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12/19/2011 10:50:24 AM

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Page 1 of 265

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PROJECT BOOK  
KEYSTONE CANYON  
( Title of Document )

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This page added to provide additional information required by NRS 111.312 Sections 1-2 and NRS 239B.030 Section 4.

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# Keystone Canyon

## Planned Unit Development

## Development Standards Handbook

Approved February 3, 2000  
First Revision – September 2003  
Second Revision – August 2004  
Third Revision – December 2011

Prepared for: City of Reno



When Recorded Return To:

Kraig Knudsen  
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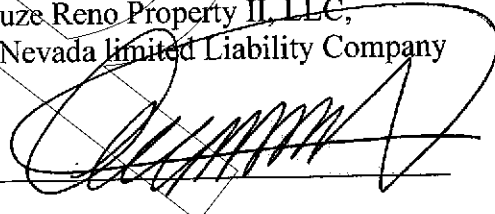
NOTICE OF DESIGN GUIDELINES FOR THE  
KEYSTONE CANYON PLANNED UNIT DEVELOPMENT  
(THIRD REVISION - DECEMBER 2011)

Notice is hereby given that the Final Development Standards Handbook for the "Keystone Community Campus Planned Unit Development" that was certified and approved by the Reno City Council in January 2005 has been revised, effective December 2011. A copy of the revised guidelines is attached hereto and incorporated herein.

This revision supersedes and terminates the applicability of the previous Handbook. The March 2005 version was recorded in the office of the Washoe County Recorder on March 17, 2005 as Document No. 3184106.

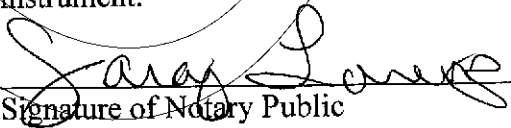
Dated this 16<sup>th</sup> day of December, 2011.

Cruze Reno Property, LLC and  
Cruze Reno Property II, LLC,  
A Nevada limited Liability Company

  
By: DDH Financial Corp., its Manager  
By: Kreg D. Rowe, its President

State of Nevada )  
 )ss.  
County of Washoe )

On this 16 day of December, 2011, before me, a Notary Public, personally appeared Kreg D. Rowe, President of DDH Financial Corp., Manager of Cruze Reno Property, LLC and Cruze Reno Property II, LLC, personally known to me or proved to me on the basis of satisfactory evidence to be the person who executed this instrument.

  
Signature of Notary Public (Seal)



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**Appendix C:**

Traffic Study Preliminary

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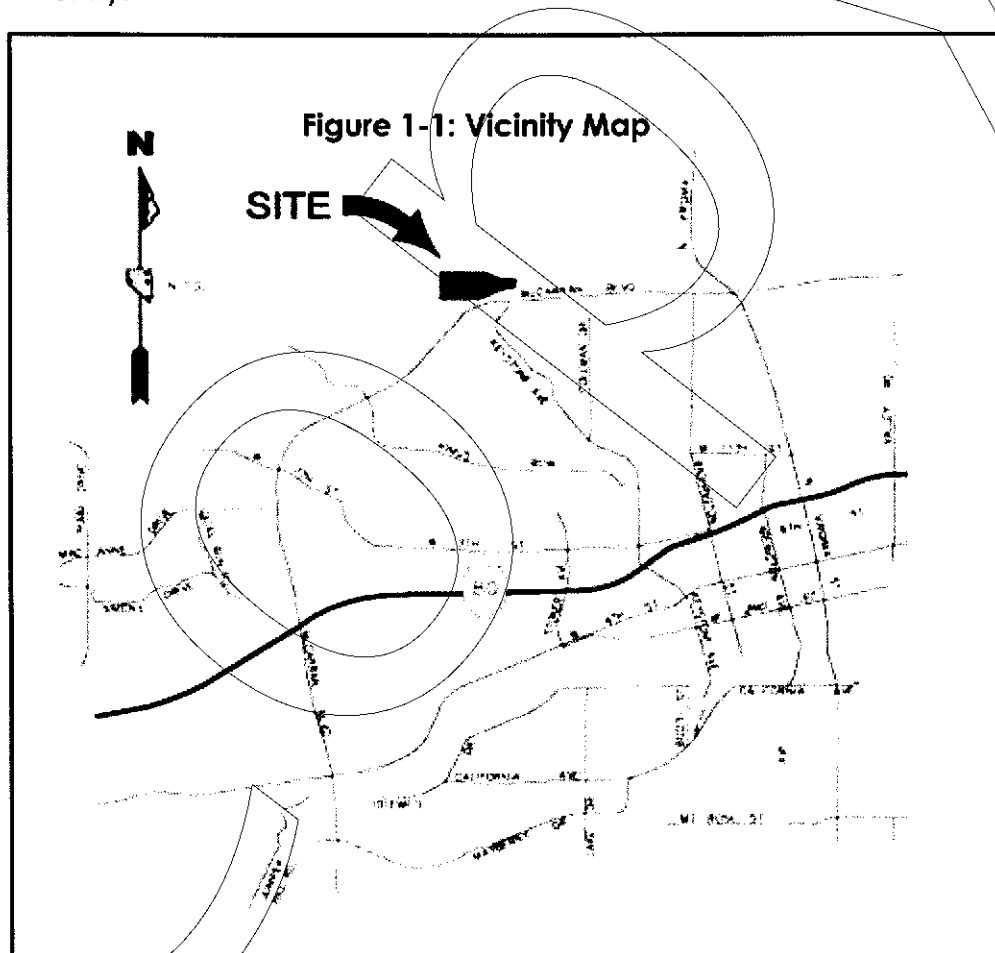
Sanitary Sewer Report

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## Chapter 1: Introduction

### Project Description

The Keystone Canyon Planned Unit Development (PUD) is located north and west of the North McCarran Boulevard and Leadership Parkway intersection. The ±101 acre project site is bound by U.S. Forest Service property to the north and west, McCarran Boulevard and the existing Sky Country subdivision to the south and Washoe County open space to the east. The Keystone Canyon PUD is a mixed-use development comprised of five planning areas including; Village Commercial, Mixed Use, Mixed Residential, Residential, and Open Space. The allowed uses and design standards, combined with generous open space and connection to the existing regional trail network, make for an exciting master planned community.



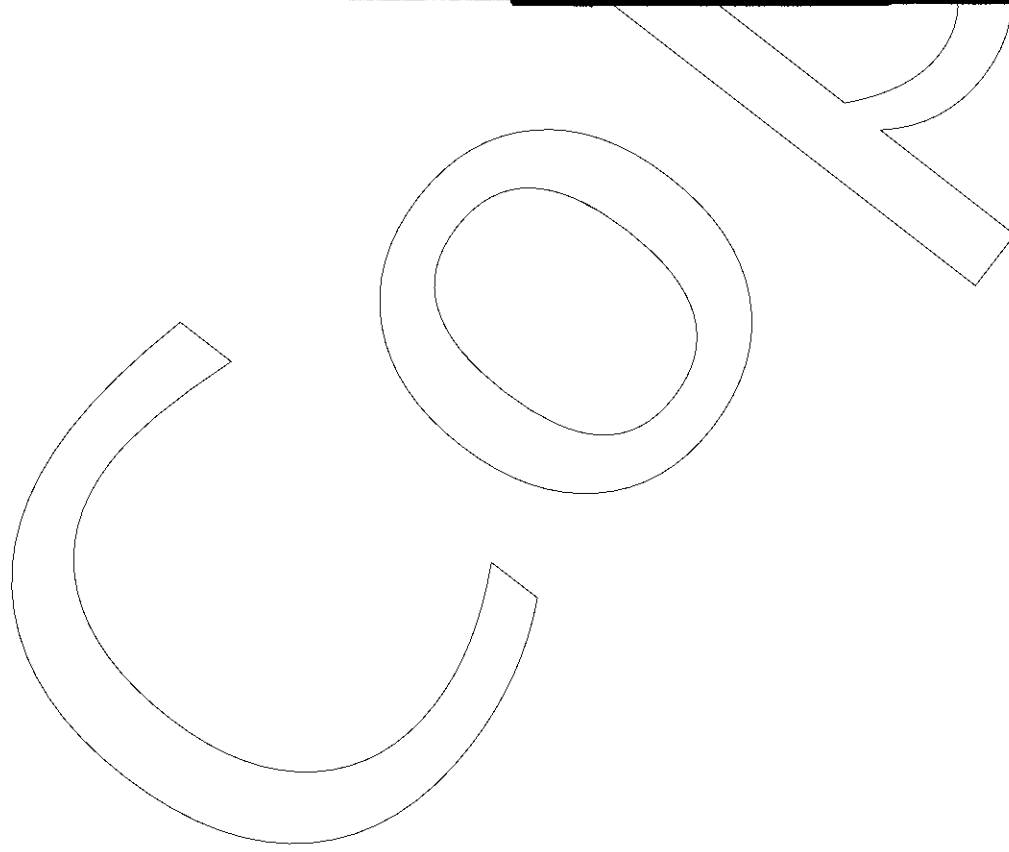
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**Project Goals**

Goal 1: Provide a variety of housing and commercial opportunities in close proximity to the University of Nevada and Downtown Reno.

Goal 2: Provide a residential and commercial environment that is conducive to and functions as a gateway to the adjacent open space and trail network.

Goal 3: Provide adequate infrastructure that effectively meets the needs of the project and the city as a whole.



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### Administration

The PUD Handbook shall be administered by the Zoning Administrator or his/her designee as defined in the City of Reno Annexation and Land Development Code. The administrator shall have the authority to reasonably interpret and apply this PUD handbook.

There shall be a master developer in place from the first phase of development of the PUD. This master developer shall continue throughout the development of the PUD until and unless a master property owners association or other entity is created to serve the role of master developer. The role of the master developer, for the purposes of this PUD, shall be:

- To prescribe and administer methods and procedures to ensure and control the quality of the development that occurs within the Keystone Canyon PUD.
- Maintain all common area improvements, storm drain and/ or irrigation channels, detention and/ or other flood control facilities;

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- Construct, or have constructed, all pedestrian trails, pathways, and sidewalks;
- Establish a Design Review Committee to maintain consistent project architecture.

Only the master developer or its authorized designee or assignee may initiate an amendment to the PUD.

### Review Process

To ensure conformance with the PUD and RMC, each project is required to receive approval of a City of Reno site plan review prior to the issuance of a grading, site improvement or building permit. The site plan review process as outlined in this PUD shall also be used in lieu of a special use permit for hillside development and cuts of greater than 20 feet and fills greater than 10 feet. In order to approve the stated entitlements the zoning administrator shall make the following findings:

1. The proposed project is consistent with the standards contained in the PUD handbook and applicable sections of RMC Title 18 as amended.
2. Adequate facilities and services exist or will exist with construction of the project.
3. The project represents an integrated development with adequate and safe pedestrian, vehicle and bicycle circulation.
4. Structures have been designed such that the window placement and height do not adversely affect the privacy of existing residential uses.
5. The applicant adequately mitigates the traffic impacts of the project.
6. Adequate screening and buffering are provided to minimize impacts to adjacent uses.
7. The proposed project mitigates environmental degradation, including slope failure, erosion, sedimentation, and storm-water run-off.
8. The proposed project utilizes grading practices that are appropriate for hillsides and designed to minimize the visibility of unsightly scarring.
9. The proposed project provides open space based on hillside constraints as set forth in RMC Sections 18.12.1607 and 18.12.1609, as amended.
10. The proposed project adheres to applicable hillside development design standards related to development in sloped areas as set

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forth in RMC, Title 18.12, Article XVI, Hillside Development, as amended.

11. The proposed project's site layout and design features adequately mitigate potential visual impacts of development near prominent ridgelines and within other visually prominent areas.
12. All slopes shall be treated in a manner which does not create negative visual impacts.
13. All grading is necessary to provide safe and adequate access to the development.

There are uses listed in Table 3-5 of this handbook which require a site plan review, special use permit or tentative map to establish. Tentative maps and special use permits require a public hearing before the Planning Commission and shall meet the applicable findings contained in City Code at the time of application, as well as applicable standards contained in this PUD. At the discretion of the applicant site plan reviews may be processed as special use permits in accordance with RMC 18.06.405 and the standards contained in this PUD.

Each development application submitted to the City shall include written documentation of approval from the master developer, written approval by the master developer does not in any way constitute city approval of a development application. The construction of individual projects, including accessory structures shall follow the City of Reno building permit process. For some uses where a tentative map, special use permit or site plan review is required, these processes shall precede the building permit process, as applicable.

To ensure the approved maximum number of residential units and/ or commercial square footage is not exceeded, each building permit shall include the existing number and cumulative total of approved residential units and/ or commercial square footage.

### **Appeals**

The applicant or developer may appeal any decision, comments, or recommendations of the Administrator in accordance with RMC Section 18.06.208, as amended.

### **Conflicts**

In the event of a conflict between these design standards and City Code, these standards shall govern development of Keystone Canyon. When a

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specific standard is not addressed by the PUD, then the applicable section of RMC Title 18, as amended, at the time of review shall prevail.

### **Flexibility**

The Land Use Plan and Development Standards contained herein are intended to depict the general acreages and densities allowed within Keystone Canyon. Sufficient flexibility shall be allowed to permit detailed planning and design at the time of actual development. The acreage of each planning area may be increased by up to 5% if it is demonstrated, to the satisfaction of the Administrator, that additional acreage is necessary due to constraints and/ or design issues to accommodate the project. Likewise the transfer of residential density up to 10% between the Mixed-Use, Mixed Residential and Residential planning areas is permitted, to the satisfaction of the Administrator, as long as the total residential units does not exceed 745.

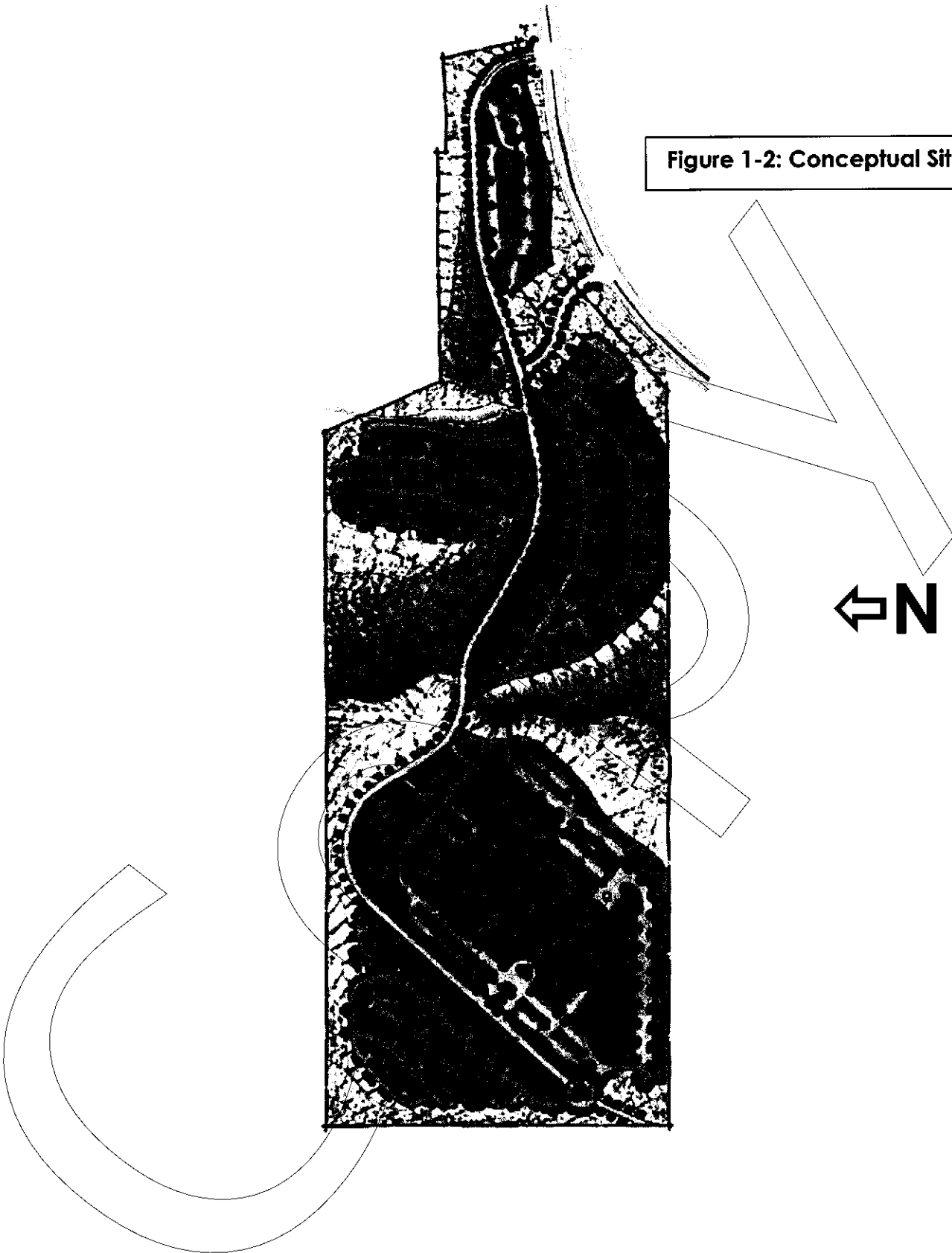
### **Modifications**

The Administrator shall have the ability to grant minor deviations as outlined in RMC 18.06.411(a) (1), as amended. Applications for minor deviations shall be accompanied by written approval from the master developer. Deviations of 10% or more shall conform to the City of Reno Variance process as outlined in RMC 18.06.408, as amended.

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**Figure 1-2: Conceptual Site Plan**



## Chapter 2: Site Characteristics

### Site Characteristics

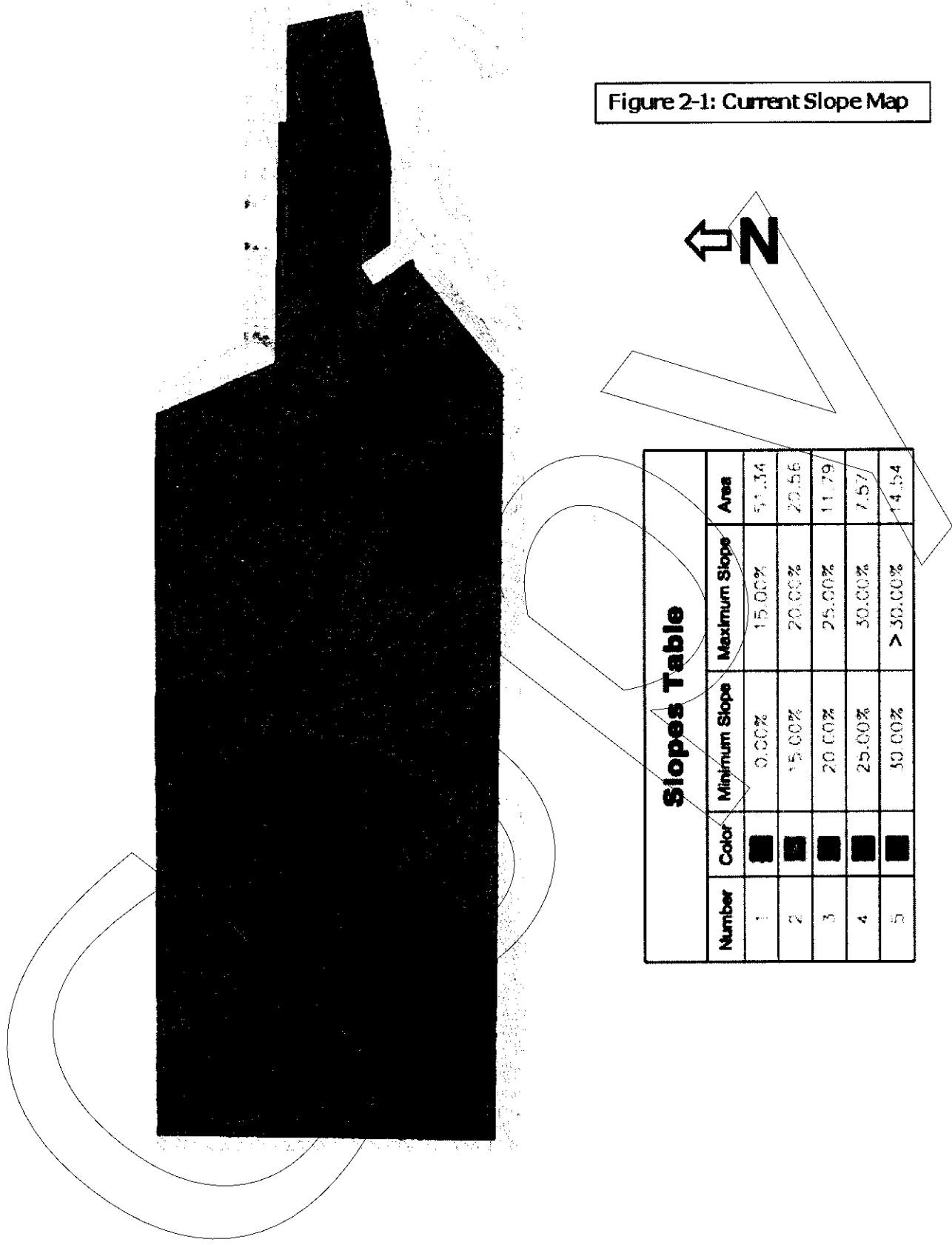
The project site is located on the south side of Peavine Mountain and is characterized by moderate to steep terrain. Site topography slopes generally from north to south, ranging from 5% to over 30%. The property is bisected by two natural major drainageways which are crossed by an existing roadway (Leadership Parkway) and its associated improvements.

### Topography & Slope Analysis

The project site contains slopes in excess of 15% on 25% or more of the site; therefore, development of the property requires conformance with the hillside development section of Reno Municipal Code. The PUD as originally approved required the project set aside 24.37 acres of open space (Table 2-1). The construction of Leadership Parkway and other associated site grading created an additional 7.34 acres of slopes in excess of 30%. As a result the site contains 14.54 acres of slope in excess of 30%, 10.07 acres of which will be set aside as open space as part of this PUD. This PUD provides 41.6 acres of open space, an increase of more than 17 acres from the original approval.

**Table 2-1: Undeveloped Slope Analysis**

<b>Slope Range</b>	<b>% of Open Space Required</b>	<b>Acres within Slope Range</b>	<b>*Required Open Space within each Slope (acres)</b>
0-15%	NONE	50.70	0
15.1-20%	25%	22.20	5.55
20.1-25%	50%	13.20	6.60
25.1-30%	75%	6.70	5.02
> than 30%	100%	7.20	7.20
<b>Total</b>			<b>24.37</b>



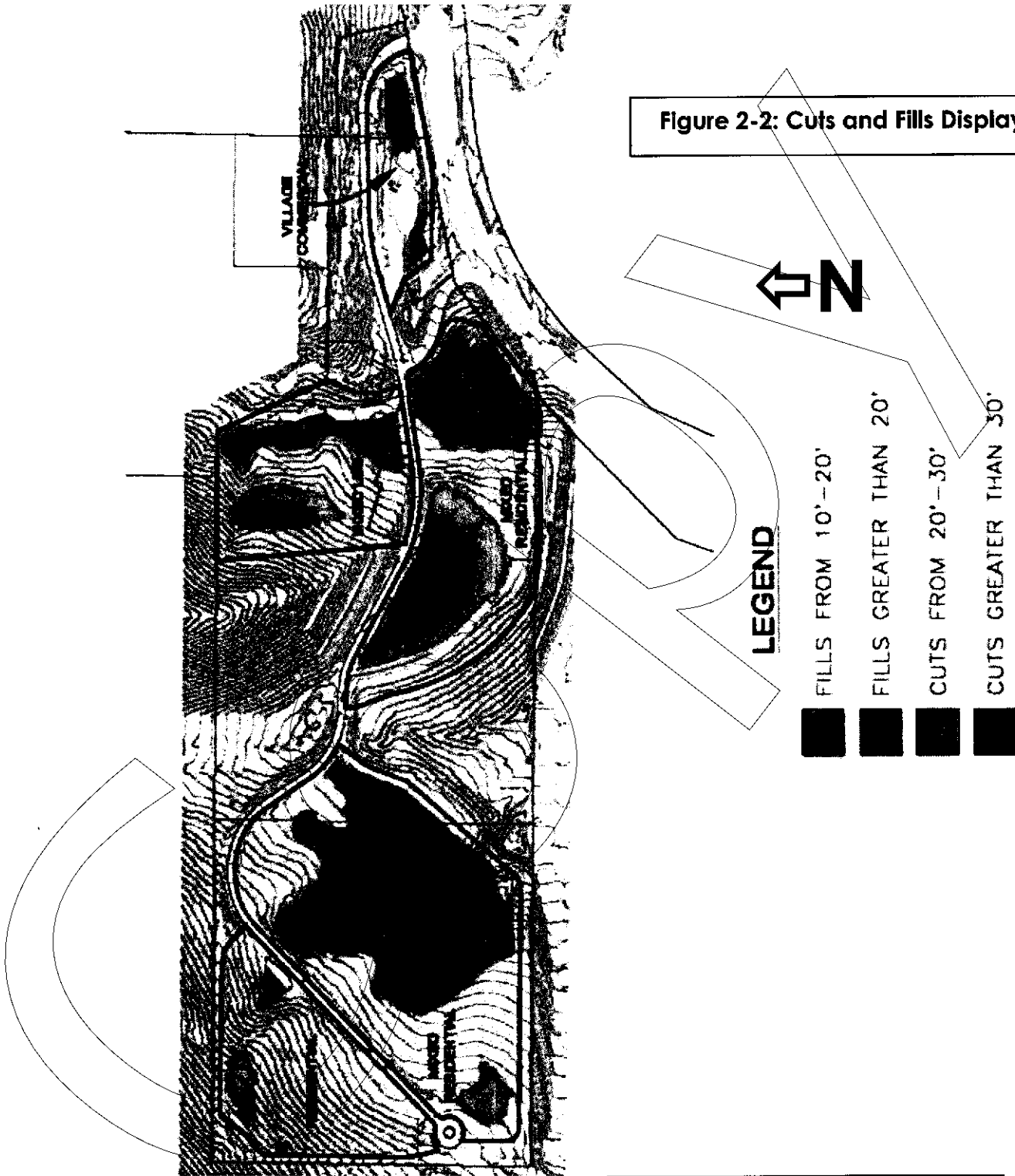
## Grading Standards

The grading and slope design shall conform to standards set forth in Reno Municipal Code, as amended. All areas disturbed by project grading shall require re-vegetation and/ or landscaping after final grading. Temporary stabilization will be applied in accordance with the Truckee Meadows Construction Site Best Management Practices Handbook. All slopes disturbed by grading, including on site/in-lot slopes that are not necessary for construction staging, shall be landscaped and/ or reseeded with native shrubs and grasses consistent with existing on-site native vegetation upon completion of final grading as deemed appropriate by the applicable entitlement process. All graded slopes steeper than 3:1 shall be stabilized with vegetation consistent with existing on-site native shrubs and grasses. Rocks used for rip-rap and retaining walls shall be of a color consistent with the site. Dirt fill shall be added to all rip-rap slopes in conjunction with native revegetation to better blend the created slopes into the area. Slopes may exceed 2:1 to minimize grading if constructed in stable rock as determined by a qualified geo-technical engineer. Figure 2-2 shows the areas anticipated to contain cuts of 20 feet or more and fills of 10 feet or more. The applicable review process required prior to each building permit (e.g. tentative map, special use permit, or site plan review) for each planning area shall determine the final slope restoration requirements to be included with the final grading permit.

It is anticipated that project grading as a whole will balance on site. To accomplish this goal, cut and fill material will need to be transferred between planning areas as necessary. When a transfer between planning areas is to occur, a haul route for the material shall be submitted and approved by the City of Reno prior to the issuance of a grading permit. Grading and slope restoration requirements associated with balancing shall be reviewed and determined as part of the applicable site plan review, SUP or tentative map.

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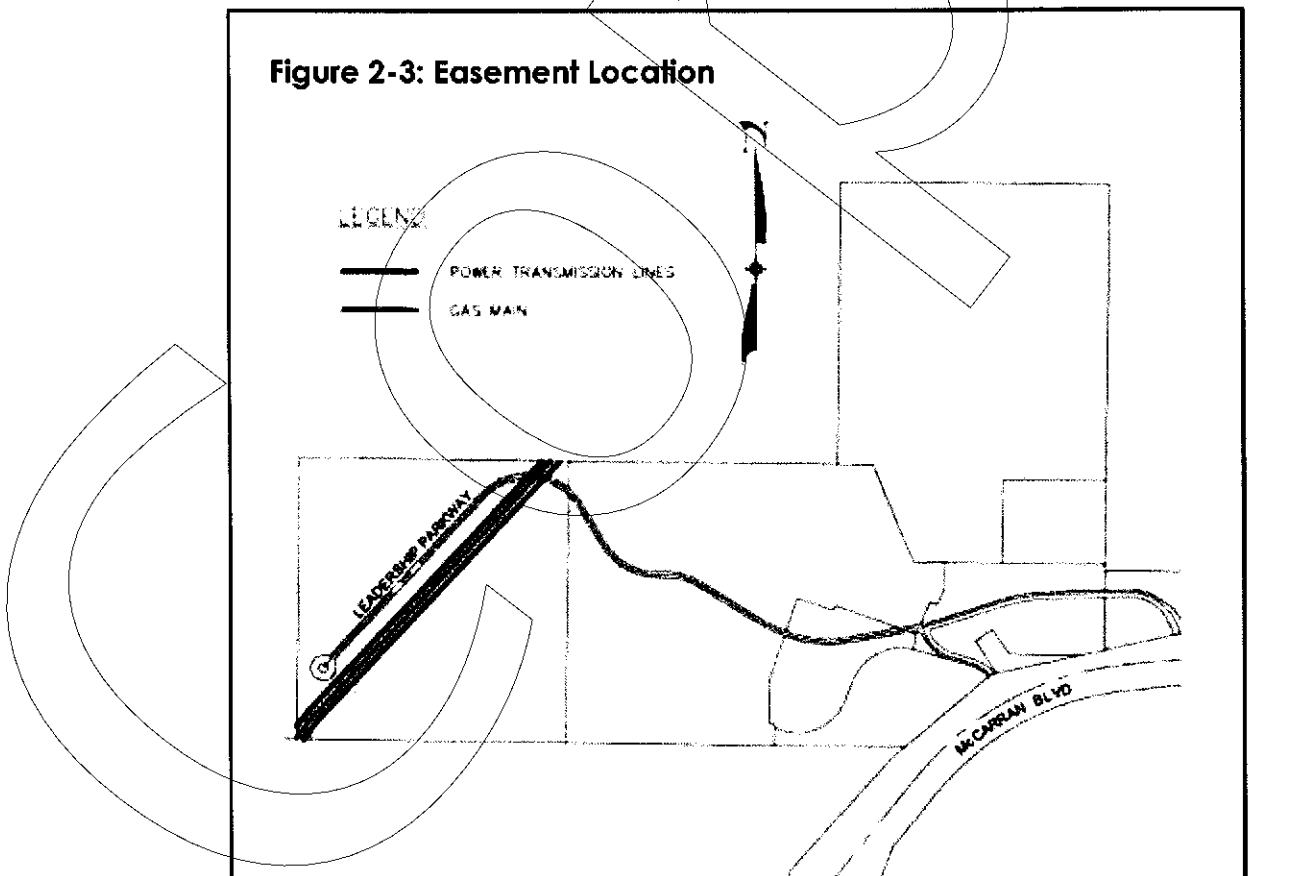
Figure 2-2: Cuts and Fills Display



## Easements

There are several roadway and utility easements on the project site. The most significant easement is a 75 foot wide NV Energy easement that crosses the westerly portion of the site as depicted in Figure 2-3 Easement Location. There is a 12-inch underground gas line, 60 KV and 120 KV overhead power lines located within this easement. Currently, it is not proposed to underground the overhead power lines. However, the lines may be undergrounded or relocated as the project develops. Any development within or adjacent to this easement will need NV Energy approval. Relocation of the 60 KV and/or 120KV overhead power lines or the underground gas line will require review in accordance with applicable sections and policies contained in the Truckee Meadows Regional Plan related to projects of regional significance and utility corridors. Any mitigation for future development within or adjacent to this easement required by the City of Reno will be determined at the required site plan review phase for the specific planning area. Additionally, a number of roadway and minor utility easements, including smaller distribution power lines, will be undergrounded and/ or relocated with development.

**Figure 2-3: Easement Location**



## Drainage & Hydrology

There is a natural major drainageway flowing in a southerly direction through the easterly portion of the project site. This drainage discharges into the existing storm drain facilities and eventually the Truckee River southeast of the project site. There is a second natural major drainageway located on the western portion of the property which eventually flows into a larger drainage way south of the property. As the project develops, the onsite flows will be conveyed through culverts and the future storm drain system. According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel Number 32031C2986E, the subject property resides in Zone X which is an area determined to be outside the 500-year floodplain. The proposed project will require a detention facility to be designed to detain a 100-year 24-hour peak flow event to insure that the proposed development is within the associated guidelines. (See Master Hydrology Report dated 09-2008, Appendix D)

## Geology & Soils

James Edward Engineering performed a geotechnical investigation for the project in 2007. The native soil/bedrock profile encountered can be characterized as sandy fat clay, moderately to closely fractured bedrock which excavates to poorly consolidated sand, elastic silt or a gravelly sand-silty sand mix. No groundwater was encountered in excavation of any of the test pits. The Reno Folio-Earthquake Hazards Map (Bingler, 1974) was reviewed and shows an east to west trending inactive Post Tertiary fault located on the northwest corner of the site. No other mapped faults are located within the project site. Since the fault is determined to be inactive, no offsets or special considerations will be required.

## Vegetation

The site consists of typical Great Basin high desert vegetation including Great Basin Sage, Rabbitbrush, Mormon Tea, native grasses and a sparse scattering of junipers in the upper north facing elevations. Keystone Canyon and the other major drainageway on the site exhibit some riparian vegetation characteristics.

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### Wildlife Habitat

The US Department of Fish and Wildlife identifies biological and wildlife characteristics and provides information on sensitive habitat and species as it pertains to the site. The property is on the fringe of the winter migration route for mule deer, but no sensitive species habitat exists on the property.

Washoe County has a series of maps contained in the 1994 Open Space Plan that identify different notable characteristics of the site.

- The "Hydrologic Resources Map" identifies Keystone Canyon as an "intermittent stream with regional significance." A significant portion of the Keystone Canyon owned by the applicant will be deeded to Washoe County to be included in Rancho San Rafael Park and is not a part of this project site.
- The "Wildlife Habitat Maps" for mule deer and mountain lion identify the site as prime habitat although this area is on the fringe of that designation. The most suitable habitat for these species is on the northwest side of Peavine.
- The "Open Space Resources Map" identifies the site as "potential open space on private land". Keystone Canyon and the adjacent ridge will be deeded to Washoe County to be included in Rancho San Rafael Park. Significant Open space is additionally included with the project site.
- The City of Reno identifies two major "natural drainageways" on and adjacent to the site. One is Keystone Canyon, and the other is to the west and carries water intermittently and exhibits some limited riparian characteristics. These areas are prime wildlife habitat designated as open space in this PUD and will remain largely undisturbed with development of the property.

### Cultural Resources

A Cultural Resources Inventory has been conducted on the property by Kautz Environmental Consultants, Inc. (KEC). The study found twelve (12) isolated flake debitage, historic features such as cairns and prospect pits, and isolated historic artifacts. These isolated finds were determined to not constitute significant historic resources either in severalty or as a group. The archaeological sites include a variable density flake scatter of Late

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Archaic age that contains a single projectile point, a core and utilized flake; a small, sparse flake scatter with a single fragment of slab metate and last, a complex of talus pits (hunting blinds) associated with an elaborate system of rock art that had been previously documented in 1983. The two flake scatter sites are recommended not significant and therefore not eligible for nomination to the National Register due to their lack of integrity, their surficial nature, and the limited number of pertinent research questions they might answer. In contrast, the rock art and talus pit site are located outside of the development area are recommended as a significant historic resource and therefore eligible for nomination to the National Register under National Register Criterion C. The master developer has met with the Reno Sparks Indian Colony and the USFS regarding this site and has agreed to prevent any unauthorized access through the PUD to this site. Conditions to address procedures when cultural and human remains are found during construction of the project are incorporated into this PUD handbook.

### **Access & Traffic**

A traffic study was completed by Solaegui Engineers, LTD. The study provides the following recommendations: (See Appendix C)

- It is recommended that any signing, striping, or traffic control improvements comply with City of Reno and Nevada Department of Transportation requirements.
- It is recommended that a traffic signal be installed at the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection when warranted.
- It is recommended that the left turn pocket at the west approach of the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection be lengthened to provide a minimum of 390 feet of storage/deceleration length and the east approach be improved to include an exclusive right turn lane with a minimum of 390 feet of storage/deceleration length in order to serve existing plus project traffic volumes.
- It is recommended that the left turn pocket at the west approach of the McCarran Boulevard/Victory Lane intersection be lengthened to provide a minimum of 390 feet of storage/deceleration length and the east approach be improved to include an exclusive right turn lane with a minimum of 290 feet of deceleration length in order to serve existing plus project traffic volumes.

## Keystone Canyon Development Standards Handbook

- It is recommended that the project's interior public streets and parking be constructed per City of Reno requirements.
- All applicable traffic studies and improvements will be addressed during review of each Site Plan Review, Special Use Permit or Tentative Map in accordance with the Conditions of Approval for LDC09-00067 Keystone Canyon, as contained in this PUD.

### **Water Service**

Truckee Meadows Water Authority will provide water service to the site. A 12-inch water line in Sky Country Estates subdivision was stubbed to the property at a midpoint location to accommodate future development. Water rights adequate to serve each phase of development will be dedicated in accordance with standard procedures.

### **Sanitary Sewer Service**

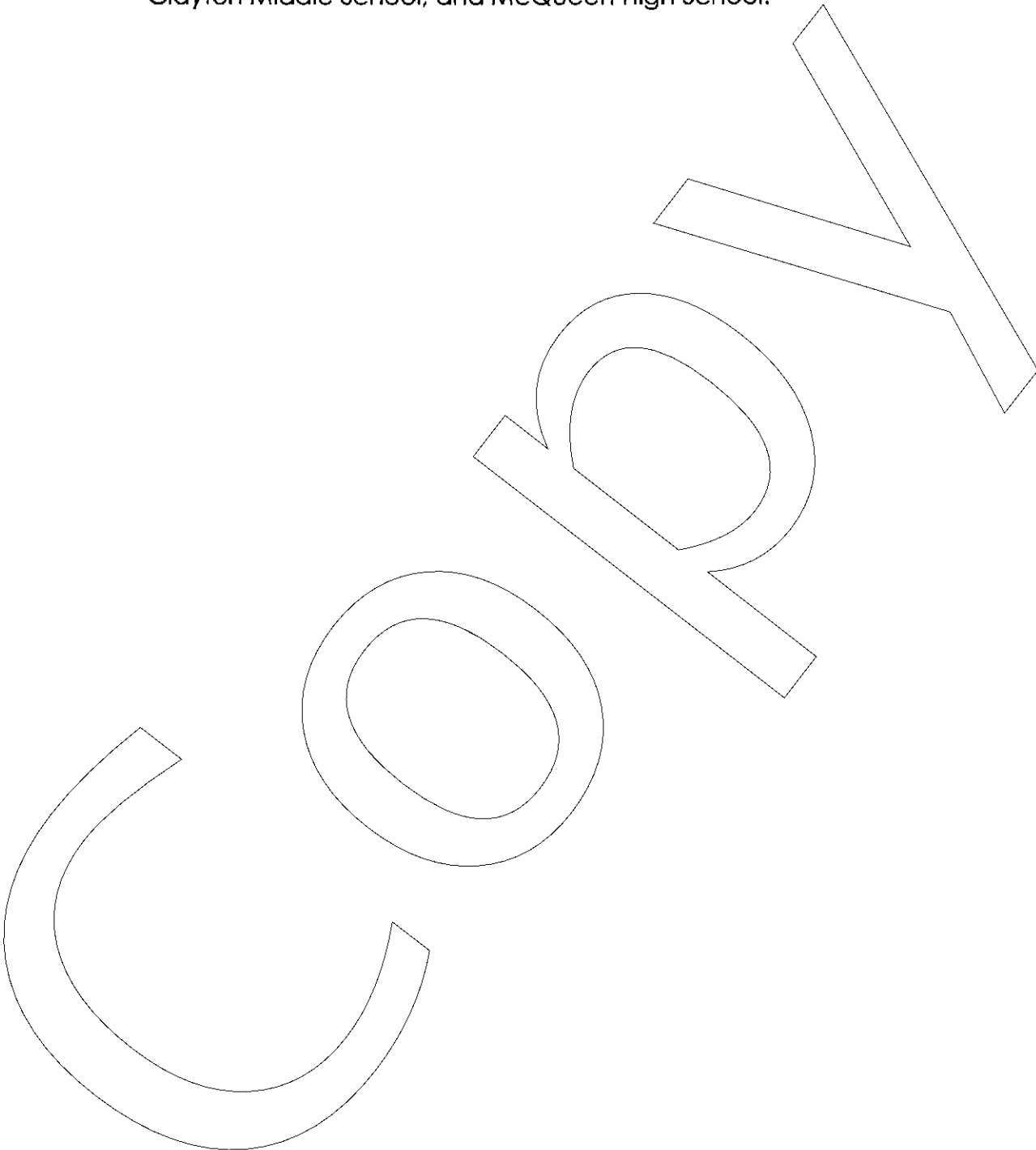
Existing sewer is located within Sky Country Estates subdivision south of the site. Significant downstream sanitary sewer improvements, including a new parallel trunk line in Severn Drive, were recently constructed to serve the remaining units of Sky Country Estates. A portion of the Keystone Canyon project will sewer south through Sky Country Estates, cross McCarran Blvd. to Severn Drive, follow Severn Drive south to Wyoming Avenue, and continue south down Wyoming and Saint Alberts Drive to the Peavine interceptor. The other portion of the project will sewer south down Victory Lane to McCarran Blvd. and parallel McCarran west to the point where the Sky Country Estates sewer crosses McCarran Blvd. (See Appendix E)

### **Utilities**

NV Energy will provide natural gas service. A 4 inch gas line in Sky Country Estates was stubbed to the property at a midpoint location to accommodate future development. NV Energy will provide electrical service and AT&T will provide telephone and internet service. Charter Communications will provide cable television and also provide internet service to the property. All new services will be provided underground. Waste Management will provide refuse collection.

**Police, Fire Protection, & School**

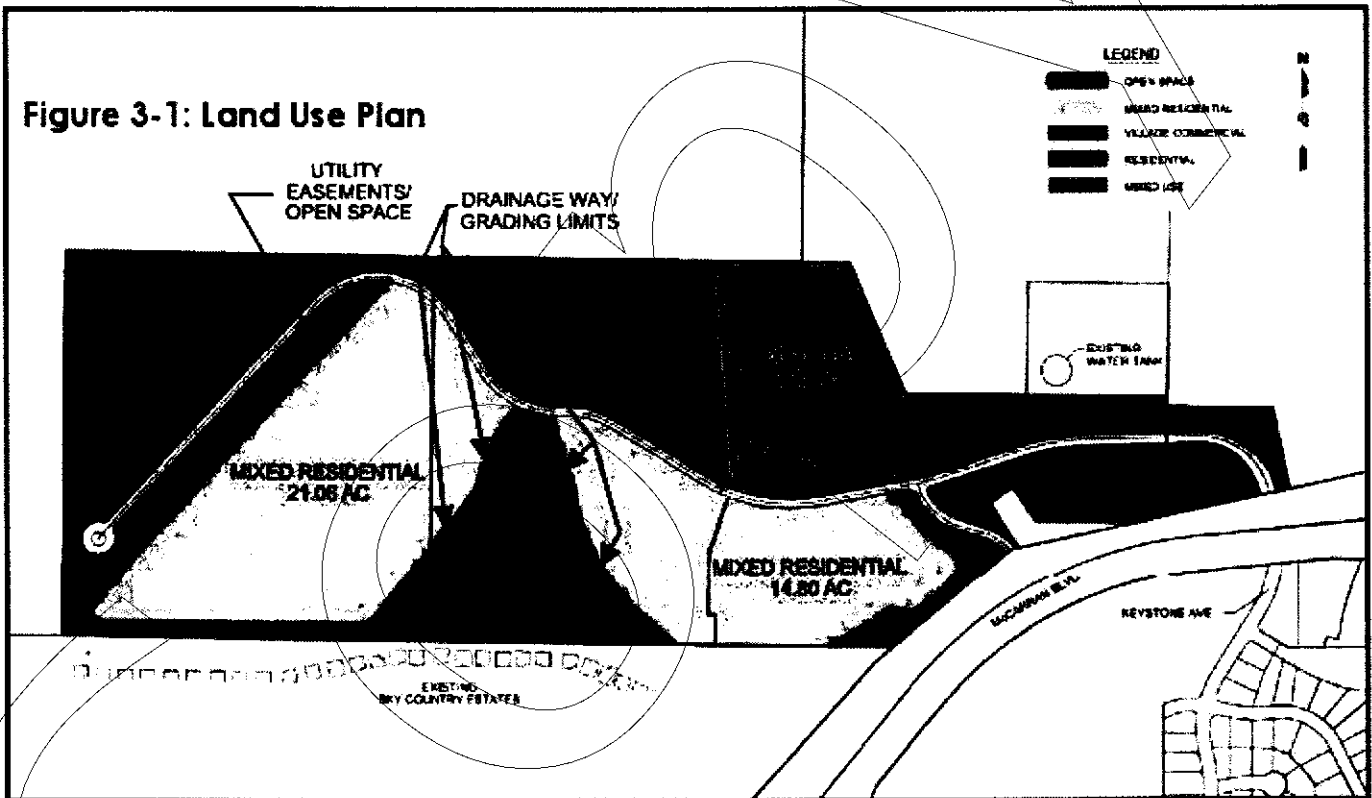
Police service will be provided by the City of Reno. Fire protection will be provided by Truckee Meadows Fire. The Keystone Canyon Planned Unit Development is zoned for the following schools: Towles Elementary School, Clayton Middle School, and McQueen High School.



## Chapter 3: Development Standards

### Land Use Plan

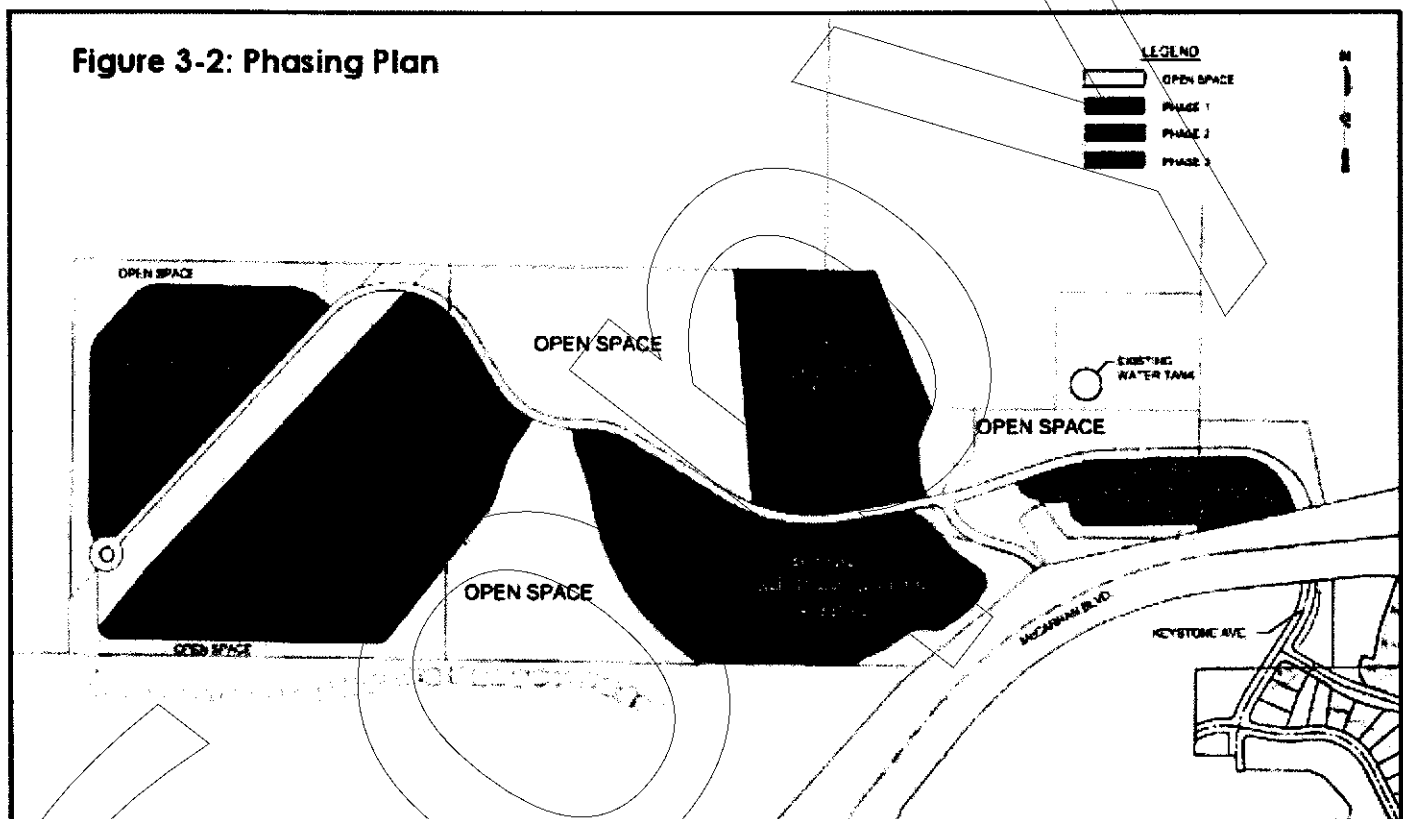
The PUD consists of five land use designations; Village Commercial, Mixed Use, Mixed Residential, Residential and Open Space. Each designation allows for a variety of land uses and sets forth specific design standards in order to achieve the desired development. The project allows for a maximum of 745 residential units consisting of multi family housing, single family attached, single family detached and senior housing. The Mixed Use and Village Commercial designations allow a variety of commercial and retail uses to complement the various residential uses.



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### Project Phasing

It is anticipated the project will be developed in three phases over 10 years. Phase 1 will consist of the Village Commercial land use designation and the eastern Mixed Residential land use designation. Phase 2 will consist of the western Mixed Residential land use designation. Phase 3 will consist of the Mixed Use and Residential land use designations located in the northeast and northwest portions of the project site. With the approval of the Zoning Administrator, the phasing plan may be modified to accommodate development.



## **Land Use Designations**

### **Village Commercial**

The Village Commercial designation allows for office, commercial and retail uses which are compatible and complementary to the proposed and existing residential land uses within and adjacent to the PUD. This area is located adjacent to McCarran Blvd in close proximity to the University of Nevada and Downtown Reno. The total square footage of commercial/ retail space shall not exceed 49,000 square feet.

### **Mixed Use**

The Mixed Use designation allows for a variety of land uses. These uses include commercial, retail and a mixture of residential uses including residential-over-retail. The mixed use designation is intended to encourage small business opportunities. Because of the proximity to the regional trail system, typical development in this designation might include low intensity commercial or retail uses (i.e. bike shop and/or outdoor eatery) combined with multi-family or single family attached residential. To allow for flexibility, there are no maximum residential densities associated with the mixed-use designation, provided the overall number of residential units in the project does not exceed 745.

### **Mixed Residential**

The Mixed Residential designation allows a variety of residential uses including multi-family; single family attached and detached units, and senior housing. Examples of development in this designation include a multi-family complex, single family attached units, an active senior community or an assisted living facility.

### **Residential**

The Residential designation allows a variety of residential uses at a much lower density than can be found in the Mixed Residential designation. Examples of development in this designation include single family residential and active senior communities.

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## Keystone Canyon Development Standards Handbook

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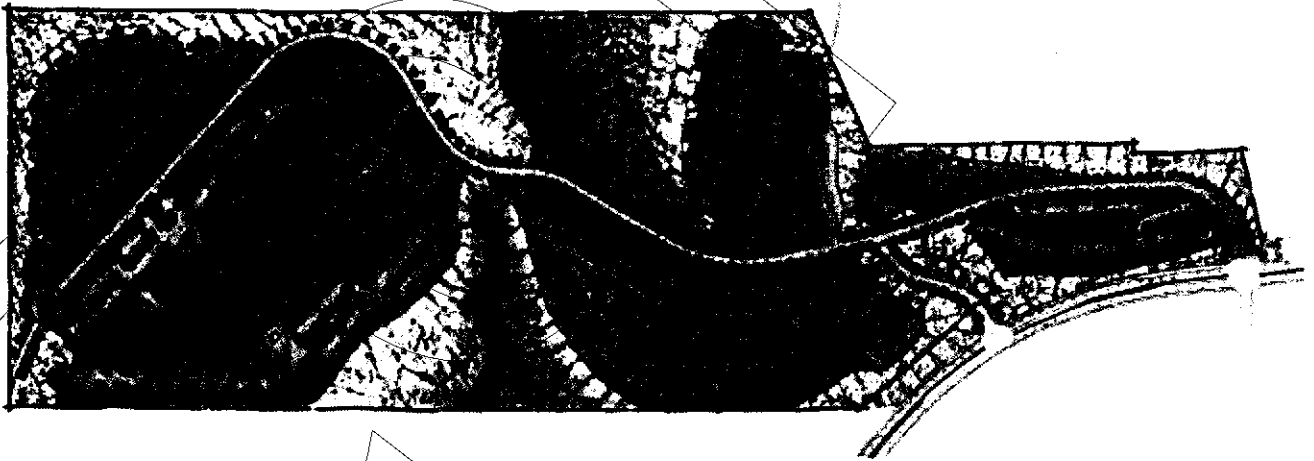
### Open Space

The Open Space designation preserves the existing natural major drainage ways and slope areas and provides recreational and scenic opportunities throughout the development. All areas designated as open space in the Land Use Plan (Figure 3) shall be deed restricted as such in conformance with RMC 18.12.101(f), as amended. Open Space areas located adjacent to each land use designation shall be identified and deed restricted prior to issuance of a building permit .

### Conceptual Site Plan

Figure 3-3 shows how the Keystone Canyon Planned Unit Development might look after build out. The goal of the figure is to show how the developed areas will interface with the existing backbone road network and the areas proposed to be preserved as open space. The figure is an artist rendering and therefore conceptual in nature. Final development plans will be determined during the applicable review process as outlined in this PUD.

**Figure 3-3: Conceptual Site Plan**



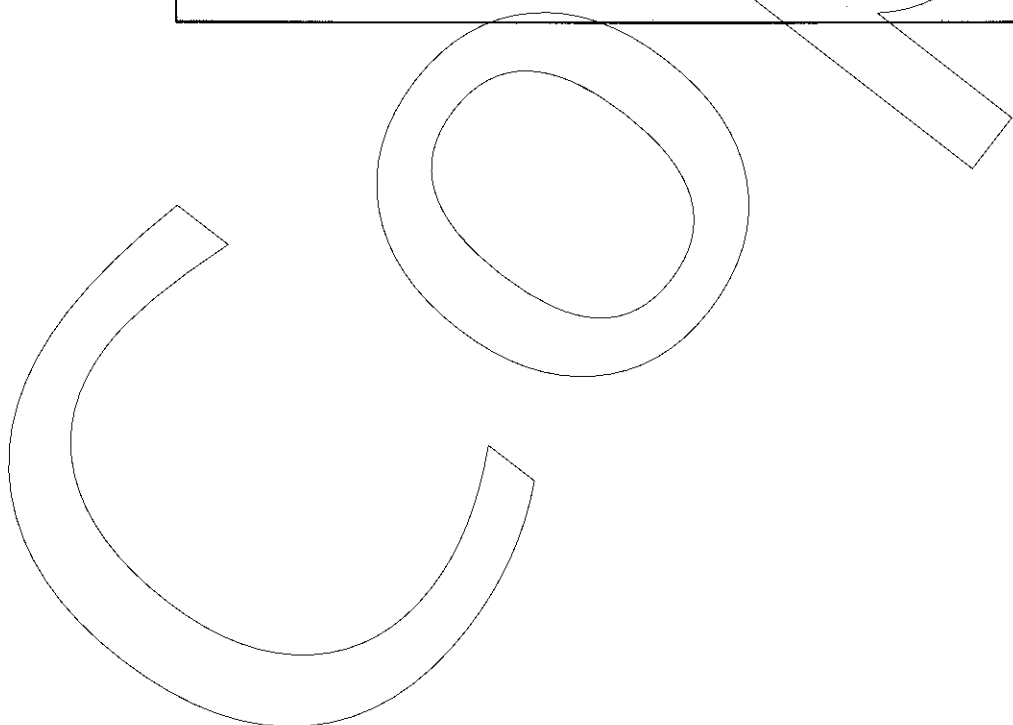
\*See Table 3-3: Mixed Residential Design Standards for minimum required setback to structure from the southern project boundary (page 3-7).

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**Design Standards**

**Table 3-1: Village Commercial Design Standards**

Village Commercial (VC)	
Commercial*	
<b>Building Scale &amp; Intensity</b>	
Maximum Building Height	45 ft.
Minimum Building Separation	10 ft.
<b>Building Setbacks</b>	
**Minimum Front Yard	10 ft.
Minimum Side Yard	0 or 10 ft.
Minimum Rear Yard	0 or 10 ft.
<p>*Cornices, canopies, eaves, chimneys, landings, or similar architectural features may extend up to 3 feet into the required front and rear yard setback. These features shall not exceed 25% of the length of any building façade.</p> <p>**15ft. adjacent to Leadership Parkway and Victory Lane.</p>	



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**Table 3-2: Mixed-Use Design Standards**

<b>Mixed-Use (MU)</b>					
	<b>Commercial*</b>	<b>Residential-Over-Retail*</b>	<b>Multi-Family*</b>	<b>Single Family Attached/Condominium/Townhouse*</b>	<b>Single Family Detached*</b>
<b>Building Scale &amp; Intensity</b>					
Maximum Building Height	55 ft.	55 ft.	55 ft.	55 ft.	40 ft.
Minimum Building Separation	10 ft.	10 ft.	20 ft.	10 ft.	10 ft.
<b>Building Setbacks</b>					
<b>**Minimum Front Yard</b>					
To Structure	10 ft.	10 ft.	15 ft.	10 ft.	10 ft.
To Porch	5 ft.	5 ft.	10 ft.	5 ft.	5 ft.
To Garage	N/A	N/A	N/A	***5 ft. or 20 ft.	***5 ft. or 20 ft.
Minimum Side Yard	0 or 10 ft.	0 or 10 ft.	5 ft.	0 or 10 ft.	5 ft.
Minimum Rear Yard	0 or 10 ft.	0 or 10 ft.	10 ft.	10 ft.	10 ft.
*Cornices, canopies, eaves, chimneys, landings, or similar architectural features may extend up to 3 feet into the required front and rear yard setback. These features shall not exceed 25% of the length of any building façade.					
** 15ft. adjacent to Leadership Parkway and Victory Lane.					
*** Parking is prohibited in driveways less than 20 feet in length.					

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**Table 3-3: Mixed-Residential Design Standards**

<b>Mixed-Residential (MR)</b>				
	<b>Single Family Detached*</b>	<b>Single Family Attached/ Condominium Townhouse*</b>	<b>Multi-Family*</b>	<b>Senior Housing*</b>
<b>Building Scale &amp; Intensity</b>				
Maximum Base Density (Dwelling Units Per Acre)	18 du/acre	18 du/acre	18 du/acre	18 du/acre
Maximum Building Height	40 ft.	55 ft.	55 ft.	55 ft.
Minimum Building Separation	10 ft.	10 ft.	20 ft.	10 ft.
<b>Building Setbacks</b>				
<b>**Minimum Front Yard</b>				
To Structure	10 ft.	10 ft.	15 ft.	15 ft.
To Porch	5 ft.	5 ft.	10 ft.	10 ft.
To Garage	***5 ft. or 20 ft.	***5 ft. or 20 ft.	N/A	N/A
Minimum Side Yard	5 ft.	0 or 10 ft.	10 ft.	10 ft.
Minimum Rear Yard	10 ft.	10 ft.	10 ft.	10 ft.
Minimum required setback to structure from southern project boundary (Adjacent to existing Sky Country Estates): Western MR Planning Area 100 feet and Eastern MR Planning Area 25 feet. Additionally, cross-sections must be submitted with the required review process demonstrating there will be no negative impacts on adjacent residential properties.				
*Cornices, canopies, eaves, chimneys, landings, or similar architectural features may extend up to 3 feet into the required front and rear yard setback. These features shall not exceed 25% of the length of any building façade.				
** 15ft. adjacent to Leadership Parkway and Victory Lane.				
*** Parking is prohibited in driveways less than 20 feet in length.				

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**Table 3-4: Residential Design Standards**

Residential (R)			
	Single Family Detached*	Single Family Attached/ Condominium Townhouse*	Multi-Family*
<b>Building Scale &amp; Intensity</b>			
Maximum Base Density (Dwelling Units Per Acre)	7 du/acre	7 du/acre	7 du/acre
Maximum Building Height	40 ft.	55 ft.	55 ft.
Minimum Building Separation	10 ft.	10 ft.	20 ft.
<b>Building Setbacks</b>			
<b>**Minimum Front Yard</b>			
To Structure	10 ft.	10 ft.	15 ft.
To Porch	5 ft.	5 ft.	10 ft.
To Garage	***5 ft. or 20 ft.	***5 ft. or 20 ft.	N/A
Minimum Side Yard	5 ft.	0 or 10 ft.	10 ft.
Minimum Rear Yard	10 ft.	10 ft.	10 ft.
<p>*Cornices, canopies, eaves, chimneys, landings, or similar architectural features may extend up to 3 feet into the required front and rear yard setback. These features shall not exceed 25% of the length of any building façade.</p> <p>** 15ft. adjacent to Leadership Parkway and Victory Lane.</p> <p>*** Parking is prohibited in driveways less than 20 feet in length.</p>			

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**Table 3-5: Permitted Uses**

P=Permitted By Right SPR=Site Plan Review SUP=Special Use Permit TM=Tentative Map (Required for For Sale Residential Units)					
	<b>Open Space</b>	<b>Residential</b>	<b>Village Commercial</b>	<b>Mixed - Use</b>	<b>Mixed Residential</b>
<b>Land Use Designations:</b>	<b>OS</b>	<b>R</b>	<b>VC</b>	<b>MU</b>	<b>MR</b>
<b>Commercial Uses:</b>					
Bakery			P	P	
Bar			SUP		
Barber Shop/Salon			P	P	
Childcare Center			P	P	
Coffee House			P	P	
Copy Center			P		
Convenience Store			SPR		
Dance Studio			P		
Dental Office			P		
Drive Through Facility (Food & Beverage)			SPR	SPR	
Farmer's Market, Outdoor (Temporary)			P	P	
Financial Institution w/ drive thru			P		
Fitness Center			P		
Florist			P	P	
Freestanding Automated Teller Machine			P	P	
General Personal Service			P	P	
General Retail Store or Commercial Use Other Than Listed			P	P	

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	Open Space	Residential	Village Commercial	Mixed - Use	Mixed Residential
Household Goods, Light Service, Repair & Assembly			P		
Ice Cream Shop			P	P	
Laundry Drop Off/ Pick Up			P		
Medical Facilities/ Day Use Only			P		
Office, Other Than Listed			P	P	
Pet Store			P	P	
Postal Annex			P		
Professional Office			P	P	
Restaurant with Alcohol Service			P	P	
Restaurant without Alcohol Service			P	P	
Veterinary Services			P		
Wine Shop			P	P	
Any use not listed in the land use category is not allowed unless it is considered accessory to a listed permitted use or is considered to be similar and/or compatible with a listed use, to the satisfaction of the Zoning Administrator, per RMC 18.08.201(a)(4), as amended.					
<b>Residential Uses:</b>					
Multi-Family		P		P	P
Nursing Home/ Assisted Living Facility		SUP			P
Private Dorm					P
Residential-Over-Retail				P/TM	
Senior Housing		SUP			P

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	Open Space	Residential	Village Commercial	Mixed - Use	Mixed Residential
Single-Family, Attached/ Condominium Townhouse		TM		TM	TM
Single-Family, Detached		TM		TM	TM
Any use not listed in the land use category is not allowed unless it is considered accessory to a listed permitted use or is considered to be similar and/or compatible with a listed use, to the satisfaction of the Zoning Administrator, per RMC 18.08.201 (a)(4), as amended.					
<b>Community Based Uses:</b>					
Cell Tower	SPR	SPR	SPR	SPR	SPR
Renewable Energy Installations As An Accessory Use Only (i.e. Wind Turbines and Solar Systems)		P	P	P	P
Library, Art Gallery or Museum			P	P	
Public Park or Recreation Area	P	P		P	P
Utility Box/Well House/Back Up Generator/ Pump House or Booster Station	P	P	P	P	P
Any use not listed in the land use category is not allowed unless it is considered accessory to a listed permitted use or is considered to be similar and/or compatible with a listed use, to the satisfaction of the Zoning Administrator, per RMC 18.08.201 (a)(4), as amended.					

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### Land Use Definitions

#### **Bakery**

A business which sells baked goods and related items. Items sold on site may be made at the facility. Catering is permitted.

#### **Bar**

A business which sells alcoholic beverages for consumption on the premises and authorizes the sale of alcoholic beverages, in original sealed or corked containers, for consumption off premises.

#### **Barber Shop/Salon**

A personal service establishment where hair is cut and other similar services are provided.

#### **Childcare Center**

Any institution, business, or establishment in which children are received and cared for any period of time with compensation. Accessory uses may include offices, recreation areas, and parking.

#### **Coffee House**

A gathering place which serves coffee, tea and other beverages which may or may not include a restaurant which does not exceed 2,000 square feet, and sales of alcohol (if any) do not exceed ten percent of gross receipts.

#### **Copy Center**

A business specializing in custom reproduction of written or graphic materials on a custom order basis for individuals or businesses. Typical processes include, but are not limited to, photocopying, small offset printing, blueprinting, and facsimile sending and receiving.

#### **Convenience Store**

A retail store containing less than 5,000 square feet of gross floor area that is designed and stocked to sell primarily food, beverages, and other household supplies to customers who purchase only a relatively few items (in contrast to a "supermarket"). It is designed to attract and depends upon a large volume of stop and go traffic. Illustrative examples of convenience stores are those operated by the "7-11" and "AM-PM" chains. A store of less than 5,000 square feet, which deals primarily with the retail sale of alcohol, would also be categorized as a convenience store. Gas sales may be an accessory use to a convenience store.

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**Dance Studio**

A building open to the general public for the purpose of providing a place for dancing where an admission is charged for the purpose of making a profit. This may include instructional dance classes.

**Dental Office**

A building or portion of a building wherein services associated with the dental profession are performed including: professional, laboratory, clerical and or administrative operations.

**Drive Through Facility (Food & Beverage)**

A facility where vehicles drive through to obtain food or services. Includes stacking spaces and queuing lanes.

**Dry Cleaners/ Pick Up & Drop Off**

An establishment or business maintained for the pickup and delivery of dry cleaning and/or laundry without the maintenance or operation of any laundry or dry-cleaning equipment or machinery on the premises.

**Farmer's Market, Outdoor (Temporary)**

Temporary or occasional outdoor retail sales of produce and or goods from temporary stands. Allowed to operate between 7am and 7 pm, subject to special activity requirements of Title 5 of RMC, as amended.

