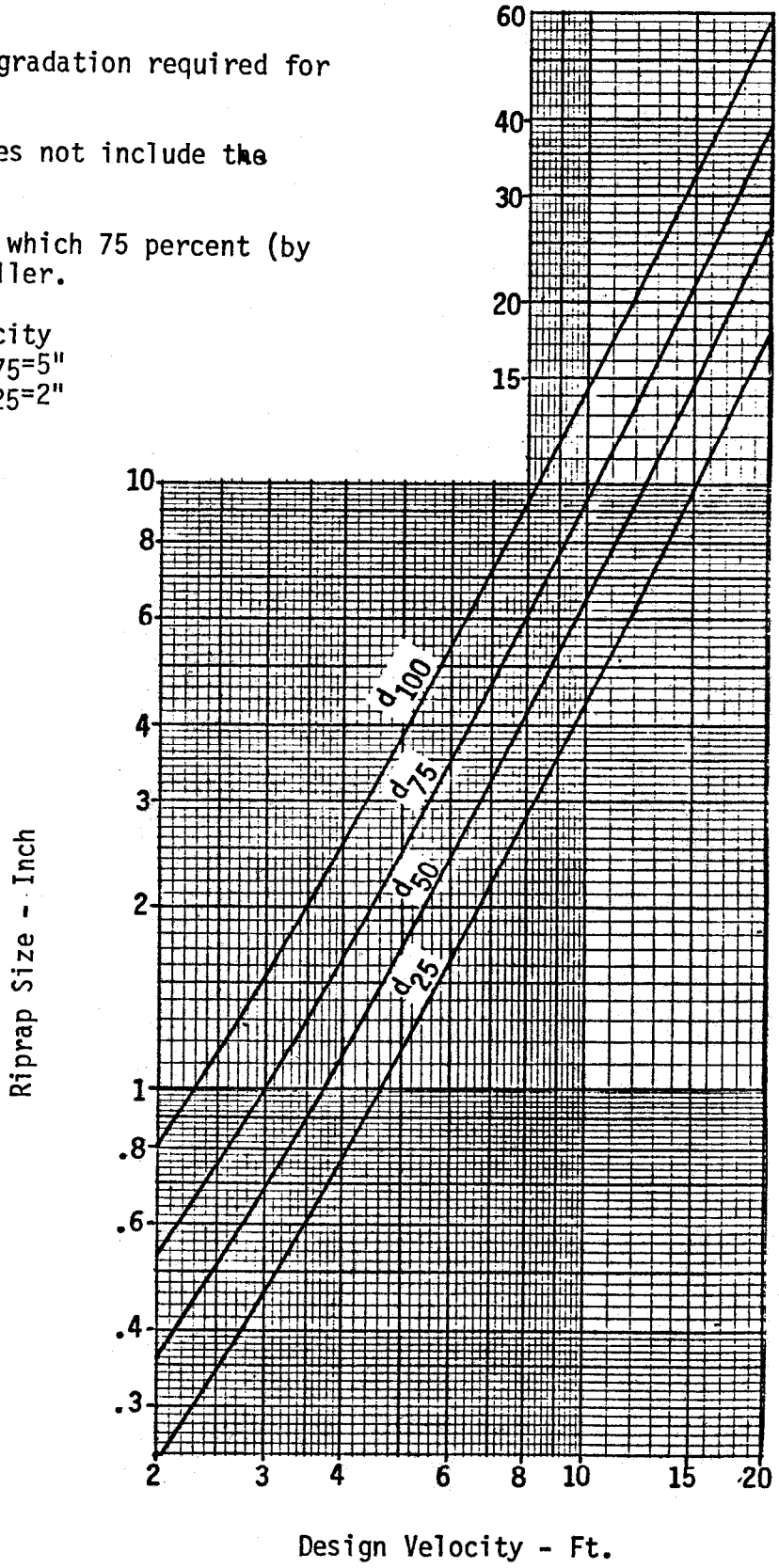
# Riprap Size For Channel Lining

Curves give average gradation required for design velocity.

Gradation percent does not include the bedding.

$d_{75}$ = Riprap size of which 75 percent (by weight) is smaller.

Example: 7 fps Velocity
$d_{100}$=7" $d_{75}$=5"
$d_{50}$ =3" $d_{25}$=2"



Use of Riprap Curves - MO-16-1

The curves on page MO-16-1 give the stable riprap gradation for any specific design velocity from 2 to 20 fps. The curves should be read to nearest full inch for stones of 3 inches or larger and to nearest ½ inch for stones under 3 inches.

Gradation limits should be set which would permit variation from the average sizes determined from the curves. The gradation limits are as follows:

| Curve | Percent Passing |
|---|---|
| $d_{100}$ | 90 - 100 |
| $d_{75}$ | 60 - 80 |
| $d_{50}$ | 35 - 55 |
| $d_{25}$ | 10 - 30 |

