Identification of Intill Opportunities

Infill refers to urban development that takes place on vacant, skipped-over parcels of land located within the perimeter of an existing urban area. While this could include golf courses, parks, empty plots, it was decided for the purposes of this study, to limit the definition to empty plots. Sites smaller than 248 m^2 were rejected as infill sites because of their unconventional shapes, which would be inappropriate for residential development. The infill sites were identified from the land use map, and were classified as 'vacant' (Figure 4.5).

Identification of Redevelopment Opportunities

Redevelopment opportunities refers to potential land as a result of demolition. For the purposes of this study, only residential buildings were evaluated. The following data informed the decision concerning redevelopment opportunities: condition of buildings, land and improvement value. Information on building condition was obtained from field survey, the Valuation Department of the Johannesburg City Council and the Wits Heritage Trust. The Wits Heritage Trust provided a rough map showing national monuments, listed buildings, buildings over fifty years old for the western section of Jeppestown - as far as Berg Street (Wits Heritage Trust, 1994). For the purposes of this study, buildings over fifty years old were not excluded as potential redevelopment opportunities, whereas listed buildings and national monuments, such as those on The Oval, were (Figure 1.2).

The buildings were classified as follows:

- buildings that are structurally poor having bad cracks, poor foundations, sunken roofs, plaster and paints in very poor condition (Class A);
- buildings in need of a little repair - small cracks, slightly sunken roofs, poor plaster and paint (Class B);

  and properties which have been well maintained and should not be considered for demolition (Class C). New and upgraded buildings also fell into this category. Class A and Class B buildings were then reclassified as 'redevelopment opportunities' (Figure 4.4).

Identification of Subdivision Opportunities

Land suitable for subdivision refers to land that is potentially subdividable, such as potential land in backyards of residential stands. This includes the situation where the land is legally subdivided and a new dwelling erected, as well as where no legal subdivision takes place but a second dwelling, granny flat or garden cottage is erected on the original stand.

The following types of data were examined: size of erf, the position of the building on the stand, slope, access. If a house occupied the centre of a small stand, then it was unlikely that it would be able to be subdivided. If, however it was placed at the front of the stand, the opportunity may exist for an additional dwelling to be placed on the stand. Also, if a house occupied the entire width of a stand and had a large back garden, the plot may still be unsuitable for subdivision due to the lack of access needed for a driveway. In Jeppestown, no subdivision opportunities were found as erf size was too small (248m² in Jeppestown South) and on the larger stands (248 and 992 m²), houses occupy the centre of stands.

Erf size was calculated from the base-map. Access and the placing of the building on the stand was determined from photo interpretation. Information on slope was obtained from field survey and from orthophotographs.