**Financial Institution**

A business establishment authorized to receive and safeguard money or other valuables; lend money at interest; execute bills of exchange; and provide other similar services.

**Fitness Center**

A facility providing exercise equipment, swimming facilities, game courts and other similar facilities.

**Florist**

A retail business whose principal activity is the selling of plants which are not grown on the site and conducting business within an enclosed building.

**Freestanding Automated Teller Machine**

A freestanding machine where financial transactions may be performed; not necessarily located within a financial institution.

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**General Personal Service**

A facility for the sale or provision of personal services. Typical personal services include, but are not limited to, shoe repair, tailor, instructional arts studio, photography studio, custom and craft work studio, safe deposit boxes, travel bureau, house cleaning services, weight reduction centers, and other similar uses as determined by the administrator.

**General Retail Store or Commercial Use, Other Than Listed**

A facility for the retail sale of general merchandise to the public for direct consumption and not for wholesale. Typical general merchandise includes clothing and other apparel, equipment for hobbies or sports, gifts, flowers and household plants, dry goods, groceries and convenience and specialty foods, toys, furniture, books and stationery, hardware, used goods, and other similar uses as determined by the administrator.

**Household Goods, Light Service, Repair & Assembly**

A facility in which household items, such as toasters, irons, tools and vacuums are repaired or assembled and where all such items are stored within a building or an inside storage area.

**Ice Cream Shop**

A business that primarily sells ice cream, the sale of other food and beverages may be incidental to the primary use of selling ice cream. Food can be sold for the consumption on or off site.

**Library, Art Gallery or Museum**

A facility or area for the acquisition, preservation, study, and exhibition of works of artistic, historic, literary or scientific value.

**Medical Facilities, day use only**

A medical office or outpatient facility which is used only during the day, and which does not provide overnight care.

**Office, Other Than Listed**

An office facility other than specifically listed or defined elsewhere in these definitions.

**Pet Store**

A commercial establishment that sells pets and pet supplies.

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**Postal Annex**

A facility consisting of post office boxes used to pick up or mail letters. Examples are UPS or FedEx annexes.

**Professional Office**

A building or portions of a building wherein services are performed involving administrative, professional, or clerical operations. "Office" includes contractors and others who perform services off-site only if major equipment and materials are not stored at the site and fabrication or similar work is not carried out on the site.

**Public Park or Recreation Area**

A park, playground, swimming pool or athletic field that not only serves the residents in the area, but is open to the general public.

**Renewable Energy Installations (i.e. wind turbines & solar)**

The use of various renewable energy sources including wind and solar as an accessory use to any given primary use. All renewable installations will not exceed 55 feet in height except when located on buildings, in which case the building and installations shall not exceed 75 feet in height.

**Restaurant with Alcohol Service**

A restaurant where alcoholic beverage drinks are prepared for service at tables for consumption in connection with a meal served on the premises. May include a lounge area where customers wait to be seated for a meal. Alcoholic beverages can be purchased directly from the bar but not for off-premise consumption. This may include food pick-up orders for off-site consumption. Outdoor dining is permitted.

**Restaurant without Alcohol Service**

A retail business licensed to serve food and non-alcoholic beverages and which utilizes a kitchen on the premises for food preparation with a minimum floor area of 200 square feet. This may include food pick-up orders for off-site consumption. Outdoor dining is permitted.

**Veterinary Services**

A business for the care and treatment of small animals and household pets.

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### **Wine Shop**

A business that sells wine and wine products, this may include the sale of food such as meats & cheeses as an accessory use and may include indoor and outdoor wine tasting areas.

Any listed use not defined in this PUD shall be subject to the definitions contained in RMC 18.24.203, as amended.

### **Hours of Operation**

The hours of operation for any non-residential use within the PUD shall be limited to between the hours of 6:00 am and 11:00 pm unless otherwise approved through the Special Use Permit process.

### **Architecture**

#### **Building Concepts**

The building concepts within Keystone Canyon are based on traditional styles of Italian and Spanish architecture. Figures 3-4 through 3-8 illustrate the styles and architectural treatments to be used within the project. Each planning area within the project shall have distinct charm and identity while maintaining the common aesthetic threads that bind the community together.

A variety of architectural materials, colors, and even textures are encouraged and shall be crucial elements of the Keystone Canyon experience. Imaginative combinations of building materials shall be used to create unique designs and simultaneously provide individual identity and character to each building. Combinations of building materials are encouraged on each building elevation to provide varied texture and graceful color transitions. All of these unique variations, when used appropriately, enrich individual buildings, streetscapes and neighborhoods. The use of varied street scenes will offer a memorable, unique and authentic architectural experience to both pedestrians and motorists alike.

#### **Building Standards**

Site and building design standards within the PUD will comply with RMC Article III Section 18.12.301, 18.12.302 and 18.12.305, as amended. All future structures within the Keystone Canyon PUD shall conform to the following standards:

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- Building articulation and exterior interest shall be provided on all sides.
- Unless expressly approved by the master developer and the zoning administrator, flat roofs shall not be permitted except for minor accent elements.
- Loading areas should not face public roadways. In the event that loading areas are adjacent to public roadways, the loading area must be screened and provide visual interest and be incorporated into the architectural style of the building and/or screening.
- Architectural elements must not end at the corner of a building and shall wrap around the corner and extend to a logical terminus point that is incorporated into the overall architectural design.
- Four (4) sided color elevations shall be provided at the time of each building permit.

Final building elevations will be approved by the design review committee and the Zoning Administrator. Approval by the DRC, does not constitute city approval of individual project or planning area building elevations.

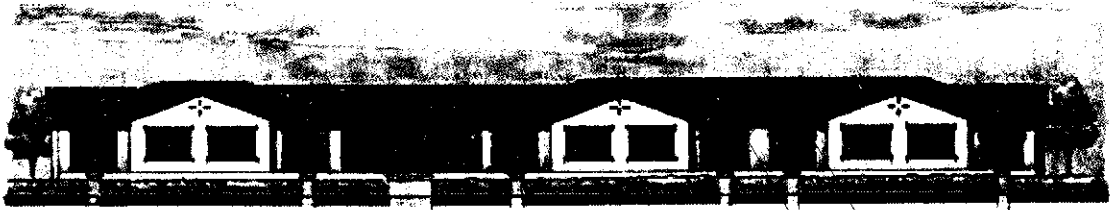
### **Building Materials**

The following building materials shall be utilized within the PUD. Other materials may be introduced as appropriate for each architectural style and to accommodate innovative design solutions. Final architectural colors and materials shall be determined during the tentative map, special use permit and/or site plan review process for each individual planning area.

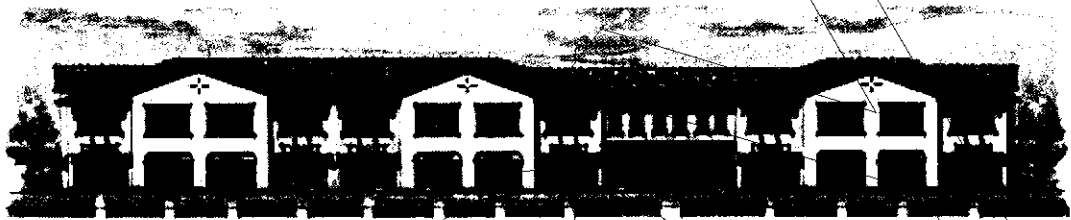
- Stucco and/ or cement plaster.
- Horizontal wood or fiber-cement siding.
- Board and batten wood or fiber-cement siding
- Wood or fiber-cement shingle siding
- Flat roof tiles
- Barrel or S tiles
- Wood shutters
- Wood or wrought iron railings
- Enhanced gable-end vents
- Wood or cement-plaster-over-foam brackets
- Wood, stucco, brick, or appropriate stone columns

**Figure 3-4: Conceptual Commercial Product (VC, MU)**

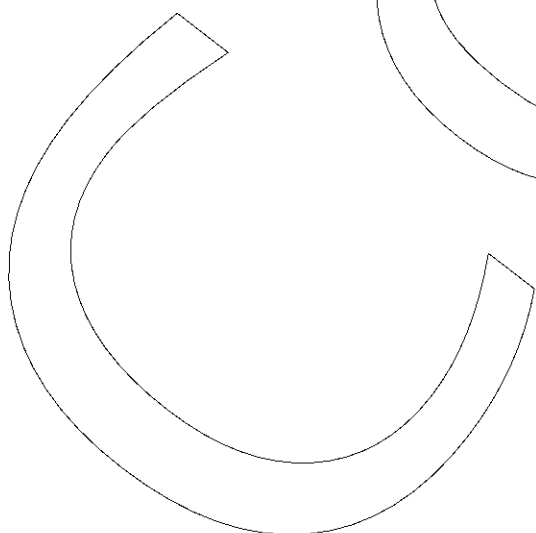
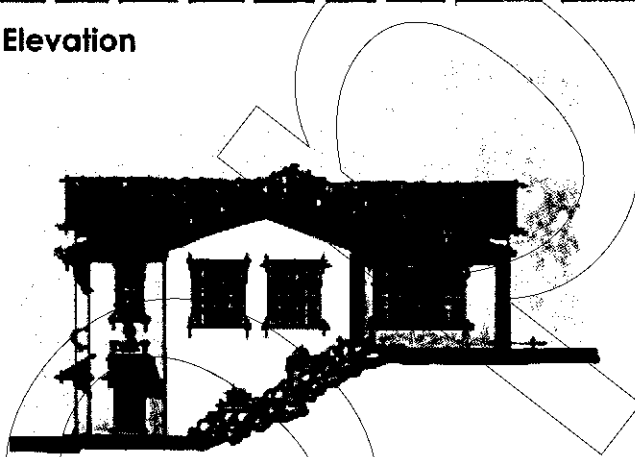
**Front Elevation**



**Rear Elevation**



**Side Elevation**

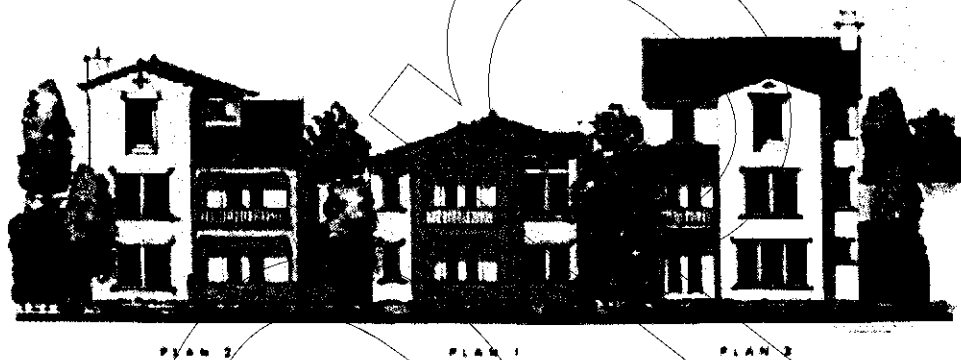


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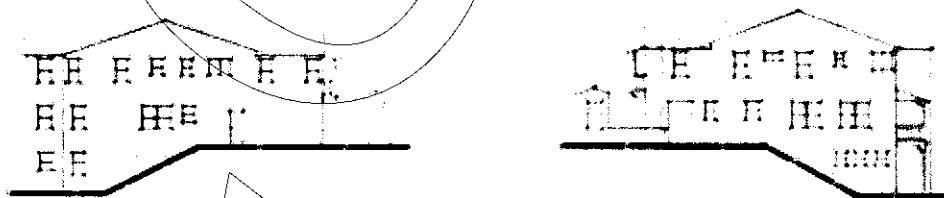
Figure 3-5: Conceptual Single Family Detached Product (MR, MU, R)



Conceptual Front Streetscene

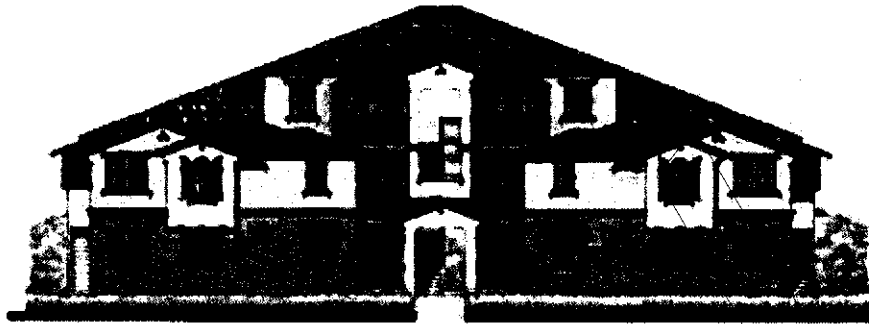


Conceptual Rear Streetscene



Typical Side Elevations

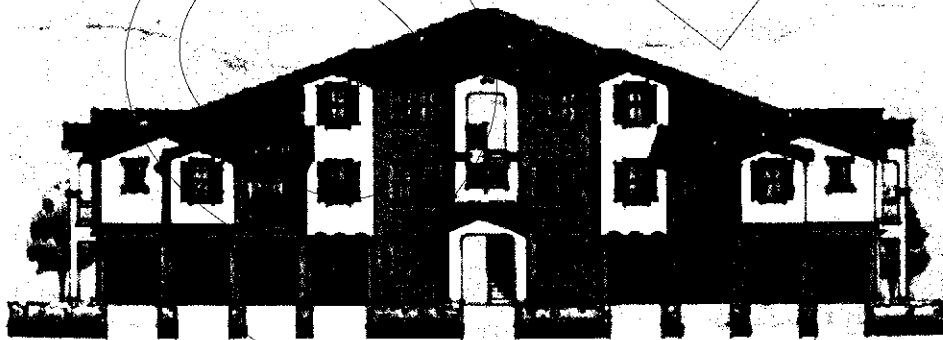
**Figure 3-6: Conceptual Multi-Family Product (MR, MU, R)**



FRONT



SIDE TYPICAL



REAR

\* The final multi-family product may or may not have a garage option included in the architectural design.

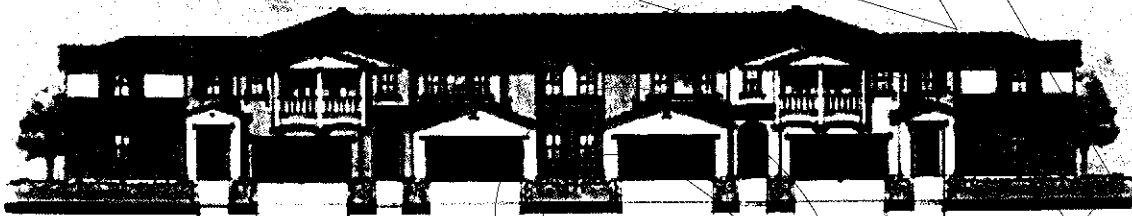
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**Figure 3-7: Conceptual Single-Family Attached Product (MR, MU, R)**

**Front Elevation**



**Rear Elevation**



**Side Elevation**



**Figure 3-8: Conceptual Senior Housing Component (MR, MU)**

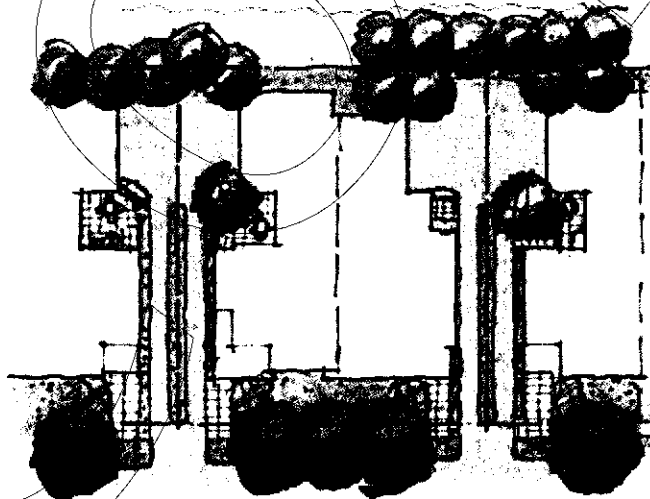
**Front Elevation**



**Duet Front Elevation**



**Duet Footprint**



## **Landscape Requirements**

### **Landscape Design Character**

The landscape design will compliment the uses allowed in the PUD as well as the open space and scenic areas of the project. The landscaping will enhance the aesthetics of the community and provide a proper visual transition between the commercial and the residential components.

### **Required Plans**

Preliminary landscape plans must be included with the following application requests:

- Tentative Map
- Special Use Permit
- Site Plan Review

At a minimum each plan will identify all areas to be landscaped including total area required and provided, tree and shrub calculations, water regime, and general types of landscaping proposed.

A final landscape plan shall be submitted with each application for a final map or building permit. Final landscape plans shall be prepared and sealed by a Nevada registered landscape architect.

The following are exempt from submitting a landscape plan:

- Individual single-family homes
- Building permits for interior remodeling
- Permits such as, but not limited to, re-roofing, siding, temporary power, change of electrical service, change of furnace, addition of interior plumbing, addition of interior electrical, fencing, on-premises, and encroachment.

### **Landscape Requirements**

Landscaping shall meet or exceed the minimum standards established in this design standards handbook. A survey of the existing landscaping and slope restoration areas, as well as a phasing plan to restore any dead or dying landscaping and/or restoration areas, shall be included with the first site plan review, special use permit or tentative map. All landscaping and screening standards not addressed in this PUD shall comply with RMC 18.12.1201-1212, as amended.

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**Table 3-6: Minimum Landscape Requirements**

Minimum Landscape Area Requirements		The minimum front yard setback, not including driveways and sidewalks, shall be comprised entirely of landscaping, which shall be credited toward compliance with the % required landscape area in this table.
Village Commercial	20%	
Mixed Residential	20%	
Mixed Use	20%	
Residential	20%	

- One tree and six shrubs shall be provided for every 300 square feet of required landscaped area
- Transitional disturbed slope areas located between formal landscaped areas and natural undisturbed areas will be revegetated in accordance with RMC 18.12.402, as amended.
- All existing landscaping and slope restoration previously constructed shall be restored to the original condition and maintained in accordance with RMC and the requirements of this Handbook.
- Slopes adjacent to developed site areas shall be permanently landscaped for a minimum of ten (10) feet.
- There shall be 1 tree provided for every 600 square feet of disturbed slope area and 5 shrubs per required tree in disturbed slope areas.
- Landscaped areas adjacent to McCarran Blvd. may meander between fifteen (15) feet and thirty (30) feet in width with an average required width of twenty (20) feet. Trees planted at a rate of one (1) tree per thirty (30) linear feet with approval per NDOT.
- All required trees shall be a minimum two and one half (2.5) inch caliper for deciduous trees and minimum six (6) foot in height for evergreens as measured from finished grade after planting with a minimum of 70% ten (10) foot in height.
- Shrubs shall be a minimum of 1 gallon and 5 gallon in size with no more than 30 percent of total shrubs being comprised of 1 gallon plantings.
- A minimum of one tree shall be planted every 30 feet on center along any public street frontage (both sides).
- Parking islands shall have a minimum of one tree for each island with the remaining area in shrubs, ground cover, grasses or seasonal color.

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- Trees shall be placed so that no parking space will be further than 75 feet from a tree.
- Parking lot landscape islands shall be a minimum of 126 square feet in area and ten feet wide.

### **Trash, Utility Areas and Mechanical Screening**

Trash, utility areas and mechanical screening shall be provided in accordance with RMC 18.12.1208, as amended.

### **Disturbed Site Area**

All site areas disturbed and left undeveloped for a period of more than 30 days shall be stabilized by the application of a dust palliative. Disturbed site areas left undeveloped for more than 90 days shall be re-vegetated.

### **Irrigation Requirements**

All areas to be permanently landscaped shall be provided with automatic irrigation systems. Shrub and tree plantings, including those trees in lawn areas will be provided with drip or trickle irrigation.

In general, ground cover planting areas shall be provided with drip irrigation; however, small areas of unique ground cover plantings may be provided with overhead sprinkler or drip-mist irrigation. All overhead sprinkler irrigation shall be designed with stream rotor type heads with low trajectories or other features intended to provide effective coverage in high wind areas. All sprinklers shall be equipped with wind sensor technology to prevent unnecessary water loss. All sprinkler heads shall be equipped with low precipitation rate nozzles to allow water infiltration.

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Irrigation scheduling shall follow adopted watering days and be developed to be compatible with soils and other environmental conditions. Irrigation systems shall comply with the requirements of local governing agencies with respect to connections and backflow requirements.

### Parking Standards

**Table 3-7: Parking Requirements:**

Land Use Category / Specific Use Type	Minimum Off Street Parking Requirement (1)(2)
<b>Commercial Uses:</b>	
Bar	1 per 110 sq.ft.
Child Care Center	1 per 9 pupils
Convenience Store	1 per 220 sq.ft.
Drive Through Facility (Food & Beverage)	140 feet of off street stacking area plus 1 per 110 sq.ft. of restaurant space
Financial Institutions	1 per 275 sq.ft.
Fitness Center	1 per 165 sq.ft.
General Commercial	1 per 220 sq.ft.
General Personal Service	1 per 220 sq.ft.
General Retail	1 per 220 sq.ft.
Professional Office	1 per 275 sq. ft.
Medical Office	1 per 165 sq. ft.
Restaurant Low Volume (>1 hour service)	1 per 100 sq.ft.
Restaurant High Volume (<1 hour service)	1 per 75 sq.ft.
<b>Residential Uses:</b>	
Condominium/ Residential Over Retail	1 per studio: 1.5 per 1 bedroom: 2 per 2 & 3 bedroom: 3 per > 3 bedroom: 1 guest space per every 10 units
Multi-Family	1 per studio: 1.5 per 1 bedroom: 2 per 2 & 3 bedroom: 3 per > 3 bedroom: 1 guest space per every 10 units
Nursing Home/ Residential Care Facility	1 per 6 beds
Private Dorm	1 per bedroom; 1 guest space per every 30 bedrooms

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<b>Land Use Category / Specific Use Type</b>	<b>Minimum Off Street Parking Requirement (1)(2)</b>
Senior Housing/ Assisted Living Facility	.5 per unit with 10ft. wide spaces
Single Family Attached/ Detached: Townhouse	1 per bedroom; subdivisions with lot sizes smaller than 4000 sq.ft. and no on street parking shall provide 1 space of common off street parking per every 4 units
<b>Community Based Uses:</b>	
Library/ Art Gallery/ Museum	1 per 350 sq.ft.
Public Park/ Recreation Area	1 per 2,200 sq.ft. of land area
<p><b>(1)</b> Parking reductions may be allowed based on calculations from the Institute of Transportation Engineers (ITE) Manual, Urban Land Institute, American Planning Association, or other analytical studies approved by the City of Reno Zoning Administrator. All parking reduction requests shall be approved by the City of Reno Zoning Administrator. In order to reduce the amount of impervious surface, parking above the minimum requirement is discouraged.</p>	
<p><b>(2)</b> Bicycle parking is required at a rate of 1 space per every 15 automobile spaces provided for all uses except single-family attached, single-family detached, senior housing and nursing home/assisted living facilities.</p>	

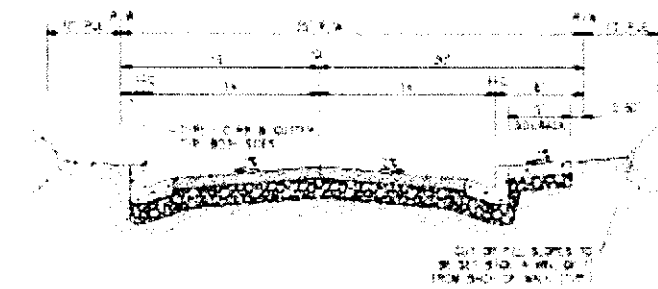
### Street Sections

Three street sections are proposed within the project. Street Section Type I represents the existing street section of a portion of Leadership Parkway and all of Victory Lane. Street Section Type I consists of a 35 foot right-of-way with a 5 foot sidewalk on one side, no parking and no parkway strips. Street Section Type II represents the remaining portion of Leadership Parkway and consists of a 30 foot right-of-way with sidewalk on one side, no parking and no parkway strips. Street Section Type III represents future private rolled curb options which may be utilized in residential developments located within the Keystone Canyon Planned Development.

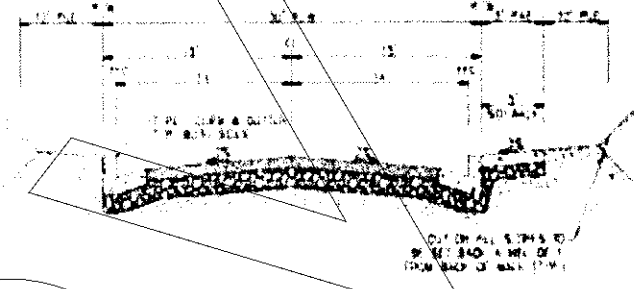
Keystone Canyon Development Standards Handbook

Figure 3-9: Street Sections

Existing Street Sections

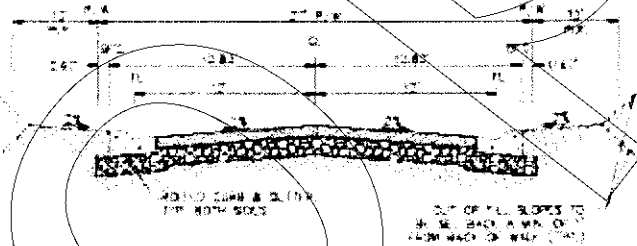


STREET SECTION TYPE E: SIDEWALK ON ONE SIDE, NO PARKING AND NO PARKWAY STRIPS  
NOT TO SCALE



STREET SECTION TYPE B: SIDEWALK ON ONE SIDE, NO PARKING, NO PARKWAY STRIPS  
NOT TO SCALE

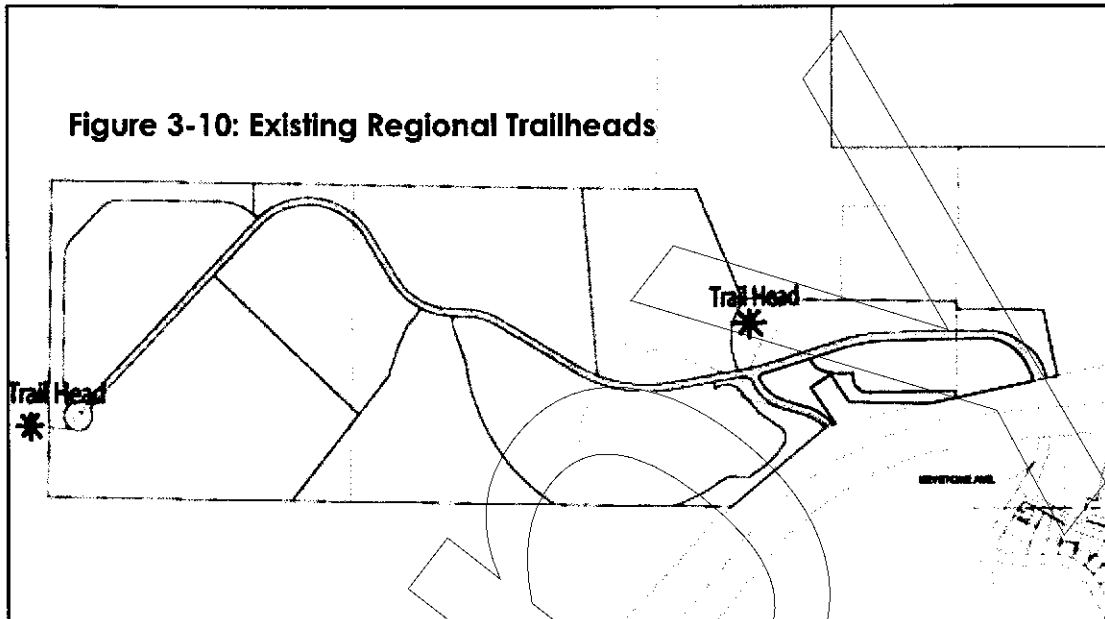
Proposed Street Section



STREET SECTION TYPE B: NO SIDEWALK, NO PARKING, NO PARKWAY STRIPS  
NOT TO SCALE

## Sidewalks, Pathways & Trails

There are two existing regional trail heads located adjacent to and within the project boundary.



An internal pedestrian network consisting of sidewalks, pathways and trails will be provided to facilitate pedestrian circulation within the project. Each individual planning area's pedestrian network shall be submitted and approved during the required site plan review, special use or tentative map process and constructed with each phase of development of the planning area. The following criteria shall be incorporated into the planning and design of the pedestrian network:

- The non-vehicular circulation system shall include sidewalks, multi-purpose pathways and trails to connect the active and passive areas of the site. The system shall provide pedestrian and bicycle connections to the various uses within the project.
- All sidewalks and pathways outside of the public right-of-way shall be located in a public use easement to provide public access throughout the project.
- Where practical due to grading, pathways and trails shall meander within open space and parkway areas. Abrupt or irregular curves and jogs should be avoided. The meandering aspect shall be coordinated with site grading.

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## Keystone Canyon Development Standards Handbook

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- Internal site pathways may be used for maintenance access to remote portions of the project.
- Sidewalks, pathways and trails shall be phased in accordance with the development plan for each village and its associated improvements.
- Where necessary, pedestrian bridge crossings will be provided to maintain easy access over drainage ways.
- Curb ramps shall be constructed wherever a sidewalk or pathway crosses a curb. Curb ramps should occur as a natural extension of the walkway, allowing pedestrians to pass from a walkway, down a ramp and onto a street crossing without deviating from the direction of the walkway or crossing. Crosswalks will also be used to allow connection to trails that bisect roadways.
- Sidewalks locations and requirements are as follows:
  - A 5 foot sidewalk shall be located along the south side of Leadership Parkway and along the east side of Victory Lane for the full length of the streets. This sidewalk will be constructed as each area develops.
  - Sidewalk connections shall be provided to each village and provide access to building entrances.
- Pathway and trail locations and requirements are as follows:
  - Pathways shall be a minimum of 5 feet in width. Pathway materials may vary depending on the intended use.
  - Materials shall consist of asphalt, concrete, segmented pavers or decomposed granite. Materials shall be determined at time of building permit.
  - Non improved surface trails may be utilized to provide pedestrian access in areas of steeper terrain.
  - A trail inventory plan for the entire project site shall be included with the submittal of the first site plan review, special use permit or tentative map. The plan shall identify which existing pedestrian and off road vehicle trails shall be maintained and which trails and associated scaring will not be utilized as part of the future trail network. The trails and scarring identified to be removed shall be restored and revegetated by the KCMA. The plan shall also include a timetable for the completion of the proposed work.
  - Trailhead location and associated directional signage packages, will be included with the trail inventory plan. Each Trailhead shall include a mutt mitt station, trash receptacle, bench, and picnic table.

## Keystone Canyon Development Standards Handbook

- Open view perimeter fencing or other acceptable means shall be installed along the west and north project perimeters to prevent unauthorized access to the adjacent public lands as determined appropriate during the site plan review process.
- Improved surface pathways shall be utilized to provide pedestrian access to areas not immediately adjacent to a roadway.
- The Master Developer shall be responsible for assuring that trails, trailheads, public improvements and associated signs are constructed. The improvements shall be maintained by the Master Association or other entity authorized by the PUD.

### Signage

The project signage package consists of entry monument signs at both of the project entrances to McCarran Boulevard at Leadership Parkway and Victory Lane, entry signs at each individual village, wall signs and cohesive directional signage throughout the project. Final location of each entry monument sign shall be determined with the associated site plan review, SUP or tentative map. All signs shall be constructed with materials and colors compatible with the associated project building architecture and consistent with the standards in Table 3-8 Sign Standards. Off-premises advertising display structures (billboards) shall be prohibited.

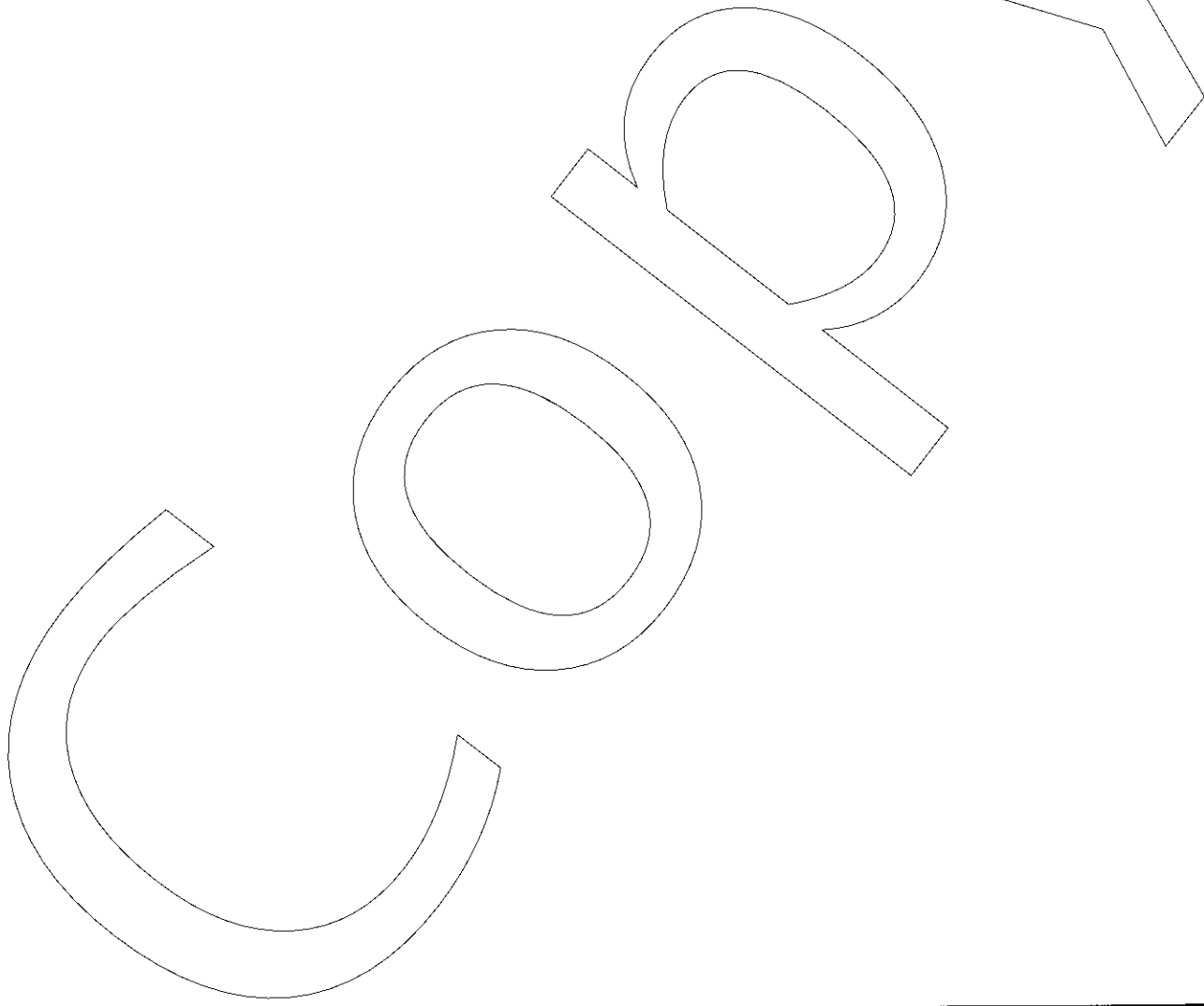
**Table 3-8: Sign Standards\***

Planning Area	Maximum Height Freestanding	Sign Area Freestanding; Number of Signs Allowed	Sign Area Wall Sign	Letter Height; Illumination
Village Commercial	35 feet/ 8 feet monument only	250 square feet; 1 sign at 35 feet, 2 signs at 8 feet	1 square foot of sign area per lineal foot of business frontage; each business is allowed a minimum of 40 square feet	5 feet; All types
Mixed Use	8 feet monument only	125 square feet; 2 signs		4 feet; All types

Keystone Canyon Development Standards Handbook

Mixed Residential	6 feet monument only	100 feet; 2 signs	20 square feet	4 feet; Indirect
Residential	6 feet monument only	75 feet; 2 signs	20 square feet	4 feet; Indirect
Entry Monument Signage	15 feet	150 square feet; 2 signs	n/a	4 feet; Indirect
Directional Signage	10 feet	50 feet; 10 signs	n/a	1 foot; Indirect

\*Entry monument signage and directional signage may encroach into the open space designation with the approval of the City of Reno Zoning Administrator.



Keystone Canyon Development Standards Handbook

Figure 3-11: Conceptual Entry Signage

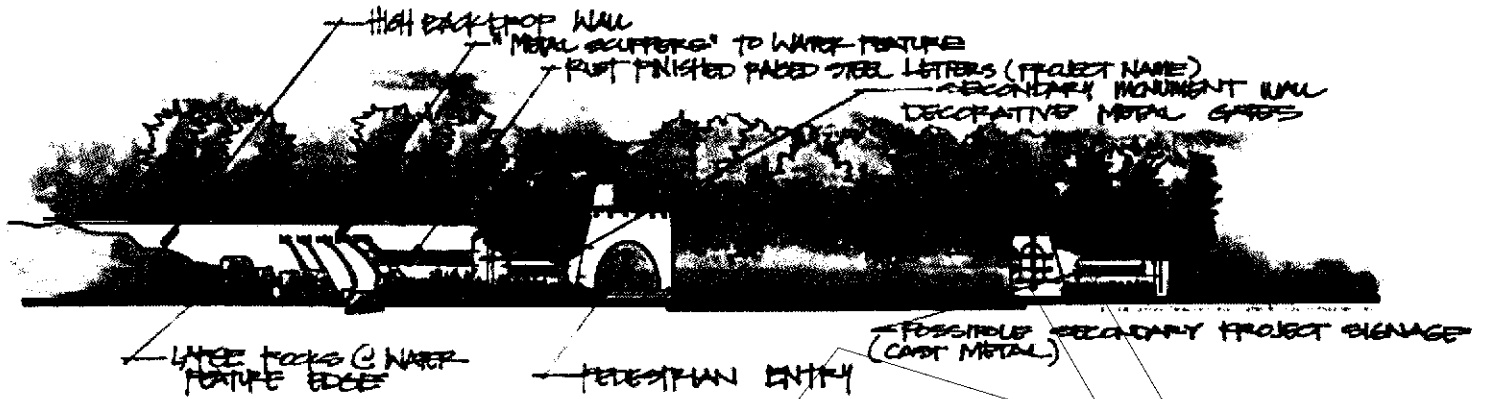
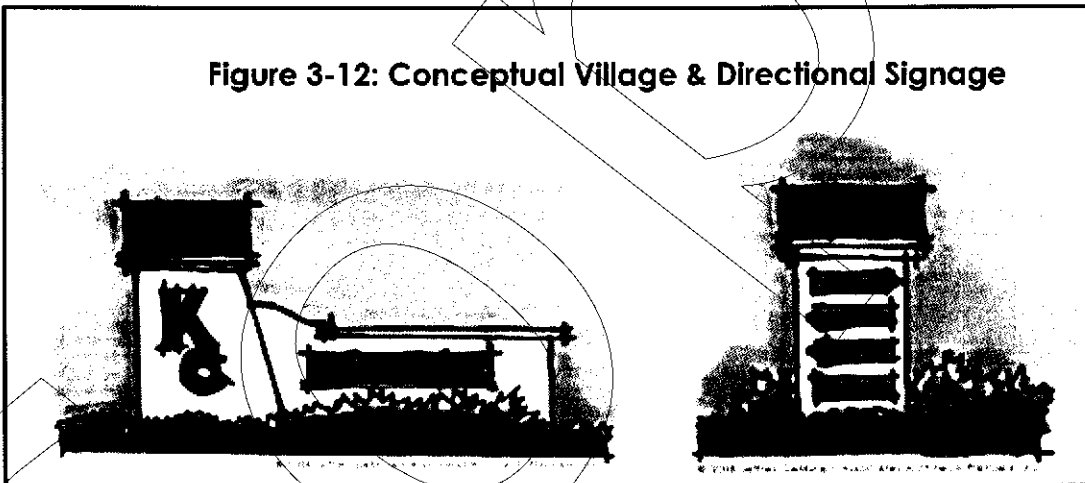


Figure 3-12: Conceptual Village & Directional Signage



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 Keystone Canyon Development Standards Handbook
 

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## Lighting

The project lighting package includes both common element and specific village lighting. Common element lighting includes street lights and any lighting necessary for common area signage. Dark Sky Lighting Techniques shall be utilized within the project and verified during review of the respective building permit or final map for each individual planning area. All lighting, including temporary lighting, within the project will comply with the following standards:

- Any off-street light source shall confine illumination to the site and protect adjacent properties from glare.
- Exterior lights shall not blink, flash or change intensity. Temporary seasonal string lights are allowed for a period not to exceed 60 days.
- All sources of light shall be concealed and directed downward. Parking lot, walkway and area lighting shall be directed downward with no light spilling offsite. The light source shall be kept as low to the ground as possible while ensuring safe and functional levels of illumination.
- Lighting shall be placed along primary pedestrian pathways, at pedestrian bridge crossings, parks, and other special high use areas.
- Lighting shall have a common design and color throughout the development.
- Bollards shall have a maximum height of 45 inches.
- Pedestrian lighting shall be spaced at intervals appropriate to facilitate the safety of pedestrians.
- A site photometric plan including lighting pole height, locations and fixtures within each project shall be approved by the Zoning Administrator prior to issuance of a building permit.

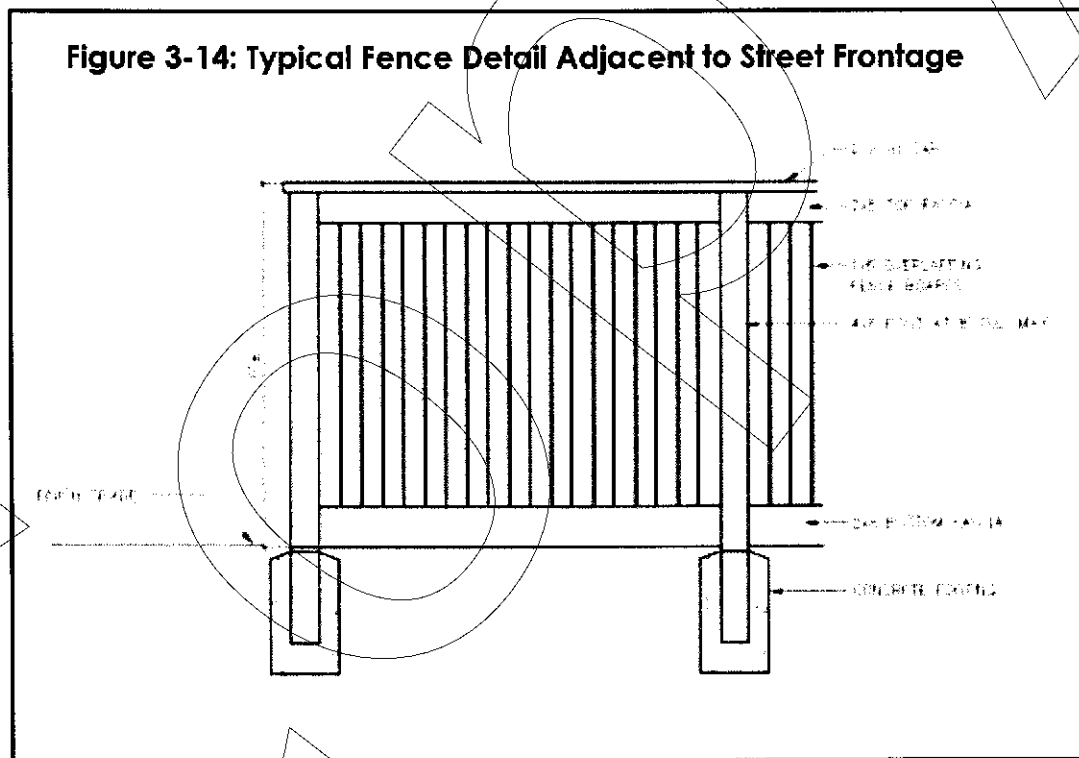
**Figure 3-13: Typical Street Lighting**



## Walls & Fencing

Walls and fences within the project shall conform to the standards specified herein and shall be approved by the Zoning Administrator with the associated site plan review, special use permit or tentative map. The approved wall and fence plan shall accompany improvement plans when submitted. Walls and fences shall be constructed by the individual builders as development occurs. Walls and fences within the project shall conform to the following standards:

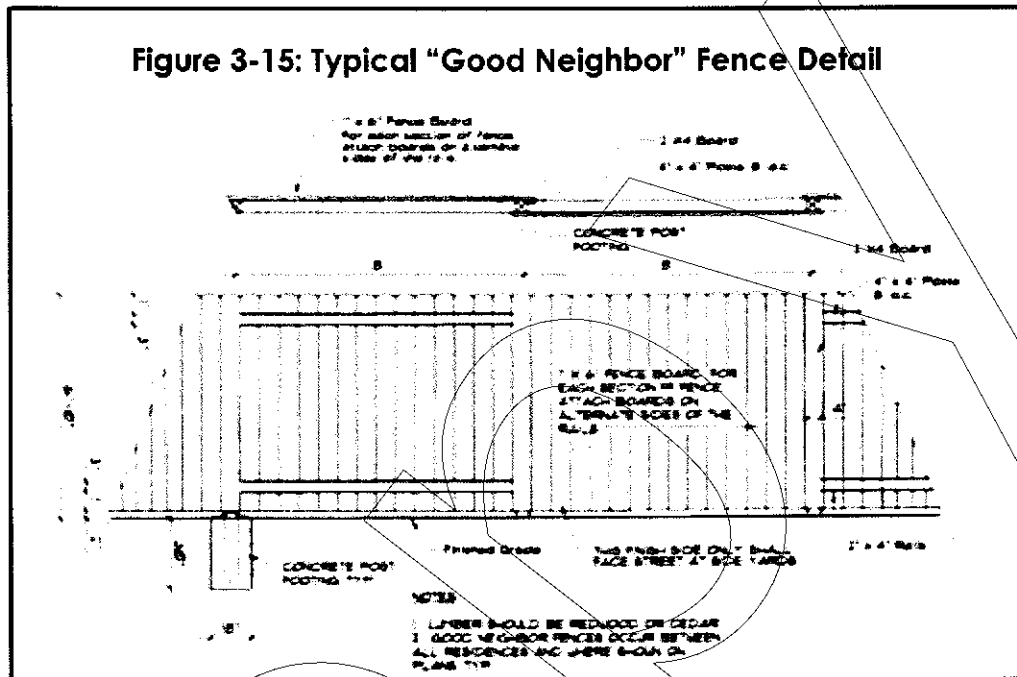
- Two types of "Good Neighbor" wooden fencing (maximum height of six (6) feet) shall be used throughout the project. Capped fencing is required adjacent to the street frontage (Figure 3-14). Dog eared fencing may be used to separate individual single-family residential lots (Figure 3-15).



- If perimeter fencing is used for residential uses located adjacent to open space and/or trails, then open metal fencing may be used to allow for a view of such amenities (Figure 3-18).

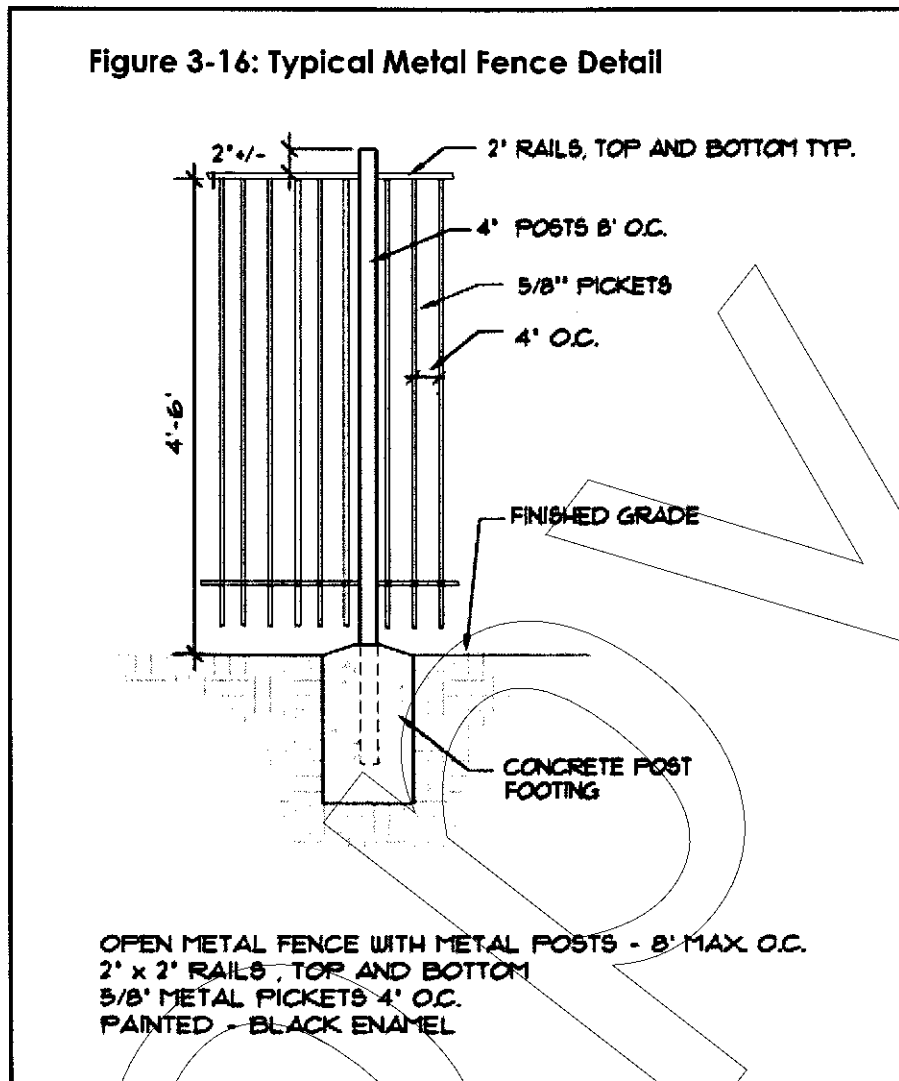
## Keystone Canyon Development Standards Handbook

- 42 inch split-rail fencing may be used in open space corridors to define/ delineate pathways and trails. Split rail fencing may be wood or concrete and must be approved by the Zoning Administrator prior to construction.
- In all instances walls or fences which abut sidewalks or internal streets shall be separated from the sidewalk by a minimum 3 foot wide landscape strip.



- All front yard walls and fences shall be set back a minimum of two feet (2') from the front façade of the home.
- All walls and fences shall maintain a uniform top horizontal plane. When changes in elevation occur, walls and fences shall be stepped in equal, vertical intervals where possible. No step should exceed twelve inches (12") where feasible.

**Figure 3-16: Typical Metal Fence Detail**

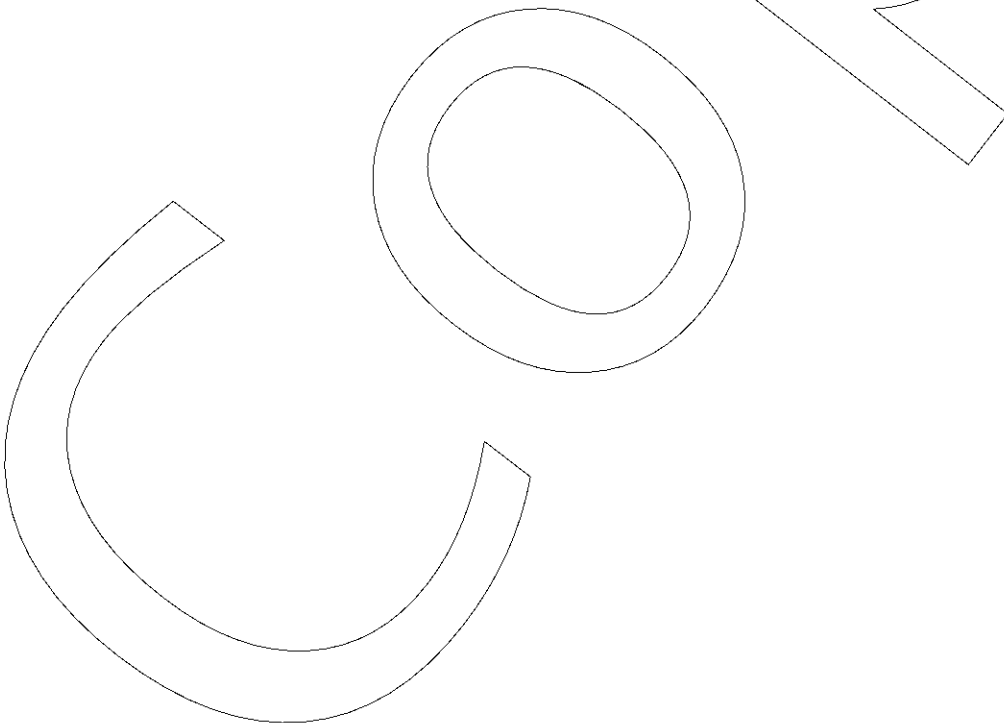


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## Keystone Canyon Development Standards Handbook

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- Chain link may be used on a temporary basis at construction sites only.
- Vinyl coated chain link may be used as a fencing material for outdoor private or public park facilities such as, but not limited to, baseball backstops or tennis courts. Said fencing shall be approved by the Zoning Administrator prior to construction and included as part of the site improvement permit.
- Barbed wire, plain exposed concrete block, and permanent chain link are prohibited.
- Walls shall be located where necessary to provide privacy, security and protection from roadway noise associated with arterial and collector roadways, as determined necessary during the site plan review process.
- Walls shall not exceed six feet (6') in height, excluding non-rockery retaining walls as required due to topography and subject to site plan review, special use permit or tentative map approval as applicable.
- Walls shall be constructed of masonry or other permanent, durable, low maintenance decorative materials and be of a consistent design throughout the project Figure 3-17.
- Landscaped earth berms may be used to minimize wall height.

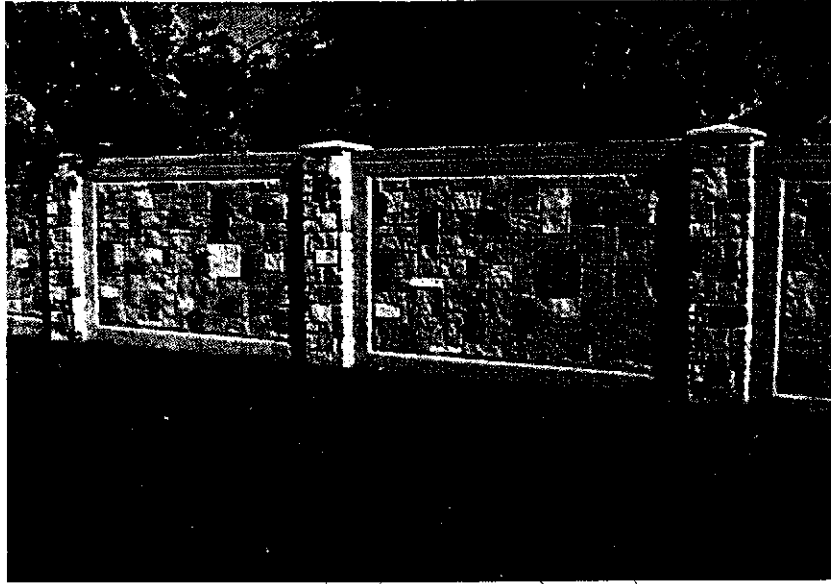


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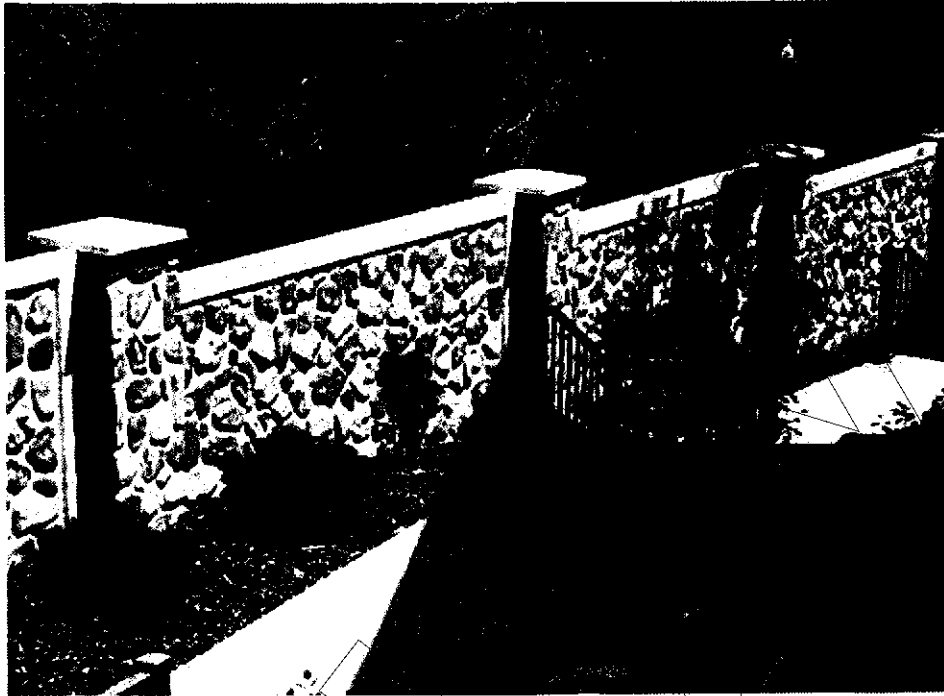
Keystone Canyon Development Standards Handbook

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**Figure 3-17: Conceptual Wall Design**



- Perimeter walls shall not exceed seventy-five linear feet (75') without a change in wall planes and shall have pilasters at maximum 50-foot intervals, at property corners or at changes in wall planes Figure 3-18.
- Open view metal fencing shall not exceed six feet (6') in height and shall be constructed of decorative wrought iron, tubular steel, simulated wood post and rail or other similar quality materials as approved by the Zoning Administrator Figure 3-16.
- Open view fences may include a solid base a maximum of two feet (2') in height, with open fencing above the solid portion.
- All wall and fence components shall be included in the site improvement plans and approved by the Zoning Administrator prior to construction.
- All walls and fences shall comply with AASHTO standards as applicable to maintain adequate sight distance requirements.
- All roadway walls shall be coated with an anti-graffiti product.

**Figure 3-18: Conceptual "Stepped" Wall Design**

### **Green Building Practices**

All individual projects located within the Keystone Canyon Planned Unit Development will be encouraged to utilize Green Building Practices. These Green Building Practices may include the use of known rating systems such as Sierra Green Building Standards or Leadership in Energy and Environmental Design (LEED) Standards. Green Buildings Practices include but are not limited to the following:

- Use of On-site Renewable Energy
- Promotion of Alternative Transportation
- Best Management Practices
- Low Impact Development Standards that are not required by City Code.
- Water Efficient Landscaping
- Innovative Wastewater Technologies

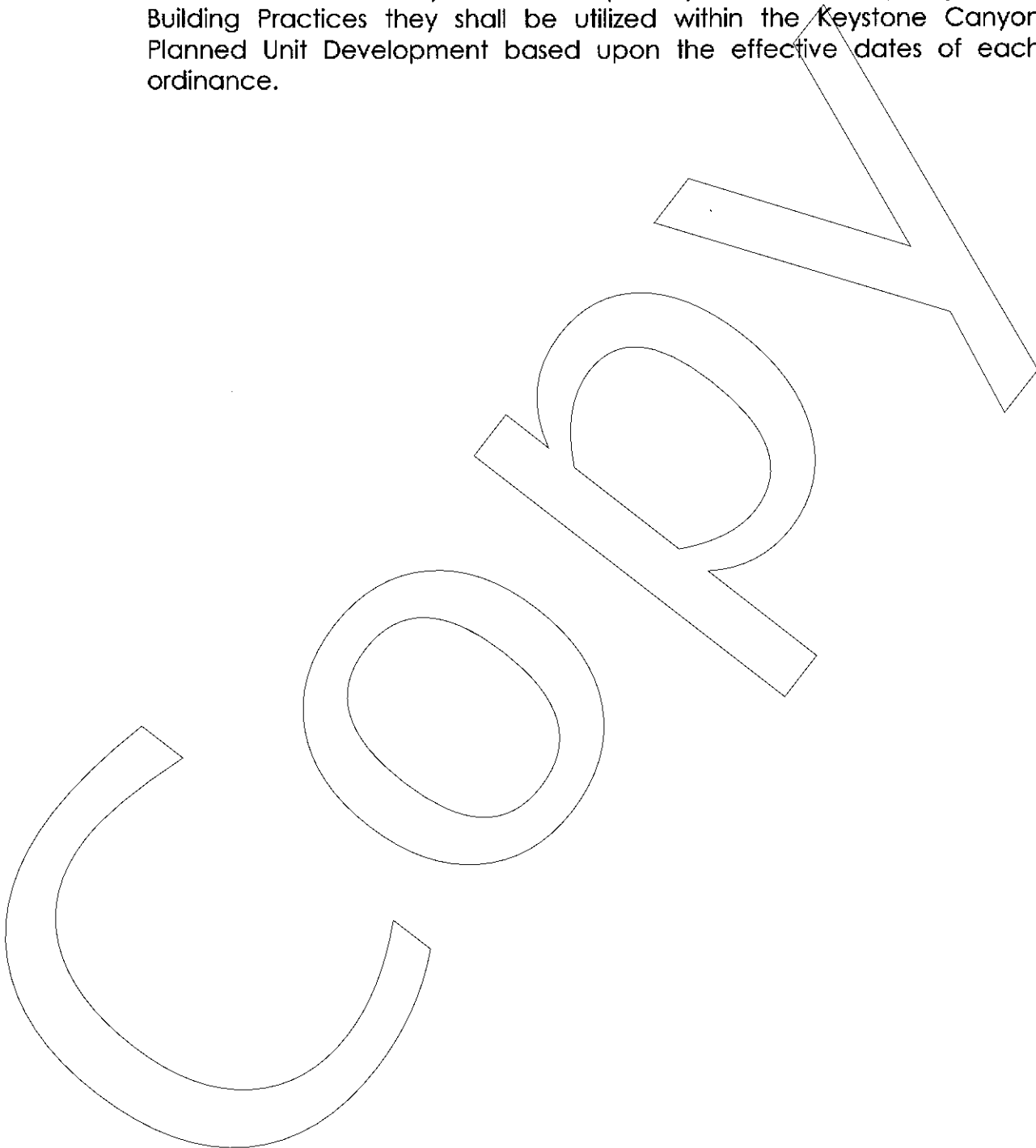
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Keystone Canyon Development Standards Handbook

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- Water Use Reduction
- Materials Recycling
- Use of Regional Materials
- Use of Rapidly Renewable Materials
- Light Pollution Reduction

At such time as the City of Reno adopts any ordinances requiring Green Building Practices they shall be utilized within the Keystone Canyon Planned Unit Development based upon the effective dates of each ordinance.



# APPENDIX A

COPY

**Lynnette R. Jones**  
*City Clerk*  
(775) 334-2030  
[jonesl@reno.gov](mailto:jonesl@reno.gov)

**Beverly Beaty-Benadom**  
*Deputy City Clerk*  
(775) 334-2030  
[Beaty-BenadomB@reno.gov](mailto:Beaty-BenadomB@reno.gov)



**Office of the City Clerk**  
*Central Casbiring (775)334-2032*  
*Parking Tickets (775)334-2279*

**FILED THIS DATE**  
12 / 16 / 11  
BY: BBB  
CITY CLERK

December 16, 2011

Tanamera Development, LLC  
ATTN: Kraig Knudsen  
5470 Reno Corporate Drive  
Reno, NV 89511

RE: Case No. LDC09-00067 (Keystone Canyon) – Certification of Handbook

Dear Applicant:

At a regular meeting held December 14, 2011, the City Council certified the Keystone Canyon Planned Unit Development (PUD) Standards Handbook. The amendments were tentatively approved by the Reno City Council on October 12, 2011.

In order to effectuate the PUD, the Handbook must be recorded at the Washoe County Recorder's Office in accordance with NRS 278A.

Sincerely,

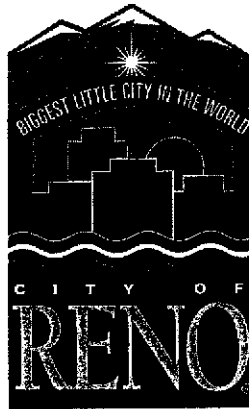
*Beverly Beaty-Benadom for*  
Lynnette R. Jones  
City Clerk

LRJ:bbb

xc: Community Development  
Traffic Design Engineer  
Terry Zeller, Parks, Recreation & Community Services  
KEYCOM, LLC  
Chris Baker, Summit Engineering Corporation

Lynnette R. Jones  
City Clerk  
(775) 334-2030  
jonesl@reno.gov

Beverly Beaty-Benadom  
Deputy City Clerk  
(775) 334-2030  
Beaty-BenadomB@reno.gov



Office of the City Clerk  
Central Cashiering (775)334-2032  
Parking Tickets (775)334-2279

October 13, 2011

Tanamera Development, LLC  
ATTN: Kraig Knudsen  
5470 Reno Corporate Drive  
Reno, NV 89511

FILED THIS DATE  
10 / 13 / 11  
BY: BBB  
CITY CLERK

RE: Case No. LDC09-00067 (Keystone Canyon) - Zoning Text Amendment

Dear Applicant:

At a regular meeting held October 12, 2011, and following a public hearing thereon, the City Council upheld the recommendation of the Planning Commission and approved the request for a zoning text amendment to the Keystone Community Campus PUD (Planned Unit Development). The changes consist of: (1) eliminating: (a) the ±73,500 square foot Community Life Center which contained a child care center for up to 250 children, a teen center, church facilities, cafeteria and resource center; (b) the ±60,000 square foot recreation and aquatic center; (c) the ±198,000 square foot worship/performing arts center; and (d) the Memorial Garden (cemetery/funeral home) uses; and (2) (a) increasing the total number of residential units from a maximum of 220 senior units to 745 mixed residential units consisting of multifamily, single family attached, single family detached and senior units with a density of 7 to 18 dwelling units per acre on ±45.12 acres of the site; (b) allowing ±10.9 acres of mixed residential and commercial uses; (c) establishing ±4.02 acres of Village Commercial uses; and (d) providing ±41.6 acres of Open Space. This is also a project of Regional Significance as it will generate more than 187,500 gallons per day (GPD) of sewage (632,532 gpd estimated); and create more than 625 housing units (745 proposed). The ±101.6 acre site is located along the north side of North McCarran Boulevard and extends ±4,200 feet to the west of the North McCarran Boulevard/Leadership Parkway intersection in the PUD zone.

The zoning text amendments to the PUD will become effective subject to approval of the Projects of Regional Significance by the Regional Planning Agency and compliance with Condition A, as follows:

- A. Approval of the amendment to Keystone Canyon Design Guidelines is subject to the modifications of the Handbook as noted in Exhibit A, the addition to the PUD Handbook of the Conditions contained in Exhibit B and any modifications made by the Planning Commission and City Council at their respective public hearings. All revisions and

RECEIVED

OCT 14 2011

Tanamera Development, LLC  
Case No. LDC09-00067 (Keystone Canyon)  
October 13, 2011  
Page 2

additions shall be incorporated into the Design Guidelines Handbook and submitted to staff in both paper and two electronic versions (Word and PDF) for review within two (2) months of the date of Regional Planning approval of the Projects of Regional Significance. The PUD amendment shall be approved and certified by the City Council and recorded within four (4) months of the date of Regional Planning's approval of the Projects of Regional Significance. Failure by the applicant to conform to either time deadline shall render this approval null and void.

