



Final Report

Fire Department Study

Knightsdale (NC) Fire Department

April 23, 2018

Presented by:
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Brooks Innovative Solutions

Brooks Innovative Solutions is a NC based small business organized as a Sole Proprietorship and Dedicated to helping clients find and implement the most innovative solution available.



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Forward

Brooks Innovative Solutions has been contracted by the Town of Knightdale Fire Department to conduct a fire department study. This study began with four main components. During site work for, and analysis of the station location assessment, it was obvious that the proximity of Knightdale Station #1, Eastern Wake Station #2 and Knightdale Station #2 did not represent an efficient deployment of resources for fire and emergency services. The consultant engaged both representatives of Wake County and the Town of Knightdale to provide a very preliminary and anecdotal assessment and recommendation that included conducting a future feasibility study for a merger/consolidation between the Town of Knightdale and the Eastern Wake Fire Rescue Department. Some references will be made throughout this report referencing the recommendation just stated. The four original components of the study are 1) evaluate existing and future station locations, 2) evaluate existing and future staffing, 3) evaluate existing and future fleet needs, and 4) evaluate the adequacy of future succession planning. The study results in analysis and recommendations for improvement in each area.

This firm is a North Carolina based small business wholly focused on helping meet the needs of organizations like the Town of Knightdale Fire Department. Brooks Innovative Solutions facilitates strategic planning and community stakeholder input, analyzing existing and modeling new fire station service areas, and conducting executive and management assessment and training focusing on Social Style and Versatility. Brooks Innovative Solutions is actively engaged with national and international professional fire organizations, is certified for training by The TRACOM Group, and holds Academy Membership with the National Speakers Association.

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Acknowledgements

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Special acknowledgement is due for Chief Guffey who served as the local project coordinator. His work in ensuring the accuracy of data provided to us and ensuring our understanding and interpretation of that data was critical. He was a partner in the management of the project and was always available when needed.

The follow individuals were principal team members of the Town of Knightdale data and project team:

Bill Summers	Town Manager
Tim Guffey	Fire Chief, Project Coordinator, Project Management, Data/Document Collection
Jason Pope	Fire Lieutenant, Fleet Assessment
A Shift	Captain Anya Blackley, Lt. Mark Guy, FF Jimmy Massey, FF Zachary Pleasants, Fleet Assessment
Chris Hills, AICP/CZO	Development Services Director
Jason Brown, AICP/CZO	Senior Planner – Long Range

The following individuals were principal contributors of data, information and perspective from other local agencies with whom the Town of Knightdale Fire Department partners with or is dependent upon for mission success:

David Cates	Fire Chief, Eastern Wake Fire Rescue Department
Nick Campasano, CFO	Director, Wake County Fire Services
Darrell Alford	Deputy Director/Chief of Operations, Wake County Fire Services
Jonathan Olson	Deputy Director, Wake County EMS
Tony Bailey	Fire Rating Inspector, Office of State Fire Marshal
Dale J. Roenigk	Lecturer/Director, NC Benchmarking Project, NC Institute of Government

Brooks Innovative Solutions Team

Paul D. Brooks	Business Principal, Project Manager, Principal Researcher and Analyst
Robert McNally	Beacon GIS Founder & Principal; GIS/Research Analyst, Fire Station Service Area Analyst
Gregory Grayson	NC Fire and EMS Innovative Solutions Founder and Principal; Facilitator

Executive Summary

The Town of Knightdale is experiencing significant growth and development. Most growth resulting in increased service demand is in large residential and mixed-use developments. Most commercial development is in-fill in nature. There are significant gaps in resource deployment compared to other agencies in the county, region and state and in standards of cover performance compared to state and national standards, guidelines and best practices. In the consultant's opinion, based upon historical analysis, the gaps are the result of resource deployment lagging behind rapid growth in the region.

There were opportunities for both internal and external stakeholder input throughout the study. The stakeholders included leaders from the community, external critical service partners, volunteer and career members of the department. The consultant provided multiple briefings for the town council, the town administrator and the fire chief. The findings from the facilitated stakeholder input sessions proved to be intuitively accurate and generally in concert with the findings of the analysis in the study. A detailed report of stakeholder feedback is provided in Chapter 2.

Local investigative reports found that Knightdale was among the suburban communities in Wake County that represent the fastest growing North Carolina municipalities in the period of 2011-2017. Also reported was, "Six of the state's fastest growing towns since 2010 were former railroad and crossroad communities in Wake..." including the Town of Knightdale. Knightdale grew by more than 28% between 2010 and 2016 compare to rates between 13% and 15% for North Carolina's most metropolitan cities. The town's overall population has grown by 54% since 2009. Based upon historical trends and current counts, the town's population will increase by nearly 2,800 people for a 17.45% increase by 2020, growing at an annual rate of about 3.5%. However, considering additional growth and development the town and department should plan for a population increase of 3,000-5,000 people over the next five years to reach a total population count of approximately 20,000 people.

Median household income at \$67,167 barely trails Wake County and exceeds the state and national median household income. The population is becoming younger, more diverse and is well educated.

Calls for service are running around 1,500 calls per year. The department responded to a total of 13,130 calls for service between 2007 and 2017. During this period the overall service demand has increased by 59.52% with an annual rate of change of 4.95%. The single largest year gain was in 2016 with a 14.93% increase over the previous year.

Early in the study it became obvious that significant inefficiencies and resource overlaps exist as a result of the close proximity of Town of Knightdale and the Eastern Wake Fire Rescue District stations and other assets. Although not included in the scope of this study, it is highly recommended that the Town, County and Fire District jointly enter into a merger/consolidation feasibility study to determine the opportunities, benefits and potential processes.

The most significant need for the Town of Knightdale is for staffing. The fire department is unable to staff and deploy the assets in the current fleet as an initial effective response force if more than one unit is required. The most significant existing unit level staffing need is for the aerial device. There are other needs for increased staffing for inspection workload and department administration. The fire chief is required to wear many hats and there is not an effective succession plan or positions in place to deal with an ultimate transition. A detailed assessment of existing staff positions and a comparative study of department staff with county, regional and state markets are provided in Chapter 5.

A very extensive deployment analysis and development of a resource deployment matrix and model indicate an immediate need for an additional fire station to serve the western and southwestern areas of development. This station can be staffed by a single unit, whether by an engine or a quint (the current aerial/pumper unit or a similar replacement).

The current Station #1 can continue to serve a reasonable first due response area and has adequate space for apparatus but might need some modifications/renovations for personnel if a second staffed fire company is housed here. This location is no longer able to serve the entire town however, due to response times and distance to new development.

The Town of Knightdale has an aging fire fleet with two pieces of apparatus beyond the age at which equipment might be moved to reserve status or retired completely. The size of the fleet is based on the hazards and risks found in the community and also generally meets the recommendations of the State of North Carolina Response Rating System upon which fire insurance rates are based. The conundrum however is that the Town does not have enough staffing to deploy the numbers of apparatus available and established by the State as the minimum needed for the jurisdiction.

The Town should evaluate its risk management and investment protection policies related to the fire fleet. The value of the existing fleet is estimated at \$1.8M while the replacement value is estimated at \$3.2M. The insured replacement values are significantly lower than the actual estimated replacement values. The insured value of the fleet is only 25% of the actual replacement value and 44% of the original acquisition costs. It is recommended that when current fleet insurance is renewed the town negotiate an "Agreed upon Value" for each unit that more closely reflects its replacement cost. This is especially important due to the current condition of the fleet. The findings and recommendations are based upon a fire fleet study which included a score card system for rating apparatus.

More specific recommendations for all areas are included in chapters 4-7.

Chapter I – Introduction

Scope of Work

Consultant provided services as described below:

The Consultant conducted through public and internal stakeholder input, data analysis, analytic projections, community comparisons, document and study reviews and geospatial analysis using GIS tools that leverage existing GIS data and mapping as well as the development of a specific fire station service and planning area model to achieve the following Fire Department Study Scope of Work:

Principal Areas of Review

1. Evaluate existing and potential station locations
2. Evaluate existing and future staffing
3. Evaluate existing and future fleet and equipment
4. Evaluate adequacy of succession planning

As this study progressed the local interests moved substantially towards an emphasis on the assessment of deployment and deployment options available to the community.

Project Objectives

1. The Consultant and the local Project Manager produced a project work plan and timeline (which was amended as necessary) to provide process guidelines, milestones, tasks and estimated delivery dates.
2. The Consultant Produced this comprehensive Fire Department Study which generally includes the following elements within the Principle Areas of Review:
 - a. **Community Comparisons**
 - i. Utilized the UNC School of Government, North Carolina Local Government Performance Measurement Project reports for Fiscal Year 2015–2016, data points developed by Wake County Fire Services Department, official Wake County data sources at WakeGOV.com and independently developed data for comparative purposes where applicable and where data was available.
 - b. **Operational Analysis**
 - i. The operational analysis considered the following questions:

1. Is the department management and administration structure sufficient, efficient, and effective in its preparedness for future vacancies? The principle responses to these areas are included in the stakeholder feedback and position analysis.
2. Are the present standards of service and their delivery for fire suppression, emergency medical, rescue, and hazardous materials response appropriate for towns with similar characteristics to Knightdale? The principle response to this question is included in the deployment analysis and comparative assessment.
3. What effects does emerging technology and equipment have on the range of services and delivery for a fire department? This question was considered in the analysis and recommendations for the Principle Areas of Review.
4. The efficiency and effectiveness of fire prevention operations such as code enforcement, inspections and other mandated regulatory inspections and approvals were assessed in stakeholder feedback, position analysis and workload analysis for the prevention program.

c. Personnel and Staffing Analysis

- i. Provide an analysis of the Department's present staffing levels and deployment. Determine if the number and configuration of the emergency response personnel and equipment is appropriate for the services which are delivered.
- ii. Provided recommendations for future staffing levels at appropriate intervals.
- iii. Reviewed each positions description and required qualifications, and recommended changes where applicable to comply with local, state, and national standards.

d. Department Apparatus and Equipment

- i. Evaluated the current fleet of equipment and vehicles to determine if it is adequate for current service delivery needs.
 1. Made recommendations of future needs at five and ten year intervals utilizing a Fleet Score Card Assessment model and an analysis of valuation and depreciation.

- ii. Performed an assessment of emergency vehicle maintenance practices to determine if current industry standards are being met by reviewing up to five years of comprehensive maintenance and repair records for each current unit in the fleet.
- iii. The appropriateness of personnel protective equipment, funding, replacement schedules, and other relevant guidelines/procedures were reviewed as part of the fleet study and historical budget review.
- iv. An assessment of tools and equipment currently carried on apparatus was considered as a part of the fleet study and historical budget review.

e. Deployment

- i. Evaluated and provided recommendations on the number of fire stations needed currently, additional stations needed in the foreseeable future, and produce a map for the strategic placement of future stations.
- ii. Conducted an assessment of current resource deployment in relation to service demand levels and ISO/Insurance Rating requirements. Deployment became the principal area of interest and analysis for this study.

f. Accreditation

- i. While evaluating, analyzing, and making recommendations, the Consultant remained mindful that it is a future goal of the Customer to obtain accreditation for the department through the Commission on Fire Accreditation International (CFAI). There is a section in the chapter referencing the management and administrative structure that makes a few specific recommendations in this area.

In addition to these stated objectives and scope of work, the firm has provided the department an electronic copy of the Fire Station Service and Planning Area Model for the Customer’s future use along with a digital data library of the principal data sets and analysis upon which this study is based.

Study Process

A tremendous amount of work was done by the KFD Team in providing relevant documents, reports and raw data or specific reports as requested by the study team. Fire Chief Tim Guffey and Senior Planner Jason Brown contributed the majority of the vast library of data and documents made available to the consultant. Document reviews have contributed to the body of knowledge for this report. The local

team has been very responsive in following up to requests for information based upon the document reviews, or making modifications to reports to add value or improve understanding.

Data collection and analysis utilizing already existing resources and creating new views of existing reports or data files helped answer standard questions and also contributed to the identification of new questions and findings. The availability of some data, the format of available data, or the process for retrieving data has been challenging at times during the study for the local team and the study team. This was especially true in attempting to collect data or present data related to critical response time elements. For these reasons there are limited references or analysis of alarm handling times for incidents and units.

Two opportunities were provided for members of the KFD team to provide stakeholder input into the assessment of community growth and community needs, organization assessment and the current condition of units of the emergency response fleet. A project orientation meeting was also held that helped tremendously in understanding local practices, data sources, and the local teams understanding of the scope of the project and the study team's needs.

Two facilitated stakeholder input sessions were conducted to offer direct stakeholder input and raise stakeholder's awareness of the project scope. One session principally engaged internal stakeholders including paid and volunteer staff. The other session principally engaged external stakeholders and community or outside department leadership.

An orientation briefing was provided for the Town Council and the Town Manager, Bill Summers on October 18, 2017. An update and progress report briefing was provided to the Council and Manager on January 9, 2018. A performance briefing for position reviews, performance and service demand projections and overview of the standard station service area assessment was provided to the fire chief on April 4, 2018. On May 4, 2018 a final draft report briefing was delivered to the Town Manager and Fire Chief.

An additional face-to-face opportunity for department stakeholder feedback was provided when conducting on-site field work for assessment of emergency response apparatus. Station shift personnel were interviewed about each major piece of apparatus and their responses which were recorded in individual apparatus assessment forms. A unit database was created using this information supplemented by more detailed information provided by the chief from department records of maintenance and repair costs.

Performance data was provided for review by the local coordinator upon initial review and assessment of service demand and future demand for service projections. Conversations were conducted electronically or by phone concerning the data available for analysis. Incident data has been recorded in a format that has met local reporting needs but which will not be in the format necessary for a full external comparison, especially for fire service accreditation. The specific data that was not available

was complete alarm handling data and clear data for fully evaluating an effective response force. There is adequate data for evaluating service demand by incident type and projecting future service demand.

A briefing was conducted with the chief once the first fire station service area matrix was created. The matrix serves as the model and framework for evaluating existing and future fire station service areas. This briefing and the feedback received was very helpful to the overall project.

Interviews were conducted with a number of personnel, some internal and some external to the Town of Knightdale. The KFD Project Coordinator was available and also reached out to other KFD staff when necessary for additional information or interpretations.

The Director and Deputy Director of Wake County Fire Services provided support and communications electronically, by phone and in person on a number of issues including county statistics and service opportunities in the Alert Fire District which surrounds the Town of Knightdale. Director Nick Campasano and Deputy Director/Chief of Operations Darrell Alford were very supportive and open in their assistance for the benefit of the Town, County and the study team. The Town is not a participant to any contractual arrangement with Wake County but does provide a closest unit response (principally to incidents of a medical nature) according to standard protocols among agencies dispatched by the Raleigh-Wake County Emergency Communications Center. The Town does have an existing contract with the Eastern Wake Fire Rescue Department to provide a first unit response to an area to the southwest of the town that is outside of the five mile service area from the Town's Fire Station #1. This area is serviced by Eastern Wake Fire Station #1.

The Town of Knightdale Community Development Director, Chris Hills, and Senior Planner Jason Brown were interviewed and provided valuable information concerning growth and development, both historically and for current projects underway. The community comprehensive plan, normally a ready and useful source of information, is under complete revision and update.

In addition to providing data from departmental assets, the KFD Fire Chief/project coordinator provided tours of the existing fire station, of the Town and areas identified in the Standard Station Service Area Model. Lt. Pope and the members of Station #1 A Shift provided access to fleet assets and other data and information as requested. The principal researcher for the study team made several visits to the jurisdiction to gather data or visit sites.

The study team utilized performance, service demand, and other GIS infrastructure and demographic data to analyze the current existing conditions and station service areas. Robert McNally, Founder and Principal for BeaconGIS served on the study team providing geospatial analysis and evaluation. A Standard Fire Station Service Area Matrix was created for the KFD jurisdiction that identifies recommended service areas for existing and future stations as well as contiguous areas served by neighboring resources. The size and orientation of the service areas in the matrix reflect service demand and population density for the town and are directly related to response capability and desired outcomes. The matrix provides a model to collect and assess various data elements that evaluate factors

contributing to growth, service demand and service capacity or performance. The model also helps to quantify threshold values for deployment, capital decisions and provides a communicable view of the community's decisions regarding acceptable and unacceptable risk.

Regression Analysis

Current and future trends of workload and service demand were identified primarily through trend analysis of historical experience using regression analysis tools. Most regression analysis was conducted using linear regression. When a standard reliability formula that was applied to every measure of the regression analysis was moderate, a second method, exponential regression was used. Both methods were presented with the resulting trend line reliability calculation result. In a few cases trends were also evaluated with a standard rolling two year average method. To ensure credibility of the results, forecasting tools were also used to validate or challenge the regression analysis. Two methods of forecasting, Growth Trend and Linear Trend, were used and averaged to arrive at specific service demand targets for each of the next seven years for the jurisdiction. Regression and Forecasting analysis are common statistical tools for predictive analysis and can be replicated by the agency or any other external stakeholder utilizing the same variable and non-variable data set(s).

Report Organization

The report is organized in chapters to present the findings of the study while satisfying the scope of work and the major objectives of assessing the current facility, determining potential new or future station locations for the jurisdiction, and evaluating the fleet and making appropriate capital recommendations. There are eight chapters:

Chapter I – Introduction

Chapter II – Environmental Scan

Chapter III – Service Demand

Chapter IV – Fire Station Location Study

Chapter V – Personnel Needs

Chapter VI - Fleet Study

Chapter VII - Recommendation Summary

Chapter II – Environmental Scan

Stakeholder Sessions

Brooks Innovative Solutions held two separate stakeholder sessions facilitated by Chief Gregory Grayson on December 11, 2017 in Knightdale at the Town’s Public Safety facility. The first session consisted of approximately fifteen (15) career and part-time staff. The second session consisted of approximately fifteen (15) community stakeholders representing neighboring fire departments, EMS, law enforcement, public schools, industry, county government, town elected officials and private citizens. Sessions lasted between two and three hours each. Similar questions were posed to each group, with a focus on hearing perspectives based around core perceptions of strengths, weaknesses, opportunities and threats with the fire department itself and providing fire and rescue services within the Town of Knightdale. While there were divergent points of view from each of the two groups, there were several key items that were consistently articulated. These were:

Imminent need for a second fire station for the Town and the need to better serve the Hodge Road area.

Need for improved fire apparatus and equipment, in particular the adequacy of the ladder truck.

Reliability for the single station and single response company is low for simultaneous secondary calls for emergency assistance along with the essential need for reciprocal automatic aid responses.

The Fire Chief needs administrative help and assistance in managing the department, with specific priority for a Deputy/Assistant Fire Chief.

More energy, effort and resources should be placed into career succession planning for the department, with a solid recognition of some current challenges.

The need to better educate the public about the department, its services and needs and the positive financial impact the department provides.

There are current needs for the fire department. However, continued growth is expected for the town and that growth will necessitate growth for the fire department.

Beyond these aligned commonalities, the staff expressed their most significant concern about the current level of minimum daily firefighter staffing and the inadequate number of firefighters on duty to mitigate basic residential structure fires, notwithstanding larger commercial fires. Also, significant concern was voiced about recruitment and retention issues of firefighters in the Town and the lack of understanding of fire operations by Town leadership as well as the perceived lack of support that the department receives from Town Government. The most basic summary was that the growth of the Town has far outpaced the growth of the fire department during the same period of time. The staff also highlighted the need for the Town to upgrade to a full-time Fire Marshal and inadequacies with the current fire station.

Beyond the consensus from the community stakeholders group, there was articulated need for improved diversity within the department as well as the need to strengthen the department’s ability to mitigate more complex incidents at commercial and industrial facilities, such as situations involving hazardous materials.

Community Description

The Town of Knightdale is a dynamic community located in Wake County and the capital metropolitan area in central North Carolina. The Raleigh News and Observer printed an article on the suburban population boom in the suburban Triangle area on May 25, 2017. This article, written by Kathryn Trogdon, documented their research based on data and estimates by the US Census Bureau. The article reported that “Suburban towns in Wake County were among the fastest-growing North Carolina

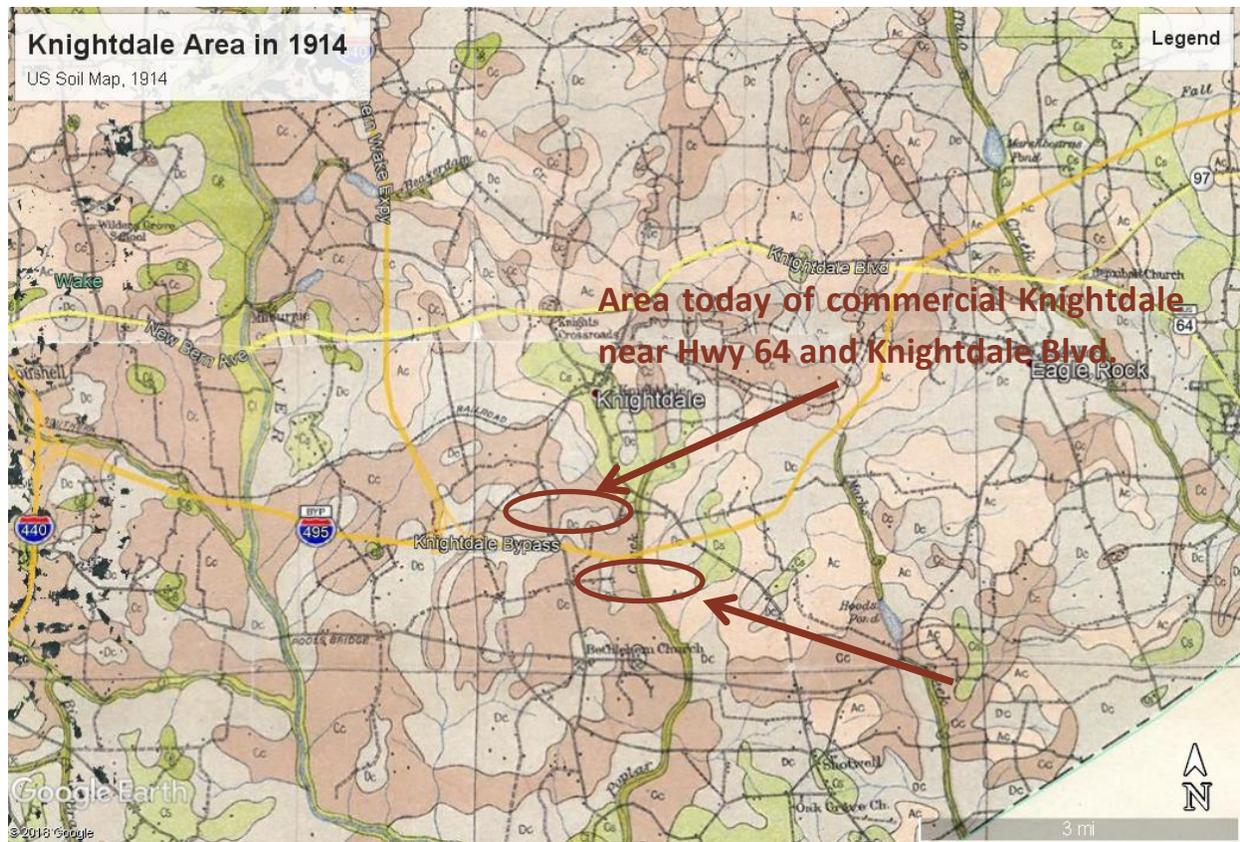


Figure 1 – 1914 Soil Map of Wake County and Knightdale, overlaid with modern major transportation network. Source: Washington, DC: US Bureau of Soils and North Carolina Department of Agriculture, 1914. NC State Archives, Google Earth.

municipalities over the last six years...” The article stated that “Six of the state’s fastest-growing towns since 2010 were former railroad and crossroad communities in Wake...” including the Town of Knightdale.

Comparatively, Charlotte grew by 14 percent, Durham grew by 14.7 percent, and Raleigh grew by 13 percent. The fastest growing town in NC was reported to be Rolesville which grew by a whopping 82 percent between 2010 and 2017. A link in the article to a US Census Bureau estimation table reported that Knightdale grew by 28.4 percent between the years of 2010 and 2016. The article quoted Amel Touikabri, a demographer with the US Census Bureau’s population division as saying, “Since the 2010 Census, the population in large southern cities (which infers their demographic areas as well) grew by 9.4 percent. In comparison, cities in the West grew 7.3 percent, while cities in the Northeast and Midwest had much lower growth rates at 1.8 percent and 3 percent respectively.” Knightdale Town Hall is located less than fifteen miles from the NC Legislative Office Building in Downtown Raleigh.

According to the January 2018 Knightdale Development Services Monthly Activity Report, the issuance of building permits in the Town in 2017 exceeded the 2016 rate by 15 percent and the 2015 rate by 19 percent. The report also cited that average improvement values of new homes increased by 5 percent. The issuance of building permits has continued to climb with 255 single family permits issued and 112 commercial permits issued.

Settlement in the area dates back to colonial times. England’s King Edward apportioned lands to willing settlers around 1730. The area economy was fueled by agriculture, primarily the raising of cotton and tobacco. The town is named for Henry Haywood Knight who donated land to the railroad in hopes of seeing commercial development. The railroad finally arrived in 1904 but after the passing of Mr. Knight. Developing as a small railroad town and regional center of commerce, the town was incorporated on March 9, 1927. As the impact of the railroad diminished over the decades, the town’s growth slowed. The widening of Hwy 64 provided a rebirth to commercial development in the area of Hwy 64 and Knightdale Boulevard. For a period of time there was a manufacturing interest in the town, led by the construction and operation of a Square D electrical equipment manufacturing plant, eventually sold to Schneider Electric, which operated in the area from the early 1970’s until the early 2000’s.



Figure 2 - 1940 Knightdale Fire, Knightdale Historic Society



Figure 3 - 1940 Knightdale Fire Burns into the night, Knightdale Historic Society

Fire protection in the town of Knightdale has taken many forms, including large cisterns and community buckets as reported by one anecdotal remembrance. The following department history is retold from significant events recorded by Mike Legaros, a local fire historian. There was no truly organized formal fire protection until after a major fire in 1940 that destroyed much of the town's business and commercial district. It was

still 1954 before the first fire department was organized. In 1955 the Knightdale Volunteer Fire Department joined the Wake County Rural Fire Protection Program serving the town and a rural district that extended five miles from the town. The district was named the Alert Fire District in 1957. In 1960 two divisions were created, town and rural. In the 1990's issues between the town and district were frequent and divisive. Finally, in 2002 the town elected not to renew a fire protection contract with the district and instead created a municipal fire department.



Figure 4 - 1940 Knightdale Fire Aftermath, Knightdale Historic Society

The early 21st Century has seen an economic resurgence and associated growth in Knightdale that was again stymied following the 2008 Recession. Growth has again returned and Knightdale is poised to accommodate significant population and housing growth over the next decades.

The town shares portions of its western boundary contiguous to the city of Raleigh, the second largest city in North Carolina and which serves as the State Capitol. Both municipalities Extra Territorial Jurisdictions touch each other. The area between the municipalities is an area of concentrated residential growth and associated development. Knightdale is in close proximity to other small municipalities experiencing their own growth resurgence. To the east are the towns of Wendell and Zebulon, while Garner is located just to the southwest. Knightdale is in a prime position to be able to accommodate growth resulting from Wake County's position as home to the Research Triangle Park, State Capital Region, Raleigh-Durham International Airport and major transportation networks and roadways that have aided economic activity throughout the county. The town area is approximately 8.5 square miles. While the town has grown in area by 22 percent in the last decade, much commercial development has been infill development. Most residential development has provided opportunities for the town to grow into new areas.

The town has developed principally in a linear fashion along the interstate and state highway corridors. The town is approximately five and one-half miles in length west to east along the NC US 64 corridor. It is approximately 4 miles wide at its maximum, generally following the I-540 corridor and beyond to Poole Road to the south. The more average width is about two miles. Most opportunity for development lies to the west and northeast and to a more limited degree to the southeast. The US 64 corridor presents developers with feasible options.

Transportation infrastructure including major roadways and a rail line, present significant barriers for development and fire resource deployment. A major interstate, I-540, bisects the community. There are virtually only two access points to this major roadway, at either end of its juncture with the town. US 64 traverses the length of the Town from west to east. To the south is the old rail line and farther south is I-495. The rail line is another physical barrier to development and deployment. The rail line generally borders the town to the south. The town was developed by the railway in the early 1900's. The original rail company has long since gone out of business and the last major operator, Norfolk Southern, now leases the line to Coastal Carolina Railway. This rail company primarily provides business freight services along its short line routes and provides connectivity to major carriers at hub sites. There may be periodic rail traffic through Knightdale carrying freight from Wilson to Raleigh but there are no customers served in the immediate area. The town backed out of a plan for commuter service on the line in the early 2000's due to an unfavorable report from a feasibility study.

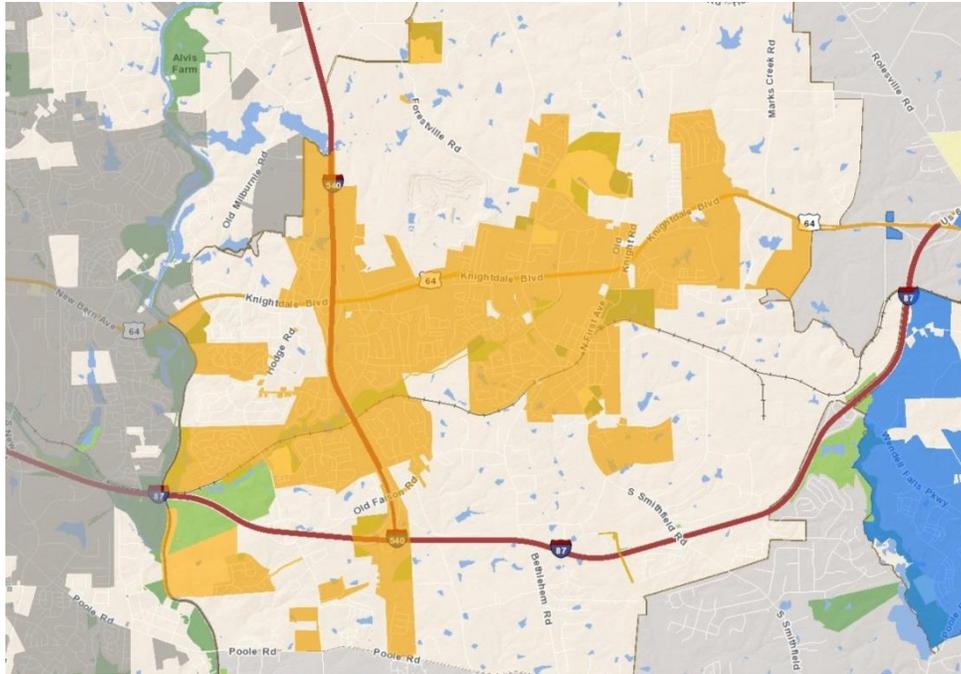
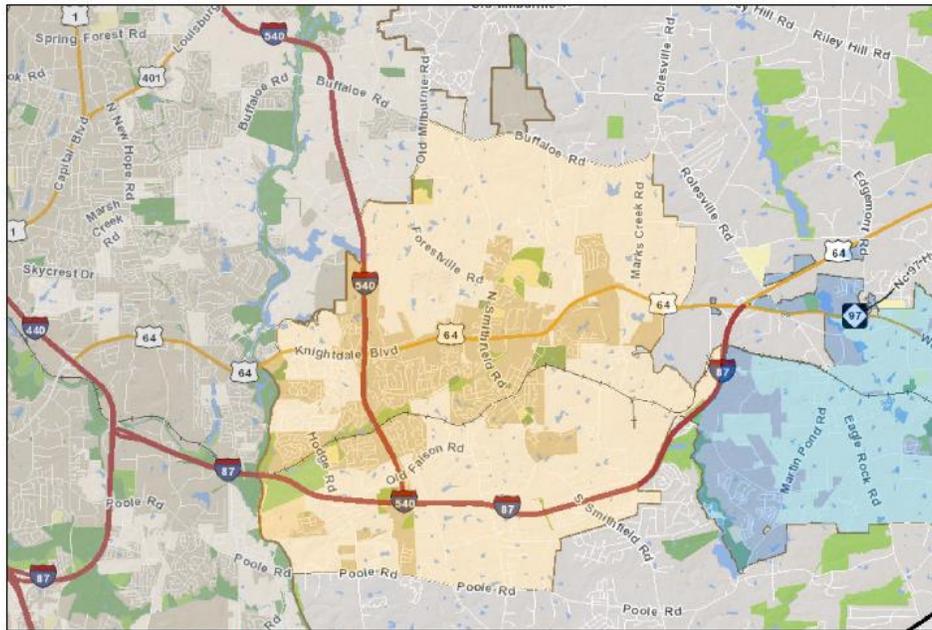
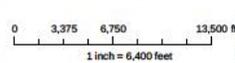


Figure 5 - Town of Knightdale and Other Jurisdictions: Source – Wake.gov/IMAPS



Town, ETJ and Transportation Network



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Figure 6 - Town of Knightdale Boundary and Major Transportation Network: Source – Wake.gov/IMAPS



Population and Demographics

Population growth in the Town of Knightdale has been rapid over the last decade. The population in the year 2009 was 10,322 persons. In 2018 the population is estimated at 15,922, an increase of 54 %. It should be noted that there are several different estimates of population, depending upon who issued the estimate. Regardless, all entities are very close and are in agreement that the population for the town has increased at a steady rate and continues to far exceed the growth rates of the county and the state. In this study we have used estimates of total population count provided by the Knightdale Department of Community Development. Estimates have been tested with data from the US Census Bureau; American Fact Finder and the NC Office of Budget and Management.

