River Refugium Project (RRP)

CERNUNNOS FOUNDATION

BRIGHT MEADOW GROUP

Systems Analysis and Solutions Consulting

Document Title:

Appendix F: Coppice Pole and Rod Production

RRP Document Number:

RRP0002-AppF

Version by date time group:

04 AUG 2026 0001

Cernunnos Foundation / Bright Meadow Group

Contact Information:

Email: robert@brightmeadowgroup.com

Website: www.cernunnosfoundation.com

RIVER REFUGIUM PROJECT Cernunnos Foundation Bright Meadow Group	**Appendix F — Coppice Pole and Rod Production** Document No: RRP0002-AppF │ Version: 1.0 │ 04 AUG 2026 0001 Status: Published — New document, issued against Series Version 2.0 │ Supersedes: None *Contact: robert@brightmeadowgroup.com │ www.cernunnosfoundation.com*

Abstract

Appendix F defines the coppice pole and rod production pathway — an RRP deployment mode in which captured nitrogen and phosphorus are converted into durable woody material rather than feed, fiber, or fuel. Where Appendix E produces a crop measured in days and constrained by what may enter an animal, this pathway produces a crop measured in years and constrained by what must survive in ground contact. The appendix specifies four species water-table bands, a fixed-datum aerated river rock channel with per-species bucket offset, a two-material design in which compost functions as root habitat and rounded rock as water corridor and behavioral containment boundary, a primary and secondary refugium structure, an inter-row duckweed alley operating as bioaccumulator and on-site compost source, tray-contained bamboo culture, a seven-step product ladder, and the containment argument that permits cultivation of species too aggressive to field-plant. It also names a structural gap: coppice is standing stock on multi-year rotation, and the RRP6 modular slot framework has no shape for a delayed-first-harvest asset. All growth, cycle, and yield figures in this document are provisional literature proxies drawn from open-field silviculture, and open-field figures are poor predictors of intensive aerated culture in either direction.

1. Position Within the RRP Framework

1.1 What This Pathway Is

The coppice pathway is a deployment mode of the River Refugium Project in which nutrient capture terminates in durable wood. Coppicing is the practice of cutting a broadleaf tree or shrub to its base and harvesting the regrowth on rotation. The stool is not killed by the cut; it responds to it. Managed stools remain productive for centuries, and the practice predates written silviculture across Europe and Asia.

RRP4 §3.7 already documents a willow coppice house producing structural biomass and char feedstock on rotational cutting cycles. This appendix takes that single greenhouse assignment and develops it into a full pathway: multiple species across a designed water-table gradient, a product ladder terminating in durable goods rather than in char, and a nutrient loop closed on site.

1.2 The Structural Mirror of Appendix E

Appendix E and Appendix F are deliberately opposite ends of the same architecture, and reading them together is the fastest way to understand what the framework actually does.

	Appendix E — Feed	**Appendix F — Coppice**
Turnover	Days to weeks	Years
Binding constraint	What may enter an animal	What survives in ground contact
Value driver	Protein content	Rot resistance and straightness
Carbon claim	Removal — contestable as relocation (E §12.3)	Sequestration — durable service life (§11)

Revenue layer	RRP12 Layer 1 and Layer 5	RRP12 Layer 1 and Layer 4
Financial shape	Turnover slot — fits RRP6 §5 with amendment	Standing stock — no existing shape (§12)

Table F-1. *Appendix E and Appendix F compared. The architecture is shared; the constraints are inverted.*

1.3 Relationship to Existing Series Documents

Document	Relationship to Appendix F
RRP3	Biofiltration architecture. Section 5 establishes a two-stage refugium structure — primary as governor, alley bed as secondary buffer.
RRP4 §3.7	Willow Coppice House. This appendix is the full development of that assignment.
RRP4 §3.9	Bamboo House. ⚠️ Requires correction — currently reads as textile fiber intent. Bamboo is positioned in this appendix as pole, structural, and char material. Textile routes are excluded per §7.4.
RRP5	HTC/HTL routing. Lignocellulosic coppice material is high-lignin and HTC-preferred. Receives all off-grade material at ladder position P-7.
RRP6 §5	Modular slot framework. Section 12 identifies a structural gap and proposes a standing-stock asset class rather than an additional slot type.
RRP8	Governing document for measurement standards. Section 5.4 adds two-station refugium verification.
RRP12	Revenue stack. This pathway is the series' cleanest Layer 4 sequestration case. See Section 11.
Appendix E	Structural mirror. The duckweed alley in Section 6 runs Class F-1 from Appendix E; its harvest is composted here rather than fed. Metal accumulation logic in E §8 applies to the compost loop.

2. The Durability Argument

Most biomass pathways end in combustion, conversion, or digestion — the carbon is released or transformed within months. Coppice is different in one respect that governs its entire economic and environmental case: the product is intended to last.