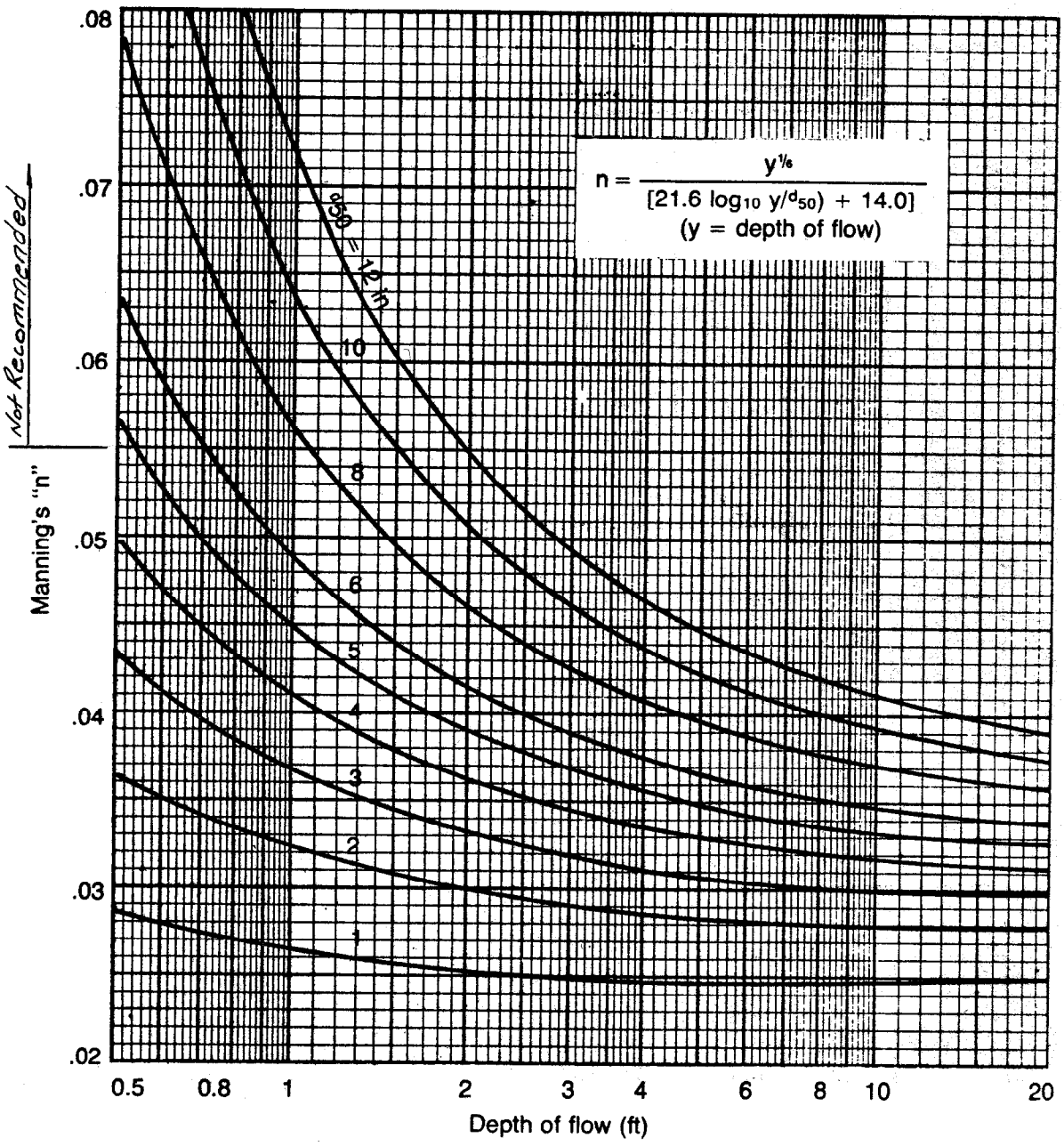
Two design approachs may be followed.

1. Only one gradation of riprap available: Determine the $d_{50}$ size of the material. Determine safe design velocity from MO-16-1. Design channel within this limit.

2. Several gradations of riprap available: Several trials will be needed for different $d_{50}$ sizes to determine the most economical design.

MO-16-3

VALUES OF MANNING'S "n"
FOR
RIPRAP-LINED CHANNELS




$d_{50}$ = Riprap size of which 50 percent by weight is smaller.

# Riprap Lined Channel

| Bottom Width Ft | $d_{50}$ = 2" v = 5.4 | | $d_{50}$ = 3" v = 6.1 | | $d_{50}$ = 4" v = 6.7 | | $d_{50}$ = 5" v = 7.8 | | $d_{50}$ = 6" v = 8.7 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Q | D | Q | D | Q | D | Q | D | Q | D |
| Grade = 2% | | | | | | | | | | |
| 2 | 29 | 1.23 | 59 | 1.75 | 100 | 2.27 | 198 | 3.09 | | |
| 3 | 32 | 1.14 | 63 | 1.65 | 104 | 2.14 | 203 | 2.93 | | |
| 4 | 36 | 1.08 | 67 | 1.55 | 109 | 2.03 | | | | |
| 5 | 39 | 1.03 | 72 | 1.48 | 115 | 1.94 | | | | |
| 6 | 43 | 1.00 | 78 | 1.44 | 122 | 1.87 | | | | |
| 8 | 51 | 0.96 | 89 | 1.36 | 138 | 1.78 | | | | |
| 10 | 60 | 0.93 | 100 | 1.31 | 154 | 1.71 | | | | |
| 12 | 68 | 0.91 | 113 | 1.27 | 170 | 1.66 | | | | |
| Grade = 3% | | | | | | | | | | |
| 2 | 19 | 0.91 | 37 | 1.31 | 62 | 1.71 | 122 | 2.33 | 201 | 2.93 |
| 3 | 22 | 0.85 | 41 | 1.23 | 67 | 1.61 | 126 | 2.19 | 206 | 2.77 |
| 4 | 24 | 0.80 | 45 | 1.16 | 71 | 1.51 | 133 | 2.08 | | |
| 5 | 27 | 0.77 | 49 | 1.11 | 77 | 1.45 | 140 | 1.99 | | |
| 6 | 30 | 0.75 | 53 | 1.07 | 83 | 1.40 | 151 | 1.94 | | |
| 8 | 37 | 0.73 | 63 | 1.03 | 97 | 1.34 | 167 | 1.84 | | |
| 10 | 44 | 0.71 | 73 | 1.00 | 109 | 1.29 | 186 | 1.76 | | |
| 12 | 50 | 0.69 | 83 | 0.97 | 123 | 1.26 | 205 | 1.70 | | |
| Grade = 4% | | | | | | | | | | |
| 2 | 14 | 0.74 | 27 | 1.07 | 45 | 1.39 | 88 | 1.91 | 142 | 2.40 |
| 3 | 16 | 0.69 | 30 | 1.00 | 49 | 1.31 | 93 | 1.80 | 150 | 2.27 |
| 4 | 19 | 0.66 | 34 | 0.95 | 54 | 1.23 | 98 | 1.70 | 158 | 2.17 |
| 5 | 21 | 0.63 | 38 | 0.91 | 58 | 1.18 | 106 | 1.63 | 166 | 2.09 |
| 6 | 24 | 0.61 | 42 | 0.88 | 64 | 1.15 | 113 | 1.58 | 175 | 2.00 |
| 8 | 29 | 0.59 | 50 | 0.85 | 76 | 1.11 | 130 | 1.51 | 196 | 1.91 |
| 10 | 35 | 0.58 | 59 | 0.83 | 88 | 1.07 | 145 | 1.44 | 221 | 1.85 |
| 12 | 40 | 0.57 | 68 | 0.81 | 98 | 1.04 | 162 | 1.40 | | |

$d_{50}$ = Riprap size of which 50 percent by weight is smaller.

