Using Choice Question Formats to Determine Compensable Values: The Case of a Landfill-Siting Process

Arthur Caplan[a, *], Therese Grijalva[b], Douglas Jackson-Smith[c]

[a] *Department of Economics, Utah State University, 3530 Old Main Hill, Logan, UT 84322-3530*
[b] *Department of Economics, Weber State University, Ogden, UT 84408-3807*
[c] *Department of Sociology, Utah State University, 0730 Old Main Hill, Logan, UT 84322-0730*

*Corresponding Author. Fax: +1-435-797-2701. Email: acaplan@econ.usu.edu. Senior authorship is unassigned.

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Abstract: Siting noxious facilities, such as community landfills, is a challenging problem for local planners who recognize the importance of economic efficiency and equity, political acceptance, and meeting federal regulatory standards. Meeting these criteria requires technical and socio-economic analyses in conjunction with public input. Planners may also recognize that political acceptance requires compensation for the host community, either in the form of monetary or in-kind transfers. Following Breffle and Rowe (2002), we use a "resource-to-resource" paired-comparison survey method to estimate compensatory values associated with an in-county landfill for both the host and non-host communities. Our results indicate that while a host-community household's minimum willingness to accept payment for hosting a landfill may exceed a non-host-community household's maximum willingness to pay, a large difference in population sizes between the two communities enables the landfill to pass a Kaldor potential compensation test.

Key Words: Landfill Siting, Choice Experiments, Kaldor-Hicks Compensation Test

1. Introduction

In their 1992 paper on the siting of noxious facilities, Swallow et al. propose a three-phased approach that integrates the technical, economic, and political dimensions relevant to the site-selection process. In the first phase, a committee of technical experts and community leaders identifies a "long list" of candidate sites meeting minimum technical standards. In phase two, the the long list is narrowed to a "short list" of candidate sites based on social suitability criteria. In phase three, a mechanism reflective of the community's preferences (e.g., an auction, referendum, or community survey) is used to identify the final site. According to Swallow et al., this approach "integrates economists' concern for efficiency and equity with a centralized process to include expert input... by outlining a method to incorporate, analytically and empirically, diverse public preferences..." (p. 284). An added benefit of this approach is that it is more pragmatic than the decentralized, market-like mechanisms previously proposed by Kunreuther et al. (1987) and Mitchell and Carson (1986).

This paper concerns the third phase of Swallow et al.'s approach, in particular the outcome of a community survey conducted in Cache County, Utah concerning its landfill-siting process.[1] In March 2004, the Cache County Council approved a resolution authorizing its garbage contractor, Logan city, to proceed with property acquisition for a proposed landfill located in the northern end of the valley (Wright, 2004). Unbeknownst to council members, the resolution culminated a process that closely mirrored the site-selection approach proposed by Swallow et al.

The process began in 1999, when a committee of technical experts and local community leaders (the Technical Committee) proposed a list of 11 possible in-county sites and two existing out-of-county landfill sites for the county's waste (Division of Environmental Services, 1999).

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[1] Cache County is located in northern Utah. Approximately 100,000 people reside in the county, with the largest concentration (40%) in the city of Logan. Efforts to find a new landfill site were stimulated by estimates that the current landfill will be full by 2010 or 2015 (Division of Environmental Services, 1999).

Later in 2000, the Technical Committee (TC) and a Citizens Advisory Committee (CAC) jointly shortened the in-county list to three possible sites. Finally, a series of studies including visual, economic, and environmental analyses as well as a community survey were conducted to help the TC, CAC, and county council identify the most preferable of the three in- and two out-of-county sites. It was therefore as if the various stakeholders in this process had agreed at the outset to follow the Swallow et al. approach.

Following Breffle and Rowe (2002), we use a paired-comparison survey method to estimate compensatory values for both the host and non-host communities.[2] Our results indicate that while the typical host-community household's minimum willingness to accept payment (WTA) for hosting a landfill exceeds the typical non-host-community household's maximum willingness to pay (WTP), a large difference in population sizes between the two communities enables the in-county site to pass a simple compensation test, in terms of both monetary and substitute-resource equivalents.[3] Further, our results help quantify potential monthly fees that non-host-community households would willingly pay to make the host community "whole", i.e., no worse off with the landfill and compensation than without the landfill.

To our knowledge, previous literature on landfill-siting decisions has not estimated household-level WTA values for hosting a landfill with the intention of performing

[2] See Adamowicz et al. (1998) and Magat et al. (1988) for examples of earlier uses of paired-comparison formats. For background on the various federal statutes and regulatory promulgations in support of this method see Jones and Pease (1997). See Champ et al. (2003) for an accessible primer on stated-preference techniques.

[3]To conveniently distinguish the host community's valuation of a landfill from the non-host community's, we liberally interpret the definition of WTA. In actuality (and as discussed further below), the values elicited from host-community households in this study are WTP measures for a particular in-county site relative to a reference out-of-county site. The values therefore represent negative WTP rather than WTA per se. As shown in Freeman (1993), negative WTP is theoretically a conservative estimate of WTA when the environmental good in question (in our case the out-of-county site) is normal. Horowitz and McConnell (2002) confirm this WTP/WTA disparity empirically. These caveats should be kept in mind when interpreting our empirical results and policy implications in Sections 5 and 6. They suggest that our estimates of WTA are indeed lower-bound.

compensation tests between host and non-host communities.[4] An exception is Sasao (2004), who finds that households negatively value landfilling waste that has originated from outside their community, especially industrial waste. Households also perceive substantial external costs associated with siting landfills near drinking water sources. Similar to our study, Sasao aggregates these negative valuations at the community level, which, given the relatively large population density of his study area, translate into substantial external costs.

The next section discusses our survey instrument, sampling procedure, and the sample's demographic characteristics.[5] The main focus of this section is the "resource-to-resource" question format used to elicit the WTA and WTP estimates. Section 3 provides two types of unconditional analyses that examine the reliability and validity of the respondents' answers to the paired-comparison questions. The first type delineates *inter alia* the respondents' level of awareness of the landfill issue, the degree of confidence in their responses to the paired-comparison questions, as well as their trust in the underlying decision-making process. The second type pertains to a validity test performed on the responses provided to the paired-comparison questions. Section 4 presents the household-level random-utility model underlying our econometric analysis, as well as the social criterion used to decide between selecting an in- versus out-of-county landfill site. Section 5 provides the corresponding empirical results. Section 6 demonstrates how the empirical results can be used to inform policy, and Section 7 concludes with a summary of our main findings.