POPULATION GROWTH SINCE 2009		
YEAR	TOK.POP.EST.	% Chg.
2009	10322	
2010	11705	13.40%
2011	12048	2.93%
2012	12091	0.36%
2013	12671	4.80%
2014	13072	3.16%
2015	13635	4.31%
2016	14083	3.29%
2017	14646	4.00%
2018	15922	8.71%
AVERAGE		4.99%

For the ten year period since 2009 the overall town population has grown by 5,600 persons with an average annual rate of increase of 5%. According to the American Community Survey – 2016, Knightdale has a young and racially diverse population. Only 8.7% of the population is older than 65 years of age

Historical Table 1 - Population Growth since 2009:
Source – Town of Knightdale

while 49% of the population is under 35 years of age. The median age is 35.5 years. Median household income at \$67,167 barely trails Wake County by just 4.88%, exceeds the state median household income by 39.19% and exceeds the US median income by 21.41%. The population is well educated with more

than 41.3% of those 25 or older having earned a bachelor’s degree or higher and 90.8% of the total population having graduated high school or higher.



According to the Wake County Economic Development, Major Employers Directory, Schneider Electric is still the largest employer in Knightdale employing approximately 445 persons. Other large employers in the town include Duke Energy, ESP/SurgeX, UNC Healthcare and Wake Stone.

Figure 7 - Major Employer, Schneider Electric; Google Earth

Zoning and Future Land Use

The current Comprehensive Plan is undergoing a major revision. Land use and zoning however is not likely to change significantly. The parcel zoning and land use plans of the town and the East Raleigh/Knightdale Area (Wake County) Land Use Plan (Figure 9) are generally in concert for most of the developable land within the town's extra-jurisdictional area and those county areas immediately adjacent. The Town has planned the principal land use in the areas currently experiencing the most activity, and the areas providing the most promise for development as General Residential but actually developments are rezoned for the specific development plan. Recent history has shown the town supports the mixed use activity centers. This is further supported by an aggressive stance on open space and public access recreational facilities. Figure 10 "Recent Residential or Mixed Use Development" illustrates development and growth patterns in the town and it's ETJ. An excellent example of such development is found in the Knightdale Station development and other similar developments.

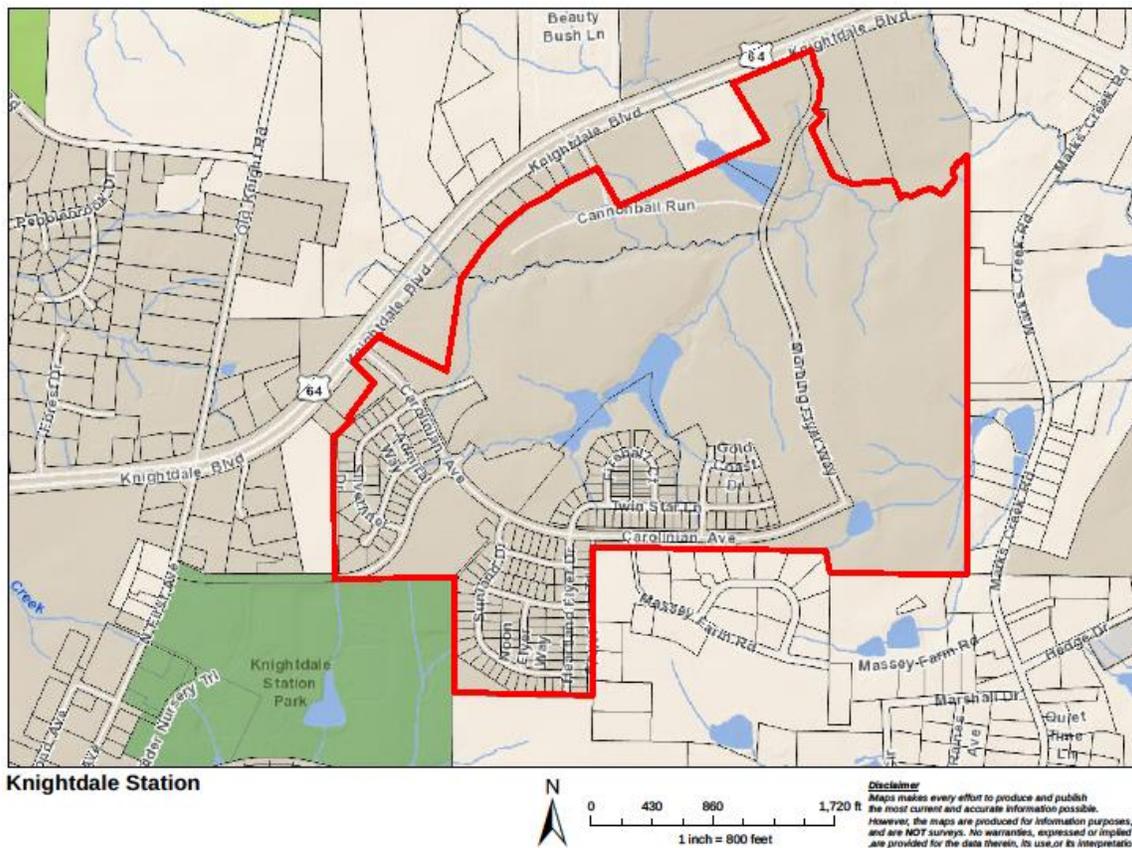


Figure 8 - Knightdale Station Development, Example of Mixed Use Development and Activity Center

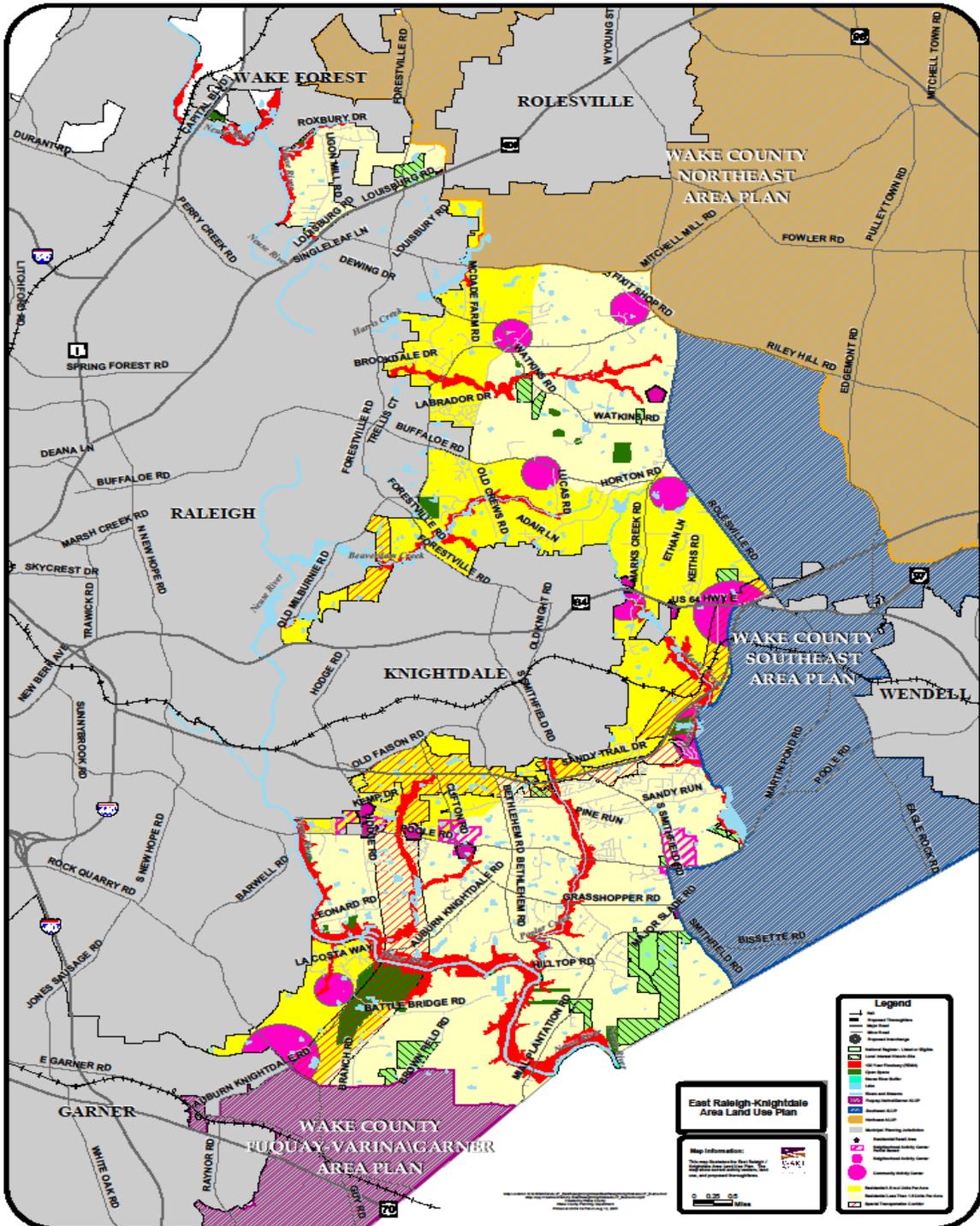
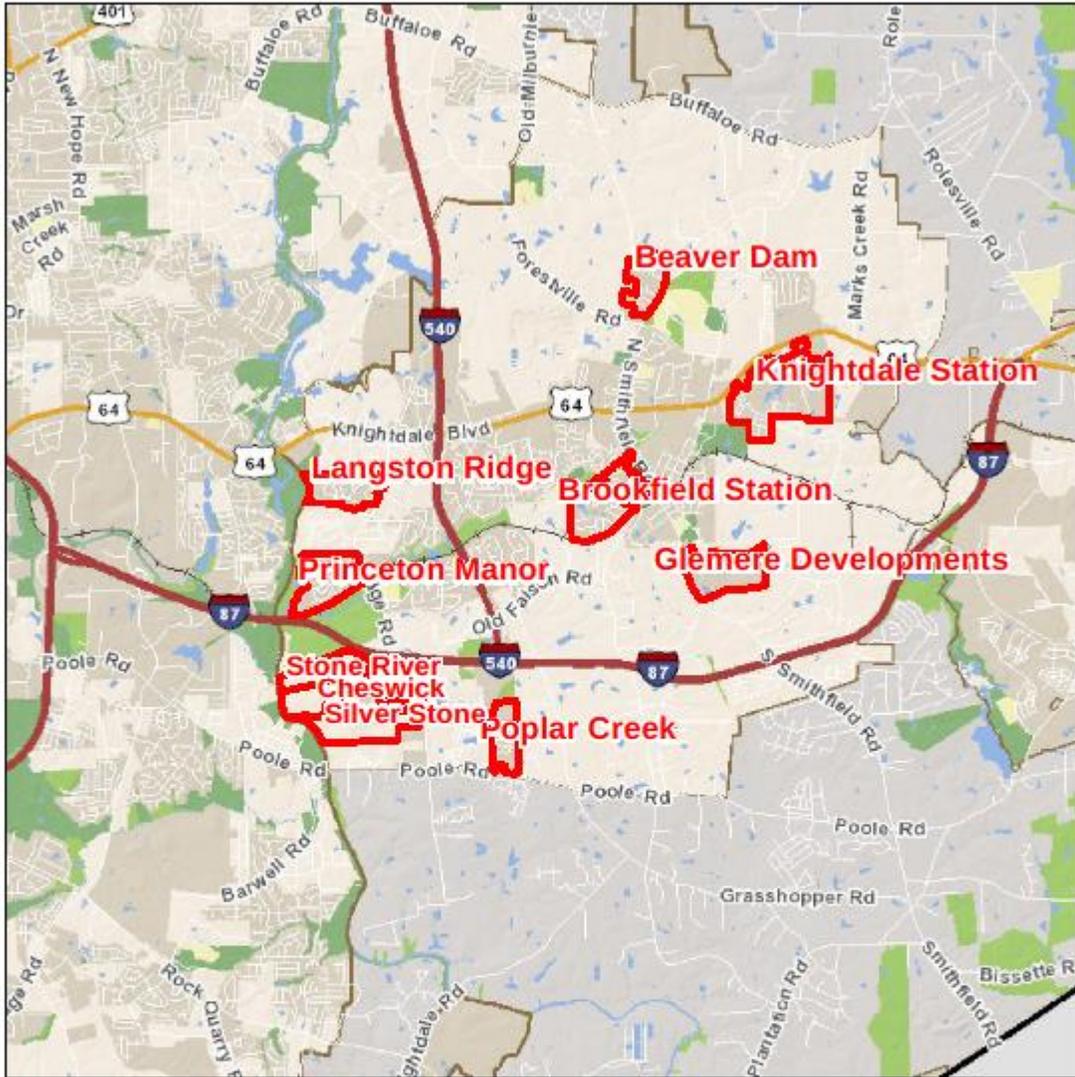
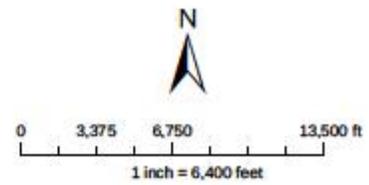


Figure 9 - East Raleigh/Knightdale Area Land Use Plan (Wake County)



Residential Developments and Activity Centers



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Figure 10 – Recent Residential or Mixed Use Developments

Any significant business or industrial development is planned for the areas along the Hwy 64 corridor. Some commercial development is approved and underway along the I-540 corridor and along Hodge Road near major residential /mixed use activity centers and medical facilities. There is zoning for light to medium industrial, manufacturing and quarry activity along US 64. The following figures offer views on other major developments recently approved, under construction or recently built out.

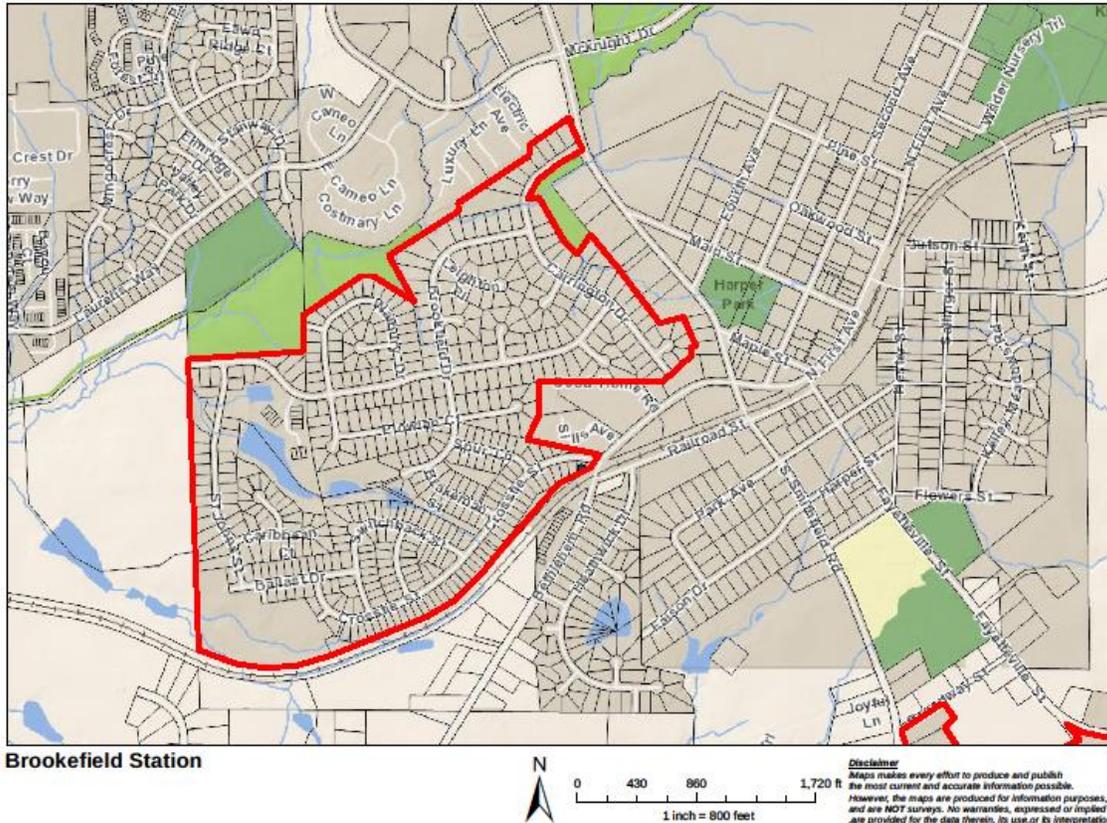


Figure 11 - Brookefield Station Development; Built Out

For unincorporated land located outside of the town’s extra-jurisdictional areas, the county has established land use through its Unified Development Ordinance and area plans. The Town of Knightdale provides an excellent project (development) tracker in the form of an interactive map where the public can find information for all commercial and residential projects under consideration or construction. This link will take you to the interactive map. <https://www.knightdalenc.gov/residents/knightdale-interactive-project-map>

Two large developments have recently received Master Plan Approval north and south of the Cheswick Development. These developments create a very significant future concentration of population in the area south of I-495 and west of Hodge Road.

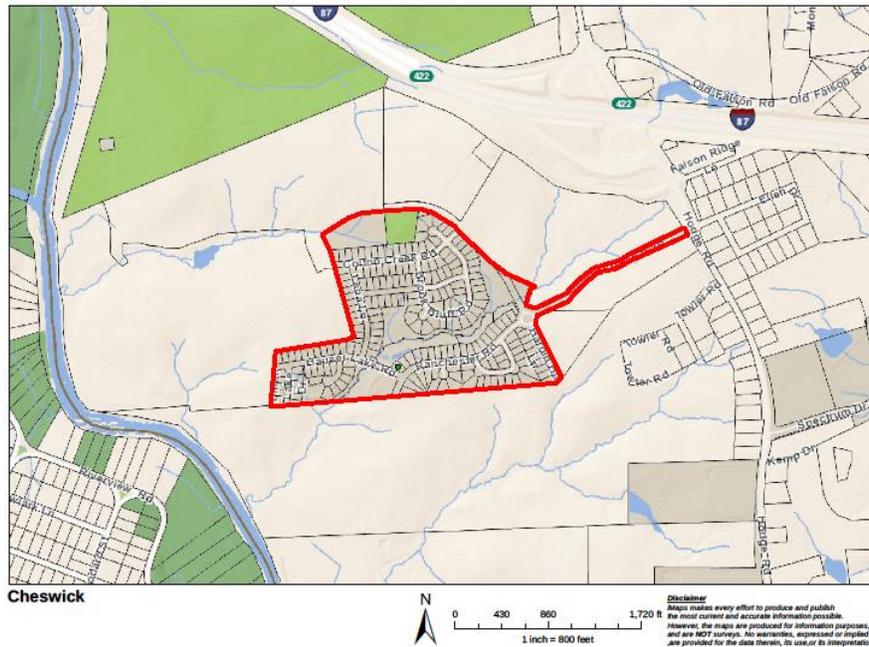


Figure 12 - Cheswick Development



Figure 13 - Newest Developments in Approval and Design Phases

Langston Ridge and Princeton Manor are large developments under construction and located in the area north of I-495 and west of I-540. These developments are just north of the Stone River, Cheswick and Silver Stone projects.

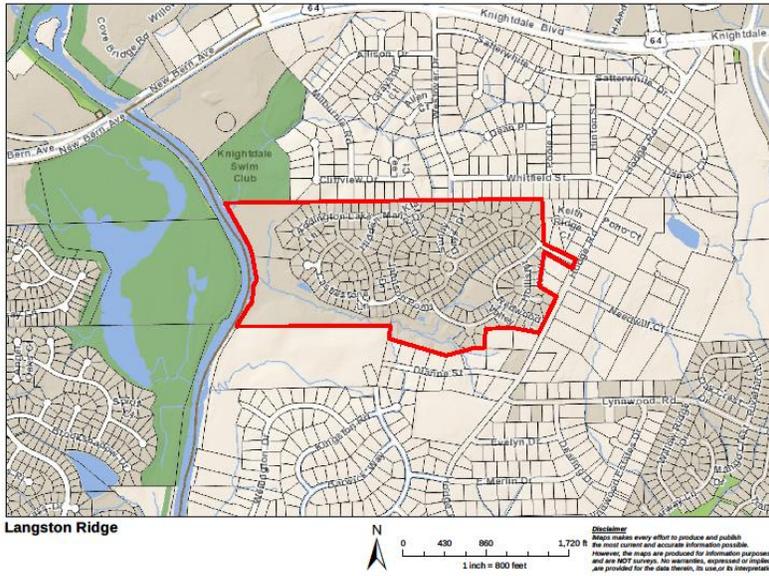


Figure 14 - Langston Ridge Development

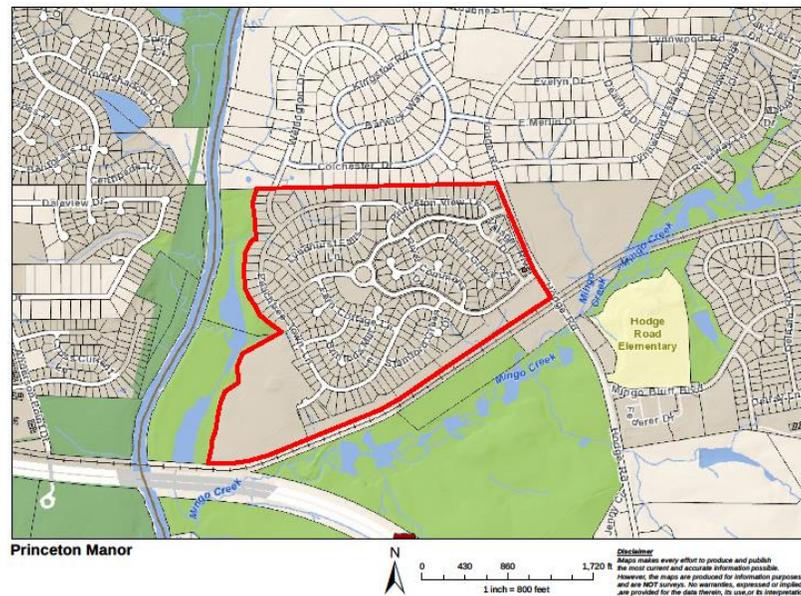


Figure 15 - Princeton Manor Development

Beaver Dam is the 2nd most northerly develop in the town following Emerald Point. It is also built out. Poplar Creek, which recently opened a new phase for construction, is the most southerly development in the town.

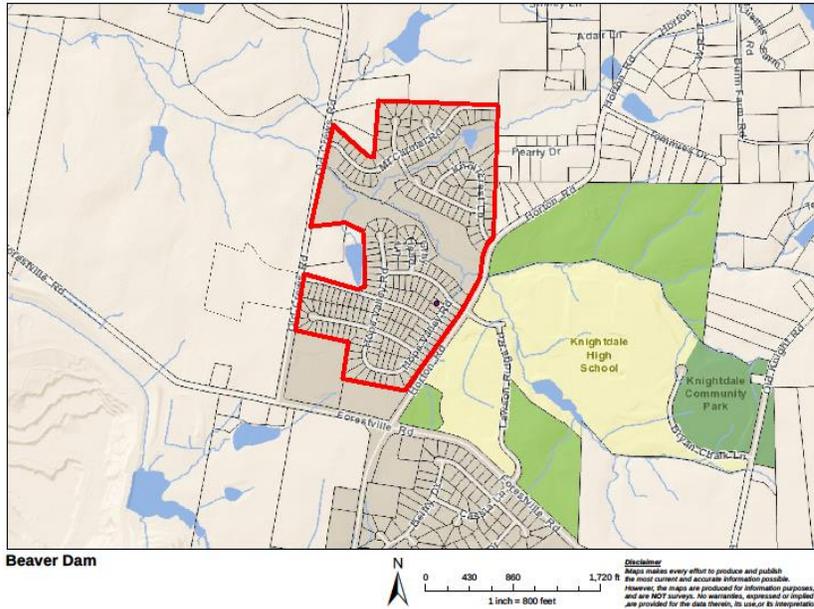


Figure 16 - Beaver Dam Development, Built Out

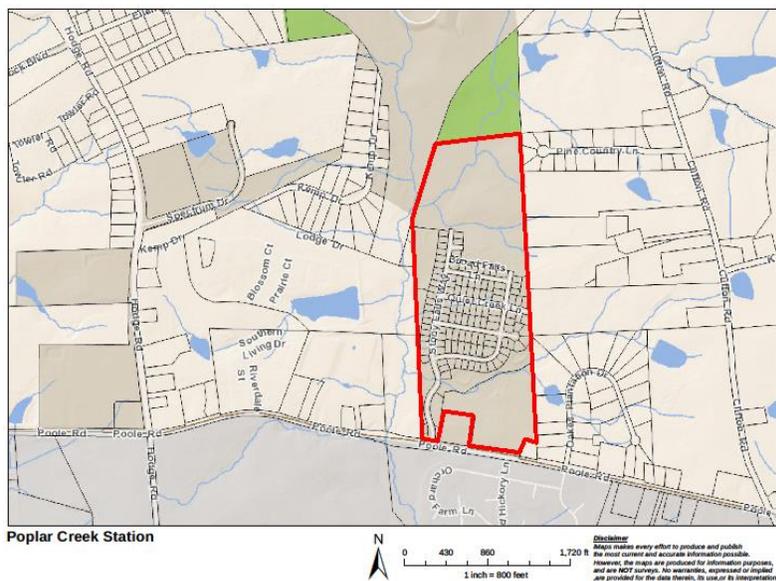


Figure 17 - Poplar Creek Village Development

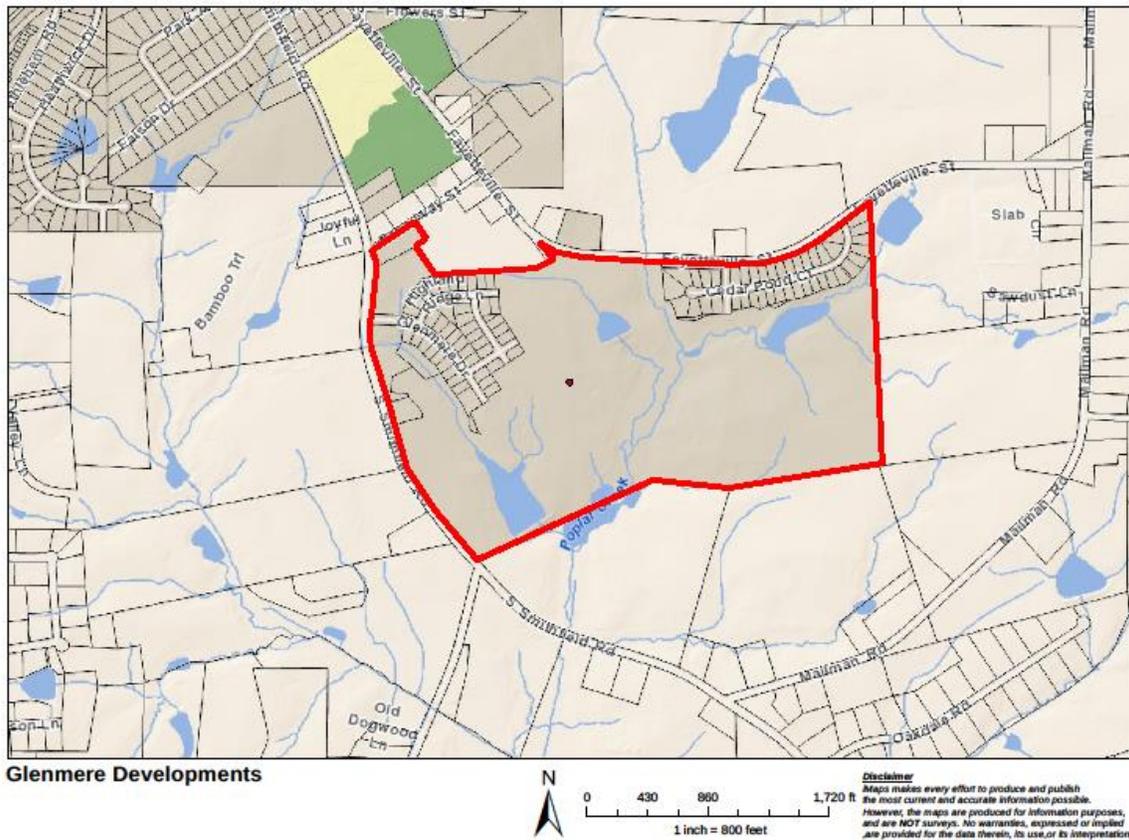


Figure 18 - Glenmere Developments

The Glenmere developments are located south-central to the town near Smithfield road. The area is comprised of two divisions, Glenmere Cove and Glenmere Forest.

The annexation/growth history for the town, depicted in Figure 19, definitely illustrates a systematic development and growth strategy, along with market influences and infrastructure availability, which have promoted growth and expansion to the northeast and to the southwest.

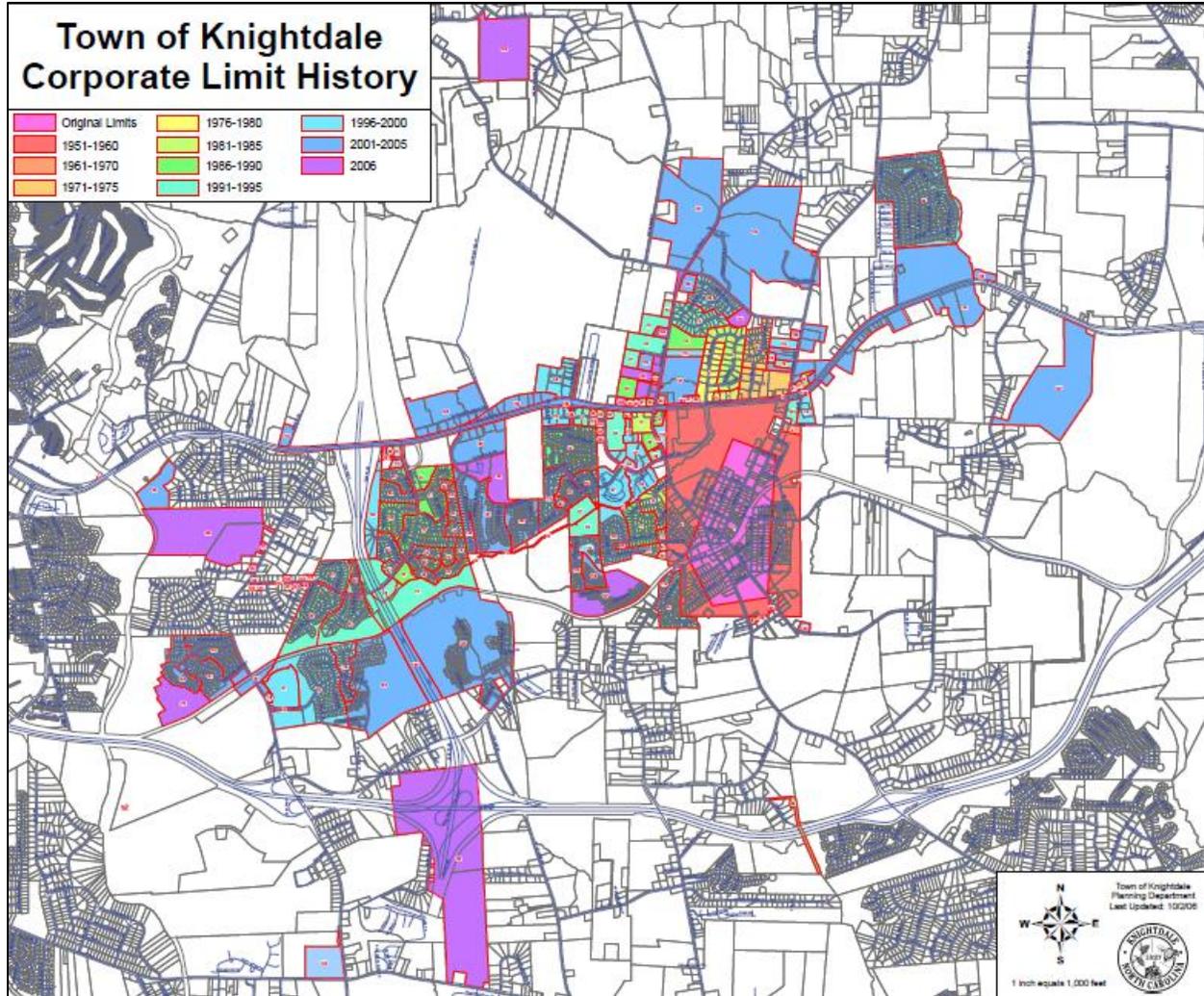


Figure 19 - Corporate Limit History

Future Growth

Future growth for the Town of Knightdale will be the result of continued buildout of current large residential developments, new residential development tracts and other business related economic development. Most of the growth in the next ten years will most likely be the overflow from the Raleigh Metropolitan area. There will be opportunities to incorporate new developments seeking utilities and other town services. Using regression analysis, we can project population growth to provide a quick view of a few growth factors that may contribute to increased service demand in the near future.

