United States Department of Agriculture
Soil Conservation Service
210 Walnut Street
693 Federal Building
Des Moines, IA 50309

March 8, 1984

ENGINEERING FIELD MANUAL
IA210-ENG - AMENDMENT IA17, CHAPTERS 2, 6, AND 14

Purpose. This notice transmits pages IA2-76(29) and (30), IA6-15(1) through (9), and IA14-111(1) and (2).

Effective Date. This amendment is effective upon receipt.

Filing Instructions. Pages IA2-76(29) and (30) should be filed in the EFM immediately following page IA2-76(28). Pages IA6-15(1) through (9) should be filed immediately following page 6-15. Pages IA14-111(1) and (2) should be filed immediately following page 14-111. Pages IA2-76(29) and (30), dated August 1982, and pages IA6-91(1) and (2), dated September 1981, are superseded and should be removed from the file.

This amendment corrects an error on page IA2-76(30), August 1982. It also issues guidelines on design of drop spillways and maximum trench depths for corrugated plastic tubing.

Each copy of the EFM should have these new pages. Additional copies may be ordered from the State Office. This transmittal should be destroyed when the material has been filed.

Hershel R. Read
Acting State Conservationist

Attachments

IA6-15(5) through IA6-15(8) is superseded by Amendment IA21

IA6-15(9) through IA6-15(10) is superseded by Amendment IA30

AC
DC + Anthon
EN2
MNTC (5)
SCE Midwest States
SO

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DESIGN PROCEDURES FOR DROP SPILLWAYS

Iowa Standard and Specification for Grade Stabilization Structure (410) shall be followed to plan, design, and install drop spillway structures. The following procedures and criteria supplement Iowa Standard 410 and are applicable to fabricated aluminum drop spillways shown on Iowa Standard Drawing No. 801; reinforced concrete toewall drop spillways shown on Drawing No. 3-L-7400; and reinforced concrete drop spillways shown on Drawing 3-L-4100.

The hydraulic capacity of all structures shall be adequate to pass the peak flow expected from a design storm of the frequency and duration specified in Standard 410. Peak flows are determined using procedures in Chapter 2, EFM, or Chapter 21, National Engineering Handbook, Section 4 (NEH-4).

A minimum of 6 inches of freeboard should be provided between the top of headwall and the water surface attained by the design discharge. In lieu of this, the formula $Q = \frac{3.1\ Lh^{3/2}}{1.10 + 0.01F}$ may be used to determine structure capacity. Freeboard is included in this formula where:

Q = flow in cfs
L = weir length in ft
h = weir depth in ft (with freeboard)
F = drop through the structure in ft

The downstream channel must be stable after the structure is installed. The channel may be considered to be stable if the flow velocity (use Manning's equation $V = \frac{1.486}{n} r^{2/3} s^{1/2}$) at bankfull stage or from the design peak flow, whichever is less, is less than the permissible bare channel velocity for the soil materials in the downstream channel. (See Table 14-2, Chapter 14 or Table 7-2, Iowa Drainage Guide.)

Channel stability may also be assumed if the bottom is on a uniform grade, signs of scour are not readily apparent on the channel bottom or sides, and grass and trees growing on the channel bottom and sides indicate that erosion has not been serious for a number of years. As a general rule of thumb, any grade steeper than 0.5% should be carefully evaluated.

Emergency spillways are not required for drop spillway structures if the weir is adequate to pass the peak flow from the frequency and duration storm specified in Standard 410 for total capacity without freeboard.

ISLAND TYPE STRUCTURES

If a drop spillway is planned as an island type structure, the capacity of the weir must be equal to the capacity of the downstream channel at the point where the auxiliary spillway flow will re-enter the channel. This design practice is set so that the ditch will be full before the overflow around the structure enters the ditch. This eliminates the possibility of erosion from flow over the ditch bank. To accomplish this, the crest of the weir must be set below the bottom elevation of the auxiliary spillway sufficiently to provide weir capacity

between these two points equal to the bankfull capacity of the channel. Generally, a portion of the weir will be submerged and this must be considered in the design.

No submergence calculations or increase in weir size is required for structures with a vertical drop of 4 feet or less.

