HOUSING CONDITIONS MAPPING ANALYSIS AND ENERGY ANALYSIS OF HOMES IN THE MARYVALE WEED AND SEED TARGET NEIGHBORHOOD

Final Report

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September 30, 2008
TABLE OF CONTENTS

1. Mapping & Spatial Analysis of Demographic and Housing Conditions 2
   1.1. Housing Conditions ................................................................. 4
   1.2. City of Phoenix Blight Violations ........................................... 5
   1.3. Social Demographic Conditions ............................................... 5
   1.4. Community Assets ............................................................... 6
   1.5. General Analysis ................................................................. 6

2. Energy Analysis of Two Maryvale Homes: Construction, Consumption, Mechanical Systems and Recommendations ......................... 7
   2.1. Lighting .................................................................................. 7
   2.2. Building Envelope: Walls ....................................................... 8
   2.3. Building Envelope: Roofs ....................................................... 10
   2.4. Floors ................................................................................... 10
   2.5. Fenestration: Windows and Doors ......................................... 11
   2.6. Mechanical Equipment and Ducting Systems ......................... 12
   2.7. 2007 Energy Consumption of Home A ................................... 12
   2.8. 2007 Energy Consumption of Home B ................................... 13

3. Appendix: Maps of Demographic and Housing Conditions ............... 15
TABLE OF MAPS

Map 1: Census Block Tracts in Designated Maryvale Weed and Seed Area
Map 2: Electrical Condition: Percentages of Housing Requiring Repair
Map 3: Plumbing Condition: Percentages of Housing Requiring Repair
Map 4: Home and Yard Condition: Percentages of Housing Requiring Repair
Map 5: Structural Condition: Percentages of Housing Requiring Repair
Map 6: Median Year Housing Structure Built
Map 7: Median Square Footage of Living Space
Map 8: Percentages of Heating Type
Map 9: Cooling Types of Housing Units
Map 10: Average Annual Water Consumption of Single-Family Detached Units (2007)
Map 11: Blight Violation Rates of Quarter-Sections
Map 12: Number of Storage Violations in Quarter Sections
Map 13: Number of Homes with Overgrown Vegetation
Map 14: Number of Unsound Fence Violations in Quarter-Sections
Map 15: Number of Inoperable Vehicle Violations in Quarter-Sections
Map 16: Number of Graffiti Violations in Quarter-Sections
Map 17: Number of Trash Violations in Quarter-Sections
Map 18: Numbers of Non-Dustproof Parking in Quarter-Sections
Map 19: Percentages of Population over 60 Years of Age
Map 20: Percentages of Population under 12 Years of Age
Map 21: Median Household Size
Map 22: Percentages of Population Living in Poverty
Map 23: Percentages Who Own and Live in Their Homes
Map 24: Community Assets
HOUSING CONDITIONS MAPPING ANALYSIS AND ENERGY ANALYSIS OF HOMES IN THE MARYVALE WEED AND SEED TARGET NEIGHBORHOOD

During Spring and Summer 2008, Arizona State University faculty, staff and graduate students from the College of Design (School of Planning and Stardust Center for Affordable Homes and the Family) provided research and technical assistance to the Maryvale Weed and Seed Program for considering low-cost restoration of homes that improved operational/energy efficiency, minor structural deterioration, and code-compliant renovations in these 50+ year-old houses.

The scope of work included: (1) field, demographic, and archival research; (b) using in part a recent City inventory of housing blight conditions in the area, a spatial analysis of these housing conditions in light of demographic and other neighborhood patterns; (c) energy analysis of two prototypical homes; and (4) the development of educational brochures providing low-cost strategies for successfully repairing and renovating their homes to be code compliant, energy efficient and by doing so reduce operational costs of maintaining their homes.

In addressing #4 above, three brochures were developed for local residents and homeowners, focusing on low-cost strategies for improving outdoor water consumption, energy use, and proper outdoor storage. The brochures were given to the Maryvale Weed and Seed Steering Committee for distribution within the community.

This final report focuses on the first three items above.

The target area for these efforts was the designated Maryvale Weed and Seed community, defined for our research gathering purposes as:

West Boundary: 47th and 51st Avenues  
East Boundary: 39th Avenue  
South Boundary: McDowell Road  
North Boundary: Indian School Road
1. Mapping & Spatial Analysis of Demographic and Housing Conditions

The first step involved a student team analyzing the demographic and residential conditions and energy/water usage data of the target area. The intent of this step was to spatially map housing, water consumption and demographic information to better visualize and assess which neighborhoods in the target area reflected inadequate or positive conditions; and to examine these maps to gauge whether certain housing conditions were more prominent in neighborhoods with particular characteristics (for example, if higher home/maintenance repair conditions were in neighborhoods with more elderly residents, or those with older homes, etc.).

