Planning for a Sustainable Future in Apache Junction: Sustainability Assessment and Recommendations for General Plan Updates

PUP548 Graduate Course Spring 2018
Arizona State University

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Executive Summary

Over the Spring semester of 2018, the Arizona State University Planning for Sustainable Communities (PUP548) Project Cities course partnered with Apache Junction to develop sustainability initiatives for future planning and governance. As one of the outputs of this project, this report represents a sustainability assessment of Apache Junction's current conditions and practices, along with recommendations for Apache Junction's General Plan 2020 Update. The assessment is based on the STAR Communities framework, such that each student (or pair of students) developed a chapter for this report that represents one of the 7 major STAR Goal Areas:

Built Environment	Climate & Energy	Economy & Jobs	Education, Arts & Community	Equity & Empowerment	Health & Safety	Natural Systems	Innovation & Process
Ambient Noise & Light	Climate Adaptation	Business Retention & Development	Arts & Culture	Civic Engagement	Active Living	Green Infrastructure	Best Practices & Processes
Community Water Systems	Greenhouse Gas Mitigation	Green Market Development	Community Cohesion	Civil & Human Rights	Community Health	Biodiversity & Invasive Species	Exemplary Performance
Compact & Complete Communities	Greening the Energy Supply	Local Economy	Educational Opportunity & Attainment	Environmental Justice	Emergency Management & Response	Natural Resource Protection	Local Innovation
Housing Affordability	Energy Efficiency	Quality Jobs & Living Wages	Historic Preservation	Equitable Services & Access	Food Access & Nutrition	Outdoor Air Quality	Good Governance
Infill & Redevelopment	Water Efficiency	Targeted Industry Development	Social & Cultural Diversity	Human Services	Health Systems	Water in the Environment	
Public Parkland	Local Government GHG & Resource Footprint	Workforce Readiness	Aging in the Community	Poverty Prevention & Alleviation	Hazard Mitigation	Working Lands	
Transportation Choices	Waste Minimization				Safe Communities		

For most chapters, the assessment is based mostly on quantitative evaluations focused on the STAR Leading Indicators, which represent a select set of measurable outcomes used to score each goal area and subsequent objectives. However, assessments are not limited exclusively to the STAR Rating System guidelines, and may include additional supportive metrics and more holistic evaluations as well.

Data was gathered from online resources, scholarly databases, and from the City of Apache Junction. Periodic seminars, interviews, and meetings with City staff allowed students to collaborate toward understanding respective contexts, particularities, and specific needs regarding the City's planning process. An on-site tour of Apache Junction with City staff and program instructors also gave students the opportunity to obtain an in-vivo contextualization and be more holistically guided toward formulating suggestions.

Each chapter opens with a brief executive summary and introduction, followed by the current sustainability assessment. Strengths and weaknesses are then highlighted to show key areas of success and improvement. The chapter concludes with general recommendations, followed by more specific suggestions for the 2020 General Plan Update with example cases from other cities and entities currently implementing novel sustainable solutions.

Overall, current strengths include a noted importance of community involvement and transparency in planning in the last General Plan, adequate stormwater research and compliance, relatively safe transportation, and major natural resources and assets such as the Superstition Mountains. Potential areas for improvement include developing economic development plans that leverage these natural assets, the local community college, and retirement community, a more multi-modal transportation system and public transit, promoting complete and walkable communities with access to healthful foods and key community services, outlining more definitive equity and empowerment initiatives, and developing a climate adaptation plan.

A few more broad and recurrent themes arise throughout the report. Several chapters acknowledge current public information sources, but call for more complete data portals that are readily accessible to a diversity of residents, minority communties, and other stakeholders. Another general recommendation is to set more specific goals with anticipated timelines to improve the likeihood of implementation and accountability to the objectives set in the General Plan.

Lastly, Apache Junction is a unique town surrounded by beautiful natural areas, yet ample development space remains. This is an optimal opportunity for The City to leverage these qualities mindfully and sustainably and develop creative ways to recycle idle or currently obsolete assets toward more sustainable solutions, while still paying homage to the town's community, history, and unique sense of place.

A special thanks to the Apache Junction directors and planners who made themselves available in this collaboration, Project Cities staff, the Sustainable Cities Network, Dr. Sara Meerow and Feifei Zhang for leading the course, and the PUP548 Spring 2018 students.

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Chapter 1 Built environment

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I.   Executive Summary

This chapter addresses the design and development patterns of the built environment in Apache Junction. Sustainability according to this STAR Community (2016) Goal Area emphasizes "…livability, choice, and access for all where people live, work, and play". The chapter begins by outlining an assessment of the current-day built environment based on the STAR Rating System. Strengths and weaknesses are then highlighted for each component, and followed by general and holistic recommendations for improvement. Lastly, more specific suggestions for the 2020 General Plan update with featured example cases and cities.

The table below summarizes quantitative results of the assessment. Overall, the main improvement areas for Apache Junction are diversifying water supplies, creating placemaking guidelines, and focusing on connectivity to Metro Phoenix public transit systems, as well as local access.

Objective & Purpose	Total Points
BE-1 Ambient Noise & Light: Minimize/manage ambient noise & light levels to protect public health and the integrity of ecological systems	N/A
BE-2 Community Water Systems*: Provide a clean and secure water supply for all local users through management of potable water, wastewater, stormwater, and other piped infrastructure	**7.5/15**
BE-3 Compact & Complete Communities: Concentrate development in compact, human-scaled, walkable centers and neighborhoods that connect to public transit, offer diverse uses and services, and provide housing options for families of all income levels	**10.9/20**
BE-4 Housing Affordability*: Construct, preserve, and maintain adequate and diverse supply of location-efficient and affordable housing options	**3.5/7**
BE-5 Infill & Redevelopment: Focus growth and redevelopment in infill areas to reduce sprawl and ensure existing infrastructure that supports the community is in satisfactory working condition	**0/10, although have infill plans**
BE-6 Public Parkland: Create a system of well-used and enjoyable public parkland that feature equitable, convenient access for residents throughout the community	N/A
BE-7 Transportation Choices*: Promote diverse transportation modes, including walking, biking, and public transit, that are safe, low-cost, and reduce vehicle miles traveled	**4.9/15**
Totals	**26.8/67**

*Leading STAR community indicators. N/A fields were not examined for this report.

II.   Introduction

This chapter provides a general sustainability perspective in the context of the *Built Environment* Goal Area of the STAR Sustainability framework, which aims to, "...achieve livability, choice, and access for all where people live, work, and play" (STAR Rating System V2, p.7). This goal area is organized into 7 objectives for achievement, listed under "Built Environment" in Table 2. As per the STAR scoring system, each objective is measured by the two types of evaluation: *Community Level Outcomes* and *Local Actions*. Here, the former is leveraged to give a baseline evaluation based on available data, with a focus on the *Leading STAR Indicators*. Where possible, additional *Outcomes* are included along with leading indicators to augment the overall assessment. Due to overlap with other chapters, and data /scope limitations, Ambient Noise & Light and Public Parkland objectives were not calculated in this report.

III.   Current Sustainability Assessment

BE-2: Community Water Systems

This is a required indicator whose purpose is to ensure that the community has a clean and secure supply of water for all users. This is accomplished through the successful management of potable water, wastewater, and stormwater (STAR Community Rating System, pg 19). This objective is measured through four different community level outcomes, through which 100% of the points can be achieved. If all of the points are not earned through community level outcomes, then local actions can be met, through which 70% of the points can be achieved. For the purposes of this report, only community level outcomes were measured, as they address the current state of the system and are most apt to making recommendations for future actions to improve. These outcomes are broken down in Table 1 below.

Table 1: A breakdown of the STAR Community Rating system for BE-2.

Objective	Description	Points
1: Drinking Water Quality	Demonstrate that the community is not in violation of EPA's drinking water rules for chemical and microbial contaminants in water pipes and turbidity	3.75/3.75
2: Water Footprint	Option A: Demonstrate that the ratio of water withdrawals for human use to the total renewable water resources is less than 0.2 Option B: Demonstrate that the ratio of water withdrawals for human use to the total renewable, stored, and allocated water resources is less than 0.2 [Partial credit applies]	0/3.75
3: Safe Wastewater Mgmt.	Demonstrate that all NPDES permit holders, including publicly owned treatment works (POTWs), are in compliance with Clean Water Act effluent and reporting guidelines	3.75/3.75
4: Safe Stormwater Mgmt.	Comply with all NPDES permit requirements for MS4s, construction activities, and regulated industrial activities	0/3.75 (based on qualitative assessment)

Water and Wastewater

The City of Apache Junction has a unique combination of rural and urban development, which is reflected in its water and wastewater infrastructure. A majority of water in Apache Junction is supplied by a public entity - the Apache Junction Water District - and a private company - Arizona Water Company. Apache Junction Water District serves 14,348 residents within Apache Junction, accounting for more than one-third of the population of 39,954 residents in 2016. It draws its water from surface water sources (District, n.d.). A map of this water district and the area it covers within the City of Apache Junction can be found in Figure A1 in the appendix. The Arizona Water Company is a private water supplier that supplies water to the rest of the Apache Junction population that gets its water from a utility service. This company services 57,647 people total and a large portion of Apache Junction, as shown in Figure A2 and draws its water from groundwater sources ("Find your Local CCR | Consumer Confidence Reports (CCR) | US EPA," n.d.). Consumer confidence reports are available from both utilities and are discussed in a later section. Several other minor utilities were reported by the EPA as servicing Apache Junction, and include Arizonian Travel Trailer, Goldfield Ghost Town, and Northern Section 4 Co-op. These utilities serve populations of 300, 100, and 27 residents respectively and all draw their water from groundwater sources. There is little to no data available for these minor sources and a consumer confidence report is only available for the Northern Section 4 Co-op through the Arizona Department of Environmental Quality ("Arizona Department of Environmental Quality, Drinking Water Watch," n.d.). In addition to these major and minor utilities, several residents of Apache Junction get their water from private groundwater well sources. At the time this report was written, data regarding the number and location of private groundwater wells was not made available.

The STAR Leading Indicators require communities to show that they do not have violations in their Consumer Confidence Reports (CCR) from their water sources. The results of these CCRs with a description of violations can be found in Table 2. Apache Junction meets this requirement, as their two major utilities demonstrate that they do not have violations for 2016. It should be noted that the Apache Junction Water District did have two violations in 2016, but these offenses were for taking samples on the wrong dates and do not concern water quality. The only water quality violation they had was in 2015 for exceeding the Total Coliform Bacteria limit. For this reason, it was decided that Apache Junction would get full points for their community water system.

Table 2: Water CCR reports from major water companies in Apache Junction, where data is available.

Company	Year	Violations	Description
Apache Junction Water District	2015	1	Total Coliform Bacteria in March 2015
Apache Junction Water District	2016	2	Total Coliform Bacteria and TTHM & HAA5 samples were not taken on correct dates
Arizona Water Company	2015	0	N/A
Arizona Water Company	2016	0	N/A

All municipal sewerage services are provided to Apache Junction by the Superstition Mountain Community Facilities District No. 1. The district was formed on July 7, 1992 and has been expanded to include 2,388 parcels of land within its service area today (Superstition Mountains Community Facilities

District No. 1, 2016). Akin to its rural and urban mix, many residents of Apache Junction also use private septic tanks to treat their own wastewater instead of municipal sewerage services, which presents an interesting mix of infrastructure present in the City. The permitting of these private septic systems is monitored by Pinal County, and routine inspection and permitting is required by the Arizona Department of Environmental Quality, or ADEQ. Prior to constructing a private septic system, a permit must be obtained from the Pinal County Planning and Development Department. After construction, routine site investigations are required to be done by a qualified professional. If any violations of the codes set forth by Pinal County occur, it results in a class 3 misdemeanor - where each day of continuing violation constituting an additional and separate offense (Pinal County, 1987). At the time this report was written, adequate data quantifying the location and number of private septic systems was not available.

The STAR Leading indicators dictate that community wastewater systems must demonstrate compliance with the Clean Water Act effluent and reporting guidelines. This was checked using EPA's ECHO system. Upon checking it was found the the Superstition Mountain Community Facilities District No. 1 facility was the only reporting facility in Apache Junction. The only violations reported for this facility were in 2015, with none in 2016, which demonstrates Apache Junction's compliance, thus giving them the full 3.75/3.75 points for wastewater systems (Table 3).

Table 3: EPA ECHO Report for Superstition Mountain Community Facilities District No. 1.

Violation	Code	Quarter	Date
Cyanide, total [as CN], Monthly	E(EffViol)	1	01/01/15 - 3/31/2015
Cyanide, total [as CN], Monthly	E(EffViol)	1	01/01/15 - 3/31/2015
Cyanide, total [as CN], Monthly	E(EffViol)	4	10/01/15 - 12/31/15
Cyanide, total [as CN], Monthly	E(EffViol)	4	10/01/15 - 12/31/15
Mercury, total recoverable, Monthly	E(EffViol)	1	01/01/15 - 3/31/2015
Mercury, total recoverable, Monthly	E(EffViol)	1	01/01/15 - 3/31/2015
Mercury, total recoverable, Monthly	E(EffViol)	2	04/01/15 - 6/30/15
Mercury, total recoverable, Monthly	E(EffViol)	2	04/01/15 - 6/30/15
Mercury, total recoverable, Monthly	E(EffViol)	3	07/01/15 - 09/30/15
Mercury, total recoverable, Monthly	E(EffViol)	3	07/01/15 - 09/30/15

Stormwater

Because of its location at the foothills of the Superstition Mountains, Apache Junction has a unique terrain that presents the city with interesting stormwater challenges. Being at the base of a mountain facilitates a large amount of runoff that is generated and carried throughout the city. This hydrology manifests itself in the presence of several main washes and minor water flow paths throughout the city. The main wash, Weekes Wash, creates a major floodplain through the western half of the city, in which a FEMA Special Flood Hazard Area is created with a regulatory floodway ("FEMA Flood Map Service Center | Search By Address," n.d.). A regulatory floodway is an area that must be kept free of all encroachment - including development or built structures. In addition to this special hazard in the Weekes Wash, a large portion of Apache Junction is contained within a flood hazard area of 0.2% chance of flood hazard.
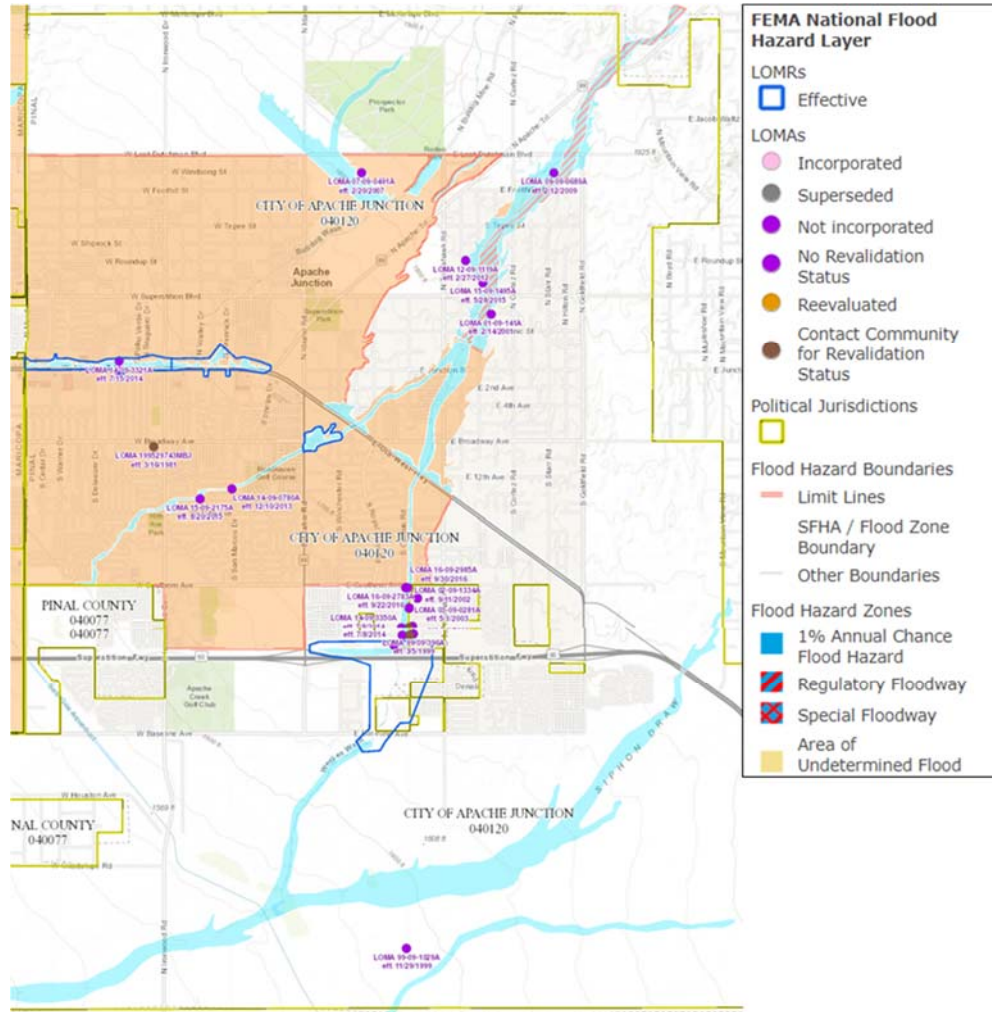

Figure 1: FEMA National Flood Hazard Map.

As a result of this special hydrological consideration, the City of Apache Junction has stormwater infrastructure to address these challenges. To the north of the city, there is a levee that diverts stormwater from potentially flooding the city.
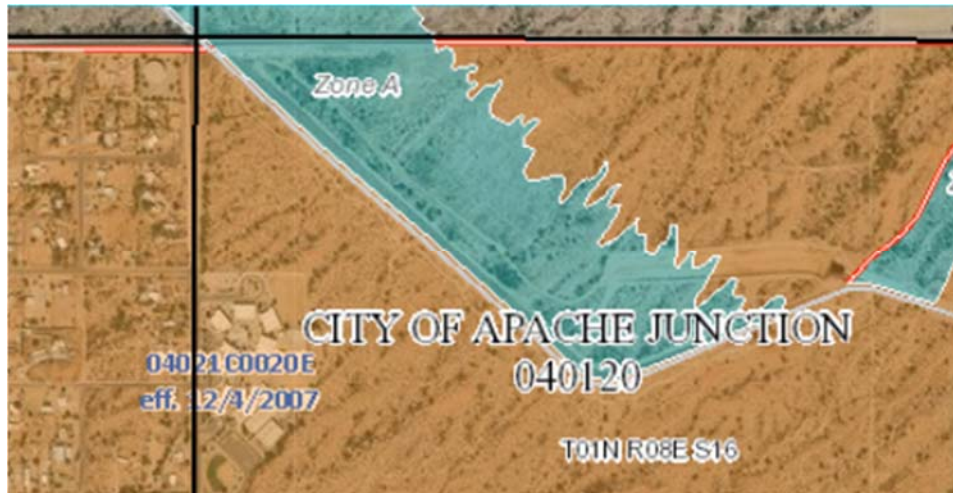
Figure 2: Closeup of the levee in Apache Junction and its effect of the shape of the flood hazard area.

With these unique challenges in mind, Apache Junction has a variety of reports and has planning practices in place in order to ensure the safe stormwater management in the city. These include the Flood Risk Report, Stormwater Management Program, and the Stormwater Master Plan Report. This acknowledgement of their stormwater challenges shows Apache Junction's understanding of their stormwater challenges. However, when the project group toured the city, there were several challenges regarding the enforcement and planning of stormwater that became evident. While touring the city, one privately owned residential lot was re-graded against permitting rules which caused a wash to form through a residential street. It is for this reason that Apache Junction does not receive full points. While the city has demonstrated concern over its unique stormwater challenges, this is not reflected in its stormwater practices.

BE-3: Compact & Complete Communities

Based on data tools used as indicators for density, transit, walkability, and complete design, the overall score for this objective was calculated to be just over 50% (Table 4). Using EPA's Smart Location Calculator (SLC), a Smart Location Index (SLI) score of 65 was derived using Apache Junction Chamber of Commerce as a proxy for Compact and Complete Centers to be analyzed for Outcome I of this objective (10 points). The H+T Compact Neighborhood score, since it considers both walkability and density as an integrated 10-point grade, served as a great method for calculating Outcome 2 (5 points) and Outcome 3 (5 points) in tandem (Fig. 3).

Table 4. Breakdown of indicators for compact and complete communities.

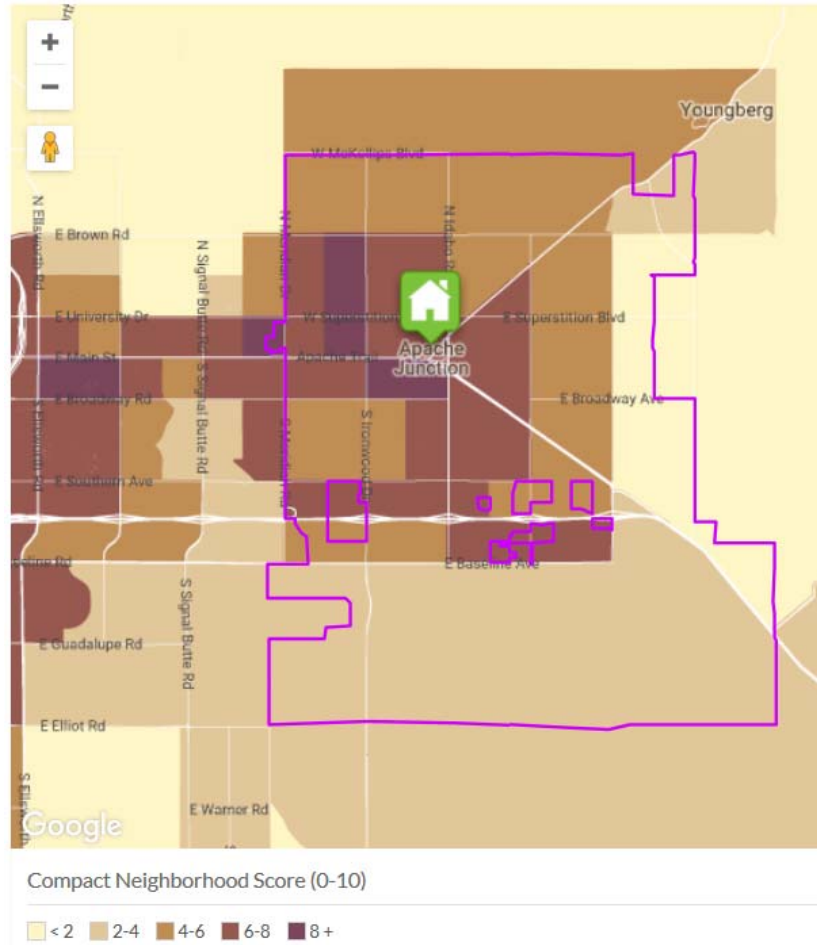| Indicator	Itemized Points	Total Points
Density, Destinations, and Transit	6.5/10	10.9/20
Walkability & Design	4.4/10	

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Figure 3. Compact Neighborhood scores per Census Block Group in Apache Junction (credit: htaindex.cnt.org)

BE-4: Housing Affordability

Housing and transportation costs serves as one of the STAR *Leading Indicators*, and was calculated to be 50% for Apache Junction (Table 5). The average housing and transportation costs as percentage of average income is 46% for Apache Junction. Two other outcomes were used as measures. First, showing that at least 80% of Census Block Groups where a household earning the Area Median Income (AMI) would spend less than 45% on housing & transportation combined, where Apache Junction was calculated have only 54.1% (Fig. 4). Second, showing that at least 60% of Census Block Groups where a household earning 80% of the Area Median Income (AMI) would spend less than 45% on housing & transportation combined. For Apache Junction this was calculated to be 7.6%.
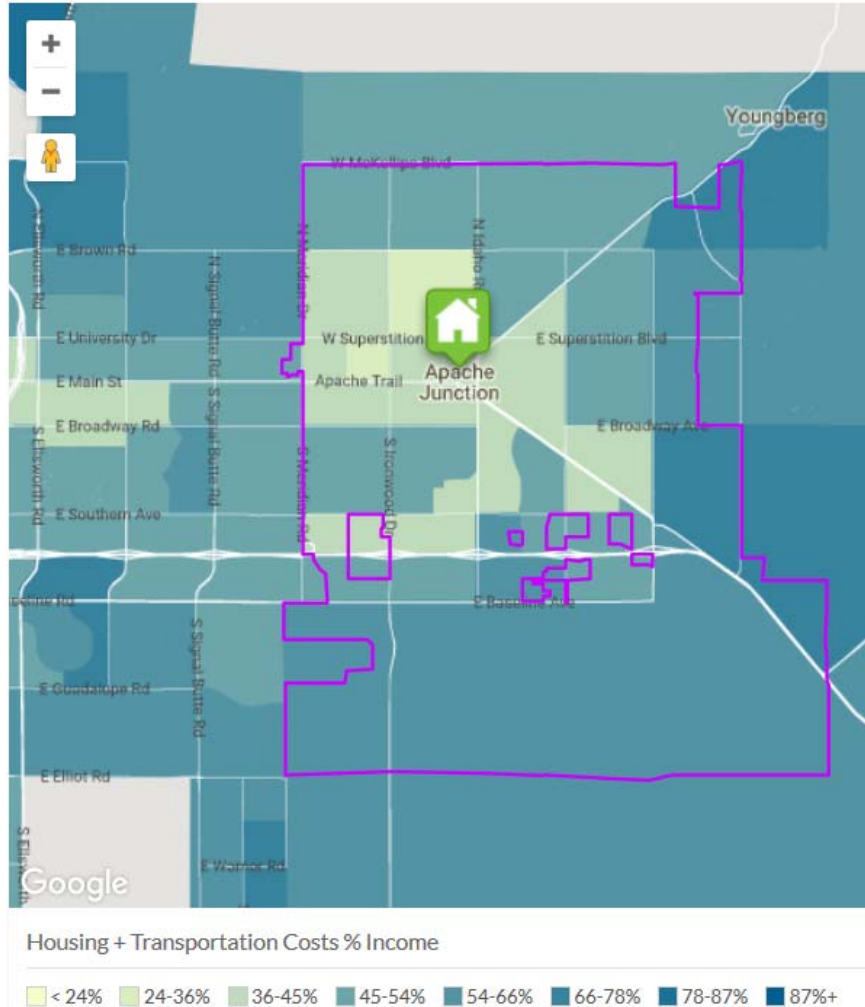
Figure 4. Housing and Transportation costs for Apache Junction as percent of Area Media Income (credit: htaindex.cnt.org)

BE-5: Infill & Redevelopment

While not a required section, the infill and development rating is worth analyzing to gain an understanding for the overall city form. This description of the urban landscape is also not included in any other section of the overall report, but is vital to understanding Apache Junction and the city's future. The infill and development indicator focuses on the growth and redevelopment of infill areas. In focusing on such, this indicator has the goal of reducing sprawl while ensuring that existing infrastructure supports the community in a satisfactory way (STAR Community Rating System, pg 28). For this indicator, 10 points are available with 70% of those being achievable community level outcomes and another 70% being achievable through local actions. Community level outcomes are outlined in Table 5 below.

Table 5: Community level outcomes for BE-5.

Outcome	Description	Points

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1: Infill Development	Option A: Demonstrate at least 51% of new residential and non-residential development occurred in locally designated infill and redevelopment areas or on infill sites that were previously developed, brownfield, and/or greyfield sites [Partial credit available] Option B: Demonstrate an increased percentage of all new residential and non-residential development occurred in locally designated infill and redevelopment areas or on infill sites that were previously developed, brownfield, and/or greyfield sites [Partial credit applies]	0/3.5
2: Existing Infrastructure	Option A: Demonstrate at least 90% of existing public infrastructure is in good or better condition Option B: Demonstrate an increased percentage of existing public infrastructure is in good or better condition over time [Partial credit applies]	0/3.5

Infill Development

Apache Junction (AJ) is well known for its rural feel, which is evident in the larger average lot sizes found in AJ and lack of medium to high density housing like multi-family residences. These larger lot sizes are a result of the city's initial founding. When Apache Junction was initially developed it was divided up into lot sizes that were larger than 1 acre each. From this point on, the city's development has echoed this same sprawled form. In more recent years, more concentrated subdivisions have formed and a few multifamily apartments and condos have been developed. The City of Apache Junction has shown an interest in increasing the density of the development and decreasing the amount of sprawl on the city's outskirts. To do so thus far, the city has created a special zoning district for their downtown area to encourage mixed use development in that area. This zoning use is pictured in light pink on Figure 5 in the land use plan from 2010 (City of Apache Junction, 2010). The city has also had an infill development report done by the EPA specifically for the city, a redevelopment plan for the downtown including the Crossroads Redevelopment Area, and several retailers, showing interest from the city in creating more infill. These factors have the potential to develop a stronger downtown area and limit sprawl in the city.
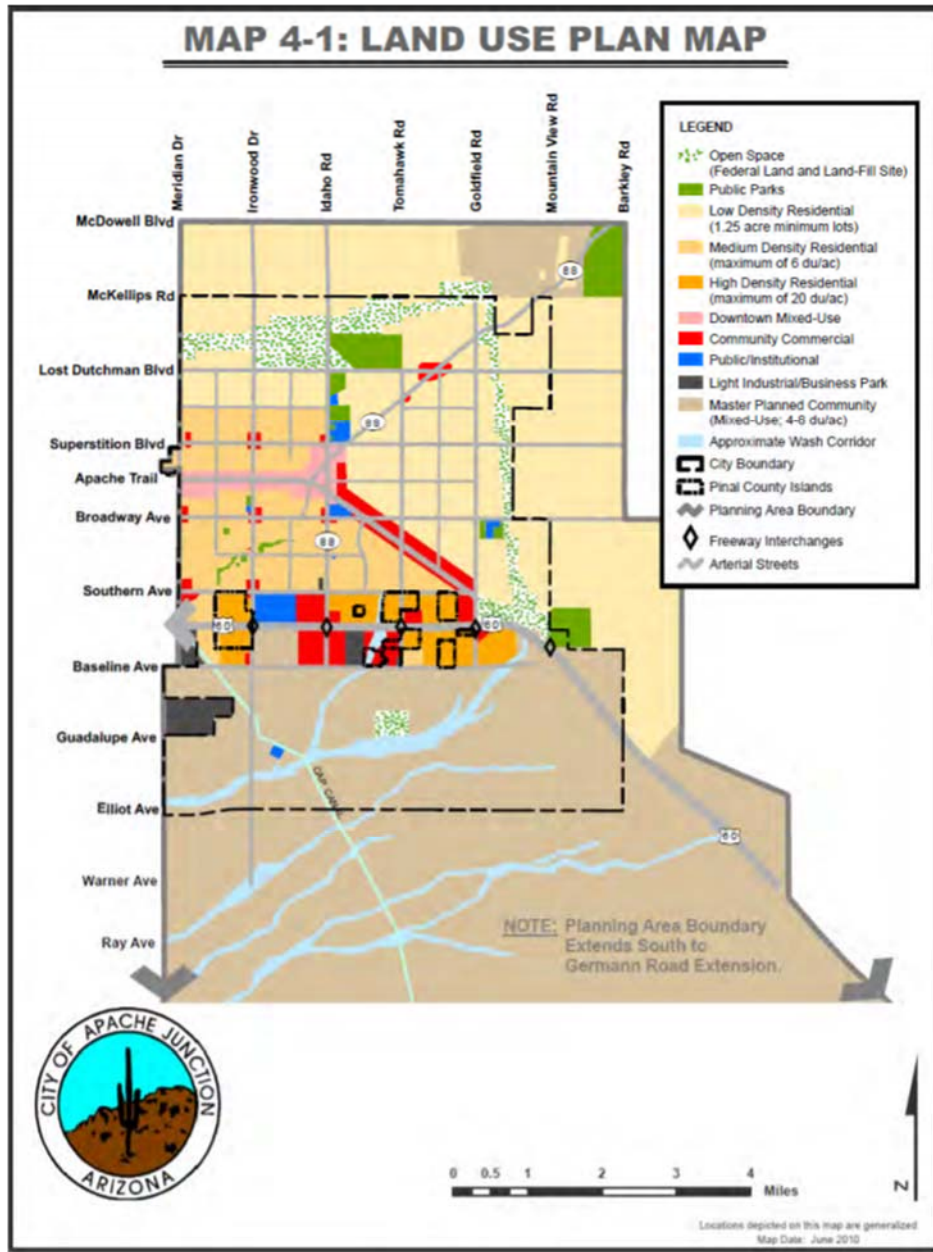
Figure 5: Land use planning map from Apache Junction General Plan 2010.

