

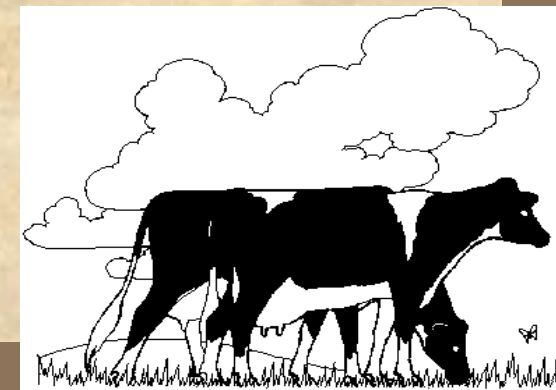
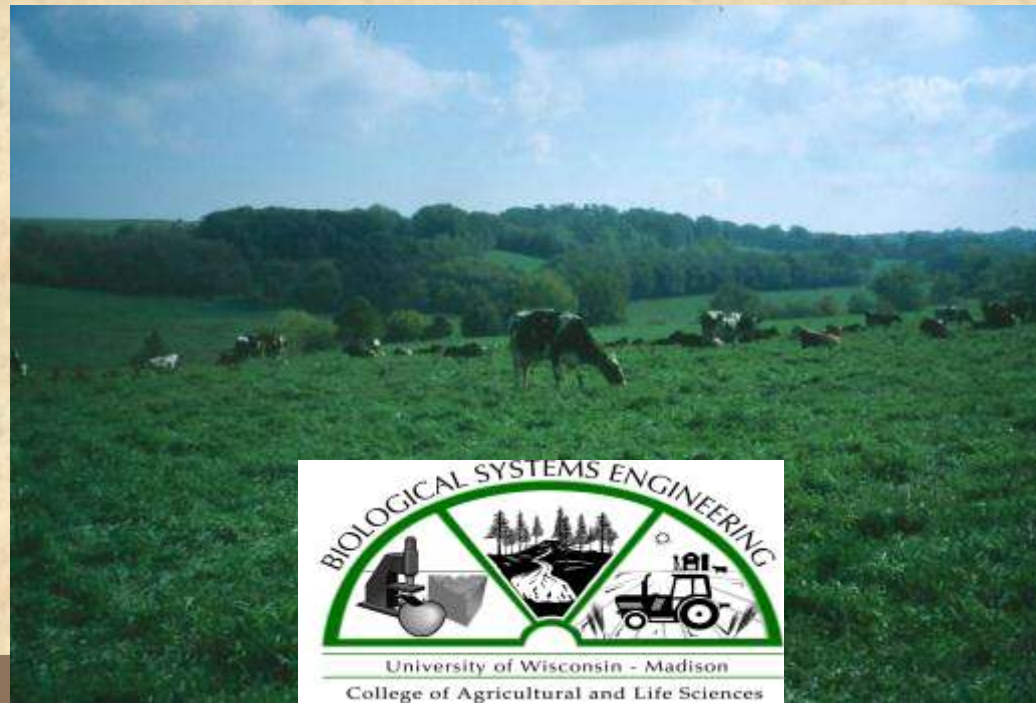
Facility Recommendations in Tropical Climates

“Modernizing Dairy Farms in Costa Rica”

David W. Kammel

Biological Systems Engineering

UW Madison



Land Base and Dairy Industry

Wisconsin

Land Base

169,637 square km

Dairy Herds

10,860 2014

Dairy Cows

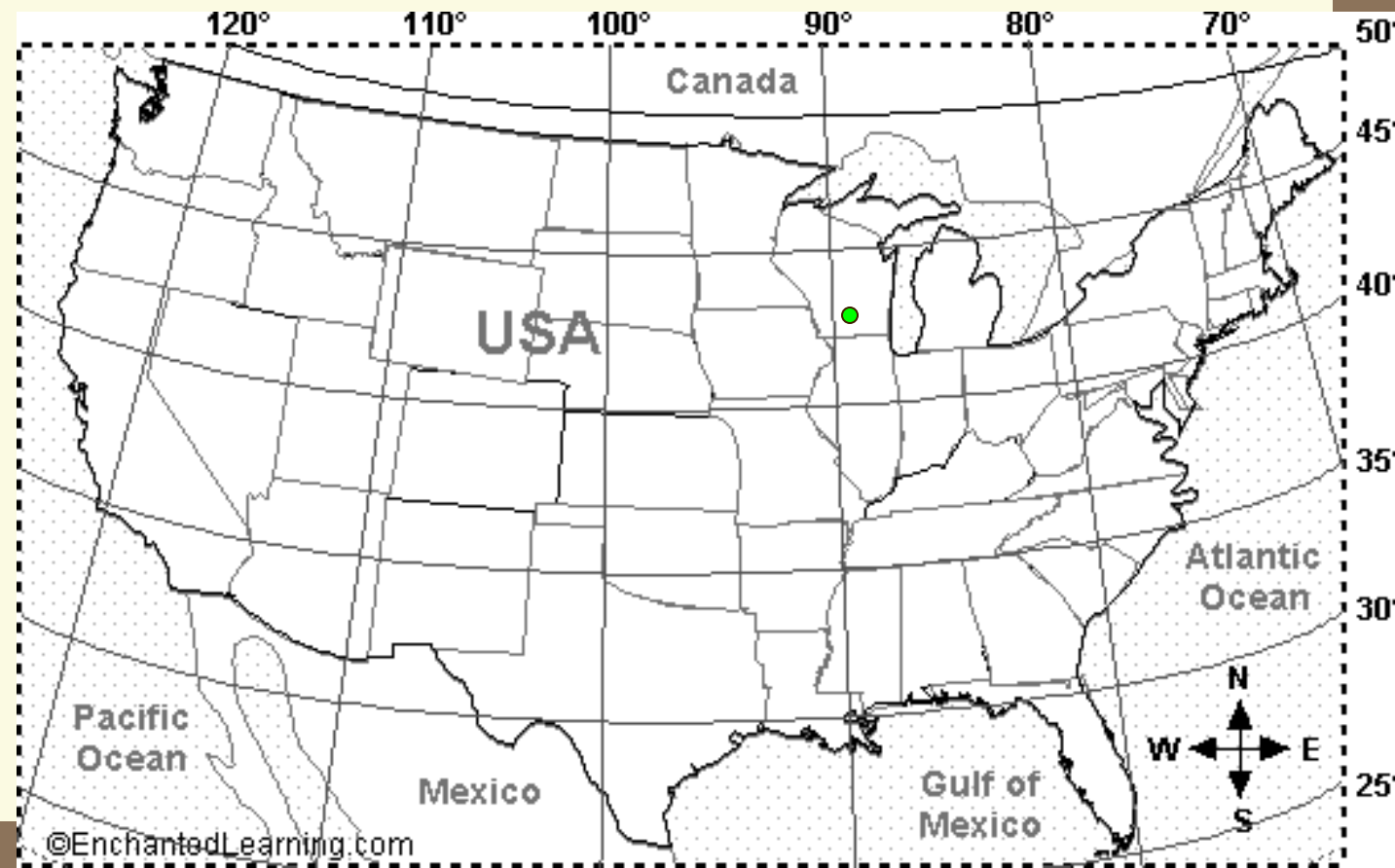
1,271,000

Average herd size

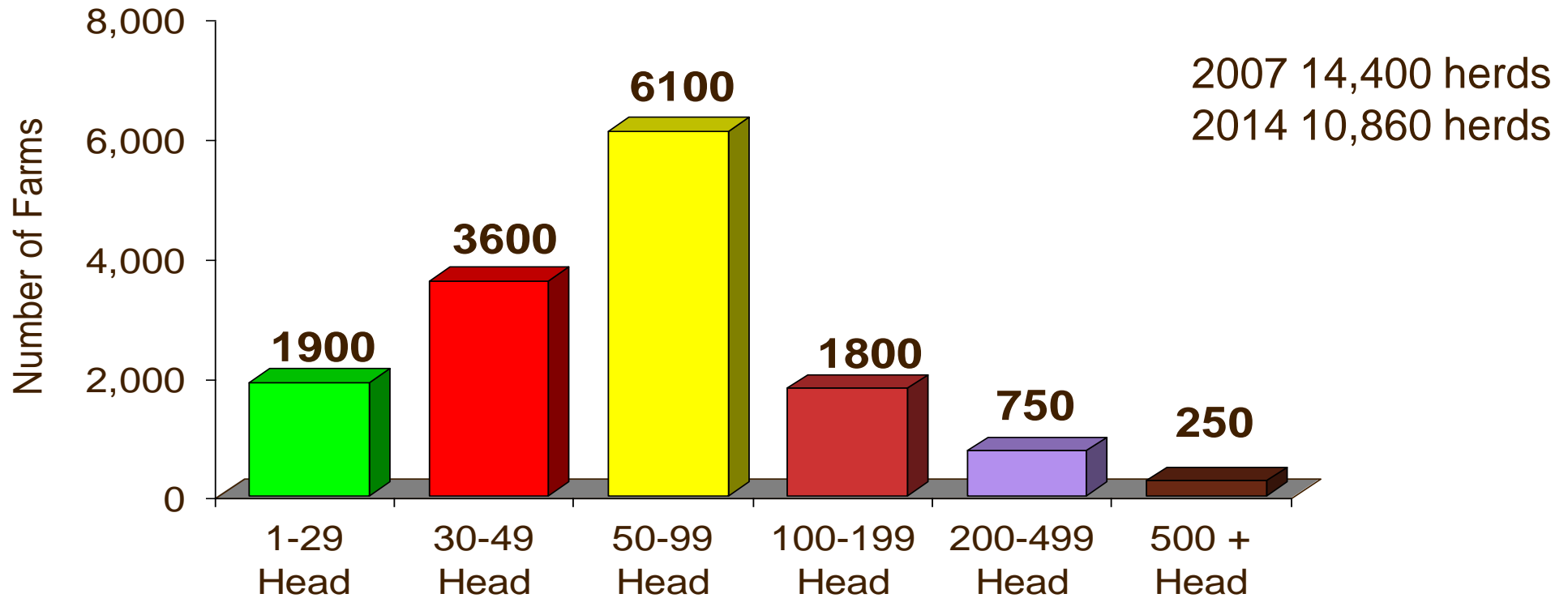
117 cows

Milk production

9860 kg/year/cow



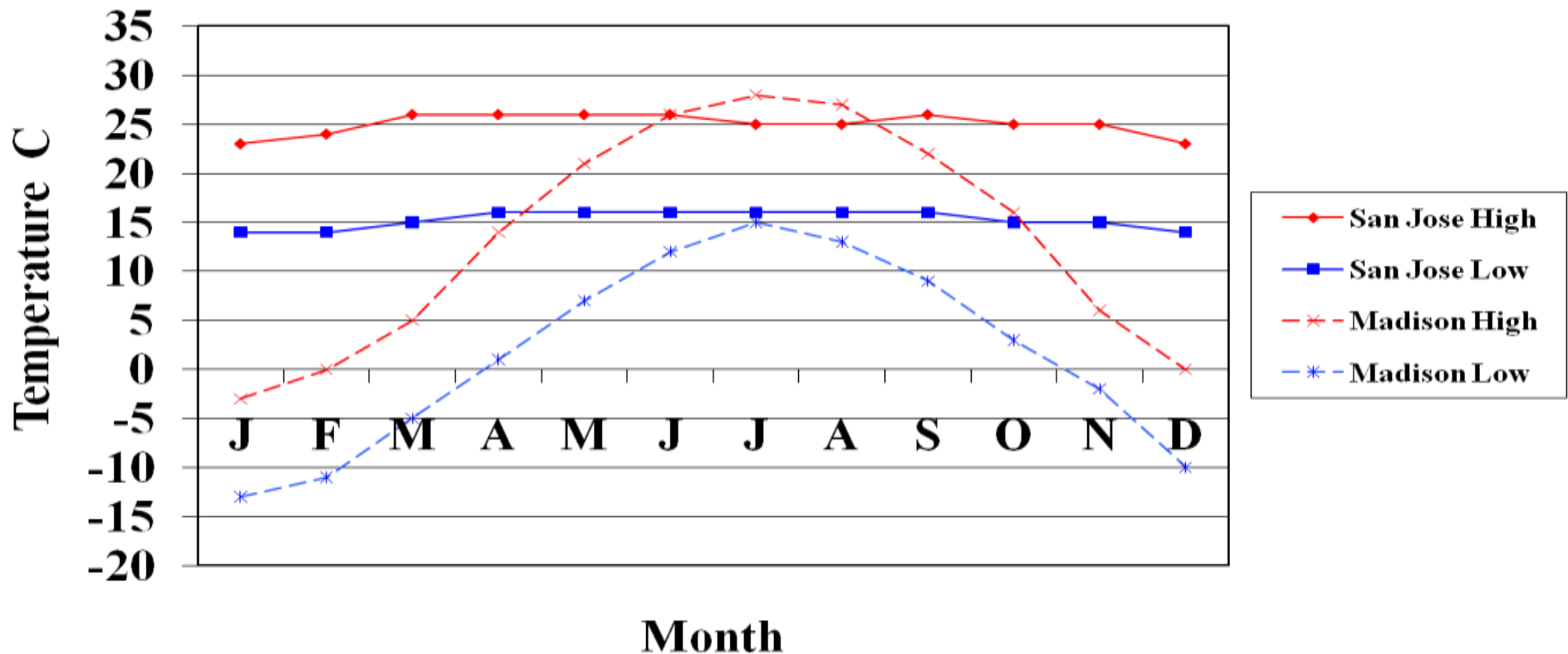
Wisconsin Dairy Farms by Herd Size, 2007*



**Preliminary estimate.*

Source: USDA/NASS, Farms, Land in Farms, and Livestock Operations Summary.

