KEITH and SCHNARS, P.A.
FLORIDA'S Big LOCAL FIRM

MEMORANDUM

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FROM: Fadi Emil Nassar, Ph.D., P.E., PTOE

DATE: May 16, 2016

SUBJECT: City of Lake Worth Traffic Calming Study-Phase I
Preliminary Citywide Data Collection Analysis
K&S Project No. 18160

Keith and Schnars, P.A. (K&S) has been retained by the City of Lake Worth (City) under the Professional Consulting Services contract (RFQ 12-13-302) to perform Phase I of a citywide traffic calming study. The City has developed a draft policy to implement traffic calming throughout the City and is considering an annual budget for phased implementation of this policy. The first phase focuses on data collection and GIS geocoding of traffic calming related information. The scope of services for Phase I includes (1) collecting field data related to stop signs, speed limit signs, and implemented traffic calming measures; (2) obtaining available data related to traffic crashes, citations and citizen complaints; (3) geocoding data into GIS layers; (4) performing preliminary generalized citywide review of collected data to identify issues and prioritize traffic calming corridors for a more detailed analysis; and (5) performing a detailed traffic calming study for two roadway sections selected in coordination with City staff. Traffic counts and speed measurements will be collected for the two selected corridors and a more focused review of crash data and citations from police reports will be conducted.

1. Study Area

Lake Worth is a coastal city of 37,000 residents extending over 7 square miles in Palm Beach County, Florida. The city is generally bordered by the intercostal waterway to the east, the West Palm Beach Canal to the north and northwest, Lake Osborn to the southwest and 18th Avenue South/Truman Street to the south. The major north-south roads are I-95, A Street, Dixie Highway and Federal Highway. The major east-west roads are 6th Avenue South, 10th Avenue North, and Lake Worth Road which split in the downtown area into a one-way pair: Lake Avenue (eastbound) and Lucerne Avenue (westbound). Within the City, avenues run in the east-west direction and streets in the north-south direction. Avenue and street names have a North or South prefix depending on their location north or south of the downtown area. The City land uses are mostly residential or public (schools, parks, etc.). However, there are some light industrial zones located primarily west of I-95 in the northwest section of the City. There is a concentration of schools near I-95 and Lake Worth Road where a number of traffic calming measures have already been implemented. The residential areas are divided into neighborhoods. **Figure 1** shows the City's main residential neighborhoods.

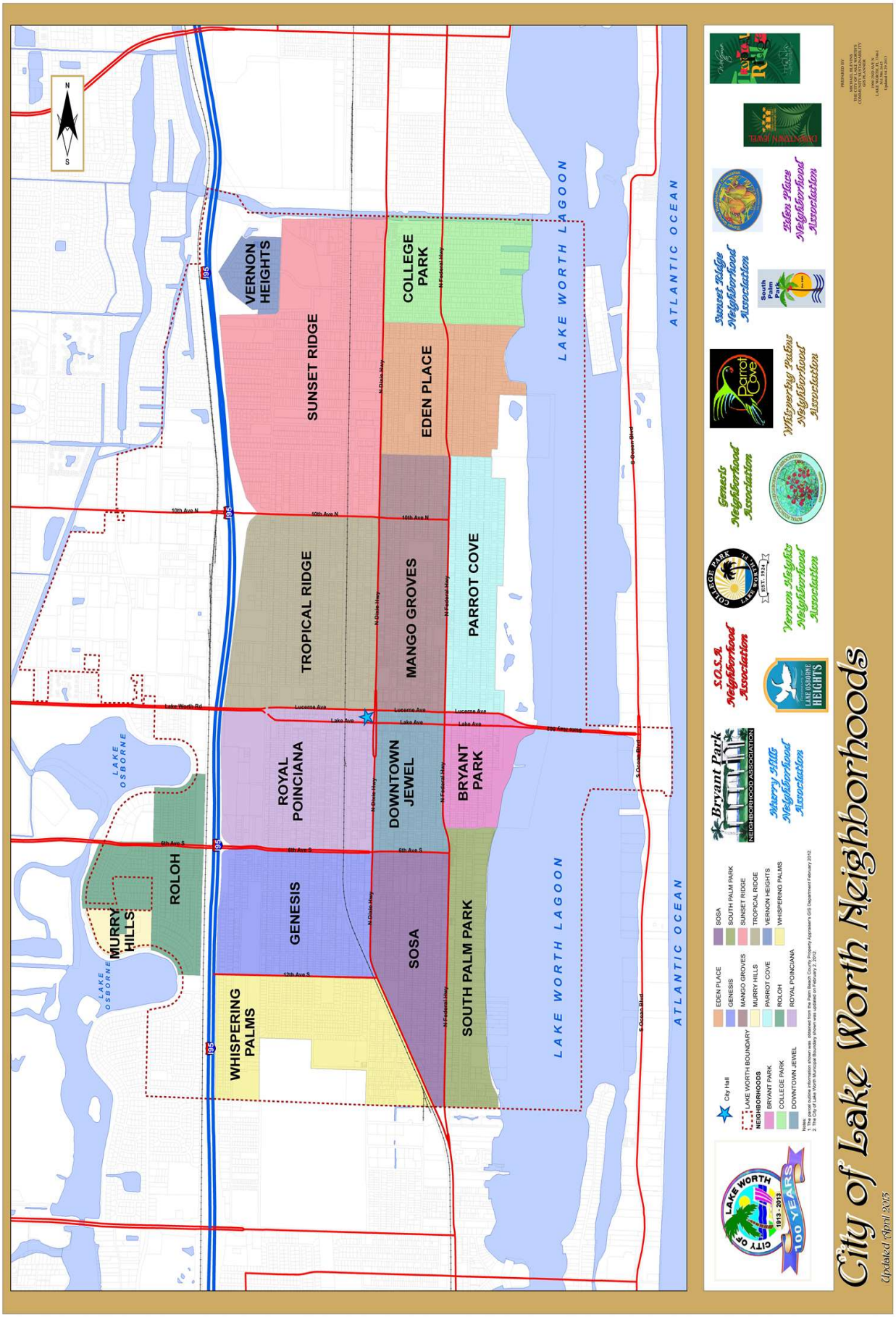

FIGURE 1	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	CITY OF LAKE WORTH NEIGHBORHOODS	

2. City Road Designation

The City of Lake Worth's Code of Ordinances (Chapter 21, Sections 12-15) uses designations including Through, Collector, Arterial, Residential and Industrial to classify the City's roadway network. Except for the 12 Through, Arterial and Collector roads listed below, all other roads are classified as either Residential or Industrial.

1. Lake Avenue - Through Street
2. Lucerne Avenue - Through Street
3. 1st Avenue South (East of the Florida East Coast Railroad) - Collector
4. 2nd Avenue North - Collector
5. 4th Avenue South (West of Dixie Highway) - Collector
6. 6th Avenue South - Through Street
7. 7th Avenue North - Collector
8. 10th Avenue North - Through Street
9. 13th Avenue North - Collector
10. US-1/Federal Highway - Through Street
11. Boutwell Road - Arterial
12. Detroit Street - Arterial

3. Analysis Methodology

The purpose of this document is to describe the data collected in the field, define the developed GIS layers and provide a preliminary citywide analysis of collected data. Another objective is to identify two corridors for a more detailed traffic calming study consistent with the City's Draft traffic calming policy provided in **Attachment A**. Traffic calming measures are primarily intended to reduce speeding and cut-through traffic. A side benefit is to make the community more livable and friendlier to pedestrians and bicyclists. This citywide traffic calming analysis is limited in scope because traffic speeds and volumes were not collected as part of this Phase I effort. Therefore, residential road segments subject to speeding and cut-through traffic cannot be identified within the scope of this study. As such, this analysis is focused on developing a GIS application to be used as part of future phases that includes an inventory of existing signs and identifying missing or misplaced stop signs and speed limit signs. This study also identifies existing traffic calming measures and relevant data such as crashes, traffic citations and school locations. It should be noted that whereas stop sign locations are provided in the GIS database, no assessment was made regarding the justification of two-way and all-way stop signs as provided in Section 2B of the MUTCD. Typically, sign placement justification can only be evaluated on a case by case basis using guidance from both the MUTCD and recent court decisions in Florida related to justification of all-way stop controls.

4. Data Collection

Existing Traffic Calming Measures

The Institute of Transportation Engineers (ITE) categorizes most common 'physical' traffic calming measures into four categories:

1. **Vertical Deflections:** speed hump, speed table, raised intersection, etc.;
2. **Horizontal Shifts:** small traffic circle, chicane, etc.;

3. **Roadway Narrowing:** choker, center island, etc.; and
4. **Road Closure:** converting a road section to a pedestrian path or landscaped area.

The first three measures are designed to reduce speed whereas the fourth measure is intended to reduce cut-through traffic. The fourth measure, road closure, also provides opportunities for additional green space, landscaping and non-motorized pathways. These traffic calming measures are generally not installed on major arterials and state roads, emergency evacuation routes, or primary transit bus routes. Furthermore, the risk of traffic diversion onto neighboring streets should be evaluated on a case by case basis.

The City of Lake Worth has implemented a number of traffic calming measures including road closures, traffic circles, road chokers and bulb outs, speed humps, speed bumps, raised crosswalks, and contrasting and/or raised intersections and crosswalks (see **Figure 2**). This information is provided on two separate GIS layers with attached pictures. One GIS layer identifies traffic calming measures, and the second layer identifies posted signs related to traffic calming and neighborhood watch. The type and location of implemented and suggested traffic calming measures are listed below:

Road Closures

1. 13th Avenue South between L Street South and N Street South;
2. 13th Avenue South between South Federal Highway and South Palmway;
3. 11th Avenue South between A Street South and Railroad Track (west of Dixie Highway);
4. 9th Avenue South (Pedestrian Walkway) between B Street South and F Street South;
5. 8th Avenue South between B Street South and F Street South;
6. 5th Avenue South between B Street South and F Street South;
7. 5th Avenue North between A Street North and C Street North;
8. 9th Avenue North between C Street North and D Street North;
9. 11th Avenue North between A Street North and the railroad track at G Street North;
10. 12th Avenue North between B Street North and C Street North;
11. 14th Avenue North between J Street North and J Terrace North; and
12. 15th Avenue North between J Street North and J Terrace North.

Horizontal Shifts - Neighborhood Traffic Circles

1. A Street North and 2nd Avenue North; and
2. Fordham Drive and Pennsylvania **Avenue** (**shown as Pennsylvania Drive in Google earth**).

Roadway Narrowing - Bulb Outs/Mid-Block Chokers

1. Wingfield Street north of Washington Avenue;
2. Wingfield Street south of Washington Avenue;
3. A Street South south of 1st Avenue South;
4. A Street South south of **Sunrise Court** (**shown as Alton Road in Google Earth**); and
5. D Street North and Lucerne Avenue (4-way intersection bulb outs).

Roundabout

Contrasting Intersection

Neighborhood Circle

Raised Intersection

Raised Pedestrian Crossing with Road Narrowing

Raised Pedestrian Crossing with Road Narrowing

Road Closure

Speed Bump

FIGURE 2	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	TRAFFIC CALMING PICTURES	

Vertical Deflections - Raised and/or contrasting Intersection

1. D Street North and 18th Avenue North;
2. D Street North and 12th Avenue North;
3. Palmway North and 6th Avenue North;
4. Washington Avenue and South Johnson Street;
5. Washington Avenue and South Douglas Street;
6. A Street North and 19th Avenue North; and
7. A Street North and 17th Avenue North.

Contrasting Raised Pedestrian Crossings

1. South A Street south of **Sunrise Court**;
2. South A Street south of 1st Avenue South; and
3. South A Street north of 4th Avenue North.

Suggested Traffic Calming Measures (2006 Traffic Calming Study)

1. Tropical Drive: *Not implemented;*
2. South D Street: *One-Way - added NB bike lane; and*
3. North D Street: *One-Way - added NB bike lane.*

Recommended Traffic Calming Measures (2011 Traffic Calming Study)

1. Installing posted speed limit signs on SE Coast, Street, G Street and H Street: *Not implemented south of Lake Avenue;*
2. Installing traffic calming on North G Street between 10th and 13th Avenue: *Not Implemented;*
3. Speed limit on A Street should be increased to 30 mph: *Not implemented; and*
4. Installing traffic calming on North A Street between 10th and 13th Avenue and South A Street between 2nd and 4th Avenue South: *No new traffic calming measures installed (a speed hump was already installed south of 11th Avenue North).*

The effectiveness of the implemented traffic calming measures in reducing speed and cut-through traffic can only be assessed by measuring the 85th percentile speed and the traffic volumes and comparing that to the speed and traffic data that was recorded prior to the implementation measure. This could be accomplished in future phases if the City desires. Crash records obtained as part of this study did not extend to the period prior to implementing these measures and therefore a before-and-after crash frequency comparison cannot be performed. Snapshots from the GIS database depicting the physical traffic calming measures implemented in the City are provided in **Attachment B**.

