

# Highland Village

Application to Washoe County for a:

## ***Tentative Subdivision Map***

Prepared by:



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Prepared for:

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Ron Bath

**September 8, 2020**

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- Tentative Map Application with Supplemental Information
- WC Application Fee Sheet
- Property Owner Affidavit
- Directors Modification Application
- Tentative Map Exhibits (Slope Map and Property Survey)
- Plan Set (Reduced sheets – 8.5 x 11)
- WC Treasurer Certificate (Payment Records)
- Preliminary Title Report

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- S1 – Overall Site Plan
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- G1 – Overall Grading Plan
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- U1- Overall Utility Plan
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- E1- Earthwork
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**Project Request** - This application includes the following request:

- A request for a Tentative Subdivision Map with Common Open Space Development to allow 216 single family detached lots with open space/common area on a 55-acre site known as Highland Village.

### Property Location

The site is located along and adjacent to Highland Ranch Parkway and will be accessed from Midnight Drive with one additional planned street connection further north on Highland Ranch. This is located on two parcels that total 55.1 acres for the entire site.

### Project Analysis of Key Development Code Elements

Highland Village is a common open space development which promotes the concept of clustering lots to the usable area and providing more open space in exchange for clustering of lots and reducing lot sizes. In this case, 38% of the site is common area and open space used primarily for the buffering and slope adjustment areas. The 62% majority of the site is development area which includes homes, yards, and streets for access.

### ***Article 408 Common Open Space: 5-part test within the purpose statement:***

- Preserve or provide open space** – The site as designed does meet this standard with 38% open space provided.
- Protect natural and scenic resources** – There are not significant natural resources or scenic resources being removed as a result of the proposed plan. The grading as it stands is necessary to accomplish a reasonable footprint for development. While the grading is significant, it is isolated with respect to the affecting topography and not any other natural resources. It does meet the development code as designed. There is approximately 250,000 cubic yards of cut and 242,000 cubic yards of fill. Finished slopes are more than 10 ft greater than the natural slope and fully addressed in the related Directors Modification application.
- Achieve a more efficient use of land** – The plan does meet the efficiency standard as a more efficient use of the land. As the minimum lot size for the project is roughly 4,700 sf, it is smaller than the minimum lot size (5,000 sf) required for HDS zoning. This is a result of the proposed variations in lot widths and setbacks. A related design feature is to create adequate footprints for flexibility to meet market demands for entry level SF housing sizes while being responsive to cost control.

Average lot size of (5,406 sf) is implicit in topographic regions like this site where there are necessary curvilinear streets that force a “pie lot” shape that always exceeds the minimum lot size. So, average is about 15% larger than the minimum which is typical

for SF land plans that involve any 3-dimensional challenges and any “non-grid” land planning patterns. An exception and way around this this would be to provide attached product. However, that attached product concept is not part of the development program for this site and this sub-market and not consistent with the applicants vision.

- d) Minimize road building** – The project as designed meets this requirement with rough flexible grid. The cul-de-sac is isolated to a single feature that is highly desired in the marketplace by home buyers, it is not a measure of inefficiency on an overall basis. There is intent to not provide connectivity to the area to the north. Potential for future connectivity to Noyes Ct is not realistic, practical, or feasible because the grades will not meet the maximum grades per the WC code and would result in a forced road alignment with excess cuts and fills. This is best visualized by thinking of a road that traverses a steep grade in a “zig-zag” fashion that is driven by engineering and not a path of least resistance by following natural grades.
  
- e) Encourage a sense of community** – The project as designed meets this requirement as the plan provides recreation areas. Common Areas 3 and 4 are broken up with terracing as needed to make the grades work. We need to create some flatter areas for the lots and then transition the backs of lots with common area and slope transition. It functions as a common community asset by creating a more pleasant visual condition versus lot-to-lot grading among shared rear property lines. This type of land plan and design is typically encouraged in land planning concepts and government agencies to avoid a lot-to-lot transition and wide variations of landscaping and fencing that vary from lot-to-lot. It results in a terribly incongruent appearance of the finished landscape.

**Article 406: Lot Standards**

Density: This site is subject to a recent rezoning and development agreement limiting to 4.2 units per acre gross density.

54.52 ac x 4.2 units per acre = 229 units allowed per zoning, 216 units are proposed

Following is the minimum lot size program designed for this neighborhood:

Minimum lot size = 47' width x 100' depth = 4,700 sf

Maximum Height: 35 feet and 2 stories allowed, and all 2 story homes are being proposed

Building setbacks are:

- Front Yards = 15' to the house and 20' to the garage
- Side yards = 5' on one side and 5' on the other side
- Rear yards = 15'

Minimum lot size is 4,747 sf, average lot size = 5,406 sf, the largest lot = 8,697 sf

HDS standards are:

Minimum lot size = 5,000 sf

Maximum Height is 35 ft

Building Setbacks are:

- Front = 20' to the house and/or garage
- Side = 5' on both sides
- Rear = 20' to the fence/property line

**Article 424 Hillside Development**

*The project does trigger this standard as designed because more than 15% slope is existing on 20% of the property. Site plan shows that the development will develop in isolated areas that are considered less suitable for development (greater than 30% slopes). This is only a small area. We have done so by demonstrating exceptions listed in 110.424.25(d) in order to build in areas less suitable for development.*

Our design does conform to the desired hillside development as broadly recommended in 110.424.30 per the following requirements:

110.424.30(b)3 - Required to make structured blend into the natural character of the hillside by reducing the visual bulk through landscaping, terraced building forms and height variations.

The design meets this standard by blending as best we can with the natural character and reducing visual bulk thru the proposed rockery wall and landscaped common area. Those are the transition area between lotted areas. It is the alternative to transitioning slope in the house itself.

110.424.30.(f)3 – Reasonably safe and adequate access from public streets without requiring massive grading or substantial vegetation removal shall be required for each created lot.

This standard is satisfied in the project as designed with maximum street grades of 6%. The two primary safety features in the project design are limitations on street grade (particularly for traction during winter conditions) and height/ stability of rock walls. Both are fairly conservative in the design. There is minimal vegetation removal to implement the plan as designed. Mass grading for a production home program and this site is typical and necessary in the land development process. Key to our design approach is the lack of environmentally significant features of the site.

110.424.30(g)1 – Multiple retaining walls shall be separated horizontally by a distance equal to at least the height of the lower retaining wall.

This standard is met in the project as designed.

110.424.30.(i) significant natural features shall be protected and preserved where appropriate and feasible include, but not limited to, ridgelines, canyons, ravines, streams and creeks, natural drainages and rock outcroppings.

Similar to that stated above in section f(3). There are no ridgelines, no canyons, no ravines, no streams, no creeks, no natural drainageways, and no out-cropping's. There is significant topography on the site that is being altered as needed to make the development program work while being responsible to safe design and reasonably sensitive to visual impacts. Something has to "give" when applying design concepts to a site with a lot of topographic variation. In this case, the zoning allows the proposed density and the project design meets the intent of all development code elements including Common Open Space Development, Lot Standards and Engineering code with the most challenging being the Hillside Development code.

Highland Village Tentative Map

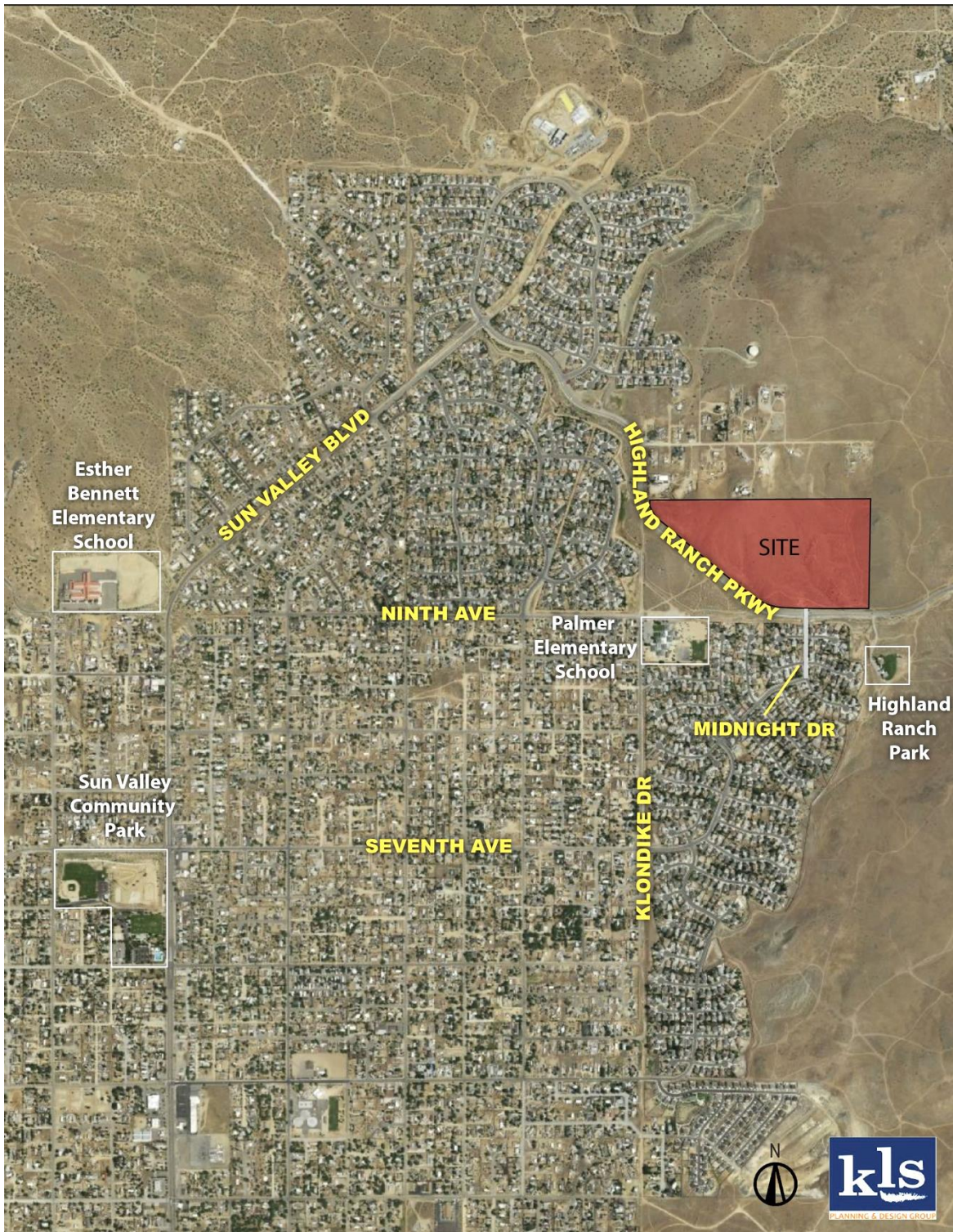


Figure 1 - Vicinity Map



Figure 2 – Site Plan



Highland Village Tentative Map

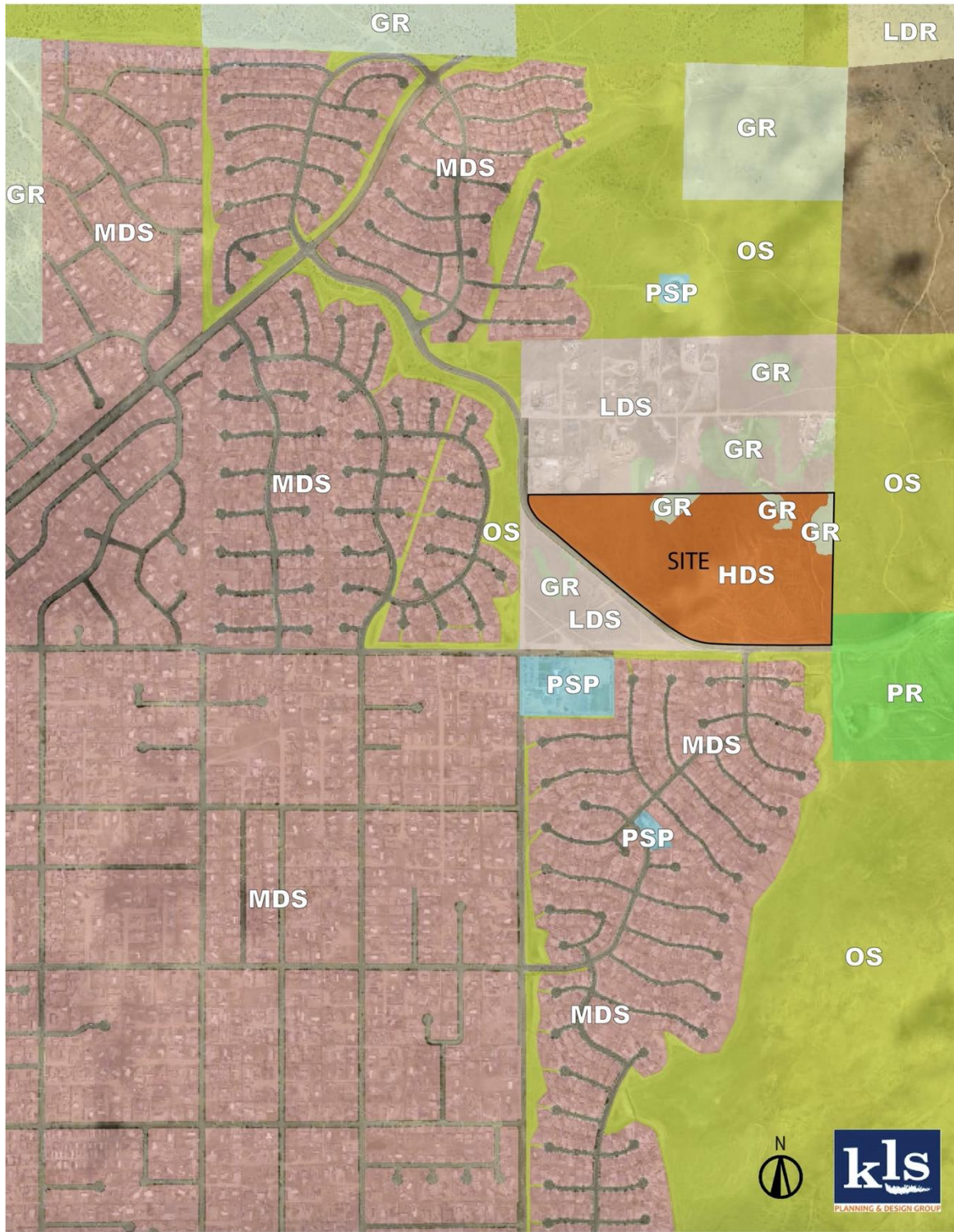


Figure 3 – WC Zoning

Highland Village Tentative Map



Figure 4 – WC Master Plan

**Tentative Map Findings:**

Washoe County Code Section 110.608.25 requires that all of the following findings be made to the satisfaction of the Washoe County Planning Commission before granting approval of the Tentative Map request.

**1) Plan Consistency. That the proposed map is consistent with the Master Plan and any specific plan.**

The proposed subdivision map meets all of the pertinent goals and policies of the Master Plan, and the Sun Valley Area Plan. The project falls under the allowable density established in the Area Plan and complies with all known policies that allow the density du per acre for residential uses.

**2) Design or Improvement. That the design or improvement of the proposed subdivision is consistent with the Master Plan and any specific plan.**

The proposed map meets all of the density, lot size and opens space criteria of the Master Plan, and the Sun Valley Area Plan. Specifically, the proposed development is within the allowable blended density of 7 units per acre of the HDS zoning with Open Space zoning which doesn't allow any density and the Suburban Residential in the master plan. Also, the proposed subdivision complies with the Common Open Space criteria for pedestrian access, open space, community amenities, etc.

**3) Type of Development. That the site is physically suited for the type of development proposed.**

The proposed subdivision appears to be well suited to the site as reflected in all of the technical products including the lot sizes, access, and grading. The site appears to be physically suited for the type of development proposed.

**4) Availability of Services. That the subdivision will meet the requirements of Article 702, Adequate Public Facilities Management System.**

The subdivision does meet all of the requirements of Article 702, Adequate Public Facilities Management System that are either planned for or will be constructed with this project.

**5) Fish or Wildlife. That neither the design of the subdivision nor any proposed improvements is likely to cause substantial environmental damage, or substantial and avoidable injury to any endangered plant, wildlife or their habitat.**

Most of the off-site infrastructure needs have been constructed with exception of water and sewer system upgrades. The improvements will not cause substantial environmental damage or substantial and avoidable injury to any endangered plant, wildlife or their habitat. There is no known habitat on the site. The site is covered with sagebrush and

low level vegetation.

- 6) **Public Health. That the design of the subdivision or type of improvement is not likely to cause significant public health problems.**

The design of the subdivision and improvements will not cause significant public health problems because most of the infrastructure is already in place. Dust control related to grading will be the most obvious public health issue which is tightly regulated with dust control permitting. Additionally, the proposed amenities such as pedestrian walkways, landscaping and common area will enhance the aesthetic and recreational value of the immediate neighborhood.

- 7) **Easements. That the design of the subdivision or the type of improvements will not conflict with easements acquired by the public at large for access through, or use of property within, the proposed subdivision.**

The subdivision as designed has taken into consideration and accommodated existing public easements for access through and use of the property.

- 8) **Access. That the design of the subdivision provides any necessary access to surrounding, adjacent lands and provides appropriate secondary access for emergency vehicles.**

The design of the subdivision will provide for good pedestrian and emergency vehicle access to these surrounding uses. An important pedestrian access item will be the walking route to and from the school which is not clearly define at time of this application. It is the applicant's intent to collaborate with staff and the community to better define this item.

- 9) **Dedications. That any land or improvements to be dedicated to the County is consistent with the Master Plan.**

All of the roadways will be dedicated to the county. The common area will remain under the ownership of the Homeowner's Association. All sewer and water improvements will be dedicated to SVGID as well.

- 10) **Energy. That the design of the subdivision provides, to the extent feasible, for future passive or natural heating or cooling opportunities in the subdivision.**

To the extent possible, the design of the subdivision provides for future passive or natural heating or cooling opportunities. The layout is very much governed by the topographic conditions on the site which is the form of widely varied slopes across the site.

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Property Owner Affidavit  
Directors Modification Application  
Tentative Map Exhibits (Slope Map and Property Survey)  
Plan Set (Reduced sheets – 8.5 x 11)  
WC Treasurer Certificate (Payment Records)  
Preliminary Title Report

## Washoe County Development Application

Your entire application is a public record. If you have a concern about releasing personal information, please contact Planning and Building staff at 775.328.6100.

<b>Project Information</b>		Staff Assigned Case No.: _____	
Project Name:			
Project Description:			
Project Address:			
Project Area (acres or square feet):			
Project Location (with point of reference to major cross streets <b>AND</b> area locator):			
Assessor's Parcel No.(s):	Parcel Acreage:	Assessor's Parcel No.(s):	Parcel Acreage:
Indicate any previous Washoe County approvals associated with this application: Case No.(s).			
<b>Applicant Information</b> (attach additional sheets if necessary)			
<b>Property Owner:</b>		<b>Professional Consultant:</b>	
Name:		Name:	
Address:		Address:	
Zip:		Zip:	
Phone:                      Fax:		Phone:                      Fax:	
Email:		Email:	
Cell:                              Other:		Cell:                              Other:	
Contact Person:		Contact Person:	
<b>Applicant/Developer:</b>		<b>Other Persons to be Contacted:</b>	
Name:		Name:	
Address:		Address:	
Zip:		Zip:	
Phone:                      Fax:		Phone:                      Fax:	
Email:		Email:	
Cell:                              Other:		Cell:                              Other:	
Contact Person:		Contact Person:	
<b>For Office Use Only</b>			
Date Received:                      Initial:		Planning Area:	
County Commission District:		Master Plan Designation(s):	
CAB(s):		Regulatory Zoning(s):	

# Tentative Subdivision Map Application Supplemental Information

(All required information may be separately attached)

1. What is the location (address or distance and direction from nearest intersection)?

2. What is the subdivision name (proposed name must not duplicate the name of any existing subdivision)?

3. Density and lot design:

a. Acreage of project site	
b. Total number of lots	
c. Dwelling units per acre	
d. Minimum and maximum area of proposed lots	
e. Minimum width of proposed lots	
f. Average lot size	

4. What utility company or organization will provide services to the development:

a. Sewer Service	
b. Electrical Service	
c. Telephone Service	
d. LPG or Natural Gas Service	
e. Solid Waste Disposal Service	
f. Cable Television Service	
g. Water Service	

5. For common open space subdivisions (Article 408), please answer the following:

- a. Acreage of common open space:

- b. What development constraints are within the development and how many acres are designated slope, wetlands, faults, springs, and/or ridgelines:

- c. Range of lot sizes (include minimum and maximum lot size):

d. Proposed yard setbacks if different from standard:

e. Justification for setback reduction or increase, if requested:

f. Identify all proposed non-residential uses:

g. Improvements proposed for the common open space:

h. Describe or show on the tentative map any public or private trail systems within common open space of the development:

i. Describe the connectivity of the proposed trail system with existing trails or open space adjacent to or near the property:

j. If there are ridgelines on the property, how are they protected from development?

k. Will fencing be allowed on lot lines or restricted? If so, how?

l. Identify the party responsible for maintenance of the common open space:

6. Is the project adjacent to public lands or impacted by "Presumed Public Roads" as shown on the adopted April 27, 1999 Presumed Public Roads (see Washoe County Engineering website at <http://www.washoecounty.us/pubworks/engineering.htm>). If so, how is access to those features provided?

7. Is the parcel within the Truckee Meadows Service Area?

<input type="checkbox"/> Yes	<input type="checkbox"/> No
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8. Is the parcel within the Cooperative Planning Area as defined by the Regional Plan?

<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, within what city?
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9. Has an archeological survey been reviewed and approved by SHPO on the property? If yes, what were the findings?

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10. Indicate the type and quantity of water rights the application has or proposes to have available:

a. Permit #		acre-feet per year	
b. Certificate #		acre-feet per year	
c. Surface Claim #		acre-feet per year	
d. Other #		acre-feet per year	

a. Title of those rights (as filed with the State Engineer in the Division of Water Resources of the Department of Conservation and Natural Resources):

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11. Describe the aspects of the tentative subdivision that contribute to energy conservation:

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12. Is the subject property in an area identified by Planning and Building as potentially containing rare or endangered plants and/or animals, critical breeding habitat, migration routes or winter range? If so, please list the species and describe what mitigation measures will be taken to prevent adverse impacts to the species:

--

13. If private roads are proposed, will the community be gated? If so, is a public trail system easement provided through the subdivision?

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14. Are there any applicable policies of the adopted area plan in which the project is located that require compliance? If so, which policies and how does the project comply?

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15. Are there any applicable area plan modifiers in the Development Code in which the project is located that require compliance? If so, which modifiers and how does the project comply?

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16. Will the project be completed in one phase or is phasing planned? If so, please provide that phasing plan:

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17. Is the project subject to Article 424, Hillside Development? If yes, please address all requirements of the Hillside Ordinance in a separate set of attachments and maps.

<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, include a separate set of attachments and maps.
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18. Is the project subject to Article 418, Significant Hydrologic Resources? If yes, please address Special Review Considerations within Section 110.418.30 in a separate attachment.

<input type="checkbox"/> Yes	<input type="checkbox"/> No	If yes, include separate attachments.
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## Grading

**Please complete the following additional questions if the project anticipates grading that involves: (1) Disturbed area exceeding twenty-five thousand (25,000) square feet not covered by streets, buildings and landscaping; (2) More than one thousand (1,000) cubic yards of earth to be imported and placed as fill in a special flood hazard area; (3) More than five thousand (5,000) cubic yards of earth to be imported and placed as fill; (4) More than one thousand (1,000) cubic yards to be excavated, whether or not the earth will be exported from the property; or (5) If a permanent earthen structure will be established over four and one-half (4.5) feet high:**

19. How many cubic yards of material are you proposing to excavate on site?

20. How many cubic yards of material are you exporting or importing? If exporting of material is anticipated, where will the material be sent? If the disposal site is within unincorporated Washoe County, what measures will be taken for erosion control and revegetation at the site? If none, how are you balancing the work on-site?

21. Can the disturbed area be seen from off-site? If yes, from which directions, and which properties or roadways? What measures will be taken to mitigate their impacts?

22. What is the slope (Horizontal/Vertical) of the cut and fill areas proposed to be? What methods will be used to prevent erosion until the revegetation is established?

23. Are you planning any berms and, if so, how tall is the berm at its highest? How will it be stabilized and/or revegetated?

24. Are retaining walls going to be required? If so, how high will the walls be, will there be multiple walls with intervening terracing, and what is the wall construction (i.e. rockery, concrete, timber, manufactured block)? How will the visual impacts be mitigated?

25. Will the grading proposed require removal of any trees? If so, what species, how many, and of what size?

26. What type of revegetation seed mix are you planning to use and how many pounds per acre do you intend to broadcast? Will you use mulch and, if so, what type?

27. How are you providing temporary irrigation to the disturbed area?

28. Have you reviewed the revegetation plan with the Washoe Storey Conservation District? If yes, have you incorporated their suggestions?

# Request to Reserve New Street Name(s)

The Applicant is responsible for all sign costs.

## Applicant Information

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
Phone : \_\_\_\_\_ Fax: \_\_\_\_\_  
% Private Citizen                      % Agency/Organization

## Street Name Requests

(No more than 14 letters or 15 if there is an "i" in the name. Attach extra sheet if necessary.)


If final recordation has not occurred within one (1) year, it is necessary to submit a written request for extension to the coordinator prior to the expiration date of the original

## Location

Project Name: \_\_\_\_\_  
% Reno                      % Sparks                      % Washoe County  
Parcel Numbers: \_\_\_\_\_  
% Subdivision                      % Parcelization                      % Private Street

Please attach maps, petitions and supplementary information.

Approved: \_\_\_\_\_ Date: \_\_\_\_\_  
Regional Street Naming Coordinator  
% Except where noted  
Denied: \_\_\_\_\_ Date: \_\_\_\_\_  
Regional Street Naming Coordinator

## Washoe County Geographic Information Services

1001 E. Ninth Street  
Reno, NV 89512-2845

Phone: (775) 328-2325 - Fax: (775) 328-6133

Property Owner Affidavit

Applicant Name: REGAL HOLDINGS OF NEVADA, LLC.

The receipt of this application at the time of submittal does not guarantee the application complies with all requirements of the Washoe County Development Code, the Washoe County Master Plan or the applicable area plan, the applicable regulatory zoning, or that the application is deemed complete and will be processed.

STATE OF NEVADA )
COUNTY OF WASHOE )

I, Charles Fornaro (please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

(A separate Affidavit must be provided by each property owner named in the title report.)

Assessor Parcel Number(s): 508-020-41 AND 508-020-43

Printed Name CHARLES FORNARO

Signed Charles Fornaro

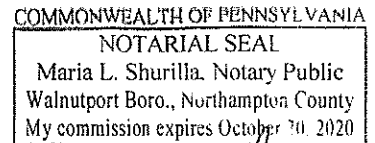
Address 3936 Eagle Cir
Slatington PA 16880

Subscribed and sworn to before me this 19 day of November

(Notary Stamp)

MARIA SHURILLA - Northampton Pa
Notary Public in and for said county and state

My commission expires: 10/20/20



Maria L. Shurilla (Signature)

\*Owner refers to the following: (Please mark appropriate box.)

- Owner
Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
Power of Attorney (Provide copy of Power of Attorney.)
Owner Agent (Provide notarized letter from property owner giving legal authority to agent.)
Property Agent (Provide copy of record document indicating authority to sign.)
Letter from Government Agency with Stewardship

Property Owner Affidavit

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STATE OF NEVADA )
COUNTY OF WASHOE )

I, DOMINICK NOFREY FORNARO
(please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

(A separate Affidavit must be provided by each property owner named in the title report.)

Assessor Parcel Number(s): 508-020-41 AND 508-020-43

Printed Name DOMINICK N. FORNARO

Signed [Signature]

Address 1404 LEON ST.

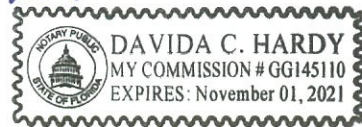
KEY WEST, FL. 33040

Subscribed and sworn to before me this 15th day of November, 2019

(Notary Stamp)

Monroe, FLORIDA [Signature]
Notary Public in and for said county and state

My commission expires: Nov. 1, 2021



\*Owner refers to the following: (Please mark appropriate box.)

- Owner (checked)
Corporate Officer/Partner
Power of Attorney
Owner Agent
Property Agent
Letter from Government Agency with Stewardship

Property Owner Affidavit

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STATE OF ~~NEVADA~~ <sup>New Jersey</sup> )  
COUNTY OF ~~WASHOE~~ <sup>Ocean</sup>

I, FRANK FORNARO JR.  
(please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

(A separate Affidavit must be provided by each property owner named in the title report.)

Assessor Parcel Number(s): 508-020-41 AND 508-020-43

Printed Name FRANK FORNARO JR

Signed Frank Fornaro Jr.

Address 15 NELSON CT.

TOMS RIVER N.J. 08757

(Notary Stamp)

Subscribed and sworn to before me this 22 day of November, 2019.

Adam C Servodio  
Notary Public in and for said county and state

My commission expires: 6/28/21

ADAM C. SERVODIO  
Notary Public - New Jersey  
OCEAN County  
My Comm. Expires 06-28-2021  
No. 50040957

\*Owner refers to the following: (Please mark appropriate box.)

- Owner
- Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
- Power of Attorney (Provide copy of Power of Attorney.)
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STATE OF NEVADA    )  
                                  )  
COUNTY OF WASHOE    )

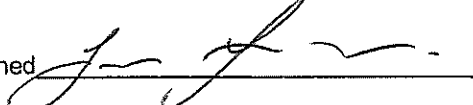
I, Joseph Fornaro \_\_\_\_\_  
                                  — (please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

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Printed Name Joseph Fornaro

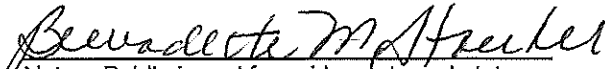
Signed 

Address 1937 Westfield Ave

Scotch Plains, NJ 07076

(Notary Stamp)

Subscribed and sworn to before me this  
25<sup>th</sup> day of Nov, 2019

  
Notary Public in and for said county and state

My commission expires: April 11, 2024

\*Owner refers to the following: (Please mark appropriate box.)

- Owner
- Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
- Power of Attorney (Provide copy of Power of Attorney.)
- Owner Agent (Provide notarized letter from property owner giving legal authority to agent.)
- Property Agent (Provide copy of record document indicating authority to sign.)
- Letter from Government Agency with Stewardship



Property Owner Affidavit

Applicant Name: REGAL HOLDINGS OF NEVADA, LLC.

The receipt of this application at the time of submittal does not guarantee the application complies with all requirements of the Washoe County Development Code, the Washoe County Master Plan or the applicable area plan, the applicable regulatory zoning, or that the application is deemed complete and will be processed.

STATE OF NEVADA )
COUNTY OF WASHOE )

I, DAVID FORNARO (please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

(A separate Affidavit must be provided by each property owner named in the title report.)

Assessor Parcel Number(s): 508-020-41 AND 508-020-43

Printed Name DAVID FORNARO

Signed [Signature]

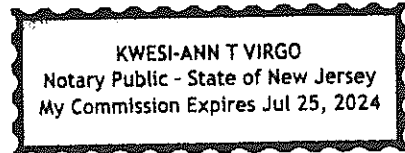
Address 1036 CIEGER AVE
UNION NJ, 07083

Subscribed and sworn to before me this 23rd day of November, 2019

[Signature]
Notary Public in and for said county and state

My commission expires: 07-25-24

(Notary Stamp)



\*Owner refers to the following: (Please mark appropriate box.)

- Owner
Corporate Officer/Partner
Power of Attorney
Owner Agent
Property Agent
Letter from Government Agency with Stewardship

# Property Owner Affidavit

**Applicant Name: REGAL HOLDINGS OF NEVADA, LLC.**

The receipt of this application at the time of submittal does not guarantee the application complies with all requirements of the Washoe County Development Code, the Washoe County Master Plan or the applicable area plan, the applicable regulatory zoning, or that the application is deemed complete and will be processed.

STATE OF NEVADA       )  
                                  )  
COUNTY OF WASHOE    )

I, Nofrey Fornaro (please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

(A separate Affidavit must be provided by each property owner named in the title report.)

Assessor Parcel Number(s): 508-020-41 AND 508-020-43

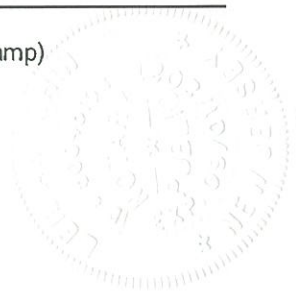
Printed Name NOFREY FORNARO  
Signed Nofrey Fornaro  
Address 3513 Bedford Blvd  
Freehold N.J. 07728

Subscribed and sworn to before me this  
19<sup>th</sup> day of November, 2019.

[Signature]  
Notary Public in and for said Hudson NJ county and state

My commission expires: 9/1/21

(Notary Stamp)



\*Owner refers to the following: (Please mark appropriate box.)

- Owner
- Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
- Power of Attorney (Provide copy of Power of Attorney.)
- Owner Agent (Provide notarized letter from property owner giving legal authority to agent.)
- Property Agent (Provide copy of record document indicating authority to sign.)
- Letter from Government Agency with Stewardship

Property Owner Affidavit

Applicant Name: REGAL HOLDINGS OF NEVADA, LLC.

The receipt of this application at the time of submittal does not guarantee the application complies with all requirements of the Washoe County Development Code, the Washoe County Master Plan or the applicable area plan, the applicable regulatory zoning, or that the application is deemed complete and will be processed.

STATE OF NEVADA
COUNTY OF WASHOE

DOMINICK FORNARO
(please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

(A separate Affidavit must be provided by each property owner named in the title report.)

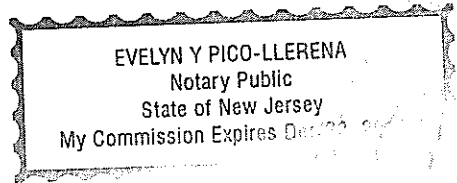
Assessor Parcel Number(s): 508-020-41 AND 508-020-43

Printed Name DOMINICK FORNARO
Signed [Signature]
Address 18 Rt 46
Columbia NJ 07832

Subscribed and sworn to before me this 22 day of November 2019

[Signature]
Notary Public in and for said county and state
My commission expires: 12/20/2019

(Notary Stamp)



\*Owner refers to the following: (Please mark appropriate box.)

- Owner
Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
Power of Attorney (Provide copy of Power of Attorney.)
Owner Agent (Provide notarized letter from property owner giving legal authority to agent.)
Property Agent (Provide copy of record document indicating authority to sign.)
Letter from Government Agency with Stewardship

Property Owner Affidavit

Applicant Name: REGAL HOLDINGS OF NEVADA, LLC.

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STATE OF NEVADA )
COUNTY OF WASHOE )

I, CAROL ANN NOWAK (please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

(A separate Affidavit must be provided by each property owner named in the title report.)

Assessor Parcel Number(s): 508-020-41 AND 508-020-43

Printed Name CAROL ANN NOWAK

Signed Carol Ann Nowak

Address 4 Covered Bridge Rd.

Flemington N.J. 08822

(Notary Stamp)

Subscribed and sworn to before me this 21st day of November, 2019.

[Handwritten signature of Kristen Kappauf]

Notary Public in and for said county and state

KRISTEN KAPPAUF
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires May 17, 2023

My commission expires: May 17, 2023

\*Owner refers to the following: (Please mark appropriate box.)

- Owner
Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
Power of Attorney (Provide copy of Power of Attorney.)
Owner Agent (Provide notarized letter from property owner giving legal authority to agent.)
Property Agent (Provide copy of record document indicating authority to sign.)
Letter from Government Agency with Stewardship

# Property Owner Affidavit

**Applicant Name: REGAL HOLDINGS OF NEVADA, LLC.**

The receipt of this application at the time of submittal does not guarantee the application complies with all requirements of the Washoe County Development Code, the Washoe County Master Plan or the applicable area plan, the applicable regulatory zoning, or that the application is deemed complete and will be processed.

STATE OF NEVADA     )  
                                  )  
COUNTY OF WASHOE    )

I, Anthony J Pietrantonio  
(please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

(A separate Affidavit must be provided by each property owner named in the title report.)

Assessor Parcel Number(s): 508-020-41 AND 508-020-43



Printed Name Matthew Pietrantonio  
Executor estate Anthony J Pietrantonio

Signed Matthew Pietrantonio

Address 255 Union Ave

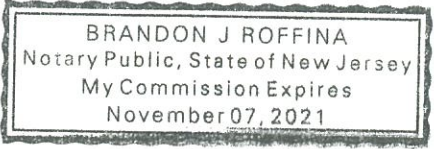
New Providence, NJ 07974

Subscribed and sworn to before me this 21 day of November, 2019.

(Notary Stamp)

Monmouth County, NJ - Braden Gallo  
Notary Public in and for said county and state

My commission expires: 11/07/2021



\*Owner refers to the following: (Please mark appropriate box.)

- Owner
- Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
- Power of Attorney (Provide copy of Power of Attorney.)
- Owner Agent (Provide notarized letter from property owner giving legal authority to agent.)
- Property Agent (Provide copy of record document indicating authority to sign.)
- Letter from Government Agency with Stewardship

**State of New Jersey  
Union County Surrogate's Court**

In the Matter of the Estate of:

**Anthony J. Pietrontone (Widowed), Deceased  
AKA: Tony Pietrontonie**

**EXECUTOR  
SHORT FORM CERTIFICATE  
OF LETTERS TESTAMENTARY**

Date of Death: **May 10, 2018**

I, **James S. LaCorte**, Surrogate of the County of Union, do hereby certify that the Last Will and Testament of the decedent, late of Union County, State of New Jersey, was admitted to Probate by the Surrogate of Union County on June 5, 2018; and that Letters Testamentary were issued to:

**Mathew Pietrontone,**

the Executor(s) named therein, who is/are duly authorized to administer the estate of said deceased agreeably to said Will and said Letters Testamentary have never been revoked and still remain in full force and effect.

WITNESS my hand and seal of office this  
**5th day of June, 2018**



  
**James S. LaCorte**  
Surrogate & Deputy Clerk of the Superior Court of NJ  
Chancery Division, Probate Part, Union County

Property Owner Affidavit

Applicant Name: REGAL HOLDINGS OF NEVADA, LLC.

The receipt of this application at the time of submittal does not guarantee the application complies with all requirements of the Washoe County Development Code, the Washoe County Master Plan or the applicable area plan, the applicable regulatory zoning, or that the application is deemed complete and will be processed.

STATE OF ~~NEVADA~~ <sup>New Jersey</sup> )
COUNTY OF ~~WASHOE~~ <sup>Hunterdon</sup> )

I, William Nowak
(please print name)

being duly sworn, depose and say that I am the owner\* of the property or properties involved in this application as listed below and that the foregoing statements and answers herein contained and the information herewith submitted are in all respects complete, true, and correct to the best of my knowledge and belief. I understand that no assurance or guarantee can be given by members of Planning and Building.

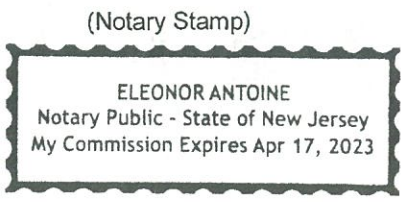
(A separate Affidavit must be provided by each property owner named in the title report.)

Assessor Parcel Number(s): 508-020-41 AND 508-020-43

Printed Name William Nowak
Signed [Signature]
Address 11118 Lake Keston Circle
Client # 3471

Subscribed and sworn to before me this 29th day of November, 2019.

[Signature]
Notary Public in and for said county and state
My commission expires: 04/17/2019



\*Owner refers to the following: (Please mark appropriate box.)

- Owner
 Corporate Officer/Partner (Provide copy of record document indicating authority to sign.)
 Power of Attorney (Provide copy of Power of Attorney.)
 Owner Agent (Provide notarized letter from property owner giving legal authority to agent.)
 Property Agent (Provide copy of record document indicating authority to sign.)
 Letter from Government Agency with Stewardship

Community Services Department  
Planning and Building  
DIRECTOR'S MODIFICATION OF  
PARKING/LANDSCAPING  
MINOR DEVIATION  
STANDARDS APPLICATION



Community Services Department  
Planning and Building  
1001 E. Ninth St., Bldg. A  
Reno, NV 89512-2845

Telephone: 775.328.6100



## Washoe County Development Application

Your entire application is a public record. If you have a concern about releasing personal information, please contact Planning and Building staff at 775.328.6100.

<b>Project Information</b>		Staff Assigned Case No.: _____	
Project Name:			
Project Description:			
Project Address:			
Project Area (acres or square feet):			
Project Location (with point of reference to major cross streets <b>AND</b> area locator):			
Assessor's Parcel No.(s):	Parcel Acreage:	Assessor's Parcel No.(s):	Parcel Acreage:
Indicate any previous Washoe County approvals associated with this application: Case No.(s).			
<b>Applicant Information</b> (attach additional sheets if necessary)			
<b>Property Owner:</b>		<b>Professional Consultant:</b>	
Name:		Name:	
Address:		Address:	
Zip:		Zip:	
Phone:		Phone:	
Fax:		Fax:	
Email:		Email:	
Cell:		Cell:	
Other:		Other:	
Contact Person:		Contact Person:	
<b>Applicant/Developer:</b>		<b>Other Persons to be Contacted:</b>	
Name:		Name:	
Address:		Address:	
Zip:		Zip:	
Phone:		Phone:	
Fax:		Fax:	
Email:		Email:	
Cell:		Cell:	
Other:		Other:	
Contact Person:		Contact Person:	
<b>For Office Use Only</b>			
Date Received:		Initial:	
County Commission District:		Planning Area:	
CAB(s):		Master Plan Designation(s):	
		Regulatory Zoning(s):	

# Director's Modification of Standards Supplemental Information

(All required information may be separately attached)

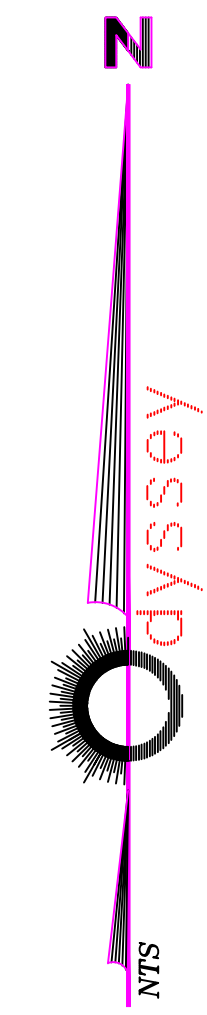
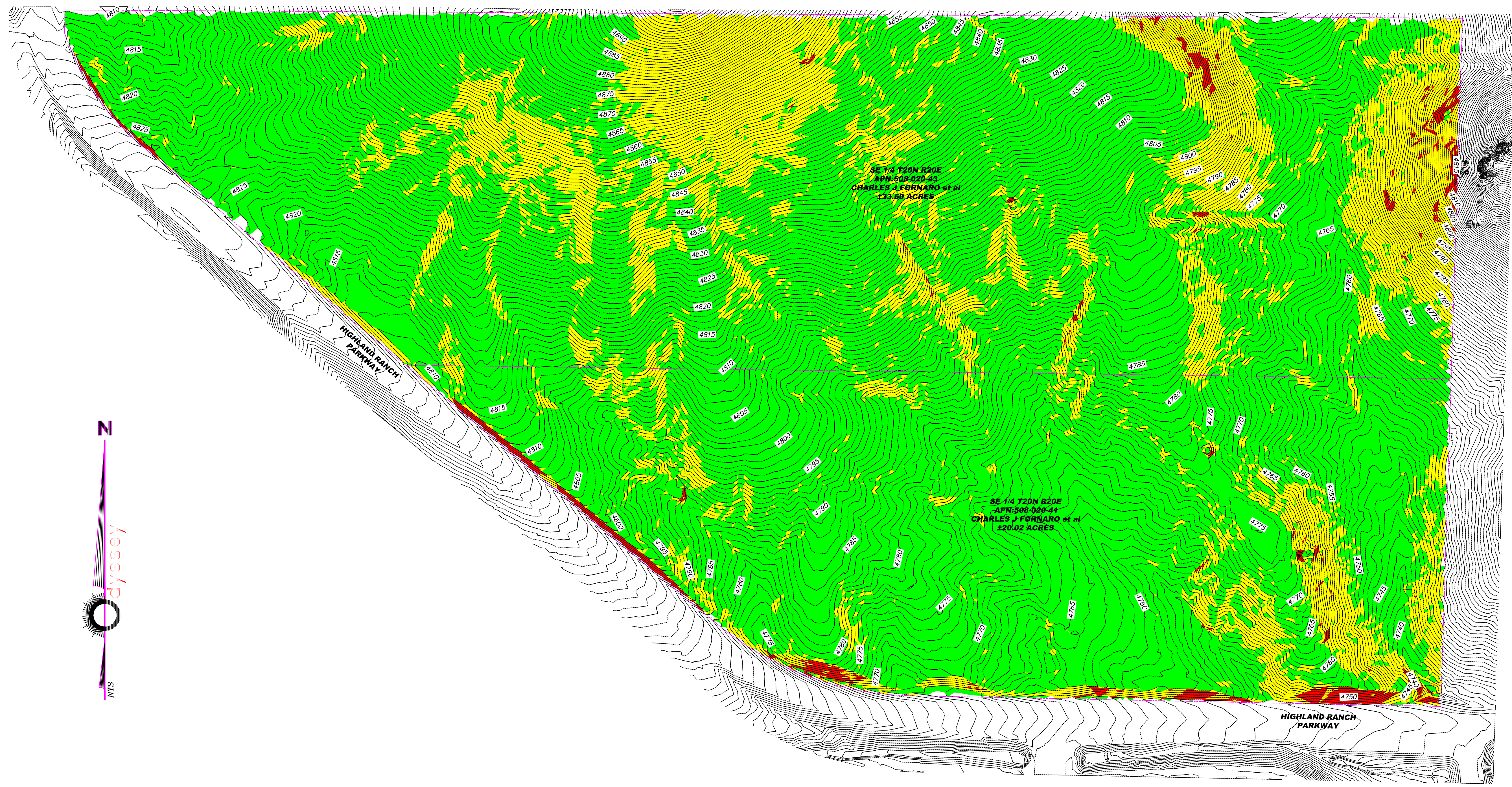
1. What modification or deviation are you requesting? **Be specific.**

2. Why is the modification or deviation necessary to the success of the project/development? **Be specific.** Are there any extenuating circumstances or physical conditions on the proposed project/development site?

3. Are you proposing to mitigate the effect of the modification or reduction?

4. What section of code are you requesting to modify or deviate? **Be specific.** List the code section and if there are specific requirements for the modification, provide detailed information. For deviation, provide the percentage of the deviation.

5. For Minor Deviation request; list what properties/parcels are affected by the deviation? Explain if there will be any impacts to the affected neighboring properties. (At a minimum, affected property owners are those owners of parcels that immediately abut the location of the proposed minor deviation.)



Slopes Table

Number	Minimum Slope	Maximum Slope	Area	Color	SITE %
1	0.00%	15.00%	1822609.89	Green	76.65%
2	15.00%	30.00%	531247.48	Yellow	22.34%
3	30.00%	170.71%	23939.74	Red	1.01%



**HIGHLANDS VILLAGE SLOPE MAP**

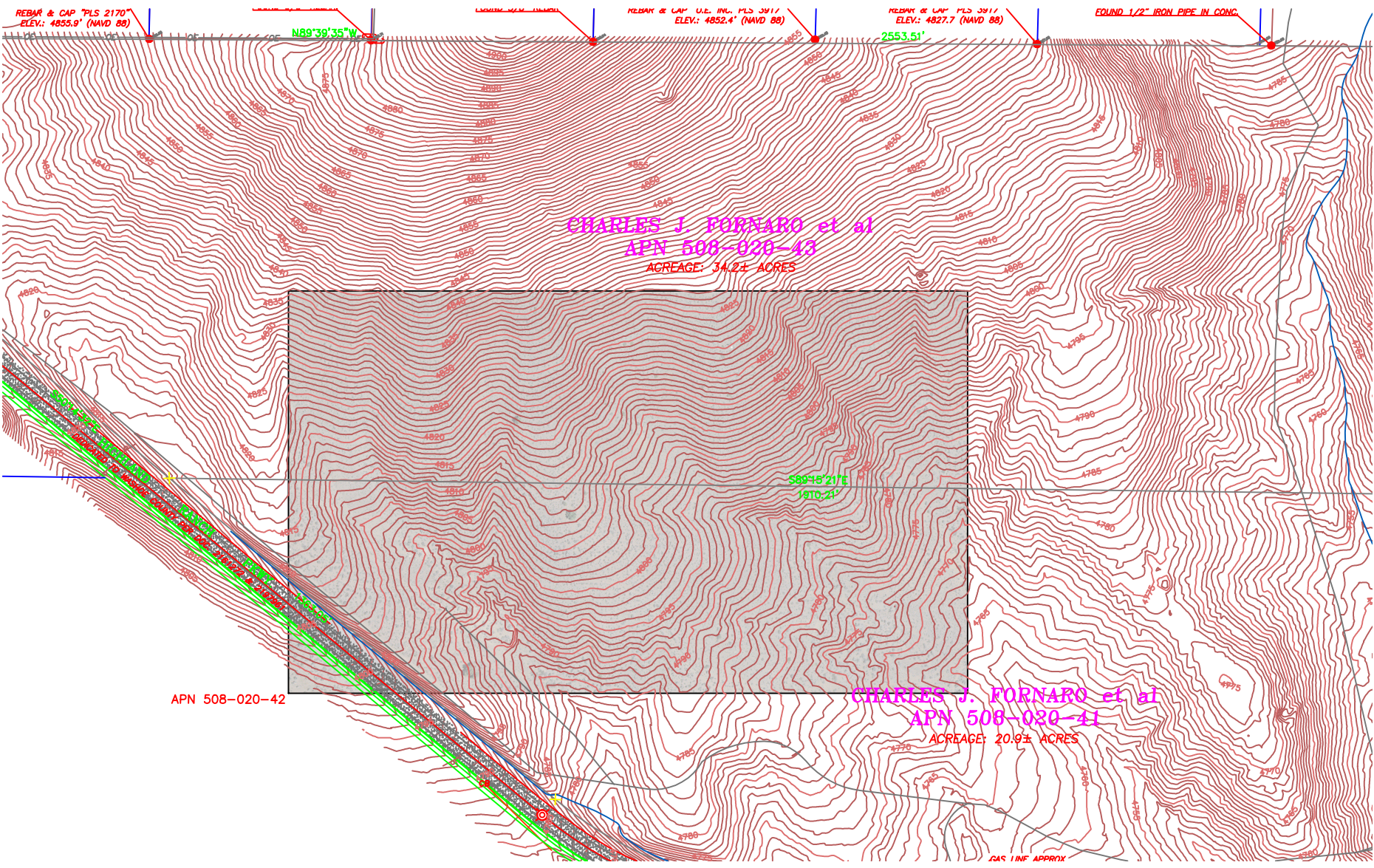
WASHOE COUNTY, NEVADA

DATE: FEBRUARY, 2020  
 DRAWN BY: F.B.  
 DESIGNED BY: F.B.  
 CHECKED BY: F.B.

895 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 359-3303 FAX: (775) 359-3304  
 ODYSSEYRENO.COM

**Odyssey ENGINEERING INCORPORATED**

SCALE  
 HORIZ. \_\_\_\_\_  
 VERT. \_\_\_\_\_  
 JOB NO. X  
 SHEET 1 OF 1



REBAR & CAP TPLS 2170'  
ELEV.: 4855.9' (NAVD 88)

N89°39'35"W

REBAR & CAP U.E. INCL. PLS 3917'  
ELEV.: 4852.4' (NAVD 88)

REBAR & CAP PLS 3917'  
ELEV.: 4827.7' (NAVD 88)

FOUND 1/2" IRON PIPE IN CONC

2553.51'

CHARLES J. FORNARO et al  
APN 508-020-43  
ACREAGE: 34.2± ACRES

APN 508-020-42

CHARLES J. FORNARO et al  
APN 508-020-41  
ACREAGE: 20.9± ACRES

S89°15'21"E  
1310.21'

GAS LINE APPROX

# TENTATIVE MAP PLANS HIGHLANDS VILLAGE

SUN VALLEY, WASHOE COUNTY, NEVADA

## OWNER

CHARLES J FORNARO et al  
3936 EAGLE CIRCLE  
SLATINGTON, PA 18080

## DEVELOPER

HIGHLAND VILLAGE PARKWAY, LLC  
3500 LAKESIDE COURT, SUITE 211  
RENO, NEVADA 89509  
(775) 303-3789

## PROJECT INFORMATION

HIGHLAND RANCH PARCEL INFO:

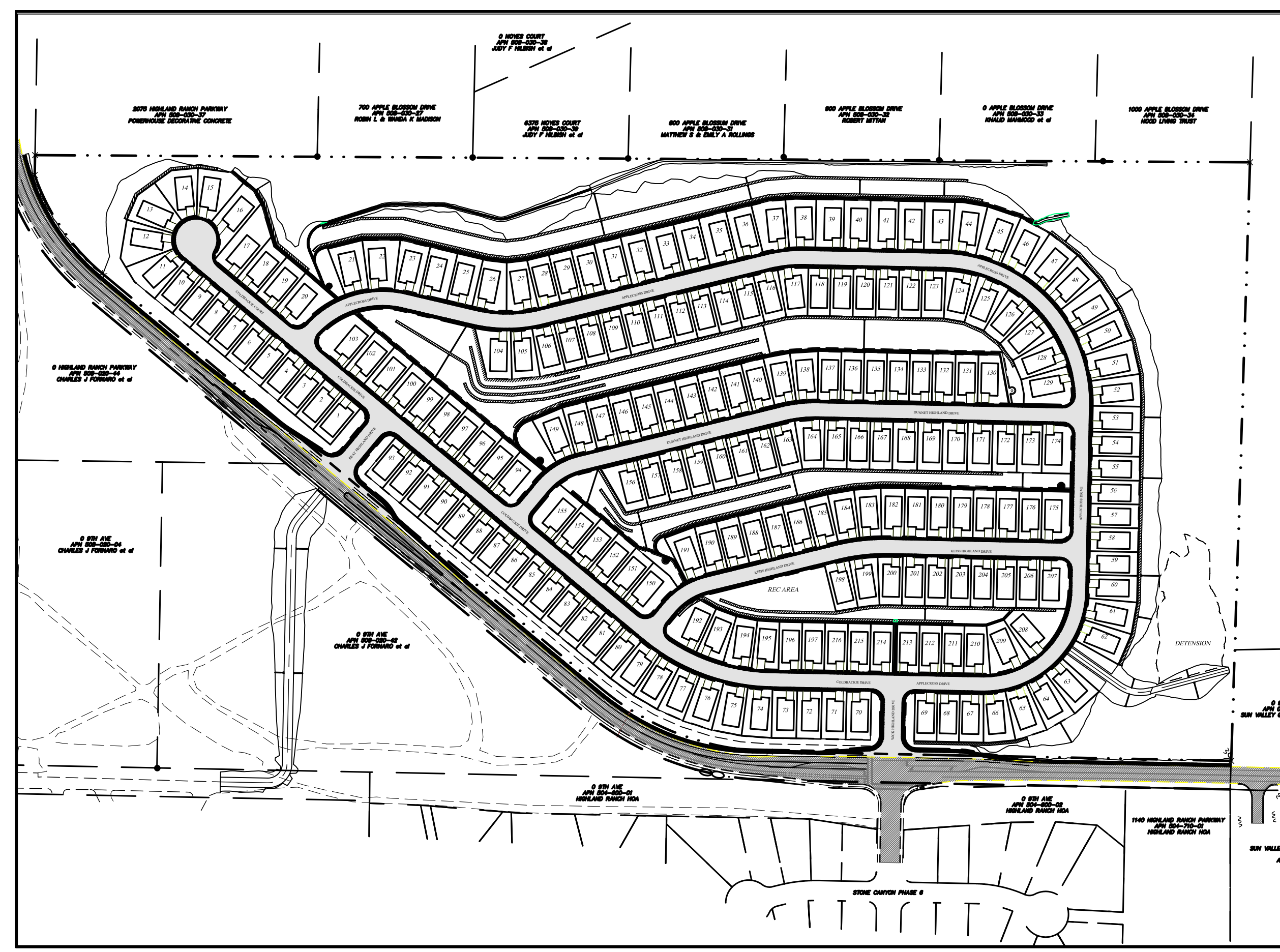
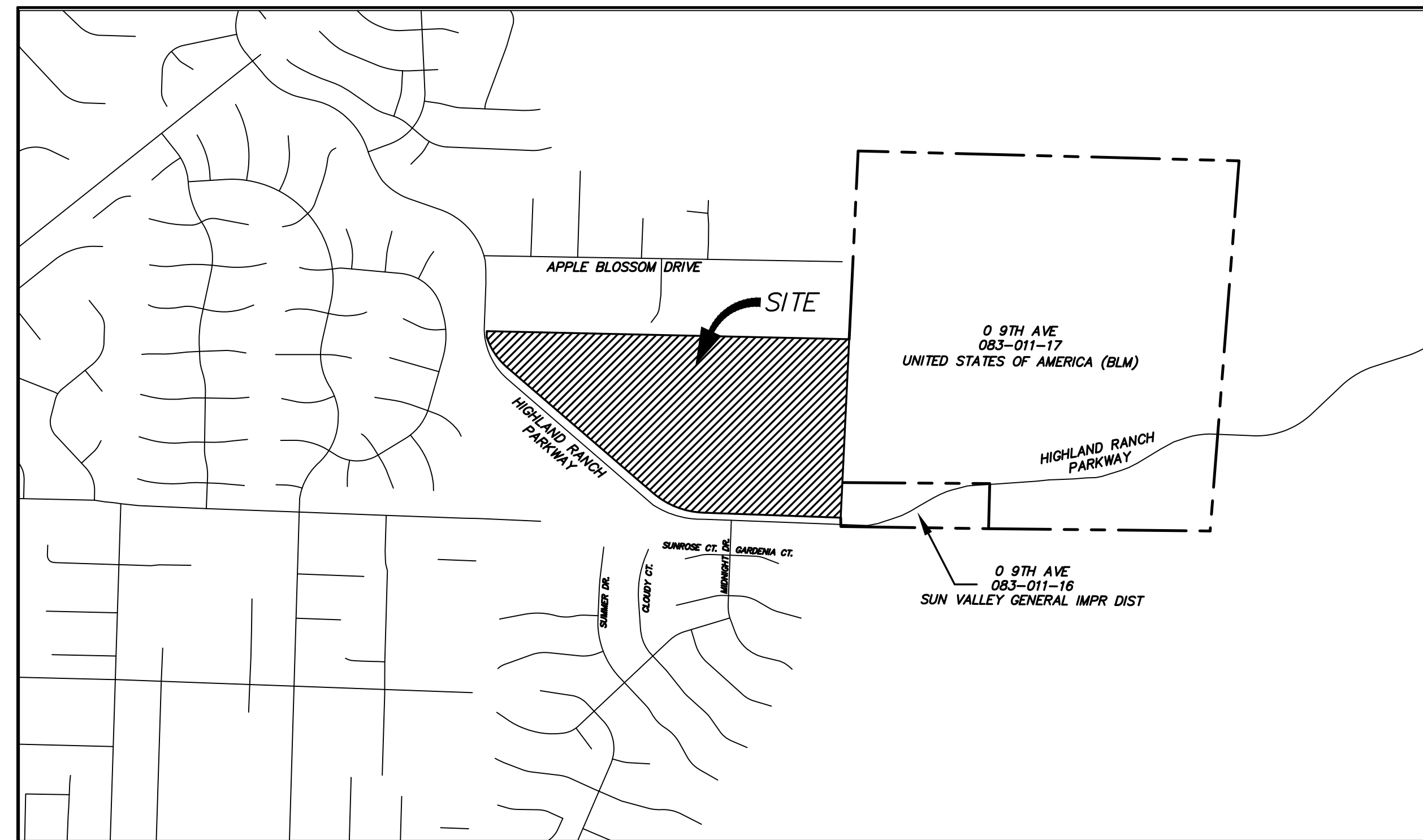
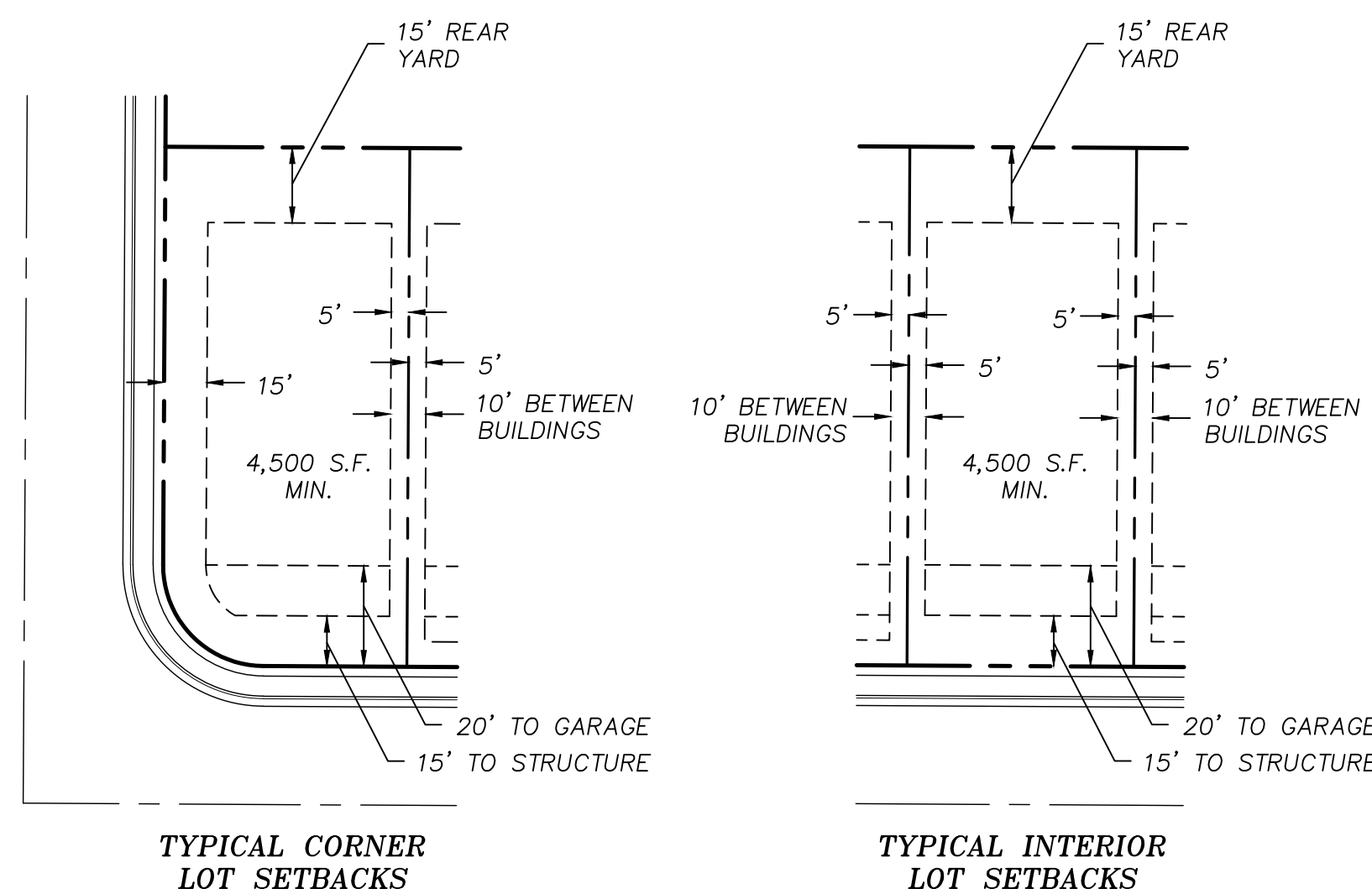
SITE LOCATION: PORTION OF SECTION 8, T20N - R20E

PROPOSED TENTATIVE MAP PARCEL INFO:

- TOTAL SITE AREA = ±55.15 ACRES
- PROPOSED COMMON AREAS = ±21.24 ACRES
- TOTAL RIGHT-OF-WAY = ±7.10 ACRES (PUBLIC)
- TOTAL LOT AREA = ±26.81 ACRES
- TOTAL No. OF UNITS = 216
- EXISTING ZONING = ?
- PROPOSED ZONING = ?
- LOT DENSITY = 8.06 UNITS/ACRE
- GROSS DENSITY = 3.92 UNITS/ACRE
- AVERAGE LOT SIZE = ±5,406 S.F.
- ASSESSORS PARCEL No. 528-330-10

## PUBLIC SERVICES

GAS SERVICE: NV ENERGY  
WATER SERVICE: SUN VALLEY GENERAL IMPROVEMENT DISTRICT  
SEWER SERVICE: SUN VALLEY GENERAL IMPROVEMENT DISTRICT  
TELEPHONE: AT&T NEVADA  
CABLE T.V.: CHARTER COMMUNICATIONS  
ELECTRICAL SERVICE: NV ENERGY  
FIRE PROTECTION: TRUCKEE MEADOWS FIRE DEPARTMENT  
POLICE PROTECTION: WASHOE COUNTY SHERIFF'S DEPARTMENT



## CIVIL SHEET INDEX

T-1	TITLE SHEET
SM-1	EXISTING SLOPE MAP
S-1	OVERALL SITE PLAN
S-2	PRELIMINARY SITE PLAN
S-3	PRELIMINARY SITE PLAN
S-4	PRELIMINARY SITE PLAN
G-1	OVERALL GRADING PLAN
G-2	PRELIMINARY GRADING PLAN
G-3	PRELIMINARY GRADING PLAN
G-4	PRELIMINARY GRADING PLAN
U-1	OVERALL UTILITY PLAN
U-2	PRELIMINARY UTILITY PLAN
U-3	PRELIMINARY UTILITY PLAN
U-4	PRELIMINARY UTILITY PLAN
CS-1	CROSS SECTIONS
E-1	EARTHWORK

## BASIS OF BEARING:

BASED ON THE NEVADA WEST COORDINATE SYSTEM OF 1983 (NAD 83) WITH A GRID TO GROUND FACTOR OF 1.000197939 APPLIED.