Temperatures in San Jose, Costa Rica and Madison, WI USA



**“Facilities are tools to
implement a management
plan”**

Grazing Paddocks

Water

Feed Storage

Corrals

Machinery
Storage

House

Water

Feed Storage

Manure Storage

Water

House

Milking
Center

Components of a Dairy Farm System

Facility Design Goals:

- Allow the implementation of the management plan to express the cow's genetic potential
- Provide:
 - ✓ Cow Comfort
 - Clean dry environment for cows
 - Adequate fresh air, feed, and water
- Be:
 - ✓ Labor efficient
 - ✓ Safe for both workers and cows
 - ✓ Environmentally friendly
- Produce:
 - ✓ Quality Food
 - ✓ Profitable Dairy Business
- Consider flow of cows, feed, manure, and people

Dairy modernization is investing in facilities that:

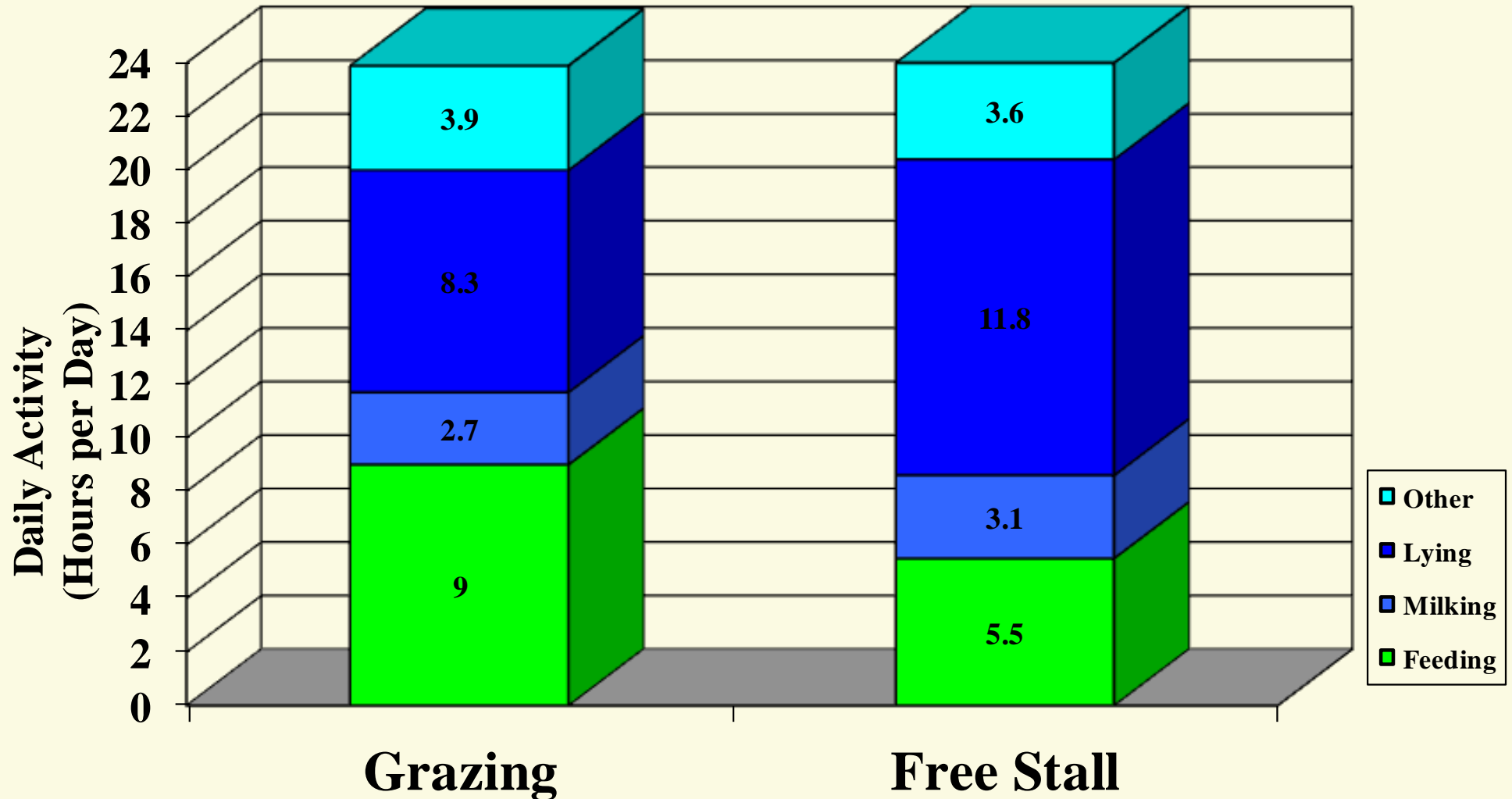
- ✓ **Improve cow comfort**
- ✓ **Increase dry matter intake (DMI)**
- ✓ **Improve labor efficiency**
- ✓ **Improve operator health and safety**
- ✓ **Increase profit**
- ✓ **Improve quality of life**

Cow Comfort

- ❑ Housing system design which:
 - Protects the cow from severe environmental conditions
 - Provides adequate space for resting, eating, drinking, and walking
 - Limits the likelihood of injury and/or disease
 - Considers all the cows in the herd
(especially the subordinate cows)

Dairy Cow Daily Time Budget

Grazing versus Free Stall Confinement System



Dairy Animal Management Plan

“Needs of the cow”

- **The cow is number one priority**
 - ✓ Provide an environment that can express the genetic potential of the cow
- **Provide adequate space for all management groups**
- **Provide optimal cow comfort**
 - ✓ Provide fresh air by ventilation
 - ✓ Adequate space for resting, eating and drinking
 - ✓ Clean & dry resting space
 - ✓ Adequate space to move to feed and water
 - ✓ Minimize social and environmental stress
 - ✓ Safe from injury
 - ✓ Manage weather extremes
 - ✓ Cow cooling in warm season
 - ✓ Shelter in the wet season

Dairy Animal Management Plan

“Needs of the owner and workers”

- **Effectively utilize a farm's resources**
 - ✓ Land
 - ✓ Capital
 - ✓ Labor
 - ✓ Genetic potential of herd
- **Safe & labor efficient**
 - ✓ Milking
 - ✓ Feeding
 - ✓ Manure Handling
 - ✓ Cow movement
- **Environmentally sustainable**

Farmstead Planning in Steps

- **Identify Limitations & prioritize investments**
- **Determine a budget based on:**
 - ✓ Number of cows
 - ✓ Financial situation
 - ✓ Risk tolerance
- **Develop farmstead master plan**
 - ✓ Identify planning zones for milking, housing, feeding, feed storage, and manure storage
 - ✓ Consider future growth (beyond the first step)
- **Phased construction (investment)**
 - ✓ Consider current needs and long term goals
 - ✓ Reuse existing facilities if possible
 - ✓ Build new facilities as needed

Farmstead Master Plan

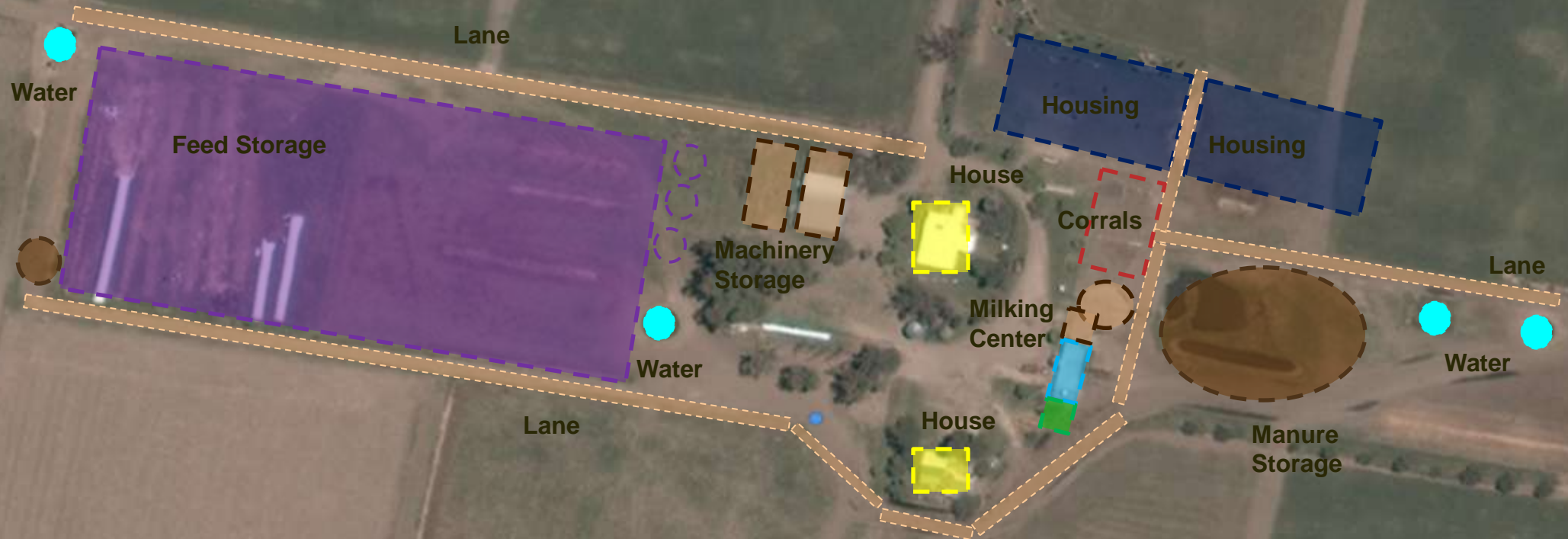
- **A master plan is a set of drawings and documents that describes the site plan with:**
 - ✓ **Physical boundaries**
 - ✓ **Natural boundaries**
 - ✓ **Existing facilities**
 - ✓ **Planned/ proposed improvements**
- **Defines the benefits/limits of the site**

Existing Farmstead



Master Farmstead Plan

Planning Zones



Master Farmstead Plan

Phased Construction Projects



Limitations

Possible Facility Improvements

- Wet weather



- Feed storage area
- Shelter feeding area
- Shelter resting area

- Hot Weather



- Shade milking area
- Shade feeding area
- Shade resting area
- Sprinklers
- Velocity fans

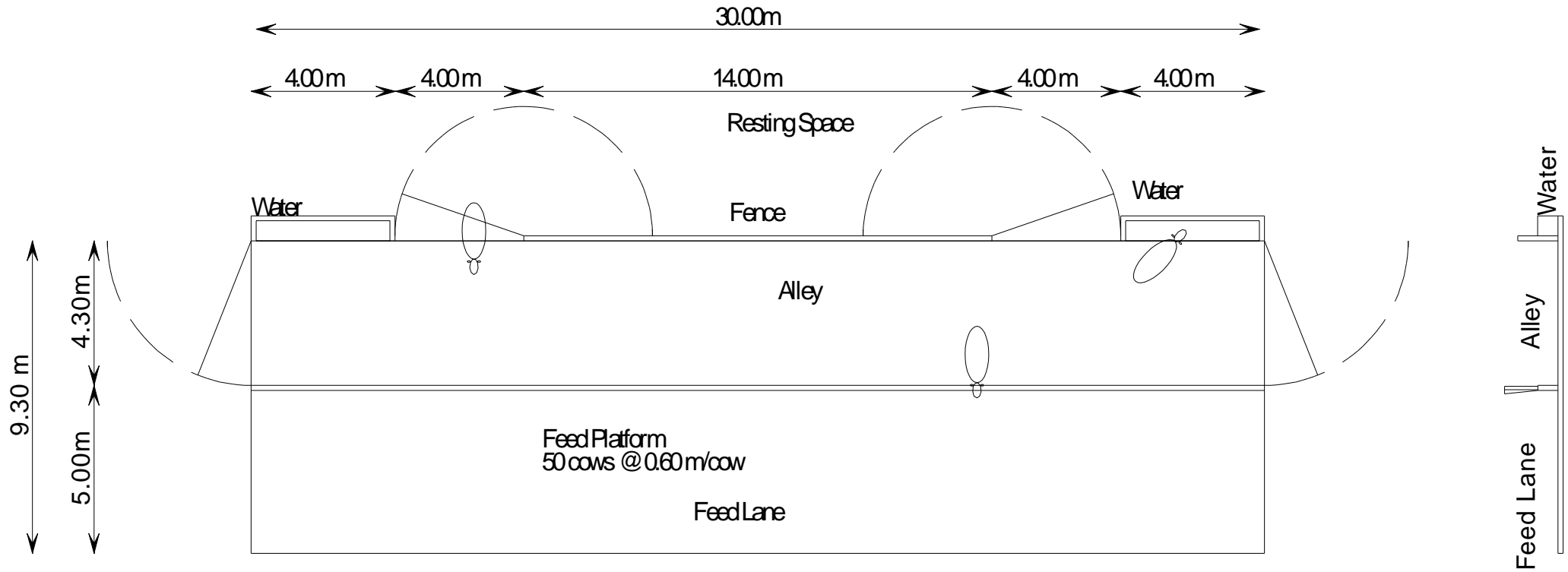
Facility Investments

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- ✓ Shade/shelter the feeding area
(with capacity to expand)
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Feeding Platform