Trapezoidal Cross Section
2:1 Side Slopes

"D" = Depth flow in feet
"Q" = Capacity in cfs
"v" = Velocity in fps

# Riprap Lined Channel

| Bottom Width Ft | $d_{50}$ = 3" v = 6.1 | | $d_{50}$ = 4" v = 6.7 | | $d_{50}$ = 5" v = 7.8 | | $d_{50}$ = 6" v = 8.7 | | $d_{50}$ = 7" v = 9.5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Q | D | Q | D | Q | D | Q | D | Q | D |
| Grade = 5% | | | | | | | | | | |
| 2 | 22 | 0.92 | 35 | 1.19 | 68 | 1.64 | 110 | 2.06 | 165 | 2.49 |
| 3 | 24 | 0.85 | 39 | 1.12 | 74 | 1.54 | 117 | 1.95 | 175 | 2.37 |
| 4 | 27 | 0.81 | 44 | 1.06 | 79 | 1.46 | 125 | 1.86 | 183 | 2.25 |
| 5 | 31 | 0.78 | 48 | 1.02 | 86 | 1.40 | 134 | 1.78 | 193 | 2.17 |
| 6 | 35 | 0.76 | 53 | 0.99 | 92 | 1.36 | 142 | 1.72 | 204 | 2.10 |
| 8 | 43 | 0.74 | 63 | 0.95 | 106 | 1.29 | 161 | 1.64 | | |
| 10 | 50 | 0.72 | 74 | 0.93 | 122 | 1.25 | 183 | 1.59 | | |
| 12 | 58 | 0.70 | 83 | 0.90 | 138 | 1.22 | 203 | 1.54 | | |
| Grade = 6% | | | | | | | | | | |
| 2 | 18 | 0.81 | 29 | 1.06 | 55 | 1.45 | 89 | 1.82 | 135 | 2.21 |
| 3 | 20 | 0.75 | 33 | 0.99 | 61 | 1.36 | 98 | 1.72 | 147 | 2.09 |
| 4 | 24 | 0.72 | 37 | 0.93 | 66 | 1.28 | 104 | 1.64 | 151 | 1.98 |
| 5 | 27 | 0.69 | 41 | 0.90 | 73 | 1.24 | 113 | 1.57 | 161 | 1.92 |
| 6 | 30 | 0.67 | 46 | 0.88 | 79 | 1.20 | 120 | 1.52 | 173 | 1.86 |
| 8 | 37 | 0.65 | 55 | 0.85 | 92 | 1.15 | 140 | 1.46 | 196 | 1.78 |
| 10 | 44 | 0.64 | 65 | 0.83 | 107 | 1.12 | 158 | 1.41 | 220 | 1.72 |
| 12 | 51 | 0.63 | 74 | 0.81 | 121 | 1.09 | 175 | 1.36 | | |
| Grade = 7% | | | | | | | | | | |
| 2 | 15 | 0.73 | 25 | 0.95 | 47 | 1.31 | 76 | 1.65 | 114 | 2.00 |
| 3 | 18 | 0.68 | 28 | 0.89 | 52 | 1.22 | 84 | 1.56 | 121 | 1.89 |
| 4 | 21 | 0.65 | 32 | 0.85 | 58 | 1.16 | 90 | 1.48 | 130 | 1.79 |
| 5 | 24 | 0.63 | 36 | 0.82 | 64 | 1.12 | 98 | 1.42 | 140 | 1.74 |
| 6 | 27 | 0.61 | 41 | 0.80 | 69 | 1.08 | 105 | 1.37 | 150 | 1.68 |
| 8 | 34 | 0.60 | 50 | 0.78 | 83 | 1.05 | 122 | 1.32 | 172 | 1.61 |
| 10 | 40 | 0.59 | 59 | 0.76 | 96 | 1.02 | 140 | 1.27 | 190 | 1.54 |
| 12 | 47 | 0.58 | 66 | 0.74 | 107 | 0.99 | 156 | 1.24 | 212 | 1.50 |

$d_{50}$ = Riprap size of which 50 percent by weight is smaller.

Trapezoidal Cross Section
2:1 Side Slopes

"D" = Depth flow in feet
"Q" = Capacity in cfs
"v" = Velocity in fps

# Riprap Lined Channel

| Bottom Width Ft | $d_{50}$ = 4" v = 6.7 | | $d_{50}$ = 5" v = 7.8 | | $d_{50}$ = 6" v = 8.7 | | $d_{50}$ = 7" v = 9.5 | | $d_{50}$ = 8" v = 10.4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Q | D | Q | D | Q | D | Q | D | Q | D |
| Grade = 8% | | | | | | | | | | |
| 2 | 22 | 0.88 | 41 | 1.20 | 63 | 1.51 | 99 | 1.83 | | |
| 3 | 26 | 0.82 | 47 | 1.13 | 73 | 1.43 | 106 | 1.74 | | |
| 4 | 29 | 0.78 | 51 | 1.06 | 80 | 1.36 | 115 | 1.65 | | |
| 5 | 33 | 0.76 | 57 | 1.03 | 87 | 1.30 | 123 | 1.59 | | |
| 6 | 37 | 0.74 | 63 | 1.00 | 94 | 1.26 | 133 | 1.54 | | |
| 8 | 46 | 0.72 | 75 | 0.97 | 110 | 1.21 | 155 | 1.48 | | |
| 10 | 53 | 0.70 | 88 | 0.94 | 127 | 1.17 | 172 | 1.42 | | |
| 12 | 61 | 0.68 | 99 | 0.92 | 142 | 1.14 | 193 | 1.37 | | |
| Grade = 10% | | | | | | | | | | |
| 2 | 18 | 0.76 | 33 | 1.04 | 53 | 1.31 | 77 | 1.57 | 114 | 1.90 |
| 3 | 21 | 0.71 | 38 | 0.98 | 59 | 1.23 | 85 | 1.50 | 121 | 1.79 |
| 4 | 24 | 0.69 | 42 | 0.93 | 65 | 1.17 | 93 | 1.42 | 131 | 1.71 |
| 5 | 28 | 0.67 | 48 | 0.90 | 72 | 1.13 | 102 | 1.37 | 141 | 1.65 |
| 6 | 32 | 0.65 | 54 | 0.88 | 77 | 1.08 | 109 | 1.33 | 154 | 1.61 |
| 8 | 39 | 0.63 | 64 | 0.85 | 95 | 1.06 | 128 | 1.27 | 177 | 1.54 |
| 10 | 47 | 0.62 | 76 | 0.83 | 108 | 1.03 | 144 | 1.22 | 197 | 1.47 |
| 12 | 54 | 0.61 | 86 | 0.81 | 121 | 1.00 | 164 | 1.20 | 222 | 1.44 |
| Grade = 12% | | | | | | | | | | |
| 2 | 15 | 0.68 | 28 | 0.93 | 44 | 1.17 | 65 | 1.41 | 95 | 1.70 |
| 3 | 18 | 0.64 | 32 | 0.87 | 50 | 1.10 | 71 | 1.33 | 102 | 1.60 |
| 4 | 20 | 0.61 | 37 | 0.83 | 55 | 1.04 | 78 | 1.26 | 112 | 1.53 |
| 5 | 25 | 0.60 | 41 | 0.80 | 62 | 1.01 | 87 | 1.22 | 120 | 1.47 |
| 6 | 28 | 0.58 | 46 | 0.78 | 68 | 0.98 | 95 | 1.18 | 132 | 1.43 |
| 8 | 35 | 0.57 | 56 | 0.76 | 82 | 0.95 | 113 | 1.15 | 152 | 1.37 |
| 10 | 42 | 0.56 | 67 | 0.74 | 96 | 0.93 | 128 | 1.11 | 172 | 1.32 |
| 12 | 48 | 0.55 | 77 | 0.73 | 108 | 0.91 | 146 | 1.08 | 195 | 1.29 |