A black locust fence post is thirty years of stored carbon doing a job. The stool it was cut from is already growing the next one, and will still be doing so after the post is replaced.

This produces a value ladder driven by durability rather than by tonnage. A tonne of willow rod and a tonne of osage orange post are not the same product, are not sold into the same market, and do not carry the same carbon claim. Species selection in Section 3 is therefore governed first by rot resistance and form, and only second by growth rate.

It also produces the pathway's characteristic economic problem, addressed in Section 12: durable products require years of standing growth before the first harvest, and the RRP financial model is built around turnover.

3. Species Classes and Water-Table Bands

Coppice species differ enormously in root-zone saturation tolerance. Willow and alder are wetland trees. Black locust and osage orange rot at the collar in standing water. The species with the best ground-contact durability are, as a rule, the ones least willing to have wet feet.

In open-field silviculture that tension is resolved by site selection — you plant what the ground supports. This system resolves it by construction instead.

The water table is a designed variable, set per species. Species are not selected to fit the water; the water is set to fit the species.

Four bands are specified. Band assignment determines bucket offset per Section 4 and flux regime per §4.6.

Band	Representative Species	Root Zone Condition	Ground-Contact Durability	Rotation to Pole
W-1 Submerged Base	Willow (Salix), alder (Alnus), poplar and cottonwood (Populus), bamboo (tray culture, §7)	Base in flow; permanent saturation tolerated	Low — except alder, which is exceptionally durable when permanently submerged and poor in soil contact	1 yr rod; 3–5 yr pole ⚑
W-2 Wicking Contact	Hazel (Corylus), mulberry (Morus), plane and sycamore (Platanus), paulownia	Base above waterline; media in capillary contact; continuous supply	Low to moderate — craft, structure, and fodder rather than ground contact	5–10 yr craft rod ⚑
W-3 Flood and Drain	Sweet chestnut (Castanea), catalpa, hornbeam (Carpinus), oak (Quercus)	Intermittent charge with full drainage between; flux cycle per §4.6	Good — chestnut and catalpa are established durable post timbers	8–15 yr post ⚑
W-4 Dry Base, Irrigated	Black locust (Robinia pseudoacacia), osage orange (Maclura pomifera), honey locust (Gleditsia)	Container culture with metered feed; no standing contact at any point in cycle	Highest — the top of the untreated ground-contact durability list	5–10 yr post ⚑
⚑ **PROVISIONAL:** *Rotation figures are drawn from traditional open-field coppice silviculture and are poor predictors of intensive aerated hydroponic culture in either direction — growth may be substantially faster under continuous nutrient supply, or substantially different in wood density and therefore in durability. Density and durability under this culture method are entirely unmeasured and are a first-order pilot question per Section 15.*				

Table F-2. *Species water-table bands. Band assignment governs bucket offset and flux regime.*

3.1 Species Excluded

- Ash (Fraxinus) — excellent coppice historically, excluded from this framework on emerald ash borer grounds. Establishing plantings of a species under active continent-scale mortality is not defensible.
- Any species intended for textile conversion — see §7.4.

3.2 The Nitrogen-Fixer Irony

Black locust and alder fix atmospheric nitrogen through root symbionts. They are, respectively, the best post timber and the best submerged timber in the catalog — and both have reduced appetite for the nitrogen this system exists to remove.

This is stated plainly rather than hidden. The correct position is that W-1 and W-4 nitrogen fixers earn their place on product value, and the duckweed alley in Section 6 carries the nutrient removal claim for those rows. A layout weighted entirely toward fixers would produce excellent poles and a weak Layer 5 credit position.

4. System Architecture — Fixed Datum, Rock Base, Bucket Offset

The architecture is a direct application of established aquaponic media-bed practice to a woody perennial. Nothing in it is novel horticulture. What is novel is the scale, the source of the water, and the use of bucket geometry as a per-species tuning variable.

> **This Is a Media Bed With Trees In It**
>
> Anyone who has run an aquaponic media bed will recognize every element of Section 4. A fixed water level, gravel to the halfway point, heavy aeration, and a bell siphon to flux the bed are standard practice at hobby scale and have been for decades.
>
> The only substitutions are what is planted in it and where the water came from. That is the whole framework in one sentence, and this appendix is the clearest place in the series to see it.

4.1 The Channel — Fixed Table and Media Base

- Channel depth held at a fixed datum, nominally 8–12 inches. ⚑ PROVISIONAL — site- and layout-dependent.
- Approximately half the channel depth filled with inert rock media, creating both the structural base for bucket placement and the colonized surface area for the bacterial population described in Section 5.
- Heavy aeration throughout. This is not optional and is discussed in §4.3.
- Flow entering from the primary refugium, not from raw or settled water.

