

# Alexandria, Virginia Fire Department

## Station Location Plan Technical Memorandum

### 1. Key Observations and Findings

The City of Alexandria is undergoing change. As the City changes, the Alexandria Fire Department must change as well. Inefficiencies in deployment of fire and EMS resources in the City will become more problematic as increased development places additional demands upon the fire services.

Several issues are emerging at this juncture in the City's development. A review by architectural/engineering professionals has indicated that four of the City's nine fire stations are physically beyond their useful life, and should be replaced in the interests of cost effectiveness.

An internal Fire Department review and two consultant studies have indicated that, independent of their physical condition, several fire stations are no longer suitable for use because they are not large enough to accommodate modern fire apparatus. Overall, there is a shortage of space in existing facilities, which constrains where certain apparatus can be placed. Critical response equipment is stored outdoors in trailers or under covers.

Several stations are not located ideally to serve the entire City. In particular, there is a concentration of older fire facilities in the City's east end, leaving other areas of the City with relatively longer response times.

An aging and poorly-placed physical plant – not sound policy or local needs – is dictating deployment of fire and rescue apparatus in the City. Specific examples include:

- The Alexandria West Area, one of the busiest areas of the City, is served by two facilities located east of Shirley Highway. Future development is likely to result in a degradation of service unless additional resources are placed in the area.
- The center of the City has no fire station. The station (203) serving the North Ridge/Rosemont area is too small to accommodate a Medic unit, meaning that primary response comes from Station 202, located in Potomac West.

Much of the new development in the City is taking places in areas along the City's boundaries, meaning that without adjustment of resources, reliance on automatic aid from surrounding jurisdictions will increase. During periods of high activity, such as storms or inclement weather, these resources are not always available.

Exacerbating the placement and condition of the facilities are the City's desire to increase staffing on fire companies to four personnel based on prevailing local practice and the findings of a post-fire analysis of a 2007 high-rise fire. The existing deficiencies in terms of living and support space in fire stations is only going to get worse. There is a need to develop fire stations that provide facilities for female employees.

Investment on facilities is a means to maximize the return on the City's ongoing investment in the Fire Department. Over the predicted lifespan of these facilities, the capital costs are insignificant when compared to the potential increased efficiencies and resulting maintenance

or improvement of service to the public.

## 2. Overview of Assignment

Manitou, Inc. was retained to assist in preparation of a capital facility plan for the Alexandria Fire Department. The Department sought technical support and strategic support in integrating several recently-completed studies into a long-range facilities plan that would encompass future development, the condition and suitability of existing fire stations and support facilities, and provide appropriate levels of “coverage” to maintain response times and emergency operations.

This document is provided as a component of the assistance provided under the agreement, executed in September 2008. It is intended as a reference for preparation of a budget submission for an October 17, 2008 deadline.

## 3. Review of Fire Service Setting and Precedent Reports

The Alexandria Fire Department (AFD) provides fire and emergency medical services including heavy rescue and hazardous materials services to the City of Alexandria through eight fire stations housing 8 engine companies, 3 ladder companies, 5 advanced life support units, a rescue squad, a hazardous materials unit, and supporting equipment. The Department is staffed with approximately 270 personnel. The AFD responded to 17,818 calls for service in 2007, of which 65 percent were emergency medical services incidents (see Figure 1).

Figure 1: AFD Incidents 2001-2007

	2001	2002	2003	2004	2005	2006	2007	Average	Proportion
Fires	433	581	457	511	531	541	534	513	3%
Explosion	163	122	130	112	99	70	23	103	1%
EMS	11,249	11,360	11,652	11,661	11,815	11,755	11,141	11,519	65%
HazMat	630	668	877	613	670	685	526	667	4%
Service	878	815	969	963	961	1,136	1,085	972	5%
Good Intent	1,507	1,696	2,279	1,952	1,747	1,961	2,340	1,926	11%
False Alarms	1,885	1,742	2,070	1,932	2,077	2,007	2,088	1,972	11%
Weather	2	4	85	6	5	15	3	17	0%
Other	554	64	76	48	50	56	58	129	1%
<b>Total</b>	<b>17,301</b>	<b>17,052</b>	<b>18,595</b>	<b>17,798</b>	<b>17,955</b>	<b>18,226</b>	<b>17,798</b>	<b>17,818</b>	<b>100%</b>

The recent incident history for the Department belies some underlying trends. The fluctuation in calls for service, particularly EMS, may reflect a number of recent circumstances including enacting fees for service, and a slight decline in population in the City possibly reflecting some displacement attendant to redevelopment. The plateau in EMS calls for service is expected to be temporary, with a small but steady increase in the future as more residents and jobs move to the City, and as the population ages, thus requiring more emergency medical service. The per capita demand for service, a measure of utilization of service, shows stability. This trend appears to be consistent with neighboring jurisdictions.

