Conjoint Analysis:
Assessing Buyer Preferences for Property Attributes to Assist with the Estimation of Land Contamination Stigma

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Abstract: The traditional approach to property valuation that dominates valuation theory and practice in Australasia is the Sales Comparison Approach. However, the approach relies heavily on the availability of comparable sales price data and the ability of the valuer to adjust these for differences in property attributes between the comparable and subject properties. A plentiful supply of sales price data greatly assists the task of determining how each of these attributes contributes to price but in circumstances where comparable sales price information is scarce, as is often the case for contaminated property, other information sources are required to achieve this.

One option open to valuers faced with a scarcity of comparable sales data is to find out directly from the buyers what their preferences are for particular property attributes. Knowing how important each property attribute is to buyers enables the attribute to be correctly weighted in the valuation process. This paper summarizes the results of a study that uses conjoint analysis, a survey-based technique, to determine the importance of land contamination and other relevant property attributes in purchasers' buying behaviour of remediated residential land. From the results, the extent that "stigma"[1] should be taken into account in valuations of post-remediated residential property was ascertained.

[1] "Stigma" is the blighting effect on property value caused by perceived risk and uncertainty. Uncertainties relate to negative intangible factors such as: the inability to effect a total "cure"; risk of failure of the remediation method; risk of changes in legislation or remediation standards; difficulty in obtaining finance, or simply, a fear of the unknown. Post-remediation "stigma" is the residual loss in value after all costs of remediation, including insurance and monitoring have been allowed for.

Brief Literature Review

> "The basic concept that perceptions of risks can affect market value of once-contaminated property is reasonable. Quantifying the effect of those perceptions in particular cases, however, is not always straightforward", (Elliot-Jones, 1995).

Due to the significance of risk perceptions in the valuation of contaminated property[2] this section reviews the literature dealing with approaches to measuring risk perceptions and discusses the effect these have on contaminated property values. The review incorporates a discussion of the theories underlying these approaches that come from various academic disciplines including finance, economics, marketing, and psychology. Further, it provides the rational for focusing on the behavioural approaches to risk analysis in this paper. By way of introduction, a brief discussion of risk perceptions from the social scientists' viewpoint is presented first.

Social Theories of Risk[3]

According to Golding (1992) risk research was first legitimised as an academic endeavour in the US with the passage of legislation in the early 1970's relating to environmental protection, with funding for it becoming available from agencies such as the Environmental Protection Agency. It was in 1979 that the Technology Assessment and Risk Analysis (TARA) program set the directions for the boundaries of risk research. Subsequently, it was at the first annual meeting of the Society for Risk Analysis that found that the public

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It equates to the difference in value between a remediated contaminated site and a comparable "clean" site with no history of contamination.

[2] Including both currently and previously contaminated property.

[3] The research reported in this section is referenced primarily from Krimsky and Golding (1992).

perceptions of risk differ markedly from expert assessments and this formed the basis for much of the risk research since then.

Krimsky and Golding (1992) explain that the divergence in views of risk is in part due to the influence on risk policies from the field of economics. The economists' view of risk is based on expected utility theory that comprises a set of decision rules that define rational behaviour. It assumes people will follow these rules if they have sufficient information and time to dwell on the consequences of alternative decision paths.

Krimsky and Golding, however, suggest that the public's perception towards risk will vary according to a wide range of variables including voluntariness, catastrophic potential, dread etc. This view, which departs from the view that risk may be reduced to a common metric, is based on "cognitive theory" of how people think and reason. This theory shows that risk decisions are made on the basis of multiple attributes that describe the risk event. It has been the driving force behind risk communication research and has become enshrined in laws such as the *Superfund Amendment and Reauthorization Act* 1986 (SARA).

A number of the studies have been conducted to help understand these divergent views of risk, and a selection of these is presented next.

In a study of risk perception Kunreuther (1992) contrasted two models of choice: expected utility theory (economics) and sequential model of choice (principles of bounded rationality). He found that individuals have a hard time dealing with the concept of probability and tend to rely on salient information (past experience) and easily accessible sources (friends and neighbours) rather than utilising statistical data and making tradeoffs between costs and benefits. Further, he found that people use rules of thumb (heuristics) that enable them either to disregard the possibility of a disastrous event or cause them to show disproportionate concern about the

potential. He suggests that violations of expected utility theory are due to attributes other than outcomes such as ambiguity or vagueness about probabilities. The result is that risks that are uncontrollable, unknowable, or have catastrophic potential, are feared by the public even though they are unlikely. He suggests that this may explain the NIMBY (Not In My Back Yard) Syndrome where experts may perceive siting of hazardous facility as safe while nearby residents focus on the impact of a potential leak.

Slovic (1992) studied peoples' perceptions toward risks and benefits, and their preferences for various kinds of risk/benefit tradeoffs. To do this he used what he terms a "psychometric approach". This approach involved the use of questionnaires that incorporate attitude questions, word associations, and scenario generations. He asked respondents to rate hazards based on various qualities such as catastrophic potential, controllability etc., to produce quantitative measures of perceived risk. Factor analysis was used to group similar characteristics of risks.

The findings showed that risk meant different things to different people. Laypeople assess risk differently from "experts". While laypeople take annual fatalities (assessed by experts) into account their judgements of risk were sensitive to other factors. From the factor analysis, Slovic found "dread risk" (seen as having catastrophic potential and been uncontrollable and involuntary) is an important factor for laypersons. This indicated that it is perceived as more risky. This was in contrast to the experts' perceptions that were not closely related to this factor. The experts see risk as synonymous with expected annual mortality. Thus, conflicts exist about risk as each group has different definitions.

Slovic's discussion of risk perception included the concept of stigma. He associates this word with risk perception and suggests the link between the two is "peril". From the results of his study he also suggests that aesthetics (ugly or upsetting), visibility, dangerous and disruptive are factors in stigmatisation. He found that

mechanisms of social amplification, such as heavy media coverage and attention drawn to problems by special interest groups, can increase the stigma.

Kasperson (1992) argues for new approaches to risk analysis that fuse the technical and social conceptions for risk. He explains that hazard events interact with psychological, social, institutional and cultural processes in ways that can heighten perceptions of risk and shape risk behaviour. The behavioural responses in turn generate secondary social or economic consequences, e.g. stigmatisation; loss of confidence in institutions; and insurance costs. These trigger demand for further institutional responses and protective actions. Thus, Kasperson defines risk as both a threat of physical harm (an event or a report of an event, releases, exposures or consequences) and the result of cultural and social processes when these events are communicated to others (social amplification) and the results of such communication.

While not denying the need for technical risk analysis, the foregoing authors simply argue for the need to include the social view of risk in the risk analysis. As such the emphasis of this paper is on risk perceptions from the social perspective. The econometric treatment of risk perception and stigma is covered adequately by other authors (see for example Dixon *et al.* 1988; Abelson 1979; Zeiss & Atwater 1989, 1990; Colwell 1990; Priestley & Evans 1990; Smolen, Moore, & Conway 1992; Levesque 1994; Bond 1995; Dotzour 1997; Simons, Bowen, & Sementelli 1997; Reichert 1997; Dale, Murdoch, Thayer, & Waddell 1999; and McCluskey & Rausser 2000). The next section provides a brief review of the property literature from a social and behavioural perspective.

Behavioural Research in the Property Literature

In a parallel to the above researchers of risk perceptions, Diaz (1999) recognises the need to consider the social and behavioural perspectives in property research by claiming "the essence of property is human

behaviour"(Diaz III 1999, p.326). Similar to the risk research, the traditional approach to property research that has dominated is what Diaz terms the "finance paradigm" which was inherited originally from economics. This approach is theoretically underpinned by the rational man ideology and the efficient market hypothesis. Regression-based econometric techniques to analyse property sales dominate the approach, but Diaz argues that such an approach that views property as an investment that can be fully defined by its cash flows is restrictive. Further, he suggests that because the finance paradigm's data are sales prices its power to illuminate the economic activity of property is limited, and it is this weakness that has led to the behavioural approach.

