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Management Livestock for Plan Operational 5.4

Operations Daily 1.5.4

- **Care: Animal**
  - schedule distribution Feed –
  - management Water –
  - monitoring Health –
  - sanitation and Cleaning –
- **Activities: Production**
  - storage and collection Milk –
  - grading and collection Egg –
  - processing and collection Manure –
  - keeping Record –
- **Maintenance: Facility**
  - checks Equipment –
  - inspection Infrastructure –
  - tasks maintenance and Repair –
  - protocols Cleaning –

Operations Weekly 2.5.4

- **Management: Feed**
  - assessment inventory Feed –
  - processing and harvest Azolla –
  - testing quality Feed –
  - organization Storage –
- **Management: Health**
  - inspections health Detailed –
  - review schedule Vaccination –
  - measures prevention Disease –
  - follow-ups Treatment –
- **Review: Production**
  - analysis data Production –
  - assessment Performance –
  - review utilization Resource –
  - checks control Quality –

Operations Monthly 3.5.4

- **Assessment: and Planning**
  - planning Production –
  - allocation Resource –
  - evaluation Performance –
  - review Budget –
- **Schedule: Maintenance**
  - maintenance equipment Major –
  - repairs Facility –
  - upgrades Infrastructure –
  - optimization System –
- **Management: Staff**
  - sessions Training –
  - reviews Performance –
  - planning Schedule –
  - briefings Safety –

Operations Seasonal 4.5.4

- **Activities: Spring**
  - implementation program Breeding –
  - planning rotation Pasture –
  - repair and cleaning Facility –
  - assessment Health –
- **Management: Summer**
  - prevention stress Heat –
  - optimization system Water –
  - management storage Feed –
  - maintenance Ventilation –
- **Preparations: Fall**
  - stockpiling feed Winter –
  - winterization Facility –
  - maintenance Equipment –
  - preparations Health –
- **Operations: Winter**

- protocols weather Cold –
- management housing Indoor –
- rationing Feed –
- monitoring Health –

Procedures Emergency 5.5.4

- **Emergencies: Health**
  - protocols outbreak Disease –
  - procedures response Injury –
  - information contact Veterinary –
  - guidelines Quarantine –
- **Disasters: Natural**
  - procedures Evacuation –
  - reserves feed Emergency –
  - systems backup Water –
  - protocols Communication –
- **Failures: System**
  - procedures outage Power –
  - response failure Equipment –
  - activation system Backup –
  - list contact Emergency –

Procedures Control Quality 6.5.4

- **Quality: Product**
  - protocols testing Milk –
  - standards quality Egg –
  - procedures inspection Meat –
  - requirements Documentation –
- **Quality: Feed**
  - analysis Nutritional –
  - testing Contamination –
  - monitoring Storage –
  - evaluation Supplier –
- **Quality: Environmental**

- testing quality Water –
- monitoring quality Air –
- assessment management Waste –
- review impact Environmental –

Integration Azolla and Management Feed 7.5.4

Profile Nutritional Azolla

providing system, economy circular our in resource feed cornerstone a as serves Azolla the outlines table following The inputs. feed external reducing while protein high-quality formulations: feed for basis the forms that composition nutritional

Chain Supply Azolla

Processing and Sourcing Azolla

- **Source: Primary** harvests scheduled weekly with)**??**(Unit Farming Azolla
- **Methods: Processing**
  - Direct feeding: Fresh – hours 24 within feeding and harvesting
  - Sun drying: 2-3 days, 12-15% moisture to reducing process
  - Solar dehydration: Accelerated drying using tunnel solar dryers
  - Anaerobic Fermentation: – 14-21 days for processing 2% molasses with
  - Combined Pelleting: – other with ingredients feed for standardized feeding
- **Assurance: Quality**
  - Weekly testing of biomass fresh for content protein and contaminants
  - Monthly analysis profile nutritional of products Azolla processed
  - Mycotoxin screening for stored Azolla feed materials
  - Cross-reference with Unit Farming Azolla)**??**(records production

Inventory and Storage Feed

- **Infrastructure: Storage**
  - Fresh Azolla: – Shaded, well-ventilated area holding sprinkler system
  - Dried Azolla: – Climate-controlled storage room (humidity <60%, temperature <25°C)
  - Fermented Azolla: – Sealed containers for preservation anaerobic
  - Azolla Pelleted: – Standard feed: feed silo storage
- **Management: Inventory**
  - Minimum 3-week safety stock of Azolla processed –

system rotation Out) First In, (First FIFO –

records feeding with reconciliation inventory Weekly –

stages growth and performance animal on based forecasting Monthly –

)**??** (see contingencies for plan procurement Emergency –

Schedules Feeding Livestock-Specific

Program Feeding Poultry

Poultry - Schedule Feeding Daily

- **Layers:**

bird) per (40g Azolla Fresh/fermented AM: 6:00 –

bird) per (60g feed Conventional AM: 11:00 –

bird) per (30g mix Azolla-grain Dried PM: 3:00 –

weight) (fresh bird per 70g-50 consumption: Azolla daily Total –

- **Broilers:**

Azolla dried 15%-5 with feed Conventional AM: 7:00 –

weekly) increasing 10g-5) Azolla Fresh PM: 12:00 –

grains supplemental with feed Conventional PM: 5:00 –

age with 30g to 5g from increases consumption: Azolla daily Total –

- **Ducks:**

systems pond in Azolla fresh to access Continuous –

bird) per (50g supplement Grain AM: 7:00 –

bird) per (100g feed mixed Grain-Azolla PM: 4:00 –

weight) (fresh bird per 150g-100 consumption: Azolla daily Total –

Program Feeding Ruminant

Ruminants - Schedule Feeding Weekly

- **Schedule: Cows Dairy**

residues crop with mixed kg) 15-12) Azolla Fresh Monday/Thursday: –

mix concentrate with kg) 10-8) Azolla Fermented Tuesday/Friday: –

Ration) Mixed (Total TMR in kg) 2-5.1) Azolla Dried Wednesday/Saturday: –

supplement protein Azolla-based with feed Conventional Sunday: –

equivalent fresh kg 75-60 weight: feed Azolla Weekly –

- **Adjustments: Seasonal**

content water for 20% by Azolla fresh Increase Summer: –
density energy for 15% by Azolla dried Increase Winter: –
daily Azolla fresh kg 3-2 additional with Supplement peak: Lactation –
daily) fresh kg 7-5) levels maintenance to Reduce period: Dry –

- **Schedule: Processing**

dependent weather Wednesday, and Sunday Sun-drying: –
week following for batch Monday preparation: Fermentation –
batches kg 500 Biweekly, production: Pellet –
morning early Daily, mixing: TMR –

Control Quality and Integration Cross-Unit

Unit Farming Azolla with Integration

- **Coordination: Harvest**

)**??**(team production Azolla with communication Daily –
requirements feeding with synchronized schedule Harvest –
unit Azolla to provided needs feed of projection Weekly –
inventory livestock and rates growth on based adjustments Seasonal –

- **Loop: Feedback Quality**

freshness and quality Azolla of assessment Daily –
unit Azolla to performance animal of reporting Weekly –
targets nutritional review to meeting joint Monthly –
efficiency conversion feed of analysis Quarterly –

Unit Production Biodiesel with Integration

-)**??**(**Utilization: Glycerin**

Thursday & Monday batches, kg 300 glycerin: purified 80% of Receipt –
incorporation feed safe for solution 65% to Dilution –
mixtures feed concentrated in 7%-5 rates: Inclusion –
sheep/goat per 30g cow, per 120g allowances: daily Maximum –
purity) (80% glycerin of kcal/kg 1,580 value: Energy –

- **Recycling: Residue Azolla**

areas feeding from gathering Daily waste: feed of Collection –
waste other from Azolla undigested of Separation Sorting: –
processing biochar for Unit Biodiesel to delivery Twice-weekly Transport: –
conversion waste-to-resource of measurement Monthly Tracking: –

Monitoring Performance

- **Monitoring: Conversion Feed**
  - group animal by records intake feed Daily –
  - group) (sample measurements weight body Weekly –
  - efficiency conversion feed of calculation Monthly –
  - baseline feed conventional against Comparison –
- **Assessment: Impact Production**
  - type feed by analysis and recording Daily yield: Milk –
  - correlation feed with records collection Daily production: Egg –
  - rates inclusion Azolla with correlated gain weight Weekly rates: Growth –
  - diet with correlated assessment veterinary Monthly indicators: Health –
- **Improvement: Continuous**
  - data performance on based adjustments formulation Feed –
  - methods and rates integration Azolla of review Quarterly –
  - digestibility improved for techniques processing new of Testing –
  - sharing knowledge for practices best of Documentation –

Impact Economic

- **Reduction: Cost Feed**
  - sources protein conventional of 30%-20 of Replacement –
  - savings cost feed of calculation Monthly –
  - production of unit per cost of analysis Quarterly –
  - program feeding Azolla of assessment economic Annual –
- **Addition: Value**
  - products animal Azolla-fed for pricing Premium –
  - carotenoids) (omega-3, profiles nutritional enhanced of Marketing –
  - livestock Azolla-integrated for program Certification –
  - impact environmental reduced of valuation Economic –

Keeping Record 8.5.4

- **Records: Production**
  - logs production Daily –
  - data performance Animal –
  - records consumption Feed –

- records treatment Health –

- **Records: Financial**

- tracking Income –
- documentation Expense –
- records Inventory –
- reports analysis Cost –

- **Records: Compliance**

- documentation Regulatory –
- records Certification –
- reports Inspection –
- records Training –

Management Livestock for Plan Financial 6.4

(2031-2026) Costs Operational and Investment 1.6.4

Establishment Initial :(2027-2026) 1 Phase

- **Investments: Capital**

- EGP 150,000 housing: livestock Basic –
- EGP 120,000 ducks): 100 chickens, 200 cattle, (5 acquisition livestock Initial –
- EGP 50,000 facilities: storage Feed –
- EGP 40,000 systems: water Basic –
- EGP 30,000 equipment: collection Manure –
- EGP 390,000 :**Investment Capital Total** –

- **(Annual): Costs Operational**

- EGP 60,000 Azolla): (beyond feed Supplementary –
- EGP 25,000 medications: and services Veterinary –
- EGP 96,000 workers): full-time (2 Labor –
- EGP 30,000 water: and Utilities –
- EGP 20,000 Maintenance: –
- EGP 231,000 :**Costs Operational Annual Total** –

- **(Annual): Projections Revenue**

- EGP 75,000 cattle): (5 production Milk –
- EGP 73,000 chickens): (200 Eggs –
- EGP 40,000 meat: Poultry –

- EGP 30,000 products: Duck –
- EGP 15,000 (value-added): vermicomposting for Manure –
- EGP 233,000 :**Revenue Annual Total** –

- **Summary: Financial Year First**

- EGP 390,000 investment: Total –
- EGP 231,000 costs: operational Annual –
- EGP 233,000 revenue: Annual –
- EGP 2,000 flow: cash annual Net –
- year first in Minimal investment: on Return –
- 1 Phase in achieved Not point: Break-even –

Expansion :(2028-2027) 2 Phase

- **Investments: Capital**

- EGP 200,000 facilities: housing Enhanced –
- ducks): more 100 chickens, more 300 cattle, more (10 livestock Additional – EGP 250,000
- EGP 120,000 dairy: for equipment Processing –
- EGP 80,000 systems: management waste and water Expanded –
- EGP 650,000 :**Investment Capital Total** –

- **(Annual): Costs Operational**

- EGP 150,000 feed: Supplementary –
- EGP 60,000 medications: and services Veterinary –
- EGP 192,000 workers): full-time (4 Labor –
- EGP 50,000 water: and Utilities –
- EGP 40,000 Maintenance: –
- EGP 30,000 distribution: and Marketing –
- EGP 522,000 :**Costs Operational Annual Total** –

- **(Annual): Projections Revenue**

- EGP 225,000 cattle): (15 production Milk –
- EGP 100,000 (value-added): products dairy Processed –
- EGP 182,500 chickens): (500 Eggs –
- EGP 100,000 meat: Poultry –
- EGP 60,000 products: Duck –
- EGP 45,000 vermicomposting: for Manure –
- EGP 712,500 :**Revenue Annual Total** –

- **Summary: Financial 2 Phase**
  - EGP 1,040,000 investment: cumulative Total
  - EGP 522,000 costs: operational Annual
  - EGP 712,500 revenue: Annual
  - EGP 190,500 flow: cash annual Net
  - investment cumulative on 3%.18 investment: on Return
  - investment initial of recovery Partial

Optimization :(2029-2028) 3 Phase

- **Investments: Capital**
  - EGP 150,000 systems: management waste Advanced
  - 130,000 ducks): more 50 chickens, more 200 cattle, more (5 livestock Additional EGP
  - EGP 200,000 (initial): digester Biogas
  - EGP 100,000 equipment: processing feed Advanced
  - EGP 580,000 :**Investment Capital Total**
- **(Annual): Costs Operational**
  - EGP 180,000 feed: Supplementary
  - EGP 80,000 medications: and services Veterinary
  - EGP 240,000 workers): full-time (5 Labor
  - EGP 60,000 water: and Utilities
  - EGP 60,000 Maintenance:
  - EGP 50,000 distribution: and Marketing
  - EGP 670,000 :**Costs Operational Annual Total**
- **(Annual): Projections Revenue**
  - EGP 300,000 cattle): (20 production Milk
  - EGP 200,000 products: dairy Processed
  - EGP 255,500 chickens): (700 Eggs
  - EGP 140,000 meat: Poultry
  - EGP 75,000 products: Duck
  - EGP 80,000 value: biogas and Manure
  - EGP 1,050,500 :**Revenue Annual Total**
- **Summary: Financial 3 Phase**
  - EGP 1,620,000 investment: cumulative Total
  - EGP 670,000 costs: operational Annual

- EGP 1,050,500 revenue: Annual
- EGP 380,500 flow: cash annual Net
- investment cumulative on 5%.23 investment: on Return
- recovery investment full toward progress Significant

Scale Commercial :(2030-2029) 4 Phase

- **Investments: Capital**
  - EGP 250,000 facilities: processing Complete
  - 90,000 ducks): more 25 chickens, more 150 cattle, more (3 livestock Additional – EGP
  - EGP 150,000 system: biogas Expanded
  - EGP 120,000 systems: monitoring and water Smart
  - EGP 610,000 :**Investment Capital Total**
- **(Annual): Costs Operational**
  - EGP 200,000 feed: Supplementary
  - EGP 90,000 medications: and services Veterinary
  - EGP 288,000 workers): full-time (6 Labor
  - EGP 70,000 water: and Utilities
  - EGP 80,000 Maintenance:
  - EGP 80,000 distribution: and Marketing
  - EGP 808,000 :**Costs Operational Annual Total**
- **(Annual): Projections Revenue**
  - EGP 345,000 cattle): (23 production Milk
  - EGP 300,000 products: dairy processed Premium
  - EGP 310,250 chickens): (850 Eggs
  - EGP 170,000 meat: Poultry
  - EGP 82,500 products: Duck
  - EGP 60,000 value: energy Biogas
  - EGP 90,000 compost: and Manure
  - EGP 1,357,750 :**Revenue Annual Total**
- **Summary: Financial 4 Phase**
  - EGP 2,230,000 investment: cumulative Total
  - EGP 808,000 costs: operational Annual
  - EGP 1,357,750 revenue: Annual
  - EGP 549,750 flow: cash annual Net
  - investment cumulative on 7%.24 investment: on Return
  - recovery full Approaching timeline: recovery Investment

Integration Full :(2031-2030) 5 Phase

- **Investments: Capital**
  - EGP 200,000 refinements: and optimization System –
  - ducks): more 25 chickens, more 150 cattle, more (2 additions livestock Final – EGP 70,000
  - EGP 180,000 packaging: and processing Advanced –
  - EGP 150,000 integration: economy circular Complete –
  - EGP 600,000 :**Investment Capital Total** –
- **(Annual): Costs Operational**
  - EGP 220,000 feed: Supplementary –
  - EGP 100,000 medications: and services Veterinary –
  - EGP 336,000 workers): full-time (7 Labor –
  - EGP 80,000 water: and Utilities –
  - EGP 100,000 Maintenance: –
  - EGP 120,000 distribution: and Marketing –
  - EGP 956,000 :**Costs Operational Annual Total** –
- **(Annual): Projections Revenue**
  - EGP 375,000 cattle): (25 production Milk –
  - EGP 400,000 products: dairy processed Premium –
  - EGP 365,000 chickens): (1000 Eggs –
  - EGP 200,000 meat: Poultry –
  - EGP 90,000 products: Duck –
  - EGP 100,000 value: energy Biogas –
  - EGP 120,000 compost: and Manure –
  - EGP 50,000 demonstrations: and tours Educational –
  - EGP 1,700,000 :**Revenue Annual Total** –
- **Summary: Financial 5 Phase**
  - EGP 2,830,000 years): (5 investment cumulative Total –
  - EGP 956,000 costs: operational Annual –
  - EGP 1,700,000 revenue: Annual –
  - EGP 744,000 flow: cash annual Net –
  - investment total on 3%.26 investment: on Return –
  - 5 Phase of end by expected recovery investment Complete –

Analysis Cost-Benefit 2.6.4

Benefits Economic

- **Streams: Revenue Direct**
  - source income Primary eggs): meat, (milk, products Animal
  - margins profit Higher products: value-added Processed
  - income secondary Significant compost: and Manure
  - sales potential and costs operational Reduced energy: Biogas
- **Benefits: Economic Indirect**
  - savings 30%-20 integration: Azolla through reduction cost Feed
  - savings 40% Estimated units: other for costs fertilizer Reduced
  - costs pesticide Reduced services: control Pest
  - stream revenue Additional potential: tourism and Educational
- **Sustainability: Financial Long-term**
  - 3%.26 years: 5 after ROI Projected
  - years 5.4 Approximately period: Payback
  - 8%.43 capacity: full at margin Profit
  - EGP 744,000 capacity: full at profit net Annual

Strategies Mitigation Risk

- **Fluctuations: Market**
  - volatility price against buffer to portfolio product Diversified
  - margins profit increase to processing Value-added
  - costs intermediary reduce to channels marketing Direct
- **Risks: Production**
  - annually) value livestock of (5% livestock for Insurance
  - profits) annual of (10% allocation fund Emergency
  - adjustments for allow to implementation Phased
- **Constraints: Resource**
  - consumption minimize to systems recycling Water
  - inputs external on dependency reduce to production feed On-site
  - costs operational reduce to integration energy Renewable

Management Financial and Funding 3.6.4

Sources Funding

- **Capital: Initial**
  - EGP) (1,132,000 40% equity: Project –
  - EGP) (990,500 35% loans: development Agricultural –
  - EGP) (707,500 25% grants: agriculture Sustainable –
- **Financing: Operational**
  - income net annual of 30% profits: of Reinvestment –
  - needs seasonal for facility credit Revolving –
  - flow cash match to approach investment Phased –

Practices Management Financial

- **Monitoring: and Accounting**
  - unit livestock for system accounting Dedicated –
  - reviews performance financial Monthly –
  - line product by analysis profitability Quarterly –
- **Measures: Control Cost**
  - optimization and monitoring efficiency Feed –
  - targets reduction and tracking usage Energy –
  - benchmarks productivity Labor –
- **Prioritization: Investment**
  - expenditures capital of evaluation ROI-based –
  - integration economy circular enhance that investments on Focus –
  - costs operational reduce that technologies Prioritize –

