



**Proand Ltd**

Agri-Business Centre  
8 Weld Street, PO Box 301  
Feilding 4740, New Zealand

Phone: +64 6 323 8633

Fax: +64 6 323 9516

email: [proand@proand.co.nz](mailto:proand@proand.co.nz)

website: [www.proand.co.nz](http://www.proand.co.nz)

**UNIVERSIDAD DE CHILE**

**AYSEN PROJECT  
SLAUGHTER AND PROCESS PLANT**

**3740**

**PROAND LIMITED**

**MICHAEL J. NIDD  
DECEMBER 2015**

While every effort is made to ensure the accuracy of the information and data contained herein, Proand Limited accepts no liability for any errors or omissions, or any opinions expressed. To the best of the author's knowledge the information is true and accurate.



## CONTENTS



	Page number
A: SITE SELECTION	3
B: CONSTRUCTION DESCRIPTION	6
C: PRELIMINARY DESIGN: BEEF/LAMB PLANT	9
D: OPERATION DESIGN: CATTLE AND SHEEP	16
E: PRELIMINARY DESIGN: BEEF PLANT	18
F: OPERATION DESIGN: CATTLE	24
G: PRODUCT YIELD ESTIMATES	26
H: SERVICES	28
I: PERSONNEL	42
J: RELATIVE IMPORTANCE	43
K: COST ESTIMATES	44



## A: SITE SELECTION

The following section discusses the criteria which should be taken into account when planning establishment operation.

- 1 The site should be located as centrally as possible with respect to the location and type of livestock to be supplied to the abattoir.
- 2 The proposed site must be accessible in all weathers to road transport during construction and abattoir operations. Road transport for delivery of sheep and cattle to the abattoir and refrigerated product despatch.
- 3 The proposed site should be suitably zoned such that the establishment and operation of an abattoir may take place as of right and without notification. If this is not available then a Consent application and hearing would be necessary for a location such as a rural site. This is time consuming and expensive, and dependent upon level of objection and amount of detail argument required. A considerable level of preliminary detail design is required for this type of Consent.
- 4 Obtain a development plan from the local authority and establish what operations associated with the slaughter and processing of animals, would not be permitted on the proposed site. This would determine the limitations of the site. Modern meat plants are designed for operations with no significant odour and low level noise. Noisy equipment such as refrigeration compressors is located in rooms with design attention to sound attenuation. Processing operations take place behind closed doors.
- 5 The establishment of a new abattoir on a site should have minimal ecological and environmental impact. The opportunity should be taken to establish a landscaped and tree buffer zone around the site.
- 6 The site should not be low-level, subject to nor have a history of flooding. Soil types which are subject to extremes of expansion, contracting and pooling of water should be avoided. The site should lend itself to construction of sound and separate below-ground drainage systems for process waste water, storm water and sanitary waste. A suitably qualified engineer should be engaged to report upon the proposed site's suitability as an abattoir location.
- 7 The suitability of the land for the proposed abattoir should include consideration of the water table and natural drainage. The water table level would have a bearing on the decision to locate a basement beneath the ground or above the ground. The site water table should be researched by a hydrologist engineer.

## A: SITE SELECTION

- 8 The site must not be subject to liquefaction in the event of an earthquake. A Geotechnical Investigation should be carried out on the site. Check if a geotechnical analysis has been carried out on the proposed site and if records are available.
- 9 A history of prior use of the site should be sought to ensure that the area had not been used as a landfill for materials which may be hazardous to an abattoir operation or make the site unstable.
- 10 Avoid any neighbouring industries existing or proposed which by nature would put the operation of the abattoir (a food operation) at risk through objectionable odours, noise, smoke, dust etc.
- 11 The site should be large enough to allow a degree of future expansion. Rather than additional processing on the abattoir site, future expansion tends to be in the stockyards and cold storage areas.
- 12 The prevailing wind direction should be taken into account. The orientation of the abattoir on the site should allow the wind to blow over the plant to the stockyards.
- 13 Clean, wholesome water of potable quality and in sufficient volumes should be available at the site boundary. Research to determine if there is a water supply history of turbidity and salinity. Water will be required year round. Ideally the water should be from a quality chlorinated supply with the alternative being an on-site bore – requiring treatment for potability.
- 14 Process effluent is a major issue in an abattoir where the volume of effluent discharged equals the water input. The most convenient system is after preliminary treatment, discharge to a local authority effluent system, ideally available at the boundary. This system will attract a charge from the local authority based upon volume and effluent quality. Spending some money by treatment of the effluent at the abattoir before discharge will improve the quality and reduce the charges. The alternative would require a much larger rural site with facultative ponds and pasture irrigation. This would be subject to an application and consent. Restrictions upon the quantity and effluent application rates will be imposed.
- 15 Provision of an hygienic efficient sewage disposal system. Ideally this should connect to the local authority sewage system.
- 16 The availability and proximity of a suitably skilled labour force for management, slaughtering, processing and maintenance of the plant is essential. Working shift work will be an integral part of plant operations which becomes difficult if employees must travel long distances to work. With regards to maintenance it is common for smaller new plants to have maintenance contracts with local businesses. This is normally welcomed by the community, as in addition to local employment of processing personnel the plant provides some opportunities for local

## A: SITE SELECTION

businesses.

- 17 Arrangements need to be made for disposal of organic abattoir waste such as blood, bones, fat, manure and intestinal contents. To avoid odours the bones and fat would be collected on a daily basis to off-site processing. Establishment of an on-site rendering operation may be difficult for consent and approval plus uneconomic for a small capacity abattoir. However an on-plant rendering operation may be the only satisfactory means of organic waste disposal. Stockyard manure and intestinal content can be disposed of as raw composting material. In addition provision must be made for disposal of inorganic waste such as cardboard, plastic wrapping etc.
- 18 Background research if there are any cultural issues associated with the proposed site and site access.
- 19 No restrictions on plant operations and contractors working outside normal hours and up to seven days per week.

## B: CONSTRUCTION DESCRIPTION

### CONSTRUCTION

- 1 General construction and plant and equipment used in the proposed plant will fully comply with modern international standards.
- 2 Main process building constructions will be steel portal frames or trusses supporting light coloured, polystyrene panel walls and ceilings.
- 3 A shade roof constructed of colour-coated galvanised steel will be constructed over the polystyrene processing areas.
- 4 Processing area services (e.g. electricity, water etc.) will be provided through the ceiling.
- 5 All floors will be concrete or an approved impervious non-toxic material, easy to clean and disinfect. They will have surfaces which minimise the risk of slipping.
- 6 Ceilings will be designed and constructed to prevent the accumulation of dirt, minimise condensation and be easy to clean. There will be no exposed wood.
- 7 The yards will have a concrete floor and will be covered.
- 8 Suitable insulation with sub-floor heating and ventilation is to be provided in the floor of the box freezers and cold stores.

### BUILDING

- 1 Building fabric to provide a vermin and bird proof envelope for the processing areas. Exterior openings will be designed to minimise insect ingress.
- 2 All junctions, crevices and surfaces in critical hygiene areas to be impervious and sealed to avoid ingress of pathogens into the building fabric.
- 3 Voids in the building structure to be avoided where possible.
- 4 All plant, equipment and services to be positively separated to allow efficient wash-down.
- 5 All materials to be durable in respect of chemical, temperature and abrasive environmental duties found within the building.
- 6 Falls to all floors to allow for drainage of liquids without ponding.
- 7 Controlled environment areas to be provided with fresh and tempered air to provide proper ventilation and temperature control. The system will prevent the ingress of dust and odours. The general airflow on the slaughter-floor will be from the clean areas to the dirty areas.
- 8 Open well-lighted spaces and significant use of natural light where possible to provide pleasant and safe working environment.

## B: CONSTRUCTION DESCRIPTION

- 9 Safe access to items of plant and ceiling and duct spaces.
- 10 All personnel doors opening to the exterior will be self-closing and will remain sealed in an approved manner during normal working hours.
- 11 All drains will be adequately vented, be vermin proofed and designed to prevent odours from entering the processing areas.
- 12 Specific fire design will be required to meet the demands of appropriate government and territorial authorities.

## EQUIPMENT

- 1 Purpose designed for slaughter and chilled cutting on a clear site.
- 2 Relatively low repairs and maintenance overheads as all vital equipment will be new.
- 3 Maximum use of non-complex equipment to keep capital costs to a minimum.
- 4 All equipment, rail support structures, stands etc. will be constructed from steel with an approved non-toxic, non-absorbent finish. All equipment to be resistant to fracture, rust and corrosion and capable of being easily cleaned.
- 5 Hand and equipment wash equipment will be of a type approved by international authorities. Hand wash facilities will be non-contact operated, fitted with soap dispensers and a disposable hand drying system.
- 6 Water from hand/apron washes, equipment and process wash areas will be contained and positively ducted to the drainage system.
- 7 A sufficient number of hose connections for an ample supply of cold and hot water will be provided inside and outside the plant. All hoses will be stored off the floor on wall mounted hose holders.
- 8 An approved enzyme foam cleaning system will be used in the processing areas.
- 9 Cold, 43°C and 82°C potable water will be generated and reticulated in sufficient quantities to satisfy the requirements of all departments.
- 10 Conveyors and rails will be constructed to an approved hygienic design to prevent dirt falling onto carcasses. Drip trays will be fitted under gearboxes and conveyor drives.
- 11 A monitoring system will be installed to record temperatures in all temperature controlled areas with the capability to provide both instantaneous readings and a continuous log.