Posted Speed Signs

The Manual on Uniform Traffic Control Devices (MUTCD-2009) states that speed limit signs (R2-1) shall display the limit established by law, ordinance, regulation, or as adopted by the authorized agency based on an engineering study. For uniform speed limits applicable to an entire city, neighborhood, or residential area a CITYWIDE (R2-5aP), NEIGHBORHOOD (R2-5bP) or RESIDENTIAL (R2-5cP) plaque may be mounted above the speed limit signs, and these speed signs are required only on the streets that enter the city, neighborhood or residential areas. Additional speed limit signs should be installed beyond entry points where it is necessary to remind drivers of the applicable speed limits, typically every few blocks. Changes from one speed limit to

another also require a posted speed sign. A Reduced Speed Limit Ahead sign (W3-5 or W3-5a) should be used if the speed limit is reduced by more than 10 mph. Speed zones should generally be within 5 mph of the 85th percentile speed of free-flowing traffic (the speed at or below 85 percent of the vehicles traveling during off-peak hours) unless statutory maximum speed limits are established by local jurisdictions. The MUTCD allows the use of two speed limits on a sign for passenger cars and trucks, or for day and night where warranted.

The posted speed signs within the City have been identified in the field and saved into a GIS application (ESRI). A high-precision handheld GPS unit was used to identify the GPS coordinates of each sign. The unit (Tremble R1 GNSS) uses a constellation of positioning satellites in addition to land based signal correction stations to generally provide sub-meter accuracy in all weather conditions.

The posted speed signs within the City are shown in **Figures 3 to 6**. In general, the posted speed is 35 mph on arterials and 25 mph on residential streets. School speed zones and roundabouts are typically 20 mph. The posted speeds on arterials are as follows:

1. Dixie Highway – 35 mph;
2. Federal Highway – 35 mph;
3. 10th Avenue North – 35 mph (except at city entrance where it is 40 mph);
4. 6th avenue South – 35 mph west of Dixie Highway and 25 mph east of Dixie Highway;
5. Lake Worth Road – 40 mph from City west limits to North Detroit Street, then 35 mph east of Detroit Street, then a 20 mph school speed zone west of I-95 followed by a 20 mph roundabout splitting Lake Worth Road into a one-way pair; Lucerne Avenue (25 mph) one-way eastbound and Lake Avenue (25 mph) one-way westbound. The posted speed on Lucerne Avenue and Lake Avenue is increased to 35 mph over the intracoastal bridge extending to Ocean Boulevard;
6. Lake Osborne Drive – 30 mph; and
7. Boutwell Road – 35 mph.

The uniform speed of 25 mph throughout the residential areas of the City is appropriate and not conducive to speeding. Signs are only needed at entry points and every few blocks to remind drivers of the speed limit or where deemed appropriate by an engineering study. Some streets, however, do not have a posted speed sign and could benefit from a sign if speeding occurs or police records show multiple crashes or citations. Roads without a posted speed sign include:

1. North K Street north of Lucerne Avenue;
2. North J Street north of Lucerne Avenue;
3. South G Street south of Lake Avenue;
4. South H Street south of Lake Avenue;
5. SE Coast Street south of Lake Avenue;
6. 8th Avenue South;
7. 18th Avenue North;
8. Cynthia Lane; and
9. Barton Lane.

The condition of the posted speed signs is generally fair to good though quite a few signs do not meet the minimum height of 5 feet or lateral clearance of 2 feet, consistent with Section 2A of the MUTCD. Speed limit sign locations were saved in a separate GIS layer. For easy identification, posted speed signs of 30 mph or higher are shown on the City map with a blue border, and 25 mph or less are shown with a red border. Pictures of posted speed signs were added to the GIS database for future reference.

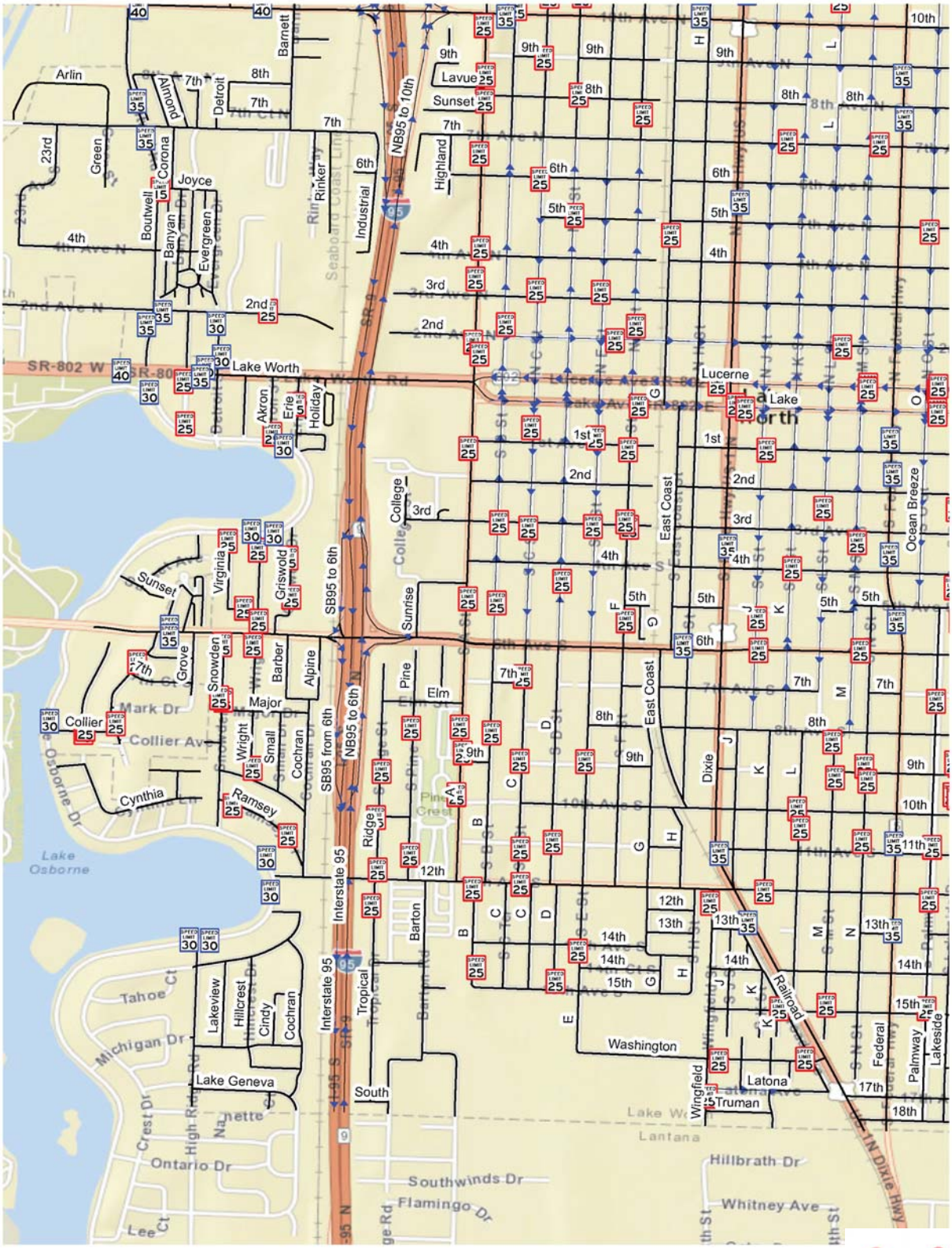

FIGURE 3	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	SPEED LIMIT SIGNS - ZONE 1	

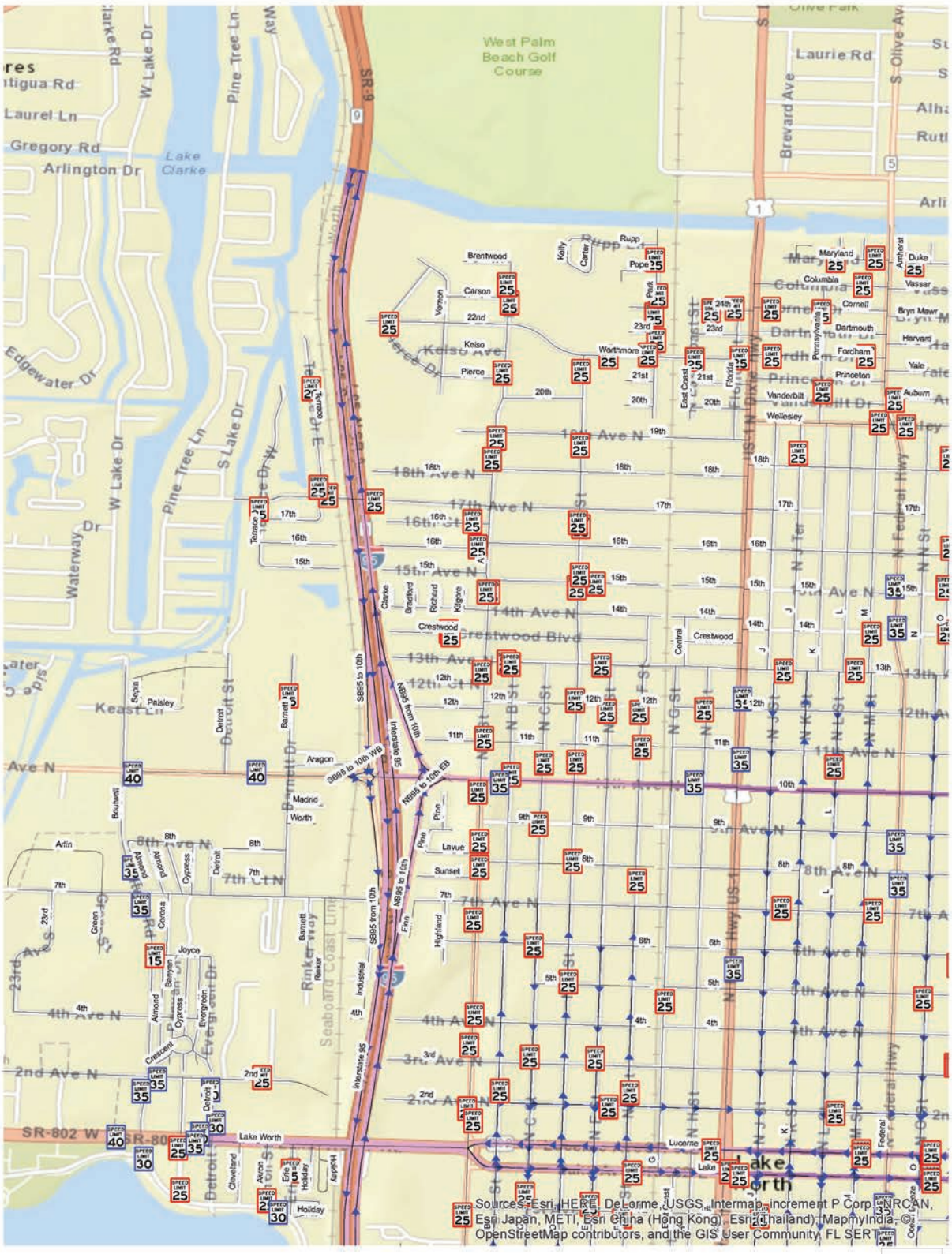

FIGURE 4	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	SPEED LIMIT SIGNS - ZONE 2	

