APPENDIX C – FERTILISER PROCESS & OPERATIONAL MANAGEMENT OVERVIEW

Mort & Co

Process and Operational Management Overview

Status	Current	Location	GR

Purpose: A Document explains how a specific process works within a facility. Its primary purpose is to clearly communicate the step-by-step flow, rationale, and function of operations, bridging the gap between high-level design documents (like P&IDs or flow diagrams) and detailed procedures or control logic.

Contents

Definitions:

1) Manure
    a. Material removed from the pens
2) Humic Compost (“compost”)
    a. Mature, well-decomposed manure that has completed the composting process on the pad.
3) Feedstock
    a. Material that has been blended, moisture adjusted and is ready to enter the intake system.
    b. “Terrus Feedstock”, “Terrus Pro Feedstock”, “Gyptek Feedstock”, et al.

Pad Operations:

1) Process Description (Overview)
    a. The pad is to accommodate the composting process of manure from the feedlot. Manure is received from Pen cleaning team via truck and is arranged on the pad into windrows. The windrows and processed with a windrow turner, delving truck and front-end loader to facilitate the composting process.

Fig 1- side tipper delivery of Raw Manure

2) Inputs and Outputs:

    a. Inputs

Product/Service	Supply Source	Rate
Manure	Feedlot	Up to 180,000T per year
Liquid Additive Blend	Water Intake and Conditioning System	Up to 600ML per year

    b. Outputs

Product/Service	Destination	Rate
Humic Compost @ Target Moisture	Feedstock stock pile ready for processing and, or Feedstock stockpile ready for direct shipment	Up to 3600t per week (Ave)

Fig 2 - Windrows of manure composting materials

3) Major Equipment and their Function
    a. Front end loader used to form windrows and move material around on the pad

b. Water truck used to add water to the top of windrows ready to be incorporated into the manure (Old Unit – Retain as Backup)
c. Screener used to process out foreign material and larger lumps of manure
d. Windrow turner and hose reel to process wind rows and apply liquid additives
e. Hydrant system to supply turner hose reel
f. Tanker to supply liquid additives to the windrow turner.

4) Operator Actions and System Responses
   a. Keep delivered manure from Short Fed and Long fed programs separate.
   b. Form manure into piles suitable for windrow turner
   c. Ensure Liquids additive batching system is operational and stocked with raw materials.
   d. Measure and record all metrics as required throughout the windrow piles to inform the turning and additive addition requirements.
   e. Operate the turner, hose reel and hydrant system to appropriately turn and add liquid additives as required to target 40% to 45% moisture.
5) Key Process parameters
   a. Moisture
   b. Temperature
   c. Monitor Gas emissions to validate compost maturity – oxygen, CO2, NHx
   d. Time
6) Control logic and interlocks
   a. Digital Data collection system for location, time, temperature and moisture readings across the pad
   b. Go/No-Go indication of compost maturity/readiness for input into factory
7) Safety and Alarm Conditions
   a. Discrete machine alarms and warnings
   b. Low level liquid additives indicators/alarms
8) Environmental Considerations to be monitorted
   a. Ambient Temperature
   b. Rain
   c. Humidity
   d. Wind
   e. Dust
   f. Odour

Water intake and Conditioning:

1) Process Description
   a. The Fertiliser plant requires water inputs for several processes. The bulk of the water will be consumed by Pad Operations in compost preparation. Some water is required for the steam boilers, and a supply to the office building and amenities is also required. To service the demand, water from Grassdale Bores/Turkey's Nest is supplied. Additional water may come from the Onsite Western CAR dam, which will require treatment. The treatment plant consists of a valve set from the CAR dam offtake to the south west of the factory, a supply line from the offtake to the factory, a filtration / sediment removal system, a desalination system, a tank to hold treated water from the CAR dam, a tank to hold bore water, two batching tanks, a molasses and liquids additive system, recirculation pumps and a supply pump feeding a hydrant system out on the pad.

