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Engineering Quality of Life™

Biosolids Program Evaluation

Walworth County Metropolitan (WalCoMet) Sewerage District

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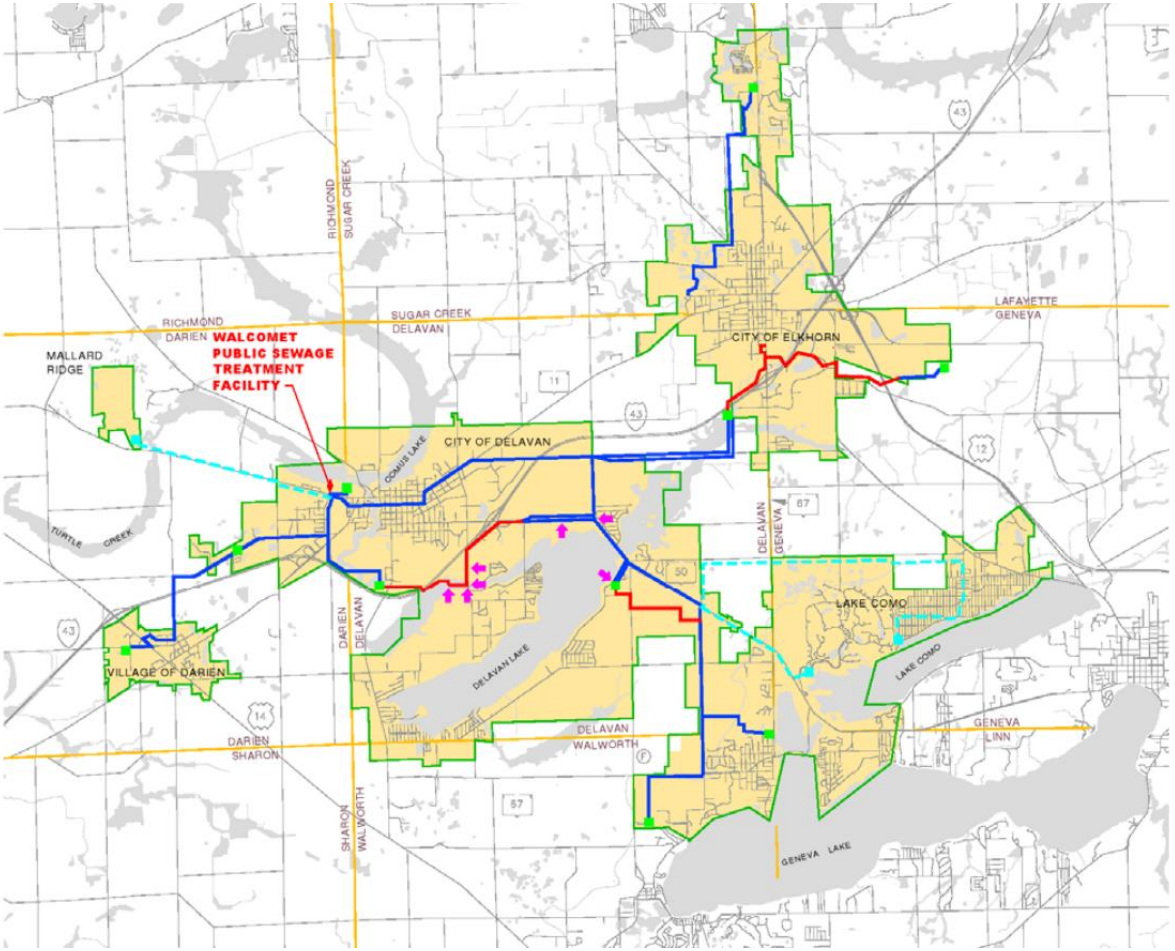
BACKGROUND

Walworth County Metropolitan Sewerage District

WalCoMet Background

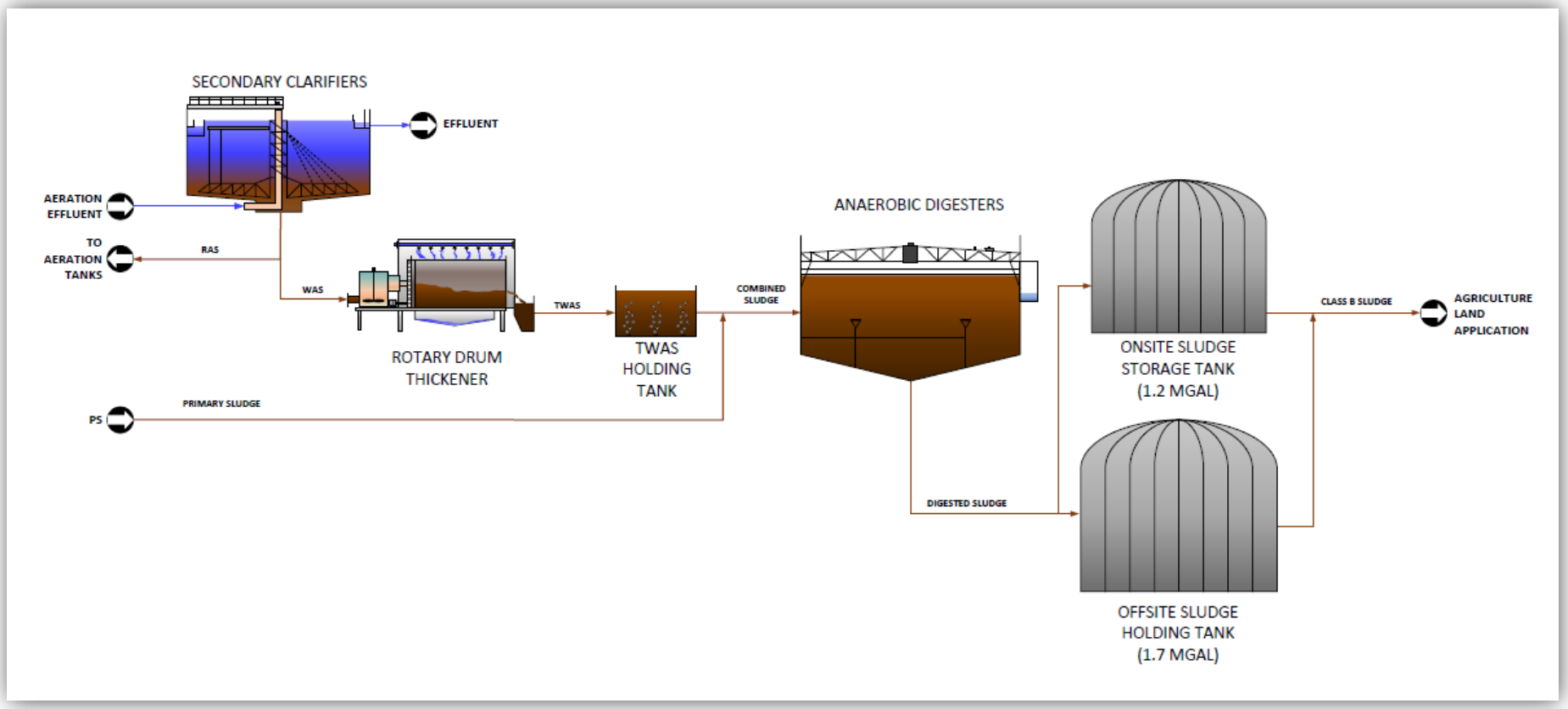
- Serves 11 entities including Elkorn, Delavan, Darien, Williams Bay
- 7.0 MGD/ 20.2 MGD
- Class “B” liquid land application

WalCoMet Background



Walworth County Metropolitan Sewerage District

Existing Biosolids Process



Existing Biosolids Program

- Biosolids applied to WalCoMet owned farm (300 ac) or to nearby farm fields ($)
- Approximately 4,000,000 gallons land applied yearly

Goals

- Analyze existing program and alternatives
- Develop financial model
- Identify low cost solutions
- Provide recommendations

Biosolids Disposal Issues

- Late harvest jeopardizes fall land application
- Potential future issues:
  - Limited land availability
  - More stringent regulations
  - Increased solids production
  - Rising resource costs