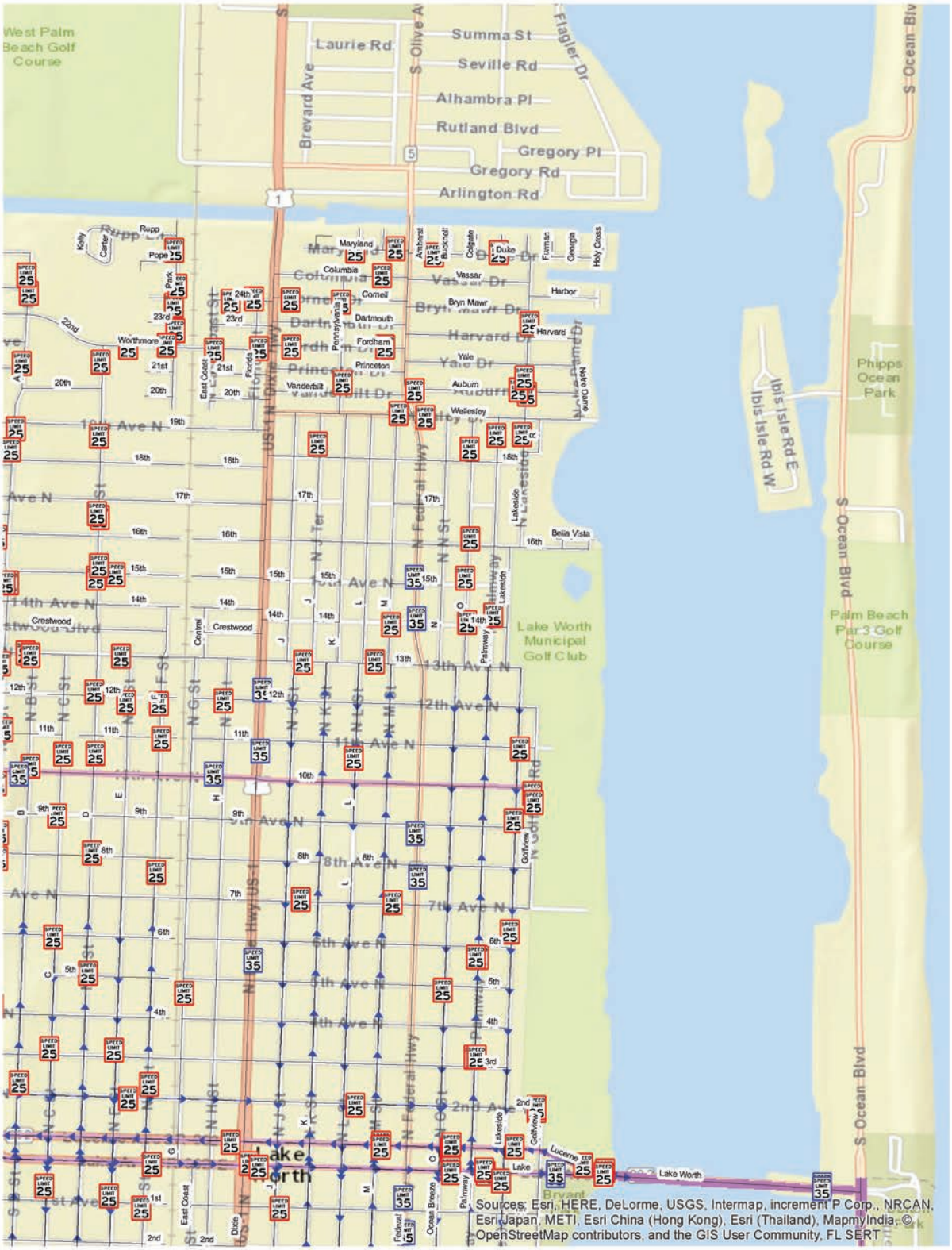

FIGURE 5	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	SPEED LIMIT SIGNS - ZONE 3	

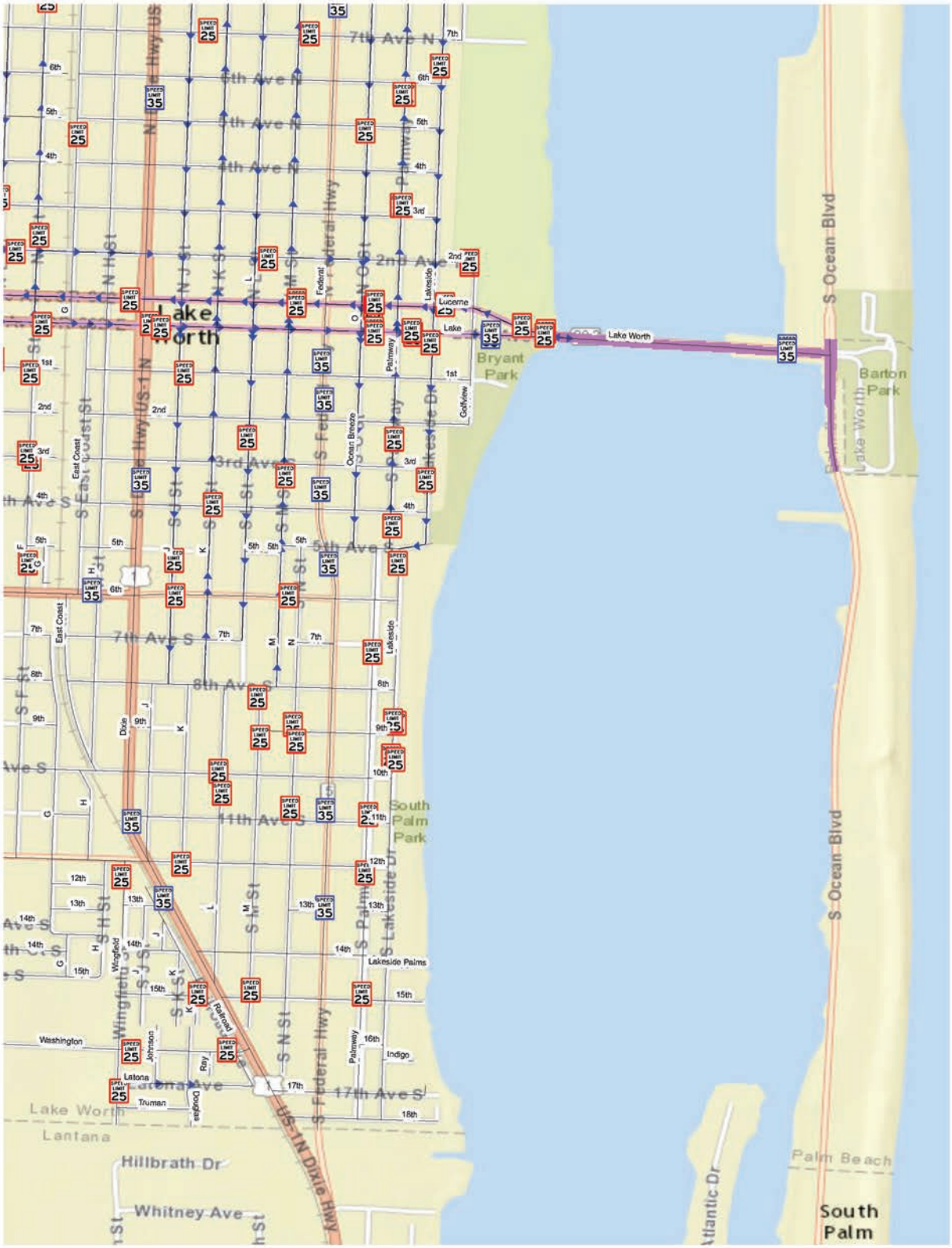

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FIGURE 6	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	SPEED LIMIT SIGNS - ZONE 4	

Stop Signs and Traffic Control

The stop signs (R1-1), yield signs (R1-2) and traffic signals have been identified in the field and uploaded into the GIS application. The stop sign, yield sign and traffic signal locations are shown in **Figures 7 to 10**.

The MUTCD states, "*The use of STOP signs on the minor-street approaches should be considered if engineering judgment indicates that a stop is always required because of one or more of the following conditions:*

A. *The vehicular traffic volumes on the through street or highway exceeds 6,000 vehicles per day;*
B. *A restricted view exists that requires road users to stop in order to adequately observe conflicting traffic on the through street or highway; and/or*
C. *Crash records indicate that three or more crashes that are susceptible to correction by the installation of a STOP sign have been reported within a 12-month period, or that five or more such crashes have been reported within a 2-year period. Such crashes include right-angle collisions involving road users on the minor-street approach failing to yield the right-of-way to traffic on the through street or highway."*

MUTCD also specifies the height and maximum distance from the intersection of STOP and YIELD signs. It is important to note that a large percentage of existing stop signs within the City do not conform to the minimum height requirement or lateral clearance. Also quite a few signs are not in good condition due to faded paint, tilted posts, reduced reflectivity or visual obstructions. Pictures of stop signs appearing to be in bad condition were added to the GIS database.

Separate GIS layers were created for stop signs, yield signs and traffic signals. A review of the stop and yield sign locations using the GIS application (see **Figures 7 to 10**) indicates that stop signs have been placed practically at all non-signalized intersections and yield signs used at roundabouts. Where it appears that stop signs are missing is mostly the result of street closures not yet reflected on the background map. Two-way stop signs are typically placed facing the minor streets. All-way stop signs are primarily located on 10th Avenue South, Elm Street, 7th Avenue North, 13th Avenue North, 16th Avenue North, Vernon Street, and Golfview Road.

No additional stop signs are recommended as a result of this study. However, numerous stop signs do not meet the height or lateral clearance requirements specified in the MUTCD. It is noted that this study does not include a review regarding the justification of the existing signs.

Other Signs

Other signs observed in the field include signs such as "One Way", "Do Not Enter", "No Trucks", "No Outlets", "No Turns", "Children at Play", "Neighborhood Watch" and "No Trespassing" signs that may have some relevance to traffic calming and reducing cut-through traffic. An effort was made to document all of these signs during field observations. However, it should be noted that not 100 percent of these signs were captured and added to the GIS database because this task was beyond the scope of services and would have

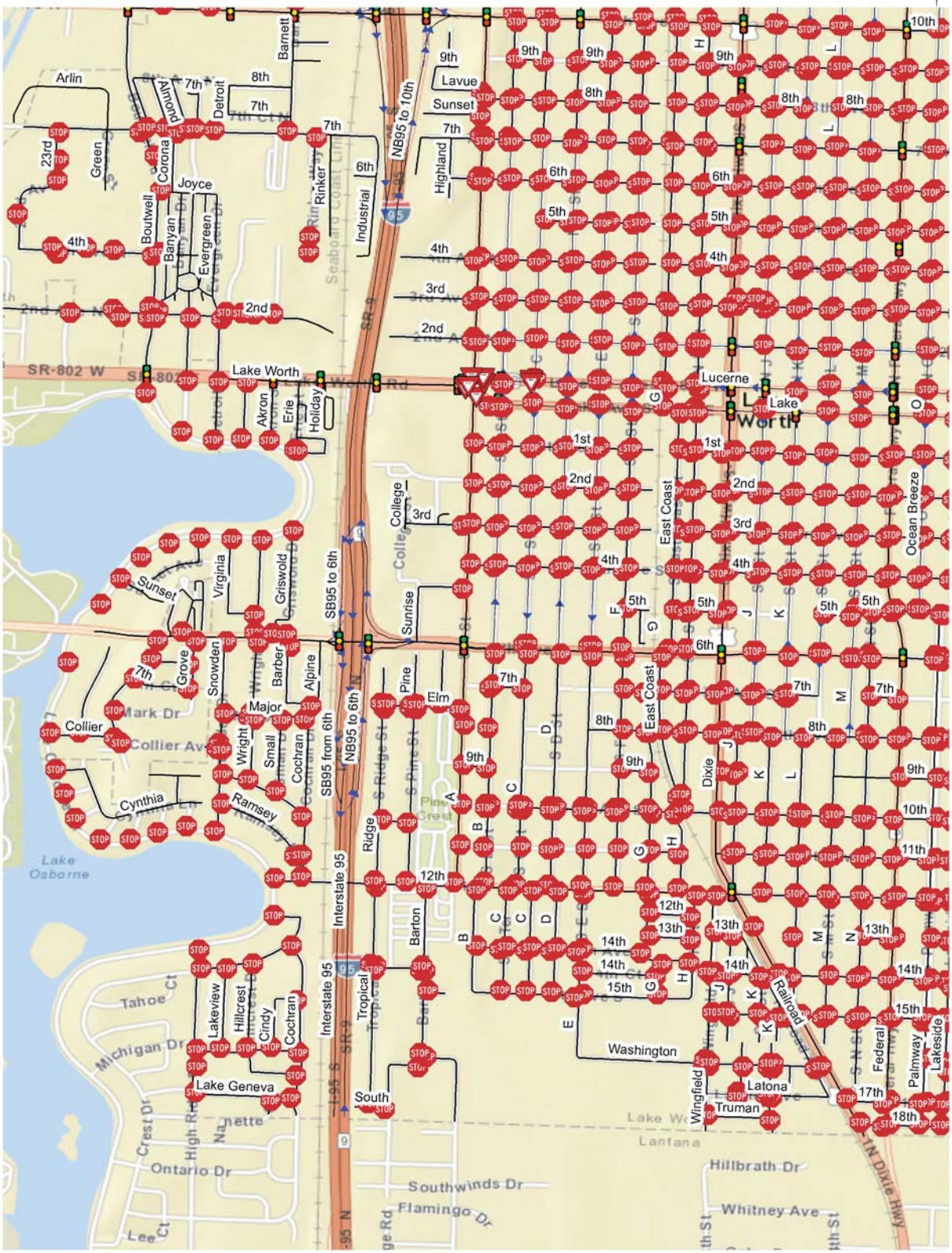

FIGURE 7	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	TRAFFIC CONTROLS SIGNS - ZONE 1	

