

LANDRY INDUSTRIES INC.

PROJECT LANDRY BIOMAT

Definitive Policy Business Plan, Industrial Masterplan & 26-SOP Operational Engineering Manual

A National 500,000-Acre Organic Hemp Biorefinery Platform (Moncton Hub)

Project Landry BioMAT is a national-scale industrial bioeconomy infrastructure initiative designed and operated by Landry Industries Group Inc. Centered in Moncton, New Brunswick, the facility refines 2,000,000 dry tonnes of organic industrial hemp (*Cannabis sativa L.*) harvested annually from a contracted ****500,000-acre national crop rotation network**** across Western, Central, and Atlantic Canada. Utilizing a zero-waste, net-zero ****Biomass Cascade Model****, the Moncton mega-biorefinery converts raw biomass into ****26 Core Primary and Secondary Bio-Commodity SKUs****. These core feedstocks replace legacy petroleum, timber, and synthetic inputs across 50,000 downstream consumer and industrial applications—including tree-free fluff pulp, tissue, corrugated packaging, technical cottonized yarns, HEFA sustainable aviation fuels, renewable diesel, pipeline-quality RNG, bio-methanol, bio-asphalt, bio-lubricants, engineered HempWood timber, hempcrete, thermal bio-insulation, activated bio-char, EV battery carbon nanosheets, automotive bioplastics, Hempoxies (non-BPA bio-epoxy resins), 3D-printable photopolymers, and organic agrifood nutrition. Supported by an upgraded ****\$2.85 Billion CAD phased capital deployment****, the facility operates an on-site 45 MW Fluidized Bed Combined Heat & Power (CHP) plant that combusts non-manufacturable process scraps, achieving 100% thermal process steam self-sufficiency and exporting ****30 MW of continuous base-load power to the NB Power grid****. At full Year 5 capacity, Project Landry BioMAT projects ****\$1.65 Billion CAD in gross annual revenue**** and ****\$920 Million CAD in net operating EBITDA**** (55.8% EBITDA margin), establishing Atlantic Canada as a global leader in advanced bio-industrial manufacturing.

Corporate Operator:

Landry Industries Group Inc.
Global Headquarters: Moncton, NB, Canada
Central Refinery: Gordon Yard Rail Corridor

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1 Corporate Policy Framework & Institutional Governance

1.1 Mandatory Operating Policies

Landry Industries Group Inc. enforces strict policy directives across all operational divisions:

POLICY DIRECTIVE #The Biomass Cascade Utilization Mandate:

POL-LBM-001 All organic matter entering Landry BioMAT facilities must be processed according to the strict **Value Pyramid**:

1. **High-Value Extractives & Biochemicals** (Pharmaceutical Cannabinoids, Seeds Oils, Protein Isolates).
2. **Advanced Bio-Materials & Resins** (Hempoxies, 3D Photopolymers, EV Battery Carbon, Auto Bioplastics).
3. **Structural & Industrial Products** (Engineered HempWood Timber, Hempcrete, Insulation, Textiles, Tissue, Fuels).
4. **Scraps-to-Energy Recovery** (Non-manufacturable micro-dust, spent sludge, and chaff routed exclusively to CHP gasification for process steam and grid electricity).

Policy Enforcement: Landfill disposal of organic process residues is strictly prohibited (0.0% Organic Landfill Policy).

POLICY DIRECTIVE #Indigenous Collaboration and Regional Farmer Equity Policy:

POL-LBM-002

- **Long-Term Farm Contracts:** Guaranteed 5-year organic crop rotation buy-back contracts for Canadian agricultural producers across Western, Central, and Atlantic Canada.
- **First Nations Equity Partnerships:** Co-development of regional decortication spokes on Indigenous lands, incorporating local workforce training, joint venture revenue sharing, and sustainable land stewardship.

POLICY DIRECTIVE #Supply Chain Risk Mitigation and Dual-Retting Protocol:

POL-LBM-003 To mitigate field-retting weather vulnerabilities across the 500,000-acre network:

- **Dual-Retting Reserve:** If adverse rainfall prevents 21-day field retting, unretted green stalks are baled at 15% moisture and treated at regional spokes using an automated ****Enzymatic Dip-Tank Retting System**** (0.5% v/v pectinase bath at 50°C for 6 hours).
- **Logistical Buffer Nodes:** Regional spokes maintain a continuous 6-month buffer inventory of high-density bales (380 kg/m³) to insulate the Moncton refinery against CN Rail freight disruptions.