Alternatives

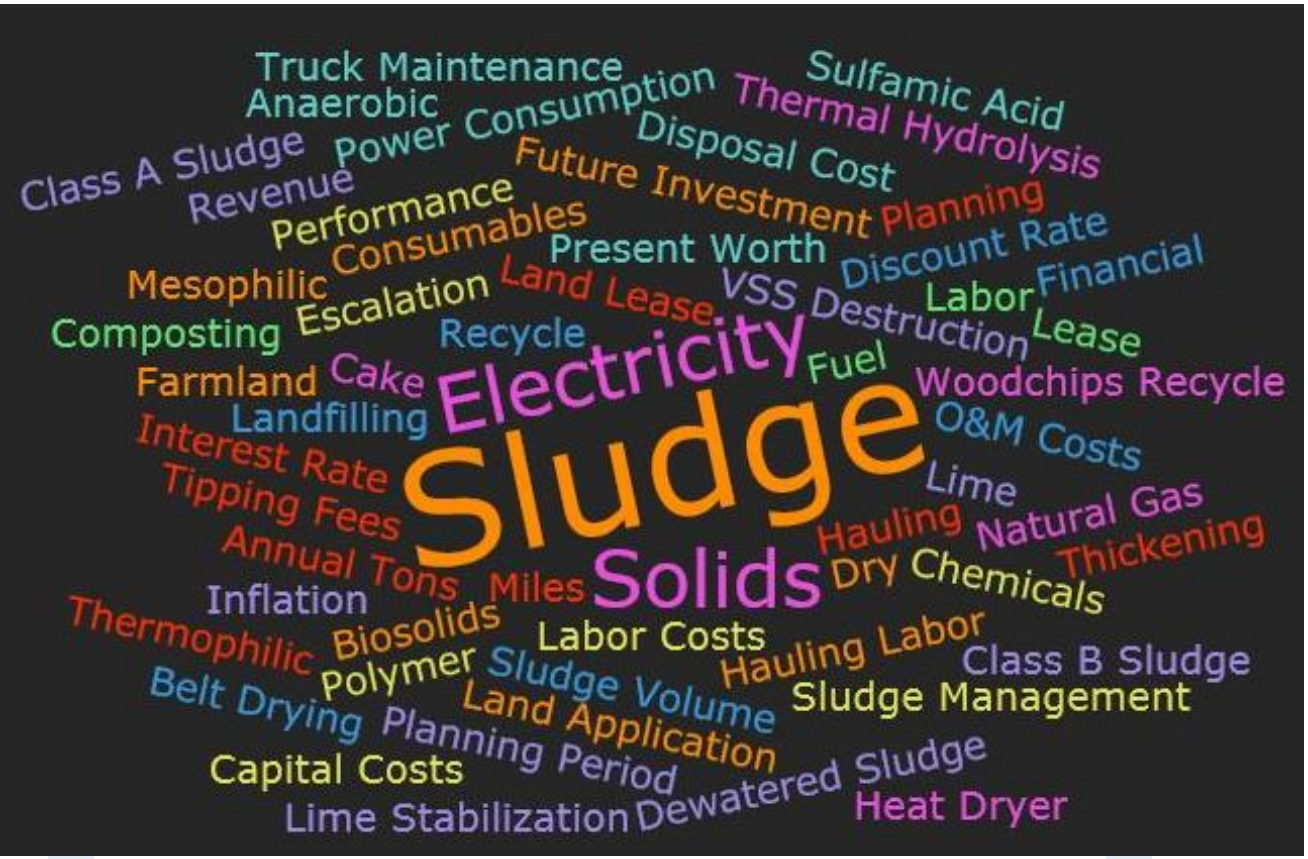
- Continued liquid land application
- Dewatering & land application
- Dewatering & landfilling
- Class “A” sludge production
  - Composting
  - Lime Stabilization
  - Heat Drying
  - Thermophilic Digestion
  - Thermal Hydrolysis

Financial Modeling Tool

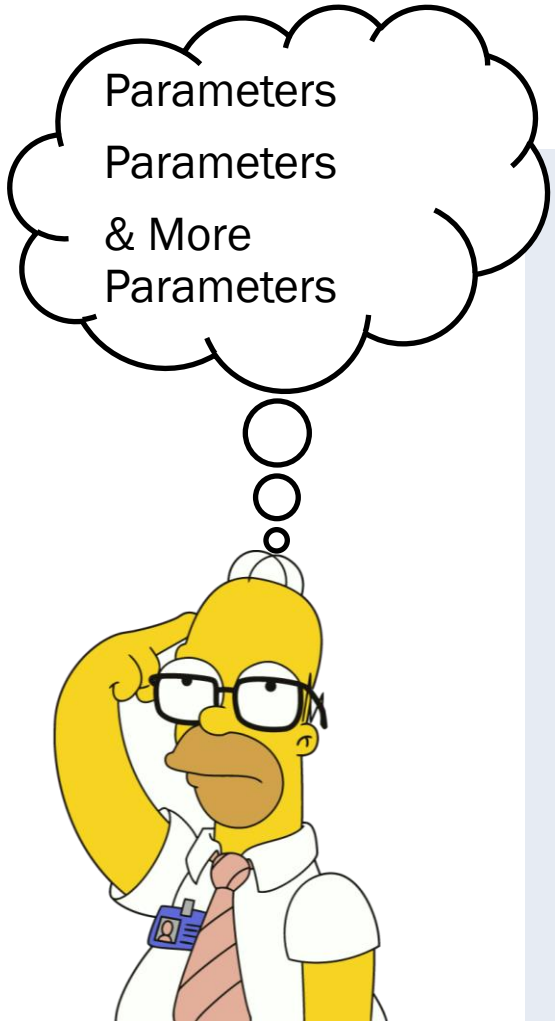
- Input operating cost parameters
- Track costs over 20 year planning period
- View costs over time for the modeled alternatives

FINANCIAL MODEL DEVELOPMENT

Financial Model



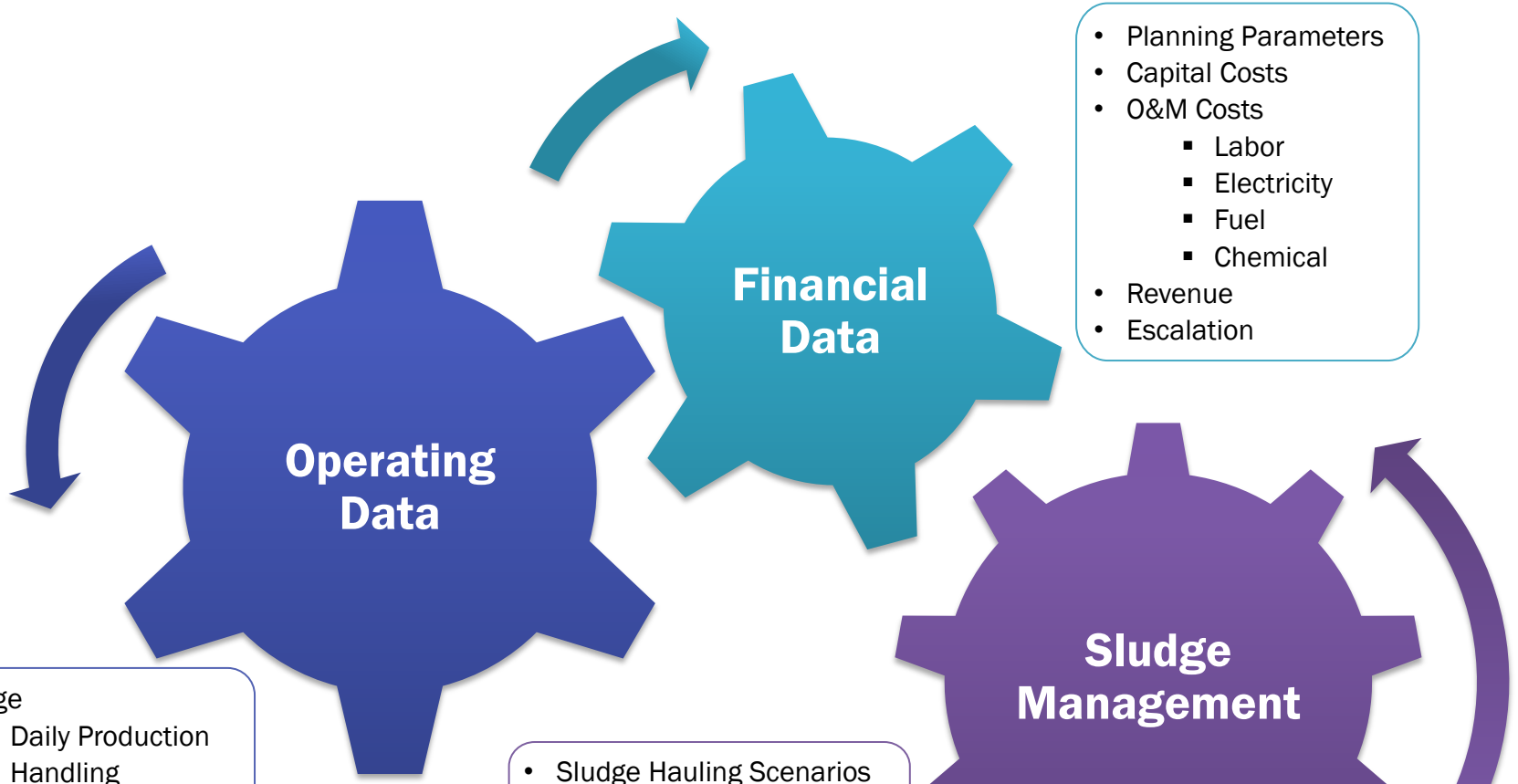
Financial Model



Financial Model Development

- **Financial Model Components**
  - Process
  - Economics
- **Adjustment to Input Parameters**
  - Compare Scenarios
- **Quantity Costs for Alternatives**
  - Capital Costs
  - O&M Costs
  - Present Value Costs