## B: CONSTRUCTION DESCRIPTION

### EXTERNAL FEATURES

- 1 Plant design is attractive, modern and hygienic. Landscaping with trees and lawns is intended to enhance the external appearance. First impressions, especially for a regulatory review officer or visitor clients, are very important.
- 2 There will be a single controlled entrance to the site. Private and unauthorised vehicles should remain parked outside the fence and all personnel must walk through the single entrance.
- 3 The perimeter security fence will surround the plant, encompassing:
  - Holding yards
  - Slaughter, boning and freezing plant
  - Plant services
  - Water tanks and water treatment
  - Amenities

All roads and vehicle access surrounding the plant will be sealed, kerbed and storm-water channelled.

- 4 The office location is such that all personnel and traffic movements through the entrance can be observed.
- 5 A facility is provided for washing and sterilising:
  - Livestock trucks
  - Meat trucks



## C: PRELIMINARY DESIGN: BEEF/LAMB PLANT

### 1 Design

The proposed design is a compact multi-species slaughter and processing plant:

- Designed with a view to US, EU, China and domestic markets
- Halal slaughter
- Sheep slaughter and processing capacity of 85 per hour
- Cattle slaughter and processing capacity of 10 per hour

### 2 Main plant components

- Sheep and cattle unload
- Covered cattle yards; capacity up to 75 head
- Covered sheep yards; capacity up to 650 head
- Cattle slaughter line; capacity 10 per hour
- Sheep slaughter line; capacity 85 per hour
- Beef red offal recovery
- Beef paunch/intestine (green offal) recovery
- Beef trotters and head recover
- Sheep red offal recovery
- Sheep paunch/intestine (green offal) recovery
- Hides, skins, blood and waste collection (non-food)
- Beef carcass chilling
- Sheep carcass chilling
- De-boning room; capacity 10 beef or 85 lambs per hour
- Packaging material dry storage
- Carton chilling
- Carton freezing
- Cold storage
- Environmental load-out
- Slaughter/deboning ante room
- Boiler/workshop room
- Refrigeration compressor room
- Electrical switchboard room
- Plant office/reception
- SAG office and amenities
- Male and female amenities
- Visitor reception and viewing area

### 3 Peripheral components

- Electrical supply and transformer
- Water supply
- Potable water treatment
- Water storage tank
- Process effluent screening; primary treatment
- Liquid effluent balance tank
- Diesel fuel tank
- Organic waste collection

## C: PRELIMINARY DESIGN: BEEF/LAMB PLANT

- Inorganic waste collection
- Car parking
- Laundry equipment
- Security control system
- First aid facility
- Exterior lighting
- Landscaping

### CRITERIA

#### 1 Projection:

- Modern slaughterhouse with emphasis in the fields of design, construction, equipment, methodology and operation in upon food safety and quality management
- Plant design to operate up to 42 weeks per year
- Plant with potential to work shift-work
- Ability to process sheep, lambs, calves, goats and cattle
- Slaughter and de-bone cattle and sheep at different time (non-concurrent)
- All carcasses cut and de-boned
- Chilled and frozen finished food products
- Design allowance to add additional capacity e.g. carcass chillers, as/when required

#### 2 Work force:

A multi-skilled work force proposed for the new meat plant. It will be necessary for the people to be trained in the correct skills necessary for:

- Hygienic slaughter and dressing of beef, sheep and lamb
- Cutting, boning and packaging of these meats to achieve the required market presentation
- Livestock handling and management
- Plant management and supervision
- Quality assurance
- Meat inspection
- Plant maintenance

Stock procurement and meat marketing are beyond the scope of this report. The parameters are taken as operations within the meat plant perimeter fence.

#### 3 Critically important to establish a programme with plant personnel in the development, documentation and implementation of a quality management and food safety system. This would include:

- HACCP (Hazard Analysis Critical Control Point) programme
- RMP (Risk Management Programme)
- SSPO (Sanitation Standard Operating Procedure)

#### 4 Processing operations:

## C: PRELIMINARY DESIGN: BEEF/LAMB PLANT

As described, the plant is designed to slaughter/process one species one day and another species the next. Cattle and sheep would have separate slaughter lines, operating at different times, but a common de-boning room.

The concept proposes plant operations commence with one crew who both slaughter a species e.g. cattle one day and de-bone that same species' carcasses e.g. beef the second day. The crew then slaughters the other species e.g. lamb on day three and de-bones that species' carcasses on day four.

### PROCESS DESCRIPTION

#### 1 Stockyards

- Sheep and cattle unloaded from road transport into the stockyards. Sheep held on steel mesh and cattle on concrete floor
- Cattle washed prior to slaughter
- Yard capacity estimated at 650 sheep/lamb and 75 cattle

#### 2 Cattle Slaughter Line

- Conventional slaughter system with carcass suspended from a non-powered overhead rail during all operations. Design rate up to 10 per hour.
- Low voltage stimulation unit for carcass tenderising process during bleeding.
- Downward over the head hide puller.
- Mechanical rise/fall platforms for legging, hide removal, carcass sawing, inspection and trimming operations.
- Carcass eviscerated into manual gut buggies.
- Red offal prepared for slaughter floor. Red offal cooled in chilled water.
- Cold wash paunch items recovered in room off slaughter floor.

#### 3 Sheep Slaughter Line

- Inverted sheep system. All overhead conveyors driven by a single reciprocating ram. Design rate up to 85 per hour.
- Restrainer, conveyor, electrical stun and landing table.
- Powered hind leg rail and conveyor. Three vertical bleed stations.
- Low voltage stimulation unit for tenderising process during bleeding.
- Fore leg rail and conveyor slave driven off hind leg conveyor. Fore leg spreader on rail. Spreader on rail. Spreader in narrow configuration following hind leg removal.

## C: PRELIMINARY DESIGN: BEEF/LAMB PLANT

- Four-prong hydraulically powered skinning machines.
- In line viscera conveyor.
- Red offal prepared on slaughter floor. Red offal cooled in chilled water.
- Intestine (runners) recover in room off slaughter floor.
- Carcasses washed, weighed and hung eight (8) to a stainless steel frame which is suspended from the high beef rail. Four carcasses on high level and four carcasses below.

### 4 Carcass Chillers

- Two carcass chillers with capacity to hold:
  - 75 beef carcasses (150 sides)and
  - 650 lambs
- Red offal from sheep and beef placed in plastic bags and stored in racks in chiller.
- Refrigeration system to reduce carcass and offal temperature from +35°C to +7°C in 12 – 15 hours.
- Chiller to be washed clean after unloading and prior to reloading with fresh product.
- Hot product should not be introduced into a chiller with cold product. Prior to next day's slaughter, chilled carcasses are railed out to the de-boning area to await boning.

### 5 Boning Room

- Room designed for quarter de-boning of beef.
- Proposed system (Beef) 10 carcasses per hour and (Lamb) 85 carcasses per hour.
- Meat cuts trimmed then wrapped or vacuum packaged followed by packing into trays or boxes.
- Individual meat cuts able to be accurately weighed and identified with the carcass.
- Bags of chilled offal brought into the boning room for packaging and packing. Offal will be vacuum packed.
- Boxes weighed, labelled and sealed before being conveyed through to box chiller.
- The room is maintained at +10°C during operations.

### 6 Distribution Dry Store

- A separate room provided for storage of plastic packaging material and empty trays before distribution to the de-boning room.

## C: PRELIMINARY DESIGN: BEEF/LAMB PLANT

### 7 Box Chiller

- A box chiller to hold finished packed product.
- The chiller to have a capacity to reduce the internal temperature of the packed product from +7°C to 0°C in approximately 24 hours.
- The box chiller has a working capacity of 1,344 boxes on pallets stacked two high

### 8 Box Freezing

- Three cabinet type box freezers. Each freezer with a capacity of 24 pallets with shelves.
- Total capacity 3,024 boxes.
- Refrigeration capacity to reduce product temperature within boxes to -12°C minimum in approximately 36 hours.

### 9 Cold Store

- Frozen boxes stored on pallets. Pallets stored three high on racking inside the cold store.
- The capacity is 9,576 boxes on 228 pallets. This is equivalent to 33 days full production.
- Cold store will operate with an air temperature of -18°C.

### 10 Environmental Load-Out

- Product is despatched through a temperature controlled environment.
- One refrigerated truck load-out dock. This dock is sealed to provide an airlock between the truck and the building.
- Forklift charging and battery storage facility provided.

