TECHNICAL DRAINAGE STUDY
RESPONSE TO CCRFCD COMMENTS

Skye Canyon
Detention Basin 2

City of Las Vegas, Nevada

Job No.: OLY1505.000
Date: May 2018

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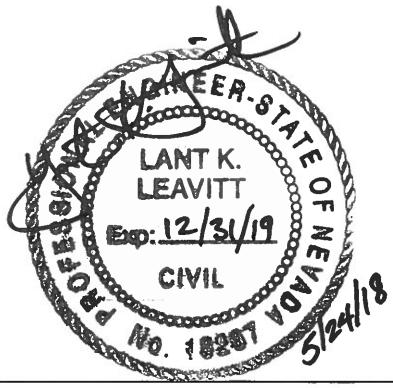

Lant Leavitt, P.E.
NV Professional Engineer No. 18287

OLY1505.000

May 22, 2018

Mr. Oh Sang Kwon, P.E.
City of Las Vegas Department of Public Works
333 North Rancho Drive
Las Vegas, NV 89106

Subject: Addendum to the Technical Drainage Study for Skye Canyon Basin #2 (DS4813C) (CCRFCD No. 18-10010)

Dear Mr. Kwon:

This letter is submitted in response to comments contained on April 18, 2018 review memorandum regarding the above referenced project by the Clark County Regional Flood Control District (CCRFCD). A copy of the CCRFCD comment letter has been included in the Appendix. The comments have been individually addressed as follows:

1. **Comment**: *Per the City of Las Vegas approval letter, the project includes structural plans as part of the proposed detention basin for the District's MPU facility MOIR 0098 and a subsequent conditional Structural Approval Letter from City of Las Vegas has been received. Note that Per District's Uniform Regulations for the Control of Drainage, Section VIII.D.13, the Lead Entity shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.*

   Response: Noted.

2. **Comment**: *Provide discussion and emergency spillway sizing calculations to support the currently proposed 12-ft spillway as shown on Details 1/D-2 and 3/D-3. Additionally, provide detail cross section for the entire emergency PMF spillway section to include the slope to the base of the spillway at the 102-ft Nevada Energy Easement.*

   Response: The emergency spillway for the basin is located such that the overflow passing out of the basin during a PMF event will be discharged into the future Iron Mountain Road alignment, which is considered to have the least impact to future development. The crest is proposed diagonal to the spillway alignment, resulting in a 140-ft crest length. A Flowmaster generic weir calculation was performed with the original TDS submittal showing a 5.79-ft depth, which resulted in over a foot of freeboard to the adjacent east spillway embankment. An updated calculation (see Appendix) has been performed using a broad-crested weir calculation that takes into account the downstream tailwater depth. The results of this calculation show a depth over the weir of 5.85-ft, which is within a tenth of the original calculation, and still provides greater than a foot of freeboard during the PMF event.

   A HEC-RAS model was performed (see Appendix) for the spillway channel, which narrows to an 87.5-ft base width downstream of the 140-ft long weir crest. Results of the model show a flow depth of 4.26-ft immediately downstream of the weir, which is the value used for the tailwater in the weir calculation. The flow depth decreases at each downstream cross section to a depth of 3.84-ft at the termination of the east embankment. Flow velocity and scour potential, and measures proposed to

mitigate potential impacts to the embankment, are addressed with the response letter to State Dam Safety comments, included with this submittal package.

Section3/D-3 is revised to show the section through the spillway to the Nevada Energy Easement.

3. **Comment**: *Provide two pairs of steps ladders within the proposed trapezoidal inflow channel to the detention basin at approximately STA 11+05 and 16+90. Note that the left offset for the ladder steps must be provided on the ladder schedule on Sheet S-2 with a longitudinal offset of approximately the bottom width of the channel. The grading plans must be updated to show the corresponding callouts for the ladder steps.*

   Response: Detail 9/S-2 has been updated to provide steps on left side of channel.

4. **Comment**: *Per Sheet S-2, the maximum expansion joint spacing is 180 feet for both the 6" slab trapezoidal and 7" slab rectangular channel. Per the District's Hydrologic Criteria and Drainage Design Manual (HCDDM), the for channels with expansion joints greater than 100 feet on center, the ratio of longitudinal steel area to concrete cross-sectional area shall be greater than 0.005. Verify reinforcement requirements and revise accordingly.*

   Response: The longitudinal reinforcing has been increased in the 7" sections to comply.

