Drainage Reports

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Stormwater Waiver Application

District at the Quarter

Traffic Impact and Mitigation Analysis
2nd Submittal - *REVISED*

Township 3 North, Range 4 East
Section 2 - Scottsdale, Arizona

August 2016
Project No. 16-0110

Prepared For:
Rick Engineering
6150 North 16th Street
Phoenix, Arizona 85015

For Submittal to:
City of Scottsdale

Prepared By:

CivTech

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08/05/16

DISTRICT AT THE QUARTER
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2ND SUBMITTAL *REVISED*

Township 3 North, Range 4 East, Section 2
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REVIEWED
DATE: 9-6-16
ACCEPTED
CITY OF SCOTTSDALE
TRANSPORTATION DEPARTMENT

For Submittal to:
City of Scottsdale

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ARIZONA U.S.A.
Expires 6/30/2019

August 2016
CivTech Project No. 16-0110

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EXECUTIVE SUMMARY

The District at the Quarter development is located on the northeast corner of Dial Boulevard/73rd Street and Greenway Hayden Loop. The proposed development is a 622-unit apartment complex with seven optional live/work units on the ground floor, a 7,855-square foot (SF) clubhouse, a 7,035-SF quality restaurant, and a 5,354-SF fitness center, the latter two of which are expected to be open to the public. The project will redevelop the site of the existing 130,000-SF International Cruise & Excursions, Inc. (ICE) offices at 15501 North Dial Boulevard in Scottsdale, on the northeast corner of Dial Boulevard/73rd Street and Greenway-Hayden Loop.

Access for residents and diners to two planned parking garages will be via two new site accesses, one each from Greenway-Hayden Loop and Dial Boulevard. Another new driveway on Dial Boulevard nearer the adjacent intersection will serve as a valet parking area for the restaurant, fitness center, and clubhouse. A second new driveway on Greenway-Hayden Loop will serve a fire lane around the complex that will re-use the existing northern site access to Dial Boulevard. Two other accesses, including the existing ICE main driveway, will be closed.

The following conclusions and recommendations have been documented in this study:

- The proposed development is expected to generate a total of 4,992 trips daily, with 283 trips (92 in/191 out) during the AM peak hour and 360 trips (214 in/146 out) during the PM peak hour. Overall, the development could generate a net of 1,878 more trips each day than the current office use with 336 fewer during the AM peak hour and 203 fewer during the PM peak hour. These trips, the majority of which are typically considered commuter trips to and from places of employment, are in the opposite direction of those currently being generated by the office building.
- Of 34 reported crashes at the three existing study intersections, 33 occurred at the intersection of Scottsdale Road and Greenway-Hayden Loop. From the above review of crash data at this intersection, it can be concluded that there are no obvious crash patterns that stand out and could be treated with any type of low-cost mitigation measures that could be implemented by the City.
- All study intersections currently operate at overall LOS D or better during the peak hours. The eastbound Kierland Boulevard approach to Scottsdale Road operates at poor levels of service (LOS E or F) in the PM peak hour with the existing signal timing.
- Right-turn deceleration lanes are not required by City of Scottsdale's Design Standards and Polices Manual Section 5-3.206 on Dial Boulevard approaching the site driveways.
- In 2017, with the proposed development, all signalized intersections are anticipated to operate at overall LOS D or better during both peak hours. The eastbound Kierland Boulevard approach to Scottsdale Road is expected to continue to operate with delays at LOS E during the PM peak hour with the existing signal timing. With the addition of site traffic, the westbound Greenway-Hayden Loop approach to Scottsdale Road is also expected to operate with delays at LOS E during the PM peak hour with the same signal timing. The City of Scottsdale

may consider modifying signal timing at this intersection to improve levels of service on the east- and westbound approaches.

- The queue storage analysis revealed that the existing turn lane storage capacities in and around the District at the Quarter development can accommodate anticipated queuing in up to 95% of situations.
- It is recommended that the proposed site driveway be designed to meet the standards established by the City of Scottsdale in its *Design Standards and Policies Manual, 2010 Update*. A CL-1 two-way commercial driveway is recommended for Accesses A and B, for the valet parking driveway on Dial Boulevard, and for the fire lane driveway to Greenway-Hayden Loop near the eastern boundary of the property. Since there are no resident-only accesses and there is a continuous drive aisle from Access A to Access B, turnarounds for errant vehicles, as requested by the City via a comment, are no longer warranted.
- The proposed valet parking area driveway to Dial Boulevard will be located approximately 270 feet north of the intersection, which exceeds the City's standard driveway spacing of 165 feet for a minor collector roadway as required by the City's 2010 *Design Standards and Policies Manual*.
- Dial Boulevard was constructed with horizontal curvature at a relatively flat grade; therefore, the only impediments to the sight distance would be existing structures and landscaping. The developer should ensure that adequate sight distance is provided at the intersections to allow safe left and right turning movements from the development and left turns into the development from Dial Boulevard. Landscaping should be maintained at a maximum of three feet in height. To maintain sight distance, tree branches should be trimmed lower than seven feet and maintained to meet current acceptable landscape requirements.

INTRODUCTION

The proposed District at the Quarter development is a 622-unit apartment complex that will redevelop the site of the existing 130,000 square foot (SF) International Cruise & Excursions, Inc. (ICE) offices at 15501 North Dial Boulevard in Scottsdale. The site is on the northeast corner of the signalized intersection of Dial Boulevard/73rd Street and Greenway-Hayden Loop and consists of two parcels that front Greenway-Hayden Loop. The vicinity is shown in **Figure 1**.

The proposed redevelopment project is expected to consist of two buildings, designated as A and B on a new site plan dated August 3, 2016. (The prior TIMA was based on a preliminary plan from September 2015.) Building A is the southern of the two and will have 332 dwelling units on four floors, a 7,855-SF clubhouse a 7,035-SF quality restaurant, and a 5,354-SF fitness center. Building B will have 290 dwelling units, also on four floors. The complex will, thus, have a total of 622 dwelling units. Access for residents and diners to two planned parking garages will be via two new site accesses, one each from Greenway-Hayden Loop and Dial Boulevard. Another new driveway on Dial Boulevard nearer the adjacent intersection will serve as a valet parking area for the restaurant, fitness center, and clubhouse. A second new driveway on Greenway-Hayden Loop will serve a fire lane around the complex that will re-use the existing northern site access to Dial Boulevard. Two other accesses, including the existing ICE main driveway, will be closed.

CivTech Inc. was retained by Rick Engineering to perform the traffic impact and mitigation analysis (TIMA) as required by the City of Scottsdale for the proposed development.

Purpose of Report and Study Objectives

The purpose of this study is to address the traffic and transportation impacts of the proposed development on the surrounding streets and intersections. This Traffic Impact Mitigation Analysis (TIMA) was prepared for submittal to the City of Scottsdale in conformance to City guidelines. The specific objectives of the TIMA are:

1. To evaluate lane requirements on all existing roadways and at all existing intersections within the study area.
2. To determine future level of service for all proposed major intersections within the study area and recommend any capacity related improvements.
3. To determine necessary lane configurations at all major intersections within the proposed development to provide acceptable future levels of service.
4. To evaluate the need for future traffic control changes within the proposed development and at the major entry points.
5. To evaluate the need for auxiliary lanes at stop and signal controlled intersections.

Study Requirements

With the concurrence of City of Scottsdale staff, the study area for this TIMA will include the following intersections:

- Scottsdale Road and Kierland Boulevard/Greenway-Hayden Loop
- Dial Boulevard/73rd Street and Greenway-Hayden Loop
- Dial Boulevard and Tierra Buena Lane

Weekday AM and PM peak hour levels of service for these study intersections will be analyzed under current conditions and under two opening year scenarios: without and with the proposed development . It is anticipated that the development will open in 2017. For purposes of this analysis, the development will be considered to be built-out upon opening. This report represents a second submittal of the TIMA revised to reflect a new site plan. The City of Scottsdale reviewed and commented on the first submittal dated March 2016. The City's comments, dated May 2016, and CivTech's responses can be found in **Appendix A**.

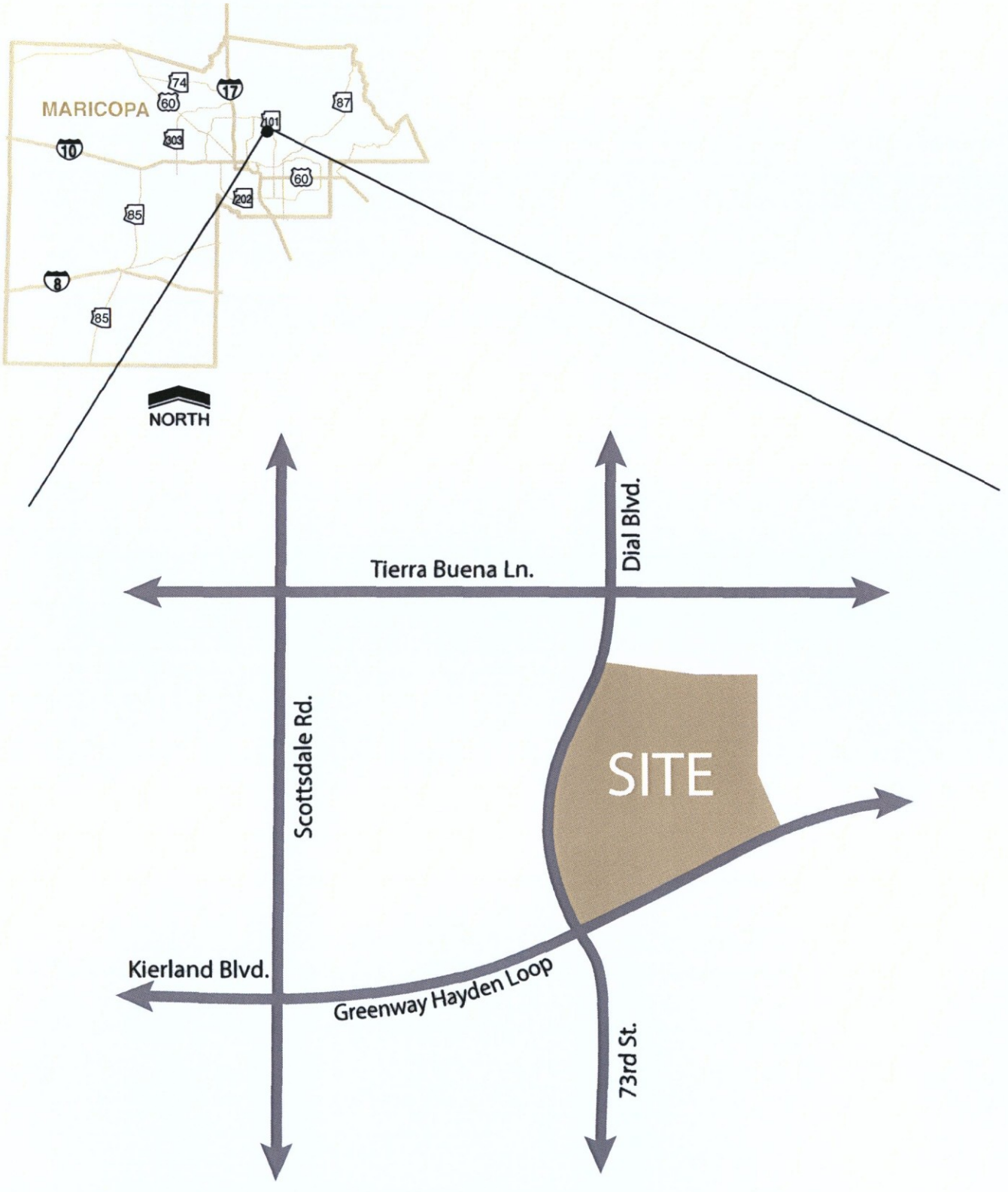


Figure 1: Vicinity Map

EXISTING CONDITIONS

EXISTING LAND USE

The proposed District at the Quarter complex ("District") will redevelop is the 130,000-SF International Cruise & Excursions, Inc. (ICE) offices at 15501 North Dial Boulevard in Scottsdale. The site is on the northeast corner of the signalized intersections of Greenway-Hayden Loop at Dial Boulevard/73rd Street and consists of two parcels that front Greenway-Hayden Loop.

The District will be located is an already highly-developed commercial and residential area of Scottsdale. On the other corners of the same intersection on which the District will be located are the Scottsdale Quarter development (southwest), a dense, multi-story, mixed-use development; a substantial, single-story industrial-flex complex (southeast); and Zocallo Plaza, a 23,300 retail center (northwest). To the east of the site is a 13,300-SF industrial-flex complex with another 21,100-SF industrial-flex building to the north. Across Dial Boulevard are the four-story Liv apartments. To the north of the Liv apartments is an Extended Stay America hotel.

EXISTING ROADWAY NETWORK

The existing roadway network within the study area includes Scottsdale Road, Dial Boulevard/73rd Street, Greenway-Hayden Loop, and Tierra Buena Lane.

Scottsdale Road is a north-south roadway that begins to the south as Rural Road in Chandler at Commonwealth Street just south of Chandler Boulevard. Traveling northbound, Rural Road is renamed Scottsdale Road at Rio Salado Parkway on the south side of the Salt River in Tempe and is again renamed to Tom Darlington Drive in the Town of Carefree, where it terminates at Cave Creek Road. Scottsdale Road provides access to the Pima Freeway (State Route Loop 101 to the west and south), Red Mountain Freeway (State Route 202), and the Superstition Freeway (US Route 60). Per the City of Scottsdale's *Street Classification Map*, Scottsdale Road is a six-lane major urban arterial with a 24-foot center raised median. Within the vicinity of the site, Scottsdale Road is currently comprised of three (3) through lanes in both directions with a raised median. Scottsdale Road is currently posted at 45 miles per hour (mph) within the vicinity of the proposed site.

Dial Boulevard is the northerly extension of ***73rd Street***, which is a north-south roadway that begins to the south at Thunderbird Road/Redfield Road. Traveling northbound, 73rd Street weaves around the west side of the Scottsdale Airpark, crosses Greenway-Hayden Loop and becomes Dial Boulevard, where it passes the subject site, and continues north until terminating at Paradise Lane. Dial Boulevard/73rd Street is a 2- lane minor urban collector. Dial Boulevard/73rd Street has a posted speed limit of 30 mph within the vicinity of the site.

Greenway-Hayden Loop is a connector roadway that aligns with Kierland Boulevard, which is a collector roadway that was constructed along the original section-line alignment of Greenway Road on the west side of Scottsdale Road in Phoenix. Beginning at Scottsdale Road, Greenway-Hayden Loop is a 6-lane minor urban arterial roadway with within the vicinity of the site with a raised center median that varies from approximately

28 feet to 18 feet. Greenway-Hayden Loop has a posted speed limit of 40 mph within the vicinity of the site.

Tierra Buena Lane is a local commercial/industrial roadway that begins in Phoenix at 71st Street, is stop-controlled as it crosses Scottsdale Road, and extends east into Scottsdale, ending at 76th Street. Tierra Buena Lane has a posted speed limit of 30 mph.

EXISTING INTERSECTION CONFIGURATIONS

The intersection of ***Scottsdale Road and Greenway-Hayden Loop/Kierland Boulevard*** is a signalized four-legged intersection. All approaches have dual left turn lanes operating with protected-only phasing. The other lanes on these approaches are configured as follows:

- Northbound and southbound: 3 throughs, 1 right.
- Eastbound and westbound: 2 throughs, 1 shared through/right.

The intersection of ***Dial Boulevard/73rd Street and Greenway-Hayden Loop*** is a signalized four-legged intersection. The other lanes on these approaches are configured as follows:

- Northbound and southbound: 1 left (permissive) 1 through, 1 right.
- Eastbound: 1 left (permissive-protected), 2 throughs, 1 shared through/right (merges left beyond intersection).
- Westbound: 1 left (permissive-protected), 2 throughs, 1 right.

The intersection of ***Dial Boulevard and Tierra Buena Lane*** is a four-legged all-way stop-controlled (AWSC) intersection. All approaches are configured with 1 left turn lane and 1 shared through/right turn lane.

Figure 2 depicts existing lane configurations and traffic controls of the study intersections.

EXISTING TRAFFIC VOLUMES

Field Data Services (FDS) conducted intersection turning movement counts at the study intersections on Tuesday, January 26, 2016. The existing hourly traffic counts used for the time periods in this study are shown on **Figure 3**. The intersection turning movement counts for the recorded volumes are provided in **Appendix B**.

LEVEL OF SERVICE ANALYSIS

The concept of level of service (LOS) uses qualitative measures that characterize operational conditions within the traffic stream. The individual levels of service are described by factors that include speed, travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations A through F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions. Levels of service for intersections are defined in terms of delay ranges. **Table 1** lists the level of service criteria for signalized and unsignalized intersections.

Peak hour capacity analyses were conducted for the study intersections based on existing intersection configurations and traffic volumes. All intersections have been analyzed using the methodologies presented in the *Highway Capacity Manual* (HCM), using Traffix software. The overall and approach levels of service are reported for signalized intersections. The resulting levels of service for the existing conditions are summarized in **Table 2**. The existing conditions analyses have been included in **Appendix C**.

Table 1 – Intersection LOS Criteria

Level of Service	Control Delay (seconds/vehicle)	
	Signalized	Unsignalized
A	≤ 10	≤ 10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50

Source: Exhibit 18-4 and Exhibit 19-1, Highway Capacity Manual 2010
*In addition, any movement that operates with a volume-to-capacity ratio greater than 1 (V:C.1), is considered to be operating at LOS F, no matter the control delay.

Table 2 – Existing (2016) Level-of-Service Summary

ID	Intersection	Stop Control	Approach	AM(PM) LOS Existing
1	Scottsdale Road and Greenway-Hayden Loop/Kierland Boulevard*	Signal	NB	B(C)
			SB	B(C)
			EB	D(E)
			WB	D(D)
			Overall	**C(C)**
2	Dial Boulevard/73rd Street and Greenway-Hayden Loop	Signal	NB	D(C)
			SB	D(D)
			EB	D(D)
			WB	C(C)
			Overall	**C(C)**
3	Dial Boulevard and Tierra Buena Lane	All-Way Stop	NB	A(A)
			SB	A(A)
			EB	A(A)
			WB	A(A)
			Overall	**A(A)**

* This intersection was analyzed using existing phasing provided by the City. The phasing is not strict NEMA phasing, which is needed for the HCM 2010 method; thus the LOS's shown are from a method used by the Synchro software.

A review of the results of the Level of Service analysis of existing conditions summarized in **Table 2** reveals that all study intersections currently operate at overall LOS C or better during the peak hours. The eastbound Kierland Boulevard approach to Scottsdale Road operates at poor levels of service (LOS E) during the PM peak hour with the existing signal timing.

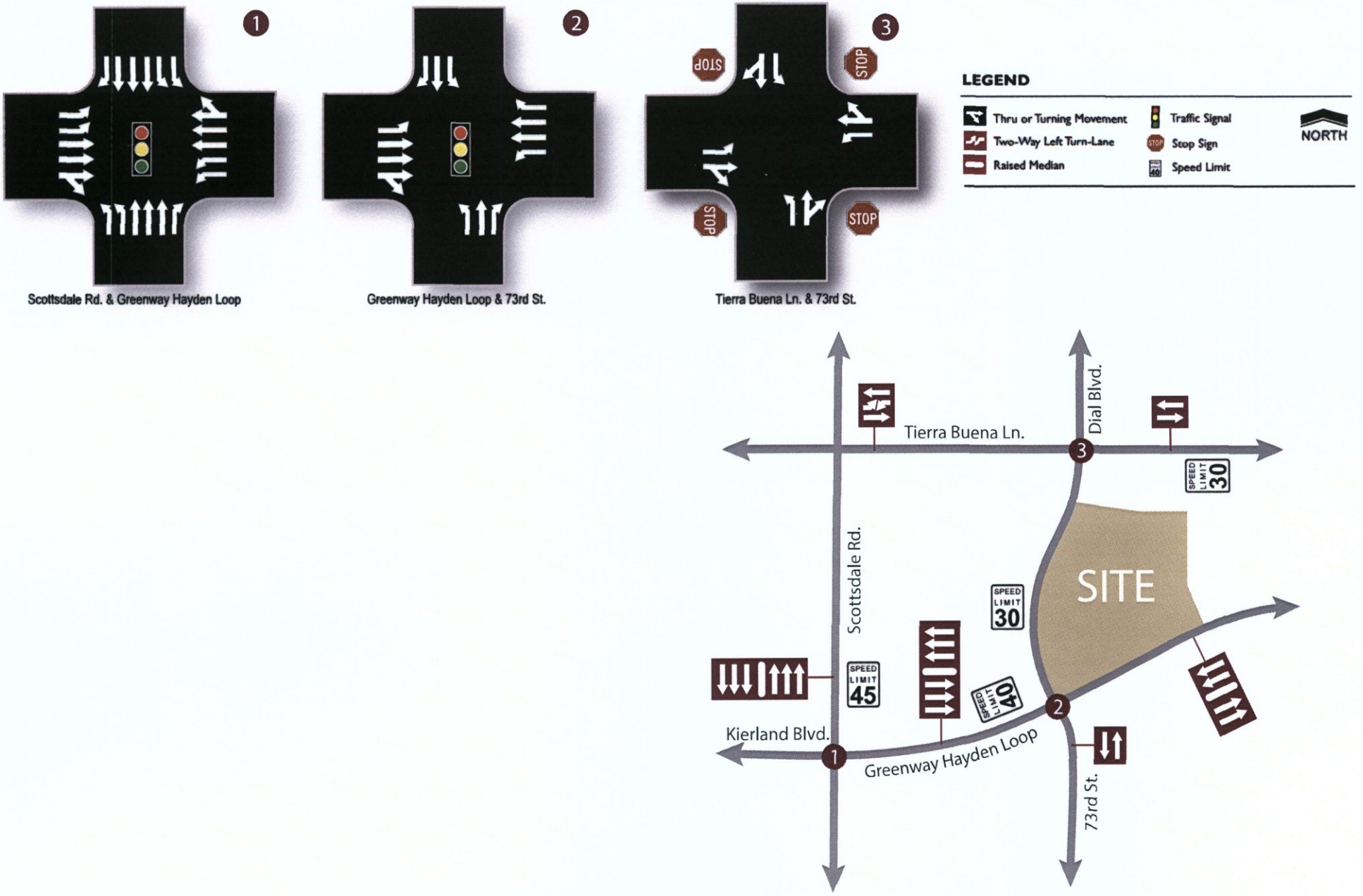
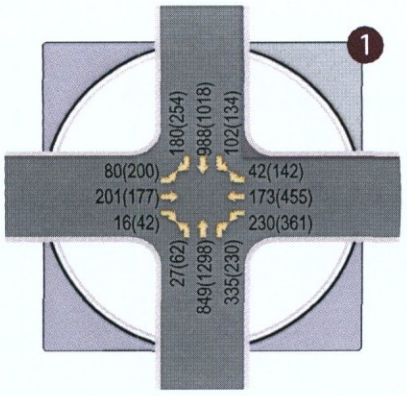
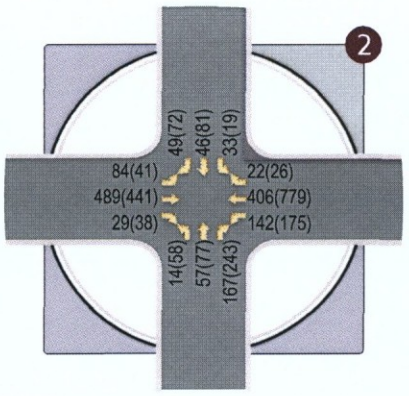


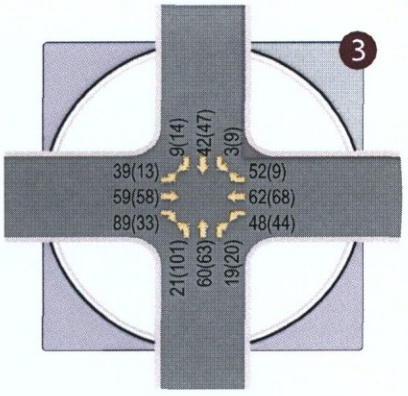
Figure 2: Existing Lane Configurations and Traffic Controls



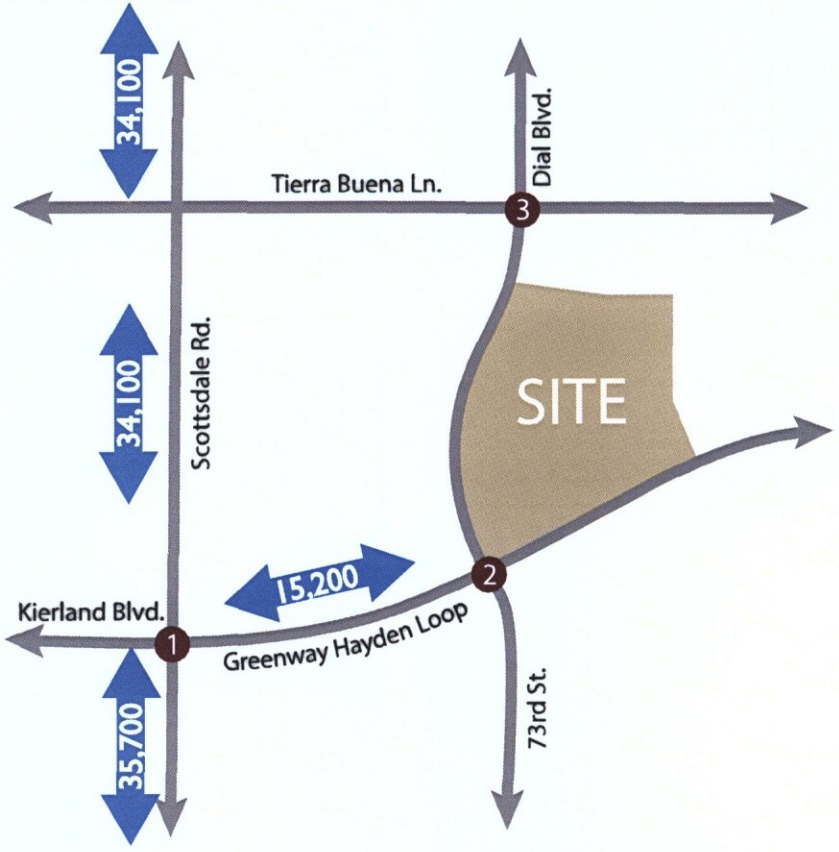
Scottsdale Rd and Greenway Hayden Loop



Dial Blvd/73rd St and Greenway Hayden Loop



Dial Blvd and Tierra Buena Lane



LEGEND

XX(XX) - AM(PM) Peak Hour Traffic Volumes

XXXXX - Daily Traffic Volumes (2014)

NORTH

Figure 3: Existing Traffic Volumes

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CRASH ANALYSIS

City staff provided crash listings for the existing study intersections for the three year period 2013 through 2015[1]. Listings showing a total of 34 incidents were provided. None of the 34 incidents resulted in fatal injuries. All but one of the 34 incidents were reported at the intersection of Scottsdale Road and Greenway-Hayden Loop. The crash listings provided to CivTech and then consolidated can be found in **Appendix B**.

Dial Boulevard and Tierra Buena Lane. At the intersection of Dial Boulevard and Tierra Buena Lane no incidents were reported during the analysis period.

Dial Boulevard/73rd Street and Greenway-Hayden Loop. During the analysis period, just a single angle crash involving southbound and eastbound vehicles occurred at the signalized intersection of Dial Boulevard/73rd Street and Greenway-Hayden Loop. Occurring on April 3, 2015, just before 6 PM, there were no injuries. The eastbound driver disregarded the traffic signal.

Scottsdale Road and Greenway-Hayden Loop/Kierland Boulevard. At the intersection of Scottsdale Road and Greenway-Hayden Loop, 33 intersection-related crashes were recorded during the analysis period. These are summarized in **Table 3**.

Table 3 – 2011-13 Crash Summary: Scottsdale & Greenway-Hayden/Kierland

	Direction	2013	2014	2015	Total
Type of Crash/Incident					
Single-Vehicle	All	1			1
Angle	All	1	4		5
Left Turn	EB & WB			1	1
Rear-End (EB rear-ends occur in Phoenix)	NB	3	2	2	7
	SB	6	3	1	10
	WB	1	1		2
Sideswipe, Same Direction	NB	1			1
	SB	1			1
Other/Unknown					5
Hit-and-Run		1	2	2	5
Crash/Incident Severity*					
Property Damage Only (PDO)		7	9	5	21
Possible/Unknown Injury		5	2	3	10
Injury		2			2
Total by Year		**14**	**11**	**8**	**33**

*Numbers represent crashes, not the numbers of vehicles involved or persons injured.

A review of the data presented in **Table 3** reveals that 19 of the 33 collisions at the intersection were rear-end type collisions. A total of five angle collisions occurred in all directions during the period, four of those in 2014, none in 2015. There are no other obvious patterns of treatable collisions. Of the five other/unknown incidents, one involved

[1] While CivTech's engineer requested, and the City graciously provided, crash listings from 2011 through 2015, crash analysis typically considers only the latest three year (or 36 months) of data available. For example, the crash experience traffic signal warrant in the *Manual on Uniform Traffic Control Devices* does not consider crash experience for more than three years prior to a study. Also, in mid-2011, there were some changes made in the way certain collisions types were defined. CivTech considers this another valid reason for not addressing the older information received.

north- and southbound vehicles colliding as they both turned in Greenway-Hayden Loop (reported as an "angle" collision), another was an opposite-direction sideswipe with the vehicles traveling at right angles to each other, another was a left turn crash involving two vehicle traveling in the same direction, one was a rear-to-rear crash, and the last was reported as an "other" type of collision.

More than 63% of the incidents (21 of 33) resulted in no reported injuries and property damage only. Only two incidents, both in 2013, resulted in reported injuries. In another ten incidents, there were unknown or only possible injuries. During the period, there were five hit-and-run incidents.

Of 34 reported crashes at the three existing study intersections, 33 occurred at the intersection of Scottsdale Road and Greenway-Hayden Loop. From the above review of crash data at this intersection, it can be concluded that there are no obvious crash patterns that stand out and could be treated with any type of low-cost mitigation measures that could be implemented by the City.

PROPOSED DEVELOPMENT

The proposed District at the Quarter development is an apartment complex proposed for the northeast corner of the signalized intersection of Dial Boulevard/73rd Street and Greenway-Hayden Loop. The site consists of two parcels that front Greenway-Hayden Loop. The layout of the proposed development is illustrated in **Figure 4**. It is expected to be opened and built out year in 2017.

Existing Land Use and Floor Areas

The project will redevelop the site of the existing 130,000-SF International Cruise & Excursions, Inc. (ICE) offices at 15501 North Dial Boulevard. The facility is a single-user office building.

Proposed Development

The proposed redevelopment project is expected to consist of two buildings, designated as A and B on a new site plan dated August 3, 2016. (The prior TIMA was based on a preliminary plan from September 2015.) Building A is the southern of the two and will have 328 dwelling units on four floors, including seven optional live/work units on the ground floor, a 7,855-SF clubhouse, a 7,035-SF quality restaurant, and a 5,354-SF fitness center, the latter two of which are expected to be open to the public. Building B will have 290 dwelling units, also on four floors. The complex will, thus, have a total of 622 dwelling units.

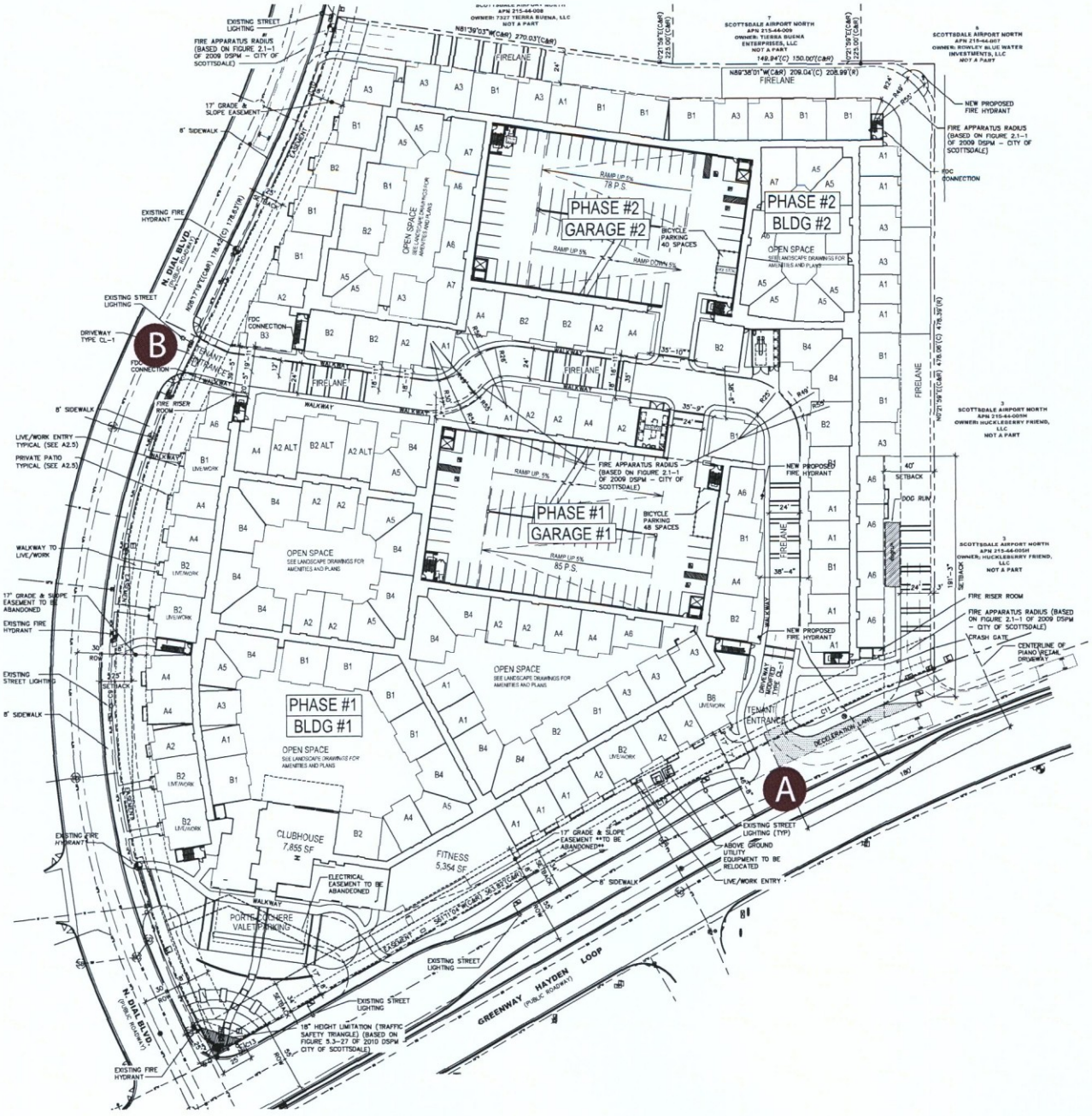
SITE ACCESS

As shown in **Figure 4**, access to the dwellings and restaurant will be via two new site accesses, one each from Greenway-Hayden Loop and Dial Boulevard. Access for residents and diners to two planned parking garages will be via two new site accesses, one each from Greenway-Hayden Loop and Dial Boulevard. Another new driveway on Dial Boulevard nearer the adjacent intersection will serve as a valet parking area for the restaurant, fitness center, and clubhouse. A second new driveway on Greenway-Hayden Loop will serve a fire lane around the complex that will re-use the existing northern site access to Dial Boulevard. Two other accesses, including the existing ICE main driveway, will be closed.

Access A will be a new driveway on Greenway-Hayden Loop. Access A will be restricted by the existing median in Greenway-Hayden Loop to right-in/right-out movements only. It will be located approximately 900 feet (on-center) east of Dial Boulevard and 180 feet west of the next nearest existing driveway on the north side of Greenway-Hayden Loop. It will be constructed with a deceleration lane that will provide 90 feet (4 vehicles) of queue storage.

Access B will be the new, full-movement, main entrance to the site on Dial Boulevard. It will be located approximately 660 feet north of Greenway-Hayden Loop. All movements will be permitted at this driveway. The next nearest driveways to Access B will be the northern Zocallo Plaza driveway on the west side of Dial Boulevard approximately 220 feet to the south and the existing northern site driveway approximately 24 feet to the north.

"Access C" in the prior submittal was an existing driveway on Dial Boulevard near the northern boundary of the site. On the current site plan it will no longer serve residents, being used only for a fire lane that continues around the complex. A new driveway on Dial Boulevard will serve as a valet parking area for the restaurant, fitness center, and clubhouse. This driveway will have a turnaround area and an emergency access-only driveway from Green-Hayden Loop. Since valet driveway volumes will be low and the other two driveways are for a fire lane, only Access A and B are considered in the analysis. Access to the parking structures will be from the drive aisle that connects Accesses A and B, an aisle that will also serve as a fire lane between the buildings.



NORTH
NTS

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Figure 4: Site Plan and Access

TRIP GENERATION ESTIMATION AND COMPARISON

The potential trip generation for the proposed development was estimated utilizing the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 9th Edition* and *Trip Generation Handbook, 2nd Edition*. The *Trip Generation Manual* contains data collected by various transportation professionals for a wide range of different land uses. The data are summarized in the report and average rates and equations have been established that correlate the relationship between an independent variable that describes the development size and generated trips for each categorized land use. The report provides information for daily and peak hour trips.

Table 4 is a detail trip generation for the existing and proposed uses of the development site. Since trips were not recorded at the existing site driveways, rates as found in the Trip Generation Manual were used to estimate existing trips generated by ICE. CivTech came to understand that the ICE facility is a call center for one or more vacation clubs (Sears Vacation Club being one); therefore, "by-employee" rates were used because they yielded a higher trip generation, which presents a somewhat more favorable result for the developer.)

Table 4 – Trip Generating Potential of Existing and Proposed Development

Land Use	ITE LUC	ITE Land Use Name	Quantity Units*	AM Distribution In	AM Distribution Out	PM Distribution In	PM Distribution Out
Current Use							
Offices	715	Single Tenant Office Building	1,200 Employees	89%	11%	15%	85%
Proposed Use							
Apartments	223	Mid-Rise Apartments	622 DUs	31%	69%	58%	42%
Fitness Center	492	Health/Fitness Club	5.354 KSF	50%	50%	57%	43%
Restaurant	931	Quality Restaurant	7.035 KSF	75%	25%	67%	33%

Land Use	ADT Avg Rate	ADT Total	AM Peak Hour Avg Rate	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour Avg Rate	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Current Use										
Offices	2.59	3,114	0.52	551	68	619	0.47	84	479	563
Proposed Use										
Apartments	6.72	4,180	0.43+	83	186	269	0.46+	167	121	288
Fitness Center	32.93	178	1.41	4	4	8	3.53	11	8	19
Restaurant	89.95	634	0.81	5	1	6	7.49	36	17	53
Totals		***4,992***		***92***	***191***	***283***		***214***	***146***	***360***
Differences		***1,878***		***-459***	***123***	***-336***		***130***	***-333***	***-203***

* KSF=1,000 SF; DUs=Dwelling Units

+Note: Average rates were calculated by generating trips using equations for and dividing by total number of dwelling units. (See below.)

CALCULATIONS (Equations shown only where available)			
Land Use	***Daily***	***AM Peak Hour***	***PM Peak Hour***
Offices [ITE LUC 715]	T_{Day} = 1,200 x 2.59 = 3,114	T_{AM} = 1,200 x 0.52 = 619	T_{PM} = 1,200 x 0.47 = 563
Apartments [ITE LUC 223]	T_{Day} = 622 x 6.72 = 4,180	T_{AM} = 622 x 0.41 + 13.06 = 269	T_{PM} = 622 x 0.48 – 11.07 = 288
Health/Fitness Club [ITE LUC 492]	T_{Day} = 5.354 x 32.93 = 178	T_{AM} = 5.354 x 1.41 = 8	T_{PM} = 5.354 x 3.53 = 19
Quality Restaurant [ITE LUC 931]	T_{Day} = 7.035 x 89.95 = 634	T_{AM} = 7.035 x 0.81 = 6	T_{PM} = 7.035 x 7.49 = 53

A review of the trip generation detailed in **Table 4** reveals that the proposed development is expected to generate a total of 4,992 trips daily, with 283 trips (92 in/191 out) during the AM peak hour and 360 trips (214 in/146 out) during the PM peak hour. Overall, the development could generate a net of 1,878 more trips each day than the current office use with 336 fewer during the AM peak hour and 203 fewer during the PM peak hour. These trips, the majority of which are typically considered commuter trips to and from places of employment are in the opposite direction of those currently being generated by the office building, which are also commuter trips. This is, of course, due to the office building being

an employment use, which brings commuter trips into the site from residential uses in the morning and sends them back to those residential uses in the afternoon.

TRIP DISTRIBUTION AND ASSIGNMENT

Daily trips for residential uses were distributed to the roadway network based on the Maricopa Association of Governments' (MAG) estimate of population within a 10-mile radius of the site. This radius is based on the average trip length between residential and employment land uses as discussed in the *NPTS Urban Travel Patterns* report (December 1999). The projected distribution of population was used as a base for determining the trip distribution of trips generated by the site. The distribution was adjusted to major travel routes to and from the site around Scottsdale Municipal Airport. **Table 5** summarizes and **Figure 5** illustrates the trip distribution percentages applied in the analyses. In addition, **Figure 5** shows how residents might pass through the study intersection of Dial Boulevard and Tierra Buena Lane to and from destinations that are north of the complex. Distribution calculations and a summary of the socioeconomic data are included in **Appendix D**.

Table 5 – Trip Distribution

Roadway	Direction(s) (To/From)	Trip Distribution
Scottsdale Road, north of Frank Lloyd Wright Boulevard	North	10%
Scottsdale Road, south of Greenway-Hayden Loop	South/Southwest	35%
73rd Street, south of Greenway-Hayden Loop	South/Southeast	8%
Frank Lloyd Wright Boulevard, east of Greenway-Hayden Loop	Northeast	10%
Frank Lloyd Wright Boulevard, west of Scottsdale Road	Northwest	18%
Kierland Boulevard, west of Scottsdale Road	West/Southwest	14%
Total	**All**	**100%**

The percentages shown in **Table 5** and **Figure 5** were applied to the trips generated to determine the site traffic at the intersections within the study area. Site generated turning movements are depicted in **Figure 6**.

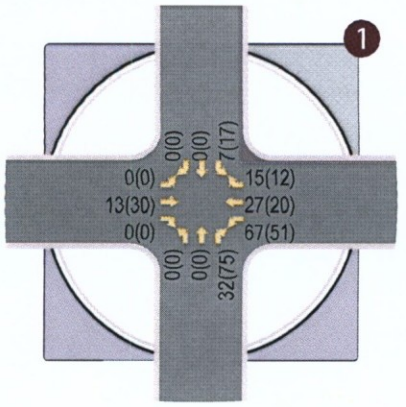
FUTURE BACKGROUND TRAFFIC

Historical daily traffic volumes were taken from the City of Scottsdale traffic count website to estimate an average annual growth rate. Average daily traffic volumes on Scottsdale Road, from Thunderbird Road to Greenway-Hayden Loop, were considered. This location experienced an average annual increase of daily traffic of 2.0 percent from 2012 to 2014. Therefore, a 2.0 percent annual growth rate was applied to the volumes at the study intersections to obtain the future background traffic volumes. Growth rate calculations and Scottsdale historical counts can be found in **Appendix E**. The opening year background traffic volumes are illustrated in **Figure 7**.

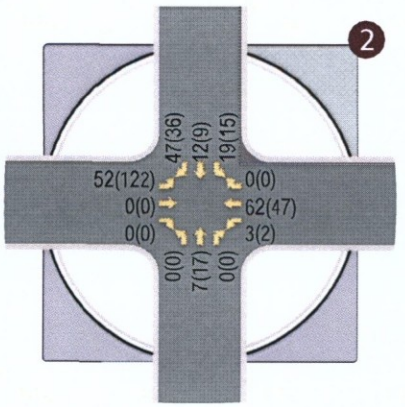
TOTAL TRAFFIC

Total traffic was determined by adding the site generated traffic to the projected background traffic for horizon year 2017. Total AM and PM peak hour traffic for horizon year 2017 is shown in **Figure 8**.

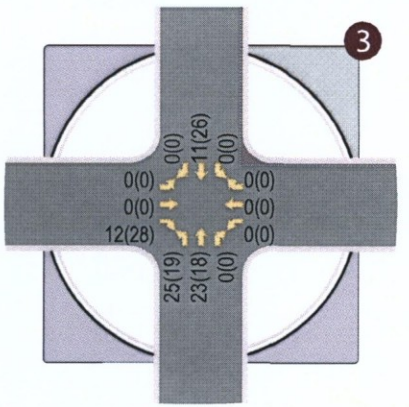
Figure 5: Trip Distribution



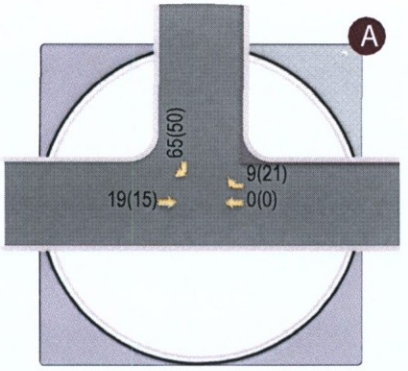
Scottsdale Rd and Greenway Hayden Loop



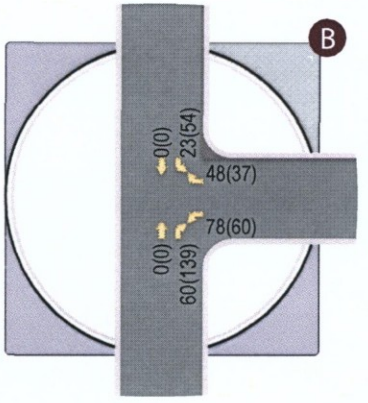
Dial Blvd/73rd St and Greenway Hayden Loop



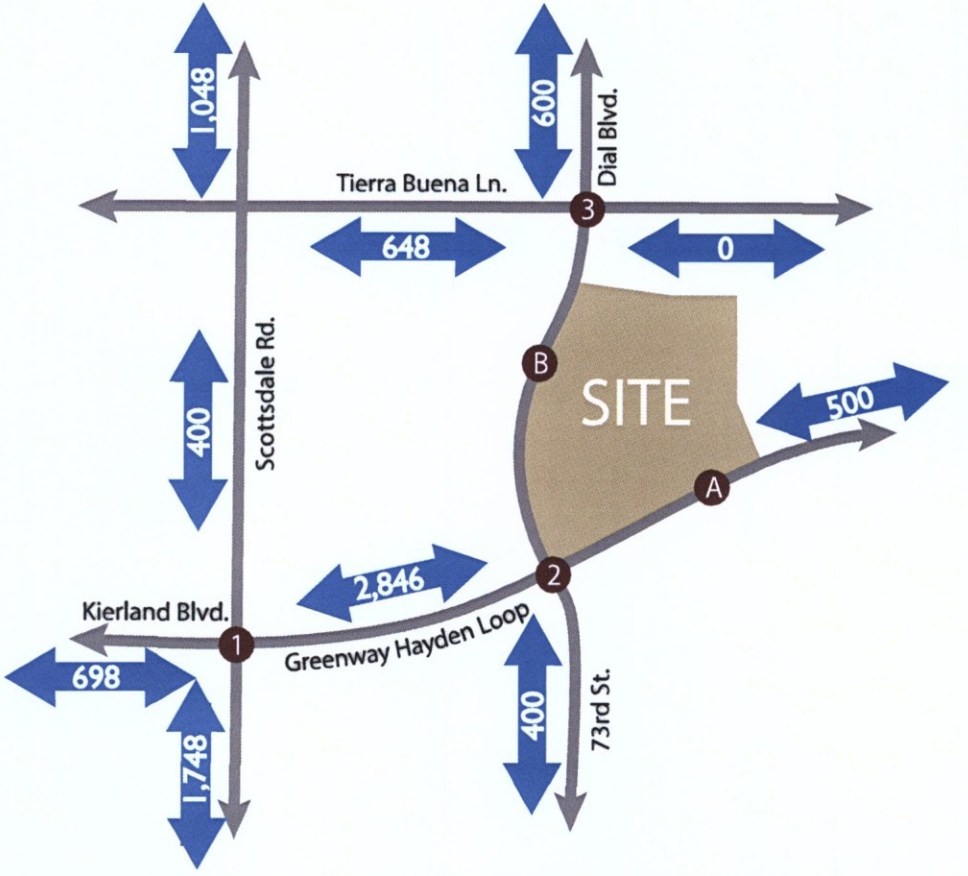
Dial Blvd and Tierra Buena Lane



Access A and Greenway Hayden Loop



Dial Blvd and Access B



LEGEND

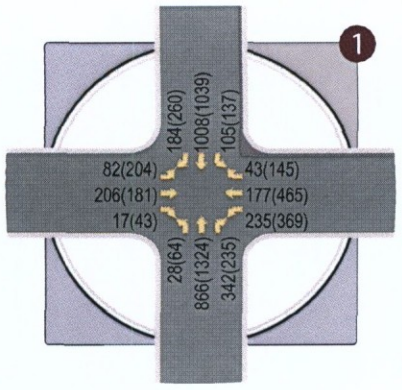
XX(XX) - AM(PM) Peak Hour Traffic Volumes

XX,XXX - Daily Traffic Volumes

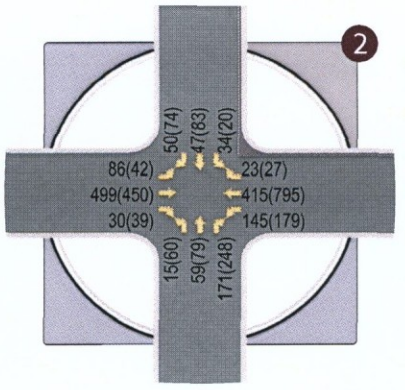
NORTH

Figure 6: 2017 Site Generated Traffic Volumes

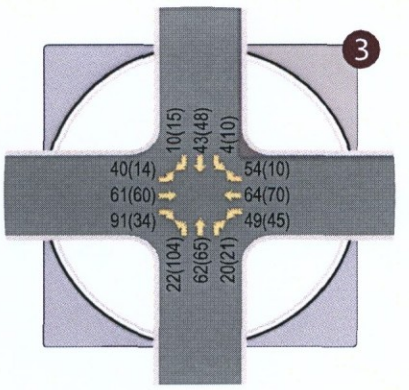
Revised 8/4/16 jfs



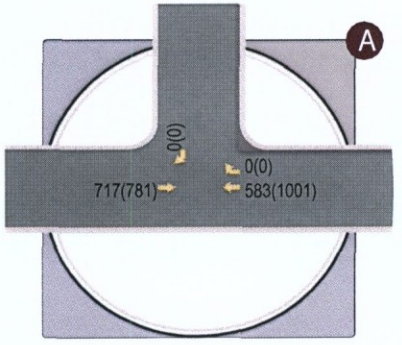
Scottsdale Rd and Greenway Hayden Loop



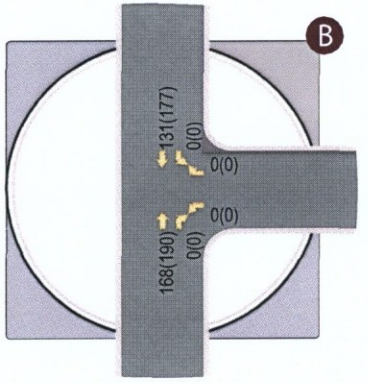
Dial Blvd/73rd St and Greenway Hayden Loop



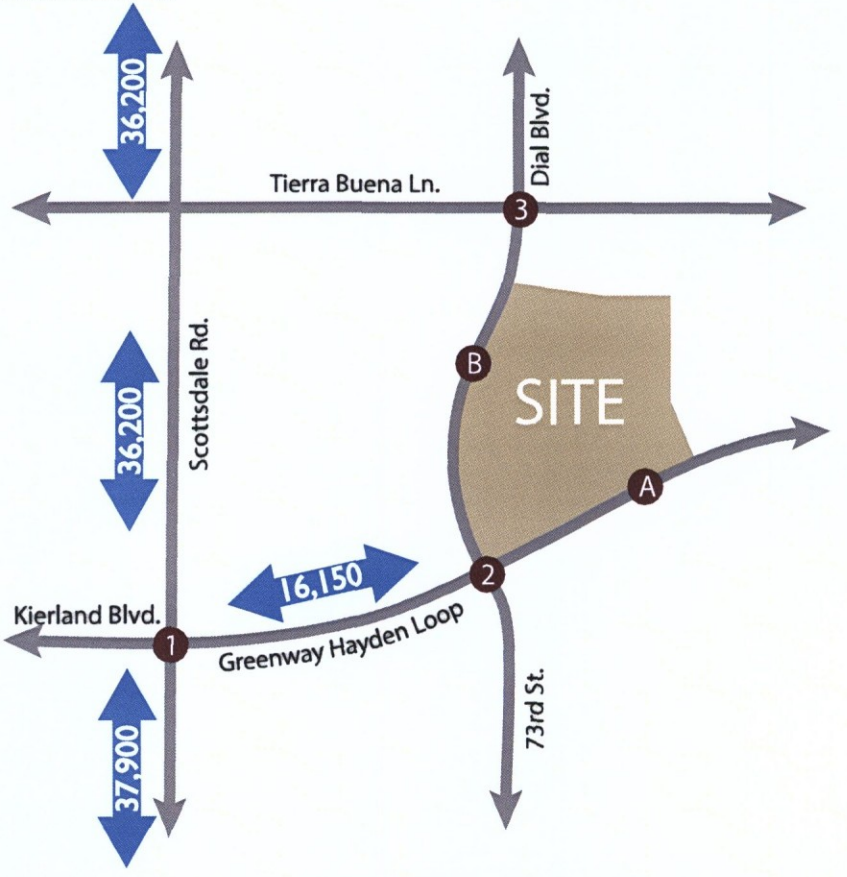
Dial Blvd and Tierra Buena Lane



Access A and Greenway Hayden Loop



Dial Blvd and Access B



LEGEND

XX(XX) - AM(PM) Peak Hour Traffic Volumes

XX,XXX - Daily Traffic Volumes

NORTH

Figure 7: 2017 Background Traffic Volumes

Revised 8/3/16 jfs

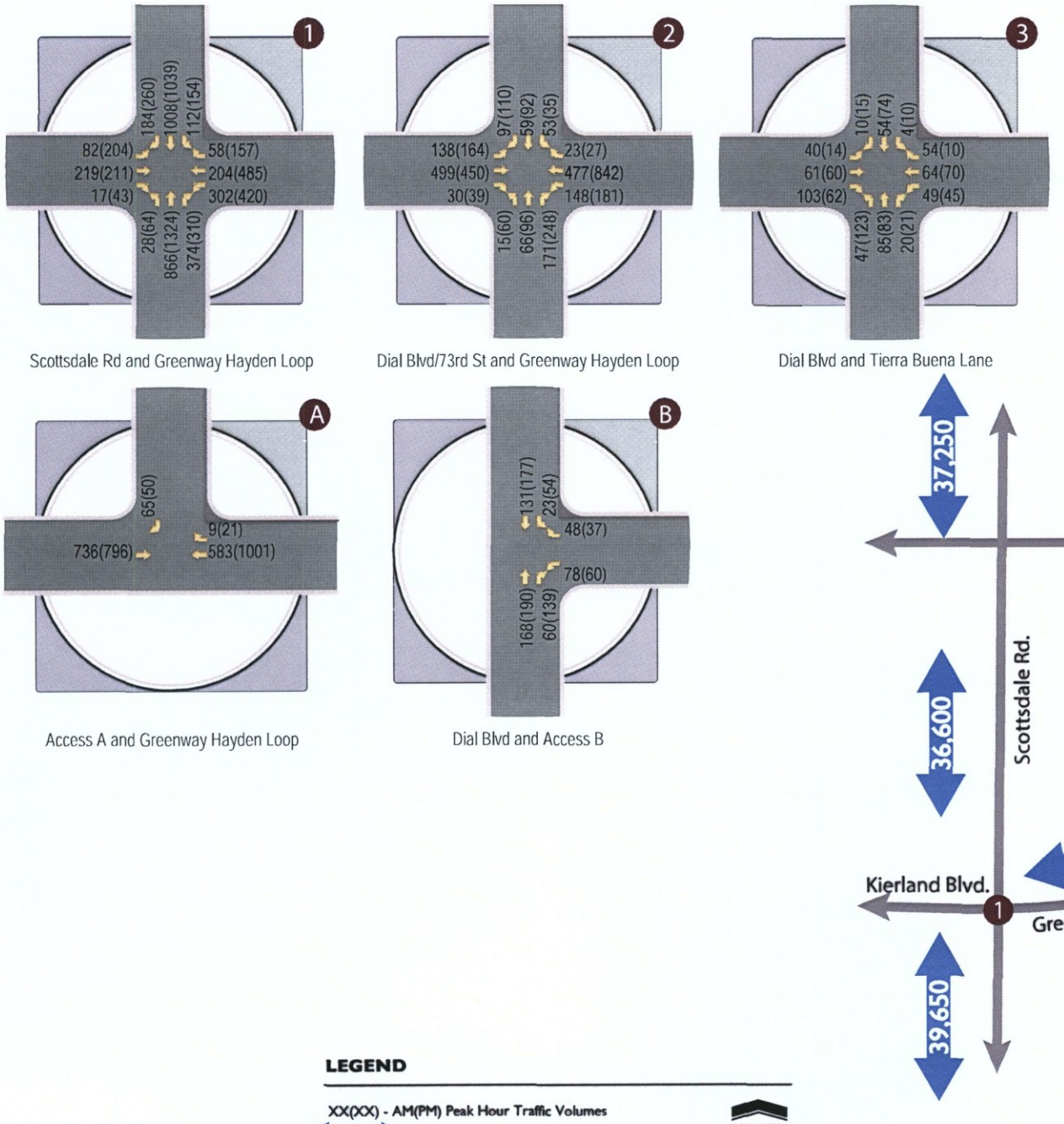


Figure 8: 2017 Total Traffic Volumes

Revised 8/4/16 jfs

TRAFFIC IMPROVEMENT AND MITIGATION ANALYSIS

LEVEL OF SERVICE ANALYSIS

The capacity analysis of future conditions was performed using the method described previously. For purposes of this TIMA, two analyses were performed for each peak hour in 2017. Results of the 2017 level-of-service analyses are shown in **Table 6** for the 2017 build-out/opening year. The analyses are based on the proposed lane configurations and traffic controls depicted in **Figure 9**. The output sheets for year 2017 are included in **Appendix F**.