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[4] Garrod and Willis (1998) and Roberts et al. (1991) employ a household-level valuation approach, but they do not perform compensation tests to determine the landfill's overall social acceptability. Jenkins et al. (2004) consider private compensation from landfill developers rather than public compensation from non-host communities. Groothuis and Miller (1994) investigate the role of NIMBY beliefs and Opaluch et al. (1993) the role of public preferences in the siting process. Smith and Desvousges (1986), Hirshfeld et al. (1992) and Minehart and Neeman (2002) employ community-level valuation approaches. See Kohlhase (1991), Nelson (1992), Hite (2001), and Cambridge Econometrics (2003) for examples of hedonic methods used to estimate changes in property values located in close proximity to landfills.

[5] The survey instrument and final report delivered to the TC and CAC are available online at http://faculty.weber.edu/tgrijalva/landfill/landfill.htm.

2. The Community Survey

The overriding goal of the community survey was to gather information regarding the concerns, perceptions, and preferences of Cache County adults related to a variety of future landfill options. While economic efficiency was not their overriding goal, local planners were concerned about making the host community whole, recognizing that acceptance requires compensation either in the form of monetary or in-kind transfers.[6,7] Using input from county residents, local government officials, and other interested parties, a mail-survey instrument was developed in the fall of 2003. The instrument was first pre-tested with focus groups from both the host and non-host communities (henceforth "H" and "NH" communities, respectively) in order to identify questions that were difficult to understand or answer and to obtain feedback regarding question wording, and survey format and length. A revised version of the survey was next presented to the CAC and TC for final review and approval. The final version of the instrument was sent to 960 randomly selected county households from the population that currently pays for waste disposal.

The sample was stratified to include equal numbers of households (320 each) in the following groups: (1) residents of the host community, (2) residents of the city of Logan, Cache Valley's largest city, and (3) residents in the remaining areas of Cache County (groups 2 and 3

[6] Flores and Thacher (2002) provide a cautionary assessment of relying strictly on in-kind transfers as a substitute for monetary compensation. Their reasoning stems from the belief that local planners are unable to judge the adequacy of using in-kind resources for compensation, and the fact that strict in-kind compensation generally results in a Pareto inefficient allocation due to heterogeneous preferences and the public-goods nature of the compensatory resources. To the contrary, Frey et al. (1996) point out that strict monetary compensation is not always the public's preference. In-kind compensation may therefore be a suitable and practical compensation mechanism. Fortunately, our survey design has incorporated both monetary and in-kind compensation mechanisms. In Section 6, we provide an example (Example 2) where a combination of monetary and in-kind compensation is provided to the host community.

[7] Bacot et al. (1994) and Lober and Green (1994) raise doubts about the adequacy of any form of compensation, suggesting that it is perhaps more important to inform public policy about how stakeholders form their perceptions of need than about potentially adequate levels of compensation. We thank an anonymous reviewer for pointing out these two studies.

together are henceforth referred to as the NH community).[8] The survey design and mailing process followed the Dillman (2000) Tailored Design Methodology. The first mailing was sent with a cover letter and a prepaid business reply envelope to all 960 households in January 2003, and a reminder postcard was sent one week later. To increase response rates, a second survey was mailed to non-respondents three weeks after the initial mailing, and again a reminder postcard was mailed one week later. In the NH communities, household drop-off, pick-up techniques (Steele et al. 2002) were used to raise the final response rates to target levels. Usable responses were received from over 66% of the eligible respondents. The specific response rates by area were 67%, 69%, and 63% for groups 1, 2, and 3, respectively.

Descriptive characteristics of H and NH respondents are presented in Table 1. The average respondent in the H community is 52.9 years old versus 43 years old in the NH community, resulting in an average county age of 46 years. Many of the respondents have lived in Cache County their entire lives, though this ranges from 24% of the NH community residents to almost half of the H-community respondents. Overall, almost 40% have completed a bachelors or graduate degree with formal education levels being the highest in the NH community. The majority of respondents are employed (58% in the H community and 70% in the NH community), 10% are retired, and under 20% are keeping house, in school, or unemployed. Logan residents have lower levels of fulltime employment, yet higher levels of part time employment, reflecting the higher proportion of students working on degrees at Utah State University.

Comparing the summary statistics reported in Table 1 with published population characteristics from the 2000 U.S. Census suggests that our samples from each of the three study

[8] Because the survey was designed to over-sample residents in the H community, numeric weights are assigned to each observation for the econometric analysis in order to correct for any over-sampling bias that may exist in the data. Details of this weighting process are provided in Jackson-Smith et al. (2003).

areas generally have a gender balance and proportion of adults living in owner-occupied housing that is quite close to the census population. The exception is over-representation of males in the H community. Across all three study areas, there tended to be proportionately fewer young adults (age 18-39) and a larger number of older adults (age 60 and over) than is present in the population. There is also an overrepresentation of adults with bachelors and graduate degrees.

Generally speaking, results obtained from the survey were as expected (Jackson-Smith et al., 2003). Most respondents are aware of the county landfill debate. Protecting the environment and minimizing the costs of waste disposal are top priorities. Residents (particularly those located in the H community) are most concerned about water quality, nuisances, and loss of habitat associated with an in-county landfill. Most adults residing in the NH community prefer an in-county option (due primarily to the retention of local control over future garbage pricing), while those residing in the H community prefer an out-of-county option. However, most residents in the NH community support mitigation of impacts and compensation for the H community should an in-county site be selected (see Jackson-Smith et al., 2003).

To investigate various compensation alternatives and to elicit quantitative estimates of the value of these alternatives, we developed a series of paired-comparison questions along the lines of Breffle and Rowe (2002). The basic design included four blocks of questions that present respondents with pairs of alternative scenarios for a future landfill. Each alternative includes a proposed landfill location, an estimated additional monthly cost to a typical household, and various levels of additional compensation provided by residents of the NH community to residents in the H community. The alternatives are designed to reflect realistic and meaningful compensation alternatives.

Two types of compensation packages are considered—local community payments and new public services. Local community payments would be made to the H community's local government, which could be used to mitigate unwanted impacts from the landfill, to reduce local property tax burdens, or for any other public purpose. New public services would involve the county paying for staff and equipment to provide new or improved public services in the H community. These services could include (1) maintenance and improvement of local roads (particularly during the winter), (2) provision of local fire and police protection services, or (3) both. Table 2 lists the specific values used in the survey for these compensation packages as well the future landfill locations and the levels of added monthly costs to households. The specific compensation packages, levels of compensation, and monthly costs were based on input from county residents, local government officials, and other stakeholders prior to the pre-testing stage of the survey. Figure 1 presents a map of the locations of in-county sites 1, 2, and 3.

