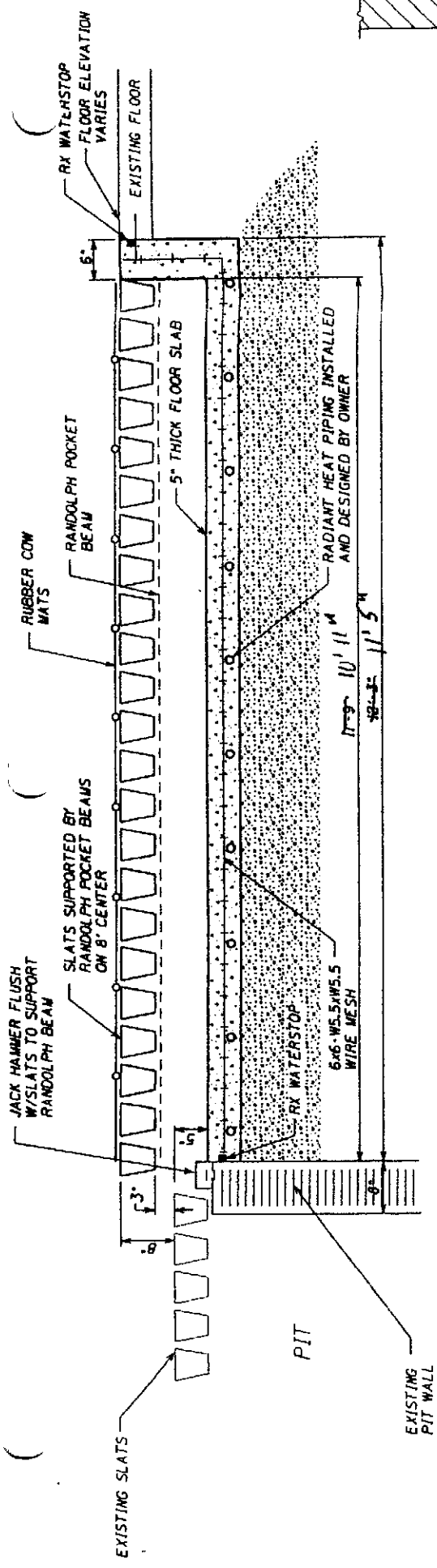
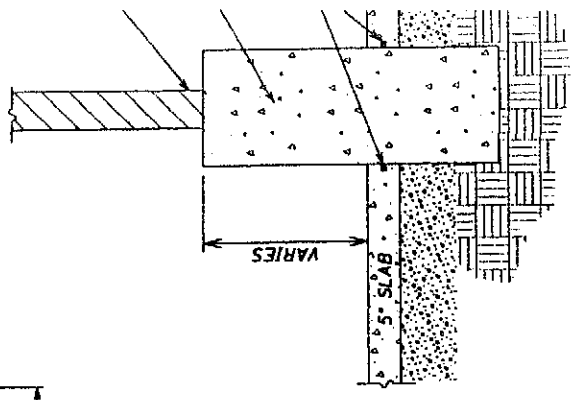


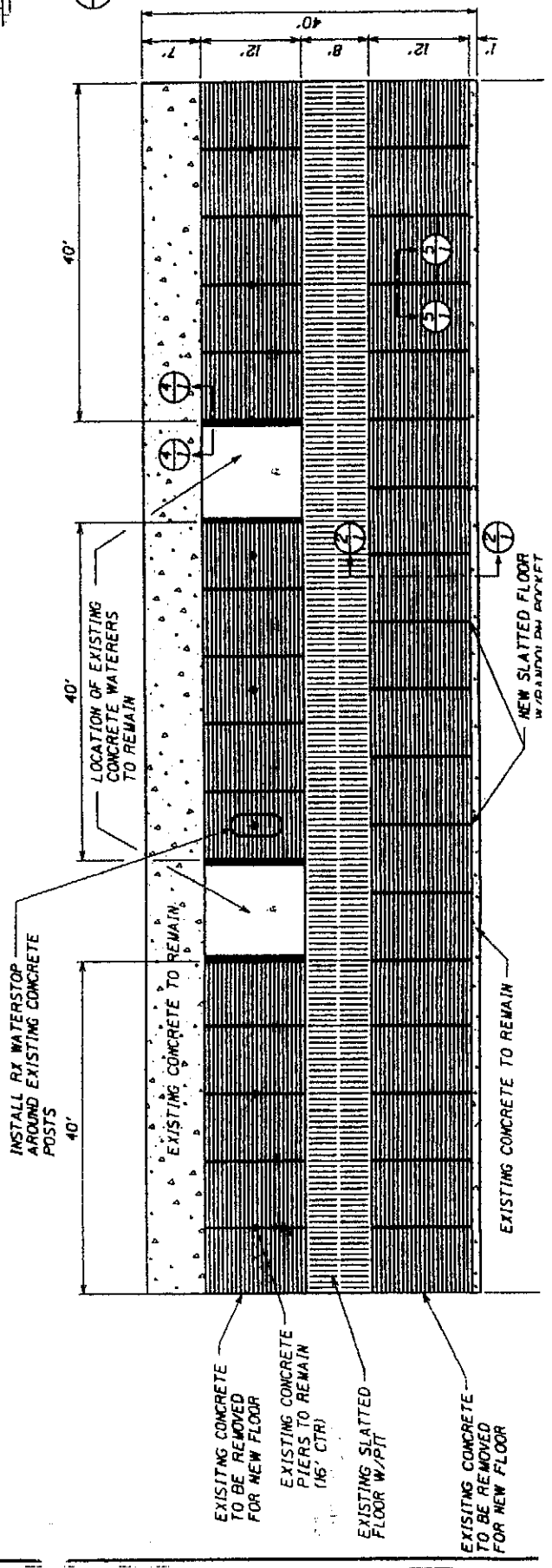
## ENGINEERING DESIGNS



2 PROPOSED SLATTED FLOOR (BARN #2)  
2 NO SCALE



3 SUPPORT POST  
2 NO SCALE



# AERIAL SIT

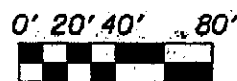
BARN #1 (164'x50')  
MANURE STORAGE PIT  
164'x12'x6' = 11,808 FT<sup>3</sup> (88,300 GAL)

BARN #2 (164'x50')  
MANURE STORAGE PIT  
164'x12'x6' = 11,808 FT<sup>3</sup> (88,300 GAL)

MACHINE  
SHED

SHOP  
AREA

FUEL  
BARRELS



McCONNELL

MAP

FEED  
STORAGE

SILO SILO SILO  
BARN #3 (112'x50')  
MANURE STORAGE PITS-  
36'x64'x8' • 36'x30'x8'  
27,072 FT<sup>3</sup> (202,500 GAL)  
TOTAL CONFINEMENT

ROAD

NOTE: ALL VOLUMES SHOWN ON  
PAGE ARE TOTAL STORAGE  
VOLUMES. THE FREEBOARD  
IS NOT INCLUDED.

PROJECT NO. 1062F08

**WILLET, HOFMANN & ASSOCIATES, INC.**  
CONSULTING ENGINEERS  
Land Surveying - Transportation - Structural  
Environmental - Architecture

809 East Second Street Dixon, Illinois 61021  
Phone 815.284.3381 Fax 815.284.3385  
Design Firm #184-000018  
www.willett-hofmann.com

## SUMMARY OF MANURE AND WASTEWATER VOLUMES AFTER IMPROVEMENTS

### 1 Livestock Waste Volume (LV)

Future Head	700	
Days of Storage	365	
Beef Cattle, Average wt = 750 lb	0.82	C.F. PER DAY PER A.U.
(Chapter 4, AWMFH Table 4-8)		

Future LV =  $(700) * 0.75 * (365 \text{ days}) * (0.82 \text{ C.F./day}) = 157,133 \text{ C.F.}$

### 2 Precipitation Volume (PV)

Earthen Holding Basin (108' x 107')	21,186 S.F.
Barn #1 (2' x 162')	324 S.F.
Barn #2 (2' x 142')	284 S.F.
25-Yr 24-Hr Rain Event	5.1 inch
May-October Precipitation	23.2 inch
Annual Precipitation	37 inch
Evaporation Rate	80%

Note: Evaporation will be taken into account in the earth holding basin.

(See attached sheets for data sources)

25-YR PV =  $((5.1 \text{ in}) / (12 \text{ in/ft})) * (21,794 \text{ S.F.}) = 9,262 \text{ C.F.}$

Barns Precipitation =  $(37 \text{ in} / (12 \text{ in/ft})) * (608 \text{ S.F.}) = 1,875 \text{ C.F.}$

Holding Basin Precipitation =  $(37 \text{ in} / (12 \text{ in/ft})) * (21,186 \text{ S.F.}) = 65,324 \text{ C.F.}$

Evaporation on Holding Basin =  $(20\% \times 23.2 / 12 \times 21,186 \text{ S.F.}) = 8,192 \text{ C.F.}$

Total Yearly PV = 25-YR PV + Barns Precipitation +

Holding Basin Precipitation - Evaporation on Holding Basin

**TOTAL PV = 68,268 C.F.**

### 4 Sludge Volume (SV)

Basin Bottom Area	21,186 S.F.
Sludge Depth	6 inch

SV =  $(6 \text{ inch}) / (12 \text{ in/ft}) * (21,186 \text{ S.F.}) = 10,593 \text{ C.F.}$

### 5 Total Volume for 1-year storage

Total Vol. (required) = LV + BV + PV + SV + WV = 235,994 C.F.