Table 6 – 2017 Opening Year Level-of-Service Summary

ID	Intersection	Stop Control	Approach	AM(PM) LOS Background	AM(PM) LOS Total
1	Scottsdale Road and Greenway-Hayden Loop/Kierland Boulevard*	Signal	NB	B(C)	B(C)
			SB	B(C)	C(C)
			EB	D(E)	D(E)
			WB	D(D)	D(E)
			Overall	**C(C)**	**B(C)**
2	Dial Boulevard/73rd Street and Greenway-Hayden Loop	Signal	NB	D(D)	D(D)
			SB	D(D)	D(D)
			EB	D(D)	D(D)
			WB	C(C)	C(C)
			Overall	**D(C)**	**D(C)**
3	Dial Boulevard and Tierra Buena Lane	All-Way Stop	NB	A(A)	A(A)
			SB	A(A)	A(A)
			EB	A(A)	A(A)
			WB	A(A)	A(A)
			Overall	**A(A)**	**A(A)**
4	Greenway-Hayden Loop and Access A	One-Way Stop (SB)	SB Right	--(--)	B(C)
			Worse	**--(--)**	**B(C)**
5	Dial Boulevard and Access B	One-Way Stop (WB)	SB Left	--(--)	A(A)
			WB	--(--)	B(B)
			Worse	**--(--)**	**B(B)**

* See note at **Table 2**.

A review of the results of the level of service analysis of opening year 2017 conditions summarized in **Table 6** reveals that all study intersections are expected to operate at overall LOS D or better during the peak hours without or with the proposed development. The eastbound Kierland Boulevard approach to Scottsdale Road is expected to continue to operate with delays at LOS E during the PM peak hour with the existing signal timing. With the addition of site traffic, the westbound Greenway-Hayden Loop approach to Scottsdale Road is also expected to operate with delays at LOS E during the PM peak hour with the same signal timing. The City of Scottsdale may consider modifying signal timing at this intersection to improve levels of service on the east- and westbound approaches.

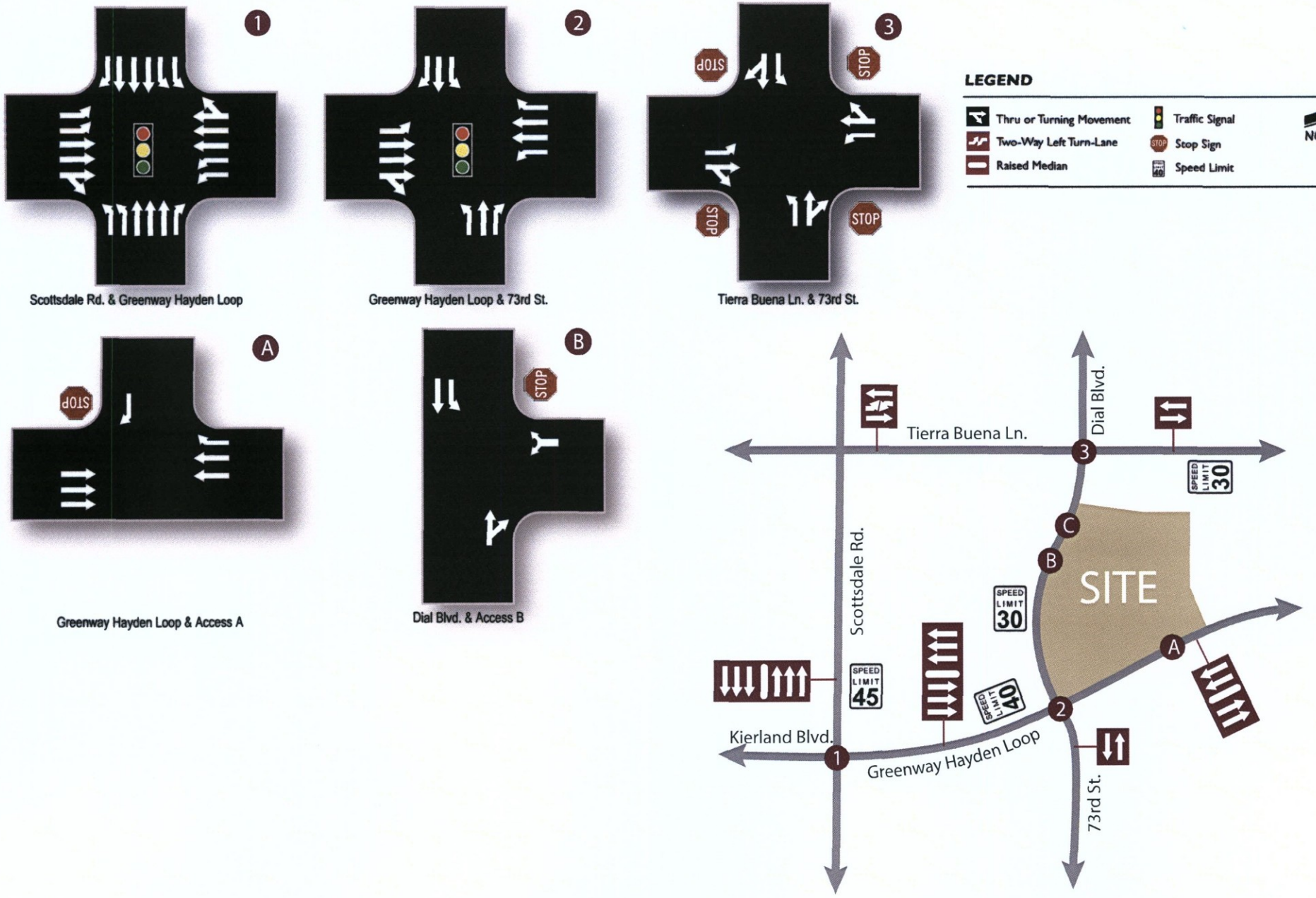


Figure 9: Proposed Lane Configurations and Traffic Controls

LEFT TURN DECELERATION LANES

Dial Boulevard currently provides approximately 40 feet of pavement (as measured from face-of-curb to face-of-curb in midblock). A continuous two-way left-turn lane (CTWLTL) has been provided north of the junction area of its intersection with Greenway-Hayden Loop. It is expected that the existing CTWLTL would be sufficient to serve the site accesses proposed along Dial Boulevard. As noted, the accesses along Greenway-Hayden Loop will be right-in/right-out only and will not need left turn lanes. Therefore, no left turn lane warrant analysis is required here.

RIGHT TURN DECELERATION LANES

The site plan shows that a right turn lane is planned into the residents-only access on Greenway-Hayden Loop. No right turn lane is proposed for the fire lane where it accesses Greenway-Hayden Loop. Thus, the need for right-turn deceleration lanes into the site accesses proposed for Dial Boulevard are considered here.

City of Scottsdale's *Design Standards & Policies Manual* (DSPM) Section 5-3.206 establishes the criteria for deceleration lanes. Copies of the applicable standards are provided in **Appendix G** for reference. New deceleration lanes have a standard storage length of 150 feet with a 100-foot storage length minimum. Deceleration lanes are required approaching all new driveways on major arterials and approaching new commercial/retail driveways on minor arterials. A deceleration lane on minor arterials or collectors is needed if the following criteria are met:

- At least 5,000 vehicles per day are expected to use the through street;
- The 85th percentile speed of the through street is at or above 45 mph for a 2-lane road or 35 mph for other roadways.
- At least 30 vehicles are expected to perform right-turns into the driveway during a 1-hour period.

Daily bi-directional traffic volume counts were not conducted on Dial Boulevard; however, it is assumed that future ADT on Dial Boulevard could exceed 5,000 vpd. (CivTech assumed in its approved March 2014 traffic study for the last expansion of the nearby Scottsdale Quarter that 73rd Street south of Greenway-Hayden Loop would exceed 5,000 vpd. While such volumes south of Greenway-Hayden Loop does not automatically mean similar volumes would travel Dial Boulevard.) CivTech estimated from the volumes entering and exiting Dial Boulevard at its intersection with Tierra Buena Lane that approximately 3,000 vpd currently travel along Dial Boulevard adjacent to the site.

The posted speed limit of Dial Boulevard adjacent to the site is 30 mph, which generally represents the 85th percentile speed. (With a traffic signal that favors Greenway-Hayden Loop and an all-way stop condition at Tierra Buena Lane, there is not a lot of distance for vehicles to attain a higher speed along Dial Boulevard.) Therefore, the speed limit criterion is not met.

The study driveways on Dial Boulevard are anticipated to experience more than 30 vehicles turning right into the site during at least one of the peak hours.

Thus, since only two of the three criteria are met, right-turn deceleration lanes are not required by DSPM Section 5-3.206 on Dial Boulevard approaching the site driveways.

QUEUE STORAGE ANALYSIS

A new right turn deceleration lane is proposed for Access A of the District at the Quarter development, the resident-only access on Greenway-Hayden Loop. The primary purpose of this analysis is to confirm the adequacy of the storage capacity for this planned turn lane.

The Synchro 9 analysis provides 95th percentile vehicle queues. The 95th percentile queue length are often used as a recommendation for minimum turn lane storage. For dual turn lanes, the software applies lane utilization factors and provides the longest queue length for a single turn lane, not an average per-lane queue length. **Table 7** summarizes the planned storage capacities, the longest 95th percentile per-lane queues for the with-development condition in the 2017 build-out year, and the recommended turn lane queue storage requirements.

Table 7 – 2017 Queue Storage Lengths (in Feet)

ID	Intersection	Control	Movement	Planned Storage	Longest 95th %ile Q (with Dev)	Recommended Storage (if diff from existing)
4	Access A and Greenway-Hayden Loop	1-Way Stop (SB)	WB right	65'	<25	N/A

A review of the queue storage analysis summarized in **Table 7** reveals that the existing turn lane storage capacities in and around the District at the Quarter development can accommodate anticipated queuing in up to 95% of situations.

SITE ACCESS DESIGN

It is recommended that all site be designed to meet the standards established by the City of Scottsdale in its *Design Standards and Policies Manual, 2010 Update*. The driveway types typically required on major urban arterial roadways such as Scottsdale Road are CH-2 and CH-3, which provide one ingress lane and two egress lanes. None of the new proposed site driveways is, however, located on a major arterial roadway. Therefore, the CL-1 two-way commercial driveway is recommended for Access A on Greenway-Hayden Loop, Access B on Dial Boulevard, for the valet parking driveway on Dial Boulevard, and for the fire lane driveway to Greenway-Hayden Loop near the eastern boundary of the property. Copies of the applicable driveway standards are provided in **Appendix G** for reference. Since there are no resident-only accesses and there is a continuous drive aisle from Access A to Access B, turnarounds for errant vehicles, as requested by the City via a comment, are no longer warranted.

Review of Valet Parking Area Driveway. With low peak hour volumes expected at the Dial Boulevard driveway serving the valet parking area for the restaurant, fitness center, and clubhouse, CivTech did not conduct a level of service analysis for the driveway. However, CivTech considers a review of its location in relation to the signalized

intersection of Dial Boulevard and Greenway-Hayden Loop and the conformance of the driveway locations to City guidelines to be of value.

The *City of Scottsdale's Design Standards and Policies Manual, 2010 Update* (see **Appendix G**) indicates that indicate that standard driveway spacing along a minor collector roadway, such as Dial Boulevard, the standard spacing is 165 feet.

The proposed valet parking area driveway to Dial Boulevard will be located approximately 270 feet north of the intersection, which exceeds the City's standard driveway spacing of 165 feet. The new driveway will approximately align with a driveway across Dial Boulevard that serves the Zocallo Plaza. The existing ICE main driveway, which will be closed, is offset approximately 40 feet to the north on the Zocallo Plaza driveway on the east side of Dial Boulevard. Therefore, the new driveway and this southern Zocallo Plaza driveway will form a four-legged intersection with Dial Boulevard. This should be an improvement over the existing condition, where there is a potential for left turning vehicles exiting the two offset intersections simultaneously to conflict. The Zocallo Plaza driveway is on the outside of a curve, which gives drivers exiting to Dial Boulevard and entering from northbound Dial Boulevard a natural advantage in terms of sight distance. Adequate sight distances as discussed in the next section, especially for existing drivers to see vehicles approaching from the right/north, should be provided from the new driveway, which is on the inside of a curve. The Zocallo Plaza driveway is currently—and the proposed valet parking driveway will be—beyond the 95 feet of storage provided for both southbound right- and left-turn movements approaching Greenway-Hayden Loop. A review of the Synchro analysis in **Appendix F** reveals the maximum 95th percentile queue for the southbound left turn lane is 3.5 vehicles during the AM peak hour, or 100 feet for 4 whole vehicles; therefore, the existing storage effectively meets the need; nor is it expected that the new valet parking driveway would conflict with queued southbound vehicles waiting to turn left onto Greenway-Hayden Loop. The maximum right turn queue is expected to be just over 6 vehicles (150 to 175 feet). While this may extend beyond the available 95 feet of storage, it would not extend back into the southern Zocallo Plaza driveway.

SIGHT DISTANCE ANALYSIS

Adequate sight distance must be provided at the intersections to allow safe turning movements into and out of the development. A sight triangle is the area encompassed by the line of sight from a stopped vehicle on the minor roadway to the approaching vehicle on the major roadway; there must be sufficient unobstructed sight distance along both approaches of a street or driveway intersection and across their included corners to allow operators of vehicles to see each other in time to prevent a collision. There must also be sufficient sight distance along the major street to allow a driver intending to turn left into the site to see an oncoming vehicle in the opposing direction.

Sight distance should be provided at the proposed access based on the standards provided in the *City of Scottsdale's Design Standards and Policies Manual, 2010 Update*.

Adjacent to the site, Dial Boulevard was constructed with horizontal curvature at a relatively flat grade; therefore, the only impediments to the site distance would be existing structures and landscaping. Existing sight distance was not measured at the site access

points. The developer should ensure that adequate sight distance is provided at the intersections to allow safe left and right turning movements from the development and left turns into the development from Dial Boulevard. Landscaping should be maintained at a maximum of three feet in height. To maintain sight distance, tree branches should be trimmed lower than seven feet and maintained to meet current acceptable landscape requirements.

Figures depicting the method and sight distance requirements are provided in the City of Scottsdale's *Design Standards and Policies Manual, 2010 Update*. Copies of the applicable standards are provided in **Appendix G** for reference.

CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations have been documented in this study:

- The proposed development is expected to generate a total of 4,992 trips daily, with 283 trips (92 in/191 out) during the AM peak hour and 360 trips (214 in/146 out) during the PM peak hour. Overall, the development could generate a net of 1,878 more trips each day than the current office use with 336 fewer during the AM peak hour and 203 fewer during the PM peak hour. These trips, the majority of which are typically considered commuter trips to and from places of employment, are in the opposite direction of those currently being generated by the office building.
- Of 34 reported crashes at the three existing study intersections, 33 occurred at the intersection of Scottsdale Road and Greenway-Hayden Loop. From the above review of crash data at this intersection, it can be concluded that there are no obvious crash patterns that stand out and could be treated with any type of low-cost mitigation measures that could be implemented by the City.
- All study intersections currently operate at overall LOS D or better during the peak hours. The eastbound Kierland Boulevard approach to Scottsdale Road operates at poor levels of service (LOS E or F) in the PM peak hour with the existing signal timing.
- Right-turn deceleration lanes are not required by City of Scottsdale's *Design Standards and Polices Manual* Section 5-3.206 on Dial Boulevard approaching the site driveways.
- In 2017, with the proposed development, all signalized intersections are anticipated to operate at overall LOS D or better during both peak hours. The eastbound Kierland Boulevard approach to Scottsdale Road is expected to continue to operate with delays at LOS E during the PM peak hour with the existing signal timing. With the addition of site traffic, the westbound Greenway-Hayden Loop approach to Scottsdale Road is also expected to operate with delays at LOS E during the PM peak hour with the same signal timing. The City of Scottsdale may consider modifying signal timing at this intersection to improve levels of service on the east- and westbound approaches.
- The queue storage analysis revealed that the existing turn lane storage capacities in and around the District at the Quarter development can accommodate anticipated queuing in up to 95% of situations.
- It is recommended that the proposed site driveway be designed to meet the standards established by the City of Scottsdale in its *Design Standards and Policies Manual, 2010 Update*. A CL-1 two-way commercial driveway is recommended for Accesses A and B, for the valet parking driveway on Dial Boulevard, and for the fire lane driveway to Greenway-Hayden Loop near the eastern boundary of the property. Since there are no resident-only accesses and there is a continuous drive aisle from Access A to Access B, turnarounds for errant vehicles, as requested by the City via a comment, are no longer warranted.
- The proposed valet parking area driveway to Dial Boulevard will be located approximately 270 feet north of the intersection, which exceeds the City's standard driveway spacing of 165 feet for a minor collector roadway as required by the City's 2010 *Design Standards and Policies Manual*.

- Dial Boulevard was constructed with horizontal curvature at a relatively flat grade; therefore, the only impediments to the sight distance would be existing structures and landscaping. The developer should ensure that adequate sight distance is provided at the intersections to allow safe left and right turning movements from the development and left turns into the development from Dial Boulevard. Landscaping should be maintained at a maximum of three feet in height. To maintain sight distance, tree branches should be trimmed lower than seven feet and maintained to meet current acceptable landscape requirements.

LIST OF REFERENCES

A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, Washington, D.C., 2001.

Design and Safety of Pedestrian Facilities, Institute of Transportation Engineers, Washington, D.C., March 1998.

Design Standards and Policies Manual, 2006 Update, City of Scottsdale

Highway Capacity Manual. Transportation Research Board, National Research Council, Washington, D.C., 2010.

Manual of Uniform Traffic Control Devices. U.S. Department of Transportation, Federal Highways Administration, Washington, D.C., 2003.

Street Classification Map, City of Scottsdale website.

Transportation and Land Development, Stover, V. G. and Koepke, F. J., Institute of Transportation Engineers, Washington, D.C, 1988.

Trip Generation 8th Edition, Institute of Transportation Engineers, Washington, D.C, 2008.

Design Standards & Policies Manual – Section 5: Transportation Impact Studies, City of Scottsdale, Arizona, January 2010.

TECHNICAL APPENDICES

APPENDIX A

REVIEW COMMENTS

REPORT REVIEW

REPORT TITLE: District at the Quarter Traffic Impact Mitigation Analysis

REPORT DATE: March 2016

PREPARED BY: Erica Eggen, CivTech.

CASE #: 8-ZN-2016

REVIEWED BY: John Bartlett

REVIEW DATE: May 2016

COMMENTS:

1. Page 6/Appendix – The northbound and southbound left-turns at Dial Boulevard and Greenway-Hayden Loop have permitted-protected phasing. Update analysis as necessary.
2. Provide 24-hour volumes for Dial Boulevard and Greenway-Hayden Loop on all volume figures.
3. Page 14 – Does the existing office use have 1,200 employees? Using square footage would be more appropriate unless the office is a call center type of use that has more employees than a typical office.
4. Figure 6 – There should be no left-turns assigned at Access A as they are prohibited by the raised median along Greenway-Hayden Loop.
5. Page 20 – The LOS for the southbound approach at the intersection of Dial Boulevard and Greenway-Hayden Loop improves with the addition of site traffic in the AM peak hour. How does the LOS improve with additional traffic? Have adjustments been made to the signal timing? If so, document that adjustments were made and why, i.e. to improve a specific movement.
6. Page 24 – Access A is recommended to provide one-way ingress only access. The driveway should provide ingress and egress, right-in/right-out only movements.
7. Page 24 – Provide a turnaround on-site at Access A to prevent vehicles from backing onto Greenway-Hayden Loop Road
8. Page 24 – Access C is recommended to provide one-way ingress only access. The driveway should provide ingress and egress movements. If the driveway is gated (labeled "resident only") a location for vehicles that cannot access the gate to turn around must be provided so that vehicles do not back onto Dial Boulevard.
9. Page 2, 26 – Access B should be a CH-2 type driveway providing one ingress lane and two egress lanes with the median offset appropriately (not centered in driveway as shown on site plan).

10. Page 1, 26 – Access C should be a CL-1 type driveway. Access A should provide ingress and egress.
11. Appendix – Provide trip generation calculations for proposed and existing land uses.

District at the Quarter **CivTech, Inc.** **Review Comments & Responses**

1st Submittal

Disposition Codes: (1) Will Comply (2) Will Evaluate (3) Delete Comment (4) Defer to Consultant/Owner

Reviewer Name, Agency: **John Bartlett, City of Scottsdale**

Item	Review Comment	(Code) & Response
1.	**Page 6/Appendix - The eastbound and westbound left-turns at Dial Boulevard and Greenway-Hayden Loop have permitted - protected phasing. Update analysis as necessary.**	(1) The analysis has been updated as necessary, included other changes per other comments below.
2.	**Provide 24-hour volumes for Dial Boulevard and Greenway-Hayden Loop on all volume figures.**	(1) The daily volumes have been added.
3.	**Page 14 - Does the existing office use have 1,200 employees? Using square footage would be more appropriate unless the office is a call center type of use that has more employees than a typical office.**	(1) As now explained in the text, the current International Cruise & Excursions, Inc. ("ICE") facility serves as a call-center providing travel experiences for their current and new customers, which is a use that has more employees than a typical office user as well as during all hours.
4.	**Figure 6 - There should be no left-turns assigned at Access A as they are prohibited by the raised median along Greenway-Hayden Loop.**	(1) This figure and others affected (total volumes, future lane configurations) have been corrected and left turn trips in and out reassigned to other driveways.
5.	**Page 20 - The LOS for the southbound approach at the intersection of Dial Boulevard and Greenway-Hayden Loop improves with the addition of site traffic in the AM peak hour. How does the LOS improve with additional traffic? Have adjustments been made to the signal timing? If so, document that adjustments were made and why, i.e. to improve a specific movement.**	(1) The analysis was re-run with adjustments made per other comments; with the same signal timing as the without-development scenario, there is now no longer any improvement in LOS with the addition of traffic. Please note that the signal timing plan provided to CivTech was the plan before the east- and westbound protected, lagging left turn phases were added; thus, the timing used, which was based on the the original signal timing, may not be precisely what is currently being used.
6.	**Page 24 - Access A is recommended to provide one-way ingress only access. The driveway should provide ingress and egress, right-in/right-out only movements.**	(1) Revisions to the site plan have rendered comments 6-8 moot. A main drive aisle between Greenway-Hayden Loop and Dial Boulevard connecting the now-two (reduced from 3) residential accesses will eliminate the need for turnarounds. Both of the driveways will now be ingress and egress.
7.	**Page 24 - Provide a turnaround on-site at Access A to prevent vehicles from backing onto Greenway-Hayden Loop Road**	
8.	**Page 24 - Access C is recommended to provide one-way ingress only access. The driveway should provide ingress and egress movements. If the driveway is gated (labeled "resident only") a location for vehicles that cannot access the gate to turn around must be provided so that vehicles do not back onto Dial Boulevard.**	

Reviewed Date: 05/12/16
CivTech Received Date: 05/12/16
CivTech Entered Date: 05/12/16
CivTech Response Date: 08/04/16

Disposition Codes: (1) Will Comply (2) Will Evaluate (3) Delete Comment (4) Defer to Consultant/Owner

Reviewer Name, Agency: **John Bartlett, City of Scottsdale**

Item	Review Comment	(Code) & Response
9.	**Page 2, 26 - Access B should be a CH-2 type driveway providing one ingress lane and two egress lanes with the median offset appropriately (not centered in driveway as shown on site plan).**	(1) Access B is now recommended to be a CH-2 type driveway and the analyses and fure lane configuration figure have been recised to reflect this.
10.	**Page 1, 26 - Access C should be a CL-1 type driveway. Access A should provide ingress and egress.**	(1) Access C is an existing driveway that will serve only a fire lane around the site; since it will carry no residential traffic, no recommendation is made as to the type of driveway it should be. Per an above response, Access A will now provide both ingress and egress.
11.	**Appendix - Provide trip generation calculations for proposed and existing land uses.**	(1) The calculations are now shown below Table 4.

Reviewed Date: 05/12/16
CivTech Received Date: 05/12/16
CivTech Entered Date: 05/12/16
CivTech Response Date: 08/04/16

APPENDIX B

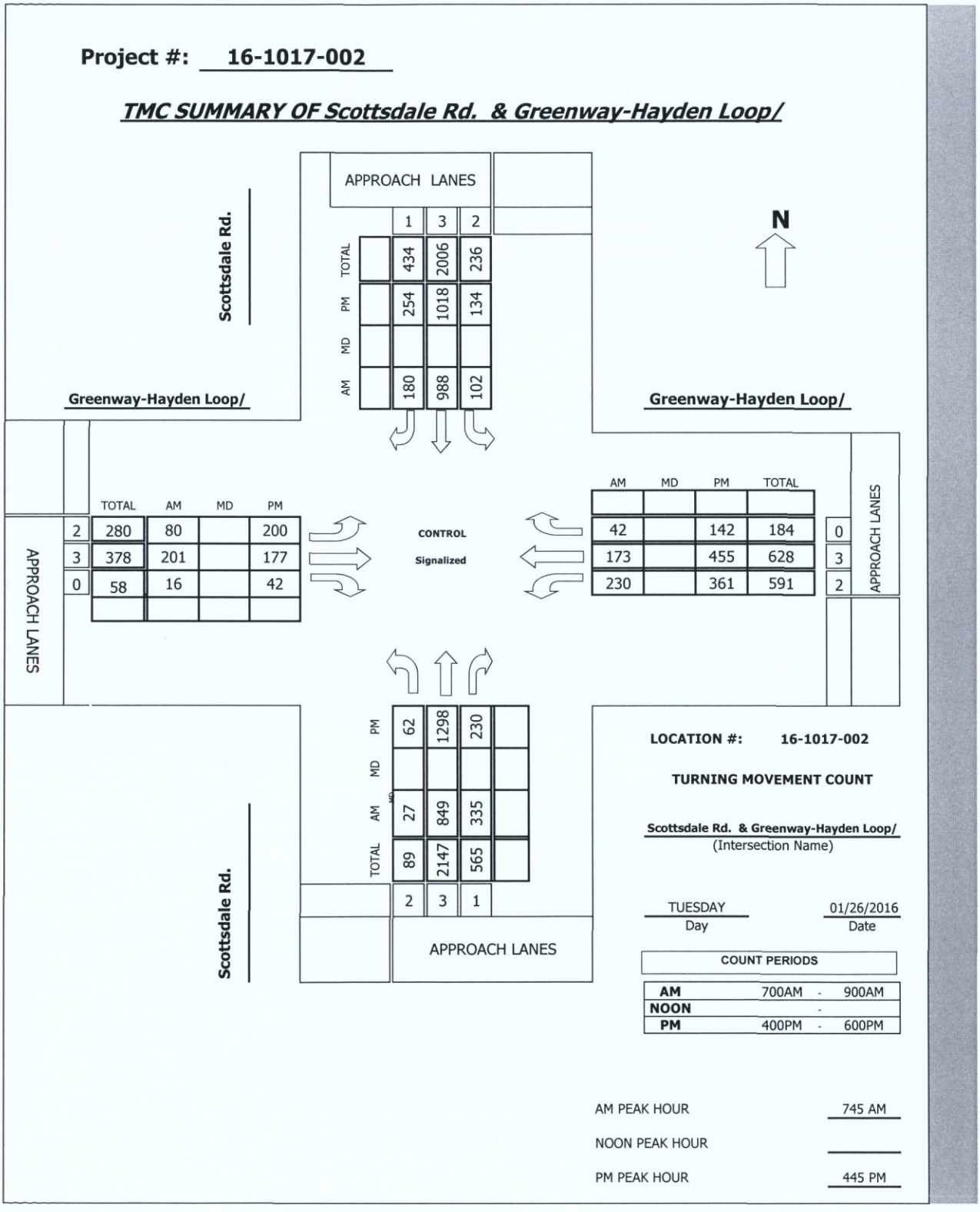
TRAFFIC COUNT AND COLLISION DATA

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

Project #: 16-1017-002

TMC SUMMARY OF Scottsdale Rd. & Greenway-Hayden Loop/



LOCATION #: 16-1017-002

TURNING MOVEMENT COUNT

Scottsdale Rd. & Greenway-Hayden Loop/
(Intersection Name)

TUESDAY (Day) 01/26/2016 (Date)

COUNT PERIODS			
AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 745 AM

NOON PEAK HOUR

PM PEAK HOUR 445 PM

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745
veracitytrafficgroup

N-S STREET: Scottsdale Rd. DATE: 01/26/2016 LOCATION: Scottsdale

E-W STREET: Greenway-Hayden Loop/ Kierland Blvd. DAY: TUESDAY PROJECT# 16-1017-002

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL 2	NT 3	NR 1	SL 2	ST 3	SR 1	EL 2	ET 3	ER 0	WL 2	WT 3	WR 0	TOTAL
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	4	150	52	21	185	15	14	27	2	36	19	7	532
7:15 AM	6	154	62	14	214	40	16	40	4	37	36	3	626
7:30 AM	4	175	80	28	194	31	23	50	4	38	46	7	680
7:45 AM	7	250	106	28	238	43	20	54	4	48	33	9	840
8:00 AM	6	195	88	26	247	40	27	54	4	80	55	8	830
8:15 AM	10	228	73	20	243	45	14	43	6	46	44	11	783
8:30 AM	4	176	68	28	260	52	19	50	2	56	41	14	770
8:45 AM	6	216	76	30	228	49	50	50	3	53	39	14	814
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	47	1544	605	195	1809	315	183	368	29	394	313	73	5875
Approach %	2.14	70.31	27.55	8.41	78.01	13.58	31.55	63.45	5.00	50.51	40.13	9.36	
App/Depart	2196	/	1800	2319	/	2232	580	/	1168	780	/	675	

AM Peak Hr Begins at: 745 AM

PEAK													
Volumes	27	849	335	102	988	180	80	201	16	230	173	42	3223
Approach %	2.23	70.11	27.66	8.03	77.80	14.17	26.94	67.68	5.39	51.69	38.88	9.44	
PEAK HR. FACTOR:		0.834			0.934			0.874			0.778		0.959

CONTROL: Signalized
COMMENT 1:
GPS: 33.625615, -111.925816

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745
veracitytrafficgroup

N-S STREET: Scottsdale Rd. DATE: 01/26/2016 LOCATION: Scottsdale

E-W STREET: Greenway-Hayden Loop/ DAY: TUESDAY PROJECT# 16-1017-002

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL 2	NT 3	NR 1	SL 2	ST 3	SR 1	EL 2	ET 3	ER 0	WL 2	WT 3	WR 0	TOTAL
1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	16	274	48	33	193	43	51	42	14	81	100	38	933
4:15 PM	14	359	51	39	252	61	38	51	18	77	71	38	1069
4:30 PM	12	311	51	28	252	58	41	29	11	98	107	28	1026
4:45 PM	18	299	56	38	242	58	48	47	10	104	102	23	1045
5:00 PM	15	343	63	25	287	55	41	31	16	88	106	44	1114
5:15 PM	20	383	58	36	266	63	67	51	10	77	125	32	1188
5:30 PM	9	273	53	35	223	78	44	48	6	92	122	43	1026
5:45 PM	11	315	61	35	228	51	39	34	10	79	82	25	970
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	115	2557	441	269	1943	467	369	333	95	696	815	271	8371
Approach %	3.69	82.14	14.17	10.04	72.53	17.43	46.30	41.78	11.92	39.06	45.74	15.21	
App/Depart	3113	/	3197	2679	/	2734	797	/	1043	1782	/	1397	

PM Peak Hr Begins at: 445 PM

PEAK													
Volumes	62	1298	230	134	1018	254	200	177	42	361	455	142	4373
Approach %	3.90	81.64	14.47	9.53	72.40	18.07	47.73	42.24	10.02	37.68	47.49	14.82	
PEAK HR. FACTOR:		0.862			0.958			0.818			0.932		0.920

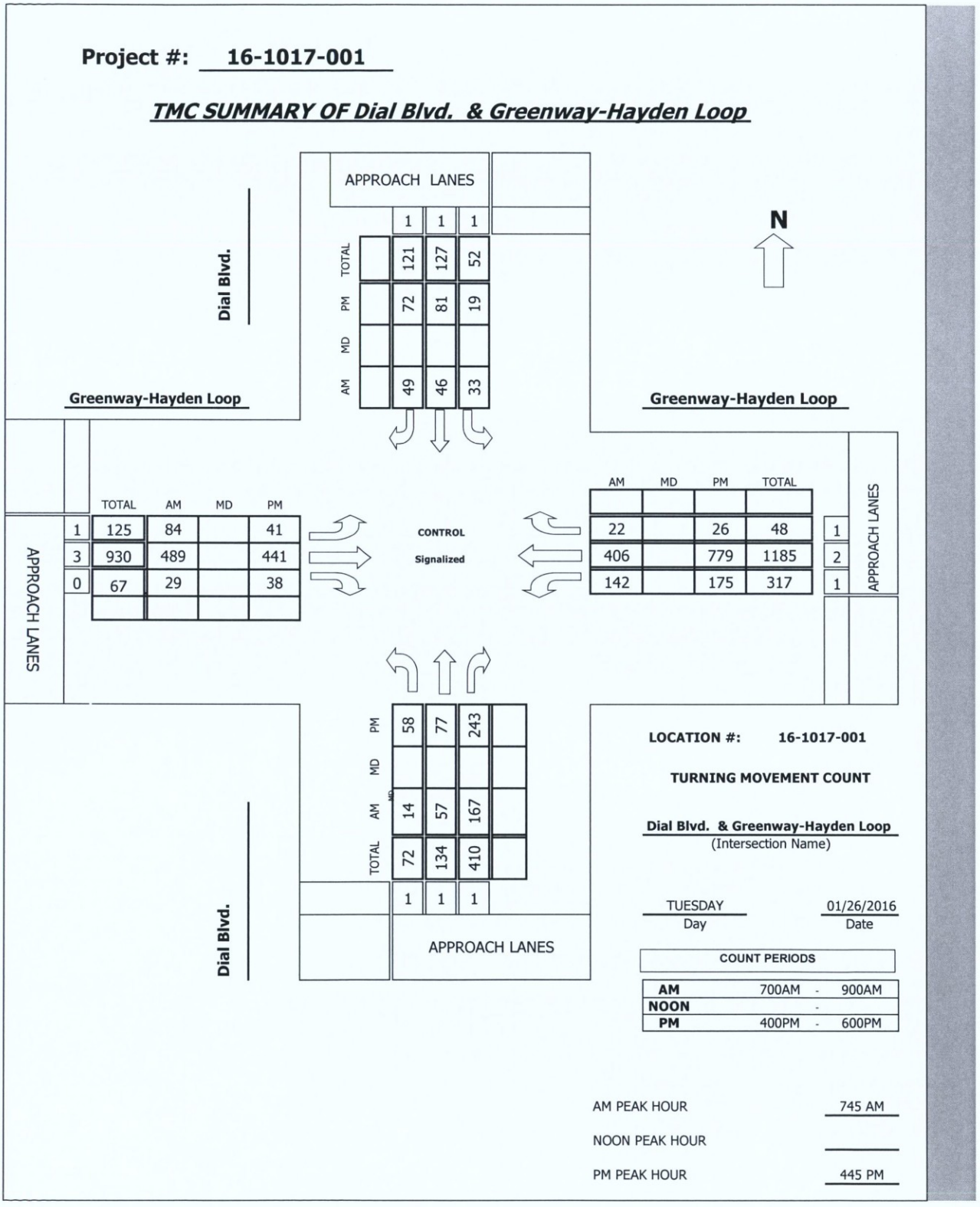
CONTROL: Signalized
COMMENT 1: 0
GPS: 33.625615, -111.925816

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

Project #: 16-1017-001

TMC SUMMARY OF Dial Blvd. & Greenway-Hayden Loop



LOCATION #: 16-1017-001

TURNING MOVEMENT COUNT

Dial Blvd. & Greenway-Hayden Loop
(Intersection Name)

TUESDAY (Day) 01/26/2016 (Date)

COUNT PERIODS			
AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 745 AM

NOON PEAK HOUR

PM PEAK HOUR 445 PM

Intersection Turning Movement

Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET: Dial Blvd. DATE: 01/26/2016 LOCATION: Scottsdale

E-W STREET: Greenway-Hayden Loop DAY: TUESDAY PROJECT# 16-1017-001

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL 1	NT 1	NR 1	SL 1	ST 1	SR 1	EL 1	ET 3	ER 0	WL 1	WT 2	WR 1	TOTAL
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	4	2	20	3	9	8	5	92	5	20	66	6	240
7:15 AM	5	7	36	2	10	5	3	111	6	38	73	1	297
7:30 AM	3	5	31	7	8	5	16	142	9	33	90	6	355
7:45 AM	3	21	53	15	12	20	18	140	3	35	89	7	416
8:00 AM	2	12	40	6	10	15	24	123	7	35	110	4	388
8:15 AM	4	8	36	9	14	8	29	108	11	34	102	4	367
8:30 AM	5	16	38	3	10	6	13	118	8	38	105	7	367
8:45 AM	7	14	40	8	6	5	23	129	14	38	94	11	389
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	33	85	294	53	79	72	131	963	63	271	729	46	2819
Approach %	8.01	20.63	71.36	25.98	38.73	35.29	11.32	83.23	5.45	25.91	69.69	4.40	
App/Depart	412	/	262	204	/	413	1157	/	1310	1046	/	834	

AM Peak Hr Begins at: 745 AM

PEAK													
Volumes	14	57	167	33	46	49	84	489	29	142	406	22	1538
Approach %	5.88	23.95	70.17	25.78	35.94	38.28	13.95	81.23	4.82	24.91	71.23	3.86	
PEAK HR. FACTOR:		0.773			0.681			0.935			0.950		0.924

CONTROL: 33.626207, -111.922366
COMMENT 1:
GPS: Signalized

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

veracitytrafficgroup

N-S STREET: Dial Blvd. DATE: 01/26/2016 LOCATION: Scottsdale

E-W STREET: Greenway-Hayden Loop DAY: TUESDAY PROJECT# 16-1017-001

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL 1	NT 1	NR 1	SL 1	ST 1	SR 1	EL 1	ET 3	ER 0	WL 1	WT 2	WR 1	TOTAL
1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	19	14	53	6	11	27	14	121	13	38	181	6	503
4:15 PM	21	19	58	3	7	18	9	110	9	44	172	6	476
4:30 PM	11	13	64	8	15	24	10	88	5	37	206	5	486
4:45 PM	14	23	59	2	19	16	11	105	13	40	181	4	487
5:00 PM	21	25	65	4	10	20	11	114	11	67	211	7	566
5:15 PM	16	15	59	7	18	18	12	117	11	30	188	7	498
5:30 PM	7	14	60	6	34	18	7	105	3	38	199	8	499
5:45 PM	13	8	34	6	15	23	16	82	7	25	151	6	386
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	122	131	452	42	129	164	90	842	72	319	1489	49	3901
Approach %	17.30	18.58	64.11	12.54	38.51	48.96	8.96	83.86	7.17	17.18	80.18	2.64	
App/Depart	705	/	270	335	/	520	1004	/	1336	1857	/	1775	

PM Peak Hr Begins at: 445 PM

PEAK													
Volumes	58	77	243	19	81	72	41	441	38	175	779	26	2050
Approach %	15.34	20.37	64.29	11.05	47.09	41.86	7.88	84.81	7.31	17.86	79.49	2.65	
PEAK HR. FACTOR:		0.851			0.741			0.929			0.860		0.905

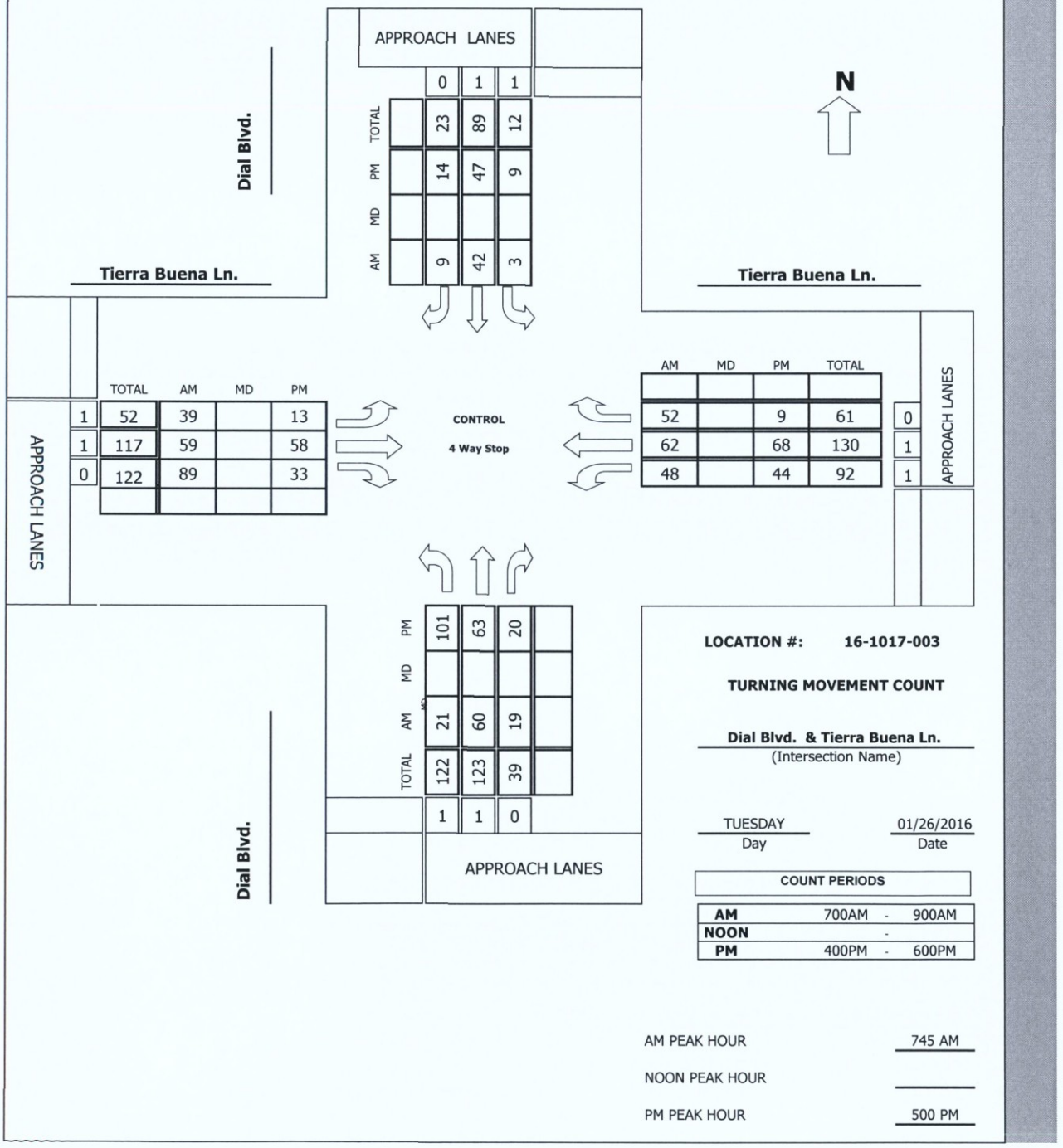
CONTROL: 33.626207, -111.922366
COMMENT 1: 0
GPS: Signalized

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745

Project #: 16-1017-003

TMC SUMMARY OF Dial Blvd. & Tierra Buena Ln.