The data sources included: 1) Phoenix Housing Conditions Evaluation report produced by Drs. Alvin Mushkatel, Marilyn Dantico and Subhrajit Guhathakurta of Arizona State University; 2) United States 2000 Census database; 3) Maricopa County Assessor’s database; 4) City of Phoenix’s Most Common Blight Baseline Assessment (December 7, 2007), provided by the Neighborhood Services Department; and 5) City of Phoenix Water Services water consumption figures. Efforts were made to get information from SRP for energy consumption patterns for census blocks or other aggregate data, but after many requests, we were unable to obtain this information.

Additionally, the students toured the different census tracts in the designated Maryvale Weed and Seed area to observe and identify specific housing conditions. The students took photographs that typified these conditions which were used in the brochures that were later developed.

To standardize maps for housing conditions and for social demographic data, we selected census tract information as the way to divide the designated area into “neighborhoods” (see Map 1). For the blight violation maps, we used quarter-sections as that was the only way the aggregate data was available to us. However, by mapping these areas, one can clearly see the correspondence of census tracts with quarter sections. We were unable to get housing conditions information or census information at a level below this (i.e. individual properties).

Maps of housing conditions and demographic data are located in the appendix of this report. The description and analysis of each of these maps is provided in the following section.
Map 1: Census Block Tracts in Designated Mayvale Weed and Seed Area

Legend:
- Dark brown: Boundaries of the study area
- Light brown: Census tract boundaries

Data source(s):
1.1. Housing Conditions

- **Electrical Condition Requiring Repair: Map 2**
  This map reveals that census tract 1123.01 and 1122.01 have the highest percentage (30-40%) of homes requiring repair.

- **Plumbing Condition Requiring Repair: Map 3**
  This map reveals that census tract 1123.01 has the highest percentage (30-45%) of homes requiring repair.

- **Home & Yard Condition Requiring Repair: Map 4**
  This map reveals that census tract 1123.01 has the highest percentage (60.01-70%) of homes requiring repair.

- **Structural Condition Requiring Repair: Map 5**
  This map reveals that census tract 1101 has the highest percentage (55.01-70%) of homes requiring repair.

- **Median Year Structure Built: Map 6**
  This map reveals that the northwest neighborhoods (1100.02 and 1100.01) and a small census tract (1122.01) on the eastern edge of this Maryvale area have homes primarily built in the mid 1950s, some of the oldest in the area. Newer homes, primarily constructed in the mid-1970s, were in the lower southwest quadrant.

- **Median Square Feet of Living Space: Map 7**
  This map reveals that the census tract in the southeast corner (1122.02 and 1122.01) has homes with the least amount of living space (941-963 sq. ft); while those on the western side are, on average, larger homes.

- **Percentages of Heating Type: Map 8**
  This map reveals that the majority of neighborhoods primarily use electricity for heating in their homes. But those within the northwest area and a small census track on the eastern edge have a high prominence of homes heated by gas.

- **Percentages of Cooling Type: Map 9**
  Evaporative cooling is the predominant cooling type across all census tracts.

- **Average Annual Water Consumption: Map 10**
  Water consumption varied across the different neighborhoods, from a low of 169.12 units (census tract 1122.01) to a high of 184.97 units (for CT 1100.01).

- **Overall Assessment of Housing Conditions**
  The southeast neighborhood (CT 1122.02) in general reflected few housing condition problems; while the southwest neighborhood (CT 1123.01) reflected many problematic housing conditions as examined above. It is also the case that the neighborhood with the fewest housing condition problems (1122.02) had homes primarily built in the mid 1960s and of much smaller size for the area, while the most problematic neighborhood (1123.01) had homes built primarily in the mid 1970s and also consists of much larger homes.
1.2. City of Phoenix Blight Violations

- **Blight Violation Rate by Quarter Section: Map 11**
  This map reveals a higher percentage of blight violations for census tract 1100.01 on the western edge (58-63%); with the least percentage in the neighborhoods directly south and north of that.

- **Number of Storage Violations: Map 12**
  Storage violations were relatively high across the area; but highest along the west and eastern edges of the south section of this area.

- **Overgrown Vegetation: Map 13**
  Again this shows a range of different overgrown vegetation conditions across the different neighborhoods.

- **Unsound Fence Violations: Map 14**
  The northeast corner has the least amount of unsound fence violations.

