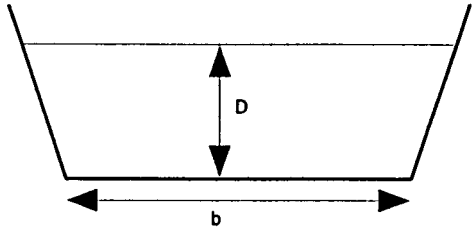
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 0.1 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20																										
30																										
40																										
50																										
60	30	3.3																								
70	38	3.1																								
80	47	3.1																								
90	55	3.0	29	3.6																						
100	64	3.0	36	3.5																						
110	72	2.9	42	3.4																						
120	80	2.9	48	3.3																						
130	88	2.9	54	3.3	31	3.7																				
140	97	2.9	60	3.2	36	3.7																				
150			66	3.2	41	3.6																				
160			72	3.2	46	3.5																				
170			78	3.1	50	3.5																				
180			84	3.1	55	3.4	29	4.1																		
190			89	3.1	59	3.4	33	4.0																		
200			95	3.1	64	3.4	37	3.9																		
210					69	3.3	41	3.9																		
220					73	3.3	44	3.8																		
230					77	3.3	48	3.8																		
240					82	3.3	52	3.8	27	4.5																
250					86	3.3	55	3.7	30	4.4																
260					91	3.3	58	3.7	33	4.3																
270					95	3.3	62	3.7	36	4.3																
280					99	3.2	65	3.6	39	4.2																
290							69	3.6	42	4.2																
300							72	3.6	45	4.1																

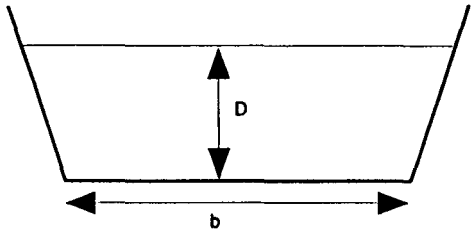
Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

Trapezoidal Waterway Design Chart

Capacity Retardance = B
Velocity Retardance = D
Sides Slopes = 6:1

Design Grade = 0.2 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20																										
30	20	2.7																								
40	32	2.5																								
50	44	2.4	24	2.8																						
60	55	2.4	32	2.7																						
70	67	2.3	41	2.6	24	3.0																				
80	78	2.3	49	2.5	31	2.9																				
90	90	2.3	57	2.5	37	2.8	23	3.1																		
100			65	2.5	43	2.7	28	3.0																		
110			73	2.5	50	2.7	33	3.0																		
120			81	2.4	56	2.7	39	2.9	23	3.3																
130			89	2.4	62	2.6	43	2.9	27	3.2																
140			96	2.4	68	2.6	48	2.8	32	3.1																
150					74	2.6	53	2.8	36	3.1																
160					80	2.6	58	2.8	40	3.0																
170					86	2.6	63	2.7	44	3.0	27	3.4														
180					92	2.5	68	2.7	48	3.0	30	3.4														
190					98	2.5	72	2.7	52	3.0	34	3.3														
200							77	2.7	56	2.9	37	3.3														
210							82	2.7	60	2.9	41	3.2	24	3.7												
220							87	2.7	63	2.9	44	3.2	27	3.6												
230							92	2.6	67	2.9	47	3.2	30	3.6												
240							96	2.6	71	2.9	50	3.1	33	3.5												
250									75	2.8	53	3.1	36	3.5												
260									78	2.8	57	3.1	39	3.5												
270									82	2.8	60	3.1	41	3.4												
280									86	2.8	63	3.1	44	3.4												
290									90	2.8	66	3.0	47	3.4	29	3.9										
300									94	2.8	69	3.0	49	3.3	31	3.8										

Bottom width (b) is based on velocity retardance.

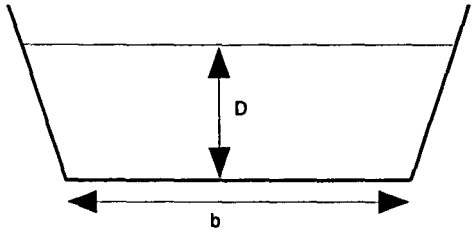
Depth (D) is based on capacity retardance.

Trapezoidal Waterway Design Chart

Capacity Retardance = B
Velocity Retardance = D

Design Grade = 0.3 %

Sides Slopes = 6:1



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	16	2.4																								
30	30	2.2	16	2.5																						
40	44	2.1	26	2.4																						
50	58	2.1	37	2.3	22	2.5																				
60	71	2.0	47	2.2	29	2.5	17	2.8																		
70	85	2.0	57	2.2	37	2.4	24	2.7																		
80	99	2.0	66	2.1	45	2.4	30	2.6																		
90			76	2.1	52	2.3	36	2.5	25	2.8																
100			86	2.1	59	2.3	42	2.5	30	2.7																
110			95	2.1	67	2.3	48	2.4	35	2.6	23	2.9														
120					74	2.3	54	2.4	40	2.6	27	2.8														
130					81	2.2	59	2.4	44	2.6	31	2.8														
140					88	2.2	65	2.4	49	2.5	35	2.7	22	3.1												
150					95	2.2	71	2.4	54	2.5	39	2.7	26	3.0												
160							77	2.3	59	2.5	43	2.7	29	3.0												
170							82	2.3	63	2.5	47	2.7	33	2.9												
180							88	2.3	68	2.4	51	2.6	36	2.9	23	3.2										
190							94	2.3	73	2.4	55	2.6	39	2.9	26	3.2										
200							99	2.3	77	2.4	59	2.6	43	2.8	29	3.1										
210									82	2.4	63	2.6	46	2.8	32	3.1										
220									87	2.4	67	2.6	49	2.8	35	3.1										
230									91	2.4	70	2.6	53	2.8	38	3.0	24	3.4								
240									96	2.4	74	2.5	56	2.8	41	3.0	27	3.4								
250											78	2.5	59	2.7	44	3.0	30	3.3								
260											82	2.5	62	2.7	46	3.0	32	3.3								
270											85	2.5	65	2.7	49	2.9	35	3.3								
280											89	2.5	68	2.7	52	2.9	37	3.2	24	3.6						
290											93	2.5	72	2.7	55	2.9	39	3.2	26	3.6						
300											97	2.5	75	2.7	57	2.9	42	3.2	29	3.5						

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

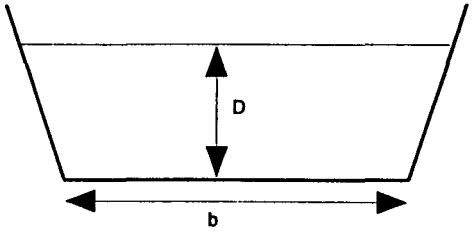
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 0.4 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	21	2.1																								
30	37	2.0	22	2.2																						
40	52	1.9	34	2.1	20	2.3																				
50	68	1.9	45	2.0	29	2.2	19	2.5																		
60	83	1.9	56	2.0	38	2.1	26	2.4	16	2.6																
70	98	1.8	67	2.0	46	2.1	33	2.3	22	2.5																
80			78	1.9	55	2.1	39	2.3	28	2.4	19	2.7														
90			89	1.9	63	2.1	46	2.2	34	2.4	24	2.6														
100					71	2.0	53	2.2	39	2.3	28	2.5	18	2.8												
110					79	2.0	59	2.2	45	2.3	33	2.5	22	2.7												
120					88	2.0	66	2.2	50	2.3	38	2.4	26	2.7												
130					96	2.0	72	2.1	56	2.3	42	2.4	30	2.6	20	2.9										
140							79	2.1	61	2.2	47	2.4	34	2.6	23	2.8										
150							85	2.1	66	2.2	51	2.3	38	2.5	27	2.8										
160							92	2.1	72	2.2	56	2.3	42	2.5	30	2.7										
170							98	2.1	77	2.2	60	2.3	46	2.5	33	2.7	23	3.0								
180									82	2.2	65	2.3	49	2.5	37	2.7	26	2.9								
190									88	2.2	69	2.3	53	2.4	40	2.6	29	2.9								
200									93	2.2	74	2.3	57	2.4	43	2.6	32	2.9	20	3.2						
210									98	2.2	78	2.3	61	2.4	46	2.6	35	2.8	23	3.2						
220											82	2.3	64	2.4	50	2.6	37	2.8	26	3.1						
230											87	2.3	68	2.4	53	2.6	40	2.8	28	3.1						
240											91	2.2	72	2.4	56	2.5	43	2.7	31	3.0	20	3.4				
250											96	2.2	75	2.4	59	2.5	46	2.7	33	3.0	22	3.4				
260											100	2.2	79	2.4	62	2.5	48	2.7	36	3.0	25	3.3				
270													83	2.4	65	2.5	51	2.7	38	2.9	27	3.3				
280													86	2.4	68	2.5	54	2.7	40	2.9	29	3.2				
290													90	2.4	71	2.5	56	2.7	43	2.9	31	3.2	21	3.5		
300													93	2.3	74	2.5	59	2.7	45	2.9	34	3.2	24	3.5		

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

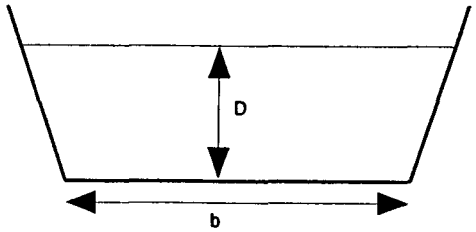
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 0.5 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	25	1.9																								
30	42	1.8	27	2.0	16	2.2																				
40	59	1.8	40	1.9	26	2.1	16	2.3																		
50	76	1.7	52	1.9	36	2.0	24	2.2	15	2.4																
60	93	1.7	64	1.8	45	2.0	32	2.1	22	2.3																
70			76	1.8	54	1.9	39	2.1	28	2.2	20	2.4														
80			88	1.8	63	1.9	46	2.1	35	2.2	26	2.3	17	2.6												
90					73	1.9	54	2.0	40	2.1	31	2.3	22	2.5												
100					82	1.9	61	2.0	46	2.1	36	2.3	26	2.4	17	2.7										
110					91	1.9	68	2.0	52	2.1	41	2.2	31	2.4	21	2.6										
120							75	2.0	58	2.1	46	2.2	35	2.3	25	2.6	16	2.9								
130							82	2.0	64	2.1	51	2.2	39	2.3	29	2.5	19	2.8								
140							90	2.0	70	2.1	56	2.2	44	2.3	32	2.5	23	2.7								
150							97	2.0	76	2.0	61	2.1	48	2.3	36	2.4	26	2.7								
160									82	2.0	66	2.1	52	2.2	40	2.4	29	2.6	20	2.9						
170									88	2.0	71	2.1	56	2.2	43	2.4	33	2.6	23	2.8						
180									94	2.0	76	2.1	60	2.2	47	2.4	36	2.5	26	2.8						
190									99	2.0	81	2.1	64	2.2	50	2.4	39	2.5	29	2.7	18	3.1				
200											86	2.1	69	2.2	54	2.3	42	2.5	32	2.7	21	3.0				
210											91	2.1	73	2.2	57	2.3	45	2.5	34	2.7	24	3.0				
220											96	2.1	77	2.2	61	2.3	48	2.5	37	2.6	26	2.9				
230													81	2.2	64	2.3	51	2.4	40	2.6	29	2.9	19	3.2		
240													85	2.2	68	2.3	54	2.4	42	2.6	31	2.8	22	3.1		
250													89	2.2	71	2.3	57	2.4	45	2.6	34	2.8	24	3.1		
260													93	2.2	75	2.3	60	2.4	48	2.6	36	2.8	27	3.1		
270													97	2.2	78	2.3	63	2.4	50	2.6	39	2.8	29	3.0	20	3.3
280															81	2.3	66	2.4	53	2.5	41	2.8	31	3.0	22	3.3
290															85	2.3	69	2.4	55	2.5	43	2.7	33	3.0	24	3.2
300															89	2.3	72	2.4	58	2.5	45	2.7	35	2.9	26	3.2

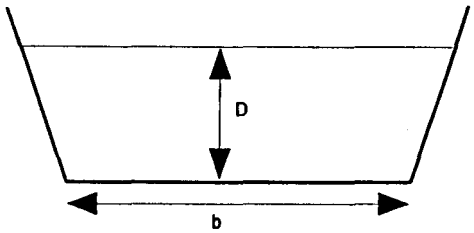
Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

Trapezoidal Waterway Design Chart

Capacity Retardance = B
Velocity Retardance = D
Sides Slopes = 6:1

Design Grade = 0.6 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	29	1.8	18	2.0																						
30	47	1.7	31	1.8	20	2.0																				
40	66	1.7	45	1.8	31	1.9	20	2.1																		
50	84	1.6	58	1.8	41	1.9	29	2.0	20	2.2																
60			71	1.7	51	1.8	37	2.0	27	2.1	19	2.3														
70			85	1.7	62	1.8	45	1.9	33	2.1	25	2.2	17	2.4												
80			98	1.7	72	1.8	52	1.9	40	2.0	30	2.1	22	2.3												
90					82	1.8	60	1.9	46	2.0	36	2.1	27	2.3	19	2.4										
100					92	1.8	68	1.9	53	2.0	41	2.1	32	2.2	23	2.4	15	2.6								
110							76	1.9	59	2.0	47	2.1	37	2.2	28	2.3	19	2.6								
120							84	1.9	66	1.9	52	2.0	41	2.1	32	2.3	23	2.5								
130							91	1.9	72	1.9	57	2.0	46	2.1	36	2.3	26	2.4	18	2.7						
140							99	1.8	78	1.9	63	2.0	50	2.1	40	2.2	30	2.4	22	2.6						
150									85	1.9	68	2.0	55	2.1	44	2.2	33	2.4	25	2.6						
160									91	1.9	74	2.0	60	2.1	47	2.2	37	2.4	28	2.5	19	2.8				
170									98	1.9	79	2.0	64	2.1	51	2.2	40	2.3	31	2.5	22	2.7				
180											84	2.0	69	2.1	55	2.2	44	2.3	34	2.5	25	2.7				
190											90	2.0	73	2.0	59	2.2	47	2.3	37	2.4	28	2.6				
200											95	2.0	78	2.0	63	2.1	50	2.3	40	2.4	30	2.6	21	2.9		
210													82	2.0	67	2.1	54	2.3	43	2.4	33	2.6	24	2.8		
220													87	2.0	71	2.1	57	2.3	46	2.4	36	2.6	26	2.8		
230													91	2.0	74	2.1	60	2.2	49	2.4	38	2.5	29	2.8	20	3.0
240													96	2.0	78	2.1	63	2.2	52	2.4	41	2.5	31	2.7	23	3.0
250															82	2.1	67	2.2	54	2.3	44	2.5	33	2.7	25	2.9
260															86	2.1	70	2.2	57	2.3	46	2.5	36	2.7	27	2.9
270															90	2.1	73	2.2	60	2.3	48	2.5	38	2.7	29	2.9
280															93	2.1	76	2.2	63	2.3	51	2.5	40	2.6	31	2.8
290															97	2.1	80	2.2	66	2.3	54	2.4	42	2.6	33	2.8
300																	83	2.2	69	2.3	56	2.4	45	2.6	35	2.8

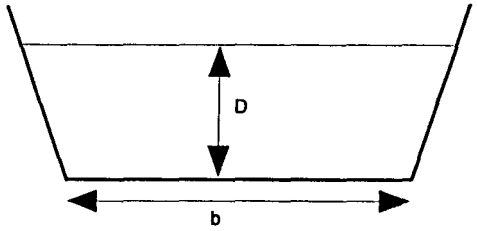
Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