The STAR Indicators require that a community demonstrate at least of 51% of new residential and non-residential development occurs in locally designated infill and redevelopment areas. This development can also occur in previously developed, brownfield, and/or grey field sites (STAR Rating System, pg 28). Apache Junction does not have a record of whether or not development has occurred in their designated infill zone, nor is it evident that this development has occurred in redeveloped, brownfield, and/or greyfield sites. The infill requirement can also be met by showing that an increased percentage of all new residential and non-residential development occurs in designated infill and redevelopment areas or the previously mentioned brownfield and/or greyfield (STAR Rating System, pg 28). While Apache Junction has set their designated infill zone, they have not yet met this requirement but are taking steps in that direction. For these two reasons, Apache Junction receives no points for infill development.

Existing Infrastructure

It is common that Infrastructure as a whole is not quantified, nor that its condition is mapped and quantified. For this study, we did not manage to acquire and analyze data on all of the infrastructure within Apache Junction, such as an asset management report. The STAR Rating system requires that a community must demonstrate that either 90% of the existing public infrastructure is in good or better condition, or that an increased percentage of public infrastructure is improving to good or better condition as time progresses (STAR Rating System, pg 28). If a city does not have a record or demonstrated inventory of its infrastructure, it is unable to demonstrate that it meets this requirement. It is for this reason that we did not assign Apache Junction points for this category under the STAR Community Rating System, although the city may have this information, and could receive the points by analyzing it in the future.

BE-7: Transportation Choices

The transportation objectives contain two outcomes considered as *Leading Indicators* and two standard outcomes, which were used to calculate and a score of 32% for this objective (Table 6). Of the leading indicators is the transportation mode split, which the following percentages of residents were found for the following journey-to-work trips (note: 2016 ACS was referenced instead of 2015):

1. Drive alone = 78.5%
2. Carpool = 10.9%
3. Public transit = 0.1%
4. Walk = 2.2%
5. Bike = 0.6%
6. Work from home = 4.7%

The average transportation Costs % of income for Apache Junction was found to be 24% of regional typical household income (STAR threshold = <15%). For the transportation safety indicator (BE-7, Outcome 3), zero fatalities were found for non-occupants and vehicle crashes for 2015 and 2016. The SLC models Vehicle Miles Traveled (VMT), which became useful given that Apache Junction was unavailable in the Federal Highway Administration's VMT database. The SLC model reported 28mi/person/day for Apache Junction, compared to Metro average of 27.3. The percent difference between the additional VMT in respect to the Metro average was used to calculate a deduction to the 2.5 points available for this outcome.

Table 6. Breakdown of transportation choice indicators.

Indicator	Itemized Points	Total Points
Mode Split	0/5	
Affordability	0/5	4.9/15
Safety	2.5/2.5	
Vehicle Miles Traveled	2.4/2.5	

IV. Strengths

Apache Junction has recognized the need to be sustainable as a community and has already taken steps to reach this goal. This section highlights some of the strengths that the City of Apache Junction has demonstrated on its journey to sustainability thus far.

Water Systems

In terms of community water systems, Apache Junction has taken steps to ensuring a safe, clean, and sustainable supply of water. This is demonstrated through CCR reports from the Apache Junction Water District and Arizona Water Co. The City has also demonstrated safe and compliant handling of wastewater, as indicated by compliance with Clean Water Act regulations in recent years. In terms of stormwater management, the City has demonstrated its concern over stormwater challenges through extensive study of the hydrological features within city limits. There are also flood control structures, such as the levee in Figure 2 that regulate stormwater flows within the city. This, coupled with the study and treatment of Weekes Wash as a regulatory floodway, show concern over safe stormwater handling.

Infill & Redevelopment
While Apache Junction is known for its rural character, associated with its sprawling development, there are several strengths that the city has regarding its infill and development. First, the city has an infill development report from the EPA, which will be extremely important in guiding future infill development (Environmental Protection Agency, 2017). The City has also created special zoning districts and has targeted areas for development that will increase infill within the City's inner downtown area. In terms of its infrastructure, while little is known overall about the state of the infrastructure, it can be assumed that it is still within its design lifespan. Because Apache Junction developed later than other municipalities in Phoenix, its infrastructure is still relatively new and should be in good or working condition. Its age, however, is not a guarantee of its condition.

Compact and Complete Communities
Despite the car-dependent sprawl, Apache Junction has ample opportunities for creating livable spaces and a vibrant town center. The indicators used to evaluate how compact and complete Apache Junction is are very general. That said, although housing is not very dense and walkability is unclear, there are many features upon which to leverage connectivity between natural areas, commercial centers, and residential communities.

Transportation
Transportation safety is a clear strength for Apache Junction as no fatalities were observed in the Fatality Analysis Report System (FARS). However, this can very quickly become a challenge as public transit, bike, pedestrian, and trail orientated plans are implemented.

V. Weaknesses

Given Apache Junction's current strengths in sustainability, it is important to recognize the areas in that the city can improve and become more sustainable. These weak points of sustainability will be used to guide the recommendations for improvement that will be used to formulate suggested additions to the 2020 General Plan in the next section of this report.

Water Systems
In regards to water, The City lacks data in some key areas and needs to seek more sustainable water supplies. During the research an analysis of this report, little data could be found regarding the water quality of private well systems as well as usage from these groundwater wells, which could be detrimental to sustainability. Along the same notes, little data exists for the quantification and permitting status of

private septic systems in Apache Junction. While on a tour of The City, it was evident that while stormwater procedures exist for the city, they are not adequate enough to prevent stormwater problems from being created. This became clear upon seeing a private lot that was graded in a way that caused a wash to be re-routed across a public roadway. These contesting points are key points that can be addressed in the next general plan for the city.

Compact and Complete Communities
As mentioned in the previous section, Apache Junction is a very car-dependent city. Judging from the SLI and H+T scores, it is likely there are many areas where access to certain services may be limited. Additionally, while these scores imply walkability, it is unclear how amenable pedestrian travel different parts of the town may be.

Housing Affordability
Residents near the Area Median Income, and especially below it, spend a relatively large amount of their income on housing and transportation. This falls in line with car-dependency and the extended commute-time residents experience. This could make it difficult for young and/or working-class families to improve their livelihoods and manage expenses.

Infill & Redevelopment
Apache Junction currently lacks infill development and has no demonstrated inventory of its public infrastructure and condition. These create inherent weaknesses for the further improvement of the City's sustainability. In terms of development, the city has created incentives and special infill zones, but otherwise has no other incentives that will drive development to these areas. The existing city form and land use also drives more sprawl around city limits. It is not uncommon that a developer would choose to construct on state lands outside the city that are currently undeveloped. Regarding the condition of infrastructure, while it is newer infrastructure, its condition is not guaranteed and largely unknown. Since the city has two main water utilities, there are also different owners of infrastructure used to convey water which could create challenges in determining the quantity and condition of infrastructure.

Transportation
Lastly, a major weakness for sustainability lies in the transportation sector. Nearly 80% of Apache Junction residents drive alone to work, along with a longer commute time compared to both the national average and the Phoenix-Scottsdale-Mesa Metro area (Census American Community Survey, 2015). Thus, transportation in Apache Junction can be regarded to be overall car-dependent. This is compounded with the challenge of affordability as many citizens spend toward and beyond half of their income on housing and transportation combined. Apache Junction does not have accessible public transit which limits transportation options for Apache Junction residents, as well as accessibility to Apache Junction for residents of neighboring cities.

VI. Recommendations for Improvement

Guided by the weaknesses mentioned in the above section, targeted areas of improvement for the City of Apache Junction can be created. These recommendations will then be used to formulate specific suggestions for the 2020 General Plan update for the city. Many of these recommendations are based upon case studies or leading examples in analogous cities or towns. These examples can be used to guide updates to the general plan and help provide prior examples for the planning, implementation, and continued enforcement of these changes.

To increase the sustainability of Apache Junction's water supply, it is recommended that the city seek to diversify its water sources and manage all water sources and wastewater under a single system as opposed to several different systems. An example of this strategy can be found in the Town of Buckeye's 2007 General plan where the town recognizes its heavy reliance on groundwater for supply and aims to focus on groundwater recharge and diversifying water supplies (Town of Buckeye, 2007). To do this the town plans to implement the following strategies: "promoting new sources including increased reclamation, CAP water supplies, Buckeye waterlogged areas, and reclamation-based irrigation practices. Furthermore, the Town aims to interconnect these diverse sources to form a single water system (Town of Buckeye, 2007). Buckeye's water resources fall under a situation similar to Apache Junction's where there are several systems, managed on public, private, and individual levels, that are not connected to one another. The town also has a heavy reliance on groundwater for its drinking water and irrigation sources. To make their supply more sustainable the town wants to diversify its sources, encourage more reclamation for irrigation use, and wants to manage the sources under a single system. This same strategy could be used to improve water sustainability in Apache Junction overall, as the two places have similar issues and climates regarding water. In addition to this, additional water related weaknesses include stormwater permitting and enforcement so that hydrological conditions are not altered in the city, and ensuring a sustainable supply of water and quantification of water usage. These are both addressed with suggestions for the 2020 General Plan.

Apache Junction has many challenges in creating a community with infill development and ensuring the quality of its infrastructure. The EPA Infill report created for Apache Junction already contains several great strategies to help create infill in specific regions and even has suggestions and examples of placemaking case studies and how to generate higher density development (Environmental Protection Agency, 2017).

To provide a more specific example, the City of Flagstaff's downtown area will be examined. The downtown area of Flagstaff is one that has successfully become a tourist attraction within the area, but is an area with a sense of place and history. The downtown area highlights the Route 66 nostalgia of the area as it still has historic buildings within the downtown and emphasizes the spirit of the Route 66 culture (Culture & Heritage - Flagstaff, Arizona). This is similar to Apache Junction's history with old Route 60 running through what is now Apache Trail. Flagstaff is also well known for its surrounding outdoor recreational opportunities and has urbanized trails and bikeways that connect the downtown areas to recreation ("Flagstaff Urban Trails and Bikeways Map | City of Flagstaff Official Website," n.d.). This also helps to create a sense of place and increase recreation within the city. A small insert of a map of urbanized trails is shown in Figure 6 below. It is clear there are several different trails that help connectivity within the city by walking or biking, but there are also several trails that lead to the outer regions of the city and to nature destinations surrounding the downtown. This unique approach, through adding connectivity to nature with trails, can help create a sense of place within a city that has natural resources, like the Superstition Mountains surrounding it, while increasing transportation connectivity for residents to the downtown area.
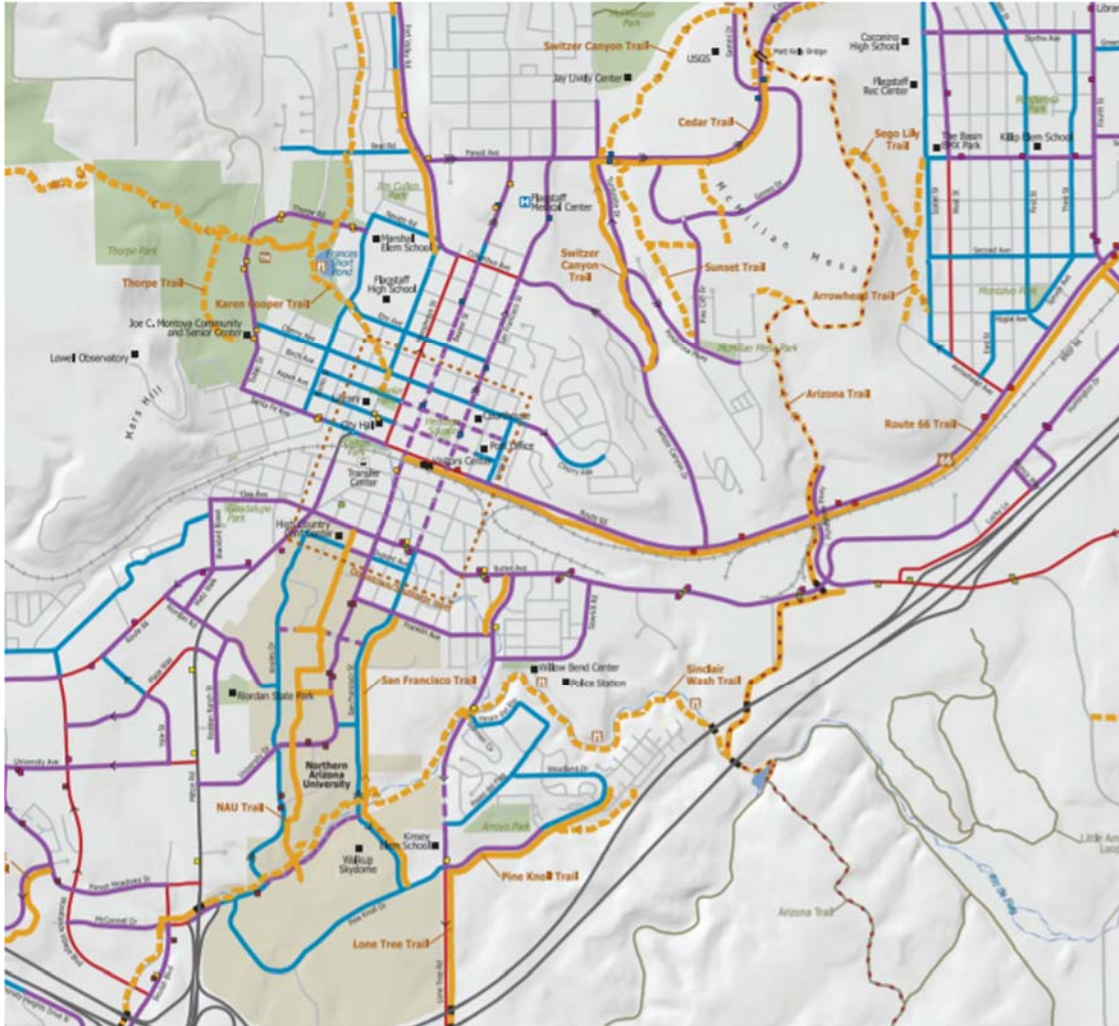
Figure 6: Urbanized trails in dashed or solid lines within downtown Flagstaff.

The infill and redevelopment guidelines from STAR Communities also require that a community demonstrate that its infrastructure is in good or continually improving condition. To do this, The City first needs to establish an inventory of its infrastructure assets. This can be accomplished through creating an asset management plan. One local example of such can be found in the City of Phoenix's solicitation for an asset management project for their water services (City of Phoenix Water Services Department, 2016). This solicitation asks for a contractor to support the city's asset management program and use software to inventory the condition and relationships between assets as well as provide a maintenance system for the assets. By developing such a system, a city is aware of its assets and their condition at all times, and is able to demonstrate the overall condition of its infrastructure. To prove the continual improvement of its infrastructure, the City of Apache Junction could set aside additional money to maintain city infrastructure. An example of such can once again be found the City of Phoenix within their Capital Improvement Program. This program shows the amount of money to be invested in selected infrastructure systems, which in turn shows the continued improvement of these systems. The program also outlines desired goals for projects, improvements, and where funding will go for each infrastructure system. For example, Phoenix aims to improve aviation with $1,329.7 million dollars and make major improvements to Sky Harbor International Airport including improvements for terminals 3 and 4 as well as the rental car

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center and Sky Train connections (City of Phoenix, 2017). A program like such demonstrates continued investment in infrastructure.

Transportation, Affordability, and Completeness
A comprehensive transportation policy could tackle improvements in several domains for Apache Junction, including compactness, completeness and affordability. Empowering residents with other transportation options could alleviate some of the costs associated with owning a vehicle (e,g, insurance, gas prices, repairs). Furthermore, public transit could enable economic growth around the town center, which could eventually produce more local jobs as more residents from neighboring towns come to shop, eat, and access natural areas.

Other implications for the future are also relevant. For example, Ford Motor Company has acknowledged the growing challenge of mobility in the rise of megacities, and the movement toward shared mobility (DeBord, 2016). Thus, Apache Junction risks lagging behind as cities in the metro region have already begun this transition with shuttles, Light Rail, and bicycle shares.

Valley Metro has recently been planning and constructing extensions to the Light Rail (Fig. 7). One of these extensions is toward Eastern Mesa. Mesa already enjoys public transit connectivity from its downtown area to Metro Phoenix. Currently, this is where public transit leaves off toward Apache Junction. Thus, it is an opportunity for Apache Junction to begin planning for ways in which to connect to the Light Rail extension plans. Given that the Light Rail has direct access to downtown Phoenix, Sky Harbor airport, and is beginning to span more extensively into West and South Phoenix, and Mesa, this mode of transportation could link Apache Junction residents to key areas for work and play.
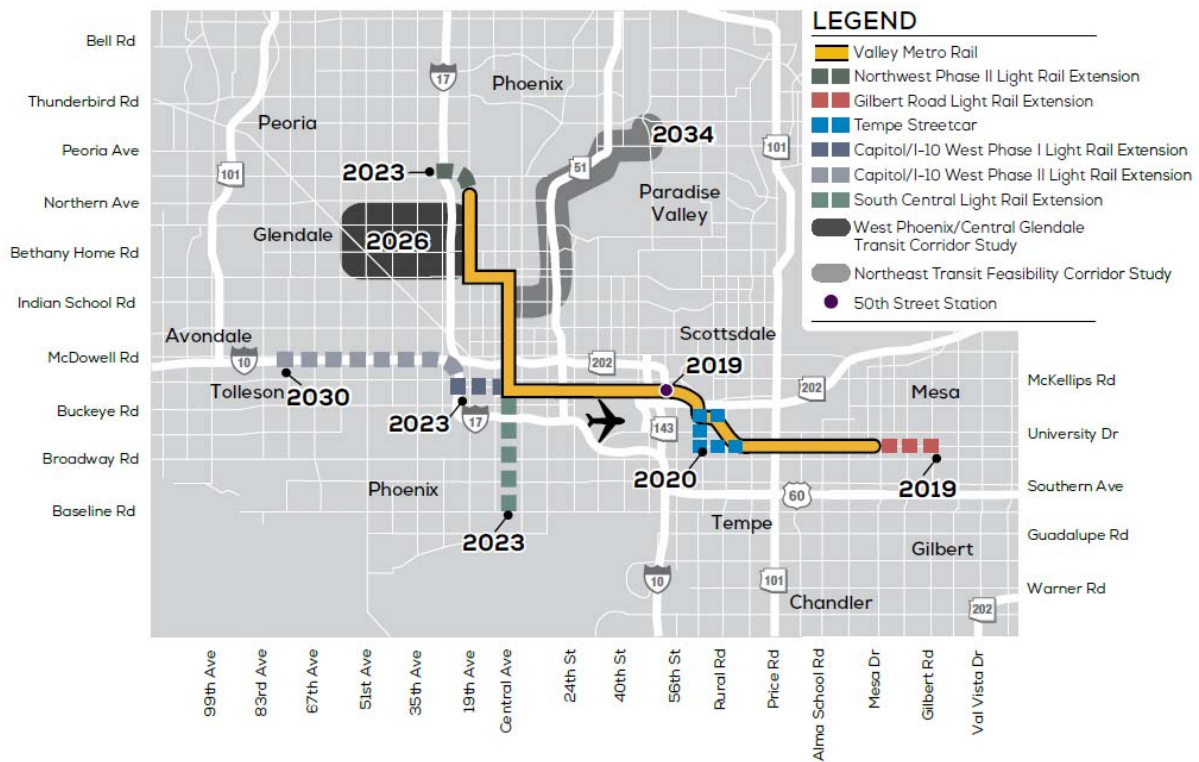
VII. Specific Suggestions for 2020 General Plan Update

Given the above recommendations for improvement, the following specific suggestions for Apache Junction's 2020 General Plan are made to create a more sustainable future for the build environment of the city.

- Develop a strategy for water resources that will implement new sources of water, increase reclamation efforts for irrigation and other uses, and create a single system to manage water resources within the city (*See* Town of Buckeye, 2007).
- Create stricter guidelines and enforcement procedures for stormwater permitting and related activity on private lands.
- Develop a system to measure groundwater withdrawals on private land and quantify water supply being used within the city.
- Develop a placemaking strategy that incorporates culture and arts, as well as guides mixed use development in downtown area of Apache Junction and include connectivity to natural resources and trails (Markusen & Gadwa, 2010).
- Create an asset management plan to inventory and assess the condition of infrastructure within Apache Junction.
- Look to Curitiba, Brazil, for inspiration and creativity for transportation planning on a tight budget. A heralded sustainable city with stringent financial constraints, Curitiba's *guiding principles* emphasize an organic user-oriented approach with flexibility and "recycling" of capital and assets (*see* Rabinovitch & Hoehn, 1995).
- Consider connectivity to the Valley Metro Light Rail system and other Metro Phoenix systems. New possibilities arising are smart shuttle start-ups like Bridj[2] and Chariot[3], which are looking for city partnerships. These shuttles may provide the flexibility and adaptability needed when major projects present too great an investment.

Table 7: Summary of suggested 2020 General Plan updates for Apache Junction.

Target Area	Suggestions
Community Water Systems	● Develop a strategy for water resources that will implement new sources of water, increase reclamation efforts for irrigation and other uses, and create a single system to manage water resources within the city. ● Create stricter guidelines and enforcement procedures for stormwater permitting and related activity on private lands. ● Develop a system to measure groundwater withdrawals on private land and quantify water supply being used within the city
Infill and Redevelop-ment	● Develop a placemaking strategy to guide mixed use development in downtown area of Apache Junction and include connectivity to natural resources and trails.

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[1] www.valleymetro.org/images/uploads/misc.../Future_Transit_Corridors_brochure.pdf

[2] www.bridj.com/city-partners/

[3] www.chariot.com/cities

	● Create an asset management plan to inventory and assess the condition of infrastructure within Apache Junction.
Transportation	● Develop plans for connectivity with Metro Phoenix public transit. ● Develop a walkability Index Map that represents current conditions and future visions ● Create a connectivity scheme, guidelines, and goals to help guide multiple modes of transportation between roads, sidewalks, and trails. ● Outline safety concerns, anticipated errors, and strategies for transitioning toward a multimodal transportation scheme.

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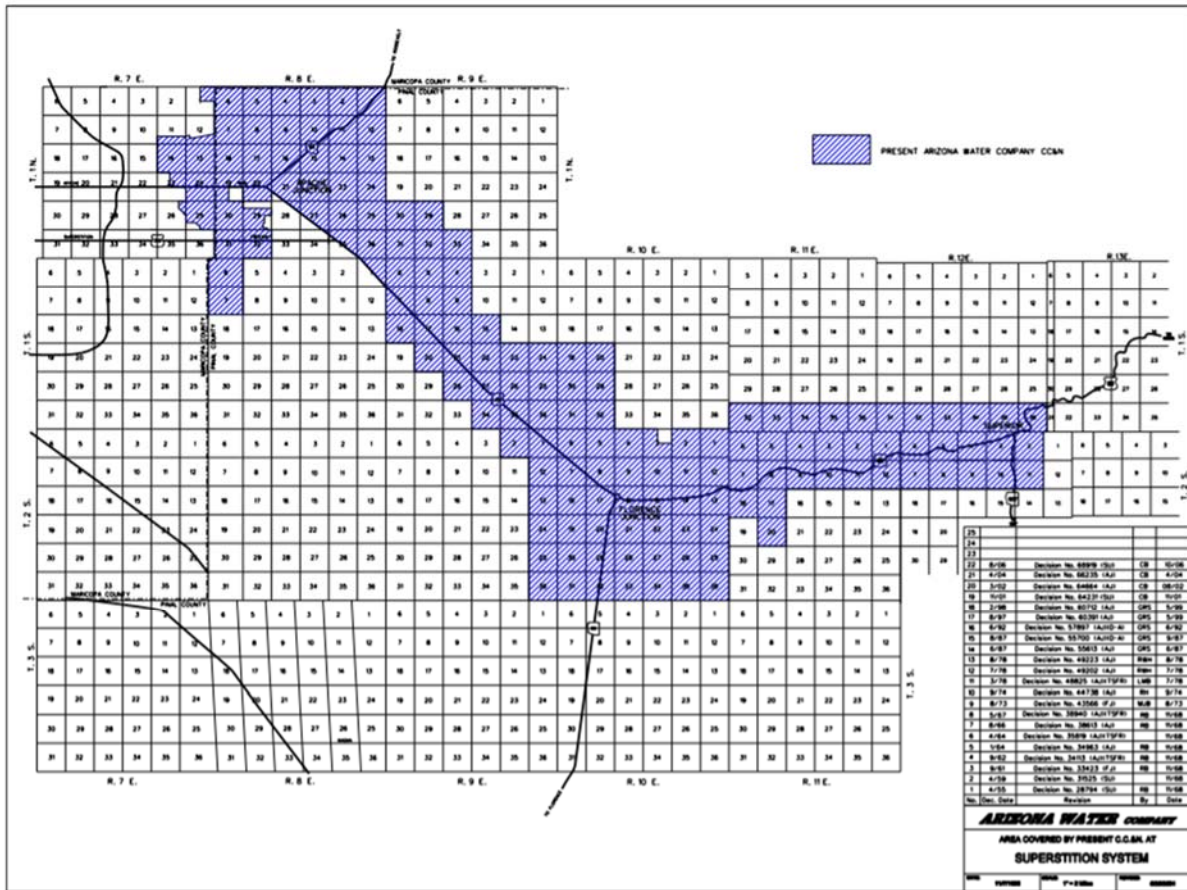http://www.buckeyeaz.gov/home/showdocument?id=298

Appendix

Figure AA1: Map of Apache Junction Water District area.

Figure AA2: Map of Arizona Water Company service area in Apache Junction

Chapter 2 Climate & Energy

Yulei Yin

I.   Executive summary

The purpose of this chapter is to analyze the current sustainability of Apache Junction's climate and energy system, including its strengths and weaknesses in order to help AJ define policies and actions to create a more sustainable and healthier community. By using STAR Communities Leading Indicators (STAR Communities, 2014), specifically Climate Adaptation, Greenhouse Gas Mitigation, Greening the Energy and Supply, Resource Efficient Buildings, and Waste Minimization, this chapter will give recommendations and specific suggestions for the General Plan 2020 update.

II.   Introduction

A. Introduction of climate and energy and importance for sustainability

- **Climate** is the statistical data of long-term weather, which is measured by evaluating patterns of changes in temperature, humidity, and other meteorological variables over a long period in a region (Planton, 2013, Climate, Wikipedia 2018). Climate change is a global challenge and has increasingly complex and important impacts on society and quality of life, such as human health, food security, water supply, transportation, energy, ecosystems, and others.
- **Energy** is essential to life and all living organisms. Energy sources such as fossil fuels will generate greenhouse gas (GHG) emissions and contribute to air pollution and higher rates of water consumption. Therefore, increase in the use of renewable-based energy and the energy efficiency will achieve sustainability in climate and energy.

B. Relevance and application to Apache Junction

Projected temperature increases, combined with the way cities amplify heat, will increase threats and costs to public health in AJ. Disruptions to urban electricity and water supplies will exacerbate these health problems (Lynne, 2014). In addition, increased warming and drought caused by or linked to climate change, have increased wildfires and impacts to people and ecosystems. Therefore, this chapter will assess AJ's current sustainability of climate and energy and define policies and actions for AJ to attain a sustainable, safe, healthy, and comfortable community.

III.   Current sustainability assessment

A. Climate Change Impacts and Adaptation

Arizona's climate is changing. The temperature in the state has risen more rapidly than any other state in the lower 48 states by about two degrees farenheit (F) in the last century, and is projected to continue increasing sharply by another three to five degrees (F) by 2050. Moreover, heat waves are becoming more common through extended periods of higher summertime temperature (Repetto, 2011). Arizona is

more vulnerable than most of the U.S. to the growing impacts of climate change, which makes it all the more important to mitigate climate change.

Climate change has significant environmental impacts on Arizona. First, air and water quality will suffer. Higher air and water temperatures will cause growing energy use, air pollution, and water pollution. The water supply will also decrease. Arizona has been suffering from the worst drought in a century for the past decade. Arizona's water supply of runoff will decline by 20-40 percent by mid-century, and water demand will rise through increasing temperatures, which exacerbates water shortages (Repetto, 2011).

Moreover, climate change also has severe economic impacts on Arizona. According to the county-by-county warming model by Hsiang, Kopp, Jina, Rising, et al, the economic damage to Maricopa County is projected to be about 8 percent, including hundreds of deaths each year (Fig. 1; Hsiang, et al, 2017). Arizona is warming already and costs associated with climate change are rising. These rising costs relate to agricultural productivity, loss of life, labor productivity, heat-associated crime, and energy use. For example, in Phoenix, energy costs per-person will rise more than 18 percent as air-conditioning demand increases (Hsiang, et al, 2017).

-13 -10 -5 0 5 10 15 20 25 28
Total economic damage (% county GDP)

Hsiang, Kopp, Jina, Rising, et al. (2017)

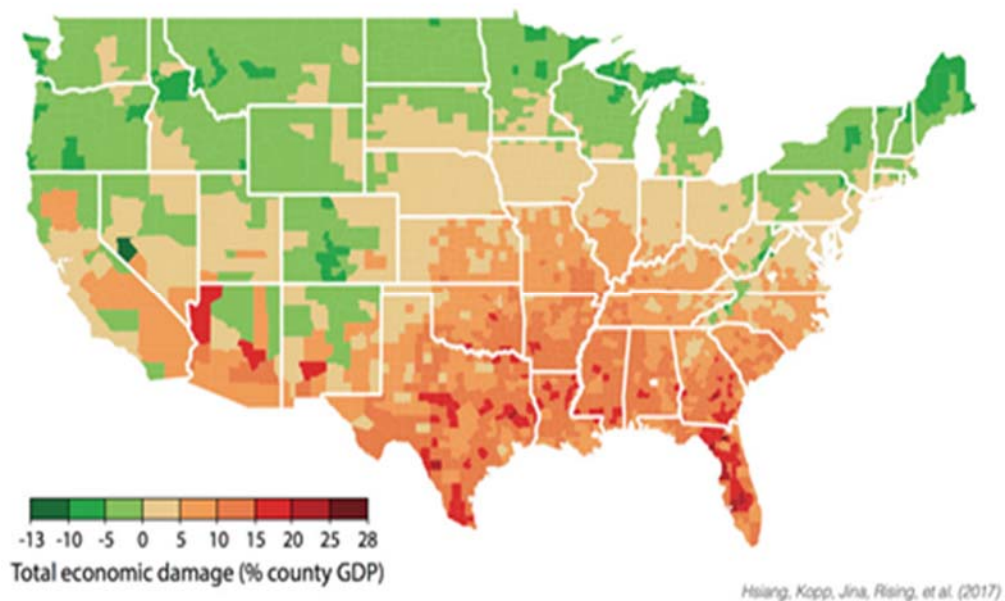Figure 1. Total economic damage by county. (Source: Hsiang, Kopp, Jina, Rising, et al., 2017, Estimating economic damage from climate change in the United States.)