Diaz argues for the need to observe human behaviour of economic activity to overcome the shortcomings of focusing the analysis on the sales analysis approach. The techniques used to do this, such as controlled experiments and opinion surveys have not been accepted by the finance tradition and generate data that require evaluative statistics different from those commonly used in the finance tradition. The theory of the behavioural approach is likewise different to those used under the finance paradigm and is grounded in psychology and the work of Newell and Simon (1972) in human information processing and problem solving.

Grissom (1991) highlights the importance of understanding buyer behaviour when applying the sales comparison approach and making adjustments to comparable properties. The skill of the valuer rests in the selection of comparable properties, the recognition of key variables, and the adjustments to make to the sale price of each comparable sale for differences in the variables between the subject property and the comparable. These adjustments are based on the valuer's judgement and expertise in interpreting buyer behaviour. Yet, Greaves (1984) implies that valuers do not fully understand how variables behave in contributing to the value of residential property.

A study by Adair *et al*. (1996) tests the hypothesis that valuers consider value elements in the same way that buyers do. "If this contention is valid, then it is reasonable to expect valuers to display a high degree of similarity to buyers in their consideration of the most salient influences". They identified 69 variables from the US and British valuation and econometric literature. After a pilot survey of valuers and buyers in Belfast, 55 variables were identified as relevant to the Belfast housing market. They then asked valuers (76) and buyers (506) in the Belfast residential market to identify from the listing of variables those factors they considered had the greatest influence on property prices/value. There were statistically significant differences of the relative influence on value for each variable between the two sample groups.

The results indicated that valuers place a greater emphasis on environmental or neighbourhood effects whereas buyers perceive property variables such as house size and condition to be more important in their purchase decisions. Valuers also place higher scores on all variables, compared to the buyers. As noted by Diaz: "this finding not only questions the appropriateness of normative valuation methodologies but challenges our understanding of value formation", (Diaz III 1999, p.329).

The question to emerge from these results was whether such difference is reflected in a significant variation between market price and value. To test this premise, Adair *et al*. compared 1,079 sales in Belfast in 1993 against the value set by the surveyor. Valuations appeared to be within 10% of price. They concluded that if this level is professionally acceptable:

> …[I]t is of more academic than practical significance that buyers and valuers perceive differently the influence of an array of variables. However, should valuers wish to improve valuation accuracy levels vis-a-vis the market, then a greater awareness ought to be shown of the factors that influence the buyers decision-making process, (*ibid*., p.34).

This provides further support for a behavioural approach to valuation.

Like the above authors, Hardin (1999) recognizes the late acceptance by finance and real estate researchers of behavioural theory as a paradigm for the study of decision-making and notes that this is in contrast to other areas of business specialization including marketing, accounting and management. However, he then goes on to question, within the field of real estate, if one can design studies of stigma, view, or any other market driven effect. Results from studies by other researchers, outlined next, would suggest that one can.

Conjoint Analysis – An Approach to Help Understand Buyer Behaviour

Conjoint analysis, the survey-based approach adopted for the research reported here, is a multivariate technique used to study consumer preferences among mutli-attribute alternatives to help understand purchasing behaviour. Hair *et al*. (1995, p.379) outline the advantages of conjoint analysis over other multivariate techniques. They claim that it is an ideal technique to use due to its flexibility and uniqueness, including "(1) its ability to accommodate either a metric or non-metric dependent variable, (2) the use of categorical predictor variables, and (3) the quite general assumptions about the relationships of independent variables with the dependent variable". Further, it differs from almost all other multivariate techniques in that it has the ability to be carried out at the individual level so that a separate model can be predicted for each respondent. Other techniques just take a single measure of preference from the analysis of data from all respondents (observations).

Very few property-valuation applications of conjoint analysis are reported in the literature. An exception is the paper by McLean and Mundy (1998). In introducing the conjoint analysis method McLean and Mundy refer to

the description provided by the NOAA Final Rule (Federal Register 1996, January 5) that includes support for use of the approach in valuation, as follows:

> Conjoint analysis is a survey procedure that is used to derive the values of particular attributes of goods or services. Information is collected about individuals' choices between different goods that vary in terms of their attributes or service levels. With this information, it is possible to derive values for each particular attribute or service. If price is included as an attribute in the choice scenarios, values can be derived in terms of dollars, which can be used with the valuation approach.

This description, however, infers the use of conjoint analysis in tandem with the "valuation approach" (presumably meaning any of the three traditional valuation methods) and not as a replacement for it.

McLean and Mundy (1998) provide only an illustration using a hypothetical example of how the conjoint analysis can be applied in practice to the valuation of contaminated property. As such, their use of an example that narrowly defines a residential property in terms of only three researcher-selected contamination-related attributes could be excusable. This choice of attributes implies that these are the most important to the buyer. It therefore ignores other property attributes that may be of greater importance such as size, quality of construction, distance to amenities, views, etc. The application of conjoint analysis, however, requires that the hypothetical "product" be as realistic as possible and comprising attributes predetermined as most important to the buyers within the target market, otherwise the results will be biased.

Despite these weaknesses, the paper provides a good explanation of conjoint analysis. The technique is presented as a complementary approach to the traditional valuation approaches for estimating damages to real property arising from contamination but one that overcomes the limitations of those approaches.

Other property-related applications of conjoint analysis that appear in the literature are reported in the marketing journals where new product design applications predominate. Examples of these include studies of: home-owners preferences for suburban land development patterns, including lot size, yard space, view from the yard, etc. (Knight & Menchik 1974); consumers' preferences for housing alternatives, focusing on asking price, number of bathrooms and bedrooms, etc. (Louviere 1979); travellers' hotel preferences focusing on seven hotel attributes to help in the design of a new hotel chain for Marriott (Wind, Green, Shifflet, & Scarborough 1989); industrialists' location/relocation preferences in terms of cost, location, and premises to help property professionals provide more competitive market solutions (Levy 1995), and business traveller's service preferences (physical environment and personal service) of luxury hotels in Singapore to inform management decisions (Mattila 1999).

Strub and Herman (1993) used conjoint analysis to survey two distinct respondent groups and found that sales force judgments bore little resemblance to customer judgments about a new multimedia desktop telecommunications device. They concluded that new product research should be done with customers. This was similar to the finding by Adair *et al.* (1996) that judgements by different respondent groups (valuers and residents) about the same stimuli (the importance of various housing attributes to price) vary. These differences highlight the need to survey the respondents making the choices between products. In terms of the research reported here of buyers' perceptions of land with a history of contamination, this is the group that should be surveyed. However, as in the Strub and Herman (1993) study, to test how closely valuers and real estate agents judgements correspond to those of their customers all three groups of respondents were surveyed. The next section outlines the research methodology employed.

Research Methodology

Introduction

There are many contributing factors that make up the worth of a property from a purchaser's viewpoint such as the size of the land, the view obtained, proximity to amenities etc. Trade-offs are made between these various factors and property sales prices, used by valuers to determine a property's value, are a weighted summation of these. It is the valuer's job to assess the important value-determining factors and the weights prescribed to each when analysing these prices to estimate value. However, as indicated above, valuers rarely know the relative contribution of each factor to the overall value of a property. As there are no formal techniques typically used to achieve this, the valuer uses his/her personal judgement to determine the relative weights.

Conjoint analysis is the technique used to improve the valuation accuracy levels *vis-a-vis* the market by gaining a greater awareness of the factors that influence the buyers' decision-making process. A study of a consumer's preference structure explains not only how important each attribute is in the overall decision about a product, but also how the differing levels within an attribute influence the formation of an overall preference. By knowing how each attribute contributes to price, valuers are better able to compare the subject property with similar properties that have sold recently and adjust sale prices for differences between these to arrive at a final value estimate. This is a more precise method of sale price adjustment than simply basing these adjustments on what the valuer intuitively believes to be the most important.

It is this aspect of conjoint analysis that will be used in the current study. Rather than predicting overall preference, the aim of this research is to determine the importance of each land attribute and the value of each land attribute for a parcel of land. Land attribute importance can be determined from respondents' overall

evaluations of a set of hypothetical land parcels (combinations of selected levels of each attribute of the land parcel).