### 11 Skin Collection

- Skins will be directed from the slaughter area to the collection areas and loaded into steel bins for daily removal from plant.
- Fat and bone waste material also stored in this area for daily off-plant disposal or on-site rendering (if required).

### 12 Ante Room

- All employees must pass through the ante rooms before entering the slaughter floor or cutting room. Employees wash and clean before starting and at the end of work.
- The ante room contains equipment to wash and hang personal hygiene equipment.
- Ante room components:

## C: PRELIMINARY DESIGN: BEEF/LAMB PLANT

- Apron wash units (+43°C water)
- Boot wash units (+43°C water)
- Hand wash units (+43°C water)
- Apron and knife pouch hanging pegs
- Knife sharpening equipment
- Every person entering the slaughter floor and de-boning room must wash their hands before entry.
- Apron and knife pouch hanging pegs are provided on the wall for employees.

### 13 Plant Room

#### Two Plant Rooms

Plant Room #1    Hot water boiler  
                          Warm water mixing valves  
                          Pumps  
                          Master switch board

Plant Room #1    Freezer  
                          Box chiller  
                          Cold store refrigeration compressors

### 14 Welfare Amenities

- Amenities are provided for males and females. The exact ratio of male and female employees is to be determined.
- The amenity area will contain:
  - Individual steel lockers for employees' street clothes, shoes and personal items
  - Toilets
  - Showers
  - Hand wash units
- All employees must wear protective clothing when working in the meat plant. Food area employees will wear white clothing and non-food employees (including stockyards) will wear blue clothing.

This clearly distinguishes food from non-food employees.

- The protective clothing will include:
  - Hats
  - Vests
  - Protective trousers
  - Rubber waterproof pants
  - Hair nets

Long hair and beards should be covered.



## C: PRELIMINARY DESIGN: BEEF/LAMB PLANT

- All the protective clothing will be individually numbered and allocated to employees. The employees will be responsible for the clothing.
- The assumption is that the protective clothing will be cleaned off the meat plant. However an option is to provide a laundry on the plant.
- At the entry to each of the male and female amenities will be located numbered racks. The clean protective clothing will be stored here. Prior to commencing work the employees will collect their clean clothes.
- At the completion of work the dirty protective clothing is placed in a laundry bag and taken to the laundry for cleaning.
- Each employee should receive two sets of protective clothing.
- All meals for employees and office staff will be taken in the canteen. A small food preparation kitchen is attached to the canteen.

### 15 Plant Office

- The plant office allows:
  - Viewing of all employees and visitor entering the meat plant
  - Viewing of all livestock and meat trucks
  - Viewing of all vehicle traffic entering and leaving the meat plant



## D: OPERATION DESIGN: CATTLE AND SHEEP

### 1 CRITERIA

- Base 7.5 hour working day
- Single shift operation
- Average daily kill 75 cattle or 650 sheep
- Work 5 days per week
- Overtime work when required
- Work up to 42 weeks (210 days) per year
- Extend working day as required e.g. 9 hours work
- Multi shift and up to 6 days work as/when required

### 2 Level (1) Operations: Start-up

- 1 crew: slaughter and de-bone sheep and cattle
- Non-concurrent slaughter and de-boning
- Day (1): slaughter sheep
- Day (2): de-bone sheep
- Day (3): slaughter cattle
- Day (4): de-bone cattle
- Sheep slaughter: 39 days
- Sheep de-bone: 39 days
- Cattle slaughter: 66 days
- Beef de-bone: 66 days
- Process work force: 20 people
- Annual potential: 25,000 sheep
- 5,000 cattle
- Annual production estimate: 975 T beef  
360 T sheep meat

### 3 Level (2) Operations

- 2 crews
- 1 crew: slaughter sheep and cattle
- 1 crew: de-bones sheep and beef
- Simultaneous slaughter and boning
- Sheep slaughter/de-bone: 77 days
- Cattle slaughter/de-bone: 133 days
- Process work force: 40 people
- Annual potential: 50,000 sheep  
10,000 cattle
- Additional water and energy required





## D: OPERATION DESIGN: CATTLE AND SHEEP

- Annual production estimate: 1,950 T beef  
720 T sheep meat
- 100% increase in production over Level (1)

### 4 Level (3) Operations

- 4 crews
- 1 crew: slaughter sheep and cattle (shift 1)  
1 crew: de-bones sheep and beef (shift 1)  
1 crew: slaughter sheep and cattle (shift 2)  
1 crew: de-bones sheep and beef (shift 2)
- Simultaneous slaughter and boning over two shifts
- Sheep slaughter/de-bone: 77 days x2 shifts  
Cattle slaughter/de-bone: 210 days x 2 shifts
- Process work force: 80 people
- Annual potential: 100,000 sheep  
20,000 cattle
- Additional: - Carcass Chiller  
- Cold storage  
- Amenities  
- Water and energy
- Annual production estimate: 1,440 T sheep meat  
3,900 T beef
- 200% increase in production over Level (1)

### 5 Other Opportunities

Other intermediate scenarios are possible to increase production:

- (a) Increase the working day to 9 hours over 5 days will give a 20% production increase at level (2)
- Potential 62,500 sheep and 12,500 cattle per year
  - No additional facilities required
- (b) Work 7.5 hours per day over 6 days will give a 20% production increase at Level (2)
- potential 62,500 sheep and 12,500 cattle per year
  - will require additional labour with increase to welfare amenities

## E: PRELIMINARY DESIGN: BEEF PLANT

### 1 Design

The proposed design is a compact cattle slaughter and processing plant:

- Designed with a view to US, EU, China and domestic markets
- Halal slaughter
- Cattle washed prior to slaughter
- Cattle slaughter and processing capacity of 15 per hour

### 2 Main plant components

- Cattle unload
- Covered cattle yards; capacity up to 100 head
- Cattle slaughter line; capacity 15 per hour
- Beef red offal recovery
- Beef paunch/intestine (green offal) recovery
- Beef trotters and head recover
- Hides, skins, blood and waste collection (non-food)
- Beef carcass chilling
- De-boning room; capacity 15 beef per hour
- Packaging material dry storage
- Carton chilling
- Carton freezing
- Cold storage
- Environmental load-out
- Slaughter/deboning ante room
- Boiler/workshop room
- Refrigeration compressor room
- Electrical switchboard room
- Plant office/reception
- SAG office and amenities
- Male and female amenities
- Visitor reception and viewing area

#### Peripheral components

- Electrical supply and transformer
- Water supply
- Potable water treatment
- Water storage tank
- Process effluent screening; primary treatment
- Liquid effluent balance tank
- Diesel fuel tank
- Organic waste collection
- Inorganic waste collection
- Car parking
- Laundry equipment
- Security control system
- First aid facility
- Exterior lighting

## E: PRELIMINARY DESIGN: BEEF PLANT

- Landscaping

### CRITERIA

#### 1 Projection:

- Modern slaughterhouse with emphasis upon design, construction, equipment, methodology and operation in upon food safety and quality management
- Plant design to operate up to 42 weeks per year
- Plant with potential to work shift-work
- Ability to process cattle and calves
- Slaughter and de-bone cattle at same time (concurrent)
- All carcasses cut and de-boned
- Chilled and frozen finished food products
- Design allowance to add additional capacity e.g. carcass chillers, as/when required

#### 2 Work force:

A multi-skilled work force proposed for the new meat plant. It will be necessary for the people to be trained in the correct skills necessary for:

- Hygienic slaughter and dressing of beef
- Cutting, boning and packaging of these meats to achieve the required market presentation
- Livestock handling and management
- Plant management and supervision
- Quality assurance
- Meat inspection
- Plant maintenance

Stock procurement and meat marketing are beyond the scope of this report. The parameters are taken as operations within the meat plant perimeter fence.

#### 3 Critically important to establish a programme with plant personnel in the development, documentation and implementation of a quality management and food safety system. This would include:

- HACCP (Hazard Analysis Critical Control Point) programme
- RMP (Risk Management Programme)
- SSPO (Sanitation Standard Operating Procedure)

#### 4 Processing operations:

As described, the plant is designed to slaughter and de-bone concurrently. Start-up operations will be one single crew slaughtering day (1) then de-boning day (2).

### PROCESS DESCRIPTION

#### 1 Stockyards

## E: PRELIMINARY DESIGN: BEEF PLANT

- Cattle unloaded from road transport into the stockyards. Cattle held on concrete floor
- Cattle washed prior to slaughter
- Yard capacity estimated at 100 cattle

### 2 Cattle Slaughter Line

- Conventional slaughter system with carcass suspended from a non-powered overhead rail during all operations. Design rate up to 15 per hour.
- Low voltage stimulation unit for carcass tenderising process during bleeding.
- Downward over the head hide puller.
- Mechanical rise/fall platforms for legging, hide removal, carcass sawing, inspection and trimming operations.
- Carcass eviscerated into manual gut buggies.
- Red offal prepared for slaughter floor. Red offal cooled in chilled water.
- Cold wash paunch items recovered in room off slaughter floor.

