

# Capital Region Council of Governments

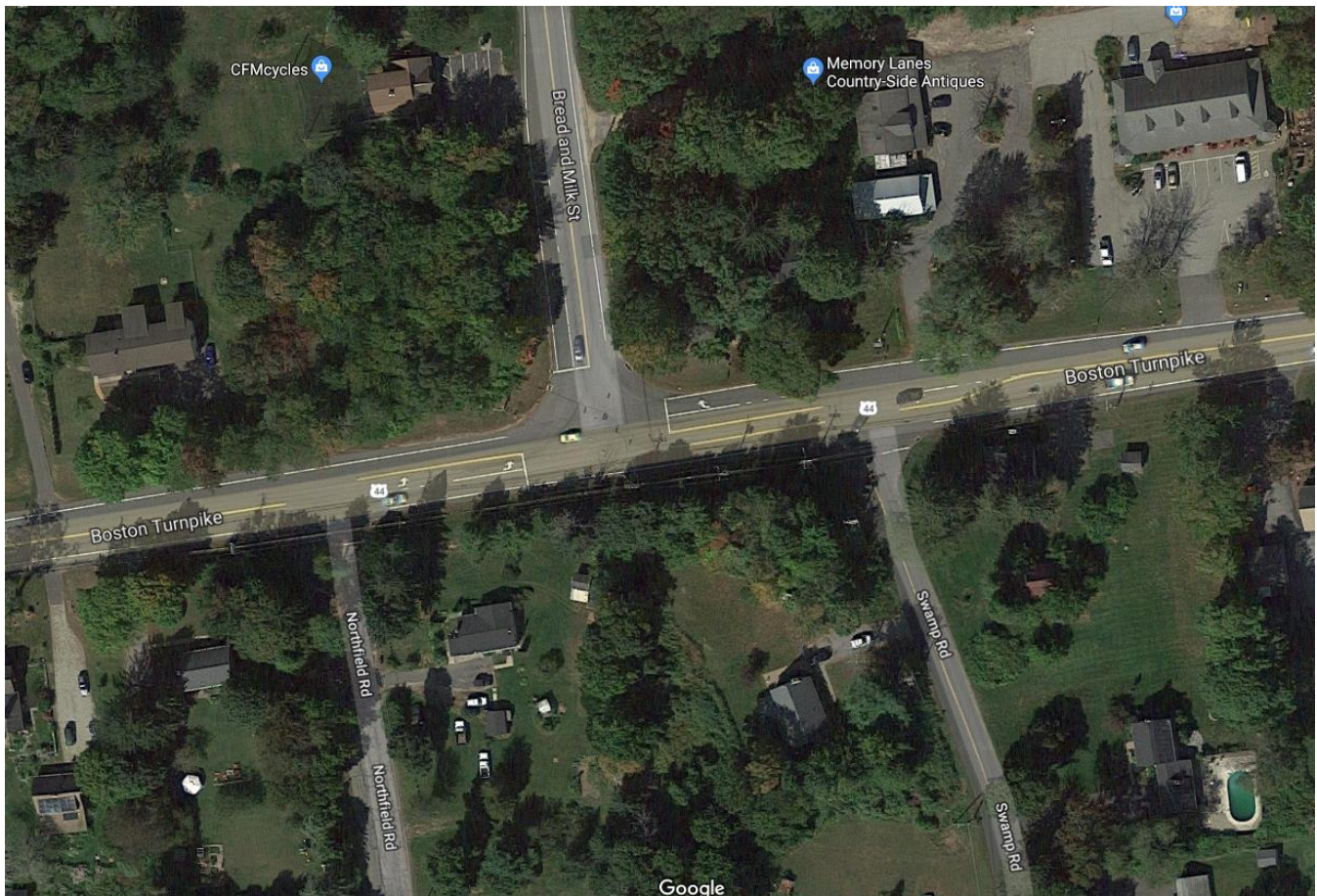
## PROJECT CONCEPT REPORT

### Realignment of Swamp and Northfield Road's approaches to Route 44 (Boston Turnpike) Town of Coventry

#### SUMMARY:

The Town of Coventry has become increasingly concerned about traffic safety and operations at the unsignalized Route 44/ Northfield Road and the Route 44/Swamp Road intersections, located just 150 feet on either side of the signalized Route 44/Bread and Milk Street (Route 31) intersection. Route 44 is a busy arterial which makes access from these sidestreets difficult, especially during the peak commuter hours where capacity analysis shows failing operations. These peak hour difficulties are compounded by queues from the nearby Route 44/Bread and Milk Street intersection routinely extending through the functional areas of the adjacent unsignalized locations. The most recent four (4) years of crash history reveals eighteen reported crashes at the two unsignalized intersections (nine at each), with four of the crashes being angle type accidents directly attributable to making difficult turning movements onto Route 44. Projected traffic increases associated with area growth (including growth surrounding UConn's Storrs campus) and a proposed Cumberland Farms development (currently in the approval process) on the northeast corner of the Route 44/Bread and Milk Street intersection add to the Town's concerns that these issues will be exacerbated.

#### PROJECT AREA



To improve existing operational and safety issues along this segment of Route 44, the Town envisions realigning Swamp and Northfield Roads' approaches to Route 44 to form a single access point opposite Bread and Milk Street under signalized control. This would necessitate significant property impacts (including a potential total take of a residence), but would allow the traffic from Swamp and Northfield Roads to enter Route 44 under safer signalized operations, with the aim of addressing the current angle crash pattern. To address operations, four (4) alternate lane arrangements for the envisioned signalized Route 44/Bread and Milk Street/Swamp Road intersection were reviewed utilizing planning level Critical Movement Analysis for 2019 and projected 2039 traffic. The 2019 traffic assumes completion and operation of the Cumberland Farms currently proposed at the northeast corner of the Route 44/Bread and Milk Street intersection. The 2039 traffic analysis utilizes traffic projected at 0.5% per year consistent with LOTCIP guidelines for projects in areas functionally classified as Urban. Based on the analysis, it was determined that the following two intersection lane arrangement alternates may satisfy both 2019 and 2039 conditions:

**Alternate 3:** Retain Bread and Milk Street's Southbound approach, provide a 2 lane (L; TR) realigned Swamp Road Northbound approach, a 3 lane (L; T; R) Route 44 Westbound approach, and a 3 lane (L; T; R) Route 44 Eastbound approach

**Alternate 4:** Retain Bread and Milk Street's Southbound approach, provide a single lane (LTR) realigned Swamp Road Northbound approach, a 3 lane (L; T; TR) Route 44 Westbound approach, and a 3 lane (L; T; TR) Route 44 Eastbound approach

**Alternate 3** involves the addition of Route 44 turn lanes, and results in 2019 operations that are similar to existing conditions, and 2039 operations within but approaching capacity during the weekday peak hours. **Alternative 4** involves the addition of both turn lanes and second eastbound and westbound through lanes on Route 44, with resulting operations for both 2019 and 2039 well under capacity.

The Town of Coventry is considering submitting a LOTCIP application for the project to the Capitol Region Council of Governments (CRCOG) as part of its 2018 solicitation. Because the project would involve modifications to a state intersection (Routes 44 and 31) and significant right-of-way acquisition, both the Town and CRCOG are interested in the Department's feedback on the project's viability prior to further advancing a concept. CRCOG has prepared this Project Concept Report to attempt to explain and quantify the likely benefits and impacts for CTDOT and Town consideration.

## EXISTING CONDITIONS:

The project area is generally sub-urban in nature with periodic commercial businesses (including some farms) spread out along Route 44 among residential land uses. Area roadways stretching north and south of Route 44 become more residential and rural in feel.

Route 44 carries heavy east-west local and commuter traffic between the more rural areas to the east and more urbanized environs to the west. Approximately 3 miles west of the project area, Route 44 merges with Route 6 westbound and becomes the I-384 expressway which carries commuter traffic towards the employment centers of Manchester and Hartford, less than 10 and 15 miles to the west, respectively. East-west traffic is generally heavier in the PM commuter peak, but does not display a real prominent commuter orientation. The lack of a clear commuter pattern aligned with employment centers to the west may be due to employment at UConn's Storrs campus and the City of Willimantic, located approximately 8 and 12 miles to the east, respectively.