Feeding Platform



Feeding Platform



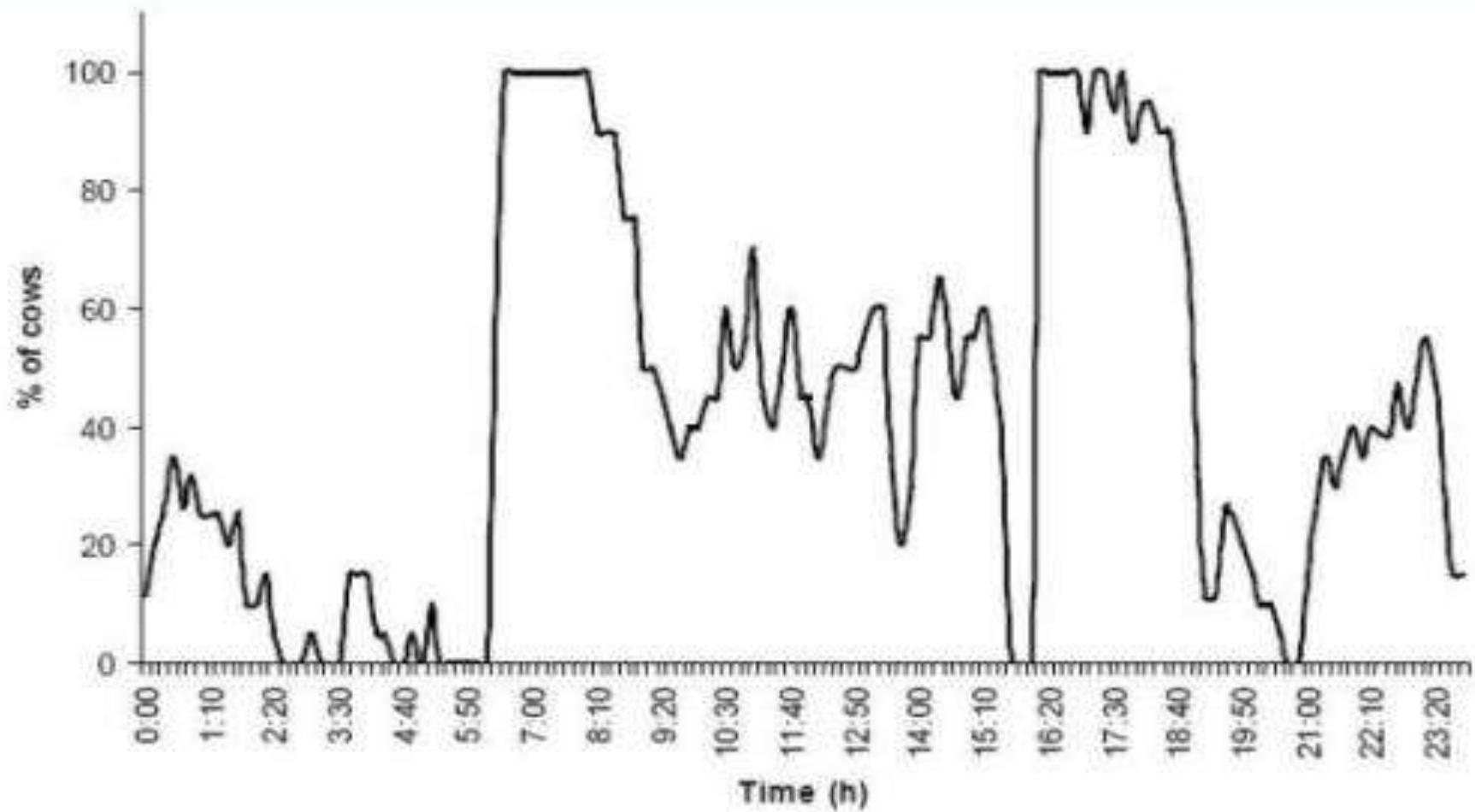
Feeding Platform



Facility Investments

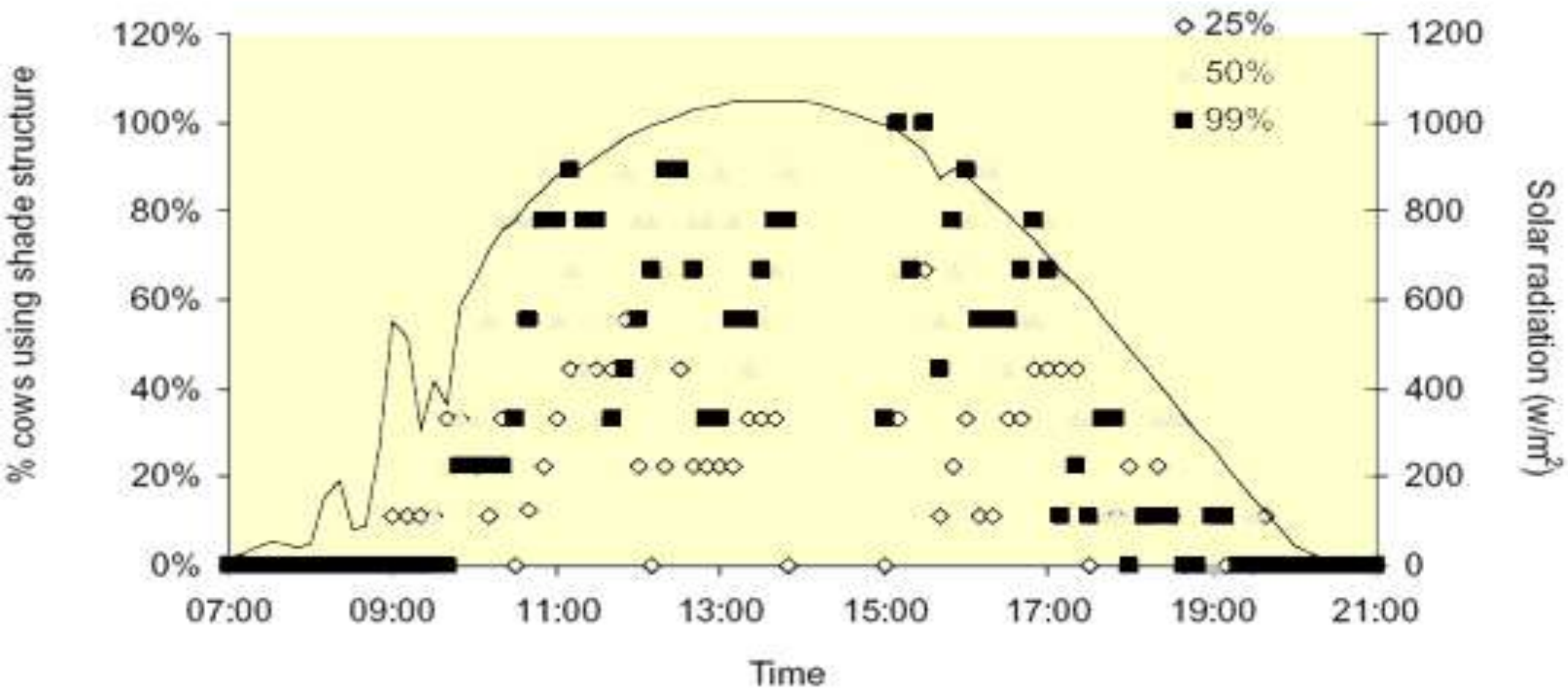
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Hourly grazing of cows



(Botheras, 2007)

Percentage of cows using shade



Shade Design

✓ Shade Area

- Cows – 4.0 -5.0 s.m.
- 200 kg calf – 2.0 s.m.
- 400 kg heifer – 3.0 s.m.

✓ Minimum of 50% sun blockage

✓ 4.3 m height minimum

✓ North South

- Allows drying under shade

✓ East West

- Less Sun penetration

✓ Natural Shade

- Controlled access to allow drying

✓ Permanent Shade

- Controlled access to allow drying
- Improved area (concrete)

✓ Portable/movable shade

- Allows drying

✓ Separate water locations, salt/mineral feeders, feed locations

North South versus East West Shade

JUNE 22

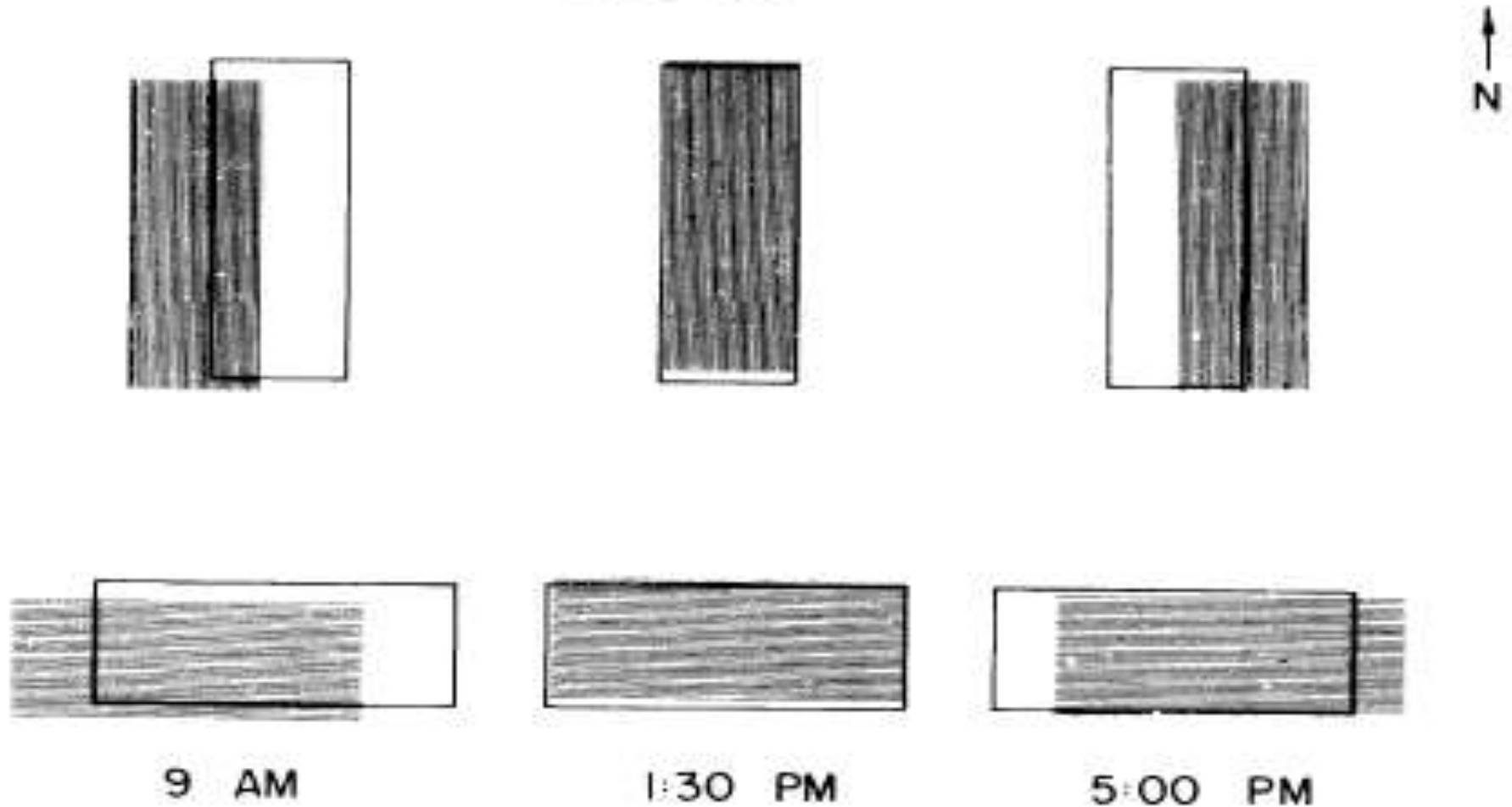


Fig. 2—Shading patterns of the described shade structure at 28 N. Latitude on June 22.