### 4 Carcass Chillers

- Two carcass chillers with capacity to hold 100 beef carcasses (200 sides)
- Red offal from beef placed in plastic bags and stored in racks in chiller.
- Refrigeration system to reduce carcass and offal temperature from +35°C to +7°C in 12 – 15 hours.
- Chiller to be washed clean after unloading and prior to reloading with fresh product.
- Hot product should not be introduced into a chiller with cold product. Prior to next day's slaughter, chilled carcasses are railed out to the de-boning area to await boning.

### 5 Boning Room

- Room designed for quarter de-boning of beef.
- Proposed system: Beef – 15 carcasses per hour (60 quarters per hour).
- Meat cuts trimmed then wrapped or vacuum packaged followed by packing into trays or boxes.
- Individual meat cuts able to be accurately weighed and identified with the carcass.
- Bags of chilled offal brought into the boning room for packaging and packing. Offal will be vacuum packed.
- Boxes weighed, labelled and sealed before being conveyed through to box chiller.
- The room is maintained at +10°C during operations.

## E: PRELIMINARY DESIGN: BEEF PLANT

### 6 Distribution Dry Store

- A separate room provided for storage of plastic packaging material and empty trays before distribution to the de-boning room.

### 7 Box Chiller

- A box chiller to hold finished packed product.
- The chiller to have a capacity to reduce the internal temperature of the packed product from +7°C to 0°C in approximately 24 hours.
- The box chiller has a working capacity of 1,344 boxes on pallets stacked two high.

### 8 Box Freezing

- Three cabinet type box freezers. Each freezer with a capacity of 24 pallets with shelves.
- Total capacity 3,024 boxes.
- Refrigeration capacity to reduce product temperature within boxes to -12°C minimum in approximately 36 hours.

### 9 Cold Store

- Frozen boxes stored on pallets. Pallets stored three high on racking inside the cold store.
- The capacity is 9,576 boxes on 228 pallets. This is equivalent to 33 days full production.
- Cold store will operate with an air temperature of -18°C.

### 10 Environmental Load-Out

- Product is despatched through a temperature controlled environment.
- One refrigerated truck load-out dock. This dock is sealed to provide an airlock between the truck and the building.
- Forklift charging and battery storage facility provided.

### 11 Skin Collection

- Skins will be directed from the slaughter area to the collection areas and loaded into steel bins for daily removal from plant.
- Fat and bone waste material also stored in this area for daily off-plant disposal or on-site rendering (if required).

## E: PRELIMINARY DESIGN: BEEF PLANT

### 12 Ante Room

- All employees must pass through the ante rooms before entering the slaughter floor or cutting room. Employees wash and clean before starting and at the end of work.
- The ante room contains equipment to wash and hang personal hygiene equipment.
- Ante room components:
  - Apron wash units (+43°C water)
  - Boot wash units (+43°C water)
  - Hand wash units (+43°C water)
  - Apron and knife pouch hanging pegs
  - Knife sharpening equipment
- Every person entering the slaughter floor and de-boning room must wash their hands before entry.
- Apron and knife pouch hanging pegs are provided on the wall for employees.

### 13 Plant Room

#### Two Plant Rooms

Plant Room #1    Hot water boiler  
                          Warm water mixing valves  
                          Pumps  
                          Master switch board

Plant Room #1    Freezer  
                          Box chiller  
                          Cold store refrigeration compressors

### 14 Welfare Amenities

- Amenities are provided for males and females. The exact ratio of male and female employees is to be determined.
- The amenity area will contain:
  - Individual steel lockers for employees' street clothes, shoes and personal items
  - Toilets
  - Showers
  - Hand wash units
- All employees must wear protective clothing when working in the meat plant. Food area employees will wear white clothing and non-food employees (including stockyards) will wear blue clothing.

This clearly distinguishes food from non-food employees.

- The protective clothing will include:

## E: PRELIMINARY DESIGN: BEEF PLANT

- Hats
- Vests
- Protective trousers
- Rubber waterproof pants
- Hair nets

Long hair and beards should be covered.

- All the protective clothing will be individually numbered and allocated to employees. The employees will be responsible for the clothing.
- The assumption is that the protective clothing will be cleaned off the meat plant. However an option is to provide a laundry on the plant.
- At the entry to each of the male and female amenities will be located numbered racks. The clean protective clothing will be stored here. Prior to commencing work the employees will collect their clean clothes.
- At the completion of work the dirty protective clothing is placed in a laundry bag and taken to the laundry for cleaning.
- Each employee should receive two sets of protective clothing.
- All meals for employees and office staff will be taken in the canteen. A small food preparation kitchen is attached to the canteen.

### 14 Plant Office

- The plant office allows:
  - Viewing of all employees and visitor entering the meat plant
  - Viewing of all livestock and meat trucks
  - Viewing of all vehicle traffic entering and leaving the meat plant

## F: OPERATION DESIGN: CATTLE

### 1 CRITERIA

- Base 7.5 hour working day
- Single shift operation
- Average daily kill 95 cattle
- Work 5 days per week
- Overtime work when required
- Work up to 42 weeks (210 days) per year
- Extend working day as required e.g. 9 hours work
- Multi shift and up to 6 days work as/when required

### 2 Level (1) Operations: Start-up

- 1 crew: slaughter and de-bone cattle
- Non-concurrent slaughter and de-boning
- Day (1): slaughter cattle  
Day (2): de-bone cattle
- Cattle slaughter: 105 days
- Beef de-bone: 105 days
- Process work force: 20 people
- Annual potential: 10,000 cattle
- Annual production estimate: 1,950 T beef

### 3 Level (2) Operations

- 2 crews
- 1 crew: slaughter cattle  
1 crew: de-bones beef
- Simultaneous slaughter and boning
- Cattle slaughter/de-bone: 210 days
- Process work force: 40 people
- Annual potential: 20,000 cattle
- Additional:
  - Cold storage
  - Amenities
  - Water and energy
- Annual production estimate: 3,900 T beef
- 100% increase in production over Level (1)

### 4 Level (3) Operations

- 4 crews
- 1 crew: slaughter cattle (shift 1)  
1 crew: de-bones beef (shift 1)





## F: OPERATION DESIGN: CATTLE

1 crew: slaughter cattle (shift 2)

1 crew: de-bones beef (shift 2)

- Simultaneous slaughter and boning over two shifts
- Cattle slaughter/de-bone: 210 days x 2 shifts
- Process work force: 80 people
- Annual potential: 40,000 cattle
- Additional:
  - Carcass Chiller
  - Cold storage
  - Amenities
  - Water and energy
- Annual production estimate: 7,800 T beef
- 200% increase in production over Level (1)

## 5 Other Opportunities

Other intermediate scenarios are possible to increase production:

- Increase the working day to 9 hours over 5 days will give a 20% production increase at level (1)
- Work 7.5 hours per day over 6 days will give a 20% production increase at level (2)





## G: PRODUCT YIELD ESTIMATES

### DAILY YIELDS: SHEEP/LAMB

Based upon slaughter and de-boning 650 per day (shift)

		Slaughter Day	De-bone Day	Slaughter/ De-bone	Slaughter/ De-bone (2 shift)
Lamb live weight	= 35 kg				
Lamb carcass weight	= 18.5 kg				
	=	12,025 kg	-	12,025 kg	24,050 kg
De-boned meat yield (70%)		-	8,400 kg	8,400 kg	16,800 kg
Red Offal		1,940 kg	-	1,940 kg	3,880 kg
Green Offal		1,080 kg	-	1,080 kg	2,160 kg
Heads/Feet		1,800 kg	-	1,800 kg	3,600 kg
Blood		765 kg	-	765 kg	1,530 kg
Slaughter waste		1,575 kg	-	1,575 kg	3,150 kg
De-boning waste		-	3,625 kg	3,625 kg	7,250 kg
Stomach contents		1,625 kg	-	1,625 kg	3,250 kg



## G: PRODUCT YIELD ESTIMATES

### DAILY YIELDS: CATTLE

- Based upon slaughter and de-boning up to 95 per day (shift)
- Data for 75 per day taken as approximately 80% of following totals

		Slaughter Day	De-bone Day	Slaughter/ De-bone	Slaughter/ De-bone (2 shift)
Beef carcass weight	= 250 kg	23,750 kg	-	23,750 kg	47,500 kg
De-boned meat yield (70%)		-	16,625 kg	16,625 kg	33,250 kg
Red Offal		760 kg	-	780 kg	1,520 kg
Green Offal		1,200 kg	-	1,200 kg	2,400 kg
Heads/Feet		3,800 kg	-	3,800 kg	7,600 kg
Blood		1,900 kg	-	1,900 kg	3,800 kg
Slaughter waste		3,800 kg	-	3,800 kg	7,600 kg
De-boning waste		-	5,000 kg	5,000 kg	10,000 kg
Stomach contents		3,800 kg	-	3,800 kg	7,600 kg

## H: SERVICES

### WATER

- 1 Only potable water will be used on the plant. The assumption is that clean water will be available in sufficient quantities for the operations.
- 2 Total plant water usage (cubic metres, per day)

	1 Shift	2 Shifts
Sheep slaughter	130.00	260.00
Sheep de-boning	3.50	7.00
Total sheep:	133.50	267.00
Cattle slaughter	150.00	300.00
Beef de-boning	5.25	10.50
Total cattle	155.25	310.50

- 3 Water heating

A major factor in the operation of a meat plant is the necessary heating of water. For the proposed new meat plant a hot water calorifier of 450KW capacity is proposed.

