APPENDIX F

EVAPORATION POND DIVERSION CHANNELS

F

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Bright People. Right Solutions.

CALCULATION COVER SHEET

Date: 8/6/08 **Page** 1 **of** 2

Project No.: 89241 **Project Title:** Pinon Ridge Mill Design

Calculation No.: 89241.6-5

Calculation Title: Evaporation Pond Diversion Design

Design Verification Required: ☐ Yes ☒ No

Calculation Type: ☐ Scoping ☐ Preliminary ☒ Final ☐ Voided
☐ Superseded by Calculation No.: _____

ORIGINAL AND REVISED CALCULATIONS/ANALYSIS APPROVAL

	Rev. 1 Printed Name/Signature/Date	Rev. ____ Printed Name/Signature/Date	Rev. ____ Printed Name/Signature/Date
Originator:	T. Kluthe 8/6/08		
Checked By:	C. Larson 10/8/08		
Approved By:	C. Larson 12/1/08		
Other:			

AFFECTED DOCUMENTS

Document Number	Document Title	Rev. No.	Responsible Project Manager Initials
DEN8R179	SITE DRAINAGE ANALYSIS AND DESIGN REPORT - PINON RIDGE MILL		CL

RECORD OF REVISION

Rev.	Reason for Revision

ATTACHMENTS

Attachment No.	Title	Total Pages
1	Evaporation Pond Diversion Design Calcs	9

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Sheet ____ of ____

PROJECT Pinon Ridge PROJECT NO. 89241

SUBJECT Evap Pond Diversion BY TAK DATE 8/6/08

REVIEWED BY CBL DATE 12/1/08

1/

Objective: Determine peak flows for 100-yr and 1,000-yr storms to design Evaporation Pond diversion channel.

Assumptions: 1) Tailing Cell A is constructed
2) Use Rocky Mtn Thunderstorm hydrograph
3) Basin 3 distributes flow equally to East and West, Basin 4 and Basin 2, respectively.
4) Assume single soil type (HSG B) for drainage, poor vegetation, CN=67

West Drainage Diversion (Basin 2)

Total Area = 74 ac. = 0.12 mi²

Maximum Flow Path = 2,000 ft = 0.38 mi

Average Slope = 0.047 ft/ft = 248 ft/mile

Distance to Centroid (assume 1/2 of flow path) = 1,000 ft = 0.19 mi

K_n = 0.07

CN = 67

East Drainage Diversion (Basin 3) incls part of 4A

Total Area = 13 ac. = 0.02 mi²

Maximum Flow Path = 1350 ft = 0.26 mi

Average Slope = 0.024 ft/ft = 125 ft/mi

Distance to Centroid (assume 1/2 of flow path) = 675 ft = 0.13 mi

K_n = 0.07

CN = 67

ROCKY MOUNTAIN (THUNDERSTORM) UNIT HYDROGRAPH 06-Aug-08

Pinon Ridge Uranium Mill Site Evaporation Pond Diversion West

Drainage Area =	0.12	sq. miles	Lg+D/2 =	0.35	Hours
Basin Slope =	248.00	ft./mile	Basin Factor =	0.00	
L =	0.38	mi., Length of Watercourse	V' =	3.09	cfs/Day
Lca =	0.19	mi., Distance to Centroid	Qs =	8.8	* q, cfs
Kn =	0.070	-, Ave. Weighted Manning's n			