Fig 3 - Windrows and hydrants on composting pad

2) Inputs and Outputs:
   a. Inputs

Product/Service	Supply Source	Rate
Farm dam water	Farm dam pump	300,000 litres per day
On site Bore water / Turkeys Nest	Turkeys nest	300,000 litres per day intermittent – Nominal 4,000 litres per minute.
Molasses	Silo	700kg per 40,000 litres of water
Liquid microbial additives	IBC's	500 litres per 40,000 litres

   b. Outputs

Product/Service	Destination	Rate (max)
Liquid Blend as required by compost phase	Turner Hose Reel hydrants	300,000 litres per day intermittent – Nominal 1200 litres per minute.

3) Major Equipment and their Function
   a. Control system integrated into the SCADA Ignition system
   b. Valve set from CAR dam supply
      i. System to control pump and water supply to feed the CAR water treatment system
   c. Filtration / dewatering plant
      i. Required to remove the bulk of the solids from the water
   d. Desalination plant
      i. Required to remove salt and sodium derivatives from the water supply
   e. Tank farm consisting of 6 tanks
      i. Tank 1 – Treated CAR Water / Bore Water
      ii. Tank 2 – Bore Water storage
      iii. Liquid additives blending tank
         1. Must be heated to liquify/dissolve additives (50degC)
      iv. Twin tanks 3 & 4 and twin tanks 5 & 6 –Batching tanks for the blending of liquid additives to the water for use on the wind rows – recirculation pumps required.
      v. Appropriate valves and recirculation pumps to allow system to function as required

f. Liquids additive batching system
    i. Used to dose Molasses and other liquid additives into the water to be used on the pad.
g. Hydrant system
    i. For distribution of the water blend to the Windrow Turner hose reel.

4) Operator Actions and System Responses
    a. This system should only require only microbial additives to be kept supplied to the dosing system.
5) Key Process parameters
    a. Water turbidity
    b. Water salinity
    c. Recipe batching accuracy
    d. Sufficient agitation/mixing to provide homogenous liquid additive.
6) Control logic and interlocks
    a. Farm dam water levels – Max min to ensure supply availability and prevent overflow events
    b. Raw material supply levels
        i. Water levels in holding tanks
        ii. Molasses, microbial additives
    c. Batch control from recipe
    d. Dosing control
    e. Blending control
    f. Batch tank selection for supply to Composting pad
    g. Interlocks on all minimum / maximum tanks levels to protect system operations
7) Safety and Alarm Conditions
    a. Low level alarms
    b. High level alarms
    c. Pump operating feedback
    d. Valve position feedback
8) Environmental Considerations
    a. Temperature for molasses storage
    b. Temperature for liquid additive batching/blending system

Raw Materials Handling and Storage

1) Process Description
    a. The raw material handling system consists of undercover compost storage, where roughly three weeks of consumption is kept. The cover is required to protect against inclement weather and enable the careful management of moisture in the finished, manufacture ready compost up until it is taken into the blending system. Other raw materials such as Meat and Bone meal, Gypsum, Sulphate of Potash and bentonite are stored in silos, ready to be fed into the system. Silos to be filled via truck blow systems or conveyor systems.
2) Inputs and Outputs:

Material	Storage Style	Storage Quantity
i. Composted Manure	Bulk in Bunker or on ground	5-10 days 2-3000 T
ii. Meat and Bone Meal	Silo x 2	50 ton x 2
iii. Gypsum (micronized)	Silo	30 ton
iv. Sulphate of Potash	Silo	30 ton
v. Bentonite	Silo	30 ton
vi. Molasses	Tank	50 m^3

vii. lignosulfonate	25kg Bags	3 ton
viii. Other Liquid additives	IBC	5 ton

Fig 4 and fig 5 – raw materials on hand for blending

3) Major Equipment and their Function
    a. Windrow Turner
    b. Front end loader
    c. Forklift
    d. Bulk bag unloader
    e. Water Supply
4) Operator Actions and System Responses
    a. Loader driver to build wind rows under covered area suitable for processing with turner
    b. Moisture readings of finished compost and subsequent liquid addition requirements to be taken and fed into system.
    c. Bulk raw materials deliveries to be managed.
    d. Loading of finished compost into the crushing/grinding intake bin
5) Key Process parameters
    a. Finished Compost moisture
    b. Raw material supply
    c. Liquid additive blend ratios
    d. Liquid additive application rate
6) Control logic and interlocks
    a. Pugmill PLC to be integrated into Ignition HMI control
    b. Pugmill operation to be managed via single point entry of recipe Via Ignition.
    c. All raw material levels and environmental conditions to be monitored.
7) Safety and Alarm Conditions
    a. Discrete machine alarms
    b. Heavy machinery and truck interaction management system required
    c. Raw material Overtemp
8) Environmental Considerations
    a. Ambient Temperature
    b. Weatherproof storage
    c. All weather truck unloading

d. General housekeeping and operational hygiene

Batching and Blending:

1) Process Description
    a. The batching and blending process is to blend raw materials in accordance with specific recipes, to generate feedstock at the correct blend ratio and moisture content ready for the granulation process.
2) Inputs and Outputs:

Material	Storage Style	Input location
i. Composted Manure	Bunker	Pug Mill Bin
ii. Meat and Bone Meal	Silo	Pug Mill Bin
iii. Gypsum (micronized)	Silo	Pug Mill Bin
iv. Sulphate of Potash	Silo	Pug Mill Bin
v. Lime	Silo	Pug Mill Bin
vi. Bentonite	Bulk Bags	Pug Mill Powder Bin
vii. Water	Tank/reticulated supply	Pug Mill Head
viii. Other Liquid additives	25kg Bags	Pug mill head (blend with water)

Fig 6 Blending and Pug Mill equipment

3) Major Equipment and their Function
    a. Front End Loader
    b. Silos outfeed conveyors
    c. Pug Mill
    d. Compost crushing/grinding system
    e. Intake Bin with live bottom
4) Operator Actions and System Responses

a. Maintaining required compost feed into grinding system to accommodate production rate of pug mill.
b. Ensuring Liquids blending additives are available and connected to blending system
c. Ensuring silos are feeding product to pugmill as desired
d. Ensuring Pugmill is blending as required
e. Ensuring Moisture level of blended feedstock is correct.
f. Diesel supply management of the pugmill and associated equipment as required.
g. Cleaning and tidying of area around and under pugmill to maintain safe access and operation of all equipment in the area.
h. Checking of raw material levels in pugmill feed bins.

5) Key Process parameters
   a. Silo fill levels
   b. Pugmill diesel level
   c. Water supply
   d. Raw material rate of inclusion
   e. Output Feedstock blended homogenously
6) Control logic and interlocks
   a. Silo and raw material level interlocks
   b. Pugmill PLC control by ignition
   c. Equipment readiness/availability confirmation
   d. Flow rate management
   e. Under speed and belt drift
   f. Overload
7) Safety and Alarm Conditions
   a. Low flow alarms
   b. Low product level alarms
8) Environmental Considerations
   a. Abrasive nature of feedstock to be considered.
   b. Ambient temperature for operational environment of motors/sensory
   c. Moisture and dust control to maintain operational hygiene and low dust environment

Raw Material Intake:

1) Process Description
   a. The Raw material intake system comprises of an intake bin with live bottom, size to be determined by mass balance, fed directly from the pugmill. The bin feeds twin centreless screw systems to transport feedstock to the granulators. The intake bin is able to feed each screw concurrently or independently. All transitions that are inside the shed must be sealed with diverging chutes work to ensure no material bridging or hangups. Both screws should be able to feed either of the two conditioners via crescent knife gates or other appropriate devices to allow no bridging when chutes are closed and full feed flow through when open.
2) Inputs and Outputs:
   a. Input into system Feedstock at required moisture level (30% to 40%)
   b. Output into conditioners feedstock.
3) Major Equipment and their Function
   a. Intake bin
      i. Act as surge bin for pugged feedstock

   b. Live bottom screws
      i. Control system feed rate of feedstock into the system
   c. Production routing (knife gates, diverters, chutes etc)
      i. Blockage free delivery of feedstock to forming process
   d. Centreless screw conveyor systems
      i. Low maintenance, fully contained transfer of feedstock throughout the plant
4) Operator Actions and System Responses
   a. The intake system should need no operator action
   b. All chutes must have cleaning hatches and are ideally lined with low adhesion liners.
   c. All motors, gearboxes and bearings must have permanent access for maintenance/cleaning.
5) Key Process parameters
   a. Feed rate suitable to supply feedstock at a rate matching the maximum granulator capacity plus safety factor.
6) Control logic and interlocks
   a. System should be cascade start and stop
   b. Motors to have run feedback
7) Safety and Alarm Conditions
   a. Estop system coverage of all items.
   b. Under speed
   c. Overload
8) Environmental Considerations
   a. Abrasive nature of feedstock to be considered.
   b. Ambient temperature for operational environment of motors/sensory
   c. Moisture and dust control to maintain operational hygiene and low dust environment

