EVALUATION OF

HIGHWAY IMPROVEMENT ALTERNATIVES

IN MILFORD, NEW HAMPSHIRE

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DEPARTMENT OF PLANNING
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Project #907201
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I. INTRODUCTION

The Town of Milford has identified a need for traffic and highway improvements to improve traffic management in the vicinity of the Milford Oval and the impacts these improvements will have throughout the Town. As the region has grown over the past decades, the traffic has increased substantially creating noticeable burden on The Oval. The continuation of development in the region will increase the demands on the management of traffic throughout the Town. Figure 1 – Site Location Map, shows the Town relative to the nearby cities of Manchester and Nashua.

Milford is situated along several major east-west highways, NH Route 101 and NH Route 101-A, the traffic has steadily increased over the years. The major employment and population centers for these corridors are the towns of Bedford and Merrimack and the cities of Keene, Manchester, and Nashua. With Milford being located in the middle of these employment and population centers, it has a high volume of commuter traffic and a significant amount of truck traffic that burdens the roadway system on a daily basis. The development of commercial, industrial, retail, and residential uses is increasing throughout the region with the highest density of development occurring near the employment and population centers.

The infrastructure improvements the Town has made to The Oval and the sense of community that The Oval exudes are qualities that should be preserved. The historical significance of the buildings, the stone bridge, and The Oval itself are constant reminders of the Town's heritage. The increased demands for traffic capacity and services the Town provides and offers in The Oval will put a premium on traffic management.

In identifying projects that will address the traffic management needs of the Town, the utilization of the State's Ten-Year Plan is the funding mechanism to try and bring these projects to fruition. Once the Town identifies specific projects and makes the necessary requests through the Nashua Regional Planning Commission (NRPC) for funding through the State's Ten-Year Plan, a Public Process is started to identify projects that warrant inclusion onto the Ten-Year Plan. The identification of short-term and long-term alternatives for traffic management will be the catalyst in which the Town will be able to prioritize the projects to be included in the request for funding through the Ten-Year Plan. The traffic forecasting and modeling, conceptual designs, and construction cost estimates developed through this process will provide the Town with the necessary tools for the NRPC to consider and present during the Public Process in the formation of the Ten-Year Plan.

HTA in conjunction with the Town and NRPC has coordinated these planning and engineering efforts to successfully establish individual projects to be included in the Ten-Year Plan.

A. Existing Traffic Data

The first step of the study was to compile all of the available traffic data that has been collected over the last five years either from the Nashua Regional Planning Commission and the New Hampshire Department of Transportation or from traffic impact studies conducted for proposed developments. Table 1 is a list of all the traffic studies that were utilized for this study.

B. Traffic Studies By Others

TABLE 1

TRAFFIC STUDIES BY OTHERS

#	Date	By	Site Name	Data
1	11/7/95	VHB	BROX	TURNING CTS AT 4 LOCATIONS WITH PROJECTIONS
2	10/21/96	NRPC	FEDERAL HILL ROAD	ATR COUNT SOUTH OF FOSTER ST
3	Oct-97	NRPC	ELEMENTARY SCHOOL	TURNING COUNTS ON ELM AT 3 LOC & ATR WEST OF UNION
4	11/30/00	CHA	BROX	TURNING COUNTS AT 4 LOCATIONS WITH PROJECTIONS
5	9/18/00	SGP	TONELLA Road	TURNING COUNT S AT 7 LOCATIONS WITH PROJECTIONS
6	10/23/96	MERIDIAN	FEDERAL HILL RD MONSON	TURNING CT AT COBBLESTONE DRIVE (am & pm)
7	Mar-96	DJK	BADGER HILL	TURNING CTS AT 3 LOCATIONS WITH PROJECTIONS ON OSGOOD AND ARMORY ROAD, ATR CTS - OSGOOD S OF BURNS RD, ARMORY E OF MELENDY, EMERSON E OF NH13, & NH 13 SOUTH OF ARMORY. **INCLUDES A CONCEPTUAL IMPROVEMENT**
8	Aug-99	SGP	TONELLA Road	ORIGINAL STUDY - SEE #5
9A&9B	Sep-99	NRPC	NH 101 CORRIDOR 2-PARTS	ATR WILTON/MILFORD TL ADT IS 22,605 (SEE PROJ PG 23), IMPROVE INT 101 & WILTON RD,
10	2/18/99	SGP	MILFORD RECREATION FACILITY	**CONCEPTUAL IMPROVEMENT DESIGN**
11	Jan-96	NRPC	BROOKLINE TRAFFIC	PAGE 8 & 9 LIST NEW ROADS - HOOD ROAD AND ADAMS ROAD
12	Dec-99	VHB	RICHMOND COMPANY	TURNING CTS AT 4 INTERSECTIONS (SAT & PM) W/CONCEPTUAL IMPROVEMENT
13	Apr-01	CLD	HITACHI CORP.	TURNING CTS AT 4 INTERSECTIONS (AM & PM) W/TWO ATR COUNTS

C. Base Plan

Base plan information was provided by a number of sources. Most of the existing maps are in paper form and not readily usable as report exhibits. Paper maps include the

Official Town Map, FIRM Flood Insurance maps and the Brox Site Industrial Park Master Plan by Clough Harbor Associates. Plans developed for the Downtown Revitalization Project constructed in 1996 were electronically scanned and used as a base for roadway improvements in the Oval area. The Milford Zoning Map was provided in electronic form by Meridian Land Services, which was used for all of the other maps developed as part of this project.

D. Traffic Data Collected By Nashua Regional Planning Commission (NRPC)

1. Traffic Counts

Manual and automatic traffic counts were taken by NRPC to supplement the traffic data from traffic impact studies discussed previously. Data in critical areas was used to examine levels of service and to determine what improvements will be required. Figure 2 shows the Average Daily Traffic Volumes town wide and Figure 3 shows the Average Daily Traffic Volumes near the Oval for both new and existing Automatic Traffic Recorder (ATR) counts. Figures 4 shows the locations of the manual intersection counts town wide and Figure 5 shows the locations of the manual intersection counts near the Oval. From examination of existing data it appears that the critical peak for design is from 4 to 7 PM and the peak hour is from 5 to 6 PM. For this level of study AM and Saturday peak counts are not used. Manual traffic counts taken by NRPC at the following locations are included in Appendix A:

Peak hour turning counts at the following intersections:

a. Intersections with Elm Street or Nashua Street (101A)
    1. Westchester Drive
    2. West Street
    3. All turns on the Oval
    4. Ponemah
b. Intersections with South Street /Mont Vernon Street (NH 13)
    1. Union Street
    2. North River Road
c. Intersections with Osgood Road
    1. West Street
    2. Union Street
d. Intersections with Union Street
    1. Lincoln Street
e. Intersections with South Street
    1. Lincoln Street
    2. Clinton Street

Automatic Traffic Recorder Counts with a minimum of two complete weekdays of data were conducted at the following locations:

a. Ponemah Hill Road north of Route 101
b. Ponemah Hill Road south of Stable Road

c. Lincoln Street west of South Street
d. Cottage Street south of Route 101a

Automatic Traffic Recorder Count data is included in Appendix B.

II. MILFORD OVAL TRAFFIC STUDY – 1987– by Dufresne-Henry

This study identified traffic problems in and around the Milford Oval in 1987. These problems included the observation that traffic using the Oval was semi-local traffic or through traffic and not local traffic using surrounding businesses, the circular traffic pattern around the Oval combined traffic volumes that would otherwise not be combined, and the on-street parking impacted the flow of the traffic and reduced the widths of the travel lanes. To address these problems and provide traffic service through the Oval while retaining its historic and business characteristic, Durfresne-Henry (D-H) suggested decreasing the volume of traffic by diverting traffic away from the Oval.

The following is a summary of their suggestions and alternatives including short-term alternatives, long-term alternatives, and physical/geometric alternatives.

A. Possible Short Term Alternatives

1. Scheme # 1 – Reduce volume of traffic by redirecting traffic away from the Oval.

In this scheme four suggestions were made:

- The first suggestion involved expediting the construction of a bridge connecting North River Road and the 101 bypass in hopes that it would provide relief to the traffic volume issues. Increased signage to direct traffic and encourage the use of the bridge was also suggested. *The North River Road bridge project was completed in the early 1990's.*
- The second suggestion was to redirect traffic traveling from Elm Street to South Street via Lincoln Street by denying a right turn onto South Street from the Oval/Elm Street. This would result in a signal being required at the intersection of Elm Street and Union Street. Also, traffic traveling from Nashua Street would need to use High Street or Clinton Street to access South Street.
- In a third suggestion D-H recommended that Clinton Street be used for westbound traffic only and South Street be used for northbound traffic only from Clinton Street north. They noted that if Clinton Street were to be used for a higher volume of two-way traffic, additional work and widening would be required.
- The fourth and final suggestion of this scheme suggested that Middle Street be opened to westbound traffic only. Each suggestion was encouraged to be considered individually as well as in conjunction with each other.
- *None of the improvements were made with the exception of the bridge at North River Road.*

2. Scheme # 2 - Reduce volume of traffic by redirecting traffic away from the Oval.

In this scheme five suggestions were made:

- The first suggestion, as in scheme number one, was to expedite the construction of a bridge connecting North River Road and the 101 bypass.
- The second was to limit traffic on Nashua Street to eastbound traffic from the Oval to School Street and to limit traffic on South Street to southbound traffic from the Oval to High Street. This would divert traffic traveling from Nashua Street to Elm Street via School Street to Middle Street and then through the Oval or via Clinton Street to South Street to Lincoln Street and then to Elm Street. The first of these routes was preferable since it included fewer left turns.
- The third suggestion was to make West Street open to southbound traffic only and Union Street to northbound traffic only. In the fourth suggestion of this scheme, D-H suggested traffic on Clinton Street to travel southbound only and traffic on High Street to travel northbound only. The final suggestion was again to make Middle Street open to westbound traffic only.
- *None of the improvements were made with the exception of the bridge at North River Road.*

3. Scheme # 3 – Drastic Measures

In this scheme, D-H, considering "drastic measures", suggested redirecting 101A and Route 13 South traffic to the bypass completely avoiding the Oval. They felt signage alone would not accomplish this task and suggested using segments of directional flow to limit the number of parallel routes available through town. This, with the limited number of bridges across the Souhegan River, would make traveling extremely difficult for motorists and emergency service vehicles. *Action has not been taken on this consideration.*

Signage is probably the only reasonable way to promote this rerouting. The suggested rerouting was over simplified as both NH Route 101A and NH 13 are state routes which cannot realistically be eliminated.

B. Physical and Geometric Alternatives

D-H recommended several physical and geometric alternatives:

- The first recommendation was to install traffic signals at major approach intersections and feeder-streets. These intersections would include the intersection of Elm Street and Union Street, Nashua Street and School Street, and Mont Vernon Street and Amherst Street. The goal of this concept was to create a

uniform flow of traffic through the Oval or to create staggered movements of traffic through the Oval.

- The second suggestion was to create a four way signalized intersection at the intersection of South Street and Nashua Street. D-H commented that this suggestion would be hard to implement due to the misalignment of Elm Street and Nashua Street, the sharp and narrow turning radius onto South Street from Elm Street, and the interference of on street parking with road widths and traveling lanes. Following this suggestion D-H suggested another alterative to modify the intersection of South Street and Nashua Street. This suggestion involved fixing the turning radius and sight distance at the right turn onto South Street. It also recommended addressing the misalignment of Elm Street and Nashua Street, and addressing the issue of on-street parking.
- The fourth recommendation was to eliminate on-street parking and create off-street parking. With this recommendation, they suggested changing the current diagonal parking spaces to parallel parking spaces creating room for three lanes of travel. Under this plan the total number of spaces around the Oval would be reduced from 67 spaces to 21 spaces.
- The final suggestion was to improve South Street by providing additional width north of High Street by removing on-street parking on the northbound side. From these physical and geometric alternatives, the only action that was taken was to place two stop signs and a flashing yellow warning light at the intersection of Mont Vernon Street and Amherst Street.

C. D-H Recommended Short Term Priorities:

D-H priorities for the short term included improvements at the Oval and measures to divert traffic from the Oval. Suggested priorities are as follows:

1. Implement traffic pattern changes described as Scheme #2 above to reduce the volume of traffic entering the Oval. Pattern changes included:
    a. Limiting Nashua Street to eastbound from the Oval to School Street and to limit traffic on South Street to southbound from the Oval.
    b. Limit traffic flow on West Street to Southbound only and Union Street to Northbound only.
    c. Limit Middle Street to westbound traffic flow only

    None of the recommended traffic pattern changes were implemented.

2. Alter the parking configuration in the Oval. *The 1996 Oval Revitalization Project reconfigured parking, but it is not known if the D-H intent was implemented.*

3. Construct an Emergency Vehicle traffic signal at the intersection of Middle Street and the Oval. *The Fire Department discussed installation of an Emergency signal in 1987 and again in 1996 as part of the Milford Oval Revitalization Project. In 1996 they went so far as to design the signal and develop cost estimates. The design took into consideration the aesthetics of the Oval and the revitalization design criteria. Signal heads were to be mounted on pedestals instead of mast*

arms to keep the "period theme" of the Oval. The Fire Department abandoned the Emergency Signal Project due to the high cost associated with the proposed design. Currently, the Department's operating procedure is to come to a stop at the intersection to increase safety. Installation of an emergency signal would have no effect on the average traffic operations at the Oval.

D. D-H Long-Term Alternatives Discussed:

In addressing long-term alternatives, D-H suggested Milford create a transition plan with the goal of developing a detailed plan for transition and development and the goal of creating a plan addressing local and downtown planning that would achieve the community's goals. D-H recommended the investigation of proposed highway improvements around the Milford area listed by the New Hampshire Department of Transportation for implementation in the late 80's and early 90's. *Of the projects noted in the report, the bridge replacement at North River Road and the re-grading of Cottage Street and the B & M Railroad were completed.*

For a long-term possibility, D-H suggested connecting North River Road with Route 13 in Amherst (north of Milford) or connecting Route 13 with 101 in Amherst. Another suggested alternative was to consider the improvement of Milford's interior network of roads to allow for better alternative routes to be mapped. This improvement included new extensions and better conditions of roads. The alternative of off-street parking was suggested to address downtown planning. The possibility of a downtown mall area and the possibility of a surface lot or multi-level parking garage was suggested to be explored. The concept of off-street parking was emphasized strongly in this report.

Many of the D-H recommendations were ambitious and not completely explored to determine their feasibility. The intent of this evaluation report is not to redo work done previously, but to explore some of the better alternatives suggested previously and determine their feasibility and identify problem areas.

III. SHORT TERM ALTERNATIVE STUDIES (This Report)

A. Low Impact Oval Improvements:

Figure 6 shows the locations of three improvements at Union Square that will assist the movement of trucks and all other vehicles through the Oval. The following locations were identified for improvements:

1. Elm Street traveling eastbound and turning southbound onto South Street: Vehicle turning templates were used to determine the path of a large truck. Based on that template a tractor-trailer truck making this maneuver uses virtually all of the available pavement on South Street, including the opposing travel lane. Smaller trucks encroach lesser amounts of the opposing travel lane, but still have difficulty making this maneuver. A large trailer truck was observed making this right turn by occupying the left turn lane.

2. Oval Pedestrian Islands: Town Officials and others have noted that large trucks frequently drive over the vertical granite curb on the Oval traffic islands. Tire marks were observed on the curbing at both islands, located north and west of the Oval. Applying the large truck turning template (Figure 6) to the plan verified that the available width between the west island and the Oval curbing is inadequate for large trucks. The template did not indicate a width deficiency problem at the north island, but the impacts can occur when parked vehicles reduce the available turning area.

3. Elm Street Westbound left-turn Pocket: Creating a left-turn pocket just east of Union Street provides storage for turning traffic which currently delays traffic in the Oval from existing to the west. Currently a short turn pocket provides storage for one or two vehicles at the most. Figure 6 shows that by eliminating six parallel spaces the left turn lane can extend from Union Street back into the Oval and provide storage for at least 8 passenger cars.

B. Intersection Utilization Capacity Methodology (Syncro & Sim Traffic Software)

The Intersection Capacity Utilization provides a straightforward method to calculate an intersection's level of service. The method simply compares the sum of the critical lane movement volumes to saturation flow rates. ICU 2000 is an ideal solution for traffic planning purposes. Its intended applications are for traffic impact studies, future roadway design, and congestion management programs. The ICU is not intended for operations or signal timing design. The primary output from ICU is analogous to the intersection volume to capacity ratio. Other methods such as Synchro and the Highway Capacity Manual (HCM) should be used for operations and signal timing design.

ICU 2000 does not provide a complete picture of intersection performance, but it does provide a clear view of the intersection's volume related to its capacity. The ICU method

is designed to give results comparable to the intersection volume to capacity ratio determined by the HCM 2000 methods. In some cases the results may vary due to differences in calculation and the philosophy behind the calculations.

Overview of calculation:

The primary calculation for ICU 2000 is to calculate a Reference Time for each movement. The Reference Time is the amount of time required for each movement at 100% capacity. The reference time is volume times Reference Cycle Length divided by the saturated flow rate. The Reference Time must be greater than the Minimum Green time and is added to the Lost Time to give the Adjusted Reference Time. The ICU is the sum of the critical Adjusted Reference Times divided by the Reference Cycle Length. The Reference Cycle Length is a fixed input with a default value of 120 seconds.

ICU 2000 Compared to the HCM Method:

For some applications, ICU 2000 provides a better methodology than the HCM signalized intersection methods. The primary benefits of the ICU are that it is easy to calculate and gives answers with a higher degree of certainty. The ICU gives a clear picture of how much extra capacity an intersection has.

The HCM's primary MOE (Measure Of Effectiveness) **is delay**. Delay based models are appropriate for designing signal timing plans and for evaluating operations. Delay is a value that can be measured and explained to the public. ICU explicitly accounts for pedestrians both through interference adjustments and through required timings. The HCM does not explicitly require that timing plans contain enough time for pedestrians. The ICU has a higher level of certainty because the calculation has fewer steps and fewer input values. An accurate method is important for applications such as roadway design and impact studies, because the resulting decisions involve large sums of money.

Calculations

Intersection Capacity Utilization: (ICU) Take the maximum of the calculated times and all the adjusted input values and divides by the Reference Cycle Length. This is the Intersection Capacity Utilization. It is similar to, but not exactly the same as the intersection volume to capacity ratio. A value less than 1 indicates that the intersection has extra capacity. A value greater than 1 indicates the intersection is over capacity.