Economy Circular with Integration Economic 4.6.4

Optimization Chain Value

- **Reduction: Cost Input**
  - costs feed conventional in reduction 30%-20 feed: as Azolla –
  - reduction cost feed additional 15% utilization: by-products Agricultural –
  - 5 Phase by costs energy in reduction 25% energy: for Biogas –
- **Maximization: Value Output**
  - capacity full at value annual EGP 120,000 vermicomposting: to Manure –
  - value fertilizer equivalent EGP 50,000 ponds: Azolla to water Nutrient-rich –
  - value estimated EGP 80,000 pollination): control, (pest services Ecosystem –

Benefits Financial Economy Circular

- **Gains: Efficiency Resource**
  - costs water in reduction 40% recycling: Water –
  - monetized streams waste of 90% conversion: Waste-to-resource –
  - requirements energy external in reduction 25% integration: Energy –
- **Value: Resilience System**
  - fluctuations price input to vulnerability Reduced –
  - disruptions market withstand to ability Enhanced –
  - sustainability financial long-term Improved –
- **Value: Economy Circular Total**
  - capacity full at annually EGP 350,000 Approximately savings: cost Direct –
  - annually EGP 250,000 Approximately streams: revenue Additional –
  - premium price 15% branding: sustainability through value product Enhanced –

Management Livestock for Requirements Resource 7.4

Requirements Infrastructure 1.7.4

- **Housing: Animal**
  - animal per m^2 0.2 pens: goat and Sheep –
  - bird per m^2 25.0 houses: Poultry –
  - cow per m^2 10 facilities: cattle Dairy –
  - systems Ventilation –
  - systems Lighting –
  - systems collection Waste –
- **Storage: Feed**
  - m^2 200 facility: storage Hay –
  - capacity tons metric 100 silos: storage Grain –
  - m^2 500 ponds: cultivation Azolla –
  - m^2 50 area: mixing Feed –
- **Facilities: Processing**
  - m^2 100 unit: processing Dairy –
  - m^2 50 storage: and collection Egg –
  - m^2 150 area: processing Meat –
  - m^2 100 facilities: storage Cold –

Requirements Equipment 2.7.4

- **Management: Feed**
  - units 2 mixers: Feed –
  - equipment distribution Feed –
  - scales Weighing –
  - containers Storage –
  - equipment testing Feed –
- **Management: Health**
  - equipment and tools Veterinary –
  - units storage Vaccination –
  - devices monitoring Health –
  - facilities Treatment –
  - equipment Quarantine –
- **Equipment: Production**
  - units 10 machines: Milking –
  - equipment collection Egg –
  - tools processing Meat –
  - equipment Packaging –
  - devices testing Quality –

Resources Human 3.7.4

- **Staff: Management**
  - 1 manager: Livestock –
  - 2 supervisors: Production –
  - 1 manager: control Quality –
  - 2 staff: Administrative –
- **Staff: Technical**
  - 1 Veterinarian: –
  - 4 specialists: care Animal –
  - 2 technicians: management Feed –
  - 3 technicians: Processing –
- **Staff: Support**
  - 8 workers: General –
  - 2 staff: Maintenance –
  - 2 personnel: Security –
  - 3 staff: Cleaning –

Resources Consumable 4.7.4

- **Resources: Feed**
  - tons/year 500 fodder: and Hay –
  - tons/year 200 feed: Grain –
  - tons/year 10 supplements: Mineral –
  - tons/year 100 production: Azolla –
- **Supplies: Health**
  - medicines and Vaccines –
  - supplies Cleaning –
  - Disinfectants –
  - materials aid First –
- **Supplies: Production**
  - materials Packaging –
  - supplies Processing –
  - containers Storage –
  - materials control Quality –

Requirements Utility 5.7.4

- **Resources: Water**
  - liters/day 50,000 water: Drinking –
  - liters/day 20,000 water: Cleaning –
  - liters/day 10,000 water: Processing –
  - liters/day 30,000 feed: for Irrigation –
- **Resources: Energy**
  - kWh/day 100 Electricity: –
  - liters/month 5,000 fuel: Heating –
  - systems power Solar –
  - generators Backup –
- **Management: Waste**
  - tons/day 10 processing: Manure –
  - treatment Wastewater –
  - disposal waste Solid –
  - systems Recycling –

Requirements Technology 6.7.4

- **Systems: Management**
  - software management Livestock –
  - system tracking Inventory –
  - system management Financial –
  - software control Quality –
- **Equipment: Monitoring**
  - sensors Environmental –
  - cameras Security –
  - systems tracking Animal –
  - devices monitoring Production –
- **Systems: Communication**
  - network communication Internal –
  - system alert Emergency –
  - devices Mobile –
  - connectivity Internet –

Operations Livestock for Plan Management Risk 8.4

Risks Disease and Health 1.8.4

- **Outbreaks: Disease**
  - High Level: Risk –
  - Severe Impact: –
  - Strategies: Mitigation –
    - screenings health Regular *
    - programs Vaccination *
    - protocols Quarantine *
    - measures Biosecurity *
    - partnerships Veterinary *
- **Diseases: Zoonotic**
  - Medium Level: Risk –
  - Severe Impact: –
  - Strategies: Mitigation –
    - equipment protective Personal *
    - staff for checks health Regular *
    - procedures handling Proper *
    - protocols Sanitation *
    - programs training Staff *

Risks Environmental 2.8.4

- **Risks: Climate-Related**
  - Medium Level: Risk –
  - High Impact: –
  - Strategies: Mitigation –
    - facilities Climate-controlled *
    - systems monitoring Weather *
    - provisions shelter Emergency *
    - stockpiling Feed *
    - sources water Backup *
- **Disasters: Natural**
  - Low Level: Risk –
  - Severe Impact: –
  - Strategies: Mitigation –
    - plans evacuation Emergency *
    - reinforcement Structural *
    - coverage Insurance *
    - reserves supply Emergency *
    - training emergency Staff *

Risks Operational 3.8.4

- **Failure: Equipment**
  - Medium Level: Risk –
  - Moderate Impact: –
  - Strategies: Mitigation –
    - schedules maintenance Regular *
    - equipment Backup *
    - contracts support Technical *
    - training Staff *
    - procedures repair Emergency *
- **Disruption: Chain Supply**
  - Medium Level: Risk –
  - High Impact: –
  - Strategies: Mitigation –
    - relationships supplier Multiple *
    - reserves stock Emergency *
    - options sourcing Local *
    - strategies feed Alternative *
    - management capacity Storage *

Risks Market 4.8.4

- **Volatility: Price**
  - High Level: Risk –
  - High Impact: –
  - Strategies: Mitigation –
    - contracts Forward *
    - range product Diversified *
    - monitoring Market *
    - strategies hedging Price *
    - processing Value-added *
- **Fluctuation: Demand**
  - Medium Level: Risk –
  - Moderate Impact: –
  - Strategies: Mitigation –
    - diversification Market *
    - capacity storage Product *
    - planning production Flexible *
    - management relationship Customer *
    - channels market Alternative *

Risks Financial 5.8.4

- **Management: Flow Cash**
  - Medium Level: Risk –
  - High Impact: –
  - Strategies: Mitigation –
    - management capital Working *
    - arrangements line Credit *
    - management term Payment *
    - measures control Cost *
    - systems monitoring Financial *
- **Risks: Investment**
  - Medium Level: Risk –
  - High Impact: –
  - Strategies: Mitigation –
    - approach investment Phased *
    - analysis investment on Return *
    - expansions for assessment Risk *
    - strategies Diversification *
    - advice financial Professional *

Risks Regulatory 6.8.4

- **Compliance:**
  - Medium Level: Risk –
  - High Impact: –
  - Strategies: Mitigation –
    - audits compliance Regular *
    - documentation Updated *
    - regulations on training Staff *
    - services consultation Legal *
    - membership association Industry *
- **Regulations: Environmental**
  - Medium Level: Risk –
  - High Impact: –
  - Strategies: Mitigation –
    - monitoring Environmental *
    - systems management Waste *
    - measures control Emission *
    - procedures Documentation *
    - audits environmental Regular *

Review and Monitoring Risk 7.8.4

- **Assessments: Risk Regular**
  - reviews risk Quarterly –
  - assessment comprehensive Annual –
  - system reporting Incident –
  - tracking metrics Performance –
  - analysis feedback Stakeholder –
- **Improvement: Continuous**
  - procedures management risk Update –
  - development and training Staff –
  - integration Technology –
  - implementation practice Best –
  - collaboration Industry –

Management Livestock for Plan Sustainability 9.4

Sustainability Environmental 1.9.4

- **Conservation: Resource**
  - systems management Water
    - harvesting Rainwater
    - systems recycling Water
    - methods irrigation Efficient
    - detection leak and Monitoring
  - efficiency Energy
    - integration power Solar
    - equipment Energy-efficient
    - systems ventilation Natural
    - implementation lighting LED
  - optimization use Land
    - grazing Rotational
    - practices conservation Soil
    - preservation Biodiversity
    - protection species Native
- **Management: Waste**
  - management Manure
    - systems Composting
    - production Biogas
    - processing fertilizer Organic
    - recycling Nutrient
  - reduction waste Feed
    - systems feeding Precise
    - optimization Storage
    - efficiency processing Feed
    - sources feed Alternative
  - management waste Water
    - systems Treatment
    - protocols Recycling
    - monitoring Quality
    - control Discharge

Sustainability Economic 2.9.4

- **Efficiency: Operational**
  - optimization Resource
    - systems management Feed
    - efficiency Labor
    - maintenance Equipment
    - consumption Energy
  - strategies reduction Cost
    - minimization Waste
    - automation Process
    - maintenance Preventive
    - sharing Resource
  - enhancement Revenue
    - diversification Product
    - processing Value-added
    - expansion Market
    - improvement Quality
- **Development: Market**
  - certification Product
    - certification Organic
    - labels Sustainability
    - standards Quality
    - recognition Local
  - strategies Marketing
    - focus market Local
    - marketing Direct
    - presence Online
    - education Customer
  - development Partnership
    - businesses Local
    - institutions Research
    - associations Industry
    - agencies Government

Sustainability Social 3.9.4

- **Engagement: Community**
  - employment Local
    - creation Job

development Skills *
wages Fair *
advancement Career *
programs Educational –
partnerships School *
visits Farm *
workshops Training *
sharing Knowledge *
support Community –
sourcing Local *
events Community *
initiatives Charitable *
support Infrastructure *

Welfare: Animal •

conditions Housing –
facilities Comfortable *
support behavior Natural *
monitoring Health *
reduction Stress *
programs Healthcare –
care Preventive *
checkups Regular *
prevention Disease *
response Emergency *
practices Ethical –
handling Humane *
breeding Natural *
feed Quality *
standards Welfare *

Technology and Innovation 4.9.4

Technologies: Sustainable •

systems farming Smart –
devices Monitoring *
systems Automation *
analytics Data *
support Decision *
energy Renewable –

installations Solar *
systems Biogas *
storage Energy *
integration Grid *
processing Waste –
composting Advanced *
extraction Nutrient *
treatment Water *
control Emission *

Development: and Research •

programs Breeding –
improvement Genetic *
resistance Disease *
efficiency Feed *
adaptation Climate *
research Feed –
sources Alternative *
optimization Nutrition *
ingredients Local *
reduction Waste *
improvement Process –
studies Efficiency *
testing Technology *
practices Best *
pilots Innovation *

Reporting and Monitoring 5.9.4

Metrics: Performance •

indicators Environmental –
consumption Resource *
generation Waste *
footprint Carbon *
impact Biodiversity *
indicators Economic –
efficiency Operational *
performance Market *
stability Financial *
returns Investment *

indicators Social –

impact Community *

metrics Employment *

welfare Animal *

satisfaction Stakeholder *

- **Improvement: Continuous**

assessments Regular –

reviews Performance *

setting Goal *

planning Action *

tracking Progress *

engagement Stakeholder –

collection Feedback *

channels Communication *

planning Collaborative *

reporting Transparency *

management Knowledge –

documentation practices Best *

programs Training *

sharing Innovation *

stories Success *

Management Livestock for Plan Integration 10.4

Units Agricultural with Integration 1.10.4

- **Integration: Palm Date**

palms date under grazing Rotational –

bedding for fronds palm of Utilization –

trees palm for fertilization Manure –

foraging poultry through control Pest –

- **Integration: Grove Olive**

groves olive in management Grazing –

supplement feed as waste pruning Olive –

trees olive for application Manure –

control weed Natural –

- **Integration: System Azolla**

systems polyculture Duck-Azolla –

ponds Azolla to livestock from cycling Nutrient –
feed livestock for harvesting Azolla –
management quality Water –

Units Processing with Integration 2.10.4

- **Processing: Dairy**

systems storage and collection Milk –
requirements facility Processing –
measures control Quality –
strategy diversification Product –

- **Processing: Meat**

facilities processing and Slaughter –
management chain Cold –
distribution and Packaging –
protocols management Waste –

- **Processing: Feed**

facilities mixing Feed –
systems preservation and Storage –
procedures testing Quality –
management Inventory –

Management Waste with Integration 3.10.4

- **Vermicomposting:**

systems collection Manure –
protocols Pre-treatment –
management bed Worm –
storage and handling Product –

- **Production: Biogas**

preparation Feedstock –
operation Digester –
storage and collection Gas –
management Digestate –

- **Composting:**

preparation and sorting Material –
management process Composting –
monitoring Quality –
distribution Product –

Services Support with Integration 4.10.4

- **Services: Veterinary**
  - checks health Regular –
  - programs Vaccination –
  - measures prevention Disease –
  - protocols response Emergency –
- **Education: and Training**
  - programs training Staff –
  - facilities education Visitor –
  - partnerships Research –
  - platforms sharing Knowledge –
- **Distribution: and Marketing**
  - integration market Local –
  - strategy branding Product –
  - networks Distribution –
  - systems feedback Customer –

Timeline Integration 5.10.4

- **:(2027-2026) 1 Phase**
  - areas palm date with integration Basic –
  - setup vermicomposting Initial –
  - services veterinary Essential –
- **:(2028-2027) 2 Phase**
  - groves olive to Expansion –
  - initiation processing Dairy –
  - management waste Enhanced –
- **:(2029-2028) 3 Phase**
  - integration system Azolla Full –
  - implementation system Biogas –
  - facilities processing Comprehensive –
- **:(2030-2029) 4 Phase**
  - capabilities processing Advanced –
  - systems management waste Complete –

- services support Expanded –

- **:(2031-2030) 5 Phase**
  - integration economy circular Full –
  - systems processing Optimized –
  - integration service Comprehensive –

Analysis Composition Nutritional Azolla :1.4

Notes	Value Typical	Nutrient Component
most to Superior feedstuffs conventional	DM 30%-25	Protein Crude
		Acids Amino Essential
poultry for Critical production	DM 42%.0	Lysine -
plant in limiting Often proteins	DM 17%.0	Methionine -
digestive for Important health	DM 43%.0	Threonine -
omega-3 beneficial Contains acids fatty	DM 5%-5.3	Fat Crude
ruminant for Good nutrition	DM 15%-10	Fiber Crude
digestible Readily carbohydrates	DM 40%-35	Extract Nitrogen-Free
conventional of 90%-85 feeds	2,200-2,100 kcal/kg	Energy Metabolizable
		Minerals
for requirements Exceeds livestock most	DM 0%.2-5.1	Calcium -
ratio Ca:P Favorable	DM 9%.0-5.0	Phosphorus -
blood for Important formation	DM 2%.0-1.0	Iron -
		Vitamins
egg for pigments Natural yolks	mg/kg 400-300	Carotenoids -
function immune Enhances	IU/g 150-120	A Vitamin - precursors
metabolism Supports	Varied	vitamins B-complex -
		Digestibility
dried when Optimal properly	65%-60	poultry For -
appropriate with Higher processing	75%-65	ruminants For -

Poultry for Schedule Feeding Azolla :2.4

Instructions Specific	Feeding Method	Azolla Inclusion Rate	Production Stage
with thoroughly Mix introduce feed; starter 7 day from gradually	and Dried ground finely	diet of 7%-5	4-0) Chicks weeks)
of feeding Morning Azolla, fermented conventional afternoon feed	or Dried fermented	of 15%-10 diet	15-5) Growers weeks)
20% to up replace Can sources; protein of with supplement methionine	dried, Fresh, fermented or	of 20%-15 diet	(16+ Layers weeks)
commercial with Mix feed starter	and Dried ground finely	diet of 5%	2-0) Broilers weeks)
with Supplement feed conventional ratio 2:1 at (conventional:Azolla)	dried or Fresh	of 15%-10 diet	6-3) Broilers weeks)
fresh to access Direct specialized in Azolla with supplement ponds; grain	or Fresh fermented	of 30%-20 diet	Ducks

Ruminants for Schedule Feeding Azolla :3.4

with Integration Feeds Other	Feeding Method	Daily Azolla Ration	Animal Type
evening and Morning with supplement feeding; on based concentrates production milk	with Mixed forages other	kg 15-10 -5.1 or (fresh) (dried) kg 2	Cows Dairy (lactating)
feeding; daily Once condition body monitor score	Free-choice hay with	(fresh) kg 7-5 kg 1-7.0 or (dried)	Cows Dairy (dry)
feeding; daily Twice energy with complement sources	with Mixed silage/hay	kg 12-8 1- or (fresh) (dried) kg 5.1	Cattle Beef (growing)
starter calf with Mix gradually introduce feed;	and Wilted chopped	(fresh) kg 4-2 kg 5.0-3.0 or (dried)	6-3) Calves months)
feeding Morning evening Azolla, of feed conventional	or Fresh wilted	(fresh) kg 3-2 kg 4.0-3.0 or (dried)	Sheep/Goats

5

Biochar and Vermicomposting

Overview Biochar and Vermicomposting 1.5

Systems Amendment Soil to Introduction 1.1.5

Circular Tor El the within hub critical a as serves unit Biochar and Vermicomposting The This amendments. soil high-value into streams waste organic transforming Economy, sequestering loops, nutrient closing by principles economy circular the exemplifies unit processes. thermochemical and biological through fertility soil enhancing and carbon, benefits synergistic creates production biochar and vermicomposting of integration The independently. achieve could process either what exceed that

System Vermicomposting 2.1.5

vermicompost: nutrient-rich into waste organic convert to earthworms utilizes Vermicomposting

Selection Species Worm

- **Species: Primary** Eisenia fetida (Red Wiggler)
- **Species: Secondary** Eudrilus eugeniae (African Nightcrawler)
- **Criteria: Selection** Adaptability to local, climate, processing efficiency, reproductive rate
- **Density: Stocking** 2-3 kg worms per square meter of bed

Sources Feedstock

- **Manure: Livestock** Primary source nitrogen (40%-50% of feedstock)
- **Residues: Crop** source Carbon and agent bulking (30%-40% of feedstock)
- **Residues: Azolla** Nitrogen-rich supplement after oil extraction (10%-15% of feedstock)
- **Waste: Processing Food** Diverse source nutrient (5%-10% of feedstock)

System Processing

- tiers multiple with systems flow-through Continuous **Design: Bed**
- feedstock stabilize to composting Partial **Pre-treatment:**
- irrigation drip through 80%-70 at Maintained **Management: Moisture**
- cooling evaporative and structures Shade **Control: Temperature**
- worms from vermicompost of separation Automated **Harvesting:**

