C- Peak Discharge Summary

Estimated Peak Discharge for Undisturbed Area Bypass Channels from 10-year, 24-hour and 10-year, 6-hour Precipitation Events.

CHANNEL	PEAK FLOW 10-YEAR, 24-HOUR (cfs)	PEAK FLOW 10-YEAR, 6-HOUR (cfs)
UD-1	4.5	.84
UD-2	6.4	.57
UD-3	5.1	.85
UD-4	2.3	.19
UD-5	3.0	.25

See Attached Printouts for Hydrograph output data.

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-1~~ UDD-1

AREA= 6.7 ACRES
AVERAGE BASIN SLOPE= 27.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 700. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0593 HOURS QPCFS= 85.42 CFS QPIN=12.6436 INCHES
C3= 62.3202 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.38	.6649	.0000	.0000	.0	.00
11.40	.6704	.0000	.0000	26.7	.00
11.42	.6758	.0000	.0000	78.6	.00
11.45	.6813	.0000	.0000	79.8	.00
11.47	.6868	.0001	.0000	52.5	.00
11.50	.6923	.0002	.0000	27.2	.01
11.52	.7290	.0011	.0009	12.1	.04
11.54	.7733	.0033	.0022	4.9	.14
11.57	.8177	.0065	.0032	1.8	.34
11.59	.8620	.0108	.0043	.6	.59
11.61	.9063	.0161	.0053	.2	.87
11.64	.9506	.0223	.0062	.0	1.16
11.85	1.3494	.1161	.0134	.0	3.38
11.88	1.3938	.1302	.0141	.0	3.59
11.90	1.4381	.1450	.0148	.0	3.79
11.92	1.4824	.1604	.0154	.0	3.98
11.95	1.5267	.1764	.0160	.0	4.17
11.97	1.5710	.1930	.0166	.0	4.35
12.00	1.6153	.2102	.0172	.0	4.52
12.02	1.6310	.2164	.0062	.0	4.38
12.04	1.6394	.2198	.0034	.0	3.55
12.07	1.6478	.2231	.0034	.0	2.51
12.09	1.6562	.2265	.0034	.0	1.74
12.11	1.6646	.2299	.0034	.0	1.30
12.14	1.6730	.2334	.0034	.0	1.10

HYDROGRAPH PEAK= 4.52 cfs
TIME TO PEAK= 12.00 Hours
RUNOFF VOLUME= .35 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL UDD-1 ~~UD-1~~

AREA= 6.7 ACRES
AVERAGE BASIN SLOPE= 27.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 700. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0593 HOURS QPCFS= 85.42 CFS QPIN=12.6436 INCHES
C3= 62.3202 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6559	.0000	.0000	.0	.00
2.28	.6832	.0000	.0000	26.7	.00
2.31	.7105	.0006	.0005	78.6	.02
2.33	.7378	.0015	.0009	79.8	.07
2.36	.7651	.0028	.0013	52.5	.15
2.38	.7924	.0046	.0017	27.2	.25
2.40	.8197	.0067	.0021	12.1	.36
2.43	.8470	.0093	.0025	4.9	.48
2.45	.8743	.0122	.0029	1.8	.59
2.48	.9016	.0155	.0033	.6	.70
2.50	.9289	.0191	.0037	.2	.81
2.52	.9371	.0203	.0012	.0	.84
2.55	.9444	.0214	.0011	.0	.71
2.57	.9518	.0225	.0011	.0	.54
2.59	.9592	.0236	.0011	.0	.42
2.62	.9666	.0248	.0012	.0	.36
2.64	.9740	.0259	.0012	.0	.34
2.67	.9813	.0271	.0012	.0	.33

HYDROGRAPH PEAK= .84 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .10 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-2~~ JDD-2

AREA= 14.7 ACRES
AVERAGE BASIN SLOPE= 37.0 PERCENT
CURVE NUMBER= 71.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 1900. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1260 HOURS QPCFS= 88.25 CFS QPIN= 5.9534 INCHES
C3= 29.3443 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.56	.8133	.0000	.0000	.0	.00
11.59	.8602	.0005	.0005	4.4	.00
11.61	.9071	.0019	.0015	27.4	.02
11.64	.9540	.0045	.0025	58.6	.08
11.67	1.0010	.0079	.0035	81.0	.21
11.69	1.0479	.0124	.0044	88.2	.42
11.72	1.0948	.0177	.0053	82.7	.72
11.74	1.1417	.0239	.0062	69.8	1.09
11.77	1.1886	.0310	.0071	54.6	1.52
11.79	1.2355	.0389	.0079	40.3	1.98
11.82	1.2824	.0476	.0087	28.4	2.46
11.84	1.3293	.0571	.0095	19.3	2.96
11.87	1.3763	.0674	.0103	12.7	3.46
11.89	1.4232	.0784	.0110	8.1	3.95
11.92	1.4701	.0901	.0117	5.1	4.43
11.94	1.5170	.1024	.0124	3.2	4.91
11.97	1.5639	.1155	.0131	1.9	5.37
11.99	1.6108	.1292	.0137	1.1	5.82
12.02	1.6307	.1352	.0060	.7	6.22
12.04	1.6396	.1379	.0027	.4	6.40
12.07	1.6485	.1407	.0027	.2	6.21
12.09	1.6573	.1434	.0028	.1	5.69
12.12	1.6662	.1462	.0028	.0	4.98
12.14	1.6751	.1490	.0028	.0	4.22
12.17	1.6840	.1518	.0028	.0	3.54
12.19	1.6929	.1547	.0029	.0	2.98

HYDROGRAPH PEAK= 6.40 cfs
TIME TO PEAK= 12.04 Hours
RUNOFF VOLUME= .57 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL UDD-2 ~~UD-2~~

AREA= 14.7 ACRES
AVERAGE BASIN SLOPE= 37.0 PERCENT
CURVE NUMBER= 71.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1900. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1260 HOURS QPCFS= 88.25 CFS QPIN= 5.9534 INCHES
C3= 29.3443 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.39	.8078	.0000	.0000	.0	.00
2.42	.8367	.0000	.0000	4.4	.00
2.44	.8656	.0006	.0005	27.4	.00
2.47	.8945	.0014	.0009	58.6	.02
2.49	.9234	.0027	.0013	81.0	.07
2.52	.9360	.0034	.0007	88.2	.14
2.54	.9438	.0038	.0005	82.7	.22
2.57	.9517	.0043	.0005	69.8	.28
2.60	.9595	.0048	.0005	54.6	.32
2.62	.9673	.0053	.0005	40.3	.33
2.65	.9751	.0059	.0006	28.4	.34
2.67	.9829	.0065	.0006	19.3	.34
2.70	.9907	.0071	.0006	12.7	.33
2.72	.9985	.0077	.0006	8.1	.33
2.75	1.0063	.0084	.0007	5.1	.33
2.77	1.0141	.0091	.0007	3.2	.34
2.80	1.0220	.0098	.0007	1.9	.35
2.82	1.0298	.0105	.0007	1.1	.36
2.85	1.0376	.0113	.0008	.7	.37
2.87	1.0454	.0121	.0008	.4	.39
2.90	1.0532	.0129	.0008	.2	.40
2.92	1.0610	.0138	.0008	.1	.42
2.95	1.0688	.0146	.0009	.0	.43
3.38	1.1783	.0294	.0010	.0	.52
3.40	1.1845	.0304	.0010	.0	.53
3.43	1.1908	.0314	.0010	.0	.54
3.45	1.1970	.0324	.0010	.0	.55
3.48	1.2033	.0334	.0010	.0	.56
3.50	1.2094	.0344	.0010	.0	.57
3.53	1.2136	.0351	.0007	.0	.57
3.55	1.2179	.0359	.0007	.0	.57
3.58	1.2222	.0366	.0007	.0	.56
3.60	1.2265	.0373	.0007	.0	.54
3.63	1.2308	.0381	.0008	.0	.52

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-2~~ UDD-2
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.65	1.2351	.0388	.0008	.0	.50
3.68	1.2394	.0396	.0008	.0	.48

HYDROGRAPH PEAK= .57 cfs
TIME TO PEAK= 3.53 Hours
RUNOFF VOLUME= .14 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-3~~ UDD-3

AREA= 8.1 ACRES
AVERAGE BASIN SLOPE= 32.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 1500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1002 HOURS QPCFS= 61.10 CFS QPIN= 7.4811 INCHES
C3= 36.8746 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.37	.6630	.0000	.0000	.0	.00
11.39	.6676	.0000	.0000	3.1	.00
11.41	.6722	.0000	.0000	19.0	.00
11.43	.6768	.0000	.0000	40.6	.00
11.45	.6815	.0000	.0000	56.1	.00
11.47	.6861	.0001	.0000	61.1	.00
11.49	.6907	.0002	.0000	57.2	.00
11.51	.7093	.0005	.0004	48.3	.00
11.53	.7466	.0019	.0013	37.8	.02
11.55	.7839	.0040	.0021	27.9	.06
11.57	.8213	.0069	.0029	19.7	.13
11.59	.8586	.0105	.0036	13.3	.26
11.61	.8959	.0148	.0043	8.8	.42
11.63	.9333	.0197	.0050	5.6	.63
11.65	.9706	.0254	.0057	3.5	.87
11.67	1.0079	.0317	.0063	2.2	1.12
11.69	1.0453	.0386	.0069	1.3	1.38
11.71	1.0826	.0461	.0075	.8	1.65
11.73	1.1199	.0543	.0081	.5	1.92
11.75	1.1573	.0629	.0087	.3	2.19
11.77	1.1946	.0722	.0092	.2	2.45
11.79	1.2319	.0820	.0098	.0	2.70
11.37	.6630	.0000	.0000	.0	.00
11.39	.6676	.0000	.0000	3.1	.00
11.41	.6722	.0000	.0000	19.0	.00
11.43	.6768	.0000	.0000	40.6	.00
11.45	.6815	.0000	.0000	56.1	.00
11.47	.6861	.0001	.0000	61.1	.00
11.49	.6907	.0002	.0000	57.2	.00
11.51	.7093	.0005	.0004	48.3	.00
11.53	.7466	.0019	.0013	37.8	.02
11.55	.7839	.0040	.0021	27.9	.06
11.57	.8213	.0069	.0029	19.7	.13
11.59	.8586	.0105	.0036	13.3	.26
11.61	.8959	.0148	.0043	8.8	.42

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-3~~ UDD-3
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.63	.9333	.0197	.0050	5.6	.63
11.65	.9706	.0254	.0057	3.5	.87
11.67	1.0079	.0317	.0063	2.2	1.12
11.69	1.0453	.0386	.0069	1.3	1.38
11.71	1.0826	.0461	.0075	.8	1.65
11.73	1.1199	.0543	.0081	.5	1.92
11.75	1.1573	.0629	.0087	.3	2.19
11.77	1.1946	.0722	.0092	.2	2.45
11.79	1.2319	.0820	.0098	.0	2.70
11.81	1.2693	.0923	.0103	.0	2.95
11.83	1.3066	.1031	.0108	.0	3.19
11.85	1.3439	.1144	.0113	.0	3.43
11.87	1.3813	.1262	.0118	.0	3.66
11.89	1.4186	.1384	.0122	.0	3.88
11.91	1.4559	.1511	.0127	.0	4.09
11.93	1.4933	.1642	.0131	.0	4.30
11.95	1.5306	.1778	.0136	.0	4.51
11.97	1.5679	.1918	.0140	.0	4.71
11.99	1.6053	.2062	.0144	.0	4.90
12.01	1.6278	.2151	.0089	.0	5.07
12.03	1.6349	.2179	.0028	.0	5.12
12.05	1.6420	.2208	.0028	.0	4.93
12.07	1.6490	.2236	.0028	.0	4.51
12.09	1.6561	.2265	.0029	.0	3.93
12.11	1.6632	.2293	.0029	.0	3.32
12.13	1.6702	.2322	.0029	.0	2.76
12.15	1.6773	.2351	.0029	.0	2.30

HYDROGRAPH PEAK= 5.12 cfs
TIME TO PEAK= 12.03 Hours
RUNOFF VOLUME= .42 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-3~~ UDD-3

AREA= 8.1 ACRES
AVERAGE BASIN SLOPE= 32.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1002 HOURS QPCFS= 61.10 CFS QPIN= 7.4811 INCHES
C3= 36.8746 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.27	.6612	.0000	.0000	.0	.00
2.29	.6842	.0000	.0000	3.1	.00
2.31	.7072	.0005	.0004	19.0	.00
2.33	.7301	.0012	.0007	40.6	.01
2.35	.7531	.0022	.0010	56.1	.04
2.37	.7761	.0035	.0013	61.1	.08
2.39	.7991	.0051	.0016	57.2	.14
2.41	.8221	.0069	.0019	48.3	.21
2.43	.8451	.0091	.0021	37.8	.30
2.45	.8681	.0115	.0024	27.9	.40
2.47	.8911	.0142	.0027	19.7	.50
2.49	.9141	.0171	.0029	13.3	.61
2.51	.9319	.0196	.0025	8.8	.72
2.53	.9381	.0204	.0009	5.6	.81
2.55	.9444	.0214	.0009	3.5	.85
2.57	.9506	.0223	.0009	2.2	.84
2.59	.9568	.0232	.0009	1.3	.78
2.61	.9630	.0242	.0010	.8	.71
2.63	.9692	.0252	.0010	.5	.63
2.65	.9754	.0262	.0010	.3	.57
2.67	.9816	.0272	.0010	.2	.51
2.69	.9879	.0282	.0010	.0	.48

HYDROGRAPH PEAK= .85 cfs
TIME TO PEAK= 2.55 Hours
RUNOFF VOLUME= .12 Acre-Feet

12/17

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-4~~ UDD-4

AREA= 5.5 ACRES
AVERAGE BASIN SLOPE= 31.0 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 1250. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1012 HOURS QPCFS= 41.12 CFS QPIN= 7.4135 INCHES
C3= 36.5410 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.57	.8296	.0000	.0000	.0	.00
11.59	.8673	.0000	.0000	2.1	.00
11.61	.9050	.0005	.0005	12.8	.00
11.63	.9426	.0017	.0011	27.3	.00
11.65	.9803	.0034	.0018	37.7	.03
11.67	1.0180	.0058	.0024	41.1	.08
11.69	1.0556	.0088	.0030	38.5	.15
11.71	1.0933	.0123	.0035	32.5	.24
11.73	1.1310	.0164	.0041	25.4	.36
11.76	1.1687	.0211	.0047	18.8	.49
11.78	1.2063	.0263	.0052	13.2	.63
11.80	1.2440	.0320	.0057	9.0	.77
11.82	1.2817	.0383	.0062	5.9	.92
11.84	1.3194	.0450	.0067	3.8	1.07
11.86	1.3570	.0522	.0072	2.4	1.22
11.88	1.3947	.0599	.0077	1.5	1.36
11.90	1.4324	.0681	.0082	.9	1.51
11.92	1.4701	.0767	.0086	.5	1.65
11.94	1.5077	.0857	.0091	.3	1.78
11.96	1.5454	.0952	.0095	.2	1.92
11.98	1.5831	.1052	.0099	.1	2.05
12.00	1.6208	.1155	.0103	.0	2.18
12.02	1.6308	.1183	.0028	.0	2.29
12.04	1.6379	.1203	.0020	.0	2.31
12.06	1.6451	.1224	.0020	.0	2.20
12.08	1.6522	.1244	.0021	.0	1.98
12.10	1.6594	.1265	.0021	.0	1.71
12.12	1.6665	.1286	.0021	.0	1.44
12.14	1.6736	.1307	.0021	.0	1.20
12.16	1.6808	.1328	.0021	.0	1.01

HYDROGRAPH PEAK= 2.31 cfs
TIME TO PEAK= 12.04 Hours
RUNOFF VOLUME= .20 Acre-Feet

PROJECT : VALLEY CAMP 10-YR 6-HR PEAK FLOW CHANNEL ~~UD-4~~ UDD-4

AREA= 5.5 ACRES
AVERAGE BASIN SLOPE= 31.0 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1250. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1012 HOURS QPCFS= 41.12 CFS QPIN= 7.4135 INCHES
C3= 36.5410 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.43	.8473	.0000	.0000	.0	.00
2.45	.8705	.0000	.0000	2.1	.00
2.47	.8937	.0003	.0003	12.8	.00
2.49	.9169	.0008	.0005	27.3	.00
2.51	.9327	.0013	.0005	37.7	.02
2.53	.9390	.0015	.0002	41.1	.03
2.55	.9453	.0018	.0002	38.5	.05
2.57	.9516	.0020	.0003	32.5	.06
2.59	.9578	.0023	.0003	25.4	.07
2.61	.9641	.0026	.0003	18.8	.07
2.63	.9704	.0029	.0003	13.2	.07
2.65	.9766	.0032	.0003	9.0	.08
2.67	.9829	.0036	.0003	5.9	.08
2.69	.9892	.0039	.0004	3.8	.08
2.71	.9955	.0043	.0004	2.4	.08
2.73	1.0017	.0047	.0004	1.5	.09
2.75	1.0080	.0051	.0004	.9	.09
2.77	1.0143	.0056	.0004	.5	.09
2.79	1.0206	.0060	.0004	.3	.10
2.81	1.0268	.0065	.0005	.2	.10
2.83	1.0331	.0069	.0005	.1	.11
2.85	1.0394	.0074	.0005	.0	.11
3.40	1.1840	.0232	.0007	.0	.17
3.42	1.1890	.0238	.0007	.0	.18
3.44	1.1940	.0245	.0007	.0	.18
3.46	1.1990	.0253	.0007	.0	.18
3.48	1.2040	.0260	.0007	.0	.18
3.50	1.2090	.0267	.0007	.0	.19
3.52	1.2125	.0272	.0005	.0	.19
3.54	1.2159	.0277	.0005	.0	.19
3.56	1.2194	.0282	.0005	.0	.18
3.58	1.2228	.0288	.0005	.0	.18
3.60	1.2263	.0293	.0005	.0	.17
3.62	1.2297	.0298	.0005	.0	.16

PROJECT : VALLEY CAMP 10-YR 6-HR PEAK FLOW CHANNEL ~~UD-4~~ UDD-4
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.64	1.2332	.0303	.0005	.0	.16

HYDROGRAPH PEAK= .19 cfs
TIME TO PEAK= 3.52 Hours
RUNOFF VOLUME= .04 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 24-HR PEAK FLOW CHANNEL ~~UD-5~~ UDD-5

AREA= 7.2 ACRES
AVERAGE BASIN SLOPE= 28.0 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 2.45 INCHES
STORM DURATION= 24.0 HOURS
HYDRAULIC LENGTH= 1100. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0961 HOURS QPCFS= 56.66 CFS QPIN= 7.8043 INCHES
C3= 38.4674 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
11.57	.8239	.0000	.0000	.0	.00
11.59	.8596	.0000	.0000	2.8	.00
11.61	.8954	.0003	.0003	17.6	.00
11.63	.9312	.0013	.0009	37.6	.00
11.65	.9670	.0027	.0015	52.0	.03
11.67	1.0028	.0048	.0020	56.7	.08
11.69	1.0386	.0074	.0026	53.1	.17
11.70	1.0744	.0105	.0031	44.8	.28
11.72	1.1101	.0141	.0036	35.0	.42
11.74	1.1459	.0182	.0041	25.9	.57
11.76	1.1817	.0229	.0046	18.2	.75
11.78	1.2175	.0280	.0051	12.4	.93
11.80	1.2533	.0335	.0056	8.2	1.11
11.82	1.2891	.0395	.0060	5.2	1.30
11.84	1.3249	.0460	.0065	3.3	1.48
11.86	1.3607	.0529	.0069	2.0	1.67
11.88	1.3964	.0603	.0073	1.2	1.85
11.90	1.4322	.0680	.0078	.7	2.03
11.92	1.4680	.0762	.0082	.4	2.20
11.94	1.5038	.0848	.0086	.3	2.37
11.95	1.5396	.0937	.0090	.1	2.54
11.97	1.5754	.1031	.0093	.0	2.70
11.99	1.6112	.1128	.0097	.0	2.86
12.01	1.6286	.1177	.0049	.0	3.00
12.03	1.6354	.1196	.0019	.0	3.05
12.05	1.6422	.1215	.0019	.0	2.95
12.07	1.6490	.1235	.0019	.0	2.69
12.09	1.6558	.1254	.0020	.0	2.35
12.11	1.6625	.1274	.0020	.0	1.99
12.13	1.6693	.1294	.0020	.0	1.66
12.15	1.6761	.1314	.0020	.0	1.39

HYDROGRAPH PEAK= 3.05 cfs
TIME TO PEAK= 12.03 Hours
RUNOFF VOLUME= .26 Acre-Feet

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-5~~ UDD-5

AREA= 7.2 ACRES
AVERAGE BASIN SLOPE= 28.0 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1100. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0961 HOURS QPCFS= 56.66 CFS QPIN= 7.8043 INCHES
C3= 38.4674 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.42	.8401	.0000	.0000	.0	.00
2.44	.8622	.0000	.0000	2.8	.00
2.46	.8842	.0002	.0002	17.6	.00
2.48	.9063	.0006	.0004	37.6	.00
2.50	.9283	.0012	.0006	52.0	.02
2.52	.9355	.0014	.0002	56.7	.03
2.54	.9415	.0016	.0002	53.1	.06
2.56	.9474	.0019	.0002	44.8	.08
2.58	.9534	.0021	.0003	35.0	.09
2.59	.9593	.0024	.0003	25.9	.09
2.61	.9653	.0027	.0003	18.2	.10
2.63	.9713	.0030	.0003	12.4	.10
2.65	.9772	.0033	.0003	8.2	.10
2.67	.9832	.0036	.0003	5.2	.10
2.69	.9891	.0039	.0003	3.3	.11
2.71	.9951	.0043	.0004	2.0	.11
2.73	1.0010	.0047	.0004	1.2	.11
2.75	1.0070	.0051	.0004	.7	.12
2.77	1.0130	.0055	.0004	.4	.12
2.79	1.0189	.0059	.0004	.3	.13
2.81	1.0249	.0063	.0004	.1	.13
2.83	1.0308	.0068	.0004	.0	.14
3.40	1.1847	.0233	.0006	.0	.23
3.42	1.1894	.0239	.0007	.0	.23
3.44	1.1942	.0246	.0007	.0	.23
3.46	1.1990	.0252	.0007	.0	.24
3.48	1.2037	.0259	.0007	.0	.24
3.50	1.2085	.0266	.0007	.0	.24
3.52	1.2119	.0271	.0005	.0	.25
3.54	1.2152	.0276	.0005	.0	.25
3.56	1.2185	.0281	.0005	.0	.24
3.57	1.2218	.0286	.0005	.0	.23
3.59	1.2250	.0291	.0005	.0	.22
3.61	1.2283	.0296	.0005	.0	.21

PROJECT : VALLEY CAMP 10-YR, 6-HR PEAK FLOW CHANNEL ~~UD-5~~ UDD-5
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.63	1.2316	.0301	.0005	.0	.21

HYDROGRAPH PEAK= .25 cfs
TIME TO PEAK= 3.52 Hours
RUNOFF VOLUME= .06 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE: UNDISTURBED DITCHES
PROJECT NO.:

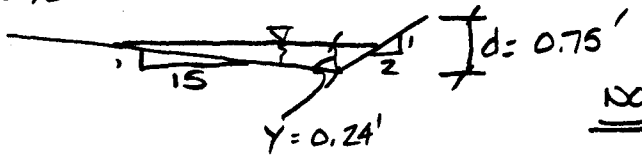
SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 2 MAY 89

UDD-1

ALL DESIGNS TO BE COMPLETED ACCORDING TO 30CFR REQUIREMENT OF A 10-YR-6HR EVENT AND AS PENDING IN NEW UTAH REG'S.

COMPUTER CALC'S SHOWN ON ATTACHED SHEETS (SHEET 2)

$S_{min} = 2\%$ $\eta = .03$ $M_1 = 15$ freeboard = 0.5'
$S_{max} = 20\%$ (field) $b = 0$ $M_2 = 2$
30% (off Map)
$Q_{design} = 0.84$ cfs



NO LINING REQ'd

UDD-2

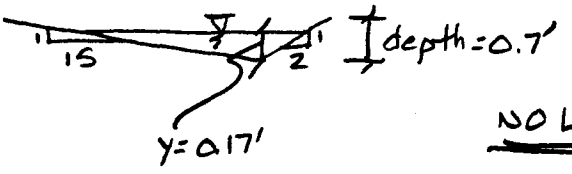
$Q_{design} = 0.57$ cfs

Try Triangular Section. $b = 0$ $S_{min} = 7\%$ > from Mapping
$\eta = .03$ $S_{max} = 23\%$ >
$M_1 = M_2 = 2$ freeboard = 0.5'

Velocity Check on Sheet 3 Shows vel > 5.0'

Change to Road Style design - (SHEET 3)

$b = 0$ $\eta = .03$
$M_1 = 15$ $S_{min} = 0.07$
$M_2 = 2$ $S_{max} = 0.23$

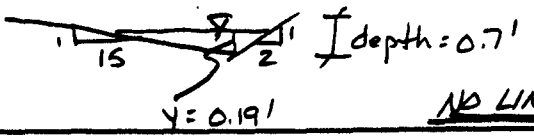


NO LINING REQ'd

UDD-3 $Q_{design} = 0.85$ cfs

$S_{min} = 7\%$ > from Mapping $b = 0$ freeboard = 0.5'
$S_{max} = 20\%$ < $M_1 = 15$
$M_2 = 2$

Use Road Style Design (SHEET 4)



NO LINING REQ'd

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	03-May-89
Project No.:	007.11.100	Time:	10:13 AM
Channel Section:	UDD-1 - Trial 1	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.84	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.30	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.24	feet
	Qn/1.49(S)1/2=	0.120	
	A(R)2/3=	0.119	
	Required Depth:	0.74	feet
	Area:	0.49	ft2
	Perimeter:	4.16	feet
	Hydraulic Radius:	0.12	feet
	Velocity:	1.70	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.15	feet
	Qn/1.49(S)1/2=	0.031	
	A(R)2/3=	0.031	
	Required Depth:	0.65	feet
	Area:	0.18	ft2
	Perimeter:	2.50	feet
	Hydraulic Radius:	0.07	feet
	Velocity:	4.70	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.30	ft/ft
	Channel Depth:	0.74	feet
	Riprap:	Not Needed	

Comment:

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company — Date: 02-May-89
Project No.: 007.11.100 — Time: 02:39 PM
Channel Section: UDD-2 - Trail 2 — Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.57	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.07	ft/ft
	Max. Bottom Slope:	0.23	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.043	
	A(R)2/3=	0.043	
	Required Depth:	0.67	feet
	Area:	0.23	ft2
	Perimeter:	2.85	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	2.46	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.13	feet
	Qn/1.49(S)1/2=	0.024	
	A(R)2/3=	0.023	
	Required Depth:	0.63	feet
	Area:	0.14	ft2
	Perimeter:	2.25	feet
	Hydraulic Radius:	0.06	feet
	Velocity:	3.97	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:

Side Slope 1:	15.0	1/m1
Side Slope 2:	2.0	1/m2
Min. Bottom Slope:	0.07	ft/ft
Max. Bottom Slope:	0.23	ft/ft
Channel Depth:	0.7	feet
Riprap:	Not Needed	

Comment: Channel Velocities < 5.0 fsp.
Design OK

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company — Date: 02-May-89
Project No.: 007.11.100 — Time: 03:33 PM
Channel Section: UDD-3 - Trial 1 — Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.85	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.07	ft/ft
	Max. Bottom Slope:	0.20	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.19	feet
	Qn/1.49(S)1/2=	0.065	
	A(R)2/3=	0.065	
	Required Depth:	0.69	feet
	Area:	0.31	ft2
	Perimeter:	3.32	feet
	Hydraulic Radius:	0.09	feet
	Velocity:	2.71	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.16	feet
	Qn/1.49(S)1/2=	0.038	
	A(R)2/3=	0.038	
	Required Depth:	0.66	feet
	Area:	0.21	ft2
	Perimeter:	2.71	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	4.06	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.07	ft/ft
	Max. Bottom Slope:	0.20	ft/ft
	Channel Depth:	0.69	feet
	Riprap:	Not Needed	

Comment: Build channel on existing scar

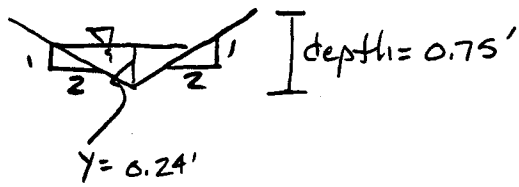
UDD-4

Qdesign = 0.19 cfs

b = 0
$M_1 = M_2 = 2$

$S_{min} = 2\%$, $S_{max} = 13\%$ } From Mapping

USE DITCH STYLE DESIGN (SHEET 6)



NO LINING REQ'd

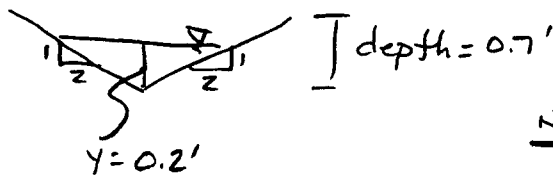
UDD-5

Qdesign = 0.25 cfs

b = 0
$M_1 = M_2 = 2$

$S_{min} = 12\%$, $S_{max} = 25\%$ } From Mapping

USE DITCH STYLE DESIGN (SHEET 7)



NO LINING REQ'd

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	02-May-89
Project No.:	007.11.100	Time:	03:41 PM
Channel Section:	UDD-4 - Trial 1	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.19	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.13	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.24	feet
	Qn/1.49(S)1/2=	0.027	
	A(R)2/3=	0.027	
	Required Depth:	0.74	feet
	Area:	0.12	ft2
	Perimeter:	1.08	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	1.62	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.18	feet
	Qn/1.49(S)1/2=	0.011	
	A(R)2/3=	0.011	
	Required Depth:	0.68	feet
	Area:	0.06	ft2
	Perimeter:	0.78	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	3.10	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.13	ft/ft
	Channel Depth:	0.74	feet
	Riprap:	Not Needed	

Comment:

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	02-May-9[illegible]
Project No.:	007.11.100	Time:	03:56 P[illegible]
Channel Section:	UDD-5 - Trial 1	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.25	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.12	ft/ft
	Max. Bottom Slope:	0.25	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.20	feet
	Qn/1.49(S)1/2=	0.015	
	A(R)2/3=	0.015	
	Required Depth:	0.70	feet
	Area:	0.08	ft2
	Perimeter:	0.87	feet
	Hydraulic Radius:	0.09	feet
	Velocity:	3.29	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.010	
	A(R)2/3=	0.010	
	Required Depth:	0.67	feet
	Area:	0.06	ft2
	Perimeter:	0.76	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	4.33	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.12	ft/ft
	Max. Bottom Slope:	0.25	ft/ft
	Channel Depth:	0.70	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit Response
FEATURE
PROJECT NO. 007.11.200

SHEET 1 OF 2
COMPUTED DEH
CHECKED
DATE 2 NOV 81

SAE's

SAE's Changed to ASCA's according to new DOGM Policy clarification.

