ECKHOFF, WATSON and PREATOR ENGINEERING

Engineering • Environmental Science • Surveying • Construction Administration

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CERTIFICATION LETTER
FOR
SUNNYSIDE COGENERATION ASSOCIATES

NATURAL DRAINAGE IN ADDITION TO SEEP FLOW

36" CMP CULVERT NORTH OF THE COARSE
REFUSE TOE POND

In accordance with the requirements of R645-301-742.312.2, R645-301-742.323, and or R645-301-742.333, I, Alane E. Boyd, Registered Professional Engineer, State of Utah, Number 8863, do hereby certify that the 36" cmp culvert under the railroad tracks north of the Coarse Refuse Toe Pond will safely carry the peak flow from the 100 year, 6 hour storm. The 10 year 6 hour design storm required for miscellaneous flows can pass through this culvert even if it had the capacity of a 12" cmp.

This certification is based on the calculations and discussions pertaining to the natural drainage in addition to seep flow through the 36" cmp culvert north of the Coarse Refuse Toe Pond and the contributing watershed as submitted on March 1, 1994 for Permit Number ACT/007/035. These are located in Appendix 7-3.

LICENSED PROFESSIONAL ENGINEER
No. 170148
ALANE E. BOYD
STATE OF UTAH

Alane E. Boyd

Alane E. Boyd, PE

March 1, 1994

Date

1121 East 3900 South, Suite C100 • Salt Lake City, Utah 84124-1214 • (801) 261-0090 • (801) 266-1671

NATURAL RUNOFF DRAINAGE IN ADDITION TO REGULAR FLOWS FROM THE COARSE REFUSE SEEP THROUGH A 36" CMP CULVERT UNDER THE ABANDONED CARBON COUNTY RAILROAD NORTH OF THE COARSE REFUSE TOE POND

A 36" CMP culvert is located about 200 feet north of the Coarse Refuse Toe Pond. It carries runoff from a 15 acre watershed on the undisturbed hillside to the north in addition to the regular flows from the seep. See Figure Two.

This culvert has sufficient capacity to easily pass a 100 year, 6 hour storm. This 36" culvert is capable of carrying the peak flow from the 10 year, 6 hour design storm required by R645-301-742.333 even when it is restricted to the capacity of a 12" cmp. Natural drainages are considered adequate to meet the conditions that have occurred throughout their developmental history.

CURVE NUMBER

The curve number is based on the Soil Conservation Service graph included as Figure One. The soil type found in this area corresponds to SCS hydrologic Class B as indicated in the SCS Soil Survey for Carbon Area, Utah. The vegetation cover consists of Juniper - Grass, Mountain Brush, and Desert Brush. Curve number was averaged from these vegetation types. The watershed area consists mainly of undisturbed area.

TIME OF CONCENTRATION

The watershed requires a certain time for the water to reach the outlet following the longest path. The runoff from this watershed is approximated by the Sedimot-II "Disturbed" unit hydrograph. The overland flow velocity was estimated using the Soil Conservation Service Upland Curves (SCS 1972) corresponding to the slope and vegetation of the drainage areas. Time of concentration was calculated by dividing the average velocity into the distance to the subwatershed outlet. A conservative time of concentration was used to increase the peak flow for the design check.

SCS Hydro Class	Vegetation Cover Density	Juniper Grass CN	Mt. Brush CN	Desert Brush CN	**Average Curve Number**	**Area acres**	Distance to outlet (ft)	Average Velocity (ft/s)	**Time of Concentration (hrs)**
B	30%	69	73	82	**75**	**15**	1200	3.33	**0.1**

STORM RUNOFF VOLUME, PEAK FLOW AND CULVERT DESIGN

Storm Event	Total Runoff (acft)	Peak Flow (cfs) 12"	36"	Pipe Length (ft)	Minimum Pipe Slope	Maximum HW (ft)	**Maximum Velocity (ft/s)**	Inlet / Outlet Conditions
100yr 6hr	0.5	x	**13**	150	4%	1.7	**4.7**	No lining required
~~10 yr 6 hr~~	~~0.1~~	~~4~~	~~x~~	~~150~~	~~4%~~	~~1~~	~~5.0~~	~~No lining req'd~~