$d_{50}$ = Riprap size of which 50 percent by weight is smaller.

Trapezoidal Cross Section
2:1 Side Slopes

"D" = Depth flow in feet
"Q" = Capacity in cfs
"v" = Velocity in fps

# Riprap Lined Channel

| Bottom Width Ft | $d_{50}$ = 4" v = 6.7 | | $d_{50}$ = 5" v = 7.8 | | $d_{50}$ = 6" v = 8.7 | | $d_{50}$ = 7" v = 9.5 | | $d_{50}$ = 8" v = 10.4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Q | D | Q | D | Q | D | Q | D | Q | D |
| Grade = 14% | | | | | | | | | | |
| 2 | 13 | 0.62 | 24 | 0.84 | 38 | 1.07 | 56 | 1.28 | 81 | 1.54 |
| 3 | 16 | 0.58 | 28 | 0.79 | 43 | 1.00 | 62 | 1.21 | 89 | 1.45 |
| 4 | 18 | 0.56 | 32 | 0.75 | 49 | 0.95 | 69 | 1.15 | 97 | 1.38 |
| 5 | 22 | 0.55 | 36 | 0.73 | 55 | 0.92 | 77 | 1.12 | 106 | 1.34 |
| 6 | 26 | 0.54 | 42 | 0.72 | 61 | 0.90 | 85 | 1.08 | 117 | 1.30 |
| 8 | 31 | 0.52 | 51 | 0.70 | 74 | 0.87 | 101 | 1.05 | 136 | 1.25 |
| 10 | 37 | 0.51 | 61 | 0.68 | 87 | 0.85 | 116 | 1.02 | 157 | 1.21 |
| 12 | 44 | 0.50 | 70 | 0.67 | 98 | 0.83 | 131 | 0.99 | 176 | 1.18 |
| Grade = 16% | | | | | | | | | | |
| 2 | | | 22 | 0.78 | 34 | 0.98 | 49 | 1.18 | 72 | 1.42 |
| 3 | | | 26 | 0.73 | 39 | 0.92 | 56 | 1.12 | 79 | 1.34 |
| 4 | | | 29 | 0.70 | 44 | 0.88 | 63 | 1.07 | 88 | 1.28 |
| 5 | | | 34 | 0.68 | 50 | 0.86 | 70 | 1.03 | 97 | 1.24 |
| 6 | | | 38 | 0.67 | 56 | 0.84 | 76 | 1.00 | 105 | 1.20 |
| 8 | | | 47 | 0.65 | 68 | 0.81 | 92 | 0.97 | 124 | 1.16 |
| 10 | | | 56 | 0.64 | 80 | 0.79 | 106 | 0.94 | 143 | 1.12 |
| 12 | | | 65 | 0.63 | 91 | 0.78 | 121 | 0.92 | 162 | 1.10 |
| Grade = 20% | | | | | | | | | | |
| 2 | | | 18 | 0.68 | 28 | 0.86 | 40 | 1.04 | 58 | 1.24 |
| 3 | | | 21 | 0.64 | 33 | 0.81 | 46 | 0.98 | 65 | 1.17 |
| 4 | | | 25 | 0.62 | 38 | 0.78 | 53 | 0.94 | 73 | 1.12 |
| 5 | | | 29 | 0.60 | 43 | 0.76 | 59 | 0.91 | 81 | 1.08 |
| 6 | | | 33 | 0.59 | 48 | 0.74 | 66 | 0.89 | 90 | 1.06 |
| 8 | | | 41 | 0.58 | 59 | 0.72 | 80 | 0.86 | 107 | 1.02 |
| 10 | | | 50 | 0.57 | 71 | 0.71 | 93 | 0.84 | 124 | 0.99 |
| 12 | | | 57 | 0.56 | 80 | 0.69 | 106 | 0.82 | 143 | 0.98 |

$d_{50}$ = Riprap size of which 50 percent by weight is smaller.