Financial Model



Financial Model

Step 1 — Financial Data

PLANNING PARAMETERS		
Start Year	2016	-
Period	20	years
Interest	2.5%	-
O&M Cost Increase		
Labor	3%	-
Electricity	3%	-
Natural Gas	2%	-
Fuel	2%	-

OPERATING COSTS & INCOME								
Labor	$ 40.96	hr^{-1}	**Chemicals**			**Revenue**		
Electricity	$ 0.070	$kW\text{-}hr^{-1}$	Caustic Soda	$ 1.900	gal^{-1}	Farm Lease	$ 150	$acre^{-1}$
Natural Gas	$ 0.843	$therm^{-1}$	Ferric Chloride	$ 1.700	gal^{-1}	Woodchip Recycle	$ 0.032	lb^{-1}
Fuel	$ 1.280	mi^{-1}	Polymer	$ 1.000	lb^{-1}	Class A Sludge	$ 1.500	ton^{-1}
Truck O&M			Wood Chips	$ 0.032	lb^{-1}			
Existing	$ 8,200	yr^{-1}	Lime	$ 0.075	lb^{-1}			
New	$ 3,000	yr^{-1}	Sulfamic Acid	$ 1.40	lb^{-1}			
Tipping Fees								

FUTURE INVESTMENT		
Parameter	Farmland	Truck
	acre	-
Year	1	5
Quantity	150	1
Cost/Unit	$ 8,000	$ 100,000
Total Cost	$ 1,200,000	$ 100,000

Step 2 — Operating Data

DAILY SLUDGE				
Sludge	Flow	% Solids	VSS/TSS	Consumable: Ferric Chloride
	gpd	-	-	gpd
Primary Sludge	8,100	1%	0.70	100
WAS	125,000	1%	0.80	0

SLUDGE HANDLING OPERATIONS									
Process	Equipment: Type	Total Units	Units in Service	Solids Capture	Operation		Sludge Properties: % Solids	Sp. Gravity	Consumable: Polymer
	-	-	-	-	day/wk	hr/day	-	-	lb/ton TSS
Thickening	Rotary Drum	1	1	90%	5	8	6%	1.02	15
	Centrifuge	1	1	90%	5	8	10%	1.02	12
Dewatering	Centrifuge	2	1	95%	5	8	20%	1.02	30
	Screw Press	1	1	95%	5	8	16%	1.02	30

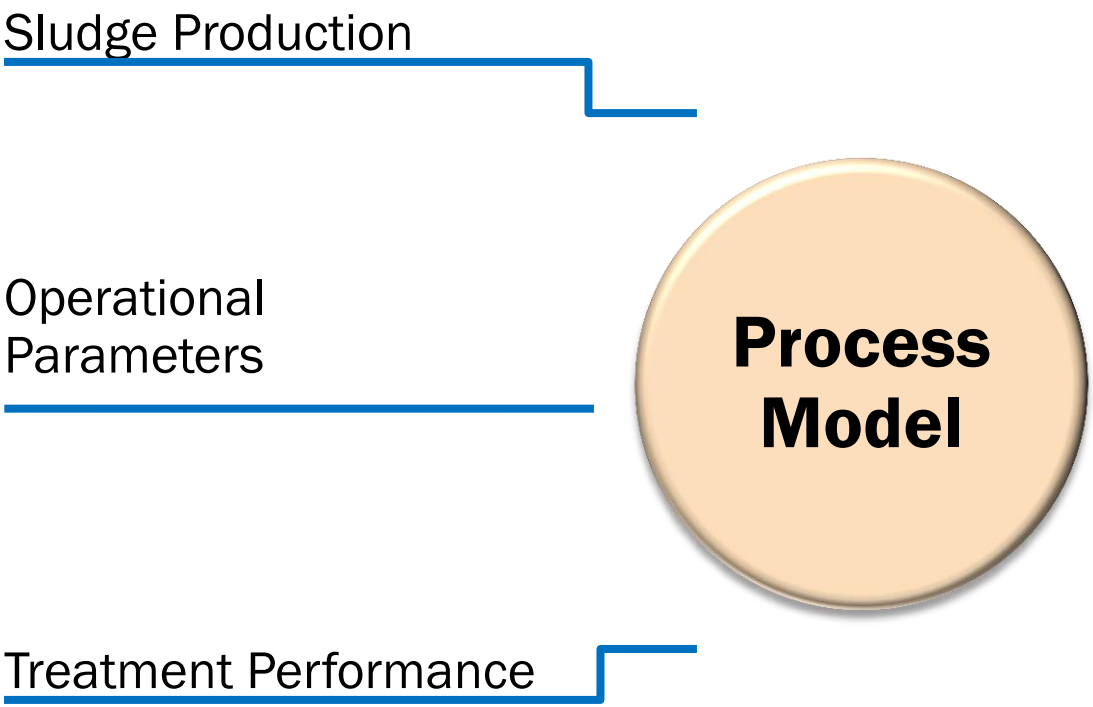
Process	Unit Operation	Equipment: Type	Toal No.	Units in Service	% VSS Destruction	day
Sludge Lysis	Hydrolysis	Reactor	1	1	10%	
Class B Sludge	Anaerobic	Digester	3	3	61%	
	Thermophilic	Digester	1	1	27%	
Class A Sludge	Composting	Windrow	NA	NA	25%	
	Heat Drying	Heat Dryer	1	1	0%	
	Lime Stabilization	Reactor	1	1	0%	
	Mesophilic	Digester	1	1	27%	
	Belt Drying	Belt Dryer	1	1	0%	

Step 3 — Sludge Management Information

REVENUE MANAGEMENT		
Class A Biosolids Sold	50%	-
Annual Woodchip Recycle	65%	-

SLUDGE HAULING				
Option	Choice	Miles	Hauling Labor: hr/year	Outside Farm: Acres
Haul & land apply on farm	Haul & land apply on farm	11,500	1,250	0
Haul & land apply < 5 mi		11,500	1,250	115
Haul & land apply > 5 mi		23,000	2,500	115
Land Acquisition		11,500	1,250	0
Outside Hauler		0	500	0
Manual Entry		0	0	0
Dewatering	-	3,276	356	0
Landfilling	NO	3,276	356	0
Class A	-	0	0	0

Process Model



Model Output

- **Annual Solids (Class A/ Class B)**
- **Consumables (Chemicals, Power, Natural Gas, Fuel, etc.)**

Process Model

Biosolids Lifecycle Cost Evaluation Tool
Walworth County Metropolitan Sewerage District (WalCoMet)

Solids Mass Balance

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Input | Summary | Design | Calculated

Parameter	Class B Sludge		Class A Sludge					Unit
	Option B-1 Liquid Sludge	Option B-2 Dewatering	Option A-1 Composting	Option A-2 Heat Drying	Option A-3 Lime Stabilization	Option A-4 TPAD	Option A-5 Thermal Hydrolysis	
Primary Sludge								
Flow	8,100	8,100	8,100	8,100	8,100	8,100	8,100	gpd
Flow	0.008	0.008	0.008	0.008	0.008	0.008	0.008	mgd
Percent Solids	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	-
Specific Gravity	1.02	1.02	1.02	1.02	1.02	1.02	1.02	-
TSS Loading	689	689	689	689	689	689	689	lb/day
VSS/TSS	0.70	0.70	0.70	0.70	0.70	0.70	0.70	-
VSS Loading	482	482	482	482	482	482	482	lb/day
Ferric Chloride Dose	100	100	100	100	100	100	100	gpd
WAS								
Flow	125,000	125,000	125,000	125,000	125,000	125,000	125,000	gpd
Flow	0.125	0.125	0.125	0.125	0.125	0.125	0.125	mgd
Percent Solids	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	-
Specific Gravity	1.02	1.02	1.02	1.02	1.02	1.02	1.02	-