When flow occurs through the auxiliary spillway, the depth of flow over the weir will be higher than the weir design depth of flow. This will require extending the height of the weir notch (top of headwall) above the design depth of flow in the auxiliary spillway so that flood flows will not overtop the headwall and erode the earthfill. In other words, the depth of the weir notch must be equal to the depth necessary to carry ditch capacity plus the design depth of flow of the auxiliary spillway.

The auxiliary spillway will often be located on cultivated land and the velocity of flow must be kept low so that scouring will not develop. The depth of flow affects the height of the structure; therefore, as flow depth increases, the cost of the structure will increase. A flow depth of 0.5 ft is about the maximum that should be considered, providing this depth will not create erosive velocities.

The upstream waterway must have the same capacity as the channel below the structure. This means that the discharge from the waterway must fill the channel before the banks of the waterway are overtopped and flow is directed to the auxiliary spillway. It should also be proportioned so that its banks will overflow near the structure as soon as channel capacity flow has been reached. Above this point of overflow it should be designed under Grassed Waterway or Outlet (412).

In order to force overflow water away from the structure, the earth fill should extend at least 40 feet from the edge of the weir notch. The top of the settled earth fill should be at least 1.0 foot higher than the top of the structure headwall. A dike should extend downstream from the earth fill to prevent auxiliary spillway flow from entering the channel within 15 feet of the structure.

Drop spillway structures have a tendency to scour for a few feet upstream of the weir. Protection can be provided by a concrete slab or riprap. A concrete slab should extend the full width of the weir for at least 3 feet upstream. It should be at least 4 inches thick and need not be reinforced. Riprap should consist of well-graded rock with a maximum size of 6 inches.

TOEWALL

A toewall is a drop spillway structure having a vertical drop of 4 feet or less. It is used to provide a stable outlet for a grassed waterway and serves as a dividing point between a wet channel and a dry waterway. It is often used to provide an outlet for subsurface drains. If the main purpose is to reduce grade in the channel, the structure is not a toewall.

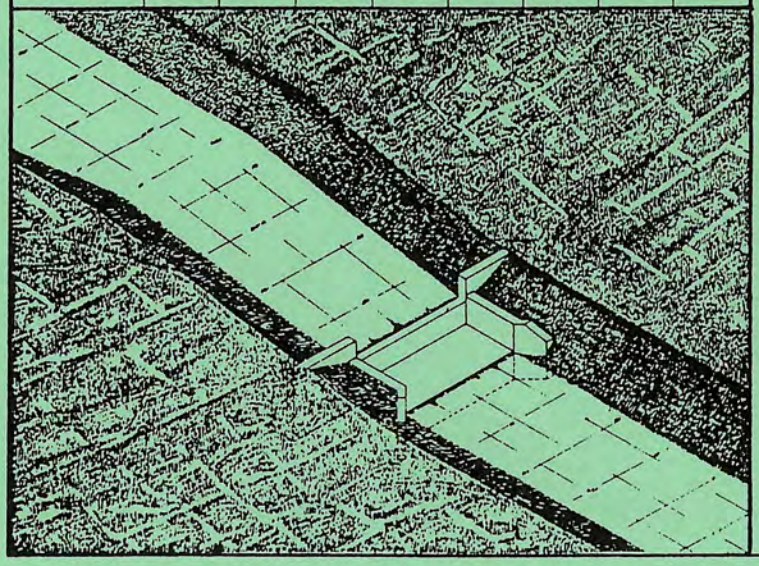
Copies of standard plans for toewalls may be ordered from the State Office. The index sheet, Drawing 3-L-7400, gives available sizes.