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815-232-3606 FAX 815 232-8515  
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JOB 1062F08

SHEET NO. 1

OF 1

CALCULATED BY MLW

DATE 1/14/10

CHECKED BY

DATE

SCALE

Total Days of Manure Storage Provided  
w/ Total Number of Future Herd at 700 Head

Total On-site Storage w/ 2' Freeboard per  
Total Manure Storage provided spreadsheet = 180,156 ft<sup>3</sup>

Total Manure and Wastewater volume after improvements  
(From spreadsheet = 235,994 C.F.)  
This includes sludge accumulation and  
25-yr, 24 hour event

Total Days of Manure Storage

$$\frac{180,156 \text{ ft}^3}{235,994 \text{ ft}^3} \times 365 \text{ days} = 279 \text{ Days}$$

## **TOTAL MANURE STORAGE PROVIDED**

	Cubic Feet	Gallons
Barn #1 - Pit (164' x 12' x 6' Deep) =	11,808	88,324
Barn #2 - Pit (144' x 8' x 8' Deep) =	9,216	68,936
Barn #3 - Pit (36' x 64' x 8' Deep and 36' x 30' x 8' Deep) =	27,072	202,499
Earthen Holding Basin (198' x 107' Top Width x 12' Deep) =	180,216	1,348,016
Total On-Site Storage Provided =	<u>228,312</u>	<u>1,707,774</u>
Reception Pit (12' x 8' x 50')	4800	35,904

## **W/ 2' Freeboard**

	Cubic Feet	Gallons
Barn #1 - Pit (164' x 12' x 4' Deep) =	7,872	58,883
Barn #2 - Pit (144' x 8' x 6' Deep) =	6,912	51,702
Barn #3 - Pit (36' x 64' x 8' Deep and 36' x 30' x 8' Deep) =	27,072	202,499
Earthen Holding Basin (190' x 99' Top Width x 10' Deep) =	138,300	1,034,484
Total On-Site Storage Provided =	<u>180,156</u>	<u>1,347,567</u>

\* Note (2' Freeboard is not applicable for Barn #3 as it is completely enclosed)

## **Individual Structure Storage Capacity**

Manure produced per day = Herd Size \* 0.75 A.U. \* 0.82 C.F./day

	Herd Size	Manure (C.F./ day)	Pit Capacity C.F.	Days of Storage
Barn #1	304	187	7,872	42
Barn #2	221	136	6,912	51
Barn #3	175	108	27,072	252



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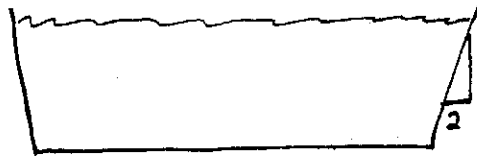
10 NORTH GALENA AVENUE, SUITE 150  
FREEPORT, ILLINOIS 61032  
815 232-3506 FAX 815 232-6515  
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JOB Meier Farms  
SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_  
CALCULATED BY M. Wagner DATE 8/4/08  
CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_  
SCALE \_\_\_\_\_

### Earthen Holding Basin Volume

Top Width = 198'

Top Length = 107'



12' Deep

Bottom Width = 150'

Bottom Length = 59'

$$\text{Total Volume} = \frac{(198' \times 107') + (150' \times 59')}{2} \times 12' = 180,216 \text{ Ft}^3 \\ (1,350,000 \text{ Gallons})$$

### W/ 2' Freeboard

Bottom Width = 150'

Upper Width = 190'

Bottom Length = 59'

Upper Length = 99'

$$\text{Total Volume} = \frac{(190' \times 99') + (150' \times 59')}{2} \times 10' = 138,300 \text{ Ft}^3 \\ (1,030,000 \text{ Gallons})$$

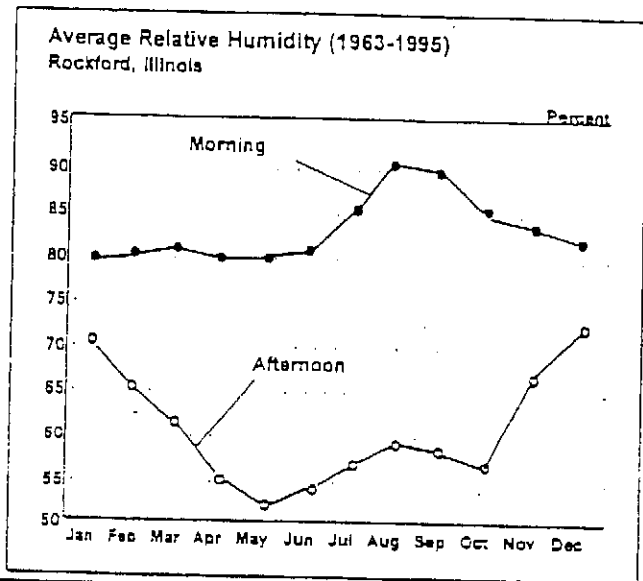


# Precipitation

## Average Relative Humidity (1963-1995)

	AM	PM
Jan .....	80%	71%
Feb .....	81%	66%
Mar .....	82%	62%
Apr .....	80%	55%
May .....	80%	53%
Jun .....	81%	54%
Jul .....	86%	57%
Aug .....	91%	59%
Sep .....	90%	58%
Oct .....	86%	57%
Nov .....	84%	67%
Dec .....	83%	73%
ANNUAL .....	84%	61%

SOURCE: National Weather Service.



## Average Monthly Precipitation (1971-2000)

Jan .....	1.41"
Feb .....	1.34"
Mar .....	2.39"
Apr .....	3.62"
May .....	4.02"
Jun .....	4.80"
Jul .....	4.10"
Aug .....	4.21"
Sep .....	3.47"
Oct .....	2.57"
Nov .....	2.63"
Dec .....	2.06"
ANNUAL .....	36.62"

SOURCE: National Weather Service.

## Average Monthly Snowfall (1971-2000)

Jan .....	10.3"
Feb .....	8.0"
Mar .....	5.6"
Apr .....	1.4"
May .....	--
Jun .....	--
Jul .....	--
Aug .....	--
Sep .....	--
Oct .....	0.1"
Nov .....	2.6"
Dec .....	10.8"
ANNUAL .....	38.8"

## Average Days of Precipitation\* (1971-2000)

Jan .....	9.4
Feb .....	8.0
Mar .....	10.7
Apr .....	11.9
May .....	11.6
Jun .....	10.2
Jul .....	9.7
Aug .....	9.2
Sep .....	8.9
Oct .....	8.7
Nov .....	9.3
Dec .....	9.90
ANNUAL .....	117.5

\*0.01 inches or more.

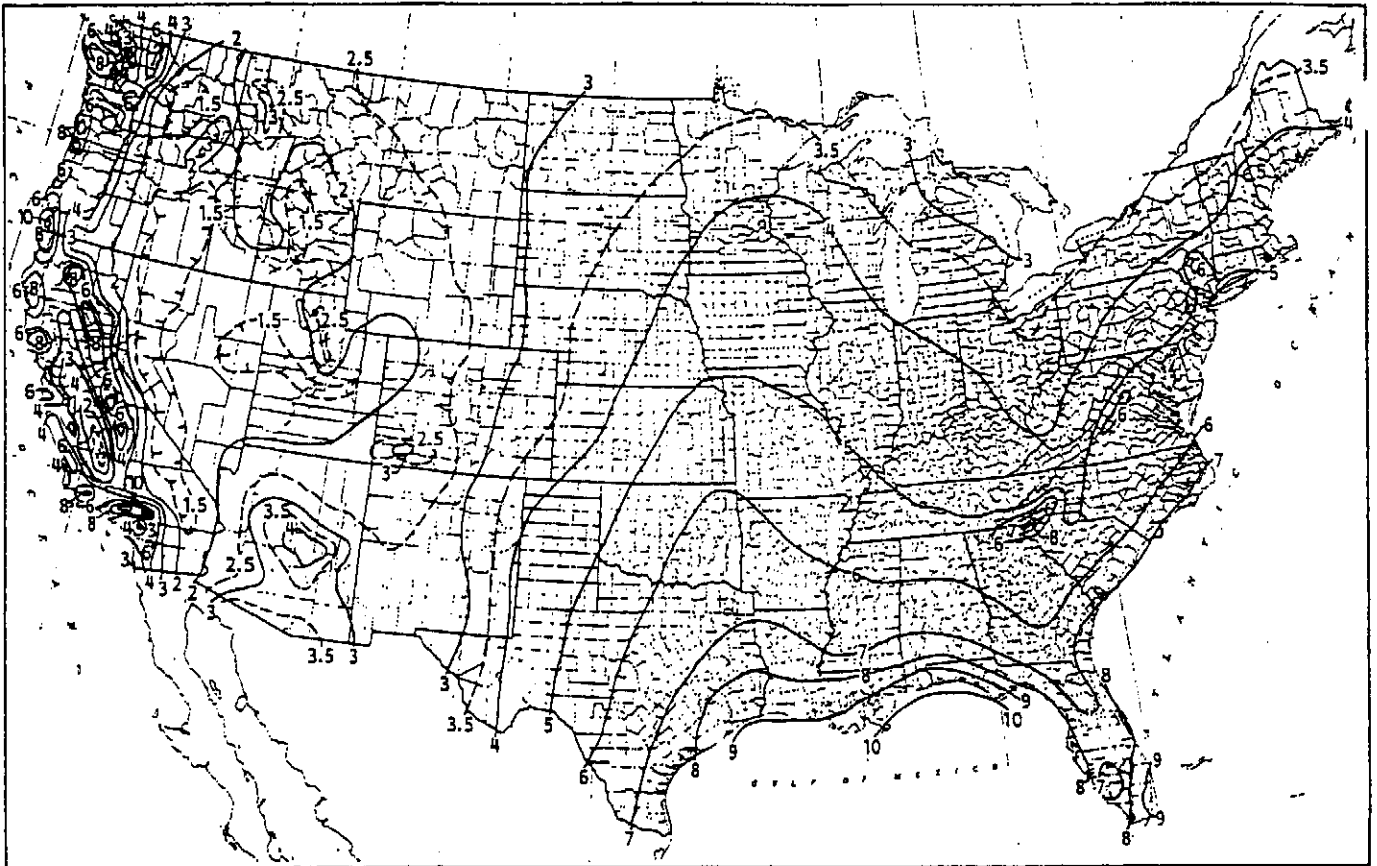


Fig 11-6. 10-yr, 24-hr rainfall, in.

