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LIQUID WASTE RECYCLING, LLC
an LJP Company

We Make Circular Simple ™

Land Application

The Environmentally Superior Way to Optimize Organic Waste Recycling

Why Land Application is *the* Environmentally Superior Way to Optimize Organic Waste Recycling

Wisconsin's Food Waste Management Landscape

SCALE

375,000 tons of food waste managed through land application annually in Wisconsin.

ENVIRONMENT

Lowest methane pathway with carbon sequestration of 0.5-0.6 t CO_2 e per hectare.

ECONOMICS

Capital costs of $50-150/ton vs. $500-1,500+ for anaerobic digestion.

CIRCULAR ECONOMY

Closes the loop between food production, consumption, and soil regeneration.

Wisconsin Context

Food Waste at a Glance

375K tons

Food waste land-applied annually.

44%

of WI food waste to land application.

1.2M

Dairy cows creating nutrient demand.

Wisconsin's existing land application infrastructure represents a proven, scalable foundation. The state ranks as a top-5 dairy state, agricultural demand aligns with organic waste supply, and Right to Farm laws provide regulatory protection.

Why Methane Matters

High Risk

Landfills: High methane generation over decades, 50-75% capture rates.

Moderate Risk

Anaerobic Digestion: Methane produced and mostly captured, but 2-8% fugitive emissions.

Lowest Risk

Land Application: Minimal methane by keeping material in oxygen-rich soils, avoiding CH formation.

Source: LJP Waste Solutions -- Land Application Methane Benefits

How Land Application Works

The Process of Nutrient Cycling

01 Collection

Organic waste collected from industrial and municipal sources

02 Processing

Material screened, tested, and nutrients analyzed

03 Application

Draghose injection places nutrients below soil surface

04 Decomposition

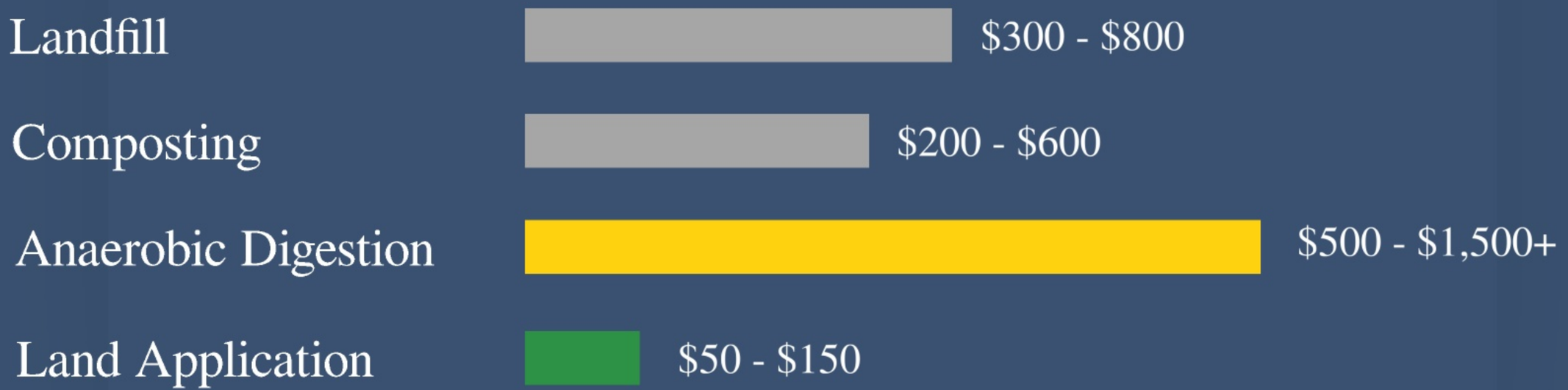
Aerobic soil microbes break down organics without methane

05 Nutrient Recycling

N, P, K returned to agricultural systems for crop growth

Economic Advantages

Capital Cost Comparison Per Ton of Annual Capacity



Land application costs 3-10x less per ton of capacity than any alternative technology, with faster deployment timelines and lower operating complexity.