2 Revised Macro-Economic Business Plan

2.1 Phased Capital Expenditure (CapEx) Pro Forma

The adjusted ****\$2.85 Billion CAD CapEx**** is deployed across four distinct 12-month buildout phases:

Table 1: Phased Capital Allocation & Buildout Budget (CAD)

Buildout Phase	Primary Infrastructure & Equipment Scope	Capital Outlay	CapEx Share
Phase I (M01–12)	Site Civil, CN Gordon Yard Siding, Primary Decortication Spokes, CHP Power	\$650,000,000	22.8%
Phase II (M12–24)	Organosolv Pulp Mill, TCF Bleaching, Tissue/Fluff Lines, HempWood Timber	\$850,000,000	29.8%
Phase III (M24–36)	HEFA Bio-Refinery (SAF/HDRD), Bio-Asphalt, Bio-Lubricants	\$780,000,000	27.4%
Phase IV (M36–48)	Advanced Resins (Hempoxies), 3D Photopolymers, EV Battery Carbon, Cannabinoids	\$570,000,000	20.0%
TOTAL CAPEX	Complete 500,000-Acre National Infrastructure Platform	\$2,850,000,000	100.0%

2.2 Annual Revenue & EBITDA Earnings Pro Forma (Year 5 Full Capacity)

At full production (2,000,000 dry tonnes processed annually), Landry BioMAT yields substantial operating margins:

3 National Agronomy & CN Rail Logistics Infrastructure

Table 2: Annual Operating Financial Income Pro Forma

Revenue Stream	Annual Revenue (CAD)	Revenue Share (%)
Tier 1: Tree-Free Fluff Pulp, Tissue, Packaging & Cottonized Yarns	\$540,000,000	32.7%
Tier 2: Refined SAF, Renewable Diesel, RNG, Bio-Methanol & Bio-Asphalt	\$460,000,000	27.9%
Tier 3: Structural HempWood Timber, Hempcrete & Activated Biochar	\$240,000,000	14.5%
Tier 4: EV Battery Carbon, Bioplastics, Hempoxies & 3D Printing Resins	\$260,000,000	15.8%
Tier 5: Organic Cold-Pressed Seed Oils, Protein Isolates & Hemp Hearts	\$120,000,000	7.3%
Tier 6: 30 MW Continuous Net Grid Power Sales (NB Power PPA)	\$30,000,000	1.8%
GROSS ANNUAL OPERATING REVENUE	\$1,650,000,000	100.0%
Annual Operating Expenses (OpEx: Farm Contracts, Freight, Labor, Chemical Auxiliaries)	(\$730,000,000)	44.2%
NET ANNUAL OPERATING EBITDA	\$920,000,000	55.8% Margin

3.1 500,000-Acre Land Distribution Policy

To maintain supply stability and regional land balance, Landry BioMAT enforces an agricultural allocation model across three Canadian zones:

Table 3: National Agricultural Footprint Allocation

Agricultural Zone	Participating Provinces	Contracted Acres	Yield / Acre (Dry)	Total Annual Biomass
Western Zone	Alberta, Saskatchewan, Manitoba	325,000 (65%)	4.0 Dry Tonnes	1,300,000 Dry Tonnes
Central Zone	Ontario, Quebec	125,000 (25%)	4.0 Dry Tonnes	500,000 Dry Tonnes
Atlantic Zone	New Brunswick, Nova Scotia, PEI	50,000 (10%)	4.0 Dry Tonnes	200,000 Dry Tonnes
TOTAL	—	500,000 Acres	4.0 Dry Tonnes	2,000,000 Dry Tonnes

3.2 CN Rail & Moncton Gordon Yard Hub Infrastructure

Primary decortication spokes near agricultural centers densify fiber (380 kg/m³) and hurd pellets (680 kg/m³). Densified materials are loaded onto **100-car CN Rail unit trains** and transported directly to Moncton, NB. The Moncton site features 3.5 km of private rail siding at CN Gordon Yard (Mile 124.8), connected via Route 15/Hwy 2 to deep-water shipping at the Port of Saint John and Port of Halifax.