## BASIS OF ELEVATION:

BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88) USING CONTROL BM 110 (EL=4509.99 FT), BASED ON RECORD OF SURVEY 3885 AS FILED IN THE OFFICIAL RECORDS OF WASHOE COUNTY, NEVADA.

## FLOOD ZONE:

THIS PROJECT LIES ENTIRELY WITHIN A FEMA UNSHADED ZONE X PER FIRM MAP PANEL 32031C3032G EFFECTIVE DATE MARCH 16, 2009

## ENGINEER'S CERTIFICATE

I, FRANK A. BIDART, DO HEREBY CERTIFY THAT THIS MAP HAS BEEN PREPARED BY ME, OR UNDER MY SUPERVISION AND WAS COMPLETED ON THIS XXTH DAY OF SEPTEMBER, 2020.

FRANK A. BIDART

P.E. #10504

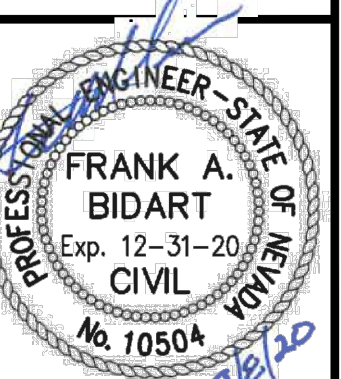
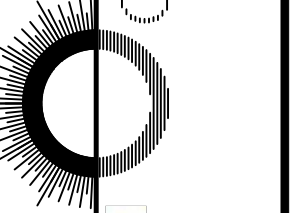
REV.	DATE	DESCRIPTION	BY	APP'D

DATE: 9-8-2020	DESIGNED BY: NZV	CHECKED BY: FAB
DRAWN BY: ACAD_ZO		

HIGHLANDS VILLAGE  
TITLE SHEET

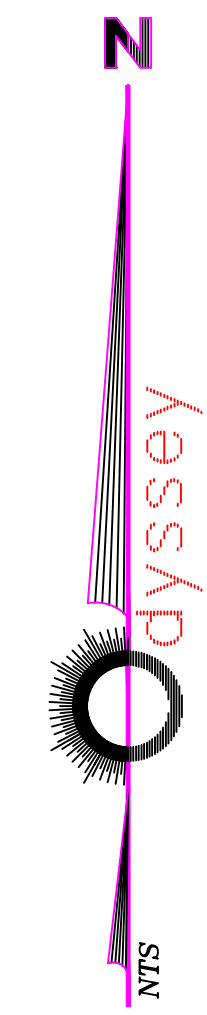
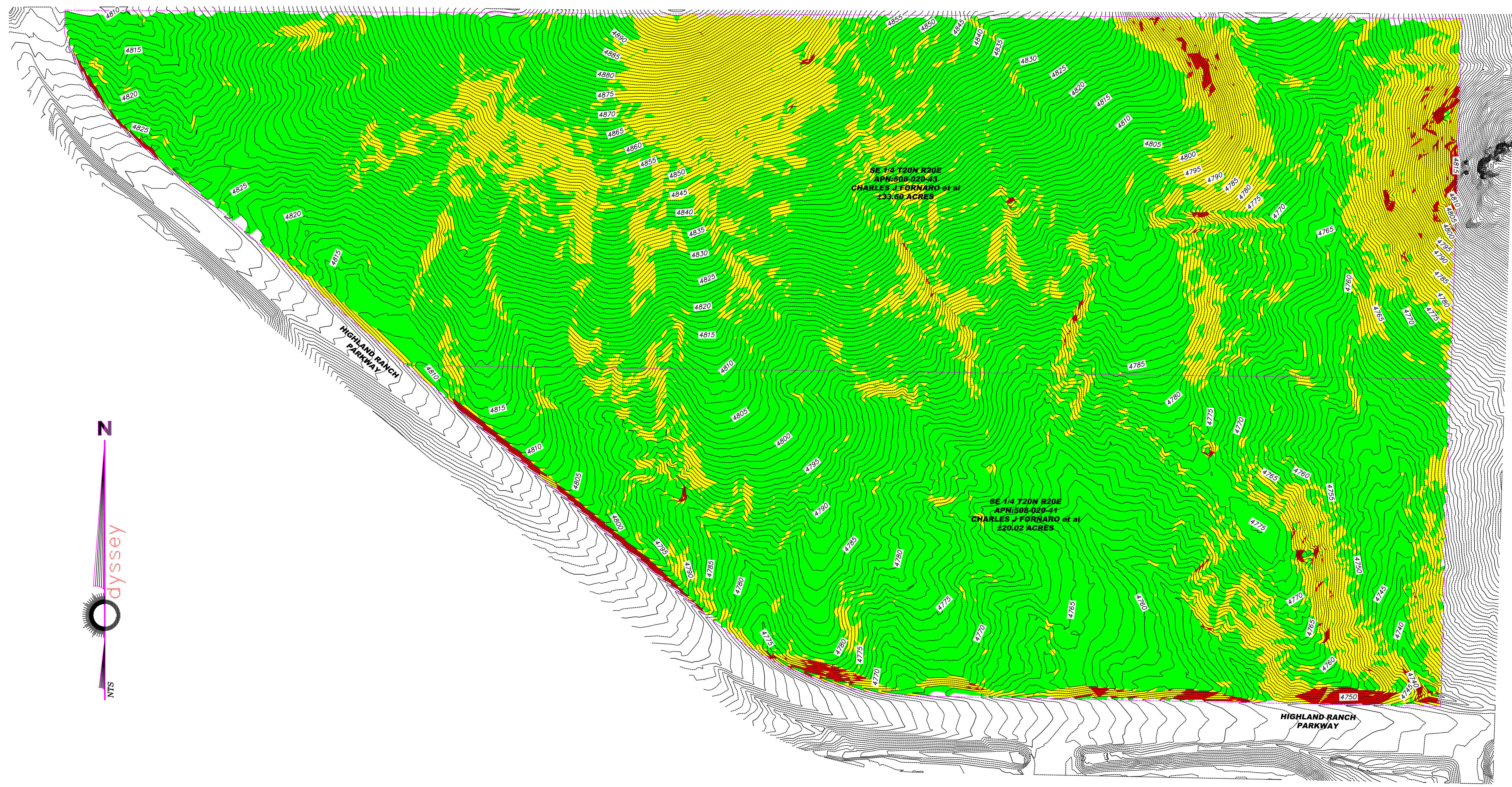
SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
(775) 369-3303 FAX (775) 359-3329  
ODYSSEYRENO.COM



SCALE	-
HORIZ.	-
VERT.	-
JOB NO.	-
JOB	-

SHEET	T-1
OF	16



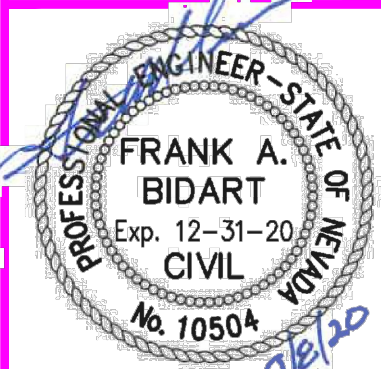
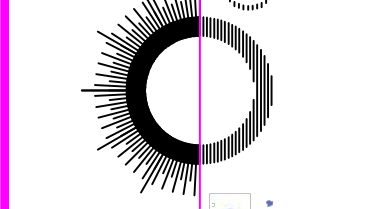
Slopes Table

Number	Minimum Slope	Maximum Slope	Area	Color	SITE %
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2	15.00%	30.00%	531247.48	Yellow	22.34%
3	30.00%	170.71%	23939.74	Red	1.01%

DATE:	REV.	DATE	DESCRIPTION	BY	APP'D
9-8-2020					
DRAWN BY: ACAD_ZO					
DESIGNED BY: NZV					
CHECKED BY: FAB					

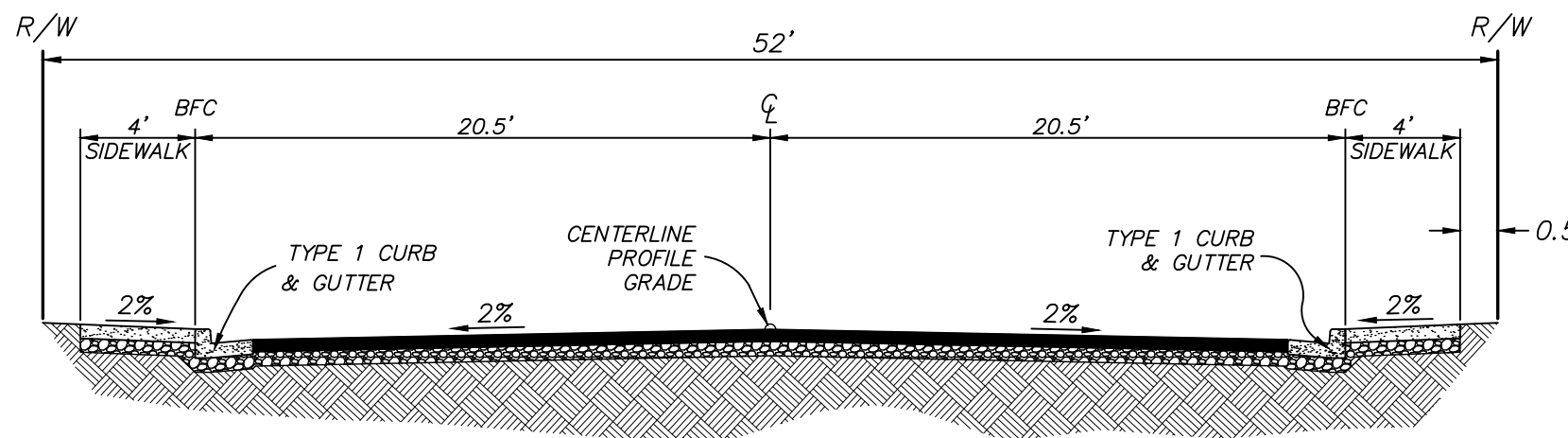
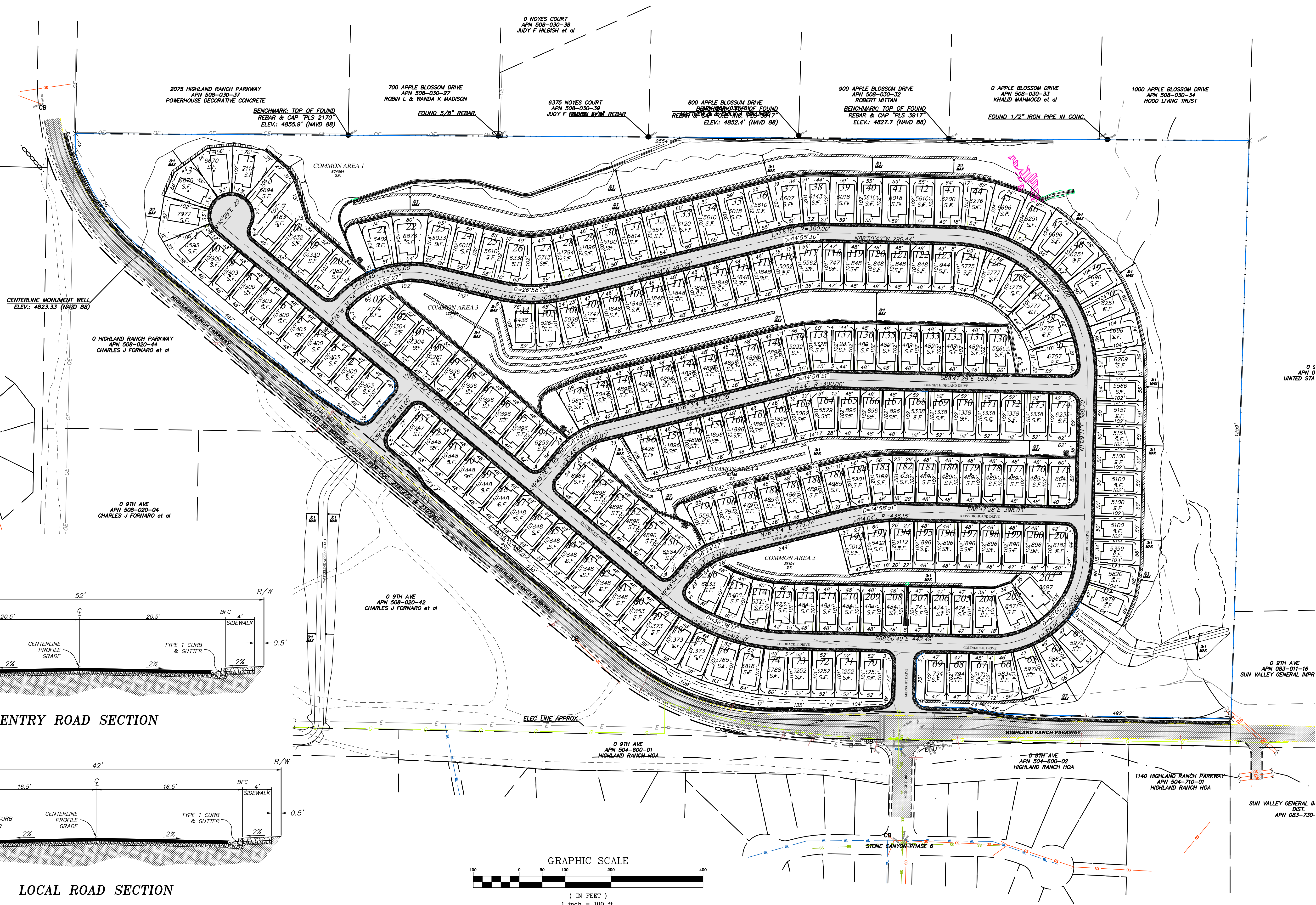
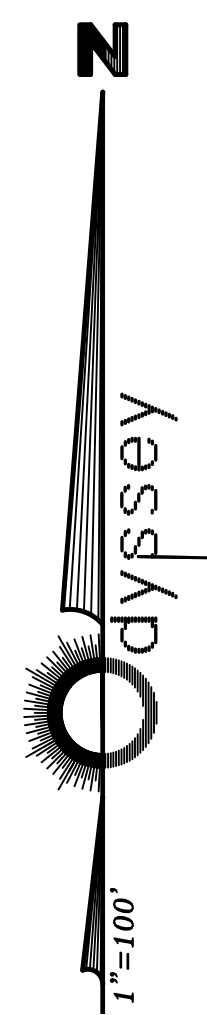
HIGHLANDS VILLAGE  
SLOPE MAP  
SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
(775) 369-3303 FAX (775) 359-3329  
ODYSSEYRENO.COM

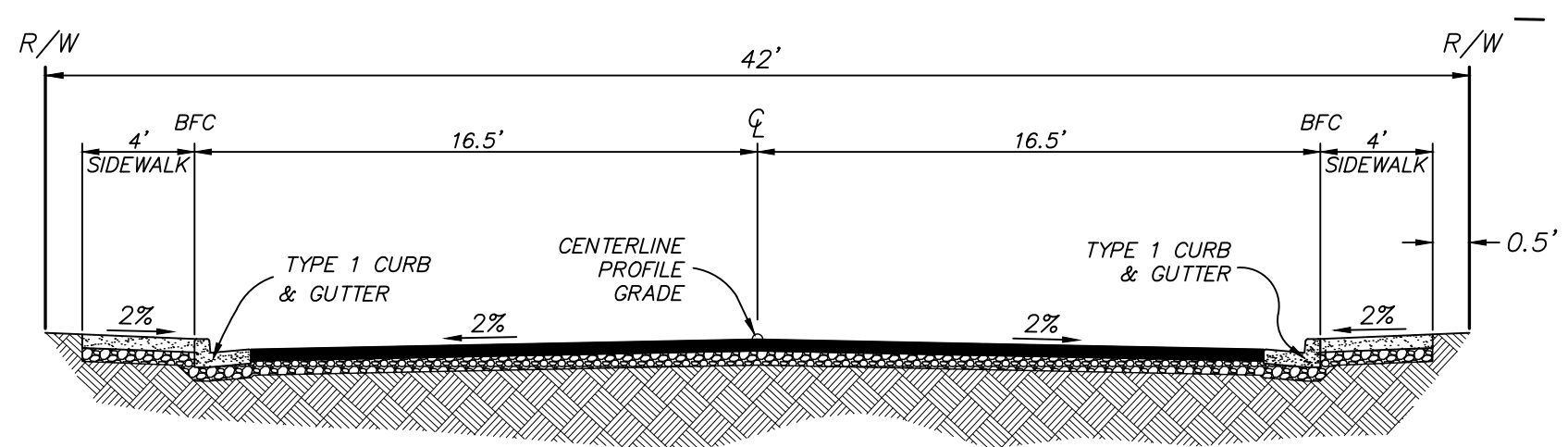


SCALE  
HORIZ. -  
VERT. -  
JOB NO.  
JOB

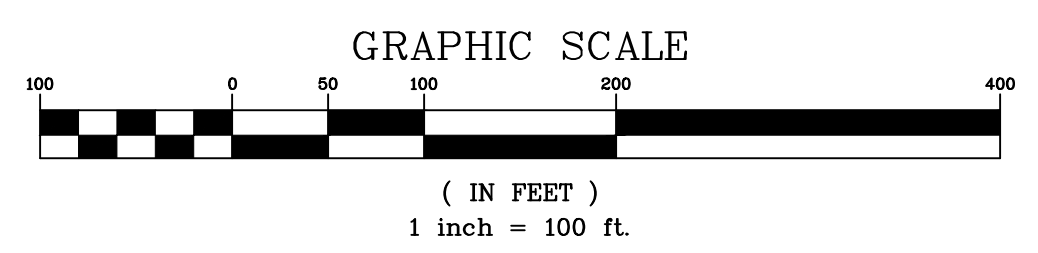
SHEET  
SM-1  
OF  
16



ENTRY ROAD SECTION



LOCAL ROAD SECTION



REV.	DATE	DESCRIPTION	BY	APP'D

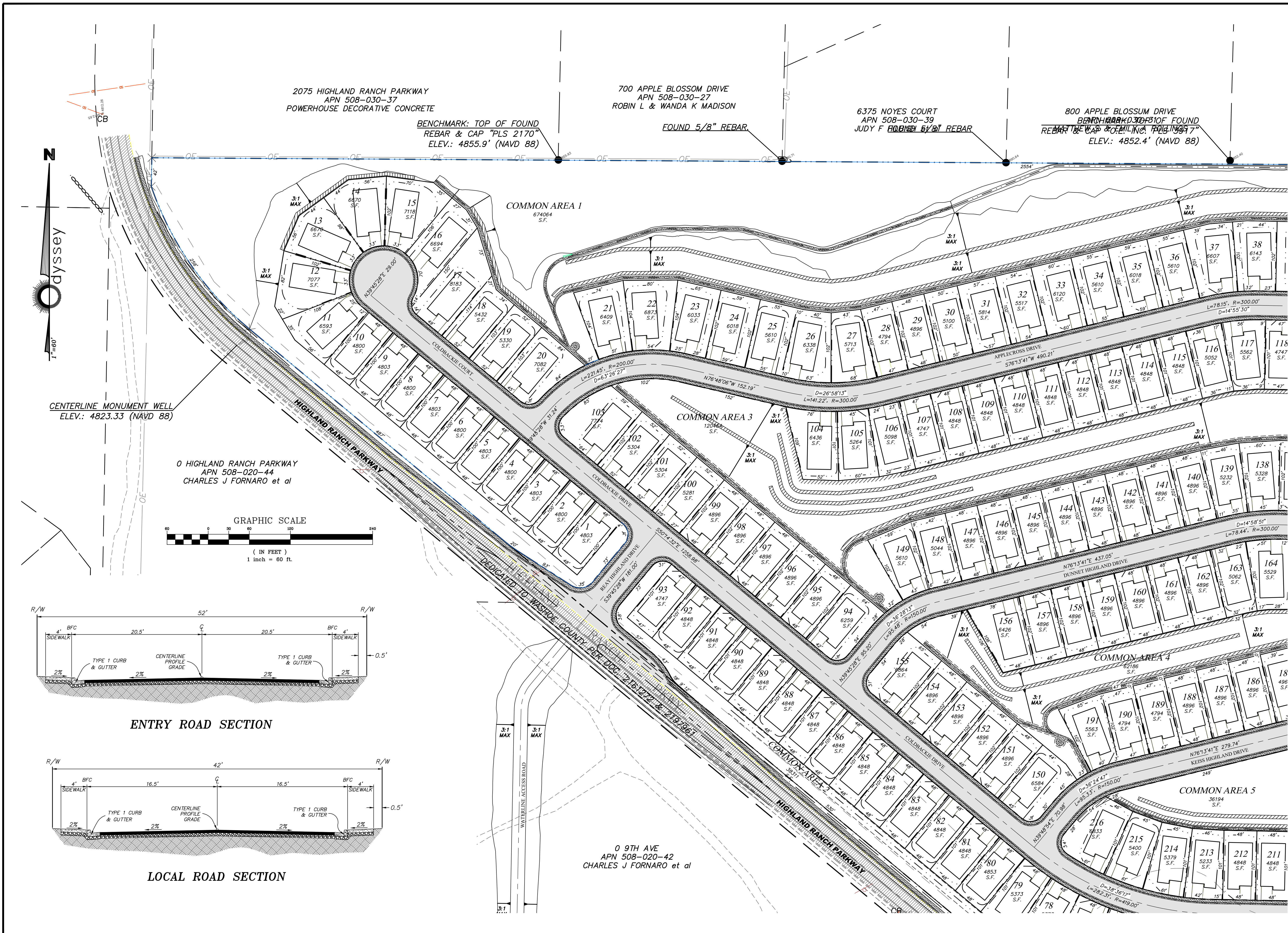
DATE: 9-8-2020	DESIGNED BY: NZV	CHECKED BY: FAB
DRAWN BY: ACAD_ZO		

**HIGHLANDS VILLAGE**  
**OVERALL SITE PLAN**  
 SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEYRENO.COM  
**odyssey ENGINEERING INCORPORATED**

**FRANK A. BIDART**  
 Exp. 12-31-20  
 CIVIL

SCALE	HORIZ. 1" = 100'
VERT.	
JOB NO.	
JOB	
SHEET	S-1
OF	16



REV.	DATE	DESCRIPTION	BY	APP'D

DATE: 9-8-2020	DESIGNED BY: NZV	CHECKED BY: FAB
DRAWN BY: ACAD 20		

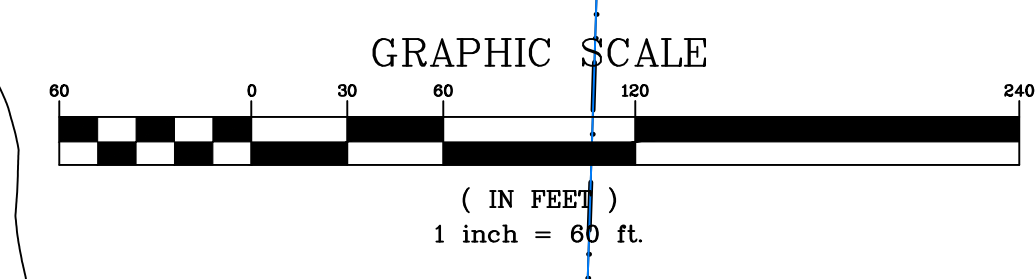
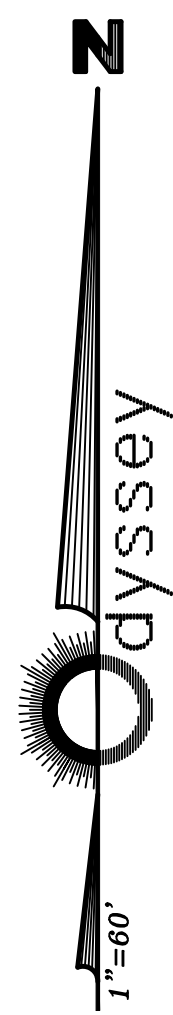
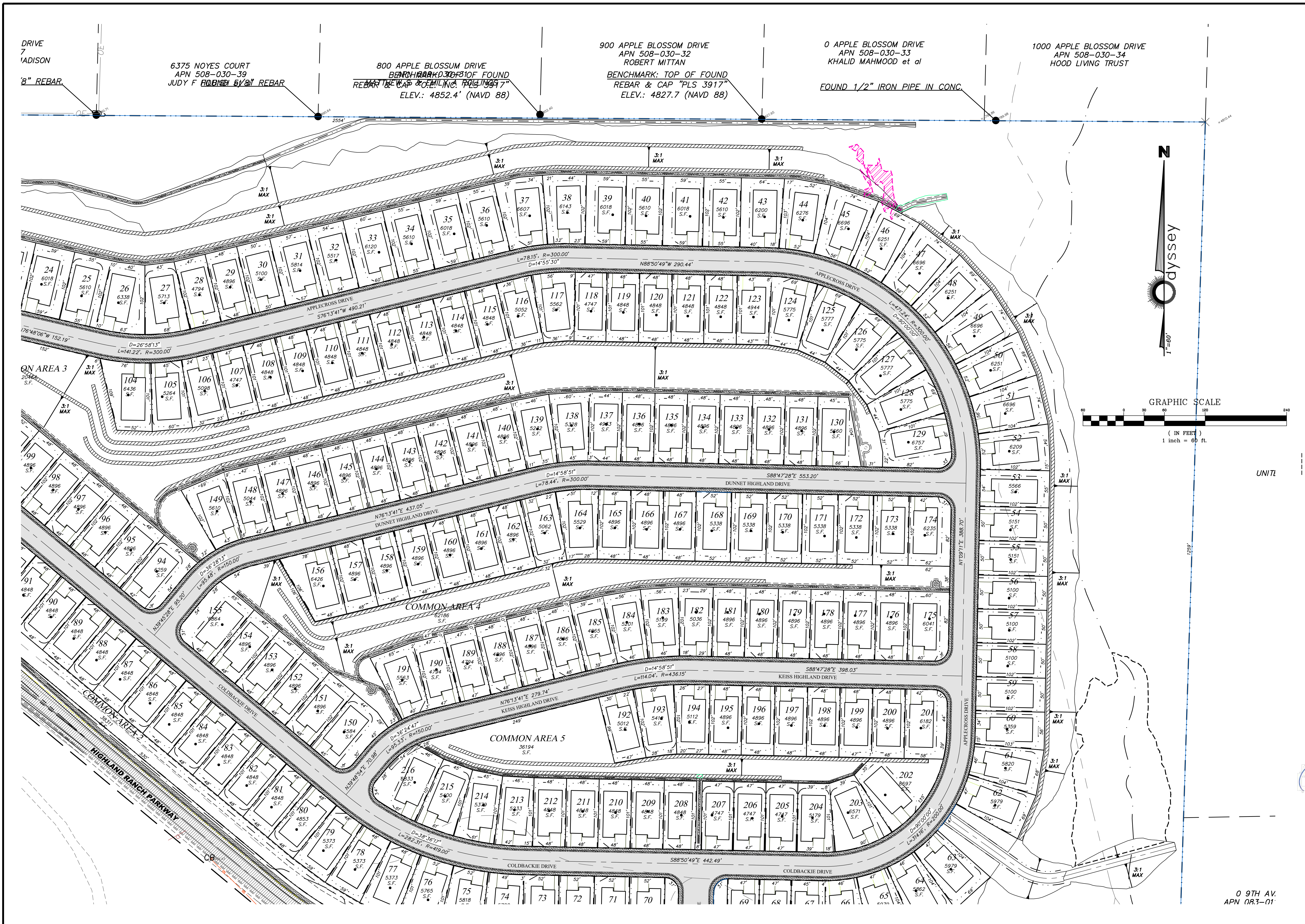
**HIGHLANDS VILLAGE**  
**PRELIMINARY SITE PLAN**  
 SUN VALLEY WASHOE COUNTY NEVADA

**odyssey ENGINEERING INCORPORATED**  
 895 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEYRENO.COM

**FRANK A. BIDART**  
 Exp. 12-31-20  
 CIVIL  
 No. 10504

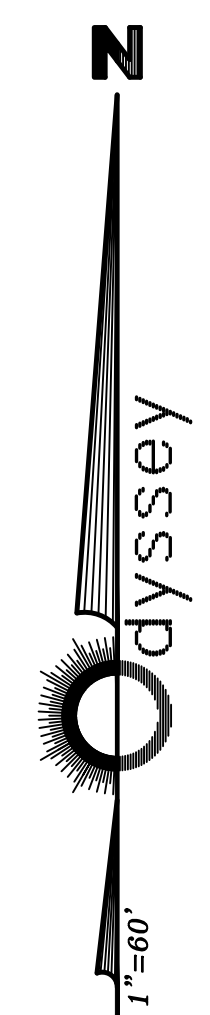
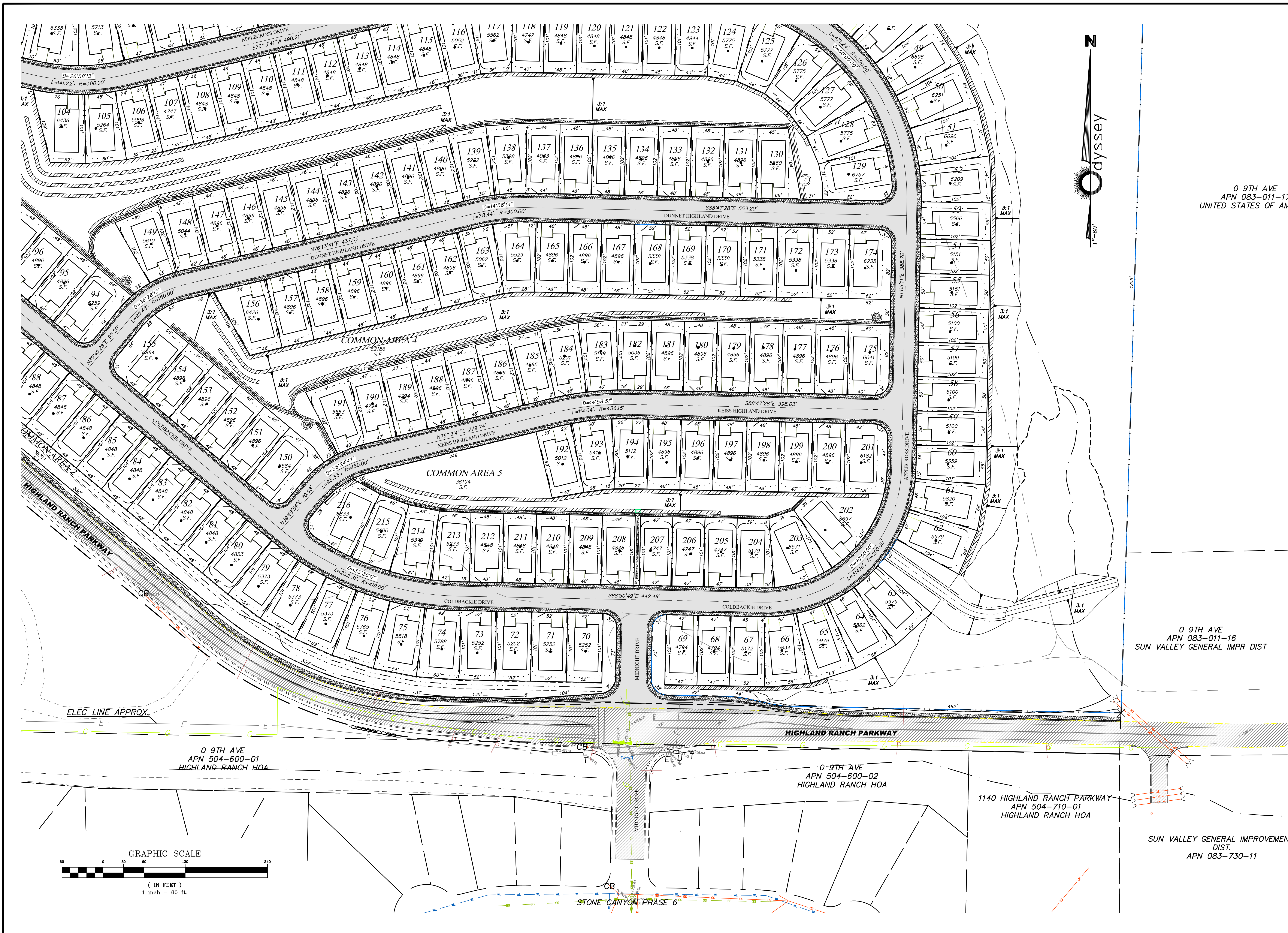
SCALE	HORIZ. 1"=60'
VERT.	-
JOB NO.	-
SHEET	S-2
OF	16





DATE: 9-8-2020	DESCRIPTION	BY: APP'D
DRAWN BY: ACAD 20	DATE	
DESIGNED BY: NZV	REV.	
CHECKED BY: FAB		
<b>HIGHLANDS VILLAGE</b> <b>PRELIMINARY SITE PLAN</b> SUN VALLEY WASHOE COUNTY NEVADA		
 <b>Odyssey ENGINEERING INCORPORATED</b> 895 ROBERTA LANE, SUITE 104, SPARKS, NV 89431 (775) 369-3303 FAX (775) 359-3329 ODYSSEYRENO.COM		
 <b>FRANK A. BIDART</b> Exp. 12-31-20 CIVIL No. 10504		
SCALE HORIZ. 1"=60' VERT. - JOB NO. JOB		
<b>S-3</b> OF <b>16</b>		

0 9TH AV.  
APN 083-01



0 9TH AVE  
 APN 083-011-1;  
 UNITED STATES OF AM

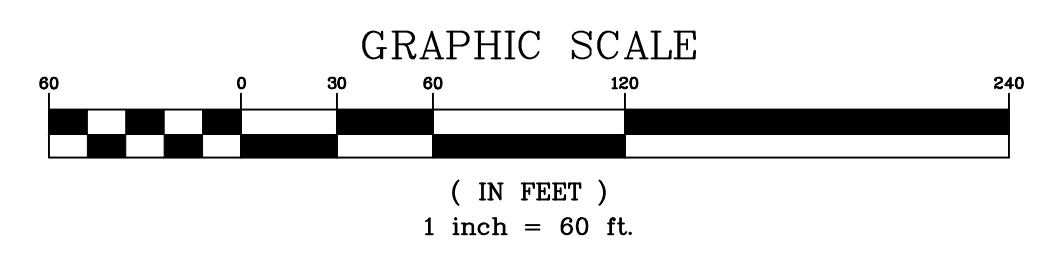
0 9TH AVE  
 APN 083-011-16  
 SUN VALLEY GENERAL IMPR DIST

0 9TH AVE  
 APN 504-600-01  
 HIGHLAND RANCH HOA

0 9TH AVE  
 APN 504-600-02  
 HIGHLAND RANCH HOA

1140 HIGHLAND RANCH PARKWAY  
 APN 504-710-01  
 HIGHLAND RANCH HOA

SUN VALLEY GENERAL IMPROVEMEN  
 DIST.  
 APN 083-730-11



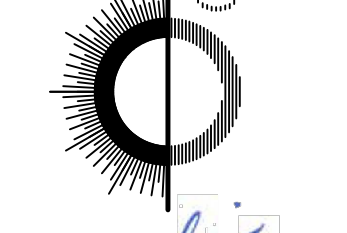
REV.	DATE	DESCRIPTION	BY	APP'D

DATE: 9-8-2020  
 DRAWN BY: ACAD 20  
 DESIGNED BY: NZV  
 CHECKED BY: FAB

HIGHLANDS VILLAGE  
 PRELIMINARY SITE PLAN

SUN VALLEY WASHOE COUNTY NEVADA

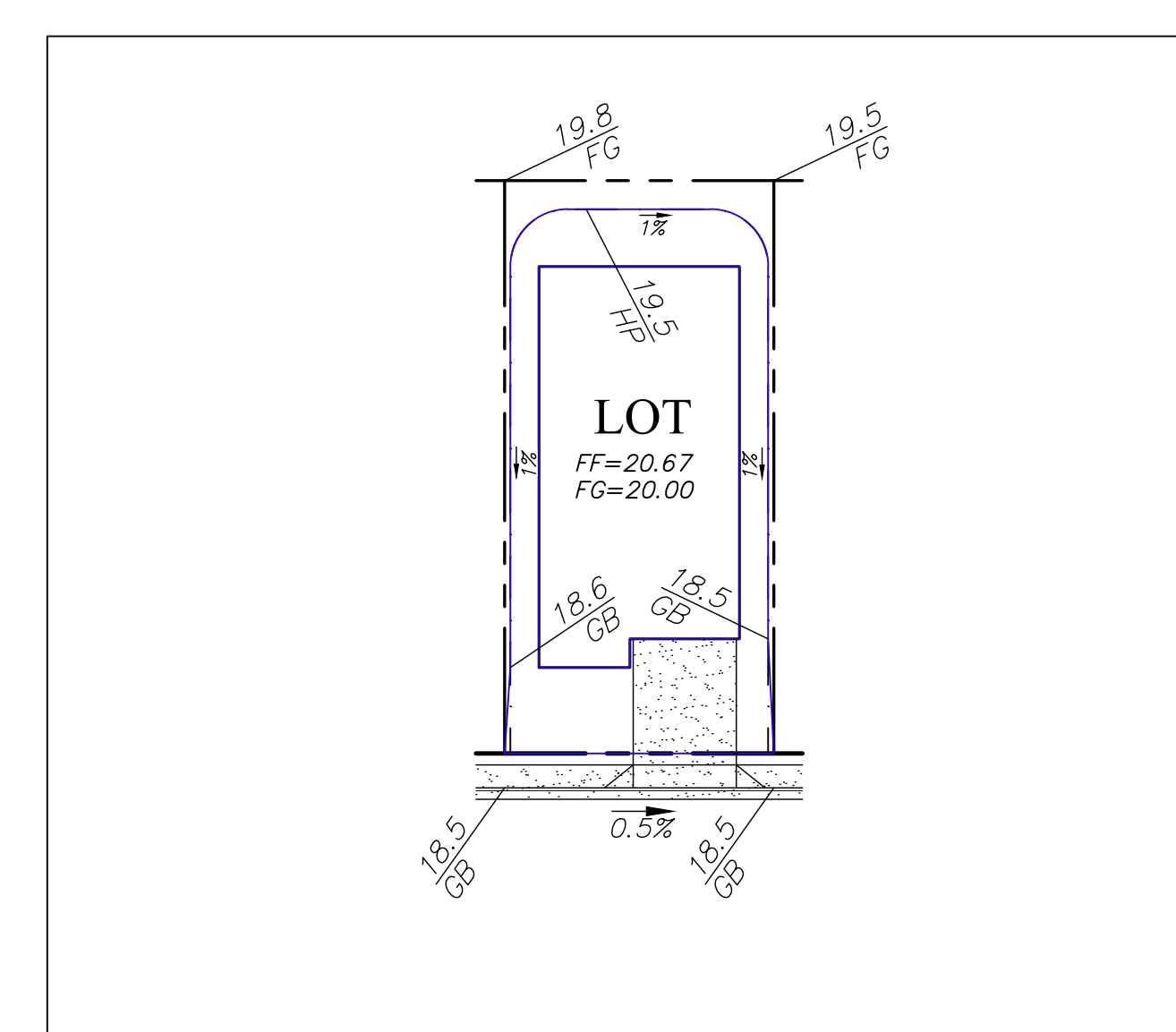
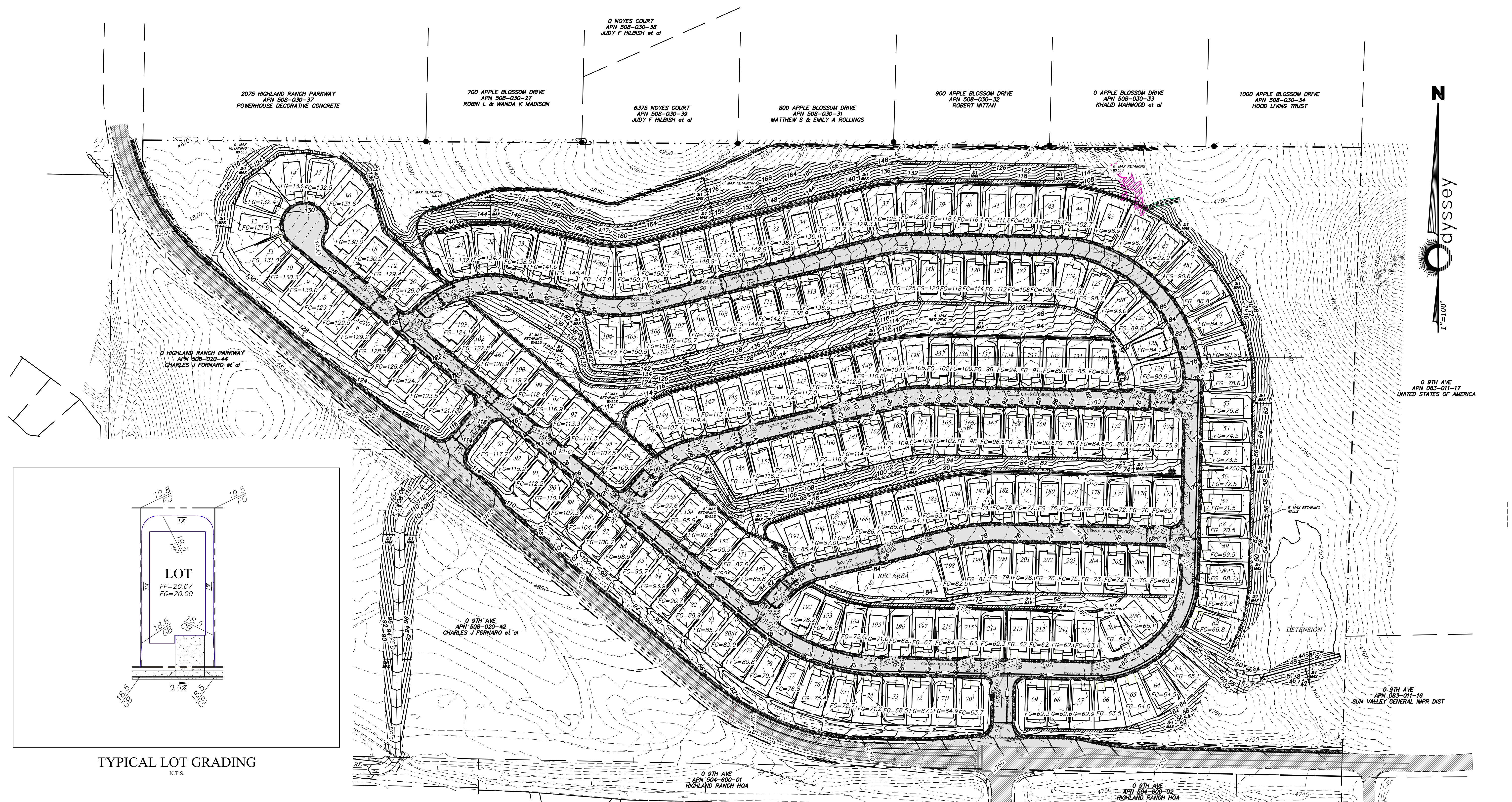
895 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEYRENO.COM



PROFESSIONAL ENGINEER - STATE OF NV  
 FRANK A. BIDART  
 Exp. 12-31-20  
 CIVIL  
 No. 10504

SCALE  
 HORIZ. 1"=60'  
 VERT. -  
 JOB NO.  
 JOB

SHEET  
 S-4  
 OF  
 16



TYPICAL LOT GRADING  
N.T.S.

**LEGEND:**

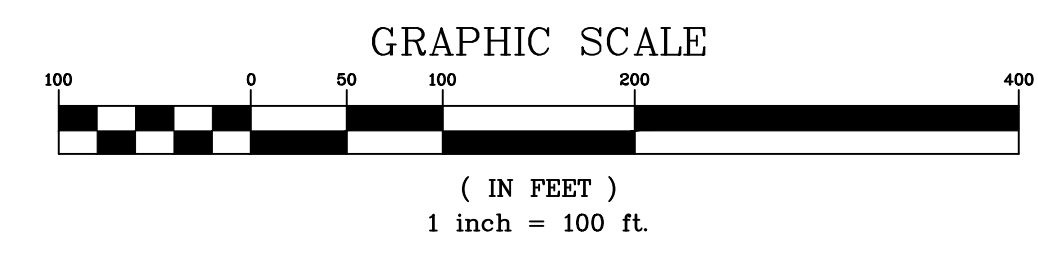
- A.C. PAVING AREA
- EXISTING A.C. PAVING
- CONCRETE AREA
- TEMPORARY ACCESS ROAD
- MANHOLE (DASHED IF EXISTING)
- CATCH BASIN
- STORM DRAIN MAIN (DASHED IF EXISTING)

- NOTES:**
1. ALL PROPOSED ROADWAYS SHALL BE PRIVATE.
  2. ALL STORM DRAIN FACILITIES SHALL BE PUBLIC.
  3. ALL SANITARY SEWER FACILITIES SHALL BE PUBLIC.
  4. ALL COMMON AREAS SHOWN SHALL BE MAINTAINED BY THE HOMEOWNER'S ASSOCIATION.
  5. SOME HOMES WITHIN THIS SUBDIVISION WILL REQUIRE DEEPENED FOOTINGS AND/OR LOWER GARAGE FINISH FLOORS. THIS INFORMATION WILL BE PROVIDED AT TIME OF BUILDING PERMIT.
  6. REF. SHEET C-2 FOR VEGETATION NOTES.
  7. ADD 4700 TO ALL SPOT ELEVATIONS.

**FLOOD ZONE**  
THE PROPOSED RESIDENTIAL LOTS ARE LOCATED WITHIN A FEMA UNSHADED ZONE X PER FIRM MAP PANEL 32051C3032G EFFECTIVE DATE MARCH 16, 2009.

**Cut/Fill Summary**

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
PADS VOLUME	1.000	1.000	494640.00 Sq. Ft.	48349.19 Cu. Yd.	79161.94 Cu. Yd.	30812.76 Cu. Yd.<Fill>
ROADS VOLUME	1.000	1.000	355810.85 Sq. Ft.	47855.48 Cu. Yd.	15270.89 Cu. Yd.	32584.59 Cu. Yd.<Cut>
DRIVE VOLUME	1.000	1.000	74331.07 Sq. Ft.	7204.93 Cu. Yd.	8307.16 Cu. Yd.	1102.24 Cu. Yd.<Fill>
SLOPES VOLUME	1.000	1.000	463753.10 Sq. Ft.	67987.95 Cu. Yd.	43852.02 Cu. Yd.	24135.93 Cu. Yd.<Cut>
LOTS VOLUME	1.000	1.000	597119.78 Sq. Ft.	77595.51 Cu. Yd.	86920.78 Cu. Yd.	9325.26 Cu. Yd.<Fill>
DETENTION VOLUME	1.000	1.000	25113.42 Sq. Ft.	1786.23 Cu. Yd.	1362.47 Cu. Yd.	423.76 Cu. Yd.<Cut>
WATER LINE VOLUME	1.000	1.000	42648.73 Sq. Ft.	147.89 Cu. Yd.	7309.51 Cu. Yd.	7161.62 Cu. Yd.<Fill>
<b>Totals</b>			<b>2053416.96 Sq. Ft.</b>	<b>250927.17 Cu. Yd.</b>	<b>242184.77 Cu. Yd.</b>	<b>8742.40 Cu. Yd.&lt;Cut&gt;</b>



DATE:	9-8-2020	DESCRIPTION:		BY:	APP'D:
DRAWN BY:	ACAD_ZO	DATE:		DESCRIPTION:	
DESIGNED BY:	NZY	REV.		DATE:	
CHECKED BY:	FAB				

**HIGHLANDS VILLAGE**  
**OVERALL GRADING PLAN**

SUN VALLEY    WASHOE COUNTY    NEVADA

**Odyssey**  
ENGINEERING  
INCORPORATED

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
(775) 369-3303 FAX (775) 359-3329  
ODYSSEY@RENDO.COM

**FRANK A. BIDART**  
Exp. 12-31-20  
CIVIL  
No. 10504

SCALE  
HORIZ. 1" = 100'  
VERT. -  
JOB NO.  
JOB  
SHEET  
**G-1**  
OF  
**16**

REV.	DATE	DESCRIPTION	BY	APP'D

DATE: 9-8-2020  
 DRAWN BY: ACAD\_ZO  
 DESIGNED BY: NZV  
 CHECKED BY: FAB

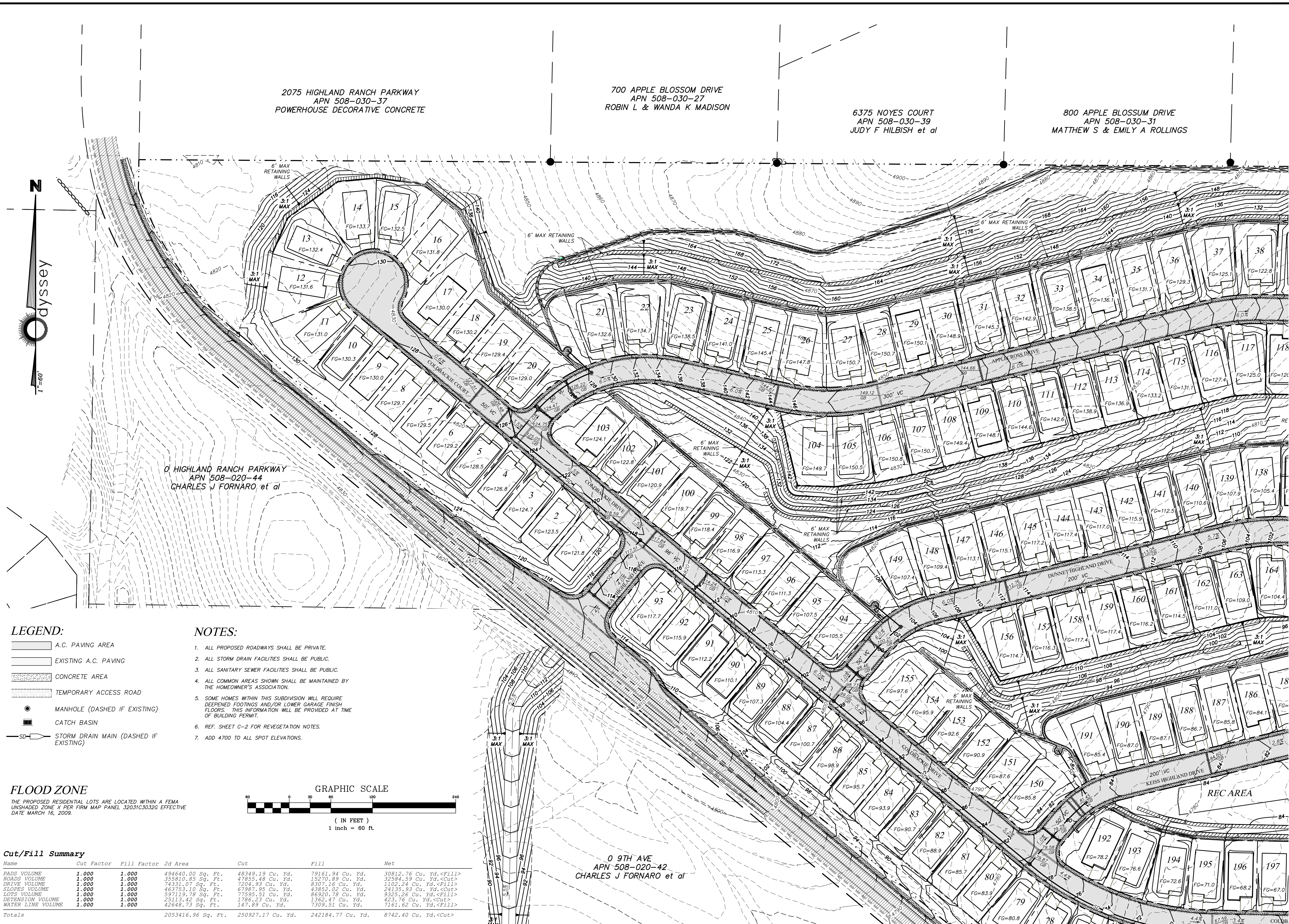
**HIGHLANDS VILLAGE**  
**PRELIMINARY GRADING PLAN**  
 SUN VALLEY WASHOE COUNTY NEVADA

odyssey  
 ENGINEERING  
 INCORPORATED  
 885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEY@TRENDO.COM

PROFESSIONAL ENGINEER - STATE OF NV  
**FRANK A. BIDART**  
 Exp. 12-31-20  
 CIVIL  
 No. 10504

SCALE  
 HORIZ. 1"=60'  
 VERT. -  
 JOB NO.  
 JOB NO.

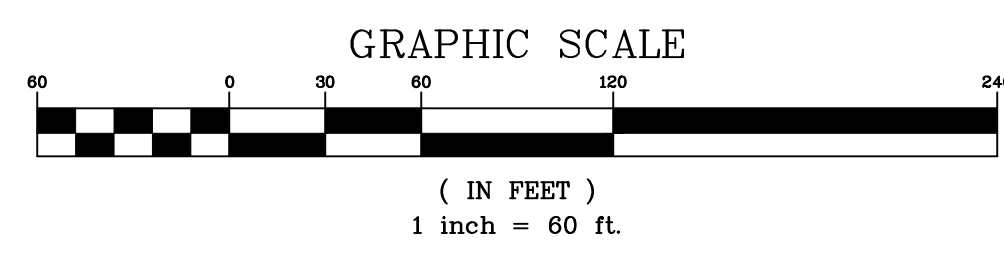
SHEET  
**G-2**  
 OF  
**16**



- LEGEND:**
- A.C. PAVING AREA
  - EXISTING A.C. PAVING
  - CONCRETE AREA
  - TEMPORARY ACCESS ROAD
  - MANHOLE (DASHED IF EXISTING)
  - CATCH BASIN
  - STORM DRAIN MAIN (DASHED IF EXISTING)

- NOTES:**
1. ALL PROPOSED ROADWAYS SHALL BE PRIVATE.
  2. ALL STORM DRAIN FACILITIES SHALL BE PUBLIC.
  3. ALL SANITARY SEWER FACILITIES SHALL BE PUBLIC.
  4. ALL COMMON AREAS SHOWN SHALL BE MAINTAINED BY THE HOMEOWNER'S ASSOCIATION.
  5. SOME HOMES WITHIN THIS SUBDIVISION WILL REQUIRE DEEPEMED FOOTINGS AND/OR LOWER GARAGE FINISH FLOORS. THIS INFORMATION WILL BE PROVIDED AT TIME OF BUILDING PERMIT.
  6. REF. SHEET C-2 FOR VEGETATION NOTES.
  7. ADD 4700 TO ALL SPOT ELEVATIONS.

**FLOOD ZONE**  
 THE PROPOSED RESIDENTIAL LOTS ARE LOCATED WITHIN A FEMA UNSHADED ZONE X PER FIRM MAP PANEL 32031C3032G EFFECTIVE DATE MARCH 16, 2009.



**Cut/Fill Summary**

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
PADS VOLUME	1.000	1.000	494640.00 Sq. Ft.	48349.19 Cu. Yd.	79161.94 Cu. Yd.	30812.76 Cu. Yd.<Fill>
ROADS VOLUME	1.000	1.000	359810.89 Sq. Ft.	47855.49 Cu. Yd.	15270.89 Cu. Yd.	32584.59 Cu. Yd.<Cut>
DRIVE VOLUME	1.000	1.000	74331.07 Sq. Ft.	7204.93 Cu. Yd.	8307.16 Cu. Yd.	1102.24 Cu. Yd.<Fill>
SLOPES VOLUME	1.000	1.000	463753.10 Sq. Ft.	67987.95 Cu. Yd.	43852.02 Cu. Yd.	24135.93 Cu. Yd.<Cut>
LOTS VOLUME	1.000	1.000	597119.78 Sq. Ft.	77595.51 Cu. Yd.	86920.78 Cu. Yd.	9325.26 Cu. Yd.<Fill>
DETENTION VOLUME	1.000	1.000	25113.42 Sq. Ft.	1786.23 Cu. Yd.	1362.47 Cu. Yd.	423.76 Cu. Yd.<Cut>
WATER LINE VOLUME	1.000	1.000	42648.73 Sq. Ft.	147.89 Cu. Yd.	7309.51 Cu. Yd.	7161.62 Cu. Yd.<Fill>
Totals			2053416.96 Sq. Ft.	250927.17 Cu. Yd.	242184.77 Cu. Yd.	8742.40 Cu. Yd.<Cut>

DRIVE  
7  
ADISON

6375 NOYES COURT  
APN 508-030-39  
JUDY F HILBISH et al

800 APPLE BLOSSOM DRIVE  
APN 508-030-31  
MATTHEW S & EMILY A ROLLINGS

900 APPLE BLOSSOM DRIVE  
APN 508-030-32  
ROBERT MITTAN

**Cut/Fill Summary**

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
PADS VOLUME	1.000	1.000	494640.00 Sq. Ft.	48349.19 Cu. Yd.	79161.94 Cu. Yd.	30812.76 Cu. Yd.<Fill>
ROADS VOLUME	1.000	1.000	355810.25 Sq. Ft.	47855.48 Cu. Yd.	15270.89 Cu. Yd.	32584.59 Cu. Yd.<Cut>
DRIVE VOLUME	1.000	1.000	74331.07 Sq. Ft.	7204.93 Cu. Yd.	8307.16 Cu. Yd.	1102.24 Cu. Yd.<Fill>
SLOPES VOLUME	1.000	1.000	463753.10 Sq. Ft.	67987.95 Cu. Yd.	43852.02 Cu. Yd.	24135.93 Cu. Yd.<Cut>
LOTS VOLUME	1.000	1.000	591119.78 Sq. Ft.	73595.51 Cu. Yd.	86920.78 Cu. Yd.	13325.27 Cu. Yd.<Fill>
DETENSION VOLUME	1.000	1.000	25113.42 Sq. Ft.	1786.23 Cu. Yd.	1362.47 Cu. Yd.	423.76 Cu. Yd.<Cut>
WATER LINE VOLUME	1.000	1.000	42648.73 Sq. Ft.	147.89 Cu. Yd.	7309.51 Cu. Yd.	7161.62 Cu. Yd.<Fill>
Totals			2053416.96 Sq. Ft.	250927.17 Cu. Yd.	242184.77 Cu. Yd.	8742.40 Cu. Yd.<Cut>

**LEGEND:**

- A.C. PAVING AREA
- EXISTING A.C. PAVING
- CONCRETE AREA
- TEMPORARY ACCESS ROAD
- MANHOLE (DASHED IF EXISTING)
- CATCH BASIN
- STORM DRAIN MAIN (DASHED IF EXISTING)

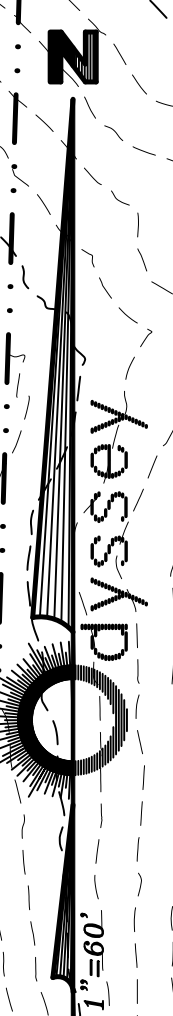
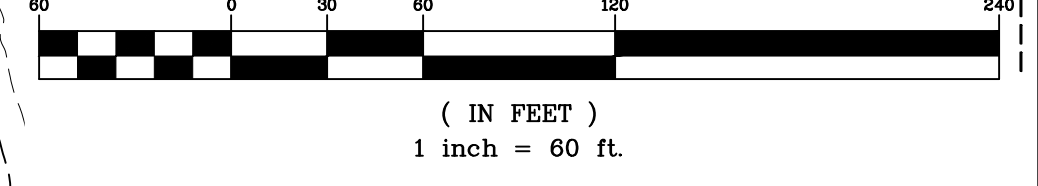
**FLOOD ZONE**

THE PROPOSED RESIDENTIAL LOTS ARE LOCATED WITHIN A FEMA UNSHADED ZONE X PER FIRM MAP PANEL 3201C3032G EFFECTIVE DATE MARCH 16, 2009.

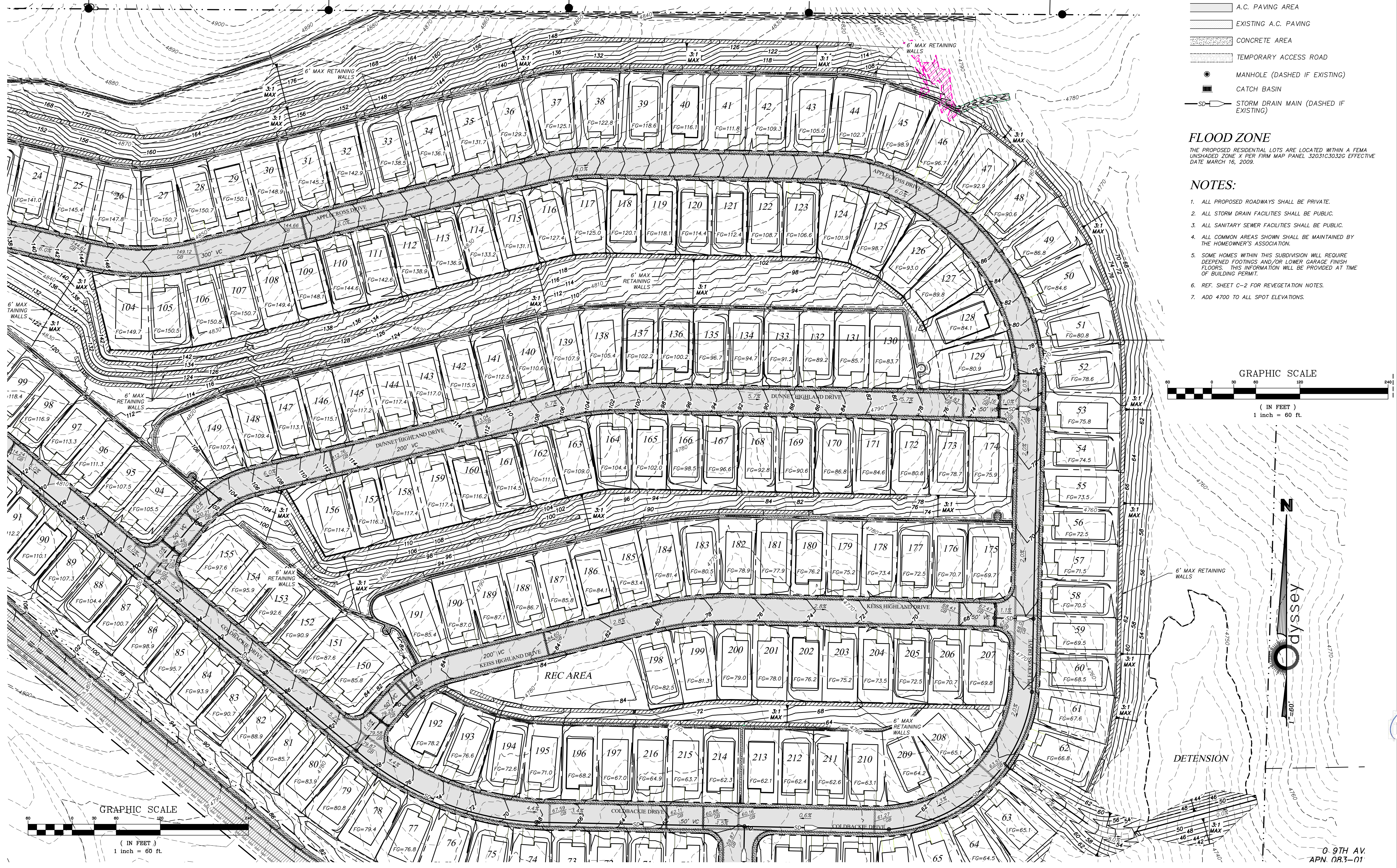
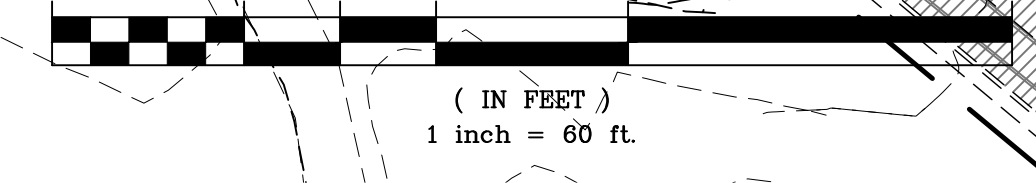
**NOTES:**

1. ALL PROPOSED ROADWAYS SHALL BE PRIVATE.
2. ALL STORM DRAIN FACILITIES SHALL BE PUBLIC.
3. ALL SANITARY SEWER FACILITIES SHALL BE PUBLIC.
4. ALL COMMON AREAS SHOWN SHALL BE MAINTAINED BY THE HOMEOWNER'S ASSOCIATION.
5. SOME HOMES WITHIN THIS SUBDIVISION WILL REQUIRE DEEPENED FOOTINGS AND/OR LOWER GARAGE FINISH FLOORS. THIS INFORMATION WILL BE PROVIDED AT TIME OF BUILDING PERMIT.
6. REF. SHEET C-2 FOR REVEGETATION NOTES.
7. ADD 4700 TO ALL SPOT ELEVATIONS.