Population Projection

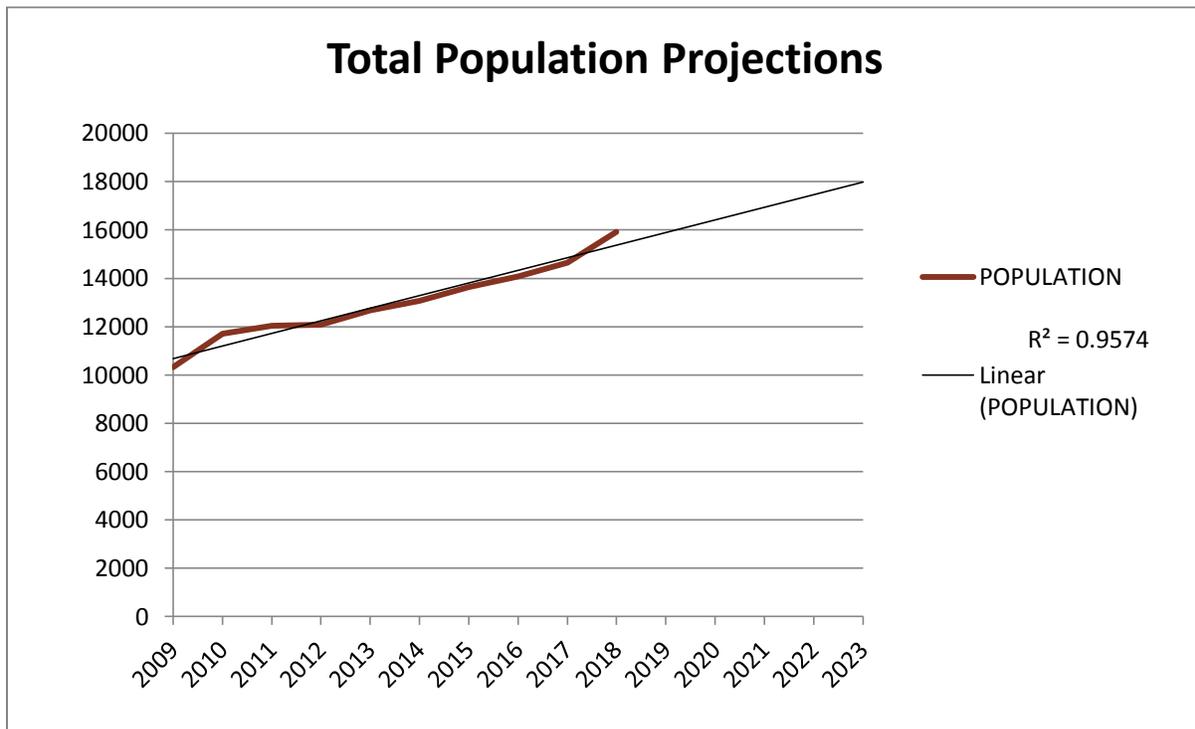


Figure 20 - Total Population Trend Line Projection

Total population will continue to keep pace with the surrounding area. It can be estimated that total population for the town, based on historical growth and current counts, will increase by nearly 2,800 people for a 17.45% increase by 2023, growing at an annual average rate of about 3.5%. Based on development history it could also be assumed that there will be new phases opening in existing development projects or completely new projects. Considering projections based on history and the potential for new development, the town and department should plan for a population increase of 3,000 to 5,000 people over the next five years to reach a new total population count of approximately 20,000.

TOWN POPULATION			
	Growth Trend	Linear Trend	Average of Trends
YEAR			
Forecasting	Linear	Growth	
2009	10322	10322	
2010	11705	11705	
2011	12048	12048	
2012	12091	12091	
2013	12671	12671	
2014	13072	13072	
2015	13635	13635	
2016	14083	14083	
2017	14646	14646	
2018	15922	15922	15922
2019	16285	15948	16116
2020	16993	16484	16739
2021	17732	17020	17376
2022	18504	17556	18030
2023	19309	18093	18701

Table 2 - Forecasting Future Population Estimates

Assessed Valuation Projection

Total assessed valuation for the town has risen slightly slower than total population, but still at a very significant rate. The current total assessed valuation is \$1,644,362,257. The valuation has risen by \$517,858,950 since 2009, within a ten year period. This was a 46% increase averaging 5% annually. Using trending and forecasting tools, it can be estimated that future valuation will grow at a rate just over 3% annually. Total assessed valuation in 2023 will be approximately \$2 billion. Growth in valuation can be interpreted a number of ways and these projects do not attempt to apply any inflationary factor. Although residential developments are being built at a higher rate than commercial, commercial development accounts for a much higher rate per project. As an example, according to the Knightdale Department of Developmental Services, 127% more permits were issued for single family residential construction than for commercial construction, yet the total project valuation of single family over commercial was only 13% higher. The total value of 255 new single family permits was \$50,777,123 (\$199,125 average value) while the total value of 112 permits issued for commercial projects was \$38,855,235 (\$346,922 average value).

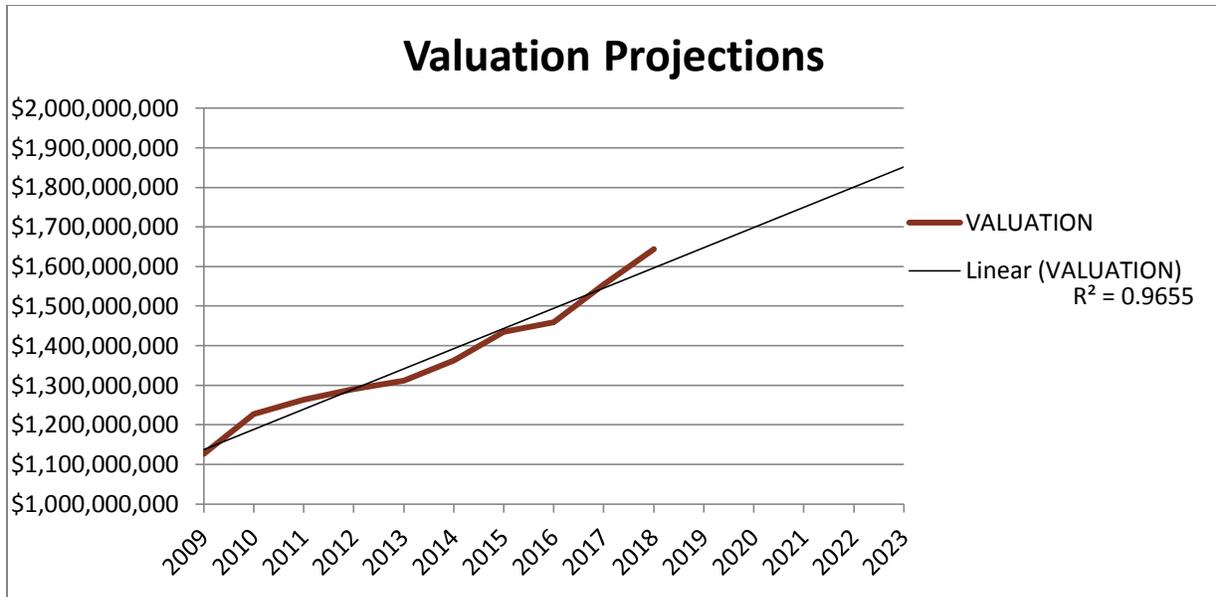


Figure 21 - Total Assessed Valuation Trend Line Projection

TOWN VALUATION			
	Growth Trend	Linear Trend	Average of Trends
YEAR			
Forecasting	Linear	Growth	
2009	\$1,126,503,307	\$1,126,503,307	
2010	\$1,227,318,524	\$1,227,318,524	
2011	\$1,263,404,900	\$1,263,404,900	
2012	\$1,290,079,778	\$1,290,079,778	
2013	\$1,311,233,473	\$1,311,233,473	
2014	\$1,363,081,049	\$1,363,081,049	
2015	\$1,435,611,732	\$1,435,611,732	
2016	\$1,458,945,389	\$1,458,945,389	
2017	\$1,554,125,464	\$1,554,125,464	
2018	\$1,644,362,257	\$1,644,362,257	\$1,644,362,257
2019	\$1,667,951,522	\$1,647,950,754	\$1,657,951,138
2020	\$1,731,143,031	\$1,698,947,876	\$1,715,045,454
2021	\$1,796,728,596	\$1,749,944,997	\$1,773,336,796
2022	\$1,864,798,915	\$1,800,942,118	\$1,832,870,516
2023	\$1,935,448,125	\$1,851,939,240	\$1,893,693,683

Table 3 - Forecasting Future Total Assessed Valuation Estimates

Land Area Projection

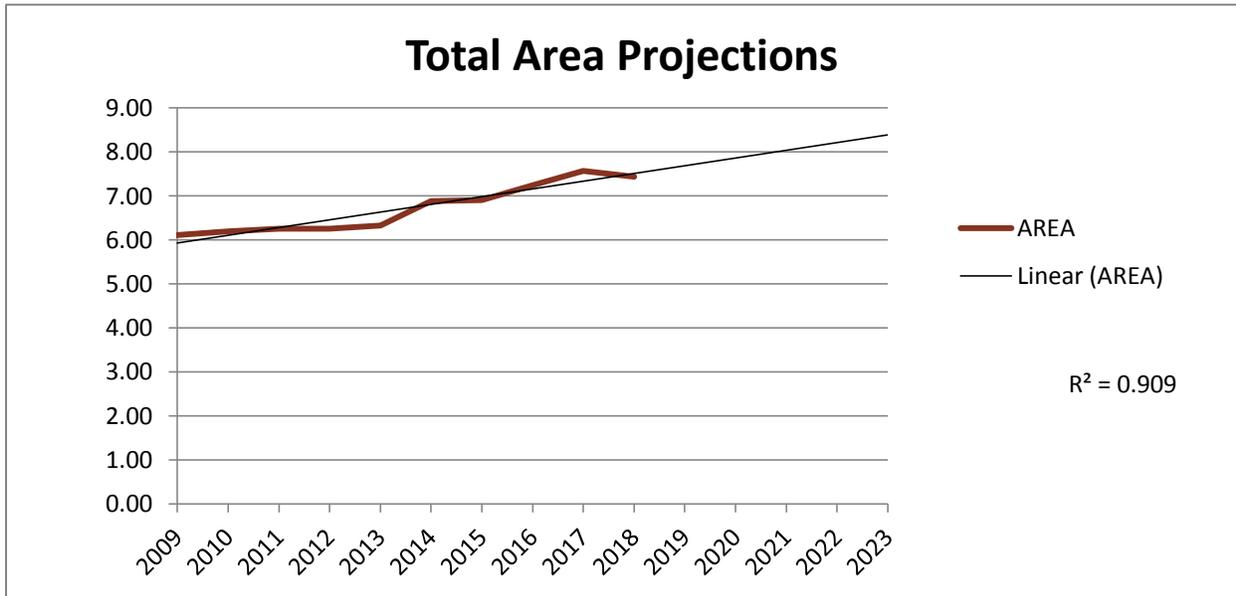


Figure 22 - Total Land Area Projection

The total land area in the Town of Knightdale in 2018 is reported to be 7.43 square miles. This is 1.32 square miles larger than in 2009 for a 22% overall increase. There was one year in the last decade reported as experiencing a reduction in area of the town. This might be explained by changes between

ACTUAL ANNUAL CHANGE		
YEAR	TOK.AR.EST.	% Chg.
2009	6.11	
2010	6.19	1.31%
2011	6.25	.97%
2012	6.25	.00%
2013	6.33	1.28%
2014	6.88	8.69%
2015	6.90	.29%
2016	7.24	4.93%
2017	7.57	4.56%
2018	7.43	-1.85%
AVERAGE		2.24%

the actual town and the ETJ. One year was reported as being in error but having been corrected. The accuracy of future projections are impacted but the overall net effect is unchanged. The town experienced growth in service area in the same period as experiencing growth in population and valuation. The rate of increase for area is not as high as population and valuation but this can also be explained by the rate of in-fill development during this time period.

Applying trending and forecasting tools, a range for future service area size in 2023 between 8.4 and 8.6 square miles is appropriate.

Table 4 - Actual Annual Change in Service Area

TOWN LAND AREA (Mi. ²)			
	Growth Trend	Linear Trend	Average of Trends
YEAR			
Forecasting	Growth	Linear	
2009	6.11	6.11	
2010	6.19	6.19	
2011	6.25	6.25	
2012	6.25	6.25	
2013	6.33	6.33	
2014	6.88	6.88	
2015	6.9	6.90	
2016	7.24	7.24	
2017	7.57	7.57	
2018	7.43	7.43	7.43
2019	7.72	7.68	7.70
2020	7.93	7.86	7.89
2021	8.13	8.03	8.08
2022	8.35	8.21	8.28
2023	8.57	8.38	8.48

Table 5 - Forecasting Future Service Area

Chapter III – Service Demand Study

The scope of work for the fire study included evaluation of the need for an additional fire station in the Town of Knightdale, and recommend locations for future stations. The Town acquired a property a number of years ago and an opinion and recommendation concerning that site was requested. Consideration for the entire KFD jurisdiction, including the rural district was included in the analysis and station location modeling.

To comply with the desire to conduct comparative analysis where possible, the industry standards for National Fire Protection Association (NFPA) 1710 and NFPA 1720 were utilized, as well as the guidelines from the Center for Public Safety Excellence (CPSE), Commission on Fire Accreditation International (CFAI). NFPA 1710 and 1720 are both deployment industry standards. *The Fire & Emergency Services Self Assessment Manual* from CFAI provides guidance for industry best practices in establishing and measuring Standards of Cover (SOC) performance. The KFD utilizes NFPA 1710 and the CFAI guidance for deployment and performance measurement in the department. This station location study includes future projections and forecasts of service demand, and a fire station service area matrix and model that are not part of the SOC.

For the purposes of this study, incident level rather than unit level data was used in most cases. Incident data was analyzed at the largest category level. More detail of incident typing within major categories is available in FireHouse, the department's incident reporting system, and from the CAD system. Eleven years of data, from 2007-2017, was used in most analysis of service demand to provide greater accuracy in identifying trends and forecasts. Trend projections and forecasts were made for five and ten year periods, whenever possible.

Demands for Service

KFD responded to 1,466 calls for service in 2017 and a total of 13,130 calls for service in the period 2007-2017. **The actual numbers may vary by a very small range from data in other data sets based upon methods for recording, vetting, and processing records of incidents. In the opinion of the consultant, there is no substantial difference in the outcomes of analysis based upon the differences.** During this period the overall service demand increased by 59.52% and the annual rate of change was 4.95%. During the study period, there were only three years when calls actually decreased, and in those years only by an average of -1.79%. The single largest year gain was in 2016 with a 14.93% gain. The largest decline was in 2009 at -2.81%. The most recent five years have seen average growth at 3.45%. The most recent five year period experienced growth at a lower rate than the previous five year period. In the previous five year period the total increase in incidents was 35.80% with an average annual growth rate of 6.46%. The most recent three to five year period is very likely more predictive of the future. This analysis is also based upon recorded call types "as found" rather than "as dispatched." There would be a higher count of structure fires from the CAD dataset based upon "as dispatched."

Rescue EMS calls represented the largest service demand over the period at 64% of total incidents. Next were False Calls (Alarms) at 12% followed by HazMat at 8%. Annual growth rate for

Rescue EMS Calls is 5.9% and 20.08% for HazMat calls. False Calls actually decreased over the study period by -7.93%.

Fire Calls was the fourth most frequent call for service representing 7% of the total calls for service during the study period experiencing overall growth of 4.35%. The average annual growth rate for Fire Calls was 1.12%. Although this incident type represents a smaller share of the overall responses than the incidents described previously, the impact of fire calls on the system are much greater. It must be remembered that fire require greater resources, more concentrated distribution, and higher consequences for life, property and the impact on the economy.

Other call types have experienced greater growth rates but the actual call volumes are much lower except for Rescue EMS. Hazmat calls have grown by 178.95% overall with an annual growth rate of 20.08% but represent only 1059 total calls over the ten year period. All other calls only account for 1,213 calls, or 9% of the total service demand.

Although the rates of change for the most recent five year period have slowed over the previous five year period, there remains a substantial overall growth. Overall demand has increased by 59.52% for the entire study period and 17.19% for the most recent five years. The annual growth rate for this five year period was 3.45%, slightly lower than the overall study period. This is likely due to the very rapid growth in the previous decade and a slower recovery of the community following the 2008 Recession.

Table 6 - Total Service Demand Changes, 2007-2017;
Source - KFD Incident Reporting

YEAR	CALLS PER YEAR	ANNUAL% CHANGE
2017	1466	-2.33%
2016	1501	14.93%
2015	1306	-0.23%
2014	1309	4.64%
2013	1251	0.24%
2012	1248	6.30%
2011	1174	10.86%
2010	1059	13.26%
2009	935	-2.81%
2008	962	4.68%
2007	919	
2007 - 2017 OVERVIEW		
MINIMUM	919	-2.81%
MEDIAN	1248	-2.33%
MAXIMUM	1501	14.93%
TOTAL CHANGE	547	59.52%
AVG ANNUAL % ^		4.95%
2013 - 2017 OVERVIEW		
MINIMUM	1251	-2.33%
MEDIAN	1309	0.24%
MAXIMUM	1501	14.93%
TOTAL CHANGE	215	17.19%
AVG ANNUAL % ^		3.45%

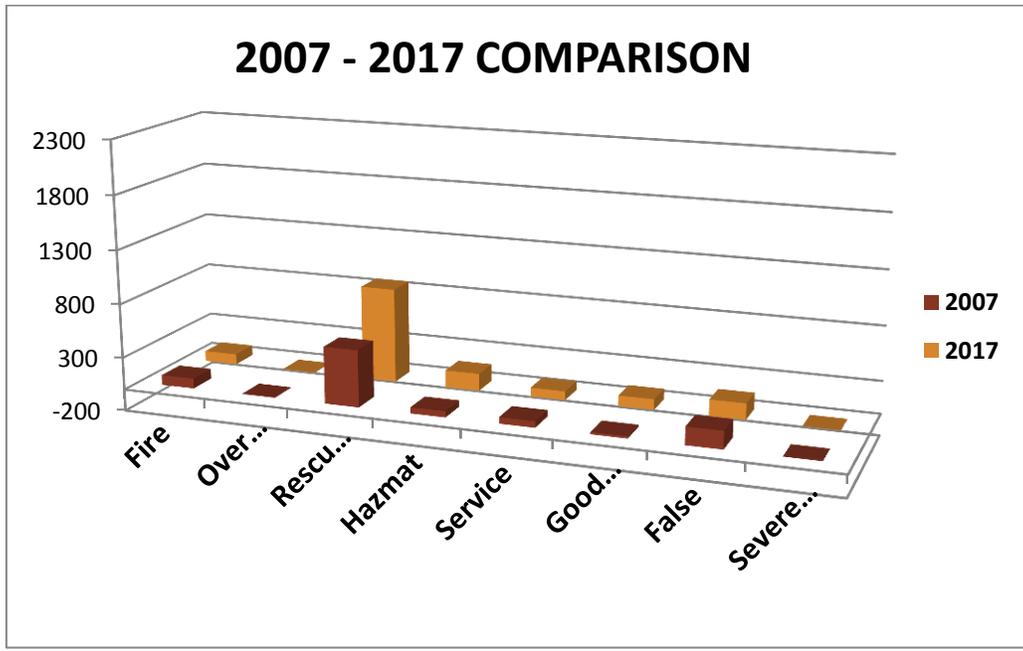
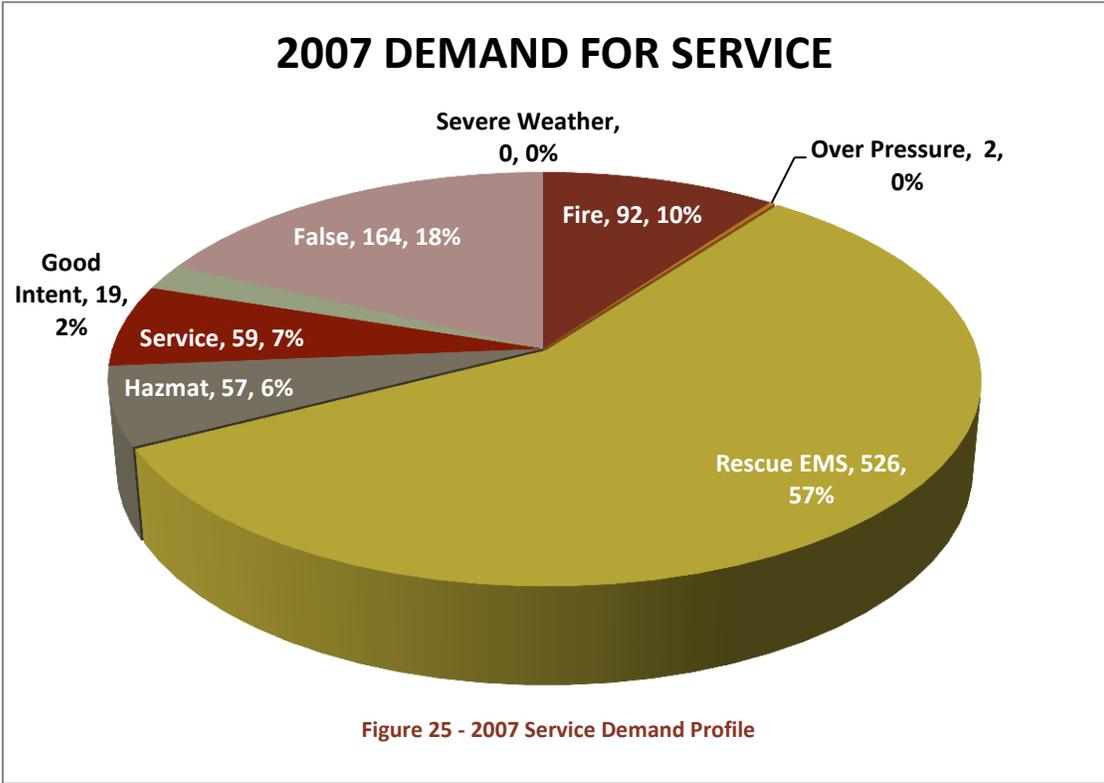
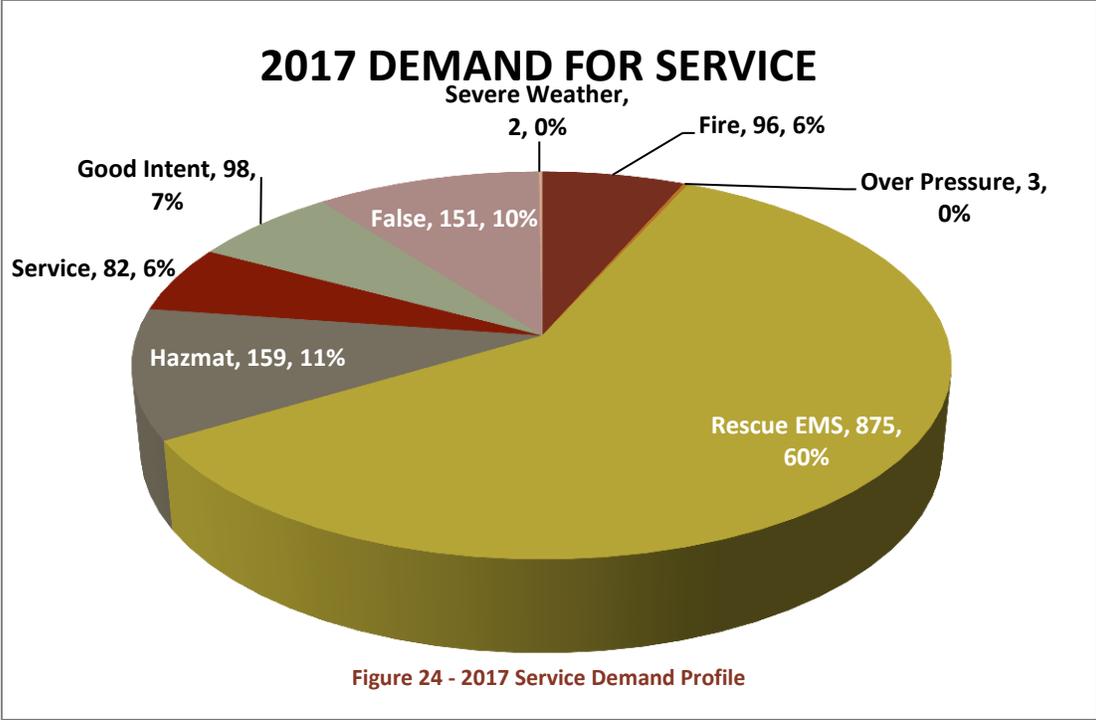


Figure 23 - 2007 - 2017 Comparisons

While the volume of calls for service has increased significantly over the study period, the distribution of calls by incident type has not changed by more than a few percentage points in any category.

Charts are provided on the following page to illustrate the distribution of incidents by type for 2007 compared to 2017.



KFD is a limited activity partner in a regional response system for fire and emergency services delivery. With a few exceptions, and for incidents other than Rescue EMS, KFD generally responds to just calls for service in the Town limits. Knightdale is dependent upon neighboring agencies for aid primarily for filling out an initial effective response force, or full first alarm, for structure fires or other incidents whose critical tasking requires more than four firefighters and one unit. Knightdale provides limited aid based upon service agreements through the Raleigh Wake County Emergency Communications Center and agreed upon operating practices through Wake County Fire Services. The department does participate as a Rescue EMS first responder as part of the Wake County EMS Director’s program and directive for closest unit response to medical emergencies. The town does have a contract for response services from Eastern Wake Fire Rescue Department for some areas outside the five mile response capability from Station #1 and in the area of Poole Road and Hodge Road.

The distribution of mutual and automatic aid, given or received is of interest, especially for the number of incidents in which aid is received as this indicates some scenario where the town might lack capability to respond in a timely manner or able to assemble an effective response force. There were 208 incidents of aid given and 341 incidents of aid received.

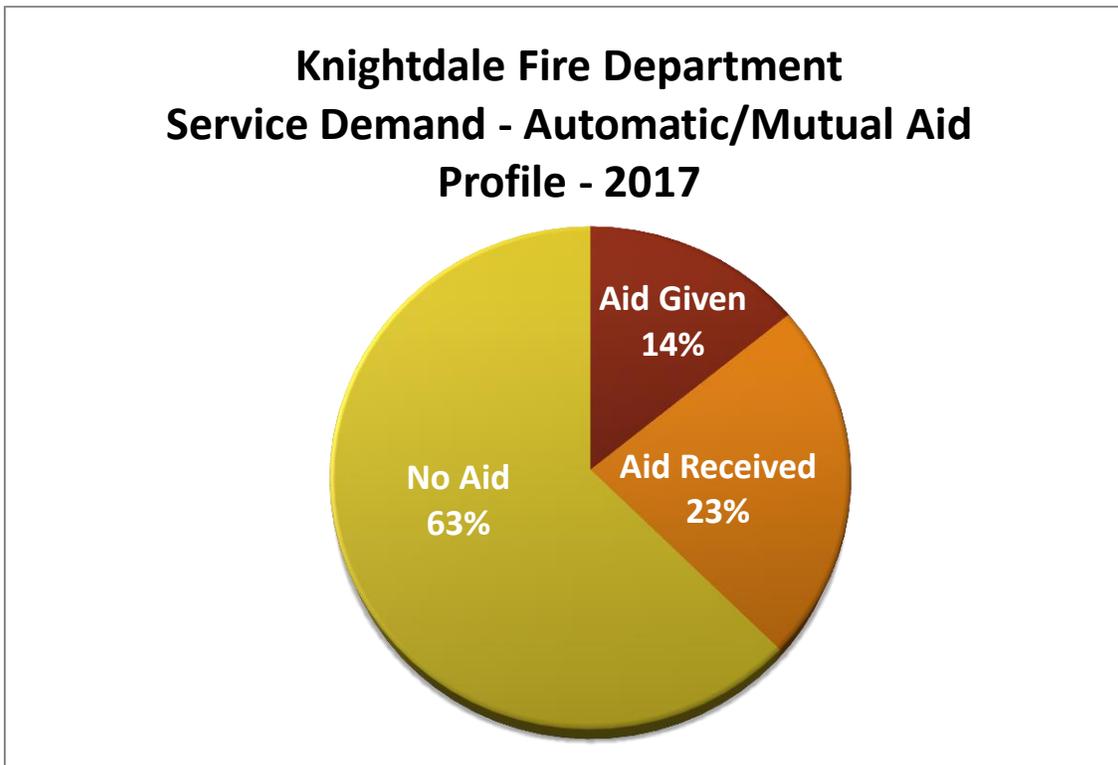


Figure 26 - 2017 Automatic-Mutual Aid Profile

The service demand is distributed across two areas; the town and jurisdictions outside of the town limits. In 2017 90% (1326) of all calls were inside the jurisdiction while only 10% (143) were outside.

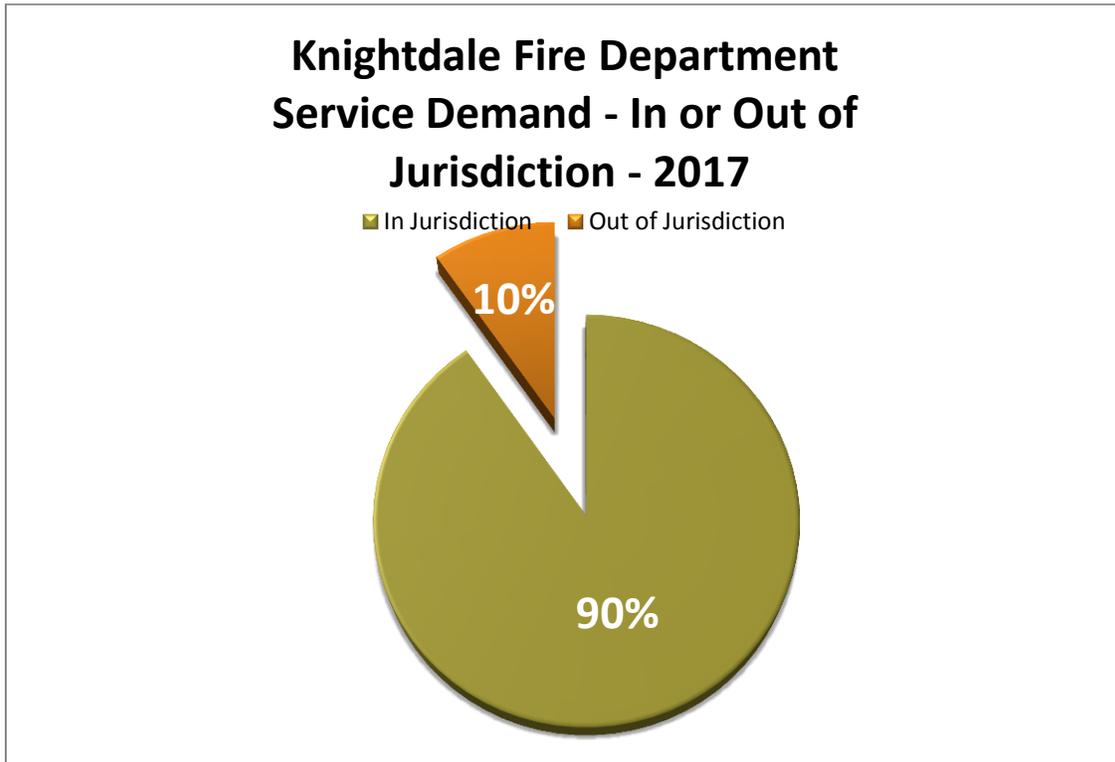


Figure 27 – 2017 Service Demand In or Out of Jurisdiction; Source - KFD Incident Data

Service Demand Projections

Due to the large volume of data and graphics, only the five year regression analysis line charts will be presented in the body of the report. Forecasting tables are presented for the ten year period. The complete ten year regression study and service demand projections are presented in Appendix A.

All Incident Types

All the major incident types demonstrate a growing trend based upon historical experience.