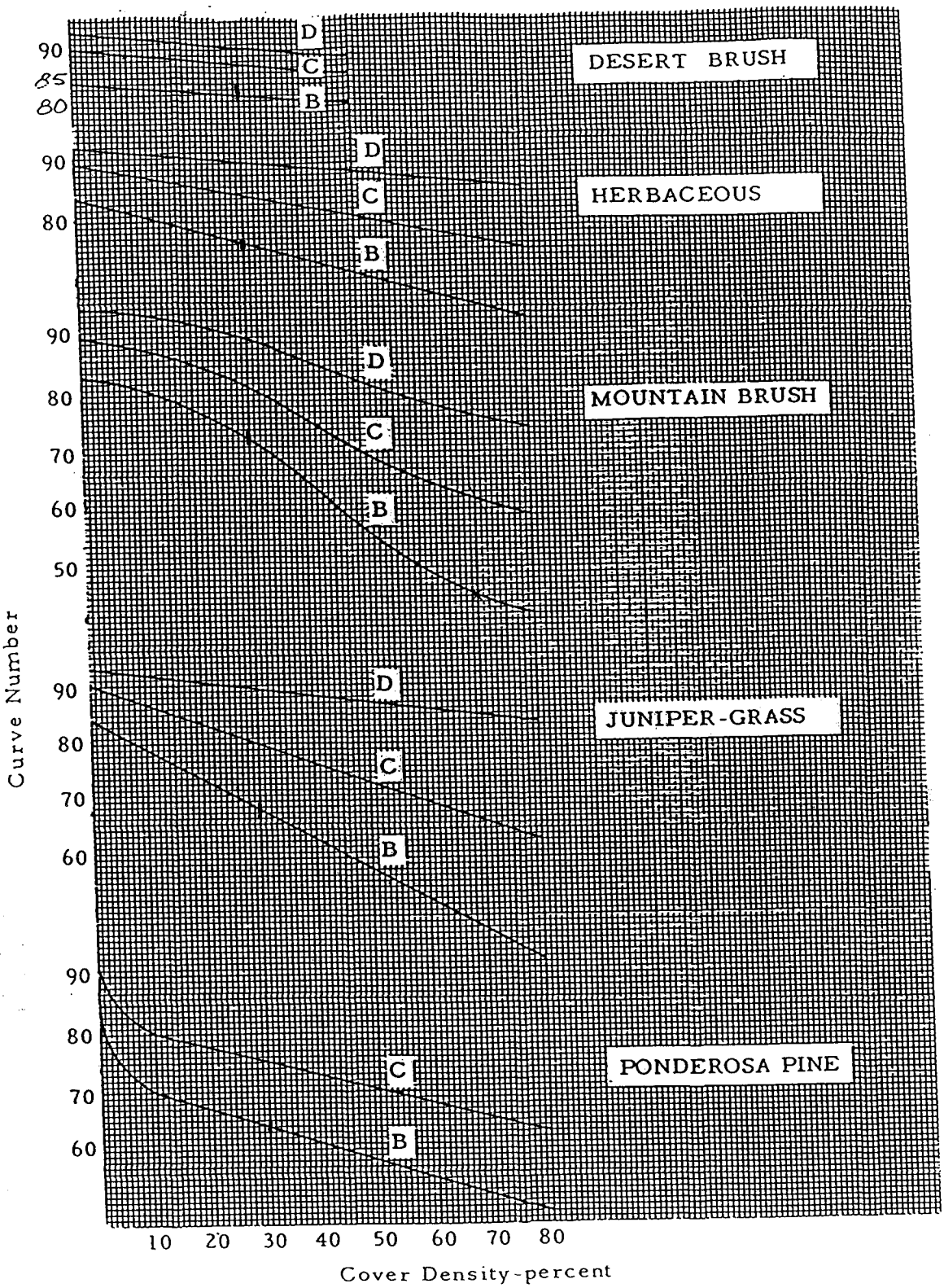


FIGURE 1

HYDROLOGIC SOIL - COVER COMPLEXES
AND ASSOCIATED CURVE NUMBERS

Soil Conservation Service

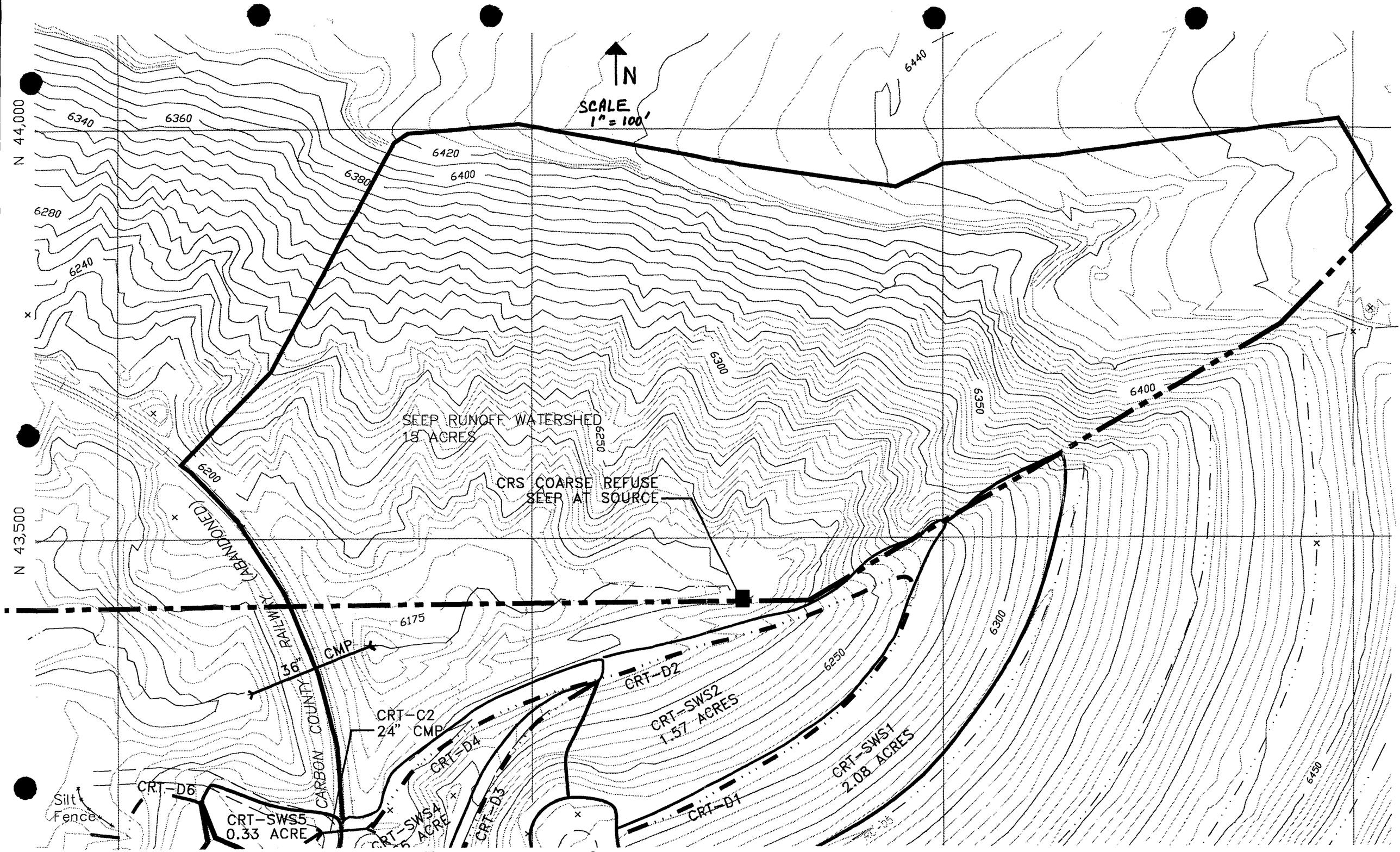


FIGURE 2 - SEEP RUNOFF WATERSHED

FIGURE 3

CULVERT DESIGN CALCULATIONS

PROJECT: SCA - SEEP Runoff

DESIGNER: SSC

DATE: 24 Nov 93

HYDROLOGIC AND CHANNEL INFORMATION

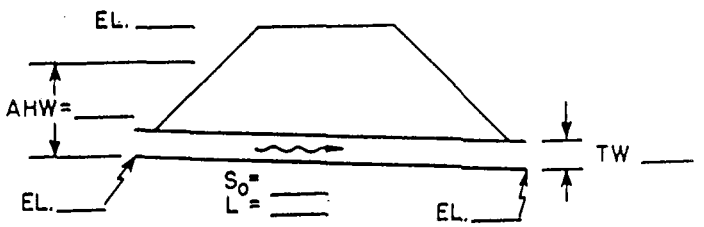
Q_1 = _____ TW_1 = _____

Q_2 = _____ TW_2 = _____

(Q_1 = DESIGN DISCHARGE, SAY Q_{25}
Q_2 = CHECK DISCHARGE, SAY Q_{50} OR Q_{100})