Conditioning:

1) Process Description
   a. Conditioning is required to prepare the feedstock for the granulators. It must elevate temperature to appropriate levels (Target 80 degrees C) to allow the addition of molasses and two different liquid binder additives and mixing the additives to a homogeneous product ready for immediate granulation. Each granulator will require its own conditioner. Each Conditioner will require 5 x pairs steam injection ports. Each steam injection port will be immediately followed by a molasses injection port and a liquid additive port. All steam and additives must be injected at toward the infeed end of the conditioner to allow sufficient mixing time before the product is delivered into the granulator. Residence time should be approximately 90 seconds at a rate of no less than 11 tons per hour. To supply the conditioners with molasses, a small, heated storage tank with two outlets will be required. Separate pumps will be required for each conditioner. A second small heated, agitated tank will be required for dissolving powder binders into water. This tank will also require two separate pumps to independently supply the two conditioners. Each steam and liquid additive port must have the ability to be turned on and off depending on the required demand from the system.

Fig 7 – Conditioner

2) Inputs and Outputs:

Material	Storage Style	Supply Quantity
1) Steam	On Demand	800kg/hr wet steam
2) Molasses	Heated tank fed from silo	200kg nominal local volume
3) Liquid Binder Solution	Mixing tank	1000 litre nominal
4.1) Powder binders (lignosulphate) 4.2) Water	Bags/pails/small form On demand	25kg per shift
5) Compost	On demand from intake system	11 tons per hour

3) Major Equipment and their Function
    a. Molasses day tank
        i. Heat to liquify molasses to nominal 45 degrees C to allow pumping/spraying into conditioner
    b. Powder and water blending tank
        i. Allow powders to be added to water and agitated to generate liquid binder solution
    c. Pumps
        i. Supply Molasses and Liquid additive solution to conditioners
    d. Conditioners
        i. Inject steam and liquid binders solution into compost and blending and heating the mixture to nominal 80 degrees C and delivering to the top of granulators

4) Operator Actions and System Responses
    a. Powder additives supply into the binder blending tank
5) Key Process parameters
    a. Feed rate of compost into conditioner
    b. Steam supply to meet target temperature
    c. Molasses dosing rate
    d. Liquid Binder Solution dosing rate
    e. Retention time in conditioner
    f. Homogenous blending
6) Control logic and interlocks

a. Steam, molasses and binder rates to be managed via recipe
b. Rates to be proportionally controlled by incoming feedstock rate.
c. Fine tuning of rates to be controlled by PID loop function, reading % of fines coming from sieve.

7) Safety and Alarm Conditions
   a. Low level alarms
   b. Steam availability
   c. Pump availability
   d. Conditioner motor speed control (VFD) and motor run feedback
   e. Estop coverage of all items
   f. Under speed
   g. Overload
8) Environmental Considerations
   a. Ambient temperature for molasses heating requirement
   b. Water temperature for binder liquid additive solution preparation
   c. Abrasive nature of feedstock to be considered.
   d. Ambient temperature for operational environment of motors/sensory
   e. Housekeeping and Dust control to maintain operational hygiene and low dust environment

Granulation/Rounding:

1) Process Description
   a. This process takes conditioned feedstock and forms it through the granulators and rounders to generate spherical granules ready for drying.