Operating Cost Advantages

No Gas Handling Systems: Unlike digesters, no biogas upgrading or flares required.

Minimal Infrastructure: Equipment is mobile and reusable, no permanent processing facility needed.

No Energy-Intensive Processing: No heating, mixing, or pH control; material applied as-received.

Revenue from Nutrient Value: Applied organics replace $200-400+ per acre in synthetic fertilizer costs.

Land application delivers the lowest total cost of ownership across all food waste management pathways.

Environmental Benefits

Carbon Recycling: Organic carbon returned to soil supports structure, microbial health, and long-term productivity -- without creating a methane liability.

Nutrient Recovery: Nitrogen, phosphorus, and potassium recycled back into agricultural systems.

Soil Biology: Organic amendments feed beneficial soil microorganisms, improving soil health.

Land application builds soil organic carbon, sequestering 0.5 - 0.6 tCO_2e per hectare annually while improving soil structure, water retention, and microbial diversity.

Circular Economy Alignment

Closing the Loop on Food Waste

Food waste transformed into a productive soil amendment closes the loop between food production, consumption, and regeneration.

Organic Waste Generation

Food production and distribution create organic waste and byproducts.

Collection & Transport

Waste collected and transported to certified facilities.

Land Application

Land application returns nutrients to soil as a productive amendment.

Soil Regeneration & Crop Yields

Builds carbon, enhances soil, and supports future crop growth.

Anaerobic Digestion Limitations

Fugitive Methane Emissions: 2-8% typical emissions, undermining climate benefits.

Digestate Disposal: Requires management, often land-applied anyway.

High Capital Requirements: $500-1,500+ per ton capacity, 12-36 month development.

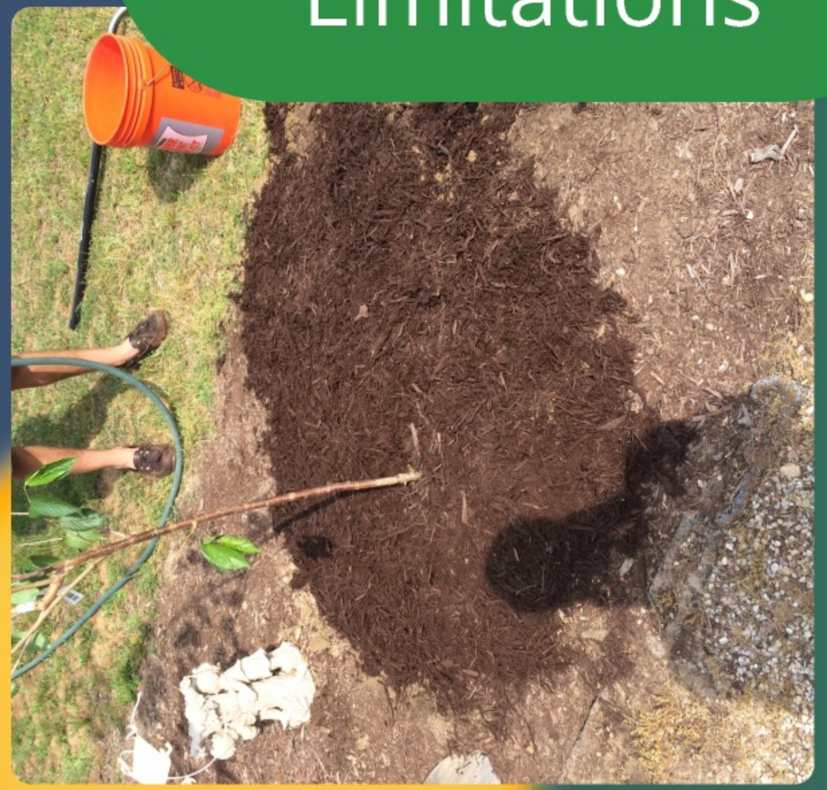
Scale Limitations: Economically viable only at large, consistent volumes.