- **Inoperable Vehicle Violations: Map 15**
  Like above, the northeast corner has the least amount of inoperable vehicle violations.

- **Graffiti Violations: Map 16**
  While graffiti ranged across this area, it was lowest in the areas corresponding to CT 1123.02.

- **Trash Violations: Map 17**
  Trash violations varied across the different neighborhoods.

1.3. Social Demographic Conditions

- **Percentage of Population Over 60: Map 19**
  A higher percentage of seniors live in census tracts 1122.02 (nearly 17%) and 1100.01 (nearly 10%); much fewer live in census tract 1101 (6.5%).

- **Percentage of Population Under 12: Map 20**
  A higher percentage of children under 12 live in census tract 1123.02 (28%), in comparison to the least percentage living in census tract 1122.02 (23%), which as indicated above has a high percentage of seniors.

- **Median Household Size: Map 21**
  This map reveals a larger household size in census tract 1122.01 (4.27), in comparison to the smallest household size in census tract 1122.02 (3.23) – the one with the highest percentage of seniors and the lowest percentage of young children of the seven census tracts.
Percentage Living in Poverty: Map 22

This map reveals a higher percentage of individuals who live in poverty in census tract 1123.02 (approximately 29%), in comparison to the least amount in census tract 1100.02 (approximately 12%).

Percentage Own & Live in Home: Map 23

While overall this area has a high percentage of homeownership, this varied across the area. The highest percentage of households who own and live in their own homes is in census tract 1100.01 (88.5%), in comparison to census tract 1123.01 where only 43% are homeowners.

1.4. Community Assets

Map 24 identifies the location of schools, churches, and major community centers and organizations in the area.

1.5. General Analysis

After analyzing these maps, the Stardust Center staff identified two key patterns. First, the neighborhood with the highest percentage of seniors and the lowest percentage of young children also had the highest concentration of blight violations related to outside storage and overgrown vegetation. These areas also had some of the smaller homes in the areas. A second pattern is the correspondence between neighborhoods with high proportions of rental properties (i.e. census tract 1123.01) and neighborhoods with homes requiring substantial electrical and plumbing repair and for blight violations related to outside storage and overgrown vegetation. Interestingly, these neighborhoods were not those with the oldest homes but rather some of the newest (mid 1970s).

Given the aggregate nature of the data, we can not determine a more causal or direct relationship. That is, we can not say that it is those particular homes occupied by seniors that are those with the highest storage violations. However, the aggregate pattern suggests further analysis and consideration that some of the housing conditions and blight violations may in part be a result of the age of residents or of neglect by absentee landlords.
2. Energy Analysis of Two Maryvale Homes: Construction, Consumption, Mechanical Systems and Recommendations

(Analysis and report by Ernesto Fonseca)

Most of the homes in the designated Maryvale Weed and Seed area were built between 1950 and 1960 (some in the 1970s), which means that insulation, mechanical systems and fenestration technology were not as developed and efficient as they are today. Two low-income residences were selected and analyzed to determine their electrical energy consumption and to explore potential ways to reduce energy usage in these homes. With assistance of the director of the Maryvale Revitalization Corporation, two homes were selected as representing typical home size and construction for the periods in which they were initially developed.

The first home (Home A) in question is a 1,098-square-foot, 3-bedroom house which was built in 1963. The second one (Home B) is a 1,286-square-foot house, also a 3-bedroom with similar characteristics to the first but built in 1954. The construction materials for both units are the same: 4x9x16-inch concrete hollow block for all exterior walls, and 2x4 wood frames for interior walls. All block walls are internally insulated with 1-1/2 inches of furring fiberglass insulation. All windows are single panes with aluminum frames. Foundation and slabs are concrete on grade with no insulation. Effective wall insulation including interior fur may add to a mere 15.5 to 17 Resistance Value (R-Value). All roofs were fabricated on site with dimensional 2X4 lumber, gable roofs and attic. The insulation used for these structures is blown fiberglass insulation sitting on top of ceiling. Despite the age difference between the two units, the 1954 unit remained in better general physical condition than the 1963 house. Both houses, however, showed similar problems with regards to their thermal performance that directly affects their energy efficiency and consumption.