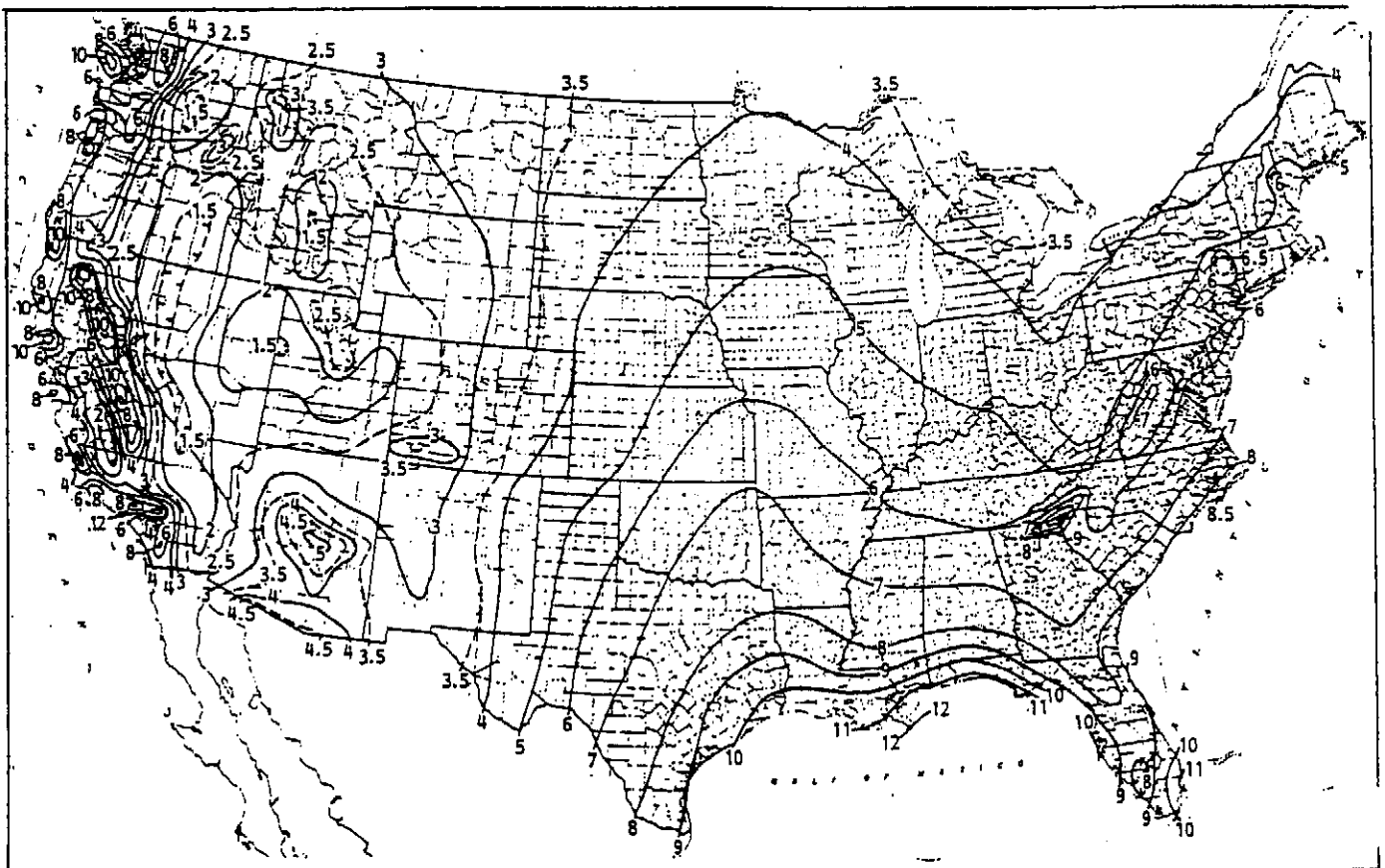


Fig 11-7. 25-yr, 24-hr rainfall, in.

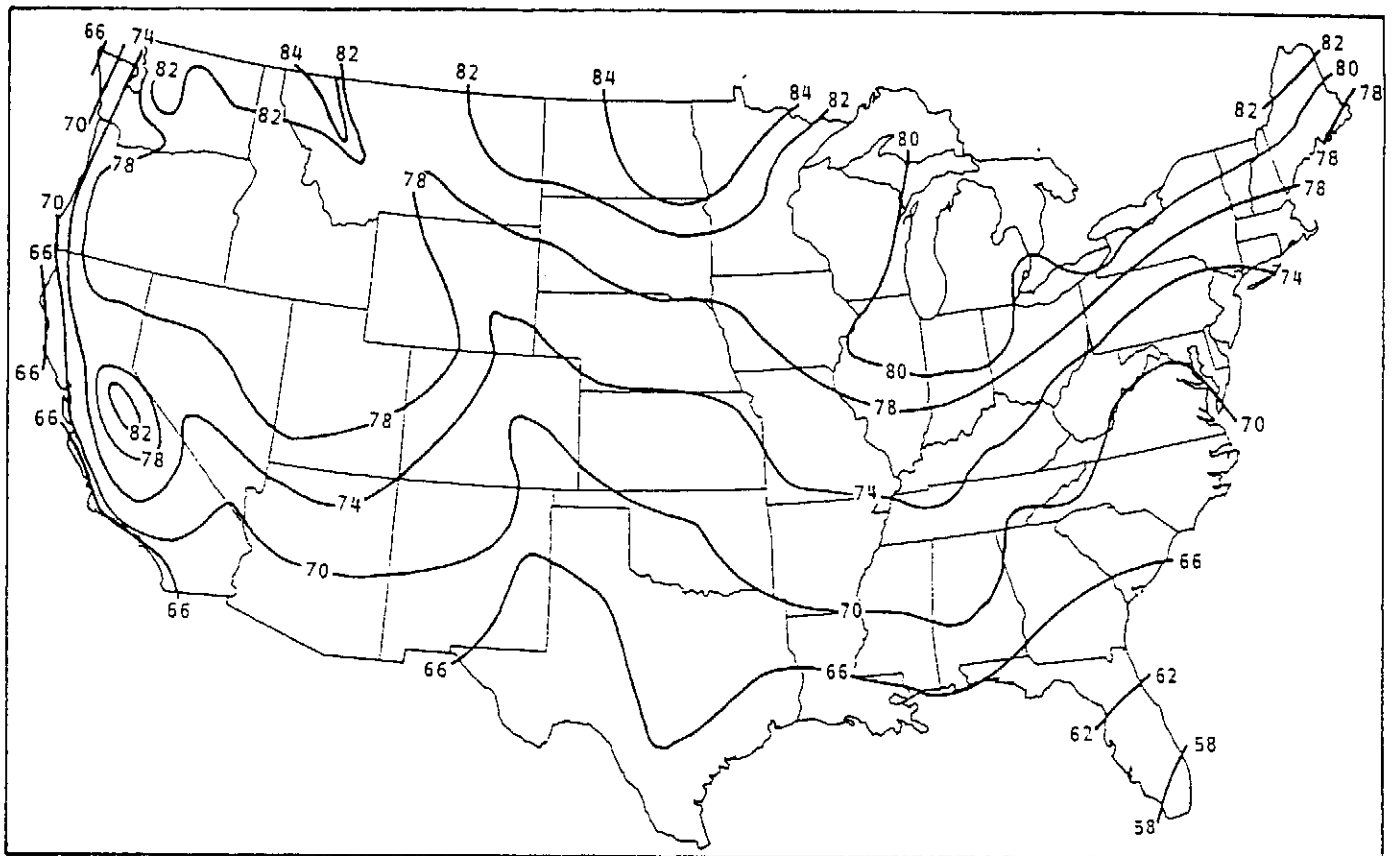


Fig 11-13. Mean May-October evaporation in percent of total.