Trapezoidal Cross Section
2:1 Side Slopes

"D" = Depth flow in feet
"Q" = Capacity in cfs
"v" = Velocity in fps

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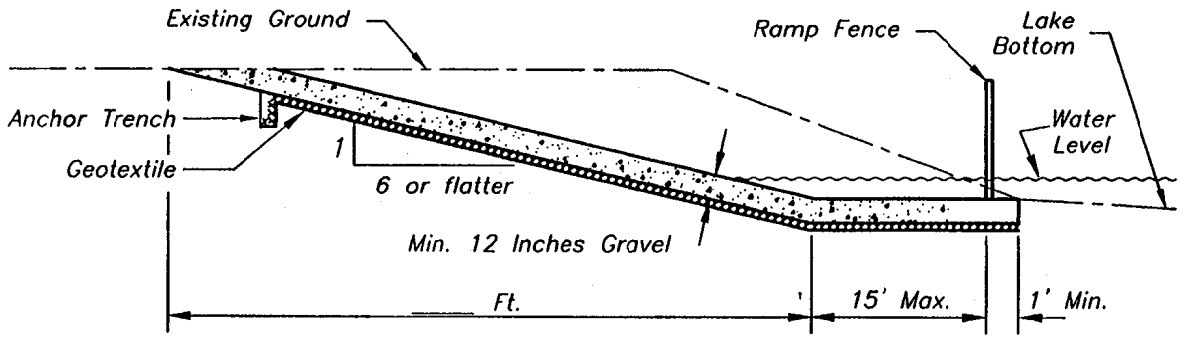
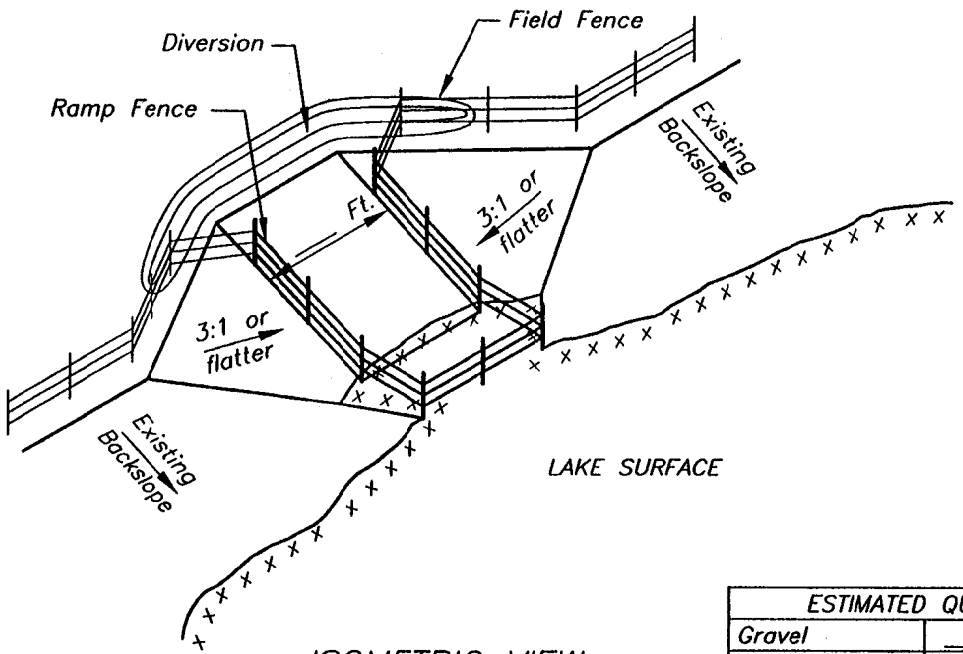



## TYPICAL CROSS SECTION




## ISOMETRIC VIEW

| ESTIMATED QUANTITIES | |
|---|---|
| Gravel | ____ Cu. Yds. |
| Geotextile | ____ Sq. Yds. |
| Excavation | ____ Cu. Yds. |
| Ramp Fencing | ____ Feet |
| Seeding | ____ Acres |

*Notes:*

1. Field Fence to be installed.
2. Ramp Fence shall be constructed of Cattle Panels as shown on sheet 2.
3. Gravel shall be rock with $D_{50}$ size ranging from 2 to 4 inches and maximum size of 6 inches. Surface to be covered with fine gravel or limestone dust to prevent injury to livestock.
4. Completed gravel placement to be compacted with construction equipment.
5. All disturbed areas not covered by gravel shall be seeded in accordance with JS-Agron-25 or equivalent.
6. Gravel shall extend a minimum of 1 foot outside fence on each side.
7. Width shall be as shown (16 ft. min., 32 ft. max.).
8. Excavated material shall be removed from site or placed at least 12 feet from top edge of back slope and spread so that its height does not exceed 2 feet. It shall have a free draining surface and side slopes shall be 3:1 or flatter.
9. Ramp shall extend to 2 to 3 feet below normal low water level or 1 foot below low water level in lake. Overexcavate to accomodate gravel thickness. Maximum depth of water shall not exceed 30 inches to prevent injury to livestock.
10. Geotextile fabric shall be non-woven, needle punched with minimum weight of 9 ounces per square yard. Geotextile shall be anchored in a trench at top of ramp slope. Trench shall be 12 inches deep and be backfilled with compacted soil. Splices in geotextile shall be made by overlapping 18 inches and securely pinning to ground.
11. To prevent damage from sunlight, all geotextile fabric laid out shall be covered with gravel the same day.

*Landowner:*

LAKESHORE WATERING ACCESS

COUNTY, MISSOURI

**U.S. DEPARTMENT OF AGRICULTURE**
**NATURAL RESOURCES CONSERVATION SERVICE**

| Designed Date | Approved by Date |
|---|---|
| Drawn | Title |
| Traced | Title |
| Checked | Sheet No. of — Drawing No. 29-L-80A |

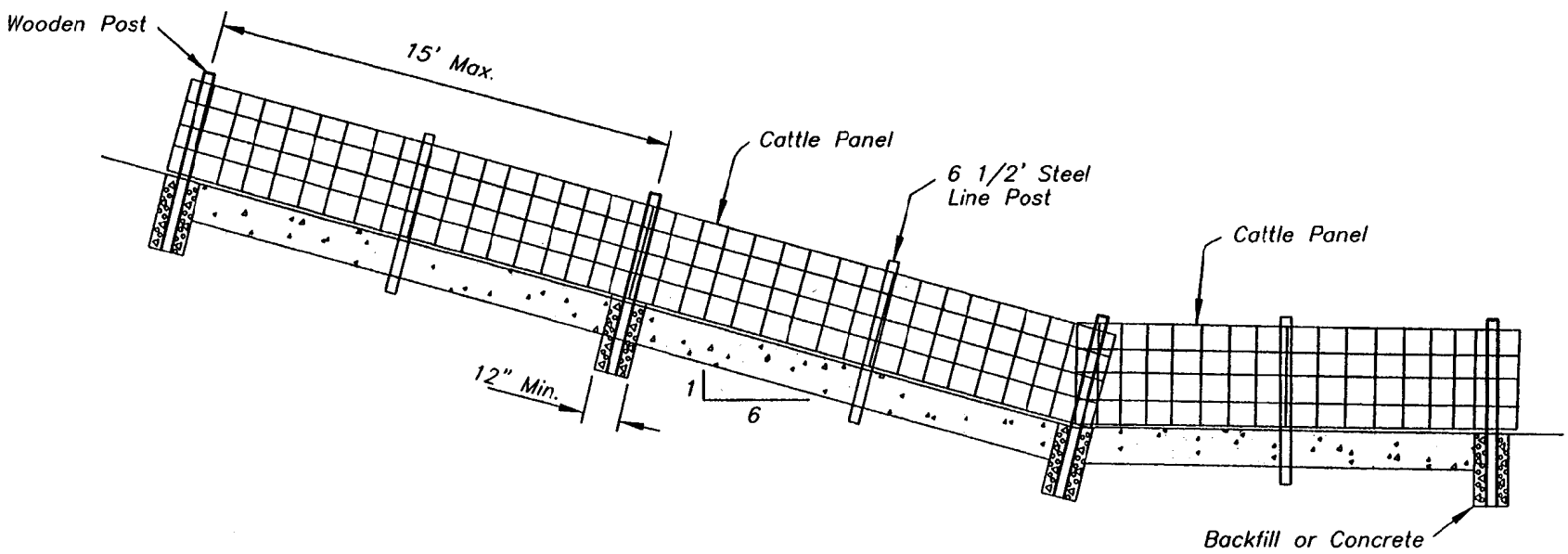
Adapted from Wisconsin Standard Drawing WI-407B

