HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: _____ Date: _____

Location of Development: a) Descriptive (Cross Streets) North/South: _____

East/West: _____

b) Section: _____ Township: _____ Range: _____

c) APN : _____

_____

Name of Owner: _____

Telephone No.: _____ Fax No.: _____ E-Mail Address: _____

Address: _____

Contact Person-Name: _____ **Telephone No.:** _____

* E-Mail Address: _____ **Fax No.:** _____

 Firm: _____

 Address: _____

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: _____ Being Developed/Disturbed: _____

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.): _____

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

6. Has the site drainage been evaluated in the past? ☐ **YES** ☐ **NO** If yes, please identify documentation: _____

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

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

	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
Engineer's Seal	Local Entity File No.		

REFERENCE:	STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL		
DRAINAGE SUBMITTAL CHECKLIST		

Project Name:	Map ID:	
Firm Name:	Engineer:	
Address:		
City:	State:	Zip:
Phone Number:	Fax Number:	

Property Owner:		
Address:		
City:	State:	Zip:

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.

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.

REFERENCE:	**STANDARD FORM 2**

II. MAPS AND EXHIBITS (Continued)

Yes   No

_____ _____ Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.

_____ _____ 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.

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.

_____ _____ 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.

REFERENCE:	**STANDARD FORM 2**

III.   DRAINAGE PLAN (Continued)

Yes   No

___   ___   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.

___   ___   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.

REFERENCE:	**STANDARD FORM 2**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL
DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes   No

_____ _____ 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.

_____ _____ Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

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 stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.

_____ _____ 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.

_____ _____ Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes   No

_____   _____   Flow split calculations and supporting documentation or reference for the method of flow split calculations used.

_____   _____   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 x v $\leq$ 8. Q_{10} d x v $\leq$ 6 and 12 foot dry lane for rights-of-way $\geq$ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.

_____   _____   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.

_____   _____   Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)

_____   _____   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.

_____   _____   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, whichever is greater.

_____   _____   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.

_____   _____   Provide a 50 percent clogging factor in the capacity calculation for drop inlets.

_____   _____   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.

_____   _____   The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.

_____   _____   Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:	STANDARD FORM 2

PRECIPITATION DEPTH VERSUS
RETURN PERIOD

A. PLOT OF 6-HOUR AND 24-HOUR PRECIPITATION DEPTH VALUES

Precipitation Depth (Inches)

2   5   10   25   50   100
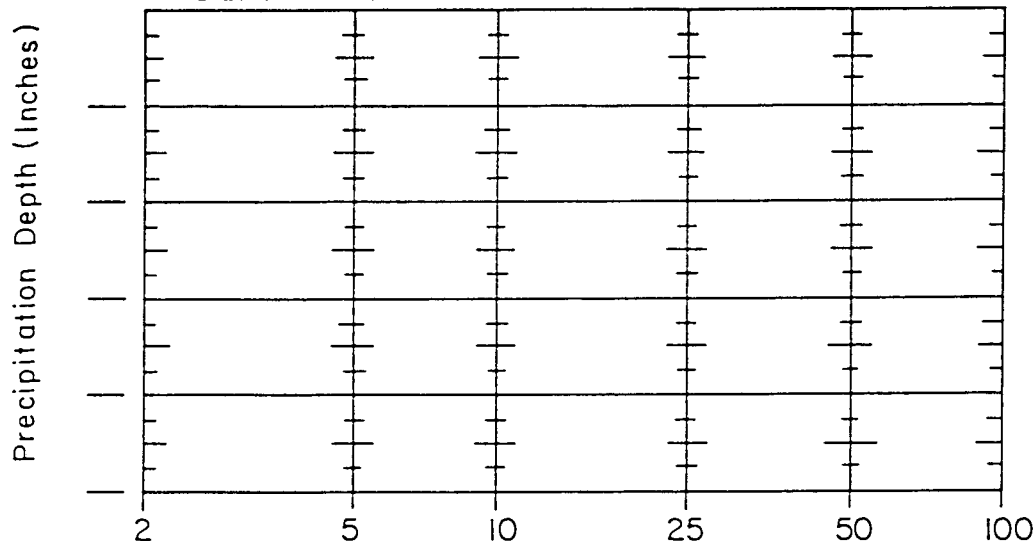
Return Period in Years, Partial - Duration Series

B. PLOT OF 1-HOUR PRECIPITATION DEPTH VALUES

Precipitation Depth (Inches)