LOCATION #: 16-1017-003

TURNING MOVEMENT COUNT

Dial Blvd. & Tierra Buena Ln.
(Intersection Name)

TUESDAY (Day) 01/26/2016 (Date)

COUNT PERIODS			
AM	700AM	-	900AM
NOON		-	
PM	400PM	-	600PM

AM PEAK HOUR 745 AM

NOON PEAK HOUR

PM PEAK HOUR 500 PM

Intersection Turning Movement
Prepared by:

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745
veracitytrafficgroup

N-S STREET: Dial Blvd. DATE: 01/26/2016 LOCATION: Scottsdale

E-W STREET: Tierra Buena Ln. DAY: TUESDAY PROJECT# 16-1017-003

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL 1	NT 1	NR 0	SL 1	ST 1	SR 0	EL 1	ET 1	ER 0	WL 1	WT 1	WR 0	TOTAL
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	4	3	3	0	4	2	7	16	13	6	5	0	63
7:15 AM	2	4	3	0	7	2	8	15	7	5	8	0	61
7:30 AM	2	5	4	1	4	2	9	13	17	2	5	0	64
7:45 AM	4	18	4	2	7	2	14	18	13	24	22	14	142
8:00 AM	5	18	7	0	10	4	12	22	20	19	29	34	180
8:15 AM	5	8	3	0	11	1	7	14	35	4	7	3	98
8:30 AM	7	16	5	1	14	2	6	5	21	1	4	1	83
8:45 AM	8	14	2	3	8	5	13	19	18	1	7	0	98
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	37	86	31	7	65	20	76	122	144	62	87	52	789
Approach %	24.03	55.84	20.13	7.61	70.65	21.74	22.22	35.67	42.11	30.85	43.28	25.87	
App/Depart	154	/	214	92	/	271	342	/	160	201	/	144	

AM Peak Hr Begins at: 745 AM

PEAK													
Volumes	21	60	19	3	42	9	39	59	89	48	62	52	503
Approach %	21.00	60.00	19.00	5.56	77.78	16.67	20.86	31.55	47.59	29.63	38.27	32.10	
PEAK HR. FACTOR:		0.833			0.794			0.835			0.494		0.699

CONTROL: 33.629305, -111.922130
COMMENT 1:
GPS: 4 Way Stop

Intersection Turning Movement

FIELD DATA SERVICES OF ARIZONA, INC.
520.316.6745
veracitytrafficgroup

N-S STREET: Dial Blvd. DATE: 01/26/2016 LOCATION: Scottsdale

E-W STREET: Tierra Buena Ln. DAY: TUESDAY PROJECT# 16-1017-003

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL 1	NT 1	NR 0	SL 1	ST 1	SR 0	EL 1	ET 1	ER 0	WL 1	WT 1	WR 0	TOTAL
1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	14	12	3	2	17	4	6	9	5	15	20	4	111
4:15 PM	15	18	4	1	11	6	5	11	5	8	11	3	98
4:30 PM	14	16	1	1	14	5	4	7	9	12	10	4	97
4:45 PM	11	16	6	1	9	4	2	7	10	10	16	1	93
5:00 PM	33	20	1	2	16	4	1	14	6	5	24	1	127
5:15 PM	19	15	3	3	15	3	2	13	8	14	17	1	113
5:30 PM	30	16	4	2	8	0	3	12	12	14	14	4	119
5:45 PM	19	12	12	2	8	7	7	19	7	11	13	3	120
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	155	125	34	14	98	33	30	92	62	89	125	21	878
Approach %	49.36	39.81	10.83	9.66	67.59	22.76	16.30	50.00	33.70	37.87	53.19	8.94	
App/Depart	314	/	176	145	/	249	184	/	140	235	/	313	

PM Peak Hr Begins at: 500 PM

PEAK													
Volumes	101	63	20	9	47	14	13	58	33	44	68	9	479
Approach %	54.89	34.24	10.87	12.86	67.14	20.00	12.50	55.77	31.73	36.36	56.20	7.44	
PEAK HR. FACTOR:		0.852			0.795			0.788			0.945		0.943

CONTROL: 33.629305, -111.922130
COMMENT 1: 0
GPS: 4 Way Stop

CITY OF SCOTTSDALE '13 -'14 COLLISION SUMMARY

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV #1	INJ. SEV #2	PHYS. COND. #1	PHYS. COND. #2	VIOLATION #1	VIOLATION #2	ACTION #1	ACTION #2	TRAV. DIR. #1	TRAV. DIR. #2	MANNER OF COLLISION	COMMENTS
14-07626	140403	1751	DIAL	BL	GREENWAY HAYDEN LOOP		AT		1	1	0	0	6	1	1	1	EB	SB	2	

KEY

INJURY SEVERITY: 1=NO INJURY, 2=POSSIBLE INJURY, 3=NON-INCAPACITATING INJURY, 4=INCAPACITATING INJURY, 5=FATAL INJURY, 99=NOT REPORTED / UNKNOWN

PHYSICAL CONDITION: 0=NO APPARENT INFLUENCE, 1=ILLNESS, 2=PHYSICAL IMPAIRMENT, 3=FELL ASLEEP / FATIGUED 4=ALCOHOL, 5=DRUGS, 6=MEDICATIONS, A=NO TEST GIVEN, B=TEST GIVEN, C=TEST REFUSED, D=TESTING UNKNOWN, 97=OTHER, 99=UNKNOWN

VIOLATION: 1=NO IMPROPER ACTION, 2=SPEED TOO FAST FOR CONDITIONS, 3=EXCEEDED LAWFUL SPEED 4=FOLLOWED TOO CLOSELY. 5=RAN STOP SIGN, 6=DISREGAREDED TRAFFIC SIGNAL7=MADE IMPROPER TURN, 8=DROVE/RODE IN OPPOSING TRAFFIC LANE, 9=KNOWINGLY OPERATED WITH FAULTY / MISSING EQUIPMENT, 10=REQUIRED MOTORCYCLE SAFETY EQUIPMENT NOT USED, 11=PASSED IN NO PASSING ZONE, 12=UNSAFE LANE CHANGE, 13=FAILED TO KEEP IN PROPER LANE, 14=DISREGARDED PAVEMENT MARKINGS, 15=OTHER UNSAFE PASSING, 16=INATTENTION/DISTRACTION, 17=DID NOT USE CROSSWALK, 18=WALKED ON WRONG SIDE OF ROAD, 19=ELECTRONIC COMMUNICATIONS DEVICE, 20=FAILED TO YIELD RIGHT OF WAY (added August 2014), 97=OTHER, 99 UNKNOWN

ACTION: 1=GOING STRAIGHT AHEAD, 2=SLOWING IN TRAFFICWAY, 3=STOPPED IN TRAFFICWAY, 4=MAKING LEFT TURN, 5=MAKING RIGHT TURN, 6=MAKING U-TURN, 7=OVERTAKING/PASSING, 8=CHANGING LANES, 9=NEGOTIATING A CURVE, 10=BACKING, 11=AVOIDING VEH/OBJ/PED/CYCLIST/ANIMAL, 12=ENTERING PARKING POSITION, 13=LEAVING PARKING POSITION, 14=PROPERLY PARKED, 15=IMPROPERLY PARKED, 16=DRIVERLESS MOVING VEHICLE, 17=CROSING ROAD, 18=WALKING WITH TRAFFIC, 19=WALKING AGAINST TRAFFIC, 20=STANDING, 21=LYING, 22=GETTING ON OR OFF VEHICLE, 23=WORKING ON/PUSHING VEHICLE, 24=WORKING ON ROAD, 97=OTHER, 99=UKNOWN

MANNER OF COLLISION: 1=SINGLE VEHICLE, 2=ANGLE (front to side, other than left turn), 3=LEFT TURN, 4=REAR END (front to rear), 5=HEAD-ON (front to front, other than left turn), 6=SIDESWIPE (same direction), 7=SIDESWIPE (opposite direction), 8=REAR-TO-SIDE, 9=REAR TO REAR, 97=OTHER, 99=UNKNOWN

TOTAL 1

CITY OF SCOTTSDALE '13 -'15 COLLISION SUMMARY

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV. #1	#2	PHYS. COND. #1	#2	VIOLATION #1	#2	ACTION #1	#2	TRAV. DIR. #1	#2	MANNER OF COLLISION	COMMENTS
14-21999	141012	1049	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		2	1	6	0	2	1	1	3	NB	NB	4	DUI
13-25480	131105	1030	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		99	1	99	0	2	1	1	3	SB	SB	4	
13-28953	131216	1222	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		99	1	99	0	2	1	1	3	WB	WB	4	HIT AND RUN
13-16071	130715	0928	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		3	3	0	0	6	1	1	1	SB	EB	2	MULTI VEH 3
13-18579	130815	1341	SCOTTSDALE	RD	GREENWAY HAYDEN		AT		1	2	0	0	2	1	1	3	SB	SB	4	
14-18383	140826	1254	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	2	1	1	3	SB	SB	4	
13-28626	131212	1910	SCOTTSDALE	RD	GREENWAY HAYDEN		AT		1	1	0	0	4	1	1	1	SB	SB	4	
14-24315	141110	1737	SCOTTSDALE	RD	GREENWAY HAYDEN	RD	AT		1	1	99	0	2	1	2	3	WB	WB	4	MULTI VEH 4
14-09785	140430	2045	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	2	1	1	1	NB	WB	2	
14-12484	140606	1100	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	6	1	1	1	WB	SB	2	
14-14983	140710	1315	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		99	1	99	0	99	1	99	3	SB	SB	4	HIT AND RUN
14-26529	141209	1510	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	2	1	1	3	SB	SB	4	
13-18116	130809	1330	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	S	101	1	1	0	0	2	1	1	1	NB	NB	4	
14-03638	140213	1300	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1		99	0	2	1	13	14	SB	NB	9	HIT AND RUN
13-06127	130315	1756	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		1	1	0	0	2	1	1	3	NB	NB	4	
13-07115	130327	0810	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		1	1	0	0	12	1	8	1	SB	SB	6	
13-03557	130213	0933	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		N	123	1	2	0	0	2	1	1	3	SB	SB	4	
13-11636	130518	1824	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		1	1	4	0	2	1	1	2	NB	NB	4	DUI
13-19264	130823	1720	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		2	2	0	0	4	1	1	3	SB	SB	4	
13-22456	131001	0927	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		1	1	0	0	12	1	8	1	NB	NB	6	
14-01368	140117	1840	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		1	1	0	0	97	1	5	1	SB	WB	2	
13-04246	130221	1551	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP	E	101		3		0		2		8		EB		1	

REPORT #	DATE YYMMDD	TIME HHMM	NORTH / SOUTH ST.	TYPE	EAST WEST ST.	TYPE	DIR FROM	DIST FROM	INJ. SEV #1	INJ. SEV #2	PHYS. COND. #1	PHYS. COND. #2	VIOLATION #1	VIOLATION #2	ACTION #1	ACTION #2	TRAV. DIR. #1	TRAV. DIR. #2	MANNER OF COLLISION	COMMENTS
14-03989	140219	0955	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		1	1	0	0	6	1	1	1	NB	EB	2	MULTI VEH 3
14-08769	140418	1110	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		1	1	0	0	2	1	1	2	NB	NB	4	MULTI VEH 3
13-28959	131216	1333	SCOTTSDALE	RD	GREENWAY HAYDEN LOOP		AT		1	1	0	0	4	1	1	2	SB	SB	4	
15-28007	151222	1815	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	2	1	8	1	WB	EB	3	
15-13235	150612	1657	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	12	1	8	1	NB	NB	3	
15-05789	150311	1339	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	2	1	1	3	NB	NB	4	
15-04377	150221	2217	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	4	1	1	1	NB	NB	4	
15-03757	150213	1825	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	2	0	0	4	1	2	3	SB	SB	4	
15-27599	151217	1213	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		1	1	0	0	20	1	5	4	NB	SB	2	
15-20815	150923	1326	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		99	1	99	0	99	1	1	4	WB	NB	7	HIT AND RUN
15-20700	150922	0440	SCOTTSDALE	RD	GREENWAY HAYDEN	LOOP	AT		99	1	99	0	6	1	1	4	NB	WB	97	HIT AND RUN

KEY

INJURY SEVERITY: 1=NO INJURY, 2=POSSIBLE INJURY, 3=NON-INCAPACITATING INJURY, 4=INCAPACITATING INJURY, 5=FATAL INJURY, 99=NOT REPORTED / UNKNOWN

PHYSICAL CONDITION: 0=NO APPARENT INFLUENCE, 1=ILLNESS, 2=PHYSICAL IMPAIRMENT, 3=FELL ASLEEP / FATIGUED 4=ALCOHOL, 5=DRUGS, 6=MEDICATIONS, A=NO TEST GIVEN, B=TEST GIVEN, C=TEST REFUSED, D=TESTING UNKNOWN, 97=OTHER, 99=UNKNOWN

VIOLATION: 1=NO IMPROPER ACTION, 2=SPEED TOO FAST FOR CONDITIONS, 3=EXCEEDED LAWFUL SPEED 4=FOLLOWED TOO CLOSELY. 5=RAN STOP SIGN, 6=DISREGAREDED TRAFFIC SIGNAL7=MADE IMPROPER TURN, 8=DROVE/RODE IN OPPOSING TRAFFIC LANE, 9=KNOWINGLY OPERATED WITH FAULTY / MISSING EQUIPMENT, 10=REQUIRED MOTORCYCLE SAFETY EQUIPMENT NOT USED, 11=PASSED IN NO PASSING ZONE, 12=UNSAFE LANE CHANGE, 13=FAILED TO KEEP IN PROPER LANE, 14=DISREGARDED PAVEMENT MARKINGS, 15=OTHER UNSAFE PASSING, 16=INATTENTION/DISTRACTION, 17=DID NOT USE CROSSWALK, 18=WALKED ON WRONG SIDE OF ROAD, 19=ELECTRONIC COMMUNICATIONS DEVICE, 20=FAILED TO YIELD RIGHT OF WAY (added August 2014), 97=OTHER, 99 UNKNOWN

ACTION: 1=GOING STRAIGHT AHEAD, 2=SLOWING IN TRAFFICWAY, 3=STOPPED IN TRAFFICWAY, 4=MAKING LEFT TURN, 5=MAKING RIGHT TURN, 6=MAKING U-TURN, 7=OVERTAKING/PASSING, 8=CHANGING LANES, 9=NEGOTIATING A CURVE, 10=BACKING, 11=AVOIDING VEH/OBJ/PED/CYCLIST/ANIMAL, 12=ENTERING PARKING POSITION, 13=LEAVING PARKING POSITION, 14=PROPERLY PARKED, 15=IMPROPERLY PARKED, 16=DRIVERLESS MOVING VEHICLE, 17=CROSING ROAD, 18=WALKING WITH TRAFFIC, 19=WALKING AGAINST TRAFFIC, 20=STANDING, 21=LYING, 22=GETTING ON OR OFF VEHICLE, 23=WORKING ON/PUSHING VEHICLE, 24=WORKING ON ROAD, 97=OTHER, 99=UKNOWN

MANNER OF COLLISION: 1=SINGLE VEHICLE, 2=ANGLE (front to side, other than left turn), 3=LEFT TURN, 4=REAR END (front to rear), 5=HEAD-ON (front to front, other than left turn), 6=SIDESWIPE (same direction), 7=SIDESWIPE (opposite direction), 8=REAR-TO-SIDE, 9=REAR TO REAR, 97=OTHER, 99=UNKNOWN

TOTAL 33

APPENDIX C

EXISTING PEAK HOUR ANALYSIS

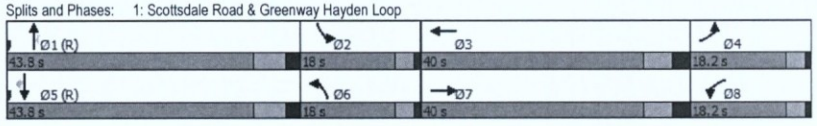
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	201	16	230	173	42	27	849	335	102	988	180
Future Volume (vph)	80	201	16	230	173	42	27	849	335	102	988	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.91	0.91	0.97	0.91	0.91	0.97	0.91	1.00	0.97	0.91	1.00
Frt		0.989			0.971				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	5029	0	3433	4938	0	3433	5085	1583	3433	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5029	0	3433	4938	0	3433	5085	1583	3433	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			46				364			196
Link Speed (mph)		40			40			45			45	
Link Distance (ft)		1500			995			700			1000	
Travel Time (s)		25.6			17.0			10.6			15.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	218	17	250	188	46	29	923	364	111	1074	196
Shared Lane Traffic (%)												
Lane Group Flow (vph)	87	235	0	250	234	0	29	923	364	111	1074	196
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	7		8	3		6	1		2	5	
Permitted Phases									1			5
Detector Phase	4	7		8	3		6	1	1	2	5	5
Switch Phase												
Minimum Initial (s)	4.0	8.0		4.0	8.0		4.0	20.0	20.0	4.0	20.0	20.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	200	177	42	361	455	142	62	1298	230	134	1018	254
Future Volume (vph)	200	177	42	361	455	142	62	1298	230	134	1018	254
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.91	0.91	0.97	0.91	0.91	0.97	0.91	1.00	0.97	0.91	1.00
Frt		0.971			0.964				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	4938	0	3433	4902	0	3433	5085	1583	3433	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	4938	0	3433	4902	0	3433	5085	1583	3433	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		43			60				249			276
Link Speed (mph)		40			40			45			45	
Link Distance (ft)		1500			995			700			1000	
Travel Time (s)		25.6			17.0			10.6			15.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	192	46	392	495	154	67	1411	250	146	1107	276
Shared Lane Traffic (%)												
Lane Group Flow (vph)	217	238	0	392	649	0	67	1411	250	146	1107	276
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	7		8	3		6	1		2	5	
Permitted Phases									1			5
Detector Phase	4	7		8	3		6	1	1	2	5	5
Switch Phase												
Minimum Initial (s)	4.0	8.0		4.0	8.0		4.0	20.0	20.0	4.0	20.0	20.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.2	33.0		11.0	33.0		11.0	39.0	39.0	11.0	39.0	39.0
Total Split (s)	18.2	40.0		18.2	40.0		18.0	43.8	43.8	18.0	43.8	43.8
Total Split (%)	15.2%	33.3%		15.2%	33.3%		15.0%	36.5%	36.5%	15.0%	36.5%	36.5%
Maximum Green (s)	14.2	33.0		14.2	33.0		14.0	36.8	36.8	14.0	36.8	36.8
Yellow Time (s)	3.0	4.3		3.0	4.3		3.0	4.8	4.8	3.0	4.8	4.8
All-Red Time (s)	1.0	2.7		1.0	2.7		1.0	2.2	2.2	1.0	2.2	2.2
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Lead/Lag	Lag	Lead		Lag	Lead		Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	1.0	2.0		1.0	2.0		1.0	0.2	0.2	1.0	0.2	0.2
Recall Mode	None	None		None	None		Max	C-Max	C-Max	Max	C-Max	C-Max
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		19.0			19.0			18.0	18.0		18.0	18.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	12.7	9.9		12.1	9.4		14.0	61.9	61.9	14.0	61.9	61.9
Actuated g/C Ratio	0.11	0.08		0.10	0.08		0.12	0.52	0.52	0.12	0.52	0.52
v/c Ratio	0.24	0.55		0.72	0.55		0.07	0.35	0.37	0.28	0.41	0.22
Control Delay	49.8	55.5		61.0	43.7		47.8	18.2	3.0	50.4	19.0	3.0
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.8	55.5		61.0	43.7		47.8	18.2	3.0	50.4	19.0	3.0
LOS	D	E		E	D		D	B	A	D	B	A
Approach Delay		53.9			52.7			14.6			19.2	
Approach LOS		D			D			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 0 (0%), Referenced to phase 1:NBT and 5:SBT, Start of Green			
Natural Cycle: 95			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.72			
Intersection Signal Delay: 25.3		Intersection LOS: C	
Intersection Capacity Utilization 54.0%		ICU Level of Service A	
Analysis Period (min) 15			

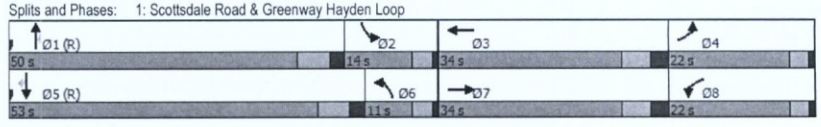
Splits and Phases: 1: Scottsdale Road & Greenway Hayden Loop



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.2	33.0		11.0	33.0		11.0	39.0	39.0	11.0	39.0	39.0
Total Split (s)	22.0	34.0		22.0	34.0		11.0	50.0	50.0	14.0	53.0	53.0
Total Split (%)	18.3%	28.3%		18.3%	28.3%		9.2%	41.7%	41.7%	11.7%	44.2%	44.2%
Maximum Green (s)	18.0	27.0		18.0	27.0		7.0	43.0	43.0	10.0	46.0	46.0
Yellow Time (s)	3.0	4.3		3.0	4.3		3.0	4.8	4.8	3.0	4.8	4.8
All-Red Time (s)	1.0	2.7		1.0	2.7		1.0	2.2	2.2	1.0	2.2	2.2
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Lead/Lag	Lag	Lead		Lag	Lead		Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	1.0	2.0		1.0	2.0		1.0	0.2	0.2	1.0	0.2	0.2
Recall Mode	None	None		None	None		Max	C-Max	C-Max	Max	C-Max	C-Max
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		19.0			19.0			18.0	18.0		18.0	18.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	11.0	9.5		20.8	19.3		7.0	57.7	57.7	10.0	60.7	60.7
Actuated g/C Ratio	0.09	0.08		0.17	0.16		0.06	0.48	0.48	0.08	0.51	0.51
v/c Ratio	0.69	0.55		0.66	0.77		0.34	0.58	0.28	0.51	0.43	0.29
Control Delay	64.2	48.3		48.3	46.1		59.1	24.5	3.5	59.4	20.2	3.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.2	48.3		48.3	46.1		59.1	24.5	3.5	59.4	20.2	3.2
LOS	E	D		D	D		E	C	A	E	C	A
Approach Delay		55.9			46.9			22.8			20.9	
Approach LOS		E			D			C			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 0 (0%), Referenced to phase 1:NBT and 5:SBT, Start of Green			
Natural Cycle: 95			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.77			
Intersection Signal Delay: 30.7		Intersection LOS: C	
Intersection Capacity Utilization 64.9%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 1: Scottsdale Road & Greenway Hayden Loop



HCM 2010 analysis expects strict NEMA phasing.

HCM 2010 Signalized Intersection Summary
1: Scottsdale Road & Greenway Hayden Loop

16-110 District at the Quarter
5/27/2016

HCM 2010 analysis expects strict NEMA phasing.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	84	489	29	142	406	22	14	57	167	33	46	49
Future Volume (vph)	84	489	29	142	406	22	14	57	167	33	46	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.91	0.91	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.991				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	5040	0	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.496			0.427			0.724			0.717		
Satd. Flow (perm)	924	5040	0	795	3539	1583	1349	1863	1583	1336	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8				55			182			95
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		995			1030			922			1086	
Travel Time (s)		17.0			17.6			21.0			24.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	91	532	32	154	441	24	15	62	182	36	50	53
Shared Lane Traffic (%)												
Lane Group Flow (vph)	91	564	0	154	441	24	15	62	182	36	50	53
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Detector Phase	7	4		3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

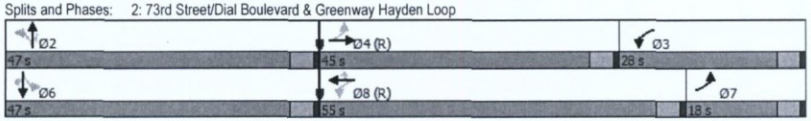
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	441	38	175	779	26	58	77	243	19	81	72
Future Volume (vph)	41	441	38	175	779	26	58	77	243	19	81	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.91	0.91	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	5024	0	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.307			0.436			0.638			0.656		
Satd. Flow (perm)	572	5024	0	812	3539	1583	1188	1863	1583	1222	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12				55			264			91
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		995			1030			922			1086	
Travel Time (s)		17.0			17.6			21.0			24.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	479	41	190	847	28	63	84	264	21	88	78
Shared Lane Traffic (%)												
Lane Group Flow (vph)	45	520	0	190	847	28	63	84	264	21	88	78
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Detector Phase	7	4		3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	4.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	9.5	31.5		9.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Total Split (s)	18.0	45.0		28.0	55.0	55.0	47.0	47.0	47.0	47.0	47.0	47.0
Total Split (%)	15.0%	37.5%		23.3%	45.8%	45.8%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
Maximum Green (s)	13.5	40.5		23.5	50.5	50.5	42.5	42.5	42.5	42.5	42.5	42.5
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead		Lag	Lead	Lead						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)		16.0			16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Flash Dont Walk (s)		11.0			11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)		0			0	0	0	0	0	0	0	0
Act Effct Green (s)	87.0	80.7		101.5	90.7	90.7	9.5	9.5	9.5	9.5	9.5	9.5
Actuated g/C Ratio	0.72	0.67		0.85	0.76	0.76	0.08	0.08	0.08	0.08	0.08	0.08
v/c Ratio	0.13	0.17		0.19	0.16	0.02	0.14	0.42	0.62	0.34	0.34	0.25
Control Delay	2.2	4.0		2.7	4.5	0.1	52.7	60.4	17.1	59.9	57.4	4.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.2	4.0		2.7	4.5	0.1	52.7	60.4	17.1	59.9	57.4	4.4
LOS	A	A		A	A	A	D	E	B	E	E	A
Approach Delay		3.7			3.9			29.5			37.9	
Approach LOS		A			A			C			D	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 47 (39%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.62
Intersection Signal Delay: 10.6 Intersection LOS: B
Intersection Capacity Utilization 37.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 2: 73rd Street/Dial Boulevard & Greenway Hayden Loop

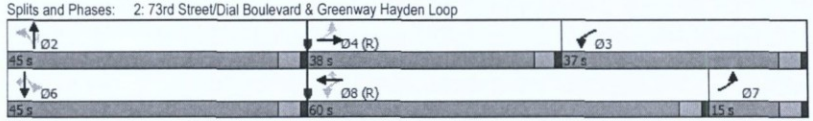


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	9.5	22.5		9.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Total Split (s)	15.0	38.0		37.0	60.0	60.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	12.5%	31.7%		30.8%	50.0%	50.0%	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Maximum Green (s)	10.5	34.0		32.5	55.5	55.5	40.5	40.5	40.5	40.5	40.5	40.5
Yellow Time (s)	3.5	3.0		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.0		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead		Lag	Lead	Lead						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	1.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)					16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Flash Dont Walk (s)					11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)					0	0	0	0	0	0	0	0
Act Effct Green (s)	74.6	68.9		99.1	90.4	90.4	11.9	11.9	11.9	11.9	11.9	11.9
Actuated g/C Ratio	0.62	0.57		0.83	0.75	0.75	0.10	0.10	0.10	0.10	0.10	0.10
v/c Ratio	0.11	0.18		0.22	0.32	0.02	0.53	0.45	0.67	0.17	0.48	0.33
Control Delay	9.1	19.5		3.6	6.0	0.5	66.4	57.5	14.5	50.4	58.4	10.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.1	19.5		3.6	6.0	0.5	66.4	57.5	14.5	50.4	58.4	10.7
LOS	A	B		A	A	A	E	E	B	D	E	B
Approach Delay		18.7			5.4			31.2			37.6	
Approach LOS		B			A			C			D	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 45 (38%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 16.2 Intersection LOS: B
Intersection Capacity Utilization 46.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 2: 73rd Street/Dial Boulevard & Greenway Hayden Loop



Intersection												
Intersection Delay, s/veh	8.7											
Intersection LOS	A											
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Traffic Vol, veh/h	0	39	59	89	0	48	62	52	0	21	60	19
Future Vol, veh/h	0	39	59	89	0	48	62	52	0	21	60	19
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	42	64	97	0	52	67	57	0	23	65	21
Number of Lanes	0	1	1	0	0	1	1	0	0	1	1	0
Approach		EB				WB				NB		
Opposing Approach		WB				EB				SB		
Opposing Lanes		2				2				2		
Conflicting Approach Left		SB				NB				EB		
Conflicting Lanes Left		2				2				2		
Conflicting Approach Right		NB				SB				WB		
Conflicting Lanes Right		2				2				2		
HCM Control Delay		8.7				8.7				8.9		
HCM LOS		A				A				A		

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	100%	0%	100%	0%
Vol Thru, %	0%	76%	0%	40%	0%	54%	0%	82%
Vol Right, %	0%	24%	0%	60%	0%	46%	0%	18%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	21	79	39	148	48	114	3	51
LT Vol	21	0	39	0	48	0	3	0
Through Vol	0	60	0	59	0	62	0	42
RT Vol	0	19	0	89	0	52	0	9
Lane Flow Rate	23	86	42	161	52	124	3	55
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.038	0.127	0.067	0.211	0.082	0.167	0.006	0.084
Departure Headway (Hd)	6.014	5.341	5.656	4.731	5.676	4.852	6.078	5.449
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	594	670	633	758	631	739	588	655
Service Time	3.76	3.087	3.394	2.469	3.415	2.591	3.826	3.199
HCM Lane V/C Ratio	0.039	0.128	0.066	0.212	0.082	0.168	0.005	0.084
HCM Control Delay	9	8.9	8.8	8.7	8.9	8.6	8.9	8.7
HCM Lane LOS	A	A	A	A	A	A	A	A
HCM 95th-tile Q	0.1	0.4	0.2	0.8	0.3	0.6	0	0.3

Intersection												
Intersection Delay, s/veh	7.3											
Intersection LOS	A											
Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Traffic Vol, veh/h	0	0	2	1	0	2	3	0	0	4	2	1
Future Vol, veh/h	0	0	2	1	0	2	3	0	0	4	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	2	1	0	2	3	0	0	4	2	1
Number of Lanes	0	1	1	0	0	1	1	0	0	1	1	0
Approach		EB				WB				NB		
Opposing Approach		WB				EB				SB		
Opposing Lanes		2				2				2		
Conflicting Approach Left		SB				NB				EB		
Conflicting Lanes Left		2				2				2		
Conflicting Approach Right		NB				SB				WB		
Conflicting Lanes Right		2				2				2		
HCM Control Delay		7				7.5				7.5		
HCM LOS		A				A				A		

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	0%	0%	100%	0%	0%	0%
Vol Thru, %	0%	67%	100%	67%	0%	100%	100%	67%
Vol Right, %	0%	33%	0%	33%	0%	0%	0%	33%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	4	3	0	3	2	3	0	3
LT Vol	4	0	0	0	2	0	0	0
Through Vol	0	2	0	2	0	3	0	2
RT Vol	0	1	0	1	0	0	0	1
Lane Flow Rate	4	3	0	3	2	3	0	3
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.006	0.004	0	0.004	0.003	0.004	0	0.004
Departure Headway (Hd)	5.051	4.318	4.556	4.323	5.055	4.555	4.553	4.32
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	712	833	0	831	711	789	0	832
Service Time	2.758	2.024	2.265	2.032	2.763	2.263	2.261	2.027
HCM Lane V/C Ratio	0.006	0.004	0	0.004	0.003	0.004	0	0.004
HCM Control Delay	7.8	7	7.3	7	7.8	7.3	7.3	7
HCM Lane LOS	A	A	N	A	A	A	N	A
HCM 95th-tile Q	0	0	0	0	0	0	0	0

Intersection				
Intersection Delay, s/veh				
Intersection LOS				
Movement	**SBU**	**SBL**	**SBT**	**SBR**
Traffic Vol, veh/h	0	3	42	9
Future Vol, veh/h	0	3	42	9
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	3	46	10
Number of Lanes	0	1	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	8.7
HCM LOS	A

Lane

Intersection				
Intersection Delay, s/veh				
Intersection LOS				
Movement	**SBU**	**SBL**	**SBT**	**SBR**
Traffic Vol, veh/h	0	0	2	1
Future Vol, veh/h	0	0	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	0	2	1
Number of Lanes	0	1	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	7
HCM LOS	A

Lane

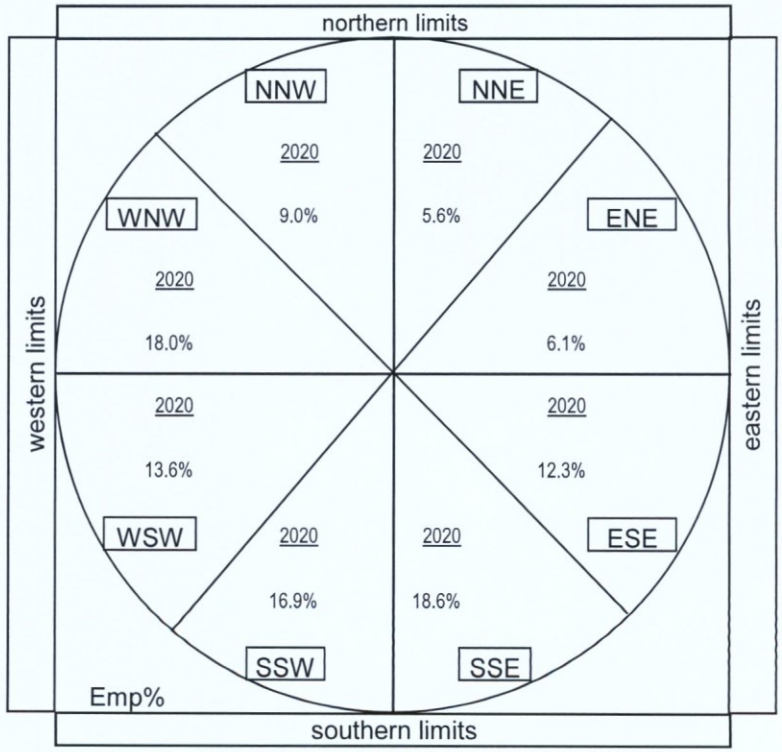
APPENDIX D

TRIP DISTRIBUTION CALCULATIONS

	2020							
Quadrant			**Employment**	**Percent**				
North Northwest			40,863	9.0%				
North Northeast			25,306	5.6%				
North			66,169	14.6%				
East Northeast			27,534	6.1%				
East Southeast			55,939	12.3%				
East			83,473	18.4%				
South Southeast			84,559	18.6%				
South Southwest			76,625	16.9%				
South			161,183	35.5%				
West Southwest			61,806	13.6%				
West Northwest			81,994	18.0%				
West			143,800	31.6%				
Totals			454,625	100.1%				

Radii

Population radius: 0 miles
Employment radius: 10 miles



10-mile radius

RAZ	MPA	2020 Employment	2030 Employment	% of TAZ	2020 Adjusted	2030 Adjusted	RAZ	MPA	2020 Employment	2030 Employment	% of TAZ	2020 Adjusted	2030 Adjusted
ENE							ESE						
229	SC	14,579	16,506	20%	2,916	3,301	230	SC	36,850	49,197	20%	7,370	9,839
230	SC	36,850	49,197	50%	18,425	24,599	247	SC	48,204	50,778	25%	12,051	12,695
231	CO	718	727	30%	215	218	248	SC	27,822	28,456	80%	22,258	22,765
247	SC	48,204	50,778	10%	4,820	5,078	249	SC	8,687	9,250		8,687	9,250
250	FH	11,569	11,573	10%	1,157	1,157	250	FH	11,569	11,573	15%	1,735	1,736
	-	-	-		-	-	264	SA	25,587	49,905	15%	3,838	7,486
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
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	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
From ENE					27,534	34,353	From ESE					55,939	63,770
From East												83,473	98,123

10-mile radius

RAZ	MPA	2020 Employment	2030 Employment	% of TAZ	2020 Adjusted	2030 Adjusted	RAZ	MPA	2020 Employment	2030 Employment	% of TAZ	2020 Adjusted	2030 Adjusted
NNW							NNE						
209	SC	5,450	6,483	20%	1,090	1,297	209	SC	5,450	6,483	30%	1,635	1,945
218	PH	4,504	4,879	30%	1,351	1,464	229	SC	14,579	16,506	70%	10,205	11,554
219	PH	6,394	10,551	80%	5,115	8,441	230	SC	36,850	49,197	30%	11,055	14,759
227	PH	16,077	18,036	30%	4,823	5,411	247	SC	48,204	50,778	5%	2,410	2,539
228	PH	33,621	42,763	80%	26,897	34,210		-	-	-		-	-
246	PH	31,742	31,757	5%	1,587	1,588		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
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	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
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	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
From NNW					40,863	52,410	From NNE					26,306	30,797
From North												66,169	83,207

10-mile radius

RAZ	MPA	2020 Em-ployment	2030 Em-ployment	% of TAZ	2020 Adjusted	2030 Adjusted	RAZ	MPA	2020 Em-ployment	2030 Em-ployment	% of TAZ	2020 Adjusted	2030 Adjusted
SSE							**SSW**						
247	SC	48,204	50,778	50%	24,102	25,389	246	PH	31,742	31,757	25%	7,936	7,939
248	SC	27,822	28,456	20%	5,564	5,691	247	SC	48,204	50,778	10%	4,820	5,078
263	SC	31,399	31,383		31,399	31,383	261	PH	35,618	35,610	40%	14,247	14,244
264	SA	25,587	49,905	25%	6,397	12,476	262	PA	7,707	8,734		7,707	8,734
272	SC	56,988	56,913	30%	17,096	17,074	271	PH	50,862	50,850	60%	30,517	30,510
	-	-	-		-	-	272	SC	56,988	56,913	20%	11,398	11,383
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
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	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
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From SSE					**84,559**	**92,013**	**From SSW**					**76,625**	**77,888**
From South												**161,183**	**169,901**

10-mile radius

RAZ	MPA	2020 Em-ployment	2030 Em-ployment	% of TAZ	2020 Adjusted	2030 Adjusted	RAZ	MPA	2020 Em-ployment	2030 Em-ployment	% of TAZ	2020 Adjusted	2030 Adjusted
WSW							**WNW**						
242	PH	9,341	9,284	50%	4,671	4,642	217	PH	11,907	14,741	10%	1,191	1,474
244	PH	16,551	16,428	80%	13,241	13,142	219	PH	6,394	10,551	10%	639	1,055
245	PH	17,221	17,152	80%	13,777	13,722	225	PH	48,176	55,429	50%	24,088	27,715
246	PH	31,742	31,757	50%	15,871	15,879	226	PH	22,773	23,681	80%	18,218	18,945
261	PH	35,618	35,610	40%	14,247	14,244	227	PH	16,077	18,036	70%	11,254	12,625
	-	-	-		-	-	228	PH	33,621	42,763	50%	16,811	21,382
	-	-	-		-	-	245	PH	17,221	17,152	20%	3,444	3,430
	-	-	-		-	-	246	PH	31,742	31,757	20%	6,348	6,351
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
	-	-	-		-	-		-	-	-		-	-
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From WSW					**61,806**	**61,629**	**From WNW**					**81,994**	**92,977**
From West												**143,800**	**154,606**

APPENDIX E

BACKGROUND GROWTH RATE CALCULATIONS

Location of counts: Scottsdale Road, Thunderbird to Greenway Hayden Loop
Source(s): City of Scottsdale Traffic Count Website
http://www.scottsdaleaz.gov/transportation/studies-reports/traffic-volume

	Year	Volume	Avg Growth Rate to 2014	Expansion Factor to 2014
Beginning	2014	35,700		
End	2012	34,300	2.0%	1.041

Growth Rate Used	2.0%
Per-Year Multiplier	1.020

Year	Expansion Factor(s)	
2016	1.000	
2017	1.020	<- Expansion factor to opening
2018	1.040	
2019	1.061	
2020	1.082	
2021	1.104	
2022	1.126	
2023	1.149	
2024	1.172	
2025	1.195	
2026	1.219	
2027	1.243	
2028	1.268	
2029	1.294	
2030	1.319	
2031	1.346	
2032	1.373	
2033	1.400	
2034	1.428	
2035	1.457	
2036	1.486	

APPENDIX F

2017 PEAK HOUR ANALYSIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	206	117	235	177	43	28	866	342	105	1008	184
Future Volume (vph)	82	206	117	235	177	43	28	866	342	105	1008	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.91	0.91	0.97	0.91	0.91	0.97	0.91	1.00	0.97	0.91	1.00
Frt		0.946			0.971				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	4811	0	3433	4938	0	3433	5085	1583	3433	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	4811	0	3433	4938	0	3433	5085	1583	3433	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		119			47				372			200
Link Speed (mph)		40			40			45			45	
Link Distance (ft)		1500			995			700			1000	
Travel Time (s)		25.6			17.0			10.6			15.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	224	127	255	192	47	30	941	372	114	1096	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	89	351	0	255	239	0	30	941	372	114	1096	200
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	7		8	3		6	1		2	5	
Permitted Phases									1			5
Detector Phase	4	7		8	3		6	1	1	2	5	5
Switch Phase												
Minimum Initial (s)	4.0	8.0		4.0	8.0		4.0	20.0	20.0	4.0	20.0	20.0

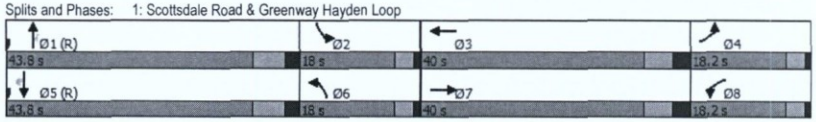
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	181	43	369	465	145	64	1324	235	137	1039	260
Future Volume (vph)	204	181	43	369	465	145	64	1324	235	137	1039	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.91	0.91	0.97	0.91	0.91	0.97	0.91	1.00	0.97	0.91	1.00
Frt		0.971			0.964				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	4938	0	3433	4902	0	3433	5085	1583	3433	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	4938	0	3433	4902	0	3433	5085	1583	3433	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		43			61				249			283
Link Speed (mph)		40			40			45			45	
Link Distance (ft)		1500			995			700			1000	
Travel Time (s)		25.6			17.0			10.6			15.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	197	47	401	505	158	70	1439	255	149	1129	283
Shared Lane Traffic (%)												
Lane Group Flow (vph)	222	244	0	401	663	0	70	1439	255	149	1129	283
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	7		8	3		6	1		2	5	
Permitted Phases									1			5
Detector Phase	4	7		8	3		6	1	1	2	5	5
Switch Phase												
Minimum Initial (s)	4.0	8.0		4.0	8.0		4.0	20.0	20.0	4.0	20.0	20.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.2	33.0		11.0	33.0		11.0	39.0	39.0	11.0	39.0	39.0
Total Split (s)	18.2	40.0		18.2	40.0		18.0	43.8	43.8	18.0	43.8	43.8
Total Split (%)	15.2%	33.3%		15.2%	33.3%		15.0%	36.5%	36.5%	15.0%	36.5%	36.5%
Maximum Green (s)	14.2	33.0		14.2	33.0		14.0	36.8	36.8	14.0	36.8	36.8
Yellow Time (s)	3.0	4.3		3.0	4.3		3.0	4.8	4.8	3.0	4.8	4.8
All-Red Time (s)	1.0	2.7		1.0	2.7		1.0	2.2	2.2	1.0	2.2	2.2
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Lead/Lag	Lag	Lead		Lag	Lead		Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	1.0	2.0		1.0	2.0		1.0	0.2	0.2	1.0	0.2	0.2
Recall Mode	None	None		None	None		Max	C-Max	C-Max	Max	C-Max	C-Max
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		19.0			19.0			18.0	18.0		18.0	18.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	13.4	10.5		12.3	9.4		14.0	61.2	61.2	14.0	61.2	61.2
Actuated g/C Ratio	0.11	0.09		0.10	0.08		0.12	0.51	0.51	0.12	0.51	0.51
v/c Ratio	0.23	0.66		0.73	0.56		0.07	0.36	0.38	0.28	0.42	0.22
Control Delay	48.8	40.9		61.2	43.9		47.9	18.9	3.1	50.5	19.7	3.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.8	40.9		61.2	43.9		47.9	18.9	3.1	50.5	19.7	3.2
LOS	D	D		E	D		D	B	A	D	B	A
Approach Delay		42.5			52.8			15.1			19.8	
Approach LOS		D			D			B			B	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 1:NBT and 5:SBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 25.2 Intersection LOS: C
Intersection Capacity Utilization 54.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 1: Scottsdale Road & Greenway Hayden Loop

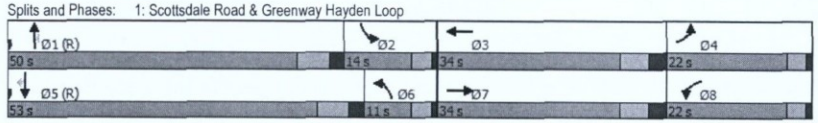


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.2	33.0		11.0	33.0		11.0	39.0	39.0	11.0	39.0	39.0
Total Split (s)	22.0	34.0		22.0	34.0		11.0	50.0	50.0	14.0	53.0	53.0
Total Split (%)	18.3%	28.3%		18.3%	28.3%		9.2%	41.7%	41.7%	11.7%	44.2%	44.2%
Maximum Green (s)	18.0	27.0		18.0	27.0		7.0	43.0	43.0	10.0	46.0	46.0
Yellow Time (s)	3.0	4.3		3.0	4.3		3.0	4.8	4.8	3.0	4.8	4.8
All-Red Time (s)	1.0	2.7		1.0	2.7		1.0	2.2	2.2	1.0	2.2	2.2
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Lead/Lag	Lag	Lead		Lag	Lead		Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	1.0	2.0		1.0	2.0		1.0	0.2	0.2	1.0	0.2	0.2
Recall Mode	None	None		None	None		Max	C-Max	C-Max	Max	C-Max	C-Max
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		19.0			19.0			18.0	18.0		18.0	18.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	11.2	9.6		21.2	19.6		7.0	57.2	57.2	10.0	60.2	60.2
Actuated g/C Ratio	0.09	0.08		0.18	0.16		0.06	0.48	0.48	0.08	0.50	0.50
v/c Ratio	0.70	0.56		0.66	0.78		0.35	0.59	0.29	0.52	0.44	0.30
Control Delay	64.1	48.7		48.2	46.0		59.4	25.1	3.8	59.7	20.7	3.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.1	48.7		48.2	46.0		59.4	25.1	3.8	59.7	20.7	3.2
LOS	E	D		D	D		E	C	A	E	C	A
Approach Delay		56.0			46.8			23.4			21.3	
Approach LOS		E			D			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 1:NBT and 5:SBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 31.0 Intersection LOS: C
Intersection Capacity Utilization 65.9% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Scottsdale Road & Greenway Hayden Loop



HCM 2010 analysis expects strict NEMA phasing.

HCM 2010 analysis expects strict NEMA phasing.

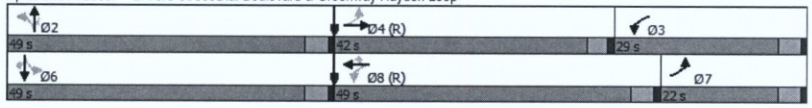
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	86	499	30	145	415	23	15	59	171	34	47	50
Future Volume (vph)	86	499	30	145	415	23	15	59	171	34	47	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.91	0.91	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.991				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	5040	0	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.491			0.421			0.724			0.715		
Satd. Flow (perm)	915	5040	0	784	3539	1583	1349	1863	1583	1332	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8				55			186			91
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		995			1030			922			1086	
Travel Time (s)		17.0			17.6			21.0			24.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	542	33	158	451	25	16	64	186	37	51	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	93	575	0	158	451	25	16	64	186	37	51	54
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Detector Phase	7	4		3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	4.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	450	39	179	795	27	60	79	248	20	83	74
Future Volume (vph)	42	450	39	179	795	27	60	79	248	20	83	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.91	0.91	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	5024	0	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.304			0.440			0.631			0.648		
Satd. Flow (perm)	566	5024	0	820	3539	1583	1175	1863	1583	1207	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14				55			270			91
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		995			1030			922			1086	
Travel Time (s)		17.0			17.6			21.0			24.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	489	42	195	864	29	65	86	270	22	90	80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	46	531	0	195	864	29	65	86	270	22	90	80
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Detector Phase	7	4		3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	4.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	9.5	22.5		9.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Total Split (s)	22.0	42.0		29.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0
Total Split (%)	18.3%	35.0%		24.2%	40.8%	40.8%	40.8%	40.8%	40.8%	40.8%	40.8%	40.8%
Maximum Green (s)	17.5	38.0		24.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5	44.5
Yellow Time (s)	3.5	3.0		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.0		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead		Lag	Lead	Lead						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	1.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)					16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Flash Dont Walk (s)					11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)					0	0	0	0	0	0	0	0
Act Effct Green (s)	89.9	84.3		101.4	90.8	90.8	9.6	9.6	9.6	9.6	9.6	9.6
Actuated g/C Ratio	0.75	0.70		0.84	0.76	0.76	0.08	0.08	0.08	0.08	0.08	0.08
v/c Ratio	0.13	0.16		0.21	0.17	0.02	0.15	0.43	0.62	0.35	0.34	0.26
Control Delay	2.1	4.0		2.8	4.5	0.2	52.8	60.5	16.9	59.9	57.3	5.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.1	4.0		2.8	4.5	0.2	52.8	60.5	16.9	59.9	57.3	5.6
LOS	A	A		A	A	A	D	E	B	E	E	A
Approach Delay		3.8			3.9			29.5			38.3	
Approach LOS		A			A			C			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 49 (41%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green			
Natural Cycle: 75			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.62			
Intersection Signal Delay: 10.7		Intersection LOS: B	
Intersection Capacity Utilization 37.7%		ICU Level of Service A	
Analysis Period (min) 15			

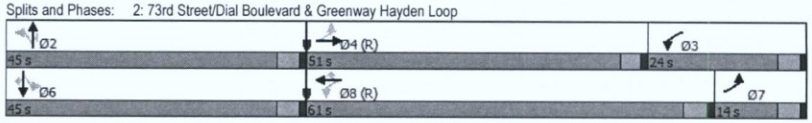
Splits and Phases: 2: 73rd Street/Dial Boulevard & Greenway Hayden Loop



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	9.5	22.5		9.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Total Split (s)	14.0	51.0		24.0	61.0	61.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	11.7%	42.5%		20.0%	50.8%	50.8%	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Maximum Green (s)	9.5	47.0		19.5	56.5	56.5	40.5	40.5	40.5	40.5	40.5	40.5
Yellow Time (s)	3.5	3.0		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.0		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead		Lag	Lead	Lead						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	1.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)					16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Flash Dont Walk (s)					11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)					0	0	0	0	0	0	0	0
Act Effct Green (s)	86.4	81.0		98.9	90.5	90.5	12.1	12.1	12.1	12.1	12.1	12.1
Actuated g/C Ratio	0.72	0.68		0.82	0.75	0.75	0.10	0.10	0.10	0.10	0.10	0.10
v/c Ratio	0.10	0.16		0.25	0.32	0.02	0.55	0.46	0.67	0.18	0.48	0.33
Control Delay	2.1	3.3		3.8	5.9	0.5	67.2	57.4	14.3	50.5	58.2	11.2
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.1	3.3		3.8	5.9	0.5	67.2	57.4	14.3	50.5	58.2	11.2
LOS	A	A		A	A	A	E	E	B	D	E	B
Approach Delay		3.2			5.4			31.3			37.7	
Approach LOS		A			A			C			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 45 (38%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green			
Natural Cycle: 75			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.67			
Intersection Signal Delay: 12.4		Intersection LOS: B	
Intersection Capacity Utilization 47.4%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: 73rd Street/Dial Boulevard & Greenway Hayden Loop



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	86	499	30	145	415	23	15	59	171	34	47	50
Future Volume (veh/h)	86	499	30	145	415	23	15	59	171	34	47	50
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	93	542	33	158	451	25	16	64	186	37	51	54
Adj No. of Lanes	1	3	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	926	1553	94	988	1312	587	215	269	229	188	269	229
Arrive On Green	0.12	0.10	0.10	0.43	0.37	0.37	0.14	0.14	0.14	0.14	0.14	0.14
Sat Flow, veh/h	1774	4904	296	1774	3539	1583	1284	1863	1583	1125	1863	1583
Grp Volume(v), veh/h	93	373	202	158	451	25	16	64	186	37	51	54
Grp Sat Flow(s),veh/h/ln	1774	1695	1810	1774	1770	1583	1284	1863	1583	1125	1863	1583
Q Serve(g_s), s	0.0	12.3	12.4	0.0	11.0	1.2	1.3	3.7	13.7	3.6	2.9	3.6
Cycle Q Clear(g_c), s	0.0	12.3	12.4	0.0	11.0	1.2	4.2	3.7	13.7	7.3	2.9	3.6
Prop In Lane	1.00		0.16	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	926	1074	573	988	1312	587	215	269	229	188	269	229
V/C Ratio(X)	0.10	0.35	0.35	0.16	0.34	0.04	0.07	0.24	0.81	0.20	0.19	0.24
Avail Cap(c_a), veh/h	926	1074	573	988	1312	587	505	691	587	443	691	587
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.87	0.87	0.87	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.9	42.2	42.3	10.3	27.2	24.1	47.0	45.5	49.8	48.7	45.2	45.5
Incr Delay (d2), s/veh	0.0	0.8	1.5	0.1	0.7	0.1	0.1	0.5	6.8	0.5	0.3	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	5.9	6.5	2.4	5.5	0.6	0.5	1.9	6.4	1.1	1.5	1.6
LnGrp Delay(d),s/veh	15.9	43.0	43.7	10.4	27.9	24.3	47.2	45.9	56.6	49.2	45.5	46.0
LnGrp LOS	B	D	D	B	C	C	D	D	E	D	D	D
Approach Vol, veh/h		668			634			266			142	
Approach Delay, s/veh		39.5			23.4			53.5			46.7	
Approach LOS		D			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		21.8	56.2	42.0		21.8	49.2	49.0
Change Period (Y+Rc), s		4.5	4.5	4.0		4.5	4.5	4.5
Max Green Setting (Gmax), s		44.5	24.5	38.0		44.5	17.5	44.5
Max Q Clear Time (g_c+I1), s		15.7	2.0	14.4		9.3	2.0	13.0
Green Ext Time (p_c), s		1.7	0.7	1.2		1.7	0.6	3.0

Intersection Summary	
HCM 2010 Ctrl Delay	36.3
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	450	39	179	795	27	60	79	248	20	83	74
Future Volume (veh/h)	42	450	39	179	795	27	60	79	248	20	83	74
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	46	489	42	195	864	29	65	86	270	22	90	80
Adj No. of Lanes	1	3	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	579	1870	159	835	1666	745	254	375	319	226	375	319
Arrive On Green	0.07	0.13	0.13	0.30	0.47	0.47	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	1774	4776	406	1774	3539	1583	1210	1863	1583	1021	1863	1583
Grp Volume(v), veh/h	46	346	185	195	864	29	65	86	270	22	90	80
Grp Sat Flow(s),veh/h/ln	1774	1695	1791	1774	1770	1583	1210	1863	1583	1021	1863	1583
Q Serve(g_s), s	0.0	11.0	11.2	0.0	20.5	1.2	5.7	4.6	19.7	2.2	4.9	5.1
Cycle Q Clear(g_c), s	0.0	11.0	11.2	0.0	20.5	1.2	10.6	4.6	19.7	6.9	4.9	5.1
Prop In Lane	1.00		0.23	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	579	1328	702	835	1666	745	254	375	319	226	375	319
V/C Ratio(X)	0.08	0.26	0.26	0.23	0.52	0.04	0.26	0.23	0.85	0.10	0.24	0.25
Avail Cap(c_a), veh/h	579	1328	702	835	1666	745	419	629	534	365	629	534
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.90	0.90	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.8	36.6	36.7	13.6	22.2	17.1	44.7	40.1	46.2	43.0	40.2	40.3
Incr Delay (d2), s/veh	0.1	0.4	0.8	0.1	1.2	0.1	0.5	0.3	6.4	0.2	0.3	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	5.3	5.7	3.5	10.2	0.5	2.0	2.4	9.2	0.6	2.5	2.3
LnGrp Delay(d),s/veh	24.8	37.0	37.5	13.8	23.4	17.2	45.2	40.4	52.6	43.2	40.6	40.7
LnGrp LOS	C	D	D	B	C	B	D	D	D	D	D	D
Approach Vol, veh/h		577			1088			421			192	
Approach Delay, s/veh		36.2			21.5			49.0			40.9	
Approach LOS		D			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		28.6	40.4	51.0		28.6	30.4	61.0
Change Period (Y+Rc), s		4.5	4.5	4.0		4.5	4.5	4.5
Max Green Setting (Gmax), s		40.5	19.5	47.0		40.5	9.5	56.5
Max Q Clear Time (g_c+I1), s		21.7	2.0	13.2		8.9	2.0	22.5
Green Ext Time (p_c), s		2.4	0.6	1.1		2.7	0.4	6.7