Sheet 1 of 2

04/00

May 2000

MO-16-9




## RAMP FENCE

NOTES:

a. Cattle panels shall be tied loosely to each post with loops of No. 9 Galvanized smooth wire near top, center and bottom of cattle panel. At wooden posts the loops shall be stapled to prevent loop from sliding down post.

b. Several feet may need to be cut off panel at bends to obtain proper fit.

c. Cattle panels shall be 1/4" diameter galvanized steel rods welded together to form a wire mesh panel 52 inches high by 16 feet long. Maximum spacing of rods shall be 6 inches vertical and 8 inches horizontal.

d. Wooden post shall be pressure treated with 0.4 pounds per cubic foot of Copper Chromate Arsenate (CCA) or equivalent. Post shall be minimum 6 inch diameter, 8 foot long. Post hole shall be minimum 42 inch deep and of sufficient width to provide 3 inch clearance all around post. Backfill shall be placed in 4 inch lifts and be well tamped. Backfill with fine angular gravel well tamped or concrete is permitted.

e. Post to be spaced as needed. Maximum 15 feet spacing on wooden post.

Landowner:

LAKESHORE WATERING ACCESS

COUNTY, MISSOURI

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

| Designed Date | Approved by Date |
|---|---|
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| Traced | Sheet No. of / Drawing 29L-80A |
| Checked | |

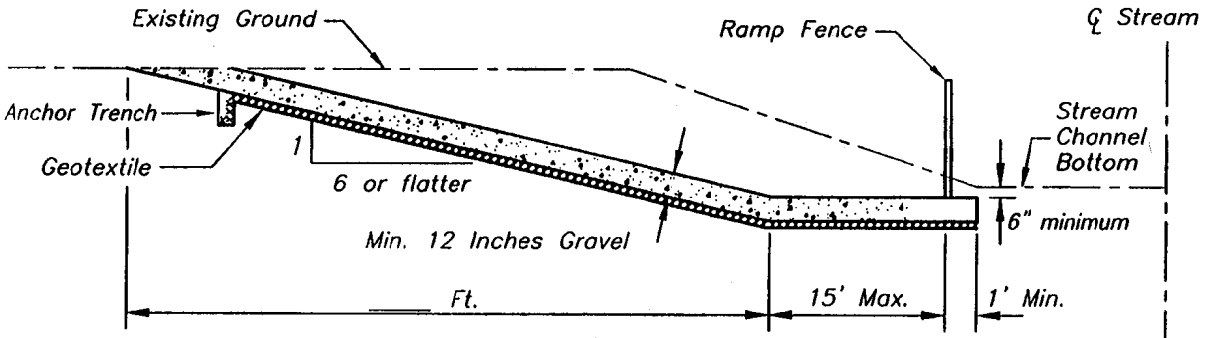


04/00

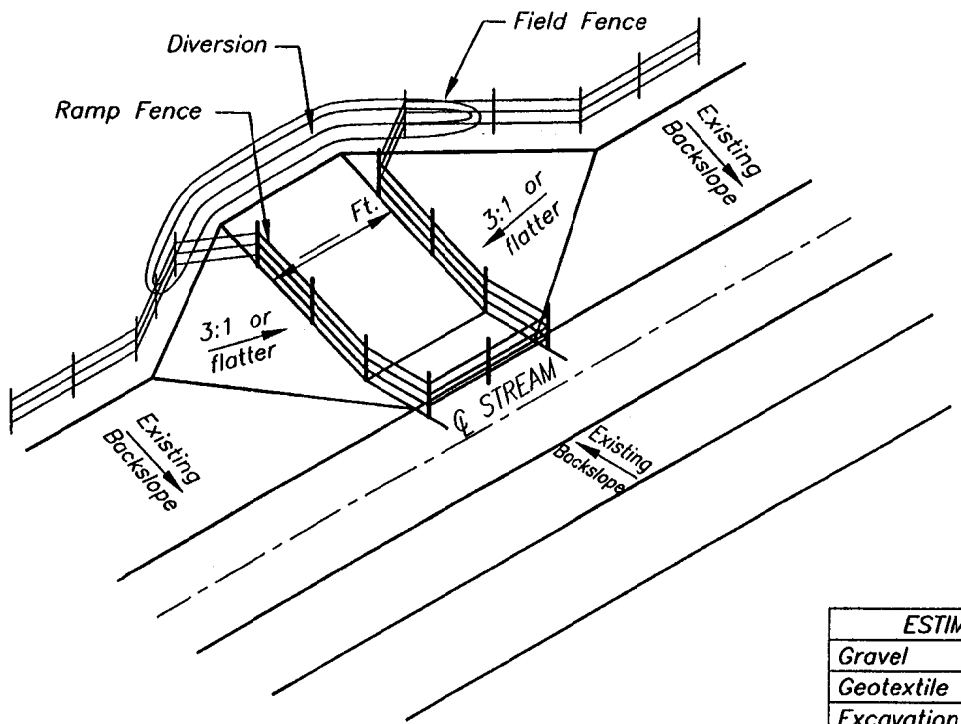
EFH Notice MO-26 May 2000

FILE: ____ Cooperator's Folder ____ Contractor ____ Landowner ____ Supplier 29L80B

MO-16-11




TYPICAL CROSS SECTION




ISOMETRIC VIEW

CAUTION: This detail should not be used on streams that do not have a reliable source of water.

