Economic Impact:
Turkey Hill Clean Water Partnership

LANCASTER COUNTY, PA
Economic Development Company
CENTER FOR REGIONAL ANALYSIS

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ENVIRONMENTAL FINANCE CENTER

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Introduction

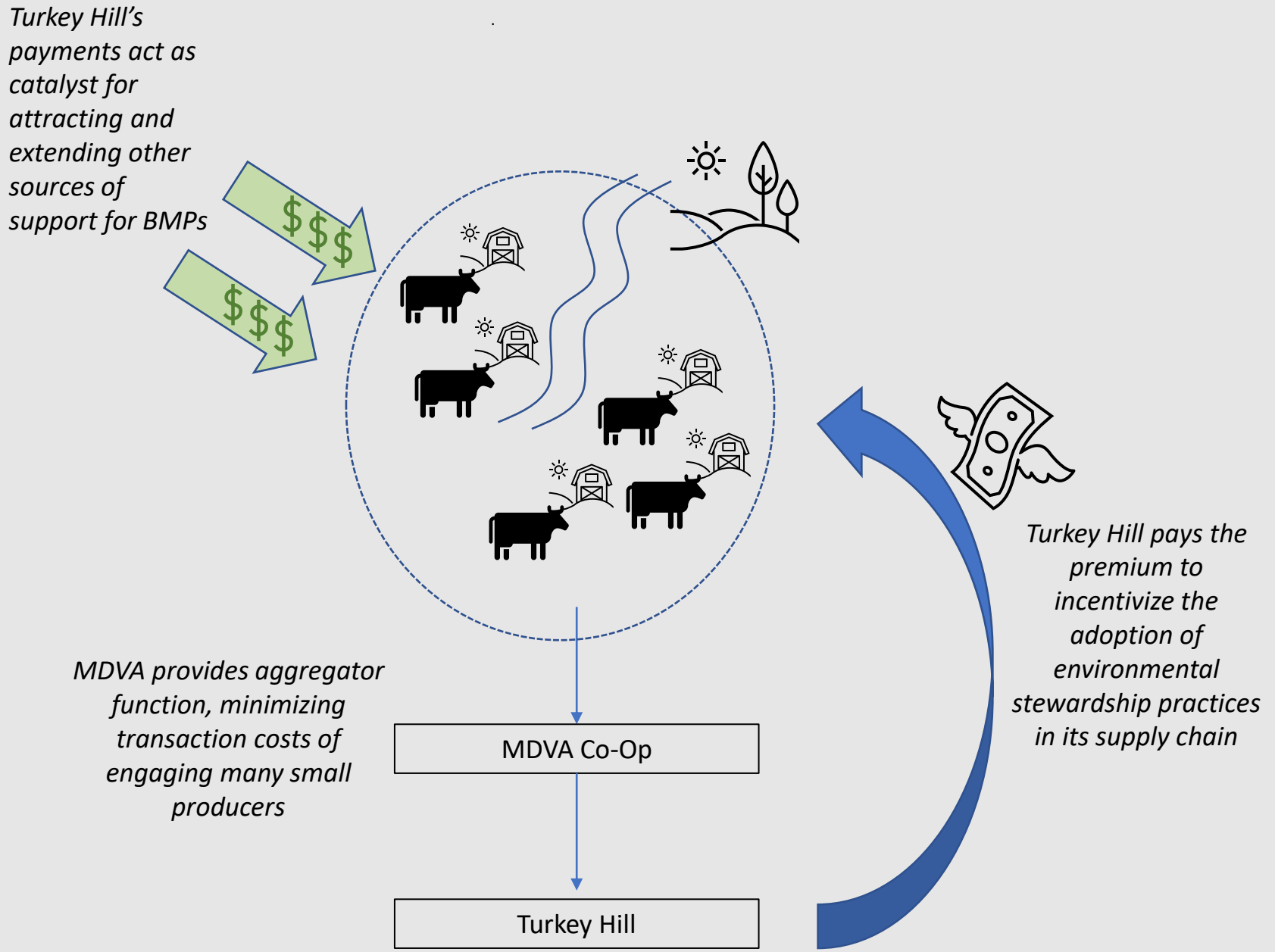
Since 2018, the Turkey Hill Clean Water Partnership has made waves in the agricultural industry; incentivizing farmers to get involved in conservation and elevating Turkey Hill's supply chain.