Mass Balance

Model Output

Biosolids Lifecycle Cost Evaluation Tool

Walworth County Metropolitan Sewerage District (WalCoMet)

Summary

Clark Dietz

Input | Calculated

ANNUAL O&M SUMMARY

Parameter	Class B Sludge		Class A Sludge					Unit
	Option B-1 Liquid Sludge	Option B-2 Dewatering	Option A-1 Composting	Option A-2 Heat Drying	Option A-3 Lime Stabilization	Option A-4 TPAD	Option A-5 Thermal Hydrolysis	
ANNUAL O&M								
Sludge Production								
Type	Class B	Class B	Class A	Class A	Class A	Class A	Class A	-
Sludge Volume	4,002,000	1,140,000	350,000	253,000	1,426,000	1,336,000	201,000	gal/yr
Solids Production	1,020	970	820	970	2,240	1,140	770	lbs TSS/yr
Labor								
Operation	2,080	2,080	4,680	3,120	4,160	4,680	4,680	hr/yr
Hauling ≥ 5 miles	-	-	-	-	-	-	-	hr/yr
Hauling < 5 miles	1,250	356	356	-	-	-	-	hr/yr
Landfilling	-	-	-	-	-	-	-	hr/yr
Electricity	1,650,155	1,709,281	1,709,281	1,919,333	1,765,808	1,374,364	1,848,538	kW-hr/yr
Natural Gas	-	-	-	81,100	-	-	54,100	therm/yr
Sludge Hauling								
≥ 5 miles	-	-	-	-	-	-	-	mi/yr
< 5 miles	11,500	3,276	-	-	-	-	-	mi/yr
Landfilling	-	-	-	-	-	-	-	mi/yr
Composting	-	-	5,750	-	-	-	-	mi/yr
Tipping Fees								
Farm Land								
≥ 5 miles	-	-	-	-	-	-	-	acre/yr
< 5 miles	-	-	-	-	-	-	-	acre/yr
Landfill	-	-	-	-	-	-	-	ton/yr
Chemicals								
Caustic Soda	-	-	-	-	-	-	3,100	gal/yr
Ferric Chloride	72,800	72,800	72,800	72,800	72,800	43,700	72,800	ga//yr
Polymer	20,800	42,600	42,600	42,600	42,600	46,300	33,800	lb/yr
Wood Chips	-	-	233,500	-	-	-	-	lb/yr
Lime	-	-	-	-	1,113,300	-	-	lb/yr
Sulfamic Acid	-	-	-	-	7,300	-	-	lb/yr
ANNUAL REVENUE								
Land Leased								
Existing	120	120	-	-	-	-	-	acre/yr
New	-	-	-	-	-	-	-	acre/yr
Wood Chip Recycle	-	-	151,800	-	-	-	-	lb/yr
Class A Sludge	-	-	410	490	1,120	570	390	lbs TSS/yr

Model Output

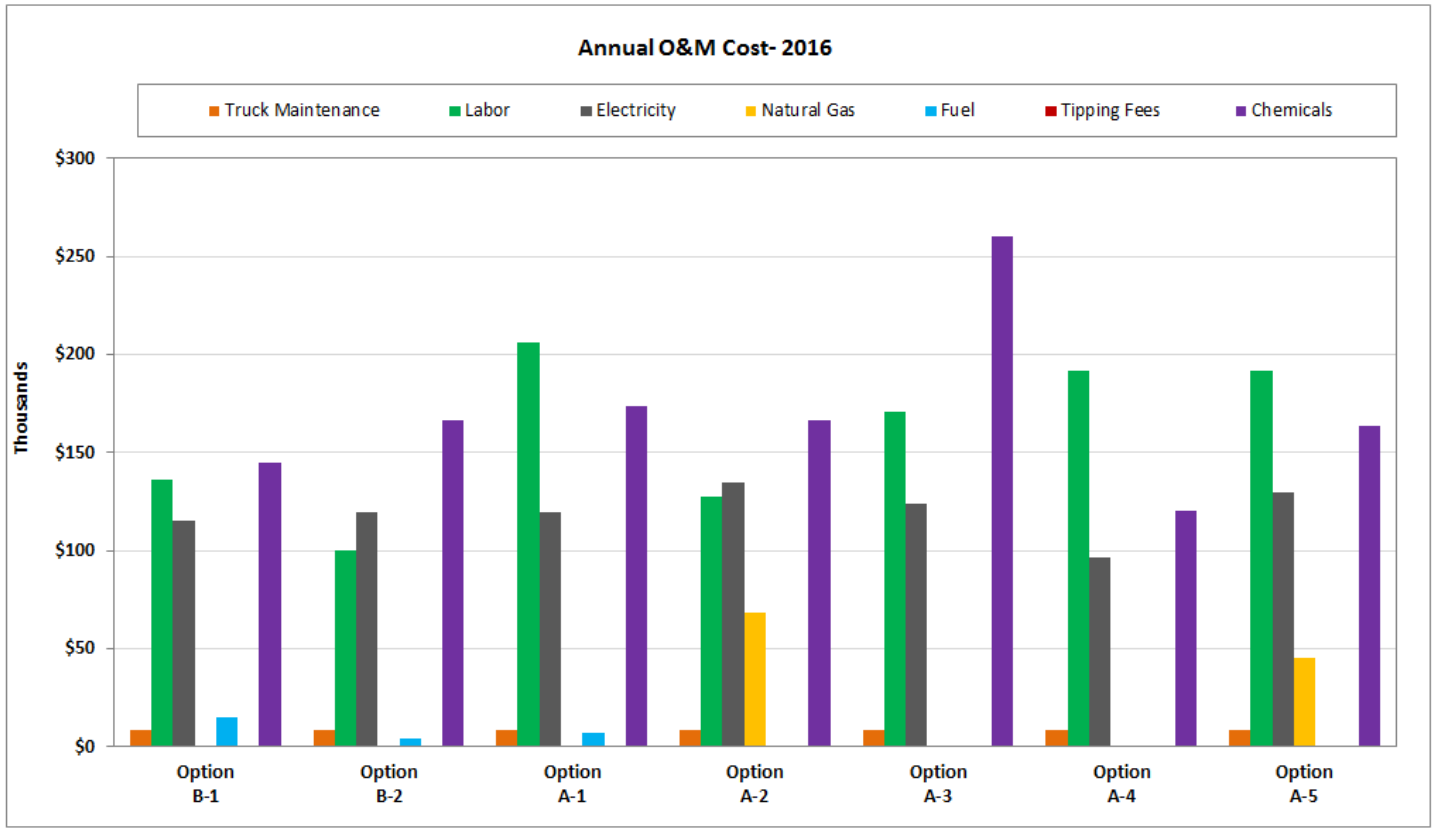
CAPITAL COST COMPARISON

Breakdown of Total Project Cost - 2016

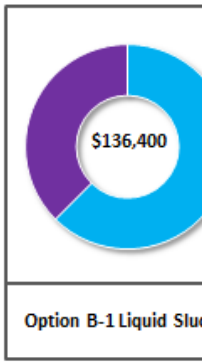
Millions

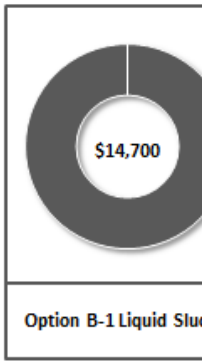
$10.0
$9.0
$8.0
$7.0
$6.0
$5.0
$4.0
$3.0
$2.0
$1.0
$0.0