Intersection Summary	
HCM 2010 Ctrl Delay	31.9
HCM 2010 LOS	C

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	61	91	49	64	64	22	62	20	4	43	10
Future Volume (vph)	40	61	91	49	64	64	22	62	20	4	43	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.910			0.925			0.963			0.972	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1695	0	1770	1723	0	1770	1794	0	1770	1811	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1695	0	1770	1723	0	1770	1794	0	1770	1811	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		876			924			1086			897	
Travel Time (s)		19.9			21.0			24.7			20.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	66	99	53	70	70	24	67	22	4	47	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	43	165	0	53	140	0	24	89	0	4	58	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	30.0%	ICU Level of Service A	
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	60	34	45	70	10	104	65	21	10	48	15
Future Volume (vph)	14	60	34	45	70	10	104	65	21	10	48	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.946			0.981			0.963			0.965	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1762	0	1770	1827	0	1770	1794	0	1770	1798	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1762	0	1770	1827	0	1770	1794	0	1770	1798	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		876			924			1086			897	
Travel Time (s)		19.9			21.0			24.7			20.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	65	37	49	76	11	113	71	23	11	52	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	102	0	49	87	0	113	94	0	11	68	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	28.3%	ICU Level of Service A	
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	8.9
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations		↰	↱			↰	↱			↰	↱	
Traffic Vol, veh/h	0	40	61	91	0	49	64	64	0	22	62	20
Future Vol, veh/h	0	40	61	91	0	49	64	64	0	22	62	20
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	43	66	99	0	53	70	70	0	24	67	22
Number of Lanes	0	1	1	0	0	1	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	2	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	2	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	2	2
HCM Control Delay	8.9	8.8	9
HCM LOS	A	A	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	100%	0%	100%	0%
Vol Thru, %	0%	76%	0%	40%	0%	50%	0%	81%
Vol Right, %	0%	24%	0%	60%	0%	50%	0%	19%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	22	82	40	152	49	128	4	53
LT Vol	22	0	40	0	49	0	4	0
Through Vol	0	62	0	61	0	64	0	43
RT Vol	0	20	0	91	0	64	0	10
Lane Flow Rate	24	89	43	165	53	139	4	58
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.04	0.134	0.069	0.219	0.084	0.187	0.007	0.088
Departure Headway (Hd)	6.068	5.393	5.695	4.772	5.705	4.851	6.135	5.498
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	589	662	628	750	627	737	581	649
Service Time	3.82	3.144	3.438	2.514	3.451	2.596	3.893	3.255
HCM Lane V/C Ratio	0.041	0.134	0.068	0.22	0.085	0.189	0.007	0.089
HCM Control Delay	9.1	9	8.9	8.9	9	8.7	8.9	8.8
HCM Lane LOS	A	A	A	A	A	A	A	A
HCM 95th-tile Q	0.1	0.5	0.2	0.8	0.3	0.7	0	0.3

Intersection	
Intersection Delay, s/veh	9
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations		↰	↱			↰	↱			↰	↱	
Traffic Vol, veh/h	0	14	60	34	0	45	70	10	0	104	65	21
Future Vol, veh/h	0	14	60	34	0	45	70	10	0	104	65	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	15	65	37	0	49	76	11	0	113	71	23
Number of Lanes	0	1	1	0	0	1	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	2	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	2	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	2	2
HCM Control Delay	8.8	9	9.3
HCM LOS	A	A	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	100%	0%	100%	0%
Vol Thru, %	0%	76%	0%	64%	0%	88%	0%	76%
Vol Right, %	0%	24%	0%	36%	0%	12%	0%	24%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	104	86	14	94	45	80	10	63
LT Vol	104	0	14	0	45	0	10	0
Through Vol	0	65	0	60	0	70	0	48
RT Vol	0	21	0	34	0	10	0	15
Lane Flow Rate	113	93	15	102	49	87	11	68
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.181	0.133	0.025	0.147	0.08	0.128	0.018	0.1
Departure Headway (Hd)	5.78	5.106	5.939	5.181	5.91	5.318	5.931	5.259
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	619	700	601	690	605	672	602	679
Service Time	3.526	2.851	3.69	2.932	3.66	3.069	3.686	3.014
HCM Lane V/C Ratio	0.183	0.133	0.025	0.148	0.081	0.129	0.018	0.1
HCM Control Delay	9.8	8.6	8.8	8.8	9.2	8.9	8.8	8.6
HCM Lane LOS	A	A	A	A	A	A	A	A
HCM 95th-tile Q	0.7	0.5	0.1	0.5	0.3	0.4	0.1	0.3

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↱	
Traffic Vol, veh/h	0	4	43	10
Future Vol, veh/h	0	4	43	10
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	4	47	11
Number of Lanes	0	1	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	8.8
HCM LOS	A

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations		↰	↱	
Traffic Vol, veh/h	0	10	48	15
Future Vol, veh/h	0	10	48	15
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	11	52	16
Number of Lanes	0	1	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	8.6
HCM LOS	A

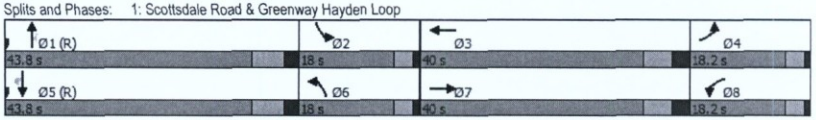
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	82	219	17	302	204	58	28	866	374	112	1008	184
Future Volume (vph)	82	219	17	302	204	58	28	866	374	112	1008	184
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.91	0.91	0.97	0.91	0.91	0.97	0.91	1.00	0.97	0.91	1.00
Frt		0.989			0.967				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	5029	0	3433	4917	0	3433	5085	1583	3433	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	5029	0	3433	4917	0	3433	5085	1583	3433	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			59				407			200
Link Speed (mph)		40			40			45			45	
Link Distance (ft)		1500			995			700			1000	
Travel Time (s)		25.6			17.0			10.6			15.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	89	238	18	328	222	63	30	941	407	122	1096	200
Shared Lane Traffic (%)												
Lane Group Flow (vph)	89	256	0	328	285	0	30	941	407	122	1096	200
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	7		8	3		6	1		2	5	
Permitted Phases									1			5
Detector Phase	4	7		8	3		6	1	1	2	5	5
Switch Phase												
Minimum Initial (s)	4.0	8.0		4.0	8.0		4.0	20.0	20.0	4.0	20.0	20.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	211	43	420	485	157	64	1324	310	154	1039	260
Future Volume (vph)	204	211	43	420	485	157	64	1324	310	154	1039	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.97	0.91	0.91	0.97	0.91	0.91	0.97	0.91	1.00	0.97	0.91	1.00
Frt		0.974			0.963				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	4953	0	3433	4897	0	3433	5085	1583	3433	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	4953	0	3433	4897	0	3433	5085	1583	3433	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		34			63				329			283
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		1500			995			700			1000	
Travel Time (s)		25.6			17.0			15.9			22.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	222	229	47	457	527	171	70	1439	337	167	1129	283
Shared Lane Traffic (%)												
Lane Group Flow (vph)	222	276	0	457	698	0	70	1439	337	167	1129	283
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24			24	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	Perm
Protected Phases	4	7		8	3		6	1		2	5	
Permitted Phases									1			5
Detector Phase	4	7		8	3		6	1	1	2	5	5
Switch Phase												
Minimum Initial (s)	4.0	8.0		4.0	8.0		4.0	20.0	20.0	4.0	20.0	20.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.2	33.0		11.0	33.0		11.0	39.0	39.0	11.0	39.0	39.0
Total Split (s)	18.2	40.0		18.2	40.0		18.0	43.8	43.8	18.0	43.8	43.8
Total Split (%)	15.2%	33.3%		15.2%	33.3%		15.0%	36.5%	36.5%	15.0%	36.5%	36.5%
Maximum Green (s)	14.2	33.0		14.2	33.0		14.0	36.8	36.8	14.0	36.8	36.8
Yellow Time (s)	3.0	4.3		3.0	4.3		3.0	4.8	4.8	3.0	4.8	4.8
All-Red Time (s)	1.0	2.7		1.0	2.7		1.0	2.2	2.2	1.0	2.2	2.2
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Lead/Lag	Lag	Lead		Lag	Lead		Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	1.0	2.0		1.0	2.0		1.0	0.2	0.2	1.0	0.2	0.2
Recall Mode	None	None		None	None		Max	C-Max	C-Max	Max	C-Max	C-Max
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		19.0			19.0			18.0	18.0		18.0	18.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	15.3	10.4		15.1	10.2		14.0	58.5	58.5	14.0	58.5	58.5
Actuated g/C Ratio	0.13	0.09		0.13	0.08		0.12	0.49	0.49	0.12	0.49	0.49
v/c Ratio	0.20	0.58		0.76	0.61		0.07	0.38	0.42	0.30	0.44	0.23
Control Delay	46.9	55.7		59.5	43.5		47.9	20.6	3.4	50.8	21.5	3.4
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.9	55.7		59.5	43.5		47.9	20.6	3.4	50.8	21.5	3.4
LOS	D	E		E	D		D	C	A	D	C	A
Approach Delay		53.5			52.1			16.1			21.4	
Approach LOS		D			D			B			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 0 (0%), Referenced to phase 1:NBT and 5:SBT, Start of Green			
Natural Cycle: 95			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.76			
Intersection Signal Delay: 27.4		Intersection LOS: C	
Intersection Capacity Utilization 56.4%		ICU Level of Service B	
Analysis Period (min) 15			

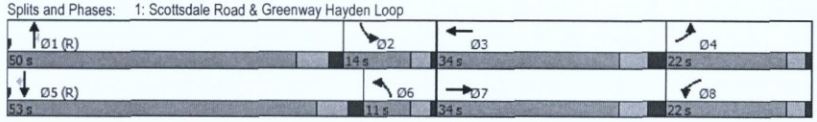
Splits and Phases: 1: Scottsdale Road & Greenway Hayden Loop



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	10.2	33.0		11.0	33.0		11.0	39.0	39.0	11.0	39.0	39.0
Total Split (s)	22.0	34.0		22.0	34.0		11.0	50.0	50.0	14.0	53.0	53.0
Total Split (%)	18.3%	28.3%		18.3%	28.3%		9.2%	41.7%	41.7%	11.7%	44.2%	44.2%
Maximum Green (s)	18.0	27.0		18.0	27.0		7.0	43.0	43.0	10.0	46.0	46.0
Yellow Time (s)	3.0	4.3		3.0	4.3		3.0	4.8	4.8	3.0	4.8	4.8
All-Red Time (s)	1.0	2.7		1.0	2.7		1.0	2.2	2.2	1.0	2.2	2.2
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	7.0		4.0	7.0		4.0	7.0	7.0	4.0	7.0	7.0
Lead/Lag	Lag	Lead		Lag	Lead		Lag	Lead	Lead	Lag	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	1.0	2.0		1.0	2.0		1.0	0.2	0.2	1.0	0.2	0.2
Recall Mode	None	None		None	None		Max	C-Max	C-Max	Max	C-Max	C-Max
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		19.0			19.0			18.0	18.0		18.0	18.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	11.2	10.4		21.4	20.6		7.0	56.2	56.2	10.0	59.2	59.2
Actuated g/C Ratio	0.09	0.09		0.18	0.17		0.06	0.47	0.47	0.08	0.49	0.49
v/c Ratio	0.69	0.60		0.75	0.78		0.35	0.60	0.37	0.58	0.45	0.31
Control Delay	64.1	51.6		68.8	56.5		59.4	26.0	3.9	61.8	21.4	3.3
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.1	51.6		68.8	56.5		59.4	26.0	3.9	61.8	21.4	3.3
LOS	E	D		E	E		E	C	A	E	C	A
Approach Delay		57.2			61.4			23.2			22.4	
Approach LOS		E			E			C			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 0 (0%), Referenced to phase 1:NBT and 5:SBT, Start of Green			
Natural Cycle: 95			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 35.0		Intersection LOS: C	
Intersection Capacity Utilization 67.0%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 1: Scottsdale Road & Greenway Hayden Loop



HCM 2010 analysis expects strict NEMA phasing.

HCM 2010 analysis expects strict NEMA phasing.

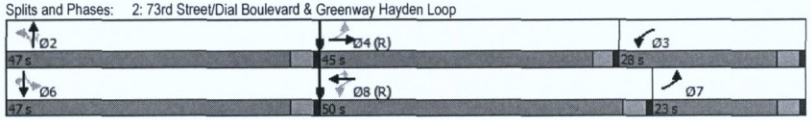
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	499	30	148	477	23	15	66	171	53	59	97
Future Volume (vph)	138	499	30	148	477	23	15	66	171	53	59	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.91	0.91	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.991				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	5040	0	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.455			0.422			0.715			0.707		
Satd. Flow (perm)	848	5040	0	786	3539	1583	1332	1863	1583	1317	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8				55			186			105
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		995			420			922			542	
Travel Time (s)		17.0			7.2			21.0			12.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	150	542	33	161	518	25	16	72	186	58	64	105
Shared Lane Traffic (%)												
Lane Group Flow (vph)	150	575	0	161	518	25	16	72	186	58	64	105
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Detector Phase	7	4		3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	4.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	164	450	39	181	842	27	60	96	248	35	92	110
Future Volume (vph)	164	450	39	181	842	27	60	96	248	35	92	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.91	0.91	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.988				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	5024	0	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.279			0.437			0.594			0.577		
Satd. Flow (perm)	520	5024	0	814	3539	1583	1106	1863	1583	1075	1863	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14				55			270			120
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		995			420			922			542	
Travel Time (s)		17.0			7.2			21.0			12.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	178	489	42	197	915	29	65	104	270	38	100	120
Shared Lane Traffic (%)												
Lane Group Flow (vph)	178	531	0	197	915	29	65	104	270	38	100	120
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4			8		8	2		2	6		6
Detector Phase	7	4		3	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	4.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	9.5	22.5		9.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Total Split (s)	23.0	45.0		28.0	50.0	50.0	47.0	47.0	47.0	47.0	47.0	47.0
Total Split (%)	19.2%	37.5%		23.3%	41.7%	41.7%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
Maximum Green (s)	18.5	41.0		23.5	45.5	45.5	42.5	42.5	42.5	42.5	42.5	42.5
Yellow Time (s)	3.5	3.0		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.0		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead		Lag	Lead	Lead						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	1.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)					16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Flash Dont Walk (s)					11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)					0	0	0	0	0	0	0	0
Act Effct Green (s)	90.8	84.9		100.3	89.4	89.4	10.7	10.7	10.7	10.7	10.7	10.7
Actuated g/C Ratio	0.76	0.71		0.84	0.74	0.74	0.09	0.09	0.09	0.09	0.09	0.09
v/c Ratio	0.22	0.16		0.21	0.20	0.02	0.13	0.43	0.60	0.49	0.39	0.44
Control Delay	2.6	3.1		3.2	5.1	0.2	50.8	58.7	15.4	65.1	56.9	15.2
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.6	3.1		3.2	5.1	0.2	50.8	58.7	15.4	65.1	56.9	15.2
LOS	A	A		A	A	A	D	E	B	E	E	B
Approach Delay		3.0			4.5			28.8			39.7	
Approach LOS		A			A			C			D	

Intersection Summary		
Area Type:	Other	
Cycle Length: 120		
Actuated Cycle Length: 120		
Offset: 47 (39%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green		
Natural Cycle: 75		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.60		
Intersection Signal Delay: 11.5	Intersection LOS: B	
Intersection Capacity Utilization 41.7%	ICU Level of Service A	
Analysis Period (min) 15		

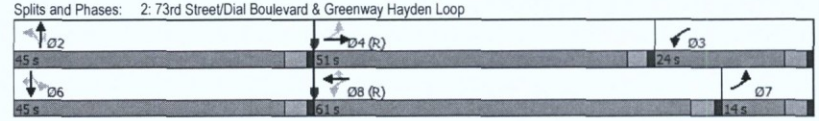
Splits and Phases: 2: 73rd Street/Dial Boulevard & Greenway Hayden Loop



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Split (s)	9.5	22.5		9.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
Total Split (s)	14.0	51.0		24.0	61.0	61.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	11.7%	42.5%		20.0%	50.8%	50.8%	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Maximum Green (s)	9.5	47.0		19.5	56.5	56.5	40.5	40.5	40.5	40.5	40.5	40.5
Yellow Time (s)	3.5	3.0		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.0		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag	Lag	Lead		Lag	Lead	Lead						
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	1.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None	None	None	None	None
Walk Time (s)					16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0
Flash Dont Walk (s)					11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)					0	0	0	0	0	0	0	0
Act Effct Green (s)	83.8	76.4		98.3	85.9	85.9	12.7	12.7	12.7	12.7	12.7	12.7
Actuated g/C Ratio	0.70	0.64		0.82	0.72	0.72	0.11	0.11	0.11	0.11	0.11	0.11
v/c Ratio	0.40	0.17		0.24	0.36	0.03	0.56	0.53	0.66	0.34	0.51	0.44
Control Delay	16.5	13.8		3.9	7.6	0.6	67.9	59.7	13.8	56.1	58.8	13.3
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	13.8		3.9	7.6	0.6	67.9	59.7	13.8	56.1	58.8	13.3
LOS	B	B		A	A	A	E	E	B	E	E	B
Approach Delay		14.5			6.8			32.7			37.2	
Approach LOS		B			A			C			D	

Intersection Summary		
Area Type:	Other	
Cycle Length: 120		
Actuated Cycle Length: 120		
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green		
Natural Cycle: 75		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.66		
Intersection Signal Delay: 16.5	Intersection LOS: B	
Intersection Capacity Utilization 53.6%	ICU Level of Service A	
Analysis Period (min) 15		

Splits and Phases: 2: 73rd Street/Dial Boulevard & Greenway Hayden Loop



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	138	499	30	148	477	23	15	66	171	53	59	97
Future Volume (veh/h)	138	499	30	148	477	23	15	66	171	53	59	97
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	150	542	33	161	518	25	16	72	186	58	64	105
Adj No. of Lanes	1	3	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	903	1676	101	960	1342	600	202	275	233	186	275	233
Arrive On Green	0.12	0.11	0.11	0.40	0.38	0.38	0.15	0.15	0.15	0.15	0.15	0.15
Sat Flow, veh/h	1774	4904	296	1774	3539	1583	1211	1863	1583	1117	1863	1583
Grp Volume(v), veh/h	150	373	202	161	518	25	16	72	186	58	64	105
Grp Sat Flow(s),veh/h/ln	1774	1695	1810	1774	1770	1583	1211	1863	1583	1117	1863	1583
Q Serve(g_s), s	0.0	12.2	12.3	0.0	12.8	1.2	1.4	4.1	13.6	5.8	3.6	7.3
Cycle Q Clear(g_c), s	0.0	12.2	12.3	0.0	12.8	1.2	5.1	4.1	13.6	9.9	3.6	7.3
Prop In Lane	1.00		0.16	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	903	1158	619	960	1342	600	202	275	233	186	275	233
V/C Ratio(X)	0.17	0.32	0.33	0.17	0.39	0.04	0.08	0.26	0.80	0.31	0.23	0.45
Avail Cap(c_a), veh/h	903	1158	619	960	1342	600	452	660	561	417	660	561
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.89	0.89	0.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.8	40.4	40.5	10.4	27.1	23.5	47.4	45.4	49.4	49.8	45.2	46.7
Incr Delay (d2), s/veh	0.1	0.7	1.2	0.1	0.8	0.1	0.2	0.5	6.1	0.9	0.4	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	6.5	9.6	10.3	4.5	10.6	1.0	0.9	3.9	10.5	3.3	3.5	5.9
LnGrp Delay(d),s/veh	17.8	41.1	41.8	10.5	27.9	23.6	47.6	45.9	55.6	50.7	45.6	48.1
LnGrp LOS	B	D	D	B	C	C	D	D	E	D	D	D
Approach Vol, veh/h		725			704			274			227	
Approach Delay, s/veh		36.5			23.8			52.6			48.1	
Approach LOS		D			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		22.2	52.8	45.0		22.2	47.8	50.0
Change Period (Y+Rc), s		4.5	4.5	4.0		4.5	4.5	4.5
Max Green Setting (Gmax), s		42.5	23.5	41.0		42.5	18.5	45.5
Max Q Clear Time (g_c+I1), s		15.6	2.0	14.3		11.9	2.0	14.8
Green Ext Time (p_c), s		2.1	0.8	1.2		2.1	0.8	3.5

Intersection Summary	
HCM 2010 Ctrl Delay	35.5
HCM 2010 LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	164	450	39	181	842	27	60	96	248	35	92	110
Future Volume (veh/h)	164	450	39	181	842	27	60	96	248	35	92	110
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	178	489	42	197	915	29	65	104	270	38	100	120
Adj No. of Lanes	1	3	0	1	2	1	1	1	1	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	560	1870	159	830	1666	745	244	380	323	218	380	323
Arrive On Green	0.07	0.13	0.13	0.30	0.47	0.47	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	1774	4776	406	1774	3539	1583	1156	1863	1583	1004	1863	1583
Grp Volume(v), veh/h	178	346	185	197	915	29	65	104	270	38	100	120
Grp Sat Flow(s),veh/h/ln	1774	1695	1791	1774	1770	1583	1156	1863	1583	1004	1863	1583
Q Serve(g_s), s	0.0	11.0	11.2	0.0	22.1	1.2	6.0	5.6	19.6	4.0	5.4	7.8
Cycle Q Clear(g_c), s	0.0	11.0	11.2	0.0	22.1	1.2	11.4	5.6	19.6	9.6	5.4	7.8
Prop In Lane	1.00		0.23	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	560	1328	702	830	1666	745	244	380	323	218	380	323
V/C Ratio(X)	0.32	0.26	0.26	0.24	0.55	0.04	0.27	0.27	0.84	0.17	0.26	0.37
Avail Cap(c_a), veh/h	560	1328	702	830	1666	745	398	629	534	352	629	534
HCM Platoon Ratio	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.86	0.86	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.4	36.6	36.7	13.8	22.7	17.1	45.0	40.3	45.8	44.3	40.2	41.1
Incr Delay (d2), s/veh	0.3	0.4	0.8	0.1	1.3	0.1	0.6	0.4	5.9	0.4	0.4	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(95%),veh/ln	9.1	8.7	9.4	6.5	16.6	1.0	3.5	5.3	14.1	2.0	5.1	6.3
LnGrp Delay(d),s/veh	35.7	37.0	37.5	14.0	24.0	17.2	45.6	40.6	51.7	44.7	40.5	41.8
LnGrp LOS	D	D	D	B	C	B	D	D	D	D	D	D
Approach Vol, veh/h		709			1141			439			258	
Approach Delay, s/veh		36.8			22.1			48.2			41.8	
Approach LOS		D			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		29.0	40.0	51.0		29.0	30.0	61.0
Change Period (Y+Rc), s		4.5	4.5	4.0		4.5	4.5	4.5
Max Green Setting (Gmax), s		40.5	19.5	47.0		40.5	9.5	56.5
Max Q Clear Time (g_c+I1), s		21.6	2.0	13.2		11.6	2.0	24.1
Green Ext Time (p_c), s		2.8	1.0	1.1		3.1	0.7	7.1

Intersection Summary	
HCM 2010 Ctrl Delay	32.7
HCM 2010 LOS	C

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	61	103	49	64	54	47	85	20	4	54	10
Future Volume (vph)	40	61	103	49	64	54	47	85	20	4	54	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.906			0.931			0.971			0.976	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1688	0	1770	1734	0	1770	1809	0	1770	1818	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1688	0	1770	1734	0	1770	1809	0	1770	1818	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		876			924			235			897	
Travel Time (s)		19.9			21.0			5.3			20.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	66	112	53	70	59	51	92	22	4	59	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	43	178	0	53	129	0	51	114	0	4	70	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	32.1%	ICU Level of Service A	
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	60	62	45	70	10	123	83	21	10	74	15
Future Volume (vph)	14	60	62	45	70	10	123	83	21	10	74	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.924			0.981			0.969			0.975	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	1721	0	1770	1827	0	1770	1805	0	1770	1816	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	1721	0	1770	1827	0	1770	1805	0	1770	1816	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		876			924			234			897	
Travel Time (s)		19.9			21.0			5.3			20.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	65	67	49	76	11	134	90	23	11	80	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	132	0	49	87	0	134	113	0	11	96	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	33.8%	ICU Level of Service A	
Analysis Period (min)	15		

Intersection	
Intersection Delay, s/veh	9.2
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	40	61	103	0	49	64	54	0	47	85	20
Future Vol, veh/h	0	40	61	103	0	49	64	54	0	47	85	20
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	43	66	112	0	53	70	59	0	51	92	22
Number of Lanes	0	1	1	0	0	1	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	2	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	2	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	2	2
HCM Control Delay	9.3	9.1	9.4
HCM LOS	A	A	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	100%	0%	100%	0%
Vol Thru, %	0%	81%	0%	37%	0%	54%	0%	84%
Vol Right, %	0%	19%	0%	63%	0%	46%	0%	16%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	47	105	40	164	49	118	4	64
LT Vol	47	0	40	0	49	0	4	0
Through Vol	0	85	0	61	0	64	0	54
RT Vol	0	20	0	103	0	54	0	10
Lane Flow Rate	51	114	43	178	53	128	4	70
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.087	0.173	0.071	0.244	0.087	0.181	0.008	0.109
Departure Headway (Hd)	6.11	5.471	5.879	4.933	5.914	5.087	6.234	5.619
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	583	651	607	724	603	700	570	632
Service Time	3.882	3.244	3.642	2.696	3.68	2.853	4.015	3.4
HCM Lane V/C Ratio	0.087	0.175	0.071	0.246	0.088	0.183	0.007	0.111
HCM Control Delay	9.5	9.4	9.1	9.3	9.2	9	9.1	9.1
HCM Lane LOS	A	A	A	A	A	A	A	A
HCM 95th-tile Q	0.3	0.6	0.2	1	0.3	0.7	0	0.4

Intersection	
Intersection Delay, s/veh	9.5
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Lane Configurations												
Traffic Vol, veh/h	0	14	60	62	0	45	70	10	0	123	83	21
Future Vol, veh/h	0	14	60	62	0	45	70	10	0	123	83	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	15	65	67	0	49	76	11	0	134	90	23
Number of Lanes	0	1	1	0	0	1	1	0	0	1	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	2	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	2	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	2	2
HCM Control Delay	9.3	9.3	9.8
HCM LOS	A	A	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	100%	0%	100%	0%	100%	0%	100%	0%
Vol Thru, %	0%	80%	0%	49%	0%	88%	0%	83%
Vol Right, %	0%	20%	0%	51%	0%	12%	0%	17%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	123	104	14	122	45	80	10	89
LT Vol	123	0	14	0	45	0	10	0
Through Vol	0	83	0	60	0	70	0	74
RT Vol	0	21	0	62	0	10	0	15
Lane Flow Rate	134	113	15	133	49	87	11	97
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.219	0.165	0.026	0.194	0.083	0.134	0.018	0.147
Departure Headway (Hd)	5.903	5.257	6.135	5.272	6.136	5.544	6.076	5.453
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	604	677	580	675	580	642	585	652
Service Time	3.671	3.026	3.908	3.045	3.912	3.319	3.857	3.234
HCM Lane V/C Ratio	0.222	0.167	0.026	0.197	0.084	0.136	0.019	0.149
HCM Control Delay	10.3	9.1	9.1	9.3	9.5	9.2	9	9.2
HCM Lane LOS	B	A	A	A	A	A	A	A
HCM 95th-tile Q	0.8	0.6	0.1	0.7	0.3	0.5	0.1	0.5

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	4	54	10
Future Vol, veh/h	0	4	54	10
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	4	59	11
Number of Lanes	0	1	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	9.1
HCM LOS	A

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Lane Configurations				
Traffic Vol, veh/h	0	10	74	15
Future Vol, veh/h	0	10	74	15
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2
Mvmt Flow	0	11	80	16
Number of Lanes	0	1	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	9.2
HCM LOS	A

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑↑↱			↱
Traffic Volume (vph)	0	736	583	9	0	65
Future Volume (vph)	0	736	583	9	0	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.91	0.91	0.91	1.00	1.00
Frt			0.998			0.865
Flt Protected						
Satd. Flow (prot)	0	5085	5075	0	0	1611
Flt Permitted						
Satd. Flow (perm)	0	5085	5075	0	0	1611
Link Speed (mph)		40	40		30	
Link Distance (ft)		420	458		200	
Travel Time (s)		7.2	7.8		4.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	800	634	10	0	71
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	800	644	0	0	71
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 22.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑↑↱			↱
Traffic Volume (vph)	0	796	1001	21	0	50
Future Volume (vph)	0	796	1001	21	0	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.91	0.91	0.91	1.00	1.00
Frt			0.997			0.865
Flt Protected						
Satd. Flow (prot)	0	5085	5070	0	0	1611
Flt Permitted						
Satd. Flow (perm)	0	5085	5070	0	0	1611
Link Speed (mph)		40	40		30	
Link Distance (ft)		420	312		200	
Travel Time (s)		7.2	5.3		4.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	865	1088	23	0	54
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	865	1111	0	0	54
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		0	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 29.8%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑↑↱			↱
Traffic Vol, veh/h	0	736	583	9	0	65
Future Vol, veh/h	0	736	583	9	0	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	800	634	10	0	71

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	322
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	-	0	575
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	575
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	12.1
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	575
HCM Lane V/C Ratio	-	-	-	0.123
HCM Control Delay (s)	-	-	-	12.1
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.4

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑↑↱			↱
Traffic Vol, veh/h	0	796	1001	21	0	50
Future Vol, veh/h	0	796	1001	21	0	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	865	1088	23	0	54

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	-	555
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	-	-	-	7.14
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	-	-	-	3.92
Pot Cap-1 Maneuver	0	-	-	-	0	407
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	-	407
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	15.2
HCM LOS			C

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	407
HCM Lane V/C Ratio	-	-	-	0.134
HCM Control Delay (s)	-	-	-	15.2
HCM Lane LOS	-	-	-	C
HCM 95th %tile Q(veh)	-	-	-	0.5

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	78	48	168	60	23	131
Future Volume (vph)	78	48	168	60	23	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	0.95
Frt	0.949		0.961			
Flt Protected	0.970				0.950	
Satd. Flow (prot)	1715	0	3401	0	1770	3539
Flt Permitted	0.970				0.950	
Satd. Flow (perm)	1715	0	3401	0	1770	3539
Link Speed (mph)	30		30			30
Link Distance (ft)	333		542			309
Travel Time (s)	7.6		12.3			7.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	52	183	65	25	142
Shared Lane Traffic (%)						
Lane Group Flow (vph)	137	0	248	0	25	142
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.2%		ICU Level of Service A	
Analysis Period (min) 15			

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	60	37	190	139	54	177
Future Volume (vph)	60	37	190	139	54	177
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	0.91
Frt	0.949		0.937			
Flt Protected	0.970				0.950	
Satd. Flow (prot)	1715	0	3316	0	1770	5085
Flt Permitted	0.970				0.950	
Satd. Flow (perm)	1715	0	3316	0	1770	5085
Link Speed (mph)	30		30			30
Link Distance (ft)	282		542			310
Travel Time (s)	6.4		12.3			7.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	40	207	151	59	192
Shared Lane Traffic (%)						
Lane Group Flow (vph)	105	0	358	0	59	192
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(ft)	12		12			12
Link Offset(ft)	0		0			0
Crosswalk Width(ft)	16		16			16
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15	9		9	15	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 28.6%		ICU Level of Service A	
Analysis Period (min) 15			

Intersection	
Int Delay, s/veh	3.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	78	48	168	60	23	131
Future Vol, veh/h	78	48	168	60	23	131
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	85	52	183	65	25	142

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	336	124	0	0	248	0
Stage 1	215	-	-	-	-	-
Stage 2	121	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	634	904	-	-	1315	-
Stage 1	800	-	-	-	-	-
Stage 2	891	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	622	904	-	-	1315	-
Mov Cap-2 Maneuver	622	-	-	-	-	-
Stage 1	800	-	-	-	-	-
Stage 2	874	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.3	0	1.2
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 706	1315	-
HCM Lane V/C Ratio	-	- 0.194	0.019	-
HCM Control Delay (s)	-	- 11.3	7.8	-
HCM Lane LOS	-	- B	A	-
HCM 95th %tile Q(veh)	-	- 0.7	0.1	-

Intersection	
Int Delay, s/veh	2.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	60	37	190	139	54	177
Future Vol, veh/h	60	37	190	139	54	177
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	65	40	207	151	59	192

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	476	179	0	0	358	0
Stage 1	282	-	-	-	-	-
Stage 2	194	-	-	-	-	-
Critical Hdwy	6.29	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	6.04	-	-	-	-	-
Follow-up Hdwy	3.67	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	539	833	-	-	1197	-
Stage 1	714	-	-	-	-	-
Stage 2	781	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	512	833	-	-	1197	-
Mov Cap-2 Maneuver	512	-	-	-	-	-
Stage 1	714	-	-	-	-	-
Stage 2	743	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	12.3	0	1.9
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	- 600	1197	-
HCM Lane V/C Ratio	-	- 0.176	0.049	-
HCM Control Delay (s)	-	- 12.3	8.2	-
HCM Lane LOS	-	- B	A	-
HCM 95th %tile Q(veh)	-	- 0.6	0.2	-

APPENDIX G

DESIGN STANDARDS AND POLICIES

B. Angle of Intersection

A right-angle intersection provides the shortest crossing distance for intersecting traffic streams. It also provides the most favorable condition for drivers to judge the relative position and speed of intersecting vehicles. Where special conditions exist, intersection angles may diverge from a right-angle by a maximum of 2 degrees (up to 4 degrees with approval of the Transportation Department) on arterial streets and major collector streets; and by a maximum of 4 degrees (up to 15 degrees with approval of the Transportation Department) on minor and local collector streets, couplets and local streets.

C. Alignment and Profile

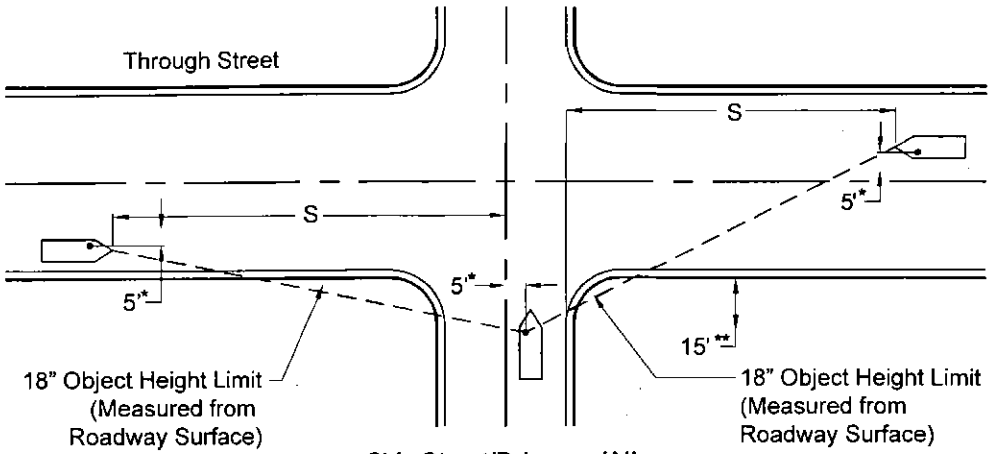
Intersections occurring on horizontal or crest vertical curves are undesirable. When there is latitude in the selection of intersection locations, vertical or horizontal curvature should be avoided. A line or grade change is frequently warranted when major intersections are involved. If a curve is unavoidable, it should be as flat as site conditions permit. Where the grade of the through roadway is steep, flattening through the intersection is desirable as a safety measure.

The maximum profile grade through an intersection is 6 percent for arterials and collector streets and 8 percent for local streets. The intersecting streets' profiles and cross slopes need to be coordinated with one another to ensure a safe and comfortable driving surface. Typically this may mean extending grades through the intersection for approximately 75 feet to 150 feet. Short vertical curves may be necessary in lieu of grade breaks.

D. Intersection and Driveway Sight Distance

In order to provide the opportunity for vehicles at an intersection to safely cross or make left or right turns onto a through street, **adequate sight distance must be provided**. Sight distance must also be provided for left turning traffic turning from the main street as described in AASHTO Intersection Sight Distance Case F. If opposing left turn lanes are present, the opposing left turns must be off-set in a positive way to allow for sight distance when opposing vehicles are present. See Figure 5.3-28 and Figure 5.3-29 for options. Sight distance should be based on the design speed for the roadway. Design speeds for new roadways should conform to those identified in Section 5-3.100 and Appendix 5-3A and Appendix 5-3B. Typically design speeds are 10 m.p.h. higher than the anticipated posted speed limit. The sight distance requirements outlined below are required for all private and public street intersections and at all intersections of driveways onto public or private streets. Internal driveway intersections on private property are excluded from these requirements.

Figure 5.3-26 depicts the technique used to determine the driver's eye location and an approaching vehicle; a line is then drawn to connect these 2 points. Continuous unobstructed line of sight must be provided along this line and throughout the approach to the intersection, providing an unobstructed sight triangle to the side street driver. Sight lines are to be drawn on roadway and landscaping plans to represent the areas that must be free of all objects and topography in excess of 18 inches above the roadway surface, however, certain vegetation will be allowed. Vegetation placed within the sight triangle will be of a low variety that remains below 18 inches when mature. Trees can be considered within the triangle as long as the canopies are above 8 feet, they are a single trunk variety, and they are not spaced in a configuration that creates a "picket fence" effect.



Side Street/Driveway/Alley
(Applies to stop controlled side street or all approaches to a signalized intersection for right-on-red traffic.

* 5 feet measured to nearest lane line or centerline.

**15 feet measured from face-of-curb or edge-of-travelway.

S = Intersection sight distance in feet on drivers left and right for right turns, left turns and through traffic. (See *2004 AASHTO Geometric Design of Highways and Streets* for additional sight distance requirements.)

(See Appendix 5-3A, Appendix 5-3B and Appendix 5-3C for distance S.)

FIGURE 5.3-26 INTERSECTION & DRIVEWAY DEPARTURE SIGHT DISTANCE REQUIREMENTS

1. Right-Angle Intersections

Right-angle intersections are those whose legs meet at an angle of 88 to 90 degrees. For these right-angle intersections the sight distances shown in Appendix 5-3A, Appendix 5-3B and Appendix 5-3C are to be used with Figure 5.3-26 to calculate the sight triangle. Appendices 5-3A and 5-3B present the intersection sight distances for all street classifications which were determined assuming passenger car traffic. Appendix 5-3C presents the sight distance requirements for varying roadway widths and design speeds for passenger cars, single unit trucks and combination trucks. If high volumes of truck traffic are anticipated, sight distances given in Appendix 5-3C will be used. Sight distances for vehicles turning left from the main street should also be considered and calculated based on the *AASHTO Geometric Design of Highways and Streets.*

2. Skewed Intersections

For skewed intersections where the intersection angles are less than 88 degrees, sight distances must be calculated in accordance with the procedures described in *AASHTO's Geometric Design of Highways and Streets.* Skewed intersection design must include appropriate design for pedestrian crossings and the location of curb ramps.

3. Intersections Within or Near a Curve

Sight distance measurements, identified as S in Figure 5.3-26, need to follow the curved street alignment when the intersection is within or near a horizontal curve.

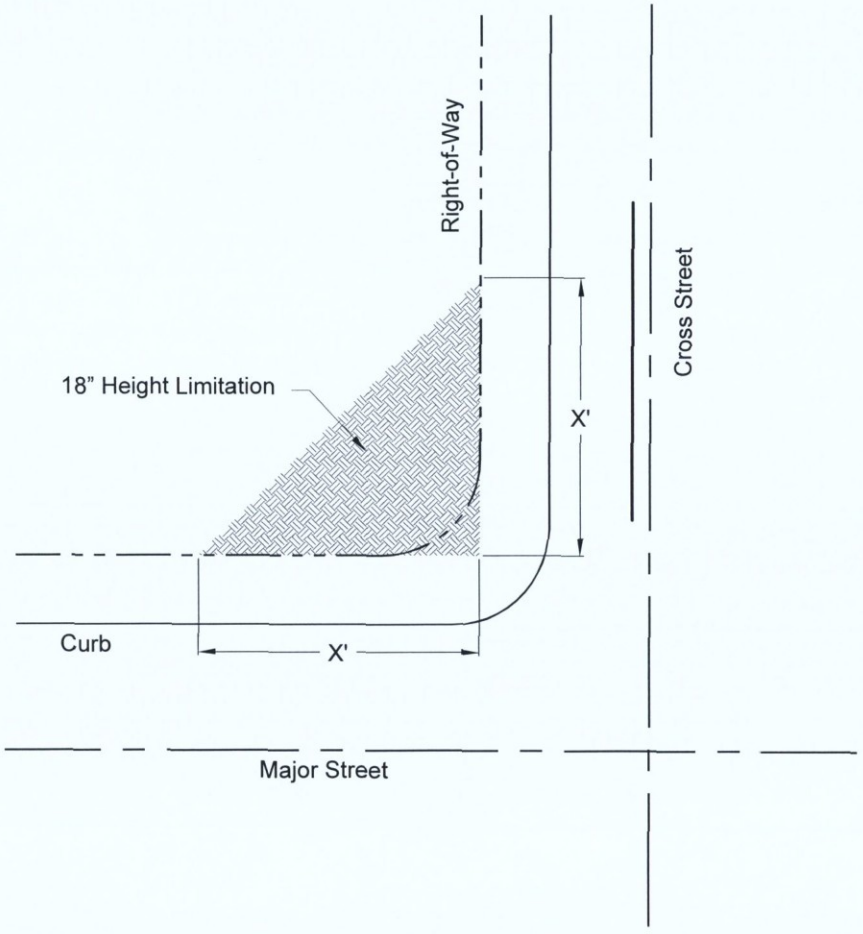
4. Traffic Safety Triangles

Traffic Safety Triangles should be used as a means to limit the height of structures, vegetation and other improvements on corner properties immediately adjacent to intersections. **Safety triangles are not to be used as a substitute for intersection sight distance!** Safety triangles provide additional visibility around corners for all intersection approaches and should be applied to the design of perimeter walls and

landscape features. Items within the safety triangle cannot be higher than 18" measured from the roadway surface. Figure 5.3-27 depicts the method used to determine the safety triangle location. The sight distance requirements contained in both Figure 5.3-26 and Figure 5.3-27 are applied at all corner lots.

5. Right-of-Way at Corners

A minimum of 25-foot radius rights-of-way shall be dedicated at street intersections to provide room for traffic control and sight distance.



Major Street Classification	X (in feet)
Parkway, Expressway, Arterials, Major Collector	25
Minor Collector	35
* Local Streets	35 / 60 / 70

* If the standard right-of-way (46 ft. local residential, 60 ft. local collector) is not available, the safety triangle (X) shall measure 60 ft. on local residential streets and 70 ft. on local collector streets from the centerlines of the streets.

FIGURE 5.3-27 TRAFFIC SAFETY TRIANGLE ON CORNER PROPERTY

E. Auxiliary Lanes

An exclusive turning lane permits separation of conflicting traffic movements and removes turning vehicles from the flow of through traffic. Figure 5.3-28 and Figure 5.3-29 depict the

design standards for auxiliary lanes. These standards apply for right and left turn lanes at street intersections and for deceleration lanes at mid-block driveways. The requirement for an auxiliary lane may necessitate additional rights-of-way. Modifications to the storage and transition lengths may be allowed by the Transportation Department where the conditions do not allow the full design standard to be met.

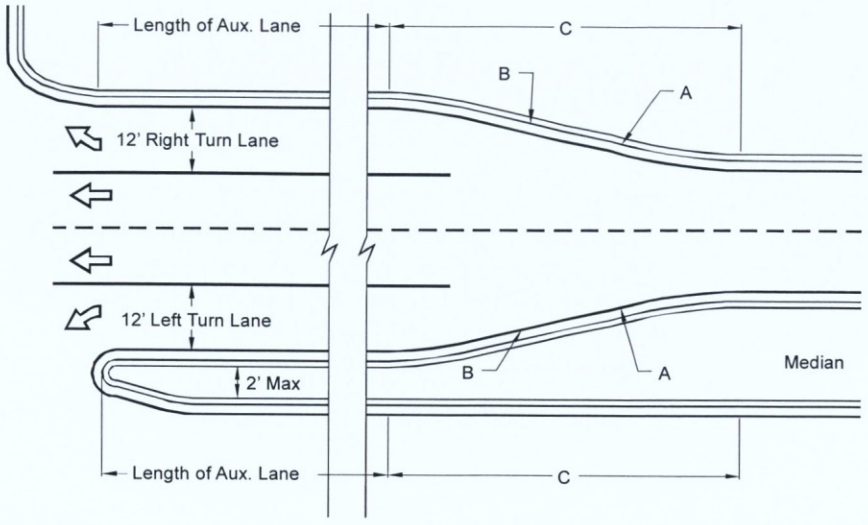
1. **Right-Turn Lanes**

   Right-turn lanes are required at all street intersections on major arterials. Right-turn lanes may be required by the Transportation Department on minor arterial and collector street intersections. The lane lengths should be determined based on the anticipated turning volume and whether there is signalized or unsignalized traffic control. The standard vehicle storage length for a right-turn lane is 150 feet, with a 100-foot minimum length. The taper prior to the storage area shall be accomplished as indicated on Figure 5.3-28 and 29.

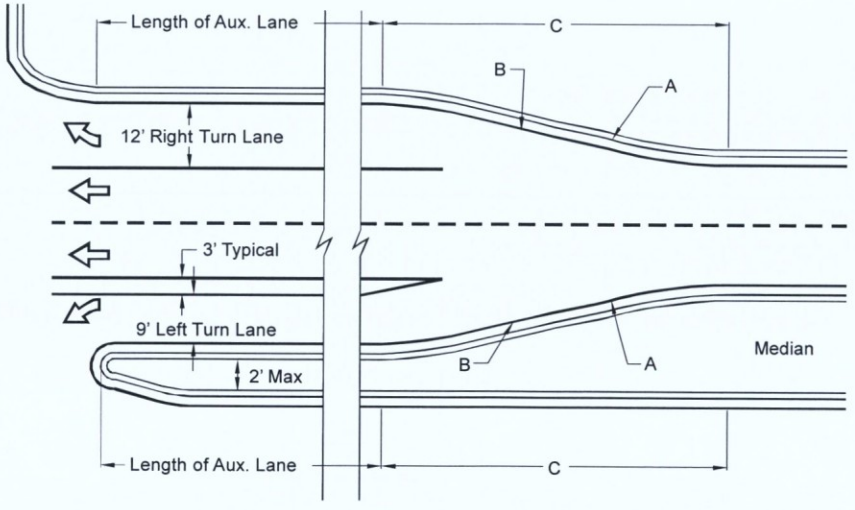
2. **Left-Turn Lanes**

   Left-turn lanes are required at all street intersections on major collectors and arterials. Left-turn lanes may also be required at street intersections on minor collectors based on the projected left-turn volume and conflicting through volume. The lane lengths should be determined based on the anticipated turning volume and whether there is signalized or unsignalized traffic control. For left turn lanes at signalized intersections, dual turn lanes should be considered when the turn volume exceeds 300 vehicles per hour, the opposing through volume exceeds 1,000 vehicles per hour, or the delay to left turning vehicles exceeds 45 seconds. Sight distance must be considered and calculated for these movements based on the AASHTO Policy on Geometric Design in order to determine the allowance of permitted left turns. Guidance for the length of taper, determination of the gap and storage length of the lane can be found in Section 430 of the ADOT Traffic Engineering Policies, Guidelines and Procedures Manual.

OPTION 1



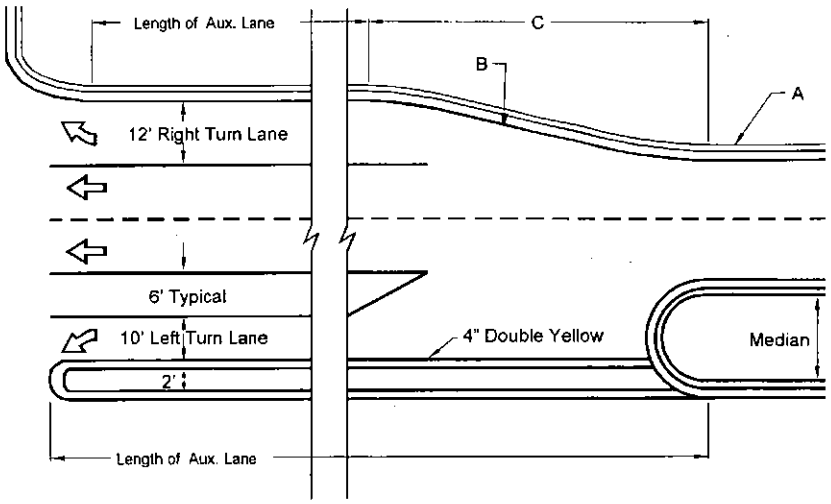
OPTION 2



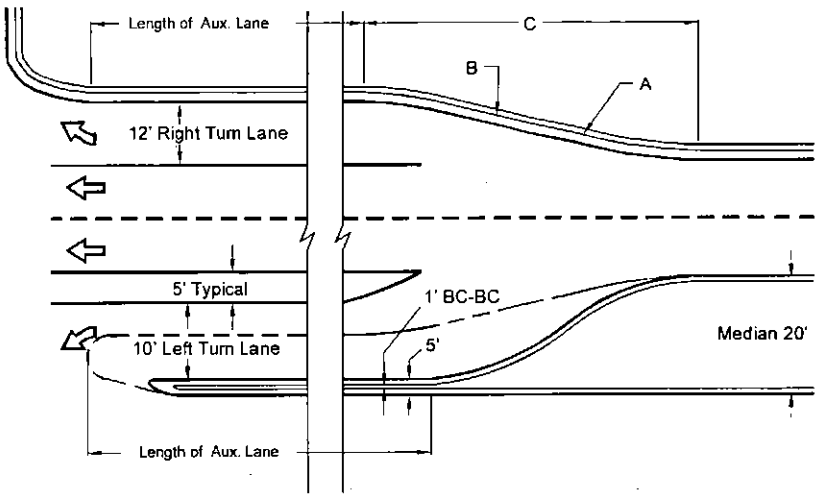
Note: See COS Standard Detail No. 2225 for radius and dimensions noted as A, B, and C.
www.ScottsdaleAZ.gov/design/COSMAGSupp.

FIGURE 5.3-28 AUXILIARY LANES – OPTIONS 1 & 2

OPTION 3



OPTION 4



Note: See COS Standard Detail No. 2225 for radius and dimensions noted as A, B, and C.
www.ScottsdaleAZ.gov/design/COSMAGSupp.

FIGURE 5.3-29 AUXILIARY LANES – OPTIONS 3 & 4

F. Median Design

Raised medians are required on arterial streets and some major collector streets to separate traffic flows, channelize left turns and reduce conflicts. On most collector streets, flush or painted medians provide space between the through traffic lanes for left turning vehicles. Standard median widths are listed for each street classification in Appendix 5-3A and Appendix 5-3B and as shown in Figure 5.3-30 through Figure 5.3-34. Variations to these standards may be approved through the master plan process or by the Transportation department.

Land Use	Street Classification	Driveway Type*	Location**
Single Family	Local Residential / Local Collector	S-1	All
Multifamily	Local Residential / Local Collector	M-1	All
	Minor Collector	M-2 / CH-1	All
	Major Collector	M-2 / CH-1	All
	Minor Arterial / Major Arterial	M-2 / CH-1	Right-In, Right-Out
		CH-2, CH-3	Full Access
Commercial	Local Commercial	CL-1	All
	Minor Collector / Major Collector	CH-1	All
	Minor Arterial / Major Arterial	CH-1	Right-In, Right Out
		CH-2, CH-3	Full Access
Industrial	Local Industrial	CL-1	All
	Minor Collector / Major Collector	CH-1	All
	Minor Arterial / Major Arterial	CH-1	Right-In, Right-Out
		CH-2, CH-3	Full Access

* See City of Scottsdale Standard Details and Figure 5.3-37 through Figure 5.3-43.

** Right-In, Right Out driveways on arterial streets are where left-turns out of the driveway are prohibited by a median or an island. Full access driveways on arterial streets align with an approved median opening. Modifications to these standards are allowed by approval of city staff.

FIGURE 5.3-35 DRIVEWAY TYPES

DRIVEWAY SPACING

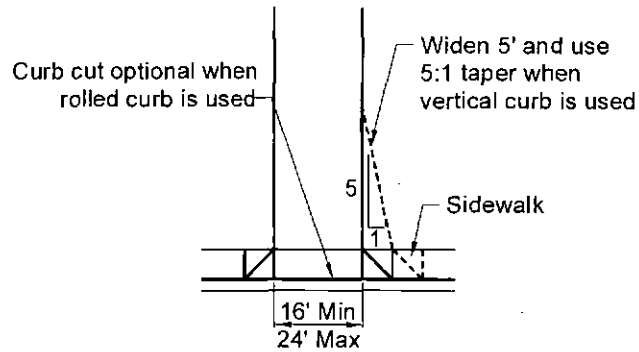
5-3.201

Minimum driveway spacing will generally conform to the following standards. This minimum spacing applies to proposed site driveway separation as well as separation from existing or planned driveways on adjacent parcels.