Bread and Milk Street (Route 31) carries moderate north-south traffic volumes, forms interchange 67 with I-84 about 4 miles north of the project area, and continues north into Rockville. This route displays commuter pattern favoring northbound trips in the morning and southbound trips in the afternoon. Swamp Road accommodates light to moderate traffic volumes, and runs between the project area and rural environs to the south where, in combination with South Road, it provides access to Route 6. As with Bread and Milk Street, Swamp Road displays a commuter pattern somewhat favoring a northbound morning commute with southbound afternoon return trips. Northfield Road provides access to and from Route 44 for a residential development containing just over 70 homes on a handful of small residential streets. This development also has direct access to Swamp Road via Forge Road.

The "T" intersection of Route 44 and Bread and Milk Street is signal controlled. Route 44's posted speed limit is 45 mph near and through the intersection. Both Swamp and Northfield Roads approach Route 44 from the south, and each terminate at and form unsignalized "T" intersections with Route 44. The approaches of both Swamp and Northfield Roads are under "STOP" sign control, with Route 44 being the uncontrolled through street under free-flow. These unsignalized intersections are located less than 150 feet east and west of the signalized Bread and Milk Street intersection, resulting in only approximately 110 feet of queuing distance available on Route 44 (in each direction) without blocking the movements out of the adjacent unsignalized sidestreets.

### ***Roadway Functional Classifications:***

Route 44	Minor Arterial (bordering between Urban and Rural designations)
Bread and Milk Street	Urban Collector
Swamp Road	Major Collector (bordering between Urban and Rural designations)
Northfield Road	Rural Local Road

### ***Existing Traffic Data and Operations:***

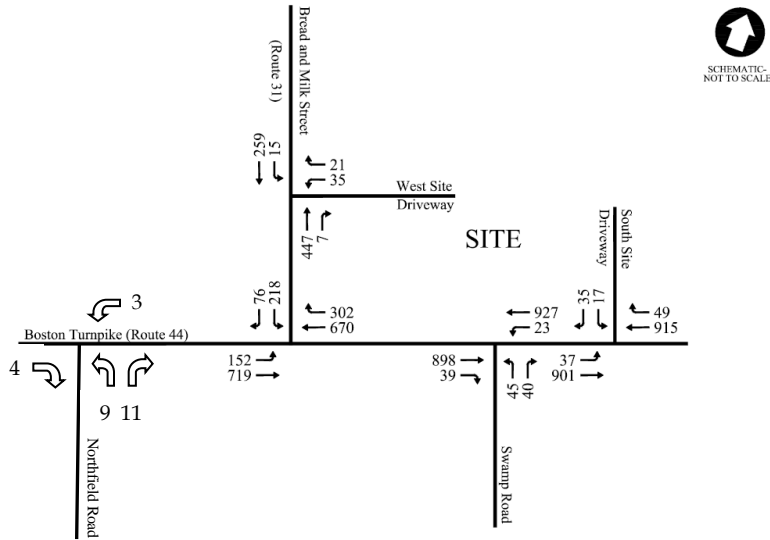
The following average daily traffic (ADT) was collected from 2014 CTDOT ADT maps for Coventry:

<b><u>Road</u></b>	<b><u>2014 ADT</u></b>
Route 44 (just east intersection)	18,200
Route 44 (just west intersection)	15,800
Bread and Milk Street. (just north of intersection)	4,600
Swamp Road (just south of intersection)	1,200
Northfield Road (just south of intersection)	350*