ASCA #3 is dropped. Area has been added to Pond 3

AREA OF ASCA #3: 0.1 ac

TOTAL AREA CONTAINED BY PONDS = 62.83 ac

POND	AREA
001A	11.53
2A	7.12
3A	7.08
4A	37.10
	62.83 ac

$Q(in) = \frac{(P-0.2S)^2}{P+0.8S}$

$CN = \frac{1000}{10+S}$

TRIBUTARY AREA FOR ASCA's

ASCA #	AREA Paved	Disturbed	Sage/Grass	Forest	TOTAL
1	—	1.13	—	—	1.13
2	0.11	1.00	—	—	1.11
3	0.75	0.87	—	0.5	2.12
4	—	0.19	—	—	0.19
5	—	1.16	—	—	1.16
6	—	0.95	—	—	0.95

Curve Numbers:

PAVED = 98
DISTURBED = 90
SAGE/GRASS = 75
FOREST = 70

$P_{10YR-24HR} = 2.45$ in

VOL = Q * AREA
Q = .245 Runoff Depth

ASCA #	Paved Area Q(in)	Vol(AF)	Dist. Area Q(in)	Vol(AF)	Sage/Grass Q(in)	Vol(AF)	Forest Area Q(in)	Vol(AF)	Runoff Vol (Ac-Ft)
1	2.22	—	1.49	0.14	—	—	—	—	0.14
2	2.22	0.02	1.49	0.12	—	—	—	—	0.14
3	2.22	0.14	1.49	0.11	—	—	0.43	0.02	0.27
4	2.22	—	1.49	0.02	—	—	—	—	0.02
5	2.22	—	1.49	0.14	—	—	—	—	0.14
6	2.22	—	1.49	0.12	—	—	—	—	0.12

C-13-24

Tributary Ditch D-13A $Q_{TOT} = 0.60$ cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 30\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 67.1$ cfs >> Q_{TOT} ✓

Pipe Flow Not Limiting

Check Inlet Conditions

- HW = 3.0'

$\frac{HW}{D} = 1.5$

From Chart 5-
Assume projecting Inlet

$Q_{HW} = 18$ cfs >> Q_{TOT} ✓

Inlet Control Not Limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.018$, $y = 0.14'$, $v = 0.21$ fps > 5.0

Q < 2.0 fps - off EPA Chart - If erosion becomes a problem, use:

$d_{50} = 0.25'$
$L = 5'$

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-14-42
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/18/89

C-14-42 (Permanent structure - Portion beneath Railroad to remain under RR Control. Design shown in Reclamation Plan)

Tributary Area = 173 * 1.401 = 242 Acres
90% Cover Oak/Aspen = 123 ac
25% Cover Sage/Grass = 119 ac

Ground cover taken by assuming that all North facing, and south facing slopes are characteristic.

North facing - 90% Oak/Aspen CN = 70
South facing - 25% Sage/Grass CN = 75

CN	A	Q
70	123	0.34
75	119	0.51

$\bar{Q} = 0.42$ $\bar{CN} = 72.5$

Precipitation = 2.25" (100yr, 6hr)

hydraulic length. 5000 feet

$$\text{slope} = \frac{(10{,}000)(400)(100)}{43{,}560\ (242)} = 37.9\%$$

Calculated Run-Off $Q_{TOT} = 52.3$ cfs

Check Pipe Flow

- D = 42"
- n = 0.024
- S = 3% min

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 94.4$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe Flow not limiting

Check Inlet Control

HW depth = 6.5' $\frac{HW}{D} = 1.86$ assume proj entrance

from Chart 5

$Q_{HW} = 90.0$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet Control not limiting

PROJECT : Valley Camp Coal. 007.11.200 Culvert C-14-42

AREA= 242.0 ACRES
AVERAGE BASIN SLOPE= 37.9 PERCENT
CURVE NUMBER= 72.5
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 5000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .2590 HOURS QPCFS= 706.62 CFS QPIN= 2.8957 INCHES
C3= 14.2729 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.12	.7236	.0000	.0000	.0	.00
2.18	.8098	.0007	.0007	35.5	.02
2.23	.8961	.0048	.0041	219.5	.30
2.28	.9823	.0125	.0077	469.1	1.50
2.33	1.0685	.0234	.0110	648.7	4.44
2.38	1.1548	.0375	.0141	706.6	9.65
2.43	1.2410	.0544	.0170	661.9	17.15
2.49	1.3273	.0741	.0197	558.7	26.64
2.54	1.3672	.0841	.0100	437.0	37.16
2.59	1.3905	.0902	.0061	322.5	46.14
2.64	1.4138	.0965	.0063	227.3	51.27
2.69	1.4371	.1029	.0064	154.3	52.25
2.75	1.4604	.1096	.0066	101.6	50.25
2.80	1.4837	.1164	.0068	65.2	46.80
2.85	1.5070	.1233	.0070	41.0	43.12
2.90	1.5303	.1305	.0071	25.2	39.93
2.95	1.5536	.1378	.0073	15.3	37.51
3.00	1.5766	.1451	.0073	9.1	35.89
3.06	1.5952	.1512	.0061	5.4	34.88
3.11	1.6139	.1574	.0062	3.1	34.13
3.16	1.6325	.1636	.0063	1.8	33.37
3.21	1.6512	.1700	.0064	1.0	32.60
3.26	1.6698	.1765	.0065	.6	31.89
3.32	1.6885	.1831	.0066	.3	31.33
3.37	1.7071	.1897	.0067	.2	30.97
3.42	1.7257	.1965	.0068	.1	30.79
3.47	1.7444	.2033	.0069	.0	30.79

HYDROGRAPH PEAK= 52.25 cfs
TIME TO PEAK= 2.69 Hours
RUNOFF VOLUME= 8.42 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.200

SHEET 2 OF
COMPUTED DEH
CHECKED
DATE 8/14/90

C-14-42 - (Continued)

Riprap Check

According to EPA, Fig 1-15,

$d_{50} \approx 0.5$ ft

$L \approx 10$ ft

PROJECT : Valley Camp Coal - C-14-42 Runoff Calculation

AREA= 242.0 ACRES
AVERAGE BASIN SLOPE= 37.9 PERCENT
CURVE NUMBER= 67.5
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 5000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .2965 HOURS QPCFS= 617.23 CFS QPIN= 2.5294 INCHES
C3= 12.4672 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.25	.9395	.0000	.0000	.0	.00
2.31	1.0382	.0012	.0012	31.0	.04
2.37	1.1370	.0061	.0049	191.7	.37
2.43	1.2357	.0146	.0086	409.8	1.68
2.49	1.3345	.0266	.0120	566.6	4.68
2.55	1.3725	.0321	.0055	617.2	9.47
2.61	1.3992	.0362	.0041	578.2	14.64
2.67	1.4259	.0406	.0044	488.0	18.65
2.73	1.4525	.0452	.0046	381.7	20.97
2.79	1.4792	.0500	.0048	281.7	21.85
2.85	1.5059	.0550	.0050	198.5	21.88
2.91	1.5326	.0603	.0052	134.8	21.58
2.97	1.5593	.0657	.0055	88.8	21.27
3.02	1.5838	.0709	.0052	57.0	21.11
3.08	1.6051	.0756	.0047	35.8	21.08
3.14	1.6265	.0804	.0048	22.0	21.04
3.20	1.6478	.0853	.0049	13.4	20.92
3.26	1.6692	.0903	.0050	8.0	20.76
3.32	1.6905	.0955	.0052	4.7	20.63
3.38	1.7119	.1008	.0053	2.7	20.58
3.44	1.7332	.1062	.0054	1.6	20.65
3.50	1.7546	.1118	.0055	.9	20.82
3.56	1.7694	.1157	.0039	.5	21.03
3.62	1.7841	.1196	.0039	.3	21.03
3.68	1.7987	.1236	.0040	.2	20.68
3.74	1.8134	.1277	.0040	.0	20.07

HYDROGRAPH PEAK= 21.88 cfs
TIME TO PEAK= 2.85 Hours
RUNOFF VOLUME= 5.46 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-15-24
PROJECT NO. 007-11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-15-24

Tributary Flow = D-15

$Q_{TOT} = 1.57$ cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 5\%$

$Q_{allow} = \frac{1.49}{n} AR^{2/3} S^{1/2}$

$Q_{allow} = 27.4$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

- HW depth = 3.2' $\frac{HW}{D} = 1.6$

Use Chart 5 Assume projecting entrance

$Q_{HW} = 18.5$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet Control not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.113$, $y = 0.32$, $V = 4.8$ fps < 5.0

NO LINING REQ'd

C-16-24

Tributary Culvert C-15-24 Q_{TOT} = 1.57 cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 10\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Q_{allow} = 38.7 cfs >> Q_{TOT} ok

Pipe Flow not limiting

Check Inlet Conditions

- HW = 1.0'

$\frac{HW}{D} = 0.5$

From Chart 5
Assuming projecting Inlet

Q_{HW} = 3.8 cfs > Q_{TOT} ok

Inlet Conditions not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.080$, $y = 0.28$, $v = 5.87$ fps > 5.0

Q < 2 cfs off EPA Chart - If erosion becomes a problem, the following riprap could be installed.

$d_{50} = 0.5''$ (min)
L = 5'

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 6/30/89

C-17-21 + C-18-21

Tributary Ditches D18A, D18B } $Q_{TOT} = 0.59 + 0.47 = 1.06$ cfs

Check Pipe Flow

- 21" CMP
- $n = 0.024$
- $S = 1\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 8.6$ cfs $> Q_{TOT}$ ✓

Pipe Flow not limiting

Check Inlet Conditions

- $HW = 1.75'$

$\frac{HW}{D} = 1.0$

From Chart 5
Assume projecting Inlet

$Q_{HW} = 8$ cfs $> Q_{TOT}$ ✓

Inlet Conditions not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.171$, $y = 0.42$, $V = 2.4$ fps < 5.0

NO LINING REQ'd

HANSEN ALLEN & LUCE INC

CLIENT: Valley Group
PROJECT: Pehmit
FEATURE: C-20-48, C-19-48
PROJECT NO.: 007.11.100

SHEET ___ OF ___
COMPUTED: Paul
CHECKED: ___
DATE: 5/16/89

C-20-48, C-19-48

Total Area = 1060 * 1.401 = 1485 acres
90% cover Oak/Aspen = 761 acres
25% cover sage/grass = 724 acres

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 16,600 feet

$$\text{slope} = \frac{(63,500)(400)(100)}{43,560\,(1485)} = 39.3\%$$

CN	Area	Q
70	761	0.096
75	724	0.185
		$\bar{Q} = 0.14$

$\bar{CN}_{10} = 72.6$

Calculated Run-off $Q_{TOT_{10yr}} = 160.7$ cfs

NOT APPLICABLE

For a 100 year, 6 hr

$P_{100} = 2.25$ inches

CN	A	Q
70	761	0.342
75	724	0.510
		$\bar{Q} = 0.424$

$\bar{CN}_{100} = 72.6$

Calculated Run-off $Q_{TOT_{100yr}} = 210.0$ cfs

Riprap Check from EPA, Fig 1-15,

$d_{50_{10yr}} = 0.5'$, $L_a \leq 10'$

Recommendations

Culvert C-19-48 - Disturb and install Riprap only if erosion is occuring.

Culvert C-20-48 - Install riprap only if active erosion is noted, or remove the culvert

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-19-48
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-19-48 - Road + Culvert to be donated to Adjacent Property owner.

Culvert Analysis

$S = 6\%$
$n = 0.024$
48" CMP

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 190.6 cfs$ OK

since $Q_{allow} > Q_{TOT}$ ~~Pipe flow~~ open channel not limiting

check Inlet Control

HW depth = 8.5'

assume projecting entrance using chart 5

$\frac{HW}{D} = \frac{8.5'}{4} = 2.1$

$Q_{HW} = 130 cfs$ OK

since $Q_{HW} > Q_{TOT}$ Inlet control not limiting for either the 10yr or 100yr Events

C-20-48 - Road + Culvert to be donated to Adjacent Property owner.

Culvert Analysis

$S = 4\%$
$n = 0.024$
48" CMP

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 155.6 cfs$ OK

Since $Q_{allow} > Q_{TOT}$ ~~Pipe flow~~ open channel not limiting

Check Inlet Control

HW depth = 9.0'

assume projecting entrance using chart 5

$\frac{HW}{D} = 2.25$

$Q_{HW} = 140 cfs$ OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting for either the 10yr or 100yr Events

PROJECT : Valley Camp Coal. 007.11.200 Culverts C-19-48, C-20-48

AREA= 1485.0 ACRES
AVERAGE BASIN SLOPE= 39.3 PERCENT
CURVE NUMBER= 72.6
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 16600. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .6624 HOURS QPCFS= 1695.40 CFS QPIN= 1.1322 INCHES
C3= 5.5807 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.25	.6457	.0000	.0000	.0	.00
2.38	.7977	.0005	.0005	85.1	.04
2.52	.9353	.0082	.0078	526.6	.91
2.65	.9764	.0123	.0040	1125.5	4.97
2.78	1.0174	.0171	.0048	1556.4	12.02
2.91	1.0585	.0226	.0055	1695.4	20.44
3.05	1.0967	.0284	.0058	1588.2	29.02
3.18	1.1295	.0338	.0054	1340.6	37.03
3.31	1.1624	.0397	.0059	1048.5	43.95
3.44	1.1952	.0460	.0063	773.7	49.69
3.58	1.2221	.0515	.0055	545.3	54.40
3.71	1.2447	.0563	.0048	370.3	57.93
3.84	1.2673	.0613	.0050	243.9	59.98
3.97	1.2899	.0664	.0052	156.5	60.71
4.11	1.3108	.0714	.0050	98.3	60.60
4.24	1.3313	.0764	.0050	60.6	60.04
4.37	1.3519	.0816	.0052	36.7	59.34
4.50	1.3723	.0868	.0053	21.9	58.74
4.64	1.3887	.0912	.0043	12.9	58.29
4.77	1.4051	.0956	.0044	7.5	57.71
4.90	1.4216	.1001	.0045	4.4	56.81
5.03	1.4380	.1047	.0046	2.5	55.71
5.17	1.4544	.1094	.0047	1.4	54.65
5.30	1.4708	.1142	.0048	.8	53.83
5.43	1.4873	.1190	.0049	.4	53.33
5.56	1.5027	.1237	.0046	.2	53.16
5.70	1.5171	.1281	.0044	.1	53.13
5.83	1.5315	.1325	.0045	.0	53.01

HYDROGRAPH PEAK= 60.71 cfs
TIME TO PEAK= 3.97 Hours
RUNOFF VOLUME= 16.96 Acre-Feet

PROJECT : Valley Camp Coal - C-19-48, C-20-48 100Yr, 6Hr Runoff Calc

AREA= 1485.0 ACRES
AVERAGE BASIN SLOPE= 39.3 PERCENT
CURVE NUMBER= 72.6
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 16600. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .6624 HOURS QPCFS= 1695.40 CFS QPIN= 1.1322 INCHES
C3= 5.5807 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.12	.7168	.0000	.0000	.0	.00
2.25	.9373	.0084	.0084	85.1	.72
2.38	1.1579	.0389	.0305	526.6	7.03
2.52	1.3577	.0830	.0441	1125.5	29.28
2.65	1.4173	.0989	.0159	1556.4	72.00
2.78	1.4769	.1160	.0170	1695.4	121.21
2.91	1.5365	.1341	.0182	1588.2	162.15
3.05	1.5919	.1520	.0178	1340.6	189.52
3.18	1.6396	.1680	.0161	1048.5	204.46
3.31	1.6873	.1848	.0167	773.7	210.00
3.44	1.7350	.2021	.0173	545.3	209.74
3.58	1.7740	.2167	.0146	370.3	206.67
3.71	1.8068	.2293	.0126	243.9	201.79
3.84	1.8396	.2422	.0129	156.5	194.94
3.97	1.8724	.2553	.0131	98.3	186.62
4.11	1.9028	.2677	.0124	60.6	177.97
4.24	1.9326	.2801	.0124	36.7	169.80
4.37	1.9624	.2927	.0126	21.9	162.57
4.50	1.9920	.3054	.0127	12.9	156.63
4.64	2.0159	.3158	.0104	7.5	151.91
4.77	2.0397	.3263	.0105	4.4	147.51
4.90	2.0636	.3370	.0106	2.5	142.85
5.03	2.0874	.3477	.0108	1.4	138.12
5.17	2.1113	.3586	.0109	.8	133.79
5.30	2.1351	.3696	.0110	.4	130.26
5.43	2.1589	.3807	.0111	.2	127.70
5.56	2.1814	.3913	.0106	.1	126.04
5.70	2.2022	.4012	.0099	.0	124.84

HYDROGRAPH PEAK= 210.00 cfs
TIME TO PEAK= 3.31 Hours
RUNOFF VOLUME= 52.14 Acre-Feet

C-21-48 IF TEMPORARY STRUCTURE

FLOW TRIBUTARY
TOTAL AREA = 1479 * 1.401 = 2072 ac
90% OAK ASPEN 645 904
25% SAGE GRASS 834 1168

ASSUMING THAT NORTH & SOUTH FACING SLOPES ARE CHARACTERISTICALLY:

NORTH FACING 90% COVER OAK/ASPEN (CN = 70)
SOUTH FACING 25% COVER SAGE/GRASS (CN = 75)

CN	A	Q
70	904	0.10
75	1168	0.19
		$\bar{Q} = 0.15$

$\bar{CN} = 73$

PRECIPITATION = 1.55 inches (10 YR, 6 HR)

HYD. LENGTH = 12,000 ft

SLOPE = $\frac{(78{,}000)(400)(100)}{43{,}560\ (2072)} = 34.6\%$ $Q = 92.6$ cfs

CHECK PIPE FLOW

- D = 48"
- n = 0.024
- S = 1%

$Q = \frac{1.49}{n} AR^{2/3} S^{1/2} = 77.81$ cfs < 92.6 - Add Avail Head (33'-4=29' Available)

$S_f = \frac{29 + 0.01(250)}{250} = 0.126$

$Q = \frac{1.49}{n} AR^{2/3} (.126)^{1/2} = 276$ cfs >> 92.6 ok

CHECK INLET FLOW (USING "HYDRAULICS CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS")

PIPE LENGTH = 250 ft
HW DEPTH = 33 ft HW/D = 8.25 HW/D = 6.0 (Max Shown on Chart)

Q = 215 cfs - ok
L for HW/D = 6.0

PIPE IS ADEQUATE

PROJECT : Valley Camp Coal - C-21-~~52~~ 48 Runoff Calculation - TEMPORARY STRUCTURE

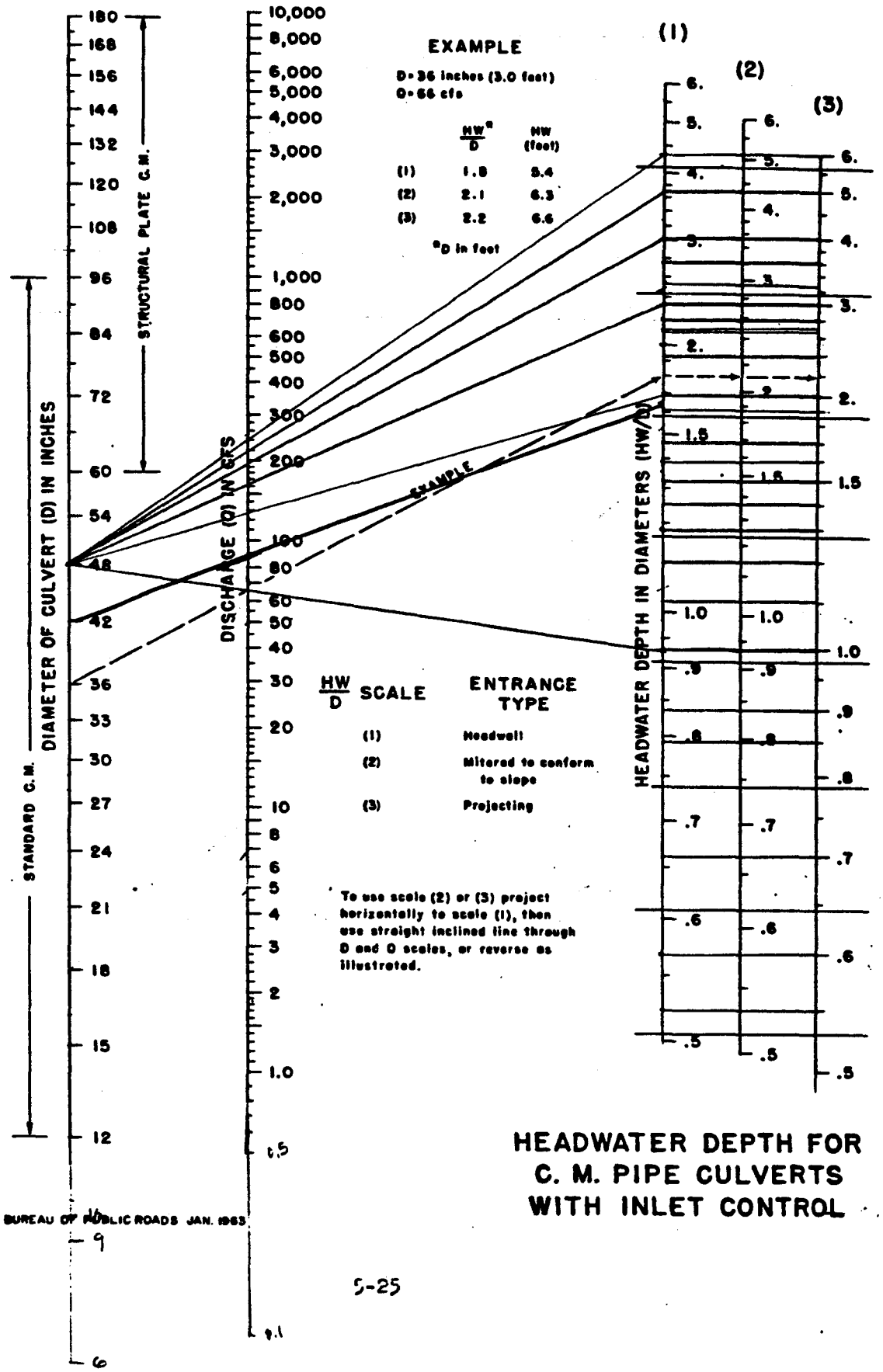
AREA= 2072.0 ACRES
AVERAGE BASIN SLOPE= 34.6 PERCENT
CURVE NUMBER= 73.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 12000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .5385 HOURS QPCFS= 2909.81 CFS QPIN= 1.3927 INCHES
C3= 6.8646 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6567	.0000	.0000	.0	.00
2.37	.7802	.0004	.0004	146.0	.06
2.48	.9038	.0070	.0065	903.8	1.35
2.58	.9563	.0120	.0050	1931.7	7.48
2.69	.9897	.0158	.0038	2671.2	18.87
2.80	1.0231	.0202	.0043	2909.8	32.51
2.91	1.0565	.0250	.0048	2725.7	45.63
3.02	1.0889	.0301	.0051	2300.8	57.15
3.12	1.1156	.0347	.0046	1799.6	66.87
3.23	1.1423	.0395	.0048	1327.9	74.59
3.34	1.1690	.0446	.0051	935.9	80.44
3.45	1.1957	.0500	.0054	635.6	84.97
3.55	1.2182	.0548	.0048	418.6	88.70
3.66	1.2366	.0588	.0040	268.7	91.43
3.77	1.2550	.0630	.0042	168.7	92.56
3.88	1.2733	.0673	.0043	103.9	92.13
3.98	1.2917	.0717	.0044	63.0	90.73
4.09	1.3086	.0758	.0042	37.6	89.06
4.20	1.3253	.0800	.0042	22.2	87.45
4.31	1.3420	.0843	.0043	12.9	86.02
4.42	1.3587	.0887	.0044	7.5	84.91
4.52	1.3747	.0930	.0043	4.3	84.21
4.63	1.3880	.0967	.0037	2.4	83.75
4.74	1.4014	.1004	.0037	1.4	83.00
4.85	1.4147	.1042	.0038	.8	81.73
4.95	1.4281	.1080	.0038	.4	80.14
5.06	1.4414	.1119	.0039	.2	78.58
5.17	1.4548	.1158	.0039	.1	77.31
5.28	1.4681	.1199	.0040	.0	76.47

HYDROGRAPH PEAK= 92.56 cfs
TIME TO PEAK= 3.77 Hours
RUNOFF VOLUME= 24.68 Acre-Feet

CHART 5



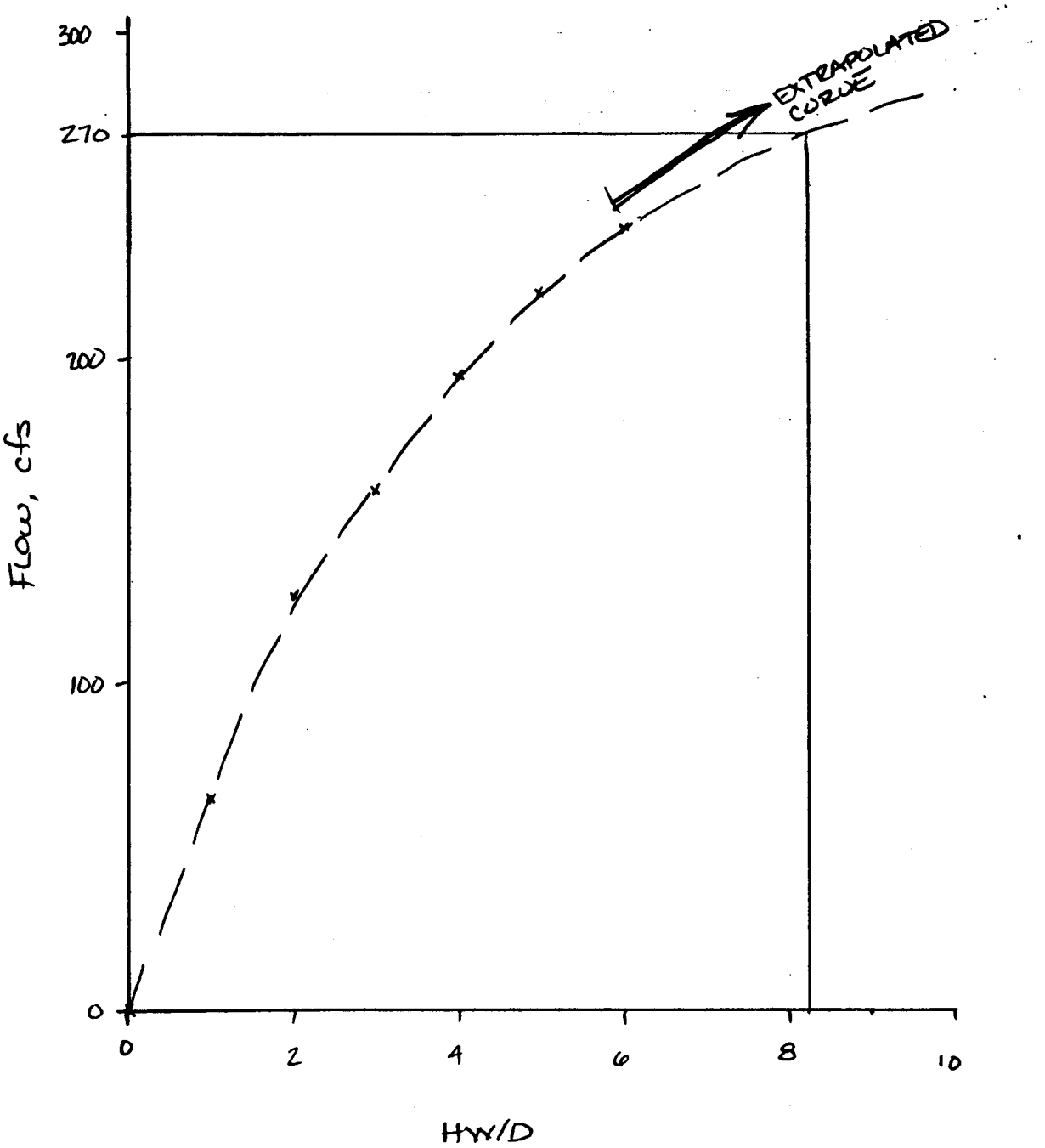
HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

HANSEN ALLEN & LUCE INC

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE:
PROJECT NO.: 007.11.200

SHEET 4 OF 7
COMPUTED: DEH
CHECKED:
DATE: 3AUG90

FLOW UNDER INLET CONDITIONS



C-21-48 IF PERMANENT STRUCTURE

Precip = 2.25 in (100 yr, 6 Hr)

Q = 330.8 cfs Neither Pipe nor Inlet Conditions will allow his amount of flow.

Extrapolating Inlet flow Curve gives @

$HW/D_{max} = 8.25$ gives $Q \sim 270$ cfs

Pipe flow$_{max}$ = 276 cfs > 270 Inlet Control Governs

Excess flow must go over road.

331 − 270 = 61 cfs.

Use broad crested weir to calculate flow depth. Dimensions are approximate.

From 1:100 Scale Mapping, available channel depth + width data is:

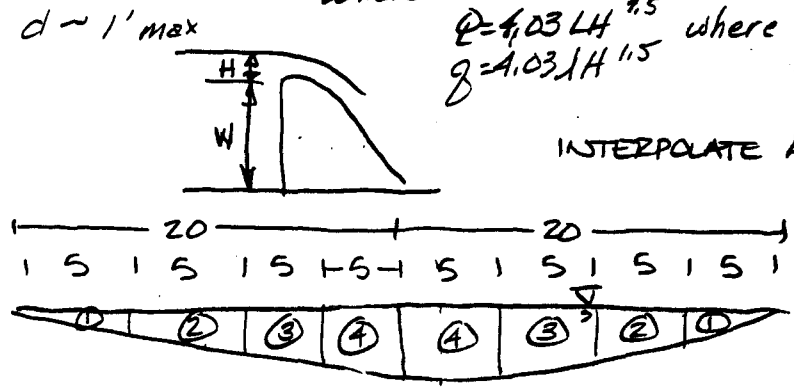
W ~ 40'
b ~ 0
d ~ 1' max

.. Weir will act much like a spillway. where

$Q = 4.03\,LH^{1.5}$ where $\frac{W}{H} \geq 1.33$

$q = 4.03\,H^{1.5}$

INTERPOLATE ANSWER



depth = 0.125 0.375 0.625 0.875 ...

Calc q for ½ width

Area	Width	depth	q
1	5	.125	0.891
2	5	.375	4.627
3	5	.625	9.956
4	5	.875	16.493

Σ 31.967 * 2 = 63.9 cfs ~ 61 cfs REQ'd

FLOW WILL PASS AT APPROX 1.0' DEPTH

270 + 63.9 = 333.9 cfs TOTAL > 330 cfs REQUIRED

PROJECT : Valley Camp Coal - C-21-48 Runoff Calculation - PERMANENT STRUCTURE

97

AREA= 2072.0 ACRES
AVERAGE BASIN SLOPE= 34.6 PERCENT
CURVE NUMBER= 73.0
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 12000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .5385 HOURS QPCFS= 2909.81 CFS QPIN= 1.3927 INCHES
C3= 6.8646 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.05	.5946	.0000	.0000	.0	.00
2.15	.7740	.0003	.0003	146.0	.05
2.26	.9533	.0117	.0113	903.8	1.94
2.37	1.1326	.0377	.0261	1931.7	14.66
2.48	1.3119	.0767	.0389	2671.2	52.00
2.58	1.3882	.0967	.0201	2909.8	119.69
2.69	1.4366	.1105	.0138	2725.7	198.86
2.80	1.4851	.1250	.0145	2300.8	264.83
2.91	1.5336	.1403	.0153	1799.6	306.57
3.02	1.5806	.1558	.0155	1327.9	326.21
3.12	1.6194	.1690	.0133	935.9	330.82
3.23	1.6582	.1827	.0137	635.6	326.11
3.34	1.6969	.1968	.0141	418.6	316.62
3.45	1.7357	.2113	.0145	268.7	306.03
3.55	1.7684	.2238	.0125	168.7	296.57
3.66	1.7951	.2343	.0104	103.9	287.74
3.77	1.8217	.2449	.0106	63.0	277.68
3.88	1.8484	.2557	.0108	37.6	266.00
3.98	1.8750	.2666	.0110	22.2	253.87
4.09	1.8996	.2769	.0103	12.9	242.66
4.20	1.9238	.2872	.0103	7.5	232.89
4.31	1.9481	.2976	.0104	4.3	224.62
4.42	1.9723	.3081	.0105	2.4	217.95
4.52	1.9955	.3183	.0102	1.4	212.88
4.63	2.0149	.3269	.0086	.8	208.86
4.74	2.0342	.3356	.0087	.4	204.56
4.85	2.0536	.3444	.0088	.2	199.35
4.95	2.0730	.3533	.0089	.1	193.65
5.06	2.0924	.3622	.0090	.0	188.22

HYDROGRAPH PEAK= 330.82 cfs
TIME TO PEAK= 3.12 Hours
RUNOFF VOLUME= 74.58 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT: VALLEY CAMP
PROJECT:
FEATURE:
PROJECT NO. 007.11.200

SHEET 7 OF 7
COMPUTED DEH
CHECKED
DATE 14 AUG 90

C-21-48 - (Continued)
RIPRAP CHECK

10yr-6hr Flow: Q = 926 cfs

from fig 1-15, EPA $d_{50} \sim 0.75'$
$L_a \sim 22'$ USE 25' *

100yr-6hr Flow: Q = 330 cfs

from fig 1-15, EPA $d_{50} \sim 2.5'$
$L_a \sim 57'$ USE 60'

Conform riprap to natural channel.