2.1. Lighting

Assessment: Both houses are oriented along East-West direction which exposes their two main facades and lighting well to direct solar heat gain during the summer season with little opportunity for effective horizontal shading without compromising the effectiveness of day-lighting. Direct incident solar radiation through the windows forces homeowners to close their blinds frequently. These houses were visited three times during the day, between 9:00 AM and 11:00 AM. On every occasion the smaller unit had almost all lighting fixtures on, perhaps as a result of working schedules since the smaller unit is occupied throughout the day. The larger unit did not have this problem. However, the homeowner of this residence reported having to close her blinds every morning to avoid a very hot house when she returns from work in the afternoon. This situation also forced her to turn on her lights as early as 5:20 p.m. This strategy can lead to the excessive use of artificial lighting, increasing lighting energy loads between 50%
and 100% during the day. This will also increase cooling loads and overall electrical usage while decreasing visual comfort.

**Recommendations:** Indoor and outdoor residential lighting represents nearly 20% of the total electrical loads. Taking advantage of daylighting can reduce lighting energy loads by 50%. However, it is a challenge to bring natural daylight into any building when direct incident solar radiation is on the windows. A simple and affordable solution is to install exterior opaque and translucent vertical shades on each of the exposed windows. These shades are most effective if attached 8 to 12 inches away from the wall to allow for air circulation between the windows and shades. This air flow will help remove additional heat from the shade fabric and window itself.

Further energy lighting improvement can be accomplished by using Compact Fluorescent Lights (CFLs) which can bring lighting energy consumption down another 50 to 60%. CFLs represent the easiest and least expensive strategy to reduce overall electrical energy usage. Overall cumulative lighting energy savings can be improved by 65% or more with combined strategies. In addition, CFLs have a longer life span, estimated to be between five and ten times longer than traditional incandescent lighting bulbs.

### 2.2. Building Envelope: Walls

**Assessment:** Most of the Maryvale residential buildings were built with masonry block and wood frame walls. The exterior walls of these two houses were also built with concrete blocks which are internally insulated with a 1½ inch fiberglass furring layer. The estimated R-Value for this assembly is approximately 15.5 to 17 units of thermal resistance, which means that these walls are rather inefficient, transmitting and releasing heat at greater rates than a traditional well-insulated wood frame wall. In addition these houses are sitting on an East-West axis, exposing both buildings to high direct incident solar radiation in the morning and then again during the afternoon causing important heat gains especially through the western walls and windows. This particular characteristic complicates the application of horizontal shading strategies, obligating homeowners to permanently block or keep their blinds on the eastern and western windows closed. This solution simultaneously increases the use of artificial lighting and cooling loads. Figure 1 shows how 1.5 inches of fiberglass insulation fails to provide enough protection on this northern wall of Home A. The temperatures recorded in this image are particularly important because of their north-side location, with 83°F demonstrated. All north facades are the least exposed layers of any structure. This means that south-
and west-facing walls record hotter temperatures during the same period of time, causing increases in cooling loads and decreases in comfort levels. Insulation in this image also shows mild distress with greater concentration in different sections, meaning that this insulation is losing its density and thermal properties.

**Recommendations:** Re-insulating exterior concrete block walls can represent a major expense that most low- and mid-income families cannot afford. The purpose of this study is to make low-cost recommendations that will increase the weather resistance of the walls without incurring high remodeling costs. The primary facades that need to be protected are the south and west elevations which are the ones that receive most of the daily solar radiation in these two cases.

The least expensive, but still attractive and effective strategy to ameliorate solar exposure on walls is the use of vegetation. Planting vines and/or trees along exposed walls will eliminate incident solar radiation and decrease temperatures by approximately 25°F or more, depending on the thickness of the vine or the shade that is being provided by the tree in question. Vines and trees are very effective, because in addition to direct shade, they also provide cool-misted shade. This releases moisture as a direct reaction to high weather temperatures which accelerates heat losses, cooling building structures at a faster rate than with a regular hot-fixed shade (i.e. any non-living structure that provides shade, roofs, thin metal, wood, etc.). This strategy is perhaps the most effective, natural and affordable. However, other solutions include:

- adding a second detached floating facade on any of the exterior walls to avoid direct solar radiation. This strategy can be effective in reducing direct exposure but it does not provide any additional passive cooling, such as moisture release, and requires extensive work involving the installation of boards on top of the walls.
- adding a second permanent exterior insulation layer with two inches of rigid blue board insulation, chicken wire, stucco and paint. This is an excellent solution that can also improve the appearance of the house while increasing its efficiency. This solution comes with high initial cost and is very labor intensive. This strategy does not provide any passive natural cooling.
- deconstructing the inner sides of all exterior walls, and replacing sagging and deficient fiberglass insulation. This can bring significant thermal resistance and also improve the interior appearance of the house. However, this strategy is costly and can be very disruptive for families and daily activities. Indoor insulation is not as effective as outdoor insulation; and similar to previous strategies, this strategy does not provide additional passive cooling in any other form as vegetation shading does.
2.3. Building Envelope: Roofs