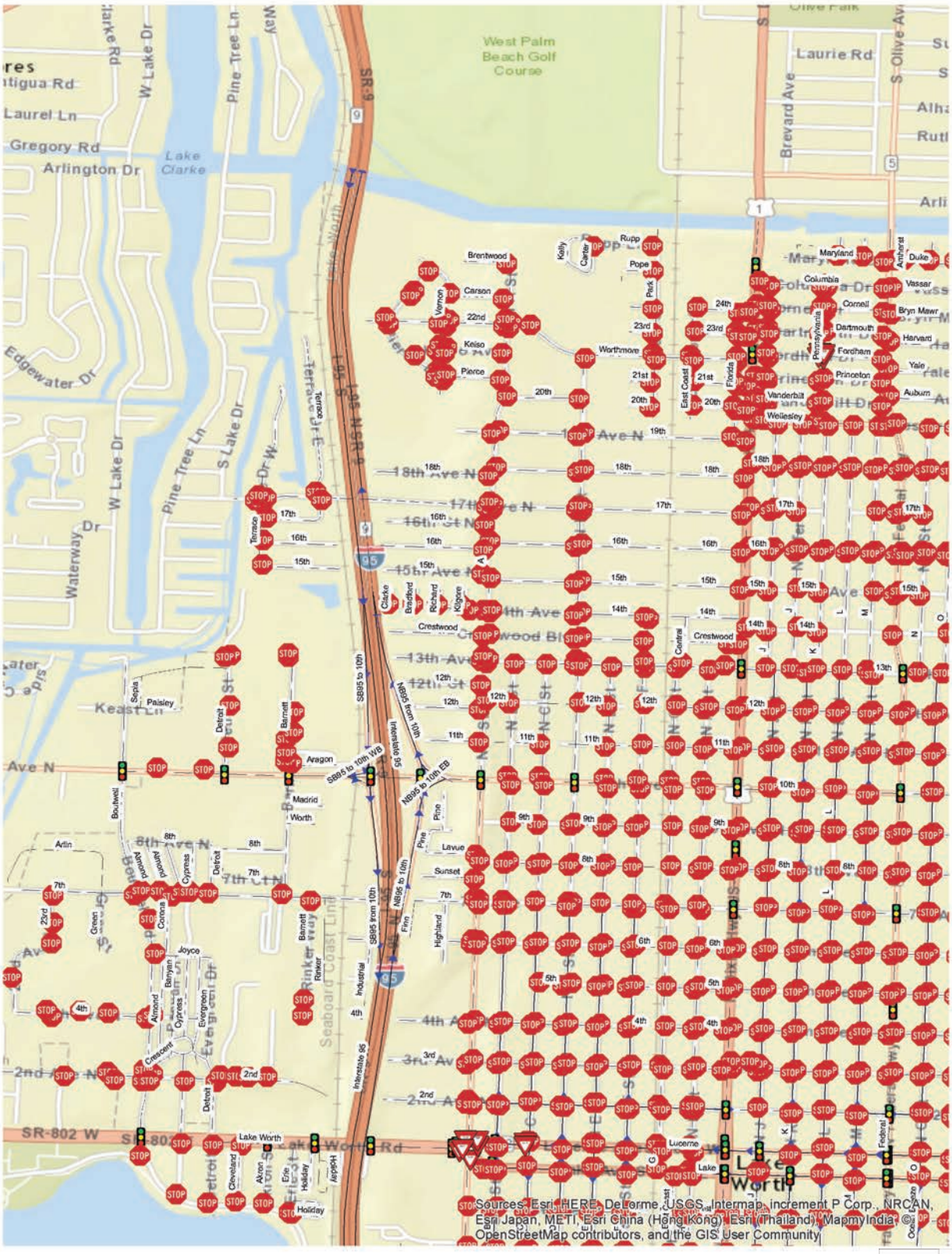

FIGURE 8	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	TRAFFIC CONTROLS SIGNS - ZONE 1	

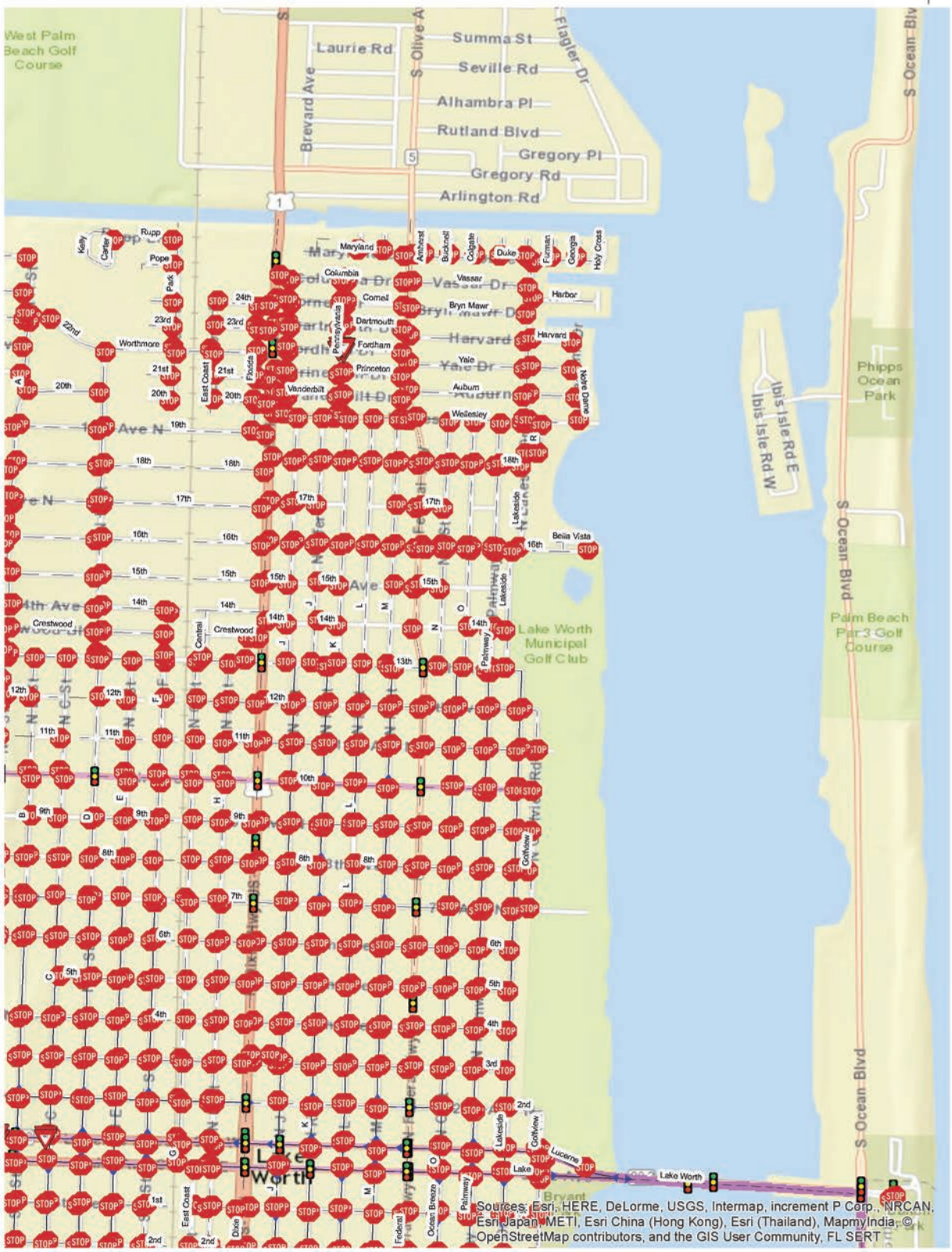

FIGURE 9	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	TRAFFIC CONTROLS SIGNS - ZONE 3	

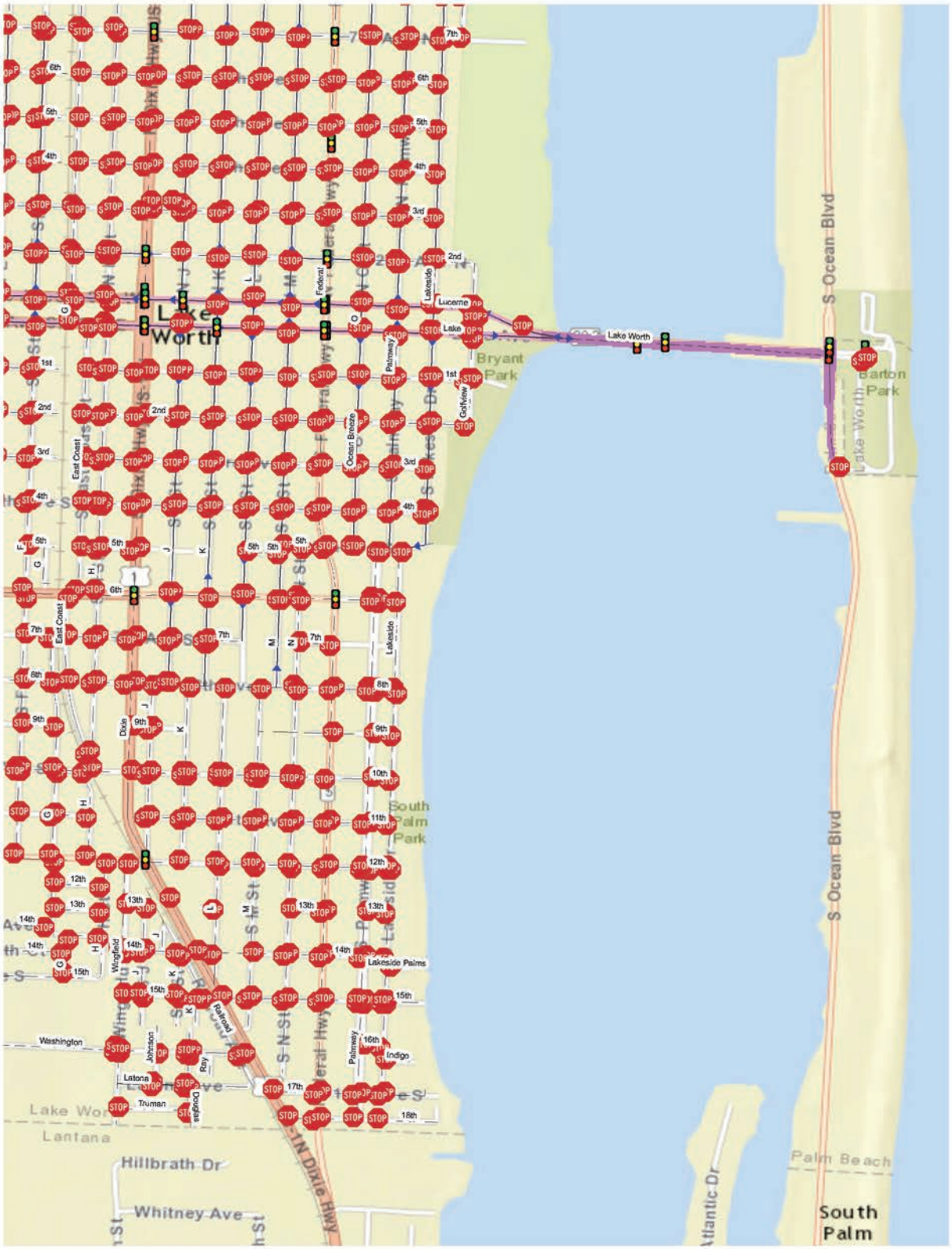

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FIGURE 10	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	TRAFFIC CONTROLS SIGNS - ZONE 4	

required extensive efforts due to the various types and numerous locations of these signs. Therefore, the corresponding GIS layers for "Other Signs" are provided for informational purposes only and can serve as the ground work for future efforts. The created GIS layer for "Other Signs" assigns a different symbol per sign type and can be filtered to display only selected sign types.