ANNUAL O&M COST COMPARISON



Model Output

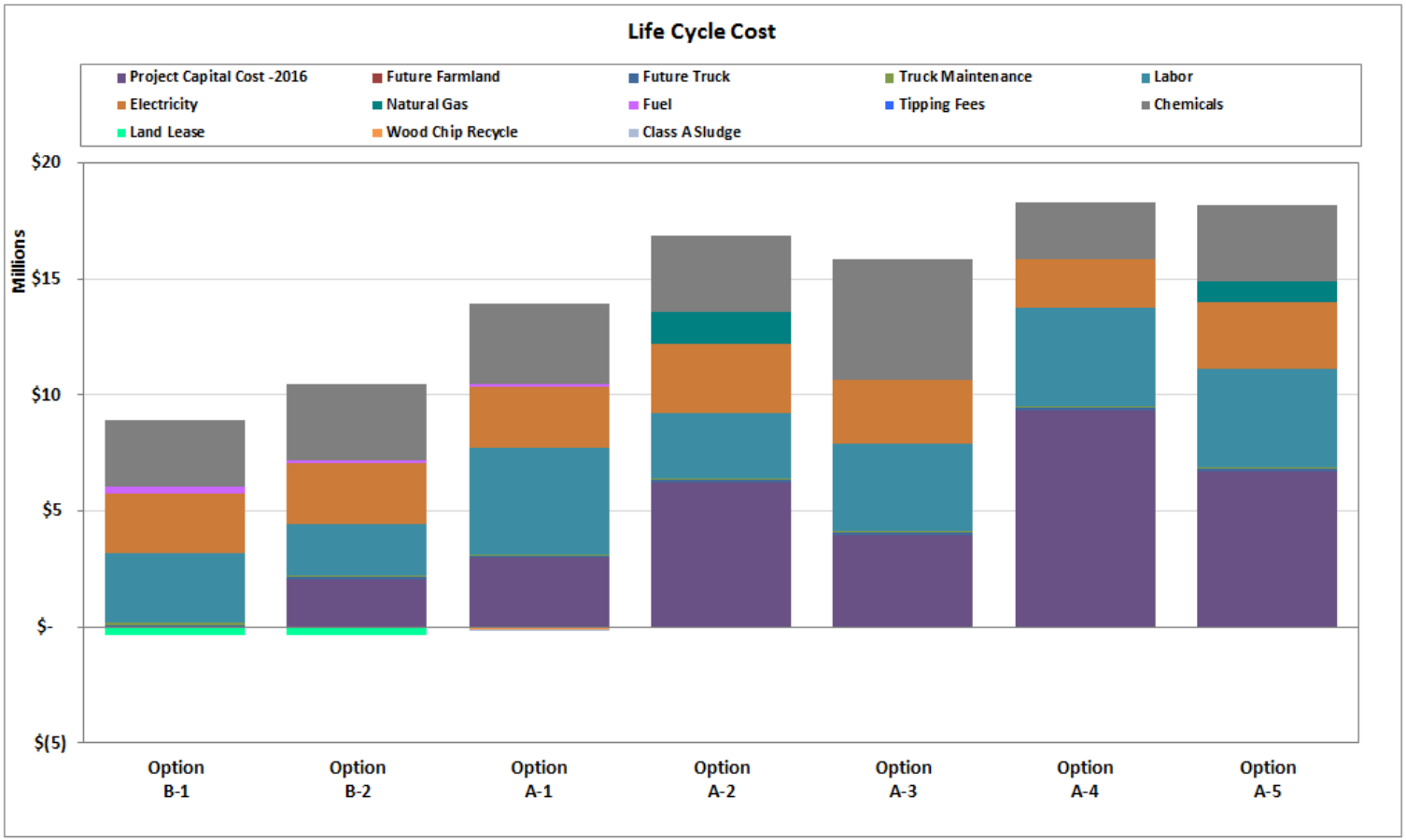




ANNUAL O&M COST DISTRIBUTION - 2016

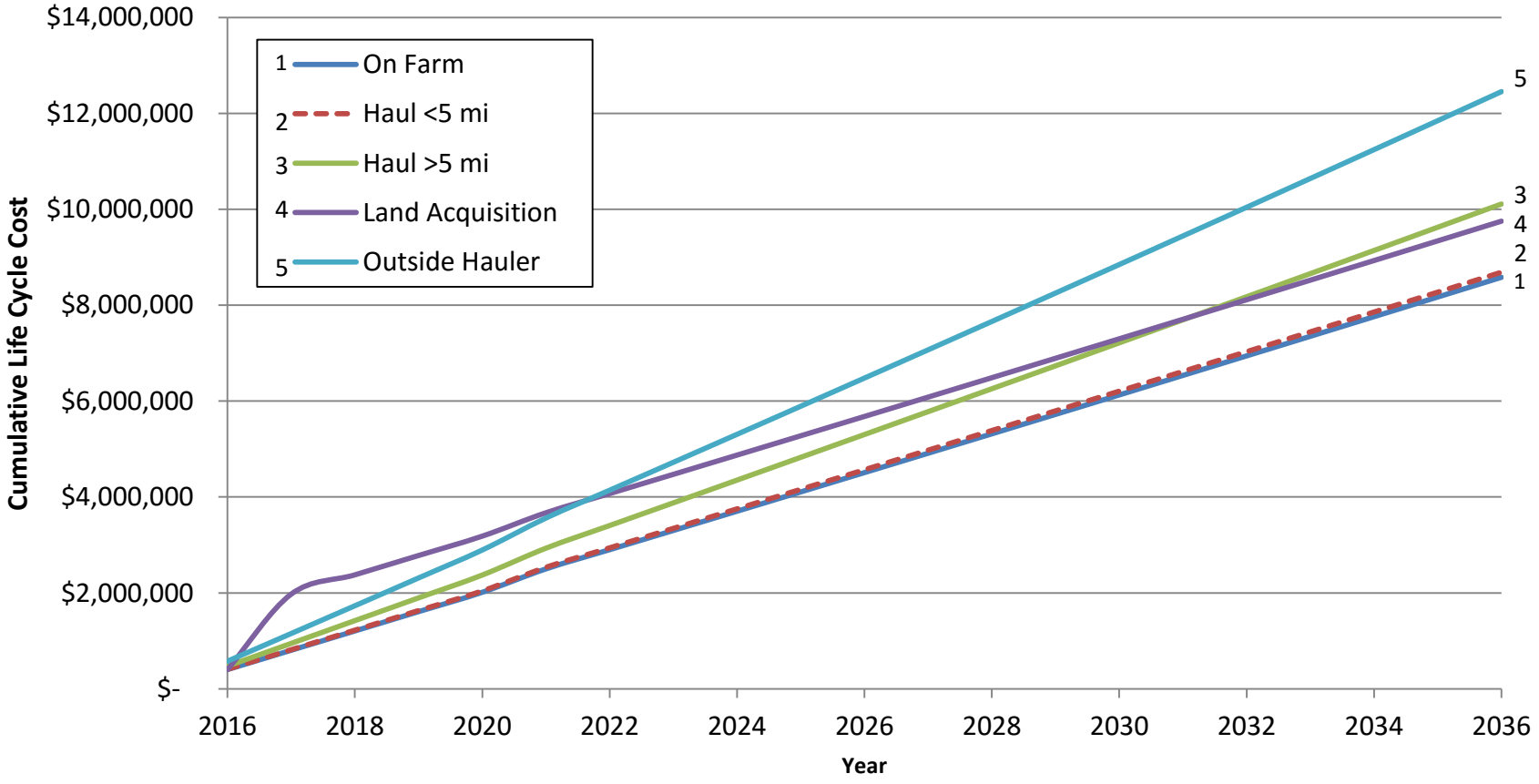
Labor Costs

LIFE CYCLE COST COMPARISON