Level of Service: Enter a letter A to H based on the table and the ICU value. Note that the ICU 2000 includes additional levels past F to further differentiate congested operation.

ICU	Level of Service
0 to 60%	A
>60% to 70%	B
>70% to 80%	C
>80% to 90%	D
>90% to 100%	E
>100% to 110%	F
>110% to 120%	G
>120%	H

C. Oval Traffic Scenarios

Table 2 list the results of the traffic analysis for the following four scenarios at the Oval. Detailed analyses are included in Appendix D.

1. Existing Configuration:

   The intersection of Elm and South currently operates at LOS D and is at 88.4% percent of capacity. Queue lengths shown on Table 2 indicate that long vehicle queues occur on 101A and South Street entering the intersection. The intersection of Elm and Union is at LOS G and is operating over its capacity if it were to be signalized with the current configuration. The estimated fuel usage within the Oval for twenty minutes during the PM peak hour is 18 gallons.

2. South Street Southbound Only from Oval

   The 1987 D-H Oval Traffic Study report suggested that a number of streets be made one-way only. Those streets included Nashua Street (eastbound from the Oval to School Street), South Street (southbound from the Oval), West Street (southbound only), and Union Street (northbound only). D-H also proposed to restrict Middle Street to westbound traffic only. Creating one-way traffic patterns results in the obvious improvement of traffic flow due to the elimination of conflicts. The negative impacts however, include the potential to increase traffic volumes and speeds, which tend to deteriorate the quality of life in a neighborhood. The resulting improvements can also require land acquisition or elimination of valuable on street parking spaces.

   Figure 7 shows a rerouting scheme that is intended to prohibit northbound traffic from entering the Oval from South Street. The elimination of this northbound traffic eliminates conflicts with traffic entering the Oval from

Nashua Street westbound and provides extra pavement width for vehicles turning right from the Oval on to South Street southbound.

Under this scenario the intersection of Elm and South would operates at LOS C and at 77.1% percent of capacity. Queue lengths shown on Table 2 indicate reduced vehicle queues on 101A entering the intersection. The intersection of Elm and Union improves to LOS C and at 75.2% percent of capacity. The estimated fuel usage within the Oval for twenty minutes during the PM peak hour drops from 18 to 14 gallons compared to the existing scenario.

To eliminate northbound traffic on South Street, traffic has to be rerouted to Lincoln and then to Union streets where it enters the Oval. South Street is also NH Route 13 and therefore it is expected to accommodate large trucks. Figure 8 shows the path of a large tractor-trailer truck, which is known as a WB-50, which stands for wheel base 50 feet. At the intersection of South and Lincoln the WB-50 truck can maneuver through the intersection with the width available today as long as Lincoln is limited to westbound traffic only. A minor widening using a 5-foot radius curb is recommended on the corner to eliminate a sharp edge.

At the intersection of Lincoln and Union widening is required so that the WB-50 truck can turn through the intersection without encroaching the southbound travel lane on Union Street. This improvement requires a large portion of the small lawn located between the multifamily residence and the street.

At the intersection of Union Street and Elm Street left and right turn lanes are needed due to the increased northbound traffic flow. In order to create a short left-turn pocket, a number of parallel parking spaces will have to be eliminated. The spaces to be eliminated are not on the Oval and are not as highly utilized as the Oval spaces. If these spaces are removed no additional widening will be required at the intersection. The need for separate left and right turn lanes may be lessened by encouraging left turns onto Elm to use Garden Street and Cottage Street as an alternate route. It is recommended that encouraging lefts at Cottage be pursued prior to development of separate left and right turn lanes.

3. Traffic Signal at the Intersection of Elm, Nashua and South Streets

Installation of a traffic signal at the intersection of Nashua and South was analyzed to determine how it would affect operations. Results of the analysis indicate that the level of service is actually worse than without a signal. The primary advantage of a signal is that the queue lengths entering the intersection on Route 101A and South Street are significantly reduced. The estimated fuel usage within the Oval for twenty minutes during the PM peak hour drops from 18 to 16.5 gallons compared to the existing scenario.

4. Traffic Signals on Elm Street at Nashua and South and at Union Street.

Installation of a traffic signal at the intersection of Elm and Union was analyzed to determine how it would affect operations. Results of the analysis indicate that the level of service improves over the unsignalized condition to a level of service C. A disadvantage of the improvement is that approximately 5 parking spaces are removed for the extension of the left turn lane. The estimated fuel usage within the Oval for twenty minutes during the PM peak hour increases from 18 to 21 gallons compared to the existing scenario. This increased fuel usage corresponds to an increase in hydrocarbons of 17%, an increase of carbon dioxides at 8% and an increase in nitrous oxides of 10.5%.

TABLE 2 Oval Traffic Model Scenarios													
	Description	Improvements Required	Fuel per 20 minutes	Level of Service		Average Queue							
				Elm & South	Elm & Union	Elm & South				Elm & Union			
						EB LEFT 101A	EB TH &R	WB 101A	NB - SOUTH	EB 101A	WB LEFT	WB THRU	NB L&R
1	Existing configuration – 2001 PM Peak Hour. Improvements are not apparent by modeling, but will help move traffic.	1. Construct signage to encourage left turns northbound at Union to divert to Garden and Cottage. 2. Widen islands to facilitate turning trucks. 3. Promote and encourage business owners to develop loading areas outside of the Oval. On street loading contributes blocks lanes and causes delays.	18 gallons	D-88.4%	G-116.5%	NA	NA	510'	220'	NA	NA	135' T &L	82'

TABLE 2												
Oval Traffic Model Scenarios												
				Level of Service		Average Queue						
	Description	Improvements Required	Fuel per 20 minutes	Elm & South	Elm & Union	Elm & South				Elm & Union			
						EB LEFT 101A	EB TH &R	WB 101A	NB - SOUTH	EB 101A	WB LEFT	WB THRU	NB L&R
2	No traffic NB on South Street to Oval. Create clockwise loop with Elm, South, Lincoln and Union.	1. Construct **barrier and signage on South St.** north of Clinton to prohibit NB travel past Clinton. 2. Widen intersection of **Lincoln and South** (insignificant) 3. Make Lincoln one way Westbound 4. Widen intersection of **Lincoln and Union** (may not be unfeasible due to house on corner). 5. Create longer westbound **left turn lane on Elm** at Union. Eliminates 4 to 6 paces. 6. Create separate left and right turn lanes for increased traffic on **Union south of Elm**. Eliminates 4 to 6 spaces that are unutilized. Necessary due to increased volume of right turns.	14 gallons	C-77.1%	C-75.2%	NA	NA	162'	South St. SB Only	NA	NA	27' WB L & T	98' NB Left & 180' NB Right

TABLE 2 Oval Traffic Model Scenarios													
				Level of Service		Average Queue							
	Description	Improvements Required	Fuel per 20 minutes	Elm & South	Elm & Union	Elm & South				Elm & Union			
						EB LEFT 101A	EB TH &R	WB 101A	NB - SOUTH	EB 101A	WB LEFT	WB THRU	NB L&R
3	Construct Signal at Elm, Nashua, and South	1. Improve radius at west corner of Intersection of Elm and South.	16.5 gallons	E-98.3% (HCS LOS= C)	No change From #1	130'	155'	121'	85'	8'	No Left Lane	80' WB L & T	209'
4	Construct Signal at Elm, Nashua, and South and at Elm and Union.	1. Coordinate traffic signals. Create longer westbound left turn lane on Elm at Union. Eliminates 4 to 6 valuable spaces on Elm.	21 gallons	Same AS #3	C-79.1% (HCS LOS=C)	143'	168'	151'	112'	231'	114'	197'	70'

D. NH Route 101A (Nashua Street) Westbound Left-Turn Lanes

A traffic study by Stephen G. Pernaw (SGP) for a proposed elderly living facility indicated that during peak hours approximately 88 vehicles turn left into the Edgewood Shopping Center and Tonella Road. If the proposed elderly housing facility is constructed off Tonella Road this volume will increase to 97. The SGP study analyzed the need for a left turn lanes on Nashua Street from Clinton Street to Laurel Street and found that "an exclusive left turn lane is warranted for westbound turns to the Edgewood Shopping Center (west drive), Tonella Road and Powers Street." The SGP study also suggested construction of right turn lanes at critical intersections and a redesign of the parking configuration at the Edgewood Shopping Center. This study proposes left turn lanes at two locations on Nashua Street at the locations recommended in the SGP study. Right turn lanes are not proposed at this time as the left turns are considered a higher priority and the impacts too great relative to the gain. Figure 10 identifies the curb-to-curb pavement width on Route 101A (Nashua Street) from the Oval east to just east of the Cemetery and the railroad track crossing.

1. Edgewood Shopping Center/Tonella Road: A short left turn lane is currently provided for turns westbound from Route 101A (Nashua Street) to Clinton Street. Figure 11 shows a 600-foot long extension to the existing left turn lane that extends easterly to Monson Place. The proposed turn lane extension would provide storage for westbound traffic turning into the Edgewood Shopping Center and to Tonella Road. The existing curb-to-curb width is 29 feet. By taking one parallel row of parking spaces from the shopping center an additional 9 feet of width would be available for the turn lane. Approximately 11 spaces would be lost. The additional 9 feet would provide adequate width for two 12-foot travel lanes with 2-foot shoulders plus a 10-foot wide turn lane. Construction cost (not including R.O.W. acquisition costs) for this improvement is estimated to be $165,000.

2. Powers Street Intersection: On Route 101A (Nashua Street) at Powers Street the existing curb-to-curb width is 35 feet. Figure 12 shows a proposed left turn lane developed by restriping the existing pavement width to provide two 12.5-foot travels lanes and a 10.0-foot left-turn lane. This width is slightly less than desirable, but will increase safety and is adequate to decrease delays caused from turning traffic. The location of Laurel Street relative to Powers Street is such that Laurel Street under this scenario should be restricted to southbound (exit to Nashua Street) travel only. If eastbound left turns were permitted to Laurel Street those turns would be in direct conflict with westbound turns into Powers Street. Construction cost for this improvement including a one-inch pavement overlay, signing and pavement marking is estimated to be $45,000.

3. Ponemah Hill Road Intersection: A separate left turn lane should be considered where ever traffic volumes or accident history indicates that a separate lane is warranted. The intersection of Ponemah Hill and Route 101A (Nashua Street)

meets the volume warrant for a separate left turn lane based on the AASHTO "Guide for Left-Turn Lanes on Two-Lane Highways" and adequate right-of-way width is available for most of the project. Curbing does not restrict the available width at this intersection. Figure 13 shows a concept plan, which utilizes the existing pavement width and provides 11-foot wide travel lanes in each direction and a 13-foot wide left-turn lane with 3-foot wide shoulders on each side. Widening is shown on the Ponemah Hill Road approach in order to separate left and right turning movements. The estimated cost for this improvement is $96,000. Additional right-of way width is needed to increase the turning radii on to and from Ponemah Hill Road.

E. Signal Warrants for Route 101A (Nashua Street & Elm Street) Intersections

Traffic signals are installed only at intersections where warranted based on published guidelines in the "Manual On Uniform Traffic Control Devices" (MUTCD) developed by the Federal Highway Administration. The year 2000 version of the MUTCD lists 8 warrants that are used. Warrant 3 (previously #11) is the Peak Hour Warrant and gives an indication of warrant based on only one peak hour of data which is convenient for planning and impact studies. Other warrants based on the 8 highest traffic hour, crash history or pedestrians crossings need to be examined in greater detail prior to actual installation of the signal.

Table 3 lists the warrants for intersections along Route 101A. Table 3 shows that the only intersections where signals are warranted, other than at existing signalized intersections is the intersection of South, Nashua, and Elm Street at the Oval. Analysis previously discussed listed the advantages and disadvantages of installing a signal at that intersection.

TABLE 3

Signal Warrants - Route 101A (Nashua Street & Elm Street) Intersections

#	Intersection (starting at Amherst T.L.)	Study	Warranted – Yes or No
1	Route 101 Eastbound Ramps	VHB-Richmond Study	Not at warrant volume but lefts onto 101A (Nashua Street) at LOS F
2	Route 101 Westbound Ramps	"	Yes
3	Lorden Plaza & Proposed Site	"	Yes
4	Capron Road	"	No
5	Ponemah Hill Road	NRPC Data	No- Mostly rights out to 101A (Nashua Street) and lefts in to Ponemah
6	Recreation Facility (Proposed)	Versent LLC #10	No
7	Powers Street	SGP #'s 5&8	No
8	Tonella Road	"	No

TABLE 3			
Signal Warrants - Route 101A (Nashua Street & Elm Street) Intersections			
#	**Intersection (starting at Amherst T.L.)**	**Study**	**Warranted – Yes or No**
9	Edgewood Road	"	No
10	Clinton Street	"	No- Mostly rights out to 101A (Nashua Street) and lefts in to Clinton
11	Oval - South Street	NRPC Data	Yes – Delays should be considered prior to installing a signal
12	Oval - Middle Street	NRPC Data	Warrants are marginal
13	Union Street	NRPC Data	No
14	West Street	NRPC Data	Yes – Existing Signal
15	Westchester Drive	NRPC Data	No

Nashua Street, between the Oval and the traffic signal at Lorden Plaza, is a very congested 1.7 mile (8,800') long section of two lane road that is the main route to downtown Milford and provides access to numerous commercial, industrial and residential properties. Year 2000 traffic volumes along Nashua Street during the PM peak hour are currently approaching 1,700 vehicles per hour (vph) and are expected to increase to approximately 2,000 vph by the year 2010. During the PM peak, nearly 60 percent of this volume is traveling in the westbound direction. Vehicles turning left onto Nashua Street from driveways and side roads experience very long delays (LOS F) waiting for an acceptable gap in the traffic stream and often accept a gap shorter than desirable. Due to this situation the Town has expressed a desire to construct a traffic signal at the best location along this section of Nashua Street so as to create gaps in the traffic stream for left turning vehicles. Figure 18 shows the locations of each intersection on Nashua Street and lists its distance from the Oval in feet.

Prior to construction of a traffic signal certain warrants must be met. Traffic signal warrants, in this case Warrant 3, are based on the total hourly volume of both directions on the major street (Nashua Street) and on the high volume minor street approach volume (one direction entering the major street). The volume of traffic on Nashua Street is high enough to easily meet the warrant volume. The volume of the side street is critical in determining signal warrants at intersections on Nashua Street. The minimum hourly volume for the side street approach is 100 vph.

Before installation of a traffic signal is warranted, other simpler solutions should be examined including the construction of separate left and right turn lanes on the side street approach. With the right turning traffic in a separate lane, that volume is removed from the analysis, as that maneuver typically does not require a traffic signal. With the right turning traffic removed from the analysis the critical volume for warrants becomes the sum of the left and through approach volumes. Warrant 3 is shown graphically on MUTCD Figure 4C-3. Copies of Figure 4C-3 are included in the Appendix C with sheets

for each of the major intersections with Nashua Street from Clinton Street to Capron Road.

Clinton Street intersects Nashua only 1,500' from the Oval and is too near to the Oval to provide gaps to the majority of the low volume streets along Nashua Street. It also has very few left turns onto Nashua Street and therefore is not close to the warrant volume.

The Edgewood Shopping Center currently has two drives. If the left turns are all made from a single drive the left turn volume is 74 vph for the year 2000 and 94 vph for 2010. If some addition development uses this access the left turn volume would likely meet the warrant. The Shopping Center is only 2,000 feet from the Oval and would not provide gaps for side street traffic near the east end of the segment. Tonnella Road only has 27 vph turning left and therefore does not meet the warrant volume. If this traffic were added to the Edgewood Shopping Center intersection warrants would be met at that intersection. However, routing a Town road through a privately owned commercial development would require reconfiguration of the entire parking lot and it poses obvious ownership and maintenance sharing problems.

Powers Street meets Nashua Street approximately 3,500 feet from the Oval (about 40 percent of the section length). This location is ideal because there are 3 residential streets within 1,000 feet on either side of Powers Street, which would be provided gaps by the signal. The available traffic data indicates that there are 60 vph making a left turn during the PM peak hour, which does not meet the minimum warrant volume. Sixty apartment units are currently being constructed that will add 40 trips during the PM peak with 68 percent entering Powers Street and 32 percent exiting (13 vph). Of the 13 vph exiting, approximately 53 percent or 7 vph will be added to the left turn volume. Adding the 7 vph brings the total left turn volume to 67 vph, which does not meet the warrant.

One of the Long Term Alternatives (discussed in a latter section of the report) is the extension of Powers Street southerly to South Street (NH Route 13). The NRPC traffic model estimates that Powers Street would carry 3,100 vehicles per day, or approximately 300 trips during the PM peak hour. In the traffic model, the traffic generated from the Powers Street land use is added to the model on Nashua Street. The modeled volume does not include the local traffic that enters the network from Powers Street. The current distribution of trips at the intersections has 30 percent of the total Powers Street traffic turning left onto Nashua Street. Using this percentage, the traffic added by the connection to South Street, to the left turning volume, is estimated to be 90 vph. Adding the local traffic to the model volume for the new connection brings the left turning traffic volume on Powers Street to 157 vph, which exceeds the warrant volume.

No traffic volumes are available for the proposed Recreation Facility intersection with Nashua Street. Based on the traffic scenarios presented for this Facility it is evident that at peak times some type of traffic control will be required. Due to the sporadic nature of this land use it would be more appropriate to utilize uniformed officers for traffic control than to install a traffic signal.

Ponemah Hill Road is located near the east end of Nashua Street, approximately 2,000 feet west of the traffic signal at Lorden Plaza. Most of the traffic from Ponemah Hill Road is to and from the east and current traffic data shows that only 19 vph turn onto Nashua Street during the PM peak hour. Capron Road is only 1,150 feet from the signal at Lorden Plaza and has only 20 vph turning onto Nashua Street during the PM peak hour.

Based on the above discussion, the best location for a traffic signal on Nashua Street is at the current intersection of Powers Street. A traffic signal is warranted at this location only in conjunction with the connection to South Street. Installation of a traffic signal at any location within this segment of Nashua Street would significantly reduce the capacity of Nashua Street unless additional through and turning lanes are added in the vicinity of the intersection. With only the addition of a westbound left turn lane and separation of the northbound left and right turning traffic (see Figure 12) a signalized intersection would exhibit LOS C during both the year 2010 AM and PM peak hour. While the intersection experiences reasonable delays during both peaks, the volumes are very near to capacity and long queues will be experienced in the eastbound direction during the AM peak and in the westbound direction during the PM peak. It should be noted that the analysis was based on limited traffic data from other sources and needs to be updated and reanalyzed prior to implementation of this project. To provide adequate capacity for the long term on Nashua Street, installation of a traffic signal at any location requires an addition through lane in each direction.