Pedestrian Crosswalks

Similar to "Other Signs" this task was not part of the scope of services, however, an effort was made to locate pedestrian crosswalks while documenting the signs in the field. Therefore not 100% of the crosswalks were located and added to the GIS database. The GIS layer for crosswalks is provided for informational purposes only and can serve as the ground work for future efforts. Future efforts by the City to assess the connectivity and quality of non-motorized travel citywide could include the recording of all crosswalks as well as existing bike lanes, sidewalks and pedestrian generators (schools, community facilities, parks, etc.). Enhancing non-motorized transportation can work in tandem with traffic calming policies to improve mobility, safety, livability and quality of life within the City.

Traffic Crashes

Traffic crash information was obtained for the City from the year 2011 to 2015. Crashes were grouped into "Fatalities", "Injuries" and "Property Damage Only". In total, there were 18 fatalities, 4400 injuries and 4420 property damage only crashes. By far the majority of crashes occurred on the main arterials. A very small percentage of crashes resulting in injuries occurred on residential streets. However, these crashes on residential streets were dispersed and did not result in discernable patterns or areas of high crash concentration. Crashes resulting in property damage only were more dispersed throughout the City though still concentrated on the main arterials. Residential streets with comparatively higher concentrations of crashes are the following:

1. North A Street between Lake Worth Road and 10th Avenue North;
2. North/South C Street between 2nd Avenue South and 7th Avenue North;
3. North J Street between Lake Worth Road and 5th Avenue North;
4. 12th Avenue South between Pine Street and Dixie Highway; and
5. 7th Avenue North between North A Street and Dixie Highway.

Once the two road sections are selected for detailed traffic calming analysis, the hard copy crash reports will be obtained and reviewed for all crashes occurring within each segment's influence area to identify those crashes susceptible to be corrected with traffic calming measures, and the most effective type of traffic calming applicable to each road segment. This requires reviewing the crash types and contributing factors for each case. The final report will document the process of how crash history can be used to assist with traffic calming studies.

Citations

Traffic citations are typically obtained by requesting individual citations from the Traffic Court Office or via their website. Considering the public benefit of this study, traffic citations for the entire City of Lake Worth were requested from District 14 of the Palm

Beach County Sheriff Office. The Sheriff's office provided us with a data file containing approximately 20,000 citations for the past five years (approximately 2,800 citations in 2015 and 2014; 2300 citations in 2012, 5400 citations in 2012 and over 6000 citations in 2011). Unfortunately, the Sheriff's Office database does not include the type of citation and therefore citations related to speeding, aggressive driving or illegal parking could not be identified. Also many of these citations may not be related to vehicle activity and may involve trespassing, damaging public property, excessive noise or homeless related issues. Nonetheless, the provided database includes addresses and coordinates which made it possible to save citations in a separate GIS application (it could not be combined with other layers because the number of citations exceeded the allowable number of data points in the GIS application).

Considering citations related to speeding or aggressive driving have a direct relevance to traffic calming, it is recommended that City staff request that the Sheriff's Office add "Citation Type" to the database for future cases so this information becomes most pertinent in identifying and prioritizing road segments for traffic calming treatments. In its current format, the database has limited usefulness in identifying locations that would benefit from traffic calming measures.

Once the two road sections are selected for detailed traffic calming analysis, the records for citations occurring on these segments will be requested from the Traffic Court to identify those citations related to speeding and aggressive driving and whether they resulted in crashes. The final report will document the process for how citations could be used to assist in implementing and monitoring the City's traffic calming objectives.

Emergency and Evacuation Routes

Traffic calming measures should generally not be implemented on emergency and evacuation routes, nor on arterials or within industrial areas with heavy truck circulation. Palm Beach County Traffic Engineering and the Emergency Management Office (EMO) were contacted to identify the primary evacuation routes. A distinct GIS layer was created to highlight evacuation routes provided by EMO.

Bus Routes

A distinct GIS layer was created for bus routes and bus stops. **Figure 11** obtained from shows the bus routes and bus stops throughout the City. Traffic calming measures should generally be avoided on road segments with frequent bus operation. This information helps identify the roads where traffic calming measures are not desirable.

School zones

Lake Worth High School is located at Lake Worth Road between South A Street and I-95. The Middle School is located on Barnett Drive west of I-95 and north of 10th Avenue North. There are several elementary schools located on K Street south of 6th Avenue South; and on Highland Avenue west of North A Street. The property boundaries of the main schools have been added to the GIS application in a distinct GIS layer (see **Figure 11)**.

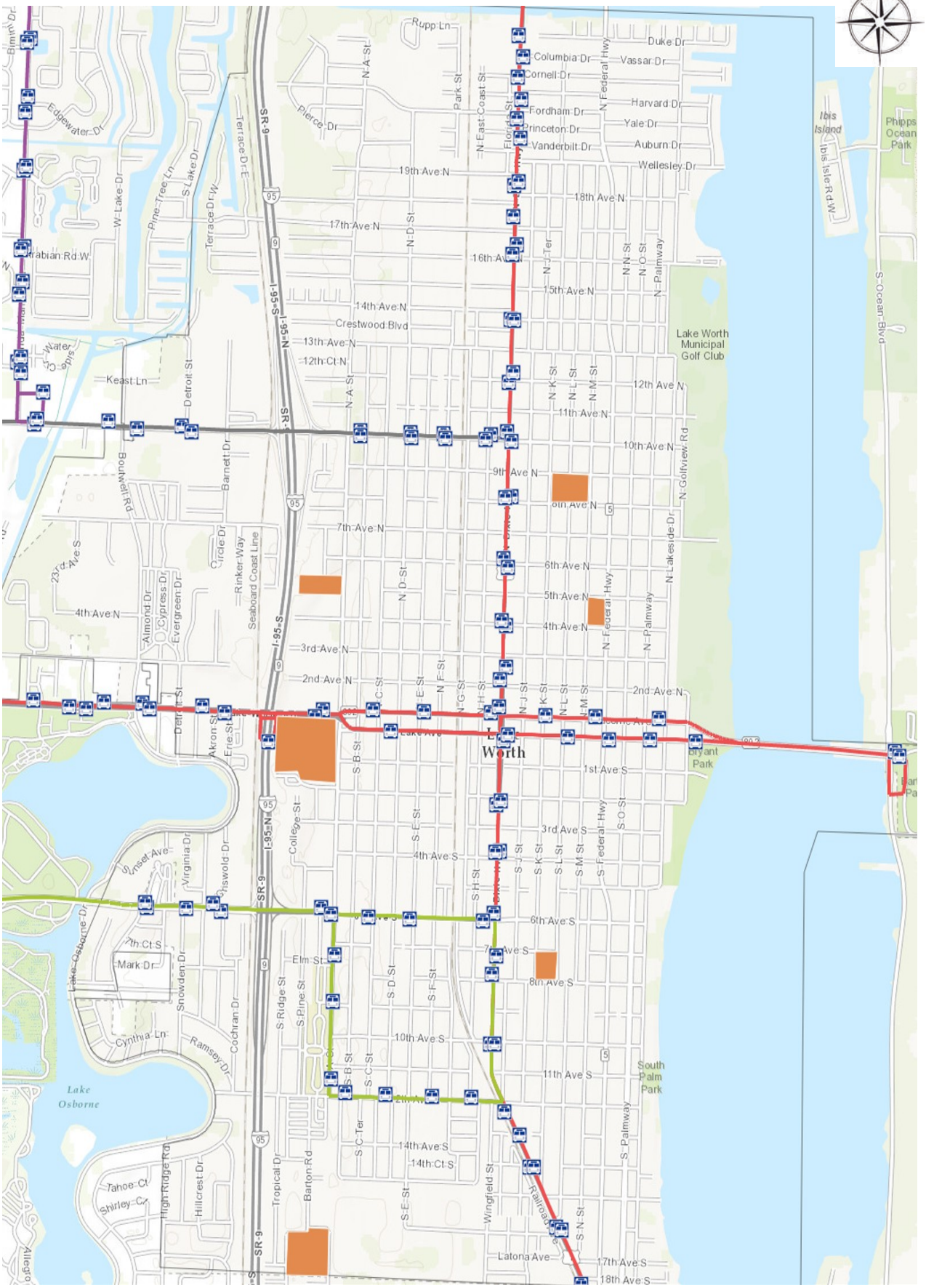


FIGURE 11	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	Bus Routes, Bus Stops and Main Schools	

Citizen Complaints/Petitions

Citizen complaints play an important role in identifying locations in need of traffic calming. The City draft traffic calming policy emphasizes public participation and the need for a majority of households within the impact area to support any petition for traffic calming on a residential street. Petitions are ranked based on a number of factors; the most important being the 85th percentile speed, crash history, lack of crosswalks and sidewalks, traffic volumes, and proximity to bus stops and community facilities.

To date, we have received via City staff only two resident complaints about speeding for the following road segments:

1. 19th Avenue North between Dixie Highway and North D Street; and
2. Wright Drive west of I-95.

In addition, a review of City commission meeting minutes identified the following citizen requests for traffic calming:

1. City Commission meeting on October 7, 2014, Resolution No. 60-2014 related to the 7th Avenue South roadway improvement project. This is in conjunction with the recently constructed multifamily units located between 7th Avenue South and 6th Avenue South and west of the railroad track. Many residents spoke of the need for traffic calming and/or traffic signals along 7th Avenue South. It should be noted that Segments on 7th Avenue South between South L Street and South N Street; and east of Federal Highway have been closed to traffic. The only paved section east of South L Street extends for one block between South N Street and Federal Highway and serves existing multifamily units;
2. Traffic calming was discussed in general at the City Commission meeting held on April 8, 2014 without specifying individual streets; and
3. Traffic calming was discussed in general in relation to the Park of Commerce at the August 24, 2013 City Commission Visioning Work Session and October 8, 2013 City Commission Work Session.

5. Data Analysis Summary

The traffic calming data collection and review efforts are summarized below:

Posted speed signs: Whereas the majority of roads have at least one posted speed sign, a few road sections do not have a posted speed sign and other sections can benefit from additional signs if traffic speeding is an issue, consistent with the MUTCD guidance.

Stop and Yield Signs: The City has ample stop signs at practically all non-signalized intersections and yield signs at roundabouts. This study does not recommend any additional stop signs. However, a large percent of existing stop signs do not satisfy the height and clearance requirements specified in the MUTCD.

Traffic Calming Measures: A number of physical traffic calming measures have been implemented and their location documented in the GIS application using a different symbol for each measure. Since traffic speeds and volumes were not collected for this task and "before" crash data was not available, the effectiveness of these measures cannot be evaluated citywide within the scope of this study.

Other Signs: Other signs including guidance, turn restrictions, children playing, and neighborhood watch signs were identified in the field while collecting other data. Documenting these signs is not part of the scope of this study and therefore the information collected is not complete. It is estimated that approximately 90% of these signs were added to the GIS database.

Crosswalks: Similar to "Other Signs", crosswalks were identified in the field while collecting other data. Since locating crosswalks is not part of the scope of this study, the information collected and coded into the GIS database is not complete though it represents over 90% of the crosswalks within the City. This data can serve as the basis of future efforts by combining it into GIS layers for crosswalks, sidewalks, bike lanes and pedestrian generators to evaluate the overall connectivity and quality of non-motorized facilities within the City.

Traffic Crashes: Crash data from 2011 to 2015 was obtained and coded into GIS layers. Different symbols were used for various crash parameters. A review of the crash data indicated that by far the majority of crashes occurred on arterials. The relatively few crashes taking place on residential streets were random without forming identifiable clusters or segments of high crash concentrations. Crash reports will be requested and evaluated for the two road segments that will be selected for the detailed traffic calming analysis to identify crashes correctible with traffic calming measures.

Traffic Citations: A large database of citations (about 20,000 records) covering the past 3 years was provided by District 14 of the Sheriff's Office. Potentially, this database can be extremely useful if citations related to speeding and aggressive driving can be identified. Unfortunately, at present the database does not indicate the citation type. It is recommended that City staff work with the Sheriff's Office to include citation type in the future. Individual citations will be requested from the County's Traffic Court for the two corridors that are selected for detailed traffic calming analysis.

Bus and Evacuation Routes: Information related to bus routes, bus stops and evacuation routes were added to the GIS database. Physical traffic calming measures in general should not be implemented on these roads.

