

ENGINEERING • SURVEYING • RESOURCES & ENVIRONMENTAL SERVICES

## **RESOURCE CONCEPTS, INC.**

January 24, 2007

**DRAFT**

Mr. G. Blake Smith  
Virginia Highlands, LLC  
7690 Town Square Way  
Reno, Nevada 89523

**Re: *Drainage Study Findings for Proposed Virginia Highlands Development  
Storey County, Nevada***

Dear Mr. Smith:

Per our discussions, this letter is prepared in advance of the full Drainage Study, and summarizes the findings related to storm water drainage for the proposed Virginia Highlands LLC project. The primary goal of this summary is to discuss peak storm water flows for existing and proposed conditions, and present several detention storage alternatives. Resource Concepts, Inc. (RCI) understands you are interested in evaluating potential storage alternatives above that necessary to offset post-development conditions.

The flood analyses and storage alternatives are preliminary, based on assumptions that might be modified to address actual design and construction parameters.

### ***Introduction***

The Virginia Highlands LLC site was formerly known as the "Old TRW Site." Based on a recent land purchase, the site is approximately 8,600 acres in size, and is owned by Virginia Highlands, LLC.

The purpose of this study is to analyze existing on-site and off-site contributing drainage, as well as determine the existing peak flows and off-site releases. This analysis considers the 100-year storm event. Summary supporting documentation is provided with this letter.

Although in the initial planning stages, the proposed development is intended to consist of a mixture of commercial and residential uses. As such, RCI used generally accepted criteria for this type of mixed-use development in the evaluation of post-development flows.

2007-01-24 Draft Drainage Ltr Smith Blake 06165.3 Blake jc-jmL1-66.doc

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### ***Property Location & Description***

The project site is located in Storey County, south of U.S. Interstate 80 and the Town of Lockwood, within Sections 31 and 32 of T.19N., R.22E., and Sections 4 through 9 and 16 through 18, T.18N., R.22E.

The project site is predominantly covered with low-lying desert shrubs and rock outcrops. Site soils are predominantly within Hydrologic Soil Group D, with generally slow permeability and a rapid run-off potential, based on the Natural Resource Conservation Service (NRCS, formally known as the Soil Conservation Service) Soil Survey for Storey County, Nevada. A very minor amount of landscaping and impervious surfaces exist around some of the existing buildings.

Existing site topography varies substantially throughout the site, with on-site flowline slopes ranging from 2.5% to 15%. Steeper slopes are present on-site. The general slope of the site is to the west. Off-site contributing drainage is from the north, east and south. Run-off from the project site and contributing watershed drains to the Long Valley Creek.

### ***Hydrologic Criteria***

Given the size of the existing property and its contributing watershed, the drainages were analyzed using the U.S. Army Corps of Engineer's, Hydrologic Engineering Center, Floodplain Analysis Program (HEC-1). Input parameters entered into the program primarily included the watershed size, vegetative cover and the precipitation distribution from a Type II storm event, as well as channel characteristics such as slope, length, and roughness. Overland flow was routed through each of the sub-areas using the SCS Curve Number Loss Rate and Dimensionless Unit Hydrograph. Channel routing was performed using the Kinematic Wave routing method.

Because the U.S.G.S. has a stream flow gaging station within the Long Valley Creek, downstream of the project site, RCI was able to calibrate the model to better match recorded peak flows. To do this, RCI analyzed not only the 8,600-acre project site and its contributing watershed, but also other off-site areas that contribute to the gaging station. As such, the total analyzed watershed area was approximately 75.1 square miles. However, the evaluation of pre-versus post-development peak flow and storage volumes were based solely on the project site area. Refer to the attached *Watershed Delineation Drainage Map (Figure 3)*.

### ***Results***

Because this letter focuses on peak flows and storage volumes as a whole, flows and volumes associates with each drainage sub-area will be discussed in the full Drainage Study to follow. The reason for the focus herein is to better understand the potential storm water impacts to downstream areas. Because the project site discharges to the Long Valley Creek, which drains through a portion of Lockwood before discharging to the Truckee River, it is important to understand any potential increase in storm flows the Virginia Highlands project might contribute during a 100-year storm event.

The area of Lockwood along the Long Valley Creek, just upstream of Interstate 80, is subject to flooding based on existing conditions. The Virginia Highlands development intends to release its on-site flows to the Long Valley Creek in amounts less than or equal to existing conditions. Therefore, there are no intended adverse impacts to downstream areas. Depending on the final land use plan and site design, the project might reduce the impact to downstream areas by potentially storing storm water in amounts greater than that required. Storing additional storm water on-site will reduce the peak flow and subsequently aid in reducing the effects of downstream flooding from that being experienced as a result of existing conditions.