4.2 Media Specification — River Rock

Rounded river rock is the specified channel medium. The specification is not incidental and is not interchangeable with crushed aggregate of equivalent nominal size.

- Rounded particles pack with a high and stable void fraction. Angular crushed stone interlocks and wedges, progressively reducing void space and creating flow-blocking zones over time.
- Smooth faces do not shear or abrade roots that contact them, and do not injure hands during placement and maintenance.
- Fluvially weathered material is already chemically stable, having lost its reactive fines and soluble fraction to the transport that shaped it.
- Availability is highest in exactly the watersheds this framework targets, which is a material consideration when a single run requires hundreds of cubic yards.

Media must be chemically inert. Limestone, dolomite, and most crushed concrete will buffer pH upward and dissolve into the system over time, fighting the alkalinity draw of nitrification in an uncontrolled and progressively changing way.

River rock describes shape, not mineralogy. A limestone-country river produces limestone cobble. A dilute acid test on a representative sample before bulk purchase is a five-minute sourcing check that prevents a permanent, unrecoverable problem — once a hundred cubic yards of reactive rock is placed under a mature coppice stool, it is not coming out.

Acceptable mineralogy: basalt, granite, quartzite, and other silicate river gravels. Expanded shale, expanded clay, and lava rock are acceptable substitutes on inertness and surface area but lack the packing and handling characteristics of rounded fluvial material.

4.3 Aeration

A saturated rock bed with tree roots growing through it will develop anoxic dead zones without forced aeration. Anoxia in this bed produces two failures at once: root rot in the crop, and denitrification consuming the nitrate the system is meant to be capturing and selling.

Aeration is what keeps the channel a biofilter rather than a swamp. It is the single highest-consequence operating parameter in the pathway.

4.4 Bucket Offset — The Tuning Mechanism

Each tree is grown in a container of compost-based media placed in the channel. Rock is placed in the bottom of the container to a depth set by the species band, raising the root crown to the required height above the channel datum.

Two independent axes result. Channel depth sets the datum for the whole run; bucket fill sets the offset for the individual row. A W-4 black locust with eight inches of rock beneath its media and a W-1 willow with none can occupy the same channel at the same water level and both be correct.

The rock layer performs a second function that is easy to overlook. Every container develops a perched water table — capillary action holds a saturated zone at the base of the media regardless of how high the container sits. A coarse drainage layer breaks that capillary column, which is what allows a W-3 or W-4 species to sit in a flooded channel without its root collar remaining wet.

4.5 Two Materials, Two Jobs

The compost and the rock are not two grades of growing medium. They are functionally distinct and the distinction governs both root behavior and system design.

	Compost Media — Habitat	**River Rock — Corridor**
Function	Biological home for the tree — fungal networks, mycorrhizal association, aggregate structure, microfauna, moisture retention.	Water passage, oxygen delivery, colonized bacterial surface area, structural bearing for containers.
Root response	Proliferation. Fine-textured, moisture-holding, biologically active material is where a perennial invests root density.	Avoidance. Coarse, freely draining, low-nutrient material offers nothing worth investing in.
Design consequence	Must be sufficient in volume and quality to support a decades-long root relationship. Inert	Delivers water and air while functioning as the containment boundary described in §4.7–4.8.

	media alone is inadequate for a woody perennial.	

Table F-3. *Material roles. The containment mechanism in §4.7 is a direct consequence of the second row.*

A woody perennial is not an annual crop tolerating a substrate for one season. It builds a root system it expects to occupy for decades, and it builds that system where the biology is. Compost volume and quality are therefore first-order design parameters rather than an amendment detail.

4.6 Flux Cycling — Gas Exchange, Not Level Adjustment

Species with narrow saturation tolerance are served by cycling the effective water table rather than holding it, using bell siphons or timed pump control on zone circuits.

The mechanism is frequently misunderstood as a wet-dry preference. It is not. The drain stroke pulls atmosphere down through the media column; the flood stroke expels it. Flood-and-drain is a gas exchange pump for the root zone, and that is why species that should not tolerate a saturated bed survive comfortably in one.

The correct way to specify a cycle is therefore in air changes delivered to the root zone, not in wet hours and dry hours. ⚑ PROVISIONAL — no cycle specification is proposed in this version.

Two engineering notes. Bell siphons are extremely reliable at bed scale and become temperamental as bed volume grows — a large, slowly filling bed will trickle-run rather than siphon cleanly. Multiple siphons on a single bed, loop siphons, or timed pump control are the standard remedies. Zone-level circuits are required in any case, because W-3 chestnut and W-1 willow want different regimes and cannot share a circuit.

4.7 Root Containment

Containment in this architecture is behavioral rather than physical, and follows directly from the material distinction in §4.5.

