Murray Five-Points Intersection
KY 1327/KY 748/KY 774/16th Street
Calloway County
Intersection Improvement Planning Study

Prepared by:
Kentucky Transportation Cabinet
Division of Planning

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Kentucky
UNBRIDLED SPIRIT

KENTUCKY TRANSPORTATION CABINET

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Executive Summary

In May 2004, Murray Mayor H. Thomas Rushing wrote a letter to the Kentucky Transportation Cabinet (KYTC) identifying the need to improve the traffic flow and congestion of the Five-Points intersection. KYTC addressed the issue by improving the signal equipment and timing during a resurfacing project in early 2005. In April 2005 a contingent from Murray met with KYTC to address the long term needs at the intersection and specifically look at the feasibility of using a roundabout. KYTC Division of Planning, with assistance from a Project Team, began an in-house study to determine the appropriate long-term solution to address traffic needs for the intersection.

In the study, KYTC established a simple project purpose: To improve the traffic flow and delays at the Five-Points intersection. Five goals were also established as part of the project:

1. Reduce future delays to level-of-service (LOS) C or better for all legs of the intersection during peak hours
2. Maintain or improve vehicular safety
3. Improve walking conditions
4. Improve bicycling conditions
5. Provide an attractive entryway to Murray State University

Several alternates were examined including keeping the intersection with 5 legs, closure of Coldwater Road, rerouting of Coldwater Road to 16th Street north of the intersection, and creating a 1-way couplet with Coldwater and 16th Street. The use of a roundabout and a traffic signal were examined for the alternates. Analysis of traffic operations, cost, community and environmental impacts as well as input from local officials were considered during the selection of the recommended alternate.

The recommended alternate is Alternate 2a: Keeping 5 legs in the intersection and using a roundabout for traffic control (Figure ES-1). It was selected because the operations (both average delay and queuing) and cost were best of the alternates. It also had the least impacts to the community and traffic patterns than the 1-way couplet or dead-end of Coldwater option. It also did not create another intersection by realigning Coldwater Road into 16th Street (Alt 3a & 3b). This avoids additional costs, impacts and creation of additional conflict points onto 16th Street and the need for a left-turn lane on 16th Street. This alternate also allows for design flexibility in the event that improvements to 16th Street north are carried out. City and university officials concurred with the recommended alternate.

The cost of the recommended alternate totals $2,700,000. This includes:

- $300,000 for design;
- $550,000 for ROW purchase;
- $1,000,000 for utility relocations;
- $850,000 for construction.

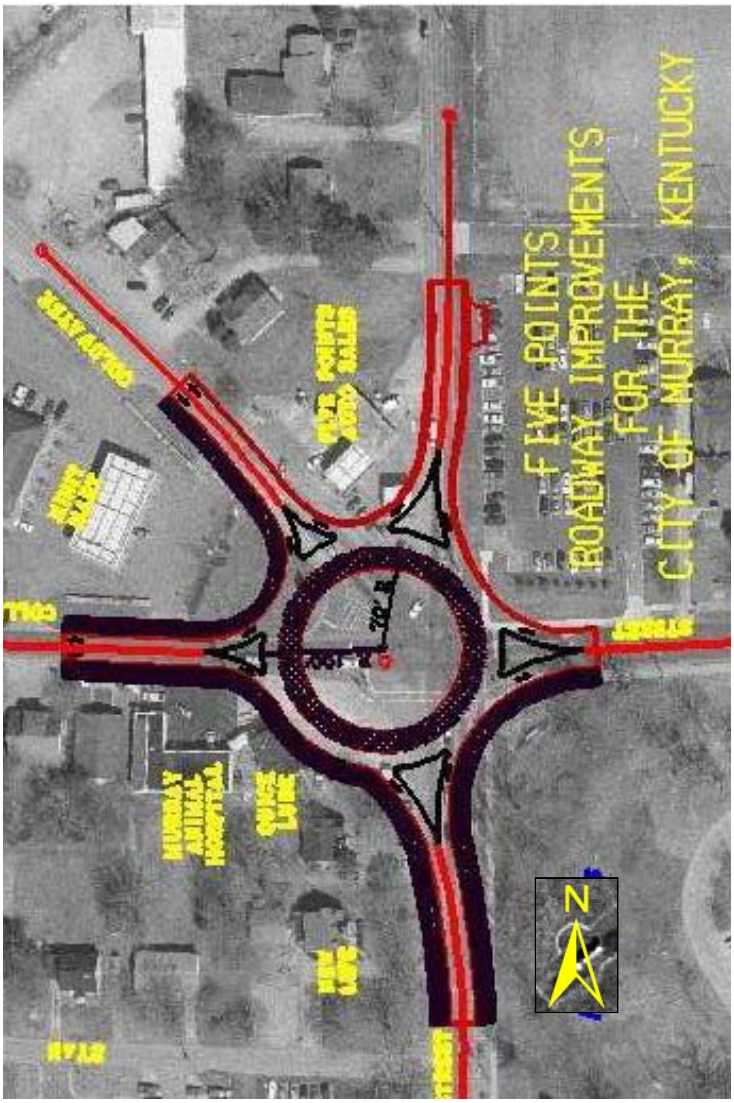


Figure ES-1: Recommended Alternate

1.0 Introduction

The Murray Five-Points Intersection Improvement Study, conducted by the staff of the Kentucky Transportation Cabinet (KYTC), was undertaken to address the traffic flow and congestion issues of the area. Five-Points is an intersection located in Murray, Calloway County in the far western Purchase Area of Kentucky. The intersection serves as a major entrance to Murray State University and is formed by three state routes and one city street (see Figure 1):

- KY1327 (College Farm Road and Chestnut Street)
- KY 774 (Coldwater Road).
- KY 748 (16th Street north)
- 16th Street south

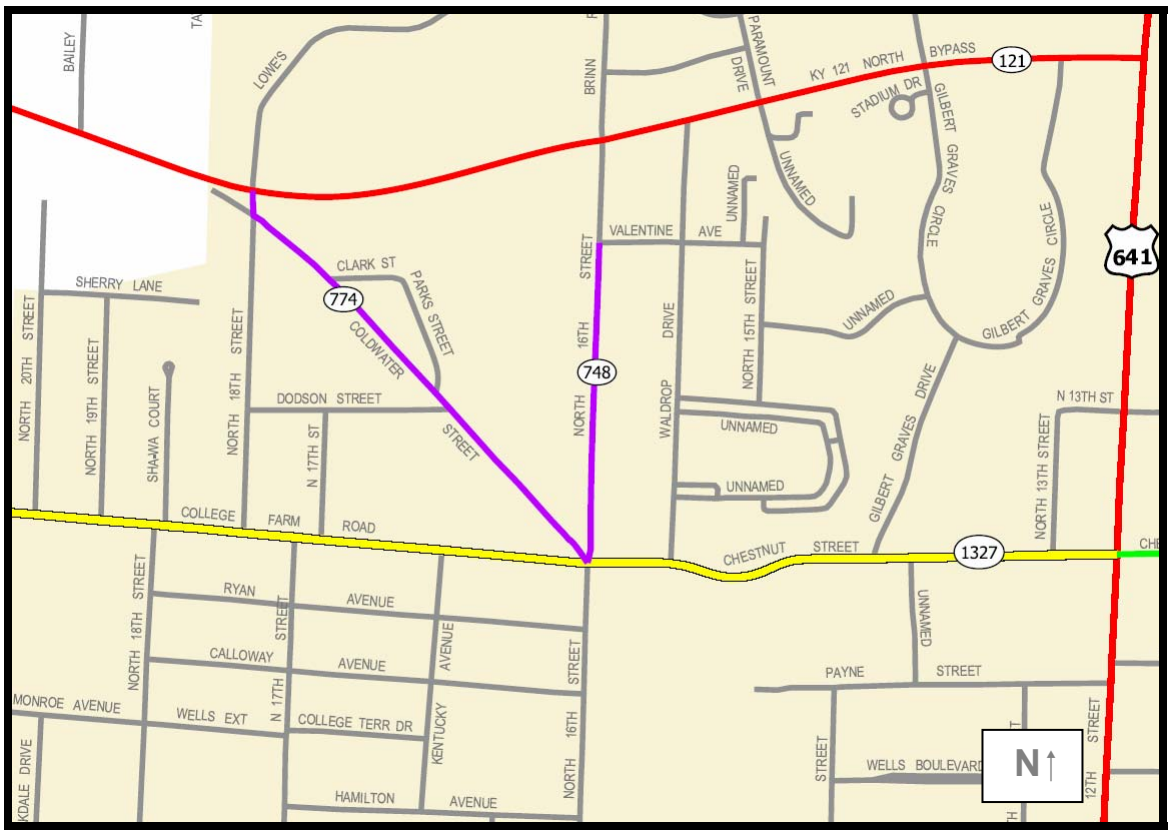


Figure 1: Five-Points Area

There are three primary types of traffic generated that flow through this intersection daily. First, the intersection serves as the primary western entrance to Murray State University for students, staff and visitors. Second, students and staff of the Calloway County Middle and High Schools located to the west on KY 1327 travel through Five-Points during the morning and afternoon rush hours. Third, the residents that live to the south and southwest travel north along 16th Street through Five-Points to access the commercial shopping area located along KY 121.

1.1 Project History

The traffic congestion and associated delays at the Five-Points intersection have been of concern to the local citizens for many years. A project need has been submitted to the KYTC Unscheduled Project List by the Purchase Area Development District (PUADD) for consideration of project funding. In June 2004, the mayor of Murray, wrote a letter expressing the need to address traffic congestion at the intersection. The letter also references a local newspaper poll which identifies Five-Points as "the number one congestion problem in the city by a wide margin." In the 2005 project prioritization the local government ranked the project high and the PUADD regional transportation committee and KYTC District 1 Office ranked it medium.

Over the years, KYTC has looked to address the traffic problems using various operational, low-cost solutions. Traffic signal timing has been adjusted and lane-use assignments have been changed. These improvements have worked with moderate success. In May, 2005, KYTC committed funds to conduct a study to determine the appropriate, long-term solution to address the Five-Points problems. A project team consisting of KYTC District 1, Purchase Area Development District and KYTC Central Office staff was developed to provide input and recommend a possible solution. The project team met twice at the KYTC District 1 Office, first on September 12, 2005 and then on November 7, 2005. A listing of the project team and project team meeting notes are included in Appendix A. In addition, members of the project team met twice with local officials from the City of Murray and Murray State University (MSU.) The first meeting with MSU officials took place at the University on September 12, 2005. The first meeting with city officials took place at City Hall on September 13, 2005. A joint meeting with both organizations took place at City Hall on November 8, 2005. Meeting notes from the local officials meetings are included in Appendix A. The purpose of the meetings was to gather input from each organization to assist the project team develop the final recommended alternate.

