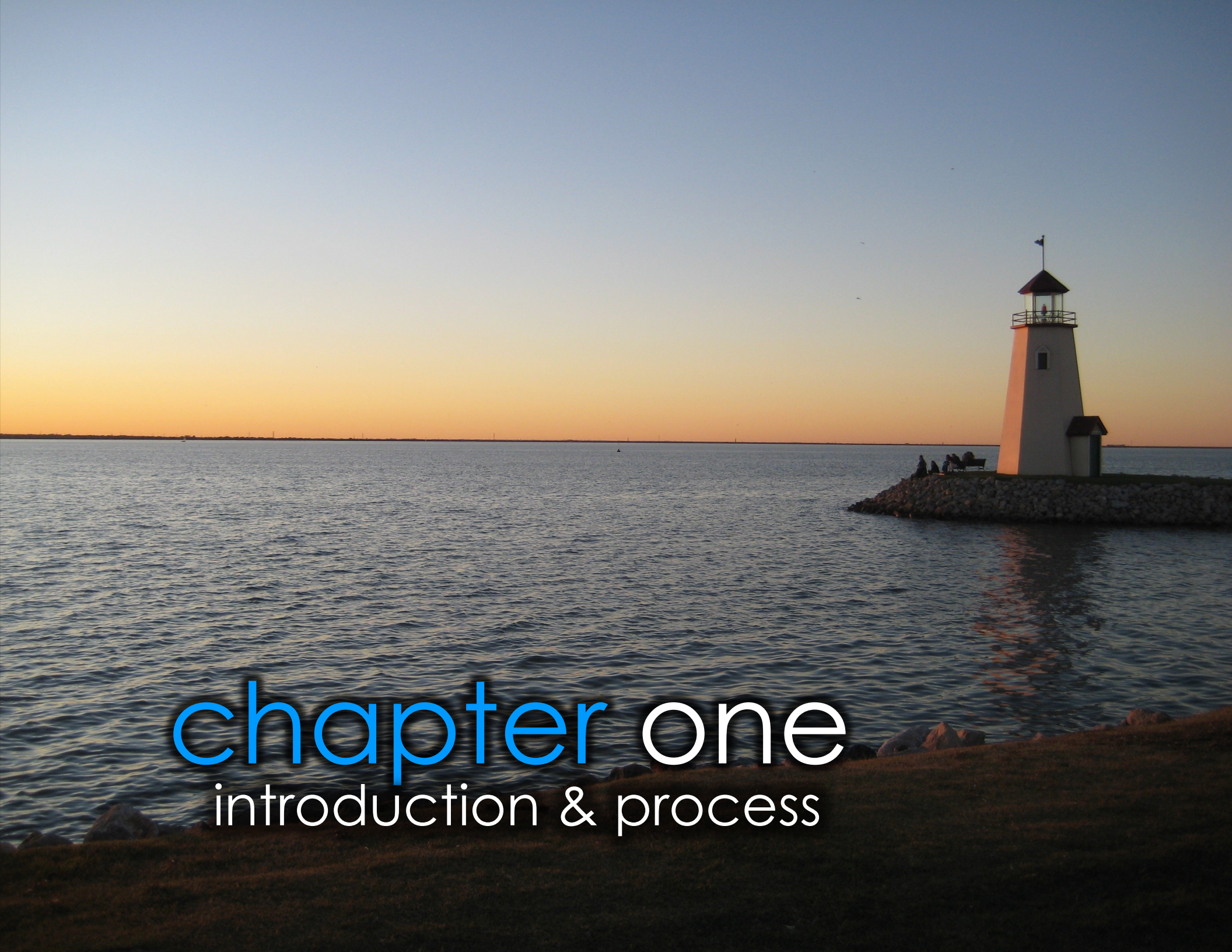


chapter one

introduction & process

CHAPTER 1: INTRODUCTION & PROCESS

1.0 Introduction

What is adaptokc?

The first of its kind for Oklahoma City, adaptokc is a policy document that identifies how we can strengthen our community in the face of economic, environmental, and social challenges. Through this plan's research and analysis, our policymakers, businesses, residents, and institutions can work together to face volatility and change with practical solutions.

In 2015, Oklahoma City adopted its first fully-new comprehensive plan since 1977, planokc. As a new vision for policy, infrastructure, and planning, it is within planokc where the seeds of a community-wide sustainability plan were planted. Through adaptokc, many of the environmental and economic components of the comprehensive plan are explored more deeply, especially amid the rapid changes we are continuing to see in every facet of society.

We are, to borrow from Sam Anderson, a boom town. We have witnessed a renaissance on the plains here in Oklahoma City thanks to the renewal of growth and revitalization first catalyzed by MAPS in 1993. Our metro is responsible for approximately 38% of Oklahoma's gross domestic product (GDP) and, at about 1.4 million residents, is home to 35% of statewide population. Through booms and busts, the Oklahoma City metro's GDP has jumped an estimated 101% between 2001 and 2017, a greater pace of GDP growth than that of the Tulsa, Denver, Kansas City, Atlanta, Chicago, and New York City metros during the same period. Throughout this unprecedented growth, however, is a crucial question: how does a city half the size of Rhode Island with a population density below that of Lawton achieve greater growth amid finite resources?

We chose to call this plan adaptokc for several reasons. One, adaptation is a dynamic process of action and refinement that seeks to constantly improve while also allowing for planning and preparation before crises. Second, in nature, organisms that adapt, that respond to external stimuli, do more than just sustain - they flourish. Third, the complexity and rate of challenges we encounter as a community will only grow and it is our responsibility to not just meet those challenges, but ensure a city where all residents can thrive. That means efficient and effective public services, an environment rich with clean air and water, livable wages, unmatched quality of life, fully-funded and maintained infrastructure, and a community of equity and opportunity.

One of the most serious threats confronting us is climate change. Characterized by changes in temperature and precipitation, climate change is a threat multiplier, intensifying existing challenges already facing us through infrastructure, safety and security, and public health. To that end, Moody's Investors Service published a white paper in early 2019 on U.S. cities addressing efforts to mitigate the impact of climate events. Based on the 50 largest Moody's-rated U.S. cities by outstanding debt, 57% have developed sustainability or adaptation plans but, when including those that intend to adopt such plans by the end of 2019, that number jumps to 82%. These plans are seen as "credit positive" as they indicate "how a city manages infrastructure vulnerabilities, current and future capital costs, mitigation of potential economic impacts and risk of population loss." Moody's notes that while the federal government has "traditionally provided strong support for cities contending with the costs of natural disasters," should those funds wane it will result in greater state and/or municipal debt to finance recovery and adaptation.

But our changing climate is not the only challenge to which we must adapt. Exponential changes in technology, labor, law and regulation, taxation and revenue, demographics, and development are slowly demanding new perspectives and approaches. Through adaptokc, we can begin to collectively sustain the growth and success Oklahoma City has seen thus far through the resilience that has come to define us.

> "Cities' increasing focus on climate risks is a credit positive, particularly as climate change is forecast to increase the frequency and severity of extreme weather events. The risks from climate change include economic disruption, infrastructure damage, insufficient health and public safety services, and population displacement."
>
> - Moody's Investors Services, "Cities' heightened focus on mitigating climate risk is credit positive," January 2019

How is adaptokc Organized?

Three core sections of adaptokc make navigation straightforward:

Chapter One: Introduction and Process establishes adaptokc's foundation by defining both adaptation and sustainability in the context of Oklahoma City. It presents an overview of research and development necessary for adaptokc and what prior plans and studies inform it.

Chapters Two - Five: Topics. Each of these four chapters are structured to present an overview of present conditions, policies, and challenges along with initiatives to pursue to accomplish goals laid out in each. The topics include electricity and renewable energy, landfill emissions, ground-level ozone air pollution, the urban heat island effect, green infrastructure, and recycling.

The chapters are:

- Energy Productivity
- Natural & Built Environment
- Air Quality
- Waste Reduction

Each chapter contains Goals, Initiatives to achieve Goals, and Policies to achieve Initiatives.

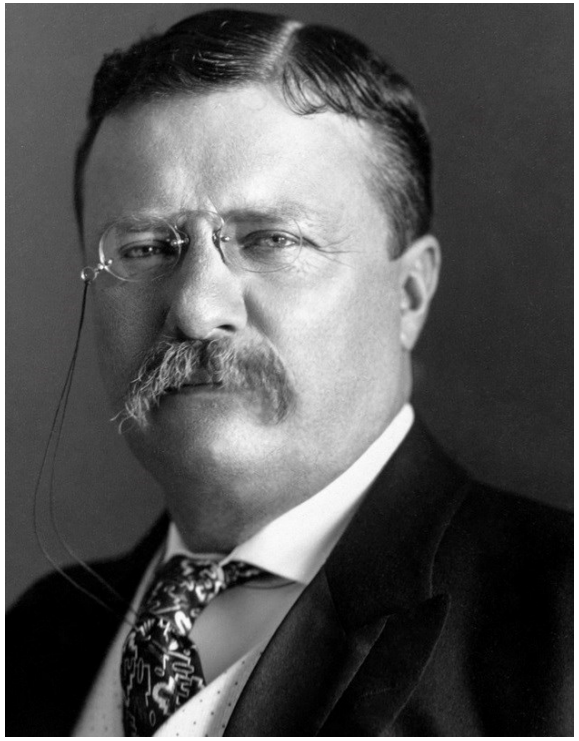
Chapter Six: Policies and Implementation lays out the next steps for adaptokc, merging the goals, initiatives, and policies with prioritized action and data-backed benchmarks to track progress in the near-term and long-term.

Maintaining adaptokc

As a living document, adaptokc requires updates to capture current and accurate progress as well as changing conditions. Such maintenance can range from updates to analysis to modification and addition of policies.

The Office of Sustainability will report accomplishments and progress toward achieving the adaptokc goals through the indicators identified in Chapter Six as well as use of the City's performance measurement platform Leading for Results (LFR). Office of Sustainability staff will aggregate data from specific existing LFR measures and proposed LFR measures to provide a snapshot of progress across City departments.

To remain consistent with the priorities of City leadership and to respond to shifts in economic, social, and environmental policy conditions, the Office of Sustainability will comprehensively evaluate the plan's progress and on-going feasibility every five years. This important evaluation will include not just updates to indicators but proposals to adjust and recalibrate targets, especially as the larger regulatory and political landscape changes. This evaluation will be presented to City officials along with any recommended policy changes.



"I recognize the right and duty of this generation to develop and use the natural resources of our land; but I do not recognize the right to waste them, or to rob, by wasteful use, the generations that come after us."

- Theodore Roosevelt
26th President of the United States, Conferred Statehood to the Oklahoma Territory

1.1 The Office of Sustainability

Oklahoma City is among more than 120 U.S. cities and counties with established sustainability offices and positions. First conceived in 2008 by a taskforce of City leaders convened at the behest of the City Manager, the City of Oklahoma City's Office of Sustainability was created with City Council's adoption of the FY10 budget and began operation on July 1, 2009.

Soon thereafter, the City received a $5.4 million award through the U.S. Department of Energy's Energy Efficiency and Conservation Block Grant (EECBG) program, funded by the American Recovery and Reinvestment Act. The Office of Sustainability led development of an Energy Efficiency and Conservation Strategy to determine how best to apply EECBG funds to meet federal program goals of increased energy efficiency, reduced fossil fuel emissions, reduced total energy use, economic growth, and job creation and retention.

Over a three year period, the Office of Sustainability primarily administered EECBG funds and managed projects and programs including the installation of the City's first fast-fill CNG fueling stations to service fleet CNG vehicles; adoption of the International Energy Conservation Code for commercial properties; development of sustainability guidelines for Historic Preservation districts; start-up capital for a downtown bike share program; installation of solar-powered trash and recycling receptacles throughout downtown; and an all-day Green Roof Symposium with engineers, architects, and experts on the implementation of vegetated roofs.

Upon full expenditure of the City's EECBG award, the Office expanded to policy development to guide the City towards reduced costs while simultaneously providing environmental benefits. These included a City recycling policy which ushered in a deskside recycling program at City buildings; a desktop printer policy to eliminate costly maintenance and paper waste by centralizing department printers and set double-sided printing as default; an update to the City's energy policy beginning the consolidation of City utility account data across all properties and departments; and a procurement policy for City buyers about the City's commitment to the purchase of products less toxic, wasteful, and costly to dispose of.

Public and private grants were also won to launch new projects and extend existing programs. These include the installation of cigarette recycling receptacles on downtown light poles; the installation of 66 bicycle racks, 4 bicycle repair stations, and pedestrian signage in 10 business districts; and an EPA award to assess green infrastructure storm water management within a square mile area of the city's urban core.

