APPENDIX G

MAIN ACCESS ROAD DRAINAGE

G

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CALCULATION COVER SHEET

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

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

Calculation No.: 89241.6-4

Calculation Title: Access Road Drainage Design

Design Verification Required: ☐ Yes ☒ No

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☐ Superseded by Calculation No.:

ORIGINAL AND REVISED CALCULATIONS/ANALYSIS APPROVAL

	Rev. 2 Printed Name/Signature/Date	Rev. ____ Printed Name/Signature/Date	Rev. ____ Printed Name/Signature/Date
Originator:	T. Klubert 8/6/08		
Checked By:	C. Larson 10/14/08		
Approved By:	C. Larson 12/1/08		
Other:			

AFFECTED DOCUMENTS

Document Number	Document Title	Rev. No.	Responsible Project Manager Initials
DEN 8RL179	SITE DRAINAGE ANALYSIS AND DESIGN RPT - PINON MOBB MILL		LGL

RECORD OF REVISION

Rev.	Reason for Revision

ATTACHMENTS

Attachment No.	Title	Total Pages
I	Access Road Drainage Design Calculations	23

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Sheet_____ of_____

PROJECT Pixon Ridge PROJECT NO. 89241

SUBJECT Access Road Drainage BY TTR DATE 8/6/08

REVIEWED BY CBR DATE 12/1/08

Objective: Determine peak flows and runoff volume for site access road ditch and Water Quality swale design, respectively. Use 100-yr and 1,000-yr design storms.

Assumptions:
1) Tailing cell A is constructed
2) Use Rocky Mtn Thunderstorm hydrograph
3) Half of Basin 3 contributes to East drainage.
4) All soil is group B, poor vegetation, CN = 67

Drainage Area Characteristics (Basin 4A)

Total Area = 98 ac (excluding 1st phase of evap ponds)
98 ac = 0.15 mi²

Maximum Flow Path = 0.86 mi

Average Slope = 0.02 ft/ft = 107 ft/mi

Distance to Centroid (assume ½ of max. flow path) = 0.43 mi

K_n = 0.07

CN = 67

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

Pinon Ridge Uranium Mill Site Evaporation Pond Road Ditch and WQ Swale

Drainage Area =	0.15	sq. miles	Lg+D/2 =	0.65	Hours
Basin Slope =	107.00	ft./mile	Basin Factor =	0.04	
L =	0.86	mi., Length of Watercourse	V' =	4.03	cfs/Day
Lca =	0.43	mi., Distance to Centroid	Qs =	6.2	* q, cfs
Kn =	0.070	-, Ave. Weighted Manning's n			

2/

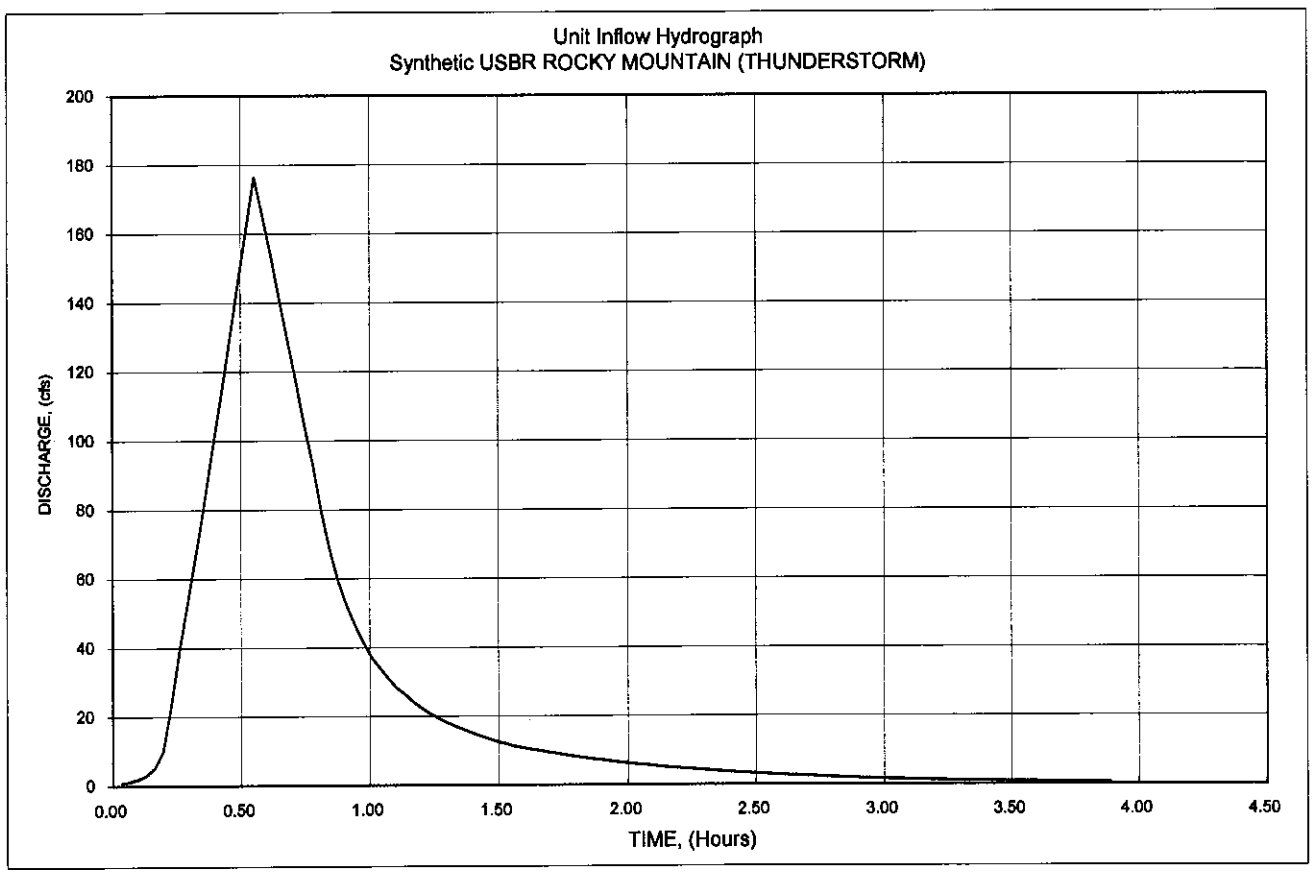
PARAMETERS:

Calculated: Lag Time, Lg = 0.61 Hours Unit Duration, D = 6.61 minutes

Calculated Timestep = 1.94 minutes

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

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



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

UI	2	6	35	72	111	152	165	134	103	72
UI	51	38	30	24	20	17	15	13	11	10
UI	9	8	7	6	6	5	5	4	4	3
UI	3	3	2	2	2	2	1	1	1	1
UI	1	1	1	1	1	1	0			
UI										
UI										
UI										
UI										
UI										
UI										
UI										

USBR calculated unitgraph peak = 177 Interpolated Peak = 165

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Sheet ____ of ____

3/

PROJECT Pinon Ridge PROJECT NO. 89241

SUBJECT Access Road Culvert BY TTR DATE 8/6/08

REVIEWED BY CLR DATE 12/1/08

Objective: Size culvert near access road, running under SH90, for 100-yr design storm.

Assumptions: 1) Minimal drainage contribution from gravel road.