Trapezoidal Waterway Design Chart

Capacity Retardance = B
Velocity Retardance = D
Sides Slopes = 6:1

Design Grade = 0.7 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	32	1.7	20	1.8																						
30	51	1.6	35	1.7	24	1.9																				
40	71	1.6	49	1.7	35	1.8	24	1.9	16	2.1																
50	90	1.6	63	1.7	45	1.8	32	1.9	23	2.0	16	2.2														
60			77	1.7	56	1.7	41	1.8	31	2.0	22	2.1	16	2.3												
70			92	1.6	67	1.7	49	1.8	38	1.9	28	2.1	22	2.2												
80					78	1.7	58	1.8	45	1.9	34	2.0	27	2.1	20	2.3										
90					89	1.7	66	1.8	52	1.9	40	2.0	32	2.1	24	2.2	16	2.4								
100					100	1.7	75	1.8	58	1.9	46	2.0	37	2.1	29	2.2	20	2.4								
110							83	1.8	65	1.9	52	1.9	42	2.0	33	2.1	24	2.3	17	2.5						
120							91	1.8	72	1.9	57	1.9	47	2.0	37	2.1	28	2.3	21	2.5						
130							100	1.8	79	1.8	63	1.9	52	2.0	42	2.1	32	2.2	24	2.4	16	2.7				
140									86	1.8	69	1.9	57	2.0	46	2.1	36	2.2	27	2.4	20	2.6				
150									92	1.8	75	1.9	62	2.0	50	2.1	39	2.2	31	2.3	23	2.5				
160									99	1.8	80	1.9	67	2.0	54	2.0	43	2.2	34	2.3	26	2.5	18	2.7		
170											86	1.9	72	1.9	58	2.0	47	2.2	37	2.3	29	2.4	21	2.7		
180											92	1.9	77	1.9	63	2.0	50	2.1	40	2.3	31	2.4	23	2.6		
190											98	1.9	81	1.9	67	2.0	54	2.1	44	2.2	34	2.4	26	2.6	17	2.9
200													86	1.9	71	2.0	57	2.1	47	2.2	37	2.4	28	2.6	20	2.8
210													91	1.9	75	2.0	61	2.1	50	2.2	40	2.4	31	2.5	23	2.8
220													96	1.9	80	2.0	64	2.1	53	2.2	43	2.3	34	2.5	25	2.7
230															84	2.0	68	2.1	56	2.2	45	2.3	36	2.5	27	2.7
240															88	2.0	72	2.1	59	2.2	48	2.3	39	2.5	30	2.7
250															92	2.0	75	2.1	62	2.2	51	2.3	41	2.4	32	2.6
260															96	2.0	79	2.1	65	2.2	54	2.3	43	2.4	34	2.6
270																	82	2.1	68	2.2	56	2.3	46	2.4	36	2.6
280																	86	2.1	71	2.2	59	2.3	48	2.4	38	2.6
290																	89	2.1	75	2.2	62	2.3	51	2.4	41	2.6
300																	93	2.1	77	2.1	64	2.3	53	2.4	43	2.5

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

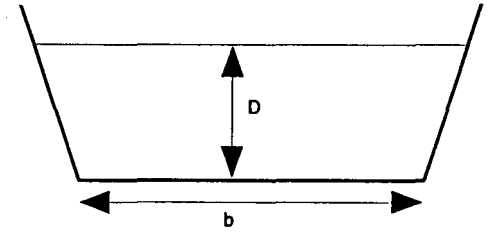
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 0.8 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	35	1.6	22	1.7																						
30	55	1.5	38	1.7	26	1.8	17	1.9																		
40	76	1.5	53	1.6	38	1.7	27	1.8	18	2.0																
50	97	1.5	68	1.6	49	1.7	36	1.8	26	1.9	19	2.1														
60			83	1.6	61	1.7	45	1.7	34	1.9	25	2.0	19	2.1												
70			98	1.6	72	1.7	54	1.7	41	1.8	32	1.9	25	2.0	18	2.2										
80					83	1.6	63	1.7	48	1.8	38	1.9	30	2.0	23	2.1	16	2.3								
90					95	1.6	72	1.7	56	1.8	44	1.9	36	2.0	28	2.1	21	2.2								
100							81	1.7	63	1.8	50	1.9	41	1.9	32	2.0	25	2.2	18	2.4						
110							90	1.7	70	1.8	56	1.8	46	1.9	37	2.0	29	2.1	21	2.3						
120							99	1.7	77	1.8	62	1.8	52	1.9	42	2.0	33	2.1	25	2.3	18	2.5				
130									84	1.8	68	1.8	57	1.9	46	2.0	37	2.1	29	2.2	21	2.4				
140									92	1.8	74	1.8	62	1.9	51	2.0	41	2.1	32	2.2	25	2.4	17	2.6		
150									99	1.8	80	1.8	67	1.9	55	2.0	45	2.1	35	2.2	28	2.3	21	2.5		
160											87	1.8	72	1.9	59	1.9	49	2.0	39	2.2	31	2.3	23	2.5	16	2.7
170											92	1.8	78	1.9	64	1.9	52	2.0	42	2.1	34	2.3	26	2.4	18	2.7
180											99	1.8	83	1.9	68	1.9	56	2.0	46	2.1	37	2.2	29	2.4	21	2.6
190													88	1.9	73	1.9	60	2.0	49	2.1	40	2.2	32	2.4	24	2.6
200													93	1.8	77	1.9	64	2.0	52	2.1	43	2.2	34	2.3	26	2.5
210													98	1.8	82	1.9	68	2.0	56	2.1	46	2.2	37	2.3	29	2.5
220															86	1.9	72	2.0	59	2.1	49	2.2	40	2.3	31	2.5
230															91	1.9	76	2.0	62	2.1	52	2.2	42	2.3	33	2.5
240															95	1.9	80	2.0	66	2.1	55	2.2	45	2.3	36	2.4
250															99	1.9	83	2.0	69	2.1	57	2.2	47	2.3	38	2.4
260																	87	2.0	72	2.1	60	2.1	50	2.3	40	2.4
270																	91	2.0	75	2.0	63	2.1	53	2.3	43	2.4
280																	94	2.0	79	2.0	66	2.1	55	2.2	45	2.4
290																	98	2.0	82	2.0	69	2.1	58	2.2	47	2.4
300																			85	2.0	72	2.1	60	2.2	50	2.4

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

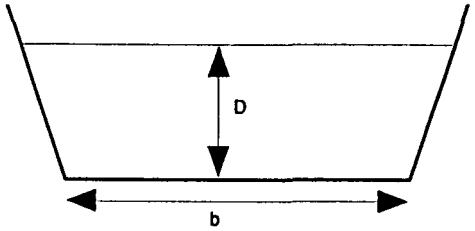
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 0.9 %



	Velocity, fps																									
Q	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	37	1.5	24	1.7	16	1.8																				
30	59	1.5	40	1.6	28	1.7	20	1.8																		
40	81	1.5	56	1.6	41	1.7	30	1.8	21	1.9																
50			72	1.5	53	1.6	40	1.7	29	1.8	22	2.0	16	2.1												
60			88	1.5	65	1.6	49	1.7	37	1.8	28	1.9	22	2.0	16	2.2										
70					77	1.6	59	1.7	45	1.8	35	1.9	27	2.0	21	2.1	15	2.2								
80					89	1.6	68	1.6	52	1.7	41	1.8	33	1.9	26	2.0	20	2.1								
90							78	1.6	60	1.7	48	1.8	39	1.9	31	2.0	24	2.1	17	2.3						
100							87	1.6	68	1.7	54	1.8	44	1.9	36	1.9	29	2.0	21	2.2	15	2.4				
110							97	1.6	76	1.7	61	1.8	50	1.9	41	1.9	33	2.0	25	2.2	19	2.3				
120									83	1.7	67	1.8	55	1.8	45	1.9	37	2.0	29	2.1	22	2.3	16	2.5		
130									91	1.7	73	1.8	60	1.8	50	1.9	41	2.0	33	2.1	26	2.2	19	2.4		
140									98	1.7	80	1.8	66	1.8	55	1.9	45	2.0	36	2.1	29	2.2	22	2.4	15	2.6
150											86	1.7	71	1.8	60	1.9	50	1.9	40	2.1	32	2.2	25	2.3	18	2.5
160											93	1.7	77	1.8	64	1.9	54	1.9	44	2.0	35	2.2	28	2.3	21	2.5
170											99	1.7	82	1.8	69	1.8	58	1.9	47	2.0	39	2.1	31	2.3	24	2.4
180													88	1.8	74	1.8	62	1.9	51	2.0	42	2.1	34	2.2	26	2.4
190													93	1.8	78	1.8	66	1.9	54	2.0	45	2.1	36	2.2	29	2.4
200													99	1.8	83	1.8	70	1.9	58	2.0	48	2.1	39	2.2	31	2.3
210															88	1.8	74	1.9	61	2.0	51	2.1	42	2.2	34	2.3
220															92	1.8	78	1.9	65	2.0	54	2.1	45	2.2	36	2.3
230															97	1.8	82	1.9	68	2.0	57	2.1	48	2.2	39	2.3
240																	86	1.9	72	2.0	60	2.1	50	2.2	41	2.3
250																	90	1.9	75	2.0	63	2.0	53	2.1	44	2.3
260																	94	1.9	79	2.0	66	2.0	56	2.1	46	2.2
270																	98	1.9	82	2.0	70	2.0	59	2.1	49	2.2
280																			86	2.0	73	2.0	61	2.1	51	2.2
290																			89	1.9	76	2.0	64	2.1	54	2.2
300																			93	1.9	79	2.0	67	2.1	56	2.2

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

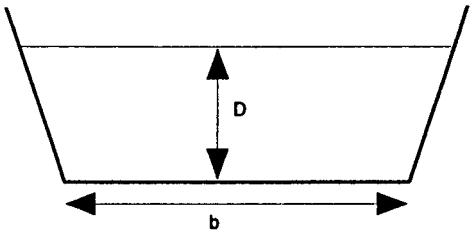
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 1.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	39	1.5	26	1.6	17	1.7																				
30	62	1.4	43	1.5	31	1.6	22	1.7																		
40	84	1.4	59	1.5	43	1.6	32	1.7	23	1.8	17	1.9														
50			75	1.5	56	1.6	43	1.7	31	1.7	24	1.9	18	2.0												
60			91	1.5	68	1.6	53	1.6	40	1.7	31	1.8	24	1.9	19	2.0										
70					81	1.5	63	1.6	48	1.7	38	1.8	30	1.9	24	2.0	18	2.1								
80					94	1.5	73	1.6	56	1.7	45	1.8	36	1.8	29	1.9	22	2.0	16	2.2						
90							83	1.6	64	1.7	51	1.7	42	1.8	34	1.9	27	2.0	21	2.1						
100							93	1.6	72	1.7	58	1.7	47	1.8	40	1.9	31	1.9	25	2.1	18	2.2				
110									80	1.7	65	1.7	53	1.8	45	1.8	36	1.9	29	2.0	22	2.2	16	2.3		
120									88	1.6	72	1.7	59	1.8	50	1.8	40	1.9	33	2.0	25	2.1	19	2.3		
130									96	1.6	78	1.7	65	1.8	54	1.8	45	1.9	36	2.0	29	2.1	23	2.2	16	2.4
140											85	1.7	70	1.8	59	1.8	49	1.9	40	2.0	32	2.1	26	2.2	19	2.4
150											92	1.7	76	1.7	65	1.8	53	1.9	44	2.0	36	2.1	29	2.2	22	2.3
160											98	1.7	82	1.7	70	1.8	57	1.9	48	1.9	39	2.0	32	2.2	25	2.3
170													87	1.7	75	1.8	62	1.9	51	1.9	42	2.0	35	2.1	28	2.3
180													93	1.7	79	1.8	66	1.8	55	1.9	46	2.0	38	2.1	30	2.2
190													99	1.7	85	1.8	70	1.8	59	1.9	49	2.0	41	2.1	33	2.2
200															89	1.8	75	1.8	63	1.9	52	2.0	44	2.1	36	2.2
210															94	1.8	79	1.8	66	1.9	55	2.0	47	2.1	38	2.2
220															99	1.8	83	1.8	70	1.9	59	2.0	50	2.1	41	2.2
230																	88	1.8	74	1.9	62	2.0	53	2.1	44	2.2
240																	92	1.8	77	1.9	65	2.0	55	2.0	46	2.1
250																	96	1.8	81	1.9	68	2.0	58	2.0	49	2.1
260																			85	1.9	72	2.0	61	2.0	51	2.1
270																			89	1.9	75	1.9	64	2.0	54	2.1
280																			92	1.9	78	1.9	67	2.0	56	2.1
290																			96	1.9	82	1.9	70	2.0	59	2.1
300																			100	1.9	85	1.9	73	2.0	62	2.1

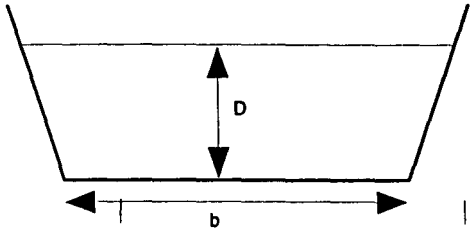
Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

Trapezoidal Waterway Design Chart

Capacity Retardance = B
Velocity Retardance = D
Sides Slopes = 6:1

Design Grade = 1.5 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	48	1.3	34	1.4	24	1.5	17	1.6																		
30	75	1.3	54	1.4	39	1.4	30	1.5	22	1.6	16	1.7														
40			74	1.4	54	1.4	42	1.5	32	1.5	25	1.6	19	1.7												
50			93	1.3	69	1.4	54	1.5	42	1.5	33	1.6	26	1.7	21	1.7	16	1.8								
60					84	1.4	66	1.4	52	1.5	41	1.6	33	1.6	27	1.7	22	1.8	17	1.9						
70					99	1.4	78	1.4	62	1.5	49	1.5	40	1.6	33	1.7	27	1.7	22	1.8	18	1.9				
80							90	1.4	72	1.5	57	1.5	47	1.6	39	1.6	33	1.7	27	1.8	22	1.9	17	2.0		
90									82	1.5	66	1.5	54	1.6	45	1.6	38	1.7	32	1.7	26	1.8	21	1.9	16	2.0
100									91	1.5	74	1.5	61	1.6	51	1.6	44	1.7	36	1.7	30	1.8	25	1.9	19	2.0
110											82	1.5	68	1.6	57	1.6	49	1.7	41	1.7	35	1.8	29	1.9	23	2.0
120											90	1.5	75	1.6	63	1.6	54	1.6	46	1.7	39	1.8	32	1.8	26	1.9
130											98	1.5	81	1.6	69	1.6	59	1.6	50	1.7	43	1.7	36	1.8	30	1.9
140													88	1.5	75	1.6	65	1.6	55	1.7	47	1.7	40	1.8	33	1.9
150													95	1.5	81	1.6	70	1.6	59	1.7	51	1.7	43	1.8	36	1.9
160															87	1.6	75	1.6	64	1.7	55	1.7	47	1.8	39	1.9
170															92	1.6	80	1.6	69	1.7	59	1.7	50	1.8	43	1.8
180															99	1.6	86	1.6	73	1.6	63	1.7	54	1.8	46	1.8
190																	91	1.6	78	1.6	67	1.7	58	1.8	49	1.8
200																	96	1.6	83	1.6	71	1.7	61	1.8	52	1.8
210																			87	1.6	75	1.7	65	1.7	56	1.8
220																			91	1.6	79	1.7	68	1.7	59	1.8
230																			96	1.6	83	1.7	72	1.7	62	1.8
240																					87	1.7	75	1.7	65	1.8
250																					92	1.7	79	1.7	68	1.8
260																					95	1.7	83	1.7	71	1.8
270																					99	1.7	86	1.7	74	1.8
280																							90	1.7	78	1.8
290																							93	1.7	81	1.8
300																							97	1.7	84	1.8