Street Type	Minimum Distance Driveway Spacing
Local Residential/Local Collector	50 feet
Local Industrial/Local Commercial	165 feet
Minor Collector	165 feet
Major Collector	250 feet
Minor Arterial	330 feet
Major Arterial	500 feet

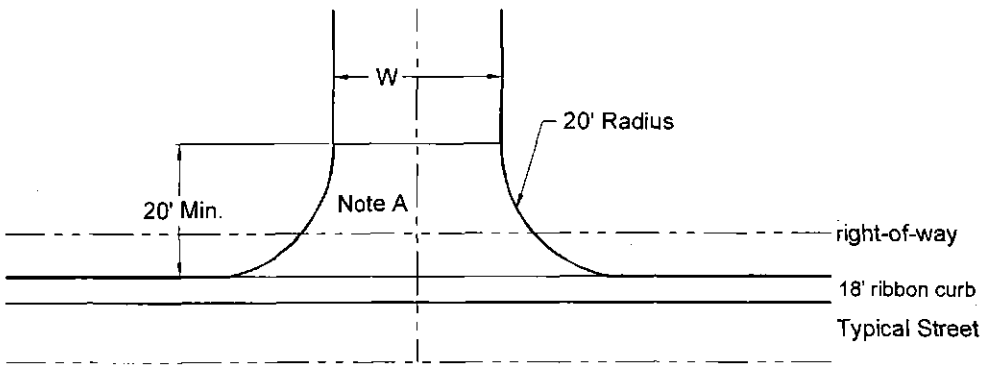
For sites that have frontage on two streets, primary access should be onto the minor street frontage. A maximum of two driveway openings is permitted to a particular site or parcel from the abutting street(s). The Transportation Department may permit additional driveway entrances when projected travel demands indicate it is in the interests of good traffic operation, and when adequate street frontage exists to maintain the above guidelines.

Where new development adjoins other similarly zoned property or compatible land uses, a cross access easement may be required to permit vehicular movement between the parcels and reduce the number of access points required onto the adjacent public street. This may be required regardless of the development status of the adjoining property, unless the cross access is determined to be unfeasible by city staff.



Surban Single Family Unit

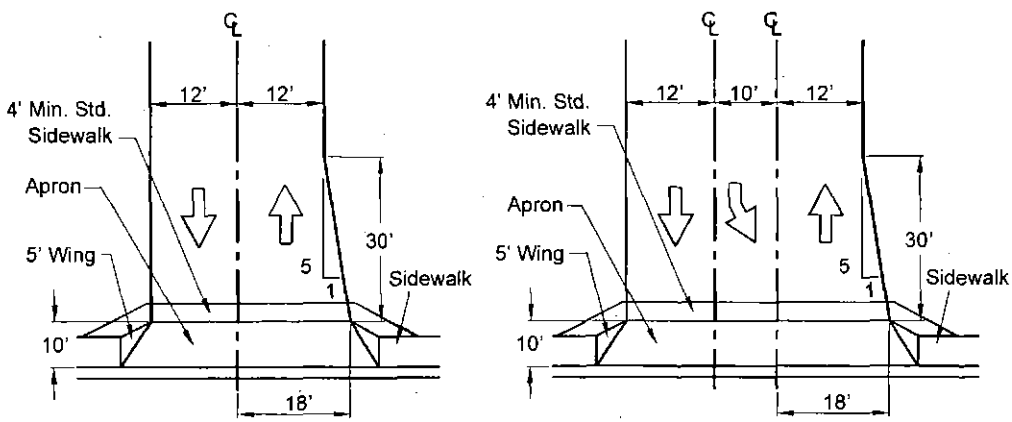
NOTE: See COS Standard Details for more specific information.



Rural/ESL Single Family Unit

- W=16' for driveway serving one lot
- W=24' for driveway serving two lots
- Note A: Pavement section-2" A.C/6" A.B.C. Minimum

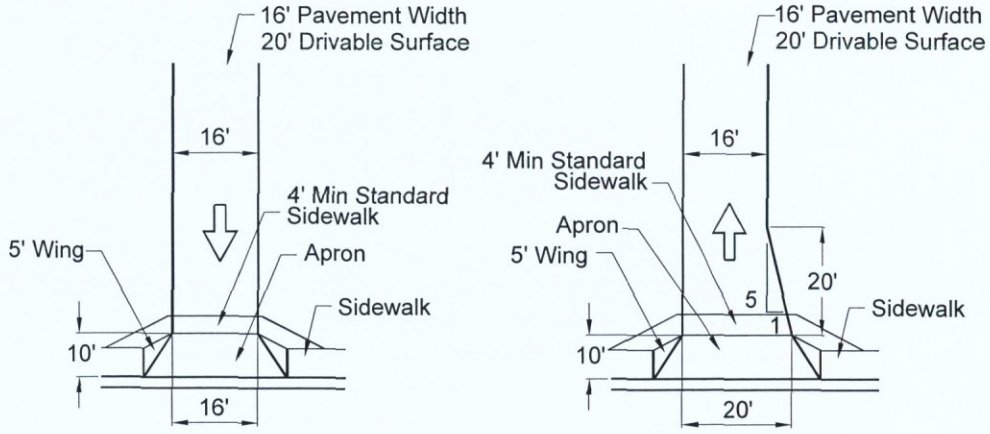
FIGURE 5.3-37 TYPE S-1 DRIVEWAY STANDARDS



Two Way
CL-1

Two Way-Two Egress Lanes
CL-2

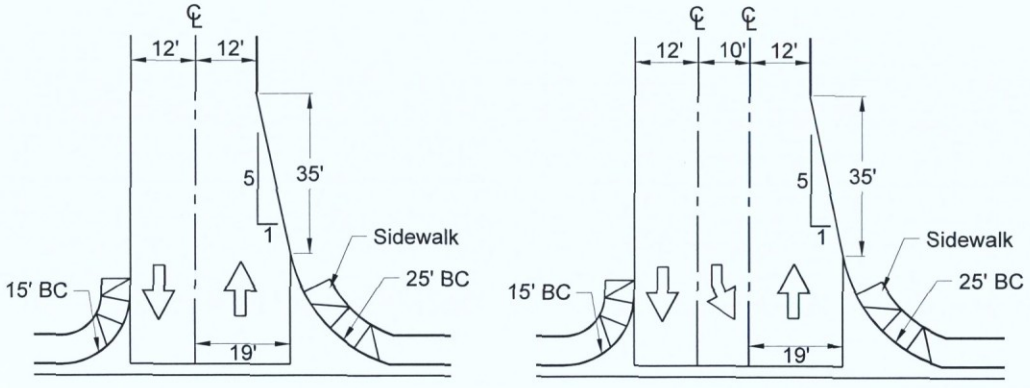
FIGURE 5.3-38 TYPE CL TWO WAY DRIVEWAYS



One Way Egress
CL-4

One Way Ingress
CL-3

FIGURE 5.3-39 TYPE CL ONE WAY DRIVEWAYS

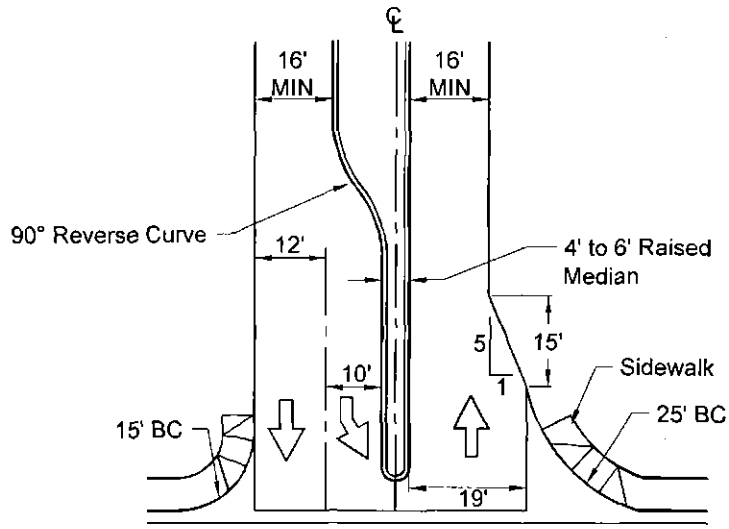


Two Way
CH-1

Two Way with Two Egress Lanes
CH-2

*Note: Pedestrian ramps in this figure are illustrative only and should be designed and constructed per COS Supplement to MAG Details.

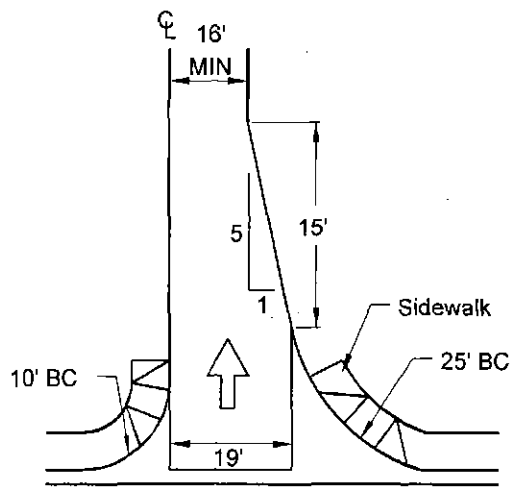
FIGURE 5.3-40 TYPE CH TWO WAY DRIVEWAYS*



Two Way Raised Median
CH-3

*Note: Pedestrian ramps in this figure are illustrative only and should be designed and constructed per COS Supplement to MAG Details.

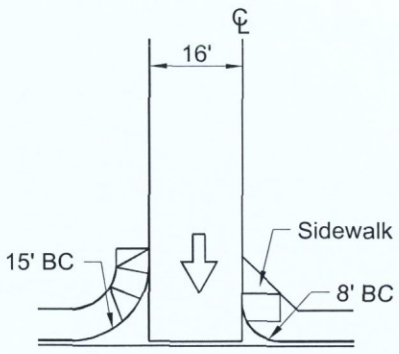
FIGURE 5.3-41 TYPE CH TWO WAY DRIVEWAYS WITH RAISED MEDIAN*



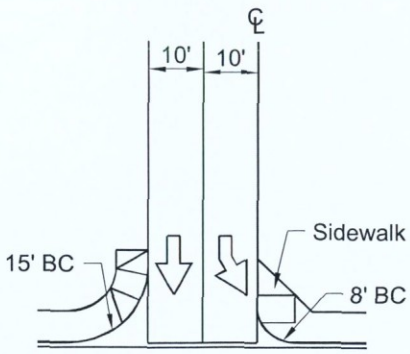
One Way Ingress
CI-1

*Note: Pedestrian ramps in this figure are illustrative only and should be designed and constructed per COS Supplement to MAG Details.

FIGURE 5.3-42 TYPE CI ONE WAY INGRESS DRIVEWAYS*



One Way Egress
CI-2



Two Lane, One Way Egress
CI-3

*Note: Pedestrian ramps in this figure are illustrative only and should be designed and constructed per COS Supplement to MAG Details.

*FIGURE 5.3-43 TYPE CI ONE WAY EGRESS DRIVEWAYS**

DECELERATION LANES

5-3.206

Figure 5.3-28 and Figure 5.3-29 depict the design standards for auxiliary lanes. These standards apply for right and left turn lanes at street intersections and for deceleration lanes at mid-block driveways. The requirement for an auxiliary lane may necessitate additional rights-of-way. The standard storage length for a deceleration lane is 150 feet, with a 100-foot minimum length. Modifications to the design standard are allowed by the Transportation Department where the conditions do not allow the full taper or storage length.

Deceleration lanes are required at all new driveways on major arterials and at new commercial/retail driveways minor arterials. Deceleration lanes for driveways may also be required on collector streets and for non-commercial/retail driveways on minor arterials. The lane length should be based on the distance needed to allow the vehicle to exit the through lane and slow to a 15 m.p.h. travel speed. To determine the need for a deceleration lane on streets classified as a minor arterial or collector, see the following criteria:

- At least 5,000 vehicles per day are expected to use the street;
- The 85th percentile traffic speed on the street is at least 35 m.p.h.; or 45 m.p.h. for a 2 lane (1 lane each direction) roadway;
- At least 30 vehicles will make right turns into the driveway during a 1-hour period.

SIDEWALKS

5-3.300

A. Sidewalk Standards

Sidewalks adjacent to all city streets are required to meet the standard cross sections contained in Figure 5.3-1 through Figure 5.3-21 and the Streets Master Plan except as noted below.

Walkways that connect main building entrances to the sidewalks on adjacent streets should have a minimum clear width of six (6) feet - excluding any parking overhangs or other obstructions. The walkway should be continuous between the street and building, and clearly recognizable by both pedestrians and drivers. Wider widths may be required by staff in

Filecopy

BIG RED DOG
ENGINEERING | CONSULTING

PRELIMINARY WATER REPORT

FOR

"DISTRICT AT THE QUARTER"

NEC OF N. GREENWAY HAYDEN LOOP & N. DIAL BLVD
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

Registered Professional Engineer (Civil)
CERTIFICATE NO.
53520
BRADLEY
LINGVAI
DATE SIGNED 6/1/2016
ARIZONA U.S.A.
Bradley J Lingvai

PREPARED FOR:

KAPLAN ACQUISITIONS, LLC
7150 EAST CAMELBACK ROAD, SUITE 444
SCOTTDALE, MARICOPA COUNTY, ARIZONA 85251

PREPARED BY:

BIG RED DOG ENGINEERING | CONSULTING, INC.
2021 E. 5TH STREET SUITE 110
AUSTIN, TEXAS 78702
ARIZONA ENGINEERING FIRM NO. 19744
BRD H001.008

Accepted w/Comment
City of Scottsdale
Water Resources Administration
9379 E. San Salvador
Scottsdale, AZ 85258

MAY 2016

3-GP-16 & 8-ZN-16
6/14/16

Doug Mann 6.28.16

BIG RED DOG
ENGINEERING | CONSULTING

H001.008

June 1, 2016

City of Scottsdale
Planning and Development
7447 E Indian School Rd
Scottsdale, AZ 85251

RE: Preliminary Engineering Reports
District At Quarter
NEC Greenway Hayden Loop & N Dial Blvd
Scottsdale, Maricopa County, Arizona

To Whom It May Concern:

Please let this letter and enclosed report serve as our formal Preliminary Basis of Design for the proposed development, District at the Quarter, at the northeast corner of N Greenway Hayden Loop and N Dial Boulevard. The proposed development will include the demolition of the existing structures followed by the construction of a ± 620 unit multi-story apartment complex which will be composed of (2) buildings wrapped around (2) structural parking garages along with all associated grading, drainage, utility, landscape, and hardscape improvements.

The subject site is currently zoned Industrial Park (I-1) and is in the process of being rezoned to Planned Unit Development (PUD). The associated General Plan Amendment and Rezoning Applications are currently under as application numbers 3-GP-2016 and 8-ZN-2016.

The 1st round of comments from the aforementioned cases have been received by the owner and design team and have been addressed accordingly. From our correspondence, it is our understanding that the preliminary reports which were previously submitted by a different engineer did not receive any comments. However, since the reports have been submitted, the owner has changed architects and engineers on the design team. Because of this, and since the site plan has changed to address the aforementioned comments (including changing from a podium style deal to a wrap-style deal), we have prepared new reports under Big Red Dog.

Please feel free to contact me at 832-730-1901 or at Patrick.Byrne@BIGREDDOG.com if you have any questions or concerns in regards to the information contained herein.. We appreciate you working with us as we move forward with the associated development.

Sincerely,

BIG RED DOG Engineering | Consulting
Texas Engineering Firm No. F-15415

Patrick Byrne

Patrick Byrne
Principal

Table of Contents

Appendix

BIG RED DOG
ENGINEERING | CONSULTING

A. INTRODUCTION

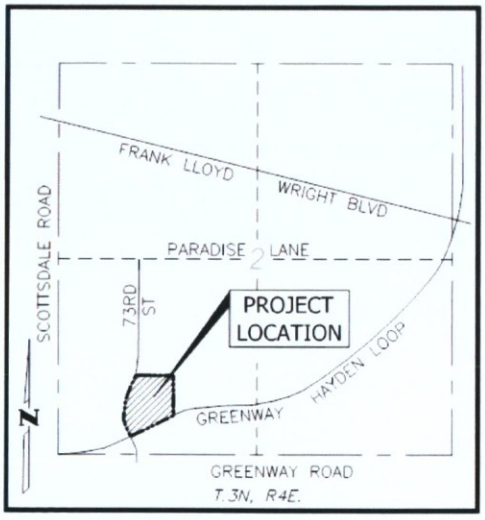
H001.008

1. Site Location / Description

The subject site associated with this Preliminary Water Report is for a proposed development, District at the Quarter, located at the northeast corner of N. Greenway Hayden Loop and N. Dial Blvd., in the Full Purpose Limits of the City of Scottsdale, AZ (see vicinity map and aerial below). The ±8.84 acre site is currently developed with a ±129,689 SF Office Building / Warehouse space, with associated utilities, desert landscaping, roadways and 4 retention ponds located throughout the site.

The proposed development will include the demolition of all existing structures followed by the construction of a ±620 unit multi-story apartment complex which will be composed of (2) buildings wrapped around (2) structural parking garages along with all associated grading, drainage, utility, landscape, and hardscape improvements.

The subject site is currently zoned Industrial Park (I-1) and is in the process of being rezoned to Planned Unit Development (PUD). The associated General Plan Amendment and Rezoning Applications are currently underway as application numbers 3-GP-2016 and 8-ZN-2016.



VICINITY MAP
NOT TO SCALE

2. Purpose / Objective

The purpose of this Preliminary Water Report is to identify and analyze the existing and proposed water demand and system conditions and characteristics as they relate to the proposed development.

B. DESIGN DOCUMENTATION

1. Design Criteria

District at the Quarter is to be designed to meet the requirements of the following:

- *City of Scottsdale Design Standard and Policies Manual (2010)*
- *MAG Uniform Standard Specifications for Public Work Construction (2016 Rev. to 2015 Ed.)*
- *City of Scottsdale Supplement to MAG Uniform Standard Specifications for Public Work Construction (2015)*
- *International Fire Code (2012)*

2. Methodology & Software

The proposed water system for District at the Quarter was modeled using WaterCAD version 8i. The model was set up and analyzed based on the impact of the proposed water demand on the existing conditions observed from the existing conditions fire flow test. The proposed water system (Phase II) is designed to be looped and running along the northern and eastern property lines under the proposed fire lane within a proposed 16' public water line easement per COS requirement. The proposed water system is to be connected to the existing 12" PVC water line located at the south of the site and the existing 12" APC water line located west of the site.

The proposed development, District at the Quarter, consists of two 4-stories buildings; Building I is 107,982 sf and Building II is 124,021 sf. The area of the largest building is used to calculate the fire flow area. The fire flow area was calculated bases on the sum of the floor areas of all floors and the calculated fire flow area was used to determine the fire flow demand by referencing the 2012 IFC – B105.1. The **Table 1.0** below provides the Fire Flow Calculation.

Table 1.0 – Fire Flow Calculation

	Description	
Building I	**107,982 SF**	
Building II	**124,021 SF**	
Largest Building	**Building II**	
Building II		
Floor Level	**Building Construction Type**	**Floor Area**
1st Floor	**I-A**	**27,150 SF**
2nd Floor	**I-A**	**27,150 SF**
3rd Floor	**I-A**	**27,150 SF**
4th Floor	**I-A**	**27,150 SF**
1st Floor	**V-A**	**96,871 SF**
2nd Floor	**V-A**	**96,871 SF**
3rd Floor	**V-A**	**96,871 SF**
4th Floor	**V-A**	**96,871 SF**
Total Fire Flow Area =		**496,084 SF**
Fire Flow Demand (2012 IFC – B105.1) =		**8,000 gpm**
Fire Flow Demand (75% Allowed Reduction) =		**2,000 gpm**

A pump (PMP-1) is set up to replicate the existing water pressure on the project site based on the Hydrant Flow Test Report by Arizona Flow Testing, LLC in the water model. Four different simulations of the water model were generated as required by the COS DSPM (2010). The **Table 2.0** below provides the description of each simulation. The *Reports and Diagrams* have been included in the Appendix as ***Exhibit 2***.

Table 2.0 – Water Model Simulations

	Description
Average Day Demand	**Calculated the Average Day Demand of the entire site using Figure 6.1-2 COS DSPM (2010). The demand is assigned to the junction, J-5, which is the furthest junction from the water source.**
Maximum Day Demand	**Calculated the Maximum Day Demand of the entire site using 2 times the Average Day Demand. The demand is assigned to the junction, J-5, which is the furthest junction from the water source.**
Peak Hour Demand	**Calculated the Peak Hour Demand of the entire site using 3.5 times the Average Day Demand. The demand is assigned to the junction, J-5, which is the furthest junction from the water source.**
Maximum Day Demand with Fire Flow	**Calculated the Maximum Day Demand with Fire Flow of the entire site using the Maximum Day Demand plus the Fire-Flow Demand for the largest building. . The demand is assigned to the junction, J-5, which is the furthest junction from the water source.**

C. EXISTING CONDITIONS

1. **Zoning / Land Use**

The 8.84 acre site is currently zoned (I-1) Industrial Park district and is currently developed with a ± 129,689 SF office building / warehouse, with all associated parking, desert landscaping , utilities, and Stormwater retention ponds. The site is currently in the process of being rezoned to Planned Unit Development (PUD). The associated General Plan Amendment and Rezoning Applications are currently underway as applications numbers 3-GP-2016 and 8-ZN-2016.

2. **Topography / Vegetation/ Landforms**

The site is currently fully developed and operating as a 129,689 SF mixed office/warehouse building with all associated parking, desert landscape areas, utilities, and Stormwater retention ponds. The site currently drains from the northeast to the southwest, and eventually into one of four retention ponds located throughout the property.

3. **Location / Description of Utilities**

The City of Scottsdale is the water provider for the subject site. There is an existing 12" APC water line located west of the site within N. Dial Boulevard and an existing 12" PVC water line located at the south of the site within E. Greenway Hayden Loop. The 12" APC domestic water service lead for the existing development is connecting to the 12" ACP water line within N. Dial Boulevard. Reference the *Existing Conditions* in the Appendix as ***Exhibit 3***.

4. **Fire Flow Results**

A hydrant flow test was performed by Arizona Flow Testing, LLC on December 8, 2015. The flow test was being conducted at the northeast corner of North Greenway Hayden Loop and N. Dial Boulevard. The **Table 1.0** below provides the flow test data with 12 PSI safety factor. The *Hydrant Flow Test Report* is included in the Appendix as ***Exhibit 4***.

Table 1.0 – Flow Test Data (with 12 PSI Safety Factor)

Static Pressure =	**72.0 PSI**
Residual Pressure =	**48.0 PSI**
Flowing GPM =	**2,866 GPM**
Maximum Day Demand with Fire Flow =	**4,351 GPM**

D. PROPOSED CONDITIONS

1. **Utility Layout**

The proposed project will be constructed in phases (Phase I and Phase II). Each phase is being designed to function independently in regards to all utility services.

Phase I will include the building and garage at the southwest corner of the site. Water service is available to Phase I of the project from the existing 12" APC water line within N Dial Boulevard and/or an existing 12" PVC water line within E Greenway Hayden Loop. No public water lines are proposed with Phase I with exception to a hydrant at the southeast corner of the proposed building. This hydrant will insure the proposed fire lane which will be built as part of Phase I will comply with fire hydrant spacing requirements (1 hydrant every 700 LF). This aforementioned hydrant will obtain service from the 12" PVC water line within E Greenway Hayden Loop and will be located within an easement accordingly. With the addition of this hydrant, as well as the existing hydrants along E Greenway Hayden Loop and N Dial Blvd, there will be adequate fire protection for all of Phase I.

In order to comply with hydrant spacing requirements, Phase II will require a 12" ductile iron public water line be extended within the fire lane on the north and east sides of the development. Two connections will be proposed to form a loop from the existing mains within the ROW. The first connection will be to the existing 12" PVC pipe near the southeast corner of the site within Greenway Hayden Loop and the second connection will be the existing 12" ACP located at the northwest corner of the site within N. Dial Boulevard. The proposed 12" water line will be located within a proposed 16' water line easement (16' is proposed in lieu of 20' due to limited space within the fire lane to run sanitary and storm lines).

SAN sewer is public per Report WHY CAN'T WE IN SAME EASEMENT.

There will be two water line connections for the proposed development, District at the Quarter, and the proposed water line is designed to be 12" Ductile Iron Pipe. The first connection is to the existing 12" PVC Pipe located at the southeast corner of the site on Greenway Hayden Loop and the

second connection is to the existing 12" ACP Pipe located at the northwest corner of the site on N. Per Section B.2, the area of the largest building (Building II) is used to calculate the fire flow area. The fire flow area was calculated bases on the sum of the floor areas of all doors and the calculated fire flow area was used to determine the fire flow demand by referencing the 2012 IFC – B105.1.

The final submittal will provide the service connections, domestic and landscape meter, fire riser room, and the locations and size of the fire line. The *Preliminary Water Line Plan* has been included in the Appendix as ***Exhibit 5***.

2. **Water Zone**
The project site is located within Pressure Zone 3 per Figure 6.1-3 Pressure Zone Map in the COS DSPM (2010).

3. **Maintenance**
The proposed water system is designed to be public and the City of Scottsdale is to be fully responsible for any maintenance for the system. Once meter locations are proposed and finalized, the project owner will be responsible for all improvements after the associated water meters.

E. COMPUTATIONS

1. **Water Demand for Existing Development**
The land use for existing development is considered as industrial and office use. Based on Figure 6.1-2 in the COS DSPM (2010), the demand for the industrial use is 1,027 $\frac{gpd}{acre}$ and the demand for the office use is 0.6 $\frac{gpd}{sf}$.

Average Day Demand Figure 6.1-2 COS DSPM (2010)

$$= \left(\frac{\text{gpd}}{\text{acres}} \times \text{acres}\right) + \left(\frac{\text{gpd}}{\text{sf}} \times \text{sf}\right)$$
$$= = (1{,}027 \times 8.34) + (0.6 \times 129{,}689)$$
$$= \mathbf{86{,}892\ gpd\ or\ 60.34\ gpm}$$

Maximum Day Demand Section 6-1.404 COS DSPM (2010)

$$= 2 \times \text{Average Day Demand (gpd)}$$
$$= 2 \times 86{,}892$$
$$= \mathbf{173{,}784\ gpd\ or\ 120.68\ gpm}$$

Peak Hour Demand Section 6-1.404 COS DSPM (2010)

$$= 3.5 \times \text{Average Day Demand (gpd)}$$
$$= 3.5 \times 86{,}892$$
$$= \mathbf{304{,}122\ gpd\ or\ 211.20\ gpm}$$

Maximum Day Demand with Fire Flow

Fire Flow
(75% Allowed deduction per 2012 IFC – B105.2)
(Type IB Building)

$$= \text{Fire Flow (gpm)} \times 75\%$$
$$= 6{,}000 \times 75\%$$
$$\mathbf{= 1{,}500\ gpm}$$

Maximum Day Demand with Fire Flow

$$= \text{Maximum Day Demand (gpm)} + \text{Fire Flow(gpm)}$$
$$= 121 + 1{,}500$$
$$\mathbf{= 1{,}621\ gpm}$$

2. **Water Demand for Proposed Development**

The proposed development, District at the Quarter, consist a multi-family apartment with 620 units, 5,000 SF of restaurant and 14,873 SF of commercial. The land use is considered as "High Density Condominium/Residential", "Restaurant" and the demand is 185.3 $\frac{\text{gal}}{\text{unit}}$ based on Figure 6.1-2 in the COS DSPM (2010).

Average Day Demand Figure 6.1-2 COS DSPM (2010)

$$= \left(\frac{\text{gpd}}{\text{unit}} \times \text{units}\right) + \left(\frac{\text{gpd}}{\text{sf}} \times \text{sf}\right) + \left(\frac{\text{gpd}}{\text{sf}} \times \text{sf}\right)$$
$$= (185.3 \times 620) + (1.3 \times 5{,}000) + (0.8 \times 14{,}873)$$
$$\mathbf{= 133{,}284\ gpd\ or\ 92.58\ gpm}$$

Maximum Day Demand Section 6-1.404 COS DSPM (2010)

$$= 2 \times \text{Average Day Demand (gpd)}$$
$$= 2 \times 133{,}284$$
$$\mathbf{= 266{,}568\ gpd\ or\ 185.15\ gpm}$$

Peak Hour Demand Section 6-1.404 COS DSPM (2010)

$$= 3.5 \times \text{Average Day Demand (gpd)}$$
$$= 3.5 \times 133{,}284$$
$$\mathbf{= 466{,}494\ gpd\ or\ 324.02\ gpm}$$

Maximum Day Demand with Fire Flow

Fire Flow
(75% Allowed deduction per 2012 IFC – B105.2)

(Type IA and V-A Building)

= Fire Flow (gpm) × 75%
= 8,000 × 75%
= 2,000 gpm

Maximum Day Demand with Fire Flow

= Maximum Day Demand (gpm) + Fire Flow(gpm)
= 185 + 2,000
= 2,185 gpm

Table 3.0 - Demand Comparison: Existing Development vs. Proposed Development

	Existing Development (gpm)	Proposed Development (gpm)
Average Day Demand	60.34	92.58
Maximum Day Demand	120.68	185.15
Peak Hour Demand	211.20	324.02
Maximum Day Demand with Fire Flow	1,622.00	2,185.15

F. SUMMARY

The proposed water system for the District at the Quarter is designed to meet all the city's design standards and policies. Phase I of the development will include the installation of (1) new fire hydrant and the associated service taps/meters. Phase II will include the installation of a second hydrant as well as ± 1035 LF of 12" Ductile Iron Pipe which will form a loop between the 12" PVC water line within North Greenway Hayden Loop and the 12" APC water line located within N. Dial Blvd. The water model hydraulic results show all pressures and head losses meet the City of Scottsdale's Design and Policy Requirements.

Table 2.0 - Water Model Hydraulic Results

	Proposed Condition	City of Scottsdale Design Requirements	Criteria Met (Y or N)
Minimum Residual Pressure (Average Day Demand)	70 psi	50 psi (Min.)	Y
Maximum Static Pressure (Average Day Demand)	74 psi	120 psi (Max.)	Y
Minimum Pressure (Maximum Day Demand with Fire Flow)	54 psi	30 psi (Min.)	Y
Maximum Headloss (Maximum Day Demand with Fire Flow)	5.69 ft / 1,000 ft	10 ft / 1,000 ft	Y

In summary, due to the change in use from office space to dense residential, the proposed water demand for the District at the Quarter is higher than the existing conditions. However, the proposed water system is designed to meet the pressure requirements in Section 6-1.406 COS DSPM (2010).

H. References

- City of Scottsdale Design Standard and Policies Manual – January 2010
- MAG Uniform Standard Specifications for Public Work Construction – January 2016
- City of Scottsdale Supplement to MAG Uniform Standard Specifications for Public Work Construction - 2015
- International Fire Code - 2012

Aerial Map | **1**

Xrefs: C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP01.dwg
C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP02.dwg
C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Exhibits\Preliminary Design Exhibits\Xref\TBLK_24x36.dwg

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HOU-001.008_AERIAL 5/18/2016 8:44:03 AM

N. SCOTTSDALE RD.

E. TIERRA BUENA LN.

N. DIAL BLVD.

N. 73RD ST.

GREENWAY HAYDEN LOOP

PROJECT SITE
8.832 ACRES

LEGEND
BOUNDARY / RIGHT OF WAY

0 30' 60' 120'

N

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

AERIAL EXHIBIT

SHEET
EX-1
1 OF 1

Registered Professional Engineer (Civil)
CERTIFICATE NO. 53520
BRADLEY LINGVAI
DATE SIGNED
ARIZONA, U.S.A.

832.730.1901
WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744
BIG RED DOG
ENGINEERING | CONSULTING
2500 SUMMER STREET, SUITE 2100 HOUSTON, TEXAS 77007
ARIZONA FIRM NO. 19744

NO.	DATE	REVISION	BY

Existing Conditions | **2**

6
SCOTTSDALE AIRPORT NORTH
APN 215-44-008
OWNER: 7327 TERRA BUENA, LLC
NOT A PART

7
SCOTTSDALE AIRPORT NORTH
APN 215-44-009
OWNER: TERRA BUENA ENTERPRISES, LLC
NOT A PART

8
SCOTTSDALE AIRPORT NORTH
APN 215-44-007
OWNER: ROWLEY BLUE WATER INVESTMENTS, LLC
NOT A PART

4
SCOTTSDALE AIRPORT NORTH
APN 215-44-007
OWNER: ROWLEY BLUE WATER INVESTMENTS, LLC

3
SCOTTSDALE AIRPORT NORTH
APN 215-44-005M
OWNER: HUCKLEBERRY FRIEND, LLC
NOT A PART

5
SCOTTSDALE AIRPORT NORTH
APN 215-44-005M
OWNER: HUCKLEBERRY FRIEND, LLC
NOT A PART

SCOTTSDALE AIRPORT NORTH
APN 215-44-009
OWNER: ROWLEY BLUE WATER INVESTMENTS, LLC

SCOTTSDALE AIRPORT NORTH
APN 215-44-007
OWNER: ROWLEY BLUE WATER INVESTMENTS, LLC

N. DIAL BLVD.
(PUBLIC ROADWAY)

GREENWAY HAYDEN LOOP
(PUBLIC ROADWAY)

MW MH
TOP ELEV. 83.74
FL 10"(NE) 71.26
FL (SE) 71.80
FL 10"(SW) 71.22
FL (NW) 72.18

MW MH
TOP ELEV. 81.31
FL 10"(NE) 70.23
FL (SE) 70.85
FL 10"(SW) 70.19
FL (NW) 70.82

MW MH
TOP ELEV. 78.84
FL 10"(N) 69.18
FL (E) 69.29
FL 10"(S) 69.14
FL (W) 69.25

STM. SWR MH
TOP ELEV. 77.13
FL 18"(SW)73.73

STM. SWR MH
TOP ELEV. 75.80
FL 18"(E)73.20

STM. SWR MH
TOP ELEV. 77.45
FL (NW) 70.65
FL 18"(NE) 71.25
FL 27"(SE) 70.61
FL 18"(W) 71.13

STM. SWR MH
TOP ELEV. 76.67
FL 72.97

STM. SWR MH
TOP ELEV. 77.01
FL 73.71

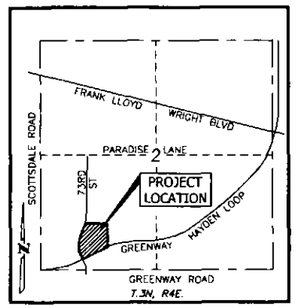
STM. SWR MH
TOP ELEV. 77.24
FL 75.14

MW MH
TOP ELEV. 79.04
FL (NW) 67.54
FL 15"(NE) 68.98
FL 8"(SE) 67.59
FL 15"(SW) 68.85

STM. SWR MH
TOP ELEV. 79.33
FL 42"(SW)-68.71
FL 42"(NE) 69.75

12" W.L.
8" W.L.

0 20' 40' 80'



VICINITY MAP
NOT TO SCALE

ELEVATIONS:
ALL EXISTING AND PROPOSED ELEVATIONS WILL REQUIRE AN ADJUSTMENT OF +1,400 FEET.

CAUTION:
CONTRACTOR TO VERIFY ALL EXISTING UTILITIES VERTICALLY AND HORIZONTALLY PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.

PROJECT CONTACTS

DEVELOPER:
KAPLAN ACQUISITIONS, LLC
520 POST OAK BLVD., SUITE 370
HOUSTON, TEXAS 77027
(713) 977-5699
CONTACT: GEOFF SIMPSON

ENGINEER:
BIG RED DOG ENGINEERING | CONSULTING
2500 SUMMER STREET, SUITE 2100
HOUSTON, TX 77007
(832) 730-1901
CONTACT: MATTHEW STEWART, P.E.

ARIZONA811 BLUE STAKE, INC.
Know what's below. Call 811 or click Arizona811.com before you dig.

SITE INFORMATION:

ADDRESS: 15510 N. 73RD STREET
SCOTTSDALE, ARIZONA 85260

LEGAL DESCRIPTION

LOTS FOUR (4) AND FIVE (5), SCOTTSDALE AIRPARK NORTH, A SUBDIVISION RECORDED IN BOOK 390 OF MAPS, PAGE 33 RECORDS OF MARICOPA COUNTY, ARIZONA,

EXCEPT 1/16TH OF ALL OIL, GASSES AND OTHER HYDROCARBON SUBSTANCES, COAL, STONE, METALS, MINERALS, FOSSILS AND FERTILIZERS OF EVERY NAME AND DESCRIPTION AND EXCEPT ALL MATERIALS WHICH MAY BE ESSENTIAL TO PRODUCTION OF FISSIONABLE MATERIAL AS RESERVED IN ARIZONA REVISED STATUTES.

FLOODPLAIN:

ACCORDING TO THE FLOOD INSURANCE RATE MAP #04013C1760 L DATED OCTOBER 16, 2013, THIS PROPERTY IS LOCATED IN FLOOD ZONE "X" (HATCHED).

BENCHMARK

CITY OF SCOTTSDALE BRASS CAP IN A HANDHOLE 0.4' DOWN AT THE INTERSECTION OF GREENWAY ROAD AND 76TH STREET. ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE:	8.83 ACRES

NO.	DATE	REVISION

WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744
BIG RED DOG
ENGINEERING | CONSULTING
2500 SUMMER STREET, SUITE 2100 HOUSTON, TEXAS 77007
ARIZONA FIRM NO. 19744
832.730.1901

Registered Professional Engineer (Civil)
CERTIFICATE NO.
53520
BRADLEY
LINGVAI
DATE SIGNED
ARIZONA, U.S.A.
Bradley Lingvai

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

EXISTING CONDITIONS

SHEET
EX-1
1 OF 1

Date Plotted: 5/9/2016 7:57 AM
HDU-001.005_EXISTING CONDITIONS

Overall Site Plan & Phasing Plan | **3**

PHASE II (YELLOW)

PHASE I (BLUE)

PROP. FIRE HYDRANT

PROP. 40'X40' BUILDING SETBACK

PROP. COMPACTOR

PROPOSED PROPERTY LINE

PROP. 6" CONCRETE CURB & GUTTER (TYP.)

FIRE LANE

FIRE LANE. (TO BE COMPLETELY INSTALLED IN PHASE I)

PARKING GARAGE

OPEN SPACE

DECK CLUB
2,500 SQ. FT.
FF=XXXX.XX

RESTAURANT
5,000 SQ. FT.
FF=XXXX.XX

FITNESS CENTER
5,373 SQ. FT.
FF=XXXX.XX

POOL AREA

CLUB HOUSE
7,000 SQ. FT.
FF=XXXX.XX

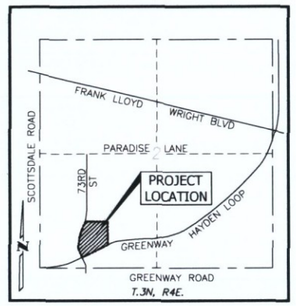
N. DIAL BLVD.
(PUBLIC ROADWAY)

GREENWAY HAYDEN LOOP
(PUBLIC ROADWAY)

0 20' 40' 80'

LEGEND

PROPERTY LINE / RIGHT OF WAY
EASEMENT / SETBACK
CURB & GUTTER



VICINITY MAP
NOT TO SCALE

CAUTION:
CONTRACTOR TO VERIFY ALL EXISTING UTILITIES VERTICALLY AND HORIZONTALLY PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.

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CONTACT: GEOFF SIMPSON

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BIG RED DOG ENGINEERING | CONSULTING
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HOUSTON, TX 77007
(832) 730-1901
CONTACT: MATTHEW STEWART, P.E.

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SITE INFORMATION:

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SCOTTSDALE, ARIZONA 85260

LEGAL DESCRIPTION

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FLOODPLAIN:

ACCORDING TO THE FLOOD INSURANCE RATE MAP #04013C1760 L, DATED OCTOBER 16, 2013, THIS PROPERTY IS LOCATED IN FLOOD ZONE "X" (HATCHED).

BENCHMARK

CITY OF SCOTTSDALE BRASS CAP IN A HANDHOLE 0.4' DOWN AT THE INTERSECTION OF GREENWAY ROAD AND 76TH STREET. ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE: 8.83 ACRES

NO.	DATE	REVISION	BY

WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744
512.669-5560
BIG RED DOG
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
ARIZONA FIRM NO. 19744

Registered Professional Engineer (Civil)
CERTIFICATE NO.
53520
BRADLEY
LINGVAI
DATE SIGNED 4/13/18
ARIZONA, U.S.A.
Bradley J. Lingvai

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

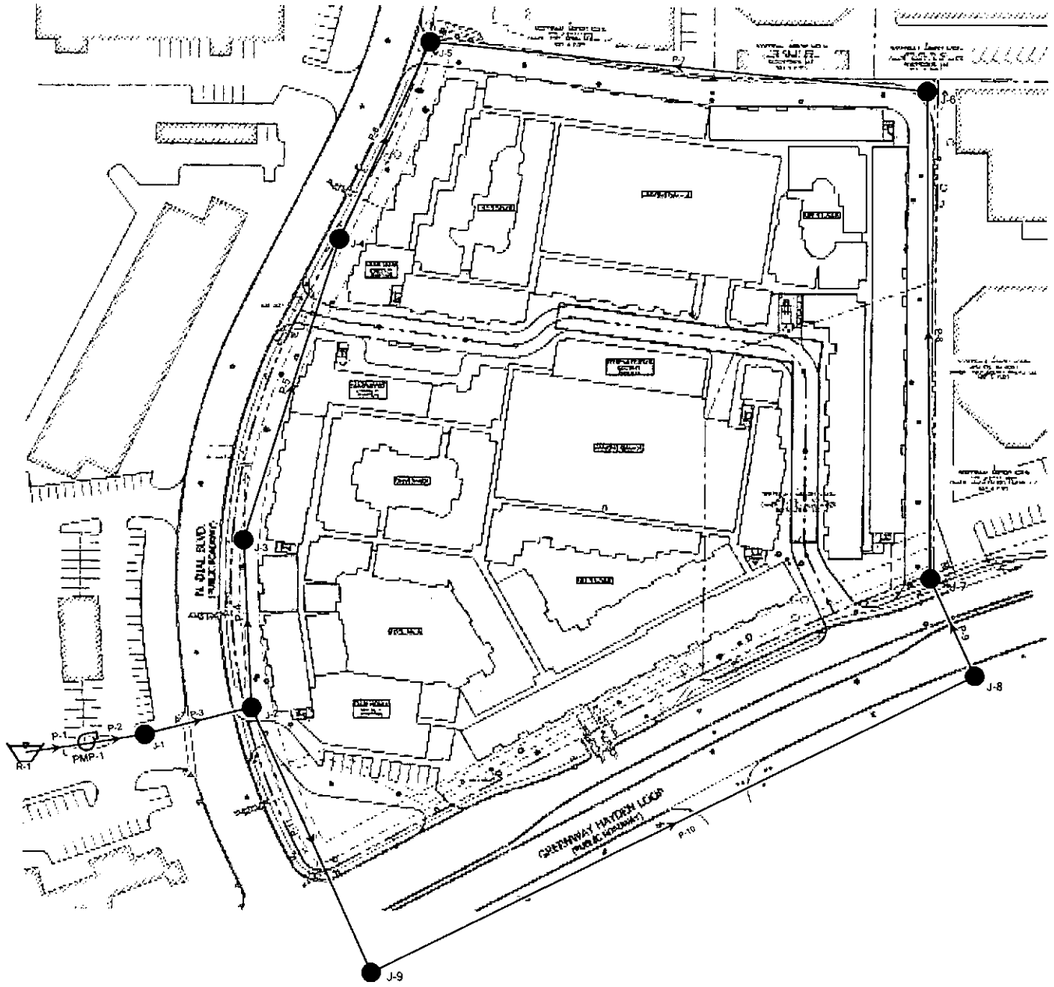
PRELIMINARY SITE PLAN (OVERALL)

SHEET
EX-1
1 OF 3

User: monica.pinals
Last Modified: May 31, 18 - 17:32
Drawing: C:\Dropbox (BRG-Houston)\Houston Projects\HOU-001-Kaplan\001008 - District At the Quarter\ACAD\Exhibits\Preliminary Design Exhibits\3_HOU-001008_SITE PLAN.dwg
3_HOU-001.008_SITE PLAN 5/31/2018 5:37 PM

Overall Site Plan & Phasing Plan | **3**

FlexTable: Juntion Table (Average Day Demand)



FlexTable: Juntion Table (Average Day Demand)

Current Time: 0.000 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Flow (In net) (gpm)	Flow (Out net) (gpm)
R-1	1,480.00	1,480.00	-93	93

FlexTable: Juntion Table (Average Day Demand)

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,480.00	0	1,646.20	72
J-2	1,479.25	0	1,646.20	72
J-3	1,480.00	0	1,646.20	72
J-4	1,480.00	0	1,646.20	72
J-5	1,484.50	93	1,646.20	70
J-6	1,484.36	0	1,646.20	70
J-7	1,480.64	0	1,646.20	72
J-8	1,480.00	0	1,646.20	72
J-9	1,475.80	0	1,646.20	74

FlexTable: Juntion Table (Average Day Demand)

Current Time: 0.000 hours

Label	Diameter (in)	Length (User Defined) (ft)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	48.0	1	Glass	140.0	93	0.02	0.00	0.000
P-2	48.0	1	Glass	140.0	93	0.02	0.00	0.000
P-3	100.0	1	Asbestos Cement	140.0	93	0.00	0.00	0.000
P-4	12.0	179	Asbestos Cement	140.0	59	0.17	0.00	0.012
P-5	12.0	300	Asbestos Cement	140.0	59	0.17	0.00	0.012
P-6	12.0	215	Asbestos Cement	140.0	59	0.17	0.00	0.012
P-7	12.0	467	Ductile Iron	130.0	-33	0.09	0.00	0.005
P-8	12.0	473	Ductile Iron	130.0	-33	0.09	0.00	0.005
P-9	12.0	91	Ductile Iron	130.0	-33	0.09	0.00	0.005
P-10	12.0	633	PVC	150.0	-33	0.09	0.00	0.003
P-11	12.0	266	Asbestos Cement	140.0	-33	0.09	0.00	0.004

FlexTable: Juntion Table (Maximum Day Demand)

Current Time: 0.000 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Flow (In net) (gpm)	Flow (Out net) (gpm)
R-1	1,480.00	1,480.00	-185	185

FlexTable: Juntion Table (Maximum Day Demand)

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,480.00	0	1,645.95	72
J-2	1,479.25	0	1,645.95	72
J-3	1,480.00	0	1,645.95	72
J-4	1,480.00	0	1,645.93	72
J-5	1,484.50	185	1,645.92	70
J-6	1,484.36	0	1,645.93	70
J-7	1,480.64	0	1,645.94	72
J-8	1,480.00	0	1,645.94	72
J-9	1,475.80	0	1,645.95	74

FlexTable: Juntion Table (Maximum Day Demand)

Current Time: 0.000 hours

Label	Diameter (in)	Length (User Defined) (ft)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	48.0	1	Glass	140.0	185	0.03	0.00	0.000
P-2	48.0	1	Glass	140.0	185	0.03	0.00	0.000
P-3	100.0	1	Asbestos Cement	140.0	185	0.01	0.00	0.000
P-4	12.0	179	Asbestos Cement	140.0	118	0.34	0.01	0.042
P-5	12.0	300	Asbestos Cement	140.0	118	0.34	0.01	0.043
P-6	12.0	215	Asbestos Cement	140.0	118	0.34	0.01	0.043
P-7	12.0	467	Ductile Iron	130.0	-67	0.19	0.01	0.017
P-8	12.0	473	Ductile Iron	130.0	-67	0.19	0.01	0.017
P-9	12.0	91	Ductile Iron	130.0	-67	0.19	0.00	0.017
P-10	12.0	633	PVC	150.0	-67	0.19	0.01	0.013
P-11	12.0	266	Asbestos Cement	140.0	-67	0.19	0.00	0.015

FlexTable: Juntion Table (Peak Hour Demand)

Current Time: 0.000 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Flow (In net) (gpm)	Flow (Out net) (gpm)
R-1	1,480.00	1,480.00	-324	324

FlexTable: Juntion Table (Peak Hour Demand)

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,480.00	0	1,645.33	72
J-2	1,479.25	0	1,645.33	72
J-3	1,480.00	0	1,645.30	72
J-4	1,480.00	0	1,645.27	72
J-5	1,484.50	324	1,645.24	70
J-6	1,484.36	0	1,645.26	70
J-7	1,480.64	0	1,645.29	71
J-8	1,480.00	0	1,645.29	72
J-9	1,475.80	0	1,645.31	73

FlexTable: Juntion Table (Peak Hour Demand)

Current Time: 0.000 hours

Label	Diameter (in)	Length (User Defined) (ft)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	48.0	1	Glass	140.0	324	0.06	0.00	0.000
P-2	48.0	1	Glass	140.0	324	0.06	0.00	0.000
P-3	100.0	1	Asbestos Cement	140.0	324	0.01	0.00	0.000
P-4	12.0	179	Asbestos Cement	140.0	207	0.59	0.02	0.119
P-5	12.0	300	Asbestos Cement	140.0	207	0.59	0.04	0.120
P-6	12.0	215	Asbestos Cement	140.0	207	0.59	0.03	0.119
P-7	12.0	467	Ductile Iron	130.0	-117	0.33	0.02	0.047
P-8	12.0	473	Ductile Iron	130.0	-117	0.33	0.02	0.047
P-9	12.0	91	Ductile Iron	130.0	-117	0.33	0.00	0.048
P-10	12.0	633	PVC	150.0	-117	0.33	0.02	0.036
P-11	12.0	266	Asbestos Cement	140.0	-117	0.33	0.01	0.041

FlexTable: Juntion Table (Maximum Day Demand with Fire Flow)

Current Time: 0.000 hours

Label	Elevation (ft)	Hydraulic Grade (ft)	Flow (In net) (gpm)	Flow (Out net) (gpm)
R-1	1,480.00	1,480.00	-2,185	2,185

FlexTable: Juntion Table (Maximum Day Demand with Fire Flow)

Current Time: 0.000 hours

Label	Elevation (ft)	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
J-1	1,480.00	0	1,612.79	57
J-2	1,479.25	0	1,612.79	58
J-3	1,480.00	0	1,612.05	57
J-4	1,480.00	0	1,610.82	57
J-5	1,484.50	2,185	1,609.94	54
J-6	1,484.36	0	1,610.70	55
J-7	1,480.64	0	1,611.47	57
J-8	1,480.00	0	1,611.62	57
J-9	1,475.80	0	1,612.41	59

FlexTable: Juntion Table (Maximum Day Demand with Fire Flow)

Current Time: 0.000 hours

Label	Diameter (in)	Length (User Defined) (ft)	Material	Hazen-Williams C	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	Headloss Gradient (ft/1000ft)
P-1	48.0	1	Glass	140.0	2,185	0.39	0.00	0.000
P-2	48.0	1	Glass	140.0	2,185	0.39	0.00	0.000
P-3	100.0	1	Asbestos Cement	140.0	2,185	0.09	0.00	0.000
P-4	12.0	179	Asbestos Cement	140.0	1,397	3.96	0.73	4.105
P-5	12.0	300	Asbestos Cement	140.0	1,397	3.96	1.23	4.106
P-6	12.0	215	Asbestos Cement	140.0	1,397	3.96	0.88	4.106
P-7	12.0	467	Ductile Iron	130.0	-788	2.23	0.76	1.630
P-8	12.0	473	Ductile Iron	130.0	-788	2.23	0.77	1.630
P-9	12.0	91	Ductile Iron	130.0	-788	2.23	0.15	1.630
P-10	12.0	633	PVC	150.0	-788	2.23	0.79	1.250
P-11	12.0	266	Asbestos Cement	140.0	-788	2.23	0.38	1.420

we typically use 130 for all pipes

prefer to see a table showing avail FF at all Nodes and the system low pressure Node identified.

Reports & Diagram | **4**

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	District at the Quarter
Project Address:	Greenway Hayden & 73rd Street, Scottsdale, Arizona, 85260
Arizona Flow Testing Project No.:	15158
Client Project No.:	4686
Flow Test Permit No.:	C49288
Date and time flow test conducted:	December 8, 2015 at 8:30 AM
Data is current and reliable until:	June 8, 2016
Conducted by:	Floyd Vaughan – Arizona Flow Testing, LLC (480-250-8154)
Witnessed by:	Phil Cipolla –City of Scottsdale-Inspector (602-828-0847)

Raw Test Data

Static Pressure: **84.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **60.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **23.0 PSI** (2½- inch)
23.0 PSI (4-inch)
(Measured in pounds per square inch)

Diffuser Orifice Diameter: One (2 ½-inch)
(Measured in inches) One (4-inch)

Coefficient of Diffuser: .9

Flowing GPM: **2,866 GPM**
(Measured in gallons per minute)
805 GPM + 2,061 GPM = 2,866GPM

GPM @ 20 PSI: **4,867 GPM**

Data with 12 PSI Safety Factor

Static Pressure: **72.0 PSI**
(Measured in pounds per square inch)

Scottsdale requires a maximum Static Pressure of 72 PSI for AFES Design.