While each individual survey included four distinct pairs of questions (each with a specific compensation package), there were eight versions of the survey used in the H and NH communities. The use of multiple versions allows the estimation of WTP (or WTA) for various levels of public services and landfill locations.[9] The first three choice questions represent in-kind, or resource-to-resource tradeoffs, while the fourth question represents what is effectively a referendum choice. Figure 2 provides an illustration of a "simple" resource-to-resource choice

[9] The specific combinations of alternatives per choice pair and characteristics per alternative were selected with the help of the SAS Optex procedure. Given the number of characteristics and the levels they can take (see Table 2), there were 132 possible alternatives and therefore an extremely large number of possible choice pairs. The Optex procedure provides an orthogonal (or efficient) experimental design that helps to mitigate subsequent effects of multicollinearity in the data, and in turn produces uncorrelated parameter estimates (for further details on efficient design see Louviere et al. (2000). In addition (and as is common with paired-comparison survey designs), we have arbitrarily eliminated all infeasible pairings, e.g., where one alternative has more services at lower added cost.

question, while Figure 3 provides an illustration of a referendum choice question.[10] Prior to receiving the resource-to-resource and referendum choice questions, respondents were provided with background information on the landfill siting decision process. The choice attributes provided in Table 2 were also fully explained immediately before the choice questions were presented to the respondents.

In Figure 2, respondents choose between a local community payment and whether or not to site an in-county landfill. The choice is resource-to-resource because one of the two resource categories for this study—Local Community Payments and New Public Services (see Table 2)—differs across alternatives. It is "simple" precisely because the only differences between the alternatives pertains to Local Community Payments (which are zero in Alternative A and $50,000 in Alternative B) and Future Landfill Location (which is out-of-county in Alternative A and in-county in Alternative B). Thus, in this particular question the respondent weighs the tradeoff between (1) siting the landfill in the H community and compensating the H community with an endowment of $50,000 per year, and (2) shipping the county's waste out-of-county and therefore not compensating the H community.[11] The referendum depicted in Figure 3 compares an out-of-county site (with a higher monthly fee) and an in-county site (with no additional fee), with no promise of additional payments or services in either case.

By varying the compensation package mixes and levels across questions and examining the choices made, mathematical methods (described in Section 4) are used to determine how much of one kind of restoration has equivalent value to different amounts of another compensation

[10] The choice is effectively a referendum because the status quo (of neither a new in-county site nor an out-of-county site) has a priori been deemed infeasible by the local authorities. We therefore interpret this choice as a referendum because only landfill site and added cost differ across the alternatives.
[11] To create a "complex" version of the comparison depicted in Figure 2 we might change New Public Services in Alternative A to County Provides Roads (see Table 2), in which case three attributes would differ across the alternatives. The specific comparisons included in our survey instrument are available in Jackson-Smith et al. (2003).

package. Because each alternative includes a cost to the household, which differs across choice pair and survey version, WTP and WTA values can be estimated.

3. Reliability and Validity of the Survey Responses

As Breffle and Rowe (2002) point out, higher awareness of the issue at hand can be expected to enhance the reliability of responses and to reduce the burden of communication in survey design. In our case, results suggest that over two-thirds of county adults had heard about the county landfill issue. To examine their depth of familiarity, respondents were asked, “How familiar are you with [the] issues [surrounding the future in-county landfill options]?” Overall, 45% of the respondents felt they were somewhat to very familiar with the issues at the time of the survey. However, this overall percentage is based on a large divergence between H and NH community respondents (89% and 43%, respectively).

Despite this divergence in awareness, approximately 70% of the respondents felt confident about their responses to the choice questions. Similarly, a large majority of NH respondents (73%) are confident that a new in-county landfill would meet federal regulatory standards and that the standards are adequate, although H-community households do not share this level of confidence (only 44%). Finally, most respondents feel powerless (84%); that is, they feel their opinions will not influence the landfill decision.

Taken together, these results indicate that while the overall majority of the respondents feel they are not well-informed of the issues surrounding the landfill siting process and that their opinions are unlikely to influence the decision anyway, the majority does feel confident of their responses to the choice questions and that an in-county landfill would meet federal standards. Thus, respondents' perceived lack of familiarity may be offset by their relatively high levels of confidence, indicating that the reliability of their responses is not necessarily compromised by lack of awareness.

We also compared the respondents' answers to the paired-comparison questions with answers to direct questions about preferred site locations from elsewhere in the questionnaire. In general, the rank order of preferences for H and NH households were consistent across both question formats. Overall, a majority of H community respondents consistently chose an out-of-county option, while a majority of NH community respondents consistently chose an in-county option. Additionally, a test was conducted by comparing a similar referendum question from two survey versions. As expected, the results show that a larger percentage of respondents in one survey (51%) selected the out-of-county option (site 5) with a lower monthly household cost of $5 than did respondents in the other survey (41%) at a monthly household cost of $15.

4. The Economic Model and Social Criterion

Using data from the survey choice experiments, a simple model is used to examine how individuals trade-off different levels of the compensation packages, and to provide estimates of monetary values associated with various package attributes. The choice-question model seeks to explain statistically each respondent's four choices from the choice pairs as a function of a number of compensation-package and individual characteristics. The model parameters therefore represent a quantitative measure of the benefits individuals receive from specific attributes (Breffle and Rowe, 2002).

In making their choices, we assume that survey respondents choose the alternative (A or B) that provides the largest net benefit. Following Breffle and Rowe (2002), let individual i's utility, i = 1,...,I, for the compensation packages be given by:

$$U_{ij}^{k_{ij}} = \boldsymbol{\beta} \mathbf{x}_{\mathbf{ij}}^{\mathbf{k_{ij}}} + \varepsilon_{ij}^{k_{ij}}, \ j = 1,...,J \text{ and } k_{ij} \in [1, 2], \quad (1)$$

where $U_{ij}^{k_{ij}}$ is the utility of the k[th] alternative of choice pair j to individual i. In our case, J = 4, since each respondent received a total of four choice questions in the survey, and k_{ij} indicates which of the two alternatives within each choice pair is ultimately chosen by the respondent. The vector $\mathbf{x}_{\mathbf{ij}}^{\mathbf{k}_{ij}}$ contains the characteristics of the k_{ij}^{th} alternative. Thus, the corresponding vector of unknown elements $\boldsymbol{\beta}$ (which we statistically estimate) can be interpreted as the respective marginal utilities. Preference heterogeneity can be modeled by interacting the vector $\mathbf{x}_{\mathbf{ij}}^{\mathbf{k}_{ij}}$ with a host of demographic, attitudinal, and knowledge-level characteristics that vary among individuals (Bishop et al., 2000; Adamowicz et al., 1997). By doing this, marginal utilities are allowed to vary by individual characteristics.

While $\boldsymbol{\beta}\mathbf{x}_{\mathbf{ij}}^{\mathbf{k}_{ij}}$ represents the non-stochastic part of utility, the term $\varepsilon_{ij}^{k_{ij}}$ represents its stochastic element. This stochastic element accounts for the fact that the respondent's preferences can vary randomly over time and that the researcher has imperfect information about what the respondent's preferences really are. For estimation purposes, we assume that $\varepsilon_{ij}^{k_{ij}}$ is independently and identically distributed across both i and j, is uncorrelated with $\mathbf{x}_{\mathbf{ij}}^{\mathbf{k}_{ij}}$, is mean-zero type 1 extreme value, and has constant unknown variance σ_{ε}^2.