Fig 8 - Granulator

Fig 9 – Granulated manure

2) Inputs and Outputs:
    a. Conditioned feedstock supplied at up to 11 ton per hour per line
    b. Electricity
    c. Compressed air
    d. Heated air supply for rounders.
    e. Output spherical granules
3) Major Equipment and their Function
    a. Granulators
        i. Generate size-controlled portions of conditioned feedstock ready for rounding
    b. Rounders
        i. Receive portioned feedstock and form them into spherical granules
        ii. Heated air from beneath the rounder disks to generate a skin on the granules.
    c. Hot air fans
        i. Supply the rounders with 45 deg air from beneath discs to aid tumbling of product and skin formation of granules.
    d. Conveyors to take the granules away from rounders and deliver them into the drying process.
4) Operator Actions and System Responses
    a. System checks for blockages
    b. Adjustments to rollers
    c. Replacement of rollers and dies as required
5) Key Process parameters
    a. Incoming feedstock temperature
    b. Granulator speed
    c. Rounder air temperature
    d. Rounder Speed
6) Control logic and interlocks

a. Motor run feedback on all motors
b. Speed feedback on Granulator
c. Speed feedback on rounders
d. Vibration and heat monitoring of major bearings and gearboxes

7) Safety and Alarm Conditions
   a. Estop coverage of all items
   b. Vibration alarm
   c. Bearing over-temperature alarm
   d. Motor Stopped
8) Environmental Considerations
   a. Housekeeping and Dust control to maintain operational hygiene and low dust environment

Drying:

1) Process Description
   a. The drying process is to receive granulated product from the rounders and dry from process moisture to desired finished product moisture. Finished product moisture will be part of the product recipe variables.
2) Inputs and Outputs:
   a. Inputs
      i. wet granulated product
      ii. Un-odorised natural gas
      iii. Electricity
      iv. Ambient air
   b. Outputs
      i. Exhaust air (saturated)
      ii. Dry granulated product
3) Major Equipment and their Function
   a. Conveyors to feed dryers
   b. Dryer unit
   c. Gas supply and control
   d. Conveyors out of dryers
   e. Air handling, cyclones, return and dust control system
4) Operator Actions and System Responses
   a. Dryers shall be automated, and system controlled
   b. Operator required to monitor and assist dryer startup and shutdown
5) Key Process parameters
   a. Incoming granule moisture
   b. Flow rate of incoming granules
   c. Outgoing granule moisture
   d. Gas supply pressure and volume
6) Control logic and interlocks
   a. Recipe driven target output moisture
   b. Downstream conveyor availability
   c. Sieve availability
   d. Weigh conveyor availability
7) Safety and Alarm Conditions

a. Estop coverage of all items
b. Dryer availability
a. Upstream availability Belt
b. Under speed and drift
c. Overload

8) Environmental Considerations
   a. Ambient Temperature
   b. Ambient humidity
   c. Housekeeping and Dust control to maintain operational hygiene and low dust environment

Bulk Storage and handling:

1) Process Description
   a. This process receives dried granulated product from the dryers, sieves the product, weighs the sieve outputs, then distributes the saleable granules to the finished goods storage systems. The sieve waste is returned to the intake bin for reworking.
2) Inputs and Outputs:
   a. Inputs
      i. Dried granulated product
      ii. Spray on additives
   b. Outputs
      i. Finished saleable product ready for outload.
      ii. Weights of saleable granules, fines and overs
      iii. Weights of product on hand (silo weights / fill heights)
3) Major Equipment and their Function
   a. Sieves x 2
      i. Separate saleable granules from fines and overs
   b. Weigh conveyors x 4
      i. Weigh saleable granules and waste from each dryer outfeed / production line
      ii. Weigh fines from each line independently
   c. Waste return conveyor system
      i. Collect fines and overs from sieves and return them to the intake bin
   d. Bucket elevators
      i. Elevate saleable granules into the overhead silo filling conveyor system
   e. Silo filling conveyors
      i. Distribute finished goods to desired silos
   f. WIP silos
      i. Hold product ready for small form packaging (bulk bags & 25kg bags)
   g. Finished goods silos
      i. Hold bulk finished goods ready for truck filling or processing through bagging lines
   h. Silo outfeed conveyors
      i. Distribute finished goods to packaging or truck filling
4) Operator Actions and System Responses
   a. Validation of silo levels
   b. Validation of product storage location from production.
5) Key Process parameters
   a. Weights of product streams

   b. Silo fill level
6) Control logic and interlocks
   a. Recipe driven silo allocation – block system from sending a different product int a partially filled silo.
   b. Interlock on full silos – not selectable as a location
   c. Packaging system supply on demand
7) Safety and Alarm Conditions
   a. Estop coverage over all items
   b. Silo full alarms
   c. Belt under-speed and drift
   d. Overload
8) Environmental Considerations
   a. Housekeeping and Dust control to maintain operational hygiene and low dust environment