Residual Pressure: **48.0 PSI**
(Measured in pounds per square inch)

Distance between hydrants: Approx. 200 Feet

Main size: Not Provided

Flowing GPM: **2,866 GPM**

GPM @ 20 PSI: **4,351 GPM**

Flow Test Location **North**

Preliminary Water Line Plan| **5**

EX – 1 | OVERALL WATER LAYOUT

EX – 2 | PHASE I WATER LAYOUT

EX – 3 | PHASE II WATER LAYOUT

CUT IN TEE

CONNECT TO EXISTING 12" WATER LINE

EXISTING F.H.

PROPOSED FIRE LANE

PROPOSED 12" WATER LINE

20'

PROPOSED F.H.

SCOTTSDALE AIRPORT NORTH
APN: 215-44-008
OWNER: TIERRA BUENA, LLC
NOT A PART

SCOTTSDALE AIRPORT NORTH
APN: 215-44-009
OWNER: TIERRA BUENA ENTERPRISES, LLC
NOT A PART

SCOTTSDALE AIRPORT NORTH
APN: 215-44-007
OWNER: ROWLEY BLUE WATER INVESTMENTS, LLC
NOT A PART

WW MH
TOP ELEV. 83.74
FL 10"(NE) 71.26
FL (SE) 71.80
FL 10"(SW) 71.22
FL (NW) 72.18

OPEN SPACE

PARKING GARAGE

DECK CLUB
2,500 SQ. FT.
FF=XXXX.XX

PROPOSED FIRE LANE

PROPOSED 12" WATER LINE

10' W.L.E.

(typ)
Need to be Adj to 4' PUE
~~TOTAL OF~~
20'

ELEC. VAULT

WW MH
TOP ELEV. 81.31
FL 10"(NE) 70.23
FL (SE) 70.85
FL 10"(SW) 70.19
FL (NW) 70.92

RESTAURANT
5,000 SQ. FT.
FF=XXXX.XX

FITNESS CENTER
5,373 SQ. FT.
FF=XXXX.XX

PARKING GARAGE

OPEN SPACE

SCOTTSDALE AIRPORT NORTH
APN: 215-44-005H
OWNER: HUCKLEBERRY FRIEND, LLC
NOT A PART

SCOTTSDALE AIRPORT NORTH
APN: 215-44-005K
OWNER: ROWLEY BLUE WATER INVESTMENTS, LLC
NOT A PART

PROPOSED FIRE LANE

PROPOSED F.H.

EXISTING F.H.

N. DIAL BLVD.
(PUBLIC ROADWAY)

OPEN SPACE

POOL AREA

CLUB HOUSE
7,000 SQ. FT.
FF=XXXX.XX

PROPOSED 12" WATER LINE

EXISTING F.H.

CONNECT TO EXISTING 12" WATER LINE

CUT IN TEES

GREENWAY HAYDEN LOOP
(PUBLIC ROADWAY)

STM. SWR. MH
TOP ELEV. 77.45
FL (NW) 70.85
FL 18"(NE) 71.23
FL 27"(SE) 70.67
FL 18"(W) 71.13

STM. SWR. INLET
TOP ELEV. 77.13
FL 18"(S) 73.73

STM. SWR. INLET
TOP ELEV. 76.90

STM. SWR. INLET
TOP ELEV. 77.01
FL 18"(S) 73.71

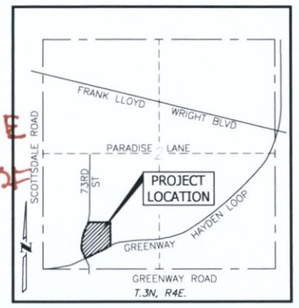
STM. SWR. MH
TOP ELEV. 77.24
FL 72.14

STM. SWR. INLET
TOP ELEV. 76.67
FL 72.97

0 20' 40' 80'

LEGEND

- BOUNDARY / RIGHT OF WAY
- EASEMENT / SETBACK
- CURB & GUTTER
- W — W — WATER LINE
- FIRE LANE
- WATER METER/VAULT
- FIRE HYDRANT
- WATER VALVE
- BFP — BACKFLOW PREVENTER



VICINITY MAP

NOT TO SCALE

ELEVATIONS:
ALL EXISTING AND PROPOSED ELEVATIONS WILL REQUIRE AN ADJUSTMENT OF +1,400 FEET.

CAUTION:
CONTRACTOR TO VERIFY ALL EXISTING UTILITIES VERTICALLY AND HORIZONTALLY PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.

PROJECT CONTACTS

DEVELOPER:
KAPLAN ACQUISITIONS, LLC
520 POST OAK BLVD., SUITE 370
HOUSTON, TEXAS 77027
(713) 977-5699
CONTACT: GEOFF SIMPSON

ENGINEER:
BIG RED DOG ENGINEERING | CONSULTING
2500 SUMMER STREET, SUITE 2100
HOUSTON, TX 77007
(832) 730-1901
CONTACT: MATTHEW STEWART, P.E.

ARIZONA811
Know what's below.
Call 811 or click Arizona811.com before you dig.

SITE INFORMATION:

ADDRESS: 15510 N. 73RD STREET
SCOTTSDALE, ARIZONA 85260

LEGAL DESCRIPTION

LOTS FOUR (4) AND FIVE (5), SCOTTSDALE AIRPARK NORTH, A SUBDIVISION RECORDED IN BOOK 390 OF MAPS, PAGE 33 RECORDS OF MARICOPA COUNTY, ARIZONA.

FLOODPLAIN:

ACCORDING TO THE FLOOD INSURANCE RATE MAP #04013C1760 L, DATED OCTOBER 16, 2013, THIS PROPERTY IS LOCATED IN FLOOD ZONE "X" (HATCHED).

BENCHMARK

CITY OF SCOTTSDALE BRASS CAP IN A HANDHOLE 0.4' DOWN AT THE INTERSECTION OF GREENWAY ROAD AND 76TH STREET. ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE: 8.83 ACRES

REVISION | NO. | DATE | BY

BIG RED DOG
WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
ARIZONA FIRM NO. 19744
512.669.5560

Registered Professional Engineer
CERTIFICATE NO.
53520
BRADLEY LINGVAI
DATE SIGNED 6/15/16
ARIZONA U.S.A.
Bradley Lingvai

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

PRELIMINARY WATER LINE PLAN (OVERALL)

SHEET
EX-1
1 OF 3

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User: marcia.prieto
Last Modified: May 31, 19 - 17:26
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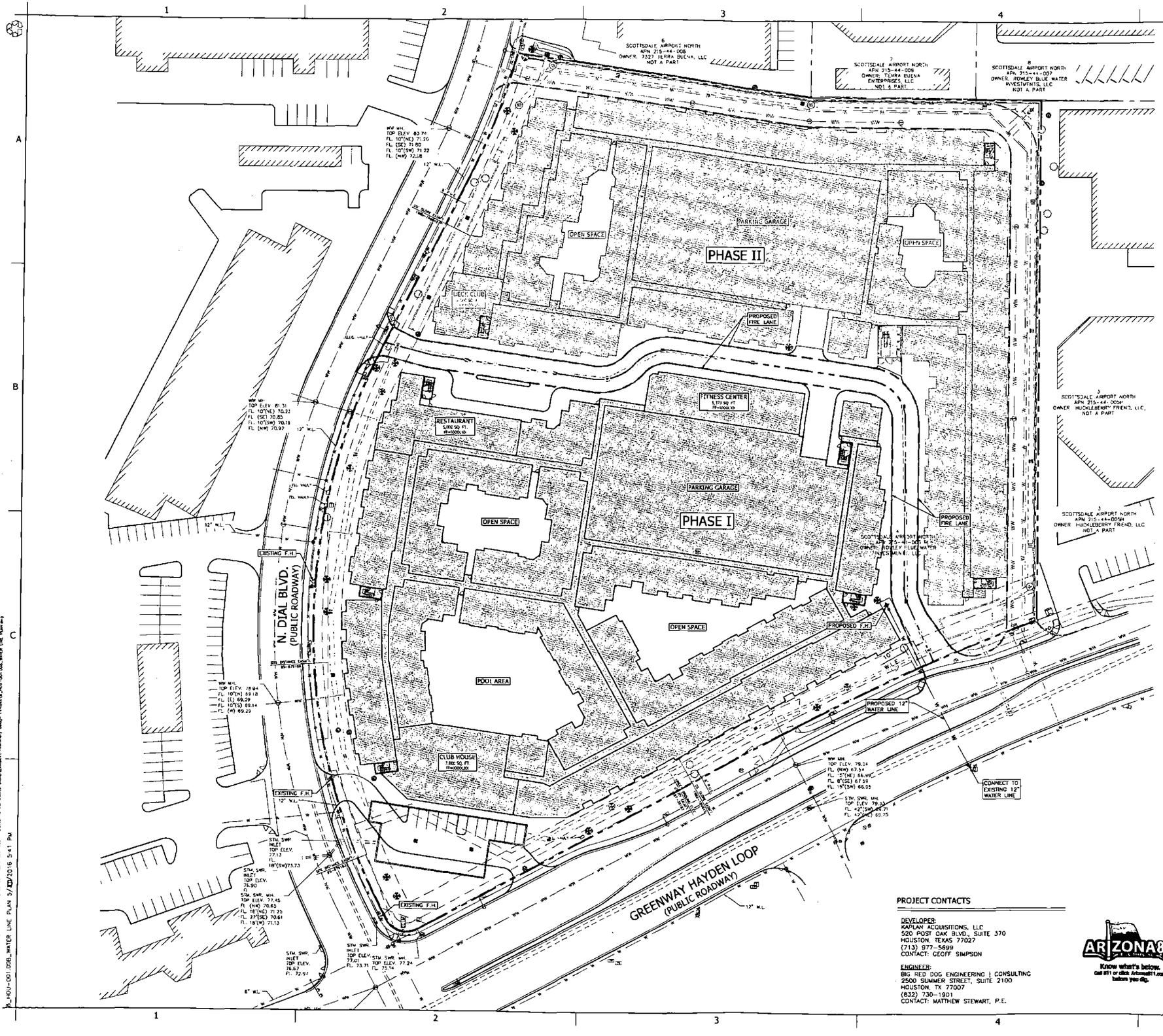
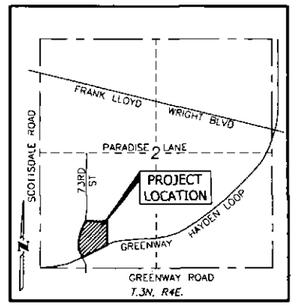


LEGEND

- BOUNDARY / RIGHT OF WAY
- EASEMENT / SETBACK
- CURB & GUTTER
- WATER LINE
- FIRE LANE
- WATER METER/VAULT
- FIRE HYDRANT
- WATER VALVE
- BFP — BACKFLOW PREVENTER



VICINITY MAP

NOT TO SCALE

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LAND USE SUMMARY:

GROSS ACREAGE:	8.83 ACRES

PROJECT CONTACTS

DEVELOPER:
KAPLAN ACQUISITIONS, LLC
520 POST OAK BLVD., SUITE 370
HOUSTON, TEXAS 77027
(713) 977-5699
CONTACT: GEOFF SIMPSON

ENGINEER:
BIG RED DOG ENGINEERING | CONSULTING
2500 SUMMER STREET, SUITE 2100
HOUSTON, TX 77007
(832) 730-1901
CONTACT: MATTHEW STEWART, P.E.

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NO.	DATE	REVISION	BY
		A	

WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 18744
512.669-5560
BIG RED DOG
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
ARIZONA FIRM NO. 18744

Registered Professional Engineer — CERTIFICATE NO. 53520 — BRADLEY LINGVAY — DATE SIGNED — ARIZONA U.S.A.
Bradley J Lingvai

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

PRELIMINARY WATER LINE PLAN (PHASE I)

SHEET
EX-2
2 OF 3

Plotted: May 31, 16 - 12:28
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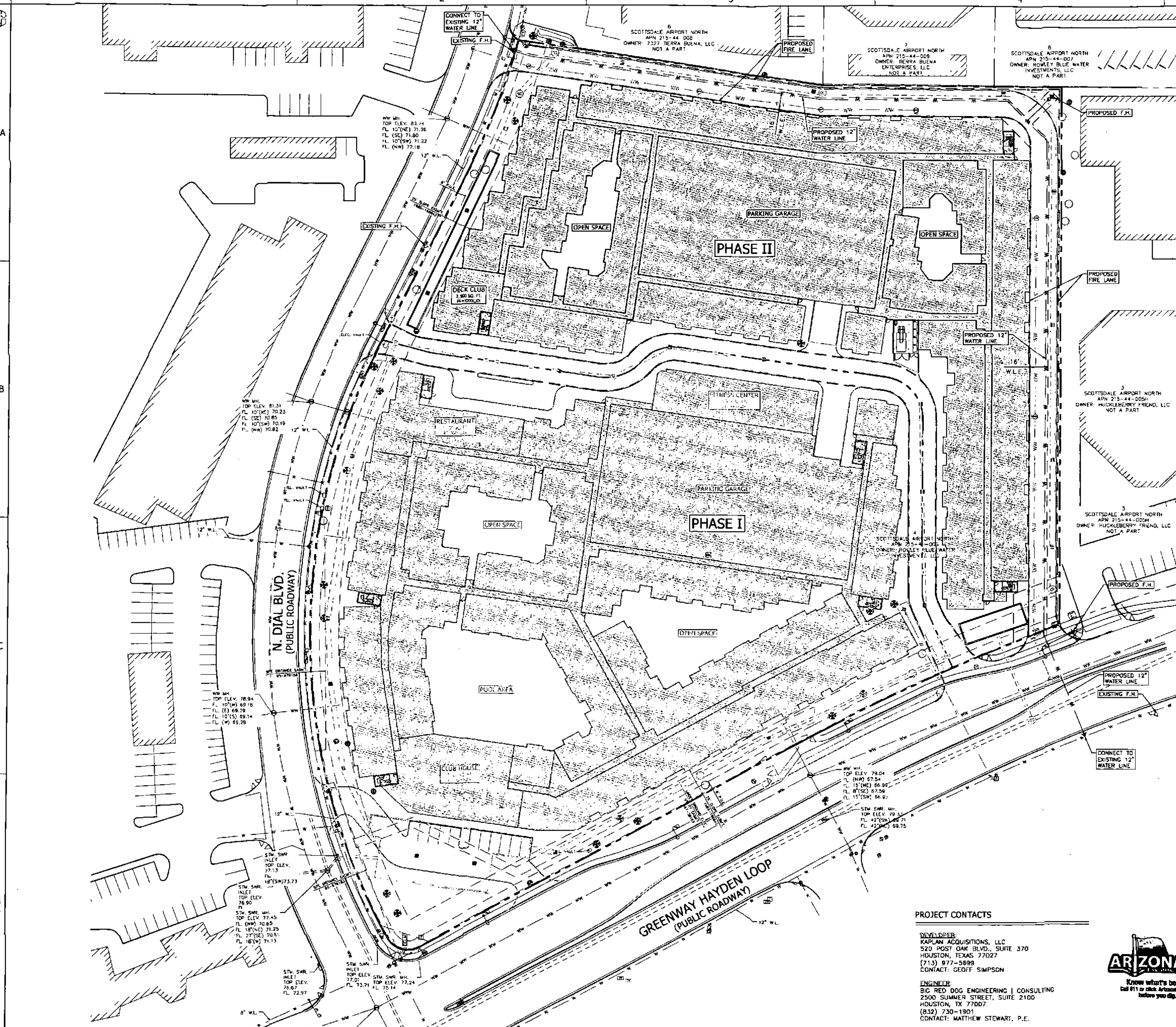
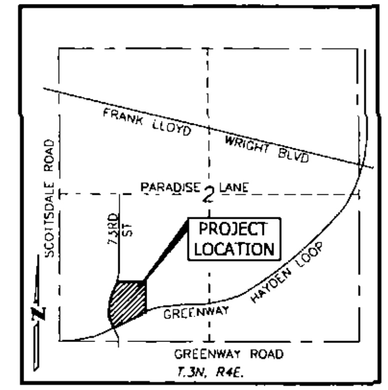


LEGEND

BOUNDARY / RIGHT OF WAY	
EASEMENT / SETBACK	
CURB & GUTTER	
— W — W —	WATER LINE
FIRE LANE	
WATER METER/VAULT	
FIRE HYDRANT	
WATER VALVE	
BFP	BACKFLOW PREVENTER



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CONTACT: GEOFF SIMPSON

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LAND USE SUMMARY:

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NO.	DATE	REVISION	BY

512.669-5560
WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744
BIG RED DOG
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
ARIZONA FIRM NO. 19744

Registered Professional Engineer (Civil)
CERTIFICATE NO. 53520
BRADLEY LINGVAI
DATE SIGNED 4/1/2016
ARIZONA U.S.A.
Bradley J. Lingvai

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

PRELIMINARY WATER LINE PLAN (PHASE II)

SHEET
EX-3
3 OF 3

B_HOU-001.008_WATER LINE PLAN 5/10/2016 5:42 PM

File Copy

BIG RED DOG
ENGINEERING | CONSULTING

PRELIMINARY WASTEWATER REPORT

FOR

"DISTRICT AT THE QUARTER"

NEC OF N. GREENWAY HAYDEN LOOP & N. DIAL BLVD
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

Registered Professional Engineer
CERTIFICATE NO.
53520
BRADLEY
LINGVAI
DATE SIGNED 6/1/2016
ARIZONA U.S.A.
Bradley J Lingvai

PREPARED FOR:

KAPLAN ACQUISITIONS, LLC
7150 EAST CAMELBACK ROAD, SUITE 444
SCOTTDALE, MARICOPA COUNTY, ARIZONA 85251

PREPARED BY:

BIG RED DOG ENGINEERING | CONSULTING, INC.
2021 E. 5TH STREET SUITE 110
AUSTIN, TEXAS 78702
ARIZONA ENGINEERING FIRM NO. 19744
BRD H001.008

Accepted w/Comments

City of Scottsdale
Water Resources Administration
9379 E. San Salvador
Scottsdale, AZ 85258

MAY 2016

3-GP-16 & 8-ZN-16
6/14/16

Doug Mann 6.28.16

BIG RED DOG
ENGINEERING | CONSULTING

H001.008

June 1, 2016

City of Scottsdale
Planning and Development
7447 E Indian School Rd
Scottsdale, AZ 85251

RE: Preliminary Engineering Reports
District At Quarter
NEC Greenway Hayden Loop & N Dial Blvd
Scottsdale, Maricopa County, Arizona

To Whom It May Concern:

Please let this letter and enclosed report serve as our formal Preliminary Basis of Design for the proposed development, District at the Quarter, at the northeast corner of N Greenway Hayden Loop and N Dial Boulevard. The proposed development will include the demolition of the existing structures followed by the construction of a ± 620 unit multi-story apartment complex which will be composed of (2) buildings wrapped around (2) structural parking garages along with all associated grading, drainage, utility, landscape, and hardscape improvements.

The subject site is currently zoned Industrial Park (I-1) and is in the process of being rezoned to Planned Unit Development (PUD). The associated General Plan Amendment and Rezoning Applications are currently under as application numbers 3-GP-2016 and 8-ZN-2016.

The 1st round of comments from the aforementioned cases have been received by the owner and design team and have been addressed accordingly. From our correspondence, it is our understanding that the preliminary reports which were previously submitted by a different engineer did not receive any comments. However, since the reports have been submitted, the owner has changed architects and engineers on the design team. Because of this, and since the site plan has changed to address the aforementioned comments (including changing from a podium style deal to a wrap-style deal), we have prepared new reports under Big Red Dog.

Please feel free to contact me at 832-730-1901 or at Patrick.Byrne@BIGREDDOG.com if you have any questions or concerns in regards to the information contained herein.. We appreciate you working with us as we move forward with the associated development.

Sincerely,

BIG RED DOG Engineering | Consulting
Texas Engineering Firm No. F-15415

Patrick Byrne

Patrick Byrne
Principal

Table of Contents

Appendix

A. INTRODUCTION

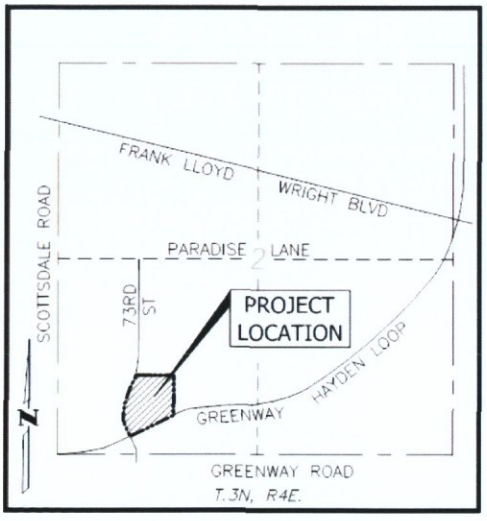
H001.008

1. **Site Location / Description**

The subject site associated with this Preliminary Sanitary Report is for a proposed development, District at the Quarter, located at the northeast corner of N. Greenway Hayden Loop and N. Dial Blvd., in the Full Purpose Limits of the City of Scottsdale, AZ (see vicinity map and aerial below). The ±8.84 acre site is currently developed with a ±129,689 SF Office Building / Warehouse space, with associated utilities, desert landscaping, roadways and 4 retention ponds located throughout the site.

The proposed development will include the demolition of all existing structures followed by the construction of a ±620 unit multi-story apartment complex which will be composed of (2) buildings wrapped around (2) structural parking garages along with all associated grading, drainage, utility, landscape, and hardscape improvements.

The subject site is currently zoned Industrial Park (I-1) and is in the process of being rezoned to Planned Unit Development (PUD). The associated General Plan Amendment and Rezoning Applications are currently underway as application numbers 3-GP-2016 and 8-ZN-2016.



VICINITY MAP
NOT TO SCALE

2. **Purpose / Objective**

The purpose of this Preliminary Sanitary Report is to identify and analyze the existing and proposed sanitary utility conditions and characteristics as it relates to the proposed development.

B. DESIGN DOCUMENTATION

1. **Design Criteria**

District at the Quarter is to be designed to meet the requirements of the following:

- *City of Scottsdale Design Standard and Policies Manual (2010)*
- *MAG Uniform Standard Specifications for Public Work Construction (2016 Rev. to 2015 Ed.)*
- *City of Scottsdale Supplement to MAG Uniform Standard Specifications for Public Work Construction (2015)*
- *International Fire Code (2012)*

2. **Methodologies**

Design standards were taken from Section 7-1.403 of the City of Scottsdale Design Standards and Policies: Chapter 7 – Wastewater. Average and Peak value factors can be seen on Figure 7.1-2 Average Day Sewer Demand in Gallons.

C. EXISTING CONDITIONS

1. **Zoning / Land Use**

The ±8.84 acre site is currently zoned (I-1) Industrial Park district and is currently developed with a ± 129,689 SF office building / warehouse, with all associated parking, desert landscaping, utilities, and stormwater retention ponds. The site is currently in the process of being rezoned to Planned Unit Development (PUD). The associated General Plan Amendment and Rezoning Applications are currently underway as application numbers 3-GP-2016 and 8-ZN-2016.

2. **Existing Topography / Vegetation**

The highest elevation point is 1,486 feet, along the northeast property line, with the lowest at 1,477 feet along the southwest property line, above Mean Sea Level. The site generally slopes from northeast to southwest. The site is fully developed but the required landscaping within the parking lots is made up of desert landscape area.

3. **Existing Utilities**

The existing sanitary system consists of a 15-inch VCP sewer main located northwest of the site and extends along N. Greenway Hayden Loop. A 10-inch VCP sewer main is also located to the west of the site along N. Dial Boulevard. An 8-inch VCP southwest of the site collects the flow and connects it to the 15-inch VCP located along N Greenway Hayden Loop. Two 8-inch VCP mains to the west of the site merge and connect the flow to the 10-inch VCP located along N. Dial Boulevard. Reference the *Existing Conditions* in the Appendix as **Exhibit 2**.

D. PROPOSED CONDITIONS

1. **Proposed Sanitary Layout – Phase 1**

Multiple sanitary sewer stubs are proposed in the N. Dial Blvd ROW to the restaurant, and south of the restaurant to the proposed development. The final stub in Phase 1 will occur along the south property line from N. Greenway Hayden Loop to the development. A *Preliminary Sanitary Sewer Layout* is in the Appendix of this report as **Exhibit 3.**

2. **Proposed Sanitary Layout – Phase 2**

Sanitary lines are proposed in the fire lane along the northern and eastern property lines. These lines will stub from N. Greenway Hayden Loop and N. Dial Blvd. from the proposed lines in the fire lane, multiple stubs are then proposed to the development. One more stub will occur in N. Dial Blvd.

and will tie into the proposed building north of the interior drive aisle. A *Preliminary Sanitary Sewer Layout* is in the Appendix of this report as **Exhibit 3.**

3. **Maintenance**

Sanitary infrastructure associated with Phase I will solely be service connections to existing lines within N Dial Blvd. and N Greenway Hayden Loop and therefore no public sanitary infrastructure is proposed with Phase I.

Phase II will require public sanitary lines to be installed within the 20' utility easement within the fire lane on the north and east side of the subject site. These lines will convey flows from the Phase II Building to N Dial Blvd. and N Greenway Hayden Loop and will be maintained by the City of Scottsdale.

E. COMPUTATIONS

1. **Average Day Sewer Demand and Peak Flow for Existing Building**

The calculation for the average day sewer demand and peak flow for existing conditions are based off Design Flows located in Chapter 7 Section 7-1.403. Per the aforementioned table, "office" and "industrial" uses have a flow demand of 0.5 gallons per sf.

$$\text{Average Day Demand} = \left(\frac{gpd}{sf}\right) * (\text{sf})$$
$$= (0.5) * (129{,}689)$$
$$= \mathbf{64{,}845\ gpd}$$

$$\text{Peak Flow} = (\text{Peaking Factor}) * (\text{Average Day Demand})$$
$$= (3) * (64{,}845)$$
$$= \mathbf{194{,}535\ gpd}$$

2. **Average Day Sewer Demand and Peak Flow for Phase 1 of Proposed Development.**

The proposed development consists of two phases with a total of 620 apartment units. Phase 1 contains 330 apartment units, 5,000 sf of restaurant space, a 5,373 sf fitness center, and 7,000 sf club house. Calculations for the proposed development are based of Design Flows Chapter 7 Section 7-1.403.

Apartment

$$\textbf{Average Day Demand} = \left(100\ \frac{gpc}{d}\right) * (\text{Demand Per Unit}) * (\text{Units})$$
$$= (100) * (2.5) * (330)$$
$$= \mathbf{82{,}500\ gpd}$$

$$\textbf{Peak Flow} = (\text{Peak Factor}) * (\text{Average Day Demand})$$
$$= (4) * (82{,}500)$$
$$= \mathbf{330{,}000\ gpd}$$

Restaurant

$$\textbf{Average Day Demand} = \left(\frac{gpd}{sf}\right) * (\text{sf})$$

$= (1.2) * (5{,}000)$
$= \mathbf{6{,}000\ gpd}$

Peak Flow $= (\text{Peak Factor}) * (\text{Average Day Demand})$
$= (6) * (6{,}000)$
$= \mathbf{36{,}000\ gpd}$

Fitness Center

Average Day Demand $= \left(\frac{g}{sf}\right) * (\text{sf})$
$= (0.4) * (5{,}373)$
$= \mathbf{2{,}149.2\ gpd}$

Peak Flow $= (\text{Peak Factor}) * (\text{Average Day Demand})$
$= (3) * (2{,}149.2)$
$= \mathbf{6{,}447.6\ gpd}$

Club House

Average Day Demand $= \left(\frac{g}{sf}\right) * (\text{sf})$
$= (0.4) * (7{,}000)$
$= \mathbf{2{,}800\ gpd}$

Peak Flow $= (\text{Peak Factor}) * (\text{Average Day Demand})$
$= (3) * (2{,}800)$
$= \mathbf{8{,}400\ gpd}$

Combined

Average Day Demand $= \text{Apartment} + \text{Restaurant} + \text{Fitness Center} + \text{Club House}$
$= 82{,}500 + 6{,}000 + 2{,}149.2 + 2{,}800$
$= \mathbf{93{,}449.2\ gpd}$

Peak Flow $= \text{Apartment} + \text{Restaurant} + \text{Fitness Center} + \text{Club House}$
$= 330{,}000 + 36{,}000 + 6{,}447.6 + 8{,}400$
$= \mathbf{380{,}848\ gpd}$

3. **Average Day Sewer Demand and Peak Flow for Phase 2 of Proposed Development.**
The proposed development consists of two phases with a total of 620 apartment units. Phase 2 contains 290 apartment units, and a 2,500 sf deck club. Calculations for the proposed development are based of Design Flows Chapter 7 Section 7-1.403.

Apartment

Average Day Demand $= \left(100\ \frac{gpc}{d}\right) * (\text{Demand Per Unit}) * (\text{Units})$
$= (100) * (2.5) * (290)$
$= \mathbf{72{,}500\ gpd}$

Peak Flow $= (\text{Peak Factor}) * (\text{Average Day Demand})$

$= (4) * (72{,}500)$
$= \mathbf{290{,}000\ gpd}$

Deck Club

Average Day Demand $= \left(\frac{g}{sf}\right) * (\text{sf})$
$= (1.2) * (2{,}500)$
$= \mathbf{3{,}000\ gpd}$

Peak Flow $= (\text{Peak Factor}) * (\text{Average Day Demand})$
$= (6) * (3{,}000)$
$= \mathbf{18{,}000\ gpd}$

Combined

Average Day Demand $= \text{Apartment} + \text{Deck Club}$
$= 72{,}500 + 3{,}000$
$= \mathbf{75{,}500\ gpd}$

Peak Flow $= \text{Apartment} + \text{Deck Club}$
$= 290{,}000 + 18{,}000$
$= \mathbf{308{,}000\ gpd}$

4. **Combined Demand for Proposed Development**

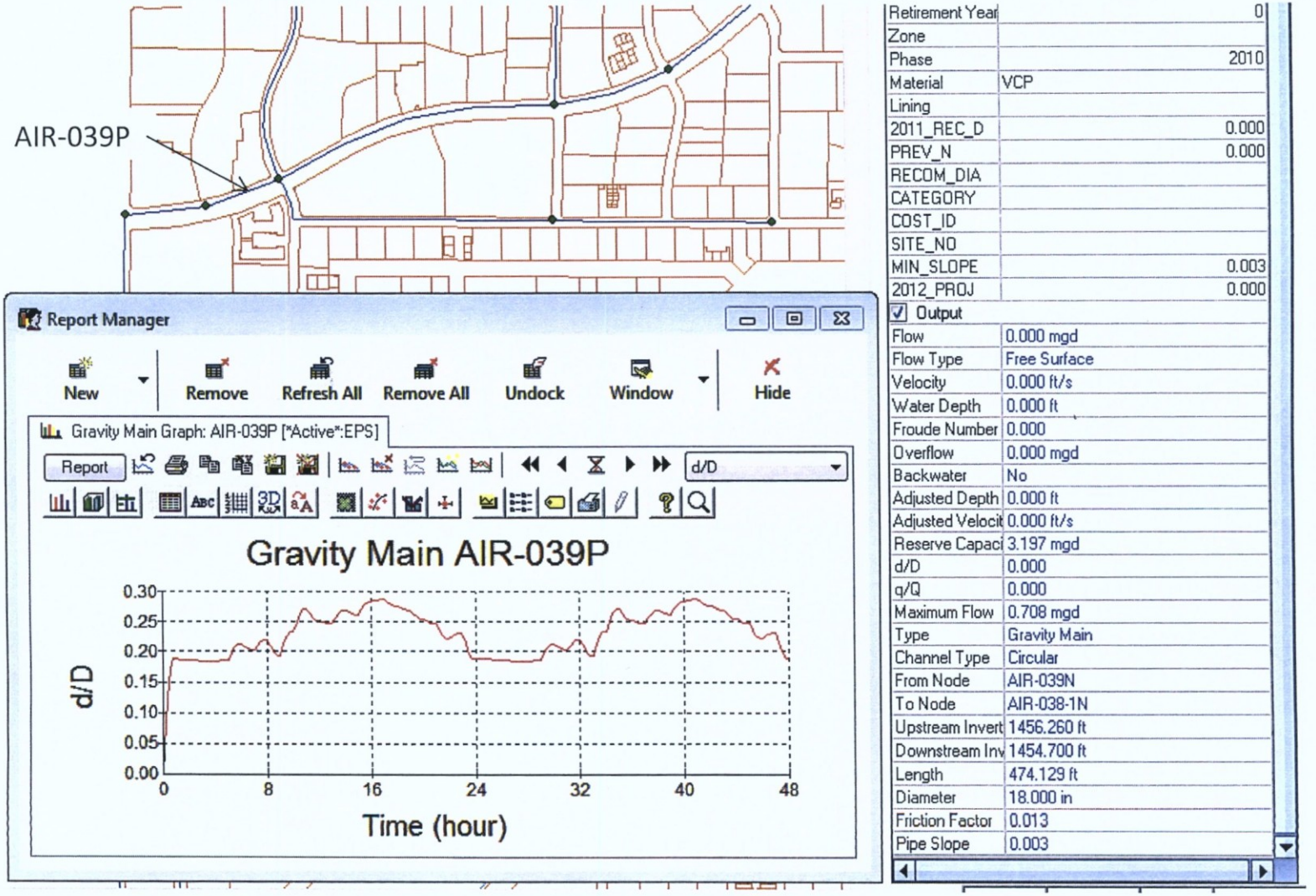
The combined development consists of 620 Apartment units, a Restaurant, Fitness Center, Club House, and Deck Club.

Average Day Demand $= \text{Phase 1} + \text{Phase 2}$
$= 93{,}449.2 + 97{,}500$
$= \mathbf{190{,}949.2\ gpd}$

Peak Flow $= \text{Phase 1} + \text{Phase 2}$
$= 380{,}848 + 308{,}000$
$= \mathbf{688{,}848\ gpd}$

F. DESIGN DOCUMENTATION

Design of the sanitary infrastructure has been done according to The City of Scottsdale Design Standards and Policies Manual: Chapter 7 – Wastewater, as well as Maricopa Associate of Governments (MAG) Uniform Standard Specifications and Details for Public Works Construction. The design complies with pipe size, material, location/placement, design flows and hydraulic requirements, as pointed out in the above references design manuals.



Retirement Year	0
Zone	
Phase	2010
Material	VCP
Lining	
2011_REC_D	0.000
PREV_N	0.000
RECOM_DIA	
CATEGORY	
COST_ID	
SITE_NO	
MIN_SLOPE	0.003
2012_PROJ	0.000
☑ Output	
Flow	0.000 mgd
Flow Type	Free Surface
Velocity	0.000 ft/s
Water Depth	0.000 ft
Froude Number	0.000
Overflow	0.000 mgd
Backwater	No
Adjusted Depth	0.000 ft
Adjusted Velocit	0.000 ft/s
Reserve Capaci	3.197 mgd
d/D	0.000
q/Q	0.000
Maximum Flow	0.708 mgd
Type	Gravity Main
Channel Type	Circular
From Node	AIR-039N
To Node	AIR-038-1N
Upstream Invert	1456.260 ft
Downstream Inv	1454.700 ft
Length	474.129 ft
Diameter	18.000 in
Friction Factor	0.013
Pipe Slope	0.003

G. SUMMARY

This Preliminary Sanitary Report outlines the existing and proposed conditions of the ±8.84 acre development located at the northeast corner of N. Greenway Hayden Loop and N. Dial Blvd, to include calculations and infrastructure layout. Current infrastructure has been captured from the City of Scottsdale GIS and design is in accordance with the design manuals referenced in Section H. References.

BIG RED DOG has proposed two stub located at N. Greenway Hayden Loop, as well as four stubs from N. Dial Blvd. The fire lane will contain sanitary lines along the northern and eastern property line with multiple stubs to the proposed buildings.

	Demand Scenario	
	Existing Conditions (gpd)	Proposed Conditions (gpd)
Average Daily Flow	64,845	190,449.2
Peak Flow	194,535	695,848

H. REFERENCES

City of Scottsdale, Design Standards and Policies Manual: Chapter 7 – Wastewater – January 2010

MAG Uniform Standard Specifications and Details for Public Works Construction – January 2016

Scottsdale Geographic Information Systems – Water and Sewer Quarter Section Map 35-45

So why has OPPSITE sewer CAPACITY to SERVE this proposed Zoning CASE Not been Addressed AS previously commented on. pls include documentation/discussion in FINAL BOD.

Aerial Map | 1

Xrefs: C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP01.dwg
C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP02.dwg
C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Exhibits\Preliminary Design Exhibits\Xref\TBLK_24x36.dwg

User: admin
Last Modified: May. 18, 16 - 08:43
Drawing: C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Exhibits\Preliminary Design Exhibits\HOU-001.008_AERIAL.dwg

HOU-001.008_AERIAL 5/18/2016 8:44 AM

N. SCOTTSDALE RD.

E. TIERRA BUENA LN.

N. DIAL BLVD.

N. 73RD ST.

GREENWAY HAYDEN LOOP

PROJECT SITE
8.832 ACRES

LEGEND
BOUNDARY / RIGHT OF WAY

0 30' 60' 120'

N

SHEET
EX-1
1 OF 1

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

AERIAL EXHIBIT

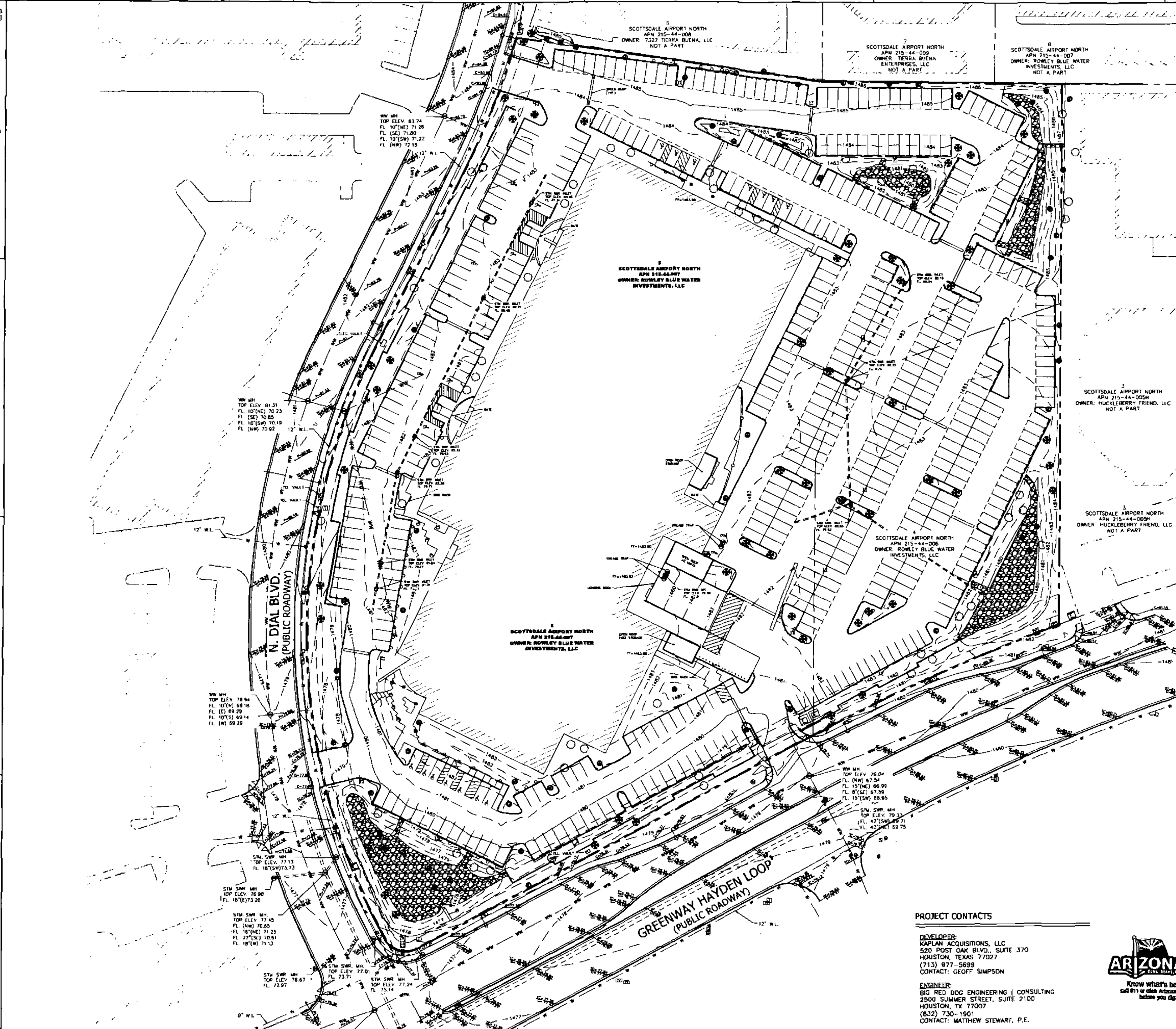
Registered Professional Engineer
CERTIFICATE NO. 53520
BRADLEY LINGVAI
DATE SIGNED
ARIZONA, U.S.A.
(CIVIL)

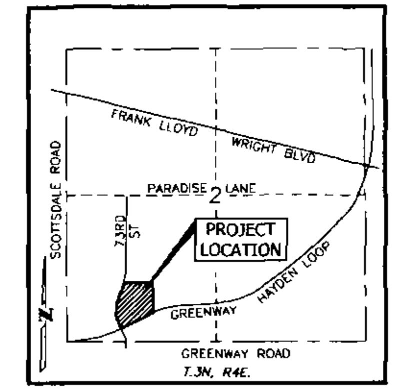
832.730.1901
WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744

BIG RED DOG
ENGINEERING | CONSULTING
2500 SUMMER STREET, SUITE 2100 HOUSTON, TEXAS 77007
ARIZONA FIRM NO. 19744

NO.	DATE	REVISION	BY

Existing Conditions | **2**





VICINITY MAP
NOT TO SCALE

ELEVATIONS:
ALL EXISTING AND PROPOSED ELEVATIONS WILL REQUIRE AN ADJUSTMENT OF +1,400 FEET.

CAUTION:
CONTRACTOR TO VERIFY ALL EXISTING UTILITIES VERTICALLY AND HORIZONTALLY PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.

PROJECT CONTACTS

DEVELOPER:
KAPLAN ACQUISITIONS, LLC
520 POST OAK BLVD., SUITE 370
HOUSTON, TEXAS 77027
(713) 977-5699
CONTACT: GEOFF SIMPSON

ENGINEER:
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HOUSTON, TX 77007
(832) 730-1901
CONTACT: MATTHEW STEWART, P.E.

ARIZONA 811
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SITE INFORMATION:

ADDRESS: 15510 N. 73RD STREET
SCOTTSDALE, ARIZONA 85260

LEGAL DESCRIPTION

LOTS FOUR (4) AND FIVE (5), SCOTTSDALE AIRPARK NORTH, A SUBDIVISION RECORDED IN BOOK 390 OF MAPS, PAGE 33 RECORDS OF MARICOPA COUNTY, ARIZONA;

EXCEPT 1/16TH OF ALL OIL, GASSES AND OTHER HYDROCARBON SUBSTANCES, COAL, STONE, METALS, MINERALS, FOSSILS AND FERTILIZERS OF EVERY NAME AND DESCRIPTION AND EXCEPT ALL MATERIALS WHICH MAY BE ESSENTIAL TO PRODUCTION OF FISSIONABLE MATERIAL AS RESERVED IN ARIZONA REVISED STATUTES.

FLOODPLAIN:

ACCORDING TO THE FLOOD INSURANCE RATE MAP #04013C1760 L, DATED OCTOBER 16, 2013, THIS PROPERTY IS LOCATED IN FLOOD ZONE "X" (HATCHED).

BENCHMARK

CITY OF SCOTTSDALE BRASS CAP IN A HANDHOLE 0.4' DOWN AT THE INTERSECTION OF GREENWAY ROAD AND 76TH STREET. ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE:	8.83 ACRES

NO.	DATE	REVISION	BY

WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744
832.730.1901
BIG RED DOG
ENGINEERING | CONSULTING
2500 SUMMER STREET, SUITE 2100 HOUSTON, TEXAS 77007
ARIZONA FIRM NO. 19744

Registered Professional Engineer (Civil) CERTIFICATE NO. 53520 BRADLEY LINGVAI DATE SIGNED ARIZONA U.S.A.

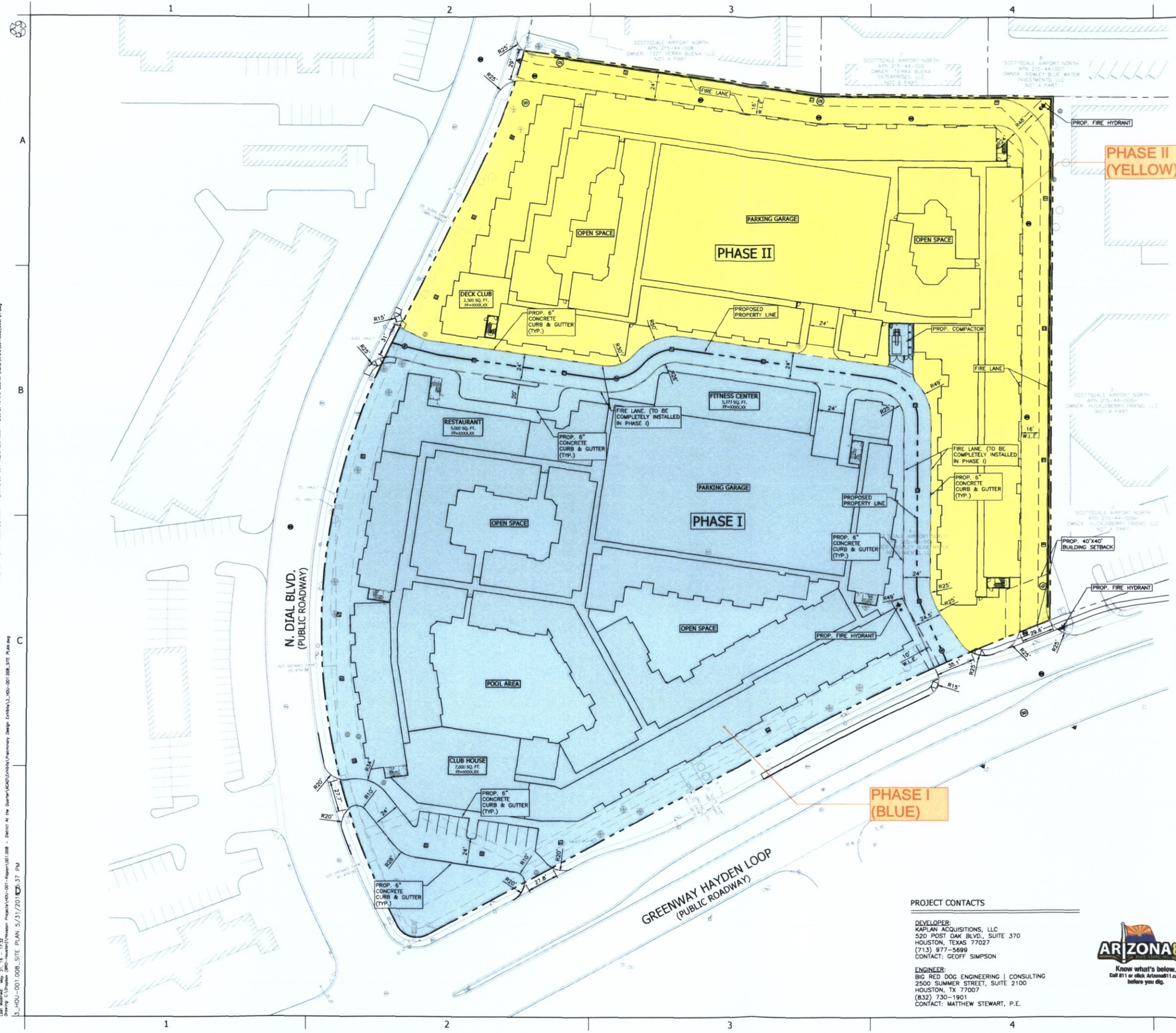
DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

EXISTING CONDITIONS

SHEET
EX-1
1 OF 1

HOU-001.008_EXISTING CONDITIONS 5/13/2016 7:57 AM

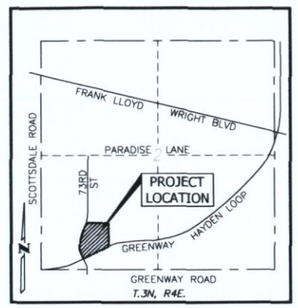
Overall Site Plan w/ Phasing | **3**



0 20' 40' 80'

LEGEND

PROPERTY LINE / RIGHT OF WAY
EASEMENT / SETBACK
CURB & GUTTER



VICINITY MAP
NOT TO SCALE

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520 POST OAK BLVD., SUITE 370
HOUSTON, TEXAS 77027
(713) 977-5699
CONTACT: GEOFF SIMPSON

ENGINEER:
BIG RED DOG ENGINEERING | CONSULTING
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(832) 730-1901
CONTACT: MATTHEW STEWART, P.E.

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LEGAL DESCRIPTION

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LAND USE SUMMARY:

GROSS ACREAGE:	8.83 ACRES

NO.	DATE	REVISION	BY

WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744
BIG RED DOG
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
ARIZONA FIRM NO. 19744
512.669-5560

Registered Professional Engineer (Civil)
CERTIFICATE NO.
53520
BRADLEY LINGVAI
DATE SIGNED
ARIZONA, U.S.A.
Bradley J Lingvai

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

PRELIMINARY SITE PLAN (OVERALL)

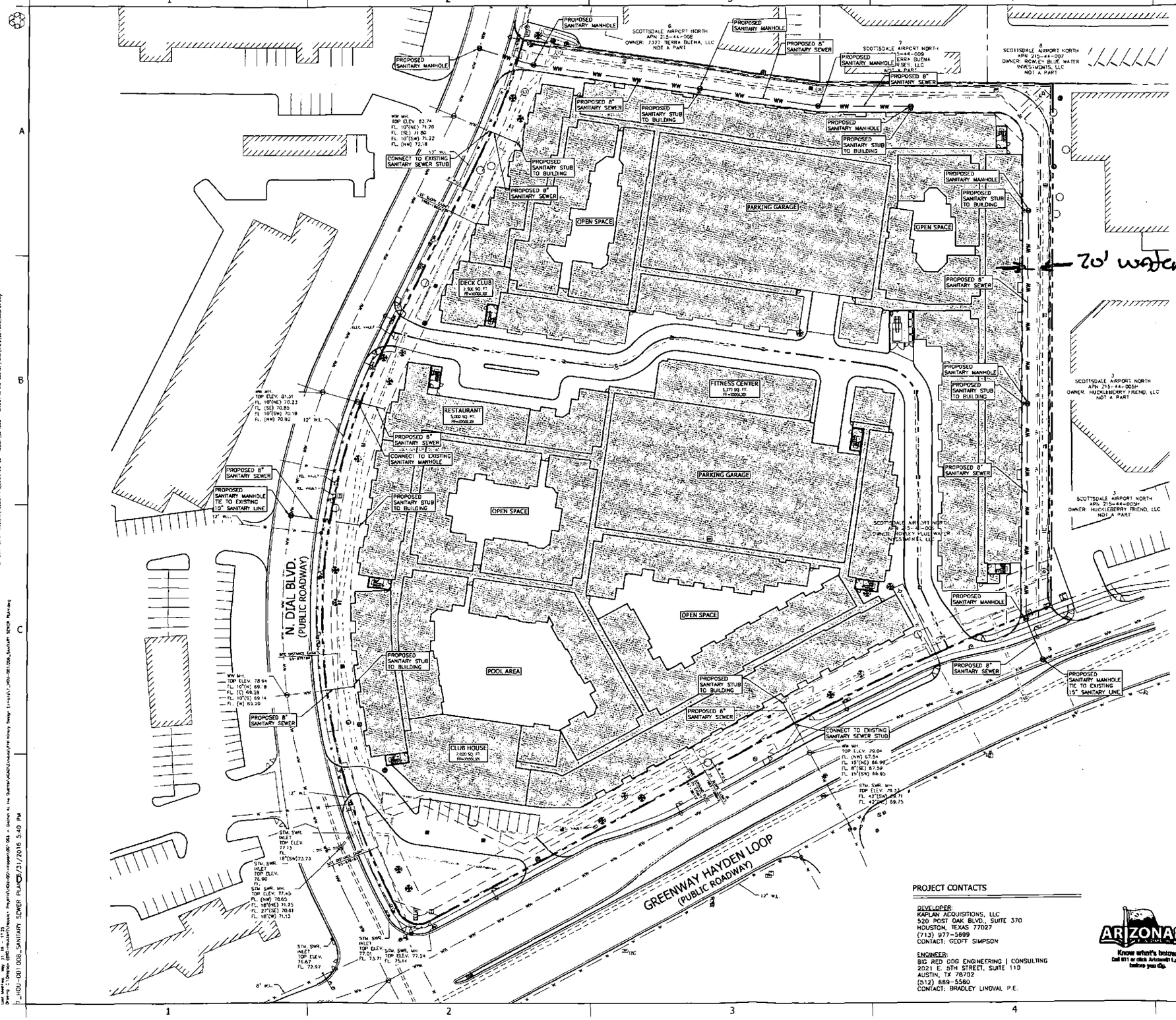
SHEET
EX-1
1 OF 3

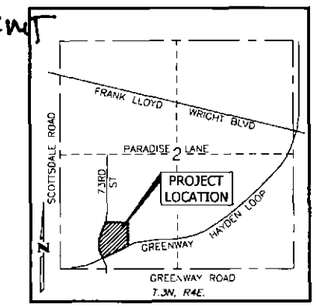
Preliminary Sanitary Sewer, **4**

EX – 1 | OVERALL SANITARY LAYOUT

EX – 2 | PHASE I SANITARY LAYOYUT

EX – 3 | PHASE II SANITARY LAYOUT





VICINITY MAP
NOT TO SCALE

CAUTION:
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ELEVATIONS:
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SITE INFORMATION:

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SCOTTSDALE, ARIZONA 85260

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FLOODPLAIN:

ACCORDING TO THE FLOOD INSURANCE RATE MAP #04013C1780 L, DATED OCTOBER 16, 2013, THIS PROPERTY IS LOCATED IN FLOOD ZONE "X" (HATCHED).