Roots go where the material they want is. Compost is where they want to be; coarse rock is not.

A root growing out of a container and into a rounded rock bed encounters a medium with low nutrient availability, low moisture retention, and no fine structure to exploit. It does not build density there. The rock bed is not a wall the roots cannot cross — it is a medium they have no reason to occupy.

This is a more durable form of containment than a barrier. A physical liner develops a single failure point and is defeated at that point. A medium the roots find unattractive continues to be unattractive along its entire length and for the entire rotation.

4.8 Limits of Behavioral Containment

Two exceptions must be stated rather than assumed away.

- The W-1 band is a deliberate exception. Willow, alder, and poplar are wetland species that will readily colonize saturated coarse substrate, because for them it is attractive material. Escape is permitted in this band and does not compromise the design intent, since these species carry no offset requirement.
- Containment is a gradient, not a seal. A vigorous tree late in a long rotation, or one whose container media has dried or exhausted, will push into the rock searching for water. Behavioral containment weakens exactly when the container is failing to serve the tree.

The maintenance answer is root inspection and pruning at the base coincident with harvest. The top is already being cut on rotation; that is the natural moment to check the root zone, refresh container media, and remove any escape that has developed. Scheduling containment maintenance to the cutting cycle costs nothing beyond the inspection itself.

4.9 Media Bed Clogging — A Constraint on Upstream Stages

Suspended solids accumulate in gravel over time. In an annual vegetable bed this is managed by periodic cleanout. Under a coppice stool with eight years of root development through the same media, cleanout is not available.

The coppice pathway therefore imposes a harder solids specification on every stage upstream of it than any other pathway in the framework. Settling and primary refugium capture must be sized to a standard that keeps the channel bed serviceable across a full rotation, or the deployment must include a designed flush path and a bed rebuild scheduled into the rotation cycle.

5. Refugium Structure — Primary and Secondary

This pathway runs two biological conditioning stages with distinct roles. Conflating them is the most likely design error.

	Primary Refugium	Secondary — Alley Channel Bed
Role	Governor. Sets the conditions.	Buffer. Holds the conditions and polishes continuously.
Function	Mineralization, nitrification, ammonia knockdown, solids capture, alkalinity stabilization. Per Appendix E §5.	Continuous polishing of bucket leachate and residual load; stable colonized surface area beneath the crop.
Input	Settled raw water	Conditioned water only — never raw
Verification	Inlet and outlet per Appendix E §10.2	Channel outlet before return — the delta a nutrient credit is written against

Table F-4. *Two-stage refugium structure. The secondary bed functions only because it inherits stable inputs from the primary.*

5.1 Why the Order Cannot Be Reversed

The alley bed is a managed bacterial colony under fixed conditions, and that is precisely why it is reliable. Deliver raw or partially conditioned water into a rock bed with tree roots in it and the result is not a colony but the swamp described in §4.3 — shock loading, anoxic pocketing, and root loss.

The primary refugium is where conditions are established and measured. The alley bed is where they are held.

5.2 A Narrow Colony Is a Stable Colony

A bacterial population held under fixed conditions adapts to the band it is held in. That is the source of its reliability and also its limitation: it does not tolerate excursion well.

This constrains the flux cycles in §4.6. Root-zone gas exchange is tuned for the trees within limits set by the colony beneath them, and where the two conflict, the colony governs — a stressed tree recovers, and a crashed bed takes the entire channel with it.

5.3 Verification

Two measurement stations are required, additive to RRP8 Axis 2:

- Primary refugium inlet and outlet — ammonia down, nitrate up, alkalinity holding, turbidity and BOD reduced. Per Appendix E §10.2.
- Alley channel outlet, before return — the final water leaving the system, and the measurement against which any nutrient removal credit is documented.

Dissolved oxygen is measured continuously in the channel bed rather than at outlet alone. DO is the leading indicator for every failure mode in §4.3.

6. The Duckweed Alley and the Compost Loop

The open water between bucket rows is not empty. It runs Class F-1 floating aquatic macrophytes — the duckweed of Appendix E §3.1 — harvested and composted on site rather than fed.

6.1 Three Jobs

- Bulk nutrient capture from the conditioned flow, carrying the Layer 5 removal claim for rows planted to nitrogen-fixing species per §3.2.
- Interception of bucket leachate. Compost media exports dissolved organic carbon, ammonia, and fines. The alley sits directly downstream of every bucket in the row.
- Production of the nitrogen fraction of the on-site compost supply.

6.2 The Closed Loop

Duckweed harvest is wet and nitrogen-rich. Coppice brash, chip, and off-grade rod are dry and carbon-rich. Composted against each other on site, they produce the media that fills the buckets.

Water column → duckweed → compost → bucket media → tree → durable wood. Nothing in that chain leaves the system except the pole.