1.2 Project Purpose and Goals

The purpose of the project is to improve the traffic flow and delays at the Five-Points intersection. The goals associated with the project, as determined by the project team, are:

1. Reduce future delays to level-of-service (LOS) C or better for all legs of the intersection during peak hours.
2. Maintain or improve vehicular safety
3. Improve walking conditions
4. Improve bicycling conditions
5. Provide an attractive entryway to Murray State University

2.0 Existing Conditions

During peak hours of traffic, it is common to see long queues of cars waiting for the signal. The volumes and associated queues in the afternoon peak hours exceed those in the morning. Examples of queuing on two of the entries are shown if Figures 2-1 and 2-2.

As part of this study, staff from Murray State University collected traffic volume and turning movement counts. To effectively allocate study resources, analysis of current and future conditions was limited to the afternoon peak hour (3:00-4:00pm), the highest hourly volume of the day. Staff from the Division of Traffic Operations collected data on queues and the geometric configuration of the intersection during the afternoon peak hour. This information along with traffic counts was used to develop and calibrate a model of the intersection using TSIS, an intersection operations modeling software. Results of the model for year 2005 show that there is an average delay of approximately 48 seconds for each vehicle traveling through the intersection during the PM peak hour. A summary of the current conditions for each leg of the intersection is included in Table 2-1.

No specific queue counts or analysis were conducted for the AM peak hour or off-peak hours because traffic counts indicate that the total volumes were significantly less (12%). Therefore, the afternoon peak hour will be the worst case scenario in planning for improvements to the intersection.

Figure 2-1: Chestnut Street (view looking east) during PM Peak

Figure 2-2: 16th Street (view looking south):
Left turn vehicle blocking through vehicles during PM Peak

Roadway Name	Average Delay (sec/vehicle)	Average Queue (vehicles)	Maximum Queue (vehicles)
KY 748 (16th St.)	52	3	13
KY 774 (Coldwater Rd.)	54	4	20
KY 1327 (College Farm)	38	3	13
16th St.	41	5	16
KY 1327 (Chestnut St.)	62	10	28

Table 2-1: Current Operational Characteristics

2.1 Roadway Characteristics

Each roadway leading to the intersection is 2 lanes wide, approximately 22 feet in width. As they approach the intersection, 4 of the legs have turning lanes. Approach speed limits, turning lane configuration including lane-use, width and length are included in Table 2-2. A depiction of turning lane lengths is included in Figure 2-3.

Roadway Name	Speed Limit	Leftmost Lane Grouping & Width	Rightmost Lane Grouping & Width	Turn Lane Length
KY 748 (N. 16th St.)	35 mph	LTR 10.5'	NA	NA
KY 774 (Coldwater Rd.)	45 mph	LT 11.0'	R 11.0'	150'
KY 1327 (College Farm)	35 mph	LT 9.0'	R 9.0'	65'
16th St.	25 mph	LT 11.0'	R 13.0'	257'
KY 1327 (Chestnut St.)	25 mph	L 11.5'	TR 11.0'	66'

Table 2-2 Roadway Characteristics

L=left turn lane
LT=left turn and through lane combined
LTR = left turn, through and right turn lane combined
TR = through and right turn lane combined
R = right turn lane

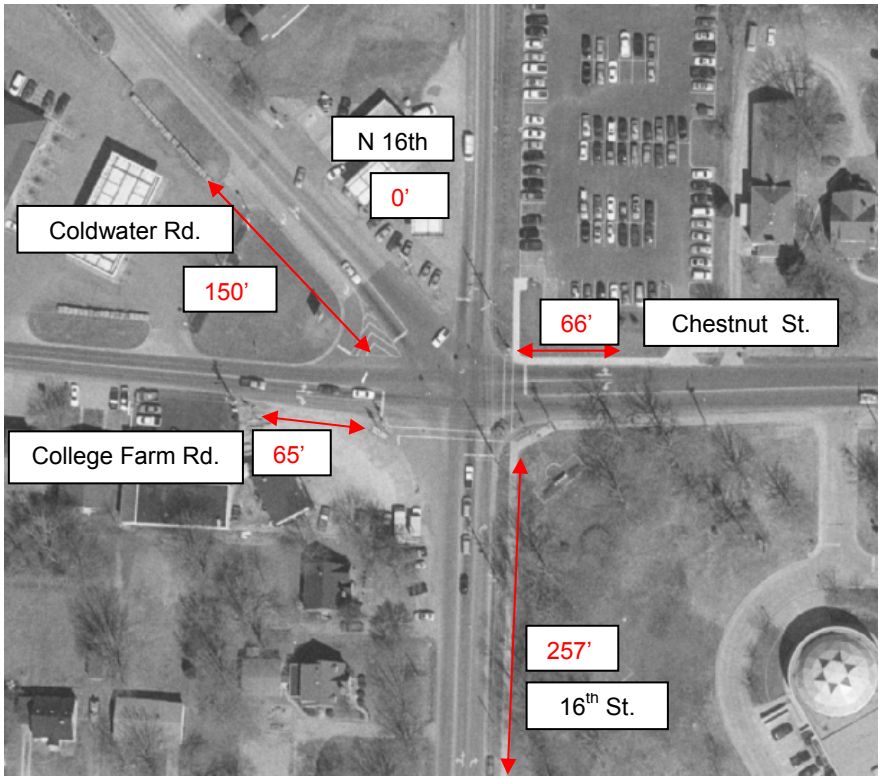


Figure 2-3 Current Turning Lane Lengths

2.2 Signal Timing

The intersection is currently controlled by a traffic signal using a fully actuated timing plan. There is only one time-of-day plan for the intersection with a maximum 100 second cycle length. There are three phases listed in Table 2-3.

Phase #	Streets	Timing (max.)
2	KY 1327 (Chestnut & College Farm)	35 seconds
3	KY774 (Coldwater)	25 seconds
4	KY 748 (16th St N&S)	40 seconds

Table 2-3 Signal Phasing and Timing

2.3 Traffic Volumes

The most current traffic volumes were taken from the data collected for the KYTC Division of Planning's traffic volume maps (Table 2-4). It is evident that Chestnut Street carries a much heavier volume. Murray State University Division of Facilities Management performed traffic counts for the turning movements during peak hours. The counts were done for 15 minute increments. A summary of the AM Peak Hour (7:15-8:15) and the PM Peak Hour (3:00-4:00) are included in Table 2-5 . The detailed turning movement counts are available in the project file.

Roadway Name	Traffic Volumes	Count Year	2005 Adjusted Volumes
KY 748 (16th St.)	5520	2002	6030
KY 774 (Coldwater Rd.)	6010	2002	6270
KY 1327 (College Farm)	4910	2002	5130
16th St.	8170	2003	8420
KY 1327 (Chestnut St.)	12700	2004	12760

Table 2-4: Traffic Counts of Average Daily Traffic Volumes and Adjusted 2005 Volumes (2 directions)

Roadway Name	AM Peak Traffic Volume	PM Peak Traffic Volume
KY 748 (16th St.)	360	238
KY 774 (Coldwater Rd.)	301	270
KY 1327 (College Farm)	290	355
16th St.	278	520
KY 1327 (Chestnut St.)	391	468
Intersection Total	**1620**	**1851**

Table 2-5 Peak Hours Traffic Volumes from Each Approach Leg (1-direction)

2.4 Pedestrian and Bicycle Facilities

There is significant pedestrian activity primarily generated from the university. Students use the sidewalks in this area to traverse the campus. There was also pedestrian activity observed between the residential areas to the west and the campus, although there are no sidewalks on the western legs of the intersection. Table 2-6 outlines the current pedestrian and bicycle facilities for each roadway in the Five-Points vicinity:

Roadway Name	Sidewalks	Crosswalk Present?	Bicycle
KY 748 (16th St.)	50' (east side only)	No	None
KY 774 (Coldwater Rd.)	None	No	None
KY 1327 (College Farm)	None	No	None
16th St.	East side only	Yes	None
KY 1327 (Chestnut St.)	Both sides	Yes	None

Table 2-6 Current Pedestrian and Bicycle Facilities

2.5 Crash Analysis

A look at the recent crash history (October 1, 2000-October 1, 2005) was obtained from the CRASH database. Crashes for each roadway are listed in Table 2-7.

Route	Total Crashes	Property Damage Only	Injury Crashes	Fatal Crashes
KY 748	6	6	0	0
KY 774	1	1	0	0
KY 1327	9	9	0	0

Table 2-7 Crash Summary by Crash Type

There have been 16 total intersection-associated crashes recorded, all of which have been property-damage only, over the last six years. An intersection is considered to have a high crash rate when the total crash rate is higher than the critical crash rate for similar roads in the state. When an intersection has a critical rate factor (CRF) greater than 1.0, this indicates that crashes at this location may not be occurring randomly. The CRF is calculated based on the methodology presented in the Kentucky Transportation Center's publication, *Analysis of Traffic Accident Data in Kentucky*.

The intersection CRF for the Five-Points intersection is 0.48, as calculated by the Kentucky Transportation Center in the research for the study, *Crash Rates at Intersections* (Green and Agent, 2003). This CRF indicates that the overall crash rate is lower than the statewide crash rate for similar intersections. Because no crashes have had fatalities or injuries, this indicates that they are happening at low speeds. Seven of the crashes involved left-turning vehicles colliding with an oncoming vehicle and six of the crashes involved rear end collisions.

With the low CRF and absence of injury crashes, there is not a serious safety problem that needs to be addressed. Regardless, in the selection of a preferred alternate, the project team will choose based on the potential for vehicular, pedestrian and bicyclist safety.

2.6 Utilities

Because of the urban location of this intersection, there are many utility lines running along the roads that form the Five-Points intersection. The City of Murray provided the project team with GIS maps of the gas, water and sewer lines in the area. This information, in addition to information about telephone, cable and fiber optic lines, was gathered during a site visit and used in creating the utility estimates for each project alternate.

3.0 Environmental Overview

The Division of Planning developed an Environmental Footprint, a map containing potential environmental concerns within the project area. From that information and other data sources, the Division of Environmental Analysis (DEA) completed a cursory environmental review. The environmental footprint and the memo from DEA containing their comments are included in Appendix B. In summary, they noted 6 sites with potential underground storage tanks or hazardous materials issues. Three of those sites are within properties located at the Five-Points intersection. An assessment will be required on the three endangered species that are located within this region. The blue line stream is outside of the project area, so a permit will unlikely be necessary. No archeological work will be required. Finally, no cultural or historic sites were surveyed but a baseline study is recommended. All of the issues will be investigated further during the Phase I Design. At this time, there are no sensitive features that will be impacted by the alternates examined in this study.

