value within 3 miles of a CAO was estimated at \$2.68 million.

Julie Janson, Minnesota⁵⁰

⁴⁶ Kiel, K, and M. Boyle, "Hedonic Studies of the Impact of Environmental Externalities", Journal of Real Estate Literature 9-2, 2001, 117-144.

⁴⁷ Palmquist, R., F. Roka, and T. Vukina (1997), "Hog Operations, Environmental Impacts, and Residential Property Values", Land Economics

⁴⁸ Taff, Steven J., Douglas Tiffany, and Sanford Weisberg, "Measured Effects of Feedlots on Residential Property Values in Minnesota: A Report to the Legislature", U. Minnesota Staff Paper Series, July, 1996.

⁴⁹ Hamed, Mubarek, Thomas Johnson, and Kathleen Miller, "The Impacts of Animal Feeding Operations on Rural Land Values", U. Missouri-Columbia Community Policy Analysis Center Report R-99-02, May, 1999.

⁵⁰ Presentation made at the ABA's Special Committee on Agricultural Management Roundtable II on Environmental Challenges in Animal Feeding Operations, dated September 23, 1999.

Ms. Janson is a homeowner in Minnesota who lives about two miles from one swine CAO and about three-quarters of a mile from a second CAO. When these CAOs were first opened, she was initially a supporter. However, she and her family immediately began suffering illnesses which they attributed to the proximate CAOs. She contacted the Minnesota poison control center and for the first time learned about the dangers of hydrogen sulfide emissions. She kept track of her illnesses and weather conditions (e.g. – wind and direction) and concluded that her illnesses were caused by the emissions from the CAOs. Badge testing was warranted, and on at least one occasion the reading was above 1,000 ppb hydrogen sulfide, well above danger levels.

***Bob and Phyllis Twietmeyer, Wichita, Kansas*⁵¹**

In 1998, a jury in rural Cheney, Kansas, awarded the Twietmeyers both actual and punitive damages as a result of the nuisance from a nearby swine CAO.

***Pasco, Washington*⁵²**

A 309-acre family farm which had been operated for many years produced alfalfa, asparagus, corn, apples, peaches, nectarines, cherries, melons, and a range of garden produce. A CAO was located nearby (distance not available), and as a result their farm product was impacted by dust, flies, fly fecal matter, and odor. The farm was appraised for litigation purposes and a value diminution of over 50% was determined, based on traditional farm appraisal methods.

***Glen Haven Farm, Dalkeith, Ontario*⁵³**

Deborah Henderson’s farm is now downwind from a 3000 hog finishing plant, and close enough that the manure lagoon can be seen from her bedroom window. According to Ms. Henderson, sales of homes in the area have ceased, and real estate agents have suggested a drop in price of \$40,000 or more from previous unimpaired values in order to entice buyers to the area.

***Lake Huron*⁵⁴**

In the summer of 2003, health officials declared about 40 kilometers of beaches on Lake Huron permanently unsafe because of E. coli bacteria emanating from nearby CAOs. This became the first new pollution hot-spot on Canada’s side of the Great Lakes in almost 20 years. Lab tests demonstrated that the E. coli levels in the streams feeding Lake Huron, and draining off nearby CAOs, exceeded water quality standards by as much as **41,000** per cent.

***Colorado College Study*⁵⁵**

Table 1
Property Tax Reductions In Areas Around CAOs

Area	Amount of Reduction	Reduction In Value Of:
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⁵¹ “Sides Debate Effect of Neighbor’s Victory Against Feedlot”, The Topeka Capital-Journal, May 28, 1998.

⁵² Greenfield Advisors files.

⁵³ Greenfield Advisors LLC files

⁵⁴ Spears, Tom, “Ontario’s West Coast Permanently Polluted”, The Ottawa Citizen, 11/15/03.; Dines, R.E., Deborah Henderson, and Louise rock, “The Case Against Intensive Hog Operations”, February, 2004, unpublished working paper.

⁵⁵ Weida, William J., “A Summary of the Regional Economic Effects of CAFOs”, Colorado College working paper, July 21, 2001.