School Zones: A GIS layer was created to identify the boundaries of the main schools serving the City residents. Traffic calming is usually desirable around school zones to improve the safety of pedestrians. The school speed limit signs were identified and are included within the sign GIS database.

Citizen Complaints/Petitions: Citizen complaints are the basis for conducting traffic calming studies to identify the need for physical or other measures to reduce speed and/or cut-through traffic. Only two citizen complaints were provided by City staff. In addition, commission meeting minutes for the past three years were reviewed and only one specific additional road segment located in a residential neighborhood was discussed at the meeting in relation to traffic calming.

6. Road Selection for Detailed Traffic Calming Analysis

This initial phase of the traffic calming analysis did not include collecting traffic speed and volume data. Considering, no speed and volume data has been collected in this first phase of analysis, the citation database provided by the Sheriff's office did not include "Citation Type", and the crash data did not show any discernible pattern or areas of high crash concentration on residential streets, the only road segments that can be recommended for detailed traffic calming analysis at this phase of the study are the following three locations identified by residents, and three locations recommended by the 2011 traffic calming study:

1. 19th Avenue North between Dixie Highway and North D Street;
2. Wright Drive west of I-95;
3. 7th Avenue South between South A Street and the railroad track;
4. A Street North between 10th and 13th Avenue North;
5. A Street South between 2nd and 4th Avenue South; and
6. G Street North between 10th and 13th Avenue North.

7. Conclusion

This first phase of the citywide traffic calming study focused on data collection and the preparation of GIS layers that in combination with other data can assist in identifying road segments in need of traffic calming measures. Speeds and volumes were not collected and therefore a detailed citywide traffic analysis cannot be performed at this stage. The remaining task of this contract is to identify two road segments for detailed traffic calming analysis. This detailed analysis will include traffic counts, speed measurements, and a review of hard copy police reports and traffic citations.

This technical memorandum provides a general assessment of the condition and coverage of speed signs and stop signs throughout the City. It also includes a recommendation to modify traffic citation reporting format used by the Sheriff's Office to make it more useful to identify roads that would benefit from traffic calming measures. **Attachment C** includes additional GIS citywide snapshots related to various layers discussed above. Details are hard to discern in these snapshots. However, layers and sublayers are easily viewed in the developed GIS application that provides the option of zooming in to selected areas or individual streets and superimposing information from various GIS layers. The GIS application has an additional functionality of filtering data within a layer such as only showing one type of traffic calming measures or certain types of crashes occurring within a

defined timeframe. The background image in the GIS application can be customized to show aerials or various types of street maps.

The final report that will document the efforts of all tasks of this contract will incorporate the information provided in this technical memorandum in addition to the detailed traffic calming analysis results of the two road segments selected for this study.

ATTACHMENT A

City of Lake Worth Draft Traffic Calming Policy

DRAFT

CITY OF LAKE WORTH - TRAFFIC CALMING POLICY

The scope and purpose of this policy is to establish:

A. The objectives and general application of traffic calming within the City of Lake Worth.

B. A predictable annual cycle and orderly process for any request that involves traffic calming funds, regardless of where the request originates, and with clear distinctions between identification of a problem by residents and analysis by Palm Beach County Sheriff's Office traffic monitoring equipment and/or solutions developed by professional consultants/traffic engineers.

C. Criteria for the review of traffic calming requests to determine further analysis and validation of significant problems and potential traffic calming measures.

D. Procedures to formally evaluate requests, including data collection, traffic calming studies, and neighborhood meetings to select a preferred solution.

E. A more equitable ranking procedure, establishing a clear and convincing case to generate a prioritized list of possible traffic calming projects, which can be employed when there are more traffic calming projects proposed than funds available to construct all projects.

This policy neither lists all traffic calming measures, nor attempts to specify which measure would be implemented in certain road or traffic operation scenarios. Proper data shall be utilized by City staff and/or a traffic consultant to develop appropriate solutions.

A. OBJECTIVES AND GENERAL APPLICATION OF TRAFFIC CALMING

Traffic calming is intended to reduce the impact of motor vehicles on roadways, residents, and road users. In the City of Lake Worth, this means primarily the reduction of motor vehicle speeds. The reduction of motor vehicle traffic volumes on specific streets is a sensitive issue because of the risk of diverting traffic onto a neighboring street. Conversely, some chronic neighborhood traffic problems concern levels of traffic volume on local streets that the residents believe is excessive. Typically, a significant portion of the traffic in these cases is considered "through" traffic, because it neither originates from nor is destined to the broader neighborhood. Traffic calming shall be used to reduce the impact of this unwanted traffic.

Collision mitigation might be accomplished by prohibiting the turn movements of a relatively low number of motor vehicles. In these cases, the benefits outweigh other considerations, unless the risk is simply transferred to a neighboring intersection.

Physical Traffic Calming Measures

There is a considerable range of options for traffic calming from enforcement or traffic signs and pavement markings to construction alternatives including traffic circles, median refuges, and bulb-outs. Construction improvements are referred to as "physical" measures in this policy.

Physical traffic calming measures are categorized in two ways:

1. Vertical deflection: raising the road by using speed humps or speed tables; and
2. Horizontal shift: moving vehicles off a certain alignment from one side or another (e.g. traffic circles).

Generally, physical traffic calming measures are the most effective form of traffic calming available. The use of these measures requires careful application, so that large vehicles can still navigate where needed. Installation of any new speed humps, speed tables, or platforms would be based on City authority to introduce these measures.

Historically, some physical traffic calming has been installed at the request of the residents when responding to neighborhood concerns about illegal, threatening, or socially disruptive driving or other behavior. Such issues will continue to be considered and evaluated on a case-by-case basis.

The City of Lake Worth's roadway network includes designations such as through, collector, arterial, and industrial. The following are designated per Chapter 21, Sec. 21-15 of the City's Code of Ordinances:

1. Lake Avenue – Through Street
2. Lucerne Avenue – Through Street
3. First Avenue South (East of the Florida East Coast Railroad) - Collector
4. Second Avenue North - Collector
5. Fourth Avenue South (West of Dixie Highway) - Collector
6. Sixth Avenue South - Through Street
7. Seventh Avenue North - Collector
8. Tenth Avenue North - Through Street
9. Thirteenth Avenue North - Collector
10. Federal Highway - Through Street
11. Boutwell Road - Arterial
12. Detroit Street - Arterial

*All other City roads are classified as either Residential or Industrial.

The application of physical traffic measures on through streets is particularly sensitive. Some forms of horizontal shift physical traffic calming can be applied to major roads, but even greater care must be taken when high speeds and/or high traffic volumes are concerned, so that road users are not placed in greater risk than by the traffic operation condition being mitigated.

Application of Traffic Calming Measures

If the problem submitted in a written traffic calming request to the City's Public Services Department is validated by recent traffic records and subsequent data collection, a traffic calming device may be installed and/or a traffic calming study can be authorized depending on the severity. If the request involves an intersection or street portion, neighboring streets and intersections must be considered in view of the traffic calming measures proposed and potential impacts on the immediate neighborhood assessed if a "spill-over" effect is anticipated. In recommending solutions, less costly and restrictive

methods of calming should be considered first.

B. ANNUAL CYCLE AND PROCESS FOR TRAFFIC CALMING REQUESTS

The steps in the traffic calming request/implementation process are:

1.Resident submits a written request defining a problem in their neighborhood.

2. Staff uses recent traffic records, Palm Beach Sheriff's Office resources, and other methods to evaluate the written request submitted by the resident. Validation of any significant problems will occur at this step.

3. If request qualifies, staff defines traffic calming area and provides recommendation and/or a traffic calming study can be authorized.

4. Resident collects signatures of support for the traffic calming recommendation from the defined traffic calming area

5. City staff shall prepare cost estimate and project priority for review by the City Commission, who will have final approval or denial of the traffic calming solution.

6. If funds are available in the current year, the project shall be constructed. If funds are not available, the project shall be included in the following year's budget.

C. CRITERIA FOR REVIEW OF TRAFFIC CALMING REQUESTS

Written traffic calming requests are submitted to the Public Services Department, providing information about observable hazardous conditions and impacts. The City staff reviews the request and recent traffic records for the area (collisions, speed and volume, and roadway geometry).

The following criteria are used in the initial staff review of traffic calming requests and validation of significant problems for further analysis and potential implementation:

1. Any residential street area; ***and***
2. To mitigate a documented collision pattern (bike, pedestrian, motor vehicle); ***and/or***
3. Where the 85th percentile speed profile is greater than 5 mph over the speed limit; ***and***
4. Where there is a documented problem of a significant or inappropriate number of "through" motor vehicles on the street or in the neighborhood.

If there is a good safety record, and the speed profile (85th percentile) is within 5 mph of the speed limit, and the traffic volume is appropriate for the street, the applicant will be advised that no further action will be taken.

If this request was not previously denied and review indicates a probable cause for further analysis, Public Services staff shall define a petition area for signature collection by the residents. When the petition is returned by the person requesting the

traffic calming and qualifying support is established from 50% + 1 of households within the defined petition area, evaluation procedures are initiated.

D. PROCEDURES TO EVALUATE REQUESTS FOR TRAFFIC CALMING

Data collection is conducted by the Palm Beach Sheriff's Office and/or a traffic engineering firm, related to the type and degree of the problem that was defined in the request. This may include raw speeds, vehicle counts, and field surveys to observe conditions. If the data validates the request as a significant problem, staff will define the traffic calming area and provide recommendations and/or a traffic calming study can be authorized.

A cost estimate can then be drafted and presented to the City Commission with a recommendation to utilize current or future funds. Should there be multiple traffic calming requests, project priority must be established (see E, next).

E. RANKING PROCEDURE AND PRIORITIZING TRAFFIC CALMING PROJECTS

A ranking procedure is applied when the evaluation is completed for potential traffic calming projects. The following point system shall be used to prioritize projects. These projects may include both unfunded items from the prior year (due to limited funds to construct physical traffic calming measures) that still qualify for consideration as significant problems and new requests.

1. Traffic Speeds (85th percentile)

   10 points for each mile per hour the 85th percentile is above the speed limit plus 5 mph. (e.g., if the speed limit is 25 mph, and the 85th percentile is 32 miles = 2 X 10 points = 20 points) [Average 85th percentile of two directions]

2. Safety Rating (Collision History)

   a) 10 points for each reportable motor vehicle-to-motor vehicle collision in the past five years which would have been preventable with traffic calming (e.g., if a collision is caused by a drunk driver, it may not be correctable with traffic calming and therefore may not factor into the rating).

   b) 25 points for each reported pedestrian or bicyclist injury or fatality in the last five years that is considered preventable with traffic calming.

3. Crosswalks and Sidewalks

   a) 25 points for each uncontrolled intersection or mid-block crosswalk.

   b) 25 points if there is no sidewalk on a portion of the street in question.

4. Traffic Volume

   1 point for each 100 vehicles of average daily traffic above the following thresholds:

   1) 2-way volume on local streets — above 1,000
   2) 1-way volume on local streets — above 500
   3) 2-way volume on collector streets — above 2,500
   4) 2-way volume on major streets — above 10,000

5. Bus Stops

   15 points for each bus stop area

6. Proximity to Designated Community Facilities (schools, recreation centers, senior &/or community centers, senior multi-family housing, hospitals or clinics, parks, libraries, etc.)

   25 points for each of these types of institutions within 500 feet of the road section or intersection in question.

7. Bike Facility

   25 points if the proposal is on a road containing bike lanes.

8. Driveways (Conflict Points)

   1 point for each driveway.

9. Proximity to Traffic Control Devices (signals, stop signs)

   10 points if there are no traffic control devices within 400 feet.