DRAWING NUMBERS AND MATERIAL QUANTITIES

HEIGHT OF HEADWALL	DEPTH OF WEIR	LENGTH OF WEIR OPENING															
		6'-0"		8'-0"		10'-0"		12'-0"		14'-0"		16'-0"		18'-0"		20'-0"	
H	h	DRAWING NO		DRAWING NO		DRAWING NO		DRAWING NO		DRAWING NO		DRAWING NO		DRAWING NO		DRAWING NO.	
		CONC. CU YDS.	STEEL LBS.	CONC CU YDS.	STEEL LBS.	CONC CU YDS.	STEEL LBS.	CONC CU YDS.	STEEL LBS.	CONC CU YDS	STEEL LBS	CONC CU YDS	STEEL LBS.	CONC CU YDS.	STEEL LBS	CONC CU YDS	STEEL LBS
1'-0"	1'-0"	7406		7408		7410		7412		7414		7416		7418		7420	
		2.3	99.0	2.6	112.0	2.9	130.0	3.2	137.0	3.5	150.0	3.8	163.0	4.1	176.0	4.4	189.0
	1'-6"	7426		7428		7430		7432		7434		7436		7438		7440	
		2.6	109.5	3.0	123.8	3.4	138.1	3.8	152.4	4.2	166.7	4.6	181.0	5.0	195.2	5.4	209.5
	2'-0"	7446		7448		7450		7452		7454		7456		7458		7460	
		1.8	139.3	2.0	156.0	2.3	173.0	2.5	190.0	2.7	207.0	3.0	224.0	3.2	241.0	3.4	258.0
	2'-6"	7466		7468		7470		7472		7474		7476		7478		7480	
		4.0	180.0	4.4	196.0	4.8	212.0	5.2	228.0	5.6	244.0	6.0	260.0	6.4	276.0	6.8	292.0
	3'-0"	7486		7488		7490		7492		7494		7496		7498		7500	
		4.5	291.0	4.9	308.8	5.3	326.8	5.7	344.9	6.1	362.9	6.5	380.4	6.9	398.8	7.3	417.0
1'-6"	1'-0"	7606		7608		7610		7612		7614		7616		7618		7620	
		2.9	129.0	3.3	147.0	3.7	164.0	4.1	182.0	4.5	200.0	4.9	217.0	5.3	231.0	5.7	252.0
	1'-6"	7626		7628		7630		7632		7634		7636		7638		7640	
		3.3	165.0	3.7	184.0	4.1	203.0	4.5	222.0	5.0	240.0	5.4	260.0	5.8	278.0	6.2	297.0
	2'-0"	7646		7648		7650		7652		7654		7656		7658		7660	
		3.7	147.0	4.1	160.0	4.6	173.0	4.9	185.0	5.3	198.0	5.7	211.0	6.1	223.0	6.5	236.0
	2'-6"	7666		7668		7670		7672		7674		7676		7678		7680	
		4.8	370.0	5.3	401.0	5.8	433.0	6.3	465.0	6.8	497.0	7.3	528.9	7.8	561.0	8.3	593.0
	3'-0"	7686		7688		7690		7692		7694		7696		7698		7700	
		5.2	390.0	5.7	414.0	6.2	448.0	6.7	468.6	7.2	495.9	7.7	523.2	8.2	551.2	8.7	577.8
2'-0"	1'-0"	7806		7808		7810		7812		7814		7816		7818		7820	
		3.8	314.0	4.3	349.0	4.8	384.0	5.3	429.0	5.8	454.0	6.3	489.0	6.8	524.0	7.3	559.0
	1'-6"	7826		7828		7830		7832		7834		7836		7838		7840	
		4.0	313.0	4.5	348.0	5.0	383.0	5.5	419.0	6.0	454.0	6.5	489.0	7.0	524.0	7.5	559.0
	2'-0"	7846		7848		7850		7852		7854		7856		7858		7860	
		4.2	336.0	4.7	372.0	5.2	407.0	5.7	443.0	6.2	478.0	6.7	515.0	7.2	550.0	7.7	586.0
	2'-6"	7866		7868		7870		7872		7874		7876		7878		7880	
		5.6	474.0	6.1	511.0	6.6	549.0	7.1	586.0	7.6	623.0	8.1	660.0	8.6	697.0	9.1	734.0
	3'-0"	7886		7888		7890		7892		7894		7896		7898		7900	
		6.1	549.0	6.6	586.0	7.1	623.7	7.6	661.0	8.1	699.0	8.6	736.0	9.1	773.0	9.6	811.0
2'-6"	1'-0"	7906		7908		7910		7912		7914		7916		7918		7920	
		4.3	343.0	4.8	380.0	5.3	417.0	5.8	454.0	6.3	491.0	6.8	528.0	7.3	565.0	7.8	602.0
	1'-6"	7926		7928		7930		7932		7934		7936		7938		7940	
		4.6	362.0	5.1	399.0	5.6	435.0	6.1	473.0	6.6	510.0	7.1	546.0	7.6	584.0	8.1	619.0
	2'-0"	7946		7948		7950		7952		7954		7956		7958		7960	
		5.0	384.0	5.6	421.0	6.1	459.0	6.7	496.0	7.3	534.0	7.8	572.0	8.4	609.0	9.0	647.0
	2'-6"	7966		7968		7970		7972		7974		7976		7978		7980	
		5.9	459.0	6.5	494.3	6.9	532.4	7.5	569.1	8.1	605.9	8.7	642.6	9.3	679.4	9.9	716.1
	3'-0"	7986		7988		7990		7992		7994		7996		7998		8000	
		6.3	535.0	6.9	574.0	7.5	616.0	8.1	662.0	8.7	703.0	9.3	744.0	9.9	786.0	10.5	825.0