2) All soils in Basin 4B soil group B, poorly vegetated, CN = 67

Drainage from East of Access Road (Basin 4B)

Total Area = 64 acres = 0.10 mi^2

Maximum Flow Path = 0.55 mi

Average Slope = 0.026 ft/ft = 138 ft/mi

Distance to Centroid (assume 1/2 max. flow path) = 0.28 mi

K_n = 0.07

CN = 67

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

Pinon Ridge Uranium Mill Site SH90 Culvert

4/

Drainage Area =	0.10	sq. miles	Lg+D/2 =	0.48	Hours
Basin Slope =	138.00	ft./mile	Basin Factor =	0.01	
L =	0.55	mi., Length of Watercourse	V' =	2.69	cfs/Day
Lca =	0.28	mi., Distance to Centroid	Qs =	5.6	* q, cfs
Kn =	0.070	-, Ave. Weighted Manning's n			

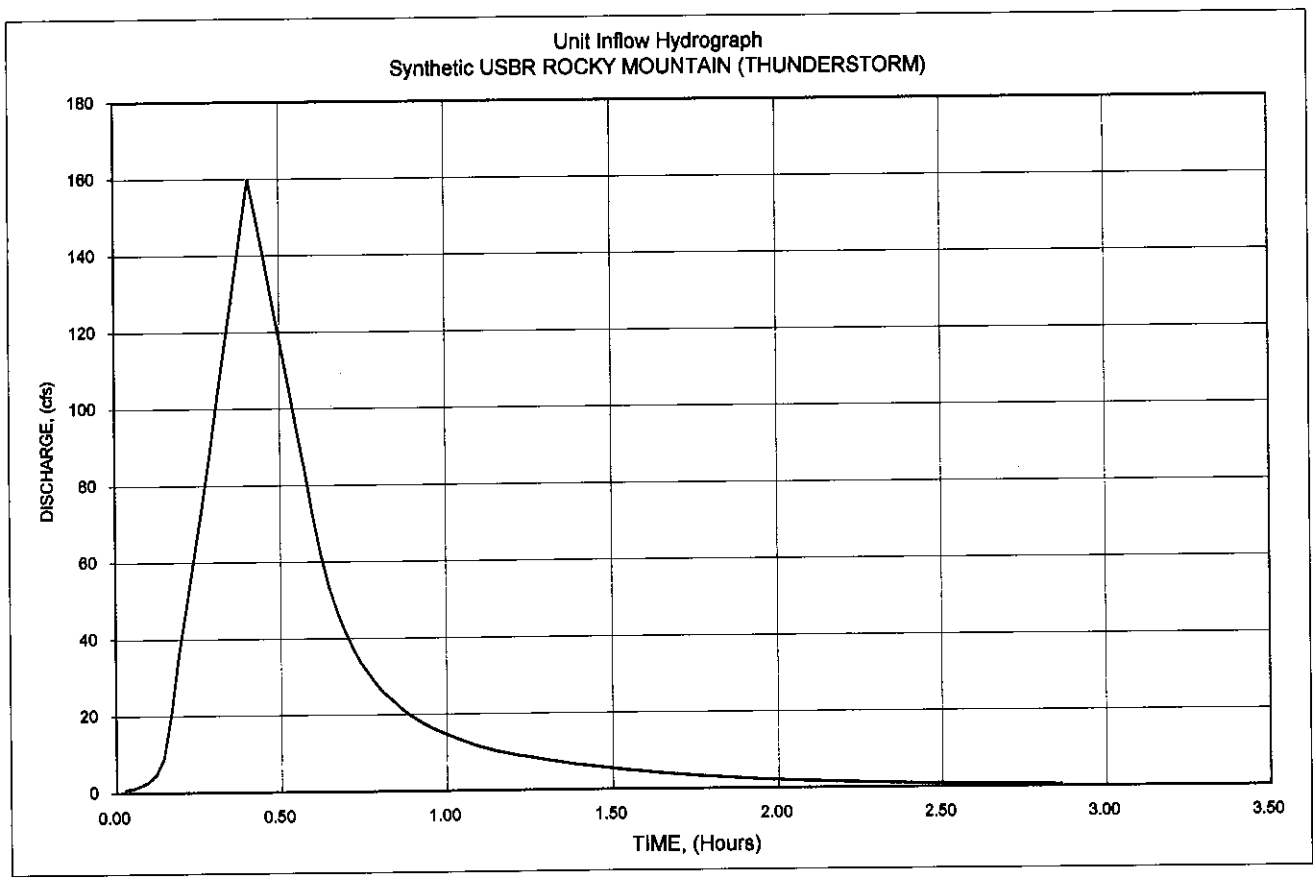
PARAMETERS:

Calculated: Lag Time, Lg = 0.44 Hours Unit Duration, D = 4.75 minutes

Calculated Timestep = 1.43 minutes

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

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



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

UI	2	21	68	117	155	117	79	48	32	24
UI	18	15	12	10	9	7	6	5	5	4
UI	3	3	3	2	2	2	1	1	1	1
UI	1	1	1	1						
UI										
UI										
UI										
UI										
UI										
UI										
UI										
UI										

USBR calculated unitgraph peak = 160 Interpolated Peak = 155

Cor 12/1/08

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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   07AUG08  TIME  09:21:25   *                                  *           (916) 756-1104             *
 *                                       *                                  *                                      *
 *****************************************                                  ****************************************
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5/

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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

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1                                                HEC-1 INPUT                                                  PAGE  1

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

 *** FREE ***
                        *DIAGRAM
            1           ID   ENERGY FUELS - PINON RIDGE URANIUM MILL
            2           ID   PROJECT NO. 89241
            3           ID   100 YEAR ACCESS ROAD DITCH DESIGN HYDROLOGY
            4           ID   AUG. 7 2008
            5           ID   ROCKY MOUNTAIN LOCAL STORM UNIT GRAPH  KN=0.07
            6           IT       5       0       0     300
            7           IO       5       1

            8           KK     B4A
            9           KM   DRAINAGE TO WEST OF ACCESS ROAD
           10           BA    0.15
           11           IN      60
           12           PB       0
           13           PC   0.033   0.066   0.105   0.144   0.192   0.240   0.294   0.360   0.441   0.543
           14           PC   0.705   1.989   2.316   2.460   2.550   2.640   2.694   2.748   2.802   2.856
           15           PC   2.892   2.928   2.964   3.000
           16           LS       0      67       5
           17           UI       2       6      35      72     111     152     165     134     103      72
           18           UI      51      38      30      24      20      17      15      13      11      10
           19           UI       9       8       7       6       6       5       5       4       4       3
           20           UI       3       3       2       2       2       2       1       1       1       1
           21           UI       1       1       1       1       1       1
           22           KO       3
                        *

           23           KK B4ACHAN
           24           KM   ACCESS ROAD WEST DITCH
           25           RD     500   0.025   0.030            TRAP     1.5       3
                        *

           26           KK B4ACULV
           27           KM   CULVERT UNDER SITE ACCESS ROAD (WEST TO EAST DRAINING)
           28           RD      60    0.01   0.024            CIRC     2.5
                        *

           29           KK     B4B
           30           KM   DRAINAGE TO EAST OF ACCESS ROAD
           31           BA    0.10
           32           LS       0      67       5
           33           UI       2      21      68     117     155     117      79      48      32      24
           34           UI      18      15      12      10       9       7       6       5       5       4
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          35          UI       3       3       3       2       2       2       1       1       1       1
          36          UI       1       1       1       1
                      *

          37          KK    SH90
          38          KM   CULVERT INLET AT SH90
          39          HC       2
                      *
          40          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

     8         B4A
                V
                V
    23     B4ACHAN
                V
                V
    26     B4ACULV
                .
                .
    29          .         B4B
                .           .
                .           .
    37        SH90............