3.1 Environmental Justice

The Purchase ADD staff obtained data regarding population, race, income and age from the Kentucky State Data Center and the U.S. Census Bureau. They compiled this data and determined that there are some Census Blocks (CB) that have a higher percentage of minorities and low income populations than the percentages of other nearby census tracts and block groups, city and county. Figure 3-1 delineates the boundaries of the Census Blocks. There are three block groups (BG-2, BG-3 and BG-4) that lie within the study area.

Table 3-1 summarizes the data available about minority, elderly and low-income populations for each CB examined within the study area. The full report is not included within this document but has been retained within the project file.

The percentage of minority populations that live within the affected block groups are slightly higher than the average for the city of Murray. When examined at the census block level, there are several blocks that contain significantly higher percentages than the average for the city of Murray (2026, 2029, 3016, 4001, 4002, 4004). The total number of minority persons living in these areas on the MSU campus is fairly high. The total number of minority persons living in these areas off the MSU campus is fairly low.

Income data is not available at the CB level, it is not feasible to determine where populations of low-income persons live within the BGs. Based on the data available at the BG level, it appears that all three BGs located in the project area have percentages substantially higher than the state, county and city. The 3 BGs in the study area have a total of 92 CBs; however only 20 CBs are located in the project study area making it difficult to determine if the target population exists within the project area or outside the project area.

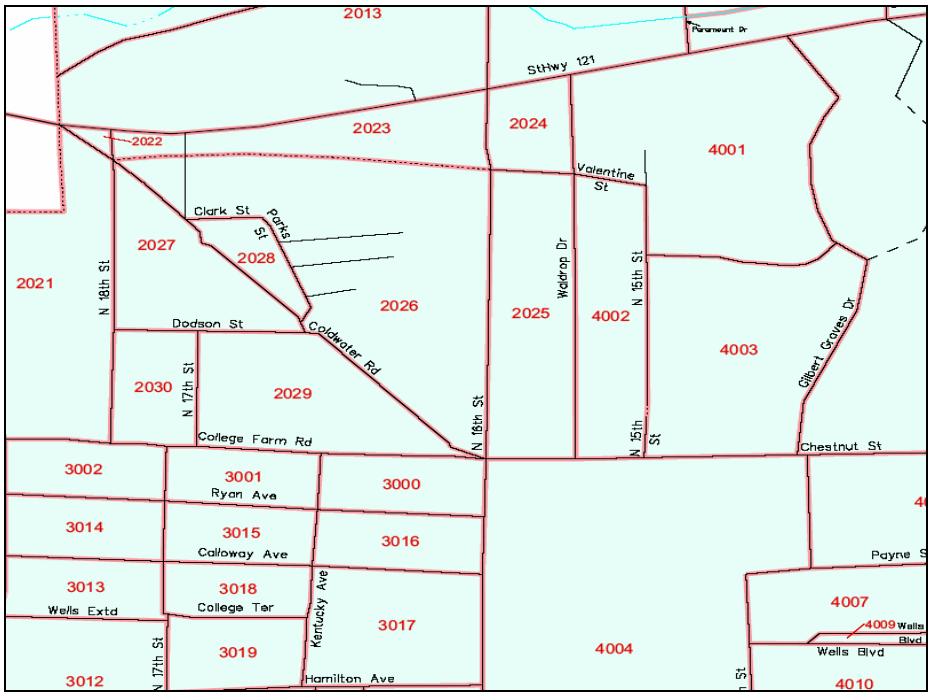


Figure 3-1: Census Blocks in Study Area

Area	Minority Population	Poverty Population	Elderly Population
United States	24.9	12.4	12.4
Kentucky	9.9	15.8	12.5
Calloway County	6.5	14.0	13.8
City of Murray	11.8	18.0	16.0
CB 2021	1.6 (2)	35.8*	27.3 (35)
CB 2022	0 (0)		0 (0)
CB 2023	0 (0)		16.6 (1)
CB 2024	0 (0)		0 (0)
CB 2025	7.1 (3)		9.5 (4)
CB 2026	15.1 (11)		4.1 (3)
CB 2027	6.5 (4)		8.1 (5)
CB 2028	12.5 (1)		0(0)
CB 2029	28.8 (15)		5.8 (3)
CB 2030	13.5 (5)		10.8 (4)
CB 3000	12.2 (4)	23.9*	19.4 (7)
CB 3001	9.4 (3)		3.1 (10)
CB 3002	0 (0)		14.3 (6)
CB 3014	0 (0)		8.6 (3)
CB 3015	0 (0)		24.4 (10)
CB 3016	22.6 (7)		16.1 (5)
CB 4001	57.1 (64)	46.5*	0 (0)
CB 4002	29.3 (159)		0.4 (2)
CB 4004	100 (1)		0 (0)

*Note: Income data not available for the CB level. Numbers indicate population level at the block group level.

Table 3-1: Census Data for Environmental Justice Population Segments % (# persons)

4.0 Alternates Analysis

The study process identified ten alternates for consideration. A listing of the alternates is provided in Table 4-1. Each alternate was examined for traffic operations, cost, and agency coordination preference. This chapter includes data and analysis used to select a preferred alternate.

Alternate Number	Description	Figure Number
1	No Build (no improvements)	-
2a	5-Legged Intersection with Roundabout	4-1
2b	5-Legged Intersection with Signal and Turning Lane Modifications	4-2
3a	4-Legged Intersection with Roundabout and with Coldwater Road Rerouted to North 16th Street	4-3
3b	4-Legged Intersection with Signal and Turning Lane Modifications and with Coldwater Road Rerouted to North 16th Street	4-4
4a	4-Legged Intersection with Roundabout and with Coldwater Road Rerouted to College Farm Road	-
4b	4-Legged Intersection with Signal and Turning Lane Modifications and with Coldwater Road Rerouted to College Farm Road	-
5a	4-Legged Intersection with Roundabout and with Coldwater Road Cul-de-Sac	4-5
5b	4-Legged Intersection with Signal and Turning Lane Modifications and with Coldwater Road Cul-de-Sac	4-6
6	1-way couplet Coldwater Road outbound, 16th Street (north) inbound	4-7

Table 4-1: Study Alternates

Note: Alternates 4a and 4b were eliminated from analysis by the Project Team. Although each of these alternates may improve the operations of Five-Points intersection, there were safety and operational concerns over the heavy volumes of left turning vehicles from Coldwater Road onto College Farm Road at the relocated intersection. The team was also concerned about the close proximity to the existing Five-Points intersection (less than 0.1 mile) and wanted to eliminate the future need for the installation of a traffic signal so close to a major intersection. As a result, no traffic analysis or cost estimate was done for Alternates 4a and 4b.