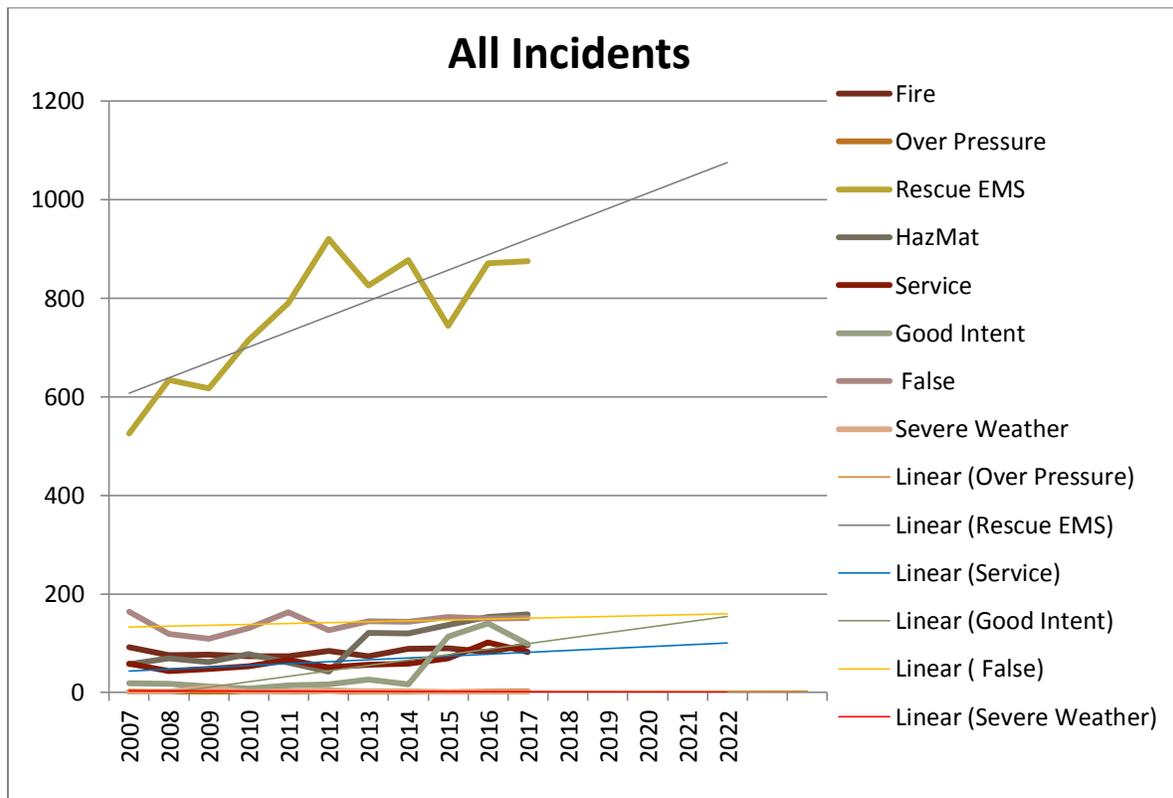


Figure 28 - Growth Patterns for All Incidents

Total annual responses will continue to grow robustly along with the growth and development of the community. Models demonstrate a range of 1793 calls (327 new) to 1962 calls (496 new) in 2023. The ten year forecast estimates a range between 2,093 and 2,534.

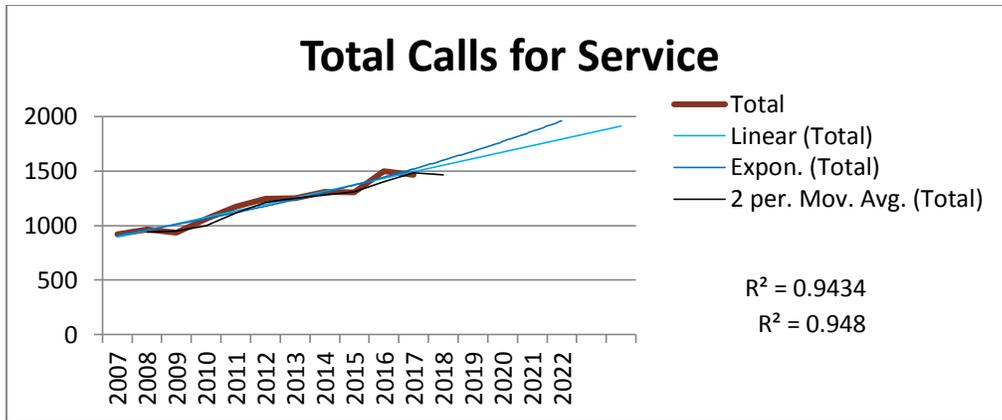


Figure 29 - Growth for Total Calls for Service

Forecasting tools indicate a high growth rate resulting in nearly doubling the total calls for service in just ten year. The ten year estimated average annual growth rate is 9.35% per year with a minimum of 6.12% in 2019 to a maximum of 13.79% in 2027.

ALL CALLS FOR SERVICE			
YEAR	Growth Trend	Linear Trend	Average of Trends
2007	916	916	
2008	962	962	
2009	935	935	
2010	1059	1059	
2011	1174	1174	
2012	1248	1248	
2013	1251	1251	
2014	1309	1309	
2015	1306	1306	
2016	1501	1501	
2017	1466	1466	
2018	1600	1553	1576
2019	1683	1613	1648
2020	1772	1673	1722
2021	1865	1733	1799
2022	1962	1793	1878
2023	2065	1853	1959
2024	2173	1913	2043
2025	2287	1973	2130
2026	2407	2033	2220
2027	2534	2093	2313

Table 7 - Forecast for Total Calls for Service

Rescue EMS

EMS incidents account for the largest percentage of all call types and this will remain true over the next ten years. Total growth is estimated at 53.43% (468 New Calls). Average Annual Growth is predicted to be 8.57% with a minimum of 5.48% in 2019 and a maximum of 11.87% in 2027.

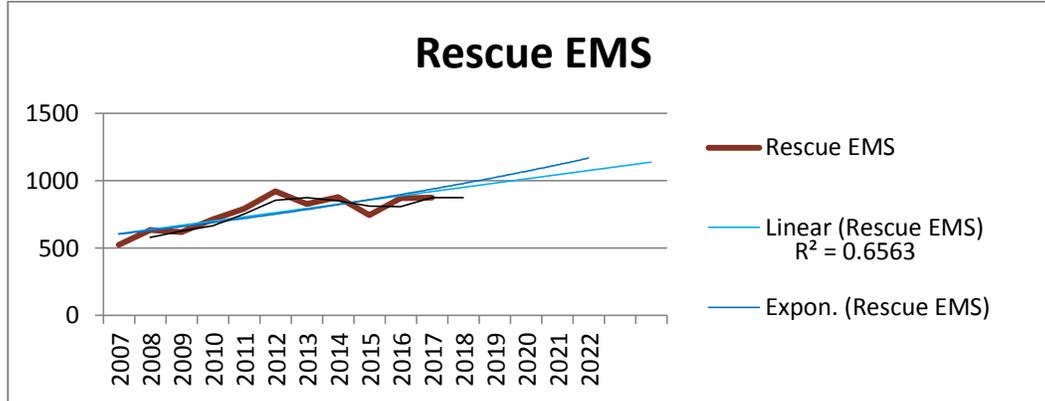


Figure 30 – Growth Trend for EMS Incidents

RESCUE EMS			
	Growth Trend	Linear Trend	Average of Trends
YEAR			
2007	526	526	
2008	634	634	
2009	617	617	
2010	715	715	
2011	790	790	
2012	920	920	
2013	825	825	
2014	877	877	
2015	744	744	
2016	871	871	
2017	875	875	
2018	979	950	965
2019	1023	982	1002
2020	1069	1013	1041
2021	1117	1044	1081
2022	1167	1075	1121
2023	1220	1106	1163
2024	1274	1138	1206
2025	1332	1169	1250
2026	1391	1200	1296
2027	1454	1231	1343

Table 8 - Forecast for EMS Calls for Service

Fires

Fire incidents account for the fourth largest percentage of all call types. Fires have the highest risk of major loss. The gross number of fire calls has been holding steady for the last decade and this experience can be expected to continue at least for the next five to ten years. It is impossible to point to a single factor in the low rate for increase in fires. It is an opinion that this could speak to an effective prevention program and also to the relatively low age of a substantial portion of the housing stock.

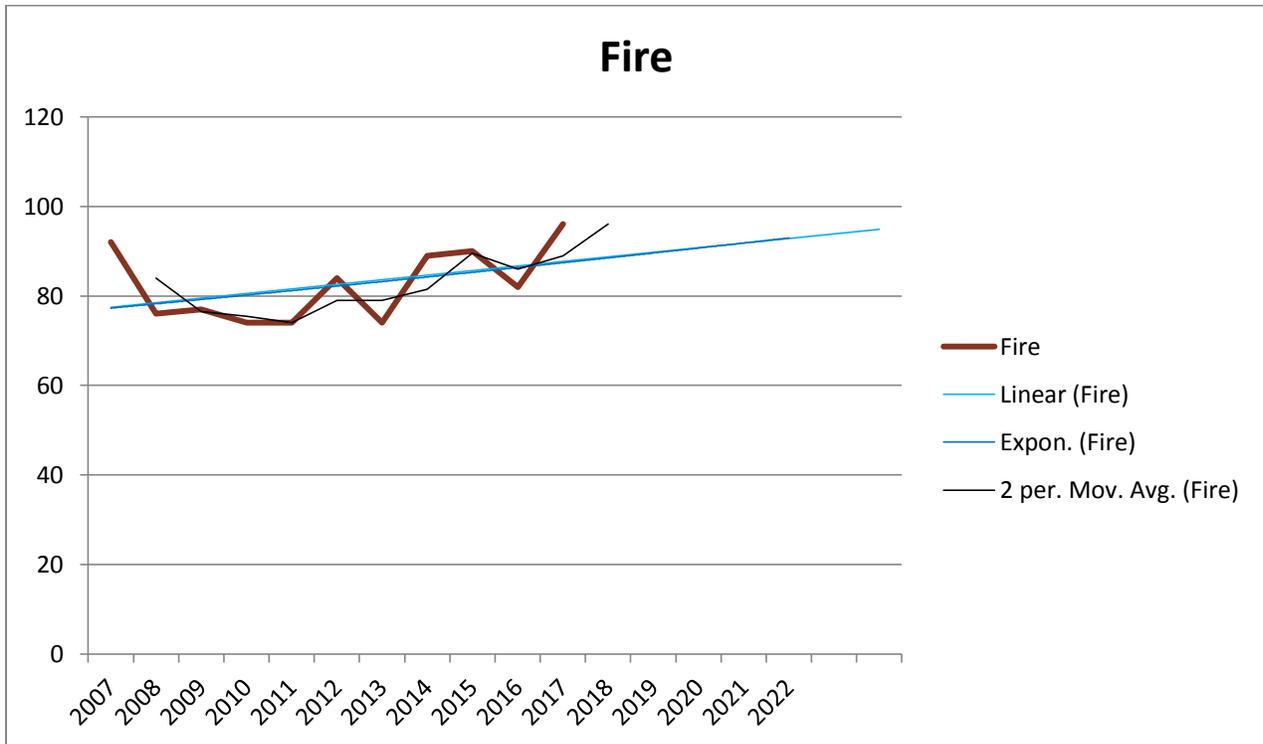


Figure 31 - Growth Trend for Fire Incidents

FIRES			
	Growth Trend	Linear Trend	Average of Trends
YEAR			
2007	92	92	
2008	76	76	
2009	77	77	
2010	74	74	
2011	74	74	
2012	84	84	
2013	74	74	
2014	89	89	
2015	90	90	
2016	82	82	
2017	96	96	96
2018	88	89	89
2019	90	90	90
2020	91	91	91
2021	92	92	92
2022	93	93	93
2023	94	94	94
2024	95	95	95
2025	96	96	96
2026	98	97	97
2027	99	98	98

Table 9 - Forecast for Fire Demand for Service

Forecasting tools indicate a modest annual rate of growth of .37% per year. The current average for the occurrence of fire events is nearly 90 per year, or more than a weekly event. In 2017 the value of property involved in a structure fire event was \$5.4 million with a total loss of \$446,000. The average loss per structure fire event was \$19,391. The total value of property exposed to any fire event type was \$6.3 million with a total loss of \$599,601.

The trending and forecasting tools use historical experience to predict future experience. But, we know that there is significant growth in housing stock with new development that will eventually result in a higher rate of occurrence for fire and other incidents.

HazMat

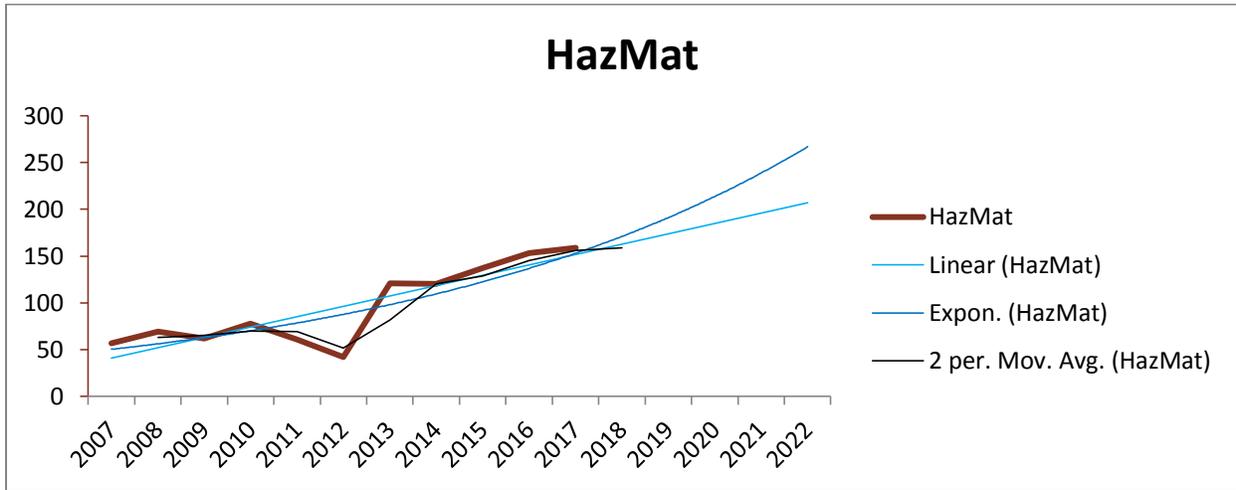


Figure 32 - Growth Trend for Hazmat Calls

HAZMAT			
YEAR	Growth Trend	Linear Trend	Average of Trends
2007	57	57	
2008	69	69	
2009	62	62	
2010	78	78	
2011	61	61	
2012	42	42	
2013	121	121	
2014	120	120	
2015	137	137	
2016	153	153	
2017	159	159	
2018	171	163	167
2019	191	174	182
2020	214	185	199
2021	239	196	217
2022	267	207	237
2023	298	218	258
2024	333	229	281
2025	373	240	306
2026	416	251	334
2027	465	262	364

Hazardous materials responses have been the fastest growing incident type over the last ten years. This is likely due to rapidly increasing traffic on the interstates and major thoroughfares' and an increase in industrial activity. Total responses will likely increase by approximately 205 calls to 364 for a 129% increase over the next ten years. Trending is moderately reliable for hazmat responses.

Table 10 – Forecast for HazMat Calls for Service

Total Response Time Analysis

Normally, fire station location studies are more focused on travel time and distances required to produce desired travel times. In this case, however, there are some issues facing the agency that travel time cannot overcome alone. We have previously discussed the impacts of the transportation network on travel time. The physical barrier of the major roadways, especially I-540, and the railroad are presenting an increasing impediment to response. Traffic is increasing and will continue to increase as more people come to work and live in Knightdale.

Traffic volume is rapidly increasing. The Annual Average Daily Traffic (AADT) count is high on major roadways that are critical routes for fire and other emergency vehicles. Annual average daily traffic is the total volume of vehicle traffic of a highway or road for a year divided by 365 days. A solution to better managing call volume and its impact on emergency vehicle response is presented in the discussion of technology later in this report.

NCDOT AADT 2016 Station Map

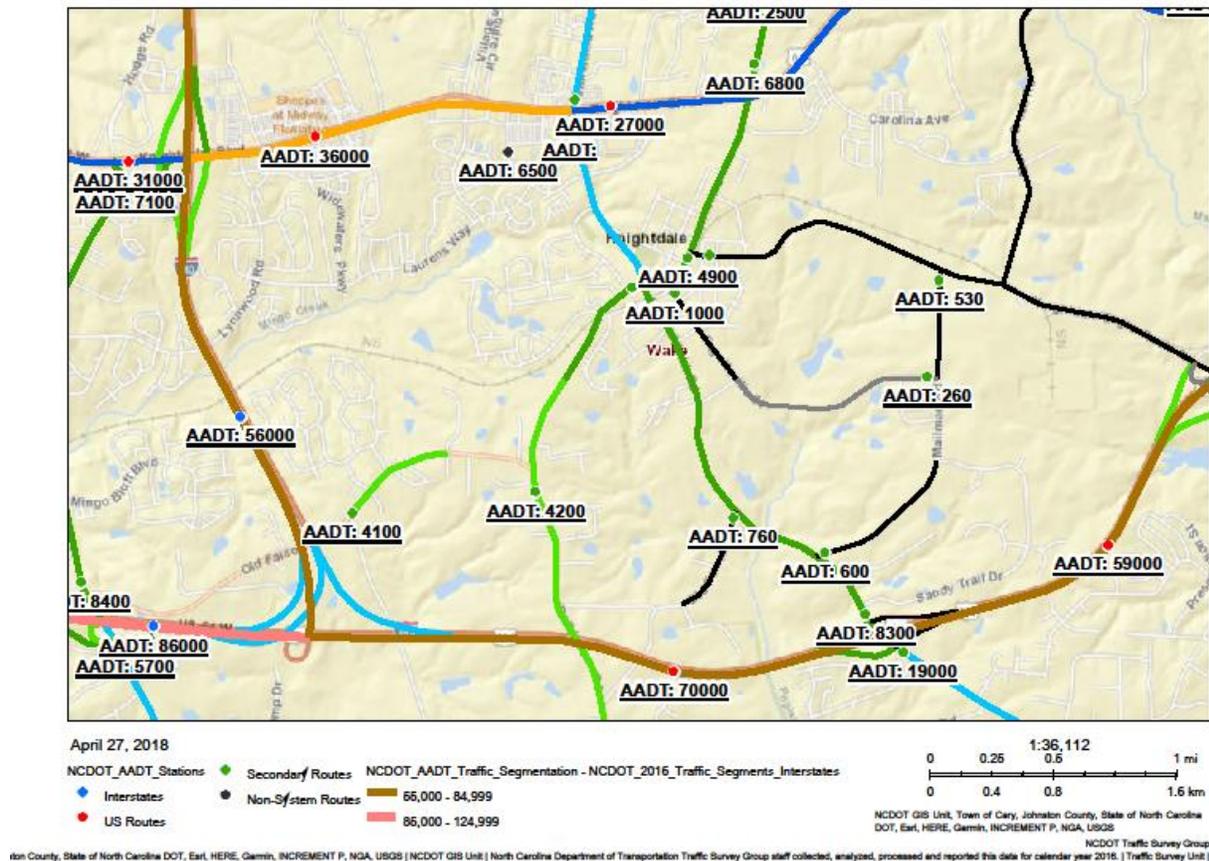


Figure 33 - NC DOT AADT 2016 MAP

Listed below are sample data from significant segments of roadway in Knightdale and the area:

- US 64 (Knightdale Blvd) Between I-540 – Smithfield Rd. 38,000 AADT
- US 64 East of Smithfield Rd. 27,000
- Smithfield Rd. North of Knightdale Blvd. 11,000
- Smithfield Rd. South of Knightdale Blvd. 12,000
- Segments at Intersection of Smithfield and Bethlehem 8,000-12,000
- Hodge Rd. Between US 64 and I-495 7,000-9,000
- Hodge Rd. South of I-495 13,000
- Hodge Rd. and Poole Rd. 11,000-13,000

The very limited access between neighborhoods created by the I-540 corridor creates separation between fire resources and the areas experiencing the greatest growth and development.

Time is a critical factor in determining outcomes in fire, medical and rescue events. This study included several views of segments of total response time. (The results of the total response time studies have identified opportunities for improvement in times and the recording of and analyzing time.) In some locations we can achieve the same desired improvement in outcomes by improving alarm handling as we could by deploying additional resources.

Communications standards are established for fire and emergency services in *NFPA 1221, Standard on the Installation, Maintenance and Use of Emergency Services Communications Systems*. These are the standards that are used to evaluate communications programs by the Commission on Fire Accreditation International (CFAI) for accreditation and by the NC Response Rating Program and ISO for scoring the communications component for a community’s insurance rating.

Turnout Time and Travel Time standards are established for the fire and emergency services industry in *NFPA 1710, Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*. This is the reference standard for performance assessment and program evaluation by the CFAI for accreditation. It is also a reference standard and a method of demonstrating compliance for distribution by the NC Response Rating program and ISO for insurance ratings.

Alarm Handling

According to the NFPA 1221 standard, for fire incidents, 90% of all calls shall be processed within 90 seconds and 95% within 106 seconds. This time period is called alarm handling. This segment of time is measured from the time the caller’s emergency call is picked up by phone in the 9-1-1 System and until the response unit is notified. Notification is usually accomplished by some alerting tone or voice notification over a radio. The data used to analyze this element of time originates within the Computer Aided Dispatch system (software program) and is then entered into the agencies incident reporting

system. For this study, the agency was not able to extract the data points necessary to confidently and effectively analyze this element.

Based upon anecdotal experience with other agencies served by the same communications center, and experience with other agencies measuring for this performance standard, it is highly unlikely, but cannot be proven without a more detailed data set, that the Alarm Handling times are meeting national and industry standards.

According to the standard, for medical incidents 90% of all calls shall be processed within 90 seconds and 99% shall be processed within 120 seconds.

In reality there is likely a performance gap in Alarm Handling when compared to the national and industry standards.

Turnout Time

Turnout Time is that segment of time from Notification and until the unit begins to move enroute to the emergency. During this time segment, personnel are ensuring the location and route for travel, donning proper personal protective gear, and securing themselves safely for travel on the apparatus by fastening themselves in with their seatbelt. For this study, we had turnout time isolated in the unit dataset but not in the incident dataset. In the incident dataset the time stamps were such that turnout time and travel time were consolidated into one time segment.

Table 11 - Turnout Time for All Units

ALL UNITS	
ALL CALLS	TURNOUT
MINIMUM	0:00:54
MEDIAN	0:01:00
AVERAGE	0:01:34
MAXIMUM	0:09:00
90TH %	0:02:00
# AT 1 Min	359
# at 2 Min	152

The data for turnout time as recorded is questionable since only two of the 565 unit responses analyzed recorded time not rounded to a whole minute. There were 359 unit responses recorded with exactly one minute turnout time. There were 152 unit responses recorded at exactly two minutes turnout time. This is highly unlikely in reality. This could be a system or a process error. There are seconds recorded in other data points. Rounding to whole numbers can create a significant margin of error, possibly as high as up to 50% or more on one minute performance objective. As a result, this information is presented as general anecdotal input rather than exact empirical input for discussions.

According to the NFPA 1710 standard, for fire incidents, turnout time shall be 80 seconds at the 90th percentile mark. For medical incidents, turnout time is 60 seconds or less at the 90th percentile mark.

According to Table 11 turnout time for all events is 120 seconds at the 90th percentile. This exceeds both fire and EMS performance objectives according to national standards.

Table 12 - Travel Time for First Due Unit

TRAVEL TIME – FIRST DUE UNIT	
ALL CALLS	
MIN	0:01:00
MED	0:05:00
AVG	0:05:19
MAX	0:19:00
90%	0:09:00
FIRE CALLS	
MIN	0:01:00
MED	0:06:00
AVG	0:05:47
MAX	0:11:00
90%	0:09:12
RESCUE-EMS CALLS	
MIN	0:01:00
MED	0:05:00
AVG	0:05:20
MAX	0:14:00
90%	0:08:00

Travel Time

Travel Time is the time segment measured from once the apparatus begins to move enroute to the incident location and until the apparatus comes to a stop at the reported location. It is easiest to remember “From Wheels Start until Wheels Stop!” For this study, we were able to calculate travel time for first due units from data in the incidents data set. Table 12 presents data for travel time for the first arriving unit to Fire Calls, Rescue EMS Calls and to all calls grouped in total.

According to the NFPA 1710 standard, for fire incidents the first due unit shall arrive within 240 seconds travel time or less to 90% of all calls. The standard also states an initial full first alarm shall arrive within 480 seconds travel time or less at the 90th percentile.

According to Table 12, travel time for first due units to fire events is 552 seconds at the 90th percentile. There is a travel time performance gap of 312 seconds for the first due unit. The gap is larger than the performance standard. The performance of the first due unit also exceeds the performance standard for an entire initial response force.

According to the NFPA 1710 standard, for medical incidents the first due unit, capable of initiating basic life support, shall arrive within 480 seconds travel time or less to 90% of all calls. As shown in Table 12, travel time for first due units to medical events are 480 seconds at the 90th percentile. The agency is exactly meeting the performance standard but has no room for error.

Alarm processing/handling is the simpler of the gaps to attack. The solution is setting a performance standard, expecting that your standard be met, and tracking that performance monthly.

Considering one or more additional stations can help close the travel time and obvious initial effective response force gap.

Current CAD data may be skewed because Knightdale data is only recorded in Minutes, not seconds. This is predicted to be corrected with a new CAD system coming soon.

Table 13 - Travel Time for All Units

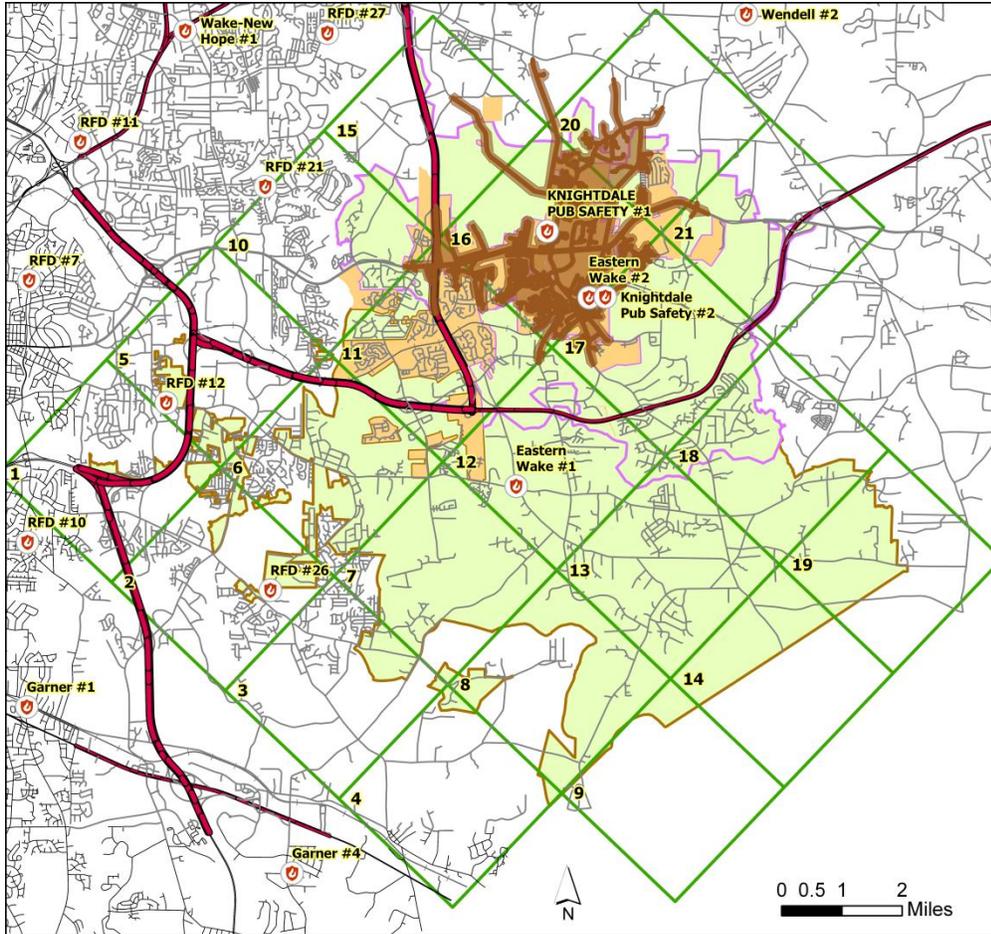
ALL UNITS	
ALL CALLS	TRAVEL
MINIMUM	0:01:00
MEDIAN	0:04:00
AVERAGE	0:04:08
MAXIMUM	0:11:00
90TH %	0:07:00

Chapter IV - Fire Station Location Study

KFD currently covers the town and the majority of its 17.76 square mile area from one station. Station #1 is located in the Town Hall Campus off Smithfield Road. This station is not located centrally in the jurisdiction, creating long response times to areas of town that exceed national standards and industry best practices for travel time. It is located closer to the newer and more densely developed areas than the older station operated by Eastern Wake Fire Rescue Department at 401 Hester Street bordering the historic district. There is a map designation for a Knightdale Station #2 but this location is a storage site for the current reserve apparatus and is not a factor in this study's deployment analysis. There are significant gaps in coverage that indicate a need to plan for new resources. During the conduct of the fire station location study it was obvious to the consulting team that the very close proximity of Knightdale Fire Station #1 and Eastern Wake Fire Rescue Station #2 is not a very efficient deployment model for the community. There are opportunities that would benefit the town, the fire district and the county if pursued in a feasibility study for merger and/or consolidation. Such merger or consolidation is not part of this study but most graphics will display both the Knightdale station and the Eastern Wake Fire Rescue stations serving the Alert Fire District.



Figure 34 - Knightdale Fire Station #1, Photo



Knightdale NC Fire Dept

Travel Time
 ■ 4 minutes Travel

■ Knightdale Grid

■ Municipal Areas

■ KNIGHTDALE

Fire Response Area DISTRICT

■ Eastern Wake #1

■ Eastern Wake #2



Figure 35 - Existing Town of Knightdale Coverage

Fire Station Service Area Model & Matrix

The study team has created a Fire Station Service Area model for the KFD as a tool to identify appropriate fire station locations based upon a desired service level outcome. In this case it is based upon desired travel times. The service area travel time criteria are based upon the desired performance outcomes for two critical incidents that are routine events for the Town of Knightdale.

Basis for Deployment

The desired outcomes for the service area model are 1) fires confined to room or area of origin and 2) basic life support with defibrillation within six to eight minutes of onset of cardiac arrest.

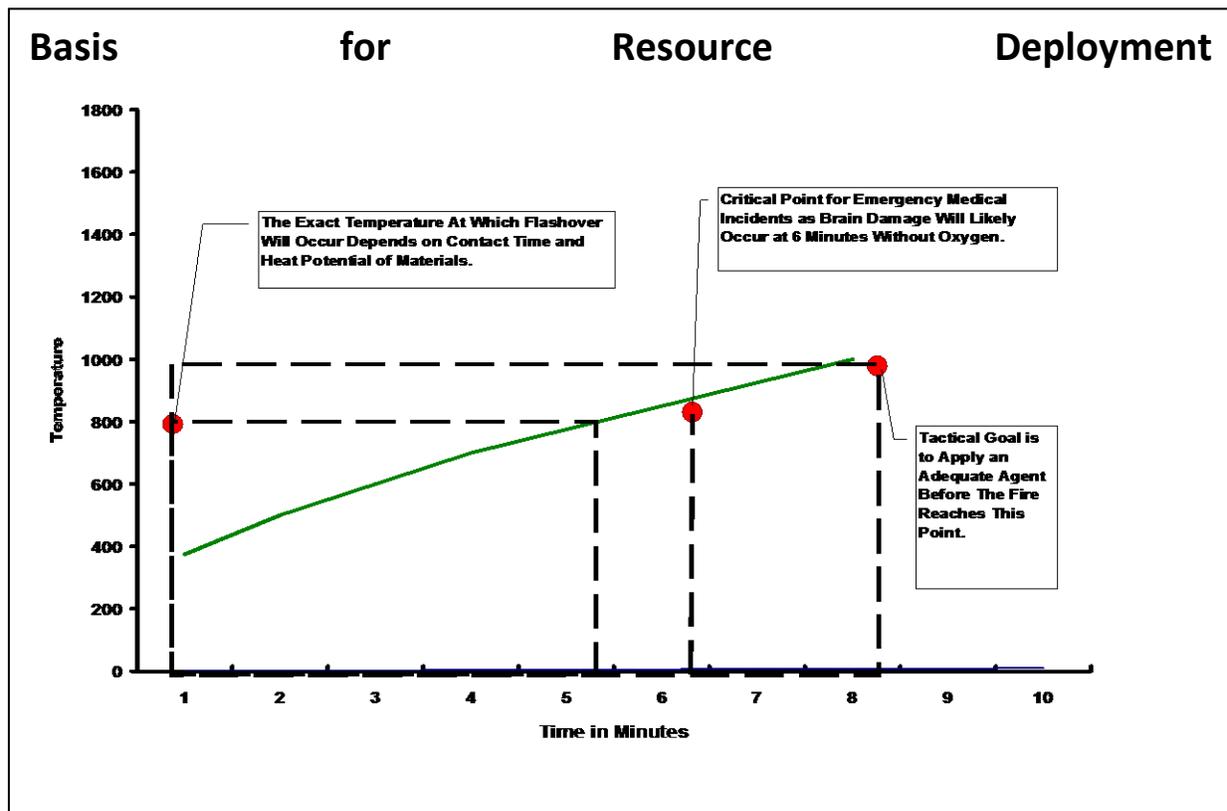
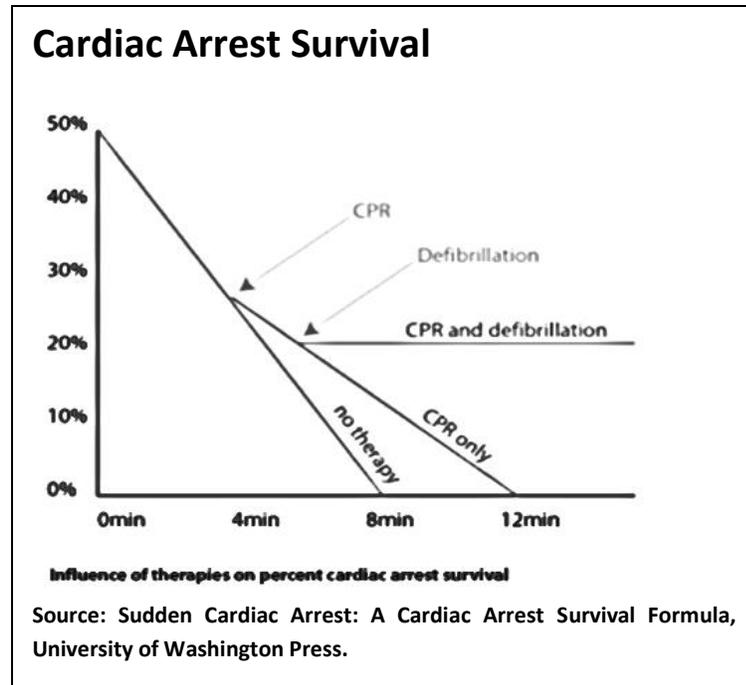


Figure 36 - Basis for Resource Deployment

An example of how to display the assumptions upon which a fire station location study and plan can be based and the findings justified is provided in the Basis for Resource Deployment chart. This graphic represents the relationships of time to fire propagation, generally expected property loss, and cardiac survival. Although there may be some who will challenge the absolute accuracy of this tool, many of the current standards and service organizations which routinely deal with these common hazards and risk use the same general benchmarks. This model assumes that the primary hazards to plan for in

determining the deployment of resources is the cardiac EMS event and the residential structure fire event.