Operational Complexity: Requires specialized staff, pH/temperature control, 24/7 monitoring.

Feedstock Sensitivity: Process degrades with variable waste, contamination can crash system.

Source: WI DNR/HDR Food Waste Evaluation (Feb 2026) — 122 AD facilities statewide, 37 accepting food waste

Composting Limitations



Significant Emissions: Generates methane and nitrous oxide during processing, 50-70% carbon lost.

Processing Timeline: 3-12 months from receipt to usable product, compared to days for land application.

Land Footprint: Requires large areas, often faces community opposition due to odor and truck traffic.

Lower Nutrient Value: Extended aerobic processing volatilizes nitrogen, reducing nutrient density.

Source: WI DNR/HDR Food Waste Evaluation (Feb 2026) — 286 licensed composting facilities, only 30 accepting food waste

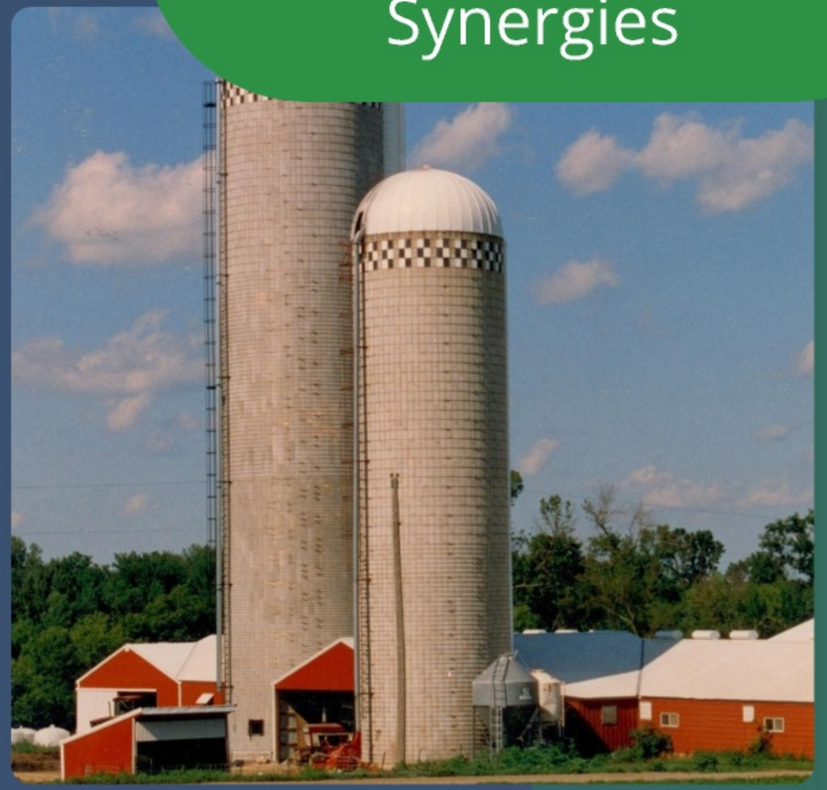
Scaling Advantage

No other technology matches land application's combination of proven scale, speed of deployment, and low capital requirements.

- Already handling 375,000 tons annually in Wisconsin — proven at scale.
- Mobile equipment deploys to any agricultural site without permanent infrastructure.
- Can scale capacity incrementally by adding application sites and equipment.
- No multi-year permitting or construction timelines — operational in weeks.
- Works with diverse waste streams: food processing, municipal biosolids, grease.
- Leverages Wisconsin's 14.3 million acres of agricultural land.

Source: WI DNR/HDR Food Waste Evaluation (Feb 2026) — landspreading manages 44% of all WI food waste

Wisconsin Agricultural Synergies



1.2M Dairy Cows: Creates consistent demand for nutrient-rich soil amendments across the state.

Established Infrastructure: Existing logistics networks simplify the addition of organic nutrient streams.