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-22-24
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/19/89

C-22-24

Tributary Area = 16 * 1.401 = 22 Acres
90% Cover Oak/Aspen CN = 70 = 20 ac
25% Cover Sage/grass CN = 75 = 2 ac

CN	A	Q
70	20	0.10
75	2	0.19

$\bar{Q} = 0.10$ $\bar{CN} = 70.5$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 2,500 ft

$$\text{slope} = \frac{(6000)(80)(100)}{43{,}560\ (22)} = 50\%$$

Calculated Run-Off = $Q_{TOT} = 0.79$ cfs

Check Pipe Flow

- 24" CMP
- n = 0.024
- S = 5.7%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 29.3$ cfs ok

Pipe flow not limiting

Check Inlet Control

- HW depth = 2.8'

$\frac{HW}{D} = 1.4$ Use Chart 5 - assume proj. entrance

$Q_{HW} = 17.0$ cfs ok

Inlet control not limiting

Riprap Check $\frac{Qn}{1.49 S^{1/2}} = 0.054$, y = 0.23, V = 3.9 < 5.0 ok

NO LINING REQD

[illegible] Runoff Calculation

AREA= 22.0 ACRES
AVERAGE WATER SLOPE= [illegible] PERCENT
CURVE NUMBER = 70.5
DESIGN STORM= 1.75 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= [illegible] HOURS QPOFB= 121.60 CFS QPIN= 5.4813 INCHES
C3= 27.0175 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.41	.8246	.0000	.0000	.0	.00
2.44	.8560	.0000	.0000	6.1	.00
2.46	.8874	.0006	.0005	37.8	.00
2.49	.9187	.0016	.0010	80.7	.03
2.52	.9354	.0023	.0007	111.6	.09
2.54	.9439	.0027	.0004	121.6	.18
2.57	.9524	.0031	.0004	113.9	.25
2.60	.9609	.0036	.0005	96.1	.31
2.63	.9694	.0041	.0005	75.2	.35
2.65	.9779	.0046	.0005	55.5	.37
2.68	.9863	.0052	.0006	39.1	.39
2.71	.9948	.0057	.0006	26.6	.40
2.74	1.0033	.0064	.0006	17.5	.41
2.76	1.0118	.0070	.0007	11.2	.42
2.79	1.0203	.0077	.0007	7.0	.44
2.82	1.0289	.0084	.0007	4.3	.46
2.85	1.0375	.0092	.0007	2.6	.48
2.87	1.0457	.0099	.0006	1.6	.50
2.90	1.0542	.0107	.0008	.9	.52
2.93	1.0627	.0116	.0008	.5	.55
2.96	1.0712	.0124	.0009	.3	.57
2.98	1.0797	.0133	.0009	.2	.59
3.01	1.0870	.0142	.0009	.1	.62
3.04	1.0943	.0149	.0008	.0	.64
3.37	1.1787	.0254	.0010	.0	.71
3.40	1.1825	.0264	.0010	.0	.73
3.42	1.1893	.0274	.0010	.0	.74
3.45	1.1961	.0284	.0010	.0	.75
3.48	1.2029	.0294	.0010	.0	.77
3.50	1.2095	.0303	.0010	.0	.78
3.53	1.2141	.0312	.0007	.0	.79
3.56	1.2186	.0319	.0007	.0	.79
3.59	1.2235	.0327	.0008	.0	.78
3.61	1.2281	.0335	.0008	.0	.75

PROJECT : Valley Camp Coal - C-22-24 Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.64	1.2328	.0342	.0008	.0	.72
3.67	1.2375	.0350	.0008	.0	.70
3.69	1.2421	.0358	.0008	.0	.67

HYDROGRAPH PEAK= .79 cfs
TIME TO PEAK= 3.53 Hours
RUNOFF VOLUME= .19 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Belmit
FEATURE C-23-24
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED ___
CHECKED ___
DATE ___

C-23-24

Total Area = 16 + 1.401 = 22 acres
90% Cover Oak/Aspen (CN=70) = 20
25% Cover Sage/Grass (CN=75) = 2

CN	A	Q
70	20	0.10
75	2	0.19
		$\bar{Q}$=0.10

$\bar{CN}$ = 70.5

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 2,500 ft

$$\text{slope} = \frac{(6{,}000)(80)(100)}{43{,}560\ (22)} = 50\%$$

Calculated Runoff: Q_{TOT} = 0.79 cfs

Check Pipe Flow

- 24" CMP
- n = 0.024
- S = 8%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Q_{allow} = 34.66 cfs OK

Pipe flow not limiting

Check Inlet Control

HW depth = 3.5'

$\frac{HW}{D}$ = 1.75

Use Chart 5 - assume projecting entrance

Q_{HW} = 20.0 cfs OK

Inlet Control not limiting

Riprap Check $\frac{Qn}{1.49 S^{1/2}}$ = 0.046, y = 0.21, v = 4.6 fps < 5.0
NO LINING REQ'd

PROJECT : Valley Camp Coal -- C-23-24 Runoff Calculation

AREA= 22.0 ACRES
AVERAGE BASIN SLOPE= 50.0 PERCENT
CURVE NUMBER= 70.5
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1368 HOURS QPCFS= 121.60 CFS QPIN= 5.4813 INCHES
C3= 27.0175 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.41	.8246	.0000	.0000	.0	.00
2.44	.8560	.0000	.0000	6.1	.00
2.46	.8874	.0006	.0005	37.8	.00
2.49	.9187	.0016	.0010	80.7	.03
2.52	.9354	.0023	.0007	111.6	.09
2.54	.9439	.0027	.0004	121.6	.18
2.57	.9524	.0031	.0004	113.9	.25
2.60	.9609	.0036	.0005	96.1	.31
2.63	.9694	.0041	.0005	75.2	.35
2.65	.9779	.0046	.0005	55.5	.37
2.68	.9863	.0052	.0006	39.1	.39
2.71	.9948	.0057	.0006	26.6	.40
2.74	1.0033	.0064	.0006	17.5	.41
2.76	1.0118	.0070	.0007	11.2	.42
2.79	1.0203	.0077	.0007	7.0	.44
2.82	1.0288	.0084	.0007	4.3	.46
2.85	1.0372	.0092	.0007	2.6	.48
2.87	1.0457	.0099	.0008	1.6	.50
2.90	1.0542	.0107	.0008	.9	.52
2.93	1.0627	.0116	.0008	.5	.55
2.96	1.0712	.0124	.0009	.3	.57
2.98	1.0797	.0133	.0009	.2	.59
3.01	1.0875	.0142	.0009	.1	.62
3.04	1.0943	.0149	.0008	.0	.64
3.37	1.1757	.0254	.0010	.0	.71
3.39	1.1825	.0264	.0010	.0	.73
3.42	1.1893	.0274	.0010	.0	.74
3.45	1.1961	.0284	.0010	.0	.75
3.48	1.2029	.0294	.0010	.0	.77
3.50	1.2095	.0305	.0010	.0	.78
3.53	1.2141	.0312	.0007	.0	.79
3.56	1.2188	.0319	.0007	.0	.79
3.58	1.2235	.0327	.0008	.0	.78
3.61	1.2261	.0335	.0008	.0	.75

PROJECT : Valley Camp Coal - C-23-24 Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.64	1.2328	.0342	.0008	.0	.72
3.67	1.2375	.0350	.0008	.0	.70
3.69	1.2421	.0358	.0008	.0	.67

HYDROGRAPH PEAK= .79 cfs
TIME TO PEAK= 3.53 Hours
RUNOFF VOLUME= .19 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-24-24
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/19/89

C-24-24

Tributary Area = 9*1.401 = 20 acres

CN = 75 (25% Cover Sage/grass)

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 2000 ft

$$\text{slope} = \frac{(4000)(80)(100)}{43{,}560\,(20)} = 44.1\%$$

Calculated Run-off: $Q_{TOT} \sim 2.04$ cfs

Check Pipe Flow

- 24" CMP
- n = 0.024
- S = 12%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 42.45$ cfs OK

Pipe Flow not limiting

Check Inlet Control

- HW depth = 4.2'

$\frac{HW}{D} = 2.1$ Use Chart 5 assume projecting entrance

$Q_{HW} = 22.0$ cfs OK

Inlet control not limiting

Riprap Check $\frac{Qn}{1.49 S^{1/2}} = 0.095$, $y = 0.3'$, $V = 6.9$ f/s

Outlet off side hill, If erosion is severe, Install riprap according to EPA,

from fig 1-15, $d_{50} \sim 0.25$ (Use 1.0' min d_{50} on hillslope)

PROJECT : Valley Camp Coal - C-24-24 Runoff Calculation

AREA= 20.0 ACRES
AVERAGE BASIN SLOPE= 44.1 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1075 HOURS QPCFS= 140.71 CFS QPIN= 6.9769 INCHES
C3= 34.3891 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6517	.0000	.0000	.0	.00
2.28	.6764	.0000	.0000	7.1	.00
2.30	.7010	.0004	.0003	43.7	.00
2.32	.7257	.0010	.0007	93.4	.02
2.34	.7503	.0020	.0010	129.2	.07
2.36	.7750	.0034	.0014	140.7	.16
2.39	.7997	.0051	.0017	131.8	.30
2.41	.8243	.0071	.0020	111.3	.49
2.43	.8490	.0095	.0023	87.0	.71
2.45	.8736	.0121	.0026	64.2	.96
2.47	.8983	.0150	.0030	45.3	1.23
2.49	.9230	.0183	.0032	30.7	1.51
2.52	.9348	.0200	.0017	20.2	1.78
2.54	.9414	.0209	.0010	13.0	1.98
2.56	.9481	.0219	.0010	8.2	2.04
2.58	.9548	.0229	.0010	5.0	1.98
2.60	.9614	.0239	.0010	3.0	1.83
2.62	.9681	.0250	.0010	1.8	1.65
2.64	.9747	.0261	.0011	1.1	1.48
2.67	.9814	.0272	.0011	.6	1.33
2.69	.9881	.0283	.0011	.4	1.22
2.71	.9947	.0294	.0011	.2	1.15
2.73	1.0014	.0305	.0012	.1	1.10
2.75	1.0081	.0317	.0012	.0	1.07

HYDROGRAPH PEAK= 2.04 cfs
TIME TO PEAK= 2.56 Hours
RUNOFF VOLUME= .31 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-25-36
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/19/89

C-25-36

Tributary Area = 108 * 1.401 = 151 acres
90% Cover Oak/Aspen (CN=70) = 78
25% Cover Sage/Grass (CN=75) = 73

CN	A	Q
70	78	0.10
75	73	0.19

$\bar{Q} = 0.14$, $\bar{CN} = 72.7$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 5,000 feet

$$\text{slope} = \frac{(6{,}500)(400)(100)}{43{,}560\ (151)} = 39.5\%$$

Calculated Run-Off: $Q_{TOT} = 17.0$ cfs

Check Pipe Flow

- 36" CMP
- n = 0.024
- S = 12%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 125.15$ cfs OK

Pipe Flow not limiting

Check Inlet Control

- HW depth = 22'

$\frac{HW}{D} = 7.33$

Use Chart 5 - assume projecting entrance

Extrapolation yields a flow of 130 cfs

Inlet control not limiting

Riprap Check from EPA, fig 1-15, $d_{50} \sim 0.25'$ - USE $d_{50\,min} = 1.0'$ on hillslope, Extend min of 10' downstream

PROJECT : Valley Camp Coal - C-25-36 Runoff Calculation

AREA= 151.0 ACRES
AVERAGE BASIN SLOPE= 39.5 PERCENT
CURVE NUMBER= 72.7
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 5000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .2523 HOURS QPCFS= 452.63 CFS QPIN= 2.9727 INCHES
C3= 14.6524 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.32	.7247	.0000	.0000	.0	.00
2.37	.7826	.0003	.0003	22.7	.00
2.42	.8405	.0021	.0018	140.6	.08
2.47	.8984	.0056	.0035	300.5	.41
2.52	.9371	.0088	.0032	415.5	1.22
2.57	.9527	.0103	.0015	452.6	2.41
2.62	.9684	.0119	.0016	424.0	3.60
2.67	.9840	.0136	.0017	357.9	4.49
2.72	.9997	.0154	.0018	279.9	5.05
2.78	1.0153	.0174	.0019	206.6	5.34
2.83	1.0309	.0194	.0020	145.6	5.49
2.88	1.0466	.0216	.0021	98.9	5.59
2.93	1.0622	.0238	.0023	65.1	5.69
2.98	1.0779	.0262	.0024	41.8	5.83
3.03	1.0918	.0284	.0022	26.2	6.01
3.08	1.1043	.0304	.0020	16.2	6.18
3.13	1.1168	.0325	.0021	9.8	6.31
3.18	1.1294	.0346	.0022	5.9	6.38
3.23	1.1419	.0368	.0022	3.5	6.42
3.28	1.1544	.0391	.0023	2.0	6.44
3.33	1.1669	.0415	.0023	1.2	6.48
3.38	1.1794	.0439	.0024	.7	6.55
3.43	1.1919	.0463	.0025	.4	6.64
3.48	1.2044	.0488	.0025	.2	6.76
3.53	1.2145	.0509	.0021	.1	6.88
3.58	1.2231	.0527	.0018	.0	6.96
3.63	1.2317	.0545	.0018	.0	6.92
3.68	1.2403	.0564	.0019	.0	6.77
3.73	1.2489	.0583	.0019	.0	6.56
3.78	1.2575	.0602	.0019	.0	6.34
3.83	1.2661	.0621	.0019	.0	6.16
3.89	1.2747	.0641	.0020	.0	6.02

HYDROGRAPH PEAK= 6.96 cfs
TIME TO PEAK= 3.58 Hours
RUNOFF VOLUME= 1.74 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE:
PROJECT NO.: 007.11.200

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 3AUG90

C-26-24

Tributary Area = 4.8ac

CN = 75 (25% Sage Grass)

Precipitation = 1.55 inches (10yr, 6hr)

Hyd. Length = 1400 feet

$$\text{Slope} = \frac{4550(25)100}{43560(4.8)} = 54.4\%$$

Calculated Runoff: $Q_{TOT} = 0.57$ cfs

Check Pipe Flow

24" CMP
$n = 0.024$
$S = 18\%$

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2} = 51.99 \text{ cfs}$$

51.99 >> 0.57 OK NOT LIMITING

Check Inlet Control

HW Depth = 4.0'

HW/D = 2.0 Use Chart 5, projecting Entrance

$Q_{HW} = 22$ cfs >> 0.57 OK

Inlet Control Not Limiting

Riprap Check $\frac{Qn}{1.49 S^{1/2}} = 0.022$, $y = 0.15'$, $V = 5.32$ f/s

Q is off EPA Chart - Use $d_{50\,min} = 1.0'$ on hillside (If severe erosion is evident)

$L_{min} = 10'$

PROJECT : Valley Camp Coal - C-26-24 Runoff Calculation

AREA= 4.8 ACRES
AVERAGE BASIN SLOPE= 54.4 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1400. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0728 HOURS QPCFS= 49.89 CFS QPIN=10.3077 INCHES
C3= 50.8068 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.27	.6663	.0000	.0000	.0	.00
2.28	.6829	.0000	.0000	2.5	.00
2.30	.6996	.0003	.0002	15.5	.00
2.31	.7163	.0007	.0004	33.1	.00
2.33	.7330	.0013	.0006	45.8	.02
2.34	.7497	.0020	.0007	49.9	.04
2.36	.7664	.0029	.0009	46.7	.07
2.37	.7831	.0039	.0010	39.4	.10
2.39	.7998	.0051	.0012	30.9	.14
2.40	.8165	.0064	.0013	22.8	.18
2.42	.8332	.0079	.0015	16.0	.23
2.43	.8499	.0095	.0016	10.9	.28
2.44	.8665	.0113	.0018	7.2	.33
2.46	.8832	.0132	.0019	4.6	.38
2.47	.8999	.0153	.0020	2.9	.42
2.49	.9166	.0174	.0022	1.8	.47
2.50	.9309	.0194	.0020	1.1	.52
2.52	.9354	.0200	.0006	.6	.56
2.53	.9399	.0207	.0007	.4	.57
2.55	.9444	.0214	.0007	.2	.55
2.56	.9489	.0220	.0007	.1	.51
2.58	.9534	.0227	.0007	.0	.45
2.59	.9580	.0234	.0007	.0	.40
2.60	.9625	.0241	.0007	.0	.35
2.62	.9670	.0248	.0007	.0	.31

HYDROGRAPH PEAK= .57 cfs
TIME TO PEAK= 2.53 Hours
RUNOFF VOLUME= .07 Acre-Feet

C-26A-24

Tributary Area = 9.2ac

CN = 75 (25% Sage/Grass)

Precipitation = 1.55 inches (10yr, 6Hr)

Hydraulic Length = 1780 ft

$$\text{Slope} = \frac{2630(80)100}{43560(9.2)} = 52.5\%$$

Calculated Runoff: $Q_{TOT} = 1.01$ cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 25\%$

$$Q_{allow} = \frac{1.49}{n} AR^{2/3} S^{1/2}$$

$Q_{allow} = 61.4$ cfs >> 1.01 cfs

Pipe Flow Not Limiting

Check Inlet Control

HW depth = 2.0 (Minimum, Actual is Greater)

HW/D = 1.0 Use Chart 5, projecting inlet

$Q_{HW} = 11$ cfs >> 1.01 cfs

Inlet Control Not Limiting

Riprap Check $\frac{Qn}{1A95^{1/2}} = 0.033$, $y = 0.18$, $V = 7.2$ fps

Q is off EPA Chart, USE $d_{50} = 1.0'$ min for 10' min

(If severe erosion is evident)

PROJECT : Valley Camp Coal - Ditch D-34B Runoff Calculation

AREA= 3.0 ACRES
AVERAGE BASIN SLOPE= 50.0 PERCENT
CURVE NUMBER= 88.2
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 670. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0273 HOURS QPCFS= 83.03 CFS QPIN=27.4469 INCHES
C3=135.2856 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.69	.2663	.0000	.0000	.0	.00
1.71	.2704	.0000	.0000	40.6	.00
1.72	.2744	.0000	.0000	83.0	.00
1.73	.2784	.0000	.0000	58.6	.00
1.75	.2824	.0002	.0000	26.7	.00
1.76	.2864	.0003	.0000	9.6	.01
1.78	.2905	.0004	.0001	3.0	.02
1.79	.2945	.0005	.0001	.8	.02
1.80	.2985	.0007	.0002	.2	.03
1.82	.3025	.0009	.0002	.0	.03
2.42	.8357	.1694	.0079	.0	1.71
2.43	.8514	.1774	.0080	.0	1.74
2.45	.8671	.1855	.0081	.0	1.77
2.46	.8827	.1938	.0083	.0	1.80
2.47	.8984	.2021	.0084	.0	1.82
2.49	.9141	.2106	.0085	.0	1.85
2.50	.9297	.2192	.0086	.0	1.88
2.51	.9342	.2217	.0024	.0	1.65
2.53	.9384	.2240	.0024	.0	1.14
2.54	.9426	.2264	.0024	.0	.78
2.55	.9469	.2288	.0024	.0	.61
2.57	.9511	.2311	.0024	.0	.55
2.58	.9553	.2335	.0024	.0	.54

HYDROGRAPH PEAK= 1.88 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .16 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: Ditch D-34B

Date: 05-May-89
Time: 11:08 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	1.88	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.58	feet
	Qn/1.49(S)1/2=	0.268	
	A(R)2/3=	0.274	
	Required Depth:	1.08	feet
	Area:	0.67	ft2
	Perimeter:	2.59	feet
	Hydraulic Radius:	0.26	feet
	Velocity:	2.79	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.48	feet
	Qn/1.49(S)1/2=	0.170	
	A(R)2/3=	0.165	
	Required Depth:	0.98	feet
	Area:	0.46	ft2
	Perimeter:	2.15	feet
	Hydraulic Radius:	0.21	feet
	Velocity:	4.08	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Channel Depth:	1.08	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE D-35
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-35

TRIBUTARY AREAS: D-42; D-37; D-35

AREA = 4.6 ACRES (3.9 ac disturbed, 0.7 ac reclaimed)

SLOPE = $\frac{2910 * 25 * 100}{4.6 * 43560}$ = 36.3%

HYD LENGTH = 1150'

CN = 90

P = 1.55"

CN	A	Q
90	3.9	0.723
85	0.7	0.484
		$\bar{Q}$ = 0.686

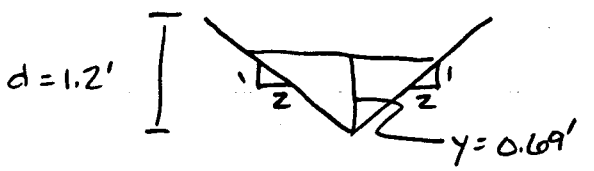
$\bar{CN}$ = 89.3

RUNOFF PREDICTION: Q = 3.0 cfs

CHANNEL DESIGN:

$S_{MIN} = S_{MAX}$ = 2% b = 0, m = 2, n = 0.03

USE TRIANGULAR CHANNEL



v = 3.2 fps < 5 NO LINING REQ'd

PROJECT : Valley Camp Coal - Ditch D-35 Runoff Calculation

AREA= 4.6 ACRES
AVERAGE BASIN SLOPE= 36.3 PERCENT
CURVE NUMBER= 89.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1150. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0473 HOURS QPCFS= 73.51 CFS QPIN=15.8485 INCHES
C3= 78.1173 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.59	.2366	.0000	.0000	.0	.00
1.61	.2412	.0000	.0000	14.9	.00
1.62	.2459	.0000	.0000	56.3	.00
1.64	.2505	.0000	.0000	73.5	.00
1.66	.2551	.0002	.0001	62.1	.00
1.67	.2598	.0003	.0001	41.3	.01
1.69	.2644	.0005	.0002	23.7	.02
1.70	.2691	.0007	.0002	12.2	.03
1.72	.2737	.0009	.0002	5.8	.04
1.73	.2784	.0012	.0003	2.6	.05
1.75	.2830	.0015	.0003	1.1	.06
1.77	.2877	.0018	.0003	.5	.07
1.78	.2923	.0022	.0004	.2	.08
1.80	.2969	.0026	.0004	.0	.09
2.40	.8119	.1850	.0097	.0	2.71
2.41	.8300	.1949	.0099	.0	2.76
2.43	.8481	.2049	.0101	.0	2.82
2.44	.8662	.2151	.0102	.0	2.87
2.46	.8843	.2255	.0104	.0	2.92
2.48	.9023	.2360	.0105	.0	2.97
2.49	.9204	.2467	.0107	.0	3.01
2.51	.9323	.2537	.0071	.0	3.00
2.52	.9372	.2567	.0029	.0	2.77
2.54	.9421	.2596	.0029	.0	2.30
2.55	.9470	.2626	.0030	.0	1.78
2.57	.9519	.2655	.0030	.0	1.39
2.59	.9567	.2685	.0030	.0	1.14

HYDROGRAPH PEAK= 3.01 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .26 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	05-May-89
Project No.:	007.11.100	Time:	11:31 AM
Channel Section:	Ditch D-35	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	3.00	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.69	feet
	Qn/1.49(S)1/2=	0.428	
	A(R)2/3=	0.435	
	Required Depth:	1.19	feet
	Area:	0.95	ft2
	Perimeter:	3.09	feet
	Hydraulic Radius:	0.31	feet
	Velocity:	3.15	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.69	feet
	Qn/1.49(S)1/2=	0.428	
	A(R)2/3=	0.435	
	Required Depth:	1.19	feet
	Area:	0.95	ft2
	Perimeter:	3.09	feet
	Hydraulic Radius:	0.31	feet
	Velocity:	3.15	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Channel Depth:	1.19	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-36
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/9/89

D-36 (Convenience Ditch)

Total Area = 517 * 0.00702 = 2.7 ac
undist. Area = 310 = 1.9 ac (25% Oak/Aspen)
dist. Area = = 0.8 ac

CN	A	Q
90	0.8	0.723
70	1.9	0.096
		$\bar{Q}$ = 0.282

$\bar{CN}$ = 79.0

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 550 feet

$$\text{slope} = \frac{(3{,}070)(25)(100)}{43{,}560\,(2.7)} = 65.3\ \%$$

Run-off Calculation: Q_{TOT} = 0.70 cfs

Convenience ditch - No design anticipated OK
(Small ditch)

PROJECT : Valley Camp Coal - D-36 Runoff Calculation

AREA= 2.7 ACRES
AVERAGE BASIN SLOPE= 65.3 PERCENT
CURVE NUMBER= 79.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 550. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0279 HOURS QPCFS= 73.10 CFS QPIN=26.8484 INCHES
C3=132.3358 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.15	.5266	.0000	.0000	.0	.00
2.18	.5586	.0003	.0003	73.1	.02
2.20	.5906	.0013	.0010	23.6	.08
2.23	.6226	.0030	.0017	2.6	.15
2.26	.6546	.0054	.0024	.2	.22
2.29	.6866	.0085	.0031	.0	.29
2.32	.7186	.0123	.0037	.0	.35
2.34	.7506	.0167	.0044	.0	.42
2.37	.7826	.0216	.0050	.0	.48
2.40	.8146	.0272	.0056	.0	.54
2.43	.8466	.0334	.0061	.0	.59
2.46	.8786	.0401	.0067	.0	.65
2.48	.9106	.0473	.0072	.0	.70
2.51	.9334	.0527	.0055	.0	.59
2.54	.9421	.0549	.0021	.0	.31
2.57	.9507	.0571	.0022	.0	.23
2.59	.9594	.0593	.0022	.0	.22
2.62	.9680	.0615	.0022	.0	.22
2.65	.9767	.0638	.0023	.0	.23

HYDROGRAPH PEAK= .70 cfs
TIME TO PEAK= 2.48 Hours
RUNOFF VOLUME= .06 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE: D-37
PROJECT NO.: 007.11.100

SHEET 1 OF
COMPUTED: DEH
CHECKED:
DATE: 4 MAY 89

D-37 DESIGN

CN DETERMINATIONS SHOWN ON D-44B SHEETS

$P_{10\ YR-6HR} = 1.55$ in

AREA: 124.4 * 0.0035 = 3.75 ac (ALL AREA DISTURBED) USE CN=90
60 * " 0.4 ac

HYD. LENGTH = 1150 ft

WATERSHED SLOPE: CONT L = 2375
CONT I = 25'

$$\frac{2375 * 25 * 100}{3.75 * 43560} = 36.3\%$$

RUNOFF PREDICTION: Q = 2.6 cfs

CHANNEL DESIGN:

$S_{min} = 2\%$
$S_{max} = 18\%$ (Except for SHORT RIPRAP SECTION AT SWITCHBACK BY COAL PILE WHICH IS 30%)
Velocities will be higher - USE Road Ditch Design

$M_1 = 1.5$ $b = 0$ $Q = 2.6$
$M_2 = 2$ $\eta = .03$

Printout Shows Riprap REQUIRED ON 18% GRADE IMMEDIATELY BELOW CONCRETE SETTLING BASIN. CHANGE CRITERIA AND BREAK OUT UPPER DITCH SECTION - RECALCULATE FLOW.

AREA = Tributary Area to 18% Ditch Section running between Concrete Settling Basin and road intersection near Culvert C-40-42 inlet.