Figure 4.4: Building Condition - Class A and B Buildings

Class A

Class B

Densification Opportunities in Jeppestown

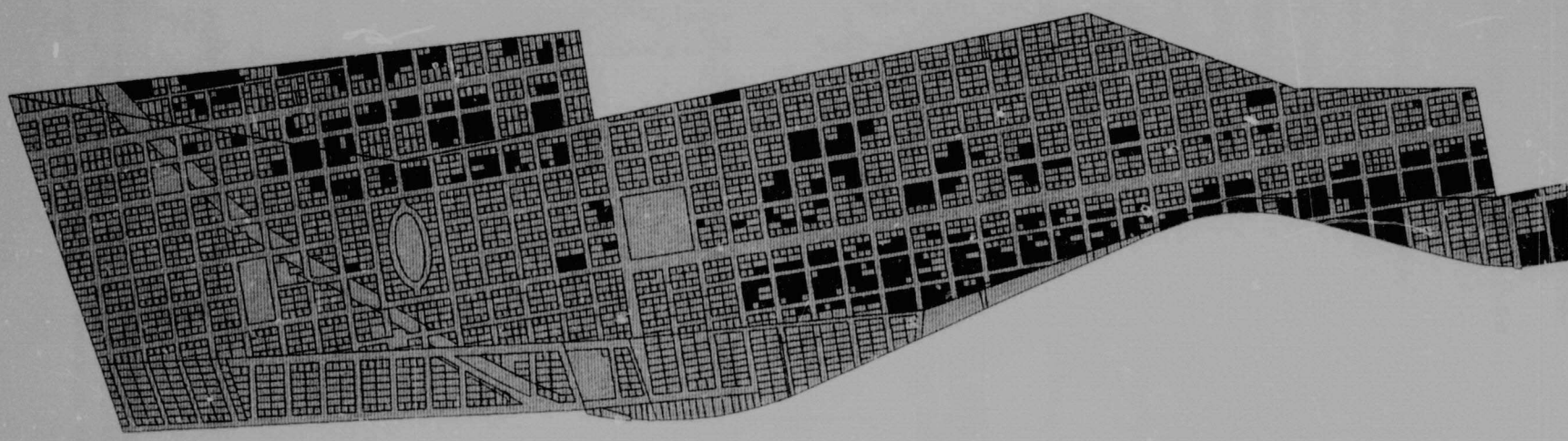

Figure 4.5 : Densification Opportunities in Jeppestown (Sources: Compiled from Figure 4.1 and Figure 4.3)

QUANTIFICATION OF DENSIFICATION OPPORTUNITIES

Once all potential land had been identified and the suitability for densification assessed, it was possible to calculate the extent of the land in hectares. This required the determination and sum of the total number of sites suitable for infill, redevelopment and subdivision for each residential stand size category. It also required the calculation of the total amount of land (ha) suitable for densification by multiplying the total number of sites by stand size per stand size category. The data that was required included the number of infill sites, number of redevelopment sites and number of subdivision sites (Table 4.2).

Table 4.2: The Number of Sites and Associated Area (ha) per Stand Size Category Suitable for Densification

	Residential Stand Sizes in Jeppestown				
	248 m²	**496 m²**	**992 m²**	**3968 m²**	**Total**
No. of Sites through Infill	31	15	0	3	49
No. of Sites through Redevelopment	160	65	2	0	227
No. of Sites Resulting from Subdivision	0	0	0	0	0
POTENTIAL LAND FOR DENSIFICATION:					
Total No. of Sites	191	85	2	3	
Amount of Potential Land (ha)	4.7	4.2	0.19	1.10	10.19
LESS LAND FOR FACILITIES:					
Total No. of Sites	191	66	2	0	
Land Suitable for Densification (ha)	4.7	3.3	0.19	0	[8] **8.19 ha**

SCENARIO DEVELOPMENT

Determination of Appropriate Housing Options

The target population was firstly determined in order to inform the decision on the appropriate housing types to be used in Jeppestown. While the target population could be an

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[8] This is the amount of land suitable for densification after an amount of 2 ha had been subtracted for urban facilities. A random amount of 20 % of the potential land for densification was subtracted for other facilities. If further capacity is required, this could be obtained from the surrounding suburbs.

actual existing community or a proposed target market, it was decided for the purposes of the study that it would be a proposed target market similar to that of the existing population. This decision was influenced by current income levels, the number of habitable rooms per household, household size and age structure of existing residents in Jeppestown.

Using the information collected from the socio-economic survey, as well as census data, it was decided that the target population would be those who are currently employed and whose household income is between R2 500 and R5 000 a month. The July 1994 socio-economic survey showed that 46 percent of Jeppestown residents fall into this category (Table 4.3). Concerning potential residents from outside of Jeppestown, the 1991 census data confirmed the choice of this target income group. It showed that 12 percent (158 867) of the urbanised African[9] population in Johannesburg, Randburg, Alberton, Germiston fall into the R1 000-R4 000 income category and could therefore be potential residents in Jeppestown. Approximately 60 percent of Jeppestown and Fairview residents are currently employed while only 6 percent are unemployed (the rest are either housewives, students, children, disabled or pensioners)(CSIR, 1994b).