Figure 4-1: Alternate 2a

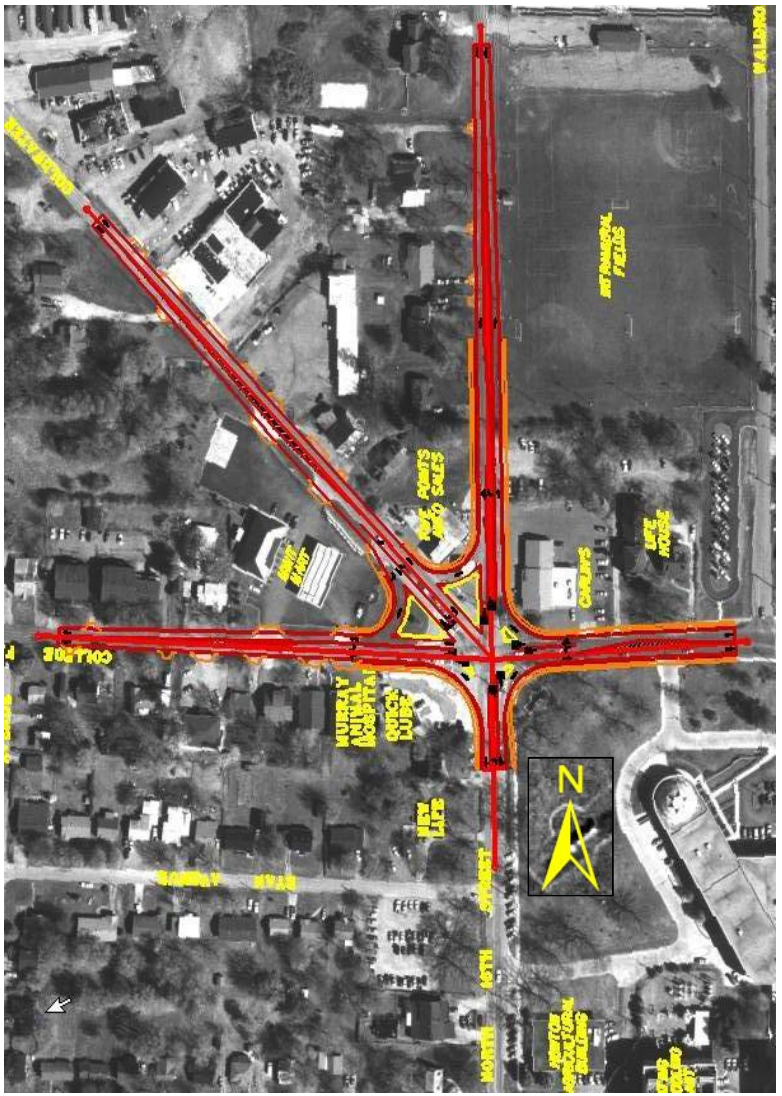


Figure 4-2: Alternate 2b

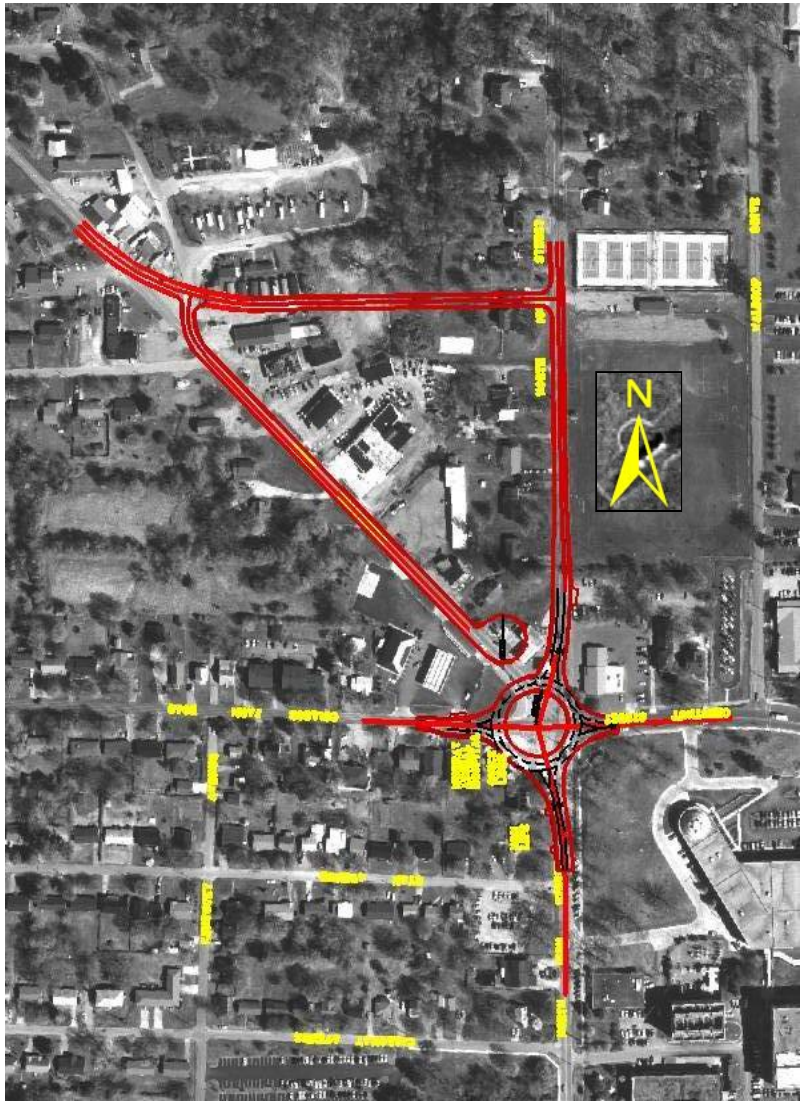


Figure 4-3: Alternate 3a

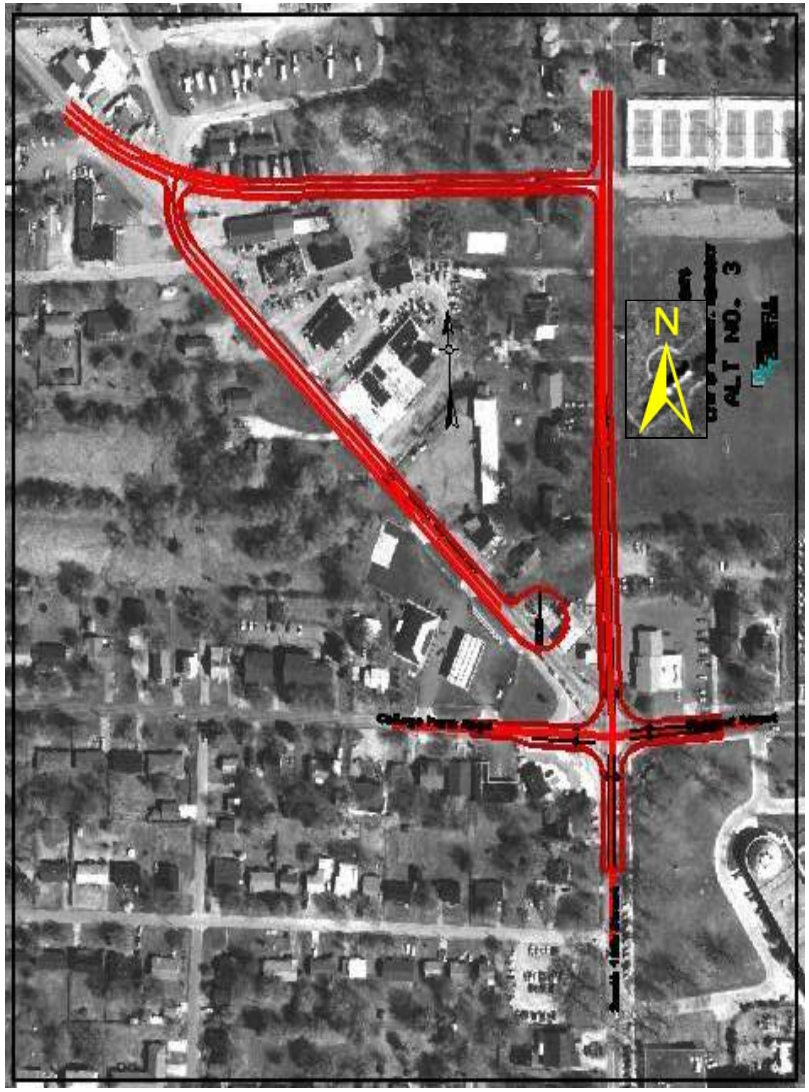


Figure 4-4: Alternate 3b

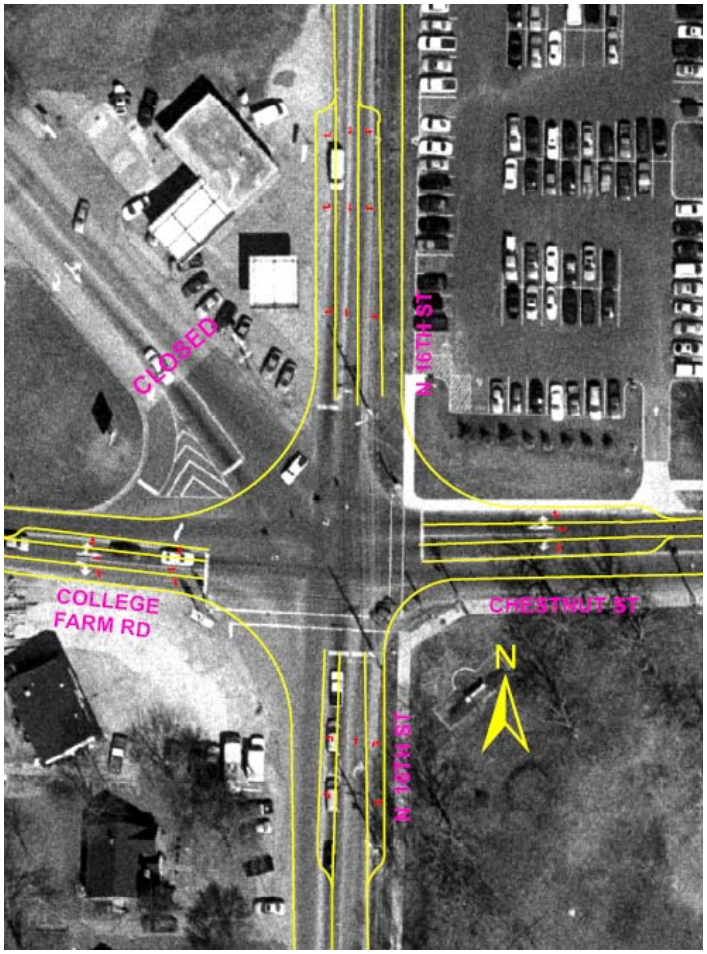


Figure 4-5: Alternate 5a

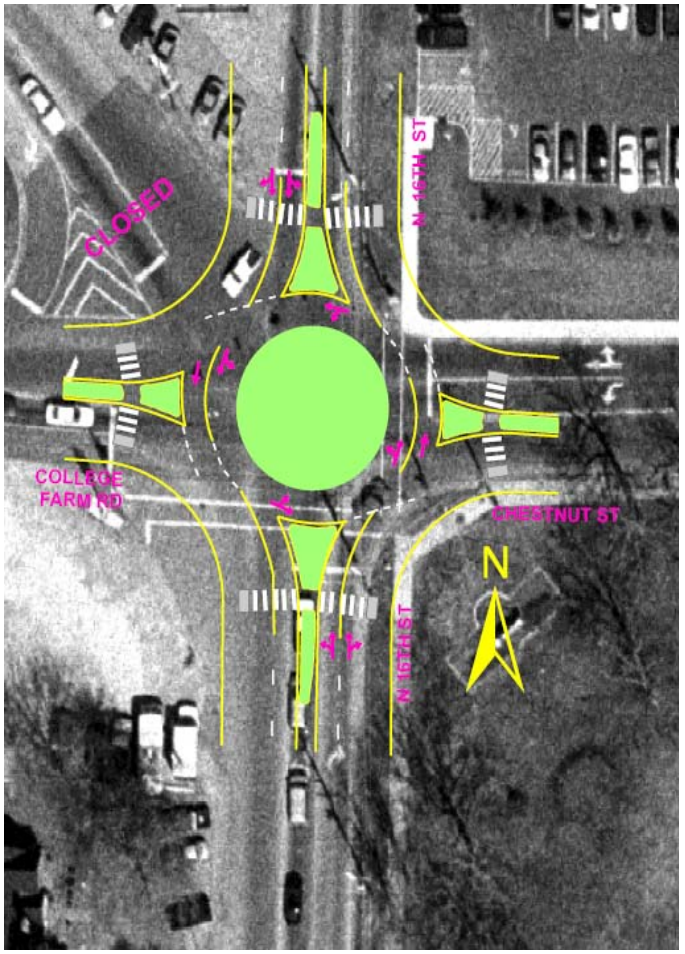


Figure 4-6: Alternate 5b

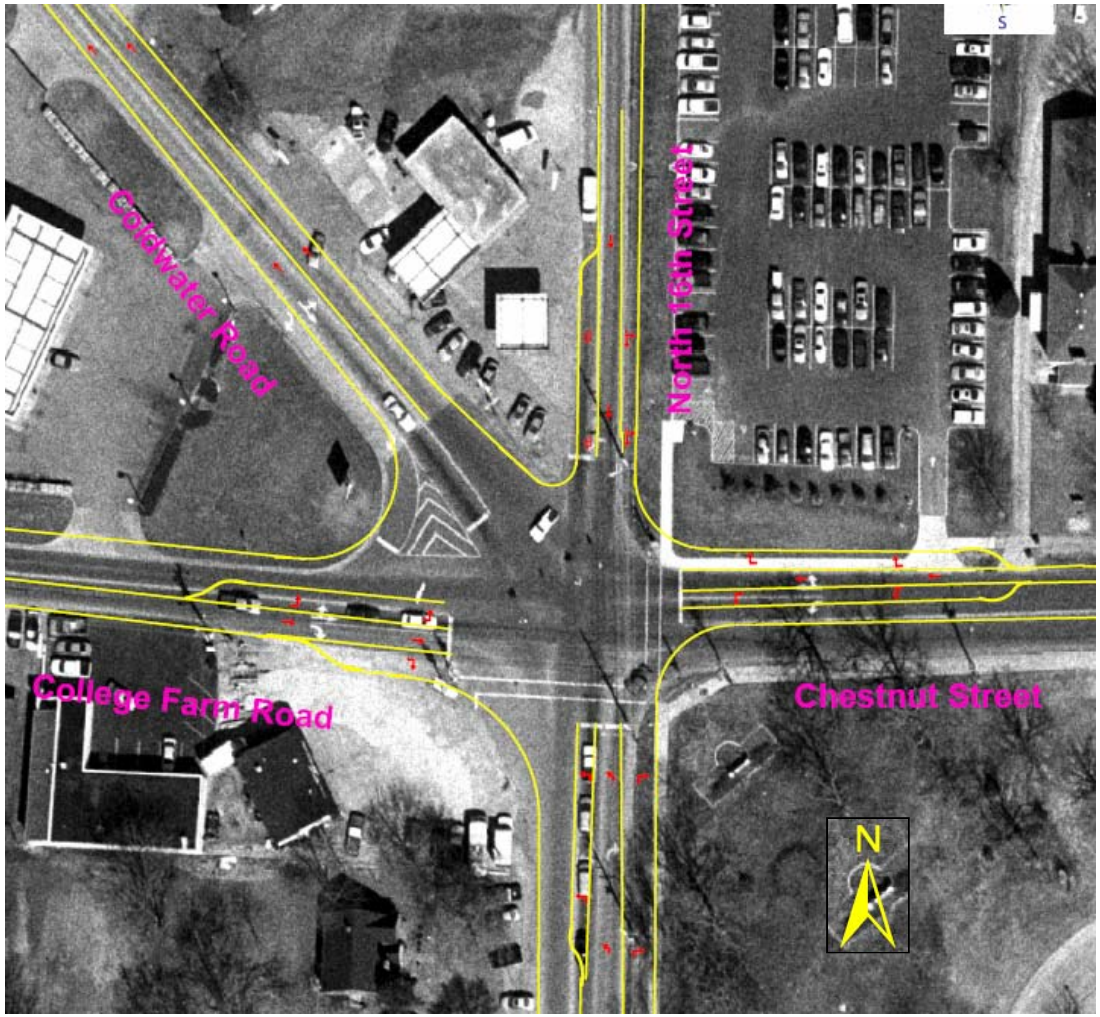


Figure 4-7: Alternate 6

4.1 Traffic Operations

The purpose of the project is to improve the traffic flow and delays at the Five-Points intersection. As such, the first goal set was to reduce delays to level-of-service (LOS) C or better for all legs of the intersection during peak hours. LOS is defined by the Highway Capacity Manual by the additional travel time experienced by a driver on average, also called the control delay. The control delay thresholds for each LOS are given in Table 4-2:

LOS	Average Control Delay per Vehicle (seconds per vehicle)
A	≤10
B	>10-20
C	>20-35
D	>35-55
E	>55-80
F	>80

Table 4-2: Motor Vehicle LOS thresholds (at signalized intersections)

Each alternate was examined to determine a peak hour control delay and associated queues for each leg of the Five-Points intersection. Because of limited time and staff resources, analysis was limited to PM peak hour, the highest intersection volume of the day.

Turning movement traffic counts and queue lengths were collected for the peak hours of traffic volumes. The heaviest hours of traffic volumes, primarily due to county schools and Murray State University, occur between 7:15 and 9:30 in the morning and 3:00 and 6:00 in the afternoon. There has been some residential growth to the southwest and commercial growth to the north of the study area. The pace of growth in these areas will affect the growth of traffic using 16th Street. Growth rates, shown in Table 4-3 were determined based on past trends in growth of traffic volumes and projected growth of development in the vicinity.

Roadway	Annual Growth Rate	20 Year Growth Rate
KY 748 (16th St.)	2.5%	63.9%
KY 774 (Coldwater Rd.)	1.4%	32.1%
KY 1327 (College Farm)	1.5%	34.7%
16th St.	1.5%	34.7%
KY 1327 (Chestnut St.)	0.5%	10.5%

Table 4-3: Traffic Growth Rates

Turning movements were then estimated by projecting traffic volumes using the traffic counts and growth rates. Turning movements estimates are included in the report, *"Calloway County Traffic Forecasts: Murray 5-Points Intersection."* The full report is not included within this document but has been retained within the project file.

RODEL, an interactive roundabout design software, was used to analyze the operations of alternates (2a, 3a, 5a) using a roundabout intersection control. These alternates were

modeled using an iterative process to develop the best geometry given the traffic and site conditions. Results were developed using a 50% confidence level and then tested using an 85% confidence level to make sure there were no unacceptable delays in the event the intersection experiences capacity well below average.

TSIS, an intersection operations modeling software, was used to analyze the operations of alternates (1, 2b, 3b, 5b, 6) using a traffic signal control. The TSIS model was developed and calibrated based on current traffic conditions and then used to project the signal operations under future traffic conditions. Similar to the roundabout analysis, these alternates were modeled using an iterative process to develop turning lane geometry and signal timings given the traffic and site conditions. It was assumed that no more than one through lane for each leg would be available because no projects to widen any legs are currently planned.

4.1.1 Operational Analysis

A brief description of the analysis of each alternate is included below. The results from the operational analysis for each alternate is summarized in the following tables at the end of this section:

- Table 4-7 Year 2025 PM Peak Hour Average Delay
- Table 4-8 Year 2025 PM Peak Hour Maximum Queue Length

Alternate 1
The analysis shows that if no improvements are made to this intersection, then the delays and queue lengths are so high that the TSIS model can not calculate it. In other words, the intersection conditions will be unacceptable because of gridlock. Additional traffic capacity will be needed at this intersection, another north-south parallel route will need to be constructed, or alternative travel modes will be needed to accommodate travelers in this area. Improved transit could be considered between the university and destinations attracting students or staff (i.e. housing, restaurants, jobs, etc.)

Alternate 2a
A preliminary analysis using the RODEL software indicates that to achieve an acceptable level of delay and queue length for future traffic, the roundabout will ultimately need to have three double lane entries for 16th Street south, Coldwater and College Farm. A design to accommodate the double entries for future traffic could be done while initially opening the roundabout to traffic as a single lane roundabout with only single lane entries. The opportunity to easily expand could be accomplished by slight modifications when the traffic levels require increased capacity. The projected average delay for the intersection during the PM peak hour is 7 seconds.