Grundy Co, MO	30%	
Mecosta Co, MI	35%	dwellings only
Changed to	20%	total property (land and structures)
Midland Co, MI	20%	
DeWitt Co, IL	30%	rescinded
McLean Co, IL	35%	
DeKalb Co, AL	base reassessment, variable rates	
Renville Co, MN	base reassessment, variable rates	dwellings only
Humbolt Co, IA	20-40%	dwellings only--now rescinded
Frederick Co, MD	10%	now reduced to 5%
Muhlenberg Co, KY	18%	dwellings only

Dr. William J. Weida of Colorado College performed an extensive study of the economic and financial impact of CAOs. While his study principally focused on the diminished economic growth rates in communities surrounding CAOs, he also noted the substantial decreases in property values in those areas, as evidenced by property tax reductions. (See Table 1)

Illinois State Study⁵⁶

Complimentary to Professor Weida’s study, Miguel Gomez and Liying Zhang of Illinois State University conducted a comprehensive study of the impact of CAOs on rural economies, and found that CAOs are the cause of “...disruption of local social and economic systems, pollution problems resulting from intensive agriculture, and negative impacts on the quality of life in rural communities.”

***Gabrojolek farm, Dunnville, Ont.*⁵⁷**

Four large hog CAOs have been developed near the Gabrojolek’s family farm – one about 200 meters distance, one about 400 meters, and two about a kilometer away. Each facility houses 2,500 – 3,000 animals. The family has been forced to install central air conditioning and air purification systems, but still suffer from the effects of noxious odors. Untreated manure is being dumped near their home, bringing with it swarms of flies.

Central Industries Inc. – Central, Mississippi

Central Industries Inc. operated a large-scale poultry rendering plant near Central, Mississippi. As part of the process large quantities of poultry processing byproducts, which are highly susceptible to bacterial contamination were brought to this facility for further processing. The plant had been subject to a number of flooding events where the holding ponds were allowed to overflow into nearby creeks spreading bacteria laced poultry byproducts into nearby creeks and rivers. Poultry byproducts were discovered in trees, low density livestock areas, crop fields, and personal residences up to 50 miles away from the rendering plant. Greenfield Advisors inspected several homes and interviewed owners from which it was discovered that a significant disruption in property values and the ability to sell these properties occurred after and as the result of the Central Industries Inc. actions.

Livingston v Jefferson Board of Equalization⁵⁸

⁵⁶ Gomez, Miguel, and Liying Zhang, “Impacts of Concentration in Hog Production on Economic Growth in Rural Illinois”, Illinois State U. working paper presented to the American Agricultural Economics Association, July, 2000.

⁵⁷ Dines, Henderson, and Rock, op. cit.

⁵⁸ Aiken, J. David “Property Valuation May be Reduced by Proximity of Livestock Operation” Cornhusker Economics, Department of Agricultural Economics University of Nebraska – Lincoln May 2002

In 2002, the Nebraska Court of Appeals ruled that county board of equalization erred in not considering a rural residence's proximity to a swine facility in determining the residence's valuation. The owner of the facility, which contained 5,200 sows, also built a house $\frac{3}{4}$ of a mile away. He had further obtained an easement to spray the hog manure on the cropland across the road from his house. The court ordered the county to ignore the fact that the swine were also the property of the owner. The court cited Nebraska livestock nuisance decisions which show that hog odors would influence the home's value. Upon the ruling the county accepted a determination by a local, independent appraiser that the value was diminished 30%.

Craven County, North Carolina Study⁵⁹

This study utilized GIS and a hedonic price model similar to the Herriges et. al study and Ready et. al to evaluate the effect of swine concentration and proximity of those operations on residential property values. It was determined that for a farm with 5,000 animals 1 mile away had a statistically significant impact on home values.

Iowa State University Study⁶⁰

Similar to the Berks County study this study attempts to expand upon the work done in the Univ. of Minnesota & University of Mississippi studies. The variables used to quantify the effects in this hedonic analysis included proximity, size, and direction of nearest facility. Direction from site was included to determine the effect of being downwind and the odor & pest issues associated. Results from this study determined that a moderate size facility (250,000 live weight) has an impact up to 6% within 1 $\frac{1}{2}$ miles and 26% within a $\frac{1}{4}$ mile.