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *              JUN   1998              *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   07AUG08  TIME  09:21:25  *
 *                                      *
 ****************************************
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6/

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*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
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                        ENERGY FUELS - PINON RIDGE URANIUM MILL
                        PROJECT NO. 89241
                        100 YEAR ACCESS ROAD DITCH DESIGN HYDROLOGY
                        AUG. 7 2008
                        ROCKY MOUNTAIN LOCAL STORM UNIT GRAPH  KN=0.07

    7 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
               SURFACE AREA           ACRES
               TEMPERATURE            DEGREES FAHRENHEIT


 *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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```
          **************
          *            *
  8 KK    *      B4A   *
          *            *
          **************

 22 KO        OUTPUT CONTROL VARIABLES
                   IPRNT          3  PRINT CONTROL
                   IPLOT          1  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

            SUBBASIN RUNOFF DATA

 10 BA        SUBBASIN CHARACTERISTICS
                   TAREA        .15  SUBBASIN AREA

              PRECIPITATION DATA

 12 PB             STORM       2.97  BASIN TOTAL PRECIPITATION

 13 PI          INCREMENTAL PRECIPITATION PATTERN
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .01      .01      .01      .01      .01      .01      .01      .01
                   .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                   .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                   .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                   .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                   .11      .11      .11      .11      .11      .11      .11      .11      .11      .11
                   .11      .11      .03      .03      .03      .03      .03      .03      .03      .03
                   .03      .03      .03      .03      .01      .01      .01      .01      .01      .01
                   .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                   .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                   .01      .01      .01      .01      .01      .01      .01      .01      .01      .01
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                   .00      .00      .00      .00      .00      .00

 16 LS        SCS LOSS RATE
                   STRTL        .99  INITIAL ABSTRACTION
                  CRVNBR      67.00  CURVE NUMBER
                   RTIMP       5.00  PERCENT IMPERVIOUS AREA

 17 UI        INPUT UNITGRAPH,  46 ORDINATES,  VOLUME = 1.00
                   2.0       6.0      35.0      72.0     111.0     152.0     165.0     134.0     103.0      72.0
                  51.0      38.0      30.0      24.0      20.0      17.0      15.0      13.0      11.0      10.0
                   9.0       8.0       7.0       6.0       6.0       5.0       5.0       4.0       4.0       3.0
                   3.0       3.0       2.0       2.0       2.0       2.0       1.0       1.0       1.0       1.0
                   1.0       1.0       1.0       1.0       1.0       1.0

                                                                  ***

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION      B4A

   TOTAL RAINFALL =    2.97, TOTAL LOSS =    2.28, TOTAL EXCESS =     .69

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR     24.92-HR
+   (CFS)       (HR)
                          (CFS)
+     24.     11.33                  8.          3.          3.          3.
                        (INCHES)   .496        .688        .688        .688
                         (AC-FT)     4.          6.          6.          6.