DISCHARGE CAPACITY OF SPILLWAY IN C.F.S.

"h" HEAD OVER CREST	LENGTH OF WEIR OPENING "L" IN FEET							
	6'-0"	8'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
0'-6"	7.0	9.0	12	14	16	19	21	23
1'-0"	19	26	33	39	46	53	59	66
1'-6"	35	47	59	72	84	96	108	121
2'-0"	53	72	90	109	128	147	166	185
2'-6"	72	99	125	151	178	204	230	257
3'-0"	93	128	162	197	232	266	301	336



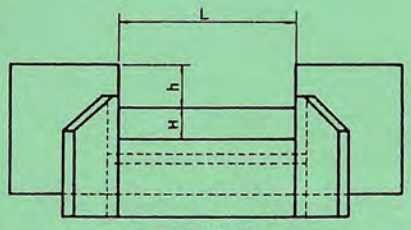
NOTE

The spillway discharge capacities are computed from the formula $Q = 3.33 (L - 0.2h) h^{3/2}$

When the crest is submerged by high tailwater in the downstream channel, the formula $Q = 3.33 (L - 0.2h)(Nh)^{3/2}$ should be used to determine spillway capacities. The value of the coefficient "N" is given in the table on drawing No 5-L-7285.

Where weirs of greater length than 20'-0" are required the apron and headwall can be expanded using the same detailing and cross-section dimensions. For expanded headwalls, buttresses (counterforts) should be added at approximately 12'-0" on centers.

This spillway should be used primarily as a toe-wall for sod flumes and at critical sections in constructed waterways.



ELEVATION

INDEX SHEET FOR
R/C STRAIGHT DROP SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CARTOGRAPHIC APPROVAL			TECHNICAL APPROVAL	
K. M. Wood			Edwin Freyburger	
DESIGNED	DRAWN	CHECKED	DATE	DRAWING NUMBER
A.F. MORATZ	C. YURK	R. MICHAUD	11-16-50	3-L-7400
				SHEET OF

4100 SERIES DROP SPILLWAY (TYPE E)

The 4100 series standard drop spillway is an alternate to the Type B series standard in NEH-11. Sound evaluation of the total head on the weir and of tailwater conditions are essential for proper performance.

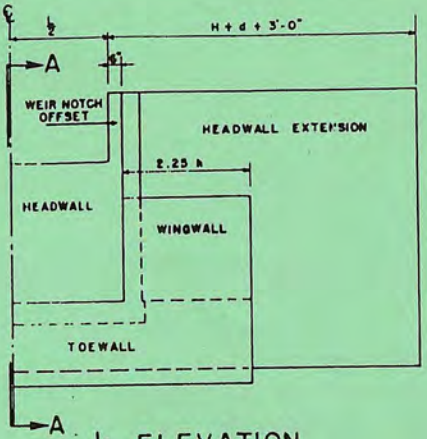
If high entrance velocities exist, erosion will occur for considerable distance upstream. Tailwater dictates apron length and stability of the downstream channel. High tailwater moves the projected nappe downstream causing long aprons and/or downstream protection. High tailwater can submerge the hydraulic jump, but high velocities exist on the apron and for some distance downstream. Low tailwater causes the hydraulic jump to move downstream.

The tendency for scour to occur downstream from the apron increases as the ratio of the total weir depth to the headwall height increases. Therefore, the 4100 series drop spillway is to be used only if the ratio of total weir depth to headwall height does not exceed 0.5 ($h/F \leq 0.5$). (See §536.08, NEM.)