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

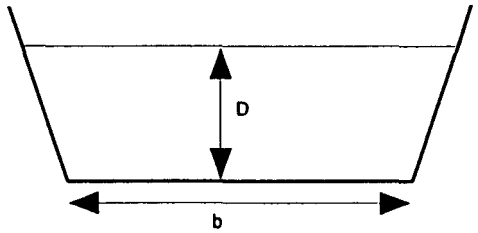
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 2.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	55	1.2	40	1.3	29	1.4	21	1.4	16	1.5																
30	85	1.2	62	1.3	45	1.3	35	1.4	28	1.4	21	1.5	16	1.6												
40			84	1.3	62	1.3	49	1.4	39	1.4	31	1.5	24	1.5	19	1.6	15	1.7								
50					79	1.3	63	1.3	50	1.4	40	1.4	32	1.5	26	1.6	22	1.6	17	1.7						
60					96	1.3	76	1.3	62	1.4	49	1.4	40	1.5	33	1.5	28	1.6	23	1.6	19	1.7	15	1.8		
70							90	1.3	73	1.4	59	1.4	48	1.5	40	1.5	34	1.6	28	1.6	24	1.7	20	1.7	16	1.8
80									84	1.4	68	1.4	56	1.5	47	1.5	40	1.5	34	1.6	29	1.6	24	1.7	20	1.8
90									95	1.4	77	1.4	64	1.4	54	1.5	46	1.5	39	1.6	34	1.6	28	1.7	24	1.7
100											86	1.4	72	1.4	60	1.5	52	1.5	44	1.6	38	1.6	33	1.7	28	1.7
110											96	1.4	79	1.4	67	1.5	58	1.5	50	1.6	43	1.6	37	1.6	31	1.7
120													88	1.4	74	1.5	63	1.5	55	1.5	48	1.6	41	1.6	35	1.7
130													95	1.4	81	1.5	69	1.5	60	1.5	52	1.6	45	1.6	39	1.7
140															87	1.5	75	1.5	65	1.5	57	1.6	49	1.6	43	1.7
150															94	1.5	81	1.5	70	1.5	62	1.6	54	1.6	47	1.7
160																	87	1.5	76	1.5	66	1.5	58	1.6	50	1.6
170																	93	1.5	81	1.5	71	1.5	62	1.6	54	1.6
180																	99	1.5	86	1.5	76	1.5	66	1.6	58	1.6
190																			92	1.5	80	1.5	70	1.6	61	1.6
200																			97	1.5	85	1.5	74	1.6	65	1.6
210																					89	1.5	78	1.6	69	1.6
220																					94	1.5	82	1.6	73	1.6
230																					99	1.5	87	1.6	76	1.6
240																							91	1.6	80	1.6
250																							95	1.6	84	1.6
260																							99	1.6	88	1.6
270																									91	1.6
280																									95	1.6
290																									99	1.6
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

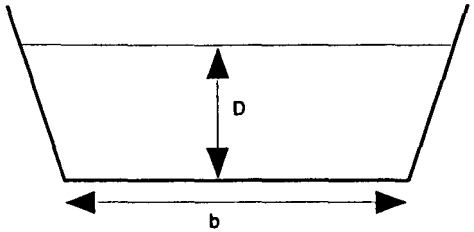
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 2.5 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	63	1.1	44	1.2	33	1.3	25	1.3	19	1.4																
30	96	1.1	69	1.2	52	1.2	40	1.3	32	1.3	25	1.4	20	1.5	15	1.5										
40			93	1.2	70	1.2	55	1.3	44	1.3	36	1.4	28	1.4	23	1.5	19	1.5	15	1.6						
50					89	1.2	70	1.3	56	1.3	46	1.3	37	1.4	31	1.4	26	1.5	21	1.5	18	1.6				
60							85	1.3	69	1.3	56	1.3	46	1.4	39	1.4	32	1.5	27	1.5	24	1.6	20	1.6	16	1.7
70									81	1.3	67	1.3	55	1.4	46	1.4	39	1.5	33	1.5	29	1.5	24	1.6	21	1.6
80									93	1.3	77	1.3	63	1.4	54	1.4	45	1.4	39	1.5	34	1.5	29	1.6	25	1.6
90											87	1.3	72	1.3	61	1.4	52	1.4	45	1.5	39	1.5	34	1.5	29	1.6
100											98	1.3	81	1.3	69	1.4	59	1.4	51	1.5	45	1.5	39	1.5	33	1.6
110													90	1.3	76	1.4	65	1.4	56	1.4	50	1.5	43	1.5	38	1.6
120													98	1.3	84	1.4	72	1.4	62	1.4	55	1.5	48	1.5	42	1.5
130															91	1.4	78	1.4	68	1.4	60	1.5	53	1.5	46	1.5
140															99	1.4	85	1.4	74	1.4	66	1.5	57	1.5	50	1.5
150																	91	1.4	79	1.4	71	1.5	62	1.5	55	1.5
160																	98	1.4	85	1.4	76	1.4	67	1.5	59	1.5
170																			91	1.4	81	1.4	71	1.5	63	1.5
180																			97	1.4	86	1.4	76	1.5	67	1.5
190																					91	1.4	80	1.5	71	1.5
200																					97	1.4	85	1.5	76	1.5
210																							90	1.5	80	1.5
220																							95	1.5	84	1.5
230																							99	1.5	88	1.5
240																									92	1.5
250																									96	1.5
260																										
270																										
280																										
290																										
300																										

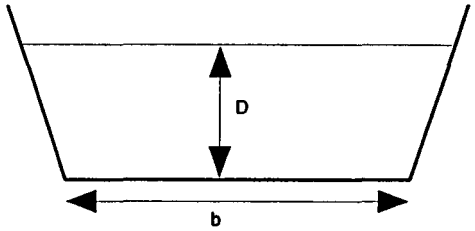
Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

Trapezoidal Waterway Design Chart

Capacity Retardance = B
Velocity Retardance = D
Sides Slopes = 6:1

Design Grade = 3.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	68	1.1	48	1.1	36	1.2	27	1.3	22	1.3	17	1.4														
30			75	1.1	56	1.2	44	1.2	35	1.3	29	1.3	23	1.4	18	1.4										
40					77	1.2	60	1.2	48	1.3	40	1.3	33	1.3	27	1.4	22	1.4	18	1.5	15	1.5				
50					96	1.2	76	1.2	62	1.2	51	1.3	42	1.3	35	1.4	29	1.4	25	1.4	21	1.5	18	1.5		
60							92	1.2	75	1.2	62	1.3	52	1.3	43	1.3	36	1.4	31	1.4	27	1.5	23	1.5	19	1.6
70									89	1.2	74	1.3	61	1.3	51	1.3	43	1.4	38	1.4	32	1.4	28	1.5	24	1.5
80											85	1.3	71	1.3	59	1.3	51	1.4	44	1.4	38	1.4	33	1.5	29	1.5
90											96	1.3	80	1.3	68	1.3	58	1.4	50	1.4	44	1.4	39	1.4	33	1.5
100													90	1.3	76	1.3	65	1.4	56	1.4	49	1.4	44	1.4	38	1.5
110													99	1.3	84	1.3	72	1.3	63	1.4	55	1.4	49	1.4	43	1.5
120															92	1.3	79	1.3	69	1.4	61	1.4	54	1.4	47	1.4
130																	86	1.3	75	1.4	66	1.4	59	1.4	52	1.4
140																	93	1.3	82	1.4	72	1.4	64	1.4	56	1.4
150																			88	1.4	77	1.4	70	1.4	61	1.4
160																			94	1.4	83	1.4	74	1.4	66	1.4
170																					89	1.4	79	1.4	70	1.4
180																					94	1.4	84	1.4	75	1.4
190																					100	1.4	90	1.4	79	1.4
200																							95	1.4	84	1.4
210																							100	1.4	88	1.4
220																									93	1.4
230																									98	1.4
240																										
250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

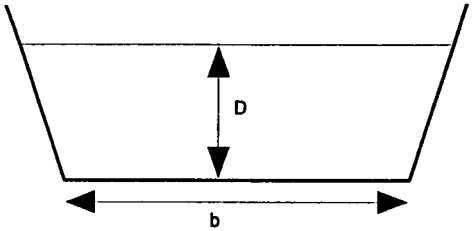
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 3.5 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	72	1.0	51	1.1	39	1.2	30	1.2	24	1.3	19	1.3	15	1.4												
30			79	1.1	61	1.1	48	1.2	38	1.2	31	1.3	25	1.3	21	1.3	17	1.4								
40					82	1.1	65	1.2	53	1.2	43	1.2	36	1.3	29	1.3	25	1.4	21	1.4	17	1.5				
50							82	1.2	67	1.2	55	1.2	46	1.3	38	1.3	32	1.3	28	1.4	24	1.4	20	1.5	18	1.5
60							99	1.2	81	1.2	67	1.2	56	1.3	47	1.3	40	1.3	34	1.4	30	1.4	26	1.4	23	1.5
70									95	1.2	79	1.2	67	1.2	56	1.3	48	1.3	41	1.3	36	1.4	31	1.4	28	1.4
80											91	1.2	77	1.2	65	1.3	56	1.3	48	1.3	42	1.4	37	1.4	33	1.4
90													87	1.2	74	1.3	63	1.3	55	1.3	48	1.3	43	1.4	38	1.4
100													98	1.2	82	1.3	71	1.3	62	1.3	54	1.3	48	1.4	43	1.4
110															91	1.3	79	1.3	69	1.3	60	1.3	53	1.4	48	1.4
120															99	1.3	86	1.3	75	1.3	66	1.3	59	1.4	53	1.4
130																	94	1.3	82	1.3	72	1.3	64	1.4	58	1.4
140																			89	1.3	78	1.3	70	1.4	63	1.4
150																			96	1.3	84	1.3	75	1.3	68	1.4
160																					90	1.3	81	1.3	73	1.4
170																					96	1.3	86	1.3	77	1.4
180																							91	1.3	83	1.4
190																							97	1.3	88	1.4
200																									92	1.4
210																									97	1.4
220																										
230																										
240																										
250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

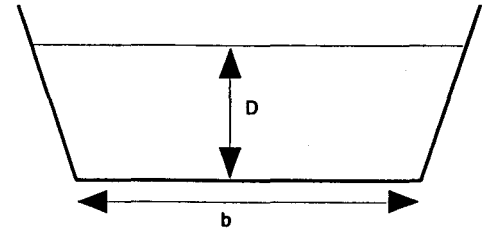
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 4.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	76	1.0	55	1.1	42	1.1	33	1.2	26	1.2	21	1.2	17	1.3												
30			83	1.1	65	1.1	51	1.1	41	1.2	34	1.2	28	1.2	23	1.3	19	1.3	15	1.4						
40					88	1.1	70	1.1	56	1.2	47	1.2	39	1.2	33	1.3	27	1.3	23	1.3	19	1.4	16	1.4		
50							88	1.1	72	1.2	60	1.2	50	1.2	42	1.2	35	1.3	30	1.3	26	1.4	22	1.4	19	1.4
60									87	1.2	72	1.2	61	1.2	52	1.2	43	1.3	37	1.3	33	1.3	28	1.4	25	1.4
70											86	1.2	72	1.2	61	1.2	51	1.3	44	1.3	39	1.3	34	1.3	30	1.4
80											98	1.2	83	1.2	71	1.2	60	1.3	52	1.3	45	1.3	40	1.3	35	1.4
90													94	1.2	80	1.2	68	1.3	59	1.3	52	1.3	46	1.3	41	1.4
100															89	1.2	76	1.2	66	1.3	58	1.3	51	1.3	46	1.3
110															99	1.2	84	1.2	73	1.3	65	1.3	57	1.3	51	1.3
120																	92	1.2	80	1.3	71	1.3	63	1.3	56	1.3
130																	100	1.2	87	1.3	77	1.3	69	1.3	61	1.3
140																			94	1.3	84	1.3	74	1.3	67	1.3
150																					91	1.3	80	1.3	72	1.3
160																					97	1.3	86	1.3	77	1.3
170																							92	1.3	82	1.3
180																							97	1.3	87	1.3
190																									92	1.3
200																									98	1.3
210																										
220																										
230																										
240																										
250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

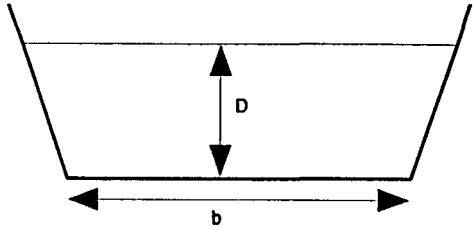
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 4.5 %



	Velocity, fps																									
Q	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	80	0.9	58	1.0	45	1.1	35	1.1	28	1.2	23	1.2	18	1.3												
30			89	1.0	69	1.1	54	1.1	44	1.1	36	1.2	30	1.2	25	1.2	21	1.3	17	1.3						
40					94	1.1	73	1.1	59	1.1	50	1.2	41	1.2	35	1.2	29	1.2	25	1.3	21	1.3	18	1.4	15	1.4
50							93	1.1	75	1.1	63	1.2	53	1.2	45	1.2	38	1.2	33	1.3	28	1.3	24	1.3	21	1.4
60									91	1.1	77	1.1	64	1.2	55	1.2	47	1.2	40	1.3	35	1.3	31	1.3	27	1.3
70											90	1.1	76	1.2	65	1.2	55	1.2	48	1.3	42	1.3	37	1.3	32	1.3
80													87	1.2	75	1.2	64	1.2	56	1.2	49	1.3	43	1.3	38	1.3
90													98	1.2	85	1.2	73	1.2	63	1.2	56	1.3	49	1.3	44	1.3
100															95	1.2	81	1.2	71	1.2	63	1.3	55	1.3	49	1.3
110																	90	1.2	78	1.2	69	1.3	61	1.3	55	1.3
120																	99	1.2	86	1.2	76	1.2	67	1.3	60	1.3
130																			93	1.2	83	1.2	73	1.3	66	1.3
140																					90	1.2	79	1.3	71	1.3
150																					96	1.2	85	1.3	76	1.3
160																							91	1.3	82	1.3
170																							97	1.3	88	1.3
180																									93	1.3
190																									99	1.3
200																										
210																										
220																										
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250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

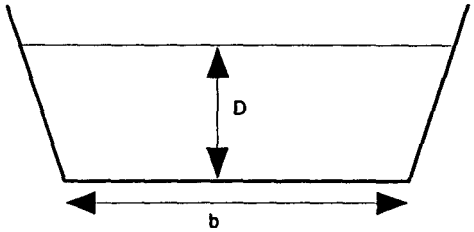
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 5.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	84	0.9	62	1.0	47	1.1	37	1.1	29	1.1	24	1.2	20	1.2	16	1.2										
30			95	1.0	72	1.1	58	1.1	46	1.1	38	1.1	32	1.2	27	1.2	22	1.2	19	1.3	15	1.3				
40					97	1.0	78	1.1	63	1.1	52	1.1	44	1.2	37	1.2	32	1.2	27	1.2	23	1.3	20	1.3	17	1.4
50							99	1.1	79	1.1	67	1.1	56	1.1	47	1.2	41	1.2	35	1.2	30	1.3	26	1.3	23	1.3
60									96	1.1	80	1.1	69	1.1	58	1.2	50	1.2	43	1.2	37	1.3	33	1.3	29	1.3
70											94	1.1	81	1.1	68	1.2	59	1.2	51	1.2	44	1.2	39	1.3	35	1.3
80													93	1.1	79	1.2	68	1.2	59	1.2	51	1.2	45	1.3	40	1.3
90															89	1.2	77	1.2	67	1.2	58	1.2	52	1.2	46	1.3
100															99	1.2	87	1.2	75	1.2	65	1.2	58	1.2	52	1.3
110																	96	1.2	83	1.2	72	1.2	64	1.2	57	1.3
120																			91	1.2	79	1.2	71	1.2	63	1.3
130																			99	1.2	86	1.2	77	1.2	69	1.3
140																					93	1.2	83	1.2	75	1.3
150																							90	1.2	81	1.2
160																							96	1.2	86	1.2
170																									92	1.2
180																									98	1.2
190																										
200																										
210																										
220																										
230																										
240																										
250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

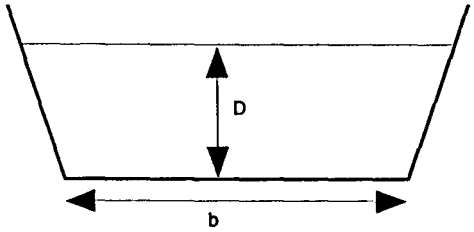
Depth (D) is based on capacity retardance.