BENCHMARK

CITY OF SCOTTSDALE BRASS CAP IN A HANDHOLE 0.4' DOWN AT THE INTERSECTION OF GREENWAY ROAD AND 76TH STREET. ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE: 8.83 ACRES

PROJECT CONTACTS

DEVELOPER:
KAPLAN ACQUISITIONS, LLC
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HOUSTON, TEXAS 77027
(713) 977-5899
CONTACT: GEOFF SIMPSON

ENGINEER:
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AUSTIN, TX 78702
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CONTACT: BRADLEY LINGVAL P.E.

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WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744

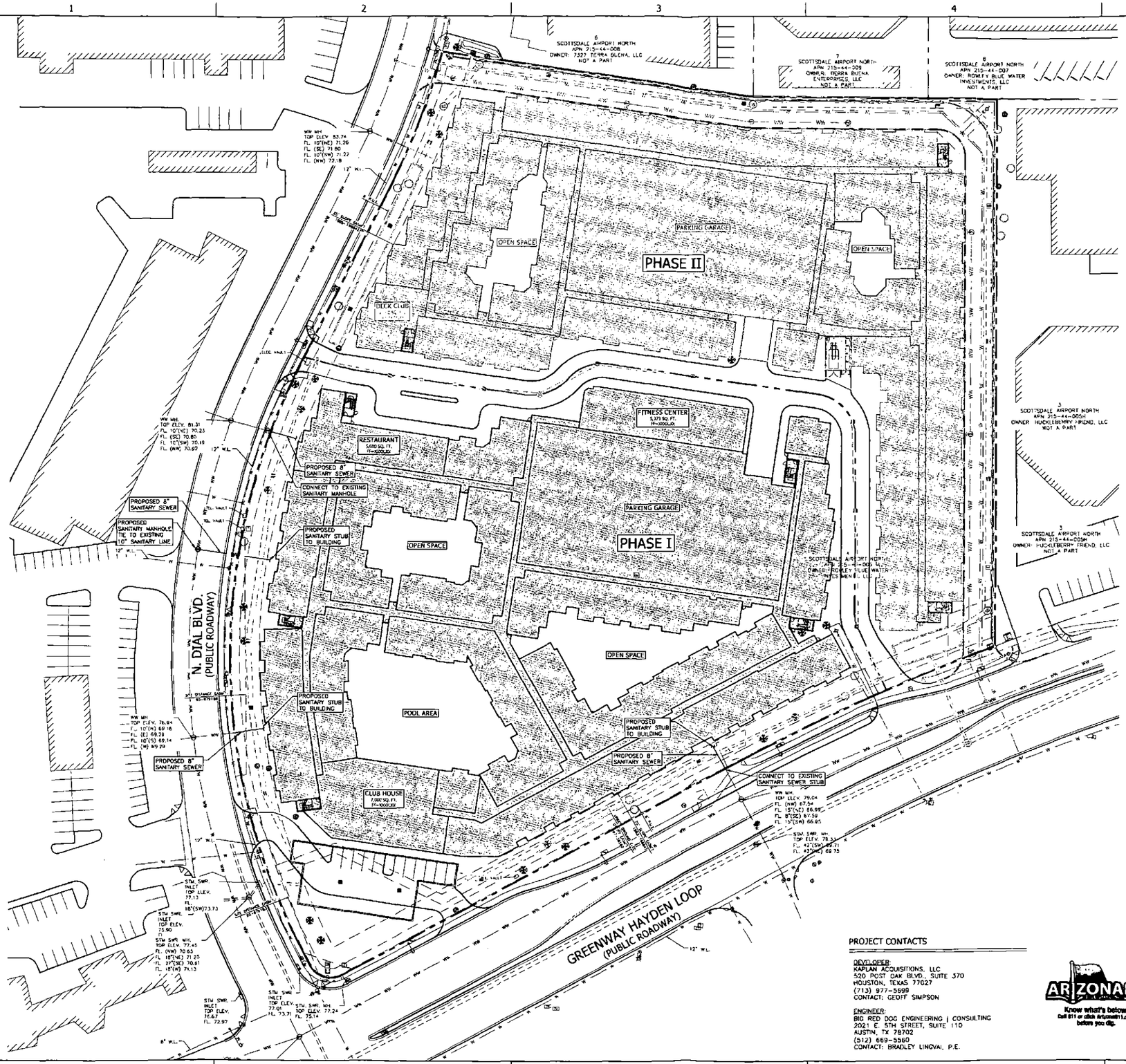
Registered Professional Engineer — CERTIFICATE NO. 53520 — BRADLEY LINGVAL — DATE SIGNED — ARIZONA U.S.A.

NO	DATE	REVISION
A		

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

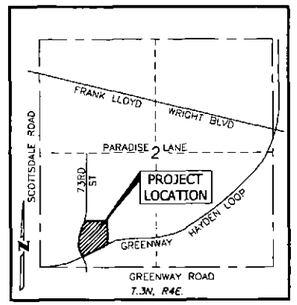
PRELIMINARY SANITARY SEWER PLAN (OVERALL)

SHEET
EX-1
1 OF 3



LEGEND

- BOUNDARY / RIGHT OF WAY
- EASEMENT / SETBACK
- CURB & GUTTER
- WW — WASTE WATER LINE
- WASTE WATER MANHOLE
- CO — CLEAN-OUT



VICINITY MAP
NOT TO SCALE

CAUTION:
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ELEVATIONS:
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SCOTTSDALE, ARIZONA 85260

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BENCHMARK

CITY OF SCOTTSDALE BRASS CAP IN A HANDHOLE 0.4' DOWN AT THE INTERSECTION OF GREENWAY ROAD AND 76TH STREET. ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE:	8.83 ACRES

PROJECT CONTACTS

DEVELOPER:
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ENGINEER:
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BIG RED DOG
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
ARIZONA FIRM NO. 19744
512.669.5560

Professional Engineer — CERTIFICATE NO. 53520 — BRADLEY LINGVAI — DATE SIGNED — ARIZONA, U.S.A.

NO	DATE	REVISION

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

PRELIMINARY SANITARY SEWER PLAN (PHASE I)

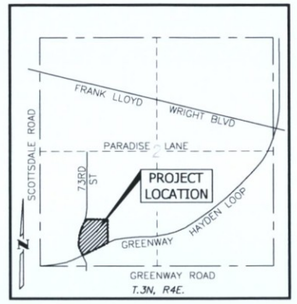
SHEET
EX-2
2 OF 3

PROPOSED SANITARY MANHOLE
PROPOSED 8" SANITARY SEWER
PROPOSED SANITARY STUB TO BUILDING
CONNECT TO EXISTING SANITARY SEWER STUB
OPEN SPACE
PARKING GARAGE
PHASE II
DECK CLUB
2,500 SQ. FT.
FF=XXXX.XX
PHASE I
20' water ESMT
N. DIAL BLVD. (PUBLIC ROADWAY)
GREENWAY HAYDEN LOOP (PUBLIC ROADWAY)
PROPOSED SANITARY MANHOLE TIE TO EXISTING 15" SANITARY LINE
SCOTTSDALE AIRPORT NORTH APN: 215-44-008 OWNER: 7327 TERRA BUENA, LLC NOT A PART
SCOTTSDALE AIRPORT NORTH APN: 215-44-007 OWNER: ROWLEY BLUE WATER INVESTMENTS, LLC NOT A PART
SCOTTSDALE AIRPORT NORTH APN: 215-44-005H OWNER: HUCKLEBERRY FRIEND, LLC NOT A PART

0 20' 40' 80'

LEGEND

- BOUNDARY / RIGHT OF WAY
- EASEMENT / SETBACK
- CURB & GUTTER
- WW — WASTE WATER LINE
- WW — WASTE WATER MANHOLE
- CO — CLEAN-OUT



VICINITY MAP
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PROJECT CONTACTS

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ENGINEER:
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LEGAL DESCRIPTION

LOTS FOUR (4) AND FIVE (5), SCOTTSDALE AIRPARK NORTH, A SUBDIVISION RECORDED IN BOOK 390 OF MAPS, PAGE 33 RECORDS OF MARICOPA COUNTY, ARIZONA.

FLOODPLAIN:

ACCORDING TO THE FLOOD INSURANCE RATE MAP #04013C1760 L, DATED OCTOBER 16, 2013, THIS PROPERTY IS LOCATED IN FLOOD ZONE "X" (HATCHED).

BENCHMARK

CITY OF SCOTTSDALE BRASS CAP IN A HANDHOLE 0.4' DOWN AT THE INTERSECTION OF GREENWAY ROAD AND 76TH STREET. ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE: 8.83 ACRES

NO.	DATE	REVISION	BY

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ARIZONA FIRM NO. 19744
BIG RED DOG
ENGINEERING | CONSULTING
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ARIZONA FIRM NO. 19744
512.669.5560

Registered Professional Engineer
CERTIFICATE NO.
53520
BRADLEY
LINGVAI
DATE SIGNED
ARIZONA, U.S.A.
Bradley J Lingvai

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

PRELIMINARY SANITARY SEWER PLAN (PHASE II)

SHEET
EX-3
3 OF 3

Xrefs: C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Units\001.008_C3DP01.dwg
User: mona.pinto
Last Modified: May 31, 18 - 17:23
Drawing: C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Units\Preliminary Design Exhibits_HOU-001.008_SANITARY SEWER PLAN.dwg
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August 2016 H001.008

City of Scottsdale
Planning and Development
7447 E Indian School Rd
Scottsdale, AZ 85251

RE: Preliminary Engineering Report
District at the Quarter
NEC Greenway Hayden Loop & N. Dial Blvd
Scottsdale, Maricopa County, Arizona

To Whom It May Concern:

Please let this letter and enclosed report serve as our formal Final Grading and Drainage Report for the proposed development, District at the Quarter, at the northeast corner of N. Greenway Hayden Loop and N. Dial Boulevard. The proposed development will include the demolition of the existing structures followed by the construction of a ± 620 unit multi-story apartment complex which will be composed of (2) buildings wrapped around (2) structural parking garages along with all associated grading, drainage, utility, landscape, and hardscape improvements.

The subject site is currently zoned Industrial Park (I-1) and is in the process of being rezoned to Planned Unit Development (PUD). The associated General Plan Amendment and Rezoning Applications are currently under as application numbers 3-GP-2016 and 8-ZN-2016.

Comments were issued on June 29, 2016, and are addressed in the Final Grading and Drainage Reports and include with this submittal package.

Please feel free to contact me at 832-730-1901 or at Patrick.Byrne@BIGREDDOG.com if you have any questions or concerns in regards to the information contained herein. We appreciate you working with us as we move forward with the associated development.

Sincerely,

BIG RED DOG Engineering | Consulting

Patrick Byrne

Patrick Byrne
Principal

Table of Contents

Appendix 1

Appendix 2

Appendix 3

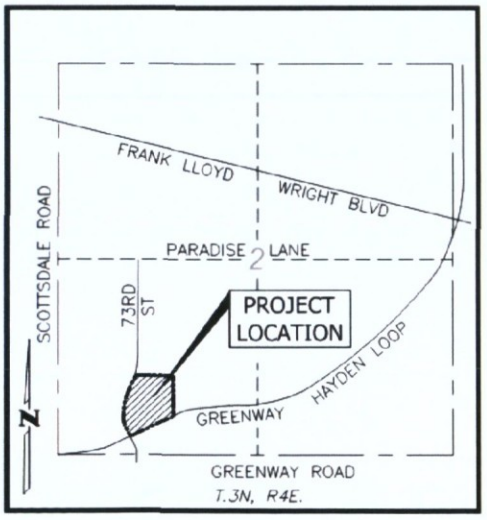
A. INTRODUCTION

1. Site Location / Description

The subject site associated with this Preliminary Grading and Drainage Report is for a proposed development, District at the Quarter, located at the northeast corner of N. Greenway Hayden Loop and N. Dial Blvd., in the Full Purpose Limits of the City of Scottsdale, AZ (see vicinity map and aerial below). The ±8.84 acre site is currently developed with a ±129,689 SF Office Building / Warehouse space, with associated utilities, desert landscaping, roadways and 4 retention ponds located throughout the site.

The proposed development will include the demolition of all existing structures followed by the construction of a ±620 unit multi-story apartment complex which will be composed of (2) buildings wrapped around (2) structural parking garages along with all associated grading, drainage, utility, landscape, and hardscape improvements.

The subject site is currently zoned Industrial Park (I-1) and is in the process of being rezoned to Planned Unit Development (PUD). The associated General Plan Amendment and Rezoning Applications are currently underway as application numbers 3-GP-2016 and 8-ZN-2016.



VICINITY MAP
NOT TO SCALE

2. Purpose / Objective

The purpose and objective of this Preliminary Grading and Drainage Report is to analyze the current drainage conditions at the subject site (onsite and offsite) and then compare the results to the proposed final design associated with the District at The Quarter Multi-Family Project. To complete this analysis, the report will focus on:

- Existing Drainage Patterns on the current development.
- Surrounding Drainage Patterns on the neighboring developments.
- Estimates of required retention volumes and where the volumes will be provided on the proposed site.

- Peak Discharge Calculations using the Rational Method for existing and proposed conditions.
- Private storm infrastructure layouts and conveyance analysis.
- Compliance with the City of Scottsdale and Maricopa County Drainage Requirements.

B. EXISTING DRAINAGE CONDITIONS AND CHARACTERISTICS

1. **Existing On-Site Drainage**

The subject site is currently fully developed and appears to generally slope from the northeast to the southwest. Developed flows are conveyed to (4) retention ponds located throughout the site as referenced in *Existing Conditions* within Appendix 1, Exhibit 2. Based off of a preliminary review of the existing conditions, and of the existing volume provided within the (4) aforementioned retention ponds, the existing infrastructure appears to have been designed to be in compliance with Chapter 4-1.402.A.1 of the COS Design Standards & Policies Manual in that the ponds "store runoff and rainfall events up to and including the 100-year, two hour duration event." It is anticipated that the existing site requires a runoff volume of 1.25 acre-ft. due to an impervious cover of 75%. Refer to the Stormwater Storage Requirements for calculations. Existing pond volume for the site is 1.13 ac-ft. It is anticipated that the remaining volume is captured in the storm infrastructure.

2. **Existing Drainage / Watershed / Floodplain**

The subject tract is located within a 100-year FEMA Zone X as shown on FIRM Panel No. 04013C1320L (October 16, 2013), although the site is not within a FEMA Special Flood Hazard Area. Reference the *FEMA Map* in the Appendix 1, Figure 4. It has also been observed through the Flood Control District of Maricopa County that the limits of the FEMA 100-Yr Floodplain are located north of Bell Rd. / Frank Lloyd Wright Blvd. The District at the Quarter is located in the limits of the Verde River Watershed. This watershed encompasses 6,624 square miles with primary land uses of open range grazing, irrigated agriculture, recreation, forestry, and some mining.

3. **Off-Site Drainage**

The subject site is adjacent to existing fully developed parcels to the north and east and is then continuous to the ROW of N. Dial Blvd. and Greenway Hayden Loop to the west and south, respectively. Based off of review of as-built drawings and existing topography within the area, developed flows from the neighboring tracts to the north and the east appear to be conveyed to the public ROW via underground infrastructure and sheet flow conditions without passing through the subject site.

The subject site to the north conveys flows to the ROW of E. Tierra Buena Lane which ultimately discharges to the infrastructure within N. Dial Blvd. The subject site to the east conveys flows to the ROW of Greenway Hayden Loop which contains an extensive underground storm sewer system. Due to the limited underground storm infrastructure within N. Dial Blvd, an offsite drainage area map has been prepared to analyze the peak flows entering the storm infrastructure within N. Dial Blvd. near the southwest corner of the site. The analysis utilized the rational method and is based on existing topographic information obtained from the City of Scottsdale. The Offsite Drainage Area Map may be found in Appendix 1, as *Exhibit 4 – Offsite Watershed Map*.
No existing or future developed flows from neighboring parcels of the subject site are anticipated to impact the drainage patterns of the proposed development.

C. PROPOSED DRAINAGE CONDITIONS

1. General Description

The proposed development will begin with demolition of the existing structures, including all retention areas throughout the site. Demolition will be followed by the construction of the two phased development consisting of a total of ±620 apartment units within a multi-story complex which will be composed of (2) buildings wrapped around (2) structural parking garages along with all associated grading, drainage, detention, utility, landscape, and hardscape improvements.

Phase I will consist of ±328 apartment units within the building at the southwest corner of the site while Phase II will consist of ±290 apartment units towards the northeast corner of the site. Each phase will contain its own independent underground detention system which will be sized to efficiently store onsite runoff of the 100-yr, 2-hr rainfall event from each phase, respectively.

With the proposed project being a multi-family development which will have a private onsite facilities maintenance group, all the criteria to qualify for Underground Stormwater Storage within Section 4-1.403 (Underground Stormwater Storage Policy) of the COS Design Standards and Policies Manual are substantially met.

The detention systems used within both Phase I and Phase II will consist of a combination of Chamber Systems, varying in size, as well as oversized pipe to gain the required volume. Storm drainage from each phase will be captured via storm inlets as well as underground roof drain connections from the buildings and courtyards. Phase I consists of ADS MC-4500 Chamber System, located in the southwestern corner, and 24" HDPE pipe along the western and southern property lines for conveyance. This system captures a total of 0.74 ac-ft. Phase II, located along the northern and eastern property lines will have ADS MC-3500 Chamber Systems and 48" HPDE. The total detention provided is 0.47ac-ft. Additional detention for Phase II will be constructed in Phase I via 54" CMP along the center of the interior fire lane. This internal system will provide an additional 0.19 ac-ft. for the entire 8.84 acres. Reference the Overall Grading and Drainage Plan for design. The breakdown of Phase I and Phase II Pond Volume Table is in the Conclusion Section of this Report.

Construction of Phase I will include the Phase I system as well as the Phase II system in the internal fire lane. A "tee" manhole will be constructed at the intersection of both systems and flow will be conveyed to the southwest, and will enter the public system near the intersection of N. Greenway Hayden Loop and N. Dial Blvd. The construction of Phase II will include the system along the north and will discharge to N. Greenway Hayden Loop. Detention in the interior fire lane will then be capped and plugged at Phase I, and rerouted northeast to Phase II. Both discharge points will gravity flow and be regulated by an orifice plate with a minimum diameter of 6 inches. Restrictor plates will insure the ponds drain within 12 to 24 hours of the rainfall as required in Section 4-1.402B of the City of Scottsdale Design Manual.

Please refer to the *Drainage Area Map* located in Appendix 1, Exhibit 5 to view the proposed location of the underground Chamber System, proposed underground stormwater system, and orifice locations and discharge rates. An overall exhibit is included for the entire project buildout as well as individual exhibits for Phase I and Phase II to clearly show how each phase operates independently.

2. **Adjacent Tracts**

Based on existing site conditions and as-built drawings, the adjacent lots to the subject site appear to be fully developed and consist of commercial shopping centers, offices, and other commercial developments. These existing developments do not appear to drain onto, or across, the subject site and therefore offsite flows are not anticipated to impact the proposed development.

At this time, it is also our understanding that no redevelopment plans are proposed for any of the adjacent developments. However, if these sites were to be redeveloped in the future, they will be required to comply with the COS Design Standards and Policies Manual which is not anticipated to allow any future stormwater discharge from the adjacent properties onto the subject site.

3. ***Stormwater Storage Requirements***

To determine the runoff volume of the entire site, as well as broken up by Phase I and Phase II, the Standard Formula for Runoff Volumes within section 4-1.807 of the COS Design Standards and Policies Manual was used. The calculated runoff volume for the entire site is 1.40 AC-FT (Phase I = 0.74 AC-FT, Phase II = 0.66 AC-FT). The associated weighted runoff coefficient (C) and precipitation amount values were obtained from the Appendix 4-1D and Figure 4.1-4 of the COS Design Standards and Policies Manuals.

A summary of the runoff volume calculations may be found below and detailed information in regards to the calculations for the weighted runoff coefficient may be found within Appendix 2 of this report.

Runoff Volume (Vr)= $\left(\frac{P}{12}\right) AC$
P=Precipitation amount for 100-year, 2 hour interval
A=Area in acres
C=Weighted Runoff coefficient

Total Runoff Volume

$$Vr = \left(\frac{2.27}{12}\right)(8.84)(0.83)$$
$$Vr = 1.39\ Acre - ft$$

Phase I

$$Vr = \left(\frac{2.27}{12}\right)(4.94)(0.79)$$
$$Vr = 0.74\ Acre - ft$$

Phase II

$$Vr = \left(\frac{2.27}{12}\right)(3.9)(0.89)$$
$$Vr = 0.66\ Acre - ft$$

Existing Development

$$Vr = \left(\frac{2.27}{12}\right)(8.84)(0.75)$$
$$Vr = 1.25\ Acre - ft$$

Both systems will capture the 100-YR, 2-hour rainfall event for each of their respective phases. Each system, and associated conveyance pipe, will be designed to comply with the COS requirements of a 75-year life-time and a minimum 5-ft cover.

4. **Stormwater Runoff Requirements**

The orifice equation has determined a flow of 2.62 cfs for Phase I and 2.50 cfs for Phase II, using the minimum orifice size of 6 inch. To achieve a drawdown time of 24 hours, the orifice would need to be 0.53" for Phase I and 0.46" for Phase II. Refer to orifice equation below.

Orifice Equation $Q = CA(2GH)^{1/2}$
Q= Release Rate in ft^3/s
C= Orifice Constant
A=Area of Orifice in ft^2
G=Gravitational Constant ft^2/s
H=Head on Orifice in ft

Reference Appendix 2 for Drawdown calculations and orifice sizing.

5. **Pre and Post Runoff Characteristics**

Existing onsite stormwater runoff is captured by (4) existing above ground detention ponds located throughout the site. These detention ponds prevent stormwater from the 100-YR, 2-hour event from leaving the subject site and having any adverse impacts downstream.

The proposed project associated with this report does not proposed to change this stormwater management method from a macro scale. Since the project is phased, (2) independently operating underground detention ponds will be constructed with Phase I and Phase II of the project to capture the 100-YR, 2 hour event from each applicable phase.

No offsite flows currently enter the subject site and no offsite flows are anticipated to enter the proposed development in the future.

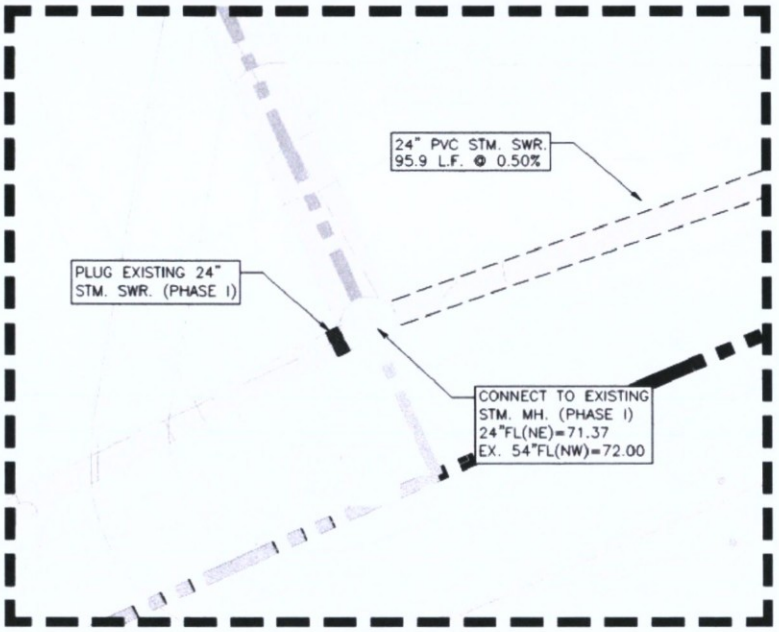
Although the internal conveyance of the stormwater within the subject site is being altered, runoff characteristics from existing conditions to proposed conditions on the subject site will not change with this project.

6. **Proposed Drainage Structures**

As mentioned previously, the proposed project will be composed of (2) phases. Each phase will propose its own underground stormwater detention system which will function independently of the other.

7. **Project Phasing**

A private drainage easement will be proposed for the drainage/detention system along the proposed property line within Phase I and Phase II. These system will capture the runoff from the fire lane/private drive and will convey the stormwater to the Phase I detention pond, along the western and southern property lines. When Phase II is built, the system will be routed to go into Phase II detention along the eastern property line. The connection of Phase I and that of the private drainage easement will be capped and plugged, and a new line will be installed to connect to Phase II. Roof drainage from Phase II will tie directly into the Phase II detention pond on all sides of the building. Hence no flows from buildings/courtyards of Phase II will connect to the Phase I pond infrastructure.



SUMMARY OF PHASE I AND PHASE II DETENTION VOLUMES

PHASE	REQUIRED	PROVIDED W/ PHASE I	PROVIDED W/ PHASE II
	AC-FT	AC-FT	AC-FT
I	0.74	0.74	0.00
II	0.66	0.23	0.47
TOTAL	1.40	0.97	0.47

D. SPECIAL CONDITIONS

No special conditions have been identified for this site.

E. DATA ANALYSIS METHODS

The proposed drainage system was designed based off of existing topographic information on, and off, the subject site as well as based on observed drainage characteristic within the vicinity of the site. The hydrologic analyses were based on the following methodologies:

- Drainage improvements associated with the proposed development were designed in accordance with the City of Scottsdale Design Standards and Policies Manual (specifically Chapter 4). Design was also done in accordance with the Drainage Design Manual for Maricopa County, Volumes I and II.
- Analysis of the offsite runoff was completed by using the 1 ft. interval topographic CAD file provided by the City of Scottsdale.
- The precipitation amount for the 100-YR, 2-hr storm was obtained using the isopluvials from Figure 4.1-4 of the COS Design Standards and Policies Manual. The corresponding P value for District at the Quarter location is approximately 2.27.
- On-site weighted runoff coefficients (C) for use in the Runoff Volume Calculations were calculated in accordance with Appendix 4-1D of the COS Design Standards and Policies Manual as well as the Drainage Design Management System (DDMSW) software from the Flood Control District of Maricopa County.
- Total required detention volume calculations were based on the Standard Formula for Runoff Volumes within Section 4-1.807 of the COS Design Standards and Policies Manual.

The preliminary design submittal will include in-depth hydraulic analysis which will include, but are not limited to, conveyance and pipe capacity calculations, backwater modeling, inlet sizing and capacity, head loss incorporation, HGL analysis, etc. Reference the Preliminary Grading and Drainage Plan in the Appendix.

F. CONCLUSIONS

1. Overall Project

The District at the Quarter is a proposed ±620 unit multi-family apartment development on ±8.84 acres of developed land located at the northeast corner of N. Greenway Hayden Loop and N. Dial Blvd. A summary of the associated drainage report are below for your reference:

- All components of the design and report are, to our knowledge, in full compliance with Chapter 4 – Grading and Drainage Criteria – of the City of Scottsdale Design Standards and Policies Manual.
- The existing subject site is currently fully developed and currently captures the 100-YR, 2-hr storm event within (4) existing above ground detention ponds with a combined volume of 1.13 ac-ft.
- No offsite flows currently anticipate the subject site.
- No offsite flows are anticipated to impact the proposed improvements.
- Underground stormwater detention is proposed with both Phase I and Phase II of the project. Each system will operate independently and will consist of a combination of a variety of Chamber Systems and oversized conveyance pipes.
- It has been determined by calculation of the orifice size that 0.53 in radius will allow onsite detention to discharge within 24 hours. Although, 6 in diameter is proposed per Section 4-

1.402B of the City of Scottsdale Design Manual. Reference Appendix 2 for Drawdown and Sizing calculations.

- A summary of the proposed detention volumes follow.

BREAKDOWN OF PHASE I AND PHASE II POND VOLUMES

PHASE	COMPONENT	VAULT AREA (SF)	PIPE LF	DEPTH (FT)	VOLUME	
					CF	AC-FT
I	SWC CHAMBER SYSTEM (MC-4500)	7,834	-	12	32,124	0.74
II	E. CHAMBER SYSTEM (MC-3500)	1,841	-	6.7	7,730	0.18
	48" PIPE	-	1015	6	12,755	0.29
	54" PIPE (TO BE BUILT W/ PHASE I)	-	520	7.5	10,210	0.23

SUMMARY OF DETENTION POND VOLUMES

PHASE	VOLUME REQ'D		VOLUME PROVIDED	
	CF	AC-FT	CF	AC-FT
I	32,234	0.74	32,124	0.74
II	28,750	0.66	30,695	0.70
TOTAL	60,984	1.40	62,819	1.44

- Once finalized, final finished floor elevations will be designed at a minimum of (1) foot above the drainage area overflow to insure there will be no onsite stormwater which ponds into the proposed buildings.
- Both the Phase I and Phase II ponds will be privately maintained by the property owner. Formal maintenance agreements will be provided at the time of the formal submittal and prior to permit issuance.

Should you have any questions regarding this project or application, please do not hesitate to contact our office.

G. WARNING AND DISCLAIMER OF LIABILITY

See Warning and Disclaimer of Liability as provided by the City of Scottsdale within the Appendix of this report.

H. REFERENCES

- City of Scottsdale, Design Standards and Policies Manual: Chapter 4 – Grading and Drainage – January 2010
- Flood Control District of Maricopa County Map Viewer
- City of Scottsdale GIS/Topographic Data.
- Drainage Design Management System (DDMSW) design software from the Flood Control District of Maricopa County.
- FEMA Flood Map Service Center

APPENDIX 1: EXHIBITS

Aerial Map | 1

0 30' 60' 120'

LEGEND

- BOUNDARY / RIGHT OF WAY
- P-1 / 1.00 Ac. / 0% — DRAINAGE AREA NAME / DRAINAGE AREA SIZE / DRAINAGE AREA IMPERVIOUS COVER
- DRAINAGE AREA BOUNDARY LINE
- (A) ANALYSIS POINT

NO	DATE	REVISION	BY

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ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
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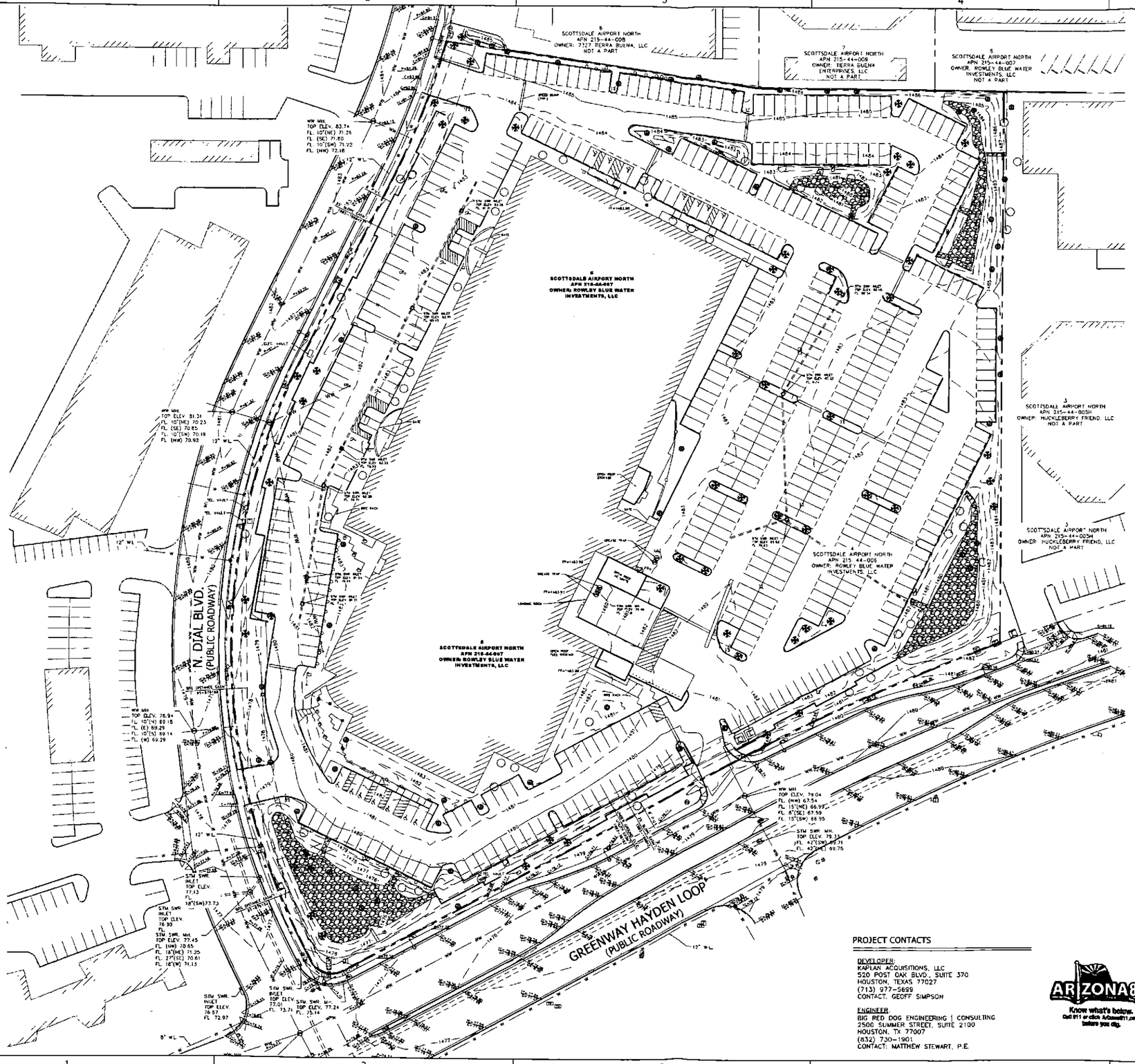
CERTIFICATE NO. 53520
BRADLEY LINGVAI
DATE SIGNED 8/3/2018
ARIZONA U.S.A.
Bradley Lingvai
Expires: 9/30/2018

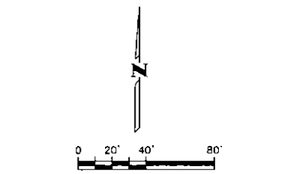
DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA 85260

OFFSITE WATERSHED MAP

SHEET
EX-1
1 OF 1

Existing Conditions | **2**





VICINITY MAP
NOT TO SCALE

ELEVATIONS:
ALL EXISTING AND PROPOSED ELEVATIONS WILL REQUIRE AN ADJUSTMENT OF +1,400 FEET.

CAUTION:
CONTRACTOR TO VERIFY ALL EXISTING UTILITIES VERTICALLY AND HORIZONTALLY PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.

SITE INFORMATION:

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GROSS ACREAGE:	8.83 ACRES

PROJECT CONTACTS

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ENGINEER:
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(832) 730-1901
CONTACT: MATTHEW STEWART, P.E.

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NO.	DATE	REVISION	BY

53520
BRADLEY LINGVAI
STATE OF ARIZONA
REGISTERED PROFESSIONAL ENGINEER
Bradley J. Lingvai
Expires: 6/30/2018

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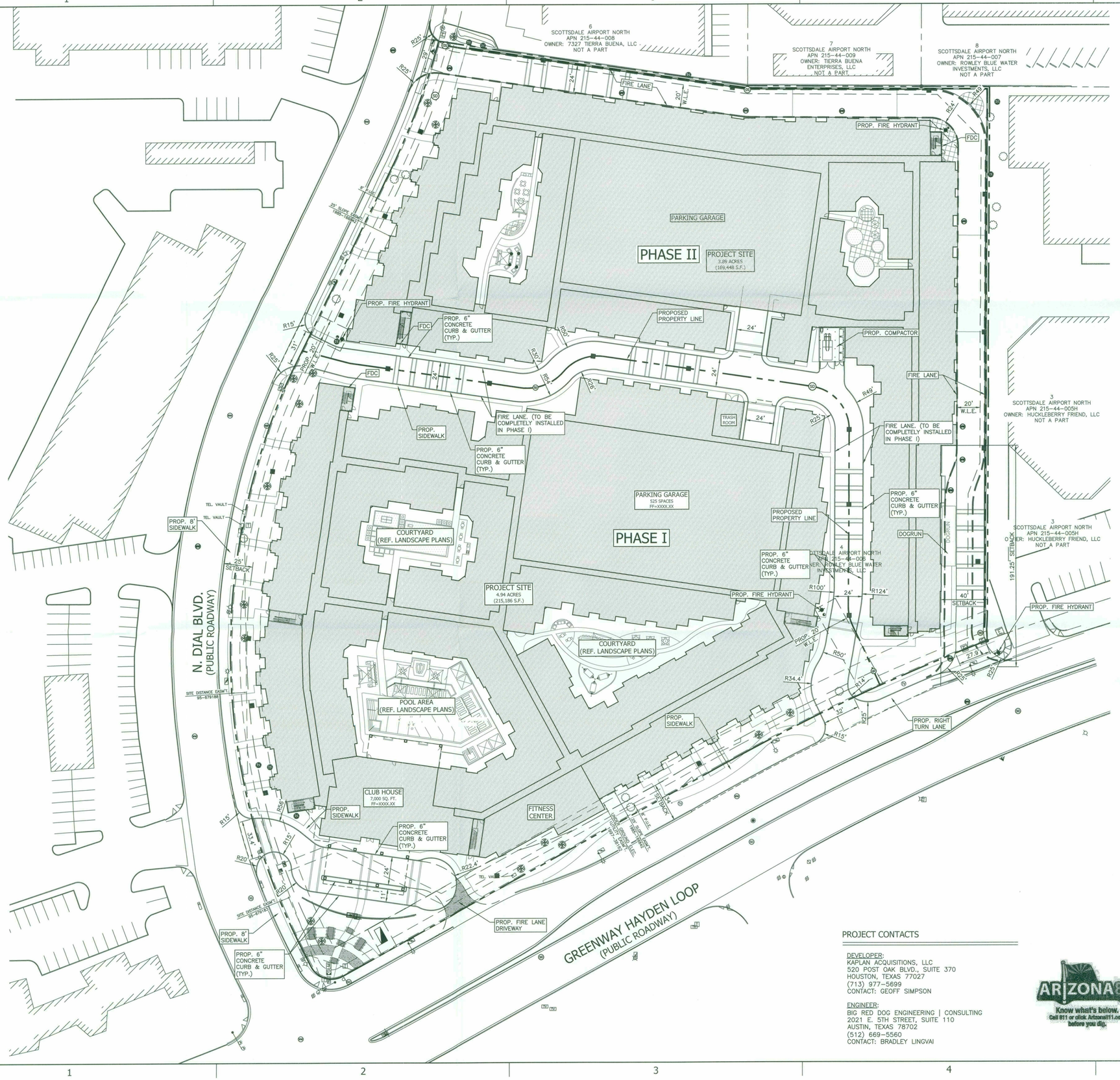
SCOTTSDALE, MARICOPA COUNTY, ARIZONA

EXISTING CONDITIONS

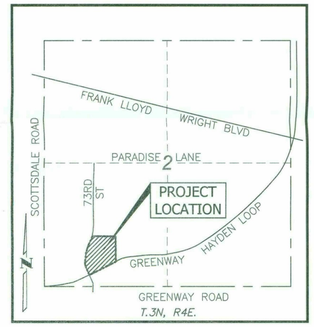
SHEET
EX-1
1 OF 1

Overall Site Plan w/ Phasing | **3**



LEGEND

- PROPERTY LINE / RIGHT OF WAY
- EASEMENT / SETBACK
- CURB & GUTTER



VICINITY MAP

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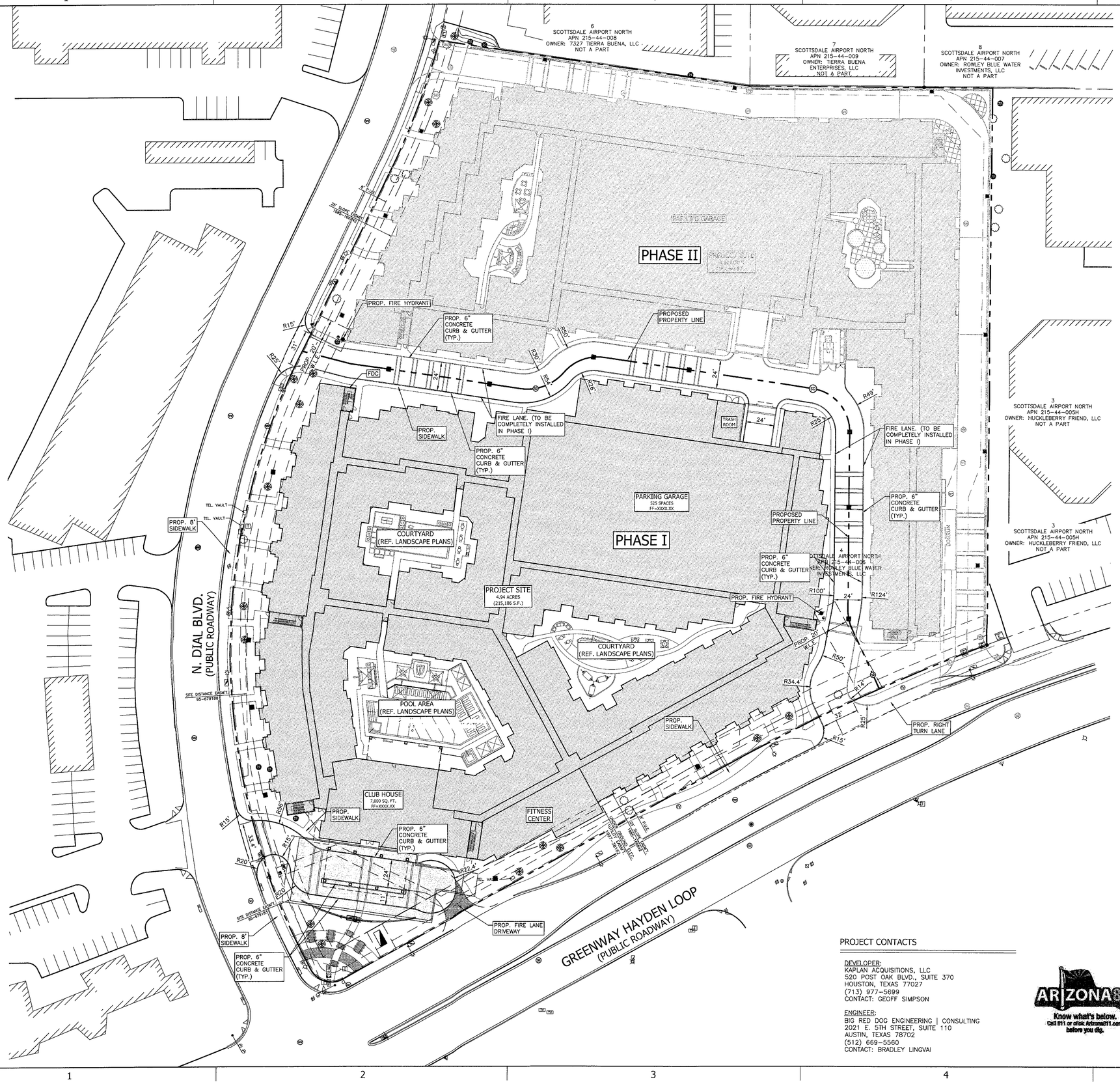
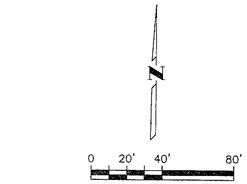
SITE PLAN (OVERALL)

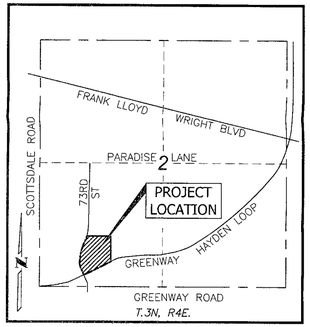
SHEET
EX-1
1 OF 3





LEGEND

- PROPERTY LINE / RIGHT OF WAY
- EASEMENT / SETBACK
- CURB & GUTTER



VICINITY MAP

NOT TO SCALE

CAUTION:
CONTRACTOR TO VERIFY ALL EXISTING UTILITIES VERTICALLY AND HORIZONTALLY PRIOR TO CONSTRUCTION. CONTRACTOR TO NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.

PROJECT CONTACTS

DEVELOPER:
KAPLAN ACQUISITIONS, LLC
520 POST OAK BLVD., SUITE 370
HOUSTON, TEXAS 77027
(713) 977-5699
CONTACT: GEOFF SIMPSON

ENGINEER:
BIG RED DOG ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110
AUSTIN, TEXAS 78702
(512) 669-5560
CONTACT: BRADLEY LINGVAI

ARIZONA811
Know what's below.
Call 811 or click Arizona811.com before you dig.

SITE INFORMATION:

ADDRESS: 15510 N. 73RD STREET
SCOTTSDALE, ARIZONA 85260

LEGAL DESCRIPTION

LOTS FOUR (4) AND FIVE (5), SCOTTSDALE AIRPARK NORTH, A SUBDIVISION RECORDED IN BOOK 390 OF MAPS, PAGE 33 RECORDS OF MARICOPA COUNTY, ARIZONA.

FLOODPLAIN:

ACCORDING TO THE FLOOD INSURANCE RATE MAP #04013C1760 L, DATED OCTOBER 16, 2013, THIS PROPERTY IS LOCATED IN FLOOD ZONE "X" (HATCHED).