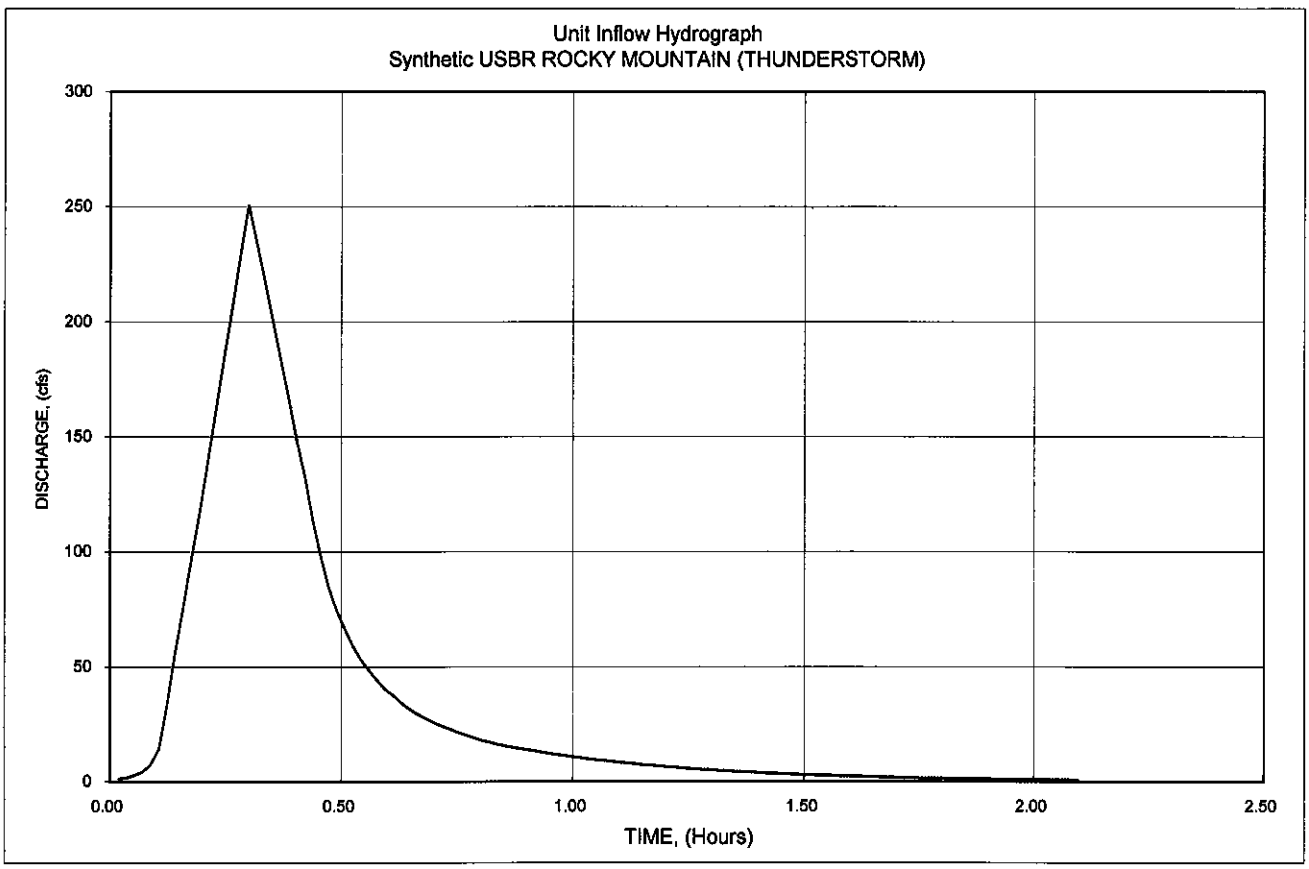
PARAMETERS:

Calculated: Lag Time, Lg = 0.31 Hours Unit Duration, D = 3.36 minutes

Calculated Timestep = 1.05 minutes

Data to be used Unit Duration, D = 5 minutes, round down to nearest of 5, 10, 15, 30, 60, 120, 180, or 360

In Analysis Selected Timestep = 5 minutes, integer value evenly divisible into 60



UI Record - Unit Graph 5 **minute interval**

UI	7	87	191	217	135	69	43	29	22	17
UI	13	11	9	7	6	5	4	3	3	2
UI	2	1	1	1	1					
UI										
UI										
UI										
UI										
UI										
UI										
UI										
UI										
UI										

USBR calculated unitgraph peak = 251 Interpolated Peak = 217

ROCKY MOUNTAIN (THUNDERSTORM) UNIT HYDROGRAPH 06-Aug-08

Pinon Ridge Uranium Mill Site Evaporation Pond Diversion East

3/

Drainage Area =	0.02	sq. miles	Lg+D/2 =	0.31	Hours
Basin Slope =	125.00	ft./mile	Basin Factor =	0.00	
L =	0.26	mi., Length of Watercourse	V' =	0.54	cfs/Day
Lca =	0.13	mi., Distance to Centroid	Qs =	1.7	* q, cfs
Kn =	0.070	-, Ave. Weighted Manning's n			