4 The 26 Core Primary Refinery SKUs (Tier A Engine)

Table 4: Master Index of the 26 Primary Landry BioMAT Feedstock SKUs

SKU Code	Primary Bio-Commodity Output	Primary Industrial Application Sector	Annual Output
SKU-LBM-010	Organic Dual-Purpose Seed & Field Stalks	Raw Harvested Biomass Feedstock	2, 250, 000 Tonnes
SKU-LBM-011	Field-Retted Baled Stalk Swaths	Retting Intermediate Fiber/Hurd	2, 000, 000 Tonnes
SKU-LBM-012	High-Density 1.80 kg/m ³ Rectangular Bales	Transportable Field Stalks	2, 000, 000 Tonnes
SKU-LBM-100	Decorticated Bast Fiber & Hurd Core Aggregates	Primary Fractionated Components	1, 800, 000 Tonnes
SKU-LBM-101	Bulk CN Rail Freight Bales & Hopper Pellets	Logistics Intermediate Feedstock	1, 800, 000 Tonnes
SKU-LBM-201	Organosolv TCF Bleached Fluff Pulp	Absorbent Hygiene & Diaper Cores	120, 000 Tonnes
SKU-LBM-202	High-Softness Parent Tissue & Towel Rolls	Sanitary Bath/Facial Paper Stock	95, 000 Tonnes
SKU-LBM-203	Unbleached High-Yield Kraft Linerboard & Fluting	Corrugated Boxes & Packaging Trays	115, 000 Tonnes
SKU-LBM-204	Enzymatic Cottonized Textile Yarns (Nm 30–60)	Apparel Denim & Industrial Canvas	50, 000 Tonnes
SKU-LBM-301	HEFA Sustainable Aviation Fuel & Renewable Diesel	Drop-in Aviation Jet A-1 & Diesel	140, 000 Tonnes
SKU-LBM-302	Polymerized AASHTO PG 64-28 Bio-Asphalt Binder	Infrastructure Highway Paving	110, 000 Tonnes
SKU-LBM-303	Estolide-Based ISO VG 46/68 Bio-Hydraulic Fluids	Industrial Machinery Lubricants	25, 000 Tonnes
SKU-LBM-304	Pipeline-Quality RNG & Chemical Bio-Methanol	Natural Gas Grids & Petrochemicals	45, 000 Tonnes
SKU-LBM-401	Engineered Structural HempWood Timber Billets	Dimensional 2 × 4/2 × 8 Lumber & Flooring	210, 000 Tonnes
SKU-LBM-402	Mineralized Pre-Cast Hempcrete Wall Blocks	Carbon-Negative Wall Building Envelopes	180, 000 Tonnes
SKU-LBM-403	Thermopertused Vapor-Permeable Insulation Batts	Cavity Wall Building Insulation	65, 000 Tonnes
SKU-LBM-404	Inoculated Agricultural Activated Bio-Char Pellets	Soil Sequestration & Bio-Fertilizers	25, 000 Tonnes
SKU-LBM-501	Hydrothermal EV Battery Carbon Nanosheets	Lithium/Sodium-Ion Anode Electrodes	15, 000 Tonnes
SKU-LBM-502	Twin-Screw Automotive Bioplastic Pellets (PP/PLA)	Injection Molded Auto Interior Panels	45, 000 Tonnes
SKU-LBM-503	Supercritical CO ₂ Cannabinoid Crude Extract	Pharmaceutical CBD/CBG Bioactives	2, 500 Tonnes
SKU-LBM-504	Epoxidized Hemp Seed Oil (EHSO / Hempoxies)	Non-BPA Bio-Epoxy Resins	28, 000 Tonnes
SKU-LBM-505	Bio-Phenalkamine Matrix Curing Hardeners	Structural Composite Hardeners	12, 000 Tonnes
SKU-LBM-506	3D Printable UV Photopolymers & DIW Pastes	Additive Manufacturing Resins	7, 500 Tonnes
SKU-LBM-601	Cold-Pressed Extra-Virgin Organic Seed Oil	Culinary Oils & Cosmetics	65, 000 Tonnes
SKU-LBM-602	70%+ High-Purity Hemp Protein Isolate Powder	Plant-Based Food Science Nutrition	75, 000 Tonnes
SKU-LBM-603	Centrifugally Dehulled Raw Organic Hemp Hearts	Edible Whole Human Nutrition	40, 000 Tonnes

5 Complete Operational SOP Master Register (Part I)

5.1 Upstream Agronomy & Field Operations

STANDARD OPERATING PROCEDURE #Soil Preparation, Organic Seeding and Growth Management:

LBM-SOP-010 **1. Purpose:** To govern soil preparation, organic seeding, and crop management across the 500,000-acre national farm network.

2. Instructions: Disc tillage, cultipacking, organic compost application (10 t/ha). Calibrate grain drills for 35 – 45 kg/ha seeding rate at 15 – 20 mm depth when soil temperature reaches 10°C. Rapid canopy closure (12 – 15 days) suppresses weeds naturally without synthetic chemicals.

3. QC Specs: Target plant density: 1.2 – 1.5 million plants/hectare.

STANDARD OPERATING PROCEDURE #Dual-Header Harvesting, Grain Separation and Field Retting:

LBM-SOP-011 **1. Purpose:** Executing simultaneous grain harvesting and stalk cutting, followed by controlled field retting.

2. Instructions: Deploy dual-header combines at 70% grain maturity. Top header threshes grain; lower sicklebar cuts stalks 10 cm high and lays swaths. Aerate grain to $\leq 9.0\%$ moisture. Field-ret swaths for 21–28 days; turn swaths at Day 14. If weather fails, execute Enzymatic Retting per Policy POL-LBM-003.

3. QC Specs: Stalk dry-down moisture prior to baling $\leq 12.0\%$.

STANDARD OPERATING PROCEDURE #Field Baling, Moisture Testing and Regional Spoke Transport:

LBM-SOP-012 **1. Purpose:** Baling retted dry stalks into high-density rectangular bales and transporting them to regional processing spokes.

2. Instructions: Probe swath moisture; prohibit baling if $> 12.0\%$. Compress into rectangular bales ($3' \times 4' \times 8'$) at density $\geq 180 \text{ kg/m}^3$. Bind with UV polypropylene twine; haul via flatbed trailers to regional spokes.

5.2 Midstream Decortication & CN Rail Freight

STANDARD OPERATING PROCEDURE #Primary Mechanical Decortication and Multi-Stream Fractionation:

LBM-SOP-100 **1. Purpose:** Decorticating dry stalks at regional spokes into clean bast fiber, woody hurd core, and micro-fines at 35.0 Tonnes/Hour.