5. **Comment**: *Provide necessary revisions to the District's Flood Threat Recognition System (FTRS) monitoring Station details on Sheets D-6, D-7, and D-8 to reflect standpipe detail, cut-out detail, funnel orientation, and revisions to detail callouts:*

   a. *Add 14-inch diameter stand pipe, 4-ft height, between the 6-inch penetrations of the Flood Control Monitoring Station details as shown on Sheet D-8. Note the stand pipe should be located under the roof penetrations.*
   b. *Provide 4"X6" vents on each side of the building (2 total), preferable above the door height in the Flood Control Monitoring Station details as shown on Sheet D-7.*
   c. *Clearly delineate the cut-out and lock on Detail 2/D-6.*
   d. *Provide callout to have the low side of the funnel to be flush with the roof in the Flood Control Monitoring Station details as shown on Sheet D-7.*
   e. *Specify callout for the 1-inch diameter penetration in the Flood Control Monitoring Station details as shown on Sheet D-8 to not protrude through the roof shingles.*

   Response:
   a. 14-inch diameter stand pipe provided as requested.
   b. 4"X6" vents provided as requested.
   c. Detail 2/D-6 revised to more clearly delineate cut-out and lock.
   d. Funnel linework adjusted and callout added to install funnel flush with roof on low side.
   e. Noted added to Sheet D-8 for 1-inch diameter penetration to not protrude through the roof shingles.

6. **Comment**: *Provide a copy of the approved Emergency Action Plan (EAP) for the proposed detention basin to the District upon availability.*

   Response: EAP will be reviewed by State concurrently with Request for Approval to Impound following completion of construction. Copy of EAP will be provided to District following approval.

7. **Comment:** *Provide trash rack capacity calculations to verify that the grate opening is adequate with 50% clogging factor.*

Response: Trash rack capacity calculation included in Appendix. Computations verify adequacy with 50% clogging factor.

8. **Comment**: *Address the following grading and structural plan comments:*

    a. *Provide fall protection for the northern rectangular inflow channel as shown on Sheet G-I and Detail 7/D-2.*

    b. *Clarify the "Not Used" callout as shown on Detail 1/D-2 as it appears this detail is specified on Sheet G-1.*

    c. *Label the depth of the concrete cut-off wall on Detail 2/D-3.*

    d. *Add construction notes callouts for the proposed chute / baffle blocks at the inflows to the detention basin to reference the structural plan.*

    e. *Provide additional steps below the pipe grate for access as shown on Detail 1/S-9.*

    Response:
    a. Fall protection provided for the northern rectangular inflow channel.
    b. "Not Used" label on Detail 1/D-2 revised to "Section".
    c. Concrete cut-off wall depth called out on Detail 2/D-3.
    d. Callouts have been added referencing structural sheets for stilling basins.
    e. Access steps provided below pipe grate, see Section B/S-10 and C/S-10.

9. **Comment**: *Per discussion with the City of Las Vegas, the engineer must provide a hard copy and CD of the supplemental information to the City of Las Vegas in order to address these comments.*

    Response: Supplement provided to City of Las Vegas.

If you have any questions or require additional information, please do not hesitate to contact us at (702) 284-5300.

Respectfully Submitted,

SLATER HANIFAN GROUP

Lant Leavitt, P.E.
Project Manager - Flood Control Division

cc: Marc Bolduc – Olympia Companies
Ben Morris – Olympia Companies
Bobby Williamson – Olympia Companies
Jerry Slater, P.E. – SHG
Mark Failla, P.E., CFM – SHG
Rhonda Miller – SHG

APPENDIX

CCRFCD Comment Letter

REGIONAL FLOOD CONTROL DISTRICT

April 18, 2018

Mr. Oh Sang Kwon, P.E.
City of Las Vegas Department of Public Works
333 North Rancho Drive
Las Vegas, NV 89106

DISTRICT COMMENT(S): **SKYE CANYON- DETENTION BASIN #2 (DS4813C) (RFCD No. 18-10010)**

Dear Mr. Kwon:

Clark County Regional Flood Control District (District) reviewed Technical Drainage Study dated July 7, 2016, Addendum No. 1 dated June 20, 2017, and Addendum No. 2 dated December 5, 2017 for above-mentioned project as submitted by SLATER HANIFAN GROUP. In addition, District is in receipt of the Conditional Letter of Acceptance from City of Las Vegas Department of Public Works dated January 11, 2018.