This also resolves the objection that a compost-media stage functions as a net nutrient exporter and undermines the removal accounting. The leachate never reaches the return — it passes through an aerated biofilm bed inches below the container and then through a duckweed stand engineered to consume exactly that fraction. Two biological barriers before the outlet.

6.3 The Light Curve

Duckweed is a full-sun crop, and the alley shades progressively as coppice regrowth advances toward harvest. Alley productivity is therefore not a constant but a curve — highest immediately after cutting, approaching zero in the final seasons before the next harvest.

Two design consequences. Alley width is a function of mature regrowth height rather than of equipment access alone. And in a rotation-block layout per Section 12, total alley yield across the site is far more stable than the yield of any single alley, because blocks are at different points in the curve simultaneously. ⚑ PROVISIONAL — the curve is unmeasured.

6.4 Metal Accumulation in Recycled Media

Duckweed is a bioaccumulator. That is why it is in the alley. Composting it back into permanent bucket media concentrates whatever it captured — year over year, into the root zone, and from there into the wood.

Appendix E §8 establishes the framework and it applies here without modification. Practical consequences specific to this pathway:

- Periodic media assay is required rather than optional. Indefinite recycling without measurement is not a defensible practice.
- Biochar or hydrochar sold as a soil amendment must be assayed. Char sold as fuel or industrial feedstock is far less constrained.
- Source-water metal loading should be characterized before a permanent recycling loop is established, because the loop is the mechanism that turns a low ambient concentration into a high media concentration over a decade.
- Wood in ground contact leaches. A post carrying accumulated metals into a pasture or garden soil is a defensible concern and should be tested rather than assumed away.

7. Bamboo — Tray Culture in the Alley

Bamboo occupies a distinct position: it is a giant grass rather than a coppicing broadleaf, harvested by culm cutting rather than by cutting to a stool, and it belongs in the alley rather than in a bucket.

7.1 Configuration

- Shallow trays set directly in the alley channel, sharing the water body with the duckweed stand.
- W-1 band — saturation is tolerated and the rhizome mass is comfortable in permanently wet media.
- Tray walls provide the rhizome containment that Section 9 requires.
- Harvest by selective culm cutting on maturity rather than by whole-clump removal, which puts bamboo on the same rotation and equipment logic as the coppice rows.

7.2 Alley Competition

Bamboo in the alley competes with duckweed for the same surface and the same light, and accelerates the shading curve described in §6.3. Alley allocation between bamboo trays and open duckweed water is a layout decision with direct consequences for both compost supply and nutrient removal performance.

7.3 Products

Structural culm, poles, stakes, split material for weaving and panel stock, and high-silica char feedstock. Culm strength and wall thickness under this culture method are unmeasured. ⚑ PROVISIONAL

7.4 Textile Routes Excluded

Most fabric marketed as bamboo is viscose rayon — chemically regenerated cellulose produced with carbon disulfide and caustic soda. The process is environmentally severe and its labeling has been the subject of regulatory enforcement action.

A pathway whose entire justification is environmental restoration cannot terminate in a chemical pulping operation. Bamboo in this framework is a pole, structural, and char crop. Textile conversion is out of scope.

RRP4 §3.9 currently describes the Bamboo House as producing high-strength fibers. That language reads as textile intent and should be corrected to structural and char material when the series is next revised.

8. Climate Envelope and Species Range

Coppice species are climate-bound in open-field culture. Sweet chestnut, paulownia, and most useful bamboos are limited to warm-temperate and subtropical ranges; northern deployments are restricted to the willow, alder, poplar, and hazel group.

A greenhouse envelope with shade management and controlled ventilation substantially widens that range, and the RRP already builds greenhouses. The relevant question is not whether the climate can be modified but what it costs to modify it.

8.1 The Waste Heat Argument

A node running HTC or HTL produces low-grade process heat as a byproduct — heat that RRP5 already treats as available for thermal self-sufficiency and that RRP12 books as Layer 6. Heat that would otherwise be rejected is a fundamentally different cost basis than purchased heat, and it changes what climate range is economically defensible.

Honest constraint: this is a cost-basis argument, not a free-energy argument. Holding a subtropical envelope through a northern winter is a large thermal load, and available waste heat is finite and seasonally mismatched with demand. Whether a given species range is reachable at a given latitude is an arithmetic question that this appendix does not answer. ⚑ PROVISIONAL — no net-energy analysis has been performed for extended-range coppice culture.

8.2 The Conservative Position

First deployments should plant to the ambient climate and treat range extension as a later, separately justified decision supported by measured thermal data from an operating node. The pathway does not require exotic species to be viable; willow and black locust are productive across most of the continental United States and cover the fast-rod and durable-post ends of the ladder between them.