Assessment: The roofs for these two units were built with traditional 2x4 wood frame structures, and were insulated with blown fiberglass or cellulose insulation. This insulation lost most of its consistency after 45+ years of poor maintenance and water damage. In the smaller unit, a large portion of the roof leaks profusely into the kitchen and dining room. Exposing soft insulation to water will flatten it, resulting in loss of its thermal and physical properties almost entirely. In addition, the rest of the roof insulation in both units has large amounts of accumulated dust which also affects insulation resistance capacity to heat transfer in both directions. Overall, these roofs and components showed substantial deterioration due to poor maintenance.

Thermal imaging was crucial to determine insulation conditions and its effectiveness. The image in Figure 2 shows a bright yellow corner with temperatures over 100°F. This indicates that the insulation is in very poor condition by allowing large solar heat loads to come into the livable space, thus increasing indoor air temperature above comfort levels. This problem as well as infiltration and low efficiency windows increases energy cooling loads, and makes it hard to maintain indoor temperatures below 81°F which is the maximum threshold for thermal comfort according to ASHRAE recommendations.

Recommendations: Attic roof solutions can present greater obstacles compared to other building structures. In particular, the roof of the smaller unit needs to be reconditioned in its entirety, replacing roof tiles and repairing several water-damaged sections. The larger house did not present any serious structural roof problem except that its insulation is in poor condition. Providing that the roofs do not leak, they will require replacing existing and deteriorated flattened insulation with new blown insulation (fiberglass, foam or cellulose). Foam has the most effective R-Values but also the highest cost. Cellulose and fiberglass are very effective if applied at the right densities and uniform amounts.

2.4. Floors

Assessment: The floors of both houses are regular 4-inch concrete slab with no steel reinforcement. Typically, homebuilders and power companies underestimate the amount of heat that is gained or lost through these floor structures. Depending on design, shading, and connectivity that slabs have with exterior patios, they can bring in large amounts of heat during the summer and lose important loads during the winter season. In this particular case, a portion of the east walls are well connected with the
exterior concrete patios without any thermal breaks. This condition allows some heat to come into the livable space, increasing cooling loads and reducing thermal comfort in the living room. Air conditioning systems tend to be very effective in most open spaces. However, walls that are heavily exposed to direct or conductive heat can cause discomfort to anyone that is sitting close to them even when indoor air temperatures are within comfort levels. In this residence, the amount of heat being transferred through the floor is not significant since only a small non-shaded section of the front patio is connected to the eastern walls. Figure 3 exemplifies the amount of heat that non-shaded concrete patios can accumulate. This image was shot at 4:05 PM on July 19, 2008. The concrete sidewalk shows temperatures of 122°F and the asphalt street recorded 145°F. If these temperatures reach any concrete wall, heat transfer will travel rapidly into any residential buildings.

Recommendations: Similar to the walls, floors can be protected from solar radiation with short shrubs that can be planted along the edges of walls. If there is an existing concrete floor that is exposed to the sun, pots and plants can be placed on the floor along the wall. Moisture and soil mass tend to keep temperatures cooler, and will help reduce floor-to-floor heat transfer.

2.5. Fenestration: Windows and Doors

Assessment: Doors and windows of the smaller house showed a large amount of physical distress (see Figure 4). Most of the windows were broken, disjointed or unsealed. These conditions exacerbate the poor efficiency that these old fixtures have in the first place. It seems that the windows and doors of neither of these structures have been changed since the purchase of the homes.

Disjointed windows and doors have increased infiltration between an estimated 150 and 200%. This excessive air exchange may have overworked the cooling unit that ultimately failed and is no longer in service. The family spent 153 days without a cooling unit, relying exclusively on highly inefficient window cooling units.
**Recommendations:** The least expensive - yet not as efficient - solution is to recondition, seal and shut all of these windows. This solution would only be temporary, and could require constant maintenance that would add up costs over time. The second recommendation would be to replace all windows and exterior doors with more efficient fixtures. This approach definitely represents the greatest expenditure. However, this solution will bring significant energy savings for the homeowner and important increments in thermal comfort.