                        CUMULATIVE AREA =     .15 SQ MI
```

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	B4A	24.	11.33	8.	3.	3.	.15		
+	ROUTED TO	B4ACHAN	24.	11.33	8.	3.	3.	.15		
+	ROUTED TO	B4ACULV	24.	11.33	8.	3.	3.	.15		
+	HYDROGRAPH AT	B4B	18.	11.25	5.	2.	2.	.10		
+	2 COMBINED AT	SH90	40.	11.25	13.	5.	4.	.25		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
B4ACHAN	MANE	1.39	23.74	681.62	.69	5.00	23.54	680.00	.69

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5506E+01 EXCESS= .0000E+00 OUTFLOW= .5506E+01 BASIN STORAGE= .8306E-03 PERCENT ERROR= .0

B4ACULV	MANE	.16	23.53	680.54	.69	5.00	23.51	680.00	.69

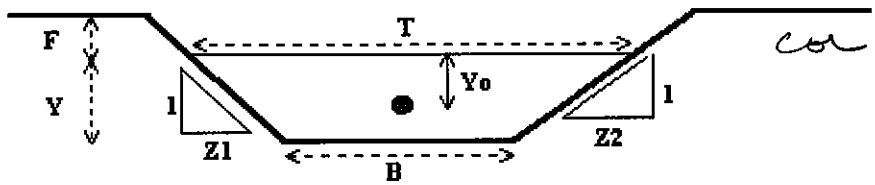
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5506E+01 EXCESS= .0000E+00 OUTFLOW= .5506E+01 BASIN STORAGE= .7224E-04 PERCENT ERROR= .0

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

9/

Normal Flow Analysis - Trapezoidal Channel

Project: Pinon Ridge
Channel ID: Main Access Rd. Ditch Sta 3+00 to 27+00



COL 12/1/08

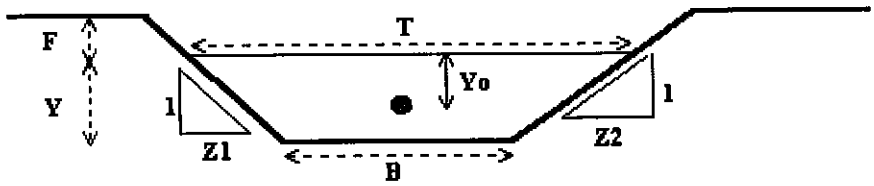
Design Information (Input)			
Channel Invert Slope	So =	0.0140	ft/ft
Manning's n	n =	0.040	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	1.22	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**24.24**	cfs
Froude Number	**Fr =**	**0.72**	
Flow Velocity	**V =**	**3.51**	fps
Flow Area	A =	6.91	sq ft
Top Width	T =	9.32	ft
Wetted Perimeter	P =	9.72	ft
Hydraulic Radius	R =	0.71	ft
Hydraulic Depth	D =	0.74	ft
Specific Energy	Es =	1.41	ft
Centroid of Flow Area	Yo =	0.48	ft
Specific Force	Fs =	0.37	kip

Normal Flow Analysis - Trapezoidal Channel

10/

Project: Pinon Ridge
Channel ID: Main Access Rd. Ditch Sta 27+00 to 35+50



CDL 12/1/03

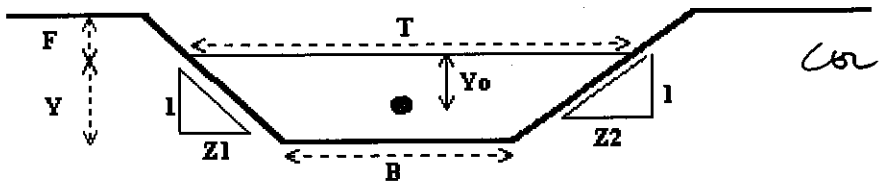
Design Information (Input)			
Channel Invert Slope	So =	0.0360	ft/ft
Manning's n	n =	0.040	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	0.98	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**24.08**	cfs
