



October 25, 2021

Mr. John Sfiropoulos, P.E.
City Engineer
City of Pompano Beach
1201 NE 5th Avenue
Pompano Beach, FL 33060

**Re: South Palm Aire Drive - West Palm Aire Drive to Powerline Road
Horizontal Alignment Warning Signage Review
Pompano Beach, Florida**

Dear Mr. Sfiropoulos:

Kimley-Horn and Associates, Inc. has completed a horizontal alignment warning signage review along South Palm Aire Drive from West Palm Aire Drive to Powerline Road in Pompano Beach, Florida. Along with an inventory of the existing signage, an advisory speed study was conducted to determine appropriate warning signage for five (5) horizontal curves (see Attachment A) along the roadway segment consistent with Federal Highway Administration's (FHWA) *Manual on Uniform Traffic Control Devices*, 2009 Edition, (MUTCD). A location map of the study roadway segment is provided in Attachment A. The following sections summarize the data collection, speed advisory study, and recommended signage.

DATA COLLECTION

A field review was conducted on October 13, 2021 (Wednesday) to document the existing signage along the South Palm Aire Drive corridor and conduct the advisory speed study. The review was conducted under normal traffic and weather conditions. Attachment B contains a location map displaying the location of existing signage and Attachment C contains a photo log of the existing signage.

The advisory speed study was conducted for the horizontal curves using a ball-bank indicator device/safe curve speed indicator. The purpose of an advisory speed study is to determine the maximum safe speed a vehicle can negotiate a horizontal curve. The device displays the angle produced by a turning vehicle along a horizontal curve at a given speed. Readings on the device are given in degrees. Section 2C.08 of MUTCD provides several thresholds for acceptable degree readings at given speeds. These thresholds can be found in Table 1 below.

Table 1: MUTCD Advisory Speed Thresholds	
Advisory Speed (mph)	Maximum Device Reading (Degrees)
20	16
25,30	14
≥35	12

ADVISORY SPEED STUDY

After completing the data collection, advisory speeds for each curve were determined using the recorded device readings and thresholds found in Table 1. Table 2 depicts each curve's maximum reading and travel speed. As seen below, the recommended advisory speed for Curve 4 and Curve 5 in the westbound direction was determined to be 15 mph. The recommended advisory speed for Curve 4 and Curve 5 in the eastbound direction was determined to be 20 mph. The recommended advisory speed for Curve 1 in the westbound direction was determined to be 25 mph. All other advisory speeds exceeded the posted speed limit of 30 mph.

Table 2: Maximum Device Readings								
Run Speed	20 mph (Degrees)		30 mph (Degrees)		40 mph (Degrees)		Recommended Advisory Speed (mph)	
Curve	EB	WB	WB	WB	EB	WB	EB	WB
1	7	7	12	15	19	21	(2)	25
2	3	3	5	7	10	11	(2)	(2)
3	5	4	10	10	16	18	(2)	(2)
4	12	17	26	27	(1)	(1)	20	15
5	12	13	27	24	(1)	(1)	20	15 (3)

Notes: (1) Run was not conducted as speed considered excessive for specific curve.

(2) Advisory speed in excess of the posted speed limit of 30 mph. No advisory speed is recommended for the curve.

(3) Advisory speed set to minimum advisory speed of both curves since curves are considered a reverse turn segment.

Signage recommendations were identified using MUTCD standards accounting for the estimated advisory speeds in Table 2. Horizontal alignment signs are warranted according to the MUTCD standards summarized in Table 3. Table 4 provides the recommended warning signage for each curve. A location map of recommended signage can be found in Attachment D.