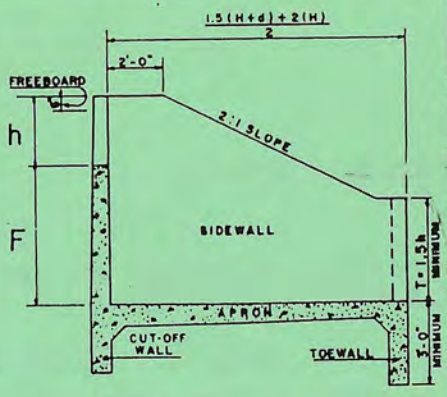
The 4100 series drop spillway was developed in the 1940's using design criteria differing drastically from current standards. Thus it is very important that site conditions are evaluated to determine that design loadings are not exceeded. Cutoff walls should be checked to determine if they are adequate to prevent piping. All #3 reinforcing bars shown in the standard plan should be replaced with #4 bars. Sidewalls may be constructed with vertical faces (no taper). Scour protection should be considered for both the upstream and downstream channels.

The designer adapting the standard plan to the site is responsible for insuring that these items are considered in the design. Generally, no other changes will be needed in the plan to adapt it for Class I through IV jobs. Copies of 4100 series standard plans may be ordered from the State Office. The index sheet, Drawing 3-L-4100, gives available sizes.