SKETCH

STATION : _____

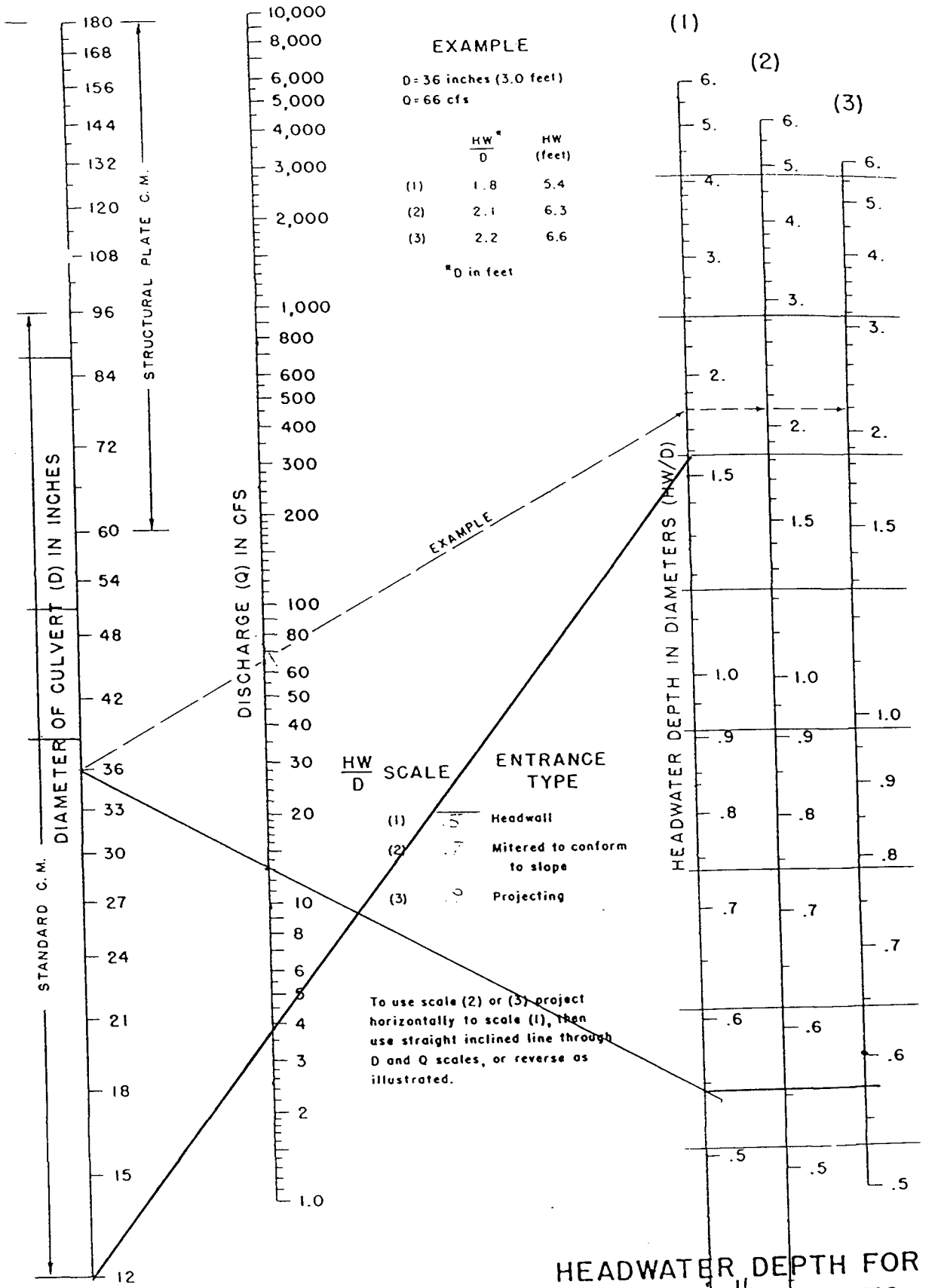


MEAN STREAM VELOCITY = _____

MAX. STREAM VELOCITY = _____

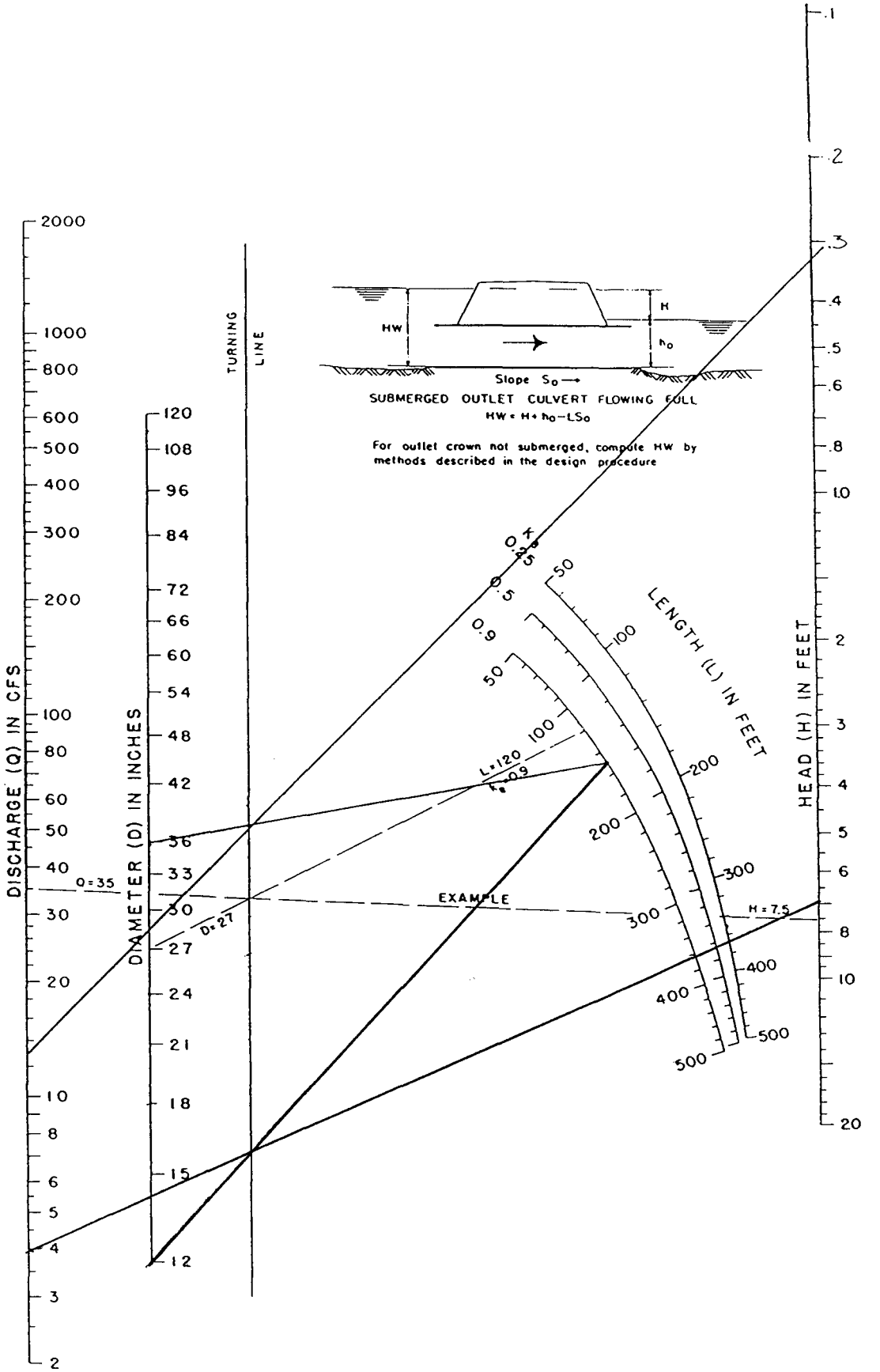
CULVERT DESCRIPTION (ENTRANCE TYPE)	Q cfs	SIZE	HEADWATER COMPUTATION: INLET CONT. $\frac{HW}{D}$	INLET CONT. HW	OUTLET CONTROL $HW=H+h_o-LS_o$: K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS_o	HW	CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
36" Cmp 150'	13	36"	.57	1.7'	.9	.34	1.2	2.1		2.1	6	-3	1.7	4.7		
12" CMP 150'	4	12"	1.85	1.85	.9	7	.8	.9	2	2	6	3	3	5.0		

