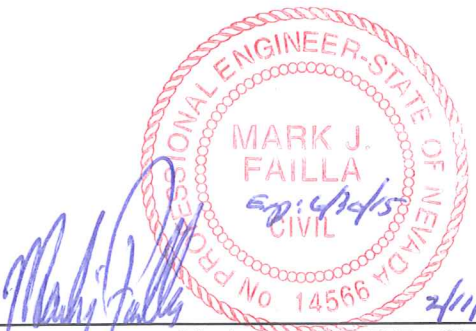
MASTER DRAINAGE STUDY
ADDENDUM NO. 2
Park Highlands West
(A.K.A. North Las Vegas 600-Acre Site)

City of North Las Vegas, Nevada

Job No.: CBH1301.002
Date: February 2014

Prepared By:
Slater Hanifan Group, Inc.
5740 S. Arville Street, Suite 216
Las Vegas, Nevada 89118
Phone: 702-284-5300 ▪ Fax: 702-284-5399

Prepared For:
Crescent Bay Holdings
7144 East Stetson Drive, Suite 410
Scottsdale, AZ 85251
Phone: 480-584-6997



2/11/15

Mark J. Failla, P.E., CFM
NV Professional Engineer No. 14566

Assisted by: Kellin Collins, P.E.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Master Drainage Study Park Highlands West (Addendum No. 2) Date: February 2014

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

East/West: Grand Teton Drive

b) Section: 18 & 19 Township: 19S Range: 61E

c) APN: See attached.

Name of Owner: Crescent Bay Holdings

Telephone No.: 480-584-6997 Fax No.: n/a E-mail Address: developaz@gmail.com

Address: 7144 East Stetson Drive, Suite 410, Scottsdale AZ 85251

Contact Person – Name: Mark J. Failla, PE, CFM Telephone No.: 702-284-5300

*E-mail Address: mfallia@shg-inc.com Fax No.: 702-284-5399

Firm: Slater Hanifan Group

Address: 5740 Arville St. #216

Type of Land Development/Land Disturbance Process:

☐	Rezoning	☐	Subdivison Map	☐	Clearing and grading Only
☐	Parcel Map	☐	Planned Unit Development	☒	Other (Please specify below)
☐	Large Parcel Map	☐	Building Permit		Master Planned Community

1. Total Owned Land Area: At Site: ±600 Acres Being Developed/Disturbed: ±600 Acres

2. Is a portion or all of the subject property located in a 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.): Master Planned Community

5. Approximate upstream land area which drains to the subject site: 3.04 square miles

6. Has the site drainage been evaluated in the past? ☒ Yes** ☐ No If yes, please identify documentation:

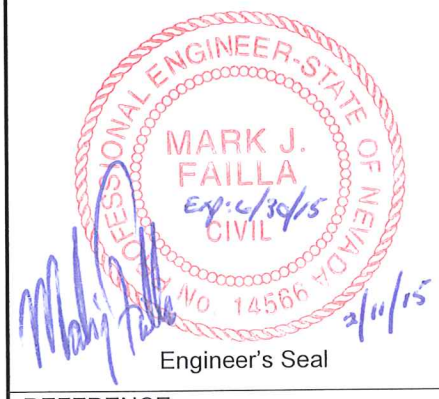
Conceptual Drainage Study for the North Las Vegas 600-Acre Site (CNLV No. 24576)

Update No. 1 to the Conceptual Drainage Study for the North Las Vegas 600-Acre Site (CNLV No. 27888)

Update No. 2 to the Conceptual Drainage Study for the North Las Vegas 600-Acre Site (CNLV No. 28463)

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Linear Park at Aliante Parkway, Aliante Golf Course Channel, Elkhorn Road & Linear Park at Aviary Way

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



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.

*Newly Required Field

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

Local Entity File No.

Revision	Date

REFERENCE: STANDARD FORM 1

Updated 05/01/2008

DEPARTMENT OF PUBLIC WORKS

CITY OF NORTH LAS VEGAS
Your Community of Choice

Drainage Study Submittal Application

- City of North Las Vegas Use Only -	Project name: Master Drainage Study Park Highlands West (Addendum No. 2)
Project #:_____ Received :____/____/____ ☐ Fee paid $_____ ☐ Engineer's seal ☐ Drainage Study Checklist	☐ Initial drainage study ☐ Concurrence ☐ CLOMR/LOMR ☑ Addendum #_1_ ☐ Amendment ☐ Supplement ☐ Update to *(original study name)*:_____ Study review process desired: ☑ In-house ☐ Outsourced

Project location (incl. cross streets): Grand Teton Drive and Decatur Boulevard

Assessor parcel number(s): see attached

Acreage: +/- 600 acres	Number of lots: n/a	Section/Township/Range: 18 & 19/19S/61E

Type of development:
☐ Residential subdivision ☐ Commercial subdivision ☐ Commercial
☐ Multi-family ☑ Other (please specify): Master Planned Community

Drainage Study Review Fee Schedule

A pre-submittal meeting must be arranged prior to Initial and Update Study submittals (702/633-1932)

Initial drainage studies:		**Other submittals:**	
☐ ≤6 gross acres	$ 500	☐ Addendum	$ 0
☐ >6 to 41 gross acres	$1000	☑ Addendum 2 or greater	(see DFC Fee Schedule)
☐ >41 to 321 gross acres	$ 2000	☐ Update	$400
☐ >321 to 2,561 gross acres	$ 4000	☐ Amendment	$400
☐ >2,561 gross acres	$ 6000	☐ CLOMR/LOMR	$0
☐ Concurrence	$250		

Additional outsourced review fees: Drainage study $4,200 Update $2,500

3 copies of the study must be supplied for outsourced review.

Engineering firm: Slater Hanifan Group	Contact person: Mark J. Failla, PE, CFM
Address: 5740 S. Arville Street, Suite 216	Phone: 702-284-5300
	Fax: 702-284-5399
City: Las Vegas State./Zip NV/89118	E-mail: mfailla@shg-inc.com
Owner/developer: Crescent Bay Holdings	Contact person: Philip Miller
Address: 7144 East Stetson Drive, Suite 410	Phone: 480-584-6997
	Fax: n/a
City: Scottsdale State/Zip AZ/85251	E-Mail: developpaz@gmail.com

Owner/developer wishes to be copied on all review correspondence: ☑ Yes ☐ No

Projects on the North Las Vegas municipal boundaries must be submitted to the adjacent jurisdiction for their review and/or approval. Projects that will impact the State's highway system must be submitted to the Nevada Department of Transportation District Office for review and approval.

Project Assessor Parcel Numbers:

124-18-110-001, 124-18-110-002
124-18-510-001 thru 124-18-510-004
124-18-210-001, 124-18-210-002
124-18-610-001 thru 124-18-610-004
124-18-310-001 thru 124-18-310-003
124-18-714-001, 124-18-714-002
124-18-410-001, 124-18-410-003
124-18-816-001, 124-18-816-002
124-19-111-001

CBH1301.002

February 10, 2014

Dan Le, P.E., CFM – Senior Engineer
Development and Flood Control Division
City of North Las Vegas Public Works
2266 Civic Center Drive, Suite 225
North Las Vegas, Nevada 89030-6307

Subject: Addendum No. 2 to the Master Drainage Study for Park Highlands West (AKA North Las Vegas 600-Acre Site) - CNLV No. 46257

Dear Mr. Le:

This letter is submitted in response to comments contained in the December 30, 2013 review memorandum regarding the above referenced project. Note that a meeting was held between Slater Hanifan Group (SHG) and the City of North Las Vegas (CNLV) on January 27, 2014 to discuss the CNLV comments on this project. Meeting minutes have been included in Appendix B. A copy of the CNLV drainage study comment letter has been included in Appendix A. The comments have been individually addressed as follows:

1. **Comment:** *Comment 14 has not been addressed. The proposed facility P73 directs urbanize runoffs toward the Conservation Transfer Areas which conflicts with the conditions specified within the Conservation Transfer Area Agreement. Please address by discussing and providing a plan to resolve the drainage issue on Grand Teton.*

   Also, please discuss the issue regarding the construction of the north-half of Grand Teton at the location of the proposed facility P73;

   Response: Proposed Facilities P72 and P73 identification ID have been removed from Exhibit P. However, an extension of Facility P71 is depicted with a note indicating that the facility extension is part of the Park Highlands East (PHE) project and is conceptually addressed as part of that project Master Drainage Study. The proposed storm drain extension that remains on Exhibit P for the storm drain system in Grand Teton Drive east of Aliante Parkway now has the following note, "Proposed facility to be designed and constructed with Park Highlands East. Refer to the Master Drainage Study for Park Highlands East for storm drain facility description and conceptual facility sizing." The extension is depicted to show that there will be a facility to intercept the flows at the intersection and convey the flows east without impacting the Conservation Transfer Area. Per the January 27, 2014 meeting, the proposed Facility P72 bubbler was removed and a closed conduit extension of Facility 71 as part of the PHE project is now proposed. The replacement of the previously proposed bubbler (P72) and open channel (P73) with a closed conduit facility was considered an acceptable resolution to their concern regarding urbanized runoff discharge to the CTA. Revised Exhibit P has been provided in Appendix C for reference.

Note that the Master Drainage Study for Park Highlands East has been submitted to the CNLV for review. Per meeting held with CNLV on January 27, 2014, the facility along Grand Teton Drive east of Aliante Parkway (known as Proposed Facility 1 in the Master Drainage Study for Park Highlands East) will need to be revised from an open channel to a closed conduit system. A closed conduit system will prevent urbanized runoff from the Grand Teton Drive and Aliante Parkway intersection from entering the Conservation Transfer Area. Additionally, the closed conduit drainage system within the right-of-way can function independently from how the roadway will be designed or constructed. Refer to January 27, 2014 meeting minutes included in Appendix B for detailed discussion regarding Comment No.1.

2. **Comment:** *Various flow and HGL data on the Summary of Existing Stub and HGL table in response to Comment 15 appear to be in conflict with the data shown on the approved improvement plans. Particularly, please verify the Q per Detailed Analysis values for Facility ID E33, E54, E55, E57, E59, and E64. Also, HGL at Manhole values for Facility ID E52, E54, E59, and E69 are lower than the HGL shown at the manholes in the approved plans. Please discuss the discrepancies and revise the data accordingly;*

   Response: The flow rates in the 'Q per Detailed Analysis' column for Facilities E33, E54, E55, E57, E59, and E64 have been corrected. As for the HGL, no changes have been made. Note that the HGL shown on the improvement plans were based on Standard Form 6 computations, which generally results in a conservative (a.k.a. higher) HGL. The elevation listed in the "HGL at Manhole" column for Facilities E52, E54, E59 and E69 are lower than the HGL shown on the improvement plans for two reasons: 1) the flows in the mainline or lateral had changed so new hydraulic models were provided which results in different losses in the storm drainage system (the new hydraulic model results replace the previous hydraulic models and established HGL) , and 2) the revised hydraulic computations were performed with WSPG which generally provides an HGL lower than Standard Form 6. The corrected table is provided on Exhibit P which is provided in Appendix C.