Alternate 2b
An iterative analysis using TSIS was done by adding turning lanes and adjusting the signal timing, keeping the intersection with five legs. Table 4-4 identifies the number of lanes entering the intersection and the lane grouping configurations. With the constraint of not adding additional through lane capacity, this alternate has unacceptably high delays and queues.

Roadway Name	Number of Lanes	Leftmost Lane Grouping	Centermost Lane Grouping	Rightmost Lane Grouping
KY 748 (N. 16th St.)	2	L	NA	TR
KY 774 (Coldwater Rd.)	2	L	NA	TR
KY 1327 (College Farm)	2	L	NA	TR
16th St.	3	L	T	R
KY 1327 (Chestnut St.)	3	L	T	R

Table 4-4: Alternate 2b Lane Groupings

Alternate 3a

In this alternate, Coldwater Road is rerouted approximately 800 feet north (across from the MSU tennis court parking lot entrance). A preliminary analysis using the RODEL software indicates that to achieve an acceptable level of delay and queue length, the roundabout will ultimately need to have two lanes for the north-south movements on 16th Street with two-lane entries for each. Both College Farm and Chestnut will operate sufficiently with a single-lane entry. The projected average delay for the intersection during the PM peak hour is 6 seconds.

All traffic that would normally use Coldwater would be redirected onto 16th Street. This change would nearly double the volumes on 16th Street; however, the projected demand does not exceed 930 vehicles per lane in a peak travel hour. With a typical peak capacity of 1700 vehicles per lane per hour capacity should not be a problem on 16th Street; however, roadway capacity may be constrained by the capacity of the intersections at each end of this roadway link between Five-Points and KY 121. The added traffic volume will negatively affect the operation of the traffic signal located at KY 121 and 16th Street.

Alternate 3b

In this alternate, Coldwater Road is rerouted approximately 800 feet north (across from the MSU tennis court parking lot entrance). An iterative analysis using TSIS was done by adding turning lanes and adjusting the signal timing, and removing Coldwater Road from the main intersection. Table 4-5 identifies the number of lanes entering the Five-Points intersection and the lane grouping configurations. Based on the average of five runs, the projected average delay for the intersection during the PM peak hour is 34 seconds.

Roadway Name	Number of Lanes	Leftmost Lane Grouping	Centermost Lane Grouping	Rightmost Lane Grouping
KY 748 (N. 16th St.)	3	L	T	R
KY 774 (Coldwater Rd.)	0	NA	NA	NA
KY 1327 (College Farm)	3	L	T	R
16th St.	3	L	T	R
KY 1327 (Chestnut St.)	3	L	T	R

Table 4-5: Alternate 3b Lane Groupings

Alternate 5a

In this alternate, Coldwater Road is cut off from the main intersection. Identical to Alternate 3a, preliminary analysis using the RODEL software indicates that to achieve an acceptable level of delay and queue length, the roundabout will ultimately need to have two lanes for the north-south movements on 16th Street with two-lane entries for each.

Both College Farm and Chestnut will operate sufficiently with a single-lane entry. The projected average delay for the intersection during the PM peak hour is 6 seconds.

All traffic that would normally use Coldwater would be redirected onto 16th Street. This change would nearly double the volumes on 16th Street; however, the projected demand does not exceed 930 vehicles per lane in a peak travel hour. With a typical peak capacity of 1700 vehicles per lane per hour capacity should not be a problem on 16th Street; however, roadway capacity may be constrained by the capacity of the intersections at each end of this roadway link between Five-Points and KY 121. The added traffic volume will negatively affect the operation of the traffic signal located at KY 121 and 16th Street.

Alternate 5b

An iterative analysis using TSIS was done by adding turning lanes and adjusting the signal timing, and removing Coldwater Road from the main intersection. In this alternate, Coldwater Road is cut off from the main intersection. Traffic normally using Coldwater Road would be diverted along KY 121 to 16th Street. Table 4-6 identifies the number of lanes entering the Five-Points intersection and the lane grouping configurations. Based on the average of five runs, the projected average delay for the intersection during the PM peak hour is 23 seconds.

All traffic that would normally use Coldwater would be redirected onto 16th Street. This change would nearly double the volumes on 16th Street; however, the projected demand does not exceed 930 vehicles per lane in a peak travel hour. With a typical peak capacity of 1700 vehicles per lane per hour capacity should not be a problem on 16th Street; however, roadway capacity may be constrained by the capacity of the intersections at each end of this roadway link between Five-Points and KY 121. The added traffic volume will negatively affect the operation of the traffic signal located at KY 121 and 16th Street.