### 2.6. Mechanical Equipment and Ducting Systems

Several Maryvale residences have evaporative coolers as their primary cooling system. The two houses have old low-efficiency evaporative coolers that were no longer functioning at the time of this assessment. They had been replaced for newer, but not new, units. The general recommendation under these conditions is to replace the cooling unit with a high efficiency heat pump with a minimum of 13 SEER. Some of the ducting systems that were installed in these houses between 1950 and 1960 were flexible ducts. After so many years, these ducts presented severe deterioration and high levels of air leakage. Air leakage is a common problem that decreases efficiency and increases cooling loads and operation costs. For any living space that has been added, it is recommended to install an independent mini-split cooling unit if the capacity of the main mechanical system is not sufficient. For all of those units that have rigid galvanized metal ducts, it would be convenient to re-seal and re-insulate them to increase their efficiencies.

### 2.7. 2007 Energy Consumption of Home A

Energy consumption can be difficult to calculate for any particular case. Energy usage is directly related not only to building efficiency, but also to climate, human behavior, personal preferences, and family size. Typically, power companies develop profiles based on similar housing parameters, in particular locations, to determine average energy consumption per household and to make comparative analyses based only on unit size versus energy usage. In the United States, a typical 1,000 to 3,000 square foot house utilizes an average of 9 to 11 kWh/sq foot/year.

In 2007, the 1,098-square-foot house consumed 19,550 kWh, which is 9,668 kWh more than an average-efficiency house in the United States. These numbers make this house nearly 50% less efficient compared to the same group of homes. According to the SRP power company, this same unit is consuming an average of 36.73% more energy during the summer compared to other units with similar characteristics within their territory. This is a clear indication that the building envelope of this unit needs immediate repairs to reduce its energy usage. In September alone, this house consumed 2,640 kWh or 13.50% of its total 2007 energy usage (see Table 1). June, July and August also recorded over 2,000 kWh of energy usage per month. The rest of the year this family reported
making little use of their electrical heaters to save on their monthly expenses. The average monthly energy usage for this house in 2007 was 17.80 kWh/sqf/year which represents a huge disparity in relation to the average house that uses 9-11 kWh/sqf/year.

### Table 1: 2007 Monthly Electrical Usage of Home A

<table>
<thead>
<tr>
<th>Month</th>
<th>kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>1,350.00</td>
</tr>
<tr>
<td>February</td>
<td>920.00</td>
</tr>
<tr>
<td>March</td>
<td>1,090.00</td>
</tr>
<tr>
<td>April</td>
<td>1,290.00</td>
</tr>
<tr>
<td>May</td>
<td>1,730.00</td>
</tr>
<tr>
<td>June</td>
<td>2,090.00</td>
</tr>
<tr>
<td>July</td>
<td>1,790.00</td>
</tr>
<tr>
<td>August</td>
<td>2,050.00</td>
</tr>
<tr>
<td>September</td>
<td>2,640.00</td>
</tr>
<tr>
<td>October</td>
<td>1,860.00</td>
</tr>
<tr>
<td>November</td>
<td>1,500.00</td>
</tr>
<tr>
<td>December</td>
<td>1,249.66</td>
</tr>
</tbody>
</table>

The summer months are the most critical times with the highest energy consumption, cooling being the biggest concern.

#### 2.8. 2007 Energy Consumption of Home B

In the same year, the 1,286-square-foot house consumed 8,368 kWh or 6.58 kWh/sqf/year. This house performed much better than the smaller unit. On paper this unit shows great efficiencies in terms of electrical usage. However, this unit did not have an air conditioning system which in itself reduces energy usage by 40%. The family also reported only using their evaporative cooler on low speed to save on energy and monthly expenses. Also the homeowner specifically said that she has a very tight budget and her goal is to keep the bills down by unplugging appliances and electrical units when they are not in use, even the washer and dryer. This house’s energy usage is almost 60% below average in relation to similar houses in that area. The average SRP house in the same area is using 11.40 kWh/sqf/year which falls within the U.S. average of 9 to 11 kWh/sqf/year. This same house is using nearly 30% less energy in relation to the lowest U.S. average house with similar characteristics.

This house is a very good example of how human behavior can affect energy usage. For the family in this larger unit, it is imperative to save on energy so they can meet their monthly expenses. Unfortunately, human comfort is being sacrificed in order to save this much of energy throughout the year. The highest energy usage for this residence

* This house is being served by APS. However, for practical purposes we are using SRP data for comparisons.
was recorded in July with 1,192 kWh (see Table 2). This is 50% less usage of that of the smaller unit.

The summer months are the most critical times with the highest energy consumption, cooling being the biggest concern. However, this home is much more efficient compared to Home A.