Froude Number	**Fr =**	**1.12**	High but ok
Flow Velocity	**V =**	**4.97**	fps
Flow Area	A =	4.84	sq ft
Top Width	T =	7.88	ft
Wetted Perimeter	P =	8.20	ft
Hydraulic Radius	R =	0.59	ft
Hydraulic Depth	D =	0.61	ft
Specific Energy	Es =	1.36	ft ✓
Centroid of Flow Area	Yo =	0.39	ft
Specific Force	Fs =	0.35	kip

Normal Flow Analysis - Trapezoidal Channel

11/

Project: Pinon Ridge
Channel ID: Main Access Rd. Ditch Sta 35+50 to 40+50



CGL 12/1/08

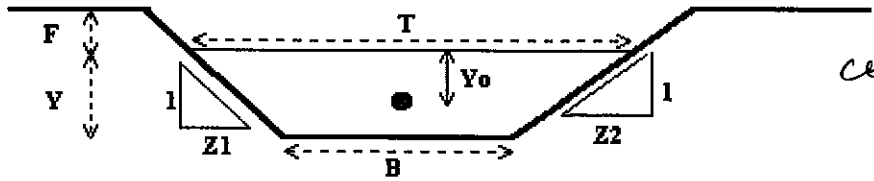
Design Information (Input)			
Channel Invert Slope	So =	0.0050	ft/ft
Manning's n	n =	0.040	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	1.53	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**24.08**	cfs
Froude Number	**Fr =**	**0.44**	
Flow Velocity	**V =**	**2.39**	fps
Flow Area	A =	10.08	sq ft
Top Width	T =	11.18	ft
Wetted Perimeter	P =	11.68	ft
Hydraulic Radius	R =	0.86	ft
Hydraulic Depth	D =	0.90	ft
Specific Energy	Es =	1.62	ft
Centroid of Flow Area	Yo =	0.58	ft
Specific Force	Fs =	0.48	kip

Normal Flow Analysis - Trapezoidal Channel

12/

Project: Pinon Ridge
Channel ID: Main Access Rd. Ditch Sta 40+50 to 52+00



CBL 12/1/08

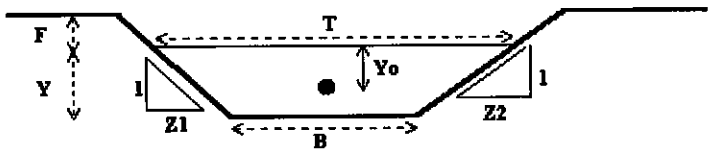
Design Information (Input)			
Channel Invert Slope	So =	0.0220	ft/ft
Manning's n	n =	0.040	
Bottom Width	B =	2.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	1.10	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	24.19	cfs
Froude Number	**Fr =**	0.89	
Flow Velocity	**V =**	4.15	fps
Flow Area	A =	5.83	sq ft
Top Width	T =	8.60	ft
Wetted Perimeter	P =	8.96	ft
Hydraulic Radius	R =	0.65	ft
Hydraulic Depth	D =	0.68	ft
Specific Energy	Es =	1.37	ft ✓
Centroid of Flow Area	Yo =	0.43	ft
Specific Force	Fs =	0.35	kip

Design of Riprap Channel Cross Section

13/

Project: Main Access Rd, West Ditch
Channel ID:



CDL 12/1/08

Design Information (Input)			