Conjoint analysis assumes that consumers evaluate the value or utility of a product (real or hypothetical) by combining the separate amounts of utility provided by each attribute and that the trade-off decisions made are revealed through their product choices. An experimental design is used to analyse this behaviour. The procedure involves asking respondents to provide their overall evaluations of a set of hypothetical products that combine the possible attributes of that product at various levels. Conjoint analysis is then used to decompose the set of overall responses to multi-attribute alternatives so that the utility of each attribute level can be inferred from the respondents' global evaluations of the alternatives.[4] The technique involves a type of analysis of variance in which the respondents' overall preferences serve as a dependent variable and the dependent variable and predictor variables are represented by the various attribute levels making up each alternative (Green & Tull 1973).

Information integration theory is the main theory underlying conjoint analysis as developed by Anderson (1970). This theory, as described by Louviere (1988), is about the behaviour of numerical data in response to multiple pieces of information. The numerical data of interest consist of individual rating (or ranking) responses to combinations of different attributes (decision variables) of a product or brand. Information integration theory can therefore be used to study information processing revealed by consumers' responses to multi-attribute options.

The basic assumptions of the theory as outlined in Louviere (1988, pp. 13-14) include:

[4] Thus, conjoint analysis is termed a decompositional model. Simply by knowing a respondent's overall preference for an object and what its attributes are, the preference can be decomposed to determine how much is due to each attribute it possesses and each possible value of that attribute.

1. The unknown and unobservable overall utility that a consumer has in her mind regarding the j-th brand is linearly related to a consumer's response on a category-rating scale. That is,

   $$Uj = a + bRj, + ej,$$

   Where Uj is the overall utility to measure of the j-th brand, Rj is the observed response on a category-rating scale, and ej, is a normally distributed error term that satisfies the assumptions of analysis of variance or multiple regression.
2. The category-ranking scale used by a consumer under appropriate experimental instructions and task conditions approximates an interval scale measurement level.
3. A consumer's response strategy reveals his decision strategy. The response strategy can be approximated by algebraic conjoint models amendable to experimental investigation and statistical parameterisation.

The general form of the conjoint model can be shown as:

$\text{Total worth for the product}_{ij:n}$ = $\text{part-worth of level}_i$ for factor_1 +

$\text{part-worth of level}_j$ for factor_2 +...+

$\text{part-worth of level}_n$ for factor_m

where the product has m attributes, each having two or more levels. The product consists of level_i of factor_1, level_j of factor_2,…up to level_n for factor_m.

In algebraic notation the basic conjoint model of consumer choice can be written as follows:

$S_{jk} = f1_k (X_{jk})$,

$V(S_{jk}) = f2_k (S_{jk})$,

$U_j = f3 [V(S_{jk})]$,

$P(j \mid A) = f3\ (U_j)$

Where:

X_{jk} = a JxK array of physical variables[5] (J represents the total number of brands,[6] K represents the total number of attributes) that underlie a consumer's attribute beliefs.

S_{jk} = an array of dimension JxK that constitutes the consumer's beliefs about the level of the k-th attribute for the j-th brand of interest.

$V(S_{j,k})$ = an array of dimension JxK that contains the measures of the part-worth utilities of every element of S_{jk}. It represents the consumer's opinions regarding the worth of the j-th brand's position (or ranking) on the k-th attribute.

U_j = a consumer's overall utilities or preference for j-th brand.

$P(j \mid A)$ = is the probability of choosing the j-th brand from choice set A, of which j is a member.

Of particular interest to this research is the property contamination attribute and its impact on value. Contaminated land, even if remediated, is often perceived negatively. People are concerned about the risks associated with such land when contemplating investment in it. However, valuers are often unclear of the magnitude of these negative perceptions and how important they are in purchasing decisions.

The levels of the contamination attribute tested in this research include:

- a clean site but next to a currently contaminated site;
- a remediated site; and
- a clean site with no history of contamination.

[5] In this case, individual characteristics of each sold property (e.g., lot size, view, sales date, post-remediated site, etc).

[6] In this case, brands equate to properties.

Conjoint Analysis Procedure

Identifying the Attributes to Study

Evidence shows that people tend to simplify choices among complex options so as to reduce the cognitive strain and information overload. They do this by focusing on a few attributes in their decision (Bruner *et al.* 1957). Thus, as a first step in the conjoint analysis it is necessary to determine which attributes to study.

Several alternative methods exist for identifying the attributes relevant to consumers in forming their preferences. This research used both resident interviews and an initial postal survey of residents to identify the determinant property attributes in the targeted segment of the vacant residential land market.

The attributes identified as important in resident's purchasing behaviour include river access, proximity to Fremantle, price, land area, and river view. A site's contamination history is an attribute significant to this research so it was also included in the analysis. The more attributes and levels there are in the conjoint study, the greater the number of parameters to be estimated. This requires either a larger number of profiles or a reduction in the reliability of parameters. As such, the number of attributes was kept to a minimum that adequately described the product (vacant residential land) in a realistic way.

Development of the Conjoint Experiment

Once the list of attributes was obtained a conjoint experiment was designed to understand how the target individuals integrate the attributes. The process involved forming all possible combinations of the attributes, and the associated levels of each and asking respondents to rank them. The attribute levels were selected to conform to actual levels encountered in a case study area[7] (obtained from sales data and site information) to make the conjoint experiment as realistic as possible. For example, land area varied from 375 to 650 square metres and prices ranged from $250,000 to $500,000, with levels selected to cover the ranges indicated in the

[7] See Appendix I for a map and details about the case study area.

data. From this it was possible to measure the relative values of the attributes considered jointly by considering the trade-offs made between attributes.

Property Attributes Studied

There were six attributes identified and between two and three levels of each were selected. All of the attributes are orthogonal. These are shown in Table 1 below.

Table 1: Attributes and Levels

Attribute	Level One	Level Two	Level Three
River Access	Within 200 m	200 – 1000 m	Over 2000 m
Proximity to Fremantle	Within 5 km	5 – 10 km	Over 10 km
Price	$250,000	$375,000	$500,000
Land Area	375 m^2	500 m^2	650 m^2
Contamination	Remediated site	Next to Contam. site	Clean site
River View	River View	No River View	

As the attributes are required to be numeric they have to be coded accordingly. Values were assigned as shown in the following table:

Table 2: Attribute Values

Factor	Level One	Level Two	Level Three
River Access	200	1000	2000
Proximity to Fremantle	5	7	10
Price	250	375	500
Land Area	375	500	650
Contamination	1	2	3
River View	1	2	

For the current study an additive main-effects model was used. This model uses the assumption that respondents given a choice of property investments will select that option which produces the highest utility. This follows the tradition of Lancaster's (1966) theory of consumer behaviour that assumes that an individual derives utility from the characteristics of a good and not from the good itself.

The additive composition rule was adopted as it enabled the use of a fractional factorial design, a feature, in addition to its simplicity, that makes it the most popular compositional rule. This rule assumes that individuals just "add up" the part-worths to calculate an overall or "total worth" score indicating their preference and that there are no interactions between attributes.

The advantage of using the fractional factorial is that it avoids the need to evaluate all 486 possible combinations (2 x 3 x 3 x 3 x 3 x 3) of the six attributes by selecting a smaller number of these alternatives. Using a fraction of all the possible combinations of the attributes helps to keep the research costs down and avoids respondent confusion and fatigue. However, when the additive compositional rule is adopted only the main effects for each factor are estimated.

Another advantage of using the fractional factor design is that the stimuli are created so that the factors are orthogonal, a requirement to ensure the correct estimation of the main effects.[8] The Conjoint software "Orthoplan" is required to generate this fraction. Orthoplan is available in SPSS and randomly selects the designs so that a main effects general linear model relating respondent preferences to the six attributes can be fitted that meets statistical criteria such as efficiency, orthogonality and balance. This process ensures that the statistical problem of multicollinearity is avoided.[9]

A model was specified for each attribute to indicate how each attribute's levels are expected to relate to the ranks. Models are selected that most accurately represent how consumers actually form overall preference (as suggested by theoretical or empirical evidence). Conjoint analysis gives the analyst three options to choose from, ranging from the most restrictive (a linear relationship) to the least restrictive (separate part worths - the

[8] Orthogonality is a mathematical constraint that the part-worth estimates be independent of each other. As Hair *et al*. (1995, p.381) explain "In CA this refers to the ability to measure the effect of changing each attribute level and separate it from the effects of changing other attribute levels and from experimental error".