There were several recent reports that are of interest to this study. They will be briefly summarized here:

TriData Corporation completed an *Assessment of Fire Department Resource Locations, Staffing, and Facilities* in October 2007. This study made recommendations for new facilities and included an assessment of existing facilities.

*J. Gordon Routley*, a fire service consultant, provided a report in early 2008 that analyzed an August 2007 residential high-rise fire that injured four civilians and six firefighters. This thorough analysis included numerous operational recommendations. It is an important contextual document. Most critical to this effort was the recommendation that the AFD move to staff fire companies with four personnel. With current staffing of three personnel per unit, adoption of this recommendation will require additional planning for space in existing and new fire stations.

*Michael Baker*, consulting engineering firm, is completing a comprehensive facilities review which will include forecasts of capital needs based solely on existing facility conditions and expected maintenance needs. This study is useful in that it has identified four fire stations that are not cost-effective to renovate and has recommended their replacement. However, this analysis does not consider the current or future operational suitability of facilities in the context of overall fire and rescue needs. These issues include such critical but prosaic concerns as room for modern fire apparatus, adequate space administrative support, and sleeping accommodations for the number of personnel at the facility.

#### 4. Environmental Overview

The City of Alexandria is a largely urbanized area, with a significant area of lower-density single-family housing. It has a historic “Old Town” section along the Potomac River, characterized by very old building stock, some of which is historic. The community is vibrant. Numerous major development initiatives are underway. Its population is 140,000, and expected to grow for the foreseeable future. Household income is relatively high, and the City has a thriving civic culture.

A number of significant, high-density developments are proposed or underway for areas along the City’s edges. These developments are mixed-use, and will contain both population and employment. Many of these developments will include high-rise buildings. In addition, the City recently developed regulations for infill development, recognizing the trend toward greater densification of older residential neighborhoods as new houses are constructed.

Significant increases are forecast in population, housing units, and employment. Changes are illustrated in Table 1. The majority of population growth will occur in multi-family housing. Figure 2 shows the major areas of growth within the City.

Table 1: Summary of Growth through 2020

Measure	2000	2020	Percent Change
Population	139,991 (2008)	152,043	+ 8.6 percent
Employment	91,277	134,463	+ 37 percent