Trapezoidal Waterway Design Chart

Capacity Retardance = B
Velocity Retardance = D

Design Grade = 6.0 %

Sides Slopes = 6:1



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	92	0.9	67	1.0	51	1.0	40	1.1	32	1.1	27	1.1	22	1.1	18	1.2	15	1.2								
30					79	1.0	62	1.0	50	1.1	42	1.1	35	1.1	30	1.1	25	1.2	21	1.2	18	1.2	15	1.3		
40							85	1.0	68	1.1	58	1.1	48	1.1	41	1.1	36	1.2	30	1.2	26	1.2	22	1.2	20	1.3
50									85	1.1	73	1.1	62	1.1	53	1.1	45	1.1	39	1.2	34	1.2	29	1.2	26	1.2
60											88	1.1	75	1.1	64	1.1	55	1.1	47	1.2	41	1.2	37	1.2	32	1.2
70													88	1.1	75	1.1	65	1.1	56	1.2	49	1.2	43	1.2	38	1.2
80															87	1.1	75	1.1	65	1.2	57	1.2	50	1.2	45	1.2
90															98	1.1	85	1.1	73	1.1	65	1.2	57	1.2	51	1.2
100																	95	1.1	82	1.1	72	1.2	64	1.2	57	1.2
110																			91	1.1	80	1.2	71	1.2	63	1.2
120																			99	1.1	88	1.2	78	1.2	70	1.2
130																					96	1.2	85	1.2	76	1.2
140																							92	1.2	82	1.2
150																							99	1.2	88	1.2
160																									94	1.2
170																										
180																										
190																										
200																										
210																										
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230																										
240																										
250																										
260																										
270																										
280																										
290																										
300																										

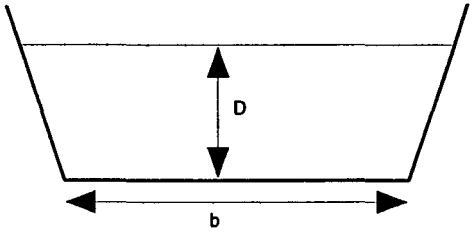
Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

Trapezoidal Waterway Design Chart

Capacity Retardance = B
Velocity Retardance = D
Sides Slopes = 6:1

Design Grade = 7.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	97	0.9	72	0.9	55	1.0	43	1.0	35	1.1	29	1.1	24	1.1	20	1.1	17	1.2								
30					84	1.0	66	1.0	54	1.0	45	1.1	38	1.1	32	1.1	28	1.1	24	1.1	20	1.2	17	1.2	15	1.2
40							90	1.0	73	1.0	61	1.1	53	1.1	45	1.1	38	1.1	34	1.1	28	1.2	25	1.2	22	1.2
50									93	1.0	77	1.0	66	1.1	57	1.1	49	1.1	43	1.1	37	1.1	32	1.2	29	1.2
60											94	1.0	80	1.1	69	1.1	59	1.1	53	1.1	45	1.1	40	1.2	36	1.2
70													94	1.1	81	1.1	70	1.1	62	1.1	54	1.1	47	1.2	43	1.2
80															93	1.1	80	1.1	72	1.1	62	1.1	55	1.2	49	1.2
90																	91	1.1	81	1.1	70	1.1	62	1.1	56	1.2
100																			90	1.1	78	1.1	69	1.1	63	1.2
110																			100	1.1	87	1.1	76	1.1	69	1.2
120																					95	1.1	84	1.1	76	1.2
130																							92	1.1	83	1.2
140																							99	1.1	90	1.1
150																									97	1.1
160																										
170																										
180																										
190																										
200																										
210																										
220																										
230																										
240																										
250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

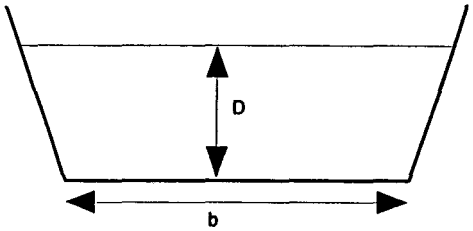
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 8.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20			75	0.9	57	0.9	47	1.0	38	1.0	31	1.0	26	1.1	22	1.1	19	1.1	16	1.1						
30					88	0.9	72	1.0	58	1.0	48	1.0	41	1.1	35	1.1	30	1.1	26	1.1	23	1.1	19	1.2	17	1.2
40							96	1.0	79	1.0	65	1.0	56	1.0	48	1.1	41	1.1	36	1.1	32	1.1	27	1.1	24	1.2
50									99	1.0	81	1.0	70	1.0	61	1.1	52	1.1	46	1.1	40	1.1	36	1.1	31	1.2
60											99	1.0	85	1.0	74	1.0	64	1.1	56	1.1	49	1.1	43	1.1	38	1.1
70															87	1.0	75	1.1	67	1.1	58	1.1	51	1.1	45	1.1
80																	86	1.1	77	1.1	67	1.1	59	1.1	53	1.1
90																	97	1.1	87	1.1	76	1.1	67	1.1	60	1.1
100																			96	1.1	85	1.1	75	1.1	67	1.1
110																					94	1.1	83	1.1	74	1.1
120																							91	1.1	81	1.1
130																							99	1.1	88	1.1
140																									95	1.1
150																										
160																										
170																										
180																										
190																										
200																										
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220																										
230																										
240																										
250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

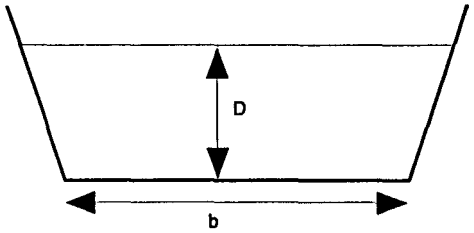
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 9.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20			79	0.9	61	0.9	49	1.0	40	1.0	33	1.0	27	1.0	24	1.1	20	1.1	17	1.1						
30					92	0.9	75	1.0	60	1.0	51	1.0	43	1.0	38	1.0	32	1.1	28	1.1	24	1.1	21	1.1	18	1.2
40									82	1.0	69	1.0	58	1.0	51	1.0	44	1.0	39	1.1	33	1.1	29	1.1	26	1.1
50											88	1.0	73	1.0	65	1.0	56	1.0	49	1.1	43	1.1	37	1.1	34	1.1
60													89	1.0	78	1.0	68	1.0	60	1.1	52	1.1	46	1.1	41	1.1
70															93	1.0	79	1.0	70	1.1	62	1.1	54	1.1	49	1.1
80																	91	1.0	81	1.0	71	1.1	62	1.1	56	1.1
90																			91	1.0	80	1.1	71	1.1	64	1.1
100																					89	1.1	79	1.1	72	1.1
110																					99	1.1	87	1.1	79	1.1
120																							96	1.1	87	1.1
130																									94	1.1
140																										
150																										
160																										
170																										
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250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

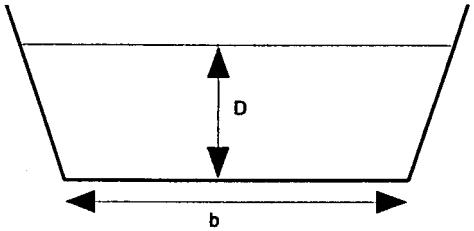
Trapezoidal Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Sides Slopes = 6:1

Design Grade = 10.0 %



Q	Velocity, fps																									
	1.00		1.25		1.50		1.75		2.00		2.25		2.50		2.75		3.00		3.25		3.50		3.75		4.00	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20			81	0.9	64	0.9	50	0.9	41	1.0	35	1.0	29	1.0	25	1.0	22	1.1	19	1.1	16	1.1				
30					97	0.9	77	0.9	64	1.0	53	1.0	46	1.0	39	1.0	34	1.0	30	1.1	26	1.1	23	1.1	19	1.1
40									86	1.0	73	1.0	62	1.0	54	1.0	47	1.0	41	1.0	36	1.1	32	1.1	28	1.1
50											91	1.0	79	1.0	68	1.0	59	1.0	52	1.0	46	1.0	41	1.1	36	1.1
60													95	1.0	82	1.0	72	1.0	63	1.0	57	1.0	49	1.1	44	1.1
70															97	1.0	84	1.0	74	1.0	66	1.0	58	1.1	51	1.1
80																	97	1.0	85	1.0	76	1.0	67	1.1	59	1.1
90																			97	1.0	86	1.0	76	1.0	67	1.1
100																					96	1.0	85	1.0	75	1.1
110																							93	1.0	83	1.1
120																									91	1.1
130																									99	1.1
140																										
150																										
160																										
170																										
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240																										
250																										
260																										
270																										
280																										
290																										
300																										

Bottom width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance.

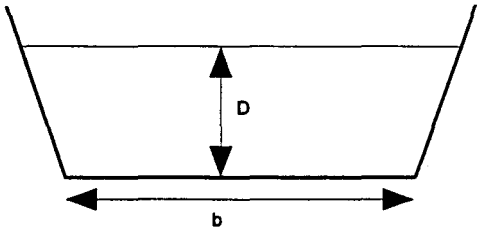
Trapezoidal Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E

Sides Slopes = 6:1

Design Grade = 0.1 %



	Velocity, fps																	
Q	0.5		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20	75	1.2	34	1.4														
30			55	1.4	28	1.6												
40			76	1.3	41	1.6	22	1.9										
50			98	1.3	55	1.5	32	1.8	15	2.2								
60					68	1.5	41	1.7	23	2.1								
70					81	1.4	50	1.7	30	2.0								
80					94	1.4	59	1.6	37	1.9	20	2.3						
90							68	1.6	44	1.9	26	2.2						
100							77	1.6	51	1.8	31	2.1						
110							86	1.6	57	1.8	36	2.1	18	2.6				
120							95	1.6	64	1.8	42	2.0	23	2.5				
130									70	1.8	47	2.0	27	2.4				
140									77	1.7	52	2.0	32	2.3				
150									84	1.7	57	1.9	36	2.3	19	2.8		
160									90	1.7	62	1.9	40	2.2	23	2.7		
170									97	1.7	67	1.9	44	2.2	27	2.6		
180											72	1.9	48	2.2	30	2.6		
190											77	1.9	52	2.2	34	2.5		
200											82	1.9	56	2.1	37	2.5	22	3.0
210											87	1.9	60	2.1	40	2.4	25	2.9
220											92	1.8	63	2.1	43	2.4	28	2.8
230											96	1.8	67	2.1	47	2.4	31	2.8
240													71	2.1	50	2.4	34	2.8
250													75	2.1	53	2.4	37	2.7
260													78	2.1	56	2.3	39	2.7
270													82	2.0	59	2.3	42	2.7
280													86	2.0	62	2.3	45	2.6
290													90	2.0	65	2.3	48	2.6
300													94	2.0	69	2.3	50	2.6

Bottom Width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

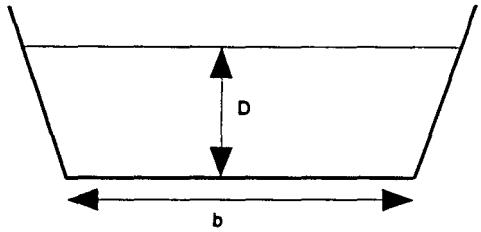
Trapezoidal Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E

Sides Slopes = 6:1

Design Grade = 0.2 %



	Velocity, fps																	
Q	0.5		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20			53	1.0	30	1.2	16	1.4										
30			83	1.0	48	1.1	29	1.3	17	1.5								
40					67	1.1	42	1.2	27	1.4	16	1.7						
50					85	1.1	55	1.2	37	1.3	24	1.6						
60							67	1.2	46	1.3	31	1.5	20	1.7				
70							80	1.2	56	1.3	39	1.5	26	1.6				
80							93	1.2	65	1.3	46	1.4	32	1.6	20	1.8		
90									75	1.3	53	1.4	38	1.6	25	1.8		
100									84	1.3	60	1.4	44	1.5	30	1.7	18	2.0
110									93	1.2	68	1.4	49	1.5	35	1.7	22	2.0
120											75	1.4	55	1.5	39	1.6	26	1.9
130											82	1.4	61	1.5	44	1.6	30	1.9
140											89	1.4	66	1.5	48	1.6	34	1.8
150											96	1.4	72	1.5	53	1.6	38	1.8
160													78	1.5	58	1.6	42	1.8
170													83	1.4	62	1.6	46	1.8
180													89	1.4	67	1.6	49	1.7
190													94	1.4	71	1.6	53	1.7
200															76	1.5	57	1.7
210															80	1.5	61	1.7
220															85	1.5	64	1.7
230															89	1.5	68	1.7
240															94	1.5	72	1.7
250															98	1.5	75	1.7
260																	79	1.7
270																	83	1.7
280																	86	1.7
290																	90	1.6
300																	93	1.6

Bottom Width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

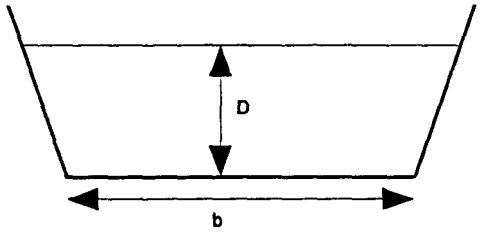
Trapezoidal Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E

Sides Slopes = 6:1

Design Grade = 0.3 %



	Velocity, fps																	
Q	0.5		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20			67	0.9	40	1.0	24	1.1										
30					63	0.9	40	1.0	26	1.2	16	1.3						
40					85	0.9	56	1.0	38	1.1	26	1.3	17	1.4				
50							72	1.0	50	1.1	35	1.2	24	1.4	16	1.6		
60							88	1.0	61	1.1	43	1.2	32	1.3	22	1.5		
70									73	1.1	52	1.2	39	1.3	28	1.4	19	1.6
80									85	1.0	61	1.2	46	1.3	34	1.4	24	1.5
90									96	1.0	70	1.1	53	1.2	40	1.4	29	1.5
100											79	1.1	60	1.2	46	1.3	34	1.5
110											87	1.1	67	1.2	51	1.3	39	1.4
120											96	1.1	74	1.2	57	1.3	43	1.4
130													81	1.2	63	1.3	48	1.4
140													88	1.2	68	1.3	53	1.4
150													95	1.2	74	1.3	57	1.4
160															80	1.3	62	1.4
170															86	1.3	67	1.3
180															91	1.3	71	1.3
190															97	1.3	76	1.3
200																	81	1.3
210																	85	1.3
220																	90	1.3
230																	95	1.3
240																	99	1.3
250																		
260																		
270																		
280																		
290																		
300																		

Bottom Width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

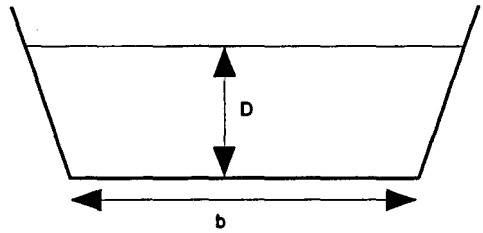
Trapezoidal Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E

Sides Slopes = 6:1

Design Grade = 0.4 %



	Velocity, fps																	
Q	0.5		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20			78	0.8	48	0.9	30	0.9	19	1.1								
30					74	0.8	48	0.9	33	1.0	23	1.1	15	1.3				
40							66	0.9	46	1.0	33	1.1	24	1.2	16	1.3		
50							84	0.9	59	0.9	44	1.0	32	1.1	24	1.3	16	1.4
60									73	0.9	54	1.0	40	1.1	31	1.2	22	1.3
70									86	0.9	64	1.0	48	1.1	37	1.2	27	1.3
80									99	0.9	74	1.0	56	1.1	44	1.2	33	1.3
90											85	1.0	64	1.1	51	1.2	39	1.2
100											95	1.0	73	1.1	58	1.1	44	1.2
110													81	1.1	64	1.1	50	1.2
120													89	1.1	71	1.1	55	1.2
130													97	1.1	77	1.1	60	1.2
140															84	1.1	66	1.2
150															91	1.1	71	1.2
160															98	1.1	77	1.2
170																	82	1.2
180																	88	1.2
190																	93	1.2
200																	99	1.2
210																		
220																		
230																		
240																		
250																		
260																		
270																		
280																		
290																		
300																		

Bottom Width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

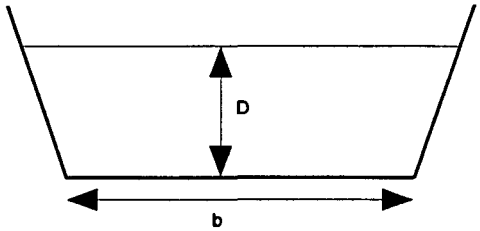
Trapezoidal Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E

Sides Slopes = 6:1

Design Grade = 0.5 %



	Velocity, fps																	
Q	0.5		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20			88	0.7	54	0.8	35	0.9	24	0.9	16	1.1						
30					83	0.8	56	0.8	39	0.9	27	1.0	19	1.1				
40							76	0.8	54	0.9	39	0.9	29	1.0	21	1.1	15	1.3
50							96	0.8	69	0.9	50	0.9	38	1.0	29	1.1	21	1.2
60									84	0.8	62	0.9	47	1.0	36	1.1	28	1.2
70									99	0.8	73	0.9	56	1.0	44	1.1	34	1.1
80											85	0.9	66	1.0	51	1.0	41	1.1
90											96	0.9	75	1.0	59	1.0	47	1.1
100													84	1.0	66	1.0	53	1.1
110													93	0.9	74	1.0	59	1.1
120															81	1.0	65	1.1
130															88	1.0	71	1.1
140															96	1.0	78	1.1
150																	84	1.0
160																	90	1.0
170																	96	1.0
180																		
190																		
200																		
210																		
220																		
230																		
240																		
250																		
260																		
270																		
280																		
290																		
300																		

Bottom Width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

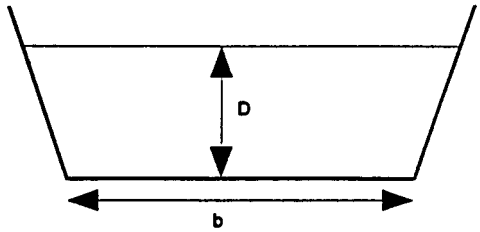
Trapezoidal Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E

Sides Slopes = 6:1

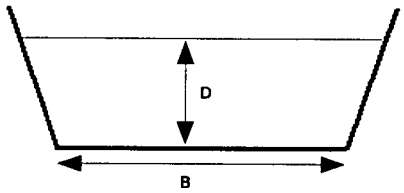
Design Grade = 0.6 %



	Velocity, fps																	
Q	0.5		0.75		1.00		1.25		1.50		1.75		2.00		2.25		2.50	
cfs	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D	b	D
20			97	0.6	59	0.7	40	0.8	27	0.9	18	0.9						
30					91	0.7	62	0.8	44	0.8	31	0.9	23	1.0	16	1.1		
40							84	0.7	60	0.8	44	0.9	33	0.9	25	1.0	19	1.1
50									77	0.8	56	0.8	43	0.9	33	1.0	26	1.1
60									93	0.8	69	0.8	54	0.9	41	1.0	33	1.0
70											81	0.8	64	0.9	49	1.0	40	1.0
80											94	0.8	73	0.9	57	1.0	46	1.0
90													84	0.9	66	0.9	53	1.0
100													93	0.9	74	0.9	60	1.0
110															82	0.9	67	1.0
120															90	0.9	74	1.0
130															98	0.9	80	1.0
140																	87	1.0
150																	94	1.0
160																		
170																		
180																		
190																		
200																		
210																		
220																		
230																		
240																		
250																		
260																		
270																		
280																		
290																		
300																		

Bottom Width (b) is based on velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.