Berks County, Pennsylvania Study⁶¹

Ready and Abdulla (2005), of Penn State's Agricultural and Environmental Economics Department expand upon the hedonic analyses of others and reviewed the amenity and disamenity impacts of agriculture including different types of open space (publicly owned, eased, vacant, pasture/crops), landfills, airports, mushroom production, and AFOs. The study determined that "...only landfills have a worse effect on adjacent property values." Further, "...a sewage treatment plant has less depressing effects on nearby housing prices than a factory farm operation..." according to their findings. The study found that the clustering of AFOs within a certain area is the controlling factor not the nearest operation when considering proximity. A threshold impacts of 4.1% from AFOs within 800m, and at least 6.4% from within 500m, both of which were half of a landfill's. The study also reviewed the effects of size, species, and environmental stewardship (registration of waste management plans). Their findings were presented at the Sustainable Hog Farming Summit in Gettysburg, PA, in June, 2003.

Summary of CAO Empirical Findings

The establishment of a CAO results in value diminution to other nearby properties both through a negative externality as well as through indirect economic impacts. The amount of the value loss is an

⁵⁹ Milla, Katherine, Michael H. Thomas, Winsbert Ansine "Evaluating the Effect of Proximity to Hog Farms on Residential Property Values: A GIS-Based Hedonic Price Model Approach" URISA Journal Vol. 17, No. 1 2005 Pg. 27 – 32

⁶⁰ Herriges, Joseph A, Silvia Secchi, and Bruce A. Babcock "Living with Hogs in Iowa: The impact of Livestock Facilities on Rural residential Property Values" Working Paper, Iowa State University Center for Agricultural and Rural Development (August 2003)

⁶¹ Ready, Richard & Charles Abdalla "The Impact of Open Space and potential Local Disamenities on Residential Property Values in Berks County, Pennsylvania" American Journal of Agricultural Economics 87 May 2005 p. 314-326

inverse function of distance (closer properties diminish more), a function of property type (newer, nicer residences lose more) and a function of property use (farms will lose due to diminished productivity and comparative marketability to other farm lands while residential use will no longer be a highest-and-best use). While the appraisal profession has only begun to quantify the loss attributable to CAOs, it is clear from the broad array of empirical studies and case studies that diminished marketability, loss of use and enjoyment, and loss of exclusivity results in a diminishment which can range from 50% to nearly 90% of otherwise unimpaired value for homes which are adjacent to the facility. Negative impacts are noted at distances exceeding 3 miles, and in the case of a flood or other weather event, waste from the facility can be spread over far greater areas.

Table 2
Summary of CAO Impacts

<u>Case Study</u>	<u>Value Loss</u>	<u>Remarks</u>
Minnesota	N/A	Significant diminution in air quality
North Carolina	N/A	Established distance component to value
U. Minnesota	N/A	CAO sited near older, less-expensive homes
Central, MS	N/A	Marketability substantially diminished
Colorado St. Study	5% - 40%	Losses confirmed by tax assessors in 8 states
<i>Dalkeith, Ontario</i>	> 50%	Severe loss of marketability
Missouri	Residential 3 miles: 6.6%	
	Residential 0.1 mile: 83%	
Washington	Family farm adjacent: 50%	Impact included flies & loss of farm income
Michigan Farm	Farm adjacent: 50%	Impact included loss of use as a farm
Michigan Res.	Residence adj.: 60-100%	Residence abandoned, could not be sold
Livingston	Residence @ ¼ mile: 30%	
Craven, NC	N/A	Statistically significant at one mile
Berks, PA	Residence ¼ mile: < 6.4%	
	Residence ½ mile: 4.1%	
Iowa St. Study	Residence ¼ mile: 26%	
	Residence 1.5 miles: 6%	