Area = 390 * .0035 = 1.37 ac
HYD. LENGTH = 500'
SLOPE : $\frac{840 * 25 * 100}{1.37 * 43560} = 35.2\%$

RUNOFF PREDICTION : $Q_{upper} = 0.99$ cfs

CHANNEL DESIGN: USE ROAD DITCH DESIGN

S = 18%; $M_1 = 1.5$, $M_2 = 2$, b = 0, $\eta = 0.03$ V = 4.0 < 5 ok

LINING NOT REQ'D

PROJECT : Valley Camp Coal - Ditch D-37 Runoff Prediction

AREA= 3.8 ACRES
AVERAGE BASIN SLOPE= 36.3 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1150. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0460 HOURS QPCFS= 61.65 CFS QPIN=16.3034 INCHES
C3= 80.3596 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.53	.2190	.0000	.0000	.0	.00
1.55	.2235	.0000	.0000	12.5	.00
1.56	.2280	.0000	.0000	47.2	.00
1.58	.2325	.0000	.0000	61.6	.00
1.59	.2370	.0002	.0001	52.1	.00
1.61	.2415	.0003	.0001	34.7	.01
1.62	.2461	.0005	.0002	19.8	.02
1.64	.2506	.0007	.0002	10.2	.03
1.66	.2551	.0009	.0002	4.9	.04
1.67	.2596	.0012	.0003	2.2	.04
1.69	.2641	.0015	.0003	.9	.05
1.70	.2686	.0019	.0003	.4	.06
1.72	.2731	.0022	.0004	.2	.07
1.73	.2777	.0026	.0004	.0	.08
2.41	.8231	.2109	.0101	.0	2.38
2.42	.8407	.2212	.0103	.0	2.42
2.44	.8583	.2316	.0104	.0	2.46
2.45	.8759	.2421	.0105	.0	2.50
2.47	.8934	.2528	.0107	.0	2.54
2.48	.9110	.2636	.0108	.0	2.57
2.50	.9286	.2745	.0109	.0	2.61
2.51	.9344	.2782	.0036	.0	2.55
2.53	.9391	.2812	.0030	.0	2.22
2.54	.9439	.2842	.0030	.0	1.76
2.56	.9486	.2872	.0030	.0	1.35
2.58	.9534	.2902	.0030	.0	1.07
2.59	.9581	.2932	.0030	.0	.90

HYDROGRAPH PEAK= 2.61 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .23 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: D-37

Date: 05-May-89
Time: 08:12 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.60	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.18	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.37	feet
	Qn/1.49(S)1/2=	0.371	
	A(R)2/3=	0.371	
	Required Depth:	0.87	feet
	Area:	1.16	ft2
	Perimeter:	6.37	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	2.25	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.25	feet
	Qn/1.49(S)1/2=	0.124	
	A(R)2/3=	0.125	
	Required Depth:	0.75	feet
	Area:	0.51	ft2
	Perimeter:	4.23	feet
	Hydraulic Radius:	0.12	feet
	Velocity:	5.10	ft/sec
	Riprap Ck (V<5?):	Required	

VEL. TOO HIGH - BREAK OUT UPPER STEEP AREA

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.18	ft/ft
	Channel Depth:	0.87	feet
	Riprap:	Required	

Comment:

PROJECT : Valley Camp Coal - Upper Section Ditch D-37 Runoff Prediction

AREA= 1.4 ACRES
AVERAGE BASIN SLOPE= 35.2 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0240 HOURS QPCFS= 43.18 CFS QPIN=31.2593 INCHES
C3=154.0771 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2197	.0000	.0000	.0	.00
1.56	.2267	.0000	.0000	43.2	.00
1.58	.2338	.0001	.0001	13.9	.00
1.61	.2409	.0003	.0002	1.5	.00
1.63	.2479	.0006	.0003	.1	.01
1.66	.2550	.0009	.0004	.0	.02
2.35	.7591	.1749	.0148	.0	.86
2.38	.7866	.1901	.0152	.0	.89
2.40	.8142	.2057	.0156	.0	.91
2.42	.8417	.2217	.0160	.0	.93
2.45	.8692	.2381	.0164	.0	.95
2.47	.8967	.2548	.0167	.0	.97
2.49	.9242	.2718	.0170	.0	.99
2.52	.9359	.2791	.0073	.0	.58
2.54	.9433	.2838	.0047	.0	.33
2.57	.9507	.2885	.0047	.0	.28
2.59	.9582	.2932	.0047	.0	.28
2.61	.9656	.2980	.0048	.0	.28
2.64	.9731	.3028	.0048	.0	.28

HYDROGRAPH PEAK= .99 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .08 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

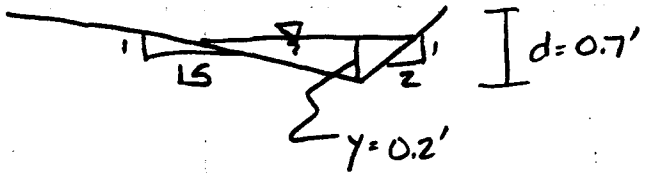
Client:	Valley Camp Coal Company	Date:	05-May-89
Project No.:	007.11.100	Time:	08:27 AM
Channel Section:	Upper D-37	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.99	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.18	ft/ft
	Max. Bottom Slope:	0.18	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.047	
	A(R)2/3=	0.047	
	Required Depth:	0.67	feet
	Area:	0.25	ft2
	Perimeter:	2.94	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	4.03	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.047	
	A(R)2/3=	0.047	
	Required Depth:	0.67	feet
	Area:	0.25	ft2
	Perimeter:	2.94	feet
	Hydraulic Radius:	0.08	feet
	Velocity:	4.03	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.18	ft/ft
	Max. Bottom Slope:	0.18	ft/ft
	Channel Depth:	0.67	feet
	Riprap:	Not Needed	

Comment:

UPPER SECTION - CROSS SECTION (18% Grade)



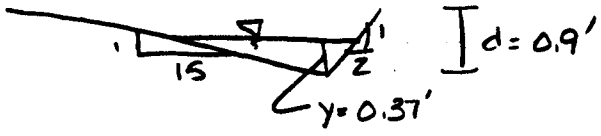
REMAINING SECTION OF DITCH (BELOW 18% GRADE)

SLOPE VARIES BETWEEN 2% AND 10% WITH 1 30% RIPRAPPED SECTION

FOR 2-10% SLOPES : Q=2.6 cfs (See Sheet 7)

$M_1 = 1.5$ $b=0$
$M_2 = 2$ $\eta = 0.03$ $V = 4.1 \angle 5$ ✓

NO LINING REQ'd



30% RIPRAP SECTION Q=2.6

From Sheet 8; $y = 0.22'$, $V = 8.1$ fps > 5.0 LINING REQ'd
$b = 1.0'$

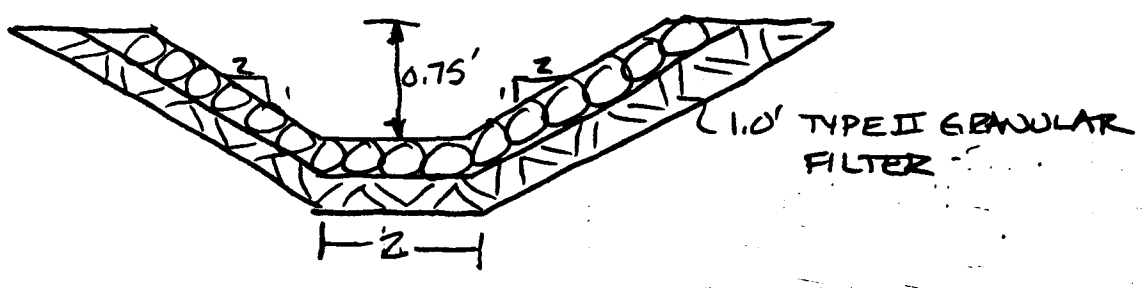
EXTRAPOLATING FROM "DESIGN OF STABLE CHANNELS WITH FLEXIBLE LININGS" FED. HIGHWAY ADM - OCT 75 - SEE SHEET 9

GIVES $D_{50} \sim 1.0'$ $\eta = .0395(D_{50})^{1/6} \sim 0.04$

IF CHANNEL IS WIDENED TO 2.0' (Sheet 10)

$y = 0.19'$ AND $D_{50} = 0.75'$ USE $B = 2.0'$

USE 1.0' TYPE II GRANULAR FILTER AS PER "URBAN STORM DRAINAGE CRITERIA MANUAL" - VOL 2 - MARCH 1969 (T615-4)



Trapezoidal Channel Flow Calculations using Mannings Equation

Client: Valley Camp Coal Company
Project No.: 007.11.100
Channel Section: Lower D-37

Date: 05-May-89
Time: 08:33 AM
Computed: DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.60	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.37	feet
	Qn/1.49(S)1/2=	0.371	
	A(R)2/3=	0.371	
	Required Depth:	0.87	feet
	Area:	1.16	ft2
	Perimeter:	6.37	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	2.25	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.27	feet
	Qn/1.49(S)1/2=	0.166	
	A(R)2/3=	0.166	
	Required Depth:	0.77	feet
	Area:	0.63	ft2
	Perimeter:	4.71	feet
	Hydraulic Radius:	0.13	feet
	Velocity:	4.10	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Channel Depth:	0.87	feet
	Riprap:	Not Needed	

Comment:

Trapezoidal Channel Flow Calculations using Mannings Equation

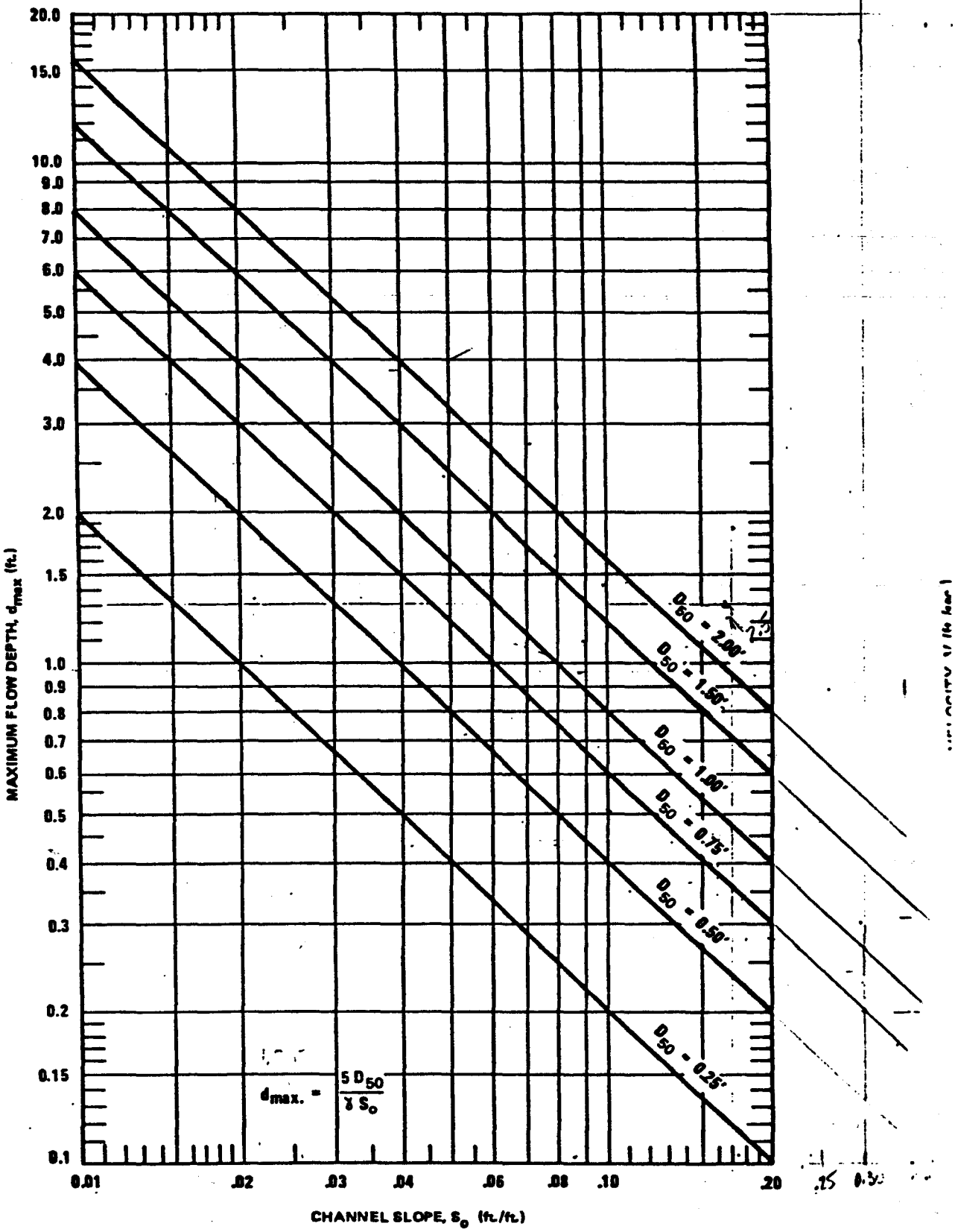
Client:	Valley Camp Coal Company	Date:	05-May-89
Project No.:	007.11.100	Time:	08:47 AM
Channel Section:	Lower D-37	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.60	cfs
	Bottom Width:	1.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.30	ft/ft
	Max. Bottom Slope:	0.30	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.22	feet
	Qn/1.49(S)1/2=	0.096	
	A(R)2/3=	0.096	
	Required Depth:	0.72	feet
	Area:	0.32	ft2
	Perimeter:	2.00	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	8.06	ft/sec
	Riprap Ck (V<5?):	Required	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.22	feet
	Qn/1.49(S)1/2=	0.096	
	A(R)2/3=	0.096	
	Required Depth:	0.72	feet
	Area:	0.32	ft2
	Perimeter:	2.00	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	8.06	ft/sec
	Riprap Ck (V<5?):	Required	

DESIGN CRITERIA:	Bottom Width:	1.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.30	ft/ft
	Max. Bottom Slope:	0.30	ft/ft
	Channel Depth:	0.72	feet
	Riprap:	Required	

Comment:

Chart 27



MAXIMUM PERMISSIBLE DEPTH OF FLOW (d_{max})
FOR CHANNELS LINED WITH ROCK RIPRAP

$n = .0395 D_{50}^{1/6}$

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	12-Jul-89
Project No.:	007.11.100	Time:	03:13 PM
Channel Section:	Lower D-37	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.60	cfs
	Bottom Width:	2.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.040	
	Min. Bottom Slope:	0.300	ft/ft
	Max. Bottom Slope:	0.300	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.19	feet
	Qn/1.49(S)1/2=	0.128	
	A(R)2/3=	0.127	
	Required Depth:	0.69	feet
	Area:	0.44	ft2
	Perimeter:	2.83	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	5.93	ft/sec
	Riprap Ck (V<5?):	Required	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.19	feet
	Qn/1.49(S)1/2=	0.128	
	A(R)2/3=	0.127	
	Required Depth:	0.69	feet
	Area:	0.44	ft2
	Perimeter:	2.83	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	5.93	ft/sec
	Riprap Ck (V<5?):	Required	

DESIGN CRITERIA:	Bottom Width:	2.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	30.0	%
	Max. Bottom Slope:	30.0	%
	Min Channel Depth:	0.69	feet
	Riprap (Min S):	Required	
	Riprap (Max S):	Required	

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-37
PROJECT NO. 007.11.100

SHEET 11 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

Riprap Gradation (From Drainage Criteria Manual) Table 5-1

Riprap Type L

Intermediate Rock Dimension (inches)	% Smaller Than Given Size By Weight
15	70-100
12	50-70
9	35-50
3	2-10

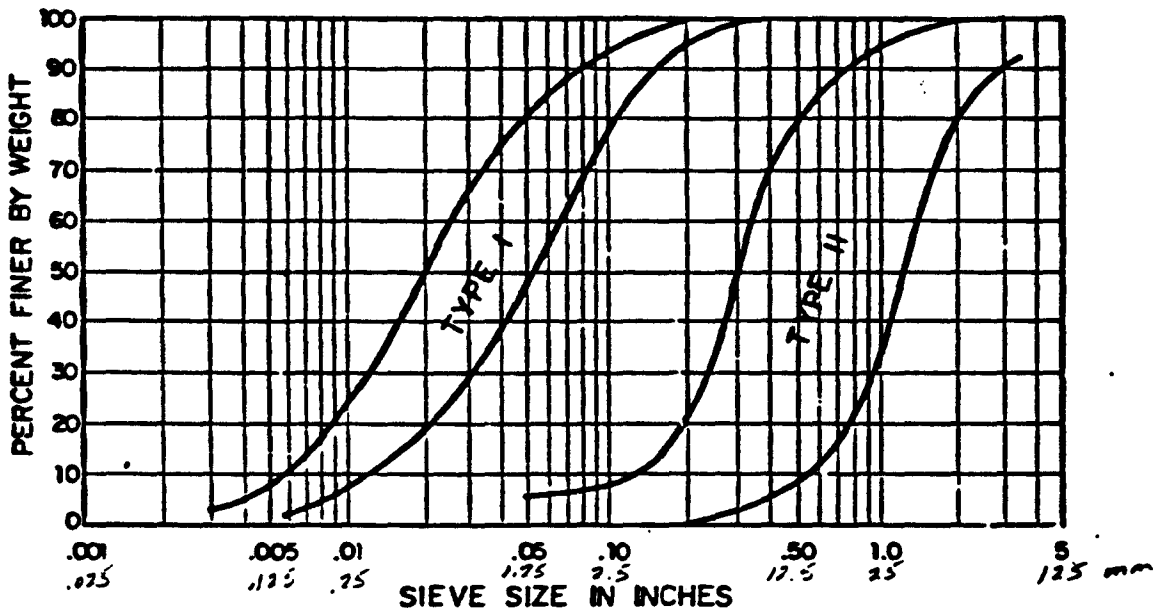


FIGURE 5-2. GRADATION CURVES FOR GRANULAR BEDDING

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 6/30/89

D-38

Total Area = 0.3 acres (Disturbed)

CN = 90

Precipitation = 1.55 inches (10yr, 6hr)

Hydraulic Length = 175 feet

$$\text{Slope} = \frac{(150)\,25(100)}{43560\,(0.3)} = 28.7\%$$

Calculated Runoff $Q_{TOT} = 0.22$ cfs

No ditch Design Anticipated. - USE GENERAL DESIGN

PROJECT : Valley Camp Coal - D-38 Runoff Calculation

AREA= .3 ACRES
AVERAGE BASIN SLOPE= 27.7 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 175. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0117 HOURS QPCFS= 19.43 CFS QPIN=64.2234 INCHES
C3=316.5573 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2199	.0000	.0000	.0	.00
1.55	.2234	.0000	.0000	19.4	.00
1.56	.2269	.0000	.0000	5.6	.00
1.57	.2305	.0000	.0000	.6	.00
1.58	.2340	.0001	.0000	.0	.00
2.42	.8428	.2224	.0081	.0	.21
2.44	.8566	.2306	.0081	.0	.21
2.45	.8704	.2388	.0082	.0	.21
2.46	.8841	.2471	.0083	.0	.21
2.47	.8979	.2555	.0084	.0	.21
2.48	.9116	.2640	.0085	.0	.22
2.50	.9254	.2725	.0086	.0	.22
2.51	.9325	.2770	.0044	.0	.14
2.52	.9362	.2793	.0023	.0	.08
2.53	.9399	.2817	.0023	.0	.06
2.54	.9436	.2840	.0023	.0	.06
2.56	.9474	.2864	.0024	.0	.06
2.57	.9511	.2887	.0024	.0	.06

HYDROGRAPH PEAK= .22 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .02 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-39A, D-39B
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/9/89

D-39A, D-39B (Convenience Ditches)

Total Area = 253 * 0.00702 = 1.8 acres

CN = 70 (25% Oak/Aspen)

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 450 feet

$$\text{slope} = \frac{(1100)(25)(100)}{(1.78)\,43{,}560} = 35.5\%$$

Run-Off Calculation: $Q_{TOT} = 0.06$ cfs

Convenience Ditches - No further design anticipated ok

PROJECT : Valley Camp Coal - D-39A, D-39B Runoff Calculations

AREA= 1.0 ACRES
AVERAGE BASIN SLOPE= 35.5 PERCENT
CURVE NUMBER= 70.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 450. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0417 HOURS QPCFS= 32.61 CFS QPIN=17.9644 INCHES
C3= 88.5466 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.42	.8406	.0000	.0000	.0	.00
2.44	.8646	.0000	.0000	16.0	.00
2.46	.8885	.0002	.0002	32.6	.00
2.48	.9125	.0007	.0005	23.0	.01
2.51	.9317	.0013	.0006	10.5	.03
2.53	.9382	.0015	.0002	3.8	.04
2.55	.9447	.0018	.0002	1.2	.03
2.57	.9512	.0020	.0003	.3	.03
2.59	.9576	.0023	.0003	.0	.02
3.36	1.1747	.0219	.0007	.0	.06
3.38	1.1799	.0226	.0007	.0	.06
3.40	1.1851	.0233	.0007	.0	.06
3.42	1.1902	.0240	.0007	.0	.06
3.45	1.1954	.0247	.0007	.0	.06
3.47	1.2006	.0255	.0007	.0	.06
3.49	1.2058	.0262	.0007	.0	.06
3.51	1.2103	.0269	.0007	.0	.06
3.53	1.2139	.0274	.0005	.0	.06
3.55	1.2175	.0279	.0005	.0	.05
3.57	1.2210	.0285	.0005	.0	.05
3.59	1.2246	.0290	.0005	.0	.05
3.61	1.2281	.0296	.0005	.0	.05

HYDROGRAPH PEAK= .06 cfs
TIME TO PEAK= 3.49 Hours
RUNOFF VOLUME= .01 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-42
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/8/89

D-42 (Convenience Ditch)

Total Area = 99 * 0.00702 = 0.7 ac

CN = 90 (disturbed)

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 275'

$$\text{slope} = \frac{(450)(25)(100)}{43{,}560\,(0.7)} = 36.9\%$$

Run-off Calculation: $Q_{TOT} = 0.51$ cfs

Convenience Ditch - No further design anticipated

ac

PROJECT : Valley Camp Coal - D-42 Runoff Calculations

AREA= .7 ACRES
AVERAGE BASIN SLOPE= 36.9 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 275. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0145 HOURS QPCFS= 36.45 CFS QPIN=51.6334 INCHES
C3=254.5012 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2201	.0000	.0000	.0	.00
1.55	.2244	.0000	.0000	36.4	.00
1.57	.2287	.0000	.0000	11.8	.00
1.58	.2330	.0001	.0000	1.3	.00
1.60	.2372	.0002	.0000	.0	.00
2.41	.8233	.2110	.0096	.0	.47
2.42	.8400	.2207	.0097	.0	.48
2.44	.8566	.2306	.0098	.0	.49
2.45	.8732	.2405	.0100	.0	.49
2.46	.8899	.2506	.0101	.0	.50
2.48	.9065	.2608	.0102	.0	.50
2.49	.9231	.2711	.0103	.0	.51
2.51	.9326	.2771	.0060	.0	.35
2.52	.9371	.2799	.0028	.0	.19
2.54	.9416	.2827	.0028	.0	.15
2.55	.9461	.2856	.0028	.0	.14
2.57	.9506	.2884	.0029	.0	.14
2.58	.9551	.2913	.0029	.0	.14

HYDROGRAPH PEAK= .51 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .04 Acre-Feet

HANSEN ALLEN & LUCE inc

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE D-44A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 4 MAY 89

D-44A DESIGN

CN determination shown on D-44B sheets $P_{10yr-6hr} = 1.55$ in

AREA: $R_{06} = 434$ $A = 434 * 0.0035 = 1.52$ ac : TOTAL
0.53 : DISTURBED CN = 90
0.99 : UNDISTURBED CN = 70

Undist. Area is Approx 25% Oak/Aspen Complex

Area	CN	$Q_{10yr-6hr}$
0.53	90	0.723
0.99	70	0.096
1.52		$\bar{Q} = 0.315$

$\bar{CN} = 80$

HYD. LENGTH ~ 510'

WATERSHED SLOPE: $\frac{\text{Cont L} * \text{Cont Int} * 100}{\text{Area} * 43560}$

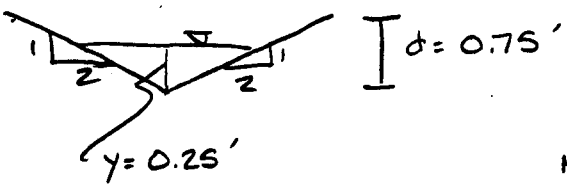
$= \frac{800 * 25 * 100}{1.52 * 43560} = 30.2\%$

RUNOFF PREDICTION:

$Q = 0.43$ cfs

CHANNEL DESIGN:

$S_{min} = 10\%$ $b = 0$
$S_{max} = 10\%$ $m_1 = m_2 = 2$



NO LINING REQ'd

PROJECT : Valley Camp Coal - Ditch D-44A Runoff Calculation

AREA= 1.5 ACRES
AVERAGE BASIN SLOPE= 30.2 PERCENT
CURVE NUMBER= 80.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 510. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0375 HOURS QPCFS= 30.66 CFS QPIN=20.0051 INCHES
C3= 98.6053 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.12	.4921	.0000	.0000	.0	.00
2.14	.5136	.0000	.0000	15.0	.00
2.16	.5351	.0005	.0004	30.7	.00
2.17	.5566	.0013	.0008	21.6	.03
2.19	.5781	.0024	.0011	9.9	.05
2.21	.5996	.0038	.0014	3.5	.08
2.23	.6211	.0056	.0018	1.1	.10
2.25	.6426	.0077	.0021	.3	.13
2.27	.6641	.0101	.0024	.0	.16
2.40	.8146	.0352	.0044	.0	.33
2.42	.8361	.0398	.0047	.0	.35
2.44	.8576	.0447	.0049	.0	.37
2.46	.8791	.0499	.0052	.0	.39
2.47	.9006	.0553	.0054	.0	.41
2.49	.9221	.0610	.0056	.0	.43
2.51	.9337	.0641	.0031	.0	.41
2.53	.9395	.0657	.0016	.0	.32
2.55	.9453	.0673	.0016	.0	.22
2.57	.9511	.0690	.0016	.0	.17
2.59	.9569	.0706	.0016	.0	.14

HYDROGRAPH PEAK= .43 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .04 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	04-May-89
Project No.:	007.11.100	Time:	04:08 PM
Channel Section:	D-44A	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.43	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.10	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.25	feet
	Qn/1.49(S)1/2=	0.027	
	A(R)2/3=	0.027	
	Required Depth:	0.75	feet
	Area:	0.12	ft2
	Perimeter:	1.10	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	3.58	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.25	feet
	Qn/1.49(S)1/2=	0.027	
	A(R)2/3=	0.027	
	Required Depth:	0.75	feet
	Area:	0.12	ft2
	Perimeter:	1.10	feet
	Hydraulic Radius:	0.11	feet
	Velocity:	3.58	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.10	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Channel Depth:	0.75	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE RUNOFF HYDROLOGY - BELINA MINE AREA
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 4 MAY 89

DITCH 44B

START w/ UPPER SMALL DITCHES TO WEST

DITCH D-44B - Includes a portion of SAE 7 plus some undisturbed area.

MAP SCALE 1:100' RDG = 408 for 1.44 ac RATIO = 0.0035

Tributary Area = 506 * .0035 = 1.8 ac
Disturbed " = 78 = 0.3 ac
Undisturbed " = 1.5 ac

USING CONSISTENT CURVE NUMBERS AS DEVELOPED IN OUR FEB 89 SED. POND REPORT.

SAGE/GRASS AREAS, SOIL GROUP C, DENSITY 25%; CN = 75
OAK/ASPEN AREAS, SOIL GROUP C, DENSITY 25%; CN = 70
OAK/ASPEN AREAS, SOIL GROUP C, DENSITY 90%; CN = 40 *

* TAKEN FROM FIG 9.5 NEH4; PG 9.11

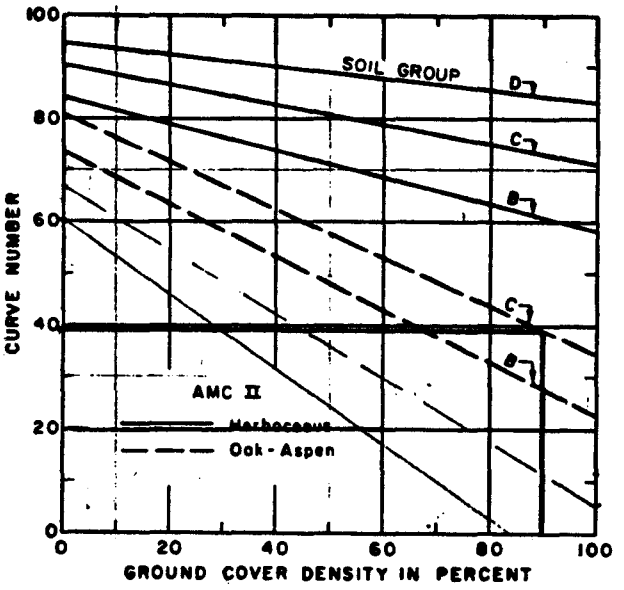


Figure 9.5.--Graph for estimating runoff curve numbers of forest-range complexes in western United States: herbaceous and oak-aspen complexes.

DISTURBED AREAS

		CN	S	CN	S
	CN = 90	98	0.204	75	3.333
RECLAIMED AREAS	CN = 85	90	1.111	70	4.286
PAVED AREAS	CN = 98	85	1.765	40	15.000

HANSEN ALLEN & LUCE inc

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE: RUNOFF HYD.
PROJECT NO.: 007.11.100

SHEET 2 OF
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DITCH D-44B

Area	CN	Runoff Depth (in) 10YR-6HR
0.3	90	0.723
1.5	40	0.155
1.8	$\bar{Q}$ =	0.25

$\overline{CN}$ = 77.8

$P_{10YR-6HR}$ = 1.55 in - Hand Calc for Example of procedure

$$Q_{in} = \frac{(P-.2S)^2}{P+.8S} \quad \text{where } S = \frac{1000}{CN} - 10$$

$$P^2 - .4PS + .04S^2 = PQ + .8QS$$
$$0.04S^2 - .4S(P+2Q) - PQ + P^2 = 0 \qquad \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$b = -0.4(P+2Q) = -0.82$
$a = 0.04 = 0.04$
$c = P(P-Q) = 2.015$

$$S = [+0.82 \pm \sqrt{(-.82)^2 - 4(.04)2.015}]\,0.08 = \frac{.82 \pm .592}{.08} = 17.65;\ 2.85$$

$$CN = \frac{1000}{S+10} = \frac{1000}{12.9} = 77.8 \quad \alpha$$

Hydraulic Length: 210 ft

Ave Slope: Measured from Map $\sim \frac{(900)25(100)}{43560\,(1.8)} = 28.7\%$

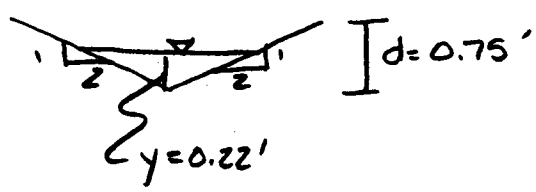
Hydro Results give Q = 0.37 cfs

Try Trap. Channel design:

$b = 0;\ m_1 = m_2 = 2;\ n = .03;\ Q = 0.4$

S_{min} = 17%
S_{max} = 21% from Printout V = 4.54 < 5 - α

NO LINING REQ'd



PROJECT : Valley Camp Coal - D-44B Runoff Calculation

AREA= 1.8 ACRES
AVERAGE BASIN SLOPE= 28.7 PERCENT
CURVE NUMBER= 77.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 710. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0536 HOURS QPCFS= 25.40 CFS QPIN=13.9920 INCHES
C3= 68.9665 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.18	.5678	.0000	.0000	.0	.00
2.20	.5831	.0000	.0000	2.4	.00
2.21	.5985	.0003	.0002	12.4	.00
2.22	.6139	.0006	.0004	22.1	.00
2.24	.6293	.0012	.0005	25.4	.01
2.25	.6446	.0019	.0007	23.0	.02
2.26	.6600	.0027	.0008	17.9	.04
2.28	.6754	.0037	.0010	12.6	.05
2.29	.6907	.0048	.0011	8.2	.07
2.30	.7061	.0061	.0013	5.0	.09
2.32	.7215	.0076	.0014	2.9	.11
2.33	.7368	.0091	.0016	1.7	.13
2.35	.7522	.0109	.0017	.9	.15
2.36	.7676	.0127	.0019	.5	.17
2.37	.7830	.0147	.0020	.3	.19
2.39	.7983	.0168	.0021	.1	.21
2.40	.8137	.0191	.0023	.0	.23
2.41	.8291	.0215	.0024	.0	.25
2.43	.8444	.0240	.0025	.0	.27
2.44	.8598	.0266	.0026	.0	.29
2.45	.8752	.0294	.0028	.0	.30
2.47	.8905	.0322	.0029	.0	.32
2.48	.9059	.0352	.0030	.0	.34
2.49	.9213	.0384	.0031	.0	.35
2.51	.9318	.0406	.0022	.0	.37
2.52	.9360	.0414	.0009	.0	.37
2.53	.9401	.0423	.0009	.0	.34
2.55	.9443	.0432	.0009	.0	.30
2.56	.9484	.0442	.0009	.0	.25
2.57	.9526	.0451	.0009	.0	.21
2.59	.9567	.0460	.0009	.0	.18
2.60	.9609	.0469	.0009	.0	.16

HYDROGRAPH PEAK= .37 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .04 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	04-May-89
Project No.:	007.11.100	Time:	03:38 PM
Channel Section:	D-44B	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.40	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.17	ft/ft
	Max. Bottom Slope:	0.21	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.22	feet
	Qn/1.49(S)1/2=	0.020	
	A(R)2/3=	0.020	
	Required Depth:	0.72	feet
	Area:	0.09	ft2
	Perimeter:	0.97	feet
	Hydraulic Radius:	0.10	feet
	Velocity:	4.25	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.21	feet
	Qn/1.49(S)1/2=	0.018	
	A(R)2/3=	0.018	
	Required Depth:	0.71	feet
	Area:	0.09	ft2
	Perimeter:	0.94	feet
	Hydraulic Radius:	0.09	feet
	Velocity:	4.54	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.17	ft/ft
	Max. Bottom Slope:	0.21	ft/ft
	Channel Depth:	0.72	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-1-32
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-1-32 Tributary Area → Ditch D-1

$Q_{TOT} = 3.9$ cfs (10 yr, 6 hr)

check pipe flow

32" CMP
$n = 0.024$
$S = 25\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 132.0$ cfs OK

Since $Q_{allow} >> Q_{TOT}$ pipe flow not limiting
OK

check Inlet control

HW depth = 5.2'

$\frac{HW}{D} = 1.9$ Using Chart 5 assume projecting entrance

$Q_{HW} = 45.0$ cfs

Since $Q_{HW} > Q_{TOT}$ inlet control limit does not
OK

Check Reqmt for Riprap

$\frac{Qn}{1.49 S^{1/2}} = 0.126$

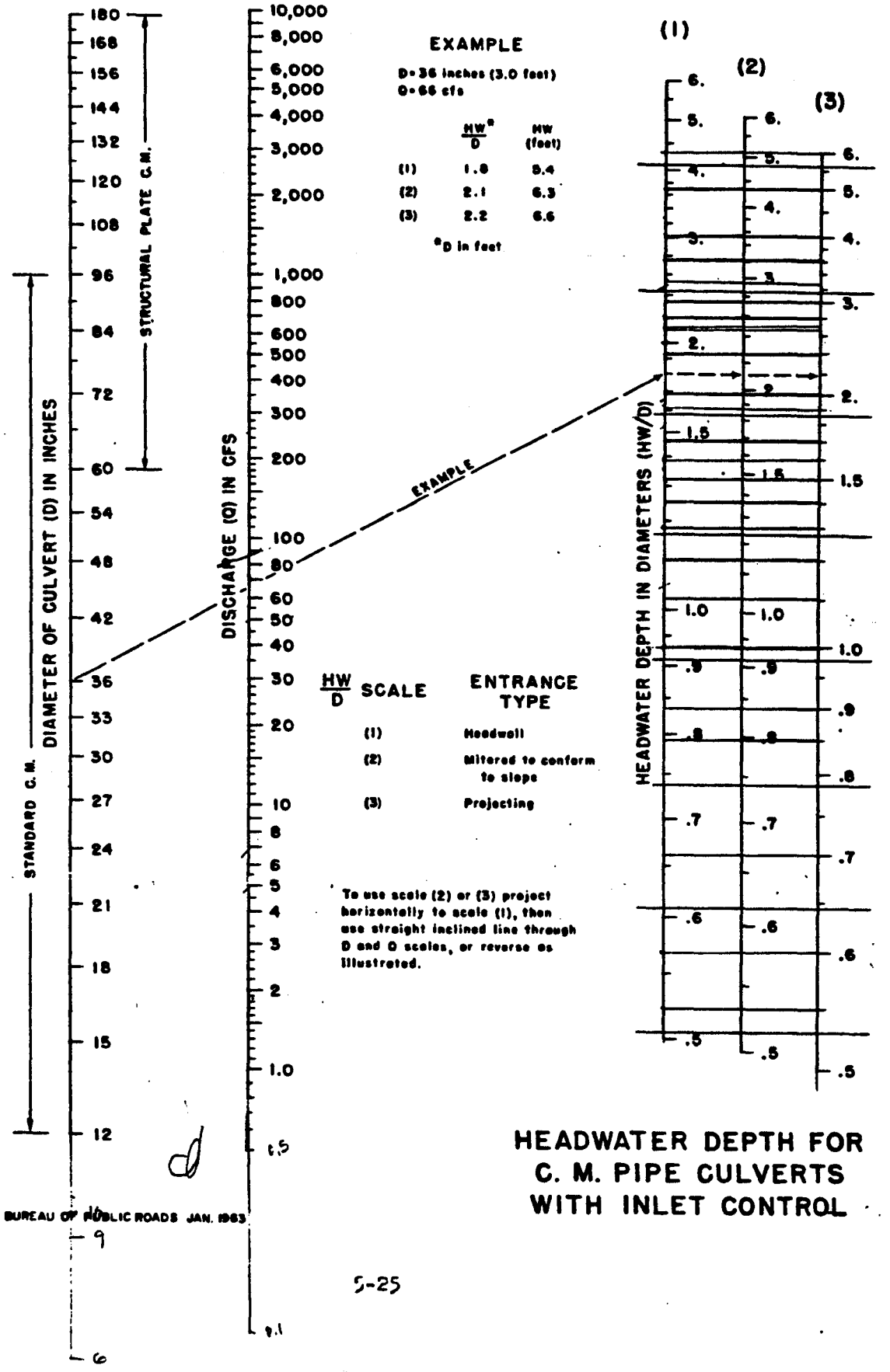
y	$AR^{2/3}$
0.2	0.041
0.3	0.096
0.35	0.132 → V = 10.6 fps > 5

USE EPA, 1976 Rock Riprap Outlet - "Erosion & Sediment Control, Surface Mining in the Eastern U.S., Vol 2, - Design", EPA, Oct 1976, pp 35-40.