Miscellaneous Trapezoidal Waterway Design Equations

Variable Definitions

Q = flow rate (*cfs*)

V = velocity (*fps*)

A = area (ft^2)

S = waterway grade (*ft/ft*)

D = flow depth (*ft*)

B = bottom width (*ft*)

P = wetted perimeter (*ft*)

R = hydraulic radius (*ft*)

z = trapezoidal channel side slopes

n = Manning's coefficient of roughness

Notes on Trapezoidal Waterway Charts

1. Velocity Retardance is used to determine bottom width.
2. Capacity Retardance is used to determine depth.
3. Depths shown on pages with "Trapezoidal Waterway Design Chart" include 0.5 foot freeboard.
4. Depths shown on pages with "Trapezoidal Waterway Design Chart - Annually Vegetated" do not include any amount of freeboard.

Equations

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

$$Q = AV$$

$$A = BD + zD^2$$

$$B = \frac{A}{D} - zD$$

$$P = B + 2D\sqrt{z^2 + 1}$$

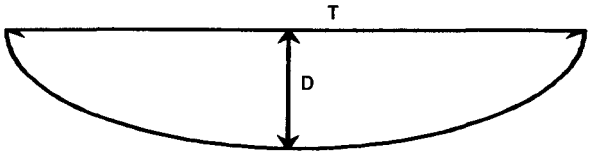
$$R = \frac{A}{P}$$

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.1 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	3.6	3.8	4.0										
20													
30	33												
40	44	30											
50	55	38											
60	66	46	33										
70	77	53	39										
80	89	61	44										
90	100	68	50										
100	111	76	56										
110	122	84	61										
120	133	91	67										
130	144	99	73										
140	155	107	78										
150		114	84										
160		122	90										
170		130	95										
180		138	101										
190		145	106										
200		153	112										
210		160	117										
220			123										
230			129										
240			134										
250			140										
260			145										
270			151										
280			157										
290													
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	3.1	3.3	3.5	3.8									
20													
30	30												
40	41	28											
50	51	35											
60	62	42	31										
70	72	50	36										
80	82	57	42	30									
90	93	64	47	34									
100	103	71	52	38									
110	113	78	57	42									
120	123	85	63	46									
130	134	92	68	50									
140	144	99	73	53									
150		107	78	57									
160		114	84	61									
170		121	89	65									
180		128	94	69									
190		135	99	73									
200		142	105	77									
210		150	110	81									
220			115	84									
230			120	88									
240			126	92									
250			131	96									
260			136	100									
270			141	104									
280			147	108									
290				111									
300				115									

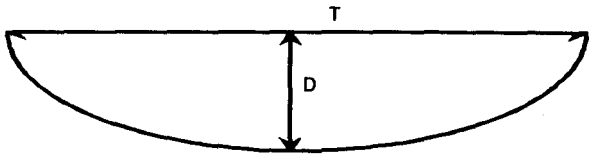
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.2 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	2.8	3.0	3.2	3.3	3.5	3.7	3.9						
20	32												
30	49	32											
40	65	44	32										
50	81	54	40	31									
60	98	65	48	37									
70	114	76	56	44	33								
80	130	87	65	50	38	30							
90	147	98	73	56	43	34							
100	163	109	81	63	48	37	30						
110		120	89	69	53	41	33						
120		131	97	75	58	45	36						
130		142	105	82	63	49	39						
140		152	114	88	68	53	42						
150		163	122	94	73	57	45						
160			130	100	78	61	48						
170			138	107	82	64	51						
180			146	113	87	68	54						
190			154	119	92	72	58						
200			162	125	97	76	61						
210				132	102	80	64						
220				138	107	83	67						
230				144	111	87	70						
240				150	116	91	73						
250				157	121	95	76						
260				163	126	99	79						
270					131	103	82						
280					136	106	85						
290					141	110	88						
300					146	114	91						

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	2.3	2.5	2.7	2.8	3.0	3.2	3.4	3.7	3.9				
20	29												
30	44	30											
40	59	40	29										
50	74	50	37	29									
60	89	60	44	34									
70	103	70	52	40	31								
80	118	79	59	46	36	28							
90	133	89	67	52	40	31							
100	148	99	74	58	45	35	28						
110		109	82	63	49	39	31						
120		119	89	69	54	42	33						
130		129	97	75	58	46	36	29					
140		139	104	81	63	49	39	32					
150		149	112	87	67	53	42	34	28				
160			119	92	72	56	45	36	31				
170			126	98	76	60	48	39	33				
180			134	104	81	63	51	41	35				
190			141	110	85	67	54	43	37				
200			149	115	90	71	56	46	39				
210				121	94	74	59	48	41				
220				127	99	78	62	50	43				
230				133	103	81	65	53	45				
240				139	108	85	68	55	47				
250				144	112	88	71	57	49				
260				150	117	92	74	60	51				
270					121	95	77	62	52				
280					126	99	79	64	55				
290					130	102	82	67	56				
300					135	106	85	69	58				

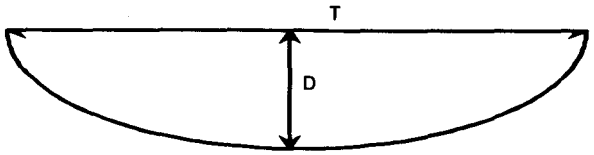
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.3 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	2.5	2.6	2.8	2.9	3.0	3.1	3.3	3.5	3.7	3.9	4.0		
20	40												
30	60	42	30										
40	81	56	40	31									
50	101	70	50	38	31								
60	121	83	60	46	37								
70	141	97	70	54	43	34							
80	161	111	80	62	49	39	31						
90		125	90	69	56	44	35						
100		139	100	77	62	49	39	32					
110		153	110	85	68	54	43	35					
120		167	120	93	74	59	47	39	32				
130			130	101	80	64	51	42	34				
140			140	108	87	69	55	45	37	31			
150			150	116	93	74	59	48	40	33			
160			160	124	99	79	63	52	42	36	31		
170				131	105	84	67	55	45	38	33		
180				139	111	89	71	58	48	40	35		
190				147	117	94	75	62	51	43	37		
200				155	124	99	79	65	53	45	39		
210				162	130	104	83	68	56	47	41		
220					136	109	87	71	59	50	43		
230					142	114	91	75	61	52	45		
240					148	119	95	78	64	54	47		
250					154	124	99	81	67	56	49		
260					161	129	103	85	70	59	51		
270						134	107	88	72	61	53		
280						139	111	91	75	63	55		
290						144	115	94	78	66	57		
300						149	119	97	80	68	59		

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	2.0	2.1	2.3	2.4	2.5	2.6	2.8	3.0	3.2	3.4	3.5	3.8	4.0
20	36												
30	54	37	27										
40	72	50	36	28									
50	90	63	45	35	28								
60	108	75	55	42	34								
70	126	88	64	49	39	31							
80	144	100	73	56	45	36	29						
90		112	82	63	51	41	33						
100		125	91	70	56	45	36	30					
110		137	100	77	62	50	40	33					
120		150	109	84	68	54	44	36	29				
130			118	91	73	59	47	39	32				
140			127	98	79	63	51	42	34	29			
150			136	105	85	68	55	45	37	31			
160			145	113	90	72	58	48	39	33	29		
170				119	96	77	62	51	42	35	31		
180				126	101	81	66	54	44	38	32		
190				133	107	86	69	57	47	40	34	29	
200				140	113	90	73	60	49	42	36	30	
210				148	118	95	77	63	52	44	38	32	
220					124	100	80	66	55	46	40	34	29
230					130	104	84	69	57	48	42	35	30
240					135	109	88	72	59	51	44	37	32
250					141	113	91	75	62	53	45	39	33
260					147	118	95	78	65	55	47	40	34
270						123	99	81	67	57	49	42	36
280						127	102	84	70	59	51	43	37
290						132	106	87	72	61	53	45	39
300						136	110	90	74	63	55	46	40

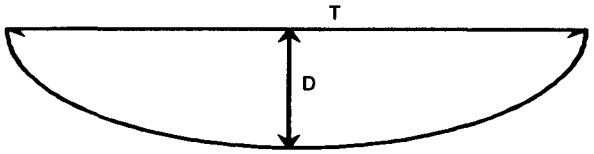
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.4 %



	Top Widths (feet) and Depths with FREEBOARD												
Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.1	3.2	3.4	3.5	3.7	3.9
Q, cfs													
20	46	32											
30	70	48	35										
40	93	65	47	36									
50	116	81	58	45	36								
60	139	97	70	54	43	35							
70	162	113	82	63	50	41	33						
80		129	93	73	58	47	38	31					
90		145	105	82	65	53	43	35					
100		161	117	91	72	59	47	39	32				
110			128	100	80	65	52	43	36				
120			140	109	87	71	57	47	39	32			
130			152	118	94	76	62	51	42	35	30		
140			163	127	101	82	67	54	45	38	32		
150				136	108	88	71	58	49	41	35	30	
160				145	116	94	76	62	52	43	37	32	
170				154	123	100	81	66	55	46	39	34	
180				163	130	106	86	70	59	49	42	36	31
190					137	112	90	74	62	52	44	38	33
200					144	117	95	78	65	54	46	41	35
210					152	123	100	82	68	57	49	43	36
220					159	129	105	86	72	60	51	45	38
230					166	135	109	90	75	63	54	47	40
240						141	114	94	78	65	56	49	42
250						147	119	98	82	68	58	51	44
260						153	124	101	85	71	61	53	46
270						159	128	106	88	74	63	55	47
280						164	133	110	91	76	65	57	49
290							138	114	95	79	68	59	51
300							143	118	98	82	70	61	53

	Top Widths (feet) and Depths with NO FREEBOARD												
Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.6	2.7	2.9	3.0	3.2	3.4
Q, cfs													
20	41	29											
30	62	43	31										
40	82	57	42	32									
50	103	72	52	41	32								
60	123	86	63	49	39	32							
70	144	101	73	57	46	37	30						
80		115	84	65	52	43	34	28					
90		129	94	73	59	48	39	32					
100		143	104	82	65	53	43	35	30				
110			115	90	72	59	48	39	33				
120			125	98	78	64	52	43	36	30			
130			136	106	85	69	56	46	39	32	28		
140			146	114	91	75	61	50	42	35	30		
150				122	98	80	65	53	45	38	32	28	
160				130	104	85	69	57	48	40	34	30	
170				139	111	91	74	61	51	43	36	32	
180				147	117	96	78	64	54	45	39	34	29
190					124	101	82	68	57	48	41	36	31
200					130	106	87	71	60	50	43	38	32
210					137	112	91	75	63	53	45	40	34
220					143	117	95	78	66	55	47	42	36
230					150	122	100	82	69	58	50	44	37
240						128	104	86	72	60	52	45	39
250						133	108	89	75	63	54	47	41
260						138	113	93	78	65	56	49	42
270						144	117	97	81	68	58	51	44
280						149	121	100	84	70	61	53	46
290							126	104	87	73	63	55	47
300							130	107	90	75	65	57	49

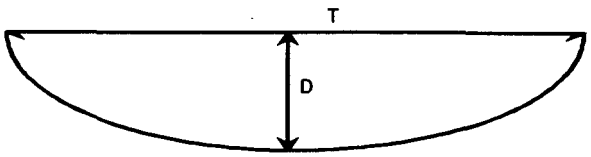
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.5 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	2.1	2.3	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.1	3.2	3.3	3.5
20	52	36											
30	78	54	40	30									
40	104	73	53	40	32								
50	129	91	66	51	40	33							
60	155	109	80	61	49	40	33						
70		127	93	71	57	47	38	31					
80		145	106	81	65	54	44	36	30				
90		163	119	91	73	60	49	40	34				
100			133	101	81	67	55	45	38	32			
110			146	111	89	74	60	49	41	35			
120			159	121	97	81	66	54	45	38	32		
130				132	105	87	71	58	49	41	35	30	
140				142	113	94	77	63	53	44	37	32	
150				152	122	101	82	67	57	48	40	35	30
160				162	130	108	88	72	60	51	43	37	33
170					138	114	93	76	64	54	46	39	35
180					146	121	99	81	68	57	48	42	37
190					154	128	104	85	72	61	51	44	39
200					162	134	110	90	75	64	54	47	41
210						141	115	95	79	67	56	49	43
220						148	121	99	83	70	59	51	45
230						154	126	104	87	73	62	54	47
240						161	132	108	90	77	65	56	49
250							137	113	94	80	67	58	51
260							143	117	98	83	70	61	53
270							148	122	102	86	73	63	56
280							154	126	106	89	75	65	58
290							159	131	110	93	78	68	60
300							165	135	113	96	81	70	62

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.6	1.8	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.6	2.7	2.8	3.0
20	45	32											
30	68	48	35	27									
40	91	64	47	36	29								
50	113	80	59	45	36	30							
60	136	96	71	54	44	36	30						
70		112	82	63	51	42	34	28					
80		128	94	72	58	48	40	32	27				
90		144	106	81	65	54	44	37	31				
100			118	90	73	60	49	41	34	29			
110			129	99	80	66	55	45	38	32			
120			141	108	87	73	59	49	41	35	29		
130				117	94	79	64	53	45	38	32	28	
140				126	102	85	69	57	48	41	34	30	
150				135	109	91	74	61	52	44	37	32	28
160				144	116	97	79	65	55	46	39	34	30
170					123	103	84	69	58	50	42	36	32
180					131	109	89	73	62	52	44	39	34
190					138	115	94	77	65	55	47	41	36
200					145	121	99	82	69	58	49	43	38
210						127	104	86	72	61	52	45	40
220						133	109	90	76	64	54	47	42
230						139	114	94	79	67	57	49	44
240						145	119	98	82	70	59	52	46
250							124	102	86	73	62	54	48
260							129	106	90	76	64	56	49
270							134	110	93	79	67	58	51
280							139	114	96	82	69	60	53
290							143	119	100	85	72	62	55
300							148	123	103	88	74	65	57