District has the following comments:

1. Per the City of Las Vegas approval letter, the project includes structural plans as part of the proposed detention basin for the District's MPU facility MOIR 0098 and a subsequent conditional Structural Approval Letter from City of Las Vegas has been received. Note that Per District's Uniform Regulations for the Control of Drainage, Section VIII.D.13, the Lead Entity shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.

2. Provide discussion and emergency spillway sizing calculations to support the currently proposed 12-ft spillway as shown on Details 1/D-2 and 3/D-3. Additionally, provide detail cross section for the entire emergency PMF spillway section to include the slope to the base of the spillway at the 102-ft Nevada Energy Easement.

3. Provide two pairs of steps ladders within the proposed trapezoidal inflow channel to the detention basin at approximately STA 11+05 and 16+90. Note that the left offset for the ladder steps must be provided on the ladder schedule on Sheet S-2 with a longitudinal offset of approximately the bottom width of the channel. The grading plans must be updated to show the corresponding callouts for the ladder steps.

4. Per Sheet S-2, the maximum expansion joint spacing is 180 feet for both the 6" slab trapezoidal and 7" slab rectangular channel. Per the District's Hydrologic Criteria and Drainage Design Manual (HCDDM), the for channels with expansion joints greater than 100 feet on center, the ratio of longitudinal steel area to concrete cross-sectional area shall be greater than 0.005. Verify reinforcement requirements and revise accordingly.

REGIONAL FLOOD CONTROL DISTRICT

5. Provide necessary revisions to the District's Flood Threat Recognition System (FTRS) Monitoring Station details on Sheets D-6, D-7, and D-8 to reflect standpipe detail, cut-out detail, funnel orientation, and revisions to detail callouts:

    a. Add 14-inch diameter stand pipe, 4-ft height, between the 6-inch penetrations of the Flood Control Monitoring Station details as shown on Sheet D-8. Note the stand pipe should be located under the roof penetration.

    b. Provide 4"X6" vents on each side of the building (2 total), preferable above the door height in the Flood Control Monitoring Station details as shown on Sheet D-7.

    c. Clearly delineate the cut-out and lock on Detail 2/D-6.

    d. Provide callout to have the low side of the funnel to be flush with the roof in the Flood Control Monitoring Station details as shown on Sheet D-7.

    e. Specify callout for the 1-inch diameter penetration in the Flood Control Monitoring Station details as shown on Sheet D-8 to not protrude through the roof shingles.

6. Provide a copy of the approved Emergency Action Plan (EAP) for the proposed detention basin to the District upon availability.

7. Provide trash rack capacity calculations to verify that the grate opening is adequate with 50% clogging factor.

8. Address the following grading and structural plan comments:

    a. Provide fall protection for the northern rectangular inflow channel as shown on Sheet G-1 and Detail 7/D-2.

    b. Clarify the "Not Used" callout as shown on Detail 1/D-2 as it appears this detail is specified on Sheet G-1.

    c. Label the depth of the concrete cut-off wall on Detail 2/D-3.

    d. Add construction notes callouts for the proposed chute / baffle blocks at the inflows to the detention basin to reference the structural plan.

    e. Provide additional steps below the pipe grate for access as shown on Detail 1/S-9.

9. Per discussion with the City of Las Vegas, the engineer must provide a hard copy and CD of the supplemental information to the City of Las Vegas in order to address these comments.

District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage*.

The consultant must be advised to submit any revisions to the Technical Drainage Study and Improvement Plans to City of Las Vegas Department of Public Works for review/re-approval. District review of any such revisions will commence upon City of Las Vegas Department of Public Works's acceptance.

Please be aware that as additional information becomes available and/or restudies of Flood Insurance Studies are performed, information submitted by SLATER HANIFAN GROUP may be superseded.