The Office of Sustainability has always had a public education component, too, speaking to civic groups, businesses, neighborhood organizations, state and federal agencies, universities and schools, and nonprofits, as well as participating in media interviews, conferences, and forum panels. The Office has also organized public event and education opportunities including workshops to repurpose donated soda syrup barrels into rainwater harvesting barrels for homeowners; walkability workshops and audits with stakeholders in and around neighborhoods, schools, and business districts; and a home energy fair to offer homeowners and property owners opportunities to learn about energy efficiency, renewables, and on-site water conservation.

Yet through all of these programs, projects, and accomplishments, the Office of Sustainability has lacked a unified, large-scale framework to define and guide the integration of sustainability into City policies and procedures. The advent of adaptokc seeks to change that. This plan includes consideration of one-off projects, externally-funded programs, and partnerships, but also mines opportunities to develop policies that codify sustainable practices for the purposes of stability, clarity, and longevity.

With this intent, the Office of Sustainability can work with City leaders, colleagues, businesses, and institutions to move Oklahoma City more strategically into the future by anticipating and adapting to change to ensure a community as resilient as it is prosperous.

The Office of Sustainability is responsible for enhancing Oklahoma City's sustainability efforts throughout the organization and the community by providing technical recommendations, sustainability planning and outreach services to City Departments and the public.

- Office of Sustainability Mission Statement

Spokies Bike Share

Oklahoma City's downtown bike share program was introduced in May 2012 with 95 bikes in a six-station system. Start-up costs were covered by EECBG funds and the system, now under the management of EMBARK, has grown with the addition of more stations and dockless bicycles.

City Energy Efficiency

Police stations, fire stations, City Parks recreation centers, the Cox Convention Center, and many other City facilities were audited for energy efficiency and received retrofits and the installation of automated building control software to reduce wasteful and costly consumption.

Electric Vehicle Parking Ordinance

City Council adopted an ordinance that granted the City's Traffic and Transportation Commission the authority to designate on-street parking spaces for electric vehicles only. Enforcement of this ordinance allows for the ticketing of non-electric vehicles parked in designated electric vehicle only spaces.

Green Home Loans

Approximately $350,000 in EECBG funds established a revolving loan fund to provide fixed interest rate loans of up to $15,000 to qualifying Oklahoma City homeowners for upgrades, retrofits, repairs, and new appliances to increase energy efficiency and reduce energy consumption.

Sustainable Purchasing Policy

Alongside the City's Finance Department, the Office of Sustainability developed an internal procurement policy to guide the purchase of products that are less toxic, wasteful, and costly to dispose of, conserve energy, water, and other natural resources, and last longer.

reBUILD Expo

Months after the devastating tornado outbreak of May 20, 2013, this daylong-event was held to assist home owners, developers, and builders navigate disaster recovery, from storm shelter installation to home energy rating systems. Speakers included the Oklahoma Insurance Commissioner, architects, and City staff.

1.2 What is Sustainability?

The consensus on the meaning of sustainability is that there is no consensus. Varying definitions have been crafted by varying bodies and they are as expansive and comprehensive as imaginable. Unfortunately, this can make discussions of sustainability and sustainable policy troublesome given the lack of a shared, established definition. In practice, however, sustainable policies and practices are common if not ubiquitous among institutions, businesses, and governments.

Oklahoma City itself has a storied, long-standing history of sound approaches to sustainability. A few illustrative examples include establishment of the City's first municipal recycling program in 1973, a second location opening soon thereafter, and the eventual curbside recycling program launched with City Council approval in 1994. Since 1996, the City's Deer Creek Wastewater Treatment Plant has provided up to three million gallons of recycled water per day for irrigation of Gaillardia Country Club's more than 600 acres of greens and landscaped property. In 2003, the City opened Oklahoma's first permanent household hazardous waste collection facility to ensure substances such as motor oil, antifreeze, pesticides, and herbicides remain out of lakes, rivers, and landfills. That same year, the EPA awarded $225,000 to the City for evaluation of reuse options at four Superfund sites, kickstarting the City's nationally-recognized brownfields program. In 2011, alternative fuels arrived to the EMBARK transit fleet with the addition of electric hybrid and compressed natural gas-powered buses. In 2012, the Oklahoma City Police Department added four electric battery-powered vehicles for downtown and Bricktown Parking Enforcement officers.

These select examples demonstrate one element at the core of sustainability: efficiency. Within the constraints of limited resources, limited funding, and expanding need, sustainability is about finding a balance between our environment, our economy, and our community. Central to this is the practice of holistically assessing costs and risks, both short-term and long-term, to resolve a critical question: how do we best achieve the most good with the fewest resources?

> "Sustainability exists at the intersection between environmental stewardship, economic vitality and community needs. To be sustainable is to consider the environmental, financial and human impacts all of our decisions and actions and to find an equitable balance between the health of our community, our economy and our environment."
>
> - City of Oklahoma City, Memo to the City Manager
> Office of Sustainability Report and Recommendations
> December 2008

With that in mind, and through peer city research, stakeholder input, and applicability to Oklahoma City's unique conditions, for the purposes of adaptokc we define sustainability as follows: **the quality of preparing for and adapting to disruptions by reducing vulnerabilities and conserving resources in order to strengthen our economy, protect our environment, and foster an equitable future.**

This quality is less about an end state and more about a process to continually assess decisions to refine and ensure maximum dividends are yielded in a way that balances among our environment, our economy, and our community. Many existing City processes are designed to consider these variables. The development review process, for example, is a multifaceted approach to determine how changes to our built environment will affect surrounding neighborhoods, businesses, infrastructure, and ecosystems. Quantitative processes such as population projections, traffic studies, water quality testing, and floodplain mapping inform our decisions today based on our best understanding of tomorrow. Our proposed approach is to recognize new options as opportunities to determine how the City can best use its finite resources.

Additionally, we know that disruptions, from extreme weather to economic disaster, will occur but we can rarely if ever anticipate when. Given that uncertainty, our perspective on sustainability sees Oklahoma City as a city continually engaged in future-proofing whereby we are uniquely positioned to be a leader in commerce, equity, and environmental protection, regardless of the challenges, obstacles, and disruptions to come.

The Foundations of Sustainability

In March 1911, Oklahoma City voters approved the first City Charter. That document endowed the government of Oklahoma City with the responsibility "to protect **health**, **life**, and **property**." This responsibility explicitly mirrors sustainability's "triple bottom line": **environment**, **society**, and **economy**. The duty which we as a city are obligated to fulfill by our own foundation is one and the same with sustainability. These responsibilities, however, do not exist in isolation but are connected, interrelated, and mutually dependent, and the relationship between those three responsibilities should not and cannot be reduced to either-or.

Environment

It is impossible to extricate ourselves from our environment. There can be no community, no economic growth or development without breathable air, uncontaminated soil, and clean water. The cost of environmental degradation is significant, even if not always readily visible. As such it does not simply jeopardize public and economic health but requires public funds at every level of government to ameliorate.

Economic growth and environmental decline need not be synonymous. Responsible, sustainable economic development is a reality; consider the growth in U.S. gross domestic product throughout the latter half of the 20th century as national environmental policies were adopted. Locally, we, too, must realize the balance between these seemingly adverse initiatives to make the most productive use of our finite natural resources while accounting for the socialized risks that can burden residents and institutions.

Society

"What is the city," Shakespeare asked, "but the people?" Societal sustainability can be translated to a phrase familiar to Oklahoma City thanks to MAPS: quality of life. More than just ensuring the basic needs of residents or even the provision of amenities, societal sustainability challenges communities to support entrepreneurship, strengthen economic mobility, foster creativity and curiosity, enhance livability, promote public health, support quality education, build affordable housing, attract and retain a talented workforce, and ensure a built environment accessible by and in service to residents of all ages.

Without a flourishing natural environment and a robust economy for all, the opportunity necessary for the people of Oklahoma City to thrive is out of reach. This social component, while sweeping and daunting, is where the efforts of sustainable programs and policies affect and yield dividends in the day-to-day lives of residents.

Economy

Resilience to market shocks is a pivotal quality of sustainable economies, especially those borne of commodity price volatility. A sufficiently diversified economy supported by a strong education system as a pipeline for skilled, talented workers and entrepreneurs is the foundation of a flourishing economy.

Due to Oklahoma City's overwhelming reliance on sales tax, high employment combined with high wages is optimal to induce local commerce and generate revenue, boosting locally-owned-and-operated businesses and broadening the scope and breadth of services local government can provide.

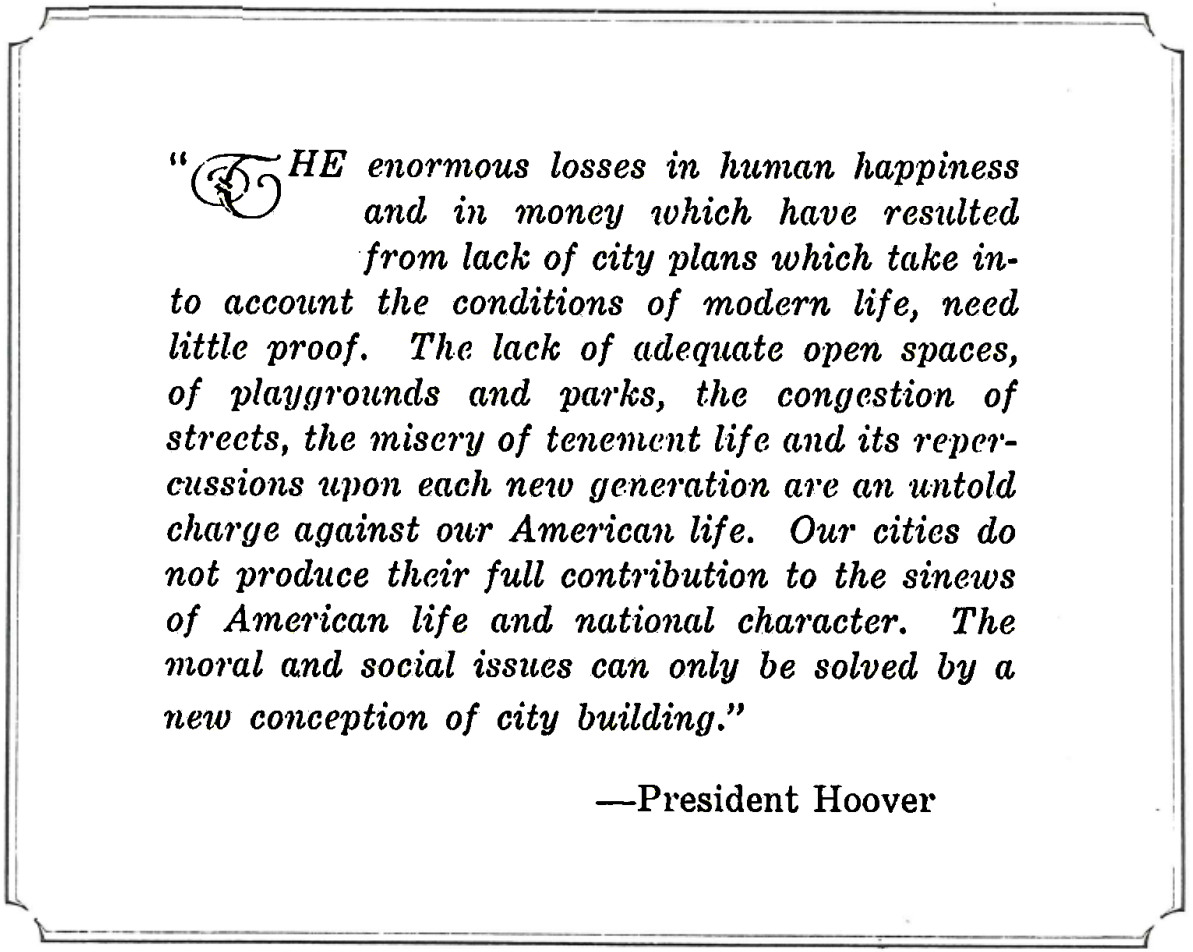
Ensuring as much money as possible is generated and spent within our economy means not just working in partnership with the business community but also unleashing the capacity of Oklahoma City residents to pursue their independence and economic freedom.

1.3 Supporting Plans and Studies

Many core practices of sustainability are central to, if not the subject of, prior City plans and studies. Some of these plans and studies were important resources in the development of adapt**okc**; the City's Hazard Mitigation Plan serves as a prime example. Others, such as bikewalk**okc** and the Water Conservation Plan, are so concentrated on one area that adapt**okc** would only be duplicative in attempting to address those same topics. Rather than trying to integrate, restate, or reproduce the research and analysis of those respective plans and studies, this section provides an overview of those resources.