In general, climate change has substantial impacts on Arizona's environment, citizens, and economy. As part of Arizona, the City of Apache Junction also suffers from the impacts of changing climate such as extreme heat events, water supply

shortages, etc. The community has not adopted a climate change adaptation plan and has not monitored climate change impacts. AJ should focus on climate adaptation efforts and programs that specifically help address climate change threats to reduce vulnerability and enhance sustainability of climate change.

B. Greenhouse Gas (GHG) Emission and Mitigation

Greenhouse gases affect global climate and temperatures. Its emissions occur from natural processes, human activities and sources, which lead to climate changes that affect our economies and environment. Therefore, it is important to measure and decrease GHG emissions in AJ. There are six internationally recognized greenhouse gases from the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Community Protocol), including Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur hexafluoride (SF_6). The Community Protocol is a helpful tool for AJ to analyze community GHG emissions, and sets five basic emissions generating activities for measurement (ICLEI, 2013):

- Community electricity use;
- Use of fuel in stationary residential and commercial combustion equipment;
- On-road passenger and freight motor vehicle travel;
- Use of energy in potable water and wastewater treatment and distribution; and,
- Generation of solid waste by the community.

AJ could use the five basic inventories to measure GHG emissions and figure out relevant targets and policies for GHG emission reduction and mitigation. Because of the limitation of energy data, this section will analyze one of the five inventories, the use of fuel in residential stationary combustion equipment, and calculate GHG emissions in the following two subsections. Data that is more specific is required in other emissions generating activities in AJ, which needs the city's efforts on collection and surveys.

1. **Estimate stationary energy use in the residential sector**

    Since AJ did not have the data of stationary energy use by energy source and sector, this report will use the state-level data to estimate the stationary energy use in the residential sector. First, the state-level data is used for households, for each fuel use type, and total fuel use to calculate per-household energy. Then the 2012-2016 American Community Survey data is used for the number of households for each fuel use type in AJ to calculate total residential fuel use of AJ (ICLEI, 2013, Appendix C). The data and calculation results are in the following tables.

Table 1. State-level households by fuel type (Million Households):

Electricity	Natural Gas	Petroleum	Biomass

4.3	2.6	0.4	0.4

(Source: The Energy Information Administration (EIA) Residential Energy Consumption Survey (RECS).)

Table 2. State-level fuel use (Trillion Btu):

Electricity	Natural Gas	Petroleum	Biomass
113.2	36.0	3.3	2.5

(Source: The Energy Information Administration (EIA) State Energy Data System (SEDS).)

Table 3. Calculate per-household energy use (MMBtu):

Electricity	Natural Gas	Petroleum	Biomass
26.3	13.8	8.25	6.25

Table 4. Households by fuel use type in AJ (Household):

Electricity	Natural Gas	LPG	Fuel oil, or Kerosene	Biomass
13905	1964	470	15	34

(Source: U.S. Census Bureau, 2012-2016 American Community Survey 5-Year Estimates.)

Table 5. Estimate residential fuel use (MMBtu):

Electricity	Natural Gas	Petroleum	LPG	Fuel oil, or Kerosene	Biomass
365701.50	365701.50	4001.25	3877.50	123.75	212.50

After calculating the total residential fuel use for each type, The City could estimate that the electricity use was 365791.50 MMBtu, natural gas use was 27103.20 MMBtu, LPG use was 3877.50 MMBtu, fuel oil or kerosene use was 123.75 MMBtu, and biomass use was 212.50 MMBtu in the residential sector of AJ during 2015-2016. The electricity use is the predominant type used in the residential sector of AJ.

2. Estimate GHG emissions from the fuel use in residential sector

With the results of total residential fuel use, this section will follow the Community

Protocol instructions to calculate GHG emissions through CO_2, CH_4, and N_2O gases emissions of the fuel use in the residential sector. First, select the appropriate CO_2, CH_4, and N_2O emissions factors for each fuel, excluding electricity. Then calculate the emissions of each GHG gas by converting CO_2, CH_4, and N_2O emissions into units of CO_2 equivalent using global warming potential (GWP) factors. Then, determine total emissions from residential stationary combustion. Repeat these steps for electricity use. The emission factors, GWP factors and calculation processes are in the Appendix A.

From the calculation results, the City of Apache Junction generated about 23,531 metric tons of GHG emissions in residential fuel use, which is about 0.25 percent of the total CO_2 emissions in Arizona. Total CO_2 emissions in Arizona is 91.0 million metric tons according to the Energy Information Administration (EIA) State Energy Data System (SEDS). In order to reduce GHG emissions in residential fuel use, the AJ government can use building codes, financial incentives, minimum regulatory requirements, technical assistance, and other programs to encourage clean energy use and reduce fuel use through enhancing the energy efficiency.

To conclude, AJ should require the GHG emissions measurement to be considered in decision-making and local government planning processes. The City should also require more relevant data collection for future growth. In addition, AJ should consider GHG reduction and mitigation strategies in the General Plan.

C. Greening the Energy Supply

The City of Apache Junction is currently served by SRP electric power, shown in the SRP electric service area (Figure 2). As one of the nation's largest public power utilities, SRP provides electricity to approximately 1 million retail customers in a 2,900-square-mile service area, and combines renewable energy resources, hydro generation, and energy efficiency programs to benefit the environment. The sustainable goal for SRP is to meet 20% of its retail requirements through sustainable resources by 2020, and the current sustainable portfolio is 15.875% of retail requirements in FY17 (SRP, 2017). Figure 3 shows retail energy requirements by type in FY17, including 56% energy efficiency programs, 24% renewable energy, 15% hydroelectric generation, and 5% banked credits.
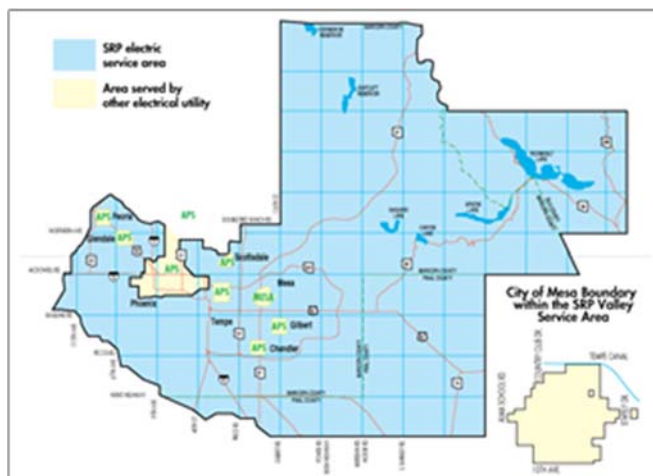
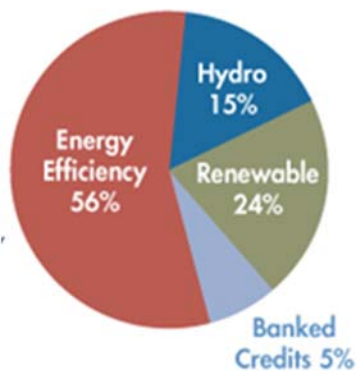Figure 2. SRP electric service area map in central Arizona. (Source:
http://www.srpnet.com/about/servicearea.aspx)

Figure 3. Retail energy requirements by type in FY17. (Source:
http://www.srpnet.com/environment/sustainableplan.aspx)

1. Renewable resources

Over the last decade, the renewable energy resources of SRP have made between 4% and 7% of its retail energy requirements, as shown in figure 4. Compared to the Renewable Energy Standard and Tariff (REST) – a policy for utilities under jurisdiction of the Arizona Corporation Commission (ACC), SRP's renewable energy performance is not inferior. When SRP is not subject to ACC's management of the renewable energy portfolio, it exceeded REST requirements when hydroelectric generation is included (SRP, 2017).
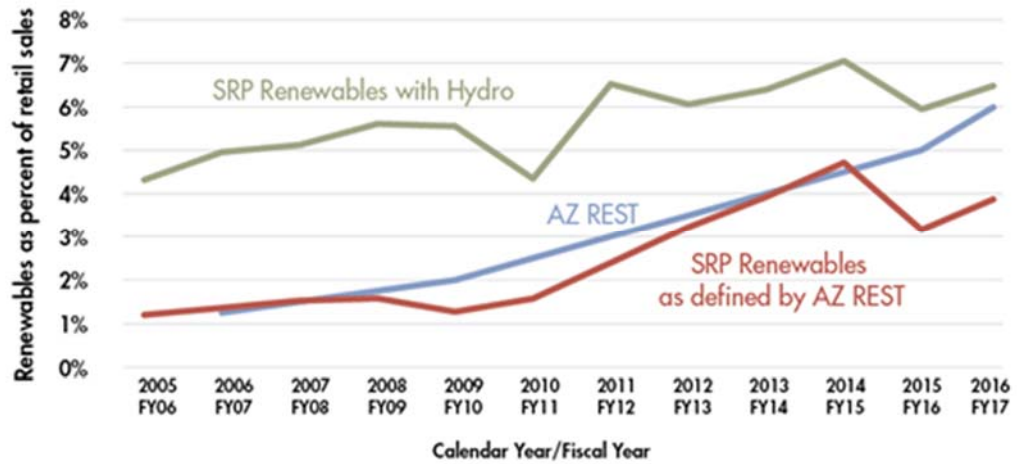
Figure 4. SRP renewable energy resources and AZ REST of its retail energy requirements. (Source: http://www.srpnet.com/environment/sustainableplan.aspx)

The electricity generated by renewable resources helps to reduce the generation of emission of the SRP. SRP takes a balanced and measurable approach, adding a variety of new renewable energy sources to the portfolio to ensure achievements of sustainable energy goals while maintaining reliable power and reducing costs.

2. Energy policies in Arizona

The State of Arizona has implemented funding and financial incentive programs to subsidize or otherwise increase investment in renewable energy resources such as wind, solar, and hydroelectric power. These programs include tax incentives, loans, rebate programs, performance-based incentives, and more. It also has regulatory policies such as a renewable portfolio standard, an Energy Efficiency Resource Standard, Energy Standards for Public Buildings, Solar/Wind Permitting Standards and so on (Ballotpedia, 2017).

Loan programs - Offer lower interest loans or other financing options to individuals and businesses to reduce the upfront costs of purchasing and installing renewable energy technologies. Arizona has locally run, utility-run, and/or privately run loan programs, but it does not have state-level loan programs for renewable energy (Ballotpedia, 2017).

Rebate programs – One of the rebate programs in Arizona is Mohave Electric Cooperative Renewable Energy Incentive Program, it provides incentives for its customers to install renewable energy systems on their homes and businesses and will provide rebates for residential and commercial photovoltaic (PV) and wind systems. Rebates for solar water heating are available only for residential systems (Dsire, NC Clean Energy Technology Center).

Renewable portfolio standard - A mandate intended to increase the production and use of renewable energy. State may give tax credits to utility companies to fulfill the requirements. Arizona was one of 30 states with a Renewable Portfolio Standard (Ballotpedia, 2017).

3. Green Building Program in AJ

In the General Plan 2010, AJ adopted a Sustainable Building Policy and implemented a program to promote green building principles and practices. It also adopted an appropriate Green Building rating system as the design and measurement tool to determine what constitutes sustainable building standards, which contributes to more green energy supply and use (City of Apache Junction, 2010).

D. Resource Efficient Buildings

1. Energy efficiency in AJ

In the past few years, SRP has provided various energy efficiency programs to help customers manage their energy use and costs. By effectively meeting the current sustainable energy goals of the SRP and promoting long-term emission intensity reductions, energy efficiency plays an important role in achieving this mission. Currently, energy efficiency accounts for 8.90%, or more than half of the annual sustainable portfolio target (SRP, 2017). Comparing to the ACC's Energy Efficiency Resource Standard (EERS), SRP exceeds the Arizona target, as shown in Figure 5.
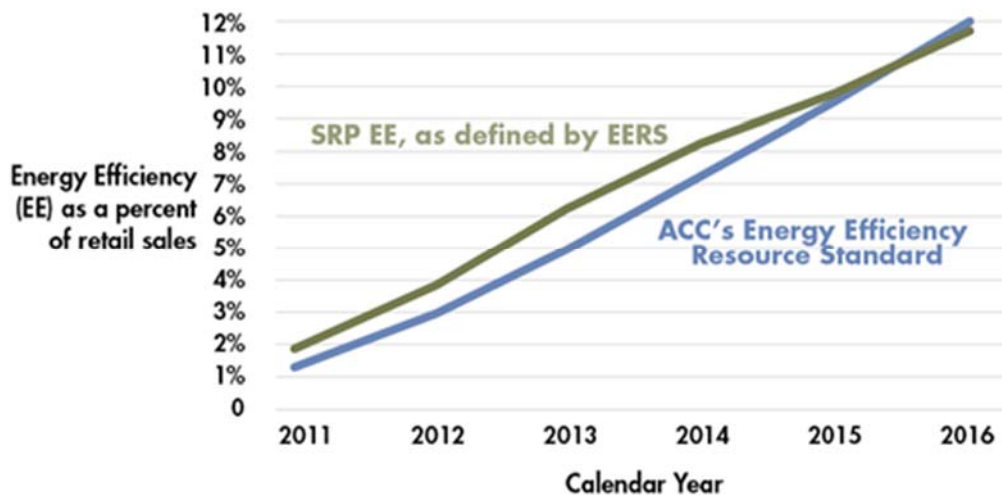
Figure 5. Energy efficiency as a percent of retail sales of SRP and ACC. (Source: http://www.srpnet.com/environment/sustainableplan.aspx)

For homeowner resources of AZ government, energy efficiency in AJ is all the rage in home renovations and construction (Apache Junction Government, Energy Efficiency). There are various ways to reduce the amount of energy consumption

and save the environment.

- AJ provides Energy Efficiency Credits and Rebate programs to help homeowners finance their Earth-conscious decisions to purchase new appliances or renovate their homes with Energy Star or environmentally friendly options.
- SRP has a variety of rebates and information available, such as SRP Shade Screen Rebate program, which makes shade screens one of the most effective and affordable energy-efficiency upgrades.
- Certain circumstances may make residents eligible to receive energy efficiency rehabilitation services through the City's Housing Rehabilitation Program. Additional organizations also offer weatherization for income eligible homeowners.
- The Energy Star website for federal tax rebates and energy saving ideas has a comprehensive list of products that have earned the Energy Star rating (Apache Junction Government, Energy Efficiency).

2. Energy Efficiency Standards in Arizona

The Arizona Corporation Commission (ACC) adopted rules in 2010, requiring certain electric and gas utilities in the state to meet prescribed energy efficiency requirements by 2020. By 2020, every investor-owned utility must achieve 22% cumulative savings of its previous year's retail electric sales. And every gas utility must achieve 6% cumulative savings of its previous year's retail sales by 2020 (Dsire, NC Clean Energy Technology Center).

3. Water efficiency

Water is provided to AJ by the Arizona Water Company (AzWC) and the Apache Junction Water Utilities Community Facilities District, which is also referred to as Apache Junction Water Company (AJWC). Water resources include groundwater wells, Central Arizona Project (CAP) water and treated effluent.

AJ incorporates water conservation methods such as water harvesting and xeriscape into new developments and redevelopments, and conserves water by renewable water supplies, landscaping, and recharge of water, which enhance the water conservation and efficiency (City of Apache Junction, 2010).

E. Waste Minimization

Currently there are three private trash/recycle collection companies that service Apache Junction. They are Apache Junction Landfill/Republic Services, Right Away Disposal (RAD), and Waste Management. Two of the companies provide customers with curbside recycling (City of Apache Junction). RAD offers a variety of free services at Apache Junction Waste & Recycling Facility, including free recycling drop off, free E-waste recycling drop off, free cardboard recycling drop-off point, and free textile recycling, which will promote the waste recycling and reduction.

There are two days out of the week that these private companies conduct business and pickup of neighborhood trash. Three neighborhood cleanup initiatives in Apache Junction have been conducted over the last three years and the residents of selected neighborhoods can bring household waste to four to five dumpsters (Arizona State University, 2016).

The total solid waste and the waste reduction goals need to be more specific in the plan, which will be helpful to implement incentives or enforce regulations, and recognition of the achieving goals.

IV.   Strengths

The City of Apache Junction General Plan 2010 proposed various and useful goals, objectives and strategies to increase energy and water efficiency. For instance, exploring and developing incentives and educational green awareness programs allows more participants in green energy use, while developing and implementing an energy conservation policy plan promotes greater use of renewable energy. The general plan also considered adopting Pinal County's strategy that meeting Energy Star rating defined by the United States Environmental Protection Agency, which contributes to energy efficiency. In addition, incorporating water conservation methods such as water harvesting and xeriscape into new developments and redevelopments, and conserving water by renewable water supplies, landscaping, and recharge of water, which will enhance the water conservation and efficiency.

V.   Weaknesses

Although the general plan has specific strategies in energy conservation and efficiency, there are still some areas that need to be improved. For example, the general plan has a lack of assessed citywide vulnerability to future climate change and a lack of an integrated climate change adaptation action plan, which are important to future sustainability of climate change. Moreover, the city lacks access to energy data and GHG emission measurements, which makes it hard to conduct a current sustainability calculation of GHG emissions. Furthermore, the plan lacks facilities throughout the community prepared for climate change threats and specific upgrades to programs and infrastructure systems that will increase water efficiency. Therefore, Apache Junction would benefit from the consideration of the weaknesses of the last general plan and make improvements to update.

VI.   Recommendations for Improvement

After assessing the current sustainability of climate and energy, with the evaluation of the strengths and weaknesses of last general plan in AJ, this chapter will consider other cities' strategies and propose four major recommendations for improvement. First, AJ could

identify climate risks and assess citywide vulnerability to future climate change and adopt adaptation strategies. The City of Chicago is a great example. It assessed future vulnerability using an "analog city analysis" and identified the most vulnerable residents in their community in order to best target heat-vulnerability outreach efforts, green infrastructure and heat island mitigation efforts (EPA). Second, AJ could participate in carbonn® Climate Registry to track and report GHG emission reductions and climate targets to mitigate climate change like the City of Flagstaff and the City of Tucson in Arizona (Carbonn® Climate Registry). Moreover, AJ could adopt SRP's Shade Tree Program to provide customers up to two free desert-adapted trees to plant in energy-saving locations around the home, which works well in the City of Phoenix (SRP). Last but not least, AJ could develop a Home Landscape Water Audit program to increase water efficiency through installing the recommended technology, which has great impacts in the City of Tempe (City of Tempe, Water Audits).

VII.   Specific Suggestions for 2020 General Plan Update

The specific suggestions for 2020 general plan update will consider the Climate Action Plan in the City of Boston, Massachusetts, since Boston was ranked by the American Council for an Energy Efficiency Economy (ACEEE) as the #1 energy efficient city in the nation. The Boston city government has many strong community partners working to develop shared strategies for fighting climate change in coordination with the city's Climate Action Plan (U.S. Department of Energy). The City of Apache Junction could learn from successful strategies in Boston to prepare for the impacts of climate change, increase energy data accessibility and GHG emission measurements, and encourage community engagement. In order to achieve these goals, there are five specific suggestions for AJ general plan 2020:

- Develop a set of indicators to provide quantitative measures of the preparedness of the AJ community, set goals in terms of these indicators, and report on them annually;
- Provide access to energy data and undertake a building energy use data collection effort to obtain more accurate, AJ–specific building energy use information for the commercial, residential and other sectors;
- Develop a Home Landscape Water Audit program to increase water efficiency;
- Support grassroots, community-driven climate action efforts and create a neighborhood climate action network
- Create a performance measurement system to track overall emissions and report progress towards climate goals on an annual basis and provide neighborhood-level data.

Appendix A: Calculation processes of GHG emissions

Table 6. CO2 emission factors for each fuel in residential sector (kg/MMBtu):

Natural Gas	LPG	Kerosene	Biomass
53.02	62.98	75.20	93.80

Table 7. CH4 emission factors for each fuel in residential sector (kg/MMBtu):

Natural Gas	Petroleum	Biomass
0.005	0.011	0.316

Table 8. N2O emission factors for each fuel in residential sector (kg/MMBtu):

Natural Gas	Petroleum	Biomass
0.0001	0.0006	0.0042

(Source: the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions – Appendix C)

Calculation for CO2, CH4, and N2O emissions:
CO2 emissions =
27103.2*53.02/1000+3877.5*62.98/1000+123.75*75.2/1000+212.5*93.8/1000 =
1710.46 metric tons
CH4 emissions = 27103.2*0.005/1000+4001.25*0.011/1000+212.5*0.316/1000 =
0.25 metric tons
N2O emissions = 27103.2*0.0001/1000+4001.25*0.0006/1000+212.5*0.0042/1000 =
0.006 metric tons

Table 9. Global warming potential (GWP) factors:

CO2	CH4	N2O
1	21	310

(Source: the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions – Appendix C)

Convert CO2, CH4, and N2O emissions to CO2e emissions:
CO2 emissions (CO2e) = 1710.46*1=1710.46 metric tons
CH4 emissions (CO2e) = 0.25*21=5.25 metric tons
N2O emissions (CO2e) = 0.006*310=1.86 metric tons
Total CO2e emissions = 1710.46+5.25+1.86=1717.57 metric tons

For GHG emissions from electricity use in the residential sector, the calculation is in

the following:

Total electricity use in residential: 365701.50MMBtu = 107259.23MWh

Table 10. Electricity emission factors:

Electricity Emission Factors Used for the Inventory				
Gas:	CO_2	CH_4	N_2O	CO_2e
Emission factor	444.64	0.029	0.010	n/a

(Source: the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions – Appendix C)

Total CO2e emissions associated with electricity use:

CO2e emissions = 107259.23*(444.64+0.029*21+0.010*310)/2204.6 = 21813.28 metric tons

Total CO2e emissions of residential fuel use:

Total CO2e emissions = 1717.57+21813.28 = 23530.86 metric tons

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Chapter 3 Economy & Jobs

Kaylin Ayotte & Caleb Carpenter

I.   Executive Summary

The intent of this chapter is to explain why sustainable economic development is vital for the continuation of a sustainable community. This chapter includes reporting on the current conditions of Apache Junction's businesses and jobs by using the most current data available and the Leading STAR indicators. The four Leading STAR indicators for economy and jobs are: Businesses, Employment, Median Household Income, and Living Wages. Each of these indicators help represent the stage at which a city is at in their endeavors towards a sustainable economy. This chapter also evaluates the strengths and weaknesses of Apache Junction's General Plan 2010 and provides recommendations based on findings from case studies and data collection. Based on our findings, our recommendations are centered around utilizing the current assets of Apache Junction in the realm of the natural landscape, harnessing networks of knowledge from Central Arizona College, and recruit retirees living in Apache Junction to spark economic development within the town. Overall, this economy and jobs chapter is an effort to help guide Apache Junction's future decisions in planning for its residents by creating more sustainable opportunities and utilizing resources available for community empowerment.

II.   Introduction

The City of Apache Junction is located in the eastern Phoenix metro area. It has rich ties to its local landscape including the Superstition Mountains and Salt River. Historically, the city's economy has been tied to that of Phoenix as it does not have its own established industry. However, the city has an opportunity for economic revival with a sustainable lens due to its already existing assets and immense potential. From a sustainability perspective, the integration of a prosperous economy and job market is vital for the well-being of the residents and the development of a sustainable city. The term "sustainability" is often divided into three sectors economy, environment, and society. The sectors are often presented as three interconnected rings aiming at bringing the concepts together in a balanced way but are often viewed with greater priority of one over the other. However, this view risks approaching and tackling issues of sustainable development in a compartmentalized manner. The separation of the sectors underplays the fundamental connections between the economy, society, and environment and leads to the assumption that trade-offs can be made between the three sectors which holds untrue (Giddings, Hopwood, O'Brien, 2002). This chapter intends to integrate these factors together to create a sustainable and thriving community. As Wheeler (2013) points out, traditional forms of economic growth may result in inequality of wealth and happiness along with an increase of environmental pollution and resource depletion. Therefore, this chapter aims to provide answers to economic development that will be a catalyst for sustainable growth that is inclusive of the community and the environment. Ultimately, providing a robust and healthy climate for both large and small businesses to thrive within Apache Junction is vital for the advancement of health, quality of life, and ecosystem viability.

This chapter's purpose is to analyze the current condition of commercial economic development and current employment rates using the Leading STAR indicators as our tool. The analysis will be focused on determining the strengths and weaknesses of the current Apache Junction General Plan along with determining areas of concern and strength within the data collected on Apache Junction. Furthermore, we will provide recommendations and targets on how to harness the current assets Apache Junction has as a catalyst for community prosperity. The chapter's strategy will be centered around three specific assets which are Central Arizona College, the natural landscape surrounding Superstition Mountains, and retirement community. The intent is to utilize these assets to create community inclusivity and to empower individuals by providing educational services and small business incentives to serve as a catalyst for economic prosperity in other areas of Apache Junction. This chapter is not intended to focus on housing as it will be addressed in a separate chapter.

III.   Current Sustainability Assessment

The City of Apache Junction most recent data for economy and jobs can be evaluated by using the Leading STAR indicators related to economy and jobs. The four main Leading STAR indicators are: Businesses, Employment, Median Household Income, and Living Wages. These four indicators will show the numbers and statistics for Apache Junction along with the next higher geography Maricopa County and Pinal County. The purpose of doing the data analysis is to better understand Apache Junction's economic current condition.

Businesses

The number of businesses thriving within Apache Junction is a vital indicator to show the health and prosperity of business development within the region. Businesses within a city provide jobs and resources for the current residents and neighboring cities. The business indicator uses the most current data from the Census Bureau's Business Patterns at the ZIP code level for the year 2015. The ZIP codes included are: 85118 (Gold Canyon, AZ), 85119 (Apache Junction, AZ), 85120 (Apache Junction). According to the 2015 U.S. Census Bureau, there are 851 establishments (businesses) and 9,370 employees within Apache Junction, while there are 88,900 businesses and 1,571,313 employees within Maricopa County and 3,365 businesses and 47,712 employees in Pinal County.

Additional information about businesses is found in the Employment by Industry data from the U.S. Census Bureau 2016, which can be seen in Table 1 (below). There are 12,516 people over the age of 16 living in Apache Junction that are employed either within Apache Junction's boundaries or in neighboring cities. As Table 1 illustrates, Apache Junction's employment is highly concentrated in educational services, health care and social assistance (21%), followed by retail trade (16%). The professional, scientific, management, administrative industry represents roughly 12% percent, while the ten other industries cover the remaining 51%. It's important to note, that the top industries for Apache Junction are similar for Maricopa and Pinal County creating similarities in industry growth.

Table 1: Employment by Industry, 2016						
Industry	Apache Junction	Percent	Maricopa County	Percent	Pinal County	Percent
Total Civilians employed population 16 years and over*	12,516		1,871,139		140,965	
Educational Services, Health Care and Social Assistance	2,658	21.24	394,682	21.09	30,043	21.31
Retail Trade	2,046	16.35	230,435	12.32	16,557	11.75
Professional, Scientific, Management, Administrative	1,445	11.55	245,304	13.11	13,892	9.85
Food Services, Arts, Entertainment	1,092	8.72	187,330	10.01	15,032	10.66
Manufacturing	1,073	8.57	142,891	7.64	13,214	9.37
Construction	867	6.93	126,789	6.78	8,599	6.10
Finance and Insurance, Real Estate, Rental and Leasing	828	6.62	183,266	9.79	8,939	6.34
Other Services, except Public Administration	786	6.28	92,148	4.92	5,827	4.13
Transportation and Warehousing, and Utilities	633	5.06	96,421	5.15	7,057	5.01

Public Administration	572	4.57	74,536	3.98	12,166	8.63
Agriculture, Forestry, Fishing and hunting, and Mining	217	1.73	12,157	0.65	4,766	3.38
Wholesale Trade	159	1.27	48,587	2.60	2,514	1.78
Information	140	1.12	36,593	1.96	2,359	1.67

Source: U.S. Census Bureau Table DP03: Selected Economic Characteristics. ACS 2012-2016
 Note that this includes retired residents, who represent a large portion of the city's population

Employment

Employment metrics can show how well a city is doing in comparison to neighboring cities and the county in which they reside. Apache Junction, as Table 2 shows, has a total unemployment rate of 10.9% for the 14,050 people over the age of 16 years in the labor force, while Maricopa County and Pinal County have an average of 6.8% and 9.4% unemployment rate respectively for age 16 and over in the labor force. A glaring concern for Apache Junction is that many age cohorts have high unemployment rates, twice as many in most and in one case three times Maricopa County's rates. Table 2 shows the cohort age 20 to 24 in Apache Junction has an unemployment rate of 18.2% and the age cohort of 30-54 has an average unemployment rate of 12.8%, while for Maricopa County and Pinal County have an average of 5.4% and 8.5% respectively for the same 30-54 age cohort (U.S. Census Bureau).

Table 2: Employment and Unemployment Rates, 2016			
Employment Status	Apache Junction	Maricopa County	Pinal County
Population 16 and Over	31,798	3,178,431	311,567
In Labor Force	14,050	2,012,129	155,847
Total Unemployment Rate	10.9%	6.8%	9.4%

Unemployment Rate by Age Cohort			
20 - 24	18.2%	10.4%	17.6%
30 - 34	13.2%	6.3%	11.0%
35 - 44	10.1%	4.9%	7.1%
45 - 54	15.1%	5.0%	7.4%

Source: U.S. Census Bureau Table DP03 and S2301: Selected Economic Characteristics and Employment Status. ACS 2012-2016

Median Household Income

The median household income indicator is used instead of average household income simply because it shows a more accurate understanding of the situation is in the area. The median household income indicator is not greatly impacted, unlike the average household income indicator, by the high and low outlier income values. Apache Junction has 16,625 households and a median household income of $38,053, which is 68% of Maricopa County's household median income ($55,676) and 74% of Pinal County's median income ($51,190) (U.S. Census Bureau Table DP03). Figure 1 (below) shows the median household income of Apache Junction for the year 2016 for each census block group. It is interesting to note that the areas with the lowest median household income is found towards the center of the city, while the peripheral areas are higher.