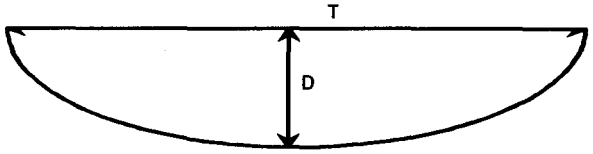
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.6 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	2.0	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.7	2.8	2.9	3.1	3.2
20	56	40	30										
30	85	61	44	33									
40	113	81	60	44	36								
50	141	101	74	56	45	37	30						
60	169	121	89	67	54	44	36	30					
70		141	104	78	63	51	43	35					
80		161	119	89	72	59	49	41	34				
90			134	100	81	66	55	46	38	32			
100			149	112	89	73	61	51	42	36	30		
110			164	123	98	81	67	56	46	39	34		
120				134	107	88	74	61	51	43	37	31	
130				145	116	95	80	66	55	47	40	34	
140				156	125	103	86	71	59	50	43	36	32
150				167	134	110	92	76	64	54	46	39	34
160					143	118	98	81	68	58	49	42	37
170					152	125	104	86	72	61	52	45	39
180					161	132	110	91	76	65	55	47	41
190						140	116	97	80	69	58	50	44
200						147	123	102	85	72	62	53	46
210						154	129	107	89	76	65	55	48
220						162	135	112	94	79	68	58	51
230							141	117	98	83	71	60	53
240							147	122	102	87	74	63	55
250							153	127	106	90	77	66	57
260							159	132	111	94	80	68	60
270							165	137	115	98	83	71	62
280								142	119	101	86	74	65
290								147	123	105	89	76	67
300								152	128	109	92	79	69

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.5	1.6	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.3	2.4	2.6	2.7
20	49	35	26										
30	73	53	39	30									
40	98	71	52	39	32								
50	122	88	65	49	40	33	27						
60	147	106	79	59	48	39	33	27					
70		124	92	69	56	46	38	32					
80		141	105	79	64	53	44	37	30				
90			118	89	72	59	49	41	34	29			
100			131	99	80	66	55	46	38	33	28		
110			144	108	88	72	60	50	42	36	31		
120				118	95	79	66	55	46	39	33	29	
130				128	103	85	71	59	50	42	36	31	
140				138	111	92	77	64	54	46	39	33	29
150				148	119	98	82	69	57	49	42	36	31
160					127	105	88	73	61	52	45	38	34
170					135	111	93	78	65	56	48	41	36
180					143	118	99	82	69	59	50	43	38
190						125	104	87	73	62	53	46	40
200						131	110	91	77	65	56	48	42
210						138	115	96	81	69	59	50	44
220						144	121	101	84	72	62	53	46
230							126	105	88	75	64	55	49
240							132	110	92	78	67	58	51
250							137	114	96	82	70	60	53
260							143	119	100	85	73	63	55
270							148	123	104	89	76	65	57
280								128	108	92	78	67	59
290								132	111	95	81	70	61
300								137	115	99	84	72	63

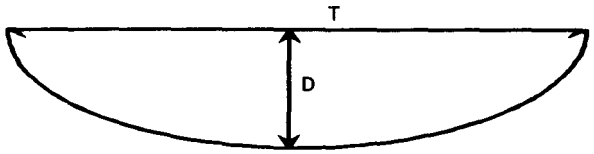
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.7 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.9	2.0	2.1	2.2	2.3	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0
20	61	44	32										
30	91	66	48	36									
40	122	87	64	48	39	32							
50	152	109	80	61	48	40	33						
60		131	97	73	58	48	40	33					
70		153	113	85	68	56	47	39	33				
80			129	97	78	64	54	45	37	32			
90			145	109	88	72	60	51	42	36	30		
100			161	121	97	80	68	56	47	40	34		
110				134	107	88	74	62	51	44	37	32	
120				146	117	96	81	67	56	48	41	35	30
130				158	127	104	88	73	61	52	44	38	33
140				170	136	112	94	79	66	56	48	41	35
150					146	120	101	84	70	60	51	44	38
160					156	127	108	90	75	64	55	47	40
170					166	135	115	96	80	68	58	50	43
180						143	121	101	84	72	61	53	46
190						151	128	107	89	76	65	56	48
200						159	135	112	94	80	68	59	51
210						167	142	118	98	84	72	61	53
220							148	124	103	88	75	64	56
230							155	129	108	92	78	67	58
240							162	135	112	96	82	70	61
250							169	140	117	100	85	73	63
260								146	122	104	89	76	66
270								151	126	108	92	79	68
280								157	131	112	96	82	71
290								163	136	116	99	85	73
300								168	141	120	103	88	76

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.4	1.5	1.6	1.7	1.8	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5
20	52	38	28										
30	79	57	42	32									
40	105	76	56	42	34	28							
50	131	95	70	53	43	35	30						
60		114	84	64	52	42	36	30					
70		133	98	75	60	49	42	35	29				
80			112	85	69	57	48	40	33	29			
90			127	96	77	64	54	45	38	32	28		
100			141	107	86	71	60	50	42	36	31		
110				117	95	78	66	55	46	39	34	29	
120				128	103	85	72	60	51	43	37	32	27
130				139	112	92	78	65	55	47	40	34	30
140				149	120	99	84	70	59	50	43	37	32
150					129	106	90	75	63	54	46	40	35
160					138	113	96	80	67	57	49	42	37
170					146	120	102	85	71	61	52	45	39
180						127	108	90	76	65	55	48	42
190						134	114	95	80	68	59	51	44
200						141	120	100	84	72	62	53	46
210						148	126	105	88	76	65	56	49
220							132	110	92	79	68	58	51
230							138	115	97	83	71	61	53
240							144	120	101	86	74	64	56
250							150	125	105	90	77	67	58
260								130	109	94	80	69	60
270								135	113	97	83	72	62
280								140	118	101	87	75	65
290								145	122	104	90	77	67
300								150	126	108	93	80	70

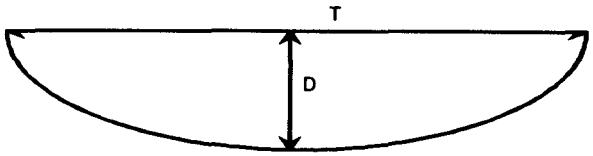
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.8 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.8	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.4	2.5	2.6	2.7	2.8
20	65	47	34										
30	98	70	52	39	31								
40	130	93	69	53	41	34							
50	163	116	86	66	52	43	36	30					
60		139	104	79	62	51	43	36	31				
70		163	121	92	73	60	50	42	36	30			
80			138	105	83	68	58	48	41	34			
90			156	118	93	77	65	55	46	39	33		
100			173	131	104	85	72	61	51	43	37	32	
110				145	114	94	80	67	56	48	41	35	30
120				158	124	102	87	73	62	52	44	38	33
130				171	135	111	94	79	67	56	48	42	36
140					145	119	101	85	72	60	52	45	39
150					156	128	109	91	77	65	56	48	41
160					166	136	116	97	82	69	60	51	44
170						145	123	103	87	74	63	55	47
180						153	130	110	92	78	67	58	50
190						162	138	116	97	82	71	61	53
200						170	145	122	102	87	74	64	56
210							152	128	108	91	78	68	58
220							159	134	113	95	82	71	61
230							167	140	118	100	86	74	64
240								146	123	104	90	77	67
250								152	128	108	93	80	69
260								158	133	113	97	84	72
270								164	138	117	101	87	75
280									143	121	105	90	78
290									149	126	108	93	81
300									154	130	112	97	83

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.3	1.5	1.5	1.6	1.7	1.8	1.8	1.9	1.9	2.0	2.1	2.2	2.3
20	56	40	30										
30	83	60	45	35	27								
40	111	80	60	46	36	30							
50	139	100	75	57	46	38	32	27					
60		120	90	69	55	45	38	32	27				
70		140	105	80	64	53	45	38	32	27			
80			120	92	73	60	51	43	36	31			
90			135	103	82	68	58	48	41	35	30		
100			150	115	91	75	64	54	46	39	33	29	
110				126	100	83	71	59	50	43	37	32	27
120				138	109	90	77	65	55	46	40	35	30
130				149	118	98	83	70	59	50	44	38	33
140					127	105	90	76	64	54	47	41	35
150					137	113	96	81	69	58	50	44	38
160					146	120	103	86	73	62	54	46	40
170						128	109	92	78	66	57	49	43
180						135	115	97	82	70	60	52	45
190						143	122	103	87	74	64	55	48
200						150	128	108	91	78	67	58	50
210							135	113	96	82	70	61	53
220							141	119	101	85	74	64	55
230							147	124	105	89	77	67	58
240								130	110	93	81	70	60
250								135	114	97	84	73	63
260								140	119	101	87	76	65
270								146	123	105	91	78	68
280									128	109	94	81	70
290									132	113	97	84	73
300									137	116	101	87	76

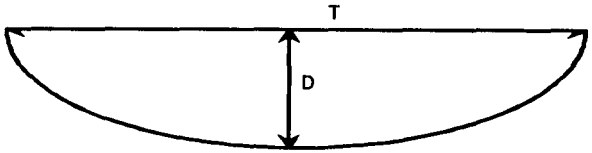
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 0.9 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	1.8	1.9	2.0	2.0	2.1	2.2	2.2	2.3	2.3	2.4	2.5	2.6	2.7
	20	69	49	37										
	30	103	73	55	43	33								
	40	137	98	74	57	44	36	30						
	50	172	122	92	71	56	45	38	32					
	60		147	110	85	67	55	46	39	33				
	70		171	129	99	78	64	53	45	39	33			
	80			147	114	89	73	61	52	44	37	32		
	90			166	128	100	82	68	58	50	42	36	31	
	100				142	111	91	76	65	55	47	40	35	30
	110				156	122	100	84	71	61	51	44	38	33
	120				170	133	109	91	78	66	56	48	42	36
	130					144	118	99	84	72	61	52	45	39
	140					155	127	106	91	78	65	56	49	42
	150					166	136	114	97	83	70	60	52	45
	160						145	122	104	89	75	64	56	48
	170						154	129	110	94	80	68	59	51
	180						163	137	117	100	84	73	63	54
	190							144	123	105	89	77	66	57
	200							152	130	111	94	81	70	60
	210							160	136	116	98	85	73	63
	220							167	142	122	103	89	77	66
	230								149	127	108	93	80	69
	240								155	133	112	97	84	72
	250								162	138	117	101	87	75
	260								168	144	122	105	91	78
	270									149	126	109	94	81
	280									155	131	113	97	84
	290									160	136	117	101	88
	300									166	140	121	104	91

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	1.3	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.8	1.9	2.0	2.1	2.2
	20	58	42	32										
	30	87	63	48	37	29								
	40	116	84	64	49	39	32	27						
	50	145	105	80	62	48	40	33	29					
	60		126	95	74	58	48	40	34	29				
	70		147	111	86	68	56	47	40	34	29			
	80			127	99	77	64	54	46	39	33	29		
	90			143	111	87	72	60	52	44	37	32	28	
	100				123	97	80	67	57	49	42	36	31	27
	110				136	106	88	74	63	54	46	40	34	30
	120				148	116	96	80	69	59	50	43	37	32
	130					126	104	87	75	64	54	47	41	35
	140					135	112	94	80	69	58	50	44	38
	150					145	119	100	86	74	63	54	47	41
	160						127	107	92	79	67	58	50	43
	170						135	114	97	83	71	61	53	46
	180						143	120	103	88	75	65	56	49
	190							127	109	93	79	68	59	52
	200							134	114	98	83	72	63	54
	210							140	120	103	88	76	66	57
	220							147	126	108	92	79	69	60
	230								132	113	96	83	72	63
	240								137	118	100	86	75	65
	250								143	123	104	90	78	68
	260								149	127	108	94	81	71
	270									132	113	97	84	73
	280									137	117	101	88	76
	290									142	121	104	91	79
	300									147	125	108	94	82

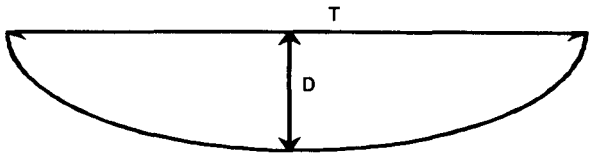
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 1.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.7	1.8	1.9	2.0	2.0	2.1	2.2	2.2	2.3	2.3	2.4	2.5	2.6
20	71	51	39	30									
30	107	77	58	45	35								
40	143	102	77	60	47	38	32						
50	178	128	97	75	59	48	40	35					
60		153	116	91	70	58	48	42	35	30			
70			135	106	82	68	57	49	41	35	30		
80			155	121	94	77	65	56	47	40	34	30	
90			174	136	105	87	73	63	53	45	38	33	
100				151	117	97	81	70	59	50	43	37	32
110				166	129	106	89	77	65	55	47	41	36
120					141	116	97	84	70	60	52	45	39
130					152	126	105	91	76	65	56	48	42
140					164	135	113	98	82	70	60	52	45
150						145	121	105	88	75	64	56	49
160						155	129	112	94	80	69	60	52
170						164	137	119	100	85	73	64	55
180							145	126	106	90	77	67	59
190							154	133	111	95	81	71	62
200							162	140	117	100	86	75	65
210							170	146	123	105	90	79	68
220								153	129	110	94	82	71
230								160	135	115	99	86	75
240								167	141	120	103	90	78
250									147	125	107	94	81
260									153	130	111	97	84
270									158	135	116	101	88
280									164	140	120	105	91
290									170	145	124	108	94
300										150	129	112	97

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.2	1.3	1.4	1.5	1.5	1.6	1.7	1.7	1.8	1.8	1.9	2.0	2.1
20	60	44	33	26									
30	90	66	50	39	30								
40	120	87	66	52	41	34	28						
50	150	109	83	65	51	42	35	31					
60		131	100	78	61	51	42	37	31	27			
70			116	91	71	59	50	43	36	31	27		
80			133	104	81	68	57	49	41	35	31	27	
90			149	117	92	76	64	55	46	40	34	30	
100				130	102	84	71	61	52	44	38	33	29
110				143	112	93	78	67	57	49	42	37	32
120					122	101	85	74	62	53	46	40	35
130					132	110	92	80	67	58	50	43	38
140					142	118	99	86	72	62	53	47	41
150						127	106	92	78	67	57	50	44
160						135	113	98	83	71	61	53	46
170						143	120	104	88	76	65	57	49
180							128	110	93	80	69	60	53
190							135	117	98	84	73	64	55
200							142	123	104	89	76	67	58
210							149	129	109	93	80	70	61
220								135	114	98	84	74	64
230								141	119	102	88	77	67
240								147	124	107	92	80	70
250									129	111	95	84	73
260									135	116	99	87	76
270									140	120	103	90	79
280									145	124	107	94	82
290									150	129	111	97	84
300										133	114	100	87

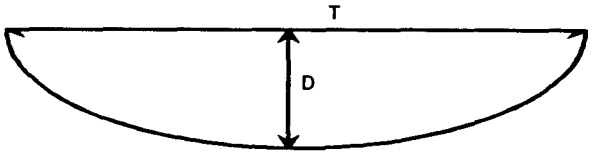
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 1.5 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	1.5	1.6	1.7	1.8	1.8	1.9	1.9	2.0	2.0	2.0	2.1	2.1	2.2
	20	86	64	48	38	30								
	30	129	96	71	56	45	36	30						
	40	173	128	95	75	60	48	40	34	30				
	50		160	119	94	75	60	50	43	37	32			
	60			143	113	90	72	60	52	45	38	33		
	70			167	132	104	84	70	60	52	45	39	34	30
	80				151	119	96	80	69	60	52	45	39	34
	90				169	134	108	90	77	67	58	50	44	38
	100					149	120	100	86	75	65	56	49	42
	110					164	132	111	94	82	71	61	54	47
	120						144	121	103	89	77	67	59	51
	130						156	131	112	97	84	73	63	55
	140						168	141	120	104	90	78	68	60
	150							151	129	112	97	84	73	64
	160							161	137	119	103	89	78	68
	170							171	146	127	110	95	83	72
	180								155	134	116	100	88	77
	190								163	141	123	106	92	81
	200								172	149	129	112	97	85
	210									156	135	117	102	89
	220									164	142	123	107	94
	230									171	148	128	112	98
	240										155	134	117	102
	250										161	139	122	106
	260										168	145	127	111
	270											151	131	115
	280											156	136	119
	290											162	141	123
	300											167	146	128

