

WCR0902.004

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District 1 Engineer
Nevada Department of Transportation
123 E. Washington Avenue
Las Vegas, NV 89101

Subject: Kyle Canyon Master Drainage Study – Drainage Narrative

Ms. Martini:

Submitted for your review is this *Master Drainage Study for Kyle Canyon*. Note that several previous drainage studies encompassing Kyle Canyon had been completed by G.C. Wallace, Inc. (GCW) and gained acceptance from Nevada Department of Transportation (NDOT), and the recent approval letter issued by NDOT has been included in this submittal. Since last approval by NDOT, the owner of the Kyle Canyon property and site plan has changed; thus meriting this updated Master Drainage Study by Slater Hanifan Group (SHG). Note that the current Master Drainage Study by SHG has gained approval from City of Las Vegas (CLV) and Clark County Regional Flood Control District (CCRFCD), and the associated approval letters have also been included in this submittal.

The Kyle Canyon master plan conforms to master planned drainage patterns published by the CLV Northwest Neighborhood Study and the CCRFCD 2008 Las Vegas Valley MPU, in addition to the previous approved Kyle Canyon master plan established by GCW. Kyle Canyon proposes to discharge into the Department right-of-way and also construct the required drainage facilities needed to perpetuate drainage patterns. The following is a brief summary of the Kyle Canyon development's impacts to the NDOT right-of-way. Note that this drainage study is only intended to establish conceptual alignments, sizes and storm flow rates; whereas, the technical design of the improvements impacting the Department right-of-way will be addressed by future studies. Please refer to the included drainage studies that were submitted to CLV for further detailed information regarding the following impacts to the Department right-of-way.

- The proposed development discharges into existing culverts and Horse Interchange RCB storm drain in the U.S. Highway 95 right-of-way. The existing culverts affected by Kyle Canyon have been identified on Exhibit F as Facilities E-9 thru E-17A. The existing culvert crossings under U.S. Highway 95 south of Kyle Canyon Road have been hydraulically analyzed as a "network" of conveyance facilities with a series of flow splits, directing flow both east and south. The "network" of culvert crossings had previously been analyzed by GCW and the Horse Drive / U.S. Highway 95 Interchange project by VTN Nevada. The rating tables for the existing culvert crossings have been referenced from GCW, which incorporated the rating tables from the VTN analysis. Note Culvert 11 (Facility E-17A), located at approximately Grand Teton Drive, is the most downstream culvert crossing in the "network" and no flow splits south from Culvert 11. This study shows that the proposed flow conveyed in Culvert 11 does not exceed the allowable flow. Additionally, this study also shows that the proposed intermediate flows for

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Culverts 1 thru 10 are less than or similar to the allowable flows. Therefore, it is anticipated that no adverse impacts occur to the Department right-of-way. The following table summarizes the comparison of proposed condition to allowable flow rates for the existing culvert crossings under U.S. highway 95.

Comparison of Allowable Flows vs. Proposed Condition Flows				
Location	ALLOWABLE		SHG ¹	
	Q ₁₀₀ (cfs)	Reference Material	Q _{PROPOSED} (cfs)	HEC-1 Node
U.S. Highway 95 Culvert 1	54	Previous Master Study Interim 1 Condition	45	DCHD1B
U.S. Highway 95 Culvert 1A	54	Previous Master Study Interim 1 Condition	45	DCHD1C
U.S. Highway 95 Culvert 2	75	Horse Drive Culvert Analysis	89	DCHD2B
U.S. Highway 95 Culvert 2A	100	Horse Drive Culvert Analysis	58	DCHD2C
U.S. Highway 95 Culvert 4	1,141	Horse Drive Culvert Analysis	68	DCHD4B
U.S. Highway 95 Culvert 4A	872	Horse Drive Culvert Analysis	89	DCHD4C
U.S. Highway 95 Culvert 5	330	Previous Master Study Interim 2 Condition	176	DCHD5B
U.S. Highway 95 Culvert 5A	153	Horse Drive Culvert Analysis	141	DCHD5C
U.S. Highway 95 Culvert 6	403	Horse Drive Culvert Analysis	260	DCHD6B
U.S. Highway 95 Culvert 6A	403	Horse Drive Culvert Analysis	304	DCHD6C
U.S. Highway 95 Culvert 8	66	Horse Drive Culvert Analysis	66	DVCUL8
U.S. Highway 95 Culvert 8A	66	Horse Drive Culvert Analysis	66	DIV8A
U.S. Highway 95 Culvert 9	1,008	Horse Drive Culvert Analysis	992	DVCUL9
U.S. Highway 95 Culvert 9A	256	Horse Drive Culvert Analysis	255	DIV9A
U.S. Highway 95 Culvert 10	18	Horse Drive Culvert Analysis	19	DCUL10
U.S. Highway 95 Culvert 10A	369	Previous Master Study Interim 1 Condition	371	DIV10A
U.S. Highway 95 Culvert 11	642	Previous Master Study Interim 1 Condition	310	DCUL11
U.S. Highway 95 Culvert 11A	1,160	Horse Drive Culvert Analysis	913	DIV11A
1 – Flow Rates determined by Addendum #3 (2/13/2012).				