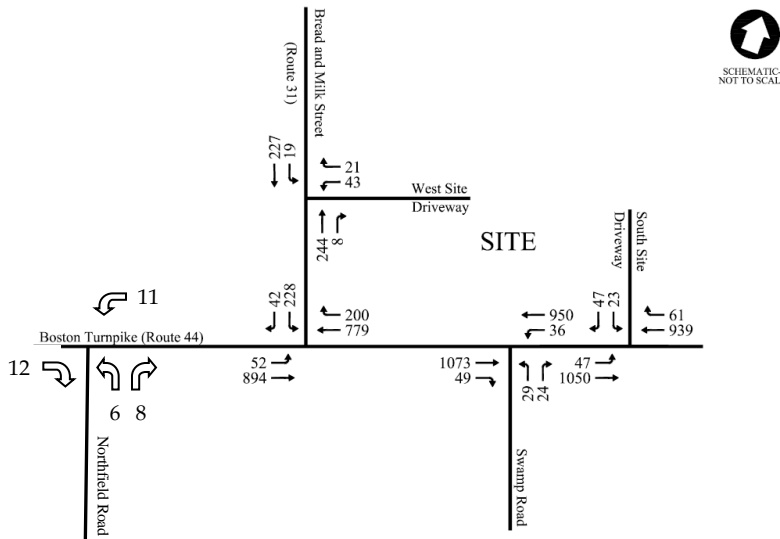
\* estimated using ITE Trip Generation Manual-7<sup>th</sup> Edition assuming half of all trips from the 70+ homes enter and exit the area using Northfield Road, with others utilizing Swamp Road

Exhibits 1 and 2 show peak hour turning movement volumes from the Impact Study under the Cumberland Farms “build” scenario, along with CRCOG estimated traffic for Northfield Road based on the ITE Trip Generation Manual – 7<sup>th</sup> Edition (and assuming trips to and from the development located south of Northfield Road are equally split between utilizing Northfield Road and Swamp Road).

**Exhibit 1: 2019 Weekday Morning Peak Hour Traffic Volumes (with Cumberland Farms Development)**



**Exhibit 2: 2019 Weekday Afternoon Peak Hour Traffic Volumes (with Cumberland Farms Development)**



**Current Traffic Operations:** Traffic analysis was performed as part of the November 2017 Cumberland Farms Development Traffic Impact Study for Route 44’s intersections with Bread and Milk Street and Swamp Road. The Route 44/Northfield Road intersection was not included in the study. As shown in Exhibits 3 and 4, under each peak weekday commuter hour scenario, capacity analysis at the Route 44/Bread and Milk Street intersection revealed acceptable Levels-of-Service (“B” and “C”), and capacity analysis at the Route 44/Swamp Road intersection revealed failing Levels-of-Service (“F”) at Swamp Road’s “STOP” controlled approach to Route 44. The study did not include analysis of the nearby Route 44/Northfield Road intersection, however field observations

show similar failing operations for vehicles exiting Northfield Road. The analysis also quantified intersection queuing, and as shown in Exhibit 5, Route 44 peak hour eastbound and westbound queuing routinely stretches from the signalized Bread and Milk Street intersection through the adjacent intersections with Swamp and Northfield Roads, exacerbating the already failing unsignalized operational issues. Due to this, it's CRCOG's opinion that the traffic study's marco-analysis (viewing each intersection separately) likely underrepresents area operational issues, and a micro-simulation model (such as SimTraffic or VISSIM) may more accurately quantify existing problems.

**Exhibit 3: Signalized Peak Hour Capacity Analysis (Build denotes Cumberland Farms development)**

Intersection	Period	2017 Existing			2019 No Build			2019 Build		
		LOS <sup>1</sup>	Delay <sup>2</sup>	V/C <sup>3</sup>	LOS	Delay	V/C	LOS	Delay	V/C
Boston Turnpike at	AM	B	14.9	0.80	B	15.2	0.81	B	16.9	0.84
Bread and Milk Street	PM	B	19.9	0.89	C	20.5	0.90	C	23.7	0.92

1 Level-of-Service

2 Average vehicle delay in seconds

3 Volume to capacity ratio

**Exhibit 4: Unsignalized Peak Hour Capacity Analysis (Build denotes Cumberland Farms development)**

Intersection	Movement	Period	2017 Existing			2019 No Build			2019 Build			
			LOS <sup>1</sup>	Delay <sup>2</sup>	V/C <sup>3</sup>	LOS	Delay	V/C	LOS	Delay	V/C	
Boston Turnpike at	NB	LR	AM	F	107.8	0.82	F	124.0	0.88	F	159.7	0.99
Swamp Road			PM	F	143.2	0.78	F	168.8	0.86	F	176.9	0.91