Figure 1: Apache Junction Median Household Income, 2016

Legend:
- < $20,000
- $20,000 to $30,000
- $30,000 to $40,000
- $40,000 to $50,000
- $50,000 to $75,000
- $75,000 to $100,000
- > $100,000
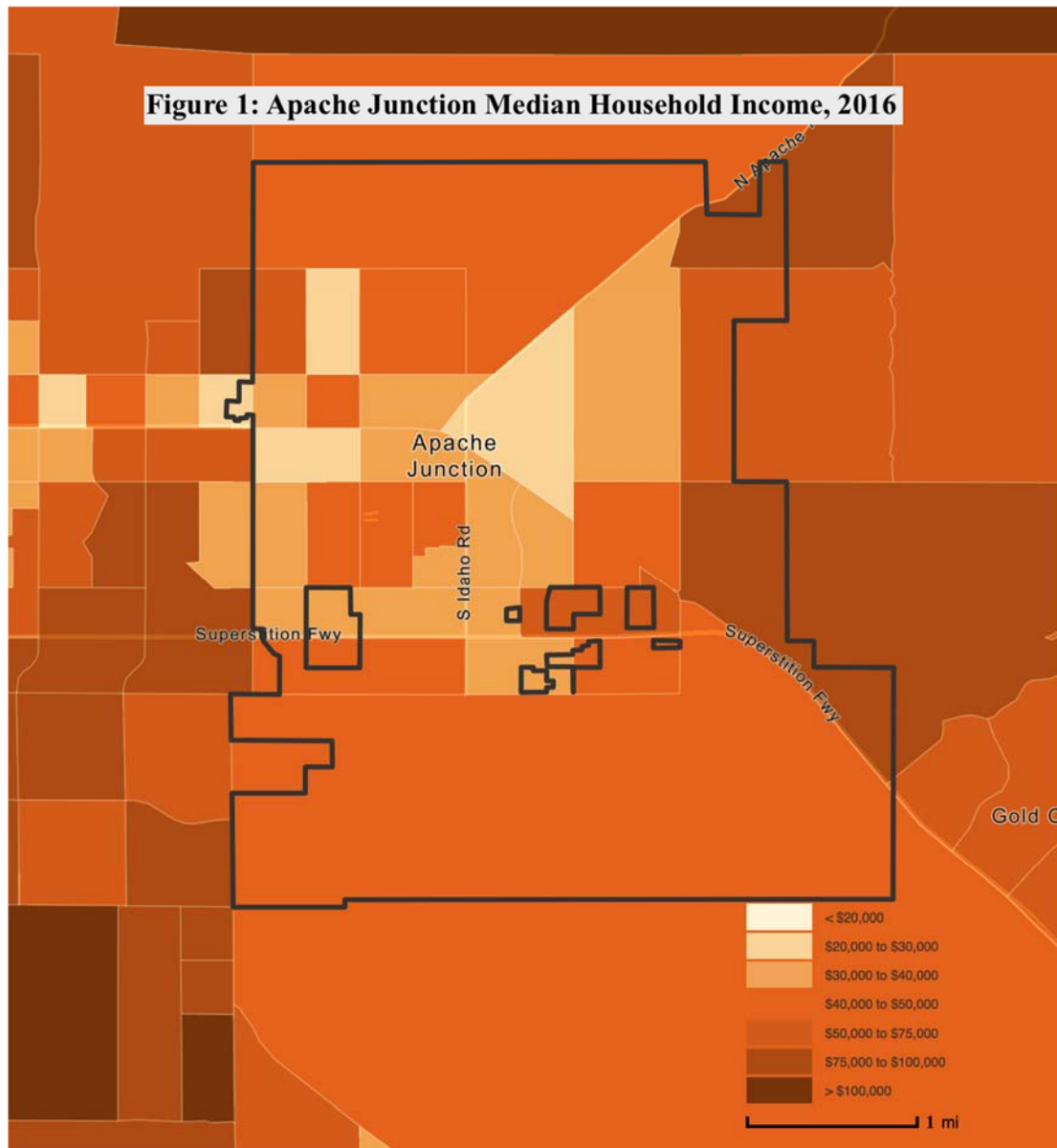
Source: U.S. Census Bureau Table B19013: Median Household Income. ACS 2012-2016

Living Wages

The living wage STAR indicator is the minimum income necessary for a worker to meet daily, monthly and annual housing needs, such as housing payments, food, clothing, utilities, etc. The calculations use the standard 40-hour work week for 52 weeks of the year. The living wages HUD guidelines state that a household should not pay more than 30% of their income on housing, because it is considered to be a cost burdened home. According to the MIT Living Wage calculator summary, Apache Junction has 13,785 (82.9%) households that are at or are above the Living Wage Annual average for the area. This calculation uses a combination of numbers from U.S. Census Bureau's ACS Tables DP02 and DP03 and the MIT Living Wage calculator. For the full MIT Living Wage spreadsheet calculations and statistics see the appendix.

Table 3: Apache Junction Living Wages Summary, 2016	
Living Wage Annual Average	$24,511
# of Households at or above	13,785
Percentage above Living Wage	82.9%

Source: U.S. Census Bureau Tables: DP02, DP03 and MIT Living Wages calculator spreadsheet

IV.   Strengths

The data tables and statistics above show a few different strengths that Apache Junction has currently with their jobs and economy. One of the most visible is from Table 1: Employment by Industry; when comparing Apache Junction to its higher geography, Maricopa County and Pinal County, it contains high percentages of the same industries. Another interesting statistic is the living wages percentage of 82.9%; Apache Junction is above the 80% of households above the living wages baseline that MIT has set forth. Both the employment by industry and the living wages are great strengths within the City.

In addition, when analyzing the Apache Junction General Plan 2010, Apache Junction emphasizes the importance of quality employment and diversification of the job market outside of retail and service-type jobs. The general plan goes on to specify the barriers currently in place limiting the advancement of this goal. The transparency of objectives and restrictions in the general plan allows for innovative answers to potentially mitigate problems and move the needle on economic integrity. The general plan also evaluates partnerships and targeted business the City of Apache Junction views as assets for development and create a quality starting point for advancement. Finally, the current Apache Junction General Plan has diverse and impactful economic goals and objectives which can be utilized to create economic prosperity.

V.   Weaknesses

Among the diverse array of positives, there are some recommendations to strengthen the Apache Junction General Plan as well. The unemployment rate data table and the median household income map above show higher numbers compared to Maricopa County and Pinal County, but this may be due to the large share of the city's population that are retired. Apache Junction has a higher unemployment rate, and in most cases, double the rate of unemployment compared to Maricopa County and Pinal County. The financial and social costs associated with a high unemployment rate create unintended stressors for the individual and the community. On an individual level, the immediate impact of unemployment is the loss of a comfortable standard of living resulting in less goods and services being purchased, hurting Apache Junction's overall economy. Prolonged unemployment can result in the erosion of skills, degrading the quality of skilled labor in the

workforce. Plus, over time, the feeling of skepticism and pessimism towards the value of education could result in younger generations being less willing to invest in training programs and higher education. In 2017, the United States paid $2.96 billion worth of benefits in the form of food assistance and Medicaid to unemployed residents creating a tangible trail of the economic costs associated with unemployment rates (Simpson, 2017). However, the social costs of unemployment may be more difficult to calculate, but still present a risk to the local community. Studies have shown that periods of higher unemployment result in less volunteerism and higher crime rates (Simpson, 2017). This statement aligns with Apache Junction having 39% more theft than the national average in 2017, with crime rates higher in Apache Junction than surrounding cities (check health chapter for further details). Therefore, the obtainment and stabilization of jobs is vital for the economic and social well-being of Apache Junction residents and community.

Furthermore, Apache Junction's median household income is very low when compared to the counties that it resides in. As stated above, the areas towards the center of the City contain the lowest income per household compared to other parts of the City. This presents a weakness for the City of Apache Junction as it creates instability of income generation for the business owners located downtown and little incentive to invest in the surrounding area for development while also presenting the risk of gentrification for home and business owners.

Although the plan states specific strategies and objectives, the plan does not have specific targets or actions associated with those strategies. For example, the plan states Apache Junction would like to "Identify potential resort and tourist locations along north Highway 88 to capitalize on City's amenities and its natural beauty" (Apache Junction General Plan, 2010). However, there is not a date set to complete this action, which creates ambiguity in how this will get done and by what time frame. Furthermore, the plan states existing conditions and issues that must be addressed in the plan associated those conditions with the verbiage of 'lack of'. For example, Apache Junction claims to have a lack of a cohesive community, a lack of activities or amenities, and a lack of pedestrian orientation (Apache Junction General Plan, 2010). Although there is an understanding that these areas are undeveloped, it is unclear what the current state is on these barriers and how they should be developed to not make them a barrier but rather an asset for Apache Junction.

VI.   Recommendations

The three recommendations we propose are to develop Apache Junction center, and investments in the Central Arizona College, the natural landscape, and the retirement community. Each strategy is intended to highlight different aspects of Apache Junction and intended to promote education, local business empowerment, tourism, and investment within the city while also preserving and connecting people with nature. The intention of these three strategies is to act as a catalyst for other growth and development to start and be the leading innovators of change for Apache Junction.

Central Arizona Community College- Superstition Mountain Campus
The key to a rural community's survival and success is a social engine that drives the community's economy and serves as a foundation for group identity formation and engagement. The purpose of Central Arizona Community College is to serve as a place of education and workforce trainings,

cultural enrichment, economic development, and continuing education for the community. The intent for the community college is to serve as an anchor to enrich, equip, and partner with local residents to enhance skill sets and strengthen trust and business relationships within the city.

Anchor Institution
The term anchor institution refers to long-standing and deeply rooted community organizations that often are large contributors to their community's continued economic stability and strength (Building Resilience, 2013). There have been numerous examples of how institutions (e.g. Arizona State University, University of Pennsylvania, Syracuse University, etc.) have transformed a community by providing a myriad of services and opportunities for the surrounding community and creating a partnership where all stakeholders benefit. Although the reported case studies of community colleges serving as anchor institutions is limited, the opportunity for Central Arizona Community College to serve as an anchor is promising. The College's ability to receive adequate funding, resources, and students depends on the health of the surrounding community, creating a vested interest for the college to improve the surrounding community.

For example, the University of Pennsylvania saw enrollment rates drop in the mid-1990s because applicants perceived West Philadelphia to be unsafe and economically depressed. Therefore, the University led a major multi-faceted effort to revitalize the community (Dubb, 2012). The University of Pennsylvania led five major initiatives (i.e. clean and safe, housing, economic development, commercial and real estate, and an education initiative) which included strategies such as; formation of business improvement district, neighborhood lighting, engaging locally, creating University partnerships with local school districts, job training/internships for high school students, etc. (Netter Center for Community Partnerships, 2008). The results of these initiatives were vibrant neighborhoods with a healthier economy and a reduction of crime, while the University has higher rankings, student applications, and funding. From a business owner perspective, there are three primary business opportunities to work with anchor institutions: to become a trusted supplier, identify and train your employees, advisory and consulting services to build your business capacity. The following subsections will describe the opportunities and benefits of Central Arizona Community College serving as an anchor institution along with case studies to provide additional depth.

Trusted Supplier of Goods and Services
Many anchor institutions actively direct their institutional purchasing to local or diverse businesses. From a college perspective, these purchasing initiatives spur healthy competition, innovation and local relationship that have the potential for greater flexibility (Dubb, 2012). The community college benefits from purchasing supplies locally, as small businesses can be more nimble and provide customized solutions tailored to the needs of the college.

Furthermore, proximity to the college facilitates shorter turnaround times for orders and reduced transportation costs. Local and diverse purchasing programs and policies create security for small businesses and create stability in times of unstable market conditions. For example, the University of Pennsylvania increased spending with local suppliers from $2.1 million to $90 million over a 22-year period under its "Buy West Philadelphia" program aimed at spurring local economic growth, while the University of Virginia has committed to increase spending with small businesses and women and minority-owned businesses by 5% each year (Dubb, 2012).

Community and Workforce Development
Educational institutions like Central Arizona College develop human capital as part of their core mission, and can help businesses find and build talent. Also, due to the easily accessible location and availability of resources, the Central Arizona College could serve as a hub to equip existing employees with practical, relevant skills, workforce trainings, and youth and senior citizen activities.

An example of this is seen at the Bevill State College in Alabama, which offers summer sports camps to meet the needs of local youth while also bringing future generations of college students to campus at an early age (Miller et al., 2007). Because of these camps, many students who would not otherwise consider postsecondary education are exposed to the idea of college and contribute to an educated workforce. The purpose of these trainings and leisure activities are meant to create resiliency within the community and the person participating. Meaning, the range of classes offered along with the skills gained creates an opportunity for community members to instill confidence within themselves and change their mindset of thinking about their potential. Plus, this setting allows for networking outside of traditional or family boundaries and can result in stronger linkages of community identity. Thus, rural community colleges both link the college with the community and link the individuals in the community.

Economic Development
In addition to workforce development and retraining programs, the community college can provide consulting services and networking opportunities to local businesses. The intent would be to provide mentorship, guidance, and strong support networks to make sure small businesses do not fail between the first two to five years, while also instilling confidence in the business owner. Companies can use the college in a variety of ways including: inviting faculty to serve on company boards, seeking business or legal advice, and serving as case studies for research. Apache Junction can also empower the network of retirees in the area to provide a range of services and knowledge to entrepreneurs and small business owners.

The City of Brevard, North Carolina tapped into the business experience of its retiree population as a tool for supporting local entrepreneurship. The small town created a Retiree Resource Network which is a collection of over 65 retired business people who provide top quality consulting and advising services to the business of Brevard and Transylvania County free of charge (Small Town, Big Ideas, 2008). Brevard and Transylvania County have taken their local retiree network to the next level and are using the network as a differentiating service when marketing their community to new businesses. These two recommendations not only serve as a function of economic rejuvenation but also social inclusiveness within the community. In order for Apache Junction to thrive there needs to be a support network injecting customized advice to business owners and that relationship stems from social connectivity within the community.

The Natural Landscape
Revitalization of downtown Apache Junction to be the epicenter of tourist activities could be done by connecting tourist to the natural landscape and vast open space that is vital for development in the area. The City of Apache Junction is surrounded by beautiful trails and natural landscape that can be utilized as an asset by incorporating connectivity of trails leading into Apache Junction.

The current state of downtown breeds little incentive for tourists to visit. Therefore, the city could partner with local businesses (e.g. Walmart), reach out to non-profits, or utilize volunteer-led community development associations, to create connectivity between trails and recreation activities for tourist. A great example of our recommendation is showcased through the case study of the Town of Chimney Rock, North Carolina. The Town's strategy was to boost tourism by showcasing natural resources in a novel way. In order to do this, the town needed to create the financial resources and build capacity for the future and did so by establishing a volunteer-led community development association. This association extended the reach of local government and improved Chimney Rock's ability to secure grant funding. With this funding, Chimney Rock improved the synergy of the downtown area by improving the appearance of buildings and outdoor spaces downtown. Local leaders worked with property owners to improve building facades and clean up park spaces in town. The town also revitalized the walkway along the river that flows around the town to create a space of walkability and fishing. The result of these efforts was $3.7 million in new private investments (these projects cost $620,000) an increase in tourism per year, and over 100 jobs being created for the small town (Small town, big ideas, 2008). The Chimney Rock example creates confidence in the ability of Apache Junction to revitalize the downtown area by utilizing natural resources.

The three recommendations presented operate in conjunction and create compounded efforts to the goal of economic development while also thinking about the social and environmental aspects of sustainability. Each recommendation would need a strategy with specific timelines and targets of completion, community support, solidification of community partnerships, and potential guiding policies in order to effectively implement and integrate into Apache Junction.

VII. Specific Suggestions for 2020

The suggestions for the 2020 Apache Junction General Plan stem from utilizing the networking power and influence of the community college and retirement community while continuing to build upon Apache Junctions natural landscape. However, creating specific plans that can complement the general plan and lay the foundation of targets and strategies would be an effective resource to utilize. The specific strategies should have year dates of completion, target dates, roles of relevant stakeholders, and their job in the completion of the project. Also, the plan should include how to create community engagement and partnerships as community inclusion is vital for implementation and funding.

Specific Suggestions Based on Other General Plans
The intent of this section is to evaluate specific plans mentioned within the chapter along with other general plans that are relevant to the planning of Apache Junction. The section will describe the specific verbiage cities use within their general plan in relation to recommendations mentioned above.

The community located in Brevard North Carolina is a small town predominantly retirement community but also has a small community college located within the town. The Brevard General Plan describes the objective of using its current institutions as a space to expand the knowledge, skills, and abilities of students. The verbiage of the plan states:

"Objective 2.3: Retention and expansion of institutions, programs, and services that expand the knowledge, skills, and abilities of our citizens.
Policy 2.3.A: Advocate for the retention and expansion of the existing small-business incubator at Blue Ridge Community College.
Policy 2.3.B: Support the establishment of an arts-based business incubator within the city.
Policy 2.4.C: Engage schools, colleges, and area non-profit entrepreneurial support services to explore ways in which the city can assist in their efforts to foster entrepreneurialism and develop an adaptable and technologically proficient workforce.
Policy 2.3.D: Support Brevard College as a year-round community asset and resource" (City of Brevard, 2015).

The University City, Pennsylvania General Plan utilizes the assets of having a total of five colleges within the area. The general plan focuses predominantly on harboring anchor institutions as a catalyst for growth. The statement below is the verbiage used in the City's mission statement.

"University City District (UCD) is a partnership of world-renowned anchor institutions, small businesses and residents that creates opportunity, and improves economic vitality and quality of life in the University City area of West Philadelphia. Our primary mission is community revitalization. We work within a place-based, data-driven framework to invest in world-class public spaces, address crime and public safety, bring life to commercial corridors, connect low-income residents to careers, and promote job growth and innovation" (University City, 2016).

Appendix

Living Wages Spreadsheet

Initial Data	
Most Recent Reporting Year	2016
Summary Table	
Living Wage Annual Average	$24,511
# of Households at or above	13,785
Percentage above Living Wage	82.9%
Data Table	
Household Data From Census (DP02)	
Total households	16,625
Family households	10,239
With own children under 18 years	3,019
Married-couple family	8,045
With own children under 18 years	1,846
Male householder, no wife present	439
With own children under 18 years	106
Female householder, no husband present	1,755
With own children under 18 years	1,067
Non-family households	6,386

Householder living alone	5,379
Average Family Size (DP02)	
Average Family Size	2.81
Income and Benefits (DP03)	
Less than $10,000	1,881
$10,000 to $14,999	959
$15,000 to $24,999	2,434
$25,000 to $34,999	2,409
$35,000 to $49,999	3,012
$50,000 to $74,999	2,963
$75,000 to $99,999	1,485
$100,000 to $149,999	1,079
$150,000 to $199,999	195
$200,000 or more	208
Living Wage Data from MIT calculator (Hourly Wages table)	
1 Adult	$11.22
1 Adult, 1 Child	$24.38
1 Adult, 2 Children	$29.47
1 Adult, 3 Children	$38.98

2 Adults	$9.33
2 Adults, 1 Child	$13.17
2 Adults, 2 Children	$16.36
2 Adults, 3 Children	$19.91

SUMMARY CALCULATIONS		
Average children per family (1 adult and 2 adult)		
# without children	= Family households - with own children	7,220
Proportion without children	= # without children/Family households	70.5%
Average family size without kids	= 2	2
# with children	= Family households with own children	3,019
Proportion with children	= # with children/Family households	29.5%
Average family size with children	= (Average Family size - (proportion without children * 2)/proportion with children)	4.75
# 2 Adult with child(ren)	= Married-couple family with own children	1,846
Proportion married with kids	= # married with children/# with children	61.1%
Average children per 2 Adult family (rounded to whole number)**	= (Average Family size with children - (proportion married with children * 2) - (proportion single with children)) * (proportion married with children)	2
# 1 adult with child(ren)	= Male householder with own children + Female householder with own children	1,173

Proportion 1 Adult, with children	= # single with children/# with children	38.9%
Average children per 1 Adult family (rounded to whole number)**	= (Average family size with children - (proportion married with children * 2) - (proportion single with children * 1)) * (proportion single with children)	1

Living Wage Data from MIT calculator		Annual Living Wage (*2080 FTE)	Associated Census Groups	Proportion of Total Households	Annual Wage Portion	Living Wage Income per Household
1 Adult	$11.22	$23,337.60	5,379	32.4%	$7,550.85	
1 Adult, 1 Child	$24.38	$50,710.40	1,173	7.1%	$3,577.94	
1 Adult, 2 Children	$29.47	$61,297.60				$24,511
1 Adult, 3 Children	$38.98	$81,078.40				
2 Adults	$9.33	$19,406.40	8,227	49.5%	$9,603.40	
2 Adults, 1 Child	$13.17	$27,393.60				
2 Adults, 2 Children	$16.36	$34,028.80	1,846	11.1%	$3,778.48	
2 Adults, 3 Children	$19.91	$41,412.80				

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Chapter 4 Education, Arts & Community

Yuqing G**e**

I.   Executive summary

This report provides an analysis and evaluation of the current status of education, arts and community in the city of Apache Junction. It analyzes educational opportunity and attainment, the number and types of arts and culture events, and the current condition of community cohesion. The City of Apache Junction had a multitude of strengths. However, it is evident there are weaknesses to this sector as spotted by the sustainability assessment. There was a relatively low high school graduation rate, a lack of art support programs and a shortage of community participation policies that needs to be addressed in the future. Lastly, this chapter offers some recommendations toward coping with these issues.

II.   Introduction

This chapter contains an assessment of the current status of education, arts and community in the city of Apache Junction, which will reasonably impact the sustainability of the city. It is then followed by key strengths and weaknesses, along with some recommendations for the city and specific suggestions for 2020 general plan update.

According to the STAR Communities Rating System, education is considered to be one of the leading indicators related to a city's economy. A quality education will ensure a more stable future for children who will earn more and contribute to the development of sustainability in the city. Education and community cohesion are also related to equity. Because of the diverse population in the city, it is necessary to ensure that everyone will have the equal opportunity to be educated and have access to community services.

Arts and culture also play an important role in the development of sustainability. Resources, arts, and cultural activities encourage participation and creative self-expression in communities. When it comes to environmental protection, art projects can offer hands-on experiences to different kinds of participating audiences, not only to raise awareness, but to demystify some of the larger, seemingly distant or abstract consequences of climate change (Wilson, C., n.d.)

III.   Current Sustainability Assessment

This chapter will assess sustainability from the aspects of education, arts and culture, community cohesion, and social and cultural diversity.

Educational Opportunity and Attainment

The two STAR leading indicators related to education are high school graduation rate & graduate rate equity, and the third-grade reading proficiency. Since we were unable to locate data related to reading proficiency, this chapter will only assess the graduation rate of the city using data

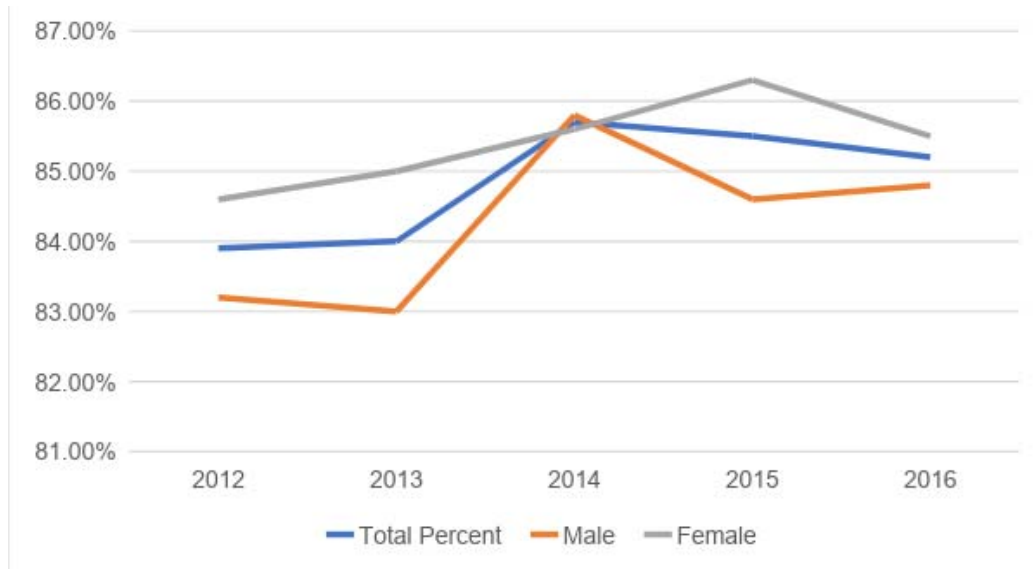from American Community Survey (Figure 1; U.S. Census Bureau, 2012-2016).

Figure 1: High school graduation rates by gender.

From 2013 to 2014, there was a notable increase in the total (male and female) high school graduation rate in Apache Junction. However, this has been decreasing since 2014. While the high school graduation rate for females is higher than the for males (except for 2014), it has been decreasing from 2015.

Though the total percent has increased a little compared to 2012, the high school graduation rate in Apache Junction still does not achieve the 90% standard that STAR leading indicator provides. If this trend continues, there might be a lower graduation rate in the future if there is no effective policy made by the educational department.
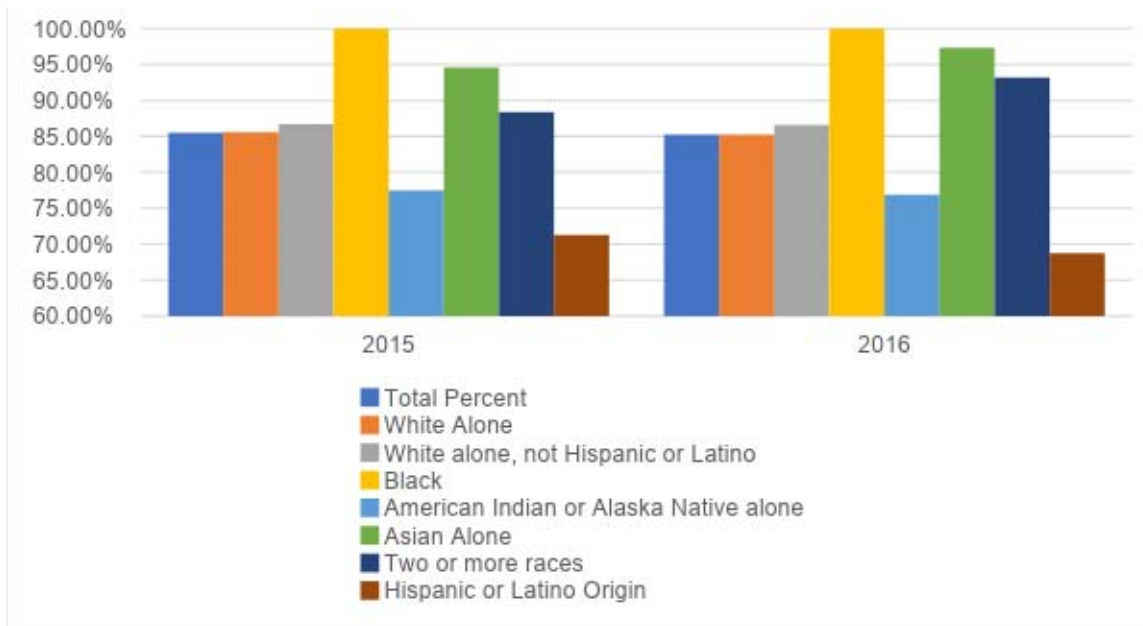
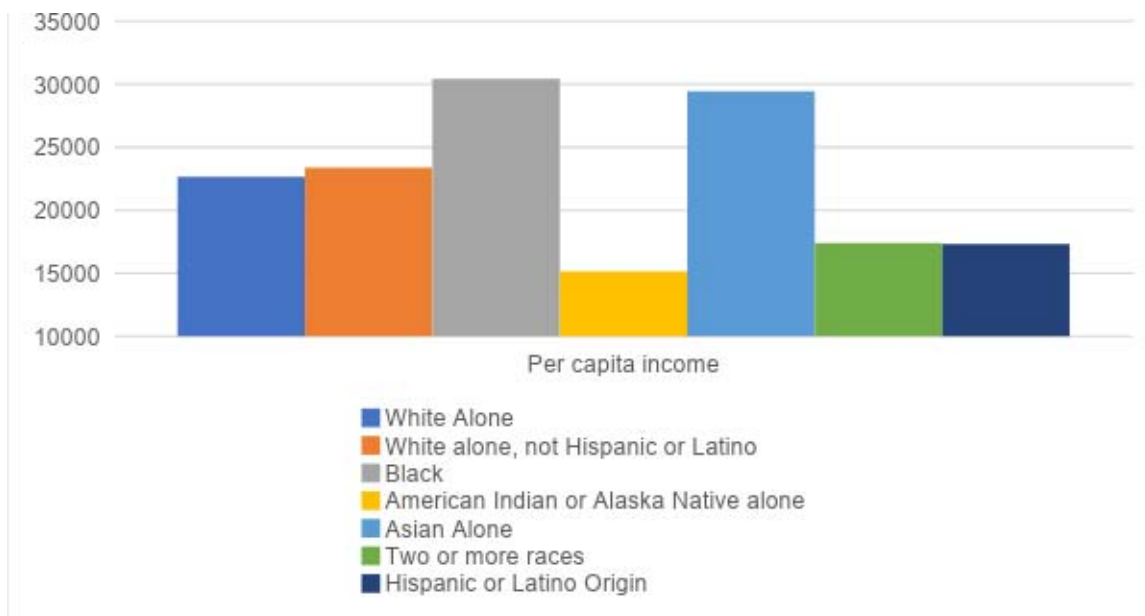**Figure 2.** Graduation equality between races (U.S. Census Bureau, 2016).

Figure 3. Per capita income by race (U.S. Census Bureau, 2016).

Arts and Culture
  ● **Events for arts and culture**
  Since arts and culture is part of the participation of the public in the communities, Apache Junction's Parks & Recreation Department has provided several opportunities and events (City of Apache Junction) for people to attend and enhance the unique arts and culture of the city.
    1. *Lost Dutchman Days*
        The event includes a full marathon, half marathon, 10K, 8K trail run and a 2- mile

fun run.
2. *Concerts in the Park*
   A free concert held at Flatiron Community Park.
3. *Halloween Festival*
   An event provides all kinds of Halloween festival activities.
4. *Holiday Program & Light Parade*
   This event will provide Santa, Snow, and Vendor booth to people. And there will be light parade at night.
5. *Superstition Sleepover*
   Outdoor activities during the day and camping in the Superstition Mountain.

- **Protect local artworks and cultural resources for future generations**

The Superstition Mountain Museum, run by the Superstition Mountain Historical Society formed on December 27, 1979 and is a non-profit corporation under Section 501 (c) 3, organized to collect and preserve the history and legends of Arizona's Superstition Mountains, and to support research, education, and publications involving the region. The Museum displays the artifacts, history, and folklore of the Superstition Mountains, Apache Junction, and the surrounding region. There are numerous events held by the Superstition Mountain Museum, including gardening classes and other lectures (Superstition Mountain Museum).

Community Cohesion

- **Community venue**

The Multi-Generational Center is a community venue which contains several amenities, including pickleball, volleyball, basketball, and a 28' climbing wall (Figure 4). The Center houses state of the art fitness equipment and offers a variety of fitness programs. Many special interest classes, sports leagues and public rentals are also available to the public. It also provides accessibility for people with disabilities in all programs, sites, and facilities. There is also an aquatic center with a community pool.

According to the STAR rating system, at least 75% of residents should live within 1 mile of a community venue that is open to the public and offers free services and/or events for residents. In figure 4, there is a one-mile radius circle and the Multi-Generational Center is in the center. The circle covers 3.14 sq. mi of the AJ. The total residential area is about 16 sq. mi. Therefore, the circle only covers 20% of the residential area of AJ. The same kind of community venues need to be built to satisfy the needs of residents.
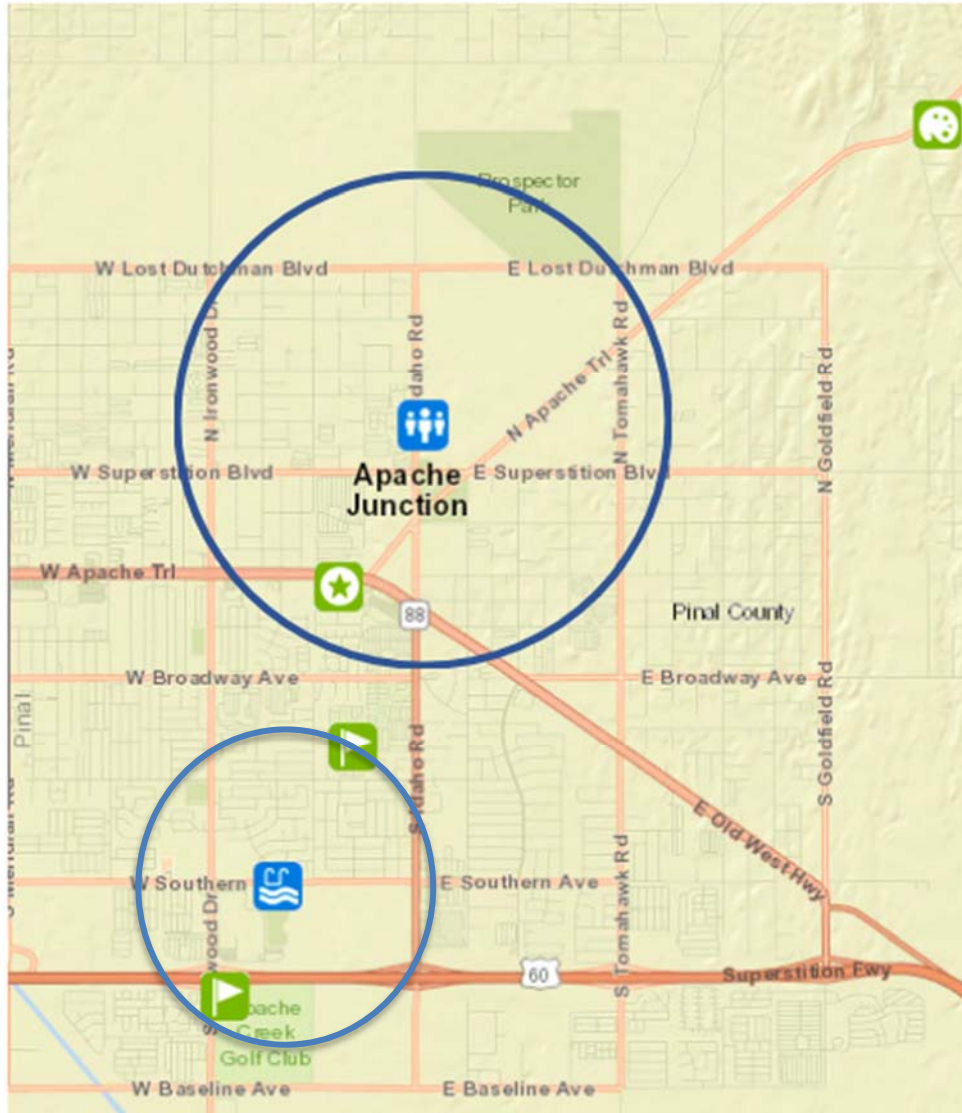
Figure 4. Location of the Multi-Generational Center & aquatic center (MAG Neighborhood Explorer).