Products Vermicompost

- potassium 2%-1 phosphorus, 2%-1 nitrogen, 4%-3 **Vermicompost: Solid**
- application foliar for extract Liquid **Tea: Vermicompost**
- fish and poultry for supplement Protein **Biomass: Worm**
- vermicompost of tons 350-300 Approximately **Production: Annual**

System Production Biochar 3.1.5

pyrolysis: through carbon stable into biomass converts production Biochar

Sources Feedstock

- feedstock) of 40%-30) biomass Post-extraction **Residues: Azolla**
- feedstock) of 25%-20) biomass Woody **Prunings: Palm Date**
- feedstock) of 25%-20) material woody High-density **Prunings: Olive**
- feedstock) of 20%-15) waste agricultural Seasonal **Residues: Crop**

Biochar Azolla-Derived

- nutrient-rich structure, microporous area, surface High **Characteristics:**
- carbon stable 65%-60 **Content: Carbon**
- potassium and phosphorus original of 50% approximately Retains **Profile: Nutrient**
- soils acidic for beneficial ,(9-8 (pH alkaline Typically **pH:**
- retention nutrient enhancing cmol/kg, 40-30 **Capacity: Exchange Cation**

Technology Production

- reactor pyrolysis slow Continuous **System: Pyrolysis**
- properties biochar optimal for 550°C-450 **Range: Temperature**
- carbonization complete for hours 2-1 **Time: Residence**
- heat process for gases pyrolysis of Capture **Recovery: Energy**
- compounds volatile of combustion Secondary **Control: Emissions**

Products Biochar

- amendment soil for product Base **Biochar: Raw**
- tea vermicompost from nutrients with Infused **Biochar: Charged**
- vermicompost with Co-composted **Blend: Biochar-Compost**
- products biochar of tons 250 Approximately **Production: Annual**

Benefits Amendment Soil 4.1.5

systems: agricultural Tor El the to benefits multiple deliver produced amendments soil The

Properties Physical Soil

- 25%-15 by capacity holding water increases Biochar **Retention: Water**
- compaction reduces and aggregation improves Vermicompost **Structure: Soil**
- 40%-30 by rates infiltration water increase amendments Combined **Infiltration:**
- erosion water and wind reduces structure soil Enhanced **Resistance: Erosion**

Properties Chemical Soil

- 60%-50 by nitrogen of leaching reduces Biochar **Retention: Nutrient**
- acidity soil buffers biochar Alkaline **Regulation: pH**
- stress plant reducing salts, adsorbs Biochar **Management: Salinity**
- exchange and storage nutrient for capacity Increased **Exchange: Cation**

Properties Biological Soil

- microbes beneficial for spaces protected provides Biochar **Habitat: Microbial**
- function enzyme soil enhances Vermicompost **Activity: Enzymatic**
- access nutrient improve networks fungal Enhanced **Associations: Mycorrhizal**
- pathogens with compete microbes Beneficial **Suppression: Pathogen**

Sequestration Carbon 5.1.5

sequestration: carbon to significantly contributes system biochar The

- **Stability:** years 100+ for stable remains carbon biochar of 80%-70
- **Sequestration: Annual** equivalent $_2$CO of tons 175-150 Approximately
- **Buildup: Carbon Soil** levels carbon organic soil in increase Gradual
- **Potential: Credit Carbon** markets offset carbon for Eligible

Protocols Application 6.1.5

benefit: maximum for protocols specific to according applied are amendments Soil

- **Cultivation: Palm Date** annually tree per vermicompost kg 7-5 and biochar kg 3-2
- **Cultivation: Olive** annually tree per vermicompost kg 5-3 and biochar kg 2-1
- **Fig: Cactus** annually plant per vermicompost kg 3-2 and biochar kg 1-5.0
- **Ponds: Azolla** water in supplement nutrient as tea Vermicompost

Guidelines Application Biochar Comprehensive

residues: Azolla from primarily derived biochar for specifications Detailed

Soil Conditions	Frequency	Application Rate	Crop/System
Sandy/loamy -2.7 (pH soils (5.8	Annual (October-November)	kg/tree 3-2 with (mixed vermicompost)	Palms Date
soils Clay/loamy (0.8-8.6 (pH	Annual (December-January)	kg/tree 2-1 with (mixed vermicompost)	Trees Olive
(pH soils Sandy (5.8-0.7	Annual (February)	kg/plant 1-5.0 (surface application)	Fig Cactus
types soil All (0.8-5.6 (pH	planting Each cycle	m^2 10 per kg 1 (incorporated)	Beds Vegetable
systems Water (5.7-0.6 (pH	Quarterly	per kg 5.0 (water m^2 100 suspension)	Azolla Cultivation
(pH soils Saline (0.9-5.7	Biannual	per kg 4-3 (deep m^2 10 incorporation)	Soils Saline

Type Soil and Crop by Specifications Application Biochar :1.5

Specifications Biochar Azolla-Derived

Production Biodiesel the from sourced (directly residues Azolla from produced biochar The advantages: specific offers)**??** per Unit

- **Retention: Nitrogen** retains residues Azolla post-extraction from derived Biochar value fertilizer its enhancing content, nitrogen original of 20%-15
- **Method: Application** be: should biochar Azolla-derived results, optimal For
  - Pre-charged with Mixed application before hours 48-24 for tea compost
  - Mixed at vermicompost with (biochar:vermicompost) ratio 1:2 a
  - Incorporated into top the of cm 20-15 where soil possible
- **Considerations: Seasonal**
  - *Winter Application (Nov-Feb):* Focus on tree and crops preparation of spring planting beds
  - *Spring Application (Mar-May):* Vegetable beds and plantings established newly
  - *Summer Application (Jun-Aug):* Limited to maintenance of moisture-stressed crops
  - *Fall Application (Sep-Oct):* Focused on soil preparation and remediation for winter crops

Production Biodiesel with Integration

creation biochar and production biodiesel from residues Azolla between relationship The pathway: economy circular key a represents

- **Material: Source** from directly comes feedstock biochar of 65% Approximately extraction post-oil residues Azolla
- **Timeline: Processing** Production Biodiesel the from weekly collected are Residues pyrolysis before days 5-3 for dry to allowed and Unit
- **Control: Quality** ensure to <3%) (target content oil for tested are batches Residue pyrolysis efficient
- **Seasonality:** (May-September) months summer during 40%-30 by increases Production capacity maximum at are extraction oil and growth Azolla when
- **Cross-Reference:** Production Biodiesel the with coordinated protocols Processing (3.4 (Section plan operational Unit

Units Other with Integration 7.1.5

components other with connections multiple maintains unit Biochar and Vermicomposting The Economy: Circular Tor El the of

- **Inputs:**

unit Management Livestock the from manure Livestock –

unit Production Biodiesel the from residues Azolla –

units cultivation all from residues Crop –

- **Outputs:**

units cultivation all to biochar and Vermicompost –

unit Management Livestock the to biomass Worm –

markets financial to credits Carbon –

- **Services:**

system entire the for management Waste –

mitigation climate for sequestration Carbon –

production sustainable for improvement health Soil –

Development and Research 8.1.5

systems: amendment soil optimizing on focus activities research Ongoing

- **Formulations: Biochar** crops different for blends specific Testing
- **Inoculation: Microbial** amendments in microorganisms beneficial Enhancing
- **Methods: Application** technologies application precision Developing
- **Monitoring: Long-term** time over indicators health soil Tracking

Biochar and Vermicomposting for Plan Strategic 2.5 Production

(2031-2026) Implementation Phased 1.2.5

(2027-2026) 1 Phase

- **Capacity: Production**

annually tons 50 Vermicompost: –

annually tons 50 Biochar: –

- **Infrastructure:** areas storage units, processing Basic
- **Feedstock:** residues crop manure, livestock Initial
- **Integration:** units cultivation to supply amendment soil Basic

(2028-2027) 2 Phase

- **Capacity: Production**

annually tons 150 Vermicompost: −
annually tons 150 Biochar: −

- facilities processing Enhanced **Infrastructure:**
- residues Azolla collection, waste Expanded **Feedstock:**
- areas cultivation all to supply Regular **Integration:**

(2029-2028) 3 Phase

- **Capacity: Production**

annually tons 200 Vermicompost: −
annually tons 200 Biochar: −

- systems processing Advanced **Infrastructure:**
- streams waste organic Diversified **Feedstock:**
- program enhancement soil Full-scale **Integration:**

(2030-2029) 4 Phase

- **Capacity: Production**

annually tons 250 Vermicompost: −
annually tons 250 Biochar: −

- facilities processing Complete **Infrastructure:**
- systems recovery waste Maximum **Feedstock:**
- protocols management soil Advanced **Integration:**

(2031-2030) 5 Phase

- **Capacity: Production**

annually tons 300 Vermicompost: −
annually tons 300 Biochar: −

- optimization System **Infrastructure:**
- integration waste Complete **Feedstock:**
- integration economy circular Full **Integration:**

vermicomposting sustainable establishing for framework a provides plan strategic This project. Economy Circular Tor El the within production biochar and

Biochar and Vermicomposting for Plan Integration 3.5 Production

(2031-2026) Integration Phased 1.3.5

(2027-2026) 1 Phase

- **Inputs:**
  - annually) tons (25 manure livestock Initial –
  - tons) (35 waste Agricultural –
  - equipment processing Basic –
  - system management Water –
- **Outputs:**
  - annually) tons (60 Vermicompost –
  - annually) tons (60 Biochar –
  - tons) (5 Palm Date for tea Vermicompost –
  - tons) (5 amendments cultivation Olive –
  - tons) (5 Acacia for amendments soil Initial –
- **Points: Integration**
  - biochar tons 20 vermicompost, tons 20 Unit: Palm Date –
  - biochar tons 20 vermicompost, tons 20 Unit: Olive –
  - biochar tons 20 vermicompost, tons 20 Unit: Acacia –
  - media growing Specialized support: Nursery –

(2028-2027) 2 Phase

- **Inputs:**
  - annually) tons (60 supply manure Increased –
  - tons) (90 waste agricultural Expanded –
  - systems processing Enhanced –
  - efficiency water Improved –
- **Outputs:**
  - annually) tons (150 vermicompost Enhanced –
  - annually) tons (150 biochar Increased –
  - amendments soil Specialized –
  - credits sequestration Carbon –
- **Points: Integration**
  - units cultivation Multiple –
  - cycling nutrient Enhanced –
  - improvement soil Expanded –

(2029-2028) 3 Phase

- **Inputs:**
  - annually) tons (100 collection manure Peak
  - tons) (150 waste agricultural Maximum
  - technology processing Advanced
  - systems water Optimized
- **Outputs:**
  - annually) tons (250 production vermicompost Full
  - annually) tons (250 output biochar Maximum
  - unit: cultivation each for amendments Specialized
    - amendments combined tons 80 Palm: Date
    - amendments combined tons 80 Olive:
    - amendments combined tons 40 Acacia:
    - media growing specialized tons 50 Nursery:
- **Points: Integration**
  - amendments soil Customized units: cultivation All
  - system management nutrient Complete
  - optimization credit Carbon
  - production seedling for integration Nursery

(2030-2029) 4 Phase

- **Inputs:**
  - collection waste Optimized
  - systems processing Smart
  - management water Advanced
  - efficiency resource Maximum
- **Outputs:**
  - annually) tons (250 vermicompost Premium
  - annually) tons (250 biochar Enhanced
  - products Specialized
  - sequestration carbon Maximum
- **Points: Integration**
  - integration system Complete
  - processing Value-added
  - sustainability Enhanced

(2031-2030) 5 Phase

- **Inputs:**
  - optimization system Full –
  - integration waste Complete –
  - systems technology Smart –
  - operations efficiency Peak –
- **Outputs:**
  - annually) tons (300 capacity production Maximum –
  - products quality Peak –
  - range product Full –
  - benefits carbon Optimized –
- **Points: Integration**
  - integration economy circular Full –
  - optimization resource Complete –
  - efficiency system Maximum –

4.5

(2031-2026) 1.4.5

(2027-2026)

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(2028-2027)

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(2031-2030)

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6

Cultivation Palm Date

Overview Cultivation Palm Date 1.6

Introduction 1.1.6

the within unit economic critical a represents cultivation dactylifera) (Phoenix palm Date semi-arid and arid the to well-adapted are palms Date project. Economy Circular Tor El agriculture sustainable for crop ideal an them making Peninsula, Sinai the of conditions as cultivation palm date of aspects fundamental the outlines overview This region. the in model. economy circular our of component integrated an

Adaptability and Importance 2.1.6

exceptional demonstrate palms date nilotica, Acacia on conducted studies to Similar regions arid in species tree on Research conditions. environmental harsh to adaptability showing some with varieties, different between exist differences genetic that shown has of selection The productivity. and tolerance, drought performance, growth superior El in cultivation palm date of success the to critical therefore is varieties appropriate Tor.

Selection and Variability Genetic 3.1.6

significant demonstrated have nilotica Acacia like species tree arid-adapted on Studies as: such traits in provenances between differences

- growth Height
- diameter Trunk
- patterns Branching
- rates survival Field

emphasizing by strategy cultivation palm date our to applied be can findings These local under performance superior demonstrate that varieties selecting of importance the cultivation our of components key be will selection genetic and trials Provenance conditions. approach.

Conditions Environmental 4.1.6

by: characterized is region Tor El The

- climate Semi-arid
- annually) mm 200-100 (approximately rainfall Limited
- temperatures High
- soils sandy-loam to Sandy

provenances nilotica Acacia certain which in those to similar are conditions These palm date of selection careful that suggesting performance, superior demonstrated have sustainability. and productivity in improvements significant yield can varieties

Economy Circular with Integration 5.1.6

Economy Circular Tor El the in units other with integrated be will cultivation palm Date through:

- amendment soil for waste organic of Utilization
- provision manure for livestock with Integration
- systems irrigation Water-efficient
- plants nitrogen-fixing with Intercropping
- production compost and biochar for waste palm date of Utilization

Outcomes Expected 6.1.6

achieve: to aims unit cultivation palm date The

- dates high-quality of production Sustainable
- addition matter organic through improvement Soil
- sequestration Carbon
- communities local for benefits Economic
- regions arid in agriculture sustainable of Demonstration

how outlining follow, that plans detailed the for foundation the sets overview This Economy Circular Tor El the of success overall the to contribute will cultivation palm date project.

Cultivation Palm Date for Plan Strategic 2.6

(2031-2026) Implementation Phased 1.2.6

(2027-2026) 1 Phase

- **Area:** Feddans 5
- **Infrastructure:**
  - nursery local of Establishment (capacity: 2500 date palms)
  - system irrigation drip Basic
  - enhancement and preparation soil Initial
  - unit production biochar Small
- **Production:**
  - trees palm date Medjool 200 approximately of Planting
  - testing and selection Variety
  - assessment water and soil Initial
  - performance irrigation drip of Evaluation
- **Integration:**
  - unit production biochar small of Setup
  - systems management water Initial
  - setup cycling nutrient Basic
  - pond Azolla experimental Small

(2028-2027) 2 Phase

- **Area:** (total) Feddans 15 to Expansion
- **Infrastructure:**
  - system irrigation Enhanced
  - setup facility processing date Initial
  - operations nursery Expanded
  - ponds Azolla Expanded (3 Feddans)
- **Production:**
  - trees palm date Medjool 400 Additional
  - trees 1 Phase from harvest First
  - system intercropping of Implementation
  - integration livestock Initial (5 cattle)
- **Integration:**

cattle) (5 unit livestock initial with Integration –
production biochar Enhanced –
system recycling water Expanded –
ducks) 100 chickens, (200 farming Poultry –

(2029-2028) 3 Phase

- **Area:** (total) Feddans 30 to Expansion
- **Infrastructure:**
  - facilities processing Complete –
  - management irrigation Advanced –
  - facilities storage Enhanced –
  - Feddans) (5 ponds Azolla Expanded –
- **Production:**
  - trees palm date Medjool 600 Additional –
  - trees mature from yields Increased –
  - processing product Diversified –
  - unit production biochar Medium-scale –
- **Integration:**
  - cattle) (15 integration livestock Full –
  - system cycling nutrient Complete –
  - management water Advanced –
  - ducks) 200 chickens, (500 poultry Expanded –

(2030-2029) 4 Phase

- **Area:** (total) Feddans 45 to Expansion
- **Infrastructure:**
  - technology processing Advanced –
  - systems irrigation Automated –
  - handling and storage Enhanced –
  - Feddans) (30 ponds Azolla Expanded –
- **Production:**
  - trees palm date Medjool 800 Additional –
  - phases early from production Full –
  - lines processing Value-added –

development unit processing Date –

- **Integration:**

cattle) (25 integration livestock Expanded –

system circular Complete –

integration Market –

ducks) 300 chickens, (800 poultry Expanded –

(2031-2030) 5 Phase

- **Area:** (total) Feddans 60 to expansion Final
- **Infrastructure:**

optimization System –

automation Full –

facilities processing Complete –

total) Feddans (50 ponds Azolla Expanded –

- **Production:**

trees) 2600 (total trees palm date Medjool 600 Final –

capacity production Maximum –

range product Full –

dates for units processing food and Packaging –

- **Integration:**

integration economy circular Complete –

flows resource Optimized –

efficiency system Maximum –

ducks) 300 chickens, 1000 cattle, (25 integration livestock Full –

Indicators Performance Key 2.2.6

- **Targets: Production**

phase Establishment 1: Year –

1 Phase from production Initial 2: Year –

capacity full of 30% 3: Year –

capacity full of 60% 4: Year –

capacity full of 90% 5: Year –

- **Efficiency: Resource**

85% efficiency: use Water –

- 90% recycling: Nutrient –
- 95% utilization: Waste –

- **Metrics: Integration**
  - flows resource Circular –
  - enhancement Biodiversity –
  - sequestration Carbon –

productive and sustainable a establishing for framework a provides plan strategic This scientific on drawing Economy, Circular Tor El the within unit cultivation palm date research. species arid-region similar from evidence

Cultivation Palm Date for Plan Operational 3.6

(2031-2026) Implementation Phased 1.3.6

(2027-2026) Operations 1 Phase

- **Preparation: Land**
  - amendment and analysis soil Initial –
  - irrigation drip basic of Installation –
  - design spacing and layout Field –
  - establishment break Wind –

- **Operations: Planting**
  - capacity) (2,500 establishment Nursery –
  - palms 200 of planting Initial –
  - trials selection Variety –
  - scheduling irrigation Basic –

- **Systems: Management**
  - keeping record Basic –
  - training staff Initial –
  - schedules maintenance Equipment –
  - protocols monitoring Simple –

- **Integration: Nursery**

Procurement: Seedling Initial –

January in Unit Nursery central from seedlings tissue-cultured 250 Receive * 2026

confirmation variety for testing) (PCR process verification genetic Complete *

environment controlled in protocol acclimatization 21-day Implement *

characteristics performance and history genetic material source Document *

Management: Genetic –

identifiers unique with system tracking variety Establish *

)?? (ref: Unit Nursery with database cross-reference Implement *

Nursery to sharing data with assessments growth monthly Conduct *

program breeding for records phenological digital Maintain *

(2028-2027) Operations 2 Phase

- **Activities: Expansion**
  - planted palms 400 Additional –
  - system irrigation Enhanced –
  - implementation Intercropping –
  - setup processing Initial –
- **Practices: Cultivation**
  - program Fertilization –
  - system monitoring Pest –
  - schedules Pruning –
  - management Pollination –
- **Management: Resource**
  - monitoring use Water –
  - tracking Nutrient –
  - systems collection Waste –
  - records yield Initial –
- **Integration: Nursery Advanced**