Notes:

1. Field Fence to be installed by others.
2. Ramp Fence shall be constructed of Cattle Panels as shown on sheet 2.
3. Gravel shall be rock with $D_{50}$ size ranging from 2 to 4 inches and maximum size of 6 inches. Surface to be covered with fine gravel or limestone dust to prevent injury to livestock.
4. Completed gravel placement to be compacted with construction equipment.
5. All disturbed areas not covered by gravel shall be seeded in accordance with JS-Agron-25 or equivalent.
6. Gravel shall extend a minimum of 1 foot outside fence on each side.
7. Width shall be as shown (16 ft. min., 32 ft. max.).
8. Excavated material shall be removed from site or placed at least 12 feet from top edge of back slope and spread so that its height does not exceed 2 feet. It shall have a free draining surface and side slopes shall be 3:1 or flatter.
9. Ramp shall extend to 6 inches below channel bottom unless otherwise approved by engineer. Overexcavate to accomodate gravel thickness.
10. Geotextile fabric shall be non-woven, needle punched with minimum weight of 9 ounces per square yard. Geotextile shall be anchored in a trench at top of ramp slope. Trench shall be 12 inches deep and be backfilled with compacted soil. Splices in geotextile shall be made by overlapping 18 inches and securely pinning to ground.
11. To prevent damage from sunlight all geotextile fabric shall be covered with gravel the same day.

| ESTIMATED QUANTITIES | |
|---|---|
| Gravel | ____ Cu. Yds. |
| Geotextile | ____ Sq. Yds. |
| Excavation | ____ Cu. Yds. |
| Ramp Fencing | ____ Feet |
| Seeding | ____ Acres |

Landowner:

STREAMBANK WATERING ACCESS

COUNTY, MISSOURI

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

| | Date | | Date |
|---|---|---|---|
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| Checked | | Sheet No. ____ of | Drawing No. 29-L-80B |

Adapted from Wisconsin Standard Drawing WI-407B

Sheet 1 of 2

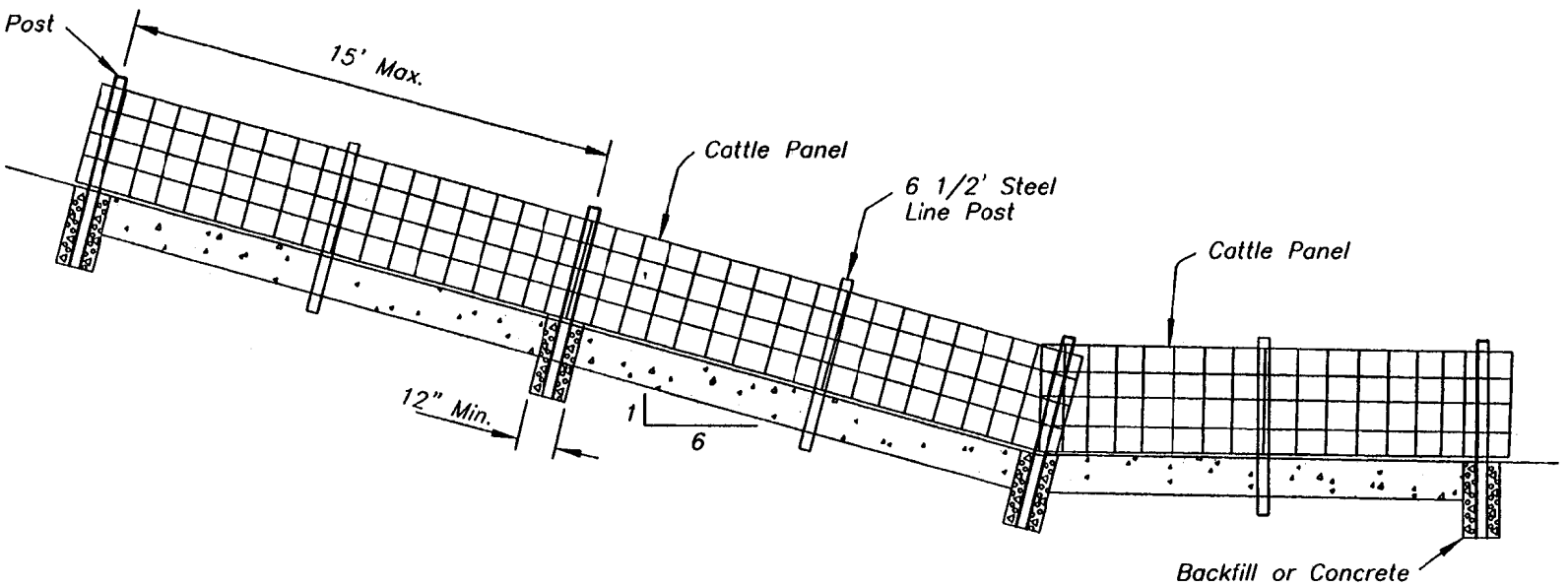
04/00

EFH Notice MO-26

May 2000

FILE: ____ Cooperator's Folder ____ Contractor ____ Landowner ____ Supplier 29L808

MO-16-12




## RAMP FENCE

NOTES:

a. Cattle panels shall be tied loosely to each post with loops of No. 9 Galvanized smooth wire near top, center and bottom of cattle panel. At wooden posts the loops shall be stapled to prevent loop from sliding down post.

b. Several feet may need to be cut off panel at bends to obtain proper fit.

c. Cattle panels shall be 1/4" diameter galvanized steel rods welded together to form a wire mesh panel 52 inches high by 16 feet long. Maximum spacing of rods shall be 6 inches vertical and 8 inches horizontal.

d. Wooden post shall be pressure treated with 0.4 pounds per cubic foot of Copper Chromate Arsenate (CCA) or equivalent. Post shall be minimum 6 inch diameter, 8 foot long. Post hole shall be minimum 42 inch deep and of sufficient width to provide 3 inch clearance all around post. Backfill shall be placed in 4 inch lifts and be well tamped. Backfill with fine angular gravel well tamped or concrete is permitted.

e. Post to be spaced as needed. Maximum 15 feet spacing on wooden post.