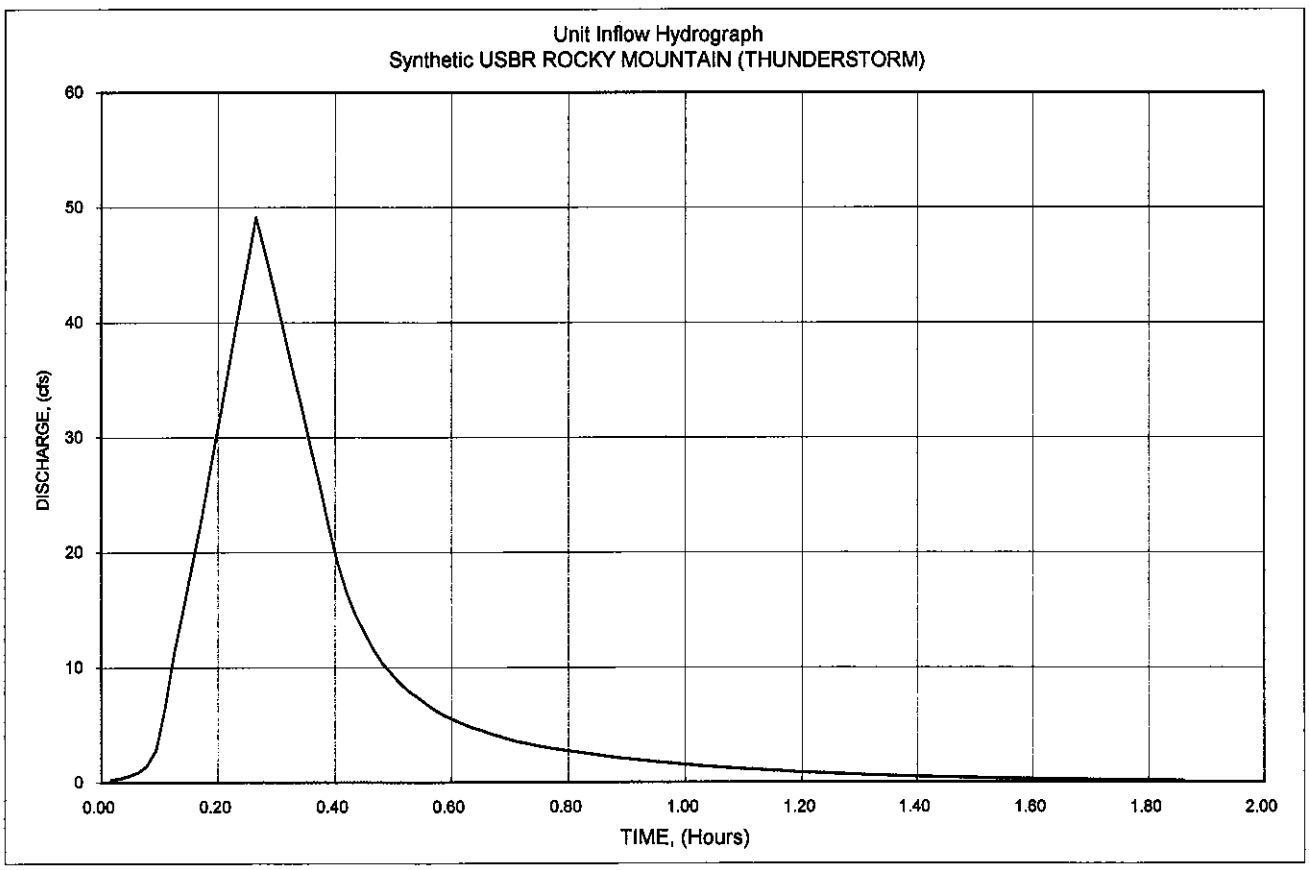
PARAMETERS:

Calculated: Lag Time, Lg = 0.27 Hours Unit Duration, D = 2.93 minutes

Calculated Timestep = 0.93 minutes

Data to be used Unit Duration, D = 5 minutes, round down to nearest of 5, 10, 15, 30, 60, 120, 180, or 360

in Analysis Selected Timestep = 5 minutes, integer value evenly divisible into 60



UI Record - Unit Graph 5 **minute interval**

UI	2	22	45	34	17	9	6	4	3	2
UI	2	2	1	1	1	1	0	0	0	0
UI	0	0								
UI										
UI										
UI										
UI										
UI										
UI										
UI										
UI										
UI										

USBR calculated unitgraph peak = 49 Interpolated Peak = 45

4/

```
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *           VERSION 4.1                 *
 *                                       *
 *  RUN DATE   06AUG08  TIME  17:13:01   *
 *                                       *
 *****************************************
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*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104          *
*                                   *
*************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   ENERGY FUELS - PINON RIDGE URANIUM MILL
  2           ID   PROJECT NO. 89241
  3           ID   10 YEAR EVAP POND DIVERSION DESIGN HYDROLOGY
  4           ID   ROCKY MOUNTAIN LOCAL STORM UNIT GRAPH  KN=0.07
  5           IT       5       0       0     300
  6           IO       5       1

  7           KK   WEST
  8           KM   DIVERSION TO WEST (TERMINATE IN ARROYO)
  9           BA    0.12
 10           IN      60
 11           PB       0
 12           PC   0.022   0.044   0.070   0.096   0.128   0.160   0.196   0.240   0.294   0.362
 13           PC   0.470   1.362   1.544   1.640   1.700   1.760   1.796   1.832   1.868   1.904
 14           PC   1.928   1.952   1.976   2.000
 15           LS       0      67       5
 16           UI       7      87     191     217     135      69      43      29      22      17
 17           UI      13      11       9       7       6       5       4       3       3       2
 18           UI       2       1       1       1       1
              *

 19           KK   EAST
 20           KM   DIVERSION TO EAST (TERMINATE IN ACCESS ROAD DITCH)
 21           BA    0.02
 22           LS       0      67       5
 23           UI       2      22      45      34      17       9       6       4       3       2
 24           UI       2       2       1       1       1       1
              *
              *
              *
 25           KM   100 YEAR EVAP POND DIVERSION DESIGN HYDROLOGY

 26           KK   WEST
 27           KM   DIVERSION TO WEST (TERMINATE IN ARROYO)
 28           BA    0.12
 29           IN      60
 30           PB       0
 31           PC   0.033   0.066   0.105   0.144   0.192   0.240   0.294   0.360   0.441   0.543
 32           PC   0.705   1.989   2.316   2.460   2.550   2.640   2.694   2.748   2.802   2.856
 33           PC   2.892   2.928   2.964   3.000
 34           LS       0      67       5
 35           UI       7      87     191     217     135      69      43      29      22      17
 36           UI      13      11       9       7       6       5       4       3       3       2
```