This groundbreaking partnership has a monumental impact on the Lancaster community, the Chesapeake Bay watershed, and beyond.

This report documents the value of these investments to produce environmental benefits.

Model for Supply Chain Environmental Stewardship

The Turkey Hill Clean Water Partnership focuses on incentives along the supply chain.



Dairy's Commitment to Environmental Stewardship

The dairy community is committed to conserving natural resources. There are 2050 goals that support making dairy an "environmental solution" by taking actions where U.S. Dairy collectively can have the greatest impact:

- *Achieving GHG neutrality.*
- *Optimizing water use while maximizing recycling.*
- *Improving water quality by optimizing utilization of manure and nutrients.*

The dairy industry recognizes the value of being able to speak to stewardship goals and taking action to combat climate change and watershed health – for the long-term viability of the industry, as well as the credibility of being a good corporate citizen.

Manure and nutrient management are a central tenant of the industry's 2050 goals. In watersheds, like the Chesapeake Bay, the relationship between nutrient management and water quality is well established. Its relationship with carbon management is emerging.

U.S. Dairy's Net Zero initiative is still evolving in implementation and integration into on-the-ground practice change. However, this latter effort is attracting attention and gaining traction in new funding streams that promoting best practices and advance the science supporting them.

Dairy's Commitment to Environmental Stewardship

New efforts to track metrics and an endorsed third-party verification protocol will offer data that substantiates success stories.

Updated in 2020, the National Dairy Farmers Assuring Responsible Management (FARM)™ Program's second-party evaluation, which 78% of U.S. cooperatives and producers participate in, includes an assessment of written nutrient-management plans, but was not inclusive of specific data points in describing success stories.

These efforts to manage environmental impact reflect state-of-the-art practice. U.S. Dairy's efforts across geographies and scales involve specific metrics, third-party verification and the review and endorsement of World Resources Institute.

Other recognized leaders in this space, including Nestle and TNC, are also supportive. Tracking and reporting progress is an important component in demonstrating success. The first report, still a few years off, is scheduled for release in 2025.

Practices to Match the Industry

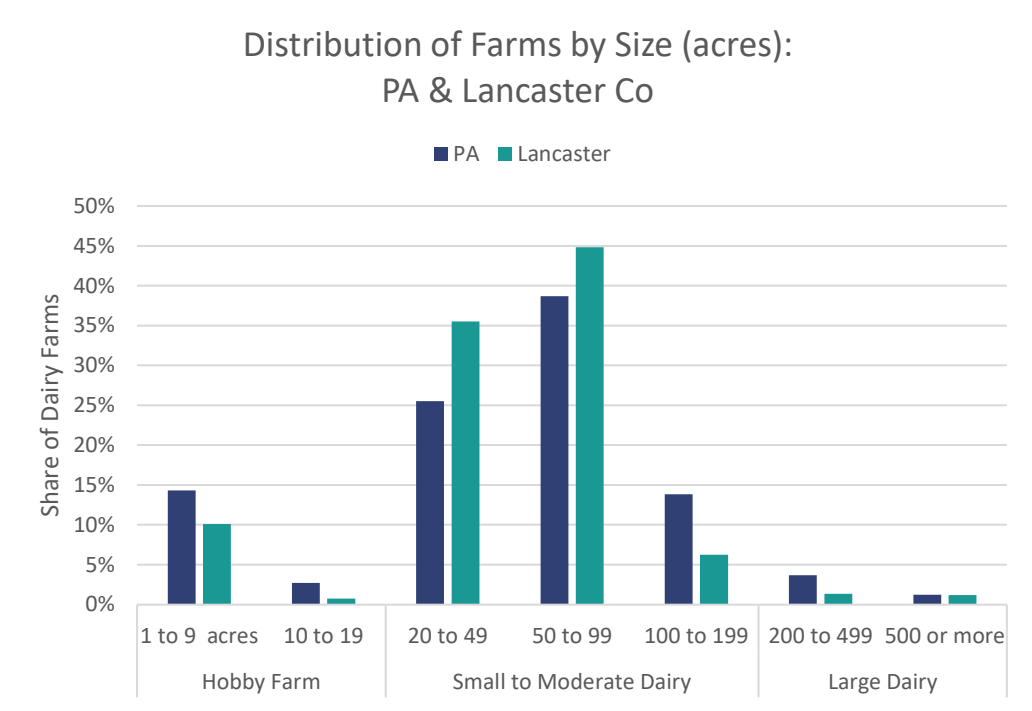
Realizing meaningful benefits requires tailoring practices and incentives to operational scale.