SUMMARY & RECOMMENDATIONS:



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

BUREAU OF PUBLIC ROADS JAN. 1963



HEAD FOR
STANDARD
C. M. PIPE CULVERTS
FLOWING FULL
n = 0.024

BUREAU OF PUBLIC ROADS JAN. 1963

FIGURE 4

SEDIMOT CALCULATIONS

100 YEAR, 6 HOUR STORM

```
*****************************************************************************
*          (program name)              * SEDIMOT S/N  : 1353220014            *
*                                      * HMVersion    :  3.20                 *
        (program description)          * Date         : 11/24/93              *
                                       * Time         : 10:16:24              *
*                                      * Input file   : seep.in               *
*                                      * Output file  : seep.out              *
*                                      *                                      *
*                                      *                                      *
*****************************************************************************
```

```
 XXXXX   XXXXXXX  XXXXXX   XXXXX  X     X   XXXXX   XXXXXXX
X     X  X        X     X    X    XX   XX  X     X     X
X        X        X     X    X    X X X X  X     X     X
 XXXXX   XXXXX    X     X    X    X  X  X  X     X     X
      X  X        X     X    X    X     X  X     X     X
X     X  X        X     X    X    X     X  X     X     X
 XXXXX   XXXXXXX  XXXXXX   XXXXX  X     X   XXXXX      X
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                 by                   :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

```
*************************************************************
*************************************************************

      UNIVERSITY OF KENTUCKY COMPUTER MODEL
      OF SURFACE MINE HYDROLOGY AND SEDIMENTOLOGY
      FOR MORE INFORMATION CONTACT THE AGRICULTURAL
      ENGINEERING DEPARTMENT

      THE UK MODEL IS A DESIGN MODEL DEVELOPED TO PREDICT
      THE HYDRAULIC AND SEDIMENT RESPONSE FROM SURFACE
      MINED LANDS FOR A SPECIFIED RAINFALL EVENT (SINGLE STORM)