Table 3: MUTCD Horizontal Alignment Sign Standards					
Sign Type	Difference Between Speed Limit and Advisory Speed				
	5 mph	10 mph	15 mph	20 mph	≥25 mph
Turn (W1-1), Curve (W1-2), Reverse Turn (W1-3), Reverse Curve (W1-4), Winding Road (W1-5), and Combination Horizontal Alignment/Intersection (W10-1)	Recommended	Required	Required	Required	Required
Advisory Speed Plaque (W13-1P)	Recommended	Required	Required	Required	Required
Chevrons (W1-8) and/or One Direction Large Arrow (W1-6)	Optional	Recommended	Required	Required	Required
Exit Speed (W13-2) and Ramp Speed (W13-3) on Exit Ramp	Optional	Optional	Recommended	Required	Required

Table 4: Recommended Warning Signage				
Curve	Difference in Speeds (mph)		Existing Signage [<i>Proposed Signage</i>]	
	EB	WB	EB	WB
1	(1)	5	None	[Combination Turn/Advisory Speed Sign (W1-1a) and five (5) Chevron Alignment Signs (W1-8) at 80 foot spacing. (2)]
2	(1)	(1)	None	None
3	(1)	(1)	None	None
4	10	15	Two (2) Chevron Alignment Signs (W1-8), [Reverse Turn Sign (W1-3), Advisory Speed Plaque (W13-1P), and one (1) Chevron Alignment Sign (W1-8) at 80 foot spacing.]	Two (2) Chevron Alignment Signs (W1-8), [Three (3) Chevron Alignment Signs (W1-8) at 40 foot spacing.]
5	10	15	Two (2) Chevron Alignment Signs (W1-8)	Chevron Alignment Sign (W1-8), [Reverse Turn Sign (W1-3), Advisory Speed Plaque (W13-1P), and three (3) Chevron Alignment Signs (W1-8) at 40 foot spacing.]

Notes: (1): Advisory speed is greater than posted speed limit.

(2): Chevron alignment signs (W1-8) along these curves are optional according to MUTCD.

As seen above, reverse turn signs (W1-3) are recommended at Curve 4 and Curve 5 in the eastbound direction and westbound direction, respectively. In cases such as this, where the tangent distance between the two (2) curves is less than 600 feet, MUTCD recommends one (1) reverse turn sign for each travel direction to avoid the installation of multiple turn signs (W1-1) in close proximity. Advisory speed plaques (W13-1P) are also recommended for installation with each reverse turn sign due to the significant difference between the posted speed and advisory speed at these curves. Additionally, a turn sign and advisory speed plaque is recommended at Curve 1 in the westbound direction. However, MUTCD Section 2C.10 allows for the installation of a combination turn/advisory speed sign (W1-1A).

If you have any questions regarding this analysis, please feel free to contact me.

Sincerely,

KIMLEY-HORN AND ASSOCIATES, INC.



John J. McWilliams, P.E.
Vice President



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Kimley-Horn and Associates, Inc.
8201 Peters Road, Suite 2200
Plantation, FL 33324
Registry # 00000696

This document has been digitally signed and sealed by John J. McWilliams, P.E., on the date adjacent to the seal.