   In reviewing the Summary of Existing Stub and HGL, the flow rate established by this MDS for Facilities E54, E55 and E94 are greater than the flow rate utilized in the technical design of the facilities. The increase in flow is believed to be negligible and the HGL remains more than 1-ft below finished grade. Therefore, the increases in flows for these facilities are considered acceptable.

3. **Comment:** *Exhibit O: It appears that the Street Section 21 is at an incorrect location. The correct location should be on Aviary Way just south of Severance Lane. The Actual Q value for Street Section 26, in the 10-Year Street Flow Capacity Summary table, should be 9 cfs in lieu of 7 cfs.*

   Please verify and revise appropriately;

   Response: Exhibit O has been revised to show the location of Cross Section 21 on Aviary Way south of Severance Lane. Additionally, the 10-Year Street Flow Capacity Summary table has been revised to correct the 10-year flow rate for Cross Section 26. The revised Exhibit O has been included in Appendix C.

4. **Comment:** *Comment 18 has not been fully addressed. Please explain why the Engineer employed both the Rational Formula Method and the HEC-1 analysis to determine the flow rates. If the Rational Formula Method is being used to determine the flow rates in the onsite streets, then please ensure that all onsite streets are delineated as drainage basins so that accurate onsite street flows could be obtained;*

   Response: The rational method was utilized only to assess roadways to specifically address previous CNLV Comment No. 18 without altering the accepted HEC-1 models. The rational method was only applied to isolated locations that were deemed necessary in order to verify roadway drainage criteria is met per CNLV comment. The criteria for providing a subbasin and applying the rational method were as follows:

   - Locations where there are no storm drain systems in the roadway that quantified the storm drain and surface flows; with exception of roadways were flows from Basin 1-4 and Concentration Point 4I is conveyed as surface flow in the roadway.
   - Locations were the mainline storm drain system in a roadway identified a surface flow rate of '0 cfs'.

   For all other cross section locations, the surface flow rate listed is substantially less than the allowable flow rate to meet street flow criteria. It is the belief of SHG that the increase in flow rate with the application of the rational method would be negligible and will still show that the roadway meets criteria. Therefore, it is deemed unnecessary to provide additional analysis to quantify adjacent roadway flows for those locations. It should also be noted that with the roadway criteria met, it proves that additional storm drain facility, beyond what is exists or proposed with this MDS, is not required. Per the January 27, 2014 meeting, no additional analysis is required. Refer to January 27, 2014 meeting minutes included in Appendix B for detailed discussion regarding Comment No.4.

   In response to this comment and reviewing Exhibit O, it was determined that an additional cross section is required which results in an additional subbasin to be assessed with the rational method. Cross Section 32 has been incorporated onto Exhibit O which is located in Appendix C. The hydrologic and hydraulic computations associated with the cross section are included in Appendix D and E, respectively.

5. **Comment:** *Comment 23 has not been fully addressed. Please adjust the Curve Number values (CN) for the portions of basins U130, U150, U155, U190, U210, U230, and U250, that are located outside of the Conservation Transfer Area, to reflect "Residential Estates" for the Ultimate condition. Please verify the zoning ordinance with the City of Las Vegas since these drain age basins are located within the Ultimate Development Boundary and should be reflected as such for the Ultimate condition. Please revise all hydrologic and hydraulic analyses to reflect the changes accordingly;*

   Response: The curve numbers for Basins U210, U250, and U230 do not require any changes because the City of Las Vegas zoning ordinance classifies this area as 'U(PROS)' which reflect 'Undeveloped – Park Recreational Open Space'. The analysis provided in this study already assesses this area as undeveloped. As for Basins U190, U150, U155, and U130, the curve numbers were not altered for the following reasons:

- Per MPU land use data, with alterations to the CN the increase in CN for these basins would be less than 1 which means the increase in flows would be negligible.
- Residential Estates (1 acre lots) per the Manual has a substantially lower curve number which results in less flow and not preferred.

It is believed that the curve number computed for Basins U130, U150, U155, U190, U210, U230, and U250 are reasonable and justified. Per the January 27, 2014 meeting, no additional analysis is required. Refer to January 27, 2014 meeting minutes included in Appendix B for detailed discussion regarding Comment No.5.

6. **Comment:** *Additional comments may be generated on the third review;*

   Response: Noted.

7. **Comment:** *A copy of this letter must accompany the subsequent submittal to the City of North Las Vegas;*

   Response: Noted. A copy of the CNLV comment letter has been provided in Appendix A.

If you have any questions or require additional information, please do not hesitate to contact us at 284-5300.

Respectfully Submitted,
SLATER HANIFAN GROUP

Kellin Collins

Kellin Collins, P.E.
Flood Control Division

pc: Jerry Slater, SHG
Mark Failla, SHG

LIST OF APPENDICIES

Appendix A City of North Las Vegas Comment Letter

Appendix B January 27, 2014 CNLV Meeting Minutes

Appendix C Revised Drainage Exhibits
- Exhibit O – Street Sections Map
- Exhibit P – Conceptual Facilities Map

Appendix D Additional Hydrologic Computations
- Rational Method for Roadway Flows

Appendix E Additional Hydraulic Computations
- Street Capacity Summary Tables
- 10-Year Street Flow Capacity Flowmaster Computations
- 100-Year Street Flow Capacity Flowmaster Computations

Appendix F Electronic Files

APPENDIX A

City of North Las Vegas Comment Letter

CITY OF
NORTH LAS VEGAS

Your Community of Choice

PUBLIC WORKS – DEVELOPMENT AND FLOOD CONTROL
2250 N Las Vegas Boulevard, Suite 200 • North Las Vegas, Nevada 89030-6307
Telephone: (702) 633-1200 • Fax: (702) 649-4696 • TDD: (800) 326-6868
www.cityofnorthlasvegas.com

December 30, 2013 Mailed via: E-mail

Mark Failla, PE, CFM
Kellin Collins, PE

Slater Hanifan Group, Inc.
5740 S. Arville Street. Suite #216
Las Vegas, Nevada 89118

Re: Master Drainage Study for Park Highlands West (AKA North Las Vegas 600-Acre Site)
CNLV No. 46257

Dear Mark and Kellin:

CNLV staff has reviewed the above referenced study, dated May 29, 2013 and Addendum #1, dated October 20, 2013, and offers the following comments:

1. Comment 14 has not been addressed. The proposed facility P73 directs urbanize run-offs toward the Conservation Transfer Areas which conflicts with the conditions specified within the Conservation Transfer Area Agreement. Please address by discussing and providing a plan to resolve the drainage issue on Grand Teton.

   Also, please discuss the issue regarding the construction of the north-half of Grand Teton at the location of the proposed facility P73.

2. Various flow and HGL data on the **Summary of Existing Stub and HGL** table in response to Comment 15 appear to be in conflict with the data shown on the approved improvement plans. Particularly, please verify the **Q per Detailed Analysis** values for **Facility ID** E33, E54, E55, E57, E59, and E64. Also, **HGL at Manhole** values for **Facility ID** E52, E54, E59, and E69 are lower than the HGL shown at the manholes in the approved plans. Please discuss the discrepancies and revise the data accordingly.

3. Exhibit O: It appears that the Street Section 21 is at an incorrect location. The correct location should be on Aviary Way just south of Severance Lane.

The **Actual Q** value for **Street Section** 26, in the **10-Year Street Flow Capacity Summary** table, should be 9 cfs in lieu of 7 cfs.

Please verify and revise appropriately.

4. Comment 23 has not been fully addressed. Please explain why the Engineer employed both the Rational Formula Method and the HEC-1 analysis to determine the flow rates.

   If the Rational Formula Method is being used to determine the flow rates in the onsite streets, then please ensure that **all** onsite streets are delineated as drainage basins so that accurate onsite street flows could be obtained.

5. Comment 23 has not been fully addressed. Please adjust the Curve Number values (CN) for the portions of basins U130, U150, U155, U190, U210, U230, and U250, that are located outside of the Conservation Transfer Area, to reflect "Residential Estates" for the Ultimate condition. Please verify the zoning ordinance with the City of Las Vegas since these drainage basins are located within the Ultimate Development Boundary and should be reflected as such for the Ultimate condition.

   Please revise all hydrologic and hydraulic analyses to reflect the changes accordingly.

6. Additional comments may be generated on the third review.

7. A copy of this letter must accompany the subsequent submittal to the City of North Las Vegas.

The City, its officials, or employees assume no liability for information, data, calculations and conclusions presented by the consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review. If you have any questions concerning this matter, please contact me at (702)633-1932.

Sincerely,

Dan Le, P.E., CFM
Senior Engineer
Development and Flood Control Division

APPENDIX B

January 27, 2014 CNLV Meeting Minutes

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS

MEETING MINUTES

Project Number: CBH1301.002
Project Name: Park Highlands West
Meeting Date: 01/27/2014
Meeting Location: City of North Las Vegas
Meeting Topic: CNLV Master Drainage Study Comment Letter Coordination

Attendees:	*Company Name:*	*Contact Info (email)*
Jennifer Doody	City of North Las Vegas	DoodyJ@cityofnorthlasvegas.com
Dan Le	City of North Las Vegas	Led@cityofnorthlasvegas.com
Michael Ross	Carwin Advisors	Michael.Ross@carwinadvisors.com
Jerry Slater	SHG	jslater@shg-inc.com
Mark Failla	SHG	mfailla@shg-inc.com
Kellin Collins	SHG	kcollins@shg-inc.com

Meeting Notes: The meeting was held to discuss the CNLV comment letter dated December 30, 2013 concerning the *Master Drainage Study for Park Highlands West* (CNLV No. 46257). Discussion on individual comments is summarized below. The comment letter is attached.