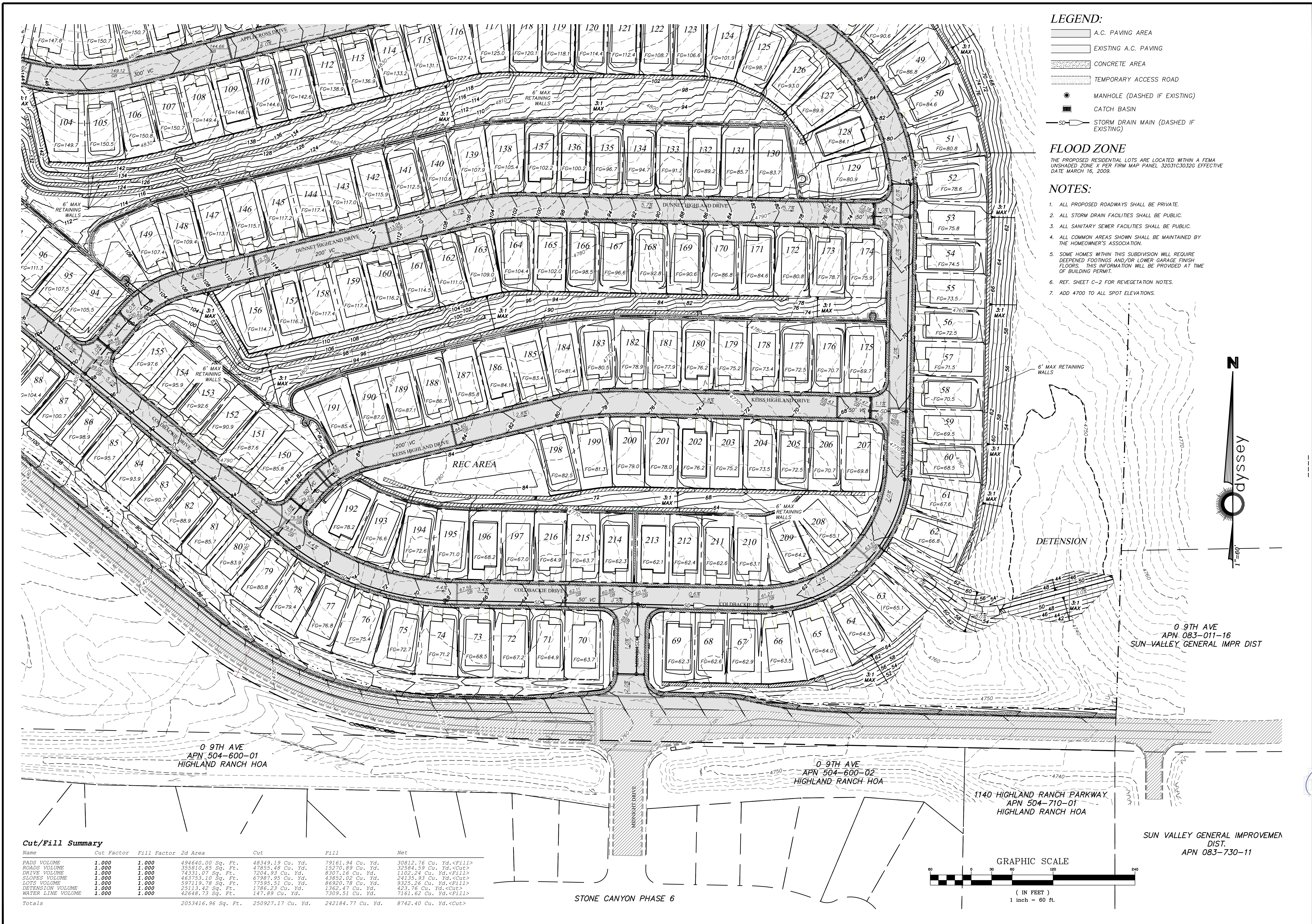
**GRAPHIC SCALE**



**GRAPHIC SCALE**



<b>DATE:</b> 9-8-2020	<b>BY:</b> APP'D
<b>DRAWN BY:</b> ACAD_ZO	<b>DESCRIPTION:</b>
<b>DESIGNED BY:</b> NZV	<b>DATE:</b>
<b>CHECKED BY:</b> FAB	<b>REV.:</b>
<b>HIGHLANDS VILLAGE</b>	
<b>PRELIMINARY GRADING PLAN</b>	
SUN VALLEY	WASHOE COUNTY
NEVADA	
 <b>odyssey ENGINEERING INCORPORATED</b>	
 <b>FRANK A. BIDART</b> Exp. 12-31-20 CIVIL	
SCALE HORIZ. 1"=60' VERT. - JOB NO. JOB	
SHEET <b>G-3</b> OF <b>16</b>	



- LEGEND:**
- A.C. PAVING AREA
  - EXISTING A.C. PAVING
  - CONCRETE AREA
  - TEMPORARY ACCESS ROAD
  - MANHOLE (DASHED IF EXISTING)
  - CATCH BASIN
  - SD — STORM DRAIN MAIN (DASHED IF EXISTING)

**FLOOD ZONE**  
 THE PROPOSED RESIDENTIAL LOTS ARE LOCATED WITHIN A FEMA UNSHADED ZONE X PER FIRM MAP PANEL 32031C3032G EFFECTIVE DATE MARCH 16, 2009.

- NOTES:**
1. ALL PROPOSED ROADWAYS SHALL BE PRIVATE.
  2. ALL STORM DRAIN FACILITIES SHALL BE PUBLIC.
  3. ALL SANITARY SEWER FACILITIES SHALL BE PUBLIC.
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  6. REF. SHEET C-2 FOR REVEGETATION NOTES.
  7. ADD 4700 TO ALL SPOT ELEVATIONS.

0 9TH AVE  
 APN 504-600-01  
 HIGHLAND RANCH HOA

0 9TH AVE  
 APN 504-600-02  
 HIGHLAND RANCH HOA

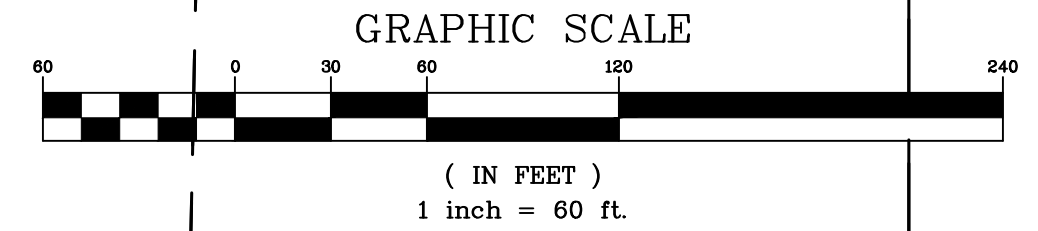
1140 HIGHLAND RANCH PARKWAY  
 APN 504-710-01  
 HIGHLAND RANCH HOA

SUN VALLEY GENERAL IMPROVEMENT DIST.  
 APN 083-730-11

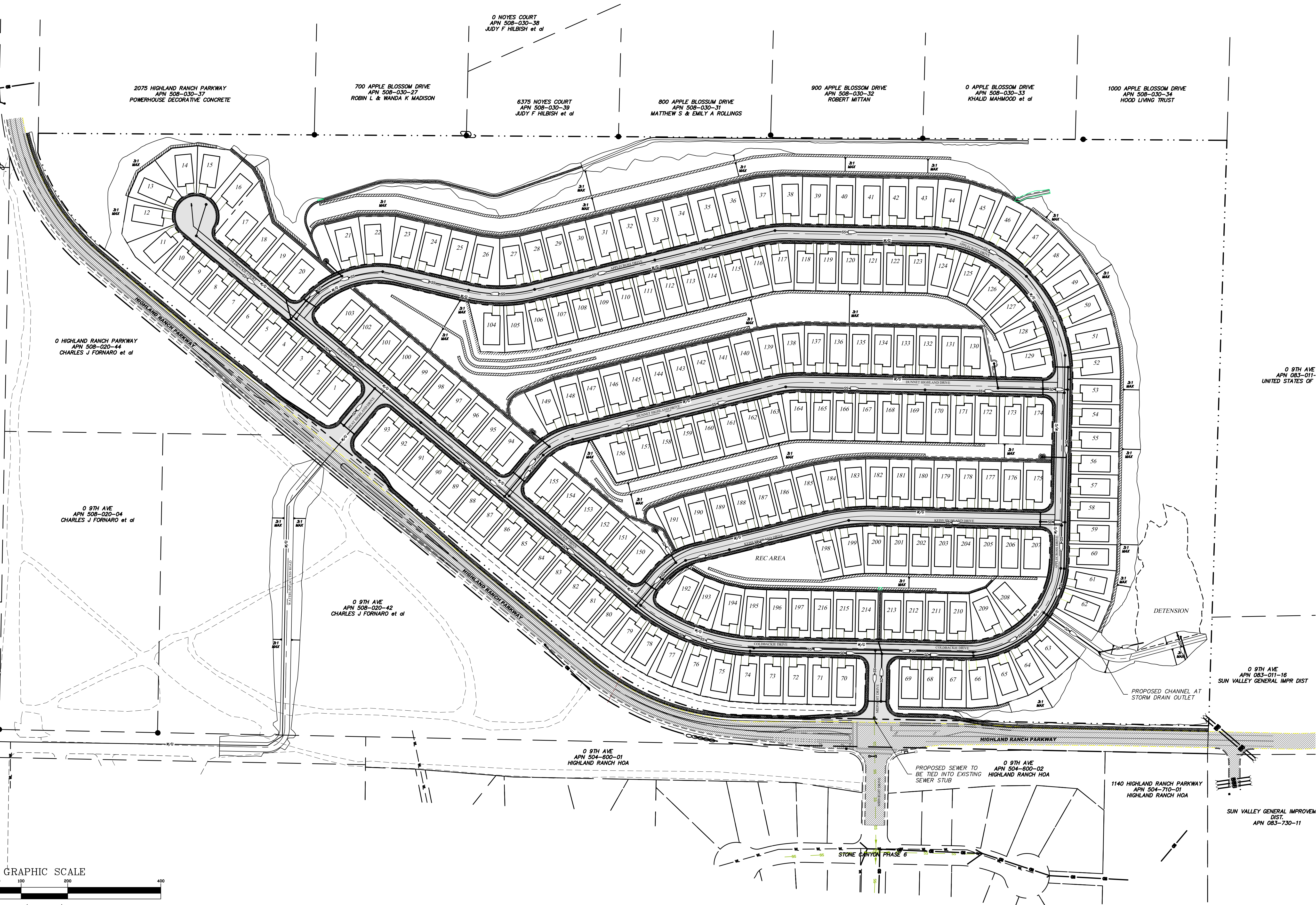
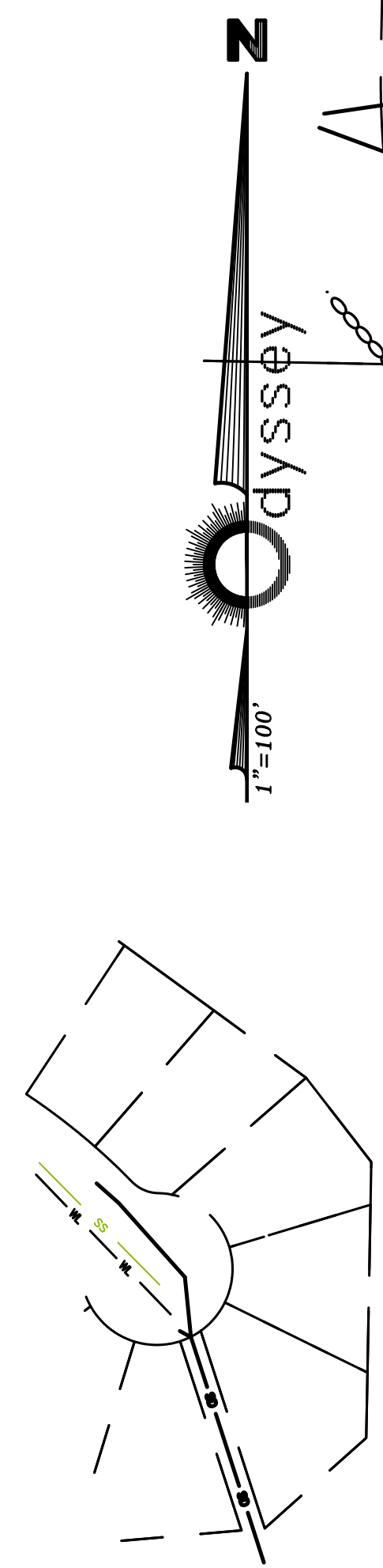
STONE CANYON PHASE 6

**Cut/Fill Summary**

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
PADS VOLUME	1.000	1.000	494640.00 Sq. Ft.	48349.19 Cu. Yd.	79161.94 Cu. Yd.	30812.76 Cu. Yd.<Fill>
ROADS VOLUME	1.000	1.000	355810.85 Sq. Ft.	47855.48 Cu. Yd.	15270.89 Cu. Yd.	32584.59 Cu. Yd.<Cut>
DRIVE VOLUME	1.000	1.000	74031.07 Sq. Ft.	7204.93 Cu. Yd.	8307.16 Cu. Yd.	1102.24 Cu. Yd.<Fill>
SLOPES VOLUME	1.000	1.000	463753.10 Sq. Ft.	67987.95 Cu. Yd.	43852.02 Cu. Yd.	24135.93 Cu. Yd.<Cut>
LOTS VOLUME	1.000	1.000	597119.78 Sq. Ft.	77595.51 Cu. Yd.	86920.78 Cu. Yd.	9325.26 Cu. Yd.<Fill>
DETENTION VOLUME	1.000	1.000	25113.42 Sq. Ft.	1786.23 Cu. Yd.	2362.47 Cu. Yd.	423.76 Cu. Yd.<Cut>
WATER LINE VOLUME	1.000	1.000	42648.73 Sq. Ft.	147.89 Cu. Yd.	7309.51 Cu. Yd.	7161.62 Cu. Yd.<Fill>
Totals			2053416.96 Sq. Ft.	250927.17 Cu. Yd.	242184.77 Cu. Yd.	8742.40 Cu. Yd.<Cut>



	BY	APP'D			
	DESCRIPTION				
	DATE				
	REV.				
DATE: 9-8-2020	DRAWN BY: ACAD_ZO	DESIGNED BY: NZV	CHECKED BY: FAB		
<b>HIGHLANDS VILLAGE</b> <b>PRELIMINARY GRADING PLAN</b> SUN VALLEY WASHOE COUNTY NEVADA					
885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431 (775) 369-3303 FAX (775) 359-3329 ODYSSEYRENO.COM					
<b>FRANK A. BIDART</b> Exp. 12-31-20 CIVIL No. 10504					
SCALE HORIZ. 1"=60' VERT. — JOB NO. JOB					
SHEET <b>G-4</b> OF <b>16</b>					



GRAPHIC SCALE  
 ( IN FEET )  
 1 inch = 100 ft.

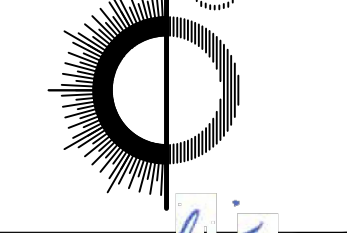
REV.	DATE	DESCRIPTION	BY	APP'D

DATE: 9-8-2020  
 DRAWN BY: ACAD\_ZO  
 DESIGNED BY: NZV  
 CHECKED BY: FAB

HIGHLANDS VILLAGE  
 OVERALL UTILITY PLAN

SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEYRENO.COM

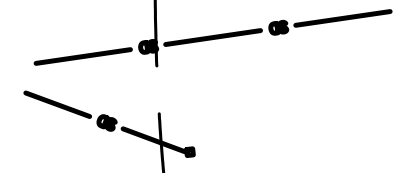


PROFESSIONAL ENGINEER - STATE OF NEVADA  
 FRANK A. BIDART  
 Exp. 12-31-20  
 CIVIL  
 No. 10504

SCALE  
 HORIZ. 1" = 100'  
 VERT. -

JOB NO.  
 JOB

SHEET  
 U-1  
 OF  
 16



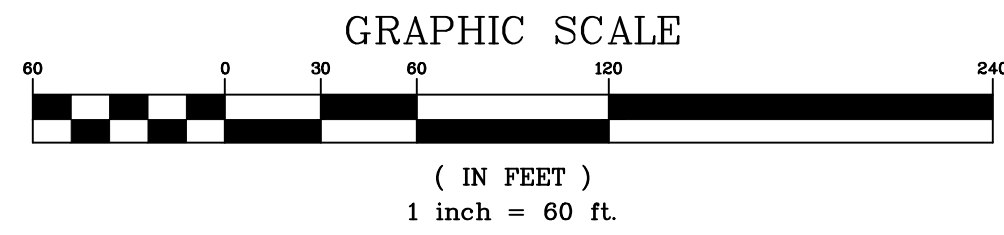
2075 HIGHLAND RANCH PARKWAY  
APN 508-030-37  
POWERHOUSE DECORATIVE CONCRETE

700 APPLE BLOSSOM DRIVE  
APN 508-030-27  
ROBIN L & WANDA K MADISON

6375 NOYES COURT  
APN 508-030-39  
JUDY F HILBISH et al

800 APPLE BLOSSOM DRIVE  
APN 508-030-31  
MATTHEW S & EMILY A ROLLINGS

0 HIGHLAND RANCH PARKWAY  
APN 508-020-44  
CHARLES J FORNARO et al

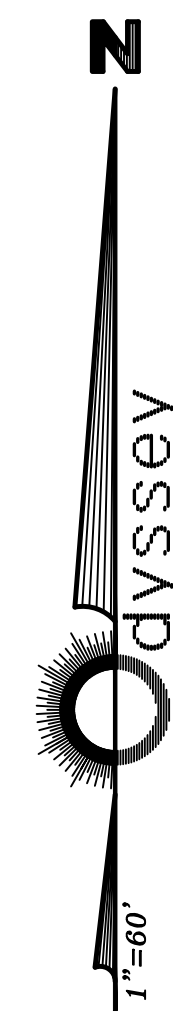


**LEGEND:**

- A.C. PAVING AREA
- EXISTING A.C. PAVING
- CONCRETE AREA
- MANHOLE (DASHED IF EXISTING)
- CATCH BASIN
- STORM DRAIN MAIN (DASHED IF EXISTING)
- SANITARY SEWER MAIN (DASHED IF EXISTING)
- WATER/GAS MAIN (DASHED IF EXISTING)

**NOTES:**

1. ALL PROPOSED ROADWAYS SHALL BE PUBLIC.
2. ALL STORM DRAIN FACILITIES SHALL BE PUBLIC.
3. ALL SANITARY SEWER FACILITIES SHALL BE PUBLIC.
4. ALL COMMON AREAS SHOWN SHALL BE MAINTAINED BY THE HOMEOWNER'S ASSOCIATION.



0 9TH AVE  
APN 508-020-42  
CHARLES J FORNARO et al

REV.	DATE	DESCRIPTION	BY	APP'D

DATE: 9-8-2020  
DRAWN BY: ACAD\_ZO  
DESIGNED BY: NZV  
CHECKED BY: FAB

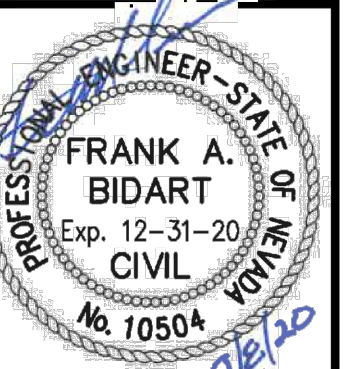
**HIGHLANDS VILLAGE  
PRELIMINARY UTILITY PLAN**

SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
(775) 369-3303 FAX (775) 359-3329  
ODYSSEY.RENO.COM

odyssey

ENGINEERING  
INCORPORATED



SCALE  
HORIZ. 1"=60'  
VERT. -  
JOB NO.  
JOB

SHEET  
**U-2**  
OF  
**16**



DRIVE  
7  
ADISON

6375 NOYES COURT  
APN 508-030-39  
JUDY F HILBISH et al

800 APPLE BLOSSUM DRIVE  
APN 508-030-31  
MATTHEW S & EMILY A ROLLINGS

900 APPLE BLOSSOM DRIVE  
APN 508-030-32  
ROBERT MITTAN

0 APPLE BLOSSOM DRIVE  
APN 508-030-33  
KHALID MAHMOOD et al

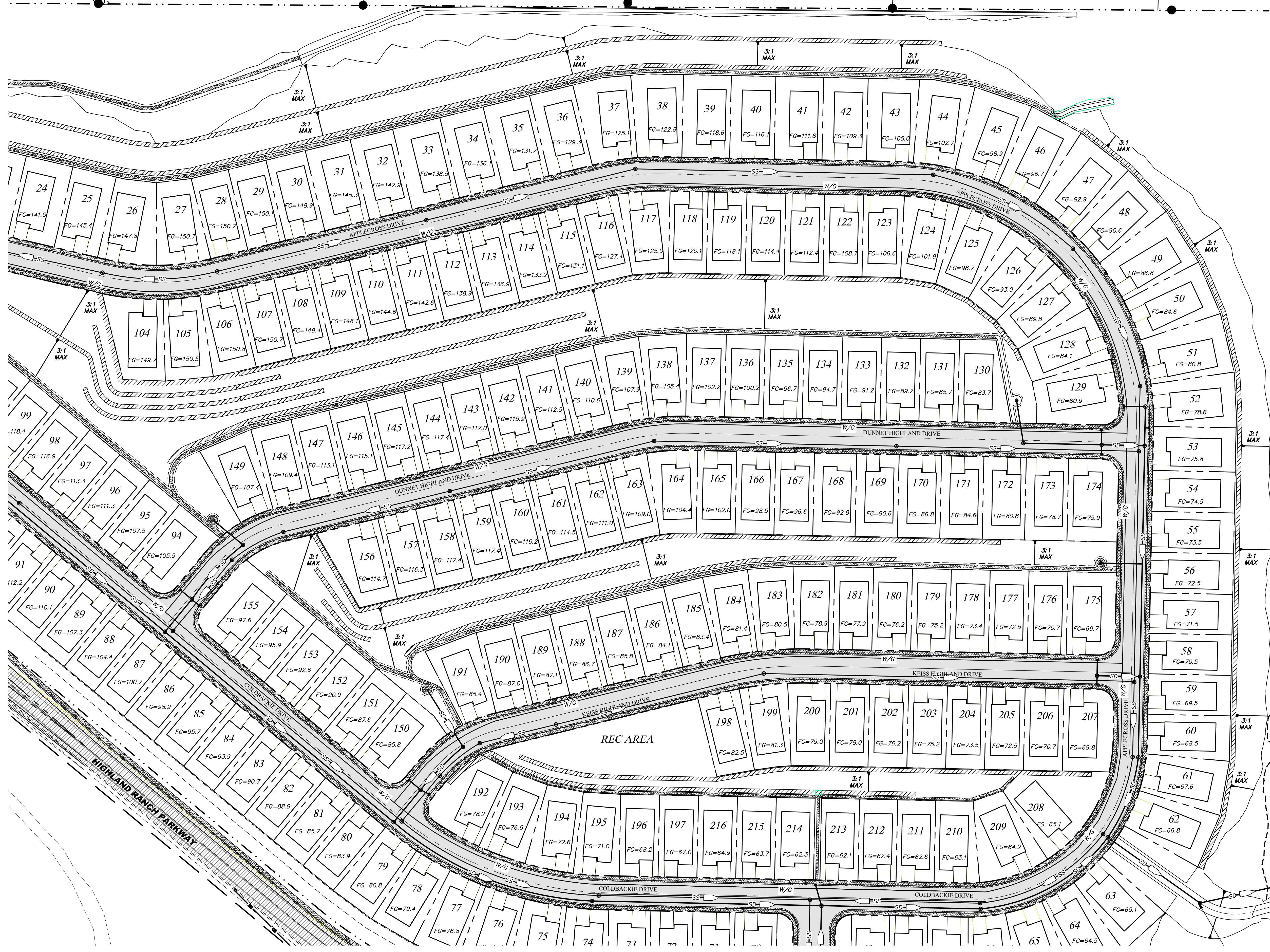
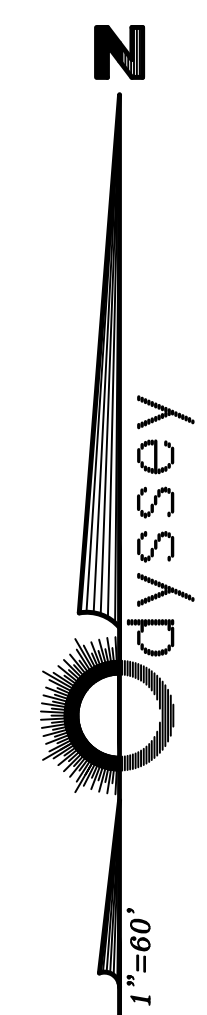
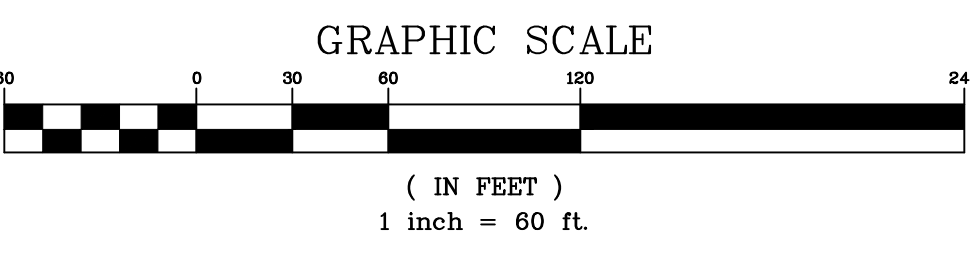
1000 APPLE  
APN 508-030-34  
HOOD I

**LEGEND:**

- A.C. PAVING AREA
- EXISTING A.C. PAVING
- CONCRETE AREA
- MANHOLE (DASHED IF EXISTING)
- CATCH BASIN
- STORM DRAIN MAIN (DASHED IF EXISTING)
- SANITARY SEWER MAIN (DASHED IF EXISTING)
- WATER/GAS MAIN (DASHED IF EXISTING)

**NOTES:**

1. ALL PROPOSED ROADWAYS SHALL BE PUBLIC.
2. ALL STORM DRAIN FACILITIES SHALL BE PUBLIC.
3. ALL SANITARY SEWER FACILITIES SHALL BE PUBLIC.
4. ALL COMMON AREAS SHOWN SHALL BE MAINTAINED BY THE HOMEOWNER'S ASSOCIATION.



UNITE

0 9TH AV  
APN 083-01;

REV.	DATE	DESCRIPTION	BY	APP'D

DATE: 9-8-2020	DRAWN BY: ACAD_ZO	DESIGNED BY: NZV	CHECKED BY: FAB
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HIGHLANDS VILLAGE  
PRELIMINARY UTILITY PLAN  
SUN VALLEY WASHOE COUNTY NEVADA

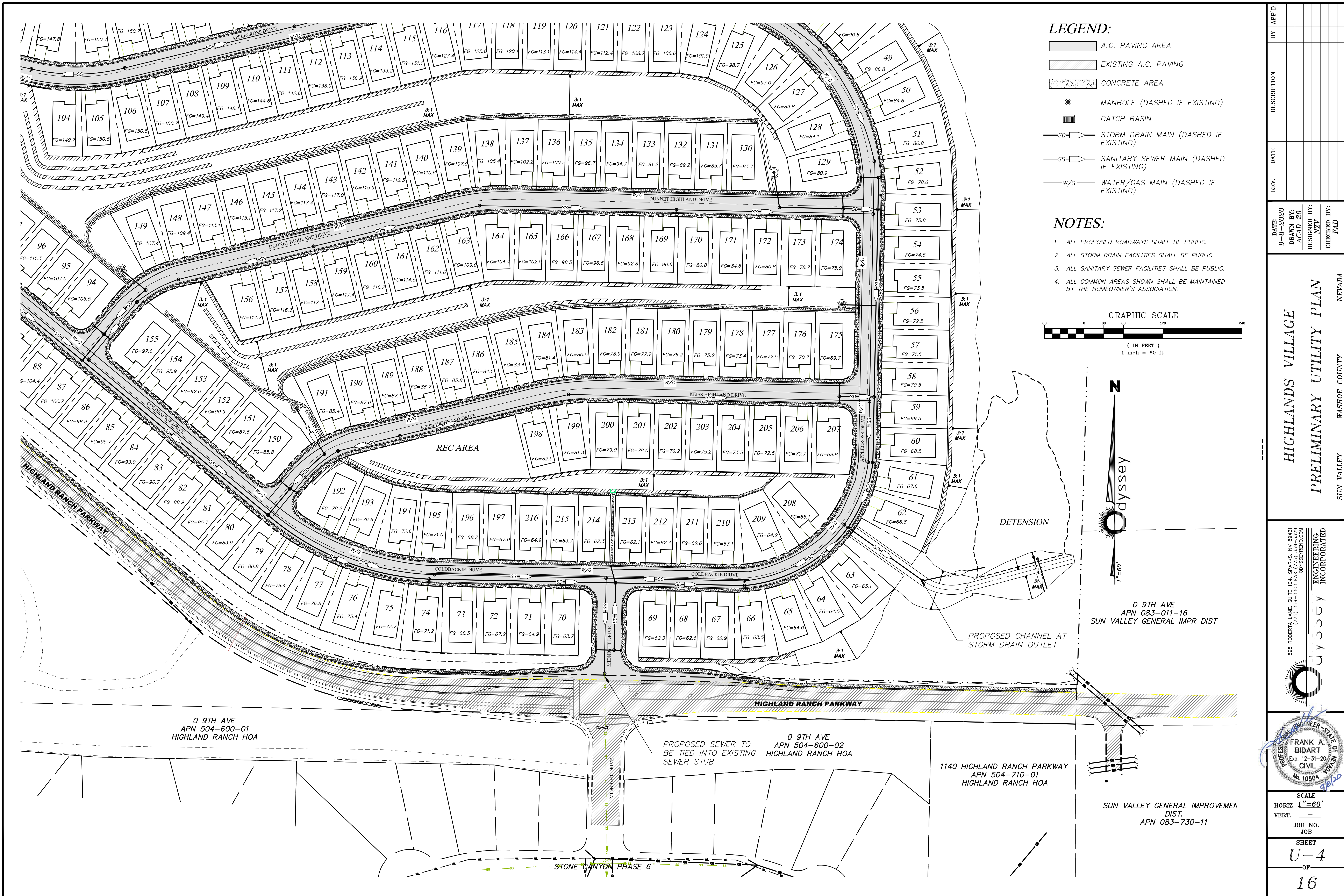
885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
(775) 369-3303 FAX (775) 359-3329  
ODYSSEYRENO.COM

odyssey ENGINEERING INCORPORATED

FRANK A. BIDART  
Exp. 12-31-20  
CIVIL  
No. 10504

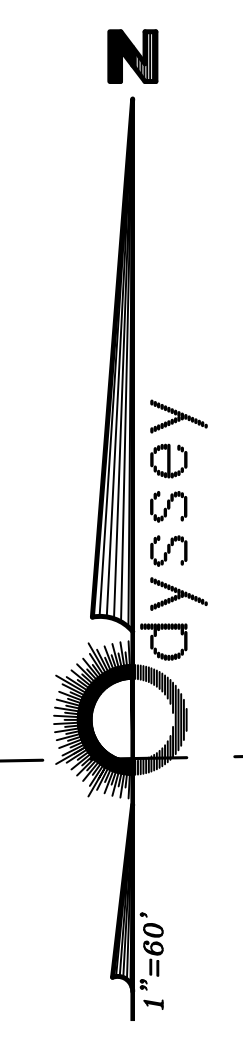
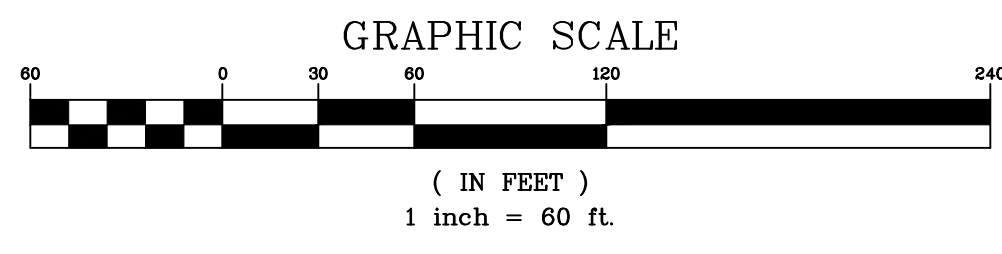
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VERT. -  
JOB NO.  
JOB

SHEET  
U-3  
OF  
16



- LEGEND:**
- A.C. PAVING AREA
  - EXISTING A.C. PAVING
  - CONCRETE AREA
  - MANHOLE (DASHED IF EXISTING)
  - CATCH BASIN
  - STORM DRAIN MAIN (DASHED IF EXISTING)
  - SANITARY SEWER MAIN (DASHED IF EXISTING)
  - WATER/GAS MAIN (DASHED IF EXISTING)

- NOTES:**
1. ALL PROPOSED ROADWAYS SHALL BE PUBLIC.
  2. ALL STORM DRAIN FACILITIES SHALL BE PUBLIC.
  3. ALL SANITARY SEWER FACILITIES SHALL BE PUBLIC.
  4. ALL COMMON AREAS SHOWN SHALL BE MAINTAINED BY THE HOMEOWNER'S ASSOCIATION.



0 9TH AVE  
 APN 083-011-16  
 SUN VALLEY GENERAL IMPR DIST

PROPOSED CHANNEL AT  
 STORM DRAIN OUTLET

0 9TH AVE  
 APN 504-600-01  
 HIGHLAND RANCH HOA

PROPOSED SEWER TO  
 BE TIED INTO EXISTING  
 SEWER STUB

0 9TH AVE  
 APN 504-600-02  
 HIGHLAND RANCH HOA

1140 HIGHLAND RANCH PARKWAY  
 APN 504-710-01  
 HIGHLAND RANCH HOA

SUN VALLEY GENERAL IMPROVEMEN  
 DIST.  
 APN 083-730-11

REV.	DATE	DESCRIPTION	BY	APP'D

DATE: 9-8-2020	DESIGNED BY: NZV	CHECKED BY: FAB
DRAWN BY: ACAD_ZO		

**HIGHLANDS VILLAGE**  
**PRELIMINARY UTILITY PLAN**

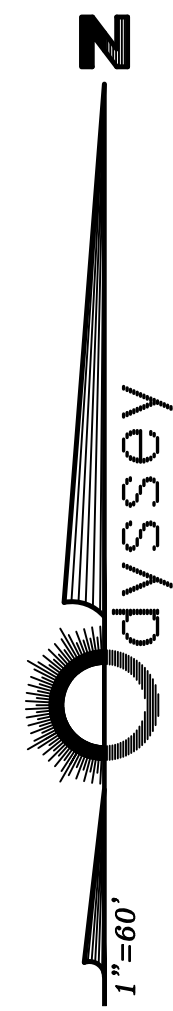
SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEY.RENO.COM

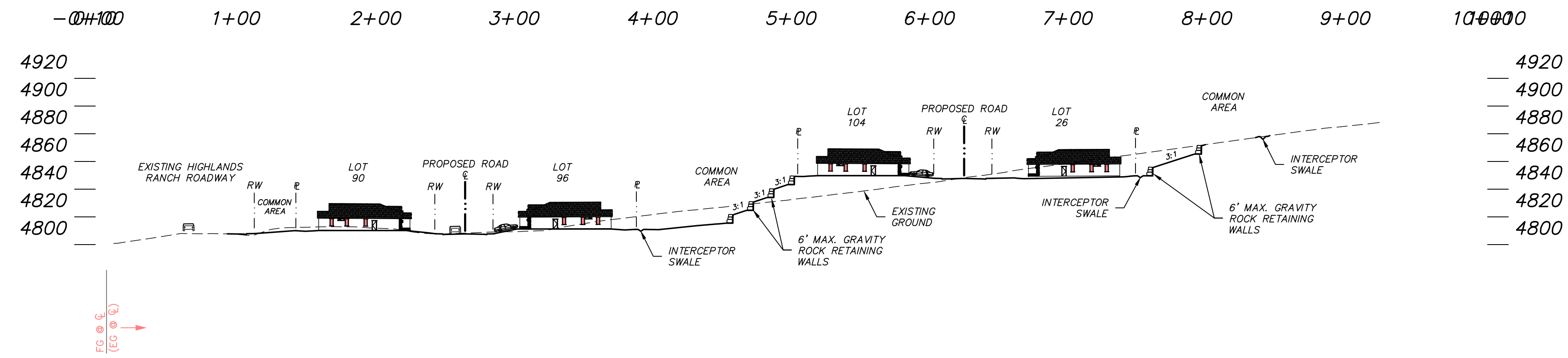
**Odyssey**  
 ENGINEERING  
 INCORPORATED

PROFESSIONAL ENGINEER - STATE OF NV  
**FRANK A. BIDART**  
 Exp. 12-31-20  
 CIVIL  
 No. 10504

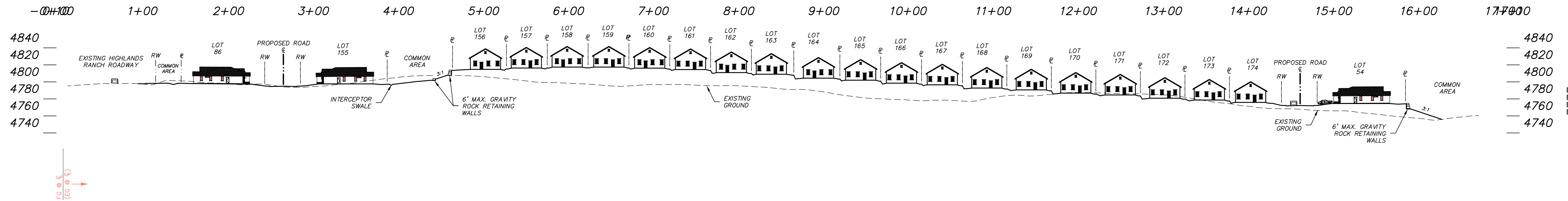
SCALE	HORIZ. 1"=60'
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JOB NO.	JOB
SHEET	U-4
OF	16



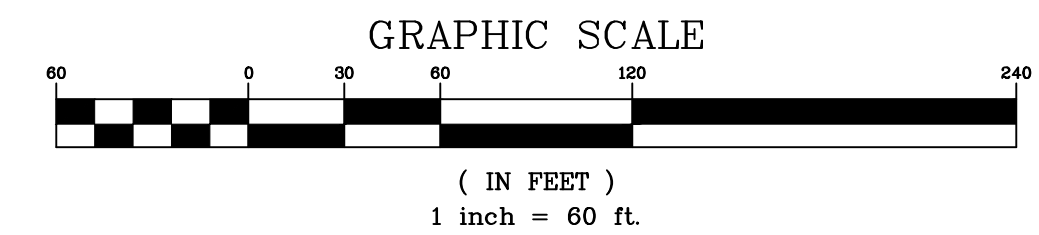
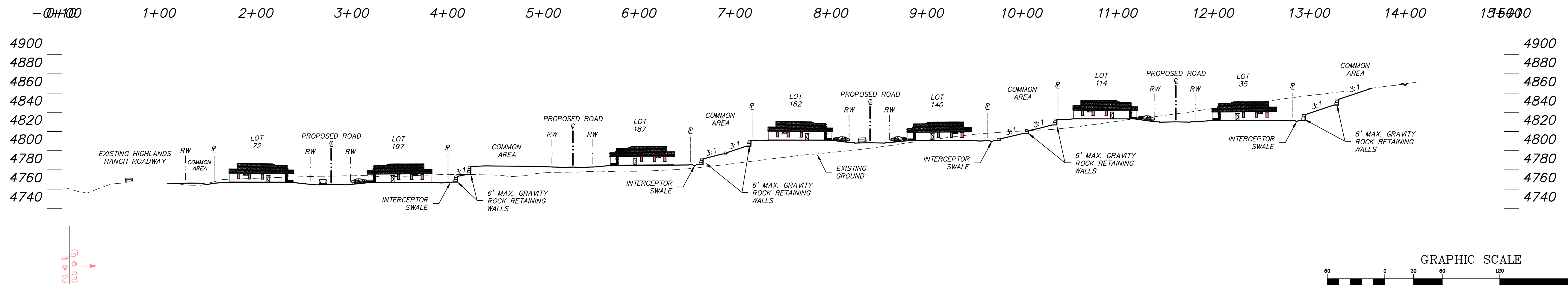
PROFILE VIEW SECTION A



PROFILE VIEW SECTION B



PROFILE VIEW SECTION C



REV.	DATE	DESCRIPTION	BY	APP'D

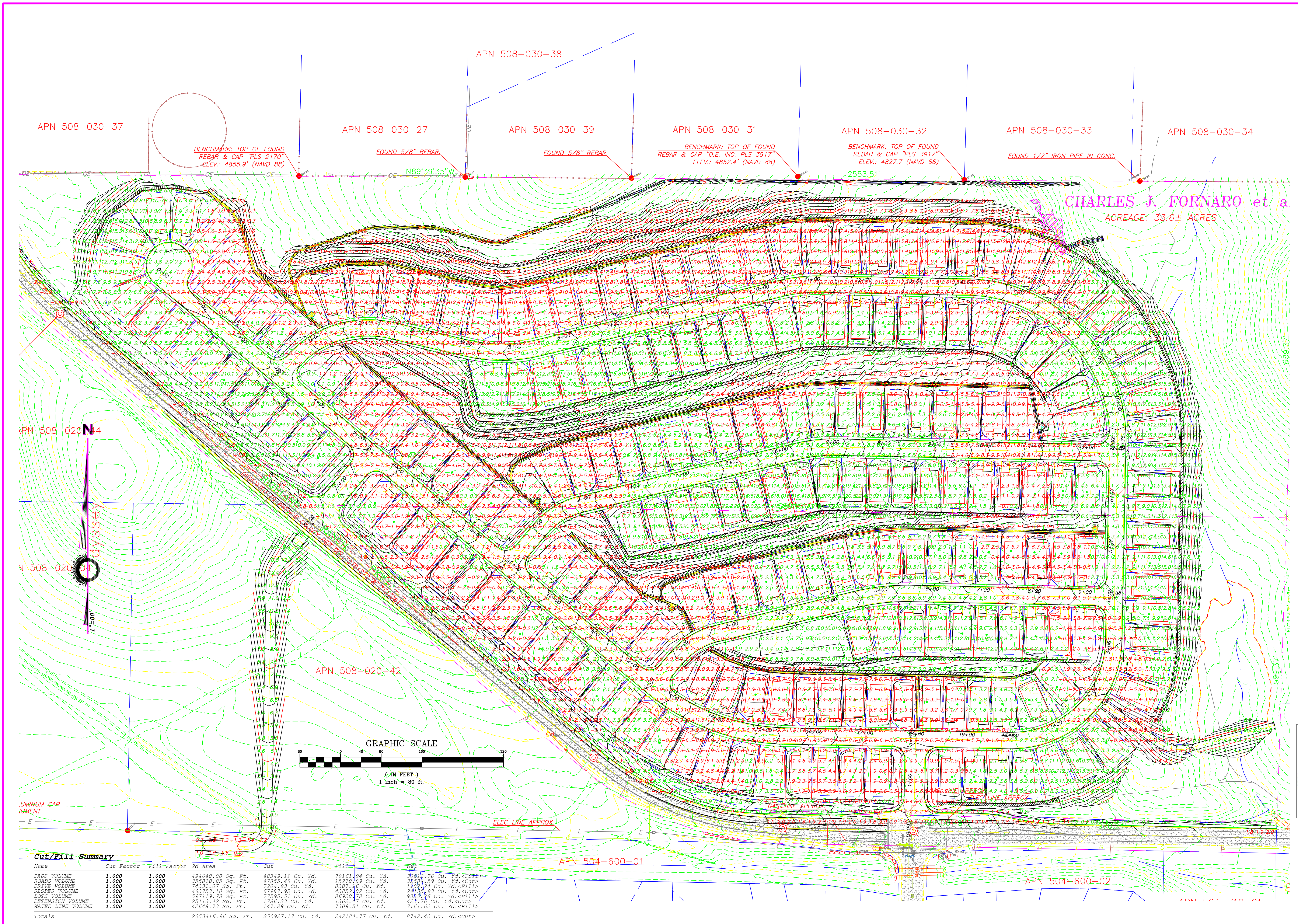
DATE: 9-8-2020  
 DRAWN BY: ACAD\_ZO  
 DESIGNED BY: NZV  
 CHECKED BY: FAB

HIGHLANDS VILLAGE  
 CROSS SECTIONS  
 SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEYRENO.COM  
 odyssey ENGINEERING INCORPORATED



SCALE  
 HORIZ. 1"=60'  
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 JOB NO.  
 JOB  
 SHEET  
 CS-1  
 OF  
 16



**Cut/Fill Summary**

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
PADS VOLUME	1.000	1.000	494640.00 Sq. Ft.	48349.19 Cu. Yd.	79161.94 Cu. Yd.	30812.76 Cu. Yd. <Fill>
ROADS VOLUME	1.000	1.000	355810.85 Sq. Ft.	47855.48 Cu. Yd.	15270.99 Cu. Yd.	32574.49 Cu. Yd. <Cut>
DRIVE VOLUME	1.000	1.000	74391.07 Sq. Ft.	7204.93 Cu. Yd.	9307.46 Cu. Yd.	1102.54 Cu. Yd. <Fill>
SLOPES VOLUME	1.000	1.000	463753.10 Sq. Ft.	67997.93 Cu. Yd.	43852.62 Cu. Yd.	24145.31 Cu. Yd. <Cut>
LOTS VOLUME	1.000	1.000	597119.78 Sq. Ft.	77595.51 Cu. Yd.	86920.78 Cu. Yd.	9324.27 Cu. Yd. <Fill>
DETENTION VOLUME	1.000	1.000	25113.42 Sq. Ft.	1786.23 Cu. Yd.	1362.47 Cu. Yd.	423.76 Cu. Yd. <Cut>
WATER LINE VOLUME	1.000	1.000	42668.73 Sq. Ft.	147.89 Cu. Yd.	7309.51 Cu. Yd.	7161.62 Cu. Yd. <Fill>
Totals			2053416.96 Sq. Ft.	250927.17 Cu. Yd.	242184.77 Cu. Yd.	8742.40 Cu. Yd. <Cut>

DATE: 9-8-2020	DATE	DESCRIPTION	BY	APP'D
DRAWN BY: ACAD_ZO	REV.			
DESIGNED BY: NZV				
CHECKED BY: FAB				

HIGHLANDS VILLAGE  
EARTHWORK

SUN VALLEY WASHOE COUNTY NEVADA

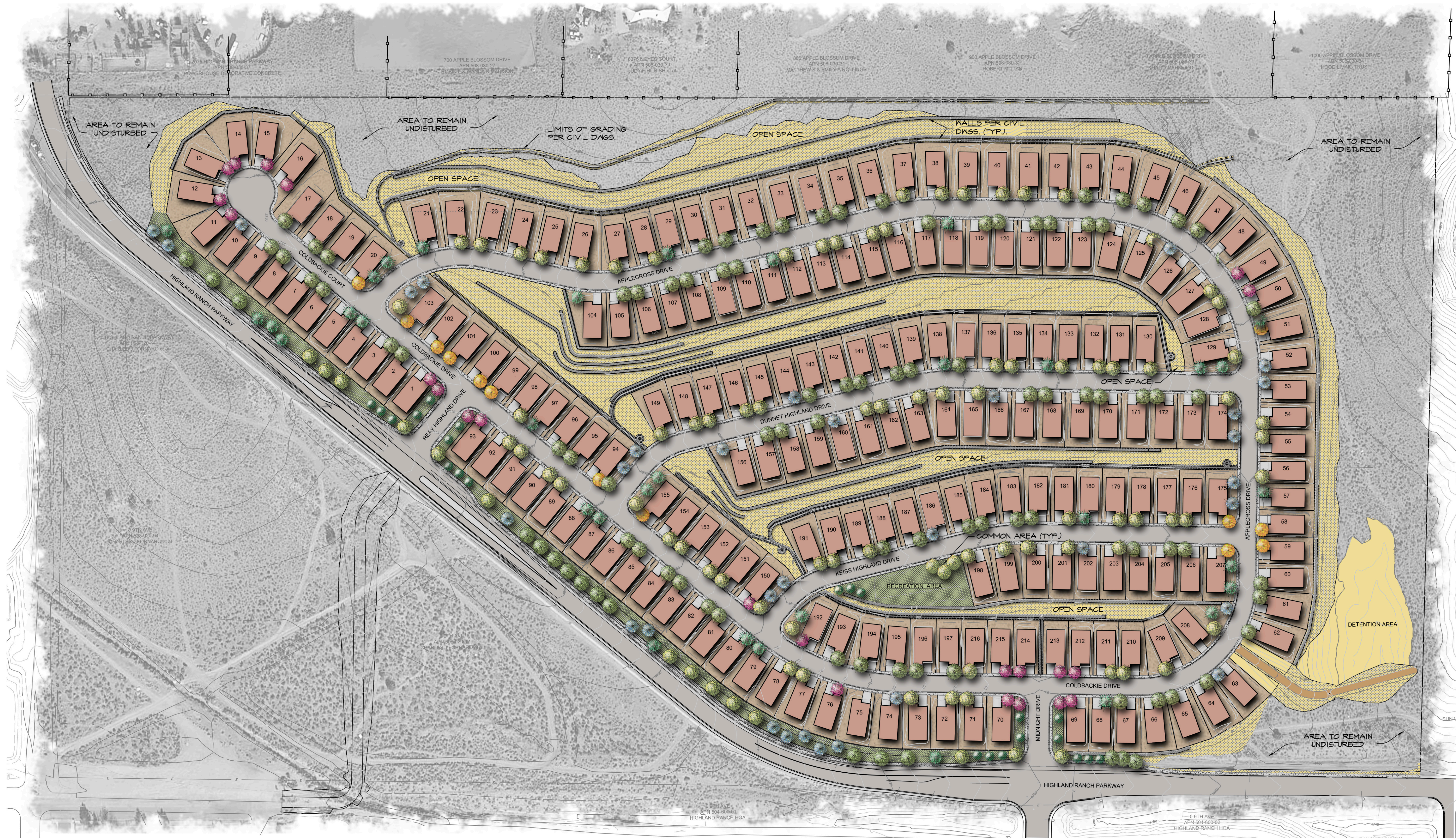
885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
(775) 369-3303 FAX (775) 359-3329  
OYDSEY.RENO.COM

**aydsey** ENGINEERING INCORPORATED

PROFESSIONAL ENGINEER - STATE OF NEVADA  
FRANK A. BIDART  
Exp. 12-31-20  
CIVIL  
No. 10504

SCALE  
HORIZ. 1"=80'  
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JOB NO. -  
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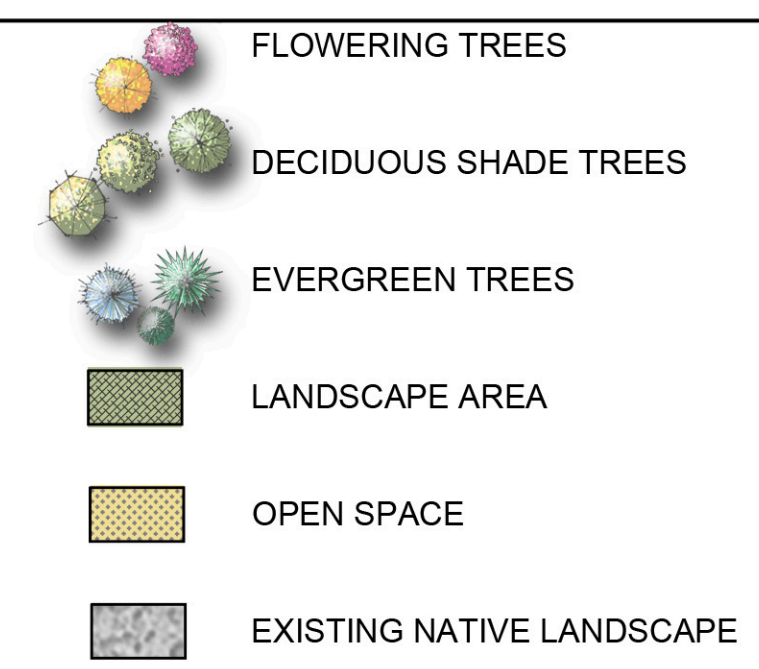
September 2, 2020 - 09:39 Dwg Name: H:\Pezonella Highland Ranch\Production Drawings\PRELIMINARY EARTHWORK 2.dwg Updated By: noh



**GENERAL NOTES**

- 1) ALL PLANTING AND IRRIGATION SHALL BE INSTALLED PER LOCAL GOVERNING CODES.
- 2) TREES
  - DECIDUOUS TREES SHALL HAVE A MINIMUM CALIPER OF 2 INCHES AND EVERGREEN TREES SHALL HAVE A MINIMUM HEIGHT OF 7 FEET.
  - ADDITIONAL TREES, BEYOND THOSE REQUIRED BY CODE, MAY BE REDUCED IN SIZE AT INSTALLATION.
- 3) FINAL PLANT SELECTION AND LAYOUT WILL BE BASED ON SOUND HORTICULTURAL PRACTICES RELATING TO MICRO-CLIMATE, SOIL, AND WATER REGIMES. ALL TREES WILL BE STAKED SO AS TO REMAIN UPRIGHT AND PLUMB FOLLOWING INSTALLATION. PLANT SIZE AND QUALITY AT TIME OF PLANTING WILL BE PER THE AMERICAN STANDARD FOR NURSERY STOCK (ANSI Z60.1-1990).
- 4) ALL SHRUB BEDS WILL RECEIVE 4" DEPTH MULCH WITH WEED CONTROL.
- 5) ALL LANDSCAPING WILL BE AUTOMATICALLY IRRIGATED. CONTAINER PLANTINGS WILL BE DRIP IRRIGATED BASED ON THE SPECIFIC HORTICULTURAL REQUIREMENTS OF EACH SPECIES. A REDUCED-PRESSURE-TYPE BACKFLOW PREVENTOR WILL BE PROVIDED ON THE IRRIGATION SYSTEM AS REQUIRED PER CODE.
- 6) PLAN IS CONCEPTUAL PER WASHOE COUNTY CODE REQUIREMENTS. PLANT LOCATIONS, FINAL SPECIES SELECTION, AND SIZE AT PLANTING SHALL BE DETERMINED DURING DEVELOPMENT OF THE FINAL CONSTRUCTION DOCUMENTS.

**PLANT LEGEND**



**LANDSCAPE DATA**

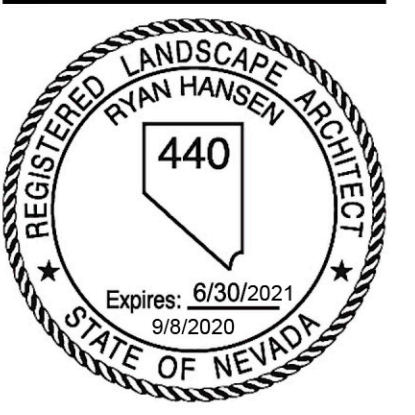
TOTAL SITE AREA = 2,401,714 SQ FT (55.1 ACRES)  
 ZONING: HDS (HIGH DENSITY SUBURBAN)  
 NON-DISTURBED AREA = 416,222 SQ FT (9.6 ACRES)  
 DEVELOPMENT AREA = 1,985,492 SQ FT (45.5 ACRES)

REQUIRED LANDSCAPE AREA = 397,098 SQ FT MIN (20% OF DEVELOPED SITE)

- COMMON AREA LANDSCAPE = 84,868 SQ FT (4.3% OF DEVELOPED SITE)
- OPEN SPACE = 397,760 SQ FT (20% OF DEVELOPED SITE)

TREES REQUIRED

- FRONT YARD TREES - 1 TREE PER 50' LN FT STREET FRONTAGE OR PORTION THEREOF
- HIGHLAND RANCH PARKWAY STREET TREES - 1 TREE PER 50 LN FT OF STREET FRONTAGE



No.	Revision Date

LA No: 185-501-08-20  
 Designed: KRJ  
 Drawn: KRJ  
 Checked: RPH  
 Date: 4/8/2020

Washoe County Treasurer  
 Tammi Davis

Bill Detail

[Back to Account Detail](#)

[Change of Address](#)

[Print this Page](#)

**Washoe County Parcel Information**

Parcel ID	Status	Last Update
50802041	Active	9/6/2020 1:47:06 AM
<b>Current Owner:</b> FORNARO, CHARLES J 3936 EAGLE CIR SLATINGTON, PA 18080		<b>SITUS:</b> 0 9TH AVE WCTY NV
<b>Taxing District</b> 4000	<b>Geo CD:</b>	
Legal Description		
Section 8 SubdivisionName _UNSPECIFIED Township 20 Range 20		

**Installments**

Period	Due Date	Tax Year	Tax	Penalty/Fee	Interest	Total Due
INST 1	8/17/2020	2020	\$1,038.80	\$41.55	\$0.00	\$1,080.35
INST 2	10/5/2020	2020	\$1,038.66	\$0.00	\$0.00	\$1,038.66
INST 3	1/4/2021	2020	\$1,038.66	\$0.00	\$0.00	\$1,038.66
INST 4	3/1/2021	2020	\$1,038.65	\$0.00	\$0.00	\$1,038.65
<b>Total Due:</b>			<b>\$4,154.77</b>	<b>\$41.55</b>	<b>\$0.00</b>	<b>\$4,196.32</b>

**Tax Detail**

	Gross Tax	Credit	Net Tax
<a href="#">State of Nevada</a>	\$237.63	(\$19.65)	\$217.98
<a href="#">Truckee Meadows Fire Dist</a>	\$754.83	(\$62.43)	\$692.40
<a href="#">Washoe County</a>	\$1,945.35	(\$160.90)	\$1,784.45
<a href="#">Washoe County Sc</a>	\$1,591.43	(\$131.63)	\$1,459.80
<a href="#">SPANISH SPRINGS WATER BASIN</a>	\$0.14	\$0.00	\$0.14
<b>Total Tax</b>	<b>\$4,529.38</b>	<b>(\$374.61)</b>	<b>\$4,154.77</b>

**Payment History**

No Payment Records Found

**Pay By Check**

Please make checks payable to:  
**WASHOE COUNTY TREASURER**

**Mailing Address:**  
 P.O. Box 30039  
 Reno, NV 89520-3039

**Overnight Address:**  
 1001 E. Ninth St., Ste D140  
 Reno, NV 89512-2845

**Change of Address**

All requests for a mailing address change must be submitted in writing, including a signature (unless using the online form).

To submit your address change online [click here](#)

Address change requests may also be faxed to: (775) 328-3642

Address change requests may also be mailed to:  
 Washoe County Assessor  
 1001 E 9th Street  
 Reno, NV 89512-2845

The Washoe County Treasurer's Office makes every effort to produce and publish the most current and accurate information possible. No warranties, expressed or implied, are provided for the data herein, its use, or its interpretation. If you have any questions, please contact us at (775) 328-2510 or [tax@washoecounty.us](mailto:tax@washoecounty.us)

This site is best viewed using Google Chrome, Internet Explorer 11, Mozilla Firefox or Safari.

Washoe County Treasurer  
 Tammi Davis

Bill Detail

[Back to Account Detail](#)

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**Washoe County Parcel Information**

Parcel ID	Status	Last Update
50802043	Active	9/6/2020 1:47:06 AM
<b>Current Owner:</b> FORNARO, CHARLES J 3936 EAGLE CIR SLATINGTON, PA 18080		<b>SITUS:</b> 0 HIGHLAND RANCH PKWY WASHOE COUNTY NV
<b>Taxing District:</b> 4000		<b>Geo CD:</b>
Legal Description		
Range 20 Township 20 SubdivisionName _UNSPECIFIED Section 8 Block Lot		

**Installments**

Period	Due Date	Tax Year	Tax	Penalty/Fee	Interest	Total Due
INST 1	8/17/2020	2020	\$1,618.96	\$64.76	\$0.00	\$1,683.72
INST 2	10/5/2020	2020	\$1,618.82	\$0.00	\$0.00	\$1,618.82
INST 3	1/4/2021	2020	\$1,618.81	\$0.00	\$0.00	\$1,618.81
INST 4	3/1/2021	2020	\$1,618.81	\$0.00	\$0.00	\$1,618.81
<b>Total Due:</b>			<b>\$6,475.40</b>	<b>\$64.76</b>	<b>\$0.00</b>	<b>\$6,540.16</b>

**Tax Detail**

	Gross Tax	Credit	Net Tax
<a href="#">State of Nevada</a>	\$379.85	(\$32.76)	\$347.09
<a href="#">Truckee Meadows Fire Dist</a>	\$1,206.58	(\$244.32)	\$962.26
<a href="#">Washoe County</a>	\$3,109.60	(\$268.17)	\$2,841.43
<a href="#">Washoe County Sc</a>	\$2,543.86	(\$219.38)	\$2,324.48
<a href="#">SPANISH SPRINGS WATER BASIN</a>	\$0.14	\$0.00	\$0.14
<b>Total Tax</b>	<b>\$7,240.03</b>	<b>(\$764.63)</b>	<b>\$6,475.40</b>

**Payment History**

No Payment Records Found

The Washoe County Treasurer's Office makes every effort to produce and publish the most current and accurate information possible. No warranties, expressed or implied, are provided for the data herein, its use, or its interpretation. If you have any questions, please contact us at (775) 328-2510 or [tax@washoecounty.us](mailto:tax@washoecounty.us)

This site is best viewed using Google Chrome, Internet Explorer 11, Mozilla Firefox or Safari.

HIGHLANDS VILLAGE  
TRAFFIC STUDY

SEPTEMBER 2020



Prepared by:  
Solaegui Engineers, Ltd.  
715 H Street  
Sparks, Nevada 89431  
(775) 358-1004



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# HIGHLANDS VILLAGE

## TRAFFIC STUDY

### EXECUTIVE SUMMARY

The proposed Highlands Village development will be located in Washoe County, Nevada. The project site is generally located north of Highland Ranch Parkway, east of Sun Valley Boulevard and west of Pyramid Highway. The project site is currently undeveloped land. The purpose of this study is to address the project's impact upon the adjacent street network. The Sun Valley Boulevard/7th Avenue intersection, the Highland Ranch Parkway intersections with Pyramid Highway, Sun Valley Boulevard, and Midnight Drive, and the project accesses have been identified for AM and PM peak hour intersection capacity analysis for the existing, existing plus project, 2040 base, and 2040 base plus project scenarios.

The proposed Highlands Village development will consist of the construction of a residential subdivision containing a total of 222 single family detached homes. Project access will be provided from two access roads intersecting Highland Ranch Parkway. The proposed Highlands Village development is anticipated to generate 2,096 average daily trips with 164 trips occurring during the AM peak hour and 220 trips occurring during the PM peak hour.

Traffic generated by the Highlands Village development will have some impact on the adjacent street network. The following recommendations are made to mitigate project traffic impacts.

