**Research Data Management Plan**

**Topic:** Assessment of Mining and Property Impacts at Broken Hill

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**Research Project Details**

Assessment of mining impacts (biophysical and socio-economic) on nearby residences and effect of proximity to mining activities upon on sale price of residences in the city of Broken Hill

**Research Project Summary**

A combined two-step method for use in the NSW under the *Environment Planning and Assessment Act* 1979 for the assessment of mining projects, including mining impacts and residential sale prices. A site study of the city of Broken Hill was chosen because of the known health impacts associated with mining and the long history of settlement.

**Method 1:** Mine-generated impacts are assessed at 33 sites up to 5 km away north, east, south and west of the centre of mining.

**Method 2:** Residential sales in Broken Hill are assessed against a range of variables, using Robust Multiple Regression of all residential sales in Broken Hill in the years 2000, 2005, 2010, 2015 and 2019.

**Keywords**

Mining, impact, price, distance, disamenity, health, social, identity

**Research Project Data**

Three Data formats are utilised, and all are stored digitally; Mine impact data, Sales data and Multiple Regression of Sales Data.

1. **Mine Impact Assessment:** Excel spreadsheet with values at the 33 sites where mining impacts were subjectively determined. Sites were at the centre of mining activity (Broken Hill Miners Memorial) 0 meters, 200m, 500m, 1000m, 1500m, 2000m, 3000m, 4000m and 5000m away in north, east, south and westerly directions. Each site records a range of biophysical, economic, social and other impacts of mining at each location, assessed by the investigator and weighted according to documented methodology. An overall impacts rating (positive or negative) is generated to reflect the impact and distance from mining activity.
2. **Sales Data:** Excel spreadsheet Broken Hill sales records of all residential properties sold during calendar years 2000, 2005, 2010, 2015 and 2019, comprising property address, characteristics of each residence, area of land on which residence is located, distance to a range of services, and the centre of mining activity.
3. **Multiple Regression Calculations:** Robust Multiple Regression, Correlation and other statistical calculations undertaken from Broken Hill sales data records.

**Background**

Mining is a critical source of economic welfare in Australia but may generate environmental and other impacts which must be managed. Mine impact assessment in NSW is undertaken under the NSW *Environmental Planning and Assessment* Act 1979, which may impose a range of operating conditions on approved projects. The assessment procedure has become a subject of debate because of an apparent lack of consideration of the potential impacts of mining activity on property sale values. This study seeks to identify a form of mine and impact assessment that will improve the transparency of the NSW assessment procedure and answer a previously unanswered public controversy: do impacts from NSW mine sites reduce the sale value of the nearby residential property?

To meet the above objective, this study outlines a combined method of qualitative and quantitative analysis of mining impacts and their effect on residential property sale values in the City of Broken Hill, NSW. The environmental impacts are recorded as severe by world standards, and part of the price impact is measured such that the average house is 2.5% lower in sale price than comparable houses located at greater distances from the main mine site. In addition to this local effect, it is evident that Broken Hill house prices are 70-80 % lower than other regional cities in NSW.

The study adds to the knowledge of NSW mining impacts and their association with residential property sale values, although the impact measured at Broken Hill is less than that at other major mine sites in Australia; Mt Isa and Kalgoorlie (6.2 - 6.9%/km). If omitted variables were added to this study's regression analysis, up to 8.153% per km is possible. The study is the first to use a combined WMA/HPA approach in mine and property impact assessment. Metal market spot prices do not appear to trigger price variation in the residential market, and lead and zinc ore production from all NSW mines exhibits a long-term decline.

The property sale price difference between Broken Hill and other regional cities in NSW could be argued as the market's valuation of the impact of mining and other factors on residential values at Broken Hill. The further reduction in house prices closer to the centre of mining activity is an additional 'local' price signal smaller than similar settings in other mining centres of Australia. The combined WMA and HP method provides transparency and potentially fills a gap evident in NSW planning assessment procedures that previously had no record of NSW mining impacting the sale value of residential property.

The disamenity of mining activity may not be universally regarded as a negative influence by (long-term) Broken Hill residents. The resilient population and their collective experiences are abstracted as a sociocultural palate to create their sense of identity and meaning and help make the city's eventual transition to an art-focused, tourist, moviemaking, culturally iconic outback location.

The most valuable asset in the future of Broken Hill is the extent to which the community recognises itself as the embodiment of a past mining industry and converts its material remains into a unique blend of sociocultural heritage while preserving stark remnants of an industrial past. The social aspect of the mining industry is highly signiﬁcant but remains largely unmeasured in mine project assessment, yet it is essential for sociocultural meaning to the populace of Broken Hill.

The study extends current methodologies in mine impact and property price assessment. It provides a transparent and improved basis for mine project impact assessment under NSW planning legislation and reduces the likelihood of discretionary intervention in planning approvals by either Ministerial action or legal appeal. The study examines the significance and magnitude of mining impacts at Broken Hill, NSW, and the extent of these impacts on house prices and their spatial and temporal distribution within this mining-centric city of outback NSW. The study undertakes a weighted matrix assessment of the extent and magnitude of mining impacts over the city using 33 sample points. It compares the extent of mining impacts with the range of residential house sale prices in 5 different years over a 20-year interval. The study allows the impacts of mining to be readily identified concerning land-use units and spatial variations to be measured.