9. Containment as a Governance Advantage

Several of the most useful species in this catalog are the ones nobody plants at scale, for reasons that have nothing to do with their utility.

- Black locust is aggressive outside its native range, spreading by seed and by root sucker, and is listed as invasive in numerous jurisdictions.
- Paulownia is fast, valuable, and a prolific seeder.
- Running bamboo spreads by rhizome and is regulated or restricted in several states.

Contained culture removes both spread mechanisms at once. The root zone is a container or a tray, which stops rhizome and sucker propagation. And a coppice rotation that cuts on a cycle shorter than reproductive maturity means the plant never flowers or seeds — the crop is harvested before it can reproduce.

This is the same structural argument as the Tier III position in Appendix E: a disqualifier in open conditions that stops applying inside a controlled system.

The argument is a governance asset as much as a horticultural one. It gives a permitting authority a defensible basis for allowing cultivation that would be refused in an open field, and it should be documented at the site level rather than asserted generally — containment method, rotation length, and reproductive maturity for each species planted, on the record.

10. Product Ladder and Disposition

The disposition doctrine of Appendix E applies without modification: material that fails a grade is reclassified, not lost. The ladder is ordered by value per unit mass, and every position is a real market.

Rung	Product	Typical Species	Notes
P-1	Craft rod and living structure	Hazel, willow, chestnut	Highest value per unit mass. Small volume, straightness-critical, relationship-based market.
P-2	Durable posts, vineyard stakes, hop poles	Black locust, osage orange, sweet chestnut, catalpa	The economic anchor of the pathway. Untreated durability substitutes for chemically treated softwood.
P-3	Garden stakes, bean poles, light structural	Most bands; bamboo culm	High volume, low unit value, steady regional demand.
P-4	Wattle, hurdle, basketry, woven panel	Willow, hazel, split bamboo	Absorbs material that fails straightness grade for P-1 through P-3.
P-5	Tree fodder	Mulberry, willow leaf	Cross-links directly to Appendix E. Subject to the full Appendix E feed qualification protocol without exception.
P-6	Firewood and charcoal	All	Historically the default coppice product. Here a mid-ladder fallback rather than a target.
P-7	HTC feedstock and biochar	All; brash and chip by default	Routed per RRP5. High lignin makes coppice material HTC-preferred. Terminal disposition for all off-grade material.

Table F-5. *Coppice product ladder. Brash and chip default to P-7 and supply the carbon fraction of the compost loop per §6.2.*

11. The Sequestration Position

Appendix E §12.3 concedes a real weakness: nitrogen embodied in feed re-enters the agricultural cycle as manure, and a credit protocol administrator is entitled to ask whether that constitutes removal or relocation.

This pathway does not have that problem.

- The carbon is fixed into lignified structural tissue and leaves the site as a durable product with a service life measured in decades.
- The nutrients are held in that tissue for the same period.
- Harvest does not kill the plant. A coppice stool regrows from the cut without replanting, without soil disturbance, and without re-establishment cost, and managed stools remain productive across timescales longer than the institutions managing them.

Harvest without mortality, on a stock that outlives its owners, producing a product that stores carbon while doing a job.

This maps to RRP12 Layer 4 rather than Layer 5 and is the cleanest sequestration claim available anywhere in the framework. It is stronger than the hydrochar permanence argument in one respect and weaker in another: service life is shorter than geological char permanence, but the product is sold into an existing market at a price that does not depend on a carbon protocol existing.

The claim requires documentation of product service life by category to be creditable, and no such documentation is proposed in this version. ⚑ PROVISIONAL — pending credit protocol negotiation.

12. Standing Stock — A Structural Gap in RRP6

RRP6 §5 defines greenhouse assignments as slot types characterized by turnover cycle, nutrient uptake profile, biomass output range, and HTC suitability. The longest existing slot, Type C, runs 12–24 weeks.

Coppice does not fit that shape, and the mismatch is not a matter of degree.

Property	Consequence for the Financial Model
Delayed first harvest	One to fifteen years from planting to first saleable product, depending on band and target rung. The model assumes revenue in the first modeled period.
Standing stock as asset	Uncut growth is an appreciating asset carried on the balance sheet, not inventory awaiting sale. No existing RRP financial construct represents this.
Rotation block structure	The site is planted in blocks and a fraction is cut each year, which annualizes revenue after the first full rotation and produces zero revenue before it.
Perpetual stool	Establishment cost is incurred once across an indefinite productive life. Amortization has no natural endpoint.
Coupled alley yield	Duckweed output varies with canopy stage per §6.3, so a secondary revenue stream is a function of the primary crop's rotation position.