It is recommended that any required signing, striping, or traffic control improvements comply with Washoe County and Nevada Department of Transportation requirements.

It is recommended that the Highland Ranch Parkway/West Access intersection be designed as a three-leg intersection with stop sign control at the north approach. It is recommended that the west Highland Ranch Parkway approach contain an exclusive left turn lane with a minimum of 315 feet of storage/deceleration length and the north approach contain one left turn lane and one right turn lane.

It is recommended that the Highland Ranch Parkway/Midnight Drive/East Access intersection be improved as a four-leg intersection with stop sign control at the north and south approaches. It is recommended that the west Highland Ranch Parkway approach contain an exclusive left turn lane with a minimum of 315 feet of storage/deceleration length and the north approach contain one shared left turn-through lane and one right turn lane.

It is recommended that the internal roadways and cul-de-sacs be designed per Washoe County street standards.

## INTRODUCTION

### STUDY AREA

The proposed Highlands Village development will be located in Washoe County, Nevada. The project site is generally located north of Highland Ranch Parkway, east of Sun Valley Boulevard, and west of Pyramid Highway. Figure 1 shows the approximate location of the project site. The purpose of this study is to address the project's impact upon the adjacent street network. The Sun Valley Boulevard/7th Avenue intersection, the Highland Ranch Parkway intersections with Pyramid Highway, Sun Valley Boulevard, and Midnight Drive, and the project accesses have been identified for AM and PM peak hour intersection capacity analysis for the existing, existing plus project, 2040 base, and 2040 base plus project scenarios.

### EXISTING AND PROPOSED LAND USES

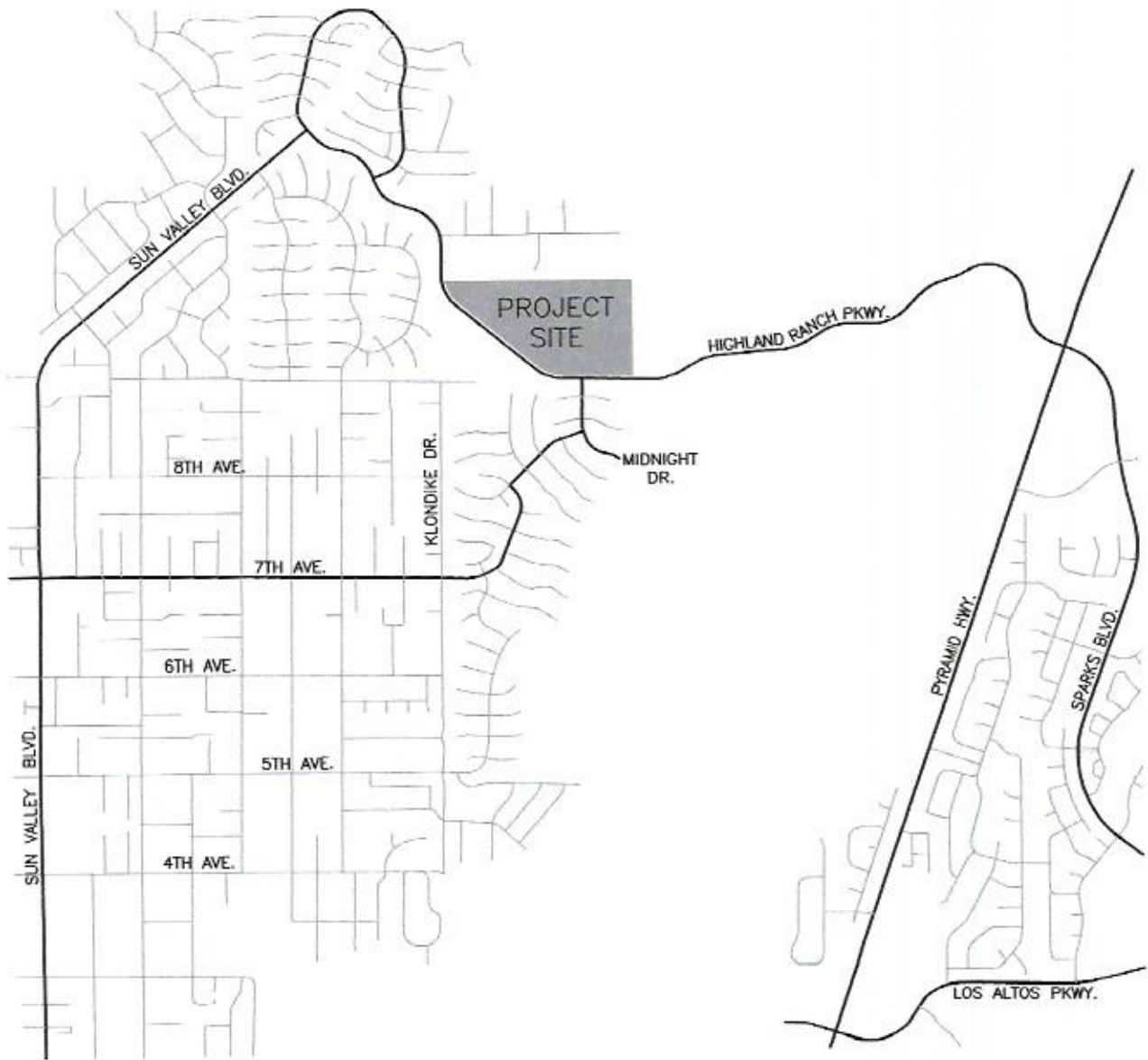
The project site is currently undeveloped land. Adjacent properties generally include residential dwelling units to the north, south and northwest and undeveloped land to the east and southwest. The proposed Highlands Village development will consist of the construction of a residential subdivision containing a total of 222 single family detached homes. Project access will be provided from two access roads intersecting Highland Ranch Parkway.

### EXISTING AND PROPOSED ROADWAYS AND INTERSECTIONS

Sun Valley Boulevard is generally a four-lane roadway with two through lanes in each direction south of 7th Avenue and a two-lane roadway with one lane in each direction from 7th Avenue to Highland Ranch Parkway. The speed limit is posted for 35 miles per hour. Roadway improvements generally include bike lanes and paved shoulders on both sides of the street with curb, gutter and sidewalk in some areas. A center two-way left turn lane exists on the four-lane section and a yellow striped centerline exists on the two-lane section.

7th Avenue is a two-lane roadway with one through lane in each direction in the vicinity of Sun Valley Boulevard. The speed limit is posted for 25 miles per hour in the vicinity of Sun Valley Boulevard. Roadway improvements generally include graded shoulders with white striped edgelines and a yellow striped centerline. A sidewalk exists on the south side of the street east of Sun Valley Boulevard.

Highland Ranch Parkway is a two-lane roadway with one through lane in each direction between Pyramid Highway and Sun Valley Boulevard. The speed limit is posted for 45 miles per hour east of Midnight Drive and 35 mile per hour west of Midnight Drive. Roadway improvements generally include graded shoulders with white striped edgelines and a yellow striped centerline. Curb, gutter and sidewalk exist on the south side of the street between Sun Valley Boulevard and Midnight Drive and left turn pockets exist at major intersections.



HIGHLANDS VILLAGE  
VICINITY MAP  
FIGURE 1

Sparks Boulevard is a four-lane roadway with two through lanes in each direction east of Pyramid Highway. The speed limit is posted for 40 miles per hour. Roadway improvements include curb, gutter, sidewalk, and bike lanes on both sides of the street and a raised center median with left turn pockets at major intersections.

Pyramid Highway is a four-lane roadway with two through lanes in each direction. The speed limit is posted for 55 miles per hour in the vicinity of Highland Ranch Parkway. Roadway improvements include bicycle lanes, white striped edge lines, and paved shoulders on both sides of the roadway. A yellow striped centerline exists south of Highland Ranch Parkway and a raised center median exists north of Highland Ranch Parkway.

Midnight Drive is a two-lane roadway with one through lane in each direction south of Highland Ranch Parkway. The speed limit is posted for 25 miles per hour. Roadway improvements include curb, gutter and sidewalk on both sides of the street.

The East and West Access Roads do not currently exist but are anticipated to be constructed as two-lane roadways north of Highland Ranch Parkway. The speed limit is anticipated to be posted for 25 miles per hour on both streets. Roadway improvements will likely include curb, gutter and sidewalk on both sides of the streets.

The Sun Valley Boulevard/7th Avenue intersection is a signalized four-leg intersection with protected/permissive phasing for the northbound and southbound left turn movements and permissive phasing for the eastbound and westbound left turn movements. The north approach contains one left turn lane, one through lane, and one shared through-right turn lane. The south approach contains one left turn lane, two through lanes, and one right turn lane. The east and west approaches each contain one shared left turn-through-right turn lane. Pedestrian crosswalks exist at the north, south, east, and west legs.

The Sun Valley Boulevard/Highland Ranch Parkway-Debussey Drive intersection is a signalized four-leg intersection with protected/permissive phasing for the westbound left turn movement and overlap phasing for the northbound right turn movement. The west approach contains one through lane and one right turn lane. The east approach contains one left turn lane and one through lane. The south approach contains one left turn lane and one right turn lane. Pedestrian crosswalks exist at the east and south legs.

The Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection is a signalized four-leg intersection with protected phasing for all left turn movements. The north approach contains dual left turn lanes, two through lanes, and one right turn lane. The south approach contains one left turn lane, two through lanes, and one right turn lane. The east approach contains dual left turn lanes, one through lane, and one free right turn lane with a northbound acceleration lane. The west approach contains one left turn lane and one shared through-right turn lane with a southbound acceleration lane. Pedestrian crosswalks exist at all approaches.

The Highland Ranch Parkway/Midnight Drive intersection is an unsignalized three-leg intersection with stop control at the south approach. The intersection contains one left turn lane and one through lane at the east approach, one through lane and one right turn lane at the west approach, and one shared left turn-right turn lane at the south approach. Pedestrian crosswalks exist at the west and south legs.

With development of the project the Highland Ranch Parkway/Midnight Drive intersection will be improved as an unsignalized four-leg intersection with stop sign control at the north and south approaches. The project's east access will form the north leg. The four-leg intersection will be analyzed with one left turn lane and one shared through-right turn lane at the east approach; one shared left turn-through lane and one right turn lane at the west approach; and one shared left turn-through-right turn lane at the north and south approaches.

The Highland Ranch Parkway/West Access intersection does not currently exist but will be an unsignalized three-leg intersection with stop sign control at the north approach. The intersection will be analyzed with one shared left turn-right turn lane at the north approach, one shared left turn-through lane at the west approach, and one shared through-right turn lane at the east approach.

## TRIP GENERATION

In order to assess the magnitude of traffic impacts of the proposed project on the key roadways and intersections, trip generation rates and peak hours had to be determined. Trip generation rates were obtained from the 10th Edition of *ITE Trip Generation* (2018) for Land Uses 210: Single Family Detached Housing. The proposed Highlands Village development will consist of the construction of 222 single family detached homes.

Trip generation was calculated for an average weekday and the weekday peak hours occurring between 7:00 and 9:00 AM and 4:00 and 6:00 PM. The periods correspond to the peak hours of adjacent street traffic. Table 1 shows a summary of the average daily traffic (ADT) and AM and PM peak hour volumes generated by the proposed project. The trip generation worksheets are included in the Appendix.

LAND USE	ADT	AM PEAK HOUR			PM PEAK HOUR		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Single Family Detached Housing (222 DU)	2,096	41	123	164	138	82	220

The proposed project is anticipated to generate 2,096 average daily trips with 164 trips occurring during the AM peak hour and 220 trips occurring during the PM peak hour.

## TRIP DISTRIBUTION AND ASSIGNMENT

The distribution of the project trips to the key intersections was based on existing peak hour traffic patterns and the locations of attractions and productions in the area. The anticipated trip distribution is shown on Figure 2. The peak hour trips shown in Table 1 were subsequently assigned to the key intersections based on the trip distribution percentages. Figure 3 shows the project trip assignment at the key intersections during the AM and PM peak hours.

## EXISTING AND PROJECTED TRAFFIC VOLUMES

The existing peak hour traffic volumes at the Sun Valley Boulevard/7th Avenue intersection were obtained from weekday traffic counts conducted in October of 2019. The existing peak hour traffic volumes at the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection were obtained from weekday traffic counts conducted in March of 2020. The existing peak hour traffic volumes at the Highland Ranch Parkway intersections with Sun Valley Boulevard and Midnight Drive were obtained from weekday traffic counts conducted in August of 2020. Figure 4A shows the existing traffic volumes at the key intersections during the AM and PM peak hours.

The August of 2020 traffic counts at the Highland Ranch Parkway intersections with Sun Valley Boulevard and Midnight Drive were conducted during construction operations on Sun Valley Boulevard between 7th Avenue and Highland Ranch Parkway. These existing traffic counts indicate that some motorists were diverting around the construction zone by utilizing 7th Avenue, Magenta Drive, Lightning Drive, and Midnight Drive between Sun Valley Boulevard and Highland Ranch Parkway. Traffic volumes for some movements at the Highland Ranch Parkway intersections with Sun Valley Boulevard and Midnight Drive were consequently re-routed to account for the temporary construction activity. It is assumed that 60% of the westbound to southbound left turn movement at the Highland Ranch Parkway/Midnight Drive intersection will divert back to the westbound to southbound left turn movement at the Sun Valley Boulevard/Highland Ranch Parkway intersection and 60% of the northbound to eastbound right turn movement at the Highland Ranch Parkway/Midnight Drive intersection will divert back to the northbound to eastbound right turn movement at the Sun Valley Boulevard/Highland Ranch Parkway intersection.

The August of 2020 traffic counts at the Highland Ranch Parkway intersections with Sun Valley Boulevard and Midnight Drive were also conducted during the COVID-19 pandemic which may have resulted in reduced traffic. In order to more closely represent normal traffic conditions the existing traffic counts on the segment of Highland Ranch Parkway east of Midnight Drive were compared with preCOVID-19 traffic volumes on this same segment of Highland Ranch Parkway. The preCOVID-19 volumes were obtained from counts obtained in March of 2020 prior to stay-at-home measures. The comparison indicates that the preCOVID-19 traffic volumes exceed the August 2020 traffic counts except for the westbound PM peak hour direction which the preCOVID-19 traffic volumes are slightly lower. The existing traffic counts at the Highland Ranch Parkway intersections with Sun Valley Boulevard and Midnight Drive were therefore adjusted accordingly.

It should be noted that the traffic counts at the Sun Valley Boulevard/7th Avenue and Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection were conducted prior to the COVID-19 pandemic and therefore no adjustments were made. Figure 4B shows the existing traffic volumes (adjusted) for the AM and PM peak hours. The adjusted peak hour traffic volumes were utilized in this study.

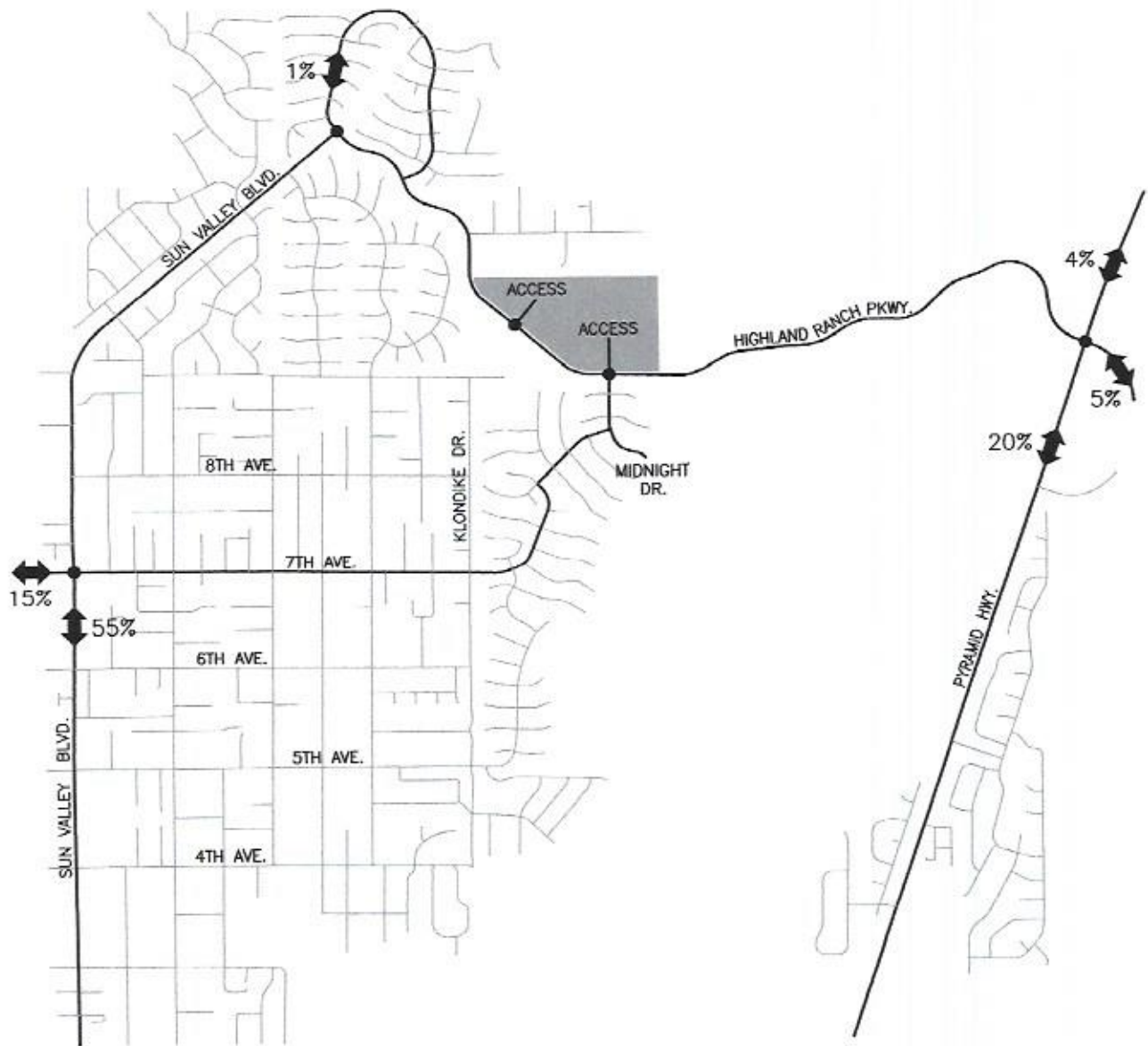
Figure 5 shows the existing plus project traffic volumes at the key intersections during the AM and PM peak hours. The existing plus project volumes were obtained by adding the trip assignment volumes shown on Figure 3 to the existing traffic volumes (adjusted) shown on Figure 4B.

Figure 6 shows the 2040 base traffic volumes at the key intersections during the AM and PM peak hours. The 2040 base traffic volumes at the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection were initially estimated based on average daily traffic volumes obtained from the Regional Transportation Commission's (RTC) traffic forecasting model. Peak hour factors and directional splits obtained from actual hourly traffic data on Pyramid Highway, Sparks Boulevard, and Highland Ranch Parkway were applied to the average daily traffic volumes in order to obtain peak hour directional link volumes at each leg of the intersection. Peak hour intersection turning movements were then estimated based on manually balancing entering and departing volumes at the intersection. The final 2040 base traffic volumes at the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection were obtained by including traffic generated by full buildout of the approved 5 Ridges development located east of the project site. The 5 Ridges land uses are not included in RTC's traffic forecasting model.

The 2040 base traffic volumes at the Sun Valley Boulevard/7th Avenue intersection and the Highland Ranch Parkway intersections with Sun Valley Boulevard and Midnight Drive were also initially estimated based on average daily traffic volumes obtained from RTC's traffic forecasting model. However, RTC's traffic forecasting model indicates a decrease in traffic volumes at the three intersections from the 2020 and 2040 planning scenarios. The traffic decrease at these intersections is attributed to RTC projects proposed for the 2027 to 2040 time frame which will divert traffic. These RTC projects include the construction of the Pyramid Highway/Sun Valley/US-395 Connector from US-395 to Pyramid Highway and the West Sun Valley Arterial from Dandini Boulevard to Eagle Canyon Road. In order to ensure conservative results a 0.5% average annual growth rate was used to estimate 2040 base traffic volumes at the Sun Valley Boulevard/7th Avenue intersection and the Highland Ranch Parkway intersections with Sun Valley Boulevard and Midnight Drive. The growth rate was derived from historic traffic count data obtained from the Nevada Department of Transportation's (NDOT) Traffic Records Information Access (TRINA) application for count station 0310346 on Sun Valley Boulevard south of 7th Avenue and count station 0311066 on 7th Avenue west of Sun Valley Boulevard.

Figure 7 shows the 2040 base plus project traffic volumes at the key intersections during the AM and PM peak hours. The 2040 base plus project traffic volumes were obtained by adding the trip assignment volumes shown on Figure 3 to the 2040 base traffic volumes shown on Figure 6.





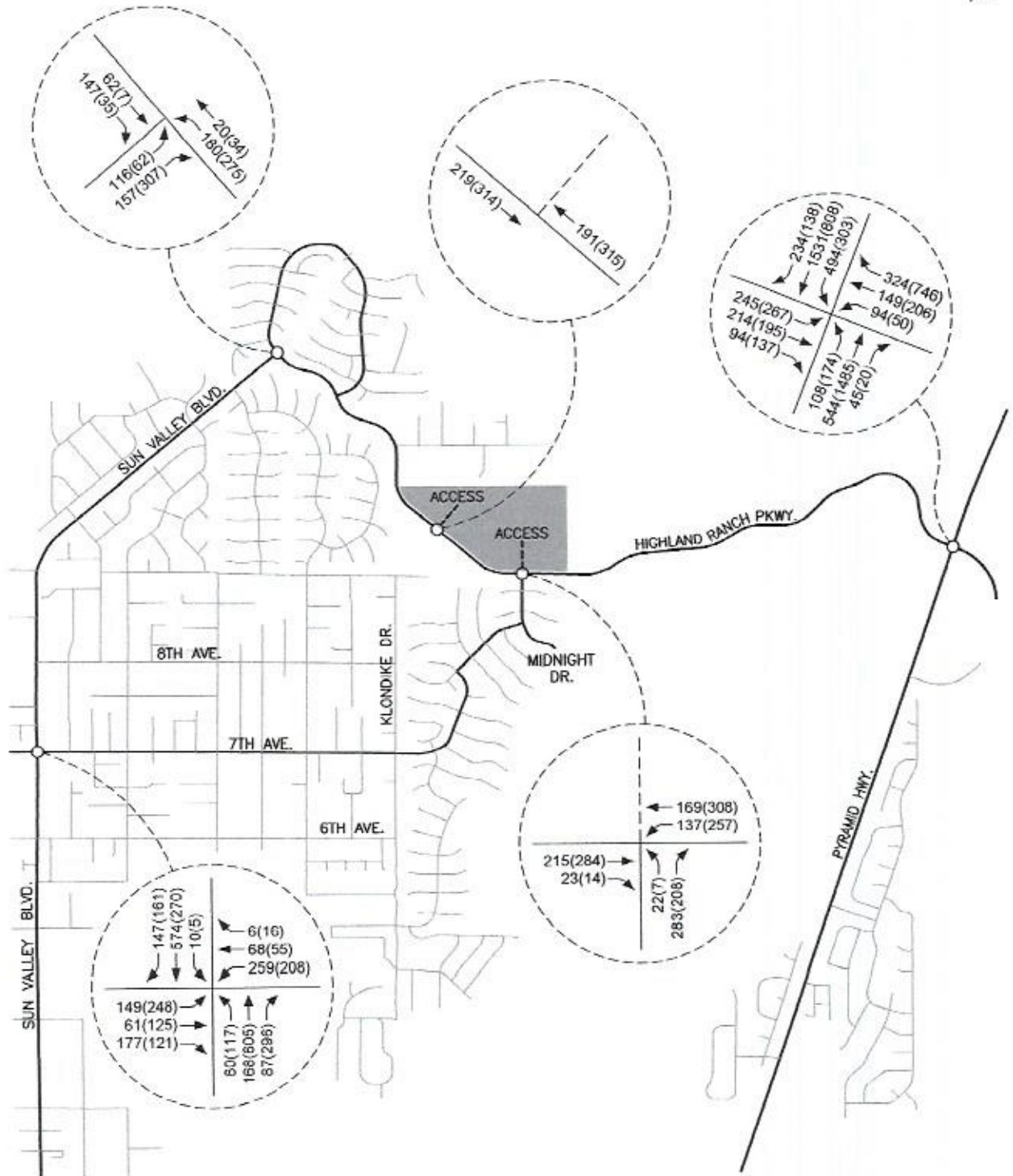
HIGHLANDS VILLAGE  
TRIP DISTRIBUTION  
FIGURE 2

**LEGEND**  
 — AM PEAK HOUR  
 (—) PM PEAK HOUR



**HIGHLANDS VILLAGE**  
**TRIP ASSIGNMENT**  
**FIGURE 3**

**LEGEND**  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR



**HIGHLANDS VILLAGE**  
**EXISTING TRAFFIC VOLUMES (RAW COUNTS)**  
**FIGURE 4A**

**LEGEND**  
 — AM PEAK HOUR  
 (—) PM PEAK HOUR



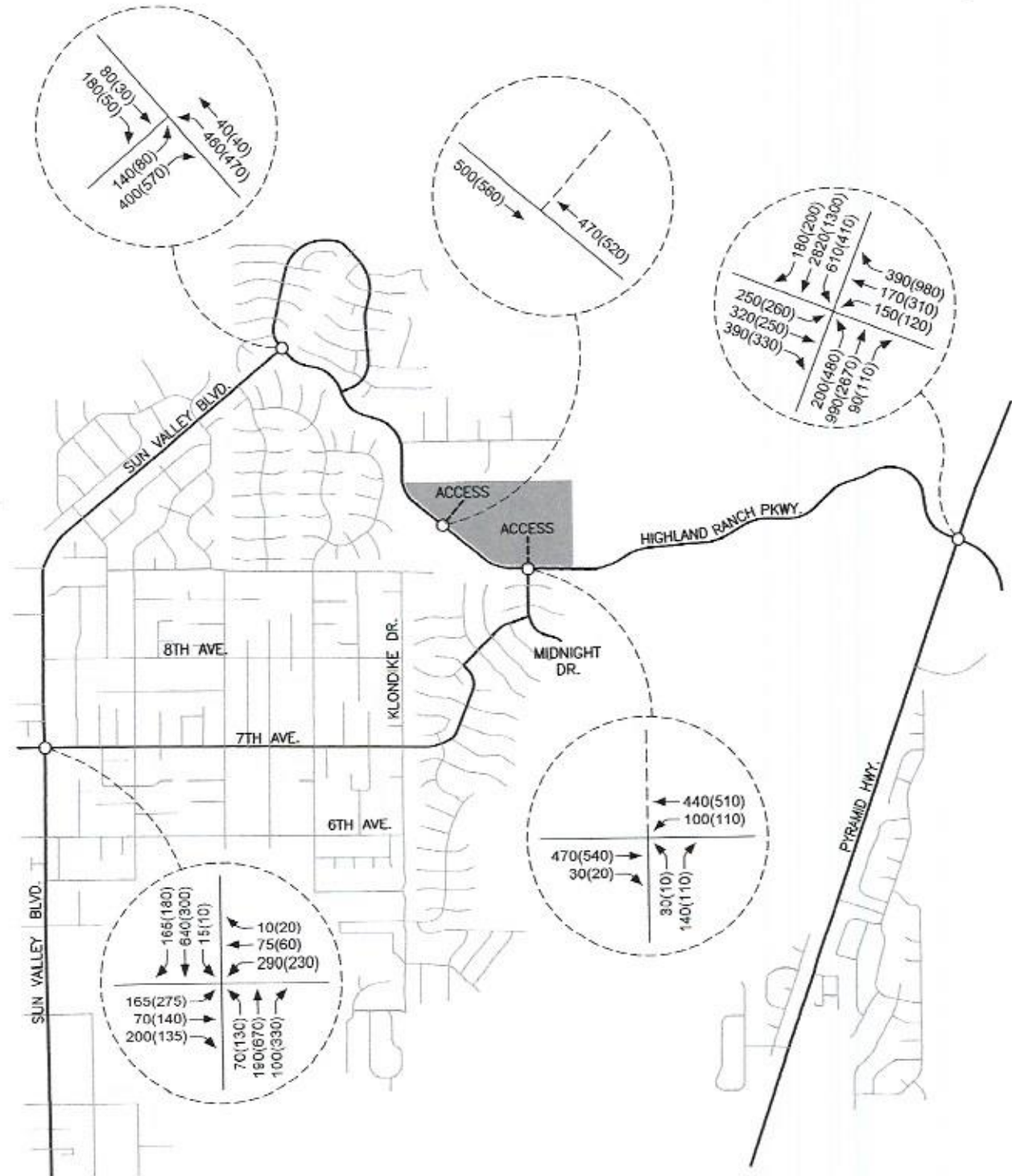
**HIGHLANDS VILLAGE**  
**EXISTING TRAFFIC VOLUMES (ADJUSTED)**  
**FIGURE 4B**

**LEGEND**  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR



**HIGHLANDS VILLAGE**  
**EXISTING PLUS PROJECT TRAFFIC VOLUMES**  
**FIGURE 5**

**LEGEND**  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR



**HIGHLANDS VILLAGE**  
**2040 BASE TRAFFIC VOLUMES**  
**FIGURE 6**



**LEGEND**  
 — AM PEAK HOUR  
 (—) PM PEAK HOUR



**HIGHLANDS VILLAGE**  
**2040 BASE PLUS PROJECT TRAFFIC VOLUMES**  
**FIGURE 7**

## INTERSECTION CAPACITY ANALYSIS

The key intersections were analyzed for capacity based on procedures presented in the *Highway Capacity Manual (6th Edition)*, prepared by the Transportation Research Board, for unsignalized and signalized intersections using the latest version of the Highway Capacity software.

The result of capacity analysis is a level of service (LOS) rating for signalized intersections and minor movements at a partial stop controlled intersection. Level of service is a qualitative measure of traffic operating conditions where a letter grade "A" through "F", corresponding to progressively worsening traffic operation, is assigned to the intersection or minor movement.

The *Highway Capacity Manual* defines level of service for stop controlled intersections in terms of computed or measured control delay for each minor movement. Level of service is not defined for the intersection as a whole. The level of service criteria for unsignalized intersections is shown in Table 2.

LEVEL OF SERVICE	DELAY RANGE (SEC/VEH)
A	$\leq 10$
B	$>10$ and $\leq 15$
C	$>15$ and $\leq 25$
D	$>25$ and $\leq 35$
E	$>35$ and $\leq 50$
F	$>50$

Level of service for signalized intersections is stated in terms of the average control delay per vehicle for a peak 15 minute analysis period. The level of service criteria for signalized intersections is shown in Table 3.

LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (SEC)
A	$\leq 10$
B	$>10$ and $\leq 20$
C	$>20$ and $\leq 35$
D	$>35$ and $\leq 55$
E	$>55$ and $\leq 80$
F	$>80$



The RTC's 2040 Regional Transportation Plan indicates that level of service standards used for assessing the need for street and highway improvements at a planning level are LOS D for all regional roadway facilities projected to carry less than 27,000 ADT and LOS E for all regional roadway facilities projected to carry 27,000 or more ADT. RTC's traffic forecasting model indicates that all roadways at the key study intersections will carry less than 27,000 ADT except for Pyramid Highway which exceeds the threshold. LOS D is therefore the level of service standard for the Sun Valley Boulevard/7th Avenue intersection and the Highland Ranch Parkway intersections with Sun Valley Boulevard, Midnight Drive-East Access, and the West Access and LOS E for the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection. It should be noted that Washoe County's Sun Valley Area Plan states that LOS C or above is the desired level for all regional roads in the Sun Valley planning area. All study intersections are within the Sun Valley planning areas except for the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection.

Table 4 shows a summary of the level of service and delay results at the key intersections for the existing, existing plus project, 2040 base, and 2040 base plus project scenarios. The intersection capacity worksheets are included in the Appendix.

INTERSECTION	EXISTING		EXISTING + PROJECT		2040 BASE		2040 BASE + PROJECT	
	AM	PM	AM	PM	AM	PM	AM	PM
Sun Valley/7th (Signal)	C23.1	C23.0	C25.1	C24.0	C26.3	C25.2	C29.7	C26.5
Sun Valley/Highland Ranch (Signal)	B17.3	B17.1	B19.0	C23.5	B19.1	C20.2	C21.8	C31.9
Pyramid/Highland Ranch/Sparks (Signal)	D48.1	D49.9	D48.7	D51.0	N/A	N/A	N/A	N/A
Existing Intersection								
Proposed Interchange	N/A	N/A	N/A	N/A	B15.6	B19.0	B15.7	B19.4
NB Ramps	N/A	N/A	N/A	N/A	C22.7	B18.1	C22.8	B18.2
SB Ramps								
Highland Ranch/Midnight (Stop at South)								
Westbound Left	A8.7	A9.0	N/A	N/A	A9.0	A9.2	N/A	N/A
Northbound Left-Right	B11.6	B12.6	N/A	N/A	C15.3	B13.5	N/A	N/A
Highland Ranch/Midnight/East Access (Stop at North & South)								
Eastbound Left	N/A	N/A	A8.3	A8.6	N/A	N/A	A8.4	A8.8
Westbound Left	N/A	N/A	A8.8	A9.0	N/A	N/A	A9.1	A9.3
Northbound Left-Thru-Right	N/A	N/A	B14.6	B12.1	N/A	N/A	C17.9	B13.0
Southbound Left-Thru-Right	N/A	N/A	D28.3	D34.6	N/A	N/A	E39.3	E47.0
Highland Ranch/West Access (Stop North)								
Eastbound Left	N/A	N/A	A8.5	A8.8	N/A	N/A	A8.6	A9.0
Southbound Left-Right	N/A	N/A	B15.0	C16.6	N/A	N/A	C16.3	C18.3

### Sun Valley Boulevard/7th Avenue Intersection

The Sun Valley Boulevard/7th Avenue intersection was analyzed as a signalized four-leg intersection for all scenarios. The intersection currently operates at LOS C with a delay of 23.1 seconds per vehicle during the AM peak hour and LOS C with a delay of 23.0 seconds per vehicle during the PM peak hour. For the existing plus project traffic volumes the intersection continues to operate at LOS C with delays increasing to 25.1 seconds per vehicle during the AM peak hour and 24.0 seconds per vehicle during the PM peak hour. For the 2040 base traffic volumes the intersection is anticipated to operate at LOS C with a delay of 26.3 seconds per vehicle during the AM peak hour and LOS C with a delay of 25.2 seconds per vehicle during the PM peak hour. For the 2040 base plus project traffic volumes the intersection continues to operate at LOS C with delays increasing to 29.7 seconds per vehicle during the AM peak hour and 26.5 seconds per vehicle during the PM peak hour. The intersection was analyzed with the existing approach lanes and phasing for all scenarios. The Sun Valley Boulevard/7th Avenue intersection meets RTC's policy LOS D standard and Washoe County's policy LOS C standard for all scenarios.

### Sun Valley Boulevard/Highland Ranch Parkway Intersection

The Sun Valley Boulevard/Highland Ranch Parkway intersection was analyzed as a signalized three-leg intersection for all scenarios. The intersection currently operates at LOS B with a delay of 17.3 seconds per vehicle during the AM peak hour and LOS B with a delay of 17.1 seconds per vehicle during the PM peak hour. For the existing plus project traffic volumes the intersection operates at LOS B with a delay of 19.0 seconds per vehicle during the AM peak hour and LOS C with a delay of 23.5 seconds per vehicle during the PM peak hour. For the 2040 base traffic volumes the intersection is anticipated to operate at LOS B with a delay of 19.1 seconds per vehicle during the AM peak hour and LOS C with a delay of 20.2 seconds per vehicle during the PM peak hour. For the 2040 base plus project traffic volumes the intersection operates at LOS C with a delay of 21.8 seconds per vehicle during the AM peak hour and LOS C with a delay of 31.9 seconds per vehicle during the PM peak hour. The intersection was analyzed with the existing approach lanes and phasing for all scenarios. The Sun Valley Boulevard/Highland Ranch Parkway intersection meets RTC's policy LOS D standard and Washoe County's policy LOS C standard for all scenarios.

### Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard Intersection

The Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection was analyzed as a signalized four-leg intersection with the existing approach lanes for the existing and existing plus project scenarios. The intersection currently operates at LOS D with a delay of 48.1 seconds per vehicle during the AM peak hour and LOS D with a delay of 49.9 seconds per vehicle during the PM peak hour. For the existing plus project traffic volumes the intersection continues to operate at LOS D with delays slightly increasing to 48.7 seconds per vehicle during the AM peak hour and 51.0 seconds per vehicle during the PM peak hour. The existing intersection meets RTC's policy LOS E standard for the existing and existing plus project scenarios.

RTC's 2040 Regional Transportation Plan indicates that a grade-separated interchange is planned for construction at the Pyramid Highway/Highland Ranch Parkway/Sparks Boulevard intersection in the 2027-2040 timeframe. The intersection was therefore analyzed for capacity as two separate signalized ramp intersections for the 2040 base and 2040 base plus project scenarios. The northbound and southbound ramp intersections are anticipated to operate at LOS C or better during the AM and PM peak hours for the 2040 base and 2040 base plus project traffic volumes. The northbound ramp intersection was analyzed with dual left turn lanes and two through lanes at the west approach, two through lanes and one right turn lane the east approach, and dual left turn lanes and one right turn lane at the south approach. The southbound ramp intersection was analyzed with dual left turn lanes and two through lanes at the east approach, two through lanes and one right turn lane the west approach, and dual left turn lanes and one right turn lane at the north approach. The proposed interchange meets RTC's policy LOS E standard for the 2040 base and 2040 base plus project scenarios.

#### Highland Ranch Parkway/West Access Intersection

The Highland Ranch Parkway/West Access intersection was analyzed as an unsignalized three-leg intersection with stop sign control at the north approach for the existing plus project and 2040 base plus project scenarios. For the existing plus project traffic volumes the intersection minor movements are anticipated to operate at LOS C or better during the AM and PM peak hours. For the 2040 base plus project traffic volumes the intersection minor movements operate at LOS C or better during the AM and PM peak hours. The three-leg intersection was analyzed with one shared left turn-right turn lane at the north approach, one shared left turn-through lane at the west approach, and one shared through-right turn lane at the east approach. The Highland Ranch Parkway/West Access intersection meets RTC's policy LOS D standard and Washoe County's policy LOS C standard for the existing plus project and 2040 base plus project scenarios.

The need for an exclusive left turn lane on Highland Ranch Parkway at the west access intersection was reviewed based on AASHTO guidelines for left turn lanes on two-lane roadways. Table 9-23 of the AASHTO publication lists traffic volumes and operating speeds which necessitate the need for left turn lanes. Advancing traffic volumes, opposing traffic volumes, and the percent of advancing traffic which is turning left are to be considered. An exclusive left turn lane is needed based on the existing plus project traffic volumes. Storage requirements were subsequently reviewed for the left turn lane based on the AASHTO criteria of providing storage for an average two minute period. Approximately 75 feet of storage length is required based on the projected left turn volumes. However, a minimum of 100 feet of storage length is suggested. A minimum deceleration length (including taper) of 215 feet is also required for the left turn lane based on the 35 mile per hour speed limit on Highland Ranch Parkway for a total length of 315 feet.

The need for an exclusive right turn lane on Highland Ranch Parkway at the west access was reviewed based on RTC's access management standards. The standards indicate that right turn deceleration lanes are needed on moderate access control arterials (Highland Ranch Parkway) if the right turn ingress movement serves more than 60 vehicles per hour. The anticipated right turn ingress volume is below the 60 vehicle per hour threshold so a right turn lane is not warranted.

It is recommended that the Highland Ranch Parkway/West Access intersection be designed as a three-leg intersection with stop sign control at the north approach. The west Highland Ranch Parkway approach should contain an exclusive left turn lane with a minimum of 315 feet of storage/deceleration length and the north approach contain separate left and right turn lanes.

#### Highland Ranch Parkway/Midnight Drive/East Access Intersection

The Highland Ranch Parkway/Midnight Drive intersection was initially analyzed as an unsignalized three-leg intersection with stop sign control at the south approach for the existing and 2040 base scenarios. The intersection minor movements currently operate at LOS B or better during the AM and PM peak hours. For the 2040 base traffic volumes the intersection minor movements are anticipated to operate at LOS C or better during the AM and PM peak hours. The three-leg intersection was analyzed with the existing approach lanes. The Highland Ranch Parkway/Midnight Drive intersection meets RTC's policy LOS D standard and Washoe County's policy LOS C standard for the existing and 2040 base scenarios.

The Highland Ranch Parkway/Midnight Drive/East Access intersection was analyzed as an unsignalized four-leg intersection with stop sign control at the north and south approaches for the existing plus project and 2040 base plus project scenarios. The project's east access road will form the new north leg. For the existing plus project traffic volumes the intersection minor movements are anticipated to operate at LOS B or better except for the southbound left turn-through-right turn movement which operates at LOS D during the AM and PM peak hours. For the 2040 base plus project traffic volumes the intersection minor movements operate at LOS C or better except for the southbound left turn-through-right turn movement which operates at LOS E during the AM and PM peak hours. The four-leg intersection was analyzed with one shared left turn-through lane and one right turn lane at the west approach; one left turn lane and one shared through-right turn lane at the east approach; and one shared left turn-through-right turn lane at the north and south approaches. The Highland Ranch Parkway/Midnight Drive/East Access intersection meets RTC's policy LOS D standard but not Washoe County's policy LOS C standard for the existing plus project scenario. The intersection does not meet RTC's policy LOS D standard or Washoe County's policy LOS C standard for the 2040 base plus project scenario.

It should be noted that available capacity exists at the adjacent Highland Ranch Parkway/West Access intersection. Project residents can easily divert to the west access if they experience longer delays at the east access. If 6 departing vehicles re-route to the west access then LOS D or better operation will be maintained at both project access intersections for the 2040 base plus project scenario.

The need for exclusive right turn lane on Highland Ranch Parkway at the east access intersection was reviewed based on RTC's access management standards. The standards indicate that a right turn deceleration lanes are needed on moderate access control arterials if the right turn ingress movement serves more than 60 vehicles per hour. The anticipated right turn ingress volume is below the 60 vehicle per hour threshold so an exclusive right turn lane is not warranted.

The need for an exclusive left turn lane on Highland Ranch Parkway at the east access intersection was reviewed based on AASHTO guidelines for left turn lanes on two-lane roadways. Table 9-23 of the AASHTO publication lists traffic volumes and operating speeds which necessitate the need for left turn lanes. Advancing traffic volumes, opposing traffic volumes, and the percent of advancing traffic which is turning left are to be considered. A review of the existing plus project traffic volumes indicates that an exclusive left turn lane is warranted. Storage requirements were subsequently reviewed for the left turn lane based on the AASHTO criteria of providing storage for an average two minute period. Approximately 25 feet of storage length is required based on the projected left turn volumes. However, a minimum of 100 feet of storage length is suggested. The left turn lane should also contain a minimum deceleration length (including taper) of 215 feet based on the 35 mile per hour speed limit on Highland Ranch Parkway for a total lane length of 315 feet.

It is recommended that the Highland Ranch Parkway/Midnight Drive/East Access intersection be improved as a four-leg intersection with stop sign control at the north and south approaches. It is recommended that the west Highland Ranch Parkway approach contain an exclusive left turn lane with a minimum of 315 feet of storage/deceleration length and the north approach contain one shared left turn-through lane and one right turn lane.

## SITE PLAN REVIEW

A copy of the site plan for the Highlands Village development is included with this submittal. The site plan indicates that project access will be provided from two roadways intersecting Highland Ranch Parkway. The east access road will align with Midnight Drive and provide direct access to the project's interior roadway network. The west access road will also provide direct access to the project's interior roadway network. The internal streets and cul-de-sacs serving the residential lots will connect to the project access streets. The project accesses and on-site roadways are anticipated to provide good access and internal circulation. It is recommended that the internal roadways and cul-de-sacs be designed per Washoe County street standards.

The project accesses were subsequently reviewed for spacing based on RTC's access management standards. The access management standards indicate that unsignalized accesses on arterials with moderate access (Highland Ranch Parkway) control shall be located a minimum of 200 feet from signalized intersections and a minimum of 300 feet from unsignalized intersections. The west access will be located  $\pm 1,350$  feet west of the east access and more than 1,300 feet east of an existing residential driveway. The east access will align with Midnight Drive which is located  $\pm 775$  feet west of an existing park access road. The east and west project accesses will meet RTC's spacing requirements.

## RECOMMENDATIONS

Traffic generated by the Highlands Village development will have some impact on the adjacent street network. The following recommendations are made to mitigate project traffic impacts.

It is recommended that any required signing, striping, or traffic control improvements comply with Washoe County and Nevada Department of Transportation requirements.

It is recommended that the Highland Ranch Parkway/West Access intersection be designed as a three-leg intersection with stop sign control at the north approach. It is recommended that the west Highland Ranch Parkway approach contain an exclusive left turn lane with a minimum of 315 feet of storage/deceleration length and the north approach contain one left turn lane and one right turn lane.

It is recommended that the Highland Ranch Parkway/Midnight Drive/East Access intersection be improved as a four-leg intersection with stop sign control at the north and south approaches. It is recommended that the west Highland Ranch Parkway approach contain an exclusive left turn lane with a minimum of 315 feet of storage/deceleration length and the north approach contain one shared left turn-through lane and one right turn lane.

It is recommended that the internal roadways and cul-de-sacs be designed per Washoe County street standards.

# APPENDIX

# Single-Family Detached Housing (210)

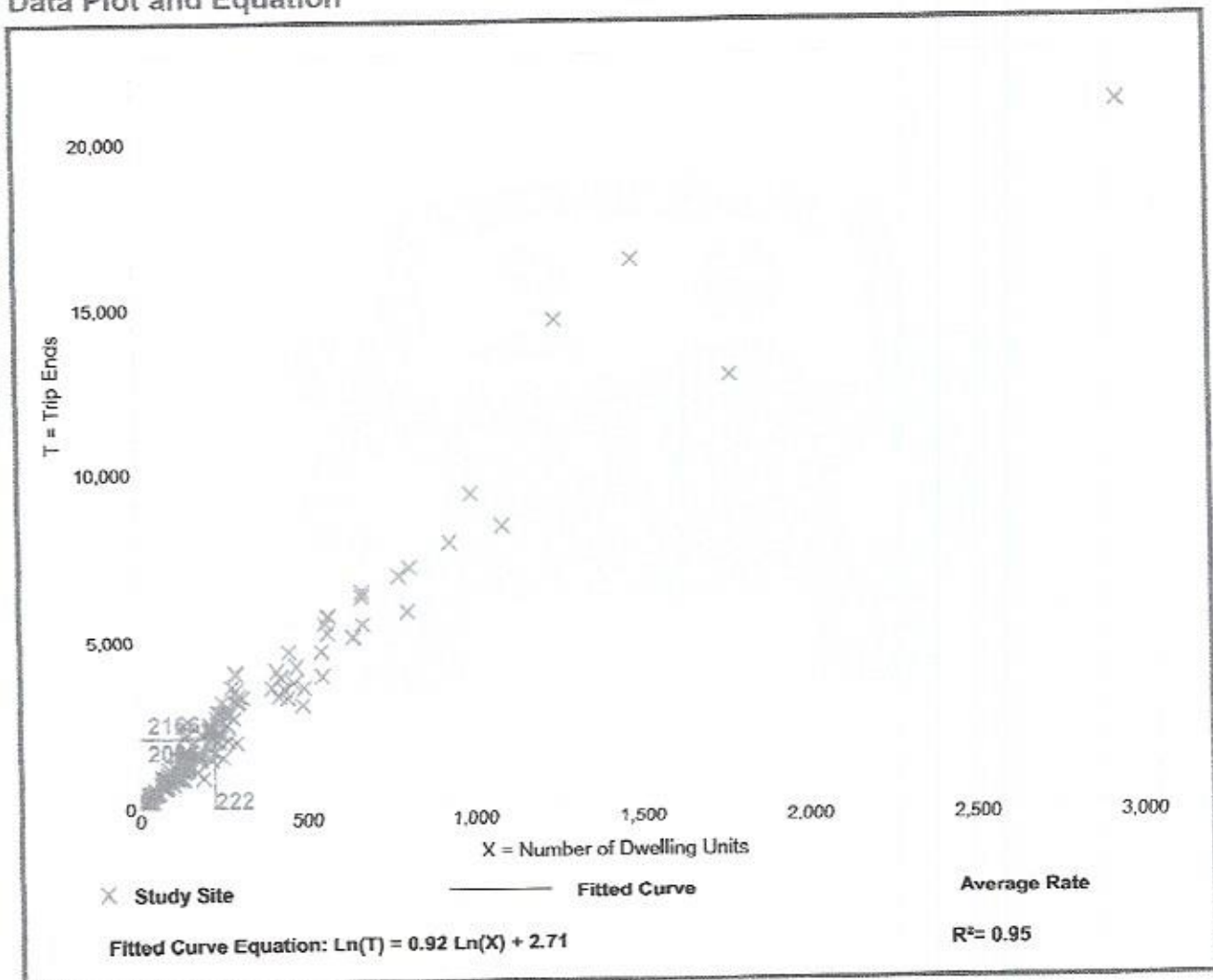
Vehicle Trip Ends vs: Dwelling Units  
On a: Weekday

Setting/Location: General Urban/Suburban  
Number of Studies: 159  
Avg. Num. of Dwelling Units: 264  
Directional Distribution: 50% entering, 50% exiting

## Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
9.44	4.81 - 19.39	2.10

## Data Plot and Equation





# Single-Family Detached Housing (210)

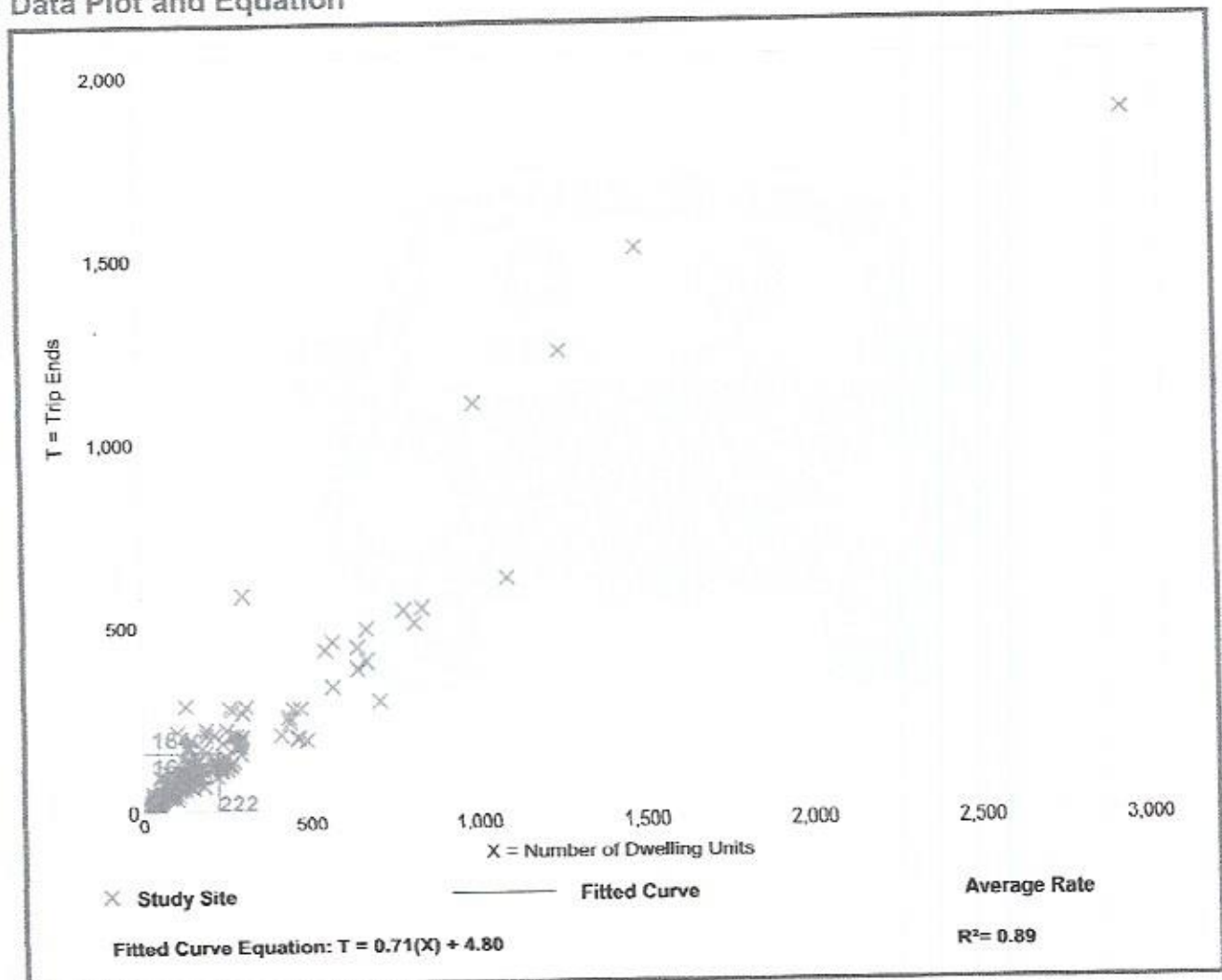
Vehicle Trip Ends vs: Dwelling Units  
 On a: Weekday,  
 Peak Hour of Adjacent Street Traffic,  
 One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban  
 Number of Studies: 173  
 Avg. Num. of Dwelling Units: 219  
 Directional Distribution: 25% entering, 75% exiting

## Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.74	0.33 - 2.27	0.27

## Data Plot and Equation



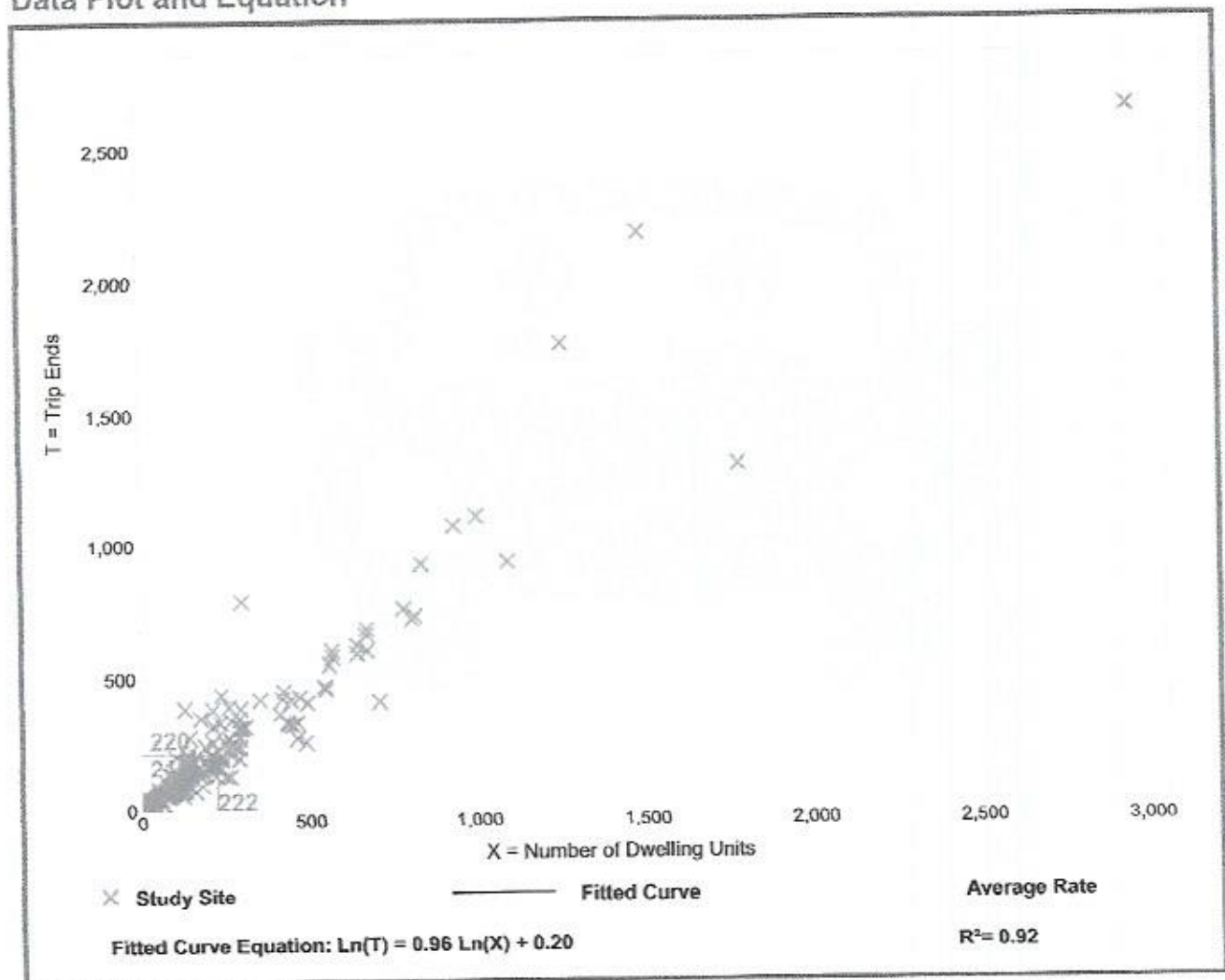
# Single-Family Detached Housing (210)

**Vehicle Trip Ends vs:** Dwelling Units  
**On a:** Weekday,  
 Peak Hour of Adjacent Street Traffic,  
 One Hour Between 4 and 6 p.m.  
**Setting/Location:** General Urban/Suburban  
 Number of Studies: 190  
 Avg. Num. of Dwelling Units: 242  
 Directional Distribution: 63% entering, 37% exiting

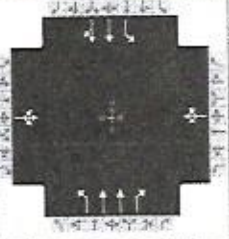
## Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.99	0.44 - 2.98	0.31

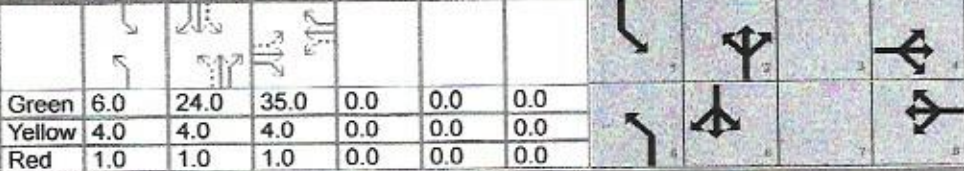
## Data Plot and Equation



## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information		
Agency	Solaegui Engineers			Duration, h	0.250	
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other	
Jurisdiction	Washoe County	Time Period	AM Peak Hour	PHF	0.92	
Urban Street		Analysis Year	Existing	Analysis Period	1> 7:00	
Intersection	Sun Valley & 7th	File Name	SvSe20ax.xus			
Project Description						

Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	149	61	177	259	68	6	60	168	87	10	574	147

Signal Information												
Cycle, s	80.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On	Green	6.0	24.0	35.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0		
				Red	1.0	1.0	1.0	0.0	0.0	0.0		

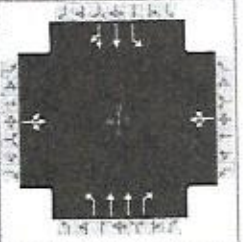
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		8.0	1.1	3.0	1.1	4.0
Phase Duration, s		40.0		40.0	11.0	29.0	11.0	29.0
Change Period, (Y+R <sub>c</sub> ), s		5.0		5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s		3.4		3.4	3.1	3.1	3.1	3.1
Queue Clearance Time (g <sub>s</sub> ), s		17.2		25.2	3.9	5.3	2.3	17.0
Green Extension Time (g <sub>e</sub> ), s		1.8		1.5	0.0	2.1	0.0	1.5
Phase Call Probability		1.00		1.00	1.00	1.00	1.00	1.00
Max Out Probability		0.00		0.09	1.00	0.00	0.25	0.26

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	410			362			65	183	84	11	393	364
Adjusted Saturation Flow Rate (s), veh/h/ln	1570			1121			1781	1781	1518	1781	1870	1724
Queue Service Time (g <sub>s</sub> ), s	0.0			8.0			1.9	3.0	3.3	0.3	14.9	15.0
Cycle Queue Clearance Time (g <sub>c</sub> ), s	15.2			23.2			1.9	3.0	3.3	0.3	14.9	15.0
Green Ratio (g/C)	0.44			0.44			0.38	0.30	0.30	0.38	0.30	0.30
Capacity (c), veh/h	750			571			286	1068	455	509	561	517
Volume-to-Capacity Ratio (X)	0.546			0.634			0.228	0.171	0.184	0.021	0.700	0.703
Back of Queue (Q), ft/ln (95 th percentile)	228.2			238.7			33.8	54.9	50.8	5.4	278	258.7
Back of Queue (Q), veh/ln (95 th percentile)	9.0			9.4			1.3	2.2	2.0	0.2	10.9	10.3
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.17	0.00	0.00	0.03	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	16.9			19.7			18.2	20.7	20.7	15.9	24.8	24.8
Incremental Delay (d <sub>2</sub> ), s/veh	0.5			1.8			0.1	0.0	0.1	0.0	3.3	3.6
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	17.3			21.4			18.3	20.7	20.8	15.9	28.1	28.5
Level of Service (LOS)	B			C			B	C	C	B	C	C
Approach Delay, s/veh / LOS	17.3		B	21.4		C	20.3		C	28.1		C
Intersection Delay, s/veh / LOS	23.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.29	B	1.69	B	1.71	B
Bicycle LOS Score / LOS	1.16	A	1.08	A	0.76	A	1.12	A

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.250
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other
Jurisdiction	Washoe County	Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	Existing	Analysis Period	1 > 7:00
Intersection	Sun Valley & 7th	File Name	SvSe20px.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	248	125	121	208	55	16	117	605	296	5	270	161

Signal Information											
Cycle, s	80.0	Reference Phase	2								
Offset, s	0	Reference Point	End								
Uncoordinated	Yes	Simult. Gap E/W	On	Green	6.0	24.0	35.0	0.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0
				Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		8.0	1.1	3.0	1.1	4.0
Phase Duration, s		40.0		40.0	11.0	29.0	11.0	29.0
Change Period, (Y+R <sub>c</sub> ), s		5.0		5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s		3.3		3.3	3.1	3.2	3.1	3.2
Queue Clearance Time (g <sub>s</sub> ), s		25.8		18.5	5.8	16.4	2.2	10.4
Green Extension Time (g <sub>e</sub> ), s		1.6		1.9	0.0	2.4	0.0	3.1
Phase Call Probability		1.00		1.00	1.00	1.00	1.00	1.00
Max Out Probability		0.12		0.01	1.00	0.35	0.14	0.08

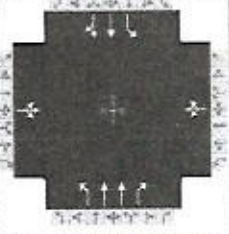

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	526			303			127	658	311	5	233	209
Adjusted Saturation Flow Rate (s), veh/h/ln	1509			1159			1781	1781	1518	1781	1870	1606
Queue Service Time (g <sub>s</sub> ), s	7.3			0.0			3.8	12.7	14.4	0.2	8.0	8.4
Cycle Queue Clearance Time (g <sub>c</sub> ), s	23.8			16.5			3.8	12.7	14.4	0.2	8.0	8.4
Green Ratio (g/C)	0.44			0.44			0.38	0.30	0.30	0.38	0.30	0.30
Capacity (c), veh/h	728			586			385	1068	455	314	561	482
Volume-to-Capacity Ratio (X)	0.722			0.518			0.330	0.616	0.683	0.017	0.415	0.433
Back of Queue (Q), ft/ln (95 th percentile)	324.9			179.9			68.1	224.7	230.5	2.7	152.3	135.4
Back of Queue (Q), veh/ln (95 th percentile)	12.8			7.1			2.7	8.8	9.1	0.1	6.0	5.4
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.34	0.00	0.00	0.01	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	19.2			17.1			17.6	24.0	24.6	17.0	22.4	22.5
Incremental Delay (d <sub>2</sub> ), s/veh	3.1			0.4			0.2	0.8	3.5	0.0	0.2	0.2
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	22.3			17.5			17.8	24.8	28.1	17.0	22.6	22.8
Level of Service (LOS)	C			B			B	C	C	B	C	C
Approach Delay, s/veh / LOS	22.3		C	17.5		B	24.9		C	22.6		C
Intersection Delay, s/veh / LOS	23.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.29	B	1.69	B	1.71	B
Bicycle LOS Score / LOS	1.36	A	0.99	A	1.39	A	0.86	A