- 4 Water temperatures required at point of use:

- 82 ° C for equipment sterilising
- 65 ° C for departmental wash down hoses
- 43 ° C for hand, boot, and apron washing
- Cold water

- 5 Hot water will be produced from an on-demand calorifier. No steam is necessary to be produced. Hot water will be generated at 95 ° C+ and circulated to provide 82 ° C.

95 ° C water will be mixed with cold water to provide 65 ° C and 43 ° C water.

- 6 Cold water will be pre-heated prior to the calorifier through:

- Heat recovery/exchange system connected to the refrigeration compressors and the calorifier exhaust flue (condensate recuperator)
- Black alkathene piping located on the black painted roof over part of the stockyards



## H: SERVICES

This is estimated to reduce the water heating cost by 15%.

### 7 Hot/cold water estimate:

	Cold Water	Hot Water
Slaughter	74%	26%
De-boning	55%	45%



## H: SERVICES

### LIGHTING

- 1 Lighting levels are measured at the working plane to be sufficient to enable accuracy of operations, hygienic slaughter inspection, and processing of animals.
- 2 Lighting levels:
  - Stockyards 150 lux
  - Suspect pen 300 lux
  - Slaughter floor 600 lux
  - Carcass chillers 250 lux
  - Boning room 600 lux
  - Dry store 150 lux
  - Non-food area 250 lux
  - Plant room 250 lux
  - Amenities 150 lux
  - Offices 500 lux
- 3 Extensive use of fluorescent tubes is recommended in all process areas. Special low temperature environment recessed sodium lamps in chillers and cold store.

Clear shatterproof protective shields to be provided over all lights in processing and food areas.

## H: SERVICES

### COMPRESSED AIR

- 1 A compressor and receiver are located in the Plant Room.
- 2 The compressed air estimate to 30 litres/second.
- 3 Air will be reticulated in the ceiling space at a minimum of 105 p.s.i. (7 bar) throughout the slaughter plant.

## H: SERVICES

### REFRIGERATION

- 1 Taking the location and local conditions into account, a Freon refrigeration system (R404) is proposed as the most appropriate system for the chilled refrigeration (carcass chiller, deboning, and carton chiller).
- 2 A continuous automatic temperature recording (CATR) system may be installed. Temperature conditions in each room could be continually monitored and recorded remotely either in the plant room or the plant office.



## H: SERVICES

### VENTILATION AND AIR CONDITIONING

- 1 Ventilation will be provided in the various areas required. Food process areas such as slaughter and offal rooms will have positive pressure to avoid ingress of smells and odours.
- 2 Areas with mechanical ventilation will have a minimum of 10 air changes per hour.
- 3 The air flow will be in a direction from clean to dirty operations. Air flows will be from food to non-food areas. The system will control temperatures and humidity by removing excessive heat and water vapour.
- 4 All personnel doors in air conditioned areas will be self-closing.
- 5 All process areas will have an extractor fan system to quickly remove steam and vapour following departmental wash down.

## H: SERVICES

### VERMIN AND FLIES

- 1 Every effort must be made to exclude vermin and flies from the interior of the meat plant.
- 2 Non-food material must be stored under cover in the non-food area, with doors closed.
- 3 Electric fly killers should be provided at strategic points around the exterior openings to the meat plant building.





H: SERVICES

### ENZYME CLEANING SYSTEM

A high pressure, low volume food operation-approved enzyme foam cleaning system is proposed to be used. The system would be portable and used to hygienically clean the work areas at the end of production.



## H: SERVICES

### EFFLUENT

- 1 Three drainage systems on the plant:
  - Process drainage system
  - Sanitary sewer system (amenities and offices)
  - Storm water system
- 2 Water from stockyards and process plants will be collected and screened prior to discharge to the effluent ponds. The expected volumes and flows will match the water input.
- 3 Process waste water will pass through a rotating milliscreen with 0.75mm apertures to remove solids.
- 4 Typical quality after screening:
  - BOD 2400mg/L
  - COD 3565mg/L
  - TSS 4035mg/L
  - TN 330mg/L
  - TP 61mg/L
- 5 A holding tank with suggested capacity 250CM (250,000L) is proposed to allow a uniform release and flow to the pond system.
  - Proposed operation to involve the screened liquid effluent passing through an anaerobic/aerobic pond system then spray irrigation.
  - The system designed to the following criteria:
    - Minimum 10 days anaerobic retention
    - Minimum 20 days aerobic retention
    - Spray irrigate for 50mm penetration
    - Nitrogen application of 700kgN/hectare/year

## H: SERVICES

### ORGANIC WASTE DISPOSAL

#### 1 Disposal options

- Rendering
- Composting
- Incineration
- Land fill
- Eel farming / fitch farming
- Vermiculture

#### 2 Rendering

- High capital cost and energy required to operate.
- Insufficient raw material input to ensure viability.
- Requires a system to treat paunch contents separately.

#### 3 Composting

- A system to convert blood, solid material, paunch grass, and manure into a stable compost.
- Such a system could also be suitable to handle organic material from off-plant.
- Estimated capital cost: US\$1.5 million.
- Residence time of 12 – 20 days through the system.

#### 4 Incineration

- Effective, but a very expensive method of solid waste disposal.

#### 5 Land fill

- This method would be the cheapest and possibly the most cost-effective method for disposal of waste material.

#### 6 Eel farming / Fitch farming

- Eels are a declining resource, and the returns on the product are good. There is an opportunity to develop eel farming using the meat plant waste as a food source.
- Fitch farming is carried out under strictly controlled conditions. Generally there are good returns on the fur. One meat company in Iceland contracts hard meat waste material to a fitch farming operation.
- Eels and fitch are predators, and escape of any would mean a threat to native wild life.\

## H: SERVICES

### 7 Vermiculture

- Vermiculture uses worms to produce a compost material. The process requires the material to be laid-out and regularly turned.
- This system is suitable for paunch grass and manure. Remaining organic waste would require alternative treatment.

## H: SERVICES

### ENERGY

#### 1 Diesel

- Boilers using diesel are readily available and may be used with dual fuels (liquid and solid). There are no technical issues associated with the delivery and use of diesel.

#### 2 Compressed Natural Gas (CNG) and Liquid Propane Gas (LPG).

- Boilers using these gases as an energy source are common in countries and locations with a regular and economic supply.
- They are high in calorific value and an excellent energy source.

#### 3 Wood

- Dry wood is a renewable energy source which may be used for the generation of hot water.
- Application of treated meat plant waste water a forestry site can result in a renewable energy source. Agricultural use has the advantage of having a greater nutrient removal from waste water. Trees can remove more water by evaporation.
- The suitable trees, which are fast growing and suitable for these purposes, include Eucalyptus and Acacia Dealbata.
- The trees generally take three years to reach harvest. Acacia can grow to around 6m and Eucalyptus to 5m.
- The average yield from a tree is approximately 12.5kg at 20% moisture content, with a trunk diameter of approximately 100 – 200 mm.
- Following cutting, the trunks are air-dried prior to firing. The cut stumps take a further three years to reach maturity once more.
- Trees are planted a density of 4,000 per hectare.

#### 4 Wind power

- Wind power is a source of energy that may be worth considering. However, as a source of regular energy it does have disadvantages:
  - Wind power requires an alternative back-up energy source when wind is not blowing.
  - A cost-effective way must be found to store the energy when the plant is not operational.
- Wind power does have some attraction as a back-up source of energy for a more conventional method.

## H: SERVICES

### 5 Biomass

- Biomass is organic material made from plant material. Biomass fuels such as ethanol and bio diesel are made from biomass materials.
- Ethanol is an alcohol fuel made from plant items. Bio diesel is fuel made from vegetable oils.
- These fuels can be used in diesel engines or boilers.
- The downside issues are:
  - Biofuels require energy to produce.
  - Biofuels are generally more expensive than fossil fuels.