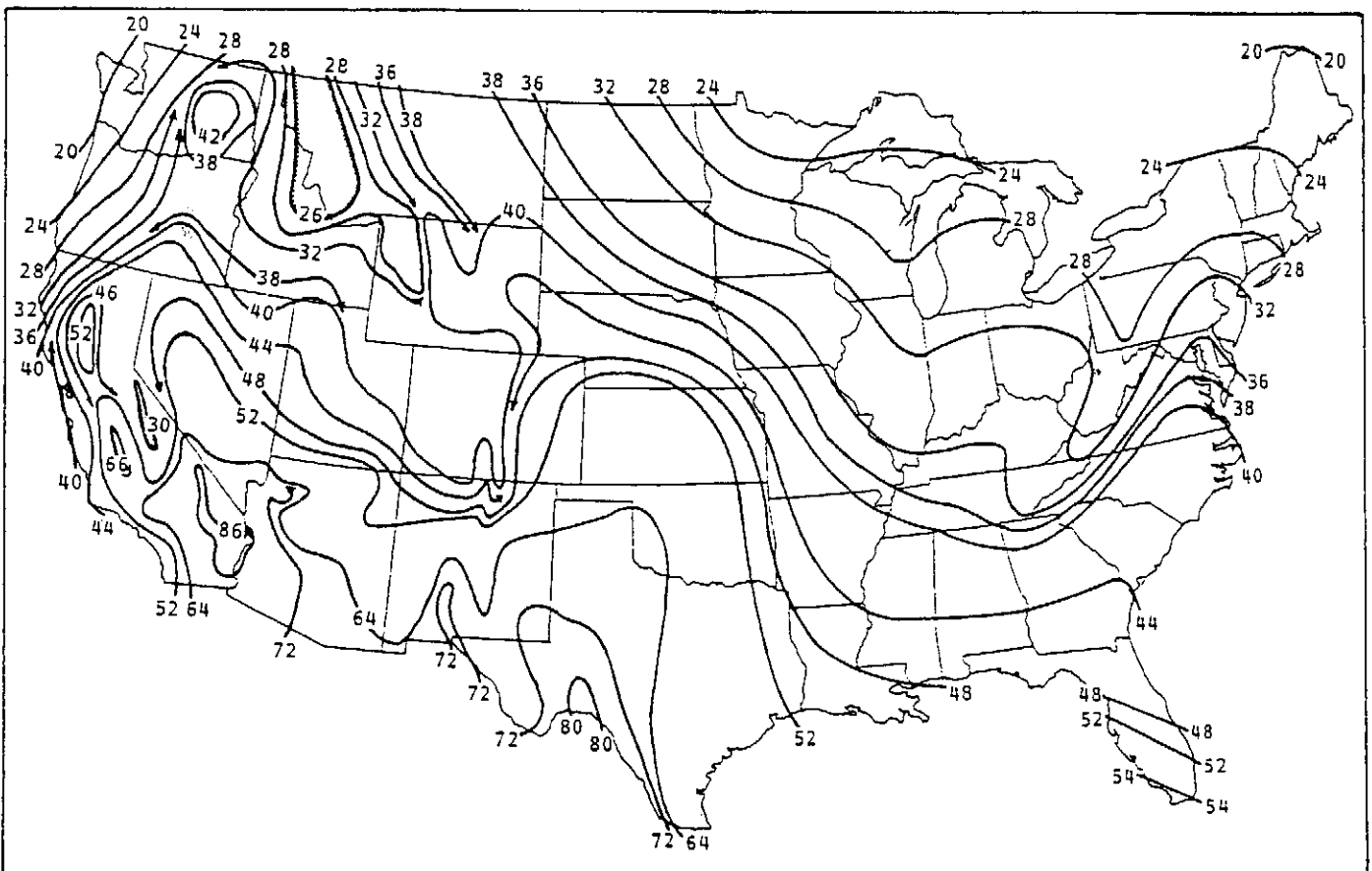


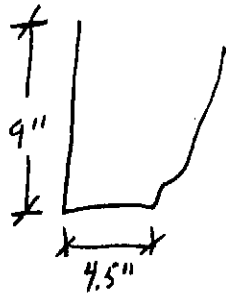
Fig 11-14. Mean annual lake evaporation, in.



## Barn #1 Gutter & Downspout Design

Existing Structure - 17' Drains into pit  
Total Roof Area to gutter -  $17' \times 164' = 2,788 \text{ ft}^2$

- Use Commercial Gutter as manufactured by Klauer (see attached drawing)



Use 0.5" of Freeboard

$$\text{Area of Gutter} = 8.5" \times 4.5" = 38.25 \text{ in}^2$$

$$\text{Wetted Perimeter} = 8.5" + 8.5" + 4.5" = 21.5 \text{ inch}$$

① Gutter Capacity  $Q_g = 0.01184 \times A \times \left(\frac{A}{w_p}\right)^{0.667}$

$$Q_g = 0.01184 \times 38.25 \text{ in}^2 \times \left(\frac{38.25 \text{ in}^2}{21.5 \text{ in}}\right)^{0.6667} = 0.66 \text{ cfs}$$

② Downspouts Try 2 - 4" x 5"  
Area =  $18.75 \text{ in}^2$  a piece

Downspout Capacity  $Q_d = 0.010457 \times A \times H^{0.5}$

$$Q_d = 0.010457 \times 18.75 \text{ in}^2 \times 8.5^{0.5} = 0.57 \text{ cfs}$$

③ Area of roof that can be served  $A_r = \frac{q \times 3,100}{p}$

$$A_r = \frac{0.57 \text{ cfs} \times 3,100}{0.60} = 3,420 \text{ ft}^2$$

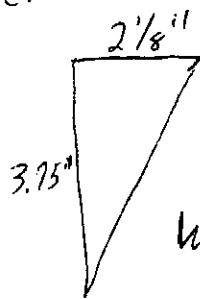
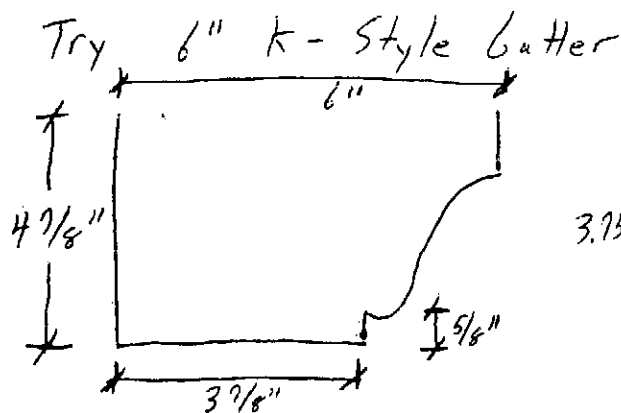
$$3,420 \text{ ft}^2 > 2,788 \text{ ft}^2 \Rightarrow \text{Gutter will work.}$$

Only Need one downspout!



## Barn #2 Gutter & Downspout Design

Existing Structure = 11.5' Drains into Pit  
Total Roof Area = 144' x 11.5' = 1,656 ft<sup>2</sup>



$$A = 4.375'' \times 3.875'' + (3.75'' \times 2.125'' \times 0.5) = 20.9 \text{ in}^2$$

$$W_p = 4.375'' + 3.875'' + 4.31'' = 12.56''$$

① Gutter Capacity  $Q_g = 0.01184 \times 20.9 \text{ in}^2 \times \left(\frac{20.9}{12.56}\right)^{0.667} = 0.35 \text{ cfs}$

② Downspout Capacity Try 1- 4" x 5"  $A = 18.75 \text{ in}^2$

$$Q_d = 0.010457 \times 18.75 \text{ in}^2 \times (4.375)^{0.5} = 0.41 \text{ cfs}$$

③ Area of Roof that can be served

$$A_r = \frac{0.35 \text{ cfs} \times 3,600}{0.60} = 2,100 \text{ ft}^2$$

$2,100 > 1,656 \Rightarrow$  gutter & downspout will work



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SCALE

Burn #1 Proposed Roof Structure Gutter & Downspout Design

Approximately 22' of Roof Area will Drain Into Pit

Total Roof Area to Drain =  $22' \times 164 = 3,608 \text{ ft}^2$

Per Previous Burn #1 Guts Downspout is Too Small

- What if we split the roof in half & half slopes to the east & half slopes to the west?

Area =  $3,608/2 = 1,804 \text{ ft}^2$

Per Burn #2 Guts

- a 6" K style gutter has a capacity of 0.35 cfs
- one downspout capacity is  $4" \times 5" = 0.41 \text{ cfs}$
- Area of roof that can be served

$$A = \frac{0.35 \times 3,608}{0.60} = 2,100 \text{ ft}^2$$

OK.