Channel Invert Slope	So =	0.0200	ft/ft
Bottom Width	B =	~~2.0~~ 1.0	ft OK
Left Side Slope	Z1 =	3.0	ft/ft
Right Side Slope	Z2 =	3.0	ft/ft
Specific Gravity of Rock	Ss =	2.60	
Radius of Channel Centerline	Ccr =	400.0	ft
Design Disharge	**Q =**	**24.0**	**cfs**

Flow Condition (Calculated)			
Riprap Type (Straight Channel)	**Type =**	VL	
Intermediate Rock Diameter (Straight Channel)	**D50 =**	6	**inches**
Calculated Manning's n (Straight Channel)	**n =**	0.0352	
Riprap Type (Outside Bend of Curved Channel)	**Type =**	VL	
Intermediate Rock Dia. (O.B. of Curved Channel)	**D50 =**	6	**inches**
Calculated Manning's N (Curved Channel)	**n =**	0.0352	
Water Depth	Y =	1.12	ft
Top Width of Flow	T =	8.2	ft
Flow Area	A =	5.4	sq ft
Wetted Perimeter	P =	8.6	ft
Hydraulic Radius (A/P)	R =	0.6	ft
Average Flow Velocity (Q/A)	V =	4.4	fps
Hydraulic Depth (A/T)	D =	0.7	ft
WARNING Froude Number (max. = 0.8)	Fr =	0.96	
Channel Radius / Top Width	Ccr/T =	48.66	
Riprap Design Velocity Factor For Curved Channel	Kv =	1.00	
Riprap Sizing Velocity For Curved Channel	V_{Kv} =	4.4	fps
Riprap Sizing Paramenter for Straight Channel	**K =**	**1.67**	OK
Riprap Sizing Paramenter for Outside Bend of Curve	**K_{curve} =**	**1.67**	
Superelevation (dh)	dh =	0.00	ft
Discharge (Check)	**Q =**	**24.1**	**cfs**

WARNING: Froude No. exceeds USDCM Volume II recommendation

Check on Rock Size for Riprap

Range of K, K_{curve}	Riprap	D50
< 3.3	VL	6 inch
≥ 3.3 to < 4.0	L	9 inch
≥ 4.0 to < 4.6	M	12 inch
≥ 4.6 to < 5.6	H	18 inch
≥ 5.6 to 6.4	VH	24 inch

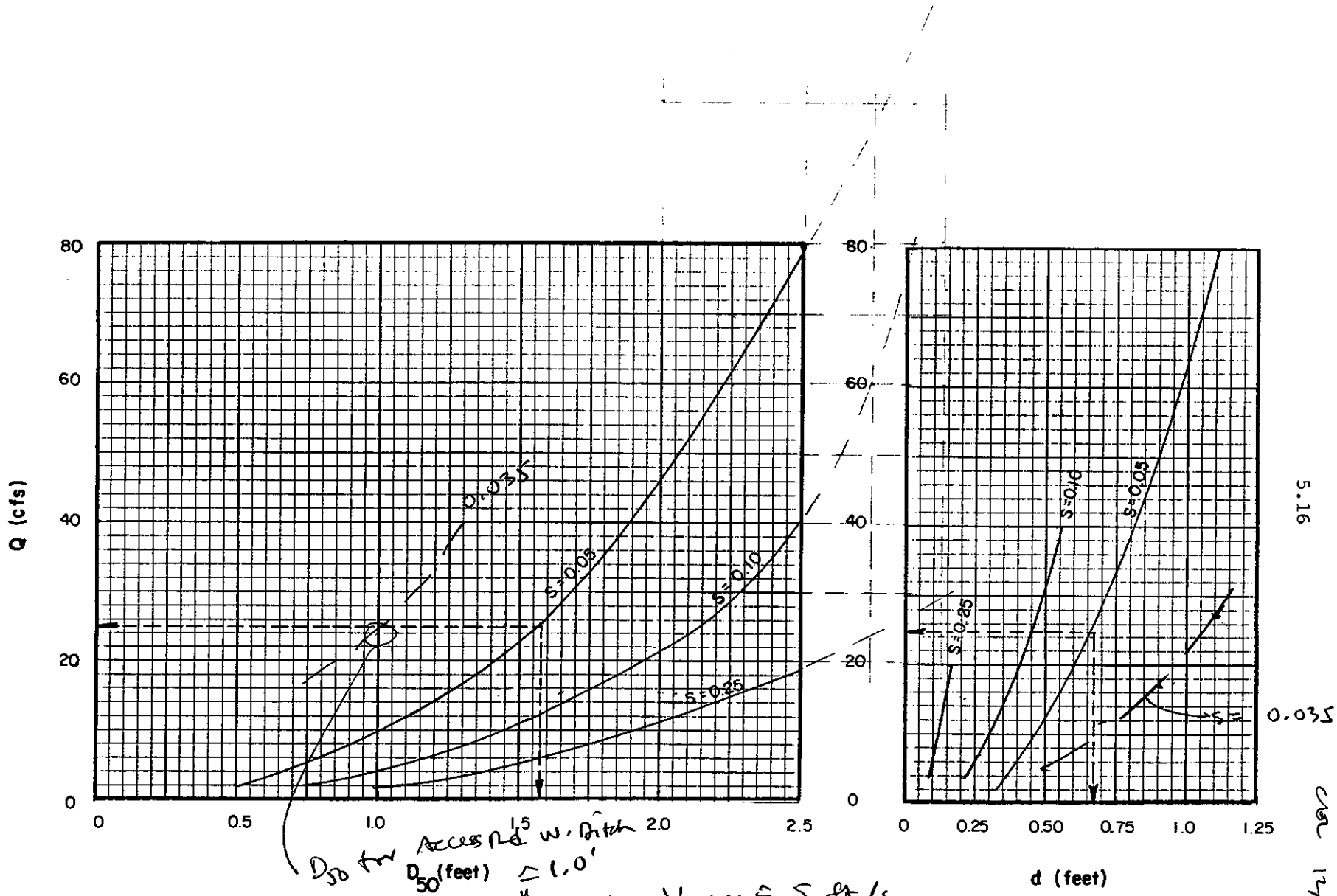


Figure 5.3. Steep slope riprap design, triangular channels, 2:1 sideslopes.

CSC 12/1/08

SH90 Culvert Crossing

CW 12/1/08

CHART 2

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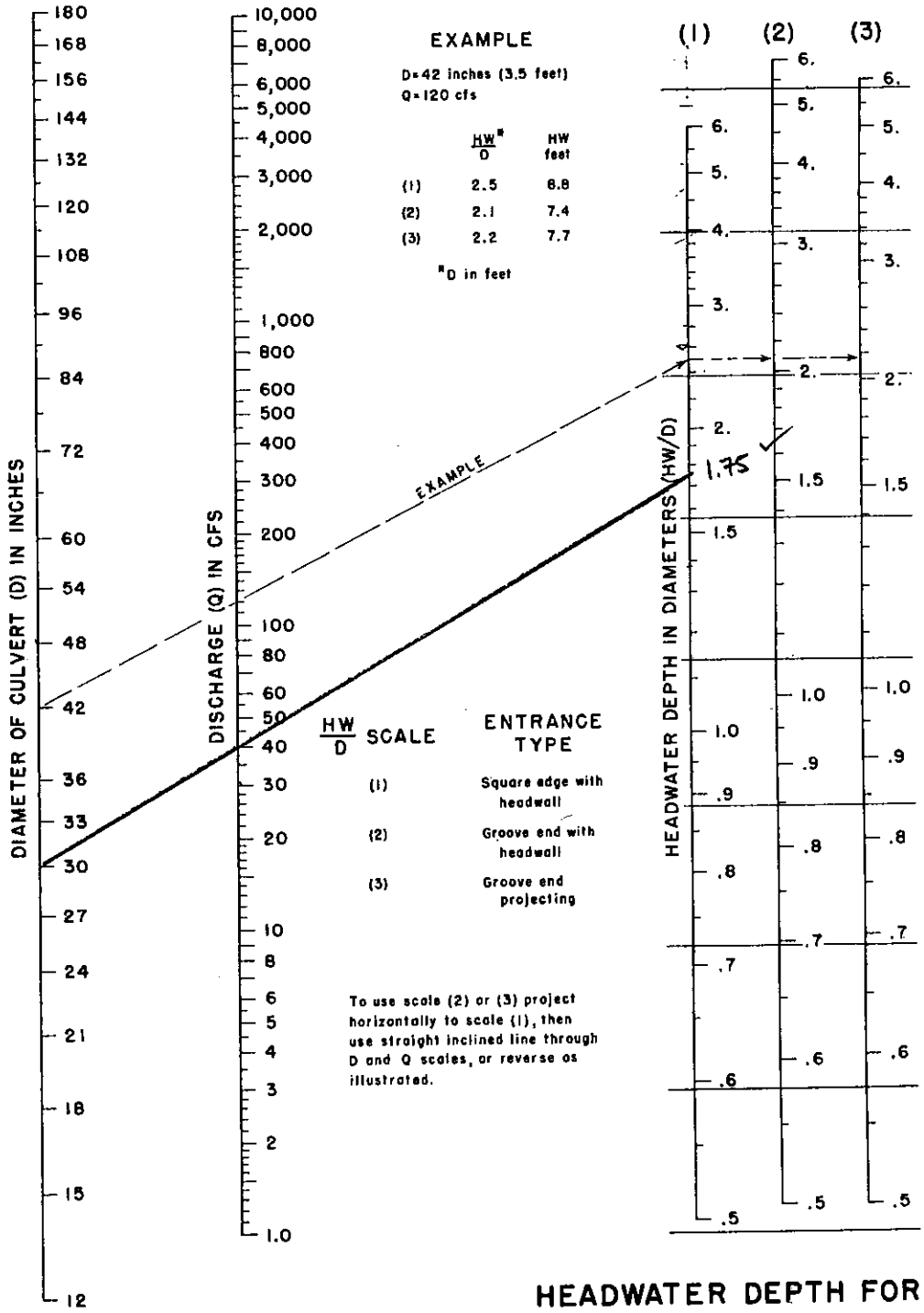

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Access Road Culvert Crossing

* Assume same flow as S.H. 90 culvert