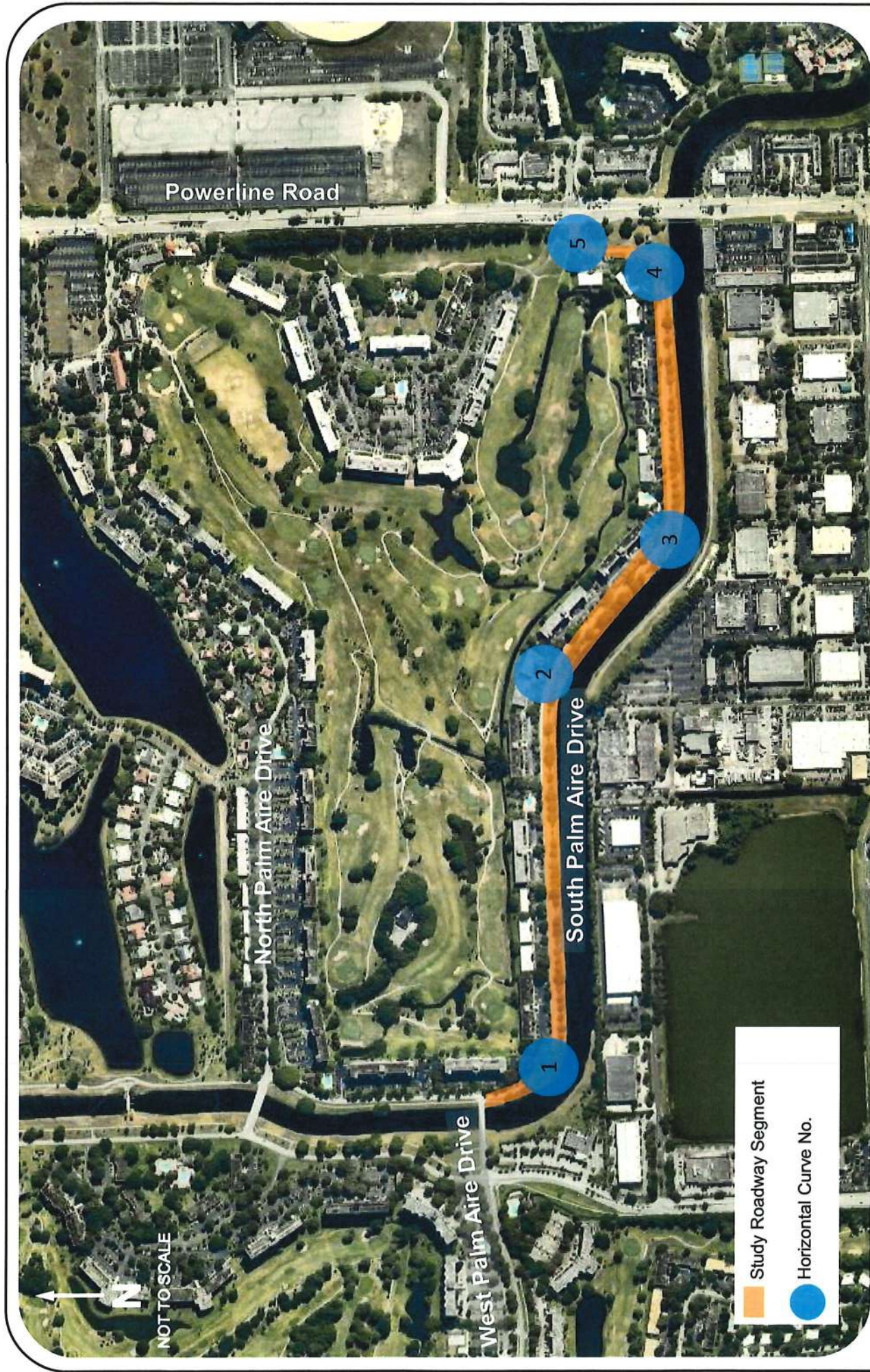
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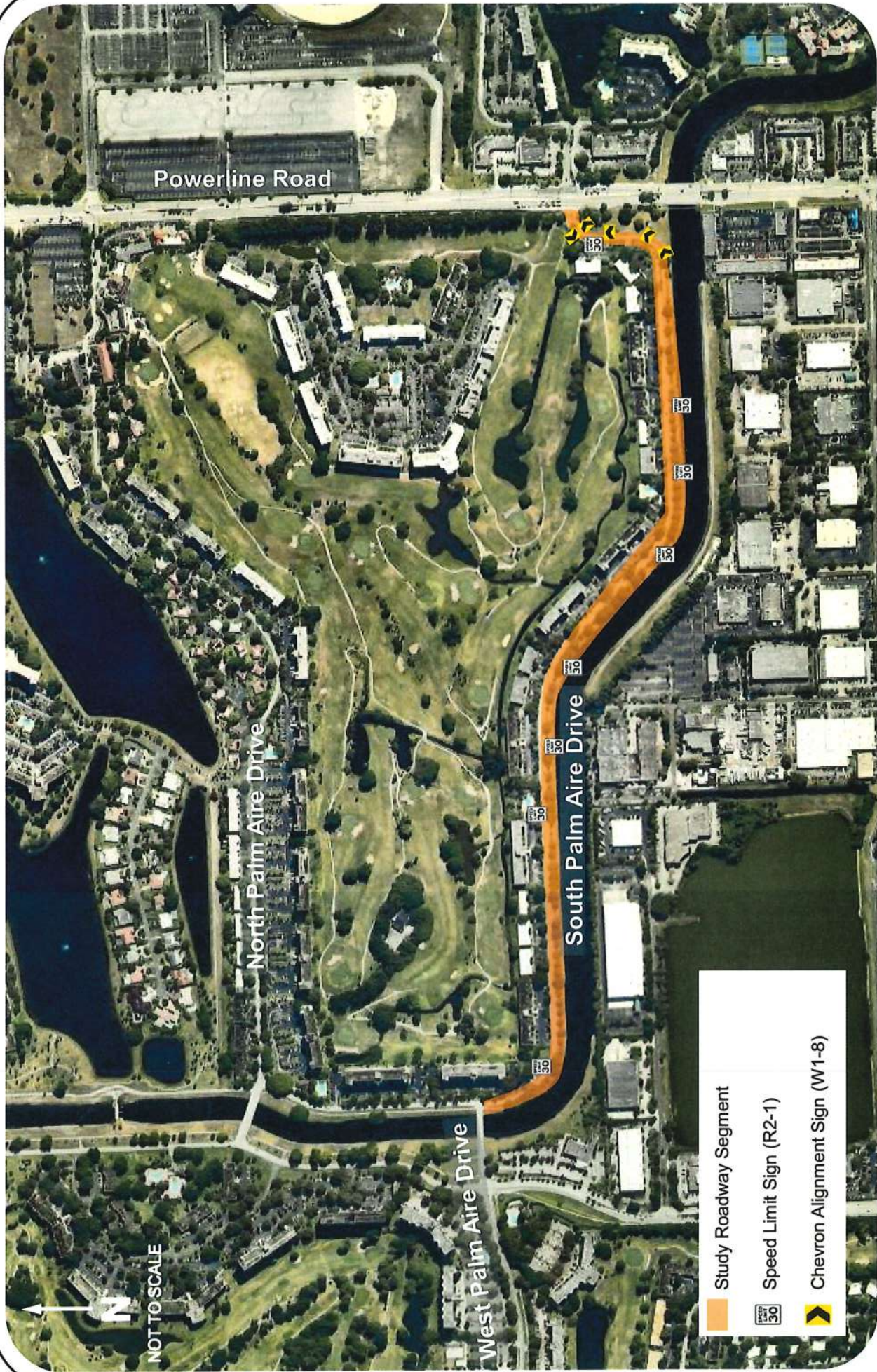
Attachment A