Buffington Collier 1983

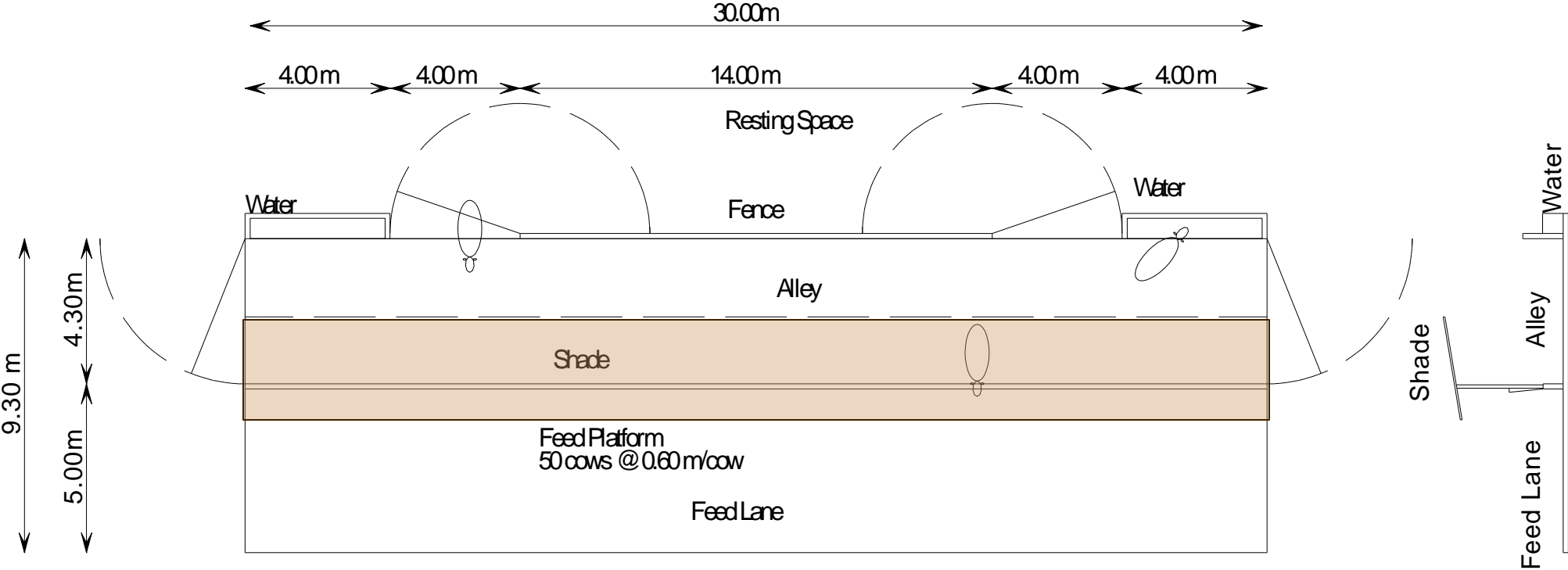
Portable Shade



Permanent Shade



Shade over feeding platform



Shade over feeding platform

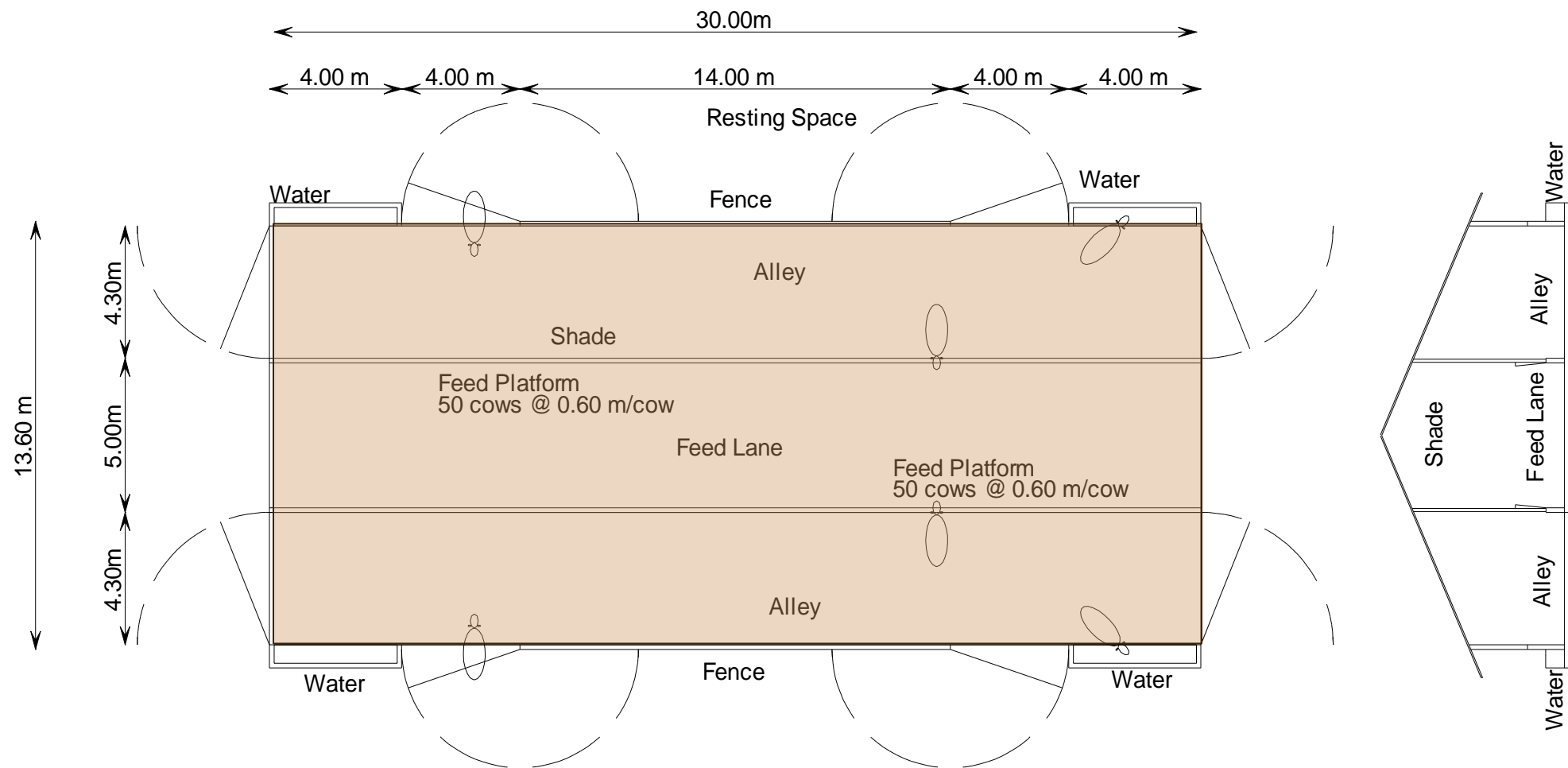


Shade over feeding platform



Shaded Feeding Platform

Drive Through Feeding





Shade Over Feeding Platform

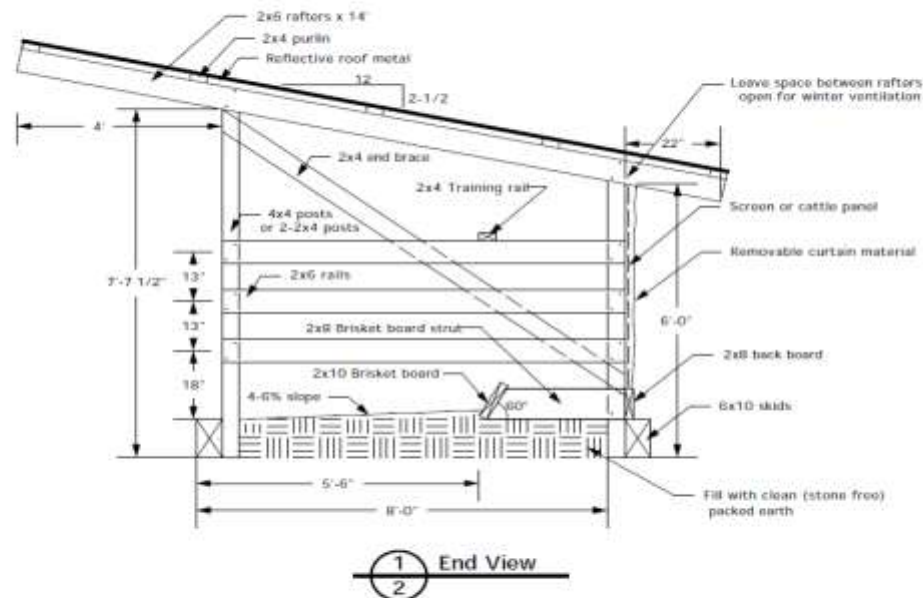
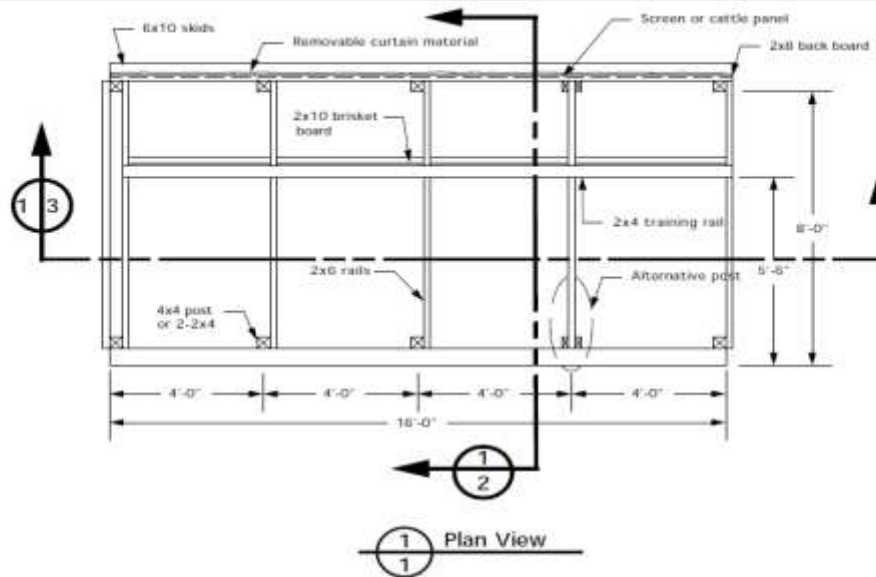
Shade Over Feeding Platform



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Cow Kennel



PENNSTATE



Agricultural and Biological
Engineering

*Penn State is an affirmative action
equal opportunity employer.*

Ds. By: R.E.G.

Dr. By: D.K.S.

Ch. By: J.T.T.

COW KENNEL

Date: 9/5/95

Sht. No. 1 of 2

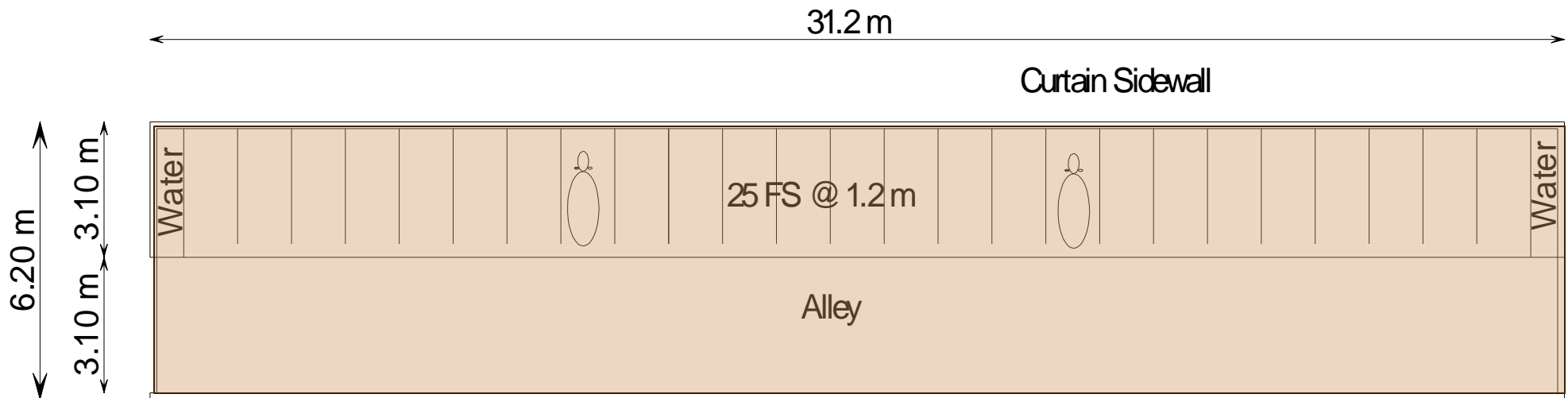
I.P. No. 723-23 rev.