Table F-6. *Why coppice is not a slow slot type.*

Proposed: RRP6 §5 is amended to define a standing-stock asset class alongside the existing turnover slot types, characterized by establishment cost, rotation length, block count, annualized steady-state yield, standing asset value, and stool productive life. This is a larger amendment than the Slot Type F addition proposed in Appendix E §13.3, and it affects the structure of the financial model rather than only its inputs. This appendix names the gap and does not close it.

13. Economics

13.1 The Substitution Case

The primary market argument at rung P-2 is substitution for chemically treated softwood. Treated posts carry preservative chemistry, a disposal problem at end of life, and restrictions on use in organic-certified agriculture. Naturally durable untreated hardwood carries none of those, and the organic and vineyard sectors pay a premium for it that reflects the difference.

Domestic supply of black locust and osage orange post material is thin and geographically concentrated. That is a market position, not just a product.

13.2 Revenue Stack Mapping

- Layer 1 — Biomass Production, realized as graded wood product sales across the P-1 to P-6 ladder.
- Layer 4 — Carbon Sequestration Credits, on durable service life per Section 11. The pathway's distinctive layer.
- Layer 5 — Nutrient Trading, carried substantially by the duckweed alley rather than by the trees, particularly on nitrogen-fixing rows.
- Layer 2 and Layer 7 — Hydrochar and productized side-streams from P-7 material and from compost surplus.

13.3 Cost Structure

- Establishment — channel construction, media purchase and placement, containers, and planting stock. Front-loaded and substantial, incurred once.
- Carrying cost through the pre-harvest years — the defining financial characteristic of the pathway and the reason it pairs naturally with a faster pathway on the same site.
- Aeration energy — continuous and non-negotiable per §4.3.
- Harvest labor — concentrated into short annual windows rather than continuous, which changes the labor model relative to Appendix E.
- Grading and sorting — the ladder in Section 10 only realizes value if material is actually graded to it.
- Bed maintenance and eventual rebuild per §4.9.

13.4 Pathway Pairing

Coppice and feed are complementary on the same site for a structural reason rather than a convenient one: the feed pathway produces revenue in weeks and the coppice pathway produces an appreciating asset over years. The alley is already running Class F-1, and a site electing to feed rather than compost a portion of that harvest is operating both pathways from one water train.

A site running coppice alone carries several years of cost before any revenue. A site running coppice with a feed alley carries considerably less.

14. Deployment Scales

14.1 Scale F-1 — Single Operator, Single Band

One channel run, one species band, willow or black locust, with a duckweed alley. Compost produced and used on site. Products at rungs P-3 and P-4 initially, reaching P-2 at first pole harvest. This is the configuration that will generate the first real growth-rate and wood-density data for the pathway, and it is deliberately narrow — a single band avoids the zone-circuit complexity of §4.6 entirely.

14.2 Scale F-2 — Multi-Band Run with Rotation Blocks

Multiple bands on zoned circuits, planted in rotation blocks so that cutting is annualized. Bamboo trays in the alley. Adds grading and sorting capability, compost production at scale, and a stable alley yield across the site per §6.3. This is the configuration at which the pathway supports a sales relationship rather than incidental disposal.

14.3 Scale F-3 — Integrated Node Assignment

Coppice operated as a standing-stock assignment within a full RRP node, drawing conditioned water from the node's biofiltration train in place of a dedicated primary refugium, and drawing greenhouse envelope and waste heat per Section 8. Requires the RRP6 standing-stock amendment in Section 12 before it can be financially modeled.

15. What the Pilot Must Prove

No field-validated data exists for coppice culture in this configuration. Open-field silviculture figures are the only available proxies and they are weak ones, because no traditional coppice has ever been grown with continuous nutrient supply and a designed root-zone gas exchange regime.

- Growth rate by band and species relative to open-field baseline — the first-order question, and the one that determines whether rotations shorten enough to change the financial shape in Section 12.
- Wood density and durability under intensive culture. Fast growth can reduce density, and density is what durability rests on. It is entirely possible to grow a locust post twice as fast and half as good, and this must be measured rather than assumed either way.
- Bucket offset validation — whether the rock-layer capillary break actually holds a W-4 root collar dry in a flooded channel across a full season.
- Flux cycle specification in root-zone air changes, by band.
- Channel bed solids accumulation rate, and the resulting upstream solids specification per §4.9.
- Behavioral containment performance — whether roots in fact decline to colonize rounded rock across a full rotation, by band and species, and how far containment degrades as container media ages.
- Void fraction retention in the channel bed over time, and whether rounded media holds its packing under root pressure and solids loading.
- Alley duckweed light curve across a full rotation, and total site yield under block rotation.
- Compost loop metal accumulation rate in recycled bucket media, and translocation into wood tissue.
- Nutrient uptake attribution between trees and alley, particularly on nitrogen-fixing rows.
- Bamboo culm strength and wall thickness under saturated tray culture.
- Stool survival and regrowth vigor after repeated cutting in containerized culture — the assumption that stools persist indefinitely is drawn from soil-grown practice and is not established here.