**Conclusions**

The results of the pre- and post-development analyses are as follows:

Area Description	Pre-Development Peak Flow (cfs)	Post-Development Peak Flow (cfs)	Increase in Peak Flow (cfs)	Req'd Storage Volume (acre-feet)
Virginia Highlands Site Only	8,042 cfs	9,355 cfs	1,313 cfs	506 ac-ft
Virginia Highlands Site & Upstream Contributing Area	15,162 cfs	16,475 cfs	1,313 cfs	506 ac-ft
Entire Analyzed Watershed	16,536 cfs	17,849 cfs	1,313 cfs	506 ac-ft

The above table shows that based on assumed post-development conditions, there is a net increase in peak flow of 1,313 cubic feet per second. This peak flow increase would require a total of 506 acre-feet of storage volume to ensure existing pre-developed flow conditions are not exceeded.

If the Virginia Highlands project detained all of its discharge and released it at a slower rate, the amount of required storage volume would be substantially higher. Assuming all 9,355 cfs was detained, the downstream peak flow would be reduced to approximately 8,494 cfs. This peak flow reduction would require approximately 2,525 acre-feet of storage volume.

Attached Figure 2 depicts a cross section of the lower Long Valley Creek, just upstream of the Largomarsino Volunteer Fire Department. This figure shows the approximate water surface elevations for three peak flow events (Existing Conditions, Existing without Virginia Highlands Contribution and Long Valley Creek Capacity at Bank Full). The purpose of the figure is to show the change in water surface elevation for different peak flow events. Also attached is Figure 1 showing the downstream representative cross section location.

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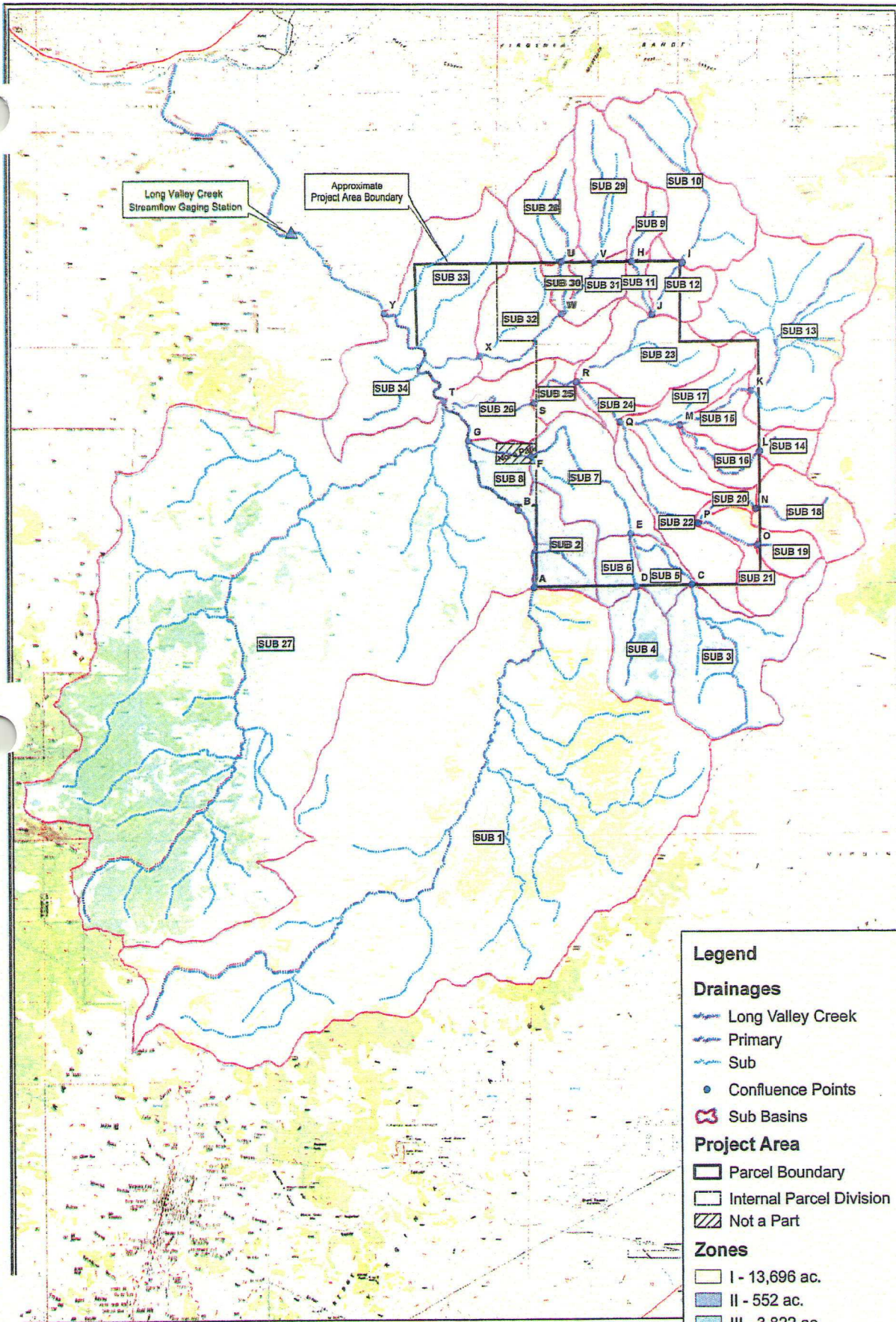
DRAFT

The report to follow will go into greater detail in explaining the above results and conclusions. However, I hope this advance information is useful for your pending discussions. Please contact me at your convenience with any questions.