Table 4.3: Monthly Household Income in Jeppestown

Monthly Income	Frequency (Households)	% of Total Households	Cumulative Total (%)
None	8	7%	7%
R1-500	17	14%	20%
R501-R1 000	25	20%	41%
R1 001-R2 500	31	25%	66%
R2 501-R4 000	26	21%	88%
R4 001-R5 000	9	7%	95%
R5 001-R6 000	4	3%	98%
R6 001-R7 000	1	1%	99%
R7 001-R8 000	1	1%	
R8 000+	0	0%	
Total	122	100%	

(Source: CSIR, 1994b)

In a survey of low-income housing in the Johannesburg inner city, the household characteristics of Jeppestown and Fairview revealed that only 11 percent of the residents are

[9] The African population excludes the coloured and asian population, as defined in the census.

single and 22 percent are married with adult offspring. Thirty three percent are married with children, while 32 percent are married with no children. A further 22 percent are parents with adult offspring (Crankshaw and White, 1992). The relatively high proportion of married people with children influenced the decision to target young married couples and families.

The predominant number of habitable rooms per household in Jeppestown (1 and 4 habitable rooms), were obtained from the socio-economic survey (Table 4.4). A habitable room refers to any room in a dwelling except bathrooms and kitchens (Calderwood, 1962).

Table 4.4: Number of Habitable Rooms per Household

No of Habitable Rooms	Frequency (Households)	% Households
1	46	25.0
2	32	17.4
3	39	21.2
4	50	27.2
5+	17	9.2
Total	184	100.0

(Source: CSIR, 1994b)

In summary, it was decided that the target population would be young, married families, earning between R2 500 and R5 000 a month. The affordable housing types were then determined and described in tabular form according to a number of characteristics (Table 4.5).

- The **number of storeys** - it was decided that a maximum of four storeys would be used in the scenarios as the literature showed that above four storeys the building and maintenance costs significantly escalate by up to fifty percent, mainly due to the necessity for lifts (Kennedy and Meaton, 1972). This is an important factor in considering the provision of housing to people where the household income is less than R3 000 a month. For flats, a three-storey block provides the cheapest unit as no lifts are necessary. Concerning residential densities, the De Loor Report (1992, 300) recommended that "multi-storey, low-rise housing, which does not require lifts, should be encouraged".

- **Coverage** - the Town Planning Scheme of the Johannesburg City Council (1979) was used to show the permissible coverages for different dwelling types (Appendix 3). Coverage is the ratio of area covered by buildings to the area of the site. It is expressed as a percentage or a decimal fraction.
- **Dwelling size** - The size of the dwellings was obtained from plans (Appendices 4 to 9) of houses by the CSIR for option A, NewHco [10] for option B, and from the Development Action Group [11] (DAG, 1994) for options C to F (Table 4.5). In order to decide on a range of appropriate unit sizes for Jeppestown, three indicators were used: affordability levels, the present typical size of houses in Jeppestown and international trends. If home ownership is to be encouraged in Jeppestown, then affordability levels need to be considered as it would also influence the range of unit sizes selected. Units of more than 100 m^2 did not seem viable as a high percentage of Jeppestown households earn less than R3 000 a month. The range of unit sizes that was therefore selected was between 50 and 100 m^2. NewHco's past success in higher density or infill housing in Jeppestown, Johannesburg, are "because it kept prices around R65 000 for 3-storey walk-ups" (Financial Mail, 1995, 50). Over a twenty year period, this works out to be R1 028 a month at an interest rate of 18.5 percent.

  International trends on unit size shows a trend in favour of unit sizes less than 100 m^2. House sizes in 1967 in France, Spain, Western Germany, Netherlands and Sweden were all below 100 m^2: 74.5m^2; 69.3 m^2; 81.19 m^2; 65 m^2 and 79.5 m^2 respectively (Van Niekerk, Konya and Scott, 1972). In the USA, however, a very generous planning standard was selected of approximately 150 m^2 for an average apartment unit and 222m^2 for a house unit, assuming an average-sized family of 3.3 people (Dantzig and Saaty, 1973).
- The **ground area of the dwelling** was calculated by dividing the dwelling size by the number of storeys.
- The **space required for parking** was calculated by multiplying the number of households per unit by one parking space area. The amount of space required for parking was used to calculate the amount of garden space per unit.