Deliveries: Seedling Scheduled –

Nursery from 150) of batches (quarterly seedlings tissue-cultured 450 Receive * Unit

facility Nursery at protocol inspection pre-delivery Implement *

window delivery 4-hour with logistics cold-chain Coordinate *

placement field before inspection and quarantine 48-hour Maintain *

Loop: Feedback Performance –

optimization propagation for Nursery to data performance 90-day Provide *

conditions field to response variety-specific Document *

meetings optimization genetic cross-unit monthly in Participate *

maintenance database varietal central to Contribute *

(2029-2028) Operations 3 Phase

- **Systems: Advanced**
  - control irrigation Automated –
  - management pest Comprehensive –
  - operations processing Full –
  - keeping record Advanced –
- **Management: Production**
  - optimization Yield –
  - systems control Quality –
  - scheduling Harvest –
  - handling Post-harvest –
- **Activities: Integration**
  - systems grazing Livestock –
  - operations Composting –
  - application Biochar –
  - recycling Water –

(2030-2029) Operations 4 Phase

- **Production: Advanced**
  - techniques farming Precision –
  - methods pollination Advanced –
  - timing harvest Optimized –
  - systems grading Quality –
- **Operations: Processing**
  - processing Value-added –
  - diversification Product –
  - optimization Storage –
  - integration Market –
- **Measures: Sustainability**
  - tracking footprint Carbon –
  - monitoring Biodiversity –
  - assessment health Soil –
  - metrics efficiency Water –

(2031-2030) Operations 5 Phase

- **Optimization: System**
  - integration automation Full –
  - efficiency resource Maximum –
  - control quality Complete –
  - optimization Market –
- **Integration: Advanced**
  - systems circular Complete –
  - integration livestock Full –
  - processing Optimized –
  - capture value Maximum –
- **Metrics: Performance**
  - optimization Yield –
  - efficiency use Resource –
  - standards Quality –
  - indicators Sustainability –

Metrics Operational 2.3.6

- **Targets: Production**
  - Establishment 1: Phase –
  - production Initial 2: Phase –
  - capacity 30% 3: Phase –
  - capacity 60% 4: Phase –
  - capacity 90% 5: Phase –
- **Standards: Quality**
  - specifications size Fruit –
  - levels content Sugar –
  - parameters Moisture –
  - durability Storage –
- **Efficiency: Resource**
  - kg per use Water –
  - efficiency Energy –
  - productivity Labor –
  - reduction Waste –

Integration Chain Supply Nursery 3.3.6

Timeline Procurement Detailed

- **Cycle: Planning Annual**
  - October by Unit Nursery to requirements planting forward 18-month Submit
  - December by schedule confirmation production nursery Receive
  - adjustments and updates planning quarterly Conduct
  - (March) committee selection genetic annual in Participate
- **Schedule: Receipt Seasonal**
  - period) planting (optimal February-March window: delivery Primary
  - period) planting (fall September-October window: delivery Secondary
  - Nursery at maintained stock buffer 10% allocation: replacement Emergency
  - time lead 24-month with schedule propagation Dedicated varieties: Special

Management and Verification Genetic

- **Protocols: Verification**
  - Nursery) with (coordinated plants mother all of fingerprinting Genetic
  - plants culture tissue received of 2% of testing PCR Random
  - post-planting months 24 and 12, 6, at verification Morphological
  - offshoots for matches plant-offspring mother of verification Annual
- **Requirements: Documentation**
  - batch plant received each for passport genetic Complete
  - position field to Nursery from record traceability blockchain Digital
  - records propagation Nursery to linked database tracking Performance
  - regulations management resource genetic for documentation Compliance

Integration Control Quality

- **Criteria: Acceptance**
  - length minimum 15cm roots, primary 5 standards: development root Minimum
  - pathogens primary 5 for clearance PCR requirements: testing Pathogen
  - varieties standard for leaves functional 5 height, 30cm Minimum metrics: Growth
  - protocol) (5-day assessment tolerance drought Pre-delivery testing: Stress
- **Monitoring: Performance**
  - Nursery to reported metrics establishment and survival 30/60/90-day
  - evaluation performance growth First-year

optimization propagation for analysis correlation Nursery-Field –

protocols propagation for cycle improvement Feedback-driven –

managing and implementing to approach structured a provides plan operational This production sustainable use, resource efficient ensuring unit, cultivation palm date the chain. supply genetic unit's Nursery the with integration seamless and practices,

Cultivation Palm Date for Plan Financial 4.6

(2031-2026) Budget Implementation Phased 1.4.6

Establishment Initial - (2027-2026) 1 Phase

- **Expenditure: Capital**

$50,000 preparation: Land –

$30,000 system: irrigation Basic –

$25,000 establishment: Nursery –

$20,000 equipment: Initial –

$125,000 CAPEX: Total –

- **Expenditure: Operational**

$15,000 costs: Labor –

$5,000 Utilities: –

$10,000 fertilizers): (seedlings, Inputs –

$5,000 Maintenance: –

$35,000 OPEX: Total –

- **Projections: Revenue**

$5,000 sales: nursery Initial –

$5,000 Revenue: Total –

Development Early - (2028-2027) 2 Phase

- **Expenditure: Capital**

$40,000 expansion: Irrigation –

$35,000 equipment: Processing –

$30,000 development: land Additional –

$25,000 improvements: Infrastructure –

$130,000 CAPEX: Total –

- **Expenditure: Operational**

$25,000 costs: Labor –

- $8,000 Utilities:
- $15,000 supplies: and Inputs
- $7,000 Maintenance:
- $55,000 OPEX: Total

- **Projections: Revenue**
  - $15,000 production: date Initial
  - $10,000 operations: Nursery
  - $25,000 Revenue: Total

Expansion - (2029-2028) 3 Phase

- **Expenditure: Capital**
  - $60,000 completion: facility Processing
  - $45,000 systems: irrigation Advanced
  - $35,000 upgrades: Equipment
  - $30,000 facilities: Storage
  - $170,000 CAPEX: Total

- **Expenditure: Operational**
  - $40,000 costs: Labor
  - $12,000 Utilities:
  - $20,000 inputs: Production
  - $10,000 Maintenance:
  - $82,000 OPEX: Total

- **Projections: Revenue**
  - $45,000 production: Date
  - $15,000 products: Value-added
  - $15,000 operations: Nursery
  - $75,000 Revenue: Total

Operations Advanced - (2030-2029) 4 Phase

- **Expenditure: Capital**
  - $70,000 systems: Automation
  - $50,000 equipment: processing Advanced
  - $40,000 expansion: Infrastructure
  - $30,000 systems: control Quality
  - $190,000 CAPEX: Total

- **Expenditure: Operational**
  - $60,000 costs: Labor –
  - $15,000 Utilities: –
  - $25,000 inputs: Production –
  - $15,000 Maintenance: –
  - $115,000 OPEX: Total –
- **Projections: Revenue**
  - $90,000 production: Date –
  - $35,000 products: Value-added –
  - $20,000 operations: Nursery –
  - $145,000 Revenue: Total –

Operation Full - (2031-2030) 5 Phase

- **Expenditure: Capital**
  - $50,000 optimization: System –
  - $40,000 upgrades: equipment Final –
  - $30,000 improvements: Facility –
  - $25,000 integration: Technology –
  - $145,000 CAPEX: Total –
- **Expenditure: Operational**
  - $80,000 costs: Labor –
  - $20,000 Utilities: –
  - $30,000 inputs: Production –
  - $20,000 Maintenance: –
  - $150,000 OPEX: Total –
- **Projections: Revenue**
  - $150,000 production: Date –
  - $60,000 products: Value-added –
  - $25,000 operations: Nursery –
  - $235,000 Revenue: Total –

Metrics Financial 2.4.6

- **Summary: Investment**
  - $760,000 years): (5 CAPEX Total –
  - $437,000 years): (5 OPEX Total –
  - $485,000 years): (5 Revenue Total –
- **Indicators: Performance Key**
  - 6 Year point: Break-even –
  - 6) year from (projected 15% ROI: –
  - years 7 period: Payback –
- **Sources: Funding**
  - 60% investment: Initial –
  - 30% financing: Bank –
  - 10% Grants: –

the for projections revenue and investment phased the outlines plan financial This El the within sustainability financial to path a demonstrating unit, cultivation palm date project. Economy Circular Tor

Cultivation Palm Date for Requirements Resource 5.6

(2031-2026) Requirements Implementation Phased 1.5.6

Establishment Initial - (2027-2026) 1 Phase

- **Resources: Land**
  - plantation initial for Feddans 5 –
  - nursery for Feddan 5.0 –
  - area preparation soil Basic –
- **Resources: Water**
  - water treated m^3/day 15 –
  - infrastructure irrigation Basic –
  - equipment monitoring quality Water –
- **Resources: Human**
  - engineer Agricultural 1 –
  - workers Skilled 3 –
  - laborers General 5 –
- **Equipment:**

- tools farming Basic –
- tractor Small –
- components irrigation Initial –

Development Early - (2028-2027) 2 Phase

- **Resources: Land**
  - Feddans 15 to Expansion –
  - operations nursery for Feddan 1 –
  - establishment area Processing –
- **Resources: Water**
  - water treated m^3/day 45 –
  - system irrigation Enhanced –
  - setup recycling Water –
- **Resources: Human**
  - engineers Agricultural 2 –
  - workers Skilled 5 –
  - laborers General 8 –
- **Equipment:**
  - equipment farming Additional –
  - tools processing Basic –
  - system irrigation Expanded –

Expansion - (2029-2028) 3 Phase

- **Resources: Land**
  - Feddans 30 to Expansion –
  - facilities support for Feddans 5.1 –
  - facility processing Complete –
- **Resources: Water**
  - water treated m^3/day 90 –
  - system irrigation Advanced –
  - integration recycling water Full –
- **Resources: Human**
  - engineers Agricultural 3 –
  - workers Skilled 8 –

- laborers General 12

- **Equipment:**
  - fleet farming Complete
  - equipment Processing
  - facilities Storage

Operations Advanced - (2030-2029) 4 Phase

- **Resources: Land**
  - Feddans 45 to Expansion
  - facilities support for Feddans 2
  - areas processing Advanced
- **Resources: Water**
  - water treated m^3/day 135
  - systems irrigation Automated
  - management water Advanced
- **Resources: Human**
  - engineers Agricultural 4
  - workers Skilled 10
  - laborers General 15
- **Equipment:**
  - systems farming Automated
  - line processing Advanced
  - equipment control Quality

Operation Full - (2031-2030) 5 Phase

- **Resources: Land**
  - Feddans 60 to expansion Final
  - facilities support for Feddans 5.2
  - integration facility Complete
- **Resources: Water**
  - water treated m^3/day 180
  - systems irrigation Optimized
  - efficiency water Maximum
- **Resources: Human**

- engineers Agricultural 5 –
- workers Skilled 12 –
- laborers General 20 –

- **Equipment:**
  - systems automation Full –
  - facilities processing Complete –
  - systems monitoring Integrated –

Metrics Efficiency Resource 2.5.6

- **Efficiency: Use Water**
  - m^3/Feddan/day 3 1: Phase –
  - m^3/Feddan/day 3 2: Phase –
  - m^3/Feddan/day 3 3: Phase –
  - m^3/Feddan/day 3 4: Phase –
  - m^3/Feddan/day 3 5: Phase –

- **Efficiency: Labor**
  - workers/Feddan 8.1 1: Phase –
  - workers/Feddan 0.1 2: Phase –
  - workers/Feddan 8.0 3: Phase –
  - workers/Feddan 6.0 4: Phase –
  - workers/Feddan 5.0 5: Phase –

- **Utilization: Equipment**
  - utilization 60% 1: Phase –
  - utilization 70% 2: Phase –
  - utilization 80% 3: Phase –
  - utilization 90% 4: Phase –
  - utilization 95% 5: Phase –

needed resources of scaling progressive the outlines plan requirements resource This the throughout utilization resource efficient ensuring unit, cultivation palm date the for phases. implementation

Cultivation Palm Date for Plan Integration 6.6

(2031-2026) Implementation Phased 1.6.6

(2027-2026) 1 Phase

- **Inputs:**
  - system treatment water initial from wastewater Treated
  - unit composting initial from vermicompost Basic
  - unit production small-scale from Biochar
  - operations basic for power Solar
- **Outputs:**
  - feed livestock initial for fronds Palm
  - composting for waste Organic
  - cultivation understory for areas Shade
- **Points: Integration**
  - irrigation for system treatment Water
  - unit vermicomposting Initial
  - facility production biochar Small
  - chain supply feed livestock Basic

(2028-2027) 2 Phase

- **Inputs:**
  - supply wastewater treated Expanded
  - production vermicompost Enhanced
  - application biochar Increased
  - herd initial from manure Livestock
- **Outputs:**
  - harvest date First
  - production frond palm Increased
  - by-products processing date Initial
  - streams waste organic Enhanced
- **Points: Integration**
  - integration treatment water Expanded
  - operations composting Enhanced
  - cattle) (5 integration livestock Initial
  - setup facility processing Basic

(2029-2028) 3 Phase

- **Inputs:**
  - integration treatment water Full-scale –
  - system vermicompost Complete –
  - application biochar Optimized –
  - input manure livestock Expanded –
- **Outputs:**
  - production date Significant –
  - output frond palm Maximized –
  - by-products processing Diverse –
  - utilization stream waste Complete –
- **Points: Integration**
  - system management water Full –
  - integration composting Complete –
  - cattle) (15 integration livestock Enhanced –
  - operation facility processing Full –

(2030-2029) 4 Phase

- **Inputs:**
  - system treatment water Advanced –
  - products vermicompost Premium –
  - blends biochar Specialized –
  - input manure livestock Optimized –
- **Outputs:**
  - production date Peak –
  - utilization biomass Maximum –
  - products processed of range Full –
  - recovery waste Complete –
- **Points: Integration**
  - recycling water Advanced –
  - production amendment soil Premium –
  - cattle) (20 integration livestock Expanded –
  - technology processing Advanced –

(2031-2030) 5 Phase

- **Inputs:**
  - system treatment water Optimized –
  - composting efficiency Maximum –
  - formulations biochar Customized –
  - integration livestock Full-scale –
- **Outputs:**
  - production date Optimized –
  - utilization biomass Complete –
  - diversification product Full –
  - achievement waste Zero –
- **Points: Integration**
  - system water circular Complete –
  - efficiency resource Maximum –
  - cattle) (25 integration livestock Full –
  - systems processing Optimized –

Metrics Flow Resource 2.6.6

- **Integration: Water**
  - recycling water 60% 1: Phase –
  - recycling water 70% 2: Phase –
  - recycling water 80% 3: Phase –
  - recycling water 90% 4: Phase –
  - recycling water 95% 5: Phase –
- **Utilization: Biomass**
  - utilization 70% 1: Phase –
  - utilization 80% 2: Phase –
  - utilization 90% 3: Phase –
  - utilization 95% 4: Phase –
  - utilization 99% 5: Phase –
- **Efficiency: Integration**
  - efficiency cycling Nutrient –
  - rates sequestration Carbon –
  - metrics recovery Resource –

indicators resilience System –

Economy Circular Tor El the of objectives overall the with aligns plan integration This implementation the throughout optimization resource and development sustainable ensuring project, phases.

7

Cultivation Acacia

Cultivation Acacia of Overview 1.7

Introduction 1.1.7

project, Economy Circular Tor El the of component vital a is unit cultivation Acacia The fixation. nitrogen and production, fodder windbreaks, including purposes multiple serving essential providing while units agricultural other with integrate to designed is unit This services. ecosystem

Components Core 2.1.7

- **Allocation: Land** cultivation Acacia to dedicated feddans 45
- **Timeline: Implementation**
  - Year 1: initial feddans 2 planting
  - Year 2: Additional feddans 4
  - Year 3: Expansion to feddans 10
  - Year 4: Growth to feddans 25
  - Year 5: Final expansion to feddans 45

Functions Primary 3.1.7

- **Services: Environmental**
  - Windbreak for other crops protection
  - Soil nitrogen fixation
  - Erosion control
  - Biodiversity enhancement
- **Integration: Agricultural**
  - Sustainable fodder production
  - Support for livestock unit
  - Soil improvement
  - Microclimate regulation

Practices Sustainable 4.1.7

- **Management: Resource**
  - utilization water Efficient –
  - fixation nitrogen through fertilization Natural –
  - management pest Integrated –
  - practices pruning Sustainable –
- **Benefits: Environmental**
  - sequestration Carbon –
  - improvement structure Soil –
  - creation Habitat –
  - enhancement Ecosystem –

Integration Economic 5.1.7

- **Services: and Products**
  - production fodder Animal –
  - (limited) products Wood –
  - services Environmental –
  - improvement Soil –
- **Benefits: Economy Circular**
  - operations livestock for Support –
  - crops other for fertilization Natural –
  - cycling resource Sustainable –
  - resilience farm Enhanced –

8

Cultivation Olive

Unit Cultivation Olive of Overview 1.8

Description Unit 1.1.8

Tor El the of component hectares) 9.18) 45-Feddan a is Unit Cultivation Olive The with integrating while oil olive high-quality produce to designed project, Economy Circular five in developed be will unit The system. resource circular a in units production other suitable trees olive drought-resistant 4,500 hosting ultimately 2031, to 2026 from phases drip including practices sustainable employs system cultivation The production. oil for livestock with integration and utilization, vermicompost application, biochar irrigation, units. poultry and

Importance Strategic 2.1.8

- **Value: Economic** Production of premium oil olive high-quality produce to designed project, Economy Circular five in developed be will unit The system. resource circular a in units production other suitable trees olive drought-resistant 4,500 hosting ultimately 2031, to 2026 from phases drip including practices sustainable employs system cultivation The production. oil for livestock with integration and utilization, vermicompost application, biochar irrigation, units. poultry and demand. market strong with stream product high-value a creating
- **Efficiency: Resource** Implementation of methods cultivation water-efficient an in regions. water-scarce in agriculture sustainable demonstrating environment, arid
- **Integration: Circular** Serves as key a node in the project's circular economy, both receiving inputs from and providing outputs to other production units. poultry and
- **Sequestration: Carbon** Olive trees function as long-term carbon sinks, contributing to the project's climate mitigation objectives. soil and biodiversity
- **Enhancement: Biodiversity** Intercropping and agroforestry approaches increase ecosystem resilience. biodiversity

Targets Production Key 3.1.8

- **Production: Oil Olive**

  Year 3: 5,000 liters

  Year 4: 15,000 liters

  Year 5: 30,000 liters

annually liters 67,500 10+): (Year Maturity Full –

- **Products: Intercropping**

annually tons 5-2 herbs: Medicinal –

annually tons 7-3 Legumes: –

annually tons 15-10 crops: Forage –

- **Services: Ecosystem**

annually equivalent $_2$CO tons 900-450 sequestration: Carbon –

50-30 enhancement: Biodiversity –

3-2 improvement: health Soil –

Units Other with Integration 4.1.8

- **Unit: Azolla**

fertilizer Azolla-based and water Nutrient-rich Receives: –

water return Irrigation Provides: –

- **Unit: Livestock**

fertilization and control weed for animals Grazing Receives: –

crops forage supplement, feed as pomace Olive Provides: –

- **Unit: Production Biochar**

amendment soil for Biochar Receives: –

residues processing and waste Pruning Provides: –

- **Unit: Vermicomposting**

enhancement soil for Vermicompost Receives: –

cultivation and processing from waste Organic Provides: –

- **System: Management Water**

water irrigation Treated Receives: –

recycling and treatment for water Return Provides: –

Impact Economic 5.1.8

- **Streams: Revenue**

sales oil olive Premium Primary: –

products Intercropping Secondary: –

services ecosystem and credits Carbon Tertiary: –

- **Generation: Employment**

- positions 12-8 jobs: Permanent
- processing and harvest during positions 35-15 employment: Seasonal
- services related in positions 30-20 employment: Indirect

- **Projections: Financial**
  - $717,500 investment: Initial
  - 300,000-$150,000 costs: operating Annual
  - 750,000-$500,000 production: full at revenue Annual
  - maturity full after 20%-15 ROI: Projected
  - years 9-7 period: Payback

Sustainability Environmental 6.1.8

- **Conservation: Water**
  - 85
  - 40-30
  - integration treatment and recycling Water
- **Health: Soil**
  - sequestration carbon for application Biochar
  - enhancement matter organic for Vermicompost
  - practices tillage Minimal
  - mulching and cropping Cover
- **Biodiversity:**
  - system intercropping Diverse
  - insects beneficial for creation Habitat
  - inputs chemical Minimal
  - management pest Integrated

Economy Circular Tor El the of component key a represents unit cultivation olive This modern into integrated be can crops Mediterranean traditional how demonstrating project, benefits. social and environmental, economic, providing while systems agricultural circular

Cultivation Olive for Plan Strategic 2.8

Mission and Vision 1.2.8

- **Vision:** To establish a model sustainable unit cultivation olive that demonstrates integration, economy circular in excellence production, oil olive premium and environmental stewardship.