F. Project List and Priorities

Accident Statistics and Traffic Problem Areas where discussed with Milford Police Chief Frederick Douglas. I contacted Chief Douglas to obtain accident statistic and to discuss problems areas. Chief Douglas said that the Department software is not currently capable of generating statistics. The Chief provided accident ratings based on experience for critical areas. The following items where discussed:

- **Shaw's right-turn out to 101A (Nashua Street) westbound:** Drivers have been observed turning right out of Shaw's west exit and then making a U-turn around the center island to head eastbound. The Chief suggested that this island should be extended to the west. The Town Planner stated that this improvement may be made as mitigation for nearby development.

- Other: New ball fields are to be constructed just to the east of the Milford Medical Center of 101A (Nashua Street). A left turn lane will be constructed in the eastbound direction.

- Many Intersections along Route 101A (Nashua Street) have high accident histories. The following intersections have high accident rates due to high volumes of through and turning traffic and usually some additional deficiency:

- **Clinton Street and 101A (Nashua Stret)**: This location has a westbound left turn lane, but is poorly signed and needs to be re-striped. Clinton Street is used as a bypass to the Oval because it leads to Lincoln Street, which is the only crossing of Great Brook other than Elm Street between the Oval and the 101 bypass. Left turns onto Clinton Street have the highest left turn volume of all the intersections between the Oval and Route 101.
- **Edgewood Shopping Center-NH101A (Nashua Street)**: Turns areas/lanes at the Shopping Center are not well defined and drivers are confused as where to turn. Existing curb-to-curb width is not adequate to add a left turn lane.
- **Tonella Road and 101A(Nashua Street)**: Tonella Road approaches 101A at an angle of approximately 52 degrees. Vehicles on Tonella approaching 101A and turning right to travel eastbound have an inadequate turning area and have been observed encroaching the westbound travel lane. As part of their impact mitigation, the developer of the proposed Elderly Care Facility on Tonella Road has been instructed to improve this turning radius.
- **Powers Street and 101A (Nashua Street)**: Heavy turning traffic occurs during the AM and PM peak hours.
- **Ponemah Hill Road and 101A (Nashua Street):** Heavy turning traffic occurs during the AM and PM peak hours.

- **Increase turning radii on the Oval** at the North island as well as at the West island: Curbing has been reset at both islands due to trucks riding over the curb.

- **Relocate the Oval crosswalk** to the north island to a location in the middle of the Oval near its former location. Drivers turning at the island are looking to the north for traffic entering the Oval and should not have to look to the left for pedestrians at the same time. No accidents have occurred to date but there have been many near accidents (close calls). Relocating the crosswalk would place it at a location where drivers could focus on the pedestrian movements.

- **Increase fine from 5$ to 10$ for exceeding the 2 hour limit in the Oval**. The P.D. currently patrols the Oval twice each day. Parking meters were installed previously and were removed as they were thought to be unfriendly by DO-IT and others. Enforcement is done by marking a tire mark with chalk and then checking two hours latter to see if the chalk mark location has changed. If it has changed a ticket is issued. The Chief noted that many of the same offenders continue to park longer than the two-hour limit and are not deterred by the fine. Increasing the fine will deter some of the offenders.
  Long-term parking is currently provided at two locations. Four hour parking is permitted at the Middle Street Lot and 8 hour parking is provided at the Putnam Street Lot.

- **Extend traffic loop on West Street Approach to Route 101A (Elm Street)**: Elm Street holds a green signal until a "vehicle call" is made from the West Street magnetic loop (cut in the pavement). The existing traffic loop ends just short of the stop bar and vehicles pass over it before reaching Elm Street. As a result the signal does not sense the vehicle and neglects to turn green.

- **Milford Christian Academy (MCA) and Route 101A (Elm Street)**: MCA is located on the north side of Elm Street and their parking lot is located on the south side. Chief Douglas has suggested that a pedestrian signal be installed along this heavily traveled section of 101A to provide a safe crossing for the students and staff. A signal in this location would also provide gaps for drives that do not have high enough exiting volumes to warrant a traffic signal.
- **Eliminate red turn arrow EB at 101 & 101A (Elm Street)**: Currently signal heads controlling the movement of the right turn lane from 101 eastbound to the 101 bypass include both a red ball signal head and a red arrow signal head (see Figure 17). The presence of the red arrow causes the traffic to routinely queue on the eastbound approach to the intersection. Red arrows are usually placed only where pedestrians cross so that right-turns-on red will not conflict with pedestrian crossings. Turns are not permitted on red arrows after stopping unless a sign indicates that they are. Conversely, a red ball means that **right-turn-on red is permitted** after stopping unless signed otherwise. In discussion with NHDOT staff, it was discovered that the red arrow was used for two reasons. The primary reason was to supplement the railroad crossing signal preemption of the traffic signal. After observation of the railroad signal indication, it is obvious that it stands out well and does not need to be supplemented with the red arrow. The second use for the arrow is to prevent right turns during the left-turn phase for the westbound Route 101A (Elm Street) turn to eastbound on the bypass. Left-turn phases typically operate well without a red arrow and are only typically used when pedestrian traffic is great enough to warrant it. The presence of the two types of traffic control in the same lane is confusing. It is recommended that the red arrow signal head be removed and replaced with a supplemental red ball.

- **101 & 101A (Elm Street) Railroad Crossing:** Vehicles headed in the westbound direction on the Milford Bypass cross over a railroad track located less than 50 from the intersection traveled way on Route 101A/101 (see Figure 17). The existing signage tells the driver to "stop before the tracks" and "do not stop on tracks", but it does not tell them exactly where to stop. Drivers typically look to stop at a stop bar at the intersection where they can look to the left and right. Chief Douglas has seen numerous drivers stopped between the tracks and the 101A (Elm Street) traveled way where the driver cannot see a stop bar or a signal head. At this intersection many of the drivers are traveling through the area and are not familiar with the intersection. Those "new to the area drivers" do not have enough time to analyze this complicated intersection and determine where to stop within the normal reaction time (less than 2 seconds). It is suggested that signs be placed at the stop bar that tell the driver exactly where to stop (stop here on red with an arrow). The existing "stop before tracks on

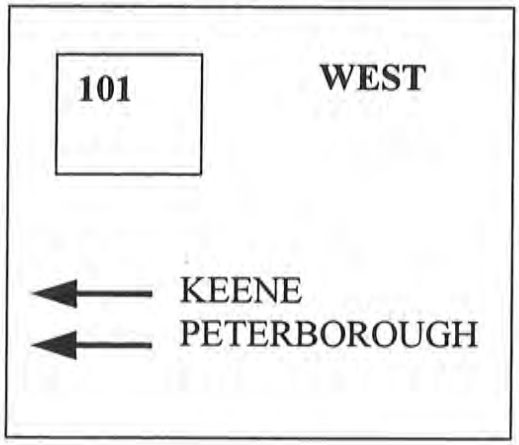
red should be relocated 50 to 100 feet upstream of the stop bar to increase the drivers reaction time.

- **Improve signage at each end of the bypass** to encourage both passenger vehicle and trucks to use the bypass. Chief Douglas stated that many of the out of town vehicles stopped for violations have stated that they did not intend to stop in town and that they did not realize that a bypass would have taken them around the town. Most of the trucks traveling through the Oval are there by necessity and not by choice. Improved signage at each end of the bypass will further decrease the volume of trucks traveling through the Oval.

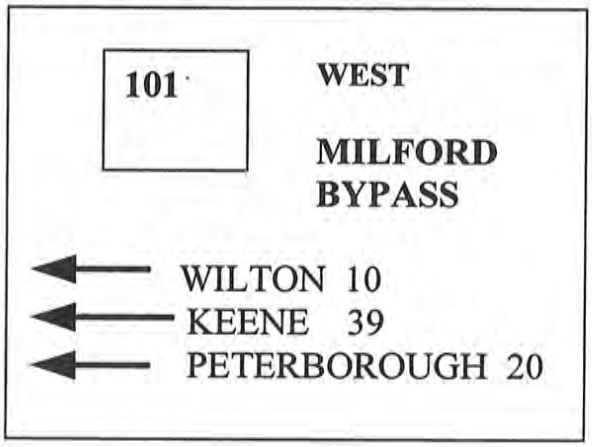
Signs shown below are located on the east side of Milford near the Amherst Town line on Route 101A (Nashua Street) west bound at the entrance to Route 101. The sign shown on the left is the existing sign and the sign on the right is proposed to encourage use of the Bypass versus traveling through the downtown and the Oval.

Signs entering Milford on the East Side from Amherst:

Existing Sign WB on 101A



Proposed Sign

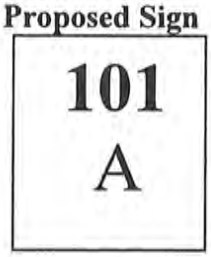


The existing sign above does not tell the out of town traveler that they should bypass Milford. Milford Police Chief, Fred Douglas, commented that many of the people that the Police Department has stopped for violations along Route 101A (Nashua Street) are there by mistake and would rather have bypassed Milford. The proposed sign informs them that Route 101 is a bypass of Milford and that it is suggested for destinations between Wilton and Keene.

The following Route 101A sign is attached to the Route 101 overpass of Route 101A in the westbound direction

Existing Sign

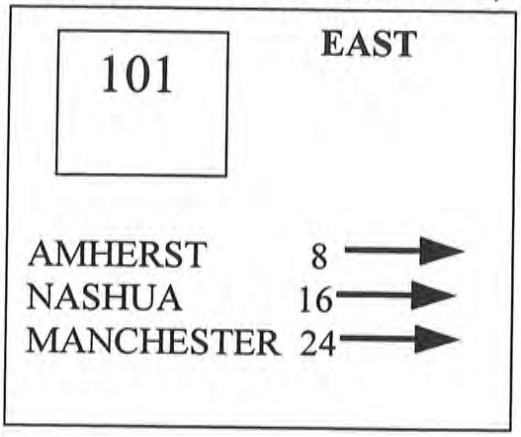
Proposed Sign



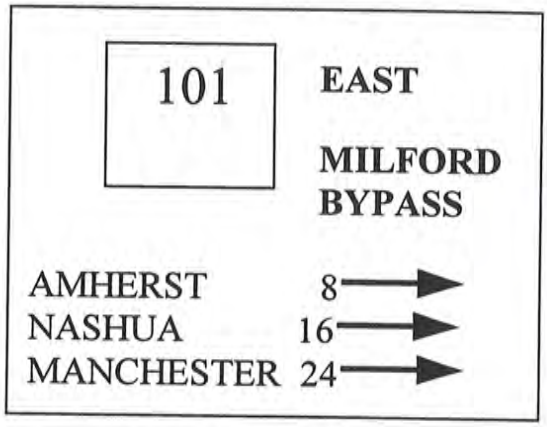
The "A" on the existing sign is difficult to see and the sign appears to be the route sign for Route 101. It is suggested that the sign size be increased by at least 50% to eliminate the confusion caused by the not being able to easily read the smaller sign.

Signs entering Milford on the West Side from Wilton:

Existing Sign EB on 101A (Elm Street)



Proposed Sign



The above-proposed sign adds the words "Milford Bypass". The range of destinations is adequate on the existing sign.

A list of short-term improvements was developed based on the previous analysis and the discussions with Chief Douglas and Town Planner Bill Parker. Table 4 lists each of the projects along with the average daily traffic volume, accident rating (high, medium or low), the priority and the estimated construction cost. Figure 14 shows the location of each of the proposed improvements. Appendix E includes program level cost estimates in spread sheet form for the major improvements. The Towns highest priorities that match the highest accident rating are projects M-3 and M-4 which are left turn lanes on Route 101A (Nashua Street) at the intersections with Powers Street and Tonella-Clinton Streets respectively.

TABLE 4 MILFORD EVALUATION OF HIGHWAY IMPROVEMENT ALTERNATIVES SHORT TERM IMPROVEMENTS						
#	**Project Location (east to west) see Figures 14 & 15**	**Improvement Description**	**Daily Traffic Volume**	**Accident Category (High, Medium, or Low)**	**PRIORITY (High, Medium, or Low)**	**Construction Cost Estimate**
NH-1	Route 101A at Amherst T.L.	Modify signs to encourage motorists to use the Bypass	29,170	NA	High	NA
M-1	Route 101A at Shaw's	Extend median 100 feet to prevent U-turns	20,500	Medium	Low	$12,000
M-2	Route 101A & Ponemah Hill Rd.	Construct Left-Turn Lane	20,000	Low	Medium	$96,000
M-3	Route 101A & Powers Street	Construct Left-Turn Lane	19,000	High	High	$45,000
M-4	Route 101A & Tonella-Clinton	Construct Left-Turn Lane	17,000	High	High	$165,000
M-5A	Intersection South, Nashua & Elms Streets (Oval)	Signalize Intersection. Costs will increase if period hardware is used to match the Oval decor.	27,000 (entering)	Low	Low	$100,000
M-5B	Intersection South, Nashua & Elms Streets (Oval)	Widen turn radius EB to SB	27,000 (entering)	High	High	$8,000
M-6	Intersection Middle and Putnam	Improve Sight Distance	2,500 (est. for Middle ST	Low	Medium	NA
M-7	Oval – North Island	Widen ramp and relocate sidewalk to mid-block	27,000 (entering)	Low	High	$3,000
M-8	Oval – West Island	Widen ramp	27,000	Low	High	$6,000

TABLE 4 MILFORD EVALUATION OF HIGHWAY IMPROVEMENT ALTERNATIVES SHORT TERM IMPROVEMENTS						
#	**Project Location (east to west) see Figures 14 & 15**	**Improvement Description**	**Daily Traffic Volume**	**Accident Category (High, Medium, or Low)**	**PRIORITY (High, Medium, or Low)**	**Construction Cost Estimate**
			(entering)			
M-9	Route 101A & Union Street	Construct WB Left Turn and create NB Left and Right lanes	19,000	Low	Low	$16,000
M-10	Cottage and Garden Streets	Add signs to promote left turns to 101A at Cottage Street instead of Union Street	17,500 on 101A at Union	Low	Low	$1,500
M-11	Route 101A & West Street	Increase length of West Street signal sensing loop	16,500 entering	Medium	Medium	$2,000
M-12	Route 101A & Milford District Court House	Coordinate with NHDOT to determine Impacts of Court House to existing signalized intersection	13,000	Low	High	NA
M-13	Route 101A & Milford Christian Academy	Construct Pedestrian Signal. Cost #1. is with wooden poles and span wire. Cost #2 is with a permanent steel installation.	13,000	Low	High	1. $25,000 2. $40,000
NH-2	Route 101A & Route 101 (west end of Bypass)	Improve signing at R.R. Crossing approach	18,600 on approach (23,700 entering intersection)	NA	High	NA
NH-3	Route 101 west of Bypass	Modify signs to encourage	15,000 on	NA	High	NA

TABLE 4 MILFORD EVALUATION OF HIGHWAY IMPROVEMENT ALTERNATIVES SHORT TERM IMPROVEMENTS						
#	**Project Location (east to west) see Figures 14 & 15**	**Improvement Description**	**Daily Traffic Volume**	**Accident Category (High, Medium, or Low)**	**PRIORITY (High, Medium, or Low)**	**Construction Cost Estimate**
		motorists to use the Bypass	the approach			
M-14	Intersection of Wilton Road and Madison Street	1. Improve sight distance (actual cost depends on right-of –way costs) and type of improvement or 2. Make Madison Street one-way northbound only.	10,000 entering	Low	Low	1. $10,000 2. $1,000

Column: M-1 is MILFORD Project #1 and NH-1 is New Hampshire Department of Transportation Jurisdiction Project number 1. Accident History and Priority rankings were made by the Milford Police Department and approved by the Planning Department.

IV. LONG TERM ALTERNATIVES

Long-term alternatives are those that require considerable more planning effort than can results from this Town wide study. This study can however, act as a starting point for planning and development of long-term alternatives.

A. NRPC Traffic Model report has been provided for in Appendix "G"

B. Traffic Model Corridors

The Nashua Regional Planning Commission (NRPC) maintains and operates the Regional Traffic Model for the Nashua Urban Area. As part of this study, a range of corridors were selected and added (one at a time) to the regional model to determine the relative traffic relief to the Oval with new routes crossing the Souhegan River. Selection of a few alternatives that cover the entire range of opportunities provided enough information to determine relief at specific crossing locations and can be used to interpolate relief gained at any other crossing locations. Each corridor location is shown on Figure 9.

Corridor locations were established to tie into the existing road network and to minimize impacts to physical and natural resources. One corridor was intended to provide access to the Town property known as the Brox Site and two corridors were placed just east and west of the Oval. River crossing locations are very preliminary as the constraint resource available for this study was the Town Master Plan. Further development of a new corridor would require an environmental impact statement, which is beyond the scope of this study. The Master Plan includes the following constraint maps that were used in a preliminary way to establish the corridors and minimize impacts to environmental resources:

- Map 1 - Perennial Streams and Water Bodies (all crossings similar)
- Map 2- Wetland Soils – Key Constraint
- Map 3 - Major Stratified Drift Aquifers – Constraint
- Map 4 - Floodplain Areas – Key Constraint
- Map 5 - Conservation Lands - Constraint
- Map 6 - Prime and Important Agricultural Soils - Constraint
- Map 7 - Scenic Roads (not a factor)
- Map 8 - Scenic Views and Vistas (not a factor)
- Map 9 - Historic Sites – Key Constraint
- Map 10 - High Potential for Prehistoric and Historic Archaeological Sites (not a significant factor in determining the site)
- Map 11 - Community Parks (not well defined on map, but would be significant depending on requirements of the original funding)

Copies of the Master Plan Resource (constraints) maps labeled above as either a "Key Constraint" or a "Constraint" are included in Appendix F with each of the Corridors sketched on. A major constraint that is not listed on the maps are the neighborhood areas that would be significantly disrupted, and or divided, if a corridor ran through the area. A major residential area was avoided that is located South of Elm Street (Route 101A) and runs from Westchester Street to West Street. Initially, the Powers Street Corridor was intended to also cross the Soughegan River. After observing the level of development in this area, it was decided to limit the corridor to just the segment shown south of Nashua Street. After eliminating these developed areas the number of potential locations for river crossing were limited to the two corridors shown. Table 4B lists some of the impacts that were considered in establishing the corridor locations.