2. Instructions: Feed bales onto intake conveyor. Inspect moisture via inline NIR (8.0 – 11.5%). De-string, pass stalks through fluted breaker rollers (3.0 mm gap) and twin scutching turbines (1, 350 RPM). Cyclone air-classify (20 m/s) into clean bast fiber, hurd core, and fine dust.

3. QC Specs: Bast fiber purity $\geq 97.0\%$; Hurd cleanliness $\leq 0.5\%$ residual fiber.

STANDARD OPERATING PROCEDURE #Railcar Loading, CN Rail Transport and Gordon Yard Freight Operations:

LBM-SOP-101 **1. Purpose:** Loading densified fiber bales and hurd pellets onto CN Rail unit trains for transport to Moncton.

2. Instructions: Load fiber bales into 60-foot boxcars (60 t/car). Pneumatically convey hurd pellets into covered hoppers (150 t/h). Assemble 100-car unit trains; transit via CN Rail to Gordon Yard in Moncton. Offload on private siding (3.5 km track) into receiving pits and central storage.

5.3 Tier 1: Hygiene, Paper, Packaging & Textiles

STANDARD OPERATING PROCEDURE #Organosolv Fluff Pulp for Diapers and Hygiene Products:

LBM-SOP-201 **1. Purpose:** Chemical-free organosolv pulping of decorticated bast fiber to produce ultra-absorbent, totally chlorine-free (TCF) fluff pulp.

2. Instructions: Cook bast fiber in 50/50 v/v ethanol-water liquor (175°C, 16.5 bar) for 65 minutes. Flash off ethanol (98.8% recovery). TCF bleach via O_3 and H_2O_2 . Defibrate into fluff pulp.

3. QC Specs: ISO Brightness $\geq 88.0\%$; Absorbency $\geq 12.5 \text{ g/g}$; Kappa Number < 2.0 .

STANDARD OPERATING PROCEDURE #Ultra-Soft Sanitary Tissue and Towel Stock Production:

LBM-SOP-202 **1. Purpose:** Manufacturing premium 2-ply ultra-soft bath tissue, facial tissue, and paper towels from blended bast and hurd pulp.

2. Instructions: Blend 70% bast pulp / 30% micro-hurd pulp. Refine to 28°SR. Inject onto crescent former fabric (1,800 m/min). Dry on Yankee drum (165°C, 6.0 bar steam). Crepe blade at 18% crepe ratio. Convert parent rolls into 2-ply tissue.

3. QC Specs: Basis Weight 14.5 g/m²/ply; MD Tensile $\geq 220 \text{ N/m}$; Softness Score ≥ 88.0 .

STANDARD OPERATING PROCEDURE #Unbleached Heavy Corrugated Containerboard and Molded Packaging:

LBM-SOP-203 **1. Purpose:** Manufacturing high-burst linerboard, fluted corrugating medium, and molded packaging from unbleached high-yield pulp.

2. Instructions: Refine coarse bast/hurd in disc refiners (30% consistency, 88% yield). Form web on Fourdrinier with 1.5% native starch size. Corrugate medium paper (150 g/m²) into C-flute rolls (175°C) and combine with linerboard (200 g/m²). Thermoform secondary slurry into molded packaging trays.

3. QC Specs: Mullen Bursting Strength ≥ 380 kPa; Edge Crush Test (ECT) ≥ 8.5 kN/m.

STANDARD OPERATING PROCEDURE #Enzymatic Cottonization and Ring-Spinning of Textile Yarns:

LBM-SOP-204 **1. Purpose:** Enzymatic degumming and cottonization of technical bast fiber to produce fine, spinnable textile fibers (1.5 – 2.5 dtex).

2. Instructions: Degum bast fiber with pectinase enzyme (0.8% v/v) at 55°C for 3.5 hours. Ultrasonic cavitation open (28 kHz) to 15 – 20 μ m filaments. Cut 38 mm staple. Blend 55% hemp / 45% organic cotton; ring-spin into high-tenacity yarn (Nm 30–60).

3. QC Specs: Fiber Tenacity ≥ 45.0 cN/tex; Elongation $\geq 3.2\%$; Impurity Content $< 0.2\%$.

5.4 Tier 2: Refined Bio-Energy, Petrochemicals & Gaseous Fuels**STANDARD OPERATING PROCEDURE #HEFA Hydro-treating for Sustainable Aviation Fuel (SAF) and Renewable Diesel:**

LBM-SOP-301 **1. Purpose:** Hydro-processing non-edible hemp seed oil and pyrolysis bio-oil into drop-in HEFA Sustainable Aviation Fuel (SAF) and Renewable Diesel (HDDR).

2. Instructions: Degum hemp oil with 0.1% H₃PO₄; silica filter metals (< 1 ppm). Hydro-deoxygenate in NiMo reactor (360°C, 100 bar) with green H₂. Isomerize over Pt/Zeolite catalyst (350°C, 80 bar). Distill into Bio-LPG (5%), SAF (35%), and Renewable Diesel (60%).