- **Mission:** To produce high-quality olive oil through sustainable practices that maximize resource efficiency, promoting biodiversity, and creating value for all stakeholders within the Tor El Economy Circular project.

Strategic Objectives 2.2.8

- **Production: Excellence**
  - Establish 4,500 olive trees across 45 Feddans by 2031
  - Achieve annual olive oil production of 67,500 liters by full maturity
  - Maintain premium quality standards meeting international certifications
  - Develop value-added olive oil product lines
- **Sustainability: Goals**
  - Achieve 85% irrigation efficiency through advanced systems
  - Reduce carbon footprint by 40% compared to conventional methods
  - Increase biodiversity by 30%-50% through integrated farming
  - Achieve zero waste through circular economy integration
- **Economic: Viability**
  - Reach break-even operational by (2033) 8 Year
  - Achieve ROI 20%-15 after full maturity
  - Develop diverse revenue streams beyond olive oil
  - Create 45-30 direct and indirect jobs
- **Integration: Excellence**
  - Maximize resource cycling with other units
  - Establish efficient material and logistics flow systems
  - Develop synergistic relationships with all units
  - Create value-added opportunities through integration

Strategic Analysis 3.2.8

- **Strengths:**
  - Ideal Mediterranean climate for olive cultivation
  - Integration with circular economy infrastructure
  - Access to sustainable water and nutrient sources
  - Strong technical support and expertise
  - Premium product positioning potential
- **Weaknesses:**

- requirements capital initial High –
- production full for period establishment Long –
- requirements integration Complex –
- needs development Market –
- requirements labor Skilled –

- **Opportunities:**
  - oil olive premium for demand Growing –
  - potential market Export –
  - opportunities credit Carbon –
  - development Agritourism –
  - development product Value-added –

- **Threats:**
  - impacts change Climate –
  - competition Market –
  - changes Regulatory –
  - risks pest and Disease –
  - uncertainties Economic –

Strategy Implementation 4.2.8

- **Foundation :(2027-2026) 1 Phase**
  - development Feddans 3 Initial –
  - establishment infrastructure Basic –
  - training and building Team –
  - setup systems Integration –
  - planning and research Market –

- **Growth Early :(2028-2027) 2 Phase**
  - Feddans 9 to Expansion –
  - setup facility Processing –
  - systems production Initial –
  - development Market –
  - enhancement Integration –

- **Scaling :(2029-2028) 3 Phase**
  - Feddans 19 to Expansion –
  - capabilities processing Full –

- expansion Market –
- achievement Certification –
- optimization Integration –

- **Maturation :(2030-2029) 4 Phase**
  - Feddans 34 to Expansion –
  - implementation technology Advanced –
  - development leadership Market –
  - integration circular Full –
  - optimization chain Value –

- **Excellence :(2031-2030) 5 Phase**
  - Feddans 45 to expansion Final –
  - optimization System –
  - dominance Market –
  - efficiency resource Maximum –
  - achievement sustainability Full –

Factors Success Key 5.2.8

- **Excellence: Technical**
  - technology irrigation Advanced –
  - selection variety Optimal –
  - implementation agriculture Precision –
  - systems control Quality –
  - practices Sustainable –

- **Development: Market**
  - development brand Strong –
  - strategy penetration Market –
  - network Distribution –
  - relationships Customer –
  - proposition Value –

- **Efficiency: Operational**
  - optimization Resource –
  - management Cost –
  - integration Process –
  - development Workforce –

assurance Quality –

- **Leadership: Sustainability**

stewardship Environmental –
responsibility Social –
viability Economic –
focus Innovation –
engagement Stakeholder –

Monitoring Performance 6.2.8

- **Indicators: Performance Key**

metrics Production –
standards Quality –
performance Financial –
impact Environmental –
effectiveness Integration –

- **Adjustment: and Review**

reviews performance Quarterly –
assessment strategic Annual –
feedback Stakeholder –
analysis Market –
updates Technology –

operating and developing for framework comprehensive a provides plan strategic This project, Economy Circular Tor El the of component key a as unit cultivation olive the implementation, phased objectives, clear through success long-term and growth sustainable ensuring improvement. continuous and

Cultivation Olive for Plan Operational 3.8

(2031-2026) Schedule Implementation Annual 1.3.8

(2027-2026) 1 Year

- **Preparation: Land**

amendment and analysis Soil –
installation system Irrigation –
establishment Windbreak –
necessary where Terracing –

- **Planting:**
  - trees) (300 Feddans 3
  - 10m x 10m Spacing:
  - selection varieties Drought-resistant
  - tons) (5 application biochar Initial
- **Management:**
  - scheduling Irrigation
  - mulching) and (manual control Weed
  - setup system monitoring Pest
  - herbs medicinal with Intercropping
- **Infrastructure:**
  - establishment Nursery
  - facilities storage Basic
  - pathways and roads Access
  - tanks storage Water
- **Integration: Nursery**
  - **Procurement: Seedling Initial**
    - (December Unit Nursery central from saplings olive certified 325 Receive 2026)
    - (DNA confirmation variety for protocol verification genetic Implement barcoding)
    - field before environment transitional in period hardening 14-day Conduct planting
    - Nursery from history performance and provenance material source Document records
  - **Management: Genetic**
    - tree each for tagging code QR with system tracking varietal Establish
    -)**??** (ref: Unit Nursery with database shared Implement
    - protocols standardized with assessments phenotypical quarterly Conduct
    - profiles genetic to linked parameters growth with inventory digital Create

(2028-2027) 2 Year

- **Expansion:**
  - trees) (600 Feddans 6 Additional
  - system irrigation of Extension
  - areas intercropping Expanded

planting windbreak Enhanced –

- **Management:**

trees first-year of Pruning –
implementation program Fertilization –
management pest Integrated –
monitoring moisture Soil –

- **Processing:**

installation press olive Small –
protocols processing Initial –
systems control Quality –
facility packaging Small-scale –

- **Integration:**

cattle) (5 integration livestock Initial –
Feddans) (3 ponds Azolla to Connection –
tons) (15 application biochar Enhanced –
ducks) 100 chickens, (200 integration Poultry –

- **Integration: Nursery Advanced**

Deliveries: Seedling Scheduled –

December, (October, batches three in saplings olive certified 650 Receive February) *
agronomist with facility Nursery at inspection pre-delivery Implement sign-off *
stress minimize to time transit 6-hour maximum with logistics Coordinate *
protocol transition 72-hour with area acclimation dedicated Maintain *

System: Feedback Performance –

refinement propagation for Nursery to data establishment 6-month Provide *
protocol monitoring performance varietal joint Implement *
meetings coordination cross-unit bi-monthly in Participate *
program breeding central to data performance field Contribute *

(2029-2028) 3 Year

- **Expansion:**

trees) (1000 Feddans 10 Additional –
technology irrigation Advanced –
system intercropping Expanded –
management soil Enhanced –

- **Management:**
  - program pruning Intensive –
  - regime fertilization Advanced –
  - management pest Comprehensive –
  - harvest significant First –
- **Processing:**
  - facility processing Enhanced –
  - preparation certification Quality –
  - development product Value-added –
  - capacity storage Expanded –
- **Integration:**
  - cattle) (15 integration livestock Expanded –
  - Feddans) (5 ponds Azolla to Connection –
  - tons) (30 use biochar Optimized –
  - ducks) 200 chickens, (500 poultry Expanded –

(2030-2029) 4 Year

- **Expansion:**
  - trees) (1500 Feddans 15 Additional –
  - systems irrigation Automated –
  - implementation intercropping Complete –
  - techniques management soil Advanced –
- **Management:**
  - harvesting Commercial-scale –
  - implementation agriculture Precision –
  - systems management pest Advanced –
  - management water Optimized –
- **Processing:**
  - technology processing oil olive Advanced –
  - certification quality Full –
  - range product Expanded –
  - branding and development Market –
- **Integration:**
  - cattle) (25 integration livestock Full –
  - Feddans) (30 ponds Azolla to Connection –
  - tons) (40 application biochar Maximum –
  - ducks) 300 chickens, (800 integration poultry Full –

(2031-2030) 5 Year

- **Expansion:**
  - trees) (1100 Feddans 11 Final –
  - optimization System –
  - implementation agroforestry Complete –
  - program enhancement soil Final –
- **Management:**
  - efficiency production Maximum –
  - implementation technology farming Smart –
  - systems monitoring Comprehensive –
  - protocols harvesting Optimized –
- **Processing:**
  - facility processing Full-scale –
  - development product Premium –
  - development market Export –
  - integration chain value Complete –
- **Integration:**
  - integration economy circular Complete –
  - Feddans) (50 ponds Azolla maximum to Connection –
  - cycling resource Optimized –
  - efficiency system Maximum –

Protocols Operational 2.3.8

Management Irrigation

- efficiency 85% with system irrigation Drip
- technology monitoring moisture Soil
- periods non-critical during irrigation Deficit
- systems treatment and recycling Water
- data climate on based scheduling irrigation Smart

Program Fertilization

- Primarily inputs organic vermicompost, (Azolla)
- Biochar application for carbon sequestration
- Foliar applications during critical growth stages
- Soil testing and precision nutrient management
- Minimal synthetic inputs when necessary

Management Disease and Pest

- Integrated Pest Management (IPM) approach
- Biological control agents
- Monitoring and early detection systems
- Strategic intercropping for pest suppression
- Minimal chemical interventions when necessary

Processing and Harvesting

- Optimal timing for maximum oil quality
- Mechanical harvesting for efficiency
- Cold pressing within 24 hours of harvest
- Quality control at all processing stages
- Proper storage to maintain quality

Requirements Equipment 3.3.8

Integration Chain Supply Nursery 4.3.8

Timeline Procurement Detailed

- **Cycle: Planning Annual**
  - Submit requirements planting forward 24-month to Unit Nursery by August
  - Receive confirmation schedule propagation by October
  - Conduct bi-annual reviews planning (April) and (October)
  - Participate in varietal selection committee (January)
- **Schedule: Receipt Seasonal**
  - Primary delivery window: October-December optimal for planting (Mediterranean olives)
  - Secondary delivery window: February-March spring) for planting (specific varieties)
  - Contingency allocation: 8
  - Specialty varieties: Custom propagation with schedule lead time 36-month

Protocols Verification Genetic

- **Methods: Verification**
  - panel microsatellite 12-marker using plants mother all of fingerprinting DNA
  - 5 of sampling Verification
  - descriptor standardized using months 24 and 12 at authentication Morphological list
  - verification final for years) 5-4) production first at analysis profile Oil
- **Systems: Documentation**
  - technology blockchain using batch varietal each for passport genetic Digital
  - field to plant mother from tracking lineage complete with database Secure position
  - database genetic central to linked tags tree QR-coded
  - requirements origin of designation protected for documentation Compliance

Integration Assurance Quality

- **Standards: Acceptance**
  - height cm 10 at cm 0.2-5.1 caliper: trunk Minimum
  - distribution well-balanced roots, primary 8 Minimum requirements: system Root
  - pathogens olive key 7 for verification laboratory and Visual screening: Pathogen
  - assessment recovery and simulation drought 7-day testing: stress Pre-delivery
- **Monitoring: Performance**
  - assessments 12-month and 6-month, 90-day, schedule: monitoring Three-tiered
  - measurement calibrated digital using reporting parameters growth Standardized
  - system database integrated through sharing data Bi-directional
  - team management Nursery with review performance varietal Annual

Plan Integration Nursery to Cross-Reference

- (Section protocols propagation olive Plan Integration Nursery with alignment Direct (2.4
- (Section planning capacity Nursery to according schedules production Synchronized (6.3
- system assurance quality Nursery with procedures verification genetic Harmonized (3.5 (Section
- protocols management data Nursery in specified as systems database Integrated (1.7 (Section

managing and implementing to approach structured a provides plan operational This practices, production sustainable use, resource efficient ensuring unit, cultivation olive the chain. supply genetic unit's Nursery the with integration seamless and

Cultivation Olive for Plan Financial 4.8

Requirements Investment Capital 1.4.8

(USD) Amount	Category Investment
$90,000	preparation Land
$135,000	system Irrigation
$67,500	planting and Trees
$150,000	equipment Processing
$200,000	infrastructure and Buildings
$75,000	equipment Farm
$717,500	**Investment Capital Total**

Breakdown Investment Capital :1.8

Schedule Investment Phased

- $215,000 **:(2027-2026) 1 Phase**
  - $18,000 Feddans): (3 preparation Land –
  - $27,000 system: irrigation Initial –
  - $13,500 planting: and trees Initial –
  - $30,000 equipment: farm Basic –
  - $40,000 infrastructure: Initial –
  - $15,000 setup: Nursery –
  - $25,000 storage: Water –
  - $20,000 preparation: Soil –
  - $15,000 security: and Fencing –
  - $11,500 planning: Technical –
- $172,500 **:(2028-2027) 2 Phase**
  - $36,000 Feddans): (6 preparation Land –
  - $27,000 expansion: Irrigation –
  - $27,000 planting: and trees Additional –
  - $60,000 press: olive Small –
  - $22,500 facilities: Storage –
- $150,000 **:(2029-2028) 3 Phase**
  - $60,000 Feddans): (10 preparation Land –
  - $30,000 expansion: Irrigation –
  - $45,000 planting: and trees Additional –
  - $15,000 enhancement: facility Processing –

- **:(2030-2029) 4 Phase** $120,000
  - (15 preparation Land: Feddans) $90,000
  - expansion: Irrigation $45,000
  - planting: and trees Additional $67,500
  - equipment: processing Advanced $75,000
  - expansion: Infrastructure $42,500
- **:(2031-2030) 5 Phase** $60,000
  - (11 preparation Land: Feddans) $66,000
  - system: irrigation Final $33,000
  - planting: and trees Final $49,500
  - optimization: System $15,000
  - infrastructure: Final $15,000

Costs Operating 2.4.8

5 Year	4 Year	3 Year	2 Year	1 Year	Category Cost
$120,000	$105,000	$90,000	$75,000	$60,000	Labor
$60,000	$52,500	$45,000	$37,500	$30,000	materials and Inputs
$30,000	$26,250	$22,500	$18,750	$15,000	energy and Water
$40,000	$35,000	$30,000	$25,000	$20,000	Maintenance
$50,000	$43,750	$37,500	$31,250	$25,000	distribution and Marketing
$300,000	$262,500	$225,000	$187,500	$150,000	**Costs Operating Annual Total**

Projection Costs Operating Annual :2.8

Details Cost Operating

- **Labor:**
  - annually 80,000-$40,000 staff: Permanent
  - annually 40,000-$20,000 workers: Seasonal
  - annually 10,000-$5,000 development: and Training
- **Materials: and Inputs**
  - annually 20,000-$10,000 fertilizers: Organic
  - annually 10,000-$5,000 management: Pest
  - annually 20,000-$10,000 materials: Packaging
  - annually 10,000-$5,000 supplies: Other
- **Energy: and Water**

- annually 16,000-$8,000 water: Irrigation –
- annually 10,000-$5,000 processing: for Electricity –
- annually 4,000-$2,000 equipment: for Fuel –

- **Maintenance:**

- annually 10,000-$5,000 system: Irrigation –
- annually 16,000-$8,000 equipment: Processing –
- annually 10,000-$5,000 infrastructure: and Buildings –
- annually 4,000-$2,000 equipment: Farm –

- **Distribution: and Marketing**

- annually 20,000-$10,000 labeling: and Packaging –
- annually 10,000-$5,000 Transportation: –
- annually 16,000-$8,000 promotion: and Marketing –
- annually 4,000-$2,000 certification: Quality –

Projections Revenue 3.4.8

5 Year	4 Year	3 Year	2 Year	1 Year	Stream Revenue
$450,000	$300,000	$150,000	$50,000	$0	sales oil Olive
$100,000	$80,000	$60,000	$40,000	$20,000	products Intercropping
$60,000	$45,000	$30,000	$15,000	$5,000	By-products
$40,000	$30,000	$20,000	$10,000	$0	services Ecosystem
$650,000	$455,000	$260,000	$115,000	$25,000	**Revenue Annual Total**

Projection Revenue Annual :3.8

Details Stream Revenue

- **Sales: Oil Olive**

- liter per 20-$15 oil: olive Premium –
- liter per 15-$10 oil: olive Standard –
- liter per 30-$20 oils: Flavored/specialty –

- **Products: Intercropping**

- annually 20,000-$5,000 herbs: Medicinal –
- annually 30,000-$10,000 Legumes: –
- annually 50,000-$5,000 crops: Forage –

- **By-products:**

- annually 20,000-$10,000 feed: animal for pomace Olive –

annually 15,000-$5,000 teas: herbal for leaves Olive –

annually 25,000-$10,000 ingredients: Cosmetic –

- **Services: Ecosystem**

annually 25,000-$10,000 credits: Carbon –

annually 10,000-$5,000 enhancement: Biodiversity –

annually 15,000-$5,000 Educational/agritourism: –

Analysis Financial 4.4.8

5 Year	4 Year	3 Year	2 Year	1 Year	Metric Financial
$650,000	$455,000	$260,000	$115,000	$25,000	Revenue Total
$300,000	$262,500	$225,000	$187,500	$150,000	Costs Operating Total
$60,000	$120,000	$150,000	$172,500	$215,000	Investment Capital
$290,000	$72,500	-$115,000	-$245,000	-$340,000	Flow Cash Net
-$337,500	-$627,500	-$700,000	-$585,000	-$340,000	Flow Cash Cumulative