JOB

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DATE \_\_\_\_\_

CHECKED BY

DATE \_\_\_\_\_

SCALE

Approx. 16' of Road Area will drain into pit.  
Total Road Area to Drain to Pit = 16' x 104' = 2,500'

- \* Per premium sales  
for wall, try commercial  
\* Per Barn #1 Cales Area 7' gutter 25.24  
Commercial gutter Wetted Perimeter 21.5 in  
and gutter capacity = 0.66 cfs

① Derivative -

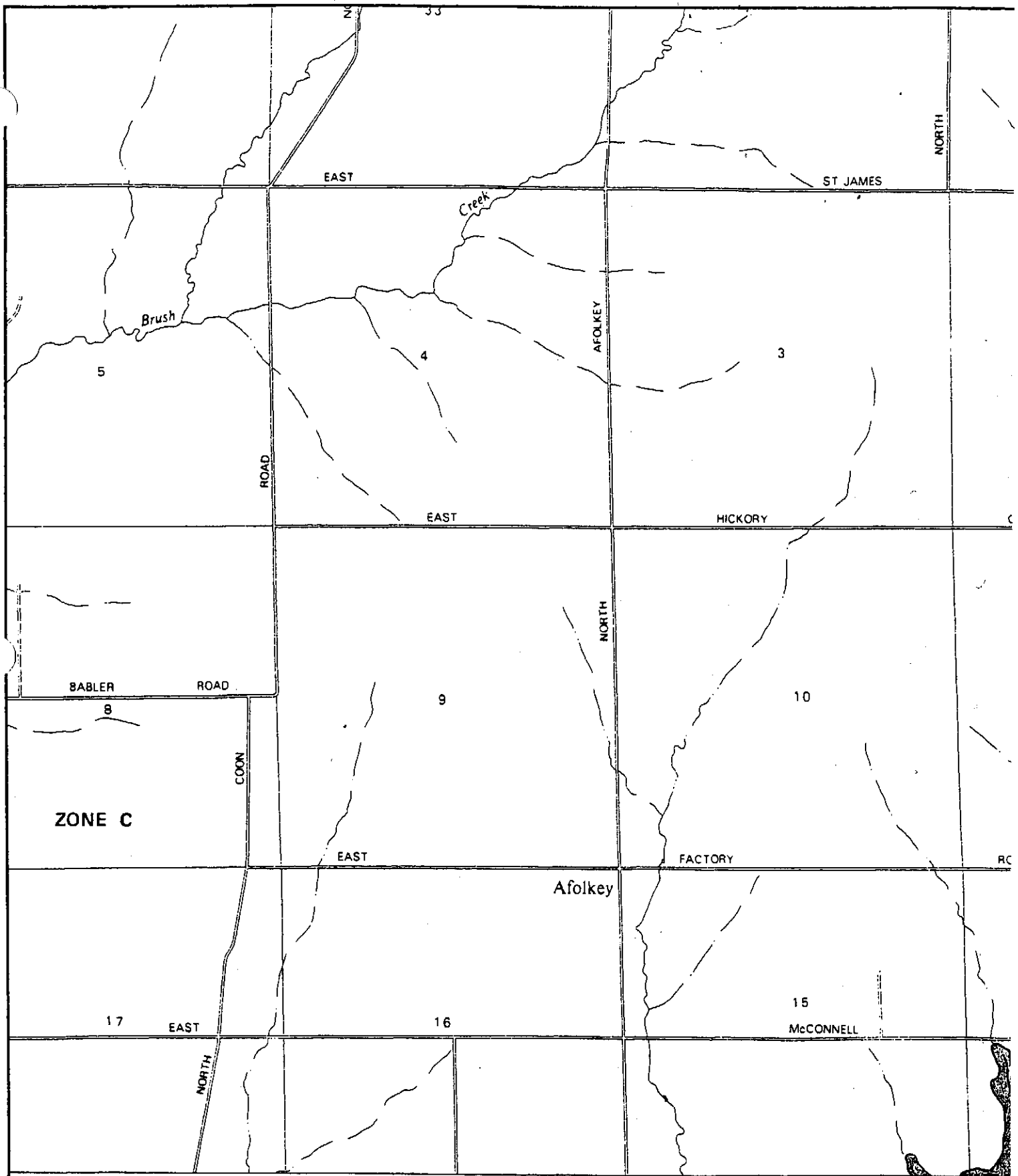
$$Q_d = 0.01043 \text{ m}^3 \times 18.7 \text{ kg/m}^3 \times 2.2 \text{ g} = 0.42 \text{ g}$$

(d) Area of the shaded region is given.

$$A_c = \frac{0.54 \times 6 \times 100}{0.60} = 5,400 \text{ mm}^2$$

Read Aloud by J. M. E.

$$2,304 \div 24 = 96$$



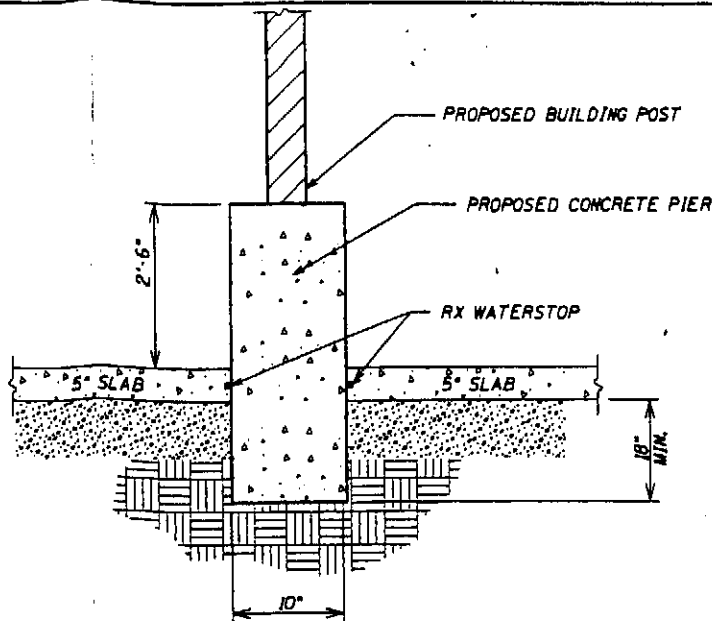
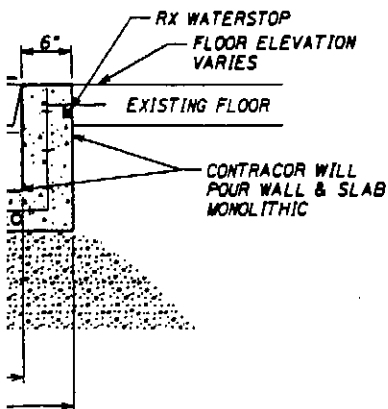




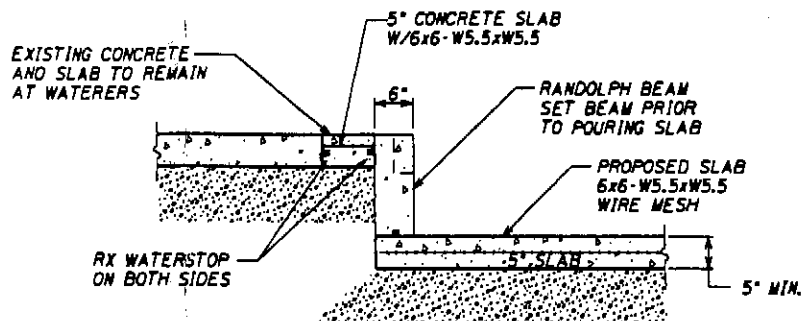
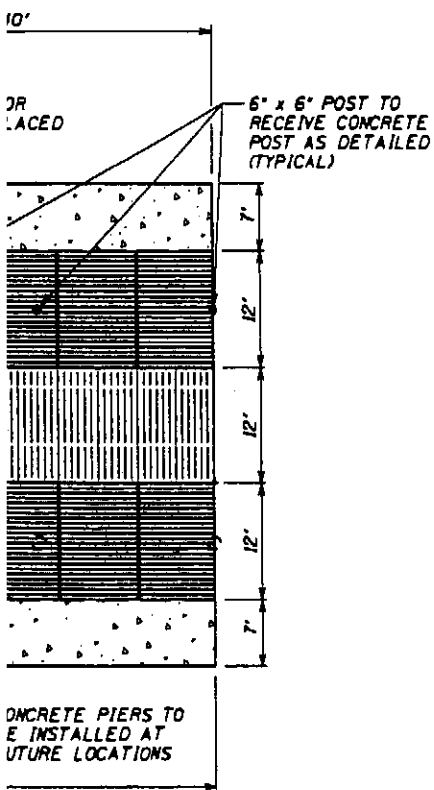