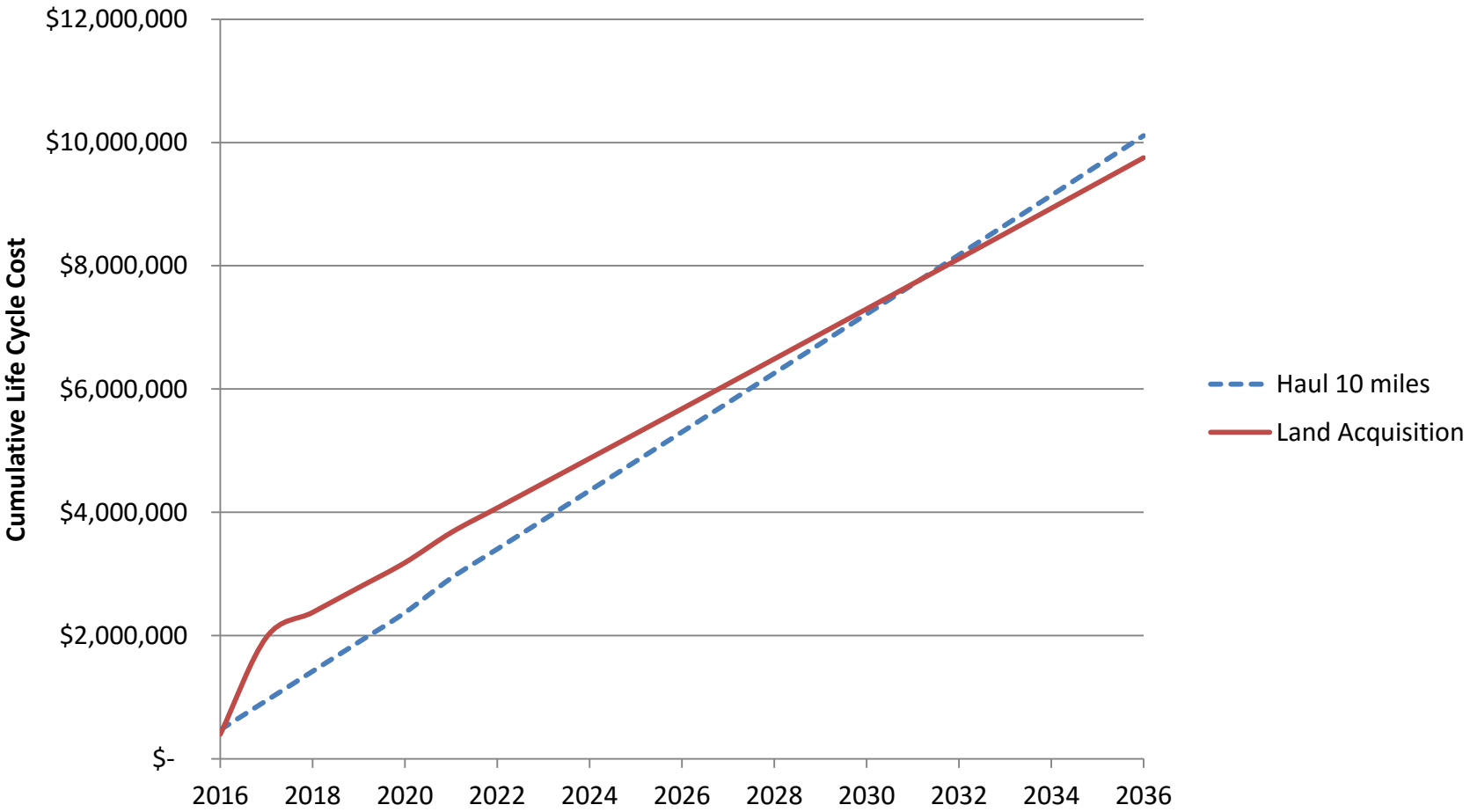


SCENARIOS

Liquid Land Application



Land Acquisition



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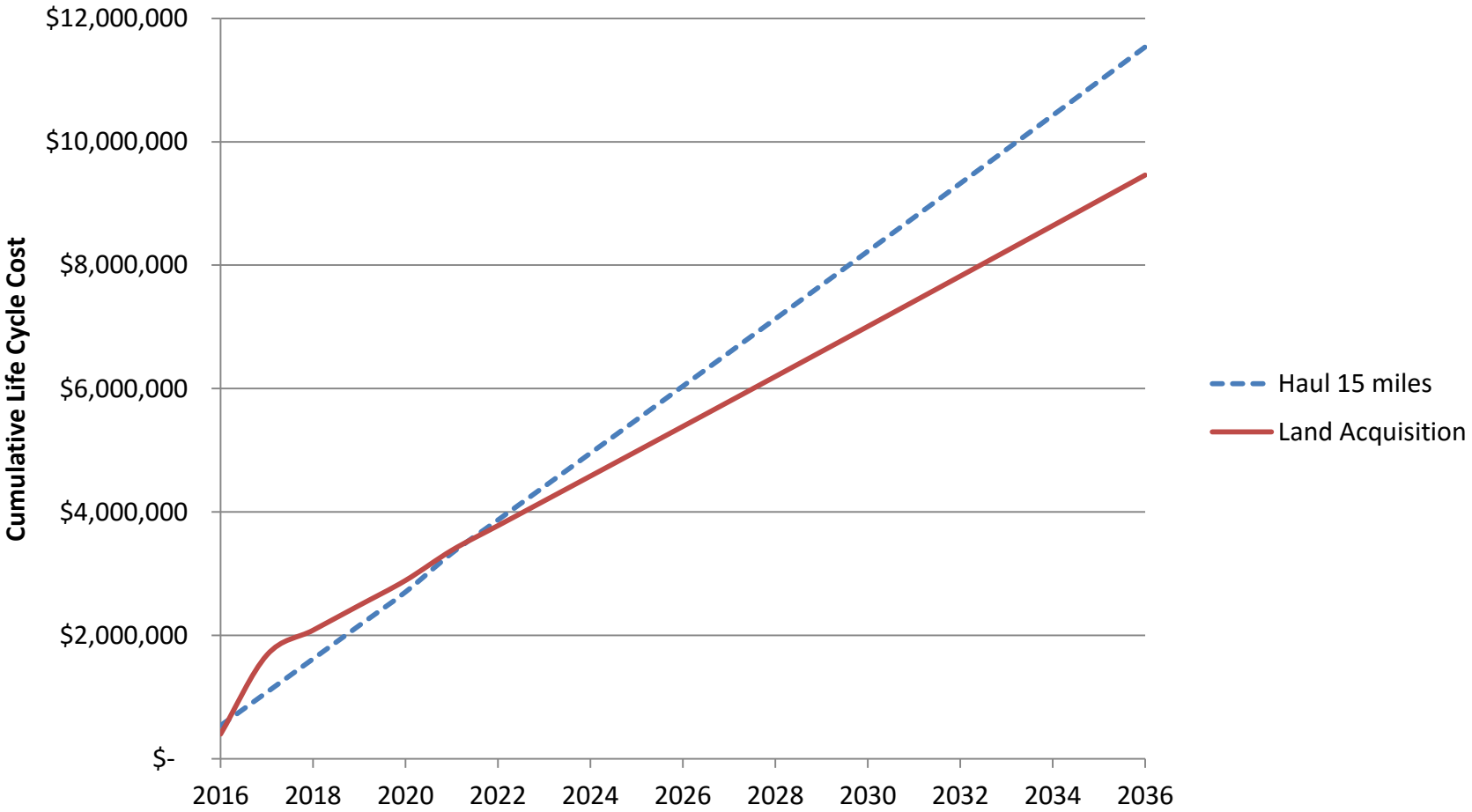
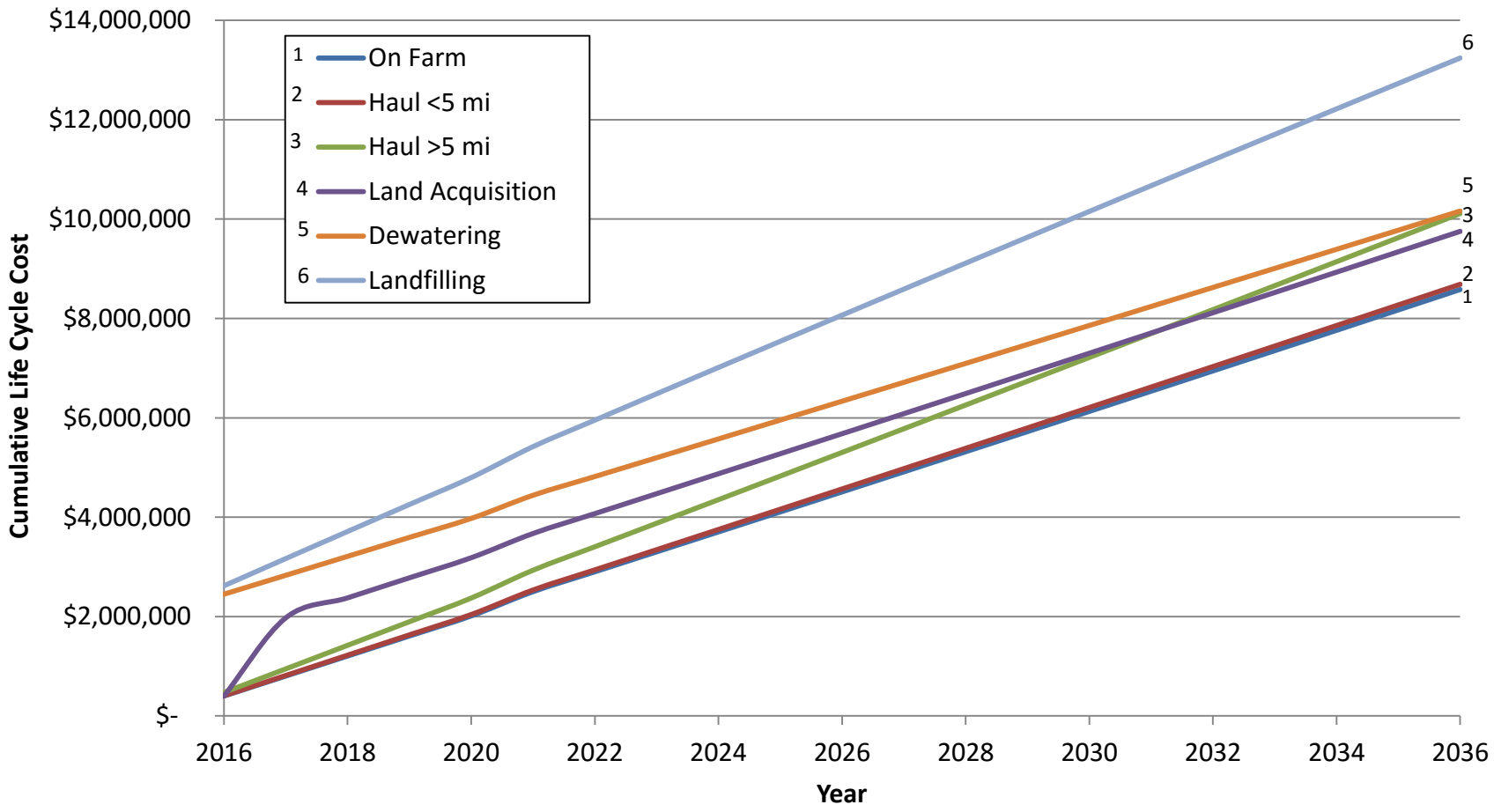