Item	*Discussion:*
1	**Comment No. 1:** SHG/CNLV discussed about what type of facility the CNLV would consider acceptable for Facility P73 as it appears that the currently proposed open channel facility is undesirable to CNLV because it potentially discharges urbanized flow to the CTA. SHG noted that the facility is anticipated to be designed and constructed with Park Highlands East (PHE). CNLV began by explaining that it is the responsibility of the Park Highlands West (PHW) development to provide the conveyance facility for drainage impacting Grand Teton Drive from Aviary Way and to the east of Aliante Parkway because the previous design by others provided the conveyance with discharge directly to the Las Vegas Wash and not to the CTA. This includes drainage impacting Grand Teton from the north side and not flows generated by the PHW project. The urbanized runoff whether from existing development or from the PHW site is not permitted to discharge into the Conservation Transfer Area (CTA). SHG explained that the proposed open channel for Facility P73 is anticipated to be located within the right-of-way of Grand Teton Drive. CNLV stated that a permanent open channel will not be permitted within a typical 100-ft right-of-way section. CNLV also added that the limit of the BLM right-of-way easement that overlays the CTA are not required to meet the requirements of the CTA. SHG believes that there is an additional 50-ft as part of the right-of-way easement that will allow for an open channel. CNLV may allow for an open channel as long as it is within the right-of-way easement but outside of the typical 100-ft roadway section, it must be concrete lined (as it will be maintained by the CNLV) and meet other Manual criteria for open channels. It was agreed, for the purposes of the Master Drainage Study, a closed conduit system will be proposed to avoid any conflict with the requirements of the CTA. CNLV expressed the need to construct a closed conduit system, without infiltration allowed, to satisfy the MPU requirements. Additionally, the closed conduit drainage system within the right-of-way can function independently from how the

Prepared By: Kellin Collins, SHG

Please notify the preparer if you have any questions, concerns or additions to these minutes within 2 days. After 2 days the content of this document will be considered accurate and accepted as the final recordation.

Item	Discussion:
	roadway will be designed and constructed. It is noted by SHG that if right-of-way exists beyond the 100-ft typical roadway section, that an open channel may be considered in the future with a technical study. Further discussion was provided about the interim condition (beyond the scope of a master study) defined as the PHW site developed and the PHE is not yet developed. What type of temporary facility will the CNLV permit along Grand Teton Drive until Facility P73 is constructed? The CNLV would allow for a temporary daylight of a closed conduit system to discharge the flow into the right-of-way of Grand Teton Drive.
2	**Comment No. 4:** SHG provided explanation as to why the rational method was used. The rational method was utilized only to assess roadways to specifically address previous CNLV Comment No. 18 without altering the accepted HEC-1 models. The rational method was only applied to isolated locations that were deemed necessary in order to verify roadway drainage criteria is met per CNLV comment. The criteria for providing a subbasin and applying the rational method were as follows: • Locations where there are no storm drain systems in the roadway that quantified the storm drain and surface flows; with exception of roadways were flows from Basin 1-4 and Concentration Point 4I is conveyed as surface flow in the roadway. • Locations were the mainline storm drain system in a roadway identified a surface flow rate of '0 cfs'. For all other cross section locations, the surface flow rate listed is substantially less than the allowable flow rate to meet street flow criteria. It is the belief of SHG that the increase in flow rate with the application of the rational method would be negligible and will still show that the roadway meets criteria. Therefore, it is deemed unnecessary to provide additional analysis to quantify adjacent roadway flows for those locations. It should also be noted that with the roadway criteria met, it proves that additional storm drain facility, beyond what exists or proposed with this MDS, is not required. The CNLV considered the reasons provided by SHG as acceptable and suggested that the reasons discussed at this meeting be provided as a response to the comment and no additional analysis would be required.
3	**Comment No. 5:** SHG provided several reasons to not re-compute the composite curve numbers for Basins U130, U150, U155, U190, U210, U230, and U250. The curve numbers for Basins U210, U250, and U230 do not require any changes because the City of Las Vegas zoning ordinance classifies this area as 'U(PROS)' which reflect 'Undeveloped – Park Recreational Open Space'. The analysis provided in this study already assesses this area as undeveloped. As for Basins U190, U150, U155, and U130, the curve numbers were not altered for the following reasons: • Per MPU land use data, with alterations to the CN the increase in CN for these basins would be less than 1 which means the increase in flows would be negligible. • Residential Estates (1 acre lots) per the Manual has a substantially lower curve number which results in less flow and not preferred. It is believed that the curve number computed for Basins U130, U150, U155, U190, U210, U230, and U250 are reasonable and justified. Therefore, no changes are required. The CNLV considered the reasons provided by SHG as acceptable and suggested that the reasons discussed at this meeting be provided as a response to the comment and no additional analysis would be required.

Prepared By: Kellin Collins, SHG

Please notify the preparer if you have any questions, concerns or additions to these minutes within 2 days. After 2 days the content of this document will be considered accurate and accepted as the final recordation.

Action Items:

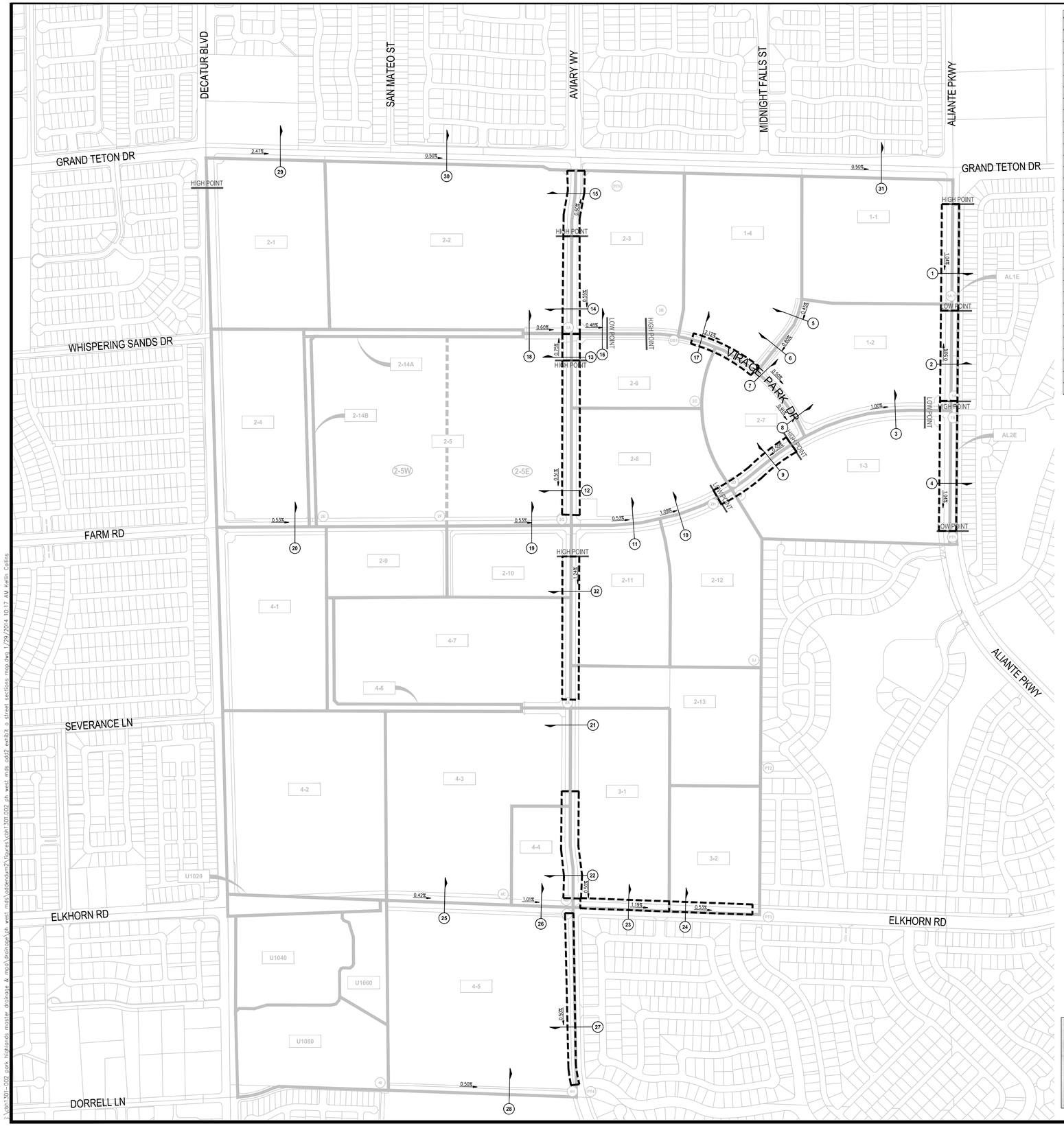
Item:	*Person:*	*Comments:*
1	SHG	Research for documentation of the BLM right-of-way easement for Grand Teton Drive east of Aliante Parkway. Documentation must identify easement limits and the rights of the easement.
2	SHG	Prepare responses to Comments 1, 4, and 5 and e-mail them to Dan Le to perform a cursory review prior to the formal submittal of the responses with the addendum.
3	CNLV	Dan Le to perform a cursory review of the responses to Comments No. 1, 4, and 5 via e-mail to ensure the responses are detailed enough and appropriately answer the concerns of the CNLV.

Prepared By: Kellin Collins, SHG

Please notify the preparer if you have any questions, concerns or additions to these minutes within 2 days. After 2 days the content of this document will be considered accurate and accepted as the final recordation.

APPENDIX C

Revised Drainage Exhibits



100-Year Street Flow Capacity Summary

Street Section	ROW Width (ft)	Slope (%)	Q (cfs)	Depth (ft)	Velocity (fps)	D x V	Control	Q at Section (cfs)	Source of Q	Criteria Met?
1	90	1.04	336	1.15	6.96	8.0	D x V	19	Rational Method	yes
2	90	0.50	389	1.37	5.83	8.0	D x V	16	Rational Method	yes
3	70	1.00	243	1.04	6.72	7.0	D x V	34	Facility E72 Suface Flow	yes
4	90	1.04	336	1.15	6.96	8.0	D x V	22	Rational Method	yes
5	52	0.45	273	1.34	5.96	8.0	D x V	55	Basin 1-4 Flow	yes
6	52	0.80	249	1.15	6.95	8.0	D x V	55	Basin 1-4 Flow	yes
7	52	0.50	268	1.31	6.13	8.0	D x V	55	Basin 1-4 Flow	yes
8	52	0.91	243	1.11	7.19	8.0	D x V	55	Basin 1-4 Flow	yes
9	70	0.50	282	1.25	5.64	7.1	D x V	12	Rational Method	yes
10	70	1.09	285	1.09	7.34	8.0	D x V	75	Facility E63 Suface Flow	yes
11	70	0.53	330	1.32	6.06	8.0	D x V	75	Facility E63 Suface Flow	yes
12	70	0.51	335	1.33	6.02	8.0	D x V	21	Rational Method	yes
13	70	0.75	310	1.20	6.66	8.0	D x V	4	Rational Method	yes
14	70	0.55	329	1.31	6.13	8.0	D x V	13	Rational Method	yes
15	70	0.60	323	1.28	6.27	8.0	D x V	9	Rational Method	yes
16	52	0.48	271	1.32	6.07	8.0	D x V	107	Facility E21 Surface Flow	yes
17	52	2.12	203	0.89	8.99	8.0	D x V	7	Rational Method	yes
18	49	0.60	273	1.24	6.45	8.0	D x V	107	Facility E18 Surface Flow	yes
19	70	0.53	329	1.32	6.06	8.0	D x V	75	Facility E56 Surface Flow	yes
20	70	0.53	329	1.32	6.06	8.0	D x V	31	Facility E53 Surface Flow	yes
21	70	1.24	279	1.06	7.57	8.0	D x V	50	Facility E98 Surface Flow	yes
22	70	0.50	335	1.34	5.98	8.0	D x V	16	Rational Method	yes
23	*100	1.19	216	1.18	6.80	8.0	D x V	7	Rational Method	yes
24	*90	0.53	190	1.35	5.92	8.0	D x V	14	Rational Method	yes
25	90	0.42	394	1.43	5.60	8.0	D x V	59	Facility P53 Surface Flow	yes
26	90	1.01	338	1.15	6.92	8.0	D x V	78	Facility P56 Surface Flow	yes
27	*70	0.50	167	1.34	5.97	8.0	D x V	11	Rational Method	yes
28	41	0.50	242	1.28	6.24	8.0	D x V	84	Concentration Point 4I	yes
29	96	2.47	273	0.92	8.68	8.0	D x V	180	Facility P9 Surface Flow	yes
30	96	0.50	389	1.33	6.01	8.0	D x V	19	Facility P28 Surface Flow	yes
31	96	0.50	389	1.33	6.01	8.0	D x V	112	Facility P67 Surface Flow	yes
32	70	1.24	279	1.06	7.57	8.0	D x V	20	Rational Method	yes