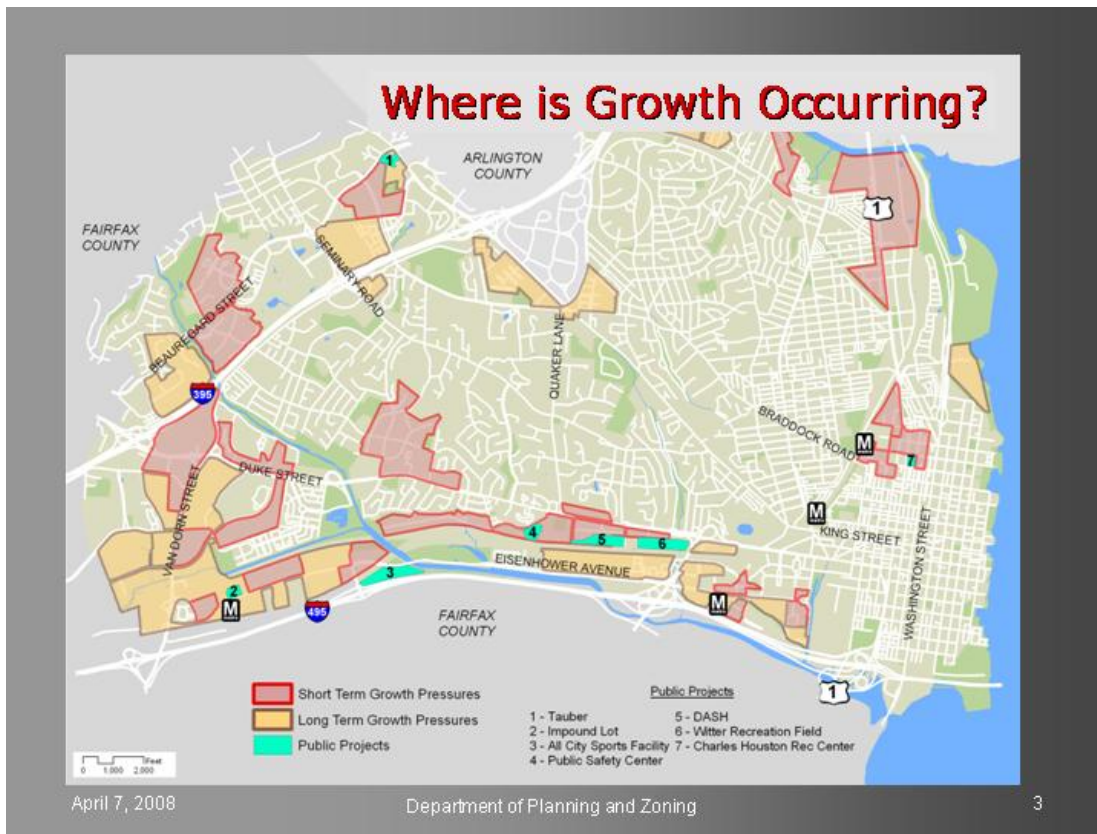


Figure 2: Future Major Growth Areas

Projected development through 2012 includes 12.5 million square feet of new construction. As indicated, much of this growth will take place on the periphery of the City (Figure 2).<sup>1</sup> The location of this growth is important to planning for fire and rescue services for two reasons: 1) it is located in areas that may not be adequately served by existing fire stations; and 2) it will cause increases in demand for service in areas that may diminish the capacity of existing on-duty resources. An aggravating factor is that this new development is in areas where primary service may be provided by fire rescue units from neighboring jurisdictions under automatic aid.

#### a. Qualitative Issues in Land Acquisition

This dynamic environment provides both challenges and opportunities in terms of acquiring property to construct new fire stations. A historic building stock and well-defined neighborhoods limit the availability of sites that do not require potential acquisition of private property and demolition of existing structures. However, large-scale developments of several areas such as Potomac Yards, a former railroad yard, present opportunities for partnership with developers to integrate fire rescue facilities into these projects. The City has undertaken an exemplary approach to this with the construction of a mixed-use station 209 in the Potomac Yards area. A similar opportunity may present itself in the Alexandria West area, in the Landmark or Mark Center areas.

<sup>1</sup> City of Alexandria, Department of Planning and Zoning, *Development and Growth Projections*, Powerpoint Presentation, April 8, 2008.

## b. Fire Station Implications

The Implications of this environment for planning new fire stations indicates that the AFD must be involved closely with the Planning and Zoning process to anticipate fire station needs and identify and acquire sites for new or relocated facilities well in advance. Given the pace of development in the City, the changes identified in this current process are likely to represent the AFD's last opportunity to develop stations in the next 20-50 years. After this wave of activity takes place, future needs will likely be met by reinforcing these facilities with additional staff and units.

## 5. Station Location Philosophy

There is no single "right" way to locate fire stations. Demand for service, local conditions, and public preferences will influence the position of facilities. Practically speaking, history is the most influential, in that historic development patterns likely determine the majority of station locations. Alexandria is no exception.

There are two competing and sometimes contradictory goals in locating fire stations. The first is to assure a timely response to all populated areas of a community. This is normally assumed, and typically uses a logic of distance or time from the nearest station to justify a new facility. The other goal is to minimize the time it takes to serve actual calls for service. Studies of fire service demand have shown that calls for service are seldom uniformly distributed throughout a community. Issues such as land use, construction type, and density of employment and population will all influence demand for service. Further, fire and EMS services are not uniformly linked, meaning that areas of high fire demand for service are not necessarily the same as those with high EMS demand. Temporal variation and severity are also relevant. While there is great complexity in understanding and describing demand, the historical demand for service provides a very useful guide for locating facilities and encompasses many of these factors.

From a fiscal standpoint, the one-time costs of building a fire station are small in comparison to the operating costs of personnel required to staff these facilities. That is, adjustments to facility locations should be considered in terms of their ability to increase the effectiveness of existing and ongoing investments in personnel. In some cases, adjustments to facility locations can avoid the need to expand staff and be a wise strategy for long-term cost containment.