Neighborhood Cohesion

The city has several Neighborhood and Community Outreach Programs (City of Apache Junction) that are designed to provide the community with essential information concerning City services, events, and public information. Programs include AJ Update on TV CH 11, Citizen Leadership Institute (CLI), Neighborhood meetings with HOA's, Associations, Mobile and RV

Parks; Community Relations and neighborhood problem solving; Media outreach / public information, and Social Media.

The City partners with neighborhood associations, community organizations, and local service providers to identify and address neighborhood-specific needs. The city also provides capacity-building programs to enable community leaders and groups to self-organize, resolve issues, and cultivate leadership.Although community cohesion is not included in AJ's general plan, through the examples presented, it is evident that the city has thought about community cohesion in their management.

IV.   Strengths

○   *Equal educational attainment of males and females*
From the assessment above, we can tell that in the city of Apache Junction, males and females have shared the same opportunities to get educated. Females have a higher high school graduation rate than male.
○   *Abundant special events for residents that enhance the arts and culture*
From the assessment above, we find that the city of Apache Junction does provide aspecial and interesting events for people of all ages.
○   *Adequate programs to enhance the community cohesion*
Though community cohesion is not included in the city's general plan, it is still regarded as an important part of planning by the government. The local government does provide adequate programs to encourage the participation of residents in the community.
○   *Large community venue in the middle of the city*
Though the community venue cannot cover the entire city area, it still plays an important role in residents' daily life. People are willing to take activities there and communicate with others.

V.   Weaknesses

○   *Lower high school graduation rates*
Compared to other cities in the county, Apache Junction has the lowest high school graduation rate (Figure 5). From the assessment above, we know that the graduation rate in AJ is decreasing since 2014. AJ already has the lowest high school graduation rate among all the cities, and action should be taken to prevent it from decreasing further and reverse the trend. Effective policies are needed.
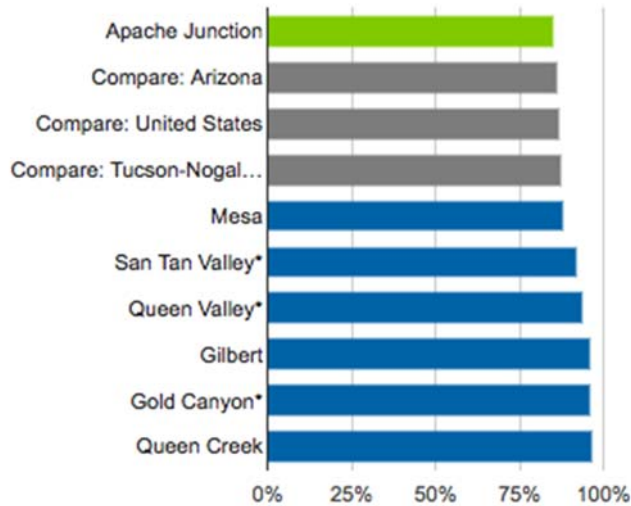
Figure 5. Graduation rates of Apache Junction and nearby cities (Apache Junction, Arizona Education Data).

- *Higher dropout rate*
  Compared to other cities in the county, Apache Junction has the highest dropout rate (Figure 6).
  AJ has the highest dropout rate of 15% of nearby communities. Since AJ already has the lowest graduation rate, the community cannot allow the dropout rate to decrease further. Decreasing the dropout rate can also improve the graduation rate in high schools.
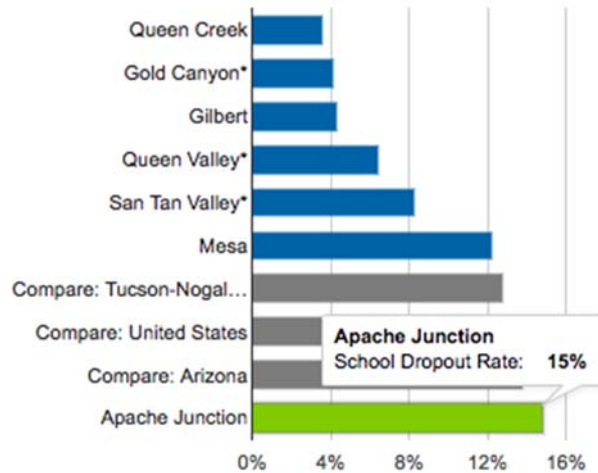
Figure 6. Dropout rates of Apache Junction and nearby cities (Apache Junction, Arizona Education Data).

- *No art programs that support local artists and advances arts education*
  The web search in this assessment did not identify any official art programs. However, AJ does have some special characteristics that should be protected and promoted. Therefore, art programs are needed to protect the special "old west" characteristic and the unique culture of the community.
- *Unclear consideration of public participation for minorities*
  No evidence was found that the city has considered the public participation of minority

populations, including non-English speakers. Though the government of AJ considered community cohesion and public participation, the accessibility of minority people who do not speak English to participate in the public decision making has not been addressed. Specifically, the government website does not provide documents in a different language.

VI.   Recommendations

Since Apache Junction has limited consideration in education, arts, and some parts of community cohesion, recommendations focus on the actions that meet the basic needs of people in the aspects of education, arts and community cohesion.

- Education
    1. *Prepare an annual progress report for the public outlining the local school system's performance.*
    The Apache Junction Unified School District website provides some basic information on schools and students, but it lacks an annual progress report that provides information and assessments on the progress of local schools. This kind of report not only provides better information to parents, but also is useful for the schools to improve their education goals.
    Case: Annual Progress Report of Fort Dodge Community School District, IA.
    In addition to standardized tests, Fort Dodge educators use classroom projects, discussions, quizzes, class participation, homework, presentations, reports and tests to measure the students' progress on a daily basis. A combination of formal and informal assessments provides the most accurate representation of the skills and concepts the students have mastered. This template will be useful to Apache Junction.
    https://www.fdschools.org/academics/annual-progress-report/
    2. *Offer multiple pathways to graduation as a way to improve educational outcomes for students*
    The graduation rate is one of the most serious issues in AJ. Multiple pathways to graduation may increase the graduation rate.
    Case: The Multiple Pathways to Graduation Mission in Portland Public Schools.
    Alternative education options can be either district operated or community based. These options are developed to meet the needs of a specific student population. Alternative education options can be either a program of a school or an independent school. To meet students' needs, alternative education options generally offer something different from or in addition to the regular curriculum and may offer something different from regular school hours. This may be a good program to investigate so that AJ can improve graduation rates.
    https://www.pps.net/domain/189
    3. *Provide funding and/or other resources to support Head Start programs in the community*
    Case: Phoenix and Mesa
    The goals of this program are: Promote healthy child development; Help parents build strong relationships with their child; Connect children and families with

needed community resources; Support families as they move towards self-sufficiency. It is a program that can help children from low-income households get equal education opportunities, http://childcrisisaz.org/what-we-do/education-and-tools-for-families/preschool-program/?gclid=EAIaIQobChMIzJiE5efP2gIV0cDACh1RAgeOEAAYASAAEgKWH_D_BwE

- Arts & Culture
  1. Make the best use of local historic and unique old west culture, and collaborate with private, non-profit, or regional organizations to increase access and participation in the arts.
  2. Adopt a strategic plan to protect, enhance, and expand the community's arts and cultural resources, and strengthen creative industries.
     Case: Arts and Cultural Strategic Plan 2018-2020 - City of North Las Vegas
     This strategic plan has some specific and practical goals: Two exhibitions in the Stone Soup Gallery in City Hall; Two or more artist residency community projects; One or more bus tours of cultural sites. For AJ's 2020 general plan update, it would be a good example for planners to think about how to promote local arts and culture.
     http://www.cityofnorthlasvegas.com/docs/NLS/Arts-Cultural-Strategic-Plan-2018.pdf
  3. Hire local artists to create artwork, sculptures, or perform in public spaces
  4. Develop special programs to advance arts education that is aligned with a core curriculum in all public schools, especially early elementary grades
- Community Cohesion
1. Adopt neighborhood plans that guide future development, recommend strategies to create or preserve community venues, and address neighborhood-specific issues
2. Provide access to information about community issues, programs, services, and activities that is also accessible to non-English speaking residents
3. Provide programs that support the development of positive, strong youth leaders, particularly in low-income and/or minority neighborhoods

VII Specific suggestions for 2020 general plan update
1. Establish special education funding to support children from low-income households to graduate from high school;
2. Set a goal of improving the high school graduation rate in the 2020 general plan;
   Case: City of Plano- Comprehensive Plan Education Elements
   This comprehensive plan includes two parts that can be useful to Apache Junction: Creating educational opportunities, and adapting to changing demographics. When AJ includes education in the 2020 general plan update, it will be useful to improve graduation rate by creating educational opportunities for all the children and educational opportunities according to the particular needs of residents in different areas.
   https://www.plano.gov/DocumentCenter/View/745
3. Establish an Art Education Program to educate people, especially children and young people to provide city youth with marketable skills.
   Case: After School Matters in Chicago, Gallery37 program, Illinois
   Gallery37 improves youth graduation rates, expands the arts and design workforce, offers

public performances throughout the City. Apache Junction not only needs new art programs, but also has difficulty with graduation rates. This program is a good choice for Apache Junction to increase the local graduation rate and promote the arts at the same time.

4. Interact with local artists and NGOs to enhance and promote the unique old west characteristic of Apache Junction through specific art programs;
5. Bring a community cohesion plan into the general plan to enhance the residents' interest of public participation.

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Chapter 5 Equity & Empowerment

Shelbie Draper

I.   Executive Summary

This chapter will focus primarily on the implementation of equity in the community and what that means. This assessment suggests that Apache Junction has considerable room for improvement with respect to the STAR Leading indicators on environmental justice and equitable access. Large portions of the community appear to be at risk of EPA identified pollutants and cancer risks, especially in high minority neighborhoods. There is also a lack of community resources and foundational assets that make access and proximity to these items difficult. There are some resources for women in Apache Junction, but education still falls short. Stakeholder engagement is also imperative for social equity, and Apache Junction does have plans to implement participation, but it is unclear how that will be done. In the final section of this paper, recommendations on how to tackle these issues and future steps are mentioned. Overall, the city does have many areas it can improve on, but it also has the drive to do so.

II.   Introduction

The concept of sustainability is becoming increasingly relevant to the urban space. A more recent addition to this campaign is social equity. Sustainability is the interaction between society, economy, and the environment that provides for the need of the present without compromising the needs of future generation (World Commission on Environment Development, 1987). Equity is the fairness of similar rights, opportunities, and access to resources among all areas of a community. Based on these definitions, one cannot have sustainability without equity. When combined, sustainability then requires needs to be met on a level of fairness, with everyone given the opportunity to grow. Thus, equity is imperative when it comes to tying together the general plan of Apache Junction, especially considering its low income and minority population.

III.   Current Sustainability Assessment

While the rise of equity has become apparent in the field of sustainability, what that word means through application is often unclear. The STAR Leading Indicators only identify two specific areas in which equity is directly measured in terms of the environment and access. These two points will be discussed in more detail below, but it is important to recognize the theme of equity in other indicators. For example:
- **Housing and Transportation**

Equitable access to homes and transportation can determine the health of a community and its members. Over the course of history, certain underprivileged groups have suffered under zoning and discriminatory lending policies, which led to concentrations of minority populations that were less able to purchase quality homes. This leads to cycles of poverty, whereby these households must work harder to achievee social mobility. Transportation has a history of being

geared toward urban centers, leaving out those affected by urban sprawl (Transportation for America, 2009). This can be seen in Apache Junction as the city is far from major industries and cultural destinations in Phoenix. This leaves people with long commute times and less growth in the workforce as well as reducing their ability to find resources and schooling opportunities (Transportation for America, 2009).

- **Climate Change Vulnerability**

It has become increasingly apparent that those in poverty or inequitable positions are those most affected by climate change. In Arizona, they are particularly vulnerable to higher temperatures and extreme weather events. A great number of Apache Junction residents fall within a flood plain, putting them specifically at risk. Low-income areas are also less likely to either have or use air conditioning due to high costs, and can suffer death, stroke, and loss of focus and attention. This is especially difficult for students (Heinrich, 2013). Thus, their care in the future of a city is vital.

- **Education**

Education is one of the main pieces to gaining equality. Education opens opportunities and gives a person the chance to better themselves and their future. Lack of education becomes an issue of equity as less privileged and "poor" groups often lack access to proper schools and after-school programs, and furthermore do not have the money or resources to send children to nearby schools in other regions. One of the other large issues is children going without food. Twenty-eight percent of kids in Arizona go without food each day, making it harder to pay attention in class and communicate with peers and teachers (Roberts, 2015).


Environmental Justice Risk and Exposure

As defined by the Environmental Protection Agency (EPA), "Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Thus, a screening tool was developed by the agency to measure these components in certain regions. Below is the evaluation of Apache Junction.

In this chapter, the population percentile, in reference to the USA percentile, is compared to several environmental indicators (EPA, 2017). These indicators include ozone, cancer risk, traffic proximity, lead paint, hazardous waste, and wastewater discharge. In all but three indicators, Apache Junction is over the 25th percentile. The most notable are Ozone, NATA Diesel PM, NATA Cancer Risk, and Wastewater Discharge. All of these are areas that put Apache Junction at risk of environmental justice issues. Often, at no fault of their own, the members of the community suffer under environmental problems that often cause health problems due to the history of the area, as well as a lack of transparency that keeps those buying homes in the dark. For example, a great number of Apache Junction residents reside in a flood plain, making them more likely to suffer under hazardous materials from stagnant water. As indicated from a sight visit, residents had their own ditches or made calls to the city to voice their concerns over washes and stagnant water. It is difficult to manage residents creating their own water diversions that may affect those living around them.

There is also an issue of trash accumulation in the front yards. As mentioned by the City, residents can take their trash disposal into their own hands and this has been an underlying

problem with accumulation. As the number of items increase, risk of injury from dangerous materials, animals, and sharp metals grow (Gammon, 2012). Kids are also less likely to bring friends home or want to spend time at home. This increases problems with school, social interactions, and drug usage (Gammon, 2012). Asthma in children is also on the rise. With traffic proximity and diesel PM percentiles high for the city, children and adults are at risk of developing asthma that may continue throughout their lives (Gammon, 2012).
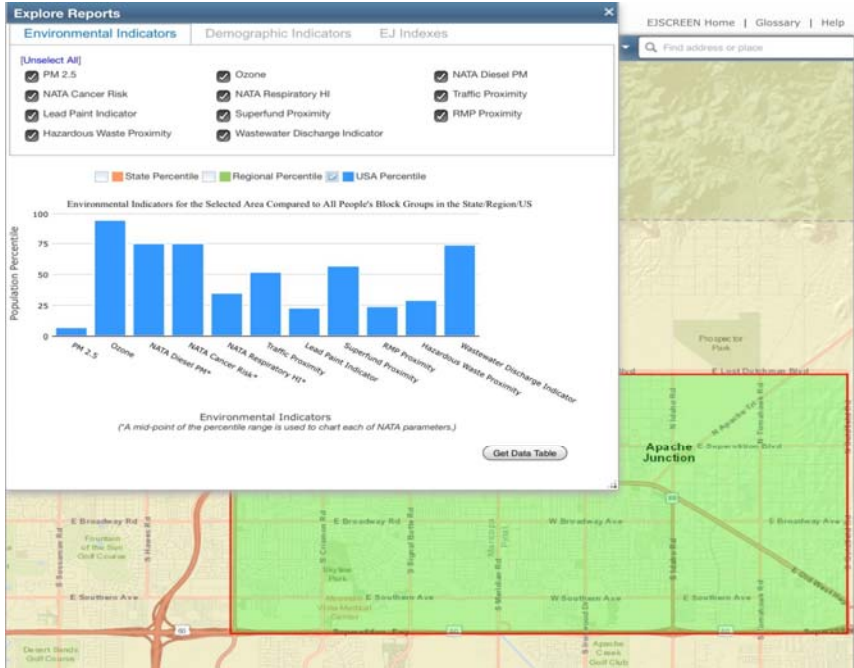
Equitable Access & Proximity to Foundational Community Assets
While the presence of resources for a community to have the opportunity to grow and better itself is key, so is the distance and access to those resources. Especially in low income and minority populations, people may find it difficult to drive or walk long distances to access community assets. Therefore, these items should be in proximity to all groups within the community.

Below are maps by Maricopa Association of Governments that illustrate the distribution of different resources.

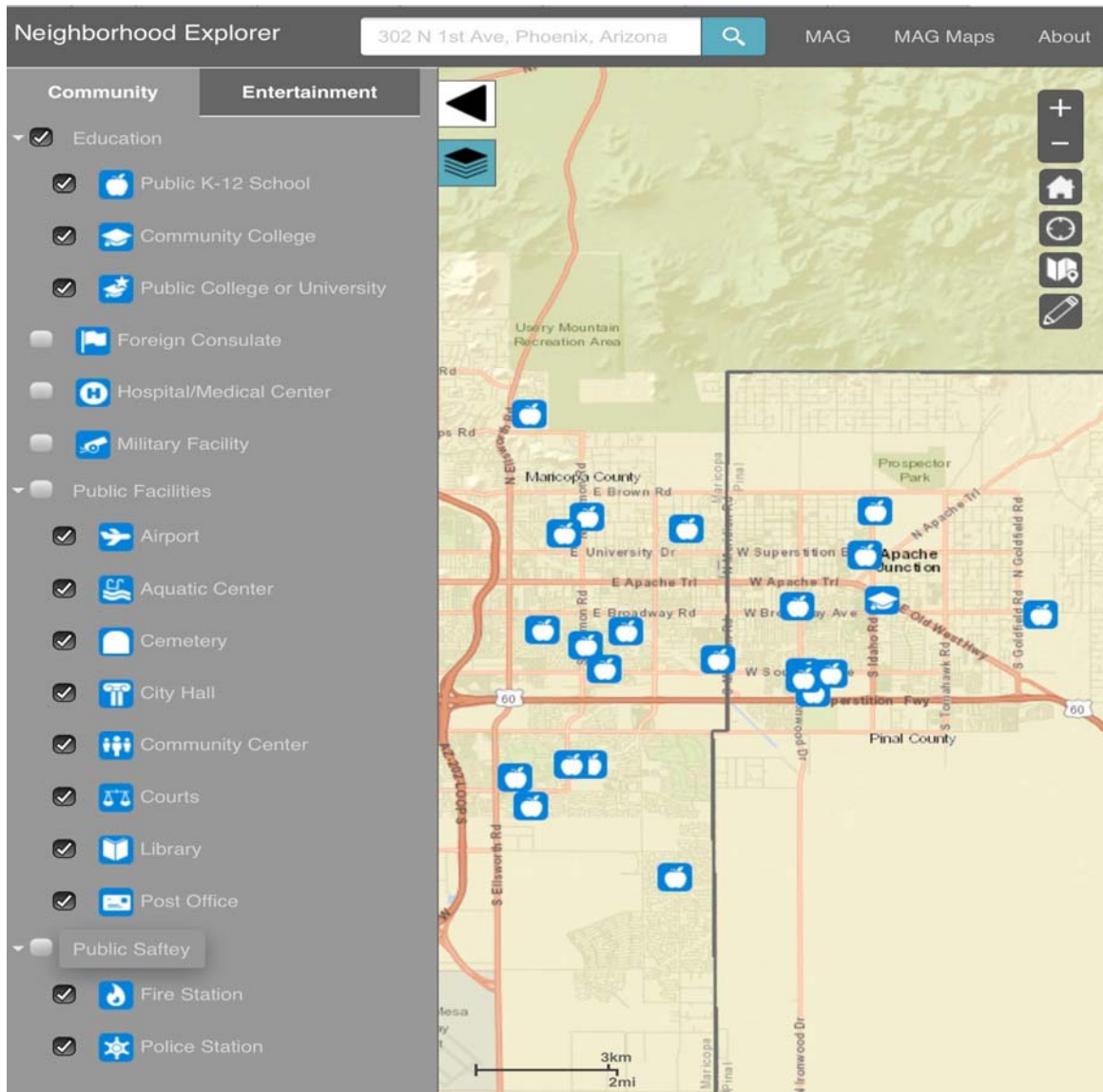Figure 1. Distribution of education facilities throughout the city. The northern side shows few to no educational facilites. However, some inaccuracies may be present as some of the schools have closed down, and others are charter schools.
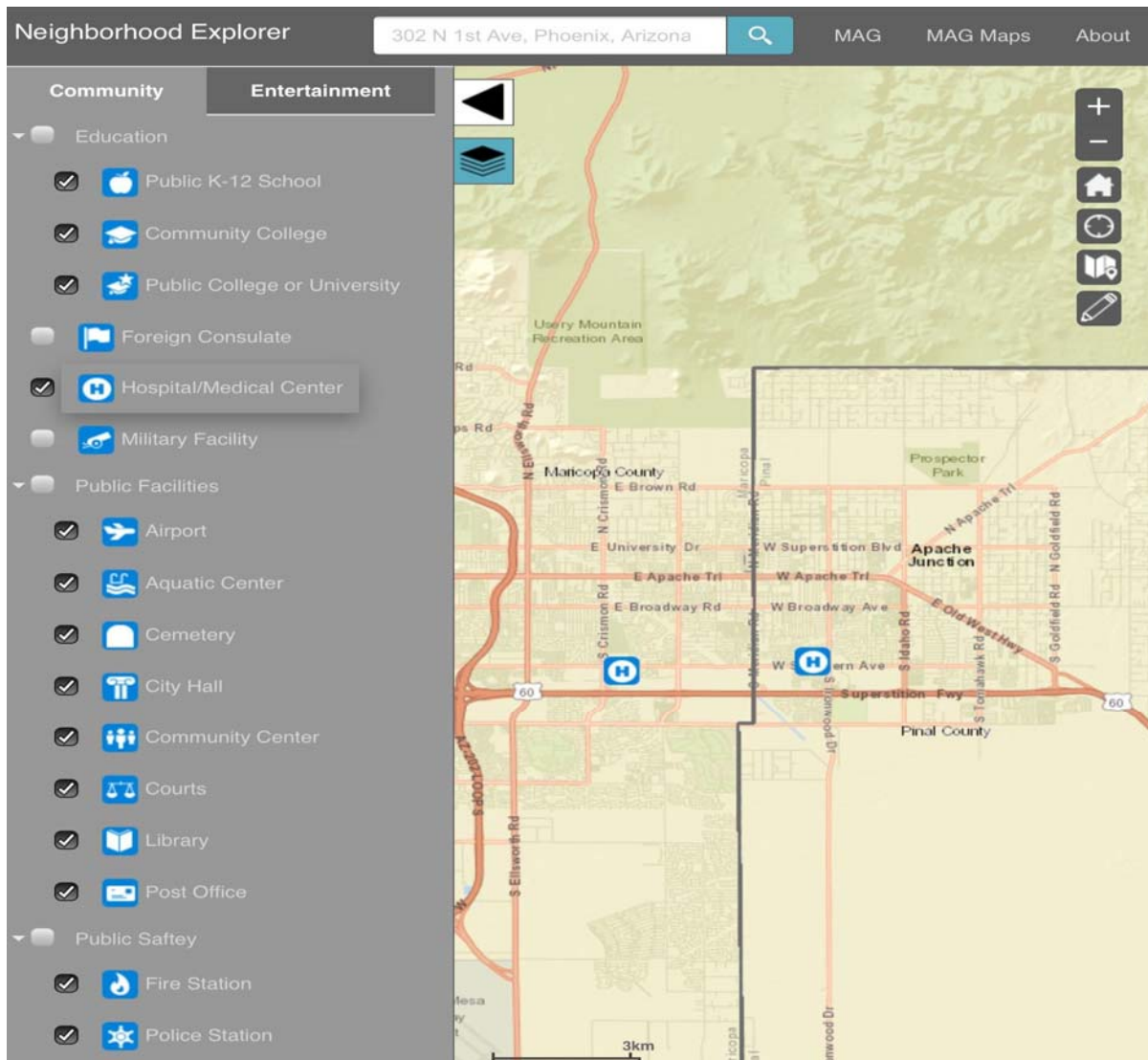
Figure 2. Locations of hospitals and medical centers. It is clear that these resources are sparse. Many residents may be unable to drive the distance, or may sacrifice care due to distance.
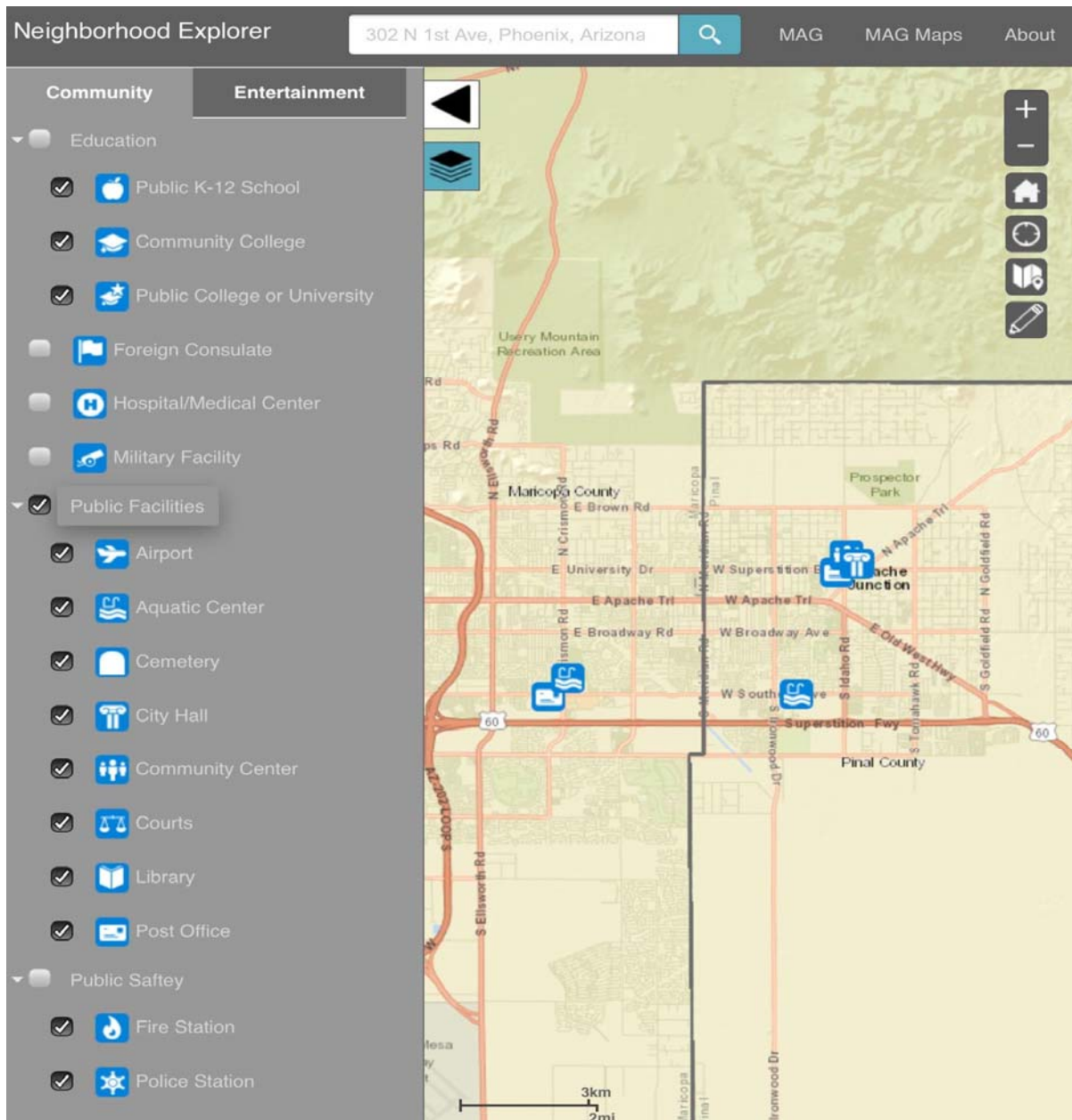
Figure 3. Public facilities are resources that allow the community to engage its population and provide areas of engagement and participation. However, Apache Junction only has one main hub of facilities, which include a community center, city hall, a post office, park, library, social security administration building, police station Pinal County Annex, drivers license bureau, food pantry, Genesis Soup Kitchen, Boys & Girls Club, etc. This northeastern location is far from most of the community. The other facilities, aquatic centers, are in the southern side and are insufficient to provide full accommodation of diverse needs in the community.
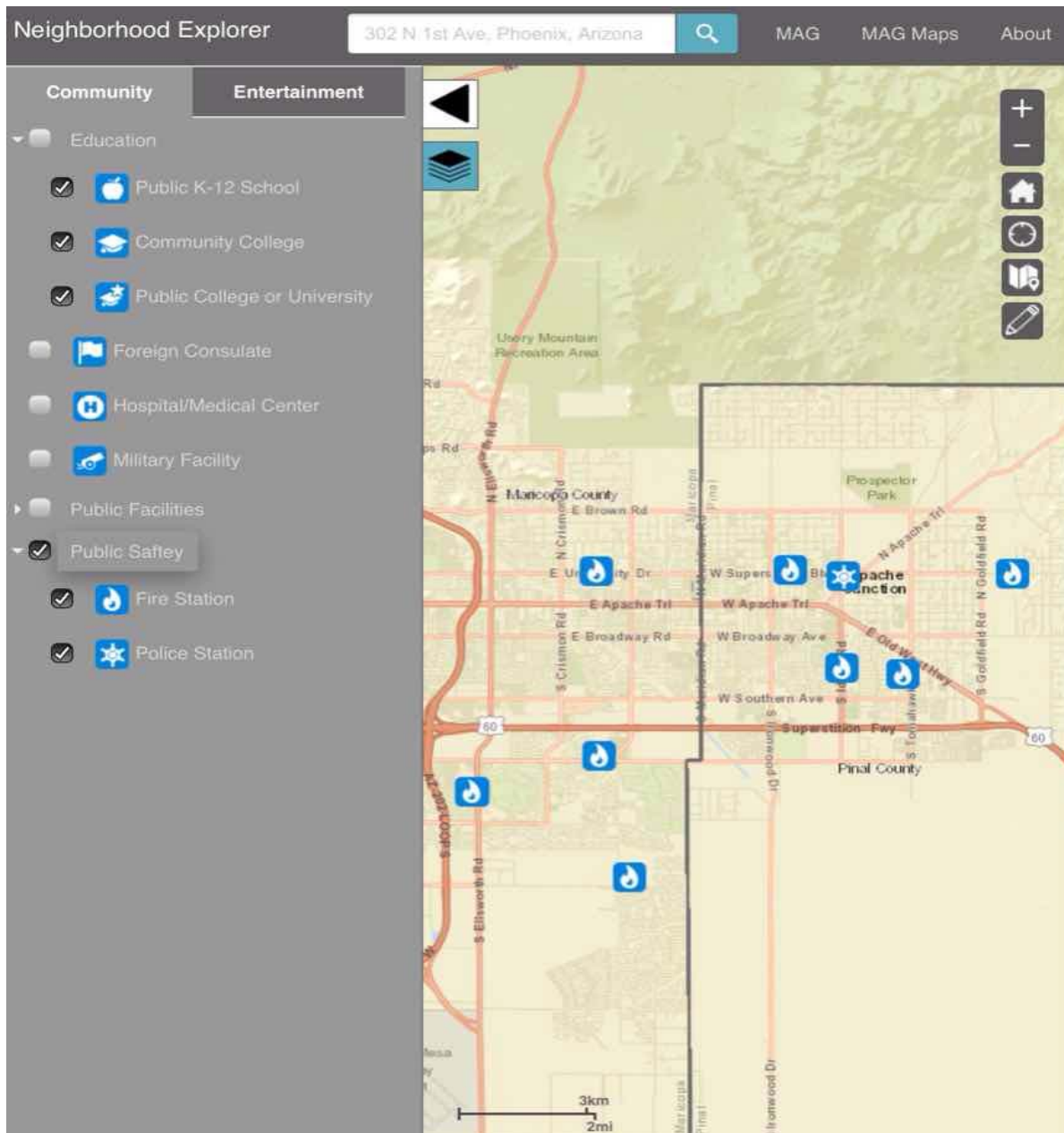
Figure 4. Apache Junction does have a better distribution of fire stations. However, there is only one police station. This increases response time and can leave citizens concerned about safety and monitoring.

