Project Design Document (PDD)

Protocol: Isometric Biochar Production and Storage v1.2

Project ID: MAUI-505-BIO-001

Date: December 12, 2025

1. Project Setup

1.1 Essential Project Details

- **Project Name:** Maui 505 Bamboo Biochar Deployment
- **Project Proponent:** Maui 505 LLC
- **Project Scale:**
    - **Feedstock Volume:** 2,500 tonnes/year (Bamboo)
    - **Projected Output:** ~500-600 tonnes Biochar/year
    - **Estimated Credits:** ~1,000 CDRCs/year
- **Project Locations:**
    - **Provisioning & Prep:** 20.9211°N, -156.3051°W
    - **Pyrolysis Reactor:** 20.9211°N, -156.3087°W
    - **Storage (Waihe'e Farm):** 20.9350°N, -156.5100°W

1.2 Ownership & Legal

- **Feedstock Ownership:** Secured via *Biomass Sourcing Agreement (Tx: a1b2...)* with Bamboo Supplier Network.
- **Carbon Rights:** Contractually assigned to Maui 505 LLC via *Farm Contract Agreement (Tx: farm001c...)* executed July 1, 2024.
- **Right of Use:** Land use authorized for Waihe'e Farm application field (12.5 acres).

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2. Protocol & Monitoring Data

2.1 Uncertainty (Section 6.5)

- **Measurement Equipment:**
    - Feedstock weight verified via calibrated Weight Sensors (Tx: b2c3...) at prep location.
    - Finished biochar weight verified via NIST Handbook 44 certified scales (Tx: iso008ce...).
- **Lab Variance:** ASTM D5291 analysis conducted by ISO 17025 accredited lab. Uncertainty ±2% based on replicate sampling.

- **Deduction:** Conservative deduction applied to Gross Removals to account for sensor drift and lab variance.

2.2 Durability (Section 12 & Storage Module)

- **Storage Pathway:** Biochar Storage in Soil Environments.
- **Durability Quantification:**
    - **Stable Carbon Factor:** 0.89 kg CO2e / kg (Based on H:C ratio < 0.4).
    - **Pyrolysis Conditions:** 450°C at 1.2 atm pressure.
- **Lab Evidence:** *Biochar Lab Test Certificate (Tx: lab001bi...)* dated 2024-07-10 confirming 89% Carbon Content.

2.3 Reversals (Appendix I)

- **Risk Assessment:**
    - **Fire/Flood:** Low risk at Waihe'e Farm location.
    - **Human Activity:** Contractual obligation for no-till or low-till practices for 10 years.
- **Buffer Pool Contribution:** 2% (Risk Score 0 - Very Low Risk) deducted from Net Credits.

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3. Environmental & Social Impacts

3.1 Environmental & Social Safeguards (Section 5)

- **Pollutant Screening:**
    - *Environmental Safeguard Analysis (Tx: iso006is...)* conducted July 15, 2024.
    - **PAHs & Heavy Metals:** Confirmed below World Biochar Certificate (WBC) thresholds for soil application.
- **Air Quality:** Closed-loop pyrolysis system with CEMS ensures no fugitive dust or particulate issues during production.

3.2 Social Impact & Safety

- **Risk Assessment:** *Social Risk Assessment PDF (Tx: iso001so...)* confirms no dust inhalation risk for local residents.
- **Worker Safety:** PPE protocols enforced during bagging and application.

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4. Stakeholder Input Process

4.1 Stakeholder Engagement (Section 5.2.2.1)

- **Event:** Community Consultation
- **Date:** June 1, 2024 | 10:00 HST

- **Outcome:** Community approval granted. Mitigation plan for transport traffic filed.
- **Evidence:** *Signed Meeting Minutes (Tx: iso001st...)*.

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5. Pathway-Specific Requirements

5.1 Sampling Procedure (Section 8.3)

- **Strategy:** Method A (Sampling Every Batch) currently utilized.
- **Frequency:** Every production batch (approx. 1,800 lbs) is sampled prior to bagging.
- **Chain of Custody:** Samples tracked via blockchain hash *ASTM D5291 Lab Result (Tx: iso007as...)*.

5.2 Reactor Design Requirements (Section 9.2)

- **Vessel Compliance:** Reactor Pressure Vessel verified compliant with 2014/68/EU standards.
- **Documentation:** *Engineering Diagram Hash (Tx: iso003en...)* and *Maintenance Log (Tx: iso003ma...)* recorded on chain.
- **Operational Parameters:**
    - Target Temp: 450°C.
    - Target Pressure: 1.2 atm.
    - Residence Time: Continuous feed (4.5 hr runtime block).

5.3 Emissions Testing (Section 10)

- **Methodology: Option 1 - Direct Continuous Measurement.**
- **Equipment:** CEMS Analyzer installed on flue stack.
- **Gases Monitored:** CH4, N2O.
- **Results:** *CEMS Analyzer Log (Tx: iso005ce...)* shows negligible N2O.
- **Net Deduction:** -0.50 kg CO2e deducted for operational emissions.

5.4 Applicability (Section 4)

- **Feedstock Eligibility:** 100% Bamboo residue verified as waste product via *Biomass Sourcing Agreement (Tx: a1b2...)*. No economic displacement.
- **Storage:** Permanent soil amendment at Waihe'e Farm.

5.5 System Boundaries (Section 7)

- **Included:**
    - Feedstock Transport (Supplier -> Prep).
    - Feedstock Prep (Chipping/Drying).
    - Pyrolysis Operations (Energy + Direct Emissions).

    - Biochar Transport (Reactor -> Farm).
    - Soil Application (Tractor fuel).
- **Calculations:**
    - Transport Emissions: 2.47 kg CO2e (Delivery to farm).
    - Operational Emissions: 0.50 kg CO2e (CEMS).

5.6 Biochar Characterization

- **Physical:** Moisture content <10% (post-pyrolysis).
- **Chemical:** Carbon Content: 89%. pH: 8.2.
- **Stability:** High stability confirmed via proxy analysis (Temp/Residence Time/Feedstock).

5.7 Quantification (Section 8)

- **Batch ID:** Bamboo-B001
- **Material Amount:** 615 kg (Biochar)
- **Gross Removals:** 2,006.95 kg CO2e
- **Total Deductions:**
    - Transport: -2.47 kg CO2e
    - Operations: -0.50 kg CO2e
    - Buffer (2%): -40.13 kg CO2e
- **Net Creditable Removal: 1,963.85 kg CO2e** (Example batch calc).

5.8 Monitoring Requirements (Appendix II)

- **Plan:**
    - **Reactor Temp:** Continuous (Sensor: *e5f6...*)
    - **Reactor Pressure:** Continuous (Sensor: *pressure...*)
    - **Soil Conditions:** Soil Temp/Moisture sensors installed at Waihe'e Farm (Sensor: *a3b4...*).
    - **Sequestration:** Satellite NDVI monitoring weekly (Proof: *monitor0...*).

5.9 Mixing Pathway

- **Status:** N/A. Biochar applied as 100% broadcast spread (not mixed with compost prior to application). Mass verified via *Final Weight Certificate (Tx: b8c9...)* prior to loading.