Cow Kennel



McFarland 2014

Single row FS with feed platform



Single Row Free Stall Barn

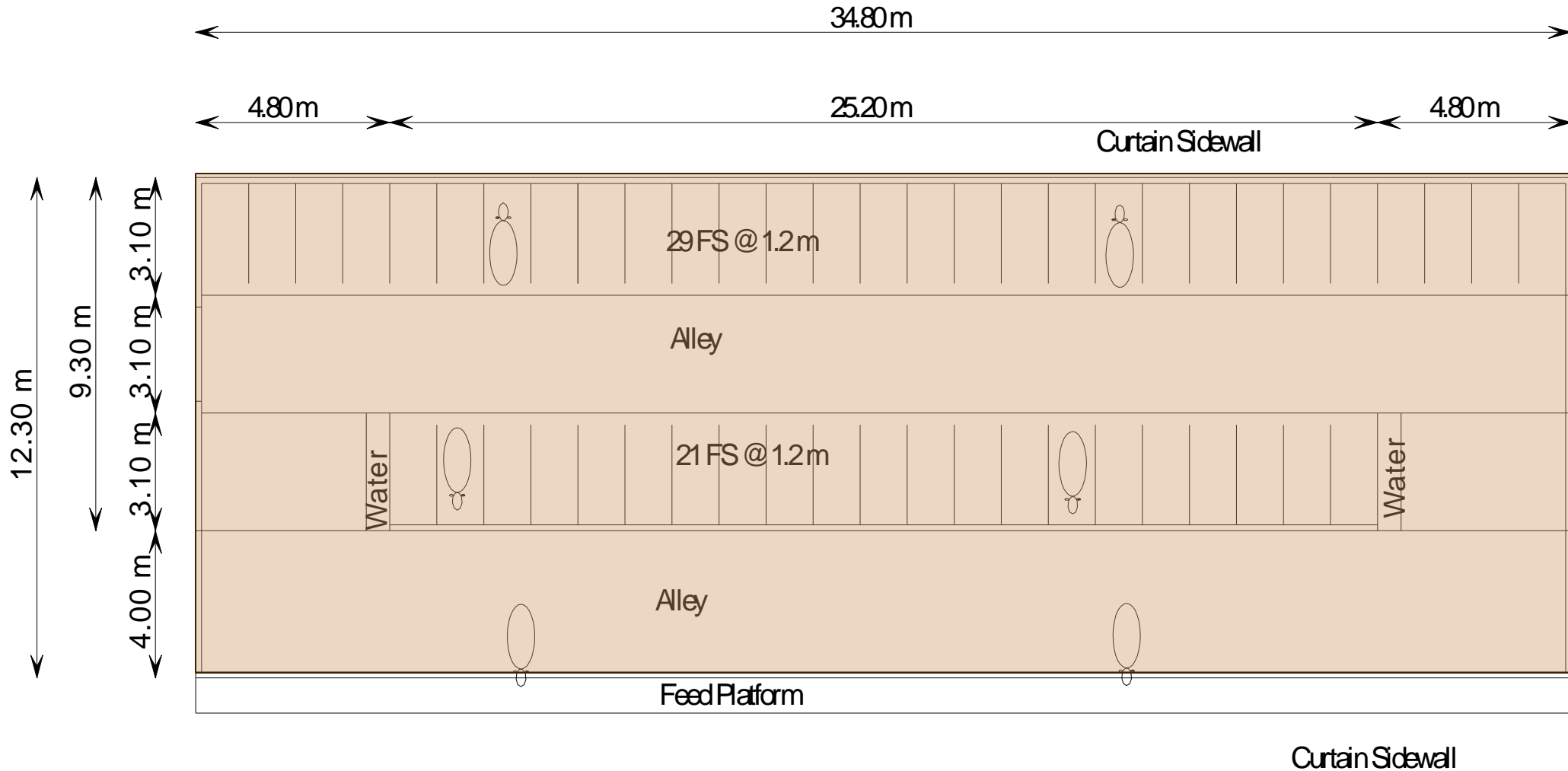


Cow Kennel



McFarland 2014

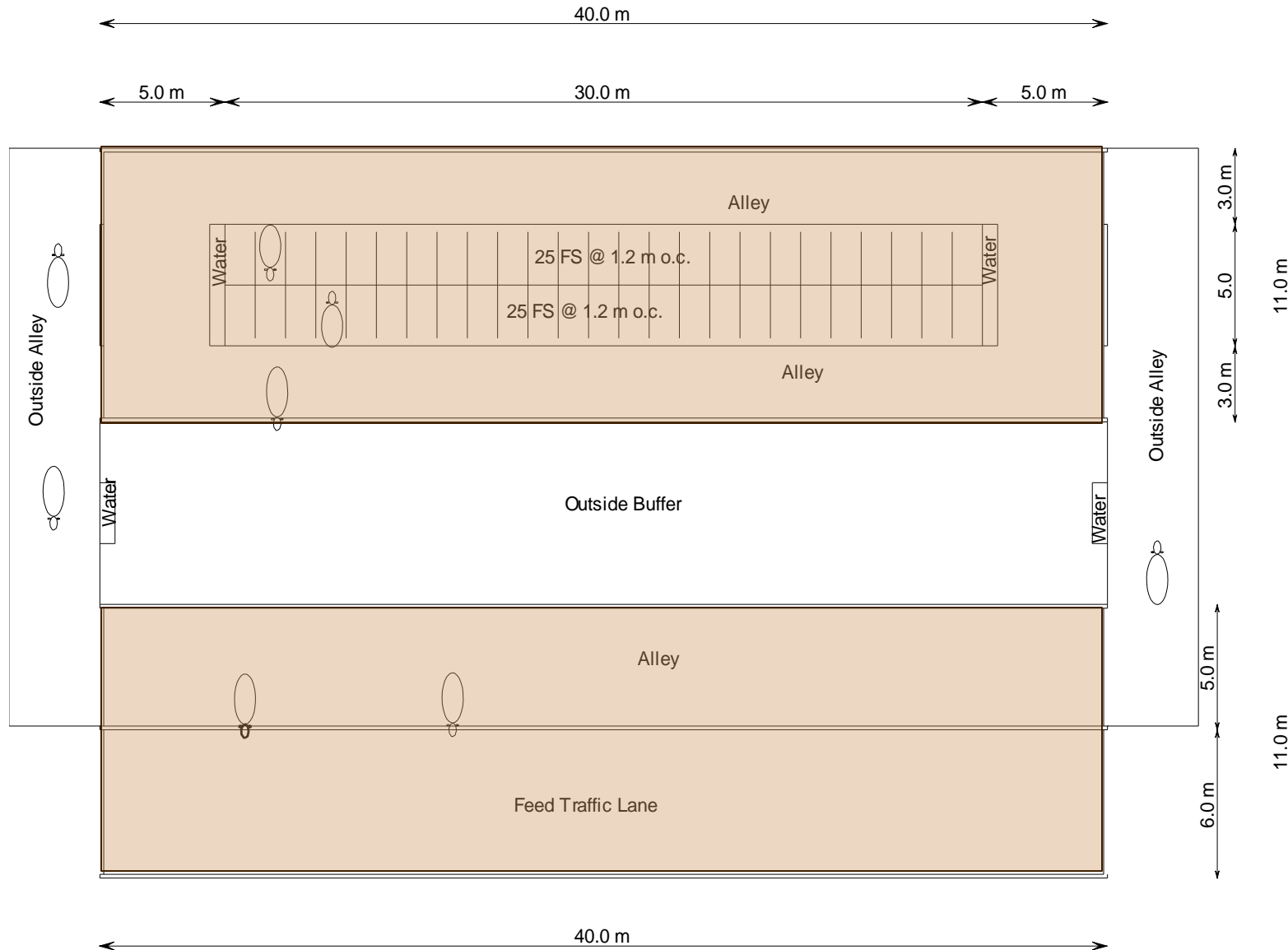
Cow Kennels with drive by feeding



Cow kennels with drive by feeding



Housing and Feeding Shelters



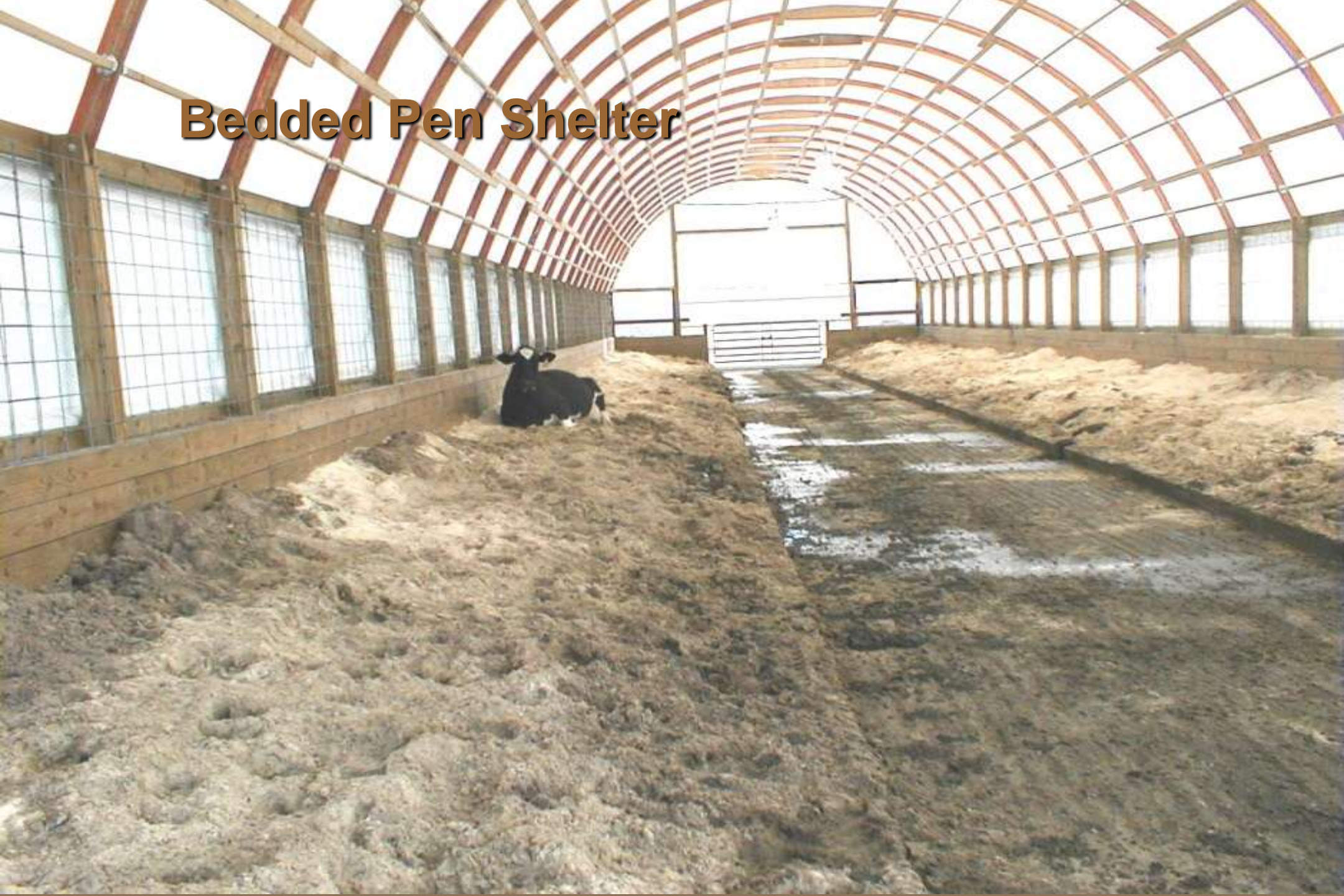
Feeding Shelter



Housing Shelter



Bedded Pen Shelter



Housing and Feeding Shelters



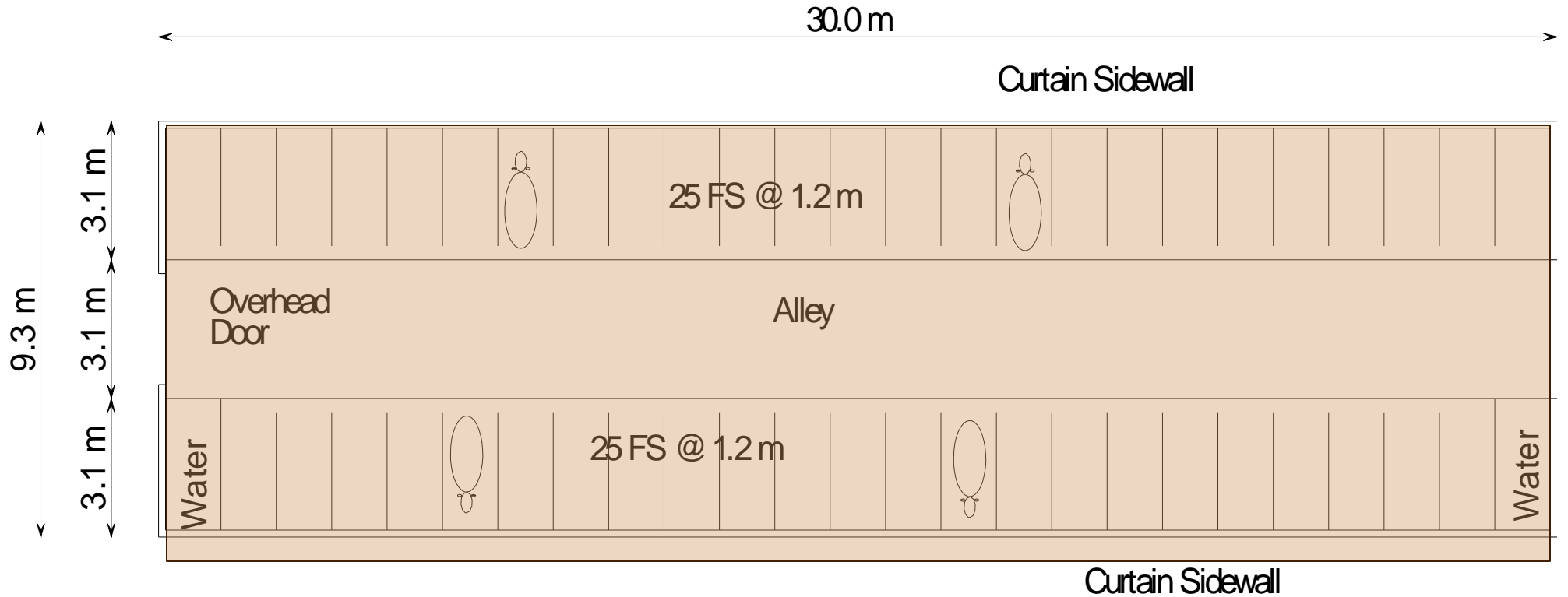
Feeding Shelter



Housing Shelter



2 row Freestall Shelter



2 row Freestall Shelter



2 row Freestall Shelter



Wooden Freestall Divider

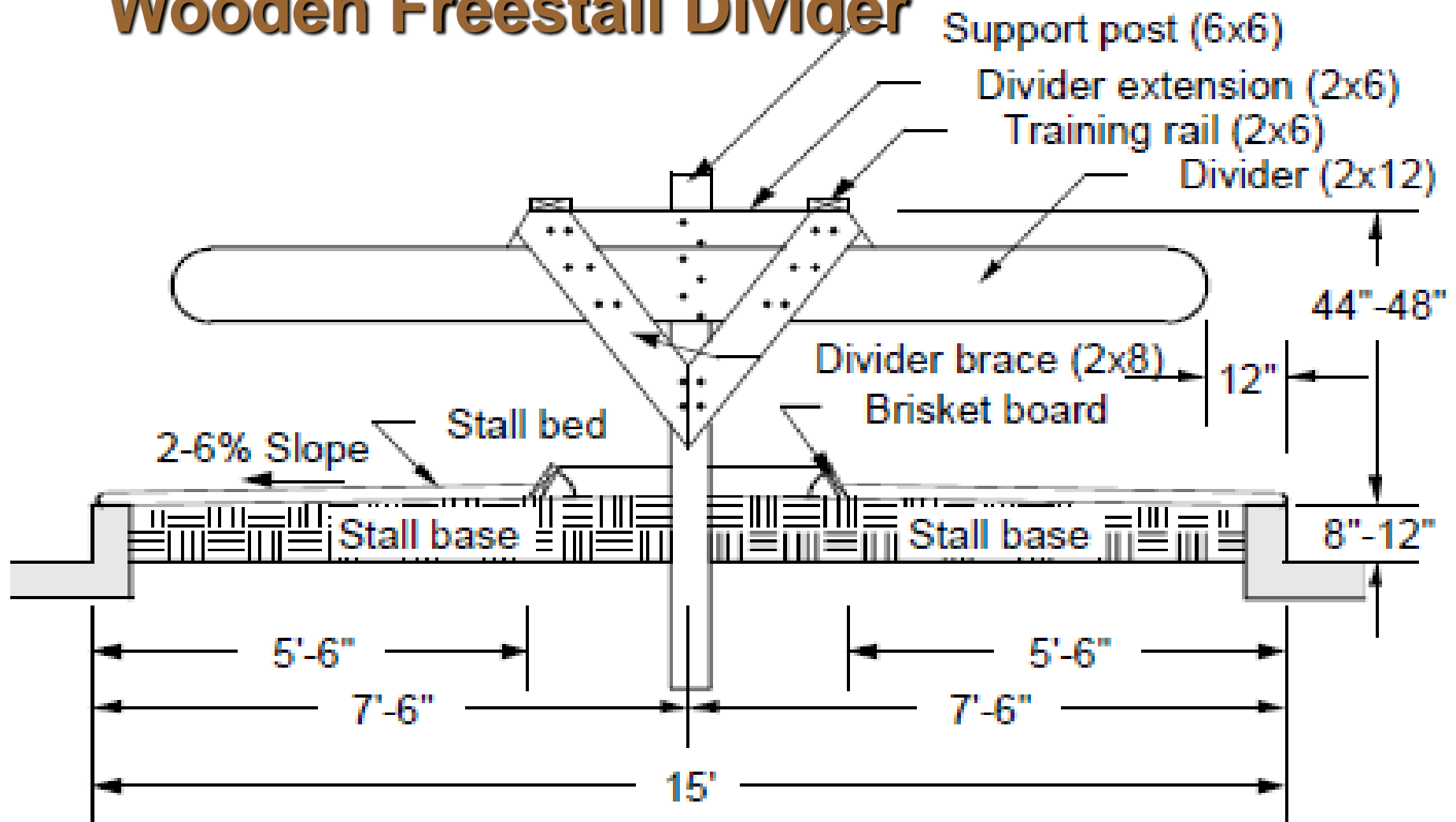
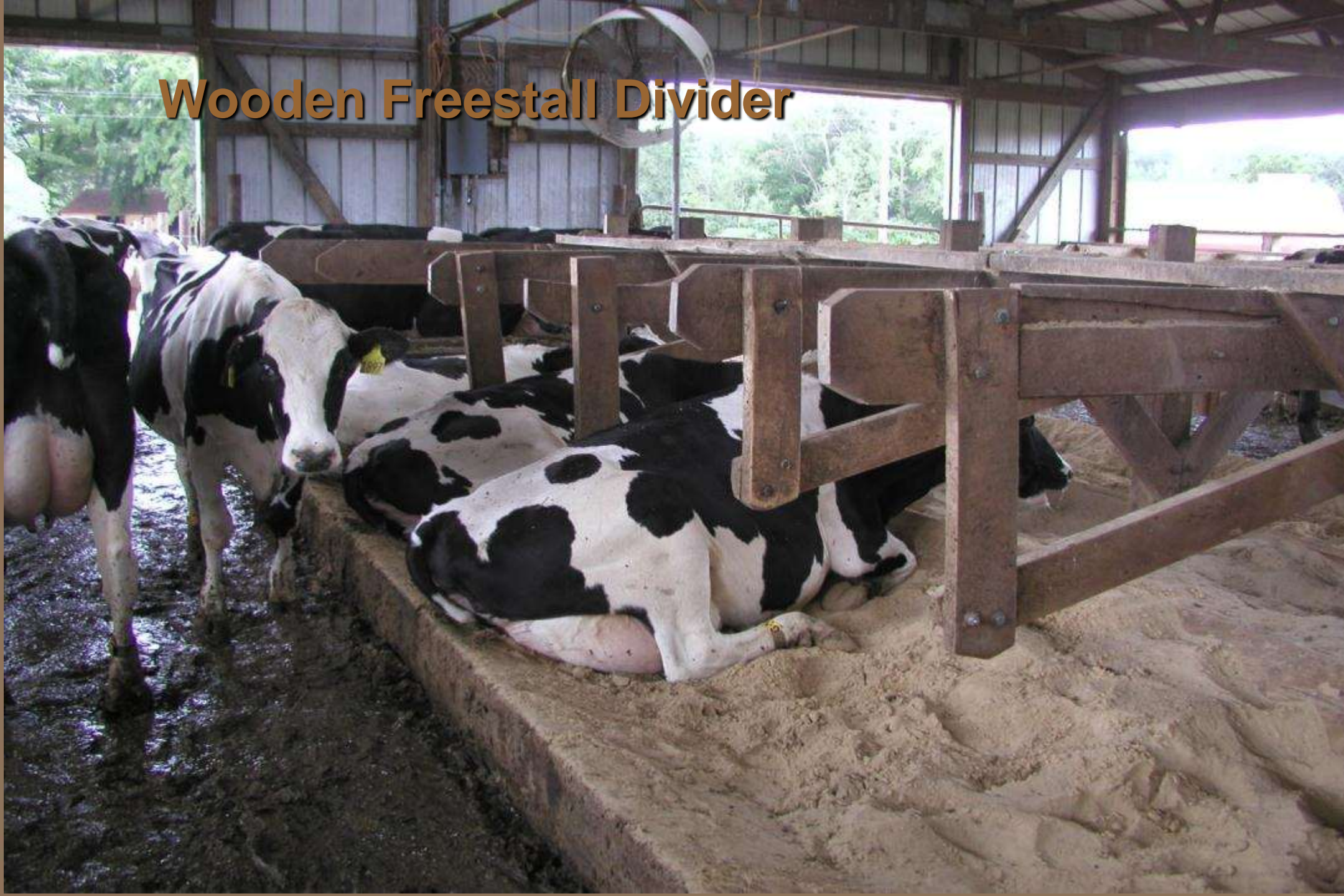


Figure 4. Wooden freestall divider.