The City of Alexandria is faced with such a decision. This decision will require consideration of long-term consequences, as well as coordinated and decisive action to assure that building sites can be acquired.

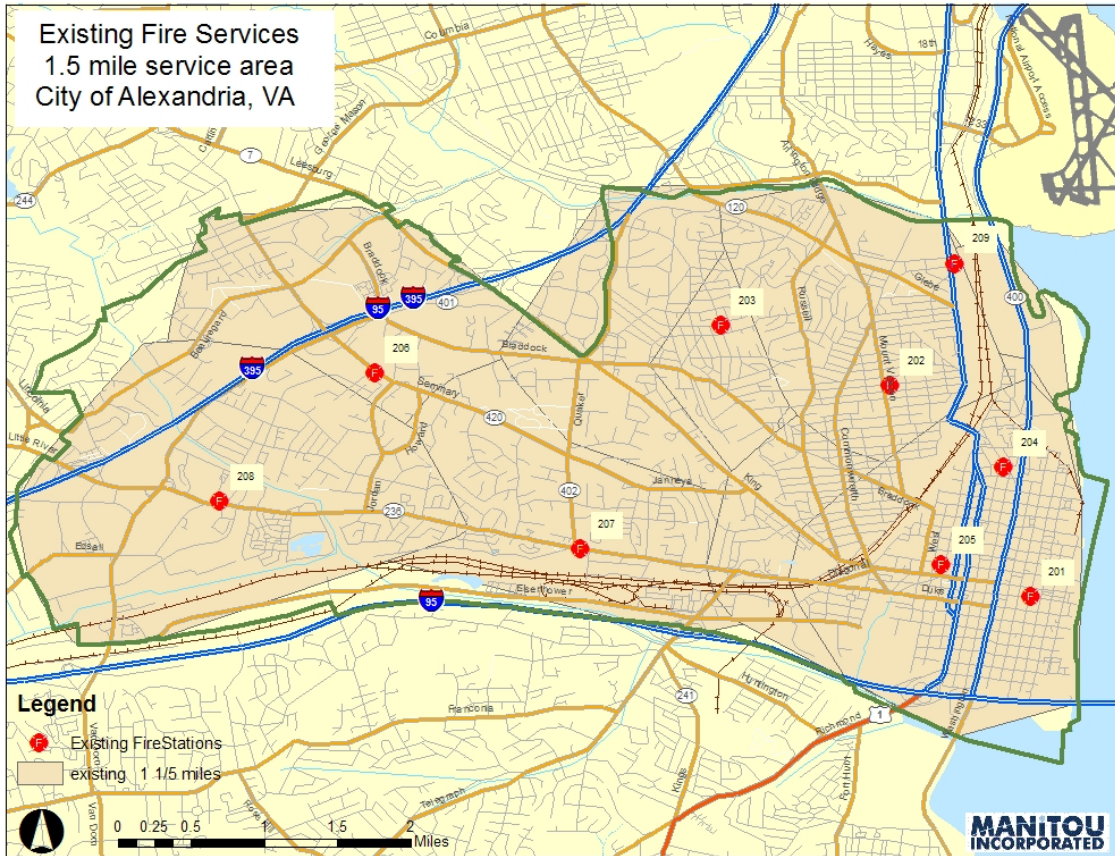


Figure 3: AFD Existing Station Locations (includes Station 9)

Figure 3 shows the current fire station locations for the City of Alexandria. As indicated in the previous discussion, the western half of the City has three fire stations, while the eastern half has six. Some of the busiest areas of the City are in the west, particularly in the Shirley Highway corridor.

## 6. Forecast of Calls for Service 2008-2030

To gain a better understanding of the likely future needs for fire and rescue service in the City, a forecast of incidents was undertaken. This forecast was limited in scope, and consisted of a high-level summary of incidents at a citywide level. Given additional resources and time, a forecast of unit demand and small-area forecasts can be produced. This effort was designed to assure that recommendations for additional facilities were qualitatively accurate. It is useful in the aggregate, but can not predict with certainty the workload for a particular unit, nor can it identify the precise placement of units that may be needed to provide service. This degree of uncertainty speaks to the need to design future facilities with a 3-bay configuration permitting maximum flexibility to position apparatus based on changing development, population, and demographic patterns.