An important part of developing adapt**okc** was identifying challenges and opportunities that have yet to be more deeply analyzed or explored by the City. Residents and policymakers should not think that because a larger discussion about bicycle and pedestrian infrastructure, for instance, is not included within adapt**okc** means it is not "sustainable" or a contributor to the City's capacity for adaptation. This is not so; rather, the City and its policymakers have already demonstrated their commitments through the adoption of the plans and studies laid out in this section, frequently doing so with associated funding. The 2017 general obligation bond propositions and the Better Streets, Safer City program both included funding to address much of what is included in these plans including sidewalks, on-street and off-street bicycle infrastructure, additional parklands, expanded transit service, affordable housing, and much more.

These plans and studies served as the building blocks throughout the development of adapt**okc** and combined with adapt**okc** represent broad, established momentum toward sustainable practices.



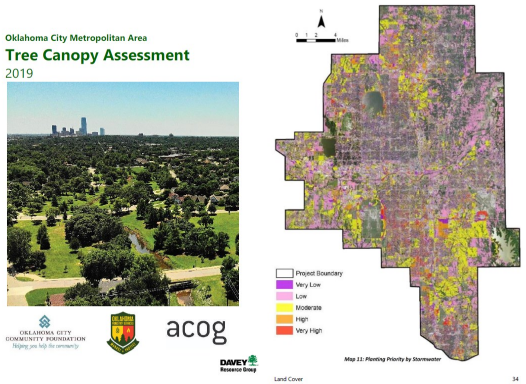
"THE enormous losses in human happiness and in money which have resulted from lack of city plans which take into account the conditions of modern life, need little proof. The lack of adequate open spaces, of playgrounds and parks, the congestion of strects, the misery of tenement life and its repercussions upon each new generation are an untold charge against our American life. Our cities do not produce their full contribution to the sinews of American life and national character. The moral and social issues can only be solved by a new conception of city building."

—President Hoover

This excerpt opened Oklahoma City's first comprehensive plan, 1930's *The City Plan of Oklahoma City.* This plan includes the foundational aspects of municipal planning: topography, population projections, population density, city demographics, street typologies, traffic volume, water and sewer service area, transit routes, and more.

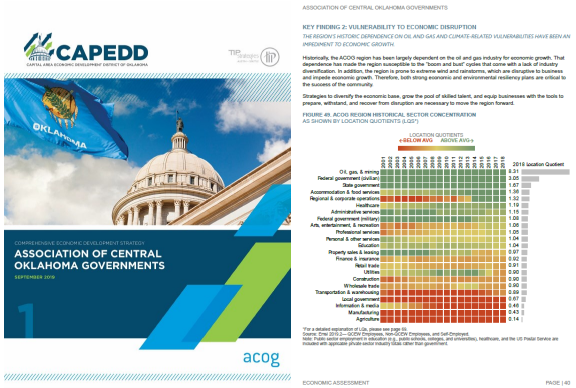
Oklahoma City Metropolitan Area Tree Canopy Assessment, 2019

A first of its kind in this part of Oklahoma, this assessment was conducted within a 536 square mile study area during the spring and summer of 2019. The Oklahoma City Community Foundation (OCCF) in partnership with the Association of Central Oklahoma Governments (ACOG) and Oklahoma Forestry Services contracted with Davey Resource Group Inc. (DRG) to conduct the assessment that determined the study area has an estimated 65 million trees providing as much as $150 million dollars in environmental benefits annually. The assessment includes planting priority maps to address both storm water runoff and the urban heat island effect.



Comprehensive Economic Development Strategy (ACOG), 2019

In 2011, ACOG received a grant from the U.S. Economic Development Administration (EDA) to develop a Comprehensive Economic Development Strategy (CEDS) for Oklahoma, Cleveland, Canadian and Logan counties. A CEDS is a long-range plan that analyzes the challenges and opportunities related to economic and community development. It includes proactive strategies and recommendations for achieving economic development objectives, as well as review infrastructure projects that will help the region attain these goals. The CEDS identifies many goals and strategies that overlap with those outlined in adapt**okc**, including: EP-2, EP-11, EP-22, EP-23, EP-24, EP-19, NB-11, WR-7.

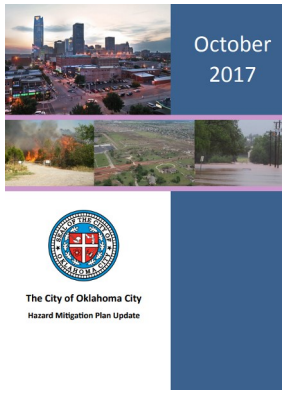


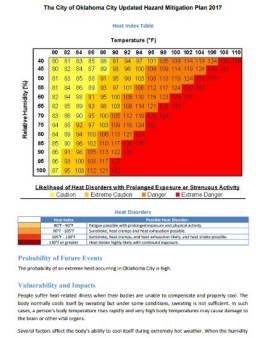
bikewalk**okc**, 2018

Oklahoma City's first bicycle-pedestrian master plan aims to transform the bicycling and walking experience within Oklahoma City to substantially improve the quality of life and health of our residents. This plan was developed to realize the plan**okc** goal to make Oklahoma City a community that offers many safe options for people to travel where they want to go - by foot, bicycle, or motorized vehicle. This requires investment in building and maintaining a multi-modal transportation network, complete with high quality trails, bicycle facilities, and sidewalks.

Hazard Mitigation Plan, 2017

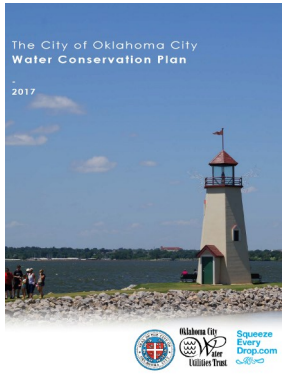
Required by FEMA as a condition of eligibility to receive federal assistance under various hazard mitigation grant programs, the City's Hazard Mitigation Plan (HMP) looks at long-term risks to residents and property in an effort to proactively determine how to best reduce or eliminate those risks. A product of the City's Office of Emergency Management alongside collaborators from all over the private and public sectors, the HMP identifies 12 natural hazards, charts their historical impacts on Oklahoma City, projects their future likelihood, and recommends tactics to mitigate the impact, both in cost and lives, to Oklahoma City.

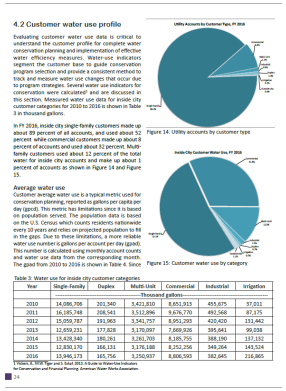




Water Conservation Plan, 2017

After the landmark 2016 settlement between Oklahoma City, the state of Oklahoma, the Choctaw Nation, and the Chickasaw Nation regarding Sardis Lake water rights, the Water Conservation Plan was developed by the City's existing water conservation staff to reflect a dedication to the responsible use of our precious water supply. Formally adopted by both the City of Oklahoma City and the Oklahoma Water Utilities Trust, the Water Conservation Plan includes goals, indicators, and recommendations for both policy and programs shaped by the American Water Works Association's conservation standards and supports specific components of planokc.





Encompass 2040 (ACOG), 2016

Developed by the Association of Central Oklahoma Governments (ACOG), Encompass 2040 is the region's Metropolitan Transportation Plan and long-range plan that guides Central Oklahoma's management, operation, and investment of billions of transportation dollars. Encompass 2040 was adopted by the ACOG Board of Directors on October 27, 2016.

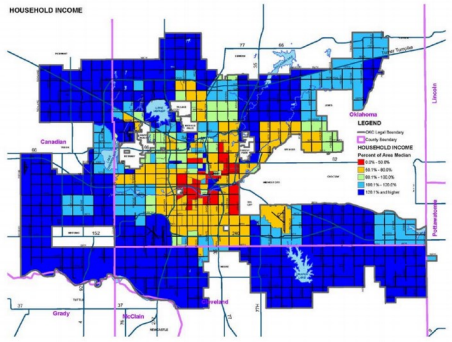
ENCOMPASS 2040
central oklahoma regional transportation plan

planokc, 2015

The City's first fully-new comprehensive plan included greenokc, the environmental and natural resources element, that assessed the impacts of development on ecological systems. The research and recommendations in greenokc served as a point of origin for adaptokc and guided us towards the needs and gaps to be addressed. Over the coming years, much of the land use elements of planokc will be developed via a community-lead process of updating Chapter 59 of the City's code. This will in turn provide us with an opportunity to craft, refine, and ultimately codify components of adaptokc for inclusion in City code to meet the goals of both adaptokc and planokc.

Consolidated Plan, 2015 - 2020

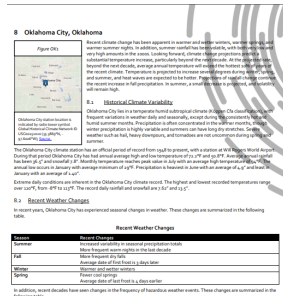
Cities who receive Community Development Block Grant (CDBG) formula funds via the U.S. Department of Housing and Urban Development are required to adopt and publish a Consolidated Plan every five years. These plans require local assessments of housing market conditions, housing costs and affordability, and populations experiencing homelessness to guide where and how localities can best allocate CDBG funds and resources to the principal benefit of low- and moderate-income persons and households. A new Consolidated Plan for the City of Oklahoma City will be developed and adopted in 2020 to comply with federal requirements.



Household Income Concentration

Climate in the Heartland, 2015

As one of five cities involved in this regional study, projections of changes to Oklahoma City's climate are a fundamental and important element of long-range planning. Based on a combination of datasets, including 30-year climate normals, long-term data from the Will Rogers World Airport weather monitoring station, and global climate models, the outputs indicate the likely scenarios facing Oklahoma City through 2080 and serve to inform what hazards are likely to threaten our infrastructure, neighborhoods, and businesses.


8 Oklahoma City, Oklahoma

Recent Weather Changes

Health Impact Assessment, 2014

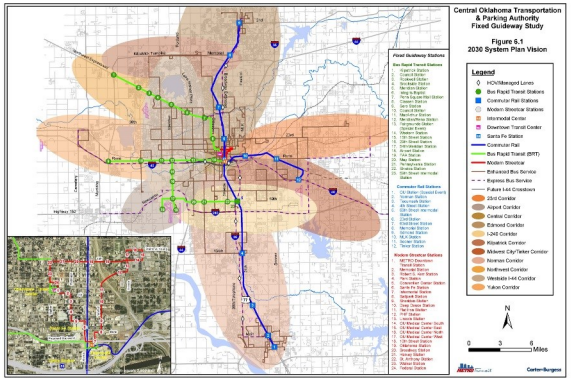
The Health Impact Assessment (HIA) was developed to gauge the overall impact of planokc components on community health in Oklahoma City. The HIA specifically sought to evaluate the effect of city-wide growth scenarios through thirty-five measures/indicators that have potential to change as a result of Oklahoma City growth patterns. The HIA identified several recommended strategies that would have a positive impact on the community, most notably: creating more opportunities for walking and biking, increasing access to fresh, healthy food, improving and protecting water quality, increasing access to parks and schools, and reducing occurrences of abandoned buildings.

Oklahoma City Parks Master Plan, 2013

Funded in part through the generosity of the Oklahoma City Community Foundation, the City's Parks Master Plan serves as a guide to the establishment of new policies and programs to maintain, improve, and leverage the park system for greater community benefit. Reflective of the city's growth, the Parks Master Plan seeks improved access to the park system across the city's 621 square mile area. Portions of the Plan build upon other plans and studies including the park typologies and standards developed in the 2005 Parks and Recreation Comprehensive Plan, planokc issues and goals, and the Oklahoma City Park System Study conducted in 2011.

Fixed Guideway Transit Study, 2006

The Fixed Guideway Transit Study identified potential regional transit solutions that improve connections among the Oklahoma City metro's growth centers, enhance economic development opportunities, improve mobility, expand transportation options and improve air quality. Those solutions included a combination of local bus, BRT, streetcar, commuter rail and other options. This plan was the foundation for the later Commuter Corridor Study and has shaped the Central Oklahoma region's approach to regional transit since; because of the analysis and input as part of the Fixed Guideway Transit Study, the region's Regional Transit Authority now exists and continues work towards an eventual realization of regional transit.



2.0 Challenges

Oklahoma City is not unique in the challenges it faces in the 21st century. An estimated 80% of the U.S. population now lives in cities and the resulting concentrations of people, resources, and investments are becoming more diverse, more connected, and more unpredictable. Whatever differences there are between Oklahoma City and other urban centers throughout the country, we are similar in that we are all competing for jobs, workers, investment and access to resources. Without a look towards the challenges that are here with us now as well as on the horizon, our ability to compete will only diminish.