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[10] A non-profit low-cost housing developer.
[11] A funded, non-profit service organisation.

- The **required stand size** was calculated by dividing the unit ground area by the coverage.
- The **amount of garden space per dwelling** was calculated by subtracting the sum of the unit ground area and the parking area from the total required stand size.
- The **number of households planned to occupy the unit** was provided. This was used to obtain the total number of additional people in each scenario.
- The **number of habitable rooms per dwelling** was obtained from the socio-economic survey and was used to deduce mean unit occupancy. A habitable refers to any room in a dwelling except bathrooms and kitchens.
- The **number of habitable rooms per household** was calculated by dividing the number of habitable rooms per dwelling by the number of households.
- The **mean dwelling occupancy** was deduced from unit size, and was also guided by the existing mean dwelling occupancies obtained from the socio-economic survey. Mean dwelling occupancies were used to calculate the total number of people in the densification scenarios.
- The **mean household occupancy** was calculated by diving the mean dwelling occupancy by the number of households.

Table 4.5: Suitable Housing Options and Accompanying Characteristics

Characteristics	Single Storey, Cluster A	Two Storey, Detached, Multiple Household B	Two Storey Row Housing C	Two Storey Row Housing D	Three Storey Flats E	Four Storey Flats F
Number of Storeys	1	2	2	2	3	4
Coverage	60%	50%	60%	60%	45%	30%
Dwelling Size (m^2)	40	202	72	85	167	140
Dwelling Ground Area (m^2)	40	101	36	43	56	35
Parking Required	13	50	13	13	50	75
Required Stand Size (m^2)	67	201	60	70	124	117
Garden Space per Dwelling	14	13	11	14	18	7
No. of Households	1	4	1	1	4	6
Number of Habitable rooms per Dwelling	3	12	4	4	9	16
Number of Habitable rooms per Household	3	3	4	4	2.3	2.7
Mean Dwelling Occupancy	3.8	14	4.4	5	10	18
Mean Household Occupancy	3.8	3.5	4.4	5	2.5	3
Number of Dwellings per stand size category:						
248 m^2	3	1	4	3	2	2
496 m^2	7	2	8	7	4	4
992 m^2	14	4	16	14	8	8
3968 m^2	59	19	66	56	32	33

(Sources: Compiled from the Town Planning Scheme of the Johannesburg City Council, 1979; CSIR,1994b; NewHco,1994; DAG,1994)

Determination of Housing Type Proportions

The number of units per stand size category was calculated in order to determine the most efficient housing types in terms of land consumption. This was in turn used to determine the proportion of housing types in each scenario (Table 4.5). For example, Table 4.5 shows that housing type 'C' is the most efficient option in that four individual row houses can be placed on a 248 m^2 stand, compared to only one of option 'B'. The number of units per stand size category was calculated by dividing the stand size category by the required stand size.

In order to determine housing proportions in the scenarios, the implications of allocating each housing option to all available land, needed to be compared. It was crucial to know which housing types gave the greatest additional population and which resulted in the best quality of life indicators. The literature suggested that the unit of measurement of persons or dwellings per hectare taken alone may be misleading, and is not necessarily a relevant indication of actual living conditions, residential amenities or overcrowding (Jensen, 1966).

For this reason, the quality of life indicators were used as well. A whole range of indicators or density measures could have been chosen, as evident from the matrix of density measures that Evans (1973) has noted (Appendix 10). However, for this study, the indicators chosen were limited to those shown on Table 4.6.