[9] A stand-alone software package "Trial Run" can also be used that produces more efficient and balanced factorial designs, however, this package was not readily available without incurring significant additional expense.

discrete model), with the quadratic model (ideal-point (decreasing preference)/anti-ideal-point (increasing preference)) falling within this range. "More" and "less" commands for the discrete and linear models are used to show the direction of the expected relationship. For example, it is expected that river access is linearly related "less" to rankings so that lower levels of the attribute (shorter distance to the river) will receive lower (more-preferred) rankings.

The choice of relationship does not affect how the stimuli are created, but it does impact on how and what types of part-worths are estimated by conjoint analysis. The "more" and "less" commands do not affect the estimates of the utilities but are used simply to identify subjects whose estimates do not match the expected outcome. Each attribute had an expected outcome for respondent-preference (with the expected most preferred options shown in brackets) as follows:

River Access: a shorter distance to the river (200 m).

Proximity to Fremantle: a shorter distance to Fremantle (5 km).

Price: a lower price ($250,000).

Land Area: a larger site size (650 m^2).

Contamination: a clean site (coded as "3").

River View: a river view (coded as "1").

Data Collection

A full-profile method, that shows all of the attributes (and not just pairs of attributes), was adopted for presentation of the stimuli as this was considered to be a more realistic, more explicit portrayal of the trade-offs among attributes than the trade-off method that shows only two attributes at a time. The full-profile approach is also the most popular method mainly due to its ability to reduce the number of comparisons through use of a

fractional factorial design (the trade-off method is unable to employ this design). Further, the approach elicits fewer judgments, however, each judgment is more complex.

The Orthoplan (stimulus design) procedure generated a set of 18 full-profile descriptions for use in the experiment allowing for the estimation of the orthogonal main effects of each factor. An instruction sheet was provided to respondents together with a sheet showing the set of 18 profiles (see Appendix II). Respondents were asked to rank each profile (stimuli) in order of preference from high to low according to their perception of how likely a resident would be to purchase the land described by each profile. This involved the respondent making a trade-off between the various attributes presented. They were requested to enter the number 1 in a column on the sheet next to the profile they consider they would most likely purchase, and a ranking of 18 next to the least likely option to be purchased, and then to rank the remaining profiles accordingly.

Sample Selection

As mentioned above, a survey of the residents of affected property was preferable, but due to the small number of respondents in the initial residents' survey indicating a willingness to participate in the conjoint study, an alternative respondent group was sought. Property valuers were identified as an appropriate alternative respondent group.

The opportunity arose to present a seminar to the Western Australian members of the Australian Property Institute on the valuation of contaminated land. Using this opportunity to run the survey ensured the required numbers of respondents[10] were present, and that they were valuers with an interest in contaminated land issues.

Due to the finding by Adair *et al.* (1996) that suggests valuers use imprecise methods to interpret residential purchasers' behaviour and as such their interpretations may be a poor proxy of buyers' behaviour it was

[10] Curry (1997) recommends at least 30-50 respondents per market segment.

considered worthwhile for comparative purposes to obtain responses from those residents who had shown a willingness to participate in this survey, despite the limited number of these.

Real estate agents were also identified as a potential respondent group as they are actively involved in marketing properties and thus have an opportunity to influence purchaser behaviour. As the case study area is located in the Fremantle Shire, it was considered most appropriate to use a focused respondent group and survey only those agents listed in the Fremantle area. It was thought that such agents would at least be aware of contaminated land issues and the controversy that exists surrounding various sites in the area.

Similar to the finding by Adair *et al*. (1996), Strub and Herman (1993) found that sales force judgments bore little resemblance to customer judgments. To test how closely valuers and real estate agents judgements correspond to those of their customers in the current study, results from all three groups of respondents were compared.

It was preferable to personally distribute the survey and be able to explain the ranking task due to the potential for it to be perceived as complex. However, due to the number of respondents to be surveyed (85 real estate agents from 11 agencies, and 9 residents) a self-administered questionnaire was selected as the most appropriate collection technique for the agent and resident groups. Various techniques were utilised to help overcome a low responses rate including inclusion of a free-post return envelope, an accompanying letter ensuring anonymity, and sending of reminder letters.

The residents survey was addressed to the named resident as supplied on the returned questionnaire from an initial residents' survey. The real estate agents survey was mailed to individual agents identified from both the

Yellow Pages and Real Estate Institute of WA sponsored web site "RealNet" (http://www.realnet.com.au). Collection was by freepost mail in both instances.

The initial mailing of the residents and real estate agents surveys took place on the 19 and 20 October 1999, respectively. Of the residents' sample, 7 completed questionnaires were returned. This indicated a response rate of 78%. Of the agents' sample, 15 responses were received, 13 of which were completed surveys. Of the two unanswered surveys, the reasons provided were that one agent had nothing to do with residential property while the other felt that the rating task was too difficult. On 17 November 1999, 70 reminders were sent out to real estate agents but no additional surveys were returned. A total response rate of 17.65% was achieved (15.3% usable). Table 3, below, summarises these responses.

Table 3: Response Rates

Valuers	Residents	Real Estate Agents
100 % (n=57)	78 % (n=7)	15 % (n=13)

Analysis of the Data

Once the survey was run and the ranks (preferences for each full-concept) were collected and entered into a spreadsheet. The ranks become a dependent variable in a general linear model. Binary variables, set equal to 1 if the attribute level was present on the profile and set equal to 0 otherwise, were entered for n-1 levels of each attribute. These binary coded variables served as the independent variable set. The SPSS Conjoint procedure involves doing a linear regression model analysis of the data. The coefficients of the independent variables are the estimated parts-worth utility scores of each attribute for each respondent and for the group. These scores are chosen by the conjoint estimation program so that when added together the total utility of each alternative product (profile) will correspond to the original ranks as much as possible.

This is the first time that conjoint analysis has been used in this way. While it has been used to analyse the purchasing behaviour of property owners (see for example Louviere, 1979)[11], no studies that the author is aware of have used conjoint analysis to assess the attributes of property affected by stigma from previous contamination. As discussed above, it is a valuable tool for valuers wanting to know how each attribute, including contamination, contributes to the price of a property.

Conjoint Analysis Results

In this section the results from the three respondent groups are presented and compared. While utilities were estimated for each individual respondent and for the group of all respondents, only the group results will be presented for each group: the valuers, real estate agents, and residents.

The next section outlines descriptive statistics about the valuer respondents. Similar detailed analysis was not sought for the other two groups as it was of less relevance in determining the representativeness of the group responses to those of the target group, the residents, that they are acting as proxies for.

Profile of Valuers' Membership, Gender, and Age

A profile of the respondents' membership, gender and age was obtained from the membership database of the WA Branch of the Australian Property Institute (API) for 54 of the valuers. As the remaining three respondents were not members of the API this information was not available for them. While the respondents covered the full range of API membership classifications and age categories, the majority were male (96.3%). Given that valuers' responses are being used in this study as proxies for buyer behaviour toward residential vacant land where the market comprises a more balanced gender mix, this sample has a gender bias that may effect how representative the results are of the target market.[12]

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[11] Louviere (1979) reported two studies of consumers' preferences for housing alternatives looking at various combinations of housing attributes such as: number of baths and bedrooms, and asking price.

[12] The breakdown by gender of the Perth population of 1,244,320 is 49% male, 51% female (1996 Census Data, Australian Bureau of Statistics 2000).

The membership classification of respondents is shown in the following table and indicates that nearly two-thirds of the respondents (65%) have at least two years valuing experience, with a third of these (20.37%) having over 10 years experience. This level of experience provided confidence in the respondents' ability to answer the survey.

