

DS #: 4510

APN: 126-13-810-012

PROJECT: MADISON GROVE @ PROVIDENCE (POD104) - PH.3

SUBMITTAL: 1ST

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____



CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM

DATE:

December 1, 2010

TO:

Land Development Services
Department of Public Works

FROM:

Albert Sung, P.E.
Flood Control Project Engineer
Department of Public Works

SUBJECT:

Drainage Study for:

Madison Grove at Providence (POD 114) – Phase 3

Cross Streets:

SWQ of Hualapai Way & Farm Road

File Number:

F:\Depot\DSMemos\DS4510A.doc

Parcel Number:

126-13-810-012

Zoning Action:

TMP-xxxxx

FEMA Flood Zone

YES

NO

X

Proposed Storm Drain

YES

NO

X

COPIES TO:

G. C. Wallace Companies

Land Baron Investments

Bart Anderson, P.E., DevCo

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	11/17/2010	12/1/2010	See Comments Below	\$400.00	157618: \$400
			TOTAL FEES (LDDRS):	\$400.00	----

REMARKS:

The Drainage Study for the subject project has been reviewed and:

	is approved subject to conformance to all City standards and the following conditions:
X	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.

1. Provide a copy of the zoning/planning conditions associated with this site (TMP-xxxxx) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. Clearly label all proposed drainage easements (between Lots 9 & 10, Lots 19 & 20 and Lots 30 & 31) as "public drainage easements and common lots to be privately maintained by the Homeowners Association" on the grading plans and recorded as such in the final map.
3. Label all existing storm drains in *Hualapai Way* with *City of Las Vegas* recorded drawing number on the grading plans.
4. Private streets must be public drainage easements. Provide a note on the grading plans "Note: All private streets are P.U.E., Public sewer easements and Public drainage easements to be privately maintained by the HOA."

NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the *Nevada Division of Environmental Protection* a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained on site; for inclusion in the Stormwater General Permit No. NVR100000. A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or

planting. For more information, including forms and applications see
<http://ndep.nv.gov/bwpc/storm01.htm> or call (775) 687-9429.

NOTES: This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.

END OF REMARKS
ays

T/R/S: T19S/R59E/13
AREA F-13

Rec'd: 11/17/10
DS 4510

F-13

**TECHNICAL DRAINAGE STUDY
FOR
MADISON GROVE AT PROVIDENCE
PHASE 3 (POD 114)**

\$400-

398-A407

TMP-40426

November 2010

Prepared for:

Land Baron Investments
10777 W. Twain Ave.
Las Vegas, NV 89135
Phone: (702) 851-3999
Fax: (702) 851-3998



G. C. WALLACE COMPANIES
ENGINEERS | PLANNERS | SURVEYORS

**TECHNICAL DRAINAGE STUDY
FOR
MADISON GROVE AT PROVIDENCE
PHASE 3 (POD 114)**

398-A407

November 2010

Prepared for:

**Land Baron Investments
10777 W. Twain Ave.
Las Vegas, NV 89135
Phone: (702) 851-3999
Fax: (702) 851-3998**

Prepared by:

**G. C. Wallace, Inc.
1555 S. Rainbow Blvd.
Las Vegas, Nevada 89146
Phone: (702) 804-2000
Fax: (702) 804-2299**

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Madison Grove at Providence Phase 3 (Pod 114) Date: November 2010

Location of Development: a) Descriptive (Cross Streets) North/South: Egan Crest Way
East/West: Farm Road

b) Section: 13 Township: 19 S Range: 59 E

c) APN: 126-13-810-012

Name of Owner: Land Baron Investments

Telephone No.: (702) 851-3999 Fax No.: (702) 851-3998 E-Mail Address: _____

Address: 10777 W. Twain Ave.; Las Vegas, NV 89135

Contact Person-Name: Grant Y. Tokumi, P.E. Telephone No.: (702) 804-2000

* E-Mail Address: GTokumi@GCWallace.com Fax No.: (702) 804-2299

Firm: G.C. Wallace, Inc.