14.3M Acres Farmland: Vast tillable acreage provides ample application capacity.

Farmer Familiarity: Farmers have decades of experience with nutrient management and land application.

Source: WI DNR/HDR Food Waste Evaluation (Feb 2026) — WI home to 1.2M+ dairy cows, animal feed = 9% of food waste

Regulatory Protection

Wisconsin's Supportive Framework

Right to Farm laws protect established agricultural operations including land application.

Wisconsin DNR provides clear permitting pathways through WPDES and sanitary permits.

Nutrient Management Plans (NMP) ensure science-based application rates.

Setback distances from wells, waterways, and property boundaries.

Annual reporting and monitoring requirements ensure ongoing compliance and transparency.

Resource Conservation

Water Conservation: Land-applied organics improve soil water-holding capacity by 20-30%.

Landfill Capacity: Every ton diverted from landfill preserves finite disposal capacity.

Fertilizer Replacement: Each ton of food waste replaces $200-$400+ of synthetic fertilizer.

Energy Savings: No thermal processing or gas compression required, lowest energy footprint.

Life Cycle Assessment Comparison

Factor	Land Application	Anaerobic Digestion	Composting	Landfill
GHG Emissions	Lowest	Moderate	Moderate-High	Highest
Carbon Sequestration	Positive	Minimal	Low	None
Energy Consumption	Lowest	High	Moderate	Low
Capital Required	$50-150/ton	$500-1,500+/ton	$200-600/ton	$300-800/ton
Nutrient Recovery	Full N/P/K	Partial	Partial (N lost)	None
Time to Deploy	Weeks	12-36 months	3-6 months	Years

- GHG Emissions: Land Application delivers the lowest emissions.
- Carbon Sequestration: Land Application offers positive carbon sequestration.
- Energy Consumption: Land Application has the lowest energy footprint.
- Capital Required: Land Application is the most cost-effective at $50-150/ton.
- Nutrient Recovery: Land Application achieves full N/P/K recovery.
- Time to Deploy: Land Application can be operational in weeks.

Climate Mitigation Impact

Land Application's Key Contributions

100%

Methane Avoidance: Prevents methane creation entirely through aerobic decomposition.

0.5-0.6

Carbon Storage: tCO_2e per hectare sequestered annually, building soil carbon.

30-60%

Fertilizer Offset: Reduction in synthetic fertilizer use and associated industrial emissions.

Responsible Implementation

- Injection or rapid incorporation into soil to minimize odor and runoff.
- Application rates matched to crop nutrient uptake per Nutrient Management Plans.
- Seasonal restrictions: avoidance of frozen, snow-covered, or saturated soils.
- Setback distances from wells, waterways, and property boundaries.
- Regular soil and waste testing to monitor nutrient levels and contaminants.
- GPS-guided application for precise rate control and regular DNR reporting for compliance.