Table 4: Membership Classification		
Member Category	**% (n)**	**Membership Description**
Student	20.37 (11)	Enrolled at Curtin University in the valuation degree program
Graduate	11.11 (6)	Graduated but not yet obtained 2 years practical valuing experience
Provisional Associate	3.70 (2)	Admitted to membership without a degree, but licensed as a valuer
Associate	44.44 (24)	Have 2 years practical experience in the property profession
Fellow	20.37 (11)	Have over 10 years valuing experience and have made a substantial contribution to the valuation profession

Table 5 below, shows the age categories of respondents. Nearly two thirds of the respondents were over 30 years of age (46% over 40 years). One would normally expect that older valuers have more experience in valuing than younger ones (they have been working in the profession longer) and thus this age distribution provides evidence to suggest that the respondents were experienced valuers and able to answer the survey knowledgably.

Table 5: Age Categories	
Age Category	**% (n)**
20-29 years	35.10 (19)
30-39 years	18.52 (10)
40-49 years	20.37 (11)
50-59 years	12.96 (7)
60-69 years	9.26 (5)
Over 70 years	3.7 (2)

Group (aggregate) Results: Valuers, Real Estate Agents and Residents

The results from each respondent group indicate that each attribute had an expected outcome for respondent-preference, outlined previously, as follows:

River Access: a shorter distance to the river (200 m).

Proximity to Fremantle: a shorter distance to Fremantle (5 km).

Price: a lower price ($250,000).

Land Area: a larger site size (650 m^2).

Contamination: a clean site (coded as "3").

River View: a river view (coded as "1").

If different levels of an attribute produce widely different utilities the person is sensitive to the level (i.e., the attribute is important to them). The graphical interpretation of the results (i.e. the utilities of each attribute)[13] in Appendix III clearly shows the relative importance of each attribute for the attributes and levels tested here. Table 6 below summarises the results for each respondent group. Both the utilities and averaged importance figures are shown.[14] The attributes are listed in decreasing order of importance for the valuer group and similarly for the other two groups. However, some attributes are listed out of decreasing order of importance for the real estate agent and resident groups where the order of importance of the attributes differs from that for the valuer group. This order is indicated by a superscript next to the averaged importance figure.

As proximity to the river and Fremantle are measured as distance from these amenities (rather than closeness to) the utilities for the River Access and Proximity to Fremantle attributes are reported as negative numbers. Similarly, for River View, the associated utility for "no river view" is reported as a negative number, while the

[13] The utilities or "part-worth estimates" are relative numbers with no specific unit of measure. These scale values are chosen by the conjoint estimation program so that the when they are added together the total utility of each alternative product will correspond to the original ranks as much as possible.

[14] The attribute with the greatest difference in utilities for the different levels of each attribute relative to the utility ranges for

expected preference for "river view" has an associated positive utility. The negative utilities for Price indicate that none of the prices listed are preferred, but respondents are less averse to some levels of price than others.

Table 6: Comparison of Respondent Groups' Responses

	Valuers (n = 57)		Agents (n = 13)		Residents (n = 6)	
Attribute	**Ave. Import.**	**Utility Range**	**Ave. Import**	**Utility Range**	**Ave. Import.**	**Utility Range**
Contamination	34.74	1.49 to 7.27	47.96[1]	-0.56 to 6.23	10.34[4]	1.61 to 2.33
River View	24.51	-2.37 to 2.37	20.35[2]	-2.01 to 2.01	27.02[2]	-2.71 to 2.71
River Access	11.89	-2.31 to -.23	11.47[3]	-1.98 to -0.19	34.69[1]	-0.73 to -7.34
Price	11.57	-3.98 to -1.99	6.60[5]	-1.91 to -0.95	16.66[3]	-3.0 to -1.5
Land Area	8.75	0.09 to 0.16	5.87[6]	0.93 to 0.54	3.63[6]	0.41 to 0.70
Proximity to Fremantle	8.56	-1.14 to -0.71	7.75[4]	-2.79 to -1.39	7.66[5]	-1.44 to -2.87

Estimated Utilities and Attribute Importance

The attribute with the broadest utility range indicates the attribute a respondent group is most sensitive to the level of. For example, the widest utility range for the valuer and real estate agent groups is for the contamination attribute (1.49 to 7.27 for the valuers, and –0.56 to 6.23 for the agents) indicating that both groups were more sensitive to the level of the contamination attribute compared to the levels of the other attributes. The resident group was most sensitive to the level of river access attribute with a utility range of -0.73 to –7.34.

Based on the utility range of each attribute, the overall rankings of the property attributes were very similar for valuers and real estate agents. The order of the first three attributes was the same for each group with the Contamination attribute ranked as most important then, ranked in decreasing order of importance was River View and River Access. The last three attributes were ranked differently for each group. Valuers ranked price as the fourth most important attribute while for agents, fourth place went to Proximity to Fremantle. Least important attribute for the valuers was Proximity to Fremantle, while for the agents Land Area was least important.

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levels of the other attributes indicates the attribute a respondent group is most sensitive to the level of.

The averaged importance weight indicates the relative range of utilities for an attribute and provides a quicker visual tool for determining the most important attribute, than the utility figures do. While both valuers and agents rank Contamination as the most important attribute, from the importance weights for this attribute it can be seen that agents are much more sensitive to this attribute than valuers (47.96 versus 34.74). For both respondent groups similar importance weights were recorded for River View, River Access and Proximity to Fremantle. However, valuers appear to be more sensitive than the agents to Price (11.57 versus 6.60) and Land Area (8.75 versus 5.87).

Residents ranked most attributes differently to the ranks of the other two respondent groups. Contamination ranked lower on a relative basis (fourth most important attribute), equal with the valuers' and agents' ranking of Price. The most important attribute for that group was River Access, ranked as the third most important attribute for the other two groups. Land Area was ranked as least most important of all the attributes, the same as the agents' ranking of this attribute.

The only similarity in results for the three respondent groups was for the River View attribute. Both the importance weightings and rankings for this attribute were similar for all respondent groups. The importance weight for the Proximity to Fremantle attribute was similar for all groups yet the ranking of this attribute differed between the groups.

While this section has discussed the most important attribute for each respondent group, the next section will outline their most preferred level of each attribute.

Level Preferences for Each Attribute

The estimated utilities for both the valuer and real estate agent group indicate that they prefer a clean site to either a clean site adjoining a contaminated site or a remediated contaminated site, the latter being least preferred of the three options. A river view is preferred to no river view, and being located within 200 metres of the river is preferred to being further away from the river, with preference decreasing with increasing distance from the river. A similar result was recorded for the Proximity to Fremantle attribute, with preference decreasing with increasing distance to Fremantle. The $250,000 price tag is preferred to the more expensive alternatives with preference decreasing as price increases. The 650 square metre land area is preferred to smaller sites, with preference decreasing as size decreases. These preferences followed the expected choice of preferences for each attribute as indicated by the expected outcomes shown above.

Residents had the same preference for each attribute as the valuers and real estate agents except for the contamination attribute. Residents preferred a clean site adjoining a contaminated site to a clean site, with a remediated site being the least preferred of the three options.

Comparison of Group Results

The roles of valuers and real estate agents are similar in that they both are required to model market behaviour. Real estate agents are responsible for assessing market behaviour and are expected to incorporate it into their asking prices. Often agents and valuers work closely to share market information. Agents are active in the market on a day-to-day basis, representing the buyers and sellers to facilitate property transactions and are aware of sale prices before valuers obtain this market information. Agents tend to be more forward looking in that they have the ability to set prices, valuers tend to be more focused on the past using historic sales data as their evidence of value. However, their close association and similarity of roles is the reason it is expected that their responses to the conjoint analysis exercise would be similar. Generally, the results appear to substantiate this expectation.

While similarities existed between the results from the valuers and agents, the difference in results between these respondents and those from the residents was somewhat disconcerting, particularly given both valuers and agents role in the real estate process is to model the behaviour of the residents (the buyers and sellers of property). However, as valuers use property sales data that are ex post and represent market fact to base their valuation opinions, two possible explanations for the differences between the valuers' and residents' responses can be given. Either, the reliability of the responses given by the residents to the conjoint analysis exercise is questionable and not in line with the market sales evidence, or the valuers themselves are interpreting the market evidence in a way that does not adequately reflect actual purchasing behaviour. This latter explanation would be in line with the finding by Adair *et al.* (1996) that valuers view critical property characteristics differently than market participants.