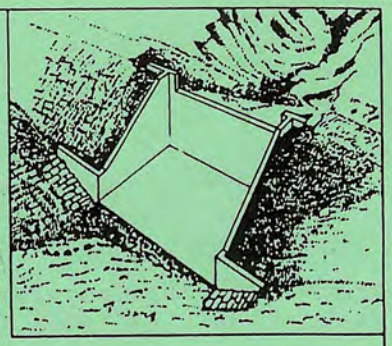
DESIGNED AND COMPILED BY G.W. FOSTER

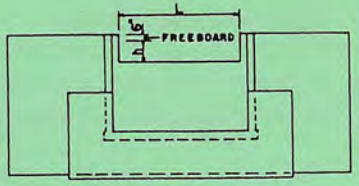


½ ELEVATION



SECTION A-A





HEAD WALL HEIGHT		TOTAL WEIR DEPTH h+6"	LENGTH OF WEIR OPENING "L" IN FEET							
			6'-0"	8'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
F		h	DRWG. NO. CU.YDS. CONC. / STEEL LBS.	DRWG. NO. CU.YDS. CONC. / STEEL LBS.	DRWG. NO. CU.YDS. CONC. / STEEL LBS.	DRWG. NO. CU.YDS. CONC. / STEEL LBS.	DRWG. NO. CU.YDS. CONC. / STEEL LBS.	DRWG. NO. CU.YDS. CONC. / STEEL LBS.	DRWG. NO. CU.YDS. CONC. / STEEL LBS.	DRWG. NO. CU.YDS. CONC. / STEEL LBS.
3'-0"		2'-0"	4110 / 7.0 / 400	4111 / 7.7 / 445	4112 / 8.3 / 499	4113 / 8.9 / 539	4114 / 9.5 / 593	4115 / 10.2 / 651	4116 / 10.8 / 697	4117 / 11.5 / 741
		2'-6"	4130 / 7.7 / 449	4131 / 8.4 / 492	4132 / 9.1 / 552	4133 / 9.7 / 594	4134 / 10.4 / 652	4135 / 11.1 / 712	4136 / 11.8 / 759	4137 / 12.4 / 806
		3'-0"	4150 / 8.5 / 519	4151 / 9.2 / 563	4152 / 9.9 / 624	4153 / 10.5 / 672	4154 / 11.2 / 727	4155 / 11.9 / 791	4156 / 12.6 / 840	4157 / 13.3 / 885
		3'-6"	4170 / 9.4 / 615	4171 / 10.1 / 662	4172 / 10.8 / 724	4173 / 11.5 / 775	4174 / 12.3 / 832	4175 / 13.0 / 893	4176 / 13.7 / 946	4177 / 14.4 / 987
4'-0"		2'-0"	4210 / 9.4 / 605	4211 / 10.3 / 670	4212 / 11.2 / 746	4213 / 12.0 / 808	4214 / 12.9 / 883	4215 / 13.8 / 965	4216 / 14.6 / 1029	4217 / 15.5 / 1093
		2'-6"	4230 / 10.3 / 665	4231 / 11.2 / 731	4232 / 12.1 / 811	4233 / 13.0 / 876	4234 / 13.9 / 954	4235 / 14.8 / 1037	4236 / 15.7 / 1106	4237 / 16.6 / 1179
		3'-0"	4250 / 11.0 / 701	4251 / 11.9 / 767	4252 / 12.8 / 849	4253 / 13.7 / 911	4254 / 14.6 / 993	4255 / 15.5 / 1075	4256 / 16.4 / 1142	4257 / 17.3 / 1207
		3'-6"	4270 / 12.6 / 869	4271 / 13.6 / 952	4272 / 14.5 / 1034	4273 / 15.5 / 1103	4274 / 16.4 / 1211	4275 / 17.3 / 1286	4276 / 18.2 / 1361	4277 / 19.2 / 1435
5'-0"		2'-0"	4310 / 11.2 / 746	4311 / 12.2 / 829	4312 / 13.2 / 926	4313 / 14.2 / 1004	4314 / 15.2 / 1105	4315 / 16.2 / 1203	4316 / 17.2 / 1286	4317 / 18.2 / 1368
		2'-6"	4330 / 12.0 / 911	4331 / 13.0 / 1004	4332 / 14.0 / 1108	4333 / 15.0 / 1197	4334 / 16.0 / 1337	4335 / 17.1 / 1418	4336 / 18.1 / 1521	4337 / 19.1 / 1613
		3'-0"	4350 / 13.5 / 993	4351 / 14.6 / 1084	4352 / 15.6 / 1191	4353 / 16.7 / 1280	4354 / 17.7 / 1423	4355 / 18.8 / 1514	4356 / 19.8 / 1606	4357 / 20.8 / 1728
		3'-6"	4370 / 15.4 / 1113	4371 / 16.4 / 1215	4372 / 17.5 / 1314	4373 / 18.6 / 1407	4374 / 19.6 / 1551	4375 / 20.6 / 1643	4376 / 21.7 / 1763	4377 / 22.8 / 1858
6'-0"		2'-0"	4410 / 14.0 / 1045	4411 / 15.2 / 1150	4412 / 16.3 / 1267	4413 / 17.5 / 1379	4414 / 18.6 / 1513	4415 / 19.7 / 1721	4416 / 20.9 / 1834	4417 / 22.1 / 1969
		2'-6"	4430 / 15.3 / 1133	4431 / 16.4 / 1238	4432 / 17.6 / 1351	4433 / 18.7 / 1521	4434 / 19.9 / 1676	4435 / 21.0 / 1796	4436 / 22.2 / 2050	4437 / 23.3 / 2180
		3'-0"	4450 / 16.0 / 1306	4451 / 17.2 / 1429	4452 / 18.3 / 1541	4453 / 19.5 / 1723	4454 / 20.6 / 1854	4455 / 21.8 / 2113	4456 / 23.0 / 2242	4457 / 24.2 / 2439
		3'-6"	4470 / 17.7 / 1450	4471 / 18.8 / 1578	4472 / 20.0 / 1692	4473 / 21.2 / 1881	4474 / 22.4 / 2021	4475 / 23.6 / 2287	4476 / 24.8 / 2442	4477 / 26.0 / 2583
7'-0"		2'-0"	4510 / 16.5 / 1410	4511 / 17.8 / 1593	4512 / 19.1 / 1715	4513 / 20.4 / 1856	4514 / 21.6 / 2018	4515 / 22.9 / 2171	4516 / 24.2 / 2328	4517 / 25.5 / 2462
		2'-6"	4530 / 17.2	4531 / 18.5 / 1647	4532 / 19.8 / 1770	4533 / 21.1 / 1919	4534 / 22.4 / 2026	4535 / 23.7 / 2226	4536 / 26.0 / 2406	4537 / 27.4 / 2512
		3'-0"	4550 / 19.1	4551 / 20.4 / 1894	4552 / 21.7 / 2009	4553 / 23.0 / 2172	4554 / 24.3 / 2330	4555 / 26.8 / 2762	4556 / $ 29.5 / 2789	4557 / $ 31.0 / 2802
		3'-6"	4570 / 20.5	4571 / 21.8 / 1908	4572 / 23.1 / 2095	4573 / 24.4 / 2205	4574 / 25.8 / 2389	4575 / 28.2 / 2564	4576 / $ 30.7 / 2875	4577 / $ 32.2 / 2934
8'-0"		2'-0"	4610 / 20.8	4611 / 22.2	4612 / 23.6 / 1996	4613 / 25.1 / 2134	4614 / 26.5 / 2352	4615 / 29.4 / 2503	4616 / $ 30.9 / 3032	4617 / $ 32.3 / 3028
		2'-6"	4630 / 22.0	4631 / 23.5	4632 / 24.9 / 2012	4633 / 26.3 / 2125	4634 / 27.7 / 2250	4635 / $ 30.7	4636 / $ 32.2	4637 / $ 33.7
		3'-0"	4650 / 24.2	4651 / 25.6	4652 / 27.0 / 2144	4653 / 28.4 / 2266	4654 / $ 31.2	4655 / $ 32.7 / 2796	4656 / $ 34.2	4657 / $ 35.6
		3'-6"	4670 / 25.8	4671 / 27.2	4672 / 28.6 / 2556	4673 / 30.0 / 2759	4674 / $ 32.8 / 2740	4675 / $ 34.3 / 3015	4676 / $ 35.8 / 3231	4677 / $ 37.3 / 3427
9'-0"		2'-0"	4710	4711	4712	4713	4714	4715	4716	4617
		2'-6"	4730	4731	4732	4733	4734	4735	4736	4737
		3'-0"	4750	4751	4752	4753	4754	4755	4756	4757
		3'-6"	4770	4771 / 36.0 / 2874	4772	4773 / 39.4 / 3132	4774	4775 / 44.5 / 3512	4776	4777
10'-0"		2'-0"	4810	4811	4812	4813	4814	4815	4816	4817
		2'-6"	4830	4831	4832 / 40.8 / 3313	4833	4834	4835	4836	4837
		3'-0"	4850	4851	4852 / 41.0 / 3339	4853	4854 / $ 46.7 / 3797	4855	4856 / $ 50.5 / 4152	4857
		3'-6"	4870	4871	4872	4873	4874	4875	4876	4877