**M.L.W.**

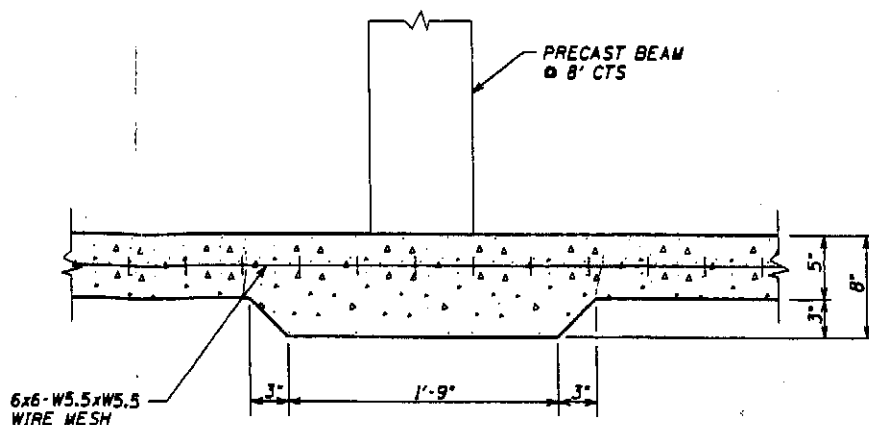




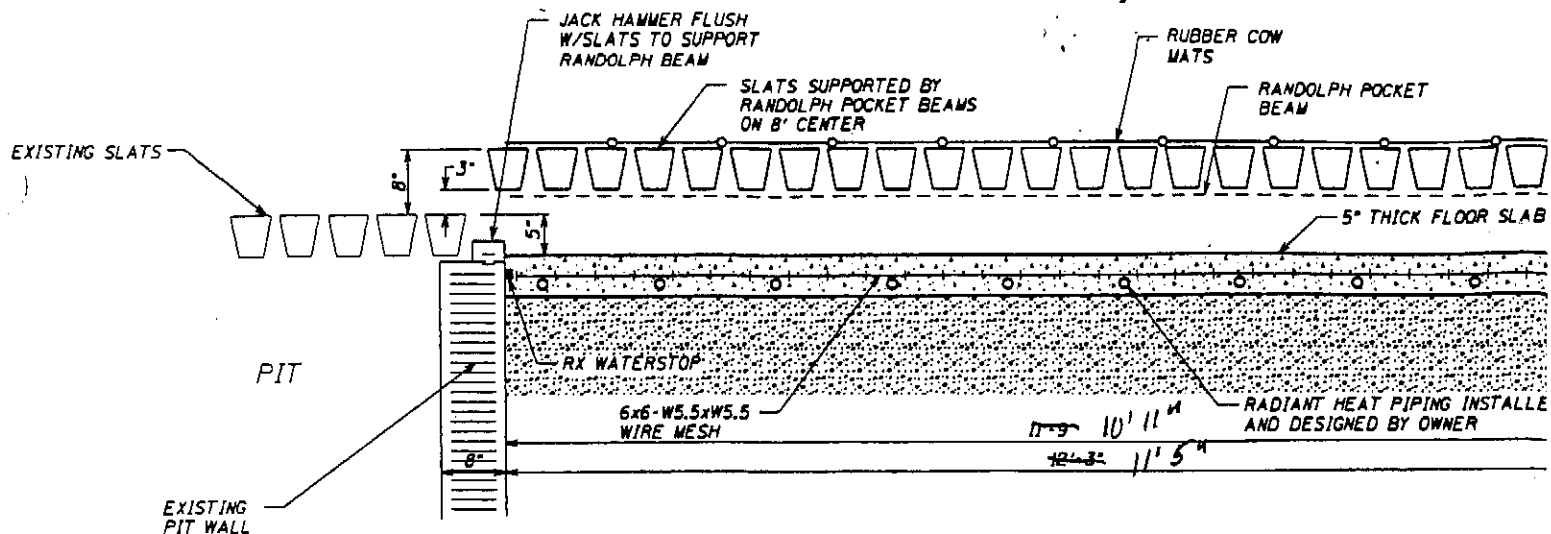
3 CONCRETE PIER DETAIL  
NO SCALE



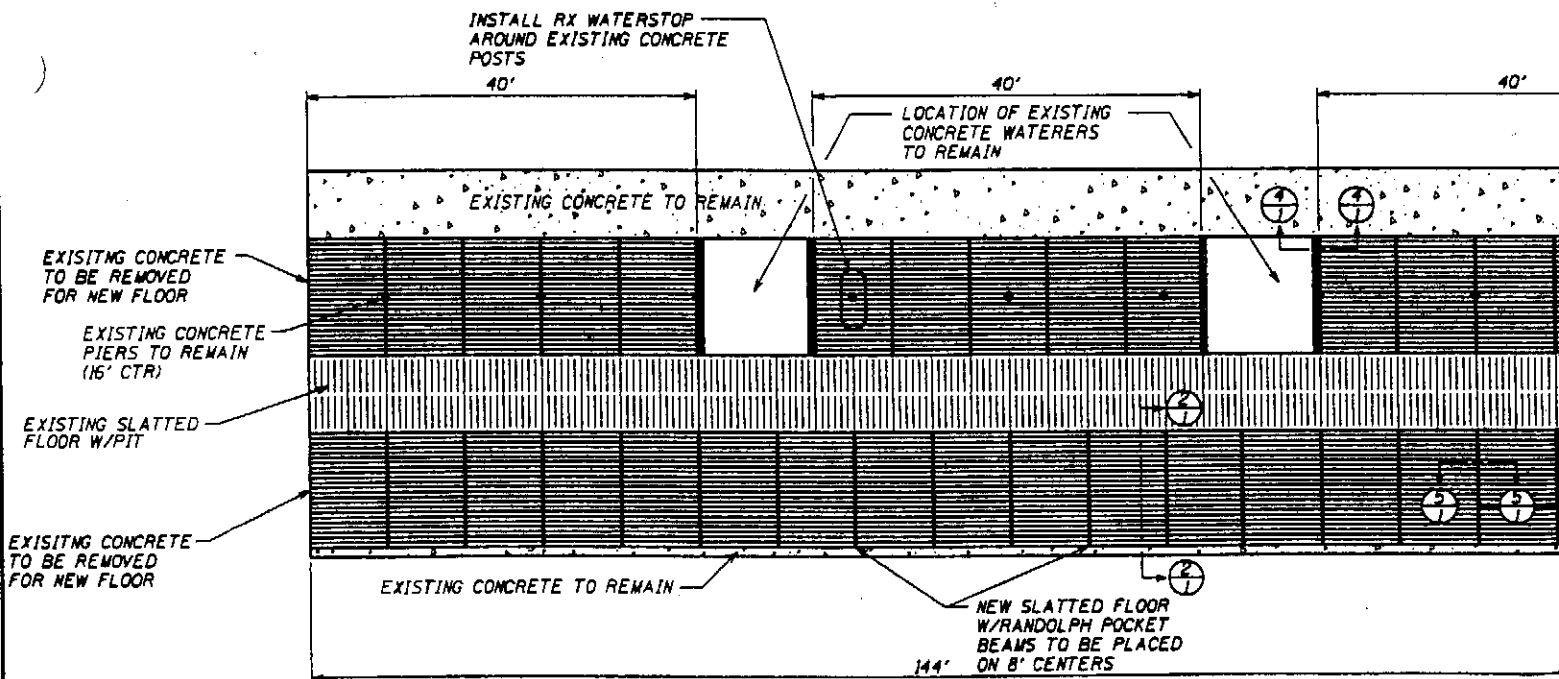
4 END WALL SECTION (BARN #1 & #2)  
NO SCALE



5 THICKENED SLAB DETAIL (TYP)  
NO SCALE



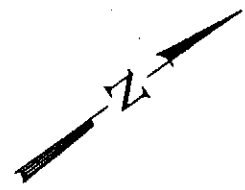
2 PROPOSED SLATTED FLOOR (BARN #2)  
2 NO SCALE



1 PLAN VIEW (BARN #2)  
2

SCALE

0' 5' 10' 15' 20'



REVISIONS

NO.	DATE	BY	REMARKS

K.B.A.

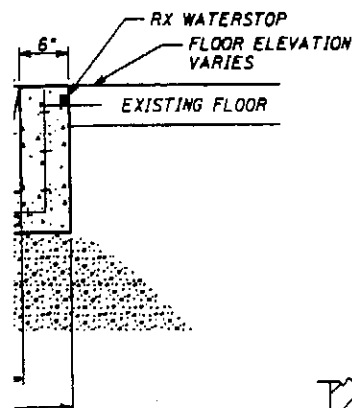
CHECKED

M.L.W.

APPROVED

M.L.W.





THE FOLLOWING TECHNICAL SPECIFICATIONS SHALL BE FOLLOWED DURING THE CONSTRUCTION PROCESS. THE CONTRACTOR IS RESPONSIBLE FOR THE STABILITY, COMPLETENESS, AND COMPLIANCE STATUS OF THE FINAL INSTALLATION. STANDARDS OF THE FOLLOWING ASSOCIATIONS OR ORGANIZATIONS SHALL BE FOLLOWED AND APPLY AS MINIMUM REQUIREMENTS.

ACI AMERICAN CONCRETE INSTITUTE  
ASTM AMERICAN SOCIETY OF TESTING METHODS  
CRSI CONCRETE REINFORCING STEEL INSTITUTE  
MWPS MIDWEST PLAN SERVICE-36

#### 1.0 GENERAL REQUIREMENTS

- A. DESIGN AND CONSTRUCTION SHALL CONFORM TO THE ACI 318-02 SPECIFICATIONS AND MIDWEST PLAN SERVICE-36.
- B. CONCRETE CONTRACTOR IS ACCOUNTABLE FOR ASSURING THAT ALL NECESSARY INSTALLATIONS ARE COMPLETE PRIOR TO EACH POUR (i.e. GROUNDING, PLUMBING, FASTENERS, AND STEEL).
- C. ALL STEEL REINFORCEMENT AND EQUIPMENT MOUNTED TO FLOORING SHALL BE INSTALLED TO COMPLETE A GROUNDING GRID THAT CONFORMS TO THE ELECTRICAL CODES PERTAINING TO THE STRAY VOLTAGE. NOTE: ANY EQUIPMENT OR REINFORCEMENT AFFECTING THE GROUNDING GRID MAY REQUIRE ELECTRICAL INSPECTOR APPROVAL PRIOR TO PLACING CONCRETE.

#### 1.1 CONCRETE MIXES

- A. ALL CONCRETE SHALL HAVE A MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF 4,000 PSI AT 28 DAYS.
- B. ALL CONCRETE SHALL BE AIR ENTRAINED 6%  $\pm 1/2\%$ , UNLESS OTHERWISE SPECIFIED

#### 1.2 CONCRETE REINFORCEMENT

##### A. REINFORCING STEEL BARS

1. ALL REINFORCING BARS TO BE ASTM A615 GRADE 60.
2. WHERE USED, DOWELS SHALL BE SPACED WITH VERTICAL REINFORCEMENT, UNLESS OTHERWISE SPECIFIED
3. ALL LAP LENGTHS TO BE A MINIMUM OF 12". ALL SPECIFIED LAP LENGTHS ARE SHOWN AS MINIMUMS.
4. ALL STEEL BAR REINFORCING COVER WILL CONFORM TO THE MIDWEST PLAN SERVICE-36.