3. QC Specs: SAF ASTM D7566 Annex A2 (Freeze Pt $\leq -47.0^\circ\text{C}$); HDRD CAN/CGSB 3.517 (Cetane Index ≥ 75.0 , Sulfur < 2.0 ppm).

STANDARD OPERATING PROCEDURE #Polymerized Bio-Asphalt Highway Paving Binder:

LBM-SOP-302 **1. Purpose:** Formulating VOC-free, carbon-negative bio-asphalt binder from heavy pyrolytic bio-oils, lignin, and polymerized lipids.

2. Instructions: Charge heavy pyrolysis bio-oil/lignin tar into high-shear reactor (165°C). Add 4.5% SBS polymer, 2.0% rubber powder, and 0.2% elemental sulfur. Shear at 4,000 RPM for 90 minutes at 175°C. Discharge to insulated tankers (150°C).

3. QC Specs: Performance Grade AASHTO M320 PG 64-28; Mass Loss (RTFO) $< 0.5\%$.

STANDARD OPERATING PROCEDURE #Heavy Industrial Bio-Hydraulic Fluids and Lubricants:

LBM-SOP-303 **1. Purpose:** Manufacturing biodegradable industrial hydraulic oils, gear lubricants, and chainsaw bar oils from estolide-modified hemp seed lipids.

2. Instructions: React fatty acids with oleic acid over H₂SO₄-silica at 90°C to form estolides. Esterify with 2-ethylhexanol. Blend base oil (94.5%) with anti-wear (1.5%), extreme-pressure (2.0%), and pour-point depressants (2.0%).

3. QC Specs: ISO VG 46/68; Viscosity Index ≥ 210 ; OECD 301B Biodegradability $> 82.0\%$ in 28 days.

STANDARD OPERATING PROCEDURE #Bio-Methanol Synthesis and Renewable Natural Gas (RNG) Pipeline Injection:

LBM-SOP-304 **1. Purpose:** Synthesis of chemical-grade bio-methanol and upgrading CHP syngas to pipeline-quality Renewable Natural Gas (RNG).

2. Instructions: Clean syngas over ZnO beds. Route stream A through nickel methanation reactor (320°C, 30 bar) + 3-bed PSA unit to produce RNG ($\geq 97.5\%$ CH₄). Inject into natural gas pipelines at 40 bar. Route stream B through Cu/ZnO reactor (250°C, 80 bar) to synthesize bio-methanol (99.9% purity).

3. QC Specs: RNG Methane $\geq 97.5\%$; Oxygen $< 0.1\%$; Bio-Methanol Purity $\geq 99.9\%$ (IMPCA standard).

5.5 Tier 3: Structural Construction Materials & Bio-Char

STANDARD OPERATING PROCEDURE #High-Density Engineered Structural HempWood Timber:

LBM-SOP-401 1. Purpose: Compressing whole crushed stalks and hurd with soy-polyurethane resin to manufacture structural $2 \times 4/2 \times 8$ lumber and flooring.

2. Instructions: Fracture dry stalks into continuous parallel strands. Dip strand mats in 8.0% w/w soy-polyurethane eco-resin. Compress in 3,500-tonne hydraulic press at 145°C for 22 minutes (850 kg/m^3 density). Gang-rip cured billets into dimensional timber.

3. QC Specs: Density $850 \text{ kg/m}^3 \pm 30 \text{ kg/m}^3$; Janka Hardness $\geq 2,200 \text{ lbf}$; MOE $\geq 14,500 \text{ MPa}$; Formaldehyde 0.00 ppm .

STANDARD OPERATING PROCEDURE #Fire-Rated Mineralized Hempcrete Blocks and Wall Aggregate:

LBM-SOP-402 1. Purpose: Formulating carbon-negative, fire-rated hempcrete wall blocks and insulation aggregate from clean hurd core and lime binders.

2. Instructions: Dedust hurd. Spray with 2.0% aluminum sulfate/sodium silicate mineralization solution. Mix mineralized hurd (40%), hydrated lime (45%), metakaolin (10%), and hydraulic lime (5%) with water ($W/B = 0.75$). Hydraulic press into blocks (5.0 MPa). Cure in 5% CO_2 chamber (30°C , 75% RH) for 48 hours.

3. QC Specs: Dry Density $320 - 380 \text{ kg/m}^3$; $\lambda \leq 0.065 \text{ W/m} \cdot \text{K}$; ASTM E119 Class A1 2-Hour Fire Rating.

STANDARD OPERATING PROCEDURE #Thermoperfused Vapor-Permeable Bio-Insulation Batts:

LBM-SOP-403 1. Purpose: Manufacturing non-toxic, vapor-permeable thermal insulation batts from blended bast fiber for building wall cavities.

2. Instructions: Air-blend 85% bast fiber, 12% BICO binder fiber, and 3% ammonium phosphate. Form 3D web (35 kg/m^3). Thermofix in dual-belt oven at 165°C . Rotary-slit into 400 mm and 600 mm stud-bay cavity batts.

3. QC Specs: Thermal Resistance $R-3.7$ per inch ($\lambda = 0.038 \text{ W/m} \cdot \text{K}$); ASTM C1338 Zero Fungal Growth.