Wooden Freestall Divider



Plastic Freestall Divider





**Steel Freestall Divider
With Deep Bed of Sand**

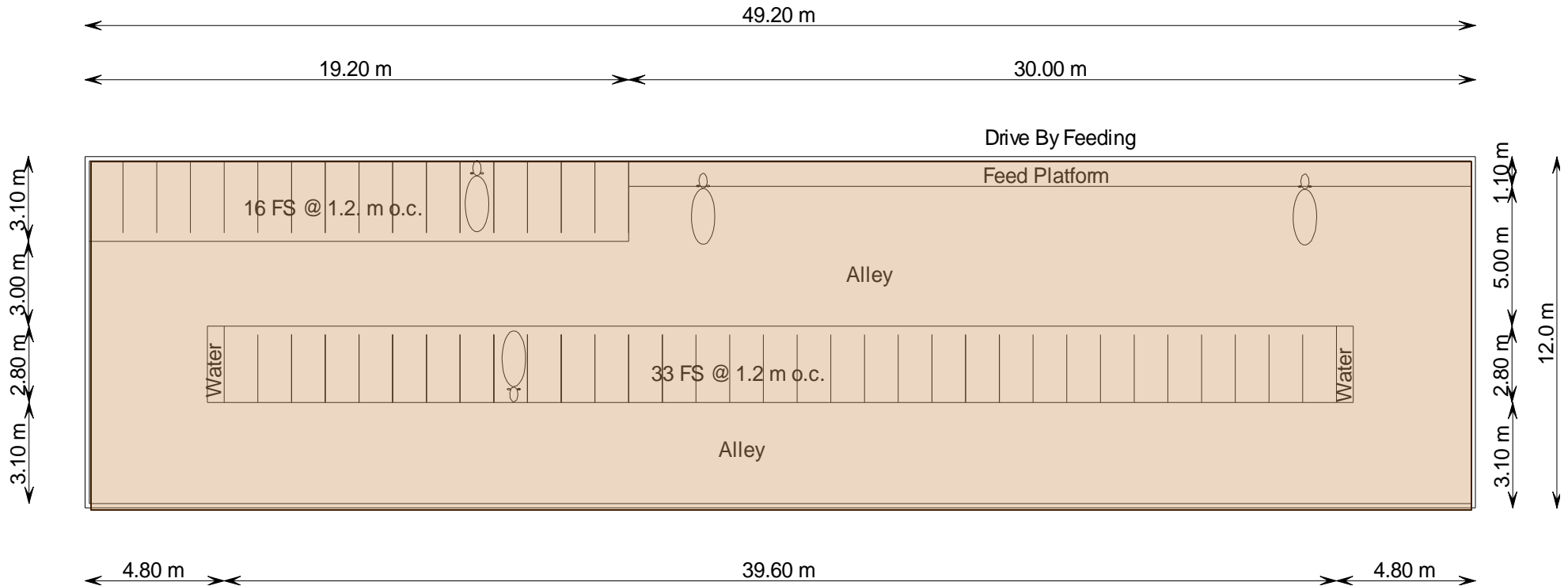
The image shows a large, rectangular industrial tank, likely a wastewater treatment component. The tank is filled with a thick, light-brown, granular material that appears to be organic solids. In the background, there are several vertical metal pipes or tubes that curve over the top of the tank. The overall scene is industrial and somewhat dimly lit.

Deep Bed of Organic Solids

Freestall Mattress



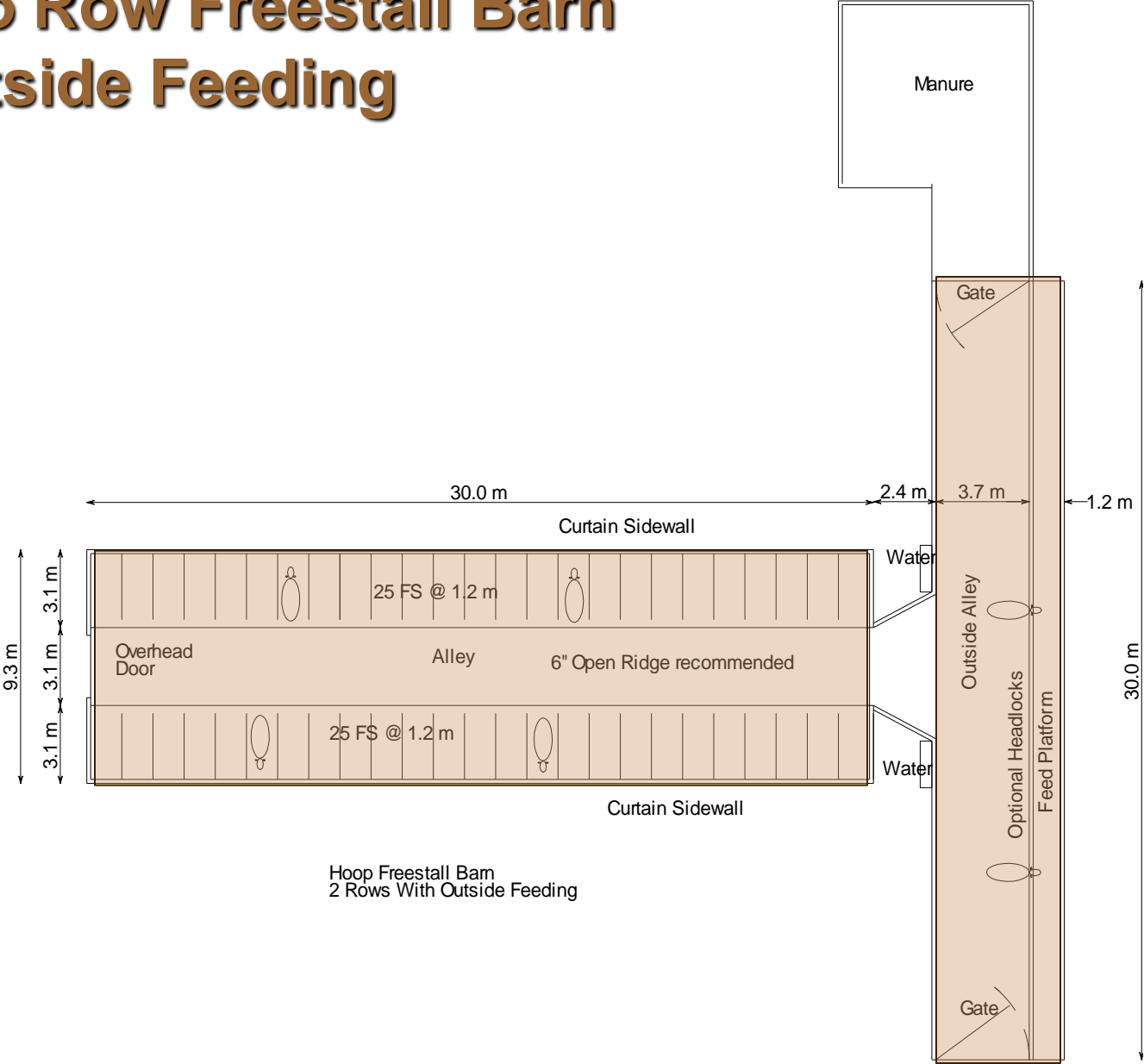
2 row Freestall Barn with Inside Feeding