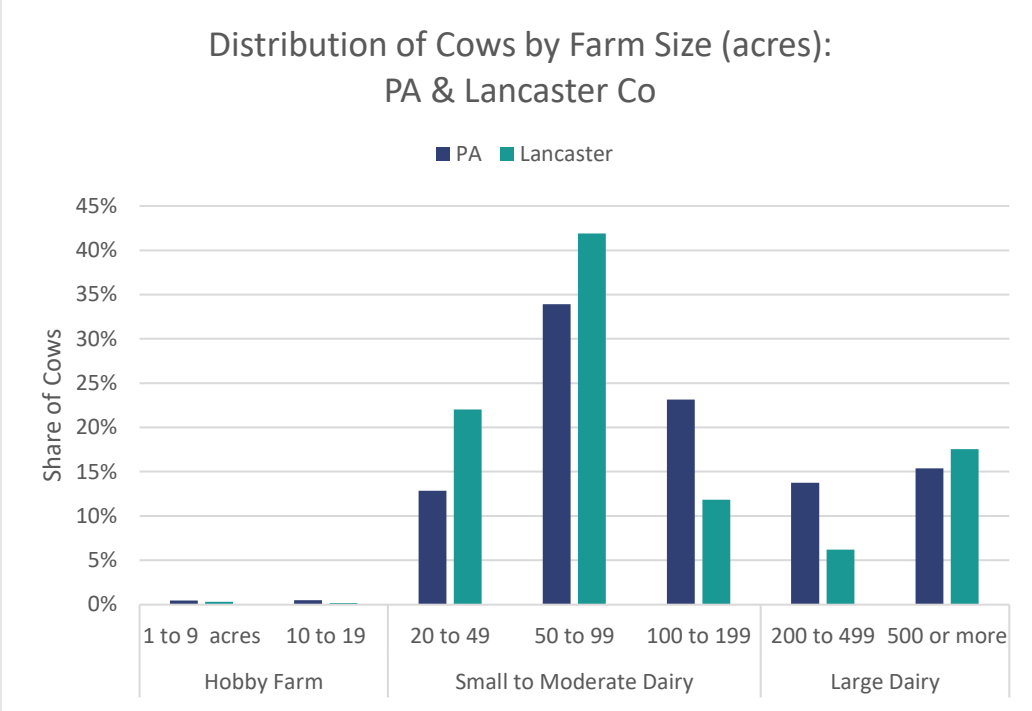
The Turkey Hill Clean Water Partnership covers dairy farms in the eastern part of Pennsylvania, Maryland and Virginia. These are key states for cow's milk, and Pennsylvania is the 6th largest producer of milk based on sales.

These dairy farms are unique from other parts of the U.S. in their scale and mix of operations. They tend to be smaller, and in some counties, such as Lancaster County, a sizeable share are also operated by Plain Sect, which alters some practices.

Adapting BMPs and investments to meet the scale of operations are important to achieving measurable benefits.

Practices to Match the Industry – Small-Scale Dairies





Lancaster County dairy operations are more concentrated in small- to moderate-sized dairy farms, which has implications for the suite of BMP that can be cost-effective.