##### B. REINFORCING WIRE FABRIC

1. ALL WELDED WIRE FABRIC (W.W.F.) WILL CONFORM TO ASTM A185.
2. ALL STEEL WELDED WIRE FABRIC REINFORCING COVER SHALL CONFORM TO THE MIDWEST PLAN SERVICE-36.

#### 1.3 PLACING CONCRETE

- A. ENSURE REINFORCEMENT, INSERTS AND EMBEDDED ITEMS ARE NOT DISTURBED DURING CONCRETE PLACEMENT.
- B. PLACE CONCRETE WITH THE AID OF MECHANICAL VIBRATORS OF APPROVED TYPE. ENOUGH VIBRATION SHALL BE USED TO CAUSE ALL CONCRETE TO FLOW OR SETTLE READILY INTO PLACE. VIBRATORS MUST NOT BE ALLOWED TO TOUCH REINFORCEMENT EMBEDDED IN PARTIALLY SET CONCRETE NOR USED TO TRANSFER CONCRETE IN FORMS.
- C. CONSTRUCTION JOINTS SHALL BE REQUIRED AT 50 FT O.C. FOR FLOORS AND AT 100 FT O.C. FOR WALLS.

#### 1.4 CONCRETE FINISHES

- A. COW ALLEYS IN ALL AREAS SHALL BE GROOVED PARALLEL TO COW TRAFFIC.

1. GROOVES SHALL BE 1/2" DEEP, AND 1/2" TO 5/8" WIDE. SQUARE.

2. GROOVES SHALL BE 4" APART OR AS APPROVED BY OWNER.

3. CARE SHOULD BE TAKEN WHEN GROOVING FLOOR SUCH THAT AGGREGATES ARE NOT LEFT EXPOSED CREATING A HOOF ABRASION PROBLEM FOR THE CATTLE.

4. CONTRACTOR SHOULD PROVIDE A 4'x4' CONCRETE SLAB WITH FINISH FOR OWNER APPROVAL. THE ACCEPTED SAMPLE MAY NOT REMAIN AS PART OF THE WORK.

- B. OTHER COW TRAFFIC AREAS SHALL BE A MEDIUM BROOMED OR LIGHT RAKED FINISH PER OWNER'S REQUEST, WITH THE TEXTURE PERPENDICULAR TO COW TRAFFIC.

##### 1. RAKED FINISH

A. AN INVERTED SPRING TINE RAKE CAN BE USED TO FINISH CONCRETE.

B. CARE SHOULD BE TAKEN WHEN FINISHING FLOORS SO THAT AGGREGATES ARE NOT LEFT EXPOSED TO CREATE HOOF ABRASION PROBLEMS FOR THE CATTLE.

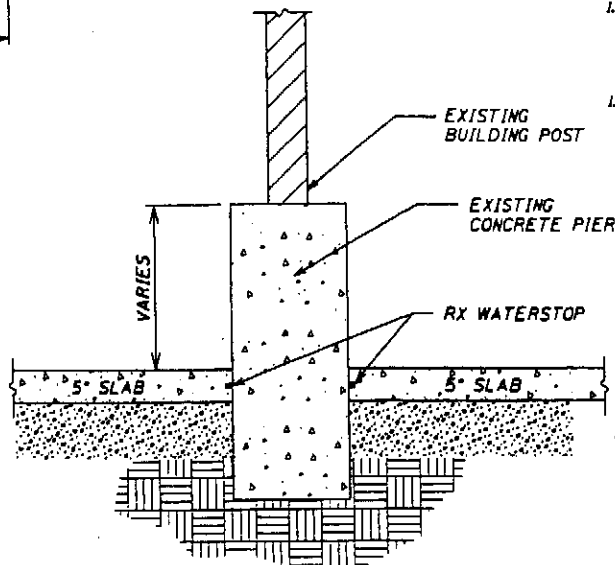
C. CONTRACTOR SHOULD PROVIDE A 4'x4' CONCRETE SLAB WITH FINISH FOR OWNER APPROVAL. THE ACCEPTED SAMPLE MAY NOT REMAIN AS PART OF THE WORK.

- C. FEED ALLEY MANGER REQUIRES A SMOOTH TROWEL FINISH WITH CEMENT CAP. SEE DRAWING FOR LOCATION.

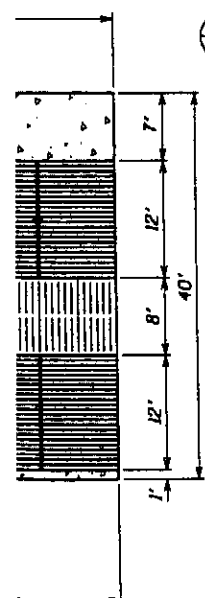
D. FORMED SURFACES: PROVIDE STANDARD FORM FINISH AT WALL AND CURB SURFACES "EXPOSED TO VIEW." REMOVE FORMING PINS AND PATCH "HONEYCOMB" AREAS.

#### 1.5 WATERSTOPS

- A. ALL COLD JOINTS, OR AREAS OF TWO DIFFERENT POURS WHERE MANURE MAY CONTACT CONCRETE SHALL BE WATERSTOPPED WITH RX WATERSTOP OR GREENSTREAK WATERSTOP PRODUCTS (SEE ATTACHED).
- B. ALL WATERSTOP LOCATIONS WILL BE REQUIRED AS PER PLANS.



3 SUPPORT POST DETAIL  
2 NO SCALE



# GUTTER & P

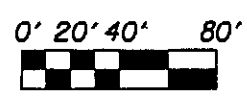
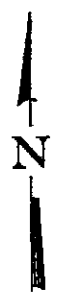
BARN PIT (164' x 50')  
MANURE STORAGE PIT  
164' x 12' x 6' = 11,808 FT<sup>3</sup> (88,300 GAL)

PROPOSED ROOF  
GUTTER OR ISOTAL

MANURE STORAGE  
44' x 8' x 9' 2.6'

MACHINE SHED SHOP AREA

FUEL BARRELS



McCONNELL

# ROUTING MAP

DOWNSPOUT OF FEED

FEED STORAGE OF FEED

FEED STORAGE OF FEED

FEED  
STORAGE

SILO SILO SILO

BARN #3 (112'x50')

MANURE STORAGE PITS-

36'x64'x8' + 36'x30'x8'

27,072 FT<sup>3</sup> (202,500 GAL)