TW depth ≤ 0.5 dia - Chart 1-15.

$d_{50} = 0.7$ ft, Lisoff graph, Use 10' Length

CHART 5



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

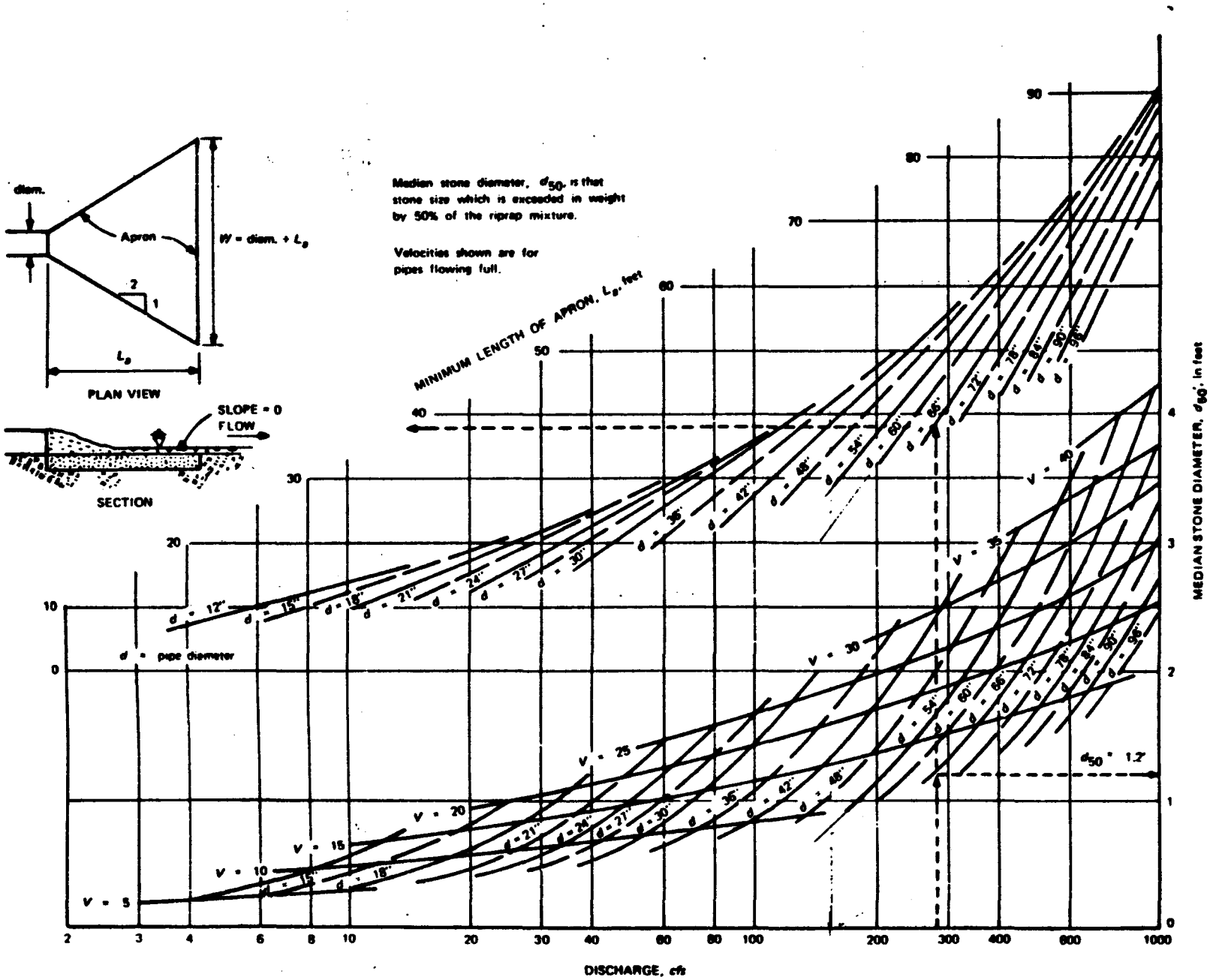


Figure I-15. Design of outlet protection – minimum tailwater condition ($T_W < 0.5$ diam.)[1]

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FEATURE
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C-2-18

This culvert drains very little area and is used for the draining of a small area sometimes used for storage of equipment. Since there is no identifiable tributary area, no calculations are made.

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FEATURE C-3-18
PROJECT NO. 007.11.100

SHEET ___ OF ___
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DATE 5/18/89

C-3-18

Tributary Flow - D-3

$Q_{TOT} = 2.61$ cfs

Check Pipe Flow

18" CMP
$n = 0.024$
$S = 3\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 9.86$ cfs OK

Since $Q_{allow} > Q_{TOT}$ pipe flow not limiting

Check Inlet Control

HW depth = 0.9' $\frac{HW}{D} = 2.7$

Using Chart 5 - Assume projecting entrance

$Q_{HW} = 12.5$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.243 \Rightarrow y = 0.53$, $V = 4.67 < 5$ fps OK - No Lining Reqd

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-4-42
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/19/89

C-4-42 (Permanent structure – Under Railroad Control upon Reclamation)

Total Area = 63 * 1.401 = 88 acres
90% Cover Oak/Aspen = 69 acres CN = 70
25% Cover Sage/Grass = 19 acres CN = 75

CN	A	Q
70	69	0.34
75	19	0.51

$\overline{Q} = 0.38$ $\overline{CN} = 71.2$

Precipitation = 2.25 inches (100 yr, 6 hr)

hydraulic length = 4,000 feet

$$\text{slope} = \frac{(16{,}000)(80)(100)}{43{,}560\,(88)} = 33.4\%$$

Calculated Runoff $Q_{TOT} = 16.6$ cfs

Check Pipe Flow

- 42" CMP
- n = 0.024
- S = 3%

$$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$Q_{allow} = 94.39$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe Flow not limiting

Check Inlet Control

- HW depth = 6.5' $\frac{HW}{D} = 1.86$

Use Chart 5 – assume projecting entrance

$Q_{HW} = 90$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

Riprap Check $\frac{Qn}{1.49 S^{1/2}} = 0.368$, y = 0.49, V = 4.84 < 5.0 fps OK

NO LINING REQ'D

PROJECT : Valley Camp Coal. 007.11.200 Culvert C-4-42

AREA= 88.0 ACRES
AVERAGE BASIN SLOPE= 33.4 PERCENT
CURVE NUMBER= 71.2
DESIGN STORM= 2.25 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 4000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .2392 HOURS QPCFS= 278.21 CFS QPIN= 3.1352 INCHES
C3= 15.4535 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.15	.7721	.0000	.0000	.0	.00
2.20	.8517	.0004	.0004	14.0	.00
2.25	.9314	.0036	.0031	86.4	.08
2.30	1.0110	.0096	.0060	184.7	.44
2.34	1.0907	.0183	.0087	255.4	1.34
2.39	1.1703	.0296	.0113	278.2	2.95
2.44	1.2500	.0434	.0137	260.6	5.31
2.49	1.3296	.0594	.0160	220.0	8.32
2.54	1.3660	.0674	.0081	172.1	11.68
2.58	1.3876	.0724	.0050	127.0	14.57
2.63	1.4091	.0775	.0051	89.5	16.24
2.68	1.4306	.0828	.0053	60.8	16.58
2.73	1.4521	.0882	.0054	40.0	15.98
2.77	1.4737	.0938	.0056	25.7	14.92
2.82	1.4952	.0995	.0057	16.1	13.77
2.87	1.5167	.1054	.0059	9.9	12.78
2.92	1.5383	.1114	.0060	6.0	12.04
2.97	1.5598	.1175	.0061	3.6	11.54
3.01	1.5801	.1235	.0059	2.1	11.26
3.06	1.5973	.1286	.0051	1.2	11.11
3.11	1.6145	.1338	.0052	.7	10.98
3.16	1.6317	.1391	.0053	.4	10.81
3.21	1.6489	.1444	.0054	.2	10.62
3.25	1.6662	.1499	.0055	.1	10.43
3.30	1.6834	.1554	.0055	.0	10.29

HYDROGRAPH PEAK= 16.58 cfs
TIME TO PEAK= 2.68 Hours
RUNOFF VOLUME= 2.77 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Dertnut
FEATURE C-5-18
PROJECT NO. 007.11.100

SHEET ___ OF ___
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DATE 5/16/89

C-5-18

Tributary Flow D-5A, D-5B

$Q_{5A} + Q_{5B} = (0.43 + 2.16)$ cfs

$Q_{TOT} = 2.59$ cfs

Check pipe characteristics

- 18" cast Iron
- $n = 0.014$
- $S = 3\%$

$Q_{allow} \frac{1.49}{n} AR^{2/3} S^{1/2}$

$Q_{allow} = 16.89$ cfs ok

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

- HW depth = 2.3'

$\frac{HW}{D} = 1.5$ assume projecting entrance or type A

Select most limiting solution using either chart 5 or 7

Chart 5 ⇒ $Q_5 = 9.0$ cfs

Chart 7 ⇒ $Q_7 = 10.5$ cfs

$Q_{HW} = 9.0$ cfs

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

Riprap Check $\frac{Qn}{1.49 S^{1/2}} = 0.141$, $y = 0.4'$, $V = 6.85$ fps > 5.0

Requirement for riprap may be marginal because outlet discharges into inlet area of C-6-18. If riprap is required by the agency it should have a

$d_{50} \sim 0.25$ ft (Riprap should only be required if additional erosion occurs.)

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE C-6-18
PROJECT NO. 007-11-100

SHEET ___ OF ___
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DATE 5/18/89

C-6-18

Tributary Flow (C-5-18) 2.59 cfs
(D-6) 0.82 cfs
Small Area - Negligable
3.41 cfs

Check pipe flow

- 18" CMP
- $n = 0.024$
- $S = 2.5\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 9.0$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW depth = 4.1 feet $\frac{HW}{D} = \frac{4.1}{1.5} = 2.7$

Use Chart 5 - Assume projecting entrance

$Q_{HW} = 13.0$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.347$, $y = 0.64$, $V = 4.74$ fps < 5.0 OK

NO LINING REQ'd

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PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
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DATE 10/30/89

C-7-24

Tributary Areas Ditch D-7A $Q = 0.57$
D-7B $Q = 1.27$
$Q_{TOT} = 1.84$ cfs

Check pipe flow:

- 24" CMP
- $n = 0.024$
- $S = 5\%$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 27.4$ cfs >> Q_{TOT} ok

Pipe Flow not limiting

Check Inlet flow

- HW = 2.8'

$\frac{HW}{D} = 1.4$

Using Chart 5 - assume projecting Inlet

$Q_{HW} = 16.5$ cfs >> Q_{TOT} ok

Inlet Control not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.133$, $y = 0.35$, $v = 4.98$ because $Q < 2$ cfs it does not appear on Fig 1-15, EPA, 76

∴ NO LINING REQ'D

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-8-18
PROJECT NO. 007.11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/18/89

C-8-18

Tributary Flows

D-8 = 1.17 cfs
D-9A, 9B = 0.07
Q_{TOT} = 1.24 cfs

Check Pipe Flow

- 18" CMP
- n = 0.024
- S = 4%

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

Q_{allow} = 11.4 cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW depth = 2.30

$\frac{HW}{D} = 1.5$ Use Chart 5 assume projecting entrance

Q_{HW} = 9.0 cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet Control not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.100$, y = 0.35', V = 3.96 < 5.0 fps OK

NO LINING REQ'd

ALSO Q < 2 cfs, EPA Chart

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CLIENT Valley Camp
PROJECT Permit
FEATURE
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 6/30/89

C-9-15

Tributary Ditches D-9A, D-9B } $Q_{TOT} = 0.07$ cfs

Check Pipe Flow

- 15" CMP
- $n = 0.024$
- $S = 0.001$

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 1.1$ cfs $> Q_{TOT}$ OK

Pipe flow not limiting

Check Inlet Control

- $HW = 1.25$

$\frac{HW}{D} = 1.0$

from Chart 5 - Projecting Inlet

$Q_{HW} = 3.5$ cfs $> Q_{TOT}$ OK

Inlet Control not limiting

Riprap Check

$Q < 0.1$ cfs - NO LINING REQ'd (By Inspection)

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Rehm
FEATURE C-10-18
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-10-18

Tributary Area Ditch D-10

Q_{TOT} = 1.18 cfs

Check Pipe flow

- 18" CMP
- n = 0.024
- S = 10%

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

Q_{allow} = 18.0 cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

- HW depth = 2.3 feet

$\frac{HW}{D} = \frac{2.3}{1.5} = 1.5$ Use chart 5 - assume projecting entrance

Q_{HW} = 9.0 cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

Riprap Check

EPA Chart, Q < 2cfs, NO LINING REQ'd

$\frac{Qn}{1.49 S^{1/2}} = 0.060$, y = 0.26, V = 5.76 fps

If erosion becomes evident, place

d_{50} = 0.25' for a distance of 5'

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CLIENT Valley Camp
PROJECT Permit
FEATURE C-11-12
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-11-12

Tributary Area = 940 * .000875 = 0.8 ac
disturbed = 840 * .000875 = 0.7 ac
paved = = 0.1 ac

CN	A	Q
90	0.7	0.72
98	0.1	1.33

$\bar{Q} = 0.80$ $\bar{CN} = 91.3$

P = 1.55 inches (10 Yr, 6 hr)

hydraulic length = 300'

$slope = \frac{(1425)(5)(100)}{43,560(0.8)} = 20.4\%$

Calculated Runoff $Q_{TOT} = 0.64$ cfs

Check Pipe Flow

- 12" CMP
- n = 0.024
- S = 8%

$Q_{allow} = \frac{1.49}{n} A R^{2/3} S^{1/2}$

$Q_{allow} = 5.5$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW = 16.0 ft (Seems high - Use 1.0')

$\frac{HW}{D} = 1$ $Q_{HW} = 2.0$ cfs OK

Inlet Control not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.036$, y = 0.23, v = 4.7 fps < 5.0 OK.
NO LINING REQ'd

PROJECT : Valley Camp Coal - C-11-12 Runoff Calculation

AREA= .8 ACRES
AVERAGE BASIN SLOPE= 20.4 PERCENT
CURVE NUMBER= 91.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 300. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0198 HOURS QPCFS= 30.51 CFS QPIN=37.8167 INCHES
C3=186.3984 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.39	.1898	.0000	.0000	.0	.00
1.41	.1932	.0000	.0000	30.5	.00
1.43	.1966	.0000	.0000	9.9	.00
1.45	.1999	.0000	.0000	1.1	.00
1.47	.2033	.0002	.0000	.0	.00
2.38	.7878	.2301	.0140	.0	.58
2.40	.8105	.2443	.0143	.0	.59
2.42	.8332	.2588	.0145	.0	.60
2.44	.8559	.2735	.0147	.0	.61
2.46	.8786	.2885	.0149	.0	.62
2.47	.9013	.3036	.0152	.0	.63
2.49	.9240	.3190	.0154	.0	.64
2.51	.9345	.3262	.0072	.0	.39
2.53	.9407	.3304	.0042	.0	.22
2.55	.9468	.3346	.0042	.0	.18
2.57	.9529	.3388	.0042	.0	.18
2.59	.9591	.3431	.0043	.0	.18
2.61	.9652	.3473	.0043	.0	.18

HYDROGRAPH PEAK= .64 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .05 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE C-12-24
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/18/89

C-12-24

Tributary Area = D-12A, D-12B

$Q_{D-12A} + Q_{D-12B} = 0.19 + 0.74$

$Q_{TOT} = 0.93$ cfs

Check Pipe Flow

- 24" CMP
- $n = 0.024$
- $S = 2\%$

$Q_{allow} = \frac{1.49}{n} AR^{2/3} S^{1/2}$

$Q_{allow} = 17.3$ cfs OK

Since $Q_{allow} > Q_{TOT}$ Pipe flow not limiting

Check Inlet Control

HW depth = 4.0'

$\frac{HW}{D} = 2.0$ Use Chart 5 - Assume projecting entrance

$Q_{HW} = 22.0$ cfs OK

Since $Q_{HW} > Q_{TOT}$ Inlet control not limiting

Riprap Check

$\frac{Qn}{1.49 S^{1/2}} = 0.106$, $y = 0.31$, $V = 3$ fps < 5.0 OK

NO LINING REQ'd

HANSEN ALLEN & LUCE INC

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FEATURE D-15
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/11/89

D-15

Total Area = 2543 * 0.00175 = 4.45ac
Paved = = 0.2
Disturbed = = 1.5
Aspen = = 1.5
Sage/Grass = = 1.0
Reclaimed = = 0.25

CN	A	Q
85	0.25	0.484
98	0.2	1.329
90	1.5	0.723
70	1.5	0.096
75	1.0	0.185

$\overline{Q} = 0.405$ $\overline{CN} = 82.8$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 900 feet

$$\text{slope} = \frac{(2565)(25)(100)}{43{,}560\ (4.2)} = 35.0\%$$

Run-off Calculation: $Q_{TOT} = 1.57$ cfs

Ditch Design:

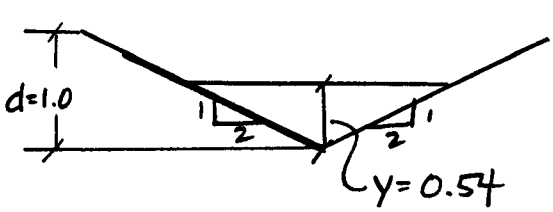
$S_{min} = 2\%$
$S_{max} = 2\%$

try trapezoidal design

$b = 0$, $M = 2$, $n = 0.03$

$V = 2.69$ ft/sec < 5.0 ft/sec OK

NO LINING NECESSARY



PROJECT : Valley Camp Coal - D-15 Runoff Calculations

AREA= 4.2 ACRES
AVERAGE BASIN SLOPE= 35.0 PERCENT
CURVE NUMBER= 82.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 900. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0501 HOURS QPCFS= 63.36 CFS QPIN=14.9611 INCHES
C3= 73.7432 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.04	.3994	.0000	.0000	.0	.00
2.05	.4186	.0000	.0000	12.8	.00
2.07	.4377	.0002	.0002	48.5	.00
2.09	.4569	.0008	.0006	63.4	.02
2.10	.4760	.0017	.0009	53.6	.05
2.12	.4952	.0029	.0012	35.7	.11
2.14	.5143	.0045	.0015	20.4	.18
2.15	.5335	.0063	.0019	10.5	.25
2.17	.5526	.0085	.0022	5.0	.33
2.19	.5718	.0109	.0024	2.3	.41
2.20	.5910	.0137	.0027	1.0	.48
2.22	.6101	.0167	.0030	.4	.56
2.24	.6293	.0200	.0033	.2	.63
2.25	.6484	.0235	.0035	.0	.70
2.40	.8208	.0662	.0056	.0	1.28
2.42	.8400	.0720	.0058	.0	1.33
2.44	.8591	.0781	.0060	.0	1.39
2.45	.8783	.0843	.0062	.0	1.44
2.47	.8974	.0908	.0064	.0	1.49
2.49	.9166	.0974	.0066	.0	1.54
2.51	.9316	.1027	.0053	.0	1.57
2.52	.9367	.1046	.0019	.0	1.50
2.54	.9419	.1064	.0019	.0	1.28
2.56	.9471	.1083	.0019	.0	1.00
2.57	.9523	.1102	.0019	.0	.78
2.59	.9574	.1121	.0019	.0	.64
2.61	.9626	.1141	.0019	.0	.56

HYDROGRAPH PEAK= 1.57 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .14 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	11-May-89
Project No.:	007.11.100	Time:	11:39 AM
Channel Section:	Ditch D-15	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	1.57	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.54	feet
	Qn/1.49(S)1/2=	0.224	
	A(R)2/3=	0.226	
	Required Depth:	1.04	feet
	Area:	0.58	ft2
	Perimeter:	2.41	feet
	Hydraulic Radius:	0.24	feet
	Velocity:	2.69	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.54	feet
	Qn/1.49(S)1/2=	0.224	
	A(R)2/3=	0.226	
	Required Depth:	1.04	feet
	Area:	0.58	ft2
	Perimeter:	2.41	feet
	Hydraulic Radius:	0.24	feet
	Velocity:	2.69	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.02	ft/ft
	Max. Bottom Slope :	0.02	ft/ft
	Min. Channel Depth:	1.04	feet
	Riprap:	Not Needed	

Comment:

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CLIENT Valley Camp
PROJECT Permit
FEATURE D-16A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/11/89

D-16A

Total Area = 2863 * 0.00175 = 5.1 ac
Paved = = 0.2 ac
disturbed = = 2.4 ac
Aspen = = 1.5 ac
Sage/Grass = = 1.0 ac

CN	A	Q
98	0.2	1.3294
90	2.4	0.723
70	1.5	0.096
75	1.0	0.185

$\bar{Q} = 0.457$ $\bar{CN} = 84.32$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 1415

$$\text{slope} = \frac{(2805)(25)(100)}{43{,}650\,(5.1)} = 31.6\%$$

Run-off Calculation: $Q_{TOT} = 2.13$ cfs

Ditch Design UPPER REACH

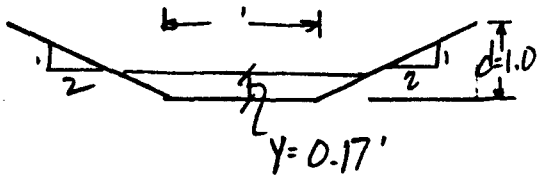
$S_{min} = 8\%$ S_{max} on upper reach ≈ 15%
$S_{max} = 37\%$ (lower reach into pond, based upon data after the 10/88 pond clean-out)

The ditch is currently lined with a conveyor belt. Because of the extreme variation in slope, it is recommended that the ditch be constructed as follows.

The upper portion of the ditch can be designed with the following parameters

b = , M = 2, n = 0.02

V = 4.75 < 5. ft/s



no lining required.

D-16A (Continued) LOWER REACH

The lower end of the channel cannot be designed practically without the use of a rip-rap pad. Therefore, the following is recommended.

Maximum Channel Slope ≈ 37%, $Q = 2.13$ cfs
$d = 0.17$ feet

Utilizing information presented in the manual "Design of Stable Channels w/ Flexible Linings", by the Federal Highway Administration. We get the following.

$$D_{50} = \frac{d_{max}\,\gamma\,S}{5}$$

where $d_{max} = 0.17$ ft
$\gamma = 62.4$
$S = 0.37$

$D_{50} = 0.8$ ft

Select $D_{50} = 1.0$ for additional safety factor and reduced maintenance.

From Table 5-1 (Urban Storm Drainage Criteria Manual Vol 2 - Wright-McLaughlin Eng. 1969)

D_{50} rock is classified as follows

TYPE L

% smaller than Given size by weight	Intermediate Rock dimen. (Inches)
70-100	15
50-70	12
35-50	9
2-10	3

The Urban Storm Drainage Criteria Manual suggests that Given the rip-rap type to be L, it is possible to use a single 12" layer of type II bedding as the underlying filter blanket.

The following cross section is proposed.

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SHEET 3 OF
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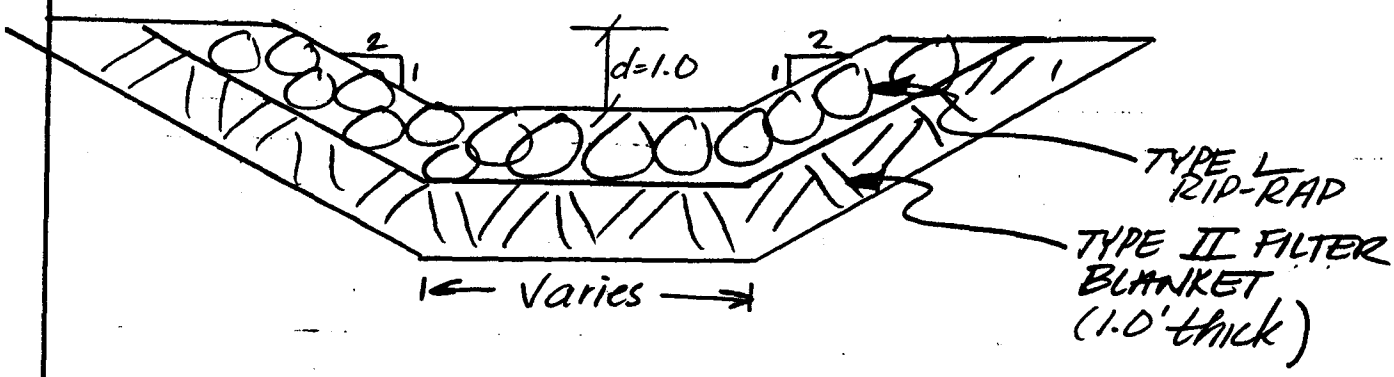
DATE 5/12/89

D-16A (Continued)



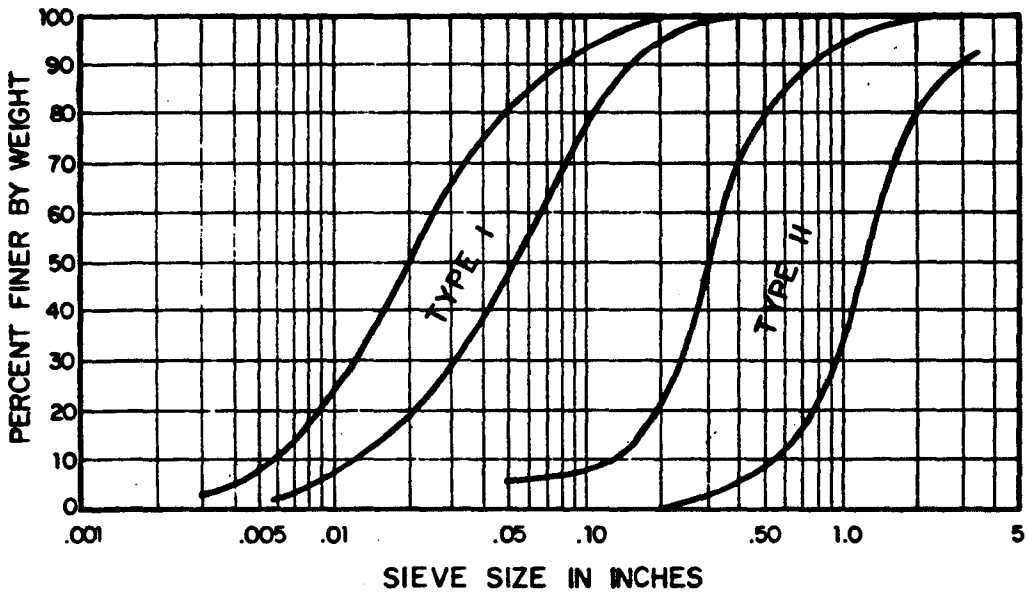


FIGURE 5-2. GRADATION CURVES FOR GRANULAR BEDDING

D-16A (Continued)

The intent is to break up the flow and prevent unnecessary erosion from occuring within the pond.

∴ design a transition zone and reign to dissipate the stream energy prior to direct pond discharge.