REGIONAL FLOOD CONTROL DISTRICT

Compliance with regulatory elements and design standards specified in *Uniform Regulations for the Control of Drainage* does not imply a guarantee that properties will be free from flooding or flood damage.

The District, its officials, or employees assume no liability for information, data, or conclusions presented by consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review.

STEVEN C. PARRISH, P.E.
General Manager/Chief Engineer

BY:

Ching C. Wang, P.E.
Senior Civil Engineer

Todd Myers, P.E.
Engineering Director

CCW:cr

c: Lant K. Leavitt, P.E., Slater Hanifan Group

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Emergency Spillway Calculations

Worksheet for DB2 Spillway Broad Crested Weir

Project Description

Solve For	Headwater Elevation

Input Data

Discharge		6112.00	ft³/s
Crest Elevation		3018.00	ft
Tailwater Elevation		3022.16	ft
Crest Surface Type	Paved		
Crest Breadth		12.00	ft
Crest Length		140.00	ft

Results

Headwater Elevation	3023.85	ft
Headwater Height Above Crest	5.85	ft
Tailwater Height Above Crest	4.16	ft
Weir Coefficient	3.09	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	3.09	US
Flow Area	818.73	ft²
Velocity	7.47	ft/s
Wetted Perimeter	151.70	ft
Top Width	140.00	ft

LEGEND

- ID — HEC-RAS SECTION
- PMF FLOW EXTENTS
- FLOW DIRECTION

SECTION 100
SECTION 150
SECTION 200
SECTION 250
SECTION 280
CONC. WALL PER DETAIL 4/D-1
IRON MOUNTAIN RD
EXISTING ACCESS ROAD
PARCEL BOUNDARY
EXISTING POWER POLE (TYP)
PROP. BLOCK & CABLE GATE PER DETAIL 5/D-3
BLOCK & CABLE FENCING (PER DETAIL 5/D-3)
12' CONCRETE ACCESS ROAD
10' DEEP CONC. CUTOFF WALL (PER DETAIL 4/D-1)
10' DEEP CONC. CUTOFF WALL PER DETAIL 4/D-1
PMF EMERGENCY OVERFLOW SPILLWAY
SKYE CANYON DETENTION BASIN 2
12' ACCESS ROAD SEE SHEET P-2
BLOCK & CABL (PER DETAIL 5
RIPRAP D50=12" T=24" SEE DETAIL 16/D-2
TRANSITION FROM TO 4'
END 32' X 36.60
17+00
16+00
15+00
0.50%
1.05%
3.10%
2.10%
87.5'
3016.3 FG
3016.20 FG
3016.33 FG
3016.18 FG
3015.60 FG
3019.74 FG
3019.7 FG
3017.79 FG
3017.90 FG
3018.0 FG
3024.93 FG
3025.37 FG
3025.0 FG
3030.0 FG
5:1 MAX
N
0 40 80
SCALE - 1"=40' FEET

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.