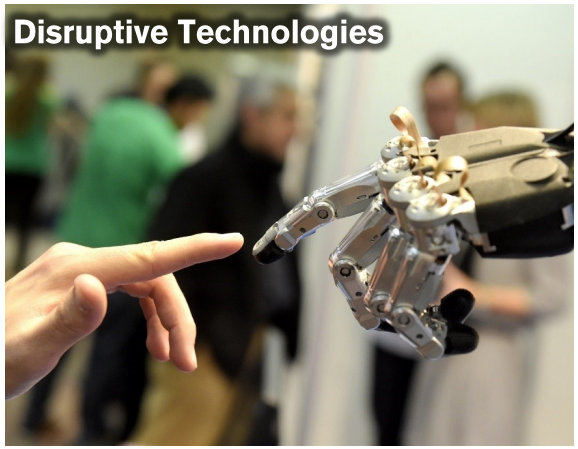
These challenges underscore how our city is changing. They are problems of scale and growth, of balancing finite resources with demands. They should not, however, be seen in isolation. Rather, they are all interrelated, each connected and dependent on one another. There are no easy answers, no one-size-fits-all solution to the formidable challenges that are already with us and threaten to loom ever larger in the years to come. However daunting they may seem, these challenges are more than surmountable - they are opportunities for Oklahoma City and its residents to meet a bright and prosperous future.

Oklahoma City's expansive system of roads and streets will continue to face challenges in the decades to come. Population growth, urbanization, fuel efficiency, freight traffic, extreme weather, and alternative fuels will all contribute to the shifting and rising costs of expanding and maintaining our infrastructure.

Urban growth is synonymous with the expansion of impervious surfaces. Given Oklahoma City's historic and projected increases of heavy precipitation events, development policies should reflect the need to mimic the natural environment to protect lives and property.

Oklahoma City is expected to see an increase in average annual temperature and, with it, heatwaves of more frequency, severity, and duration. With such an increase comes significant risk to our residents, our infrastructure, and our vital water resources.

Emerging sectors can provide livable wages, enhance workforce retention, and expand opportunities. The more diverse Oklahoma City's corporate landscape, the more resilient our economy will be, shielding us from the historical boom and bust cycle and its effect on revenue and employment.



Advances in robotics and artificial intelligence portend unprecedented shifts in employment. Drastic changes to the transportation, manufacturing, and service sectors could dramatically alter our economy.

Our health and wellbeing is directly affected by the condition of our natural and built environments. The design and structure of our city is itself a social service powerful enough to influence - for better or worse - the wellness of our residents.

All are vulnerable to disaster, be it natural or manmade. The consequences, however, are not borne equally. Small business owners, seniors, populations with limited English proficiency, rural residents, and others may face a greater struggle to recover from unexpected crises.

From ice storms and tornadoes to earthquakes and drought, extreme weather has proven costly to our community. Opportunities to harden against and mitigate the impacts of such events can be proactively included in the design and growth of Oklahoma City.

"The future is already here – it's just not very evenly distributed."

- William Gibson

Issue Focus 1: Transportation Costs

Oklahoma City's continued growth is projected to include the addition of approximately 300,000 people by 2050. Commensurate with that population increase will be new development, added lane miles of streets, greater transit service demand, increased congestion, increased vehicle miles traveled, increased emissions, increased freight traffic, and increased maintenance needs for our roads and streets.

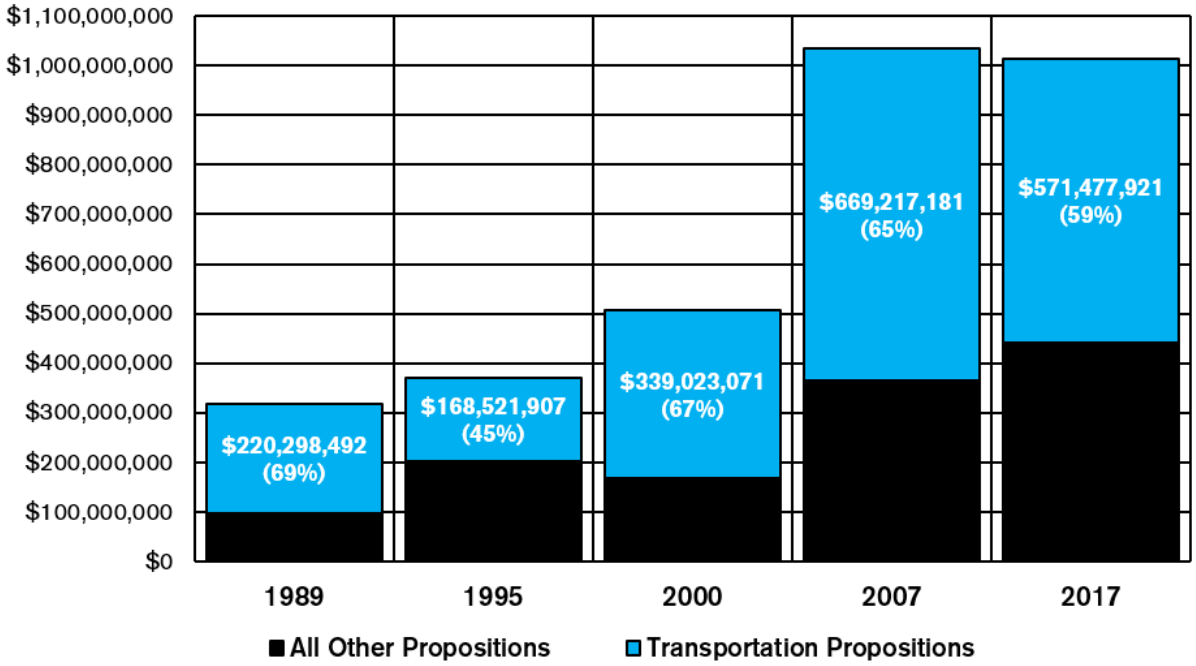
Presently, the City uses local, state, and federal dollars to support transportation infrastructure projects. Local general obligation bonds have, since 1989, put an inflation-adjusted total of $1.9 billion towards roads, streets, bridges, and traffic control. State gas tax remittances average just $1 million annually. Federal surface transportation dollars have supported Oklahoma City projects with a minimum of $44.5 million between federal fiscal years 2009 and 2017. Despite these investments, residents express consistent dissatisfaction with our streets and roads, identifying their condition as the single most important issue in every Oklahoma City Citizen Survey conducted thus far.

Over time, federal and state funding sources will at best rise and fall but likely diminish. State gas tax remittances will erode due to increased vehicle fuel efficiency as well as wider adoption of alternative fuels not subject to a volumetric fuel excise tax. These same factors have and will continue to reduce federal transportation dollars available as the Highway Trust Fund, the federal government's primary repository of federal gas tax revenue, continues to flirt with insolvency. Within the Central Oklahoma region, federal funds will grow more competitive as regional communities similarly continue to grow. More frequent extreme weather will escalate maintenance needs and costs across all sizes and levels of government, from routine maintenance to catastrophic destruction.

As illustrated in **Figure IF-1**, Oklahoma City's streets and highways cumulatively consume approximately 30 square miles. While some interstates and highways are the responsibility of the Oklahoma Department of Transportation, the vast majority are local roads and streets. For context, 30 square miles is larger than virtually every city and town in the metro with the notable exceptions of Edmond, Norman, Piedmont, and El Reno. If the funds for streets and roads from the 2017 general obligation bond were apportioned across all 30 square miles equally, the investment would equate to about $140,000 per square mile.

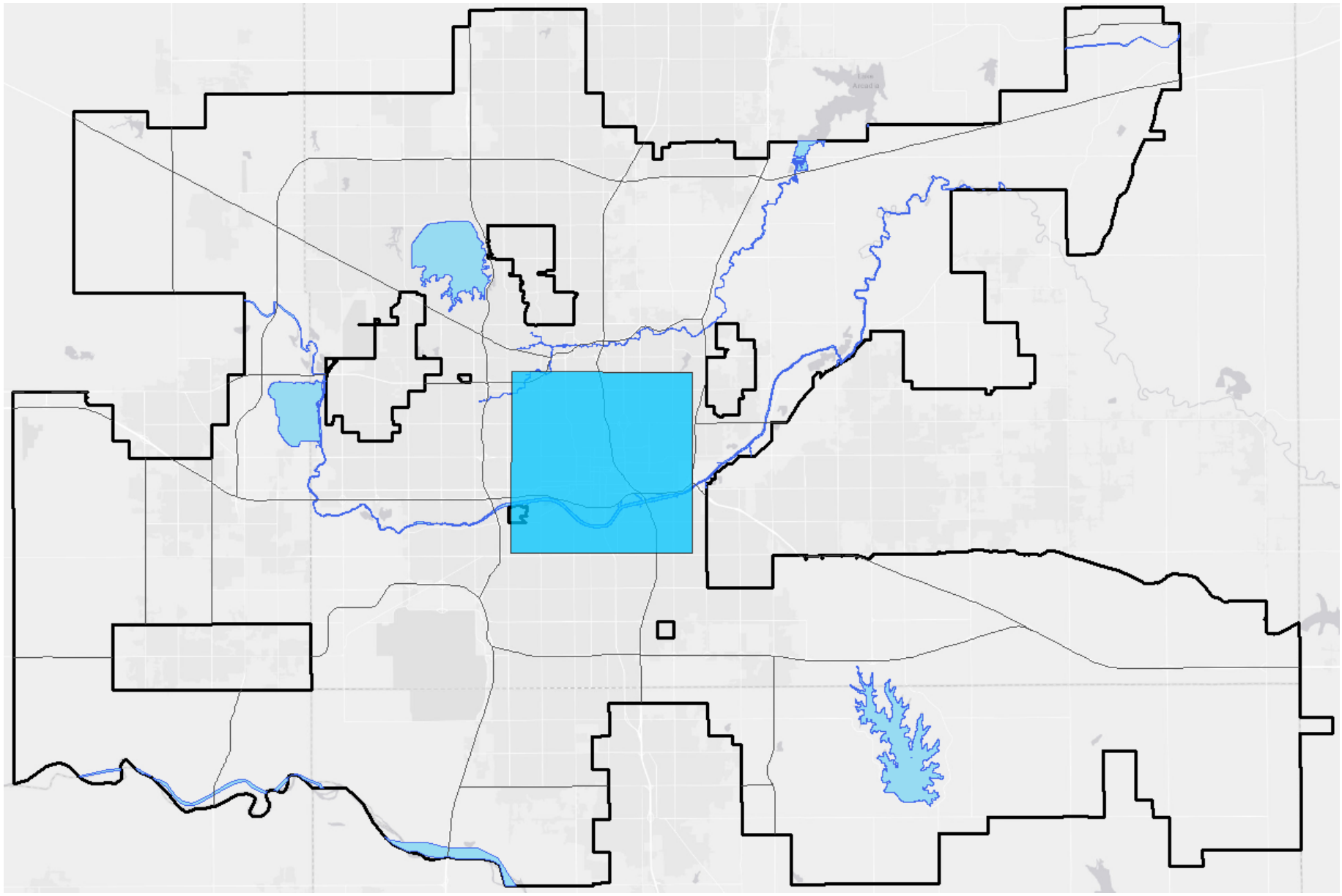
As evidenced by the Better Streets, Safer City program, Oklahoma City residents know our streets and roads are core but costly infrastructure. The daunting task of maintaining the scale of a small municipality of asphalt and concrete will only grow more of a fiscal burden if we continue to grow with our historical approach to land use and transportation.

Oklahoma City General Obligation Bonds, 1989 - 2017



City general obligation bonds between 1989 and 2017 were adjusted for inflation based on 2019 rates from the U.S. Department of Labor's Consumer Price Index. "Transportation propositions" includes totals for streets, traffic control, and bridges, and in the 2017 bond, notably included costs for sidewalks. During this 28-year period across five bonds an inflation-adjusted total of $1.9 billion has been approved by voters for expenditure on transportation infrastructure.

Figure IF-1, Representative Scale of Consolidated Street and Highway Pavement



Planimetric data was used to estimate the total quantity of land area consumed by transportation infrastructure (excluding sidewalks) across Oklahoma City's 621 square miles. The blue square above represents the approximate 30 total square miles - about 5% of the city - covered by roadway of which public dollars are responsible for maintaining.