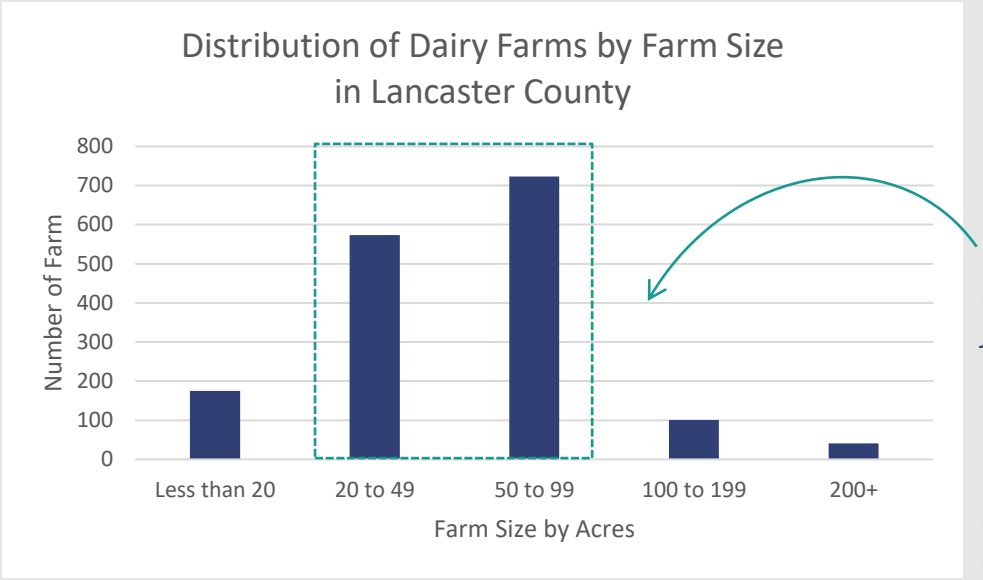
Lancaster County dairy operations have a larger concentration of cow in small- to moderate-sized dairy farms, suggesting that their environmental impacts are more concentrated.

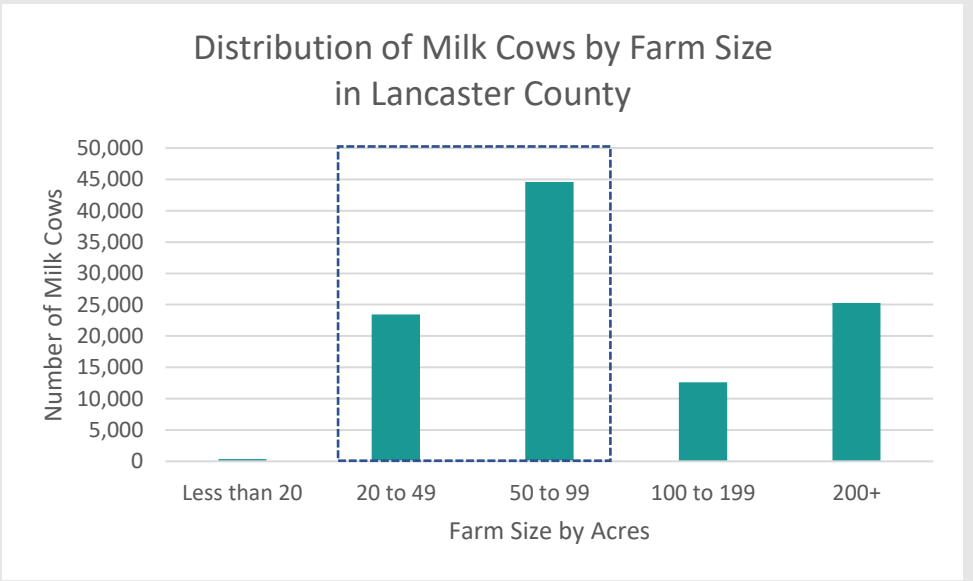
Practices to Match the Industry - Milk Coop to reach small dairies

Cooperatives, like MDVA, provide a critical aggregator role that facilitates the incentive signal.

MDVA has around 260 dairy farms that are concentrated in the scale of farms that represent the most significant segment of the industry with respect to environmental impacts.

This means that the coop likely has the deepest reach into the dairy industry in the County.





MDVA's members largely reflect dairy farms of these scales.

This segment of the dairy industry manages the largest share of milk cows, positioning it to be most impactful for reducing nutrient loads and other adverse environmental impacts.