Finished goods Packaging and loadout:

1) Process Description
   a. This system takes product from the external Bulk finished goods silos and delivers it to an open top truck via belt conveyor or the bagging lines. The system is designed to transfer product at a rate of 100 ton per hour.

Fig 10 - 1 T and 25 kg bagging

   b. Inputs
      i. Stored finished product.
   a. Outputs
      i. Finished product in bulk, 1T, 25 kg Bags
      ii. Weight of product delivered to truck
      iii. Pallets of bagged product

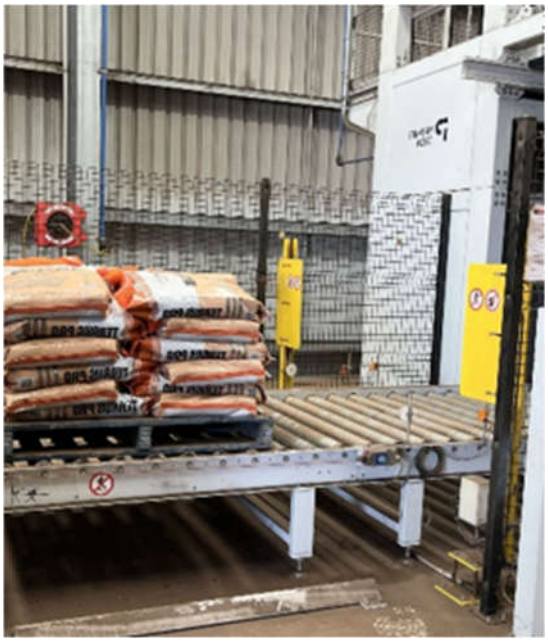

Fig 11 – 25 kg bag

Fig 12 – 1 T bag

2) Major Equipment and their Function
   a. Conveyor system from silo outfeed
   b. Cover/structure over conveyor outlet for inclement weather truck filling.
   c. 1 Tonne Bagging line
   d. 25 kg bagging line and automated palletising system

3) Operator Actions and System Responses
   a. Validation of order for transfer to truck
   b. Bag and pallet weigh labelling
   c. Palletising and wrapping
   d. Storage in racking
   e. Validation of system parameters to select correct product
   f. Manage and validate truck in loading position
   g. Manage truck relocation for even product delivery into trailer
   h. Manage paperwork for transaction and traceability
4) Key Process parameters
   a. Truck and Order validation
   b. Bulk outload delivery rate of 100 tph
   c. 15 t / hr bagging (1 T, 25 kg bags)
5) Control logic and interlocks
   a. Truck in location
   b. Product availability verification
   c. Start and stop outload (must include runout of conveyors and accommodation to calc in flight product)
6) Safety and Alarm Conditions
   a. Estop coverage on all items
   b. Belt under speed and drift

c. Overload

7) Environmental Considerations
   a. Housekeeping and Dust control to maintain operational hygiene and low dust environment