The difference in energy consumption between the two assessed units clearly exemplifies the difficulties determining energy efficiency. Home A used 17.80 kWh/sqf/year and Home B 6.58 kWh/sqf/year. This last number does not necessarily mean that Home B is much more efficient. After analyzing both units, it was determined that both were rather inefficient, because: (1) in order to maintain indoor temperatures within comfort levels, Home A had to spend hundreds of dollars to achieve that; and (2) in order for Home B to reduce energy usage, the family had to make drastic changes in their behavior and sacrifice thermal comfort to accomplish energy savings.
3. Appendix: Maps of Demographic and Housing Conditions

Map 2: Electrical Condition: Percentages of Housing Requiring Repair

Legend:
- 00.01 - 10 % requiring repair
- 20.01 - 30 % requiring repair
- 30.01 - 40 % requiring repair

Data source(s):
Map 3: Plumbing Condition: Percentages of Housing Requiring Repair

Legend:
- 00.01 - 15 % requiring repair
- 15.01 - 30 % requiring repair
- 30.01 - 45 % requiring repair

Data source(s):
Map 4: Home and Yard Condition: Percentages of Housing Requiring Repair

Legend:
- 10.01 - 20 % requiring repair
- 20.01 - 30 % requiring repair
- 30.01 - 40 % requiring repair
- 40.01 - 50 % requiring repair
- 50.01 - 60 % requiring repair

Data source(s):
Map 5: Structural Condition: Percentages of Housing Requiring Repair

Legend:
- 10.01 - 25% requiring repair
- 25.01 - 40% requiring repair
- 40.01 - 55% requiring repair
- 55.01 - 70% requiring repair

Data source(s):
Map 6: Median Year Housing Structure Built

Legend:
- Built in 1957
- Built in 1958
- Built in 1965
- Built in 1967
- Built in 1976

Data source(s):
Census 2000.
Map 7: Median Square Footage of Living Space

Legend:
- 941.4579 - 963.5413 sf
- 963.5414 - 1008.6632 sf
- 1008.6633 - 1131.4459 sf
- 1131.4460 - 1235.8508 sf
- 1235.8509 - 1523.3794 sf

Data source(s):
Maricopa County Assessor's Office Online Residential Property Information.
Map 8: Percentages of Heating Type

Legend:
- Lightest yellow: 29.9% electricity, 69.1% gas, 1.1% other or no fuel
- Light yellow: 34.9% electricity, 63.6% gas, 1.5% other or no fuel
- Medium yellow: 38.0% electricity, 60.1% gas, 1.9% other or no fuel
- Dark yellow: 61.7% electricity, 35.6% gas, 2.7% other or no fuel
- Medium dark yellow: 62.3% electricity, 34.8% gas, 2.9% other or no fuel
- Dark brown: 75.5% electricity, 24.5% gas, 0.0% other or no fuel
- Darkest brown: 79.8% electricity, 19.6% gas, 0.5% other or no fuel

Data source(s):
Map 9: Cooling Types of Housing Units

Legend:
- Refrigeration
- Evaporative cooling
- Wall AC
- None
- Missing data

Data source(s):
Maricopa County Assessor’s Office Online Residential Property Information.
Map 10: Average Annual Water Consumption of Single-Family Detached Units (2007)

Legend:
- 169.12 units
- 171.28 units
- 173.12 units
- 173.22 units
- 177.15 units
- 182.06 units
- 184.97 units where 1 unit = 748 gallons

Data source(s):
City of Phoenix Water Services Department
Map 11: Blight Violation Rates of Quarter-Sections

Legend:
- 0.00 - 20.3125 %
- 20.3126 - 42.2003 %
- 42.2004 - 53.5473 %
- 53.5474 - 58.1152 %
- 58.1153 - 63.2743 %
- Quarter-section borders

Data source(s):
Excel Spreadsheet of Maryvale W&S Blight Violation Survey.
Map 12: Number of Storage Violations in Quarter-Sections

Legend:
- 40.00 - 46.00
- 46.01 - 104.00
- 104.01 - 132.00
- 132.01 - 156.00
- 156.01 - 175.00
- Quarter-section borders

Data source(s):
Excel Spreadsheet of Maryvale W&S Blight Violation Survey.
Map 13: Number of Homes with Overgrown Vegetation

Legend:

- 0.00 - 37.00
- 37.00 - 66.00
- 66.01 - 116.00
- 116.01 - 132.00
- 132.01 - 147.00

Data source(s):
Excel Spreadsheet of Maryvale W&S Blight Violation Survey.
Map 14: Number of Unsound Fence Violations in Quarter-Sections

Legend:

<table>
<thead>
<tr>
<th>Category</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 - 2.00</td>
<td></td>
</tr>
<tr>
<td>2.01 - 23.00</td>
<td></td>
</tr>
<tr>
<td>23.01 - 46.00</td>
<td></td>
</tr>
<tr>
<td>46.01 - 58.00</td>
<td></td>
</tr>
<tr>
<td>58.01 - 75.00</td>
<td></td>
</tr>
</tbody>
</table>

Data source(s):
Excel Spreadsheet of Maryvale W&S Blight Violation Survey.
Map 15: Number of Inoperable Vehicle Violations in Quarter-Sections

Legend:

- 0.00 - 7.00
- 7.01 - 15.00
- 15.01 - 31.00
- 31.01 - 44.00
- 44.01 - 57.00

Data source(s):
Excel Spreadsheet of Maryvale W&S Blight Violation Survey.
Map 16: Number of Graffiti Violations in Quarter-Sections

Legend:
- 0.00 - 1.00
- 1.01 - 4.00
- 4.01 - 7.00
- 7.01 - 10.00
- 10.01 - 13.00

Data source(s):
Excel Spreadsheet of Maryvale W&S Blight Violation Survey.
Map 17: Number of Trash Violations in Quarter-Sections

Legend:
- 0.00 - 36.00
- 36.01 - 64.00
- 64.01 - 105.00
- 105.01 - 153.00
- 153.01 - 189.00

Data source(s):
Excel Spreadsheet of Maryvale W&S Blight Violation Survey.
Map 18: Numbers of Non-Dustproof Parking in Quarter-Sections

Legend:

- Light Pink: 38.00 - 52.00
- Pink: 52.01 - 73.00
- Medium Pink: 73.01 - 104.00
- Dark Pink: 104.00 - 131.00
- Maroon: 131.01 - 140.00

Data source(s):
Excel Spreadsheet of Maryvale W&S Blight Violation Survey.
Map 19: Percentages of Population over 60 Years of Age

Legend:
- 6.51 %
- 6.70 %
- 7.13 %
- 8.68 %
- 9.25 %
- 9.93 %
- 16.83 %

Data source(s):
Map 20: Percentages of Population under 12 Years of Age

Legend:
- 23.18 %
- 25.83 %
- 26.24 %
- 26.44 %
- 27.42 %
- 28.33 %

Data source(s):
Map 21: Median Household Size

Legend:

<table>
<thead>
<tr>
<th>Value</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.23</td>
<td>Lightest Pink</td>
</tr>
<tr>
<td>3.49</td>
<td>Light Pink</td>
</tr>
<tr>
<td>3.68</td>
<td>Medium Pink</td>
</tr>
<tr>
<td>3.75</td>
<td>Medium Dark Pink</td>
</tr>
<tr>
<td>4.01</td>
<td>Dark Pink</td>
</tr>
<tr>
<td>4.23</td>
<td>Darker Pink</td>
</tr>
<tr>
<td>4.27</td>
<td>Darkest Pink</td>
</tr>
</tbody>
</table>

Data source(s):

**Map 22: Percentages of Population Living in Poverty**

Legend:
- 12.38 %
- 16.08 %
- 18.72 %
- 26.20 %
- 27.42 %
- 28.25 %
- 29.07 %

Data source(s):
Map 23: Percentages Who Own and Live in Their Homes

Legend:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>43.12%</td>
<td>Purple</td>
</tr>
<tr>
<td>47.12%</td>
<td>Medium Purple</td>
</tr>
<tr>
<td>53.26%</td>
<td>Dark Purple</td>
</tr>
<tr>
<td>55.02%</td>
<td>Light Purple</td>
</tr>
<tr>
<td>66.64%</td>
<td>Darker Purple</td>
</tr>
<tr>
<td>74.86%</td>
<td>Very Dark Purple</td>
</tr>
<tr>
<td>88.56%</td>
<td>Darkest Purple</td>
</tr>
</tbody>
</table>

Data source(s):
Map 24: Community Assets

Legend:
1. Pueblo Del Sol Middle School
2. Joseph Zito Elementary School
3. Arizona Buddhist Church
4. Salvation Army
5. West Phoenix Baptist Church
6. Golden Gate Community Center
7. Beacon Light Seventh Day Church
8. Prayer Assembly Church of God

Data source(s):
1. Salvation Army
2. Golden Gate Community Center
Through research, educational outreach, advocacy and design innovation, the ASU Stardust Center for Affordable Homes and the Family supports organizations, neighborhoods, and professionals in their efforts to improve the growth of quality affordable homes and sustainable communities.