Medical Rescue Response with Cardiac Event



The American Heart Association still teaches that brain cells begin to die between four and six minutes when suffering from a lack of oxygen. Much research now points to a combination of timely CPR and Defibrillation for survival of cardiac arrest to hospital discharge. A paper published by the University of Washington Press, and based upon work done at the University of Washington School of Medicine, documented in an article titled, *Sudden Cardiac Arrest: A Cardiac Arrest Survival Formula*, suggests that CPR begun within four minutes of cardiac arrest and defibrillation begun within six minutes should result in a sustainable survival rate of 20% to hospital discharge.

Figure 37 - Cardiac Arrest Survival Model

Structure Fire Event

The time/temperature curve for fires, better stated today as the fire propagation curve, is undergoing considerable scrutiny and may be changing somewhat due to very valuable and recent research on differences between modern and traditional residential fire interior configuration, construction, furnishings and air flow paths. A generalization would state that there has not been significant data that changes the survivability and economic loss projections for fires confined to room of origin and fires that extend beyond room of origin. There is evidence that in modern structures, the time/temperature curve looks very different and that flashover can occur much earlier in the modern event. The biggest changes so far based on recent research are not substantially changing the recommended times for response or even the critical tasking and staffing requirements, but rather the order in which critical tasks are performed and the tactical decisions made during the initial attack on the fire. Generally, we can still apply the guidance from figures like the Fire Propagation Curve identified by Gerard and Jacobsen. Figures very similar appear in many other guidance documents, such as NFPA 1710.

Fire Propagation Curve

Clearly, an early aggressive and offensive initial interior attack on a working structural fire results in greatly reduced loss of life and property damage. Consequently, given that the progression of a structural fire to the point of “flashover” (the very rapid spreading of the fire due to super heating of room contents and other combustibles) generally occurs in less than 10 minutes, two of the most important elements in limiting fire spread are the quick arrival of sufficient numbers of personnel and equipment to attack and extinguish the fire as close to the point of its origin as possible.

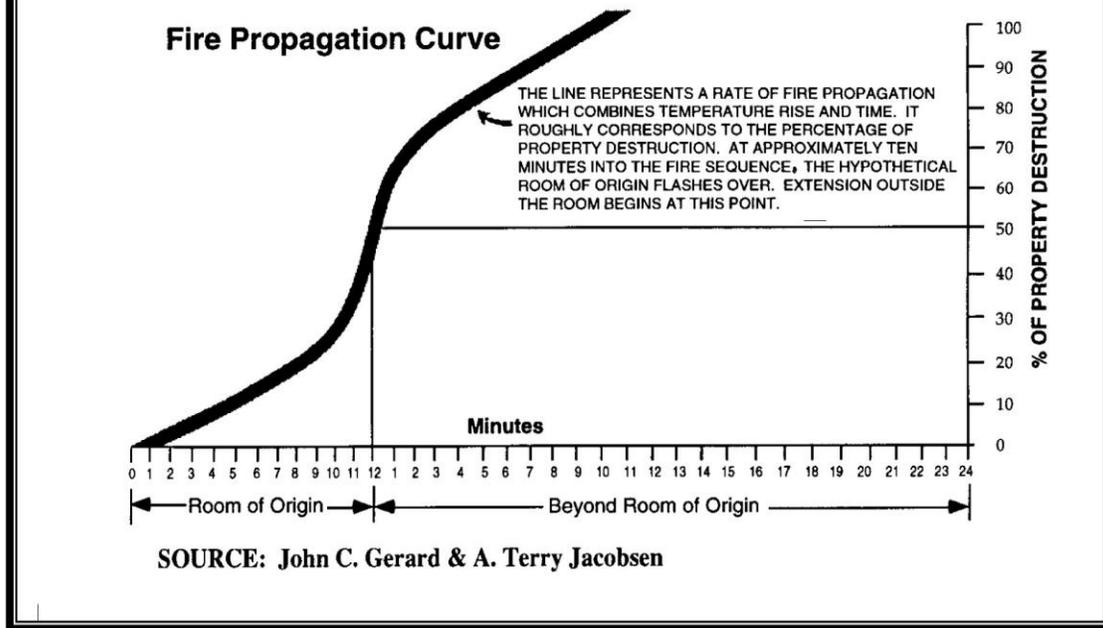


Figure 38 - Fire Propagation Curve

Time is a critical and measurable element in emergency response and can be directly related to incident outcomes. Although the current research and information on time to flashover is undergoing significant updating, it is clear that there is a point in time before which we must assemble and deploy an appropriate and effective response force in order to impact the outcomes for lower loss of life and injury as well as reduced property losses. The NFPA Fire Analysis and Research Division reports differences in outcomes in NFPA Standard 1710, Annex A: Explanatory Material. There is a documented

Consequences of Flame Spread per 1000 Fires

1.91 – Civilian death rate for fires confined to room of origin

22.73 – Civilian death rate when fire extends beyond room of origin to floor of origin

Source: NFPA Fire Analysis and Research Division as reported in NFPA 1710 Annex A.

increase of more than 1,000% in civilian deaths when fires extend beyond room of origin to floor of origin. Civilian injuries increase by 153% and property loss per structure fire increase by 149%. Survivability of the victim(s) has been associated with time for both EMS and fire incidents. Even the safety of our responders and reasonable expectations for responder capability has been related to time in recent research.

Travel Time and Explanation of Matrix

The matrix used in the fire station location model reflects the desired travel times. The matrix reflects a four minute travel time. Total Response time then for first arriving units to the scene of a structure fire or a cardiac event should be within six to eight minutes to achieve the desired

Figure 39 - Consequences of Flame Spread per 1,000 Fires

outcomes. This matrix can be laid down over the community and existing resources to better evaluate and plan deployment.

Station Service Area Matrix

The matrix uses diamond shaped representations of station service areas. The shape and size represent an ideal station service area that meets travel time standards. The grids in this matrix are three miles distant from point to point and cover an area of 4.5 square miles. The result, if a fire station is located at or near the centroid of a service area, is travel time performance of four minutes at the 80-90th percentile. This model provides a standard tool for collecting and analyzing data according to critical growth, service demand and service capability factors for resource deployment planning.

Each category has a set of factors. These factors are weighted since they are all considerations in making deployment decisions but are not generally equal in terms of impact. Decisions about weighting are local

Service Area Evaluation Factors	
Growth Factors	
Developable Land	5.00%
Population	15.00%
Developed Land	20.00%
<i>Sub-Total</i>	40.00%
Service Demand Factors	
Call Volume	5.00%
Commercial Sq Footage	5.00%
Risk Score	15.00%
Property Valuation	15.00%
<i>Sub-Total</i>	40.00%
Performance / Capability	
Distance to Fire Station	5.00%
Over 4 minute Calls	10.00%
% Covered in 4 Minutes	5.00%
<i>Sub-Total</i>	20.00%
Grand Total	100.00%

Table 14 - Service Area Evaluation Factors

decisions and should be made deliberately and based upon analysis and data, not to drive a specific outcome.

Growth factors are directly related to increasing or decreasing service demand. You can use other growth factors but population and development related factors are easily understood by community decision makers. In Knightdale, population and development growth are the biggest known factors affecting the community.

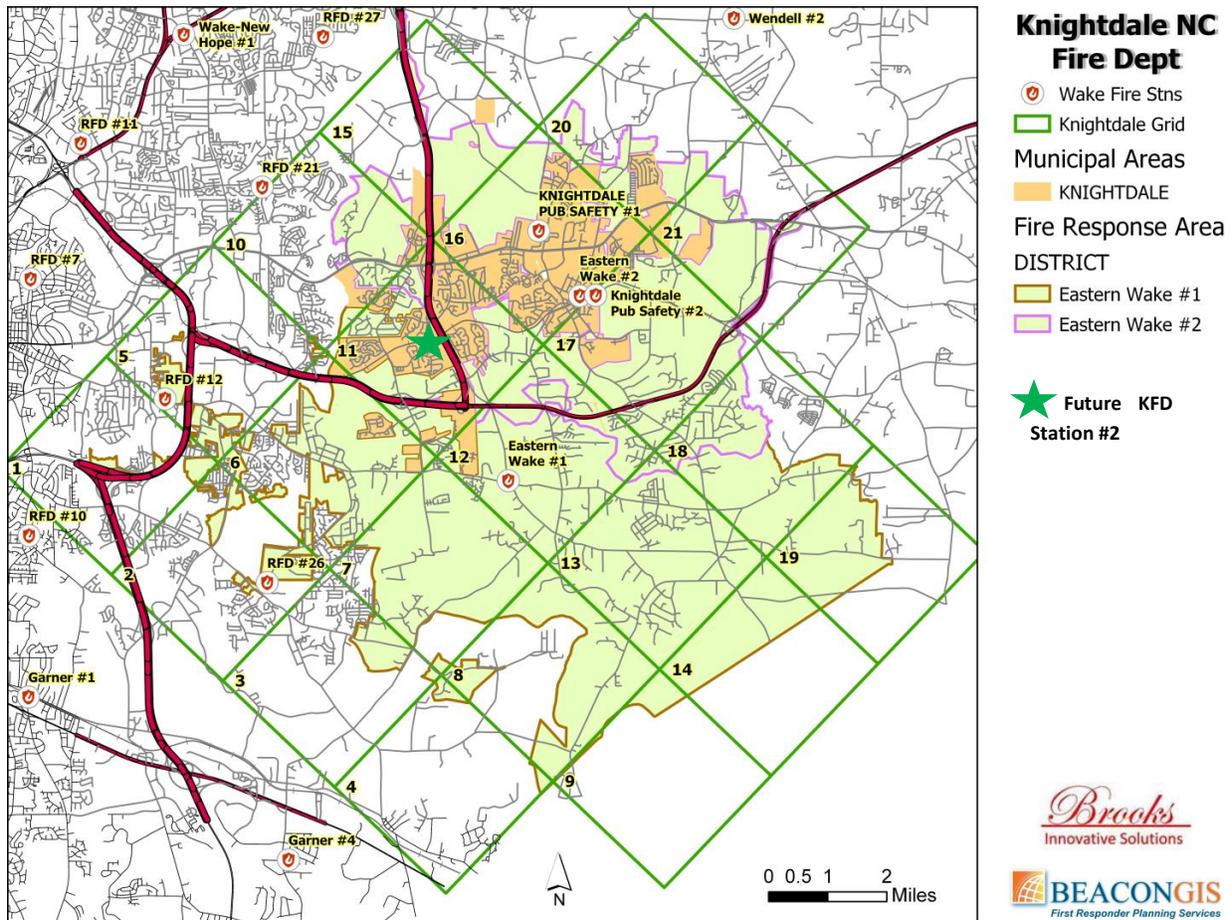


Figure 40 - Knightdale Fire Station Location Matrix

Service demand factors are the results of growth factors. Growth factors are predictive of service demand, while actual service demand factors relate directly to the communities changing need and requirements for service delivery. As growth and service demand factors increase, the need for new resources, or additional resources, inside the station service area increase.

Performance and capability factors reflect the department’s ability to respond to increasing or decreasing demand based upon growth or other changes. As growth and service demand increase, their ability to meet the demand becomes more challenging. When all of the categories are scored and combined, the service area score is determined; the higher the service area score, the greater the need for resources.

Service Area Scoring

When the service area grid is laid down on the Town of Knightdale it helps to identify service level gaps and improvements that can be realized with the deployment of a new fire station. The theoretically ideal site is in the immediate area of the Lynnwood Road and the overpass of I-540. Practically, it is most desirable to remain as close to the center of the standard service area as possible while identifying sites that meet other practical needs. Moving west to the area around the intersection of Lynnwood Road and Hodge Road might be a reasonable alternative. West of I-540 is more beneficial than east of I-540. Hodge Road provides access to growth and development to the south and beyond I-495.

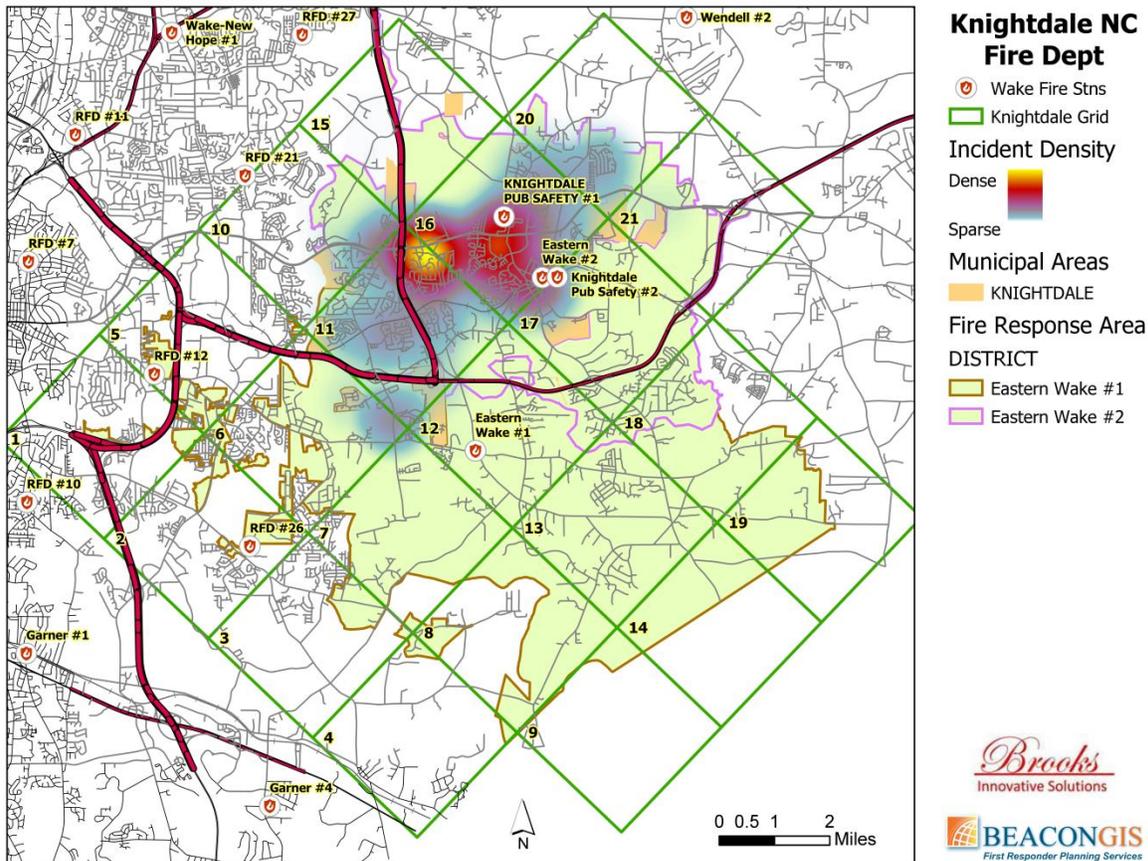


Figure 41 - Knightdale Demand Density

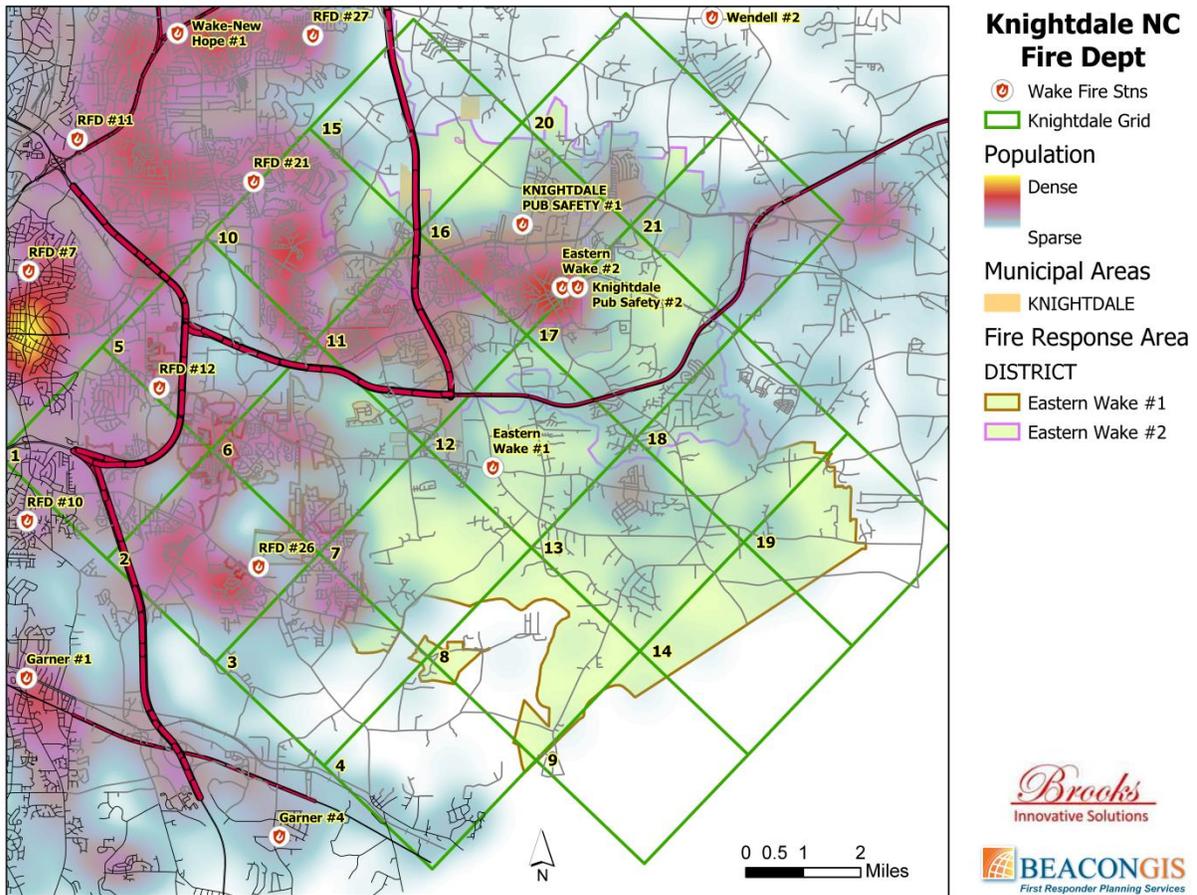


Figure 42 - Knightdale Population Density

The orientation depicted in Figure #40 results in better coverage of historical incident activity, moves resources closer to locations of higher population density, and improves travel time by maximizing the four minute travel time coverage capability. The following figures illustrate these points.

The highest density of incidents is located in the standard service area (Grid 16) which contains KFD Sta. #1. However, demand is expanding to the southwest (Grid 11) with the greatest intensity of development in that direction. The existing location for KFD Sta. #1 is well suited for the standard service area in which it lies but it cannot reach the area of highest density of future service demand nor the developing areas to the southeast within desired standards of cover, therefore gaps exist in service like was identified in the response time analysis portion of the study.

As seen in Figure #41, Knightdale Demand Density on the previous page, the central grid in the matrix (Grid 16 – Knightdale Sta. #1) captures the second greatest number of historical events while still providing excellent travel time performance within this service area, just as the model is designed to achieve. Of the nearly 12,000 events that are plotted here, more than 6,000, or 51%, occurred within

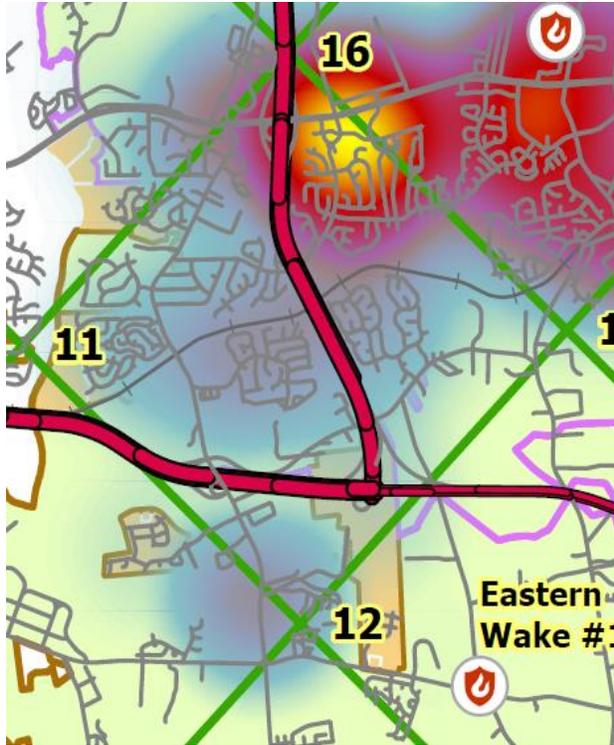


Figure 43 - Grid #11 with Population Density

this grid. The grid to the southwest (Grid 11) experienced the second highest number, nearly 4,000 incidents, or 32%, and this area does not have a fire station currently deployed. Deploying a second fire station in this grid, when added to the capability of KFD Sta. #1, would service 83% of the total demand in the entire area between both stations.

The Existing KFD Sta. #1 and New KFD Sta. #2 would capture the highest population density in the town as well. The total population covered by the overall fire station location matrix is approximately 28,700 persons. 15,922 are estimated to live within the town in 2018. Grid 16 – KFD Station #1, the central grid in Figure 42, Knightdale Population Density, covers a population of 4,748 persons or 30 % of the total population of the jurisdiction and 17% of the total matrix. The currently unserved Grid #11 actually contains the highest population concentration with 7,158

persons representing 45% of the total town population and 25% of the total matrix. Combined these two grids cover a total population of 11,906 persons; 75% of the total town population.



Figure 45 - Lynnwood Road East of I-540



Figure 44 - Lynnwood Road West of I-540

Figure #46, Knightdale Four Minute Travel Time, illustrates the current coverage of Knightdale Station #1. It must be pointed out that the consultant does not consider the current Knightdale Station #2 as a viable part of a fire deployment model since it is primarily a storage site for reserve apparatus. This graphic helps to illustrate that point. There is no current practical intent to respond a unit from this site and there is no readily available staffing to turn any unit out from this facility. This site is located so close to KFD Station #1 that it adds little capability inside the town even if it were a different type of facility with staffing available for a unit. It poses the same concerns over inefficiency and duplicity as does coverage into the town from Eastern Wake Fire-Rescue #2 located about one block away.

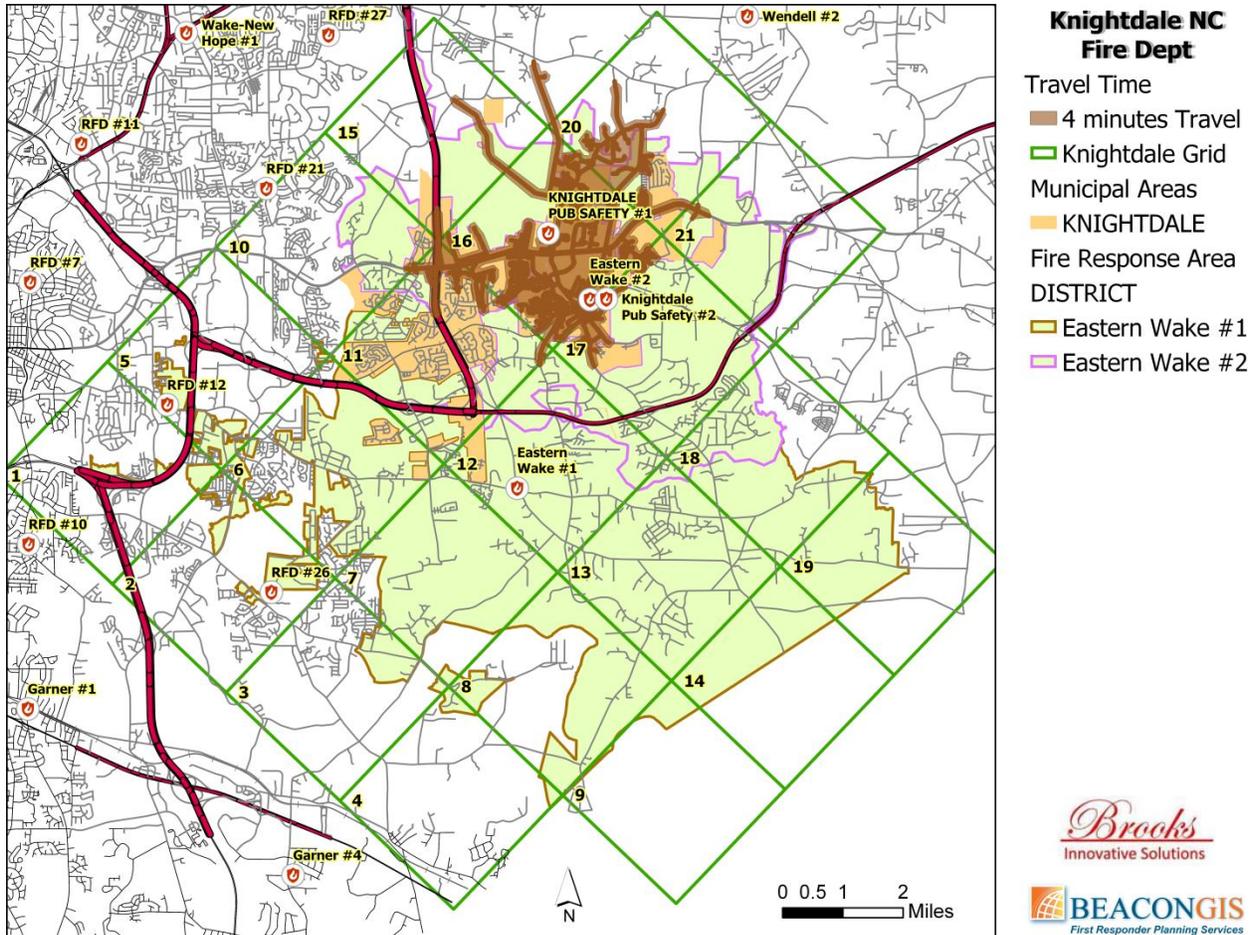


Figure 46 - Knightdale Four Minute Travel Time

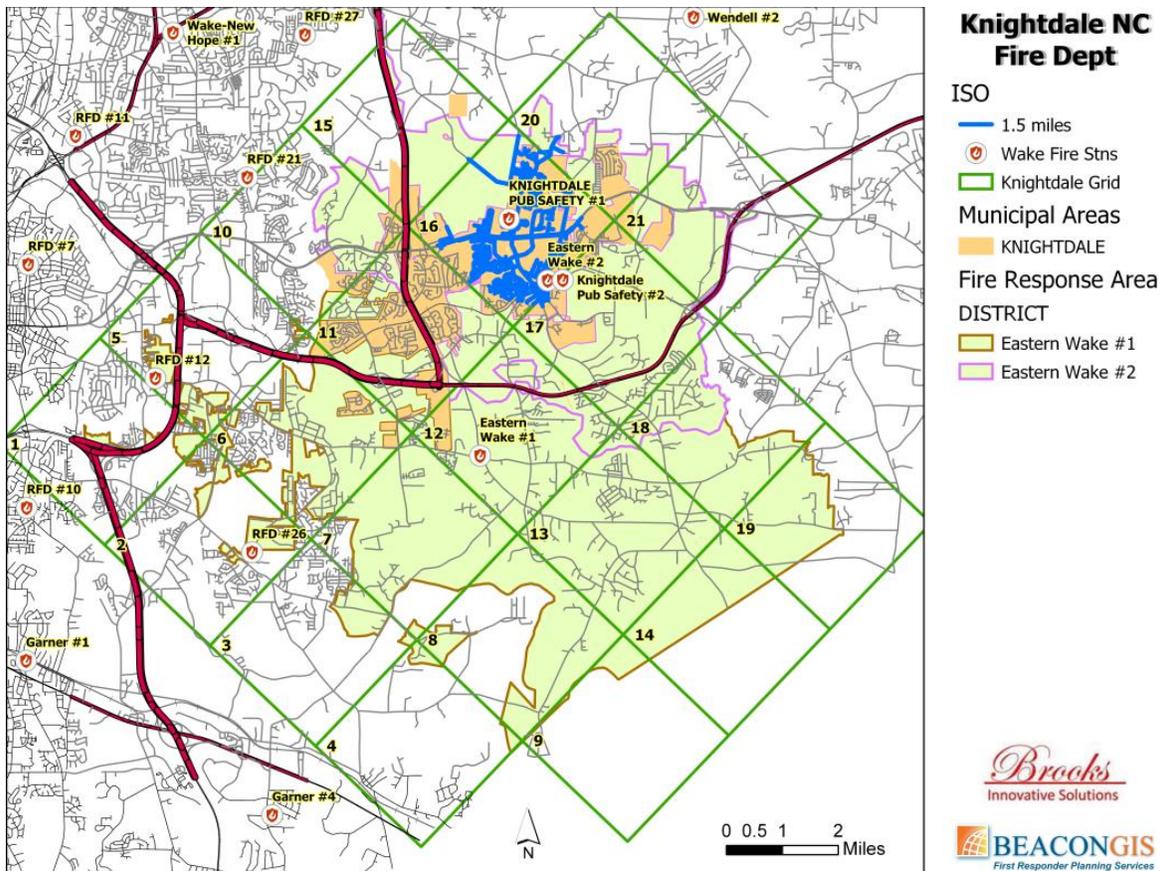
The KFD Station #1 Grid, #16 on the map, resulted in four minutes or less drive time for 6,020 incidents, 97.9% of all historical incidents plotted in this entire grid. Recall that this also captured more than 51% of the total historical incidents plotted on the entire matrix.

KFD Station #1 does not provide similar service to Grid #11, the next highest total scored grid on the entire matrix. This grid experienced four minute response times for only 9% of the historical incidents

analyzed however, 32% of the total incidents occurred in this grid and 7,158 persons live within this grid. Other significant factors that indicate a need for a fire station in this grid are:

- 99.1% - the percentage of land in this grid that is developable (indicating it will continue to build out)
- 54.5% - the percentage of land has already been developed (indicating structures and occupants at risk rather than just open land);
- 5,249,963 - the square footage of structures within the grid (second only to Grid #16 which already has a fire station deployed); and,
- \$686,900,812 – the value of property within this grid (second only to Grid #16 which already has a fire station deployed)

The town enjoys a low ISO rating for insurance premiums and desires to maintain this rating in the future. The existing KFD Sta. #1 and the recommended new KFD Sta. #2 site provides excellent coverage for distribution of engine companies as measured by the NC Rural Response Rating System and ISO comparing engine company locations to areas within 1.5 miles or within the four minute travel time guide presented in NFPA 1710 and the CFAI Accreditation model.