Location Curve Map



Location Curve Map
South Palm Aire Drive
Pompano Beach, Florida

Attachment B
Existing Signage Map



Existing Signage
South Palm Aire Drive
Pompano Beach, Florida

Attachment C

Photo Log

Photo No. 1



Remarks:

Speed Limit Sign (R2-1) located eastbound along Curve 2.

Photo No. 2



Remarks:

Speed Limit Sign (R2-1) located eastbound along Curve 2.

Photo No. 3



Remarks:

Speed Limit Sign (R2-1) located eastbound along Curve 3.

Photo No. 4



Remarks:

Speed Limit Sign (R2-1) located eastbound along Curve 3.

Photo No. 5



Remarks:

Speed Limit Sign (R2-1) located eastbound between Curves 3 and 4.

Photo No. 6



Remarks:

Chevron Alignment Signs (W1-8) located eastbound along Curve 4.

Photo No. 7



Remarks:

Chevron Alignment Signs (W1-8) located eastbound along Curve 5.

Photo No. 8



Remarks:

Chevron Alignment Signs (W1-8) located westbound along Curve 4.

Photo No. 9



Remarks:

Chevron Alignment Sign (W1-8) located westbound along Curve 5.

Photo No. 10



Remarks:

Speed Limit Sign (R2-1) located westbound along Curve 5.

Photo No. 11



Remarks:

Speed Limit Sign (R2-1) located westbound between Curves 1 and 2.