Roadway Name	Number of Lanes	Leftmost Lane Grouping	Centermost Lane Grouping	Rightmost Lane Grouping
KY 748 (N. 16th St.)	3	L	T	R
KY 774 (Coldwater Rd.)	0	NA	NA	NA
KY 1327 (College Farm)	3	L	T	R
16th St.	3	L	T	R
KY 1327 (Chestnut St.)	3	L	T	R

Table 4-6: Alternate 5b Lane Groupings

Alternate 6

In this alternate, Coldwater Road is converted to a 1-way road heading northwest and 16th Street N is converted into a 1-way road heading south, forming a pseudo 1-way couplet. This simplifies the traffic signal timing by creating only four legs entering the intersection. Although the delays projected using 20-year traffic projections are high (37 seconds), this could serve as a low-cost, intermediate solution to improve the traffic flow for the near future until a long term solution could be implemented. The average delay using 2005 traffic volumes for Alternate 6 is 36 seconds compared to 49 seconds under current traffic conditions, a 13 second average delay improvement. This assumes signing, traffic signal timing modifications and no geometric improvements to Five-Points intersection. This alternate was primarily considered as an intermediate, low-cost solution.

Alternate	16th St. N	Coldwater	College Farm	16th St S	Chestnut
1 No Build	300+ (F)	300+ (F)	300+ (F)	300+ (F)	300+ (F)
2a 5 Legs Roundabout	8 (A)	4 (A)	5 (A)	5 (A)	10 (B)
2b 5 Legs Conventional	67 (E)	133 (F)	132 (F)	66 (E)	123 (F)
3a 4 Legs Roundabout: Coldwater to 16th St. N	3 (A)	NA	10 (B)	4 (A)	8 (A)
3b 4 Legs Conventional: Coldwater to 16th St. N	39 (D)	NA	40 (D)	25 (C)	32 (C)
5a 4 Legs Roundabout w/Coldwater Closed	3 (A)	NA	10 (B)	4 (A)	8 (A)
5b 4 Legs Signal w/Coldwater Closed	22(C)	NA	27 (C)	21 (C)	22 (C)
6 5 Legs w/1-Way Couplet	31 (C)	NA	39 (C)	33 (C)	50 (C)

Table 4-7: Year 2025 PM Peak Hour
Average Delay in seconds (LOS)

Alternate	16th St. N	Coldwater	College Farm	16th St S	Chestnut
1 No Build	Gridlock	Gridlock	Gridlock	Gridlock	Gridlock
2a 5 Legs Roundabout	1	1	1	1	2
2b 5 Legs Conventional	24	34	29	40	31
3a 4 Legs Roundabout: Coldwater to 16th St. N	1	NA	2	1	2
3b 4 Legs Conventional: Coldwater to 16th St. N	21	NA	17	17	12
5a 4 Legs Roundabout w/Coldwater Closed	1	NA	2	1	2
5b 4 Legs Signal w/Coldwater Closed	15	NA	12	14	11
6 5 Legs w/1-Way Couplet	12	NA	13	15	14

Table 4-8: Year 2025 PM Peak Hour
Maximum Queue Length in # cars

NA = Not applicable

4.1.2 Overall Delay Estimates

Table 4-9 outlines the average delay and corresponding LOS for each PM peak hour traffic condition in year 2025 at the Five-Points Intersection.

Alternate	PM Peak Hour Delay
1 No Build	Gridlock
2a 5 Legs Roundabout	7 (A)
2b 5 Legs Conventional	100 (F)
3a 4 Legs Roundabout: Coldwater to 16th St. N	6 (A)
3b 4 Legs Conventional: Coldwater to 16th St. N	34 (C)
5a 4 Legs Roundabout w/Coldwater Closed	6 (A)
5b 4 Legs Signal w/Coldwater Closed	23 (C)
6 5 Legs w/1-Way Couplet	37 (D)

Table 4-9: Average Intersection Delay per Vehicle in seconds (LOS)

4.2 Project Cost Estimates

Estimated costs for each alternate are shown in Table 4-10.

Alternate	Design	ROW	Utilities	Construction	Total
1 No Build	0	0	0	0	**0**
2a 5 Legs Roundabout	300	550	1,000	850	**2,700**
2b 5 Legs Conventional	350	900	1,500	1,300	**4,050**
3a 4 Legs Roundabout w/Coldwater	450	850	1,500	1,700	**4,500**
3b 4 Legs Conventional w/Coldwater	450	750	1,500	1500	**4,200**
5a 4 Legs Roundabout w/Coldwater Closed	300	450	900	850	**2,500**
5b 4 Legs Signal w/Coldwater Closed	350	800	1400	1300	**3,850**
6 5 Legs w/1-Way Couplet	0	0	0	200	**200**

Table 4-10: Project Cost Estimates (in thousands 2005 dollars)

4.3 Pedestrian and Bicycle Accommodations

The project team decided that the safe accommodation of pedestrians is important for this area because of the surrounding land uses and known pedestrian traffic. For this reason, it is assumed that each alternate will have sidewalks and pedestrian crossings within the project limits.

The project team also decided that the safe accommodation of bicyclists is important for this area because of the surrounding land uses and student population that uses bicycles for transportation; however, it was also assumed that no additional bicycle facilities will be built as part of this project because this is primarily an intersection improvement project, there are low speed limits, and because no trails or bicycle lanes have been planned on any of the roadways at Five-Points.

4.4 Environmental and Community Impacts

Based on the preliminary information collected in the development of the environmental footprint and environmental justice overview (sections 3.0 and 3.1), no alternate was eliminated from consideration because of adverse impacts on the natural or built environment. Further analysis will be conducted when the project is advanced to Phase I design.

5.0 Recommendations

The project team considered the project goals, current conditions, impacts and level of improvements in deciding on a preferred alternate. In this analysis of a long-term improvement, short-term or intermediate, low-cost improvements were also considered. This section outlines the decisions made by the project team on the intermediate and long-term improvements, level of project support and other project issues that should be considered if the project is advanced.

5.1 Intermediate Improvements

There are no recommended low-cost improvements recommended at this time.

5.2 Long-Term Improvements

Based on the traffic operations analysis, project cost estimates and review of environmental data, the Project Team recommended that Alternate 2a, 5-legged roundabout, be selected to carry forward to Phase I design. The projected traffic operation is excellent and the cost was the second lowest of the alternates considered. There is also flexibility to fit potential modifications to 16th Street should a road improvement project be funded. As a note, Alternate 5a had slightly better results in the traffic analysis and a slightly lower cost; however, the project team felt that the closure of Coldwater Road and resultant change in the traffic patterns would be too burdensome and would not be acceptable to the residents and local business owners.

The RODEL traffic analysis showed that future traffic will warrant a two-lane entry at three of the roads (Coldwater Road, College Farm Road, 16th Street South) and a two-lane circular roadway. The phase 1 design project team should consider the design of a roundabout that may be opened initially as single-lane roundabout with one-lane entries but can be easily modified to allow for multiple lane entries and circular roadway in the future should traffic volumes exceed the single-lane capacity. This approach allows the driving public to learn to drive in a single-lane roundabout initially. Should conditions develop that lower traffic projections (i.e. creation of a north-south connector road or the closing of 16th Street South), a single lane roundabout may be all that is needed for final design.

The project team also identified issues that should be addressed in the next phase:

1. A public education campaign is recommended to educate drivers, pedestrians and bicyclists to use the roundabout.
2. A right-turn bypass may be needed from 16th Street to Coldwater Road and from Coldwater Road to College Farm Road to provide the proper turning radius for large vehicles.
3. Sidewalks on all edges of entering roadways will be needed.
4. Pedestrian crossings for all legs will be needed.
5. Special care should be taken to discourage pedestrians from cutting through the central island and to encourage the use of designated crossings.
6. No fountains or statues should be allowed within the central island.
7. Landscaping materials and placement should be chosen so that necessary sight-distance can be maintained within the functional area of the intersection.

8. Currently, the City of Murray is exploring the possibility of building a north-south connector (Doran Road extension) to the west of Five-Points that would alleviate some of the projected traffic demand on 16th Street.

Murray State University officials have expressed interest in the reconstruction of the stretch of 16th Street between Five-Points and KY 121. They would like to address some of the geometric problems, primarily the large dip just to the south of KY 121. They are also interested in a landscaped median and pedestrian and bicycle facilities along this route. Currently, no funding for this project is identified.

5.3 Project Support

Project team members met with local officials from the City of Murray and Murray State University on November 8, 2005 to present the findings and recommendations of the study. Minutes of this meeting are included in Appendix A. Based on the presentation, all officials in attendance concurred that Alternate 2a was preferred and would support the findings of the study. A letter of support from the mayor of the City of Murray and MSU is included in Appendix C.

MSU officials have also indicated their willingness to donate right-of-way to the project from the property that they own at the intersection.

5.4 System Modifications

The state routes that make up four of the five legs at Five-Points intersection function as local or collector roads. Therefore, it is recommended to remove each of them from the state system.

5.5 Maintenance

Murray State University officials expressed their willingness to assume maintenance responsibility of all landscaping that is installed within the central island and on right-of-way within the project area. A maintenance agreement should be drafted between KYTC and MSU at the beginning of Phase I design.

5.6 Contact Information

For further information regarding this project, the following people may be contacted:

Mr. Daryl J. Greer, PE
Director

Division of Planning
Kentucky Transportation Cabinet
200 Mero Street
Frankfort, KY 40622

Mr. Brent A. Sweger, PE
Project Manager

Division of Planning
Kentucky Transportation Cabinet
200 Mero Street
Frankfort, KY 40622
502-564-7183

5.7 Acknowledgements

We would like to acknowledge the following individuals and organizations for their contributions to this study:

- G. Dewey Yates and Kim Oatman of Murray State University for providing traffic counts, university growth plans and project input
- Don Elias, David Roberts and Mayor H. Thomas Rushing of the City of Murray for providing land use information and project input
- Stacey Courtney of Purchase Area Development District for conducting the environmental justice review and project team participation
- Allen Thomas, Jeff Thompson, Tim Choate of District 1 for providing cost estimates, drawings, and other information for this study
- Dawn Boyd, Telma Lightfoot, and Jason Hyatt of KYTC Division of Traffic Operations for completing the TSIS analysis of alternatives.
- Gary Bunch, Division of Environmental Analysis, for coordinating the environmental footprint review.
- Frank Bush of Division of Design; Larry Irish of Division of Traffic; Chris Kuntz, Henry Luken, Michael Oliver, Randy Williams, and Everett Wilson of District 1 for serving on the project team and development of the final report.

5.8 Commitments

During the course of this study, no commitments were made by the Project Team.