10-Year Street Flow Capacity Summary

Street Section	ROW Width (ft)	Slope (%)	Q (cfs)	Depth (ft)	Velocity (fps)	D x V	Control	Actual Q (cfs)	Source of Q	Criteria Met?
1	90	1.04	53	0.65	3.97	2.6	Dry Lane	10	Rational Method	yes
2	90	0.50	37	0.65	2.76	1.8	Dry Lane	8	Rational Method	yes
3	70	1.00	16	0.45	3.08	1.4	Dry Lane	4	Facility E72 Suface Flow	yes
4	90	1.04	53	0.65	3.97	2.6	Dry Lane	12	Rational Method	yes
5	52	0.45	128	1.00	4.62	4.6	Depth	25	Basin 1-4 Flow	yes
6	52	0.80	164	0.98	6.09	6.0	D x V	25	Basin 1-4 Flow	yes
7	52	0.50	137	1.00	4.89	4.9	Depth	25	Basin 1-4 Flow	yes
8	52	0.91	159	0.95	6.30	6.0	D x V	25	Basin 1-4 Flow	yes
9	70	0.50	11	0.45	2.18	1.0	Dry Lane	7	Rational Method	yes
10	70	1.09	16	0.45	3.21	1.4	Dry Lane	1	Facility E63 Suface Flow	yes
11	70	0.53	11	0.45	2.24	1.0	Dry Lane	1	Facility E63 Suface Flow	yes
12	70	0.51	11	0.45	2.20	1.0	Dry Lane	11	Rational Method	yes
13	70	0.75	14	0.45	2.67	1.2	Dry Lane	2	Rational Method	yes
14	70	0.55	12	0.45	2.28	1.0	Dry Lane	7	Rational Method	yes
15	70	0.60	12	0.45	2.38	1.1	Dry Lane	5	Rational Method	yes
16	52	0.48	132	1.00	4.77	4.8	Depth	50	Facility E21 Surface Flow	yes
17	52	2.12	140	0.77	7.79	6.0	D x V	4	Rational Method	yes
18	49	0.60	160	1.00	5.23	5.2	Depth	50	Facility E18 Surface Flow	yes
19	70	0.53	11	0.45	2.24	1.0	Dry Lane	1	Facility E56 Surface Flow	yes
20	70	0.53	11	0.45	2.24	1.0	Dry Lane	1	Facility E53 Surface Flow	yes
21	70	1.24	17	0.45	3.43	1.5	Dry Lane	0	Facility E98 Surface Flow	yes
22	70	0.50	11	0.45	2.18	1.0	Dry Lane	9	Rational Method	yes
23	*100	1.19	60	0.78	4.87	3.8	Dry Lane	4	Rational Method	yes
24	*90	0.53	11	0.55	2.50	1.4	Dry Lane	7	Rational Method	yes
25	90	0.42	33	0.65	2.53	1.6	Dry Lane	7	Facility P53 Surface Flow	yes
26	90	1.01	52	0.65	3.92	2.5	Dry Lane	9	Facility P56 Surface Flow	yes
27	*70	0.50	6	0.45	2.18	1.0	Dry Lane	6	Rational Method	yes
28	41	0.50	134	1.00	4.96	5.0	Depth	41	Concentration Point 4I	yes
29	96	2.47	118	0.71	7.06	5.0	Dry Lane	0	Facility P9 Surface Flow	yes
30	96	0.50	53	0.71	3.17	2.3	Dry Lane	0	Facility P28 Surface Flow	yes
31	96	0.50	53	0.71	3.17	2.3	Dry Lane	31	Facility P67 Surface Flow	yes
32	70	1.24	17	0.45	3.43	1.5	Dry Lane	11	Rational Method	yes

* Only Half Street Calculations were analyzed for these cross sections

Rational Method Results

Cross Section ID	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
1	2.67	10	19
2	2.24	8	16
4	3.17	12	22
9	1.76	7	12
12	2.93	11	21
13	0.51	2	4
14	1.91	7	13
15	1.27	5	9
17	0.94	4	7
22	2.28	9	16
23	1.02	4	7
24	1.98	7	14
27	1.62	6	11
32	2.79	11	20

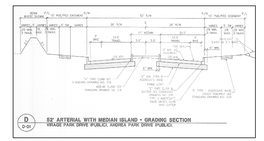
N

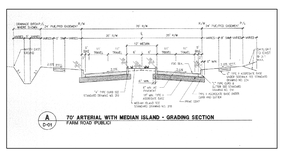
0 350 700
SCALE – 1" = 350' FEET

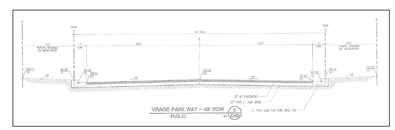
LEGEND

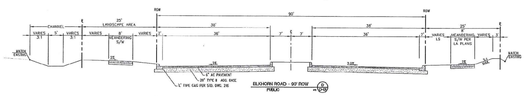
- BASIN BOUNDARY
- I D — BASIN ID
- SUBBASIN BOUNDARY
- I D — SUBBASIN ID
- I D — CONCENTRATION POINT
- SUBBASIN BOUNDARY FOR FLOWMASTER SECTION (RATIONAL METHOD)
- I D — FLOWMASTER SECTION
- 0.00% — SLOPE AND FLOW DIRECTION

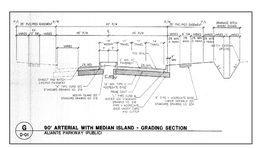
TYPICAL CROSS SECTIONS UTILIZED

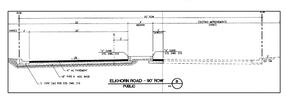

D — 82' ARTERIAL WITH MEDIAN ISLAND - GRADING SECTION
VRAGE PARK DRIVE PUBLIC; VARIES PARK DRIVE PUBLIC

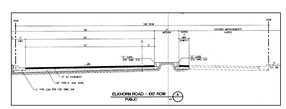

A — 70' ARTERIAL WITH MEDIAN ISLAND - GRADING SECTION
FARM ROAD PUBLIC

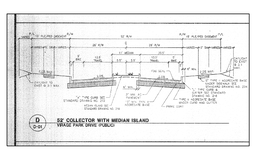

VRAGE PARK WAY - 49' ROW
PUBLIC

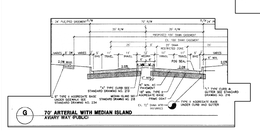

ELKHORN ROAD - 90' ROW
PUBLIC

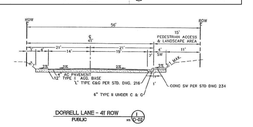

G — 90' ARTERIAL WITH MEDIAN ISLAND - GRADING SECTION
ALIANTE PARKWAY PUBLIC


ELKHORN ROAD - 90' ROW
PUBLIC


ELKHORN ROAD - 90' ROW
PUBLIC


D — 82' COLLECTOR WITH MEDIAN ISLAND
VRAGE PARK DRIVE PUBLIC


G — 70' ARTERIAL WITH MEDIAN ISLAND
ASAPPY WAY PUBLIC


DORRELL LANE - 41' ROW
PUBLIC

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

NO.	DESCRIPTION	DATE	BY	APP. DATE	APP.