Revised 9-1-81

CHART SHOWING CAPACITY OF WEIRS

HEAD h	LENGTH OF WEIR OPENING "L" IN FEET							
	6'-0"	8'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
1'-6"	34.9	47.1	59.3	71.6	83.8	96.1	108	121
2'-0"	52.8	71.6	90.4	109	128	147	166	185
2'-6"	72.4	98.7	125	151	178	204	230	257
3'-0"	93.4	128	162	197	232	266	301	336
3'-6"	116	159	203	246	290	333	377	421

CAPACITY OF WEIRS

$Q = 3.33\,(L - 0.2h)\,h^{3/2}$

DESIGN DATA

f_s = 18,000, f'_c = 2,000, f_c = 800, v = 40, u = 100,
Stresses in pounds per square inch
Trapezoidal loading on headwall = 60 lbs. per sq. ft., on sidewalls = 40 lbs. per sq. ft.
Steel cover = 2", except on earth = 3".
Where possible, all steel shall be secured in place before concrete is poured.
Only material conforming to A.S.T.M. standards shall be used.
Steel to be intermediate grade new billet deformed bars.
Fillets may be used on inside corners if desired.
Curved lip and entrance are optional.
Construction joints, when necessary, to be formed by using beveled 2" x 4".
Steel weights do not allow for waste due to cutting.
If footings are required, add 10% to steel weights and 15% to volume of concrete.

NOTE "STRUCTURE DATA SHEET MUST ACCOMPANY REQUEST FOR DETAIL PLANS."

"B" = Dams with buttresses.

INDEX SHEET R/C TYPE "E" STRAIGHT DROP SPILLWAYS

RELATIVE DIMENSIONS, CONCRETE AND STEEL QUANTITIES, DRAWING NUMBERS, AND WEIR CAPACITIES.

REGION 5 — REGIONAL OFFICE

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
H.H. BENNETT, CHIEF

REFERENCE:

DRAFTING APPROVAL	TECHNICAL APPROVAL			
DESIGNED	DRAWN	CHECKED	DATE	DRWG. NO.
G.W. FOSTER	C.L. YULE	G.W. FOSTER	10-17-'40	3-L-4100