Letting $K_{ij} \in [1, 2]$ be a random variable that is the choice for individual i when confronted with choice pair j, the individual is assumed to choose the k_{ij}^{th} alternative with probability[12]

$$P\left(K_{ij} = k_{ij}\right) = P_{ij}^{k_{ij}} = P\left(U_{ij}^{k_{ij}} > U_{ij}^{3-k_{ij}}\right), \qquad (2)$$

[12] Thus, if the individual chooses alternative k_{ij} = 1(or 2), then the un-chosen alternative is 3 – k_{ij} = 2(or 1).

where k_{ij} is the observed value of K_{ij} resulting from the survey response. From equations (1) and (2) and the assumptions on $\varepsilon_{ij}^{k_{ij}}$, the probability of choosing alternative k_{ij} may be rewritten as

$$P_{ij}^{k_{ij}} = P\left(\boldsymbol{\beta}\mathbf{x}_{\mathbf{ij}}^{\mathbf{k_{ij}}} + \varepsilon_{ij}^{k_{ij}} > \boldsymbol{\beta}\mathbf{x}_{\mathbf{ij}}^{\mathbf{3-k_{ij}}} + \varepsilon_{ij}^{3-k_{ij}}\right) = \Psi\left(-\boldsymbol{\beta}\left(\mathbf{x}_{\mathbf{ij}}^{\mathbf{k_{ij}}} - \mathbf{x}_{\mathbf{ij}}^{\mathbf{3-k_{ij}}}\right)\right), \qquad (3)$$

where $\Psi(.)$ is the univariate logistic distribution function. This probability enters into the following likelihood function L,

$$L\left(k_{ij}, i = 1,\ldots,I; j = 1,\ldots,J \mid \mathbf{x}_{\mathbf{ij}}^{\mathbf{1}}, \mathbf{x}_{\mathbf{ij}}^{\mathbf{2}}; \boldsymbol{\beta}, \sigma_{\varepsilon}^{2}\right) = \prod_{i=1}^{I}\prod_{j=1}^{J} P_{ij}^{k_{ij}}, \qquad (4)$$

where the 1 and 2 superscripts on $\mathbf{x_{ij}}$ denote alternative 1 and 2, respectively, and the || operators indicate that the J observations for each respondent are "stacked" to produce a dataset with JI observations.

Two model specifications are used in this study: restricted and full. The following empirical specification of $U_{ij}^{k_{ij}}$ represents the restricted model,

$$\begin{aligned} U_i &= \beta_Y\left(Y_i - C_i\right) + \beta_A D_A \\ &+ \sum_{r=1}^{3}\beta_r^{loc}\left(D_{loc} \bullet \text{roads}_r\right) + \beta_p^{loc}\left(D_{loc} \bullet \text{payment}\right) + \sum_{w=1}^{4}\beta_w^{loc}\left(D_{loc} \bullet \text{landfill}_w\right) + \varepsilon_i \end{aligned} \qquad (5a)$$

while the full model is,

$$\begin{aligned} U_i &= \beta_Y\left(Y_i - C_i\right) + \beta_A D_A \\ &+ \sum_{r=1}^{3}\beta_r^{loc}\left(D_{loc} \bullet \text{roads}_r\right) + \beta_p^{loc}\left(D_{loc} \bullet \text{payment}\right) + \sum_{w=1}^{4}\beta_w^{loc}\left(D_{loc} \bullet \text{landfill}_w\right) \\ &+ \sum_{r=1}^{3}\beta_r^{know}\left(D_{know} \bullet \text{roads}_r\right) + \beta_p^{know}\left(D_{know} \bullet \text{payment}\right) + \sum_{w=1}^{4}\beta_w^{know}\left(D_{know} \bullet \text{landfill}_w\right) \\ &+ \sum_{r=1}^{3}\beta_r^{sconf}\left(D_{sconf} \bullet \text{roads}_r\right) + \beta_p^{sconf}\left(D_{sconf} \bullet \text{payment}\right) + \sum_{w=1}^{4}\beta_w^{sconf}\left(D_{sconf} \bullet \text{landfill}_w\right) \\ &+ \sum_{r=1}^{3}\beta_r^{vconf}\left(D_{vconf} \bullet \text{roads}_r\right) + \beta_p^{vconf}\left(D_{vconf} \bullet \text{payment}\right) + \sum_{w=1}^{4}\beta_w^{vconf}\left(D_{vconf} \bullet \text{landfill}_w\right) \\ &+ \sum_{r=1}^{3}\beta_r^{comp}\left(D_{comp} \bullet \text{roads}_r\right) + \beta_p^{comp}\left(D_{comp} \bullet \text{payment}\right) + \sum_{w=1}^{4}\beta_w^{comp}\left(D_{comp} \bullet \text{landfill}_w\right) \\ &+ \sum_{r=1}^{3}\beta_r^{minc}\left(D_{minc} \bullet \text{roads}_r\right) + \beta_p^{minc}\left(D_{minc} \bullet \text{payment}\right) + \sum_{w=1}^{4}\beta_w^{minc}\left(D_{minc} \bullet \text{landfill}_w\right) \\ &+ \sum_{r=1}^{3}\beta_r^{hinc}\left(D_{hinc} \bullet \text{roads}_r\right) + \beta_p^{hinc}\left(D_{hinc} \bullet \text{payment}\right) + \sum_{w=1}^{4}\beta_w^{hinc}\left(D_{hinc} \bullet \text{landfill}_w\right) + \varepsilon_i \end{aligned} \qquad (5b)$$

where $U_{ij}^{k_{ij}}$ is replaced by U_i to simplify notation. Each of the variables included in (5a) and (5b) are defined in Table 3.

With the exception of β_A, which controls for the fact that a respondent is more likely to choose alternative A, the β parameters in (5b) measure the marginal utilities associated with one unit changes in the corresponding variables. For example, β_Y indicates the increase in utility if the cost of the compensation package decreases by $1, and thus may be interpreted as the (constant) marginal utility of money. The remaining individual-characteristic parameters—β^{loc}, β^{know}, β^{sconf}, β^{vconf}, β^{comp}, β^{minc}, and β^{hinc}—represent the change in utility associated with a unit change in each of the respective individual characteristics (relative to their respective base categories), all else equal.

Referring to (5b), when loc = H and r = 1, $\beta_r^{loc} = \beta_{r=1}^{H}$ indicates the change in an H-community household's utility associated with county provision of road service to the H community. Similarly, when an individual perceives herself as being somewhat to very informed about the landfill issue and r = 1, $\beta_{r=1}^{know}$ indicates the change in this individual's utility associated with county provision of road service to the host community.