5/

```
  37          UI      2      1      1      1      1
              *

  38          KK   EAST
  39          KM   DIVERSION TO EAST (TERMINATE IN ACCESS ROAD DITCH)
  40          BA    0.02
  41          LS      0     67      5
  42          UI      2     22     45     34     17      9      6      4      3      2
  43          UI      2      2      1      1      1      1
              *
              *
              *
1                                        HEC-1 INPUT                                          PAGE  2

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  44          KM   1000 YEAR EVAP POND DIVERSION DESIGN HYDROLOGY

  45          KK   WEST
  46          KM   DIVERSION TO WEST (TERMINATE IN ARROYO)
  47          BA    0.12
  48          IN      60
  49          PB       0
  50          PC   0.000  0.049  0.097  0.155  0.213  0.284  0.354  0.434  0.532  0.651
  51          PC   0.802  1.041  2.937  3.420  3.633  3.766  3.898  3.978  4.058  4.138
  52          PC   4.217  4.271  4.324  4.377  4.430
  53          LS      0     67      5
  54          UI      7     87    191    217    135     69     43     29     22     17
  55          UI     13     11      9      7      6      5      4      3      3      2
  56          UI      2      1      1      1      1
              *

  57          KK   EAST
  58          KM   DIVERSION TO EAST (TERMINATE IN ACCESS ROAD DITCH)
  59          BA    0.02
  60          LS      0     67      5
  61          UI      2     22     45     34     17      9      6      4      3      2
  62          UI      2      2      1      1      1      1
  63          ZZ
1****************************************                                  ****************************************
*                                      *                                  *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *   U.S. ARMY CORPS OF ENGINEERS       *
*              JUN   1998              *                                  *   HYDROLOGIC ENGINEERING CENTER      *
*           VERSION 4.1                *                                  *         609 SECOND STREET            *
*                                      *                                  *      DAVIS, CALIFORNIA 95616         *
*  RUN DATE   06AUG08  TIME  17:13:01  *                                  *          (916) 756-1104              *
*                                      *                                  *                                      *
****************************************                                  ****************************************


                    ENERGY FUELS - PINON RIDGE URANIUM MILL
                    PROJECT NO. 89241
                    10 YEAR EVAP POND DIVERSION DESIGN HYDROLOGY
                    ROCKY MOUNTAIN LOCAL STORM UNIT GRAPH  KN=0.07

  6 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          1  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                   NMIN          5  MINUTES IN COMPUTATION INTERVAL
                  IDATE     1    0  STARTING DATE
                  ITIME       0000  STARTING TIME
                     NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     2    0  ENDING DATE
                 NDTIME       0055  ENDING TIME
                 ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE   24.92 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
```

CEL 12/1/08

6/

SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

1

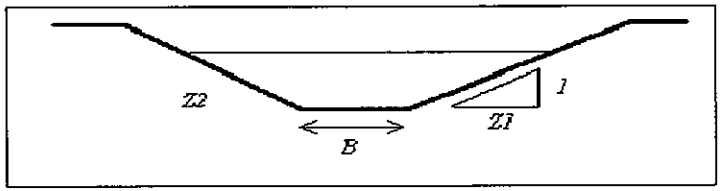
RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	WEST	7.	11.17	2.	1.	1.	.12		
+	HYDROGRAPH AT	EAST	1.	11.08	0.	0.	0.	.02		
+	HYDROGRAPH AT	WEST Q_{100}	23.	11.17	6.	2.	2.	.12		
+	HYDROGRAPH AT	EAST Q_{100}	4.	11.08	1.	0.	0.	.02		
+	HYDROGRAPH AT	WEST Q_{1000}	57.	12.08	15.	5.	5.	.12		
+	HYDROGRAPH AT	EAST Q_{1000}	10.	12.08	3.	1.	1.	.02		