Address: 1555 Rainbow Blvd

Type of Land Development/Land Disturbance Process:

☐	Rezoning	☐	Subdivision Map	☐	Clearing and Grading Only
☐	Parcel Map	☒	Planned Unit Development	☐	Other (Please specify below)
☐	Large Parcel Map	☐	Building Permit		

1. Total Owned Land Area: At Site: 28.3 Being Developed/Disturbed: 14 +/- ac.

2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No

3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ Yes** ☒ No

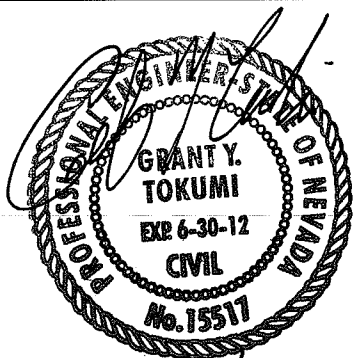
4. Proposed type of development (Residential, Commercial, Etc.): Residential

5. Approximate upstream land area which drains to the subject site: 16.38 ac.

6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: Master Drainage Study for Cliff's Edge, PBS&J, Aug. 2003; TDS for Madison Grove at Providence Phase 3 (Pod 114), GCW, Sep. 2005

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Hualapai Way

8. Briefly describe your proposed schedule for the subject project: ASAP



Engineer's Seal

Submit this form as part of the required drainage study to the local entity which has jurisdiction over the subject property. This form may provide sufficient information to serve as the Conceptual Drainage Study.

*New Required Field

**Review and concurrence of the Clark County Regional Flood Control District is required.

	Revision	Date

Local Entity File No. _____

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Madison Grove at Providence Phase 3 (Pod 114)	Map ID:
Firm Name: G. C. Wallace, Inc.	Engineer: Grant Y. Tokumi, PE
Address: 1555 South Rainbow Boulevard	
City: Las Vegas	State: Nevada Zip: 89146
Phone Number: 804-2000	Fax Number: 804-2299

Property Owner: Land Baron Investments

Address: 10777 W. Twain Ave.

City: Las Vegas State: Nevada Zip: 89135

Reviewed By: Date Received: Date Accepted for Review:

The following checklist is intended as a guide for the engineer preparing a Technical Drainage Study to submit to the local entity and Clark County Regional Flood Control District (if necessary). The listed items are the minimum information required prior to the entity performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (MANUAL).

This document is intended as an aid in preparing Technical Drainage Studies. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT:

Yes	No	
☒	☐	Design Manual Standard Form 1 with the engineer's seal and signature.
☒	☐	Design Manual Standard Form 4 .
☒	☐	2 copies of the 24" x 36" Drainage Plan.
☐	☒	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

Reference:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS

Yes	No	
☒	☐	A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
☒	☐	A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
☒	☐	On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
☒	☐	Vicinity Map with local and major cross streets identified and a north arrow.
☒	☐	Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.

III. DRAINAGE PLAN

Yes	No	
☒	☐	Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
☒	☐	Minimum scale: 1" = 60'.
☒	☐	Project name.
☒	☐	Vicinity Map with local and major cross streets.
☒	☐	Revision box.
☒	☐	North arrow and bar scale.
☒	☐	Engineer's/consultant's address and phone number.
☒	☐	Elevation datum and benchmark.
☒	☐	Legend for symbols and abbreviations.
☒	☐	Cut/fill scarps, where applicable.
☒	☐	Street names, grades, widths.
☒	☐	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☒	☐	Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
☒	☐	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
☒	☐	Proposed typical street sections.
	☒	Streets with off-set crowns.
☒	☐	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
☒	☐	Property lines.
☒	☐	Right-of-way lines and widths, existing and proposed.
☒	☐	Existing improvements and their elevations.
☒	☐	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
☒	☐	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
☒	☐	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
☒	☐	Location and cross-section of street capacity calculations.
	☒	Cross-sectional detail for channels, including cutoff wall locations.
☒	☐	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
☒	☐	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
☒	☐	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
☒	☐	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☒	☐	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood Walls with 8-inch concrete masonry unit.
☒	☐	Building and/or lot numbers.
☐	☒	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
☐	☒	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
☐	☒	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
☐	☒	Appropriately elevated "humps" 6 inches above the 100-year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
☒	☐	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

IV. HYDROLOGIC ANALYSIS

Yes	No	
☒	☐	Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
☐	☒	Input and output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	Input and output information for future conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	Use of correct precipitation values in and around the McCarran Airport Rainfall Area.
☒	☐	A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
☒	☐	A summary table of storm water flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where acceptable.
☒	☐	Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
☒	☐	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
	NA	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
X		Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
X		A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
	NA	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
X		Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
X		Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, which ever is greater.
	NA	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub- and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
X		Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
X		Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
X		The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.