      VERSION DATE 5-25-83

      DISCLAIMER: NEITHER THE UNIVERSITY NOR ANY OF ITS EMPLOYEES
      ACCEPT ANY RESPONSIBILITY OR LEGAL LIABILITY FOR THE
      CONCLUSIONS DRAWN FROM THE RESULTS OF THIS MODEL


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


            ***********************************************
                 WATERSHED IDENTIFICATION CODE
                 -----------------------------
                 Seep Runoff Flows for
            ***********************************************


============================  STORM  INPUT  ============================

QUESTION
   NO.

    1. STORM TYPE -                                          SCS'S TYPE 2
    2. RAINFALL DEPTH -                                        2.05 INCHES
    3. STORM DURATION -                                        6.00 HOURS
    4. TIME INCREMENT -                                         .10 HOURS

=====================================================================


===========================  WATERSHED DATA  ==========================

 ESTION
  NO.
    1. NUMBER OF JUNCTIONS - 1
    2. JUNCTION     NUMBER OF BRANCHES
```

1 1
3. COMPUTATION - HYDROLOGY ONLY

==========

========== STRUCTURE INPUT FOR JUNCTION #1 ==========

BRANCH	NUMBER OF STRUCTURES
1	1

==========

========== BETWEEN STRUCTURE ROUTING PARAMETERS ==========

BRANCH NO.	BETWEEN	PARAMETERS 1 TIME	2 MUSK. K	3 MUSK. X,
1	PRIOR J OR S TO STRUCTURE 1	.00	.00	.00

==========

========== STRUCTURE DATA FOR JUNCTION #1 ==========

JUNCTION
NO.
1. NUMBER OF SUBWATERSHEDS - 1

==========

JUNCTION 1, BRANCH 1, STRUCTURE 1

***** RESULTS FROM SUBWATERSHED 1 *****

*** HYDROGRAPH AND SEDIMENT GRAPH ***
(TWO CONSECUTIVE VALUES PER LINE)

TIME (HR)	DISCHARGE (CFS)	******* *	TIME (HR)	DISCHARGE (CFS)
.00	.000	*	.10	.000
.20	.000	*	.30	.000
.40	.000	*	.50	.000
.60	.000	*	.70	.000
.80	.000	*	.90	.000
1.00	.000	*	1.10	.000
1.20	.000	*	1.30	.000
1.40	.000	*	1.50	.000
1.60	.000	*	1.70	.000
1.80	.000	*	1.90	.000

2.00	.000	*	2.10	.000
2.20	.000	*	2.30	.000
2.40	.000	*	2.50	.000
2.60	.000	*	2.70	1.294
2.80	5.030	*	2.90	8.227
3.00	10.914	*	3.10	2.336
3.20	2.415	*	3.30	2.492
3.40	2.567	*	3.50	2.639
3.60	1.384	*	3.70	1.402
3.80	1.420	*	3.90	1.438
4.00	1.456	*	4.10	1.073
4.20	1.082	*	4.30	1.091
4.40	1.100	*	4.50	1.109
4.60	.869	*	4.70	.874
4.80	.879	*	4.90	.884
5.00	.889	*	5.10	.638
5.20	.641	*	5.30	.644
5.40	.646	*	5.50	.649
5.60	.651	*	5.70	.654

```
* * * * * * * * * * * * * * * * * * * * * * * *
    JUNCTION  1, BRANCH  1, STRUCTURE  1
* * * * * * * * * * * * * * * * * * * * * * * *
```

*** HYDRAULIC INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	AREA ACRES	CURVE NUMBER	TC HR	TT HR	ROUTING COEFFICIENTS K-HRS	X,	UNIT HYDRO
1	15.00	75.00	.100	.000	.000	.00	.0

* * * COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS * * *

WATERSHED	PEAK FLOW (CFS)	RUNOFF (INCHES)
1	10.91	.41

***** SUMMARY TABLE FOR TOTAL WATERSHED *****

STORM DURATION	=	6.00	HOURS
PRECIPITATION DEPTH	=	2.05	INCHES
RUNOFF VOLUME	=	.5071	ACRE-FT
PEAK DISCHARGE	=	10.9137	CFS
AREA	=	15.0000	ACRES
TIME OF PEAK DISCHARGE	=	3.00	HRS

*** RUN COMPLETED ****

SEDIMOT CALCULATIONS

10 YEAR, 6 HOUR STORM