2 row Freestall Barn with Inside Feeding



Two Row Freestall Barn Outside Feeding



Two Row Freestall Barn Outside Feeding



Two Row Freestall Barn



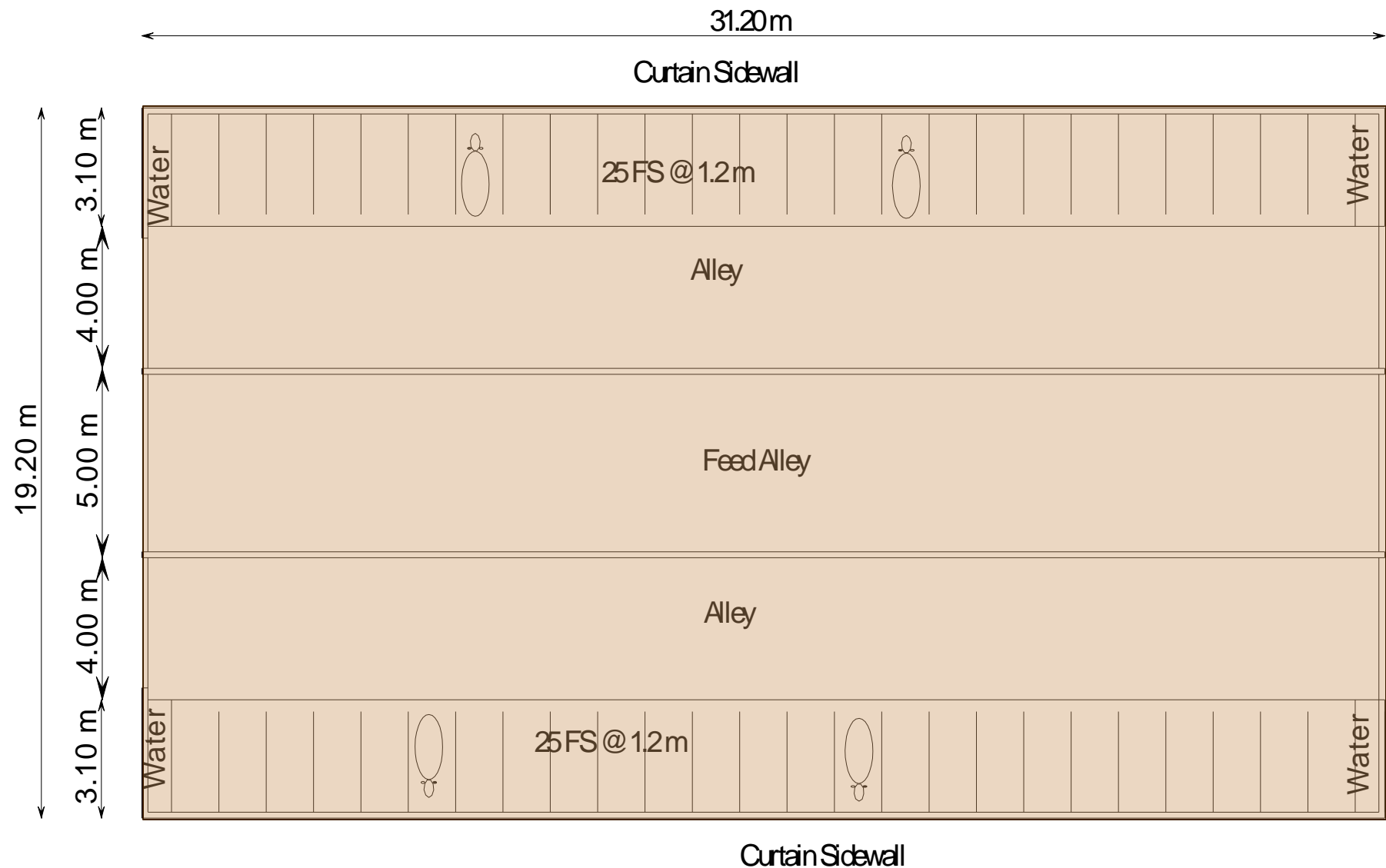
Two Row Freestall Barn



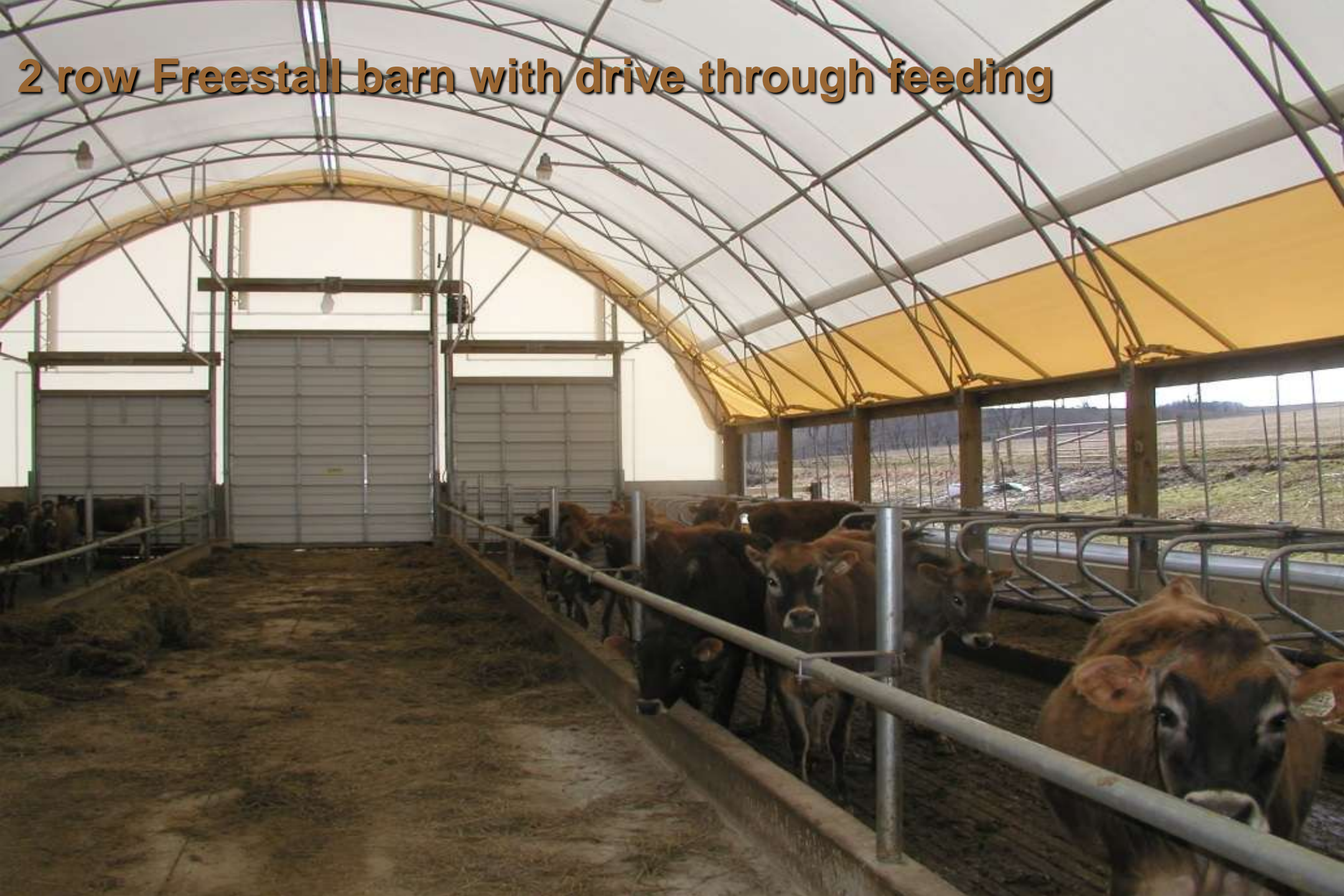
Outside Feeding



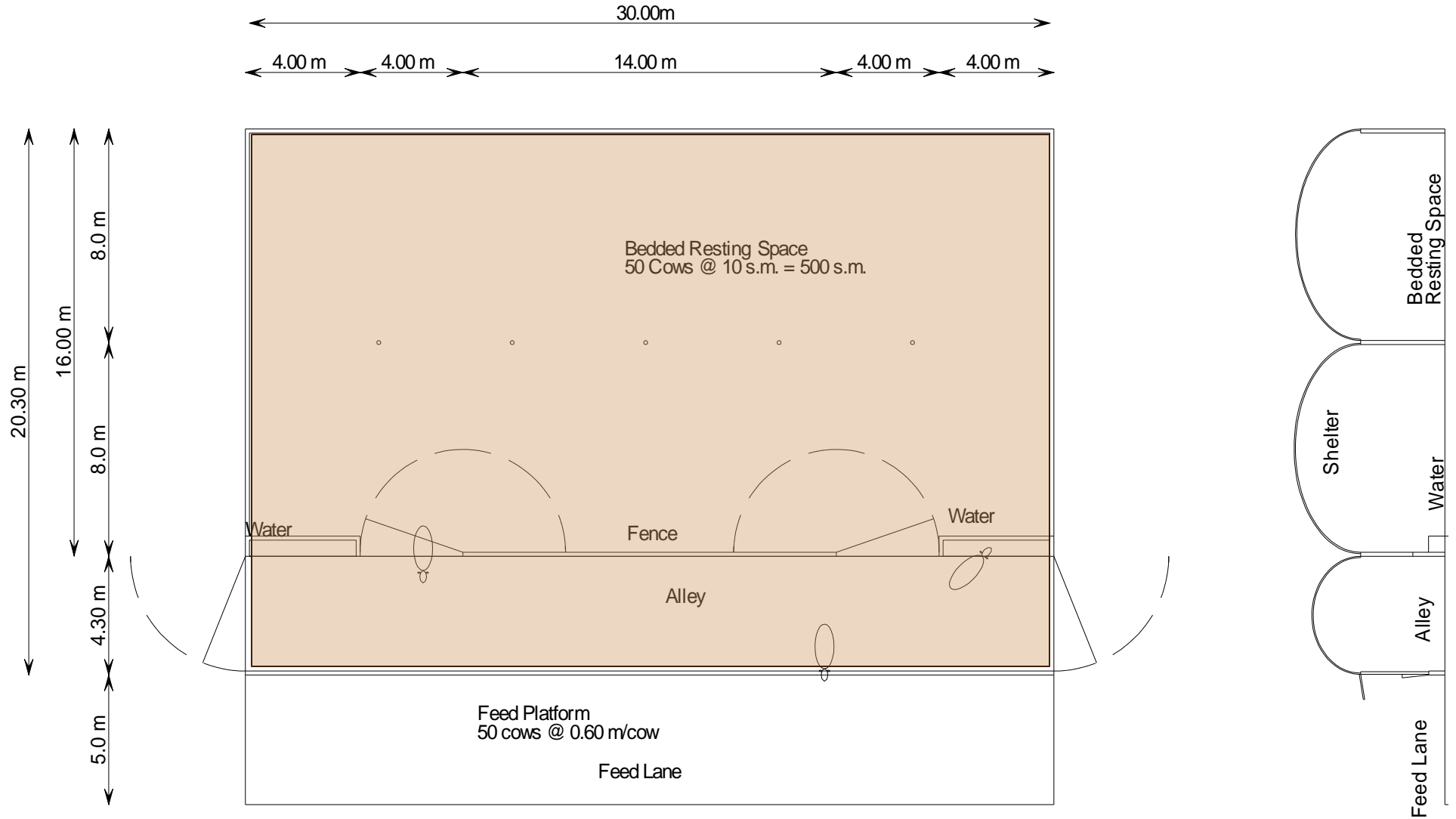
2 row Freestall barn with drive through feeding



2 row Freestall barn with drive through feeding



Bedded Pen Shelter with drive by feeding



Bedded Pen Shelter with drive by feeding



Bedded Pen Shelter with drive by feeding



**Bedded Pen Shelter with drive
by feeding**



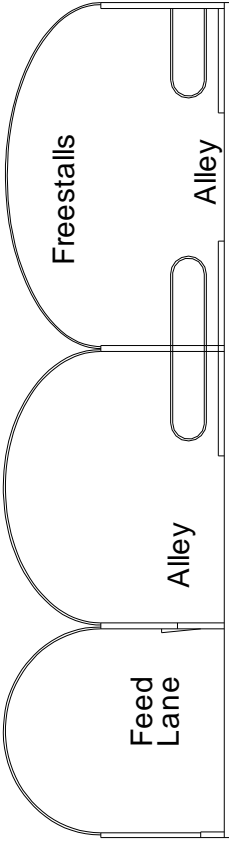
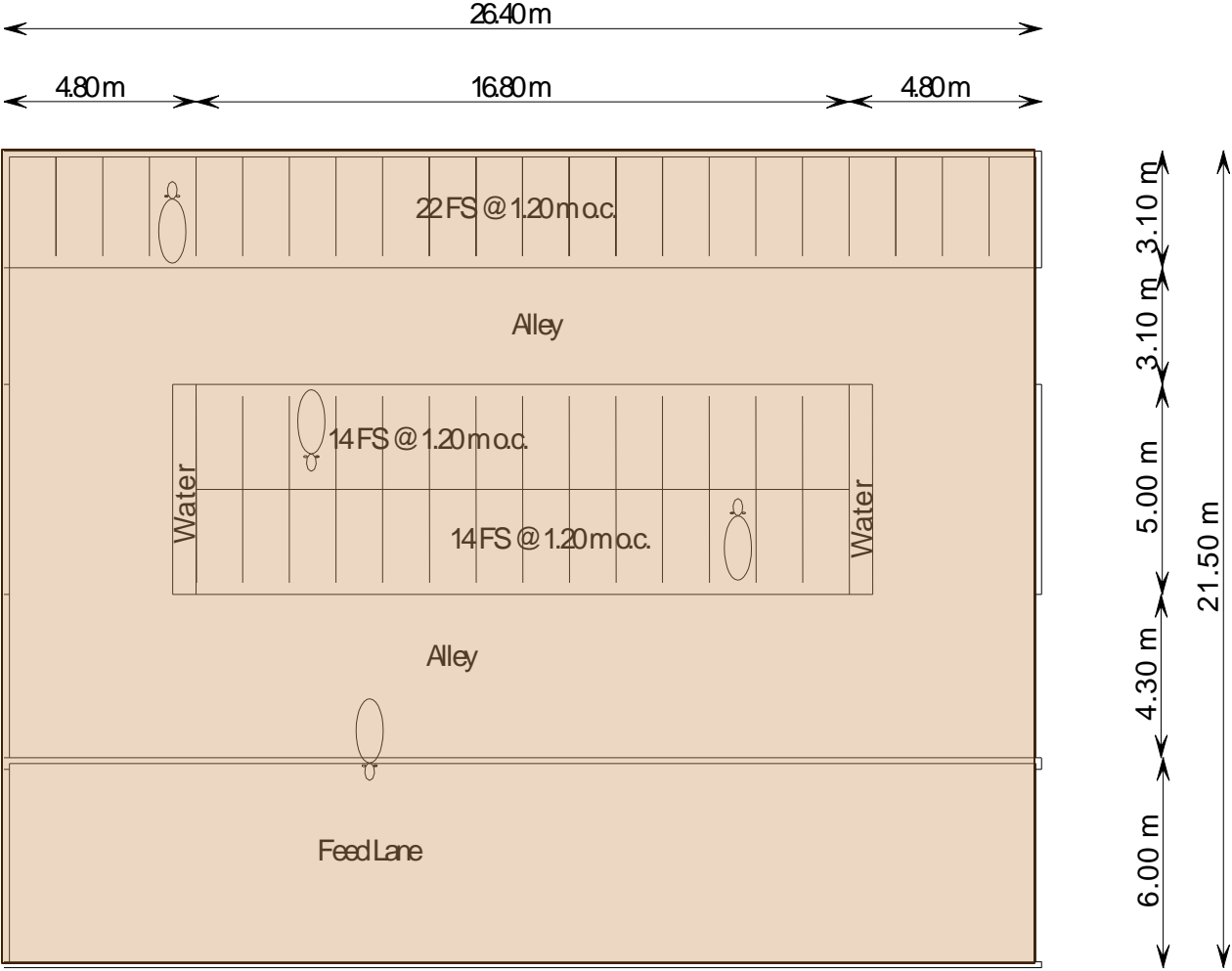
Bedded Pen Shelter with drive by feeding



Bedded Pen Shelter with drive by feeding



3 row Freestall barn with drive by feeding



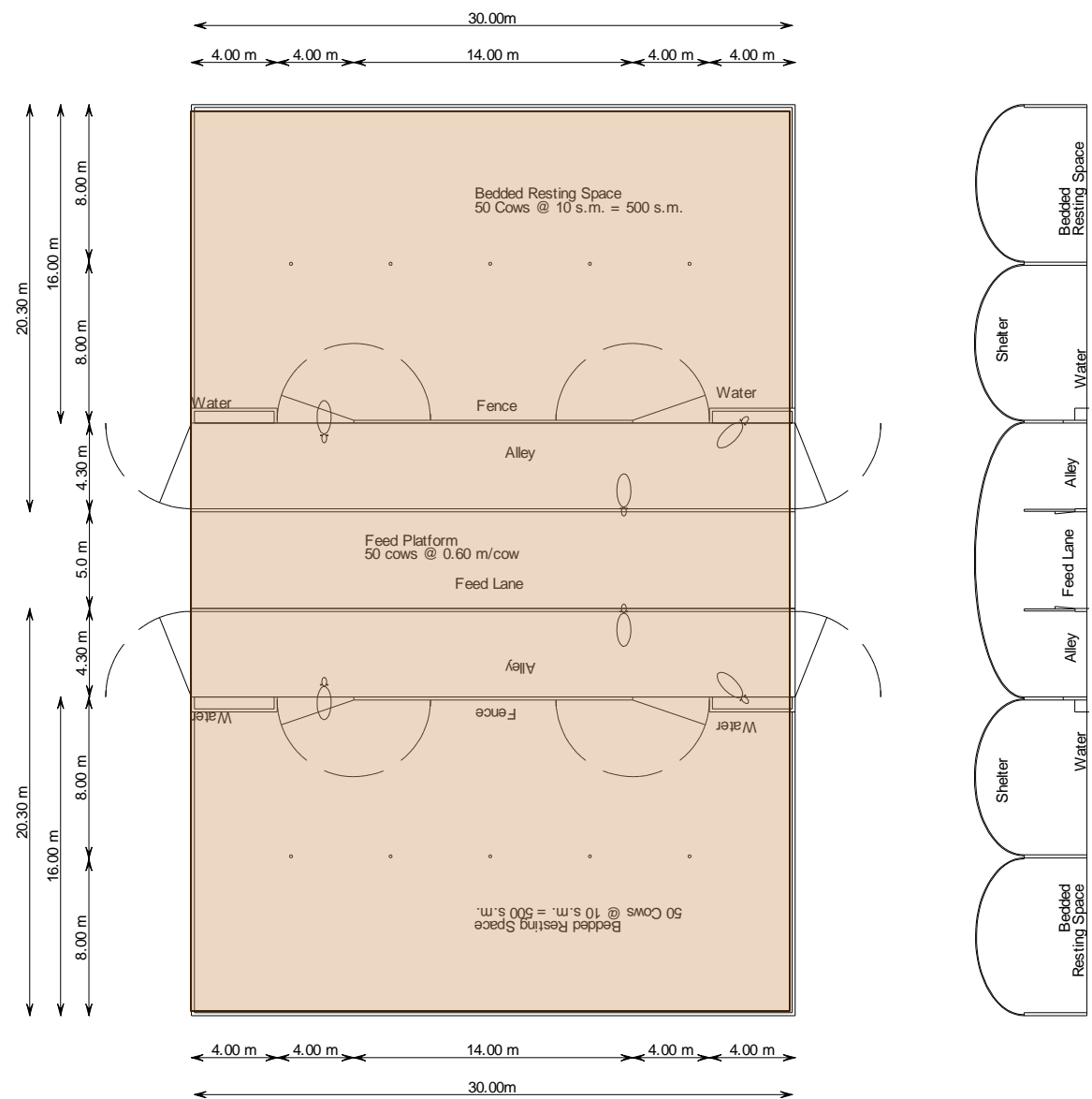
3 row Freestall barn with drive by feeding