The EPA has developed a methodology for a tan tailed energy dissipator, which receives flow from a culvert. (Erosion and sediment Control-Surface Mining in the Eastern U.S. - EPA technology transfer Seminar Publication.) See figure 1-15 below

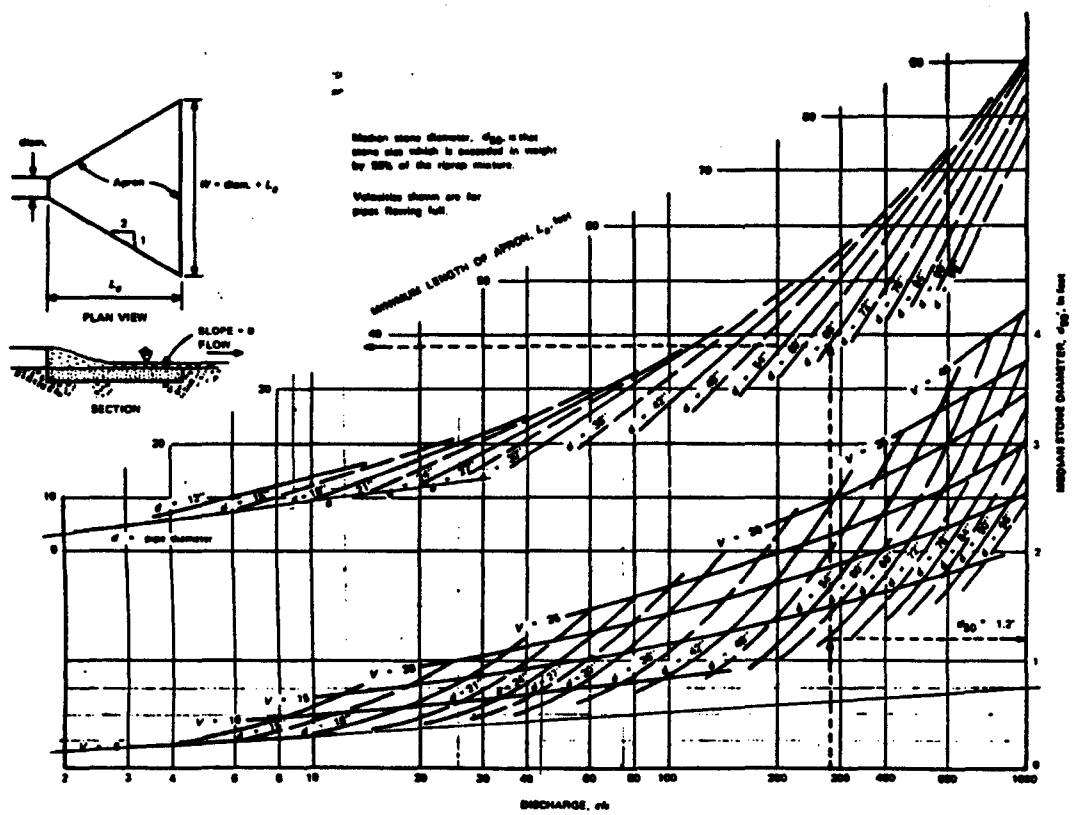


Figure I-15. Design of outlet protection – minimum tailwater condition (T_{tw} < 0.5 diam.)[1]

Note: The Graph indicates a minimum length of 10 feet for a flow of 2.13 cfs (for all pipe diameters). As we are not on a zero % slope as in this method. It is recommended that we use 20' for a transition length.

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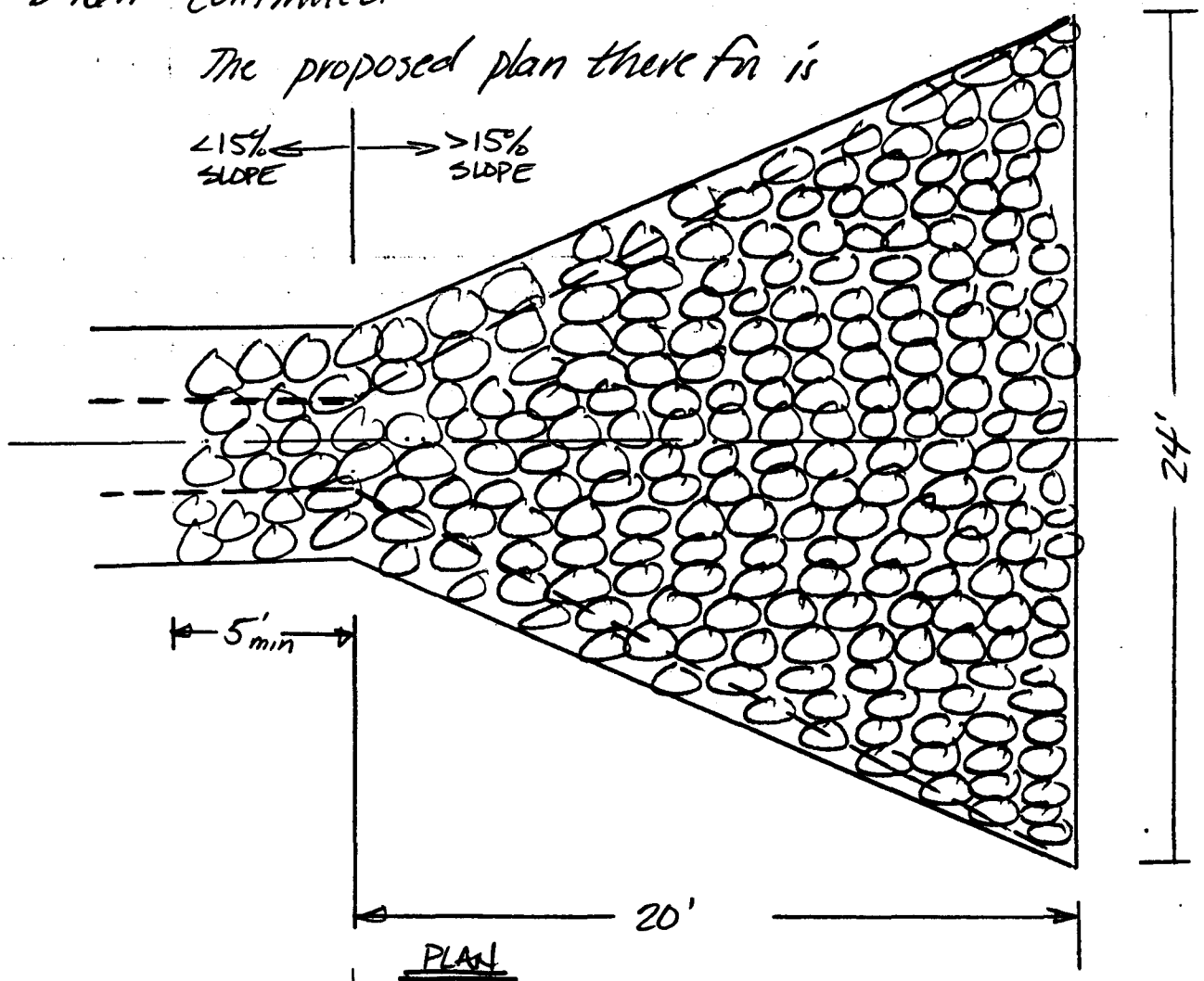
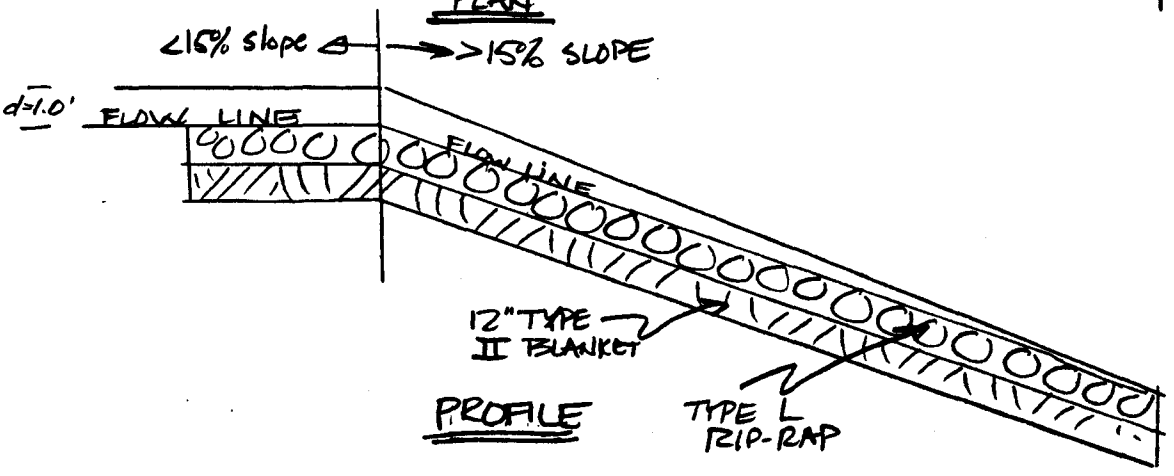
D-16A Continued

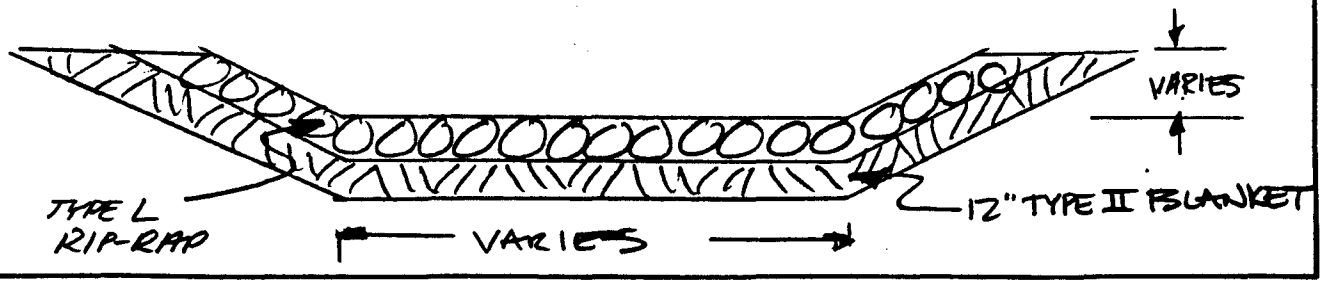
The proposed plan therefore is



PLAN



PROFILE



PROJECT : Valley Camp Coal - D-16A Runoff Calculations

AREA= 5.1 ACRES
AVERAGE BASIN SLOPE= 31.6 PERCENT
CURVE NUMBER= 84.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1415. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0720 HOURS QPCFS= 53.55 CFS QPIN=10.4128 INCHES
C3= 51.3249 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.00	.3591	.0000	.0000	.0	.00
2.02	.3756	.0000	.0000	2.7	.00
2.03	.3921	.0002	.0002	16.6	.00
2.05	.4087	.0007	.0005	35.5	.00
2.06	.4252	.0015	.0008	49.2	.02
2.07	.4417	.0025	.0010	53.5	.04
2.09	.4582	.0038	.0013	50.2	.08
2.10	.4748	.0053	.0015	42.3	.14
2.12	.4913	.0071	.0018	33.1	.20
2.13	.5078	.0092	.0020	24.4	.27
2.15	.5243	.0114	.0023	17.2	.35
2.16	.5408	.0140	.0025	11.7	.44
2.18	.5574	.0167	.0027	7.7	.52
2.19	.5739	.0197	.0030	4.9	.61
2.20	.5904	.0228	.0032	3.1	.69
2.22	.6069	.0262	.0034	1.9	.78
2.23	.6235	.0298	.0036	1.2	.86
2.25	.6400	.0336	.0038	.7	.94
2.26	.6565	.0376	.0040	.4	1.02
2.28	.6730	.0418	.0042	.2	1.10
2.29	.6895	.0461	.0044	.1	1.17
2.30	.7061	.0507	.0045	.0	1.25
2.43	.8548	.0992	.0060	.0	1.84
2.45	.8713	.1054	.0062	.0	1.90
2.46	.8878	.1117	.0063	.0	1.96
2.48	.9043	.1181	.0065	.0	2.02
2.49	.9209	.1247	.0066	.0	2.07
2.51	.9320	.1293	.0045	.0	2.12
2.52	.9365	.1311	.0018	.0	2.13
2.54	.9409	.1329	.0018	.0	2.06
2.55	.9454	.1348	.0018	.0	1.90
2.56	.9499	.1366	.0019	.0	1.68
2.58	.9543	.1385	.0019	.0	1.46
2.59	.9588	.1404	.0019	.0	1.25

PROJECT : Valley Camp Coal - D-16A Runoff Calculations
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.61	.9633	.1423	.0019	.0	1.08

HYDROGRAPH PEAK= 2.13 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .19 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	12-May-89
Project No.:	007.11.100	Time:	10:45 AM
Channel Section:	Ditch D-16A	Computed:	PGH

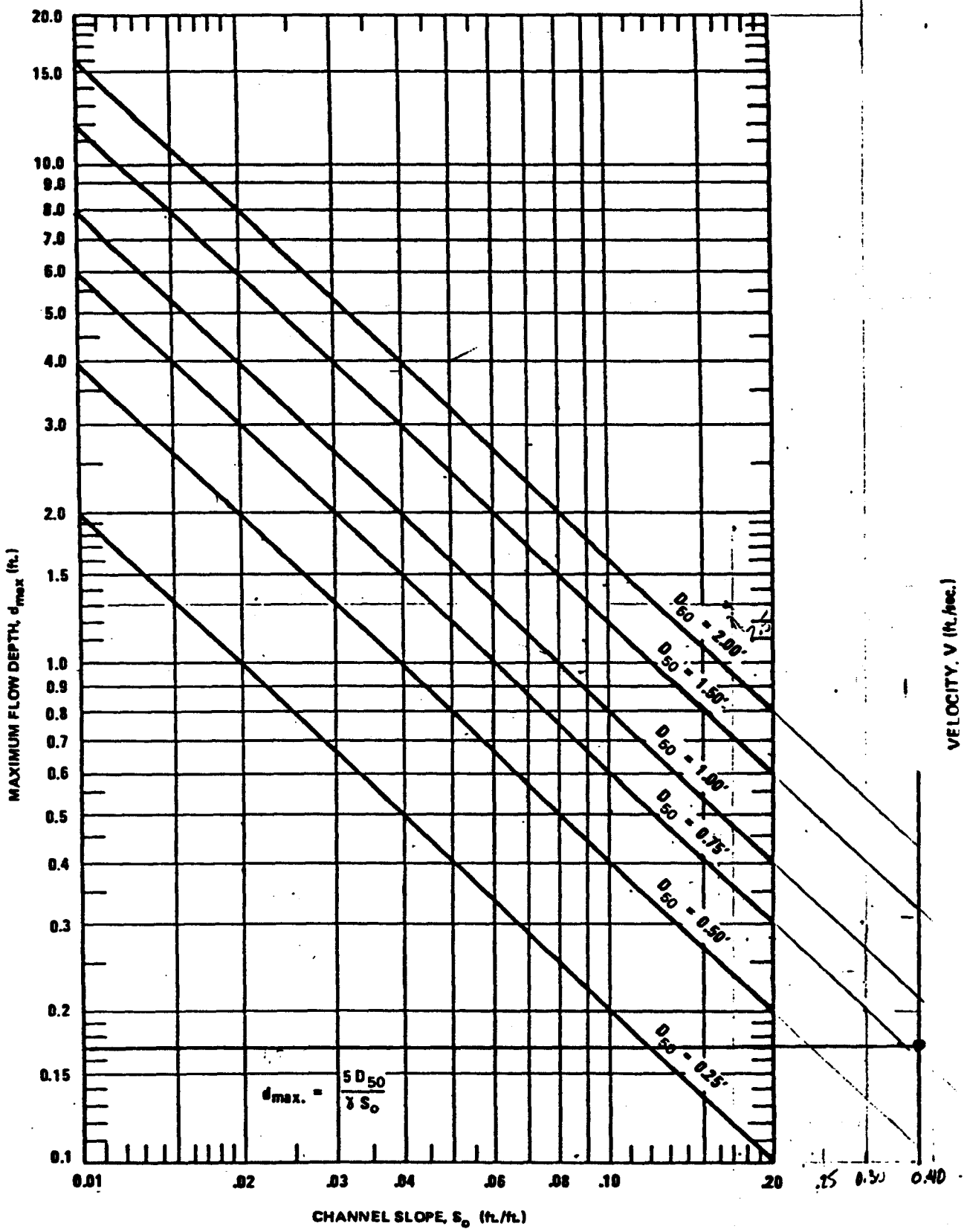
			UNITS
GENERAL CRITERIA:	Design Flow:	2.13	cfs
	Bottom Width:	3.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.08	ft/ft
	Max. Bottom Slope:	0.15	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.17	feet
	Qn/1.49(S)1/2=	0.152	
	A(R)2/3=	0.153	
	Required Depth:	0.67	feet
	Area:	0.55	ft2
	Perimeter:	3.74	feet
	Hydraulic Radius:	0.15	feet
	Velocity:	3.88	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.14	feet
	Qn/1.49(S)1/2=	0.111	
	A(R)2/3=	0.112	
	Required Depth:	0.64	feet
	Area:	0.45	ft2
	Perimeter:	3.61	feet
	Hydraulic Radius:	0.12	feet
	Velocity:	4.75	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	3.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.08	ft/ft
	Max. Bottom Slope :	0.15	ft/ft
	Min. Channel Depth:	0.67	feet
	Riprap:	Not Needed	

Comment: upper reach where S≤15%

Design of stable channels with flexible linings - Fed. Highway Administ

Chart 27



MAXIMUM PERMISSIBLE DEPTH OF FLOW (d_{max})
FOR CHANNELS LINED WITH ROCK RIPRAP

$n = .0395 D_{50}^{1/6}$

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-16B
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5/11/89

D-16B

TOTAL AREA: 415 * 0.00175 = 0.7 ac

CN = 90

PRECIPITATION: 1.55 inches (10yr, 6hr)

HYD. LENGTH = 400'

SLOPE: $\frac{(2050)\,5(100)}{43560\,(0.7)} = 33.6\%$

CALCULATED RUNOFF $Q_{TOT} = 0.5$ cfs

DITCH DESIGN - UPPER SECTION TO EDGE OF POND SLOPE

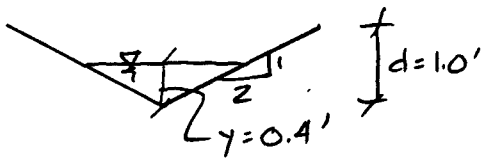
$S_{MIN} = 1\%$
$S_{MAX} = 10\%$

Try Trapezoidal Channel

$b = 0,\ m = 2,\ n = 0.03$

$V = 3.7$ fps < 5.0 ok

NO LINING REQUIRED



PROJECT : Valley Camp Coal - D-16B Runoff Calculations

AREA= .7 ACRES
AVERAGE BASIN SLOPE= 33.6 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 400. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0205 HOURS QPCFS= 25.77 CFS QPIN=36.5095 INCHES
C3=179.9552 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2203	.0000	.0000	.0	.00
1.56	.2263	.0000	.0000	25.8	.00
1.58	.2324	.0000	.0000	8.4	.00
1.60	.2384	.0002	.0001	.9	.00
1.62	.2444	.0004	.0002	.0	.00
2.36	.7665	.1790	.0128	.0	.45
2.38	.7901	.1920	.0131	.0	.46
2.40	.8136	.2054	.0134	.0	.47
2.42	.8371	.2190	.0136	.0	.48
2.44	.8606	.2329	.0139	.0	.49
2.46	.8841	.2471	.0142	.0	.49
2.48	.9076	.2615	.0144	.0	.50
2.50	.9303	.2756	.0141	.0	.50
2.52	.9367	.2796	.0040	.0	.24
2.54	.9430	.2836	.0040	.0	.15
2.56	.9494	.2876	.0040	.0	.14
2.58	.9557	.2917	.0040	.0	.14
2.60	.9621	.2957	.0041	.0	.14

HYDROGRAPH PEAK= .50 cfs
TIME TO PEAK= 2.48 Hours
RUNOFF VOLUME= .04 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	12-May-89
Project No.:	007.11.100	Time:	09:53 AM
Channel Section:	Ditch D-16B	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.50	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.01	ft/ft
	Max. Bottom Slope:	0.10	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.40	feet
	Qn/1.49(S)1/2=	0.101	
	A(R)2/3=	0.102	
	Required Depth:	0.90	feet
	Area:	0.32	ft2
	Perimeter:	1.79	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	1.56	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.26	feet
	Qn/1.49(S)1/2=	0.032	
	A(R)2/3=	0.032	
	Required Depth:	0.76	feet
	Area:	0.14	ft2
	Perimeter:	1.16	feet
	Hydraulic Radius:	0.12	feet
	Velocity:	3.70	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.01	ft/ft
	Max. Bottom Slope :	0.10	ft/ft
	Min. Channel Depth:	0.90	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-18A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/10/89

D-18A

calibrate planimeter $\frac{(250\ ft)^2}{43560} = 0.00175$ Ac/in²

$\frac{43560}{822}$

Total Area = 1200 * 0.00175 = 2.1 Acres
dist. area = 273 = 0.5 Ac
Aspen = 724 = 1.3 Ac
Sage/Grass = = 0.3 Ac

CN	Ac	Q
90	0.5	0.723
70	1.3	0.096
75	0.3	0.185

$\bar{Q} = 0.258$ $\bar{CN} = 78.1$

Precipitation = 1.55 inches (10yr, 6hr)

Hydraulic length = 750 feet

$$\text{slope} = \frac{(1575)(25)(100)}{43{,}560\ (2.1)} = 43\%$$

Run-off Calculation: Q = 0.46 cfs

Ditch Design:

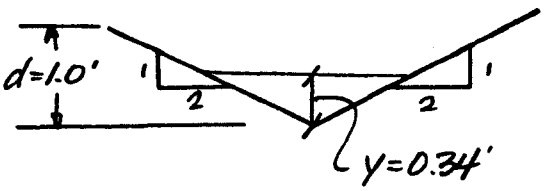
$S_{min} = 2\%$
$S_{max} = 5\%$

Try trapezoidal design

$b = 0$, $M = 2$, $\eta = 0.03$

$V = 2.73$ ft/sec < 5 ft/sec OK

No lining necessary



PROJECT : Valley Camp Coal - D-18A Runoff Calculation

AREA= 2.1 ACRES
AVERAGE BASIN SLOPE= 43.0 PERCENT
CURVE NUMBER= 78.1
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 750. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0453 HOURS QPCFS= 35.03 CFS QPIN=16.5406 INCHES
C3= 81.5285 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.18	.5582	.0000	.0000	.0	.00
2.19	.5755	.0000	.0000	7.1	.00
2.21	.5929	.0004	.0003	26.8	.00
2.22	.6102	.0009	.0005	35.0	.01
2.24	.6275	.0015	.0007	29.6	.03
2.25	.6448	.0024	.0009	19.7	.05
2.27	.6622	.0035	.0011	11.3	.08
2.28	.6795	.0048	.0013	5.8	.10
2.30	.6968	.0063	.0015	2.8	.13
2.31	.7142	.0080	.0017	1.3	.16
2.33	.7315	.0098	.0018	.5	.18
2.34	.7488	.0118	.0020	.2	.21
2.36	.7662	.0140	.0022	.0	.24
2.37	.7835	.0164	.0024	.0	.26
2.39	.8008	.0189	.0025	.0	.29
2.40	.8182	.0216	.0027	.0	.31
2.42	.8355	.0245	.0029	.0	.34
2.43	.8528	.0275	.0030	.0	.36
2.45	.8702	.0307	.0032	.0	.38
2.46	.8875	.0341	.0034	.0	.41
2.48	.9048	.0376	.0035	.0	.43
2.49	.9221	.0412	.0037	.0	.45
2.51	.9326	.0435	.0023	.0	.46
2.52	.9372	.0446	.0010	.0	.43
2.54	.9419	.0456	.0010	.0	.36
2.55	.9466	.0467	.0011	.0	.29
2.57	.9513	.0477	.0011	.0	.23
2.58	.9560	.0488	.0011	.0	.19
2.60	.9607	.0499	.0011	.0	.17

HYDROGRAPH PEAK= .46 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .05 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	10-May-89
Project No.:	007.11.100	Time:	03:00 PM
Channel Section:	Ditch D-18A	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.46	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.34	feet
	Qn/1.49(S)1/2=	0.066	
	A(R)2/3=	0.066	
	Required Depth:	0.84	feet
	Area:	0.23	ft2
	Perimeter:	1.52	feet
	Hydraulic Radius:	0.15	feet
	Velocity:	1.99	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.29	feet
	Qn/1.49(S)1/2=	0.042	
	A(R)2/3=	0.043	
	Required Depth:	0.79	feet
	Area:	0.17	ft2
	Perimeter:	1.30	feet
	Hydraulic Radius:	0.13	feet
	Velocity:	2.73	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.05	ft/ft
	Channel Depth:	0.84	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE inc

CLIENT Valley Camp
PROJECT Permit
FEATURE D-18B
PROJECT NO. 007-11-100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/10/89

D-18-B (Convenience Ditch)
Tributary Area

Area D-18B = 913 * 0.00175 = 1.65 ac
sage/grass = 377 = 0.7
Aspen = = 0.2
Disturbed = 286 = 0.5
Reclam = 143 = 0.25

CN	Area	Q
85	0.25	0.484
75	0.7	0.185
70	0.2	0.096
90	0.5	0.723

$\bar{Q} = 0.388$ $\bar{CN} = 82.3$

Precipitation = 1.55 inches (10yr, 6hr)

hydraulic length = 850 ft

$$\text{slope} = \frac{(850)(25)(100)}{43{,}560\ (1.4)} = 34.8$$

Run-Off Calculation: Q = 0.59 cfs

No additional design anticipated

PROJECT : Valley Camp Coal - D-18B Runoff Calculations

AREA= 1.6 ACRES
AVERAGE BASIN SLOPE= 34.8 PERCENT
CURVE NUMBER= 82.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 850. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0488 HOURS QPCFS= 25.56 CFS QPIN=15.3608 INCHES
C3= 75.7135 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.05	.4153	.0000	.0000	.0	.00
2.07	.4340	.0000	.0000	5.2	.00
2.08	.4527	.0002	.0002	19.6	.00
2.10	.4713	.0008	.0005	25.6	.00
2.12	.4900	.0016	.0008	21.6	.02
2.13	.5087	.0028	.0011	14.4	.04
2.15	.5274	.0042	.0014	8.2	.07
2.17	.5460	.0059	.0017	4.2	.09
2.18	.5647	.0079	.0020	2.0	.12
2.20	.5834	.0102	.0023	.9	.15
2.21	.6021	.0127	.0025	.4	.18
2.23	.6207	.0155	.0028	.2	.21
2.25	.6394	.0186	.0030	.0	.24
2.41	.8261	.0616	.0053	.0	.48
2.43	.8448	.0670	.0055	.0	.50
2.44	.8635	.0727	.0056	.0	.52
2.46	.8821	.0785	.0058	.0	.54
2.47	.9008	.0845	.0060	.0	.56
2.49	.9195	.0907	.0062	.0	.58
2.51	.9322	.0950	.0043	.0	.59
2.52	.9373	.0968	.0017	.0	.55
2.54	.9423	.0985	.0017	.0	.46
2.56	.9473	.1003	.0018	.0	.36
2.57	.9524	.1020	.0018	.0	.28
2.59	.9574	.1038	.0018	.0	.23
2.60	.9625	.1056	.0018	.0	.21

HYDROGRAPH PEAK= .59 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .05 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-19A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/18/89

D-19A

Total Area = 5 * 1.401 = 7.0 Acres

CN = 75

Precip = 1.55 inches (10 yr, 6 hr)

hydraulic length = 1,200 ft

$$\text{slope} = \frac{(900)(80)(100)}{43{,}560\,(7)} = 23.6\%$$

Calculated Runoff $Q_{TOT_{10\,yr}} = 0.74$ cfs

Ditch Design

$S_{min} = 3\%$

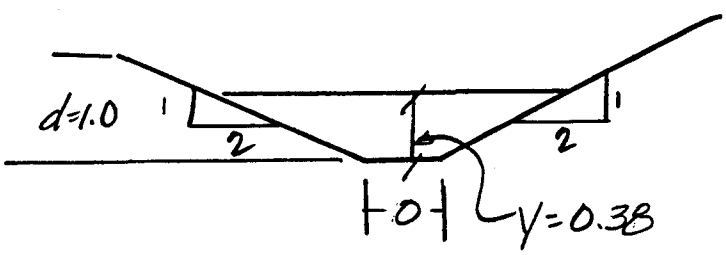
$S_{max} = 4\%$

try trapezoidal channel

$b = 0,\ m = 2,\ n = 0.03$

$V_{max} = 2.85 < 5.0$ fps ok.

No Lining Required



PROJECT : Valley Camp Coal - D-19A Runoff Calculation

AREA= 7.0 ACRES
AVERAGE BASIN SLOPE= 23.6 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1200. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0976 HOURS QPCFS= 54.21 CFS QPIN= 7.6803 INCHES
C3= 37.8561 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.27	.6610	.0000	.0000	.0	.00
2.28	.6834	.0000	.0000	2.7	.00
2.30	.7058	.0005	.0004	16.8	.00
2.32	.7282	.0011	.0007	36.0	.01
2.34	.7506	.0021	.0009	49.8	.03
2.36	.7730	.0033	.0012	54.2	.07
2.38	.7954	.0048	.0015	50.8	.12
2.40	.8178	.0066	.0018	42.9	.18
2.42	.8402	.0086	.0020	33.5	.25
2.44	.8626	.0109	.0023	24.7	.34
2.46	.8850	.0134	.0025	17.4	.42
2.48	.9074	.0162	.0028	11.8	.51
2.50	.9298	.0193	.0030	7.8	.61
2.52	.9360	.0201	.0009	5.0	.69
2.54	.9421	.0210	.0009	3.1	.74
2.56	.9481	.0219	.0009	1.9	.74
2.58	.9542	.0228	.0009	1.2	.70
2.60	.9602	.0238	.0009	.7	.64
2.62	.9663	.0247	.0009	.4	.57
2.64	.9723	.0257	.0010	.2	.50
2.66	.9784	.0267	.0010	.1	.45
2.68	.9844	.0277	.0010	.0	.42

HYDROGRAPH PEAK= .74 cfs
TIME TO PEAK= 2.56 Hours
RUNOFF VOLUME= .11 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	12-Jul-89
Project No.:	007.11.100	Time:	02:31 PM
Channel Section:	D-19A	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.74	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.030	ft/ft
	Max. Bottom Slope:	0.040	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.38	feet
	Qn/1.49(S)1/2=	0.086	
	A(R)2/3=	0.086	
	Required Depth:	0.88	feet
	Area:	0.28	ft2
	Perimeter:	1.68	feet
	Hydraulic Radius:	0.17	feet
	Velocity:	2.63	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.36	feet
	Qn/1.49(S)1/2=	0.075	
	A(R)2/3=	0.077	
	Required Depth:	0.86	feet
	Area:	0.26	ft2
	Perimeter:	1.61	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	2.85	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	3.0	%
	Max. Bottom Slope:	4.0	%
	Min Channel Depth:	0.88	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-19B
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/18/89

D-19B

Total Area = 530 * 0.00087 = 0.5 Acres

CN = 75

Precipitation = 1.55" (10 yr, 6 hr)

hydraulic length = 625'

slope = $\frac{(250)(5)(100)}{43{,}560(0.5)}$ = 5.7%

Calculated Run-off = $Q_{TOT_{100yr}}$ = 0.05 cfs

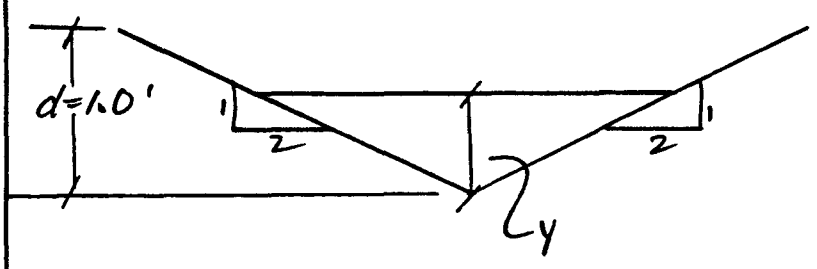
Ditch Design

S_{min} = 2%

S_{max} = 4%

by trapezoidal channel

b=0, m=2, n=0.03



FLOW IS MINIMAL
USE GENERAL DESIGN

PROJECT : Valley Camp Coal - D-19B Runoff Calculation

AREA= .5 ACRES
AVERAGE BASIN SLOPE= 5.7 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 625. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1179 HOURS QPCFS= 3.21 CFS QPIN= 6.3606 INCHES
C3= 31.3515 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.26	.6591	.0000	.0000	.0	.00
2.29	.6862	.0001	.0001	.2	.00
2.31	.7132	.0006	.0005	1.0	.00
2.33	.7403	.0016	.0009	2.1	.00
2.36	.7673	.0030	.0014	2.9	.00
2.38	.7944	.0047	.0018	3.2	.00
2.41	.8214	.0069	.0022	3.0	.00
2.43	.8485	.0094	.0025	2.5	.02
2.45	.8755	.0123	.0029	2.0	.02
2.48	.9026	.0156	.0033	1.5	.03
2.50	.9296	.0192	.0036	1.0	.04
2.52	.9372	.0203	.0011	.7	.04
2.55	.9445	.0214	.0011	.5	.05
2.57	.9518	.0225	.0011	.3	.05
2.59	.9591	.0236	.0011	.2	.05
2.62	.9664	.0247	.0011	.1	.04
2.64	.9738	.0259	.0012	.0	.04
2.66	.9811	.0271	.0012	.0	.04
2.69	.9884	.0283	.0012	.0	.03
2.71	.9957	.0296	.0012	.0	.03

HYDROGRAPH PEAK= .05 cfs
TIME TO PEAK= 2.57 Hours
RUNOFF VOLUME= .00 Acre-Feet

HAUL ROAD DITCH CALCULATIONS - CHECK / REVIEW

CHECK DITCHES 21 thru 28 (Ditch 27 does not exist)

COLVERT #	DITCH #	FLOW (cfs)
C-21-48	D-21	0.42
C-23-24	D-23	0.79
C-24-24	D-24	2.04
C-25-36	D-25A	0.19
	D-25B	6.96
C-26-24	D-26	0.57
C-26A-24	D-26A	1.01
C-28-24	D-28	3.3

Concrete/Asphalt $n = 0.015$

Calculations herein are approximate only and are used as a relative guide to field conditions. They are intended to give an approximate magnitude of runoff conditions to evaluate concrete ditch characteristics.