1 Level-of-Service

2 Average vehicle delay in seconds

3 Volume to capacity ratio

n/a Not Applicable

**Exhibit 5: Peak Hour Queuing Analysis (Build denotes Cumberland Farms development)**

Weekday Morning Peak Hour								
Intersection	Movement	2017 Existing			2024 No Build		2024 Build	
		50th Queue <sup>1</sup>	95th Queue <sup>2</sup>	50th Queue	95th Queue	50th Queue	95th Queue	
Boston Turnpike (Route 44) at	EB	L	18	36	19	37	21	38
Bread and Milk Street (Route 31)		T	128	212	135	220	155	234
	WB	T	232	370	243	383	269	410
	R		0	36	0	36	0	36
	SB	L	84	#190	87	#194	105	#238
	R		0	36	0	35	0	36
Weekday Afternoon Peak Hour								
Intersection	Movement	2017 Existing		2024 No Build		2024 Build		
		50th Queue <sup>1</sup>	95th Queue <sup>2</sup>	50th Queue	95th Queue	50th Queue	95th Queue	
Boston Turnpike (Route 44) at	EB	L	6	13	6	14	7	15
Bread and Milk Street (Route 31)		T	192	293	200	306	214	331
	WB	T	337	#579	350	#599	379	#643
	R		0	30	0	31	0	30
	SB	L	111	#189	117	#196	140	#245
	R		0	24	0	24	0	25

1 50th Percentile Queue Length, in feet

2 95th Percentile Queue Length, in feet

n/a Not Applicable

**Recent Crash Data:** CRCOG queried the UConn Crash Repository for the latest 4 years of reported crashes at the three study area intersections. Between January 1, 2014 and December 31, 2017, 38 crashes (24 rear-end type) were reported. Nine (9) crashes were coded as occurring closest to the Northfield Road intersection, twenty (20) closest to the Bread and Milk Street intersection, and nine (9) nearest the Swamp Road intersection. Exhibit 6 shows the number of total crashes attributable to each intersection for each year. At Northfield Road, two (2) crashes were

determined to be angle type associated with vehicles attempting to enter Route 44 traffic. Similarly, at Swamp Road two (2) crashes were determined to be angle type associated with vehicles attempting to enter Route 44 traffic. Due to a lack of crash description detail, it not possible to determine the exact cause of many of the other sideswipe and rear-end crashes. It should be noted that more crashes were observed in 2017 (21 crashes) than the three prior years combined (17 crashes), which seems to point to either an anomaly in actual crash history or in crash database operations. Additionally, the Cumberland Farms proposal includes an unsignalized access driveway on the north side of Route 44 just east of Swamp Road which will further add conflict points to the area.

**Exhibit 6: 2014-2017 Crash Data as attributed to Area Intersections**

Year	Rt. 44 at Northfield Road	Rt. 44 at Bread and Milk Street	Rt. 44 at Swamp Road	Area Total
2014	1	2	1	4
2015	3	2	0	5
2016	0	6	2	8
2017	5	10	6	21
<b>2014 thru 2017</b>	<b>9</b>	<b>20</b>	<b>9</b>	<b>38</b>

*Existing Geometric Data:* There does not appear to be any non-conforming geometric issues. Intersection sight distances seem to be adequate based on data included in the Cumberland Farms traffic impact study and a cursory review of google street-view.

## PROJECT CONCEPT:

The Town has drafted the concepts appearing in Exhibit 7 below. Each concept includes the realignment of Swamp Road to access Route 44 directly opposite Bread and Milk Street resulting in a standard four-leg signalized location. Each alternative also includes the elimination of the Route 44/Northfield Road intersection by realigning Northfield Road to form an intersection with Swamp Road just south of Route 44. As an additional alternative, instead of realigning Northfield Road, it may be desirable to cul-de-sac it just south of Route 44, thereby eliminating property acquisitions associated its realignment. For the cul-de-sac option, the access that Northfield Road provides to the local neighborhood would be provided by the existing connection to Swamp Road via Forge Road (just south of Exhibit 7's image limits).



