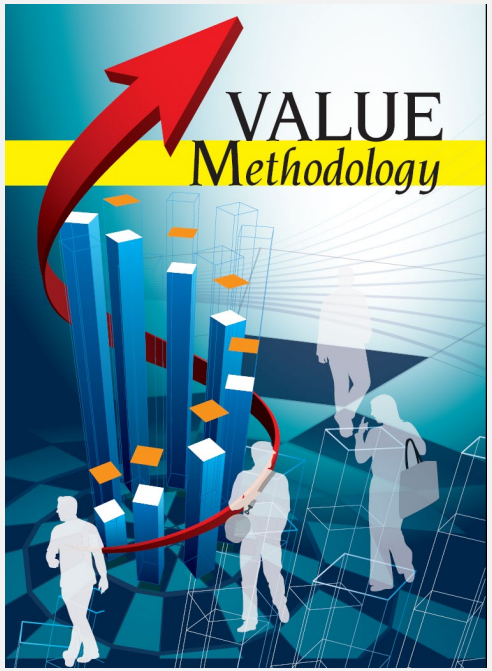
Michigan Association of County Drain Commissioners



The Power of the Value Methodology for Drains

Greg Lamkin, Stephen Kirk, Christopher Quattrin
Berrien County

February 13-15, 2019
macdc.us

ABSTRACT

During the past year, Berrien County applied **Value Based Decision Making Methods** to enhance the value of Drain improvements to the end-user while reducing projected capital and life cycle costs. Value Methods apply to project scoping, selection of the preferred design concept and refining the engineering solution. Techniques to be illustrated include life cycle costing, risk analysis, choosing by advantages, and others.

OUTLINE

- **What were the Results of Using the Value Methodology?** Christopher Quattrin, Barrien County Drain Commissioner
- **How Was the Results Achieved?** Stephen Kirk, Certified Value Specialist, Kirk Value Planners, Michigan
- **How Did It Help the Design Engineer?** Greg Lamkin, PE, LSG Engineers and Surveyors, Michigan
- **Is VM Cost Effective for Counties?** Christopher Quattrin
- **What are the Next Steps?** Stephen Kirk

What were the Results of Using the Value Methodology?

- Significant Drain Cost Savings
- Enhanced Drain Performance
- Collaborative Approach
- Creative Exploration of Ideas
- Use of Solid Techniques
- Clear Project Direction

What were the Results of Using VM?

Project, Berrien County, MI	Approach	Performance Improvements	Capital Savings, %	Life Cycle Cost Savings
1. Yellow Creek Drain Improvements, Royalton Township	Traditional Value Analysis (2 Day)	Level of Service, Public Acceptance	$122,700 25%	$126,700
2. South Watervliet Drain Improvements, Watervliet Charter Township	Traditional Value Analysis (2 Day)	Environment, LOS, Risk, Flexibility	$1,151,000 22%	$1,520,000
3. Harbert Drain Improvements, Chikaming Township	VA + Choosing By Advantages (2 Day)	Public Acceptance, Risk, LOS, Environ.	$495,300 18%	Over $500,000
4. Oscar Damon Drain Improvements, Hagar Township	VA + Choosing By Advantages (1 Day)	Reduced Schedule, Public Accept, Risk	$340,000 36%	$435,000
5. Dakin & Peters Drain Improvements, Bainbridge Township	Traditional Value Analysis (1 Day)	Risk, LOS, Public Acceptance, Environ.	$264,850 39%	$332,340
6. Baushke & Brado Drain Improvements, Benton Charter and Hagar Townships	VA Project Scoping, (1 ½ Day)	Public Acceptance, Risk, LOS, Environ.	Budget Established	

What were the Results of Using VM?

Project, Berrien County, MI	Approach	Performance Improvements	Capital Savings, %	Life Cycle Cost Savings
7. Lemon Creek Drain Improvements, Royalton Township	Traditional Value Analysis (1 ½ Day*)	Reduced Schedule, Flexibility, Environ.	$66,100 28%	Over $66,100
8. Sober & Becker Drain Improvements, Royalton Township	Traditional Value Analysis (1 ½ day*)	Reduced Schedule, Flexibility, Environ.	$110,500 28%	Over $110,500
9. Beebe Drain Improvements, Royalton Township	Traditional Value Analysis (1 ½ day*)	Reduced Schedule, Public Acceptance	$327,100 32%	Over $327,100
10. Kephart Woods Drain Improvements, Oronoko Township	VA + Customer Function (1 ½ Day)	Public Accept, Risk, LOS, Schedule	$5,040,000 32%	Over $5,040,000
11. Sawyer Village Drain Improvements, Chikaming Township	VA + Risk Model (1 Day)	Risk, Public Accept., LOS, Environment	$648,550 15%	Over $650,000
Summary	3 Approaches	Many Improvements	**$8,566,100**	**$9,107,700**