Manitou has developed and refined a methodology for forecasting incidents based on empirical information and consistent with theories on relationships between community characteristics and demand for services. The methodology can be adjusted for available data and the planning

horizon used, and is very robust. We used fire department incident data from 1985 to 2007, and population, housing, and employment information compiled by the City’s Department of Planning and Zoning. We relate existing demand for service to the population and employment within the City. We develop per capita demand for service for EMS and all other incidents, and then examine the per capita rates to see if they are increasing or decreasing. Therefore, change in demand for service is attributable to a) change in population and b) change in utilization rates. Although we can disaggregate calls for service and carry this methodology down to small areas, in this case we only looked at citywide data.

EMS is the dominant source of demand for service in most departments providing this service. Per capita rates for EMS appear to be decreasing in recent years. This is contrary to many departments, which have experienced an apparent unending increase in EMS demand for service. All non-EMS calls for service were analyzed separately, and had a stable to slightly increasing per capita rate.

These trends indicate that the primary cause of increased demand for service in Alexandria will be attributable to increased population and employment, rather than underlying changes in the rate of utilization of service. Employed population contributes to calls for service, and are converted to “resident equivalents” by multiplying each employee by a factor to reflect a 40 hour presence for 52 weeks a year, or roughly 0.23. Thus, 1000 jobs equates to having an additional 230 residents, in terms of calls for service.

Two forecasts were produced: a low forecast and a high forecast. In the low forecast, rates for calls for service were fixed at current (2007) levels, and any changes in demand were attributable to increases in population (adjusted for employment). In the high forecast, EMS per capita demand was forecast to grow at 0.36 percent annually, which is comparable to EMS per capita demand increasing from its level of 65 calls per 1,000 population per year, to its average over the past eight years of 70 calls per 1,000 population. For non-EMS calls (fire and other incidents), a rate of increase of 0.25 percent annually was used based on the average rate of change from 2000-2007.

Tables 2 and 3 present the low and high forecasts, which relied on the *Statistical Profile Alexandria 2007 Update* dated May 2008, and updated forecasts of population and employment provided by the Department of Planning and Zoning in October 2008.<sup>2</sup>

Table 2: Low Forecast 2008-2030

Incident Type	2008	2009	2010	2015	2020	2025	2030
EMS	10803	10905	10929	11522	12070	12685	13300
Fire and Other	7094	7154	7177	7694	8181	8585	8988
Total	17898	18002	18106	19216	20251	21270	22289

Under the low forecast, incidents increase to 22,289 in 2030, or an increase of 4,391 incidents. The relative balance between fire and EMS incidents remains unchanged under the low

<sup>2</sup> The newer forecasts projected higher employment than the previous estimates. The net effect was to add about 1,000 incidents per year at the end of the forecast in 2030.

forecast.

In Table 3, we see the high forecast, which shows 23,744 incidents by 2030. What is remarkable about these two forecasts is their similarity. Because rates of growth in per capita demand are so small, there is not a large difference between the low and high estimates.

Table 3: High Forecast 2008-2030

Incident Type	2008	2009	2010	2015	2020	2025	2030
EMS	10803	10905	10968	11809	12671	13549	14456
Fire and Other	7094	7154	7195	7713	8230	8753	9287
Total	17898	18059	18163	19522	20902	22303	23744

Of course, this growth in demand, while not staggering, will have the effect of increasing the workload on AFD units. These increases in demand are not spread uniformly across the City. The growth will be concentrated with development patterns. As a consequence, we can foresee that the increase in demand will be especially pronounced on station 206 and 208, and 209, and to a lesser extent, Stations 205 and 207.

## 7. Station Location Recommendations

Its current configuration of stations can be thought of as a dense network of facilities serving the “Old Town” area, with a much less dense configuration serving the remainder of the City. As some of the original facilities were established before motorized vehicles, these locations are not necessarily suited to modern needs.

The consequence of this pattern is that existing fire stations are heavily concentrated along the eastern end of the City. Only one facility is located in the center of the City, and Two facilities serve the entire western end of the City. This pattern results in a considerable mismatch between supply and demand for service such that units on the western end of the City are busier than units located elsewhere. This situation means that resources are poorly distributed in terms of 1) providing service and 2) assuring utilization of existing resources.

Two primary options are presented for new station configurations. These options are informed by the foregoing discussion and the consultant and internal reports. Analysis of current fire station placement in the City clearly indicates that there is a need to create a facility to serve the geographic center of the City by moving the resources at one of the existing facilities in the east. Stations 203 and 205 are both identified as needing replacement, and Station 205 could be moved to the west with a net improvement of coverage. Stations 206 and 207 are also identified for replacement, presenting further opportunities for adjustment.