TABLE 4B

MILFORD EVALUATION OF HIGHWAY IMPROVEMENT ALTERNATIVES

LONG TERM ALTERNATIVES RESOURCE IMPACT COMPARISONS

CORRIDOR	**BROX SITE**	**WEST STREET**	**POWERS STREET**	**EAST-WEST**
CONSTRAINT				
Wetlands	Crosses at narrow point. Impacts wet on roads planned by others south of 101.	No impacts crossing river. Major impact in interchange area.	No impacts shown	Minor impact to poorly drained soil.
Aquifers	Crosses middle of fastest flow area	Minimizes impacts	No impact by proposed route	Minor impacts
Floodplain	Crosses at 2nd narrowest location	Crosses narrowest location & minimizes bridge cost.	No impact	No impact
Conservation land	Minor impact	No impact	No impact	Minor impact
Farm land	Major impacts	Minimizes impact at crossing. Impacts in interchange area.	No impact with proposed roads	Minor impacts
Historic sites	No impacts	Possible impacts to Moore and Barracott Houses	No impacts	No impacts

As can be seen from the above table, both of the potential Soughegan River crossings have environmental impacts. The key to obtaining approval of environmental permits is to pick the least damaging alternative.

The East–West Corridor was modeled (not a river crossing) to create an east/west collector route in the south part of Milford. This corridor was not intended to provide relief to the Oval, but to relieve local north/south local roads that are providing access to numerous new residential developments in the south part of Milford. Comparisons with and without this corridor will indicate the impact of the new developments on the local road system. Appendix G is the NRPC's traffic model report, which includes the model

methodology and spreadsheet that lists design year 2010 average daily traffic volumes for each scenario at nineteen (19) locations and at corridor specific locations. Figure 9 shows the location of each corridor and each traffic count location listed on the NRPC spreadsheet.

C. Outlying Roads

The impact of the ongoing residential development in the south part of Milford was considered by the NRPC in their traffic modeling process. Table 5 shows the average daily traffic volumes at key locations for the Outlying Roads. The first column of Table 5 is the Model count location, which is shown on Figure 9. The existing pavement width (based on NRPC data and field checked) is listed in the 3d column. Pavement type is listed in the 4th column as either bituminous concrete (bit conc.), surface treated gravel (STG), gravel, or as a path (not town maintained). Average daily traffic volumes are listed for the existing year 2000 scenario and forecasted to the year 2010 for the existing scenario as well as each of the traffic model corridors. The Brox and West Street Corridors are the scenarios with a crossing of the Souhegan River. The Powers Street and East-West Corridors do not include River crossings.

The Regional Traffic model used by NRPC does not include all of the outlying roads and therefore assigns all of the estimated traffic to the major roads. Model volumes are also skewed due to the lack of driveways that are used. While each house has a driveway, the model combines drives which adds traffic at only a few points, which concentrates the traffic volume at those locations. In order to account for these inherent traffic model characteristics, traffic volumes shown on Table 5 where estimated by expanding existing volumes based on growth rates calculated by comparing the Modeled volumes and adjusted to replicate traffic that is expected at full build out.

Table 5 includes two columns that include standards from the American Association of State Highway and Transportation Officials (AASHTO 'S) Guidelines for pavement and shoulder widths (4th Edition Exhibit 5-5) based on average daily traffic volumes. A comparison of the existing pavement width to the AASHTO standards indicates that most of the existing outlying roads do not meet standards. A few of the roads meet the standards for traveled way width but none have both the traveled way width and the shoulder width listed in the standard. It should be noted that AASHTO' S criteria are only guidelines and are not typically met with existing conditions.

As traffic volumes increase the design speed of the road should also be increased. A higher design speed increases the safety by resulting in roads that have straighter horizontal and vertical alignments and improved sight distance. Most of the existing roads have undulating alignments that do not meet the criteria for the minimum 30 mile per hour design speed. Higher volume roads typically include truck traffic where the need for wider lanes is obvious and it may be necessary to increase the design speed to 40 miles per hour.

Virtually all of the outlying roads listed were constructed to provide access to homes. As development progresses and traffic volumes increase, the function of these roads changes to that of collector road and some even would be considered arterial roads. Minimizing access points on existing high traffic collector and arterial roads becomes an issue that becomes increasingly difficult for the town to deal with. It is much easier to plan new collector roads and limit the number of access points.

TABLE 5
OUTLYING ROADS

Model Loc. #	Road Name	Paved Width	Surface Type	TRAFFIC VOLUMES (ADT'S) 2000 Existing	2010 NO BUILD	2010 East/ West	2010 Brox	2010 West Street	2010 Powers Street	AASHTO STD. Traveled Way Width	AASHTO STD. Shoulder Width
Est.	**Armory**	20'	Bit. Conc.	2000	6500	6500	6200	5600	5800	24	8
16	**Federal Hill**	20'	STG	700	3000	2800	2800	2800	2800	24	8
	Foster Road										
Est.	Brookline TL to East of FH	20'	STG	300	600	600	600	600	600	20	5
Est.	East of FH to 1000' East	15'	Gravel	10	600	600	600	600	600	20	5
**	1000' East of FH to Ponemah	12'	Path	10	**	**	**	**	**	**	**
	Jennison										
2	North River to 600' north	18'	STG	4000	4000	4000	4200	5500	4300	24	8
2	Remainder of Jennison	22'	STG	4400	4400	4400	4600	5900	4700	24	8
Est.	**Joslin**	20'	STG	500	1000	1000	1000	1000	1000	20	5
14-18	**Mason**	22'	Bit. Conc.	2600	7900	3300	7500	6500	6800	24	8
	Melendy										
Est.	Route 13 to Ball Hill	20'	STG	500	1000	1100	1000	1000	1000	20	5
Est.	Ball Hill to Osgood	20'	STG	500	1000	1100	1000	1000	1000	20	5
	Mile Slip (south to north)										
Est.	Brookline TL 1.0 mile North	16'	Path	10	**	**	**	**	**	**	**
Est.	Near East-West Corridor	18'	Gravel	200	2000	500	2000	2000	2000	22	6
Est.	Mason Rd to 1 mile south	20'	Bit. Conc.	200	4000	2000	4000	4000	4000	24	8

TABLE 5

OUTLYING ROADS

Model Loc. #	Road Name	Paved Width	Surface Type	TRAFFIC VOLUMES (ADT'S) 2000 Existing	2010 NO BUILD	2010 East/ West	2010 Brox	2010 West Street	2010 Powers Street	AASHTO STD. Traveled Way Width	AASHTO STD. Shoulder Width
3	**North River**	24'	Bit. Conc.	3800	5100	5100	3800	5600	5100	24	8
	Osgood (south to north)										
Est.	Brookline TL to Young	22'	Bit Conc.	200	500	500	500	500	500	20	5
18	Burns to Melendy	20'	Bit Conc.	400	2400	800	2200	2400	2400	24	8
18	Young to Burns	20'	Bit Conc.	400	2400	800	2200	2400	2400	24	8
	Ponemah Hill (south to north)										
Est.	Amherst TL to Stable Rd.	18'	STG	600	1500	1400	1400	1400	1100	20	5
10	Stable Road to 101A	20'	Bit Conc.	3200	6200	6000	6000	6000	4100	24	8
1	**Purgatory**	22'	STG	1500	1600	1600	1700	1200	1600	22	6
12	**Savage**	20'	Bit Conc.	300	400	300	400	400	300	18	2
13	**Whitten**	20'	Bit Conc.	1400	4000	4200	2200	3000	3800	24	8

Note: All of the above information provided by the NRPC and adjusted. Volumes were adjusted for specific locations and widths and surface type via field check.

All corridors are alternates with connector options, which cross the Soughegan River.

STG - Surface Treated Gravel

Bit. Conc.- Bituminous Concrete

Path – A typical unimproved road or path without Town maintenance

** Depends on future development – construct to minimum Town standards

AASHTO Design Guidelines for Pavement and Shoulder Width (4th Edition Exhibit 5-5)				
Design Speed	ADT < 400	400-1500	1500-2000	ADT > 2000
30 or 40 mph	18-2	20-5	22-6	24-8

D. Strategies To Relieve Congestion In The Oval

1. Relocate the Town Transfer Station to Brox site or another location that has good access.

The Transfer Station is located near the bank of the Souhegan River and northwest of the Oval. During the day on Saturday the majority of trips to the Transfer Station are through the Oval. The only other crossing of the Souhegan River is via the bridge on the west end of Town near the end of the 101 By-pass. Virtually all of the trips from the southeast quadrant of the Town must pass through the Oval on their trip to the Transfer Station. These trips through the Oval could be eliminated by either providing community trash pickup or by relocating the Transfer Station to a location with better access such as the Brox site.

2. Develop Off Street Parking in the Downtown

Figure 16 shows the locations of parking areas in the vicinity of the Oval provided by the Downtown Ongoing Improvement Team (DO-IT). Virtually any road improvement that will significantly improve traffic flow in the downtown requires the removal of on street parking spaces. However, on street spaces are key to the businesses and they do not typically give up spaces without alternative parking acceptable to their location.

The Institute of Transportation Engineers (ITE) provides statistics that show typical distances walked for various trip purposes and by the urban area population size. For populations in the range of 10,000 to 15,000 (Milford's population in 1999 was 13,078 according to the NRPC) the distance expected for shopping trips and other personal business is only 200 feet. The distance increases to 270 feet for work trips. By comparison, the distance walked for shopping trips in large urban areas in the 500,000 to 1,000,000-population range expect to walk 560 feet.

Parking for shopping trips in the Oval could be increased simply by providing parking for employees in more remote lots. Figure 16 shows the locations of remote sites that can easily be walked for work trips, but are not close enough to the Oval to support businesses. The following locations should be considered for remote parking for employees:

- Congregational Church Lot - 53 spaces approximately 600 feet from the Oval which are not utilized during the week
- Unitarian Church Lot - approximately 600 feet from the Oval which are not utilized during the week
- Bank of New Hampshire South Lot – 23 spaces approximately 400 feet from the Oval

- Mason's Lot - approximately 800 feet from the Oval which are not utilized during the week
- Fletcher's Paint Store Site – approximately 1,200 feet from the Oval

3. Create Off-Street Loading and Unloading Areas

Roadway improvements in the vicinity of the Oval will not improve traffic circulation if trucks unloading goods occupy travel lanes. A large Coca Cola tractor-trailer truck was observed on two occasions parked on the east side of South Street just south of Nashua Street. The truck was parked in a legal parking area, but less than 200 feet from the center of the Oval, which is considered a prime location for shopping parking trips. A truck parked in this location also increases the difficulty of other trucks turning right from Elm Street to South Street.

The traffic island ramp on the westerly side of the Oval has been identified as having deficient pavement width for large trucks. A large truck was observed unloading on Elm Street where the ramp intersects Elm Street. Even with the improvements recommended for this island, it is likely that trucks will not be able to make this turn if another truck is parked in the receiving area of the turn. It is recommended that off-street loading areas be created wherever possible, and where it is not possible, on street loading zones need to be created in locations that do not restrict traffic flow.

E. Plan for future Town Development at the Brox Site

1. New Interchange With NH Route 101:

The location of a new interchange on the Route 101 bypass depends on a number of Design Criteria. Following are some of the criteria that need to be considered when locating an interchange:

- Provide a minimum of 16.5' of clearance over Route 101
- Route 101 has 18,000 vpd (greater than 6,000 vpd)
- Route 101 has a 60mph design speed which equates to a 8 meter clear zone from the edge of the traveled way
- A minimum span of 80 feet is required to meet clear zone requirements
- Depth of bridge girder for an 80 foot span is 40 inches or 3.33 feet
- A minimum road to road separation of 16.5 plus 3.33'= ±20 feet is required
- Interchanges should be a minimum of one mile apart
- Avoid changing the elevation of Route 101 to minimize costs and facilitate construction.
- Avoid wetlands and other environmental constraints

a. The first location considered is an underpass of Route 101 located approximately 3,400 feet east of Old Wilton Road and is within the Brox

property. The NHDOT investigated the feasibility of constructing an interchange at this location previously and determined that the wetland impact would be too severe to obtain the necessary permits. The underpass location is also less than one mile from the intersection of Old Wilton Road and Route 101. It is likely that construction of an underpass at any location between the existing underpass and Osgood Road would encounter wetland or drainage problems as Route 101 was constructed near the existing ground elevation.

b. NHDOT record plans were obtained to determine if there are any locations where an overpass could be constructed with a minimum impact and preferably at a location that is higher than Route 101. The best location, based on this very preliminary information is located approximately 4,700 feet east of Old Wilton Road. This distance does not meet the minimum criteria between interchanges, but Old Wilton Road is a signalized intersection and the approach speed is lowered to 40 mph in the vicinity of the intersection. At that location the elevation of the service road which runs parallel to Route 101 is 19.4 feet higher than Route 101 and near the minimum separation listed above of 20 feet. This location is also within the Brox Property and could provide direct access.

c. A third location that was considered is the existing overpass at Osgood Road. This site is east of the Brox property, but extending the existing service road paralleling Route 101 easterly to Osgood Road could provide access. Wetland impacts are anticipated in the area just to the west of Osgood Road. West Street is located approximately 300 feet north of the overpass and would have to be relocated in order to construct an interchange at this location. Osgood Road is located just 4,600 feet west of the interchange with Route 13, which does not meet the NHDOT criteria of a one-mile minimum between interchanges.

2. Relocate Downtown ball fields:

Ball fields that are in the path of one of the Long Range Alternatives. New ball fields could be constructed in the vicinity of the proposed school to replace the ball field in the path of the West Street long-range access alternative.

V. CONCLUSIONS AND RECOMMENDATIONS:

The increased demands for traffic capacity and services the Town provides and offers in The Oval will put a premium on traffic management. This study identifies the construction projects that will address the traffic management needs of the Town and in the Oval in particular. It is also a tool to plan future projects to reduce traffic in the Oval and to maintain a reasonable capacity on Town Maintained roads.

Projects have been identified and are listed in Table 4 along with accident ratings, traffic volume, and estimated cost information that can be used in considering Town Priorities. Once the Town identifies specific projects and makes the necessary requests through the Nashua Regional Planning Commission (NRPC) for funding through the State's Ten-Year Plan, a Public Process is started to identify projects that warrant inclusion onto the Ten-Year Plan.

A. Oval Traffic Scenarios

Four traffic scenarios were analyzed for the Oval to determine if significant improvements can be accomplished for the short term without a new crossing of the Souhegan River. The existing configuration was modeled to use as a basis of comparison to other configurations. Table 2 lists the level of service and queue lengths at critical areas for each of the following scenarios.

1. Existing Configuration
2. South Street Southbound Only from Oval
3. Traffic Signal at the Intersection of Elm, Nashua and South Streets
4. Traffic Signals on Elm Street at Nashua and South Streets and at Union Street.

Making South Street one-way only out of the Oval makes the greatest improvement to the Oval traffic flow. Congestion currently occurs at the intersection of Elm, Nashua and South where heavy traffic flows enter the Oval from two directions and are in conflict. Eliminating traffic flow entering at South Street greatly reduces congestions at the intersection and the backups on Nashua Street. However, this improvement comes with a cost as the traffic that would enter from South Street has to be rerouted through the intersection of Lincoln and Union Streets where intersection improvements would be required to accommodate turning truck traffic. This improvement would require that the majority of the front lawn of the property at the intersections northeast quadrant be lost due to the widening. Due to the degree of impact this improvement type changes from a short term to a long-term improvement, but it is recommended that it remain in consideration, as this type of impact is typical of any significant improvement that could be made to the Oval.

Two traffic signal scenarios were analyzed to determine the amount of relief that could be expected. In order to have a signal function well at the Oval, widening would be required which would take parking spaces and traffic improvements realized were less than by

making south Street one-way only. Also, considerable extra cost would be required so that the appearance of the equipment would still maintain its function and not detract from the Historical aspects of the Oval. We do not recommend installation of traffic signals on the Oval.

B. Short Term Project List And Priorities

Accident Statistics and Traffic Problem Areas where discussed with Milford Police Chief Frederick Douglas. The Chief provided accident ratings based on experience for critical areas. A list of short-term improvements was developed based on the traffic analysis and the discussions with Chief Douglas and Town Planner Bill Parker.

Table 4 lists each of the projects along with the average daily traffic volume, accident rating (high, medium or low), the estimated construction cost and the priority. Of the eighteen improvements listed, the Town has rated nine (9) as having a high priority. Three (3) of the high priority projects listed are within the maintenance jurisdiction of the New Hampshire Department of Transportation (NHDOT). The NHDOT is currently considering funding and implementation of these improvements. Two of the DOT projects include modifications to signage at each end of the Bypass so that people, and truck traffic in particular, wishing to bypass the downtown will be better informed. The third improvement is to the signalize intersection at the west end of the bypass where improvements include improved signage and signal improvements to reduce delays and add a signal head.

Many Intersections along Route 101A (Nashua Street) have high accident histories. Of the remaining 15 projects the Town has identified 6 as having a high priority, which should be considered for inclusion to the Ten Year Plan. Two of the locations which have been identified as high priority improvement locations are on Route 101A (Nashua Street). A westbound left-turn is proposed to extend the existing turn lane at Clinton Street along the frontage of the Edgewood Shopping Center and end east of Tonella Road. This improvement includes widening along the south side of 101A within the Shopping Center frontage and has an estimated cost of $165,000. A second westbound left turn is proposed at the intersection of Powers Street and 101A. This improvement is intended to utilize the existing curb-to-curb pavement width and is estimated at $45,000.

Three of the Towns highest priorities listed on Table 4 are the widening projects that improve traffic flow on the Oval. The total estimated cost for the 3 projects is $17,000 and should be implemented as soon as possible.

The Town's last high priority project is the pedestrian signal on Route 101A (Elm Street) at the Milford Christian Academy. This section of 101A (Elm Street) has an average daily traffic volume of 13,000 vehicles per day (vpd) and no existing cross walks or nearby signal to slow the through traffic. A recent article in the Institute of Transportation Engineers (ITE) Journal states that isolated unsignalized cross walks are less safe than none at all and should be eliminated. A pedestrian traffic signal is recommended that will provide a safe crossing for students and staff that park on the

south side of 101A and attend school on the north side. The estimated cost for this improvements ranges from $25,000 to $40,000 depending on the type of equipment used.