- Although the U.S. Highway 95 existing culvert crossings and Horse Interchange RCB storm drain allow flow to split east across U.S. Highway 95 in the current condition, in the future it is anticipated that improvements will be completed to effectively result in U.S Highway 95 functioning as a hydrologic cut-off boundary. Therefore, the ultimate conditions has been analyzed assuming all runoff generated to the west will be collected and conveyed south within the U.S. 95 right-of-way. This study shows that the ultimate condition flow in this alignment is in conformance with the design of the Horse Interchange RCB storms drain and the CCRFCD 2008 MPU. The following table summarizes the comparison of proposed to allowable flow rates for the ultimate condition design of U.S. highway 95. Refer to Exhibit H for reference to the locations of the below comparisons.

Comparison of Ultimate Condition U.S. Highway 95 Flow Rates				
Location	Design Q_{100} (cfs) ¹	2008 MPU Q_{100} (cfs)	Local $Q_{ULTIMATE}$ (cfs) ²	Regional $Q_{ULTIMATE}$ (cfs) ³
Facility F-1, CCRFCD Facility CN95 0167	N/A	2,160	2,332 = 95STH	2,132 = 95STH
Facility E-18, CCRFCD Facility CN95 0333	329	333	352 = CHD05B	327 = NW62-S
Facility E-23, CCRFCD Facility CN95 0199	1,715	1,609	1,722 = 95STH – CNW71-E	1,522 = 95STH – CNW71-E
1 – Ultimate Condition flow rates shown on Horse Interchange Plans.				
2 – Flow Rates determined by Addendum #3 (2/13/2012).				
3 – Flow Rates determined by Addendum #2 (10/15/2011).				

- The Horse Drive Interchange project did not extend its constructed RCB facility to Culvert 5. At the request of CLV, this project has proposed a 5-ft by 5-ft RCB that will connect Culvert 5 to the Horse Drive Interchange RCB. The proposed facility is intended to mimic the planned ultimate drainage condition which provides U.S. Highway 95 as a hydrologic cut-off boundary, and also assist in remediating existing drainage issues in Brent Lane adjacent to the adjacent existing school. In addition, this project has also identified the concept of extending storm drain north in Oso Blanco in the future (by others) to further the plan of the ultimate condition hydrologic cut-off boundary. The following table summarizes the above detailed facilities, whose locations are identified on Exhibit H.

Comparison of Oso Blanco Drainage Facilities				
Facility ID	Proposed Q_{100} (cfs) ¹	Ultimate Q_{100} (cfs) ¹	Description	HEC-1 Node
P66W	37	99	42-inch RCP	WPT49
P71W	244	352	5-ft wide by 5-ft high RCB	CHD05B
U1	N/A	86	Future Offsite Facility (By Others)	WGED1B + OFFW
1 – Flow Rates determined by Addendum #3 (2/13/2012).				

- Per the previously established drainage patterns in the area, the Kyle Canyon project is responsible to direct its developed condition flow, in excess of the allowable flows at the other discharge locations, across U.S. Highway 95 in the approximate Sheep Mountain Parkway alignment toward the intersection of Fort Apache Road and Moccasin Road. As a result, this project proposes a storm drain crossing U.S. Highway 95 at Kyle Canyon Road (SR-157). In addition, the project also proposes a storm drain lateral to collect flow into the Kyle Canyon storm drain crossing alignment from the existing culverts in the Kyle Canyon interchange. Note these storm drain facilities have been designed to accept ultimate condition flow rates when a planned future CCRFCD regional storm drain facility is constructed west in SR-157. The following table summarizes the above detailed facilities, whose locations are identified on Exhibit H.

Comparison of US-95 & SR-157 Drainage Facilities				
Facility ID	Proposed Q ₁₀₀ (cfs) ¹	Ultimate Q ₁₀₀ (cfs) ¹	Description	HEC-1 Node
P69W	232	228	60-inch RCP	NW50-C
P69AW	476	228	6-ft wide by 5-ft high RCB	CP27A + OFFX
P70W	1578	3324	14-ft wide by 8-ft high RCB	CKC5
P70AW	1914	3477	14-ft wide by 8-ft high RCB	CKC6
1 – Flow Rates determined by Addendum #3 (2/13/2012).				

- Kyle Canyon intends to utilize and not remove/replace the existing roadway and drainage improvements constructed by the Horse Drive Interchange.
- Kyle Canyon intends to propose roadway improvements in Sky Pointe Drive from the Kyle Canyon Road interchange to the Horse Drive interchange. In addition, in order to convey storm flows across the western portion of Kyle Canyon, storm drain is proposed to connect into several of the existing culvert crossings under Sky Pointe. The following table summarizes the proposed Sky Pointe storm drain facilities, whose locations are identified on Exhibit F.

Comparison of Sky Pointe Drainage Facilities				
Facility ID	Proposed Q ₁₀₀ (cfs) ¹	Ultimate Q ₁₀₀ (cfs) ¹	Description	HEC-1 Node
P01E	22	30	36-inch RCP	95-7A + 95-7B
P05E	84	33	48-inch RCP	DCHD4C
P14E	59	50	48-inch RCP	DCHD2B
P15E	150	153	60-inch RCP	COFF9
1 – Flow Rates determined by Addendum #3 (2/13/2012).				

In conclusion, the included drainage study shows that although Kyle Canyon discharges into and proposed drainage facilities within the NDOT right-of-way, it does not result in adverse impacts to the drainage patterns in U.S. Highway 95 and State Route 157. If you have any questions or require additional information, please do not hesitate to contact us at 284-5300.

Respectfully Submitted,

SLATER HANIFAN GROUP



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