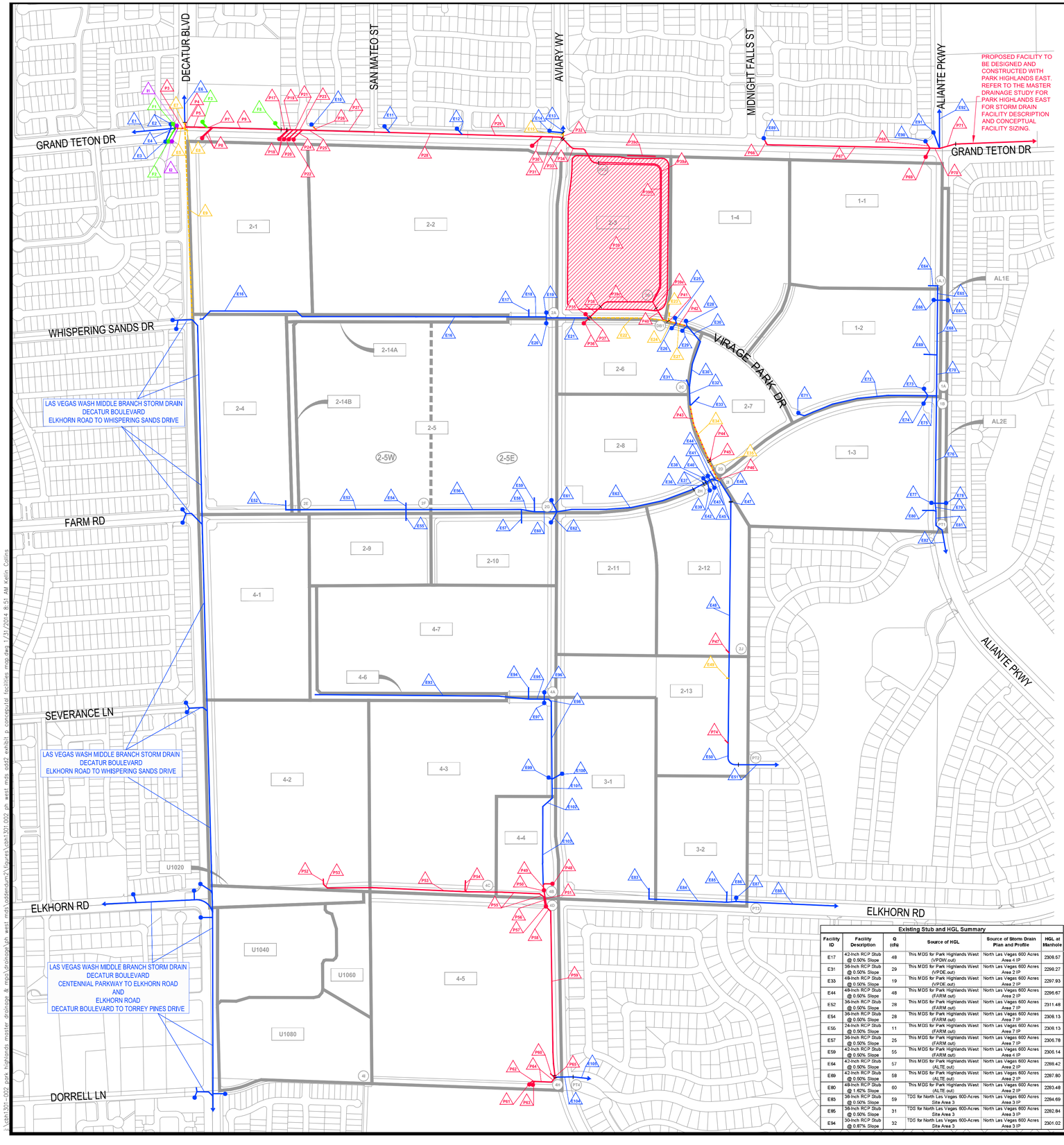
CRESCENT BAY HOLDINGS

MASTER DRAINAGE STUDY PARK HIGHLANDS WEST
STREET SECTIONS MAP

DATE: FEB 2014
DRAFTER: KC/ETM
DESIGNER: KC/ETM
CHECKED: MJF

PROJECT NO.
CBH1301.002

EXHIBIT O
SHEET 1 OF 1



Existing Interim Facility Summary
Interim Condition

Facility ID	Facility Description (Type, Size & Slope)	Flow Breakdown/ Notes	Q_{100} Total (cfs)	Q_{100} Storm Drain (cfs)	Q_{100} Surface (cfs)
E2	6'-0"ft Type Neenah R-3295-2-L Drop Inlet with 15-inch RCP Lateral @ 2.47% Slope 6'-0"ft Type Neenah R-3295-2-L Drop Inlet with 24-inch Lateral @ 1.48% Slope	Concentration Point CP19 - Facility E1 & E6	169/170	24/26	134/951
E3		Bypass from Facility E2	159/699	22/27	134/951

Existing Facility Summary
Ultimate Condition

Facility ID	Facility Description (Type, Size & Slope)	Flow Breakdown/ Notes	Q_{100} Total (cfs)	Q_{100} Storm Drain (cfs)	Q_{100} Surface (cfs)
E1	48-inch RCP @ 0.54% Slope	Per CLV 12/4/2947	N/A	69/69	N/A
E2	6'-0"ft Type Neenah R-3295-2-L Drop Inlet with 15-inch RCP Lateral @ 2.47% Slope 6'-0"ft Type Neenah R-3295-2-L Drop Inlet with 24-inch RCP Lateral @ 1.48% Slope	To be Removed/Abandoned	-	-	-
E4	48-inch RCP @ 1.09% Slope	To be Removed/Abandoned	-	-	-
E5	48-inch RCP @ 1.09% Slope	To be Removed/Abandoned	-	-	-
E6	36-inch RCP @ 6.29% Slope	Per CLV 12/4/2947	N/A	30/30	N/A
E7	36-inch RCP @ 0.25% Slope	To be Removed/Abandoned	-	-	-
E8	54-inch RCP Stub @ 0.25% Slope	To be Removed/Abandoned	-	-	-
E9	30-inch RCP @ 0.22% Slope	To be Removed/Abandoned	-	-	-
E10	15'-0"ft Type CM Drop Inlet with Lateral to be Removed/Replaced 10'-0"ft Type CM Drop Inlet with 36-inch MDRE Lateral @ 3.09% Slope	Bypass from Facility E11 + the Difference between Concentration Points CP18 & CP19	3/27	3/54	0/42
E11		Bypass from Facility E12 + the Difference between Concentration Points CP18 & CP20	5/62	5/51	0/11
E12	15'-0"ft Type CM Drop Inlet with 30-inch RCP Lateral @ 2.92% Slope	Bypass from Facility E11	2/11	2/11	0/0
E13	72-inch RCP @ 5.17% Slope	Concentration Point CP21	49/160	49/160	0/0
E14	13.5-ft Modified Type C Drop Inlet with 18-inch RCP Lateral @ 0.50% slope	Nuisance	Nuisance	Nuisance	0/0
E15	72-inch RCP @ 1.33%	To be Removed/Abandoned	-	-	-
E16	30-inch RCP @ Varying Slopes (0.58% to 0.71%)	Previous approaching flows has been diverted south in Regional facility	0/0	0/0	0/0
E17	42-inch RCP Stub @ 5.50% Slope	Half of Basin 2-2	72/48	22/48	0/0
E18	48-inch RCP @ 0.50% Slope	Concentration Point 2A	72/166	22/48	59/107
E19	5'-6"ft Type CM Drop Inlet with 15-inch RCP Lateral @ 0.50% Slope	Half of Bypass from Facility E18)	35/54	Nuisance	35/54
E20	5'-6"ft Type CM Drop Inlet with 15-inch RCP Lateral @ 0.50% Slope	Half of Bypass from Facility E18)	35/54	Nuisance	35/54
E21	48-inch RCP @ 0.50% Slope	Concentration Point 2A	72/166	22/48	59/107
E22	48-inch RCP @ 0.74% Slope	To be Removed/Abandoned	-	-	-
E23	42-inch RCP Stub @ 0.50% Slope	To be Removed/Abandoned	-	-	-
E24	66-inch RCP @ 0.47% Slope	To be Removed/Abandoned	-	-	-
E25	5'-6"ft Type C Drop Inlet with 15-inch RCP Lateral @ 0.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E26	5'-6"ft Type C Drop Inlet with 15-inch RCP Lateral @ 0.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E27	69-inch RCP @ 0.47% Slope	To be Removed/Abandoned	-	-	-
E28	5'-5"ft Type G Drop Inlet with 42-inch RCP Lateral @ 1.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E29	5'-5"ft Type G Drop Inlet with 42-inch RCP Lateral @ 1.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E30	72-inch RCP @ Varying Slopes (0.58% to 0.40%)	Concentration Point DB1	141/231	141/231	0/0
E31	36-inch RCP Stub @ 0.50% Slope	Basin 2-6	15/29	15/29	0/0
E32	72-inch RCP @ 0.30% Slope	Concentration Point 2C	141/232	141/232	0/0
E33	48-inch RCP Stub @ 0.50% Slope	Basin 2-7	7/19	7/19	0/0
E34	48-inch RCP @ 0.30% Slope	To be Removed/Abandoned	-	-	-
E35	48-inch RCP @ 0.39% Slope	To be Removed/Abandoned	-	-	-
E36	69-inch RCP @ 0.79% Slope	Concentration Point 2D	183/222	102/147	1/75
E37	Transition Structure	Concentration Point 2D	183/222	102/147	1/75
E38	21'-0"ft Type CM Drop Inlet with 54-inch RCP Lateral @ 1.50% Slope	Half of the Bypass from Facility E37	1/38	1/38	0/0
E39	21'-0"ft Type CM Drop Inlet with 54-inch RCP Lateral @ 1.50% Slope	Half of the Bypass from Facility E37	1/38	1/38	0/0
E40	14'-0" RCB @ 0.30% Slope	Concentration Point 2D	183/222	102/222	0/0
E41	21'-0"ft Type CM Drop Inlet with 48-inch RCP Lateral @ 1.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E42	21'-0"ft Type CM Drop Inlet with 48-inch RCP Lateral @ 1.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E43	14'-0" RCB @ 0.30% Slope	Concentration Point 3D	183/222	102/222	0/0
E44	48-inch RCP Stub @ 0.50% Slope	Basin 2-8	34/48	34/48	0/0
E45	14'-0" RCB @ 0.30% Slope	Concentration Point 3H	137/209	137/209	0/0
E46	14'-0" RCB @ 0.30% Slope	Concentration Point 3	189/255	189/255	0/0
E47	Transition Structure	Concentration Point 3	189/255	189/255	0/0
E48	10'-0" Arch @ 0.30% Slope	Concentration Point 3I	189/255	189/255	0/0
E49	54-inch RCP Stub @ 0.50% Slope	To be Removed/Abandoned	-	-	-
E50	10'-0" Arch @ 0.30% Slope	Concentration Point PT2	245/464	245/464	0/0
E51	Alante Flood Channel	Concentration Point PT2	245/464	245/464	0/0
E52	36-inch RCP Stub @ 0.50% Slope	Basin 2-4	29/55	29/28	9/28
E53	36-inch RCP @ 0.40% Slope	Concentration Point 3E	29/59	29/28	9/31
E54	36-inch RCP Stub @ 0.50% Slope	Subbasin 2-MV	29/60	29/28	9/32
E55	24-inch RCP Stub @ 0.50% Slope	Basin 2-9	11/24	11/11	0/13
E56	54-inch RCP @ 0.40% Slope	Concentration Point 2F	61/142	61/67	1/75
E57	36-inch RCP Stub @ 0.50% Slope	Basin 2-10	13/25	13/26	0/0
E58	54-inch RCP @ 1.40% Slope	Concentration Point 2F + Basin 2-10	73/167	73/92	1/75
E59	42-inch RCP Stub @ 0.50% Slope	Subbasin 2-5E	25/55	25/55	0/0
E60	54-inch RCP @ 0.39% Slope	Concentration Point 3G	183/222	102/147	1/75
E61	5'-5"ft Type C Drop Inlet with 18-inch RCP Lateral @ 0.50% Slope	Half of Bypass from Facility E60	1/38	Nuisance	1/38
E62	5'-5"ft Type C Drop Inlet with 18-inch RCP Lateral @ 0.50% Slope	Half of Bypass from Facility E60	1/38	Nuisance	1/38
E63	54-inch RCP @ 1.76% Slope	Concentration Point 3G	183/222	102/147	1/75
E64	42-inch RCP Stub @ 5.50% Slope	Basin 1-1	29/57	29/57	0/0
E65	42-inch RCP @ 0.34% Slope	Basin 1-1	29/57	29/57	0/0
E66	5'-5"ft Modified Type C Drop Inlet with 24-inch RCP Lateral @ 0.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E67	Drop Inlet and Lateral	Basin 4&1E	3/5	3/5	0/0
E68	54-inch RCP @ 0.34% Slope	Concentration Point 1A-1	31/51	31/51	0/0
E69	42-inch RCP Stub @ 1.50% Slope	Basin 1-2	29/50	29/58	0/0
E70	66-inch RCP @ 0.34% Slope	Concentration Point 1A	52/139	52/113	0/0
E71	11.5-ft Modified Type C Drop Inlet with 30-inch RCP Lateral @ 0.50% Slope	Basin 1-4	20/55	21/21	4/34
E72	36-inch RCP @ 0.50% Slope	Basin 1-4	29/55	21/21	4/34
E73	11.5-ft Modified Type C Drop Inlet with 36-inch RCP Lateral @ 2.00% Slope	Bypass from Facility E72	4/34	4/34	0/0
E74	7.5-ft Type B Drop Inlet with 24-inch RCP Lateral @ 2.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E75	48-inch RCP @ 0.50% Slope	Basin 1-4	25/55	20/55	0/0
E76	66-inch RCP @ 0.34% Slope	Concentration Point 1B	83/187	83/187	0/0
E77	7.5-ft Type B Drop Inlet with 24-inch RCP Lateral @ 2.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E78	Drop Inlet and Lateral	Basin 4&1E	3/5	3/5	0/0
E79	66-inch RCP @ 0.39% Slope	Concentration Point 1B + Basin A-3E	83/170	83/172	0/0
E80	48-inch RCP Stub @ 1.62% and 1.94% Slopes	Basin 1-3	27/50	27/50	0/0
E81	66-inch RCP @ 0.28% Slope	Concentration Point PT1	169/222	139/232	0/0
E82	66-inch RCP	Concentration Point PT1	169/222	139/232	0/0
E83	36-inch RCP Stub @ 1.50% Slope	Basin 3-1	30/60	30/59	0/0
E84	42-inch RCP @ 0.50% Slope	Basin 3-1	30/60	30/59	0/0
E85	36-inch RCP Stub @ 1.50% Slope	Basin 3-2	14/31	14/31	0/0
E86	42-inch RCP @ 1.50% Slope	Concentration Point PT3	43/66	43/66	0/0
E87	11.5-ft Modified Type C Drop Inlet with 24-inch RCP Lateral @ 0.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E88	48-inch RCP @ 0.57% Slope	Concentration Point PT3	43/66	43/66	0/0
E89	14.5-ft Modified Type C Drop Inlet	Basin UT20	29/57	28/28	9/38
E90	14.5-ft Modified Type C Drop Inlet	Concentration Point CP25 - Facility E89	31/112	31/71	0/41
E91	4-ft Type A Drop Inlet with 18-inch RCP Lateral @ 2.25% Slope	Nuisance	Nuisance	Nuisance	0/0
E92	66-inch RCP @ 0.39% Slope	Basin UT20	52/122	51/122	0/0
E93	66-inch RCP @ 0.40% Slope	Basin 4-1 + 4-6 + Half of Basin 4-7	47/57	Nuisance	47/57
E94	30-inch RCP Stub @ 0.87% Slope	Half of Basin 4-7	14/22	14/22	0/0
E95	36-inch RCP @ 0.30% Slope	Concentration Point 4A	51/129	14/32	47/97
E96	5'-5"ft Type B Drop Inlet with 24-inch RCP Lateral @ 0.50% Slope	Nuisance	Nuisance	Nuisance	0/0
E97	11.5-ft Modified Type C Drop Inlet with 30-inch RCP Lateral @ 0.50% Slope	Bypass from Facility E96	4/29	4/14	0/15
E98	48-inch RCP @ 0.39% Slope	Concentration Point 4A	51/129	51/129	0/0
E99	66-inch RCP @ 0.40% Slope	Basin 4-1 + 4-6 + Half of Basin 4-7	47/57	Nuisance	47/57
E100	66-inch RCP @ 0.41% Slope	Concentration Point 4A	51/129	51/129	0/0
E101	66-inch RCP @ 0.39% Slope	Concentration Point 4A	51/129	51/129	0/0
E102	69-inch RCP @ 0.50% and 0.41% Slopes	Concentration Point 4A	51/129	51/129	0/0
E103	66-inch RCP @ 0.41% Slope	Concentration Point 4A	51/129	51/129	0/0
E104	Dual 8'x4' RCBs	Concentration Point PT4	245/505	240/464	0/41
E105	Linear Park	Concentration Point PT4	245/505	240/464	-