10. Proximity to Existing Physical Traffic Calming Measures (speed humps, circles)

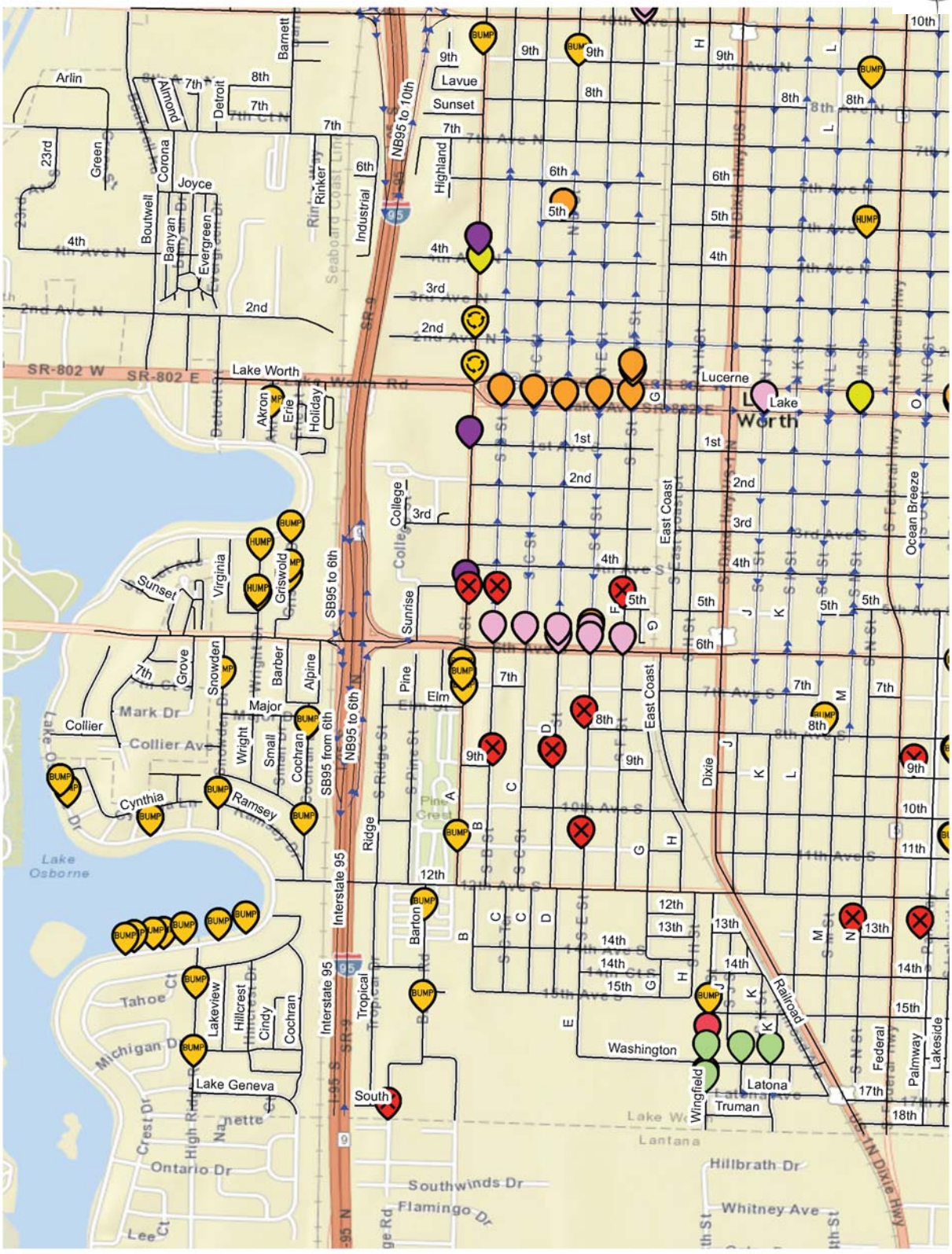
    25 points if there are no traffic calming measures within 400 feet in any direction.

11. Trial of Less-Restrictive, Non-Physical, Corrective Traffic Calming Measures

    25 points if other methods have been tested already, and proven to be unsuccessful

ATTACHMENT B

GIS Application Snapshots of Traffic Calming Measures



BULB OUT	CHOKER	CONTRASTING INTERSECTION	CONTRASTING PEDESTRIAN CROSSING	CONTRASTING RAISED PEDESTRIAN	RAISED INTERSECTION	RAISED PEDESTRIAN CROSSING	ROAD CLOSURE	ROUNDABOUT

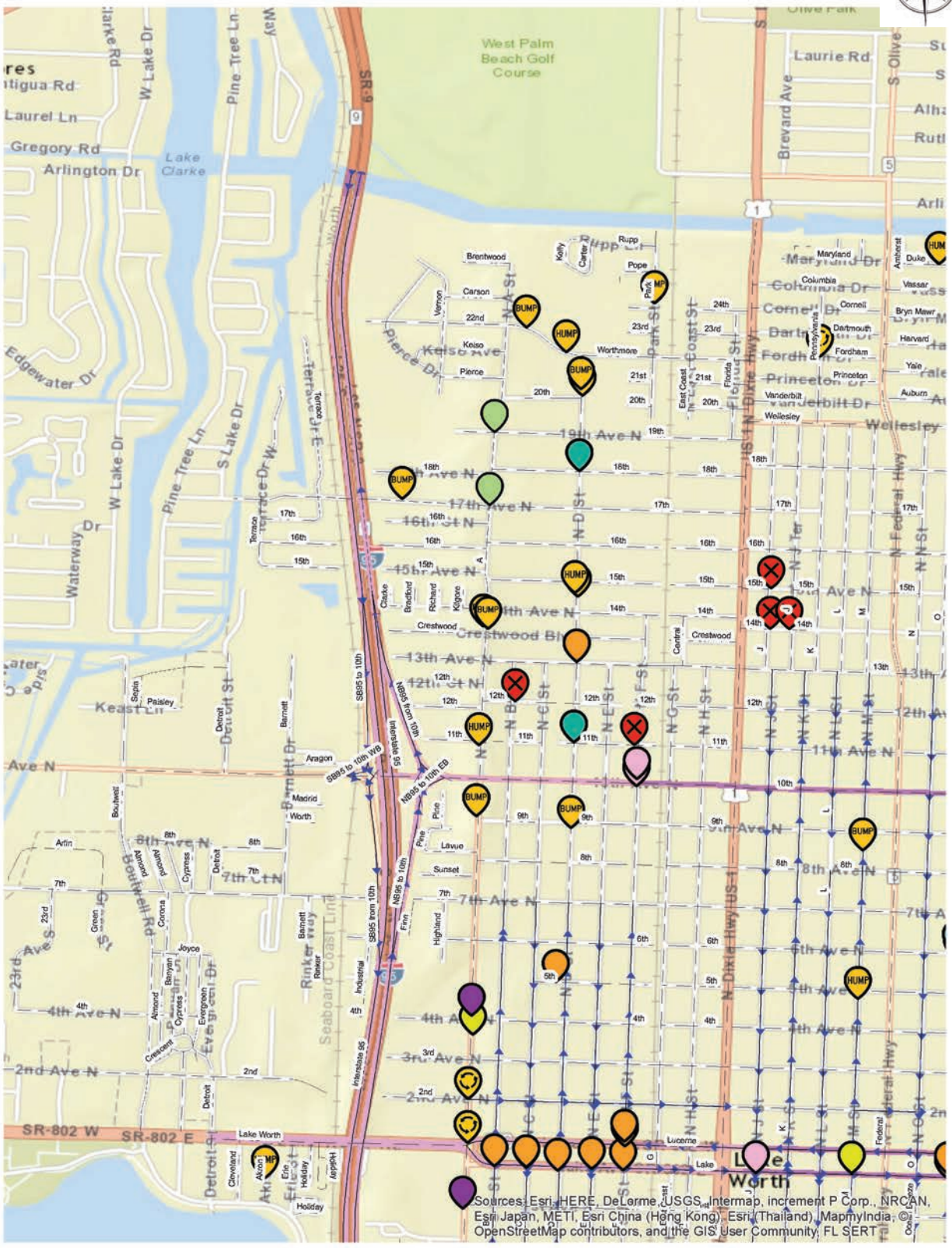
2 3
1 4

FIGURE B-1

CITY OF LAKE WORTH TRAFFIC CALMING STUDY

PHYSICAL TRAFFIC CALMING MEASURES

KEITH and SCHNARS
FLORIDA'S Big LOCAL FIRM



BULB OUT	CHOKER	CONTRASTING INTERSECTION	CONTRASTING PEDESTRIAN CROSSING	CONTRASTING RAISED PEDESTRIAN	RAISED INTERSECTION	RAISED PEDESTRIAN CROSSING	ROAD CLOSURE	ROUNDABOUT

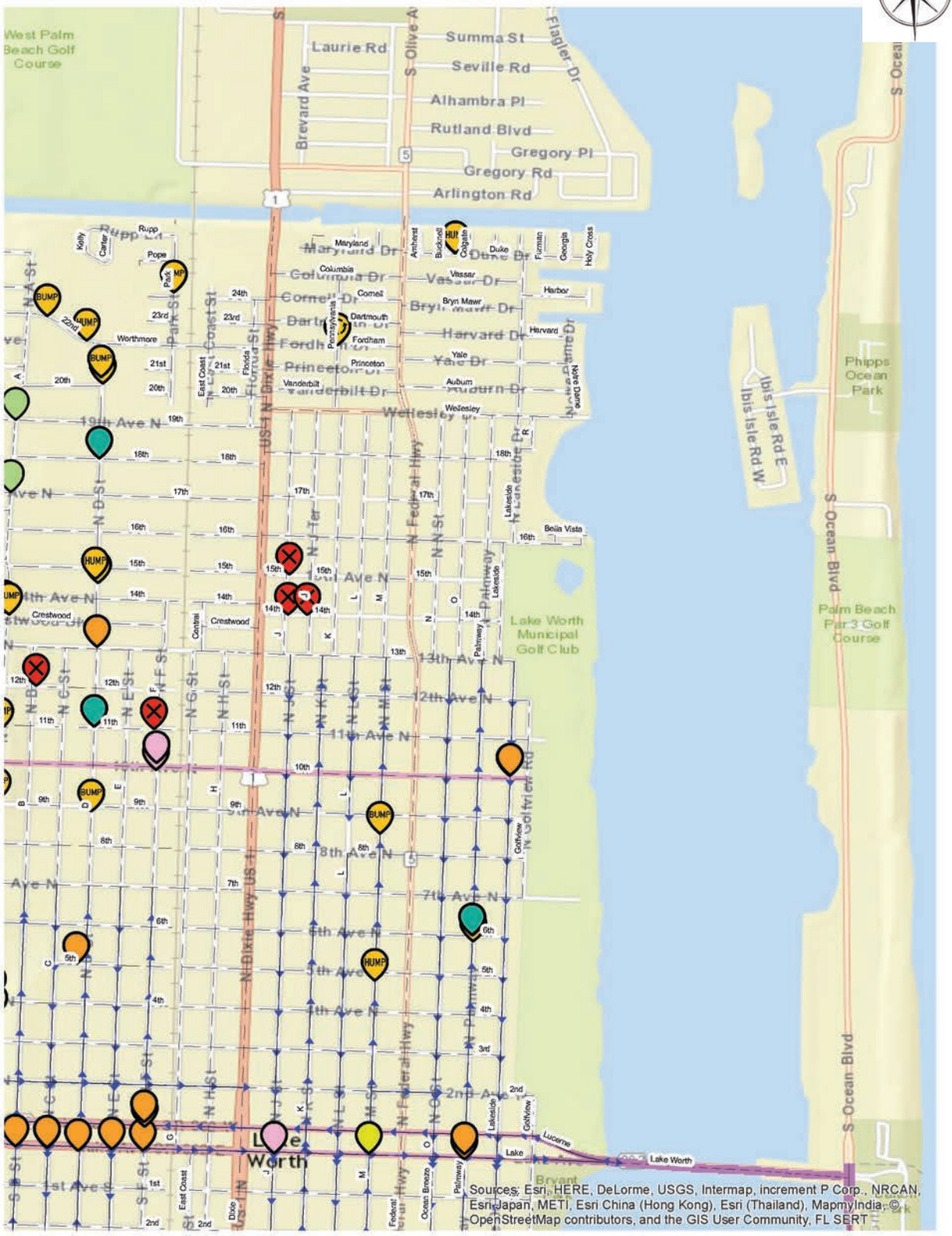
2 3
1 4

FIGURE B-2

CITY OF LAKE WORTH TRAFFIC CALMING STUDY

PHYSICAL TRAFFIC CALMING MEASURES - ZONE 2

KEITH and SCHNARS
FLORIDA'S Big LOCAL FIRM



BULB OUT	CHOKER	CONTRASTING INTERSECTION	CONTRASTING PEDESTRIAN CROSSING	CONTRASTING RAISED PEDESTRIAN	RAISED INTERSECTION	RAISED PEDESTRIAN CROSSING	ROAD CLOSURE	ROUNDABOUT