Liquid vs Solid Application



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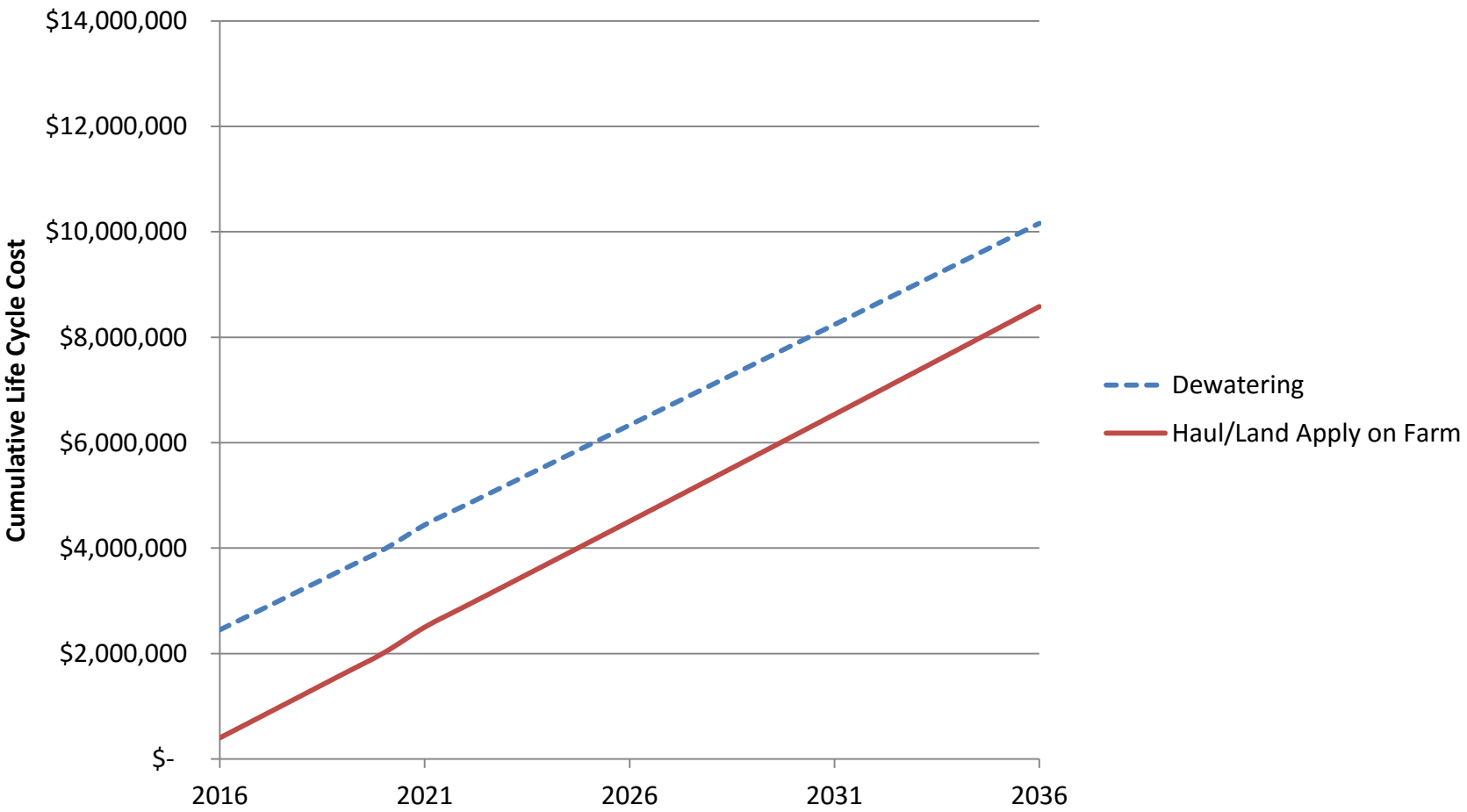

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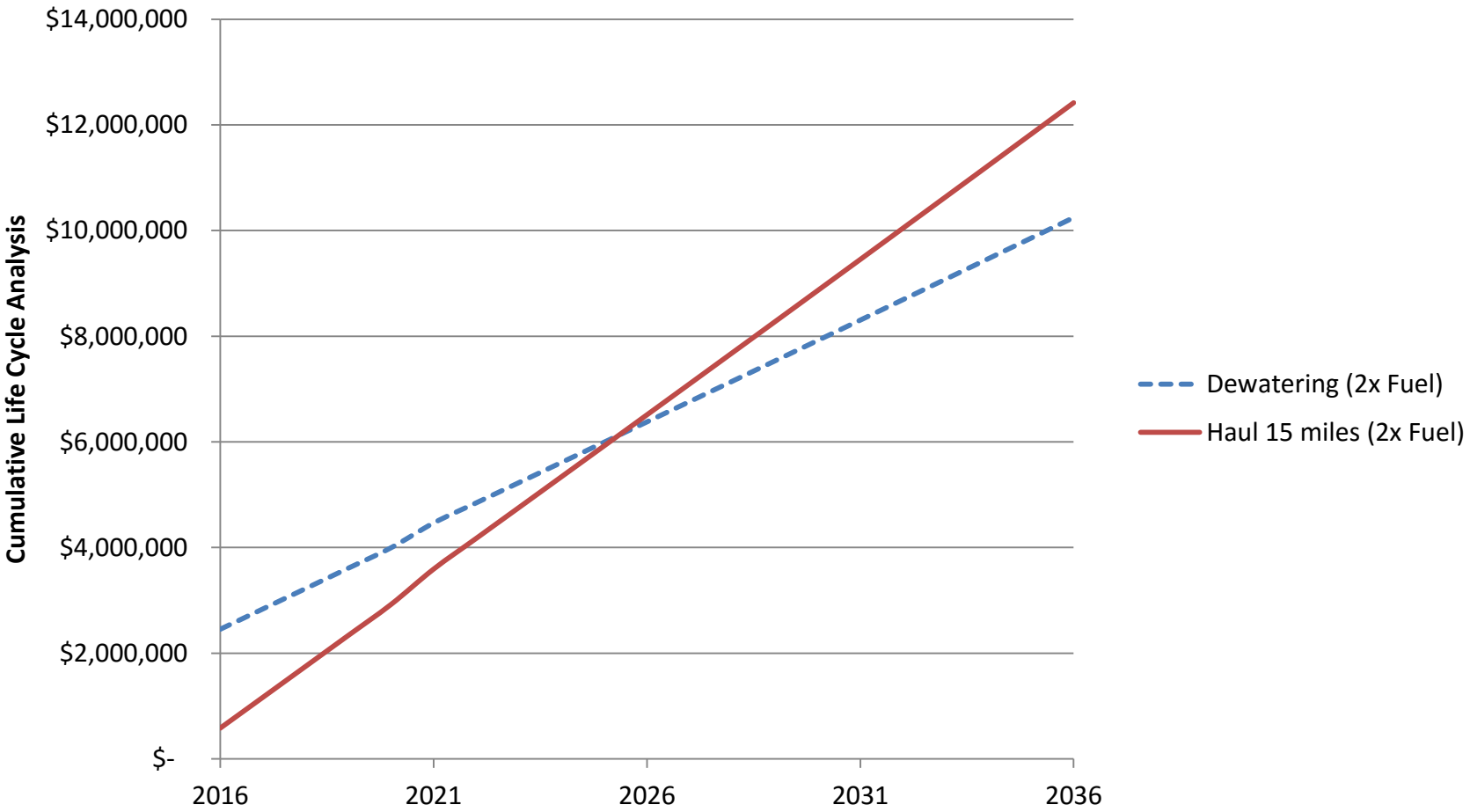