TOTAL CONFINEMENT

FEED

FEED STORAGE

FEED STORAGE

FEED STORAGE

FEED STORAGE

FEED STORAGE

PROJECT NO. 1062F08

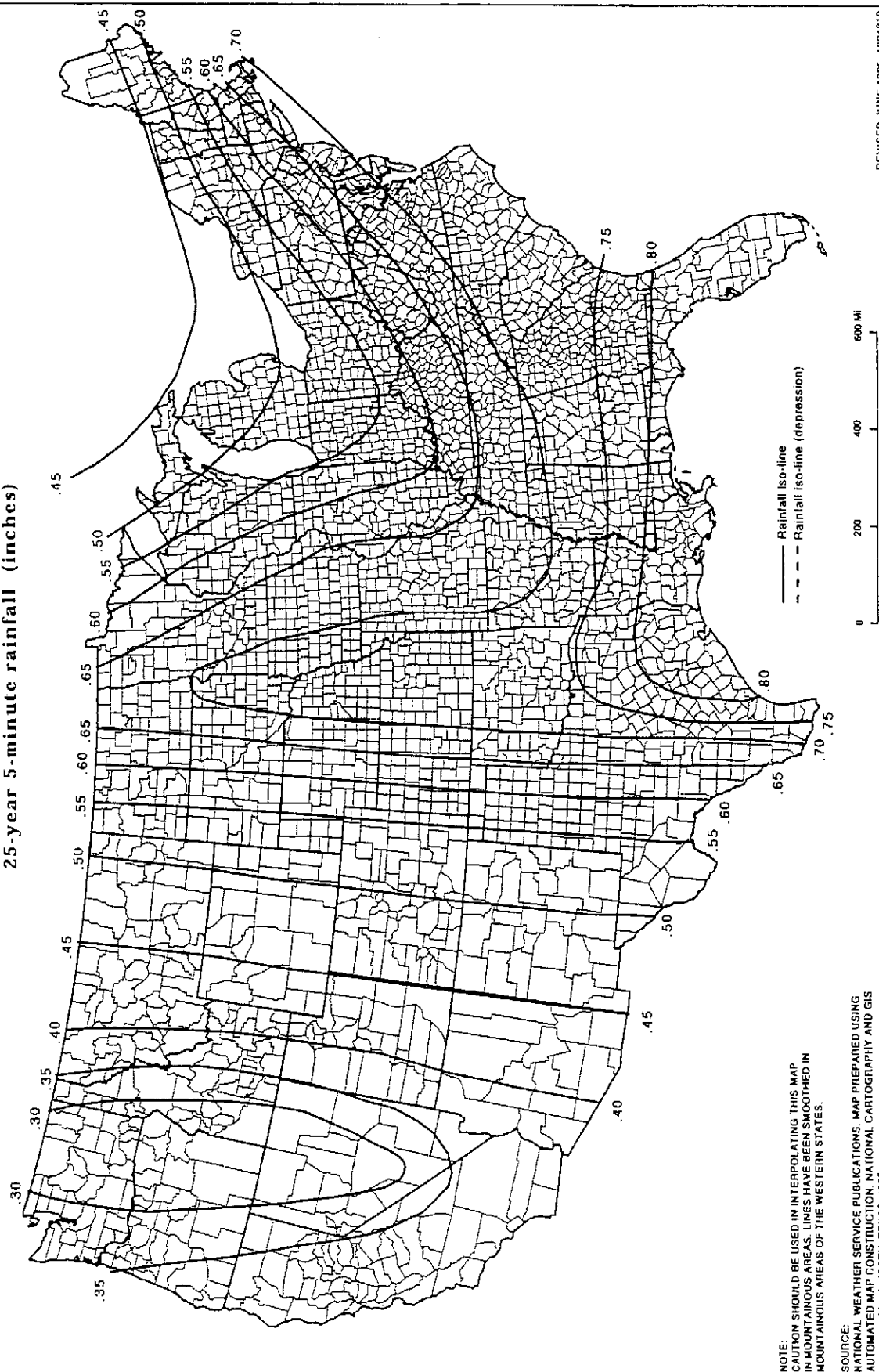
ROAD

NOTE: ALL VOLUMES SHOWN ON  
PAGE ARE TOTAL STORAGE  
VOLUMES. THE FREEBOARD  
IS NOT INCLUDED.

**WILLET, HOFMANN & ASSOCIATES, INC.**  
CONSULTING ENGINEERS  
Land Surveying • Transportation • Structural  
Environmental • Architecture

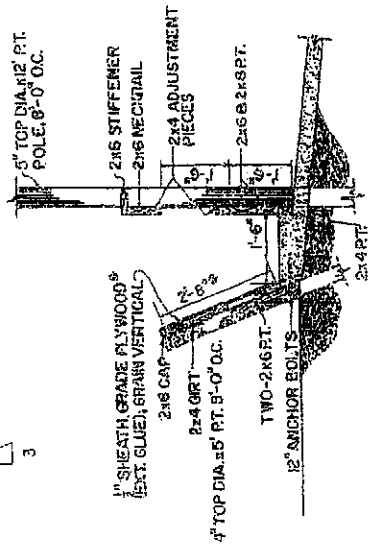
809 East Second Street Dixon, Illinois 61021  
Phone 815.284.3381 Fax 815.284.3385  
Design Firm #184-000918  
www.willettthofmann.com

**Figure 10B-4**  
**25-year 5-minute rainfall (inches)**

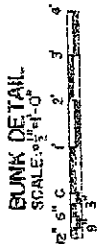








3 PLYWOOD BUNK LINER CUT IN 2'-8" LENGTHS  
FROM STANDARD SHEET (3 PIECES PER SHEET)



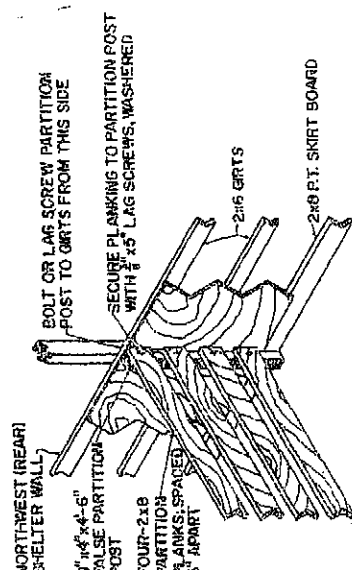
AREA OF ANIMAL USE	50 <sup>#</sup>	63
RESTING SHELTER <sup>1</sup>	175	139
FEEDING ALLEY	77	61
TOTAL SLOPED FLOOR	252	200
LITTER ALLEY	86	58
TOTAL ANIMAL AREA <sup>2</sup>	338	260
FEED BUNK	69	70

<sup>1</sup>NO H/VPEN RECOMMENDED HOT WEATHER PEN POPULATION UNTIL EXPERIENCE IS GAINED IN FACILITY MANAGEMENT.

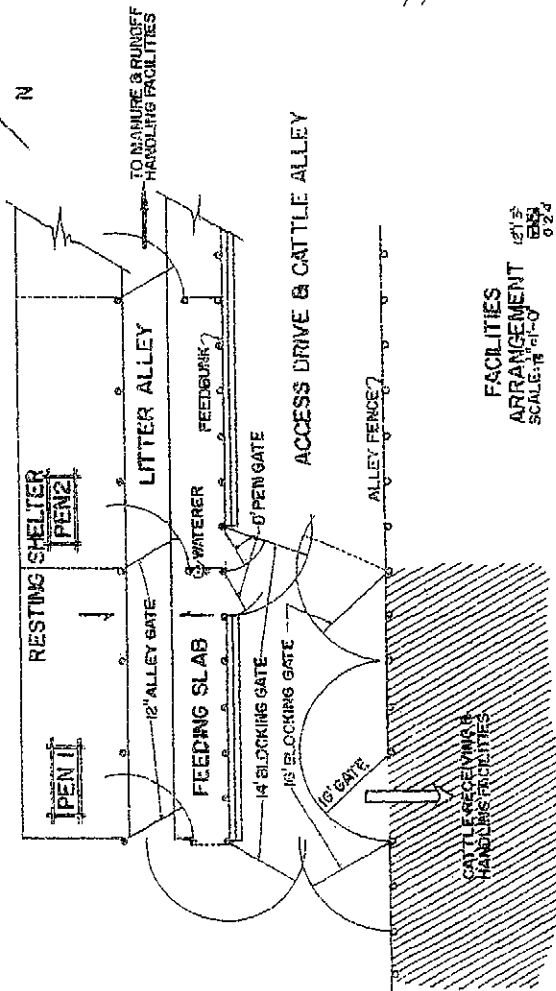
<sup>2</sup>DOES NOT INCLUDE FEED BUNK ROOF SHELTER

2) TOTAL ANIMAL AREA IS 69% OF FLOOR.

1) DOES NOT INCLUDE FEED BUNK ROOF SHELTER  
2) TOTAL ANIMAL AREA IS 68% ROOFED.



**PEN PARTITION DETAIL**  
**NOT TO SCALE**



FACILITIES  
ARRANGEMENT  
SCALE: 1" = 1'-0"

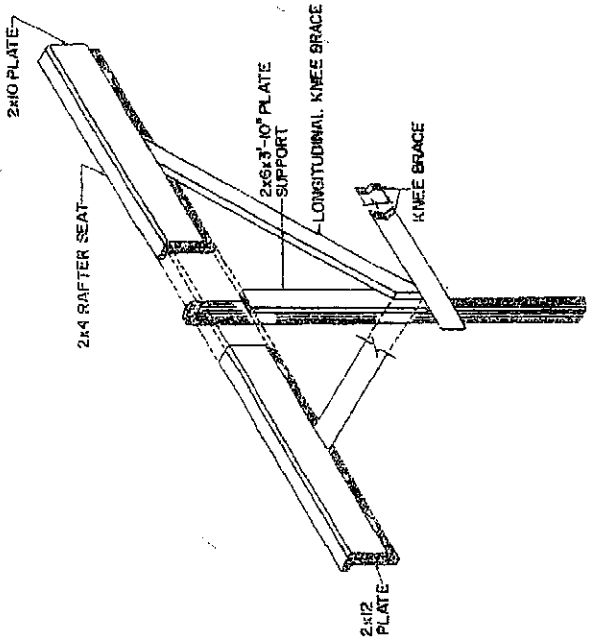
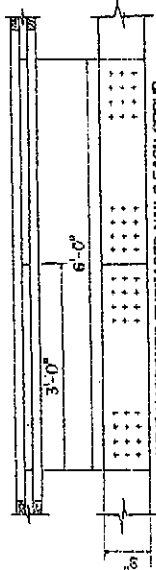
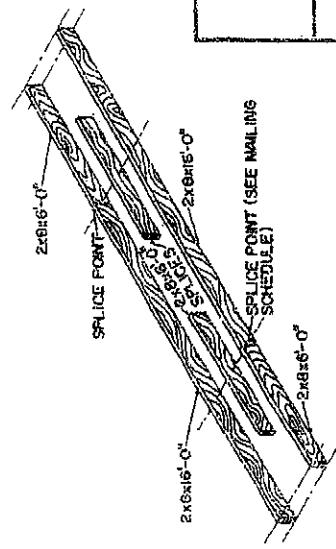


PLATE DETAIL  
NOT TO SCALE



USE 12 HARDENED THREADED NAILS EACH GROUP  
20D WITH LUMBER S4S, 60D WITH ROUGH LUMBER

**SPLICED RAFTER NAILING SCHEDULE**  
**NOT TO SCALE**



ALTERNATE RAFTER DESIGN  
NOT TO SCALE



**BEF FEEDING PENS  
COUNTER-SLOPED**

W. '78	6297	SHEET 2 OF 2
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uac. i

1944-1945

1

2

3

4

5

6

7

8

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Page 10  
100

(

3

1" x 6" x 10' post  
for STRECH (if necessary)  
ADVANCED  
CUTTING MACHINE (see drawing)

2.7  
3.3  
COLUMBIA

2.7  
3.3

1000 1000

de  
view

5000 5000