Other Indicators of Equity and Empowerment

Beyond the STAR Leading Indicators, there are several other measurements to be taken into account when evaluating the equity of an area, and ensuingly, adding that value into a general plan. These areas consist of women empowerment and stakeholder engagement. To achieve social equity, women need the same opportunities for growth as men. When it comes to developing a plan meant for the betterment of a city, it requires the participation and engagement of the various stakeholders who affect and are affected by the general plan.

- Empowering women

Equal educational opportunities, as well as access to community resources are the two factors most associated with women's empowerment. In Apache Junction, the number of single women with kids, as well as teenage mothers, is above the state average. Often times, these mothers must sacrifice their own education and work opportunities to take care of children. This affects their ability to acquire jobs in the future, as well as, provide adequately for themselves and their families. There is a rehabilitation center, and a domestic violence center in Apache Junction that have services for women in need. There is also a center for pregnant and parenting women, Hope Center, that provides classes and daycare to help young mothers receive education in school and in caring for children. The center also gives self-defense, nutrition, and financing classes. However, education disparities can also begin at a young age as a relatively high percentage of the Apache Junction's residents lack a college, or even high school degree (see chapter 4).

- Stakeholder engagement

One of the most crucial indicators of social equity is the engagement and participation of stakeholders. This is especially important in cities, as a city is meant to be for the people living there. Without engagement and participation, initiatives can be put in place that do not benefit the community or are unwanted, causing setbacks for a city. An example of this is the bike lanes on S. McClintock Drive in Tempe, Arizona. The City of Tempe believed that constructing bike lanes would be beneficial and add more green infrastructure. However, the increased amount of traffic raised complaints and led to residents loudly voicing their concerns. Tempe is now removing the protected lanes, a project that cost them millions (Dale, 2017).

The addition of sustainability to general plans is on the rise (Godschalk, 2014). However, rather than implementing what "sounds good," or seems green, it is important to take into account the individual lives and opinions of the groups that live in an area. To do this, diversity must be maintained at meetings, rather than the same people attending each one, and participants must be able to voice their concerns and be a part of the solution process. From the lack of data, it is clear that Apache Junction may not be taking these items into account. When moving further into this, it will be imperative to identify disadvantaged groups, include the community to ensure their voice is heard, and these stakeholders are present at meetings.

IV.   Strengths

Apache Junction's current general plan does not address equity directly, but it does discuss one of the most important features that is addressed in this chapter: community involvement. On page 11, chapter 2 of the General plan, Apache Junction lists one of the main goals as public involvement. It goes on to say that all stakeholders should be included and invited to public meetings. Transparency is also encouraged throughout the plan-making process. Another strength of the plan in the realm of equity is the environmental planning discussed in chapter 7. There are goals to increase public facilities, such as parks, as well as ensure greater public health when it comes to air, water, and waste pollution. As mentioned before, Apache Junction does not directly mention equity within its plan, however, it has a starting point in some of the goals mentioned.

V.   Weaknesses

The weakness of the plan falls into what is lacking in the strengths. While there are goals to include minority populations and engage the community for public meetings, how this is to be executed is not mentioned. It takes more than holding an open meeting or discussion to get stakeholders to show up. What is the best way to distribute information and provide that transparency stated in the plan? Increasing public facilities is also noteworthy, however, adding these in disadvantaged communities is most important. Also, more detail needs to be given to the numbers produced by the EPA analysis. Air and water pollution prevention is necessary, but so is the clean-up of areas that leave certain communities at risk of environmental injustice. There is also a lack of mention on how to improve the lives of women and include them in decision making.

VI.   Recommendations for the Future

The upcoming General plan has been one in the making as many city officials are doing the best they can to create a sustainable city that has equity for all. While this may be difficult, there are some example cities and recommendations that Apache Junction can follow and implement.

Regarding environmental equity, the most important aspect is transparency. Flyers should be handed out to each area explaining the land they are living on, what hazards exist there, and the possible problems with those hazards. Things such as lead paint can be easily fixed, as well as providing a list of products and materials that increase cancer risk. There can be a designated trash day where these items are thrown out. Also, the dangers of diesel and the wastewater that is already apparent to the city and many residents needs to be noted to create a possibility for change.

One of the first things that needs to be done is an evaluation of the community areas to show those most disadvantaged, as well as those that lack reliable transportation. Once this information is gained, planning for community resources and assets can be planned in these areas. This can include more libraries, community centers, schools, even entertainment spaces. This information will also be relevant to stakeholder engagement. As seen in the City of Portland, Oregon residents may show up to city council meetings, but not in the diversity that you need. Often times, it is the same people. To encourage others to go, it is important to target those disadvantaged communities and see what they need to be a part of decision making. This may include late night meetings, on-site daycare, etc. It is also important for city officials to sometimes make the trek to these homes and talk personally with people. This shows the amount of care put in their opinions and may increase participation.

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Chapter 6 Health & Safety

Brian Rojas & Kellie Rorex

I. Executive Summary

This chapter analyzes and evaluates the city of Apache Junction regarding Health and Safety. Specific areas of focus and evaluation included Health Systems in Apache Junction, Food Security and Assistance, Access to Healthful Food, Violent Crime Rates, Emergency Management and Response, and Hazard Mitigation. For an effective analysis, we used the Star Community Rating System Version 2.0 as our measuring tool, as well as several other research methods. STAR Communities is a nationally recognized program used by counties and cities to measure their progress across social, economic and environmental performance areas. Data was collected and evaluated for each area mentioned. Results were determined and presented, strengths and weaknesses were identified with recommendations for policy improvements, and specific suggestions for the 2020 General Plan update are also included.

II. Introduction

"The development of healthy, safe, and resilient communities requires proactive efforts to prevent disease, injury, and premature death by fortifying protective factors and reducing risk factors that undermine healthy outcomes" ("Health & Safety").

Health and safety are two of the most important objectives a city is tasked with. A healthy community creates a strong economic ground for a city to rise on. Therefore, it is the city's job through planning and design, to ensure a healthy and safe living environment by offering the right amenities and facilitating access physically and economically for all residents. The City of Apache Junction's health and safety amenities will be analyzed to better understand the current conditions as well as what can be improved upon for the general plan update. Analysis will be accompanied by case studies and best practices when available and recommendations will be made at the end of the chapter. STAR Community indicators as well as additional indicators have been chosen to use as an analysis framework so that Apache Junction can measure and compare their health and safety goals with other STAR communities.

III. Current Sustainability Assessment

A. Health Systems in Apache Junction

A robust health system allows for the care and safety of a diverse community. The more health services offered the happier and healthier residents of a city are. Health systems take into consideration amenities that are open and accessible to the public. It is important for cities to understand what services are offered in their community and what services they are lacking in. In this section we will be taking stock of all health services that the City of Apache Junction has for their residents to better understand what opportunities and barriers there are for supplying a

healthy community for residents.

By analyzing existing health services, determining access, and researching education and outreach methods we can begin to understand the health system Apache Junction has, how it is working and how it could improve.

Looking at Figure 1 below, we can see that the City of Apache Junction has over a dozen medical, or health facilities. Physical access to medical facilities is important in that people have close, reliable medical service in an emergency. Looking at the medical facilities listed on appendix A and seen on the map, it shows that there are many diverse services offered to residents in Apache Junction. Unfortunately, the health facilities are all located around Apache Trail, meaning those living in the rural parts of the City do not necessarily have adequate physical access to services.
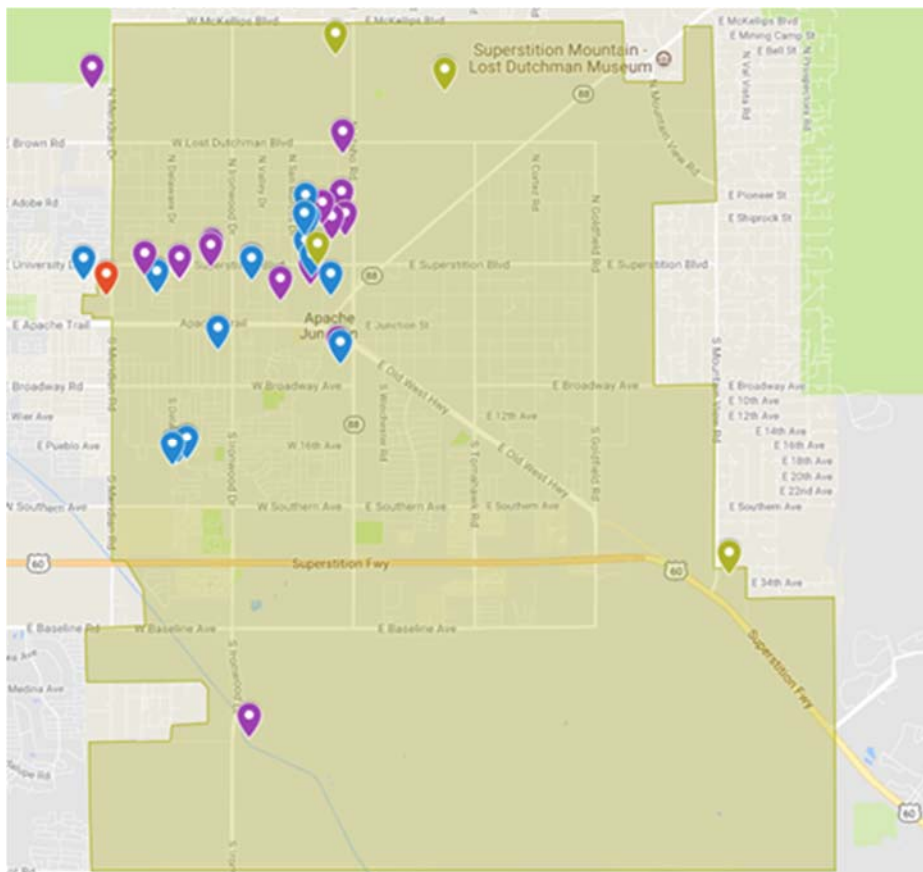
Figure 1: Google Map of Health facilities in the Apache Junction Region. Purple = Non-Profit Organization, Blue= Health/Medical Facility, Green = Park, Red = Recreational Facility

- Planet Fitness
- Apache Junction Senior Center
- Easter Seals Blake Foundation
- 1620 Foundation
- Community Alliance Against Fam
- Central Arizona Association
- Boys & Girls Clubs of the East Valley
- Superstition Mountains Community Facil...
- Empowerment Systems Inc
- Apache Junction Food Bank
- AZ Living Well Institute
- Triple R
- Genesis Project
- Spectrum College Transition
- Community Nutrition Resources
- Arizona Youth Rough Riders
- Hope Women's Center
- Society of St. Vincent de Paul - Apache J...
- Prospector Park
- Silly Mountain Trail Head
- Flatiron Park
- Lost Dutchman Days Rodeo

- Banner Goldfield Medical Center
- Rising Star Wellness Center
- Heavens Medical, PLC
- Heavens Medical, PLC
- Saguaro Rehabilitation & Aquatic Therapy
- NextCare Urgent Care
- La Frontera Empact
- Independent Wellness Center
- Sun Life Family Health Center
- Banner Children's - Banner Health Clinic
- Banner Goldfield Medical Center
- Phoenician Medical Center
- Raven Wellness Center
- Dr. Conrad M Lawrence
- Nature's Wonder Dispensary
- Horizon Health & Wellness
- Kathleen Casey, NP

Next, we looked at access to medical/health services by analyzing U.S. Census data. According to the U.S. Census ACS 2012-2016 5-Year Estimates, 86.4% of the population has health insurance (ACS 5-Year Estimates). Knowing the percent of population with and without insurance can identify at risk groups in need of certain medical services. Also, by tying the percent of insured populous with other socio-demographic information, certain groups can be identified with specialized health needs. For example, the City of Apache Junction has a large percentage of veterans in their community and therefore, knowing that the area is low-income and 14% of their population is uninsured, veterans could be an at-risk group for low access to medical services. This information can lead to more detailed research on at-risk groups in Apache Junction which will help the city identify medical needs that should be brought into the City in order for their residents to thrive.

Lastly, we analyzed health services that are not offered by medical facilities such as parks, recreational facilities, education and outreach by the City, and non-profit interactions, which all contribute to a healthy lifestyle. Apache Junction has many non-profit organizations in the City working with people to create a healthy lifestyle. However, there are very few parks in the area, and even fewer recreational facilities (See Figure 1). The City's outreach program consists of providing information for local and state resources, yet there are no specific goals laid out in the last general plan relating to health outreach and education ("Community Services, Programs & Resources | Apache Junction, AZ - Official Website," n.d.). Education and outreach are important tools used by cities and businesses to encourage healthy choices and behaviors that will benefit all community members. Therefore, a city-wide health goal should be established.

A good example of planning for public health and creating city-wide health goals is the Health Element in the Santa Clara County's General Plan. The section is split into several subchapters that determine health conditions, equity and access, and other health elements that are found in this analysis such as access to healthy food, sustainable food systems, and safety ("Health Element"). It also consists of a handful of other sections such as air quality and housing, which is already in the last Apache Junction General Plan.

Apache Junction has many health services and non-profits helping to create a healthy and happy community. However, there is no formal research on at-risk groups in the City or city-wide health goals, and there is a lack of recreational facilities and parks. These two barriers prevent Apache Junction from being a leader in health provision. The City needs to determine what citizens need health-wise to set goals for the next general plan update.

Data in this section is limited to online resources due to the lack of access to business permits that would allow for a more comprehensive list of medical facilities and non-profits offering health services. Therefore, the statements made are an analysis of surface data to call attention to certain areas that the City should focus on in setting goals for the health and safety of the City in the future.

B. Food Security and Assistance

According to Feeding America.org, food insecurity is a measure used by the United States Department of Agriculture (USDA) to quantify the lack of access to enough food for an active, healthy life for all household members. It also measures the limited or uncertain availability of nutritionally adequate foods. Food-insecure households are not necessarily food insecure at all times. Food insecurity may reflect a household's need to make trade-offs between important basic needs, such as housing or medical bills, and purchasing nutritionally adequate foods.

The purpose of this analysis is to ensure adults and children of all income levels in Apache Junction have physical and economic access to fresh and healthful food and have opportunities to learn about nutritious eating and food safety (Star Rating System, Version 2.0; HS-4 Food Access & Nutrition).

To analyze and measure Apache Junction's level of food security and assistance, the Leading Star Community Indicator 18: Food Security and Assistance was used with outcome 1. Food assistance programs were assessed by looking at census data and online information. The goal here was to provide the Food Insecurity Rate for the overall population and child population in Pinal County. County-level data was used because citywide data was not available. The Meal Gap tool from the Feeding America's Map wesite was used to access appropriate data. The data in Figure 2 provided the overall Food Insecurity in Arizona, as well as food security by county.

Map the Meal Gap 2017:
Overall Food Insecurity in Arizona by County in 2015 [1]

County	Population	Food insecurity rate	Estimated number food insecure individuals (rounded)	Likely Income Eligibility for Federal Nutrition Assistance [2]	
				% below 185% poverty	% above 185% poverty
				SNAP, WIC, free school meals, CSFP, TEFAP	Charitable Response
Apache	72,124	26.6%	19,180	93%	7%
Cochise	129,647	15.0%	19,460	71%	29%
Coconino	136,701	19.9%	27,220	71%	29%
Gila	53,165	18.5%	9,830	80%	20%
Graham	37,407	15.8%	5,910	73%	27%
Greenlee	9,023	13.3%	1,200	82%	18%
La Paz	20,335	16.0%	3,240	100%	0%
Maricopa	4,018,143	15.0%	604,200	71%	29%
Mohave	203,362	19.1%	38,760	78%	22%
Navajo	107,656	23.0%	24,730	89%	11%
Pima	998,537	14.6%	145,800	76%	24%
Pinal	389,772	14.7%	57,290	71%	29%
Santa Cruz	47,073	8.6%	4,040	100%	0%
Yavapai	215,996	16.8%	36,220	71%	29%
Yuma	202,987	17.5%	35,470	83%	17%
State Total[6]	6,828,065	15.8%	1,078,190	69.3%	30.7%

For additional data and maps by county, state, and congressional district, please visit www.feedingamerica.org/mapthegap .

Figure 2: Food Security and Assistance

The overall food insecurity average rate in the state of Arizona was 15.8% in 2015, with an estimated number of food insecure individuals rounded to 1,078,190. Individuals likely ineligible for federal nutrition programs (incomes above 185% of poverty) were at 30.7% and income-eligible individuals for nutrition programs (at or below 185% of poverty) were at 69.3%.

In Pinal County, the overall average rate for food insecurity in the state of Arizona was 14.7% in 2015, with an estimated number of food insecure individuals rounded to 57,290. Individuals likely ineligible for federal nutrition programs (incomes above 185% of poverty) were at 29% and income-eligible individuals for nutrition programs (at or below 185% of poverty) were at 71%.

Figure 3 shows that the overall Food Insecurity Rate in Pinal County in 2015 was 14.7%. The food insecure rate for children in Pinal County was 24.0%, which is around 23,300 children. The percentage of children likely ineligible for federal nutrition programs (incomes above 185% of poverty) was at 26% and income-eligible individuals for nutrition programs (at or below 185% of poverty) was at 74%. Average Meal Cost is $2.81 and additional money to meet food needs was $28,878,000
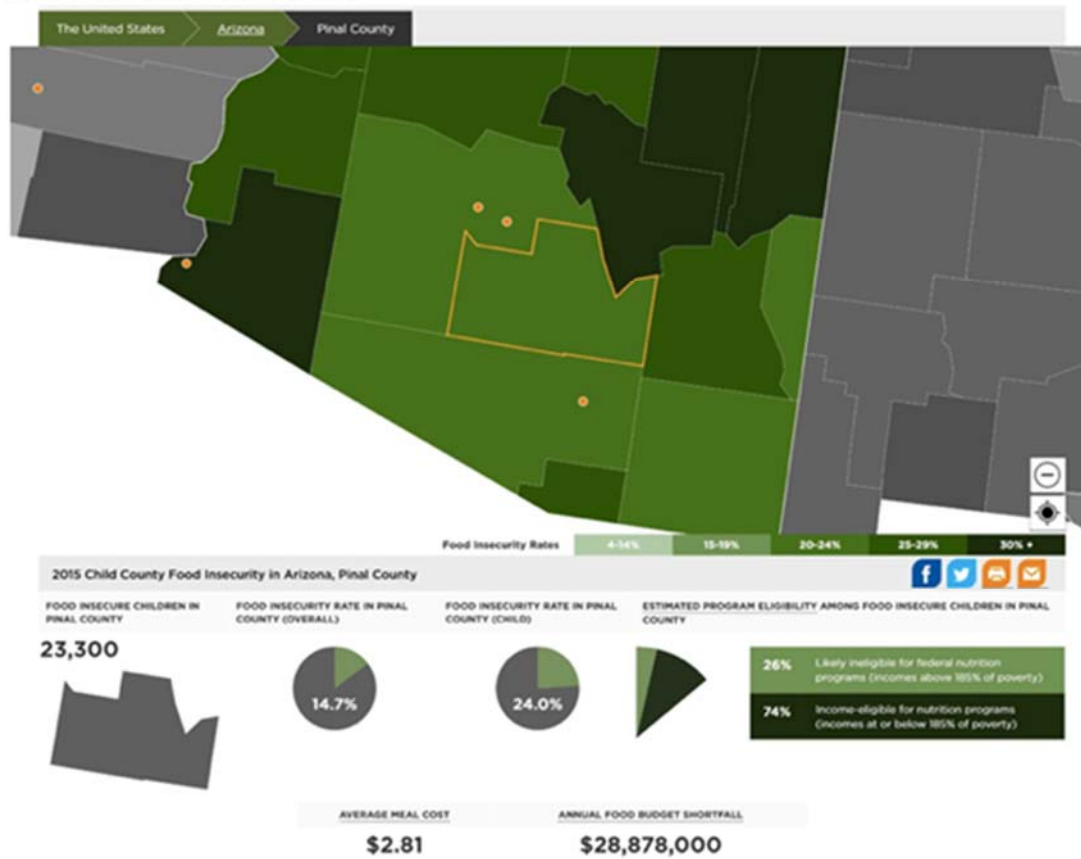

Figure 3: Food Security and Assistance

Figure 4 provides specific data for children living in Apache Junction. For example, the total number of children under 18 years of age living in Apache Junction in 2015 was 7,102. The total

number of children in households for whom poverty status is determined was 6,769. Median family income for 2015 for families with own children was $31,294. Children living in households with Supplemental Security Income (SSI), cash public assistance income, or Food Stamp/SNAP benefits was 53.7%.

Subject	Apache Junction city, Arizona							
	Total		In married-couple family household		In male householder, no wife present, family household		In female householder, no husband present, family household	
	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error
Children under 18 years in households	7,102	+/-731	3,999	+/-664	459	+/-519	2,584	+/-706
AGE								
Under 6 years	36.9%	+/-5.8	34.9%	+/-7.2	35.7%	+/-17.1	39.2%	+/-10.3
6 to 11 years	33.6%	+/-5.1	32.7%	+/-6.1	46.8%	+/-15.4	33.5%	+/-9.0
12 to 17 years	29.5%	+/-5.6	32.4%	+/-8.0	17.4%	+/-25.6	27.3%	+/-8.2
MEDIAN FAMILY INCOME IN THE PAST 12 MONTHS (IN 2015 INFLATION-ADJUSTED DOLLARS) FOR FAMILIES WITH OWN CHILDREN								
Median income (dollars)	31,294	+/-4,376	49,093	+/-14,921	2,500-	***	17,939	+/-3,024
Children under 18 years in households	7,102	+/-731	3,999	+/-664	459	+/-519	2,584	+/-706
PUBLIC ASSISTANCE IN THE PAST 12 MONTHS								
Children living in households with Supplemental Security Income (SSI), cash public assistance income, or Food Stamp/SNAP benefits	53.7%	+/-8.1	43.9%	+/-12.5	64.3%	+/-45.5	67.4%	+/-14.0
POVERTY STATUS IN THE PAST 12 MONTHS								
Children in households for whom poverty status is determined	6,769	+/-713	3,984	+/-657	310	+/-248	2,464	+/-641
Income in the past 12 months below poverty level	45.5%	+/-7.5	34.4%	+/-11.0	51.9%	+/-40.5	62.3%	+/-15.3
Income in the past 12 months at or above poverty level	54.5%	+/-7.5	65.6%	+/-11.0	48.1%	+/-40.5	37.7%	+/-15.3
HOUSING TENURE								
Children under 18 years in occupied housing units	7,102	+/-731	3,999	+/-664	459	+/-519	2,584	+/-706
In owner-occupied housing units	50.8%	+/-9.6	53.4%	+/-10.2	92.8%	+/-11.8	39.3%	+/-13.4
In renter-occupied housing units	49.2%	+/-9.6	46.6%	+/-10.2	7.2%	+/-11.8	60.7%	+/-13.4

Figure 4: Food Security and Assistance

The total population of Apache Junction in 2015 was 37,775. Approximately 7,105 of those were children under 18 years old, which is only about 18%. However, of those 7,105 children, 6,769 (95%) of those children lived in households where poverty status had been determined. This also means 45.5% of those whose household income was below the poverty level and most likely has turned to federal assistance, food banks, or other charitable and nonprofit community services to purchase healthful food.

Apache Junction has one soup kitchen, a food bank, the Genesis Project, and the Hope Women's Center that helps families gain access to food. All four locations are located near Apache Trail between Ironwood and Idaho Street. These businesses do not calculate the number of people they serve, but resources such as these are very important for communities as well as residents who are living below the poverty level or who suffer from poor food security.

C. Access to Healthful Food
Planning for public health has been an important tool used by many cities to achieve social justice and improve the life of citizens. One way to plan for public health is by prioritizing access to healthful food. Access can be defined in three ways: the ability to afford healthy food

(economic access), the ability to get to the store (physical access), and proximity to healthy food stores. When residents are able to buy and consume healthy food their risk for obesity and other adverse health effects, such as diabetes, is minimized. Often times, low-income areas and minorities are the most disadvantaged group, lacking basic access to healthful food in their communities.

Residential areas need to be located near grocery stores or be located near public transit that makes stores accessible. Alternative means of transportation allow for people without access to vehicles, such as low-income, elderly, or disabled people an equitable means to buy fresh food. Secondly, fresh, healthy food needs to be affordable. In rural communities the price of fresh food can be high due to the amount of money and energy in supplying fresh food by small local stores. Often times this means fresh food is located in town centers, which can be too far for some to get to.

The most recent general plan in Apache Junction does not mention access to healthful food and therefore, it is important to analyze access in the community to determine the city's opportunities and barriers. Once those are determined the city can set goals for their 2020 General Plan update. To analyze Apache Junction's access to healthful food, Leading Star Community Indicator 19 from STAR Communities with outcome 2, mapping food deserts, was used. Additionally, census data, the concentration of food stores, and their proximity to residential areas was used to identify areas of need in the community. The purpose of measuring access to healthy food is to ensure that people of all ages and income levels have both physical and economic access to healthy and nutritious food.

Apache Junction is characterized as being a low-income, mostly white community, with 46% of its households making under $39,999 a year and just over 20% of its population under the poverty level (ACS 5-Year Estimates). Compared to other Arizona cities, Apache Junction's median household income lags behind. Within the City's own county, Pinal, the median household income falls about $2,000 short of the county average ("City of Apache Junction Housing Assessment; Strategic Plan," 2010). Apache Junction's median age for a citizen is 52 years old, and the city does not have public transportation (ACS 5-Year Estimates). This data highlights possible risks to access within the city. Mentioned prior, low-income people are usually the ones most disadvantaged when it comes to access to healthful food. Also, with an aging population and no public transit, grocery stores need to be located near residential areas so that all people have access to nutritious food.

To determine if there is limited access to healthy food, Apache Junction was evaluated by considering food deserts. A food desert is any area that is not within ½ mile to a mile of a grocery store, or ten miles in a rural area. This was mapped using the USDA Food Access Research Atlas. The data the Atlas uses for ApacheJ comes from 2015 sources and maps low-income areas within ½-1 mile (urban) and 10 miles (rural) of a supermarket. The Atlas also helped determine low-income areas andareas with low vehicle access. Both low-income and low vehicle access could be potential barriers for residents to access healthful food. The maps are seen below.

Figure 5: Low income and Low Access at 1 and 10 Miles

Figure 6: Low income and Low Access at 1/2 and 10 Miles

Figure 7: Low Vehicle Access

Figure 8: Low-Income Area

We can see from the maps that most of Apache Junction can be considered a food desert, with a large percent of the population living over a mile away from a supermarket. To investigate this further we mapped supermarket locations using google maps. This map can be seen below.

Figure 9: Google Map of Supermarkets in Apache Junction Region
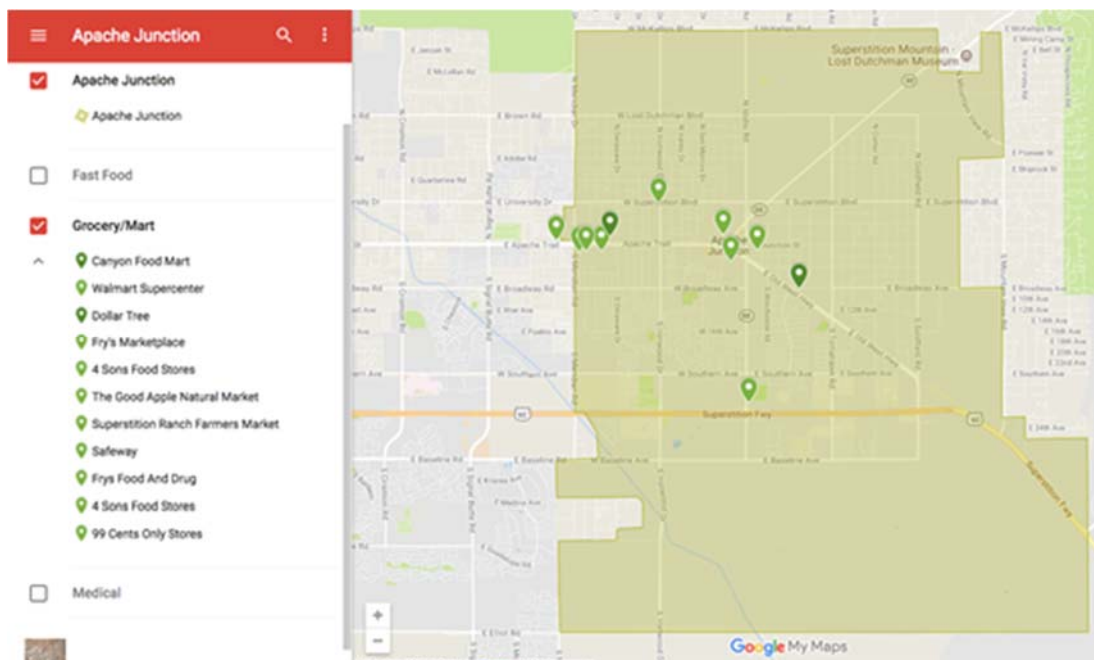
Most of the food stores are located near Apache Trail, which matches the USDA Food Atlas

maps. Being in a food desert not only means a resident may have low access to healthful food, but can mean that risks of diabetes or obesity are much higher, especially with higher access to fast food. Access to fast food was mapped via fast food restaurants on Google Maps and compared to the 2010 Apache Junction General Plan land use map, noting residential areas. Additionally, Pinal County data was used to see diabetes prevalence. These maps are below.