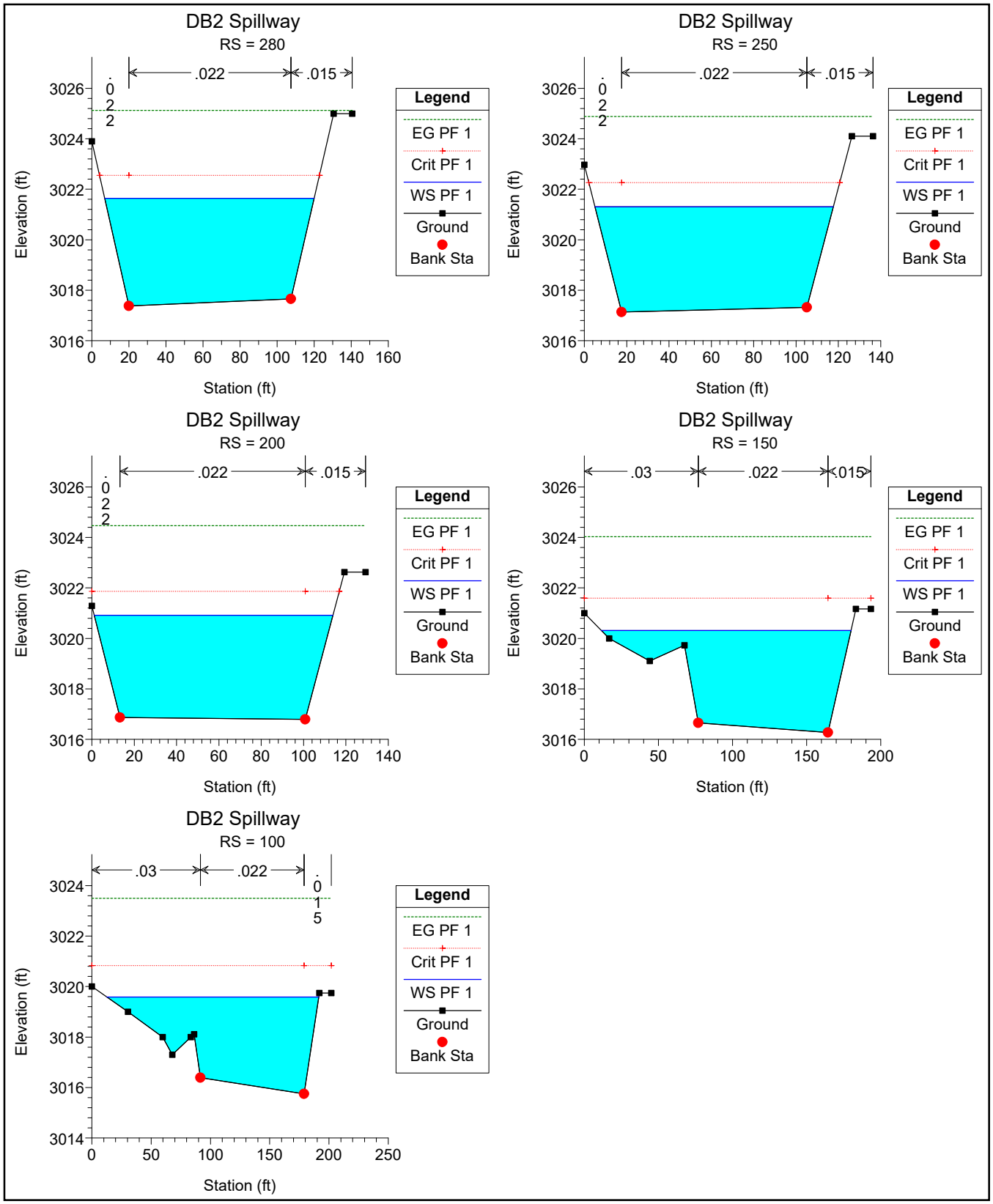
NINETY-FIVE MANAGEMENT LLC

SKYE CANYON DETENTION BASIN 2
PMF OVERFLOW SPILLWAY EXHIBIT

DATE: MAY 2018
DRAFTER:
DESIGNER:
CHECKED:
PROJECT NO. OLY1505

HEC-RAS Plan: Plan 01 River: DB2 Reach: Spillway Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Spillway	280	PF 1	6112.00	3017.38	3021.64	3022.56	3025.13	0.007752	15.29	413.38	113.04	1.33
Spillway	250	PF 1	6112.00	3017.13	3021.31	3022.27	3024.88	0.008032	15.46	408.37	112.61	1.35
Spillway	200	PF 1	6112.00	3016.79	3020.91	3021.87	3024.47	0.007954	15.40	409.29	112.73	1.34
Spillway	150	PF 1	6112.00	3016.27	3020.32	3021.59	3024.03	0.009137	15.88	431.68	168.52	1.43
Spillway	100	PF 1	6112.00	3015.75	3019.59	3020.83	3023.50	0.011360	16.65	431.07	178.82	1.57


DB2 Spillway
RS = 280
.022
.015
.022
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
DB2 Spillway
RS = 250
.022
.015
.022
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
DB2 Spillway
RS = 200
.022
.015
.022
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
DB2 Spillway
RS = 150
.03
.022
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
DB2 Spillway
RS = 100
.03
.022
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

HEC-RAS HEC-RAS 5.0.4 April 2018
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: DB2 Spillway
Project File : DB2Spillway.prj
Run Date and Time: 5/21/2018 11:53:09 AM