Issue Focus 2: Urban Flooding

Development is synonymous with impermeable surfaces, be it asphalt, concrete, roofs, parking lots, sidewalks, streets, driveways, or slabs. These surfaces disrupt and alter the landscape's natural hydrology - where and how water flows - and, if not properly mitigated, contribute to flooding conditions both in and out of federally-designated flood zones.

Approximately 5,000 buildings, predominately residential, are located within Oklahoma City's 100-year floodplains. Since 1977, Oklahoma City residents have made more than 1,300 claims to FEMA's National Flood Insurance Program with a total inflation-adjusted payout of $22.5 million. Of those claims, 380 - about 28% - have come from structures within the floodplain. Another 12% were filed for structures within the 500-year floodplain. That means about 60% of claims were outside of designated floodplains.

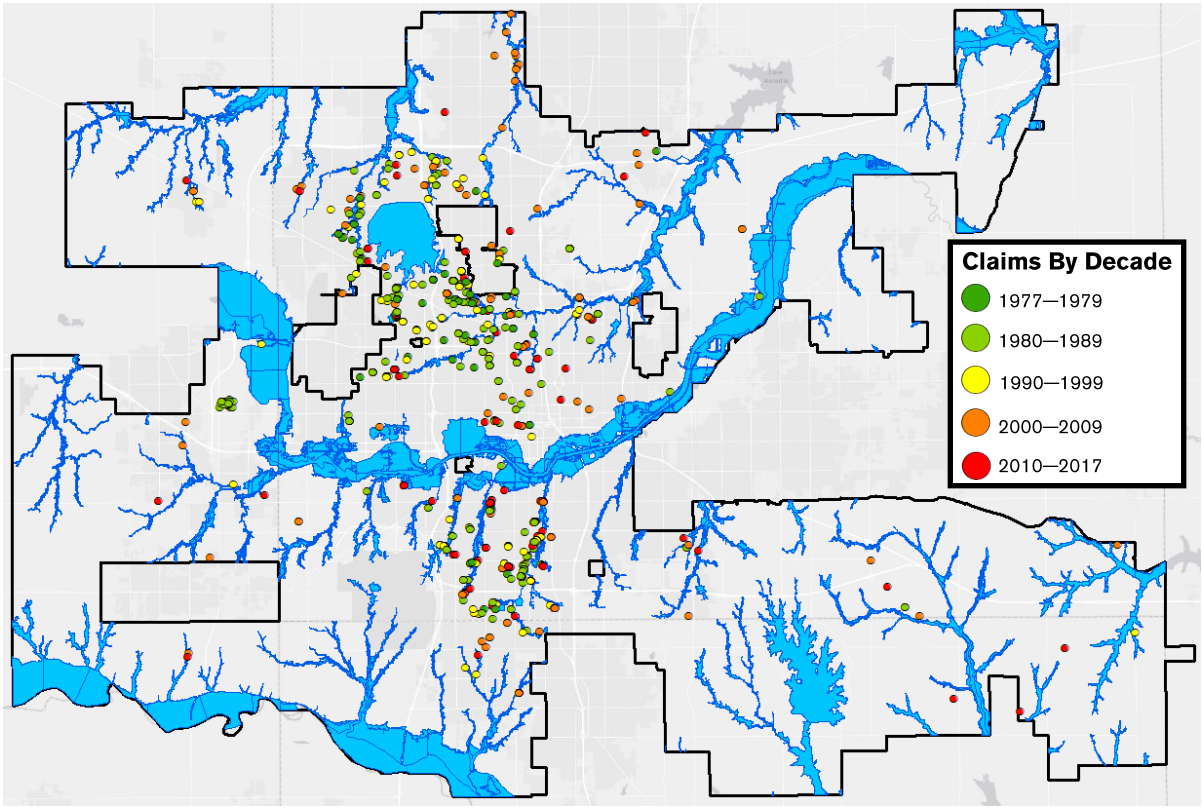
Heavy rain events have been part of Oklahoma's historical climate, but the frequency and intensity of events are increasing. According to the U.S. Global Change Research Program's 2017 Climate Science Special Report, heavy rainfall, defined as the top 1% of annual events, increased by 12% in the Southern Great Plains between 1958 and 2016. The frequency and intensity of heavy precipitation events are also projected to continue to increase over the 21st century. Seasonally, rainfall is projected to increase in winter and spring and decrease in summer and fall by the end of the 21st century, but projected seasonal changes are small compared to natural variations in a highly-variable climate like Oklahoma City's.

In short, when rain events happen in Oklahoma City, they are more intense than historical rainfall events. This increase in intensity of precipitation coupled with a growing footprint of impervious surfaces, increases flood risk in more parts of the city.

Between 2010 and 2015, development added about 13 square miles of pavement, a 19% increase. This amount of pavement is equivalent to adding a surface parking lot the size of the city of Mustang plus one more square mile to Oklahoma City' s land area. By comparison, Oklahoma City's population during that same period grew 8%, meaning development added approximately 7,400 square feet of pavement for every person added to our population.

Flooding is no longer an issue about where we build but how we build. Future development must be sensitive not only to designated areas prone to flooding but how contributions to our infrastructure can exacerbate urban floods.

Oklahoma City FEMA Flood Claims Outside of Flood Zones, 1977 - 2017



Source: FEMA

ABOVE: MAP OF FLOOD CLAIMS OUTISDE OF FLOOD ZONES

The map above highlights the importance of flash flood preparedness by illustrating the nearly 60% of flood claims since 1977 originating outside of a designated floodplain.

Issue Focus 3: Disruptive Technologies

Innovations in technology have historically driven revolutions in commerce, from the steam engine to the smart phone. Those innovations, however, can swiftly challenge existing practices, procedures, and regulations that were developed in a past era.

No example is more germane than that of e-commerce. Online transactions began in the early-to-mid 90s yet barriers to taxation were not removed until a U.S. Supreme Court decision in 2018. Consider, too, how Oklahoma City has had to respond and adapt to home sharing and ride sharing platforms. Policies must be crafted to ensure a changing, technology-driven market does not outpace important sources of revenue such as the hotel/motel tax, sales tax, and use tax.

A more structural disruption has gradually emerged on the horizon: job automation. A 2017 study by the McKinsey Global Institute estimates that in the U.S. alone, 39 to 73 million jobs - about a third of total national employment - could be automated by 2030. Joint research by Citigroup and the Oxford Martin School at the University of Oxford estimates 47.1% of Oklahoma City jobs are at high risk of automation. A 2019 report from the Brookings Institution similarly estimated about 46% of Oklahoma City metro jobs are susceptible to automation. This workforce vulnerability comes as automation expands to the service sector whereas, historically, it has been limited to manufacturing.

Oklahoma's largest employer is Walmart with an estimated 31,845 jobs statewide. In conjunction with the McKinsey Global Institute, in 2019 Walmart published "America at Work: A National Mosaic and Roadmap for Tomorrow" to examine "resiliency, or the capacity to respond to change - in this case, automation." The estimated "range of automation potential," defined as "the proportion of time spent on job activities that current technologies can automate," is expressed on a county-by-county basis. Oklahoma County is 33% to 45% with all surrounding metro counties at a range of 36% to 54%. While Walmart is just one employer, and certainly not singular in its investment towards job automation, their demonstrated intent speaks to how fundamentally the labor market will not just change but will continue to change. As their report says, "All agree that automation has arrived and is quickly changing the American workplace."

Generally, more specialized cities have a larger share of jobs at high risk of automation, while diversified cities are more resilient to the expanding scope of automation. In other words, economic and industrial diversification can make cities more resilient to negative demand shocks in any specific industry. The Oklahoma Office of Workforce Development identified 100 "critical occupations" based on several factors that include being "vital to the success of Oklahoma's" economy. Cross-referenced with a 2013 study by Carl Frey and Michael Osborne, 38 of the 100 critical occupations have a greater than 50% risk of being automated.

Those 38 occupations include several estimated to grow the most within Oklahoma between 2016 and 2025 including heavy and tractor-trailer truck drivers, accountants and auditors, operating engineers and other construction equipment operators, and industrial machinery mechanics. The majority of the 38 occupations - 56% - require a high school diploma or equivalent, which translates to severely reduced opportunity for those without college degrees or advanced education. As a result, automation is likely to lead to increased income inequality with high-paying creative and cognitive jobs at a premium while middle- and low-skill opportunities are gradually displaced. For example, were automation to replace just 20% of Oklahoma City metro jobs that pay below the full-time livable wage threshold of $11.31 for a single adult, that would eliminate 29,482 jobs from the economy - more jobs across the regional economy than employees at Tinker Air Force Base.

The reverberations to labor markets and regional wages due to disruptive technologies would be far-reaching. We are not alone in grappling with the uncertainty of the U.S. workforce nor the uncertainty of how best to respond through the mechanisms of public policy. But the effects are significant enough to warrant closer attention as Oklahoma City continues to grow.

LEFT: GROCERY AUTOMATION

The 2017 addition of a 20-foot by 80-foot "Pickup Tower" to the parking lot of an Oklahoma City Walmart Super Center location marked the retail giant's first U.S. foray into automated shopping. Consumers can select more than 30,000 grocery items online and retrieve them from the unattended kiosk. In 2018, Walmart intended to make Pickup Towers available to nearly 40% of the U.S. population.

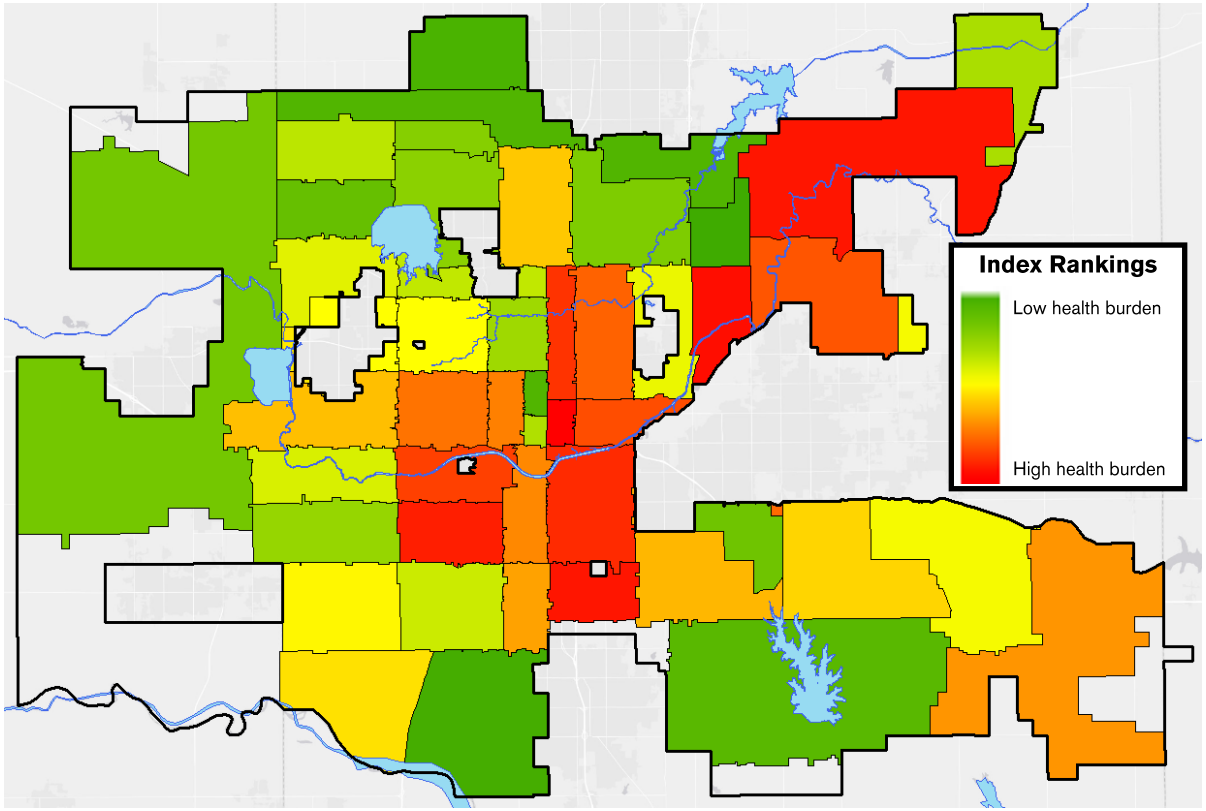
Issue Focus 4: Environmental & Public Health

The world we live in is the cumulative product of deliberate choices. Through the decades, both public policy and market forces have driven the growth and decline, spurred by technology, population, economics, and many other variables. All of those choices have and continue to shape our built environment as well as alter our natural environment in ways that affect and influence us every day. These effects and risks of exposure are part of a mosaic of factors that affect our well-being.