*** NORMAL END OF HEC-1 ***

RATING CURVE FOR TRAPEZOIDAL CHANNEL

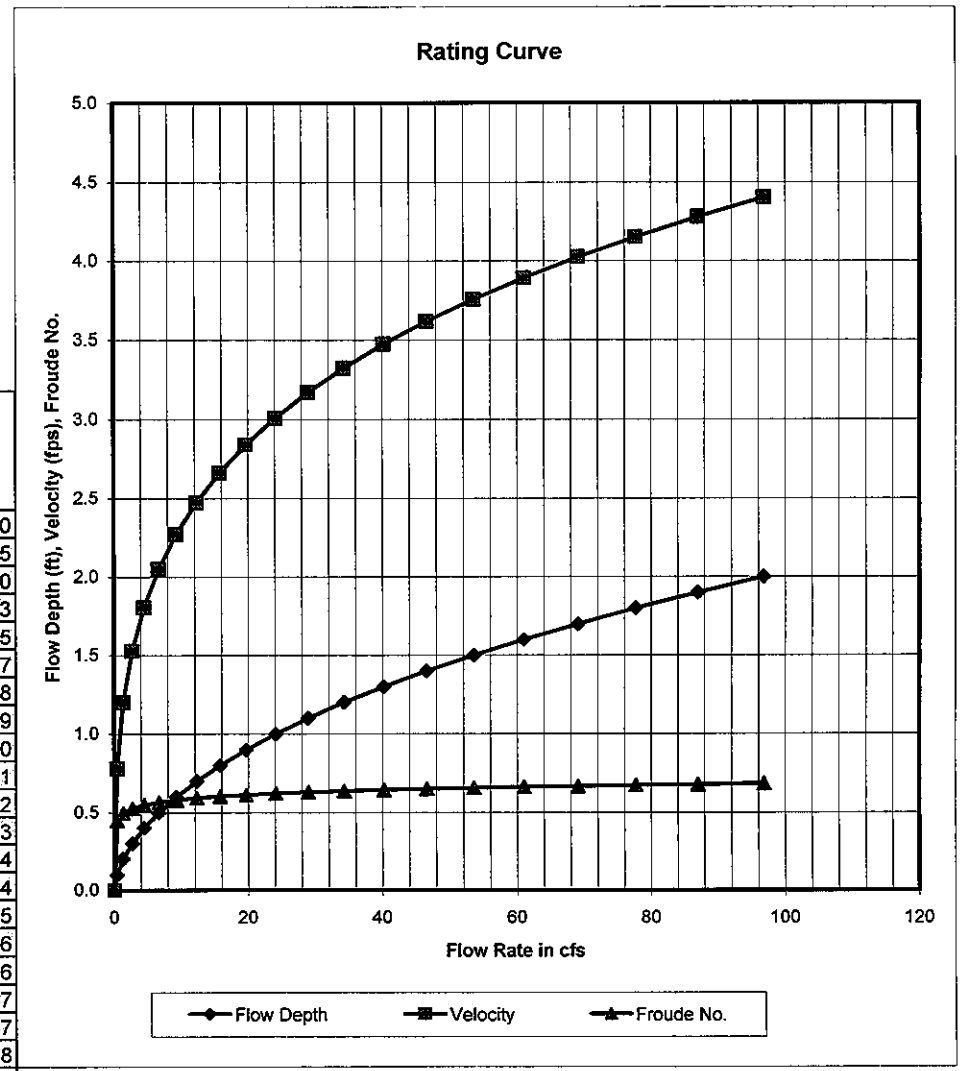
RATING CURVE FOR TRAPEZOIDAL CHANNEL



Bottom Width	B =	5.00	feet
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Manning's n	n =	0.035	
Longitudinal Slope	S =	0.0080	ft/ft

Flow Depth Y (ft)	Flow Area A (sq ft)	Wetted Perimeter P (ft)	Hydraulic Radius R (ft)	Flow Velocity V (fps)	Flow rate Q (cfs)	Froude Number Fr
0.00	0.00	5.00	0.00	0.0	0.0	0.00
0.10	0.53	5.63	0.09	0.8	0.4	0.45
0.20	1.12	6.26	0.18	1.2	1.3	0.50
0.30	1.77	6.90	0.26	1.5	2.7	0.53
0.40	2.48	7.53	0.33	1.8	4.5	0.55
0.50	3.25	8.16	0.40	2.0	6.7	0.57
0.60	4.08	8.79	0.46	2.3	9.3	0.58
0.70	4.97	9.43	0.53	2.5	12.3	0.59
0.80	5.92	10.06	0.59	2.7	15.8	0.60
0.90	6.93	10.69	0.65	2.8	19.7	0.61
1.00	8.00	11.32	0.71	3.0	24.1	0.62
1.10	9.13	11.96	0.76	3.2	28.9	0.63
1.20	10.32	12.59	0.82	3.3	34.3	0.64
1.30	11.57	13.22	0.88	3.5	40.2	0.64
1.40	12.88	13.85	0.93	3.6	46.6	0.65
1.50	14.25	14.49	0.98	3.8	53.5	0.66
1.60	15.68	15.12	1.04	3.9	61.0	0.66
1.70	17.17	15.75	1.09	4.0	69.1	0.67
1.80	18.72	16.38	1.14	4.2	77.7	0.67
1.90	20.33	17.02	1.19	4.3	87.0	0.68
2.00	22.00	17.65	1.25	4.4	96.8	0.68