Photo No. 12



Remarks:

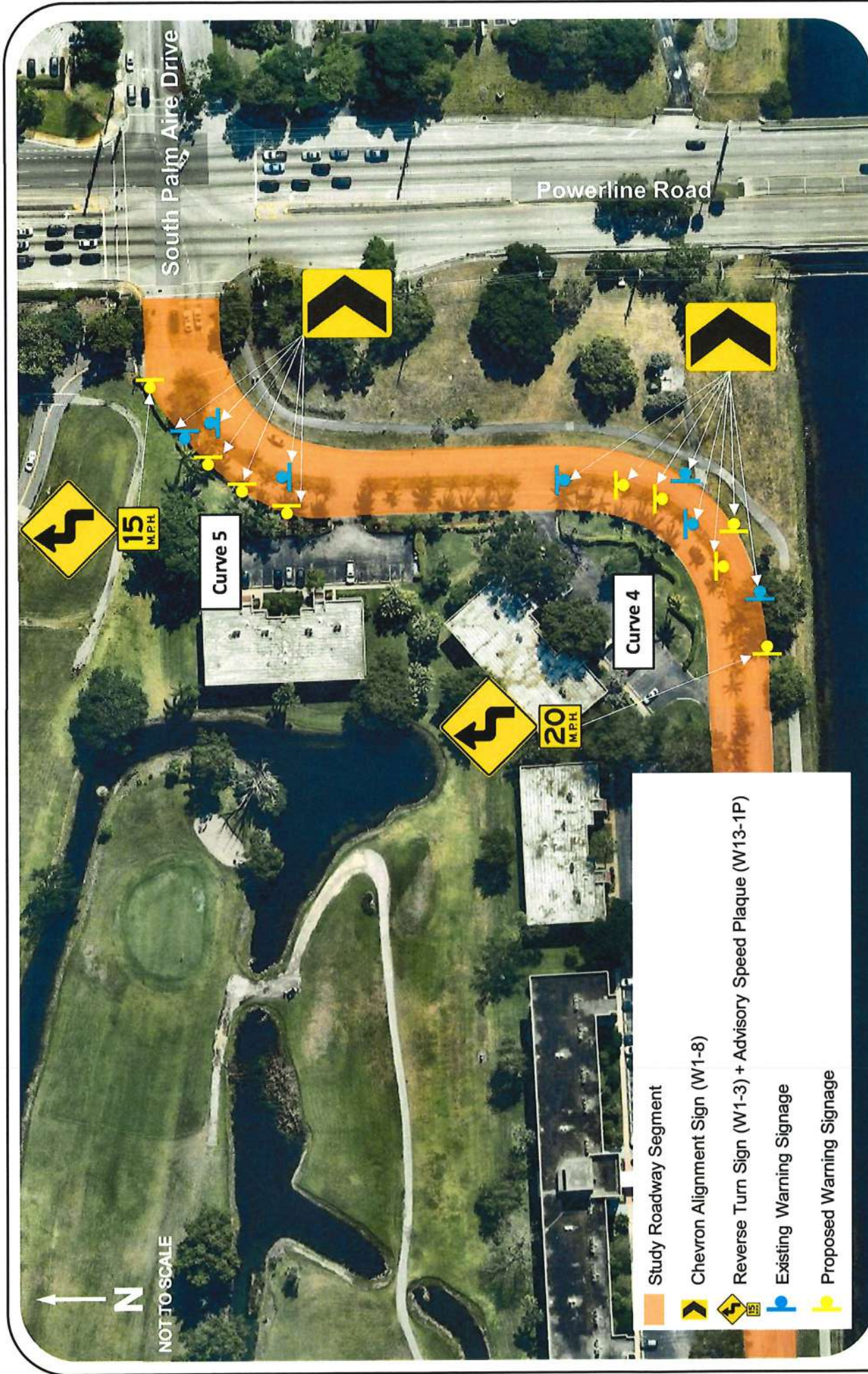
Speed Limit Sign (R2-1) located westbound along Curve 1.

Attachment D

Recommended Signage Maps



Recommended Warning Signage – Curve 1
 South Palm Aire Drive
 Pompano Beach, Florida



Recommended Warning Signage – Curves 4 and 5
 South Palm Aire Drive
 Pompano Beach, Florida