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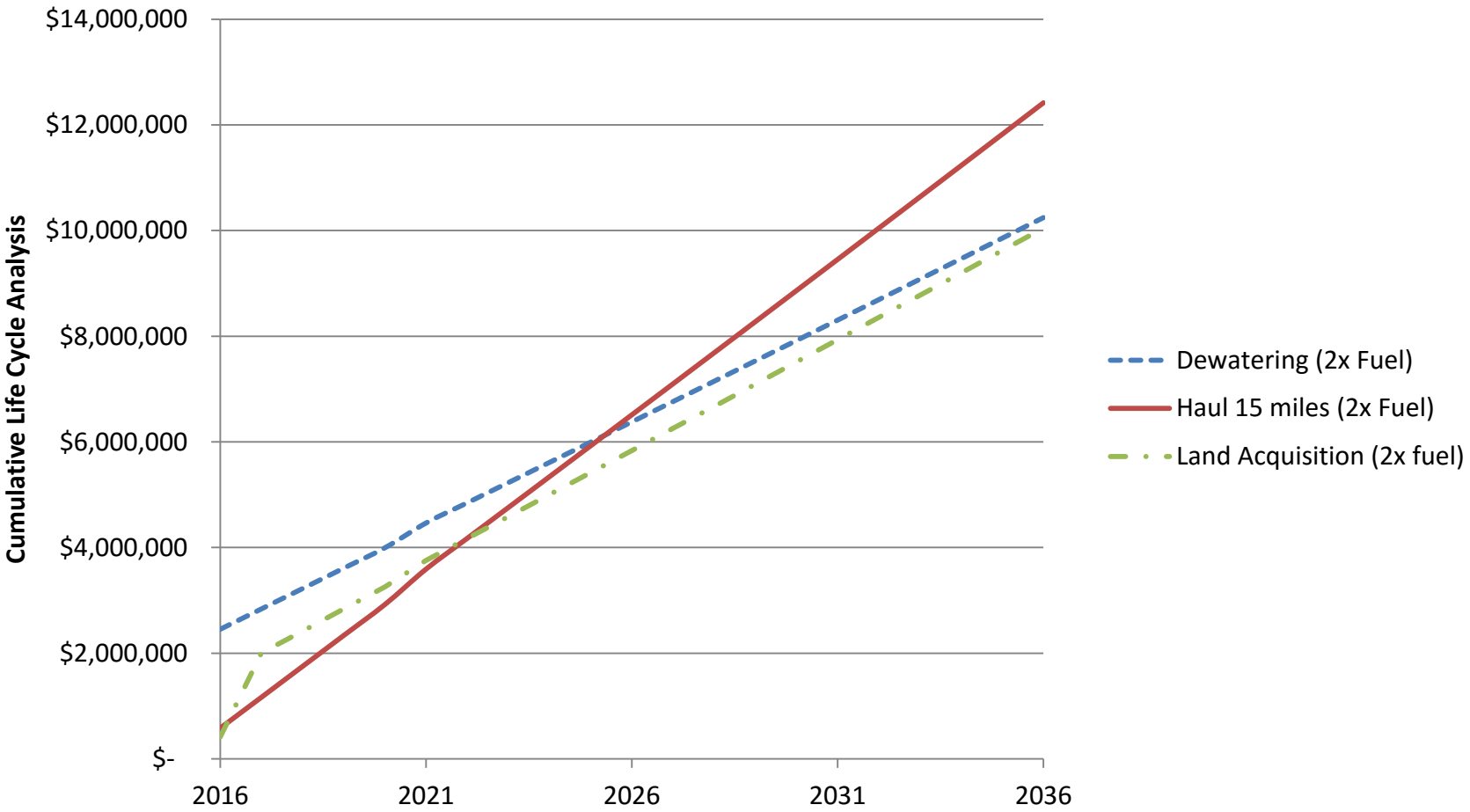
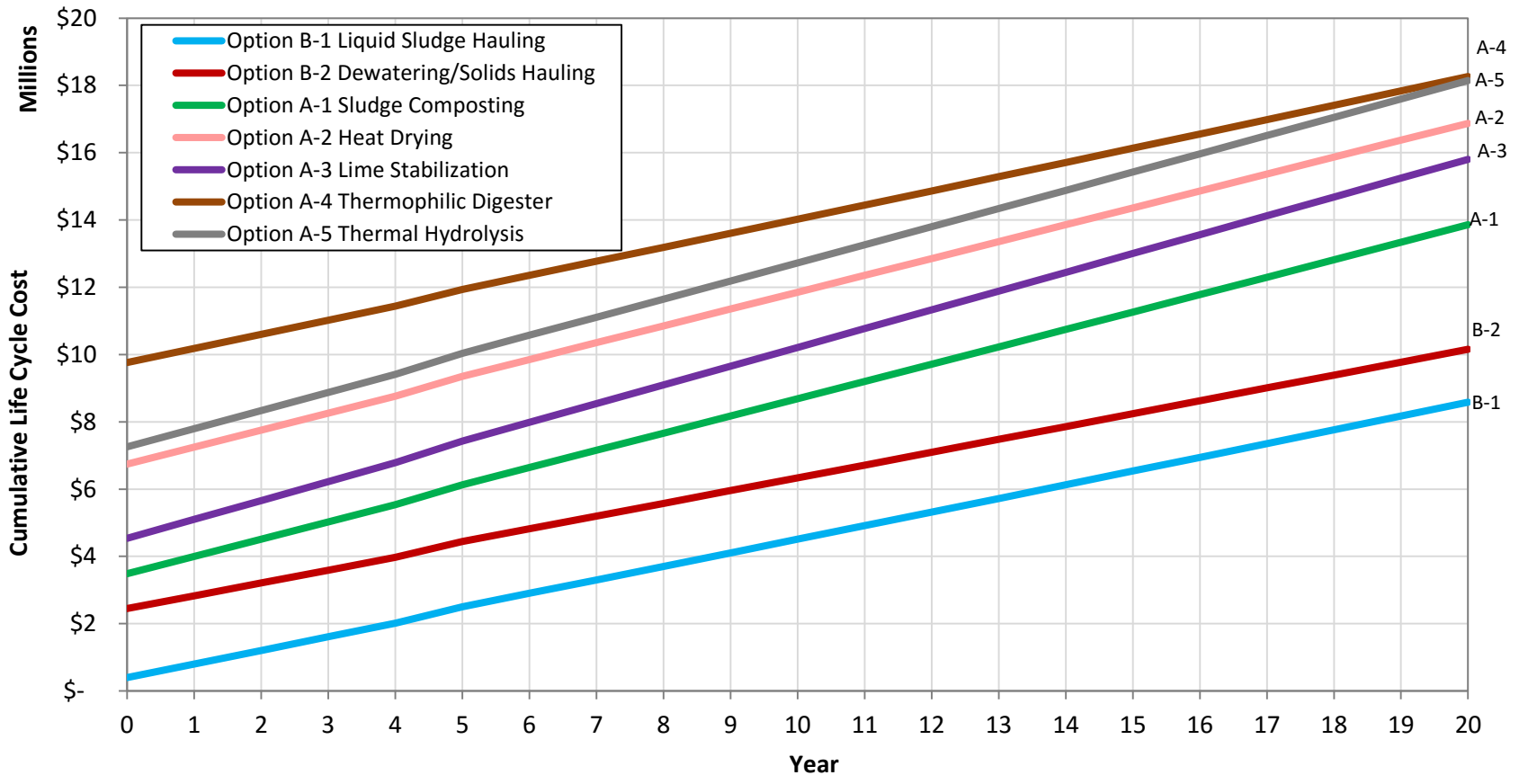


Class “A” Alternatives



Recommendations

- Current biosolids program is the lowest cost and proven option
  - Land acquisition and crop rotation will help ensure long term success
- Capital costs of alternatives outweigh potential savings over a 20 year outlook
- Monitor operation and maintenance costs using the model to track trends

Questions?

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