Another explanation of the difference in the valuers and agents responses compared to those from the residents is that the resident group surveyed are those that have already purchased in an area with a history of contamination and may not represent the entire population of potential land purchasers that the valuers and agents need to consider when carrying out their respective roles. Such residents are, by the very fact that they have purchased in an area where contamination has been/is an issue, less sensitive to this than might be the case for the market as a whole.

Alternatively, the residents' apparent lower sensitivity to the contamination attribute may be due to the possible affect of cognitive dissonance reduction. In this case, they are not necessarily less sensitive to the contamination but are unwilling to admit, due to the large amounts of money already paid, that they may have made a poor purchasing decision to buy a remediated contaminated site and one next to a contaminated site. This would also help to explain the difference in preference for the level of the attribute contamination between the residents and

the other two respondent groups. The former preferred a clean site adjoining a contaminated site to a clean site, while the latter groups preferred the clean site, as was expected.

The resident group represents a biased sample. Should a wider group of potential residential purchasers have been surveyed the results may have been more in line with those from the valuer and agent groups. The sample selection bias was inevitable as the purpose for surveying this specific group of residents was so that the results of the conjoint analysis could be validly compared to regression results from a parallel study (not reported here).

Accuracy of the Model

Conjoint analysis derives a model that predicts the total worth of a product by adding up the part-worths of each level of each attribute. The least squares model produced from the above provide estimates of the part-worths for each level of each attribute. To assess how accurately the estimated model predicts consumer preferences correlations based on the actual and the predicted ranks are used (Spearman's rho and Kendall's tau). These correlations are tested for statistical significance. The analysis of the valuers responses had a Person's R[15] coefficient of 0.977 and a Kendall's tau-b[16] statistic of 0.948. These statistics were 0.977 and 0.941, respectively, for the real estate agents group, and 0.974 and 0.817 for the residents group.

Kendall's tau-b is the most appropriate statistic for ranked data and indicates a strong positive linear relationship exists between the predicted and actual ranks and that this correlation was statistically significant at the 0.05 level. This test indicates that the models are generally very accurate in predicting respondent preference for vacant residential land in the scenario presented. As would be expected, the most accurate

[15] The Pearson's R or product moment correlation coefficient is a dimensionless index that ranges from -1.0 to 1.0 inclusive and reflects the extent of a linear relationship between the dependent and independent variables, Microsoft (1997).

[16] Kendall's tau-b is a nonparametric measure of correlation for ordinal or ranked variables that take ties into account. The sign of the coefficient indicates the direction of the relationship, and its absolute value indicates the strength, with larger absolute values indicating stronger relationships. Possible values range from -1 to 1, but a value of -1 or +1 can only be

model was for the model derived from group with the largest number of respondents, the valuers. Despite the small sample size of the other two groups the models derived from their responses also show a high level of accuracy.

Limitations of the Conjoint Analysis Approach and Results

The most serious limitation of the conjoint analysis study was the reliance on a small sample of residential responses. This limitation was addressed by inclusion of more than one respondent group in the study and a comparison of the responses from each group. However, despite the use of more than one respondent group, samples from each were not generated from probability-based methods.

For example, as mentioned previously, sample selection of the resident group was on the basis that they lived in the case study area and were willing to participate. As such, their responses do not represent those of all potential residents. Of course, as explained earlier, this sample selection bias was inevitable as the purpose for surveying this specific group of residents was so that the results of the conjoint analysis could be validly compared to the regression results from a parallel study (not reported here).

The valuer group sample was similarly biased. It was of those attending a seminar on the valuation of contamination land. Attendance at this seminar signifies that these valuers have knowledge of, and/or an interest in, contamination issues and may not be fully representative of all valuers. However, it is expected that valuers with experience in contaminated land issues would be better able to model buyer behaviour where land contamination may be an issue than valuers without such experience. As such, this biased sample was an advantage for this survey where the purpose for obtaining the valuer responses was for use as a proxy for buyer behaviour.

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obtained from square tables, Microsoft (1997).

The length of the form and number of profiles to rank (18) may have caused some potential real estate respondents to discard the questionnaire. Those who completed the form from all three respondent groups may have done so but have developed respondent fatigue. Both of these problems may have limited the reliability of the conjoint analysis results by affecting representativeness and limiting the accuracy of the ranking task.

Finally, it is important to note that for all conjoint analysis results reported here, the indicated importance of each attribute is only relevant for the attributes and levels tested in this study. Should the range of levels of an attribute being tested change, the relative importance of that attribute is also likely to change.

Summary and Conclusion

The conjoint study has demonstrated that conjoint measurement can be used to validly determine the importance of vacant residential land attributes to purchasers. The attribute importance and price information is particularly useful to valuers when valuing property affected by land contamination issues, including stigma. Knowledge of how each attribute contributes to price will assist with the comparison of the subject property to similar properties that have sold recently and more precise estimates of adjustments to be made for differences that exist between them. Adjusting sale prices in this manner provides a more reasoned approach to the analysis than simply basing adjustments on subjective judgement of what the valuer intuitively believes to be most important. Thus, with each attribute that contributes to a property's value correctly weighted a better reasoned and more realistic value estimate can be achieved. Further, by calculating the dollar worth of each attribute and using this information in combination with the hedonic prices of each attribute calculated from a regression analysis can result in a more informed value estimate.

Conjoint analysis is a flexible multivariate technique that is readily accessible through the relevant computer software to most practitioners in the property field. Further, compared to some of the more recent multivariate

techniques advocated, such as discrete choice modelling, it is less complex and therefore more readily understood and easier to learn. These advantages will likely ensure the continued popularity and use of the technique in favour of the more recent, complex techniques as a tool for understanding consumer preferences.

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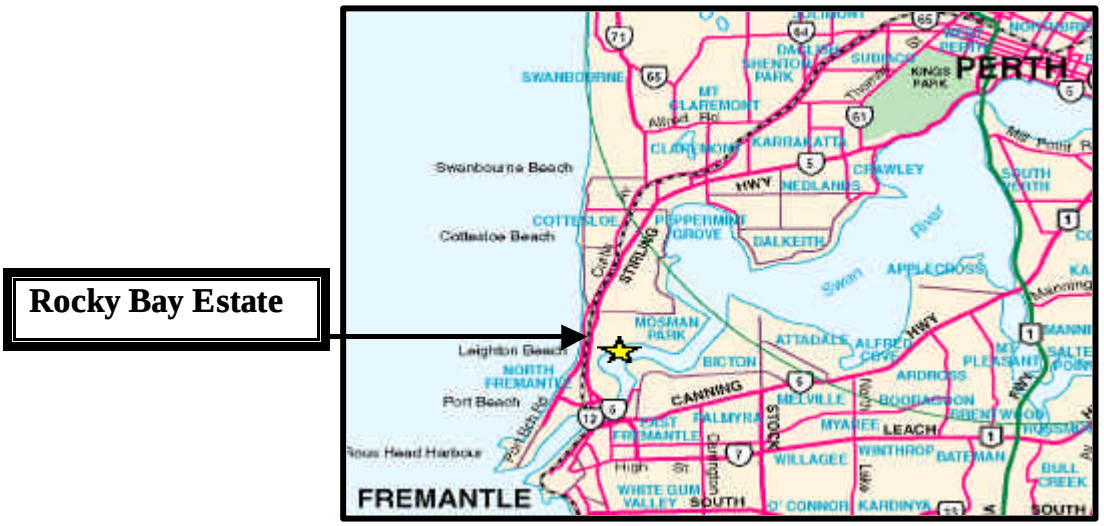
Appendix I – Case Study Area: Rocky Bay Estate



The case study area comprises some 8 hectares of prime riverfront land located on the northern border of North Fremantle. Riverfront property is traditionally the most valuable in Perth. Since Federation much of it has been occupied by the Federal or State governments, which have sporadically released land for private residential development.

In 1990-92, the former State Engineering Works site was redeveloped as a high-class, single-family residential suburb, known as Rocky Bay Estate, containing approximately 110 fully serviced sites ranging in size from 249 to 880 m^2. The subdivision also includes areas of public open space, in addition to a 9m wide strip of general open space comprised of a cycle path and walkway between the site and the top of the cliff adjacent to the Swan River.