In terms of serving areas of growing demand for service where existing coverage is marginal or could become so in the future, there are two geographic areas of concern in the City: the Eisenhower Valley and “Alexandria West” (Seminary West).

The Eisenhower Valley is located along the southern boundary of the City, and is geographically isolated by the railroad tracks. There are limited crossings, meaning that units must take a

circuitous route to reach this area. An existing development plan for the eastern end of the Valley is already in progress, and a major development is planned in the western end of the Valley. The area is generally not served within desired response time guidelines for the City. Additionally, there is an ethanol transfer facility in this area that had added to concerns. First-arriving units to this area of the City would likely come from Fairfax County under automatic aid.

A second area of forecasted growth that may need additional resources is the area known as “Alexandria West” to the west of Shirley Highway to the City’s boundary. This area is currently served by Stations 206 and 208. Because of the large areas these stations cover, they are the busiest in the City. Future growth in demand for service is expected to continue as major development takes place. Major projects expected include the Mark Center Department of Defense project, and redevelopment of the Landmark area. Increased traffic congestion and increasing calls for service will make the units currently serving the area busier, resulting in longer response times as a larger share of calls are answered by other stations. As with the Eisenhower area, first response to some incidents will come from automatic aid from Fairfax County.

a. Automatic Aid

The Northern Virginia area, as part of the national capital region, was an early innovator in the concept of automatic aid. Automatic aid refers to a situation in which resources from more than one fire department are alerted and respond jointly on an initial alarm. This concept should be distinguished from mutual aid, where a special request is made from one jurisdiction to another for resources on a case by case basis. The main advantage of automatic aid is that the time it takes to get assistance to the scene of an emergency is reduced. An added element of automatic aid in Northern Virginia is that the closest station is alerted to respond to an emergency regardless of the political jurisdiction. The use of automatic aid has many benefits including a higher level of service to the public, and reduced costs, by eliminating duplication of facilities and services. In large scale incidents, the use of automatic aid fosters closer and effective working relationships due to frequent interaction between crews in adjacent departments.

Owing in part to its irregular boundary and small size relative to its neighbors, the City of Alexandria has a large proportion of incidents where some units are drawn from Arlington or Fairfax Counties. This is a wise practice, and should be continued. There is a balance between the notion of relying on automatic aid and versus adding facilities near a jurisdiction’s boundary. It is intended as a reciprocal relationship. The pace of development in some of these border areas threatens to create an imbalance.

The effectiveness of automatic aid is constrained by the communication linkages between jurisdictions. The effectiveness of automatic aid is directly linked to the speed with which communication can take place between the departments involved. Alexandria maintains its own fire dispatch facility, as does Arlington County and Fairfax County. These facilities are connected by telephone. Each maintains its own dispatching system software and communications system.

The lack of real-time connection between dispatch centers places added burdens on dispatchers and effectively delays response. At present, automatic aid works as follows:

- Alexandria Dispatcher dispatches a call for service, including automatic aid unit(s)
- Alexandria Dispatcher then calls Arlington or Fairfax to advise of the call, and request the unit(s)
- The Arlington or Fairfax dispatcher then advises 1) if unit is available; and b) if not, if another unit can be sent in its place.
- The Alexandria dispatcher then adjusts the response as necessary (this may require contacting another communication Center before the appropriate number of units are sent).

The process is even more cumbersome when we realize that this is repeated hundreds of times annually. The underlying problem is two-fold – dispatchers have no awareness of the status of units outside their jurisdiction, and the process of initiating a dispatch requires a telephone conversation.

The most direct way to address this problem is for the City to enter into an agreement to have fire calls dispatched by another agency. Both Arlington and Fairfax Counties have recently completed “state-of-the-art” communications facilities. By having dispatch performed by the same agency, there is no delay due to “handing off” the call, and that dispatch center would have awareness of unit status for all units within its service area, eliminating the need to modify dispatch assignments during the early moments of an incident.

The second way to address this problem is through use of technology to provide linkages between the communications centers. These linkages are through software and communications protocols. Because Alexandria has an older computer aided dispatching (CAD) system, it is necessary to do a custom-programmed interface.<sup>3</sup> At the minimum, this interface will enable each dispatch center to see the status of units in neighboring jurisdictions. Ideally, such an interface would allow a call from one jurisdiction to appear directly in the CAD system of a neighbor, eliminating the need for a telephone relay of information.