Landowner:

STREAMBANK WATERING ACCESS

COUNTY, MISSOURI

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

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Sheet 2 of 2

04/00

FILE: ____ Cooperator's Folder ____ Contractor ____ Landowner ____ Supplier 29L81

LIST OF MATERIALS

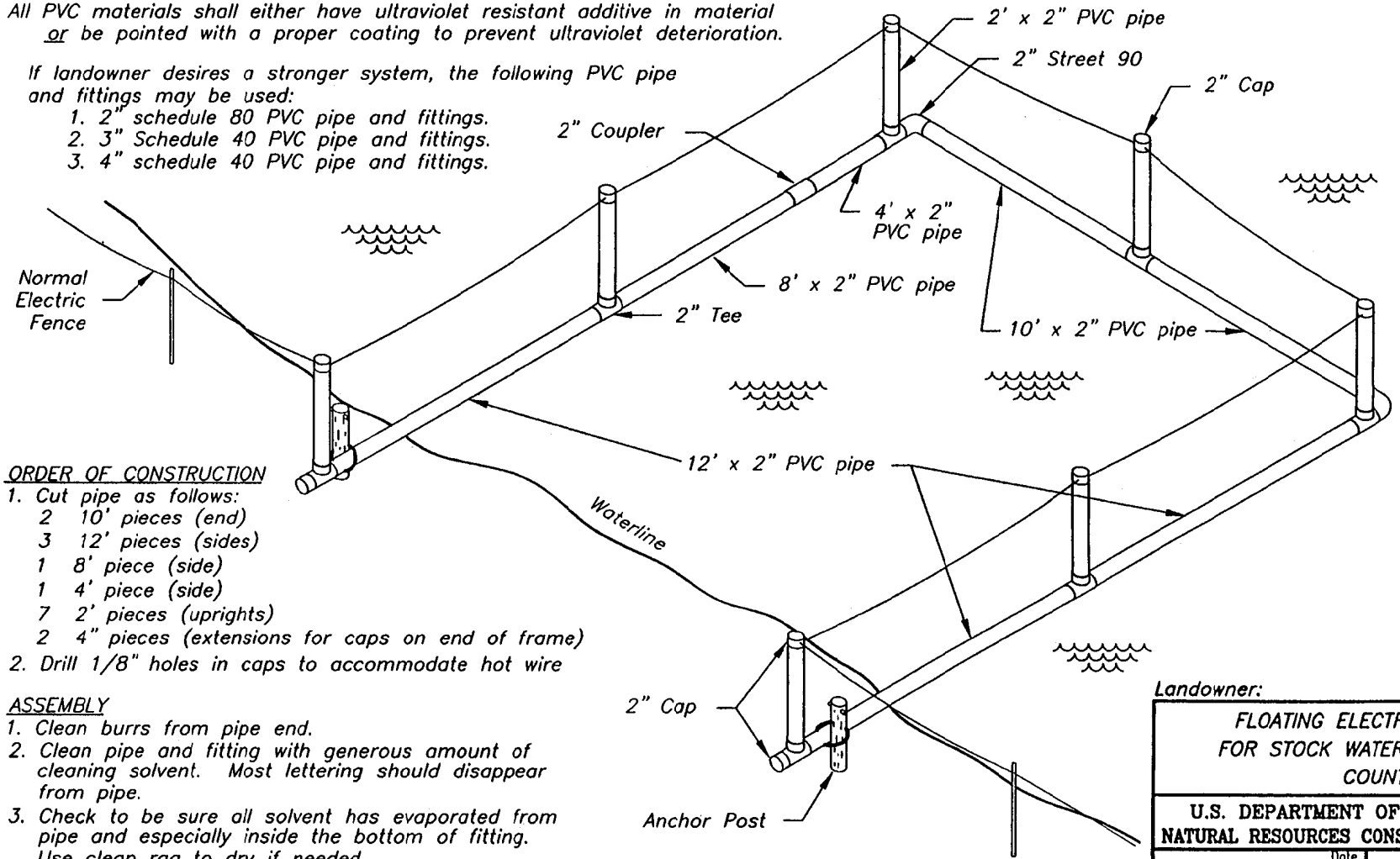
4 20' Sections of Schedule 40 PVC pipe
1 3' Section of Schedule 40 PVC pipe
2 2" 90° Street Elbow, Schedule 40, pressure type recommended
7 2" Tees, Schedule 40, pressure type recommended
9 2" Caps
1 2" Coupler
PVC Cleaner and PVC Cement
2 Anchor posts
Wire loops or light chain fabricated to easily slide up and down anchor post

All PVC materials shall either have ultraviolet resistant additive in material or be pointed with a proper coating to prevent ultraviolet deterioration.

If landowner desires a stronger system, the following PVC pipe and fittings may be used:
1. 2" schedule 80 PVC pipe and fittings.
2. 3" Schedule 40 PVC pipe and fittings.
3. 4" schedule 40 PVC pipe and fittings.

ANCHOR DETAIL

1. Anchor post may be wood or steel firmly anchored a minimum of 2' into the ground with 1' protruding above ground.
2. Attach bolt or steel rod to top of anchor post to prevent anchor loop from coming off anchor post.
3. Anchor loops shall be fabricated from #9 galvanized smooth wire or #1 Twin Loop pet chain fastened with bolts, nuts and washers.




ORDER OF CONSTRUCTION

1. Cut pipe as follows:
   - 2 10' pieces (end)
   - 3 12' pieces (sides)
   - 1 8' piece (side)
   - 1 4' piece (side)
   - 7 2' pieces (uprights)
   - 2 4" pieces (extensions for caps on end of frame)
2. Drill 1/8" holes in caps to accommodate hot wire

ASSEMBLY

1. Clean burrs from pipe end.
2. Clean pipe and fitting with generous amount of cleaning solvent. Most lettering should disappear from pipe.
3. Check to be sure all solvent has evaporated from pipe and especially inside the bottom of fitting. Use clean rag to dry if needed.
4. Apply generous amount of cement to pipe and fitting.
5. Join pieces, twisting slightly to desired position, hold together a few seconds.

Not to Scale

04/00

Landowner:

FLOATING ELECTRIC FENCE
FOR STOCK WATERING PONDS
COUNTY, MISSOURI

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

| Designed Date | Approved by Date |
|---|---|
| Drawn | Title |
| Traced | Title |
| Checked | Sheet No. of / Drawing No. 29-L-81 |