Existing Stub and HGL Summary

Facility ID	Facility Description	Q (cfs)	Source of HGL	Source of Storm Drain Plan and Profile	HGL at Manhole
E17	42-inch RCP Stub @ 0.50% Slope	48	This MDS for Park Highlands West (VPDW.out)	North Las Vegas 600 Acres Area 4 IP	2308.57
E31	36-inch RCP Stub @ 0.50% Slope	29	This MDS for Park Highlands West (VPDE.out)	North Las Vegas 600 Acres Area 2 IP	2298.27
E33	48-inch RCP Stub @ 0.50% Slope	19	This MDS for Park Highlands West (VPDE.out)	North Las Vegas 600 Acres Area 2 IP	2297.93
E44	48-inch RCP Stub @ 0.50% Slope	48	This MDS for Park Highlands West (FARM.out)	North Las Vegas 600 Acres Area 2 IP	2296.67
E52	36-inch RCP Stub @ 0.50% Slope	28	This MDS for Park Highlands West (FARM.out)	North Las Vegas 600 Acres Area 7 IP	2311.48
E54	36-inch RCP Stub @ 0.50% Slope	28	This MDS for Park Highlands West (FARM.out)	North Las Vegas 600 Acres Area 7 IP	2308.13
E55	24-inch RCP Stub @ 0.50% Slope	11	This MDS for Park Highlands West (FARM.out)	North Las Vegas 600 Acres Area 7 IP	2308.13
E57	36-inch RCP Stub @ 0.50% Slope	25	This MDS for Park Highlands West (FARM.out)	North Las Vegas 600 Acres Area 7 IP	2306.78
E59	42-inch RCP Stub @ 0.50% Slope	55	This MDS for Park Highlands West (FARM.out)	North Las Vegas 600 Acres Area 4 IP	2306.14
E64	42-inch RCP Stub @ 0.50% Slope	57	This MDS for Park Highlands West (ALTE.out)	North Las Vegas 600 Acres Area 2 IP	2288.42
E69	42-inch RCP Stub @ 0.50% Slope	58	This MDS for Park Highlands West (ALTE.out)	North Las Vegas 600 Acres Area 2 IP	2287.80
E80	48-inch RCP Stub @ 1.62%	60	This MDS for Park Highlands West (ALTE.out)	North Las Vegas 600 Acres Area 2 IP	2293.48
E83	36-inch RCP Stub @ 0.50% Slope	59	TDS for North Las Vegas 600-Acres Site Area 3	North Las Vegas 600 Acres Area 3 IP	2284.69
E85	36-inch RCP Stub @ 0.50% Slope	31	TDS for North Las Vegas 600-Acres Site Area 3	North Las Vegas 600 Acres Area 3 IP	2282.84
E94	30-inch RCP Stub @ 0.87% Slope	32	TDS for North Las Vegas 600-Acres Site Area 3	North Las Vegas 600 Acres Area 3 IP	2301.02

Future Facility Summary
Ultimate Condition

Facility ID	Facility Description (Type, Size & Slope)	Flow Breakdown/ Notes	Q_{100} Total (cfs)	Q_{100} Storm Drain (cfs)	Q_{100} Surface (cfs)
F1	Drop Inlet and Lateral (type, size & slope TBD)	Concentration Point CP17 - Facilities E1 & E6, Facilities F1 and F2 are connected to receive Facilities E2, E3 and E4	225/844	225/422	0/422
F2	Drop Inlet and Lateral (type, size & slope TBD)				
F3	Drop Inlet with dual 36-Inch RCP Laterals	Half of the Bypass from Facility E1+F2	12/211	12122 (5/51 per lateral)	0/85
F4	Facility ID F4 thru F7 are Not Used				
F8	Drop Inlet with 24-Inch RCP Lateral	Bypass from Facility F8 + the Difference between Concentration Points CP17 & CP19	9/91	1/24	0/67

Proposed Interim Facility Summary
Interim Condition

Facility ID	Facility Description (Type, Size & Slope)	Flow Breakdown/ Notes	Q_{100} Total (cfs)	Q_{100} Storm Drain (cfs)	Q_{100} Surface (cfs)
I1	34-5 Trench Drain (Neenah R-4994-L4)	Concentration Point CP19 - Facility E1, E2, E3 & E6	134/951	69/175	65/405
I2	17-5-ft Type CM Drop Inlet with 42-Inch RCP Lateral @ 2.54% Slope	Bypass from Facility I1	65/465	41/93	24/422