100 yr Flow



CGL 7/1/08

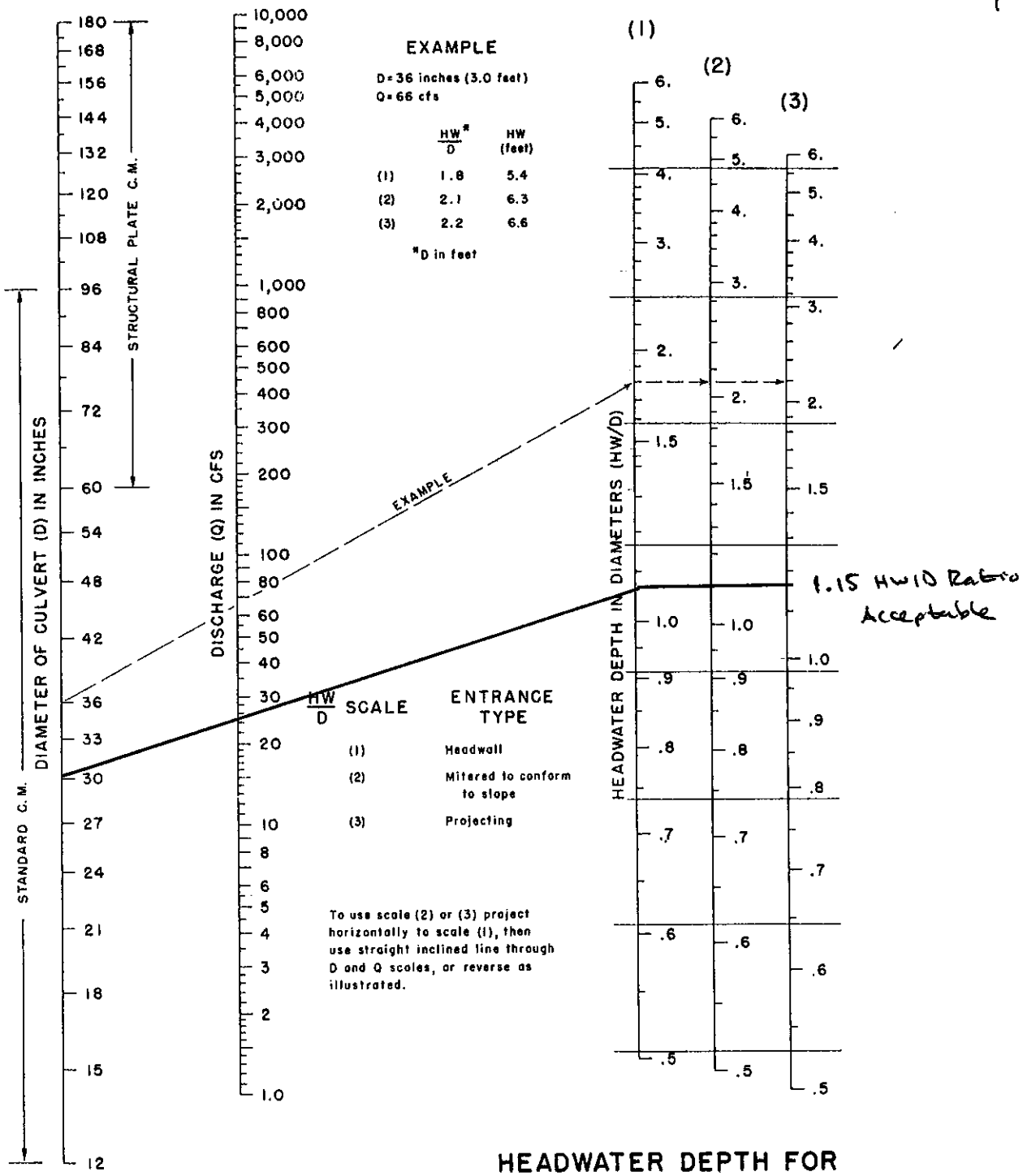
~~East~~ ~~West~~ Evap. Pond Diversion Channel Culvert