BENCHMARK

CITY OF SCOTTSDALE BRASS CAP IN A HANDHOLE 0.4' DOWN AT THE INTERSECTION OF GREENWAY ROAD AND 76TH STREET.
ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE:	8.83 ACRES

NO	DATE	REVISION	BY

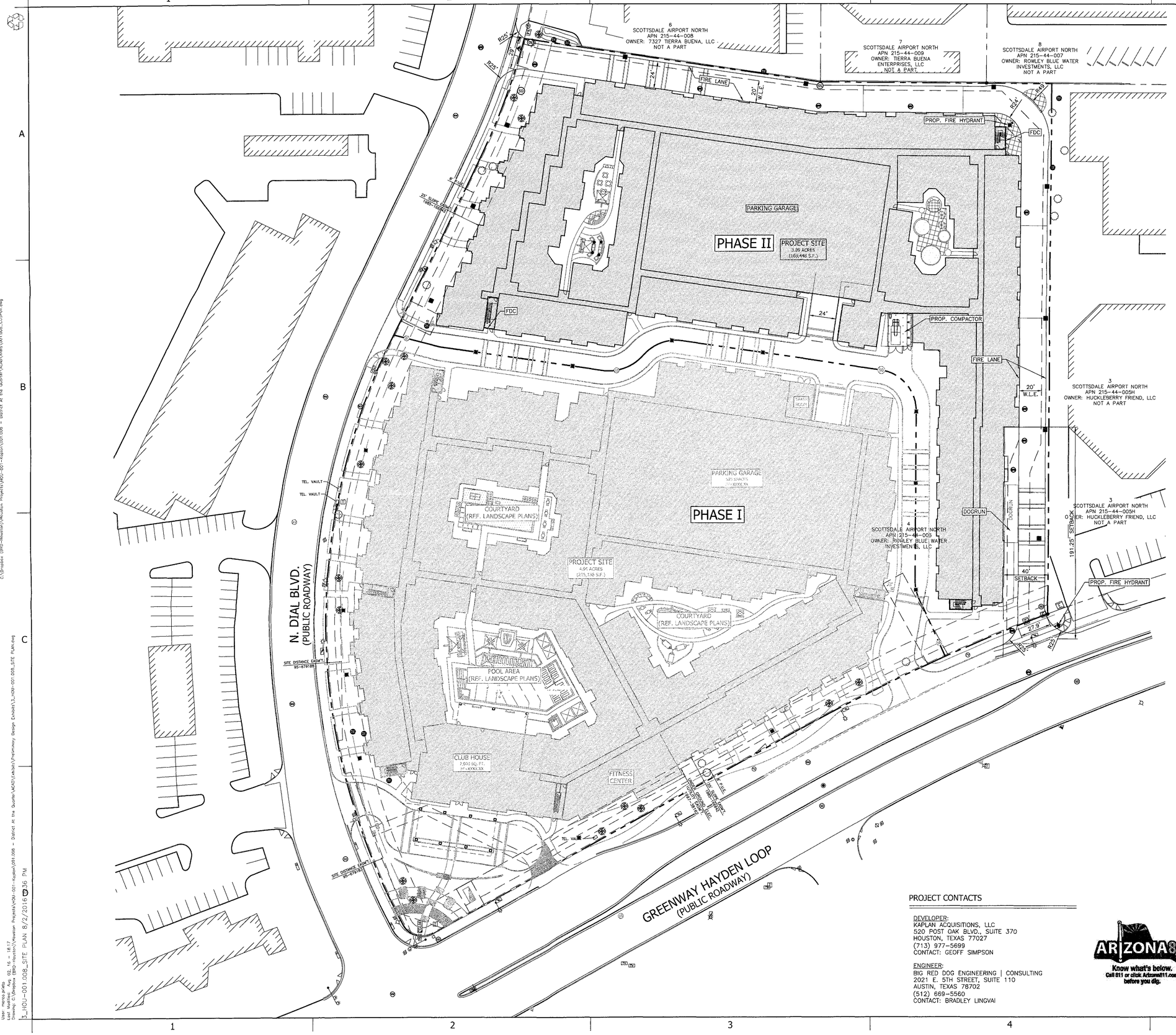
WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744
BIG RED DOG
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
ARIZONA FIRM NO. 19744
512.669-5560

Registered Professional Engineer (Civil)
CERTIFICATE NO.
53520
BRADLEY
LINGVAI
DATE SIGNED
8/3/2016
ARIZONA, U.S.A.
Bradley J Lingvai
Expires: 6/30/2018

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA 85260

SITE PLAN (PHASE I)

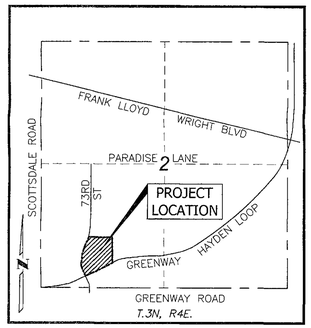
SHEET
EX-2
2 OF 3



0 20' 40' 80'

LEGEND

- PROPERTY LINE / RIGHT OF WAY
- EASEMENT / SETBACK
- CURB & GUTTER



VICINITY MAP

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LEGAL DESCRIPTTION

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ELEVATION=1475.534 (NAVD88)

LAND USE SUMMARY:

GROSS ACREAGE:	8.83 ACRES

NO.	DATE	REVISION	BY

BIG RED DOG ENGINEERING
WWW.BIGREDDOG.COM
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512.669-5560

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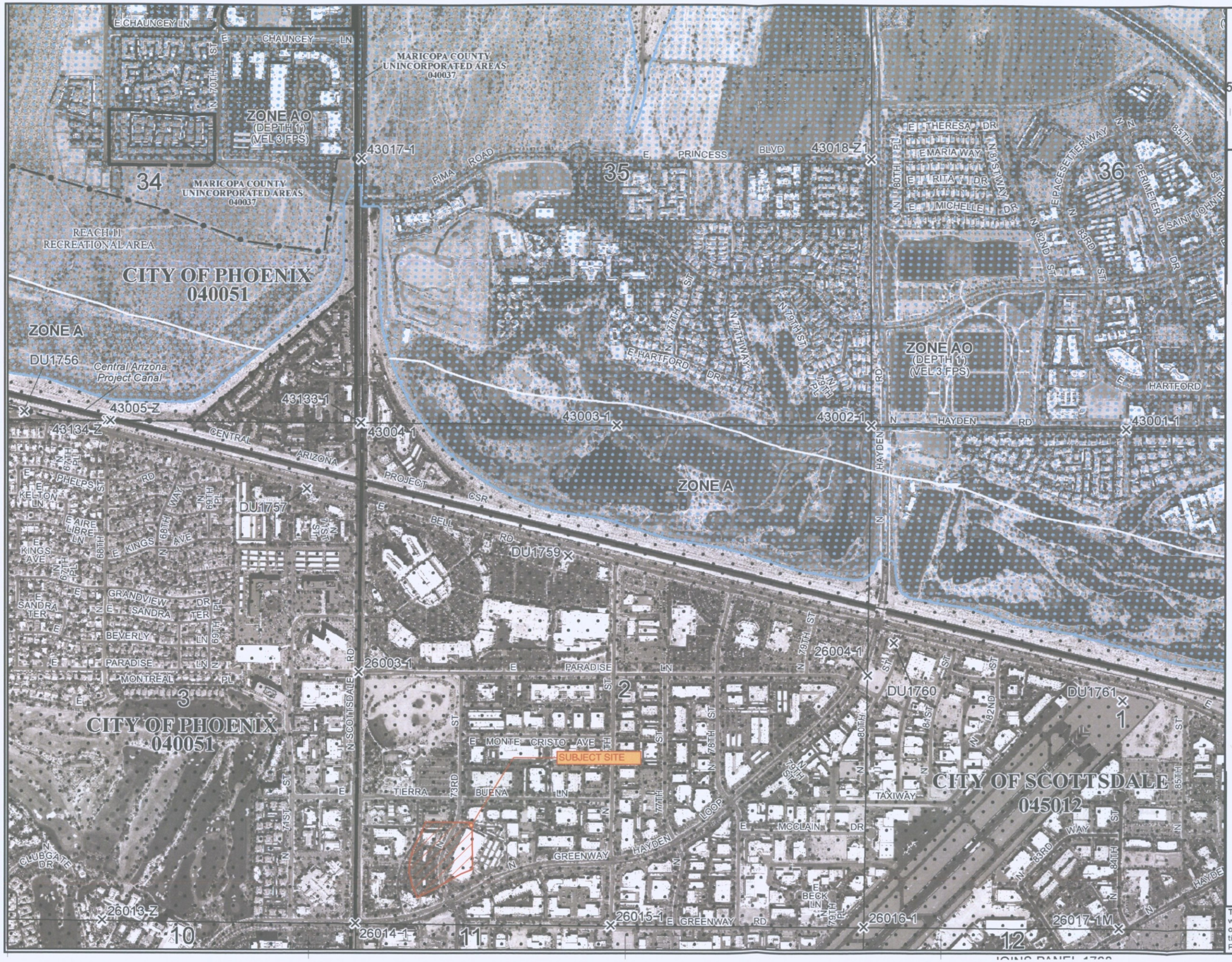
BRADLEY
LINGVAI
8/2/2016
STATE OF ARIZONA U.S.A.
Bradley Lingvai
Expires: 6/30/2018

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA 85260

SITE PLAN (PHASE II)

SHEET
EX-3
3 OF 3

FEMA Map | **4**



NFIP

PANEL 1320L

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1320 OF 4425

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1320	L
PHOENIX, CITY OF	040051	1320	L
SCOTTSDALE, CITY OF	045012	1320	L

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1320L

MAP REVISED
OCTOBER 16, 2013

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

Off-Site Watershed | **5**

E. TIERRA BUENA LN.

N. SCOTTSDALE RD.

N. DIAL BLVD.

GREENWAY HAYDEN LOOP

PROJECT SITE
8.832 ACRES

0 30' 60' 120'

LEGEND

BOUNDARY / RIGHT OF WAY

NO	DATE	REVISION	BY

BIG RED DOG
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110, AUSTIN, TEXAS 78702
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BRADLEY
LINGVAI
DATE SIGNED 8/3/2018
ARIZONA U.S.A.
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DISTRICT AT THE QUARTER
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SCOTTSDALE, MARICOPA COUNTY, ARIZONA

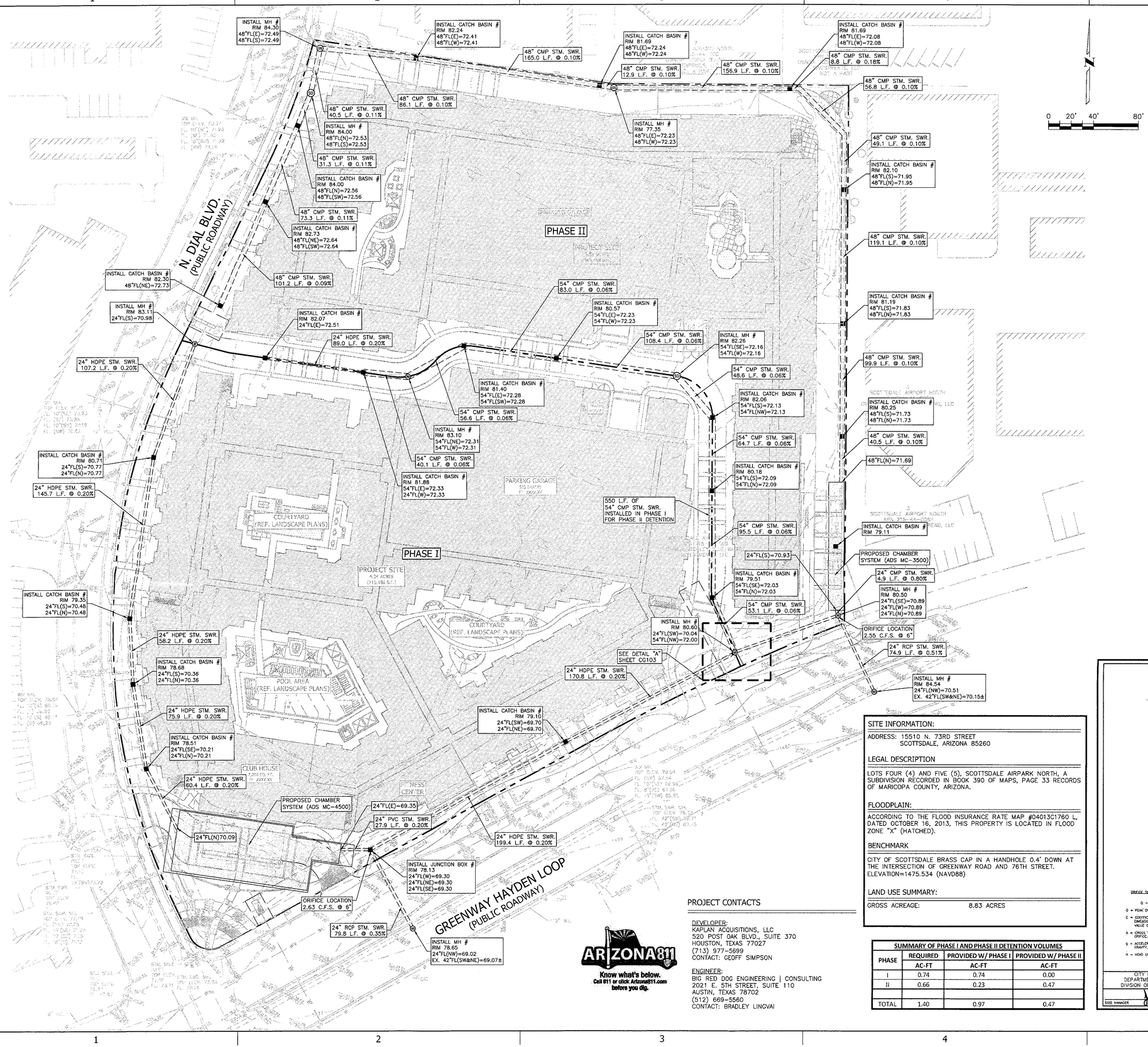
AERIAL EXHIBIT

SHEET
EX-1
1 OF 1

EX-1 – Overall Proposed Development

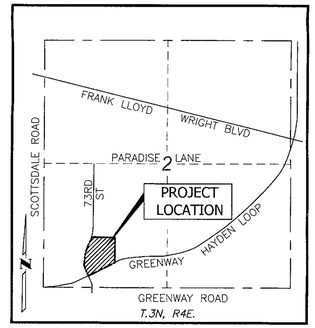
EX-2 – Phase I

EX-3 – Phase II



LEGEND

	BOUNDARY / RIGHT OF WAY
	EASEMENT / SETBACK
	CURB & GUTTER
1470	CONTOUR (GRADE) ELEV.
	STORM SEWER PIPE
	RETAINING WALL
	TOP OF BANK
(30)	STORM DRAIN MANHOLE
	STORM DRAINAGE INLET
1030.00	PROP. FINISHED GRADE ELEV.
TC	TOP OF CURB ELEVATION
G	GUTTER ELEVATION
FG	FINISH GROUND
HP	HIGH POINT ELEVATION
M.E.	MATCH EXISTING
TG	TOP OF GRATE
TP	TOP OF PAVEMENT
1%	DIRECTION OF FLOW



VICINITY MAP

NOT TO SCALE

NOTE:
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ELEVATIONS:
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LAND USE SUMMARY:

GROSS ACREAGE: 8.83 ACRES

PROJECT CONTACTS

DEVELOPER:
KAPLAN ACQUISITIONS, LLC
520 POST OAK BLVD., SUITE 370
HOUSTON, TEXAS 77027
(713) 977-5699
CONTACT: GEOFF SIMPSON

ENGINEER:
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(512) 669-5560
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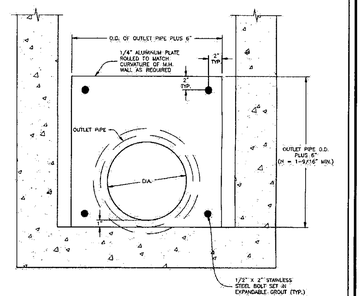
SUMMARY OF PHASE I AND PHASE II DETENTION VOLUMES

PHASE	REQUIRED	PROVIDED W/ PHASE I	PROVIDED W/ PHASE II
	AC-FT	AC-FT	AC-FT
I	0.74	0.74	0.00
II	0.66	0.23	0.47
TOTAL	1.40	0.97	0.47



ORIFICE SIZING EQUATION

$Q = CA(2gH)^{0.5}$

Q = PEAK DISCHARGE RATE, cfs
C = COEFFICIENT OF DISCHARGE (UNCLASSIFIED, USE 0.6 MINIMUM VALUE OF 0.61)
A = CROSS SECTIONAL AREA OF ORIFICE, SQUARE FEET.
g = ACCELERATION DUE TO GRAVITY, 32.16 FT/SEC/SEC
H = HEAD ON THE ORIFICE, FEET.

NOTES:
1. ORIFICE PLATE TO BE SET ON OUTLET PIPE WALL AT EACH BASIN AS INDICATED ON PLANS.

CITY OF COLUMBUS, OHIO DEPARTMENT OF PUBLIC UTILITIES DIVISION OF SEWERAGE & DRAINAGE	OUTLET CONTROL ORIFICE PLATE	STANDARD DRAWING AA-S145
SSIS MANAGER		REVISED 7/9/12
		PAGE 1

BIG RED DOG
ENGINEERING | CONSULTING
2021 E. 5TH STREET, SUITE 110 AUSTIN, TEXAS 78702
ARIZONA FIRM NO. 19744
512.669.5560
WWW.BIGREDDOG.COM
ARIZONA FIRM NO. 19744

Registered Professional Engineer (Civil) CERTIFICATE NO. 53520 BRADLEY LINGVAI DATE SIGNED 8/3/2016 ARIZONA, U.S.A. Bradley Lingvai Expires: 6/30/2018

NO.	DATE	REVISION	BY

DISTRICT AT THE QUARTER
15510 N. 73RD STREET
SCOTTSDALE, MARICOPA COUNTY, ARIZONA 85260

DRAINAGE PLAN (OVERALL)

SHEET
CG100
1 OF 3

Xrefs: C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP01.dwg C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP02.dwg C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_DBSP01.dwg C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\Preliminary Design Exhibits\E_HOU-001.008_GRADING AND DRAINAGE PLAN.dwg C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_DBSP02.dwg C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP03.dwg C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP04.dwg
User: marco.prieto
Last Modified: Aug 03, 16 - 14:05
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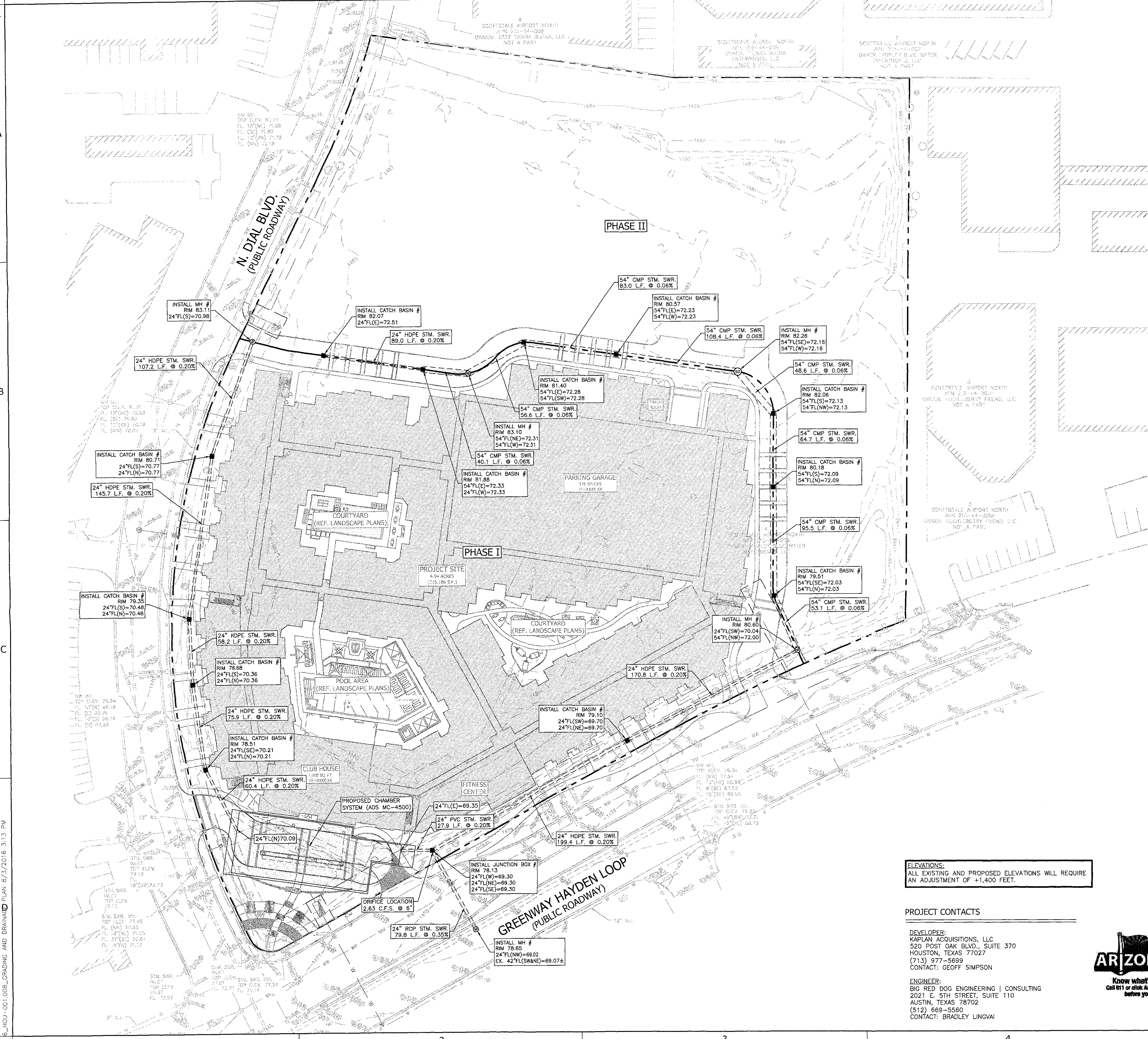
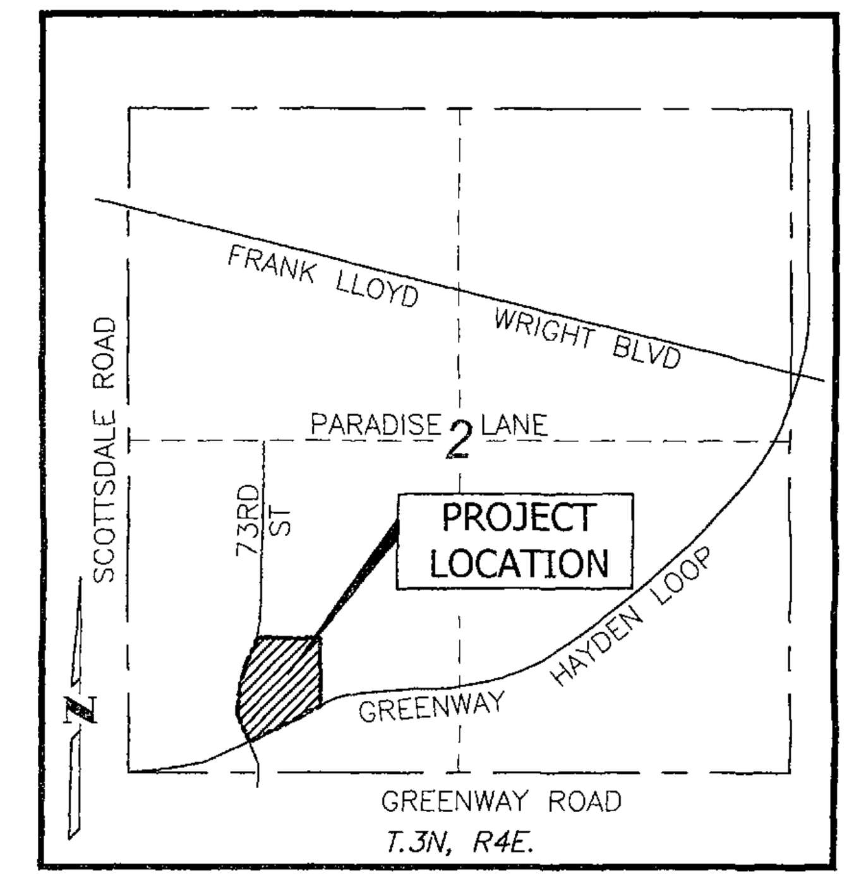


0 20' 40' 80'

LEGEND

	BOUNDARY / RIGHT OF WAY EASEMENT / SETBACK
	CURB & GUTTER
1470	CONTOUR (GRADE) ELEV.
	STORM SEWER PIPE
	RETAINING WALL
	TOP OF BANK
SD	STORM DRAIN MANHOLE
	STORM DRAINAGE INLET
1030.00	PROP. FINISHED GRADE ELEV.
TC	TOP OF CURB ELEVATION
G	GUTTER ELEVATION
FG	FINISH GROUND
HP	HIGH POINT ELEVATION
M.E.	MATCH EXISTING
TG	TOP OF GRATE
TP	TOP OF PAVEMENT
1%	DIRECTION OF FLOW



VICINITY MAP
NOT TO SCALE

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DRAINAGE PLAN (PHASE I)

SHEET
CG101
2 OF 3

Xrefs: C:\Dropbox (BRD-Houston)\Houston Projects\HOU-001-Kaplan\001.008 - District At the Quarter\ACAD\Xrefs\001.008_CSSP02.dwg
User: marco.prieto
Last Modified: Aug. 03, 16 - 15:05
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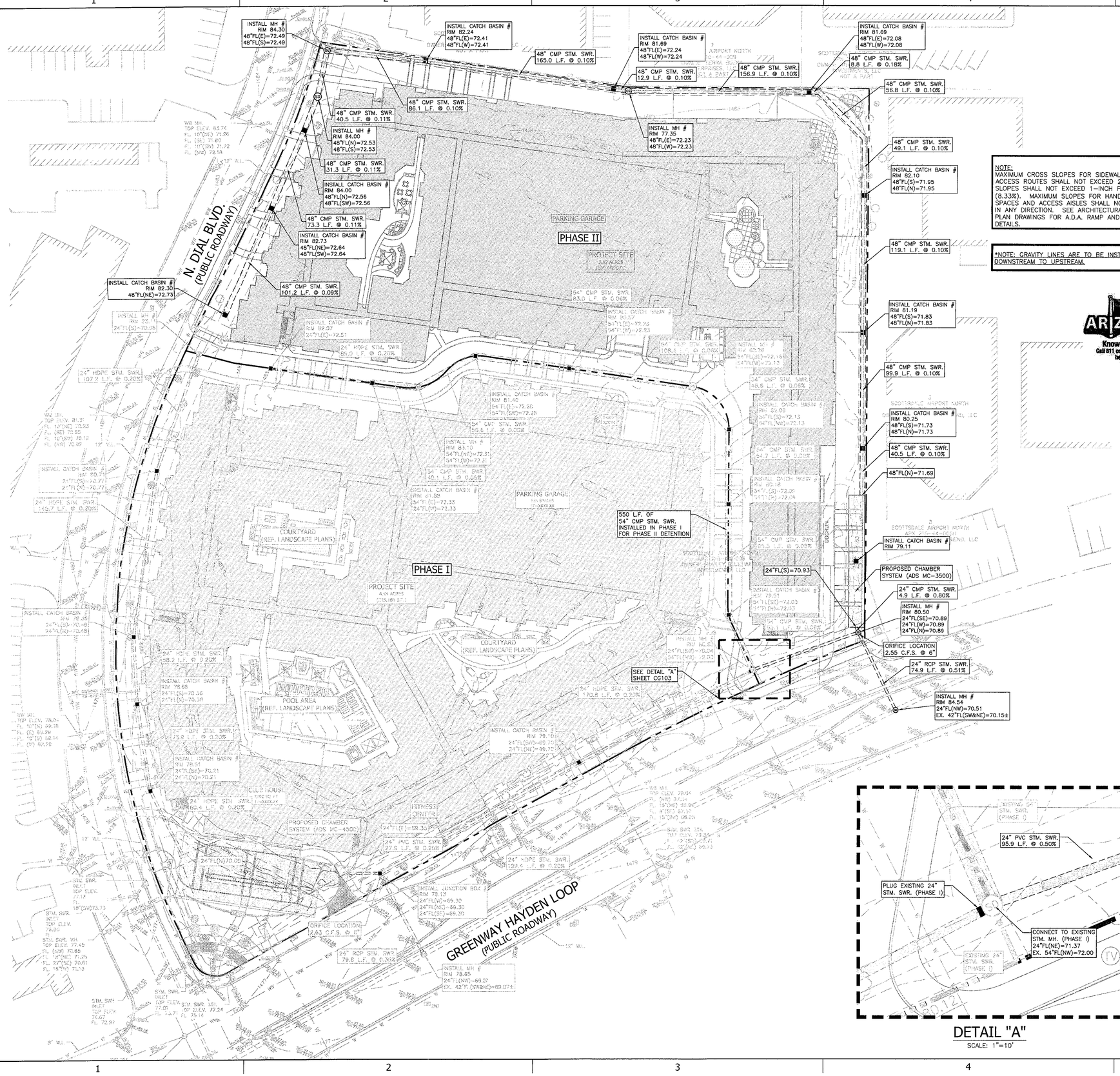

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LEGEND

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	CURB & GUTTER
1470	CONTOUR (GRADE) ELEV.
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	RETAINING WALL
	TOP OF BANK
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	STORM DRAINAGE INLET
1030.00	PROP. FINISHED GRADE ELEV.
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G	GUTTER ELEVATION
FG	FINISH GROUND
HP	HIGH POINT ELEVATION
M.E.	MATCH EXISTING
TG	TOP OF GRATE
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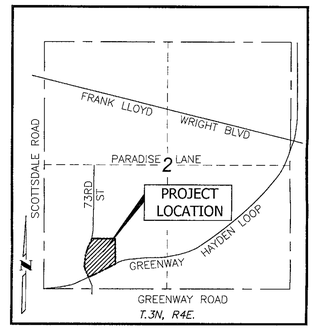
1%	DIRECTION OF FLOW



VICINITY MAP

NOT TO SCALE

ELEVATIONS:
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DETAIL "A"

SCALE: 1"=10'

PROJECT CONTACTS

DEVELOPER:
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HOUSTON, TEXAS 77027
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NO.	DATE	REVISION	BY

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Bradley Lingvai
Expires: 6/30/2018

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SCOTTSDALE, MARICOPA COUNTY, ARIZONA 85260

DRAINAGE PLAN (PHASE II)

SHEET
EX-3
3 OF 3

Appendix 2: CALCULATIONS

Drainage Analysis | **1**

Flood Control District of Maricopa County
Drainage Design Management System
PROJECT DEFAULTS

Project

Reference	
Title	DISTRICT AT THE QUART
Location	NEC OF N. GRENWAY HAYDEN LOOP & N. DIAL BLVD.
Agency	FLOOD CONTROL DISTRICT OF MARIPOCA COUNTY

Project Defaults

Model	RATIONAL
Land use Agency	FCDMC
Rainfall	NOAA14
Roads Agency	MCDOT
Inlets Agency	MCDOT

(stRanMulti.rpt)

Flood Control District of Maricopa County
Drainage Design Management System
RAINFALL DATA
Project Reference: DISTRICT AT THE QUAR

4/28/2016

ID	Method	Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
DEFAULT	NOAA14	5 MIN	0.250	0.336	0.404	0.494	0.563	0.634
	NOAA14	10 MIN	0.380	0.512	0.614	0.751	0.856	0.965
	NOAA14	15 MIN	0.471	0.634	0.761	0.931	1.061	1.196
	NOAA14	30 MIN	0.634	0.854	1.025	1.254	1.429	1.611
	NOAA14	1 HOUR	0.785	1.057	1.269	1.552	1.769	1.994
	NOAA14	2 HOUR	0.912	1.212	1.442	1.760	1.995	2.243
	NOAA14	3 HOUR	1.004	1.309	1.552	1.894	2.166	2.446
	NOAA14	6 HOUR	1.193	1.521	1.786	2.143	2.420	2.710
	NOAA14	12 HOUR	1.331	1.680	1.952	2.320	2.602	2.895
	NOAA14	24 HOUR	1.566	2.014	2.373	2.874	3.269	3.682

(stRanMulti.rpt)

Map Index No. 64
Cell No. 926-927

Flood Control District of Maricopa County
Drainage Design Management System
LAND USE
Project Reference: DISTRICT AT THE QUAR

5/26/2016

Sub Basin	Land Use Code	Area (acres)	Area (%)	Kb	Runoff Coefficient C						Description
					2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	
Major Basin ID: 01											
BUILD	190	5.54	100.0	0.035	0.67*	0.67*	0.67*	0.74*	0.80*	0.83*	Very High Density Residential - Multi Family (> 15 du per ac
		5.540	**100.0**								
OPEN	700	2.17	100.0	0.075	0.40	0.40	0.40	0.44	0.48	0.50	General Open Space (Open space where no detail available)
		2.170	**100.0**								
ROAD	2002	1.13	100.0	0.040	0.76*	0.76*	0.76*	0.84*	0.91*	0.95*	Pavement and Rooftops
		1.130	**100.0**								

* Non default value

Flood Control District of Maricopa County
Drainage Design Management System
LAND USE
Project Reference: DISTRICT AT THE QUAR

6/1/2016

Sub Basin	Land Use Code	Area (acres)	Area (%)	Kb	Runoff Coefficient C						Description
					2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	
Major Basin ID: 01											
BUILD	190	2.96	100.0	0.035	0.67*	0.67*	0.67*	0.74*	0.80*	0.83*	Very High Density Residential - Multi Family (> 15 du per ac
		2.960	**100.0**								
OPEN	700	1.68	100.0	0.075	0.40	0.40	0.40	0.44	0.48	0.50	General Open Space (Open space where no detail available)
		1.680	**100.0**								
ROAD	2002	0.30	100.0	0.040	0.76*	0.76*	0.76*	0.84*	0.91*	0.95*	Pavement and Rooftops
		0.300	**100.0**								

* Non default value

Flood Control District of Maricopa County
Drainage Design Management System
LAND USE
Project Reference: DISTRICT AT THE QUAR

6/1/2016

Sub Basin	Land Use Code	Area (acres)	Area (%)	Kb	Runoff Coefficient C						Description
					2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	
Major Basin ID: 01											
BUILD	190	2.58	100.0	0.035	0.67*	0.67*	0.67*	0.74*	0.80*	0.83*	Very High Density Residential - Multi Family (> 15 du per ac
		2.580	**100.0**								
OPEN	700	0.48	100.0	0.075	0.40	0.40	0.40	0.44	0.48	0.50	General Open Space (Open space where no detail available)
		0.480	**100.0**								
ROAD	2002	0.83	100.0	0.040	0.76*	0.76*	0.76*	0.84*	0.91*	0.95*	Pavement and Rooftops
		0.830	**100.0**								

* Non default value

Flood Control District of Maricopa County
Drainage Design Management System
Agency: FCDMC - LAND USE DEFAULTS
Project Reference: DISTRICT AT THE QUAR

Code	Description	Rational Method C						Resistance Coefficient Kb
		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	
Agriculture								
750	Agriculture	0.20	0.20	0.20	0.22	0.24	0.25	LOW
Commercial								
200	General Commercial (Commercial where no detail available)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
210	Specialty Commercial (<=50,000 sq. ft.)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
220	Neighborhood Commercial (50,000 to 100,000 sq. ft.)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
230	Community Commercial (100,000 to 500,000 sq. ft.)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
240	Regional Commercial (500,000 to 1,000,000 sq. ft.)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
250	Super-Regional Commercial (>= 1,000,000 sq. ft.)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
Industrial								
300	General Industrial (Industrial where no detail available)	0.80	0.80	0.80	0.88	0.95	0.95	MIN
310	Warehouse/Distribution Centers	0.85	0.85	0.85	0.94	0.95	0.95	MIN
320	Industrial	0.80	0.80	0.80	0.88	0.95	0.95	MIN
Institutional								
520	Educational (Public schools, private schools and universitie	0.75	0.75	0.75	0.83	0.90	0.94	MIN
530	Institutional (Includes hospitals and churches)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
550	Public Facilities(Include community centers, power substatio	0.85	0.85	0.85	0.94	0.95	0.95	MIN
Landscaping								
2000	Landscaping with impervious under treatment	0.85	0.85	0.85	0.94	0.95	0.95	MIN
2001	Landscaping w/o impervious under treatment	0.40	0.40	0.40	0.44	0.48	0.50	MIN
Office								
400	Office General (Office where no detail available)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
410	Office Low Rise (1-4 stories)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
420	Office Mid Rise (5-12 stories)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
430	Office High Rise (13 stories or more)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
810	Business Park (Includes enclosed industrial, office or retai	0.85	0.85	0.85	0.94	0.95	0.95	MIN
Open Space								
540	Cemeteries	0.25	0.25	0.25	0.28	0.30	0.31	LOW
700	General Open Space (Open space where no detail available)	0.40	0.40	0.40	0.44	0.48	0.50	LOW
710	Active Open Space (Includes parks)	0.25	0.25	0.25	0.28	0.30	0.31	MIN
720	Golf courses	0.25	0.25	0.25	0.28	0.30	0.31	MIN
730	Passive Open Space (Includes mountain preserves and washes)	0.55	0.55	0.55	0.61	0.66	0.69	MAX
740	Water	1.00	1.00	1.00	1.00	1.00	1.00	MIN
900	Vacant (Existing land use database only)	0.40	0.40	0.40	0.44	0.48	0.50	LOW
NDR	Undeveloped Desert Rangeland, Little topographic relief, slopes < 5%	0.40	0.40	0.40	0.44	0.48	0.50	LOW
NHS	Hillslopes, Sonoran Desert, Moderate topographic relief, slopes > 5%	0.55	0.55	0.55	0.61	0.66	0.69	HI
NMT	Mountain Terrain, High topographic relief, slopes > 10%	0.80	0.80	0.80	0.88	0.95	0.95	MAX
Other								
560	Special Events (Includes stadiums, sports complexes and fair	0.85	0.85	0.85	0.94	0.95	0.95	MIN
Other Employment								
570	Other Employment - low (Proving grounds and land fills)	0.85	0.85	0.85	0.94	0.95	0.95	MIN
580	Other Employment - medium	0.85	0.85	0.85	0.94	0.95	0.95	MIN
590	Other Employment - high	0.85	0.85	0.85	0.94	0.95	0.95	MIN
Residential								
110	Rural Residential (<= 1/5 du per acre)	0.42	0.42	0.42	0.46	0.50	0.53	MIN
120	Estate Residential (1/5 du per acre to 1 du per acre)	0.42	0.42	0.42	0.46	0.50	0.53	MIN
130	Large Lot Residential - Single Family (1 du per acre to 2 du	0.48	0.48	0.48	0.53	0.58	0.60	MIN
140	Medium Lot Residential - Single Family (2-4 du per acre)	0.65	0.65	0.65	0.72	0.78	0.80	MIN

Flood Control District of Maricopa County
Drainage Design Management System
Agency: FCDMC - LAND USE DEFAULTS
Project Reference: DISTRICT AT THE QUAR

Code	Description	Rational Method C						Resistance Coefficient Kb
		2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr	
150	Small Lot Residential - Single Family (4-6 du per acre)	0.68	0.68	0.68	0.75	0.80	0.84	MIN
160	Very Small Lot Residential - Single Family (>6 du per acre-i	0.75	0.75	0.75	0.83	0.90	0.94	MIN
170	Medium Density Residential - Muli Family (5-10 du per acre)	0.75	0.75	0.75	0.83	0.90	0.94	MIN
180	High Density Residential - Multi Family (10-15 du per acre)	0.75	0.75	0.75	0.83	0.90	0.94	MIN
190	Very High Density Residential - Multi Family (> 15 du per ac	0.75	0.75	0.75	0.83	0.90	0.94	MIN
Tourist								
510	Tourist and Visitor Accommodations (Hotels, motels and resor	0.85	0.85	0.85	0.94	0.95	0.95	MIN
Transportation								
600	General Transportation (Transportation where no detail avail	0.95	0.95	0.95	0.95	0.95	0.95	MIN
610	Transportation (Includes railroads, railyards, transit cente	0.95	0.95	0.95	0.95	0.95	0.95	MIN
620	Airports (Includes public use airports)	0.80	0.80	0.80	0.88	0.95	0.95	MIN
630	Transportation	0.95	0.95	0.95	0.95	0.95	0.95	MIN
2002	Pavement and Rooftops	0.95	0.95	0.95	0.95	0.95	0.95	MIN
2003	Gravel Vehicular travel lanes and shoulders	0.70	0.70	0.70	0.77	0.84	0.88	MIN

Drainage Calculations |**2**

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ENGINEERING | CONSULTING

Project Name: District at the Quarter
Address: NEC of N. Greenway Hayden Loop and N. Dial Blvd.
BRD Job #: H001.008

Weighted Runoff Coefficient

$$C_w = \frac{A_1C_1 + A_2C_2 + A_3C_3}{A_1 + A_2 + A_3}$$

C_w Weighted Runoff Coefficient
A Area per Land Classification
C Runoff Coefficient per Land Classification - Reference Fig 4.1-4 of the COS DS&PM

Overall Runoff Coefficient

Land Use	Runoff Coefficient (C)100 Year	Area (Acres)
Apartments & Condominimum (R-3, R-5)	0.94	5.54
Undisturbed natural desert or desert landscaping	0.45	2.16
Paved streets, parking lots (concrete or asphalt), roofs, drive-ways, etc.	0.95	1.13

Cw = 0.82

Phase I Weighted Runoff Coefficient

Land Use	Runoff Coefficient (C) 100 Year	Area (Acres)
Apartments & Condominimum (R-3, R-5)	0.94	2.96
Undisturbed natural desert or desert landscaping	0.45	1.68
Paved streets, parking lots (concrete or asphalt), roofs, drive-ways, etc.	0.95	0.3

Cw = 0.77

Phase II Weighted Runoff Coefficient

Land Use	Runoff Coefficient (C)100 Year	Area (Acres)
Apartments & Condominimum (R-3, R-5)	0.94	2.58
Undisturbed natural desert or desert landscaping	0.45	0.48
Paved streets, parking lots (concrete or asphalt), roofs, drive-ways, etc.	0.95	0.83

Cw = 0.88

Flood Control District of Maricopa County
Drainage Design Management System
RATIONAL METHOD FLOW SUMMARY - ALL
Project Reference: DISTRICT AT THE QUAR

5/11/2016

Type ID	Length (ft)	Conveyance Velocity (ft/sec)	Tpipe (min)	Combine		Return Period (Years) 2	5	10	25	50	100
Maior Basin ID: 01											
Sub Basin	-	-	-	-	Q (cfs)	9.8	13.8	17.0	23.8	29.8	35.0
BUILD					CA (ac)	3.71	3.71	3.71	4.10	4.43	4.60
					Tc (min)	7.4	6.5	6.0	5.4	5.1	5.0
					i (in/hr)	2.63	3.72	4.59	5.80	6.72	7.61
Sub Basin	-	-	-	-	Q (cfs)	2.6	3.5	4.2	5.6	7.0	8.3
OPEN					CA (ac)	0.87	0.87	0.87	0.95	1.04	1.09
					Tc (min)	5.1	5.0	5.0	5.0	5.0	5.0
					i (in/hr)	2.98	4.03	4.85	5.93	6.76	7.61
Sub Basin	-	-	-	-	Q (cfs)	2.4	3.3	4.1	5.6	7.0	8.1
ROAD					CA (ac)	0.86	0.86	0.86	0.95	1.03	1.07
					Tc (min)	6.6	5.8	5.3	5.0	5.0	5.0
					i (in/hr)	2.75	3.86	4.77	5.93	6.76	7.61

* First Pipe

Flood Control District of Maricopa County
Drainage Design Management System
RATIONAL METHOD FLOW SUMMARY - ALL
Project Reference: DISTRICT AT THE QUAR

6/1/2016

Type ID	Length (ft)	Conveyance Velocity (ft/sec)	Tpipe (min)	Combine		Return Period (Years) 2	5	10	25	50	100
Maior Basin ID: 01											
Sub Basin	-	-	-	-	Q (cfs)	5.1	7.3	9.0	12.6	15.8	18.7
BUILD					CA (ac)	1.98	1.98	1.98	2.19	2.37	2.46
					Tc (min)	7.6	6.6	6.1	5.6	5.3	5.0
					i (in/hr)	2.60	3.70	4.56	5.74	6.65	7.61
Sub Basin	-	-	-	-	Q (cfs)	0.3	0.5	0.6	0.8	0.9	1.1
OPEN					CA (ac)	0.12	0.12	0.12	0.13	0.14	0.15
					Tc (min)	5.6	5.0	5.0	5.0	5.0	5.0
					i (in/hr)	2.90	4.03	4.85	5.93	6.76	7.61
Sub Basin	-	-	-	-	Q (cfs)	3.5	5.0	6.1	8.4	10.3	12.2
ROAD					CA (ac)	1.28	1.28	1.28	1.41	1.53	1.60
					Tc (min)	6.5	5.7	5.2	5.0	5.0	5.0
					i (in/hr)	2.76	3.88	4.80	5.93	6.76	7.61

* First Pipe

Flood Control District of Maricopa County
Drainage Design Management System
RATIONAL METHOD FLOW SUMMARY - ALL

Page 1 — Project Reference: DISTRICT AT THE QUAR — 6/1/2016

Type ID	Length (ft)	Conveyance Velocity (ft/sec)	Tpipe (min)	Combine		Return Period (Years) 2	5	10	25	50	100
Maior Basin ID: 01											
Sub Basin	-	-	-	-	Q (cfs)	4.5	6.4	7.9	11.0	13.7	16.2
BUILD					CA (ac)	1.73	1.73	1.73	1.91	2.06	2.14
					Tc (min)	7.7	6.7	6.2	5.6	5.3	5.1
					i (in/hr)	2.59	3.68	4.54	5.74	6.65	7.57
Sub Basin	-	-	-	-	Q (cfs)	0.6	0.8	0.9	1.2	1.6	1.8
OPEN					CA (ac)	0.19	0.19	0.19	0.21	0.23	0.24
					Tc (min)	5.5	5.0	5.0	5.0	5.0	5.0
					i (in/hr)	2.92	4.03	4.85	5.93	6.76	7.61
Sub Basin	-	-	-	-	Q (cfs)	1.7	2.4	3.0	4.2	5.1	6.0
ROAD					CA (ac)	0.63	0.63	0.63	0.70	0.76	0.79
					Tc (min)	6.7	5.8	5.4	5.0	5.0	5.0
					i (in/hr)	2.73	3.86	4.74	5.93	6.76	7.61

* First Pipe

Drawdown Calculations and Orifice Sizing | **3**

Drawdown time for Phase I Detention through Orifice

Pond ID: Phase I

Maximum pond elevation: 1477.02 ft
Maximum Pond Volume: 32124 cu-ft
Pond outlet elevation: 1469.3 ft

Shape of Orifice: Circle

Dimensions of Orifice: 0.044 R, ft 0.53 in
0.021 n/a

Number of Oricices 1

Q = RELEASE RATE = $CA(2GH)^{1/2}$

G = GRAVITATIONAL CONSTANT = 32.2 FT/S^2
C = ORIFICE COEFFICIENT = 0.6
A = AREA OF ORIFICE = 0.01
H = HEAD ON ORIFICE MAXIMUM = 7.675981
MINIMUM = 0

Pond Elevation	Cum.Pond Volume	Inc. Pond Volume	Head	Flowrate	Time
ft	ac-ft	ac-ft	ft	CFS	minutes
1477.02	0.7374656	0.008	7.68	0.081	73.4
1476.92	0.7292715	0.008	7.58	0.081	73.9
1476.82	0.7210774	0.008	7.48	0.080	74.3
1476.72	0.7128834	0.008	7.38	0.079	74.8
1476.62	0.7046893	0.008	7.28	0.079	75.4
1476.52	0.6964953	0.008	7.18	0.078	75.9
1476.42	0.6883012	0.008	7.08	0.078	76.4
1476.32	0.6801071	0.008	6.98	0.077	77.0
1476.22	0.6719131	0.008	6.88	0.077	77.5
1476.12	0.6637190	0.008	6.78	0.076	78.1
1476.02	0.6555249	0.008	6.68	0.076	78.7
1475.92	0.6473309	0.008	6.58	0.075	79.3
1475.82	0.6391368	0.008	6.48	0.074	79.9
1475.72	0.6309428	0.008	6.38	0.074	80.5
1475.62	0.6227487	0.008	6.28	0.073	81.1
1475.52	0.6145546	0.008	6.18	0.073	81.8
1475.42	0.6063606	0.008	6.08	0.072	82.5
1475.32	0.5981665	0.008	5.98	0.072	83.2
1475.22	0.5899725	0.008	5.88	0.071	83.9
1475.12	0.5817784	0.008	5.78	0.070	84.6
1475.02	0.5735843	0.008	5.68	0.070	85.3
1474.92	0.5653903	0.008	5.58	0.069	86.1
1474.82	0.5571962	0.008	5.48	0.068	86.9
1474.72	0.5490021	0.008	5.38	0.068	87.7
1474.62	0.5408081	0.008	5.28	0.067	88.5
1474.52	0.5326140	0.008	5.18	0.067	89.4
1474.42	0.5244200	0.008	5.08	0.066	90.2
1474.32	0.5162259	0.008	4.98	0.065	91.1
1474.22	0.5080318	0.008	4.88	0.065	92.1
1474.12	0.4998378	0.008	4.78	0.064	93.0
1474.02	0.4916437	0.008	4.68	0.063	94.0
1473.92	0.4834496	0.008	4.58	0.063	95.0
1473.82	0.4752556	0.008	4.48	0.062	96.1
1473.72	0.4670615	0.008	4.38	0.061	97.2
1473.62	0.4588675	0.008	4.28	0.061	98.3
1473.52	0.4506734	0.008	4.18	0.060	99.5
1473.42	0.4424793	0.008	4.08	0.059	100.7
1473.32	0.4342853	0.008	3.98	0.058	101.9
1473.22	0.4260912	0.008	3.88	0.058	103.3
1473.12	0.4178972	0.008	3.78	0.057	104.6
1473.02	0.4097031	0.008	3.68	0.056	106.0
1472.92	0.4015090	0.008	3.58	0.055	107.5
1472.82	0.3933150	0.008	3.48	0.055	109.0
1472.72	0.3851209	0.008	3.38	0.054	110.6

1472.62	0.3769268	0.008	3.28	0.053	112.3
1472.52	0.3687328	0.008	3.18	0.052	114.1
1472.42	0.3605387	0.008	3.08	0.051	115.9
1472.32	0.3523447	0.008	2.98	0.050	117.8
1472.22	0.3441506	0.008	2.88	0.050	119.9
1472.12	0.3359565	0.008	2.78	0.049	122.0
1472.02	0.3277625	0.008	2.68	0.048	124.3
1471.92	0.3195684	0.008	2.58	0.047	126.7
1471.82	0.3113743	0.008	2.48	0.046	129.2
1471.72	0.3031803	0.008	2.38	0.045	131.9
1471.62	0.2949862	0.008	2.28	0.044	134.7
1471.52	0.2867922	0.008	2.18	0.043	137.8
1471.42	0.2785981	0.008	2.08	0.042	141.1
1471.32	0.2704040	0.008	1.98	0.041	144.6
1471.22	0.2622100	0.008	1.88	0.040	148.4
1471.12	0.2540159	0.008	1.78	0.039	152.5
1471.02	0.2458219	0.008	1.68	0.038	157.0
1470.92	0.2376278	0.008	1.58	0.037	161.9
1470.82	0.2294337	0.008	1.48	0.036	167.3
1470.72	0.2212397	0.008	1.38	0.034	173.3
1470.62	0.2130456	0.008	1.28	0.033	180.0
1470.52	0.2048515	0.008	1.18	0.032	187.5
1470.42	0.1966575	0.008	1.08	0.030	196.0
1470.32	0.1884634	0.008	0.98	0.029	205.8
1470.22	0.1802694	0.008	0.88	0.027	217.2
1470.12	0.1720753	0.008	0.78	0.026	230.8
1470.02	0.1638812	0.008	0.68	0.024	247.2
1469.92	0.1556872	0.008	0.58	0.022	267.8
1469.82	0.1474931	0.008	0.48	0.020	294.6
1469.72	0.1392991	0.008	0.38	0.018	331.5
1469.62	0.1311050	0.008	0.28	0.015	387.0
1469.52	0.1229109	0.008	0.18	0.012	484.6
1469.42	0.1147169	0.008	0.08	0.008	720.0

Drawdown time for Phase II Detention through Orifice

Pond ID: *Phase II*

Maximum pond elevation: 1477.56 ft
Maximum Pond Volume: 28750 cu-ft
Pond outlet elevation: 1470.51 ft

Shape of Orifice: Circle

Dimensions of Orifice: 0.038 R, ft 0.46 in
0.021 n/a

Number of Oricices 1

Q = RELEASE RATE = $CA(2GH)^{1/2}$

G = GRAVITATIONAL CONSTANT = 32.2 FT/S^2
C = ORIFICE COEFFICIENT = 0.6
A = AREA OF ORIFICE = 0.005
H = HEAD ON ORIFICE MAXIMUM = 7.011728
MINIMUM = 0

Pond Elevation	Cum.Pond Volume	Inc. Pond Volume	Head	Flowrate	Time
ft	ac-ft	ac-ft	ft	CFS	minutes
1477.56	0.660	0.007	7.01	0.059	90.9
1477.46	0.653	0.007	6.91	0.058	91.5
1477.36	0.645	0.007	6.81	0.058	92.2
1477.26	0.638	0.007	6.71	0.057	92.9
1477.16	0.631	0.007	6.61	0.057	93.6
1477.06	0.623	0.007	6.51	0.056	94.3
1476.96	0.616	0.007	6.41	0.056	95.0
1476.86	0.609	0.007	6.31	0.056	95.8
1476.76	0.601	0.007	6.21	0.055	96.6
1476.66	0.594	0.007	6.11	0.055	97.3
1476.56	0.587	0.007	6.01	0.054	98.2
1476.46	0.579	0.007	5.91	0.054	99.0
1476.36	0.572	0.007	5.81	0.053	99.8
1476.26	0.565	0.007	5.71	0.053	100.7
1476.16	0.557	0.007	5.61	0.052	101.6
1476.06	0.550	0.007	5.51	0.052	102.5
1475.96	0.543	0.007	5.41	0.051	103.5
1475.86	0.535	0.007	5.31	0.051	104.4
1475.76	0.528	0.007	5.21	0.051	105.4
1475.66	0.521	0.007	5.11	0.050	106.4
1475.56	0.513	0.007	5.01	0.050	107.5
1475.46	0.506	0.007	4.91	0.049	108.6
1475.36	0.499	0.007	4.81	0.049	109.7
1475.26	0.491	0.007	4.71	0.048	110.9
1475.16	0.484	0.007	4.61	0.048	112.1
1475.06	0.477	0.007	4.51	0.047	113.3
1474.96	0.469	0.007	4.41	0.046	114.6
1474.86	0.462	0.007	4.31	0.046	115.9
1474.76	0.455	0.007	4.21	0.045	117.3
1474.66	0.447	0.007	4.11	0.045	118.7
1474.56	0.440	0.007	4.01	0.044	120.2
1474.46	0.433	0.007	3.91	0.044	121.7
1474.36	0.425	0.007	3.81	0.043	123.3
1474.26	0.418	0.007	3.71	0.043	124.9
1474.16	0.411	0.007	3.61	0.042	126.6
1474.06	0.403	0.007	3.51	0.041	128.4
1473.96	0.396	0.007	3.41	0.041	130.3
1473.86	0.389	0.007	3.31	0.040	132.2
1473.76	0.381	0.007	3.21	0.040	134.3
1473.66	0.374	0.007	3.11	0.039	136.4
1473.56	0.367	0.007	3.01	0.038	138.7
1473.46	0.359	0.007	2.91	0.038	141.0
1473.36	0.352	0.007	2.81	0.037	143.5
1473.26	0.345	0.007	2.71	0.036	146.1

1473.16	0.337	0.007	2.61	0.036	148.9
1473.06	0.330	0.007	2.51	0.035	151.9
1472.96	0.323	0.007	2.41	0.034	155.0
1472.86	0.315	0.007	2.31	0.034	158.3
1472.76	0.308	0.007	2.21	0.033	161.8
1472.66	0.301	0.007	2.11	0.032	165.6
1472.56	0.293	0.007	2.01	0.031	169.7
1472.46	0.286	0.007	1.91	0.031	174.1
1472.36	0.279	0.007	1.81	0.030	178.8
1472.26	0.271	0.007	1.71	0.029	183.9
1472.16	0.264	0.007	1.61	0.028	189.6
1472.06	0.257	0.007	1.51	0.027	195.7
1471.96	0.249	0.007	1.41	0.026	202.6
1471.86	0.242	0.007	1.31	0.025	210.1
1471.76	0.235	0.007	1.21	0.024	218.6
1471.66	0.227	0.007	1.11	0.023	228.3
1471.56	0.220	0.007	1.01	0.022	239.3
1471.46	0.213	0.007	0.91	0.021	252.0
1471.36	0.205	0.007	0.81	0.020	267.1
1471.26	0.198	0.007	0.71	0.019	285.3
1471.16	0.191	0.007	0.61	0.017	307.7
1471.06	0.183	0.007	0.51	0.016	336.4
1470.96	0.176	0.007	0.41	0.014	375.1
1470.86	0.169	0.007	0.31	0.012	431.0
1470.76	0.161	0.007	0.21	0.010	523.0
1470.66	0.154	0.007	0.11	0.007	720.0
1470.56	0.147	0.000	0.01	0.002	0.0

Appendix 3

Warning and Disclaimer of Liability | 1

Appendix 4-1C

WARNING & DISCLAIMER OF LIABILITY

The Drainage and Floodplain Regulations and Ordinances of the City of Scottsdale are intended to "minimize the occurrence of losses, hazards and conditions adversely affecting the public health, safety and general welfare which might result from flooding caused by the surface runoff of rainfall" (Scottsdale Revised Code §37-16).

As defined in S.R.C. §37-17, a flood plain or "*Special flood hazard* area means an area having flood and/or flood related erosion hazards as shown on a FHBM or FIRM as zone A, AO, A1-30, AE, A99, AH, or E, and those areas identified as such by the floodplain administrator, delineated in accordance with subsection 37-18(b) and adopted by the floodplain board." It is possible that a property could be inundated by greater frequency flood events or by a flood greater in magnitude than a 100-year flood. Additionally, much of the Scottsdale area is a dynamic flood area; that is, the floodplains may shift from one location to another, over time, due to natural processes.

WARNING AND DISCLAIMER OF LIABILITY PURSUANT TO S.R.C §37-22

"The degree of flood protection provided by the requirements in this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Floods larger than the base flood can and will occur on rare occasions. Floodwater heights may be increased by man-made or natural causes. This article (Chapter 37, Article II) shall not create liability on the part of the city, any officer or employee thereof, or the federal government for any flood damages that result from reliance on this article or any administrative decision lawfully made thereunder."

Compliance with Drainage and Floodplain Regulations and Ordinances does not insure complete protection from flooding. The Floodplain Regulations and Ordinances meet established local and federal standards for floodplain management, but neither this review nor the Regulations and Ordinances take into account such flood related problems as natural erosion, streambed meander or man-made obstructions and diversions, all of which may have an adverse affect in the event of a flood. You are advised to consult your own engineer or other expert regarding these considerations.

I have read and understand the above. If I am an agent for an owner I have made the owner aware of and explained this disclaimer.

8-24-2016 3-GP-2016		8/3/2016
Plan Check No.	Owner or Agent	Date