STANDARD OPERATING PROCEDURE #Pyrolyzed Bio-Char and Organic Soil Enhancer Pellets:

LBM-SOP-404 1. Purpose: Pyrolysis conversion of oversized hurd fines into activated agricultural bio-char for permanent carbon sequestration.

2. Instructions: Pyrolyze oversized hurd fines in continuous rotary kiln (550°C) under N_2 sweep for 35 min. Quench bio-char with water; inoculate with liquid compost extract (10% v/w). Extrude into 6.0 mm fertilizer pellets.

3. QC Specs: Fixed Carbon $\geq 82.0\%$; Specific Surface Area $\geq 320 \text{ m}^2/\text{g}$; IBI Class 1 Certified.

5.6 Tier 4: Advanced Automotive, Chemical, Hempoxies & 3D Printing

STANDARD OPERATING PROCEDURE #EV Battery Anode Carbon Nanosheet Synthesis:

LBM-SOP-501 1. Purpose: Synthesizing porous carbon nanosheets from organosolv lignin and hurd dust for lithium-ion and sodium-ion EV battery anodes.

2. Instructions: React organosolv lignin/hurd dust in water (1 : 10) in autoclave at 220°C , 25 bar for 4 hours. Dry-blend hydrochar with KOH (1 : 3 w/w). Pyrolyze in N_2 rotary furnace at 800°C for 120 minutes. 1.0 M HCl acid wash, deionized water rinse to neutral pH, vacuum dry (110°C), and jet-mill to $D_{50} = 5.0 \mu\text{m}$.

3. QC Specs: BET Surface Area $\geq 1,850 \text{ m}^2/\text{g}$; Reversible Capacity $\geq 460 \text{ mAh/g}$ at 0.1C; ICE $\geq 88.5\%$.

STANDARD OPERATING PROCEDURE #Automotive Structural Bio-Composite Thermoplastic Pellets:

LBM-SOP-502 1. Purpose: Compounding staple bast fiber with Polypropylene (PP) or PLA resin to produce injection molding pellets for automotive panels.

2. Instructions: Gravimetric dose 35% staple bast fiber (3 mm), 60% PP impact copolymer, and 5% MAPP coupling agent into twin-screw extruder ($L/D = 48 : 1$). Melt PP in Zones 1–3 (190°C). Force-feed fiber into Zone 4 via side-feeder. Degas at Zone 11 (-0.90 bar). Extrude, water quench (18°C), and strand cut into 3.0 mm pellets.

3. QC Specs: Tensile Modulus $\geq 4.5 \text{ GPa}$; Flexural Strength $\geq 78 \text{ MPa}$; HDT (1.8 MPa) $\geq 128^{\circ}\text{C}$.

STANDARD OPERATING PROCEDURE #Supercritical CO_2 Extraction of Pharmaceutical Cannabinoids:

LBM-SOP-503 1. Purpose: Extracting full-spectrum CBD, CBG, and terpenes from organic floral biomass using supercritical carbon dioxide.

2. Instructions: Decarboxylate floral biomass at 115°C for 45 min. Load 200 kg into 800 L vessel. Recirculate supercritical CO_2 (300 bar, 48°C) for 150 minutes. Precipitate waxes in Separator 1 (90 bar, 40°C); condense pure cannabinoid crude oil in Separator 2 (45 bar, 18°C). Recirculate CO_2 (99.5% recovery).

STANDARD OPERATING PROCEDURE #Synthesis of Epoxidized Hemp Seed Oil (EHSO) and Bio-Epoxy Resins (Hempoxies):

LBM-SOP-504 **1. Purpose:** Chemical synthesis of non-BPA Epoxidized Hemp Seed Oil (EHSO) bio-epoxy resins (Hempoxies) via in-situ epoxidation.

2. Instructions: Charge 1,000 kg hemp oil (Iodine Value ≥ 150), 85 kg formic acid (88%), and 50 kg Amberlite IR-120 catalyst into glass-lined reactor (450 RPM). Meter 450 kg of 50% H_2O_2 dropwise over 2.5 hours at 60 – 65°C. Hold at 65°C for 5 hours. Decant acid layer. Wash oil phase 3 times with 5% $NaHCO_3$ solution. Vacuum-flash at 80°C/20 mbar. Filter through 1 μm press.

3. QC Specs: Oxirane Oxygen $\geq 7.2\%$; Residual Iodine Value ≤ 10.0 g $I_2/100g$; Viscosity 450–650 mPa·s; EEW = 215–235 g/eq.

STANDARD OPERATING PROCEDURE #Formulating Non-BPA Bio-Epoxy Hardener and Structural Matrix Systems:

LBM-SOP-505 **1. Purpose:** Compounding EHSO bio-epoxy resin with bio-based hardeners to produce matrix resins for composites, adhesives, and coatings.

2. Instructions: Blend 70% EHSO resin, 30% epoxidized cardanol, and bio-phenalkamine hardener (1 : 0.95 ratio) at 40°C for 15 min. Vacuum degas (–0.95 bar). Infuse into fiber preforms via VARTM at 65°C. Gel at 80°C for 2 hours; post-cure at 140°C for 3 hours.