Sincerely,

  
Lynnette R. Jones  
City Clerk

LRJ:bbb

xc: Community Development  
Traffic Design Engineer  
Terry Zeller, Parks, Recreation & Community Services  
KEYCOM, LLC  
Chris Baker, Summit Engineering Corporation

## Exhibit B Conditions of Approval

1. Prior to the approval of each permit or final map, the applicant shall have an approved Sewerage Report in accordance with the Public Works Design Manual. Adequate access shall be provided for all sanitary sewer improvements per the Public Works Design Manual. All required on-site and off-site sanitary sewer improvements necessary to serve the project shall be complete and functional prior to the issuance of any certificate of occupancy.
2. All proposed on-site sewer facilities and improvements shall be privately owned and maintained and shall be designed and constructed, with adequate access, in accordance with the City's minimum standards as set forth in the Public Works Design Manual.
3. Prior to the approval of each permit or final map, the applicant shall have an approved Hydrology Report addressing on-site and off-site storm water flows and facility capacities for the pre-development and post-development site conditions.
4. On-site storm water management facilities and appurtenances will be privately owned and maintained. Adequate maintenance access shall be provided for all storm water management improvements per the Public Works Design Manual.
5. Site circulation design, traffic control devices, and operational characteristics of the site accesses, common use driveways, on-site drive aisles, emergency accesses, fire access lanes, pedestrian routes, sidewalks, and parking areas shall be in accordance with the Public Works Design Manual and shall meet with the approval of the City Fire and Community Development Departments.
6. The applicant shall provide sidewalks and demonstrate accessible and ADA compliant pedestrian routes from all adjacent public rights-of-way to the on-site buildings.
7. Prior to the approval of each permit or final map, the applicant shall demonstrate adequate street lighting exists or shall propose street lighting in accordance with City standards for the project entrances and adjoining properties.
8. Prior to the approval of each permit or final map, the applicant shall have a current City, RTC, and NDOT approved traffic study for the project. This study shall evaluate background and project traffic patterns, site accesses, and pedestrian routes and review of the roadway capacities, intersection levels of service for the roadway network included in the project. Prior to issuance of a certificate of occupancy for each phase, the applicant shall have all recommended roadway or intersection improvements completed.

9. Prior to approval of each permit or final map, the applicant shall provide a written response from RTC defining transit requirements for this project and shall dedicate rights-of-way or grant appropriate easements and construct transit improvement in accordance with RTC's requirements prior to the approval of any certificate of occupancy to the satisfaction of the Community Development Department staff.
10. Prior to approval of each permit or final map, the applicant shall demonstrate all necessary on-site and off-site easement vacations, relocations, and grants are complete or in place. These easements include, but are not limited to; project construction, site access and cross access, utility access, emergency access, maintenance access, sewer lines, surface drainage, storm drains, irrigation ditches, and utility improvements. All required access, sewer, storm drainage, and utility improvements shall be constructed prior to the issuance of any certificates of occupancy.
11. Prior to approval of each permit or final map, the applicant shall have plans approved and shall obtain associated encroachment and excavation permits. Additionally, the applicant shall provide necessary dedications for rights-of-way and/or public use easements for the roadway, sidewalk, and pedestrian ramp improvements proposed along each project frontage.
12. Prior to the approval of each permit, the applicant shall have a preconstruction meeting and an approved Construction Management Plan. This plan shall include provisions for on-site and off-site construction material storage, employee parking and construction activity phasing and staging. The plan shall also depict the proposed construction transportation and delivery routes within the project vicinity. Access to adjacent businesses and properties shall be maintained during construction.
13. Prior to approval of each permit or final map, the applicant shall develop a rehabilitation plan in conjunction with requirements established by engineering staff to determine the extents and nature of upgrades, repairs, renovations, or reconstruction of the pavement structure and surface for the roadways identified as construction transportation and delivery routes within the project vicinity as depicted in the Construction Management Plan and all updates thereto. The rehabilitation plan shall establish milestone traffic generating occupancies for completion of the required roadway rehabilitation. Prior to the issuance of any certificate of occupancy associated with the improvements required by the rehabilitation plan, the applicant shall complete all pavement structure and roadway surface improvements necessary to sustain minimum roadway functional classifications within the project vicinity resulting from construction and project traffic impacts. The applicant shall replace all roadway markings and striping affected or displaced by the pavement improvements.

14. Prior to the approval of each permit or final map, the applicant shall comply with the Quality Assurance Program as set forth in the Public Works Design Manual, Chapter VI, titles "Inspection, Testing and Verification" and "Quality Assurance Program."
15. Prior to performing any work within the McCarran Boulevard ROW, applicant shall obtain NDOT encroachment permit.
16. Prior to approval of each permit or final map, the applicant shall have a site plan review and obtain approval of final grading plans.

Utility Corridor Setbacks

17. All building and site improvements proposed adjacent the onsite utility corridors shall be consistent with the utility corridor set backs contained in the Truckee Meadows Regional Plan.

Emergency Access Gate

18. Prior to approval of the first site plan review or tentative map as applicable, the applicant shall have plans approved to install an emergency access gate at or near the south end of Leadership Parkway to the satisfaction of City Fire staff and in consultation with US Forest Service staff. The type of gate, its' location, ownership, maintenance responsibility and operational characteristics shall also be determined.

Cultural Resources

19. At least 48 hours prior to any initial ground disturbance, the project representatives shall notify the Reno-Sparks Indian Colony (RSIC) Cultural Resources Program (775) 785-1363 in order for the Colony to provide a qualified Native American monitor, at the Colony's expense, to be on site during any and all initial ground disturbance for the purpose identifying any unanticipated discovery of cultural resources.

If any Native American cultural resources are discovered during the initial ground disturbance activity or anytime thereafter, the monitor will be allowed to inspect all cultural resources (along with the qualified project staff and archaeologist) and the site to determine the extent of the discovery.

The RSIC is requesting there be no scientific study or destructive analysis on any cultural items or human remains that are discovered or removed from this proposed project site.

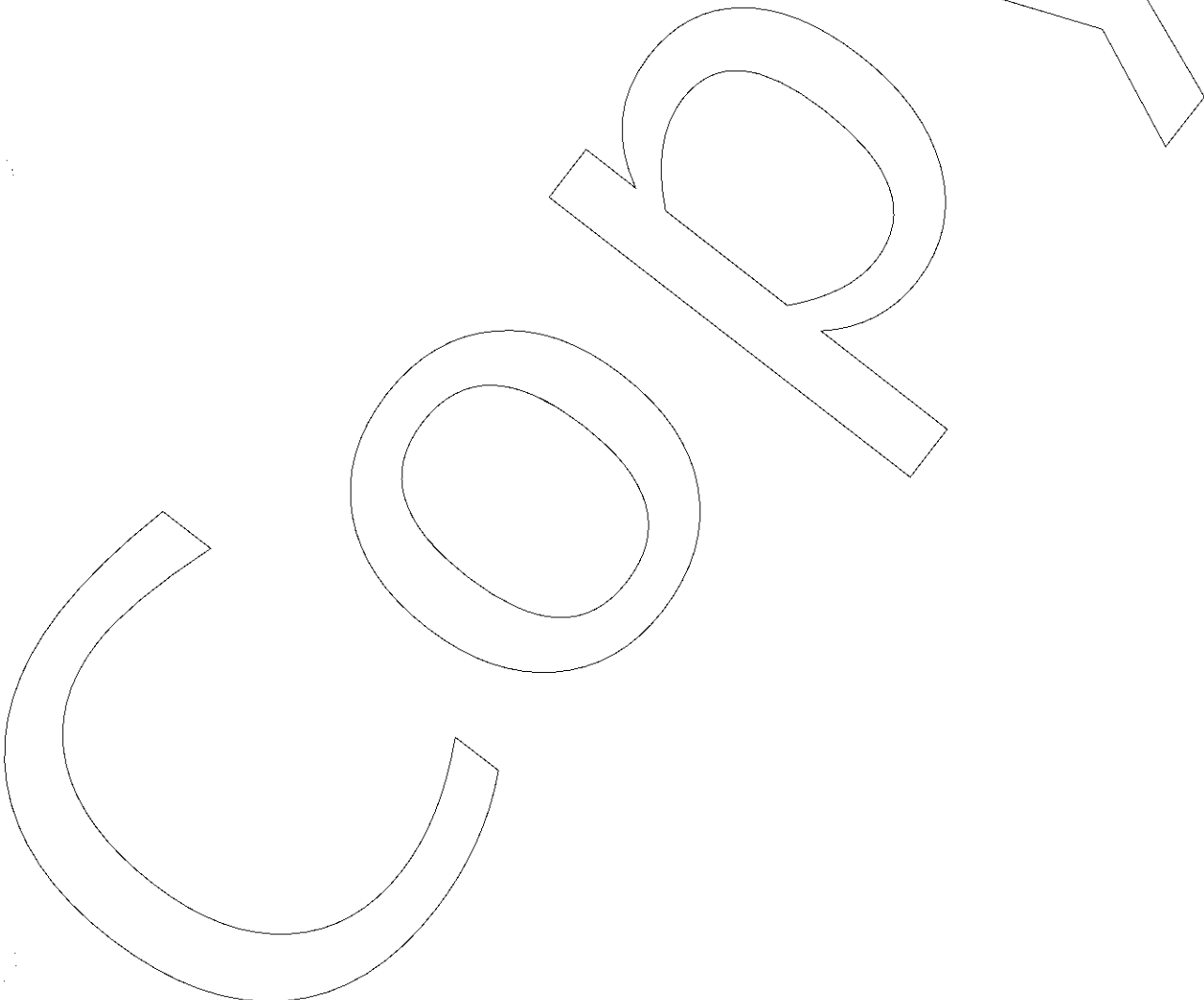
Notwithstanding applicable laws, the RSIC will have the opportunity to remove and secure ownership of any Native American cultural resources for the purpose of preservation and education.

### Discovery of Human Remains

20. In the event that Native American human remains and associated funerary objects are discovered, the RSIC Cultural Resource Program (775) 785-1363 will be notified within one (1) hour of discovery.

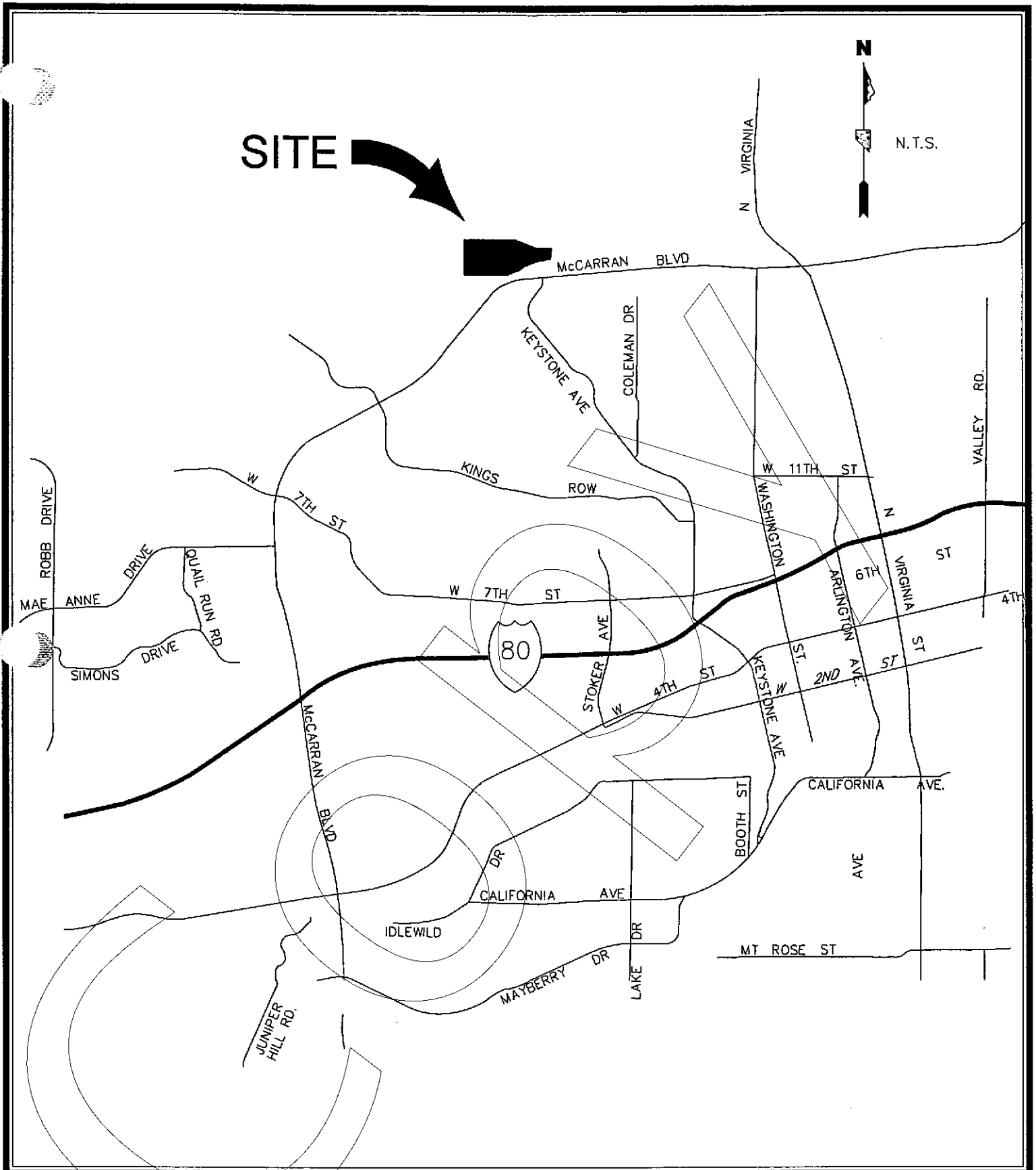
The RSIC Cultural Resource Program will be a part of the initial and subsequent discussions with any State, County, Federal and local representatives of any unanticipated discovery of human remains and associated funerary objects.

In the event that Native American human remains must be recovered or removed, the RSIC respectfully asks authorization to take care of this in a culturally sensitive manner, abiding by all State, Federal and Tribal laws. This will ensure the RSIC's spiritual and cultural responsibility and respect to the human remains. This will also address confidentiality of the reburial.



# APPENDIX B

COPY



KEYSTONE CANYON

VICINITY MAP

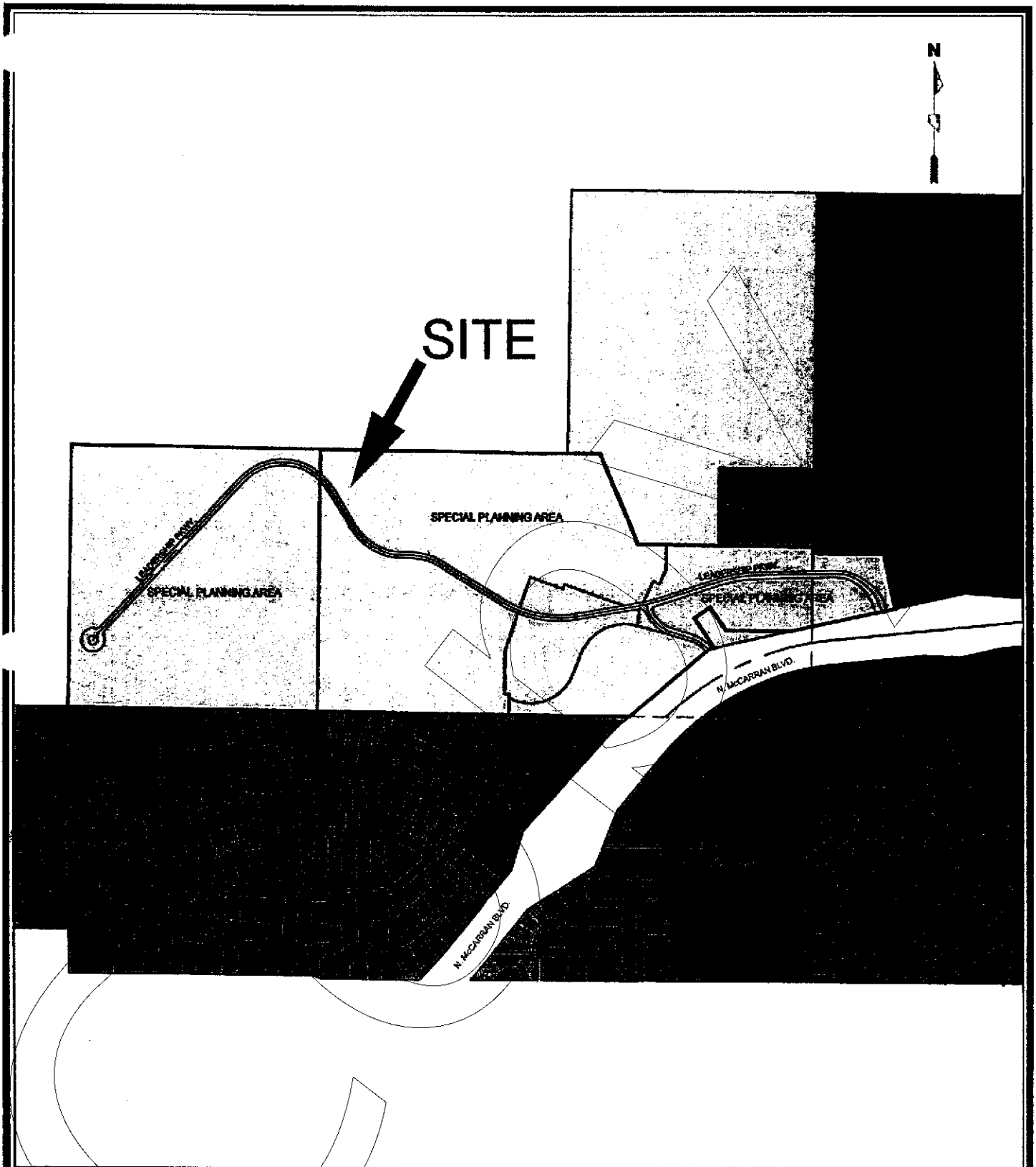
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FIGURE #1

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KEYSTONE CANYON  
MASTER PLAN MAP

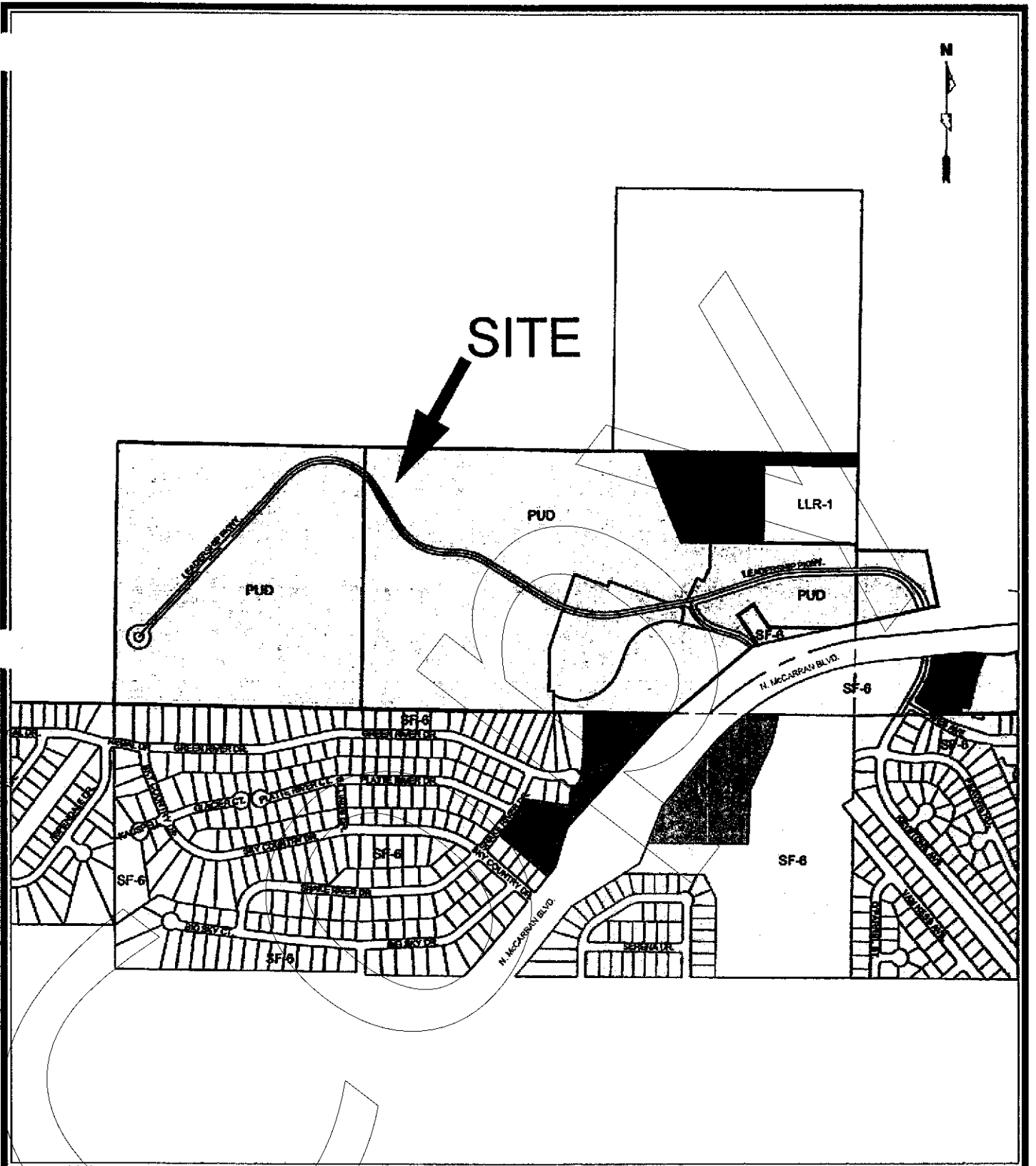
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**KEYSTONE CANYON  
EXISTING AND PROPOSED  
ZONING DESIGNATION**

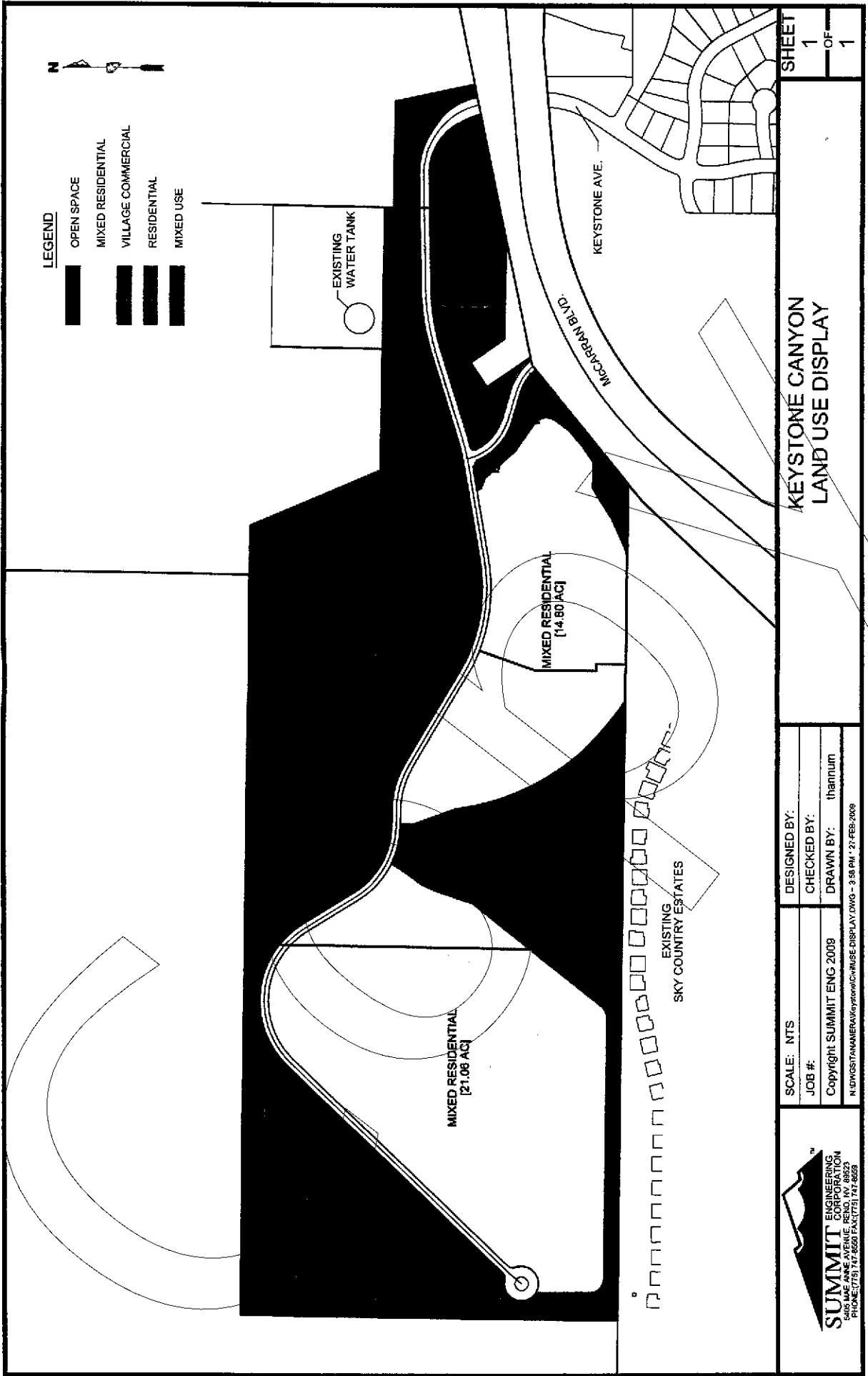
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<p><b>KEYSTONE CANYON LAND USE DISPLAY</b></p>		<p>SHEET 1 OF 1</p>	
		<p>SCALE: NTS</p>	<p>DESIGNED BY:</p>
<p>JOB #:</p>	<p>CHECKED BY:</p>	<p>Copyright SUMMIT ENG 2009</p>	
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**SUMMIT ENGINEERING**  
A DIVISION OF  
5405 LAKE ANNE AVENUE, RENO, NV 89523  
PHONE: (775) 747-8550 FAX: (775) 747-8559

**EXHIBIT "A"**  
**LEGAL DESCRIPTION**

APN 002-020-21, 002-020-22, 082-631-14, 082-631-15,  
082-631-16, 082-631-17, 082-631-18, 082-631-19, 082-631-20,  
082-631-21, 082-631-22, 082-631-23 and 082-631-24

Ten parcels of land located within the South Half of Section 33 and within the Southwest Quarter of the Southwest Quarter of Section 34, Township 20 North, Range 19 East, being more particularly described as follows:

Beginning at the South Quarter corner of said Section 33;  
thence along the South boundary of said Section 33 North  $89^{\circ}12'06''$  West a distance of 1306.32 feet to the Southwest corner of Parcel 142 as shown on Record of Survey Map 1071, File Number 464356, of the Official Records of Washoe County, Nevada;  
thence along the West boundary of said Parcel 142 North  $00^{\circ}46'39''$  East a distance of 1347.66 feet to the Northwest corner of said Parcel 142;  
thence along the North boundary of said Parcel 142 South  $89^{\circ}14'43''$  East a distance of 1308.97 feet to the Northwest corner of Parcel A as shown on Parcel Map 3511, File Number 2341361, of said Official Records;  
thence along the Northerly boundary of said Parcel A South  $89^{\circ}11'49''$  East a distance of 1476.28 feet;  
thence South  $22^{\circ}48'03''$  East a distance of 505.58 feet;  
thence South  $89^{\circ}07'16''$  East a distance of 147.88 feet to the Northwest corner of Parcel 1 as shown on Parcel Map 2668, File Number 1638210, of said Official Records;  
thence along the North boundary of said Parcel 1 South  $89^{\circ}08'57''$  East a distance of 779.19 feet to the Northeast corner of said Parcel 1;  
thence along the East boundary of said Parcel 1 South  $01^{\circ}05'53''$  East a distance of 32.36 feet to the Northwest corner of Parcel D of said Parcel Map 3511;  
thence along the North boundary of said Parcel D South  $89^{\circ}07'32''$  East a distance of 375.00 feet to the Northeast corner of said Parcel D;  
thence along the Easterly boundary of said Parcel D South  $11^{\circ}56'49''$  East a distance of 288.09 feet to the Southeasterly corner of said Parcel D;  
thence along the Southerly boundary of said Parcel D South  $78^{\circ}09'24''$  West a distance of 47.33 feet to a point on the right-of-way of Leadership Parkway as shown on Dedication Tract Map 3980, File Number 2569662, and modified by Document Numbers 2797035, 2797036, 2797037 and 2962327 of said Official Records;  
thence along said right-of-way from a tangent which bears North  $12^{\circ}14'40''$  West, along a circular curve to the left with a radius of 277.00 feet and a central angle of  $14^{\circ}08'53''$  an arc length of 68.40 feet;  
thence along a tangent circular curve to the left with a radius of 193.00 feet and a central angle of  $28^{\circ}14'34''$  an arc length of 95.14 feet;  
thence North  $54^{\circ}38'07''$  West a distance of 37.04 feet;  
thence along a tangent circular curve to the left with a radius of 265.00 feet and a central angle of  $36^{\circ}25'41''$  an arc length of 168.48 feet;

thence South  $88^{\circ}56'12''$  West a distance of 402.04 feet;  
 thence along a tangent circular curve to the left with a radius of 815.00 feet and a central angle of  $16^{\circ}28'03''$  an arc length of 234.24 feet;  
 thence South  $72^{\circ}28'09''$  West a distance of 305.76 feet;  
 thence along a tangent circular curve to the right with a radius of 785.00 feet and a central angle of  $07^{\circ}49'21''$  an arc length of 107.17 feet;  
 thence South  $80^{\circ}17'30''$  West a distance of 333.63 feet;  
 thence along a tangent circular curve to the right with a radius of 585.00 feet and a central angle of  $40^{\circ}42'29''$  an arc length of 415.63 feet;  
 thence North  $59^{\circ}00'02''$  West a distance of 376.90 feet;  
 thence along a tangent circular curve to the left with a radius of 315.00 feet and a central angle of  $29^{\circ}31'38''$  an arc length of 162.33 feet;  
 thence North  $88^{\circ}31'41''$  West a distance of 63.49 feet;  
 thence along a tangent circular curve to the right with a radius of 285.00 feet and a central angle of  $57^{\circ}08'15''$  an arc length of 284.21 feet;  
 thence North  $31^{\circ}23'26''$  West a distance of 216.76 feet;  
 thence along a tangent circular curve to the left with a radius of 315.00 feet and a central angle of  $105^{\circ}05'20''$  an arc length of 577.76 feet;  
 thence South  $43^{\circ}31'15''$  West a distance of 1061.15 feet;  
 thence along a tangent circular curve to the right with a radius of 24.00 feet and a central angle of  $60^{\circ}17'29''$  an arc length of 25.25 feet;  
 thence from a tangent which bears North  $76^{\circ}11'00''$  West, along a circular curve to the left with a radius of 61.00 feet and a central angle of  $305^{\circ}19'36''$  an arc length of 325.07 feet;  
 thence from a tangent which bears North  $21^{\circ}30'52''$  West, along a circular curve to the right with a radius of 24.00 feet and a central angle of  $65^{\circ}02'07''$  an arc length of 27.24 feet;  
 thence North  $43^{\circ}31'15''$  East a distance of 1057.92 feet;  
 thence along a tangent circular curve to the right with a radius of 285.00 feet and a central angle of  $105^{\circ}05'20''$  an arc length of 522.73 feet;  
 thence South  $31^{\circ}23'26''$  East a distance of 216.76 feet;  
 thence along a tangent circular curve to the left with a radius of 315.00 feet and a central angle of  $57^{\circ}08'15''$  an arc length of 314.13 feet;  
 thence South  $88^{\circ}31'41''$  East a distance of 63.49 feet;  
 thence along a tangent circular curve to the right with a radius of 285.00 feet and a central angle of  $29^{\circ}31'38''$  an arc length of 146.87 feet;  
 thence South  $59^{\circ}00'02''$  East a distance of 376.90 feet;  
 thence along a tangent circular curve to the left with a radius of 615.00 feet and a central angle of  $40^{\circ}42'27''$  an arc length of 436.95 feet;  
 thence North  $80^{\circ}17'30''$  East a distance of 328.27 feet;  
 thence South  $09^{\circ}42'30''$  East a distance of 5.00 feet;  
 thence from a tangent which bears North  $80^{\circ}17'30''$  East, along a circular curve to the right with a radius of 14.00 feet and a central angle of  $78^{\circ}15'33''$  an arc length of 19.12 feet;  
 thence with a non-tangent line North  $68^{\circ}33'02''$  East a distance of 5.00 feet;

thence from a tangent which bears South  $21^{\circ}26'57''$  East, along a circular curve to the left with a radius of 215.00 feet and a central angle of  $51^{\circ}59'18''$  an arc length of 195.08 feet;  
 thence South  $73^{\circ}26'15''$  East a distance of 100.00 feet;  
 thence along a tangent circular curve to the right with a radius of 185.00 feet and a central angle of  $32^{\circ}19'09''$  an arc length of 104.35 feet to the intersection of the Northerly right-of-way of North McCarran Boulevard;  
 thence along said Northerly right-of-way with a non-tangent line South  $50^{\circ}33'11''$  West a distance of 522.81 feet to a point on the South boundary of said Section 33;  
 thence along said South boundary North  $89^{\circ}09'50''$  West a distance of 635.05 feet to the Southeast corner of Parcel A of said Parcel Map 3511;  
 thence along the South boundary of said Parcel A North  $89^{\circ}09'50''$  West a distance of 1012.00 feet to the Point of Beginning.

TOGETHER WITH, two parcels of land being portions of Parcel D of Parcel Map 3511, File Number 2341361, and Parcel 1 of Parcel Map 2668, File Number 1638210, of the Official Records of Washoe County, Nevada, situated within the Southeast Quarter of the Southeast Quarter of Section 33 and within the Southwest Quarter of the Southwest Quarter of Section 34, Township 20 North, Range 19 East, MDM, being more particularly described as follows:

Beginning at the Southeast corner of said Parcel 1 from which the South Quarter corner of said Section 33 bears South  $80^{\circ}32'31''$  West a distance of 2650.81 feet;  
 thence along the Southerly boundary of said Parcel 1 South  $78^{\circ}09'42''$  West a distance of 108.96 feet;  
 thence North  $89^{\circ}07'50''$  West a distance of 353.18 feet;  
 thence North  $34^{\circ}42'37''$  West a distance of 144.59 feet;  
 thence South  $55^{\circ}56'10''$  West a distance of 100.00 feet;  
 thence South  $34^{\circ}03'50''$  East a distance of 187.02 feet;  
 thence South  $78^{\circ}09'47''$  West a distance of 11.92 feet to a point on the right-of-way of Leadership Parkway as shown on Dedication Tract Map 3980, File Number 2569662, and modified by Document Numbers 2797035, 2797036, 2797037 and 2962327 of said Official Records;  
 thence along said right-of-way from a tangent which bears North  $38^{\circ}42'41''$  West, along a circular curve to the left with a radius of 220.01 feet and a central angle of  $34^{\circ}43'34''$  an arc length of 133.35 feet;  
 thence North  $73^{\circ}26'15''$  West a distance of 100.00 feet;  
 thence along a tangent circular curve to the right with a radius of 179.99 feet and a central angle of  $47^{\circ}47'07''$  an arc length of 150.11 feet;  
 thence from a tangent which bears North  $27^{\circ}32'23''$  West, along a circular curve to the right with a radius of 14.00 feet and a central angle of  $103^{\circ}25'47''$  an arc length of 25.27 feet;  
 thence along a tangent circular curve to the left with a radius of 820.00 feet and a central angle of  $03^{\circ}25'15''$  an arc length of 48.96 feet;  
 thence North  $72^{\circ}28'09''$  East a distance of 305.76 feet;

thence along a tangent circular curve to the right with a radius of 780.00 feet and a central angle of 16°28'03" an arc length of 224.18 feet;  
 thence North 88°56'12" East a distance of 402.04 feet;  
 thence along a tangent circular curve to the right with a radius of 204.00 feet and a central angle of 65°04'34" an arc length of 231.70 feet;  
 thence South 25°59'14" East a distance of 22.16 feet;  
 thence along a tangent circular curve to the right with a radius of 218.00 feet and a central angle of 13°38'03" an arc length of 51.88 feet to a point on the Southerly boundary of said Parcel D;  
 thence along said Southerly boundary with a non-tangent line South 78°09'24" West a distance of 343.67 feet to the Point of Beginning.

TOGETHER WITH, a median island parcel located within the Westerly cul-de-sac of Leadership Parkway as shown on Dedication Tract Map 3980, File Number 2569662, and modified by Document Numbers 2797035, 2797036, 2797037 and 2962327 of said Official Records, situated within the Southeast Quarter of the Southwest Quarter of Section 33, Township 20 North, Range 19 East, being more particularly described as follows:

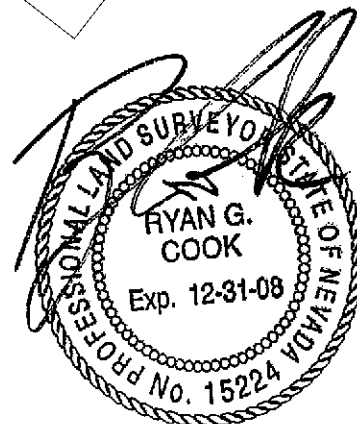
Beginning at a point on the Centerline of said Leadership Parkway from which the South Quarter corner of said Section 33 bears South 71°54'07" East a distance of 1221.07 feet;  
 thence from a tangent which bears South 51°55'19" East, along a circular curve to the right with a radius of 24.00 feet and a central angle of 176°33'42" an arc length of 73.96 feet;  
 thence along a tangent circular curve to the right with a radius of 24.00 feet and a central angle of 183°26'18" an arc length of 76.84 feet to the Point of Beginning.

Said thirteen parcels contain an area of approximately 101.65± acres.

BASIS OF BEARINGS: Nevada State Plane Coordinate System West Zone, (NAD 83/94).

*Description Prepared By:*  
 Ryan G. Cook, PLS 15224  
 Summit Engineering Corp.  
 5405 Mae Anne Ave.  
 Reno, NV 89523

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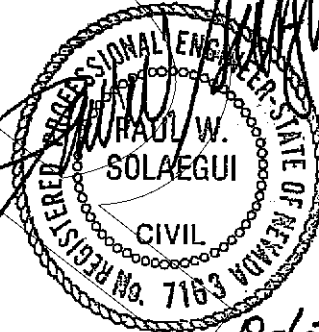
# APPENDIX C

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KEYSTONE CAMPUS P.U.D.  
TRAFFIC ANALYSIS

AUGUST, 2008



8-6-08  
EXP 6-30-10

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

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# KEYSTONE CAMPUS P.U.D.

## TRAFFIC ANALYSIS

### EXECUTIVE SUMMARY

The proposed Keystone Campus P.U.D. is located in the City of Reno, Nevada. The project site is located north of McCarran Boulevard (SR-651) and west of Keystone Avenue. 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 McCarran Boulevard intersections with Keystone Avenue/ Leadership Parkway and Victory Lane have been identified for intersection capacity analysis. The key roadways in the vicinity of the site have been identified for roadway capacity analysis.

The proposed Keystone Campus P.U.D. development will include the construction of 415 condominium units, 330 attached senior housing units,  $\pm$  22,000 square feet of retail building,  $\pm$  22,000 square feet of office building and  $\pm$  5,000 square feet of high turn-over (sit-down) restaurant. The project is expected to generate 5,403 average daily trips with 324 trips occurring during the AM peak hour and 422 trips occurring during the PM peak hour.

Traffic generated by Keystone Campus P.U.D. 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 City of Reno and Nevada Department of Transportation requirements.

It is recommended that a traffic signal be installed at the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection when warranted.

It is recommended that the left turn pocket at the west approach of the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection be lengthened to provide a minimum of 390 feet of storage/deceleration length and the east approach be improved to include an exclusive right turn lane with a minimum of 390 feet of storage/deceleration length in order to serve existing plus project traffic volumes.

It is recommended that the left turn pocket at the west approach of the McCarran Boulevard/Victory Lane intersection be lengthened to provide a minimum of 390 feet of storage/deceleration length and the east approach be improved to include an exclusive right turn lane with a minimum of 290 feet of deceleration length in order to serve existing plus project traffic volumes.

It is recommended that the project interior streets and parking be constructed per City of Reno requirements.

## INTRODUCTION

### STUDY AREA

The proposed Keystone Campus P.U.D. development is located in the City of Reno, Nevada. The project site is located north of McCarran Boulevard (SR-651) and west of Keystone Avenue. The location of the project site is shown in Figure 1. The purpose of this study is to address the project's impact upon the adjacent street network. The McCarran Boulevard intersections with Keystone Avenue/Leadership Parkway and Victory Lane have been identified for intersection capacity analysis. The key roadways in the vicinity of the site have been identified for roadway capacity analysis.

### EXISTING AND PROPOSED LAND USES

The project site is currently undeveloped land. Adjacent land includes undeveloped land to the north and west, single family dwelling units to the east and residential development to the south. The proposed Keystone Campus P.U.D. development will include the construction of 415 condominium units, 330 attached senior housing units,  $\pm$  22,000 square feet of retail building,  $\pm$  22,000 square feet of office building and  $\pm$  5,000 square feet of high turn-over (sit-down) restaurant.

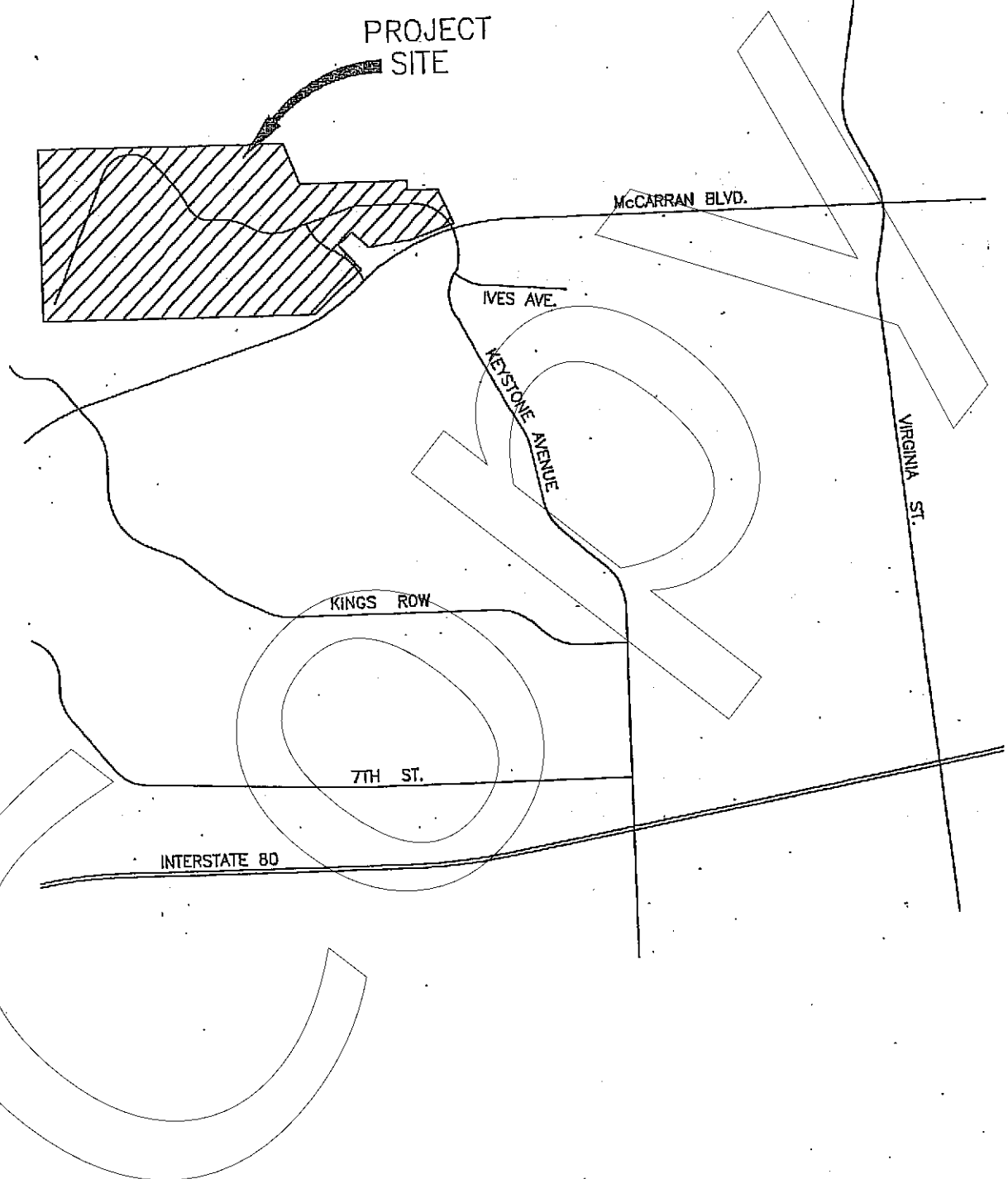
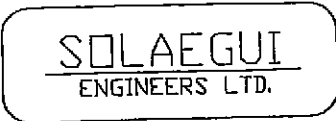
### EXISTING AND PROPOSED ROADWAYS AND INTERSECTIONS

McCarran Boulevard (SR-651) is a four-lane roadway with two lanes in each direction in the vicinity of the site. The speed limit is posted for 50 miles per hour in the vicinity of the project site. Roadway improvements include curb, gutter and gravel sidewalks on both sides of the street except for curb, gutter and a concrete sidewalk on north side of the street between Leadership Parkway and Victory Lane, bike lanes on both sides of the street and a raised center median with left turn pockets at major intersections.

Keystone Avenue is a two-lane roadway with one lane in each direction south of McCarran Boulevard. The speed limit is not posted. Roadway improvements generally include curb, gutter and sidewalks on the east side of the street and curb and gutter on the west side of the street.

Leadership Parkway is a two-lane roadway with one lane in each direction north of McCarran Boulevard. The speed limit is posted for 25 miles per hour. Roadway improvements generally include curb, gutter and sidewalks on the west side of the street, curb and gutter on the east side of the street and a short section of raised median near McCarran Boulevard.

Victory Lane is a two-lane roadway with one lane in each direction north of McCarran Boulevard. The speed limit is posted for 25 miles per hour. Roadway improvements generally include curb, gutter and sidewalks on the east side of the street and curb and gutter on the west side of the street.



KEYSTONE CAMPUS P.U.D.  
VICINITY MAP  
FIGURE 1

The McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection is an unsignalized four-leg intersection with stop sign control at the north and south approaches. The east and west approaches each contain one left turn lane, one through lane and one shared through-right turn lane. The north approach contains one left turn lane and one shared through-right turn lane. The south approach contains a single lane from which all movements are made.

The McCarran Boulevard/Victory Lane intersection is an unsignalized "T" intersection with stop sign control at the north approach. The west approach contains one left turn lane and two through lanes. The east approach contains one through lane and one shared through-right turn lane. The north approach contains a single lane from which all movements are made.

## TRIP GENERATION

In order to assess the magnitude of traffic impacts of the proposed development on the key roadways and intersections, trip generation rates and peak hours had to be determined. Trip generation rates were obtained from the Seventh Edition of *ITE Trip Generation* (2003) for Land Use 230: Residential Condominium/Townhouse, Land Use 252: Elderly Housing-Attached, Land Use 820: Shopping Center, Land Use 710: General Office Building and Land Use 932: High Turnover (Sit-Down) Restaurant.

Per ITE, internal capture is appropriate for mixed use developments. Accordingly, an internal capture rate of 5% was applied to the project trips.

Chapter 5 of the *ITE Trip Generation Handbook* Provides guidelines for quantifying pass-by trips for shopping center and high turnover restaurant. Pass-by trips are made as intermediate stops on the way from an origin to a primary trip destination and are attracted directly from the adjacent street traffic stream. The *ITE Trip Generation Handbook* indicates that 34% of the PM peak hour trips generated by the shopping center land use are pass-by trips. AM peak hour pass-by rates are typically 10% less than the PM peak hour pass-by rates. A pass-by rate of 24% was therefore assumed for the AM peak hour. 33% of the AM peak hour trips and 43% of the PM peak hour trips generated by the high turnover restaurant land use are pass-by trips.

Trips generated by the proposed development were calculated for the peak hours between 7:00 and 9:00 AM and 4:00 and 6:00 PM, which correspond to the peak hours of adjacent street traffic. The trip generation worksheet is included in the Appendix. Table 1 shows a summary of the average daily traffic (ADT) volumes and peak hour volumes generated by the proposed development.

TABLE 1  
TRIP GENERATION

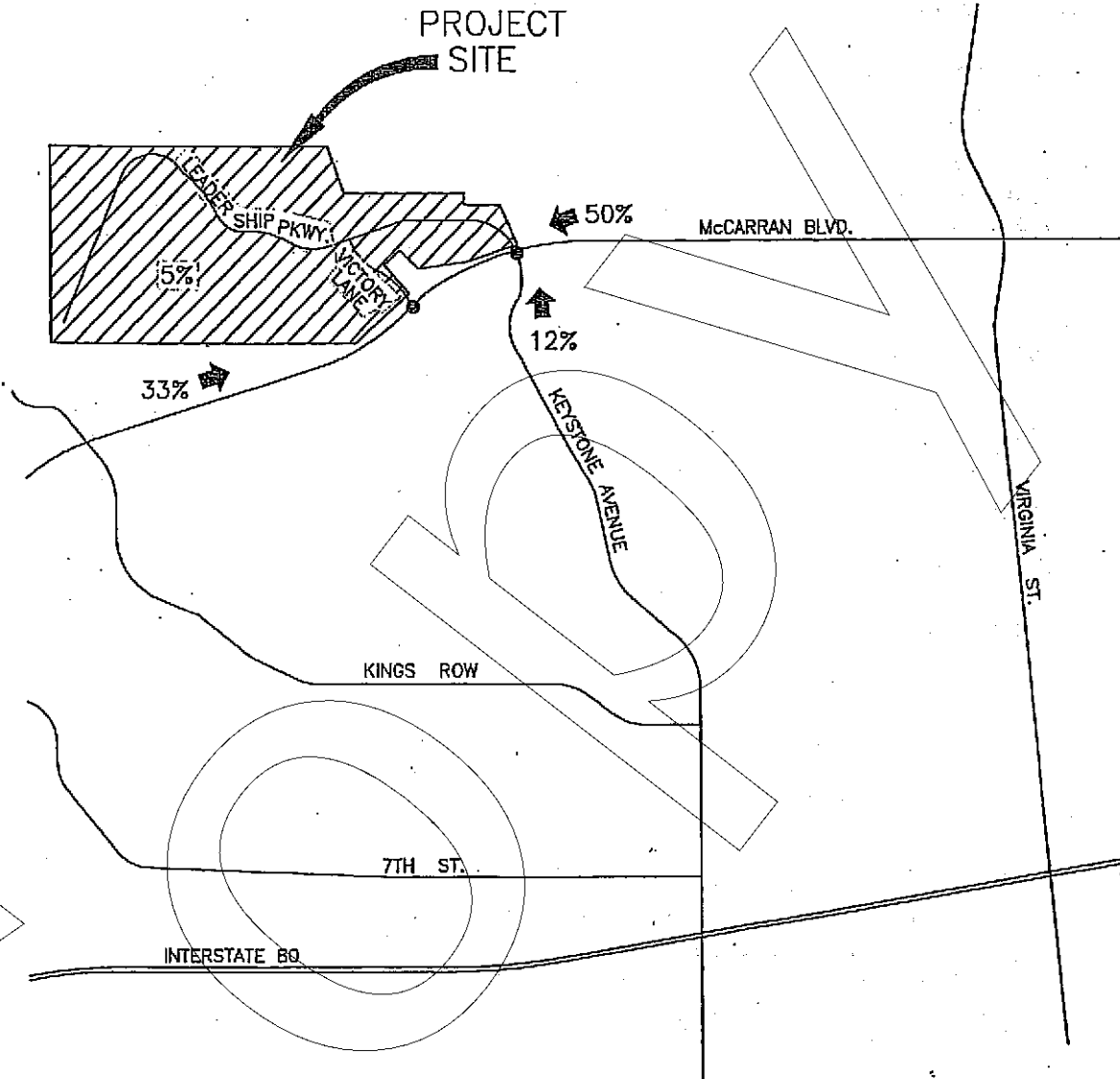
LAND USE	ADT	AM PEAK HOUR			PM PEAK HOUR		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Condominium 415 Dwelling Units	2,432	29	154	183	145	71	216
Elderly Housing - Attached 330 Occupied Dwelling Units	1,148	13	13	26	23	13	36
Shopping Center 22,000 Square Feet	945	14	9	23	40	43	83
Pass-by-Reduction New Trips	<u>-274</u> 671	<u>-3</u> 11	<u>-3</u> 6	<u>-6</u> 17	<u>-14</u> 26	<u>-14</u> 29	<u>-28</u> 55
General Office Building 22,000 Square Feet	242	30	4	34	6	27	33
High Turnover (Sit-Down) Restaurant 5,000 Square Feet	636	30	28	58	33	21	54
Pass-by-Reduction New Trips	<u>-242</u> 394	<u>-10</u> 20	<u>-10</u> 18	<u>-20</u> 38	<u>-12</u> 21	<u>-12</u> 9	<u>-24</u> 30
TOTAL TRIP GENERATION	5,403	116	208	324	247	175	422
TOTAL PASS-BY TRIPS	<u>-516</u>	<u>-13</u>	<u>-13</u>	<u>-26</u>	<u>-26</u>	<u>-26</u>	<u>-52</u>
TOTAL NEW TRIPS	4,887	103	195	298	221	149	370

## TRIP DISTRIBUTION AND ASSIGNMENT

The distribution of the project traffic to the key intersections was based upon existing peak hour traffic patterns and the locations of attractions and productions in the area. The anticipated directions of approach are shown in Figure 2. The project trips were subsequently assigned to the key intersections based on these directions of approach. Figure 3 shows the peak hour project trip assignment during the AM and PM peak hours.

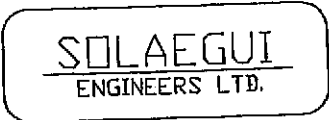
## EXISTING AND PROJECTED TRAFFIC VOLUMES

Existing AM and PM peak hour traffic volumes at the key intersections were obtained from traffic counts taken during July, 2008. Figure 4 shows the existing AM and PM peak hour traffic volumes at the key intersections. Figure 5 shows the existing plus project traffic volumes at the key intersections for the AM and PM peak hours. The existing plus project traffic volumes were obtained by adding traffic generated by the project to the existing traffic volumes.

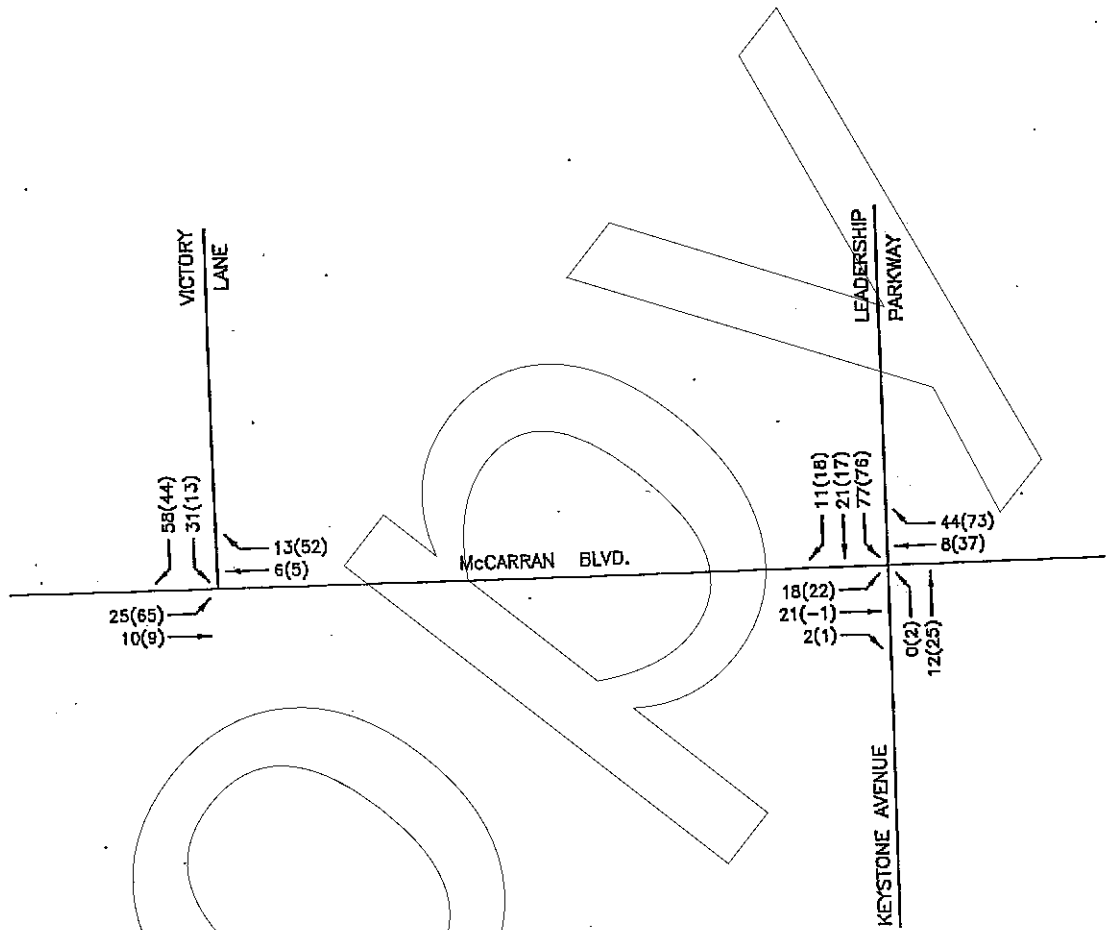


LEGEND  
● KEY INTERSECTION

KEYSTONE CAMPUS P.U.D.  
DIRECTIONS OF APPROACH  
FIGURE 2

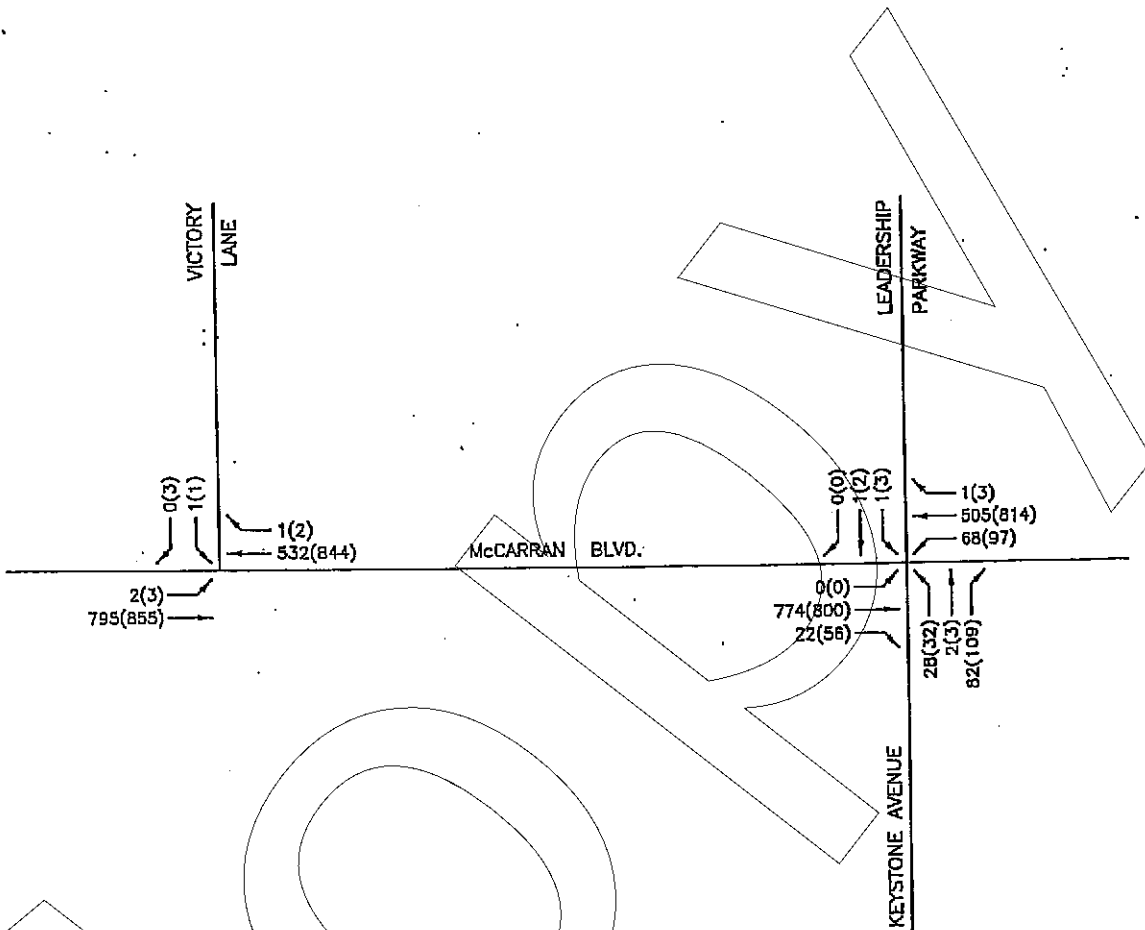


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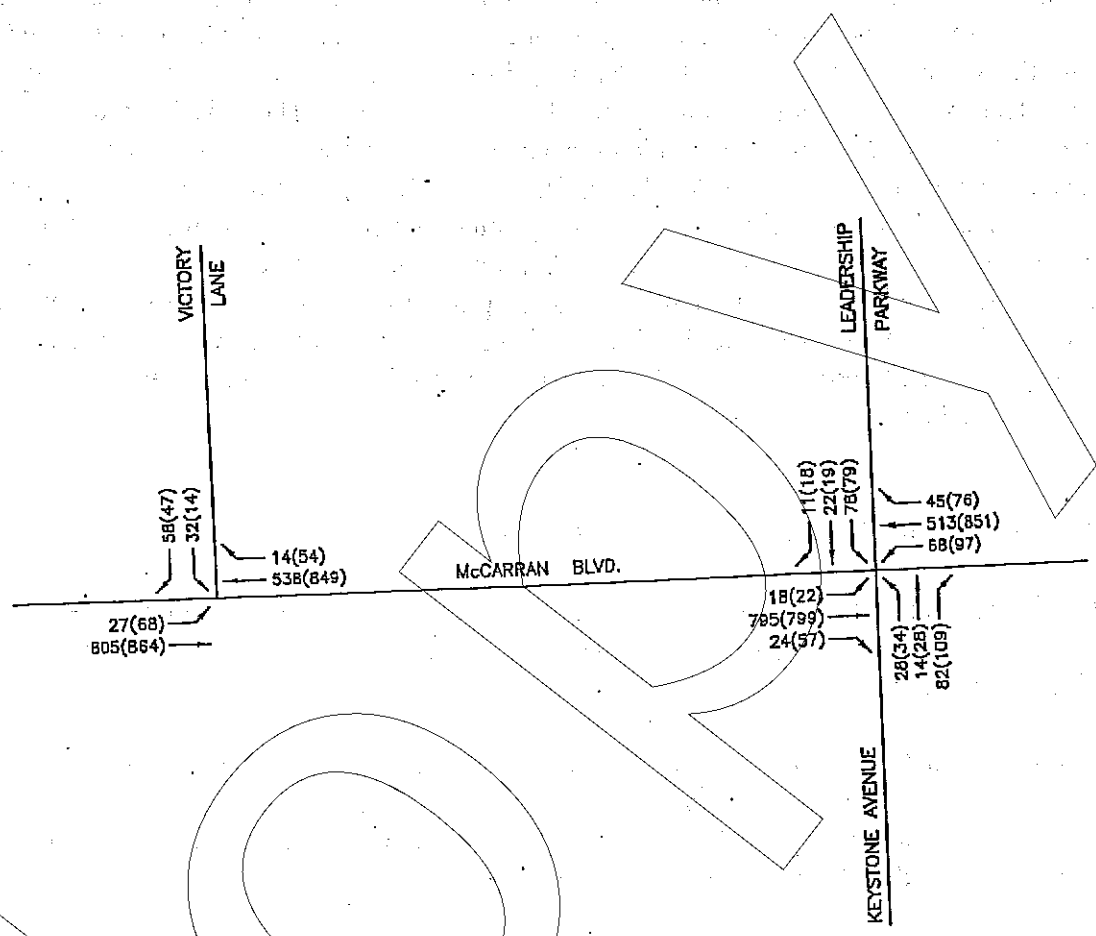
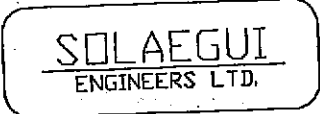
**LEGEND**  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR

KEYSTONE CAMPUS P.U.D.  
 PEAK HOUR PROJECT TRIP ASSIGNMENT  
 FIGURE 3



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

**KEYSTONE CAMPUS P.U.D.**  
**EXISTING PEAK HOUR TRAFFIC VOLUMES**  
**FIGURE 4**



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

**KEYSTONE CAMPUS P.U.D.**  
**EXISTING PLUS PROJECT PEAK HOUR TRAFFIC VOLUMES**  
**FIGURE 5**

Figures 6 and 7 show the AM and PM peak hour traffic volumes at the key intersections for the 2018 background and background plus project scenarios, respectively. Figures 8 and 9 show the AM and PM peak hour traffic volumes at the key intersections for the 2030 background and background plus project scenarios, respectively. Figures 10 and 11 show the AM and PM peak hour traffic volumes at the key intersections for the 2040 background and background plus project scenarios, respectively. Figure 12 shows the 2018, 2030 and 2040 background and background plus project average daily traffic volumes on the key roadways.