• Figure 47 - Knightdale Station #1 1.5 Mile ISO Coverage.

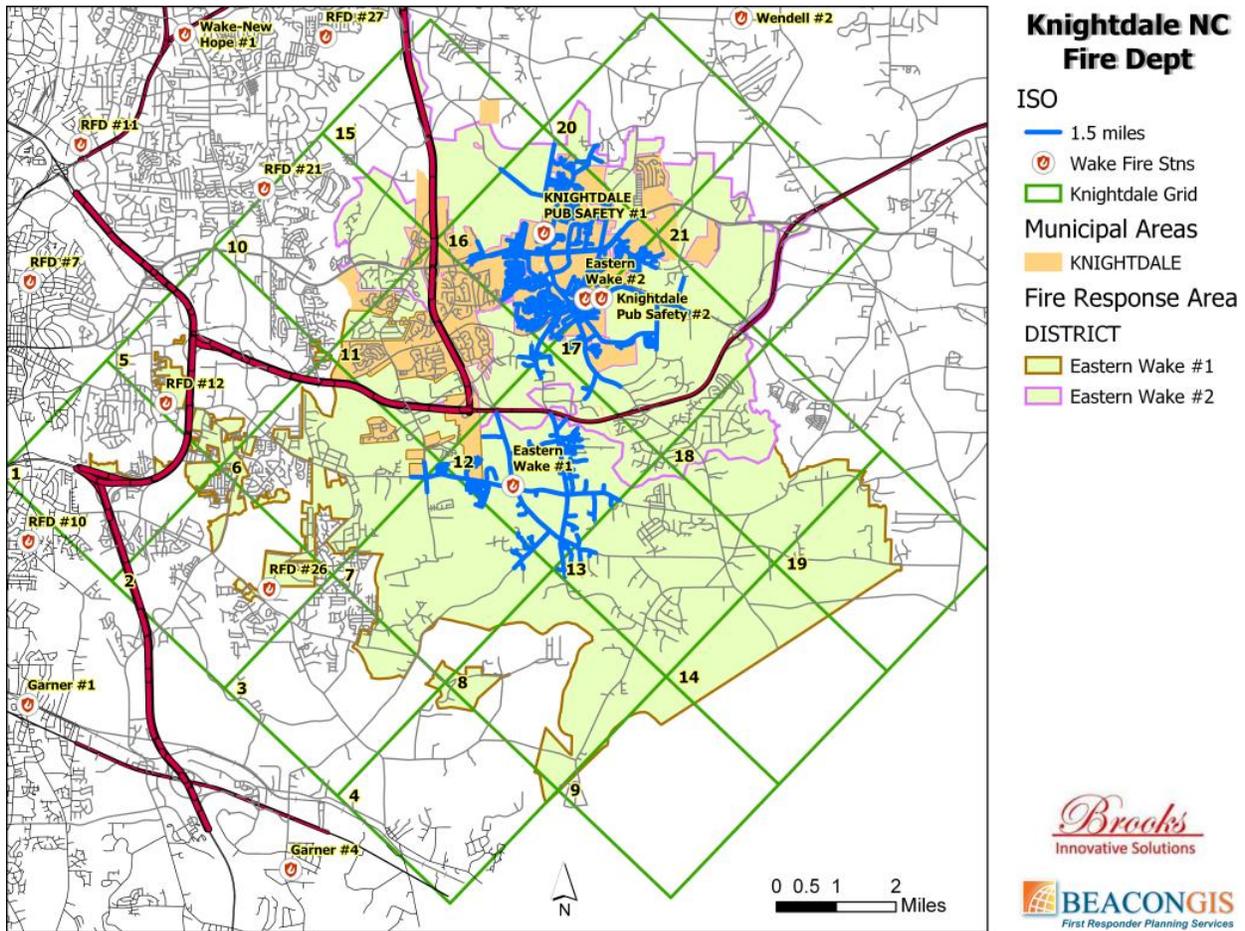


Figure 48 - Knightdale #1 & Eastern Wake #1 1.5 Mile ISO Coverage

We can see with the fire station location matrix that a new station located in Grid #11, in support of the current KFD Sta. #1 located in Grid #16, takes maximum advantage of the roadway networks available to overcome to some degree the obstacles the roadway network presents to the current deployment model. We can also see that without the new station Grid #11 is left uncovered even with assistance from Eastern Wake #1, although Eastern Wake #1 is closer to the southern end of Grid #11 service area than the existing Knightdale Fire Station #2.

The combination of coverage from KFD Sta. #1 and a new KFD Sta. #2 provide the best overall coverage for the Town of Knightdale and also provide the longest term coverage before needing any additional fire stations. Figure #49 on the next page provides a view of the four minute travel time coverage achievable from these two sites.

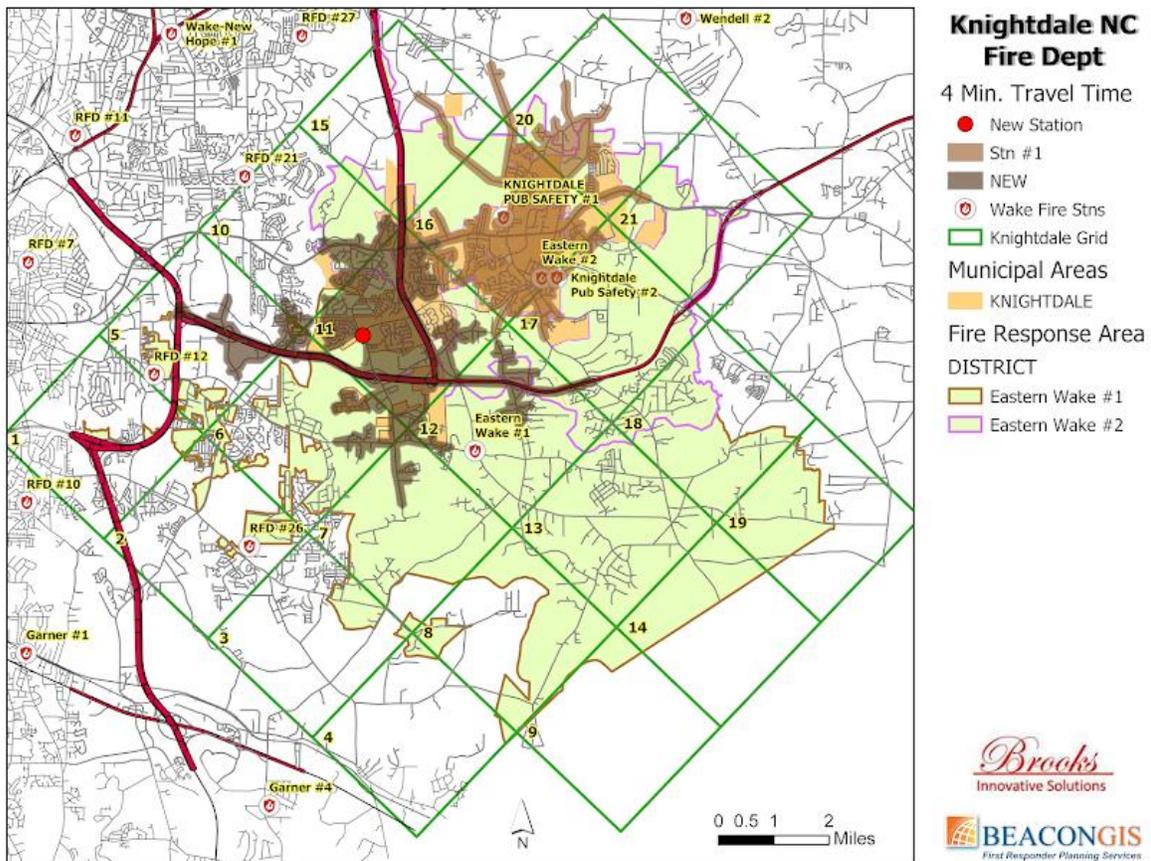


Figure 49 - Knightdale Travel Time, Sta. #1 and New Sta. #2

The fire station location matrix provides an excellent tool for looking into the future for other station locations. The model, if updated periodically, provides a dynamic tool for tracking expanding growth and demand factors in other station service areas. Decision makers can then begin to plan well in advance and will be able to determine best resource distribution locations well ahead of actual high density development.

1. The area which the model seems to forecast next is Grid #10. This may be consistent with evolving subdivision development but there are hard barriers that may block any truly significant additional expansion in this area. The area to the west actually abuts the City of Raleigh and Raleigh has already deployed a fire station on the northwestern boundary of Grid #10. This presents opportunities for closest unit response agreements with other jurisdictions. There is little remaining of Knightdale’s ETJ in this grid. If the town moves to deploy resources in Grid #11, those assets should be able to cover the relatively small area of Grid #10.

2. Grid #15 will not significantly develop more than it already has. Only a small area is included in Knightdale’s ETJ. The remainder of Grid #11 which includes KFD Fire Station #1 is nearly built-out with the remaining land zoned principally as quarry manufacturing.
3. The ETJ lying in Grid #20 to the north/northeast of town are principally built out and adequately covered by KFD Station #1.
4. **The grids presenting the most potential future deployment challenges are Grids #21, #17 and #12 located generally to the south and including land between the town and I-495, and areas to the south and slightly west of the town identified as the current growth and development centers. Eastern Wake Fire-Rescue Department Sta. #2 is well situated in this area to provide coverage assistance to the town.**
5. Grid #6, to the far southwest of the town’s ETJ might experience residential growth but the ETJ only covers about two-thirds of the grid, The City of Raleigh development is contiguous, and The City of Raleigh already has two stations located near this grid.

Threshold Values

The study has assessed each fire station service area, identified by a grid in the fire station location matrix. The higher the service area/grid scores the greater the need for deploying resources. The chart in Figure 50 displays the comparison/relationships of scoring for each of the service area/grids in the matrix. Based upon the analysis of the grids in the fire station location matrix, we make recommendations for threshold values to be considered by the town for assessing the need for and establishing trigger points for future fire stations. Obviously these threshold values would not be the only considerations and are in no way absolute values in every scenario. A single factor scoring above the recommended thresholds is in of itself not sufficient either. A combination of several factors exceeding the recommended thresholds does indicate a need. Thresholds provide reasonable data points to guide discussions concerning future resource deployment. The following values are recommended for each of the factors listed to initiate the discussion of resource deployment.

Population in a Service Area/Grid	5,000
Valuation of properties within the service area/grid	\$690,000,000
% of land (area) of the service area/grid that has been developed	>50%
% of service area/grid uncovered in four minute drive time	>50%

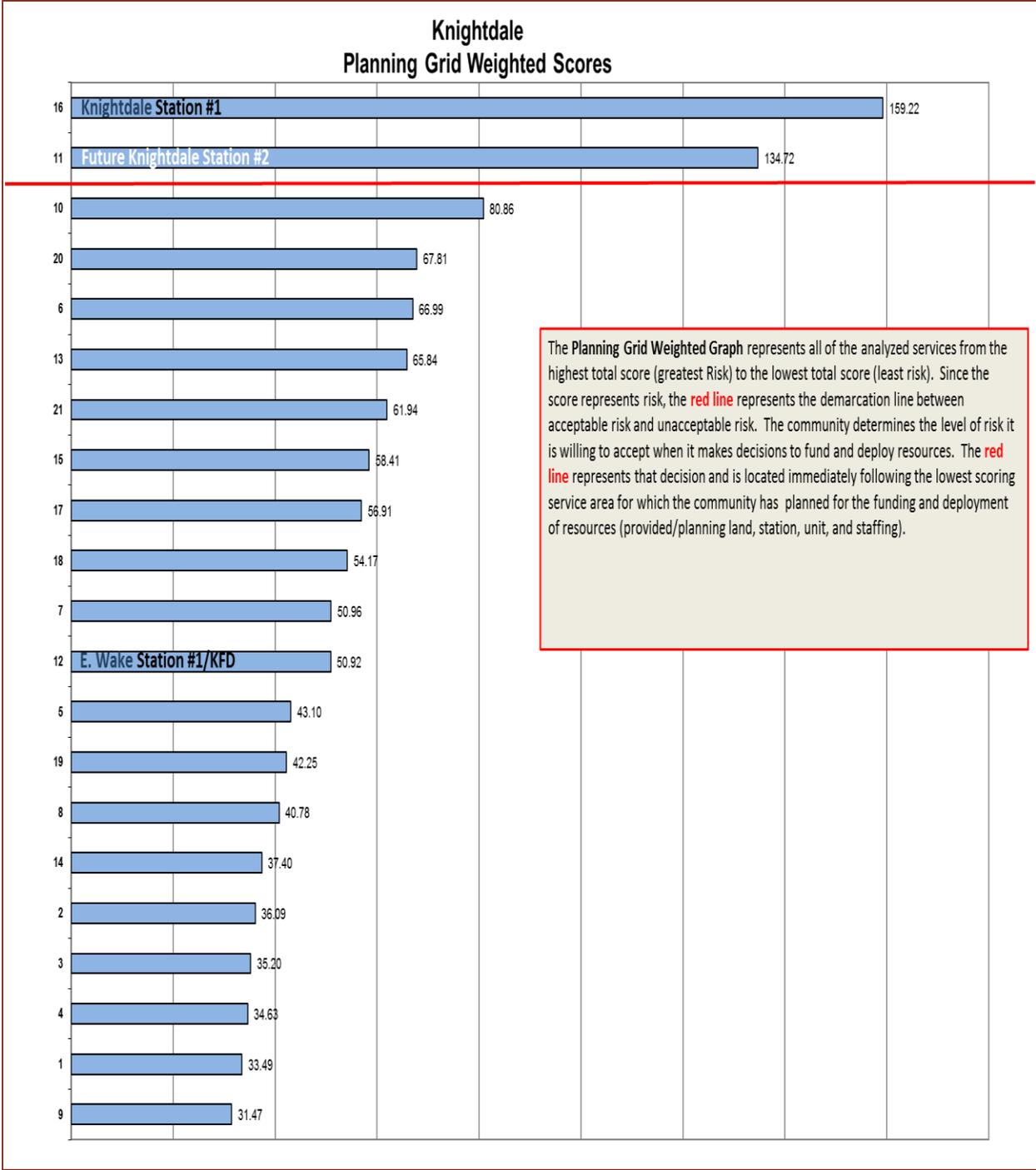


Table 15 -Knightdale Station Matrix Scores

Station Location Recommendations

These recommendations are in priority order.

1. Although a second station is needed to serve the developing areas to the west and south west, staffing is the greatest resource deployment challenge facing the department. Staffing is specifically addressed in the next chapter.
2. Commission a feasibility/implementation study to evaluate a merger/consolidation of operations/organizations between the town of Knightdale Fire Department and the Eastern Wake Fire-Rescue Department.
3. Develop plans for land purchase for a station location in Grid 11 of the Station Location Matrix located as near as practical to Lynwood Road and the I-540 overpass. This would include search in the area of Lynwood Road and Hodge Road.
4. Begin Design work and financial planning for a new fire station to principally serve first due to Grid 11 in the Station Location Matrix. The entire project for the deployment of a new station and the resources required for equipping and staffing the station with a single engine company or quint would be planned over budgets from 2019 until 2021. Based upon recent and similar projects in the region, it is recommended that an estimated budget might be approximately \$350,000 for planning and design, and \$3.5 million to \$4.5 million for land acquisition and construction.
5. Begin negotiations with Wake County Fire Services to begin participating in the Wake County Cost Share Program as part of a merger/consolidation effort.
6. Begin negotiations with Wake County EMS. This organization has a very strong interest in co-locating in a station that provides them the options in response which new Station #2 might. The degree of financial participation may be based on a number of factors, but could be as high as 20%-33%. The negotiation could include offsets for some operating costs associated with EMS use of a portion of the bay and crew areas.
7. Utilizing the forward view approach encouraged by this model, develop a long term plan for additional fire stations (15-20 years out) as the jurisdiction continues to develop.
8. The Mingo Bluff property is not a very effective or efficient location for a fire station. It will not be of value to co-locating partners. Access to the nearest main thoroughfare requires negotiating neighborhood streets and would be very close to a school. The property itself may be very expensive to prepare for construction. The recommendation is to find another use for this site other than emergency response deployment.
9. Begin a process to routinely capture and analyze Alarm Handling Time, Turnout Time and Travel Time for the first due unit for incidents as well as the full effective response force. This behavior and data will be required for accreditation.

Chapter V – Personnel

Although this study was focused more on fire station locations the consultant was asked to provide feedback on personnel and staffing issues found while conducting the principal research and analysis of the original study. The consultant was asked to conduct an assessment of position descriptions and qualifications and make appropriate recommendations.

Staffing was addressed by stakeholders in several specific areas; staffing on units and the makeup of an effective response force was addressed, the inspection workload and part-time inspector, and the unreasonable expectations of the fire chief without administrative support.

Position Description Analysis

As the Town of Knightdale Fire Department has evolved and matured, the requirements of each individual position has become more complex and require periodic review and evaluation. Wake County Government issued a study in January, 2016 outlining the Triangle Region market as well as some statewide comparative analysis through the North Carolina League of Municipalities. A copy of this report has been provided to Chief Guffey to review. Although 2 years dated, the report provides insight on structure and compensation for Knightdale’s regional market.

A review of this report, the titles used and the requirements as well as the market for each position may be prudent for the Town of Knightdale as a component of this overall analysis. The Town of Knightdale was not strongly represented in the analysis performed by Wake County Government.

Within the current structure, there are some considerations that could be made to improve and enhance the job requirements and bring them slightly more in alignment with fire and rescue industry best practices in North Carolina. These include, but are not limited to:

Volunteer Firefighter

The six-month time-period to obtain hazmat operations and the Wake County Essentials training may be adequate. However, much would be based upon availability. It may be beneficial to consider a twelve-month time-period for obtaining these credentials.

Limited Service Firefighter

This category and associated requirements seem to be an excellent fit for a career firefighter from another fire department that is helping to assemble a minimum staffing level for Knightdale. Consider clarifying the years of fire experience to one year of career service *or* three years of volunteer service. Hiring off duty career firefighters promises to be a continuing competitive market in the Wake County area.

Limited Service Fire Inspector

As noted earlier, the workload is such that Knightdale should consider establishing a full-time career Fire Marshal position. However, with the current structure, a higher level of Fire Inspector Certification credential would seem appropriate. This person should be able to perform at a higher level than the Fire Captain. In the current descriptions, the Fire Chief is the only career member of the department requiring a Level III certificate. This Fire Inspector position should hold at least a Level II certificate with a probationary Level III desired. This is also an issue of sustainability, redundancy and career development. The current part-time fire inspector actually holds a Level III Inspector Certification and does most of the plans review.

Also, three (3) years of fire service experience would seem adequate for background for this person and making that change would bring a higher level of uniformity to experience requirements across the department. Consideration could be given to providing an option of a fire inspector certificate completion as an equivalent for the years of experience necessary for the job for persons who seek to specialize in the prevention and inspection track of the profession.

Bloodborne Pathogen training should also be added to this position as all fire department personnel should be expected to provide the highest level of patient care that they can when emergencies occur, or until other responders arrive.

Volunteer Recruitment and Retention Coordinator

Although grant funded, consideration should be given to this person holding an EMT-B certification so that they could provide the highest level of patient care possible until other responders arrive.

Also, five (5) years of fire service experience would seem adequate for background for this person and making the change would bring a higher level of uniformity to experience requirements across the department.

Firefighter

The requirements as stated appear to be within the job market for this position.

Master Firefighter

Consideration should be given to providing the ability for an individual to advance from Firefighter to Master Firefighter after twelve (12) months in the Firefighter role. Data will demonstrate that early in a firefighter's career is the most vulnerable time for them to leave the organization to move to another career firefighter role with another local government. Strengthening the ability to advance in Knightdale after twelve (12) months could provide a more robust career advancement opportunity for individuals that are ready for that advancement. It would not be an entitlement, only available for persons who met the necessary criteria and their job performance was reflective of the advancement. This change would also bring the move from Firefighter to Master Firefighter in alignment with the move from Master Firefighter to Firefighter First Class.

Firefighter First Class

The requirements as stated appear to be within the job market for this position.

Fire Lieutenant

The thirty (30) hours of Leadership and Tactics courses may be somewhat ambiguous. Many organizations determine that more narrowly defining this requirement can prevent confusion and delay when promotional processes occur. Some considerations may include completion of specific identified courses or certificate programs. As an example, nearby Durham Technical Community College offers a Fire Management Certificate consisting of eighteen (18) semester hours of credit. In contrast, nearby Wilson Community College offers a fire officer certificate program with twelve (12) semester credit hours.

Options could be developed that would allow a grouping of National Fire Academy (NFA) courses as well. However, placing NFA course requirements in job descriptions is problematic because students are not guaranteed admission into the programs or courses which they apply to attend.

Regardless of the methods chosen, the Lieutenant rank is an important position for the long-term sustainability of the leadership in the department and is ideal to elevate the level of advanced education in a meaningful way to help prepare individuals to qualify for promotion to Captain and beyond.

Fire Captain

Consideration should be given to implementing a job requirement for an Associate Degree at this level, established with a future effective date. The overall fire service industry is advancing requirements for company officers to hold associate degrees. While fire departments mandating this level of education may be in the minority at this time, the need is growing and will be prevalent in the foreseeable future. Setting an implementation date of requiring an associate degree five (5) years out would allow incumbents time to obtain the needed education if they did not already hold an AAS degree. More importantly, it would provide guidance and direction for the balance of the fire department members that advanced education is important and that they will need the higher education in order to advance in the department.

This move would support career succession planning for the Town. It is important to note that when establishing progressive higher education requirements that the Town will need to invest in their personnel to offset the costs of obtaining this education. Generally, that is in the form of educational incentives and tuition reimbursement as well as ample access to computers during shift work hours at nights and during on duty down time. The department may also need to work with individuals to schedule class time that could possibly not occur on line.

Fire Chief

As identified earlier, the department should consider a Deputy Chief or Assistant Chief position. If engaged, this person should have a minimum of an AAS degree and preferably a BS/BA degree. This

level of experience will provide internal individuals the opportunity to become Fire Chief when an opening occurs.

For the Fire Chief position as described, the technical requirements to achieve, and possibly most importantly, to maintain are high. The Fire Chief as described is very diverse in the credentials outlined. In comparison to market, consideration may be given to reducing the level of technical expertise as a Fire/Arson Investigator. The Fire and Life Safety Educator certification may also become more optional with a full-time Fire Marshal.

Otherwise, the job requirements are within the market and expectations of a municipal fire chief within the region.

Staffing Levels

Inspections

Fire inspections and plans review are currently conducted by a part-time fire inspector. There are also career personnel staffing fire apparatus that have Level I and Level II inspection certifications. These personnel conduct some certificate of occupancy and fire safety acceptance inspections along with

INSPECTION ACTIVITY					
YEAR	INSPECTION TYPE				TOTAL INSPECTIONS
	ANNUAL	CONSTRUCT	PERMIT, SPECIAL	REINSPECTIONS	
2017	271	75	49	104	499
2016	219	63	26	57	365
2015	163	43	9	78	293
TOTAL	653	181	84	239	1157

Table 16 - Total Inspection Activity

some periodic maintenance inspections. Scheduled inspections by the on duty fire company are often delayed or missed when the unit is unavailable due to an emergency response. This will become a significant issue as both inspections and service demand continue to grow.

The fire chief holds inspection certifications, confers with business and individual citizens on projects, and generally oversees the inspection program. The part-time fire inspector holds Level III Inspection Certification and conducts the majority of the plan reviews. Inspections are growing along with the community.

The number of inspections has increase by an average of 31% per year over the last three years. In 2017 the number of inspections per 1000 population was 17/1000. The re-inspection rate for follow-up and

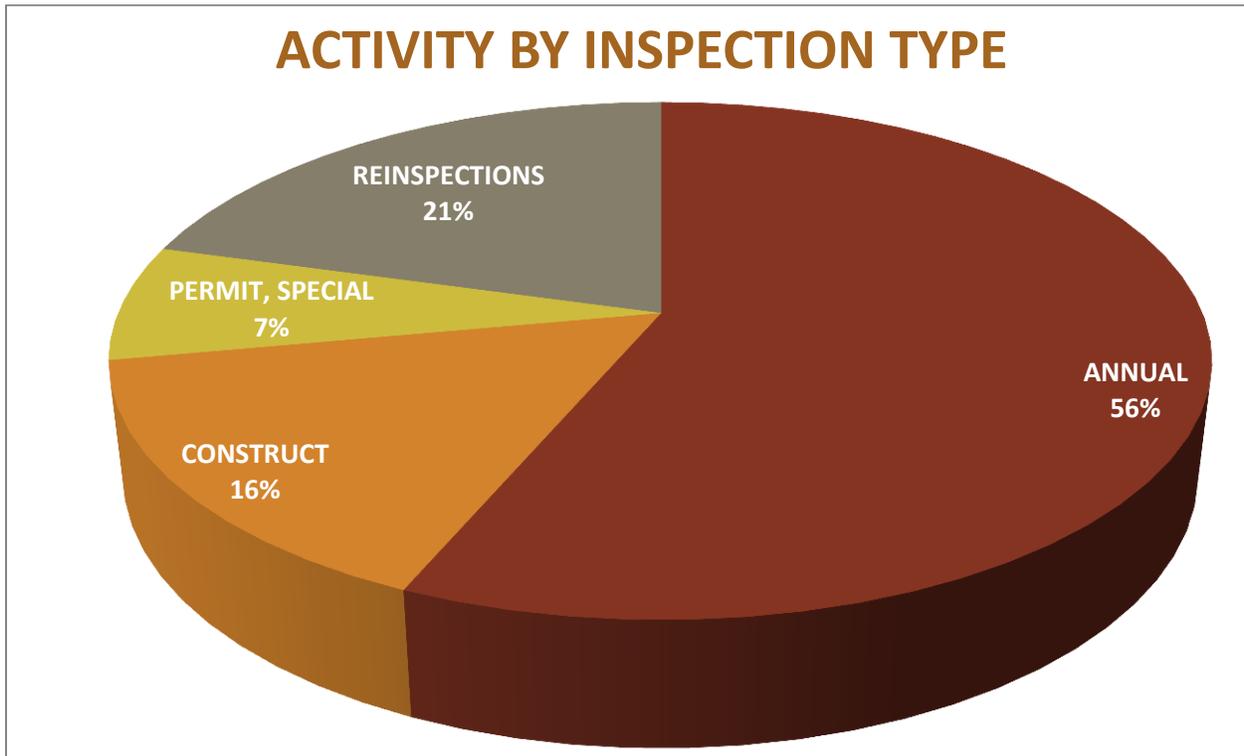
clearing of violations has averaged 27%. The number of plan reviews has averaged 141 per year. Total inspection activity in 2020 is forecast to be approximately 1,160 total events.

It is recommended that the part-time inspector position be transitioned to full-time over the next three years to accommodate the forecast workload.

FORECAST TOTAL INSP. ACTIVITY			
YEAR	GROWTH	LINEAR	AVERAGE
2015	420	420	
2016	546	546	
2017	613	613	
2018	759	719	739
2019	917	816	866
2020	1108	912	1010

Table 17 - Forecasting Total Inspection Activity

Figure 50 - Inspection Activity by Type



Company Level Staffing

The department does not meet industry standards for an effective response force to structure fire scenarios. *NFPA 1710: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments* and *NFPA 1720: Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations and Special Operations to the Public by Volunteer Fire Departments* are the industry standards for unit level and effective response force staffing. The accreditation model follows the NFPA standards. The State of North Carolina has adopted similar standards of cover performance statements for guidance and evaluation.

A typical structure fire event for Knightdale will be the residential structure fire. The models for areas like Knightdale prescribe critical tasking guidance that calls for unit level staffing of four personnel on each engine and ladder company and a full initial response force of 14-15 personnel.

Knightdale can usually assembly four personnel but for only one unit. As noted in the ISO discussion in the Fleet chapter, ISO prescribes that three engines and one ladder company are required. Knightdale has the apparatus to comply but do not have the personnel to get more than one of the four units out

CRITICAL TASKING MODEL	
RESIDENTIAL FIRE	
TASK	NFPA 1710/20
INCIDENT COMMAND	1
WATER SUPPLY	1
FIRE FLOW	4
ATTACK SUPPORT	2
SEARCH & RESCUE	2
LADDER & VENTILATION	2
IRIC	2
SUB TOTAL	14
AERIAL OPERATOR	1
TOTAL	15

on an initial response. The town is dependent upon aid from neighboring departments and the volunteer turnout to assemble any force larger than the ingle unit response. It should be noted however that the fire chief does respond to multi-unit deployments and frequently would assume the command role. Table #18 provides the critical tasking and staffing for a typical residential structure fire according to industry guidelines.

With mutual aid from Eastern Wake Fire-Rescue Department, Knightdale can currently assembly an initial response force to a residential structure fire of eleven-twelve personnel. There are times when the initial response is dependent upon volunteer response or career personnel responding from home. This is a very significant issue since responses from home can take fifteen minutes or more before arriving on the scene. This seriously impacts the ability to assemble an effective response and further impacts the ability to provide desired outcomes. As currently staffed, Ladder 135 would not be able to respond as part of the initial

Table 18 - Critical Tasking and Staffing

response force since it is typically unmanned. The town should develop a plan to staff Ladder 135 with four personnel full time. This would provide eight to nine personnel from the town on an initial response but, with mutual aid, the additional personnel would allow the town to deploy personnel in compliance

with the industry standard. A total dependence on mutual aid is not realistic since, as described in Chapter 1, the initial effective response force must arrive within ten to twelve minutes in order to have a chance at confining a fire to the room of origin.

The most significant issue with internal stakeholders was the staffing issue. This issue was also recognized by the community leaders.

The company level staffing for the ladder is necessary, even for other incident types. The standards specifically call for staffing from four to six on a ladder company depending upon the hazard/risk level. A staffed ladder company would also improve the responses to calls like rescues that are manpower intensive.

A fully staffed ladder company provides the town with an additional unit that can respond to medical incidents when the first out unit is already deployed on other calls or other activities. Having the second unit should improve overall reliability in response to medical and other emergencies.

Comparative Deployment Analysis

This section addresses comparative analysis of Knightdale's deployment capability and/or practices with other communities in the county and state. Two sources of data are used to conduct the analysis. First, a resource survey was conducted in January, 2018 by the department and the data was verified and utilized by the consultant analyze and present Knightdale's position in comparison with other similar departments located in Wake County.

The second significant source of data for comparing deployment is data collected by the NC School of Government and its Performance Measurements project. This data is collected annually from participating departments from across that state and is analyzed to evaluate potential benchmarks for performance measurement by units of local government.

The comparative analysis further demonstrates the validity of this study's findings and recommendations beyond simply compliance with a standard or industry best practice. These two data sets demonstrate actual deployment practices within the state and region and Knightdale's the same performance or deployment measures. This comparative deployment analysis is not intended to be predictive but rather serves as a comparative view based upon the most recent current practices.

Wake County Comparative Non-Administrative Position Analysis

Data was collected from a number of similar organizations in Wake County. The results of the analysis presented in this section focus on the Town of Knightdale and nine other organizations. Although a tremendous amount of data was collected and analyzed, the findings in this section focus on rates for various measures which are based on two or more factors each. The full data collected and included in this analysis is presented in *Appendix E: Wake County Deployment Comparative Analysis*.

The rates provide an even comparison, much clearer and less ambiguous than simple counts or single measures. Rates allow the standardizing of performance that is independent of size in any of the measures. Once the rates were determined then each organization was ranked according to and for each rate/element. The Town of Knightdale was consistently at the bottom of each rate category for all but one out of nine elements.

The area covered by deployed resources impacts the timeliness of service delivery and the quality and success of outcomes. Knightdale ranked tenth for square miles per station municipal coverage area. The median coverage area for fire departments in the survey was 4.25 sq. mi. while Knightdale attempts to cover the entire 7.28 sq. mi. jurisdiction from a single station.

Although a unit is housed at the Robertson Street location, this location was not considered by the consultant to be viable for inclusion in the deployment model. This location is not staffed, the apparatus is very rarely responded on an actual emergency call, and then only after other units from Station #1 and mutual/automatic aid units have been deployed. In the opinion of the consultant, this is simply a storage location.

Larger station service areas result in larger numbers of citizens residing, schooling, working and recreating in a fire station service area. At some point the number exceeds a reasonable point and citizenry become underserved. Knightdale ranked tenth out of ten in this element. All of Knightdale's 15,922 residents are covered by a single station compared to the median population served for all departments of 7,459 per station area.

Knightdale ranked three out of ten for the number of firefighters per square miles (total) protected. Knightdale has .79 firefighters compared to a slightly lower median for the group of .70 firefighters per square miles (total) protected area. The minimum is .33 in Rolesville while the maximum is 2.35 in Morrisville. The relatively positive ranking of Knightdale for this element is attributed to the fact that most of the other departments have municipal and rural areas to protect giving them much larger service areas. When looking at only the municipal service area covered Knightdale ranks tenth again at 1.21 firefighters per square mile of municipal area protected compared to the median of 2.95 firefighters per square mile of municipal area protected, a gap of 1.74 firefighters (59%) less than the median.