CHART 5 CEL 12/1/08

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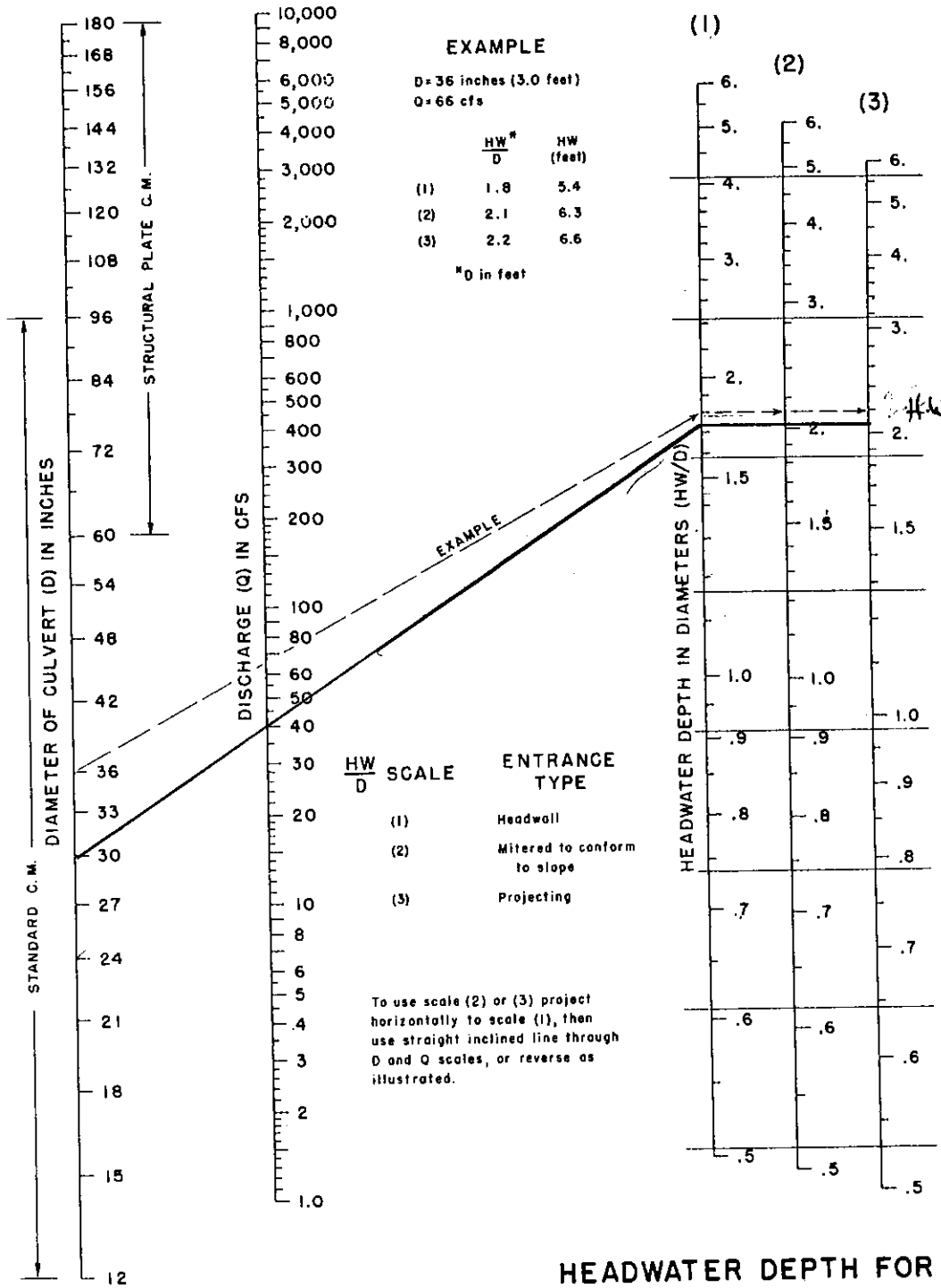

HW/D Ratio of 2 acceptable.

Note - actual culvert would convey ≈ 35 cfs before roadway OT occurs, but OK.

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

BUREAU OF PUBLIC ROADS JAN. 1963

Access Road Culverts near Ore Pad Area.

CHART 5

CSL 12/1/03

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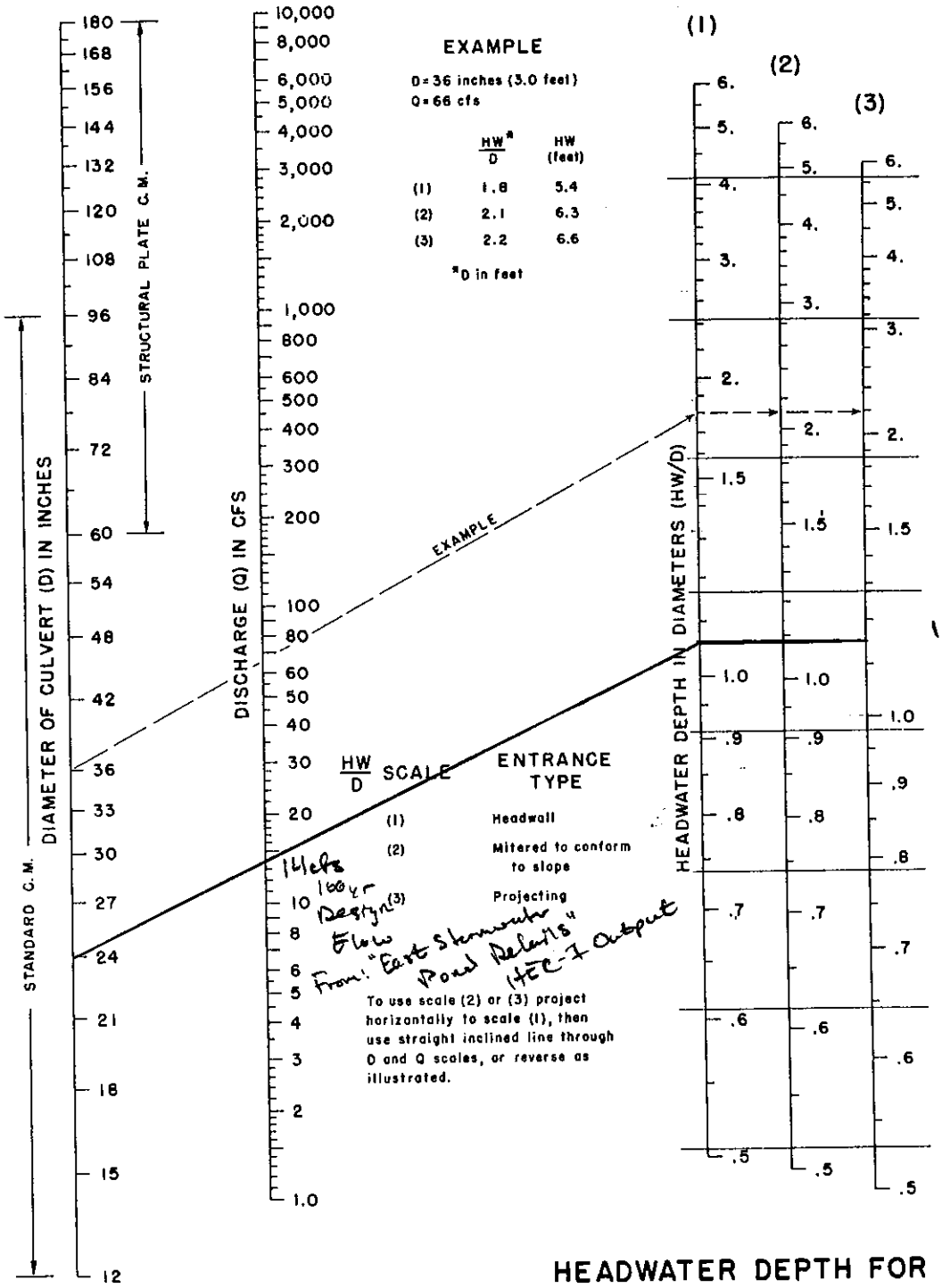

144 cfs 100 yr Design Flow From: "East Stormwater Pond Reports" HEC-1 Output

1.15 Hw/D Acceptable

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

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Administration Building Culvert Sizes

cor 12/1/08

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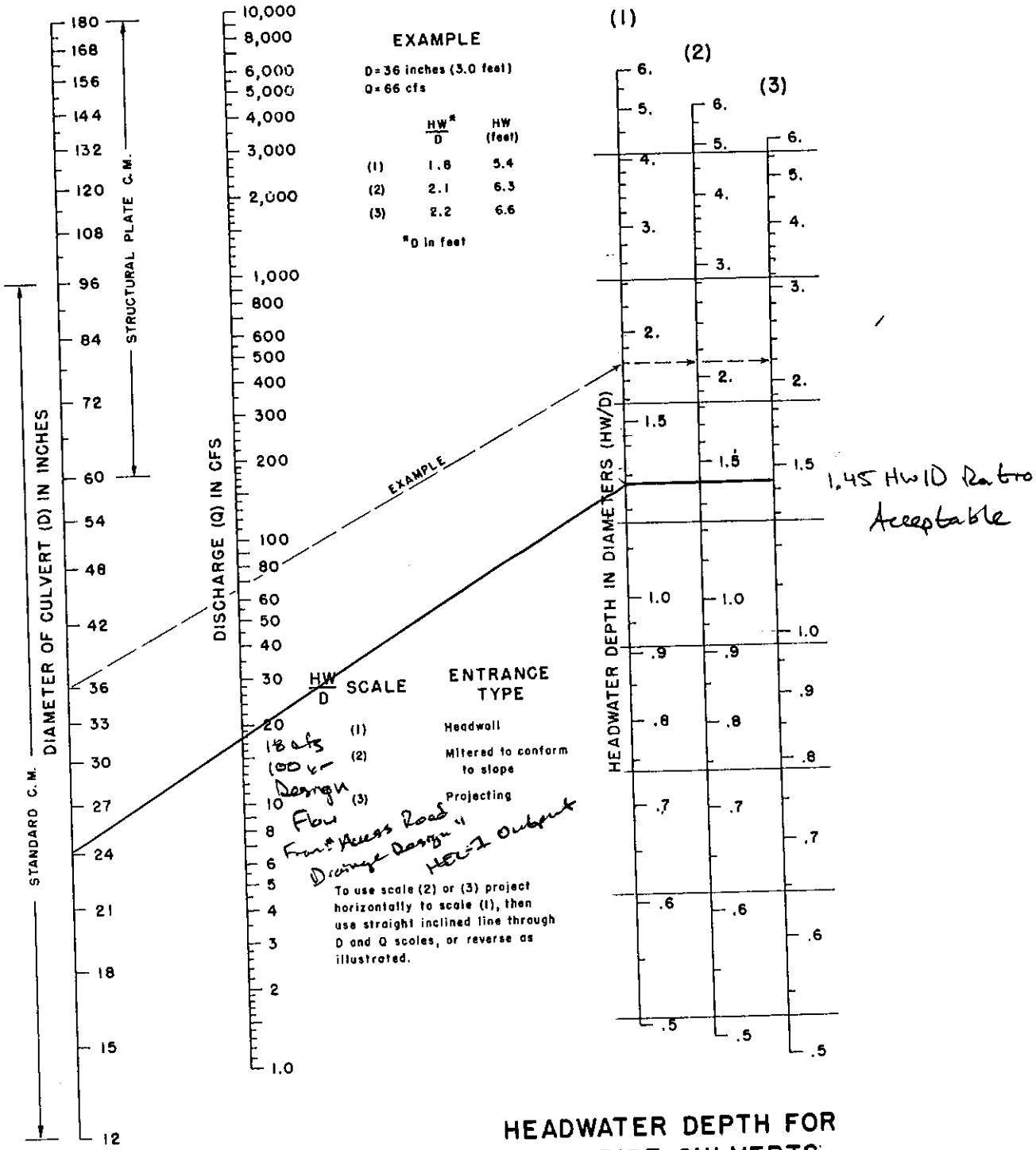
CHART 5



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

BUREAU OF PUBLIC ROADS JAN. 1963

G

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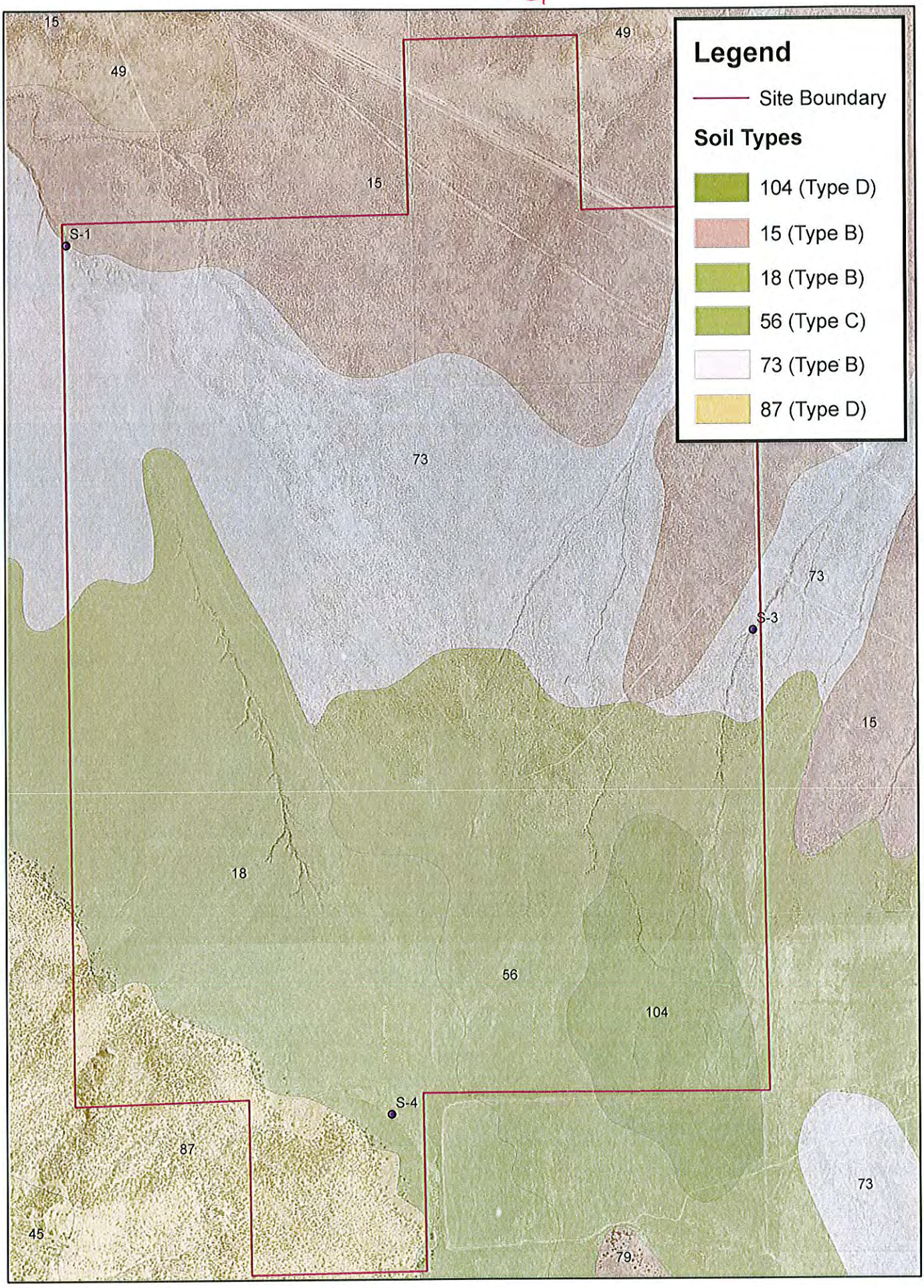

0 500 1,000 2,000 Feet

Pinon Ridge Soils Map

N

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2]	A [3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a, = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

App G

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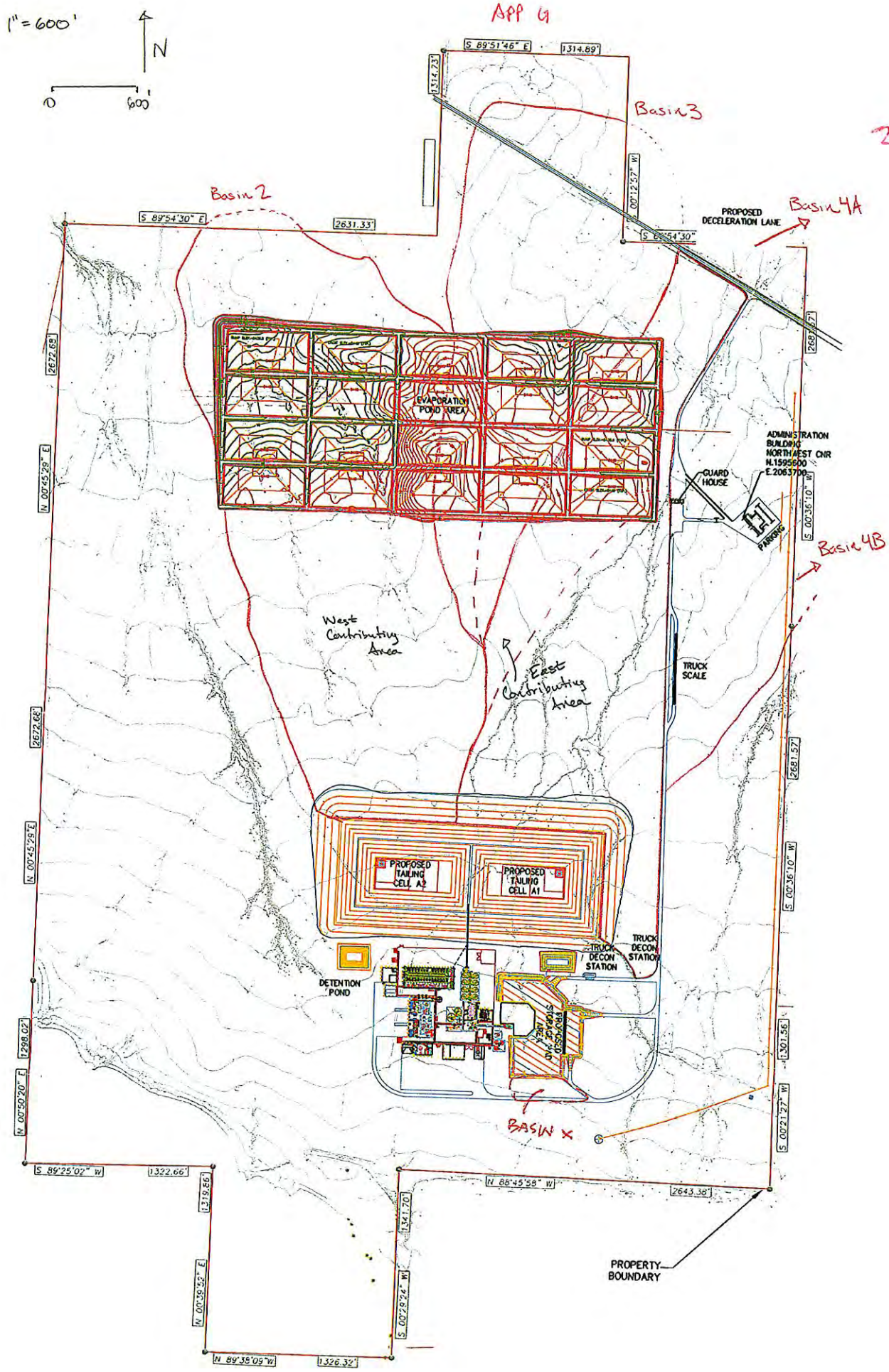
1" = 600'
N
0
600'
S 89°51'46" E
1314.89'
1314.73'
Basin 3
Basin 2
S 89°54'30" E
2631.33'
PROPOSED DECELERATION LANE
Basin 4A
2681.57'
2672.68'
N 00°45'29" E
EVAPORATION POND AREA
ADMINISTRATION BUILDING NORTHWEST CNR N.1595600 E.2063700
GUARD HOUSE
PARKING
S 00°36'10" W
Basin 4B
West Contributing Area
East Contributing Area
TRUCK SCALE
PROPOSED TAILING CELL A2
PROPOSED TAILING CELL A1
TRUCK DECON STATION
DETENTION POND
1298.02'
N 00°50'20" E
1301.56'
S 00°21'27" W
BASIN X
S 89°25'02" W
1322.66'
1318.86'
N 88°45'58" W
2643.38'
1341.70'