C. Long Term Alternatives

NRPC maintains and operates the Regional Traffic Model for the Nashua Urban Area. As part of this study, a range of corridors were selected and added (one at a time) to the regional model to determine the relative traffic relief to the Oval with new routes crossing the Souhegan River. Selection of a few alternatives that cover the entire range of opportunities provided enough information to determine relief at specific crossing locations and can be used to interpolate relief gained at any other crossing locations.

Brox Corridor:
One corridor referred to as the Brox Corridor was located to provide access to the Town property known as the Brox site. This corridor provided the most feasible location to construct a new interchange on Route 101.

West Street Corridor:
The West Street Corridor, which is an extension of West Street north across the Souhegan River, provides the greatest traffic relief to the Oval and was estimated to carry 7,800 vpd during the design year 2010. With this corridor, the volume of traffic on the Oval at Route 13 over the Souhegan River decreased from 17,100 to 13,000 vpd. It is recommended that further feasibility and environmental studies be conducted to determine if a river crossing is can be constructed in the vicinity of this location. The interchange location also has environmental issues that need to be examined further.

Powers Street Corridor:
The Powers Street Corridor is just east of the Oval and connects Powers Street,or both Powers Street and Tonella Road, to South Street (NH route 13) just to the north of the existing interchange with Route 101. With this connection, the traffic volume at the intersection of Nashua Street and Powers Street increases to the point where it meets the volume necessary to warrant a traffic signal, which would provide gaps in the traffic stream for vehicles entering busy Nashua Street. If this signal is constructed Nashua Street may need to be widened in the vicinity of the intersection to maintain the capacity of Nashua Street. This alternative could also be used to reroute northbound traffic on South Street and permit making Sooth Street one-way south from the Oval.

East/West Corridor:
A fourth corridor was modeled (not a river crossing) to create an east/west collector route in the south part of Milford. This East/West Corridor was not intended to provide relief to the Oval, but to relieve local north/south local roads that are providing access to numerous new residential developments in the south part of Milford. This alternative greatly reduces the traffic on Mile Slip Road, Osgood Road and Melandy Road by diverting traffic away from those roads to Route 13.

Other Alternatives:

1. Outlying Roads

The impact of the ongoing residential development in the south part of Milford was considered by the NRPC in their traffic modeling process. Table 5 shows the average daily traffic volumes at key locations for the Outlying Roads, the existing pavement width, and pavement type. Average daily traffic volumes are listed for the existing year 2000 scenario and forecasted to the year 2010 for the existing scenario as well as each of the traffic model corridors. A comparison of the existing pavement width to the AASHTO standards indicates that most of the existing outlying roads do not meet standards. It is suggested that this information be used to create a plan for road improvements that can be implemented during the long term and be constructed in part with development impact fees.

2. Transfer Station

The transfer station is located near the bank of the Souhegan River and northwest of the Oval. During mid-day on Saturday the majority of trips to the Transfer Station are through the Oval. Virtually all of the trips from the southeast quadrant of the Town must pass through the Oval on their trip to the Transfer Station. These trips through the Oval could be eliminated by either providing community trash pickup or by relocating the Transfer Station to a location with better access such as the Brox site.

3. Develop Off Street Parking in the Downtown

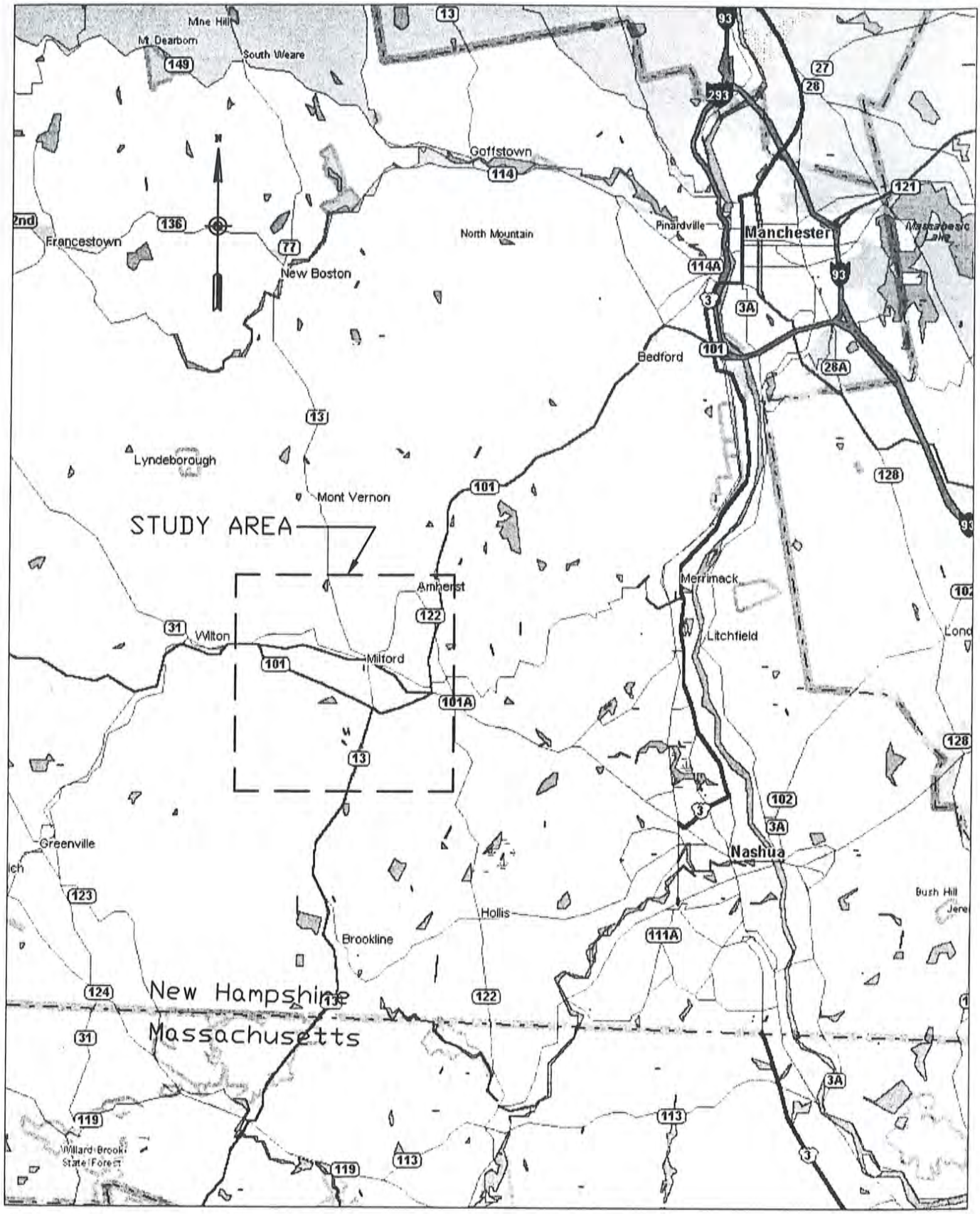
Figure 13 shows the locations of parking areas in the vicinity of the Oval provided by the Downtown Ongoing Improvement Team (DO-IT). Virtually any road improvement that will significantly improve traffic flow in the downtown requires the removal of on street parking spaces. However, on street spaces are key to the business's and they do not typically give up spaces without alternative parking acceptable to their location. Parking for shopping trips in the Oval could be increased by mandating that employees park in remote lots.

4. Create Off-Street Loading and Unloading Areas

Roadway improvements in the vicinity of the Oval will not improve traffic circulation if trucks unloading goods occupy travel lanes. It is recommended that off-street loading areas be created wherever possible, and where it is not possible, on street loading zones need to be created in locations that do not restrict traffic flow.

5. Relocate Downtown ball fields

Ball fields are in the path of one of the Long Range Alternatives. New ball fields could be constructed in the vicinity of the proposed school to replace the ball field in the path of the West Street long-range access alternative.



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EVALUATION OF ALTERNATE
TOWN OF MILFORD, N.H.

HIGHWAY IMPROVEMENTS

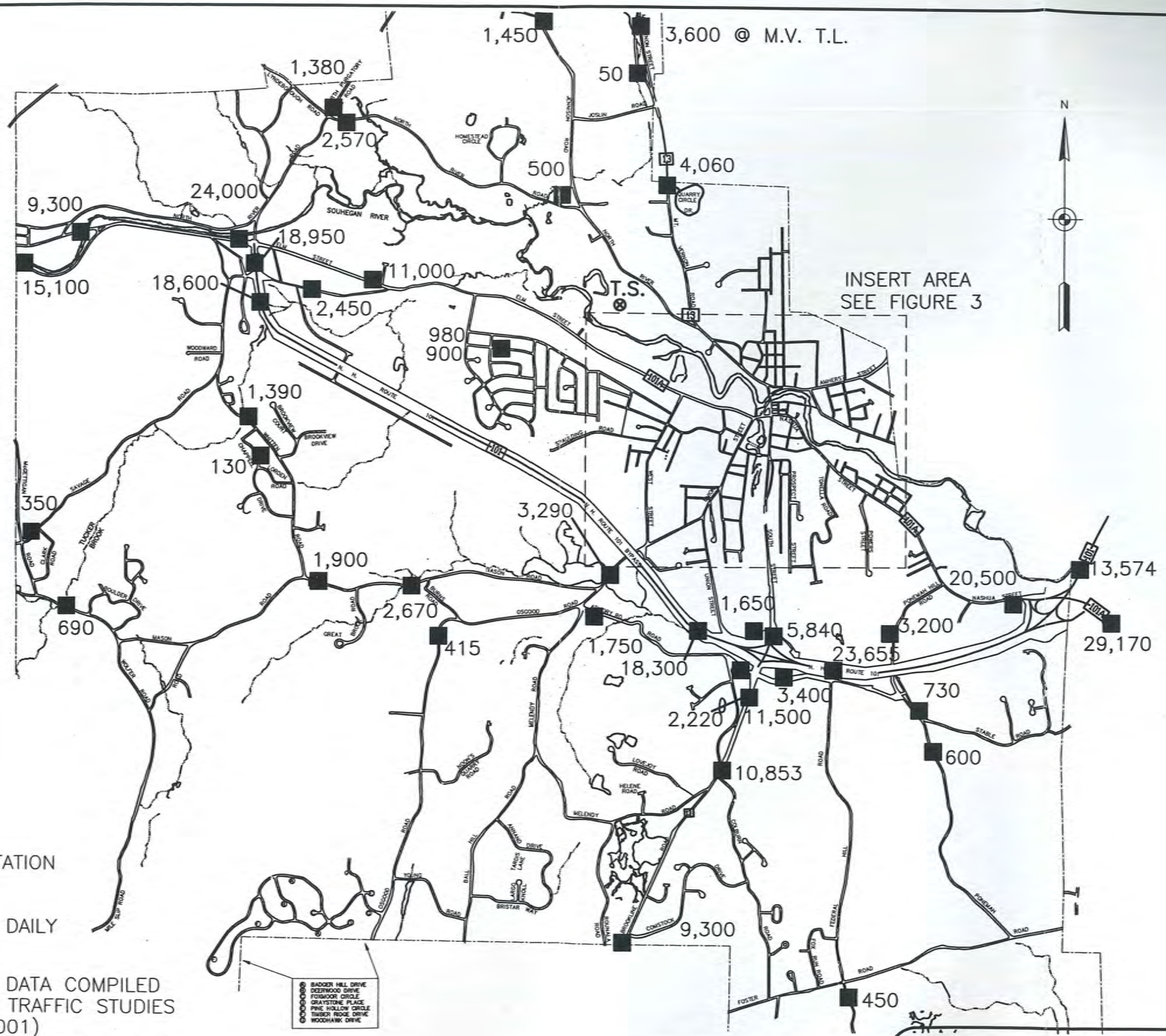
SITE LOCATION MAP SCALE 1'=3.6 miles

HTA Consulting Engineers

FILENAME: milford-locus.dwg

DATE: 08/01/01

FIGURE 1



T.S. TRANSFER STATION

KEY
11,500–AVERAGE DAILY TRAFFIC VOLUME

■ TRAFFIC COUNT DATA COMPILED FROM CURRENT TRAFFIC STUDIES (FROM 1990–2001) AND FROM NRPC & NHDOT DATA.

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Dr. By: pdh
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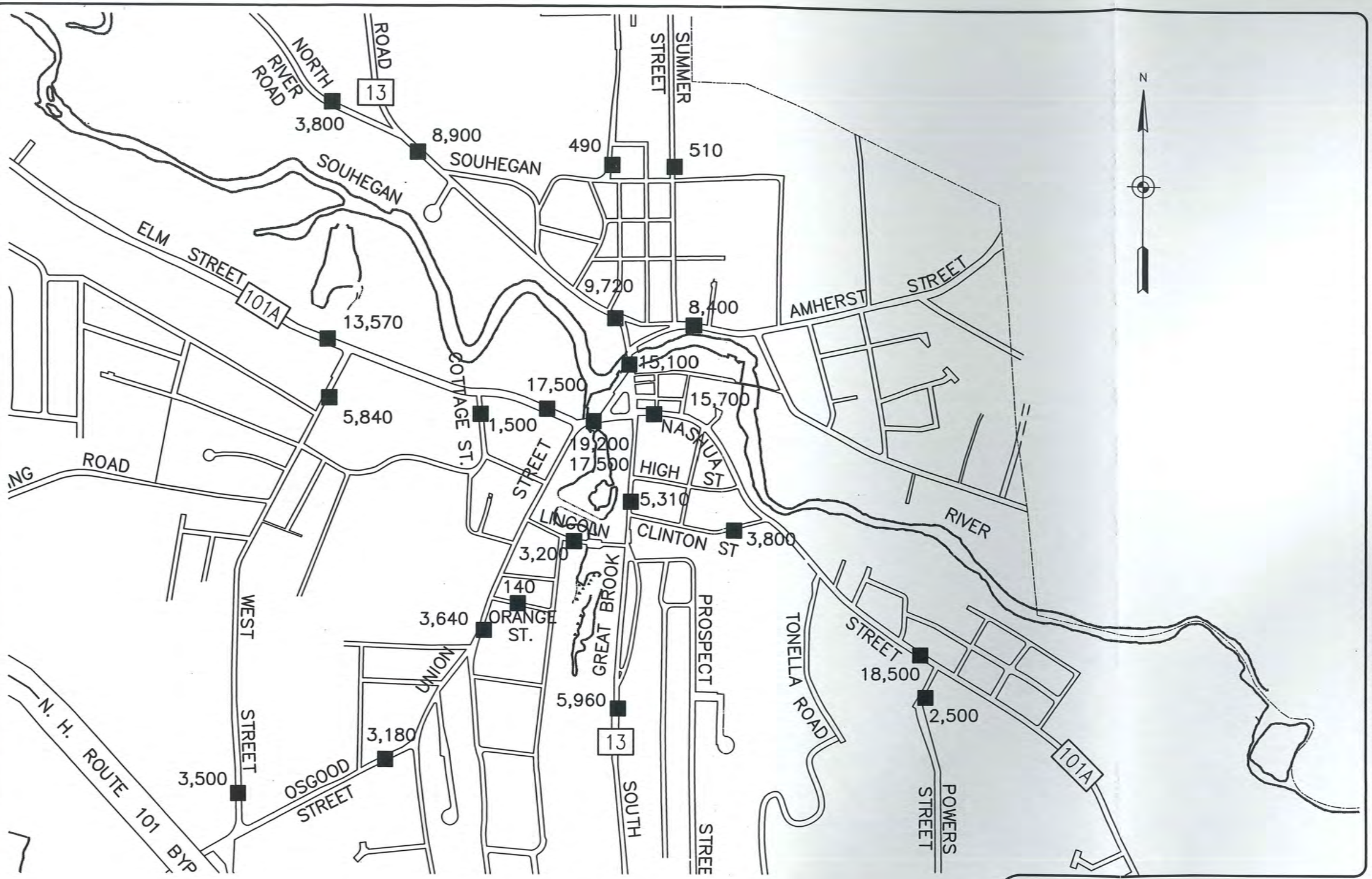
Date: 08/01/01
Scale: 1"=3000'

TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

AVERAGE DAILY TRAFFIC VOLUMES 1

FIGURE
2



3,500 AVERAGE DAILY TRAFFIC VOLUMES

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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