The analysis reveals a spatial correlation between mining impacts on a residence's sale price and the city's surroundings. While the sampling of land-use units is derived from local government, the mining impacts have a modest sample rate, and the impact on the sale price of residences is well sampled. The variance in sale price shows a divergence from previous trends in the years after heritage status was awarded to the city (2015). Additional undetected variables are the likely source of this variance, comprising socio-economic variables which, if included in the modelling, would improve the robustness of the regression results derived from the sales data.

**Research Project Data Files**

**Mine Impact:** Excel spreadsheet with values at 33 sites where mining impacts were subjectively determined.

Appendix 2. Weighted matrix assessment at a grid of sample points for mine impact assessment (Figure 4.1). (Full copy in thesis).

Appendix 3. WMA(ES) model of Broken Hill SCEO and DistanceMM data via Multiple Regression using NCSS (2022) software. (Full copy in thesis).

**Sales Data:** Excel spreadsheet Broken Hill sales records of all residential properties sold during calendar years 2000, 2005, 2010, 2015 and 2019, comprising property address, characteristics of each residence, area of land on which residence is located, distance to a range of services, and the centre of mining activity.

Appendix 4. RP Data listing of sales and address information for single residences in the City of Broken Hill from 2000 to 2019 from CoreLogic (2021). [RP Data, CoreLogic Australia](https://www.bing.com/ck/a?!&&p=f481e8376eb13d21JmltdHM9MTY2OTI0ODAwMCZpZ3VpZD0zZjY0MTllYi1iOTUzLTY1MjgtMGY3OS0wOTdhYjhjMzY0ZTgmaW5zaWQ9NTE3OQ&ptn=3&hsh=3&fclid=3f6419eb-b953-6528-0f79-097ab8c364e8&psq=corelogic+rp+data&u=a1aHR0cHM6Ly93d3cuY29yZWxvZ2ljLmNvbS5hdS9zb2Z0d2FyZS1zb2x1dGlvbnMvcnAtZGF0YQ&ntb=1) (2021).

Appendix 5. RP Data listing of transfer of ownership of single residences in the City of Broken Hill in the years 2000 to 2019 (CoreLogic, 2021).

Appendix 6. Broken Hill, Total Sales data set of single residences sold in the City of Broken Hill 2000, 2005, 2010, 2015 and 2019.

**Multiple Regression Files:** Robust Multiple Regression, Correlation and other statistical calculations undertaken from Broken Hill sales data records. The sale price is regressed against various variables recorded in the Broken Hill sales dataset. Alternately distance versus mining impacts is compared for each land use unit identified from local government data.

Figure 4.4. The Heat map shows the correlation between all independent variables, as calculated by the NCSS (2022) Factor Analysis procedure.

Figure 5.1. The correlation heat map of variables in the WMA data set is recorded in Table 5.3. The highest correlations are between the WMA assessment's ES, BE and PC components. BE and PC are thus excluded from the regression analysis.

Figure 5.3. The single-variable linear model plot of Sale Price versus DistanceMM for the Broken Hill sales dataset (Robust Regression: NCSS, 2022).

Table Source Files ( up to 8.5 MB each) – Table captions are listed below.

Table 4.7. Statistics for Broken Hill sales data set of all variables in the linear model examined via the All-Possible Regressions Procedure of NCSS (2022).

Table 5.4. Regression of the WMA (ES) variables DistanceMM and SCEO versus ES (WMA) rating using WMA results in Table 5

Table 5.5. Robust Regression of Broken Hill sales data set using Linear Model calculated by NCSS (2022) procedure.

Table 5.6A. Result of Robust Regression of Eight variable regression model of the sales data set via NCSS(2022) procedure.

Table 5.6B. Result of Robust Regression of Seven variable regression model of the sales data set via NCSS(2022) procedure.

Table 5.6C. Result of Robust Regression of Five-variable model examine reduced Northside sales data, all via NCSS(2022) procedure.

Table 5.6D. The result of Robust Regression of the Five-variable model examines reduced Southside sales data, all via NCSS(2022) procedure.

Table 5.7A. Semi-Log Models with Natural Logarithm for Sale Price.

Table 5.7B. Semi-Log Model LOG (Base 10) for Sale Price.

Table 5.8A. Natural Log-Natural Log Model.

Table 5.8B. LOG (Base 10)-Natural Log Model.

Table 5.9. Linear Model including Year variables.

Table 5.10. Natural Log-Linear Model including Dummy Year variables.

Table 5.11. LOG10 - Linear Model including Dummy Year variables.

Table 5.12. Natural Log-Natural Log Model including Dummy Year variables.

Table 5.13. LOG10-Natural Log Model with Dummy Year variables.

Table 5.14A. (Reduced) Models for interpreting Broken Hill sales dataset from Linear to Semi-Ln and Log-Ln forms using core independent variables.

Table 5.14B. (Reduced) Models for interpreting Broken Hill sales dataset from Linear to Semi-Ln and Log-Ln forms using core independent variables.

Table 5.14C. (Reduced) Models for interpreting Broken Hill sales dataset from Linear to Semi-Ln and Log-Ln forms using core independent variables.

Table 5.14D. (Reduced) Models for interpreting Broken Hill sales dataset from Linear to Semi-Ln and Log-Ln forms using core independent variables.

Table 5.14E. (Reduced) Model for interpreting Broken Hill sales dataset - Log-Ln form using core independent variables.

Appendix 7. Model 1.

Appendix 8. Model 2.

Appendix 9. Model 3.