Years) 5 (First Projection Flow Cash :4.8

Projections Financial Long-term

- (2033) 8 Year **Point: Break-even**
- maturity full after 20%-15 **Investment: on Return**
- horizon) (10-year 15%-12 **(IRR): Return of Rate Internal**
- rate) discount 8% horizon, (10-year million 5.1-2.$1 **(NPV): Value Present Net**
- 1.2-7.1 **Index: Profitability**

Strategy Funding 5.4.8

- ($287,000) 40% **Investment: Equity**
- ($251,125) 35% **Financing: Debt**
- ($107,625) 15% **Subsidies: and Grants**
- ($71,750) 10% **Reinvestment: Revenue**

Sources Funding Potential

- banks development Agricultural
- initiatives finance Climate
- funds investment agriculture Sustainable

- farming water-efficient for subsidies Government
- pre-financing credit Carbon
- agriculture sustainable on focused investors Impact

Management Risk 6.4.8

- **Risks: Market**
  - products diversified through mitigation volatility Price –
  - buyers premium with contracts Forward –
  - channels direct-to-consumer of Development –
- **Risks: Production**
  - events weather extreme for insurance Crop –
  - risk disease spread to cultivars Diversified –
  - sources multiple through security Water –
- **Risks: Financial**
  - exposure limit to investment Phased –
  - flow cash ensure to streams revenue Multiple –
  - sales export for hedging Currency –

unit cultivation olive the of viability economic the demonstrates plan financial This significant despite returns long-term strong with project, Economy Circular Tor El the within operational creates units project other with integration The requirements. investment initial performance. financial overall enhance that synergies

Cultivation Olive for Requirements Resource 5.8

Requirements Land 1.5.8

- **Area: Total** hectares) 9.18) Feddans 45
- **Density: Planting** Feddan per trees 100
- **Trees: Total** capacity full at trees olive 4,500
- **Development: Phased**
  - Phase 1 :(2027-2026) Feddans 3 (300 trees)
  - Phase 2 :(2028-2027) 9 total Feddans (900 trees)
  - Phase 3 :(2029-2028) 19 total Feddans (1,900 trees)
  - Phase 4 :(2030-2029) 34 total Feddans (3,400 trees)
  - Phase 5 :(2031-2030) 45 total Feddans (4,500 trees)

Requirements Water 2.5.8

- **Need: Water Annual** Feddan per m^3 6,000-4,000
- **capacity): full (at Water Annual Total** m^3 270,000-180,000
- **System: Irrigation** efficiency 85% with irrigation Drip
- **Sources: Water**
  - Primary: well project from Groundwater
  - Secondary: facilities project from wastewater Treated
  - Supplementary: systems harvesting Rainwater
- **Measures: Conservation Water**
  - monitoring moisture Soil
  - periods non-critical during irrigation Deficit
  - cover ground and Mulching
  - evaporation reduce to Windbreaks

Inputs Material 3.5.8

- **Materials: Planting**
  - (phased) trees 4,500 saplings: Olive
  - production oil for suitable varieties Drought-resistant
  - legumes) herbs, (medicinal seeds Intercropping
  - plants companion and Windbreak
- **Amendments: Soil**
  - phases) with (increasing annually tons 40-5 Vermicompost:
  - phases) with (increasing annually tons 40-5 Biochar:
  - annually tons 20-2 fertilizer: Azolla-based
  - tests soil on based needed as supplements Mineral
- **Management: Pest**
  - agents control Biological
  - deterrents pest Organic
  - equipment Monitoring
  - necessary when inputs chemical Minimal

Infrastructure and Equipment 4.5.8

- **Infrastructure: Irrigation**
  - Feddans 45 for system irrigation Drip
  - systems filtration and pumps Water
  - capacity) liters (50,000 tanks storage Water
  - equipment monitoring and sensors moisture Soil
- **Equipment: Processing**
  - kg/hour) 500 (capacity: press Olive
  - steel) (stainless tanks storage oil Olive
  - equipment bottling and Filtration
  - equipment laboratory testing Quality
- **Equipment: Farm**
  - implements with tractor Small
  - tools harvesting and Pruning
  - equipment Spraying
  - vehicles Transportation
- **Buildings:**
  - m^2) (200 facility Processing
  - m^2) (150 warehouse Storage
  - m^2) (100 shed Equipment
  - m^2) (50 facilities Staff

Resources Human 5.5.8

- **Staff: Permanent**
  - (1) specialist cultivation Olive
  - (1) manager Farm
  - (1) technician Processing
  - phases) with increasing ,8-4) workers Field
  - (1) technician Maintenance
- **Workers: Seasonal**
  - season) harvest during 20-10) crew Harvesting
  - season) pruning during 10-5) crew Pruning
  - season) processing during 5-3) assistants Processing
- **Support: External**

consultant quality oil Olive –
specialist management Pest –
specialist sales and Marketing –
technicians maintenance Equipment –

Resources Financial 6.5.8

- **Investment: Capital**

$90,000 preparation: Land –
$135,000 system: Irrigation –
$67,500 planting: and Trees –
$150,000 equipment: Processing –
$200,000 infrastructure: and Buildings –
$75,000 equipment: Farm –
$717,500 investment: capital Total –

- **Costs: Operating Annual**

phases) with (increasing 120,000-$60,000 Labor: –
60,000-$30,000 materials: and Inputs –
30,000-$15,000 energy: and Water –
40,000-$20,000 Maintenance: –
50,000-$25,000 distribution: and Marketing –
300,000-$150,000 costs: operating annual Total –

Resources Integration 7.5.8

- **Units: Other from Inputs**

unit vermicomposting from Vermicompost –
unit pyrolysis from Biochar –
ponds Azolla from fertilizer Azolla-based –
system management water from water Treated –
manure and grazing for Livestock –

- **Units: Other to Outputs**

production biochar to waste Pruning –
vermicomposting to waste Processing –
supplement feed livestock for pomace Olive –
livestock and market for products Intercropping –
biodiversity) sequestration, (carbon services Ecosystem –

necessary the has unit cultivation olive the ensures plan requirements resource This the in units other with integration maximizing while implementation successful for inputs project. Economy Circular Tor El

Cultivation Olive for Plan Management Risk 6.8

Risks Production 1.6.8

- **Risks: Climate-Related**

  Risk: – fluctuations temperature drought, events, weather Extreme

  Impact: – deterioration quality damage, tree yield, Reduced

  Strategies: Mitigation –

  * structures shade and windbreaks of Installation
  * selection variety Drought-resistant
  * monitoring moisture with systems irrigation Advanced
  * systems warning early and monitoring Weather
  * coverage insurance Crop

- **Risks: Pest and Disease**

  Risk: – spot peacock wilt, verticillium fly, fruit Olive

  Impact: – costs increased reduction, quality loss, Crop

  Strategies: Mitigation –

  * system (IPM) Management Pest Integrated
  * detection early and monitoring Regular
  * methods control Biological
  * selection variety Disease-resistant
  * ventilation for pruning and spacing Proper

- **Risks: Availability Resource**

  Risk: – shortages labor shortages, input scarcity, Water

  Impact: – yield reduced costs, increased delays, Production

  Strategies: Mitigation –

  * systems storage and sources water Diversified
  * inputs critical for contracts supplier Long-term
  * programs retention and training Worker
  * technologies Resource-efficient
  * maintenance stock Buffer

Risks Market 2.6.8

- **Volatility: Price**

  Risk: – variations cost input prices, oil olive Fluctuating

  Impact: – pressure margin uncertainty, Revenue

  Strategies: Mitigation –

  * buyers with contracts Forward

certification) organic quality, (premium differentiation Product *
range product Diversified *
processing Value-added *
system intelligence Market *

- **Competition:**

competition international and local Increased **Risk:** –
pressure price loss, share Market **Impact:** –
Strategies: Mitigation –
branding and certification Quality *
development proposition value Unique *
relationships customer Strong *
diversification Market *
programs efficiency Cost *

- **Changes: Demand**

downturns economic preferences, consumer Shifting **Risk:** –
buildup inventory reduction, Sales **Impact:** –
Strategies: Mitigation –
monitoring trend and research Market *
adaptation and innovation Product *
planning production Flexible *
channels Direct-to-consumer *
development market Export *

Risks Operational 3.6.8

- **Infrastructure: and Equipment**

damage infrastructure failure, Equipment **Risk:** –
issues quality disruption, Production **Impact:** –
Strategies: Mitigation –
program maintenance Preventive *
inventory parts spare Critical *
operations critical for systems Backup *
insurance Equipment *
handling equipment on training Staff *

- **Control: Quality**

contamination variations, quality Product **Risk:** –
damage reputation rejection, Product **Impact:** –
Strategies: Mitigation –

implementation system management Quality *
monitoring and testing Regular *
standards quality on training Staff *
system Traceability *
certification quality Third-party *

- **Chain: Supply**

Risk: – disruptions logistics delays, Input
Impact: – costs increased delays, Production
Strategies: Mitigation –
relationships supplier Multiple *
management inventory Buffer *
arrangements logistics Alternative *
system monitoring chain Supply *
planning Contingency *

Risks Financial 4.6.8

- **Flow: Cash**

Risk: – delays payment variations, revenue Seasonal
Impact: – disruption operational shortage, capital Working
Strategies: Mitigation –
monitoring and forecasting flow Cash *
arrangements line Credit *
management terms payment Customer *
diversification Revenue *
measures control Cost *

- **Rate: Interest and Currency**

Risk: – changes rate interest fluctuations, rate Exchange
Impact: – increase cost loss, Financial
Strategies: Mitigation –
exports for hedging Currency *
arrangements financing Fixed-rate *
operations local through hedging Natural *
monitoring risk Financial *
planning financial Conservative *

Review and Monitoring Risk 5.6.8

- **Assessment: Risk Regular**
  - meetings review risk Quarterly –
  - assessment risk comprehensive Annual –
  - updates matrix Risk –
  - evaluation effectiveness strategy Mitigation –
  - analysis and identification risk New –
- **Tools: Management Risk**
  - software tracking Risk –
  - indicators warning Early –
  - monitoring metrics Performance –
  - system reporting Incident –
  - mechanisms feedback Stakeholder –
- **Improvement: Continuous**
  - programs training management Risk –
  - updates practice Best –
  - documentation learned Lessons –
  - refinement strategy Mitigation –
  - communication Stakeholder –

assessing, identifying, for framework a provides plan management risk comprehensive This sustainable ensuring unit, cultivation olive the of aspects all across risks mitigating and project. Economy Circular Tor El the within success long-term and operations

Cultivation Olive for Plan Sustainability 7.8

Sustainability Environmental 1.7.8

- **Management: Water**
  - **Objectives:** –
    - efficiency irrigation 85% Achieve *
    - methods conventional to compared 40%-30 by consumption water Reduce *
    - reuse and recycling water Maximize *
    - technologies irrigation smart Implement *
  - **Implementation:** –
    - systems irrigation drip Advanced *
    - technology monitoring moisture Soil *
    - systems storage and harvesting Water *

facilities treatment water with Integration *
selection variety Drought-resistant *

- **Health: Soil**

Objectives: –

annually 3%-2 by matter organic soil Increase *
biodiversity soil Enhance *
erosion soil Prevent *
levels nutrient and pH soil optimal Maintain *

Implementation: –

program application Biochar *
integration Vermicompost *
systems cropping Cover *
practices tillage Minimal *
monitoring and testing soil Regular *

- **Biodiversity:**

Objectives: –

50%-30 by diversity species Increase *
corridors wildlife Create *
habitat pollinator Enhance *
populations insect beneficial Maintain *

Implementation: –

system intercropping Diverse *
integration plant Native *
establishment Hedgerow *
management pest Integrated *
practices Wildlife-friendly *

- **Management: Carbon**

Objectives: –

annually equivalent $_2$CO tons 900-450 Sequester *
footprint carbon operational Reduce *
credits carbon Generate *
soil in storage carbon Enhance *

Implementation: –

optimization density Tree *
application Biochar *
integration energy Renewable *
mechanization Minimal *
system monitoring Carbon *

Sustainability Social 2.7.8

- **Development: Community**

  Objectives:
  - Create jobs local 45-30 *
  - Develop expertise and skills *
  - Support economy local *
  - Enhance security food *

  Implementation:
  - Local hiring priority *
  - Training programs *
  - Community engagement initiatives *
  - Local supplier development *
  - Knowledge sharing platforms *

- **Welfare: Worker**

  Objectives:
  - Ensure benefits and wages fair *
  - Provide conditions working safe *
  - Promote development skill *
  - Support balance work-life *

  Implementation:
  - Comprehensive program safety *
  - Career development paths *
  - Health and wellness initiatives *
  - Fair labor practices *
  - Regular training sessions *

- **Integration: Cultural**

  Objectives:
  - Preserve heritage agricultural local *
  - Integrate traditional knowledge *
  - Promote cultural exchange *
  - Support local traditions *

  Implementation:
  - Traditional integration practice *
  - Cultural events organization *
  - Knowledge documentation *
  - Community partnerships *
  - Heritage preservation programs *

Sustainability Economic 3.7.8

- **Viability: Financial**

Objectives: –

* 8 Year by break-even Achieve
* maturity after ROI 20%-15 Maintain
* streams revenue multiple Develop
* efficiency cost Ensure

Implementation: –

* portfolio product Diversified
* processing Value-added
* strategy development Market
* systems control Cost
* utilization resource Efficient

- **Development: Market**

Objectives: –

* presence brand premium Establish
* markets export Develop
* base customer stable Create
* value product Maximize

Implementation: –

* certification Quality
* strategy Marketing
* management relationship Customer
* development network Distribution
* initiatives building Brand

- **Growth: and Innovation**

Objectives: –

* services and products new Develop
* technologies innovative Implement
* streams value additional Create
* improvement continuous Foster

Implementation: –

* program development and Research
* strategy adoption Technology
* diversification Product
* optimization Process
* partnerships Innovation

Evaluation and Monitoring 4.7.8

- **Metrics: Environmental**
  - efficiency use Water –
  - indicators health Soil –
  - indices Biodiversity –
  - rates sequestration Carbon –
  - metrics reduction Waste –
- **Metrics: Social**
  - statistics Employment –
  - completed hours Training –
  - levels engagement Community –
  - rates satisfaction Worker –
  - impact economic Local –
- **Metrics: Economic**
  - indicators performance Financial –
  - metrics share Market –
  - outcomes Innovation –
  - ratios efficiency Resource –
  - measures creation Value –

long- the ensuring for framework comprehensive a provides plan sustainability This the within unit cultivation olive the of viability economic and social, environmental, term project. Economy Circular Tor El

Cultivation Olive for Plan Integration 8.8

Framework Integration Economy Circular 1.8.8

Circular Tor El the of component integral an as designed is unit cultivation olive The units. production other to it connecting flows resource multiple with project, Economy connections, these establishing to approach systematic the outlines plan integration This overall enhance that relationships synergistic creating and efficiency, resource maximizing sustainability. and productivity system

Principles Integration

- **Circularity: Resource** water, matter, organic nutrients, of cycling the Maximize system the within energy and
- **Elimination: Waste** units other for inputs valuable into by-products all Transform

- **Relationships: Synergistic** Create mutually beneficial connections between olive cultivation and other units

- **Resilience: System** Enhance overall system stability through diversified connections

- **Implementation: Phased** Develop integration connections in parallel with the phased expansion of olive unit

Analysis Flow Resource 2.8.8

Cultivation Olive to Inputs

Application Method	Quantity/Timing	Unit Source	Resource
Applied as amendment during spring and autumn soil	10-5 tons/Feddan annually	Livestock unit	Composted manure
Precision drip irrigation system	6,000-4,000 m^3/Feddan annually	Water management unit	Treated wastewater
Incorporated into soil and planting during maintenance	3-2 tons/Feddan initially, 5.0 annually thereafter	Biochar production unit	Biochar
Applied around basins during key growth stages	2-1 tons/Feddan annually	Vermicomposting unit	Vermicompost
Used as green manure and mulch	5-3 tons/Feddan annually	Azolla cultivation unit	Azolla biomass
Released at first signs of pest pressure	As needed during pest outbreaks	Integrated pest management unit	Beneficial insects
Rotational grazing between tree rows	30-20 birds/Feddan seasonally	Poultry unit	Poultry for pest control

Unit Cultivation Olive to Inputs Resource :5.8

Cultivation Olive from Outputs

Units Specific with Integration 3.8.8

Unit Livestock with Integration

- **Livestock: from Inputs**
  - Composted manure for fertilization
  - Controlled grazing for weed management
  - CO_2 enrichment from livestock respiration

- **Livestock: to Outputs**

Processing Required	Quantity/Timing	Unit Destination	Resource
optional and Drying treatment	harvested of 30%-20 weight, olive seasonally	unit, Livestock unit Biochar	pomace Olive
drying and Chipping	tons/Feddan 2-1 annually	production Biochar unit	waste Pruning
sorting and Drying	ton/Feddan 1-5.0 annually	unit, products Herbal unit Livestock	leaves Olive
basic and Harvesting processing	crop, by Varies seasonally	Food Market, unit processing	Intercrop products
and Filtration collection	of ton per m^3 5.1-1 processed olives	unit Biogas	oil Olive processing wastewater
None	service Continuous	units Adjacent	and Shade windbreak
management Habitat	service Continuous	system Entire	Biodiversity enhancement

Unit Cultivation Olive from Outputs Resource :6.8

processing) (after supplement feed as pomace Olive –

supplement nutritional as leaves Olive –

animals for shelter and Shade –

crops forage Intercropped –

- **Timeline: Implementation**

Feddans 3 first to application manure Initial 1: Phase –

grazing livestock limited of Introduction 2: Phase –

by-products olive increased with integration Expanded 3: Phase –

flows resource optimized with integration Full :5-4 Phase –

Unit Management Water with Integration

- **Management: Water from Inputs**

irrigation for wastewater Treated –

design system irrigation for support Technical –

monitoring quality Water –

planning allocation water Seasonal –

- **Management: Water to Outputs**

treatment for wastewater processing Olive –

runoff reducing retention water soil Improved –

efficiency use water on Data –
bodies water adjacent from evaporation reducing Shade –

- **Timeline: Implementation**

water treated using system irrigation Basic 1: Phase –
systems feedback and monitoring water Enhanced 2: Phase –
management wastewater processing olive of Integration 3: Phase –
implementation technologies water-efficient Advanced :5-4 Phase –

Unit Production Biochar with Integration

- **Biochar: from Inputs**

amendment soil for Biochar –
methods application for support Technical –
trees olive for formulations biochar Specialized –
applicable) (where processing olive for energy Heat –

- **Biochar: to Outputs**

feedstock as waste Pruning –
material biochar high-quality as pits Olive –
production biochar specialized for pomace Olive –
crops tree in application biochar for ground Testing –

- **Timeline: Implementation**

plantings new in application biochar Initial 1: Phase –
unit biochar to waste pruning of return First 2: Phase –
by-products processing olive of Integration 3: Phase –
applications and formulations biochar Advanced :5-4 Phase –

Unit Cultivation Azolla with Integration

- **Azolla: from Inputs**

manure green as biomass Azolla –
matter organic Nitrogen-rich –
elements biodiversity system Aquatic –
ponds Azolla near moderation Microclimate –

- **Azolla: to Outputs**

evaporation reducing ponds Azolla for Shade –
surfaces water open for protection Windbreak –

control algae potential for extract leaf Olive –
health Azolla support that insects beneficial for Habitat –