### 6 Solar panels

- Solar panels are dependent on the weather for the generation of heating of the water source.
- Efficiency can fluctuate from 90% in summer down to 25% over the winter months.
- Flow rate is low. Typically using panels to heat 21,000 litres of water per 24 hours with a temperature rise 50 ° C requires 420m<sup>2</sup> of panel.
- Covering half the stockyards roof with solar panels (160m<sup>2</sup>) would require a capital investment of approximately \$350,000. The rate of heating achieved in this area is indeterminate; however it would have a beneficial effect upon pre-heating water.

### 7 Tallow

- Tallow is the liquid fat resulting when organic meat plant waste is heated. A diesel fired boiler can successfully operate on hot liquid tallow.
- In such an operation the boiler starts on diesel, switches to tallow, and finishes the day on diesel. This is to avoid the tallow solidifying in the feed pipes. This would involve a dual fuel burner.
- The down side of this proposed is that it would require the meat plant to undertake on-site rendering, which involves high capital cost disproportionate to the volume of material available. General acceptance is input material of 10 tonnes per day before positive economic returns can be achieved.

### 8 Peat

- Peat is a biomass fuel source which may or may not be available in quantity. There appears to be no technical issues associated with the use of peat as a fuel source. The calorific value of peat is not dissimilar to wood.



## H: SERVICES

- A peat-fired boiler would require another fuel such as diesel for start-up and ancillary firing.
- The peat would need to be extracted and delivered to the boiler as follows:
  - The peat is mined and compressed into sods.
  - Sods are air dried out in the open (cover unnecessary).
  - Sods are moved for final drying under cover.
  - Dry sods are loaded into a day hopper.
  - The day hopper would feed a disintegrator for direct feed to the boiler.
- The downsides of peat:
  - Additional capital cost to prepare for burning.
  - Non-renewable energy source.

## 9 Coal

- Coal is a fossil fuel which may be available. There are modern coal-fired hot water boilers which are extremely efficient and clean burning.

## I: PERSONNEL

- 1 The following manning is preliminary and indicative of what may be expected in a modern meat plant.
- 2 SAG veterinarian inspection is excluded.
- 3 Process workers:
  - Labour to slaughter one day and de-bone the next = 20 persons (Level 1)
  - Labour to simultaneously slaughter and de-bone = 40 persons (Level 2)
  - Labour to simultaneously slaughter and de-bone over two shifts = 80 persons
- 4 Generally in the meat industry the apportionment is approximately 67% and 33% female.
- 5 Management and technical staff:
  - Plant Manager = 1
  - Production Manager = 1
  - Supervisors = 4
  - Chief Engineer = 1
  - Quality Assurances / Laboratory = 3
  - Administration / Office = 4
  - Maintenance = 6

## J: RELATIVE IMPORTANCE

The following factors are rated (1) to (9). (1) is considered the most important and (9) the least important.

- (1) Energy availability: vital for plant viability
- (2) Water availability: no water = no operation
- (3) Potential use of non-conventional renewable energies (NCRE): essential to counter high electricity costs
- (4) Connectivity – i.e., proximity to ports and airport: necessary for uninterrupted despatch of finished products to markets
- (5) Distance from the herds: compliance with the law requiring maximum transport time for livestock
- (6) Distance from service centres: close proximity and availability of plant and equipment servicing
- (7) Accessibility – e.g., quality of roads: modern road transport more able to cope with poor roads
- (8) Land slope: a plant can be designed to suit any topography
- (9) Soil type: can be countered with good engineering design.

## K: COST ESTIMATES

### BEEF PLANT

#### 1 Drawing 3470.1.01 – beef plant layout.

- This shows the layout for an entire plant, with a capacity of 15 cattle per hour
- The buildings cover an area of 2518m<sup>2</sup>
- The estimated capital cost to construct this plant:

Site works: buildings	US\$ 4,500,000
Plant and equipment	4,200,000
Utilities	4,800,000
Project management: administration	1,500,000
	<hr/>
	US\$15,000,000

- The estimate assumes services at the plant boundary and excludes cost of land.

#### 2 Drawing 3470.1.02 – site layout.

- This shows the beef plant laid out on a site 100.00 x 130.00 = 130,000m<sup>2</sup>
- The site allows ample area for future development and expansion.
- Effluent treatment lagoons are not included within the site boundaries.

## K: COST ESTIMATES

### BEEF/LAMB PLANT

#### 1 Drawing 3470.1.03 – beef/lamb plant layout.

- This shows the layout for an entire plant, with a capacity of 11 cattle and 85 sheep per hour
- The buildings cover an area of 2365m<sup>2</sup>
- The estimated capital cost to construct this plant:

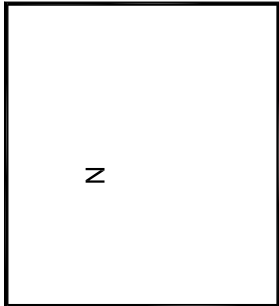
Site works: buildings	US\$ 4,300,000
Plant and equipment	4,000,000
Utilities	4,500,000
Project management: administration	1,500,000
	<hr/>
	US\$14,300,000

- The estimate assumes services at the plant boundary and excludes cost of land.

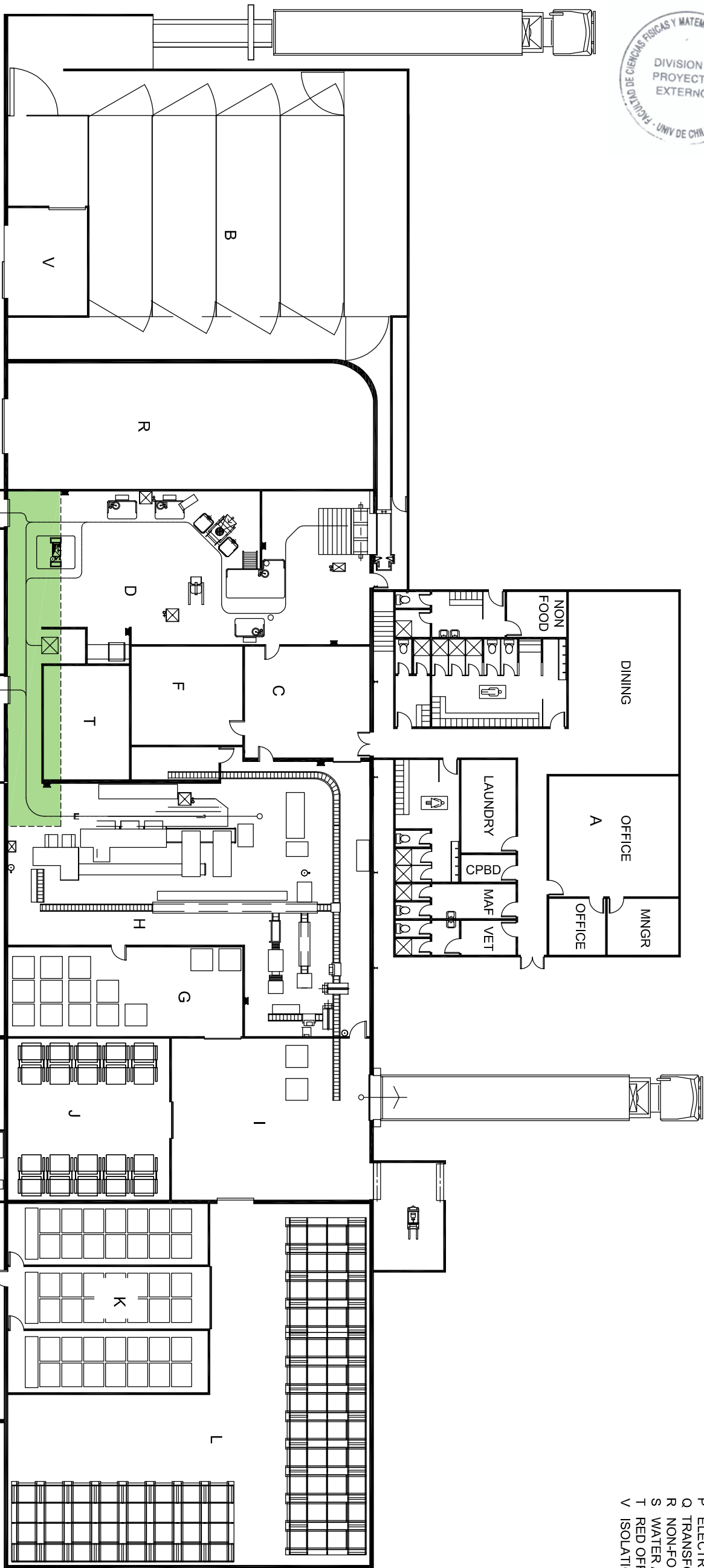
#### 2 Drawing 3470.1.04 – site layout.