2   5   10   25   50   100
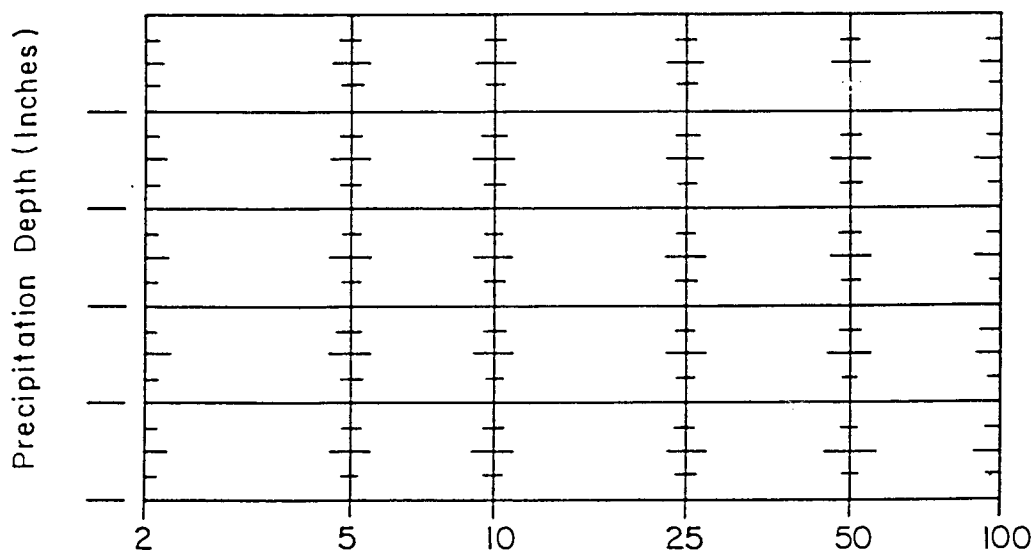
Return Period in Years, Partial - Duration Series

Revision	Date

REFERENCE: NOAA ATLAS 2, VOLUME VII NEVADA, 1973

STANDARD FORM 3

TIME OF CONCENTRATION AND HEC-1 INPUT

DEVELOPMENT _____

CALCULATED BY _____ DATE _____

Sub-Basin Data				Initial/Overland Time (t_i)			Travel Time (t_t)				tc Check (Urbanized Basins)		Final t_c			Remarks
KK			BA											UD	LS	HEC-1 Card
Desig: (1)	K (2)	Area Ac (3)	Area sq mi (4)	Length Ft (5)	Slope % (6)	t_i Min (7)	Length F1 (8)	Slope % (9)	Vel. FPS (10)	t_t Min (11)	Total Length Ft (12)	$t_c = (L/180) + 10$ Min (13)	Min (14)	LagTime hr (15)	CN (16)	

$$t_i = 1.8 \, (1.1 - K) \, L^{1.2} / S^{1/3}$$

$$t_c = t_i + t_t$$

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TABULAR HYDROGRAPH DISCHARGE SUMMARY

Project _____

Circle one: Present Developed

Location _____

Frequency (yr) _____

By _____ Date _____

Checked _____ Date _____

Select and enter hydrograph times in hours from Table 603

Discharges at selected hydrograph times [1]

— (cfs) —

Basic watershed data used			
Sub-area T_c (hr)	ΣT_t to outlet (hr)	I_a/P	A Q (mi²-in)

Subarea name

Composite hydrograph at outlet

Notes:
1. Hydrograph discharge for selected times is A*Q multiplied by tabular discharge from appropriate Table 603.

Revision	Date

REFERENCE:

STANDARD FORM 5

STORM SEWER HYDRAULIC CALCULATIONS

CONDUIT DATA						FLOW DATA								ENERGY LOSS DATA								ENERGY AND HYDRAULIC DATA					COMMENTS
STATION		SIZE / TYPE	INVERTS		LENGTH	A (FT²)	ℓ	Q (CFS)	V (FPS)	Hᵥ = v²/2g (FT)	S f (FT/FT)	AVE. S f (FT/FT)		PIPE	TRANSITIONS						PIPE		TRANSITION		PRESS. FLOW ?	OTHER
FROM	TO		D/S ELEV.	U/S ELEV.										Hf (FT)	Hf (FT)	Hj (FT)	Hm (FT)	H (FT)	H (FT)	TOTAL (FT)	U/S EGL ELEV.	U/S HGL ELEV.	U/S EGL ELEV.	U/S HGL ELEV.		
																				Enter Starting EGL and HGL Here ⟶					⟶	

$$S_f = \frac{\Sigma\, H_v}{R^{1.33}} \qquad \Sigma = \frac{2g\,(n^2)}{2.21}$$

Revision	Date

WRC ENGINEERING, INC.   REFERENCE:

STANDARD FORM 6

CULVERT RATING

PROJECT:

LOCATION:

STATION:

CULVERT DATA

TYPE: _____ n: _____
INLET: _____ Q_{FULL}: _____
K_e: _____ V_{FULL}: _____

OUTLET CONTROL EQUATIONS

(1) $H_w = H + h_o - LS_o$

(2) For $T_w < D$; $h_o = \dfrac{d_c + D}{2}$ or T_w (whichever is greater)

$T_w \geq D$; $h_o = T_w$

(3) For Box Culvert: $d_c = 0.315(Q/B)^{2/3} \leq D$

LOW POINT ELEV. _____

CROWN LOW POINT ELEV. _____

ELEV. _____

ELEV. _____

Q	STORM EVENT	INLET CONTROL		H	OUTLET CONTROL						TYPE OF CONTROL	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY
		$\dfrac{H_w}{D}$	H_w		T_w	$T_w < D$	$\dfrac{d_c + D}{2} = h$	$T_w \geq D$	H_w				
						d_c		h_o					
1	2	3	4	5	6	7	8	9	10		11	12	13

Revision	Date

REFERENCE:

STANDARD FORM 7