The Oklahoma City-County Health Department (OCCHD) found an "18-year gap in life expectancy" between "those living in the Oklahoma City ZIP codes with the best health outcomes versus those living in the one experiencing the poorest health outcomes." As illustrated by their data, the ZIP code an Oklahoma City resident lives in determines their life expectancy. Per the OCCHD 2017 Wellness Score, mortality rates for cardiovascular disease, diabetes, chronic lower respiratory disease, cancers, and Alzheimer's disease within the City-County area all exceed both the statewide and national rates. Overall life expectancy within the city-county area is 74.9 years, which is 3.9 years fewer than the national average. Our land use requirements are at the crux of these issues as they instruct the design and placement of development, both of which can have immense consequences that may not be reflected in the development review process. A closer relationship with OCCHD to collaborate on design review through the lens of public health policy could provide a more comprehensive perspective on our built environment.

There is no panacea for the public health issues that face Oklahoma City. Efforts to better integrate considerations of environmental health can, however, contribute to improvements in addition to crafting a better, more sustainable built environment that enriches and extends life for residents.

Oklahoma City Health and Wellness Index Rankings by ZIP Code, 2013 - 2015



Source: Oklahoma City-County Health Department

A multitude of population, public health, and land use data was combined by the Oklahoma City-County Health Department to express ZIP code-level insight based on factors including education, income, maternal and child health, mental health, mortality, healthcare access, crime, infectious disease and the built environment.

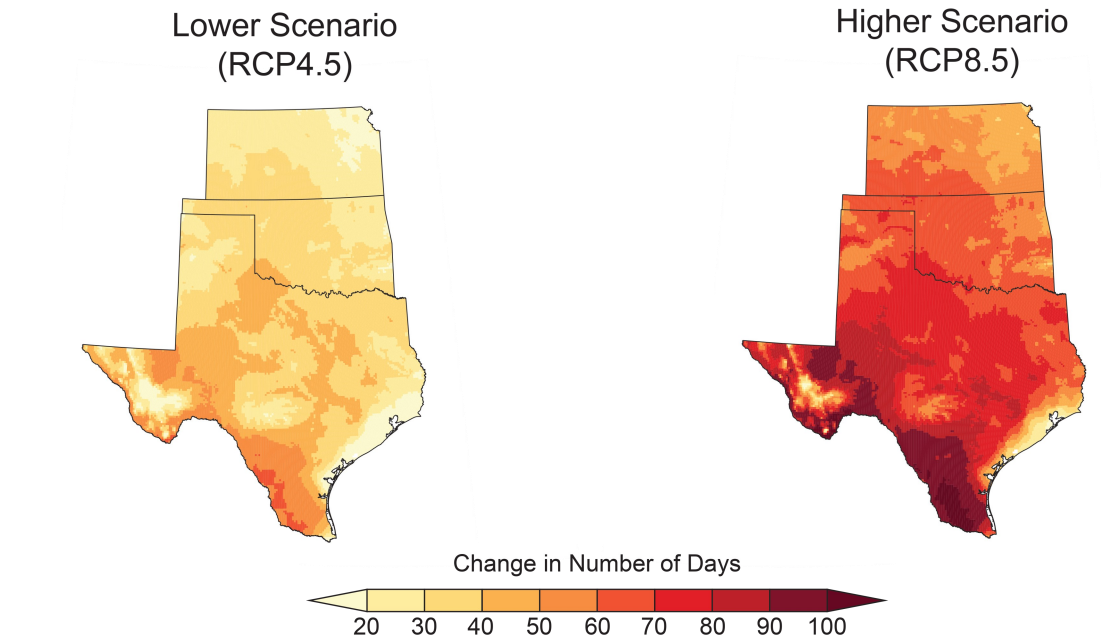
Issue Focus 5: Extreme Heat

The summers of 2011 and 2012 in Oklahoma City were so hot they overtook temperature records set during the Dust Bowl. At 113°F, August 3rd, 2012 is now tied with August 11th, 1936, for Oklahoma City's all-time highest temperature. Similarly, the sheer quantity of hot days broke records; 2011 alone had 21 days greater than or equal to 105°F. More than a quarter of calendar days in 2011 were at or above 90°F. The extreme heat of these consecutive summers stressed the electricity grid, damaged infrastructure and agriculture, threatened water supplies, contributed to wildfires, and cost some Oklahomans their lives. They serve as warnings not only for the threat of extreme heat today, but also the threats projected for tomorrow.

The U.S. Global Change Research Program's (USGCRP) 2017 Climate Science Special Report identifies an increase in frequency and intensity of heatwaves and extreme heat events across the U.S. since 1960 and projects this trend to continue as global temperatures continue to rise. At present, annual temperature data for Central Oklahoma from NOAA's Southern Regional Climate Center show a significant warming trend since 1998, the longest since the Dust Bowl, during which extreme drought was also present. In 2012, the state saw its highest average annual temperature ever recorded, 63.2°F. Central Oklahoma, which contains the Oklahoma City metro, has an average annual temperature of 60.3°F, which is higher than the average statewide annual temperature of 59.8°F.

Extreme heat is relatively common in Oklahoma City, but is projected to get worse. Synthesizing findings from National Climate Assessment publications, the Southern Climate Impacts Planning Program's *Simple Planning Tool for Oklahoma Climate Hazards v 1.5* indicates that by mid-century, Oklahomans will see a 20- to 27-day increase in the number of days that reach 95°F and 100°F (the historical top 2% of hot days each year). In addition, the number of nights per year that do not drop below 70°F to 75°F (the top 2% of warmest nights) are expected to increase by an additional 35 nights per year.

Projected Increase in Number of Days Above 100°F, Late 21st Century



Under both lower– and higher-scenario climate change projections, the number of days exceeding 100°F is projected to increase across the Southern Great Plains by the end of the century (2070-2099 as compared to 1976-2005). Source: The USGCRP 2017 Climate Science Special Report.

Residential energy consumption is highly correlated with heating and cooling degree days, both of which would see significant change via these projections. The Residential Energy Demand Temperature Index (REDTI) designed by NOAA estimates residential energy demand by way of annual heating and cooling degree days. During the 122 years between 1895 and 2017, Oklahoma's residential energy demand surpassed that of the contiguous U.S. during 43 of those years when normalized by population. Having become more common in recent years, 21 of those years occurred since 1980 whereas 22 occurred in the 85 years prior.

Impacts of extreme heat include community-wide costs to augment the electricity grid and the risk of higher heat-related mortality. When people are exposed to extreme heat, they can suffer from potentially deadly illnesses such as heat exhaustion and heat stroke. Warm nights are also problematic for those without air conditioning, since the body has a hard time cooling off. Hot temperatures can also contribute to deaths from heart attacks, strokes, and other forms of cardiovascular disease, all of which are established public health challenges in Oklahoma City.

Issue Focus 6: Economic Diversification

The oil and gas sector has long served as Oklahoma City's economic base, evidenced by the presence of companies like Devon Energy, Continental Resources, Chesapeake Energy, and SandRidge Energy. Analysis of 2015 employment data by the Brookings Institution estimates Oklahoma City has at least 11.61% greater concentration of oil and gas extraction jobs than the U.S. as a whole. Economic diversification is necessary to increase resilience to market shocks like commodity price volatility, specifically oil and gas.

What Oklahoma City experienced in 2015 and 2016 is illustrative in that a downturn in the oil and gas industry, despite otherwise low unemployment, reverberated throughout the local economy with job losses, reduced wages, and ultimately dramatic impacts on sales and use tax revenue. The price of West Texas Intermediate crude oil dropped about $75 between mid-2014 and early 2016, a 70% reduction per barrel.

As a result, City sales tax collections for FY16 were 1.9% below projections with the proposed budget citing "the energy sector contraction as rig counts declined and service providers to the energy sector experienced lower sales." In FY17, collections fared even worse with sales tax revenue 3.1% below projections. While the City has seen annual sales tax collections below revenue - FY10, for example, was 7.25% below projections - FY16 and FY17 marked the first consecutive years below projections since FY86 and FY87.

The effect of the oil and gas industry contraction was not exclusively quantifiable by the City's sales tax collections. Between 2015 and 2016, the Oklahoma City MSA saw an inflation-adjusted decline in real GDP of 2.22%. By comparison, the MSA experienced real GDP growth of 2.38% between calendar years 2008 and 2009. In other words, the plummeting price of oil caused a local recession with economic effects far more severe than the national recession that saw U.S. GDP contract by 4.2% between 2007 and 2009 and approximately 8.7 million jobs lost across the country.

The Oklahoma City metro's major employers demonstrate the challenge of economic diversification is not necessarily the concentration of jobs in any one sector, but the concentration of high wages. Based on data from the Greater Oklahoma City Chamber, regional employer centers are predominately public institutions. Between the State of Oklahoma, Tinker Air Force Base, the University of Oklahoma (including the Health Sciences Center and OU Medical Center), the Federal Aviation Administration, the University of Central Oklahoma, Oklahoma City Community College, and Rose State College, government and publicly-funded institutions represent approximately 109,000 jobs. Comparatively, the region's major oil and gas employers supply about 7,000 direct jobs.

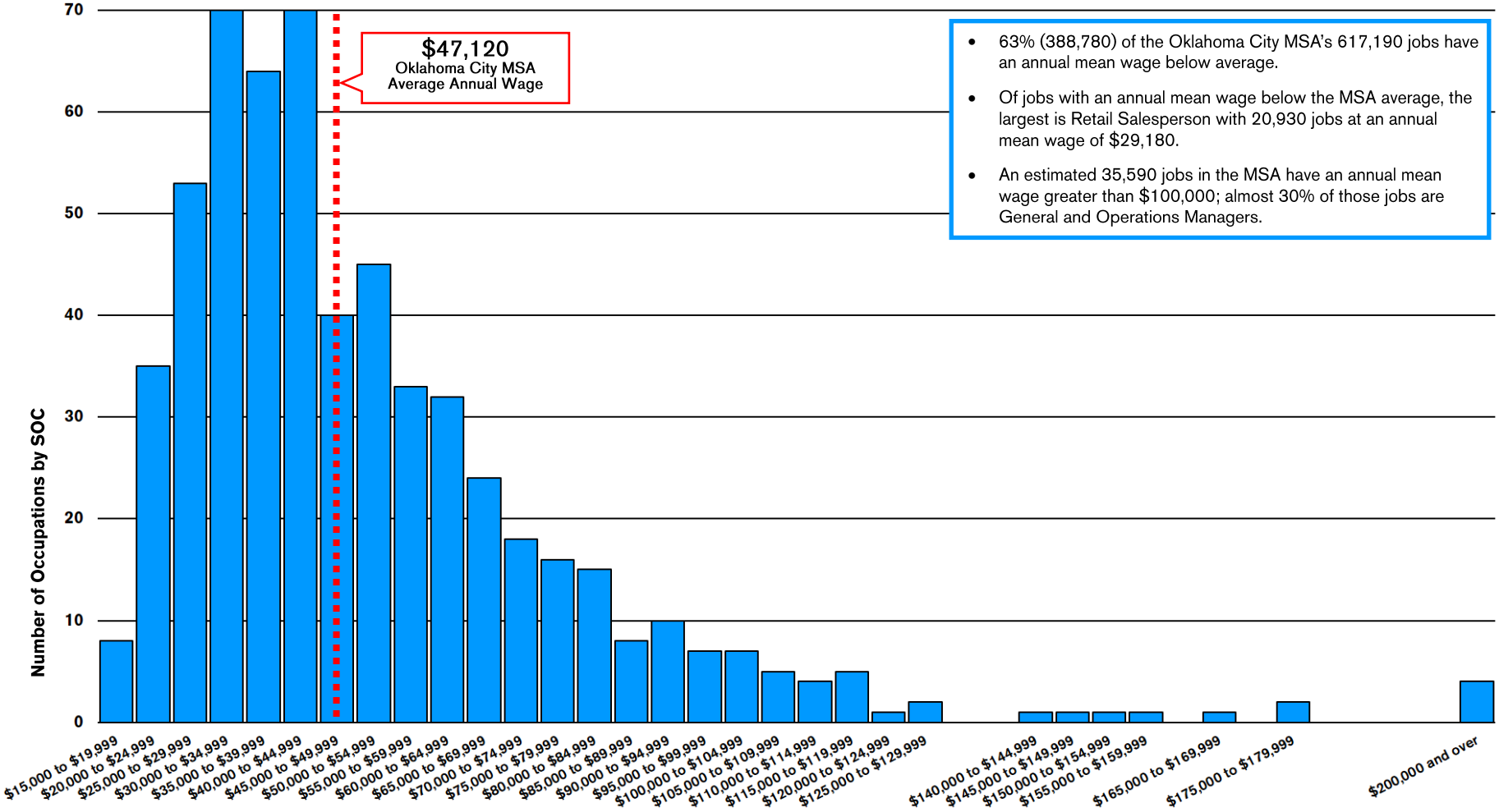
The Oklahoma Employment Security Commission's (OESC) Wage Report for 2018 found that within the Oklahoma City MSA, petroleum engineers have the second highest annual mean wage of any job outside of the medical/healthcare sector after chief executives ($157,730 and $176,340, respectively). Based on OESC data, the Oklahoma City MSA has 583 occupations based on classifications from the Standardized Occupational Classification system; of those 583, almost 60% - 340 occupations - make the regional annual average wage of about $47,000 or below.