AVERAGE DAILY TRAFFIC NEAR THE OVAL

FIGURE 3

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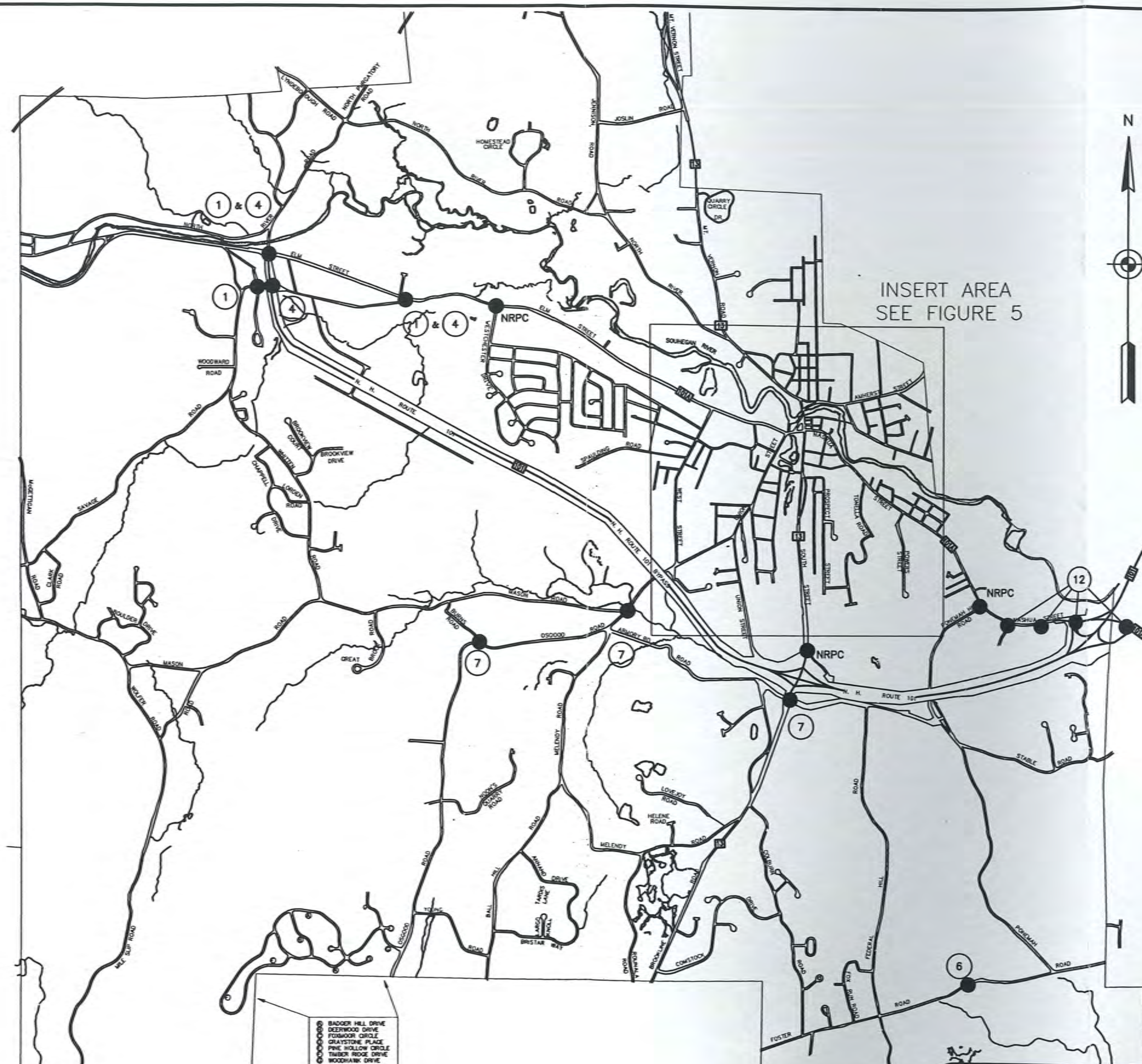

1 TRAFFIC STUDY - SEE TABLE 1

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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

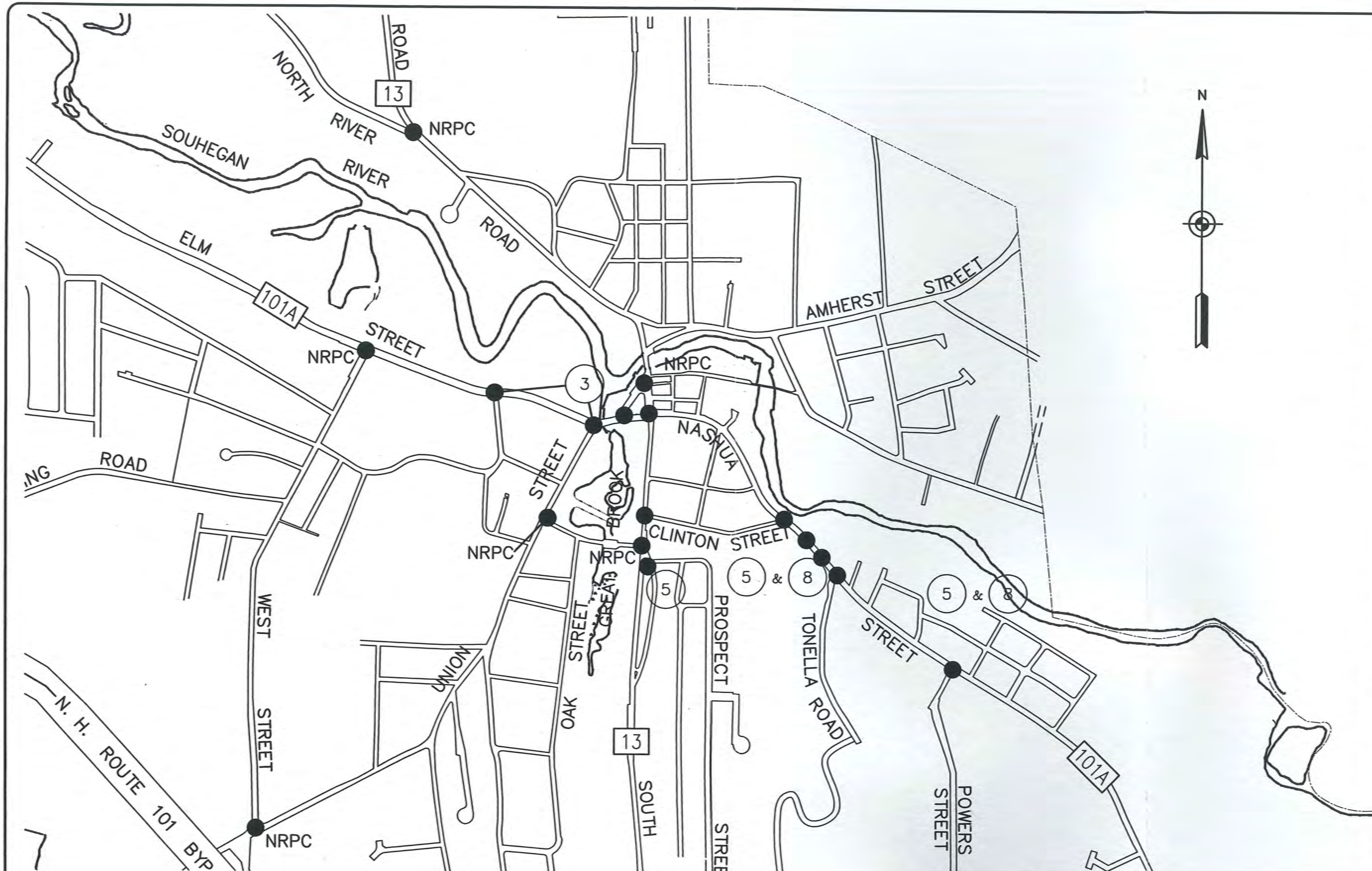
HIGHWAY IMPROVEMENTS

TURNING COUNT LOCATIONS

[illegible]

Des. By:	jpc	Filename:	turncts.dwg
Dr. By:	pdh	Date:	08/01/01
Ck. By:	crm	Scale:	1"=3000'

FIGURE
4



(X) SEE TRAFFIC STUDY – SEE TABLE 1

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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

Turning Count Locations Near the Oval

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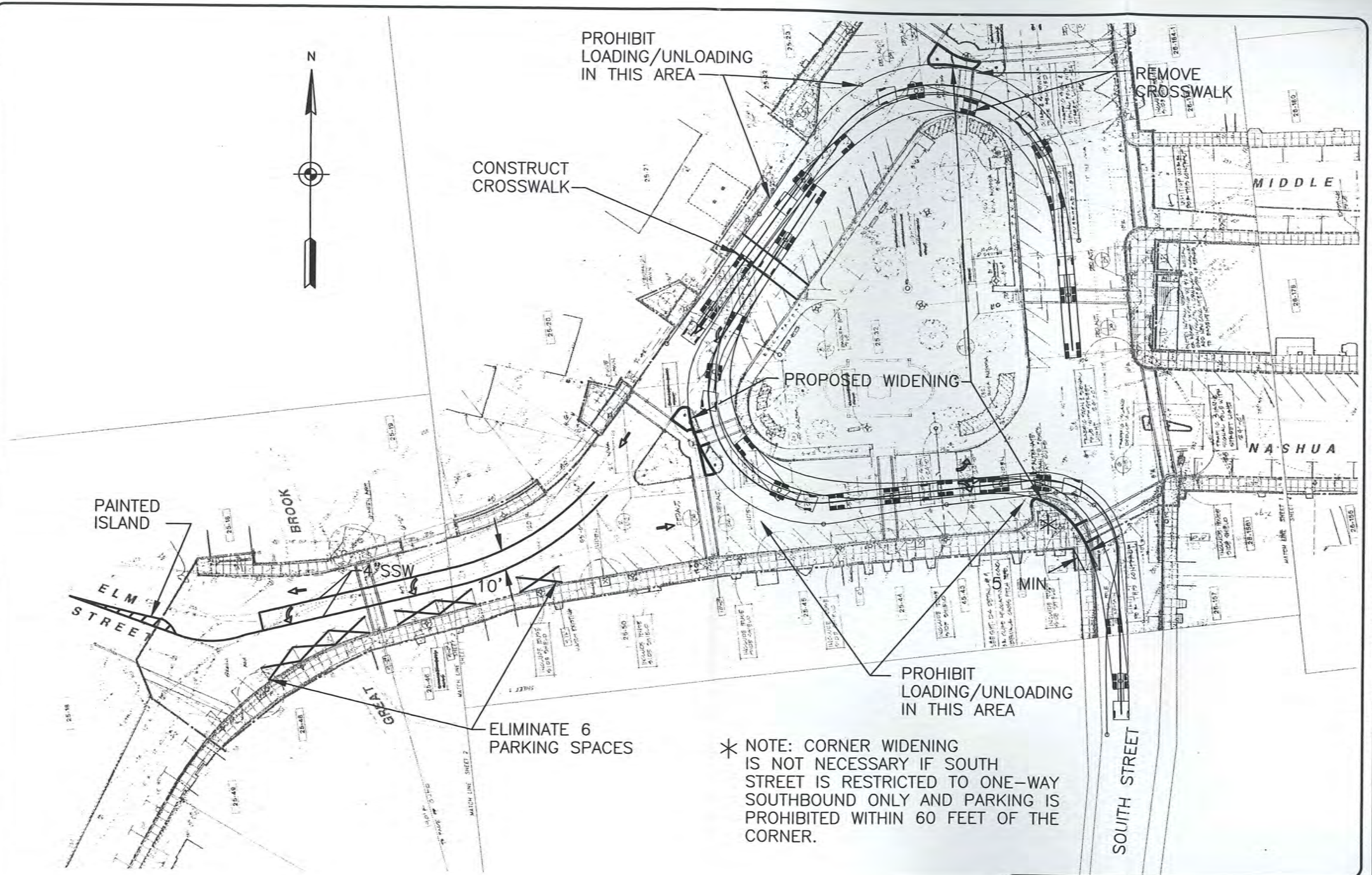
FIGURE 5



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Dr. By: pdh
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Filename: ovalimp1.dwg
Date: 08/01/01
Scale 1"=50'

TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

Oval Improvements (Without Rerouting Traffic)

FIGURE
6

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ELM STREET

IMPROVEMENT:
REMOVE PARKING ON UNION ST. NB AND CREATE SEPARATE LEFT & RIGHT TURN LANES.

COTTAGE ST.

101 A WB

GARDEN ST.

STREET

IMPROVEMENT:
WIDEN TURN RADIUS WB TO NB
SEE FIGURE 8.

OVAL

ONE WAY

101 A WB

GREAT BROOK

R.R. BED

UNION

ONE WAY

LINCOLN

STREET

SOUTH ST.

IMPROVEMENT:
WIDEN TURN RADIUS NB TO WB
SEE FIGURE 8.

MIDDLE STREET

SCHOOL ST.

SOUHEGAN RIVER

NASHUA STREET

HIGH STREET

CONSTRUCT ISLAND TO PROHIBIT NORTHBOUND TRAFFIC.

CLINTON STREET

FRANKLIN STREET

Des. By: jpc	Filename: Oval-reroute.dwg	
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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

Milford Oval Rerouting Alternative

FIGURE 7

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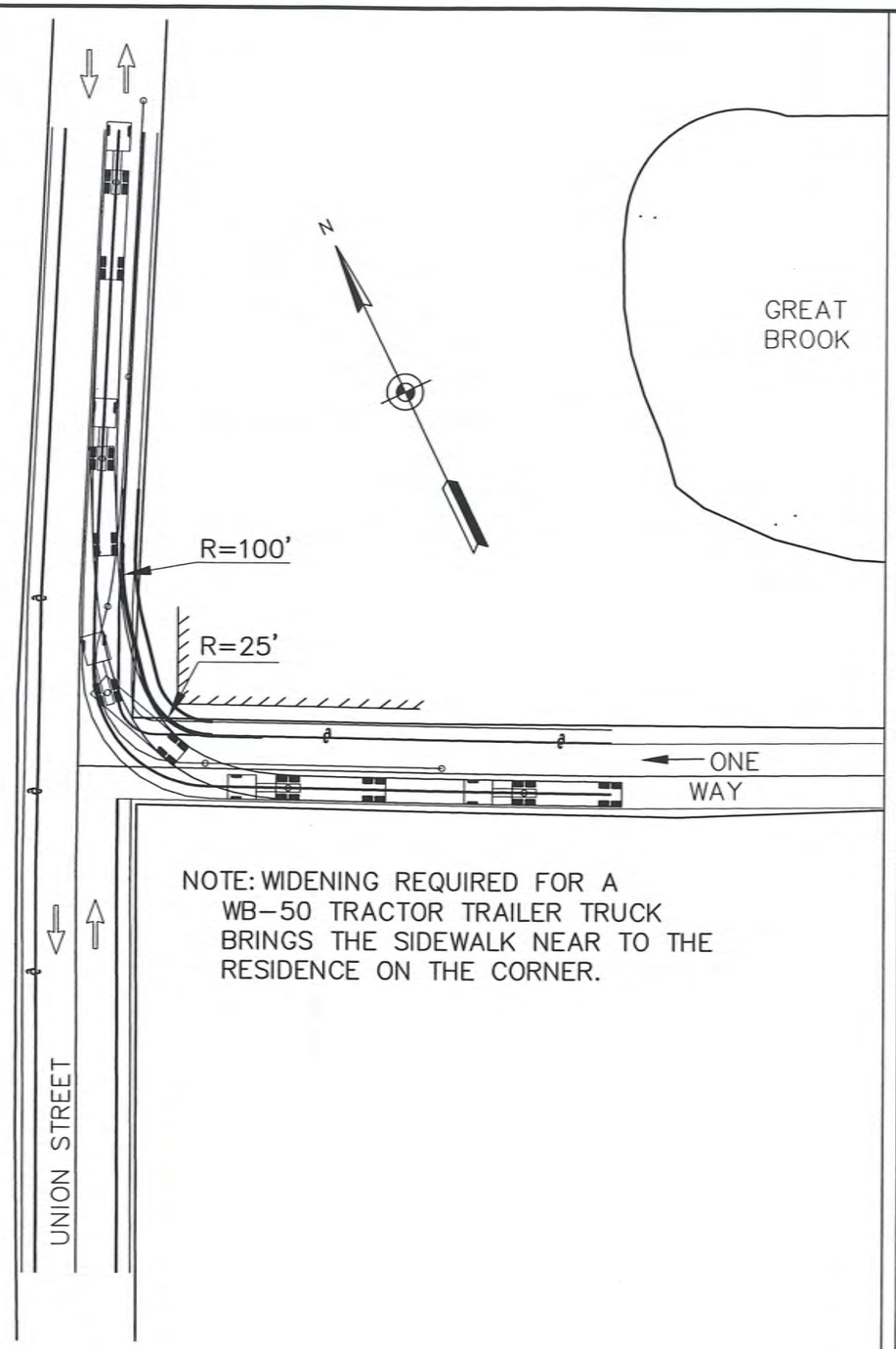
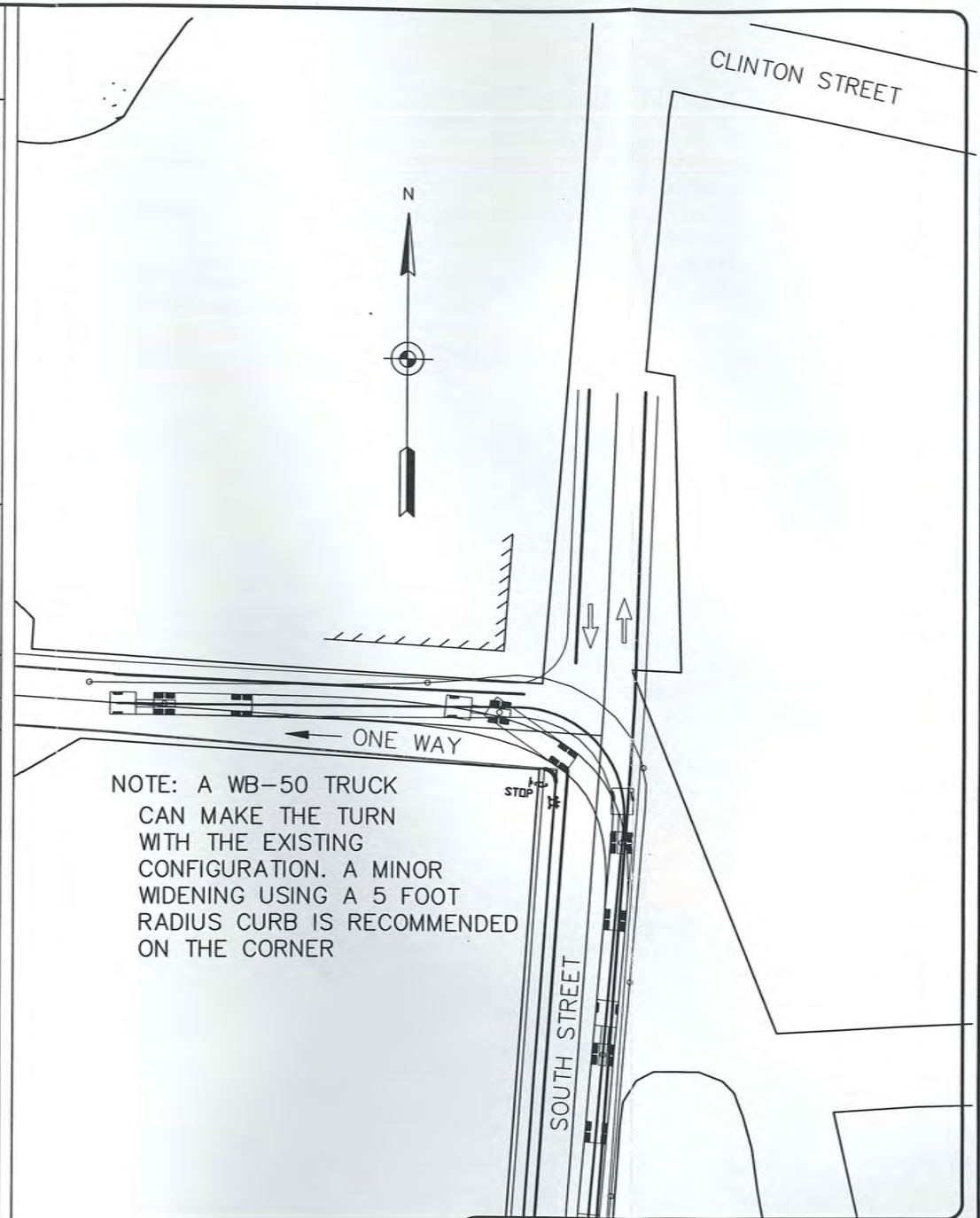


NOTE: WIDENING REQUIRED FOR A WB–50 TRACTOR TRAILER TRUCK BRINGS THE SIDEWALK NEAR TO THE RESIDENCE ON THE CORNER.