Figure 10: Google Map of Fast Food Restaurants in the Apache Junction Region

Figure 11: Apache Junction Land Use Map, Residential in Pale to Dark Orange

Figure 12: Pinal County Diabetes Prevalence

Fast food restaurants are also located around Apache Trail just as the supermarkets are. However, when we look at diabetes pre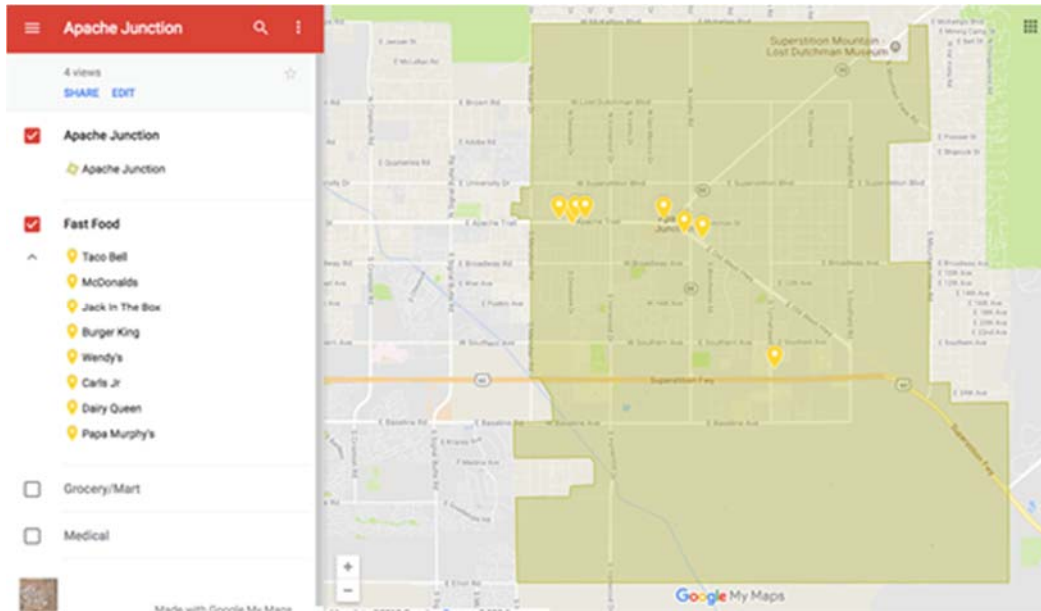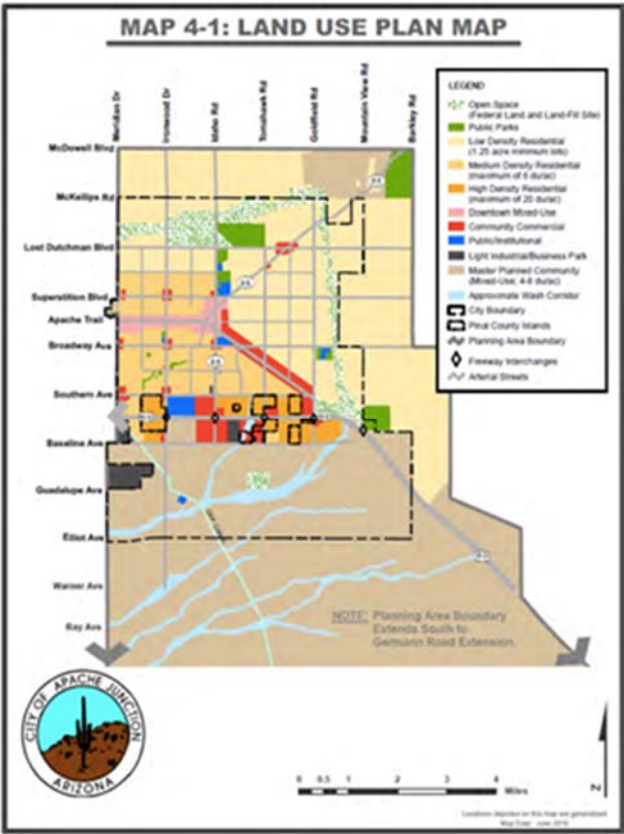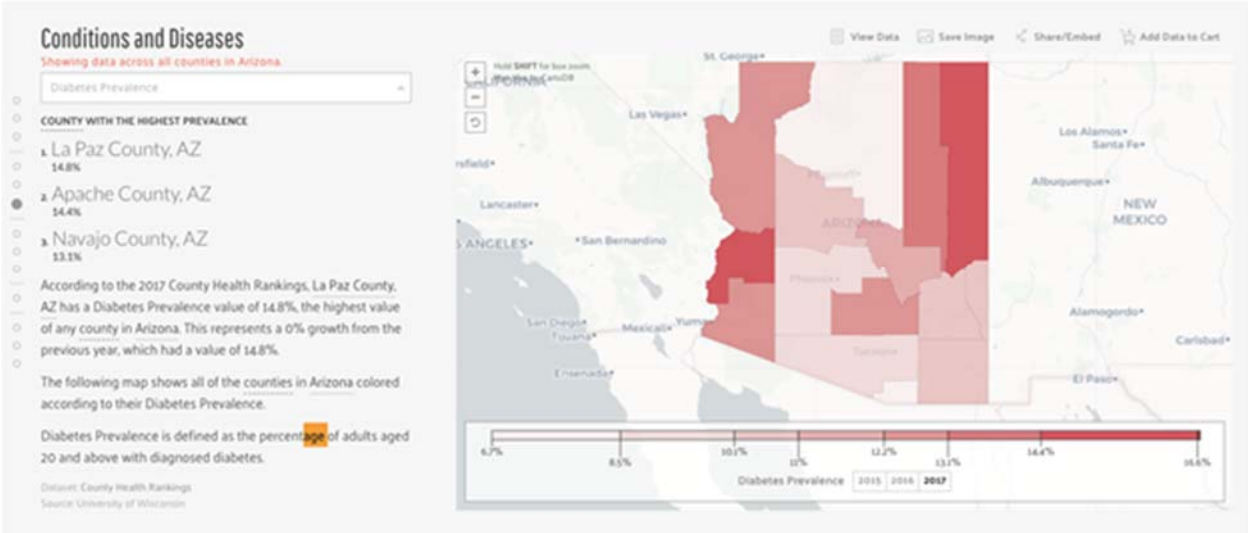valence by county from DATA USA: Apache Junction, we see that Pinal County has a moderate prevalence of diabetes compared to its neighbors, Maricopa and Pima County. Also, looking at DATA USA: Apache Junction charts, the average car ownership is two cars per a household (see figure 13). The Apache Junction Access to a Vehicle map, figure 7, showed that a large portion of west Apache Junction had low car access. Combining this data suggests that most people who have access to a car already live closer to the concentration of services in East Apache junction.

Figure 13: Car Ownership in Apache Junction
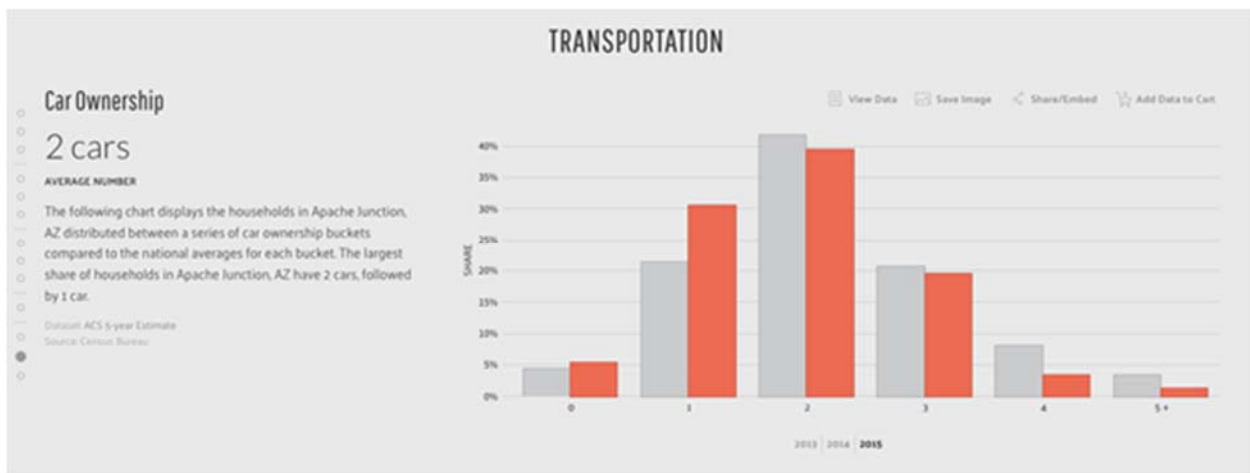
Apache Junction has just under a dozen food stores and a similar number of fast food restaurants. Both food stores and fast food restaurants are located along Apache Trail, meaning that residential areas located ½ mile to 1 mile away from Apache Trail do not have adequate access to food supply and are thus, food deserts. The expansive food desert that is the majority of Apache Junction is made worse when comparing the average car ownership data with low vehicle access, which suggests there is very poor mobility for those living in west Apache Junction. This problem could potentially become a larger issue as the City and number of residents grows in the future, especially if food stores are not built in the western part of the City.

To plan for sustainable growth, where food access is equal for all residents within Apache Junction, the City should consider its opportunities and barriers. The City has the opportunity with the new general plan to create more commercial zones in residential areas experiencing densification and prioritize plans for nutritious grocery stores in those areas. As neighborhoods become more dense, small shopping nodes will both supply adequate access to healthful food and limit the cost of travel to distant grocery stores.

The state of Ohio, in 2015, began the Healthy Food for Ohio (HFFO) program. The program is intended to help fund "projects, provide healthy food retailers with financing for costs associated with land acquisition, pre-development, construction, equipment, and infrastructure and related expenses" ("Ohio"). If Apache Junction uses the HFFO program as an example and scaled it down for their city, they would be able to use zoning as well as assisted funds to build small

shopping nodes in rural areas with poor access.

Barriers that the City faces concern the number of low-income people in Apache Junction as well as the number of people living in rural areas. Rural Apache Junction is not economically favorable for nutritious/health food stores and therefore it will be difficult to implement there. This means limited physical access for many who choose to live in rural areas. Secondly, low-income people might not have the resources to buy fresh produce no matter where they live. Therefore, Apache Junction should look into creating pop-up farmers markets.

In a case study from Dubuque, Iowa, a college student along with the City began mapping food deserts in the area and determined where pop-up food markets could best serve residents ("Case Study: Bringing Equity into the Sustainability Conversation | STAR Communities," n.d.). In Tucson, Arizona Market on the Move is a program that has allowed for all types of people to buy 60lbs of produce for $10 and the location moves to a new spot every month ("Market on the Move," n.d.). Combining these two ideas would allow Apache Junction to supply cheap healthy food to areas that lack physical and economic access. A barrier to this recommendation would be promoting the pop-up market and letting residents know of its upcoming locations. However, both Tucson and Dubuque used community areas, churches, and schools to both target specific areas and dispense at well-known and high use places.

D. Violent Crime Rates
Analyzing violent crime rates is one of the Leading Star Community Health and Safety indicators that evaluates whether or not a city or community can be deemed safe. The overall purpose and goal for this section is to prevent and reduce crime to increase perceptions of safety through interagency collaboration as well as with residents in Apache Junction. Currently, the Apache Junction General Plan does provide some information regarding Police-Law Enforcement in Chapter 11 Public Services and Facilities Element. However, the Apache Junction Police Department does have its own stand-alone Strategic Plan that identifies specific goals and strategies.

To analyze violent crime, the Leading Star Communities evaluation measure HS-7 Safe Communities, outcome 1 crime rates was used. The way a city or community is determined safe is by demonstrating the average crime rate for the past 3 years is below the following thresholds:
- 5.5 homicides per 100,000 residents
- 70 incidents of rape or attempted rape per 100,000 residents
- 462.7 aggravated assaults per 100,000 residents
- 2,596.1 incidents of property crime per 100,000 residents

Several data sources were accessed including the FBI's Uniform Crime Reports (UCR) System, City Data, Neighborhood Scout, and Area Vibes. Figure 14 below is a matrix of the data that was obtained.

Figure 14 Safe Communities

POPULATION	Star Evaluation Measure	3-Year Average between 2014-2016
	Per /100k	Per /100k
Violent Crime		175.23
Murder	5.5	2.00
Rape	70	16.67
Robbery		58.60
Assault	462.7	355.67
Property Crime	2,591	797.33
Burglary		1535.07
Theft		3435.20
Vehicle Theft		376.20
Total Crime		0.00
Arson		40.00
Full-Time law enforcement		
Officers per 100k / residents		1.48

As presented, the 3-year average in all four categories was less than the Leading Star Evaluation (LSE) measures. For example, the LSE measure for murder is 5.5 and the 3-year average for Apache Junction was 2.00. The LSE measure for incidence of rape is 70 and the 3-year average for rape in Apache Junction was 16.67. Aggravated assaults for LSE measure is at 462.7 and the 3-year average in Apache Junction was 355.67. Lastly, LSE for property crime is 2,591 and Apache Junction came in at 797.33 for a 3-year average.

Many of the goals and implementation strategies within the AJPD strategic plan do align with the Star Community rating system for action. For example, one action calls for adopting safe communities with strategic plans that have a comprehensive, balanced approach that includes violence prevention, intervention, suppression and enforcement, community policing and reentry strategies.

Apache Junction has similar goals, objectives, and strategies in the Police department's strategic plan (see Safe Communities 2). For example, listed under Goal 2: Partner with the Community, some of the objectives listed are providing accurate and concise public information such as participating in community events, promoting involvement in community organizations, and providing crime prevention and education programs.

One item of note, the Federal Bureau of Investigation strongly cautions against UCR data to rank communities or evaluate law enforcement effectiveness because crime rates can vary widely due to economic stability, job availability, population density and degree of urbanization, and the concentration of youth.

As in the case for Apache Junction, the validity of the LSE results may be questionable. The total population for the town of Apache Junction was only 37,775 in 2015 and measuring LSE is based on 100k per person. Another factor that may skew the resulting data, as mentioned earlier, is the degree of urbanization, or density.

E. Emergency Management and Response

The purpose of this component is to analyze and evaluate the preparedness of emergency responders to efficiently and effectively respond to emergencies. The goal is to reduce harm to humans and property by utilizing collaborative approaches to increase capability and capacity to respond to emergency incidents. Currently, the Apache Junction General Plan does provide information regarding Fire protection in Chapter 11 Public Services and Facilities Element. According to the General Plan, AJ has 4 fire stations 98 employees, 18 fire fighting vehicles. The city itself is part of the Superstition Fire and Medical District.

To analyze and measure Apache Junction's level of Emergency management and response, Leading Star Community Objective HS-3: Emergency Management and Response was used. Measurable outcomes that were applied included:

Outcome 1: Superior fire protection by achieving a current ISO rating of 3 or higher. The Superstition Fire & Medical District was last reviewed by ISO in 2015 and received a Public Protection Classification of 3. Also, the Arizona Fire and Medical Authority has accreditation with the Center for Public Safety Excellence (CPFA).

Outcome 2: Fire and Police Accreditation by demonstrating the police department has obtained Commission on Accreditation for Law Enforcement Agencies (CALEA) accreditation. Currently, the City of Apache Junction is not accredited through CALEA. Current law enforcement agency cities in Arizona that are accredited include: Buckeye, Chandler, Glendale, Maricopa City, Peoria, Scottsdale, Sierra Vista, and Surprise

Outcome 3: Community Emergency Management by demonstrating that the local government has received accreditation by the Emergency Management Accreditation Program (EMAP). Currently, Arizona as a whole is not accredited under this program, since the last accreditation was 2014.

F. Hazard Mitigation

The purpose of Hazard Mitigation is to eliminate the long-term risk to life and property from existing hazard events through an ongoing process that occurs before, during, and after disasters according to the Leading Star Health and Safety Component. Federal Emergency Management Administration (FEMA) has a similar definition where Hazard Mitigation is any action taken to reduce or eliminate long term risk to people and property from natural disasters. Hazard Mitigation planning is a process used by State, tribal, and local governments to identify risks and vulnerabilities associated with natural disasters and develop mitigation strategies to reduce or eliminate long term risks.

Within the General Plan, there is no section of Hazard Mitigation most likely because the city of

Apache Junction falls under the jurisdiction of Pinal County and is part of the Pinal County Multi-Jurisdictional Hazard Mitigation Plan 2016. (see Figure 15: Apache Junction Hazard Mitigation Map).

Figure 15: Apache Junction Hazard Mitigation Plan

Map 2-6: City of Apache Junction Land Use
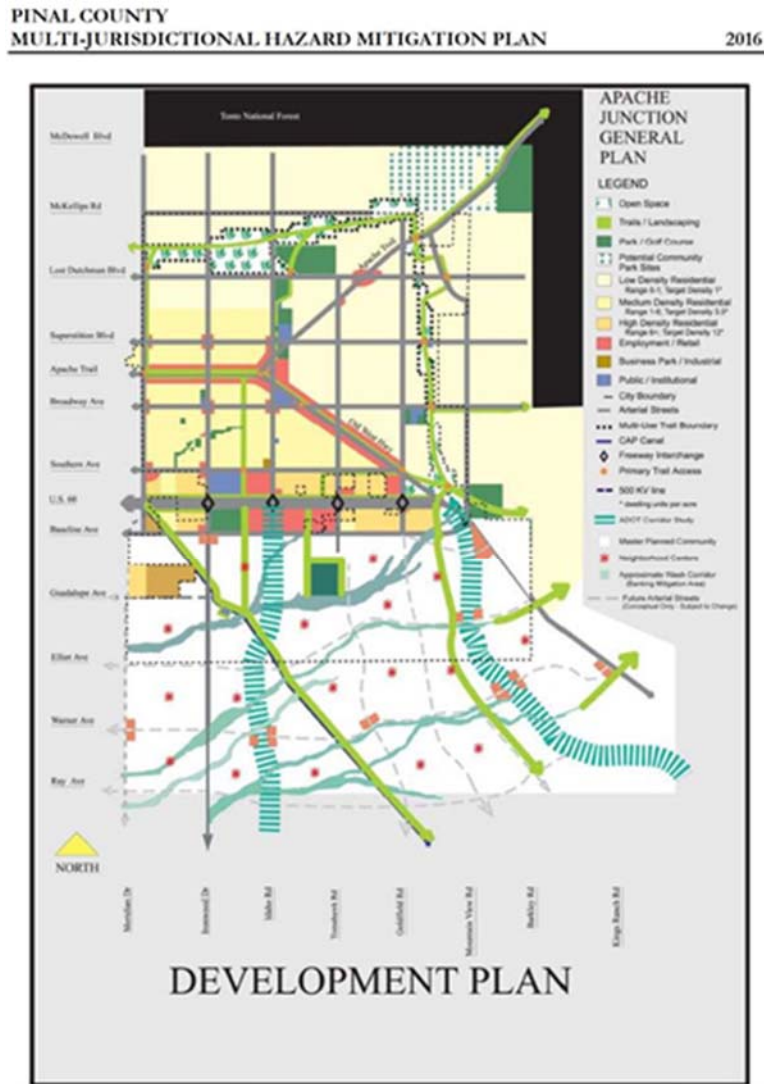
On August 18th of 2017, FEMA did approve the Pinal County Multi-Jurisdictional Hazard Mitigation plan under Title 44 Code of Federal Regulations (CFR) Part 201.6 Local Mitigation

Plans. The approval ensured continued eligibility for project grants under FEMA's Hazard Mitigation Assistance programs that includes: the Hazard Mitigation Program, Pre-Disaster Mitigation Program, and Flood Mitigation Assistance Program.

To analyze and measure effectiveness of Pinal County and the city of Apache Junction, the Leading Star Communities HS-6: Hazard Mitigation indicator was used. Some of the evaluation measures applied include:
Outcome 1: Location Specific Hazards by reducing over time the percentage of residents living in designated high-risk areas.
Outcome 2: Full Community Hazards by demonstrating a measurable reduction in vulnerability and/or increase in resiliency to existing communitywide hazard threats over time. Both of these Leading Star Outcomes align with the Pinal County Hazard Mitigation Plan. Section 5: Mitigation Strategy; 5.2 Mitigation Goals state:

GOAL: Reduce or eliminate the risk to people and property from natural hazards.
Objective 1: Reduce or eliminate risks that threaten life and property within Pinal County.
Objective 2: Reduce risk to critical facilities and infrastructure from impacts of hazards within Pinal County.
Objective 3: Promote hazard mitigation throughout Pinal County.
Objective 4: Increase public awareness of hazards and risks within Pinal County.

Figure 16 provides a matrix identifying risk profiles for cities within Pinal County. Three profiles are considered a high vulnerability to Apache Junction. Flooding, severe wind, and drought. Within the General Plan, under Chapter 11 Public Services and Facilities Element, flooding and stormwater management is discussed with goals such as implementing the 2002 City of Apache Junction Stormwater Master Plan, continuing to work with the Flood Control District of Maricopa County on stormwater management, and continuing to foster the joint use of retention basin facilities for both flood control and recreational activities.

Figure 16: Hazards to be Mitigated

Table 4-4: Hazards to be Mitigated

Jurisdiction	Flooding	Severe Wind	Wildfire	Drought	Fissure	Levee Failure	Subsidence	Dam Failure
Unincorporated Pinal County	x	x	x	x	x	x	x	
Apache Junction	x	x		x				
Casa Grande	x	x		x				
Coolidge	x	x		x				x
Eloy	x	x			x			
Florence	x	x	x	x				
Kearny	x	x	x	x				
Mammoth	x	x	x	x				
Maricopa	x	x						
Superior	x	x	x	x				

Hazard listed in order of most threatening as determined by the jurisdictions' CPRIs.

Vulnerability to flooding

Probability:	Highly Likely
Magnitude:	Critical
Warning Time:	6-12 hours
Duration:	24 hours
Rating:	3.35

Several homes are located within the 1-percent chance annual flood hazard area due to their close proximity to the Weekes Wash. The City is subject to the effects of both summer flash flooding, and general winter storm flooding. Two structures included in the Buckhorn-Mesa Watershed Project, the Apache Junction FRS and Weekes Wash Dam, help reduce the flooding hazard within the community. However, due to large the extent of homes, businesses, and infrastructure located within FEMA mapped flood hazard areas, potential magnitude/severity is rated as critical, as the impact to the community could be extensive.

Vulnerability from high winds

Probability:	Highly Likely
Magnitude:	Critical
Warning Time:	Less than 6 hours
Duration:	Less than 24 hours
Rating:	3.50

Apache Junction has a high number of manufactured homes as well as older homes which are more susceptible to damage from high wind events. In Chapter 12 under Housing Element, this issue is addressed though the General Plan with well-documented discussions about future housing rehabilitation, quality, diversity, needs according to the Pinal County Needs Assessment, and goals, strategies and objectives.

Vulnerability to Drought

Probability:	Highly Likely

Magnitude: Negligible
Warning Time: more than 24 hours
Duration: 1 week
Rating: 2.65

Apache Junction depends on tourism from the recreational activities of the four lakes, (e.g., Roosevelt, Apache, Canyon and Saguaro) northeast of The City on the Salt River. An extended drought (4-5 years) could have an adverse effect on these lakes which would result in a great economic impact on tourism dollars. Apache Junction is also dependent on the winter visitor population a drought could possibly affect these tourists as well. In Chapter 10 Water Resources of the general plan, implementation actions include developing a drought response plan by the Apache Junction Water Company and developing and participating in public education efforts for water conservation.

IV.   Strengths

Apache Junction has many strengths regarding health and safety. As seen in section IIIA, the City is home to quite a few non-profits that offer educational and outreach methods that teach people how to live healthier and safer lives. A strength for Apache Junction related to community safety is the Apache Junction Police Department Strategic Plan. Many of the goals and implementation strategies align with the Star Community rating system for action. For example, one action; Action 2 Plan Development calls for adopting safe communities with strategic plans that have a comprehensive, balanced approach that includes violence prevention, intervention, suppression and enforcement, community policing and reentry strategies. Apache Junction has similar goals, objectives, and strategies in the Police department's strategic plan (see Safe Communities 2). For example, listed under Goal 2: Partner with the Community, some of the objectives listed are providing accurate and concise public information such as participating in community events, promoting involvement in community organizations, and providing crime prevention and education programs.

V. Weaknesses

The City of Apache Junction does have some weaknesses. One problem seen throughout the chapter is that the City has a concentration of amenities along Apache Trail. This is potentially problematic for low-income people who do not have the means to travel to amenities when needed. It is also notable that most of the city could be considered a food desert which will become a future problem if the city begins to grow and residential areas form further and denser away from the main street. The City also lacks health goals in their general plan, therefore there is no comprehensive study on health amenities needed and wanted by residents in the area. Currently within Police-Law Enforcement, there are no strategies to address specific safety goals in the general plan.

VI. Recommendations for Improvement

In order for the City to become a leader in health and safety, there are a few recommendations that can be made. First, as seen in section IIIC, the city is mostly a food desert. However, with pop-up food markets, more people can achieve greater access to healthful foods at a discounted price. This type of market can also foster stronger community ties, and promote healthy eating and healthy choices in the community.

Another recommendation is in reference to section IIID Violent crime rates. After reviewing the Apache Junction Police Department Strategic Plan, one additional strategy that can be added is to perform ongoing data collection, evaluation, and monitoring from multiple agencies to track trends and identify emerging community needs. This could be added to Goal 1: Providing Public Safety Services to the People Within the City; Objective 1.1 Utilize Effective Patrol Practices.

VII. Specific Suggestions for 2020 General Plan Update

For the 2020 General Plan Update, the city should begin to increase residential density around Apache Trail. This will help bring more residents closer to health facilities and grocery stores. Also, encouraging residential nodes to be created in the more rural residential parts of the city would be beneficial. Nodes will allow for sustainable development and decrease reliance on stores and facilities along Apache Trail. Hopefully, nodes will contain healthful food stores so that some areas can become less of a food desert. The City should also increase education and outreach for health and safety training. Currently, there are no health and safety goals in the Apache junction General Plan and therefore, education and outreach can help the City determine what those goals are and how they can implement a plan to achieve them. This is an important step towards creating a healthy safe, and equitable community.

Another suggestion would be to incorporate law enforcement policies into the General Plan. Currently, there are no policies or strategic goals addressing law enforcement. The last version of the Apache Junction Police Department Strategic Plan was in 2009. An ideal example would be within the General Plan Envision Glendale 2040. Section 6.4 Public Health and Safety Element; Goal S-1: Maintaining adequate and effective law enforcement and incorporating crime prevention features in developments. Policies such as S-1.2 "The city shall employ best-practice law enforcement communication techniques to decrease response times. Another policy reference to consider is S-1.9 providing police education and assistance for community policing efforts, such as staff Block Watch programs, which adequately assign police officers as liaisons for specific neighborhoods. These types of policies could provide and acknowledge a unity between the city of Apache Junction, the police department, and the public.

VIII. Appendix

Appendix A: List of Health Facilities in Apache Junction

Planet Fitness - Gym
Apache Junction Senior Center – Senior care
Easter Seals Blake Foundation – Veteran care
1620 Foundation – Veteran care
Community Alliance Against Fam – Family care
Central Arizona Association - Academic, career training and personal enrichment classes
Boy's and Girl's Club of the East Valley – Child resource
Superstition Mountains Community Facility – Non-profit sewage collection
Empowerment Systems Inc - health education and wellness programs
Apache Junction Food Bank – Low-income, homeless care
AZ Living Well Institute - health education and wellness programs
Triple R - Provides services to adults with serious mental illness
Genesis Project - Organization seeking to feed, clothe and rehabilitate the homeless
Spectrum College Transition – Autism
Community Nutrition Resources – Nutrition resources
Arizona Youth Rough Riders – Youth Organization
Hope Women's Center – Women's services, classes, education, and assistance
Society of At. Vincent de Paul – Low-income assistance
Prospector Park - Park
Silly Mountain Trail Head - Trail
Flatiron Park - Park
Lost Dutchman Days Rodeo – Rodeo grounds
Banner Goldfield Medical Center - Hospital
Rising Star Wellness Center - Services to individuals/families with mental, co-occurring and substance use disorders
Heavens Medical, PLC – General medical care
Heavens Medical, PLC – General medical care
Saguaro Rehabilitation & Aquatic Therapy - Rehabilitation
NextCare Urgent Care – General medical care
La Frontera Empact – Mental health clinic
Independent Wellness Center – Medical marijuana facility
Sun Life Family Health Center – Primary health care
Banner Childrens - Hospital
Banner Goldfield Medical Center - Hospital
Phoenician Medical Center – General medical care
Raven Wellness Center – Naturopathic medicine
Dr. Conrad M Lawrence – Family Practice
Nature's Wonder Dispensary – Medical marijuana
Horizon Health & Wellness – Mental health and primary care
Kathleen Casey, NP – Nurse practitioner

Appendix B: Case Studies and Best Practices Mentioned in Analysis

Section IIIA
Santa Clara County Health Element in their General Plan:
https://www.sccgov.org/sites/dpd/DocsForms/Documents/HealthElement_20150825_Adopted_Final.pdf

Section IIIC
Market on the Move, Tucson
http://the3000club.org/wordpress/marketonthemove/

Pop-up Markets in Dubuque
http://www.starcommunities.org/star-updates/case-study-bringing-equity-into-the-sustainability-conversation/

Healthy Food For Ohio
http://www.healthyfoodaccess.org/node/46346

Section VII Specific Suggestions for 2020 General Plan Update
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Chapter 7 Natural Systems

Catyana Falsetti and Dwita Renanda

I.   Executive Summary

The City of Apache Junction (The City) encompasses approximately 22,272 acres and sits at the base of the Superstition Wilderness Area (Superstition Wilderness Area, 2018). The City's natural systems include the interconnected network of waterways, wetlands, woodlands, wildlife habitats, greenways and protected lands. These natural networks were evaluated using the Sustainability Tools for Assessing and Rating (STAR) community system. The STAR metrics are used by local governments to measure their progress towards a sustainable community and take into account environmental, economic, and social factors (AJ General Plan, 2010). This analysis also included examining data from the Apache Junction GIS site, Central Arizona Conservation Alliance map system, an i-Tree site analysis, and the U.S. Fish and Wildlife Service National Wetlands Inventory.

Apache Junction's current General Plan 2010 (The Plan) acknowledges the importance of natural systems through their discussion and included maps. Although the significance of natural networks is stated in The Plan, the document does not outline specific actions to preserve the environment. The Plan also notes the importance of the STAR Community Rating System but shows no steps or benchmarks to demonstrate the efficacy of the General Plan's goals.

Our recommendations arise from comparisons using examples from other cities and from a detailed literature review. Some of these suggestions include creating partnerships with local organizations including the Central Arizona Conservation Alliance, and creating nature trail connectivity with the surrounding jurisdictions. Since the Bureau of Land Management and the State Trust owns much of the land within The City, it would be wise to maintain these areas as a natural resource by designating them as preserves. Other suggestions include encouraging green initiatives by partnering with local schools and residents to plant native vegetation and trees around the city, removing invasive species, and organizing events related to improving natural habitat and ecosystem.

Consideration of natural systems in a holistic manner is required for a sustainable future. New development should be encouraged to use environmentally friendly designs strategies such as porous pavement, green roofs and green streets (EPA, 2009).

Policy recommendations include those that increase density in this built environment, which will decrease encroachment into the natural systems. This could be achieved through tiering the costs of utilities for future development. The developer would pay more the further away from the central business district a building is located. This higher density development would then lead to a more walkable environment, which would increase human health and lower air and sound pollution from vehicles. Other possible incentives include utilizing tax credits for water conservation including rainwater harvesting, native planting and xeriscaping.

II.   Introduction

Definition of Natural Systems
Green infrastructure can be made of natural, semi-natural and artificial networks of ecological systems (Tzoulas, 2007) including parks, reserves, trails, greenways, community gardens, and tree-lined streets (Wolch, 2014). Natural systems are the interconnected network of waterways, wetlands, woodlands, wildlife habitats, greenways and protected land. The term green infrastructure is in contrast to grey infrastructure, which consists of roads, utility lines, hospitals, schools, and prisons (Benedict, 2002).