Knightdale ranked seventh for total population and is tenth for highest count of total population served per firefighter. The staff serves 1,769 residents per firefighter position compared to the median for the group of 963. Ranking tenth for municipal population served per firefighter Knightdale also ranks tenth with 1,769 residents per firefighter compared to the median for municipal residents per firefighter of 539. Another way to look at the relationship between numbers of firefighters and the population they protect is to determine the rate of firefighters per capita, or per 1,000 people protected.

January 2018 Wake County Comparative Analysis - Study Score Card Result											
Department Name	Mun. Sq. Mi. Station Rank	Mun. Pop. Per Station Rank	FF Per Square Miles (Total) Protected Rank	FF Per Square Mile Municipal Rank	Total Residents Per FF Rank	Municipal Residents Per FF Rank	FF Per 1,000 People Protected Total Rank	FF Per 1000 Mun. People Protected Rank	Emergency Responses Per Firefighter Rank	SCORE CARD RESULT	Rank
Wendell Fire Department	1	1	7	3	3	3	3	1	6	25	1
Morrisville Fire Department	2	6	1	1	1	9	1	3	1	34	2
Zebulon Fire Department	6	2	9	5	4	1	4	2	9	35	3
Wake Forest Fire Department	3	5	2	2	2	8	2	6	3	40	4
Rolesville Fire Department	5	3	10	7	9	2	9	4	5	45	5
Garner Fire Department	4	4	6	4	7	5	7	5	8	49	6
Fuquay-Varina Fire Department	7	7	8	6	8	4	8	7	7	57	7
Holly Springs Fire Department	9	8	3	9	5	7	5	8	2	61	8
Apex Fire Department	8	9	5	8	6	6	6	9	4	62	9
Knightdale Fire Department	10	10	4	10	10	10	10	10	10	87	10

Table 19 - Wake County Comparative Score Card Ranking

The rate for Knightdale for firefighters per total population protected is .57 compared to the median of 1.04. When looking only at the municipal population the rate remains .57 compared with the median of 1.86. In both measures Knightdale ranked tenth.

A comparative analysis of workload, measured as emergency responses per firefighter, indicates that Knightdale has the highest number of incidents per firefighter. This is also interpreted as the lowest number of firefighters for the service demand generated by the community. Based on the survey data Knightdale ranks tenth again with a service demand per firefighter of 136 incidents compared to the median for the group of 81 incidents per firefighter.

As part of the analysis of survey results, a Score Card approach was used to develop an overall comparative relationship among the ten participants in the survey. The overall score card result is the compilation score of all rankings for all nine performance measures (See Table 19.) The median score was 47. Knightdale ranked tenth with a score of 87. The score card result for Knightdale was 85% greater than the median and was 40% greater than the next closest scoring department.

NC School of Government Deployment Performance Measures Comparative Analysis

An additional comparative analysis was conducted referencing select data collected in the NC School of Government Performance Measurement Program. This is an annual survey of participating municipalities from across the State reporting typical performance measurements for each area of local government service. Fifteen municipalities participated in the most recent reporting report (2015-2016) from which data was used. Two of the participating municipalities are from Wake County. The participating municipalities represent a broad mixture of jurisdictions from across the state. Due to the range in size of organizations, only rates were used for comparative purposes rather than raw counts. Select raw data is presented in *Appendix F – NC School of Government Comparative Analysis*.

NC SCHOOL OF GOVERNMENT (SOG) PERFORMANCE MEASUREMENT PROGRAM COMPARATIVE RATES							
	Costs Per Capita	Costs per \$1K Property Protected	FTE's per 10K Population	Square Miles per Station	Stations per 10K Population	FD Responses per 1K Population	FD Responses per FF FTE
SOG Average	\$184	\$1.85	18.70	6.51	0.95	121	73.55
Knightdale	\$93	\$0.96	5.65	7.43	0.63	92	162.89

Table 20 - NC SCHOOL OF GOVERNMENT (SOG) PERFORMANCE MEASUREMENT PROGRAM COMPARATIVE RATES

Comparative rates indicate Knightdale lags behind state level benchmarks for deployment of fire and rescue resources.

A review of the budget and costs invested by Knightdale in fire and rescue protection are more in line with a rural district rather than an urban/suburban environment found in the jurisdiction. The per capita cost for the fire department lags the average by \$91 (49%). The cost per \$1,000 of protected assessed

valuation lags the average by \$.89 (48%). Although there are no regulated or required funding levels for municipalities in NC, there is guidance legislated for rural fire districts in NC General Statutes that can provide some comparison. According to NC General Statute 69, Article 3A, Section 69-25.1, rural fire districts can be funded at a rate up to \$0.15 per \$100 valuation. This rate would result in revenue up to \$2,331,188 based on the most recent data provided for the Town of Knightdale assessed valuation. The most recent budget funded the fire department at \$1,485,912.

Wake County assesses a tax on assessed valuation for fire protection at \$0.96 per \$100 valuation. This model would result in revenue based upon Knightdale’s assessed valuation of \$1,491,960.

Regional/State Administrative Position Analysis

A comparison of administrative positions was conducted among similar departments located in Wake County and from across the region and state. Although Knightdale ranks eleventh in population among sixteen surveyed agencies it ranked sixteenth in total administrative positions and sixteenth in administrative positions per capita (1,000 population).

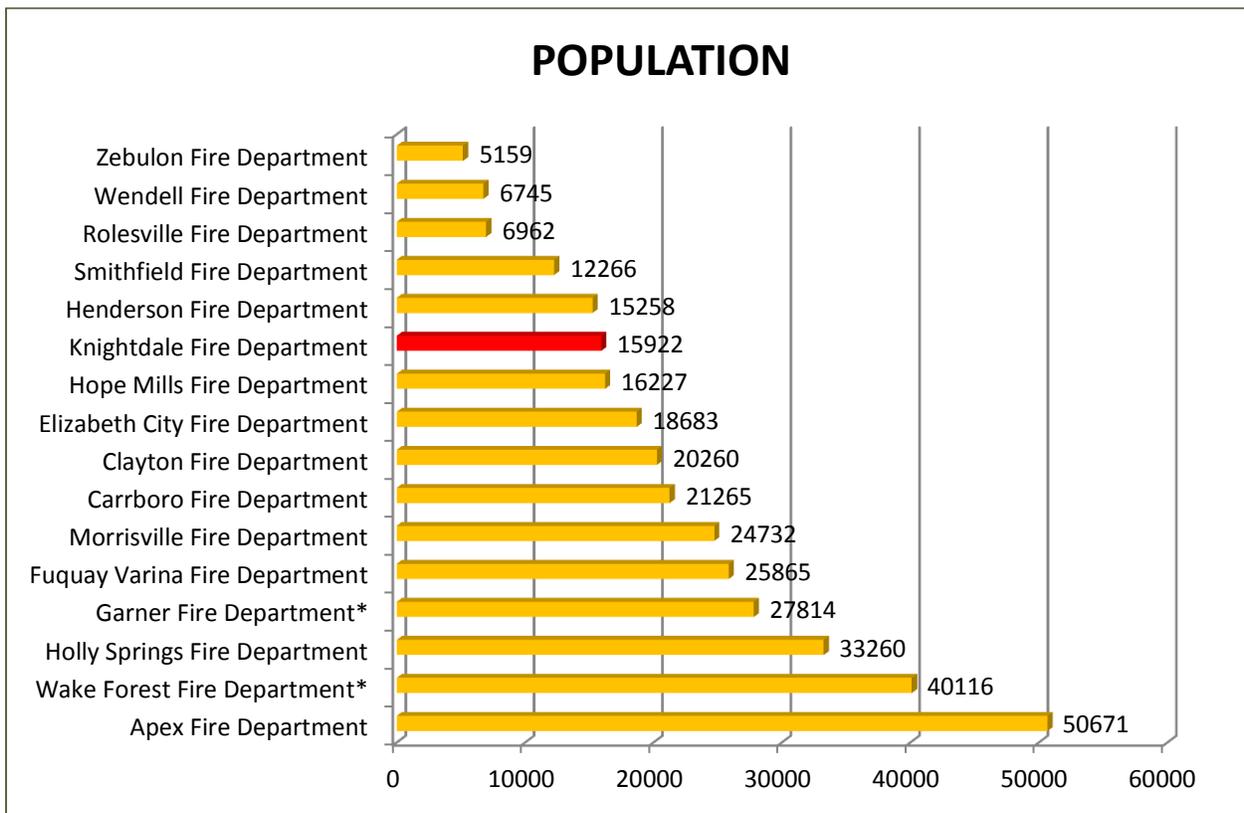


Table 21 - Administrative position survey participants sorted by population.

As noted in the earlier position analysis, the issue of the fire chief wearing too many hats is a major issue with internal and external stakeholders. In Knightdale, the fire chief is the only non-operational position and is the only administrative officer on staff other than the part-time inspector. Among the sixteen

survey participants all but Knightdale and Morrisville have at least one Deputy or Assistant Chief. Morrisville has five other administrative positions however. All of the participants other than Knightdale have at least three battalion chiefs (usually shift command officers) and all of the agencies other than Knightdale, and who are responsible for fire inspections have at least one full time inspector.

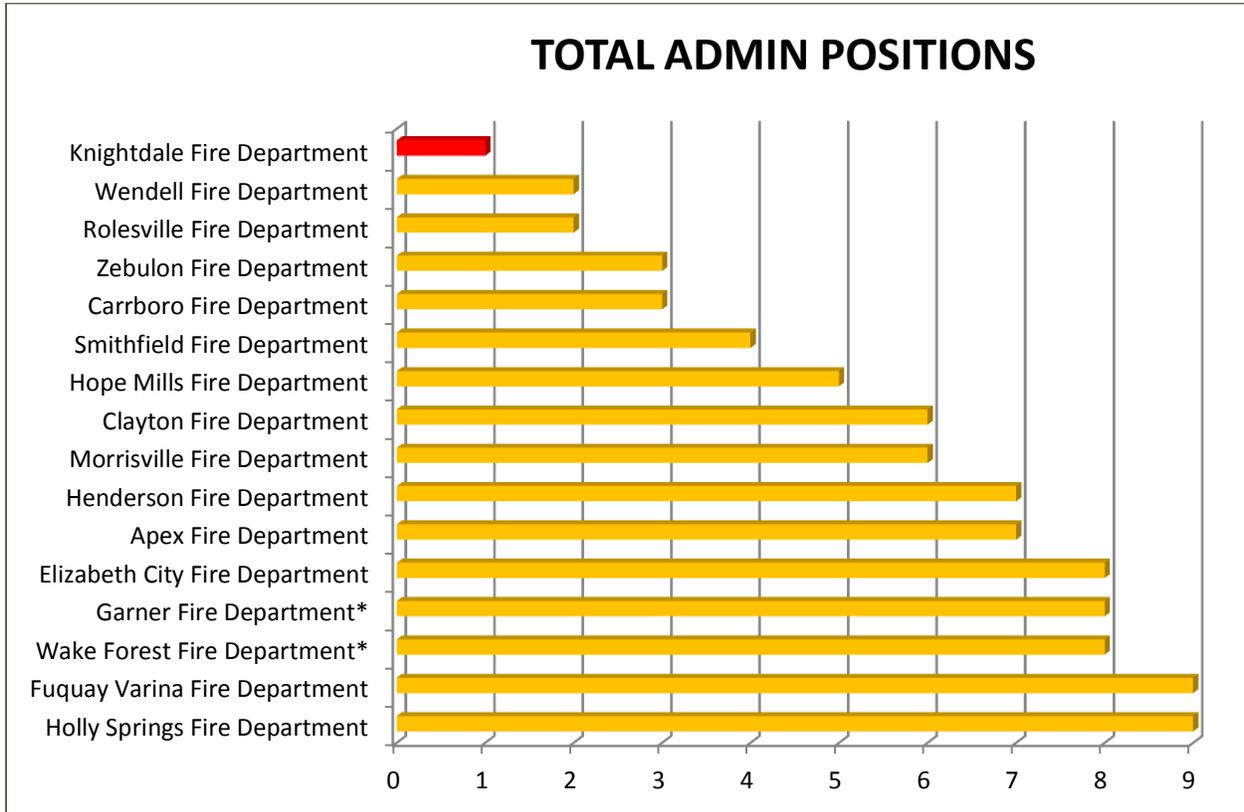


Table 22 - Administrative position survey participants sorted by total administrative positions.

*Private non-profit corporation contracted by municipality for fire and rescue related services.

** Jurisdictions where the County conducts all inspection services.

Counts provide anecdotal information upon which some conclusions can be drawn but rates provide a clearer and more direct comparison. When the survey participants are ranked by the number of administrative personnel per 1,000 population protected Knightdale ranks last in sixteenth position with a per capita rate of .06 administrative positions per 1,000 population protected. Knightdale lags the median of the group (.29/1,000 population) by 79% and lags behind the next closest ranked participant (.13) by 54%.

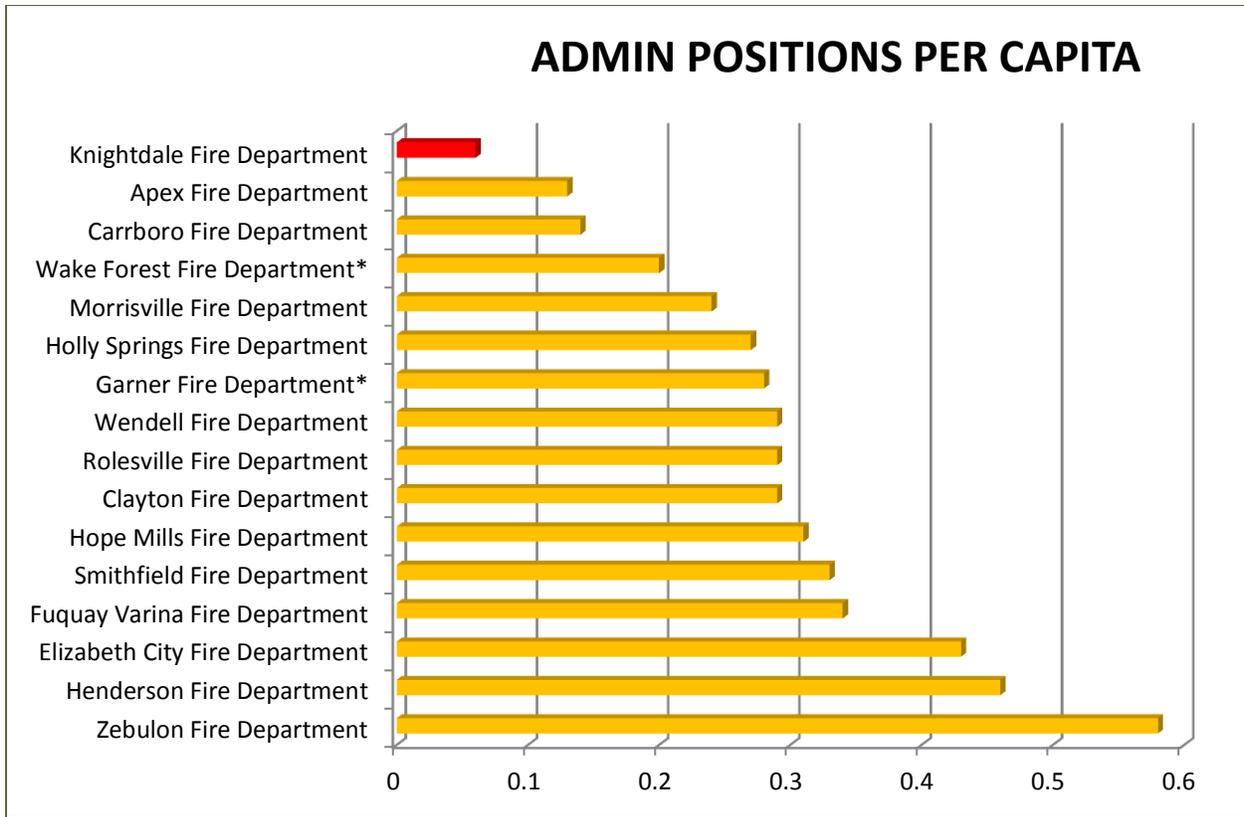


Table 23 - Administrative position survey participants sorted by total administrative positions.

The full data from the administrative positions survey can be found in *Appendix G: County/Regional/State Survey of Administrative Positions*.

Personnel Recommendations

Note – In addition to those found in the position description analysis summary.

1. There is an immediate need to add four personnel to staff the ladder company.
2. Plan for company staffing of four personnel for a company located in the new Knightdale Sta. #2.
3. Add a deputy or assistant chief position to assist fire chief with administrative and department management and to enable future succession planning for fire chief's position.
4. Transition part-time fire inspector position to full time.

Chapter VI – Fire Fleet Study

Description of Fleet

The Town of Knightdale Fire Department operates a fleet that meets the needs of the town and the composition is based upon the hazards and risks found in the community. The fleet inventory includes one rescue engine, two engines, one ladder truck, one reserve engine, one command vehicle, one heavy utility vehicle which is also used for county EMS calls, and a medium duty utility vehicle used for fire inspections.



Figure 51 - First Out Apparatus During Daily Inspection

The fleet is aging with two pieces of apparatus beyond the age at which equipment might be moved to reserve status or retired. The aerial apparatus, Ladder 135, is 21 years old. Engine 133 is 16 years old while two others are 12 and 10 years old. The average age of the fleet is 12 years, but this is deceiving since Engine 131 is only a few months old having just been purchased.

The department utilizes, except for very minor issues, independent vendors and contractors to perform mechanical maintenance and repairs. They also utilize vendors for annual and other testing of apparatus and equipment including ground ladders, etc. The average annual cost to the department over the most recent five year period for maintenance and repairs is \$39,876. The annual average cost for individual pieces of equipment range from \$3,395 to \$15,114. The average annual cost for maintenance and repair across all large fire apparatus is \$7,975.

Engine 133 was recently moved to reserve status since the new replacement engine was put into service as Engine 131. This status is appropriate for its age and condition.

The KFD has minimal internal policies for fleet unit life cycles. Industry standards and county wide policies for vehicle acquisition, deployment maintenance and repair could provide benchmark best practices for the town to consider.

Standards

NFPA 1911

The dominant industry standards for fire apparatus are NFPA 1901 and NFPA 1911. These standards are observed industry wide and internationally as proven science and research based. *NFPA Standard 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Emergency Vehicles* provides very detailed information as well as sample guidelines, procedures and forms for every aspect of fire fleet management. Highlights from NFPA 1911 provide some guidance for evaluating the current status and planning for KFD’s fleet. Annex D, Guideline for First-In and Reserve Fire Apparatus makes the following specific points:

- Apparatus should be renovated, upgraded, or moved to reserve status or retired after fifteen years.
- “...fire departments should seriously consider the value (or risk) to firefighters of keeping apparatus in first-line service (after the fifteen year point.)
- Although providing extensive guidelines for the refurbishment or upgrade of apparatus, the standard challenges fire chiefs and other administrators to consider the practicality and long term cost benefit of renovating twenty plus year old apparatus.
- Any apparatus over twenty-five years old should be retired from emergency service regardless of first-line or reserve status.
- The standard does provide information that can be used to develop your own vehicle score card assessment process.

Average Annual Maintenance & Repair Costs		
Unit	Costs	
Engine 131		\$2,000
Engine 133		\$3,395
Engine 134		\$4,934
Ladder 135		\$14,433
Engine 132		\$15,114
Total Costs		\$39,876
Maximum Unit Cost		\$15,114
Minimum Unit Cost		\$2,000
Average Unit Cost		\$7,975

Table 24 - Fleet Annual Maintenance and Repair Costs

Wake County Apparatus Policy and Procedures

Although there are many resources available to departments for aiding in fleet assessment and renovation/retirement decisions, one of the best found during this project are the policies and procedures for fleet management of the Wake County Fire Commission Apparatus Committee. The adopted policy and procedures provide the structure for fleet management of county owned emergency fire apparatus. The affected apparatus are those owned and operated directly by the county, apparatus

and equipment provided to or purchased with tax assets for the rural fire tax insurance districts, and the county funded apparatus held by municipalities participating in the county cost sharing program.

The policy and procedures provide the following general guidelines:

- A vehicle replacement workbook should be developed for each piece of equipment.
- Generally, Engines, Pumper/Tankers, Tankers, Rescues, and Ladder/Aerials should be replaced when twenty years old or older.
- Brush trucks that are fifteen years old should be replaced.
- Apparatus replacement decisions will be aided by the results of the vehicle replacement workbook assessment, essentially a vehicle score card.
 - The principal factors, in addition to vehicle type, are apparatus age, road mileage and/or hours of operation, and annual expenses of the apparatus.

The policy and procedures provide prescriptive guidance in how to score the factors to ensure consistency and benefit. The factors and prescriptive rating points were used in this study as the principal core to develop vehicle score cards for the heavy vehicles in the KFD fleet.

There are provisions in the policy and guidelines for considering the consolidation of two apparatus into one. This could be important to the town when considering retirements and replacements within the fleet.

Challenges

There are a number of challenges when considering fleet size and structure for the KFD. The majority of the district is generally suburban in nature with the majority of fire risks found in residential properties. The impact of the Interstate, State and high volume North Carolina highways, and the associated hazards and risks, along with the industrial and manufacturing component of the local economy require a significant fleet for an initial effective response force. All of these risks require a fleet of diverse capability.

With the exception of the newest engine, the remaining three engines are relatively close in age, mileage, engine hours and maintenance costs. The depreciating values are relatively close as well.

Vehicle Age		
Unit	Year of Manf.	Age
Ladder 135	1997	21
Engine 133	2002	16
Engine 134	2006	12
Engine 132	2008	10
Engine 131	2017	1
Maximum Age		21
Minimum Age		1
Average Age		12

Table 25 - KFD Fleet Age

The size of the fleet contributes to space pressures on the apparatus bay of the existing station, and will be a design consideration for a new facility. The number of apparatus certainly outnumbers the

available staff, paid and volunteer, who can respond with and place the apparatus in service. It is the consultant’s opinion that the department should evaluate every opportunity to reduce the number and size of apparatus in the fleet to reduce or better manage the impacts.

The age and escalating annual maintenance costs for apparatus and the increasing uncertainty of reliability, especially for Engine 133 and Ladder 135 will create additional pressure on the town’s budget and potentially on a cost sharing program as replacement options are considered.

Fleet Investment

Large fire apparatus is very expensive to purchase and maintain but has a relatively long service life of ten to twenty years. The original acquisition costs for the total existing fleet was approximately \$1.8M. The replacement cost of the fleet, as estimated by the consultant, is \$3.2M. This replacement value may actually be a little low.

The insured replacement values are significantly lower than the estimated replacement values. The formula for determining insured value by the current insurance contract is Acquisition Costs minus Depreciation.

Fleet Values			
Unit	Acquisition costs	Insured Value	Replacement Value
Ladder 135	\$450,000	\$0	\$1,200,000
Engine 131	\$512,000	\$486,400	\$515,000
Engine 133	\$152,000	\$30,400	\$500,000
Engine 134	\$325,000	\$130,000	\$500,000
Engine 132	\$375,000	\$187,500	\$500,000
Total	\$1,814,000	\$834,300	\$3,215,000

Table 26 - KFD Fleet Values



The insured value of the fleet is only 25% of actual replacement value and 44% of the original acquisition cost. It is recommended that, when the current fleet insurance coverage is up for renewal, the town negotiate an “Agreed upon Value” for each unit in the fleet that more closely reflects its replacement cost. This is a more expensive strategy but one that could significantly reduce the risk to the town, especially in light of the current state of units in the fleet.

Major Fleet Assets

Engine 131



Figure 52 - Engine 131

This engine is the newest unit in the fleet, replacing the former Engine 131 in February of 2018. Engine 131 is the first unit out of Knightdale Station #1. It is a 2017 Spartan with a pump rating of 1,250 Gallons per Minute (GPM) and a 750 gallon water tank capacity. Road mileage is approximately 3,310 with 221 hours on the engine. Pump hours are not recorded. The Gross Vehicle Weight (GVW) on the front axle is 20,000 lbs. and 27,000 lbs. on the rear for a total GVW of 47,000 Lbs. The Acquisition cost for this unit was \$512,000 and the insured value is approximately \$486,400. This unit is on a twenty-year depreciation schedule. The actual replacement value is estimated at \$515K.

Engine 132

This engine is the second engine out from Knightdale Station #1. It was originally purchased in 2008. It is a 2008 Pierce - Sabre with a pump rating of 1,250 Gallons per Minute (GPM) and a 750 gallon water tank capacity. Road mileage is approximately 56,565 with 6,353 hours on the engine. Pump hours are not recorded. The Gross Vehicle Weight (GVW) on the front axle is 16,000 lbs. and 27,000 lbs. on the rear for a total GVW of 43,000 Lbs. The Acquisition cost for this unit was \$375,000 and the insured/depreciated value is approximately \$187,500. This unit is in year ten on a twenty-year depreciation schedule. The actual replacement value is estimated at \$500K.



Figure 53 - Engine 132

Engine 133



Figure 54 - Engine 133

This engine is the old Engine 131 and has been placed in reserve status since its replacement. It was originally purchased in 2002 and is the oldest engine in the fleet. It is a 2002 International with a pump rating of 1,250 GPM and a 750 gallon water tank capacity. Road mileage is approximately 41,790 with 4,155 hours on the engine. Pump hours are not recorded. The GVW on the front axle is 12,000 lbs. and 24,000 lbs. on the rear for a total GVW of 36,000 Lbs. The Acquisition cost for this unit was \$152,000 and the insured/depreciated value is approximately \$30,400. This unit is in year sixteen on a twenty-year depreciation schedule. The actual replacement value is estimated at \$500K.

Engine 134

This engine is the third engine out for the town of Knightdale. This unit is stored at the Robertson Street Station. It is a 2006 Pierce – Contender Series with a pump rating of 1,250 GPM and a 750 gallon water tank capacity. Road mileage is approximately 49,780 with 4,790 hours on the engine. Pump hours are not recorded. The GVW on the front axle is 16,000 lbs. and 24,000 lbs. on the rear for a total GVW of 40,000 Lbs. The Acquisition cost for this unit was \$325,000 and the insured/depreciated value is approximately \$130,000. This unit is in year 12 on a twenty-year depreciation schedule. The actual replacement value is estimated at \$500K. The water tank must be emptied when not in first line service due to serious leaking. Several valves are leaking and some gauges are not working.



Figure 55 - Engine 134



Figure 56 - Ladder 135

Ladder 135

This is the only aerial apparatus in the fleet. It is occasionally deployed when there are volunteers or other personnel available to put it in service. It is a 1997 Pierce Quantum 105" quint capable of being deployed as an aerial ladder device and as an engine. Road mileage is approximately 18,475. There are 8,599 engine hours and 1,205 pump hours recorded. GVW on the front axle is 20,800 Lbs. and 22,000 Lbs. on the rear. Total GVW is 64,800 lbs. This apparatus was purchased used in 2008 and had been refurbished at the time of purchase. The acquisition cost was \$450,000 and the insured/depreciated value is \$0.00. This unit is twenty-one years of age and fully depreciated. The actual replacement value is estimated at \$1.2 M. The chassis and body have had significant damage from delamination corrosion.

ISO Rating Impact

The town enjoys a very good NC Response Rating System (ISO) classification upon which insurance premiums for the town and rural district are determined. The current rating is Class 3 as published in 2017. The size and makeup of the fleet were rated during the evaluation and scoring. A 3,000 gallon per minute required fire flow was determined under the rating schedule and is based upon the town and district makeup and size. Three engines/pumpers are needed to receive credit for meeting the required fire flow. There are also a small number of buildings located throughout the jurisdiction that are more than three stories or thirty-five feet in height, or which have a required fire flow of more than 3,500 GPM establishing the need for an aerial ladder apparatus. Therefore, at least four large apparatus are needed to continue to maintain the favorable ISO rating. This fleet size requires large apparatus space and other associated space for supplies and equipment for such a large fleet.

The conundrum is that the department does not have the staff or volunteers to deploy the apparatus in the fleet that is available for response. There is enough staff to deploy one unit fully manned or two units if staffing is split. Splitting staff between apparatus is not a desirable situation since it splits crews and reduces effective unit staffing, options for rapid interior entry to fire scenarios, and increases risk of injury for firefighters. For active/working and major events, the department is dependent upon mutual aid, and for volunteers to respond to the station and then deploy additional apparatus. This is a time consuming process and frequently, available apparatus remains in the station for lack of staffing.

Vehicle Score Card

A system of vehicle score cards, whether by that name or by some other, provides a standard method of auditing the fleet to help determine replacement needs and track maintenance and other costs. It also provides a system of annual assessment that helps support more informed decision making.

There are many systems available and used in fleet management applications for determining when, and at what costs, to replace or renovate assets. After evaluating several, the Wake County factors for developing the Vehicle Replacement Workbook, was selected as the core of a study evaluation of fleet assets. In addition to the factors of age, mileage, M&R costs, and vehicle type, a factor for component assessment was added. This factor is actually made up of at least eleven sub-factors. Some examples are mechanical factors, body and paint condition and the condition of compartments. On duty staff assisted during the assessment process and this step was used to further gather input from shift personnel and other members. The Vehicle Score Card assessment documentation will be left with the agency as part of the promised data library, and which they can maintain if they choose.

The process of creating score cards for each piece of heavy apparatus helps to rate and rank units for action, like retirement or replacement. Even the opportunities for consolidation of units can be helped with information from this process. The high level results of the vehicle score card process are presented in Figure 42, Vehicle Score Card Results.

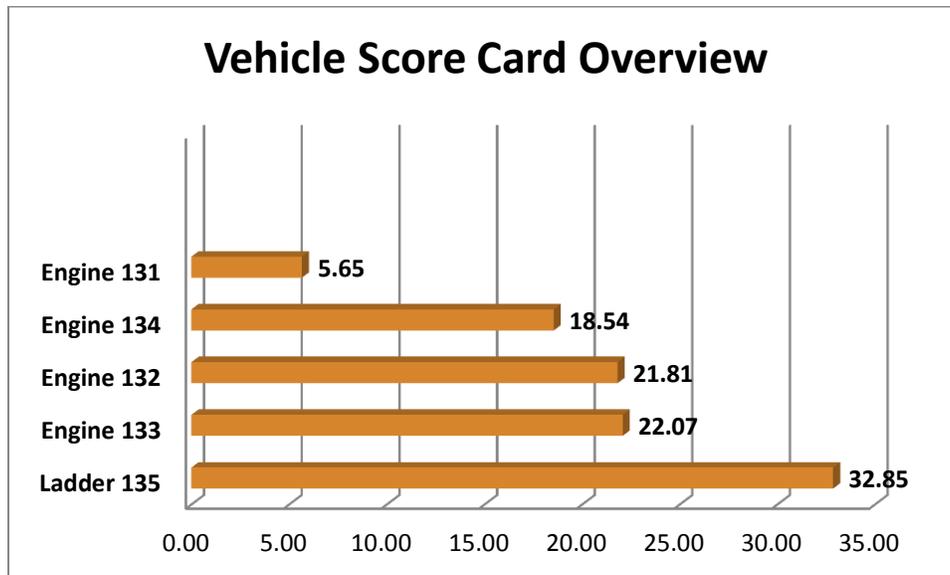


Figure 57 - Vehicle Score Card Results

Recommendations

1. There is an immediate need to replace L135. This piece of equipment is twenty-one years old, six years older than the current industry standard recommends for the maximum age of a first line piece of fire equipment and is older than the recommended replacement age in the Wake County Fire Commission Apparatus Committee, Policy and Procedures. This aerial device is larger than the district would require therefore, it is further recommended to investigate replacing the 105 foot aerial with a 75' or 85' aerial on a shorter and much lighter chassis.
2. It is recommended to replace Engine 134 in the year following Ladder 135 and rotate apparatus to place the new engine as first out and remaining engines in order based upon their current serviceability. Although Engine 134 is not the oldest engine in the fleet, the component assessment, maintenance and repair costs and current general poor operating condition suggests moving it ahead in the replacement schedule.
3. A fleet capital plan should be developed to begin programming replacements for large apparatus based upon industry standards and score card results. According to the industry standard, Engine 133 already exceeds the industry standard for first line service and should be retired in 2022. Engine 132 should be taken out of first line service in 2023 and should be retired in 2028. The town has guidelines for replacement schedules for the command vehicle and two utility vehicles.
4. It is recommended that the department maintain the Vehicle Score Card System used in this study, or some similar process to help manage a fleet replacement and capital program.

Chapter VII – Recommendation Summary

Station Location Study Recommendations

These recommendations are in priority order and are in concert with preceding recommendations in the chapter on existing station assessment.