D-21 Find Flow.

Area = 11.6 ac
CN = 70.5 (Matching C-22-24 data)
S = 50%
H_L = 2070'
P = 1.55 in, 6 hr

$\Big\}$ Q = 0.42 cfs

Typical Section:

Ditch Slope = 0.037 ft/ft (flat section)

Depth - Typical Section has b=0, T=6', d=0.75', n=0.015

$\frac{Qn}{1.49 S^{1/2}} = AR^{2/3} = 0.022$

(Calc. using Trap. Section with no bottom width

Y	$AR^{2/3}$
0.5	0.39
0.22	0.044
0.17	0.022

A = 0.116
V = 3.63

Y = 0.17' freeboard = 0.58'

PROJECT : VALLEY CAMP - DITCH D-21 RUNOFF DESIGN

AREA= 11.6 ACRES
AVERAGE BASIN SLOPE= 50.0 PERCENT
CURVE NUMBER= 70.5
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2070. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1176 HOURS QPCFS= 74.57 CFS QPIN= 6.3747 INCHES
C3= 31.4210 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.40	.8153	.0000	.0000	.0	.00
2.42	.8423	.0000	.0000	3.7	.00
2.45	.8693	.0002	.0002	23.2	.00
2.47	.8963	.0008	.0006	49.5	.00
2.49	.9233	.0017	.0009	68.5	.03
2.52	.9355	.0023	.0005	74.6	.07
2.54	.9428	.0026	.0003	69.8	.12
2.56	.9501	.0030	.0004	59.0	.16
2.59	.9574	.0034	.0004	46.1	.19
2.61	.9647	.0038	.0004	34.0	.20
2.64	.9719	.0042	.0004	24.0	.21
2.66	.9792	.0047	.0005	16.3	.21
2.68	.9865	.0052	.0005	10.7	.21
2.71	.9938	.0057	.0005	6.9	.21
2.73	1.0011	.0062	.0005	4.3	.22
2.75	1.0084	.0068	.0006	2.7	.22
2.78	1.0157	.0073	.0006	1.6	.23
2.80	1.0230	.0079	.0006	1.0	.24
2.82	1.0303	.0085	.0006	.6	.25
2.85	1.0376	.0092	.0006	.3	.26
2.87	1.0449	.0099	.0007	.2	.27
2.89	1.0522	.0105	.0007	.1	.28
2.92	1.0595	.0112	.0007	.0	.29
3.39	1.1813	.0262	.0008	.0	.39
3.41	1.1871	.0271	.0009	.0	.39
3.44	1.1930	.0279	.0009	.0	.40
3.46	1.1988	.0288	.0009	.0	.41
3.48	1.2046	.0297	.0009	.0	.41
3.51	1.2100	.0305	.0008	.0	.42
3.53	1.2140	.0312	.0006	.0	.42
3.55	1.2180	.0318	.0006	.0	.42
3.58	1.2220	.0325	.0006	.0	.41
3.60	1.2261	.0331	.0007	.0	.40
3.62	1.2301	.0338	.0007	.0	.38

PROJECT : VALLEY CAMP - DITCH D-21 RUNOFF DESIGN
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
3.65	1.2341	.0344	.0007	.0	.37
3.67	1.2381	.0351	.0007	.0	.35

HYDROGRAPH PEAK= .42 cfs
TIME TO PEAK= 3.53 Hours
RUNOFF VOLUME= .10 Acre-Feet

D-23

$Q = 0.79$

Ditch Slope = 5/50 = 0.1 (fairly uniform)
Depth = 0.5

$\frac{Qn}{1.49 S^{1/2}} = 0.025$

y	$AR^{2/3}$	
0.1	0.005	
0.2	0.034	A = 0.130
0.18	0.026 ⇒	V = 6.10

y = 0.18' freeboard = 0.57'

D-24

$Q = 2.04$

Ditch Slope = 5/80 = 0.063

$\frac{Qn}{1.49 S^{1/2}} = 0.082$

y	$AR^{2/3}$	
0.3	0.100	
0.28	0.083 →	A = 0.314
		V = 6.505

d = 0.28', freeboard = 0.47'

D-25A Calc Flow

A = 1.5ac
CN = 75 (Same as C-24-24)
P = 1.55in, 6hr
S = 44%
H_L = 775'

} Q = 0.19cfs

Ditch Slope = 5/130 = 0.038
$M_1 = M_2 = 4$
b = 0
n = 0.015

$\frac{Qn}{1.49 S^{1/2}} = 0.010$

y	$AR^{2/3}$	
0.2	0.034	A = 0.068
0.13	0.011 ⇒	V = 2.81

d = 0.13', freeboard = 0.62'

PROJECT : VALLEY CAMP - DITCH D-25A RUNOFF DESIGN

AREA= 1.5 ACRES
AVERAGE BASIN SLOPE= 44.0 PERCENT
CURVE NUMBER= 75.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 775. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0504 HOURS QPCFS= 22.50 CFS QPIN=14.8782 INCHES
C3= 73.3348 ITERATIONS= 8 SCS 6-hour
Type B?

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.27	.6639	.0000	.0000	.0	.00
2.28	.6783	.0000	.0000	2.1	.00
2.29	.6928	.0002	.0002	11.0	.00
2.31	.7072	.0005	.0003	19.6	.00
2.32	.7217	.0009	.0004	22.5	.00
2.33	.7362	.0014	.0005	20.4	.02
2.34	.7506	.0021	.0006	15.9	.03
2.36	.7651	.0028	.0008	11.1	.04
2.37	.7795	.0037	.0009	7.2	.05
2.38	.7940	.0047	.0010	4.4	.06
2.39	.8084	.0058	.0011	2.6	.08
2.41	.8229	.0070	.0012	1.5	.09
2.42	.8373	.0083	.0013	.8	.10
2.43	.8518	.0097	.0014	.4	.12
2.44	.8662	.0113	.0015	.2	.13
2.46	.8807	.0129	.0016	.1	.14
2.47	.8951	.0147	.0017	.0	.16
2.48	.9096	.0165	.0018	.0	.17
2.49	.9240	.0184	.0019	.0	.18
2.51	.9323	.0196	.0012	.0	.19
2.52	.9362	.0202	.0006	.0	.19
2.53	.9401	.0207	.0006	.0	.18
2.55	.9440	.0213	.0006	.0	.16
2.56	.9479	.0219	.0006	.0	.13
2.57	.9518	.0225	.0006	.0	.11
2.58	.9557	.0231	.0006	.0	.10
2.60	.9596	.0237	.0006	.0	.09

HYDROGRAPH PEAK= .19 cfs 0.67 Type II
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .02 Acre-Feet

D-25B

Q = 7 cfs (This is very conservative since not all C-25-36 flow travels down ditch)

Ditch Slope = 0.10

$m_1 = 4$

$m_2 = 4$

$b = 0$

$n = 0.015$

$\frac{Qn}{1.49 S^{1/2}} = 0.223$

y	$AR^{2/3}$	
0.5	0.389	
0.2	0.034	A = 0.207
0.41	0.229 ⇒	V = 10.41

y = 0.41', freeboard = 0.34'

D-26

Q = 0.57 cfs

Ditch Slope = 5/65 = 0.077

$m_1 = 4$

$m_2 = 4$ $n = .015$ $b = 0$

$\frac{Qn}{1.49 S^{1/2}} = 0.021$

y	$AR^{2/3}$	
0.1	0.005	A = 0.12
0.17	0.022 →	V = 4.9 fps

y = 0.17 ft, freeboard = 0.58'

D-26A

Q = 1.01 cfs

Ditch Slope = 0.10

$\frac{Qn}{1.49 S^{1/2}} = 0.032$

y	$AR^{2/3}$	
0.1	0.005	A = 0.16
0.2	0.039 →	V = 6.31

y = 0.2 ft, freeboard = 0.55'

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D-28

$Q = 3.3$ cfs

Ditch Slope = 0.1

$\frac{Qn}{1.49 S^{1/2}} = 0.105$

y	$AR^{2/3}$
0.2	0.034
0.25	0.061
0.3	0.100
0.31	0.109 →

$A = 0.38$
$V = 8.59$

$y = 0.31$ ft, freeboard = 0.44

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D-29A

Tributary Area = 1.7ac

			Q
Undisturbed	= 0.67ac	CN = 70	0.096
Disturbed	= 1.03ac	CN = 90	0.723

$\bar{Q} = 0.476$ $\bar{CN} = 84.8$

Precipitation = 1.55 in (10yr-6hr)

Hydraulic Length = 500 ft

Slope = $\frac{(1490)\,25(100)}{43560\,(1.7)}$ = 50.3 %

Runoff Calculation : Q_{TOT} = 0.80 cfs

DITCH LIES IN STORAGE YARD - USE GENERAL DESIGN

b = 0, m = 2, d = 1.0' max

PROJECT : Valley Camp Coal - D-29A Runoff Calculation

AREA= 1.7 ACRES
AVERAGE BASIN SLOPE= 50.3 PERCENT
CURVE NUMBER= 84.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0244 HOURS QPCFS= 52.67 CFS QPIN=30.7227 INCHES
C3=151.4323 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.99	.3536	.0000	.0000	.0	.00
2.00	.3593	.0000	.0000	25.8	.00
2.01	.3733	.0001	.0001	52.7	.00
2.03	.3873	.0005	.0003	37.1	.02
2.04	.4013	.0010	.0005	16.9	.04
2.05	.4153	.0017	.0007	6.1	.06
2.06	.4293	.0027	.0009	1.9	.09
2.08	.4433	.0038	.0011	.5	.12
2.09	.4573	.0052	.0013	.1	.15
2.10	.4713	.0067	.0015	.0	.17
2.42	.8355	.1002	.0052	.0	.71
2.43	.8495	.1056	.0053	.0	.73
2.44	.8635	.1110	.0054	.0	.74
2.45	.8775	.1165	.0055	.0	.76
2.47	.8915	.1222	.0056	.0	.77
2.48	.9055	.1279	.0057	.0	.79
2.49	.9195	.1337	.0058	.0	.80
2.50	.9309	.1386	.0048	.0	.79
2.52	.9347	.1402	.0016	.0	.66
2.53	.9385	.1418	.0016	.0	.45
2.54	.9423	.1434	.0016	.0	.32
2.55	.9461	.1451	.0016	.0	.26
2.56	.9499	.1467	.0016	.0	.24

HYDROGRAPH PEAK= .80 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .07 Acre-Feet

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D-29B

Tributary Area = 1.2ac

			Q
Undisturbed Area	= 0.86ac	CN = 70	0.096
Disturbed Area	= 0.34ac	CN = 90	0.723

$\bar{Q} = 0.274$ $\bar{CN} = 78.7$

Precipitation = 1.55 inches (10yr, 6hr)

Hydraulic Length = 440 feet

Slope = $\frac{(1400)25(100)}{43560\,(1.2)}$ = 66.9%

Runoff Calculation: Q_{TOT} = 0.31cfs

DITCH LIES IN STORAGE YARD - USE GENERAL DESIGN

b=0, m=2, d=1.0' max

PROJECT : Valley Camp Coal - D-29B Runoff Calculation

AREA= 1.2 ACRES
AVERAGE BASIN SLOPE= 66.9 PERCENT
CURVE NUMBER= 78.7
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 440. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0233 HOURS QPCFS= 38.95 CFS QPIN=32.1899 INCHES
C3=158.6639 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.14	.5202	.0000	.0000	.0	.00
2.17	.5469	.0000	.0000	39.0	.00
2.19	.5736	.0004	.0004	12.5	.01
2.21	.6003	.0013	.0009	1.4	.04
2.24	.6270	.0026	.0014	.1	.06
2.26	.6537	.0045	.0019	.0	.09
2.28	.6804	.0068	.0023	.0	.12
2.31	.7071	.0096	.0028	.0	.14
2.33	.7339	.0128	.0032	.0	.16
2.35	.7606	.0164	.0036	.0	.19
2.38	.7873	.0205	.0041	.0	.21
2.40	.8140	.0250	.0045	.0	.23
2.42	.8407	.0298	.0049	.0	.25
2.45	.8674	.0351	.0052	.0	.27
2.47	.8941	.0407	.0056	.0	.29
2.49	.9209	.0467	.0060	.0	.31
2.52	.9347	.0499	.0033	.0	.21
2.54	.9420	.0517	.0017	.0	.12
2.56	.9492	.0534	.0018	.0	.10
2.59	.9564	.0552	.0018	.0	.09
2.61	.9636	.0570	.0018	.0	.10
2.63	.9708	.0588	.0018	.0	.10

HYDROGRAPH PEAK= .31 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .03 Acre-Feet

HANSEN ALLEN & LUCE INC

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FEATURE D-30
PROJECT NO. 007.11.100

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D-30

TOTAL AREA = 1748 * .00702 = 12.3ac
UNDIST AREA = 1029 = 7.2ac (25% OAK/ASPEN)
PAVED AREA = 122 = 0.9ac
DIST AREA = = 4.2ac

CN	A	Q
98	0.9	1.329
90	4.2	0.723
70	7.2	0.096
		$\bar{Q}$ = 0.401

$\overline{CN}$ = 82.8

PRECIP = 1.55'

HYD. LENGTH = 1450'

SLOPE: $\frac{9450 * 25 * 100}{12.3 * 43560}$ = 44:1

RUNOFF CALCULATION: Q = 4.5cfs

DITCH DESIGN:

S_{min} = 10%
S_{max} = 12½%

DITCH CURRENTLY LINED WITH CONCRETE GUTTER ALONG ROAD. NO EROSION POTENTIAL

NO ADD'L DESIGN CONTEMPLATED

PROJECT : Valley Camp Coal - Ditch D-30 Runoff Calculation

AREA= 12.3 ACRES
AVERAGE BASIN SLOPE= 44.1 PERCENT
CURVE NUMBER= 82.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1450. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0654 HOURS QPCFS= 142.22 CFS QPIN=11.4670 INCHES
C3= 56.5206 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.04	.4067	.0000	.0000	.0	.00
2.06	.4254	.0000	.0000	13.5	.00
2.08	.4442	.0004	.0003	69.6	.00
2.09	.4629	.0011	.0007	123.7	.04
2.11	.4817	.0020	.0010	142.2	.11
2.13	.5004	.0033	.0013	128.8	.22
2.14	.5192	.0049	.0016	100.3	.38
2.16	.5380	.0068	.0019	70.4	.56
2.17	.5567	.0090	.0022	45.8	.76
2.19	.5755	.0114	.0024	28.1	.97
2.21	.5942	.0142	.0027	16.4	1.19
2.22	.6130	.0171	.0030	9.3	1.41
2.24	.6317	.0204	.0032	5.1	1.62
2.26	.6505	.0239	.0035	2.7	1.83
2.27	.6692	.0276	.0037	1.4	2.03
2.29	.6880	.0316	.0040	.7	2.24
2.31	.7067	.0358	.0042	.4	2.43
2.32	.7255	.0403	.0044	.2	2.62
2.34	.7442	.0449	.0047	.0	2.81
2.35	.7630	.0498	.0049	.0	2.99
2.37	.7818	.0549	.0051	.0	3.17
2.39	.8005	.0602	.0053	.0	3.35
2.40	.8193	.0657	.0055	.0	3.52
2.42	.8380	.0714	.0057	.0	3.68
2.44	.8568	.0773	.0059	.0	3.84
2.45	.8755	.0834	.0061	.0	4.00
2.47	.8943	.0897	.0063	.0	4.16
2.49	.9130	.0962	.0065	.0	4.31
2.50	.9305	.1023	.0062	.0	4.45
2.52	.9355	.1041	.0018	.0	4.50
2.53	.9406	.1060	.0018	.0	4.27
2.55	.9457	.1078	.0018	.0	3.77
2.57	.9508	.1097	.0019	.0	3.17
2.58	.9558	.1115	.0019	.0	2.62
2.60	.9609	.1134	.0019	.0	2.19

PROJECT : Valley Camp Coal - Ditch D-30 Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.62	.9660	.1153	.0019	.0	1.89

HYDROGRAPH PEAK= 4.50 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .41 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
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FEATURE D-31
PROJECT NO. 007.11.100

SHEET ___ OF ___
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DATE 5/9/89

D-31 (Convenience Ditch)

Total Area = 473 * 0.00702 = 3.3 acres
disturbed area = 1.9 acres
undisturbed area = 1.4 acres (25% Oak/Aspen)

CN	Area	Q
70	1.4	0.096
90	1.9	0.723
		$\bar{Q}$ = 0.457

$\bar{CN}$ = 84.3

Precipitation = 1.55 in (10 yr, 6 hr)

hydraulic length = 700 feet

slope = $\frac{(2300)(25)(100)}{43{,}560\ (3.3)}$ = 40.0%

Run-Off Calculation: Q_{TOT} = 1.48 cfs

Convenience Ditch - No design anticipated

PROJECT : Valley Camp Coal - D-31 Runoff Calculations

AREA= 3.3 ACRES
AVERAGE BASIN SLOPE= 40.0 PERCENT
CURVE NUMBER= 84.3
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 700. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0365 HOURS QPCFS= 68.46 CFS QPIN=20.5723 INCHES
C3=101.4008 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.01	.3626	.0000	.0000	.0	.00
2.02	.3835	.0000	.0000	33.5	.00
2.04	.4044	.0005	.0005	68.5	.02
2.06	.4253	.0015	.0009	48.3	.07
2.08	.4462	.0028	.0014	22.0	.13
2.10	.4671	.0046	.0018	7.9	.21
2.11	.4880	.0068	.0022	2.4	.28
2.13	.5089	.0093	.0026	.7	.36
2.15	.5299	.0123	.0029	.2	.43
2.17	.5508	.0156	.0033	.0	.50
2.39	.8017	.0804	.0070	.0	1.21
2.41	.8226	.0876	.0072	.0	1.25
2.42	.8435	.0951	.0075	.0	1.30
2.44	.8644	.1028	.0077	.0	1.35
2.46	.8853	.1107	.0079	.0	1.39
2.48	.9062	.1189	.0082	.0	1.43
2.50	.9271	.1273	.0084	.0	1.48
2.52	.9349	.1304	.0032	.0	1.33
2.53	.9405	.1328	.0023	.0	.97
2.55	.9462	.1351	.0023	.0	.67
2.57	.9518	.1375	.0024	.0	.51
2.59	.9575	.1398	.0024	.0	.46
2.61	.9631	.1422	.0024	.0	.44

HYDROGRAPH PEAK= 1.48 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .13 Acre-Feet

HANSEN ALLEN & LUCE INC

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FEATURE D-32A, D-32B
PROJECT NO. 007.11.100

SHEET ___ OF ___
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D-32A, D-32B (Convenience Ditches)

Total Area = 845 * 0.00702 = 5.9 ac
undisturbed = = 5.3 ac
disturbed = = 0.6 ac

CN	A	Q
90	0.6	0.723
70	5.3	0.096
		$\bar{Q}$ = 0.160

$\bar{CN}$ = 73.8

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 820 feet

$$\text{slope} = \frac{(5000)(25)(100)}{(43{,}560)(5.9)} = 48.6\%$$

Run-off Calculation: Q_{TOT} = 0.58 cfs

Convenience Ditches - No design contemplated

PROJECT : Valley Camp Coal - D-32A, D-32B Runoff Calculations

AREA= 5.9 ACRES
AVERAGE BASIN SLOPE= 48.6 PERCENT
CURVE NUMBER= 73.8
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 820. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0519 HOURS QPCFS= 85.93 CFS QPIN=14.4441 INCHES
C3= 71.1952 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.30	.7032	.0000	.0000	.0	.00
2.32	.7230	.0000	.0000	17.4	.00
2.34	.7429	.0003	.0003	65.8	.00
2.35	.7627	.0008	.0005	85.9	.03
2.37	.7826	.0015	.0007	72.6	.07
2.39	.8024	.0023	.0009	48.3	.12
2.41	.8223	.0034	.0011	27.6	.18
2.42	.8421	.0047	.0013	14.2	.25
2.44	.8620	.0062	.0015	6.8	.32
2.46	.8818	.0079	.0017	3.1	.39
2.48	.9017	.0098	.0019	1.3	.46
2.49	.9216	.0119	.0021	.5	.53
2.51	.9331	.0132	.0013	.2	.58
2.53	.9385	.0138	.0006	.0	.56
2.54	.9438	.0144	.0006	.0	.49
2.56	.9492	.0151	.0006	.0	.39
2.58	.9545	.0158	.0007	.0	.32
2.60	.9599	.0164	.0007	.0	.27
2.61	.9653	.0171	.0007	.0	.25

HYDROGRAPH PEAK= .58 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .08 Acre-Feet

HANSEN ALLEN & LUCE INC

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D-33A

TOTAL AREA	2037 * .00702	= 14.3 acres
PAVED AREA	189 *	= 1.3
RECLAIMED AREA	175 *	= 1.2
DISTURBED AREA	578 *	= 4.1
UNDISTURBED AREA	1095 *	= 7.7

CN	A	Q
98	1.3	1.329
90	4.1	0.723
85	1.2	0.484
70	7.7	0.096
		$\bar{Q}$ = 0.421

$\overline{CN}$ = 83.4

PRECIP = 1.55" (10YR-6HR)

HYD LENGTH = 2000'

$$\text{SLOPE} = \frac{10650 * 25 * 100}{14.3 * 43560} = 42.3\%$$

RUNOFF CALCULATION: Q = 5.36 cfs

DITCH DESIGN

S_{min} = 4% ? DITCH CURRENTLY LINED WITH CONCRETE.
S_{max} = 4% GUTTER ALONG ROAD. NO EROSION POTENTIAL

NO ADDL DESIGN CONTEMPLATED

PROJECT : Valley Camp Coal - Ditch D-33A Runoff Calculation

AREA= 14.3 ACRES
AVERAGE BASIN SLOPE= 42.3 PERCENT
CURVE NUMBER= 83.4
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2000. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0847 HOURS QPCFS= 127.74 CFS QPIN= 8.8588 INCHES
C3= 43.6652 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.03	.3930	.0000	.0000	.0	.00
2.05	.4124	.0001	.0001	6.4	.00
2.07	.4318	.0006	.0005	39.7	.00
2.08	.4512	.0014	.0008	84.8	.03
2.10	.4707	.0026	.0012	117.3	.09
2.12	.4901	.0041	.0015	127.7	.19
2.13	.5095	.0059	.0018	119.7	.34
2.15	.5289	.0081	.0022	101.0	.52
2.17	.5483	.0105	.0025	79.0	.74
2.18	.5678	.0133	.0028	58.3	.97
2.20	.5872	.0164	.0031	41.1	1.22
2.22	.6066	.0198	.0034	27.9	1.48
2.23	.6260	.0234	.0036	18.4	1.74
2.25	.6454	.0273	.0039	11.8	2.00
2.27	.6649	.0315	.0042	7.4	2.26
2.29	.6843	.0360	.0044	4.6	2.51
2.30	.7037	.0407	.0047	2.8	2.76
2.32	.7231	.0456	.0049	1.7	3.00
2.34	.7425	.0508	.0052	1.0	3.23
2.35	.7620	.0562	.0054	.6	3.46
2.37	.7814	.0619	.0057	.3	3.69
2.39	.8008	.0678	.0059	.2	3.90
2.40	.8202	.0739	.0061	.1	4.12
2.42	.8396	.0802	.0063	.0	4.33
2.44	.8591	.0867	.0065	.0	4.53
2.46	.8785	.0934	.0067	.0	4.73
2.47	.8979	.1003	.0069	.0	4.92
2.49	.9173	.1074	.0071	.0	5.11
2.51	.9318	.1129	.0054	.0	5.28
2.52	.9371	.1149	.0020	.0	5.36
2.54	.9423	.1169	.0020	.0	5.23
2.56	.9476	.1189	.0020	.0	4.87
2.57	.9528	.1209	.0020	.0	4.35
2.59	.9581	.1230	.0020	.0	3.78
2.61	.9633	.1250	.0021	.0	3.26

PROJECT : Valley Camp Coal - Ditch D-33A Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.62	.9686	.1271	.0021	.0	2.82

HYDROGRAPH PEAK= 5.36 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .50 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-5B
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED paul
CHECKED
DATE 5/11/89

D-5B

Total Area = 1614 * 0.00175 = 2.8 acres
disturbed = = 2.4
paved = 234 = 0.4

CN	A	Q
90	2.4	0.723
98	0.4	1.329
		$\bar{Q}$=0.810

$\bar{CN}$ = 91.5

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 850 feet

$$\text{slope} = \frac{(4075)(5)(100)}{43{,}560\,(2.8)} = 16.7\%$$

Calculated Run-Off: Q_{TOT} = 2.16 cfs

Ditch Design

Smin = 3%

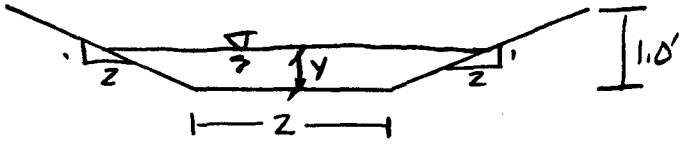
Smax = 11%

try trapezoidal channel

b=0, m_1=2, m_2=2, n=0.03

V = 4.78 ft/sec < 5.0 ft/sec OK

No Lining required



PROJECT : Valley Camp Coal - D-5B Runoff Calculations

AREA= 2.8 ACRES
AVERAGE BASIN SLOPE= 16.7 PERCENT
CURVE NUMBER= 91.5
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 850. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0500 HOURS QPCFS= 42.36 CFS QPIN=15.0016 INCHES
C3= 73.9430 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.35	.1837	.0000	.0000	.0	.00
1.37	.1866	.0000	.0000	8.6	.00
1.38	.1894	.0000	.0000	32.5	.00
1.40	.1922	.0000	.0000	42.4	.00
1.42	.1951	.0000	.0000	35.8	.00
1.43	.1979	.0002	.0000	23.8	.00
1.45	.2008	.0002	.0000	13.6	.00
1.47	.2036	.0003	.0000	7.0	.00
1.48	.2065	.0004	.0001	3.3	.01
1.50	.2093	.0006	.0001	1.5	.01
1.52	.2142	.0008	.0003	.6	.02
1.53	.2192	.0012	.0003	.3	.03
1.55	.2241	.0015	.0004	.1	.03
1.57	.2290	.0019	.0004	.0	.04
2.40	.8158	.2546	.0122	.0	1.99
2.42	.8350	.2670	.0124	.0	2.02
2.43	.8541	.2796	.0126	.0	2.05
2.45	.8732	.2923	.0127	.0	2.08
2.47	.8923	.3052	.0129	.0	2.11
2.48	.9115	.3182	.0130	.0	2.14
2.50	.9302	.3311	.0129	.0	2.16
2.52	.9353	.3347	.0036	.0	2.09
2.53	.9405	.3383	.0036	.0	1.80
2.55	.9457	.3419	.0036	.0	1.41
2.57	.9508	.3455	.0036	.0	1.08
2.58	.9560	.3491	.0036	.0	.86
2.60	.9612	.3527	.0036	.0	.73

HYDROGRAPH PEAK= 2.16 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .19 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT: VALLEY CAMP
PROJECT: PERMIT
FEATURE: D-33B
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-33B

TRIBUTARY AREAS: D-35; D-39A-B; D-38; D-36; D-33B

AREA: CHANGE PLANIMETER SCALE TO 20
Rdg: 817 A = 5.74 ac RATIO 0.00702

TOTAL	1905 * 0.00702	= 13.4 ac	
DIST.	1336	= 7.4 ac	CN = 90
UNDIST	569	= 4.0 ac	CN = 75
RECLAIMED		2.2 ac	CN = 85

CN RATIONAL SHOWN ON D-44B SHEETS

VOL. WEIGHT CN: (P = 1.55 in)

CN	A	Q	
90	7.4	0.723	$\bar{Q}$ = 0.526
75	4.0	0.185	
85	2.2	0.484	$\overline{CN}$ = 86.0

HYD. LENGTH: (UP DITCH 37) = 1630'

$$\text{SLOPE} = \frac{10160 * 25 * 100}{13.4 * 43560} = 43.5\%$$

RUNOFF PREDICTION: Q = 6.6 cfs

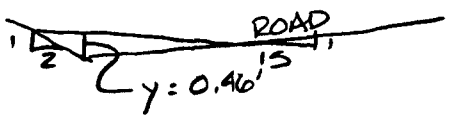
CHANNEL DESIGN: (Channel currently uses a Belt Liner)

Smin: 4%
Smax: 4%

PRELIMINARY CHECK W/ TRAP. CHANNEL SHOWS EXCESSIVE VELOCITIES.

USE ROAD TYPE CHANNEL.

b = 0	n = .03		
M_1 = 15	Q = 6.6		
M_2 = 2	S = 4%	V = 3.7 < 5 fps	NO LINING REQ'D



Id = 1.0'

PROJECT : Valley Camp Coal - Ditch D-33B Runoff Calculation

AREA= 13.4 ACRES
AVERAGE BASIN SLOPE= 43.5 PERCENT
CURVE NUMBER= 86.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1630. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0647 HOURS QPCFS= 156.51 CFS QPIN=11.5827 INCHES
C3= 57.0911 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.89	.3254	.0000	.0000	.0	.00
1.91	.3301	.0000	.0000	14.9	.00
1.93	.3349	.0000	.0000	76.7	.00
1.94	.3397	.0001	.0000	136.2	.00
1.96	.3444	.0002	.0000	156.5	.01
1.98	.3492	.0003	.0001	141.7	.03
1.99	.3540	.0005	.0001	110.3	.04
2.01	.3652	.0009	.0005	77.4	.06
2.02	.3837	.0020	.0011	50.3	.11
2.04	.4023	.0035	.0014	30.9	.22
2.06	.4209	.0053	.0018	18.1	.40
2.07	.4395	.0074	.0022	10.2	.63
2.09	.4580	.0100	.0025	5.6	.90
2.10	.4766	.0128	.0029	3.0	1.19
2.12	.4952	.0160	.0032	1.6	1.48
2.14	.5137	.0195	.0035	.8	1.77
2.15	.5323	.0233	.0038	.4	2.06
2.17	.5509	.0274	.0041	.2	2.34
2.19	.5694	.0318	.0044	.0	2.61
2.41	.8294	.1191	.0076	.0	5.68
2.43	.8480	.1269	.0078	.0	5.86
2.44	.8666	.1349	.0080	.0	6.03
2.46	.8851	.1431	.0082	.0	6.19
2.48	.9037	.1515	.0084	.0	6.36
2.49	.9223	.1600	.0085	.0	6.52
2.51	.9329	.1650	.0050	.0	6.61
2.53	.9379	.1674	.0024	.0	6.44
2.54	.9430	.1698	.0024	.0	5.86
2.56	.9480	.1721	.0024	.0	5.03
2.57	.9530	.1745	.0024	.0	4.17
2.59	.9580	.1770	.0024	.0	3.45
2.61	.9630	.1794	.0024	.0	2.91

HYDROGRAPH PEAK= 6.61 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .59 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	05-May-89
Project No.:	007.11.100	Time:	11:24 AM
Channel Section:	Ditch D-33B	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	6.60	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	15.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.04	ft/ft
	Max. Bottom Slope:	0.04	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.46	feet
	Qn/1.49(S)1/2=	0.666	
	A(R)2/3=	0.668	
	Required Depth:	0.96	feet
	Area:	1.80	ft2
	Perimeter:	7.94	feet
	Hydraulic Radius:	0.23	feet
	Velocity:	3.67	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.46	feet
	Qn/1.49(S)1/2=	0.666	
	A(R)2/3=	0.668	
	Required Depth:	0.96	feet
	Area:	1.80	ft2
	Perimeter:	7.94	feet
	Hydraulic Radius:	0.23	feet
	Velocity:	3.67	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	15.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.04	ft/ft
	Max. Bottom Slope:	0.04	ft/ft
	Channel Depth:	0.96	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE D-34A
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-34A (RECLAIMED) - Small Oak Aspen Area Ignored - Calcs ∴ Conservative.