The subdivision is bounded by the Swan River to the east and southeast, the Land Corp-owned McCabe Street contaminated site (known as Minim Cove)[17] to the northeast with a concentration of light industrial and residential to the west and south. Located above the river, the area obtains views over the river to Preston Point and East Fremantle in the south. The subdivision is conveniently located within walking distance of Leighton Beach, easy commuting distance (5-10 minutes) of both Fremantle and Mosman Park and is within 20 km of Perth's central business district.

Site History and Contamination

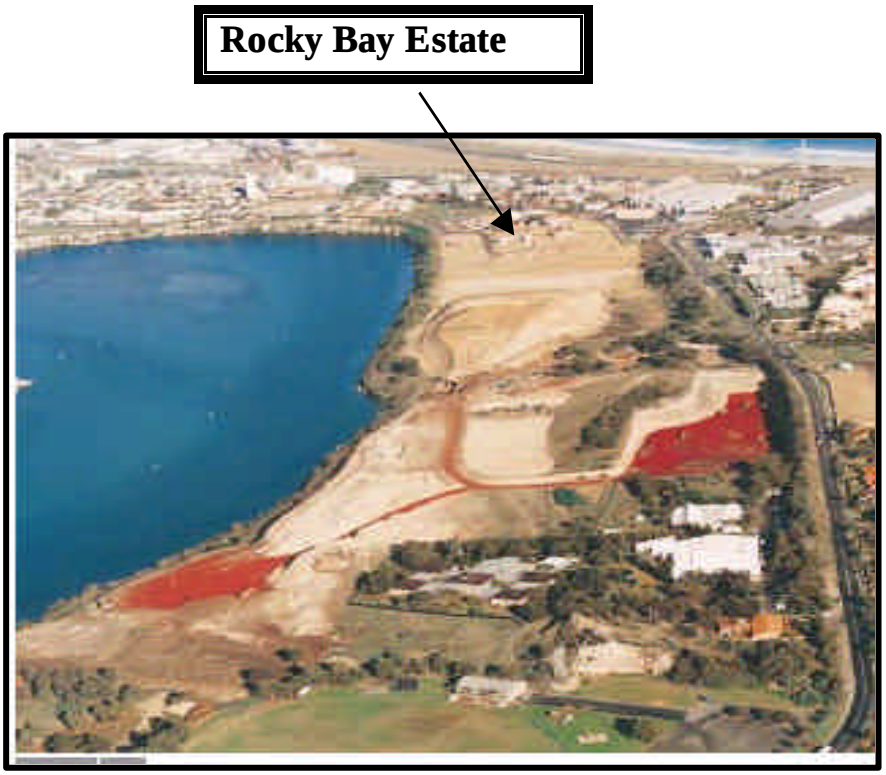
The State Engineering Works (SEW) previously occupied the site. Operations commenced at the SEW in the early 1900's that involved mostly the manufacture of harvesters and ploughs. During World War II the SEW were used for naval repairs and, up until 1986, for metal fabrication (such as casting keels for yachts). The SEW were finally closed down in 1987.

In 1988, groundwater test results indicated excessive levels of nitrate and salinity. Additionally, arsenic and cyanide were at the upper limits of safe standards for domestic supply. Results from the tests indicated that the

[17] The Minim Cove land was leased in the 1909 by CSBP who built a fertiliser factory to manufacture superphosphate. The factory was closed in 1969. In 1988, it was found that the site was heavily and extensively contaminated with heavy metals, cadmium, lead, cyanide and arsenic and that these had been leaching into the groundwater. Clean-up of the site commenced in 1997 and is ongoing (September, 2000).

site's waste materials (including, foundry clinker, coal residues and bulky by-product pyrites cinders from the adjoining site) had heavy metal values many times greater than established recommended concentrations in soils set by Australian authorities for various land uses. These wastes were found to be leaching into the sands beneath and resulted in the elevated levels of selected heavy metals found in the ground waters.

Site clean-up commenced in 1989. This involved relocating 47,500m^3 of visually contaminated materials (pyrites-clinkers, building rubble) off-site to the Landfill in Henderson. The additional 15,000m^3 of contaminated sands beneath these wastes were relocated on-site but well away from the river and covered with 5m of clean sand. The entire site was then covered with clean sand to a minimum depth of 1.5m. Environmental clearance was obtained from the Environmental Protection Authority (EPA) in April 1991 permitting the site to be redeveloped for residential purposes. Subsequently, the redeveloped residential lots have been sold mostly by auction during 1992-1995.



Appendix II

Instruction Sheet – Attribute Importance Survey

The aim of this survey is determine the level of attribute importance in purchasing behaviour. For example, this survey will help to answer questions such as, are river views more important than river access, or is site size more important than a site's contamination history, in residential purchasing behaviour? This survey focuses on **residential** land purchased for the purpose of building an **owner-occupied** single-unit dwelling on it.

In order to determine ***how*** important each attribute is in a resident's purchasing behaviour we present a number of possible combinations of a selected group of attributes known to be important to residential purchasers of vacant land. We ask you to rate each combination of attributes according to your perception of how likely a resident would be to purchase the land. This will involve making a trade-off between the various attributes presented.

The attached sheet shows 18 possible combinations of the attributes, and the associated levels of each. Please enter the number 1 in the column titled "rating" next to the plan you consider is most likely to be purchased, and a rating of 18 next to the least likely option to be purchased. Upon completion of this exercise each plan should have a ***unique rating*** from 1 to 18 written in the corresponding box under the "Rating" column.

For example, in the following table which presents three options, you might rate Plan 3, as the most likely of the three options to be purchased and so would write "***1***" in the column titled "Rating". You might then rate Plan 1 as the next most likely option to be purchased (writing a "2" in the appropriate space) and Plan 2 as the least likely of the three options to be purchased, etc.

Plan	Price	River View	Access to River	Proximity to Fremantle	Size	Contamination	Rating
1	$375,000	No view	Over 2000m	Between 5-10km	500m2	Ex-contaminated	2
2	$500,000	No view	Between 200m-1000m	Between 5-10km	375m2	Clean site	3
3	$250,000	View	Within 200m	Over 10km	500m2	Clean site	***1***

We appreciate your time and courtesy in participating in this study. Thank you for helping to enhance understanding of attribute importance in residential purchasing behaviour.