Project in English units

PLAN DATA

Plan Title: Plan 01
Plan File : j:\OLY1505-000 Skye DB2\Drainage\Technical Study\RTC-CCRFCD\Calcs\DB2 Spillway Calcs\DB2Spillway.p01

Geometry Title: Proposed
Geometry File : j:\OLY1505-000 Skye DB2\Drainage\Technical Study\RTC-CCRFCD\Calcs\DB2 Spillway Calcs\DB2Spillway.g01

Flow Title : Proposed
Flow File : j:\OLY1505-000 Skye DB2\Drainage\Technical Study\RTC-CCRFCD\Calcs\DB2 Spillway Calcs\DB2Spillway.f01

Plan Summary Information:
Number of: Cross Sections = 5 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Proposed
Flow File : j:\OLY1505-000 Skye DB2\Drainage\Technical Study\RTC-CCRFCD\Calcs\DB2 Spillway Calcs\DB2Spillway.f01

Flow Data (cfs)

River	Reach	RS	PF 1
DB2	Spillway	280	6112

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
DB2	Spillway	PF 1	Normal S = 0.00775	Normal S = 0.045

GEOMETRY DATA

Geometry Title: Proposed
Geometry File : j:\OLY1505-000 Skye DB2\Drainage\Technical Study\RTC-CCRFCD\Calcs\DB2 Spillway Calcs\DB2Spillway.g01

CROSS SECTION

RIVER: DB2
REACH: Spillway RS: 280

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	3023.9	20	3017.38	107.5	3017.65	130.5	3025	140.5	3025

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	20	.022	107.5	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
20	107.5	30	30	.1	.3

CROSS SECTION

RIVER: DB2

REACH: Spillway RS: 250

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	3022.97	17.6	3017.13	105.1	3017.32	126.4	3024.1	136.4	3024.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	17.6	.022	105.1	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
17.6	105.1	50	50	.1	.3

CROSS SECTION

RIVER: DB2
REACH: Spillway RS: 200

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	3021.29	13.3	3016.86	100.8	3016.79	119.3	3022.63	129.3	3022.63

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	13.3	.022	100.8	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
13.3	100.8	50	50	.1	.3

CROSS SECTION

RIVER: DB2
REACH: Spillway RS: 150

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	3021	16.8	3020	44.2	3019.1	67.6	3019.73	76.9	3016.65
164.4	3016.27	183.3	3021.17	193.3	3021.17				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	76.9	.022	164.4	.015

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
76.9	164.4	50	50	.1	.3

CROSS SECTION

RIVER: DB2
REACH: Spillway RS: 100

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	3020	30.5	3019	59.8	3018	67.9	3017.3	83.5	3018
86.3	3018.11	91.5	3016.39	179	3015.75	191.9	3019.74	201.9	3019.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	91.5	.022	179	.015

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
91.5	179	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:DB2

Reach	River Sta.	n1	n2	n3
Spillway	280	.022	.022	.015
Spillway	250	.022	.022	.015
Spillway	200	.022	.022	.015
Spillway	150	.03	.022	.015
Spillway	100	.03	.022	.015

SUMMARY OF REACH LENGTHS

River: DB2

Reach	River Sta.	Left	Channel	Right
Spillway	280	30	30	30
Spillway	250	50	50	50
Spillway	200	50	50	50
Spillway	150	50	50	50
Spillway	100	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: DB2

Reach	River Sta.	Contr.	Expan.
Spillway	280	.1	.3
Spillway	250	.1	.3
Spillway	200	.1	.3
Spillway	150	.1	.3
Spillway	100	.1	.3