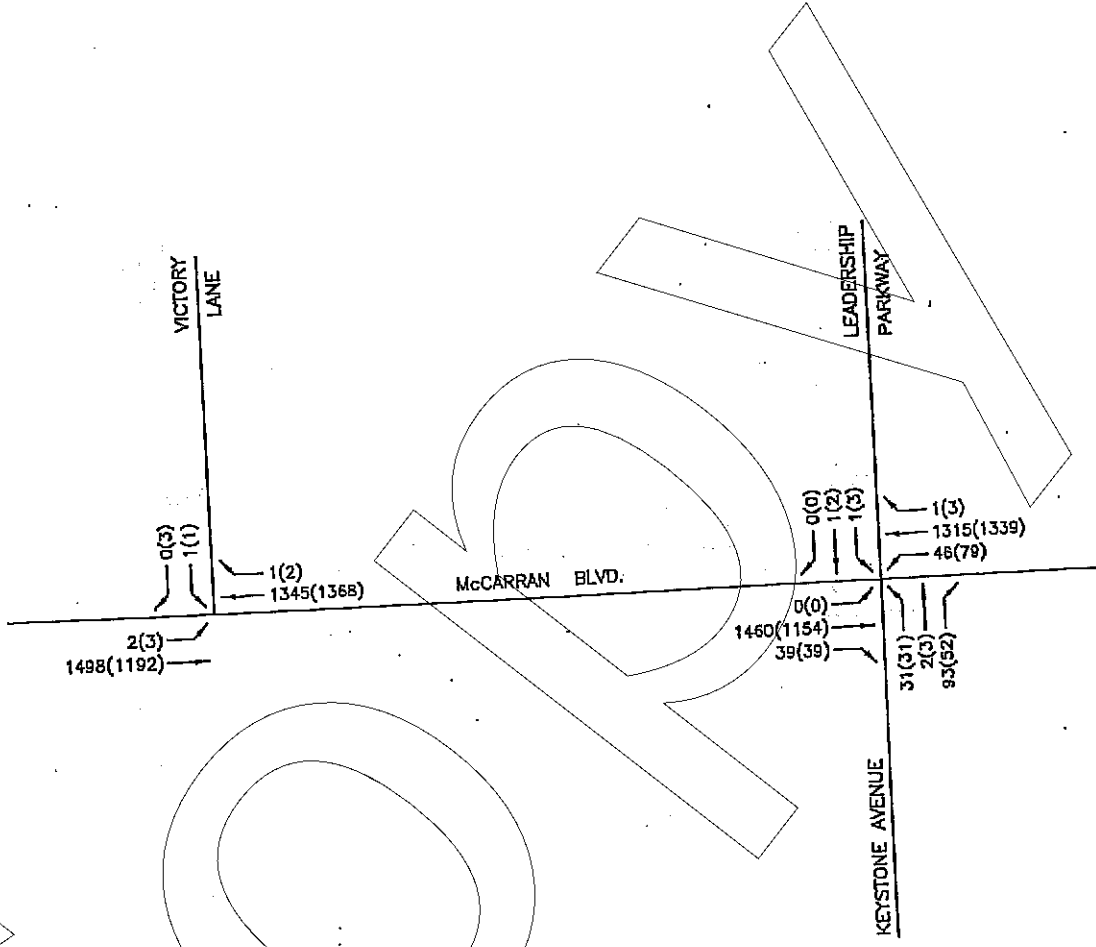
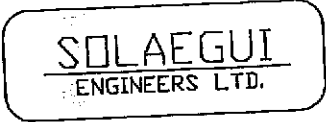
The 2018, 2030 and 2040 background and background plus project average daily traffic volumes on the key roadways and the AM and PM peak hour turning movement volumes at the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection were obtained directly from the Regional Transportation Commission's traffic forecasting model. The RTC's modeling data is included in the Appendix. The RTC turning movement data does not show future peak hour traffic volumes at the north leg of the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection and therefore existing and existing plus project volumes were used for these movements for the future background and background plus project scenarios, respectively. The 2018, 2030 and 2040 background and background plus project AM and PM peak hour turning movement volumes at the McCarran Boulevard/Victory Lane intersection were estimated based on the turning movement volumes at the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection and the project trip assignment.

## INTERSECTION CAPACITY ANALYSIS

The key intersections were analyzed for capacity based on procedures presented in the *Highway Capacity Manual (2000)*, prepared by the Transportation Research Board, for unsignalized and signalized intersections.

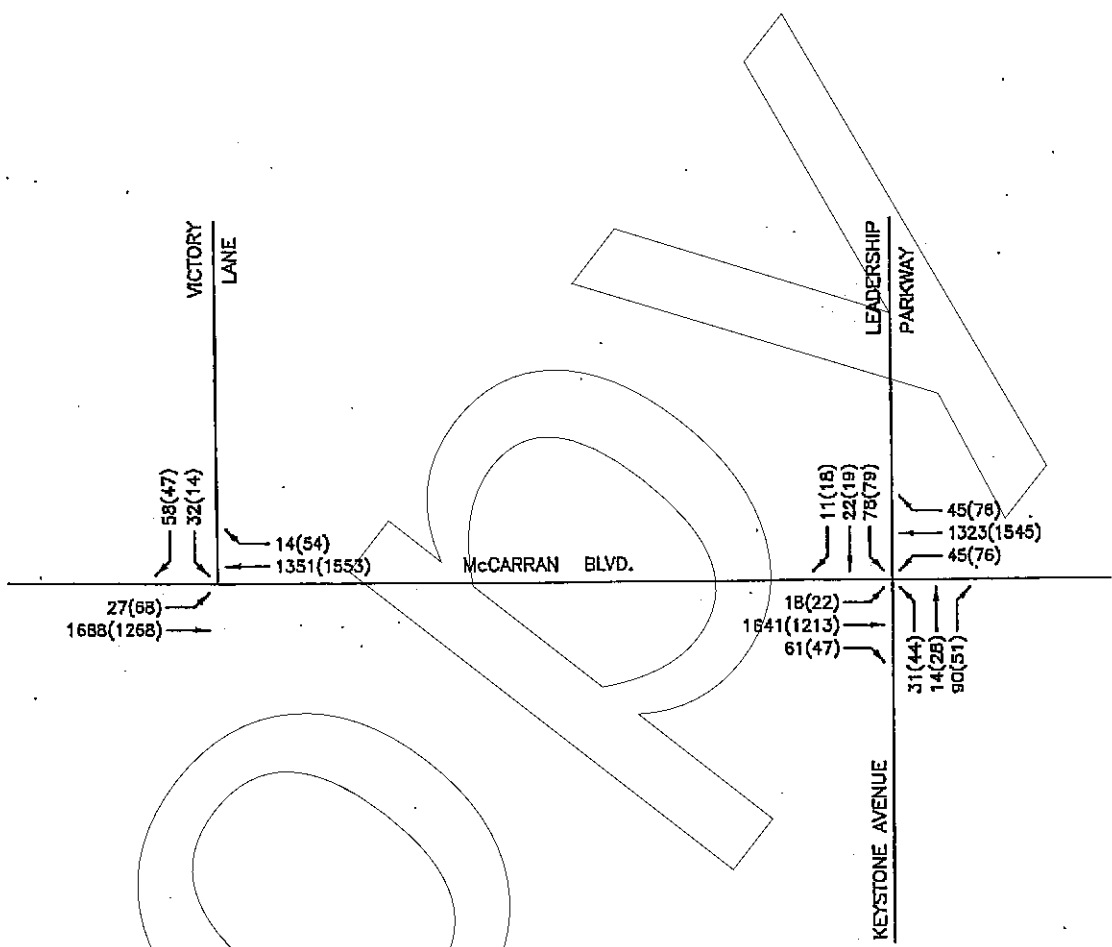
The result of capacity analysis is a level of service (LOS) rating for each signalized intersection or unsignalized intersection minor movement. LOS is a qualitative measure of traffic operating conditions where a letter grade "A" through "F", corresponding to progressively worsening traffic operation, 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 unsignalized intersection LOS criteria are shown in Table 2.



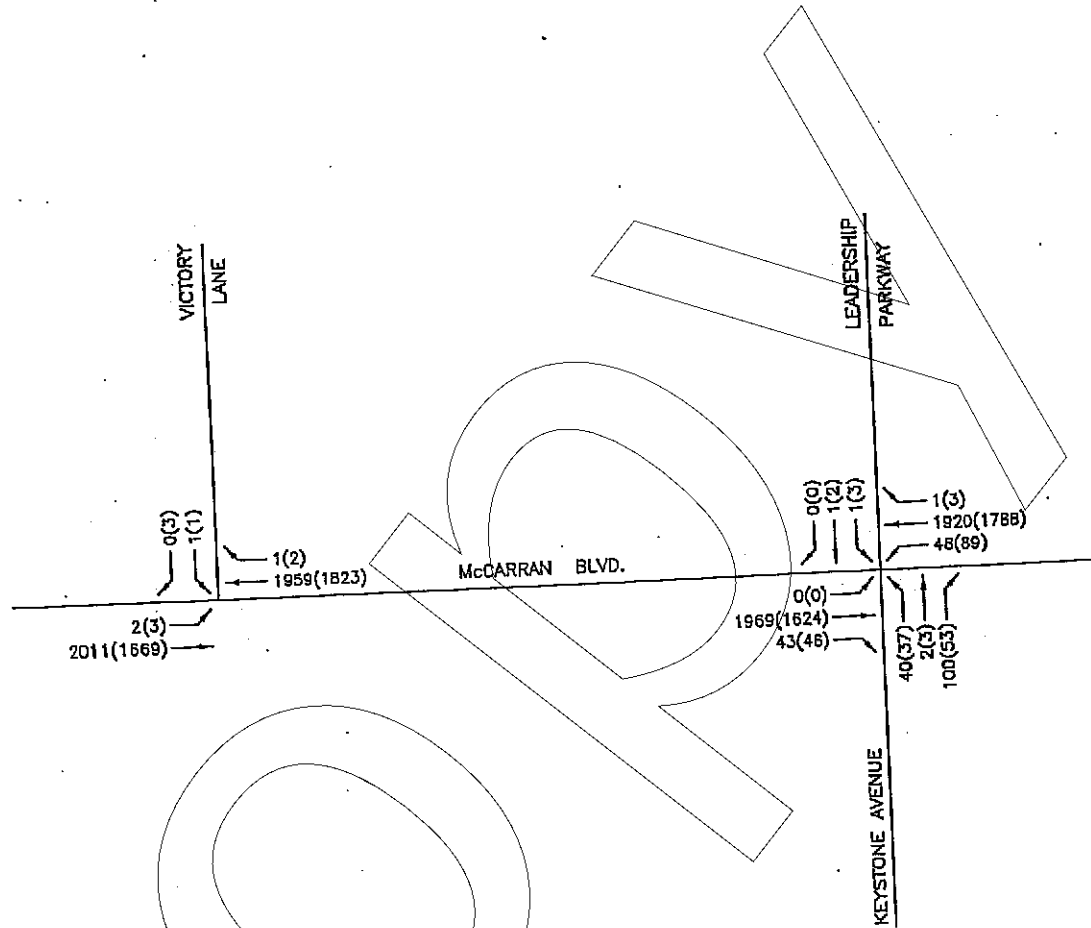
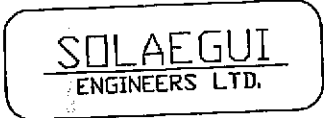
**LEGEND**  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR

KEYSTONE CAMPUS P.U.D.  
 YEAR 2018 BACKGROUND PEAK HOUR TRAFFIC VOLUMES  
 FIGURE 6



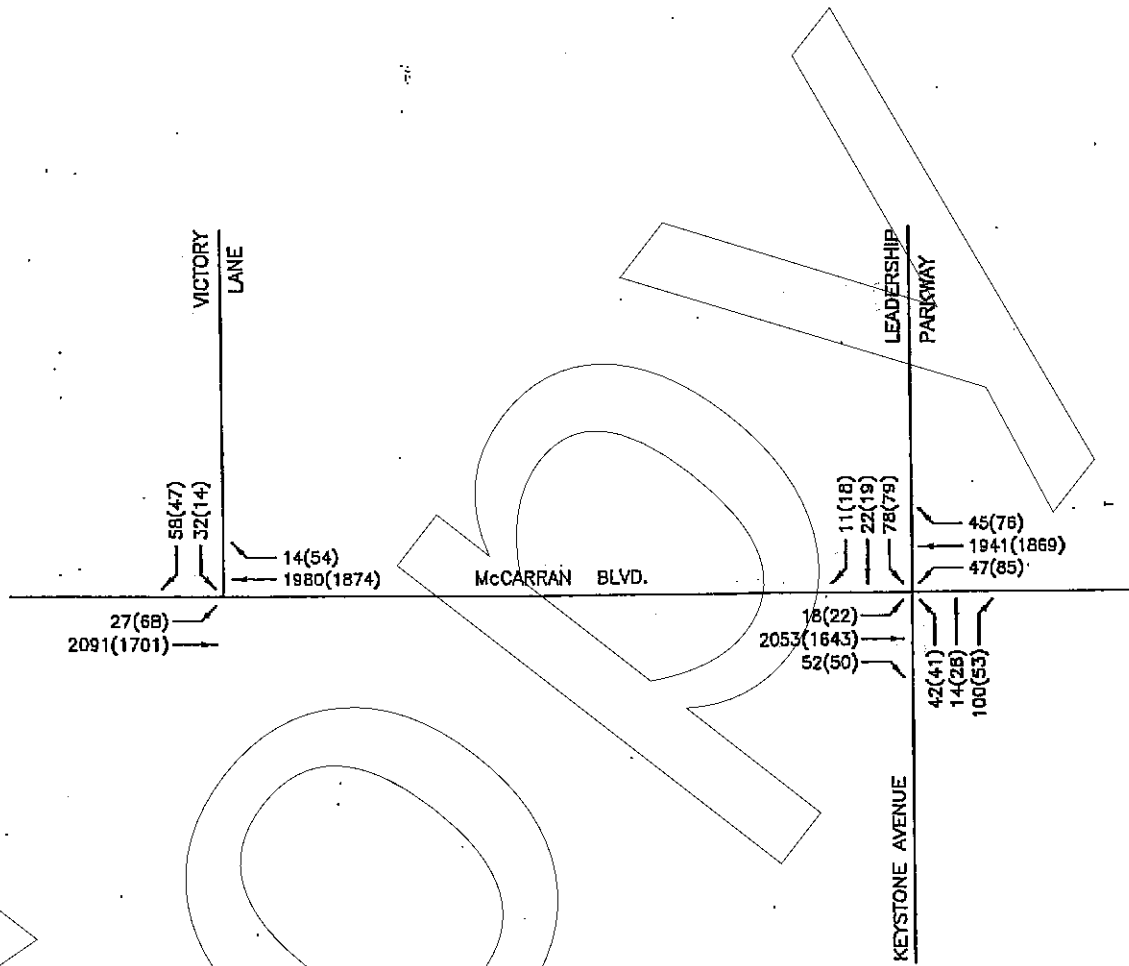
**LEGEND**  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR

**KEYSTONE CAMPUS P.U.D.**  
**2018 BACKGROUND PLUS PROJECT PEAK HOUR TRAFFIC**  
**FIGURE 7**



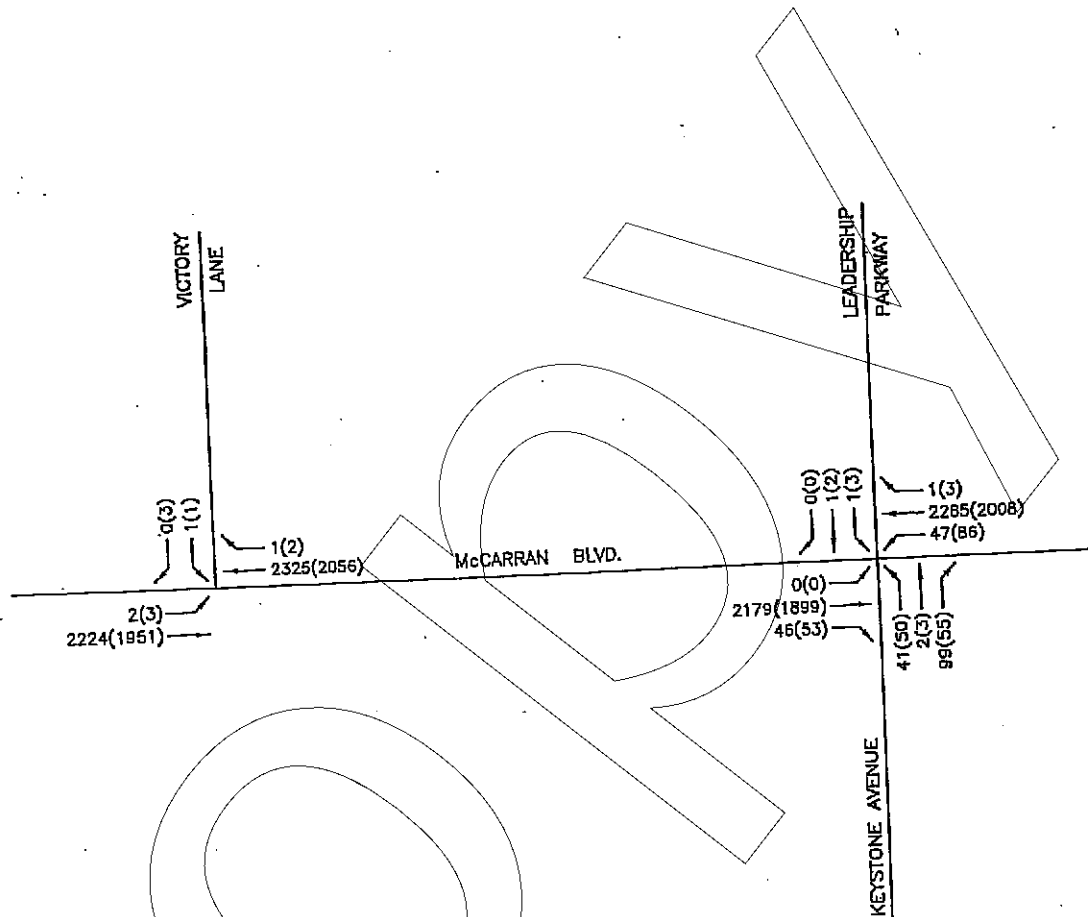
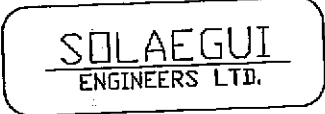
**LEGEND**  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR

KEYSTONE CAMPUS P.U.D.  
 YEAR 2030 BACKGROUND PEAK HOUR TRAFFIC VOLUMES  
 FIGURE 8



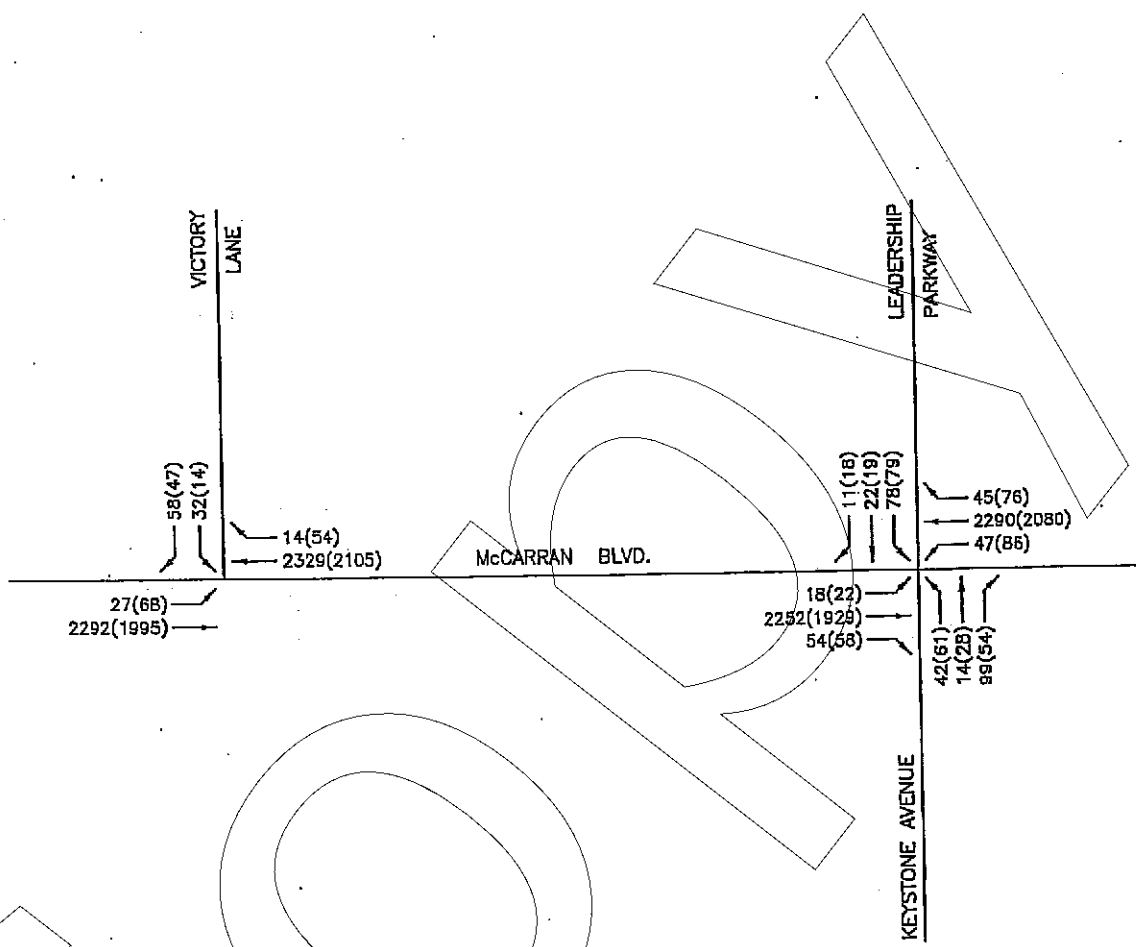
**LEGEND**  
 - AM PEAK HOUR  
 (-) PM PEAK HOUR

**KEYSTONE CAMPUS P.U.D.**  
**2030 BACKGROUND PLUS PROJECT PEAK HOUR TRAFFIC**  
**FIGURE 9**



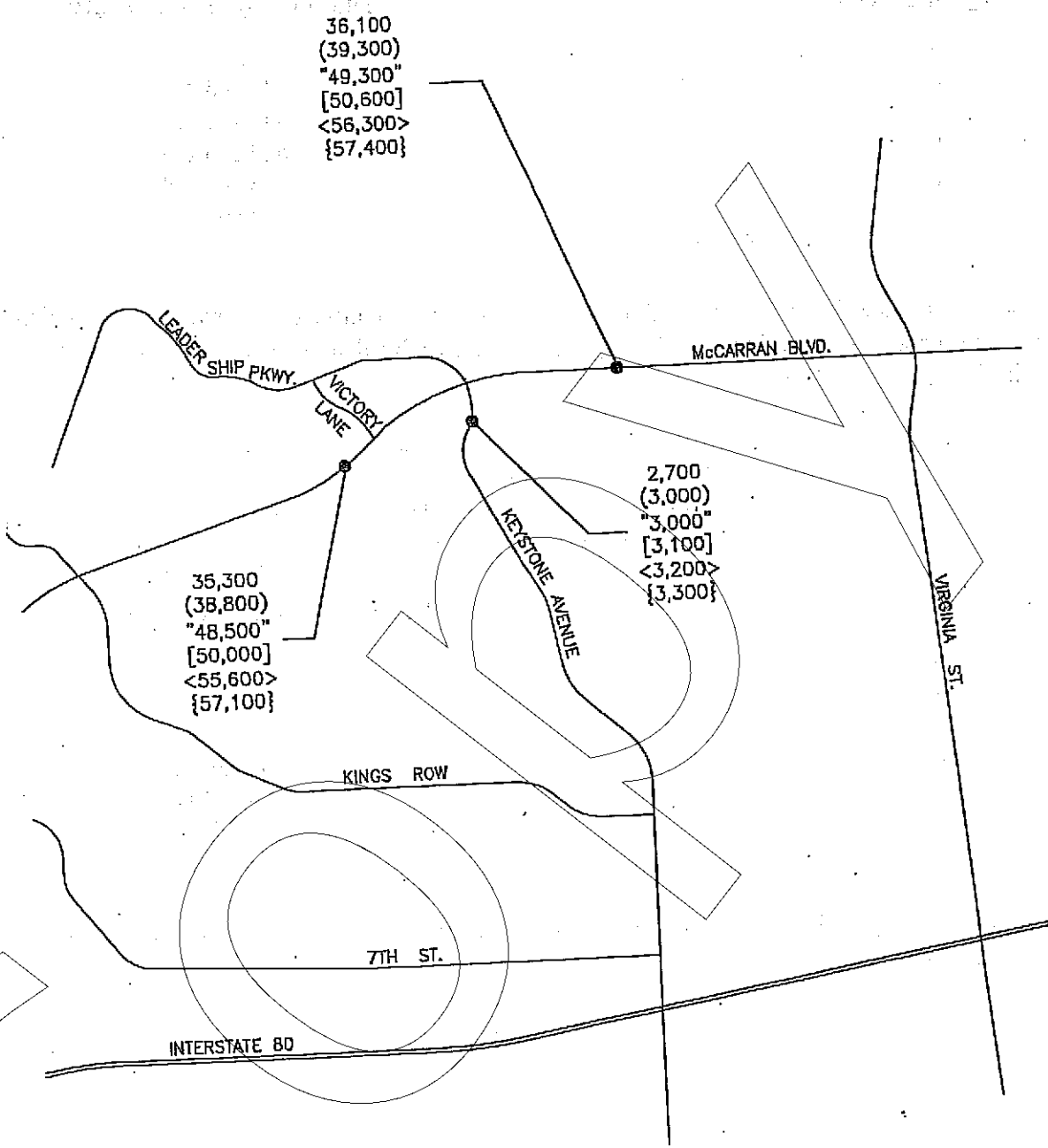
**LEGEND**  
 — AM PEAK HOUR  
 (-) PM PEAK HOUR

KEYSTONE CAMPUS P.U.D.  
 YEAR 2040 BACKGROUND PEAK HOUR TRAFFIC VOLUMES  
 FIGURE 10



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

**KEYSTONE CAMPUS P.U.D.**  
**2040 BACKGROUND PLUS PROJECT PEAK HOUR TRAFFIC**  
**FIGURE 11**



- LEGEND**
- YEAR 2018 BACKGROUND
  - (-) YEAR 2018 BACKGROUND + PROJECT
  - "-" YEAR 2030 BACKGROUND
  - [-] YEAR 2030 BACKGROUND + PROJECT
  - <-> YEAR 2040 BACKGROUND
  - {-} YEAR 2040 BACKGROUND + PROJECT

**KEYSTONE CAMPUS P.U.D.**  
**FUTURE AVERAGE DAILY TRAFFIC VOLUMES**  
**FIGURE 12**

**TABLE 2**  
**LOS CRITERIA FOR UNSIGNALIZED INTERSECTIONS**

<u>LEVEL OF SERVICE</u>	<u>DELAY RANGE (SEC/VEH)</u>
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

The "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 signalized intersection level of service (LOS) criteria is shown in Table 3.

**TABLE 3**  
**LOS CRITERIA FOR SIGNALIZED INTERSECTIONS**

<u>LEVEL OF SERVICE</u>	<u>CONTROL DELAY PER VEHICLE (SEC)</u>
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

A summary of the level of service (LOS) operation for the key intersections in this analysis is shown in Table 4.

TABLE 4  
INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS

INTERSECTION	EXISTING		EXISTING +PROJECT		YEAR 2018		YEAR 2018 +PROJECT	
	AM	PM	AM	PM	AM	PM	AM	PM
McCarran/Keystone/Leadership								
Unsignalized								
EB Left	A8.7	A9.8	A9.0	B10.6	B12.3	B12.5	B13.0	C15.4
WB Left	B10.7	B10.9	B10.8	B10.9	B14.8	B12.7	C17.2	B13.2
NB Left/Through/Right	E40.4	F81.6	F161	F733	F834	F515	F	F
SB Left	E42.5	F83.2	F359	F	F303	F257	F	F
SB Through/Right	F51.8	F88.7	F69.2	F124	F362	F301	F	F
Signalized	N/A	N/A	B12.2	B13.2	N/A	N/A	B11.7	B11.6
McCarran/Victory								
Unsignalized								
EB Left	A8.8	A10.0	A9.0	B10.9	A10.0	B10.1	A9.6	B10.6
SB Left/Right	C23.1	C17.2	C21.2	D25.4	E35.8	C17.0	D26.7	C19.7

TABLE 4 (CONTINUED)  
INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS

INTERSECTION	YEAR 2030		YEAR 2030 +PROJECT		YEAR 2040		YEAR 2040 +PROJECT	
	AM	PM	AM	PM	AM	PM	AM	PM
McCarran/Keystone/Leadership								
Unsignalized								
EB Left	C18.0	C16.5	C19.8	C19.5	C23.4	C19.1	D26.3	C23.1
WB Left	C22.5	C18.9	C24.5	C19.0	D27.6	C24.9	D30.1	D25.9
NB Left/Through/Right	F	F	F	F	F	F	F	F
SB Left	F	F	F	F	F	F	F	F
SB Through/Right	F	F	F	F	F	F	F	F
Signalized	N/A	N/A	B13.9	B12.7	N/A	N/A	B16.4	B14.2
McCarran/Victory								
Unsignalized								
EB Left	B12.3	B11.7	B11.4	B11.8	B14.2	B12.8	B12.7	B12.8
SB Left/Right	F85.0	D26.1	F112	D34.9	F143	D34.7	F409	F69.0

McCarran Boulevard/Keystone Avenue/Leadership Parkway

The McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection was analyzed as an unsignalized four-leg intersection with stop sign control at the north and south approaches for all scenarios. The intersection critical movements currently operate at level of service B or better with the exception of the northbound and southbound critical movements which operate at level of service E/F during the AM and PM peak hours. With the addition of project traffic, the intersection critical movements are anticipated to operate at level of service B or better with the exception of the northbound and southbound critical movements which operate at level of service F during the AM and PM peak hours. For the 2018, 2030, and 2040 background and background plus project traffic volumes, the intersection critical movements are anticipated to operate at level of service D or better with the exception of the northbound and southbound critical movements which operate at level of service F during the AM and PM peak hours. The intersection was analyzed with the existing approach lanes for all scenarios.

Peak hour traffic signal warrant #3 per Figure 4C-4 of the *Manual on Uniform Traffic Control Devices, 2003 Edition* (MUTCD) was reviewed at the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection. The peak hour warrant is met for the existing plus project traffic volumes based on the total minor street (Leadership Parkway) left turn volume. The McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection was subsequently analyzed for capacity as a signalized intersection and is expected to operate at level of service B during the AM and PM peak hours for the existing plus project and 2018, 2030, and 2040 background plus project traffic volumes. The signalized intersection was analyzed with the existing approach lanes for the existing plus project traffic volumes and with one left turn lane, two through lanes and one shared through-right turn lane at the east and west approaches, one left turn lane and one shared through-right turn lane at the north approach and one shared left turn-through-right turn lane at the south approach for the 2018, 2030 and 2040 background plus project traffic volumes.

McCarran Boulevard/Victory Lane

The McCarran Boulevard/Victory Lane intersection was analyzed as an unsignalized "T" intersection with stop sign control at the north approaches for all scenarios. The intersection critical movements currently operate at level of service C or better during the AM and PM peak hours. With the addition of project traffic, the intersection critical movements are anticipated to operate at level of service D or better during the AM and PM peak hours. For the 2018 background and background plus project, the southbound movements are expected to operate at level of service E and D, respectively, and the other movements at level of service C or better during the AM and PM peak hours. For the 2030 and 2040 background and background plus project traffic volumes, the eastbound left turn movement is anticipated to operate at level of service B and the southbound movements are anticipated to operate at level of service F during the AM and PM peak hours with the exception of level of service D for the 2040 background southbound movements during the PM peak hour. The intersection was analyzed with the existing approach lanes for the existing and existing plus project traffic volumes and with one left turn lane and three through lanes at the

west approach, two through lanes and one shared through-right turn lane at the east approach and one shared left turn-right turn lane at the north approach.

An alternate route for the McCarran Boulevard/Victory Lane intersection southbound left turn movements is provided via Leadership Parkway to the future signalized McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection. It is anticipated that motorists experiencing delay at the McCarran Boulevard/Victory Lane intersection will use this alternate route.

## ROADWAY CAPACITY ANALYSIS

McCarran Boulevard and Keystone Avenue were reviewed for capacity for the year 2018, 2030 and 2040 background and background plus project traffic volumes based on the average daily level of service thresholds obtained from the Regional Transportation Commission (RTC). McCarran Boulevard is classified as a high access control arterial in the vicinity of the site. Keystone Avenue is classified as a low access control arterial in the vicinity of the site. Table 5 shows the daily level of service thresholds for high and low access control arterials.

TABLE 5  
LEVEL OF SERVICE CRITERIA FOR ROADWAY SEGMENTS

FACILITY/LANES	AVERAGE DAILY TRAFFIC VOLUME			
	LOS A-C	LOS D	LOS E	LOS F
<b>High Access Arterial</b>				
2 Lanes	≤17,300	17,301-19,200	19,201-20,300	>20,300
4 Lanes	≤36,100	36,101-38,400	38,401-40,600	>40,600
6 Lanes	≤54,700	54,701-57,600	57,601-60,900	>60,900
8 Lanes	≤73,200	73,201-76,800	76,801-81,300	>81,300
<b>Low Access Arterial</b>				
2 Lanes	≤6,900	6,901-13,400	13,401-15,100	>15,100
4 Lanes	≤15,700	15,701-28,400	28,401-30,200	>30,200
6 Lanes	≤24,800	24,801-43,100	43,101-45,400	>45,400
8 Lanes	≤34,000	34,001-57,600	57,601-60,600	>60,600

A summary of the "Level of Service" (LOS) operation for the key roadways in this analysis is shown in Table 6.

**TABLE 6**  
**ROADWAY SEGMENT LEVEL OF SERVICE RESULTS**

<u>ROADWAY/FACILITY</u>	<u>YEAR 2018</u>		<u>YEAR 2030</u>		<u>YEAR 2040</u>	
	<u>BACK</u>	<u>WITH</u>	<u>BACK</u>	<u>WITH</u>	<u>BACK</u>	<u>WITH</u>
<b>McCARRAN BOULEVARD</b>						
East of Keystone Avenue	36,100	39,300	49,300	50,600	56,300	57,400
4 Lane High	C	E	F	F	F	F
6 Lane High	C	C	C	C	D	D
West of Keystone Avenue	35,300	38,800	48,500	50,000	55,600	57,100
4 Lane High	C	E	F	F	F	F
6 Lane High	C	C	C	C	D	D
<b>KEYSTONE AVENUE</b>						
South of McCarran Boulevard	2,700	3,000	3,000	3,100	3,200	3,300
2 Lane Low	C	C	C	C	C	C

### McCarran Boulevard

McCarran Boulevard was reviewed for capacity as a high access control arterial. The existing four-lane sections east and west of Keystone Avenue are anticipated to operate at level of service C for the 2018 background, level of service E for the 2018 background plus project and level of service F for the 2030 and 2040 background and background plus project scenarios. McCarran Boulevard east and west of Keystone Avenue will need to be widened to six lanes in order to maintain level of service D or better operation for the 2018 background plus project and 2030 and 2040 background and background plus project scenarios. The RTC's General Administrative Manual & Capital Improvements Plan (4th Edition) dated December 3, 2007 indicates that McCarran Boulevard between North Virginia Street and Sky Country Drive is scheduled to be widened to six lanes in the 2008 to 2017 timeframe.

### Keystone Avenue

Keystone Avenue was reviewed for capacity as a low access control arterial. The existing two-lane section south of McCarran Boulevard is anticipated to operate at level of service C for all scenarios. No improvements are planned for Keystone Avenue in the RTC's 2030 Regional Transportation Plan.

## SITE PLAN REVIEW

A copy of the site plan for the proposed Keystone Campus P.U.D. development is included in this submittal. The site plan indicates that project access will be provided from Leadership Parkway and Victory Lane via McCarran Boulevard. The project driveways and the interior roadways are anticipated to provide adequate site circulation.

The need for westbound right turn deceleration lanes on McCarran Boulevard at Leadership Parkway and Victory Lane was reviewed based on City of Reno standards and RTC's access management standards. RTC access management standards indicate that right turn lanes are required on high access control arterials at driveways if the movement serves more than 30 vehicles per hour. City of Reno standards indicate that right turn lanes are required at driveways if the movement serves more than 40 vehicles per hour. The right turn ingress movements at Leadership Parkway and Victory Lane on McCarran Boulevard are anticipated to serve more than 40 vehicles per hour and therefore exclusive westbound right turn lanes are required. A desirable length of 390 feet storage/deceleration and 290 feet deceleration are required at Leadership Parkway and Victory Lane on McCarran Boulevard based on the 50 mile per hour posted speed limit, respectively.

The left turn storage requirement was reviewed at the west approach of the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection based on the Poisson Method for signalized intersections with a 95% confidence level and 90 second cycle length. Approximately 50 feet of storage length is needed based on the existing plus project traffic volumes. NDOT requires a minimum 100 feet of storage for left turns and non-free right turns. NDOT's access management standards indicate that the left turn lane should also contain 290 feet of deceleration length based on the 50 mile per hour speed limit on McCarran Boulevard. Therefore, a total of 390 feet of storage/deceleration length is needed for the left turn lane at the west approach of the intersection. The left turn pocket at the west approach currently contains approximately 220 feet of storage/deceleration length which is inadequate to serve the existing plus project traffic volumes. It is recommended that the left turn lane at the west approach of the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection be improved to contain a minimum of 390 feet of storage/deceleration length.

Left turn storage requirements were subsequently reviewed at the west approach of the McCarran Boulevard/Victory Lane intersection based on the unsignalized criteria of storing 3 minutes of waiting vehicles. Approximately 100 feet of storage length is needed based on the existing plus project traffic volumes. NDOT's access management standards indicate that the left turn lane should also contain 290 feet of deceleration length based on the 50 mile per hour speed limit on McCarran Boulevard. Therefore, a total of 390 feet of storage/deceleration length is needed for the left turn lane at the west approach of the intersection. The left turn pocket at the west approach currently contains approximately 220 feet of storage/deceleration length which is inadequate to serve the existing plus project traffic volumes. It is recommended that the left turn lane at the west approach of the McCarran Boulevard/Victory Lane intersection be improved to contain a minimum of 390 feet of storage/deceleration length.

## RECOMMENDATIONS

Traffic generated by Keystone Campus P.U.D. 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 City of Reno and Nevada Department of Transportation requirements.

It is recommended that a traffic signal be installed at the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection when warranted.

It is recommended that the left turn pocket at the west approach of the McCarran Boulevard/Keystone Avenue/Leadership Parkway intersection be lengthened to provide a minimum of 390 feet of storage/deceleration length and the east approach be improved to include an exclusive right turn lane with a minimum of 390 feet of storage/deceleration length in order to serve existing plus project traffic volumes.

It is recommended that the left turn pocket at the west approach of the McCarran Boulevard/Victory Lane intersection be lengthened to provide a minimum of 390 feet of storage/deceleration length and the east approach be improved to include an exclusive right turn lane with a minimum of 290 feet of deceleration length in order to serve existing plus project traffic volumes.

It is recommended that the project interior streets and parking be constructed per City of Reno requirements.

APPENDIX

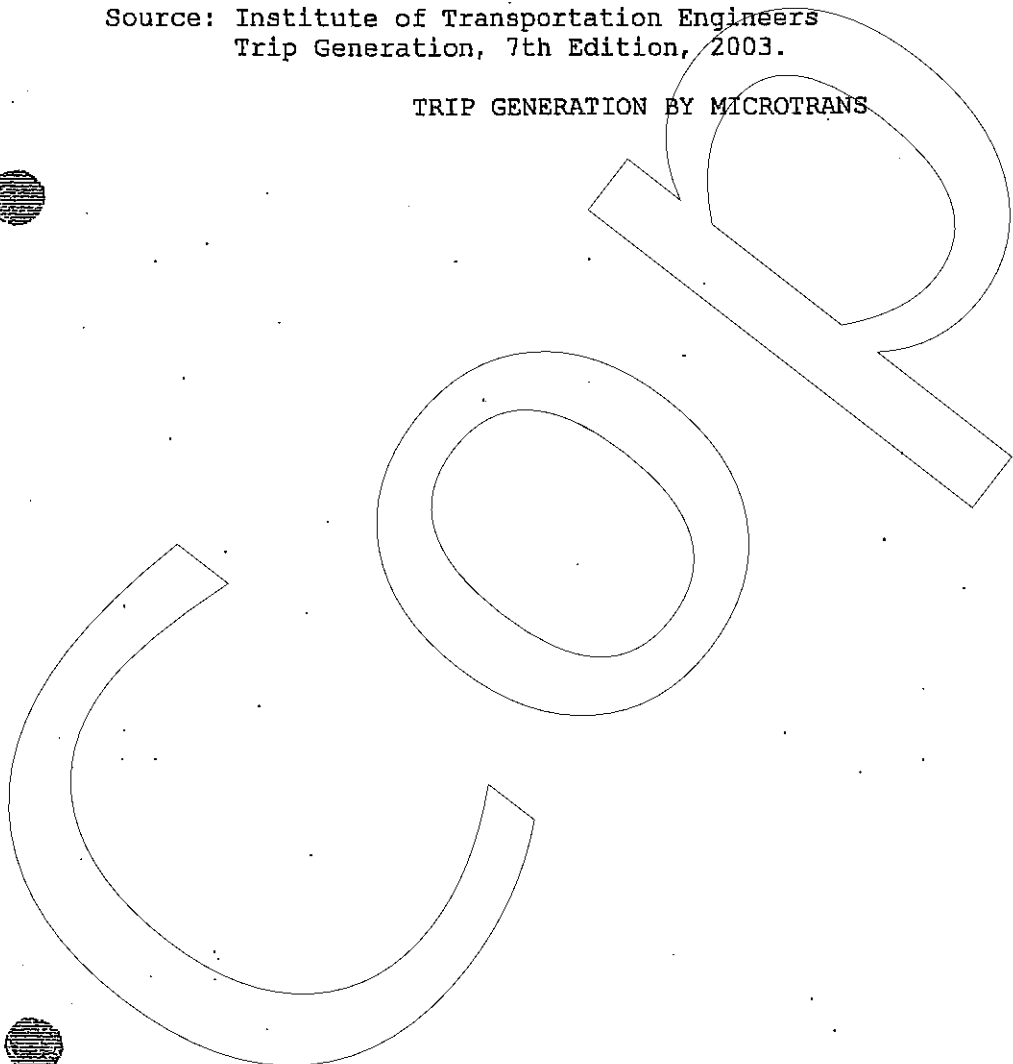
COPY

KEYSTONE COMMUNITY CAMPUS  
 Summary of Average Vehicle Trip Generation  
 For 415 Dwelling Units of Residential Condominium / Townhouse  
 July 31, 2008

	24 Hour Two-Way Volume	7-9 AM Pk Hour		4-6 PM Pk Hour	
		Enter	Exit	Enter	Exit
Average Weekday	2432	29	154	145	71
	24 hour Two-Way Volume	Peak Hour			
		Enter	Exit		
Saturday	2353	104	91		
Sunday	2009	91	95		

Note: A zero indicates no data available.  
 Source: Institute of Transportation Engineers  
 Trip Generation, 7th Edition, 2003.

TRIP GENERATION BY MICROTRANS



KEYSTONE COMMUNITY CAMPUS  
 Summary of Average Vehicle Trip Generation  
 For 330 Occupied Dwelling Units of Elderly Housing - Attached  
 July 31, 2008

	24 Hour Two-Way Volume	7-9 AM Pk Hour		4-6 PM Pk Hour	
		Enter	Exit	Enter	Exit
Average Weekday	1148	13	13	23	13
				Peak Hour	
				Enter	Exit
Saturday	828			0	0
Sunday	891			0	0

Note: A zero indicates no data available.  
 Source: Institute of Transportation Engineers  
 Trip Generation, 7th Edition, 2003.

TRIP GENERATION BY MICROTRANS

COPY

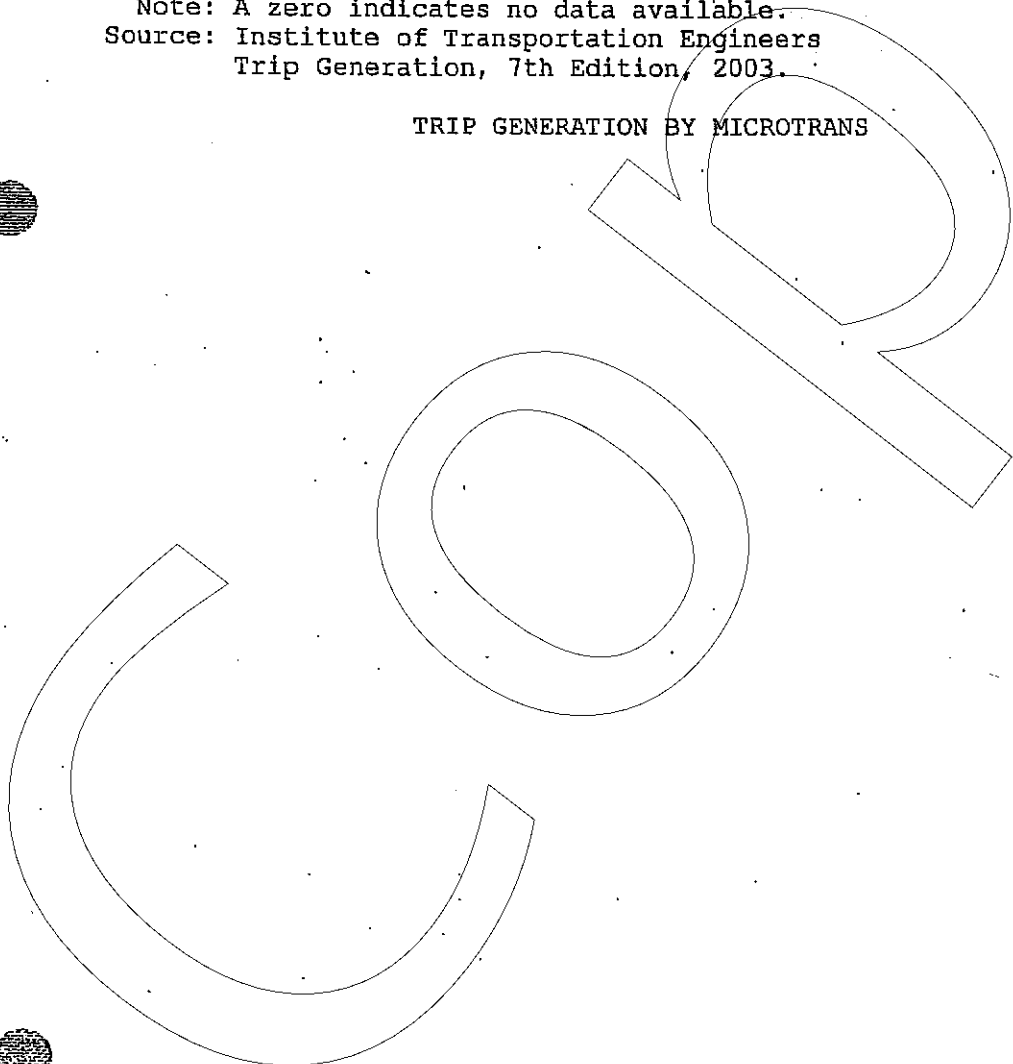
COPY

KEYSTONE COMMUNITY CAMPUS  
 Summary of Average Vehicle Trip Generation  
 For 22 T.G.L.A. of Shopping Center  
 July 31, 2008

	24 Hour Two-Way Volume	7-9 AM Pk Hour		4-6 PM Pk Hour	
		Enter	Exit	Enter	Exit
Average Weekday	945	14	9	40	43
	24 hour Two-Way Volume	Peak Hour			
		Enter	Exit		
Saturday	1099	57	53		
Sunday	555	34	35		

Note: A zero indicates no data available.  
 Source: Institute of Transportation Engineers  
 Trip Generation, 7th Edition, 2003.

TRIP GENERATION BY MICROTRANS

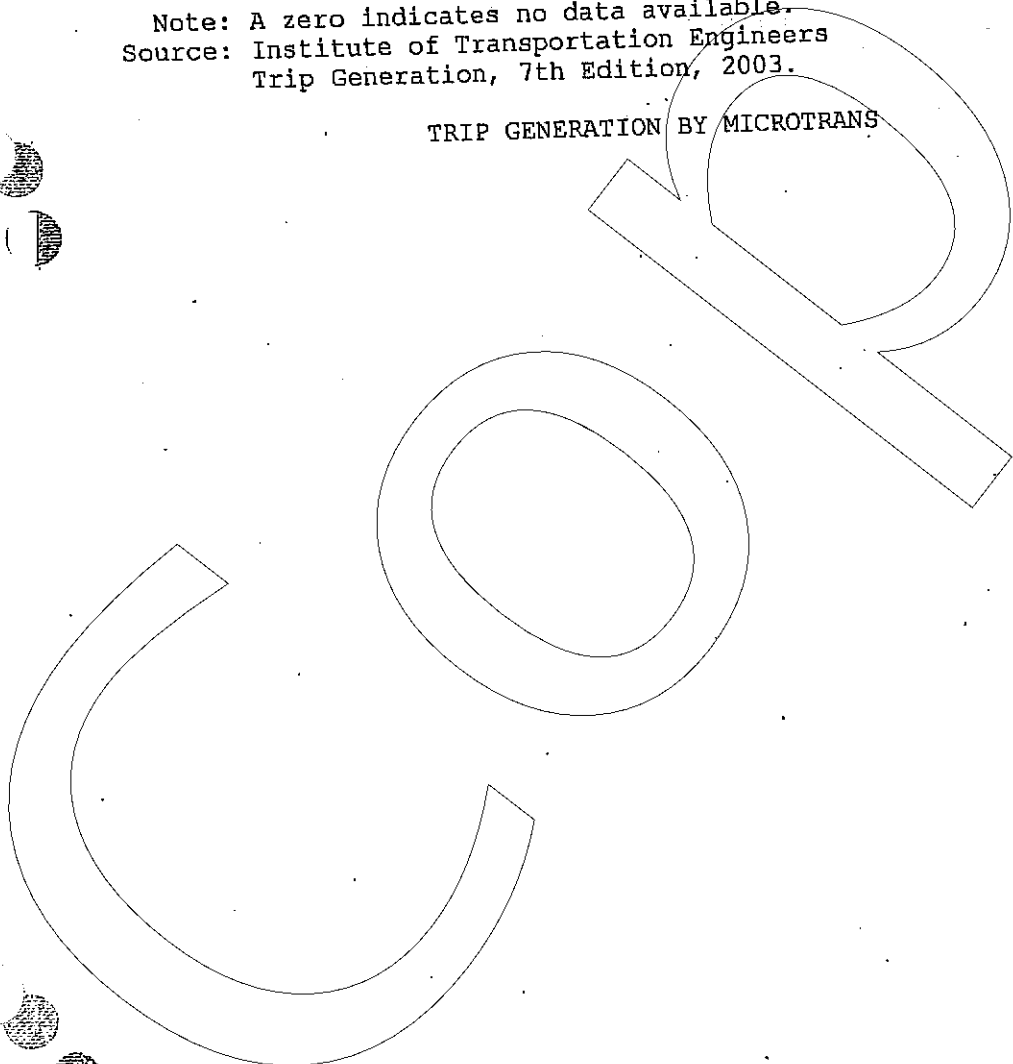


KEYSTONE COMMUNITY CAMPUS  
 Summary of Average Vehicle Trip Generation  
 For 22 Th.Gr.Sq.Ft. of General Office Building  
 July 31, 2008

	24 Hour Two-Way Volume	7-9 AM Pk Hour		4-6 PM Pk Hour	
		Enter	Exit	Enter	Exit
Average Weekday	242	30	4	6	27
	24 hour Two-Way Volume	Peak Hour			
		Enter	Exit		
Saturday	52	5	4		
Sunday	22	2	1		

Note: A zero indicates no data available.  
 Source: Institute of Transportation Engineers  
 Trip Generation, 7th Edition, 2003.

TRIP GENERATION BY MICROTRANS

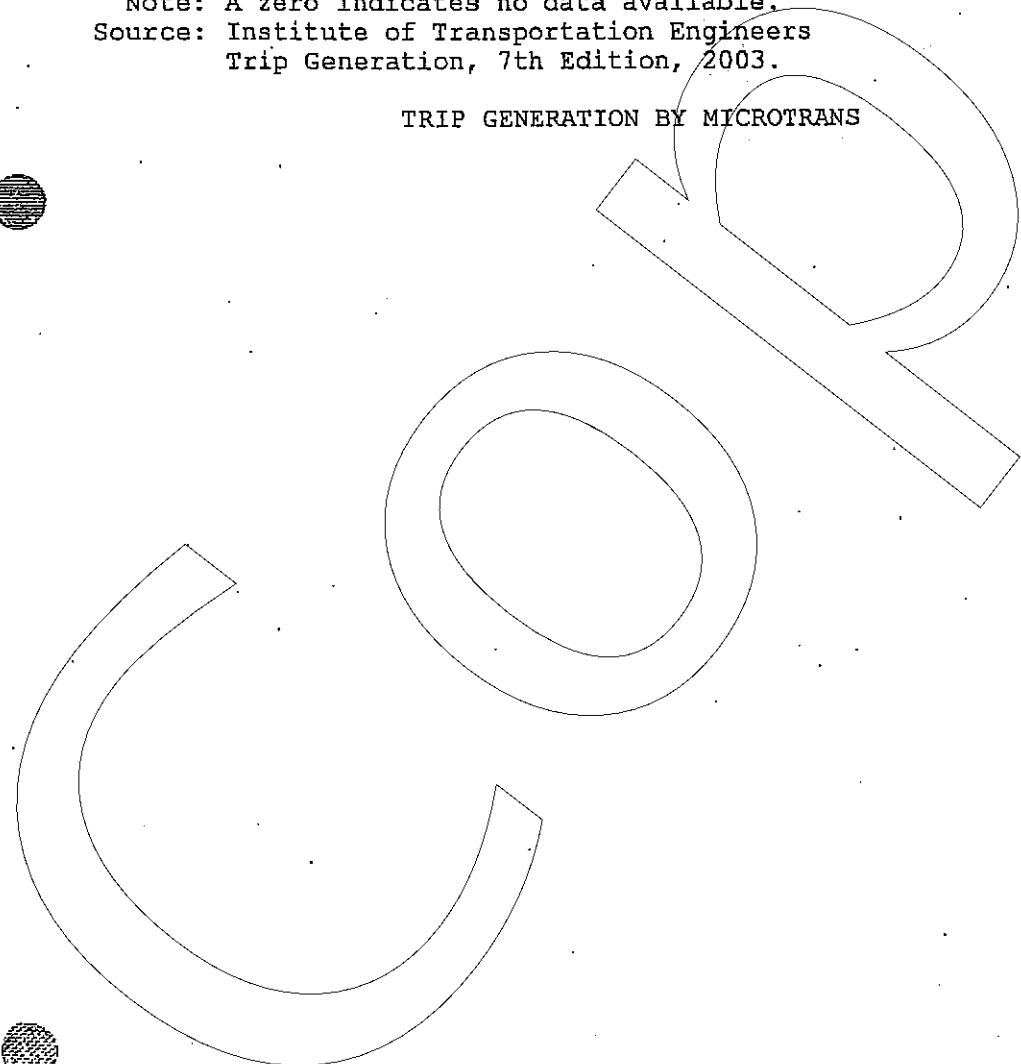


KEYSTONE COMMUNITY CAMPUS  
 Summary of Average Vehicle Trip Generation  
 For 5 Th.Gr.Sq.Ft. of High Turnover (Sit-Down) Restaurant  
 July 31, 2008

	24 Hour Two-Way Volume	7-9 AM Pk Hour		4-6 PM Pk Hour	
		Enter	Exit	Enter	Exit
Average Weekday	636	30	28	33	21
	24 hour Two-Way Volume	Peak Hour			
		Enter	Exit		
Saturday	792	63	37		
Sunday	659	51	42		

Note: A zero indicates no data available.  
 Source: Institute of Transportation Engineers  
 Trip Generation, 7th Edition, 2003.

TRIP GENERATION BY MICROTRANS



TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: Existing  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Major Street: Approach Movement	Vehicle Volumes and Adjustments				Westbound		
	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume	0	774	22	68	505	1	
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	
Hourly Flow Rate, HFR	0	932	26	81	608	1	
Percent Heavy Vehicles	2	--	--	2	--	--	
Median Type/Storage				/ 0			
RT Channelized?					1	2	0
Lanes		1	2	0	1	2	0
Configuration		L	T	TR	L	T	TR
Upstream Signal?		No	No	No	No	No	No

Minor Street: Approach Movement	Northbound				Southbound		
	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume	28	2	82	1	1	0	
Peak Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	
Hourly Flow Rate, HFR	33	2	98	1	1	0	
Percent Heavy Vehicles	2	2	2	2	2	2	
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage			No	/	1	1	No
Lanes	0	1	0		L	1	0
Configuration		LTR			L	TR	

Approach Movement Lane Config	Delay, Queue Length, and Level of Service							
	EB	WB	Northbound			Southbound		
	1	4	7	8	9	10	11	12
	L	L	L	LTR	L	L	L	TR
v (vph)	0	81		133		1		1
C(m) (vph)	966	714		229		97		78
v/c	0.00	0.11		0.58		0.01		0.01
95% queue length	0.00	0.38		3.27		0.03		0.04
Control Delay	8.7	10.7		40.4		42.5		51.8
LOS	A	B		E		E		F
Approach Delay				40.4			47.1	
Approach LOS				E			E	

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: Existing  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	0	800	56	97	814	3
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	0	888	62	107	904	3
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal?	No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	32	3	109	3	2	0
Peak Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	35	3	121	3	2	0
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0			0		
Flared Approach: Exists?/Storage	No			/ No		
Lanes	0	1	0	1	1	0
Configuration	LTR			L TR		

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	EB	WB	Northbound			Southbound		
	1 L	4 L	7 L	8 LTR	9 L	10 L	11 L	12 TR
v (vph)	0	107	159	3	2	3	2	2
C(m) (vph)	746	719	188	49	45	49	45	45
v/c	0.00	0.15	0.85	0.06	0.04	0.06	0.04	0.04
95% queue length	0.00	0.52	6.12	0.19	0.14	0.19	0.14	0.14
Control Delay	9.8	10.9	81.6	83.2	88.7	83.2	88.7	88.7
LOS	A	B	F	F	F	F	F	F
Approach Delay	81.6			85.4				
Approach LOS	F			F				

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: Existing + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	18	795	24	68	513	45
Peak-Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	21	957	28	81	618	54
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes Configuration	1 L	2 T	0 TR	1 L	2 T	0 TR
Upstream Signal?		No			No	

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	28	14	82	78	22	11
Peak Hour Factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Hourly Flow Rate, HFR	33	16	98	93	26	13
Percent Heavy Vehicles	2	2	2	2	0	2
Percent Grade (%)	0			/		
Flared Approach: Exists?/Storage	No			/		
Lanes Configuration	0	1 LTR	0	1 L	1 TR	0

Approach Movement Lane Config	Delay, Queue Length, and Level of Service						
	EB 1 L	WB 4 L	Northbound 7 LTR	9	Southbound 10 L	11 TR	12 TR
v (vph)	21	81	147		93		39
C(m) (vph)	915	697	137		66		93
v/c	0.02	0.12	1.07		1.41		0.42
95% queue length	0.07	0.39	8.08		7.83		1.73
Control Delay	9.0	10.8	161.5		359.1		69.2
LOS	A	B	F		F		F
Approach Delay			161.5				273.4
Approach LOS			F				F

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: Existing + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	22	799	57	97	851	76
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	24	887	63	107	945	84
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes Configuration	1 L	2 T	0 TR	1 L	2 T	0 TR
Upstream Signal?		No			No	

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	34	28	109	79	19	18
Peak Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	37	31	121	87	21	20
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		No
Lanes Configuration	0	1 L	0 TR	1 L	1 T	0 TR

Approach Movement Lane Config	Delay, Queue Length, and Level of Service					
	EB		WB		Southbound	
	1	4	7	8	9	10
	L	L	L	LTR	L	TR
v (vph)	24	107	189	87	41	66
C(m) (vph)	671	719	80	11	66	66
v/c	0.04	0.15	2.36	7.91	0.62	2.66
95% queue length	0.11	0.52	17.64	12.18	2.66	2.66
Control Delay	10.6	10.9	733.2	3779	124.4	124.4
LOS	B	B	F	F	F	F
Approach Delay			733.2		2609	
Approach LOS			F		F	

HCS+: Signalized Intersections Release 5.21

Analyst: Thiva  
 Agency: Solaegui Engineers  
 Date: 7/31/2008  
 Period: AM Peak Hour  
 Project ID: Keystone Community Campus  
 E/W St: McCarran Boulevard

Inter.: McCarran/Keystone/Leadership  
 Area Type: All other areas  
 Jurisd: City of Reno  
 Year : Existing + Project  
 N/S St: Keystone Ave/Leadership Pkwy

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	0	0	1	0	1	1	0
LGConfig	L	TR		L	TR			LTR		L	TR	
Volume	18	795	24	68	513	45	28	14	82	78	22	11
Lane Width	12.0	12.0		12.0	12.0			12.0		12.0	12.0	
RTOR Vol			4			7			12			2

Duration 0.25 Area Type: All other areas

Phase Combination	Signal Operations							
	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
WB Left	A	A			SB Left	A		
Thru		A	A		Thru	A		
Right		A	A		Right	A		
Peds			X		Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	3.0	1.0	41.0			10.0		
Yellow	4.0	0.0	4.0			4.0		
All Red	1.0	0.0	1.0			1.0		

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	76	1770	0.29	0.04	34.6	C	9.1	A
TR	2068	3531	0.47	0.59	8.5	A		
Westbound								
L	228	1770	0.36	0.13	28.8	C	9.4	A
TR	2102	3503	0.32	0.60	7.0	A		
Northbound								
LTR	216	1509	0.63	0.14	33.8	C	33.8	C
Southbound								
L	170	1191	0.55	0.14	31.8	C	30.3	C
TR	252	1766	0.15	0.14	26.6	C		

Intersection Delay = 12.2 (sec/veh) Intersection LOS = B

Analyst: Thiva  
 Agency: Solaegui Engineers  
 Date: 7/31/2008  
 Period: PM Peak Hour  
 Project ID: Keystone Community Campus  
 E/W St: McCarran Boulevard

Inter.: McCarran/Keystone/Leadership  
 Area Type: All other areas  
 Jurisd: City of Reno  
 Year : Existing + Project  
 N/S St: Keystone Ave/Leadership Pkwy

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	2	0	1	2	0	0	1	0	1	1	0
LGConfig	L	TR		L	TR			LTR		L	TR	
Volume	22	799	57	97	851	76	34	28	109	79	19	18
Lane Width	12.0	12.0		12.0	12.0			12.0		12.0	12.0	
RTOR Vol			9			11			16			3

Duration 0.25 Area Type: All other areas  
 Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
WB Left		A	A		SB Left	A		
Thru			A	A	Thru	A		
Right			A	A	Right	A		
Peds			X		Peds	X		
EB Right					EB Right			
SB Right					WB Right			
Green		3.0	1.0	39.0		12.0		
Yellow		4.0	0.0	4.0		4.0		
All Red		1.0	0.0	1.0		1.0		

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	76	1770	0.32	0.04	34.9	C		
TR	1956	3511	0.48	0.56	9.6	A	10.2	B
Westbound								
L	228	1770	0.47	0.13	29.9	C		
TR	2001	3502	0.51	0.57	9.3	A	11.3	B
Northbound								
LTR	265	1546	0.65	0.17	32.5	C	32.5	C
Southbound								
L	181	1056	0.49	0.17	28.3	C		
TR	294	1717	0.13	0.17	24.8	C	27.2	C

Intersection Delay = 13.2 (sec/veh) Intersection LOS = B

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2018 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Major Street: Approach Movement	Eastbound				Westbound	
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	0	1460	39	46	1315	1
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	1536	41	48	1384	1
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb / 0					
RT Channelized?						
Lanes Configuration	1 L	2 T	0 TR		1 L	2 T
Upstream Signal?	No					

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	31	2	93	1	1	0
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	32	2	97	1	1	0
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0					
Flared Approach: Exists?/Storage	No			/		
Lanes Configuration	0	1 LTR	0		1 L	1 TR

Approach Movement Lane Config	Delay, Queue Length, and Level of Service					
	EB 1 L	WB 4 L	Northbound 7 LTR	Southbound 10 L	11	12 TR
v (vph)	0	48	131	1		1
C(m) (vph)	490	414	53	13		11
v/c	0.00	0.12	2.47	0.08		0.09
95% queue length	0.00	0.39	13.41	0.22		0.25
Control Delay	12.3	14.8	834.4	303.8		362.7
LOS	B	B	F	F		F
Approach Delay				333.3		
Approach LOS				F		

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2018 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	0	1154	39	79	1339	3
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	1214	41	83	1409	3
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes Configuration	1 L	2 T	0 TR	1 L	2 T	0 TR
Upstream Signal?	No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	31	3	52	3	2	0
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	32	3	54	3	2	0
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0			0		
Flared Approach: Exists?/Storage	No			/ No /		
Lanes Configuration	0	1 L	0 TR	1 L	1 T	0 TR

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	EB	WB	Northbound			Southbound		
	1 L	4 L	7 L	8 L	9 L	10 L	11 L	12 TR
v (vph)	0	83	89	3	2			
C(m) (vph)	479	550	52	17	14			
v/c	0.00	0.15	1.71	0.18	0.14			
95% queue length	0.00	0.53	8.54	0.50	0.40			
Control Delay	12.5	12.7	515.3	257.6	301.1			
LOS	B	B	F	F	F			
Approach Delay			515.3			275.0		
Approach LOS			F			F		

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2018 Background + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	18	1641	61	45	1323	45
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	18	1727	64	47	1392	47
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes	1 L	2 T	0 TR	1 L	2 T	0 TR
Configuration		No			No	
Upstream Signal?						