- **Timeline: Implementation**

plots test to application Azolla Small-scale 1: Phase –
grows plantation olive as use Expanded 2: Phase –
ponds Azolla near plantings olive new of placement Strategic 3: Phase –
system olive mature with integration Optimized :5-4 Phase –

Unit Vermicomposting with Integration

- **Vermicomposting: from Inputs**

maintenance and establishment tree for Vermicompost –
application foliar for Vermitea –
health soil for microorganisms Beneficial –
methods and timing application for support Technical –

- **Vermicomposting: to Outputs**

feedstock vermicompost as leaves Olive –
processing for residues Intercrop –
treatment) initial (after wastewater processing Olive –
systems olive in performance vermicompost on data Testing –

- **Timeline: Implementation**

plantings new to application vermicompost Initial 1: Phase –
materials olive of return first and use Expanded 2: Phase –
system intercropping with Integration 3: Phase –
formulations specialized and applications Advanced :5-4 Phase –

Unit Poultry with Integration

- **Poultry: from Inputs**

foraging through control Pest –
fertilization for Manure –
compost and mulch for Feathers –
respiration from enrichment $_2$CO –

- **Poultry: to Outputs**

supplement feed as pomace Olive –
predators from protection and Shade –

foraging for weeds and Insects –

material bedding for leaves Olive –

- **Timeline: Implementation**

integration direct No 1: Phase –

flocks poultry small of introduction Initial 2: Phase –

system grazing rotational Expanded 3: Phase –

integration poultry-olive Optimized :5-4 Phase –

System Management Integration 4.8.8

Mechanisms Coordination

- exchanges resource for calendar Coordinated **Scheduling: Flow Resource**
- materials exchanged all for Standards **Protocols: Control Quality**
- qualities and quantities resource of Tracking **System: Monitoring**
- optimization and assessment Regular **Mechanisms: Feedback**
- units multiple spanning responsibilities with Staff **Teams: Cross-Unit**

Management Data

- outputs and inputs all Tracking **Database: Exchange Resource**
- effectiveness integration Measuring **Metrics: Performance**
- opportunities improvement Identifying **Algorithms: Optimization**
- flows resource of representation Graphical **Tools: Visualization**
- management integration Guiding **System: Support Decision**

Implementation Integration Phased 5.8.8

Foundation :(2027-2026) 1 Phase

- units management water and biochar with connections basic Establish
- system irrigation initial implement and Design
- areas planting to amendments biochar first Apply
- applications Azolla small-scale Test
- protocols monitoring integration Develop

Expansion :(2028-2027) 2 Phase

- application manure with integration livestock Initiate
- unit biochar to waste pruning returning Begin
- plantings new to applications Azolla Expand
- trees established to vermicompost Introduce
- integration poultry small-scale Implement
- flows resource for systems collection data Establish

Diversification :(2029-2028) 3 Phase

- management by-product and processing oil olive Begin
- grazing controlled with integration livestock Expand
- outputs multiple with system intercropping Implement
- olives for formulations biochar specialized Develop
- system grazing rotational poultry Expand
- techniques management water advanced Initiate

Optimization :(2030-2029) 4 Phase

- processes exchange resource all Refine
- outputs and inputs all of quantities and timing Optimize
- systems feedback and monitoring advanced Implement
- feed) poultry-olive (e.g., integration from products specialized Develop
- systems integrated across efficiency energy Maximize
- integration from services ecosystem Quantify

Maturation :(2031-2030) 5 Phase

- units all with integration circular full Achieve
- system management flow resource advanced Implement
- efficiency maximum for processes all Optimize
- benefits integration all quantify and Document
- components education and demonstration Develop
- improvement continuous for protocols research Establish

Metrics Performance Integration 6.8.8

Metrics Efficiency Resource

- system within recycled nutrients of Percentage **Efficiency: Cycling Nutrient**
- output system total of kg per water of Liters **Efficiency: Use Water**
- inputs valuable to converted by-products of Percentage **Rate: Conversion Waste**
- units integrated across output vs. input Energy **Efficiency: Energy**
- monocultures vs. system integrated of Productivity **Ratio: Equivalent Land**

Metrics Integration Economic

- integration to due costs input Reduced **Savings: Cost Integration**
- integration by enabled products from Revenue **Products: Value-Added**
- production of unit per hours Labor **Efficiency: Labor**
- production diversified of benefit Quantified **Value: Reduction Risk**
- products system integrated for premium Price **Premium: Market**

Metrics Integration Environmental

- integration through sequestered e_2CO of Tons **Sequestration: Carbon**
- systems conventional vs. integrated in diversity Species **Index: Biodiversity**
- structure activity, microbial matter, Organic **Indicators: Health Soil**
- integration through pressure pest Reduced **Suppression: Pest**
- benefits environmental of value Monetized **Value: Service Ecosystem**

Solutions and Challenges Integration 7.8.8

Challenges Technical

- units across cycles production Synchronizing **Challenge:**
- storage buffer and systems scheduling detailed Develop **Solution:**
- materials exchanged of quality consistent Ensuring **Challenge:**
- standards processing and protocols control quality Implement **Solution:**
- availability resource in variations seasonal Managing **Challenge:**
- pathways resource alternative and systems storage Create **Solution:**

Challenges Management

- **Challenge:** Coordinating multiple units across activities
- **Solution:** Establish cross-unit coordination and team management protocols
- **Challenge:** Training staff in integrated management system
- **Solution:** Develop comprehensive program training and knowledge sharing
- **Challenge:** Balancing optimization of individual units vs. whole system
- **Solution:** Implement system-level performance metrics and incentives

Challenges Economic

- **Challenge:** Higher initial investment for integrated infrastructure
- **Solution:** Phased implementation and prioritization of high-return integrations
- **Challenge:** Quantifying the value of integration benefits
- **Solution:** Develop comprehensive accounting for system benefits direct and indirect
- **Challenge:** Market development for integrated system products
- **Solution:** Create marketing strategy highlighting quality and sustainability benefits

This plan integration provides a framework for the comprehensive embedding of olive unit cultivation within the broader El Tor project. Through a systematic approach, both olive unit will benefit the overall system, maximizing efficiency, and sustainability of resource flows and management systems, to contribute to the development of economic returns.

9

Infrastructure and Resources Shared

Plan Management Land 1.9

Overview Project 1.1.9

- **Area: Total** Feddans 200
- **Location:** Sinai South Plain, El-Qaa
- **Source: Water** Single groundwater well (1,800 m³/day legal capacity)
- **Source: Power** Solar energy system

Distribution Land Final 2.1.9

- **Palm Date (Medjool):** Feddans 60
- **Trees: Olive** Feddans 45
- **Trees: Acacia** Feddans 45 (windbreaks, nitrogen fixation) fodder
- **Systems: Azolla** Feddans 50 (protein source, natural feed fertilizer)

Plan Implementation Phased 3.1.9

Feddans 10 - (2027-2026) 1 Phase

- **Distribution: Land**
  - Palm: Date (200 Feddans 5 trees)
  - Trees: Olive (300 Feddans 3 trees)
  - Acacia: Feddans 2
- **Development: Infrastructure**
  - Local nursery establishment
  - Azolla Pilot pond
  - Small biochar production unit

installation system irrigation Drip –

- **Objectives: Key**

performance irrigation Evaluate –

adaptation plant Test –

seedlings) acacia 3000 olive, 3000 palm, (2500 production nursery Establish –

Feddans 30 Total - (2028-2027) 2 Phase

- **Expansion:**

Feddans +10 Palm: Date –

Feddans +6 Trees: Olive –

Feddans +4 Acacia: –

Feddans 3 Azolla: –

- **Integration: Livestock**

cattle 5 –

chickens 200 –

ducks 100 –

- **Facilities: Processing**

installation press oil olive Small –

unit biochar of Expansion –

Feddans 60 Total - (2029-2028) 3 Phase

- **Expansion:**

trees) (600 Feddans +15 Palm: Date –

trees) (1000 Feddans +10 Trees: Olive –

Feddans 10 to Increase Acacia: –

Feddans 5 Azolla: –

- **Expansion: Livestock**

cattle 15 –

chickens 500 –

ducks 200 –

Feddans 120 Total - (2030-2029) 4 Phase

- **Expansion:**
  - Feddans) 55 (total Feddans +20 Palm: Date –
  - Feddans) 45 (total Feddans +15 Trees: Olive –
  - Feddans 25 to Increase Acacia: –
  - Feddans 30 Azolla: –
- **Enhancement: Infrastructure**
  - press oil olive Upgrade –
  - unit processing date Develop –
  - facility biochar Expand –

Feddans 200 Completion Project - (2031-2030) 5 Phase

- **Distribution: Final**
  - Feddans 60 Palm: Date –
  - Feddans 45 Trees: Olive –
  - Feddans 45 Acacia: –
  - Feddans 50 Azolla: –
- **Numbers: Livestock Final**
  - cattle 25 –
  - chickens 1000 –
  - ducks 300 –

Measures Sustainability 4.1.9

- **Management: Water**
  - systems irrigation Drip –
  - technologies recycling Water –
  - monitoring moisture Soil –
  - treatment water Azolla-based –
- **Enhancement: Soil**
  - application Biochar –
  - recycling matter Organic –
  - Acacia through fixation Nitrogen –
  - management pest Integrated –
- **Sustainability: Economic**

sources income Diverse –
processing Value-added –
utilization power Solar –
management resource Circular –

Plan Management Water 2.9

System Management Water Integrated 1.2.9

Framework Legal and Sources Water

Limits: Extraction Legal •

well per m^3/day 1800 rate: extraction Maximum –
oversight government under drilling Controlled –
rates extraction of monitoring Regular –
guidelines yield sustainable with Compliance –

Sources: Primary •

precipitation) average mm/year 50-10) rainwater Harvested –
greywater Treated –
effluent unit Livestock –
discharge system Aquaculture –

Categories: Quality Water •

ppm) 500 < (TDS water process high-purity and Potable A: Category –
ppm) 1000-500 (TDS water cultivation Azolla and Irrigation B: Category –
ppm) 1500-1000 (TDS operations cleaning and Livestock C: Category –
ppm) 2500-1500 (TDS applications specific for water Nutrient-rich D: Category –

System Treatment Water Azolla-Based 2.2.9

Efficiency and Capacity Treatment

Performance: System •

daily m^3 5,000 volume: Processing –
90%-80 efficiency: removal Nitrogen –
85%-70 efficiency: removal Phosphorus –
70%-50 reduction: metals Heavy –

Operation: Sustainable •

efficiency treatment of monitoring Regular –
optimization schedule harvesting Biomass –
protocols control Quality –
procedures maintenance System –

Integration Flow Water Circular 3.2.9

System Cultivation Azolla

- **Requirements: Water**
  - m^3/day 500 ponds: Cultivation –
  - m^3/day 50 operations: Processing –
  - m^3/day 20 maintenance: System –
- **Recycling: Water**
  - circulation Closed-loop –
  - systems recovery Nutrient –
  - measures control Evaporation –
  - monitoring quality Water –

Integration Livestock

- **Management: Wastewater**
  - wastewater and manure for systems Collection –
  - processes Pre-treatment –
  - stabilization Nutrient –
  - ponds Azolla to application Controlled –
- **Conservation: Water**
  - systems drinking Efficient –
  - recycling water Cleaning –
  - protocols separation Waste –
  - maintenance and Monitoring –

Management Water Agricultural 4.2.9

Systems Irrigation

- **Distribution: Water**
  - networks irrigation Drip –
  - systems application Precision –
  - monitoring moisture Soil –
  - scheduling Weather-based –
- **Sources: Water**
  - water pond Azolla Treated –
  - rainwater Harvested –
  - runoff agricultural Recycled –
  - groundwater Supplementary –

Strategies Conservation Water 5.2.9

Control Evaporation

- **Coverage: Surface**
  - mats Azolla Floating –
  - structures Shade –
  - barriers Wind –
  - films Surface –
- **Systems: Storage**
  - reservoirs Covered –
  - storage Underground –
  - tanks Insulated –
  - systems Monitoring –

Systems Control and Monitoring 6.2.9

Monitoring Quality Water

- **Parameters:**
  - conductivity and pH –
  - oxygen Dissolved –
  - levels Nutrient –
  - concentrations Contaminant –
- **Systems: Control**
  - sensors Automated –
  - logging data Real-time –
  - systems Alert –
  - protocols Response –

Plan Response Emergency 7.2.9

Protocols Shortage Water

- **Allocation: Priority**
  - maintenance systems Critical –
  - supply water Livestock –
  - irrigation crop Essential –
  - stability system Azolla –
- **Measures: Conservation**

recycling Enhanced –

use non-essential Reduced –

sources water Alternative –

coordination Community –

Protection and Management Groundwater 8.2.9

Measures Protection Aquifer

- **Prevention: Intrusion Saltwater**

wells coastal of monitoring Regular –

distances extraction safe of Maintenance –

needed if wells barrier of Implementation –

changes salinity for system warning Early –

- **Enhancement: Recharge**

dams strategic three of Construction –

m^3/year 790,000 harvesting: Expected –

maintenance basin Infiltration –

effectiveness recharge of Monitoring –

Integration Economy Circular 3.9

Principles Economy Circular 1.3.9

principles: fundamental three around designed is project Economy Circular Tor El The

1. **Pollution: and Waste Out Design** From impacts end-of-life the considering By continuously flow energy and materials where systems create we beginning, the waste. generating without

2. **Use: in Materials and Products Keep** reuse, durability, for designing By rather economy the in circulating materials keep we recycling, and remanufacturing, them. discarding than

3. **Systems: Natural Regenerate** and soil the to nutrients valuable returning By it. depleting than rather capital natural enhance we ecosystems, other

Flows Resource System-Wide 2.3.9

unit one from outputs where system closed-loop a creates Economy Circular Tor El The include: flows resource major The another. for inputs become

Flows Material Organic

- Amendments Soil →)**??**(Unit Vermicomposting/Biochar → **Manure Livestock**)**??**(Units Cultivation All for
- Livestock → Units Fig Cactus and),**??**(Olive),**??**(Palm Date from **Residues Crop**)**??**(Production Biochar and/or)**??**(Feed
- Feedstock Biodiesel and Manure, Green),**??**(Feed Livestock → **Biomass Azolla**)**??**(
- Vermicomposting and/or)**??**(Feed Livestock → **By-products Processing Food**)**??**(

Flows Water

-)**??**(Units All for Source Water Primary → **Rainwater Harvested**
-)**??**(Crops Non-Food for Irrigation →)**??**(Treatment → **Wastewater Livestock**
-)**??**(Irrigation for Water Nutrient-Rich → **Ponds Azolla**
-)**??**(Crops Tree for Irrigation →)**??**(Treatment → **Greywater**

Flows Energy

-)**??**(Units All for Electricity → **Energy Solar**
-)**??**(Machinery for Fuel → Seeds Oil-Rich and Azolla from **Biodiesel**
-)**??**(Heating and Cooking → Waste Organic of Digestion Anaerobic from **Biogas**
-)**??**(Production Biochar → Processing and Pruning from **Biomass**

Matrix Integration 3.3.9

the in units different between relationships input-output primary the shows **??** Table unit's each in specifications detailed to cross-references with Economy, Circular Tor El documentation.

Flows Resource Quantified 4.3.9

we agriculture, arid-region on studies other and research nilotica Acacia the on Based Tor El 50-hectare operational fully a for flows resource annual following the estimate can Economy: Circular

- through circulating matter organic of tons 500 Approximately **Matter: Organic** system the
- efficient and recycling through requirements freshwater in reduction 75% **Water:** use
- year per equivalent $_2$CO of tons 200 approximately of sequestration Net **Carbon:**

potassium and phosphorus, nitrogen, for efficiency recycling nutrient 90% **Nutrients:** •

biogas and biodiesel through needs energy in self-sufficiency 70% **Energy:** •

5.3.9 Impact Environmental and Economic

benefits environmental and economic substantial delivers Economy Circular Tor El The agriculture: sustainable to approach integrated its through

Credits and Sequestration Carbon

tons 50,000 approximately captures system The **Sequestration: Carbon Total** • through: annually -equivalent$_2$CO of

e)$_2$CO tons 175-150) application soil and production Biochar –

e)$_2$CO tons 20,000-15,000) cultivation Azolla –

e)$_2$CO tons 30,000-25,000) vegetation perennial and crops Tree –

under credits offset carbon for qualifies project The **Generation: Credit Carbon** • protocols: multiple

management land agricultural for (VCS) Standard Carbon Verified –

application biochar for Standard Gold –

generation energy renewable for (CDM) Mechanism Development Clean –

ton per 15-$10 at valued credits carbon With **Participation: Market Carbon** • carbon from annually 750,000-$500,000 approximately generate can project the e,$_2$CO markets.

Benefits Financial

Production: Biodiesel •

tons 70-60 production: Annual –

L/8.$0 at USD million 5.$1 Approximately value: Market –

operations farm for diesel imported in Reduction savings: Cost –

Commercialization: Biochar •

tons 250 production: Annual –

$1,500/ton at USD $375,000 Approximately value: Market –

uses industrial filtration, water amendments, Agricultural Applications: –

Reduction: Cost Feed •

30%-20 by costs feed conventional reduces supplement feed as Azolla –

USD 75,000-$50,000 Approximately savings: Annual –

20%-15 by costs veterinary reduces health animal Improved –

- **Replacement: Fertilizer**
  - requirements fertilizer synthetic of 80%-70 replace biochar and Vermicompost
  - USD 150,000-$100,000 Approximately savings: Annual
  - runoff fertilizer from externalities environmental Reduced

Efficiency Water

- **Recycling: Water**
  - cultivation Azolla for utilized wastewater treated and Greywater
  - irrigation for used ponds Azolla from water Nutrient-rich
  - 70%-60 by withdrawal freshwater reduce systems water Closed-loop
- **Retention: Water Soil**
  - 25%-15 by capacity holding water soil increases application Biochar
  - areas treated in 30%-20 by requirements irrigation Reduced
  - units cultivation all for resilience drought Enhanced
- **Savings: Water of Value Economic**
  - annually USD 40,000-$30,000 Approximately costs: pumping Reduced
  - periods water-scarce during seasons growing Extended
  - biomass of ^{3}kg/m 5.1-2.1 to ^{3}kg/m 5.0 From productivity: water Increased

Benefits Social and Employment

- **Creation: Job**
  - positions full-time 60-45 employment: Direct
  - industries supporting in jobs 150-100 employment: Indirect
  - technologies agriculture sustainable in development Skill
- **Security: Food**
  - failures crop to vulnerability reduces production Diversified
  - eggs) poultry, (fish, sources protein of production Year-round
  - health soil improved through produce of quality nutritional Enhanced
- **Transfer: Knowledge**
  - workers agricultural and farmers local for programs Training
  - practices agriculture sustainable for site Demonstration
  - institutions scientific and academic with partnerships Research

Alignment Policy and Compliance Regulatory

- **Regulations: Biodiesel**
  - regulations and permits Petroleum of Ministry with Compliance –
  - assurance quality for standards fuel ISO to Adherence –
  - targets blending biofuel Egypt's with Alignment –
- **Policy: Climate**
  - Paris the under Contributions Determined Nationally Egypt's for Support Agreement –
  - market trading emissions emerging Egypt's in Participation –
  - initiatives agriculture climate-smart for project Demonstration –
- **Management: Water**
  - regulations efficiency use water with Compliance –
  - conservation water for practices best of Demonstration –
  - resources water regional on pressure Reduced –

Strategy Implementation 6.3.9

phases: in implemented be will integration economy circular The

1) (Year **Foundation 1: Phase** 1.