NOTE: A WB–50 TRUCK CAN MAKE THE TURN WITH THE EXISTING CONFIGURATION. A MINOR WIDENING USING A 5 FOOT RADIUS CURB IS RECOMMENDED ON THE CORNER

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Ck. By:	crm
Filename:	lincolnimp.dwg
Date:	08/01/01
	Scale 1"=50'

TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

Lincoln Improvements for Rerouting Alternative

FIGURE 8

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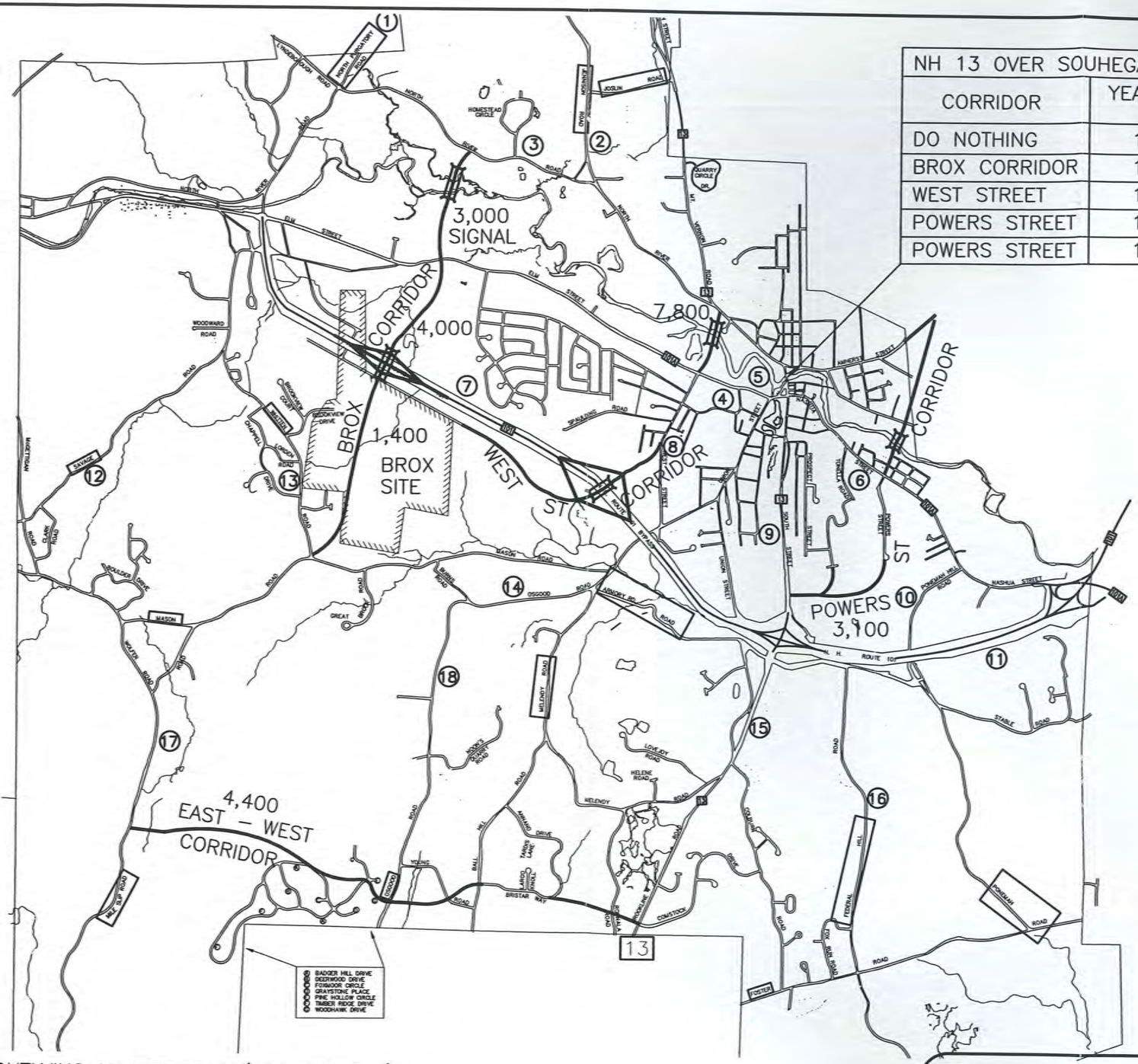
NH 13 OVER SOUHEGAN RIVER	
CORRIDOR	YEAR 2010 ADT
DO NOTHING	17,100
BROX CORRIDOR	16,200
WEST STREET	13,000
POWERS STREET	16,700
POWERS STREET	16,900



XXXX — OUTLYING MAJOR ROAD (SEE TABLE 5)

(XX) — TRAFFIC MODEL VOLUME LOCATIONS (SEE NRPC REPORT IN APPENDIX C)

XXXX — FORECASTED AVERAGE DAILY TRAFFIC VOLUMES (ADT) YEAR 2010

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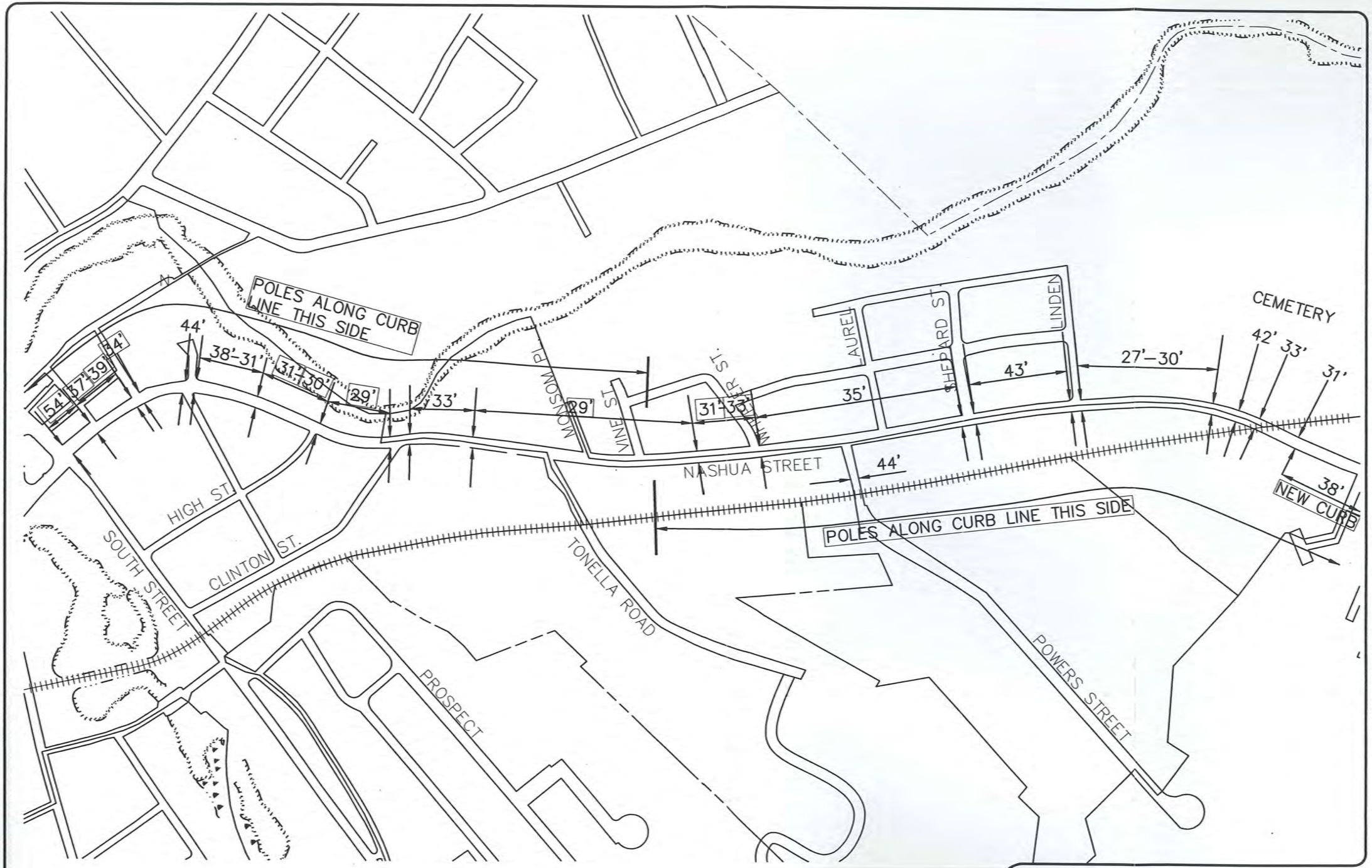
Dr. By: PDH | Date: 08/01/01
Ck. By: CRM | Scale: 1"=3000'

TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

Traffic Model Corridors

FIGURE 9



Des. By:	jpc
Dr. By:	JBM
Ck. By:	PDH
Filename:	twltl101.dwg
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	Scale 1"=400'

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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS
CURB TO CURB PAVEMENT WIDTHS

FIGURE
10

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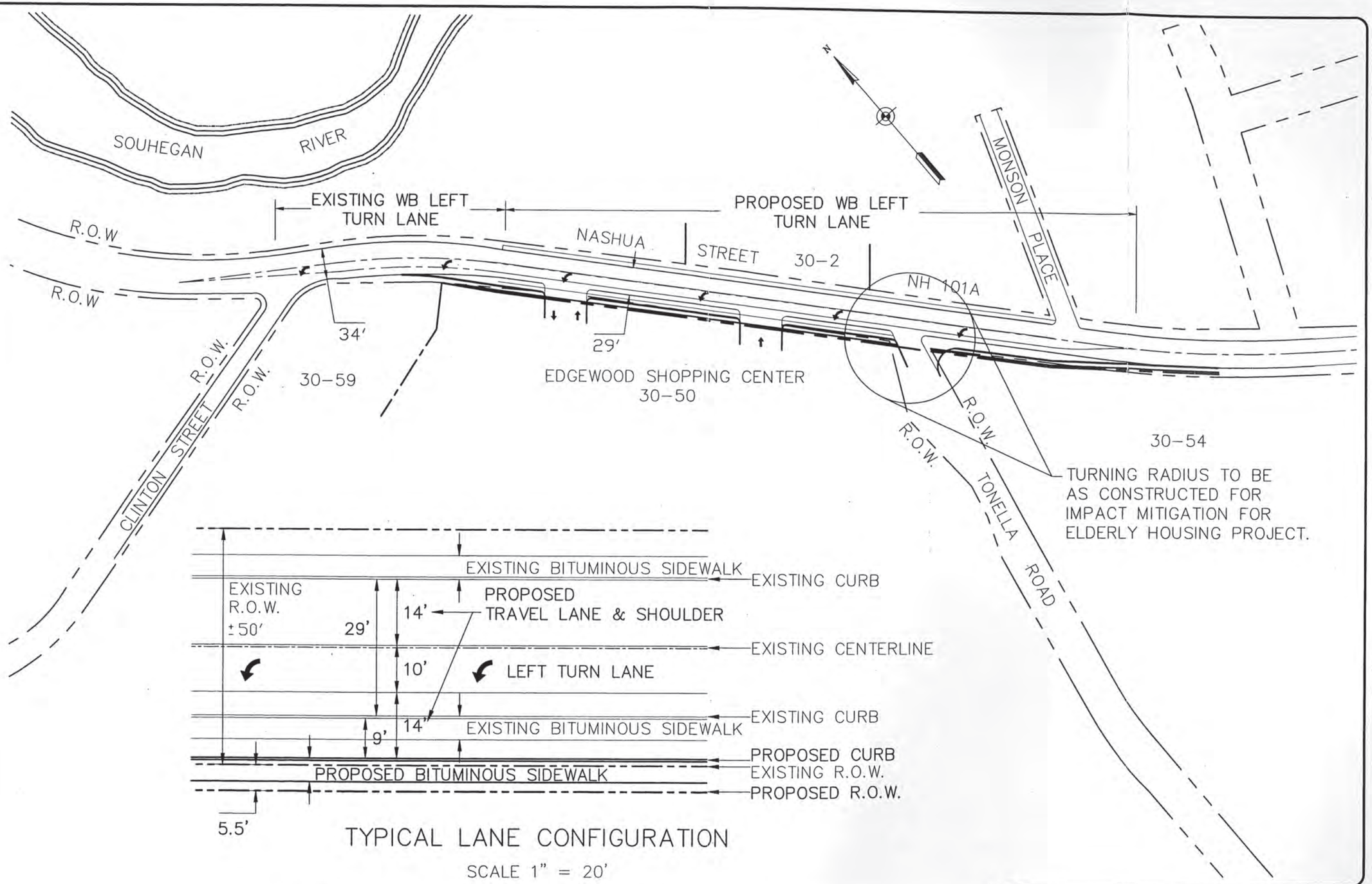

TYPICAL LANE CONFIGURATION

SCALE 1" = 20'

NOTE: TOTAL WIDENING WIDTH IS 9 FEET. (FROM 29' TO 38').
WIDENING REQUIRES ELIMINATION OF ON ROW OF PARKING SPACES PARALLEL TO THE STREET WHICH EQUAL 11 LOST SPACES.

Filename: LTTRNEDGWD.dwg
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Dr. By: pdh
Ck. By: crm
Date: 08/01/01
Scale 1"=100'

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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

NH 101A Left Turn Lane at Edgewood S.C.

FIGURE 11

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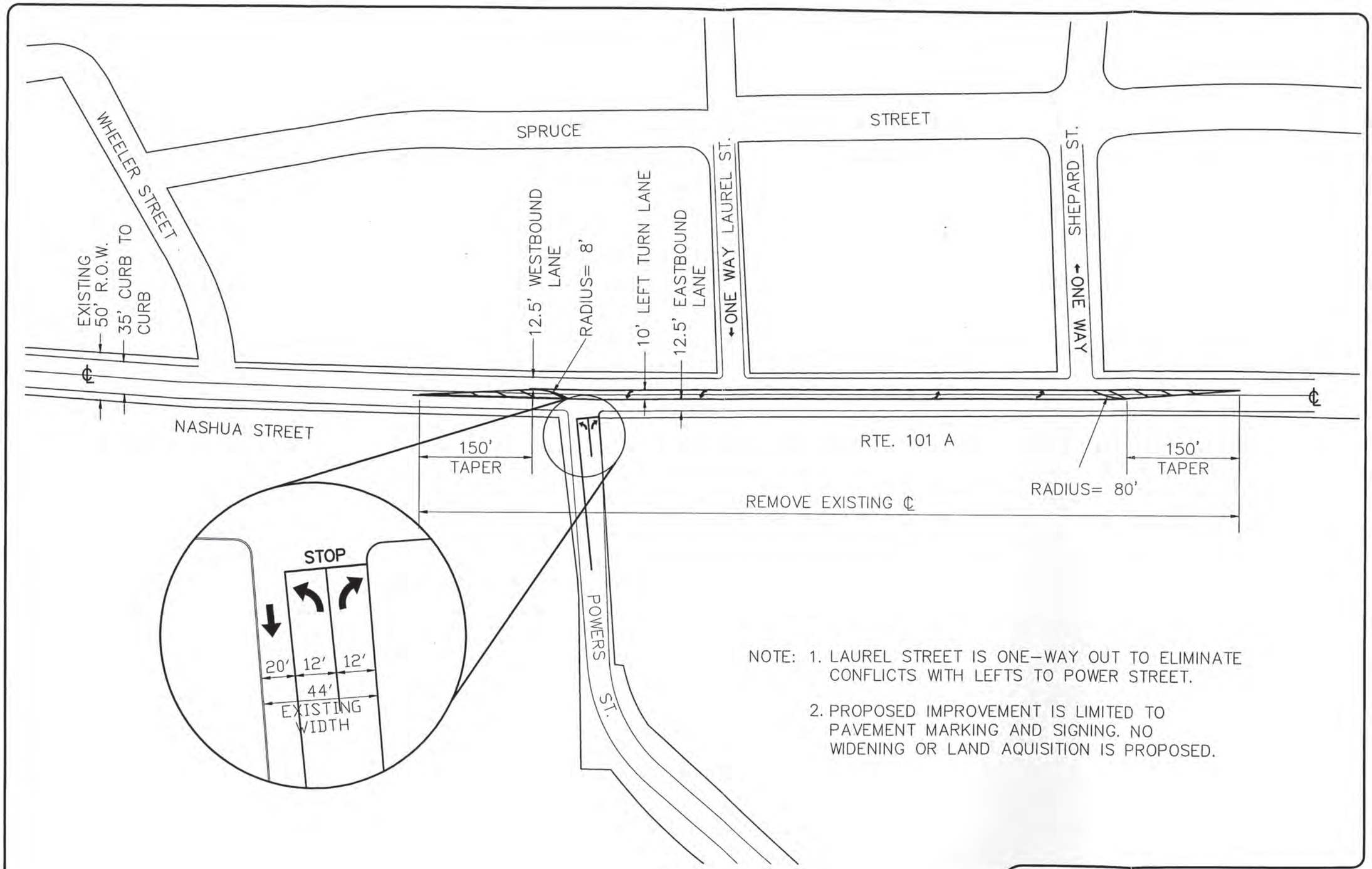

NOTE: 1. LAUREL STREET IS ONE-WAY OUT TO ELIMINATE CONFLICTS WITH LEFTS TO POWER STREET.

2. PROPOSED IMPROVEMENT IS LIMITED TO PAVEMENT MARKING AND SIGNING. NO WIDENING OR LAND AQUISITION IS PROPOSED.

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Dr. By: pdh | Date: 08/01/01
Ck. By: crm | Scale 1"=100'

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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

NH 101A Left Turn Lane at Powers St.