# HCS7 Signalized Intersection Results Summary

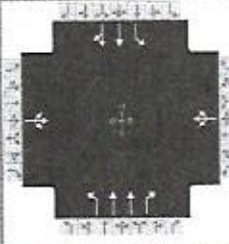
General Information				Intersection Information											
Agency	Solaegui Engineers			Duration, h	0.250										
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other										
Jurisdiction	Washoe County	Time Period	AM Peak Hour	PHF	0.92										
Urban Street		Analysis Year	Existing + Project	Analysis Period	1 > 7:00										
Intersection	Sun Valley & 7th	File Name	SvSe20aw.xus												
Project Description															
Demand Information				EB			WB			NB			SB		
Approach Movement		L	T	R	L	T	R	L	T	R	L	T	R		
Demand (v), veh/h		154	62	177	266	70	6	60	188	89	10	635	163		
Signal Information															
Cycle, s	80.0	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On	Green	6.0	24.0	35.0	0.0	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0					
				Red	1.0	1.0	1.0	0.0	0.0	0.0					
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase				4		8		5	2	1	6				
Case Number				8.0		8.0		1.1	3.0	1.1	4.0				
Phase Duration, s				40.0		40.0		11.0	29.0	11.0	29.0				
Change Period, (Y+R <sub>c</sub> ), s				5.0		5.0		5.0	5.0	5.0	5.0				
Max Allow Headway (MAH), s				3.4		3.4		3.1	3.1	3.1	3.1				
Queue Clearance Time (g <sub>s</sub> ), s				17.6		26.2		3.9	5.4	2.3	19.1				
Green Extension Time (g <sub>e</sub> ), s				1.9		1.5		0.0	2.3	0.0	1.4				
Phase Call Probability				1.00		1.00		1.00	1.00	1.00	1.00				
Max Out Probability				0.01		0.14		1.00	0.01	0.25	0.58				
Movement Group Results				EB			WB			NB			SB		
Approach Movement		L	T	R	L	T	R	L	T	R	L	T	R		
Assigned Movement		7	4	14	3	8	18	5	2	12	1	6	16		
Adjusted Flow Rate (v), veh/h		416			372			65	204	86	11	437	403		
Adjusted Saturation Flow Rate (s), veh/h/ln		1569			1116			1781	1781	1518	1781	1870	1722		
Queue Service Time (g <sub>s</sub> ), s		0.0			8.6			1.9	3.4	3.4	0.3	17.1	17.1		
Cycle Queue Clearance Time (g <sub>c</sub> ), s		15.6			24.2			1.9	3.4	3.4	0.3	17.1	17.1		
Green Ratio (g/C)		0.44			0.44			0.38	0.30	0.30	0.38	0.30	0.30		
Capacity (c), veh/h		750			568			264	1068	455	497	561	516		
Volume-to-Capacity Ratio (X)		0.555			0.654			0.247	0.191	0.189	0.022	0.779	0.780		
Back of Queue (Q), ft/ln (95 th percentile)		232.7			248.4			33.8	61.9	52.1	5.4	323.6	300.7		
Back of Queue (Q), veh/ln (95 th percentile)		9.2			9.8			1.3	2.4	2.1	0.2	12.7	12.0		
Queue Storage Ratio (RQ) (95 th percentile)		0.00			0.00			0.17	0.00	0.00	0.03	0.00	0.00		
Uniform Delay (d <sub>1</sub> ), s/veh		17.0			20.0			18.8	20.8	20.8	15.9	25.6	25.6		
Incremental Delay (d <sub>2</sub> ), s/veh		0.5			2.2			0.2	0.0	0.1	0.0	6.3	6.9		
Initial Queue Delay (d <sub>3</sub> ), s/veh		0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0		
Control Delay (d), s/veh		17.5			22.2			18.9	20.8	20.8	15.9	31.9	32.5		
Level of Service (LOS)		B			C			B	C	C	B	C	C		
Approach Delay, s/veh / LOS		17.5		B	22.2		C	20.5		C	32.0		C		
Intersection Delay, s/veh / LOS		25.1						C							
Multimodal Results				EB			WB			NB			SB		
Pedestrian LOS Score / LOS		2.43		B	2.29		B	1.69		B	1.71		B		
Bicycle LOS Score / LOS		1.17		A	1.10		A	0.78		A	1.19		A		

## HCS7 Signalized Intersection Results Summary

General Information					Intersection Information											
Agency	Solaegui Engineers				Duration, h	0.250										
Analyst	MSH	Analysis Date	Aug 28, 2020		Area Type	Other										
Jurisdiction	Washoe County	Time Period	PM Peak Hour		PHF	0.92										
Urban Street		Analysis Year	Existing + Project		Analysis Period	1> 7:00										
Intersection	Sun Valley & 7th	File Name	SvSe20pw.xus													
Project Description																
Demand Information					EB			WB			NB			SB		
Approach Movement					L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h					267	127	121	212	56	16	117	673	304	5	311	172
Signal Information																
Cycle, s	80.0	Reference Phase	2													
Offset, s	0	Reference Point	End													
Uncoordinated	Yes	Simult. Gap E/W	On		Green	6.0	24.0	35.0	0.0	0.0	0.0					
		Simult. Gap N/S	On		Yellow	4.0	4.0	4.0	0.0	0.0	0.0					
Force Mode	Fixed				Red	1.0	1.0	1.0	0.0	0.0	0.0					
Timer Results					EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase						4		8	5	2	1	6				
Case Number						8.0		8.0	1.1	3.0	1.1	4.0				
Phase Duration, s						40.0		40.0	11.0	29.0	11.0	29.0				
Change Period, (Y+R <sub>c</sub> ), s						5.0		5.0	5.0	5.0	5.0	5.0				
Max Allow Headway (MAH), s						3.3		3.3	3.1	3.2	3.1	3.2				
Queue Clearance Time (g <sub>s</sub> ), s						27.8		18.4	5.8	16.9	2.2	11.5				
Green Extension Time (g <sub>e</sub> ), s						1.5		2.0	0.0	2.6	0.0	3.3				
Phase Call Probability						1.00		1.00	1.00	1.00	1.00	1.00				
Max Out Probability						0.26		0.01	1.00	0.44	0.14	0.14				
Movement Group Results					EB			WB			NB			SB		
Approach Movement					L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement					7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h					549			309			127	732	320	5	263	235
Adjusted Saturation Flow Rate (s), veh/h/ln					1499			1168			1781	1781	1518	1781	1870	1615
Queue Service Time (g <sub>s</sub> ), s					9.3			0.0			3.8	14.5	14.9	0.2	9.2	9.5
Cycle Queue Clearance Time (g <sub>c</sub> ), s					25.8			16.4			3.8	14.5	14.9	0.2	9.2	9.5
Green Ratio (g/C)					0.44			0.44			0.38	0.30	0.30	0.38	0.30	0.30
Capacity (c), veh/h					725			590			364	1068	455	292	561	485
Volume-to-Capacity Ratio (X)					0.758			0.523			0.349	0.685	0.702	0.019	0.469	0.485
Back of Queue (Q), ft/ln (95 th percentile)					349.8			183			68.2	252.6	239.1	2.7	175.7	155.5
Back of Queue (Q), veh/ln (95 th percentile)					13.8			7.2			2.7	9.9	9.4	0.1	6.9	6.2
Queue Storage Ratio (RQ) (95 th percentile)					0.00			0.00			0.34	0.00	0.00	0.01	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh					19.8			17.1			17.8	24.7	24.8	17.4	22.8	22.9
Incremental Delay (d <sub>2</sub> ), s/veh					4.1			0.4			0.2	1.5	4.1	0.0	0.2	0.3
Initial Queue Delay (d <sub>3</sub> ), s/veh					0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh					23.9			17.5			18.0	26.2	28.9	17.4	23.0	23.2
Level of Service (LOS)					C			B			B	C	C	B	C	C
Approach Delay, s/veh / LOS					23.9	C		17.5	B		26.0	C		23.1	C	
Intersection Delay, s/veh / LOS					24.0						C					
Multimodal Results					EB			WB			NB			SB		
Pedestrian LOS Score / LOS					2.43	B		2.29	B		1.69	B		1.71	B	
Bicycle LOS Score / LOS					1.39	A		1.00	A		1.46	A		0.90	A	

## HCS7 Signalized Intersection Results Summary

General Information					Intersection Information		
Agency	Solaegui Engineers				Duration, h	0.250	
Analyst	MSH	Analysis Date	Aug 28, 2020		Area Type	Other	
Jurisdiction	Washoe County	Time Period	AM Peak Hour		PHF	0.92	
Urban Street		Analysis Year	2040 Base		Analysis Period	1> 7:00	
Intersection	Sun Valley & 7th	File Name	SvSe40ax.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	165	70	200	290	75	10	70	190	100	15	640	165

Signal Information													
Cycle, s	80.0	Reference Phase	2										
Offset, s	0	Reference Point	End	Green	6.0	24.0	35.0	0.0	0.0	0.0			
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.0	0.0	0.0	0.0			

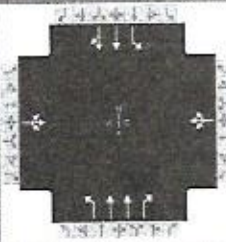
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		8.0	1.1	3.0	1.1	4.0
Phase Duration, s		40.0		40.0	11.0	29.0	11.0	29.0
Change Period, (Y+R <sub>c</sub> ), s		5.0		5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s		3.4		3.4	3.1	3.1	3.1	3.1
Queue Clearance Time (g <sub>s</sub> ), s		20.1		31.7	4.2	5.9	2.5	19.3
Green Extension Time (g <sub>e</sub> ), s		2.1		0.9	0.0	2.4	0.0	1.4
Phase Call Probability		1.00		1.00	1.00	1.00	1.00	1.00
Max Out Probability		0.03		1.00	1.00	0.01	0.40	0.63

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	462			408			76	207	98	16	441	407
Adjusted Saturation Flow Rate (s), veh/h/ln	1586			1051			1781	1781	1518	1781	1870	1721
Queue Service Time (g <sub>s</sub> ), s	0.0			11.7			2.2	3.4	3.9	0.5	17.3	17.3
Cycle Queue Clearance Time (g <sub>c</sub> ), s	18.1			29.7			2.2	3.4	3.9	0.5	17.3	17.3
Green Ratio (g/C)	0.44			0.44			0.38	0.30	0.30	0.38	0.30	0.30
Capacity (c), veh/h	757			540			262	1068	455	496	561	516
Volume-to-Capacity Ratio (X)	0.611			0.755			0.291	0.193	0.215	0.033	0.786	0.787
Back of Queue (Q), ft/ln (95th percentile)	264.3			299			39.8	62.5	59.9	8.1	328.5	305.2
Back of Queue (Q), veh/ln (95th percentile)	10.4			11.8			1.6	2.5	2.4	0.3	12.9	12.2
Queue Storage Ratio (RQ) (95th percentile)	0.00			0.00			0.20	0.00	0.00	0.04	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	17.7			22.0			19.0	20.8	21.0	16.0	25.7	25.7
Incremental Delay (d <sub>2</sub> ), s/veh	1.1			5.4			0.2	0.0	0.1	0.0	6.7	7.3
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	18.7			27.4			19.2	20.8	21.0	16.0	32.4	33.0
Level of Service (LOS)	B			C			B	C	C	B	C	C
Approach Delay, s/veh / LOS	18.7		B	27.4		C	20.6		C	32.3		C
Intersection Delay, s/veh / LOS	26.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.29	B	1.69	B	1.71	B
Bicycle LOS Score / LOS	1.25	A	1.16	A	0.80	A	1.20	A

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.250
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other
Jurisdiction	Washoe County	Time Period	PM Peak Hour	PHF	0.92
Urban Street		Analysis Year	2040 Base	Analysis Period	1 > 7:00
Intersection	Sun Valley & 7th	File Name	SvSe40px.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	275	140	135	230	60	20	130	670	330	10	300	180

Signal Information													
Cycle, s	80.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	6.0	24.0	35.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0			
				Red	1.0	1.0	1.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		8.0	1.1	3.0	1.1	4.0
Phase Duration, s		40.0		40.0	11.0	29.0	11.0	29.0
Change Period, (Y+R <sub>c</sub> ), s		5.0		5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s		3.4		3.4	3.1	3.2	3.1	3.2
Queue Clearance Time (g <sub>s</sub> ), s		30.6		21.4	6.3	18.6	2.3	11.5
Green Extension Time (g <sub>e</sub> ), s		1.2		2.1	0.0	2.2	0.0	3.4
Phase Call Probability		1.00		1.00	1.00	1.00	1.00	1.00
Max Out Probability		0.72		0.04	1.00	0.64	0.25	0.15

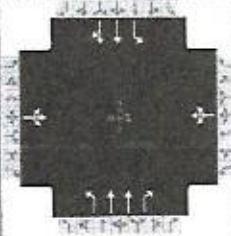
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	587			337			141	728	348	11	262	232
Adjusted Saturation Flow Rate (s), veh/h/ln	1505			1128			1781	1781	1518	1781	1870	1601
Queue Service Time (g <sub>s</sub> ), s	9.2			0.0			4.3	14.4	16.6	0.3	9.1	9.5
Cycle Queue Clearance Time (g <sub>c</sub> ), s	28.6			19.4			4.3	14.4	16.6	0.3	9.1	9.5
Green Ratio (g/C)	0.44			0.44			0.38	0.30	0.30	0.38	0.30	0.30
Capacity (c), veh/h	726			572			364	1068	455	293	561	480
Volume-to-Capacity Ratio (X)	0.808			0.589			0.388	0.682	0.764	0.037	0.467	0.484
Back of Queue (Q), ft/ln (95 th percentile)	392.8			208.8			76.5	251.5	270.4	5.4	175	153.9
Back of Queue (Q), veh/ln (95 th percentile)	15.5			8.2			3.0	9.9	10.6	0.2	6.9	6.2
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.38	0.00	0.00	0.03	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	20.6			17.9			18.0	24.6	25.4	17.4	22.8	22.9
Incremental Delay (d <sub>2</sub> ), s/veh	6.3			1.1			0.3	1.5	6.8	0.0	0.2	0.3
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	26.9			19.0			18.2	26.1	32.2	17.4	23.0	23.2
Level of Service (LOS)	C			B			B	C	C	B	C	C
Approach Delay, s/veh / LOS	26.9		C	19.0		B	26.9		C	23.0		C
Intersection Delay, s/veh / LOS	25.2						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.29	B	1.69	B	1.71	B
Bicycle LOS Score / LOS	1.46	A	1.04	A	1.49	A	0.90	A



## HCS7 Signalized Intersection Results Summary

General Information					Intersection Information	
Agency	Solaegui Engineers				Duration, h	0.250
Analyst	MSH	Analysis Date	Aug 28, 2020		Area Type	Other
Jurisdiction	Washoe County	Time Period	AM Peak Hour		PHF	0.92
Urban Street		Analysis Year	2040 Base + Project		Analysis Period	1 > 7:00
Intersection	Sun Valley & 7th	File Name	SvSe40aw.xus			
Project Description						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	170	71	200	297	77	10	70	210	102	15	701	181

Signal Information														
Cycle, s	80.0	Reference Phase	2											
Offset, s	0	Reference Point	End											
Uncoordinated	Yes	Simult. Gap E/W	On	Green	6.0	24.0	35.0	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0				
				Red	1.0	1.0	1.0	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		8.0	1.1	3.0	1.1	4.0
Phase Duration, s		40.0		40.0	11.0	29.0	11.0	29.0
Change Period, (Y+R <sub>c</sub> ), s		5.0		5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s		3.4		3.4	3.1	3.1	3.1	3.1
Queue Clearance Time (g <sub>s</sub> ), s		20.5		32.7	4.2	5.9	2.5	21.6
Green Extension Time (g <sub>e</sub> ), s		2.1		0.7	0.0	2.7	0.0	0.9
Phase Call Probability		1.00		1.00	1.00	1.00	1.00	1.00
Max Out Probability		0.03		1.00	1.00	0.02	0.40	1.00

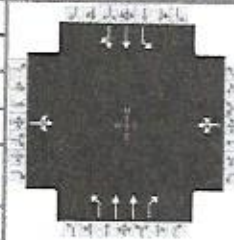
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	468			417			76	228	100	16	485	446
Adjusted Saturation Flow Rate (s), veh/h/ln	1585			1049			1781	1781	1518	1781	1870	1719
Queue Service Time (g <sub>s</sub> ), s	0.0			12.2			2.2	3.8	3.9	0.5	19.6	19.6
Cycle Queue Clearance Time (g <sub>c</sub> ), s	18.5			30.7			2.2	3.8	3.9	0.5	19.6	19.6
Green Ratio (g/C)	0.44			0.44			0.38	0.30	0.30	0.38	0.30	0.30
Capacity (c), veh/h	756			539			241	1068	455	485	561	516
Volume-to-Capacity Ratio (X)	0.620			0.775			0.315	0.214	0.220	0.034	0.865	0.865
Back of Queue (Q), ft/ln (95 th percentile)	269.2			311.8			39.9	69.5	61.3	8.1	390.5	362.8
Back of Queue (Q), veh/ln (95 th percentile)	10.6			12.3			1.6	2.7	2.4	0.3	15.4	14.5
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.20	0.00	0.00	0.04	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	17.8			22.3			19.6	20.9	21.0	16.0	26.5	26.5
Incremental Delay (d <sub>2</sub> ), s/veh	1.2			6.3			0.3	0.0	0.1	0.0	12.8	13.7
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	19.0			28.6			19.9	21.0	21.1	16.0	39.2	40.2
Level of Service (LOS)	B			C			B	C	C	B	D	D
Approach Delay, s/veh / LOS	19.0	B		28.6	C		20.8	C		39.3	D	
Intersection Delay, s/veh / LOS	29.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.43	B	2.29	B	1.69	B	1.71	B
Bicycle LOS Score / LOS	1.26	A	1.18	A	0.82	A	1.27	A

## HCS7 Signalized Intersection Results Summary

### General Information

Agency	Solaegui Engineers			Intersection Information	
Analyst	MSH	Analysis Date	Aug 28, 2020	Duration, h	0.250
Jurisdiction	Washoe County	Time Period	PM Peak Hour	Area Type	Other
Urban Street		Analysis Year	2040 Base + Project	PHF	0.92
Intersection	Sun Valley & 7th	File Name	SvSe40pw.xus	Analysis Period	1> 7:00
Project Description					



### Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	294	142	135	234	61	20	130	738	338	10	341	191

### Signal Information

Cycle, s	80.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	6.0	24.0	35.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0			
				Red	1.0	1.0	1.0	0.0	0.0	0.0			

### Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8	5	2	1	6
Case Number		8.0		8.0	1.1	3.0	1.1	4.0
Phase Duration, s		40.0		40.0	11.0	29.0	11.0	29.0
Change Period, (Y+R <sub>c</sub> ), s		5.0		5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s		3.4		3.4	3.1	3.2	3.1	3.2
Queue Clearance Time (g <sub>s</sub> ), s		32.8		21.3	6.3	19.2	2.3	12.7
Green Extension Time (g <sub>e</sub> ), s		0.7		2.2	0.0	2.2	0.0	3.6
Phase Call Probability		1.00		1.00	1.00	1.00	1.00	1.00
Max Out Probability		1.00		0.04	1.00	0.74	0.25	0.23

### Movement Group Results

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	610			342			141	802	357	11	293	259
Adjusted Saturation Flow Rate (s), veh/h/ln	1496			1142			1781	1781	1518	1781	1870	1609
Queue Service Time (g <sub>s</sub> ), s	11.6			0.0			4.3	16.3	17.2	0.3	10.4	10.7
Cycle Queue Clearance Time (g <sub>c</sub> ), s	30.8			19.3			4.3	16.3	17.2	0.3	10.4	10.7
Green Ratio (g/C)	0.44			0.44			0.38	0.30	0.30	0.38	0.30	0.30
Capacity (c), veh/h	723			578			344	1068	455	272	561	483
Volume-to-Capacity Ratio (X)	0.843			0.592			0.410	0.751	0.783	0.040	0.521	0.535
Back of Queue (Q), ft/ln (95 th percentile)	426.9			211.3			76.6	282.6	281.2	5.4	198.4	176
Back of Queue (Q), veh/ln (95 th percentile)	16.8			8.3			3.0	11.1	11.1	0.2	7.8	7.0
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.38	0.00	0.00	0.03	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	21.2			17.9			18.2	25.3	25.6	17.8	23.2	23.4
Incremental Delay (d <sub>2</sub> ), s/veh	8.5			1.1			0.3	2.7	7.9	0.0	0.4	0.6
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0			0.0			0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	29.7			19.0			18.5	28.0	33.5	17.9	23.7	24.0
Level of Service (LOS)	C			B			B	C	C	B	C	C
Approach Delay, s/veh / LOS	29.7	C		19.0	B		28.5	C		23.7	C	
Intersection Delay, s/veh / LOS	26.6						C					

### Multimodal Results

	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	2.43	B		2.29	B		1.69	B		1.71	B	
Bicycle LOS Score / LOS	1.49	A		1.05	A		1.56	B		0.95	A	

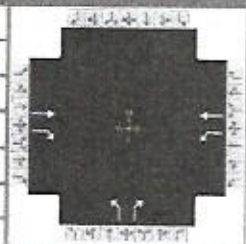
# HCS7 Signalized Intersection Results Summary

## General Information

Agency	Solaegui Engineers		
Analyst	MSH	Analysis Date	Aug 28, 2020
Jurisdiction	Washoe County	Time Period	AM Existing
Urban Street		Analysis Year	Existing
Intersection	Highland Ranch & Sun...	File Name	HrSv20ax.xus
Project Description			

## Intersection Information

Duration, h	0.250
Area Type	Other
PHF	0.85
Analysis Period	1> 7:00



## Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		68	162	419	32		128		360			

## Signal Information

Cycle, s	85.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
		Green		15.0	30.0	25.0	0.0	0.0	0.0	0.0		
		Yellow		4.0	4.0	4.0	0.0	0.0	0.0	0.0		
		Red		1.0	1.0	1.0	0.0	0.0	0.0	0.0		

## Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		35.0	20.0	55.0		30.0		
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0		5.0		
Max Allow Headway (MAH), s		3.3	3.1	3.3		3.4		
Queue Clearance Time (g <sub>s</sub> ), s		8.0	16.7	2.8		23.7		
Green Extension Time (g <sub>e</sub> ), s		0.5	0.0	0.5		0.3		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	1.00	0.00		1.00		

## Movement Group Results

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	2	12	1	6			3		18			
Adjusted Flow Rate (v), veh/h	80	144	493	38			151		424			
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1451	1767	1781			1737		1300			
Queue Service Time (g <sub>s</sub> ), s	2.5	6.0	14.7	0.8			5.7		21.7			
Cycle Queue Clearance Time (g <sub>c</sub> ), s	2.5	6.0	14.7	0.8			5.7		21.7			
Green Ratio (g/C)	0.35	0.35	0.55	0.59			0.29		0.47			
Capacity (c), veh/h	655	512	820	1048			511		622			
Volume-to-Capacity Ratio (X)	0.122	0.280	0.601	0.036			0.295		0.681			
Back of Queue (Q), ft/ln (95 th percentile)	47.1	90	231.2	11.8			103.7		267.6			
Back of Queue (Q), veh/ln (95 th percentile)	1.8	3.5	9.0	0.5			4.1		10.5			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00	0.00	0.00			0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh	18.6	19.7	12.0	7.4			23.2		17.7			
Incremental Delay (d <sub>2</sub> ), s/veh	0.0	0.1	0.9	0.0			0.1		2.5			
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0	0.0	0.0			0.0		0.0			
Control Delay (d), s/veh	18.6	19.9	12.8	7.4			23.3		20.2			
Level of Service (LOS)	B	B	B	A			C		C			
Approach Delay, s/veh / LOS	19.4	B	12.5	B			21.0	C	0.0			
Intersection Delay, s/veh / LOS	17.3						B					

## Multimodal Results

	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.91	B	0.68	A	1.95	B	2.01	B				
Bicycle LOS Score / LOS	0.86	A	1.36	A	F							

# HCS7 Signalized Intersection Results Summary

## General Information

Agency: Solaegui Engineers				Intersection Information	
Analyst: MSH	Analysis Date: Aug 28, 2020	Duration, h: 0.250	Area Type: Other		
Jurisdiction: Washoe County	Time Period: PM Existing	PHF: 0.90	Analysis Period: 1 > 7:00		
Urban Street: Highland Ranch & Sun...	Analysis Year: Existing	File Name: HrSv20px.xus			
Project Description:					

## Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		25	42	429	34		74		518			

## Signal Information

Cycle, s: 90.0	Reference Phase: 2										
Offset, s: 0	Reference Point: End										
Uncoordinated: Yes	Simult. Gap E/W: On										
Force Mode: Fixed	Simult. Gap N/S: On										

## Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		30.0	30.0	60.0		30.0		
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0		5.0		
Max Allow Headway (MAH), s		3.2	3.1	3.2		3.4		
Queue Clearance Time (g <sub>s</sub> ), s		3.6	16.0	2.8		27.0		
Green Extension Time (g <sub>e</sub> ), s		0.2	0.7	0.2		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	0.03	0.00		1.00		

## Movement Group Results

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	2	12	1	6	3	18						
Adjusted Flow Rate (v), veh/h	28	36	477	38	82	576						
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1443	1767	1781	1735	1299						
Queue Service Time (g <sub>s</sub> ), s	1.0	1.6	14.0	0.8	3.2	25.0						
Cycle Queue Clearance Time (g <sub>c</sub> ), s	1.0	1.6	14.0	0.8	3.2	25.0						
Green Ratio (g/C)	0.28	0.28	0.58	0.61	0.28	0.56						
Capacity (c), veh/h	515	401	937	1089	482	738						
Volume-to-Capacity Ratio (X)	0.054	0.089	0.509	0.035	0.171	0.780						
Back of Queue (Q), ft/ln (95 th percentile)	19.5	25.3	217.8	11.9	59.7	365.1						
Back of Queue (Q), veh/ln (95 th percentile)	0.8	1.0	8.5	0.5	2.3	14.3						
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00						
Uniform Delay (d <sub>1</sub> ), s/veh	23.8	24.1	11.1	7.0	24.6	15.9						
Incremental Delay (d <sub>2</sub> ), s/veh	0.0	0.0	0.2	0.0	0.1	4.9						
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0	0.0	0.0	0.0	0.0						
Control Delay (d), s/veh	23.8	24.1	11.3	7.0	24.7	20.8						
Level of Service (LOS)	C	C	B	A	C	C						
Approach Delay, s/veh / LOS	24.0	C	10.9	B	21.3	C	0.0					
Intersection Delay, s/veh / LOS	17.1						B					

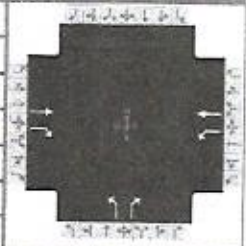
## Multimodal Results

	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.92	B	0.68	A	1.96	B	1.97	B				
Bicycle LOS Score / LOS	0.59	A	1.34	A		F						

# HCS7 Signalized Intersection Results Summary

## General Information

Agency	Solaegui Engineers			Intersection Information	
Analyst	MSH	Analysis Date	Aug 28, 2020	Duration, h	0.250
Jurisdiction	Washoe County	Time Period	AM Existing	Area Type	Other
Urban Street		Analysis Year	Existing + Project	PHF	0.85
Intersection	Highland Ranch & Sun...	File Name	HrSv20aw.xus	Analysis Period	1> 7:00
Project Description					



## Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		69	162	496	33		128		385			

## Signal Information

Cycle, s	85.0	Reference Phase	2													
Offset, s	0	Reference Point	End													
Uncoordinated	Yes	Simult. Gap E/W	On	Green	15.0	30.0	25.0	0.0	0.0	0.0						
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
				Red	1.0	1.0	1.0	0.0	0.0	0.0						

## Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		35.0	20.0	55.0		30.0		
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0		5.0		
Max Allow Headway (MAH), s		3.3	3.1	3.3		3.4		
Queue Clearance Time (g <sub>s</sub> ), s		8.0	17.0	2.8		26.1		
Green Extension Time (g <sub>e</sub> ), s		0.5	0.0	0.5		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	1.00	0.00		1.00		

## Movement Group Results

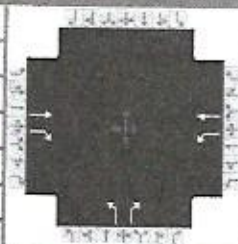
Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	2	12	1	6			3		18			
Adjusted Flow Rate (v), veh/h	81	144	584	39			151		453			
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1451	1767	1781			1737		1300			
Queue Service Time (g <sub>s</sub> ), s	2.5	6.0	15.0	0.8			5.7		24.1			
Cycle Queue Clearance Time (g <sub>c</sub> ), s	2.5	6.0	15.0	0.8			5.7		24.1			
Green Ratio (g/C)	0.35	0.35	0.55	0.59			0.29		0.47			
Capacity (c), veh/h	655	512	819	1048			511		622			
Volume-to-Capacity Ratio (X)	0.124	0.280	0.713	0.037			0.295		0.728			
Back of Queue (Q), ft/ln (95 th percentile)	47.9	90	291.1	12.2			103.7		295.8			
Back of Queue (Q), veh/ln (95 th percentile)	1.9	3.5	11.4	0.5			4.1		11.6			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00	0.00	0.00			0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh	18.6	19.7	13.7	7.4			23.2		18.3			
Incremental Delay (d <sub>2</sub> ), s/veh	0.0	0.1	2.5	0.0			0.1		3.8			
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0	0.0	0.0			0.0		0.0			
Control Delay (d), s/veh	18.6	19.9	16.3	7.4			23.3		22.0			
Level of Service (LOS)	B	B	B	A			C		C			
Approach Delay, s/veh / LOS	19.4	B	15.7	B			22.3	C	0.0			
Intersection Delay, s/veh / LOS	19.0						B					

## Multimodal Results

	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.91	B	0.68	A	1.95	B	2.01	B				
Bicycle LOS Score / LOS	0.86	A	1.51	B		F						

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other		
Jurisdiction	Washoe County	Time Period	PM Existing	PHF	0.90		
Urban Street		Analysis Year	Existing + Project	Analysis Period	1> 7:00		
Intersection	Highland Ranch & Sun...	File Name	HrSv20pw.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		26	42	481	35		74		605			

Signal Information													
Cycle, s	90.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	25.0	25.0	25.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0			
				Red	1.0	1.0	1.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		30.0	30.0	60.0		30.0		
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0		5.0		
Max Allow Headway (MAH), s		3.2	3.1	3.2		3.4		
Queue Clearance Time (g <sub>s</sub> ), s		3.6	18.5	2.8		27.0		
Green Extension Time (g <sub>e</sub> ), s		0.2	0.7	0.2		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	0.15	0.00		1.00		

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	2	12		1	6		3		18			
Adjusted Flow Rate (v), veh/h	29	36		534	39		82		672			
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1443		1767	1781		1735		1299			
Queue Service Time (g <sub>s</sub> ), s	1.0	1.6		16.5	0.8		3.2		25.0			
Cycle Queue Clearance Time (g <sub>c</sub> ), s	1.0	1.6		16.5	0.8		3.2		25.0			
Green Ratio (g/C)	0.28	0.28		0.58	0.61		0.28		0.56			
Capacity (c), veh/h	515	401		936	1089		482		738			
Volume-to-Capacity Ratio (X)	0.056	0.089		0.571	0.036		0.171		0.911			
Back of Queue (Q), ft/ln (95 th percentile)	20.3	25.3		250	12.2		59.7		519.7			
Back of Queue (Q), veh/ln (95 th percentile)	0.8	1.0		9.8	0.5		2.3		20.3			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh	23.8	24.1		11.6	7.0		24.6		18.3			
Incremental Delay (d <sub>2</sub> ), s/veh	0.0	0.0		0.5	0.0		0.1		15.1			
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0		0.0	0.0		0.0		0.0			
Control Delay (d), s/veh	23.9	24.1		12.1	7.0		24.7		33.4			
Level of Service (LOS)		C		C	B		A		C			
Approach Delay, s/veh / LOS	24.0		C	11.8		B	32.4		C	0.0		
Intersection Delay, s/veh / LOS	23.5						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.92	B	0.68	A	1.96	B	1.97	B
Bicycle LOS Score / LOS	0.59	A	1.43	A		F		

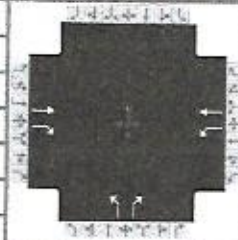
# HCS7 Signalized Intersection Results Summary

## General Information

Agency	Solaegui Engineers		
Analyst	MSH	Analysis Date	Aug 28, 2020
Jurisdiction	Washoe County	Time Period	AM Peak Hour
Urban Street		Analysis Year	2040 Base
Intersection	Highland Ranch & Sun...	File Name	HrSv40ax.xus
Project Description			

## Intersection Information

Duration, h	0.250
Area Type	Other
PHF	0.85
Analysis Period	1> 7:00



## Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		80	180	460	40		140		400			

## Signal Information

Cycle, s	85.0	Reference Phase	2											
Offset, s	0	Reference Point	End											
Uncoordinated	Yes	Simult. Gap E/W	On	Green	15.0	30.0	25.0	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0				
				Red	1.0	1.0	1.0	0.0	0.0	0.0				

## Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		35.0	20.0	55.0		30.0		
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0		5.0		
Max Allow Headway (MAH), s		3.3	3.1	3.3		3.4		
Queue Clearance Time (g <sub>s</sub> ), s		9.0	17.0	2.9		27.0		
Green Extension Time (g <sub>e</sub> ), s		0.6	0.0	0.6		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	1.00	0.00		1.00		

## Movement Group Results

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	2	12		1	6		3		18			
Adjusted Flow Rate (v), veh/h	94	165		541	47		165		471			
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1451		1767	1781		1737		1300			
Queue Service Time (g <sub>s</sub> ), s	2.9	7.0		15.0	0.9		6.3		25.0			
Cycle Queue Clearance Time (g <sub>c</sub> ), s	2.9	7.0		15.0	0.9		6.3		25.0			
Green Ratio (g/C)	0.35	0.35		0.55	0.59		0.29		0.47			
Capacity (c), veh/h	655	512		808	1048		511		622			
Volume-to-Capacity Ratio (X)	0.144	0.322		0.670	0.045		0.322		0.756			
Back of Queue (Q), ft/ln (95 th percentile)	55.8	0.9		262.1	14.8		114.5		314.8			
Back of Queue (Q), veh/ln (95 th percentile)	2.2	0.0		10.2	0.6		4.5		12.3			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh	18.7	20.1		12.9	7.4		23.4		18.7			
Incremental Delay (d <sub>2</sub> ), s/veh	0.0	0.1		1.8	0.0		0.1		4.7			
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0		0.0	0.0		0.0		0.0			
Control Delay (d), s/veh	18.8	20.2		14.7	7.4		23.5		23.4			
Level of Service (LOS)	B	C		B	A		C		C			
Approach Delay, s/veh / LOS	19.7	B		14.1	B		23.4	C		0.0		
Intersection Delay, s/veh / LOS	19.1						B					

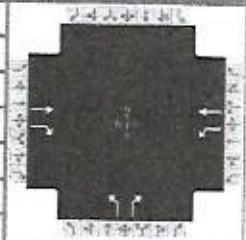
## Multimodal Results

	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.91	B	0.68	A	1.95	B	2.01	B
Bicycle LOS Score / LOS	0.91	A	1.46	A		F		

# HCS7 Signalized Intersection Results Summary

## General Information

Agency	Solaegui Engineers			Intersection Information	
Analyst	MSH	Analysis Date	Aug 28, 2020	Duration, h	0.250
Jurisdiction	Washoe County	Time Period	PM Peak Hour	Area Type	Other
Urban Street		Analysis Year	2040 Base	PHF	0.90
Intersection	Highland Ranch & Sun...	File Name	HrSv40px.xus	Analysis Period	1> 7:00
Project Description					



## Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		30	50	470	40		80		570			

## Signal Information

Cycle, s	90.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	25.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0
				Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0

## Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		30.0	30.0	60.0		30.0		
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0		5.0		
Max Allow Headway (MAH), s		3.2	3.1	3.2		3.4		
Queue Clearance Time (g <sub>s</sub> ), s		4.1	17.9	2.9		27.0		
Green Extension Time (g <sub>e</sub> ), s		0.2	0.7	0.2		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	0.11	0.00		1.00		

## Movement Group Results

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	2	12	1	6	3	18						
Adjusted Flow Rate (v), veh/h	33	44	522	44	89	633						
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1443	1767	1781	1735	1299						
Queue Service Time (g <sub>s</sub> ), s	1.2	2.1	15.9	0.9	3.5	25.0						
Cycle Queue Clearance Time (g <sub>c</sub> ), s	1.2	2.1	15.9	0.9	3.5	25.0						
Green Ratio (g/C)	0.28	0.28	0.58	0.61	0.28	0.56						
Capacity (c), veh/h	515	401	932	1089	482	738						
Volume-to-Capacity Ratio (X)	0.065	0.111	0.560	0.041	0.184	0.858						
Back of Queue (Q), ft/ln (95 th percentile)	23.5	31.8	243.4	14	64.9	446.2						
Back of Queue (Q), veh/ln (95 th percentile)	0.9	1.2	9.5	0.5	2.5	17.4						
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00						
Uniform Delay (d <sub>1</sub> ), s/veh	23.9	24.2	11.5	7.0	24.7	17.3						
Incremental Delay (d <sub>2</sub> ), s/veh	0.0	0.0	0.5	0.0	0.1	9.5						
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0	0.0	0.0	0.0	0.0						
Control Delay (d), s/veh	23.9	24.3	12.0	7.0	24.8	26.8						
Level of Service (LOS)	C	C	B	A	C	C						
Approach Delay, s/veh / LOS	24.1	C	11.6	B	26.5	C	0.0					
Intersection Delay, s/veh / LOS	20.2						C					

## Multimodal Results

	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.92	B	0.68	A	1.96	B	1.97	B				
Bicycle LOS Score / LOS	0.62	A	1.42	A		F						



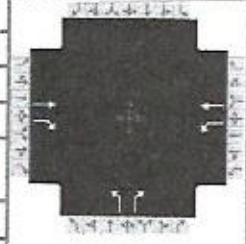
# HCS7 Signalized Intersection Results Summary

## General Information

Agency	Solaegui Engineers		
Analyst	MSH	Analysis Date	Aug 28, 2020
Jurisdiction	Washoe County	Time Period	AM Peak Hour
Urban Street		Analysis Year	2040 Base + Project
Intersection	Highland Ranch & Sun...	File Name	HrSv40aw.xus
Project Description			

## Intersection Information

Duration, h	0.250
Area Type	Other
PHF	0.85
Analysis Period	1> 7:00



## Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		81	180	537	41		140		425			

## Signal Information

Cycle, s	85.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	15.0	30.0	25.0	0.0	0.0	0.0	[Diagram]		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0	[Diagram]		
				Red	1.0	1.0	1.0	0.0	0.0	0.0	[Diagram]		

## Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		35.0	20.0	55.0		30.0		
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0		5.0		
Max Allow Headway (MAH), s		3.3	3.1	3.3		3.4		
Queue Clearance Time (g <sub>s</sub> ), s		9.0	17.0	3.0		27.0		
Green Extension Time (g <sub>e</sub> ), s		0.6	0.0	0.6		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	1.00	0.00		1.00		

## Movement Group Results

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (v), veh/h		95	165	632	48		165		500			
Adjusted Saturation Flow Rate (s), veh/h/ln		1856	1451	1767	1781		1737		1300			
Queue Service Time (g <sub>s</sub> ), s		3.0	7.0	15.0	1.0		6.3		25.0			
Cycle Queue Clearance Time (g <sub>c</sub> ), s		3.0	7.0	15.0	1.0		6.3		25.0			
Green Ratio (g/C)		0.35	0.35	0.55	0.59		0.29		0.47			
Capacity (c), veh/h		655	512	806	1048		511		622			
Volume-to-Capacity Ratio (X)		0.146	0.322	0.783	0.046		0.322		0.804			
Back of Queue (Q), ft/ln (95 th percentile)		56.5	0.9	334.1	15.2		114.5		351			
Back of Queue (Q), veh/ln (95 th percentile)		2.2	0.0	13.1	0.6		4.5		13.7			
Queue Storage Ratio (RQ) (95 th percentile)		0.00	0.00	0.00	0.00		0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh		18.8	20.1	15.1	7.4		23.4		19.3			
Incremental Delay (d <sub>2</sub> ), s/veh		0.0	0.1	4.6	0.0		0.1		7.0			
Initial Queue Delay (d <sub>3</sub> ), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (d), s/veh		18.8	20.2	19.7	7.4		23.5		26.3			
Level of Service (LOS)		B	C	B	A		C		C			
Approach Delay, s/veh / LOS	19.7	B		18.8	B		25.7	C		0.0		
Intersection Delay, s/veh / LOS	21.8						C					

## Multimodal Results

	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.91	B		0.68	A		1.95	B		2.01	B	
Bicycle LOS Score / LOS	0.92	A		1.61	B			F				

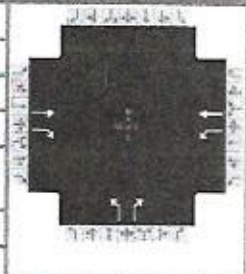
## HCS7 Signalized Intersection Results Summary

### General Information

Agency	Solaegui Engineers		
Analyst	MSH	Analysis Date	Aug 28, 2020
Jurisdiction	Washoe County	Time Period	PM Peak Hour
Urban Street		Analysis Year	2040 Base + Project
Intersection	Highland Ranch & Sun...	File Name	HrSv40pw.xus
Project Description			

### Intersection Information

Duration, h	0.250
Area Type	Other
PHF	0.90
Analysis Period	1 > 7:00



### Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		31	50	522	41		80		657			

### Signal Information

Cycle, s	90.0	Reference Phase	2													
Offset, s	0	Reference Point	End													
Uncoordinated	Yes	Simult. Gap E/W	On	Green	25.0	25.0	25.0	0.0	0.0	0.0						
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0						
				Red	1.0	1.0	1.0	0.0	0.0	0.0						

### Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6		8		
Case Number		7.3	1.0	4.0		9.0		
Phase Duration, s		30.0	30.0	60.0		30.0		
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0		5.0		
Max Allow Headway (MAH), s		3.2	3.1	3.2		3.4		
Queue Clearance Time (g <sub>s</sub> ), s		4.1	20.6	2.9		27.0		
Green Extension Time (g <sub>e</sub> ), s		0.2	0.6	0.2		0.0		
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	0.51	0.00		1.00		

### Movement Group Results

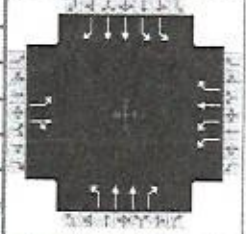
Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (v), veh/h		34	44	580	46		89		730			
Adjusted Saturation Flow Rate (s), veh/h/ln		1856	1443	1767	1781		1735		1299			
Queue Service Time (g <sub>s</sub> ), s		1.2	2.1	18.6	0.9		3.5		25.0			
Cycle Queue Clearance Time (g <sub>c</sub> ), s		1.2	2.1	18.6	0.9		3.5		25.0			
Green Ratio (g/C)		0.28	0.28	0.58	0.61		0.28		0.56			
Capacity (c), veh/h		515	401	931	1089		482		738			
Volume-to-Capacity Ratio (X)		0.067	0.111	0.623	0.042		0.184		0.989			
Back of Queue (Q), ft/ln (95 th percentile)		24.3	31.8	278.4	14.4		64.9		678.4			
Back of Queue (Q), veh/ln (95 th percentile)		0.9	1.2	10.9	0.6		2.5		26.5			
Queue Storage Ratio (RQ) (95 th percentile)		0.00	0.00	0.00	0.00		0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh		23.9	24.2	12.0	7.0		24.7		20.0			
Incremental Delay (d <sub>2</sub> ), s/veh		0.0	0.0	1.0	0.0		0.1		30.2			
Initial Queue Delay (d <sub>3</sub> ), s/veh		0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (d), s/veh		23.9	24.3	13.0	7.0		24.8		50.2			
Level of Service (LOS)		C	C	B	A		C		D			
Approach Delay, s/veh / LOS	24.1		C	12.6		B	47.5		D	0.0		
Intersection Delay, s/veh / LOS	31.9						C					

### Multimodal Results

	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.92		B	0.68		A	1.96		B	1.97		B
Bicycle LOS Score / LOS	0.62		A	1.52		B			F			

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	AM Peak Hour	PHF	0.92		
Urban Street		Analysis Year	Existing	Analysis Period	1 > 7:00		
Intersection	Pyramid & Highland Ra...	File Name	PySp20ax.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	245	214	94	94	149	324	108	544	45	494	1531	234

Signal Information													
Cycle, s	150.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	14.0	12.0	59.0	6.0	14.0	25.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	0.0	4.0	4.0	0.0	4.0			
				Red	1.0	0.0	1.0	1.0	0.0	1.0			

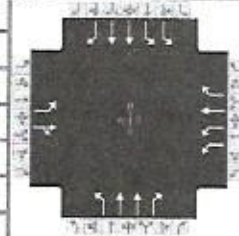
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	44.0	11.0	30.0	19.0	64.0	31.0	76.0
Change Period, (Y+R <sub>c</sub> ), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (MAH), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (g <sub>s</sub> ), s	22.9	21.4	6.4	27.0	11.7		22.8	
Green Extension Time (g <sub>e</sub> ), s	0.1	1.4	0.0	0.0	0.0	0.0	0.9	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.00	1.00	1.00	1.00		0.02	

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	266	280		102	162	298	117	591	49	537	1664	254
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1882		1730	1870		1759	1744	1536	1802	1841	1603
Queue Service Time (g <sub>s</sub> ), s	20.9	19.4		4.4	11.8		9.7	18.6	3.0	20.8	65.2	14.9
Cycle Queue Clearance Time (g <sub>c</sub> ), s	20.9	19.4		4.4	11.8		9.7	18.6	3.0	20.8	65.2	14.9
Green Ratio (g/C)	0.17	0.26		0.04	0.17		0.09	0.39	0.39	0.21	0.47	0.47
Capacity (c), veh/h	309	489		138	312		164	1372	604	745	1743	759
Volume-to-Capacity Ratio (X)	0.861	0.573		0.738	0.520		0.715	0.431	0.081	0.721	0.955	0.335
Back of Queue (Q), ft/ln (95 th percentile)	435.4	362.4		102.3	240.4		212.8	315.6	51.1	368.8	1010	243.2
Back of Queue (Q), veh/ln (95 th percentile)	17.1	14.3		4.0	9.5		8.4	12.3	2.0	14.5	39.5	9.6
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	60.8	48.3		71.2	57.0		66.1	33.2	28.5	55.5	38.0	24.7
Incremental Delay (d <sub>2</sub> ), s/veh	20.3	1.1		16.7	0.7		12.0	1.0	0.3	3.0	13.2	1.2
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	81.1	49.3		87.9	57.7	0.0	78.0	34.2	28.8	58.4	51.2	25.9
Level of Service (LOS)	F	D		F	E	A	E	C	C	E	D	C
Approach Delay, s/veh / LOS	64.8		E	32.6		C	40.7		D	50.2		D
Intersection Delay, s/veh / LOS	48.1						D					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	2.46		B	2.61		C	2.51		C	1.99		B
Bicycle LOS Score / LOS	1.39		A	1.41		A	1.11		A	2.51		C

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	PM Peak Hour	PHF	0.95		
Urban Street		Analysis Year	Existing	Analysis Period	1 > 7:00		
Intersection	Pyramid & Highland Ra...	File Name	PySp20px.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	267	195	137	50	206	746	174	1485	20	303	808	138

Signal Information													
Cycle, s	140.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	15.0	3.0	62.0	7.0	8.0	25.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	0.0	4.0	4.0	0.0	4.0			
				Red	1.0	0.0	1.0	1.0	0.0	1.0			

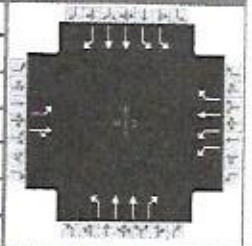
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	20.0	38.0	12.0	30.0	23.0	70.0	20.0	67.0
Change Period, (Y+R <sub>c</sub> ), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (g <sub>s</sub> ), s	22.0	25.2	4.1	27.0	15.6		14.1	
Green Extension Time (g <sub>e</sub> ), s	0.0	1.4	0.0	0.0	0.2	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.19	1.00	1.00	0.01		1.00	

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	281	323		53	217	364	183	1563	21	319	851	145
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1811		1730	1870		1759	1744	1538	1802	1841	1602
Queue Service Time (g <sub>s</sub> ), s	20.0	23.2		2.1	15.1		13.6	60.9	1.0	12.1	23.4	7.8
Cycle Queue Clearance Time (g <sub>c</sub> ), s	20.0	23.2		2.1	15.1		13.6	60.9	1.0	12.1	23.4	7.8
Green Ratio (g/C)	0.14	0.24		0.05	0.18		0.16	0.46	0.46	0.11	0.44	0.44
Capacity (c), veh/h	265	427		173	334		289	1619	714	386	1630	710
Volume-to-Capacity Ratio (X)	1.060	0.757		0.304	0.649		0.634	0.965	0.029	0.826	0.522	0.205
Back of Queue (Q), ft/ln (95 th percentile)	546.5	426.3		41.2	297.4		257.7	919	17.1	256.5	389.7	134.8
Back of Queue (Q), veh/ln (95 th percentile)	21.5	16.8		1.6	11.7		10.1	35.9	0.7	10.1	15.2	5.3
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	60.0	49.8		64.2	53.4		54.6	36.4	20.4	61.2	28.3	23.9
Incremental Delay (d <sub>2</sub> ), s/veh	72.0	6.8		0.4	3.5		3.4	15.5	0.1	12.9	1.2	0.7
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	132.0	56.6		64.5	56.9	0.0	58.0	51.9	20.4	74.1	29.5	24.5
Level of Service (LOS)	F	E		E	E	A	E	D	C	E	C	C
Approach Delay, s/veh / LOS	91.7		F	24.8		C	52.2		D	39.8		D
Intersection Delay, s/veh / LOS	49.9						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.46	B	2.61	C	3.00	C	1.96	B
Bicycle LOS Score / LOS	1.48	A	1.53	B	1.95	B	1.57	B

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	AM Peak Hour	PHF	0.92		
Urban Street		Analysis Year	Existing + Project	Analysis Period	1 > 7:00		
Intersection	Pyramid & Highland Ra...	File Name	PySp20aw.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	250	221	118	94	151	324	116	544	45	494	1531	236

Signal Information													
Cycle, s	150.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	14.0	12.0	59.0	6.0	14.0	25.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	0.0	4.0	4.0	0.0	4.0			
				Red	1.0	0.0	1.0	1.0	0.0	1.0			

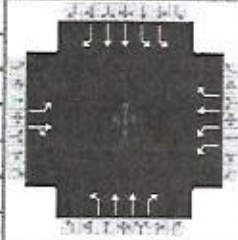
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	44.0	11.0	30.0	19.0	64.0	31.0	76.0
Change Period, (Y+R <sub>c</sub> ), s	0.0	5.0	5.0	5.0	5.0	5.0	0.0	5.0
Max Allow Headway (MAH), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (g <sub>s</sub> ), s	23.4	24.6	6.4	27.0	12.5		22.8	
Green Extension Time (g <sub>e</sub> ), s	0.1	1.4	0.0	0.0	0.0	0.0	0.9	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.01	1.00	1.00	1.00		0.02	

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	272	314		102	164	298	126	591	49	537	1664	257
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1858		1730	1870		1759	1744	1536	1802	1841	1603
Queue Service Time (g <sub>s</sub> ), s	21.4	22.6		4.4	12.0		10.5	18.6	3.0	20.8	65.2	15.0
Cycle Queue Clearance Time (g <sub>c</sub> ), s	21.4	22.6		4.4	12.0		10.5	18.6	3.0	20.8	65.2	15.0
Green Ratio (g/C)	0.17	0.26		0.04	0.17		0.09	0.39	0.39	0.21	0.47	0.47
Capacity (c), veh/h	309	483		138	312		164	1372	604	745	1743	759
Volume-to-Capacity Ratio (X)	0.879	0.650		0.738	0.527		0.768	0.431	0.081	0.721	0.955	0.338
Back of Queue (Q), ft/ln (95 th percentile)	450.3	411.4		102.3	243.4		233.8	315.6	51.1	368.8	1010	245.4
Back of Queue (Q), veh/ln (95 th percentile)	17.7	16.2		4.0	9.6		9.2	12.3	2.0	14.5	39.5	9.7
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	61.0	49.4		71.2	57.1		66.4	33.2	28.5	55.5	38.0	24.8
Incremental Delay (d <sub>2</sub> ), s/veh	23.0	2.4		16.7	0.8		17.8	1.0	0.3	3.0	13.2	1.2
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	84.0	51.9		87.9	57.9	0.0	84.2	34.2	28.8	58.4	51.2	26.0
Level of Service (LOS)	F	D		F	E	A	F	C	C	E	D	C
Approach Delay, s/veh / LOS	66.8		E	32.8		C	42.1		D	50.2		D
Intersection Delay, s/veh / LOS	48.7						D					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	2.46		B	2.61		C	2.51		C	1.99		B
Bicycle LOS Score / LOS	1.45		A	1.42		A	1.12		A	2.52		C

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 28, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	PM Peak Hour	PHF	0.95		
Urban Street		Analysis Year	Existing + Project	Analysis Period	1 > 7:00		
Intersection	Pyramid & Highland Ra...	File Name	PySp20pw.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	270	200	153	50	214	746	201	1485	20	303	808	143

Signal Information													
Cycle, s	140.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	15.0	3.0	62.0	7.0	8.0	25.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	0.0	4.0	4.0	0.0	4.0			
				Red	1.0	0.0	1.0	1.0	0.0	1.0			

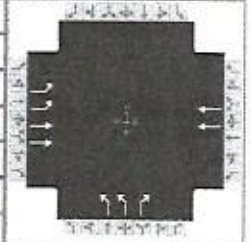
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	4.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	20.0	38.0	12.0	30.0	23.0	70.0	20.0	67.0
Change Period, (Y+R <sub>c</sub> ), s	0.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.1	3.2	3.0	3.2	2.9	0.0	2.9	0.0
Queue Clearance Time (g <sub>s</sub> ), s	22.0	27.4	4.1	27.0	18.0		14.1	
Green Extension Time (g <sub>e</sub> ), s	0.0	1.2	0.0	0.0	0.2	0.0	0.1	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.42	1.00	1.00	0.11		1.00	

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	284	345		53	225	364	212	1563	21	319	851	151
Adjusted Saturation Flow Rate (s), veh/h/ln	1856	1803		1730	1870		1759	1744	1538	1802	1841	1602
Queue Service Time (g <sub>s</sub> ), s	20.0	25.4		2.1	15.7		16.0	60.9	1.0	12.1	23.4	8.1
Cycle Queue Clearance Time (g <sub>c</sub> ), s	20.0	25.4		2.1	15.7		16.0	60.9	1.0	12.1	23.4	8.1
Green Ratio (g/C)	0.14	0.24		0.05	0.18		0.16	0.46	0.46	0.11	0.44	0.44
Capacity (c), veh/h	265	425		173	334		289	1619	714	386	1630	710
Volume-to-Capacity Ratio (X)	1.072	0.813		0.304	0.674		0.732	0.965	0.029	0.826	0.522	0.212
Back of Queue (Q), ft/ln (95 th percentile)	557.9	468.4		41.2	309.9		304.5	919	17.1	256.5	389.7	140.2
Back of Queue (Q), veh/ln (95 th percentile)	22.0	18.4		1.6	12.2		12.0	35.9	0.7	10.1	15.2	5.5
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d <sub>1</sub> ), s/veh	60.0	50.6		64.2	53.7		55.6	36.4	20.4	61.2	28.3	24.0
Incremental Delay (d <sub>2</sub> ), s/veh	75.7	10.7		0.4	4.3		8.1	15.5	0.1	12.9	1.2	0.7
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	135.7	61.3		64.5	58.0	0.0	63.7	51.9	20.4	74.1	29.5	24.7
Level of Service (LOS)	F	E		E	E	A	E	D	C	E	C	C
Approach Delay, s/veh / LOS	94.9		F	25.7		C	52.9		D	39.7		D
Intersection Delay, s/veh / LOS	51.0						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.46	B	2.61	C	3.00	C	1.96	B
Bicycle LOS Score / LOS	1.53	B	1.55	B	1.97	B	1.58	B

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 31, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	AM Peak Hour	PHF	0.90		
Urban Street		Analysis Year	2040 Base	Analysis Period	1> 7:00		
Intersection	Pyramid/HR/Sparks NB...	File Name	NB40ax.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	250	930			320		200		90			

Signal Information															
Cycle, s	80.0	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	No	Simult. Gap E/W	On												
Force Mode	Fixed	Simult. Gap N/S	On												
		Green		15.0	30.0	20.0	0.0	0.0	0.0						
		Yellow		4.0	4.0	4.0	0.0	0.0	0.0						
		Red		1.0	1.0	1.0	0.0	0.0	0.0						

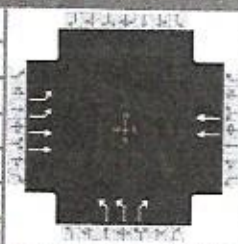
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		8.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (Y+R <sub>c</sub> ), s	5.0	5.0		5.0		5.0		
Max Allow Headway (MAH), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (g <sub>s</sub> ), s	7.7					6.1		
Green Extension Time (g <sub>e</sub> ), s	0.4	0.0		0.0		0.6		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.02					0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6		3		18			
Adjusted Flow Rate (v), veh/h	278	1033			356		222		100			
Adjusted Saturation Flow Rate (s), veh/h/ln	1730	1781			1781		1730		1585			
Queue Service Time (g <sub>s</sub> ), s	5.7	12.3			5.5		4.1		4.0			
Cycle Queue Clearance Time (g <sub>c</sub> ), s	5.7	12.3			5.5		4.1		4.0			
Green Ratio (g/C)	0.19	0.62			0.38		0.25		0.25			
Capacity (c), veh/h	649	2226			1335		865		396			
Volume-to-Capacity Ratio (X)	0.428	0.464			0.266		0.257		0.252			
Back of Queue (Q), ft/ln (95 th percentile)	103.7	183.1			101.5		73.8		66.7			
Back of Queue (Q), veh/ln (95 th percentile)	4.1	7.2			4.0		2.9		2.6			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00		0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh	28.7	7.9			17.4		24.0		24.0			
Incremental Delay (d <sub>2</sub> ), s/veh	0.2	0.7			0.5		0.1		0.1			
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0			0.0		0.0		0.0			
Control Delay (d), s/veh	28.9	8.6			17.8		24.1		24.1			
Level of Service (LOS)	C	A			B		C		C			
Approach Delay, s/veh / LOS	12.9		B	17.8		B	24.1		C	0.0		
Intersection Delay, s/veh / LOS	15.6						B					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.87		B	1.68		B	2.14		B	2.46		B
Bicycle LOS Score / LOS	1.57		B	0.78		A			F			

# HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 31, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	PM Peak Hour	PHF	0.90		
Urban Street		Analysis Year	2040 Base	Analysis Period	1 > 7:00		
Intersection	Pyramid/HR/Sparks NB...	File Name	NB40px.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	260	660			430		480		110			

Signal Information																	
Cycle, s	80.0	Reference Phase	2														
Offset, s	0	Reference Point	End														
Uncoordinated	No	Simult. Gap E/W	On														
Force Mode	Fixed	Simult. Gap N/S	On														
				Green	15.0	30.0	20.0	0.0	0.0	0.0	0.0						
				Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0						
				Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		8.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (Y+R <sub>c</sub> ), s	5.0	5.0		5.0		5.0		
Max Allow Headway (MAH), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (g <sub>s</sub> ), s	7.9					13.6		
Green Extension Time (g <sub>e</sub> ), s	0.4	0.0		0.0		1.0		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.02					0.18		

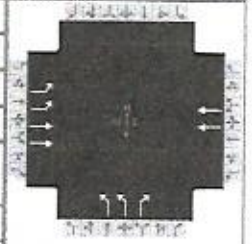
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6		3		18			
Adjusted Flow Rate (v), veh/h	289	733			478		533		122			
Adjusted Saturation Flow Rate (s), veh/h/ln	1730	1781			1781		1643		1427			
Queue Service Time (g <sub>s</sub> ), s	5.9	7.8			7.7		11.6		5.6			
Cycle Queue Clearance Time (g <sub>c</sub> ), s	5.9	7.8			7.7		11.6		5.6			
Green Ratio (g/C)	0.19	0.62			0.38		0.25		0.25			
Capacity (c), veh/h	649	2226			1335		822		357			
Volume-to-Capacity Ratio (X)	0.445	0.329			0.358		0.649		0.343			
Back of Queue (Q), ft/ln (95 th percentile)	108.4	115.5			142.3		201.7		83.7			
Back of Queue (Q), veh/ln (95 th percentile)	4.3	4.5			5.6		7.9		3.3			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00		0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh	28.8	7.1			18.0		26.9		24.6			
Incremental Delay (d <sub>2</sub> ), s/veh	0.2	0.4			0.7		1.4		0.2			
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0			0.0		0.0		0.0			
Control Delay (d), s/veh	29.0	7.5			18.8		28.3		24.8			
Level of Service (LOS)	C	A			B		C		C			
Approach Delay, s/veh / LOS	13.6		B	18.8		B	27.6		C	0.0		
Intersection Delay, s/veh / LOS	19.0						B					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.87		B	1.68		B	2.71		C	2.46		B
Bicycle LOS Score / LOS	1.33		A	0.52		A			F			



## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 31, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	AM Peak Hour	PHF	0.90		
Urban Street		Analysis Year	2040 Base + Project	Analysis Period	1> 7:00		
Intersection	Pyramid/HR/Sparks NB...	File Name	NB40aw.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	255	937			322		208		90			

Signal Information												
Cycle, s	80.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap EW	On									
Force Mode	Fixed	Simult. Gap N/S	On									
Green	15.0	30.0	20.0									
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		8.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (Y+R <sub>c</sub> ), s	5.0	5.0		5.0		5.0		
Max Allow Headway (MAH), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (g <sub>s</sub> ), s	7.8					6.3		
Green Extension Time (g <sub>e</sub> ), s	0.4	0.0		0.0		0.6		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.02					0.00		

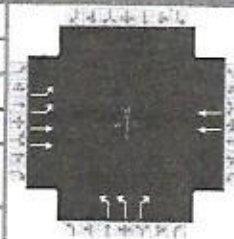
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6		3		18			
Adjusted Flow Rate (v), veh/h	283	1041			358		231		100			
Adjusted Saturation Flow Rate (s), veh/h/ln	1730	1781			1781		1730		1585			
Queue Service Time (g <sub>s</sub> ), s	5.8	12.4			5.6		4.3		4.0			
Cycle Queue Clearance Time (g <sub>c</sub> ), s	5.8	12.4			5.6		4.3		4.0			
Green Ratio (g/C)	0.19	0.62			0.38		0.25		0.25			
Capacity (c), veh/h	649	2226			1335		865		396			
Volume-to-Capacity Ratio (X)	0.437	0.468			0.268		0.267		0.252			
Back of Queue (Q), ft/ln (95 th percentile)	106	185.2			102.1		76.9		66.7			
Back of Queue (Q), veh/ln (95 th percentile)	4.2	7.3			4.0		3.0		2.6			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00		0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh	28.8	7.9			17.4		24.1		24.0			
Incremental Delay (d <sub>2</sub> ), s/veh	0.2	0.7			0.5		0.1		0.1			
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0			0.0		0.0		0.0			
Control Delay (d), s/veh	28.9	8.7			17.9		24.2		24.1			
Level of Service (LOS)	C	A			B		C		C			
Approach Delay, s/veh / LOS	13.0		B	17.9		B	24.2		C	0.0		
Intersection Delay, s/veh / LOS	15.7						B					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.87		B	1.68		B	2.14		B	2.46		B
Bicycle LOS Score / LOS	1.58		B	0.78		A			F			

# HCS7 Signalized Intersection Results Summary

## General Information

Agency	Solaegui Engineers			Intersection Information	
Analyst	MSH	Analysis Date	Aug 31, 2020	Duration, h	0.250
Jurisdiction	NDOT	Time Period	PM Peak Hour	Area Type	Other
Urban Street		Analysis Year	2040 Base + Project	PHF	0.90
Intersection	Pyramid/HR/Sparks NB...	File Name	NB40pw.xus	Analysis Period	1 > 7:00
Project Description					



## Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	263	665			438		507		110			

## Signal Information

Cycle, s	80.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
		Green	15.0	30.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

## Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		
Case Number	2.0	4.0		8.3		9.0		
Phase Duration, s	20.0	55.0		35.0		25.0		
Change Period, (Y+R <sub>c</sub> ), s	5.0	5.0		5.0		5.0		
Max Allow Headway (MAH), s	3.1	0.0		0.0		3.2		
Queue Clearance Time (g <sub>s</sub> ), s	8.0					14.4		
Green Extension Time (g <sub>e</sub> ), s	0.4	0.0		0.0		1.0		
Phase Call Probability	1.00					1.00		
Max Out Probability	0.03					0.29		