Appendix A
Project Team Members
Meeting Summaries

Project Team Members

Ted Merryman	KYTC District 1 Chief District Engineer
Allen Thomas	KYTC District 1 Planning
Jeff Thompson	KYTC District 1 Planning
Tim Choate	KYTC District 1 Preconstruction
Chris Kuntz	KYTC District 1 Design
Randy Williams	KYTC District 1 Traffic Operations
Everett Wilson	KYTC District 1 Construction
Henry Luken	KYTC District 1 Operations
Michael Oliver	KYTC District 1 Operations
Stacey Courtney	Purchase Area Development District
Ted Noe	KYTC Central Office Planning (Deputy Project Manager)
Larry Irish	KYTC Central Office Traffic Operations
Frank Bush	KYTC Central Office Highway Design
Gary Bunch	KYTC Central Office Environmental Analysis
Brent Sweger	KYTC Central Office Planning (Project Manager)

Murray 5-Points Intersection Improvement
Project Team Meeting 1
Meeting Minutes
September 12, 2005
10:30 am (CT)

Attendees:

Tim Choate	DO Pre-construction
Stacey Courtney	Purchase ADD
Chris Kuntz	DO Design
Henry Luken	DO Operations
Michael Oliver	DO Operations
Allen Thomas	DO Planning
Jeff Thompson	DO Planning
Randy Williams	DO Traffic
Everett Wilson	DO Construction
Gary Bunch	CO Environmental Analysis
Frank Bush	CO Highway Design
Larry Irish	CO Traffic Operations
Ted Noe	CO Planning
Brent Sweger	CO Planning (Project Manager)

1. Project Purpose & Goals – A draft of project purpose and goals was passed out and discussed. The team reached consensus of both the purpose and goals with the understanding that they may be modified as the study progresses.

    - Purpose: To improve the traffic flow and delays at the 5-Points intersection
    - Goals
        i. Improve traffic flow & reduce delays to LOS C or better for all legs during peak hours (current LOS as calculated by D-1 is LOS D)
        ii. Maintain or improve vehicular safety
        iii. Improve walking conditions and pedestrian safety
        iv. Improve biking conditions and bicyclist safety
        v. Provide an attractive entryway to the MSU campus

2. Data: The environmental footprint, aerial photograph, and crash history were shown to the team. D-1 staff also presented ground-level photographs to understand the existing conditions. Murray State University agreed to conduct new turning movement counts for the peak hours at the intersection (completed September 8, 2005).

3. Additional data that will be needed is:

    - 20-year traffic forecast (ADT and peak hour turning movements) for the alternates.
    - Review of environmental justice conditions and impacts will be needed.
    - Plans from MSU on the growth and changes being considered that will affect this area.
    - Willingness of both City and MSU to contribute to this project
    - Utility locations
    - Cost estimate of alternatives

4. Issues: The following issues and questions were raised by project team members:

    - There is discussion that Brinn Road will be improved and connect the new KY 80 project to the north to this area via 16th street. This could increase the traffic accessing MSU at the intersection.
    - Concern about accommodating bicyclists and pedestrians
    - Utilities – it appears to have a lot of utilities (water, sewer, gas, electric, cable) that will affect project design and construction cost.
    - There is a desire by MSU and the city to improve 16th street from 5-Points north to KY 121.
    - Possible underground fuel storage tank on north property (car lot).

5. D-1 staff presented some potential alternates that had been developed by a consultant for MSU in 2003. The team discussed these alternates and brainstormed to determine a list to carry forward. Alternates to be considered:

    i. 5-leg intersection
        1. with roundabout
        2. with proper turning lane improvements and signal retiming
    ii. 4-leg intersection with Coldwater Rd rerouting to north 16th Street
        1. roundabout at both intersections
        2. roundabout at one intersection
        3. conventional intersections at both
    iii. 4-leg intersection with Coldwater Rd rerouting to College Farm Rd
        1. roundabout at both intersections
        2. roundabout at one intersection
        3. conventional intersections at both
    iv. 4-leg intersection with Coldwater cul-de-sac
    v. 1-way couplet Coldwater outbound, N16th inbound

6. Public Involvement – Because this is a preliminary study and there are no funding commitments at this time for construction, the project team decided that involvement be limited to meetings with staff of the city and MSU.

7. Future Public Involvement – As funding becomes available, the project team will provide more direct outreach with business owners and the general public. If a major change such as rerouting Coldwater or the use of a roundabout is chosen as the preferred solution, then it will require a public education campaign to teach drivers how to maneuver the area.

8. 16th Street (north leg between 5-Points and KY 121) has several deficiencies in geometrics (width, vertical alignment, sight distance) that need to be addressed in a future project. There is a 1-block segment of this link that is not designated a part of the state-maintained highway system.

9. Analysis: Each alternate will need to be examined for peak hour LOS delay and queues. A decision on the preferred solution will include delay, queue length, cost, and impacts.

Murray 5-Points Intersection Improvement
Meeting with Murray State University
Meeting Minutes
September 12, 2005
2:30 pm (CT)

Attendees:

Tim Choate	DO Pre-construction
Allen Thomas	DO Planning
Dewey Yates	Murray State University
Kim Oatman	Murray State University
Frank Bush	CO Highway Design
Larry Irish	CO Traffic Operations
Ted Noe	CO Planning
Brent Sweger	CO Planning (Project Manager)

1. Introductory remarks – the goals of the project were explained to the MSU staff. The purpose of the meeting was to find out the university's issues, concerns and desires for the project.

2. MSU Growth – Discussion of planned development and anticipated growth of the university were outlined. New fields and tennis courts were built on the east side of 16th Street (north). Potential residential growth could take place along the west side of 16th Street (north), although nothing is planned at this time. A parking lot and access road were also recently built in the northeast quadrant of the intersection. They have anticipated residential dormitory growth along Waldrup. Additional academic buildings are being planned along the west side of 16th Street (south).

3. Project Issues: The MSU administration wants the project to address the traffic situation at 5-Points intersection. They want their future growth plans to be considered and to minimize the impacts to their facilities. They would like to see the aesthetics of the intersection and vicinity improved since 5-Points will serve as a major entrance. They would like a roundabout to be considered as an option since President Alexander has experienced many successful roundabouts in England.

4. Cost Sharing: MSU would be willing to share in some costs to improve the aesthetic design (light fixtures, signal poles, landscaping, signing). They would also be willing to handle the landscaping maintenance costs. They are willing to enter discussions on ROW donation to the project.

5. 16th Street (north): MSU sees improvements to the link between KY 121 and 5-Points as a much needed project. They would like it be a 2 lane with grass or landscaped median to improve the drivability and aesthetics leading to campus. They would also like a sprinkler system to be installed, which they would be willing to pay for capital, maintenance and operations.

Murray 5-Points Intersection Improvement
Project Team Meeting 2
Meeting Minutes
November 7, 2005
3:00 pm (CT)

Attendees:

Stacey Courtney	Purchase ADD
Allen Thomas	DO Planning
Jeff Thompson	DO Planning
Joel Tracy	DO Construction
Gary Bunch	CO Environmental Analysis
Frank Bush	CO Highway Design
Larry Irish	CO Traffic Operations
Jim Wilson	CO Planning
Brent Sweger	CO Planning (Project Manager)

1. Several of the scheduled district office attendees were unable to attend because of last-minute schedule conflicts. They were given opportunities to provide comments to the team prior to the meeting.

2. Brent Sweger reviewed the project purpose & goals, alternates considered, the cost estimates prepared by District 1 staff and the projected operational conditions for future 2025 traffic. Attendees discussed the benefits, costs and issues for the alternates in order to determine the recommended alternate.

3. Project Team Recommended Alternate

    - Alternate 2a Roundabout traffic control. Keeping Coldwater Road open.
    - Operations (both average delay and queuing) and Cost were best of the alternates
    - Less impacts to community and traffic patterns than 1-way couplet or dead-end of Coldwater option. ((Alt 5a, 5b, 6)
    - Did not create another intersection with realigning Coldwater Road into 16th Street (Alt 3a & 3b). This avoids adding additional conflict points onto 16th Street and the need for a left-turn lane on 16th Street.
    - Keeps flexibility for possible future improvements to 16th Street north because of limited modifications to that leg in the recommended alternate.

4. The team also discussed some issues that should be considered by the project team during the next stage of implementation (design):
    - Future traffic projections for year 2025 indicate a need for 2-lane entries from Coldwater, College Farm and 16th Street south which would most likely drive a need for a full double-lane roundabout. A design that would allow for initial opening to traffic using a single lane roundabout would be preferable and allow for minor modifications if and when traffic indicates the need for additional intersection capacity (expanding to 2 lane entries & circular roadway).
    - Sidewalks on all edges of entering roadways and crossings for all legs will be needed.

- Pedestrian design – special care must be taken in design to discourage pedestrians cutting through the central island and to encourage the use of designated crossings.
- Bicycles – with no planned trails or bicycle lanes and low speed roadways, bicycles can be accommodated using the street network. No special accommodations are planned at this time.
- Landscaping – all landscaping (plants, sprinklers, etc.) within the project area beyond the cost of seeding will be the responsibility of either local government or MSU. The same entity will be responsible for long-term maintenance of landscaping. A maintenance agreement will need to be crafted during the design stage.
- Landscaping – all landscaping materials must be chosen so that necessary sight distance can be maintained within the intersection's functional area. No fountains or statues will be allowed in the central island.
- Removal of links from state highway system – Coldwater, 16th St and Chestnut should be removed from the system because they primarily function as local roads.
- A right-turn bypass will be needed from 16th to Coldwater and from Coldwater to College Farm Road.
- An educational campaign to teach drivers and pedestrians to maneuver the roundabout is critical to its success and should be developed as part of the project.

5. Intermediate, low cost improvements were discussed to help alleviate the current traffic congestion. The first option was creating a one-way couplet for a cost of less than $200,000 (signing, markings). The project team felt that it would be difficult for the city to accept politically because of the change in traffic patterns, both from the current patterns and then back when the project is constructed. The second option considered was the change in lane-use configurations and signal timing. Based on analysis by Division of Traffic Operations, there was no recommendation that would improve the current traffic delays.

6. The meeting adjourned at approximately 4:40pm CT.

Murray 5-Points Intersection Improvement
Meeting with City of Murray and Murray State University Officials
Meeting Minutes
November 8, 2005
8:00 am (CT)

Attendees:

H. Thomas Rushing	Mayor, City of Murray
Don Elias	City of Murray
Thomas Clendener	City of Murray
David Roberts	City of Murray
G. Dewey Yates	Murray State University – Facilities Management
Kim Oatman	Murray State University – Facilities Management
Stacey Courtney	Purchase ADD
Jeff Thompson	DO Planning
Frank Bush	CO Highway Design
Jim Wilson	CO Planning
Brent Sweger	CO Planning (Project Manager)

1. Brent Sweger reviewed the project purpose & goals, alternates considered, the cost estimates prepared by District 1 staff and the projected operational conditions for future 2025 traffic. The Project Team Recommended Alternate was presented with the following reasons:

    - Alternate 2a Roundabout traffic control. Keeping Coldwater Road open.
    - Operations (both average delay and queuing) and Cost were best of the alternates
    - Less impacts to community and traffic patterns than 1-way couplet or dead-end of Coldwater option. (Alt 5a, 5b, 6)
    - Did not create another intersection with realigning Coldwater Road into 16th Street (Alt 3a & 3b). This avoids adding additional conflict points onto 16th Street and the need for a left-turn lane on 16th Street.
    - Keeps flexibility for possible future improvements to 16th Street north because of limited modifications to that leg in the recommended alternate.