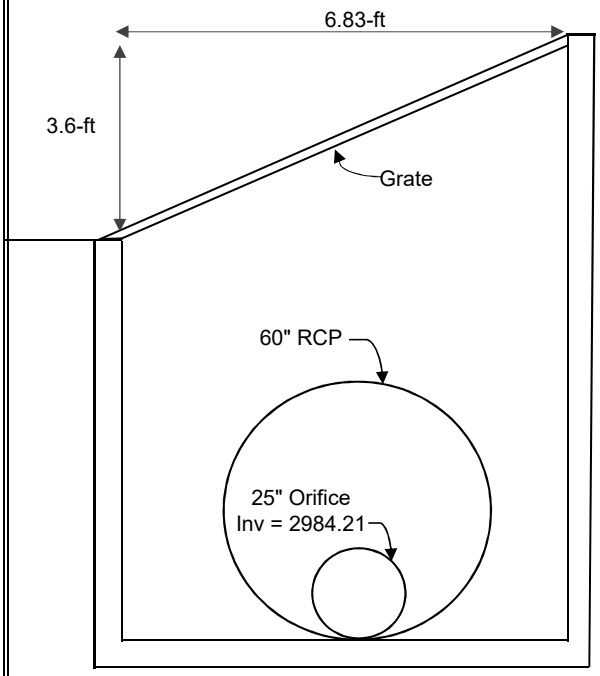
Trash Rack Capacity Calculations

SLATER HANIFAN GROUP
CONSULTING ENGINEERS & PLANNERS

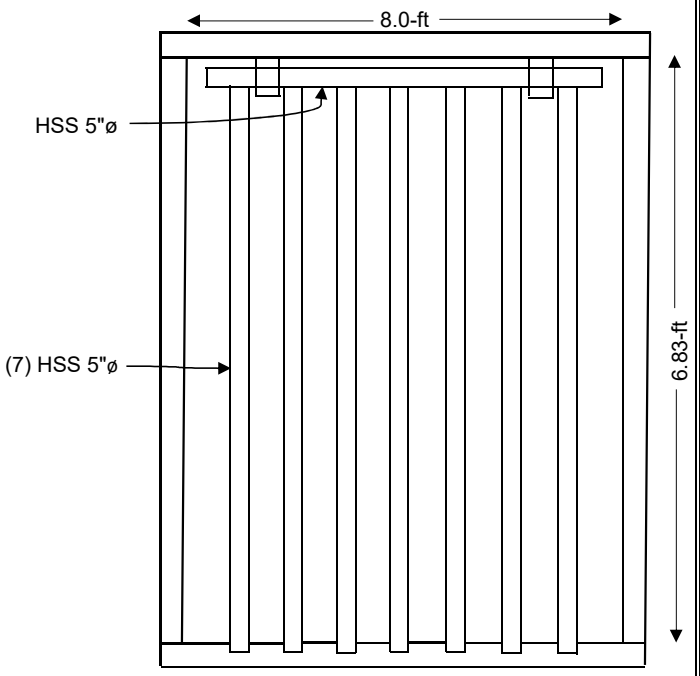
Trash Rack Capacity Calculation

Project: Skye Canyon Detention Basin No. 2
Date: 5/1/2018

GRATE SECTION VIEW



GRATE PLAN VIEW



GRATE CAPACITY CALCULATION

Capacity of grate under orifice conditions

Q = CoAg(2gd)^0.5, where Co=0.67, Ag=grate opening, g=32.2, d=ponding depth

Ag = Opening area - Bar area

Ag = (6.83 ft)(8 ft) - ((7 bars)(6.83 ft)(0.417 ft dia)+(1 bar)(8 ft)(0.417 ft dia)+(2 mounts)(1 ft)(0.584)) = 30.2 sqft

50% Clogging Factor

Ag_{50} = (Ag)(0.50)

Ag_{50} = (30.2 sqft)(0.50) = 15.1 sqft

WSE	GRATE CAPACITY Depth[1]	Grate[2]	ORIFICE CAPACITY Depth[3]	Orifice[4]
(ft)	(ft)	(cfs)	(ft)	(cfs)
3000	5.3	186.9	15.8	64.7
3005	10.3	260.6	20.8	75.9
3010	15.3	317.6	25.8	85.7
3015	20.3	365.8	30.8	94.5
3020	25.3	408.4	35.8	102.5
3025	30.3	446.9	40.8	109.9

[1]Depth: depth of water above grate centroid.

[2]Grate: capacity of grate based on orifice equation (above) with 50% clogging factor

[3]Depth: depth of water above orifice invert (10.5 ft below grate centroid)

[4]Orifice: capacity of 25" diameter orifice outlet per TDS Discharge Summary Table

Capacity of grate with 50% clogging factor exceeds capacity of orifice outlet, therefore grate size is sufficient.

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