Proposed Facility Summary
Ultimate Condition

Facility ID	Facility Description (Type, Size & Slope)	Flow Breakdown/ Notes	Q_{100} Total (cfs)	Q_{100} Storm Drain (cfs)	Q_{100} Surface (cfs)
	Facility ID P1 and P2 are Not Used				
P3	12'x5' RCB @ 1.14% Slope	Concentration Point CP17 - Facility E6	336/927	306/505	0/422
P4	36-inch RCP @ 0.61% Slope	Facility E6	N/A	30/30	N/A
P5	12'x5' RCB @ 1.14% Slope	Concentration Point CP17	336/927	336/505	0/422
P7	12'x5' RCB @ 1.14% Slope	Concentration Point CP17	336/957	336/657	0/300
P8	Drop Inlet with Dual 36-Inch RCP Laterals @ Varying Slopes (0.50% to 15.08%)	Half of the Bypass from Facility F1/F2	12/211	12122 (6/61 per lateral)	0/89
P9	12'x5' RCB @ 1.14% and 1.50% Slopes	Concentration Point CP17	336/959	336/779	0/180
	Facility ID P10 thru P16 are Not Used				
P17	Transition Structure @ 1.50% Slope	Concentration Point CP18	337/959	337/803	0/156
P18	Drop Inlet with Dual 24-Inch RCP Lateral @ Varying Slopes (0.50% to 18.45%)	Bypass from Facility P8	0/89	0/51 (0/25.5 per lateral)	0/38
P19	12'x7' Arch @ 0.45% Slope	Concentration Point CP18	337/959	337/854	0/105
P20	Drop Inlet with 24-Inch RCP Lateral @ 0.50% and 18.58% Slopes	Bypass from Facility P18	0/37	0/13	0/25
P21	12'x7' Arch @ 0.45% Slope	Concentration Point CP18	337/959	337/867	0/92
P22	Drop Inlet with 24-Inch RCP Lateral @ 0.50% and 18.39% Slopes	Bypass from Facility P20	0/25	0/10	0/15
P23	12'x7' Arch @ 0.45% Slope	Concentration Point CP18	337/959	337/877	0/82
P24	Drop Inlet with 24-Inch RCP Lateral @ 0.50% and 18.78% Slopes	Bypass from Facility P22	0/15	0/7	0/8
P25	12'x7' Arch @ 0.45% Slope	Concentration Point CP19	344/989	337/884	7/105
P26	36-Inch RCP Lateral @ 13.30% Slope	Bypass from Facility F8 + the Difference Between Concentration Points CP18 & CP19	7/97	7/54	0/43
P27	12'x7' Arch @ 0.45% Slope	Concentration Point CP20	349/1008	344/938	5/70
P28	12'x7' Arch @ 0.45% Slope	Concentration Point CP20	349/1008	349/989	0/19
P29	12'x7' Arch @ 0.45% Slope	Concentration Point CP20	349/1008	349/1000	0/8
P30	Drop Inlet with 18-Inch RCP Lateral @ 2.00% Slope	Bypass from Facility P24	0/8	0/8	0/0
P31	12'x7' Arch @ 0.45% Slope	Concentration Point CP20	349/1008	349/1008	0/0
P32	72-Inch RCP @ 0.50% Slopes	Concentration Point CP21	46/102	46/102	0/0
P33	Junction Structure	Concentration Point CPGTA	358/1026	358/1026	0/0
P34	12'x7' Arch @ 0.30% Slopes	Concentration Point CPGTA	358/1026	358/1026	0/0
P35	Drop Inlet with 36-Inch RCP Lateral @ 0.50% Slope	Half of (Concentration Point 2A - Facility E17)	25/53	25/53	0/0
P36	Drop Inlet with 36-Inch RCP Lateral @ 0.50% Slope	Half of (Concentration Point 2A - Facility E17)	25/53	25/53	0/0
P37	Junction Structure	Concentration Point 2A	72/155	72/155	0/0
P38	66-Inch RCP @ 0.5% Slope	Concentration Point 2A	72/155	72/155	0/0
P39	Detention Basin/Park	Concentration Point 2B	370/1066	370/1066	N/A
P39a	10-Year Conveyance Channel	Concentration Point CPGTA2	360/-	360/-	N/A
P39b	7.0-ft Wide Low Flow Channel	N/A	N/A	12/12	N/A
P39c	5.0-ft Wide Low Flow Channel	N/A	N/A	15/15	N/A
P39d	200.0-ft Spillway	N/A	N/A	N/A	N/A
P39e	54-inch Orifice Plate & Trash Rack	Concentration Point DB1	141/231	141/231	0/0
P40	72-inch RCP @ 0.39% Slope	Concentration Point DB1	141/231	141/231	0/0
P41	72-inch RCP @ 0.30% Slope	Concentration Point DB1	141/231	141/231	0/0
P42	72-inch RCP @ 0.30% Slope	Concentration Point DB1	141/231	141/231	0/0
P43	72-inch RCP @ 0.32% Slope	Concentration Point 2C	141/232	141/232	0/0
P44	48-Inch RCP Stub @ 0.50% Slope	Basin 2-7	7/19	7/19	0/0
P45	Junction Structure	Concentration Point 2D	142/232	142/232	0/0
P46	6'x5' RCB @ 0.32% Slope	Concentration Point 2D	142/232	142/232	0/0
P47	48-Inch RCP Stub @ 0.50% Slope	Concentration Point 2J	39/82	39/82	0/0
P48	Drop Inlet with 18-Inch RCP Lateral at 0.50% Slope	Nuisance	Nuisance	Nuisance	0/0
P49	54"x88" Arch @ 0.41% Slope	Concentration Point 4A	61/129	61/129	0/0
P50	Drop Inlet	Half of (Bypass from Facility P56 + Basin 4-4)	8/49	8/49	0/0
P51	54"x88" Arch @ 0.41% Slope	Concentration Point 4A + Half of (Bypass from Facility P56 + Basin 4-4)	72/188	72/188	0/0
P52	36-Inch RCP Stub @ 0.50% Slope	Basin 4-2	43/86	43/43	0/43
P53	36-Inch RCP @ 0.67% Slope	Basin 4-2 + U1020	50/102	43/43	7/59
P54	36-Inch RCP Stub @ 0.50% Slope	Basin 4-3	30/65	30/30	0/35
P55	48-Inch RCP @ 0.58% Slope	Concentration Point 4C	72/151	63/73	9/78
P56	48-Inch RCP @ 0.41% Slope	Concentration Point 4C	72/151	63/73	9/78
P57	Drop Inlet	Half of (Bypass from Facility P56 + Basin 4-4)	8/49	8/49	0/0
P58	8'x4' RCB @ 0.41% Slope	Concentration Point 4D	150/316	150/316	0/0
P59	8'x4' RCB @ 0.42% Slope	Concentration Point 4D	150/316	150/316	0/0
P60	48-Inch RCP Stub @ 0.50% Slope	Basin 4-5	50/100	50/100	0/0
P61	Drop Inlet with 24-Inch RCP Lateral @ 1.00% Slope	Concentration Point 4I	41/81	24/24	17/57
P62	24-Inch RCP @ 0.50% Slope	Concentration Point 4I	41/81	24/24	17/57
P63	Drop Inlet with 18-Inch RCP Lateral @ 1.00% Slope	Bypass from Facility P61	17/57	17/17	0/40
P64	36-Inch RCP @ 0.50% Slope	Concentration Point 4I	41/81	41/41	0/40
P65	Junction Structure	Concentration Point PT4	241/487	241/487	0/40
P66	30-Inch RCP Lateral @ 0.50% Slope	Basin UT20	28/57	28/29	0/28
P67	30-Inch RCP @ 0.50% Slope	Concentration Point CP26	59/141	28/29	31/112
P68	42-Inch Lateral @ 0.50% Slope	Bypass from Facility P67	31/112	31/71	0/41
P69	Drop Inlet with 18-Inch Lateral @ 0.50% Slope	Bypass from Facility P67	31/112	Nuisance	0/41
P70	48-Inch RCP @ 0.50% Slope	Concentration Point CP26	59/141	59/100	0/41
P71	72-Inch RCP @ 0.50% Slope	Concentration Point CP27	101/248	101/207	0/41
P74	36-Inch RCP Stub @ 0.50%	Basin 2-13	18/39	18/39	0/0

0 350 700
SCALE – 1" = 350' FEET

N

LEGEND

- STORM DRAIN FACILITY (RCP, RCB, DITCH, ETC.)
- STORM DRAIN FACILITY (DETENTION BASIN)
- STORM DRAIN FACILITY (DROP INLET)
- FACILITY ID
- EXISTING
- PROPOSED
- PROPOSED INTERIM
- FUTURE (BY OTHERS)
- EXISTING TO BE REMOVED OR ABANDONED
- SURFACE FLOW
- BASIN BOUNDARY
- BASIN ID
- SUBBASIN BOUNDARY
- SUBBASIN ID
- CONCENTRATION POINT

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS
5740 S. ARVILLE STREET #216, LAS VEGAS, NV 89118
PHONE (702) 284-5300 FAX (702) 284-5399

NO.	DESCRIPTION	DATE	BY	APP.	APP. DATE

CRESCENT BAY HOLDINGS

MASTER DRAINAGE STUDY PARK HIGHLANDS WEST

CONCEPTUAL FACILITIES MAP

DATE: FEB 2014
DRAFTER: KC/ETM
DESIGNER: KC/ETM
CHECKED: MJF
PROJECT NO. CBH1301.002

EXHIBIT P
SHEET 1 OF 1

APPENDIX D

Additional Hydrologic Computations

Rational Method for Roadway Flows

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS

Rational Method

Project Name: Park Highlands West
Date: January 2014
File Name: CBH1301.002 West MDS ADD2 Rational
By: KC

Reference:
CCRFCD Design Manual

Rational Method: Q = CiA

C_{10} = 0.90 Per Table 601 (Paved Streets and Roads)
C_{100} = 0.93 Per Table 601 (Paved Streets and Roads)
i_{10} = 4.20 Per Table 506 (Assume Tc = 5 minutes)
i_{100} = 7.56 Per Table 506 (Assume Tc = 5 minutes)

Rational Method Results

Cross Section ID	A, Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
1	2.67	10	19
2	2.24	8	16
4	3.17	12	22
9	1.76	7	12
12	2.93	11	21
13	0.51	2	4
14	1.91	7	13
15	1.27	5	9
17	0.94	4	7
22	2.28	9	16
23	1.02	4	7
24	1.98	7	14
27	1.62	6	11
32	2.79	11	20

APPENDIX E

Additional Hydraulic Computations

Street Capacity Summary Tables

10-Year Street Flow Capacity Summary										
Street Section	ROW Width (ft)	Slope (%)	Q (cfs)	Depth (ft)	Velocity (fps)	D x V	Control	Actual Q (cfs)	Source of Q	Criteria Met?
1	90	1.04	53	0.65	3.97	2.6	Dry Lane	10	Rational Method	yes
2	90	0.50	37	0.65	2.76	1.8	Dry Lane	8	Rational Method	yes
3	70	1.00	16	0.45	3.08	1.4	Dry Lane	4	Facility E72 Suface Flow	yes
4	90	1.04	53	0.65	3.97	2.6	Dry Lane	12	Rational Method	yes
5	52	0.45	128	1.00	4.62	4.6	Depth	25	Basin 1-4 Flow	yes
6	52	0.80	164	0.98	6.09	6.0	D x V	25	Basin 1-4 Flow	yes
7	52	0.50	137	1.00	4.89	4.9	Depth	25	Basin 1-4 Flow	yes
8	52	0.91	159	0.95	6.30	6.0	D x V	25	Basin 1-4 Flow	yes
9	70	0.50	11	0.45	2.18	1.0	Dry Lane	7	Rational Method	yes
10	70	1.09	16	0.45	3.21	1.4	Dry Lane	1	Facility E63 Suface Flow	yes
11	70	0.53	11	0.45	2.24	1.0	Dry Lane	1	Facility E63 Suface Flow	yes
12	70	0.51	11	0.45	2.20	1.0	Dry Lane	11	Rational Method	yes
13	70	0.75	14	0.45	2.67	1.2	Dry Lane	2	Rational Method	yes
14	70	0.55	12	0.45	2.28	1.0	Dry Lane	7	Rational Method	yes
15	70	0.60	12	0.45	2.38	1.1	Dry Lane	5	Rational Method	yes
16	52	0.48	132	1.00	4.77	4.8	Depth	50	Facility E21 Surface Flow	yes
17	52	2.12	140	0.77	7.79	6.0	D x V	4	Rational Method	yes
18	49	0.60	160	1.00	5.23	5.2	Depth	50	Facility E18 Surface Flow	yes
19	70	0.53	11	0.45	2.24	1.0	Dry Lane	1	Facility E56 Surface Flow	yes
20	70	0.53	11	0.45	2.24	1.0	Dry Lane	1	Facility E53 Surface Flow	yes
21	70	1.24	17	0.45	3.43	1.5	Dry Lane	0	Facility E98 Surface Flow	yes
22	70	0.50	11	0.45	2.18	1.0	Dry Lane	9	Rational Method	yes
23	*100	1.19	60	0.78	4.87	3.8	Dry Lane	4	Rational Method	yes
24	*90	0.53	11	0.55	2.50	1.4	Dry Lane	7	Rational Method	yes
25	90	0.42	33	0.65	2.53	1.6	Dry Lane	7	Facility P53 Surface Flow	yes
26	90	1.01	52	0.65	3.92	2.5	Dry Lane	9	Facility P56 Surface Flow	yes
27	*70	0.50	6	0.45	2.18	1.0	Dry Lane	6	Rational Method	yes
28	41	0.50	134	1.00	4.96	5.0	Depth	41	Concentration Point 4I	yes
29	96	2.47	118	0.71	7.06	5.0	Dry Lane	0	Facility P9 Surface Flow	yes
30	96	0.50	53	0.71	3.17	2.3	Dry Lane	0	Facility P28 Surface Flow	yes
31	96	0.50	53	0.71	3.17	2.3	Dry Lane	31	Facility P67 Surface Flow	yes
32	70	1.24	17	0.45	3.43	1.5	Dry Lane	11	Rational Method	yes