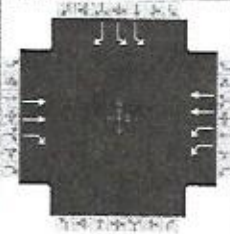
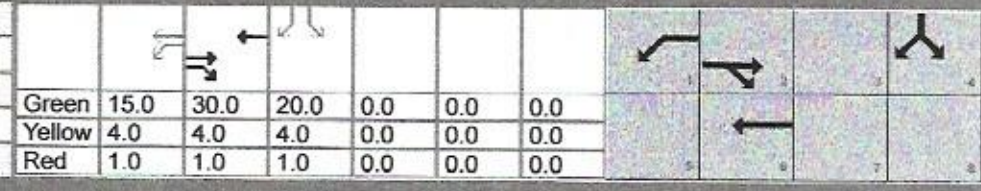
## Movement Group Results

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6		3		18			
Adjusted Flow Rate (v), veh/h	292	739			487		563		122			
Adjusted Saturation Flow Rate (s), veh/h/ln	1730	1781			1781		1643		1427			
Queue Service Time (g <sub>s</sub> ), s	6.0	7.9			7.9		12.4		5.6			
Cycle Queue Clearance Time (g <sub>c</sub> ), s	6.0	7.9			7.9		12.4		5.6			
Green Ratio (g/C)	0.19	0.62			0.38		0.25		0.25			
Capacity (c), veh/h	649	2226			1335		822		357			
Volume-to-Capacity Ratio (X)	0.451	0.332			0.364		0.686		0.343			
Back of Queue (Q), ft/ln (95 th percentile)	109.7	116.9			145.3		214.1		83.7			
Back of Queue (Q), veh/ln (95 th percentile)	4.3	4.6			5.7		8.4		3.3			
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00		0.00		0.00			
Uniform Delay (d <sub>1</sub> ), s/veh	28.8	7.1			18.1		27.2		24.6			
Incremental Delay (d <sub>2</sub> ), s/veh	0.2	0.4			0.8		2.0		0.2			
Initial Queue Delay (d <sub>3</sub> ), s/veh	0.0	0.0			0.0		0.0		0.0			
Control Delay (d), s/veh	29.0	7.5			18.9		29.1		24.8			
Level of Service (LOS)	C	A			B		C		C			
Approach Delay, s/veh / LOS	13.6		B	18.9		B	28.4		C	0.0		
Intersection Delay, s/veh / LOS	19.4						B					

## Multimodal Results

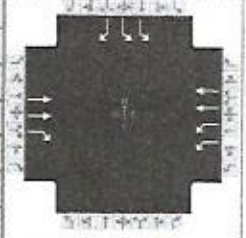
	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.87		B	1.68		B	2.71		C	2.46		B
Bicycle LOS Score / LOS	1.34		A	0.52		A			F			

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information											
Agency	Solaegui Engineers			Duration, h	0.250										
Analyst	MSH	Analysis Date	Aug 31, 2020	Area Type	Other										
Jurisdiction	NDOT	Time Period	AM Peak Hour	PHF	0.90										
Urban Street		Analysis Year	2040 Base	Analysis Period	1 > 7:00										
Intersection	Pyramid/HR/Sparks SB...	File Name	SB40ax.xus												
Project Description															
Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h					570	390	150	370					610		180
Signal Information															
Cycle, s	80.0	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	No	Simult. Gap EW	On												
Force Mode	Fixed	Simult. Gap N/S	On	Green	15.0	30.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase					2	1	6				4				
Case Number					7.3	2.0	4.0				9.0				
Phase Duration, s					35.0	20.0	55.0				25.0				
Change Period, (Y+R <sub>c</sub> ), s					5.0	5.0	5.0				5.0				
Max Allow Headway (MAH), s					0.0	3.1	0.0				3.2				
Queue Clearance Time (g <sub>s</sub> ), s						5.3					16.6				
Green Extension Time (g <sub>e</sub> ), s					0.0	0.2	0.0				0.9				
Phase Call Probability						1.00					1.00				
Max Out Probability						0.00					0.92				
Movement Group Results				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement					2	12	1	6					7		14
Adjusted Flow Rate (v), veh/h					633	322	167	411					678		200
Adjusted Saturation Flow Rate (s), veh/h/ln					1781	1585	1730	1781					1730		1585
Queue Service Time (g <sub>s</sub> ), s					10.8	12.8	3.3	3.9					14.6		8.7
Cycle Queue Clearance Time (g <sub>c</sub> ), s					10.8	12.8	3.3	3.9					14.6		8.7
Green Ratio (g/C)					0.38	0.38	0.19	0.62					0.25		0.25
Capacity (c), veh/h					1335	594	649	2226					865		396
Volume-to-Capacity Ratio (X)					0.474	0.542	0.257	0.185					0.784		0.505
Back of Queue (Q), ft/ln (95 th percentile)					198	218.1	60.1	57.9					262.1		143.8
Back of Queue (Q), veh/ln (95 th percentile)					7.8	8.6	2.4	2.3					10.3		5.7
Queue Storage Ratio (RQ) (95 th percentile)					0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d <sub>1</sub> ), s/veh					19.0	19.6	27.7	6.4					28.0		25.7
Incremental Delay (d <sub>2</sub> ), s/veh					1.2	3.5	0.1	0.2					4.3		0.4
Initial Queue Delay (d <sub>3</sub> ), s/veh					0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (d), s/veh					20.2	23.1	27.8	6.5					32.3		26.2
Level of Service (LOS)					C	C	C	A					C		C
Approach Delay, s/veh / LOS				21.2	C	12.7	B	0.0			30.9	C			
Intersection Delay, s/veh / LOS				22.7				C							
Multimodal Results				EB			WB			NB			SB		
Pedestrian LOS Score / LOS				1.68	B	1.87	B	2.46	B	2.45	B				
Bicycle LOS Score / LOS				1.28	A	0.96	A				F				

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	Solaegui Engineers			Duration, h	0.250		
Analyst	MSH	Analysis Date	Aug 31, 2020	Area Type	Other		
Jurisdiction	NDOT	Time Period	PM Peak Hour	PHF	0.90		
Urban Street		Analysis Year	2040 Base	Analysis Period	1 > 7:00		
Intersection	Pyramid/HR/Sparks SB...	File Name	SB40px.xus				
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h		510	330	120	790					410		200

Signal Information												
Cycle, s	80.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
Green	15.0	30.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

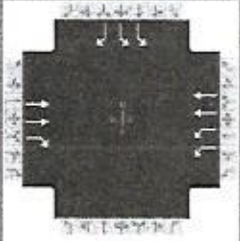
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		35.0	20.0	55.0				25.0
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0				5.0
Max Allow Headway (MAH), s		0.0	3.1	0.0				3.2
Queue Clearance Time (g <sub>s</sub> ), s			4.6					11.8
Green Extension Time (g <sub>e</sub> ), s		0.0	0.2	0.0				1.2
Phase Call Probability			1.00					1.00
Max Out Probability			0.00					0.08

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate (v), veh/h		567	283	133	878					456		222
Adjusted Saturation Flow Rate (s), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time (g <sub>s</sub> ), s		9.5	10.9	2.6	9.8					9.1		9.8
Cycle Queue Clearance Time (g <sub>c</sub> ), s		9.5	10.9	2.6	9.8					9.1		9.8
Green Ratio (g/C)		0.38	0.38	0.19	0.62					0.25		0.25
Capacity (c), veh/h		1335	594	649	2226					865		396
Volume-to-Capacity Ratio (X)		0.424	0.477	0.206	0.394					0.527		0.561
Back of Queue (Q), ft/ln (95 th percentile)		174.3	190.4	47.6	146.2					164.2		165.6
Back of Queue (Q), veh/ln (95 th percentile)		6.9	7.5	1.9	5.8					6.5		6.5
Queue Storage Ratio (RQ) (95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d <sub>1</sub> ), s/veh		18.6	19.0	27.5	7.5					25.9		26.2
Incremental Delay (d <sub>2</sub> ), s/veh		1.0	2.7	0.1	0.5					0.3		1.1
Initial Queue Delay (d <sub>3</sub> ), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (d), s/veh		19.6	21.8	27.5	8.0					26.2		27.3
Level of Service (LOS)		B	C	C	A					C		C
Approach Delay, s/veh / LOS	20.3	C		10.6	B		0.0			26.6	C	
Intersection Delay, s/veh / LOS	18.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.68	B	1.87	B	2.46	B	2.42	B
Bicycle LOS Score / LOS	1.19	A	1.32	A				F

## HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	Solaegui Engineers			Duration, h	0.250
Analyst	MSH	Analysis Date	Aug 31, 2020	Area Type	Other
Jurisdiction	NDOT	Time Period	AM Peak Hour	PHF	0.90
Urban Street		Analysis Year	2040 Base + Project	Analysis Period	1> 7:00
Intersection	Pyramid/HR/Sparks SB...	File Name	SB40aw.xus		
Project Description					



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand ( v ), veh/h		582	414	150	380					610		182

Signal Information														
Cycle, s	80.0	Reference Phase	2											
Offset, s	0	Reference Point	End	Green	15.0	30.0	20.0	0.0	0.0	0.0				
Uncoordinated	No	Simult. Gap E/W	On	Yellow	4.0	4.0	4.0	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On	Red	1.0	1.0	1.0	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		35.0	20.0	55.0				25.0
Change Period, ( Y+R <sub>c</sub> ), s		5.0	5.0	5.0				5.0
Max Allow Headway ( MAH ), s		0.0	3.1	0.0				3.2
Queue Clearance Time ( g <sub>s</sub> ), s			5.3					16.6
Green Extension Time ( g <sub>e</sub> ), s		0.0	0.2	0.0				0.9
Phase Call Probability			1.00					1.00
Max Out Probability			0.00					0.92

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate ( v ), veh/h		647	349	167	422					678		202
Adjusted Saturation Flow Rate ( s ), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time ( g <sub>s</sub> ), s		11.1	14.1	3.3	4.0					14.6		8.8
Cycle Queue Clearance Time ( g <sub>c</sub> ), s		11.1	14.1	3.3	4.0					14.6		8.8
Green Ratio ( g/C )		0.38	0.38	0.19	0.62					0.25		0.25
Capacity ( c ), veh/h		1335	594	649	2226					865		396
Volume-to-Capacity Ratio ( X )		0.484	0.587	0.257	0.190					0.784		0.510
Back of Queue ( Q ), ft/ln ( 95 th percentile)		202.3	237.8	60.1	59.8					262.1		145.9
Back of Queue ( Q ), veh/ln ( 95 th percentile)		8.0	9.4	2.4	2.4					10.3		5.7
Queue Storage Ratio ( RQ ) ( 95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay ( d <sub>1</sub> ), s/veh		19.1	20.0	27.7	6.4					28.0		25.8
Incremental Delay ( d <sub>2</sub> ), s/veh		1.3	4.2	0.1	0.2					4.3		0.5
Initial Queue Delay ( d <sub>3</sub> ), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay ( d ), s/veh		20.4	24.2	27.8	6.6					32.3		26.3
Level of Service ( LOS )		C	C	C	A					C		C
Approach Delay, s/veh / LOS	21.7	C		12.6	B		0.0				30.9	C
Intersection Delay, s/veh / LOS	22.8						C					

Multimodal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.68	B		1.87	B		2.46	B			2.45	B
Bicycle LOS Score / LOS	1.31	A		0.97	A							F

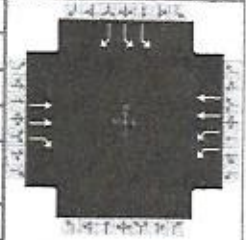
# HCS7 Signalized Intersection Results Summary

## General Information

Agency	Solaegui Engineers		
Analyst	MSH	Analysis Date	Aug 31, 2020
Jurisdiction	NDOT	Time Period	PM Peak Hour
Urban Street		Analysis Year	2040 Base + Project
Intersection	Pyramid/HR/Sparks SB...	File Name	SB40pw.xus
Project Description			

## Intersection Information

Duration, h	0.250
Area Type	Other
PHF	0.90
Analysis Period	1 > 7:00



## Demand Information

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h		518	346	120	825					410		205

## Signal Information

Cycle, s	80.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
Green	15.0	30.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

## Timer Results

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2	1	6				4
Case Number		7.3	2.0	4.0				9.0
Phase Duration, s		35.0	20.0	55.0				25.0
Change Period, (Y+R <sub>c</sub> ), s		5.0	5.0	5.0				5.0
Max Allow Headway (MAH), s		0.0	3.1	0.0				3.2
Queue Clearance Time (g <sub>s</sub> ), s			4.6					12.1
Green Extension Time (g <sub>e</sub> ), s		0.0	0.2	0.0				1.2
Phase Call Probability			1.00					1.00
Max Out Probability			0.00					0.09

## Movement Group Results

Approach Movement	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6					7		14
Adjusted Flow Rate (v), veh/h		576	301	133	917					456		228
Adjusted Saturation Flow Rate (s), veh/h/ln		1781	1585	1730	1781					1730		1585
Queue Service Time (g <sub>s</sub> ), s		9.6	11.7	2.6	10.4					9.1		10.1
Cycle Queue Clearance Time (g <sub>c</sub> ), s		9.6	11.7	2.6	10.4					9.1		10.1
Green Ratio (g/C)		0.38	0.38	0.19	0.62					0.25		0.25
Capacity (c), veh/h		1335	594	649	2226					865		396
Volume-to-Capacity Ratio (X)		0.431	0.507	0.206	0.412					0.527		0.575
Back of Queue (Q), ft/ln (95 th percentile)		177.5	202.8	47.6	155.3					164.2		171.3
Back of Queue (Q), veh/ln (95 th percentile)		7.0	8.0	1.9	6.1					6.5		6.7
Queue Storage Ratio (RQ) (95 th percentile)		0.00	0.00	0.00	0.00					0.00		0.00
Uniform Delay (d <sub>1</sub> ), s/veh		18.6	19.3	27.5	7.6					25.9		26.3
Incremental Delay (d <sub>2</sub> ), s/veh		1.0	3.1	0.1	0.6					0.3		1.3
Initial Queue Delay (d <sub>3</sub> ), s/veh		0.0	0.0	0.0	0.0					0.0		0.0
Control Delay (d), s/veh		19.7	22.4	27.5	8.1					26.2		27.6
Level of Service (LOS)		B	C	C	A					C		C
Approach Delay, s/veh / LOS	20.6		C	10.6		B	0.0			26.7		C
Intersection Delay, s/veh / LOS	18.2						B					

## Multimodal Results

	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	1.68		B	1.87		B	2.46		B	2.42		B
Bicycle LOS Score / LOS	1.21		A	1.35		A						F

# HCS7 Two-Way Stop-Control Report

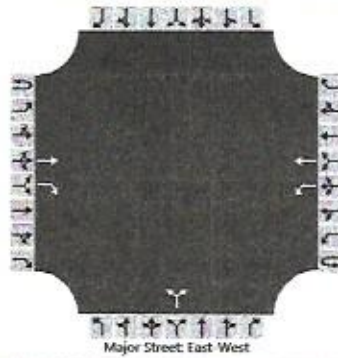
## General Information

Analyst	MSH
Agency/Co.	Solaegui Engineers
Date Performed	8/28/2020
Analysis Year	2020
Time Analyzed	AM Existing
Intersection Orientation	East-West
Project Description	

## Site Information

Intersection	Highland Ranch/Midnight
Jurisdiction	Washoe County
East/West Street	Highland Ranch Parkway
North/South Street	Midnight Drive
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	1	0	1	1	0		0	1	0		0	0	0
Configuration			T	R		L	T				LR					
Volume (veh/h)			424	25		88	402			24		124				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized			No													
Median Type   Storage																Undivided

## Critical and Follow-up Headways

Base Critical Headway (sec)						4.1					7.1				6.2	
Critical Headway (sec)						4.12					6.42				6.22	
Base Follow-Up Headway (sec)						2.2					3.5				3.3	
Follow-Up Headway (sec)						2.22					3.52				3.32	

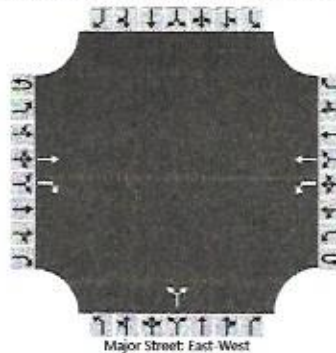
## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						98					164					
Capacity, c (veh/h)						1065					707					
v/c Ratio						0.09					0.23					
95% Queue Length, Q <sub>95</sub> (veh)						0.3					0.9					
Control Delay (s/veh)						8.7					11.6					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)								1.6					11.6			
Approach LOS																B

# HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	MSH	Intersection	Highland Ranch/Midnight
Agency/Co.	Solaegui Engineers	Jurisdiction	Washoe County
Date Performed	8/28/2020	East/West Street	Highland Ranch Parkway
Analysis Year	2020	North/South Street	Midnight Drive
Time Analyzed	PM Existing	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6	7	8	9		10	11	12	
Priority																
Number of Lanes	0	0	1	1	0	1	1	0	0	1	0		0	0	0	
Configuration			T	R		L	T				LR					
Volume (veh/h)			491	17		103	462			8		100				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized			No													
Median Type   Storage							Undivided									

## Critical and Follow-up Headways

Base Critical Headway (sec)					4.1				7.1		6.2					
Critical Headway (sec)					4.12				6.42		6.22					
Base Follow-Up Headway (sec)					2.2				3.5		3.3					
Follow-Up Headway (sec)					2.22				3.52		3.32					

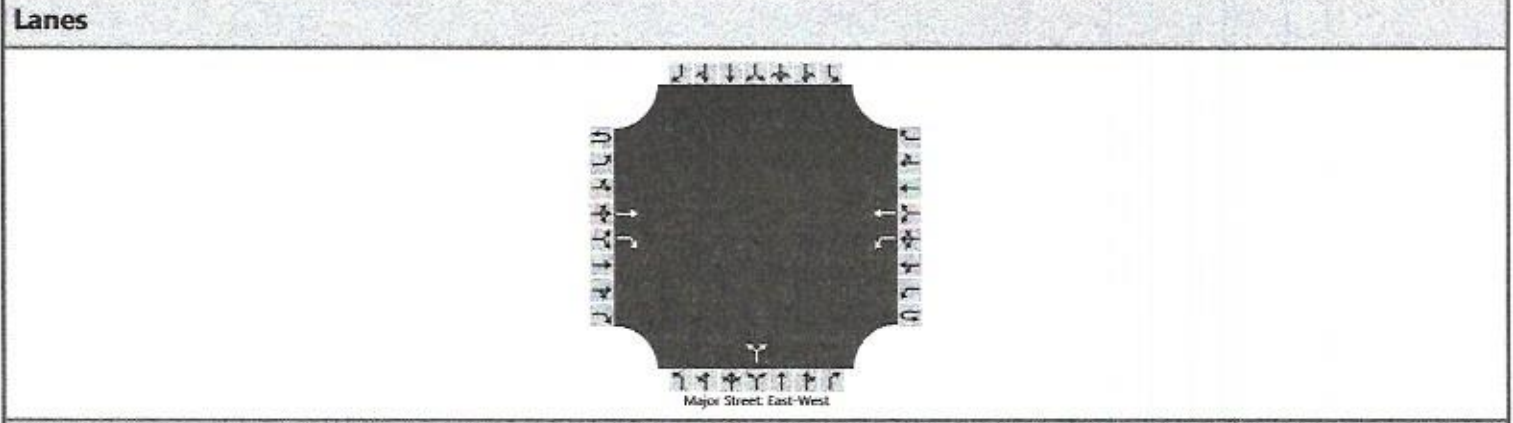
## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)					112					117						
Capacity, c (veh/h)					1018					590						
v/c Ratio					0.11					0.20						
95% Queue Length, Q <sub>95</sub> (veh)					0.4					0.7						
Control Delay (s/veh)					9.0					12.6						
Level of Service (LOS)					A					B						
Approach Delay (s/veh)					1.6				12.6							
Approach LOS									B							



# HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	MSH	Intersection	Highland Ranch/Midnight
Agency/Co.	Solaegui Engineers	Jurisdiction	Washoe County
Date Performed	8/28/2020	East/West Street	Highland Ranch Parkway
Analysis Year	2040	North/South Street	Midnight Drive
Time Analyzed	AM Base	Peak Hour Factor	0.90
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			



**Vehicle Volumes and Adjustments**

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	1	0	1	1	0		0	1	0		0	0	0
Configuration			T	R		L	T				LR					
Volume (veh/h)			470	30		100	440			30		140				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No														
Median Type   Storage		Undivided														

**Critical and Follow-up Headways**

Base Critical Headway (sec)					4.1					7.1		6.2				
Critical Headway (sec)					4.12					6.42		6.22				
Base Follow-Up Headway (sec)					2.2					3.5		3.3				
Follow-Up Headway (sec)					2.22					3.52		3.32				

**Delay, Queue Length, and Level of Service**

Flow Rate, v (veh/h)					111					189						
Capacity, c (veh/h)					1015					537						
v/c Ratio					0.11					0.35						
95% Queue Length, Q <sub>95</sub> (veh)					0.4					1.6						
Control Delay (s/veh)					9.0					15.3						
Level of Service (LOS)					A					C						
Approach Delay (s/veh)					1.7						15.3					
Approach LOS					A						C					

# HCS7 Two-Way Stop-Control Report

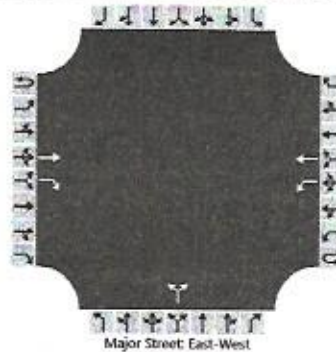
## General Information

Analyst	MSH
Agency/Co.	Solaegui Engineers
Date Performed	8/28/2020
Analysis Year	2040
Time Analyzed	PM Base
Intersection Orientation	East-West
Project Description	

## Site Information

Intersection	Highland Ranch/Midnight
Jurisdiction	Washoe County
East/West Street	Highland Ranch Parkway
North/South Street	Midnight Drive
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	1	0	1	1	0		0	1	0		0	0	0
Configuration			T	R		L	T				LR					
Volume (veh/h)			540	20		110	510			10		110				
Percent Heavy Vehicles (%)						2				2		2				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized		No														
Median Type   Storage		Undivided														

## Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.12				6.42		6.22				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.22				3.52		3.32				

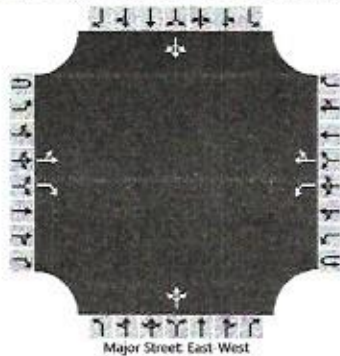
## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						120					130					
Capacity, c (veh/h)						970					556					
v/c Ratio						0.12					0.23					
95% Queue Length, Q <sub>95</sub> (veh)						0.4					0.9					
Control Delay (s/veh)						9.2					13.5					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)						1.6				13.5						
Approach LOS										B						

# HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	MSH	Intersection	Highland Ranch/Midnight
Agency/Co.	Solaegui Engineers	Jurisdiction	Washoe County
Date Performed	8/28/2020	East/West Street	Highland Ranch Parkway
Analysis Year	2020	North/South Street	Midnight Drive
Time Analyzed	AM Existing + Project	Peak Hour Factor	0.90
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6	7	8	9		10	11	12	
Priority																
Number of Lanes	0	0	1	1	0	1	1	0	0	1	0		0	1	0	
Configuration		LT		R		L		TR		LTR					LTR	
Volume (veh/h)		6	440	25		88	407	7		24	3	124		20	9	22
Percent Heavy Vehicles (%)		2				2				2	2	2		2	2	2
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No															
Median Type   Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.12				4.12				7.12	6.52	6.22		7.12	6.52	6.22
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.22				2.22				3.52	4.02	3.32		3.52	4.02	3.32

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		7				98				168					57	
Capacity, c (veh/h)		1101				1049				542					211	
v/c Ratio		0.01				0.09				0.31					0.27	
95% Queue Length, Q <sub>95</sub> (veh)		0.0				0.3				1.3					1.0	
Control Delay (s/veh)		8.3				8.8				14.6					28.3	
Level of Service (LOS)		A				A				B					D	
Approach Delay (s/veh)	0.2				1.5				14.6				28.3			
Approach LOS									B				D			

# HCS7 Two-Way Stop-Control Report

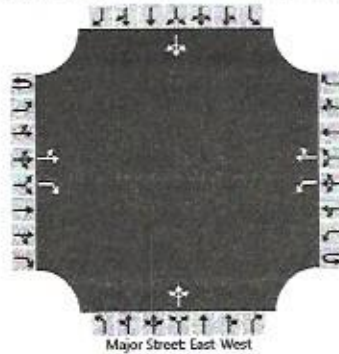
## General Information

Analyst	MSH
Agency/Co.	Solaegui Engineers
Date Performed	8/28/2020
Analysis Year	2020
Time Analyzed	PM Existing + Project
Intersection Orientation	East-West
Project Description	

## Site Information

Intersection	Highland Ranch/Midnight
Jurisdiction	Washoe County
East/West Street	Highland Ranch Parkway
North/South Street	Midnight Drive
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound				
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Priority																	
Number of Lanes	0	0	1	1	0	1	1	0		0	1	0		0	1	0	
Configuration		LT		R		L		TR			LTR				LTR		
Volume (veh/h)		22	502	17		103	478	24		8	10	100		13	5	15	
Percent Heavy Vehicles (%)		2				2				2	2	2		2	2	2	
Proportion Time Blocked																	
Percent Grade (%)										0				0			
Right Turn Channelized		No															
Median Type   Storage		Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.12				4.12				7.12	6.52	6.22		7.12	6.52	6.22
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.22				2.22				3.52	4.02	3.32		3.52	4.02	3.32

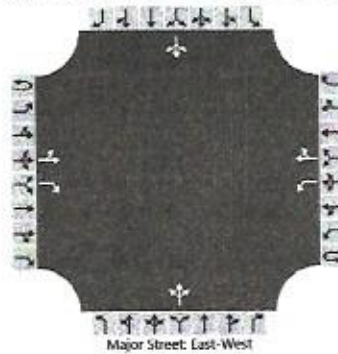
## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		24				112					128					36	
Capacity, c (veh/h)		1024				1007					635					157	
v/c Ratio		0.02				0.11					0.20					0.23	
95% Queue Length, Q <sub>95</sub> (veh)		0.1				0.4					0.8					0.8	
Control Delay (s/veh)		8.6				9.0					12.1					34.6	
Level of Service (LOS)		A				A					B					D	
Approach Delay (s/veh)		0.6				1.5				12.1				34.6			
Approach LOS		A				A				B				D			

# HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	MSH	Intersection	Highland Ranch/Midnight
Agency/Co.	Solaegui Engineers	Jurisdiction	Washoe County
Date Performed	8/28/2020	East/West Street	Highland Ranch Parkway
Analysis Year	2040	North/South Street	Midnight Drive
Time Analyzed	AM Base + Project	Peak Hour Factor	0.90
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	1	0	1	1	0		0	1	0		0	1	0
Configuration		LT		R		L		TR			LTR				LTR	
Volume (veh/h)		6	486	30		100	445	7		30	3	140		20	9	22
Percent Heavy Vehicles (%)		2				2				2	2	2		2	2	2
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No														
Median Type   Storage		Undivided														

## Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.12				4.12				7.12	6.52	6.22		7.12	6.52	6.22
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.22				2.22				3.52	4.02	3.32		3.52	4.02	3.32

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		7				111					192					57	
Capacity, c (veh/h)		1062				1000					469					160	
v/c Ratio		0.01				0.11					0.41					0.35	
95% Queue Length, Q <sub>95</sub> (veh)		0.0				0.4					2.0					1.5	
Control Delay (s/veh)		8.4				9.1					17.9					39.3	
Level of Service (LOS)		A				A					C					E	
Approach Delay (s/veh)		0.2				1.6				17.9				39.3			
Approach LOS										C				E			

# HCS7 Two-Way Stop-Control Report

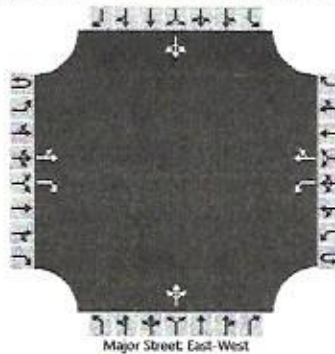
## General Information

Analyst	MSH
Agency/Co.	Solaegui Engineers
Date Performed	8/28/2020
Analysis Year	2040
Time Analyzed	PM Base + Project
Intersection Orientation	East-West
Project Description	

## Site Information

Intersection	Highland Ranch/Midnight
Jurisdiction	Washoe County
East/West Street	Highland Ranch Parkway
North/South Street	Midnight Drive
Peak Hour Factor	0.92
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	1	0	1	1	0		0	1	0		0	1	0
Configuration		LT		R		L		TR			LTR				LTR	
Volume (veh/h)		22	551	20		110	526	24		10	10	110		13	5	15
Percent Heavy Vehicles (%)		2				2				2	2	2		2	2	2
Proportion Time Blocked																
Percent Grade (%)										0				0		
Right Turn Channelized		No														
Median Type   Storage		Undivided														

## Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.12				4.12				7.12	6.52	6.22		7.12	6.52	6.22
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.22				2.22				3.52	4.02	3.32		3.52	4.02	3.32

## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		24				120					141					36
Capacity, c (veh/h)		979				960					593					121
v/c Ratio		0.02				0.12					0.24					0.30
95% Queue Length, Q <sub>95</sub> (veh)		0.1				0.4					0.9					1.1
Control Delay (s/veh)		8.8				9.3					13.0					47.0
Level of Service (LOS)		A				A					B					E
Approach Delay (s/veh)		0.6				1.5				13.0				47.0		
Approach LOS		A				A				B				E		

# HCS7 Two-Way Stop-Control Report

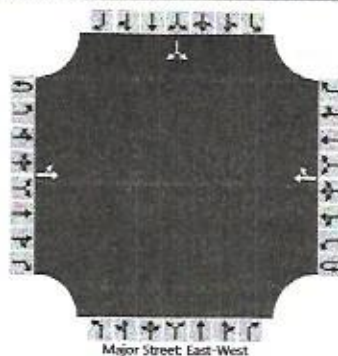
## General Information

Analyst	MSH
Agency/Co.	Solaegui Engineers
Date Performed	8/28/2020
Analysis Year	2020
Time Analyzed	AM Existing + Project
Intersection Orientation	East-West
Project Description	

## Site Information

Intersection	Highland Ranch/West Acces
Jurisdiction	Washoe County
East/West Street	Highland Ranch Parkway
North/South Street	West Access
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		20	455				448	5						16		56
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type   Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)	4.1													7.1		6.2
Critical Headway (sec)	4.12													6.42		6.22
Base Follow-Up Headway (sec)	2.2													3.5		3.3
Follow-Up Headway (sec)	2.22													3.52		3.32

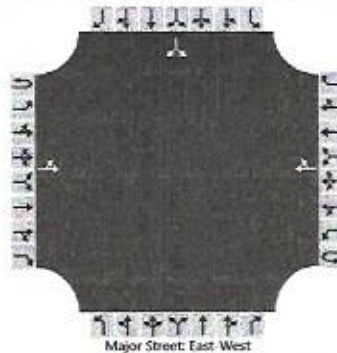
## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)	22															80
Capacity, c (veh/h)	1061															440
v/c Ratio	0.02															0.18
95% Queue Length, Q <sub>95</sub> (veh)	0.1															0.7
Control Delay (s/veh)	8.5															15.0
Level of Service (LOS)	A															B
Approach Delay (s/veh)	0.6															
Approach LOS	B															

# HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	MSH	Intersection	Highland Ranch/West Acces
Agency/Co.	Solaegui Engineers	Jurisdiction	Washoe County
Date Performed	8/28/2020	East/West Street	Highland Ranch Parkway
Analysis Year	2020	North/South Street	West Access
Time Analyzed	PM Existing + Project	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			

## Lanes



## Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		66	530				485	16						11		38
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type   Storage	Undivided															

## Critical and Follow-up Headways

Base Critical Headway (sec)	4.1													7.1		6.2
Critical Headway (sec)	4.12													6.42		6.22
Base Follow-Up Headway (sec)	2.2													3.5		3.3
Follow-Up Headway (sec)	2.22													3.52		3.32

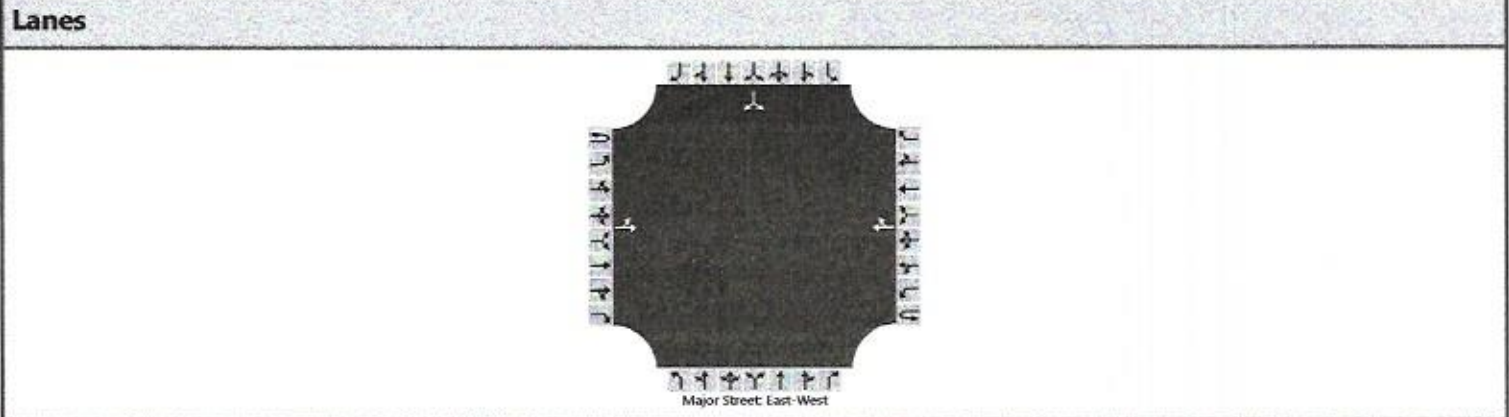
## Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)	72															53
Capacity, c (veh/h)	1024															364
v/c Ratio	0.07															0.15
95% Queue Length, Q <sub>95</sub> (veh)	0.2															0.5
Control Delay (s/veh)	8.8															16.6
Level of Service (LOS)	A															C
Approach Delay (s/veh)	1.8												16.6			
Approach LOS	A												C			



# HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	MSH	Intersection	Highland Ranch/West Acces
Agency/Co.	Solaegui Engineers	Jurisdiction	Washoe County
Date Performed	8/28/2020	East/West Street	Highland Ranch Parkway
Analysis Year	2040	North/South Street	West Access
Time Analyzed	AM Base + Project	Peak Hour Factor	0.90
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			



**Vehicle Volumes and Adjustments**

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		20	506				492	5						16		56
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type   Storage	Undivided															

**Critical and Follow-up Headways**

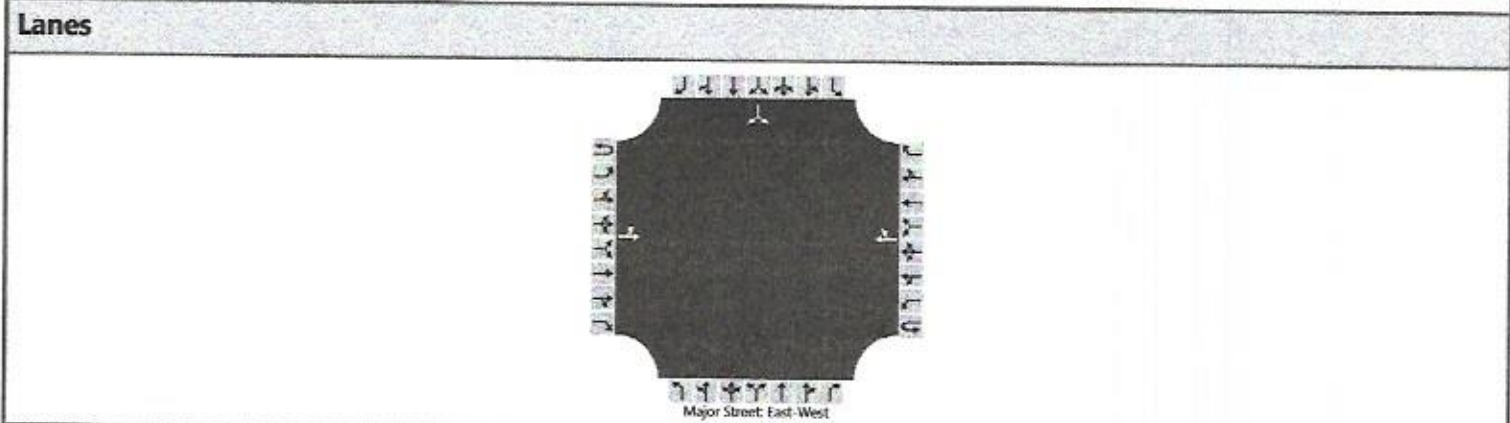
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

**Delay, Queue Length, and Level of Service**

Flow Rate, v (veh/h)		22														80	
Capacity, c (veh/h)		1018														398	
v/c Ratio		0.02														0.20	
95% Queue Length, Q <sub>95</sub> (veh)		0.1														0.7	
Control Delay (s/veh)		8.6														16.3	
Level of Service (LOS)		A														C	
Approach Delay (s/veh)		0.6												16.3			
Approach LOS														C			

# HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	MSH	Intersection	Highland Ranch/West Acces
Agency/Co.	Solaegui Engineers	Jurisdiction	Washoe County
Date Performed	8/28/2020	East/West Street	Highland Ranch Parkway
Analysis Year	2040	North/South Street	West Access
Time Analyzed	PM Base + Project	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			



**Vehicle Volumes and Adjustments**

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		66	582				535	16						11		38
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)														0		
Right Turn Channelized																
Median Type   Storage		Undivided														

**Critical and Follow-up Headways**

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

**Delay, Queue Length, and Level of Service**

Flow Rate, v (veh/h)		72														53	
Capacity, c (veh/h)		978														324	
v/c Ratio		0.07														0.16	
95% Queue Length, Q <sub>95</sub> (veh)		0.2														0.6	
Control Delay (s/veh)		9.0														18.3	
Level of Service (LOS)		A														C	
Approach Delay (s/veh)		1.8												18.3			
Approach LOS														C			

**PRELIMINARY  
HYDROLOGIC AND HYDRAULIC  
ANALYSIS REPORT**

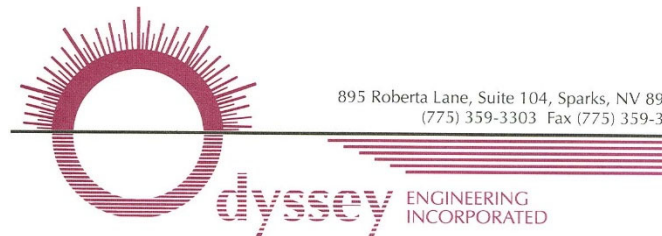
**FOR**

**HIGHLANDS VILLAGE SUBDIVISION**

**PREPARED FOR:**

Washoe County Community Services Department  
Planning and Building  
1001 E. Ninth St., Bldg. A  
Reno, Nevada 89512-2845

**PREPARED BY:**



**Odyssey Engineering Incorporated**  
**895 Roberta Lane, Suite 104**  
**Reno, Nevada 89431**  
**(775) 359-3303**

September 2020

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## APPENDICES

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## **1      INTRODUCTION**

The following report represents the preliminary hydrologic and hydraulic analysis for the Highlands Village Subdivision project, which is located north of Highland Ranch Parkway, east of Stone Creek Subdivision, and south of Apple Blossom Drive. The proposed subdivision is a project that includes 216 single-family units, common areas, public roadways, and a detention basin. The project limits are currently within two different parcels, which those Accessor Parcel Numbers are 508-020-43 and 508-020-41. Reference the Vicinity Map (Figure 1).

The proposed Highlands Village is located within the Southeastern 1/4 of Section 9, Township 20 North, and Range 20 East. The site is undeveloped ground with native shrubs and grasses. The majority of the topography consists of slopes from north to southeast, ranging from 0% to 36%, with the majority of the water draining to the southeast corner into an existing storm drain channel and through two existing culverts and underneath Highland Ranch Parkway.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community-Panel Number 32031C3032G dated March 16, 2009, the subject property is in Unshaded Zone X. Unshaded Zone X is an area determined to be outside the 100-year floodplain. Reference FEMA panel in Appendix A.

The purpose of this preliminary report is to analyze the existing and proposed conditions of the subject property based on the 5-year and 100-year peak flow events.

## **2      METHODOLOGY**

### **2.1      HYDROLOGIC ANALYSIS METHOD**

Hydrologic analyses were performed to determine the peak discharge for the 5-year and 100-year peak flow events. *AutoDesk Storm and Sanitary Analysis (SSA)* and Truckee Meadows Regional Drainage Manual (TMRDM) was used to perform a *Rational Method* analysis to model the hydrologic basins that contribute in

the existing and proposed conditions.

The runoff coefficients were obtained from the TMRDM (Reference Appendix A). The resulting Rational Method developed flows determined from the above information was used to determine the proposed detention, retention, and the associated conveyances.

The rainfall characteristics were modeled using TMRDM and NOAA Atlas 14, Volume 1, Version 5 Point Precipitation Estimates and use for the rainfall data to determine site specific precipitation intensity (Appendix A).

## **2.2 HYDRAULIC ANALYSIS METHODS**

Hydraulic analyses were performed using the associated hydrologic data to provide the estimates of the elevation of floods for the selected recurrence intervals. Water-surface elevations were computed in SSA using hydrodynamic routing. Hydrodynamic routing solves the complete Saint Venant equations throughout the drainage network and includes modeling of backwater effects, flow reversal, surcharging, looped connections, pressure flow, and interconnected ponds. Hydrodynamic routing provides a formulation for the existing drainages and the associated detention created by the proposed mass grading, channels and culverts, including translation and attenuation effects.

## **3 EXISTING CONDITIONS HYDROLOGY**

For the existing catchment a Time of Concentration was calculated using Equation 704 in the TMRDM and using the Rational Method, a Runoff Coefficient was selected based on the associated soil properties and TMRDM (Appendix A), taking into consideration the catchment characteristics, which include catchment area, slope and length of the longest channel, watershed boundaries, urbanization, and land cover. Table 1 and Figure 2 summarize the characteristics of the catchment in the study area.

**Table 1 – Existing Conditions Model Summary for the Highlands Village Subdivision.**

<b>Sub-Basin</b>	<b>Area (Ac.)</b>	<b>Runoff Coefficient (5-Year/100-Year)</b>	<b>Time of Concentration (Mins)</b>	<b>5-Year Peak Flows (cfs)</b>	<b>100-Year Peak Flows (cfs)</b>
BASIN -A	39.42	0.20/0.50	13.92	9.64	61.21
BASIN - B	84.45	0.20/0.50	17.07	18.53	117.67
<b>TOTAL</b>	<b>123.87</b>	-----	-----	----	-----

The total 5-year and 100-year peak flows in the existing conditions are 44.43 cfs and 111.06 cfs, respectively. The flows are discharged towards the existing storm drain culverts, which are located in the southeast corner of the site, then continue south underneath Highland Ranch Parkway. There is one existing point of discharge located north of Highland Ranch Parkway in the southeast corner of the project limits (Figure 2). Reference Appendix B for existing hydrology data.

#### **4 PROPOSED CONDITIONS HYDROLOGY AND HYDRAULICS**

##### **4.1 PROPOSED HYDROLOGY**

The proposed subdivision project has discharge values of the proposed sub-basins (Table 2) which will be directed through the proposed storm drain system, existing ephemeral drainages, engineered channels, the proposed detention facility, and the associated outlet structures.

There are thirty-one on-site proposed development sub-basins within the development area (Figures 3). The sub-areas took into account the proposed on- and off-site flows that affect the site. The calculated 5-year and 100-year peak flows can be found in Table 2. The proposed storm drain system and engineered detention basin will route and attenuate flows to the point of discharge in the southeast corner of the site (Figure 3). Refer to Appendix C, Hydrologic Analysis, for all data and supporting calculations using the Rational Method.

**Table 2 – Proposed Model Summary for the Highlands Village Subdivision.**

<b>Sub-Basin</b>	<b>Area (Ac.)</b>	<b>Runoff Coefficient (5-Year/100-Year)</b>	<b>Time of Concentration (Mins)</b>	<b>5-Year Peak Flows (cfs)</b>	<b>100-Year Peak Flows (cfs)</b>
SUB-01	1.68	0.45/0.60	10.00	2.74	3.65
SUB -02	0.93	0.45/0.60	10.00	1.51	2.02
SUB -03	3.07	0.20/0.50	10.00	5.01	5.56
SUB -04	1.29	0.45/0.60	10.00	2.10	2.80
SUB -05	0.51	0.45/0.60	10.00	0.83	1.11
SUB -06	1.48	0.45/0.60	10.00	2.42	3.22
SUB -07	1.52	0.45/0.60	10.00	2.47	3.29
SUB -08	0.66	0.45/0.60	10.00	1.08	1.44
SUB -09	0.71	0.45/0.60	10.00	1.16	1.54
SUB -10	0.12	0.45/0.60	10.00	0.20	0.26
SUB -11	1.87	0.45/0.60	10.00	3.05	4.06
SUB -12	3.49	0.45/0.60	10.00	5.69	7.59
SUB -13	0.91	0.45/0.60	10.00	1.49	1.99
SUB -14	0.60	0.45/0.60	10.00	0.98	1.30
SUB -15	0.54	0.45/0.60	10.00	0.88	1.18
SUB -16	0.92	0.45/0.60	10.00	1.50	2.00
SUB -17	79.51	0.20/0.50	17.07	44.32	110.79
SUB -18	4.09	0.45/0.60	10.00	6.66	8.88
SUB -19	3.46	0.45/0.60	10.00	5.64	7.52
SUB -20	1.25	0.45/0.60	10.00	2.04	2.72
SUB -21	2.02	0.45/0.60	10.00	3.29	4.39



<b>Sub-Basin</b>	<b>Area (Ac.)</b>	<b>Runoff Coefficient (5-Year/100-Year)</b>	<b>Time of Concentration (Mins)</b>	<b>5-Year Peak Flows (cfs)</b>	<b>100-Year Peak Flows (cfs)</b>
SUB -22	2.26	0.45/0.60	10.00	3.68	4.90
SUB -23	0.79	0.45/0.60	10.00	1.28	1.71
SUB -24	0.41	0.45/0.60	10.00	0.67	0.89
SUB -25	2.02	0.45/0.60	10.00	3.29	4.38
SUB -26	0.09	0.45/0.60	10.00	0.15	0.20
SUB -27	0.83	0.45/0.60	10.00	1.35	1.80
SUB -28	1.46	0.45/0.60	10.00	2.37	3.16
SUB -29	2.76	0.45/0.60	10.00	4.50	6.01
SUB -30	2.64	0.45/0.60	10.00	4.30	5.74
SUB -31	2.11	0.20/0.50	10.00	1.53	3.82
<b>TOTAL</b>	<b>126.00</b>	-----	-----	----	----

#### 4.2 DETENTION

The proposed detention basin is approximately 8 feet deep with an overall detention capacity of 2.15 ac-ft. During 100-year peak flow event, the proposed detention facility will have a peak flow of 166.66 cfs and will discharge 75.09 cfs with a freeboard of 1 foot. Reference Appendix D for detention basin calculations.

### 5 CONCLUSIONS

The proposed improvements and the analyses presented herein are in accordance with drainage regulations presented in Chapter II – Storm Drainage, in conjunction with the *Truckee Meadows Regional Drainage Manual (TMRDM, April 30, 2009)*.

This analysis is a preliminary hydrologic analysis to provide an overview of the proposed development. A comprehensive hydrologic and hydraulic analysis will be completed once the civil improvements have been completed. However, this preliminary analysis determined that the proposed project improvements,

roadways, and storm water conveyance facilities, once constructed, will not adversely impact upstream or downstream properties adjacent to this site. The proposed improvements will improve drainage since there will be a decrease in the 100-year peak flow towards the existing storm drain culverts crossing underneath Highland Ranch Parkway.



## **APPENDIX A**

**NOTES TO USERS**

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was State Plane Nevada West FIPS Zone 2703. The **horizontal datum** was NAD 83, GRS80. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NGS Information Services  
NOAA, NNGS12  
National Geodetic Survey  
SSMC-3, #9202  
1315 East-West Highway  
Silver Spring, Maryland 20910-3282  
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

**Base map** road centerline information shown on this FIRM was provided by the Washoe County GIS Program. This data, dated 2005 or later, was provided in digital format, at a scale of 1:1,200 in urban areas and 1:2,400 in rural areas.

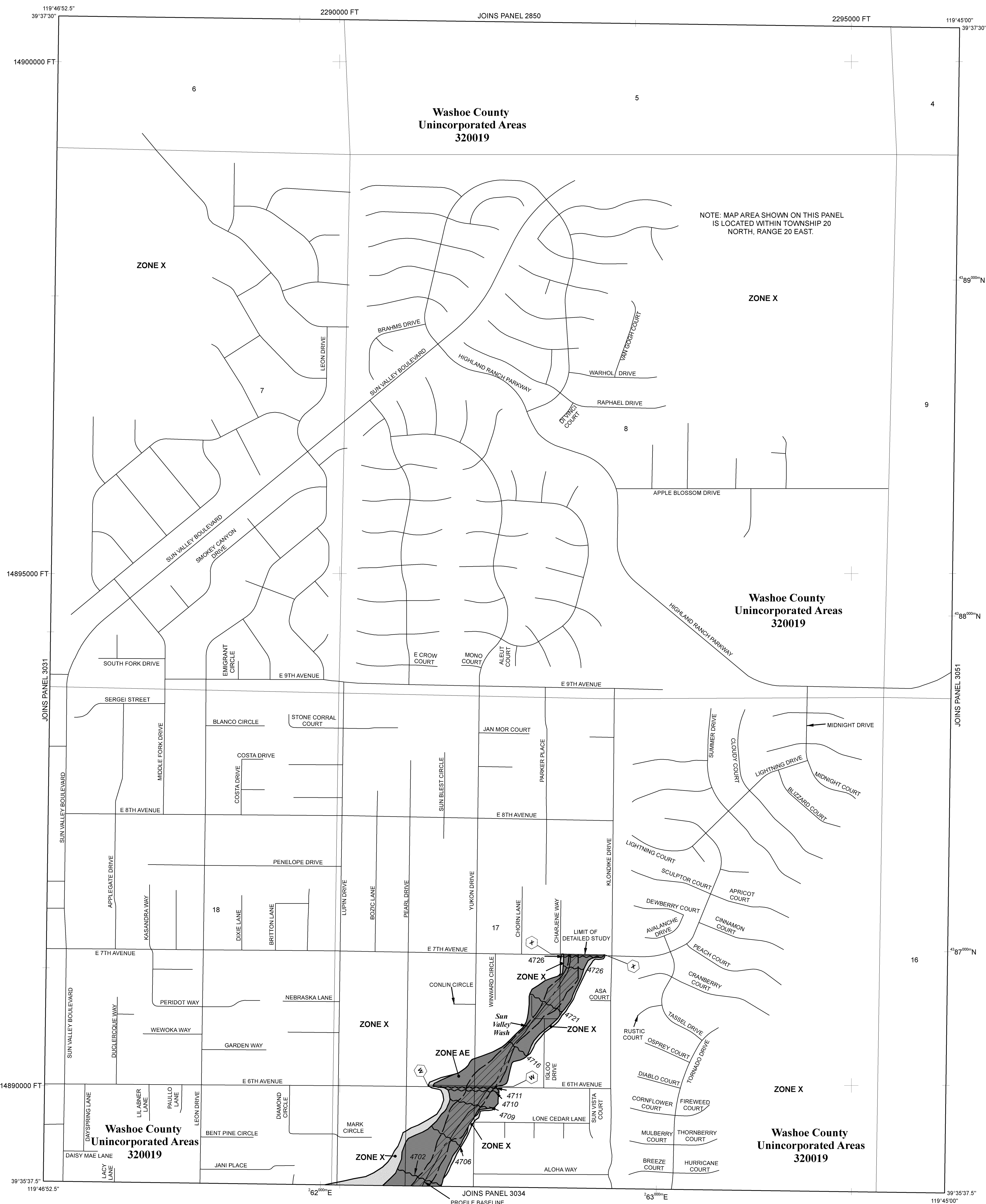
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at <http://msc.fema.gov>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov>.



**LEGEND**

**SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- ZONE A** No Base Flood Elevations determined.
- ZONE AE** Base Flood Elevations determined.
- ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

**FLOODWAY AREAS IN ZONE AE**  
The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

**OTHER FLOOD AREAS**  
**ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

**OTHER AREAS**  
**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.  
**ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**  
**OTHERWISE PROTECTED AREAS (OPAs)**  
CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

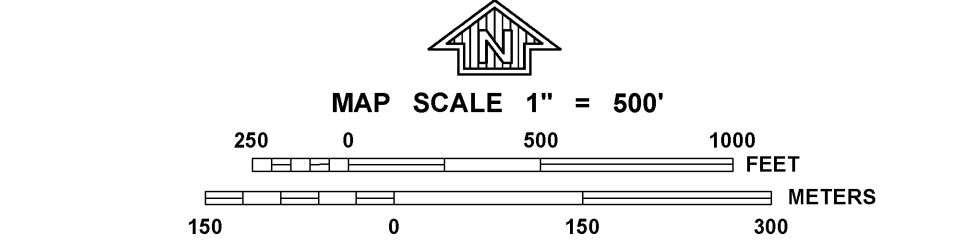
- Floodplain boundary
- Floodway boundary
- - - Zone D boundary
- ..... CBRS and OPA boundary
- ..... Boundary dividing Special Flood Hazard Area zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 Base Flood Elevation line and value; elevation in feet\* (EL. 987)
- Base Flood Elevation value where uniform within zone; elevation in feet\*

- \* Referenced to the North American Vertical Datum of 1988
- A Cross section line
- Transsect line
- 87°07'45", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 76°00'N 1000-meter Universal Transverse Mercator grid values, zone 11
- 600000 FT 5000-foot grid ticks: Nevada State Plane coordinate system, West zone (FIPSZONE 2703), Transverse Mercator projection
- DX5510 x Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 River Mile

**MAP REPOSITORY**  
Refer to listing of Map Repositories on Map Index  
**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
September 30, 1994

**EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL**  
January 19, 2001 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to add roads and road names, and to incorporate previously issued Letters of Map Revision.  
March 18, 2009 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.  
To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.



PANEL 3032G

**FIRM**  
**FLOOD INSURANCE RATE MAP**

**WASHOE COUNTY, NEVADA AND INCORPORATED AREAS**  
**PANEL 3032 OF 3475**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:	COMMUNITY	NUMBER	PANEL	SUFFIX
	WASHOE COUNTY	320019	3032	G

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**  
32031C3032G  
**MAP REVISED**  
MARCH 16, 2009  
Federal Emergency Management Agency



**NOAA Atlas 14, Volume 1, Version 5**  
**Location name: Sun Valley, Nevada, USA\***  
**Latitude: 39.61°, Longitude: -119.7572°**  
**Elevation: 4850.52 ft\*\***



\* source: ESRI Maps  
 \*\* source: USGS

**POINT PRECIPITATION FREQUENCY ESTIMATES**

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps & aerials](#)

**PF tabular**

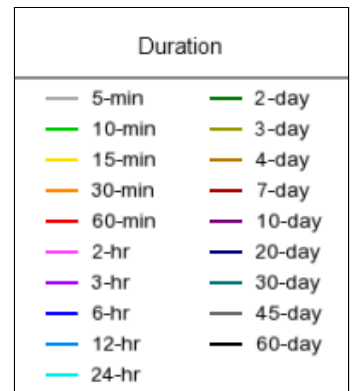
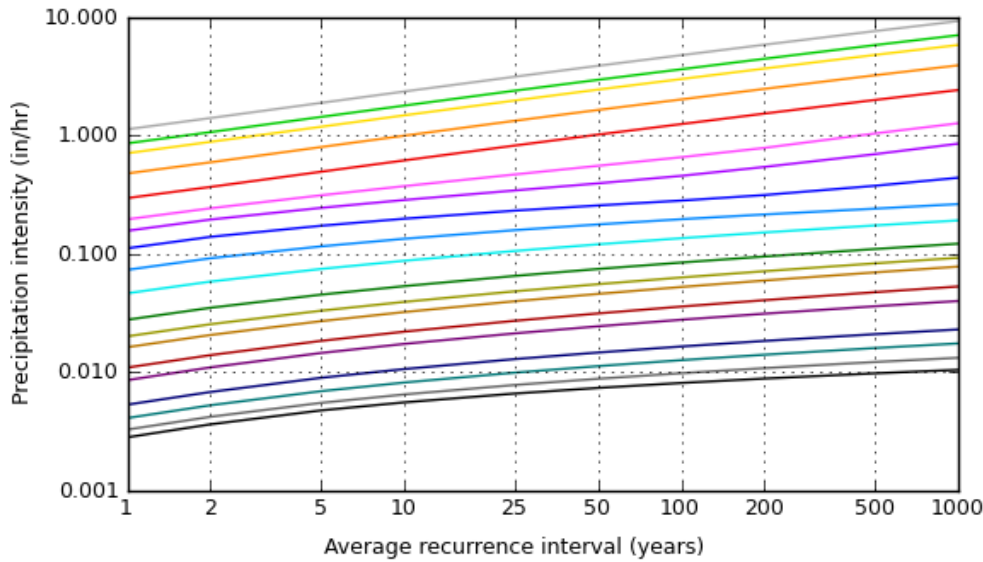
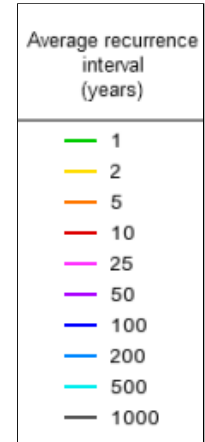
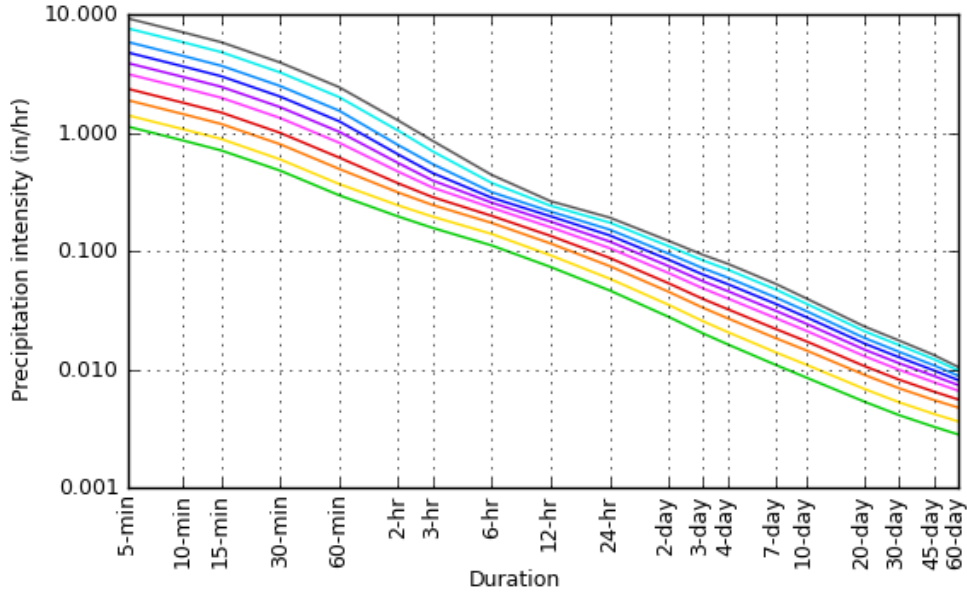
<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)<sup>1</sup></b>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.13 (0.960-1.30)	1.40 (1.19-1.64)	1.88 (1.60-2.22)	2.35 (1.98-2.80)	3.13 (2.59-3.78)	3.88 (3.11-4.73)	4.76 (3.71-5.92)	5.84 (4.37-7.42)	7.61 (5.38-10.0)	9.24 (6.25-12.4)
10-min	0.858 (0.726-0.990)	1.07 (0.900-1.25)	1.43 (1.22-1.69)	1.79 (1.51-2.12)	2.39 (1.97-2.87)	2.95 (2.37-3.61)	3.62 (2.82-4.50)	4.45 (3.33-5.65)	5.80 (4.09-7.61)	7.03 (4.76-9.46)
15-min	0.708 (0.596-0.816)	0.884 (0.744-1.03)	1.18 (1.00-1.40)	1.48 (1.25-1.76)	1.97 (1.63-2.38)	2.44 (1.96-2.98)	3.00 (2.33-3.72)	3.68 (2.75-4.67)	4.79 (3.38-6.29)	5.81 (3.93-7.82)
30-min	0.478 (0.404-0.550)	0.594 (0.502-0.696)	0.798 (0.678-0.942)	0.996 (0.840-1.18)	1.33 (1.10-1.60)	1.64 (1.32-2.00)	2.02 (1.57-2.50)	2.48 (1.85-3.14)	3.22 (2.28-4.24)	3.91 (2.65-5.26)
60-min	0.296 (0.249-0.341)	0.368 (0.310-0.430)	0.494 (0.419-0.583)	0.616 (0.520-0.731)	0.822 (0.680-0.990)	1.02 (0.816-1.24)	1.25 (0.971-1.55)	1.53 (1.15-1.95)	2.00 (1.41-2.62)	2.42 (1.64-3.26)
2-hr	0.196 (0.174-0.226)	0.243 (0.216-0.280)	0.312 (0.274-0.361)	0.374 (0.324-0.431)	0.468 (0.394-0.546)	0.554 (0.456-0.654)	0.656 (0.524-0.784)	0.786 (0.608-0.982)	1.04 (0.755-1.32)	1.27 (0.888-1.65)
3-hr	0.157 (0.141-0.178)	0.195 (0.176-0.222)	0.245 (0.219-0.278)	0.285 (0.252-0.325)	0.343 (0.299-0.393)	0.394 (0.337-0.457)	0.456 (0.382-0.536)	0.543 (0.444-0.661)	0.695 (0.551-0.890)	0.853 (0.646-1.11)
6-hr	0.112 (0.100-0.125)	0.139 (0.125-0.157)	0.173 (0.155-0.195)	0.198 (0.177-0.224)	0.232 (0.204-0.263)	0.257 (0.222-0.293)	0.282 (0.241-0.326)	0.314 (0.264-0.368)	0.376 (0.308-0.450)	0.440 (0.355-0.560)
12-hr	0.073 (0.066-0.082)	0.092 (0.083-0.103)	0.116 (0.104-0.130)	0.134 (0.119-0.150)	0.159 (0.139-0.179)	0.177 (0.154-0.202)	0.196 (0.168-0.226)	0.215 (0.181-0.251)	0.241 (0.197-0.287)	0.264 (0.211-0.319)
24-hr	0.047 (0.042-0.052)	0.058 (0.053-0.066)	0.075 (0.067-0.084)	0.088 (0.078-0.098)	0.106 (0.094-0.119)	0.120 (0.106-0.136)	0.136 (0.119-0.154)	0.152 (0.131-0.173)	0.174 (0.148-0.200)	0.192 (0.160-0.222)
2-day	0.028 (0.025-0.031)	0.035 (0.031-0.040)	0.045 (0.040-0.051)	0.053 (0.047-0.060)	0.065 (0.057-0.074)	0.075 (0.065-0.085)	0.085 (0.073-0.097)	0.095 (0.081-0.110)	0.110 (0.091-0.129)	0.122 (0.099-0.145)
3-day	0.020 (0.018-0.023)	0.026 (0.023-0.029)	0.033 (0.029-0.038)	0.039 (0.035-0.045)	0.048 (0.042-0.055)	0.056 (0.048-0.063)	0.063 (0.054-0.073)	0.071 (0.060-0.083)	0.083 (0.069-0.097)	0.093 (0.075-0.110)
4-day	0.016 (0.014-0.019)	0.021 (0.018-0.024)	0.027 (0.024-0.031)	0.032 (0.028-0.037)	0.040 (0.035-0.045)	0.046 (0.040-0.053)	0.053 (0.045-0.060)	0.060 (0.050-0.069)	0.070 (0.058-0.082)	0.078 (0.063-0.092)
7-day	0.011 (0.010-0.013)	0.014 (0.012-0.016)	0.018 (0.016-0.021)	0.022 (0.019-0.025)	0.027 (0.023-0.032)	0.031 (0.027-0.036)	0.036 (0.030-0.042)	0.041 (0.034-0.048)	0.048 (0.039-0.057)	0.053 (0.043-0.064)
10-day	0.009 (0.008-0.010)	0.011 (0.010-0.013)	0.015 (0.013-0.017)	0.017 (0.015-0.020)	0.021 (0.018-0.025)	0.024 (0.021-0.028)	0.028 (0.024-0.032)	0.031 (0.026-0.037)	0.036 (0.030-0.043)	0.040 (0.033-0.048)
20-day	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.011 (0.009-0.012)	0.013 (0.011-0.015)	0.015 (0.013-0.017)	0.017 (0.014-0.019)	0.018 (0.016-0.021)	0.021 (0.017-0.025)	0.023 (0.019-0.027)
30-day	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.015)	0.014 (0.012-0.016)	0.016 (0.013-0.019)	0.018 (0.014-0.021)
45-day	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.006-0.007)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.008-0.011)	0.011 (0.009-0.012)	0.012 (0.010-0.014)	0.013 (0.011-0.015)
60-day	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.005 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.006-0.008)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.008-0.011)	0.011 (0.009-0.012)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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**PF graphical**

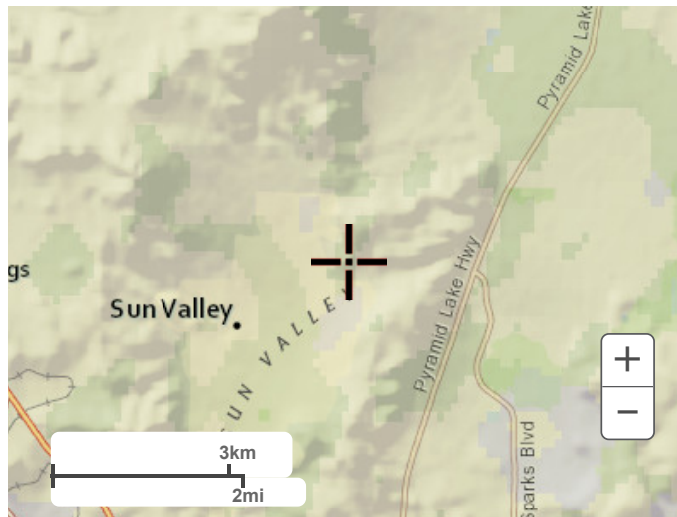
PDS-based intensity-duration-frequency (IDF) curves  
Latitude: 39.6100°, Longitude: -119.7572°



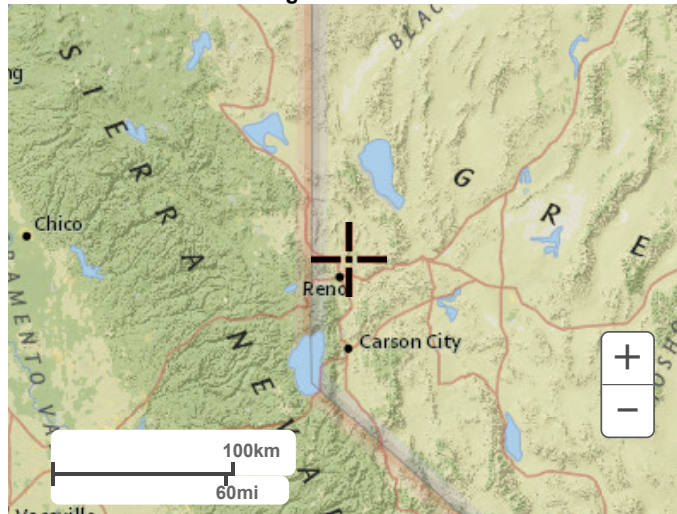
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### Maps & aerials

Small scale terrain



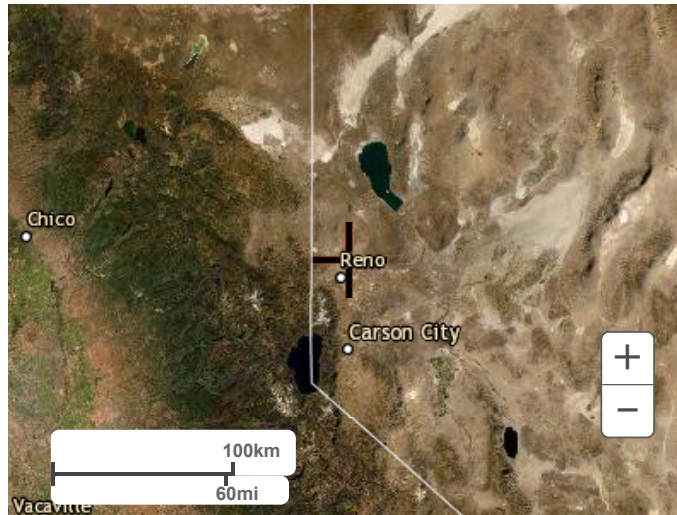
Large scale terrain



Large scale map



Large scale aerial



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Engineering Handbook, Section 4 (SCS, 1985). The antecedent moisture condition of the watershed is explained as follows:

The amount of rainfall in a period of 5 to 30 days preceding a particular storm is referred to as antecedent rainfall, and the resulting condition of the watershed in regard to potential runoff is referred to as an antecedent moisture condition. In general, the heavier the antecedent rainfall, the greater the direct runoff that occurs from a given storm. The effects of infiltration and evapotranspiration during the antecedent period are also important, as they may increase or lessen the effect of antecedent rainfall. Because of the difficulties of determining antecedent storm conditions from data normally available, the conditions are reduced to three cases, AMC-I, AMC-II and AMC-III.