REFERENCE:

STANDARD FORM 2



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 06/06/01)

The following checklist is intended as a supplemental **guide** for the engineer preparing a Technical Drainage Study submittal to the City of Las Vegas. This supplement focuses on requirements specific to the City of Las Vegas. The requirements presented are in addition to the Clark County Regional Flood Control District Manual Standard Form 2. The listed items are the minimum information required prior to the City performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (Design Manual).

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT		
Yes	No	
	NA	A notarized letter from the adjacent property owner(s) allowing off-site grading. (A copy of the letter must be received prior to final acceptance of the drainage study.)
		Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.

II. GRADING PLAN INFORMATION		
Yes	No	
X		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
X		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street. Note: Proposed top of curb elevations must be provided for both sides of roadways even if only half street construction is required.
X		Label existing topography at a minimum 5 foot elevation interval including adjacent developments, finished floor elevations of existing buildings and top of existing curbs extending 100 feet* around the perimeter of the site. (*Measured from the centerline of the adjacent roadway.)
X		Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
X		All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
X		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
X		Back of lot elevations and lot drainage pattern for all lots including common lots.
X		Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
X		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
X		This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
	NA	Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
	NA	Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
X		Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
	NA	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
X		Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections.
X		Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.
	NA	Lots with "B and C Type Drainage" shall be required to install an underground nuisance drainage system or a 2-foot valley gutter through the lot. 16" x 24" minimum block wall openings are required for both options.
	NA	Bubblers are required across 80 foot and greater ROW streets. When flows exceed 10 cfs, bubblers larger than 18 inches will be required up to a maximum of 36". Inlets must be sized to match the pipe size provided.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

- An appointment must be made to preview this checklist in conjunction with Clark County Regional Flood Control District Manual Standard Form 2 prior to the City accepting a new Drainage Study for review. The engineer may contact the Flood Control Section at 229-6541.
- Following the acceptance of the Drainage Study (meeting the minimum acceptable information above), there will be a charge of \$250 for each Drainage Study review submittal. These fees are payable at the time the Grading Permit is obtained.
- The Drainage Study must be accepted prior to submitting grading plans to the Land Development Section for review.

This document is intended as an **aid** in preparing Technical Drainage Studies for the City of Las Vegas. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all-inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

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6-Jun-01

398-A407

Writer's Contact Information:

November 17, 2010

804-2000

Albert Y. Sung, P.E.
Flood Control Project Manager
City of Las Vegas – Land Development Services
Department of Public Works
731 South Fourth Street
Las Vegas, Nevada 89101

Re: Technical Drainage Study for Madison Grove at Providence Phase 3 (Pod 114)

Dear Mr. Sung:

The *Technical Drainage Study for Madison Grove at Providence Phase 3 (Pod 114)* (hereafter referred to as the Phase 3 Study) was originally approved by the City of Las Vegas on February 22, 2006. The project is part of Pod 114 at the Cliff's Edge Master Planned Development. The Phase 3 Study referenced ultimate conditions hydrology from the *Technical Drainage Study for Madison Grove at Providence* (hereafter referred to as the Phase 1 & 2 Study). The Phase 3 Study also analyzed prorated subbasins and provided hydraulic analysis of the proposed interior streets and storm drain. The purpose of this study is to address revisions to the design of the project since original approval, and is being presented as a new Technical Drainage Study because of a revised Tentative Map and subsequent need for a new CLV drainage study number. Pertinent reference material from the Phase 3 Study and the Phase 1 & 2 Study have been provided in Appendix C.