N 00°39'52" E
S 00°29'24" W
N 89°35'09" W
1326.32'
PROPERTY BOUNDARY

KLEINFELDER
Bright People. Right Solutions.

Sheet 1 of 2

22/

PROJECT Pinon Ridge PROJECT NO. 89241

SUBJECT Drainage Dsn. BY CDR DATE 11/19/08

REVIEWED BY DATE

compute Q_{100} for culvert under access entrance rd to Ore Pad - Basin "X"

Drainage area = 1.7 ac.

100 yr - 1 hr rainfall depth:

$Y_{100}(1hr) = 0.494 + 0.755[(X_3)(X_3/X_4)]$

where X_3 = 100 yr - 6 hr depth from NOAA Atl. 2, Vol III

X_4 = 100 yr - 24 hr depth from " " " "

$Y_{100}(1hr) = 0.494 + 0.755[(1.83)(1.83/2.4)]$

$= 1.61$ in

See attached UDFCD Rational method spreadsheet for Q_{100} calculation

Summary: $Q_{100} \approx 3.5$ cfs

∴ Use 18" CMP (min. culvert size)

ENG-07 REV 05/08

2/2

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CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

USL 12/1/08

Project Title: Pinon Ridge
Catchment ID: Basin X

I. Catchment Hydrologic Data

Catchment ID = X
Area = 1.70 Acres
Percent Imperviousness = 2.00 %
NRCS Soil Type = C A, B, C, or D

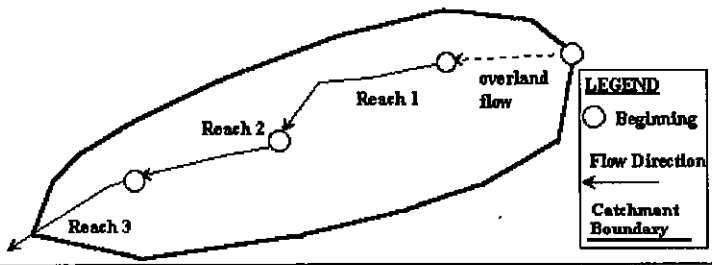
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100	years	(input return period for design storm)
C1 =	28.50		(input the value of C1)
C2=	10.00		(input the value of C2)
C3=	0.786		(input the value of C3)
P1=	1.61	inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.51
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.16
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0075	200	0.16	N/A	0.13	26.30
1	0.0182	220		10.00	1.35	2.72
2						
3						
4						
5						
	Sum	420				

Computed Tc = 29.02
Regional Tc = 12.33
User-Entered Tc = 12.33

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I =	2.56	inch/hr	Peak Flowrate, Qp =	2.22	cfs
Rainfall Intensity at Regional Tc, I =	3.99	inch/hr	Peak Flowrate, Qp =	3.45	cfs
Rainfall Intensity at User-Defined Tc, I =	3.99	inch/hr	Peak Flowrate, Qp =	3.45	cfs