Multi-Criteria Decision Framework

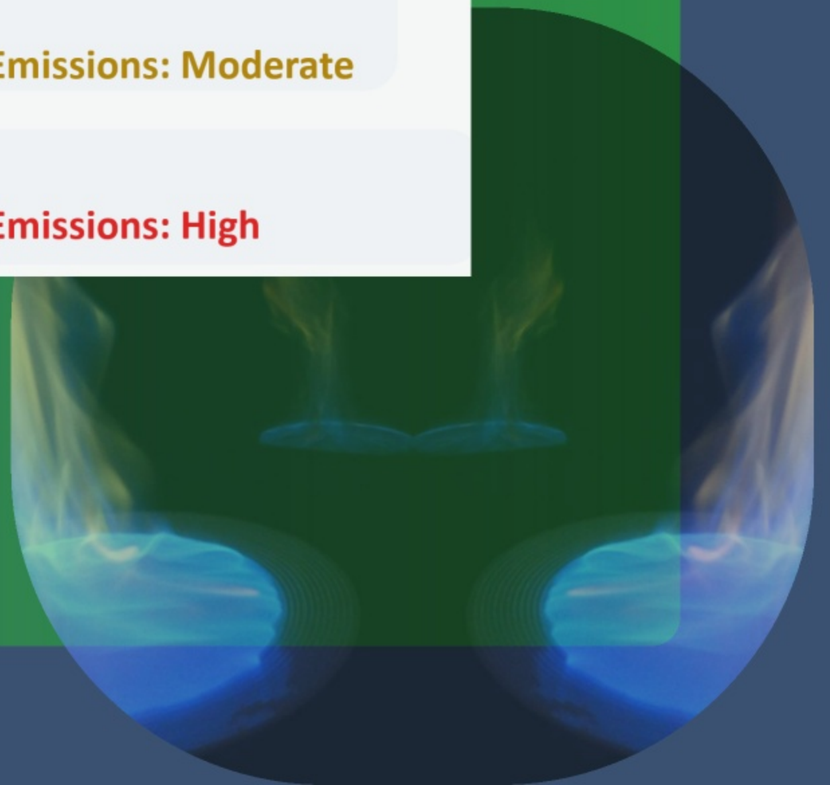
Criterion	Land App	AD	Composting	Landfill
Economic Viability	★★★★★	★★	★★★	★★★
Environmental Impact	★★★★★	★★★	★★★	★
Carbon Performance	★★★★★	★★★	★★	★
Scalability	★★★★★	★★	★★★	★★★★
Circular Economy	★★★★★	★★★	★★★★	★
Deployment Speed	★★★★★	★★	★★★	★★

- Economic Viability: Land Application consistently ranks highest.
- Environmental Impact: Land Application consistently ranks highest.
- Carbon Performance: Land Application consistently ranks highest.
- Scalability: Land Application consistently ranks highest.
- Circular Economy: Land Application consistently ranks highest.
- Deployment Speed: Land Application consistently ranks highest.

Methane Generation Comparison

Land Application	Generation: Minimal	Capture: N/A (not generated)	**Net Emissions: Near Zero**
Anaerobic Digestion	Generation: High (intentional)	Capture: 92-98% typical	**Net Emissions: Low / Mod**
Composting	Generation: Moderate	Capture: None	**Net Emissions: Moderate**
Landfill	Generation: High (decades)	Capture: 50-75%	**Net Emissions: High**

***The cleanest methane is the methane that never gets created. Land application minimizes methane by preventing its formation altgether.*



Recommended Food Waste Hierarchy

Land application should be elevated from a "disposal" perception to a recognized high-value recycling pathway.

Reduction & Rescue

Prioritize preventing waste and redistributing edible food.

Animal Feed & Land Application

Utilize organics for animal feed or direct soil application.

Processing (Composting, AD)

Convert non-applicable organics through controlled processing.

Landfill (Last Resort)

Highest methane generation; 50-75% capture, decades of emissions.

Conclusion -- Land Application vs Alternatives

Technology	Capital Cost	Methane Risk	Infrastructure	WI Scale	Assessment
Land Application	$50-150/ton	Near zero	Minimal	44% of WI food waste	**Lowest cost, lowest emissions, proven at scale**
Anaerobic Digestion	$500-1,500+/ton	2-8% fugitive	High complexity	37 of 122 accept food waste	Costly, complex, methane leakage risk
Composting	$200-600/ton	Moderate	Moderate	30 of 286 accept food waste	Capacity gaps, significant emissions
Landfill	$300-800/ton	High (decades)	Existing	900K+ tons in 2024	Largest single waste category, 50-75% capture

Land application manages 44% of Wisconsin's food waste at the lowest cost, with near-zero methane emissions and proven scalability across 14.3 million acres of agricultural land.

Source: WI DNR/HDR Food Waste Evaluation (Feb 2026) , LJP360, ReFED Insights Engine

Contact Us

1-888-558-9611 | sales@ulwrllc.com
715 Morgan St. | PO Box 99 | Clyman, WI

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