Table 4.6: Densification Indicators and Quality of Life Indicators Chosen for Jeppestown

DENSIFICATION INDICATORS:
- Additional Household Units
- Additional People
- Net residential density
- Gross residential density
- Town Density

QUALITY OF LIFE INDICATORS:
- Privacy: People per habitable room
- Living space: Floor Space Rate
- Private recreational space: Garden space per person

The implication of the housing options were compared by allocating each housing option to all available land (Table 4.7). The calculations for the set of indicators showing the implications of the housing options are described below:

- The **additional household units** was calculated by multiplying the total number of additional dwellings by the number of households.
- The **additional population** was calculated by multiplying the additional household units by the mean dwelling occupancy.
- The **number of people per habitable room** was calculated by dividing the additional people by the product of the total number of additional dwellings and number of habitable rooms per dwelling.
- The **Floor Space Rate**[12] was calculated by dividing the additional population into the product of the total number of additional dwellings and dwelling size.
- The **garden space per person** was calculated by dividing additional population into the product of garden space per dwelling and total number of additional dwellings.

[12] The Floor Space Rate (FSR) is the amount of floor space per member of a household (m^2 per person).

Table 4.7: Implications of Allocating One Housing Option to All Identified Land

	HOUSING OPTIONS					
	Single Storey, Cluster A	Two Storey, Detached, Multiple Household B	Two Storey Row Housing C	Two Storey Row Housing D	Three Storey Flats E	Four Storey Flats F
INDICATORS:						
Additional Household Units	1063	1324	1324	1063	2648	3972
Additional Population	3933	4634	5826	5315	6620	11 916
No. of People per Habitable Room	1.2	1.2	1.1	1.3	1.1	1.1
Floor Space Rate (FSR)	11	14	16	17	17	8
Garden Space per Person (m^2)	3.7	0.9	2.5	2.8	1.8	0.4

(Sources: Calculated from Table 4.2 and Table 4.5.)

Table 4.7 shows that the four storey flats (option F) results in the highest number of additional household units and population, while option A, the least. The results of the quality of life indicators were retabulated to obtain a comparable score (Table 4.8). Table 4.8 shows that the two storey row house (option D) and the three storey flats (E) result in the best results for people per habitable room and FSR (36.6 and 37.2 respectively). The single storey cluster (A) and the two storey row house (D), result in the most amount of garden space per person (30.5 and 23.1 respectively). Option A results in the best overall score of all the quality of life indicators (60.3 percent), which is not surprising since option A is a single storey cluster where a larger amount of garden space per person is expected compared to options B to F. Options C and D result in the next best average result of all the quality of life indicators (56.6 and 59.7 respectively).

Table 4.8: Comparative Scores Obtained for Quality of Life Indicators per Housing Type

	Score (%) per Housing Option					
	A	B	C	D	E	F
INTERNAL SPACE:						
[13] People per Habitable Room (m^2)	16.6	16.6	16.8	16.2	16.8	16.8
[14] FSR	13.0	16.8	19.2	20.4	20.4	9.6
Sub Total	29.6	33.4	36	36.6	37.2	26.4
EXTERNAL SPACE:						
[15] Garden Person (m^2) Space per	30.5	7.4	20.6	23.1	14.8	3.3
TOTAL (%)	60.3	40.8	56.6	59.7	52	30

(Source: Table 4.7)

It was now possible to decide on alternative proportional allocations of housing types for each scenario. Any number of different proportional allocations could have been used, and it is largely up to the discretion of the planner as to which scenarios are developed. The intention with scenario planning is that contrasting alternatives are set, in order to gain a comprehensive understanding of the range of options. The following range of scenarios were used:

- two low density scenarios (Table 4.9 and Table 4.10)
- an equal proportion of dwellings (Table 4.11)
- three quality of life scenarios (Tables 4.12; 4.13; 4.14)
- a higher density scenario (Table 4.15).

Using Table 4.5, 4.7 and 4.8, a spreadsheet was used to generate tables 4.9 to 4.15. On this spreadsheet, the proportion of each housing option was entered as a percentage. This generated the results containing the quality of life indicators and the resulting additional number of units and population per scenario. For the purposes of this study, an assumption

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[13] Calculated by inverting the values presented on Table 4.7 in order to make them comparable with FSR and Garden Space per Person (Appendix 11.)
[14] Calculated by summing the values on Table 4.7 for FSR and obtaining a percentage for each housing option.
[15] Calculated by summing the values on Table 4.7 for Garden Space per Person and obtaining a % for each housing option.