```
*****************************************************************************
*          (program name)                * SEDIMOT S/N   : 1353220014          *
*                                        * HMVersion     :  3.20               *
*       (program description)            * Date          :  2/24/94            *
*                                        * Time          : 16:21:08            *
*                                        * Input file    : SEEP.IN2            *
*                                        * Output file   : SEEP.OT2            *
*                                        *                                     *
*                                        *                                     *
*****************************************************************************
```

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 xxxxx   xxxxxxx  xxxxxx   xxxxx  x     x   xxxxx   xxxxxxx
x     x  x        x     x    x    xx   xx  x     x     x
x        x        x     x    x    x x x x  x     x     x
 xxxxx   xxxxx    x     x    x    x  x  x  x     x     x
      x  x        x     x    x    x     x  x     x     x
x     x  x        x     x    x    x     x  x     x     x
 xxxxx   xxxxxxx  xxxxxx   xxxxx  x     x   xxxxx      x
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                 by                   :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```

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        CONCLUSIONS DRAWN FROM THE RESULTS OF THIS MODEL


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


            ********************************************
                 WATERSHED IDENTIFICATION CODE
                 -----------------------------
        MINIMUM ACCEPTED PIPE SIZE FOR RR CULVERT NEAR SEEP
            ********************************************


============================  STORM  INPUT  ============================

QUESTION
   NO.

    1. STORM TYPE -                                          SCS'S TYPE 2
    2. RAINFALL DEPTH -                                        1.31 INCHES
    3. STORM DURATION -                                        6.00 HOURS
    4. TIME INCREMENT -                                         .10 HOURS

=====================================================================


===========================  WATERSHED DATA  ==========================

QUESTION
   NO.
    1. NUMBER OF JUNCTIONS - 1
    2. JUNCTION     NUMBER OF BRANCHES
```

1 1
3. COMPUTATION - HYDROLOGY ONLY

==========

========== STRUCTURE INPUT FOR JUNCTION #1 ==========

BRANCH	NUMBER OF STRUCTURES
1	1

==========

========== BETWEEN STRUCTURE ROUTING PARAMETERS ==========

BRANCH NO.	BETWEEN	PARAMETERS 1 TIME	2 MUSK. K	3 MUSK. X,
1	PRIOR J OR S TO STRUCTURE 1	.00	.00	.00

==========

========== STRUCTURE DATA FOR JUNCTION #1 ==========

QUESTION NO.
1. NUMBER OF SUBWATERSHEDS - 1

==========

* *
JUNCTION 1, BRANCH 1, STRUCTURE 1
* *

*** HYDRAULIC INPUT VALUES FOR SUBWATERSHEDS ***

WATER SHED	AREA ACRES	CURVE NUMBER	TC HR	TT HR	ROUTING COEFFICIENTS K-HRS	X,	UNIT HYDRO
1	15.00	75.00	.100	.000	.000	.00	.0

* * * COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS * * *

WATERSHED	PEAK FLOW (CFS)	RUNOFF (INCHES)
1	2.61	.10

***** SUMMARY TABLE FOR TOTAL WATERSHED *****

STORM DURATION	=	6.00	HOURS
PRECIPITATION DEPTH	=	1.31	INCHES
RUNOFF VOLUME	=	.1301	ACRE-FT
PEAK DISCHARGE	=	2.6057	CFS
AREA	=	15.0000	ACRES
TIME OF PEAK DISCHARGE	=	3.00	HRS

*** RUN COMPLETED ****