Using federal Homeland Security funding, we understand that a project is just beginning to engage a contractor to design an interface that will allow for the real-time exchange of information on unit status between the City of Alexandria, Arlington, and Fairfax counties. This project is critical, and the feasibility of consolidating fire dispatch should be carefully evaluated, especially in light of plans to move the current dispatch center and create a new facility at the Alexandria Police facility. A consolidated dispatch would likely result in cost savings as well.

There are two scenarios for station options – each is based on differing assumptions. In reality, there are numerous combinations and permutations of these moves, particularly when administrative space and functions are considered.

b. Scenario One -- Optimize Facility Locations

Scenario One assumes that the City is able to move facilities in order to maximize the

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<sup>3</sup> New CAD systems typically enable this feature of a common data exchange protocol recently promoted by the federal government.

effectiveness of the current stations. This option requires the addition of one new station and movement of two stations, for a net increase of one new station. Station 210, already planned for Eisenhower Valley, would continue.

Table 2: Scenario One Station Recommendations

Fire Station	Action	New Location	Comments
210	New Facility	Impound Lot	
203	Rebuild 3-bay facility	No change	Provides space for Medic Unit
205	Move	Quaker Ln and Seminary Rd	
206	Move	Braddock and Beauregard St	

Station 205 would be moved to the area of Quaker Lane and Seminary Road.<sup>4</sup> From this location, it would provide good coverage for the center of the City, and second-arriving support for stations 207, 206, 203, while continuing to support stations 202, 204, and 201. If this facility were moved, it would permit Station 206 to be moved to the other side of Shirley Highway in order to provide better coverage for the large number of calls for service that are anticipated along Beauregard St.

c. Scenario Two -- Limited Facility Relocation (Maximize retention of existing facilities)

Assuming that a central Alexandria location for a relocated fire station can't be found, then this option requires the addition of two stations. Station 210, already planned for Eisenhower Valley, would continue.

A new Station 211 would be constructed on Beauregard St. south of Seminary Road. This station would provide service to the rapidly-growing Alexandria West area, which will increasingly be a center of high activity.

Table 3: Scenario Two Station Recommendations

Fire Station	Action	New Location	Comments
210	New Facility	Impound Lot	
203	Rebuild 3-bay facility	No change	Provides space for Medic Unit
205	Rebuild 2-bay facility	No change	
206	Rebuild 3-bay facility	No change	
211	New Facility	Beauregard St south of Seminary Rd	

d. Other Alternatives

The alternatives presented above are intended to capture the key elements of a long-term facilities plan for the AFD. They are not exhaustive, and there are numerous alternatives within these scenarios with regard to placement of apparatus and use of space by support functions

<sup>4</sup> A review by the City shows that its current site is too small for a 3-bay facility.

such as training and fire prevention. Also, the movement of Station 207 or 205 toward the Center of the City and/or the Eisenhower East area can be considered as a viable alternative of equal merit to the plan proposed in the scenarios above. The important point is that resources are moved toward the center of the City, and closer to the area of high and growing demand in Alexandria West.

Construction or renovation of facilities will call for movement of apparatus to adjust coverage citywide on a dynamic basis. Over time, changes in the development patterns and mix of apparatus will also call for adjustments of unit locations. The facilities should be constructed now to permit maximum flexibility to make these adjustments in the future.

## 8. Conclusions

The City of Alexandria is undergoing a period of sustained development that will likely culminate in the nearly complete build-out of major parcels within the City. These changes will result in shifts in relative concentrations of population and employment that will affect the demand for fire and rescue service. The existing stock of fire stations needs considerable investment to maintain its usefulness, and several facilities should be replaced. These circumstances present an opportunity to the city to position the AFD for the next 30-50 years in terms of its facilities, and assure that levels of service to the public can be maintained.

NOTE: As this document was being finalized, the AFD produced *Station Renovation-Replacement-New Construction Options* dated October 20, 2008. While there is a difference between the Department's plan and the scenarios recommended in this report, the AFD plan and this document are in agreement as to the need to move more resources to the west, and to add resources in Alexandria West. The AFD plan is sensible and will achieve the desired outcomes. Uncertainties in site acquisition may end up requiring Scenario Two, which assumes (in a worst case) that current facilities can not be moved from their existing sites.