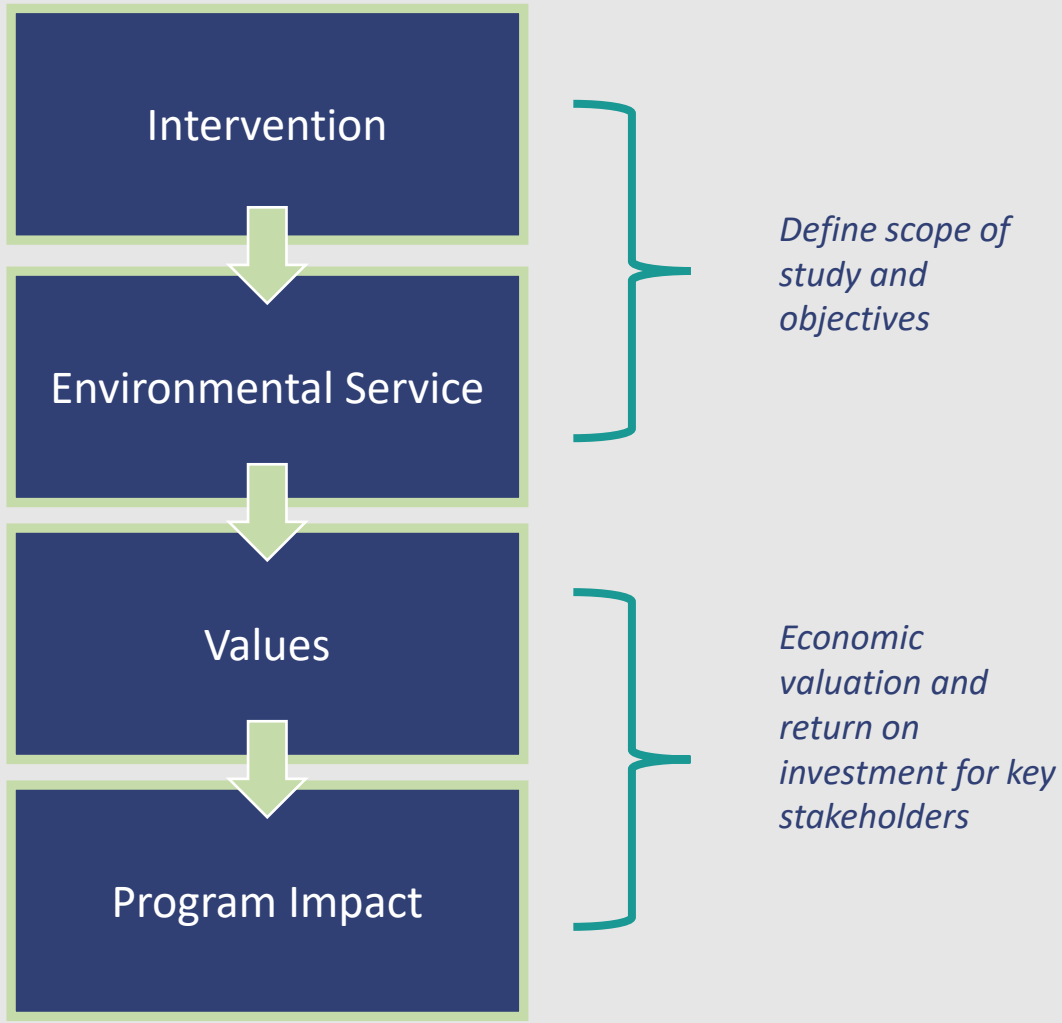
ROI Framework to Evaluate the Economic Impact

Economic impact uses a Return-On-Investment framework that allows the return to be calculated from different stakeholder perspectives.

In this analysis, the intervention is focused on Lancaster County dairy farms in the MDVA and the environmental service is nutrient reductions, as measured by nitrogen.

The values reflect:

- premium to producers
- investment in BMPs and
- benefits to society through improved environmental quality.



Economic Impact of the Turkey Hill Clean Water Partnership

To estimate the total economic impact of the Turkey Hill Clean Water Partnership, this report scales up current implementation levels to reflect 100% compliance and implementation of BMPs that would be contained in a nutrient management plan.

Full implementation is defined as:

- 260 dairy farms in Lancaster County participating
- Minimum of manure management including barnyard runoff control and/or covered waste storage structures at all dairies.

Economic Impact of the Turkey Hill Clean Water Partnership

This framing of full implementation does not represent the full complexity and range of BMPs that could be adopted at dairy farms. It is intentionally simplistic, making the analysis tractable and conservatively estimating both costs and benefits.

It also focuses on nutrient management as it relates to water quality. This narrow focus is not meant to discount the wide array of co-benefits stemming from these practices or opportunities to address other impacts, such as GHG, at dairy farms.