**For the Washoe County area, an AMC-II condition shall be used for determining storm runoff.**

Having determined the soil group, land use and treatment class and the antecedent moisture condition, CN values can be determined from Table 702.

There will be areas to which the values in Table 702 do not apply. The percentage of impervious area for the various types of residential areas or the land use condition for the pervious portions may vary from the conditions assumed in Table 702. A curve for each pervious CN can be developed to determine the composite CN for any density of impervious area. Figure 702 has been developed assuming a CN of 98 for the impervious area. The curves in Figure 702 can help in estimating the increase in runoff as more land within a given area is covered with impervious material.

There are a number of methods available for computing the percentage of impervious area in a watershed. Some methods include using U.S. Geological Survey topographic maps, land use maps, aerial photographs, and field reconnaissance. Care must be exercised when using methods based on such parameters as population density, street density, and age of the development as a means of determining the percentage of impervious area. The available data on runoff from urban areas are not yet sufficient to validate widespread use of these methods. Therefore, the CN to be used in the Washoe County area shall be based on Table 702 or Figure 702 in this Manual. A CN computation example is included in Section 711.

## 704 RATIONAL FORMULA METHOD

For drainage basins that are not complex and have small drainage areas, the design storm runoff may be analyzed using the Rational Formula Method in accordance with Section 304.3. This method was introduced in 1889 and is still being used in many engineering offices in the United States. Even though this method has frequently come under academic criticism for its simplicity, no other practical drainage design method has evolved to such a level of general acceptance by practicing engineers. The Rational Formula Method, when properly understood and applied, can produce satisfactory results for determining peak discharge.

### 704.1 METHODOLOGY

The Rational Formula Method is based on the formula:

$$Q = CIA \tag{708}$$

Q is defined as the maximum rate of runoff in cubic feet per second (actually, Q has units of acre inches per hour, which is approximately equal to the units of cubic feet per second). C is a runoff coefficient and represents the runoff-producing conditions of the subject land area (see Section 704.5).

I is the average intensity of rainfall in inches per hour for a duration equal to the time of concentration.  
A is the contributing basin area in acres.

#### **704.2 ASSUMPTIONS**

The basic assumptions made when applying the Rational Formula Method are as follows:

1. The computed maximum rate of runoff to the design point is a function of the average rainfall rate during the time of concentration to that point.
2. The maximum rate of rainfall occurs during the time of concentration, and the design rainfall depth during the time of concentration is converted to the average rainfall intensity for the time of concentration.
3. The maximum runoff rate occurs when the entire area is contributing flow. However, this assumption has been modified from time to time when local rainfall/runoff data was used to improve calculated results.

#### **704.3 LIMITATIONS ON METHODOLOGY**

The Rational Formula Method adequately approximates the peak rate of runoff from a rainstorm in a given basin. The critics of the method usually are unsatisfied with the fact that the answers are only approximations. A shortcoming of the Rational Formula Method is that only one point on the runoff hydrograph is computed (the peak runoff rate).

Another disadvantage of the Rational Formula Method is that with typical design procedures one normally assumes that all of the design flow is collected at the design point and that there is no "carry over water" running overland to the next design point. However, this is not the fault of the Rational Formula Method, but of the design procedure. The problem becomes one of routing the surface and subsurface hydrographs which have been separated by the storm sewer system. In general, this sophistication is not warranted and a conservative assumption is made wherein the entire routing occurs through the storm sewer system when this system is present.

#### **704.4 RAINFALL INTENSITY**

The rainfall intensity, I, is the average rainfall rate in inches per hour for the period of maximum rainfall of a given frequency having a duration equal to the time of concentration. After the design storm frequency has been selected, a graph should be prepared showing rainfall intensity versus time. Information on local rainfall data is presented in Section 600 of this Manual.

#### **704.5 RUNOFF COEFFICIENT**

The runoff coefficient, C, represents the integrated effects of infiltration, evaporation, retention, flow routing, and interception, all which affect the time distribution and peak rate of runoff. Determination of the coefficient requires judgment and understanding on the part of the engineer. Table 701 presents the recommended values of C for the various recurrence frequency storms. The values are presented for different surface characteristics as well as for different aggregate land uses. Variations to these values are subject to the approval of the Jurisdictional Entity.

A composite runoff coefficient is computed on the basis of the percentage of different types of surfaces in the drainage area. For homogeneous developed areas, this procedure is often applied to a typical "sample" area as a guide to selection of reasonable values of the coefficient for an entire area. Suggested coefficients with respect to surface type are also given in Table 701 under the column

labeled "Percent Impervious". Where land use features are mixed, a composite C analysis will result in more accurate results. The runoff coefficients in Table 701 also vary with recurrence frequency.

#### **704.6 APPLICATION OF THE RATIONAL FORMULA METHOD**

The first step in applying the Rational Formula Method is to obtain a topographic map and define the boundaries of all the relevant drainage basins. Basins to be defined include all basins tributary to the area of study and sub-basins within the study area. A field check and possibly field surveys should be made for each basin. At this stage of planning, the possibility for the diversion of transbasin waters should be identified.

The major storm drainage basin does not always coincide with the minor storm drainage basin. This is often the case in urban areas where a low flow will stay next to a curb and follow the lowest grade, but when a large flow occurs the water will be deep enough so that part of the water will overflow street crowns and flow into a new sub-basin. An example of how to apply the Rational Formula Method is presented in Section 711.

#### **704.7 MAJOR STORM ANALYSIS**

When analyzing the major runoff occurring within an area that has a storm sewer system sized for the minor storm, care must be used when applying the Rational Formula Method. Normal application of the Rational Method assumes that all of the runoff is collected by the storm sewer. For the minor storm design, the time of concentration is dependent upon the flow time in the sewer. However, during the major storm runoff, the sewers will probably be at capacity and would not carry the additional water flowing to the inlets. This additional water then flows overland past the inlets, generally at a lower velocity than the flow in the storm sewers.

If a separate time of concentration analysis is made for the pipe flow and surface flow, a time lag between the surface flow peak and the pipe flow peak will occur. This lag, in effect, will allow the pipe to carry a larger portion of the major storm runoff than would be predicted using the minor storm time of concentration. The basis for this increased benefit is that the excess water from one inlet will flow to the next inlet downhill, using the overland route. If that inlet is also at capacity, the water will often continue on until capacity is available in the storm sewer. The analysis of this aspect of the interaction between the storm sewer system and the major storm runoff is complex. The simplified approach of using the minor storm time of concentration for all frequency analysis is acceptable for use in Washoe County.

### **705 SCS UNIT HYDROGRAPH METHOD**

The SCS Unit Hydrograph method was developed for the SCS by Mr. Victor Mockus. The SCS Unit Hydrograph was derived from a large number of natural unit hydrographs from watersheds varying widely in size and geographic location. The SCS Unit Hydrograph has been in use for many years and has produced satisfactory results for many applications. This method may be used for drainage areas within the Washoe County area in accordance with Section 304.3.

#### **705.1 METHODOLOGY**

The SCS Unit Hydrograph method uses the unit hydrograph theory as a basis for runoff computations. The unit hydrograph theory computes rainfall excess hydrographs for a unit amount of rainfall excess applied uniformly over a sub-basin for a given unit of time (or unit duration). The rainfall excess hydrographs are then transformed to a sub-basin hydrograph by superimposing each excess hydrograph lagged by the unit duration.

## SECTION 700

### STORM RUNOFF

#### 701 INTRODUCTION

For the area within the jurisdiction of this Manual, two deterministic hydrological models can be used to predict storm runoff (Policy Section 304). These models are the Rational Formula Method and the Soil Conservation Service, U.S. Department of Agriculture (SCS) Unit Hydrograph method. The procedures for using these methods are presented in this section. The Rational Formula Method may be employed without the use of computers. Computer modeling using the U.S. Army Corps of Engineers HEC-1 or HEC-HMS Flood Hydrograph Package or other hydrologic computer modeling programs is required for the SCS method. For certain circumstances, where adequate recorded stream flow data are available and the drainage area is large (> 10 square miles), a statistical analysis may be required to predict the storm runoff peaks or for calibration of deterministic models (see Section 708).

##### 701.1 BASIN CHARACTERISTICS

The basin characteristics needed for the subject runoff computation methods include the drainage area, soil type, the various flow path lengths, slopes, and characteristics (i.e., overland, grassed channel, gutter) and land use types. The drainage basin boundary and area may be determined from available topographic maps or site-specific mapping depending upon the level of detail required. A field investigation is recommended to verify drainage boundaries. The land use and flow path characteristics can be obtained from zoning maps, aerial photographs, field investigations, or detailed topographic maps.

#### 702 TIME OF CONCENTRATION

The definition of the time of concentration,  $t_c$ , for the purpose of this Manual, is the time required for water to flow from the hydraulically most distant part of the drainage area to the point under consideration. For the Rational Formula Method, the time of concentration must be estimated so that the average rainfall rate for the corresponding duration can be determined from the rainfall intensity-duration-frequency curves. For the SCS Unit Hydrograph method, the time of concentration is used to determine the time-to-peak,  $t_p$ , of the unit hydrograph and subsequently, the peak runoff.

In the past, several different time of concentration equations have been used with the runoff methods discussed in the following sections. However, as both methods have the same definition of the time of concentration, and to promote consistency between the two runoff methods, the time of concentration equations presented in this section shall be used for all watersheds of total area less than one square mile and whose basin slope is less than ten percent. For larger watersheds and for watersheds with basin slopes equal to or greater than ten percent, the basin lag equation shall be used (see Section 705.3).

For urban areas, the time of concentration consists of an inlet time or overland flow time ( $t_i$ ) plus the time of travel ( $t_t$ ) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time ( $t_i$ ) plus the time of travel in a combined form, such as a small swale, channel, or wash. The latter portion ( $t_t$ ) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or wash. Inlet time, on the other hand, will vary with surface slope, depression storage, surface cover,

antecedent rainfall, and infiltration capacity of the soil, as well as distance of surface flow. Thus, the time of concentration for both urban and non-urban areas shall be calculated as follows:

$$t_c = t_i + t_t \quad (701)$$

In which  $t_c$  = time of concentration (minutes)  
 $t_i$  = initial, inlet, or overland flow time (minutes)  
 $t_t$  = travel time in the ditch, channel, gutter, storm sewer, etc. (minutes)

To aid in the computation of  $t_c$ , Standard Form 2 (see Section - 1500) has been developed to organize the computation. In all drainage studies,  $t_c$  calculations should be submitted using Standard Form 2.

The initial or overland flow time,  $t_i$ , may be calculated using the following equation:

$$t_i = \frac{1.8 (1.1 - R) L_o^{1/2}}{S^{1/3}} \quad (702)$$

Where  $t_i$  = initial or overland flow time (minutes)  
 $R$  = flow runoff coefficient  
 $L_o$  = length of overland flow (feet, 500 feet maximum)  
 $S$  = average overland basin slope (percent)

Equation 702 was originally developed by the Federal Aviation Administration (FAA, 1970) for use with the Rational Formula Method. However, the equation is also valid for computation of the initial or overland flow time for the SCS Unit Hydrograph method using the appropriate flow runoff coefficient.

For the Rational Formula Method, the 5-year runoff coefficient,  $C_5$ , presented in Table 701 shall be used as the flow runoff coefficient,  $R$ . For the SCS Unit Hydrograph method,  $R$  shall be calculated using the following equation:

$$R = .0132 CN - 0.39 \quad (703)$$

This equation was developed by converting CN factors to typical  $C_5$  runoff coefficients.

The overland flow length,  $L_o$ , is generally defined as the length of flow over which the flow characteristics appear as sheet flow or very shallow flow in grassed swales. Changes in land slope, surface characteristics, and small drainage ditches or gullies will tend to force the overland flow into a concentrated flow condition. Thus, the initial flow time would generally end at these locations.

For longer basin lengths, initial or overland flow needs to be considered in combination with the travel time,  $t_t$ , which is calculated using the hydraulic properties of the swale, ditch, or channel. For preliminary work, travel time can be estimated with the help of Figure 701 (SCS, 1985). The time of concentration is then the sum of the initial flow time,  $t_i$  and the travel time  $t_t$  (Equation 701). The minimum  $t_c$  in Washoe County for non-urban watersheds shall be 10 minutes.

### 702.1 URBANIZED BASINS

Overland flow in urbanized basins can occur from the back of the lot to the street, in parking lots, in greenbelt areas, or within park areas. It can be calculated using the procedure described in Section 702 except that the travel time,  $t_t$ , to the first design point or inlet is estimated using the "Paved Area (Sheet Flow) & Shallow Gutter Flow" line in Figure 701. The time of concentration for the first design point in an urbanized basin using this procedure should not exceed the time of concentration

calculated using Equation 704, which was developed using rainfall/runoff data collected in urbanized regions (USDCM, 1969).

$$t_c = L/180 + 10 \quad (704)$$

Where  $t_c$  = time of concentration at the first design point in an urban watershed (minutes)

L = watershed length (feet)

Equation 704 may result in a lesser time of concentration at the first design point and thus would govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream reaches. The minimum  $t_c$  for urbanized paved areas shall be 5 minutes and 10 minutes for vegetated landscaped areas.

A common mistake in calculating  $t_c$  is to assume travel velocities (for  $t_t$ ) that are too small or not using post development slopes. Another common error is to not analyze the portion of basin which would result in the longest computed time of concentration. This error is most often encountered in long basins, or a basin where the upper portion contains grassy park land and the lower developed urban land. However, a check should be performed to assure that calculated runoff from the total area is not exceeded by calculated runoff from only the urbanized area.

When performing hydrologic calculations for proposed conditions, the overland flow path should be taken perpendicular to the proposed, and not preexisting, contours. Additionally, the time of concentration calculation should utilize the flow path defined by the proposed improvements which act to intercept storm flows.

## 703 PRECIPITATION LOSSES

Precipitation loss calculations are required for the SCS Unit Hydrograph method. The calculation methodology for precipitation losses within Washoe County is presented in the following section. For the Rational Formula Method, the precipitation losses are not computed separately. Therefore, the following methodology does not apply to the Rational Formula Method.

### 703.1 INTRODUCTION

Land surface interception, depression storage and infiltration are referred to as precipitation losses. Interception and depression storage are intended to represent the surface storage of water by trees or grass, in local depressions in the ground surface, in cracks and crevices in parking lots or roofs, or in a surface area where water is not free to move as overland flow. Infiltration represents the movement of water to areas beneath the land surface.

Two important factors should be noted about the precipitation loss computations to be used for the SCS Unit Hydrograph methods. First, precipitation which does not contribute to the runoff process is considered to be lost from the system. Second, the equations used to compute the losses do not provide for soil moisture or surface storage recovery.

The precipitation loss component of the SCS Unit Hydrograph method is considered to be sub-basin average (uniformly distributed over an entire sub-basin). In some instances, there are negligible precipitation losses for a portion of a sub-basin. This would be true for an area containing a lake, reservoir or impervious area. In this case, precipitation losses will not be computed for a specified percentage of the area labeled as impervious.

**RATIONAL FORMULA METHOD  
RUNOFF COEFFICIENTS**

Land Use or Surface Characteristics	Aver. % Impervious Area	Runoff Coefficients	
		5-Year (C <sub>5</sub> )	100-Year (C <sub>100</sub> )
<u>Business/Commercial:</u>			
Downtown Areas	85	.82	.85
Neighborhood Areas	70	.65	.80
<u>Residential:</u> (Average Lot Size)			
1/8 Acre or Less (Multi-Unit)	65	.60	.78
1/4 Acre	38	.50	.65
1/8 Acre	30	.45	.60
1/2 Acre	25	.40	.55
1 Acre	20	.35	.50
<u>Industrial:</u>			
	72	.68	.82
<u>Open Space:</u> (Lawns, Parks, Golf Courses)			
	5	.05	.30
<u>Undeveloped Areas:</u>			
Range	0	.20	.50
Forest	0	.05	.30
<u>Streets/Roads:</u>			
Paved	100	.88	.93
Gravel	20	.25	.50
<u>Drives/Walks:</u>			
	95	.87	.90
<u>Roof:</u>			
	90	.85	.87

Notes:

1. Composite runoff coefficients shown for Residential, Industrial, and Business/Commercial Areas assume irrigated grass landscaping for all pervious areas. For development with landscaping other than irrigated grass, the designer must develop project specific composite runoff coefficients from the surface characteristics presented in this table.

VERSION: April 30, 2009

REFERENCE:

USDCM, DROCOG, 1969  
(with modifications)

TABLE  
701

WRC ENGINEERING, INC.

## **APPENDIX B**



<b>SN</b>	<b>Element ID</b>	<b>Area</b> <b>(acres)</b>	<b>Drainage Node ID</b>	<b>Weighted Runoff Coefficient</b>	<b>Accumulated Precipitation</b> <b>(inches)</b>	<b>Total Runoff</b> <b>(inches)</b>	<b>Peak Runoff</b> <b>(cfs)</b>	<b>Rainfall Intensity</b> <b>(inches/hr)</b>	<b>Time of Concentration</b> <b>(days hh:mm:ss)</b>
1	BASIN-A	39.42	Out-01	0.2000	0.29	0.06	9.64	1.223	0 00:13:55
2	BASIN-B	84.45	Out-01	0.2000	0.31	0.06	18.53	1.097	0 00:17:04

<b>SN</b>	<b>Element ID</b>	<b>Area (acres)</b>	<b>Drainage Node ID</b>	<b>Weighted Runoff Coefficient</b>	<b>Accumulated Precipitation (inches)</b>	<b>Total Runoff (inches)</b>	<b>Peak Runoff (cfs)</b>	<b>Rainfall Intensity (inches/hr)</b>	<b>Time of Concentration (days hh:mm:ss)</b>
1	BASIN-A	39.42	Out-01	0.5000	0.73	0.36	61.21	3.106	0 00:13:55
2	BASIN-B	84.45	Out-01	0.5000	0.79	0.40	117.67	2.787	0 00:17:04

## **APPENDIX C**

**5-YEAR SUBBASIN SUMMARY**

<b>SN</b>	<b>Element ID</b>	<b>Area</b> <b>(acres)</b>	<b>Drainage Node ID</b>	<b>Weighted Runoff Coefficient</b>	<b>Accumulated Precipitation</b> <b>(inches)</b>	<b>Total Runoff</b> <b>(inches)</b>	<b>Peak Runoff</b> <b>(cfs)</b>	<b>Rainfall Intensity</b> <b>(inches/hr)</b>	<b>Time of Concentration</b> <b>(days hh:mm:ss)</b>
1	Sub-01	1.68	CB-05	0.4500	0.60	0.27	2.74	3.620	0 00:10:00
2	Sub-02	0.93	CB-04	0.4500	0.60	0.27	1.51	3.620	0 00:10:00
3	Sub-03	3.07	CB-01	0.4500	0.60	0.27	5.01	3.620	0 00:10:00
4	Sub-04	1.29	CB-02	0.4500	0.60	0.27	2.10	3.620	0 00:10:00
5	Sub-05	0.51	CB-03	0.4500	0.60	0.27	0.83	3.620	0 00:10:00
6	Sub-06	1.48	CB-08	0.4500	0.60	0.27	2.42	3.620	0 00:10:00
7	Sub-07	1.52	CB-09	0.4500	0.60	0.27	2.47	3.620	0 00:10:00
8	Sub-08	0.66	CB-06	0.4500	0.60	0.27	1.08	3.620	0 00:10:00
9	Sub-09	0.71	CB-06	0.4500	0.60	0.27	1.16	3.620	0 00:10:00
10	Sub-10	0.12	CB-07	0.4500	0.60	0.27	0.20	3.620	0 00:10:00
11	Sub-11	1.87	CB-15	0.4500	0.60	0.27	3.05	3.620	0 00:10:00
12	Sub-12	3.49	CB-15	0.4500	0.60	0.27	5.69	3.620	0 00:10:00
13	Sub-13	0.91	CB-12	0.4500	0.60	0.27	1.49	3.620	0 00:10:00
14	Sub-14	0.60	CB-11	0.4500	0.60	0.27	0.98	3.620	0 00:10:00
15	Sub-15	0.54	CB-10	0.4500	0.60	0.27	0.88	3.620	0 00:10:00
16	Sub-16	0.92	CB-09	0.4500	0.60	0.27	1.50	3.620	0 00:10:00
17	Sub-17	79.51	STOR-01	0.2000	0.79	0.16	44.32	2.787	0 00:17:04
18	Sub-18	4.09	CB-23	0.4500	0.60	0.27	6.66	3.620	0 00:10:00
19	Sub-19	3.46	CB-24	0.4500	0.60	0.27	5.64	3.620	0 00:10:00
20	Sub-20	1.25	CB-20	0.4500	0.60	0.27	2.04	3.620	0 00:10:00
21	Sub-21	2.02	CB-22	0.4500	0.60	0.27	3.29	3.620	0 00:10:00
22	Sub-22	2.26	CB-21	0.4500	0.60	0.27	3.68	3.620	0 00:10:00
23	Sub-23	0.79	CB-19	0.4500	0.60	0.27	1.28	3.620	0 00:10:00
24	Sub-24	0.41	CB-12	0.4500	0.60	0.27	0.67	3.620	0 00:10:00
25	Sub-25	2.02	CB-18	0.4500	0.60	0.27	3.29	3.620	0 00:10:00
26	Sub-26	0.09	CB-13	0.4500	0.60	0.27	0.15	3.620	0 00:10:00
27	Sub-27	0.83	CB-14	0.4500	0.60	0.27	1.35	3.620	0 00:10:00
28	Sub-28	1.46	CB-17	0.4500	0.60	0.27	2.37	3.620	0 00:10:00
29	Sub-29	2.76	CB-14	0.4500	0.60	0.27	4.50	3.620	0 00:10:00
30	Sub-30	2.64	CB-16	0.4500	0.60	0.27	4.30	3.620	0 00:10:00
31	Sub-31	2.11	STOR-01	0.2000	0.60	0.12	1.53	3.620	0 00:10:00

**100-YEAR SUBBASIN SUMMARY**

<b>SN</b>	<b>Element ID</b>	<b>Area (acres)</b>	<b>Drainage Node ID</b>	<b>Weighted Runoff Coefficient</b>	<b>Accumulated Precipitation (inches)</b>	<b>Total Runoff (inches)</b>	<b>Peak Runoff (cfs)</b>	<b>Rainfall Intensity (inches/hr)</b>	<b>Time of Concentration (days hh:mm:ss)</b>
1	Sub-01	1.68	CB-05	0.60	0.60	0.36	3.65	3.62	0 00:10:00
2	Sub-02	0.93	CB-04	0.60	0.60	0.36	2.02	3.62	0 00:10:00
3	Sub-03	3.07	CB-01	0.50	0.60	0.30	5.56	3.62	0 00:10:00
4	Sub-04	1.29	CB-02	0.60	0.60	0.36	2.80	3.62	0 00:10:00
5	Sub-05	0.51	CB-03	0.60	0.60	0.36	1.11	3.62	0 00:10:00
6	Sub-06	1.48	CB-08	0.60	0.60	0.36	3.22	3.62	0 00:10:00
7	Sub-07	1.52	CB-09	0.60	0.60	0.36	3.29	3.62	0 00:10:00
8	Sub-08	0.66	CB-06	0.60	0.60	0.36	1.44	3.62	0 00:10:00
9	Sub-09	0.71	CB-06	0.60	0.60	0.36	1.54	3.62	0 00:10:00
10	Sub-10	0.12	CB-07	0.60	0.60	0.36	0.26	3.62	0 00:10:00
11	Sub-11	1.87	CB-15	0.60	0.60	0.36	4.06	3.62	0 00:10:00
12	Sub-12	3.49	CB-15	0.60	0.60	0.36	7.59	3.62	0 00:10:00
13	Sub-13	0.91	CB-12	0.60	0.60	0.36	1.99	3.62	0 00:10:00
14	Sub-14	0.60	CB-11	0.60	0.60	0.36	1.30	3.62	0 00:10:00
15	Sub-15	0.54	CB-10	0.60	0.60	0.36	1.18	3.62	0 00:10:00
16	Sub-16	0.92	CB-09	0.60	0.60	0.36	2.00	3.62	0 00:10:00
17	Sub-17	79.51	STOR-01	0.50	0.79	0.40	110.79	2.79	0 00:17:04
18	Sub-18	4.09	CB-23	0.60	0.60	0.36	8.88	3.62	0 00:10:00
19	Sub-19	3.46	CB-24	0.60	0.60	0.36	7.52	3.62	0 00:10:00
20	Sub-20	1.25	CB-20	0.60	0.60	0.36	2.72	3.62	0 00:10:00
21	Sub-21	2.02	CB-22	0.60	0.60	0.36	4.39	3.62	0 00:10:00
22	Sub-22	2.26	CB-21	0.60	0.60	0.36	4.90	3.62	0 00:10:00
23	Sub-23	0.79	CB-19	0.60	0.60	0.36	1.71	3.62	0 00:10:00
24	Sub-24	0.41	CB-12	0.60	0.60	0.36	0.89	3.62	0 00:10:00
25	Sub-25	2.02	CB-18	0.60	0.60	0.36	4.38	3.62	0 00:10:00
26	Sub-26	0.09	CB-13	0.60	0.60	0.36	0.20	3.62	0 00:10:00
27	Sub-27	0.83	CB-14	0.60	0.60	0.36	1.80	3.62	0 00:10:00
28	Sub-28	1.46	CB-17	0.60	0.60	0.36	3.16	3.62	0 00:10:00
29	Sub-29	2.76	CB-14	0.60	0.60	0.36	6.01	3.62	0 00:10:00
30	Sub-30	2.64	CB-16	0.60	0.60	0.36	5.74	3.62	0 00:10:00
31	Sub-31	2.11	STOR-01	0.50	0.60	0.30	3.82	3.62	0 00:10:00

## **APPENDIX D**

5-YEAR DETENTION TABLE

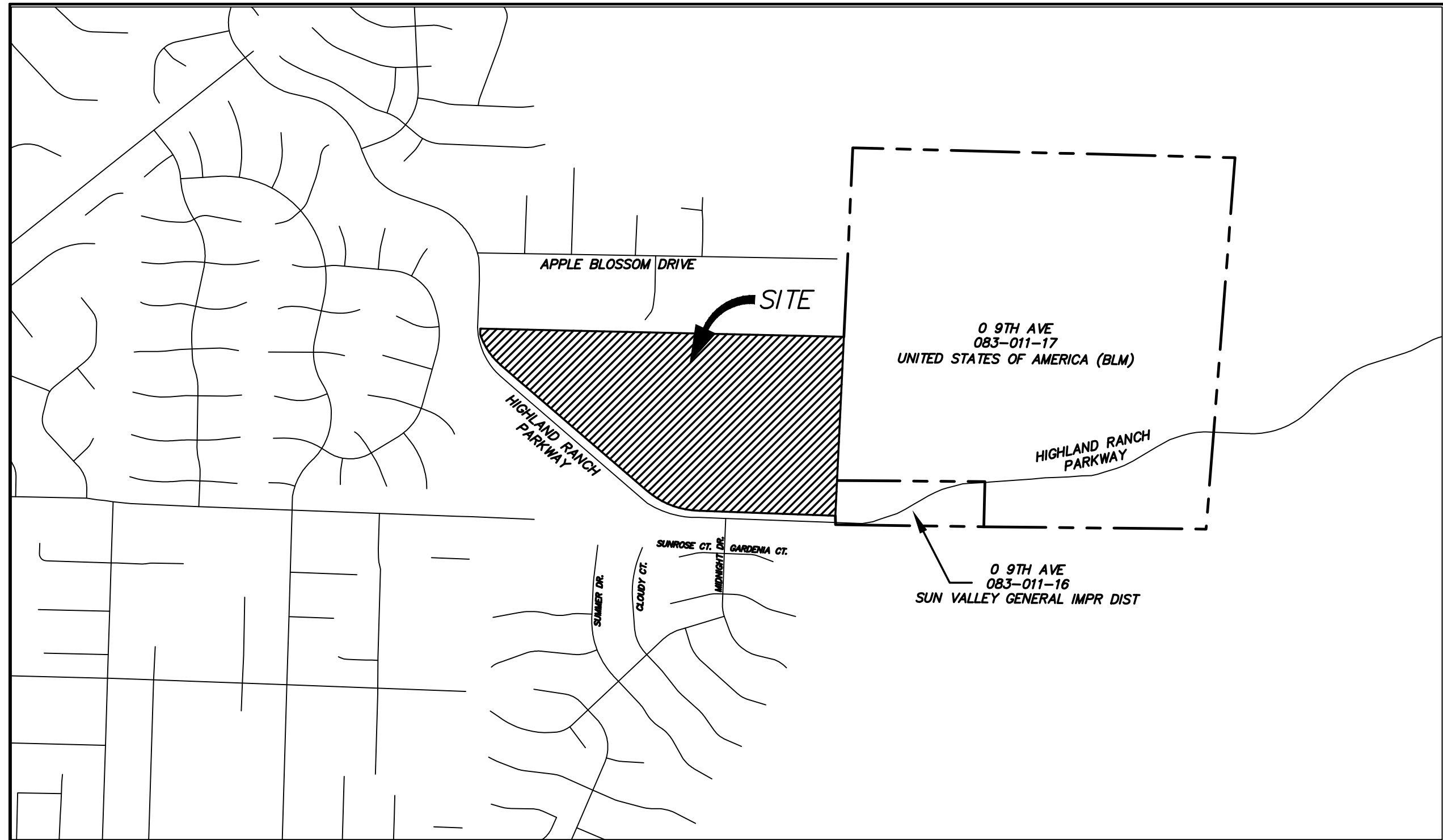
SN	Element ID	Invert Elevation	Max (Rim) Elevation	Max (Rim) Offset	Initial Water Elevation	Initial Water Depth	Ponded Area	Peak Inflow	Peak Lateral Inflow	Peak Outflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Total Flooded Volume	Total Time Flooded	Total Retention Time
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft <sup>2</sup> )	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-inches)	(minutes)	(seconds)
1	STOR-01	4742.00	4750.00	8.00	4742.00	0.00	25200.00	98.41	44.77	61.52	4747.12	5.12	4742.14	0.14	0 00:19	0.00	0.00	0.00

100-YEAR DETENTION TABLE

SN	Element ID	Invert Elevation	Max (Rim) Elevation	Max (Rim) Offset	Initial Water Elevation	Ponded Area	Peak Inflow	Peak Lateral Inflow	Peak Outflow	Maximum HGL Elevation Attained	Maximum HGL Depth Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Maximum HGL Occurrence	Total Flooded Volume	Total Time Flooded	Total Retention Time
		(ft)	(ft)	(ft)	(ft)	(ft <sup>2</sup> )	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-inches)	(minutes)	(seconds)
1	STOR-01	4742.00	4750.00	8.00	4742.00	25200.00	166.66	111.90	75.09	4749.43	7.43	4742.24	0.24	0 00:23	0.00	0.00	0.00

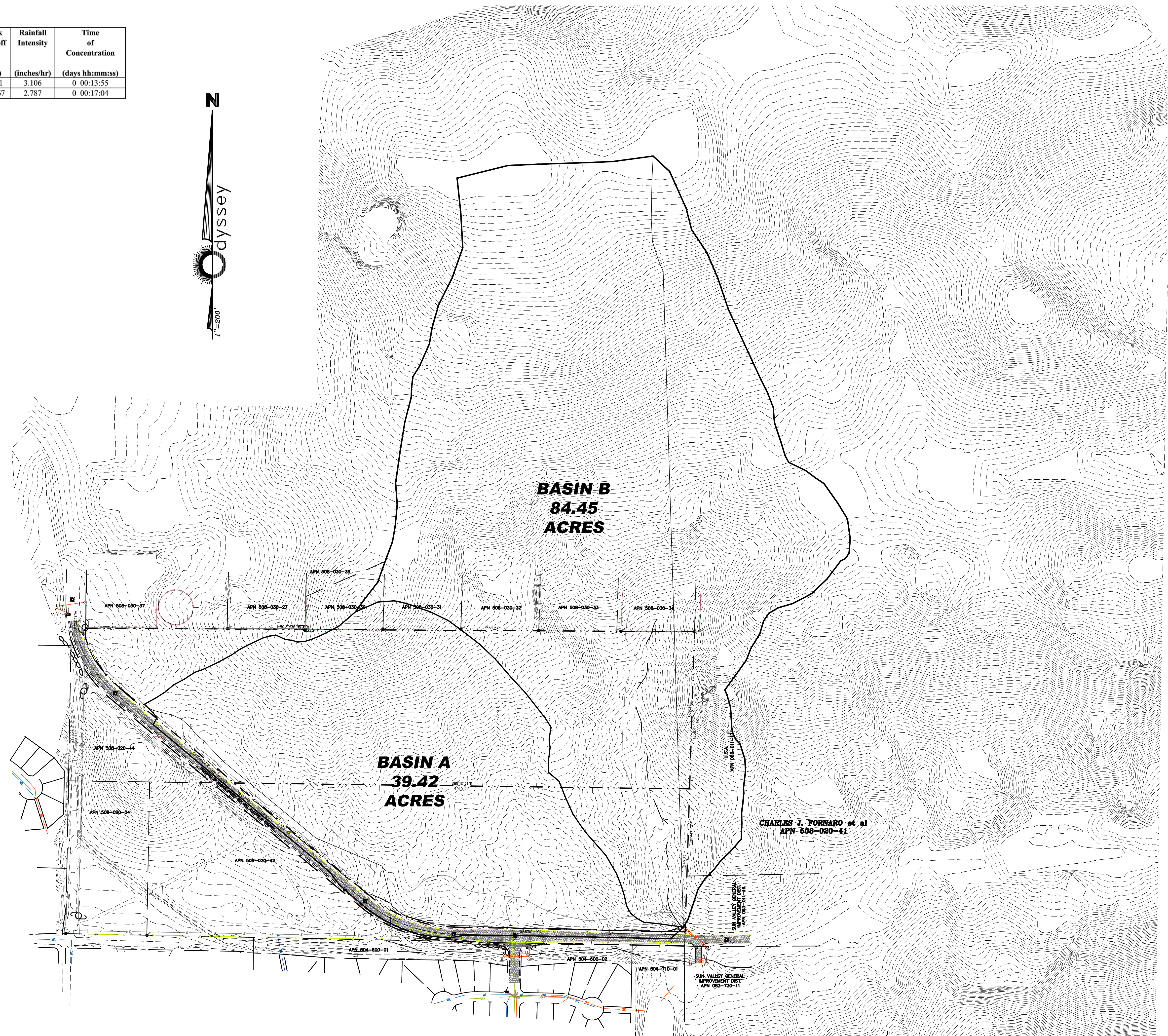
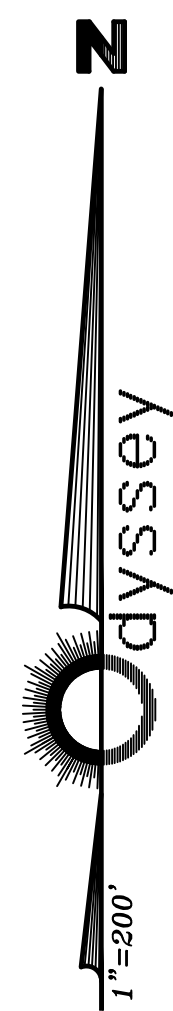
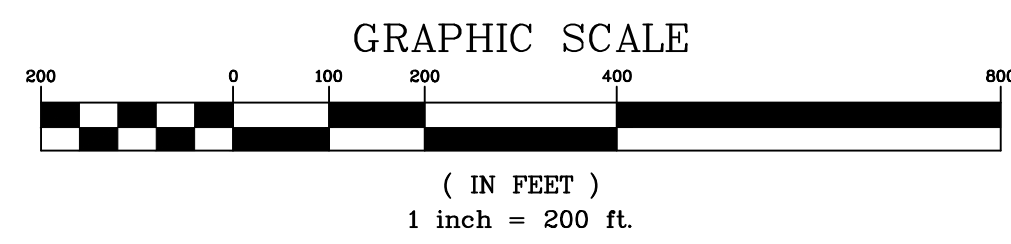


## **FIGURES**



VICINITY MAP

SN	Element ID	Area (acres)	Drainage Node ID	Weighted Runoff Coefficient	Accumulated Precipitation (inches)	Total Runoff (inches)	Peak Runoff (cfs)	Rainfall Intensity (inches/hr)	Time of Concentration (days hh:mm:ss)
1	BASIN-A	39.42	Out-01	0.5000	0.73	0.36	61.21	3.106	0 00:13:55
2	BASIN-B	84.45	Out-01	0.5000	0.79	0.40	117.67	2.787	0 00:17:04



REV.	DATE	DESCRIPTION	BY	APP'D

DATE:	9-8-2020
DRAWN BY:	ACAD_ZO
DESIGNED BY:	NZY
CHECKED BY:	FAB

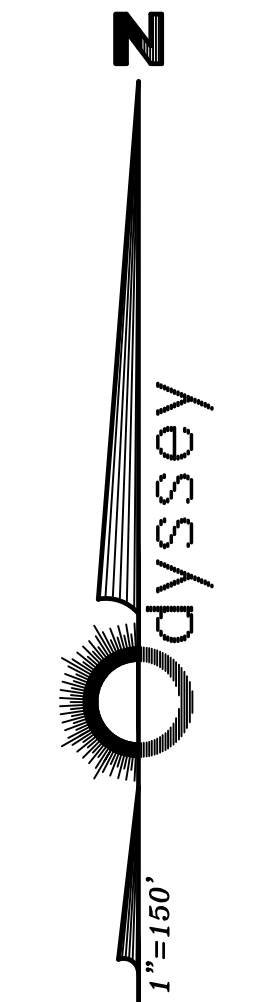
**HIGHLANDS VILLAGE**  
**EXISTING HYDROLOGY**  
 SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEYRENO.COM  
**odyssey** ENGINEERING INCORPORATED

SCALE  
 HORIZ. 1" = 200'  
 VERT. -  
 JOB NO.  
 JOB

SHEET  
**H-1**  
 OF  
**1**

SN	Element ID	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Pipe Diameter or Height (inches)	Manning's Roughness	5-Year Peak Flow (cfs)	5-Year Max Flow Velocity (ft/sec)	100-Year Peak Flow (cfs)	Max Flow Velocity (ft/sec)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)
1	PIPE-01	CB-01	MH-01	46.88	4823.53	4823.30	0.49	15.00	0.01	0.72	2.95	4.57	4.48	5.88	0.78	0.00	0.97
2	PIPE-02	MH-01	MH-02	94.28	4823.20	4819.75	3.66	12.00	0.01	0.72	4.87	4.58	6.88	8.86	0.52	0.00	0.79
3	PIPE-03	CB-02	MH-02	5.07	4820.00	4819.75	4.93	12.00	0.01	0.73	3.80	2.49	4.06	10.28	0.24	5.00	1.00
4	PIPE-04	CB-03	MH-02	24.10	4821.00	4819.75	5.19	12.00	0.01	0.29	3.25	0.99	3.69	10.55	0.09	0.00	0.60
5	PIPE-05	MH-02	MH-03	50.58	4819.65	4819.40	0.49	18.00	0.01	1.62	3.58	7.38	5.01	9.60	0.77	0.00	1.17
6	PIPE-06	CB-04	MH-03	40.98	4823.00	4819.30	9.03	12.00	0.01	0.56	5.44	1.88	7.09	13.92	0.14	0.00	0.41
7	PIPE-07	CB-05	MH-03	5.93	4820.50	4819.40	18.55	12.00	0.01	0.00	0.00	0.00	0.00	19.95	0.00	0.00	0.24
8	PIPE-08	MH-03	MH-05	233.90	4819.30	4808.25	4.72	18.00	0.01	2.10	9.49	8.90	12.18	29.68	0.30	0.00	0.66
9	PIPE-09	CB-06	MH-04	8.62	4809.50	4808.87	7.31	12.00	0.01	1.73	6.03	6.82	8.75	12.52	0.54	0.00	0.97
10	PIPE-10	CB-07	MH-04	28.13	4810.00	4808.87	4.02	12.00	0.01	0.07	1.96	0.25	2.31	9.28	0.03	0.00	0.52
11	PIPE-11	MH-04	MH-05	103.48	4808.77	4808.25	0.50	18.00	0.01	1.78	3.85	6.05	5.13	9.68	0.63	0.00	0.95
12	PIPE-12	MH-05	MH-08	362.89	4808.15	4793.53	4.03	18.00	0.01	3.84	10.65	14.98	14.04	27.41	0.55	0.00	0.90
13	PIPE-13	CB-08	MH-06	48.23	4799.14	4798.33	1.68	12.00	0.01	0.85	4.87	2.86	6.34	6.00	0.48	0.00	0.56
14	PIPE-14	MH-06	MH-07	92.56	4798.23	4793.89	4.69	12.00	0.01	0.84	3.54	2.86	5.01	10.03	0.29	0.00	0.68
15	PIPE-15	CB-09	MH-07	17.87	4794.97	4793.89	6.04	12.00	0.01	1.34	5.18	4.55	5.99	11.39	0.40	1.00	1.00
16	PIPE-16	CB-10	MH-07	10.87	4794.97	4793.89	9.94	12.00	0.01	0.32	3.76	1.05	4.36	14.60	0.07	0.00	0.68
17	PIPE-17	MH-07	MH-08	52.02	4793.79	4793.53	0.50	18.00	0.01	2.47	4.00	8.40	5.19	9.65	0.87	0.00	1.29
18	PIPE-18	MH-08	MH-11	367.40	4793.43	4774.37	5.19	18.00	0.01	6.30	13.11	23.13	15.11	31.10	0.74	0.00	1.29
19	PIPE-19	CB-11	MH-09	83.66	4779.25	4777.90	1.61	12.00	0.01	0.36	3.97	1.22	5.46	5.88	0.21	0.00	0.64
20	PIPE-20	MH-09	MH-10	74.55	4777.80	4774.73	4.12	12.00	0.01	0.36	3.03	1.89	3.25	9.40	0.20	1.00	1.00
21	PIPE-21	CB-12	MH-10	17.87	4776.40	4774.73	9.35	12.00	0.01	0.77	5.90	2.63	6.59	14.16	0.19	3.00	1.00
22	PIPE-22	CB-13	MH-10	11.12	4776.38	4774.73	14.84	12.00	0.01	0.06	2.77	1.45	3.14	17.84	0.08	3.00	1.00
23	PIPE-23	MH-10	MH-11	51.97	4774.63	4774.37	0.50	15.00	0.01	1.17	3.00	3.99	3.37	5.94	0.67	5.00	1.25
24	PIPE-24	MH-11	MH-12	268.53	4774.27	4763.63	3.96	18.00	0.01	7.30	12.37	26.10	15.67	27.18	0.96	0.00	1.34
25	PIPE-25	MH-12	MH-14	283.27	4763.53	4753.57	3.52	24.00	0.01	7.30	6.69	26.00	10.11	55.15	0.47	0.00	1.53
26	PIPE-26	CB-15	MH-13	26.71	4755.75	4754.18	5.88	15.00	0.01	2.61	5.72	8.84	7.20	20.36	0.43	10.00	1.25
27	PIPE-27	CB-16	MH-13	10.04	4754.75	4754.18	5.68	15.00	0.01	3.12	4.54	10.14	8.26	20.01	0.51	16.00	1.25
28	PIPE-28	MH-13	MH-14	102.26	4754.08	4753.57	0.50	24.00	0.01	5.73	4.28	18.85	6.00	20.77	0.91	11.00	2.00
29	PIPE-29	CB-14	MH-14	26.00	4755.69	4753.57	8.15	12.00	0.01	2.15	7.84	7.25	9.34	13.23	0.55	9.00	1.00
30	PIPE-30	MH-14	MH-15	196.66	4753.47	4752.49	0.50	36.00	0.01	13.58	5.80	47.18	6.68	61.21	0.77	3.00	3.00
31	PIPE-31	MH-15	MH-16	185.40	4752.39	4751.46	0.50	36.00	0.01	13.59	5.07	47.20	6.70	61.41	0.77	1.00	3.00
32	PIPE-32	MH-17	MH-16	106.83	4761.07	4751.46	9.00	24.00	0.01	6.56	8.77	22.05	10.79	88.21	0.25	0.00	1.38
33	PIPE-33	MH-19	MH-17	99.66	4762.44	4761.07	1.37	24.00	0.01	6.56	8.88	22.05	10.71	34.48	0.64	0.00	1.25
34	PIPE-34	CB-17	MH-18	9.87	4763.98	4762.90	10.94	12.00	0.01	0.80	5.12	2.70	5.79	15.32	0.18	0.00	0.84
35	PIPE-35	CB-18	MH-18	18.87	4763.98	4762.90	5.72	12.00	0.01	1.11	4.89	3.75	5.41	11.08	0.34	0.00	0.97
36	PIPE-36	MH-18	MH-19	52.98	4762.80	4762.54	0.49	18.00	0.01	1.90	2.77	6.42	3.63	9.57	0.67	4.00	1.50
37	PIPE-37	TEE-01	MH-19	139.12	4765.27	4762.54	1.96	24.00	0.01	4.83	6.43	16.24	7.28	41.20	0.39	0.00	1.36
38	PIPE-38	CB-19	TEE-01	51.67	4765.79	4765.27	1.01	12.00	0.01	0.43	1.83	1.43	2.58	4.65	0.31	0.00	0.80
39	PIPE-39	MH-22	TEE-01	145.98	4768.14	4765.27	1.97	18.00	0.01	4.44	8.12	14.89	9.92	19.15	0.78	0.00	1.19
40	PIPE-40	CB-20	MH-20	51.37	4777.04	4773.02	7.83	12.00	0.01	0.67	8.19	2.28	11.01	12.96	0.18	0.00	0.31
41	PIPE-41	MH-20	MH-21	96.75	4772.92	4768.60	4.47	12.00	0.01	0.67	3.06	2.28	4.12	9.79	0.23	0.00	0.66
42	PIPE-42	CB-21	MH-21	10.87	4769.67	4768.60	9.84	12.00	0.01	1.22	5.48	4.11	6.17	14.53	0.28	0.00	0.90
43	PIPE-43	CB-22	MH-21	17.90	4769.98	4768.60	7.71	12.00	0.01	1.09	5.03	3.68	5.75	12.86	0.29	0.00	0.82
44	PIPE-44	MH-21	MH-22	52.98	4768.50	4768.24	0.49	24.00	0.01	2.95	4.05	9.97	4.75	20.60	0.48	0.00	1.31
45	PIPE-45	TEE-02	MH-22	21.99	4769.52	4768.24	5.82	12.00	0.01	1.71	6.85	5.74	8.25	11.17	0.51	0.00	1.00
46	PIPE-46	CB-23	TEE-02	3.87	4770.02	4769.52	12.92	12.00	0.01	0.64	6.97	0.64	6.97	16.65	0.04	0.00	0.75
47	PIPE-47	MH-23	TEE-02	26.25	4771.04	4769.52	5.79	12.00	0.01	1.71	7.53	5.78	8.05	11.15	0.52	0.00	0.92
48	PIPE-48	CB-24	MH-23	25.95	4772.55	4771.14	5.43	12.00	0.01	1.71	8.20	5.79	8.93	10.80	0.54	0.00	0.79
49	PIPE-49	MH-16	MH-24	139.72	4751.36	4750.66	0.50	42.00	0.01	20.10	6.60	68.76	8.73	92.58	0.74	0.00	2.68
50	PIPE-50	MH-24	STOR-01	95.95	4750.56	4748.00	2.67	42.00	0.01	20.10	11.38	68.76	14.19	213.64	0.32	0.00	1.76
51	PIPE-51	STOR-01	CB-25	7.21	4742.00	4741.79	2.91	18.00	0.01	19.48	11.44	27.88	15.78	1.61	17.33	58.00	1.50
52	PIPE-52	CB-25	Out-01	63.14	4742.00	4740.00	3.17	30.00	0.01	19.48	9.27	58.59	13.32	73.00	0.80	0.00	2.10



DATE	REV.	DATE	DESCRIPTION	BY	APP'D
9-8-2020					

**HIGHLANDS VILLAGE**  
**PROPOSED HYDROLOGY**  
 SUN VALLEY WASHOE COUNTY NEVADA

885 ROBERTA LANE, SUITE 104, SPARKS, NV 89431  
 (775) 369-3303 FAX (775) 359-3329  
 ODYSSEY@ODYSSEYINC.COM  
**Odyssey** ENGINEERING INCORPORATED

SN	Element ID	Area (acres)	Drainage Node ID	Weighted Runoff Coefficient	Accumulated Precipitation (inches)	Total Runoff (inches)	Peak Runoff (cfs)	Rainfall Intensity (inches/hr)	Time of Concentration (days hh:mm:ss)
1	Sub-01	1.68	CB-05	0.60	0.68	0.41	3.32	3.30	0 00:12:15
2	Sub-02	0.93	CB-04	0.60	0.66	0.39	1.88	3.38	0 00:11:37
3	Sub-03	3.07	CB-01	0.50	0.75	0.38	4.62	3.01	0 00:14:56
4	Sub-04	1.29	CB-02	0.60	0.69	0.41	2.49	3.22	0 00:12:52
5	Sub-05	0.51	CB-03	0.60	0.69	0.42	0.99	3.24	0 00:12:45
6	Sub-06	1.48	CB-08	0.60	0.69	0.42	2.88	3.24	0 00:12:45
7	Sub-07	1.52	CB-09	0.60	0.70	0.42	2.89	3.18	0 00:13:13
8	Sub-08	0.66	CB-06	0.60	0.65	0.39	1.34	3.36	0 00:11:43
9	Sub-09	0.71	CB-06	0.60	0.69	0.41	1.38	3.23	0 00:12:49
10	Sub-10	0.12	CB-07	0.60	0.63	0.38	0.26	3.52	0 00:10:37
11	Sub-11	1.87	CB-15	0.60	0.80	0.48	3.08	2.74	0 00:17:33
12	Sub-12	3.49	CB-15	0.60	0.80	0.48	5.83	2.78	0 00:17:08
13	Sub-13	0.91	CB-12	0.60	0.67	0.40	1.82	3.32	0 00:12:01
14	Sub-14	0.60	CB-11	0.60	0.65	0.39	1.23	3.41	0 00:11:21
15	Sub-15	0.54	CB-10	0.60	0.67	0.40	1.09	3.34	0 00:11:55
16	Sub-16	0.92	CB-09	0.60	0.67	0.40	1.84	3.32	0 00:12:01
17	Sub-17	79.51	STOR-01	0.50	0.96	0.48	85.52	2.15	0 00:26:52
18	Sub-18	4.09	CB-23	0.60	0.80	0.48	6.73	2.75	0 00:17:31
19	Sub-19	3.46	CB-24	0.60	0.79	0.47	5.79	2.79	0 00:17:03
20	Sub-20	1.25	CB-20	0.60	0.74	0.44	2.29	3.05	0 00:14:28
21	Sub-21	2.02	CB-22	0.60	0.74	0.44	3.69	3.04	0 00:14:33
22	Sub-22	2.26	CB-21	0.60	0.74	0.44	4.12	3.05	0 00:14:31
23	Sub-23	0.79	CB-19	0					



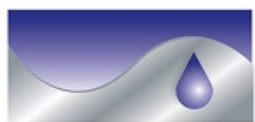
**Project X**

**Preliminary Water and  
Wastewater Capacity Study**

**March, 2020**

DRAFT

**Sandra Ainsworth, Chairperson  
Susan Severt, Vice Chair  
Carmen Ortiz, Treasurer  
Joseph Barstow, Trustee  
Michael Rider, Trustee**



**SHAW**  
ENGINEERING

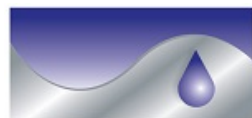
**Jon Combs, General Manager  
Chris Melton, Public Works Director**



## **Project X**

# **Preliminary Water and Wastewater Capacity Study**

**March, 2020**



**SHAW**  
ENGINEERING

*20 Vine Street  
Reno, Nevada 89503  
775.329.5559  
775.329.5406 (Fax)*

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## 1.0 Summary

The purpose of this Study is to preliminarily evaluate the ability of the Sun Valley General Improvement District (SVGID) to supply potable water and wastewater service to the proposed Project X which is a 222 lot residential development (hereinafter referred to as the “Development”). The Development layout and location, as provided by Odyssey Engineering, is shown in **Figure 1, Page 2**.

This Study identifies the offsite water and wastewater infrastructure improvements anticipated to be required to serve the Development at the time this Study was prepared. Total project cost for the water infrastructure required is estimated to be **\$413,000** (refer to **Figure 2 page 14**) and for the wastewater is estimated to be **\$545,000** (refer to **Figures 3 and 4 pages 11 and 12**). These improvements could change since any excess system capacity is distributed on a first come first serve basis and this Study should be updated when appropriate. A water capacity report will also have to be prepared and submitted to Washoe County Health at the time that an intent to serve letter is desired.

## 2.0 Water System Evaluation

### 2.1 Givens and General Assumptions

All of the existing water system information was obtained from the *SVGID Water System Master Plan Update*, dated September, 2016, (WMP) that was prepared by Shaw Engineering. As identified in the WMP, the following demands were utilized in this Study;

Average Day Demand, (ADD)	262 Gallons per Day/Customer (GPD/Customer)
Maximum Day Demand (MDD)	603 GPD/Customer (PF=2.3)
Peak Hour Demand (PHD)	1,025 GPD/Customer (PF=3.6)
Minimum Month Demand (MDD)	140 GPD/Customer (PF=0.46)

This Study utilized existing SVGID planning and design criteria consistent with the WMP and summarized as follows;

#### Source of Supply (via TMWA Wholesale)

Sullivan + Raleigh Heights	=Maximum Day Demand
Raleigh	=Minimum Month Demand

#### Storage

Operational	=17% of Maximum Day Demand
Emergency	=2 Average Day Demand
Fire	=As dictated by Fire Authority



Figure 1  
Site Location Map

Pumping (with adequate Zone Storage)

With Largest Pump Offline =Maximum Day Demand

Distribution

- 20 psi residual pressure @ Tank ½ Full at Maximum Day plus Fire
- 30 psi residual pressure @ Tank LWL at Peak Hour
- 40 psi residual pressure @ Tank LWL at Maximum Day

SVGID’s existing water service customers, active wills serves and planned future developments are summarized in **Table 1 below**;

<b>Table 1 Existing and Expanded Service Area Customers</b>		
<b>Customer</b>	<b>Existing Service Area</b>	<b>Expanded Service Area</b>
Existing Customers/Meters	6,100 (±)	
Infill Customers/Meters	354	
Active Will Serves		
Ladera Phase 1	25	
Planned Future Developments <sup>1</sup>		
Project X (March, 2020)		222
Valle Vista (March, 2020)	75	
Ladera Phases 2-6 (February, 2020)	294	
5 Ridges Phase 1 and 2 (Dec, 2019)	1,218	
5 Ridges Phase 3 (Dec, 2019)		582
Sun Mesa Phase 3 (March, 2019)	44	
Sun Mesa Phase 4 (Sept, 2016)	58	
Sub Total	8,168 <sup>2</sup>	806
<b>Total</b>		<b>8,974</b>

*Footnotes:*

1. Capacity studies of various levels have been completed. Will serves are issued by SVGID on a first come first serve basis.
2. Total service area buildout projected in the 2016 Water Master Plan Update of 6,950 plus recently annexed 5 Ridges of 1,218.

The existing and expanded service area customers broken down by hydraulic pressure zone are shown below in Table 2.

<b>Table 2 Existing and Expanded Service Area Customers By Pressure Zone</b>		
<b>Pressure Zone</b>	<b>Existing Service Area</b>	<b>Expanded Service Area</b>
Southern	229	
Central	3,120	
Chocolate	3,089	806
Sidehill/Chimney	1,330	
West 7th	1	
Boundary	399	
Sub Total	8,168	806
<b>Total</b>	<b>8,974</b>	

Within the Development a typical residential fire flow of 1,500 GPM was assumed to be required in this Study.

System improvements recently completed and incorporated into the hydraulic modeling utilized for this Study includes the following;

- a. New 12 inch transmission main loop constructed for the new Middle School.
- b. New Juniper Terrace Pump Station.
- c. Integration of the Sidehill and Chimney Hydraulic Pressure Zones.
- d. Ladera Phase 1 distribution mains.

The Development surface elevations range from approximately 4760 to 4870 feet. The proposed Development site is therefore located in the Chocolate Hydraulic Pressure Zone. The Chocolate Pressure Zone also serves the lower Central and Southern Pressure zones via pressure regulating stations and provides operational storage for the upper Chimney/Sidehill pressure zone (in addition to the operational storage also provided in the Chimney/Sidehill tanks).

Based upon all of the above presented information, the total demands utilized in this Study are summarized in Table 3 page 5.

Table 3 Total System Wide Demands, GPM/MGD				
Customers	Average Day	Maximum Day	Peak Hour	Minimum Month
8,974 (Existing + Expanded Service Area)	1,633/2.35	3,758/5.41	6,388/9.20	872/1.26

## 2.2 Source Capacity

SVGID currently has a total source capacity available during all times of the year of up to 4,700 GPM from two TMWA wholesale points, Sullivan Lane (3,600 GPM) and Raleigh Heights (1,100 GPM) per the TMWA/SVGID Contract and Amendment. The Sullivan Lane wholesale point is pumped into the SVGID Chocolate Zone storage via SVGID's Main Pump Station. The Main Pump Station capacity is 3,155 GPM (largest pump off line on dedicated standby power) (WMP, Table 3.1). The Raleigh Heights wholesale point gravity feeds into SVGID system via the Boundary Tank.

With the largest wholesale point (Sullivan) and/or the Main Pump Station completely off line (an emergency event), SVGID has the ability to provide a total gravity source capacity of 1,100 GPM (Raleigh Heights via Boundary Tank).

The proposed Maximum Day Demand is 3,758 GPM (Table 3) and the proposed Minimum Month Demand is 872 GPM (Table 3)

Since the existing source capacity (4,255 GPM maximum day and 1,100 GPM minimum month) exceeds the proposed Maximum Day Demand (3,758 GPM) and Minimum Month Demand (872 GPM), the SVGID system has the source capacity to meet the proposed Development Demands.

## 2.3 Pumping Station Capacity

The Main Pump Station, in combination with the Raleigh Heights gravity feed, has the capacity to meet the Development. Refer to Section 2.2.

## 2.4 Storage Capacity

Table 4 page 6 presents the storage evaluation. The required storage capacity for the Chocolate Zone is 5.215 MG and the available capacity is 6.04. Since the existing storage volume (6.04 MG) exceeds the required storage volume (5.241 MG), the SVGID system has the storage volume capacity to meet the proposed Development demands.

Table 4 Storage Evaluation							
Zone	Customers Served	Required Storage SVGID Standards, MG			Existing Storage, MG		Meets Criteria
		Operational (17% MDD)	Fire (as red)	Emergency (2 ADD)	Tank Name	Volume, MG	
Southern	229	0.743	0.54	3.796	Chocolate	0.92	
Central	3,120				Eastside	1.40	
Chocolate	3,895				Klondike (Elev. 4993)	1.71	
Sidehill/ Chimney	1,330	0.136	0	0	Jun. Terr.	0.48	
					Westside	1.53	
<b>Total</b>	<b>8,574</b>	<b>5.215</b>			<b>6.04</b>		<b>Yes</b>
West 7 <sup>th</sup>	1	0.041	0.54	0.210	Boundary	1.35	
Boundary	399						
<b>Total</b>	<b>400</b>	<b>0.791</b>			<b>1.35</b>		<b>Yes</b>

## 2.5 Transmission/Distribution System Capacity

The existing water transmission and distribution system was modeled for the expanded service area buildout condition to verify that the existing SVGID distribution/transmission system could meet the minimum conditions while providing service to the Development.