2. The City of Murray indicated the possibility of extending Doran Road, a north-south facility to the west of the Five-Points area. This road has the potential to remove some of the traffic that would normally travel on 16th Street. This supports the option of initially constructing the road as a single-lane roundabout with the expansion to two lanes only if traffic volumes require additional intersection capacity.

3. Other issues discussed include:

    - Funding opportunities for future phases. The study recommendations will be forwarded to be considered in the development of the FY-2007-12 Six Year Highway Plan. City and university officials will discuss other funding options with their state legislators.
    - Maintenance – MSU is interested in the landscaping of the central island and other areas around the intersection. They would also like to build a sprinkler system to serve those areas as part of the construction project.

They are willing to fund the additional costs for landscaping and sprinklers. They are also willing to enter into an agreement with KYTC to maintain those areas.

- Pedestrians need to be accommodated into the design, particularly on the 16th Street south leg.
- It was agreed by all that no objects such as monuments, statues or fountains that may attract pedestrians to the central island would be allowed.
- There was a concern about large vehicles traversing a roundabout. Project team members assured that the design will accommodate a large truck and that the design will allow emergency vehicles and school buses to easily maneuver.
- Central island and roadway edge design will only permit low lying vegetation in areas necessary for sufficient sight distance.
- Education of drivers and pedestrians on how to drive/cross a roundabout intersection is necessary.
- The university expansion will take place primarily to the southwest of the Five-Points intersection. There is a possibility of expansion to the northwest but there are no definitive plans currently.

4. Both city and university officials supported the recommended alternate and justification for it's choice. They will send a letter of support to KYTC indicating so.

5. The meeting adjourned approximately 9:10am CT.

Appendix B
Division of Environmental Analysis Review

TRANSPORTATION CABINET
Frankfort, Kentucky 40622
www.kentucky.gov

Ernie Fletcher
Governor

Bill Nighbert
Acting Secretary

Marc Williams
Commissioner of Highways

INTRA-DEPARTMENTAL MEMO

TO: Daryl Greer, P.E.
Acting Director
Division of Planning

FROM: Gary Bunch.
Environmental Project Manager
Division of Environmental Analysis

RECEIVED
JAN 27 2006

DATE: November 2, 2005

SUBJECT: Five Points Intersection
Calloway County

The subject matter experts in the Division of Environmental Analysis have reviewed the information provided for the Five Points Intersection improvement study. Their comments for each environmental area are as follows:

Permits – There doesn't appear to be any big issues, but need to know the design or what will be done to give a definite answer.

UST/HAZMAT – (Map attached)
Site 1. Currently being used as an oil changing facility. Was formerly a gasoline service station. The USTs were reportedly removed approximately 5 years ago and a No Further Action (NFA) letter was issued.
Site 2. Reportedly the UST system of the Speedway station located at Site 3 was located in this area. The system was removed and upgraded approximately 3-5 years ago. It is unknown if a NFA letter associated with the former UST system has been issued by the KDWM.
Site 3. Currently operating as a Speedway filling station/convenient mart. The UST system was reportedly upgraded 3-5 years ago.
Site 4. Currently being operated as a used car dealership. Appears to have been a BP gasoline service station in the past. There is no indication that the UST system associated with the former BP station has been removed.
Site 5. Appears that this site is being used for storage. There are several retractable doors on the building indication that it may have been used as an automotive repair facility in the past.
Site 6. Currently being operated as an automotive repair station.

Biology – Calloway County has the following endangered species listed: *Myotis grisescens* (Gray bat), *Apios priceana* (Price's Potato Bean), and *Haliaeetus Leucocephalus* (Bald Eagle) according to United States Fish and Wildlife Service (FWS#05-0953 Dated June 1, 2005). This list is subject to change by the Service given any new or additional information regarding threatened or endangered species. Before funds are authorized for construction of this project, impacts to these species must be address through either a Habitat Assessment or Biological Assessment in order to comply with Sec. 7 of the Endangered Species Act (ESA) of 1973 as amended. This assessment needs to state why this project is not likely to affect, or

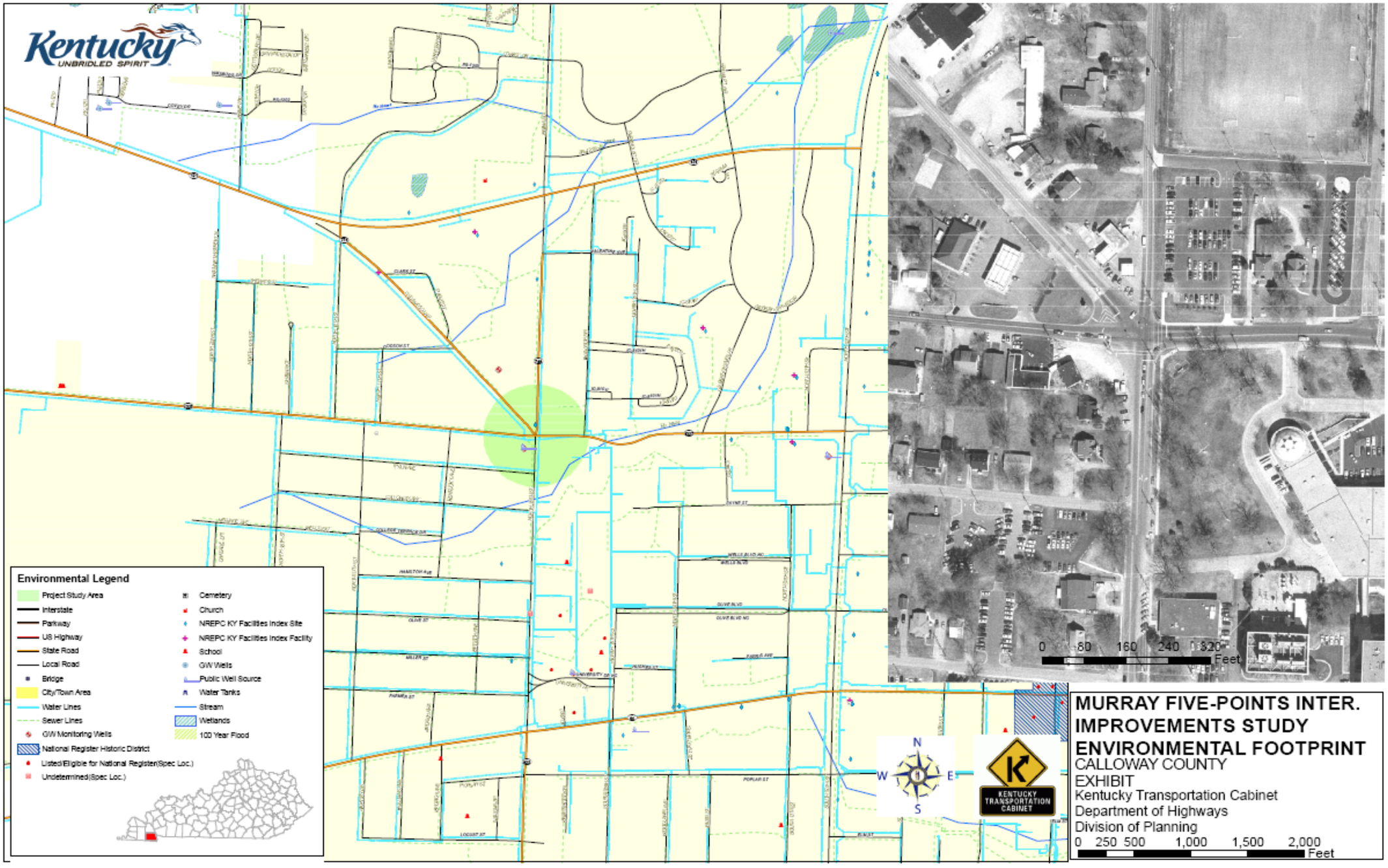
affect either of these species. Due to lack of well-defined plans, the impacts can not be guaranteed at this time.

Cultural/Historic – No sites surveyed in the area; however, a full baseline study is recommended.

Archaeology – No archaeology is required.

DMW/gb

Attachments



Study Area Environmental Footprint

Appendix C
Local Officials' Letters

Murray State University
Department for Facilities Management
615 Gilbert Graves Drive
Murray, KY 42071-3354
Phone (270) 762-4291 Fax (270) 762-6270

November 8, 2005

Mr. Brent A. Sweger, P.E.
Transportation Engineer Specialist
Transportation Cabinet
Division of Planning
200 Mero Street, 5th Floor
Mail Code, W5-05-01
Frankfort, KY 40622

Re: Five-Points Intersection Project
Murray, Kentucky

Dear Mr. Sweger:

The purpose of this letter is to express our appreciation to you and your study team for your diligent review and engineering analysis of the Five-Points Intersection. Murray State University applauds the Transportation Cabinet's efforts to re-engineer this dangerous and confusing intersection. We concur with your study as presented this morning at the Murray City Hall that the most cost effective and operationally efficient engineering solution to this problem will be a round-about. Please let us know how we can further support your efforts to improve this intersection.

Should you have any questions or require additional information from the University, please do not hesitate to contact me at 270-762-6979.

Sincerely,

G. Dewey Yeatts, Ed.D.
Chief Facilities Officer and
Associate Vice President

Cc: Mr. Kim Oatman, Director of Facilities Design & Construction

Equal education and employment opportunities M/F/D, AA employer

H. Thomas Rushing
Mayor

City of Murray

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Transportation Cabinet

November 11, 2005

Brent Sweger
Ky. Transportation Cabinet
200 Mero Street, 5th Floor, W5-05-01
Frankfort, KY 40622

RE: Murray 5-Points Intersection

Dear Mr. Sweger:

As Mayor of the City of Murray I would like to express to you our community's desire to make improvements to the 5-Points intersection here in Murray. This intersection has been identified by the Murray City Council as the top priority for local road improvements.

The 5-Points intersection serves as one of the primary entrances into Murray State University as well as a major corridor to the Calloway County School System. It also handles a great deal of traffic traveling from our residential districts to the south to the retail districts in the northern part of our community. Due to the intersection of five busy roads and the lack of sufficient turning lanes vehicles are now backing up for several blocks and often have to sit through multiple light changes before passing through the intersection.

The City of Murray is eager to partner with the Transportation Cabinet to improve the traffic congestion at this intersection and look forward to working with you in this endeavor.

Sincerely,

H. Thomas Rushing, Mayor

104 North 5th Street, Suite B - Murray, Kentucky 42071
TELEPHONE (270) 762-0350 FAX 270-762-0306 TDD 270-753-1621
Website: www.murrayky.gov