However, this leveraging of funds is a key component of the return on investment to a supplier incentivized program. The practical reality of current resources available to dairy farms focuses on conservation of land and water resources through land management and nutrient application.

Focus on Manure Management

Focus on practices that best reflect the characteristics of the targeted operations.

Best management practices (BMPs) available to dairy farms are varied. A review of information provided by the Alliance for the Chesapeake Bay demonstrates 25 different BMPs on 16 dairy farms in Lancaster County. The BMPs includes grazing practice changes, fencing, and plantings, in addition to waste storage structures and waste management systems.

Waste storage structures, closely followed by addressing high use areas, were implemented on nearly every farm, making them the most common BMPs. The nearly universal use of these BMPs aligns with the intensive system that comes with the smaller-scale dairy farms characterizing Lancaster County.

It also reflects the value proposition of manure as a useful byproduct that when effectively managed can help dairy operations meet their on-farm nutrient needs without contributing to nutrients loads in ground water and surface water.

Focus on Manure Management

Waste storage structures closely followed by addressing high use areas were implemented at nearly all of the farms, making them the most common BMPs.

NRCS code	BMP name	Cost per Farm			Frequency of Use*
		Average	Minimum	Maximum	
PA313	Waste storage structure	$65,500	$5,600	$202,000	88%
PA561	High Use Area	$27,300	$1,600	$72,000	81%
PA620	Underground outlet	$9,000	$500	$33,600	81%
PA634	Waste transfer system	$21,200	$6,100	$89,100	75%
PA367	Roofs and covers	$56,600	$20,800	$121,500	56%
PA484	Mulching	$2,000	$300	$9,100	56%
PA575	Animal trail and walkway	$4,800	$200	$17,400	56%
PA558	Roof runoff structure	$4,100	$2,200	$8,100	44%
PA342	Critical area planting	$300	$30	$700	25%
PA382	Safety Fence	$7,100	$2,700	$11,300	25%
PA500	Obstruction removal	$9,900	$2,800	$17,000	25%
PA533	Pumping Plant	$18,400	$3,000	$38,000	25%
PA560	Access Road	$10,700	$5,700	$17,600	25%
PA606	Subsurface drain	$5,600	$800	$17,100	25%
PA412	Grassed Waterway	$2,800	$700	$4,500	19%
PA587	Structure for water control	$2,800	$600	$5,900	19%
PA632	Waste Facility Separation	$50,700	$3,700	$131,100	19%
PA468	Lined waterway or outlet	$7,200	$2,100	$12,200	13%
PA512	Forage and biomass planting	$1,700	$1,200	$2,200	13%
PA614	Watering facility	$2,400	$300	$4,500	13%
PA391	Riparian Forest Buffer	$4,000	$4,000	$4,000	6%
PA516	Livestock pipeline	$1,400	$1,400	$1,400	6%
PA528	Prescribeed grazing	$1,600	$1,600	$1,600	6%
PA578	Stream Crossing	$2,500	$2,500	$2,500	6%
PA590	Nutrient Management Plan	$2,300	$2,300	$2,300	6%
PA635	Vegetated treatment area	$2,900	$2,900	$2,900	6%

*Based on review of 16 farms. Frequency does not sum to 100%, because one farm can have several BMPs.

Total on Farm Investments

Per-farm and waste manure storage BMP costs varied widely across sampled farms.

Based on a sample from the Alliance for the Chesapeake Bay, dairy farms in Lancaster County implemented an average of 8 BMPs. The median per-farm investment for the BMPs was $153,000.