Since the initial review of CAOs affect on proximate property values, multiple new trends have been identified. First, the increased use of GIS in local governments has provided researchers with the ability to conduct investigations that are more thorough. Providing researchers with more data, in abundance and in detail, allows them to better locate which factors and to what degree are having an affect. Second, in conjunction with more data and use of GIS an improvement in the hedonic analyses performed. The Berks County study noted that previous studies such as the, University of Minnesota study and the North Carolina study, were conducted on less than 300 sales transactions each, but that the Berks County study and the Iowa State studies reviewed 8,090 and 1,145 transactions respectively. While more data does not imply more significant results it does allow researchers to be more discriminating when compiling their datasets.

Second, because of the increased use of GIS and the results from the hedonic analysis that were found in the new case studies it was shown that a CAOs basic impact is related to proximity and size, but that other factors such as the operations waste management practices can alter that impact higher or lower. Overall, the new studies confirm the valuation impacts from the previously cited studies as they ranged from 3.1% to 26% loss depending on multiple factors. More importantly however was the discussion on the impact of other site-specific factors that were considered as part the hedonic analyses. The Berks County Study showed at 800 meters, an operation with a waste management plan diminished a house's value 1.1%, while an operation without would diminish the value 4.2%. Also related to this was the

affect that operation size has. Both the Berks County study and Iowa State study showed that a larger facility in close proximity would not necessarily decrease the value of a more than a smaller facility. Both of the studies concluded that this effect could be attributed to un-modeled characteristics such as waste management practices and other site-specific attributes.

Review of the Jacobson Appraisal

Both this review and the Jacobson appraisal were performed for (the “client”), and other intended users include those involved in his property tax appeal as well as other parties to negotiations or litigation arising out of this matter. I have not developed my own opinion of value concerning the property, but rather am simply opining on the methodology followed by Mr. Jacobson. The Jacobson appraisal was dated March 11, 2009, and is effective as of that date. There are no unusual assumptions or hypothetical conditions evidenced in the Jacobson report.

To summarize, the property is a 1½ story, 2,602 square foot, single family home, built in 1977, on a 0.63 acre site. The site is zoned AG-1 (agricultural), and according to the appraisal, neither the property nor the neighborhood evidence any unusual factors except for the proximate location of a hog feeding operation. My review will be limited to the manner in which Jacobson deals with that negative externality.

The Jacobson appraisal and report thereof treat the negative externality in two different, but consistent ways:

1. As external obsolescence in the cost approach
2. As a location adjustment in the sales comparison approach.

Both of these methods are widely accepted, and certainly meet the appraisal standards requirements. Further, Jacobson derives his adjustments through a set of “matched pairs”, where he compares the sales prices of two properties which are also proximate to CAO with the “unimpaired” appraised values of those properties. Again, Jacobson uses a well-accepted method for deriving his adjustment.

Jacobson derives a negative adjustment of 30%, which is certainly consistent with the appraisal literature, with our studies in this field, and with what other appraisers would be expected to find.

Certification of this Review

I certify that, to the best of my knowledge and belief:

- The statements of fact contained in this report are true and correct.

- The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are our personal, impartial, and unbiased professional analyses, opinions, and conclusions.
- Neither Greenfield Advisors nor I have a present or prospective interest in the property that is the subject of the work under review and no (or the specified) personal interest with respect to the parties involved.
- I have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment.
- My engagement in this assignment was not contingent upon developing or reporting predetermined results.
- My compensation is not contingent on an action or event resulting from the analyses, opinions, or conclusions in this report or from its use.
- My compensation for completing this assignment is not contingent upon the development or reporting of predetermined assignment results or assignment results that favors the cause of the client, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal review.
- The reported analyses, opinions, and conclusions were developed and this report was prepared in conformity with the Uniform Standards of Professional Appraisal Practice.
- I have made not an inspection of the property that is the subject of this report.
- No one provided significant professional assistance in the conduct of this appraisal.
- This assignment has been performed and this report developed in compliance with the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute.
- The Appraisal Institute retains the right to review this report.

Sincerely,

GREENFIELD ADVISORS LLC



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