The linear empirical model specified in (5a) and (5b) allows for straightforward compensating-surplus (CS) computations of WTA and WTP. CS is computed as the change in utility between the "new" and "reference" situations (e.g. between r=1 and r=0; w=1 and w=0; etc.) divided by the marginal utility of money (i.e. β_Y),

$$CS_i = \frac{\beta^s}{\beta_Y},\ s \in [\text{set of individual characteristics}] \qquad (6)$$

where β^s represents the β parameter associated with the given individual characteristic. For example, if loc = NH and r = 1, then β^s and CS_i refers to the typical NH household's estimated WTP for county provision of roads in the H community. Similarly, if loc = H and w=1, then β^s and CS_i equals the typical H household's estimated WTA payment for selecting site 1 in the H community. To the contrary, if loc = NH, then CS_i equals the typical NH household's estimated WTP for selecting site 1 in the H community.

Turning now to the social criterion for determining whether an in-county site should be chosen over an out-of-county site, let (1) C_{IC} and C_{OC} represent the costs of constructing and operating a new in-county landfill and shipping waste out-of-county, respectively, (2) n_H and n_{NH} be the number host and non-host community households, respectively, and (3) $\overline{WTP}$ and $\overline{WTA}$ represent mean WTP and mean WTA, respectively, for a given community and landfill location. For a given in-county site to be selected over a given out-of-county site the following condition must therefore hold,

$$C_{IC} + \left(n_H \times \overline{WTA}_H^{IC} - n_{NH} \times \overline{WTP}_{NH}^{IC}\right) \leq C_{OC} + \left(n_{NH} \times \overline{WTA}_{NH}^{OC} - n_H \times \overline{WTP}_H^{OC}\right), \quad (7)$$

where the terms in parentheses represent respective welfare changes, defined as the welfare cost of a site location to one community (e.g., $n \times \overline{WTA}$) less the corresponding welfare benefit to the other community (e.g., $n \times \overline{WTP}$). A given in-county site is selected when its total cost (the sum of construction and operating costs plus the associated welfare change) is not more than the total cost associated with shipping the county's waste to a given out-of-county landfill.[13] Note that in the case of multiple in- and out-of-county sites, the social criterion requires that the respective in-

[13] Because the benefits and costs are incurred over a given time horizon, equation (7) refers to the present value of the stream of benefits and costs that will accrue over that horizon.

and out-of-county sites first be rank-ordered. Then, the lowest-cost in-county site is compared with the lowest-cost out-of-county site.

If (7) holds and the net welfare change satisfies a Kaldor Potential Compensation Test (Freeman, 1993), i.e., $n_H \times \overline{WTA}_H^{IC} \leq n_{NH} \times \overline{WTP}_{NH}^{IC}$, then the level of compensation (COMP) provided (per household) from the non-host community (in monetary-equivalent terms) should satisfy

$$\frac{\left(n_H \times \overline{WTA}\right)}{n_{NH}} \leq COMP \leq \overline{WTP}. \qquad (8)$$

Condition (8) ensures that the aggregate level of compensation provided to the host community is somewhere between the host community's aggregate WTA and the non-host community's aggregate WTP for the in-county site.

5. Empirical Results

We turn now to the results associated with the estimation of equations (5a) and (5b), presented in Tables 4 and 6, respectively. A total of 2265 observations provided useful responses from the choice experiments, while 2008 observations provided useful choice responses, and data on income, awareness of the issue (KNOW), levels of confidence in regards to a landfill meeting regulatory standards (CONF), and opinions regarding compensation of H communities (COMP). Summary statistics for each model are presented in the bottom sections of Tables 4 and 6. The χ^2 statistic tests the null hypothesis that all coefficients are jointly equal to zero; for both models this hypothesis is rejected, showing that each is significant at the 0.01 level. The terms ρ and $\overline{\rho}^2$ indicate by what proportion a model explains respondent choices. The models therefore explain approximately 20% to 23% of the variation, respectively.

We estimate (5a) in order to focus on the most important determinants of our CS measures. To this end, the set of individual-characteristic parameters, excluding β^{loc}, are assumed equal to zero. Referring to Table 4, several of the β coefficients in (5a) are statistically significant. For example, locating an in-county landfill at sites 1, 2, and 3, respectively, relative to the "left-out" out-of-county site 5, increases the typical NH household's utility by 0.875, 0.516, and 0.721 utils, implying that of the three possible in-county landfill sites, the typical NH household most prefers site 1. Converting these marginal utility estimates to their corresponding CS values via (6) results in monthly household WTP values of $14.14, $8.33, and $11.65 for in-county sites 1, 2, and 3, respectively. Given the results for the community endowment fund (i.e. payments) and new public services (i.e. roads, police and fire protection), NH households apparently are unwilling to fund these compensation packages through contributions to an H-community endowment fund.

Not surprisingly, H households would need to be compensated before they would willingly accept the siting of a landfill in their community. The typical H household's utility decreases by 2.217, 2.566, and 1.264 utils, respectively, as in-county sites 1, 2, and 3 are chosen, implying that the typical H household prefers site 2 the least.[14] Converting these marginal utility estimates to their corresponding CS values via (6) results in monthly household WTA values of $35.81, $41.45, and $20.42 for in-county sites 1, 2, and 3, respectively. These dollar amounts reflect the perceived social costs that these households will suffer as a result of a landfill sited in their community. Similar to the NH households, the typical H household does not appear to have preference for a particular out-of-county site.

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[14] The aversion of H-households to site 2 reflects its proximity to both of the towns of Clarkston and Newton in Figure 1, and is consistent with comments made at public meetings during the study process. Similarly, the aversion of H households to site 1 reflects the fact that all of the H-community towns are en route to this site.

Comparing these results with Sasao (2004), we find that while our household-level WTA estimates are generally larger, our marginal utility estimates are comparable. For example, Sasao reports a decrease in marginal utility of 1.678 for the typical host-community household with respect to a landfill that accepts industrial waste from within the metropolitan area. This is relatively close to the average of our three values reported above (2.016). However, Sasao's utility decrease translates into a *one-time* WTP of approximately -$200, while our corresponding WTA translates into an average value of approximately -$32.50 *per month* for an indefinite period of time.

While there are possible explanations for this discrepancy, there is one notable difference between the two studies. Sasao reports that "In the questions asked before the [stated-choice] questions, 68% of the respondents admitted that a certain amount of additional landfill inevitable, and 8% insisted that many more landfills are necessary (page 759)." This type of non-negative attitude (borne of a sense of inevitability) toward an in-county landfill was uniformly absent in the opinions and attitudes of the H community households in our survey. Indeed, as Jackson-Smith et al. (2003) report, 85% of the H community households stated a strong preference for an out-of-county site over an in-county site. This preference, in turn, likely accounts for at least some of the discrepancy between Sasao's and our results.