**Safety:** The concepts aim to improve safety by consolidating Swamp and Northfield Road traffic and providing access to Route 44 at a single signalized location opposite Bread and Milk Street. As indicated in the existing conditions, the concept would directly address four (4) angle collisions that were associated with vehicles exiting the unsignalized locations in the last four (4) years. It is not known how many additional collisions the concept may address, as exact cause of many of the rear-end and sideswipe crashes could not accurately be determined from the crash data output. The concept would also simplify potentially problematic traffic movements that may arise between the existing Swamp Road intersection and the proposed Cumberland Farms driveway, which is to be located on the north side of Route 44 just east of existing Swamp Road.

**Reassigned 2019 and Projected 2039 Traffic Volumes:** Traffic for the proposal was determined by reassigning the traffic turning movements from the Traffic Impact Study (assuming Cumberland Farms is fully operational) that were associated with Swamp Road to the new roadway network and superimposing generated and distributed traffic movements from Northfield Road. Traffic distributions to the network were assigned as merited by the observed existing traffic splits (percentages). The resulting reassigned 2019 peak hour turning movements are shown in Exhibit 8.

LOTICIP guidelines indicate that projects should be designed to accommodate 20 years of projected traffic growth. The guidelines also dictate that 20 year traffic growth of 10% (0.5% per year) should be utilized for projects in areas functionally designated as urban. Most of the project area is functionally designated as urban, and therefore traffic growth of 10% was utilized to determine the future 2039 turning movement volumes shown in Exhibit 9.

**Exhibit 8: Reassigned 2019 Turning Movement Volumes**

Morning Route 44 at Bread and Milk	NB			WB			SB			EB		
	L	T	R	L	T	R	L	T	R	L	T	R
2019 AM Build	40	16	49	26	636	288	209	9	76	150	680	34
2019 PM Build	29	7	31	47	745	194	219	9	42	51	847	52

**Exhibit 9: Projected 2039 Turning Movement Volumes**

Route 44 at Bread and Milk	NB			WB			SB			EB		
	L	T	R	L	T	R	L	T	R	L	T	R
2039 AM Build	44	18	54	29	700	317	230	10	84	165	748	37
2039 PM Build	32	8	34	52	820	213	241	10	46	56	932	57

**Realigned Intersection Traffic Operations:** For this project concept report, a simplified “planning level” traffic analysis was performed for the realigned concept Route 44/Bread and Milk Street/Swamp Road 4-leg signalized intersection. The “Quick Estimation Method” was utilized as described in detail in the 2010 Highway Capacity Manual and in Section 3.3.6 of the FHWA Signal Timing Manual, where it is referred to as a “Critical Movement Analysis”. This simplified analysis yields an approximate critical volume/capacity ratio that can be used to assess overall operation of the intersection. Critical Movement Analysis was performed for the concept with four (4) alternate intersection lane arrangements. Each analysis utilized a similar three (3) phase operation and 84 second cycle length as modeled in the Cumberland Farms Traffic Impact Study. The results appear in Exhibit 10. Based on the analysis, it was determined that the following two intersection lane arrangement alternates may satisfy both 2019 and 2039 conditions.

**Alternate 3:** Retain Bread and Milk Street’s Southbound approach, provide a 2 lane (L; TR) realigned Swamp Road Northbound approach, a 3 lane (L; T; R) Route 44 Westbound approach, and a 3 lane (L; T; R) Route 44 Eastbound approach

**Alternate 4:** Retain Bread and Milk Street’s Southbound approach, provide a single lane (LTR) realigned Swamp Road Northbound approach, a 3 lane (L; T; TR) Route 44 Westbound approach, and a 3 lane (L; T; TR) Route 44 Eastbound approach

**Alternate 3** involves the addition of Route 44 turn lanes, and results in 2019 operations that are similar to existing conditions, and 2039 operations within but approaching capacity during the weekday peak hours. **Alternative 4** involves the addition of second eastbound and westbound through lanes, with resulting operations for both 2019 and 2039 well under capacity. It should be noted that if one or more of these concepts are to be explored in more detail, then a more sophisticated design level traffic analysis may need to be performed.