3. QC Specs: $T_g \geq 128^\circ C$; Tensile Strength ≥ 68 MPa; Bio-Based Content $\geq 82.5\%$ (ASTM D6866).

STANDARD OPERATING PROCEDURE #Formulation and Additive Manufacturing of 3D-Printable UV-Curable and DIW Hempoxy Resins:

LBM-SOP-506 **1. Purpose:** Chemical modification of EHSO into Acrylated Epoxidized Hemp Seed Oil (AESHO) for SLA/DLP photopolymers and DIW pastes.

2. Instructions: Line A (SLA/DLP): React EHSO with acrylic acid and TPP catalyst at 105°C for 6 hours to yield AESHO. Blend 75% AESHO, 23% isosorbide diacrylate, and 2.0% TPO photoinitiator under vacuum. Print on 405 nm DLP printers (2.5 s layer exposure). **Line B (DIW):** Compound 65% EHSO, 10% bio-hardener, 20% micro-hurd dust ($< 10 \mu m$), and 5% fumed silica in planetary mixer (1,200 RPM). Extrude via 6-axis robotic arm (1.2 mm nozzle, 45 mm/s). Thermal post-cure at 120°C for 2 hours.

3. QC Specs: DLP Viscosity 250 – 450 mPa·s; DLP Cured Tensile Strength ≥ 58 MPa; DIW Tensile Modulus ≥ 4.2 GPa; Bio-Content $\geq 88.0\%$.

5.7 Tier 5: Agrifood & Consumer Nutrition**STANDARD OPERATING PROCEDURE #Cold-Pressing and Filtration of Organic Hemp Seed Oil:**

LBM-SOP-601 **1. Purpose:** Cold-pressing cleaned grain to produce extra-virgin, unrefined hemp seed oil rich in Ω -3 and Ω -6 fatty acids.

2. Instructions: Clean raw grain to 99.9% purity. Feed into screw expeller press at 3.0 t/h keeping barrel temperature $\leq 42^\circ C$. Settle crude green oil under nitrogen blanket for 24 hours. Pump through 0.5 μm plate filter press. Package in amber glass or nitrogen-flushed totes.

3. QC Specs: Free Fatty Acids (FFA) $\leq 0.5\%$; Peroxide Value ≤ 1.5 meq/kg.

STANDARD OPERATING PROCEDURE #Cryogenic Milling and Air-Classification for 70%+ Organic Protein Isolate:

LBM-SOP-602 **1. Purpose:** Processing defatted seed cake into 70%+ high-purity organic hemp protein isolate powder.

2. Instructions: Cool defatted press cake (residual oil $< 8.0\%$) with liquid nitrogen to $-15^\circ C$ in pin mill. Mill to flour ($D_{90} < 35 \mu m$). Air-classify (4,800 RPM) to separate light protein isolate (70%+ protein) from heavy hulls. Package in nitrogen-flushed paper bags.

3. QC Specs: Protein Content $\geq 70.5\%$ (Dry basis); Particle Size 100% passing 100-mesh sieve ($< 150 \mu m$).

STANDARD OPERATING PROCEDURE #Mechanical Dehulling and Processing of Organic Hemp Hearts:

LBM-SOP-603 **1. Purpose:** De-hulling raw organic seed grain to produce soft, edible organic hemp seed hearts for human nutrition.

2. Instructions: Feed cleaned grain into centrifugal impact de-huller (2,200 RPM). Air-aspirate light outer hulls. Pass inner kernels through optical color sorter to eliminate specks. Package edible raw hemp hearts in vacuum-sealed nitrogen foil pouches.

5.8 Tier 6: Refinery Utilities & Energy Recovery

STANDARD OPERATING PROCEDURE #Bubbling Fluidized Bed CHP Gasification and 30 MW Power Export:

LBM-SOP-701 1. Purpose: Conversion of facility process scraps into high-pressure steam and 30 MW exported electricity via Bubbling Fluidized Bed (BFB) gasification.

2. Instructions: Convey non-manufacturable scraps (dust, extraction mash, lignin, chaff) to fuel silo (14 – 18% moisture). Meter into BFB Gasifier (880°C) via augers at 35.0 t/h. React with sub-stoichiometric primary air to form low-Btu syngas. Secondary combustion at 1,100°C. Route flue gas through HRSG boiler (45 bar, 450°C superheated steam). Extract 15 bar saturated steam (30 t/h) for plant dryers; direct remaining steam through condensing turbine to generate 45 MW gross electricity (15 MW plant load, **30 MW continuous exported to NB Power grid**). Clean flue gas via dry lime scrubber, carbon injection, and baghouse filter.

3. CEMS Limits: PM < 8.0 mg/Nm³; NO_x < 120 mg/Nm³; SO₂ < 20 mg/Nm³.

STANDARD OPERATING PROCEDURE #Industrial Closed-Loop Wastewater Treatment and Solvent Recovery:

LBM-SOP-702 1. Purpose: Treating process wastewater and recovering organic solvents (ethanol, CO₂, wash water) in a closed-loop zero-liquid-discharge (ZLD) system.