* Only Half Street Calculations were analyzed for these cross sections

100-Year Street Flow Capacity Summary										
Street Section	ROW Width (ft)	Slope (%)	Q (cfs)	Depth (ft)	Velocity (fps)	D x V	Control	Q at Section (cfs)	Source of Q	Criteria Met?
1	90	1.04	336	1.15	6.96	8.0	D x V	19	Rational Method	yes
2	90	0.50	389	1.37	5.83	8.0	D x V	16	Rational Method	yes
3	70	1.00	243	1.04	6.72	7.0	D x V	34	Facility E72 Suface Flow	yes
4	90	1.04	336	1.15	6.96	8.0	D x V	22	Rational Method	yes
5	52	0.45	273	1.34	5.96	8.0	D x V	55	Basin 1-4 Flow	yes
6	52	0.80	249	1.15	6.95	8.0	D x V	55	Basin 1-4 Flow	yes
7	52	0.50	268	1.31	6.13	8.0	D x V	55	Basin 1-4 Flow	yes
8	52	0.91	243	1.11	7.19	8.0	D x V	55	Basin 1-4 Flow	yes
9	70	0.50	282	1.25	5.64	7.1	D x V	12	Rational Method	yes
10	70	1.09	285	1.09	7.34	8.0	D x V	75	Facility E63 Suface Flow	yes
11	70	0.53	330	1.32	6.06	8.0	D x V	75	Facility E63 Suface Flow	yes
12	70	0.51	335	1.33	6.02	8.0	D x V	21	Rational Method	yes
13	70	0.75	310	1.20	6.66	8.0	D x V	4	Rational Method	yes
14	70	0.55	329	1.31	6.13	8.0	D x V	13	Rational Method	yes
15	70	0.60	323	1.28	6.27	8.0	D x V	9	Rational Method	yes
16	52	0.48	271	1.32	6.07	8.0	D x V	107	Facility E21 Surface Flow	yes
17	52	2.12	203	0.89	8.99	8.0	D x V	7	Rational Method	yes
18	49	0.60	273	1.24	6.45	8.0	D x V	107	Facility E18 Surface Flow	yes
19	70	0.53	329	1.32	6.06	8.0	D x V	75	Facility E56 Surface Flow	yes
20	70	0.53	329	1.32	6.06	8.0	D x V	31	Facility E53 Surface Flow	yes
21	70	1.24	279	1.06	7.57	8.0	D x V	50	Facility E98 Surface Flow	yes
22	70	0.50	335	1.34	5.98	8.0	D x V	16	Rational Method	yes
23	*100	1.19	216	1.18	6.80	8.0	D x V	7	Rational Method	yes
24	*90	0.53	190	1.35	5.92	8.0	D x V	14	Rational Method	yes
25	90	0.42	394	1.43	5.60	8.0	D x V	59	Facility P53 Surface Flow	yes
26	90	1.01	338	1.15	6.92	8.0	D x V	78	Facility P56 Surface Flow	yes
27	*70	0.50	167	1.34	5.97	8.0	D x V	11	Rational Method	yes
28	41	0.50	242	1.28	6.24	8.0	D x V	84	Concentration Point 4I	yes
29	96	2.47	273	0.92	8.68	8.0	D x V	180	Facility P9 Surface Flow	yes
30	96	0.50	389	1.33	6.01	8.0	D x V	19	Facility P28 Surface Flow	yes
31	96	0.50	389	1.33	6.01	8.0	D x V	112	Facility P67 Surface Flow	yes
32	70	1.24	279	1.06	7.57	8.0	D x V	20	Rational Method	yes

* Only Half Street Calculations were analyzed for these cross sections

10-Year Street Flow Capacity Flowmaster Computations

SECTION 32 10-YR
Worksheet for Irregular Channel

Project Description	
Worksheet	SECTION32 10-YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	1.2400	%
Water Surface Elevation	0.45	ft

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.014	
Elevation Range	0.00 to 1.12	
Discharge	17.39	cfs
Flow Area	5.1	ft²
Wetted Perimeter	32.00	ft
Top Width	31.00	ft
Actual Depth	0.45	ft
Critical Elevation	0.51	ft
Critical Slope	0.5290	%
Velocity	3.43	ft/s
Velocity Head	0.18	ft
Specific Energy	0.63	ft
Froude Number	1.49	
Flow Type	Supercritical	

Calculation Messages:
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+29.00	0.016
0+29.00	0+41.00	0.013
0+41.00	0+68.00	0.016
0+68.00	0+70.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.50
0+00.50	0.48
0+00.50	0.00
0+02.00	0.13
0+02.00	0.17
0+29.00	0.71
0+29.01	0.79

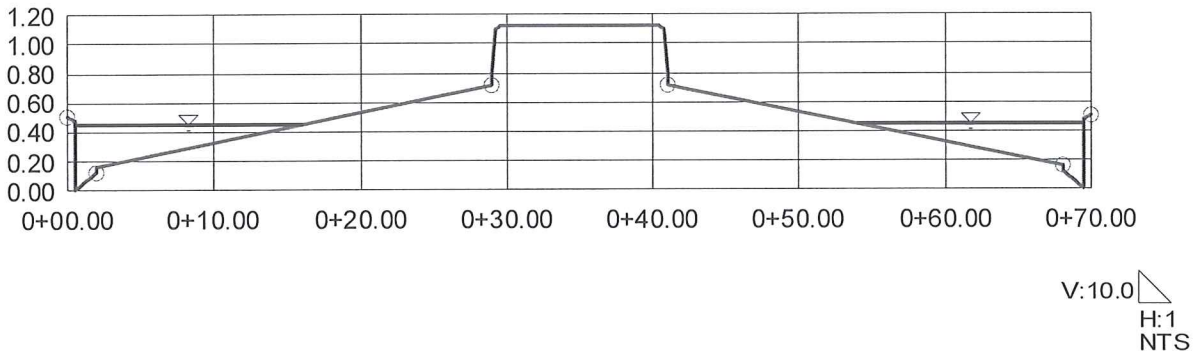
SECTION 32 10-YR
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+29.26	1.10
0+29.68	1.12
0+40.32	1.12
0+40.74	1.10
0+40.99	0.79
0+41.00	0.71
0+68.00	0.17
0+68.00	0.13
0+69.50	0.00
0+69.50	0.48
0+70.00	0.50

SECTION 32 10-YR
Cross Section for Irregular Channel

Project Description	
Worksheet	SECTION32 10-YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficient	0.014	
Channel Slope	1.2400	%
Water Surface Elevation	0.45	ft
Elevation Range	0.00 to 1.12	
Discharge	17.39	cfs



100-Year Street Flow Capacity Flowmaster Computations

SECTION 32 100-YR
Worksheet for Irregular Channel

Project Description	
Worksheet	SECTION32 100-YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Channel Slope	1.2400	%
Discharge	279.00	cfs

Options	
Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results		
Mannings Coefficient	0.016	
Water Surface Elevation	1.06	ft
Elevation Range	0.00 to 1.12	
Flow Area	36.9	ft²
Wetted Perimeter	61.02	ft
Top Width	58.45	ft
Actual Depth	1.06	ft
Critical Elevation	1.33	ft
Critical Slope	0.4083	%
Velocity	7.57	ft/s
Velocity Head	0.89	ft
Specific Energy	1.95	ft
Froude Number	1.68	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.55593861 ft.
Flow is divided.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+02.00	0.013
0+02.00	0+29.00	0.016
0+29.00	0+41.00	0.013
0+41.00	0+68.00	0.016
0+68.00	0+70.00	0.013

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.50
0+00.50	0.48
0+00.50	0.00
0+02.00	0.13
0+02.00	0.17
0+29.00	0.71

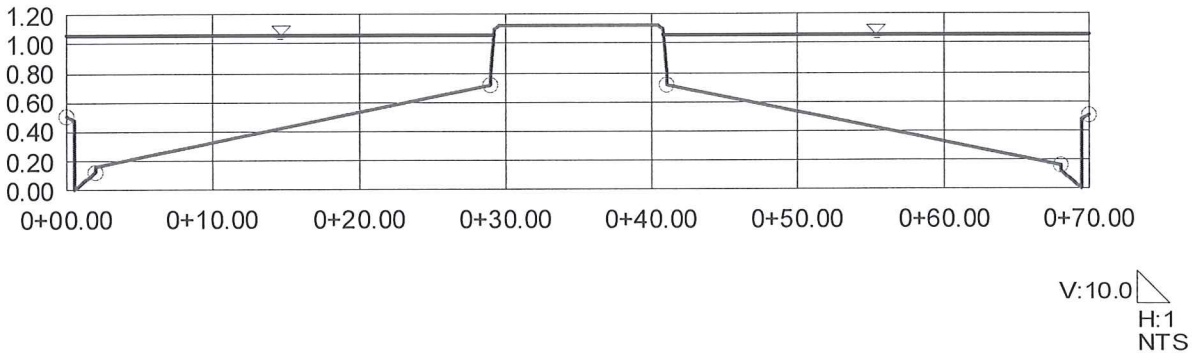
SECTION 32 100-YR
Worksheet for Irregular Channel

Natural Channel Points	
Station (ft)	Elevation (ft)
0+29.01	0.79
0+29.26	1.10
0+29.68	1.12
0+40.32	1.12
0+40.74	1.10
0+40.99	0.79
0+41.00	0.71
0+68.00	0.17
0+68.00	0.13
0+69.50	0.00
0+69.50	0.48
0+70.00	0.50

SECTION 32 100-YR
Cross Section for Irregular Channel

Project Description	
Worksheet	SECTION32 100-YR
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficient	0.016	
Channel Slope	1.2400	%
Water Surface Elevation	1.06	ft
Elevation Range	0.00 to 1.12	
Discharge	279.00	cfs



APPENDIX F

Electronic Files