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	1.0	1.1	1.2	1.3	1.3	1.4	1.4	1.5	1.5	1.5	1.6	1.6	1.7
	20	70	53	40	32	25								
	30	105	80	60	48	38	31	26						
	40	141	107	80	64	51	41	35	29	26				
	50		133	100	80	63	51	43	37	32	28			
	60			120	96	76	62	52	45	39	33	29		
	70			140	111	89	72	60	52	45	39	34	30	26
	80				127	101	82	69	59	52	45	39	34	30
	90				143	114	92	78	67	58	50	44	38	34
	100					127	102	86	74	65	56	49	43	37
	110					140	113	95	82	71	62	54	47	41
	120						123	104	89	77	67	58	51	45
	130						133	112	96	84	73	63	55	48
	140						143	121	104	90	78	68	60	52
	150							130	111	97	84	73	64	56
	160							138	119	103	90	78	68	60
	170							147	126	110	95	83	73	64
	180								133	116	101	88	77	67
	190								141	122	106	92	81	71
	200								148	129	112	97	85	75
	210									135	118	102	89	79
	220									142	123	107	94	82
	230									148	129	112	98	86
	240										134	117	102	90
	250										140	122	106	93
	260										146	126	111	97
	270											131	115	101
	280											136	119	105
	290											141	124	108
	300											146	128	112

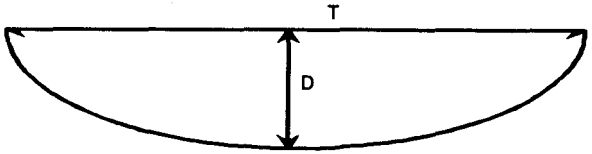
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 2.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.4	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.9	1.9	1.9	2.0
20	98	73	55	43	35								
30	147	109	82	65	53	42	35	30					
40		145	110	87	71	57	47	40	34	30			
50		182	137	108	88	71	59	50	43	38	33		
60			164	130	106	85	70	60	52	45	40	35	31
70				151	124	99	82	70	61	53	47	41	36
80				173	141	113	94	80	69	60	53	47	41
90					159	127	106	90	78	68	60	52	46
100					177	141	117	100	87	75	67	58	52
110						156	129	109	95	83	73	64	57
120						170	141	119	104	90	80	70	62
130							152	129	113	98	86	76	67
140							164	139	121	105	93	82	72
150							176	149	130	113	100	87	78
160								159	139	120	106	93	83
170								169	147	128	113	99	88
180									156	135	120	105	93
190									164	143	126	111	98
200									173	150	133	117	103
210										158	140	122	109
220										165	146	128	114
230										173	153	134	119
240											160	140	124
250											166	146	129
260											173	151	134
270												157	140
280												163	145
290												169	150
300												175	155

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.9	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.4	1.4	1.5
20	78	59	45	36	30								
30	117	89	68	54	44	36	30	25					
40		118	91	72	59	48	40	34	29	26			
50		148	113	90	74	60	50	42	37	32	28		
60			136	108	89	71	59	51	44	39	34	30	27
70				126	104	83	69	59	52	45	40	35	31
80				144	118	95	79	68	59	52	46	40	36
90					133	107	89	76	67	58	52	45	40
100					148	119	99	85	74	64	57	50	45
110						131	109	93	81	71	63	55	49
120						143	119	101	89	77	69	60	54
130							129	110	96	84	74	65	58
140							138	118	103	90	80	70	63
150							148	127	111	97	86	75	67
160								135	118	103	91	80	72
170								144	126	109	97	85	76
180									133	116	103	90	80
190									140	122	109	95	85
200									148	129	114	100	89
210										135	120	105	94
220										142	126	110	98
230										148	131	115	103
240											137	120	107
250											143	125	112
260											149	130	116
270												135	121
280												140	125
290												145	130
300												150	134

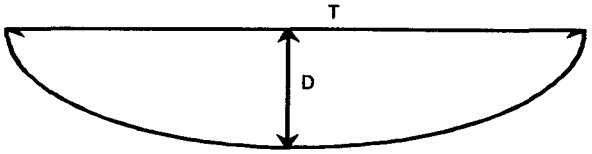
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 2.5 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.3	1.4	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.8	1.8	1.8	1.8
20	110	80	62	49	40	32							
30	166	120	93	73	59	49	40	34					
40		160	124	97	79	65	53	45	39	34	30		
50			155	122	99	81	67	57	49	42	38	33	30
60				146	119	97	80	68	58	51	45	40	36
70				171	138	113	93	79	68	59	53	47	41
80					158	129	106	91	78	68	61	54	47
90					178	145	120	102	88	76	68	60	53
100						161	133	113	97	85	76	67	59
110						178	146	125	107	93	83	74	65
120							160	136	117	102	91	80	71
130							173	147	126	110	98	87	77
140								159	136	119	106	94	83
150								170	146	127	113	101	89
160									156	136	121	107	95
170									165	144	129	114	100
180									175	153	136	121	106
190										161	144	127	112
200										170	151	134	118
210											159	141	124
220											166	147	130
230											174	154	136
240												161	142
250												168	148
260												174	154
270													160
280													165
290													171
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.8	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.3
20	86	64	51	40	33	27							
30	129	96	76	60	49	40	33	29					
40		128	101	80	65	54	44	38	33	29	26		
50			127	100	82	67	56	48	41	36	32	28	25
60				120	98	80	67	57	49	43	39	34	30
70				140	114	94	78	67	57	50	45	40	35
80					131	107	89	76	66	57	51	46	40
90					147	121	100	86	74	65	58	51	45
100						134	111	95	82	72	64	57	50
110						147	122	105	90	79	71	63	56
120							133	114	98	86	77	68	61
130							144	124	107	93	83	74	66
140								133	115	100	90	80	71
150								143	123	108	96	86	76
160									131	115	103	91	81
170									139	122	109	97	86
180									147	129	115	103	91
190										136	122	108	96
200										144	128	114	101
210											135	120	106
220											141	125	111
230											148	131	116
240												137	121
250												143	126
260												148	131
270													136
280													141
290													146
300													

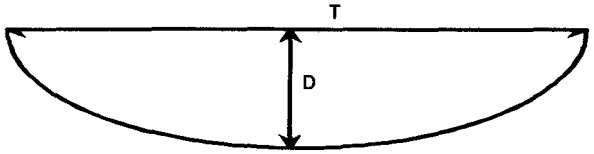
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 3.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.2	1.3	1.4	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.7	1.8
20	119	88	67	53	43	36	30						
30	179	132	101	80	65	54	45	38	32				
40		176	134	106	87	72	59	50	43	38	33	30	
50			168	133	108	90	74	63	53	47	41	37	33
60				159	130	108	89	75	64	56	50	45	39
70					152	126	104	88	75	66	58	52	46
80					173	144	119	101	86	75	66	60	53
90						162	134	113	96	85	74	67	59
100						180	148	126	107	94	83	75	66
110							163	138	118	103	91	82	72
120							178	151	128	112	99	90	79
130								163	139	122	107	97	85
140								176	150	131	116	105	92
150									160	141	124	112	99
160									171	150	132	120	105
170										159	140	127	112
180										169	149	135	118
190										178	157	142	125
200											165	149	131
210											173	157	138
220												164	144
230												172	151
240													158
250													164
260													171
270													177
280													
290													
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.7	0.8	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.3
20	91	69	54	43	35	30	25						
30	137	104	81	65	53	44	37	31	27				
40		139	108	86	71	59	49	42	36	31	28	25	
50			135	108	89	74	61	52	45	39	35	32	28
60				129	106	89	73	62	53	47	42	38	33
70					124	103	86	73	62	55	49	44	39
80					142	118	98	83	71	63	56	50	44
90						133	110	94	80	71	62	57	50
100						148	122	104	89	78	69	63	56
110							135	115	98	86	76	69	61
120							147	125	107	94	83	76	67
130								135	116	102	90	82	72
140								146	125	110	97	88	78
150									134	118	104	94	83
160									143	126	111	101	89
170										133	118	107	94
180										141	125	113	100
190										149	132	120	105
200											139	126	111
210											146	132	116
220												138	122
230												145	128
240													133
250													139
260													144
270													150
280													
290													
300													

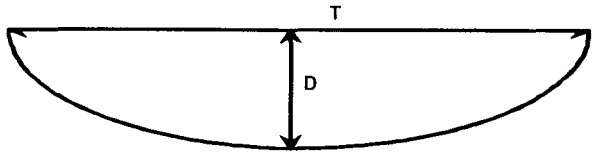
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 3.5 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	1.2	1.3	1.3	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.7
	20	128	92	72	58	47	39	33						
	30	192	139	108	86	70	58	49	41	35	31			
	40		185	144	115	94	77	65	55	47	41	36	32	
	50			180	144	117	97	81	69	59	52	45	40	37
	60				173	140	116	98	82	71	62	54	48	44
	70					164	136	114	96	83	72	63	56	51
	80						155	130	110	94	82	72	65	59
	90						174	146	123	106	93	82	73	66
	100							162	137	118	103	91	81	73
	110							179	151	130	113	100	89	81
	120								164	141	124	109	97	88
	130								178	153	134	118	105	95
	140									165	144	127	113	102
	150									177	155	136	121	110
	160										165	145	129	117
	170										175	154	137	124
	180											163	145	132
	190											172	153	139
	200												161	146
	210												169	154
	220												177	161
	230													168
	240													176
	250													
	260													
	270													
	280													
	290													
	300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	0.7	0.8	0.8	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.2
	20	96	72	57	46	38	32	27						
	30	145	108	86	69	57	47	40	34	29	26			
	40		143	114	93	76	63	53	45	39	34	30	27	
	50			143	116	95	79	66	56	49	43	38	34	31
	60				139	114	95	80	68	58	51	45	40	37
	70					133	110	93	79	68	60	53	47	43
	80						126	106	90	78	68	60	54	49
	90						142	120	101	87	77	68	61	55
	100							133	113	97	85	75	67	61
	110							146	124	107	94	83	74	68
	120								135	117	103	90	81	74
	130								146	126	111	98	87	80
	140									136	120	106	94	86
	150									146	128	113	101	92
	160										137	121	108	98
	170										145	128	114	104
	180											136	121	110
	190											143	128	116
	200												135	122
	210												141	129
	220												148	135
	230													141
	240													147
	250													
	260													
	270													
	280													
	290													
	300													

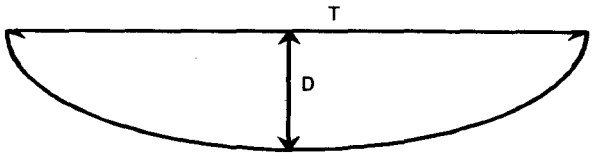
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 4.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	1.1	1.2	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.6
	20	136	99	78	62	50	43	36						
	30		148	117	93	75	64	53	45	38	33			
	40			156	124	100	85	71	60	50	44	39	35	31
	50				155	126	106	89	75	63	55	49	43	39
	60				186	151	127	107	90	75	66	59	52	46
	70					176	149	124	105	88	77	69	60	54
	80						170	142	120	101	87	78	69	62
	90							160	135	113	98	88	78	70
	100							177	150	126	109	98	86	77
	110								165	138	120	108	95	85
	120								180	151	131	118	104	93
	130									163	142	127	112	100
	140									176	153	137	121	108
	150										164	147	129	116
	160										175	157	138	124
	170											167	147	131
	180											176	155	139
	190												164	147
	200												173	154
	210												181	162
	220													170
	230													178
	240													
	250													
	260													
	270													
	280													
	290													
	300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	0.6	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1
	20	101	76	61	49	40	34	29						
	30		114	91	74	60	51	43	37	31	27			
	40			122	99	81	68	58	49	41	36	32	29	26
	50				123	101	86	72	61	51	45	40	36	32
	60				148	121	103	86	73	62	54	49	43	39
	70					141	120	101	86	72	63	57	50	45
	80						137	115	98	82	72	65	57	51
	90							129	110	92	81	73	64	58
	100							144	122	103	90	81	72	64
	110								135	113	99	89	79	71
	120								147	123	108	97	86	77
	130									134	117	105	93	83
	140									144	126	113	100	90
	150										135	121	107	96
	160										144	129	114	103
	170											137	122	109
	180											146	129	116
	190												136	122
	200												143	128
	210												150	135
	220													141
	230													148
	240													
	250													
	260													
	270													
	280													
	290													
	300													

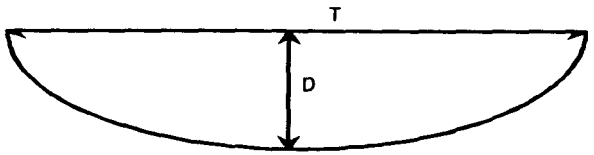
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 4.5 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.1	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.6
20	142	105	83	66	53	45	37	32					
30		157	125	99	80	67	56	48	41	35	31		
40			167	132	107	89	74	64	55	47	42	37	33
50				166	134	111	93	80	69	59	52	46	41
60					160	133	111	96	82	71	63	55	50
70					187	156	130	112	96	83	73	64	58
80						178	148	128	110	94	84	73	66
90							167	144	123	106	94	83	74
100							185	160	137	118	104	92	83
110								176	151	130	115	101	91
120									164	142	125	110	99
130									178	154	136	119	107
140										165	146	128	116
150										177	157	138	124
160											167	147	132
170											178	156	140
180												165	149
190												174	157
200													165
210													174
220													182
230													
240													
250													
260													
270													
280													
290													
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.6	0.7	0.7	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1
20	105	79	64	52	43	36	30	26					
30		119	97	78	64	53	45	39	33	29	26		
40			129	104	85	71	60	52	45	39	34	30	27
50				130	106	89	74	65	56	48	43	38	34
60					128	107	89	78	67	58	51	45	41
70					149	125	104	91	78	67	60	53	48
80						142	119	103	89	77	68	60	55
90							134	116	100	87	77	68	61
100							149	129	111	96	86	75	68
110								142	122	106	94	83	75
120									133	115	103	91	82
130									145	125	111	98	89
140										135	120	106	95
150										144	128	113	102
160											137	121	109
170											145	128	116
180												136	123
190												143	129
200													136
210													143
220													150
230													
240													
250													
260													
270													
280													
290													
300													

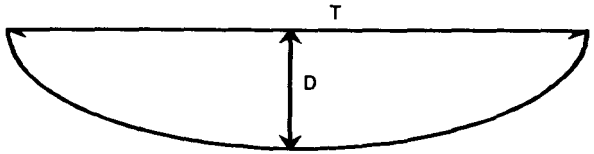
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 5.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.1	1.1	1.2	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.5
20	149	113	87	70	56	47	40	34					
30		170	130	105	84	71	60	50	44	38	33		
40			174	140	113	95	80	67	59	50	44	39	35
50				175	141	119	100	84	73	63	55	49	44
60					169	142	120	101	88	75	66	58	52
70						166	140	117	102	88	77	68	61
80							160	134	117	100	87	78	70
90							179	151	132	113	98	87	79
100								168	146	125	109	97	87
110								184	161	138	120	107	96
120									176	151	131	116	105
130										163	142	126	114
140										176	153	136	122
150											164	146	131
160											175	155	140
170												165	149
180												175	157
190													166
200													175
210													184
220													
230													
240													
250													
260													
270													
280													
290													
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.6	0.6	0.7	0.8	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0
20	108	85	67	55	44	38	32	27					
30		127	100	82	67	57	48	40	35	31	27		
40			133	109	89	75	64	54	47	41	36	32	29
50				136	111	94	80	67	59	51	44	40	36
60					133	113	96	81	71	61	53	48	43
70						132	111	94	83	71	62	56	50
80							127	108	94	81	71	63	57
90							143	121	106	91	80	71	65
100								135	118	101	89	79	72
110								148	130	111	98	87	79
120									142	122	107	95	86
130										132	116	103	93
140										142	124	111	100
150											133	119	107
160											142	127	115
170												135	122
180												143	129
190													136
200													143
210													150
220													
230													
240													
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260													
270													
280													
290													
300													