1. Commission a feasibility/implementation study to evaluate a merger/consolidation of operations/organizations between the town of Knightdale Fire Department and the Eastern Wake Fire-Rescue Department.
2. Develop plans for land purchase for a station location in Grid 11 of the Station Location Matrix located as near as practical to Lynwood Road and the I-540 overpass. This would include search in the area of Lynwood Road and Hodge Road.
3. Begin Design work and financial planning for a new fire station to principally serve first due to Grid 11 in the Station Location Matrix. The entire project for the deployment of a new station and the resources required for equipping and staffing the station with a single engine company or quint would be planned over budgets from 2019 until 2021. Based upon recent and similar projects in the region, it is recommended that an estimated budget might be approximately \$350,000 for planning and design, and \$3.5 million to \$4.5 million for land acquisition and construction.
4. Begin negotiations with Wake County Fire Services to begin participating in the Wake County Cost Share Program as part of a merger/consolidation effort.
5. Begin negotiations with Wake County EMS. This organization has a very strong interest in co-locating in a station that provides them the options in response which new Station #2 might. The degree of financial participation may be based on a number of factors, but could be as high as 20%-33%. The negotiation could include offsets for some operating costs associated with EMS use of a portion of the bay and crew areas.
6. Utilizing the forward view approach encouraged by this model, develop a long term plan for additional fire stations (15-20 years out) as the jurisdiction continues to develop.
7. The Mingo Bluff property is not a very effective or efficient location for a fire station. It will not be of value to co-locating partners. Access to the nearest main thoroughfare requires negotiating neighborhood streets and would be very close to a school. The property itself may be very expensive to prepare for construction. The recommendation is to find another use for this site other than emergency response deployment.
8. Begin a process to routinely capture and analyze Alarm Handling Time, Turnout Time and Travel Time for the first due unit for incidents as well as the full effective response force. This behavior and data will be required for accreditation.

Personnel Recommendations

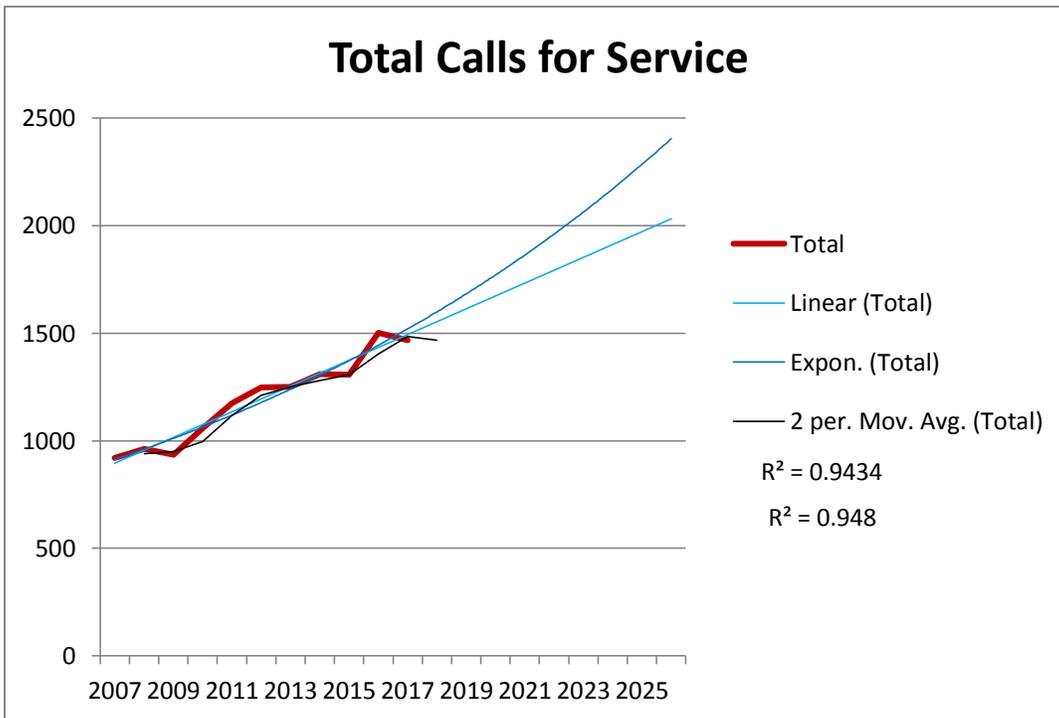
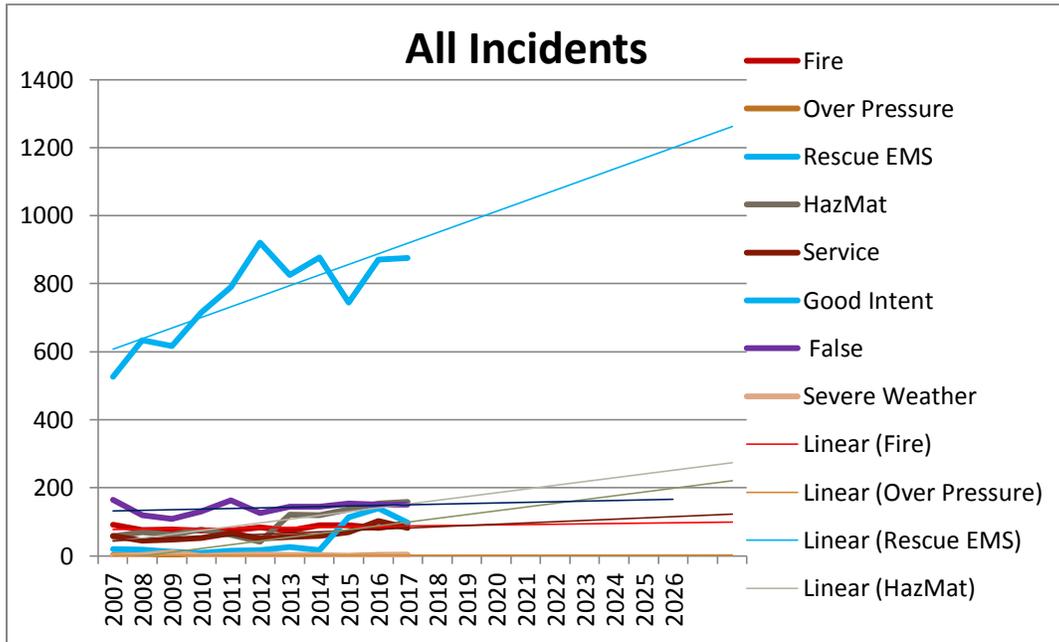
Note – In addition to those found in position analysis summary.

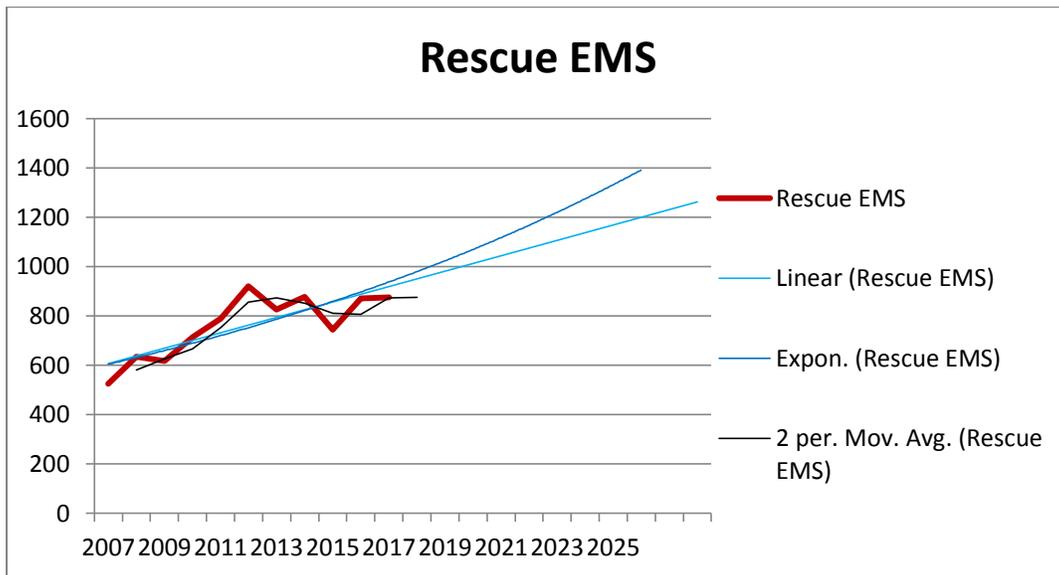
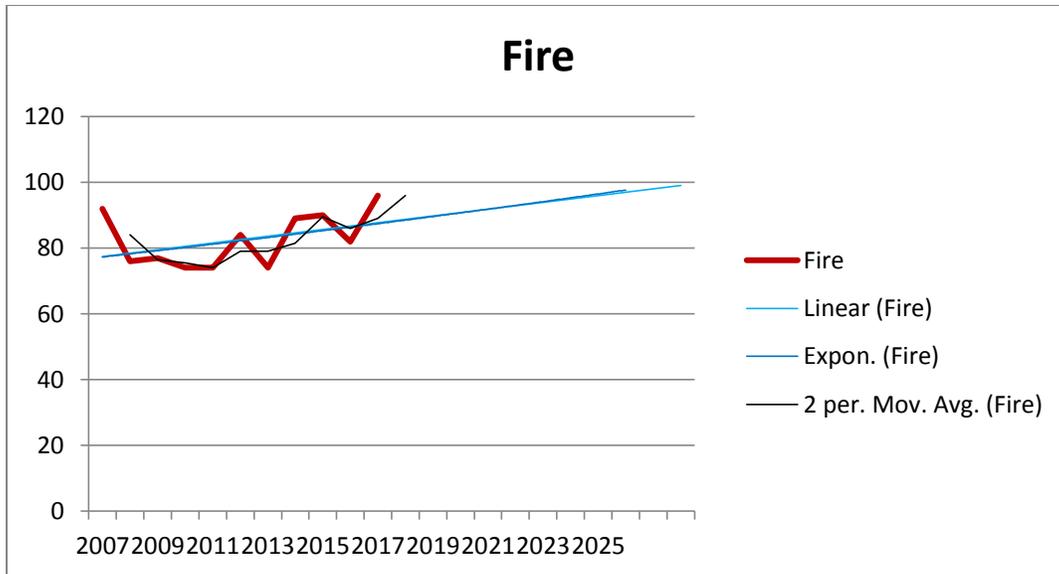
1. There is an immediate need to add four personnel to staff the ladder company.
2. Plan for company staffing of four personnel for a company located in the new Knightdale Sta. #2.
3. Add a deputy or assistant chief position to assist the fire chief with administration and department management and to enable future succession planning for fire chief's position.
4. Transition the part-time fire inspector position to full time.

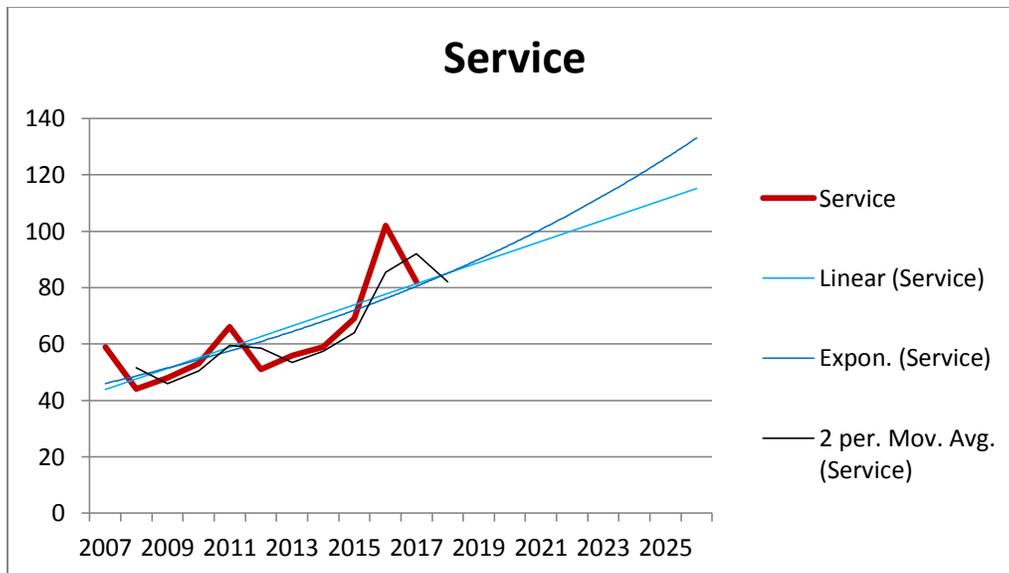
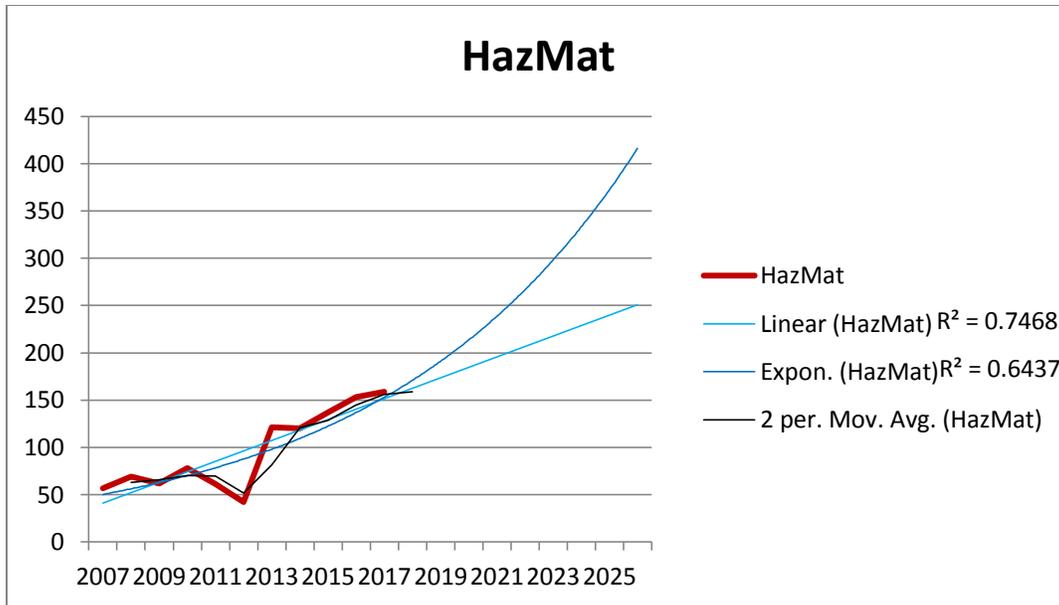
Fleet Study Recommendations

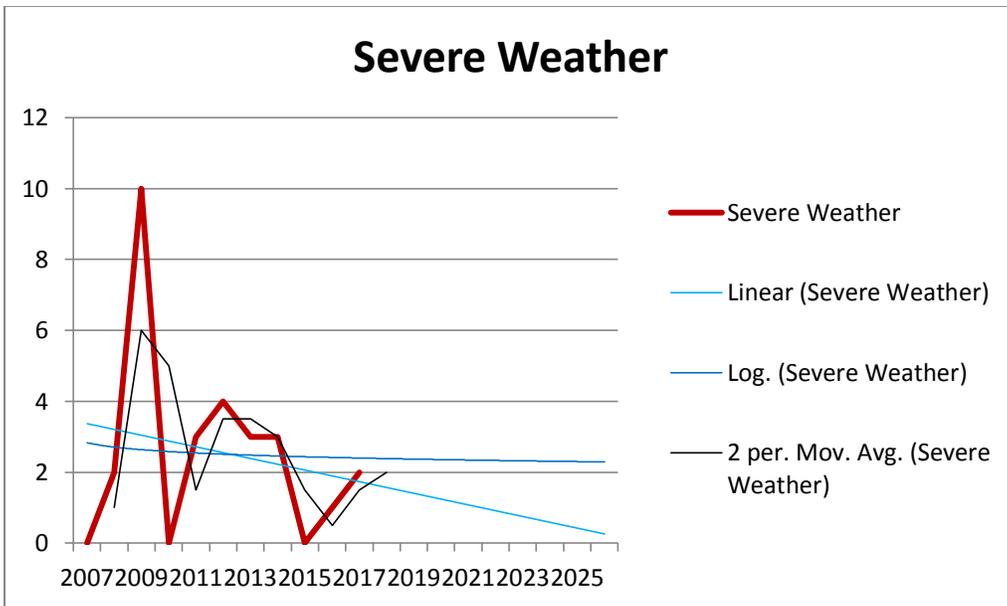
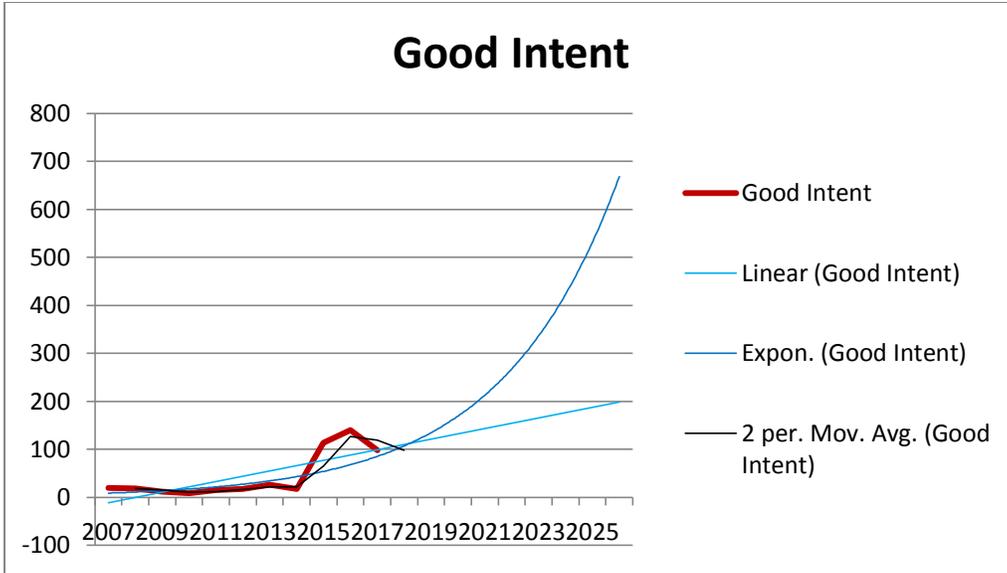
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2. It is recommended to replace Engine 134 in the year following Ladder 135 and rotate apparatus to place the new engine as first out and remaining engines in order based upon their current serviceability. Although Engine 134 is not the oldest engine in the fleet, the component assessment, maintenance and repair costs and current general poor operating condition suggests moving it ahead in the replacement schedule.
3. A fleet capital plan should be developed to begin programming replacements for large apparatus based upon industry standards and score card results. According to the industry standard, Engine 133 already exceeds the industry standard for first line service and should be retired in 2022. Engine 132 should be taken out of first line service in 2023 and should be retired in 2028. The town has guidelines for replacement schedules for the command vehicle and two utility vehicles.
4. It is recommended that the department maintain the Vehicle Score Card System used in this study, or some similar process to help manage a fleet replacement and capital program.

Appendix A: Five Year Regression Analysis with Service Demand Projections for 2023









Appendix B: Current Job Analysis Review

Town of Knightdale Fire Department Job Analysis Review										
CURRENT STATUS - January, 2018										
Job Requirements	Volunteer Firefighter	Limited Svc. Firefighter	Limited Svc. Fire Inspector	Volunteer Recruit and Retain Coord.	Firefighter	Master Firefighter	Firefighter 1st Class	Fire Lieutenant	Fire Captain	Fire Chief
Education										
HS/GED	X or pursuing	X	X		X				X	
Management Certificate								30 hours	X	
AAS				X						
BS/BA										Fire, PA, Bus.
Experience										
		3 years fire experience	4 years fire experience	7 years fire experience		2 yrs as Firefighter	1 yr as Master FF	Meet FF 1st Class reqs.	Meet Lt. requirements	10 years fire experience
										5+ at Company
										Officer +
FLSA Classification										
	Unpaid	P-T Hourly	P-T Hourly	P-T Hourly Grant Funded	Non-Exempt	Non-Exempt	Non-Exempt	Non-Exempt	Non-Exempt	Exec. Exempt
Certifications										
NC Firefighter 1	Within 2.5 yrs.				X	X	X			
NC Firefighter 2		X	X	X	X	X	X	X	X	X
NC EMT-B		X	X		X	X	X	X	X	X
OSHA Bloodborne Pathogen		X		X	X	X	X	X	X	
NC Haz Mat Operations	Within 6 mos.	X	X	X	X	X	X	X	X	X
NC Class B OL	Class C	X	X	X	X	X	X	X	X	X
NC Emergency Vehicle Driver				X						X
NC Driver Operator /Pumps						X	X	X	X	
NC Driver Operator/Aerials							X	X	X	
NC Tech Rescue VMR						X	X	X	X	
NC Fire Officer 1								X	X	
NC Fire Officer 2				X					X	X
NC Fire Inspector Level 1			X					within 3 yrs	X	
NC Fire Inspector Level 2										
NC Fire Inspector Level 3										X
NC Fire Instructor 1									X	
NC Fire Instructor 2										X
NC Fire & Life Safety Educator 1								X	X	
NC Fire & Life Safety Educator 2										X
NC Fire Arson Investigator										X
ICS 100, 200	Within 30 days	X	X	X	X	X	X	X	X	X
ICS 300, 400				X			X	X	X	X
ICS 700, 800	Within 30 days	X	X	X	X	X	X	X	X	X
Wake County Firefighter Essentials	Within 6 mos.					X				
NHTSA Child Passenger Seat Tech.										

Appendix C: Wake County Deployment Comparative Analysis

January 2018 Wake County Comparative Analysis - Study Score Card Result

Department Name	Stations	Mun. Sq. Mi. Per Station	% of Median	Rank	Mun. Pop. Per Station	% of Median	Rank	Operational Personnel (FTE)	Total Square Miles	Municipal Square Miles	FF Per Total Square Miles Protected	% of Median	Rank	FF Per Square Mile Municipal	% of Median	Rank
Wendell Fire Department	2	2.61	61.29%	1	3068	41.13%	1	20	32.49	5.21	0.62	88.21%	7	3.84	130.22%	3
Morrisville Fire Department	3	2.87	67.45%	2	7854	105.30%	6	48	20.42	8.60	2.35	336.83%	1	5.58	189.33%	1
Zebulon Fire Department	1	4.26	100.24%	6	4905	65.76%	2	13	29.26	4.26	0.44	63.66%	9	3.05	103.52%	5
Wake Forest Fire Department	5	3.25	76.52%	3	7063	94.70%	5	64	35.12	16.26	1.82	261.13%	2	3.94	133.52%	2
Rolesville Fire Department	1	4.24	99.76%	5	6221	83.41%	3	12	36.72	4.24	0.33	46.83%	10	2.83	96.00%	7
Garner Fire Department	4	3.80	89.29%	4	6713	90.00%	4	51	79.54	15.18	0.64	91.88%	6	3.36	113.97%	4
Fuquay-Varina Fire Department	3	4.45	104.78%	7	7934	106.38%	7	38	67.95	13.36	0.56	80.13%	8	2.84	96.48%	6
Holly Springs Fire Department	3	5.51	129.65%	9	10268	137.66%	8	37	35.79	16.53	1.03	148.14%	4	2.24	75.93%	9
Apex Fire Department	4	4.88	114.71%	8	11565	155.05%	9	51	67.59	19.50	0.75	108.12%	5	2.62	88.72%	8
Knightdale Fire Department	1	7.43	174.82%	10	15922	213.47%	10	9	7.43	7.43	1.21	173.57%	3	1.21	41.09%	10
MEDIAN		4.25			7458.70						0.70			2.95		

Table 28 - January 2018 Wake County Comparative Analysis - Study Score Card Result

Department Name	Total Population Protected	Municipal Population Protected	Total Residents Per FF	% of Median	Rank	Municipal Residents Per FF	% of Median	Rank	FF Per 1,000 People Protected Total	% of Median	Rank	FF Per 1000 Mun. People Protected	% of Median	Rank
Wendell Fire Department	14500	6135	725	75.27%	3	189	31.19%	3	1.38	132.43%	3	3.26	175.66%	1
Morrisville Fire Department	24,664	23,562	514	53.35%	1	1154	190.58%	9	1.95	186.85%	1	2.04	109.77%	3
Zebulon Fire Department	9,874	4,905	760	78.85%	4	168	27.69%	1	1.32	126.40%	4	2.65	142.81%	2
Wake Forest Fire Department	42,828	35,317	669	69.47%	2	1006	166.09%	8	1.49	143.47%	2	1.81	97.65%	6
Rolesville Fire Department	15,225	6,221	1269	131.72%	9	169	27.98%	2	0.79	75.67%	9	1.93	103.94%	4
Garner Fire Department	55,495	26,850	1088	112.97%	7	526	86.96%	5	0.92	88.23%	7	1.90	102.35%	5
Fuquay-Varina Fire Department	48,193	23,803	1268	131.67%	8	350	57.86%	4	0.79	75.70%	8	1.60	86.02%	7
Holly Springs Fire Department	33,606	30,803	908	94.29%	5	861	142.15%	7	1.10	105.71%	5	1.20	64.73%	8
Apex Fire Department	51,927	46,260	1018	105.71%	6	684	113.04%	6	0.98	94.29%	6	1.10	59.41%	9
Knightdale Fire Department	15922	15922	1769	183.67%	10	1769	328.13%	10	0.57	54.27%	10	0.57	30.46%	10
MEDIAN		23682.50	963.22			605.45			1.04			1.86		

Department Name	Emergency Responses 2015	Emergency Responses Per Firefighter	% of Median	Rank	SCORE CARD RESULT	Rank
Wendell Fire Department	1730	86.5	107.35%	6	25	1
Morrisville Fire Department	2,230	46.46	57.66%	1	34	2
Zebulon Fire Department	1,510	116.15	144.14%	9	35	3
Wake Forest Fire Department	3,196	49.94	61.98%	3	40	4
Rolesville Fire Department	896	74.66	92.65%	5	45	5
Garner Fire Department	4,922	96.51	119.77%	8	49	6
Fuquay-Varina Fire Department	3,606	94.90	117.77%	7	57	7
Holly Springs Fire Department	1,800	48.65	60.37%	2	61	8
Apex Fire Department	2,860	56.08	69.60%	4	62	9
Knightdale Fire Department	1361	136.1	168.90%	10	87	10
MEDIAN		80.58			47	

Appendix D: NC School of Government Deployment Comparative Analysis

NC SCHOOL OF GOVERNMENT DEPLOYMENT COMPARATIVE ANALYSIS DATA									
INPUTS							RATES		
Department	Sq. Miles	Population	Valuation (Billions)	Stations	Total Responses	FF FTEs	Sq. Mi. per Station	Stations per 10K Population	FD Responses per FF FTE
Apex	65.78	50,412	\$5.9	4	2,822	51.0	16.45	0.79	55.33
Asheville	56.52	95,191	\$11.9	12	17,636	238.0	4.71	1.26	74.10
Burlington	30.52	52,240	\$4.7	5	8,942	81.0	6.10	0.96	110.40
Cary	62.67	160,136	\$24.6	9	8,671	213.0	6.96	0.56	40.71
Chapel Hill	22.77	60,130	\$7.6	5	4,642	79.0	4.55	0.83	58.76
Charlotte	313.14	833,836	\$93.3	42	117,625	1034.0	7.46	0.50	113.76
Concord	67.54	90,594	\$10.1	11	10,616	180.0	6.14	1.21	58.98
Greensboro	139.22	291,686	\$26.4	25	36,237	533.0	5.57	0.86	67.99
Greenville	36.40	88,364	\$6.0	6	16,308	142.0	6.07	0.68	114.85
Hickory	42.76	45,385	\$5.0	7	6,604	117.0	6.11	1.54	56.44
High Point	67.05	119,304	\$9.9	14	12,981	210.0	4.79	1.17	61.81
Raleigh	145.16	440,621	\$53.6	28	39,300	536.0	5.18	0.64	73.32
Salisbury	22.22	34,278	\$2.8	5	5,416	66.0	4.44	1.46	82.06
Wilson	30.52	49,357	\$4.3	5	4,091	81.0	6.10	1.01	50.51
Winston Salem	132.45	238,899	\$20.4	19	27,056	321.2	6.97	0.80	84.23
SOG AVERAGE	82.31	176,695	\$19.10	13	21,263	258.81	6.51	0.95	73.55
Knightdale	7.43	15,922	\$1.6	1	1,466	9.0	7.43	0.63	162.89

Table 29 - NC SCHOOL OF GOVERNMENT DEPLOYMENT COMPARATIVE ANALYSIS DATA

Appendix E: County/Regional/State Survey of Administrative Positions

SORTED BY POPULATION									
Municipality	Municipal Population	Fire Chief	Deputy Chief	Asst. Chief	Batt. Chief	Fire Inspectors	Total	Admin per 1000 pop	POPULATION RANK
Apex Fire Department	50671	1	0	1	3	2	7	0.13	1
Wake Forest Fire Department*	40116	1	0	2	3	2	8	0.2	2
Holly Springs Fire Department	33260	1	0	3	3	2	9	0.27	3
Garner Fire Department*	27814	1	1	1	3	2	8	0.28	4
Fuquay Varina Fire Department	25865	1	1	1	3	3	9	0.34	5
Morrisville Fire Department	24732	1	0	0	3	2	6	0.24	6
Carrboro Fire Department	21265	1	0	1	0	1	3	0.14	7
Clayton Fire Department	20260	1	0	1	3	1	6	0.29	8
Elizabeth City Fire Department	18683	1	1	0	3	3	8	0.43	9
Hope Mills Fire Department	16227	1	1	2	0	1	5	0.31	10
Knightdale Fire Department	15922	1	0	0	0	0	1	0.06	11
Henderson Fire Department	15258	1	0	1	4	1	7	0.46	12
Smithfield Fire Department	12266	1	0	1	0	2	4	0.33	13
Rolesville Fire Department	6962	1	0	1	0	**	2	0.29	14
Wendell Fire Department	6745	1	0	1	0	**	2	0.29	15
Zebulon Fire Department	5159	1	0	1	0	1	3	0.58	16

Table 30 - Administrative Survey sorted by population

SORTED BY TOTAL ADMIN POSITIONS									
Municipality	Municipal Population	Fire Chief	Deputy Chief	Asst. Chief	Batt. Chief	Fire Inspectors	Total	Admin per 1000 pop	TOTAL POS. RANK
Holly Springs Fire Department	33260	1	0	3	3	2	9	0.27	1
Fuquay Varina Fire Department	25865	1	1	1	3	3	9	0.34	1
Wake Forest Fire Department*	40116	1	0	2	3	2	8	0.2	3
Garner Fire Department*	27814	1	1	1	3	2	8	0.28	3
Elizabeth City Fire Department	18683	1	1	0	3	3	8	0.43	3
Apex Fire Department	50671	1	0	1	3	2	7	0.13	6
Henderson Fire Department	15258	1	0	1	4	1	7	0.46	6
Morrisville Fire Department	24732	1	0	0	3	2	6	0.24	8
Clayton Fire Department	20260	1	0	1	3	1	6	0.29	8
Hope Mills Fire Department	16227	1	1	2	0	1	5	0.31	10
Smithfield Fire Department	12266	1	0	1	0	2	4	0.33	11
Carrboro Fire Department	21265	1	0	1	0	1	3	0.14	12
Zebulon Fire Department	5159	1	0	1	0	1	3	0.58	12
Rolesville Fire Department	6962	1	0	1	0	**	2	0.29	14
Wendell Fire Department	6745	1	0	1	0	**	2	0.29	14
Knightdale Fire Department	15922	1	0	0	0	0	1	0.06	16

Table 31 - Administrative Survey sorted by total administrative positions

SORTED BY ADMIN PER CAPITA									
Municipality	Municipal Population	Fire Chief	Deputy Chief	Asst. Chief	Batt. Chief	Fire Inspectors	Total	Admin per 1000 pop	PER CAPITA RANK
Zebulon Fire Department	5159	1	0	1	0	1	3	0.58	1
Henderson Fire Department	15258	1	0	1	4	1	7	0.46	2
Elizabeth City Fire Department	18683	1	1	0	3	3	8	0.43	3
Fuquay Varina Fire Department	25865	1	1	1	3	3	9	0.34	4
Smithfield Fire Department	12266	1	0	1	0	2	4	0.33	5
Hope Mills Fire Department	16227	1	1	2	0	1	5	0.31	6
Clayton Fire Department	20260	1	0	1	3	1	6	0.29	7
Rolesville Fire Department	6962	1	0	1	0	**	2	0.29	7
Wendell Fire Department	6745	1	0	1	0	**	2	0.29	7
Garner Fire Department*	27814	1	1	1	3	2	8	0.28	10
Holly Springs Fire Department	33260	1	0	3	3	2	9	0.27	11
Morrisville Fire Department	24732	1	0	0	3	2	6	0.24	12
Wake Forest Fire Department*	40116	1	0	2	3	2	8	0.2	13
Carrboro Fire Department	21265	1	0	1	0	1	3	0.14	14
Apex Fire Department	50671	1	0	1	3	2	7	0.13	15
Knightdale Fire Department	15922	1	0	0	0	0	1	0.06	16

Table 32 - Administrative Survey sorted administrative positions per capita