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	31	14	90	78	22	11
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	32	14	94	82	23	11
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage		No	/		No	/
Lanes	0	1 L	0	1 L	1 T	0 TR
Configuration		LTR				

Approach Movement Lane Config	Delay, Queue Length, and Level of Service							
	EB 1 L	WB 4 L	Northbound 7   8 LTR		Southbound 9   10 L		11 T	12 TR
v (vph)	18	47	140		82			34
C(m) (vph)	468	342	0		0			10
v/c	0.04	0.14						3.40
95% queue length	0.12	0.47						5.37
Control Delay	13.0	17.2						1823
LOS	B	C	E		F			F
Approach Delay								
Approach LOS								

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
Agency/Co.: Solaegui Engineers  
Date Performed: 7/30/2008  
Analysis Time Period: PM Peak Hour  
Intersection: McCarran/Keystone/Leadership  
Jurisdiction: City of Reno  
Units: U. S. Customary  
Analysis Year: 2018 Background + Project  
Project ID: Keystone Community Campus  
East/West Street: McCarran Boulevard  
North/South Street: Keystone Ave./Leadership Pkwy.  
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	22	1213	47	76	1545	76
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	23	1276	49	80	1626	80
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes Configuration	1 L	2 T	0 TR	1 L	2 T	0 TR
Upstream Signal?	No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	44	28	51	79	19	18
Peak Hour Factor, PHE	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	46	29	53	83	20	18
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0			0		
Flared Approach: Exists?/Storage	No			/ No /		
Lanes Configuration	0	1 L	0 TR	1 L	1 T	0 TR

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	EB	WB	Northbound			Southbound		
	1 L	4 L	7 L	8 L	9 L	10 L	11 L	12 TR
v (vph)	23	80		128		83		38
C(m) (vph)	369	517		0		0		15
v/c	0.06	0.15						2.53
95% queue length	0.20	0.54						5.48
Control Delay	15.4	13.2						1217
LOS	C	B		F		F		F
Approach Delay								
Approach LOS								

HCS+: Signalized Intersections Release 5.21

Analyst: Thiva  
 Agency: Solaegui Engineers  
 Date: 7/31/2008  
 Period: AM Peak Hour  
 Project ID: Keystone Community Campus  
 E/W St: McCarran Boulevard

Inter.: McCarran/Keystone/Leadership  
 Area Type: All other areas  
 Jurisd: City of Reno  
 Year : 2018 Background + Project  
 N/S St: Keystone Ave/Leadership Pkwy

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	0	1	0	1	1	0
LGConfig	L	TR		L	TR			LTR		L	TR	
Volume	18	1641	61	45	1323	45	31	14	90	78	22	11
Lane Width	12.0	12.0		12.0	12.0			12.0		12.0	12.0	
RTOR Vol			9			7			14			2

Duration 0.25 Area Type: All other areas

Phase Combination	Signal Operations							
	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A		
Thru				A	Thru	A		
Right				A	Right	A		
Peds				X	Peds	X		
WB Left	A	A			SB Left	A		
Thru		A		A	Thru	A		
Right		A		A	Right	A		
Peds				X	Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	3.0	1.0	39.0			12.0		
Yellow	4.0	0.0	4.0			4.0		
All Red	1.0	0.0	1.0			1.0		

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	76	1770	0.25	0.04	34.1	C	11.3	B
TR	2811	5046	0.63	0.56	11.1	B		
Westbound								
L	228	1770	0.21	0.13	27.8	C	9.7	A
TR	2885	5049	0.50	0.57	9.1	A		
Northbound								
LTR	262	1527	0.49	0.17	27.7	C	27.7	C
Southbound								
L	216	1259	0.38	0.17	26.8	C	26.2	C
TR	304	1771	0.11	0.17	24.6	C		

Intersection Delay = 11.7 (sec/veh) Intersection LOS = B

Analyst: Thiva  
 Agency: Solaegui Engineers  
 Date: 7/31/2008  
 Period: PM Peak Hour  
 Project ID: Keystone Community Campus  
 E/W St: McCarran Boulevard

Inter.: McCarran/Keystone/Leadership  
 Area Type: All other areas  
 Jurisd: City of Reno  
 Year : 2018 Background + Project  
 N/S St: Keystone Ave/Leadership Pkwy

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	0	1	0	1	1	0
LGConfig	L	TR		L	TR			LTR		L	TR	
Volume	22	1213	47	76	1545	76	44	28	51	79	19	18
Lane Width	12.0	12.0		12.0	12.0			12.0		12.0	12.0	
RTOR Vol			7			11			8			3

Duration 0.25 Area Type: All other areas  
 Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
WB Left	A				SB Left	A		
Thru		A	A		Thru	A		
Right		A	A		Right	A		
Peds			X		Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	3.0	1.0	39.0		12.0			
Yellow	4.0	0.0	4.0		4.0			
All Red	1.0	0.0	1.0		1.0			

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	76	1770	0.30	0.04	34.7	C		
TR	2811	5046	0.47	0.56	9.4	A	9.9	A
Westbound								
L	228	1770	0.35	0.13	28.8	C		
TR	2879	5038	0.59	0.57	10.0+	B	10.9	B
Northbound								
LTR	258	1505	0.47	0.17	27.4	C	27.4	C
Southbound								
L	224	1307	0.37	0.17	26.7	C		
TR	295	1718	0.12	0.17	24.7	C	26.1	C

Intersection Delay = 11.6 (sec/veh) Intersection LOS = B

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2030 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Major Street: Approach Movement	Eastbound				Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R	
Volume	0	1969	43	48	1920	1	
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	
Hourly Flow Rate, HFR	0	2072	45	50	2021	1	
Percent Heavy Vehicles	2	--	--	2	--	--	
Median Type/Storage	Raised curb				/ 0		
RT Channelized?							
Lanes Configuration	1 L	2 T	0 TR		1 L	2 T	0 TR
Upstream Signal?		No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	40	2	100	1	1	0
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	42	2	105	1	1	0
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		No
Lanes Configuration	0	1 L	0 L		1 L	0 TR

Approach Movement Lane Config	Delay, Queue Length, and Level of Service							
	EB 1 L	WB 4 L	7	Northbound 8 LTR	9	Southbound 10 L	11	12 TR
v (vph)	0	50		149		1		1
C(m) (vph)	277	255		7		0		2
v/c	0.00	0.20		21.29				0.50
95% queue length	0.00	0.71		20.48				0.55
Control Delay	18.0	22.5		10159				2339
LOS	C	C		F		F		F
Approach Delay				10159				
Approach LOS				F				

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2030 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	0	1624	46	89	1788	3
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	1709	48	93	1882	3
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb / 0					
RT Channelized?						
Lanes Configuration	1 L	2 T	0 TR	1 L	2 T	0 TR
Upstream Signal?	No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	37	3	53	3	2	0
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	38	3	55	3	2	0
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0			0		
Flared Approach: Exists?/Storage	No /			No /		
Lanes Configuration	0	1 L	0 TR	1 L	1 TR	0

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	EB	WB	Northbound			Southbound		
	1 L	4 L	7 L	8 L	9 L	10 L	11 L	12 TR
v (vph)	0	93		96		3		2
C(m) (vph)	314	352		7		0		3
v/c	0.00	0.26		13.71				0.67
95% queue length	0.00	1.04		13.74				0.81
Control Delay	16.5	18.9		6750				1735
LOS	C	C		F		F		F
Approach Delay				6750				
Approach LOS				F				

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2030 Background + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Major Street: Approach Movement	Eastbound				Westbound		
	1 L	2 T	3 R		4 L	5 T	6 R
Volume	18	2053	52		47	1941	45
Peak-Hour Factor, PHF	0.95	0.95	0.95		0.95	0.95	0.95
Hourly Flow Rate, HFR	18	2161	54		49	2043	47
Percent Heavy Vehicles	2	--	--		2	--	--
Median Type/Storage	Raised curb				/ 0		
RT Channelized?							
Lanes Configuration	1 L	2 T	0 TR		1 L	2 T	0 TR
Upstream Signal?		No				No	

Minor Street: Approach Movement	Northbound				Southbound		
	7 L	8 T	9 R		10 L	11 T	12 R
Volume	42	14	100		78	22	11
Peak Hour Factor, PHF	0.95	0.95	0.95		0.95	0.95	0.95
Hourly Flow Rate, HFR	44	14	105		82	23	11
Percent Heavy Vehicles	2	2	2		2	0	2
Percent Grade (%)		0					
Flared Approach: Exists?/Storage	No				/		
Lanes Configuration	0	1 L	0 L		1 L	1 L	0 TR

Approach Movement Lane Config	Delay, Queue Length, and Level of Service							
	EB 1 L	WB 4 L	Northbound 7   8 LTR		Southbound 9   10 L		11 11 TR	12 12 TR
v (vph)	18	49	163		82			34
C(m) (vph)	261	233	0		0			34.00
v/c	0.07	0.21						6.19
95% queue length	0.22	0.77						21528
Control Delay	19.8	24.5	F		F			F
LOS	C	C	F		F			F
Approach Delay								
Approach LOS								



HCS+: Signalized Intersections Release 5.21

Analyst: Thiva  
 Agency: Solaegui Engineers  
 Date: 7/31/2008  
 Period: AM Peak Hour  
 Project ID: Keystone Community Campus  
 E/W St: McCarran Boulevard

Inter.: McCarran/Keystone/Leadership  
 Area Type: All other areas  
 Jurisd: City of Reno  
 Year : 2030 Background + Project  
 N/S St: Keystone Ave/Leadership Pkwy

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	0	1	0	1	1	0
LGConfig	L	TR		L	TR			LTR		L	TR	
Volume	18	2053	52	47	1941	45	42	14	100	78	22	11
Lane Width	12.0	12.0		12.0	12.0			12.0		12.0	12.0	
RTOR Vol			8			7			15			2

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
WB Left		A	A		SB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
EB Right					EB Right			
SB Right					WB Right			
Green	3.0	1.0	39.0		12.0			
Yellow	4.0	0.0	4.0		4.0			
All Red	1.0	0.0	1.0		1.0			

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
<b>Eastbound</b>								
L	76	1770	0.25	0.04	34.1	C	13.9	B
TR	2816	5055	0.78	0.56	13.7	B		
<b>Westbound</b>								
L	228	1770	0.21	0.13	27.8	C	12.2	B
TR	2890	5057	0.72	0.57	11.8	B		
<b>Northbound</b>								
LTR	257	1499	0.58	0.17	29.8	C	29.8	C
<b>Southbound</b>								
L	202	1176	0.41	0.17	27.2	C	26.4	C
TR	304	1771	0.11	0.17	24.6	C		

Intersection Delay = 13.9 (sec/veh) Intersection LOS = B

Analyst: Thiva  
Agency: Solaegui Engineers  
Date: 7/31/2008  
Period: PM Peak Hour  
Project ID: Keystone Community Campus  
E/W St: McCarran Boulevard

Inter.: McCarran/Keystone/Leadership  
Area Type: All other areas  
Jurisd: City of Reno  
Year : 2030 Background + Project  
N/S St: Keystone Ave/Leadership Pkwy

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	0	1	0	1	1	0
LGConfig	L	TR		L	TR			LTR		L	TR	
Volume	22	1643	50	85	1869	76	41	28	53	79	19	18
Lane Width	12.0	12.0		12.0	12.0			12.0		12.0	12.0	
RTOR Vol			8			11			8			3

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
WB Left		A	A		SB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
EB Right					EB Right			
WB Right					WB Right			
Green	3.0	1.0	39.0		12.0			
Yellow	4.0	0.0	4.0		4.0			
All Red	1.0	0.0	1.0		1.0			

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	76	1770	0.30	0.04	34.7	C		
TR	2815	5052	0.63	0.56	11.0	B	11.3	B
Westbound								
L	228	1770	0.39	0.13	29.1	C		
TR	2882	5044	0.71	0.57	11.6	B	12.3	B
Northbound								
LTR	260	1516	0.46	0.17	27.4	C	27.4	C
Southbound								
L	224	1309	0.37	0.17	26.7	C		
TR	295	1718	0.12	0.17	24.7	C	26.1	C

Intersection Delay = 12.7 (sec/veh) Intersection LOS = B

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
Agency/Co.: Solaegui Engineers  
Date Performed: 7/30/2008  
Analysis Time Period: AM Peak Hour  
Intersection: McCarran/Keystone/Leadership  
Jurisdiction: City of Reno  
Units: U. S. Customary  
Analysis Year: 2040 Background  
Project ID: Keystone Community Campus  
East/West Street: McCarran Boulevard  
North/South Street: Keystone Ave./Leadership Pkwy.  
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	0	2179	46	47	2285	1
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	2293	48	49	2405	1
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal?	No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	41	2	99	1	1	0
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	43	2	104	1	1	0
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0			0		
Flared Approach: Exists?/Storage	No			/ No		
Lanes	0	1	0	1	1	0
Configuration	LTR			L TR		

Approach Movement Lane Config	Delay, Queue Length, and Level of Service					
	EB		WB		Southbound	
	1	4	7	8	9	10 11 12
	L	L	L	LTR	L	L TR
v (vph)	0	49	149	0	1	1
C(m) (vph)	196	208	0			1
v/c	0.00	0.24				0.61
95% queue length	0.00	0.89				4878
Control Delay	23.4	27.6				
LOS	C	D	F		F	F
Approach Delay						
Approach LOS						

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2040 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	0	1899	53	86	2008	3
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	0	1998	55	90	2113	3
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes Configuration	1 L	2 T	0 TR	1 L	2 T	0 TR
Upstream Signal?	No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	50	3	55	3	2	0
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	52	3	57	3	2	0
Percent Heavy Vehicles	2	2	2	2	2	2
Percent Grade (%)	0					
Flared Approach: Exists?/Storage	No			/ No /		
Lanes Configuration	0	1 LTR	0	1 L	1 TR	0

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	EB	WB	Northbound			Southbound		
	1 L	4 L	7 L	8 LTR	9 L	10 L	11 L	12 TR
v (vph)	0	90		112		3		2
C(m) (vph)	255	270		0		0		1
v/c	0.00	0.33						2.00
95% queue length	0.00	1.41						0.93
Control Delay	19.1	24.9						5644
LOS	C	C		F		F		F
Approach Delay								
Approach LOS								

HCS+: Unsignalized Intersections Release 5.21

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran/Keystone/Leadership  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2040 Background + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Keystone Ave./Leadership Pkwy.  
 Intersection Orientation: EW Study period (hrs): 0.25

Major Street: Approach Movement	Vehicle Volumes and Adjustments					
	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	18	2252	54	47	2290	45
Peak-Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Hourly Flow Rate, HFR	18	2370	56	49	2410	47
Percent Heavy Vehicles	2	--	--	2	--	--
Median Type/Storage	Raised curb			/	0	
RT Channelized?						
Lanes Configuration	1 L	2 T	0 TR	1 L	2 T	0 TR
Upstream Signal?		No			No	

Minor Street: Approach Movement	Northbound				Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R	
Volume	42	14	99	78	22	11	
Peak Hour Factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	
Hourly Flow Rate, HFR	44	14	104	82	23	11	
Percent Heavy Vehicles	2	2	2	2	2	2	
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage	0	1	0	/	1	1	No
Lanes Configuration		LTR			L	TR	

Approach Movement Lane Config	Delay, Queue Length, and Level of Service							
	EB 1 L	WB 4 L	Northbound 7   8 LTR		Southbound 9   10 L		11 TR	12 TR
v (vph)	18	49	162		82			34
C(m) (vph)	187	192	0		0			1
v/c	0.10	0.26						34.00
95% queue length	0.31	0.97						6.19
Control Delay	26.3	30.1						21528
LOS	D	D	F		F			F
Approach Delay								
Approach LOS								



HCS+: Signalized Intersections Release 5.21

Analyst: Thiva  
 Agency: Solaegui Engineers  
 Date: 7/31/2008  
 Period: AM Peak Hour  
 Project ID: Keystone Community Campus  
 E/W St: McCarran Boulevard

Inter.: McCarran/Keystone/Leadership  
 Area Type: All other areas  
 Jurisd: City of Reno  
 Year : 2040 Background + Project  
 N/S St: Keystone Ave/Leadership Pkwy

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	0	1	0	1	1	0
LGConfig	L	TR		L	TR			LTR		L	TR	
Volume	18	2252	54	47	2290	45	42	14	99	78	22	11
Lane Width	12.0	12.0		12.0	12.0			12.0		12.0	12.0	
RTOR Vol			8			7			15			2

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A							
Thru			A					
Right			A					
Peds			X					
WB Left	A	A						
Thru		A	A					
Right		A	A					
Peds			X					
NB Right								
SB Left					A			
Thru					A			
Right					A			
Peds					X			
EB Right								
WB Right								
Green	3.0	1.0	39.0		12.0			
Yellow	4.0	0.0	4.0		4.0			
All Red	1.0	0.0	1.0		1.0			

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
<b>Eastbound</b>								
L	76	1770	0.25	0.04	34.1	C	16.2	B
TR	2817	5056	0.86	0.56	16.1	B		
<b>Westbound</b>								
L	228	1770	0.21	0.13	27.8	C	15.3	B
TR	2891	5059	0.85	0.57	15.0	B		
<b>Northbound</b>								
LTR	257	1499	0.57	0.17	29.7	C	29.7	C
<b>Southbound</b>								
L	202	1181	0.41	0.17	27.2	C	26.4	C
TR	304	1771	0.11	0.17	24.6	C		

Intersection Delay = 16.4 (sec/veh) Intersection LOS = B

Analyst: Thiva  
Agency: Solaegui Engineers  
Date: 7/31/2008  
Period: PM Peak Hour  
Project ID: Keystone Community Campus  
E/W St: McCarran Boulevard

Inter.: McCarran/Keystone/Leadership  
Area Type: All other areas  
Jurisd: City of Reno  
Year : 2040 Background + Project  
N/S St: Keystone Ave/Leadership Pkwy

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	3	0	1	3	0	0	1	0	1	1	0
LGConfig	L	TR		L	TR			LTR		L	TR	
Volume	22	1929	58	86	2080	76	61	28	54	79	19	18
Lane Width	12.0	12.0		12.0	12.0			12.0		12.0	12.0	
RTOR Vol			9			11			8			3

Duration 0.25 Area Type: All other areas  
Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left		A			NB Left	A		
Thru			A		Thru	A		
Right			A		Right	A		
Peds			X		Peds	X		
WB Left	A		A		SB Left	A		
Thru		A	A		Thru	A		
Right		A	A		Right	A		
Peds			X		Peds	X		
EB Right					EB Right			
SB Right					WB Right			
Green	3.0	1.0	39.0		12.0			
Yellow	4.0	0.0	4.0		4.0			
All Red	1.0	0.0	1.0		1.0			

Cycle Length: 70.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
L	76	1770	0.30	0.04	34.7	C		
TR	2815	5052	0.74	0.56	12.8	B	13.0	B
Westbound								
L	228	1770	0.40	0.13	29.2	C		
TR	2884	5047	0.78	0.57	13.1	B	13.7	B
Northbound								
LTR	252	1468	0.56	0.17	29.4	C	29.4	C
Southbound								
L	212	1237	0.39	0.17	27.0	C		
TR	295	1718	0.12	0.17	24.7	C	26.3	C

Intersection Delay = 14.2 (sec/veh) Intersection LOS = B



TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: Existing  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound				Westbound	
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	3	855			844	2
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	3	950			937	2
Percent Heavy Vehicles	2	--			--	--
Median Type/Storage	Raised curb / 0					
RT Channelized?						
Lanes Configuration	1 L	2 T			2 T	0 TR
Upstream Signal?	No				No	

Minor Street: Approach Movement	Northbound				Southbound	
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				1		3
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				1		3
Percent Heavy Vehicles				2		2
Percent Grade (%)	0					
Flared Approach: Exists?/Storage					/	0
Lanes Configuration					0	No /
					LR	

Approach Movement	Delay, Queue Length, and Level of Service							
	EB	WB	Northbound				Southbound	
	1	4	7	8	9	10	11	12
Lane Config	L						LR	
v (vph)	3						4	
C(m) (vph)	726						298	
v/c	0.00						0.01	
95% queue length	0.01						0.04	
Control Delay	10.0-						17.2	
LOS	A						C	
Approach Delay							17.2	
Approach LOS							C	

HCS+: Unsignalized Intersections Release 5.21

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: Existing + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

Study period (hrs): 0.25

Major Street: Approach Movement	Eastbound				Westbound	
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	27	805			538	14
Peak-Hour Factor, PHF	0.83	0.83			0.83	0.83
Hourly Flow Rate, HFR	32	969			648	16
Percent Heavy Vehicles	2	--			--	--
Median Type/Storage	Raised curb					
RT Channelized?					2	0
Lanes Configuration	1 L	2 T			T No	TR
Upstream Signal?		No				

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				32		58
Peak Hour Factor, PHF				0.83		0.83
Hourly Flow Rate, HFR				38		69
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/	0	No /
Lanes Configuration					LR	

Approach Movement Lane Config	Delay, Queue Length, and Level of Service					
	EB 1 L	WB 4	Northbound 7 8 9			Southbound 10 11 12 LR
v (vph)	32					107
C(m) (vph)	921					328
v/c	0.03					0.33
95% queue length	0.11					1.38
Control Delay	9.0					21.2
LOS	A					C
Approach Delay						21.2
Approach LOS						C

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
Agency/Co.: Solaegui Engineers  
Date Performed: 7/30/2008  
Analysis Time Period: PM Peak Hour  
Intersection: McCarran Boulevard/Victory Lane  
Jurisdiction: City of Reno  
Units: U. S. Customary  
Analysis Year: Existing + Project  
Project ID: Keystone Community Campus  
East/West Street: McCarran Boulevard  
North/South Street: Victory Lane  
Intersection Orientation: EW

Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	68	864			849	54
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	75	960			943	60
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Raised curb			/ 0		
RT Channelized?						
Lanes Configuration	1 L	2 T			2 T	0 TR
Upstream Signal?	No			No		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				14		47
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				15		52
Percent Heavy Vehicles				2		2
Percent Grade (%)	0				0	
Flared Approach: Exists?/Storage				/		No /
Lanes Configuration				0		0 LR

Approach Movement	Delay, Queue Length, and Level of Service					
	EB	WB	Northbound			Southbound
Lane Config	1 L	4	7	8	9	10   11   12 LR
v (vph)	75					67
C(m) (vph)	686					243
v/c	0.11					0.28
95% queue length	0.37					1.09
Control Delay	10.9					25.4
LOS	B					D
Approach Delay						25.4
Approach LOS						D

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2018 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

Study period (hrs): 0.25

Major Street: Approach Movement	Eastbound				Westbound	
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	2	999			897	1
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95
Hourly Flow Rate, HFR	2	1051			944	1
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type/Storage	Raised curb					
RT Channelized?					2	0
Lanes Configuration	1 L	2 T			T	TR
Upstream Signal?		No			No	

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				1		0
Peak Hour Factor, PHF				0.95		0.95
Hourly Flow Rate, HFR				1		0
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	No
Flared Approach: Exists?/Storage				/	0	0
Lanes Configuration					LR	

Approach Movement Lane Config	Delay, Queue Length, and Level of Service					
	EB 1 L	WB 4	Northbound 7	8	9	Southbound 10 11 LR 12
v (vph)	2					118
C(m) (vph)	722					0.01
v/c	0.00					0.03
95% queue length	0.01					35.8
Control Delay	10.0					E
LOS	A					35.8
Approach Delay						E
Approach LOS						E

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
Agency/Co.: Solaegui Engineers  
Date Performed: 7/30/2008  
Analysis Time Period: PM Peak Hour  
Intersection: McCarran Boulevard/Victory Lane  
Jurisdiction: City of Reno  
Units: U. S. Customary  
Analysis Year: 2018 Background  
Project ID: Keystone Community Campus  
East/West Street: McCarran Boulevard  
North/South Street: Victory Lane  
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments							
Major Street: Approach Movement	Eastbound			Westbound			
	1 L	2 T	3 R	4 L	5 T	6 R	
Volume	3	795			912	2	
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95	
Hourly Flow Rate, HFR	3	836			960	2	
Percent Heavy Vehicles	2	--	--		--	--	
Median Type/Storage	Raised curb			/ 0			
RT Channelized?							
Lanes Configuration	1 L	2 T			2 T	0 TR	
Upstream Signal?	No			No			

Minor Street: Approach Movement	Northbound			Southbound			
	7 L	8 T	9 R	10 L	11 T	12 R	
Volume				1		3	
Peak Hour Factor, PHF				0.95		0.95	
Hourly Flow Rate, HFR				1		3	
Percent Heavy Vehicles				2		2	
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage				/		No	/
Lanes Configuration				0		0	LR

Approach Movement Lane Config	Delay, Queue Length, and Level of Service							
	EB 1 L	WB 4	Northbound 7 8 9			Southbound 10 11 12		
v (vph)	3					4		
C(m) (vph)	711					304		
v/c	0.00					0.01		
95% queue length	0.01					0.04		
Control Delay	10.1					17.0		
LOS	B					C		
Approach Delay						17.0		
Approach LOS						C		



TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2018 Background + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound				Westbound	
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	68	846			1036	54
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95
Hourly Flow Rate, HFR	71	890			1090	56
Percent Heavy Vehicles	2	--			--	--
Median Type/Storage	Raised curb / 0					
RT Channelized?						
Lanes Configuration	1 L	2 T			2 T	0 TR
Upstream Signal?	No				Yes	

Minor Street: Approach Movement	Northbound				Southbound	
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				14		47
Peak Hour Factor, PHF				0.95		0.95
Hourly Flow Rate, HFR				14		49
Percent Heavy Vehicles				2		2
Percent Grade (%)	0					
Flared Approach: Exists?/Storage					0	No /
Lanes Configuration					0	LR

Approach Movement Lane Config	Delay, Queue Length, and Level of Service							
	EB 1 L	WB 4 	Northbound 7 8 9 			Southbound 10 11 12 LR		
v (vph)	71					63		
C(m) (vph)	711					307		
v/c	0.10					0.21		
95% queue length	0.33					0.76		
Control Delay	10.6					19.7		
LOS	B					C		
Approach Delay						19.7		
Approach LOS						C		

HCS+: Unsignalized Intersections Release 5.21

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2030 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

study period (hrs): 0.25

Major Street: Approach Movement	Vehicle Volumes and Adjustments			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	2	1341			1306	1
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95
Hourly Flow Rate, HFR	2	1411			1374	1
Percent Heavy Vehicles	2	--			--	--
Median Type/Storage		Raised curb		/ 0		
RT Channelized?					2	0
Lanes Configuration	1 L	2 T			T	TR
Upstream Signal?		No			No	

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				1		0
Peak Hour Factor, PHF				0.95		0.95
Hourly Flow Rate, HFR				1		0
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/	0	No /
Lanes Configuration					LR	0

Approach Movement Lane Config	Delay, Queue Length, and Level of Service					
	EB 1 L	WB 4	Northbound 7 8 9			Southbound 10 11 12 LR
v (vph)	2					1
C(m) (vph)	495					46
v/c	0.00					0.02
95% queue length	0.01					0.07
Control Delay	12.3					85.0
LOS	B					F
Approach Delay						85.0
Approach LOS						F

HCS+: Unsignalized Intersections Release 5.21

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2030 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments							
Major Street:	Approach Movement	Eastbound			Westbound		
		1	2	3	4	5	6
		L	T	R	L	T	R
Volume		3	1113			1216	2
Peak-Hour Factor, PHF		0.95	0.95			0.95	0.95
Hourly Flow Rate, HFR		3	1171			1280	2
Percent Heavy Vehicles		2	--			--	--
Median Type/Storage		Raised curb / 0					
RT Channelized?							
Lanes Configuration		1	2			2	0
Upstream Signal?		L	T			T	TR
		No				No	

Minor Street:	Approach Movement	Northbound			Southbound		
		7	8	9	10	11	12
		L	T	R	L	T	R
Volume					1		3
Peak Hour Factor, PHF					0.95		0.95
Hourly Flow Rate, HFR					1		3
Percent Heavy Vehicles					2		2
Percent Grade (%)		0					
Flared Approach: Exists?/Storage					/	0	No /
Lanes Configuration					0		0
						LR	

Delay, Queue Length, and Level of Service							
Approach Movement	EB	WB	Northbound			Southbound	
	1	4	7	8	9	10	11 12
Lane Config	L						LR
v (vph)	3						4
C(m) (vph)	537						175
v/c	0.01						0.02
95% queue length	0.02						0.07
Control Delay	11.7						26.1
LOS	B						D
Approach Delay							26.1
Approach LOS							D

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2030 Background + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

Study period (hrs): 0.25

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	27	1394			1320	14
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95
Hourly Flow Rate, HFR	28	1467			1389	14
Percent Heavy Vehicles	2	--	--	--	--	--
Median Type/Storage	Raised curb					
RT Channelized?				0		
Lanes Configuration	1 L	2 T			2 T	0 TR
Upstream Signal?		No			Yes	

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				32		58
Peak Hour Factor, PHF				0.95		0.95
Hourly Flow Rate, HFR				33		61
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/	0	No /
Lanes Configuration					LR	

Approach Movement Lane Config	Delay, Queue Length, and Level of Service					
	EB 1 L	WB 4	Northbound 7 8 9			Southbound 10 11 12 LR
v (vph)	28					94
C(m) (vph)	594					114
v/c	0.05					0.82
95% queue length	0.15					4.82
Control Delay	11.4					112.3
LOS	B					F
Approach Delay						112.3
Approach LOS						F

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2030 Background + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound				Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R	
Volume	68	1134			1250	54	
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95	
Hourly Flow Rate, HFR	71	1193			1315	56	
Percent Heavy Vehicles	2	--	--		--	--	
Median Type/Storage	Raised curb / 0						
RT Channelized?							
Lanes Configuration	1 L	2 T			2 T	0 TR	
Upstream Signal?	No				Yes		

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				14		47
Peak Hour Factor, PHF				0.95		0.95
Hourly Flow Rate, HFR				14		49
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		No /
Lanes Configuration				0	LR	0

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	EB	WB	Northbound			Southbound		
	1 L	4	7	8	9	10	11	12
v (vph)	71						63	
C(m) (vph)	603						182	
v/c	0.12						0.35	
95% queue length	0.40						1.45	
Control Delay	11.8						34.9	
LOS	B						D	
Approach Delay							34.9	
Approach LOS							D	

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2040 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

Study period (hrs): 0.25

Vehicle Volumes and Adjustments							
Major Street: Approach Movement	Eastbound				Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R	
Volume	2	1483			1550	1	
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95	
Hourly Flow Rate, HFR	2	1561			1631	1	
Percent Heavy Vehicles	2	--	--		--	--	
Median Type/Storage	Raised curb				/ 0		
RT Channelized?							
Lanes	1	2			2	0	
Configuration	L	T			T	TR	
Upstream Signal?		No			No		

Minor Street: Approach Movement	Northbound				Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R	
Volume				1		0	
Peak Hour Factor, PHF				0.95		0.95	
Hourly Flow Rate, HFR				1		0	
Percent Heavy Vehicles				2		2	
Percent Grade (%)		0			0		
Flared Approach: Exists?/Storage				/	0	No	/
Lanes					0	0	
Configuration					LR		

Delay, Queue Length, and Level of Service							
Approach Movement	EB	WB	Northbound			Southbound	
	1	4	7	8	9	10	11 12
Lane Config	L						LR
v (vph)	2						1
C(m) (vph)	394						27
w/c	0.01						0.04
95% queue length	0.02						0.11
Control Delay	14.2						143.4
LOS	B						F
Approach Delay							143.4
Approach LOS							F

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2040 Background  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound				Westbound	
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	3	1301			1371	2
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95
Hourly Flow Rate, HFR	3	1369			1443	2
Percent Heavy Vehicles	2	--			--	--
Median Type/Storage	Raised curb / 0					
RT Channelized?						
Lanes Configuration	1 L	2 T			2 T	0 TR
Upstream Signal?	No				No	

Minor Street: Approach Movement	Northbound				Southbound	
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				1		3
Peak Hour Factor, PHF				0.95		0.95
Hourly Flow Rate, HFR				1		3
Percent Heavy Vehicles				2		2
Percent Grade (%)	0					
Flared Approach: Exists?/Storage					/	No /
Lanes Configuration					0	0 LR

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	EB	WB	Northbound			Southbound	
	1	4	7	8	9	10	11 12
v (vph)	3						4
C(m) (vph)	465						125
v/c	0.01						0.03
95% queue length	0.02						0.10
Control Delay	12.8						34.7
LOS	B						D
Approach Delay							34.7
Approach LOS							D

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: AM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2040 Background + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Eastbound			Westbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	27	1528			1553	14
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95
Hourly Flow Rate, HFR	28	1608			1634	14
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Raised curb / 0					
RT Channelized?						
Lanes Configuration	1 L	2 T			2 T	0 TR
Poststream Signal?	No / Yes					

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				32		58
Peak Hour Factor, PHF				0.95		0.95
Hourly Flow Rate, HFR				33		61
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/	0	No /
Lanes Configuration					0	LR

Approach Movement Lane Config	Delay, Queue Length, and Level of Service					
	EB 1 L	WB 4	Northbound 7 8 9			Southbound 10 11 12 LR
v (vph)	28					94
C(m) (vph)	497					62
v/c	0.06					1.52
95% queue length	0.18					8.26
Control Delay	12.7					409.6
LOS	B					F
Approach Delay						409.6
Approach LOS						F

TWO-WAY STOP CONTROL SUMMARY

Analyst: Thiva  
 Agency/Co.: Solaegui Engineers  
 Date Performed: 7/30/2008  
 Analysis Time Period: PM Peak Hour  
 Intersection: McCarran Boulevard/Victory Lane  
 Jurisdiction: City of Reno  
 Units: U. S. Customary  
 Analysis Year: 2040 Background + Project  
 Project ID: Keystone Community Campus  
 East/West Street: McCarran Boulevard  
 North/South Street: Victory Lane  
 Intersection Orientation: EW

Study period (hrs): 0.25

Vehicle Volumes and Adjustments

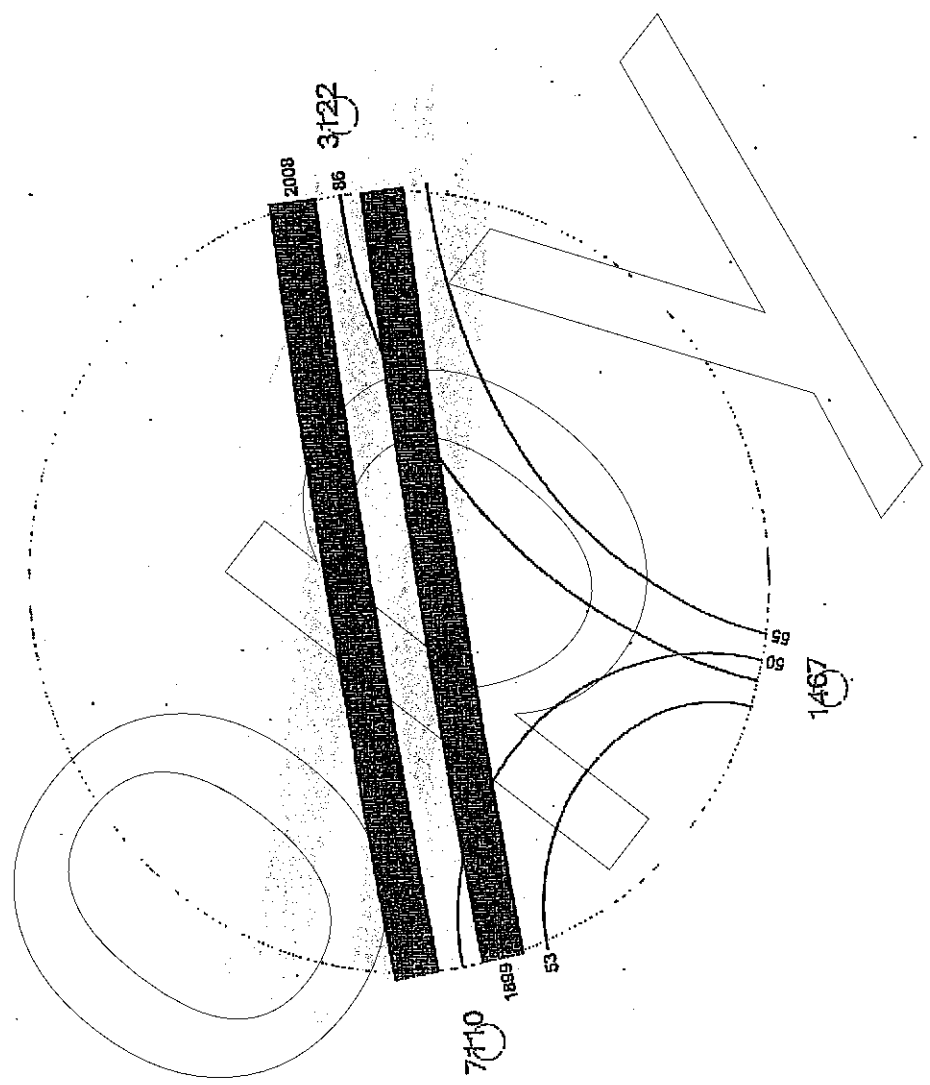
Major Street: Approach Movement	Eastbound				Westbound	
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	68	1330			1404	54
Peak-Hour Factor, PHF	0.95	0.95			0.95	0.95
Hourly Flow Rate, HFR	71	1400			1477	56
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Raised curb / 0					
RT Channelized?						
Lanes Configuration	1 L	2 T			2 T	0 TR
Upstream Signal?	No				Yes	

Minor Street: Approach Movement	Northbound			Southbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume				14		47
Peak Hour Factor, PHF				0.95		0.95
Hourly Flow Rate, HFR				14		49
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		No /
Lanes Configuration				0		0 LR

Delay, Queue Length, and Level of Service

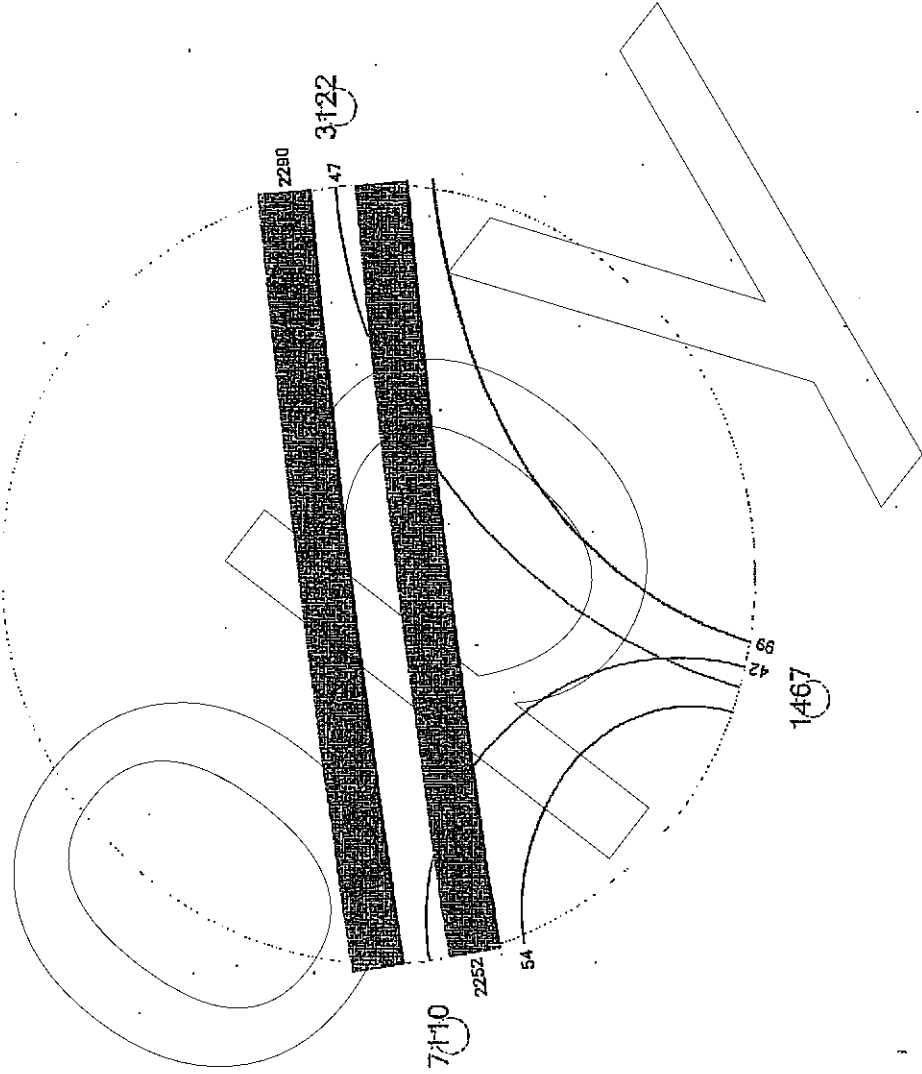
Approach Movement Lane Config	EB	WB	Northbound			Southbound	
	1 L	4 	7 	8	9 	10 	11 12 LR
v (vph)	71						63
C(m) (vph)	531						115
v/c	0.13						0.55
95% queue length	0.46						2.60
Control Delay	12.8						69.0
LOS	B						F
Approach Delay							69.0
Approach LOS							F

Intersection node 2337; PM	
From	To Observed Computed
1467 3122	55
1467 7110	50
3122 1467	86
3122 7110	2008
7110 1467	53
7110 3122	1899



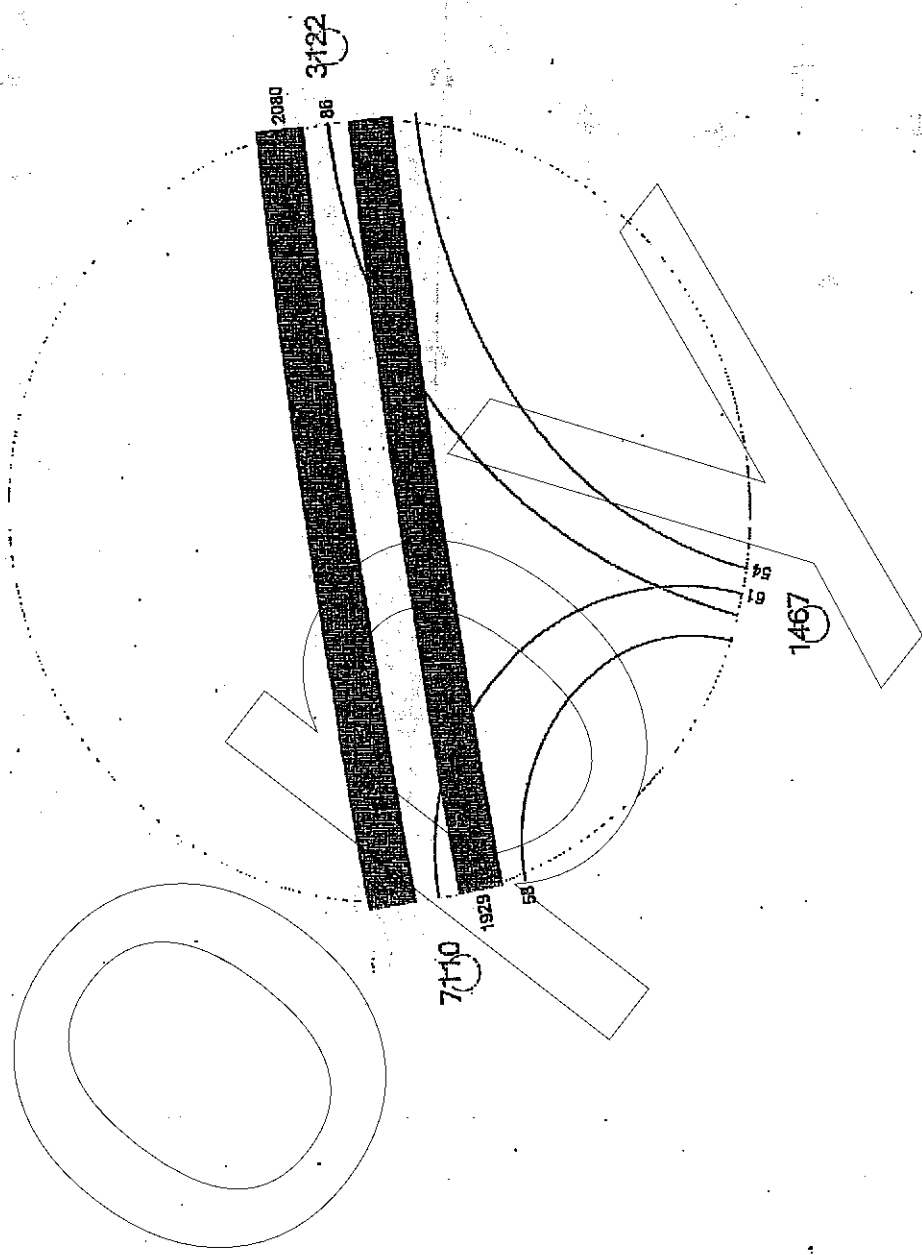
McGarran/KeyStone  
 E308027\_BASE\_J for 2040  
 1040; E308027\_BASE\_J for 2040  
 Intersection\_PM (@ppm.pk)

Intersection node 2337. AM		
From	To	Observed / Computed
1467	3122	99
1467	7110	42
3122	1467	47
3122	7110	2290
7110	1467	54
7110	3122	2252

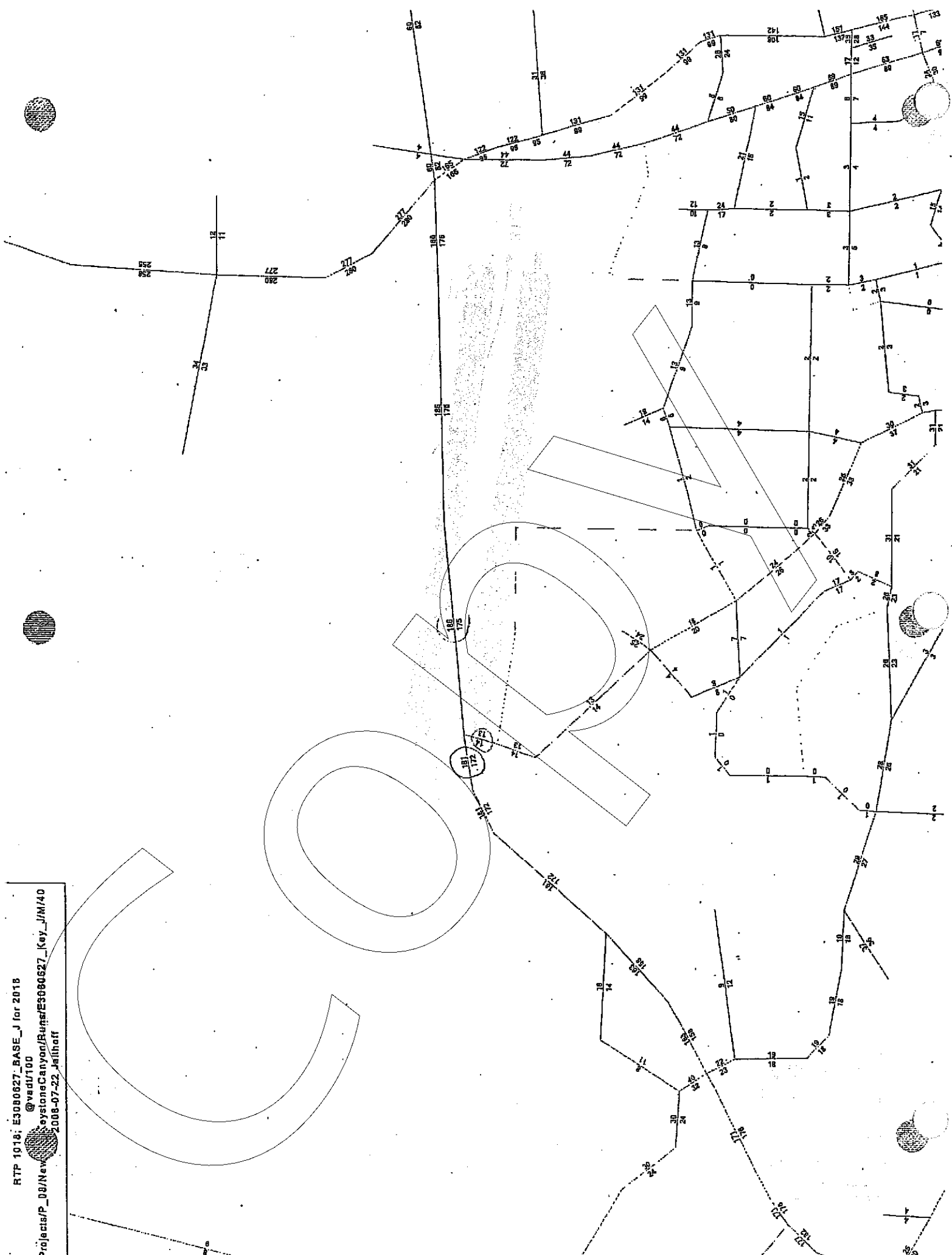


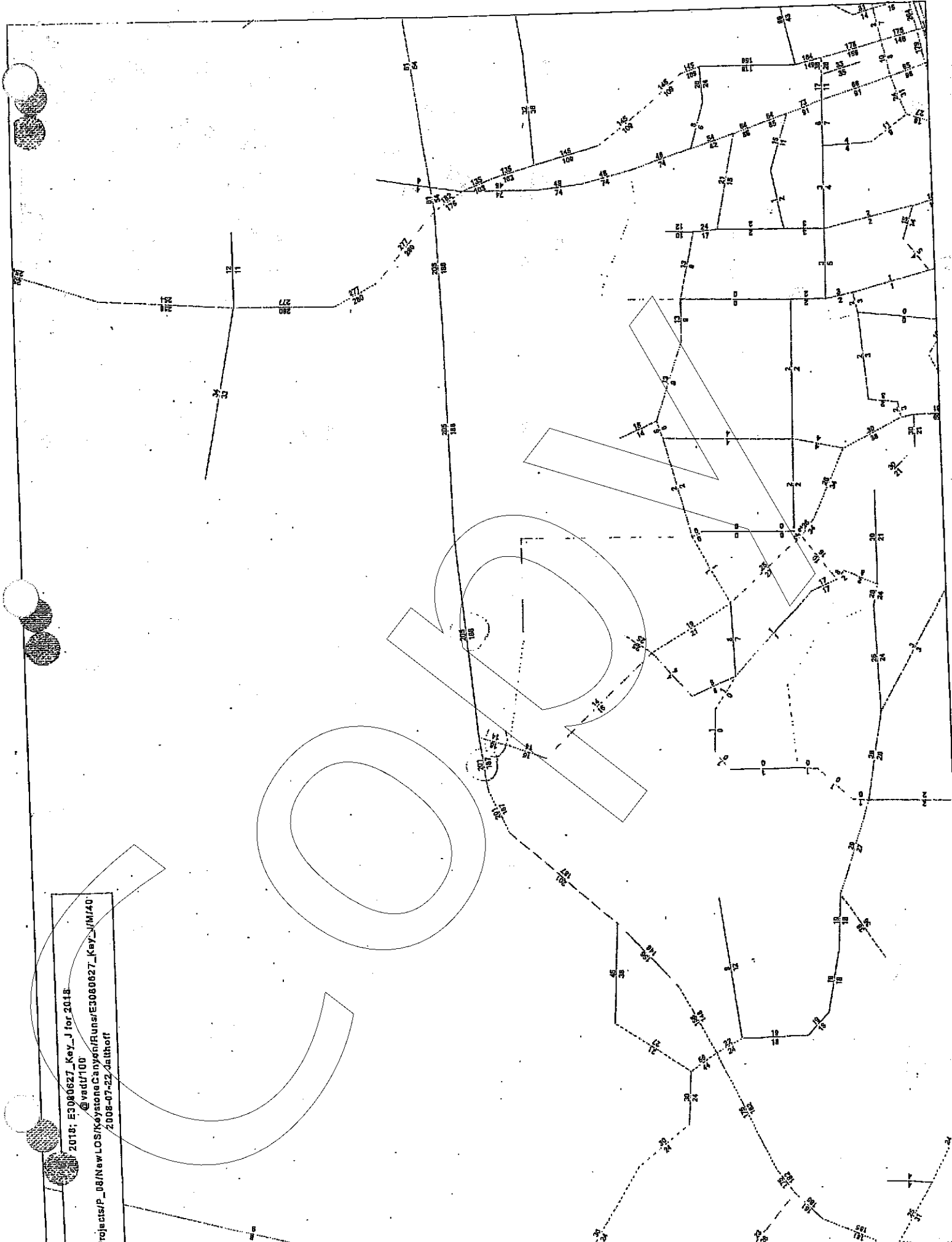
McCarren/Keystone  
 E3080627\_Key\_J for 2040  
 2040 ; E3080627\_Key\_J for 2040  
 Intersection\_AM (@pam.pl)

Intersection nodes 2337.PM		
From	To	Computed
1467	3122	54
1467	7110	61
3122	1467	88
3122	7110	2080
7110	1467	58
7110	3122	1929

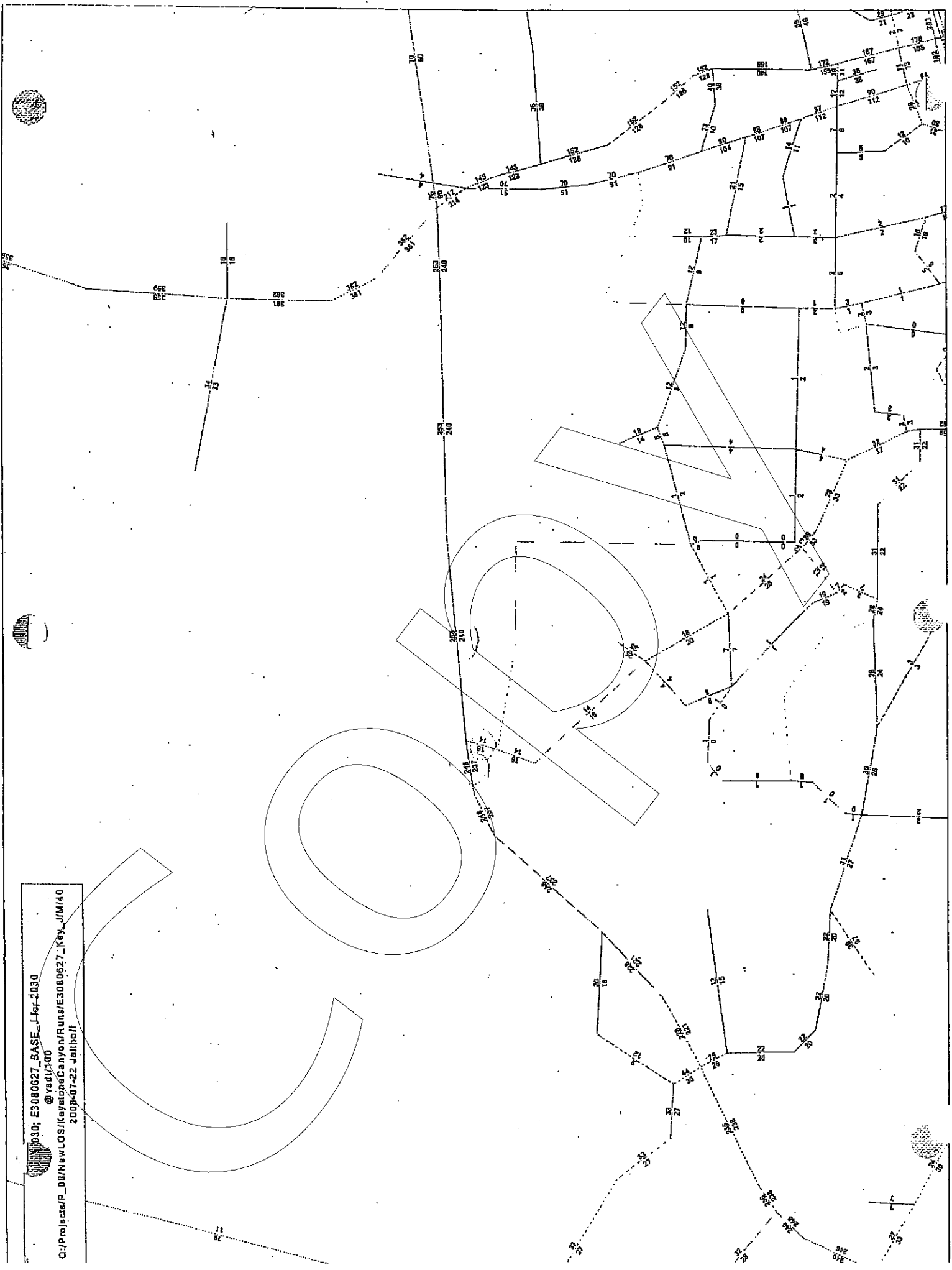


McCarraukoy@stano  
 E3080827\_Key\_J for 2040  
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 Intersection\_PM [ppmpk]

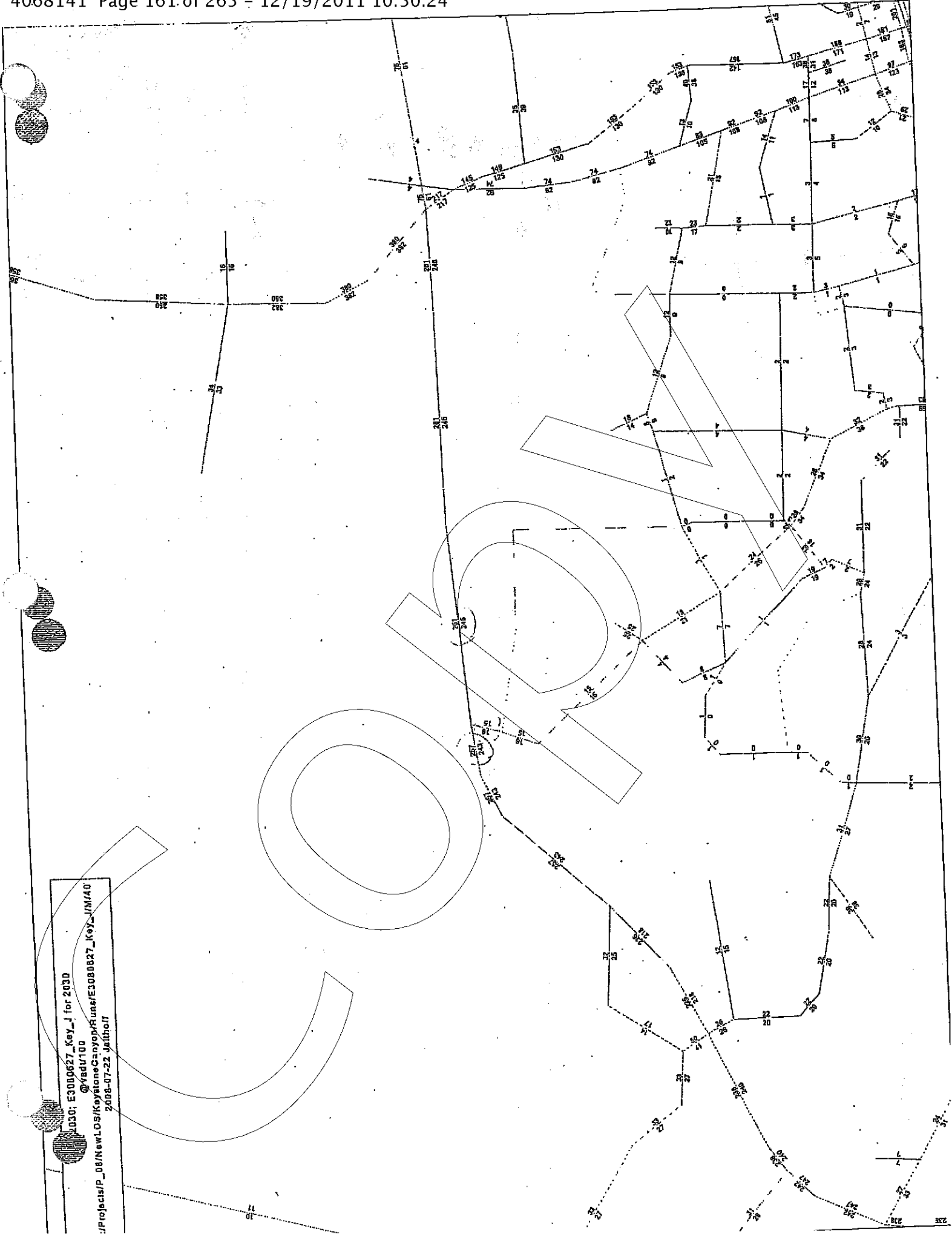




2018: E3080627\_Key\_J for 2018  
@ vadu100  
/Projects/P\_08/NewLOS/KeystoneCanyon/Runs/E3080627\_Key\_J/M140  
2008-07-22/dathoff

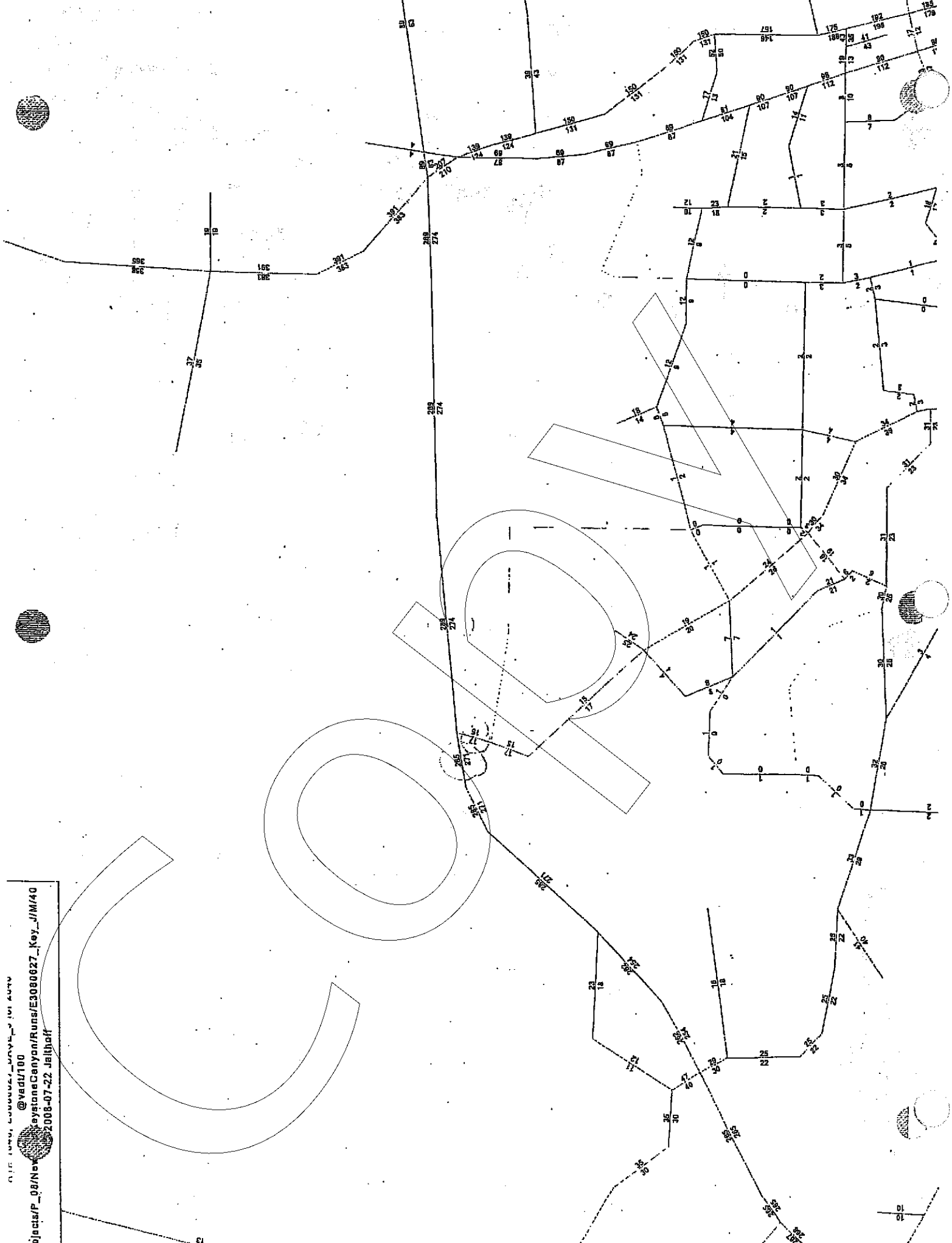


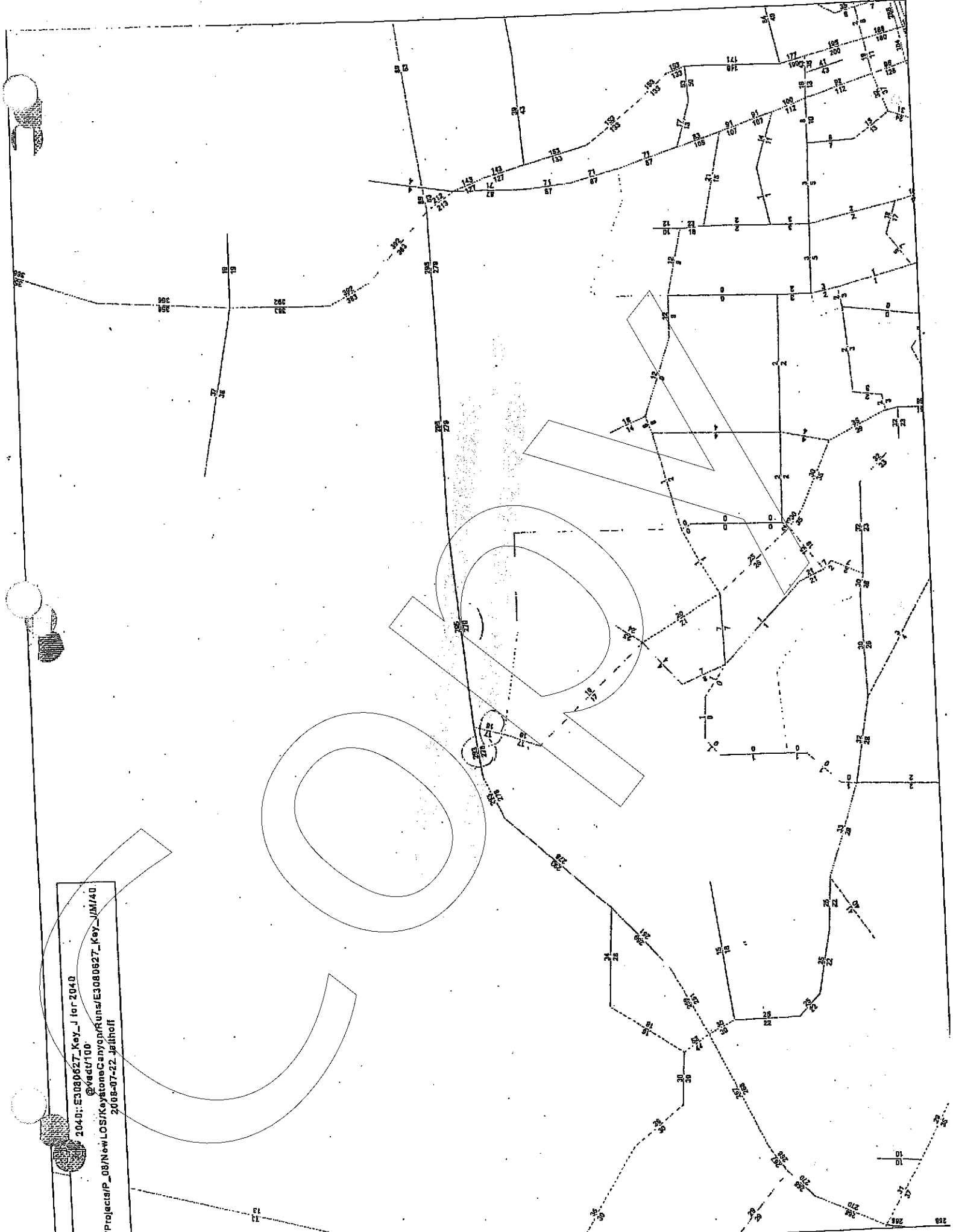
030; E3080627\_BASE\_1 for 2030  
@vadt180  
Q:\Projects\P\_08\NewLOS\Keys\cns\Canyon\Runs\E3080627\_Key\_JIM\40  
2009-07-22 Jaliloff



2030; E3080627\_Key\_1 for 2030  
@vadu100  
:/projects/P\_08/NewLOS/KeyStoneCanyon/Runs/E3080627\_Key\_1/JM/40  
2008-07-22 Jasthoff