2. Instructions: Distill organosolv wash streams (85°C) to recover ethanol at 99.2% purity. Route high-COD wastewater to UASB anaerobic reactor (37°C) to generate biogas (CH₄) for CHP boilers. Pass treated effluent through Membrane Bioreactor and 2-stage Reverse Osmosis units. Recirculate purified water (< 10 µS/cm) to plant boilers. Evaporate brine concentrate to achieve Zero Liquid Discharge (ZLD).

6 Downstream End-User Transformation Policy (Tier B)

Downstream OEM partners transform Landry BioMAT's 26 core SKUs into over **50,000 commercial applications**:

DOWNSTREAM APPLICATION SOP #Automotive Interior Door Panel Injection Molding (Downstream OEM):

APP-SOP-101 Feedstock Input: Landry BioMAT SKU-LBM-502 (35% Bast Fiber / 60% PP Pellets).

Execution: Dry pellets at 80°C for 3 hours (< 0.05% moisture). Feed into 1,200-tonne injection molder (barrel zones 180°C – 195°C). Inject into cooled mold tool (35°C) at 85 bar. Robotically extract and ultrasonic trim.

Specs: Weight reduction –22% vs glass-filled PP; Flexural Modulus ≥ 4.2 GPa; FMVSS 302 flammability compliant.

DOWNSTREAM APPLICATION SOP #Wind Turbine Blade Root Composite Vacuum Infusion (Downstream OEM):

APP-SOP-201 Feedstock Inputs: Landry BioMAT SKU-LBM-504 (EHSO Resin) + SKU-LBM-505 (Bio-Hardener) + SKU-LBM-204 (Woven Bast Fabric).

Execution: Lay 24 plies of bi-axial woven fabric (600 g/m²) into 40-meter blade root mold. Seal vacuum bag and evacuate to –0.98 bar. Mix EHSO resin and bio-hardener at 1 : 0.95 ratio at 45°C. Infuse under vacuum (45 min). Thermal cure: gel at 80°C for 2 hours; post-cure at 135°C for 3 hours.

Specs: Interlaminar Shear Strength ≥ 52 MPa; T_g ≥ 130°C; Carbon Negative Footprint.

DOWNSTREAM APPLICATION SOP #Compostable Ultra-Absorbent Baby Diaper Assembly (Downstream OEM):

APP-SOP-301 Feedstock Input: Landry BioMAT SKU-LBM-201 (Organosolv TCF Fluff Pulp).

Execution: Defibrate fluff pulp rolls in rotary defibrator (3,600 RPM). Mix defibrated fiber (60%) with Bio-SAP (40%) in vacuum drum core former (12.5 g core). Encapsulate core between spunbond hemp top-sheet and PLA back-sheet. Hot-melt bio-adhesive seal at 140°C. Cut and fold at 800 diapers/min.

Specs: Retention Capacity ≥ 380 ml saline; 100% industrially compostable in 90 days.

DOWNSTREAM APPLICATION SOP #Patient-Specific Ankle-Foot Orthosis (AFO) SLA/DLP 3D Printing (Downstream OEM):

APP-SOP-401 Feedstock Input: Landry BioMAT SKU-LBM-506 (3D Printable Photopolymer UV Resin).

Execution: Slice patient 3D foot scan at 50 µm layer height. Fill DLP printer vat with SKU-LBM-506 resin heated to 35°C. Execute 3D printing using 405 nm UV LED engine (2.2 s layer exposure). Wash printed orthotic in bio-ethanol bath for 5 min; post-cure in 405 nm UV oven (60°C) for 20 min.

Specs: Flexural Strength ≥ 82 MPa; Shore D Hardness 80D; ISO 10993 biocompatible certified.

7 Phased Implementation Roadmap & Milestone Governance

Phase I: Site Engineering, Spokes and CHP Power (Months 01–12) Complete FEED engineering; secure NB Environment permits; build CN Gordon Yard rail siding (3.5 km); construct 4 regional decortication spokes; build 45 MW CHP power plant; sign 100,000-acre farmer contracts. → **Capital: \$650M CAD**

Phase II: Pulp, Tissue and Structural Wood (Months 12–24) Erect organosolv pulp mill, TCF bleaching towers, Yankee tissue machines, and 3,500-tonne hydraulic HempWood press lines; expand national farming network to 250,000 acres. → **Capital: \$850M CAD**

Phase III: HEFA Bio-Refinery and Infrastructure Materials (Months 24–36) Install HEFA hydro-treating reactors (NiMo/Pt-Zeolite catalysts), bio-asphalt polymerization tanks, and estolide lubricant blending lines; execute 30 MW power export connection to NB Power. → **Capital: \$780M CAD**

Phase IV: Advanced Materials, Hempoxies and Global Scaling (Months 36–48) Install EHSO epoxidation reactors, 3D printing photopolymer synthesis lines, and hydrothermal carbon nanosheet autoclaves; scale acreage to full 500,000 acres (2,000,000 dry tonnes/year); initiate global exports via the Port of Saint John and Port of Halifax. → **Capital: \$570M CAD**