The Natural Systems Goal Area as defined by the STAR Community Rating System are the ecosystem service benefits that provide food, water, and natural regulating processes. They also include cultural interests which bring aesthetic and recreational value. There are six objectives in the STAR Rating System under the Natural Systems category. These include Green Infrastructure, Biodiversity and Invasive Species, Natural Resource Protection, Outdoor Air Quality, Water in the Environment and Working Lands (STAR Rating system V. 2, 2017).

Importance of Natural Systems
Approximately 25,000 acres of wetlands are lost each year to greenfield development, primarily due to sprawl (Benedict, 2002). Greenfield land is undeveloped land. This degradation can lead to the disappearance and fragmentation of open spaces, the deterioration of water resources, and the decreased ability for nature to respond to change (Benedict, 2002). Adaptability is especially important in the face of changing weather patterns. It is essential to preserve the currently undeveloped areas as they support the ecological integrity of The City to promote physical activity, mental health and the overall health of residents. Greenspace filters air, removes pollution, lessens noise, cools temperatures, replenishes groundwater and provides food systems for those within the ecosystem (Wolch, 2014).

Based on an EPA 2009 report on Green Infrastructure in Arid and Semi-Arid Climates, the purposes of green infrastructure has benefits to the environment, society and the economy. These benefits that can include the reduction of flooding, water quality improvement, habitats to maintain a balanced ecosystem, reduction of the urban heat island effect, mitigation global warming, and increases in groundwater recharge. All of this together allows for increased biodiversity, which helps stabilize the environment.

Societal benefits include the cultivation of social networks around public spaces. A well-developed green infrastructure bestows social benefits including improving public health, beautifying neighborhoods, calming traffic, reducing landscape maintenance costs, increasing groundwater resources, reducing water imports, and reducing energy use (EPA, 2009). An improved green infrastructure can be an urban greenspace or community park where residents can build communities, and improve public health. Physical activity is increased with well-designed parks that have amenities including shade, greenspace, sitting areas, and recreational areas (Giles-Corti, 2003). This increased physical activity lessens illness and reduces mortality (Wolch, 2014). An increase in greenery will reduce stress for individuals, which in turn minimizes disease (Tzoulas, 2002).

The economic benefits include uses of trails, which attract more residents and tourists. In addition, a healthier community lowers medical costs, has fewer emergency room visits, and increases the output of the population.

About the Project
This project assessed the total area of greenspace within The City limits based on STAR Communities Natural System indicator measurement. The information was gained from different digital sources including Central Arizona Conservation Alliance (CAZCA), U.S. Fish and Wildlife and i-Tree sites. Based on the results, a set of recommendations was provided to assist the city in developing the city's natural system. Other cities' best practices for improving green infrastructure were provided for examples of implementation.

III.   Apache Junction Current Sustainability Assessment

Methodology

Assessment of The City's green infrastructure distribution was performed by implementing steps established with the STAR Leading Indicator for Designated Green Infrastructure (Indicator 21) as follows:

The percentage of the total area of green infrastructure distribution within the city was identified based on the following digital system/tools:

- a. Apache Junction ArcGIS tool
- b. Apache Junction Site Visit
- c. National Wetland Inventory (https://www.fws.gov/wetlands/Data/Data-Download.html)
- d. i-Tree Calculator
  - Tree coverage
- e. Greenprint or Central Arizona Conservation Alliance was access and the data were observed:
  - Hydrography Data includes wetlands, waterbodies, watershed and floodplain
  - Tree coverage

Then, the Apache Junction General Plan 2010 was reviewed to determine what actions are currently underway by The City. This was followed by recommendations for the future, gathered from literature review, as well as examples of how other communities are maintaining their natural resources.

Results

AJ ArcGIS

Using the AJ ArcGIS, 13,796.5 acres of land were found to be undeveloped, and were considered greenspace. This suggests that at least 62% of the available land in The City of Apache Junction is undeveloped, which is well above the STAR Communities recommended 35%. The largest amount of undeveloped areas are seen along the north, south and eastern borders of The City (Figure 1).

Figure 1. Greenspace in Apache Junction; Source: AJ GIS

Site Visit

On March 21, 2018 the Arizona State University Planning for Sustainable Communities class performed a site visit with a tour guide of The City. During this tour we noted that there was little tree cover, or a unified central business district. The city's residents are geographically spread apart, and there were multiple types of housing ranging from mobile housing units, which represent more than half of the population, to large one and a quarter acre lot homes (AJ General Plan 2010).

The City does not provide waste disposal uniformly, thus many residents choose to dump trash on land within The City. This is harmful to the natural resources such as groundwater, the ecosystem and potential chemical pollution.

CAZCA (Greenprint) findings
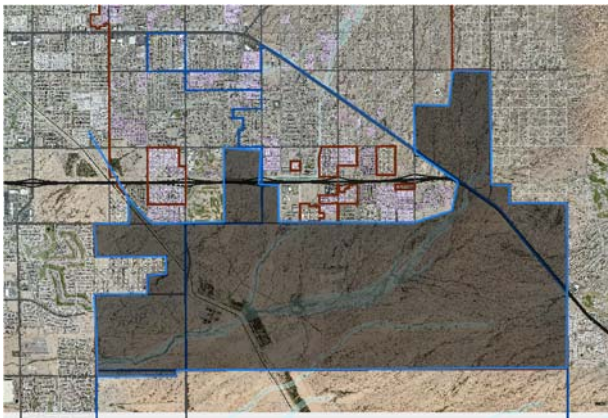
The Conservation Alliance of Central Arizona (CAZCA) is a creation of the Desert Botanical Garden to gather information to preserve systems that "support healthy ecological systems functions and provide beautiful, safe open spaces for recreation, education, and relaxation" (About Us, 2018). CAZCA has created partnerships with governmental, and non-governmental agencies around Arizona to integrate all ecologically relevant data. This is a resource for the public, builders, developers, and other agencies to easily access relevant data for the planning of projects in an environmentally sound manner.

Figure 2. Hydrography data; Source: CAZCA

CAZCA finds that there are many valuable water resources running throughout The City. There is a total hydrography area 8,933.2 acres or 40% of the area that needs to be taken into consideration during development.

Figure 3. Habitat integrity; Source: CAZCA

According to CAZCA 18,246.6 acres of Apache Junction is necessary to ensure. Habitat Integrity - all types, which is 82% of The City of Apache Junction's total area.
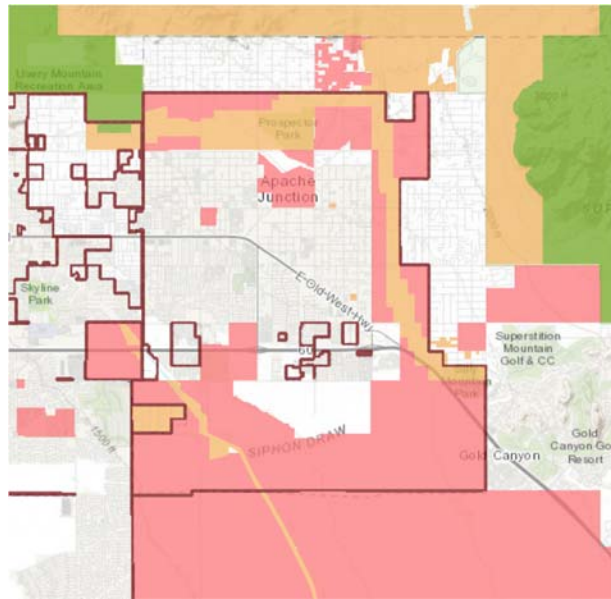
Figure 4. Protection level; Source: CAZCA

Figure 4 shows that the majority of the undeveloped land has no protection status (red) and could be developed in the future. There are connected trails that are protected (orange), which provides a natural corridor for human hikers and biodiversity.
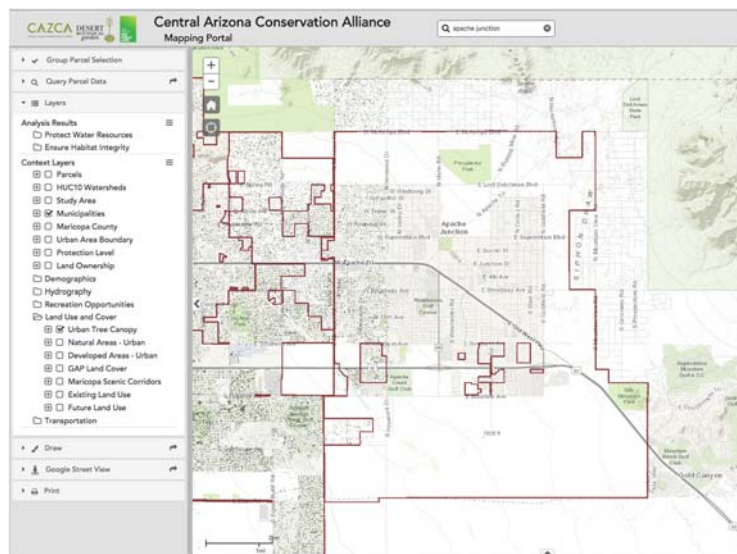
Figure 5. Urban Natural Areas; Source: CAZCA

There are few Urban Natural Areas (parks and recreational areas within the city)
Measuring 2,142 acres or 9.6% of are area of within The City of Apache Junction
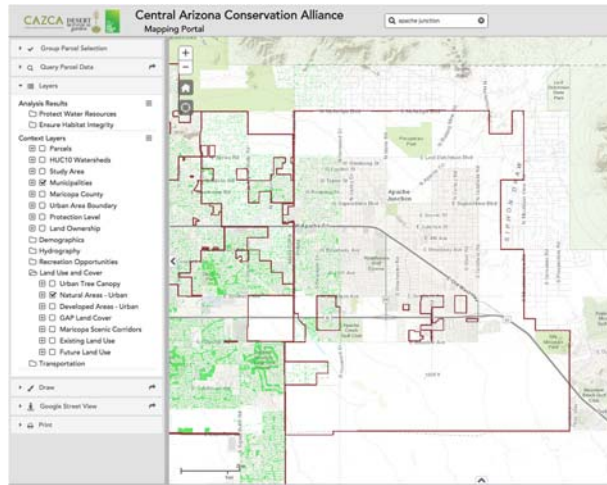
Figure 6. Cazca Tree Coverage; Source: CAZCA

The tree coverage is shown as green dots that were largely found in the western region of The City. The rest of Apache Junction shows little to no tree coverage.

i-Tree

i-Tree is a web based application that allows users to measure the tree coverage of a geographic area. It is a software suite from the U.S.D.A. Forest Service that provides analysis and assessment tools. Based on the data using i-Tree Canopy tool using 1,000 points as reference, the outcomes were 7.71% tree coverage, 81.6% non-tree coverage, and 10.7% shrub coverage (Figure 7).

Figure 7. i-Tree Canopy results

The benefits of having tree coverage are outlined in the i-Tree report (Figure 8), which include the removal of carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide, the percentages of these benefits from the amount of trees calculated are shown below.

Tree Benefit Estimates

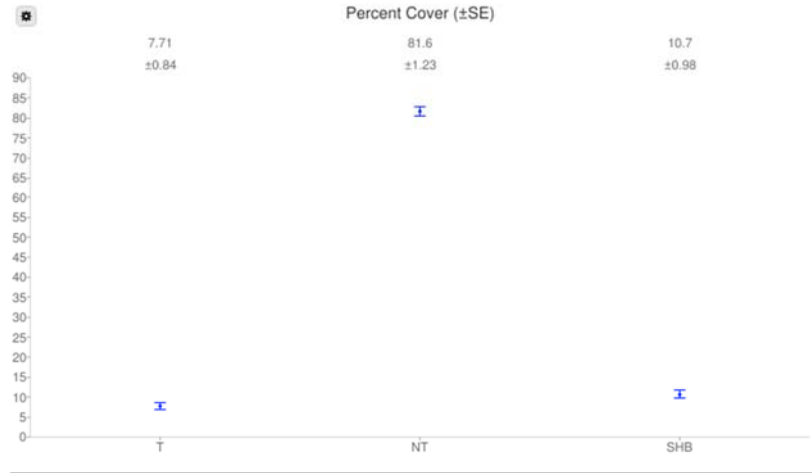| Abbr.	Benefit Description	Value (USD)	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	62.41 USD	±6.83	1,472.35 lb	±161.19
NO2	Nitrogen Dioxide removed annually	107.45 USD	±11.76	4.01 T	±0.44
O3	Ozone removed annually	5,595.91 USD	±612.64	39.98 T	±4.38
PM2.5	Particulate Matter less than 2.5 microns removed annually	11,567.77 USD	±1,266.45	1.94 T	±0.21
SO2	Sulfur Dioxide removed annually	18.78 USD	±2.06	2.53 T	±0.28
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	4,062.49 USD	±444.76	13.39 T	±1.47
CO2seq	Carbon Dioxide sequestered annually in trees	286,996.16 USD	±31,420.53	8,140.49 T	±891.23
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	7,236,067.29 USD	±792,209.33	205,247.20 T	±22,470.60

i-Tree Canopy Annual Tree Benefit Estimates based on these values in lbs/acre/yr and USD/T/yr: CO 0.902 @ 85.08 USD | NO2 4.917 @ 26.86 USD | O3 48.968 @ 140.47 USD | PM2.5 2.379 @ 5,975.67 USD | SO2 3.096 @ 7.45 USD | PM10* 16.403 @ 304.43 USD | CO2seq 9,970.817 @ 35.38 USD | CO2stor is a total biomass amount of 251,395.359 @ 35.38 USD
Note: Currency is in USD
Note: Standard errors of removal amounts and benefits were calculated based on standard errors of sampled and classified points.

About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

A Cooperative Initiative Between:
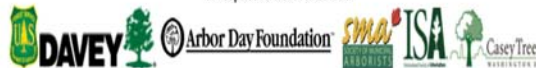
www.itreetools.org

Figure 8. i-Tree Benefit Estimates
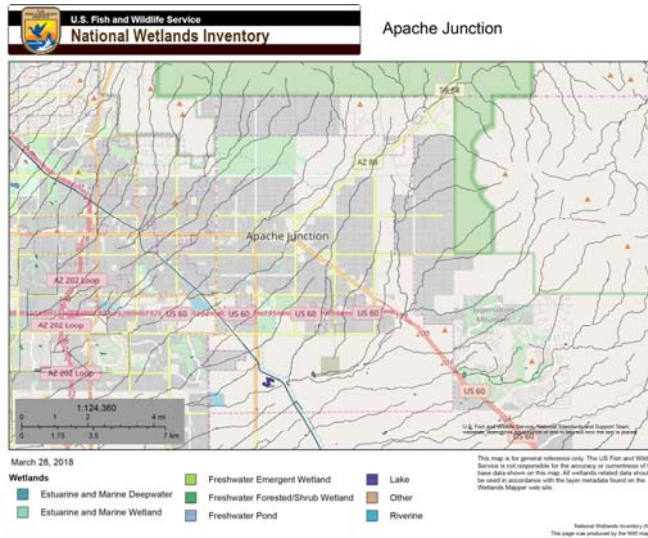
Figure 9. US Fish and Wildlife Service Wetlands

US Fish and Wildlife Service National Wetlands Inventory Results

The black lines show wetland areas (Figure 9) that run diagonally through the entire jurisdiction of The City of Apache Junction. There are over 14 identified wetlands that are natural paths for water to be present. These are often a result of runoff from the Superstition Mountains or during the heavy rain season.

Apache Junction Land Ownership
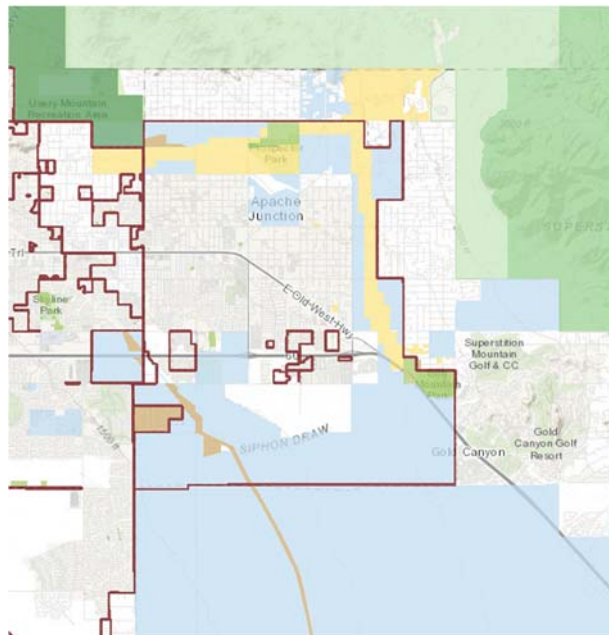
Figure 10. Land Ownership; Source: CAZCA

Approximately 53% of the land within the City of Apache Junction is owned by other agencies, largely the State Trust Land (blue) or the Bureau of Land Management (yellow) (Figure 10).
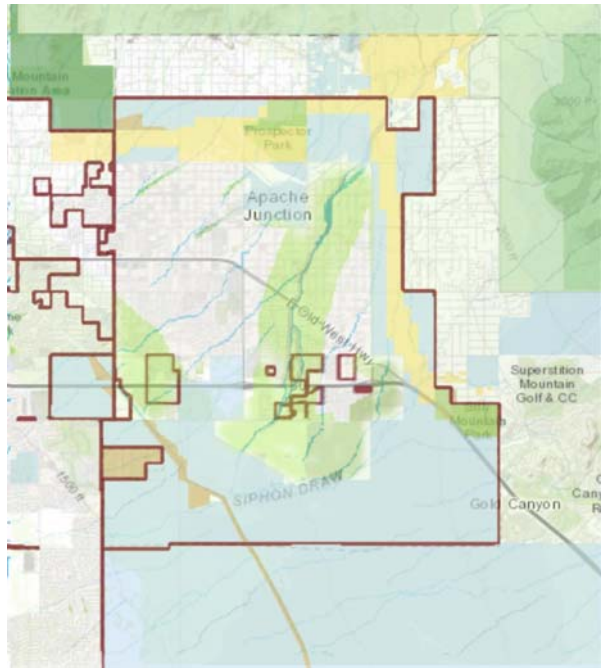
Figure 11. Habitat areas and water resources; Source: CAZCA

The most valuable habitat areas and water resources overlaid with land ownership illustrates that most of the valuable land is owned by the state or federal government. There are significant water resource areas that run diagonally through The City (green) which should be considered in future development or during the reinforcement of new infrastructure.

Apache Junction's Current Actions for Natural Systems

The administrative policies The City has implemented were identified based on the 7 actions established in STAR Leading Indicators on Green Infrastructure Objective Area. The following sources were observed to identify the actions:

a. Apache Junction 2010 – 2020 General Plan
b. Apache Junction Trail Connectivity, Downtown Visioning & State Land Visioning
c. Apache Junction Site Visit

Current Action 1: Inventory, Assessment or Survey
Based on the General Plan, The City determines the existing and future parks and open city within city limits. However, there are no continual assessment steps on the specific usage of stormwater and watershed distribution (see Figure 12).
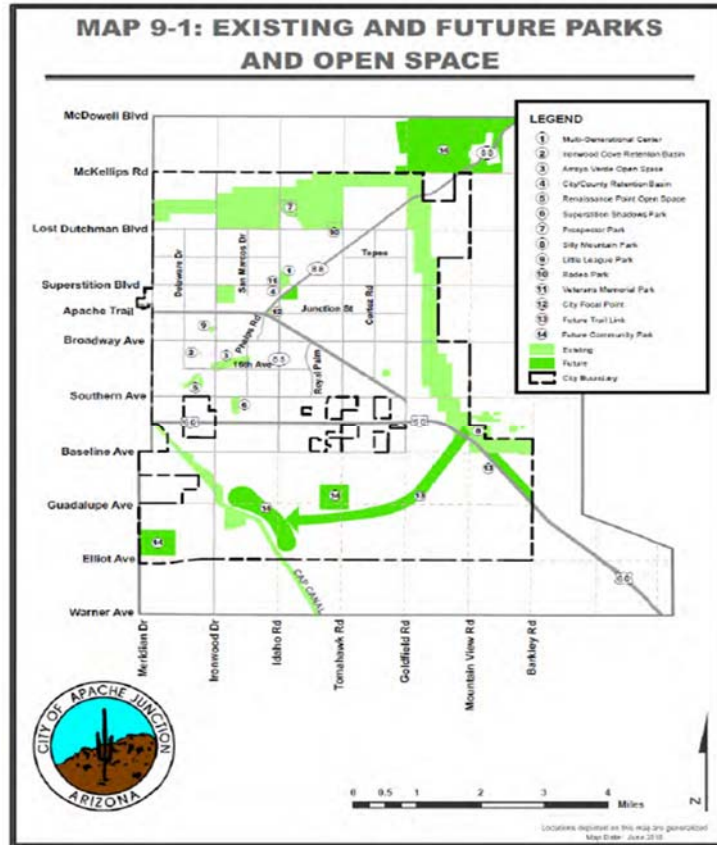
Figure 12. AJ GP, 2010

Current Action 2: Plan Development

The City established implementation action plan for Environmental and Energy elements. However, progress reports for each program are unavailable or could not be found. In addition, for the educational efforts, no department has been assigned to this action.

Table 1. Implementation Tasks from Apache Junction General Plan 2010

Apache Junction General Plan Element	Implementation Action	Department Responsible for Implementation	Implementation Priority
Chapter 7 Environmental	Develop process to evaluate long-term environmental costs of all municipal activities		Long Term
	Develop education and communication programs focused on environmental awareness		Medium Term
	Adopt and implement a	Development Services	Medium Term

	sustainable building policy		
	Implement green building standards for non-residential buildings > 5,000 sq. ft.	Development Services	Long Term
	Update landscape standards to better address heat island effect	Management Services	Medium Term
	Develop and implement a city wide recycling program.	Development Services	Medium Term
	Re-evaluate The City's Dark Skies ordinance.	Development Services	Medium Term
Chapter 14 Energy	Require green building practices for new construction of public buildings and facilities.	Public Works	Medium Term
	Develop a green procurement strategy for office equipment and supplies.	Public Works and Management	Long Term
	Convert a portion of The City's vehicle fleet to alternative fuels.	Public Works	Long Term
	Convert City facilities low energy lighting.	Public Works	Medium Term
	Develop green incentives for green private development practices.	Development Services	Medium Term
	Develop and implement an energy conservation policy plan.	Management Services	Long Term
	Establish a green building program.	Development Services	Medium Term

Current Action 3: Policy and Code Adjustment

In Land Use Element section of the General Plan, The City states that one goal is to "encourage and promote sustainable land use development" with general objectives and strategies as follows:

Objective: Create and administer a Green Building Program
1. Policy: Encourage use of green building standards
2. Policy: Zoning regulation should include sustainable development standards

Objective: Promote educational outreach of sustainable technologies and practices
1. Policy: utilize City resources to promote sustainable awareness

Strategies:
- Review and update zoning regulations to include appropriate green development standards.
- Create a voluntary green building program.
- Use City's web site to educate and inform the public.
- Use City's cable system to educate and inform the public.
- Train appropriate City staff to understand and administer sustainable building/development programs." (AJ's General Plan, 2010)

The implementation report or any updates about the above statements are unavailable, thus further assessments could not be performed.

Current Action 4: Partnerships and Collaboration

In the Parks and Recreation implementation plan, The City's short term goal to pursue partnerships with local land management organizations to preserve open space.

In the Water Resources goals, objectives and strategies, The City also includes the following subject:

- Investigate creative partnerships for the supply and delivery of water to existing and new development in Apache Junction

Yet, no further specification is described in regards of the above statements.

Current Action 5: Enforcement and Incentives

In Energy element goals, objectives and strategies run by municipal initiatives stated is:

- "Explore and develop incentives and educational green awareness programs for developers, builders and residents that identify the short, mid and long-term benefits of energy efficiency
- Develop and implement an energy conservation policy plan that will document policies and incentives to promote greater use of renewable energy"

In the Energy implementation section, The City plans to develop green incentives for green private development practices as medium-term priority. However, no further specification is described in regards of these statements.

Current Action 6: Practice Improvements

There are no established green infrastructure monitoring program and regular report on status of desired outcomes.

Current Action 7: Facility and Infrastructure Improvements

The City has shown a commitment to green building by upgrading their city hall into a LEED-certified building. Further clarification and description must be done in this section. Further observation must be done to identify if the city dedicates a percentage of funding invested in green infrastructure.

IV.   Strengths

The City of Apache Junction has many valuable natural resources. The majority of the land within The City is currently undeveloped. The City sits at the base of the Superstition Mountains and has precious natural habitat used for hiking, biking, and horseback riding. It is located between the Superstition Mountains to the east, the city of Mesa to the west and the Goldfield Mountains to the north. Maintaining these natural connectors is vital to keeping the value of these resources viable. There are many recreational trails, from the Usery Mountain Regional Park and throughout the Superstition Wilderness Area, which has ~160,200 acres (Superstition Wilderness Area, 2018).

Another strength is the willingness that The City has demonstrated to work to gain new ideas, which is shown through this Project Cities partnership with ASU and the time dedicated by the staff during this process.

V.   Weaknesses

Significant weaknesses include a lack of active protection of natural resources. The State or Federal government owns many of the valuable natural systems within The City and there are no mechanisms in place to guarantee the preservation of these resources. Another prominent weakness in The City is the low tree-coverage, which reduces the comfort of the environment, due to heat and pollution.

There is a lack of the prioritization of the natural environment for future building development, and natural resources information is currently not present on the Apache Junction website. There were no apparent partnerships with other local jurisdictions to create a coherent plan for the maintenance and usage of natural resources.

Another flaw is the lack of implementation strategies to reach the General Plan 2010 goals, or a reporting system to demonstrate the progress of The City and its inhabitants in preserving their natural resources.

VI.   Recommendations for improvement

The following is an itemized, but not exclusive, list of recommendations for The City of Apache Junction to implement in order to improve its use of existing natural resources, establish partnerships to aid in developing a long term sustainable plan, and to define clear and objective measures to evaluate progress.

Priority actions
- Partner with state and federal land owners
  - Solidify long-term preservation of the wildlife corridors by creating contracts with the State of Arizona Bureau of Land Management to maintain the natural corridor.

- ○ Example: In Flagstaff, Arizona the city worked with the Arizona Game and Fish Department along with Coconino County to create a more effective plan to conserve wildlife. They also work with other agencies, including the Greater Flagstaff Forests Partnership to ensure healthy forests, focusing on how to address invasive species and protection of water systems (Flagstaff Regional Plan, 2017). The City of Apache Junction should partner with existing agencies or non-governmental entities or other non-profit organizations who have the same goals, or similar knowledge of the region.
- Inventory, Assessment or Survey
  - ○ Collaborate with the Central Arizona Conservation Alliance (CAZCA) to gather natural resource information
- Policy and Code Adjustment
  - ○ Use the information from CAZCA to inform permitting decisions to maintain the natural resources for new building and development
  - ○ Include green standards in the existing policies such as International Green Construction Code (IGCC) or U.S. Green Building Council's green building requirements
- Formal Partnerships and Collaboration
  - ○ Partner with CAZCA to integrate natural system information into the AJ GIS System
  - ○ Partner with the Bureau of Land Management and the State to make the BLM and State Trust Land into a preserve and connect the trail system from Usery Mountain Recreational Area
  - ○ Partner with local and regional schools to further the public's education. Example: The City of Portland, Oregon partnered with its residents and schools *to green the city through planting trees and other vegetation, removing invasive species and improving watershed health and creating new wildlife habitat*. The city also established a Learning Landscape Program that employs 700 students and teachers from nine schools with low-level of green canopy to plant over 70 trees (Figure 13). Fifteen low-level canopy neighborhoods were given about fifty educational workshops on how to maintain and to preserve the trees (Portland's CAP Progress Report, 2017)
  - ○

Figure 13. Portland, WA landscape educational program (EPA, 2014)

Map 2-2: Connectivity Network with Land Ownership   SECTION 2

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Figure 14. ASU Trail Connectivity Map (ASU MUEP, 2016)

- ○ Utilize the Arizona State University (ASU) Trail connectivity plan to enhance the usage of natural lands for recreational use and to maintain future natural resources (Figure 14)
- ○ Actively participating in regional involvement such as:
    - Low Impact Development & Green Infrastructure Group, county-wide committee that working on local standards and specifications for stormwater pollution minimization according to Municipal Separate Storm Sewer System (MS4) Permits
    - ASU's Sustainable Cities Network
    - Best Practices & Green Building Working Group
- ● Enforcement and Incentives
  - ○ Create a tiered pricing system for future development implementing higher costs further away from the city center
  - ○ Create promotion cards to showcase and solicit participation of The City's green building program in homes or commercial projects
  - ○ Create incentive programs to encourage landowners to adopt green infrastructure practices that link to broader green infrastructure systems (STAR Community, 2018)
- ● Practice Improvements
  - ○ Become a STAR Community Member and utilize their rating system requirements for development and adopt the suggested actions for the preservation and development of lands including educating the community as to the importance of the natural resources, beyond the "view" or economic impacts (STAR Community, 2018)
  - ○ Use "Nature-based solutions" to promote urban regeneration. These enhance sustainable urbanism through ensuring ecosystem functions are protected, to restore the functionality of any degraded systems, developing climate change adaptation mitigation by redesigning human made systems, and improving risk management by using nature based design, which provides many services including reduction of pollution, carbon storage, biodiversity conservation, reducing heat and enhancing water retention (Scott, 2017)
  - ○ Use a "Green Infrastructure Spatial Planning (GISP) model that uses six criteria for development assessment. The criteria include: stormwater management, social vulnerability, greenspace, air quality, urban heat island amelioration and landscape connectivity (Meerow, 2016)
- ● Facility and Infrastructure Improvements
  - ○ Dedicate a percentage of funding invested in green infrastructure

○　Upgrade public spaces and public buildings based upon locally adopted or recognized best practices in green infrastructure; where possible, create demonstration projects to enhance public support (STAR Community, 2018)

VII.　Recommended Updates to the General Plan

- Include prioritization of the open space and the environment, language below taken from the Town of Queen Creek General Plan 2018 (page 4):

> "**Recreation, Parks, & Open Space Element**
> Goal 1: Develop a comprehensive park system to provide open spaces and recreation opportunities appropriate to a community the size of Queen Creek.
>
> **Environmental Element**
> Goal 3: Prevent pollution of the Queen Creek and Sonoqui washes and groundwater system. Goal 4: Promote environmental sensitivity in the built environment. Goal 5: Maintain the desert character and environment in the San Tan Foothills"

- Add green street implementation to the AJ General Plan. This policy adoption is seen in Tucson, Pima County AZ methods to enhance resilience to flooding and drought are implemented through partnership with Non-governmental Organizations (NGOs) using a concept called green street (Figure 15). This idea integrates planting with street designs to infiltrate rainwater, augment local water supplies, reduce water pollution, increase aesthetics, and reduce the heat island effect (EPA, 2016).

Figure 15. Tucson, AZ Green Street (EPA, 2014)

- Plan Development
  - Enhance financial benefits to encourage development in the downtown area.
  - Outline the societal, economic and environmental benefits of urban compactness around a central area in the General Plan
- The AJ General Plan should adopt a tree ordinance. An example of this is seen in Scottsdale, AZ policy with the use of Tree City USA, "*where a community must adopt a tree ordinance; appoint a board, department or commision to advise the city on urban forest issues; spend at least $2 per*

capita on community forestry activities; and hold an Arbor Day celebration" (Figure 16) (Scottsdale General Plan Report, 2016).

Figure 16. Tree City USA (Scottsdale, 2016)

VIII.   Conclusion

The importance of preserving the existing green infrastructure cannot be stressed enough. The City of Apache Junction has valuable natural resources that can promote the health of its population, balancing the ecosystem and adds financial value for tourism, and residents. Taking the recommendations outlined in this chapter and putting them into action can be performed with relative ease and at a low cost to The City. These natural systems will only benefit The City and its residents in both seen and unseen ways.

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