While H households would gain utility from the county provision of roads and fire/police protection services, the combination of roads and fire/police protection has no statistical effect on utility. On the surface, this is a curious result. One would think that the more public goods provided, the larger the increase in the household's utility level. However, in this case adding fire and police protection to the provision of roads completely eliminates the utility gain of 0.806 utils that the household obtained solely from the provision of roads. One explanation for this result is that while the H community may be comfortable with the county assuming responsibility for providing roads services, they are uncomfortable with the county being in a de facto monopoly position of supplying public goods to the community. Another explanation may simply be that while H households may trust the county to adequately provide roads alone, if the county is also responsible for police and fire protection it may not have the resources to adequately ensure quality road provision in the future.

Finally for the restricted model, Table 5 presents the 95% confidence bounds on the WTP and WTA estimates for the in-county landfill sites. For the H community, the WTA intervals for sites 1 and 2 overlap, indicating that the H community's preferences for these two sites are roughly equal. The NH community's WTP intervals for all three in-county sites similarly overlap.

Table 6 presents results for the unrestricted model (5b). To save space, only the statistically significant individual-specific variables are reported, along with the community- and alternative-specific variables. Note that with the individual-specific variables included in the model, the WTP values for the typical NH household for in-county sites 1, 2, and 3 are no longer statistically significant. In other words, WTP is a function of household characteristics (e.g., confidence) more so than where the household resides.

The WTA results for H households have also changed relative to the restricted model. WTA is now highest for site 1 rather than site 2. Note that the typical H household's WTA estimates are significant for each in-county site. However, the estimates for county provision of roads and for police and fire protection are no longer positive, indicating that welfare losses incurred by H households cannot be partially offset by these new public services.

However, with respect to the individual-specific variables that explain a typical household's WTA/WTP, we find that households that are either somewhat or very confident that an in-county landfill will meet federal regulatory standards are willing to pay a positive monthly amount to avoid having to ship the county's waste out-of-county. For example, respondents who identify themselves as "somewhat confident" are willing to pay approximately $12 per month, all else equal, to ensure that in-county site 1 is chosen rather than out-of-county site 5, while those who are "very" confident are willing to pay approximately $21 per month. Similar to the results from the restricted model, results from the fully specified model suggest that monetary compensation possibilities exist.

Finally, information provided by engineers indicate that both out-of-county sites have greater costs, particularly operating costs, and thus represent more expensive options than the in-county sites. Of the three in-county options, site 1 has the longest useful life, the lowest capital costs, yet the highest operating costs (HDR Engineering 2003). From a cost and useful-life perspective, site 1 seems to represent the most realistic in-county option. Using this information along with our empirical estimates of WTP and WTA from Tables 4 or 6 enables a straightforward application of conditions (7) - (8). Examples of this application exercise are provided in Section 6.

6. Using the Empirical Results to Inform Policy

To show how this information on WTP and WTA can help to answer the overriding question, "At what level would NH residents have to compensate H residents such that they are made whole in the event that a landfill is sited in their community?," we provide two examples based on the restricted model results. The first example explores (1) whether the willingness of NH households to compensate H households in aggregate is larger than the H households' willingness to accept compensation, and (2) at what level the typical NH household would have to compensate the H community in order for the typical H household to be made whole. The second example looks at whether a combination of compensation packages might be feasible for the typical H household to be made whole.

Example 1: According to the U.S. Census 2000, there are 439 and 27,104 households located in the H and NH communities, respectively. Thus, assuming site 1 is chosen as the preferred in-county landfill site, our empirical results indicate that NH community would be willing to pay approximately $383,250 per month ($14.14 per household per month x 27,104 households) for locating a landfill at that site rather than shipping the county's waste out-of-county. However, the H community would need compensation of approximately $15,720 per month ($35.81 per household per month x 439 households). Thus, applying condition (8) to this result indicates that site 1 passes a simple compensation test, i.e., that the WTP of the NH community is sufficient to fully compensate H households for any losses associated with selecting site 1. Similarly, sites 2 and 3 pass a simple Kaldor-Hicks compensation test. This test is "simple" because it only measures the ability of the NH community to compensate the H community in aggregate. It does not ensure that the distribution of this compensation will be sufficient to make every household in the H community at least as well off as before the selection of site 1.

An alternative way of using this information is to consider the minimum monthly cost to the typical NH household that would be necessary to make the H community whole. To do this, simply divide the aggregate WTA of H households ($15,720 per month) by the total number of NH households (27,104) for a monthly cost of approximately $0.60 per NH household. In other words, charging each NH household approximately $0.60 per month would raise enough money to fully compensate the H community.

Example 2: An alternative to strict monetary compensation might be some combination of local community payments, new public services, and monetary compensation. Again, suppose in-county site 1 is selected. According to our empirical results, if the NH community provides road service for the H community, the typical H household will obtain the equivalent of $15.21 in value per month, for an aggregate community value of approximately $6,677 per month.[15] Thus, if roads are provided, then only $15,720 - $6,677 = $9,043 per month would need to be provided to the H community in monetary compensation, or $0.33 ($9,043/27,104) per NH household.

7. Conclusions

By having followed the three-stage approach advocated by Swallow et al. (1992), Cache County decision-makers integrated economists' concern for efficiency and equity with a centralized process that incorporated both expert input and diverse public preferences. In the end, the decision makers decided to proceed with property acquisition for in-county site 1. A cornerstone of this process was the conducting of a community survey that elicited compensating surplus measures from both host- and non-host-community households using a "resource-to-resource" question format recently pioneered by Breffle and Rowe (2002).

Our empirical results suggest that room exists for the non-host community to fully compensate the host community for any negative effects, actual or perceived, that might eventually occur due to the new landfill. This finding has two implications. First, by virtue of passing a simple compensation test, the siting of an in-county landfill results in positive net benefits for Cache County residents in the aggregate relative to the selection of either of two

[15] Based on the WTP values presented in Table 4, the NH community would not willingly provide road service for the H community (e.g., the typical NH-community household's WTP for this service is not statistically different than zero). However, it should be kept in mind that these values are partial, in the sense that respondents were never explicitly asked about various combinations of in-kind and monetary compensation packages, such as that described in this example. It may therefore be the case that had NH households explicitly been asked about such combinations their WTP for the entire package would have been statistically greater than zero. Regardless, as it stands in this example the provision of road service would have to be by decree. It would nevertheless be acceptable form of compensation for the H community. We thank an anonymous referee for pointing out this fact.

possible out-of-county sites. Second, non-host-community households are indeed willing to compensate the host community at a level that would make the typical host-community household whole. This compensation could take the form of strictly a monetary payment, or a combination of monetary payment and the provision of new public services. Due to the large difference in number of households across the two communities, the cost of compensation to the typical non-host-community household would likely equal something less than $1.00 per month.