**Rights of Way:** It’s apparent from Exhibit 7 that each concept involves major right-of-way acquisition, including the potential total taking of a residential property. The magnitude of the right-of-way impacts is anticipated to be a major factor if a concept moves forward. As previously mentioned, an alternative not shown in Exhibit 7 could involve cul-de-sac’ing Northfield Road just south of Route 44 instead of realigning it, thereby eliminating some of the required property acquisitions. For the cul-de-sac option, the access that Northfield Road provides to the local neighborhood would be provided by an existing connection to Swamp Road via Forge Road (just south of the provided image’s limits).



**Funding:** CRCOG has recently issued a 2018 solicitation for LOTCIP projects. The Town has inquired regarding this concept's viability with the intention of submitting a LOTCIP application for a project if it is deemed feasible. If an application is submitted, the project would be rated utilizing CRCOG project selection criteria and would compete for funding versus the other project proposals the region receives. If the project were selected, the application for LOTCIP funding would be forwarded to CTDOT. However, if the project is selected and LOTCIP funding were to be discontinued, the project would be submitted to CTDOT for use of STP-Urban funding.

A preferred project concept and lane arrangements has not yet been selected, and formal cost estimates for the project concepts have not yet been prepared. However, it should be noted that CRCOG currently caps participating LOTCIP funding for project applications at \$3 million.

**Exhibit 10: Weekday Peak Hour Traffic Operations for Project Concept with Alternate Lane Arrangements**

<b>Alternate 1</b>		<b>v/c</b>	<b>Est. LOS</b>
In addition to existing, provide a 2 lane (L; TR) realigned Swamp Road Northbound approach	2019 AM	<b>1.26</b> ****	<b>F</b>
	2019 PM	<b>1.49</b> ****	<b>F</b>
	2039 AM	<b>1.38</b> ****	<b>F</b>
	2039 PM	<b>1.63</b> ****	<b>F</b>
<b>Alternate 2</b>		<b>v/c</b>	<b>Est. LOS</b>
In addition to existing, provide a 2 lane (L; TR) realigned Swamp Road Northbound approach, and a 3 lane (L; T; R) Route 44 Westbound approach	2019 AM	<b>0.81</b> *	<b>C or better</b>
	2019 PM	<b>0.92</b> **	<b>D</b>
	2039 AM	<b>0.89</b> **	<b>D</b>
	2039 PM	<b>1.01</b> ****	<b>F</b>
<b>Alternate 3</b>		<b>v/c</b>	<b>Est. LOS</b>
In addition to existing, provide a 2 lane (L; TR) realigned Swamp Road Northbound approach, a 3 lane (L; T; R) Route 44 Westbound approach, and a 3 lane (L; T; R) Route 44 Eastbound approach	2019 AM	<b>0.81</b> *	<b>C or better</b>
	2019 PM	<b>0.88</b> **	<b>D</b>
	2039 AM	<b>0.89</b> **	<b>D</b>
	2039 PM	<b>0.97</b> ***	<b>E</b>
<b>Alternate 4</b>		<b>v/c</b>	<b>Est. LOS</b>
In addition to existing, provide a single lane (LTR) realigned Swamp Road Northbound approach, a 3 lane (L; T; TR) Route 44 Westbound approach, and a 3 lane (L; T; TR) Route 44 Eastbound approach	2019 AM	<b>0.71</b> *	<b>C or better</b>
	2019 PM	<b>0.61</b> *	<b>C or better</b>
	2039 AM	<b>0.78</b> *	<b>C or better</b>
	2039 PM	<b>0.68</b> *	<b>C or better</b>

\* v/c < 0.85; Intersection operating under capacity. Excessive delays are typically not experienced.

\*\* v/c 0.85-0.95; Intersection operating near its capacity. Higher delays may be expected, but continuously increasing queues should not occur.

\*\*\* v/c 0.95-1.00; Unstable flow results in a wide range of delay. Intersection improvements will be required soon to avoid excessive delays.

\*\*\*\* v/c > 1.00; The demand exceeds the available capacity of the intersection. Excessive delays and queuing are anticipated.