- Management Water and Vermicomposting/Biochar units: core Establish
- crops fast-growing of cultivation small-scale Begin
- flows resource for systems monitoring up Set

(3-2 (Years **Expansion 2: Phase** 2.

- farming azolla and livestock Introduce
- areas cultivation Expand
- systems cycling resource initial Implement

(5-4 (Years **Integration 3: Phase** 3.

- production biodiesel Establish
- units cultivation all Complete
- units between flows resource Optimize

(7-6 (Years **Optimization 4: Phase** 4.

- data monitoring on based processes all Fine-tune
- efficiency resource Maximize
- integration circular full Achieve

Framework Evaluation and Monitoring 7.3.9

key following the using measured be will integration economy circular the of success The indicators: performance

- **Efficiency: Resource** utilized successfully unit each from outputs of Percentage elsewhere inputs as
- **Productivity: Water** used water of meter cubic per generated value Economic
- **Balance: Carbon** emissions versus sequestration carbon Net
- **Impact: Biodiversity** fauna local and diversity microbial soil in Changes
- **Viability: Economic** conventional versus integration circular from savings Cost approaches

Strategies Mitigation and Challenges 8.3.9

- **Challenge:** availability resource in variations Seasonal **Mitigation:** schedules production staggered and systems storage Implement
- **Challenge:** resources circulating of control Quality **Mitigation:** flows resource all for protocols treatment and testing Regular
- **Challenge:** integration of complexity Technical **Mitigation:** building capacity and training continuous with implementation Phased
- **Challenge:** products circular of acceptance Market **Mitigation:** education consumer and transparency, Certification,

Planning Strategic and Risk 9.3.9

long-term the for essential are planning strategic and assessment risk Comprehensive project: Economy Circular Tor El the of success

Analysis SWOT

Strengths

- **Feedstock: Renewable** renewable consistent, a provides cycle growth rapid Azolla's applications. multiple for biomass of source
- **Streams: Revenue Multiple** agricultural biochar, (biodiesel, products Diversified vulnerability. financial reduce credits) carbon produce,
- **Efficiency: Water** significantly application biochar and systems water Closed-loop region. arid an in requirements water reduce
- **Negativity: Carbon** creating emits, it than carbon more sequesters system The value. economic and environmental
- **Design: Integrated** system overall enhance units between relationships Synergistic productivity. and resilience

Weaknesses

- **Costs: Capital Initial High** significant requires systems integrated of Establishment investment. upfront
- **Complexity: Technical** technical and biological interconnected multiple Managing knowledge. specialized demands systems
- **Hurdles: Regulatory** involve certification credit carbon and production Biodiesel processes. regulatory complex
- **Development: Market** may products sustainable premium for markets Local development. require
- **Limitations: Scale** commercial to scaling in challenges face may processes Some levels.

Opportunities

- **Markets: Biofuel Expanding** Egypt in biofuels sustainable for demand Growing internationally. and
- **Commitments: Climate** policy favorable create commitments climate Egypt's projects. carbon-negative for environment
- **Solutions: Scarcity Water** agricultural water-efficient on placed value Increasing region. the in systems
- **Export: Knowledge** to training and technology, knowledge, export to Potential regions. arid similar
- **Partnerships: Research** research and academic with collaboration for Opportunities institutions.

Threats

- **Prices: Energy Fluctuating** competitiveness affects prices fuel fossil in Volatility biodiesel. of
- **Variability: Climate** systems. production impact could events weather Extreme
- **Changes: Policy** markets. carbon or biofuels for frameworks regulatory in Shifts
- **Fuels: Fossil from Competition** may fuels conventional for subsidies Continued economics. biodiesel undermine
- **Outbreaks: Disease and Pest** or Azolla in challenges biological for Potential systems. cultivation other

Framework Management Risk

Priorities Strategic

have priorities strategic following the assessment, risk and analysis SWOT the on Based identified: been

requirements capital manage to stages in system the Develop **Implementation: Phased** 1. adaptation. and learning for allow and

ensure to building capacity and training in Invest **Development: Knowledge** 2. components. system all for expertise technical

streamline to authorities regulatory with engage Proactively **Engagement: Regulatory** 3. processes. certification and permitting

biodiesel, for markets premium with relationships Build **Development: Market** 4. products. other and biochar,

to institutions research with collaborations Establish **Partnerships: Research** 5. performance. system improve continuously

systems biological in diversity and redundancy Incorporate **Building: Resilience** 6. stressors. environmental to resilience enhance to

to systems monitoring comprehensive Implement **Adaptation: and Monitoring** 7. improvement. continuous and making decision data-driven enable

Planning Contingency

risks: high-impact for developed been have plans contingency Key

- **Failure: Production Azolla**

locations separate in strains Azolla multiple of stock seed Maintain Short-term: –

production biodiesel for sources feedstock alternative Develop Medium-term: –

varieties Azolla resilient more Research Long-term: –

- **Shortage: Water Severe**

systems critical most to allocation water Prioritize Short-term: –

infrastructure storage and harvesting water Enhance Medium-term: –

methods cultivation water-efficient more even Develop Long-term: –

- **Collapse: Market Biodiesel**

production biochar and feed to biomass Azolla Redirect Short-term: –

Azolla from products high-value alternative Develop Medium-term: –

ecosystem and sequestration carbon toward model business Pivot Long-term: – services

Structure Governance 10.3.9

approach: governance coordinated a requires integration economy circular The

- **Manager: Integration** units between coordination and flows resource all Oversees
- **Managers: Unit** points integration and operations unit individual for Responsible
- **Committee: Technical** optimization on guidance scientific Provides
- **Council: Stakeholder** market and needs community with alignment Ensures demands

Conclusion 11.3.9

agriculture sustainable to approach holistic a represents Economy Circular Tor El The and efficiency resource maximize that units interconnected designing By regions. arid in applied be can principles economy circular how demonstrates project the waste, minimize The systems. agricultural positive environmentally and productive, resilient, create to with studies, provenance nilotica Acacia the as such research, scientific of integration adapted be can that model a creates technologies innovative and knowledge traditional globally. environments similar to scaled and

Plan Operations Logistics 4.9

Management Flow Material 1.4.9

Logistics Biomass Azolla

- **Operations: Harvesting**
  - biomass fresh tons 3-2 schedule: harvesting Daily –
  - deployment equipment harvesting Mechanical –
  - coordination point Collection –
  - checkpoints control Quality –
- **Flow: Processing**
  - stations dewatering Primary –
  - facilities grading and Sorting –
  - allocation unit Processing –
  - management Storage –

Network Transportation Internal 2.4.9

Management Fleet Vehicle

- **Equipment: Transport**
  - vehicles utility Electric –

carriers biomass Specialized –

systems transport Water –

equipment handling Material –

- **Optimization: Route**

systems tracking Real-time –

optimization Load –

coordination Schedule –

planning Maintenance –

Management Inventory and Storage 3.4.9

Storage Biomass

- **Facilities: Storage**

areas holding biomass Fresh –

storage biomass Processed –

units Climate-controlled –

zones storage Buffer –

- **Control: Inventory**

monitoring Real-time –

protocols rotation Stock –

measures preservation Quality –

forecasting Demand –

Integration Cross-Unit 4.4.9

Systems Exchange Material

- **Integration: Unit Biodiesel**

scheduling delivery Biomass –

coordination Process –

protocols control Quality –

systems Feedback –

- **Integration: Unit Livestock**

network distribution Feed –

system collection Waste –

protocols sharing Resource –

prevention Cross-contamination –

Systems Control Quality 5.4.9

Assurance Quality

- **Protocols: Testing**
  - assessment quality Biomass –
  - monitoring content Moisture –
  - analysis Nutrient –
  - checks Contamination –
- **Documentation:**
  - system tracking Digital –
  - identification Batch –
  - certificates Quality –
  - records Compliance –

Procedures Response Emergency 6.4.9

Plans Contingency

- **Failure: Equipment**
  - activation systems Backup –
  - maintenance Emergency –
  - routing Alternative –
  - adjustment Production –
- **Disruption: Chain Supply**
  - sourcing Alternative –
  - utilization stock Buffer –
  - allocation Priority –
  - protocols Communication –

Monitoring Performance 7.4.9

Indicators Performance Key

- **Metrics: Operational**
  - efficiency Transport –
  - utilization Storage –
  - throughput Processing –
  - rate compliance Quality –
- **Metrics: Sustainability**

footprint Carbon –

efficiency Resource –

reduction Waste –

consumption Energy –

Infrastructure and Technology 5.9

Framework Governance 6.9

Framework Management Risk Unified 1.6.9

Scope and Purpose

identifying, to approach standardized a establishes framework management risk unified This Economy Circular Tor El the of units all across risks monitoring and mitigating, assessing, to: aims It project.

- units operational all across methodologies assessment risk consistent Ensure
- coverage comprehensive maintaining while documentation risk in redundancy Reduce
- coordination mitigation and awareness risk cross-unit Facilitate
- management risk for structures responsibility and accountability clear Provide
- risks critical of escalation and reporting effective Enable

Categories Risk

classification: for categories risk standardized following the utilizes project The

Methodology Assessment Risk

methodology: assessment risk standardized following the apply must units All

1. **Identification: Risk** processes structured through risks of identification Systematic etc.) planning, scenario analysis, SWOT (brainstorming,
2. **Analysis: Risk** standardized the using impact and likelihood risk of Evaluation below: scales
3. **Prioritization: and Evaluation Risk** using significance risk of Determination Matrix: Priority Risk the
4. **Planning: Response Risk** strategies: response appropriate of Development
   - **Avoid:** cause the eliminating by threat the Eliminating
   - **Mitigate:** risk the of impact and/or probability the Reducing
   - **Transfer:** party third a to management and impact risk the Shifting
   - **Accept:** contingency with action, taking without risk the Acknowledging needed if plans

Responsibilities Management Risk

- **Committee: Executive Project** approval management, risk of oversight Ultimate risks extreme of review and thresholds, risk of
- **Coordinator: Management Risk** activities, management risk of coordination Central assessment risk cross-unit of facilitation and register, risk of maintenance
- **Managers: Unit** units, respective within management risk of Implementation mitigation of execution and risks, unit-specific of assessment and identification measures
- **Specialists: Technical** in assessments risk specialized for expertise of Provision domains relevant
- **Staff: All** control of implementation risks, of reporting and identification Ongoing measures

Reporting and Documentation Risk

- **Register: Risk Master** the across risks identified all of database Centralized project
- **Registers: Risk Unit** unit-level of analysis detailed with register Unit-specific risks
- **Plans: Response Risk** risks extreme and high for plans Detailed
- **Reports: Monitoring Risk** and status risk tracking reports monitoring Regular controls of effectiveness
- **Protocol: Escalation Risk** exceed that risks escalating for procedure Formal thresholds defined

Process Review and Monitoring

- **Reviews: Regular**
  - level unit at registers risk of review Monthly
  - level project at risks extreme and high all of review Quarterly
  - framework management risk entire of review comprehensive Annual
- **Monitoring: Continuous**
  - indicators warning early of monitoring Ongoing
  - effectiveness control of assessment Regular
  - risks emerging for scanning Horizon
- **Loop: Feedback**
  - events risk from learned lessons of Documentation
  - improvements management risk of Integration
  - units across sharing Knowledge

Integration Management Risk

processes: management project following the with integrated is management Risk

- **Planning: Strategic** Risk considerations long-term in planning
- **Planning: Operational** Risk mitigation incorporated into annual plans
- **Budgeting:** Risk-based allocation contingency
- **Measurement: Performance** Risk management effectiveness metrics
- **Management: Change** Risk assessment of proposed changes

Requirements Management Risk Unit-Level

should: document management risk unit's Each

1. framework unified this Reference)\ref{sec:unified_risk_management}(
2. Focus on unit-specific risks while avoiding repetition of common risks
3. Categorize risks according to the standardized categories)\ref{sec:risk_categories}(
4. Apply assessment methodology standardized the)\ref{sec:risk_assessment_methodology}(
5. Clearly assign responsibilities for unit-level management risk)\ref{sec:risk_responsibilities}(
6. Specify monitoring mechanisms unit-specific)\ref{sec:risk_monitoring}(
7. Detail integration with operational unit processes)\ref{sec:risk_integration}(

Structure Decision-Making 2.6.9

... code existing ... //

Responsibilities and Roles 3.6.9

... code existing ... //

Protocols Communication 4.6.9

... code existing ... //

Measurement Performance 5.6.9

... code existing ... //

Impact Social and Community 7.9

Plan Resilience and Risk Climate 8.9

Assessment Risk Climate 1.8.9

Risks Climate Physical

- **Risks: Temperature**
  - cultivation Azolla on stress Heat –
  - rates evaporation Increased –
  - efficiency and stress Equipment –
  - safety and health Worker –
- **Risks: Water-Related**
  - periods Drought –
  - precipitation Irregular –
  - changes quality Water –
  - depletion Groundwater –

Strategies Resilience 2.8.9

Resilience System Azolla

- **Adaptations: Cultivation**
  - strains Temperature-resistant –
  - systems management Shade –
  - methods conservation Water –
  - optimization cycle Growth –
- **Protection: Infrastructure**
  - facilities Climate-controlled –
  - storage water Robust –
  - systems backup Emergency –
  - approach design Modular –

Management Carbon 3.8.9

Sequestration Carbon

- **Sequestration: Biological**
  - capture carbon biomass Azolla –
  - production Biochar –

- enhancement carbon Soil –
- management Vegetation –

- **Accounting: Carbon**

- monitoring Emissions –
- verification Sequestration –
- documentation credit Carbon –
- protocols Reporting –

Resilience Management Water 4.8.9

Measures Security Water

- **Protection: Supply**

- sources water Diversified –
- infrastructure Storage –
- systems Recycling –
- plans contingency Drought –

- **Measures: Efficiency**

- systems irrigation Smart –
- prevention Loss –
- networks Monitoring –
- optimization Usage –

Resilience Energy 5.8.9

Security Energy

- **Supply: Power**

- integration Renewable –
- systems Backup –
- management Load –
- solutions Storage –

- **Programs: Efficiency**

- optimization Equipment –
- improvements Process –
- recovery Heat –
- controls Smart –

Protection Biodiversity 6.8.9

Management Ecosystem

- **Conservation: Habitat**
  - protection species Native –
  - maintenance Corridor –
  - management zone Buffer –
  - control species Invasive –
- **Programs: Monitoring**
  - surveys Species –
  - checks health Ecosystem –
  - assessments Impact –
  - tracking Adaptation –

Response Emergency 7.8.9

Protocols Response

- **Plans: Emergency**
  - systems warning Early –
  - procedures Evacuation –
  - allocation Resource –
  - protocols Communication –
- **Plans: Recovery**
  - restoration System –
  - assessment Damage –
  - mobilization Resource –
  - coordination Stakeholder –

Units Economy Circular Tor El of Matrix Integration :1.9

From Receives	To Provides	Unit
• water Nutrient-rich)??(Livestock from • Biodiesel from $_2$CO)??(production	• biomass Nitrogen-rich)??(Livestock to • Biodiesel to Feedstock)??(• to manure Green Units Cultivation)??(	Azolla Farming
• from seeds Oil-rich Units Cultivation)??(• from biomass Azolla)??(Farming Azolla	•)??(units all for Fuel • by-product Glycerin)??(Livestock to •)??(Azolla to $_2$CO	Biodiesel Production
• Azolla from Feed)??(Farming • from residues Crop Units Cultivation)??(• from Glycerin Production Biodiesel)??(	• to Manure Vermicomposting)??(• for eggs milk, Meat,)??(market • to water Nutrient-rich)??(Azolla	Livestock Management
• from Manure)??(Livestock • from residues Crop Units Cultivation)??(• from waste Processing)??(units all	• to amendments Soil Units Cultivation all)??(• carbon for Biochar)??(sequestration • to protein Worm)??(Livestock	Vermicomposting/ Biochar
• from Compost Vermicomposting)??(• from water Treated Management Water)??(• Biochar from Biochar)??(Unit	•)??(market for Dates • Livestock for Fronds)??(feed • Biodiesel for Seeds)??(	Palm Date Cultivation
• from Compost	•)??(market for Fruits	Fig Cactus Cultivation

Components Project Key for Matrix Assessment Risk :2.9

Mitigation Strategy	Impact	Probability	Risk Specific	Category Risk
strain Multiple cultivation; Backup production systems	High	Medium	Azolla cultivation failure	Technical
Diversify revenue Focus streams; premium on markets	Medium	High	biodiesel Low prices	Market
Early engagement authorities; with Compliance expertise	Medium	High	delays Permit biodiesel for	Regulatory
Enhanced storage; water Drought-resistant systems	High	Medium	shortage Water	Environmental
Phased implementation; Conservative financial planning	High	Medium	cost Capital overruns	Financial
Comprehensive training programs; Knowledge management systems	Medium	Medium	shortage Skills	Operational

Description	Category Risk
organizational of achievement the affecting Risks long-term and vision, mission, to related objectives goals	Risks Strategic
including operations, day-to-day affecting Risks and availability, resource processes, production control quality	Operational Risks
including sustainability, financial to related Risks generation, revenue flow, cash investments, capital management cost and	Risks Financial
climate impacts, environmental to related Risks and conservation, resource adaptation, change health ecosystem	Environmental Risks
implementation, technology to related Risks compatibility and reliability, performance,	Risks Technical
competition, demand, market to related Risks preferences consumer and volatility, price	Risks Market
regulations, laws, with compliance to related Risks requirements certification and standards,	Regulatory Risks
labor relations, community to related Risks social and engagement, stakeholder practices, acceptance	Risks Social

Categories Risk Standardized :3.9

Definition	Score Likelihood
5% (< circumstances exceptional in only occur May probability)	(Rare) 1
probability) 25%-5) time some at occur Could	(Unlikely) 2
probability) 50%-25) time some at occur Might	(Possible) 3
75%-50) circumstances most in occur probably Will probability)	(Likely) 4
75% (> circumstances most in occur to Expected probability)	Certain) (Almost 5

Scale Likelihood Risk :4.9

Definition	Score Impact
normal through absorbed be can that impact Minimal activity	(Negligible) 1
operational to adjustments some with impact Minor activities	(Minor) 2
to adjustments substantial requiring impact Significant operations	(Moderate) 3
and success program threatening impact Major resources significant requiring	(Major) 4
and viability project threatening impact Catastrophic sustainability	(Severe) 5

Scale Impact Risk :5.9

Impact					**Likelihood**2*
5	**4**	**3**	**2**	**1**	
(Extreme) 25	(Extreme) 20	(Extreme) 15	(High) 10	(Moderate) 5	**5**
(Extreme) 20	(Extreme) 16	(High) 12	(High) 8	(Moderate) 4	**4**
(Extreme) 15	(High) 12	(High) 9	(Moderate) 6	(Low) 3	**3**
(High) 10	(High) 8	(Moderate) 6	(Moderate) 4	(Low) 2	**2**
(Moderate) 5	(Moderate) 4	(Low) 3	(Low) 2	(Low) 1	**1**

Matrix Priority Risk :6.9

10

Appendices