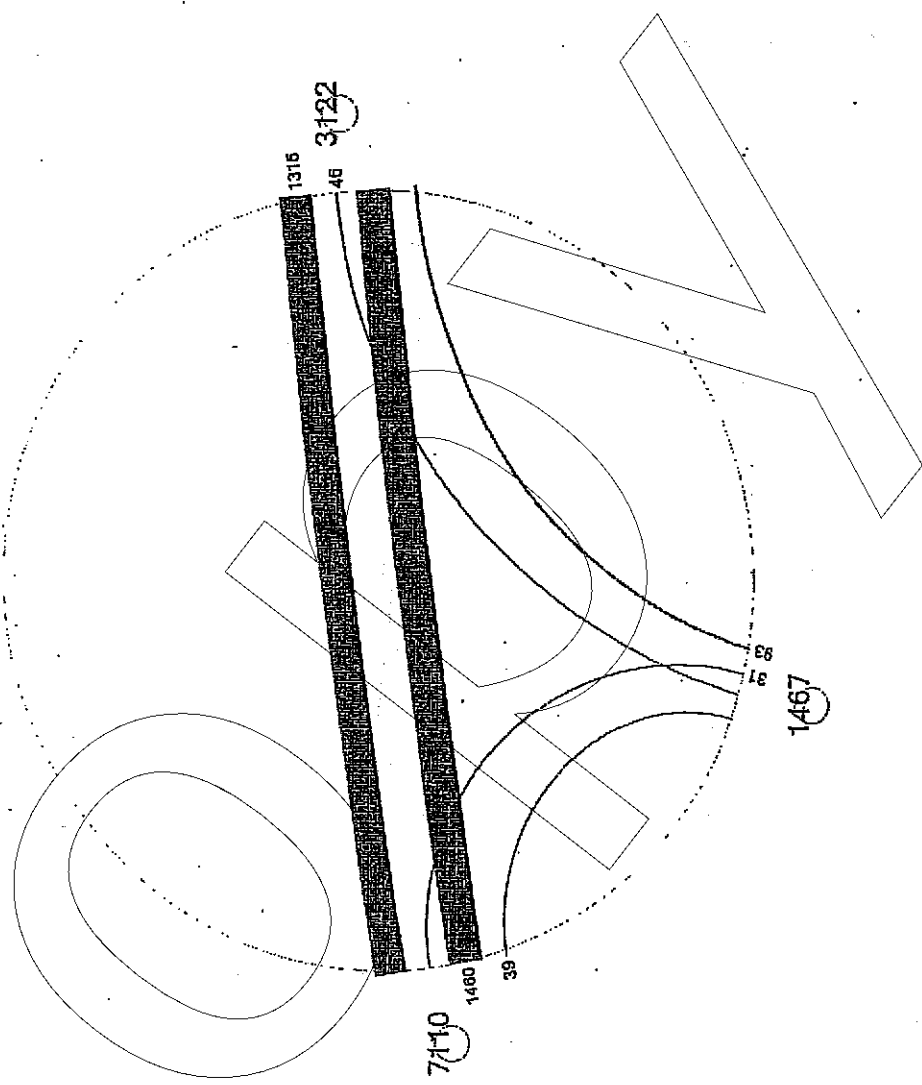
\\fs1\apps\lucy\maps\100\4068141\_08\No...  
@vadi100  
...aystoneCanyon/Runs/E3080627\_Key\_JIM/40  
...2008-07-22 Jalhoff



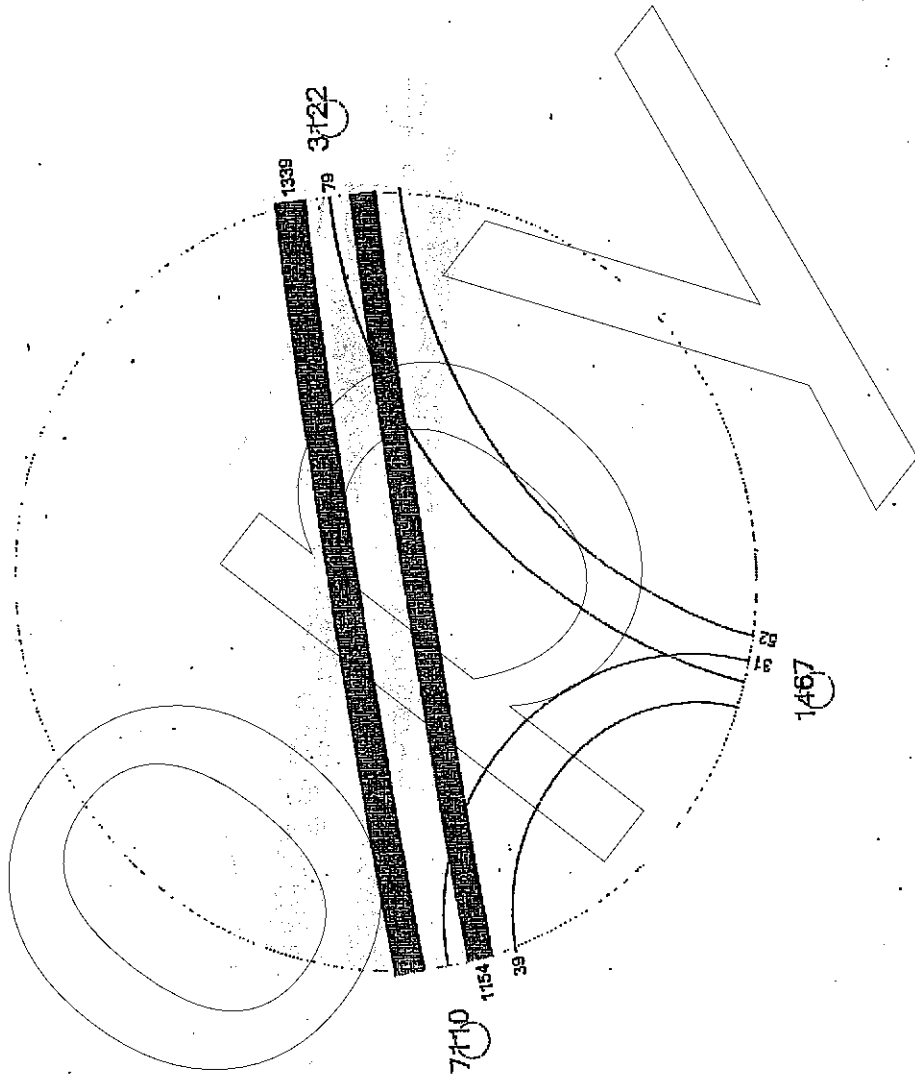
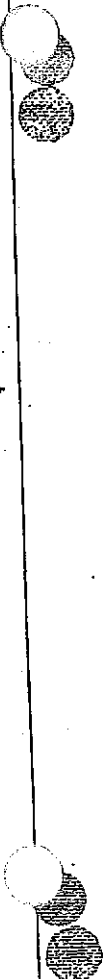


204.D: E3080627\_Key\_1 for 204D  
@VedU100  
:Project\IP\_08\New\LOS\KeyStoneCanyon\Runs\E3080627\_Key\_1\JM\40  
2008-07-22\_jalhoff

Intersection node 2337: AM		
From	To	Observed/ Computed
1467	3122	93
1467	7110	31
3122	1467	46
3122	7110	1315
7110	1467	39
7110	3122	1460



McCarran/Kyslyona  
 E3080627\_BASE\_J for 2018  
 1016 : E3080627\_BASE\_J for 2018  
 Intersection\_AM (@pam.pk)

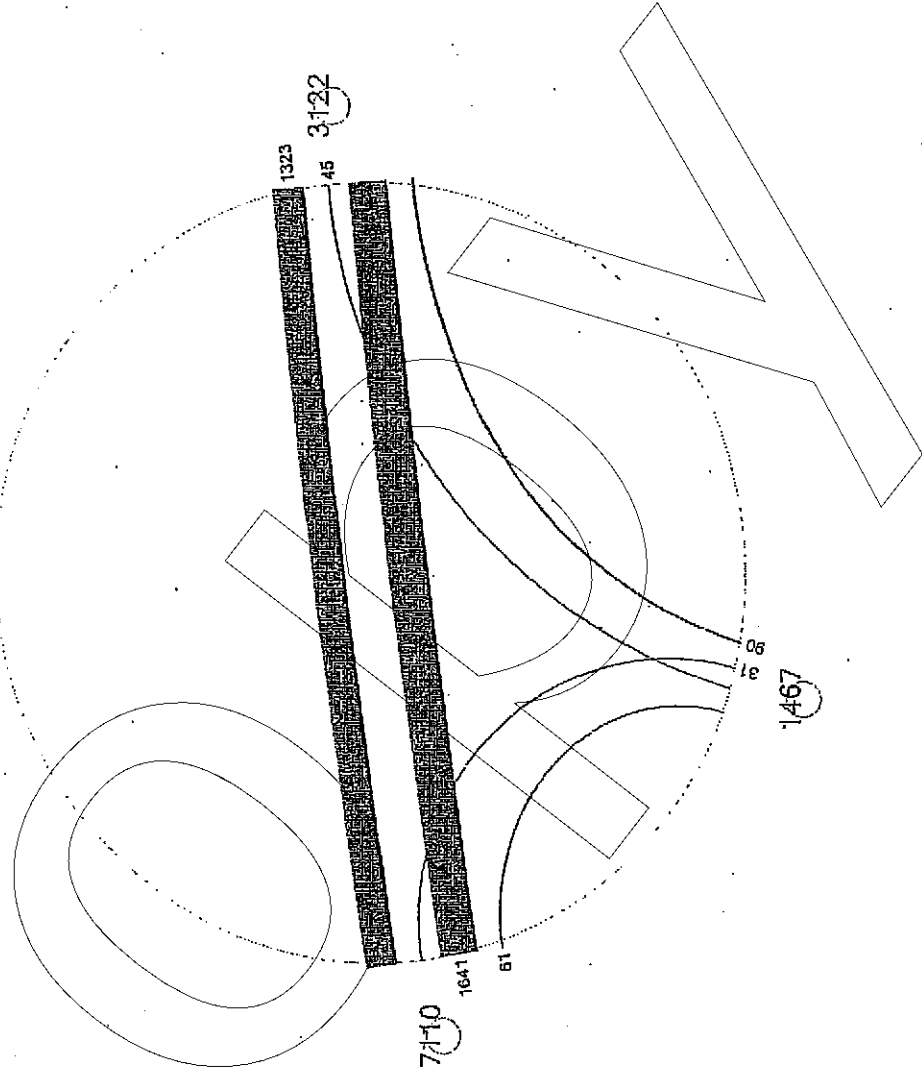


Intersection node 2337: PM

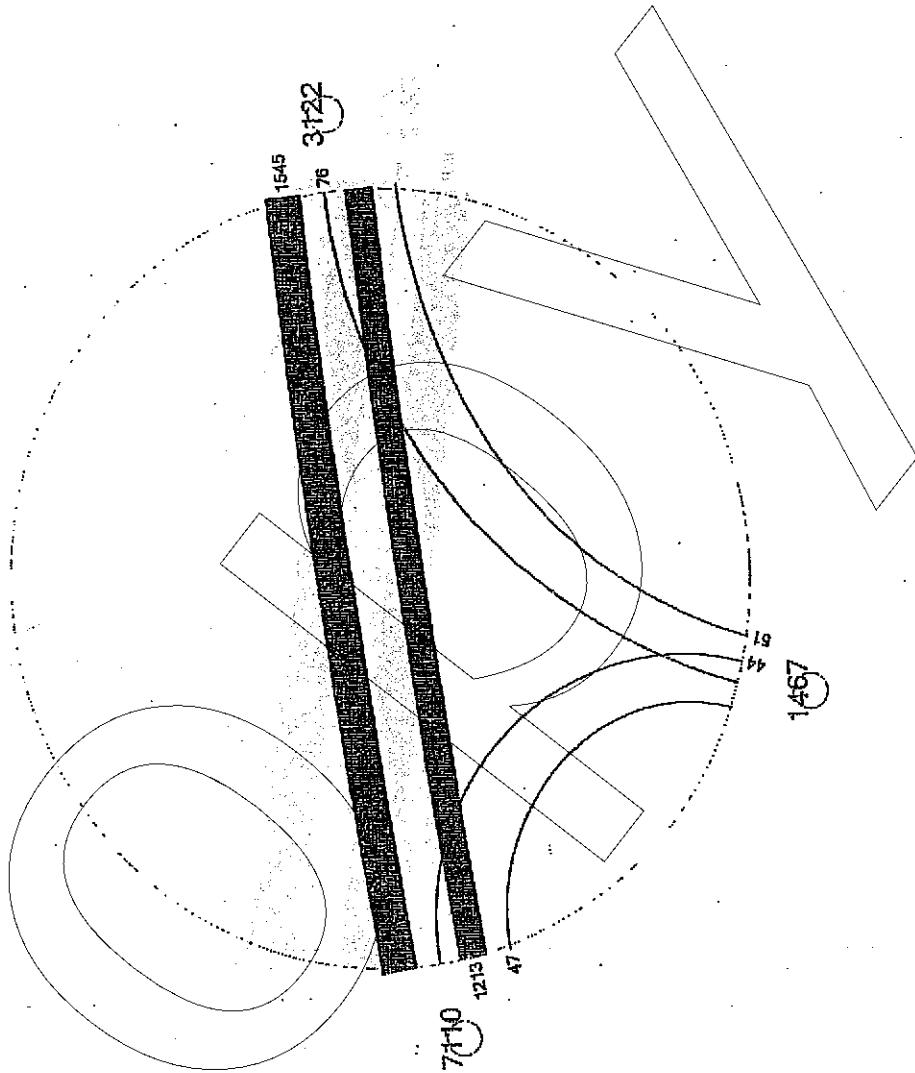
From	To	Observed	Computed
1467	3122	57	
1467	7110	31	
3122	1467	79	
3122	7110	1338	
7110	1467	39	
7110	3122	1154	

McCarroll/Keyelona  
 E3080627\_BASE\_J for 2018  
 1018 ; E3080627\_BASE\_J for 2018  
 Intersection\_PM (@ppm.pk)

Intersection node 2337: AM		
From	To	Observed / Computed
1467	3122	90 / 31
1467	7110	45 / 45
3122	7110	1323 / 61
7110	1467	1841 / 1841



McCarrauldKeystone  
 E3080627\_key\_J for 2018  
 2018; E3080627\_key\_J for 2018  
 Intersection\_AM (@panipk)



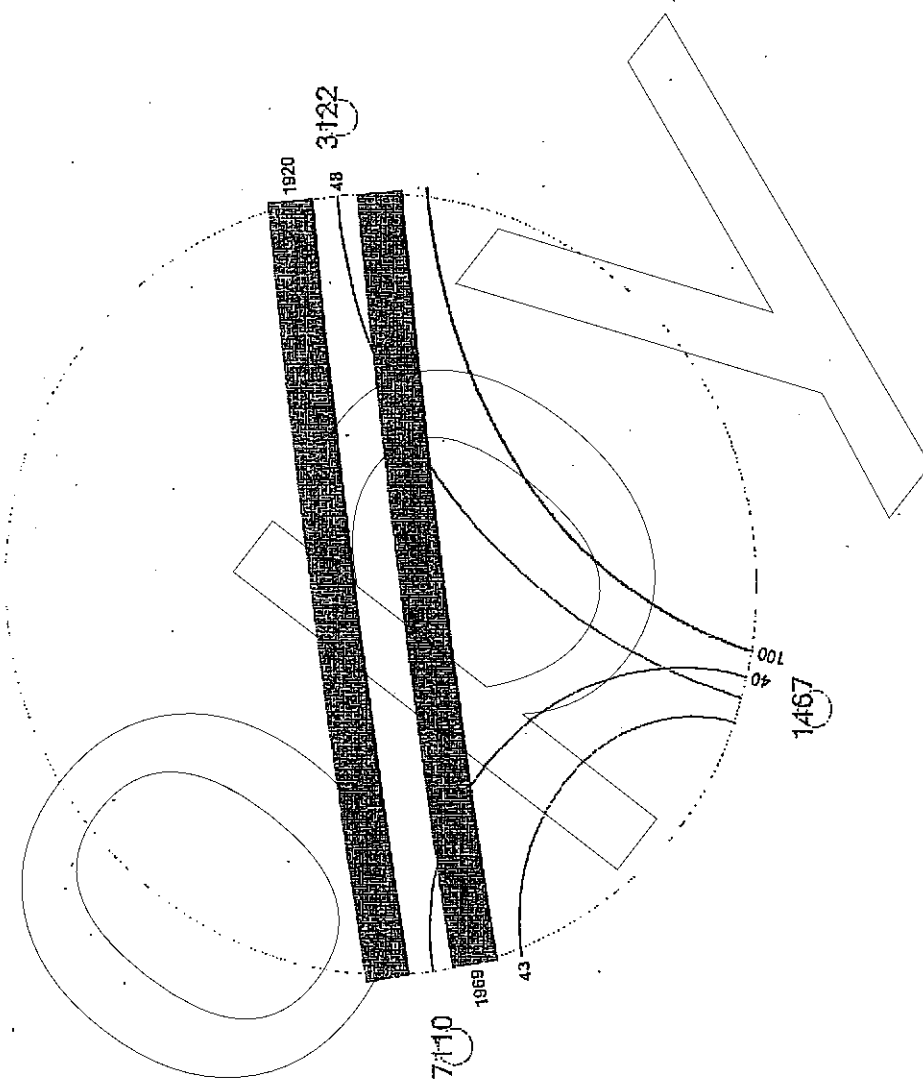
Intersection node: 2337: PM

From	To	Observed	Computed
1467	3122	51	
1467	7110	44	
3122	1467	76	
3122	7110	1545	
7110	1467	47	
7110	3122	1213	

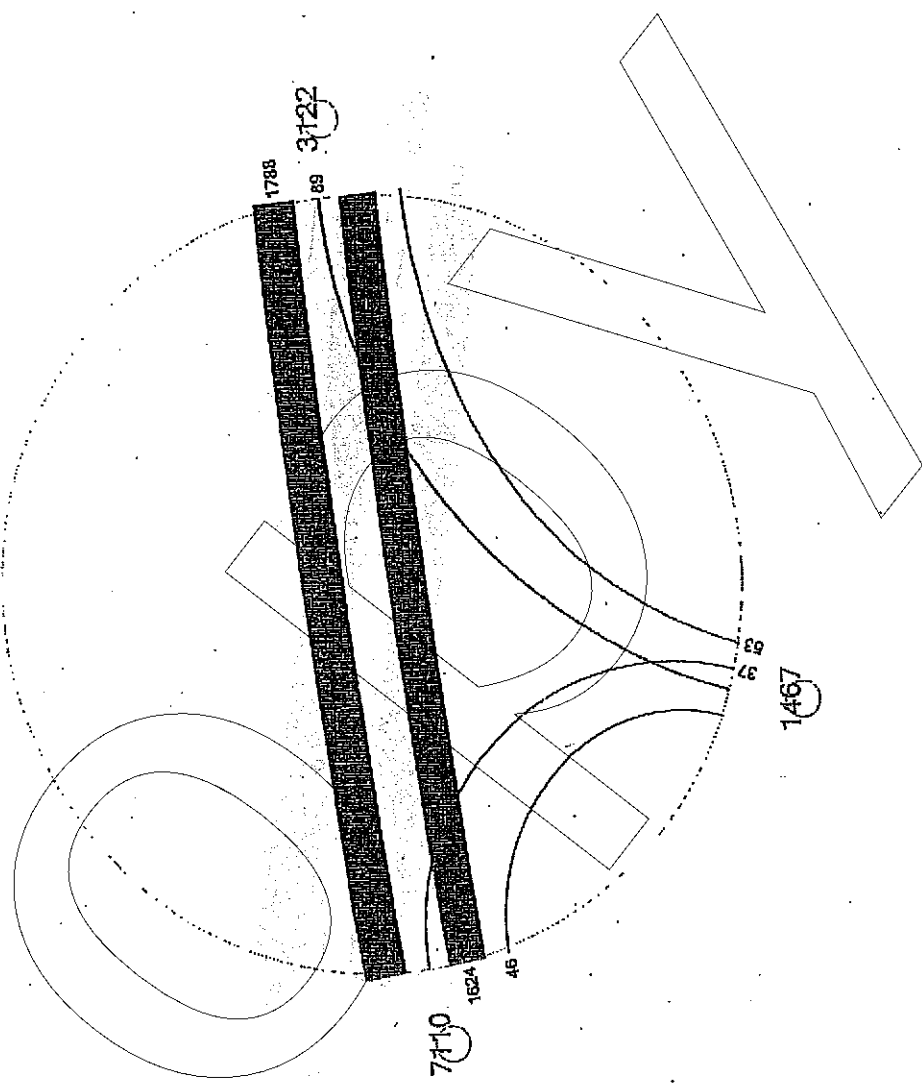
McCarranKeyStations  
 E3080627\_Key\_J for 2018  
 2018 : E3080627\_Key\_J for 2018  
 Intersection\_PM (@ppmpk)

Intersection node 2337: AM

From	To	Observed	Computed
1467	3122	100	
1467	7110	40	
3122	1467	48	
3122	7110	1920	
7110	1467	43	
7110	3122	1969	



McCarran/KeyStone  
 E:\000027\_BASE\_J for 2030  
 1030; E:\000027\_BASE\_J for 2030  
 Intersection\_AM (@pam.plc)

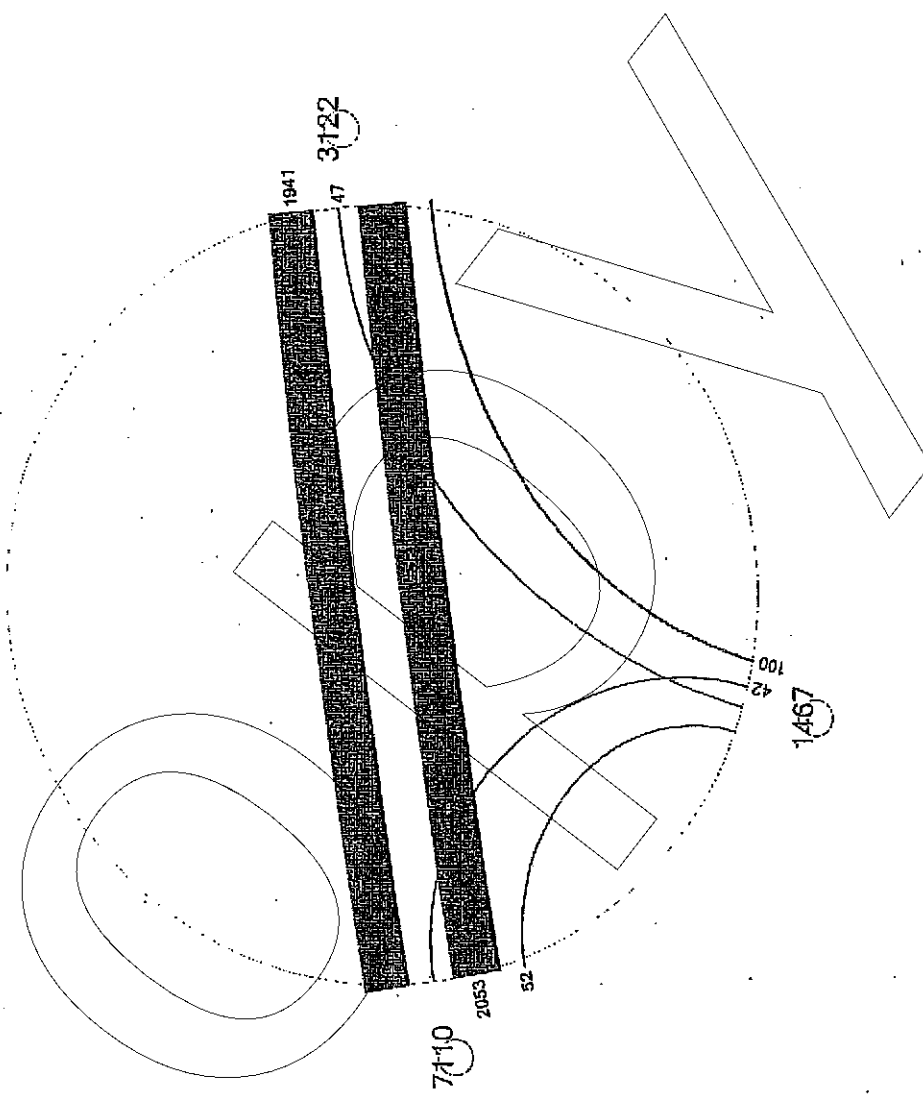


Intersection node 2337: PM

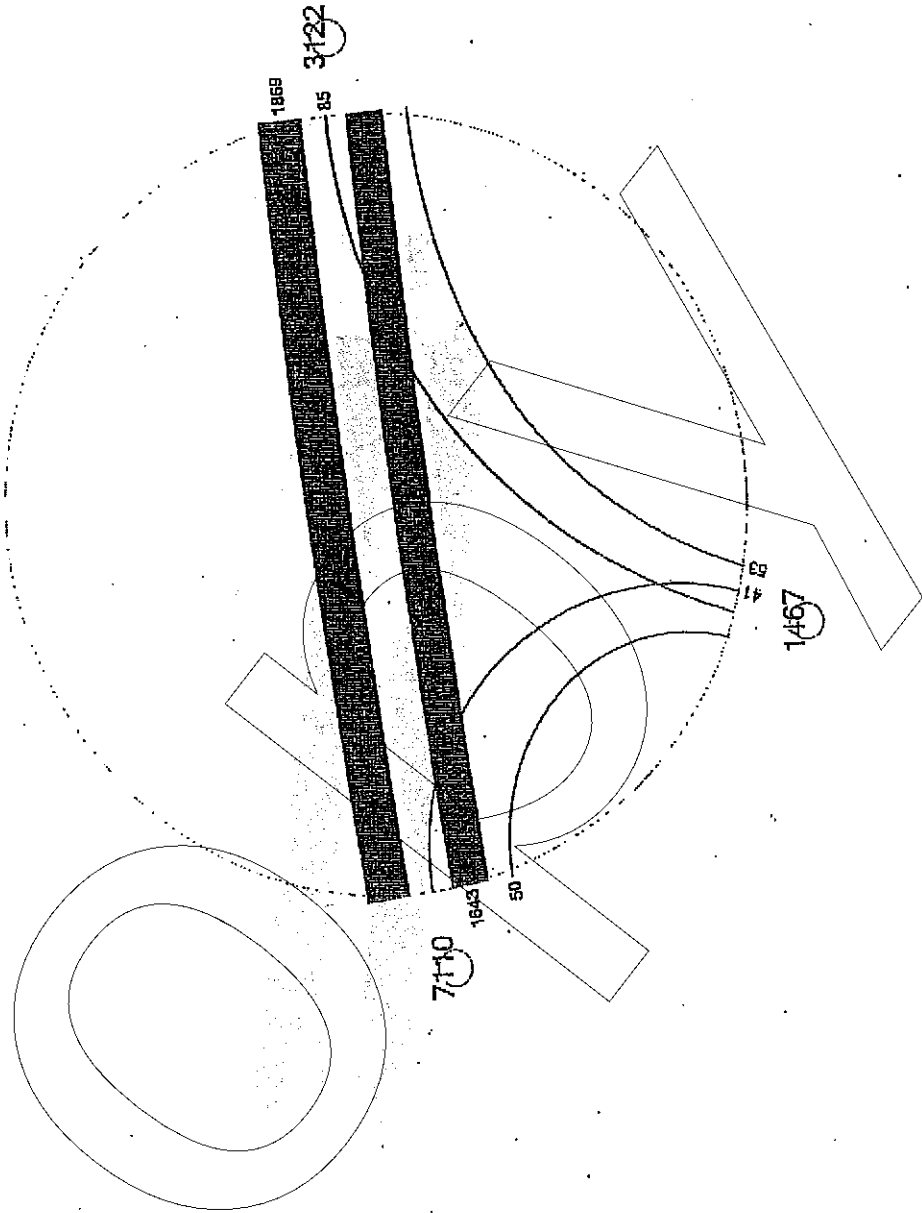
From	To	Observed	Computed
1467	3122	53	37
1467	7110	37	89
3122	1467	1788	
3122	7110	46	
7110	1467	46	
7110	3122	1624	

McCarran/Keystone  
 E:\3080627\_BASE\_J for 2030  
 1030 : E:\3080627\_BASE\_J for 2030  
 Intersection\_PM (@ppm.pk)

Intersection node 2337: AM		
From	To	Observed / Computed
1467	3122	100
1467	7110	42
3122	1467	47
3122	7110	1941
7110	1467	52
7110	3122	2053



McCarran/Keystone  
 E:\080827\_Key\_J for 2030  
 2030 : E:\080827\_Key\_J for 2030  
 Intersection\_AM [pamplk]

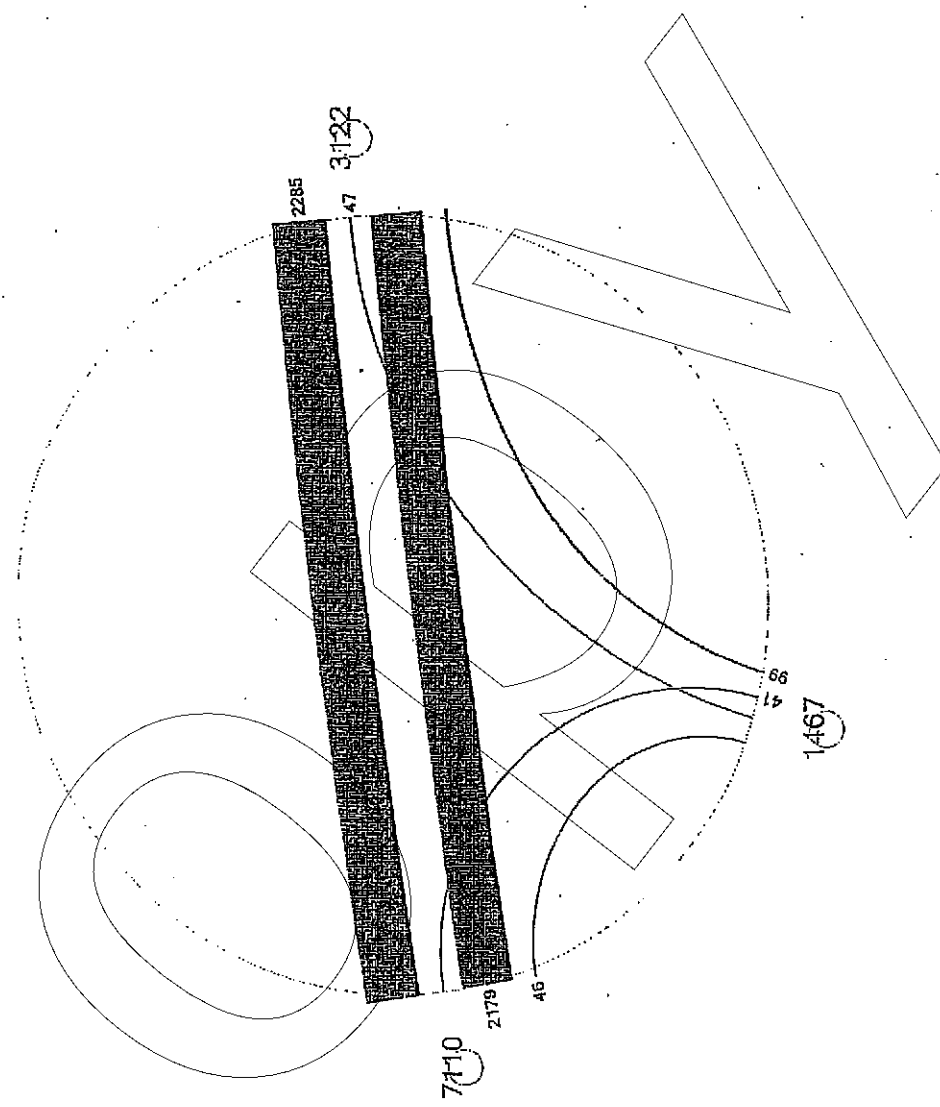


Intersection node: 2337: PM			
From	To	Observed	Computed
1467	3122	53	
1467	7110	41	
3122	1467	85	
3122	7110	1869	
7110	1467	50	
7110	3122	1843	

McCarren/KeyStone  
 E:\200827\_Key\_J for 2030  
 2030; E:\200827\_Key\_J for 2030  
 intersection\_fm @ppmpk

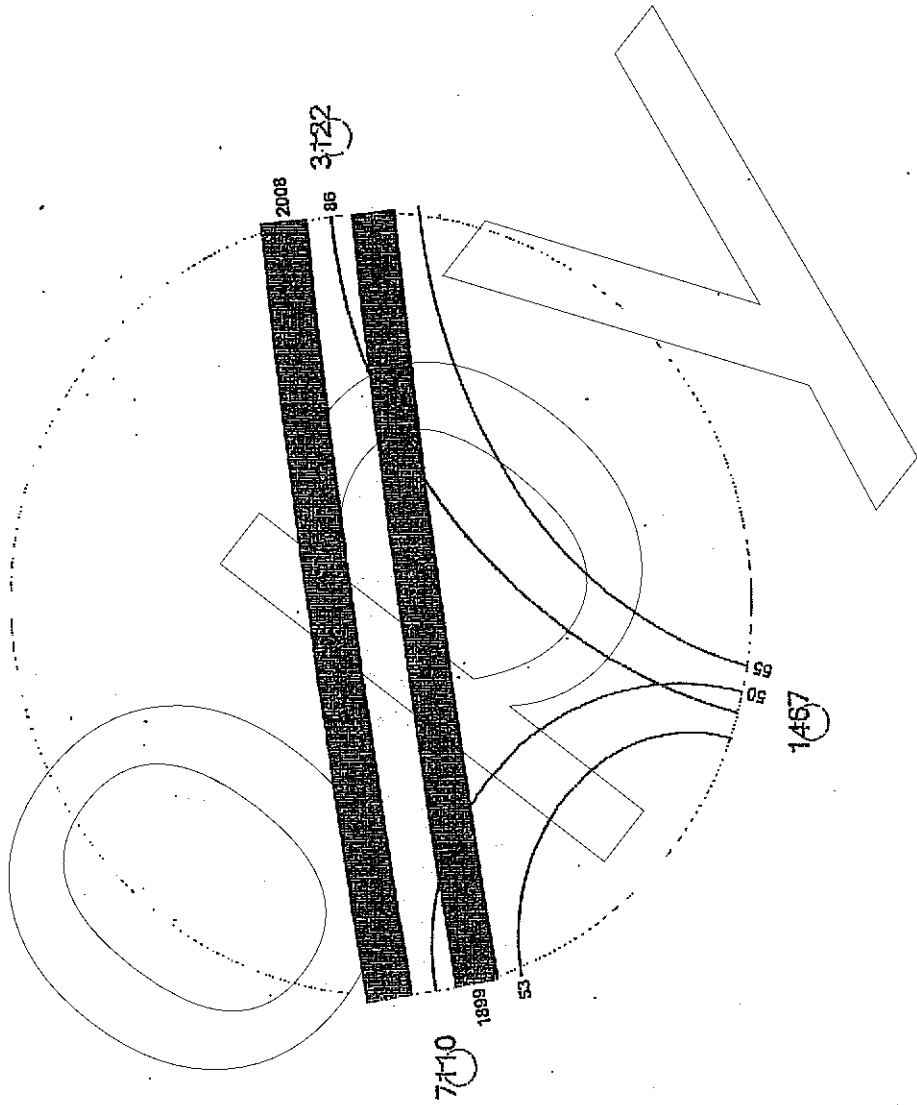
Intersection node 2337: AM

From	To	Observed	Computed
1467	3122	:	99
1467	7110	:	41
3122	1467	:	47
3122	7110	:	2285
7110	1467	:	46
7110	3122	:	2179



McCarren/Keystone  
 E3080627\_BASE\_J for 2040  
 1040 ; E3080627\_BASE\_J for 2040  
 Intersection\_AM (@pam.pk)

Intersection node 2337: PM		
From	To	Observed Computed
1467	3122	55
1467	7110	50
3122	1467	86
3122	7110	2008
7110	1467	53
7110	3122	1889



McCarran/Keystone  
 E3080627\_BASE\_J for 2040  
 1040; E3080627\_BASE\_J for 2040  
 intersection\_PM [ppm.pk]

COPY

# APPENDIX D

COPY

# MASTER HYDROLOGY REPORT

FOR

## *KEYSTONE CANYON*

prepared for

Bridgeport Group  
5845 Jean Road  
Lake Oswego, OR 97035

prepared by

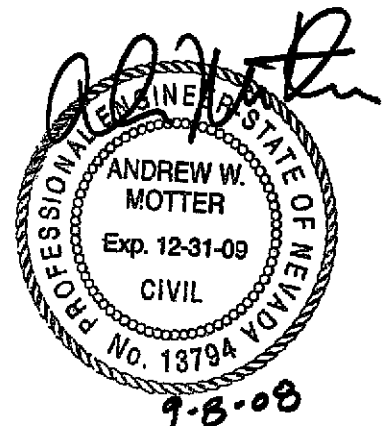


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September 2008



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**APPENDIX B (CALCULATIONS AND SUPPORTING DATA)**  
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## INTRODUCTION

The following report represents the preliminary hydrology analysis for the proposed Keystone Canyon development. Keystone Canyon Development is located north of McCarran Blvd and west of Leadership Parkway in Reno, Nevada. The enclosed vicinity map is shown as Figure 1, in this report. This report analyzes the impact of the proposed site and compares it to the existing state of the subject area. The property surrounding this project is as follows:

South:	McCarran blvd, and Sky Country Estates
East:	Leadership Parkway, Washoe County (082-020-17)
North:	BLM USA (082-631-01), and Washoe County (082-631-13)
West:	BLM USA (082-631-01)

Keystone Canyon consists of approximately 105 acres and is located within the southern half of Section 13, Township 20 North, and Range 19 East, MDB&M, Washoe County, Nevada. The site has some native vegetation and is partially developed. Site topography consists of slopes generally from north to south, ranging from 5% to 30%. Rainfall runoff from the site flows in a southerly direction towards McCarran Blvd. The flows eventually discharge into Keystone Canyon, which is a drainage that conveys flows through the property.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel Number 32031C2986E the subject parcel resides in Zone X, effective date September 30, 1994. Zone X is an area determined to be outside the 500-year floodplain. Reference FEMA panel in Appendix A.

The purpose of this report is to summarize the proposed on-site and off-site hydrology in accordance with the City of Reno Department of Public Works Design Manual (CRDPWDM) and the Washoe County Hydrologic Criteria and Drainage Design Manual (WCHCDDM), and to discuss the impacts of the development on the existing drainage and detention/retention facilities.

## METHODOLOGY

### SCS Curve Number

*Visual HEC-1* by Haestad Methods was used to model the off- and onsite hydrologic basins that contribute to the ephemeral drainage that is adjacent to the proposed site. The method used to determine loss rate and rainfall runoff method within the model was the SCS Curve Number Method. The SCS Curve Number Method uses the SCS runoff curve number (CN) loss rate, related to potential abstraction.

$$CN = \frac{1000}{S + 10} \text{ where; } S(\text{in.}) = \text{initial abstraction}$$

The precipitation runoff is determined using the SCS Unit Hydrograph method for runoff transformation. SCS lag times were determined by determining the Time of Concentration ( $T_c$ ). SCS lag times were determined by:

$$T_{Log} = 22.1K_n(L(L_c/S^{0.5}))^{0.33}$$

Where:

$K_n$  = Roughness Factor (determined from Table 703 in the WCHCDDM)

$L$  = Length of the longest watercourse (ft.)

$L_c$  = Length along the longest watercourse upstream to centroid of watershed (ft.)

$S$  = Slope of the longest watercourse (ft./mile)

Composite runoff curve numbers are based on hydrologic soil groups, where group A is sandy and well drained, group B is a sandy loam, group C is a clay loam or shallow sandy loam, and group D has a poorly drained, heavy clay that swells when wet. The composite curve numbers were calculated using the data provided by the National Resource Conservation Service (NRCS) water features soil data (<http://websoilsurvey.nrcs.usda.gov/app/>). Refer to Appendix A for NRCS soil data.

The rainfall characteristics were modeled by the defined balance method using the NOAA database ([http://dipper.nws.noaa.gov/hdsc/pfds/sa/nv\\_pfds.html](http://dipper.nws.noaa.gov/hdsc/pfds/sa/nv_pfds.html)) to determine site specific depth of precipitation for the subject property.

### Peak Flow Detention Facility

Upon the determination of requirement any flow detention will be analyzed using by *VisualHEC* and/or *PondPACK* by Haestad Methods. The detention ponds will have a minimum of one foot of freeboard, which is in accordance with the City of Reno Department of Public Works Design Manual (CRDPWDM) and the Washoe County Hydrologic Criteria and Drainage Design Manual (WCHCDDM), and have adequate capacity to detain the 100-year 24-hour peak flows.

*CulvertMaster for Windows* by Haestad Methods, the WCHCDDM and the CRDPWDM will be used to analyze any of the future culverts that may be required to convey the 100-year peak flows under existing and future roads. In addition *CulvertMaster* will be used to model the discharge from any future detention facilities.

### Riprap Sizing for Outlet Structures

The procedure for determining the size of rock needed for an outlet basin can be based on mean channel velocity, longitudinal channel slope, and specific gravity of rock. The shear stress exerted by the flow on the channel perimeter, where shear stress is governed by the size and weight of the individual rock, the shape of the rock, the mean channel velocity, longitudinal slope, current direction, and eddy action. The rock used in the outlet basin must be large enough in both size and weight to resist the force of the water. If the rock is not large enough to withstand the shear stress exerted by the flow, it will be washed downstream.

The following method will be used to determine the appropriate size rock for the outlet basin within the project:

$$d_{50} = \frac{0.05V^2 S^{0.34}}{(S_s - 1)^{1.332}}$$

where

$d_{50}$  = Rock size for which 50% of riprap by weight is smaller (feet)

$V$  = Mean channel velocity (fps)

$S$  = Longitudinal channel slope (feet/feet)

$S_s$  = Specific gravity of rock (minimum  $S_s = 2.50$ ) (dimensionless)

### EXISTING HYDROLOGY

In the existing conditions, a significant ephemeral drainage runs through the subject property. This drainage discharges into existing culverts that run under McCarran Boulevard and discharge into the existing detention facility. The flows are conveyed through existing storm drain facilities and eventually the Truckee River southeast of the site.

A HEC-1 model (Appendix B) was used to analyze the on- and offsite flows in the existing condition to determine peak runoff and combined with the existing FEMA Flood Insurance Panel 32031C2986E dated September 30, 1994 for Washoe County (Appendix A). Reference Appendix A for the peak rainfall depths and the calculated SCS Lag time that were used to determine the 5-year, and 100-year peak flows. Weighted CN values were calculated based on soil types and were used to determine the 5-year, and 100-year peak flows. In addition, NOAA online Point Precipitation Data Server referencing the "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4 (Appendix A). Reference Table 1 for the 5-year, and 100-year peak flows and the associated design parameters.

**Table 1 - HEC-1 Model Existing Conditions**

Basin	Area (Sq. Mile)	Weighted CN	SCS Lag (hr.)	5-Year Peak Flows (cfs)	100-Year Peak Flows (cfs)
Basin #1	0.445	73.9	0.70	26	157
Basin #2	0.316	75.0	0.72	21	115
Total at CP1	-----	-----	-----	48	272
Basin #3	1.728	75.7	1.25	87	418
Total at CP2	-----	-----	-----	120	611

### PROPOSED HYDROLOGY

In the proposed conditions, the onsite flows will be conveyed through culverts and the proposed storm drain that will discharge into the existing ephemeral drainage located adjacent to the subject property.

A HEC-1 model (Appendix C) was used to analyze the on- and offsite flows in the proposed condition to determine peak runoff. In comparison of existing and proposed peak flows, the changes in the parameters

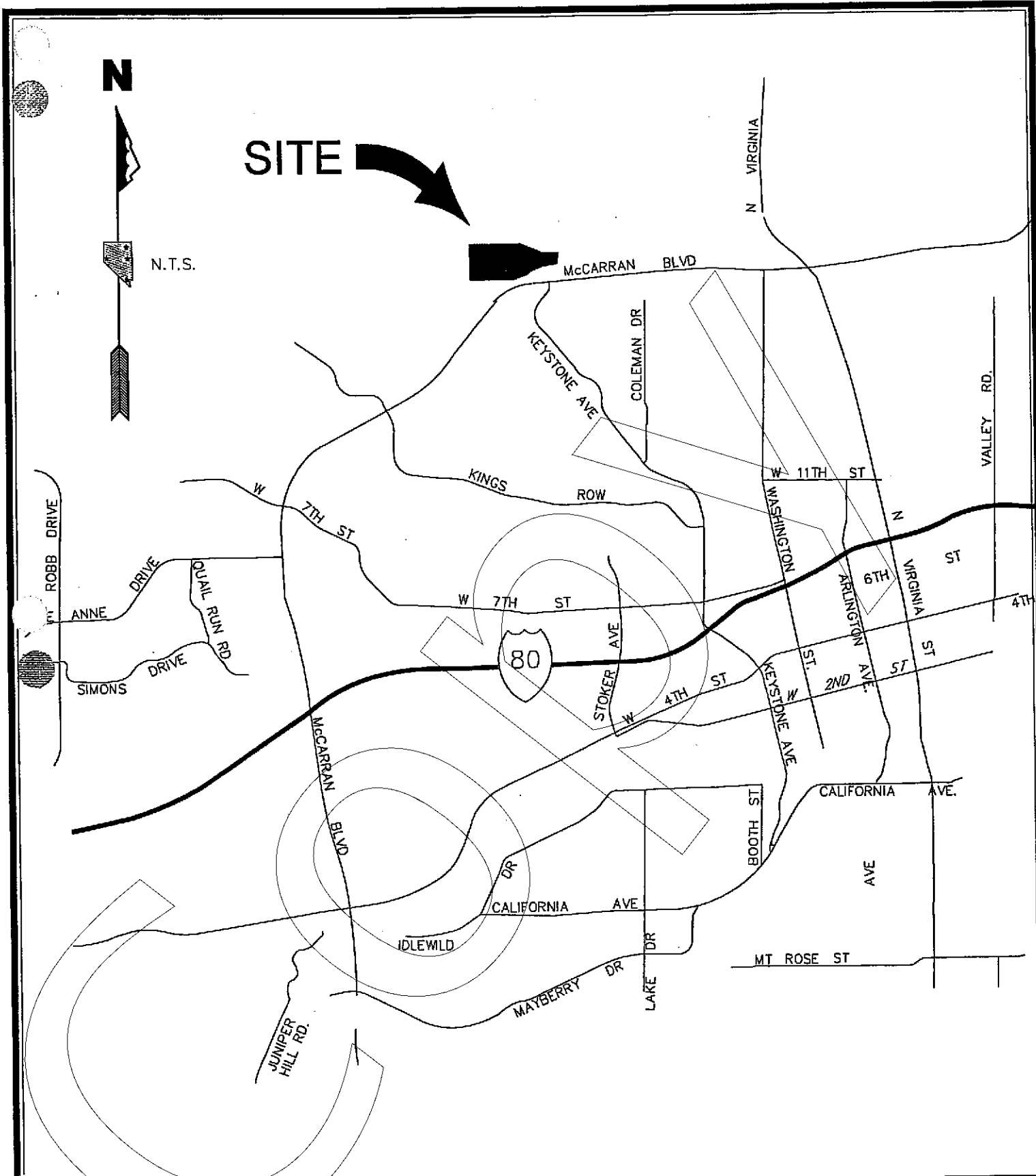
occurred in hydrographic basins #1, #2 and #3. In Basin #1 the weighted curve number increased from 73.9 to 74.7 due to the proposed development, and the SCS lag time remained from 0.70 hours. In Basin #2 the weighted curve number increased from 75.0 to 76.0 due to the proposed development, and the SCS lag time decreased from 0.72 to 0.71 hours. In Basin #3 the weighted curve number increased from 75.7 to 75.9 due to the proposed development, and the SCS lag time decreased from 1.25 to 1.24 hours. As seen in Table #2, according to the HEC-1 model the proposed development increased the 5-year, and 100-year peak flow events 6 cfs, and 19 cfs, respectively.

**Table 2 – HEC-1 Model Proposed Conditions**

Basin	Area (Sq. Mile)	Weighted CN	SCS Lag (hr.)	5-Year Peak Flows (cfs)	100-Year Peak Flows (cfs)
Basin #1	0.445	74.7	0.70	29	163
Basin #2	0.316	76.0	0.71	24	122
Total at CP1	-----	-----	-----	53	286
Basin #3	1.728	75.9	1.24	89	425
Total at CP2	-----	-----	-----	126	630

## CONCLUSION

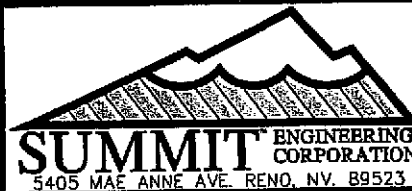
The existing and proposed site hydrologic conditions were determined in accordance with WCHCDDM and CRDPWDM. Supporting documentation is included with this Hydrology Report. The SCS Curve Number method was modeled in HEC-1 to determine both the existing and proposed peak flows. The proposed condition HEC-1 analysis showed an increase in 5-year, and 100-year peak flows of 6 cfs, 19 cfs respectively over that of the existing condition HEC-1 analysis. The proposed detention facility will be designed in accordance with WCHCDDM and detain the 100-year 24-hour peak flow event to insure that the proposed development is within the associated guidelines.



**KEYSTONE CANYON  
TANAMERA  
VICINITY MAP**

N.T.S  
FIGURE #1

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OF  
1

**APPENDIX A**

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### POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14



Nevada 39.557401 N 119.854583 W 5055 feet  
 from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4  
 G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley  
 NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Thu Jun 5 2008

Confidence Limits	Seasonality	Location Maps	Other Info.	GIS data	Maps	Help	Docs	U.S. Map
-------------------	-------------	---------------	-------------	----------	------	------	------	----------

Precipitation Frequency Estimates (inches)																		
ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.10	0.16	0.19	0.26	0.32	0.43	0.52	0.76	1.04	1.36	1.68	2.01	2.39	2.71	3.49	4.16	5.04	5.79
2	0.13	0.19	0.24	0.32	0.40	0.53	0.65	0.95	1.30	1.71	2.12	2.56	3.06	3.49	4.47	5.35	6.49	7.49
5	0.17	0.26	0.32	0.43	0.53	0.68	0.81	1.17	1.63	2.16	2.72	3.35	4.06	4.64	5.92	7.06	8.56	9.87
10	0.21	0.32	0.40	0.53	0.66	0.81	0.93	1.33	1.89	2.53	3.21	4.01	4.87	5.55	7.04	8.39	10.11	11.59
25	0.28	0.42	0.52	0.70	0.87	1.00	1.12	1.55	2.23	3.05	3.91	4.96	6.02	6.83	8.57	10.20	12.18	13.79
50	0.34	0.52	0.64	0.87	1.07	1.18	1.27	1.71	2.48	3.46	4.47	5.74	6.96	7.85	9.76	11.61	13.76	15.42
100	0.42	0.64	0.79	1.06	1.31	1.38	1.47	1.87	2.75	3.89	5.07	6.58	7.97	8.94	11.01	13.06	15.37	17.03
200	0.51	0.78	0.96	1.30	1.60	1.64	1.73	2.06	3.01	4.33	5.71	7.49	9.04	10.07	12.29	14.56	16.98	18.60
500	0.66	1.01	1.25	1.69	2.09	2.12	2.19	2.42	3.35	4.95	6.61	8.80	10.57	11.65	14.05	16.60	19.14	20.63
1000	0.81	1.23	1.52	2.05	2.53	2.60	2.62	2.80	3.64	5.44	7.33	9.89	11.82	12.93	15.42	18.20	20.78	22.11

\* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)																		
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.12	0.18	0.22	0.30	0.37	0.49	0.59	0.85	1.16	1.53	1.91	2.29	2.76	3.13	4.00	4.79	5.69	6.56
2	0.15	0.23	0.28	0.38	0.47	0.61	0.73	1.06	1.45	1.92	2.40	2.91	3.54	4.02	5.14	6.17	7.33	8.48
5	0.20	0.30	0.38	0.51	0.63	0.78	0.91	1.30	1.82	2.42	3.08	3.81	4.69	5.35	6.79	8.13	9.65	11.18
10	0.25	0.38	0.47	0.63	0.78	0.93	1.06	1.49	2.11	2.84	3.64	4.56	5.63	6.40	8.08	9.65	11.41	13.11
25	0.33	0.50	0.62	0.84	1.04	1.16	1.27	1.74	2.51	3.42	4.45	5.65	6.98	7.89	9.85	11.75	13.79	15.65
50	0.41	0.63	0.78	1.05	1.29	1.38	1.47	1.94	2.82	3.88	5.11	6.56	8.10	9.10	11.26	13.41	15.62	17.56
100	0.51	0.78	0.96	1.30	1.60	1.65	1.71	2.14	3.16	4.39	5.84	7.57	9.33	10.40	12.78	15.18	17.51	19.44
200	0.64	0.97	1.20	1.62	2.00	2.02	2.05	2.40	3.50	4.92	6.62	8.67	10.66	11.80	14.36	17.01	19.46	21.31
500	0.85	1.30	1.61	2.17	2.69	2.71	2.74	2.86	3.98	5.67	7.77	10.32	12.62	13.81	16.61	19.57	22.13	23.82
1000	1.06	1.61	2.00	2.69	3.33	3.37	3.40	3.43	4.39	6.29	8.74	11.72	14.25	15.47	18.41	21.66	24.23	25.69

\* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.

\*\* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.

Please refer to the documentation for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)																		
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.09	0.13	0.16	0.22	0.27	0.38	0.47	0.69	0.94	1.23	1.49	1.79	2.09	2.38	3.07	3.66	4.45	5.08
2	0.11	0.17	0.20	0.28	0.34	0.47	0.59	0.86	1.18	1.54	1.88	2.27	2.67	3.06	3.94	4.71	5.72	6.56
5	0.14	0.22	0.27	0.37	0.46	0.60	0.72	1.05	1.47	1.94	2.41	2.96	3.54	4.05	5.20	6.20	7.53	8.64
10	0.18	0.27	0.34	0.45	0.56	0.70	0.83	1.19	1.69	2.27	2.83	3.53	4.24	4.84	6.17	7.34	8.87	10.12

25	0.23	0.35	0.43	0.58	0.72	0.85	0.98	1.37	1.96	2.71	3.42	4.33	5.19	5.90	7.46	8.87	10.63	12.01
50	0.27	0.42	0.52	0.69	0.86	0.97	1.10	1.49	2.16	3.05	3.89	4.96	5.95	6.74	8.44	10.02	11.96	13.35
100	0.32	0.49	0.61	0.82	1.02	1.11	1.24	1.61	2.36	3.40	4.36	5.62	6.74	7.60	9.43	11.19	13.25	14.65
	0.38	0.58	0.71	0.96	1.19	1.28	1.42	1.75	2.53	3.75	4.85	6.31	7.55	8.46	10.41	12.36	14.53	15.88
500	0.46	0.70	0.87	1.18	1.46	1.58	1.75	2.00	2.75	4.22	5.50	7.25	8.66	9.61	11.71	13.90	16.17	17.47
1000	0.54	0.82	1.01	1.36	1.69	1.85	2.04	2.28	2.92	4.58	6.00	8.00	9.53	10.52	12.70	15.06	17.37	18.57

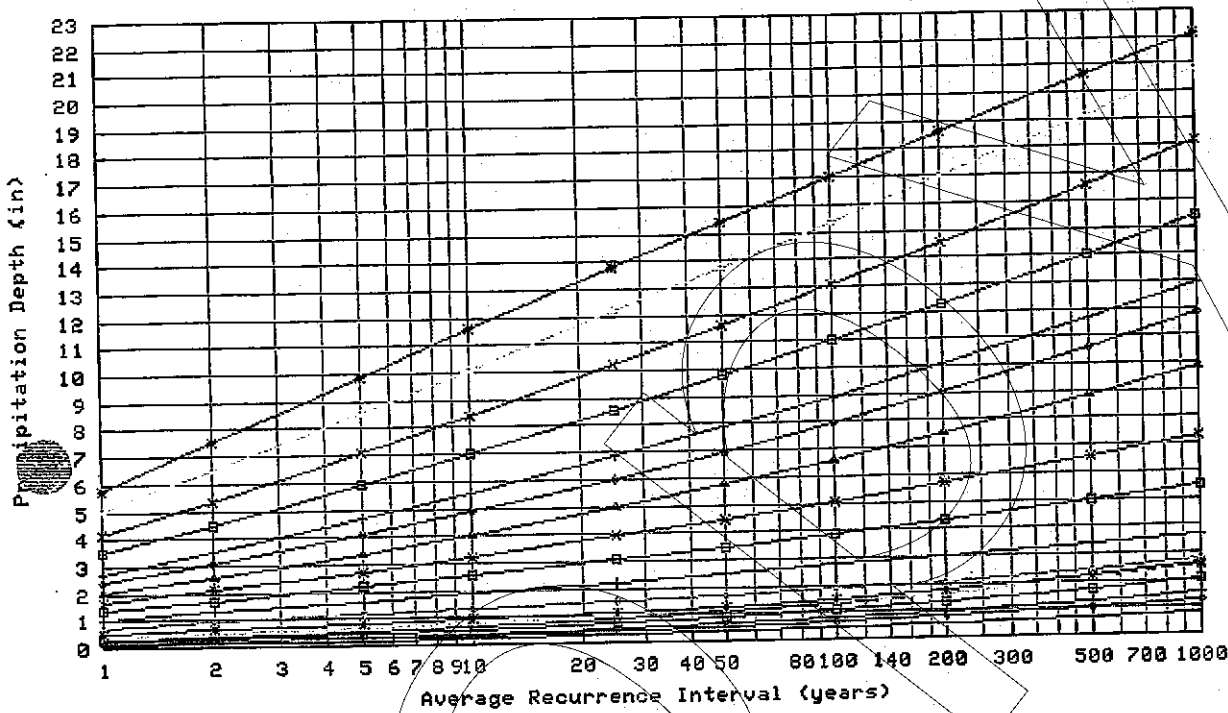
\* The lower bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are less than.

\*\* These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval.

Please refer to the [documentation](#) for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables

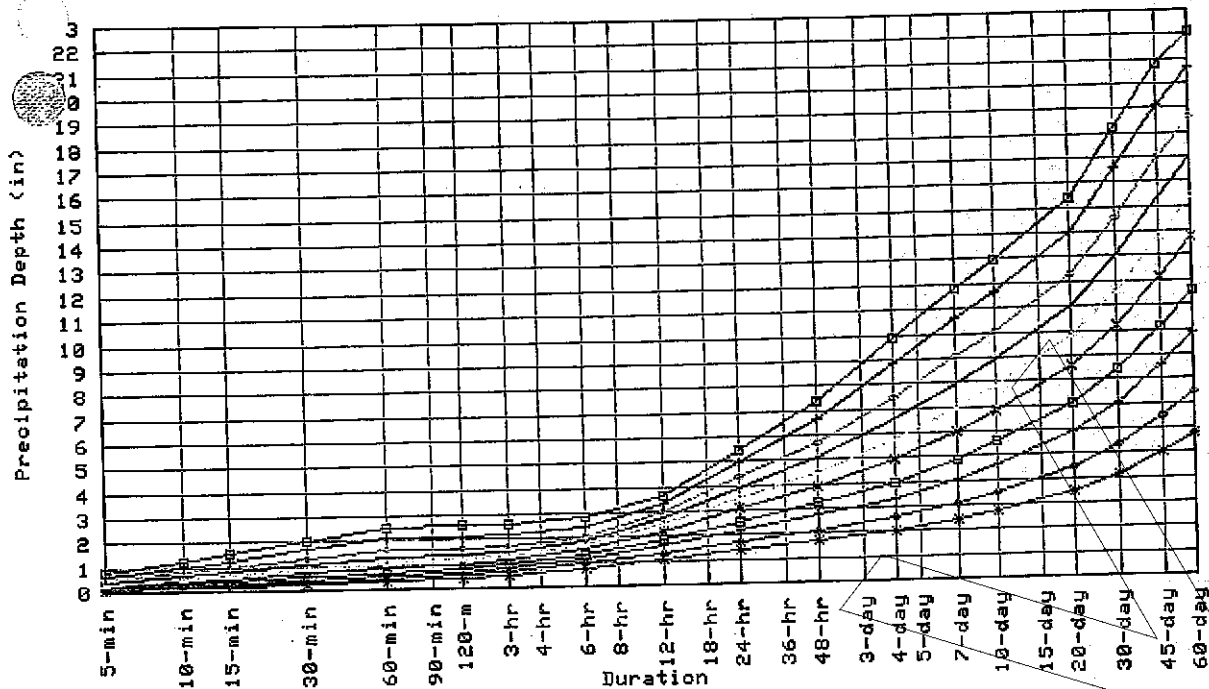
Partial duration based Point Precipitation Frequency Estimates - Version: 4  
39.557401 N 119.854593 W 5055 ft



Thu Jun 05 14:04:08 2008

Duration			
5-min	—	3-hr	*
10-min	+	6-hr	+
15-min	+	12-hr	+
30-min	□	24-hr	□
60-min	*	48-hr	*
		30-day	*
		60-day	*
		10-day	+
		20-day	□

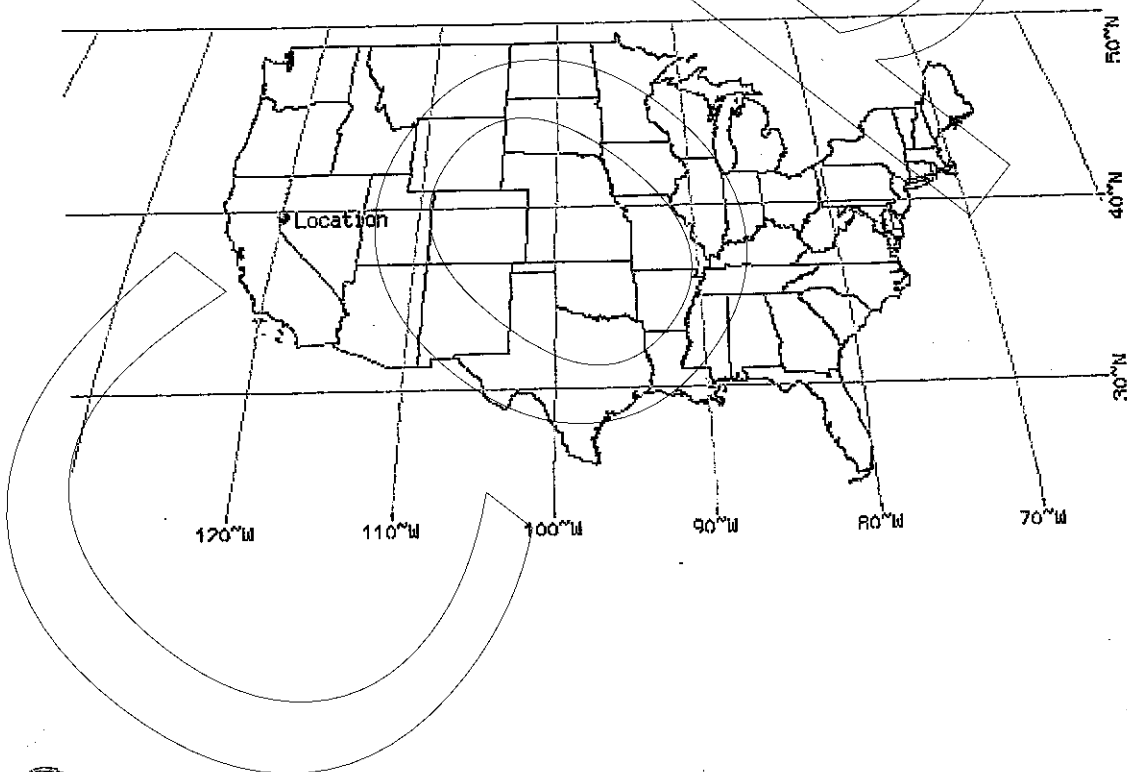
Partial duration based Point Precipitation Frequency Estimates - Version: 4  
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Thu Jun 05 14:04:08 2008

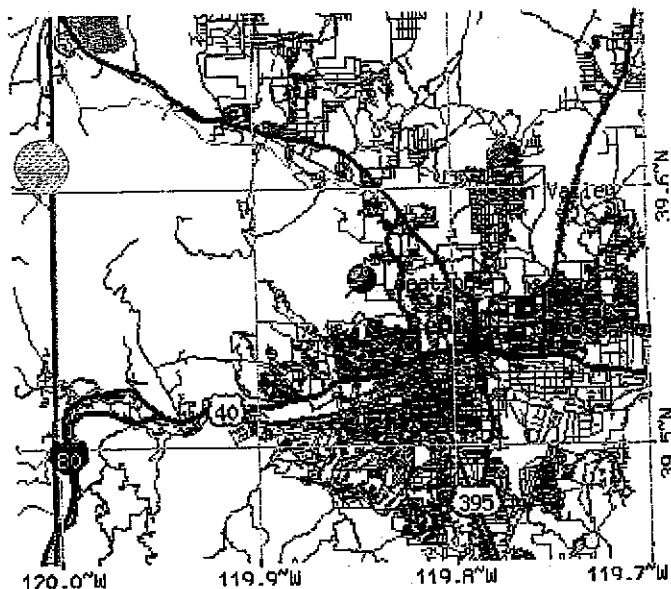
Average Recurrence Interval (years)	
1	*
2	+
5	+
10	+
25	+
100	+
250	+
500	+
1000	+

Maps -



These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.



### Other Maps/Photographs -

View [USGS digital orthophoto quadrangle \(DOQ\)](#) covering this location from TerraServer; [USGS Aerial Photograph](#) may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the [USGS](#) for more information.

### Watershed/Stream Flow Information -

Find the [Watershed](#) for this location using the U.S. Environmental Protection Agency's site.

### Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely [NCDC](#). The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to our documentation.

Using the [National Climatic Data Center's \(NCDC\)](#) station search engine, locate other climate stations within:

...OR...

of this location (39.557401/-119.854583). Digital ASCII data can be obtained directly from

[NCDC](#).

Find [Natural Resources Conservation Service \(NRCS\) SNOTEL \(SNOWpack TELemetry\)](#) stations by visiting the [Western Regional Climate Center's state-specific SNOTEL station maps](#).

Hydrometeorological Design Studies Center  
 DOC/NOAA/National Weather Service  
 1325 East-West Highway  
 Silver Spring, MD 20910  
 (301) 713-1669  
 Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

[Disclaimer](#)

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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.

The shape of the SCS Unit Hydrograph is based on studies of various natural unit hydrographs. The basic governing parameters of this curvilinear hydrograph are as follows:

1. The time-to-peak,  $T_p$ , of the unit hydrograph approximately equals 0.2 times the time-of-base,  $T_b$ .
2. The point of inflection of the falling leg of the unit hydrograph approximately equals 1.7 times  $T_p$ .

For ease of calculation, an equivalent triangular unit hydrograph was derived from the natural curvilinear unit hydrograph. From the triangular unit hydrograph, equations for the peak discharge,  $Q_p$ , time-to-peak,  $T_p$ , and the time of concentration,  $t_c$ , were developed based on a single lag factor (TLAG). The discharge hydrograph is then determined for the SCS Unit Hydrograph method based on the storm excess precipitation applied to the unit hydrograph whose parameters are determined by TLAG. TLAG is defined and discussed in Section 705.3.

### 705.2 ASSUMPTIONS

The basic assumptions made when applying the SCS Unit Hydrograph method (and all other unit hydrograph methods) are as follows:

1. The effects of all physical characteristics of a given drainage basin are reflected in the shape of the storm runoff hydrograph for that basin.

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2. At a given point on a stream, discharge ordinates of different unit graphs of the same unit time of rainfall excess are mutually proportional to respective volumes.
3. A hydrograph of storm discharge that would result from a series of bursts of excess rain or from continuous excess rain of variable intensity may be constructed from a series of overlapping unit graphs each resulting from a single increment of excess rain of unit duration.

### 705.3 LAG TIME

Input data for the Soil Conservation Service dimensionless unit hydrograph method (SCS, 1985) consists of a single parameter, TLAG, which is equal to the lag (in hours) between the center of mass of rainfall excess and the peak of the unit hydrograph. For small drainage basins (less than one square mile) and basin slopes less than ten percent the lag time may be related to the time of concentration,  $t_c$ , by the following empirical relationship:

$$\text{TLAG} = 0.6 t_c \quad (709)$$

The  $t_c$  is computed as presented in Section 702.