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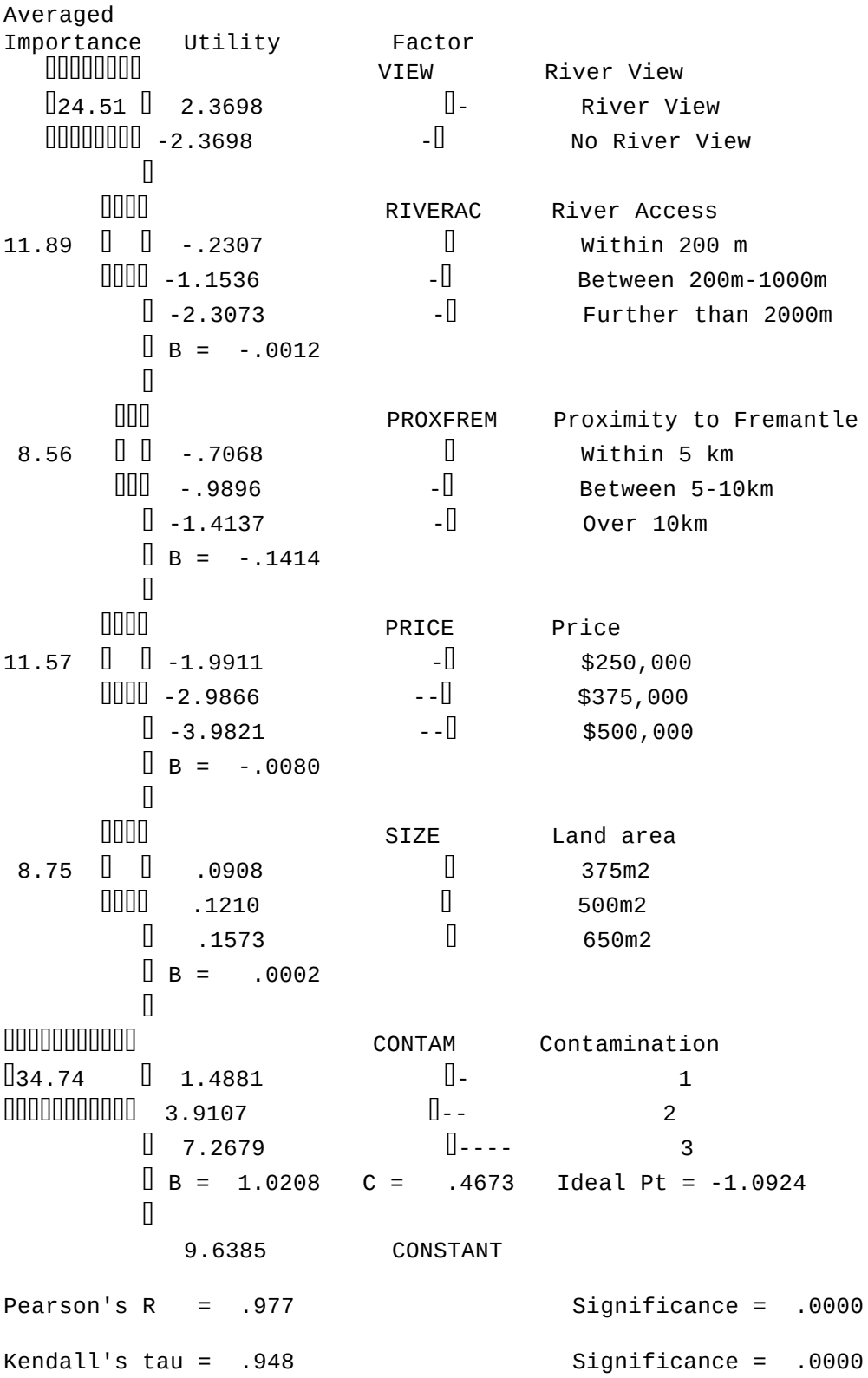
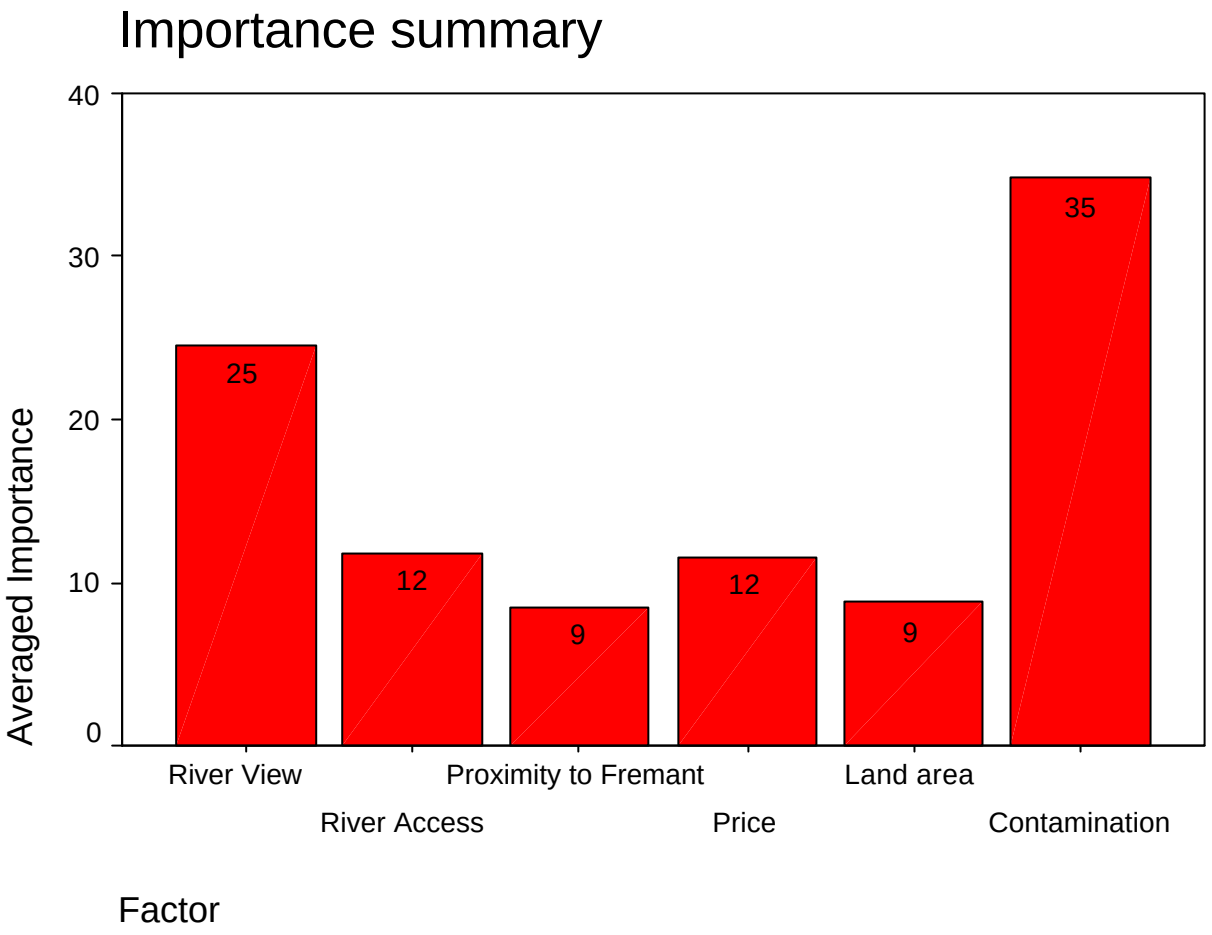
Plan	Price	Access to River	Proximity to Fremantle	Size	Contamination	River View	Rating
1	$250,000	Between 200m-1000m	Between 5-10km	500m2	No Contamination, but next to contaminated site	River View	
2	$500,000	Within 200 m	Over 10km	500m2	No Contamination, but next to contaminated site	No River View	
3	$250,000	Further than 2000m	Within 5 km	500m2	No contamination - area clean	River View	
4	$500,000	Further than 2000m	Within 5 km	500m2	Ex-Contaminated (heavy metals)	No River View	
5	$375,000	Between 200m-1000m	Within 5 km	650m2	No contamination - area clean	No River View	
6	$250,000	Within 200 m	Between 5-10km	650m2	No contamination - area clean	No River View	
7	$375,000	Within 200 m	Within 5 km	375m2	No Contaminated, but next to contaminated site	River View	
8	$500,000	Between 200m-1000m	Within 5 km	650m2	No Contamination, but next to contaminated site	River View	
9	$500,000	Within 200 m	Between 5-10km	650m2	Ex-Contaminated (heavy metals)	River View	
10	$375,000	Further than 2000m	Over 10km	650m2	Ex-Contaminated (heavy metals)	River View	
11	$250,000	Between 200m-1000m	Over 10km	375m2	Ex-Contaminated (heavy metals)	No River View	
12	$375,000	Between 200m-1000m	Between 5-10km	500m2	Ex-Contaminated (heavy metals)	River View	
13	$500,000	Further than 2000m	Between 5-10km	375m2	No contamination - area clean	River View	
14	$250,000	Further than 2000m	Over 10km	650m2	No Contamination, but next to contaminated site	River View	
15	$250,000	Within 200 m	Within 5 km	375m2	Ex-Contaminated (heavy metals)	River View	
16	$375,000	Further than 2000m	Between 5-10km	375m2	No Contamination, but next to contaminated site	No River View	
17	$375,000	Within 200 m	Over 10km	500m2	No contamination - area clean	River View	
18	$500,000	Between 200m-1000m	Over 10km	375m2	No contamination - area clean	River View	

Appendix III




Importance summary
Averaged Importance
40
30
20
10
0
25
12
9
12
9
35
River View
River Access
Proximity to Fremant
Price
Land area
Contamination
Factor