- This shows the beef/lamb plant laid out on a site 100.00 x 130.00 = 130,000m<sup>2</sup>
- The site allows ample area for future development and expansion.
- Effluent treatment lagoons are not included within the site boundaries

9-PC



- A PLANT OFFICES/AMENITIES
- B STOCKYARDS
- C ANTE ROOM
- D SLAUGHTER
- E CARCASS CHILLERS
- F GREEN OFFAL
- G CARTON STORE
- H DE-BONING
- I PALETTEISE
- J CARTON CHILL
- K FREEZERS
- L COLD STORE
- M PLANT ROOM
- N DRY STORE
- O BOILER / WORKSHOP
- P ELECTRICAL
- Q TRANSFORMER
- R NON-FOOD
- S WATER / EFFLUENT TANKS
- T RED OFFAL
- V ISOLATION / EMERGENCY SLAUGHTER



LEGEND

BASEMENT

REV	DESCRIPTION	DATE	BY

CLIENT UNIVERSIDAD DE CHILE

PROJECT AYSEN PROJECT

TITLE BEEF PLANT LAYOUT

DESIGNED BY	DATE	SHEET SIZE & SCALE
M.I. NIND	22/12/2015	A1
DRAWN BY	DATE	SCALE
V.S.	34/10/1	1:250
PROJECT NUMBER	DWG NUMBER	DWG STATUS
3470	1.01	PRELIMINARY

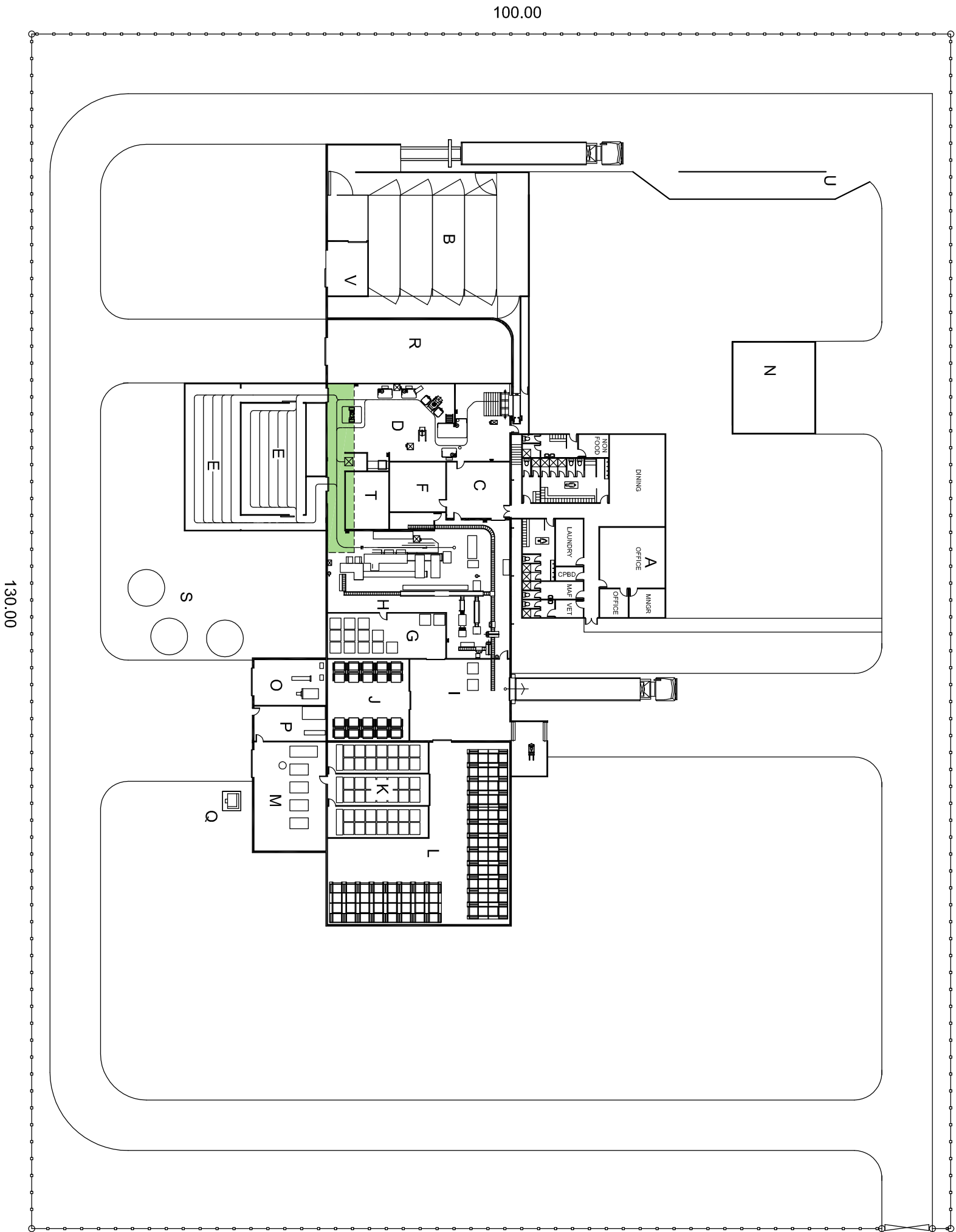
**PROAND LIMITED**

8 WELD STREET  
PO BOX 301  
FIELDING 4740  
NEW ZEALAND

PHONE: +64 6 323 8693  
FAX: +64 6 323 9516  
EMAIL: [proand@proand.co.nz](mailto:proand@proand.co.nz)  
WEBSITE: [www.proand.co.nz](http://www.proand.co.nz)

COPYRIGHT © PROAND LIMITED

9-72



- A PLANT OFFICES/AMENITIES
- B STOCKYARDS
- C ANTE ROOM
- D SLAUGHTER
- E CARCASS CHILLER
- F GREEN OFFAL
- G CARTON STORE
- H DE-BONING
- I PALETTEISE
- J CARTON CHILL
- K FREEZERS
- L COLD STORE
- M PLANT ROOM
- N DRY STORE
- O BOILER / WORKSHOP
- P ELECTRICAL
- Q TRANSFORMER
- R NON-FOOD
- S WATER / EFFLUENT TANKS
- T RED OFFAL
- U TRUCK WASH
- V ISOLATION / EMERGENCY SLAUGHTER

REV	DESCRIPTION	DATE	BY

CLIENT UNIVERSIDAD DE CHILE

PROJECT AYSÉN PROJECT

TITLE BEEF PLANT  
SITE LAYOUT

DESIGNED BY	DATE	SHEET SIZE & SCALE
M.J. NOD	23/12/2015	A1
DRAWN BY	CAD REF (DWG)	A3 1:500
N.S.	34/01/01	DO NOT SCALE
PROJECT NUMBER	DWG NUMBER	REVISION STATUS
3470	102	PRELIMINARY

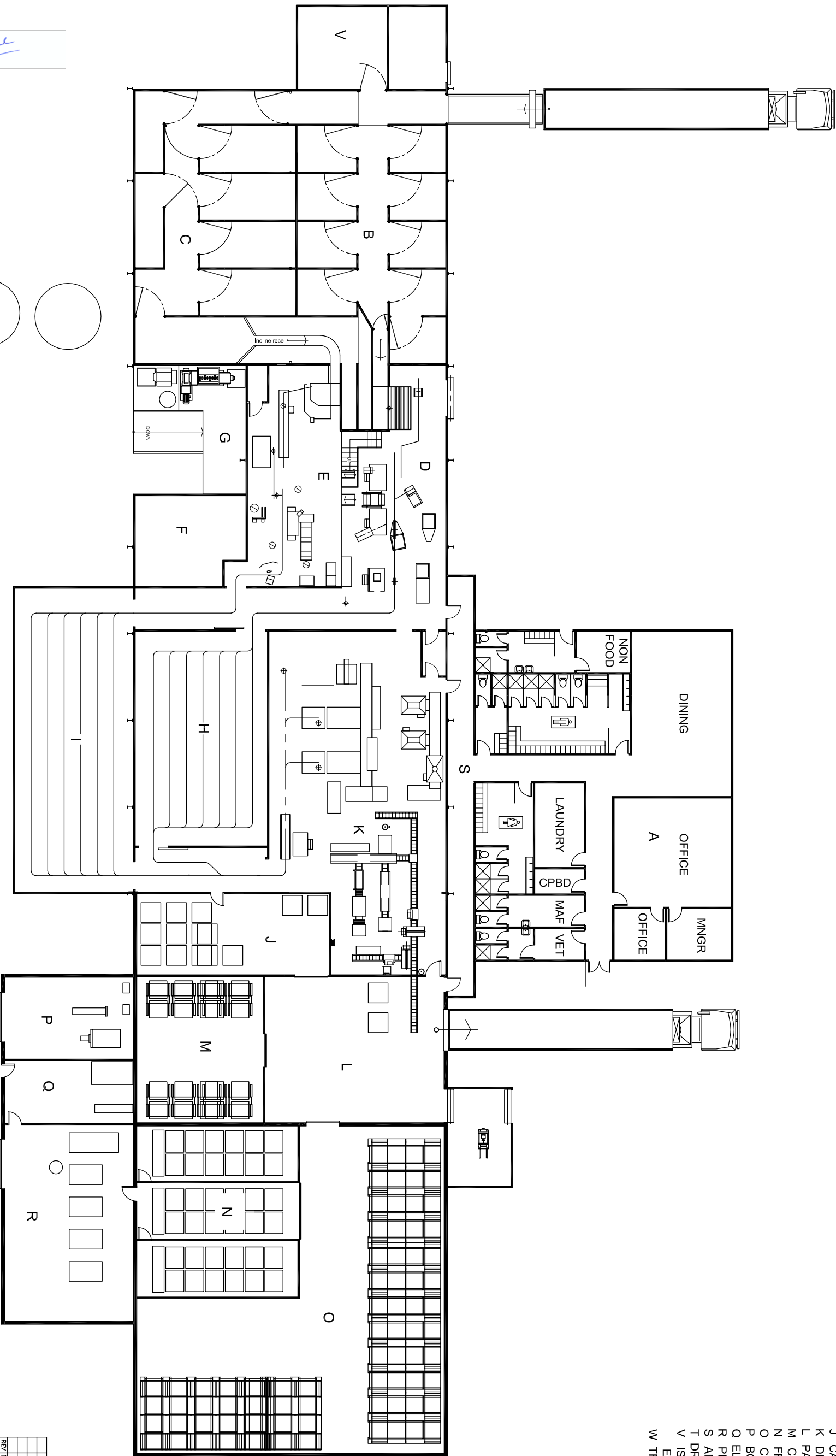
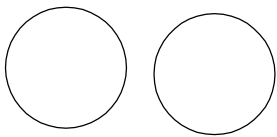
**PROAND LIMITED**