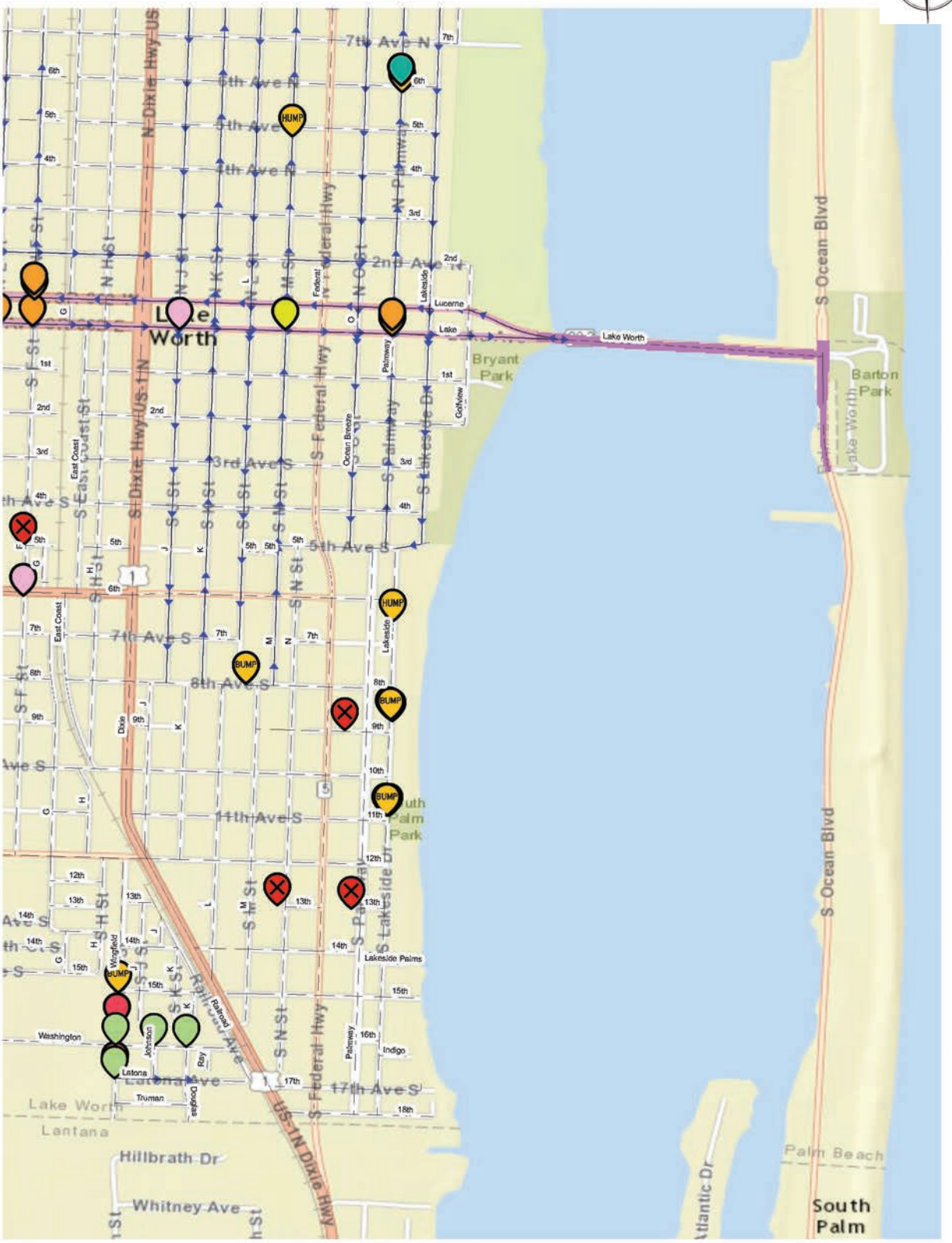
2 3
1 4

FIGURE B-3

CITY OF LAKE WORTH TRAFFIC CALMING STUDY

PHYSICAL TRAFFIC CALMING MEASURES - ZONE 3

KEITH and SCHNARS
FLORIDA'S Big LOCAL FIRM



BULB OUT	CHOKER	CONTRASTING INTERSECTION	CONTRASTING PEDESTRIAN CROSSING	CONTRASTING RAISED PEDESTRIAN	RAISED INTERSECTION	RAISED PEDESTRIAN CROSSING	ROAD CLOSURE	ROUNDABOUT

2 3
1 4

FIGURE B-4

CITY OF LAKE WORTH TRAFFIC CALMING STUDY

PHYSICAL TRAFFIC CALMING MEASURES - ZONE 4

KEITH and SCHNARS
FLORIDA'S Big LOCAL FIRM

ATTACHMENT C

Snapshots of Selected GIS Layers

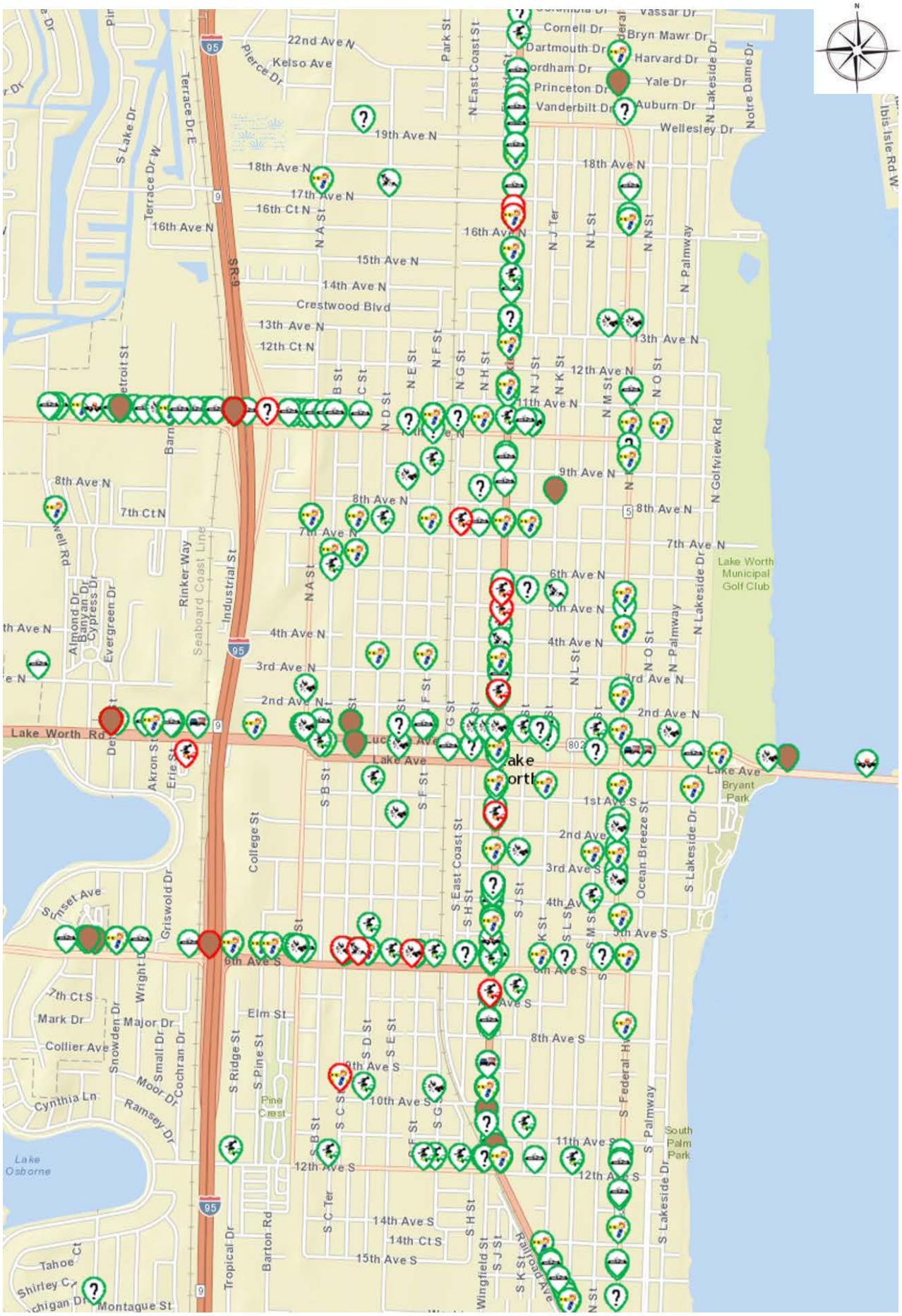


FIGURE C-1	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	Vehicle Crashes Resulting in Injuries 2012-2015	

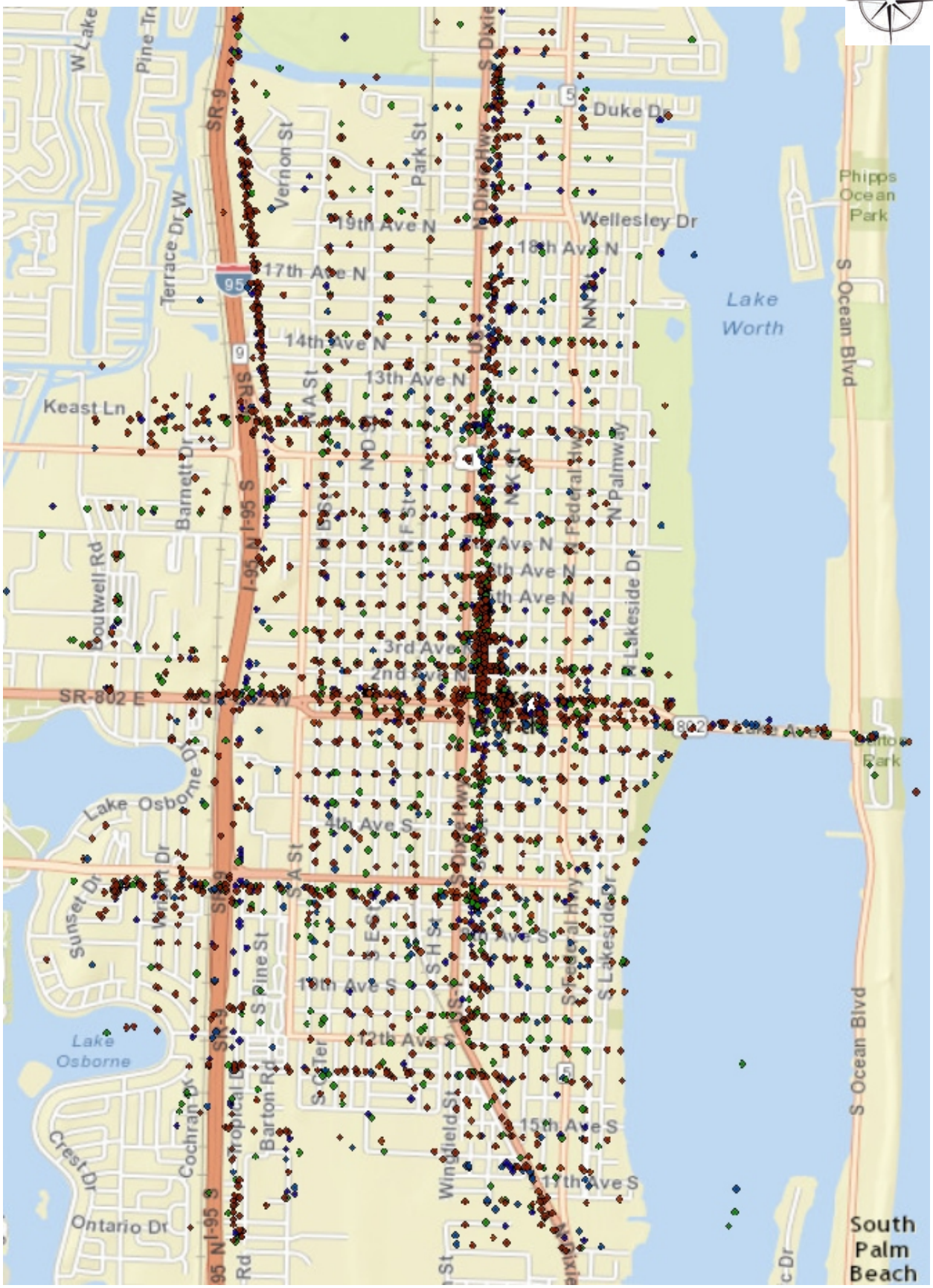


FIGURE C-2	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	Citation Locations for 2012-2015	

FIGURE C-3	CITY OF LAKE WORTH TRAFFIC CALMING STUDY	KEITH and SCHNARS FLORIDA'S Big LOCAL FIRM
	Data from various Layers Including Crosswalks, Watch, No Trespassing	