For larger drainage basins (greater than one square mile) and basins with a basin slope equal to or greater than ten percent, the lag time (and  $t_c$ ) is generally governed mostly by the concentrated flow travel time, not the initial overland flow time. In addition, as the basin gets increasingly larger, the average flow velocity (and associated travel time) becomes more difficult to estimate. Therefore, for these basins, the following lag equation is recommended for use in computing TLAG:

$$\text{TLAG} = 22.1 K_n (L L_c / S^{0.5})^{0.33} \quad (710)$$

where  $K_n$  = Roughness factor for the basin channels  
 $L$  = Length of longest watercourse (miles)  
 $L_c$  = Length along longest watercourse measured upstream to a point opposite the centroid of the basin (miles)  
 $S$  = Representative (average) slope of the longest watercourse (feet per mile)

This lag equation is based on the United States Bureau of Reclamation's analysis of the above parameters for several drainage basins in the Southwest desert, Great Basin, and Colorado Plateau area (USBR, 1989). Since the SCS and the USBR define lag differently, this equation was developed by modifying the USBR's S-graph lag equation to correspond to the SCS's definition of the dimensionless unit hydrograph lag equation.

In order to obtain comparable results between the  $t_c$  calculation and the TLAG calculation, it is recommended that either method be used as a check of the other method for drainage areas around one square mile in size.

#### 705.3.1 Roughness Factor

The selection of a proper roughness factor for use in the lag time calculation is highly subjective. Therefore, in order to obtain more consistent lag time and runoff analysis results, the roughness factor,  $K_n$ , shall be determined using the factors presented in Table 703. These factors are based on roughness factor analysis performed in the Washoe County and Carson City areas, analysis performed for the Sacramento, California area, and by USBR (1989).

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$$Q_{s,6} = 0.45 * 1.18 * 4.65 = 2.5 \text{ cfs}$$

$$Q_{s,7} = 0.45 * 1.14 * 15.5 = 8.0 \text{ cfs}$$

**Step 9:** The 100-year peak flow at each design point was not performed in this example problem but may be obtained by repeating Steps 6 through 8 using 100-year runoff coefficients and rainfall intensities.

**APPLICATION:** The results from the Rational Formula Method are used to design the drainage system in an urban environment. The results from this example problem will be used in subsequent example problems.

**709.2 EXAMPLE: SCS UNIT HYDROGRAPH METHOD**

**Problem:** Determine the 100-year, 24-hour runoff hydrograph on Doe Creek immediately upstream of John Boulevard and Rose Subdivision.

**Solution:**

**Step 1:** Measure the drainage area of the basin. For this example, assume the drainage area is:

$$DA = 3.34 \text{ square miles} = 2140 \text{ acres}$$

**Step 2:** Estimate the average curve number of the basin. Assume the basin can be divided into the following land uses.

Land Use	Soil Type	CN	Area (Acres)
Forest	B	54	200
Forest	C	66	1100
Shrub/Brush	B	56	840

$$CN_{Ave} = (54 * 200 + 66 * 1100 + 56 * 840) / 2140 = 61.0$$

**Step 3:** Measure the length of the longest water course (L).

$$L = 22100 \text{ feet} = 4.19 \text{ miles}$$

**Step 4:** Measure the length along Doe Creek from the John Boulevard Bridge to the point opposite the centroid of the basin (L<sub>c</sub>).

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$$L_c = 2.05 \text{ miles}$$

Step 5: Calculate the average slope of Doe Creek.

Elevation of furthest upstream point = 7,276 feet  
Elevation at John Boulevard = 4,920 feet

$$\text{Slope} = \frac{7276 - 4920}{4.19} = 563 \text{ feet/mile}$$

Step 6: Estimate the average roughness factor,  $K_n$  for Doe Creek using Table 703.

Land Use	$K_n$	Area
Forest	.15	1,300
Shrub/Brush	.1	840

$$K_n = (0.15 * 1300 + 0.1 * 840) / 2,140 = 0.130$$

Step 7: Calculate the lag time (TLAG) for the SCS dimensionless unit hydrograph using Equation 710.

$$\text{TLAG} = 22.1 * K_n * (L * L_c / S)^{0.33}$$

$$\text{TLAG} = 22.1 * 0.13 * (4.19 * 2.05 / 563)^{0.33} = 2.05 \text{ hours}$$

Step 8: Input the necessary information into the HEC-1 program and run HEC-1 to obtain the 100-year, 24-hour storm hydrograph at John Boulevard Bridge. The HEC-1 program will require KK, BA, LS, PH, and UD cards. The rainfall distribution information was obtained from Section 604.2. The results from HEC-1 model are provided in Figure 704.

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**RUNOFF CURVE NUMBERS**

Land Use or Surface Characteristics	Aver. % Impervious Area	Runoff Curve Numbers			
		Soil Comp A	Soil Comp B	Soil Comp C	Soil Comp D
<u>Business/Commercial:</u>	85	89	92	94	95
Downtown Areas	70	80	87	91	93
Neighborhood Areas					
<u>Residential:</u>					
(Average Lot Size)					
1/8 Acre or Less (Multi-Unit)	65	77	85	90	92
1/4 Acre	38	61	75	83	87
1/3 Acre	30	57	72	81	86
1/2 Acre	25	54	70	80	85
1 Acre	20	51	68	79	84
	72	81	88	91	93
<u>Industrial:</u>					
<u>Irrigated Areas:</u>					
Lawns, Parks, Golf Courses/	5	41	62	75	81
Agriculture	0	39	61	74	80
<u>Undeveloped Areas (Open Space):</u>					
Herbaceous (grasses)	0	40	62	74	85
Mixed Grass and Shrub	0	39	61	73	82
Shrub/Brush	0	35	56	70	77
Forest (Evergreen)	0	30	54	66	75
Outcrops	70	77	86	91	94
<u>Street/Roads:</u>					
Paved	100	98	98	98	98
Gravel	20	76	85	89	91
<u>Drives/Walks:</u>					
	95	97	97	97	97
<u>Roofs:</u>					
	90	95	95	95	95

**Notes:**

1. Grass - Grassed Landscaping or Irrigated Vegetation

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**REFERENCE:**

SCS TR-55, USDA, June 1986  
 (with modifications)

**TABLE**  
**702**

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**LAG EQUATION ROUGHNESS FACTORS**

LAND USE	RANGE OF AVERAGE IMPERVIOUS AREA	$K_n$
<b>Developed Areas</b>		
Commercial/Industrial/Office/Business	70 - 85	.05
High and Medium Density Residential	30 - 65	.05
Low Density Residential	20 - 25	.07
Rural Residential	10 - 15	.08
Irrigated Grass (Golf Course/Parks/Cemeteries)	0 - 5	.10
<b>Undeveloped Areas</b>		
Rock Outcroppings	-	.04
Irrigated Agriculture	-	.10
Rangelands:		
Herbaceous (grasses)	-	.08
Mixed grass and shrub	-	.09
Heavy shrub/brush	-	.10
Forest (Evergreen)	-	.15

VERSION: December 2, 1996

WRC ENGINEERING, INC.

REFERENCE:

U.S. Department of Interior, 1989  
(with modifications)TAE  
703

Keystone Canyon Soils Data  
Sub-Basin Worksheet

Total Area (Acres) 284.9  
Total Area (mi.<sup>2</sup>) 0.445

	Percentage of Major SCS Soil Types				Area (Acres)	Portion of Total Area	Contributing to Watershed			
	A	B	C	D			A	B	C	D
311				100	83.7	0.294	0.00	0.00	0.00	29.38
650				100	11.3	0.040	0.00	0.00	0.00	3.98
651				100	8.2	0.029	0.00	0.00	0.00	2.87
652				100	19.0	0.067	0.00	0.00	0.00	6.68
653				100	21.0	0.074	0.00	0.00	0.00	7.38
872			100	100	15.0	0.053	0.00	0.00	0.00	5.25
882				100	17.4	0.061	0.00	0.00	6.11	0.00
994				100	24.7	0.087	0.00	0.00	0.00	8.65
1054				100	3.7	0.013	0.00	0.00	0.00	1.30
1271		33	33	33	80.9	0.284	0.00	9.47	9.37	9.47
				Totals	284.9	1.00	0.0	9.5	15.5	75.0

Land Use Description	Area (Acres)
Land Use	284.9
Shrub/Brush	284.9

Curve Number (CN) Estimate (Weighted Average)	Runoff Curve Numbers				Weighted CN
	A	B	C	D	
Land Use	Area (ac.)	Land Use %			
Shrub/Brush	284.9	100	35	70	77
Total Land Use		100			73.9

Keystone Canyon (Existing Conditions)

Watershed:	BASIN 1
Acres=	284.9
mi. <sup>2</sup> =	0.445

Watershed Geometry	
Length (L) (mi.)=	1.55
Centroid Length (L <sub>c</sub> ) (mi.)=	0.7
Elevation High (ft.)=	5798
Elevation Low (ft.)=	4810
Height (ft.)=	988
Height (mi.)=	0.187
Slope (%)=	12.07
Slope (ft./mi.)=	637.42
Roughness Factor (K <sub>n</sub> )=	0.09

Roughness Factor (K <sub>n</sub> ):		
Land Use	K <sub>n</sub>	Area (Acres)
Shrub/Brush	0.09	284.9
	Total	284.9

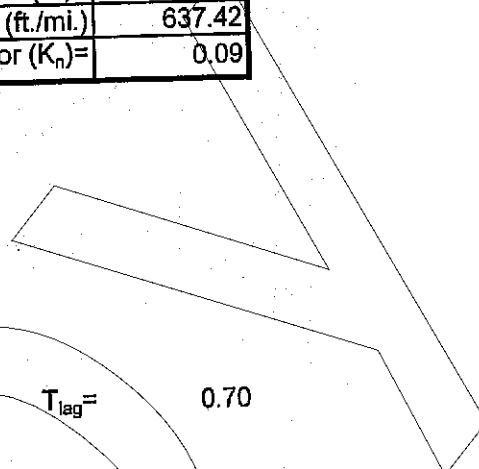
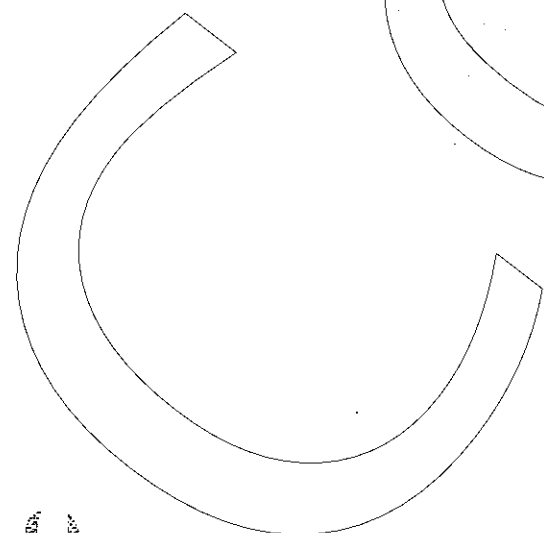
K<sub>n</sub> = 0.09

Lag Time (T<sub>lag</sub>) Calculations

$$T_{lag} = 22.1 * K_n * (L * (L_c / S)^{0.5})^{0.33}$$

T<sub>lag</sub> = 0.70

- K<sub>n</sub> = Roughness Factor (determined from Table 703 in the WCHCDDM)
- L = Length of longest watercourse (ft.)
- L<sub>c</sub> = Length along longest watercourse upstream to centroid of watershed
- S = Slope of longest watercourse (ft./mile)



Keystone Canyon  
BASIN 2 (Existing)

Keystone Canyon Soils Data  
Sub-Basin Worksheet

Total Area (Acres) 202.4  
Total Area (mi.<sup>2</sup>) 0.316

	Percentage of Major SCS Soil Types <sup>1</sup>				Area (Acres)	Portion of Total Area	Contributing to Watershed			
	A	B	C	D			A	B	C	D
311				100	21.2	0.105	0.00	0.00	0.00	10.48
312				100	21.9	0.108	0.00	0.00	0.00	10.84
653				100	0.4	0.002	0.00	0.00	0.00	0.19
861				100	29.6	0.146	0.00	0.00	0.00	14.61
862				100	2.3	0.011	0.00	0.00	0.00	1.14
871				100	11.0	0.054	0.00	0.00	0.00	5.41
872				100	27.4	0.135	0.00	0.00	0.00	13.54
880			50	50	39.2	0.194	0.00	0.00	0.00	9.68
882			100	100	0.5	0.002	0.00	0.00	0.00	0.25
901			100	100	37.5	0.185	0.00	0.00	0.00	18.53
994				100	11.5	0.057	0.00	0.00	0.00	5.67
Totals				Totals	202.4	1.00	0.0	0.0	0.0	71.5
						%A	%B	%C	%D	

Land Use Description	Area (Acres)
Land Use	202.4
Shrub/Brush	202.4

Curve Number (CN) Estimate (Weighted Average)				Weighted CN			
Runoff Curve Numbers							
Land Use	Area (ac.)	Land Use %	A	B	C	D	
Shrub/Brush	202.4	100	35	56	70	77	
Total Land Use				100			
							75.0

Keystone Canyon (Existing Conditions)

Watershed:	BASIN 2
Acres=	202.4
mi. <sup>2</sup> =	0.316

Watershed Geometry	
Length (L) (mi.)=	1.59
Centroid Length (L <sub>c</sub> ) (mi.)=	0.72
Elevation High (ft.)=	5822
Elevation Low (ft.)=	4810
Height (ft.)=	1012
Height (mi.)=	0.192
Slope (%)=	12.05
Slope (ft./mi.)=	636.48
Roughness Factor (K <sub>n</sub> )=	0.09

Roughness Factor (K <sub>n</sub> ):		
Land Use	K <sub>n</sub>	Area (Acres)
Shrub/Brush	0.09	202.4
	Total	202.4

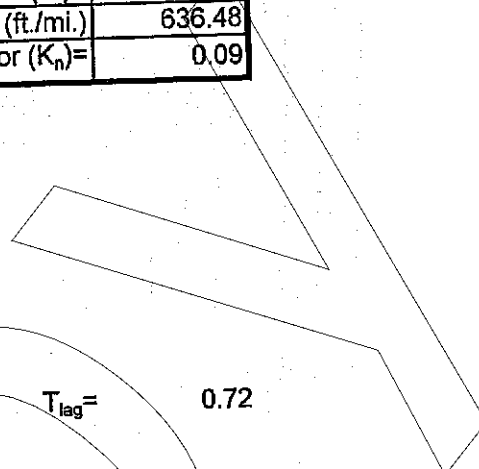
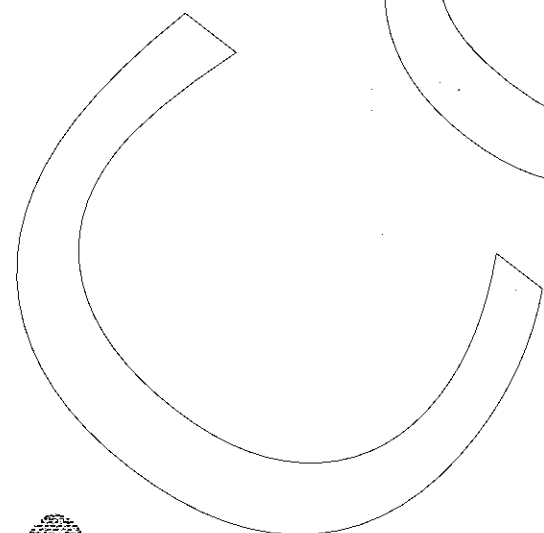
K<sub>n</sub> = 0.09

Lag Time (T<sub>lag</sub>) Calculations

$$T_{lag} = 22.1 * K_n (L * (L_c / S)^{0.5})^{0.33}$$

T<sub>lag</sub> = 0.72

- K<sub>n</sub> = Roughness Factor (determined from Table 703 in the WCHCDDM)
- L = Length of longest watercourse (ft.)
- L<sub>c</sub> = Length along longest watercourse upstream to centroid of watershed
- S = Slope of longest watercourse (ft./mile)



Keystone Canyon  
BASIN 3 (Existing)

Keystone Canyon Soils Data  
Sub-Basin Worksheet

Total Area (Acres) 1105.6  
Total Area (mi<sup>2</sup>) 1.7

	Percentage of Major SCS Soil Types				Area (Acres)	Portion of Total Area	Contributing to Watershed			
	A	B	C	D			A	B	C	D
221				100	2.9	0.003	0.00	0.00	0.00	0.26
281				100	57.4	0.052	0.00	0.00	0.00	5.19
310				100	4.8	0.004	0.00	0.00	0.00	0.44
311				100	13.0	0.012	0.00	0.00	0.00	1.18
312				100	28.9	0.026	0.00	0.00	0.00	2.61
313			20	80	41.3	0.037	0.00	0.00	0.75	2.99
350				100	9.2	0.008	0.00	0.00	0.00	0.83
861				100	20.5	0.019	0.00	0.00	0.00	1.85
862				100	2.3	0.002	0.00	0.00	0.00	0.21
871				100	53.2	0.048	0.00	0.00	0.00	4.81
872				100	63.3	0.057	0.00	0.00	0.00	5.73
873				100	24.0	0.022	0.00	0.00	0.00	2.17
880			50	50	170.4	0.154	0.00	0.00	7.71	7.71
882			100	100	98.3	0.089	0.00	0.00	8.89	8.89
900				100	104.5	0.095	0.00	0.00	0.00	9.46
901				100	390.6	0.353	0.00	0.00	0.00	35.33
991				100	20.9	0.019	0.00	0.00	1.89	1.89
Totals				Totals	1105.6	1.00	0.0	0.0	19.2	80.8
						%A	%B	%C	%D	

Land Use Description
Land Use Area (Acres)
Shrub/Brush 1105.6
1105.6

Curve Number (CN) Estimate (Weighted Average)
Runoff Curve Numbers
Land Use Area (ac.) Land Use %
Shrub/Brush 1105.6 100
35 70 77
Total Land Use 100
Weighted CN
7565.3
75.7

Keystone Canyon (Existing Conditions)

Watershed:	BASIN 3
Acres=	1105.6
mi. <sup>2</sup> =	1.728

Watershed Geometry	
Length (L) (mi.)=	3.4
Centroid Length (L <sub>c</sub> ) (mi.)=	1.4
Elevation High (ft.)=	6165
Elevation Low (ft.)=	4860
Height (ft.)=	1305
Height (mi.)=	0.247
Slope (%)=	7.27
Slope (ft./mi.)=	383.82
Roughness Factor (K <sub>n</sub> )=	0.09

Roughness Factor (K <sub>n</sub> ):		
Land Use	K <sub>n</sub>	Area (Acres)
Shrub/Brush	0.09	1105.6
	Total	1105.6

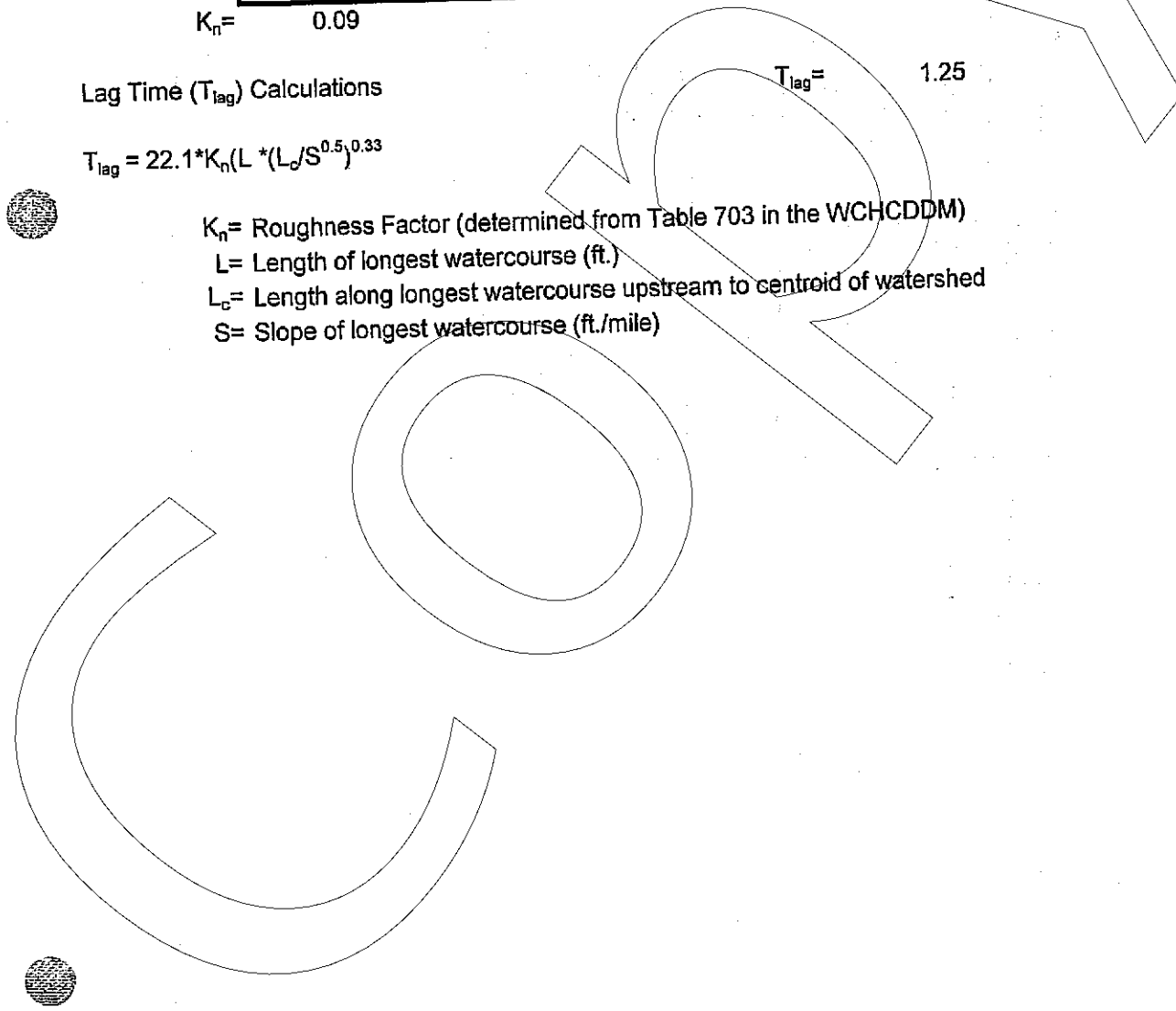
K<sub>n</sub>= 0.09

Lag Time (T<sub>lag</sub>) Calculations

$$T_{lag} = 22.1 * K_n * (L * (L_c * S)^{0.5})^{0.33}$$

T<sub>lag</sub>= 1.25

- K<sub>n</sub>= Roughness Factor (determined from Table 703 in the WCHCDDM)
- L= Length of longest watercourse (ft.)
- L<sub>c</sub>= Length along longest watercourse upstream to centroid of watershed
- S= Slope of longest watercourse (ft./mile)



Keystone Canyon  
BASIN 1 (Proposed)

Keystone Canyon Soils Data  
Sub-Basin Worksheet

Total Area (Acres) 284.9  
Total Area (mi.<sup>2</sup>) 0.445

	Percentage of Major SCS Soil Types				Area (Acres)	Portion of Total Area	Contributing to Watershed			
	A	B	C	D			A	B	C	D
311				100	83.7	0.294	0.00	0.00	0.00	29.38
650				100	11.3	0.040	0.00	0.00	0.00	3.98
651				100	8.2	0.029	0.00	0.00	0.00	2.87
652				100	19.0	0.067	0.00	0.00	0.00	6.68
653				100	21.0	0.074	0.00	0.00	0.00	7.38
872				100	15.0	0.053	0.00	0.00	0.00	5.25
882			100	17.4	0.061	0.00	0.00	0.00	6.11	0.00
994				100	24.7	0.087	0.00	0.00	0.00	8.65
1054				100	3.7	0.013	0.00	0.00	0.00	1.30
1271		33	33	33	80.9	0.284	0.00	0.00	9.37	9.47
		33	33	Totals	284.9	1.00	0.0	9.5	15.5	75.0

%A %B %C %D

Land Use Description	Area (Acres)
Land Use	270.5
Shrub/Brush	14.4
Residential	284.9

Curve Number (CN) Estimate (Weighted Average)	Runoff Curve Numbers				Weighted CN
	A	B	C	D	
Land Use	Area (ac.)	Land Use %			
Shrub/Brush	270.5	95%	35	70	7012.2
Residential	14.4	5%	77	90	459.7
Total Land Use		100			74.7

Keystone Canyon (Proposed Conditions)

Watershed:	BASIN 1
Acres=	284.9
mi. <sup>2</sup> =	0.445

Watershed Geometry	
Length (L) (mi.)=	1.55
Centroid Length (L <sub>c</sub> ) (mi.)=	0.7
Elevation High (ft.)=	5798
Elevation Low (ft.)=	4810
Height (ft.)=	988
Height (mi.)=	0.187
Slope (%)=	12.07
Slope (ft./mi.)=	637.42
Roughness Factor (K <sub>n</sub> )=	0.08898912

Roughness Factor (K <sub>n</sub> ):		
Land Use	K <sub>n</sub>	Area (Acres)
Shrub/Brush	0.09	270.5
Residential	0.07	14.4
Total		284.9

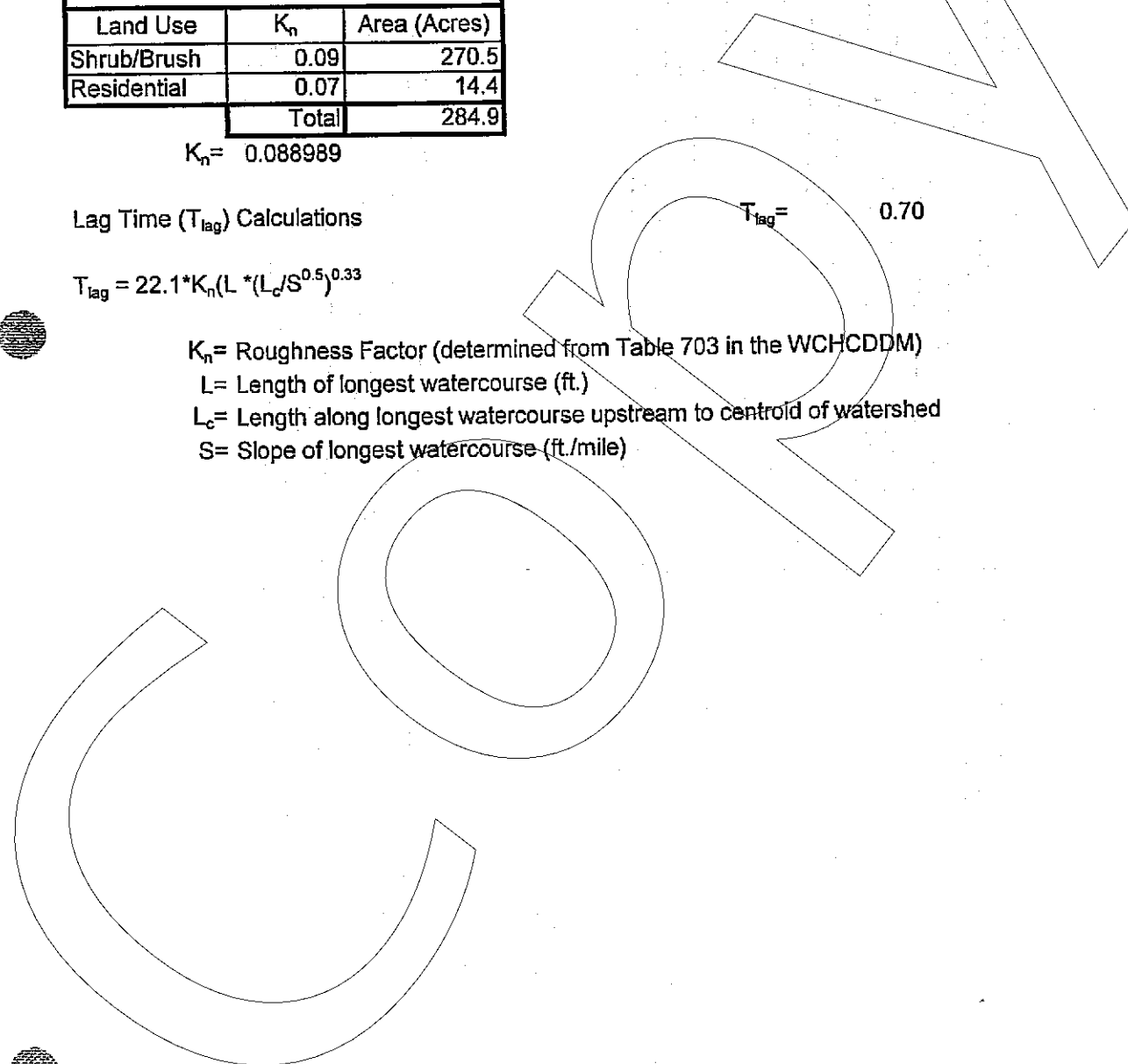
$K_n = 0.088989$

Lag Time (T<sub>lag</sub>) Calculations

$T_{lag} = 22.1 * K_n (L * (L_c / S)^{0.5})^{0.33}$

$T_{lag} = 0.70$

- K<sub>n</sub> = Roughness Factor (determined from Table 703 in the WCHCDDM)
- L = Length of longest watercourse (ft.)
- L<sub>c</sub> = Length along longest watercourse upstream to centroid of watershed
- S = Slope of longest watercourse (ft./mile)



Keystone Canyon  
BASIN 2 (Proposed)

Keystone Canyon Soils Data  
Sub-Basin Worksheet

Total Area (Acres) 202.4  
Total Area (mi.<sup>2</sup>) 0.316

	Percentage of Major SCS Soil Types <sup>1</sup>				Area (Acres)	Portion of Total Area	Contributing to Watershed			
	A	B	C	D			A	B	C	D
311				100	21.2	0.105	0.00	0.00	0.00	10.48
312				100	21.9	0.108	0.00	0.00	0.00	10.84
653				100	0.4	0.002	0.00	0.00	0.00	0.19
861				100	29.6	0.146	0.00	0.00	0.00	14.61
862				100	2.3	0.011	0.00	0.00	0.00	1.14
871				100	11.0	0.054	0.00	0.00	0.00	5.41
872				100	27.4	0.135	0.00	0.00	0.00	13.54
880			50	50	39.2	0.194	0.00	0.00	0.00	9.68
882			100	100	0.5	0.002	0.00	0.00	0.00	0.00
901			100	100	37.5	0.185	0.00	0.00	0.00	18.53
994				100	11.5	0.057	0.00	0.00	0.00	5.67
Totals					202.4	1.00	0.0	0.0	28.5	71.5
							%A	%B	%C	%D

Land Use Description	Area (Acres)
Land Use	189.8
Shrub/Brush	12.6
Residential	202.4

Curve Number (CN) Estimate (Weighted Average)	Runoff Curve Numbers				Weighted CN
	A	B	C	D	
Land Use	Area (ac.)	Land Use %			
Shrub/Brush	189.8	94%	35	77	7033.9
Residential	12.6	6%	77	92	569.2
Total Land Use		100			76.0

Keystone Canyon (Proposed Conditions)

Watershed:	BASIN 2
Acres=	202.4
mi. <sup>2</sup> =	0.316

Watershed Geometry	
Length (L) (mi.)=	1.59
Centroid Length (L <sub>c</sub> ) (mi.)=	0.72
Elevation High (ft.)=	5822
Elevation Low (ft.)=	4810
Height (ft.)=	1012
Height (mi.)=	0.192
Slope (%)=	12.05
Slope (ft./mi.)=	636.48
Roughness Factor (K <sub>n</sub> )=	0.08875494

Roughness Factor (K <sub>n</sub> ):		
Land Use	K <sub>n</sub>	Area (Acres)
Shrub/Brush	0.09	189.8
Residential	0.07	12.6
Total		202.4

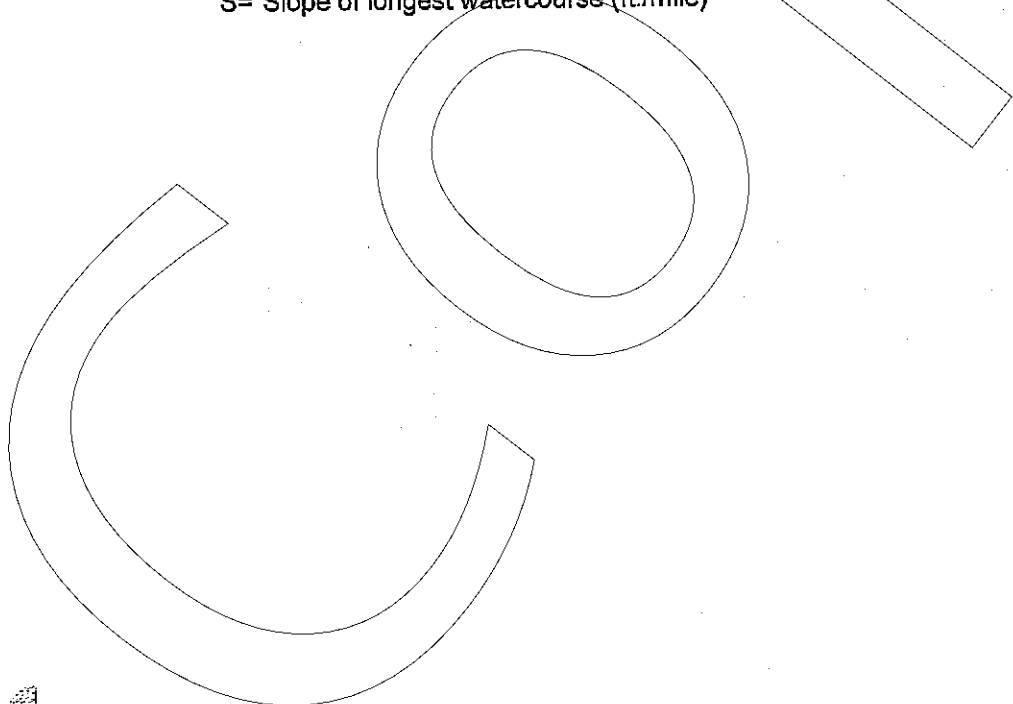
$K_n = 0.088755$

Lag Time (T<sub>lag</sub>) Calculations

$T_{lag} = 22.1 * K_n * (L * (L_c / S)^{0.5})^{0.33}$

$T_{lag} = 0.71$

- K<sub>n</sub> = Roughness Factor (determined from Table 703 in the WCHCDDM)
- L = Length of longest watercourse (ft.)
- L<sub>c</sub> = Length along longest watercourse upstream to centroid of watershed
- S = Slope of longest watercourse (ft./mile)



Keystone Canyon  
BASIN 3 (Proposed)

Keystone Canyon Soils Data  
Sub-Basin Worksheet

Total Area (Acres) 1105.6  
Total Area (mi.<sup>2</sup>) 1.7

	Percentage of Major SCS Soil Types				Area (Acres)	Portion of Total Area	Contributing to Watershed			
	A	B	C	D			A	B	C	D
221				100	2.9	0.003	0.00	0.00	0.00	0.26
281				100	57.4	0.052	0.00	0.00	0.00	5.19
310				100	4.8	0.004	0.00	0.00	0.00	0.44
311				100	13.0	0.012	0.00	0.00	0.00	1.18
312				100	28.9	0.026	0.00	0.00	0.00	2.61
313			20	80	41.3	0.037	0.00	0.00	0.75	2.99
350				100	9.2	0.008	0.00	0.00	0.00	0.83
861				100	20.5	0.019	0.00	0.00	0.00	1.85
862				100	2.3	0.002	0.00	0.00	0.00	0.21
871				100	53.2	0.048	0.00	0.00	0.00	4.81
872				100	63.3	0.057	0.00	0.00	0.00	5.73
873				100	24.0	0.022	0.00	0.00	0.00	2.17
880			50	50	170.4	0.154	0.00	0.00	7.71	7.71
882			100	100	98.3	0.089	0.00	0.00	8.89	8.89
900				100	104.5	0.095	0.00	0.00	0.00	9.46
901				100	390.6	0.353	0.00	0.00	0.00	35.33
991			100	100	20.9	0.019	0.00	0.00	1.89	1.89
Totals					1105.6	1.00	0.00	0.00	19.2	80.8
							%A	%B	%C	%D

Land Use Description	Land Use Area (Acres)
Land Use	1088.6
Shrub/Brush	17.0
Residential	1105.6

Curve Number (CN) Estimate (Weighted Average)	Runoff Curve Numbers				Weighted CN		
	A	B	C	D			
Land Use	Area (ac.)	Land Use %					
Shrub/Brush	1088.6	98%	35	56	70	77	7449.0
Residential	17.0	2%	77	85	90	92	140.9
Total Land Use			100				75.9

Keystone Canyon (Proposed Conditions)

Watershed:	BASIN 3
Acres=	1105.6
mi. <sup>2</sup> =	1.728

Watershed Geometry	
Length (L) (mi.)=	3.4
Centroid Length (L <sub>c</sub> ) (mi.)=	1.4
Elevation High (ft.)=	6165
Elevation Low (ft.)=	4860
Height (ft.)=	1305
Height (mi.)=	0.247
Slope (%)=	7.27
Slope (ft./mi.)=	383.82
Roughness Factor (K <sub>n</sub> )=	0.08969247

Roughness Factor (K <sub>n</sub> ):		
Land Use	K <sub>n</sub>	Area (Acres)
Shrub/Brush	0.09	1088.6
Residential	0.07	17
Total		1105.6

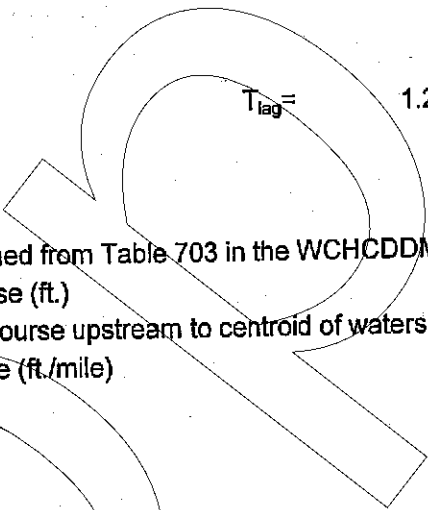
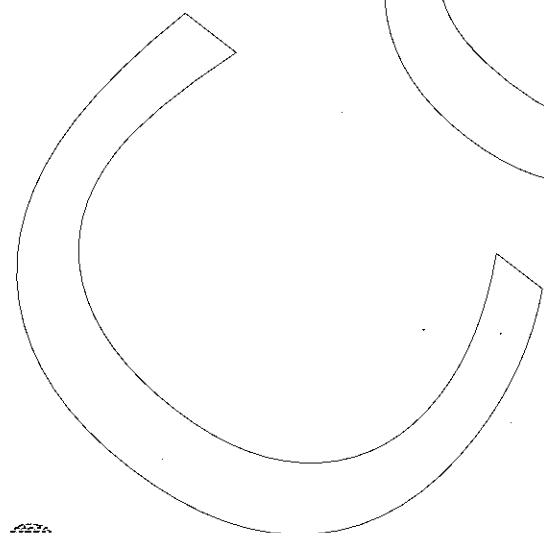
$K_n = 0.089692$

Lag Time (T<sub>lag</sub>) Calculations

$T_{lag} = 22.1 * K_n * (L * (L_c / S)^{0.5})^{0.33}$

- K<sub>n</sub>= Roughness Factor (determined from Table 703 in the WCHCDDM)
- L= Length of longest watercourse (ft.)
- L<sub>c</sub>= Length along longest watercourse upstream to centroid of watershed
- S= Slope of longest watercourse (ft./mile)

$T_{lag} = 1.24$



FILED IN THE OFFICE OF THE CLERK OF THE DISTRICT COURT OF THE DISTRICT OF COLUMBIA

RECEIVED  
OFFICE OF THE CLERK OF THE DISTRICT COURT OF THE DISTRICT OF COLUMBIA  
12/19/2011

FILED IN THE OFFICE OF THE CLERK OF THE DISTRICT COURT OF THE DISTRICT OF COLUMBIA  
12/19/2011

**APPENDIX B**

COPY

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12/19/2011

3 YEAR (EXISTING)

HEC1 S/N: 1343001909

HMVersion: 6.33

Data File: C:\WINDOWS\TEMP\~vbh0823.TMP

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*   MAY 1991 *
*   VERSION 4.0.1E *
*   *
* RUN DATE 06/30/2008 TIME 14:42:13 *
*   *
*****

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```

*****
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
*   609 SECOND STREET *
*   DAVIS, CALIFORNIA 95616 *
*   (916) 756-1104 *
*****

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```

X   X  XXXXXXX  XXXXX      X
X   X X      X   X      XX
X   X X      X           X
XXXXXXX XXXX  X   XXXXX  X
X   X X      X           X
X   X X      X   X      X
X   X  XXXXXXX  XXXXX      XXX

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::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::
::: Full Microcomputer Implementation :::
::: by :::
::: Haestad Methods, Inc. :::
:::
::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::

```

37 Brookside Road \* Waterbury, Connecticut 06708 \* (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.

THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM



HEC1 S/N: 1343001909 HMVersion: 6.33 Data File: C:\WINDOWS\TEMP\--vhh0823.TMP

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* MAY 1991 *
* VERSION 4.0.1E *
* RUN DATE 06/30/2008 TIME 14:42:13 *
*****

```

```

*****
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*****

```

KEYSTONE CANYON 5 YEAR (EXISTING)

```

3 IO OUTPUT CONTROL VARIABLES
      IPRNT      5 PRINT CONTROL
      IPLOT      0 PLOT CONTROL
      QSCAL      0. HYDROGRAPH PLOT SCALE

```

```

IT HYDROGRAPH TIME DATA
      NMIN      1 MINUTES IN COMPUTATION INTERVAL
      IDATE      1 0 STARTING DATE
      ITIME      0000 STARTING TIME
      NQ        1441 NUMBER OF HYDROGRAPH ORDINATES
      NDDATE     2 0 ENDING DATE
      NDTIME     0000 ENDING TIME
      ICENT      0 CENTURY MARK

```

```

COMPUTATION INTERVAL 0.02 HOURS
TOTAL TIME BASE 24.00 HOURS

```

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ENGLISH UNITS
DRAINAGE AREA SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

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\*\*\*\*\*

4 KK

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*****
* B1 *
*****

```

```

OUTPUT CONTROL VARIABLES
      IPRNT      5 PRINT CONTROL
      IPLOT      0 PLOT CONTROL
      QSCAL      0. HYDROGRAPH PLOT SCALE

```

IPNCH	0	PUNCH COMPUTED HYDROGRAPH
IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORDINATE PUNCHED OR SAVED
ISAV2	1441	LAST ORDINATE PUNCHED OR SAVED
TIMINT	0.017	TIME INTERVAL IN HOURS

VALUE EXCEEDS TABLE IN LOGLOG      0.01667      0.01667      24.00000

\*\*\*\*\*

\*\*\*\*\*  
 \*                    \*  
 11 KK    \*    B2    \*  
 \*                    \*  
 \*\*\*\*\*

13 KO      OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE
IPNCH	0	PUNCH COMPUTED HYDROGRAPH
IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORDINATE PUNCHED OR SAVED
ISAV2	1441	LAST ORDINATE PUNCHED OR SAVED
TIMINT	0.017	TIME INTERVAL IN HOURS

VALUE EXCEEDS TABLE IN LOGLOG      0.01667      0.01667      24.00000

\*\*\*\*\*

\*\*\*\*\*  
 \*                    \*  
 18 KK    \*    CP1    \*  
 \*                    \*  
 \*\*\*\*\*

20 KO      OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE
IPNCH	0	PUNCH COMPUTED HYDROGRAPH
IOUT	22	SAVE HYDROGRAPH ON THIS UNIT
ISAV1	1	FIRST ORDINATE PUNCHED OR SAVED
ISAV2	1441	LAST ORDINATE PUNCHED OR SAVED
TIMINT	0.017	TIME INTERVAL IN HOURS

\*\*\*\*\*

\*\*\*\*\*  
\* \*  
\* B3 \*  
\* \*  
\*\*\*\*\*

22 KK

24 KO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL  
IPLOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
IPNCH 0 PUNCH COMPUTED HYDROGRAPH  
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT  
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED  
ISAV2 1441 LAST ORDINATE PUNCHED OR SAVED  
TIMINT 0.017 TIME INTERVAL IN HOURS

VALUE EXCEEDS TABLE IN LOGLOG 0.01667 0.01667 24.00000

\*\*\* WARNING \*\*\* UNIT HYDROGRAPH TRUNCATED FROM 377 TO 300 INTERVALS

\*\*\*\*\*

\*\*\*\*\*  
\* \*  
\* CP2 \*  
\* \*  
\*\*\*\*\*

29 KK

31 KO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL  
IPLOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
IPNCH 0 PUNCH COMPUTED HYDROGRAPH  
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT  
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED  
ISAV2 1441 LAST ORDINATE PUNCHED OR SAVED  
TIMINT 0.017 TIME INTERVAL IN HOURS

RUNOFF SUMMARY  
 FLOW IN CUBIC FEET PER SECOND  
 TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	B1	26.	12.83	13.	5.	5.	0.44		
HYDROGRAPH AT	B2	21.	12.83	10.	4.	4.	0.32		
2 COMBINED AT	CP1	48.	12.83	23.	9.	9.	0.76		
HYDROGRAPH AT	B3	87.	13.50	57.	21.	21.	1.73		
2 COMBINED AT	CP2	120.	13.23	80.	30.	30.	2.49		

\*\*\* NORMAL END OF HEC-1 \*\*\*

Q

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C

UNCLASSIFIED  
DATE 08-11-2011 BY 60322 UCBAW/STP

NO	NAME	UNIT	GRADE	STATUS	DATE	TIME	LOCATION	REMARKS
1	...	...	...	...	...	...	...	...
2	...	...	...	...	...	...	...	...
3	...	...	...	...	...	...	...	...
4	...	...	...	...	...	...	...	...
5	...	...	...	...	...	...	...	...
6	...	...	...	...	...	...	...	...
7	...	...	...	...	...	...	...	...
8	...	...	...	...	...	...	...	...
9	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...

COPY

118 YEARS (EXTENDING)

HEC1 S/N: 1343001909

HMVersion: 6.33

Data File: C:\WINDOWS\TEMP\vbh0461.TMP

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*   MAY 1991 *
*   VERSION 4.0.1E *
*   RUN DATE 06/30/2008 TIME 14:44:17 *
*****

```

```

*****
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*****

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X X XXXXXX XXXXX X
X X X X X XX
X X X X X
XXXXXXXX XXXX X XXXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXXX XXX

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::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
::: Full Microcomputer Implementation :::
::: by :::
::: Haestad Methods, Inc. :::
:::
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::

```

37 Brookside Road \* Waterbury, Connecticut 06708 \* (203) 755-1666

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THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM



HEC1 S/N: 1343001909

HMVersion: 6.33

Data File: C:\WINDOWS\TEMP\vbh0461.TMP

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*   MAY 1991 *
*   VERSION 4.0.1E *
*   RUN DATE 06/30/2008 TIME 14:44:17 *
*****

```

```

*****
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*****

```

KEYSTONE CANYON 100 YEAR (EXISTING)

3 IO

OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLOT      0 PLOT CONTROL
QSCAL     0. HYDROGRAPH PLOT SCALE

```

IT

HYDROGRAPH TIME DATA

```

NMIN      1 MINUTES IN COMPUTATION INTERVAL
IDATE     1 0 STARTING DATE
ITIME     0000 STARTING TIME
NQ        1441 NUMBER OF HYDROGRAPH ORDINATES
NDDATE    2 0 ENDING DATE
NDTIME    0000 ENDING TIME
ICENT     0 CENTURY MARK

```

```

COMPUTATION INTERVAL 0.02 HOURS
TOTAL TIME BASE      24.00 HOURS

```

ENGLISH UNITS

```

DRAINAGE AREA      SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW               CUBIC FEET PER SECOND
STORAGE VOLUME     ACRE-FEET
SURFACE AREA       ACRES
TEMPERATURE        DEGREES FAHRENHEIT

```

\*\*\*\*\*

4 KK

```

*****
* B1 *
*****

```

OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLOT      0 PLOT CONTROL
QSCAL     0. HYDROGRAPH PLOT SCALE

```

```

IPNCH      0 PUNCH COMPUTED HYDROGRAPH
IOUT       22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1      1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2     1441 LAST ORDINATE PUNCHED OR SAVED
TIMINT     0.017 TIME INTERVAL IN HOURS

```

VALUE EXCEEDS TABLE IN LOGLOG      0.01667      0.01667      24.00000

\*\*\* \*\*

```

*****
*
11 KK * B2 *
*
*****

```

```

13 KO      OUTPUT CONTROL VARIABLES
          IPRNT        5 PRINT CONTROL
          IPLLOT       0 PLOT CONTROL
          QSCAL        0. HYDROGRAPH PLOT SCALE
          IPNCH        0 PUNCH COMPUTED HYDROGRAPH
          IOUT         22 SAVE HYDROGRAPH ON THIS UNIT
          ISAV1        1 FIRST ORDINATE PUNCHED OR SAVED
          ISAV2       1441 LAST ORDINATE PUNCHED OR SAVED
          TIMINT      0.017 TIME INTERVAL IN HOURS

```

VALUE EXCEEDS TABLE IN LOGLOG      0.01667      0.01667      24.00000

\*\*\* \*\*

```

*****
*
18 KK * CF1 *
*
*****

```

```

20 XO      OUTPUT CONTROL VARIABLES
          IPRNT        5 PRINT CONTROL
          IPLLOT       0 PLOT CONTROL
          QSCAL        0. HYDROGRAPH PLOT SCALE
          IPNCH        0 PUNCH COMPUTED HYDROGRAPH
          IOUT         22 SAVE HYDROGRAPH ON THIS UNIT
          ISAV1        1 FIRST ORDINATE PUNCHED OR SAVED
          ISAV2       1441 LAST ORDINATE PUNCHED OR SAVED
          TIMINT      0.017 TIME INTERVAL IN HOURS

```

\*\*\* \*\*

\*\*\*\*\*  
\*  
\* B3 \*  
\*  
\*\*\*\*\*

24 KO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL  
IPILOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
IPNCH 0 PUNCH COMPUTED HYDROGRAPH  
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT  
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED  
ISAV2 1441 LAST ORDINATE PUNCHED OR SAVED  
TIMINT 0.017 TIME INTERVAL IN HOURS

VALUE EXCEEDS TABLE IN LOGLOG 0.01667 0.01667 24.00000

\*\*\* WARNING \*\*\* UNIT HYDROGRAPH TRUNCATED FROM 377 TO 300 INTERVALS

\*\*\*\*\*  
\*\*\* \*\* \*\* \*\* \*\*

\*\*\*\*\*  
\*  
\* CP2 \*  
\*  
\*\*\*\*\*

31 KO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL  
IPILOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
IPNCH 0 PUNCH COMPUTED HYDROGRAPH  
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT  
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED  
ISAV2 1441 LAST ORDINATE PUNCHED OR SAVED  
TIMINT 0.017 TIME INTERVAL IN HOURS

**RUNOFF SUMMARY**  
**FLOW IN CUBIC FEET PER SECOND**  
**TIME IN HOURS, AREA IN SQUARE MILES**

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	B1	157.	12.77	46.	17.	17.	0.44		
HYDROGRAPH AT	B2	115.	12.78	34.	13.	13.	0.32		
2 COMBINED AT	CP1	272.	12.78	80.	30.	30.	0.76		
HYDROGRAPH AT	B3	418.	13.33	185.	71.	71.	1.73		
2 COMBINED AT	CP2	611.	13.02	264.	101.	101.	2.49		

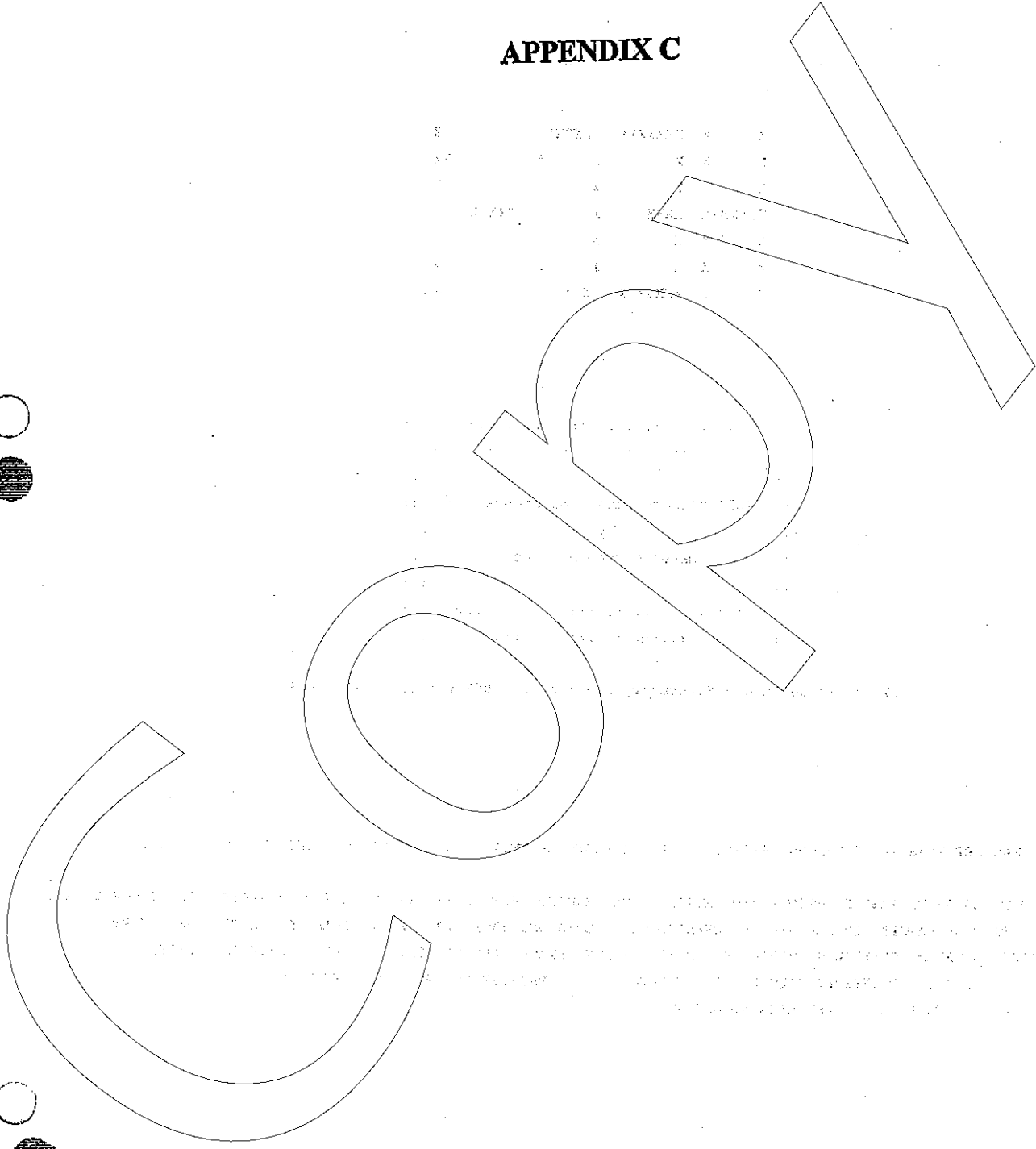
\*\*\* NORMAL END OF HEC-1 \*\*\*

COPY

COPY

RECEIVED... 12/19/2011 10:50:24

**APPENDIX C**



HEC1 S/N: 1343001909

HMVersion: 6.33

Data File: C:\WINDOWS\TEMP\--vbh3509.TMP

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*   MAY 1991                       *
*   VERSION 4.0.1E                 *
*   RUN DATE 06/30/2008 TIME 12:06:03 *
*****

```

```

*****
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET            *
* DAVIS, CALIFORNIA 95616     *
* (916) 756-1104              *
*****

```

```

X   X  XXXXXXX  XXXXX      X
X   X  X      X   X      XX
X   X  X      X           X
XXXXXXX XXXX  X   XXXXX  X
X   X  X      X           X
X   X  X      X   X      X
X   X  XXXXXXX  XXXXX  ...XXX

```

```

:-----:
:-----:
::
:: Full Microcomputer Implementation ::
::           by                       ::
:: Haestad Methods, Inc.             ::
:-----:
:-----:

```

37 Brookside Road \* Waterbury, Connecticut 06708 \* (203) 755-1666

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM



HEC1 S/N: 1343001909

HMVersion: 6.33

Data File: C:\WINDOWS\TEMP\--vbh3509.TMP

```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* MAY 1991 *
* VERSION 4.0.1E *
*
* RUN DATE 06/30/2008 TIME 12:06:03 *
*
*****

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*
*****

```

KEYSTONE CANYON 5 YEAR (PROPOSED)

3 IO OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLLOT     0 PLOT CONTROL
QSCAL      0. HYDROGRAPH PLOT SCALE

```

IT HYDROGRAPH TIME DATA

```

NMIN       1 MINUTES IN COMPUTATION INTERVAL
IDATE     .1 0 STARTING DATE
ITIME     0000 STARTING TIME
NQ        1441 NUMBER OF HYDROGRAPH ORDINATES
NDDATE    2 0 ENDING DATE
NDTIME    0000 ENDING TIME
ICENT     0 CENTURY MARK

```

```

COMPUTATION INTERVAL 0.02 HOURS
TOTAL TIME BASE      24.00 HOURS

```

ENGLISH UNITS

```

DRAINAGE AREA      SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW               CUBIC FEET PER SECOND
STORAGE VOLUME     ACRE-FEET
SURFACE AREA       ACRES
TEMPERATURE        DEGREES FAHRENHEIT

```

\*\*\*\*\*

4 KK

```

*****
*
* B1 *
*
*****

```

KO

OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLLOT     0 PLOT CONTROL
QSCAL      0. HYDROGRAPH PLOT SCALE

```

```

IPNCH      0 PUNCH COMPUTED HYDROGRAPH
IOUT       22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1      1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2     1441 LAST ORDINATE PUNCHED OR SAVED
TIMINT     0.017 TIME INTERVAL IN HOURS

```

VALUE EXCEEDS TABLE IN LOGLOG      0.01667      0.01667      24.00000

\*\*\*\*\*

```

*****
*           *
11 KK *   B2   *
*           *
*****

```

```

13 KO      OUTPUT CONTROL VARIABLES
           IPRNT      5 PRINT CONTROL
           IPLOT      0 PLOT CONTROL
           QSCAL      0. HYDROGRAPH PLOT SCALE
           IPNCH      0 PUNCH COMPUTED HYDROGRAPH
           IOUT       22 SAVE HYDROGRAPH ON THIS UNIT
           ISAV1      1 FIRST ORDINATE PUNCHED OR SAVED
           ISAV2     1441 LAST ORDINATE PUNCHED OR SAVED
           TIMINT     0.017 TIME INTERVAL IN HOURS

```

VALUE EXCEEDS TABLE IN LOGLOG      0.01667      0.01667      24.00000

\*\*\*\*\*

```

*****
*           *
18 KK *   CPL   *
*           *
*****

```

```

20 KO      OUTPUT CONTROL VARIABLES
           IPRNT      5 PRINT CONTROL
           IPLOT      0 PLOT CONTROL
           QSCAL      0. HYDROGRAPH PLOT SCALE
           IPNCH      0 PUNCH COMPUTED HYDROGRAPH
           IOUT       22 SAVE HYDROGRAPH ON THIS UNIT
           ISAV1      1 FIRST ORDINATE PUNCHED OR SAVED
           ISAV2     1441 LAST ORDINATE PUNCHED OR SAVED
           TIMINT     0.017 TIME INTERVAL IN HOURS

```

\*\*\*\*\*

\*\*\*\*\*  
\* \*  
\* B3 \*  
\* \*  
\*\*\*\*\*

22 KK

24 KO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL  
IPLOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
IPNCH 0 PUNCH COMPUTED HYDROGRAPH  
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT  
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED  
ISAV2 1441 LAST ORDINATE PUNCHED OR SAVED  
TIMINT 0.017 TIME INTERVAL IN HOURS

VALUE EXCEEDS TABLE IN LOGLOG 0.01667 0.01667 24.00000

\*\*\* WARNING \*\*\* UNIT HYDROGRAPH TRUNCATED FROM 374 TO 300 INTERVALS

\*\*\*\*\*

\*\*\*\*\*  
\* \*  
\* CP2 \*  
\* \*  
\*\*\*\*\*

31 KO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTRL  
IPLOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
IPNCH 0 PUNCH COMPUTED HYDROGRAPH  
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT  
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED  
ISAV2 1441 LAST ORDINATE PUNCHED OR SAVED  
TIMINT 0.017 TIME INTERVAL IN HOURS

RUNOFF SUMMARY  
 FLOW IN CUBIC FEET PER SECOND  
 TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	B1	29.	12.82	14.	5.	5.	0.44		
HYDROGRAPH AT	B2	24.	12.82	11.	4.	4.	0.32		
2 COMBINED AT	CP1	53.	12.82	25.	9.	9.	0.76		
HYDROGRAPH AT	B3	89.	13.48	58.	21.	21.	1.73		
2 COMBINED AT	CP2	126.	13.15	82.	31.	31.	2.49		

\*\*\* NORMAL END OF HEC-1 \*\*\*



MINERAL RIGHTS  
PROPERTY TAX MAP PROJECT  
COUNTY OF WASHINGTON, WASHINGTON

SECTION	TOWNSHIP	RANGE	SECTION	ACRES	OWNER	PROPERTY TAX	ASSESSMENT
14	1	1E	14	160.00	STATE OF WASHINGTON	0.00	0.00
15	1	1E	15	160.00	STATE OF WASHINGTON	0.00	0.00
16	1	1E	16	160.00	STATE OF WASHINGTON	0.00	0.00
17	1	1E	17	160.00	STATE OF WASHINGTON	0.00	0.00
18	1	1E	18	160.00	STATE OF WASHINGTON	0.00	0.00
19	1	1E	19	160.00	STATE OF WASHINGTON	0.00	0.00
20	1	1E	20	160.00	STATE OF WASHINGTON	0.00	0.00
21	1	1E	21	160.00	STATE OF WASHINGTON	0.00	0.00
22	1	1E	22	160.00	STATE OF WASHINGTON	0.00	0.00
23	1	1E	23	160.00	STATE OF WASHINGTON	0.00	0.00
24	1	1E	24	160.00	STATE OF WASHINGTON	0.00	0.00
25	1	1E	25	160.00	STATE OF WASHINGTON	0.00	0.00
26	1	1E	26	160.00	STATE OF WASHINGTON	0.00	0.00
27	1	1E	27	160.00	STATE OF WASHINGTON	0.00	0.00
28	1	1E	28	160.00	STATE OF WASHINGTON	0.00	0.00
29	1	1E	29	160.00	STATE OF WASHINGTON	0.00	0.00
30	1	1E	30	160.00	STATE OF WASHINGTON	0.00	0.00
31	1	1E	31	160.00	STATE OF WASHINGTON	0.00	0.00
32	1	1E	32	160.00	STATE OF WASHINGTON	0.00	0.00
33	1	1E	33	160.00	STATE OF WASHINGTON	0.00	0.00
34	1	1E	34	160.00	STATE OF WASHINGTON	0.00	0.00
35	1	1E	35	160.00	STATE OF WASHINGTON	0.00	0.00
36	1	1E	36	160.00	STATE OF WASHINGTON	0.00	0.00
37	1	1E	37	160.00	STATE OF WASHINGTON	0.00	0.00
38	1	1E	38	160.00	STATE OF WASHINGTON	0.00	0.00
39	1	1E	39	160.00	STATE OF WASHINGTON	0.00	0.00
40	1	1E	40	160.00	STATE OF WASHINGTON	0.00	0.00
41	1	1E	41	160.00	STATE OF WASHINGTON	0.00	0.00
42	1	1E	42	160.00	STATE OF WASHINGTON	0.00	0.00
43	1	1E	43	160.00	STATE OF WASHINGTON	0.00	0.00
44	1	1E	44	160.00	STATE OF WASHINGTON	0.00	0.00
45	1	1E	45	160.00	STATE OF WASHINGTON	0.00	0.00
46	1	1E	46	160.00	STATE OF WASHINGTON	0.00	0.00
47	1	1E	47	160.00	STATE OF WASHINGTON	0.00	0.00
48	1	1E	48	160.00	STATE OF WASHINGTON	0.00	0.00
49	1	1E	49	160.00	STATE OF WASHINGTON	0.00	0.00
50	1	1E	50	160.00	STATE OF WASHINGTON	0.00	0.00

COPY





HEC1 S/N: 1343001909

HMVersion: 6.33

Data File: C:\WINDOWS\TEMP\~vbh0F28.TMP

```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*   MAY 1991 *
*   VERSION 4.0.1E *
*
* RUN DATE 06/30/2008 TIME 12:07:11 *
*
*****

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
*   609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
*   (916) 756-1104 *
*
*****

```

KEYSTONE CANYON 100 YEAR (PROPOSED)

3 IO OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLOT      0 PLOT CONTROL
QSCAL     0. HYDROGRAPH PLOT SCALE

```

IT HYDROGRAPH TIME DATA

```

NMIN      1 MINUTES IN COMPUTATION INTERVAL
IDATE     1 0 STARTING DATE
ITIME     0000 STARTING TIME
NQ        1441 NUMBER OF HYDROGRAPH ORDINATES
NDDATE    2 0 ENDING DATE
NDTIME    0000 ENDING TIME
ICENT     0 CENTURY MARK

```

```

COMPUTATION INTERVAL 0.02 HOURS
TOTAL TIME BASE      24.00 HOURS

```

ENGLISH UNITS

```

DRAINAGE AREA      SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION  FEET
FLOW                CUBIC FEET PER SECOND
STORAGE VOLUME     ACRE-FEET
SURFACE AREA       ACRES
TEMPERATURE        DEGREES FAHRENHEIT

```

\*\*\*\*\*

4 KK

```

*****
*
*
*
*
*****

```

OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLOT      0 PLOT CONTROL
QSCAL     0. HYDROGRAPH PLOT SCALE

```

KD

```

IPNCH      0 PUNCH COMPUTED HYDROGRAPH
IOUT       22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1      1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2     1441 LAST ORDINATE PUNCHED OR SAVED
TIMINT     0.017 TIME INTERVAL IN HOURS

```

VALUE EXCEEDS TABLE IN LOGLOG      0.01667      0.01667      24.00000

\*\*\* \*\*

```

*****
*           *
11 KK *   B2   *
*           *
*****

```

13 KO      OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLOT      0 PLOT CONTROL
QSCAL     0. HYDROGRAPH PLOT SCALE
IPNCH      0 PUNCH COMPUTED HYDROGRAPH
IOUT       22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1      1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2     1441 LAST ORDINATE PUNCHED OR SAVED
TIMINT     0.017 TIME INTERVAL IN HOURS

```

VALUE EXCEEDS TABLE IN LOGLOG      0.01667      0.01667      24.00000

\*\*\* \*\*