Even without having conducted the community survey, Cache County may have decided to proceed with property acquisition for in-county site 1. However, as a result of having conducted the survey, local decision makers are now informed as to possible compensation packages that can potentially make the host community whole. From a methodological standpoint, we therefore conclude that the application of the resource-to-resource format to a landfill-siting decision is particularly appealing. The format not only enables a convenient and straightforward way of obtaining traditional monetary compensating-surplus measures, but also resource-based measures that allow the non-host community to examine a wide variety of resource tradeoffs as possible forms of compensation for the host community.

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Table 1
Household Demographic Characteristics

Characteristic		Host	Non-Host
Percent of adults 18-39 years old			
	Census 2000	45.7	61.4
	Survey Sample	25.0	49.3
Percent of adults 40-59 years old			
	Census 2000	35.1	24.8
	Survey Sample	43.3	28.8
Percent of adults 60 and over			
	Census 2000	19.2	13.8
	Survey Sample	31.7	22.0
Percent male			
	Census 2000	51.0	48.5
	Survey Sample	59.8	49.2
Percent of adults (25 and over) with 4-year college degree or higher			
	Census 2000	22.4	32.0
	Survey Sample	26.2	44.8
Percent that owns their own house			
	Census 2000	89.6	64.8
	Survey Sample	91.0	68.3
Percent native to Cache County		47.1	24.0
Overall Employment		57.9	70.6
Percent employed fulltime		46.9	41.2
Percent self employed		1.8	11.5
Percent employed part time		9.2	17.9
Percent “keeping house”		7.7	16.7
Percent Retired		17.9	12.3
Age of respondent		52.9	43.2

Table 2
Summary of the Compensation Packages.

1. Local Community Payments ($/year):
    - 5,000
    - 10,000
    - 50,000

2. New Public Services:
    - County provides roads.
    - County provides police and fire protection.
    - County provides roads, police, and fire protection.

3. Future Landfill Location:
    - In-County Site 1
    - In-County Site 2
    - In-County Site 3
    - Out-of-County Site 4
    - Out-of-County Site 5

4. Added Costs to Household ($/mo.):
    - 5
    - 10
    - 15

Table 3
Model Variables

Variable	Definition	Mean (std. dev.)
Compensation Variables		
C_i	Monthly household cost (in dollars).	10.33 (5.06)
$roads_r$, r , [1,3]	=1 if New Public Services are provided at level r =0 otherwise.	
	Roads (r=1);	0.05 (0.21)
	police/fire protection (r=2);	0.11 (0.31)
	roads & police/fire protection (r=3)	0.12 (0.33)
payment*	Level of annual payment to H community in thousands of dollars.	8.65 (17.25)
$landfill_w$, w , [1,4]	Future landfill site.	
	In-county site 1;	0.21 (0.41)
	In-county site 2;	0.22 (0.41)
	In-county site 3;	0.20 (0.40)
	Out-of-County site 4;	0.19 (0.39)
	Out-of-County site 5**	0.19 (0.39)
Individual Characteristics		
D_{loc}, loc , [H, NH]	=1 if household location is NH =0 otherwise	0.36 (0.48)
D_{know}	=1 if somewhat to very informed about landfill issue =0 otherwise	0.13 (0.33)
D_{sconf}	=1 if somewhat confident that in-county landfill will meet federal regulations =0 otherwise	0.52 (0.50)
D_{vconf}	=1 if very confident that in-county landfill will meet federal regulations =0 otherwise	0.38 (0.49)
D_{comp}	=1 if you believe communities located near landfills should be compensated =0 otherwise	0.61 (0.49)
D_{minc}	=1 if annual household income is $35,000-$49,999 =0 otherwise	0.42 (0.49)
D_{hinc}	=1 if annual household income is greater than $50,000 =0 otherwise	0.37 (0.48)
Alternative-Specific Variables		
D_A	=1 if alternative is A =0 otherwise	0.50 (0.50)

*Treated as a continuous variable for estimation purposes.
**Out-of-County site 5 is the reference landfill site. For the roads and payment variables, the reference service and level are "none" and 0, respectively.

Table 4
Estimation Results for Restricted Empirical Model.

Variable	β	$Stderr_{\beta}$	Marginal Utility	p-value	WTP/WTA ($/mo./HH)[*]
NH Community					
payment	–0.021	0.004	–0.021	0.045	–0.35[**]
Out-of-County Site 4	-0.107	0.116	-0.107	0.356	---
In-County Site 1	0.875	0.122	0.875	0.000	14.14
In-County Site 2	0.516	0.132	0.516	0.000	8.33
In-County Site 3	0.721	0.111	0.721	0.000	11.65
roads	0.136	0.211	0.136	0.518	---
police/fire protection	-0.046	0.148	-0.046	0.755	---
roads & police/fire protection	0.092	0.150	0.092	0.540	---
H Community					
payment	0.022	0.006	0.001	0.001	0.02[**]
Out-of-County Site 4	-0.041	0.176	-0.148	0.816	---
In-County Site 1	-3.093	0.216	-2.217	0.000	-35.81
In-County Site 2	-3.082	0.242	-2.566	0.000	-41.45
In-County Site 3	-1.986	0.179	-1.264	0.000	-20.42
roads	0.806	0.402	0.942	0.045	15.21
police/fire protection	0.481	0.263	0.435	0.068	7.02
roads & police/fire protection	0.349	0.250	0.441	0.162	---
Alternative-Specific					
Alternative A	0.111	0.066	---	0.093	---
Y - cost	0.062	0.006	0.062	0.000	---
n	2265				
Log-Likelihood	-1258.1				
Log-Likelihood (restricted)	-1568.9				
χ^2	621.5				
ρ^{2}[***]	0.20				
$\bar{\rho}^{2}$[***]	0.19				

*WTP/WTA values are not provided for those cells demarked by "---" due to the statistical insignificance associated with the corresponding coefficient estimates.
**WTP/WTA per $1000 of compensation.
***The goodness-of-fit measure ρ^2 is defined as $1 - L_u/L_R$, where L_u is the value of the log-likelihood function at its maximum and L_R is the log-likelihood function when all parameters are zero. $\bar{\rho}^2$ is defined as $1 - (L_u - K)/L_R$, where K is the number of parameter estimates (Ben-Akiva and Lerman 1985).

Table 5
95% Confidence Intervals Around Estimated WTP and WTA for Restricted Model

SITE		WTA/WTP	Lower bound	Upper bound
H-Community WTA				
	SITE 1	$35.81	$26.67	$44.95
	SITE 2	$41.45	$30.90	$52.00
	SITE 3	$20.42	$13.93	$26.91
NH-Community WTP				
	SITE 1	$14.14	$9.93	$18.35
	SITE 2	$8.33	$4.09	$12.57
	SITE 3	$11.65	$7.98	$15.32

Table 6
Estimation Results for the Unrestricted Empirical Model.