16. Provisional Status

⚑ **PROVISIONAL** — All growth rates, rotation lengths, durability ratings, yields, and channel dimensions in this appendix are drawn from open-field silviculture literature or are unestablished. Open-field figures are poor predictors of intensive aerated culture and may err in either direction. No figure in this document should be used as the basis for a capital commitment, a planting plan, a product specification, or a credit claim without site-specific validation. Durability in particular must not be assumed from species identity alone, because it depends on wood density and this culture method's effect on density is unmeasured.

Closing Note

Coppice is the oldest continuous silvicultural practice in the temperate world. It was abandoned not because it stopped working but because it does not fit an economy organized around annual returns and mechanized single-pass harvest.

What this appendix proposes is not a revival of the practice for its own sake. It is the observation that a system already moving nutrient-laden water through aerated media beds has, almost incidentally, built the ideal conditions for it — and that the resulting product stores carbon, resists rot without chemistry, regrows without replanting, and outlives everyone who planted it.

The trees do not care that the water came from a polluted river. They care that it arrives conditioned, aerated, and at the height they want it. That is an engineering problem, and it is solved.

Notes

Citations follow Chicago Notes-Bibliography style. Internal Bright Meadow Group / Cernunnos Foundation documents are cited by document title and year. Figures marked ⚑ are provisional proxies pending replacement by RRP pilot data per RRP8. Regulatory references are provided for orientation and do not constitute legal or regulatory advice.

1. *Bright Meadow Group, "RRP3 — Water Treatment & Biofiltration," Version 2.0. CF/BMG, 01 April 2026.*

2. *Bright Meadow Group, "RRP4 — Greenhouse & Biomass Module," Version 2.0, §3.7 Willow Coppice House and §3.9 Bamboo House. CF/BMG, 01 April 2026.*

3. *Bright Meadow Group, "RRP5 — HTC/HTL Thermochemical Processing," Version 2.0, §2 Feedstock Routing. CF/BMG, 01 April 2026.*

4. *Bright Meadow Group, "RRP6 — Economic & Deployment Model," Version 2.0, §5 Modular Slot Framework. CF/BMG, 01 April 2026.*

5. *Bright Meadow Group, "RRP8 — Verification, Monitoring & Performance Certification," Version 2.0. CF/BMG, 01 April 2026. Governing document for all measurement standards.*

6. *Bright Meadow Group, "RRP12 — Deployment Economics & Revenue Stack," Version 2.0. CF/BMG, 01 April 2026.*

7. *Bright Meadow Group, "RRPe — Appendix E: Agricultural Feed Production Pathway," Version 1.0. CF/BMG, 04 August 2026. Class F-1 species definition, refugium architecture, trace metal review framework.*

8. *Buckley, G.P., ed., Ecology and Management of Coppice Woodlands. Chapman & Hall, 1992. ⚑ Provisional — open-field rotation and stool longevity reference.*

9. *Evans, J., Silviculture of Broadleaved Woodland. Forestry Commission Bulletin 62, HMSO, 1984. ⚑ Provisional — species rotation reference.*

10. *U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Wood Handbook: Wood as an Engineering Material. General Technical Report FPL-GTR-190, 2010. Natural decay resistance classifications and density-durability relationship.*

11. *Keresztesi, B., "Black Locust: The Tree of Agriculture," Outlook on Agriculture 17 (1988): 77–85. ⚑ Provisional — growth and durability reference.*

12. *Vítková, M., Müllerová, J., Sádlo, J., Pergl, J., and Pyšek, P., "Black Locust (Robinia pseudoacacia) Beloved and Despised," Forest Ecology and Management 384 (2017): 287–302. Invasiveness and management reference for Section 9.*

13. *Volk, T.A., Abrahamson, L.P., Nowak, C.A., et al., "The Development of Short-Rotation Willow in the Northeastern United States for Bioenergy and Bioproducts," Biomass and Bioenergy 30 (2006): 715–727. ⚑ Provisional — short-rotation coppice yield reference.*

14. *U.S. Federal Trade Commission, enforcement actions and guidance regarding labeling of rayon produced from bamboo. Basis for the textile exclusion in §7.4.*

15. *Rakocy, J.E., Masser, M.P., and Losordo, T.M., "Recirculating Aquaculture Tank Production Systems: Aquaponics — Integrating Fish and Plant Culture." Southern Regional Aquaculture Center Publication 454, 2006. Media bed, flood-and-drain, and biofilter practice underlying Section 4.*

16. *Bright Meadow Group, "RRP Field Documentation Kit," Forms A, B, and C. CF/BMG, 2026.*