Fig 13 – In Factory Bag house

Fig 14 – External cyclones and air handling

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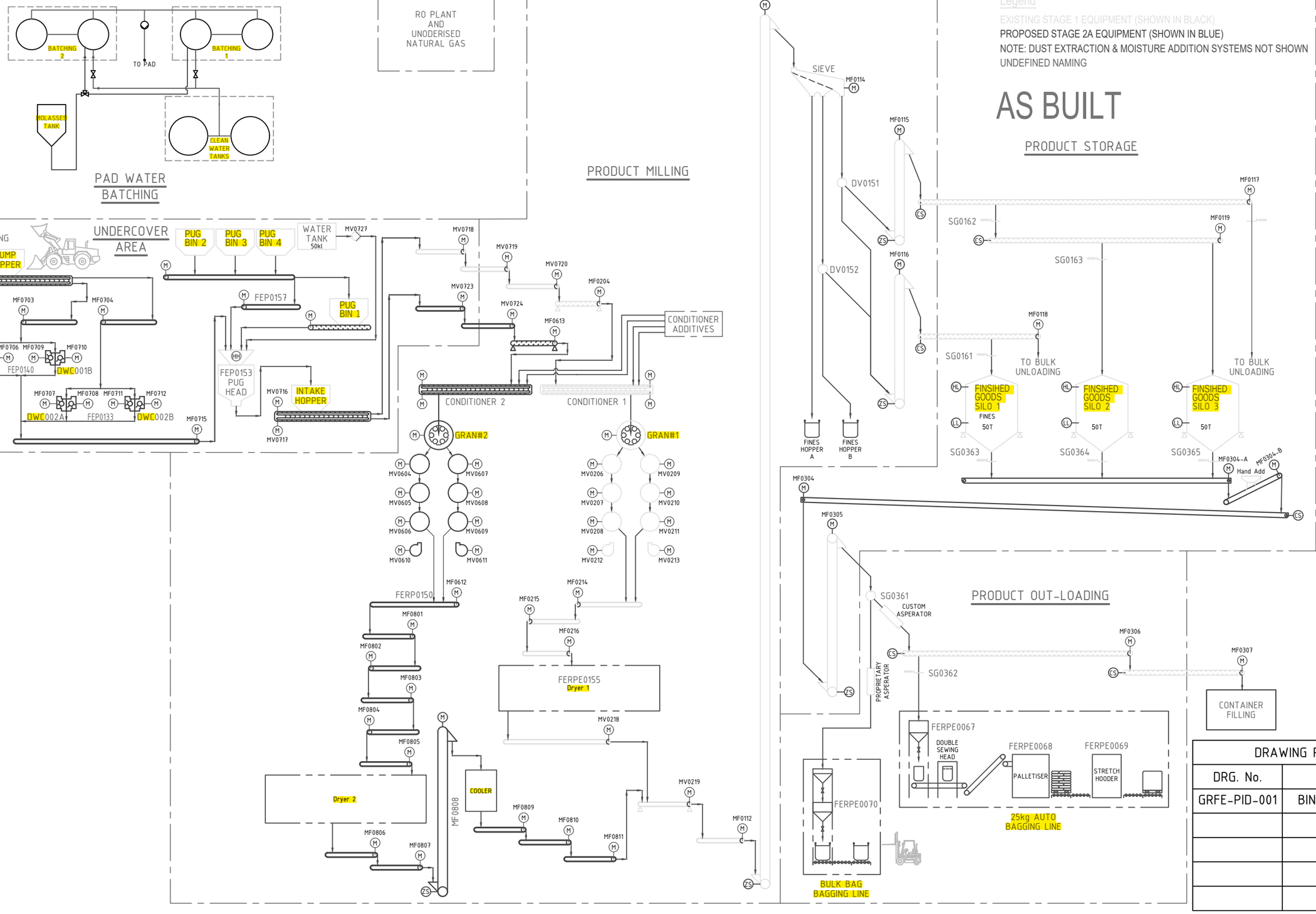