8 WELD STREET  
PO BOX 301  
FIELDING 4740  
NEW ZEALAND

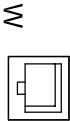
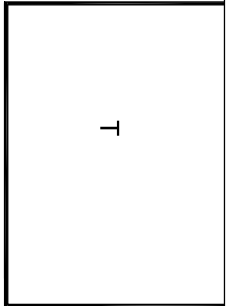
PHONE: +64 6 323 8633  
FAX: +64 6 323 9516  
EMAIL: [proand@proand.co.nz](mailto:proand@proand.co.nz)  
WEBSITE: [www.proand.co.nz](http://www.proand.co.nz)

COPYRIGHT © PROAND LIMITED

9.24



- A PLANT OFFICES/AMENITIES
- B CATTLE YARDS
- C SHEEP YARDS
- D CATTLE SLAUGHTER
- E SHEEP SLAUGHTER
- F RED/GREEN OFFAL
- G NON-FOOD
- H BEEF CHILLER
- I SHEEP CHILLER
- J CARTON STORE
- K DE-BONING
- L PALLETISE
- M CARTON CHILLER
- N FREEZERS
- O COLD STORE
- P BOILER / WORKSHOP
- Q ELECTRICAL
- R PLANT ROOM
- S ANTE ROOM
- T DRY STORE
- V ISOLATION / EMERGENCY SLAUGHTER
- W TRANSFORMER



COPYRIGHT © PROAND LIMITED

**proand**

**PROAND LIMITED**

8 WELD STREET  
PO BOX 301  
FIELDING 4740  
NEW ZEALAND  
PHONE: +64 6 323 8633  
FAX: +64 6 323 9516  
EMAIL: [proand@proand.co.nz](mailto:proand@proand.co.nz)  
WEBSITE: [www.proand.co.nz](http://www.proand.co.nz)

REV DESCRIPTION		DATE	BY
REVISION DETAILS			

CLIENT UNIVERSIDAD DE CHILE

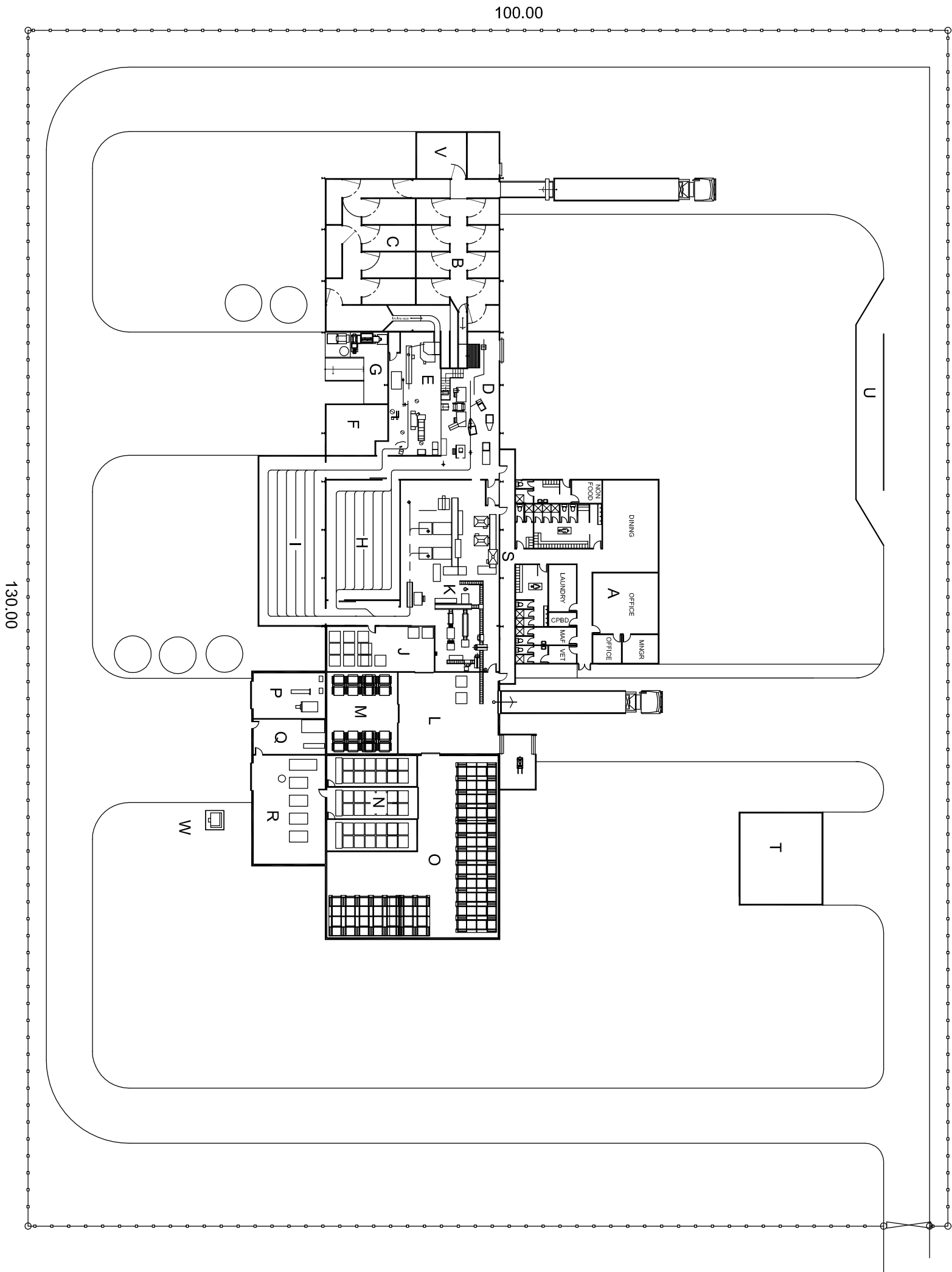
PROJECT AYSÉN PROJECT

TITLE BEEF / LAMB PLANT LAYOUT

DESIGNED BY	DATE	SHEET SIZE & SCALE
M.J. NIND	23/12/2015	A1
DRAWN BY	CAD REF (DWG)	DO NOT SCALE
N.S.	3470-01	DO NOT SCALE
PROJECT NUMBER	DWG NUMBER	REV
3470	1.03	PRELIMINARY



9.72



- A PLANT OFFICES/AMENITIES
- B CATTLE YARDS
- C SHEEP YARDS
- D CATTLE SLAUGHTER
- E SHEEP SLAUGHTER
- F RED/GREEN OFFAL
- G NON-FOOD
- H BEEF CHILLER
- I SHEEP CHILLER
- J CARTON STORE
- K DE-BONING
- L PALLETISE
- M CARTON CHILLER
- N FREEZERS
- O COLD STORE
- P BOILER / WORKSHOP
- Q ELECTRICAL
- R PLANT ROOM
- S ANTE ROOM
- T DRY STORE
- U TRUCK WASH
- V ISOLATION / EMERGENCY SLAUGHTER
- W TRANSFORMER

**PROAND LIMITED**

8 WELD STREET  
PO BOX 301  
FIELDING 4740  
NEW ZEALAND

PHONE: +64 6 323 8633  
FAX: +64 6 323 9516  
EMAIL: [proand@proand.co.nz](mailto:proand@proand.co.nz)  
WEBSITE: [www.proand.co.nz](http://www.proand.co.nz)