Variable	β	$Stderr_{\beta}$	Marginal Utility	p-value	WTP/WTA ($/mo./HH)[*]
NH Community					
payment	–0.023	0.015	–0.023	0.131	–0.37[**]
Out-of-County Site 4	0.304	0.429	0.304	0.479	---
In-County Site 1	-0.134	0.515	-0.134	0.795	---
In-County Site 2	-0.357	0.532	-0.357	0.503	---
In-County Site 3	-0.257	0.390	-0.257	0.510	---
roads	0.745	0.892	0.745	0.404	---
police/fire protection	0.443	0.624	0.443	0.478	---
roads & police/fire protection	0.417	0.563	0.417	0.459	---
H Community					
payment	0.015	0.008	–0.008	0.081	–0.13[**]
Out-of-County Site 4	-0.311	0.233	-0.007	0.183	---
In-County Site 1	-3.211	0.294	-3.345	0.000	-53.97
In-County Site 2	-2.480	0.313	-2.836	0.000	-45.76
In-County Site 3	-1.704	0.251	-1.961	0.000	-31.65
roads	0.636	0.545	1.381	0.243	---
police/fire protection	0.200	0.347	0.642	0.565	---
roads & police/fire protection	0.198	0.614	0.338	0.559	---
Alternative-Specific					
Alternative A	0.118	0.072	---	0.101	---
Y - cost	0.062	0.006	0.062	0.000	---
Individual-Specific					
$D_{sconf=1}$ x $landfill_{w=1}$	0.875	0.463	0.741	0.059	11.95
$D_{sconf=1}$ x $landfill_{w=2}$	0.965	0.481	0.608	0.045	9.81
$D_{sconf=1}$ x $landfill_{w=3}$	0.616	0.335	0.359	0.066	5.79
$D_{vconf=1}$ x $landfill_{w=1}$	1.419	0.477	1.284	0.003	20.72
$D_{vconf=1}$ x $landfill_{w=2}$	1.640	0.497	1.283	0.001	20.70
$D_{vconf=1}$ x $landfill_{w=3}$	1.275	0.358	1.018	0.000	16.42
$D_{comp=1}$ x $landfill_{w=2}$	-0.605	0.242	-0.962	0.012	-15.53
$D_{know=1}$ x $landfill_{w=2}$	-0.549	0.280	-0.906	0.050	-14.62
$D_{know=1}$ x $roads_{r=3}$	0.585	0.311	1.002	0.060	16.16
$D_{hinc=1}$ x $landfill_{w=4}$	0.421	0.245	0.725	0.086	11.70
$D_{hinc=1}$ x $roads_{r=3}$	-0.877	0.367	-0.461	0.017	-7.43
n	2008				

Log-Likelihood	-1072.1
Log-Likelihood (restricted)	-1390.5
χ^2	636.8
ρ^{2***}	0.23
$\bar{\rho}^{2***}$	0.18

*WTP/WTA values are not provided for those cells demarked by "---" due to the statistical insignificance associated with the corresponding coefficient estimates.

**WTP/WTA per $1000 of compensation.

***The goodness-of-fit measure ρ^2 is defined as $1 - L_u/L_R$, where L_u is the value of the log-likelihood function at its maximum and L_R is the log-likelihood function when all parameters are zero. $\bar{\rho}^2$ is defined as $1 - (L_u - K)/L_R$, where K is the number of parameter estimates (Ben-Akiva and Lerman, 1985).

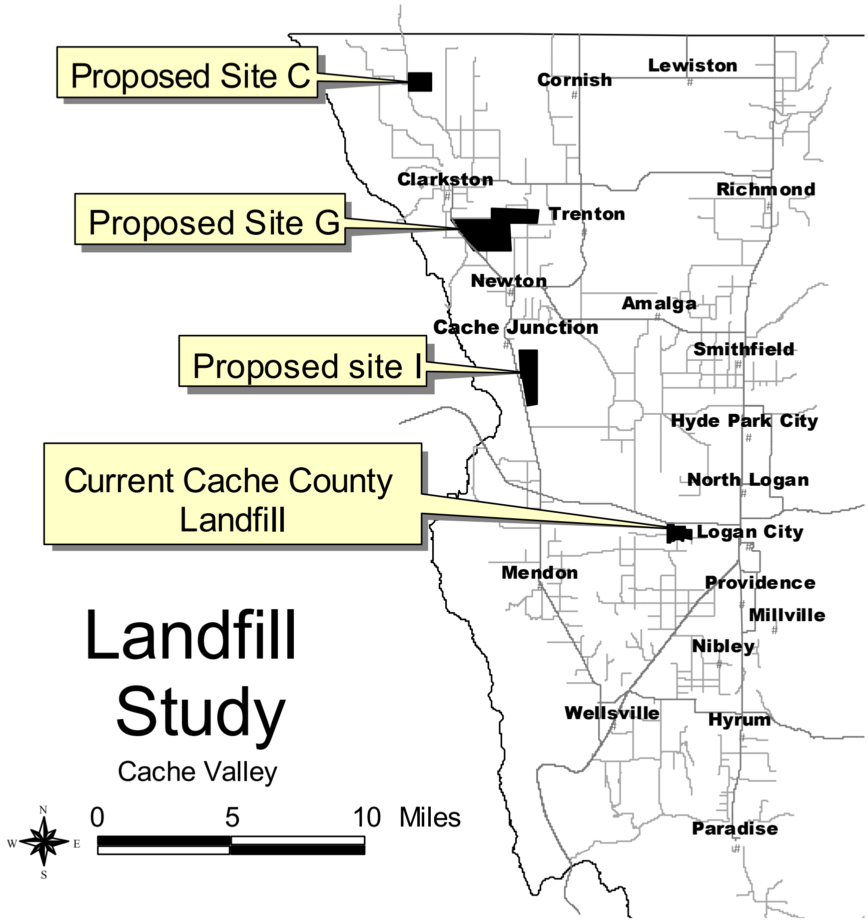

Fig. 1. Map of Proposed In-County Landfill Sites*

*The map above shows the approximate locations of the current county landfill (in Logan) and three proposed Cache County sites that could be used for a future landfill, where Sites C, G, and I refer to Sites 1, 2, and 3, respectively, as identified in the text. Actual boundaries of future landfills would be somewhat smaller (text taken directly from the survey).

	Alternative A	Alternative B
Local Community Payments	No Payments	$50,000 per year
New Public Services	No New Services	No New Services
Future Landfill Location	Ship to Out-of-County Site 5	Use In-County Site 2
Added Cost to your Household	$10 per month	$10 per month

☐ I prefer Alternative A

☐ I prefer Alternative B

Fig. 2. A Simple Resource-to-Resource Choice Question.

	Alternative A	Alternative B
Local Community Payments	No Payments	No Payments
New Public Services	No New Services	No New Services
Future Landfill Location	Ship to Out-of-County Site 5	Use In-County Site 2
Added Cost to your Household	$5 per month	$0 per month

☐ I prefer Alternative A

☐ I prefer Alternative B

Fig. 3. A Simple Referendum Choice Question.