AREA: 189 * .00702 = 1.32c
HYD LENGTH = 450'
SLOPE = $\frac{1160' * 25 * 100}{1.3 * 43560}$ = 51.2%

CN = 85 (See D-44B design Sheets)
P = 1.55"

RUNOFF PREDICTION: Q = 0.64

CHANNEL DESIGN:

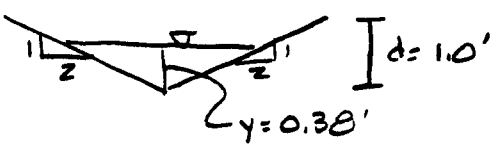
S_{min} = 2%
S_{max} = 2%

TRY TRAPEZOIDAL DESIGN

b = 0, m = 2, n = 0.03

V = 2.2 < 5 fps ∝

NO LINING REQ'd



PROJECT : Valley Camp Coal - Ditch D-34A Runoff Calculation

AREA= 1.3 ACRES
AVERAGE BASIN SLOPE= 51.2 PERCENT
CURVE NUMBER= 85.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 450. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0221 HOURS QPCFS= 44.52 CFS QPIN=33.9588 INCHES
C3=167.3829 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.99	.3529	.0000	.0000	.0	.00
2.01	.3677	.0001	.0001	44.5	.00
2.03	.3930	.0009	.0008	14.3	.04
2.05	.4183	.0023	.0014	1.6	.08
2.08	.4437	.0044	.0021	.1	.12
2.10	.4690	.0072	.0027	.0	.15
2.36	.7730	.0808	.0086	.0	.51
2.39	.7983	.0897	.0090	.0	.54
2.41	.8236	.0991	.0094	.0	.56
2.43	.8490	.1088	.0097	.0	.58
2.45	.8743	.1189	.0101	.0	.60
2.47	.8996	.1293	.0104	.0	.62
2.50	.9250	.1400	.0107	.0	.64
2.52	.9355	.1446	.0046	.0	.37
2.54	.9423	.1476	.0030	.0	.22
2.56	.9492	.1506	.0030	.0	.19
2.58	.9560	.1536	.0030	.0	.18
2.61	.9629	.1567	.0031	.0	.18
2.63	.9697	.1597	.0031	.0	.19

HYDROGRAPH PEAK= .64 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .05 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	05-May-89
Project No.:	007.11.100	Time:	10:35 AM
Channel Section:	Ditch D-34A	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.64	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.38	feet
	Qn/1.49(S)1/2=	0.091	
	A(R)2/3=	0.089	
	Required Depth:	0.88	feet
	Area:	0.29	ft2
	Perimeter:	1.70	feet
	Hydraulic Radius:	0.17	feet
	Velocity:	2.22	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.38	feet
	Qn/1.49(S)1/2=	0.091	
	A(R)2/3=	0.089	
	Required Depth:	0.88	feet
	Area:	0.29	ft2
	Perimeter:	1.70	feet
	Hydraulic Radius:	0.17	feet
	Velocity:	2.22	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Channel Depth:	0.88	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT VALLEY CAMP
PROJECT PERMIT
FEATURE D-34B
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 5 MAY 89

D-34B

ALL DIST. EXCEPT FOR OAK/ASPEN AREA

TOTAL AREA = 435 * .00702 = 3.0 ac
OAK AREA = 67 * .00702 = 0.5 ac
DIST AREA = 2.5 ac

PRECIP = 1.55" (10 YR-6 HR)

VOL WEIGHTED CN.

CN	A	Q
40	0.5	0.155
90	2.5	0.723
	$\bar{Q}$ =	0.628

$\overline{CN}$ = 88.2

HYD LENGTH = 670'

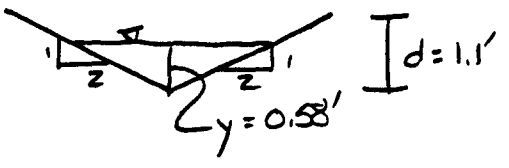
$$\text{SLOPE} = \frac{2610 * 25 * 100}{3.0 * 43560} = 50\%$$

RUNOFF CALCULATION: Q = 1.88 cfs

CHANNEL DESIGN:

Smin = 2%
Smax = 5%

TRY TRAP. CHANNEL.



NO LINING REQ'D

APPENDIX R614-301-742.310

Hydrologic Calculations

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Akmil
FEATURE D-1
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/16/89

D-1

Total Area = 4686 * 0.00175 = 8.2 Acres
disturbed = 1000 : 1.9
Undisturbed = 3.2 (Sage/grass)
Paved 0.1

CN	Area	Q
90	4.9	0.723
75	3.2	0.185
98	0.1	1.329
		Q = 0.520

$\overline{CN} = 85.9$

Precipitation - 1.55 inches (10 yr, 6 hr)

hydraulic length = 2290 feet Contour Length = 6180 feet

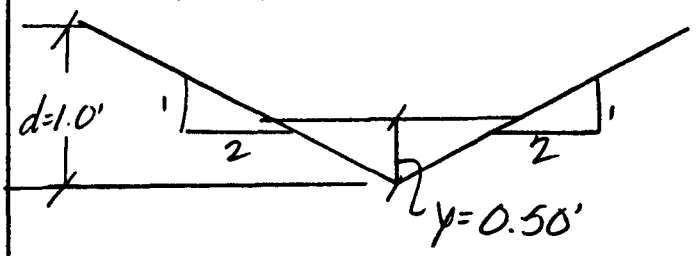
$$\text{slope} = \frac{(6180)(25)(100)}{43{,}560\,(8.2)} = 43.3\%$$

Calculated Runoff: $Q_{TOTAL} = 3.9$ cfs

Ditch Design

$S_{min} = 3\%$
$S_{max} = 5\%$

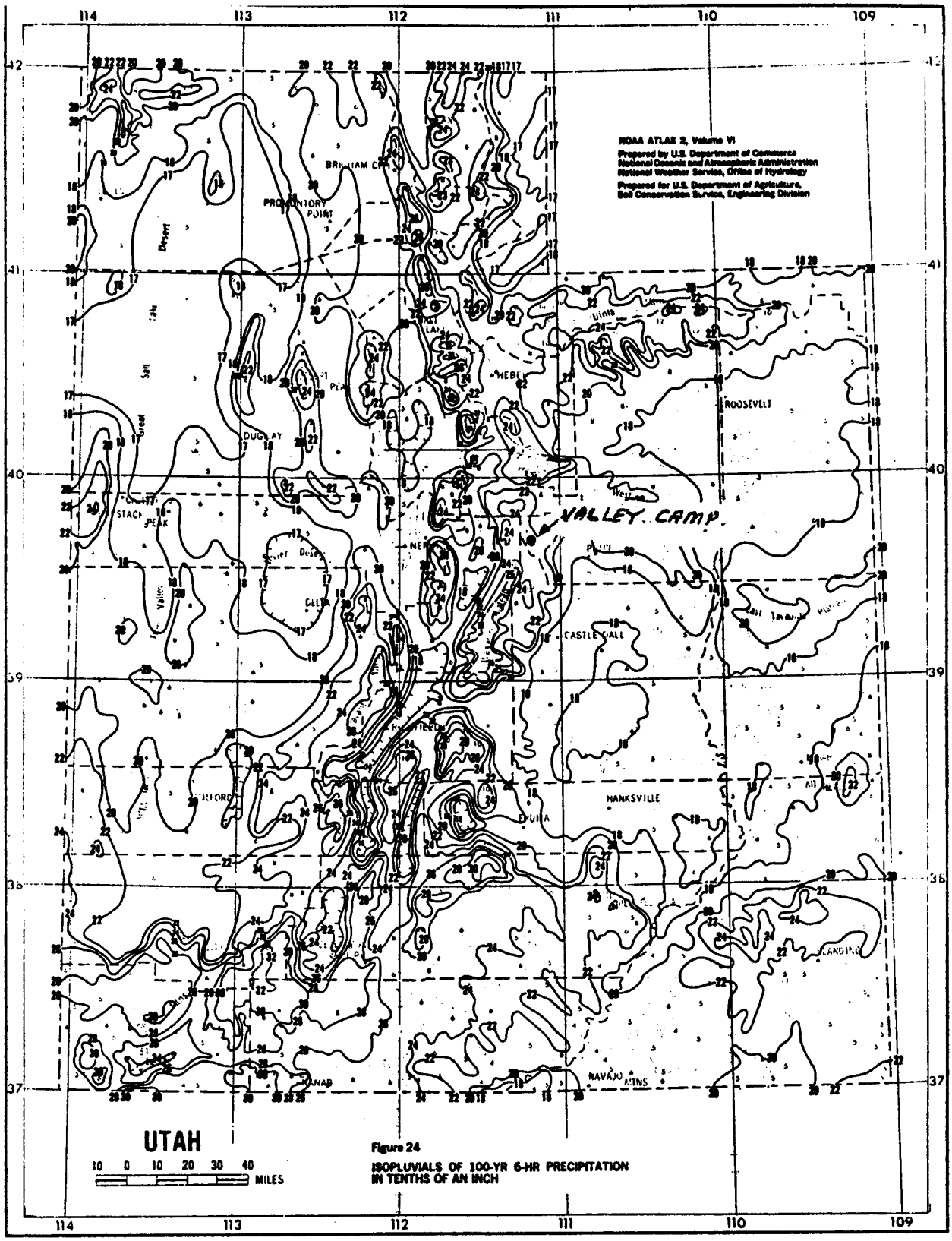
try trapezoidal channel
$b = 1$ $M = 2$, $n = 0.03$



$V = 4.71$ ft/sec < 5.0 ft/sec OK

No lining required

2



UTAH

10 0 10 20 30 40 MILES

Figure 24

ISOPLUVIALS OF 100-YR 6-HR PRECIPITATION IN TENTHS OF AN INCH

100 yr, 6 hr ⇒ P = 2.25

PROJECT : Valley Camp Coal - D-1 Runoff Calculation

AREA= 8.2 ACRES
AVERAGE BASIN SLOPE= 43.3 PERCENT
CURVE NUMBER= 85.9
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2290. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0855 HOURS QPCFS= 72.54 CFS QPIN= 8.7726 INCHES
C3= 43.2401 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.90	.3264	.0000	.0000	.0	.00
1.91	.3315	.0000	.0000	3.6	.00
1.93	.3365	.0000	.0000	22.5	.00
1.95	.3415	.0001	.0000	48.2	.00
1.97	.3466	.0002	.0000	66.6	.00
1.98	.3516	.0003	.0001	72.5	.00
2.00	.3570	.0005	.0002	67.9	.02
2.02	.3767	.0014	.0009	57.4	.03
2.03	.3963	.0027	.0013	44.9	.05
2.05	.4159	.0044	.0017	33.1	.11
2.07	.4355	.0066	.0021	23.3	.20
2.09	.4551	.0091	.0025	15.8	.32
2.10	.4747	.0120	.0029	10.4	.46
2.12	.4943	.0153	.0033	6.7	.62
2.14	.5139	.0189	.0036	4.2	.79
2.15	.5335	.0228	.0040	2.6	.97
2.17	.5532	.0271	.0043	1.6	1.15
2.19	.5728	.0317	.0046	.9	1.32
2.21	.5924	.0366	.0049	.6	1.50
2.22	.6120	.0418	.0052	.3	1.67
2.24	.6316	.0473	.0055	.2	1.83
2.26	.6512	.0531	.0058	.1	1.99
2.27	.6708	.0591	.0061	.0	2.15
2.41	.8277	.1165	.0080	.0	3.24
2.43	.8473	.1247	.0082	.0	3.36
2.45	.8669	.1331	.0084	.0	3.48
2.46	.8866	.1417	.0086	.0	3.59
2.48	.9062	.1505	.0088	.0	3.70
2.50	.9258	.1594	.0090	.0	3.81
2.51	.9342	.1633	.0039	.0	3.89
2.53	.9395	.1658	.0025	.0	3.87
2.55	.9448	.1683	.0025	.0	3.68
2.56	.9501	.1708	.0025	.0	3.34
2.58	.9554	.1733	.0025	.0	2.93

PROJECT : Valley Camp Coal - D-1 Runoff Calculation
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.60	.9607	.1759	.0025	.0	2.53
2.62	.9660	.1784	.0025	.0	2.17

HYDROGRAPH PEAK= 3.89 cfs
TIME TO PEAK= 2.51 Hours
RUNOFF VOLUME= .36 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	30-Jun-89
Project No.:	007.11.100	Time:	04:21 PM
Channel Section:	D-1	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	3.90	cfs
	Bottom Width:	1.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.030	ft/ft
	Max. Bottom Slope:	0.050	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.50	feet
	Qn/1.49(S)1/2=	0.455	
	A(R)2/3=	0.457	
	Required Depth:	1.00	feet
	Area:	1.00	ft2
	Perimeter:	3.24	feet
	Hydraulic Radius:	0.31	feet
	Velocity:	3.90	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.44	feet
	Qn/1.49(S)1/2=	0.352	
	A(R)2/3=	0.353	
	Required Depth:	0.94	feet
	Area:	0.83	ft2
	Perimeter:	2.97	feet
	Hydraulic Radius:	0.28	feet
	Velocity:	4.71	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	1.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	3.0	%
	Max. Bottom Slope:	5.0	%
	Min Channel Depth:	1.00	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-3
PROJECT NO. 007.11.100

SHEET 1 OF
COMPUTED Paul
CHECKED
DATE 5/11/83

D-3

Total Area = 3215 * 0.00175 = 5.6 acres
Sage/grass = = 2.4 ac
disturbed = = 3.1 ac
Paved (Bldg) = = 0.1 ac

CN	A	Q
75	2.4	0.185
90	3.1	0.723
98	0.1	1.329

$\bar{Q} = 0.503$ $\bar{CN} = 85.5$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 1775 feet

$S = \frac{(4080)(25)(100)}{(43{,}560)(5.6)} = 41.8\%$

Calculated Run-off ⇒ $Q_{TOT} = 2.61$ cfs

Ditch Design

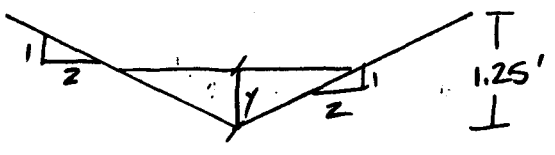
$S_{min} = 1.5\%$ try trapezoidal channel

$S_{max} = 10\%$ $b = 0$, $M_1 = 2$, $M_2 = 2$ $n = 0.03$

Only occurs in extreme upper end of channel where flow is negligible.

$v = 2.74$ ft/sec < 5.0 ft/sec

OK



No lining required

PROJECT : Valley Camp Coal - D-3 Runoff Calculations

AREA= 5.6 ACRES
AVERAGE BASIN SLOPE= 41.8 PERCENT
CURVE NUMBER= 85.5
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1775. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0720 HOURS QPCFS= 58.83 CFS QPIN=10.4178 INCHES
C3= 51.3495 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.93	.3357	.0000	.0000	.0	.00
1.94	.3399	.0000	.0000	3.0	.00
1.96	.3442	.0000	.0000	18.3	.00
1.97	.3484	.0000	.0000	39.1	.00
1.99	.3526	.0001	.0000	54.0	.00
2.00	.3580	.0002	.0001	58.8	.00
2.02	.3745	.0007	.0005	55.1	.00
2.03	.3910	.0015	.0008	46.5	.02
2.04	.4075	.0026	.0011	36.4	.05
2.06	.4241	.0040	.0014	26.8	.10
2.07	.4406	.0057	.0017	18.9	.16
2.09	.4571	.0077	.0019	12.8	.24
2.10	.4736	.0099	.0022	8.5	.32
2.12	.4901	.0123	.0025	5.4	.42
2.13	.5066	.0150	.0027	3.4	.52
2.15	.5231	.0180	.0030	2.1	.62
2.16	.5397	.0212	.0032	1.3	.72
2.17	.5562	.0246	.0034	.8	.82
2.19	.5727	.0283	.0036	.4	.92
2.20	.5892	.0321	.0039	.3	1.02
2.22	.6057	.0362	.0041	.2	1.12
2.23	.6222	.0405	.0043	.0	1.21
2.43	.8534	.1197	.0067	.0	2.30
2.45	.8699	.1265	.0069	.0	2.36
2.46	.8865	.1335	.0070	.0	2.43
2.48	.9030	.1407	.0071	.0	2.49
2.49	.9195	.1479	.0073	.0	2.55
2.51	.9316	.1534	.0054	.0	2.60
2.52	.9361	.1554	.0020	.0	2.61
2.53	.9405	.1574	.0020	.0	2.53
2.55	.9450	.1595	.0020	.0	2.33
2.56	.9495	.1615	.0020	.0	2.07
2.58	.9539	.1636	.0021	.0	1.80
2.59	.9584	.1656	.0021	.0	1.54

PROJECT : Valley Camp Coal - D-3 Runoff Calculations
(Continued)

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.61	.9629	.1677	.0021	.0	1.33

HYDROGRAPH PEAK= 2.61 cfs
TIME TO PEAK= 2.52 Hours
RUNOFF VOLUME= .24 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	30-Jun-89
Project No.:	007.11.100	Time:	04:26 PM
Channel Section:	D-3	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.61	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.015	ft/ft
	Max. Bottom Slope:	0.015	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.69	feet
	Qn/1.49(S)1/2=	0.430	
	A(R)2/3=	0.435	
	Required Depth:	1.19	feet
	Area:	0.95	ft2
	Perimeter:	3.09	feet
	Hydraulic Radius:	0.31	feet
	Velocity:	2.74	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.69	feet
	Qn/1.49(S)1/2=	0.430	
	A(R)2/3=	0.435	
	Required Depth:	1.19	feet
	Area:	0.95	ft2
	Perimeter:	3.09	feet
	Hydraulic Radius:	0.31	feet
	Velocity:	2.74	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	1.5	%
	Max. Bottom Slope:	1.5	%
	Min Channel Depth:	1.19	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Co.	Date:	30-Jun-89
Project No.:	007.11.100	Time:	04:55 PM
Channel Section:	D-5B	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.16	cfs
	Bottom Width:	2.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.030	ft/ft
	Max. Bottom Slope:	0.110	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.28	feet
	Qn/1.49(S)1/2=	0.252	
	A(R)2/3=	0.253	
	Required Depth:	0.78	feet
	Area:	0.70	ft2
	Perimeter:	3.23	feet
	Hydraulic Radius:	0.22	feet
	Velocity:	3.08	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.19	feet
	Qn/1.49(S)1/2=	0.131	
	A(R)2/3=	0.133	
	Required Depth:	0.69	feet
	Area:	0.45	ft2
	Perimeter:	2.85	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	4.78	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	2.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	3.0	%
	Max. Bottom Slope:	11.0	%
	Min Channel Depth:	0.78	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-6
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/11/89

D-6

Total Area = 630 * 0.00175 = 1.1 acres
disturbed = = 1.0 ac
paved (Bldg) = = 0.1 ac

CN	A	Q
90	1.0	0.723
98	1.1	1.329
		$\bar{Q}$: 0.778

$\bar{CN} = 91.0$

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 500 feet

$$\text{slope} = \frac{(950')(5')(100)}{43{,}560\,(1.1)} = 9.9\%$$

Calculated Run-Off $Q_{TOT} = 0.82$ cfs

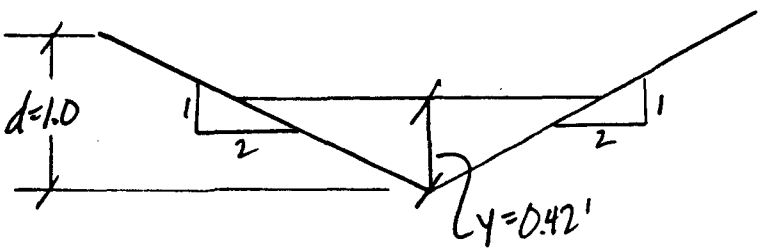
Ditch Design

$S_{min} = 2\%$

$S_{max} = 2\%$

try trapezoidal channel
$b=0$, $m=2$, $n=0.03$

$V = 2.30$ ft/sec < 5.0 ft/sec
No lining required



PROJECT : Valley Camp Coal - D-6 Runoff Calculations

AREA= 1.1 ACRES
AVERAGE BASIN SLOPE= 9.9 PERCENT
CURVE NUMBER= 91.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0434 HOURS QPCFS= 19.17 CFS QPIN=17.2837 INCHES
C3= 85.1915 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.43	.1976	.0000	.0000	.0	.00
1.45	.2000	.0000	.0000	3.9	.00
1.46	.2025	.0000	.0000	14.7	.00
1.47	.2050	.0000	.0000	19.2	.00
1.49	.2074	.0000	.0000	16.2	.00
1.50	.2104	.0002	.0000	10.8	.00
1.52	.2146	.0003	.0001	6.2	.00
1.53	.2189	.0004	.0002	3.2	.00
1.55	.2232	.0006	.0002	1.5	.00
1.56	.2274	.0009	.0002	.7	.00
1.58	.2317	.0011	.0003	.3	.01
1.59	.2359	.0014	.0003	.1	.02
1.61	.2402	.0017	.0003	.0	.02
2.41	.8323	.2480	.0104	.0	.77
2.43	.8489	.2585	.0105	.0	.78
2.44	.8655	.2691	.0106	.0	.79
2.46	.8821	.2798	.0107	.0	.80
2.47	.8986	.2907	.0108	.0	.81
2.49	.9152	.3016	.0110	.0	.82
2.50	.9305	.3118	.0102	.0	.82
2.52	.9350	.3148	.0030	.0	.79
2.53	.9395	.3178	.0030	.0	.67
2.54	.9439	.3208	.0030	.0	.53
2.56	.9484	.3239	.0030	.0	.40
2.57	.9529	.3269	.0030	.0	.32
2.59	.9574	.3300	.0030	.0	.28

HYDROGRAPH PEAK= .82 cfs
TIME TO PEAK= 2.50 Hours
RUNOFF VOLUME= .07 Acre-Feet

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Rpmt
FEATURE D-5A
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED ___
DATE 5/11/89

D-5A (Convenience Ditch)

Total Area = 330 * 0.00175 = 0.6 acres

CN = 90 (disturbed)

Precipitation = 1.55 inches (10 year, 6 hr)

hydraulic length = 225 feet

$$\text{slope} = \frac{(450')(5')(100)}{43{,}560\,(0.6)} = 8.6\%$$

Calculated Run-off $Q_{TOT} = 0.43$ cfs

No further design anticipated

VC to provide standard ditch section with

b = 0
m = 2
depth = 1.0'

PROJECT : Valley Camp Coal - D-5A Runoff Calculations

AREA= .6 ACRES
AVERAGE BASIN SLOPE= 8.6 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 225. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0256 HOURS QPCFS= 17.71 CFS QPIN=29.2676 INCHES
C3=144.2600 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.54	.2204	.0000	.0000	.0	.00
1.56	.2279	.0000	.0000	17.7	.00
1.59	.2355	.0002	.0001	5.7	.00
1.61	.2430	.0004	.0002	.6	.00
1.64	.2506	.0007	.0003	.0	.00
2.33	.7377	.1633	.0154	.0	.37
2.36	.7671	.1793	.0159	.0	.38
2.38	.7965	.1957	.0164	.0	.39
2.41	.8259	.2125	.0168	.0	.40
2.43	.8553	.2298	.0173	.0	.41
2.46	.8847	.2474	.0177	.0	.42
2.49	.9141	.2655	.0180	.0	.43
2.51	.9336	.2777	.0122	.0	.33
2.54	.9416	.2827	.0050	.0	.17
2.56	.9495	.2877	.0050	.0	.13
2.59	.9575	.2928	.0051	.0	.12
2.61	.9654	.2979	.0051	.0	.12
2.64	.9734	.3030	.0051	.0	.12

HYDROGRAPH PEAK= .43 cfs
TIME TO PEAK= 2.49 Hours
RUNOFF VOLUME= .04 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	18-May-89
Project No.:	007.11.100	Time:	11:42 AM
Channel Section:	Ditch D-6	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.82	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.02	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.42	feet
	Qn/1.49(S)1/2=	0.117	
	A(R)2/3=	0.117	
	Required Depth:	0.92	feet
	Area:	0.36	ft2
	Perimeter:	1.89	feet
	Hydraulic Radius:	0.19	feet
	Velocity:	2.30	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.42	feet
	Qn/1.49(S)1/2=	0.117	
	A(R)2/3=	0.117	
	Required Depth:	0.92	feet
	Area:	0.36	ft2
	Perimeter:	1.89	feet
	Hydraulic Radius:	0.19	feet
	Velocity:	2.30	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.02	ft/ft
	Max. Bottom Slope :	0.02	ft/ft
	Min. Channel Depth:	0.92	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-7A
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/11/89

D-7A

Total Area = 453 * 0.00175 = 0.8 ac

CN = 90 (disturbed)

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 500 feet

$$\text{slope} = \frac{(1650)(5)(100)}{43{,}560\,(0.8)} = 23.7\%$$

Calculated Run-off: $Q_{TOT} = 0.57$ cfs

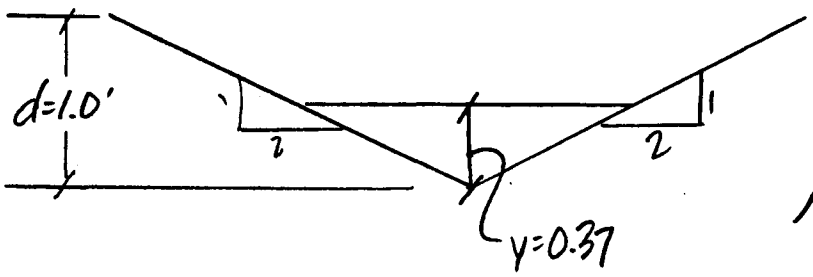
Ditch Design

$S_{min} = 2\%$

$S_{max} = 8\%$

try trapezoidal channel

$b = 0,\ m = 2,\ n = 0.03$



$V = 3.51$ ft/sec < 5.0 ft/sec ok

No lining necessary

PROJECT : Valley Camp Coal - D-7A Runoff Calculations

AREA= .8 ACRES
AVERAGE BASIN SLOPE= 23.7 PERCENT
CURVE NUMBER= 90.0
DESIGN STORM= 1.55 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 500. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0292 HOURS QPCFS= 20.69 CFS QPIN=25.6497 INCHES
C3=126.4273 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.52	.2147	.0000	.0000	.0	.00
1.55	.2233	.0000	.0000	20.7	.00
1.58	.2319	.0000	.0000	6.7	.00
1.61	.2405	.0003	.0002	.7	.00
1.64	.2491	.0006	.0003	.0	.00
2.31	.7084	.1480	.0169	.0	.47
2.34	.7419	.1656	.0176	.0	.49
2.37	.7754	.1839	.0183	.0	.51
2.39	.8089	.2027	.0189	.0	.53
2.42	.8424	.2221	.0194	.0	.54
2.45	.8759	.2421	.0200	.0	.56
2.48	.9094	.2626	.0205	.0	.57
2.51	.9335	.2776	.0150	.0	.46
2.54	.9425	.2833	.0057	.0	.23
2.57	.9516	.2890	.0057	.0	.17
2.60	.9606	.2948	.0058	.0	.16
2.63	.9697	.3006	.0058	.0	.16
2.66	.9787	.3064	.0058	.0	.16

HYDROGRAPH PEAK= .57 cfs
TIME TO PEAK= 2.48 Hours
RUNOFF VOLUME= .05 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client:	Valley Camp Coal Company	Date:	12-May-89
Project No.:	007.11.100	Time:	03:09 PM
Channel Section:	Ditch D-7A	Computed:	PGH

			UNITS
GENERAL CRITERIA:	Design Flow:	0.57	cfs
	Bottom Width:	0.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:	0.030	
	Min. Bottom Slope:	0.02	ft/ft
	Max. Bottom Slope:	0.08	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. Flow):	0.37	feet
	Qn/1.49(S)1/2=	0.081	
	A(R)2/3=	0.081	
	Required Depth:	0.87	feet
	Area:	0.27	ft2
	Perimeter:	1.65	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	2.10	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. Flow):	0.29	feet
	Qn/1.49(S)1/2=	0.041	
	A(R)2/3=	0.041	
	Required Depth:	0.79	feet
	Area:	0.16	ft2
	Perimeter:	1.27	feet
	Hydraulic Radius:	0.13	feet
	Velocity:	3.51	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	0.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope :	0.02	ft/ft
	Max. Bottom Slope :	0.08	ft/ft
	Min. Channel Depth:	0.87	feet
	Riprap:	Not Needed	

Comment:

HANSEN ALLEN & LUCE INC

CLIENT Valley Camp
PROJECT Permit
FEATURE D-7B
PROJECT NO. 007.11.100

SHEET ___ OF ___
COMPUTED Paul
CHECKED
DATE 5/11/89

D-7B

Total Area = 905 * 0.00175 = 1.6 ac
paved = 155 = 0.3 ac
disturbed = = 1.3 ac

CN	A	Q
98	0.3	1.329
90	1.3	0.723
		$\bar{Q}$=0.837

$\bar{CN}$=91.9

Precipitation = 1.55 inches (10 yr, 6 hr)

hydraulic length = 700'

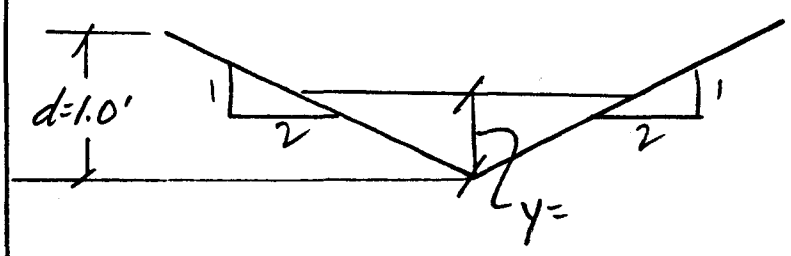
slope = $\frac{(1875)(5)(100)}{43{,}560\,(1.6)}$ = 13.5%

Calculated Run-Off ⇒ Q_{TOT} = 1.27 cfs

Ditch Design

S_{min} = 4.5% by trapezoidal channel

S_{max} = 11% b=1.0, M=2, n=0.03



v = 4.54 ft/sec < 5.0 ft/sec OK

No lining required