DRAWING REFERENCES	
DRG. No.	DESCRIPTION
GRFE-PID-001	BINDER 1 & MOLASSES

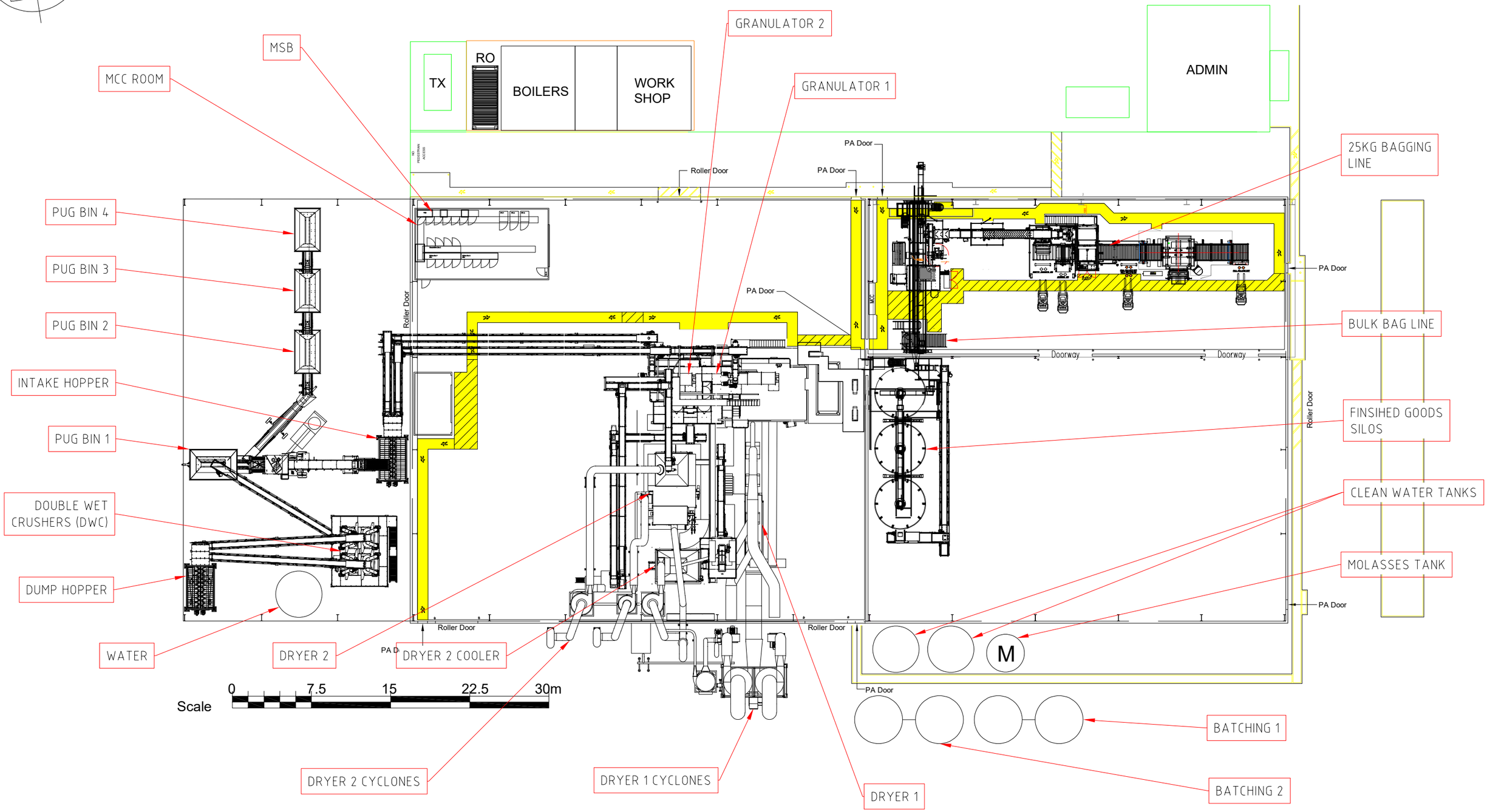
Rev.	Details	Drawn	Date
0	AS BUILT	JK	16/04/26
B	CONDITIONER ADDITIVES ADDED	JK	07/07/25
A	AS BUILT STAGE 1 & PROP STAGE 2	JK	02/08/22

Drawing Title:
GRASSDALE FRETILIERS
PROCESS FLOW DIAGRAM
AS BUILT

Drawn By:	Drawn Date:	Sheet Size:
J. KILLALEA	06/06/25	A3
Approved By:	Approved Date:	Scale:
		NTS
Drawing No.:		Revision No.:
GRFE-PFD-02		B

Legend

- Pedestrian Path (128m nom.)
- Pedestrian / Vehicle Shared Zone (60m nom.)
- Safety Bollards



Rev.	Details	Drawn	Date
1	As Built	CPW	23/06/26

MORT & Co

Drawing Title: Mort & Co Fertilisers Grassdale Facility Prime Equipment Layout			
Drawn By: CPW	Drawn Date: 23/06/26	Sheet Size: A3	
Approved By:	Approved Date:	Scale: DNS	
Drawing No.: GRFE-VMP-04		Revision No.: 1	

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