WEST

CGL 12/1/08

CHART 5

8/



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

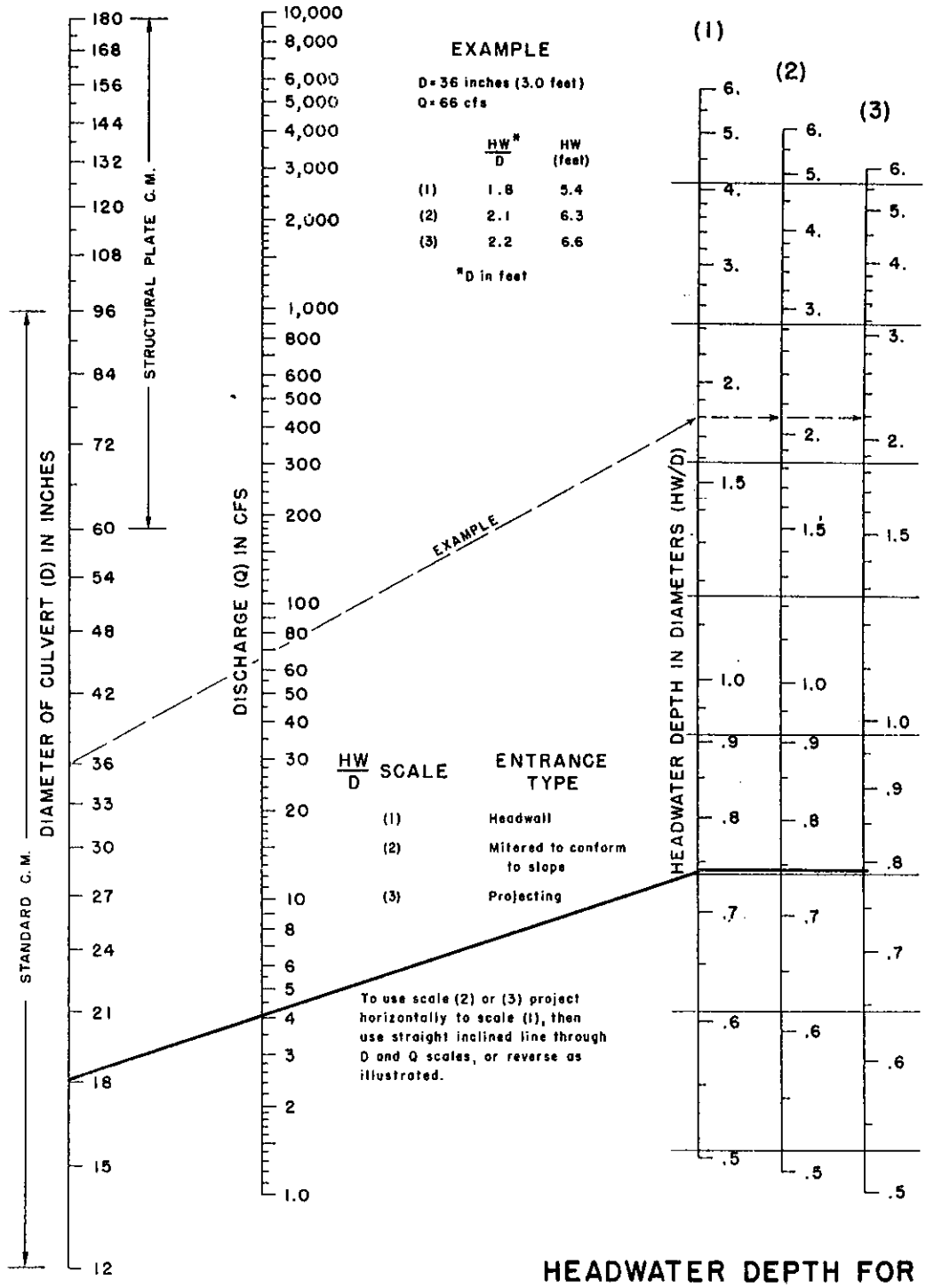
~~WEST~~ Evap Pond Diversion Channel Culvert

~~EAST~~

CR 12/1/08

CHART 5

9/



0.8 HW/D Ratio Acceptable

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963