FIGURE
12

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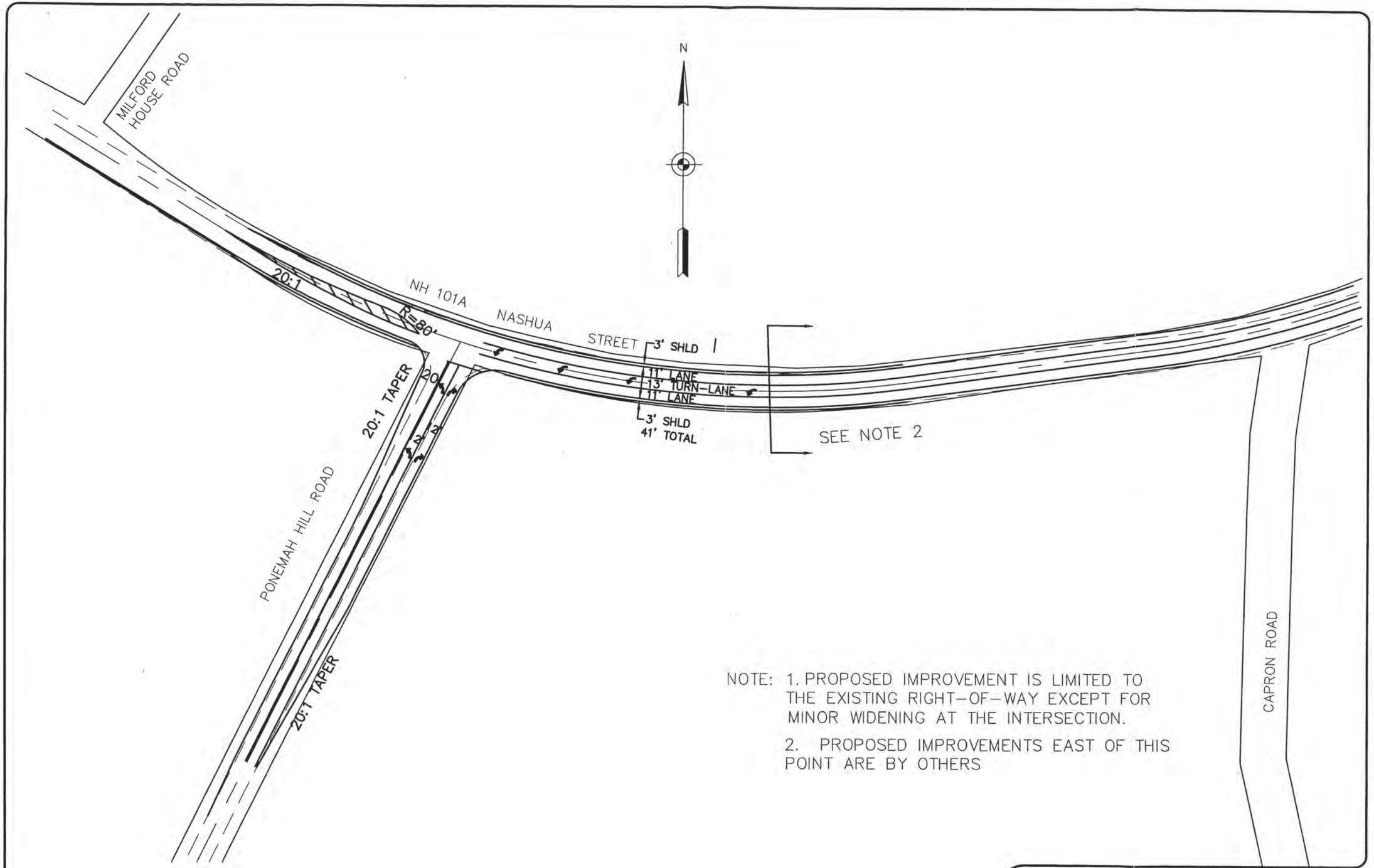

NOTE: 1. PROPOSED IMPROVEMENT IS LIMITED TO THE EXISTING RIGHT-OF-WAY EXCEPT FOR MINOR WIDENING AT THE INTERSECTION.

2. PROPOSED IMPROVEMENTS EAST OF THIS POINT ARE BY OTHERS

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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

NH 101A Left Turn Lane at Ponemah Hill Rd.

FIGURE 13

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M–14
WILTON RD./MADISON ST.

NH–3
MILFORD BY–PASS SIGNS EB

NH–2
INT. 101/101A WEST
& R.R.CROSSING

M–13
CONSTRUCT PEDESTRIAN
SIGNAL @ MILFORD CHRISTAIN ACADEMY

M–12
COORDINATE MILFORD DISTRICT COURT HOUSE
TRAFFIC IMPACTS

M–11
WEST ST. SIGNAL LOOP

INSERT AREA
SEE FIGURE 14

M–4
LEFT TURN LANE
101A–CLINTON TO
TONELLA DR.

M–3
101A/POWERS ST.

M–2
101A/PONEMAH HILL RD.

M–1
SHAWS–EXTEND MEDIAN

NH–1
MILFORD BYPASS
SIGN EB
101A SIGN

T.S. TRANSFER STATION

KEY
11,500–AVERAGE DAILY
TRAFFIC VOLUME

● PROJECT LOCATION

BADGER HILL DRIVE
DEERWOOD DRIVE
FOXMOOR CIRCLE
GRAYSTONE PLACE
PINE HOLLOW CIRCLE
TIMBER RIDGE DRIVE
WOODHAWK DRIVE

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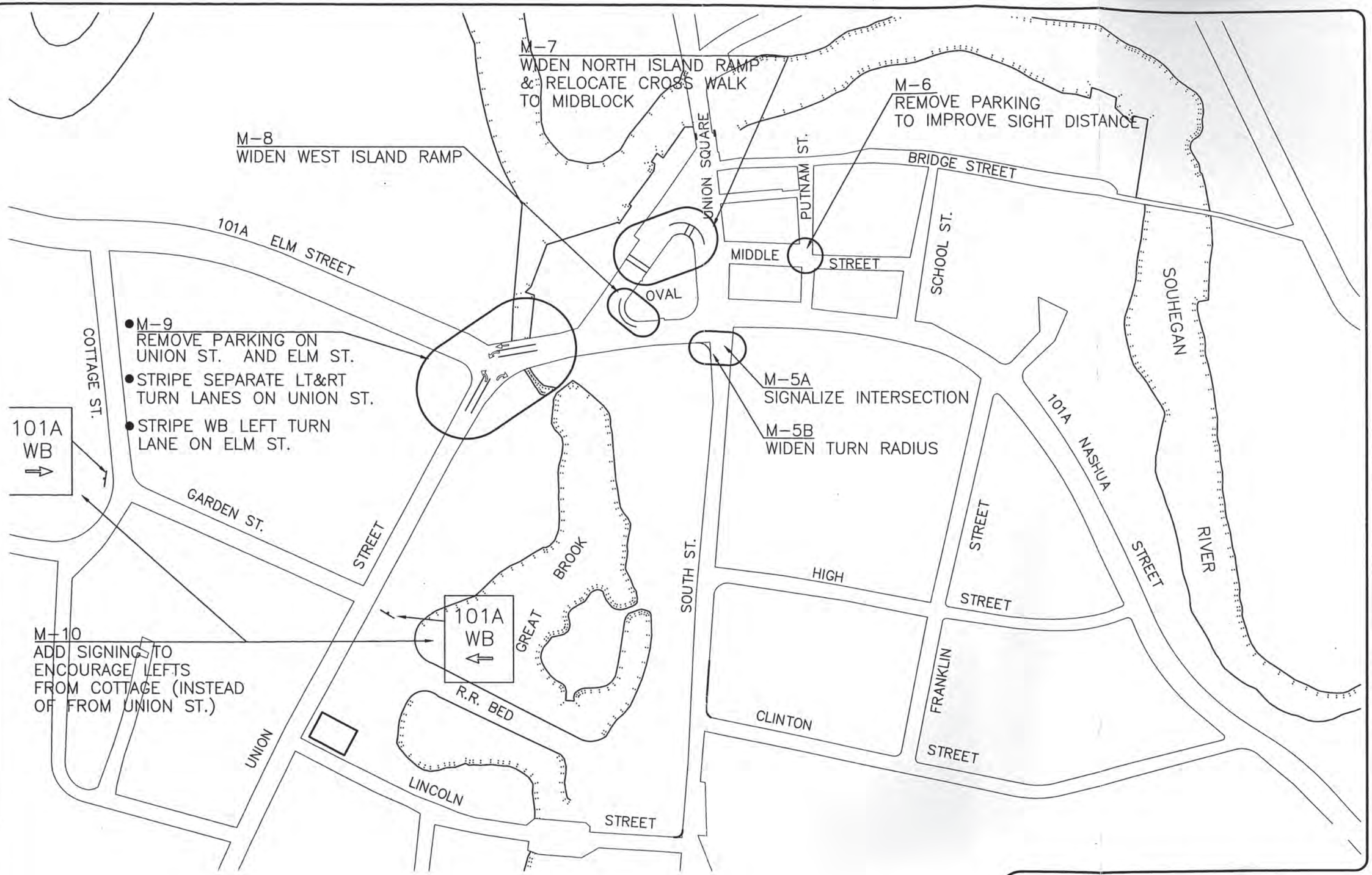
TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS
SHORT TERM IMPROVEMENTS

FIGURE
14



Filename:	downtown-imp.
Des. By:	jpc
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Dr. By:	pdh
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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

Improvements in the Downtown Area

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FIGURE
15

SOUHEGAN RIVER

1,000'

750'

500'

400'

300'

200'

MASON'S

MONT VERNON STREET

AMHERST STREET

POTENTIAL OFF STREET PARKING

UNITARIAN CHURCH

8 HR. LIMIT

4 HR. LIMIT

POTENTIAL OFF STREET PARKING

POTENTIAL OFF STREET PARKING

FLETCHERS' SITE

30

19+2HC

BRIDGE STREET

35

12

8+1HC

MIDDLE STREET

4

5

21

SCHOOL STREET

2 HR. LIMIT

17

OVAL

6+1HC

7+1HC

2

8

NASHUA STREET

ELM STREET

10

34+1HC

12

20

PINE STREET

COTTAGE STREET

27+2HC

17

22+1HC

9

22

COMMUNITY HOUSE

BANK OF NEW HAMPSHIRE

23

22

15 UNION SQUARE

UNION STREET

53

CONGREGATIONAL CHURCH

4 HR. LIMIT

SOUTH STREET

GARDEN STREET

HIGH STREET

8 HR. LIMIT

TOTAL PUBLIC	188
TOTAL PRIVATE	235
TOTAL FOR RENT	65
	488 PARKING SPACES

KEY 53 — PARKING AREA WITH 53 SPACES

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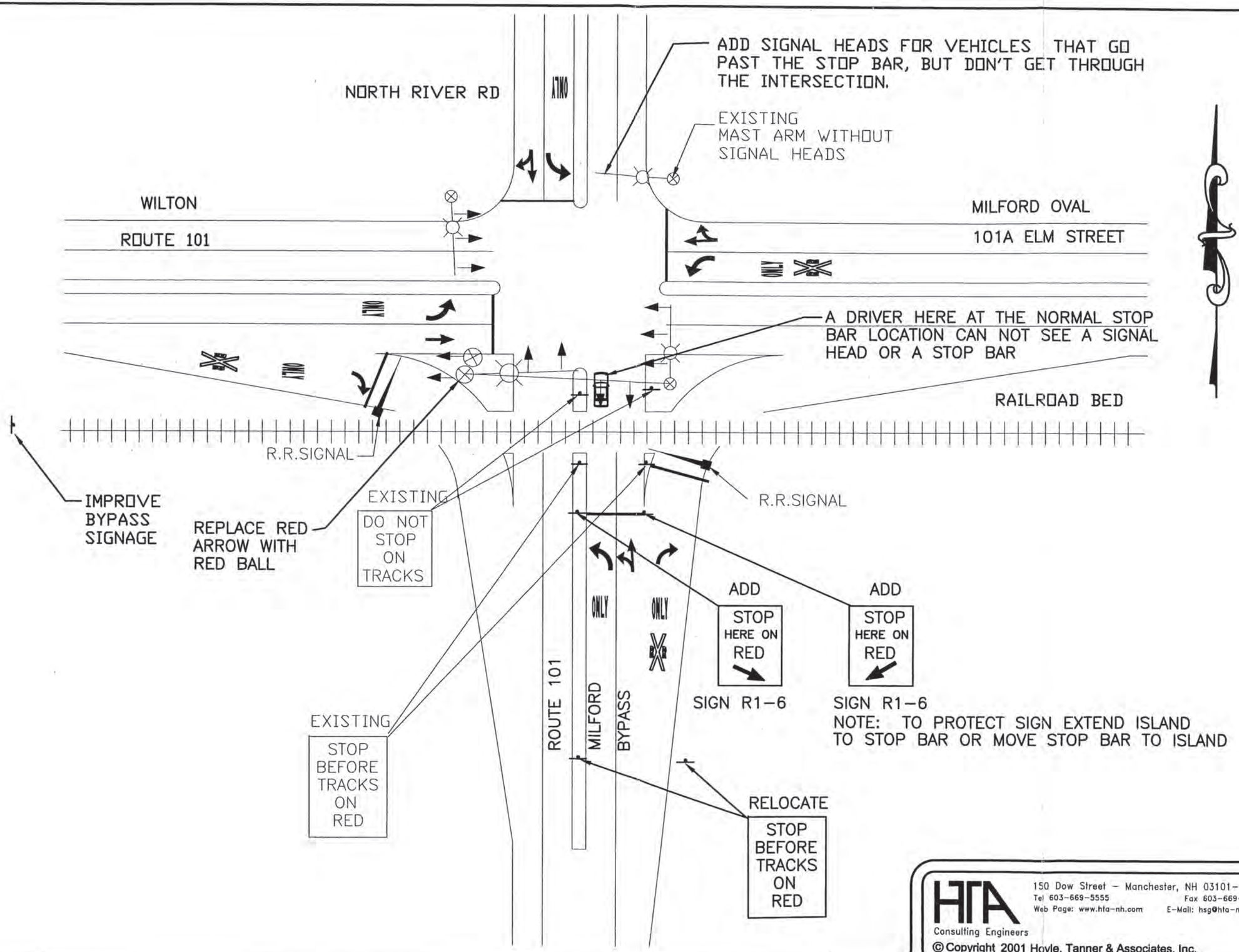
TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

Milford Oval Parking

FIGURE 16



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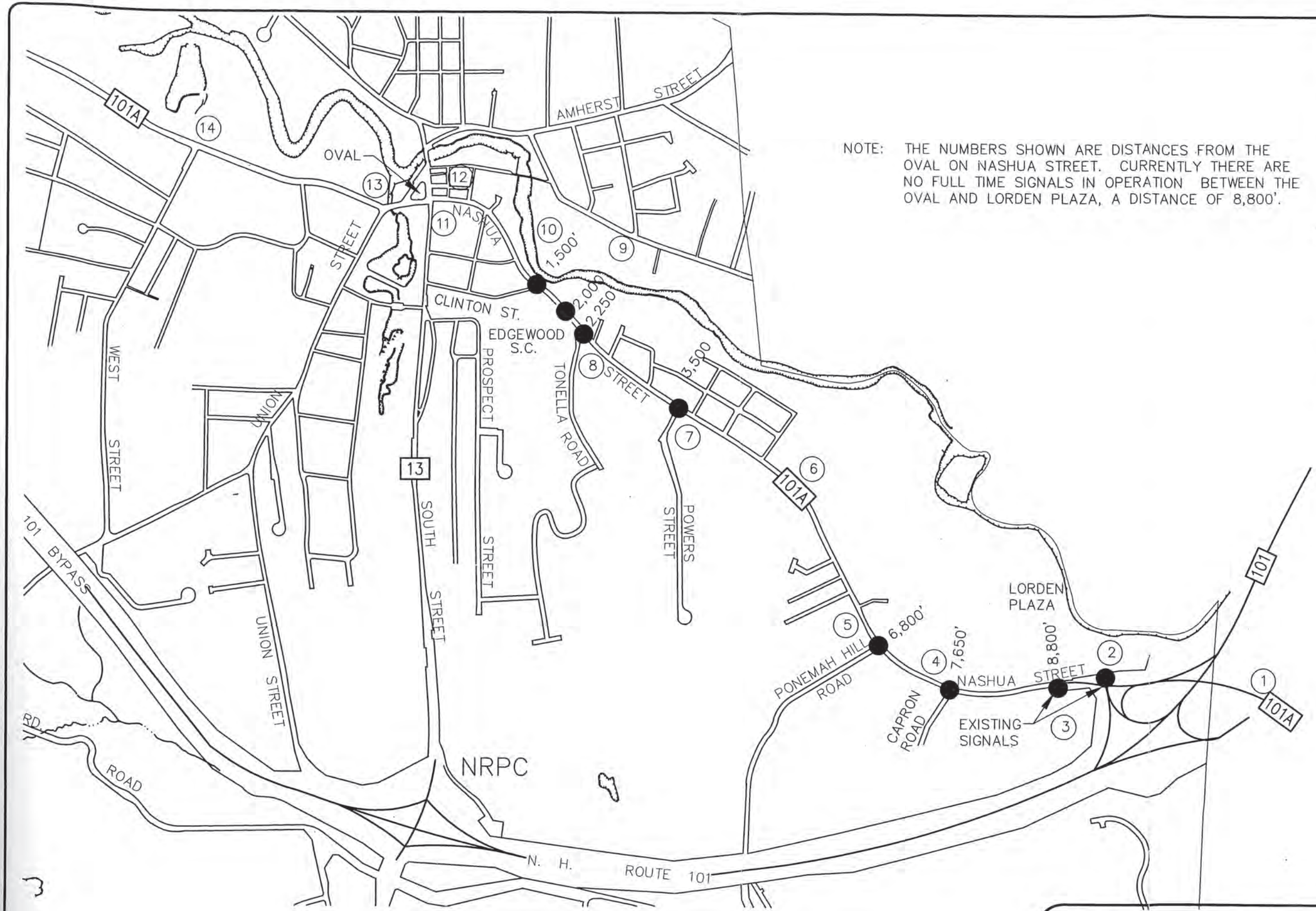
TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

West Intersection of 101 and 101A

FIGURE
17



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TOWN OF MILFORD, N.H.
EVALUATION OF ALTERNATIVES

HIGHWAY IMPROVEMENTS

SIGNAL WARRANTS

FIGURE
18