3 row Freestall barn with drive by feeding



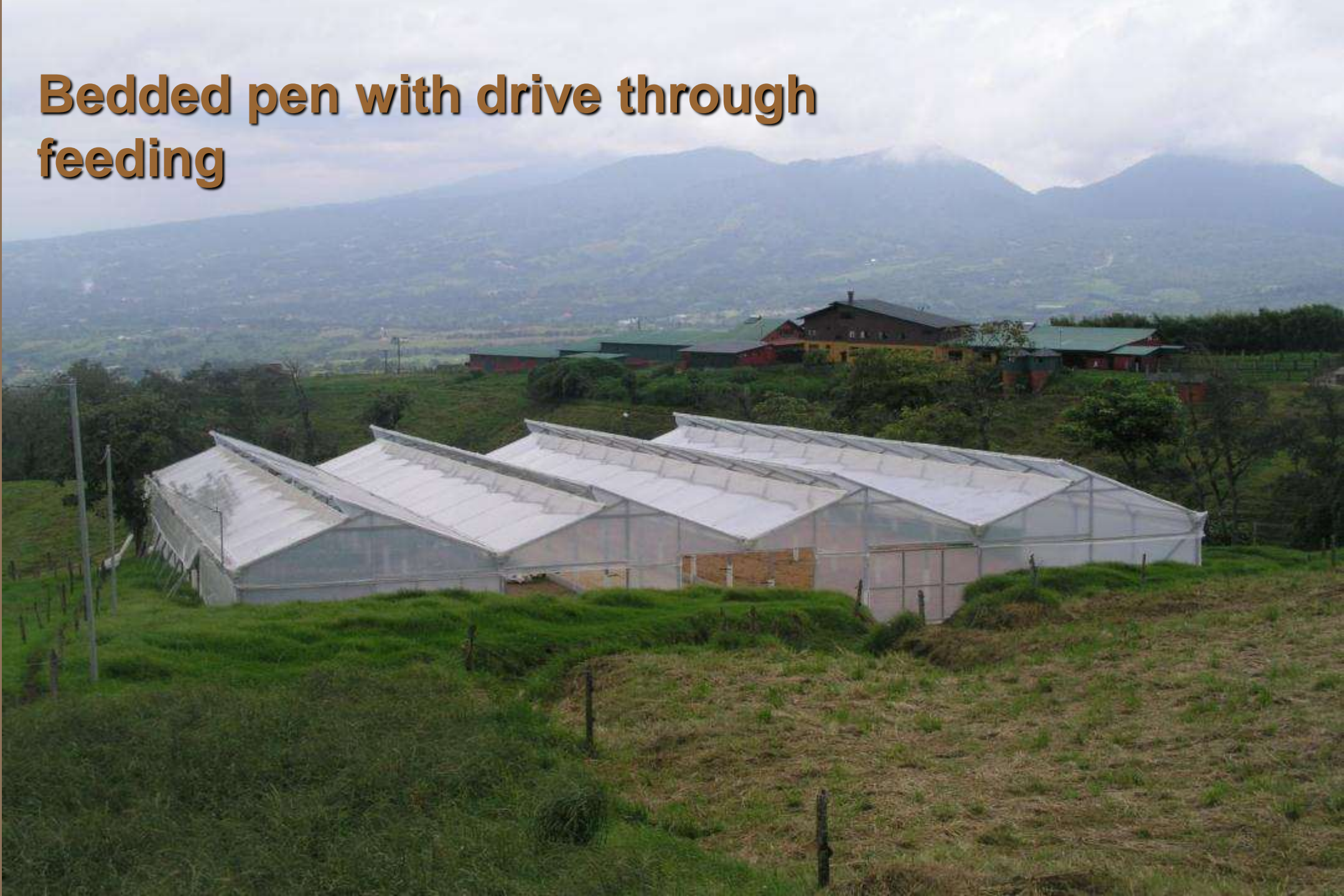
Bedded pen with drive through feeding



Bedded pen with drive through feeding



Bedded pen with drive through feeding



Bedded pen with drive through feeding



Calf Housing Hutches



Calf Housing Calf Barn w/ Individual Pens



Calf Housing

Group Calf Pens



Calf Housing Weaned Calf Super Hutch



Calf Housing

Weaned Calf

Super Hutch



Calf Housing Weaned Calf Barn w/ group Pens



Heifer Housing

Bedded Group Pens with outside feeding



Heifer Housing

Bedded Group Pens with outside feeding



Heifer Housing Bedded Group Pens with sheltered feeding



Heifer Housing

Bedded Group Pens with sheltered feeding



Heifer Housing Bedded Platforms



Heifer Housing

Bedded Group Pens with sheltered feeding



Heifer Housing

Bedded Group Pens with sheltered feeding



Heifer Housing

Bedded Group Pens with sheltered feeding



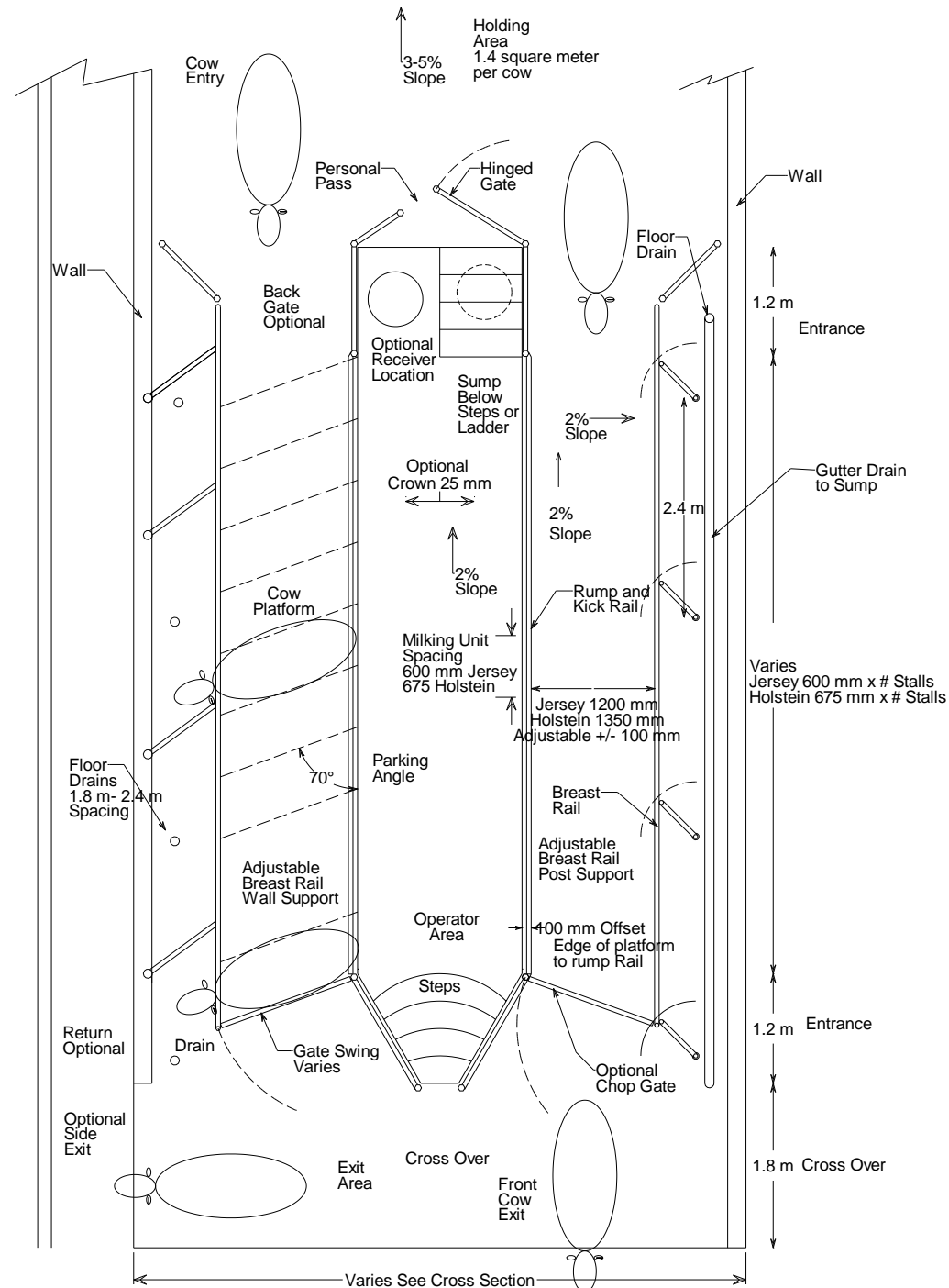
Facility Investments

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(with capacity to expand)
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- ✓ Feed storage
- ✓ Manure storage

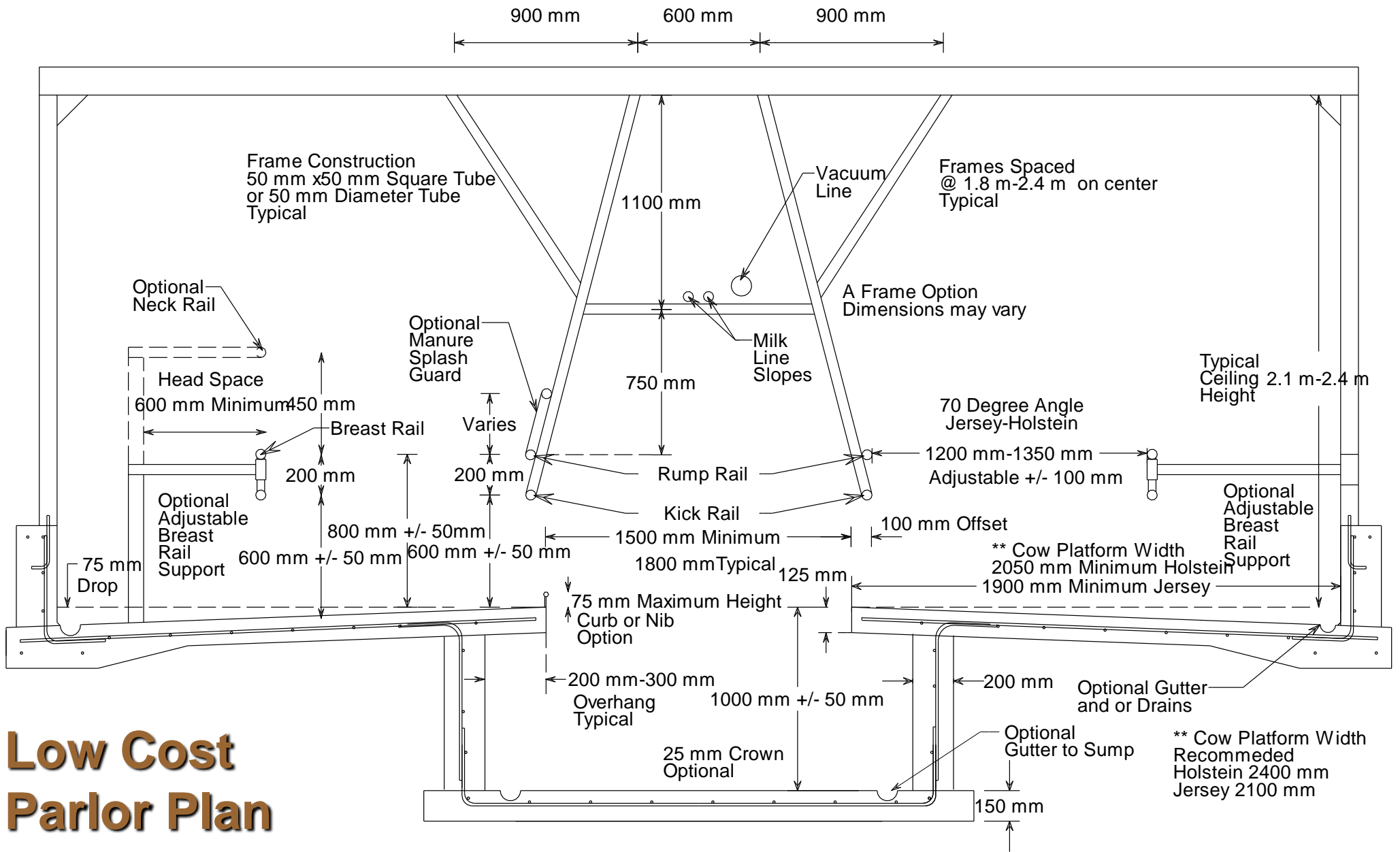
Shaded Holding Area



Low Cost Parlor Plan



Low Cost Parlor Plan



Interior Wall to Wall Holstein 5.7 m minimum, 6.7 m Typical

Interior Wall to Wall Jersey 5.4 m minimum, 6.1 m Typical

Low Cost Parlor



Low Cost Parlor



Low Cost Parlor



Low Cost Parlor



Low Cost Parlor



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- ✓ **Manure storage**



Manure Collection
and Transfer

Feeding Platform Manure Collection



Alley Manure Collection



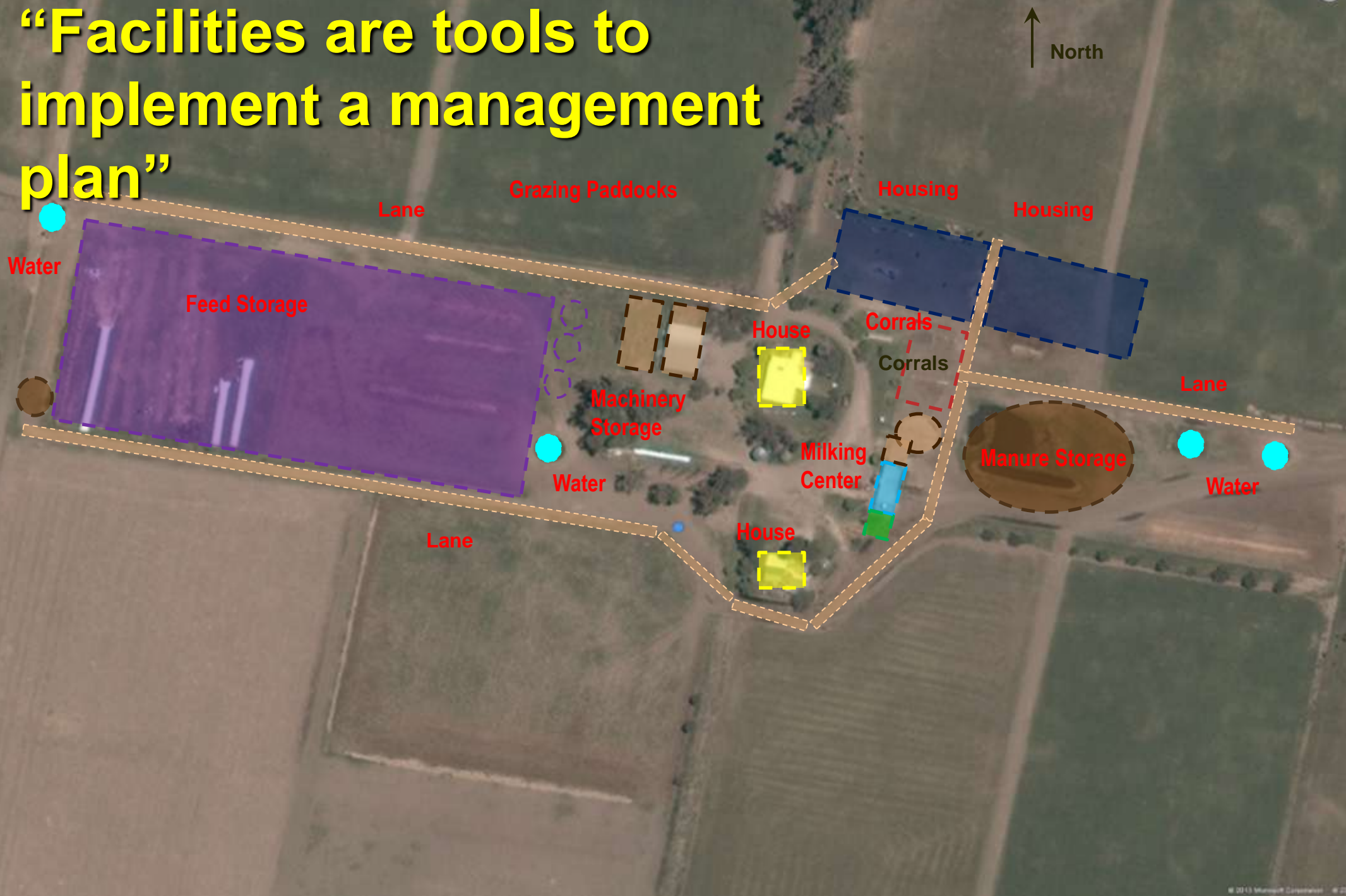
Alley Manure Collection



Alley Manure Collection



“Facilities are tools to implement a management plan”





Preguntas!