```

*****
*           *
18 KK *   CP1  *
*           *
*****

```

20 KO      OUTPUT CONTROL VARIABLES

```

IPRNT      5 PRINT CONTROL
IPLOT      0 PLOT CONTROL
QSCAL     0. HYDROGRAPH PLOT SCALE
IPNCH      0 PUNCH COMPUTED HYDROGRAPH
IOUT       22 SAVE HYDROGRAPH ON THIS UNIT
ISAV1      1 FIRST ORDINATE PUNCHED OR SAVED
ISAV2     1441 LAST ORDINATE PUNCHED OR SAVED
TIMINT     0.017 TIME INTERVAL IN HOURS

```

\*\*\* \*\*

\*\*\*\*\*  
\*  
\* B3 \*  
\*  
\*\*\*\*\*

KK

24 KO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL  
IPLOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
IPNCH 0 PUNCH COMPUTED HYDROGRAPH  
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT  
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED  
ISAV2 1441 LAST ORDINATE PUNCHED OR SAVED  
TIMINT 0.017 TIME INTERVAL IN HOURS

VALUE EXCEEDS TABLE IN LOGLOG 0.01667 0.01667 24.00000

\*\*\* WARNING \*\*\* UNIT HYDROGRAPH TRUNCATED FROM 374 TO 300 INTERVALS

\*\*\*\*\*

\*\*\*\*\*  
\*  
\* CP2 \*  
\*  
\*\*\*\*\*

31 KO

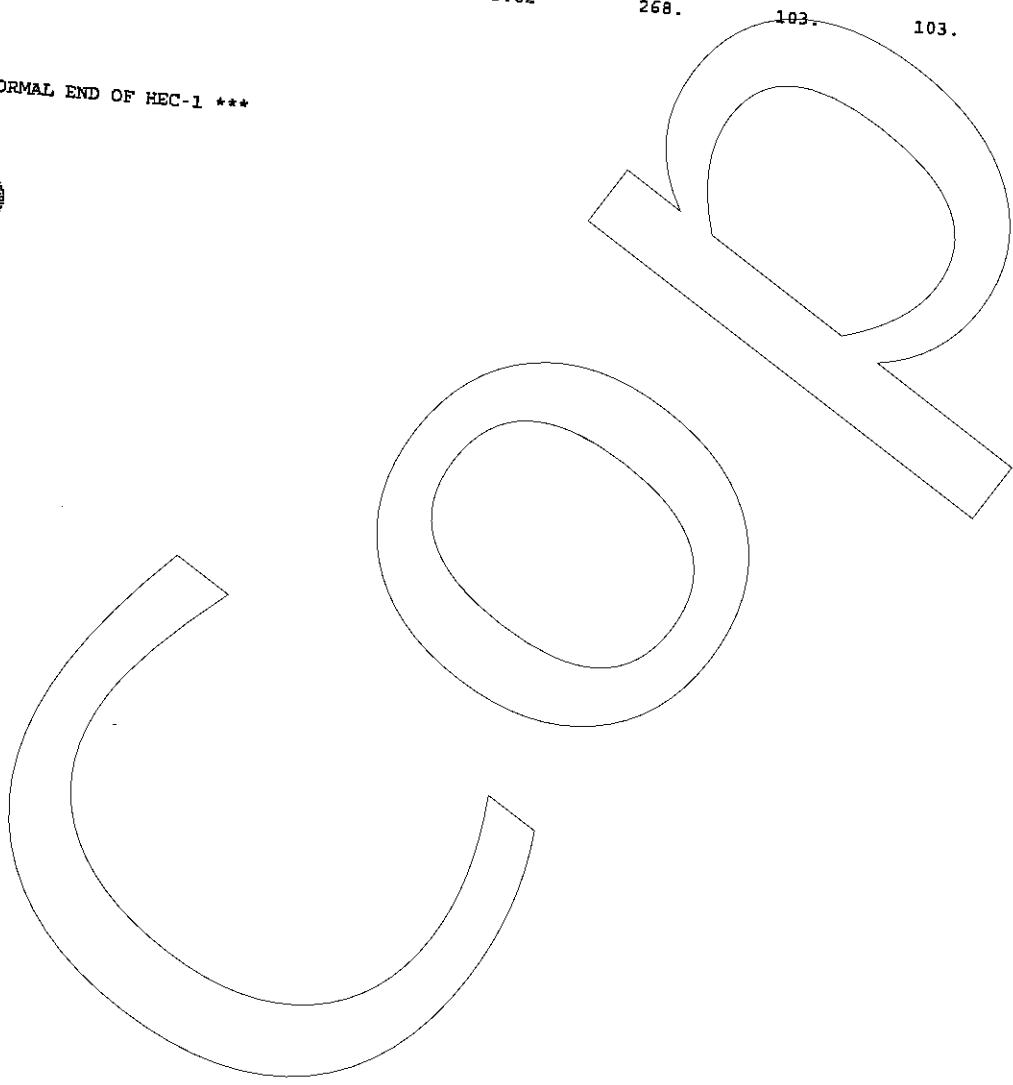
OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL  
IPLOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
IPNCH 0 PUNCH COMPUTED HYDROGRAPH  
IOUT 22 SAVE HYDROGRAPH ON THIS UNIT  
ISAV1 1 FIRST ORDINATE PUNCHED OR SAVED  
ISAV2 1441 LAST ORDINATE PUNCHED OR SAVED  
TIMINT 0.017 TIME INTERVAL IN HOURS

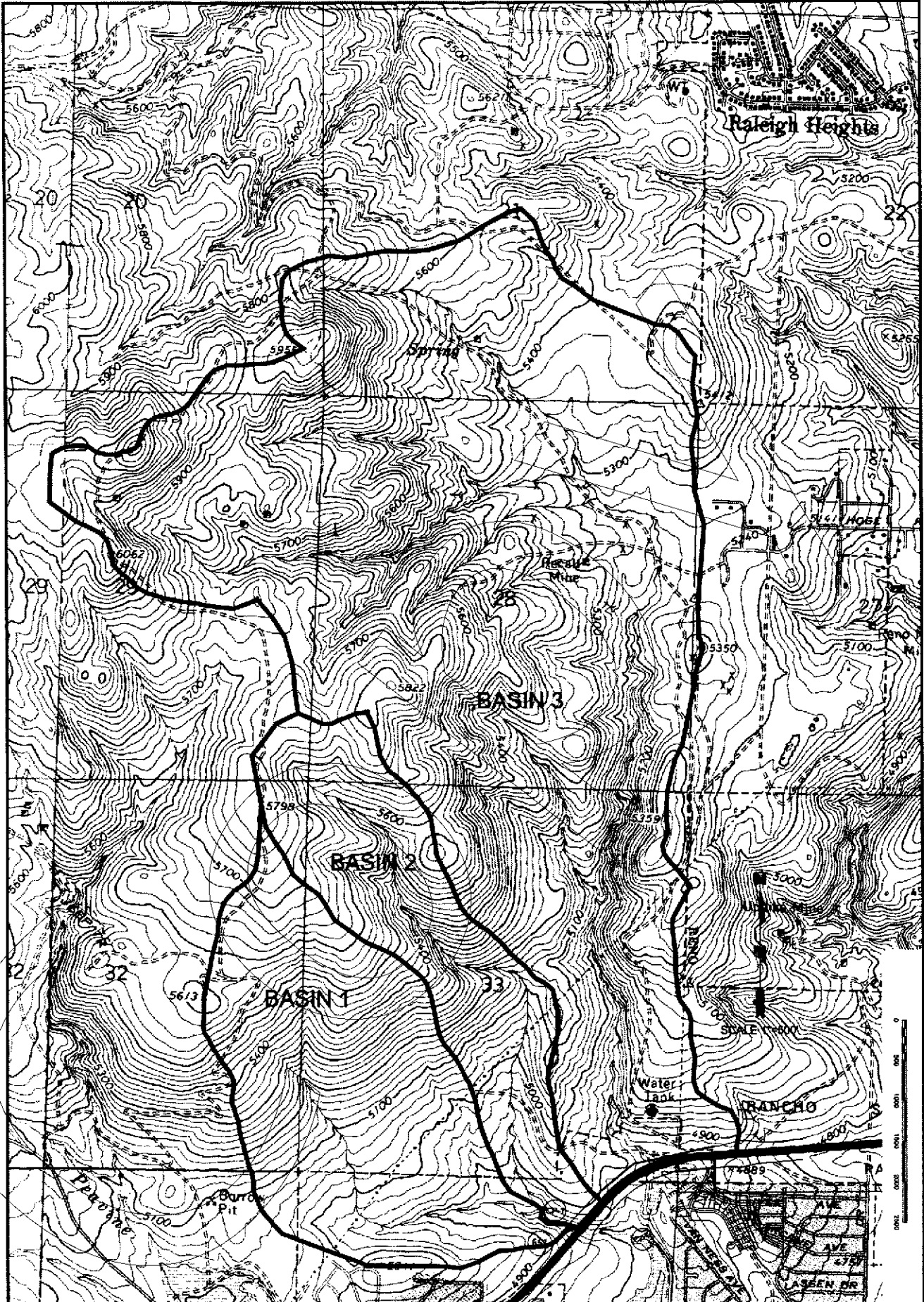
RUNOFF SUMMARY  
 FLOW IN CUBIC FEET PER SECOND  
 TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD			BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
				6-HOUR	24-HOUR	72-HOUR			
HYDROGRAPH AT	B1	163.	12.77	47.	18.	18.	0.44		
HYDROGRAPH AT	B2	122.	12.78	36.	14.	14.	0.32		
2 COMBINED AT	CP1	286.	12.77	83.	32.	32.	0.76		
HYDROGRAPH AT	B3	425.	13.32	186.	72.	72.	1.73		
2 COMBINED AT	CP2	630.	13.02	268.	103.	103.	2.49		

\*\* NORMAL END OF HEC-1 \*\*\*







SHEET	SCALE	REV.	DATE	DESCRIPTION	BY	APPD.
1	HORIZ: 1"=500'					
1	VERT:					
	JOB NO:					

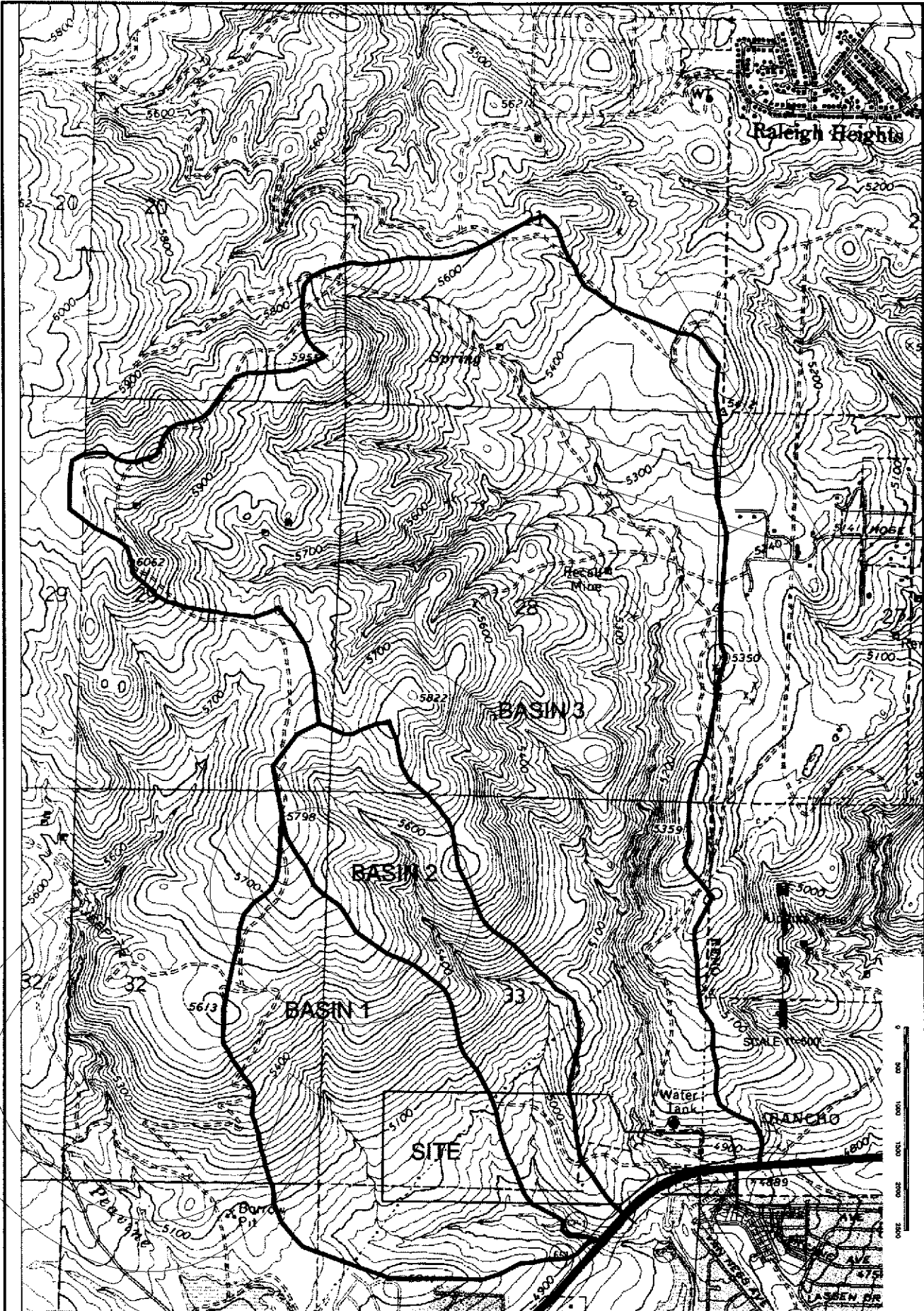
**EXISTING CONDITIONS HYDROLOGY MAP**  
**KEYSTONE CANYON TANAMERA**  
**FIGURE 3**

RENG WASHOE COUNTY NEVADA

DESIGNED BY: RWR  
 DRAWN BY: bob  
 CHECKED BY: CD  
 Copyright SUMMIT ENG 2009

**SUMMIT**  
 ENGINEERING  
 CORPORATION

8005 HAZEL AVE. RENO, NV 89523  
 PHONE: (775) 797-8500 FAX: (775) 797-8509



SHEET	SCALE	REV.	DATE	DESCRIPTION	BY	APP'D.
1	HORIZ. 1"=600'					
	VERT.					
1	JOB NO.:					

**PROPOSED CONDITIONS HYDROLOGY MAP**  
**KEYSTONE CANYON TANAMERA**  
**FIGURE 4**  
 RENO WASHOE COUNTY NEVADA

DESIGNED BY:  
 DRAWN BY: bob  
 CHECKED BY:  
 Copyright SUMMIT ENG 2006



# APPENDIX E

COPY

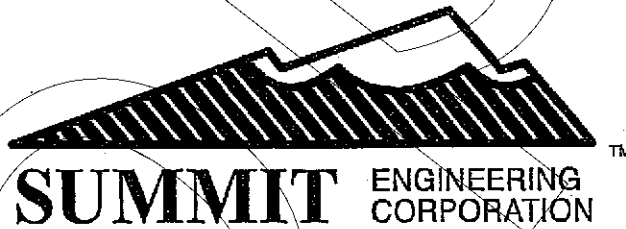
**PRELIMINARY MASTER SANITARY SEWER REPORT**

**FOR  
KEYSTONE CANYON**

**Prepared for:**  
Tanamera Commercial Development, LLC  
5470 Reno Corporate Drive.  
Reno, NV. 89511

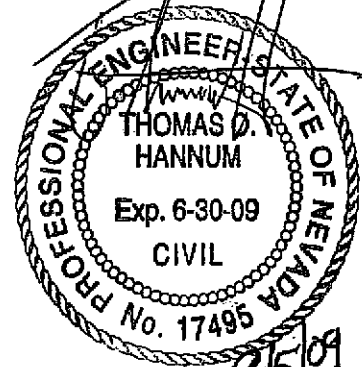
Job No. #28821

**Prepared by:**



**SUMMIT ENGINEERING CORPORATION**  
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Reno, Nevada 89523  
(775) 747-8550

March 09



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**Appendix A: Pipe Calculations**

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## **INTRODUCTION**

This report represents the preliminary sanitary sewer analysis for Keystone Canyon, a proposed 102 acre Planned Unit Development located in the City of Reno, southern half of section 33, Township 20 North, Range 19 East, M.D.B. & M. and consists of Washoe County Assessor's Parcel Numbers: 002-020-21, 002-020-22, and 082-631-14 through 082-631-24. (Reference Figure 1: Vicinity Map). Keystone Canyon is bound to the north and west by United States public land, to the north and east by Washoe County public land, and to the south by McCarran Blvd. and existing Sky County Estates subdivision. It is proposed that a portion of this development sewer south through Sky Country Estates, cross McCarran Blvd. to Severn Dr., follow Severn Dr. South to Wyoming Ave, and continue south down Wyoming and Saint Alberts Dr. to the Peavine interceptor, while the other portion sewer south to McCarran Blvd. and parallel McCarran west to the point where The Sky Country Estates sewer crosses McCarran (see Figure 2: Proposed Sewer Route). Several previous studies and reports were researched in the preparation of this report (see the references section of this report for a complete list of previous studies).

## **DESIGN STANDARDS**

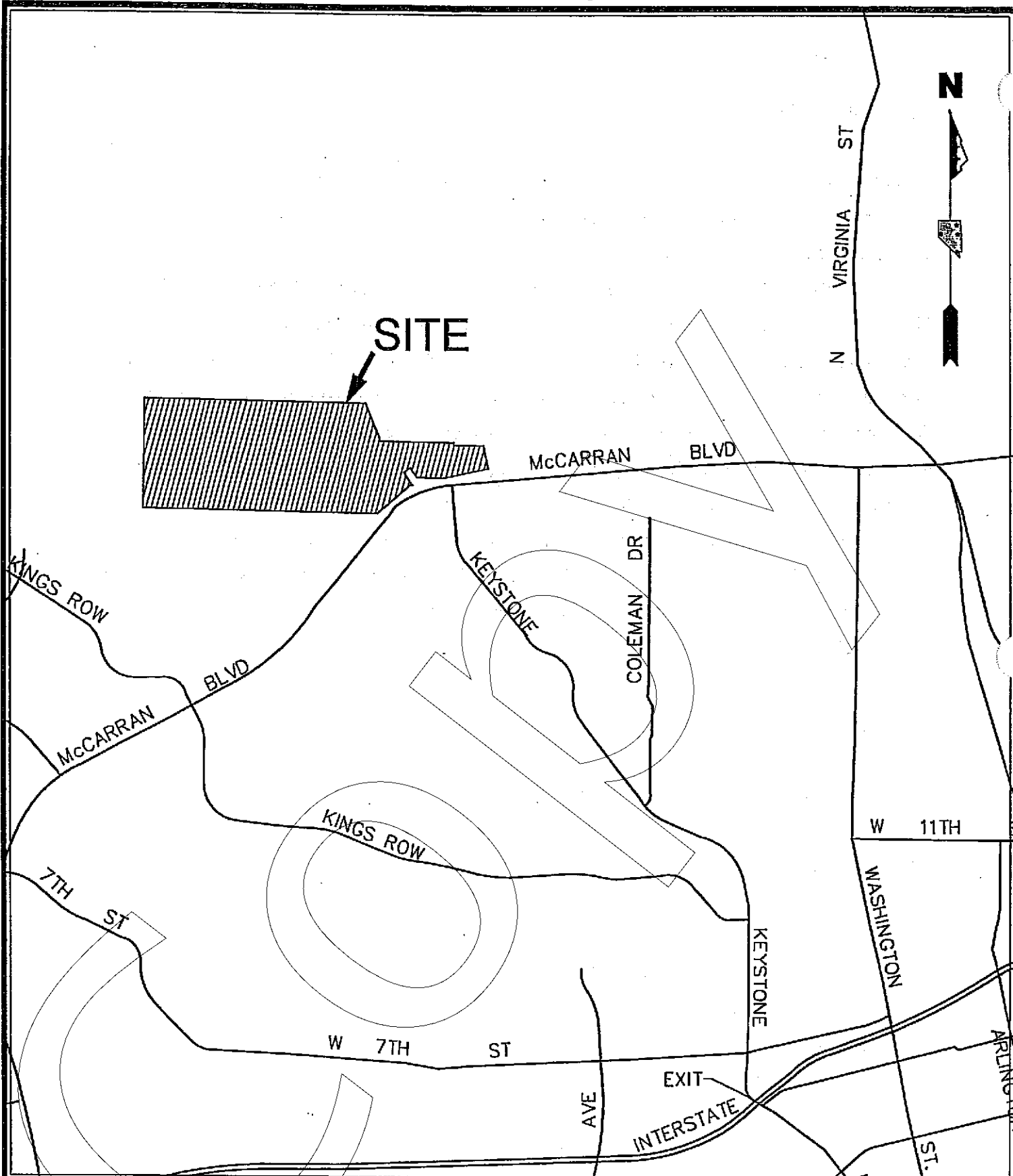
Design standards for this report were taken from chapter IV of the City of Reno Public Works Design Manual June 30, 2007 edition. Those standards can be summarized as follows:

### **Generation (peak flow):**

- Mains (8") – 350 gallons per capita per day.
- Trunk Sewers ( $\geq 10"$ ) – 250 gallons per capita per day
- Office / Public Facility – 3,200 gallons per acre per day
- Commercial – 10,000 gallons per acre per day.

### **Occupancy Rates:**

- |                            |     |                         |
|----------------------------|-----|-------------------------|
| Single Family Residential: | 3.0 | Capita / Dwelling Unit. |
| Apartment / Condominium    | 2.0 | Capita / Dwelling Unit. |

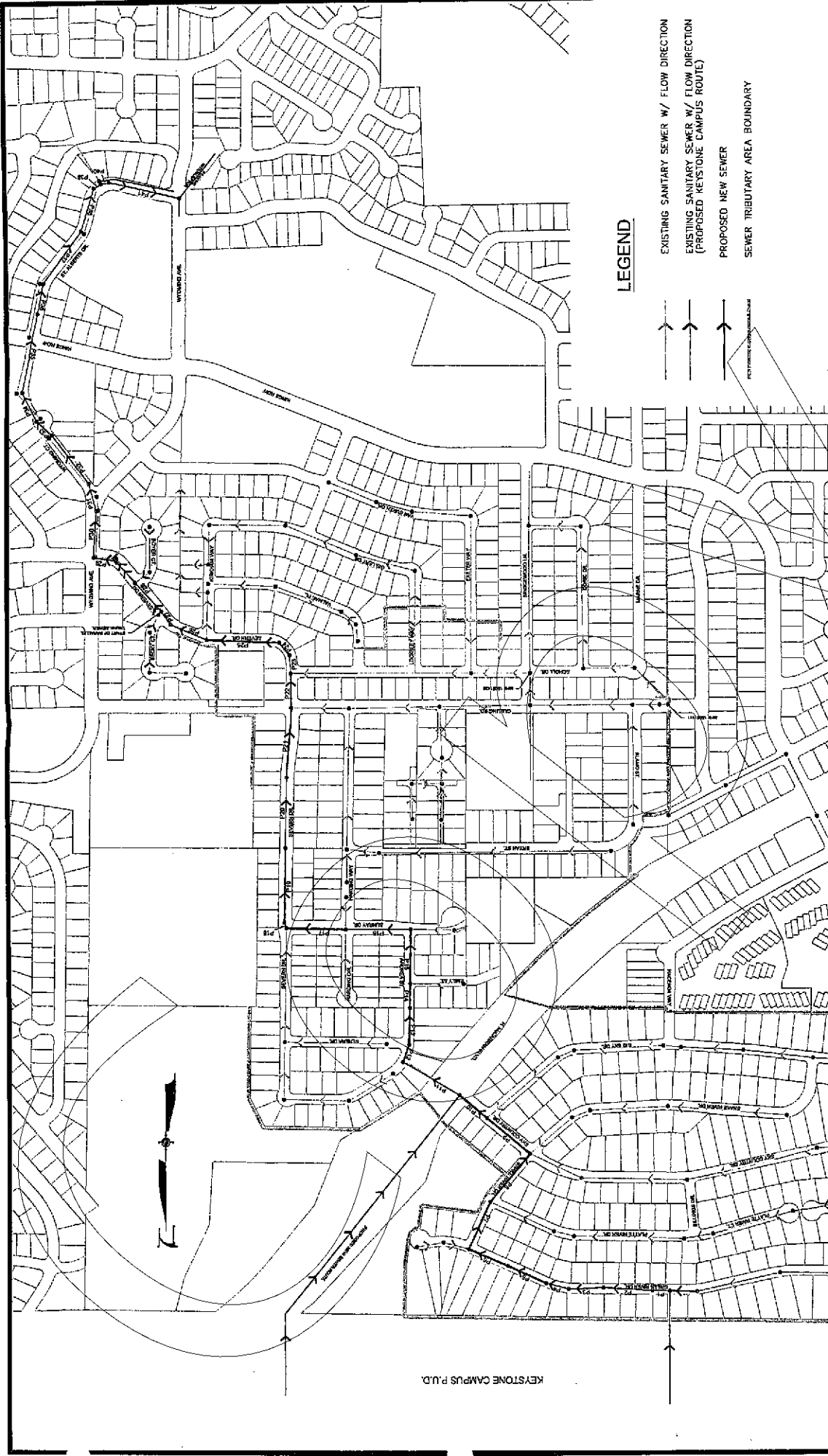


VICINITY MAP FOR  
 KEYSTONE CANYON P.U.D.  
 FIGURE 1

N.T.S.  
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**LEGEND**

- EXISTING SANITARY SEWER W/ FLOW DIRECTION
- - - → EXISTING SANITARY SEWER W/ FLOW DIRECTION (PROPOSED KEYSTONE CAMPUS ROUTE)
- PROPOSED NEW SEWER
- SEWER TRIBUTARY AREA BOUNDARY

<p><b>DISPLAY MAP FOR</b>  <b>KEYSTONE CANYON P.U.D.</b>  <b>FIGURE 2 PROPOSED SEWER ROUTE</b></p>		<p>SHEET          1 OF 1</p>
<p>SCALE: N.T.S.</p>	<p>DESIGNED BY:</p>	
<p>JOB #: 28519</p>	<p>CHECKED BY:</p>	
<p>Copyright SUMMIT ENG 2009</p>	<p>DRAWN BY: thantium</p>	
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 <p><b>SUMMIT</b> ENGINEERING CORPORATION          5405 MAE AVE, REED, NY 13923          PHONE: (715) 747-8550 FAX: (715) 747-8550</p>		

**DESIGN STANDARDS CONTINUED****Determination of flow characteristics:**

Normal depth and velocity were found using Manning's Equation and a roughness coefficient of  $n=0.014$  for pvc pipe. The percent full of each pipe was determined to be the calculated normal depth divided by the diameter of the pipe.

**Manning's Equation:**

$$Q = \left( \frac{1.49}{n} \right) AR^{2/3} \sqrt{s}$$

Q = Flow (cfs.)

$n$  = Manning's roughness coefficient

A = crosssection area of flow (ft<sup>2</sup>)

R = wetted perimeter (ft)

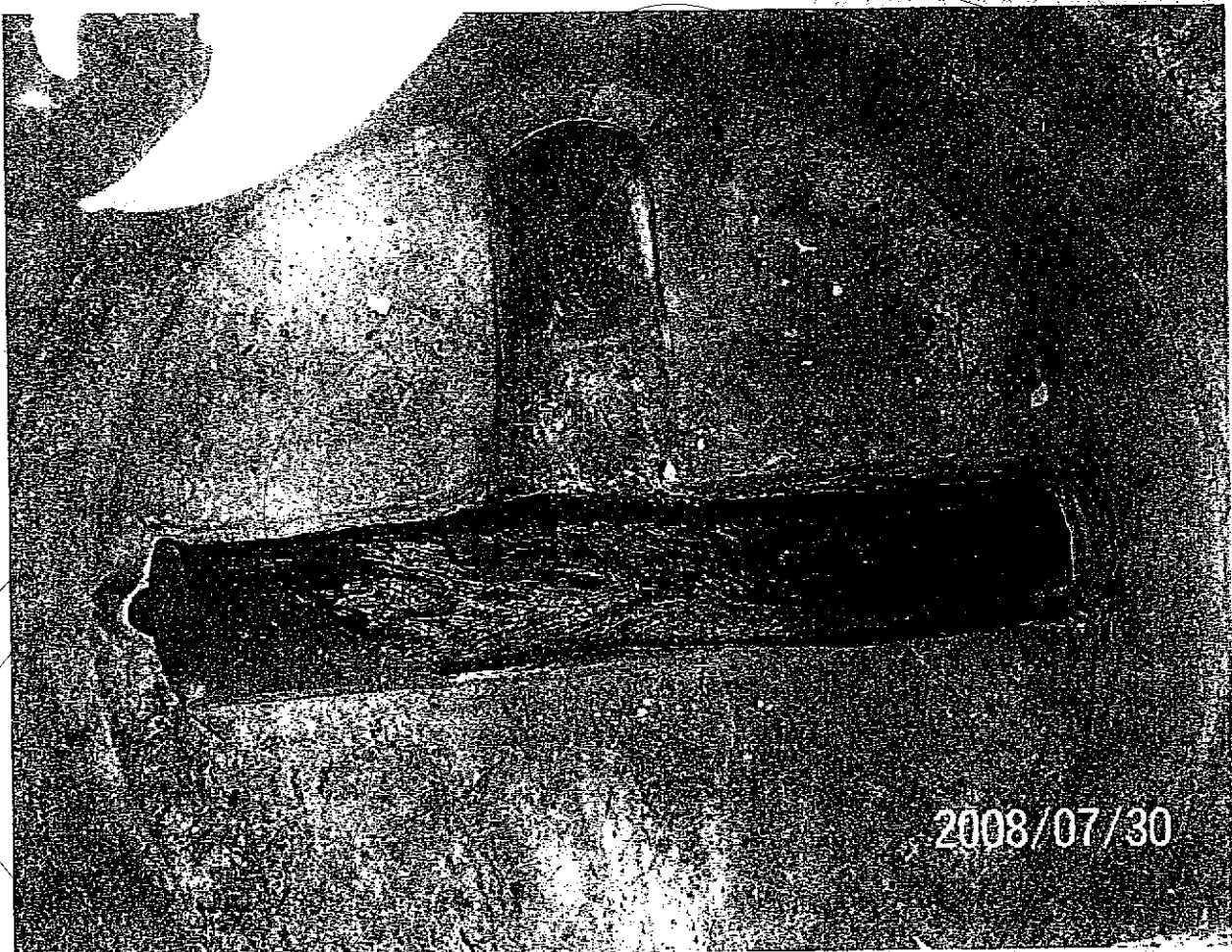
s = slope (ft/ft)

Because Keystone Canyon is the last foreseeable development in the upper reaches of the tributary area to the Peavine Interceptor, and based on the recommendations of previous reports and city staff, mains shall be allowed to reach 60% full at peak design flow and trunk sewers will be allowed to reach 65% full at peak design flow.

**TRIBUTARY AREA**

Previous studies and reports as well as field inspection of manholes were used to determine the limits of the tributary area to the proposed sewer route to the Peavine Interceptor. It will be helpful to read this section with the "Display Map for Keystone Canyon Proposed Sewer Route" out for reference (located in the map pocket of the appendix). The tributary area for the proposed sewer route is relatively easy to define north of McCarran Blvd, and consists of King's View Estates and Sky Country Estates. The area south of McCarran to Wyoming required more investigation because several re-routings and capacity improvements have been performed in this area. With the development of Silverado Ranch Estates Unit 5 at the north terminus of Kings Row, a flow split at MH # 15051411 in Gulling Rd. between Rayburn Dr. and

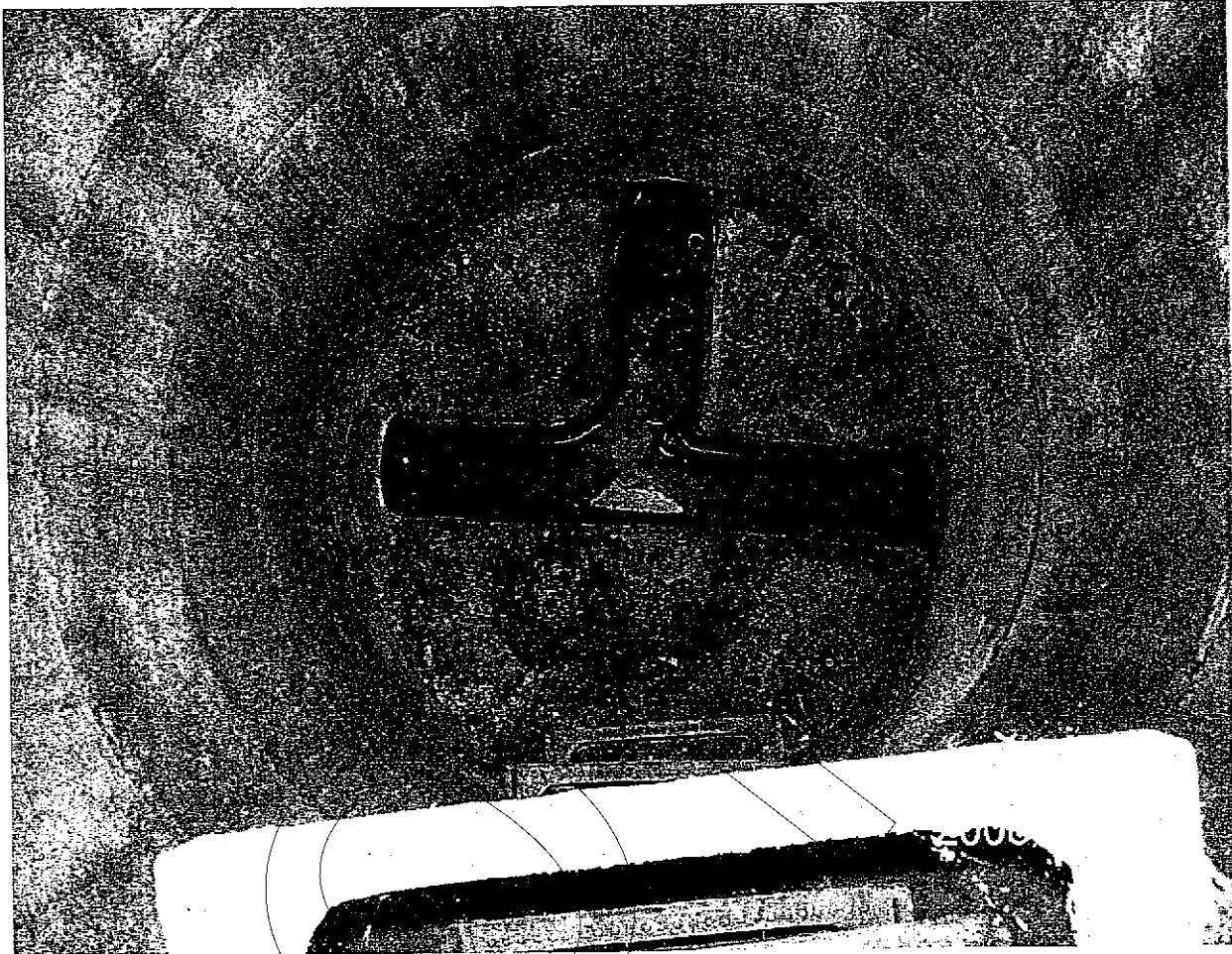
Alamo St. along with other down stream improvements was proposed. This flow split would take half of the flow traveling down North Kings Row and Bryan St. and send it down Gulling Rd. and Bridgewood Ln. Successively, a flow split at MH # 15051439 in the intersection of Scholl Dr. and Bidgewood Ln. was proposed with the development of Sky Country Estates Unit 7, sending half of the flow from the increased Gulling – Bridgewood sewer down Scholl Dr. to the proposed Keystone Canyon sewer route in Severn Dr. The combination of these two flow splits has the potential to significantly increase flows to the proposed sewer route for Keystone Canyon. Field inspection of MH # 15051411 in Gulling Rd. showed that the flow split was constructed, but later was blocked with a concrete plug (see picture below). In the current state, flows are not split at MH # 15051411 and no flow from the north Kings Row / Silverado Ranch Estates tributary area is routed down Gulling / Scholl to the Severn Dr. sewer.



Picture of MH# 15051411 taken facing east on Gulling Rd.

Field inspection of MH # 15051439 at the intersection of Bridgewood Ln. and Scholl Dr. shows that although not functioning very effectively, the flow split at this location is in place and under peak flow conditions will probably route a portion of sewer flows from Bridgewood down Scholl to the Severn Dr. sewer.

Picture of MH # 15051439 taken facing east in the intersection of Bridgewood and Scholl.



For the purpose of this report we assume that half of the peak flow coming down Bridgewood north of Scholl will be split at MH # 15051439, and travel down Scholl to the Severn Dr. sewer. With the development of Sky Country Estates Unit 7, a parallel trunk sewer was constructed in Severn Dr. beginning approximately at the intersection of Severn and Becky ct. and continuing down Severn Dr., Wyoming Ave, Wyoming Ct., and St. Alberts St. to the Peavine Interceptor. There are no other sewer contributors to the proposed Keystone Canyon sewer route from the start of the parallel trunk sewer to the Peavine Interceptor.

## SEWER GENERATION

The sewer generation for the proposed route was divided into **Existing Generation** for existing down stream developments within the tributary area, and **Proposed Generation** for the proposed Keystone Canyon.

### Existing Sewer Generation

Each existing residential and non-residential use in the tributary area was delineated and quantified as to number of lots or acreage in order to estimate existing sewer generation (reference "Display Map for Keystone Canyon Proposed Sewer Route" in map pocket). This information is summarized in Table 1: "Existing Sewer Generation" (pg. 9).

### Proposed Sewer Generation

Keystone Canyon has four main land use designations that were used to calculate sewer generation: Commercial, Office, Mixed Residential, Mixed Use, and Residential (reference Figure 3 Land Use Display). Sewer generation was calculated for each non-residential land use designation using peak flow per acre figures from the City of Reno Public Works Design Manual chapter IV. Sewer generation for residential and mixed uses was derived using the maximum allowable density for each land use area. The Community Commercial / Office, Mixed Residential 1, and Mixed Use 1 areas will be routed south down Victory Ln. to McCarran Blvd, parallel McCarran west to the sewer crossing McCarran from Sky Country Estates to Severn Dr (reference Table 2: "Proposed Sewer Generation" - pg. 11, and Figure 3: Keystone Canyon Land Use Display - pg. 12).

**TABLE 1: EXISTING SEWER GENERATION**

Development	Acres	Lots	Unit Flow (gal/unit/day)	Occupancy	Peak Flow (gpd)
King's View Estates Unit 1	n/a	51	350	3	53,550
King's View Estates Unit 2	n/a	43	350	3	45,150
Sky Country Estates Unit 8	n/a	30	350	3	31,500
Sky Country Estates Unit 7	n/a	28	350	3	29,400
Sky Country Estates Unit 6	n/a	25	350	3	26,250
Sky Country Estates Unit 5	n/a	37	350	3	38,850
Sky Country Estates Unit 4	n/a	32	350	3	33,600
Sky Country Estates Unit 3	n/a	42	350	3	44,100
Sky Country Estates Unit 2	n/a	20	350	3	21,000
Sky Country Estates Unit 1	n/a	26	350	3	27,300
Sky Country Park	5.03	n/a	3200	n/a	16,096
Sage Crest Estates	n/a	40	350	3	42,000
P.M. # 2829	n/a	2	350	3	2,100
R.O.S. # 5023	n/a	2	350	3	2,100
P.M. # 3897	n/a	3	350	3	3,150
P.M. # 3898	n/a	3	350	3	3,150
Sunray Subdivision	n/a	12	350	3	12,600
Sunburst Subdivision	n/a	41	350	3	43,050
Severn View Subdivision	n/a	6	350	3	6,300
P.M. # 191	n/a	2	350	3	2,100
P.M. # 4469	n/a	4	350	3	4,200
P.M. # 4302	n/a	4	350	3	4,200
P.M. # 4467	n/a	4	350	3	4,200
P.M. # 419	n/a	3	350	3	3,150
P.M. # 484	n/a	2	350	3	2,100
P.M. # 460	n/a	3	350	3	3,150
P.M. # 463	n/a	2	350	3	2,100
Severn Heights Subdivision	n/a	27	350	3	28,350
P.M. # 3236	n/a	2	350	3	2,100
P.M. # 3031	n/a	2	350	3	2,100
P.M. # 3032	n/a	4	350	3	4,200
P.M. # 3033	n/a	4	350	3	4,200
P.M. # 1652	n/a	2	350	3	2,100
P.M. # 3034	n/a	3	350	3	3,150
P.M. # 3035	n/a	2	350	3	2,100
Church Hill Estates	n/a	8	350	3	8,400
P.M. # 4468	n/a	4	350	3	4,200
Harding Way Subdivision	n/a	9	350	3	9,450
Gulling Subdivision	n/a	8	350	3	8,400
P.M. # 2268	n/a	2	350	3	2,100
P.M. # 2035	n/a	4	350	3	4,200
P.M. # 2230	n/a	4	350	3	4,200
P.M. # 2253	n/a	4	350	3	4,200
P.M. # 1429	n/a	3	350	3	3,150
P.M. # 701	n/a	3	350	3	3,150
P.M. # 1090	n/a	2	350	3	2,100

Sub-total of peak flow going to proposed route this page: 596,746

\*Shaded entries indicate flows that are split at corner of Bridgewood and Scholl MH#15051439.  
Only half of these flows travel to the proposed route.

**TABLE 1: EXISTING SEWER GENERATION (continued)**

Development	Acres	Lots	Unit Flow (gal/unit/day)	Occupancy	Peak Flow (gpd)
Portion of Sierra Heights Reno Unit 3-E	n/a	19	350	3	19,950
Portion of Sierra Heights Reno Unit 3-D	n/a	24	350	3	25,200

Sub-total of peak flow going to proposed route this page: **55,163**

Total existing peak flow going to proposed route: **651,909**

Trunk line multiplier for 10" and larger = 0.714

Total existing peak flow for trunk sewer 10" and larger: **465,649**

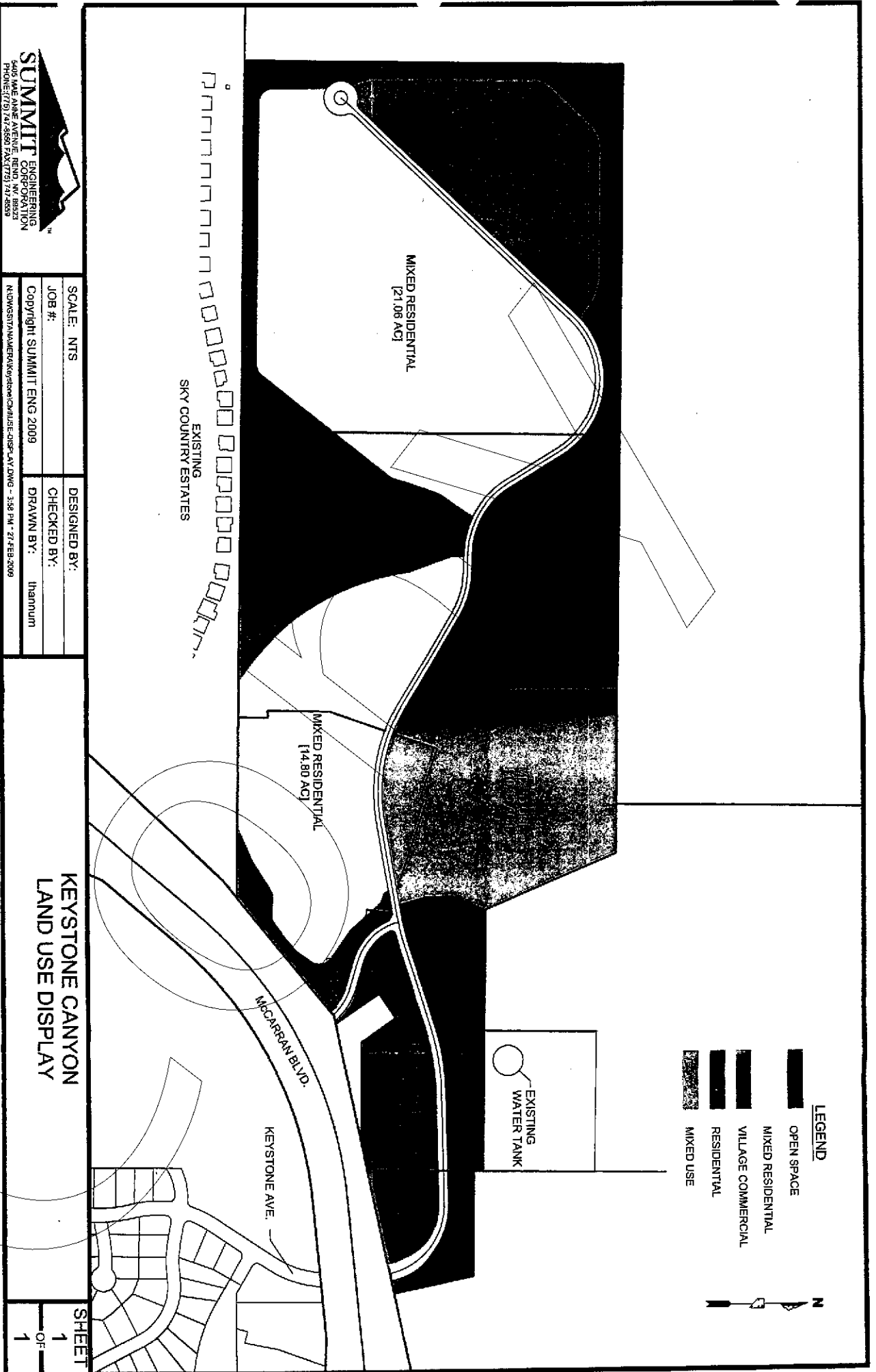
\*Shaded entries indicate flows that are split at corner of Bridgewood and Scholl MH#15051439. Only half of these flows travel to the proposed route.

**TABLE 2: PROPOSED SEWER GENERATION**

Land Use	Acres	Allowable Density	Number of Units	Unit Flow (gal/unit/day)	Occupancy	Peak Flow (gpd)	Routing
Commercial	2.01	n/a	n/a	10,000	n/a	20,100	McCarran
Office	2.01	n/a	n/a	3,200	n/a	6,432	McCarran
Residential	9.26	7	65	350	2 <sup>(1)</sup>	45,500	Sky Country
Mixed Residential Ph-2	21.06	18	379	350	2 <sup>(1)</sup>	265,300	Sky Country
Mixed Residential Ph-1	14.80	18	266	350	2 <sup>(1)</sup>	186,200	McCarran
Mixed Use <sup>(2)</sup>	10.90	n/a	n/a	10,000	N/A	109,000	McCarran
<b>Total proposed peak flow:</b>						<b><u>632,532</u></b>	
Trunk line multiplier for 10" and larger (250/350) =						0.714	
<b>Total proposed peak flow for trunk sewer 10" and larger:</b>						<b><u>451,809</u></b>	
Total peak flow through Sky Country Estates:				310,800			
Total peak flow parallel McCarran Blvd.:				321,732			
<b>Note:</b>							
(1) Occupancy of 2 was used, corresponding to multifamily dwelling units because laying out the site for single family dwelling units would result in significantly lower density.							
(2) The Mixed-Use sewer calculation is based on 10.9 acres of commercial use; but due to topographic constraints, actual development of the Mixed-Use planning area will most likely contain only ± two (2) acres of commercial combined with any residential density not achieved in other designated planning areas. (Calculation: Commercial peak sewer flow is based on 10,000 gallons per acre per day; 10,000 gal per acre per day x ±2 acres = ±20,000 gallons per day)							

**EXISTING DOWNSTREAM SEWER SYSTEM**

Pipe and manhole information taken from previous studies was used to analyze the downstream sewer system capacity. Contributing number of lots and non-residential flows within the tributary area were tabulated and a cumulative peak flow for each pipe along the proposed route was used to determine the percent full of each pipe. This information is presented in tabular form in Table 3: Existing Downstream pipe network.



EXISTING  
SKY COUNTRY ESTATES

MIXED RESIDENTIAL  
[21.08 AC]

MIXED RESIDENTIAL  
[14.80 AC]

EXISTING  
WATER TANK

McCARRAN BLVD.

KEYSTONE AVE.

KEYSTONE CANYON  
LAND USE DISPLAY



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**TABLE 3: EXISTING DOWNSTREAM PIPE NETWORK**

Street Name	MH# Up Stream	MH# Down Stream	Pipe #	Pipe Size	Pipe Slope (%)	Additional Existing Lots	Total Existing Lots	Additional Flows	Total Existing Flow (Gpd.)	Keystone Campus Flow (Gpd.)	Total Proposed Flow (Gpd.)	Percent Full Existing	Percent Full Proposed
Green River Dr.	15052417	15052418	1	8	3.15	32	32		33,600	310,800	344,400	11.1	35.3
Green River Dr.	15052418	15052419	2	8	3.07	6	38		39,900	310,800	350,700	12.1	35.9
Green River Dr.	15052419	15052401	3	8	3.09	4	42		44,100	310,800	354,900	12.7	36.1
Green River Dr.	15052401	15052402	4	8	0.98	3	45		47,250	310,800	358,050	17.4	49.9
Green River Dr.	15052402	15052403			0.50	6	51		53,550	310,800	364,350	21.8	
Green River Dr.	15052403	15052404			0.50	4	55		57,750	310,800	368,550	22.7	
Snake River Dr.	15052404	15052407			0.40	7	62		66,100	310,800	375,900	25.5	
Snake River Dr.	15052407	15051930			0.46	152	214	16096 (1)	240,796	310,800	551,596	49.4	
Sky County Dr.	15051930	15051928			0.73	68	282		312,196	310,800	622,996	50.2	
Sky County Dr.	15051928	15051929			1.00	52	334		366,796	310,800	677,596	50.3	50.1
McCarran Blvd.	15051929	15052022	11	8	7.06	0	334		366,796	632,532	999,328	29.6	
Andrea St.	15052022	15052024			1.10	3	337		369,946	632,532	1,002,478	49.2	
Andrea St.	15052024	15052025			1.10	2	339		372,046	632,532	1,004,578	49.3	
Andrea St.	15052025	15052026			2.35	3	342		375,196	632,532	1,007,728	40.1	
Andrea St.	15052026	15052028			2.35	19	361		395,146	632,532	1,027,678	41.2	
Sunray Dr.	15052028	15052011	16	8	4.90	13	374		408,796	632,532	1,041,328	34.4	57.4
Sunray Dr.	15052011	15052004	7		1.34	20	394		429,796	632,532	1,062,328	50.7	
Severn Dr.	15052004	15052006			1.35	50	444		482,296	632,532	1,114,828	54.2	
Severn Dr.	15052006	15052008			0.50	10	454		482,296	451,809	803,806	42.6	56.8
Severn Dr.	15052008	15051502	20	10	1.00	10	464		351,997	451,809	811,306	35.7	
Severn Dr.	15051502	15051504			4.40	8	472		359,497	451,809	811,306	35.7	
Severn Dr.	15051504	15051508			4.84	74	546		511,696	632,532	1,144,228	40.0	
Severn Dr.	15051508	15051511	23	10	2.34	47.5 (2)	593.5	6338 (3)	589,396	632,532	1,221,928	42.1	
Severn Dr.	15051511	15051513	24		4.87	2	595.5		461,149	451,809	912,958	32.5	47.2
Severn Dr.	15051513	15051514	25		4.26	5	600.5		647,709	632,532	1,280,241	44.2	
Severn Dr.	15051514	15051546	26	10	5.67	0	600.5		652,959	632,532	1,285,491	46.2	
Severn Dr.	15051546	15051544	27	10	2.35	0	600.5		466,399	451,809	918,208	26.1	37.1
Severn Dr.	15051544	15051545	28	10	2.57	0	600.5		466,399	451,809	918,208	32.7	47.4
Severn Dr.	15051545	15051543	29	10	1.35	0	600.5		466,399	451,809	918,208	32.0	46.2
Wyoming Ave	15051543	15051041			0.30	0	600.5		466,399	451,809	918,208	37.9	55.9
Wyoming Ave	15051041	15051043	31	12	0.63	0	600.5		466,399	451,809	918,208	43.9	52.4

Notes: Shaded cells indicate pipes that are flowing above 60% full for mains and 65% for trunks

- (1) Sky Country Park @ 3200 gpd/Ac.
- (2) Represents half of the lots from the shaded sub-tributary area that is split at MH#15051439 at the intersection of Bridgewood and Scholl
- (3) half of the flows from the AT&T property APN: 001-041-05 + half of the flows from Church APN: 001-041-04 each @ 3200 gpd/Ac.

TABLE 3: EXISTING DOWNSTREAM PIPE NETWORK (continued)

Street Name	MH# Up Stream	MH# Down Stream	Pipe #	Pipe Size	Pipe Slope (%)	Additional Existing Lots	Total Existing Lots	Additional Flows	Total Existing Flow (Gpd.)	Keystone Campus Flow (Gpd.)	Total Proposed Flow (Gpd.)	Percent Full Existing	Percent Full Proposed
Wyoming Ct	15051043	15060655	32	12	0.32	0	600.5		466,399	451,809	918,208	43.1	63.8
Wyoming Ct	15060655	15060654	33	12	0.32	0	600.5		466,399	451,809	918,208	43.1	63.8
Wyoming Ct	15060654	15060653	34	12	0.32	0	600.5		466,399	451,809	918,208	43.1	63.8
St. Alberts Dr.	15060653	15060652	35	12	0.32	0	600.5		466,399	451,809	918,208	43.1	63.8
St. Alberts Dr.	15060652	15060651	36	12	0.32	0	600.5		466,399	451,809	918,208	43.1	63.8
St. Alberts Dr.	15060651	15051042	37	12	0.32	0	600.5		466,399	451,809	918,208	42.4	63.8
St. Alberts Dr.	15051042	15050582	38	12	0.34	0	600.5		466,399	451,809	918,208	43.1	63.8
St. Alberts Dr.	15050582	15050581	39	12	0.32	0	600.5		466,399	451,809	918,208	43.1	63.8
St. Alberts Dr.	15050581	15050580	40	12	0.32	0	600.5		466,399	451,809	918,208	43.1	63.8
St. Alberts Dr.	15050580	15051037	41	12	0.31	0	600.5		466,399	451,809	918,208	43.1	63.8

**FINDINGS**

The proposed sewer route for the Keystone Canyon P.U.D. has several pipes that will flow above 60% full under the proposed peak flow conditions. These pipes include: P5 – P10 in Sky Country Estates, P12 – P15 in Andrea St., P17-P19 in Sunray Dr. and Severn Dr., and P21, P22, P24, P25 in Severn Dr. (reference "Display Map For Keystone Canyon P.U.D. Proposed Sewer Route" in the map pocket Appendix B).

**CONCLUSION**

Improvements necessary to the down stream sewer system will be dependant on the scope and the phasing of each development within the Keystone Canyon P.U.D. Each site improvement permit under the Keystone Canyon P.U.D. shall be accompanied by a sewer report that details the contribution of the proposed development and the impacts to the down stream sewer system. As an alternative, flow metering shall be allowed to determine actual sewer flows and the necessity of improvements.

## REFERENCES

City of Reno Public Works Design Manual - June 30, 2007 Edition

Washoe County Assessor's Maps and Washoe County Recorded Maps.

### Previous Studies

Wood Rodgers. (2008, January 3). *Keystone Canyon – Offsite Sewer Study*

CFA Inc (1999, April 28). *Master Sanitary Sewer Report for Keystone Community Campus*

Summit Engineering Corp. (1998, April). *Sanitary Sewer Report for Silverado Ranch Estates Unit 5*

Odyssey Engineering Inc. (1998, March). *Sewer Report for Sky Country Estates Unit 7*

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APPENDIX A

COPY

Item	Description	Quantity	Unit	Price	Total
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**KEYSTONE CANYON P.U.D. SEWER PIPE CALCULATIONS Report Report**

Label	Solve For	Friction Method	Roughness Coefficient	Channel Slope (ft)	Normal Depth (ft)	Diameter (ft)	Discharge (gal/day)	Percent Full (%)	Velocity (ft/s)	Maximum Discharge (gal/day)
P1 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.03150	0.89	8.00	33600.00	11.1	2.45	1384526.49
P1 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.03150	2.83	8.00	344400.00	35.3	4.83	1384526.49
P2 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.03070	0.97	8.00	39900.00	12.1	2.56	1366832.14
P2 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.03070	2.88	8.00	350700.00	35.9	4.81	1366832.14
P3 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.03090	1.02	8.00	44100.00	12.7	2.64	1371277.13
P3 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.03090	2.89	8.00	354900.00	36.1	4.83	1371277.13
P4 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00980	1.39	8.00	47250.00	17.4	1.80	772251.98
P4 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00980	3.99	8.00	358050.00	49.9	3.18	772251.98
P5 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00500	1.75	8.00	53550.00	21.8	1.47	551608.56
P5 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00500	4.98	8.00	364350.00	62.3	2.47	551608.56
P6 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00500	1.81	8.00	57250.00	22.7	1.50	551608.56
P6 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00500	5.02	8.00	368550.00	62.8	2.47	551608.56
P7 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00400	2.04	8.00	65100.00	25.5	1.44	493373.69
P7 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00400	5.51	8.00	375900.00	68.9	2.27	493373.69
P8 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00460	3.95	8.00	240796.00	49.4	2.17	529084.34
P8 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00460	5.19	8.00	551569.00	64.8	2.39	529084.34
P9 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00730	4.02	8.00	312196.00	50.2	2.75	666511.16
P9 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00730	6.60	8.00	622996.00	82.5	3.13	666511.16
P10 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.01000	4.03	8.00	366796.00	50.3	3.22	780092.31

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**KEYSTONE CANYON P.U.D. SEWER PIPE CALCULATIONS Report Report**

Label	Solve For	Equation Method	Roughness Coefficient	Channel Slope (ft/ft)	Normal Depth (ft)	Diameter (ft)	Discharge (gal/day)	Percent Full (%)	Velocity (ft/s)	Maximum Discharge (gal/day)
P10 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.01000	6.13	8.00	677596.00	76.6	3.65	780092.31
P11 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.07060	2.37	8.00	366796.00	29.6	6.57	2072756.78
P11 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.07060	4.09	8.00	999328.00	51.1	8.62	2072756.78
P12 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.01100	3.93	8.00	369946.00	49.2	3.35	818167.71
P12 Proposed Peak Flow	Full Flow Capacity	Manning Formula	0.014	0.01100	8.00	8.00	760453.19	100.0	3.37	818023.96
P13 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.01100	3.95	8.00	372046.00	49.3	3.35	818167.71
P13 Proposed Peak Flow	Full Flow Capacity	Manning Formula	0.014	0.01100	8.00	8.00	760566.83	100.0	3.37	818167.71
P14 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.02350	3.21	8.00	375196.00	40.1	4.44	1195858.86
P14 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.02350	5.97	8.00	1007728.00	74.6	5.58	1195858.86
P15 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.02350	3.29	8.00	395146.00	41.2	4.51	1195858.86
P15 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.02350	6.07	8.00	1027678.00	75.9	5.60	1195858.86
P16 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.04900	2.76	8.00	408796.00	34.4	5.94	1726807.93
P16 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.04900	4.69	8.00	1041328.00	58.7	7.57	1726807.93
P17 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.01340	4.06	8.00	429796.00	50.7	3.74	903022.13
P17 Proposed Peak Flow	Full Flow Capacity	Manning Formula	0.014	0.01340	8.00	8.00	839489.37	100.0	3.72	903022.13
P18 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.01350	4.34	8.00	482286.00	54.2	3.86	906385.35
P18 Proposed Peak Flow	Full Flow Capacity	Manning Formula	0.014	0.01350	8.00	8.00	842595.90	100.0	3.73	906385.35
P19 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00500	4.26	10.00	351997.00	42.6	2.46	1000132.86
P19 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00500	7.18	10.00	803806.00	71.8	2.97	1000132.86
P20 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.01000	3.57	10.00	359497.00	35.7	3.18	1414401.46

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**KEYSTONE CANYON P.U.D. SEWER PIPE CALCULATIONS Report Report**

Label	Solve For	Friction Method	Roughness Coefficient	Channel Slope (ft/s)	Normal Depth (ft)	Diameter (ft)	Discharge (gal/day)	Percent Full (%)	Velocity (ft/s)	Maximum Discharge (gal/day)
P20 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.01000	5.68	10.00	811306.00	56.8	3.92	1414401.46
P21 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.04400	3.20	8.00	511696.00	40.0	6.07	1636335.42
P21 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.04400	5.18	8.00	1144228.00	64.8	7.40	1636335.42
P22 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.04840	3.37	8.00	589396.00	42.1	6.54	1716203.07
P22 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.04840	5.25	8.00	1221928.00	65.6	7.79	1716203.07
P23 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.02340	3.25	10.00	461149.00	32.5	4.63	2163618.19
P23 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.02340	4.73	10.00	912958.00	47.3	5.57	2163618.19
P24 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.04870	3.54	8.00	647709.00	44.2	6.72	1721513.67
P24 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.04870	5.42	8.00	1280241.00	67.7	7.88	1721513.67
P25 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.04260	3.69	8.00	652959.00	46.2	6.41	1610092.38
P25 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.04260	5.71	8.00	1286491.00	71.4	7.46	1610092.38
P26 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.05670	2.61	10.00	466399.00	26.1	6.38	3367939.06
P26 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.05670	3.71	10.00	918208.00	37.1	7.72	3367939.06
P27 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.02350	3.27	10.00	466399.00	32.7	4.65	2168236.38
P27 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.02350	4.74	10.00	918208.00	47.4	5.59	2168236.38
P28 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.02570	3.20	10.00	466399.00	32.0	4.80	2267458.03
P28 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.02570	4.61	10.00	918208.00	46.1	5.78	2267458.03
P29 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.01350	3.79	10.00	466399.00	37.9	3.81	1643385.99
P29 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.01350	5.59	10.00	918208.00	55.9	4.53	1643385.99
P30 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00300	5.27	12.00	466399.00	43.9	2.17	1259746.94

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**KEYSTONE CANYON P.U.D. SEWER PIPE CALCULATIONS Report Report**

Label	Solve For	Friction Method	Roughness Coefficient	Channel Slope (ft/m)	Normal Depth (ft)	Diameter (in)	Discharge (gal/day)	Percent Full (%)	Velocity (ft/s)	Maximum Discharge (gal/day)
P30 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00300	8.00	12.00	918208.00	66.7	2.55	1259746.94
P31 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00630	4.30	12.00	466399.00	35.8	2.85	1825546.75
P31 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00630	6.29	12.00	918208.00	52.4	3.41	1825546.75
P32 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	5.17	12.00	466399.00	43.1	2.23	1301061.05
P32 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	7.82	12.00	918208.00	65.2	2.62	1301061.05
P33 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	5.17	12.00	466399.00	43.1	2.23	1301061.05
P33 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	7.82	12.00	918208.00	65.2	2.62	1301061.05
P34 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	5.17	12.00	466399.00	43.1	2.23	1301061.05
P34 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	7.82	12.00	918208.00	65.2	2.62	1301061.05
P35 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	5.17	12.00	466399.00	43.1	2.23	1301061.05
P35 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	7.82	12.00	918208.00	65.2	2.62	1301061.05
P36 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	5.17	12.00	466399.00	43.1	2.23	1301061.05
P36 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	7.82	12.00	918208.00	65.2	2.62	1301061.05
P37 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	5.17	12.00	466399.00	43.1	2.23	1301061.05
P37 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	7.82	12.00	918208.00	65.2	2.62	1301061.05
P38 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00340	5.08	12.00	466399.00	42.4	2.28	1341103.03
P38 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00340	7.66	12.00	918208.00	63.8	2.68	1341103.03
P39 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	5.17	12.00	466399.00	43.1	2.23	1301061.05
P39 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	7.82	12.00	918208.00	65.2	2.62	1301061.05
P40 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	5.17	12.00	466399.00	43.1	2.23	1301061.05

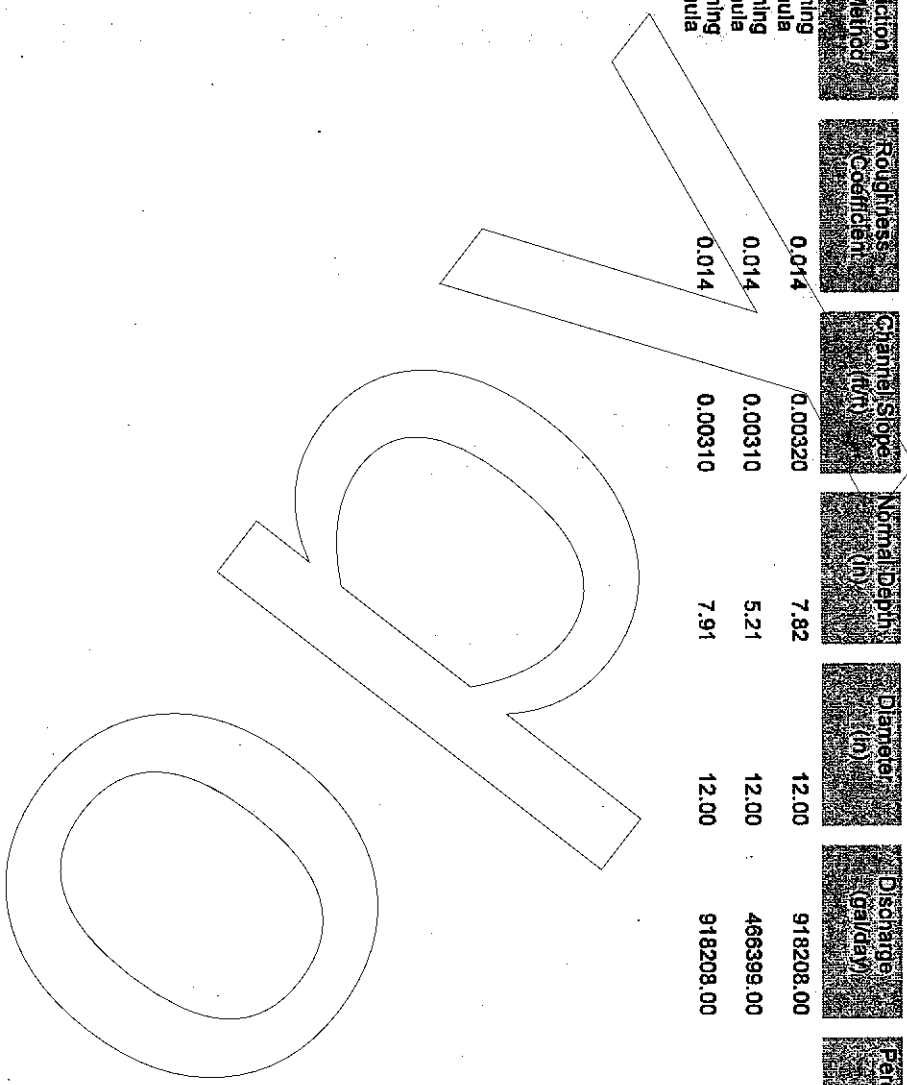
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**KEYSTONE CANYON P.U.D. SEWER PIPE CALCULATIONS Report Report**

Label	Solve For	Friction Method	Roughness Coefficient	Channel Slope (ft/ft)	Normal Depth (in)	Diameter (in)	Discharge (gal/day)	Percent Full (%)	Velocity (ft/s)	Maximum Discharge (gal/day)
P40 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00320	7.92	12.00	918208.00	65.2	2.62	1301061.05
P41 Existing Peak Flow	Normal Depth	Manning Formula	0.014	0.00310	5.21	12.00	466399.00	43.5	2.20	1280570.61
P41 Proposed Peak Flow	Normal Depth	Manning Formula	0.014	0.00310	7.91	12.00	918208.00	65.9	2.59	1280570.61







# WASHOE COUNTY RECORDER

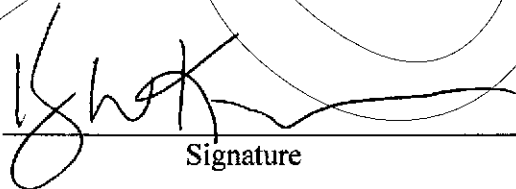
OFFICE OF THE RECORDER  
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