The two most common occupations in the Oklahoma City MSA are Retail Sales Person (20,930) and Customer Service Representatives (14,330) with annual mean wages of $29,180 and $32,930. Under the assumption of full-time employment of 40 hours per week for 52 weeks, these annual mean wages each translate to hourly wages of $14.03 and $15.83. Applying MIT's Living Wage Calculator to the Oklahoma City metro, these gross hourly wages would be below a living wage for a single working adult with any children, a two-adult household with children where only one adult works, or a two-adult household with three or more children where both parents work.

In 2014, the Oklahoma Legislature passed and then-Governor Mary Fallin signed SB1023, which preempted all municipalities from increasing the minimum wage. Yet strong wages are vital for macroeconomic strength given Oklahoma's unique reliance on sales tax for municipal operations. **Economic diversification is more than just range of occupations, but a depth of wages; if high wages are too consolidated within a particular sector, the ebb and flow of that sector can have a disproportionate and cascading impact on the entirety of the local economy.** Tools at the state and local level do exist to encourage economic diversification, particularly the Quality Jobs Program administered by the Oklahoma Department of Commerce and the City's Strategic Investment Program (SIP). The SIP is an especially robust program, supported by voter-approved bond packages in 2007 and 2017, as it is not limited to specific sectors and is structured as a pay-for-performance job creation program with requirements for each eligible company to be awarded incentives "based on an economic impact analysis to provide meaningful measures, accountability and a level playing field." The SIP's Standard Program requires applying companies "to pay 90% of the most current" Oklahoma City MSA average wage.

Continued economic development can cultivate higher wage opportunities but cannot comprehensively accomplish this goal singlehandedly. Investment in and support of education - primary, secondary, higher, and vocational - is a crucial method of producing a skilled workforce better able to navigate high wage occupations. While this has proven challenging given the City's constrained role in education, there remains both public and political will for broader involvement in public education. Additionally, companies themselves are seeking to

Oklahoma City MSA Distribution of Annual Mean Wages by Occupation, 2018



Source: Oklahoma Employment Security Commission

address workforce gaps through dedicated training programs, especially in the aerospace and aviation sectors driven by Tinker Air Force Base, the state's largest single-site employer.

We must also look to emerging technologies - as in, both those new to market and those new to the Oklahoma City market - as opportunities to expand good wages and capitalize on the region's resources. The Bureau of Labor Statistics (BLS) found the two occupations with the fastest growth rate between 2018 and 2028 are solar photovoltaic installers (63%) and wind turbine service technicians (57%) with 2018 median wages of $42,680 and $54,370, respectively. Of the 20 occupations BLS projects through 2028, those two are the only ones with a highest percent change of employment greater than 50%. While occupational growth is certainly not exclusive to the renewable energy sector, it does underscore a need to look to markets and industries thus far unestablished in Oklahoma City to foster employment opportunities that provide strong wages for a wider swath of our residents. While a greater diversity of wages does to an extent insulate the City from commodity price volatility, it more importantly provides means for our residents to flourish and continue positive momentum for Oklahoma City's future.

Issue Focus 7: Disproportionate Vulnerability

There are differing degrees of vulnerability in Oklahoma City. These differences can change based on a myriad of variables but are predicated on the fact that the distribution of risk is highly uneven. Just as we seek to better understand the likely disasters Oklahoma City will face in the future, better understanding the degrees of our community's vulnerability will further enable us to provide meaningful resources.

Facets of vulnerability include but are not limited to structurally substandard housing, low income, low proximity and/or low accessibility to basic services, low educational attainment, exclusion from community decision-making and/or social marginalization, homelessness, disability, and proximity to sources of pollution and environmental hazards. These factors interact and impact one another in addition to basic indicators such as age, income, gender, race, and ethnicity.

The increase in frequency and severity in extreme weather is the primary motivator behind a better understanding of vulnerability in Oklahoma City. While extreme weather events are indiscriminate, some residents have less capacity to prepare for, respond to, and recover from such events and their effects. For example, residents of mobile homes may be more vulnerable to property damage due to high winds than suburban and exurban homes, yet those suburban and exurban homes are at significantly greater risk of wildfires due to their location on or near rural, undeveloped land where fires can start and spread quickly.

Vulnerability is a concern because extreme and hazardous weather is almost a certainty. The City's Hazard Mitigation Plan identifies 12 natural hazards and calculates the probability of each occurring within Oklahoma City: extreme heat, flooding, hail, high winds, lightning, tornadoes, winter weather, drought, wildfire, earthquake, dam failure, and mosquito-borne disease. All but one - dam failure - are rated as "high." Before these hazards befall

> "Social vulnerability refers to the ability of people, organizations, and societies to withstand adverse impacts from multiple stressors to which they are exposed."
>
> - City of Oklahoma City Hazard Mitigation Plan, 2017

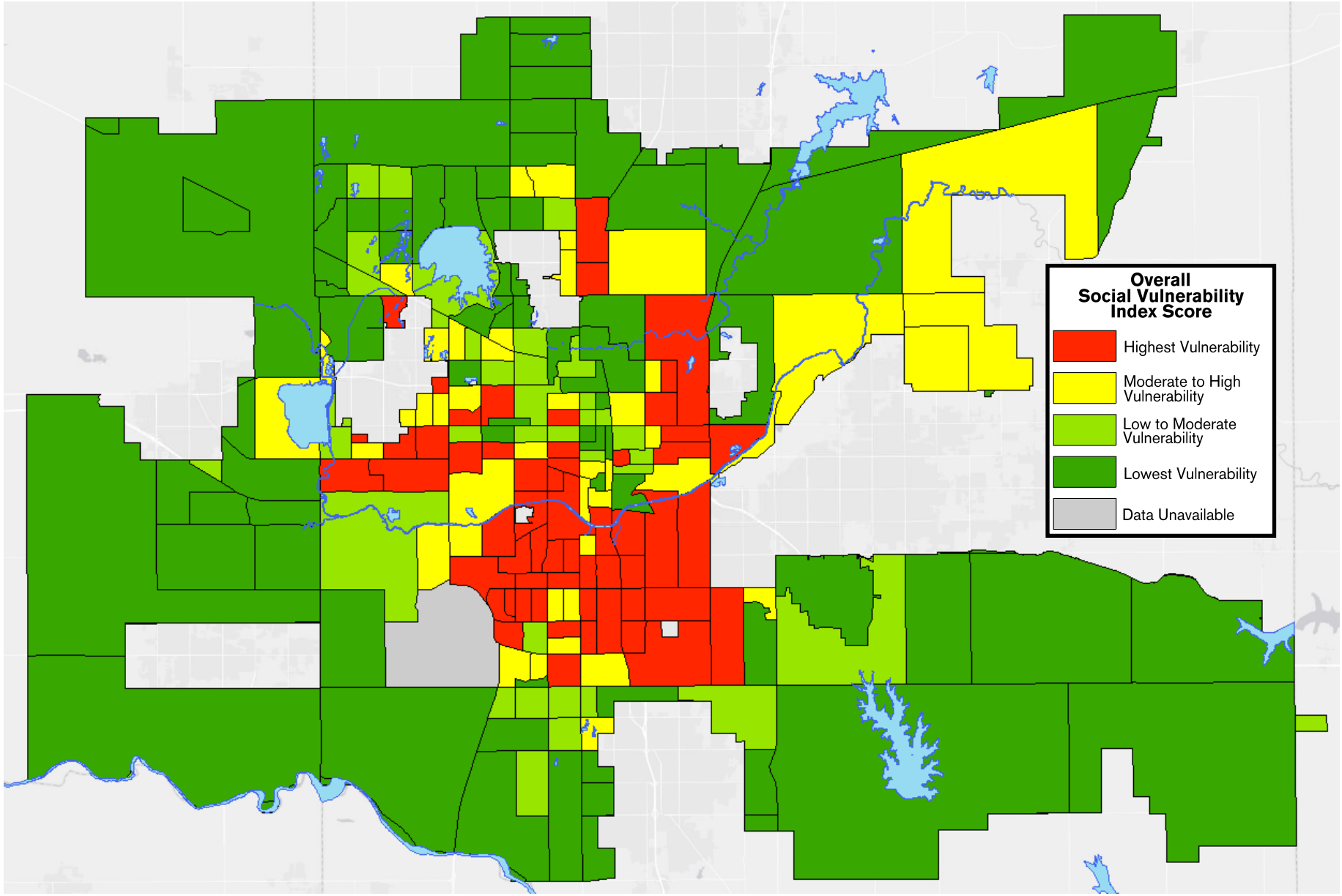
Oklahoma City and its residents, it is important to know and understand where populations of our most vulnerable reside so as to better strengthen our ability to respond and assist.

The U.S. Agency for Toxic Substances and Disease Registry created the Social Vulnerability Index (SVI) to identify and map communities most likely to need support before, during, and after a hazardous event. The SVI indicates the relative vulnerability of every U.S. Census tract, which are subdivisions of counties for which the Census collects statistical data. The SVI ranks tracts on 15 social factors, including unemployment, minority status, and disability, and further groups them into four related themes. Those rankings are on a scale from 0 to 1, with 0 meaning lowest vulnerability and 1 meaning highest vulnerability. Those tract rankings are illustrated in Oklahoma City via **Figure IF-2**. Broadly, many high vulnerability tracts are clustered in south-central Oklahoma City but include west-central and northeastern portions of the city.

A prime example of disproportionate vulnerability is linguistic isolation. American Community Survey (ACS) five-year estimates indicate more than 11,000 Oklahoma City households are linguistically isolated, meaning households where all adults speak a language other than English and none speak English well. Census tracts with high concentrations of linguistically isolated households are clustered south of the Oklahoma River. Many of these linguistically isolated tracts are within the 95th to 100th percentile in comparison to national data and are in similarly high percentiles for low income, less than high school educational attainment, and percentage of population under the age of five. While Spanish and Vietnamese are the predominant non-English languages in Oklahoma City households, ACS data identifies at least 36 other languages spoken in Oklahoma City households including German, Arabic, French, and Urdu.

Language barriers are just one complicating factor that, without preparation and planning, make public service delivery challenging, whether from a meter reader or a police officer. We can and should reflect the values, culture, and languages of our residents as a government and an ever-expanding effort towards inclusivity can do more than gird against calamitous hazards - they can help us create a more vibrant city that leaves no one behind, least of all the most vulnerable.

Figure IF-2, Oklahoma City Census Tracts by Social Vulnerability Index, 2016



Source: Centers for Disease Control and Prevention

The SVI synthesizes data including socioeconomic status (poverty, employment, income, educational attainment), household composition and disability, minority status and language spoken, and housing and transportation (vehicle ownership, multi-unit structures, mobile homes, etc.).