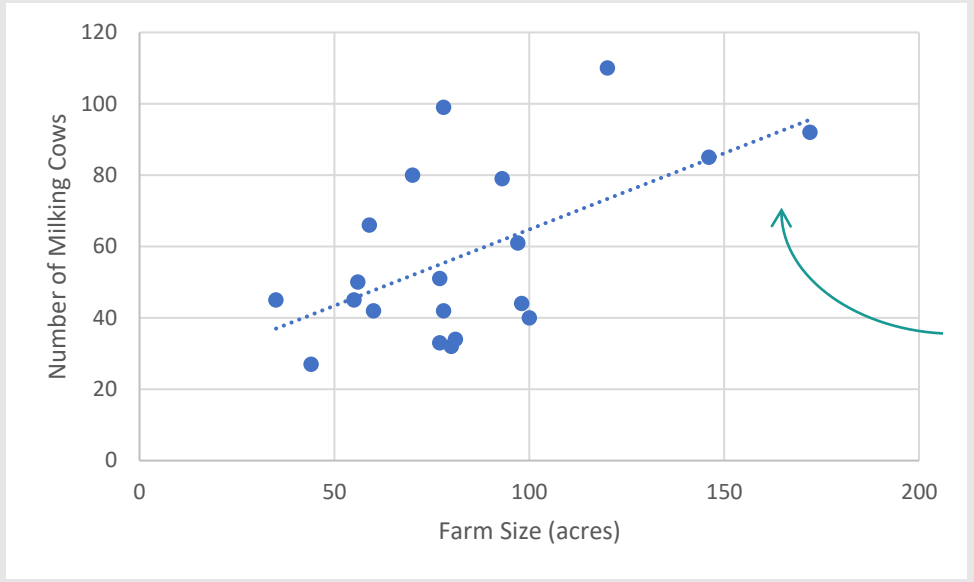
The BMP costs per farm was wide-ranging. The smallest was $14,000; the largest was $381,000. While the number of BMPs and total BMP investment did not track closely with the farm size or number of cows, the largest milk producers tended to have larger BMP investments.

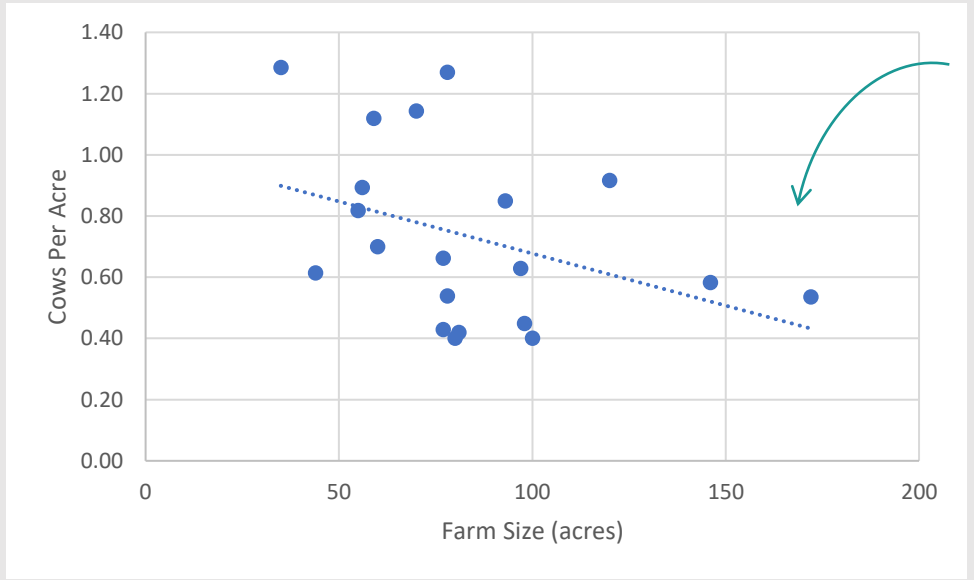
At minimum, each suite of BMPs included manure waste storage. The average cost for waste storage was $65,500, but the range $5,600 to $202,000 per farm.

Cost Drivers – Supply Chain versus Traditional Approaches

The incentive payments are paid based on milk production. This basis for incentives and costs differs from traditional approaches to reducing pollutant loads. Programs like NRCS and other conservation programs tend to pay for practices or on a per farm basis.

In the case of dairy farms, nutrient loads are linked to cows. Preliminary analysis shows that the intensity of cows and production are highly variable and farm acres does not serve as strong indicator of costs.





As farm acres increase, the number of cows also increases. But, the intensity of cows per acre falls.

This suggests the return on incentive payments can be higher on smaller farms.

Premium for Dairy Farms

While premium payments are not sufficient to directly pay for BMPs, they serve as a catalyst attracting technical assistance and access to other funding to expand on-farm BMP implementation.

With an estimated 260 Lancaster County dairy farmers in Turkey Hill's supply chain, the total cost of the premium would be roughly $180,000 per year. This estimate reflects $0.05 per 100 lbs paid for over 360 million pounds of milk. The premium increases the cost to Turkey Hill by roughly 0.3%.