Phase 3 is bordered on the west by Phase 2 and Pod 117B, on the north by Phase 2, on the South by Pod 117A, and on the east by Hualapai Way. The site is not located within a FEMA-designated 110-year Zone A floodplain or Special Flood Hazard Area (refer to referenced Figure 3 from the Phase 3 Study). Figure F-13 has been reproduced from the *CCRFCD 2008 Las Vegas Valley Master Plan Update* (2008 MPU) and has been included in Appendix A as Figure 4. As shown on the figure, Phase 3 is not adjacent to or crossed by an existing or proposed CCRFCD Facility.

The curve numbers for the onsite drainage basins were established in the Phase 1 & 2 Study and were based on Table 602A from the Hydrologic Criteria and Drainage Design Manual (HCDDM) for "Townhouses/6,000 sq ft lots or less". The average lot size proposed with this study is over 5,000 sq ft. Therefore, the curve number is still appropriate and has not been revised.

Several lots that faced Marbury Street in the Phase 3 study now face the adjacent east-west streets. Onsite drainage basins and prorated subbasins have been redelineated accordingly. The resulting area change for each onsite drainage basin is less than 0.10 acres. Therefore, the HEC-1 model shown in the Phase 1 & 2 Study has not been revised. However, prorated subbasin flows have been revised. Tables 1 and 2 summarize the results of the HEC-1 model and prorated flows, respectively.

TABLE 1 Summary of Ultimate Conditions HEC-1 Analysis			
Subbasin/ Combination Point	AREA (ac)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
+ON-1	10.08	24	10
+ON-4	2.20	6	2
+CP-1 (ON1+ON4)	N/A	29	12
+ON-2	4.09	10	4
+ON-3	3.78	9	4
+CP-2 (ON2+ON3)	N/A	20	8
+CP-3 (CP1+CP2)	N/A	48	20
**117B (OF-1)	-	**18	-
+ON-5	8.06	19	8
CP-4 (117B+ON5)	N/A	37	-

* See Figure 5R

+ Referenced from Phase 1 & 2 Study

++ Referenced from the Cliff's Edge Pod 117 Study

TABLE 2 Prorated Subbasin Summary					
Prorated Basin	Prorated Area (ac)	ON5 Flow (cfs)	ON5 Area (ac)	Cfs/Acre	Prorate Subbasin Flow (cfs)
PRO1	1.7	19	8.04	2.36	4
PRO1a	1.9	19	8.04	2.36	4
PRO2	3.3	19	8.04	2.36	8
PRO3	1.2	19	8.04	2.36	3

* See Figure 5R

Street grading in several locations has been revised from the Phase 3 Study. Overall drainage patterns remain the same; however, the grade changes have required revisions to some street normal depth calculations and drop inlet calculations. Table 3 summarizes the revised street flow hydraulic computations. Revised hydraulic calculations have been included in Appendix B.

TABLE 3 100-Year Ultimate Conditions Street Flow Characteristics					
SECTION	SLOPE (%)	Q100 (cfs)	V (ft/s)	D (ft)	VxD
1	0.60	20	2.45	0.48	1.18
2	3.25	29	5.01	0.42	2.10
3	0.60	31	2.9	0.54	1.57
4	3.37	26	4.95	0.4	1.98
5	4.00	22	5.07	0.38	1.93
6	2.61	4	2.89	0.25	0.72
*HUAL-1	0.55	15	2.4	0.49	1.18
*HUAL-2	0.57	15	2.43	0.48	1.17

* See Figure 5R

Street flow and drop inlet calculations unrevised from the Phase 3 Study are provided in Appendix C. Revised street flow and drop inlet calculations are provided in Appendix B.

The flow on north Marbury Street at Section 1-1 is from CP2 (20 cfs). Two (2) 7.5-foot drop inlets will pick up 7 cfs each for a total of 14 cfs captured at 6 cfs bypass.

The flow on Tarbell Grove Avenue at Section 2-2 is from CP1 (29 cfs). Two (2) 7.5-foot drop inlets will pick up 6 cfs each for a total of 12 cfs captured and 17 cfs bypass.

The flow on Marbury Street at Section 3-3 is from bypass from 1-1 (6 cfs), bypass from 2-2 (17 cfs), PRO1 (4 cfs), and PRO1a (4 cfs) for a total of 31 cfs. One (1) 7.5-foot drop inlet on grade on the east side will capture 9 cfs, while one (1) 7.5-foot sump drop inlet on the west side will capture 15 cfs for a total of 24 cfs captured and 7 cfs bypass.