Sincerely,

Joseph E. Cacioppo, Jr., P.E.  
Vice-President

JEC:jm



**Legend**

**Drainages**

- Long Valley Creek
- Primary
- Sub
- Confluence Points
- Sub Basins

**Project Area**

- Parcel Boundary
- Internal Parcel Division
- Not a Part

**Zones**

- I - 13,696 ac.
- II - 552 ac.
- III - 3,822 ac.
- IV - 9,627 ac.
- V - 15,400 ac.
- VI - 4,292 ac.
- VII - 983 ac.

**Figure 3**  
**Virginia Highlands, LLC.**  
**Watershed Delineation**  
**Drainage Map**

1:68,000  
 0 0.5 1 Miles  
 Prepared: January 24, 2007



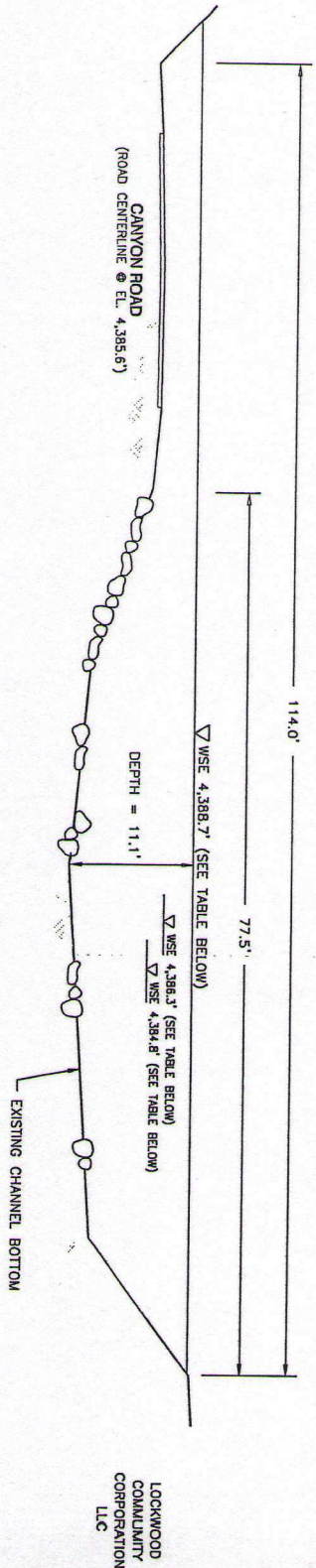
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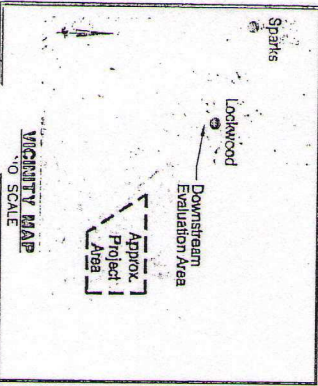
**FIGURE 1**  
**Downstream Site Plan**  
**Long Valley Creek**  
**for**  
**Virginia Highlands, LLC**

**RESOURCE CONCEPTS, INC.**

Prepared: January 23, 2007



- NOTES:**
1. INFORMATION SHOWN IS APPROXIMATE AND BASED ON FIELD MEASUREMENTS. NO SURVEY WAS CONDUCTED.
  2. WATER SURFACE ELEVATIONS ONLY REFLECT THE UPSTREAM ANALYZED CONDITION. BACKWATER EFFECTS, IF ANY, ARE NOT CONSIDERED.
  3. THE CREEK SECTION SHOWN IS LOOKING DOWNSTREAM.



**SUMMARY OF VARIOUS FLOW CONDITIONS**

WATER SURFACE	PEAK FLOW	STORM EVENT	DESCRIPTION
4,388.7 FT	16,536 CFS	100-YEAR	EXISTING CONDITION (NO POST-DEVELOPMENT FLOW)
4,386.3 FT	8,494 CFS	100-YEAR	EXISTING CONDITION (NO VIRGINIA HIGHLANDS CONTRIBUTION)
4,384.8 FT	5,693 CFS	100-YEAR	APPROXIMATE CAPACITY OF LONG VALLEY CREEK

Note: No Virginia Highlands contribution assumes the subject property will detain all its run-off.

**FIGURE 2**

Downstream Evaluation  
Long Valley Creek  
for  
Virginia Highlands, LLC