Figure 2, page 7 illustrates the main improvements required to serve the Development.

The SVGID distribution/transmission system has the capacity to meet the Maximum Day Demand plus 1500 GPM Fire Flow (at 20 psi minimum residual pressure), the Maximum Day Demand (at 40 psi minimum residual pressure), and the Peak Hour Demand (at 30 psi minimum residual pressure).

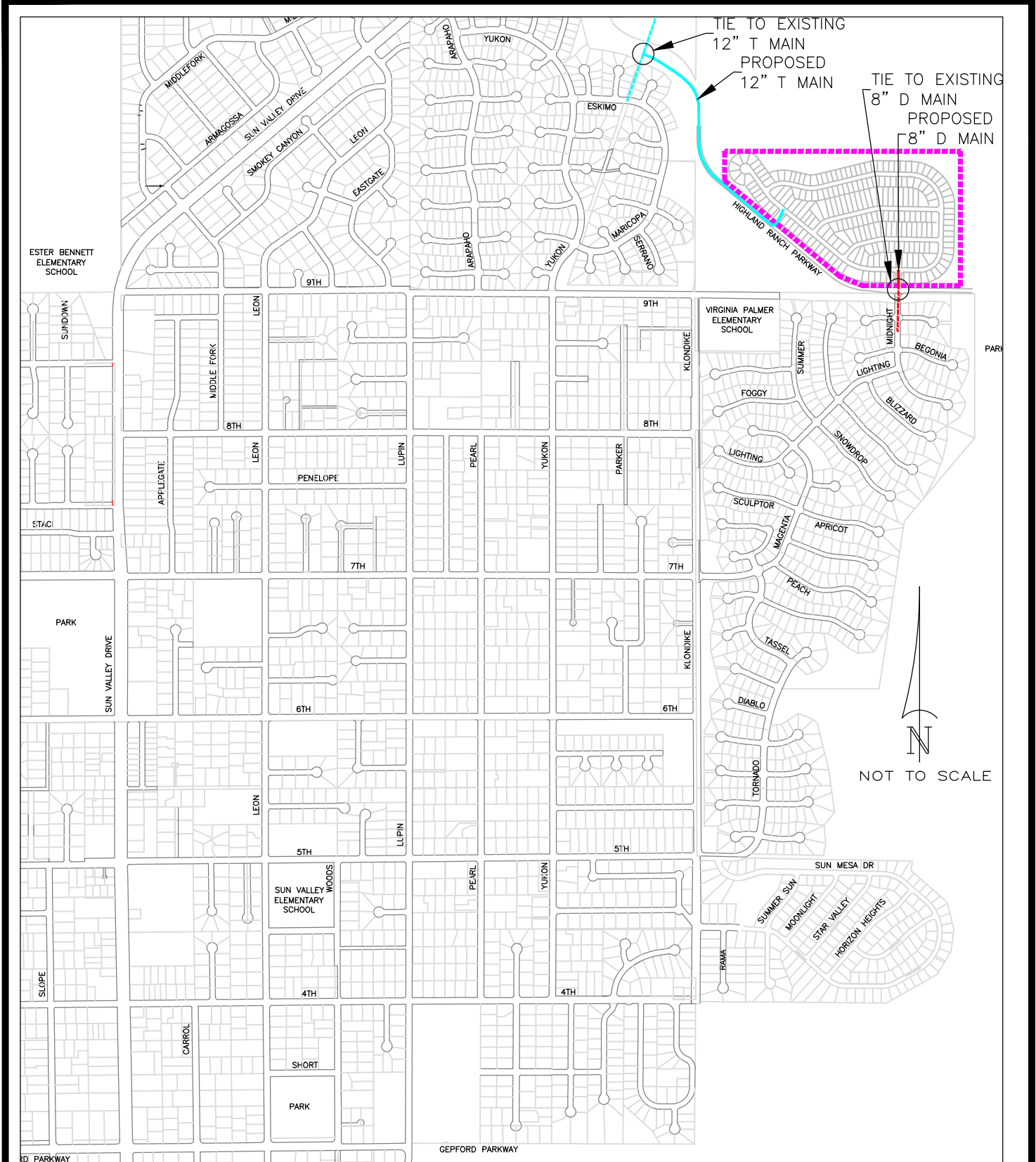


Figure 2  
Water System Improvements

## 2.6 Project Costs

The estimated total project cost to construct the water infrastructure necessary to serve the Development to the two points of connection required is shown in **Table 5** below

<b>Table 5 Water Infrastructure Estimated Project Cost</b>			
<b>Item</b>	<b>Quantity</b>	<b>Unit Price</b>	<b>Total</b>
12" PVC T Main-Highland Ranch Pkwy	2,300	\$95/lf	\$219,000
8" PVC-Midnight	220	\$65/lf	\$14,000
Connect to existing 12"	1	\$15,000	\$15,000
Connect to existing 8"	1	\$2,000	\$2,000
Asphalt Replacement	N/A-In Shoulder	\$10/sf	\$0
Subtotal			\$250,000
Contractor OH & Profit, 15%			\$38,000
Planning, Permitting, Engineering, & Const. Administration, 20%			\$50,000
Contingency, 30%			\$75,000
<b>Total Estimated Project Cost-Water</b>			<b>\$413,000</b>

## 3.0 Wastewater Treatment and Conveyance Evaluation

### 3.1 Givens and General Assumptions

The existing wastewater system information was obtained from the *SVGID Wastewater System Master Plan*, dated August, 2011 that was prepared by Shaw Engineering (WWMP) as well as from any subsequent work related to various developments that have occurred since the WWMP was completed.

As identified in the WWMP, the following flows were utilized in this Report;

Annual Average Day Flow	186 Gallons per Day/Equivalent Residential Unit (GPD/ERU)
Peak Month Average Day Flow	201 GPD/ERU



This Study utilized existing SVGID planning and design criteria consistent with the WWMP and is summarized as follows;

Treatment Plant Capacity	Peak Month
8" Peak Hour Factor	3.0
10" and 12" Peak Hour Factors	2.5
15" and above Peak Hour Factor	2.25
Pipe Capacity (d/D)	75%

The wastewater collection system was originally modeled utilizing Haestaed Methods SewerCAD v5.5 hydraulic modeling software for the WWMP and then updated utilizing Excel for this Study.

System improvements recently completed and incorporated into the hydraulic modeling utilized for this Study includes the following;

- a. East Basin 15 inch Main Replacement (WWMP Section 5.2.3).
- b. Repair manhole at 5<sup>th</sup> and Pearl (WWMP Section 5.2.1)

The customer counts by EDU utilized for this Study are summarized below in **Table 6**.

<b>Table 6 Existing and Expanded Service Area EDU's</b>		
<b>Customer</b>	<b>Existing Service Area</b>	<b>Expanded Service Area</b>
SVGID (Existing + Infill)	6,394	
WCDWR	986	
Active Will Serves		
Ladera Phase 1	25	
Planned Future Developments <sup>1</sup>		
Project X (March, 2020)		222
Valle Vista (March, 2020)	75	
Ladera Phases 2-6 (February, 2020)	294	
Sun Mesa Phase 3 (March, 2019)	44	
Sun Mesa Phase 4 (Sept, 2016)	58	
Sub Total	7,876 <sup>2</sup>	222
<b>Total</b>		<b>8,098</b>

*Footnotes:*

1. Wastewater capacity studies have been completed. Will serves are issued by SVGID on a first come first serve basis.
2. Derived from WWMP Table 2.10. Total service area buildout projected in the 2011 Wastewater Master Plan Update of 6,847 plus 43 additional Ladera (356 to 399 lots).

Based upon all of the above presented information, the total flows utilized in this Study are summarized below in **Table 7**.

<b>Table 7 Total System Wide Flows, GPM/MGD</b>		
<b>EDU's</b>	<b>Average Day Flow</b>	<b>Peak Month Flow</b>
7,876 (Existing Service Area)	1,017/1.46	1,099/1.58
8,098 (Expanded Service Area)	1,046/1.51	1,130/1.63

### 3.2 Collection System Capacity

The SVGID point of connection is currently envisioned to be located at the intersection of Highland Ranch Parkway and Midnight Drive. The WWMP has previously identified two sections as being overcapacity and requiring regrading (WWMP Section 5.2.4 along Carrol and along Prosser) for the existing plus service area buildout scenario. Neither of these two projects will have to be undertaken to serve this Development however the next development will likely trigger these two projects. The existing collection system has the capacity to pass the projected flows to the interceptor. **Figure 3, page 11** illustrates the point of connection to the existing system.

### 3.3 SVGID Interceptor Capacity

The interceptor begins at SVGID Flow Meter Station #1 located at Prosser and travels all the way to the intersection of Sparks Boulevard and Baring Way where it then discharges into the City of Sparks Spanish Springs Interceptor that then travels to TMWRF.

The WWMP has previously identified one section in the interceptor as being overcapacity and requiring regrading (WWMP Section 5.3.4 between manholes 61 and 63,). This project will have to be undertaken to serve the Development. **It is also noted that the WWMP identified one other area along the interceptor (WWMP Section 5.3.1 between manholes 18 and 19) to be monitored. It is assumed in this Study that ongoing monitoring continues to support that there are no issues between SSMH 18 and 19.** The required improvement is shown in **Figure 4, page 12**.



Figure 3  
Collection System Improvements

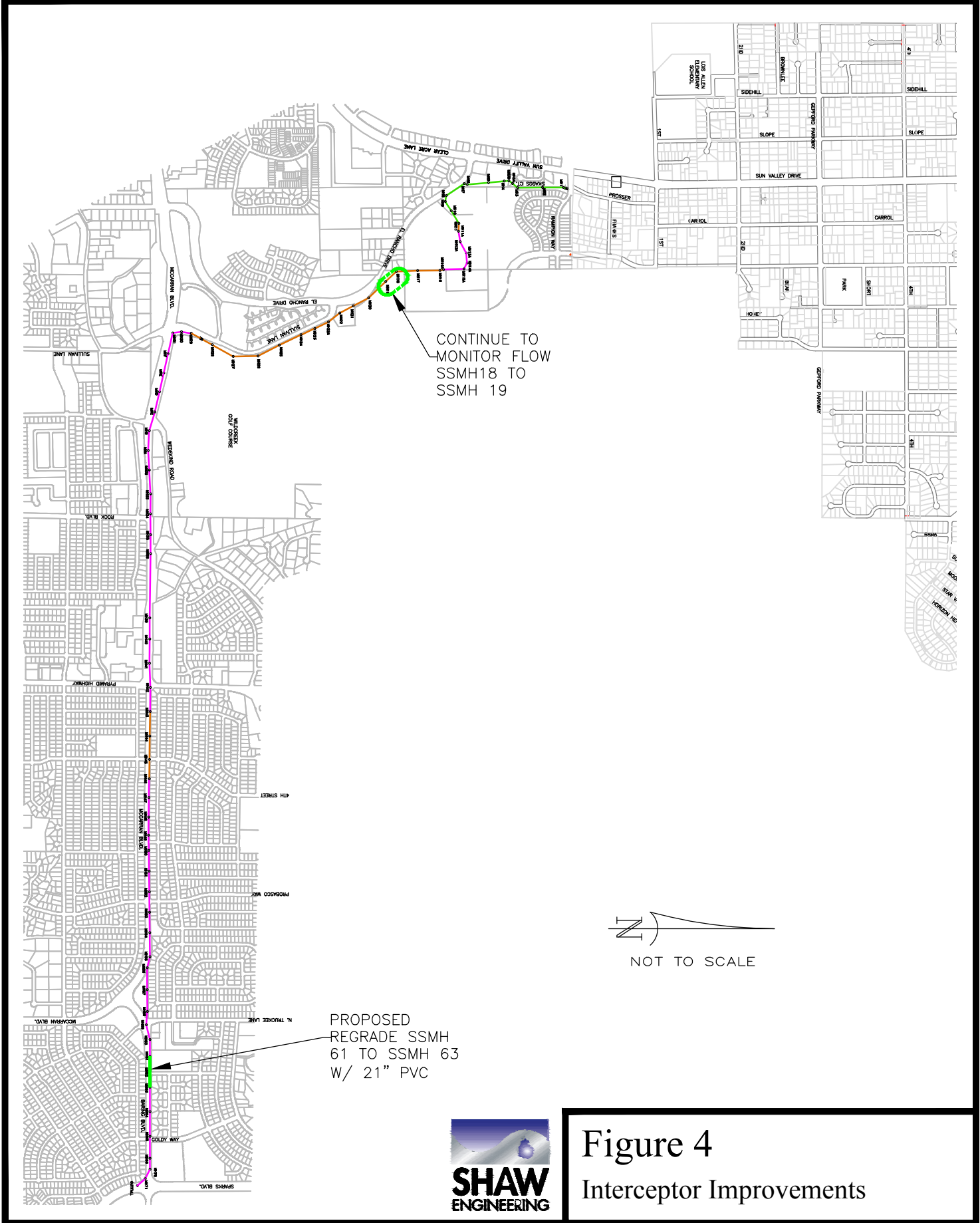


Figure 4  
Interceptor Improvements

### 3.4 Treatment Capacity at TMWRF

SVGID has 2.099 MGD of total treatment capacity at the Truckee Meadows Water Reclamation Facility (TMWRF) of which 0.479 MGD is dedicated to Washoe County. The capacity available to SVGID is therefore 1.62 MGD. The service area buildout scenario for SVGID is 7,112 EDU's (Table 6, 8,098 EDU's minus the 986 WCDWR ERU's) which equates to a peak month flow of 1.43 MGD. SVGID therefore has the treatment capacity available to serve the Development.

### 3.5 Project Costs

The estimated total project cost to construct the wastewater infrastructure necessary to serve the Development is shown in **Table 8 below**

Table 8 Wastewater Infrastructure Estimated Project Cost			
Item	Quantity	Unit Price	Total
Traffic Control	1	\$20,000	\$20,000
Bypass Pumping	1	\$30,000	\$30,000
21" PVC-Baring (SSMH 61-63)	485	\$210/lf	\$102,000
60" Manholes	3	\$12,000	\$36,000
8" PVC-Midnight	220	\$80/lf	\$18,000
Connection to Existing 8"	1	\$2,000	\$2,000
Asphalt Replacement	12,200 SF	\$10/sf	\$122,000
Subtotal			\$330,000
Contractor OH & Profit, 15%			\$50,000
Planning, Permitting, Engineering, & Const. Administration, 20%			\$66,000
Contingency, 30%			\$99,000
<b>Total Estimated Project Cost-Wastewater</b>			<b>\$545,000</b>

#### **4.0 Opinions of Project Costs**

Opinions on construction costs provided are made on the basis of experience and qualifications of Shaw Engineering. These estimates are based upon 2019 prices and appropriate escalation or de-escalation factors need to be considered as time passes. Since Shaw Engineering has no control over the cost of labor, materials, equipment or services furnished by others, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, SVGID and the Development are cautioned that the prices presented cannot and do not guarantee that the actual construction bid(s) will not vary from opinions of construction cost presented herein. If SVGID and the Development wish greater assurance as to construction cost estimates, consideration to employing an independent cost estimator should be made.



KW Commercial  
10539 Professional Circle, #100  
Reno Nevada 89521

June 26, 2019

Attention Mr. Ron Bath

Highland Ranches  
Washoe County, Nevada

Gentlemen:

We have performed a preliminary soils evaluation on the property known as Highland Ranches. Located in Sun Valley along Highland Ranch Parkway, APN 508-020-41. The site is undeveloped at the present time and is made up of rolling hills.

We excavated four test pits as shown on the attached site plan. The test pits were dug four to five feet in depth. The excavator was relatively small articulating equipment. As a result, the test pits encountered refusal at shallow depths. Samples of the materials were obtained and placed in plastic bags tagged for location and depth. The samples were returned to our laboratory for selective testing.

The soils encountered were silty and clayey sands (SC), underlain by clayey sands with gravel (SC). The test pit logs are depicted on the attached plates. Laboratory test were performed which consisted of sieve analysis and Atterberg limits for determining classification. Based on local geological maps the on-site materials are made up of surficial silty and clayey sands underlain by Mesozoic granitic rock. Resistive rock at shallow depths can be expected, during mass grading and utility operations. These materials may require special equipment or blasting to remove.

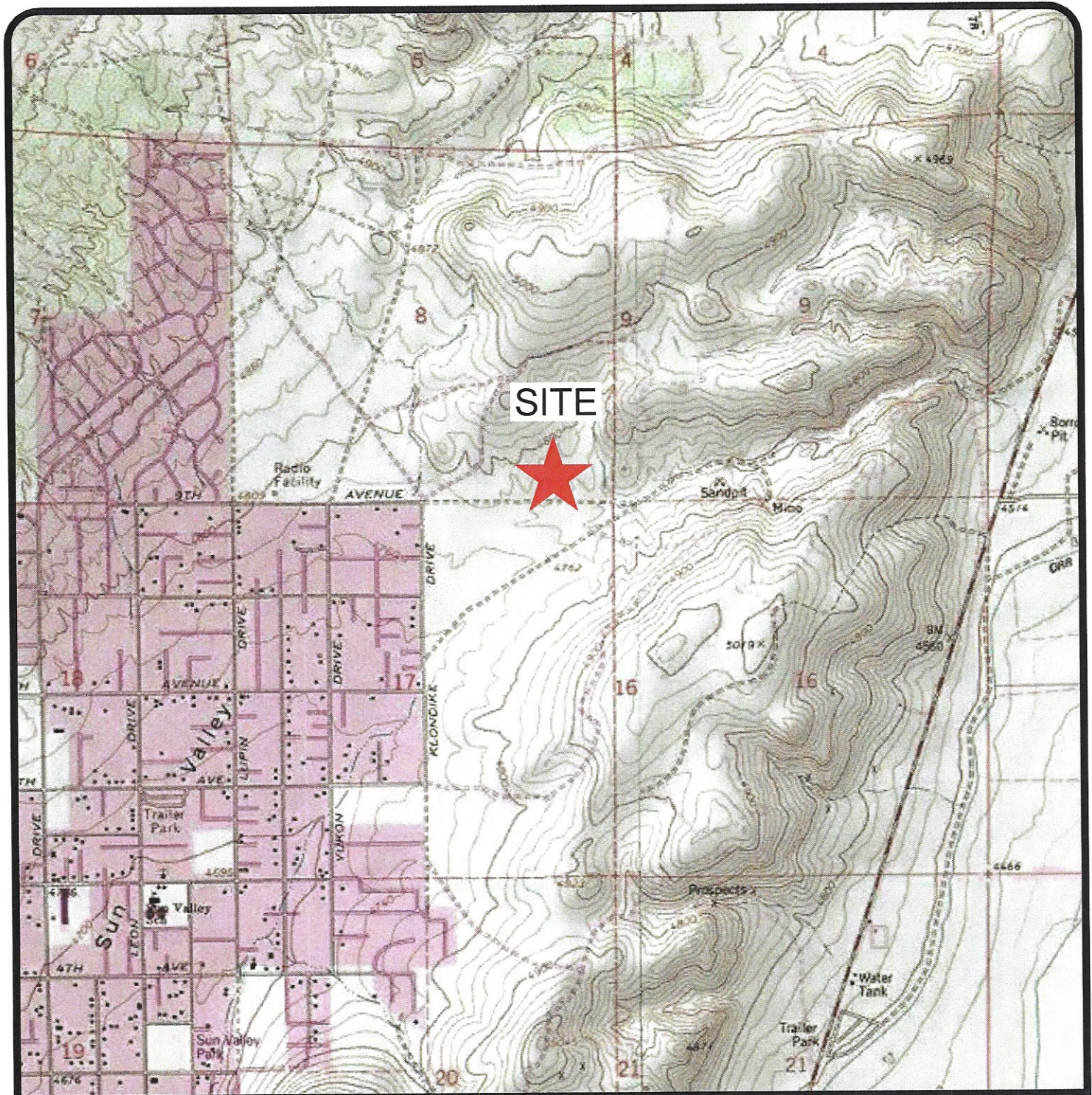
Based on our preliminary evaluation the site would be suitable for single family housing development. The only concerns is the amount of grading required to obtain level lots for construction. Also, as deeper cuts are required and utilities such as sewer, could be challenging. Resistive rock at isolated areas could cause the use of blasting or specialized equipment.

We trust this provides you with the information you requested at this time. If you have any questions please don't hesitate to call us.

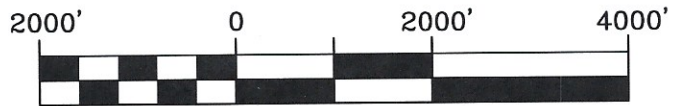
Sincerely,

Raymond M. Pezonella Principal





Base Map:  
 USGS Topographic map,  
 Reno 7.5- Minute Quadrangle



Job No. RM-19-070

Site Location Plan

06-28-2019



Highland Ranches  
 Highland Ranch Parkway  
 Reno, Washoe County, Nevada

Plate No. 1





Image Source:  
Google Earth



Key  
Test Pit Location



B-1

Job No. RM-19-070

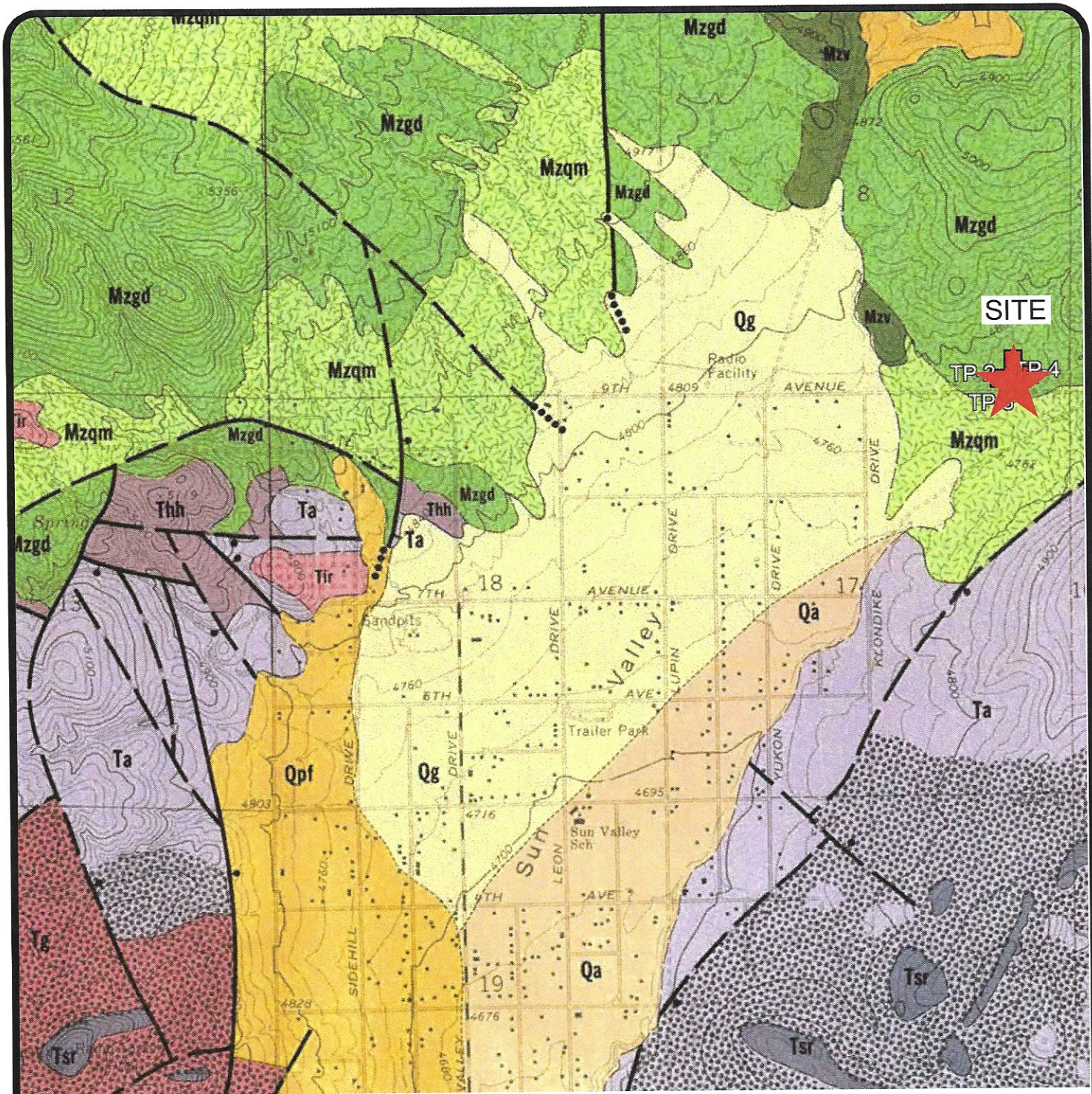
Test Pit Location Plan

06-28-2019

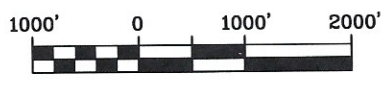


Highland Ranches  
Highland Ranch Parkway  
Reno, Washoe County, Nevada

Plate No. 2



Sources:  
 Nevada Bureau of Mines and Geology  
 USGS  
 Google Earth



Key  
 Fault: ———  
 Site: ★  
 Mzgd: Mesozoic Granodiorite

Job No. RM-19-070	<b>Geology</b>	06-28-2019
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	Highland Ranches Highland Ranch Parkway Reno, Washoe County, Nevada	Plate No. 3
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# National Flood Hazard Layer FIRMette



39°36'42.81"N



## Legend

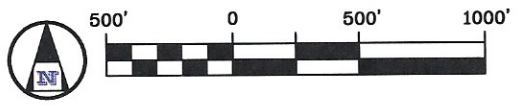
- SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT
- SPECIAL FLOOD HAZARD AREAS**
    - Without Base Flood Elevation (BFE) Zone A, V, A99
    - With BFE or Depth Zone AE, AO, AH, VE, AP
    - Regulatory Floodway
  - OTHER AREAS OF FLOOD HAZARD**
    - 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
    - Future Conditions 1% Annual Chance Flood Hazard Zone X
    - Area with Reduced Flood Risk due to Levee. See Notes, Zone X
    - Area with Flood Risk due to Levee Zone D
  - OTHER AREAS**
    - Area of Minimal Flood Hazard Zone X
    - Effective LOMRs
    - Area of Undetermined Flood Hazard Zone D
  - GENERAL STRUCTURES**
    - Channel, Culvert, or Storm Sewer
    - Levee, Dike, or Floodwall
  - OTHER FEATURES**
    - Cross Sections with 1% Annual Chance Water Surface Elevation
    - Coastal Transect
    - Base Flood Elevation Line (BFE)
    - Limit of Study
    - Jurisdiction Boundary
    - Coastal Transect Baseline
    - Profile Baseline
    - Hydrographic Feature
  - MAP PANELS**
    - Digital Data Available
    - No Digital Data Available
    - Unmapped
- The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards.

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/28/2019 at 6:58:11 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and undetermined areas cannot be used for regulatory purposes.

Source:  
FEMA



Job No. RM-19-070	Flood Map	06-28-2019
	Highland Ranches Highland Ranch Parkway Reno, Washoe County, Nevada	Plate No. 4



**LOG OF TEST PIT  
No. TP-1**

PROJECT: Highland Ranches PROJECT NO.: RM-19-070  
 CLIENT: KW Commercial  
 PROJECT LOCATION: Highland Ranch Parkway, Reno, Nevada  
 LOCATION: 39.607815°, -119.754234° NAD 83 Datum ELEVATION: 4,762' NAVD88  
 OPERATOR: Brad Canuth LOGGED BY: RMP  
 EXCAVATION METHOD: Kubota Mini Excavator DATE: 06/07/2019  
 DEPTH TO WATER, INITIAL: ☹ N/E AFTER 24 HOURS: ☹ CAVING> ☹

This information pertains only to this test pit and should not be interpreted as being indicative of the entire site.

Elevation/ Depth (Ft)	Description	Graphic	USCS	SAMPLERS	% < #200	TEST RESULTS				
						Plastic Limit	Water Content - ●			Liquid Limit
						10	20	30	40	50
0	CLAYEY SAND (SC): Brown; loose; dry		SC	☒	19					
4760	SILTY CLAYEY SAND (SC): Reddish brown; very dense; moist		SC-SM	☒	24					
5	Test pit terminated at 5 feet; no free water encountered									
4755										
10										
4750										
15										
4745										
20										
4740										
25										
4735										
30										
4730										
35										



**LOG OF TEST PIT  
No. TP-2**

PROJECT: Highland Ranches PROJECT NO.: RM-19-070  
 CLIENT: KW Commercial  
 PROJECT LOCATION: Highland Ranch Parkway, Reno, Nevada  
 LOCATION: 39.608043°, -119.754968° NAD 83 Datum ELEVATION: 4,770' NAVD88  
 OPERATOR: Brad Canuth LOGGED BY: RMP  
 EXCAVATION METHOD: Kubota Mini Excavator DATE: 06/07/2019  
 DEPTH TO WATER, INITIAL: N/E AFTER 24 HOURS: CAVING> C

This information pertains only to this test pit and should not be interpreted as being indicative of the entire site.

Elevation/ Depth (Ft)	Description	Graphic	USCS	SAMPLERS	% < #200	TEST RESULTS				
						Plastic Limit	Water Content - ●			Liquid Limit
						10	20	30	40	50
4770 - 0	CLAYEY SAND (SC): Brown; loose; moist		SC	×	19					
	SILTY, CLAYEY SAND (SC-SM): Reddish brown; very dense; moist		SC-SM	×	20					
4765 - 5	Test pit terminated at 4.5 feet, no free water encountered									
4760 - 10										
4755 - 15										
4750 - 20										
4745 - 25										
4740 - 30										
4735 - 35										



**LOG OF TEST PIT  
No. TP-3**

PROJECT: Highland Ranches PROJECT NO.: RM-19-070  
 CLIENT: KW Commercial  
 PROJECT LOCATION: Highland Ranch Parkway, Reno, Nevada  
 LOCATION: 39.60769°, -119.755621° NAD 83 Datum ELEVATION: 4,779' NAVD88  
 OPERATOR: Brad Canuth LOGGED BY: RMP  
 EXCAVATION METHOD: Kubota Mini Excavator DATE: 06/07/2019  
 DEPTH TO WATER, INITIAL: ∅ N/E AFTER 24 HOURS: ∅ CAVING> ∅

This information pertains only to this test pit and should not be interpreted as being indicative of the entire site.

Elevation/ Depth (Ft)	Description	Graphic	USCS	SAMPLERS	% < #200	TEST RESULTS				
						Plastic Limit	Water Content - ●			Liquid Limit
						10	20	30	40	50
0	CLAYEY SAND (SC): Reddish brown; loose; dry		SC	⊗	14					
1.5	SILTY, CLAYEY SAND WITH GRAVEL (SC-SM): Grayish brown; very dense; moist		SC-SM	⊗						
4.775	Test pit terminated at 4 feet; no free water encountered									
5										
4.770										
10										
4.765										
15										
4.760										
20										
4.755										
25										
4.750										
30										
4.745										
35										



**LOG OF TEST PIT  
No. TP-4**

PROJECT: Highland Ranches PROJECT NO.: RM-19-070  
 CLIENT: KW Commercial  
 PROJECT LOCATION: Highland Ranch Parkway, Reno, Nevada  
 LOCATION: 39.608380°, -119.754978° NAD 83 Datum ELEVATION: 4,796' NAVD88  
 OPERATOR: Brad Canuth LOGGED BY: RMP  
 EXCAVATION METHOD: Kubota Mini Excavator DATE: 06/07/2019  
 DEPTH TO WATER, INITIAL: ∞ N/E AFTER 24 HOURS: ∞ CAVING> C

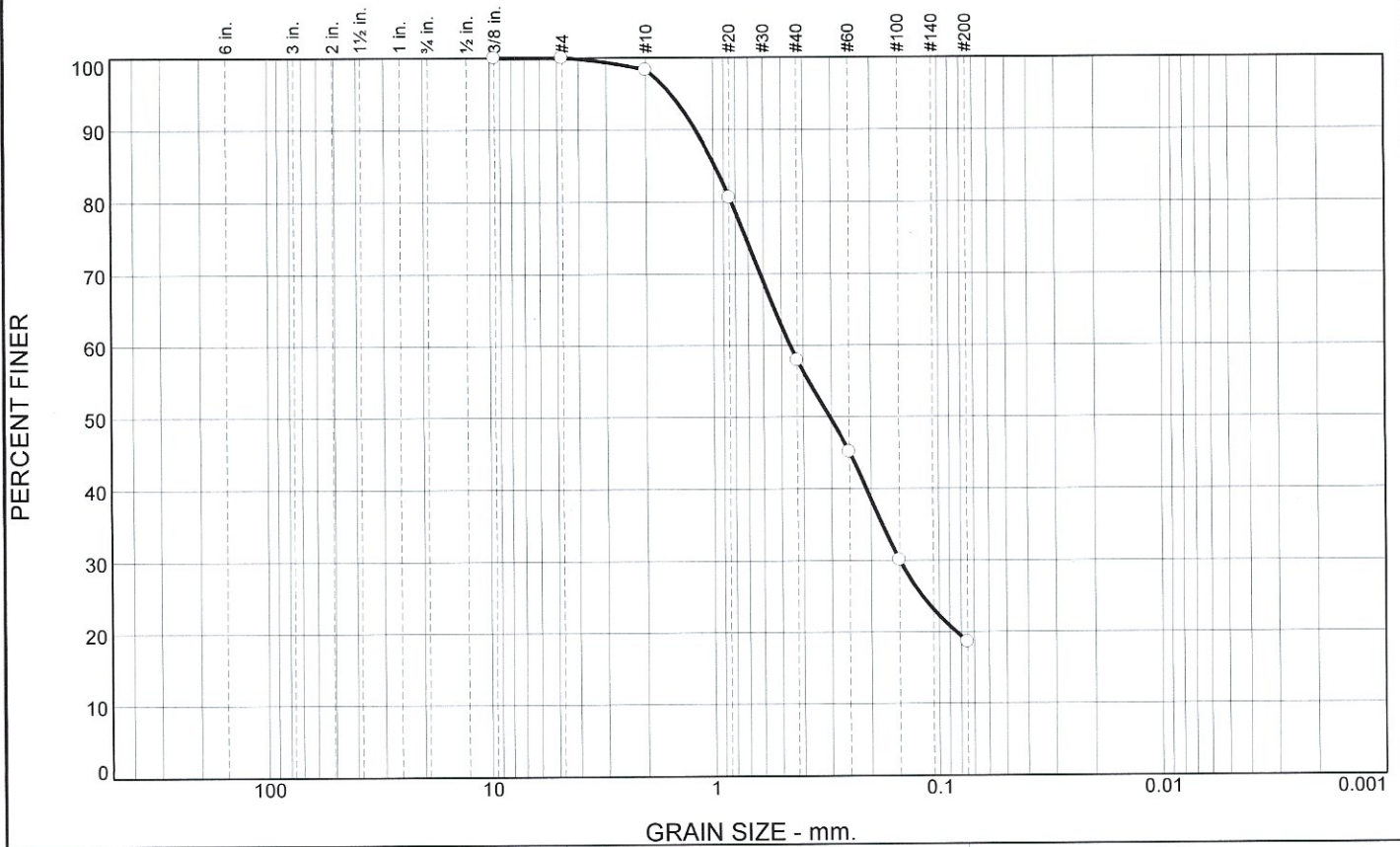
This information pertains only to this test pit and should not be interpreted as being indicative of the entire site.

Elevation/ Depth (Ft)	Description	Graphic	USCS	SAMPLERS	% < #200	TEST RESULTS				
						Plastic Limit	Water Content - ●			Liquid Limit
						10	20	30	40	50
0	CLAYEY SAND (SC): Brown; loose; dry		SC	×	19					
1.5	SILTY, CLAYEY SAND WITH GRAVEL (SC-SM): Grayish Brown; very dense; moist		SC-SM	×						
5	Test pit terminated at 5 feet; no free water encountered									
4795										
4790										
4785										
4780										
4775										
4770										
4765										
4760										

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS  (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
	SAND AND SANDY SOILS	CLEAN SANDS  (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
	FINE GRAINED SOILS	SILTS AND CLAYS  LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS  LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	
			CH	INORGANIC CLAYS OF HIGH PLASTICITY	
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	
HIGHLY ORGANIC SOILS					
<b>NOVA GEOTECHNICAL &amp; INSPECTION SERVICES</b>	CLIENT:	KW Commercial			<b>Materials Classification</b>
	PROJECT:	Highland Ranches			
				RM-19-070	8A



# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	2	40	39	19	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375"	100		
#4	100		
#10	98		
#20	81		
#40	58		
#60	45		
#100	30		
#200	19		

**Soil Description**  
Clayey sand (SC)

**Atterberg Limits**  
 PL=                      LL=                      PI=

**Coefficients**  
 D<sub>90</sub>= 1.2010      D<sub>85</sub>= 0.9861      D<sub>60</sub>= 0.4575  
 D<sub>50</sub>= 0.3049      D<sub>30</sub>= 0.1496      D<sub>15</sub>=  
 D<sub>10</sub>=                      C<sub>u</sub>=                      C<sub>c</sub>=

**Classification**  
 USCS= SC                      AASHTO=

**Remarks**

\* (no specification provided)

Location: TP1  
Depth: 0-2

Date: 6-20-19

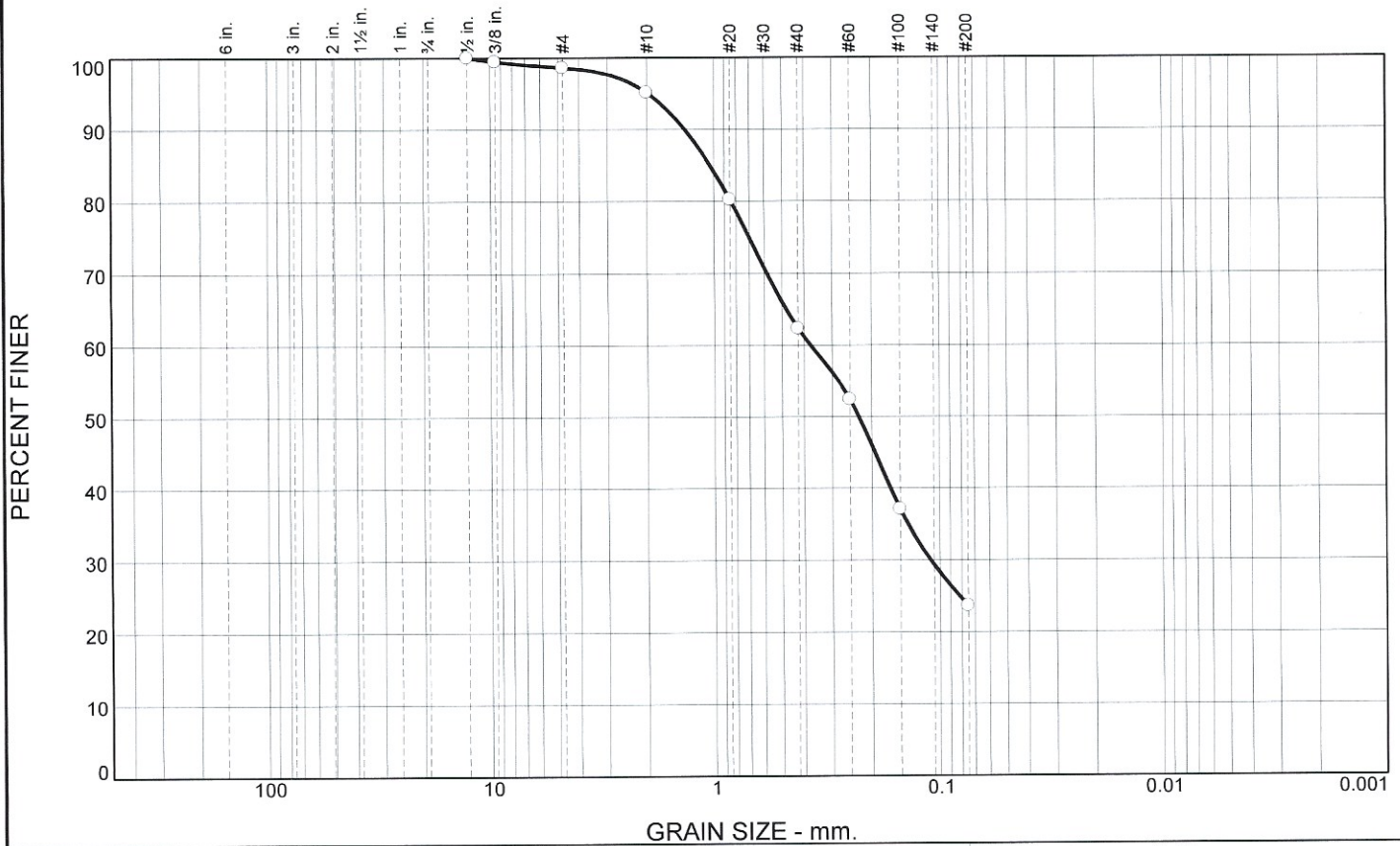
**Nova Geotechnical  
and Inspection Services  
Reno, Nevada**

Client: KW Commercial  
Project: Highland Ranches

Project No: RM-19-070

Plate 9

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	4	33	38	24	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.50"	100		
.375"	99		
#4	99		
#10	95		
#20	80		
#40	62		
#60	52		
#100	37		
#200	24		

**Soil Description**

Silty, clayey sand (SC-SM)

**Atterberg Limits**

PL= 15                      LL= 20                      PI= 5

**Coefficients**

D<sub>90</sub>= 1.3547              D<sub>85</sub>= 1.0431              D<sub>60</sub>= 0.3747  
D<sub>50</sub>= 0.2286              D<sub>30</sub>= 0.1103              D<sub>15</sub>=  
D<sub>10</sub>=                      C<sub>u</sub>=                      C<sub>c</sub>=

**Classification**

USCS= SC-SM                      AASHTO= A-2-4(0)

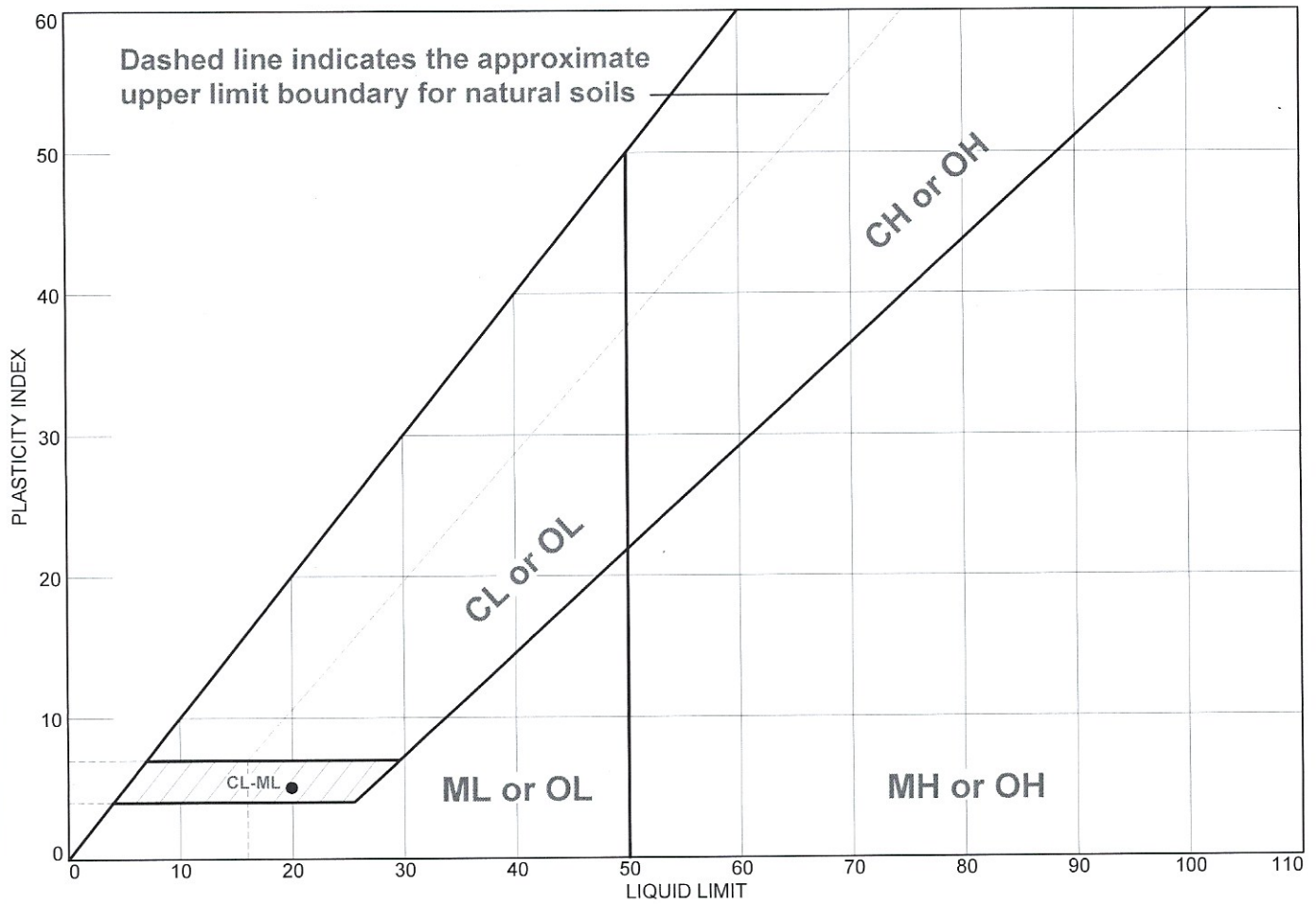
**Remarks**

\* (no specification provided)

Location: TP1  
Depth: 2-5

Date: 6-20-19

# LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● Silty, clayey sand (SC-SM)	20	15	5	62	24	SC-SM

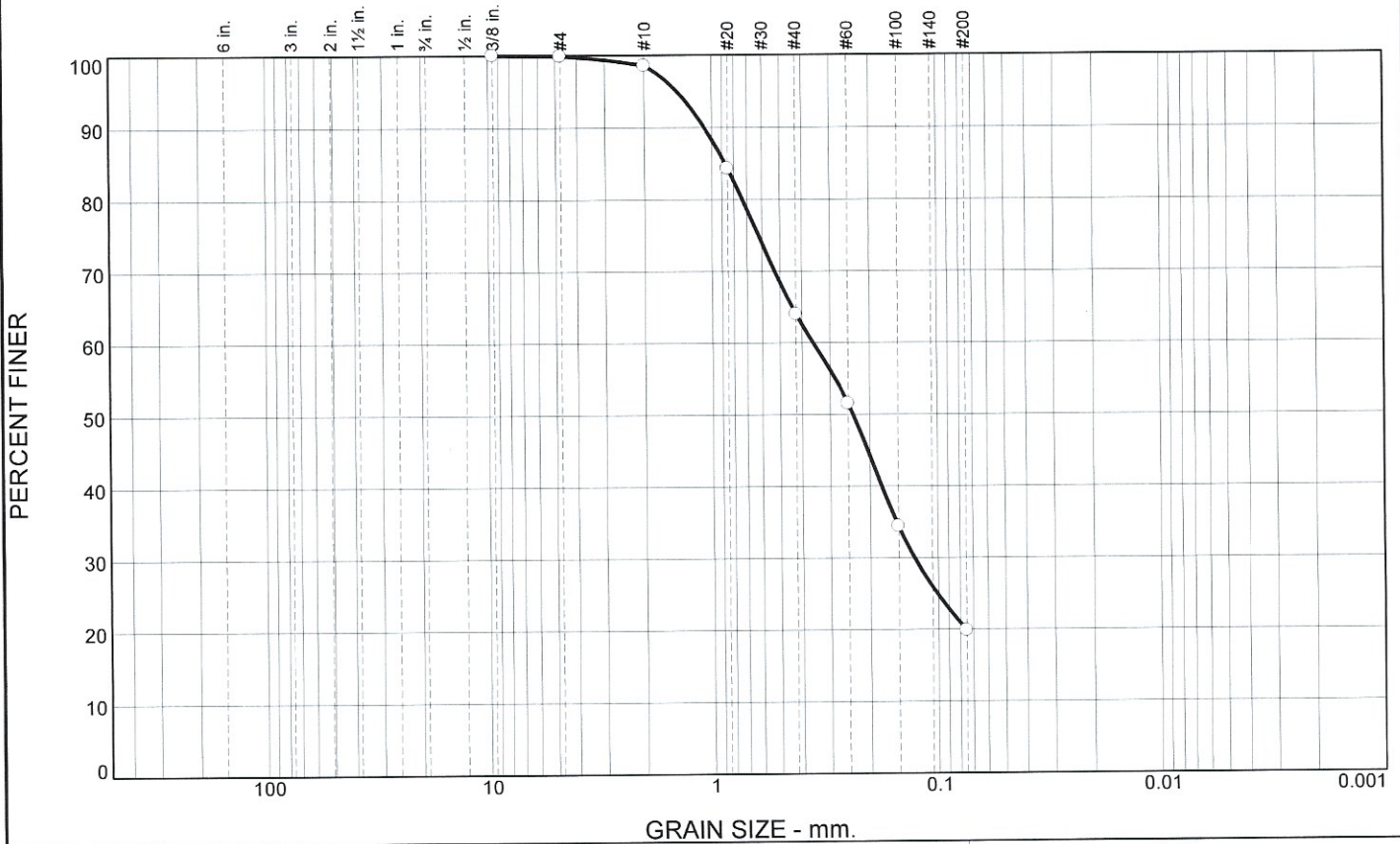
**Project No.** RM-19-070    **Client:** KW Commercial  
**Project:** Highland Ranches  
**● Location:** TP1    **Depth:** 2-5

**Remarks:**

**Nova Geotechnical  
and Inspection Services  
Reno, Nevada**

Tested By: CP \_\_\_\_\_

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	1	35	44	20	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375"	100		
#4	100		
#10	99		
#20	84		
#40	64		
#60	52		
#100	34		
#200	20		

**Soil Description**  
Clayey sand (SC)

**Atterberg Limits**  
 PL=                      LL=                      PI=

**Coefficients**  
 D<sub>90</sub>= 1.0799      D<sub>85</sub>= 0.8738                      D<sub>60</sub>= 0.3572  
 D<sub>50</sub>= 0.2378      D<sub>30</sub>= 0.1278                      D<sub>15</sub>=  
 D<sub>10</sub>=                      C<sub>u</sub>=                                      C<sub>c</sub>=

**Classification**  
 USCS= SC                      AASHTO=

**Remarks**

\* (no specification provided)

Location: TP2  
Depth: 0.0

Date: 6-20-19

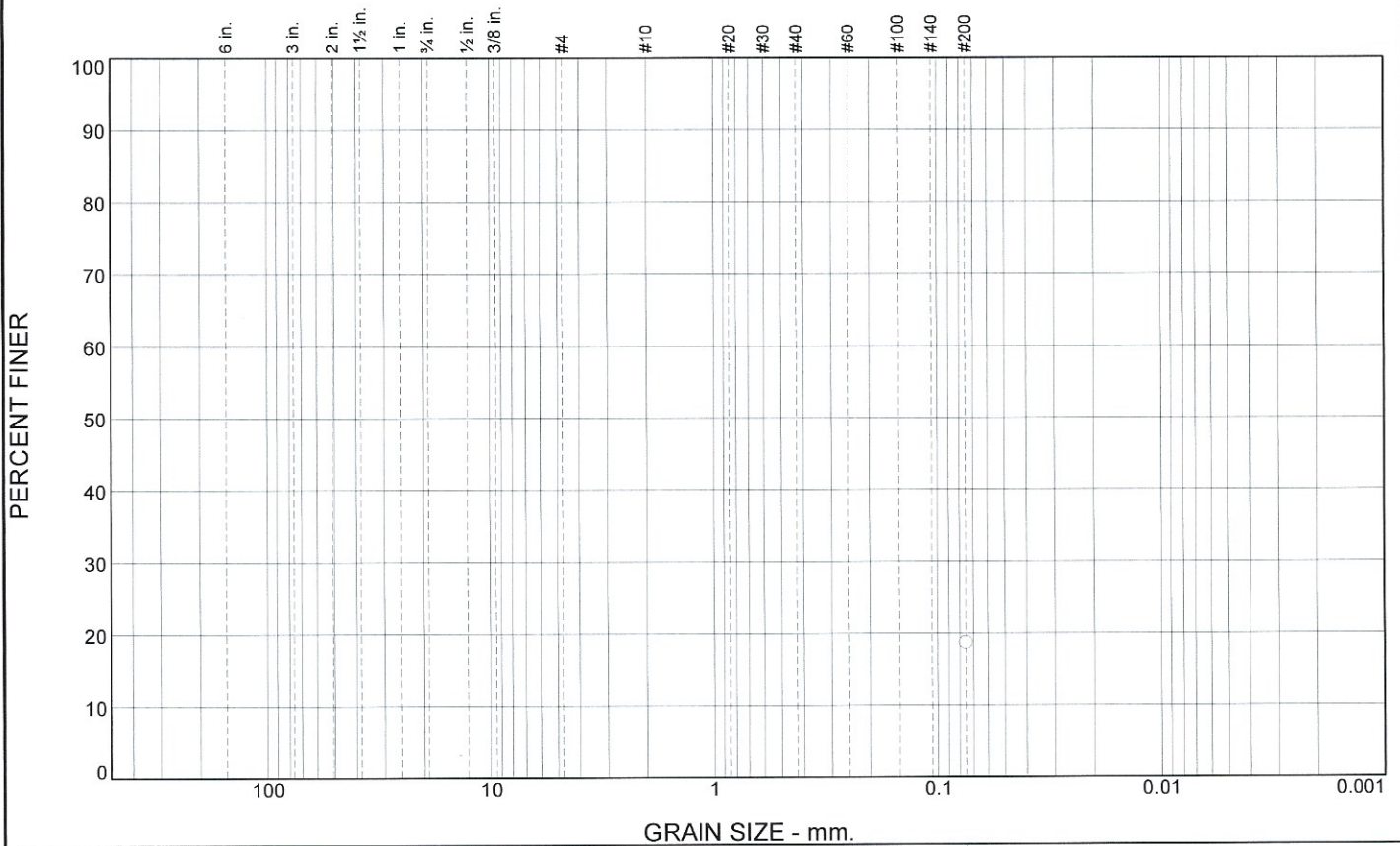
**Nova Geotechnical  
and Inspection Services  
Reno, Nevada**

Client: KW Commercial  
Project: Highland Ranches

Project No: RM-19-070

Plate 12

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
						19	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	19		

**Soil Description**

**Atterberg Limits**  
 PL=                      LL=                      PI=

**Coefficients**  
 D<sub>90</sub>=                      D<sub>85</sub>=                      D<sub>60</sub>=  
 D<sub>50</sub>=                      D<sub>30</sub>=                      D<sub>15</sub>=  
 D<sub>10</sub>=                      C<sub>u</sub>=                      C<sub>c</sub>=

**Classification**  
 USCS=                      AASHTO=

**Remarks**

\* (no specification provided)

**Location:** TP2  
**Depth:** 0'-4'

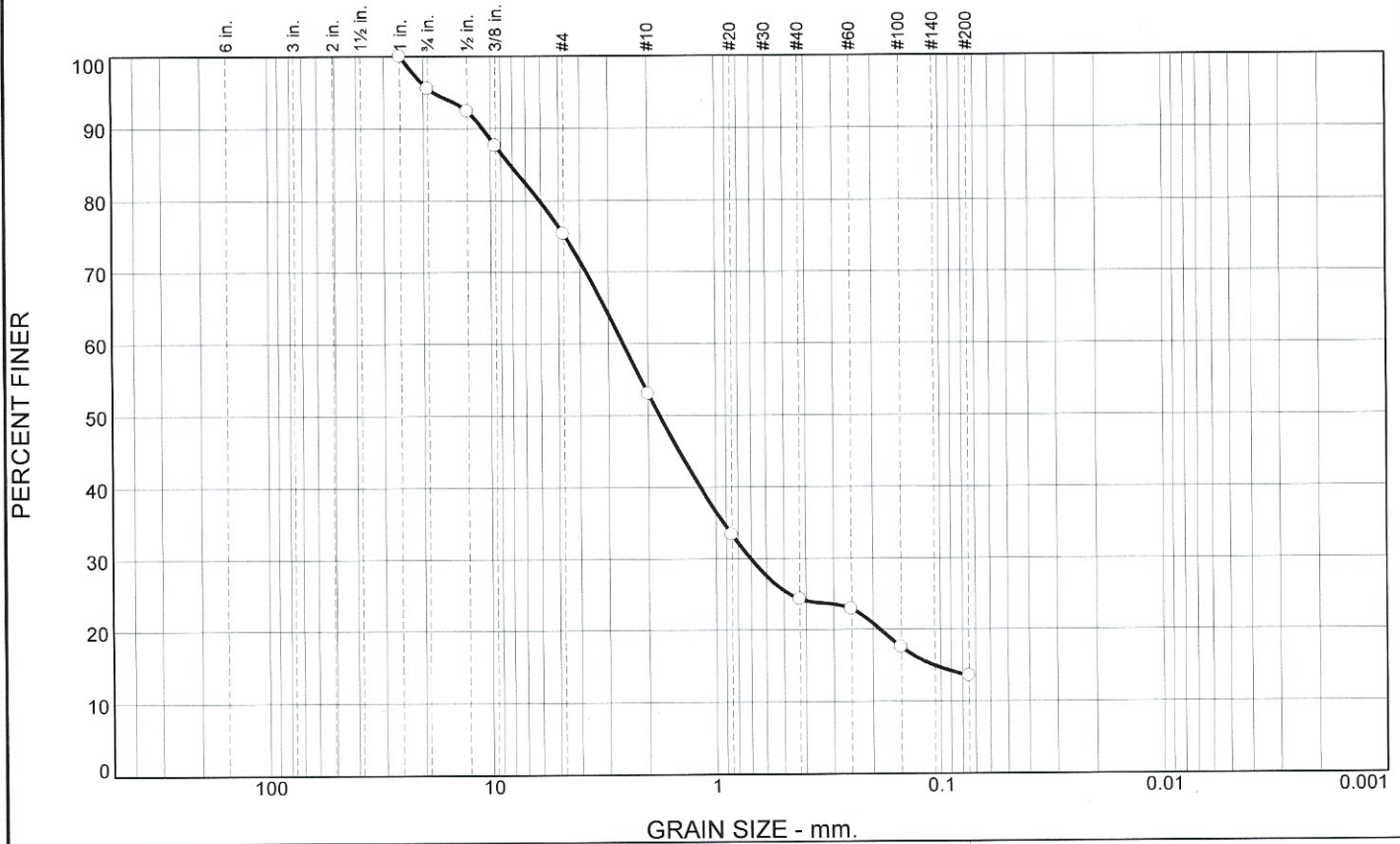
**Date:**

**Nova Geotechnical  
 and Inspection Services  
 Reno, Nevada**

**Client:** KW Commercial  
**Project:** Highland Ranches  
**Project No:** RM-19-070

**Plate** 13

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	4	21	22	29	10	14	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0"	100		
.75"	96		
.50"	92		
.375"	88		
#4	75		
#10	53		
#20	33		
#40	24		
#60	23		
#100	18		
#200	14		

**Soil Description**

Silty, clayey sand w/ gravel (SC-SM)

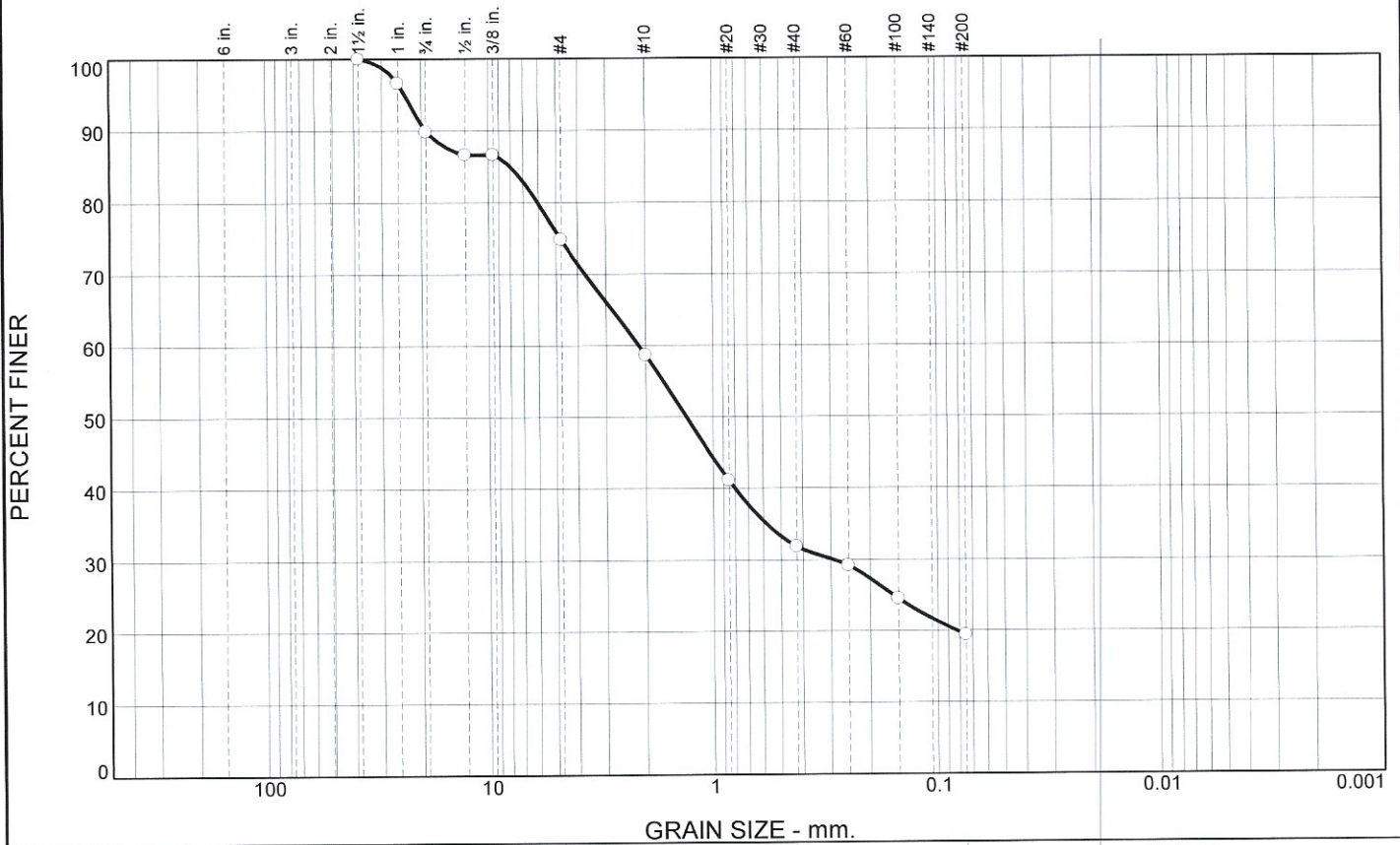
  

PL=	<b>Atterberg Limits</b>	PI=
	LL=	
	<b>Coefficients</b>	
D <sub>90</sub> = 10.8565	D <sub>85</sub> = 8.1995	D <sub>60</sub> = 2.5853
D <sub>50</sub> = 1.7825	D <sub>30</sub> = 0.7035	D <sub>15</sub> = 0.1070
D <sub>10</sub> =	C <sub>u</sub> =	C <sub>c</sub> =
	<b>Classification</b>	
USCS= SC-SM	AASHTO=	
<b>Remarks</b>		

\* (no specification provided)

Location: TP3 Date: 6-20-19  
 Depth: 1.5

# Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	10	15	16	27	13	19	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100		
1.0"	97		
.75"	90		
.50"	87		
.375"	87		
#4	75		
#10	59		
#20	41		
#40	32		
#60	29		
#100	24		
#200	19		

**Soil Description**  
Silty, clayey sand w/ gravel (SC-SM)

**Atterberg Limits**  
 PL=                      LL=                      PI=

**Coefficients**  
 D<sub>90</sub>= 19.2252      D<sub>85</sub>= 7.9820                      D<sub>60</sub>= 2.1452  
 D<sub>50</sub>= 1.3203        D<sub>30</sub>= 0.2910                      D<sub>15</sub>=  
 D<sub>10</sub>=                      C<sub>u</sub>=                                      C<sub>c</sub>=

**Classification**  
 USCS= SC-SM                      AASHTO=

**Remarks**

\* (no specification provided)

**Location:** TP4  
**Depth:** 1'-4'

**Date:** 6-20-19

**Nova Geotechnical  
and Inspection Services  
Reno, Nevada**

**Client:** KW Commercial  
**Project:** Highland Ranches

**Project No:** RM-19-070

**Plate** 15