The flow on Meriweather Grove Avenue at Section 4-4 is from Pod 117 (18 cfs) and PRO2 (8 cfs) for a total of 26 cfs. Two (2) 10-foot drop inlets will pick up 7 cfs each for a total of 14 cfs captured and 12 cfs bypass.

The flow on Meriweather Grove Avenue at Section 5-5 is from bypass from 3-3 (7 cfs), bypass from 4-4 (12 cfs) and PRO3 (3 cfs) for a total of 22 cfs. One (1) 7.5-foot sump drop inlet will capture the entire flow. An emergency overflow weir calculation at the 39-foot drainage easement between Lots 19 and 20 indicates a weir head of 0.35 feet for the 22 cfs.

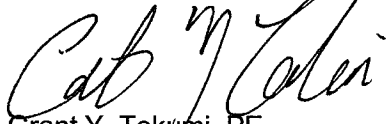
Consistent with the Phase 3 Study, 100-percent of the onsite flow will be captured in the onsite drop inlets and will be conveyed in proposed storm drain to an existing storm drain in Hualapai Way. The north storm drain will discharge 26 cfs to Hualapai Way via a drainage easement between lots 9 and 10. This is a decrease of 2 cfs from the 28 cfs shown in the Phase 3 Study. In addition, a Flowmaster Exhibit from *Supplement #1 to Addendum #2 to the Technical Drainage Study for Cliff's Edge: Infrastructure Phase 2* (hereafter referred to as the Infrastructure Study) shows the drop inlets in Hualapai Way downstream of the easement have a capacity for 29 cfs. The south storm drain will discharge 60 cfs to the existing storm drain in Hualapai Way. This is an increase of 1 cfs from the 59 cfs shown in the Phase 3 Study. The infrastructure study shows that the storm drain lateral has capacity for 66 cfs. Therefore, the improvements proposed in this study will not negatively impact downstream improvements. Standard Form 6 calculations for the onsite storm drain are provided in Appendix B.

All criteria from the CCRFCD Hydrologic Criteria and Drainage Design Manual (HCDDM) relevant to storm drain, street flow, emergency overflow, and finished floor elevations have been met.

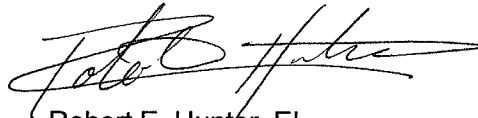
If you have any questions or require additional information, please contact us at 804-2000.

Cordially,

G. C. WALLACE COMPANIES



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c: Derick Yoro, GCW

**MADISON GROVE AT PROVIDENCE
PHASE 3 (POD 114)
APPENDIX LAYOUT**

Appendix A. Figures

1. Figure 4 – 2008 MPU Figure F-13
2. Figure 5R – Ultimate Conditions Drainage Map
3. Figure 6R – Facilities Map

Appendix B. Hydraulic Calculations and Information

1. Street Normal Depth Calculations
2. Vertical Curve Calculations
3. Drop Inlet Calculations
4. Standard Form 6 Calculations
5. Emergency Overflow Calculation

Appendix C. Reference Information

1. Response to Comments on the Technical Drainage Study for Madison Grove at Providence Phase 3 (Pod 114)
 - a. CLV approval letter
 - b. Improvement Plans
2. Technical Drainage Study for Madison Grove at Providence Phase 3 (Pod 114)
 - a. Figure 3 – F.I.R.M.
 - b. Figure 5 – Ultimate Conditions Drainage Map
 - c. Figure 6 – Facilities Map
3. Technical Drainage Study for Madison Grove at Providence
 - a. CLV approval letter
 - b. CCRFCD Concurrence
 - c. Rainfall information
 - d. Soils and Curve Number Information
 - e. Ultimate Conditions Standard Form 4
 - f. Ultimate Conditions HEC-1 Model
 - g. Figure 6 – Ultimate Conditions Drainage Map
4. Supplement #1 to Addendum #2 to the Technical Drainage Study for Cliffs Edge; infrastructure Phase 2
 - a. FlowMaster Exhibit

APPENDIX A

Figures