This level of premium for Lancaster Dairy produces generates an average annual payment of $600 per farm. Given the production levels of dairy farms in the MDVA, annual farm level payment ranges between $400 and $970. At this scale, the premium paid to the farm is not sufficient to offset BMP costs.

Instead, the premium can be viewed as a signal to technical service providers about the farms interest in accessing other funding streams, such as NRCS. In this context, the return on investment for Turkey Hill is how the premium acts as a catalyst and leverages investment in BMPs that deliver environmental benefits.

Nutrient Reductions

Waste management practices tie most closely to nitrogen reductions.

With a focus on waste storage and other manure management facilities being installed at all Lancaster County dairy farms in the MDVA, an estimated 440,143 lbs of nitrogen annually is diverted from waterways. This estimate is a central estimate. The range is conservatively estimated between 392,800 and 564,600 lbs of nitrogen per year.

At the central estimate, this reflect roughly 1700 lbs per farm (with a range of 1,500 and 2,200lbs of nitrogen per year per farm).

Valuing Nutrient Reductions

Nitrogen reductions as a result of catalyzing incentives is likely valued over $1 million.

Work by the Environmental Finance Center at the University of Maryland estimates that the value of nitrogen captured through waste storage and other attendant structures, such as those implemented at smaller dairy farms, delivers almost $7.60 of benefits per 1000 gallons of manure.

Given the estimated range of annual nitrogen abatement, the BMPs incentivized through the Turkey Hill Clean Water Partnership is $1.04 million to $1.5 million per year. The central estimate is $1.17 million.

These benefits last the life of the BMPs.

Net Impact of the Program

Nitrogen reductions as a result of catalyzing incentives is likely over $1 million.

The return on investment for Turkey Hill is significant. Every $1 provided in a premium to dairy producers in its supply chain potentially has a $13 to $24 return in matched funds for on-farm BMPs and environmental benefits from nitrogen abatement.

However, the net benefits of the program are negative. The BMP costs outweigh the environmental returns from nitrogen abatement. Under the central estimate, every dollar of environmental benefit requires accompanying farm investment of $2.72. The premium helps to offset this investment requirement from other sources funding farm BMPs.

ROI of the Turkey Hill Clean Water Partnership

Even at its lowest range, a $1 investment from Turkey Hill results in $13 of net benefits per farm.

Number of Farms		259	
	Low	**Central**	**High**
BMP Cost Per Farm[1]	$64,007	$153,224	$223,422
Annualized over 20 years at 5%	$5,135	$12,295	$17,925
All measures per farm per year…	**Low**	**Central**	**High**
Avg number of milk cows	44	49	63
Gallons of Manure Treated[2]	54,160	60,693	77,858
TN lb captured by BMP[3]	1,516	1,699	2,180
Environmental Value of TN treated	$4,029	$4,515	$5,796
Turkey Hill Premium per Farm		$698	
ROI for Turkey Hill	**$13.1**	**$24.1**	**$34.0**
Net Benefits per Farm	*-$1,107.12*	*-$7,780.12*	*-$12,132.13*
Investment required to gain $1 of environmental gain	$1.10	$2.35	$2.75

Notes: *[1] Low reflects 25th percentile of farm costs; high reflects the 75th percentile of farm costs. [2] Based on 20% of TN capture from barnyard runoff controls and accounting for 72% of manure is in excess of the farm's nutrient needs. [3] 28lb of TN per 1000 gallons of manure based on personal communication with Team Ag.*

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Summary and Key Insights

- Analysis of dairy farms in Pennsylvania, Lancaster County, and within the MDVA Cooperative validates Turkey Hills approach to incentivizing BMPs.
- While the scale of incentives cannot offset BMP costs, participation is a “stewardship signal” to technical service providers that facilitate access to funding that expands on-farm BMP implementation and associated nutrient reductions.
- Smaller farms, likely to have the greatest needs, are experiencing higher returns.
- The nutrient reduction benefits achieved also deliver co-benefits that improve environmental and community health.

References

Source: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_US/usv1.pdf

Table 15, Milk Cow Herd Size by Inventory and Sales: 2017

https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Pennsylvania/cp99042.pdf

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