Issue Focus 8: Preparedness & Resilience

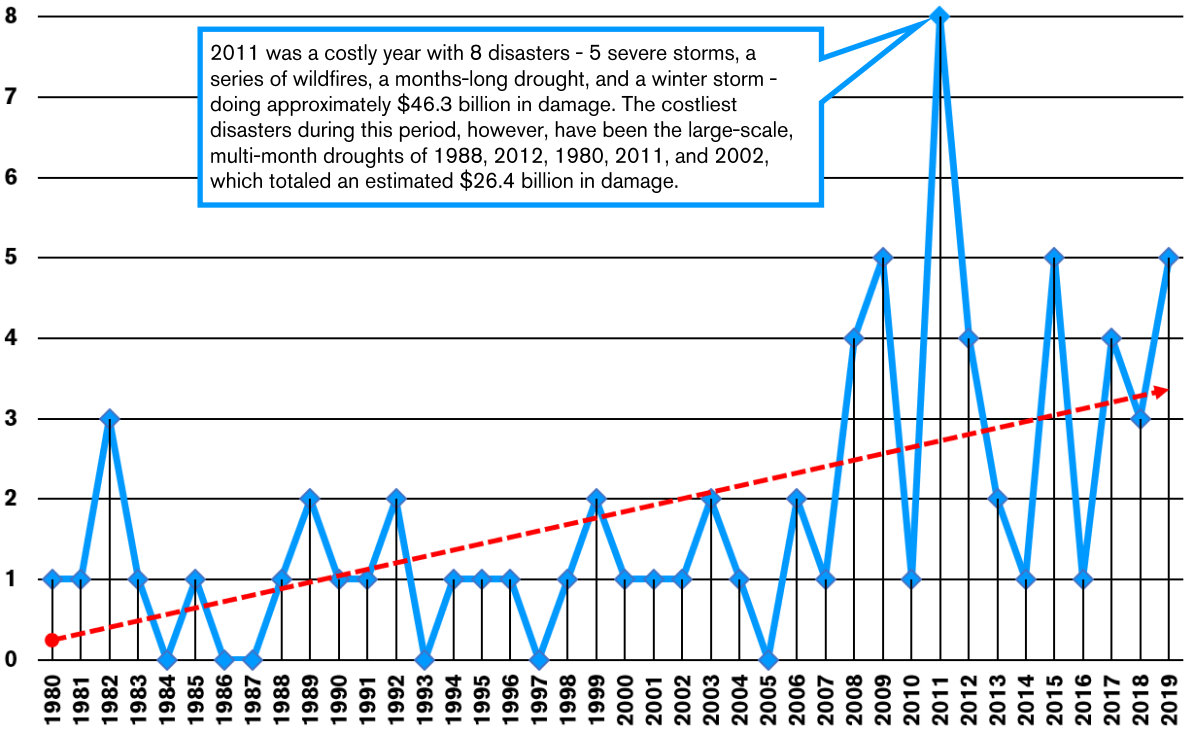
Oklahoma City is no stranger to severe and extreme weather events. The City's Hazard Mitigation Plan (HMP), updated and adopted by City Council in 2017, provides evaluations of natural hazards to which the City is most at risk and specifies actions to reduce the effects of those hazards. Projected changes to Oklahoma City's climate through 2080 indicate shifts germane to long-term hazard mitigation planning for enhancement of community preparedness as well as resilience during and after such extreme events.

The National Oceanic and Atmospheric Administration estimates since 1980, disasters have inflicted $1.7 trillion in damages across the U.S. FEMA data places Oklahoma third in the nation for number of federal major disaster declarations with 86, surpassed only by California (97) and Texas (99). These major disaster declarations include severe storms, severe winter storms, wildfires, flooding, tornadoes, and straight-line winds. The HMP identifies 35 mitigation actions to address hazards for which Oklahoma City is prone. These actions represent significant steps towards enhancing the preparedness and resilience of Oklahoma City and its residents. Better integration of the these concepts into the planning process across the City's functions could help growth occur in a more resilient way and assist residents in recovery when unavoidable extreme weather events occur.

Nationally, the number of major disaster declarations has increased since the inception of such declarations. Because these declarations can include federal assistance, they represent a growing burden not only on federal dollars but private insurance, states, localities, businesses, and residents. The figure opposite reflects the high percentage of supplemental, or ad hoc, funds Congress has provided to FEMA for the Disaster Relief Fund, the primary source of funding for the federal government's domestic general disaster relief programs pursuant to the Robert T. Stafford Disaster Relief and Emergency Assistance Act. This does not, however, reflect separate and distinct disaster relief programs funded and managed by other federal agencies including the Departments of Transportation, Agriculture, Housing and Urban Development, Small Business Administration and Defense. Planning for and mitigating the effects of disasters is thus critical to not only avoid local loss of life and property but to contain costs that could be distributed across society as a whole.

Billion-Dollar Climate Disasters Affecting Oklahoma, 1980 - 2019

In 2019 Dollars, Adjusted for Inflation



Source: NOAA

Both the costs and the frequency of billion-dollar climate disasters have and continue to increase. These disasters represent those that have affected some portion of Oklahoma and often include impacts on neighboring states or, in some large scale events such as multi-month droughts, significant portions of the U.S. The disasters depicted above have cumulatively cost approximately $372 billion and, more importantly, have cost 4,037 lives.

Federal Disaster Relief Fund Appropriations, FFY97 - 18

In 2018 Dollars, Adjusted for Inflation

Federal Fiscal Year	Annual Appropriation (Percentage Supplement or Contingency)	U.S. Major Disaster Declarations
1997	$6,989,480,000 (71%)	44
1998	$2,879,375,000 (83%)	65
1999	$3,129,984,000 (53%)	50
2000	$4,017,487,000 (89%)	45
2001	$2,251,693,000 (81%)	45
2002	$14,122,045,000 (93%)	49
2003	$2,995,856,000 (64%)	56
2004	$5,641,239,000 (58%)	68
2005	$86,921,490,000 (97%)	48
2006	$9,524,143,000 (77%)	52
2007	$6,699,654,000 (74%)	63
2008	$15,181,965,000 (89%)	75
2009	$1,612,240,000 (0%)	59
2010	$7,596,456,000 (76%)	81
2011	$2,935,777,000 (0%)	99
2012	$7,711,365,000 (90%)	47
2013	$19,832,033,000 (62%)	62
2014	$6,569,461,000 (0%)	45
2015	$7,382,189,000 (0%)	44
2016	$7,675,279,000 (0%)	46
2017	$15,040,665,000 (50%)	59
2018	$50,070,720,000 (84%)	59
Total	**$286,780,596,000**	**1,261**
Average	**$13,035,481,636**	**57**

Source: FEMA, Congressional Research Service

"Oklahoma County, Oklahoma, is one of the most disaster-prone counties in the United States. The county contains 14 municipalities and 22% of the state's population. It has experienced 23 declared disasters in the last decade and 42 since 1964—the year that the Federal Emergency Management Agency (FEMA) began collecting disaster declaration data at the county-level. The county has been hit by, and recovered from, almost every type of emergency and disaster situation … The county has experienced 14 severe storms, 13 fires, 7 severe ice storms, 4 floods, 2 tornadoes, 1 hurricane, 1 human-cased event - the Oklahoma City bombing - and has started to experience earthquakes, although not yet at a magnitude that has lead to disaster."

- The National Association of Counties, 2018

3.0 Planning Process

The genesis of adaptokc lies in planokc, the City's first wholly new comprehensive plan in more than twenty years. Adopted in 2015, planokc is a policy document that crafts a framework to guide decisions about future growth, development, policy, and capital improvements. Sustainability is in part defined by planokc as "the capacity to endure" and is discussed in economic, fiscal, and environmental terms.

Generally, these three notions address the necessity for greater economic diversity, the exponential costs of continued sprawl, and, via the greenokc element chapter, "understanding the relationship between how we develop land and the health of our environment." Moreover, 39 policies in planokc identify the Office of Sustainability as or among the responsible parties. Consideration of how to achieve the goals of each policy served as the foundation of adaptokc's scope. The policies included a wide combination of concerns and directions, some of which were collapsed into one another and others expanded to ensure adaptokc focuses on critical challenges and opportunities for Oklahoma City. It remains essential that adaptokc serves to implement the comprehensive plan while simultaneously identifying new methods to strengthen our city.

A second essential component of the planning process was the September 2015 report *Climate in the Heartland: Historical Data and Future Projections for the Heartland Regional Network*. The cities of Iowa City, Iowa; Columbia, Missouri; Lincoln, Nebraska; Lawrence, Kansas; and Oklahoma City cooperated on this regional study convened through an informal conclave of municipal and county sustainability officers throughout the Midwest.

With the expertise of state climatologists and the Iowa State University Climate Science Program, the report uses historical climate data to inform nine climate models in differing emissions scenarios to identify common factors across all models and downscale those to each locality. These downscaled results serve as estimates of changes to local climate in the period of 2021 to 2050 and 2051 to 2080, comparable to the thirty-year climate averages of the 1981 to 2010 period. While these projections are vital to understanding and planning for the challenges Oklahoma City will experience in the coming decades, we also know many of their effects are manifesting here and now. Given the time spans of many capital funding programs such as the decennial general obligation bonds or the irregular renewal of the penny sales tax, responses to these projections require both near-term and long-term solutions.

Projected Changes in Oklahoma City Climate, 1981 - 2080

Season	Metric	1981-2010	2021-2050	2051-2080
Annual	Average	60.7°F	▲ 63.2°F	▲ 66.0°F
	Minimum	49.8°F	▲ 52.4°F	▲ 55.3°F
	Maximum	71.5°F	▲ 74.0°F	▲ 76.8°F
	Precipitation	36.6"	▲ 38.0"	▲ 38.7"
Spring	Average	51.3°F	▲ 54.8°F	▲ 58.4°F
	Precipitation	10.7"	▲ 11.2"	= 11.2"
Summer	Average	77.1°F	▲ 79.8°F	▲ 82.5°F
	Minimum	66.8°F	▲ 69.6°F	▲ 72.3°F
	Maximum	87.4°F	▲ 90.1°F	▲ 92.7°F
	Precipitation	11.2"	▼ 11.0"	▼ 10.6"
Fall	Average	73.1°F	▲ 74.4°F	▲ 76.5°F
	Precipitation	9.8"	▲ 10.5"	▲ 11.5"
Winter	Average	39.8°F	▲ 42.5°F	▲ 45.4°F
	Minimum	29.6°F	▲ 32.2°F	▲ 34.8°F
	Maximum	50.0°F	▲ 52.8°F	▲ 56.1°F
	Precipitation	4.9"	▲ 5.3"	▲ 5.4"

Source: Climate in the Heartland

For the two 30-year periods of 2021 to 2050 and 2051 to 2080, Oklahoma City is projected to see only a slight decrease in summer precipitation and a leveling off of spring precipitation. All other metrics are projected to increase in comparison to what we experienced between 1981 and 2010.

Many of the primary authors of planokc helped to shape the scope of adaptokc. Given the years-long public process for and development of planokc, this informal committee helped to define and narrow adaptokc's reach. With their help, Office of Sustainability staff established topic areas, began research to establish baseline policies and data, and identified important voices whose expertise would be needed to provide practical, informed perspectives through direct focus group input.

Focus Groups

Staff recruited private and public sector subject matter experts as well as specialists within the City to each participate in one of six focus groups, each on a different topic: energy; water; natural assets; materials management; transportation; and preparedness and resilience. Over the course of structured meetings, each focus group discussed Oklahoma City's present situation including strengths, weaknesses, and opportunities, learned about successful programs developed and implemented in comparable cities, and responded to and refined prospective topic goals, objectives, and targets.

These subject matter experts and specialists brought diverse perspectives and proved invaluable in gaining a better understanding of the range of possibilities for both implementing and building upon plan**okc**'s policy recommendations. Their discussion with facilitators as well as each other provided staff with a preliminary assessment of needs, available data, and feasibility - both practical and political.

Additionally, surveys were provided to all participants following each focus group session. Each of these surveys was tailored in response to the topics, questions, and interactions of the session. These allowed for an anonymous means of input and feedback, recommendations for future session discussion, an opportunity to verify conclusions reached by staff, recommendation for additional participants, and general satisfaction with meeting organization and presentation.

Ultimately, the exceptional input and direction provided by our more than 90 expert participants across greater than 20 structured meetings and interviews helped us establish a sufficiently narrow scope. Changes were made on recommendations including the merging of water and natural assets into a combined natural and built environment topic; integration of preparedness and resilience into each topic rather than as a standalone focus; and concentrating the transportation topic on emissions and air quality rather than mode.

Office of Sustainability staff worked closely with partners to obtain data and conduct research. As the analysis and research revealed correlations and trends, the chapters of the plan evolved from the original workgroup focus areas to chapters that better communicate and more accurately align with findings.

ABOVE: NATURAL ASSETS FOCUS GROUP

Comprised of internal and external subject matter experts, the natural assets topic spanned impervious surfaces - particularly overabundant surface parking - and the urban heat island effect; access to food and food waste; and reforestation and the urban tree canopy.

Adoption and Implementation

Nothing in adapt**okc** overrides or supersedes existing policies, ordinances, or Council resolutions, nor does it modify the purview, composition, or powers of decision-making bodies. This document does not create new programs nor impose new requirements. The proposed policies and recommendations herein will each require greater development and vetting, ultimately to be subject to review, recommendation, and/or approval by public bodies including but not limited to the Planning Commission and/or City Council - in addition to the ultimate arbiters of City policy, the public.

Under the quasi-judicial powers granted the Oklahoma City Planning Commission by state statute (§19-866.10), any amendment to the comprehensive plan must be adopted by the Planning Commission. As just such an amendment, adapt**okc** is ancillary to plan**okc** and extracts from it elements of long-range policy to inform policymakers, stakeholders, and the community at large; to articulate a vision and goals for the City and the community; to identify roles and responsibilities; and to recommend paths forward