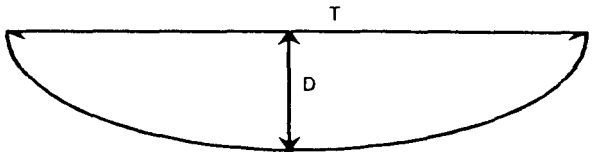
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 6.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5
20	166	121	95	76	61	52	44	38	33				
30		181	143	114	92	78	66	56	49	42	36	33	
40			191	152	122	104	88	75	65	56	48	43	38
50				190	153	130	111	94	81	69	61	54	48
60					183	156	133	112	98	83	73	65	58
70						182	155	131	114	97	85	76	67
80							177	150	130	111	97	87	77
90								168	146	125	109	98	87
100								187	163	139	121	108	96
110									179	153	133	119	106
120										167	145	130	115
130										180	157	141	125
140											169	152	135
150											182	162	144
160												173	154
170												184	163
180													173
190													183
200													
210													
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240													
250													
260													
270													
280													
290													
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0
20	118	89	72	58	48	41	35	30	26				
30		133	108	87	71	61	52	44	39	33	29	26	
40			143	116	95	82	70	59	52	44	39	35	31
50				146	119	102	87	74	65	56	49	44	39
60					143	122	105	89	78	67	58	52	47
70						143	122	104	90	78	68	61	55
80							139	118	103	89	78	70	62
90								133	116	100	87	79	70
100								148	129	111	97	87	78
110									142	122	107	96	86
120										133	116	105	94
130										144	126	114	101
140											136	122	109
150											146	131	117
160												140	125
170												149	132
180													140
190													148
200													
210													
220													
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240													
250													
260													
270													
280													
290													
300													

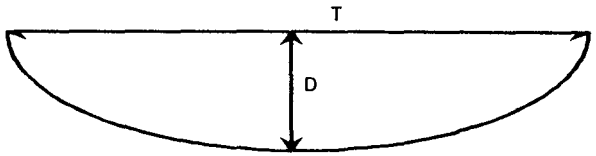
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 7.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.0	1.0	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4
20	176	132	102	82	67	56	48	40	35	31			
30		198	152	123	100	84	72	61	53	47	40	35	32
40			203	164	134	112	96	81	70	62	53	47	42
50					167	139	120	101	88	78	66	58	53
60						167	144	121	105	93	80	70	63
70							168	142	123	109	93	82	74
80							192	162	140	124	106	93	85
90								182	158	140	120	105	95
100									175	155	133	116	106
110										171	146	128	116
120										186	159	140	127
130											173	151	137
140											186	163	148
150												175	159
160												186	169
170													180
180													
190													
200													
210													
220													
230													
240													
250													
260													
270													
280													
290													
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9
20	123	95	75	62	51	43	38	32	28	25			
30		143	113	93	77	65	56	48	41	37	32	28	25
40			150	124	103	86	75	63	55	49	42	37	34
50					128	108	93	79	69	61	53	46	42
60						130	112	95	83	74	63	56	51
70							131	111	97	86	74	65	59
80							149	127	110	98	84	74	68
90								143	124	110	95	84	76
100									138	123	105	93	85
110										135	116	102	93
120										147	126	111	102
130											137	121	110
140											148	130	119
150												139	127
160												148	136
170													144
180													
190													
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300													

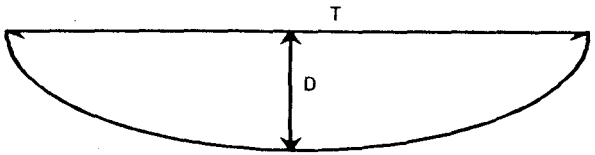
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 8.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3
20	187	140	107	88	72	59	51	44	38	34			
30		210	160	131	108	89	76	66	57	50	44	38	34
40				175	144	118	102	88	76	67	58	51	45
50					180	148	127	110	95	84	73	64	56
60						178	152	132	114	101	87	77	68
70							178	154	133	117	102	90	79
80								176	152	134	116	102	90
90									171	151	131	115	101
100									190	168	145	128	113
110										185	160	141	124
120											174	153	135
130											189	166	147
140												179	158
150													169
160													180
170													
180													
190													
200													
210													
220													
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240													
250													
260													
270													
280													
290													
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8
20	128	99	78	65	55	45	39	34	30	26			
30		149	117	98	82	68	59	51	45	39	34	30	27
40				130	109	91	78	68	59	52	46	40	36
50					136	114	98	86	74	66	57	51	45
60						136	118	103	89	79	69	61	54
70							137	120	104	92	80	71	63
80								137	118	105	91	81	72
90									133	118	103	91	80
100									148	131	114	101	89
110										144	126	111	98
120											137	121	107
130											149	131	116
140												141	125
150													134
160													143
170													
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300													

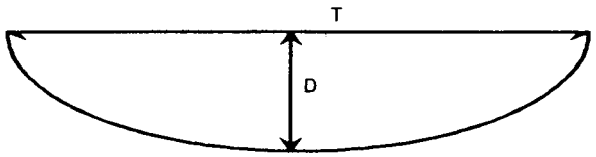
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 9.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3
20	195	148	113	92	76	64	53	48	40	35			
30			169	139	114	96	80	71	60	53	46	40	36
40				185	151	128	106	95	80	71	62	54	49
50					189	161	133	119	101	89	77	67	61
60						193	159	143	121	106	93	81	73
70							186	167	141	124	108	94	85
80								191	161	142	124	108	97
90									181	159	139	121	109
100										177	155	135	121
110											170	148	133
120											186	161	145
130												175	158
140												188	169
150													181
160													
170													
180													
190													
200													
210													
220													
230													
240													
250													
260													
270													
280													
290													
300													

Top Widths (feet) and Depths with NO FREEBOARD

Q, cfs \ Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
Depth, ft.	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8
20	132	104	81	68	57	49	41	37	31	28			
30			122	102	85	73	61	55	47	41	36	32	29
40				136	114	97	81	73	62	55	48	42	38
50					142	122	102	92	78	69	60	53	48
60						146	122	110	93	82	72	63	57
70							142	128	109	96	84	74	67
80								146	124	110	96	84	76
90									140	124	109	95	86
100										137	121	105	95
110											133	116	105
120											145	126	114
130												137	124
140												147	133
150													142
160													
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290													
300													

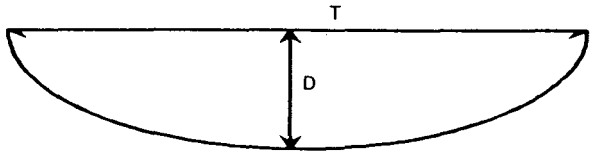
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart

Capacity Retardance = B

Velocity Retardance = D

Design Grade = 10.0 %



Top Widths (feet) and Depths with FREEBOARD

Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	0.9	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3
20		198	151	120	96	80	68	58	50	44	38	34		
30				179	143	120	101	87	75	65	57	51	44	39
40					191	159	135	116	100	87	76	68	58	52
50						199	169	145	125	109	96	85	73	64
60								173	149	130	115	101	88	77
70									174	152	134	118	102	90
80										174	153	135	117	103
90										195	172	152	131	116
100											191	169	146	129
110												186	161	142
120													175	155
130													190	168
140														180
150														193
160														
170														
180														
190														
200														
210														
220														
230														
240														
250														
260														
270														
280														
290														
300														

Top Widths (feet) and Depths with NO FREEBOARD

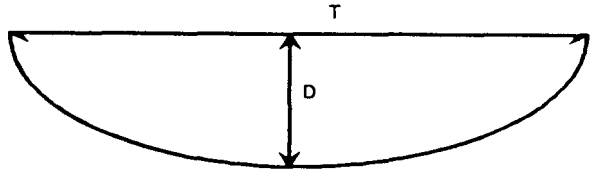
Q, cfs	Vel., fps	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00
	Depth, ft.	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.8
20		133	105	85	70	59	51	44	38	33	29	26		
30				128	104	89	76	66	57	50	44	39	34	30
40					139	118	101	88	76	66	59	52	45	40
50						148	127	110	95	83	74	65	57	50
60								131	114	100	88	78	68	60
70									133	116	103	91	79	70
80										133	118	104	91	80
90										149	132	117	102	90
100											147	130	113	100
110												143	125	110
120													136	120
130													147	130
140														140
150														150
160														
170														
180														
190														
200														
210														
220														
230														
240														
250														
260														
270														
280														
290														
300														

Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance. Depth (D) is based on capacity retardance. The "with FREEBOARD" chart includes 0.5 foot freeboard.

Parabolic Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E



Design Grade = 0.1 %

	Top Widths (feet) and Depths with NO FREEBOARD								
Vel., fps	0.5	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Depth, ft.	1.5	1.8	1.9	2.1	2.3	2.5	2.7	2.9	3.1
Q, cfs									
20	117	57	33						
30	175	86	50	33					
40		115	67	44	31				
50		143	83	55	39				
60			100	66	47	34			
70			117	77	55	40			
80			133	88	63	46	34		
90			150	99	71	51	38	30	
100				110	78	57	42	33	
110				121	86	63	46	36	30
120				132	94	68	51	40	33
130				143	102	74	55	43	36
140					110	80	59	47	38
150					118	86	64	50	41
160					125	92	68	53	44
170					133	97	72	57	47
180					141	103	76	60	50
190					149	109	81	63	52
200						114	85	67	55
210						120	89	70	58
220						126	93	74	61
230						132	98	77	64
240						137	102	80	66
250						143	106	84	69
260						149	111	87	72
270							115	90	75
280							119	94	77
290							123	97	80
300							128	100	83

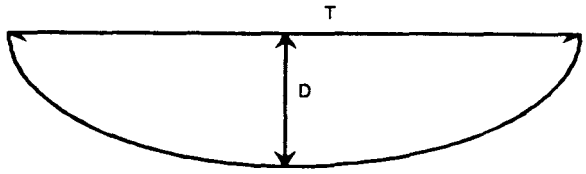
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

Parabolic Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E



Design Grade = 0.2 %

	Top Widths (feet) and Depths with NO FREEBOARD								
Vel., fps	0.5	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Depth, ft.		1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2
Q, cfs 20		83	49	32					
30		125	74	48	35				
40			99	65	46	35			
50			123	81	58	43	33		
60			148	97	70	52	40	31	
70				113	81	61	46	36	
80				129	93	69	53	41	33
90				145	104	78	60	46	37
100					116	87	67	51	41
110					128	95	73	57	45
120					139	104	80	62	49
130						113	86	67	53
140						121	93	72	58
150						130	100	77	62
160						139	106	82	66
170						147	113	87	70
180							120	93	74
190							126	98	78
200							133	103	82
210							140	108	86
220							146	113	90
230								118	94
240								123	99
250								129	103
260								134	107
270								139	111
280								144	115
290								149	119
300									123

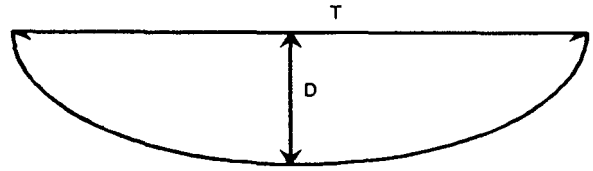
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

Parabolic Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E



Design Grade = 0.3 %

	Top Widths (feet) and Depths with NO FREEBOARD								
Vel., fps	0.5	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Depth, ft.		1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
Q, cfs									
20		102	62	41					
30			93	61	44	32			
40			124	82	58	43	34		
50				102	73	54	42	33	
60				123	87	65	51	40	32
70				143	102	75	59	47	37
80					116	86	68	54	43
90					131	97	76	60	48
100					145	108	84	67	54
110						118	93	73	59
120						129	101	80	64
130						140	110	87	70
140							118	94	75
150							127	100	80
160							135	107	86
170							143	114	91
180								120	96
190								127	102
200								134	107
210								140	112
220								147	118
230									123
240									128
250									134
260									139
270									144
280									150
290									
300									

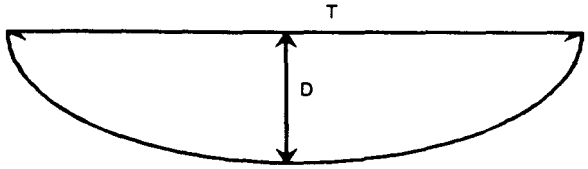
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

Parabolic Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E



Design Grade = 0.4 %

	Top Widths (feet) and Depths with NO FREEBOARD								
Vel., fps	0.5	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Depth, ft.		1.0	1.1	1.2	1.3	1.3	1.4	1.5	1.6
Q, cfs 20		117	73	48	34				
30			109	72	51	38	30		
40			146	96	68	51	40	32	
50				119	85	64	49	40	32
60				143	102	76	59	48	38
70					119	89	69	56	45
80					136	102	79	64	51
90						115	89	72	58
100						127	99	80	64
110						140	108	89	70
120							118	97	77
130							128	105	83
140							138	113	89
150							148	121	96
160								129	102
170								137	109
180								145	115
190									121
200									128
210									134
220									141
230									147
240									
250									
260									
270									
280									
290									
300									

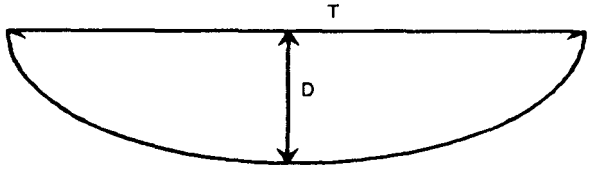
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

Parabolic Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E



Design Grade = 0.5 %

	Top Widths (feet) and Depths with NO FREEBOARD								
Vel., fps	0.5	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Depth, ft.		0.9	1.0	1.1	1.2	1.2	1.3	1.4	1.4
Q, cfs									
20		131	81	55	39				
30			122	82	59	43	34		
40				109	78	58	45	36	30
50				137	98	72	56	45	37
60					117	86	67	54	44
70					137	101	78	63	52
80						115	90	72	59
90						130	101	81	67
100						144	112	90	74
110							123	99	81
120							134	108	89
130							146	117	96
140								126	104
150								136	111
160								145	118
170									126
180									133
190									141
200									148
210									
220									
230									
240									
250									
260									
270									
280									
290									
300									

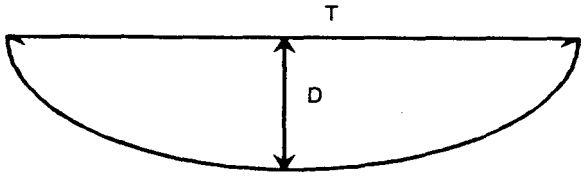
Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.

Parabolic Waterway Design Chart
Annually Vegetated

Capacity Retardance = C

Velocity Retardance = E

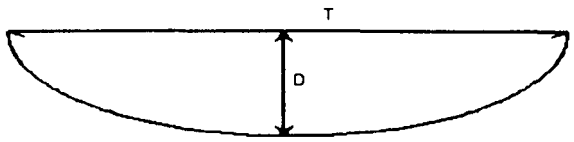


Design Grade = 0.6 %

	Top Widths (feet) and Depths with NO FREEBOARD								
Vel., fps	0.5	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50
Depth, ft.		0.8	1.0	1.0	1.1	1.1	1.2	1.3	1.3
Q, cfs									
20		145	90	60	44	32			
30			135	90	65	47	37	30	
40				121	87	63	50	39	33
50					109	79	62	49	41
60					131	95	75	59	49
70						110	87	69	58
80						126	99	79	66
90						142	112	89	74
100							124	99	82
110							137	108	90
120							149	118	99
130								128	107
140								138	115
150								148	123
160									131
170									140
180									148
190									
200									
210									
220									
230									
240									
250									
260									
270									
280									
290									
300									

Top Width (T) is based on capacity retardance, using the shape factor determined by the velocity retardance.

Depth (D) is based on capacity retardance. No freeboard has been added to the design depths.



Miscellaneous Parabolic Waterway Design Equations

Notes on Parabolic Waterway Charts

1. Velocity Retardance is used to determine parabolic shape factor.
2. Capacity Retardance is used to determine depth.
3. Depths shown in the table with FREEBOARD, shown on pages with "Parabolic Waterway Design Chart", include 0.5 foot freeboard.
4. Depths shown in the table with NO FREEBOARD, shown on pages with "Parabolic Waterway Design Chart", do not include any amount of freeboard.
5. Depths shown on pages with "Parabolic Waterway Design Chart - Annually Vegetated" do not include any amount of freeboard.

Variable Definitions

Q = flow rate (*cfs*)

V = velocity (*fps*)

A = area (ft^2)

S = waterway grade (*ft/ft*)

D = flow depth (*ft*)

T = top width (*ft*)

P = wetted perimeter (*ft*)

R = hydraulic radius (*ft*)

M = parabolic shape factor

n = Manning's coefficient of roughness

Equations

$$Q = \frac{1.486}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

$$Q = AV$$

$$A = \frac{2}{3} TD$$

$$T = \frac{3A}{2D}$$

$$P = T + \frac{8D^2}{3T}$$

$$M = \frac{4D}{T^2}$$

$$R = \frac{A}{P}$$

$$T = 2\sqrt{\frac{D}{M}}$$