** Joint VA Workshop*

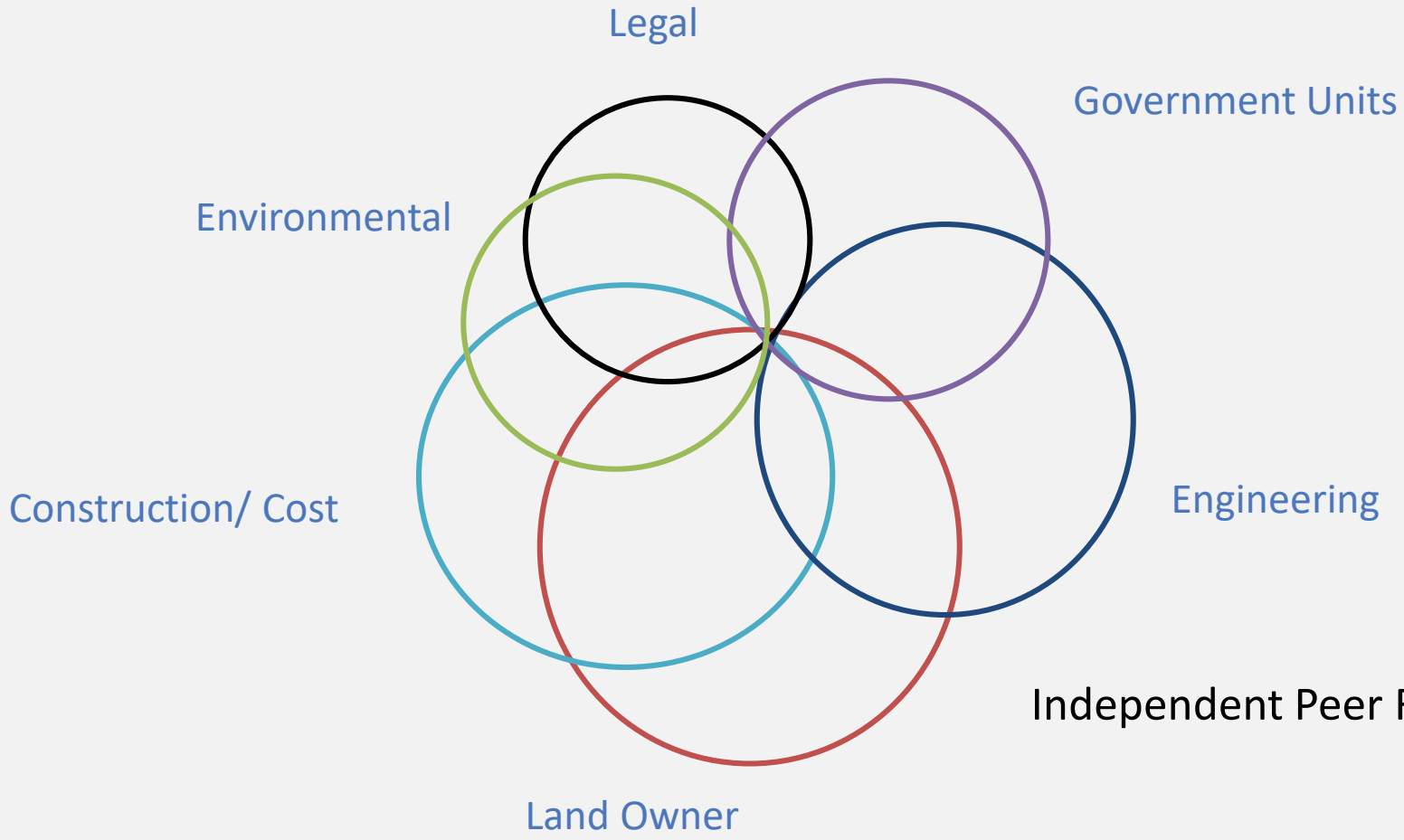
What were the Results of Using the Value Methodology?

- Improved Collaboration Between Stakeholders
- Better Cost Estimates
- Shared Knowledge Among Engineers
- Allows Benchmarking Comparisons
- Created New Unique Drain "VM Tool Kit"
  - Drain Performance Model
  - Life Cycle Cost Database & Cost Models
  - Drain Risk Model
  - Environmental Model
- Communicated Results to Community

How Was the Results Achieved?

- Conducted VM **Awareness** Seminar
  - County Drain Commissioner Staff
  - Invited Drain Engineering Consultants
- Established a "**VM Steering Committee**"
- Selected Initial **Drain Projects & Team**
- Held 1-2 Day **VM Workshops**
- Offered 1 Day **Seminars**
  (Function Analysis, LCC, Risk)
- **Implementation Meetings**
- Design Changes Incorporated

STAKEHOLDERS



Independent Peer Review

Stakeholders and Interests

Figure 4

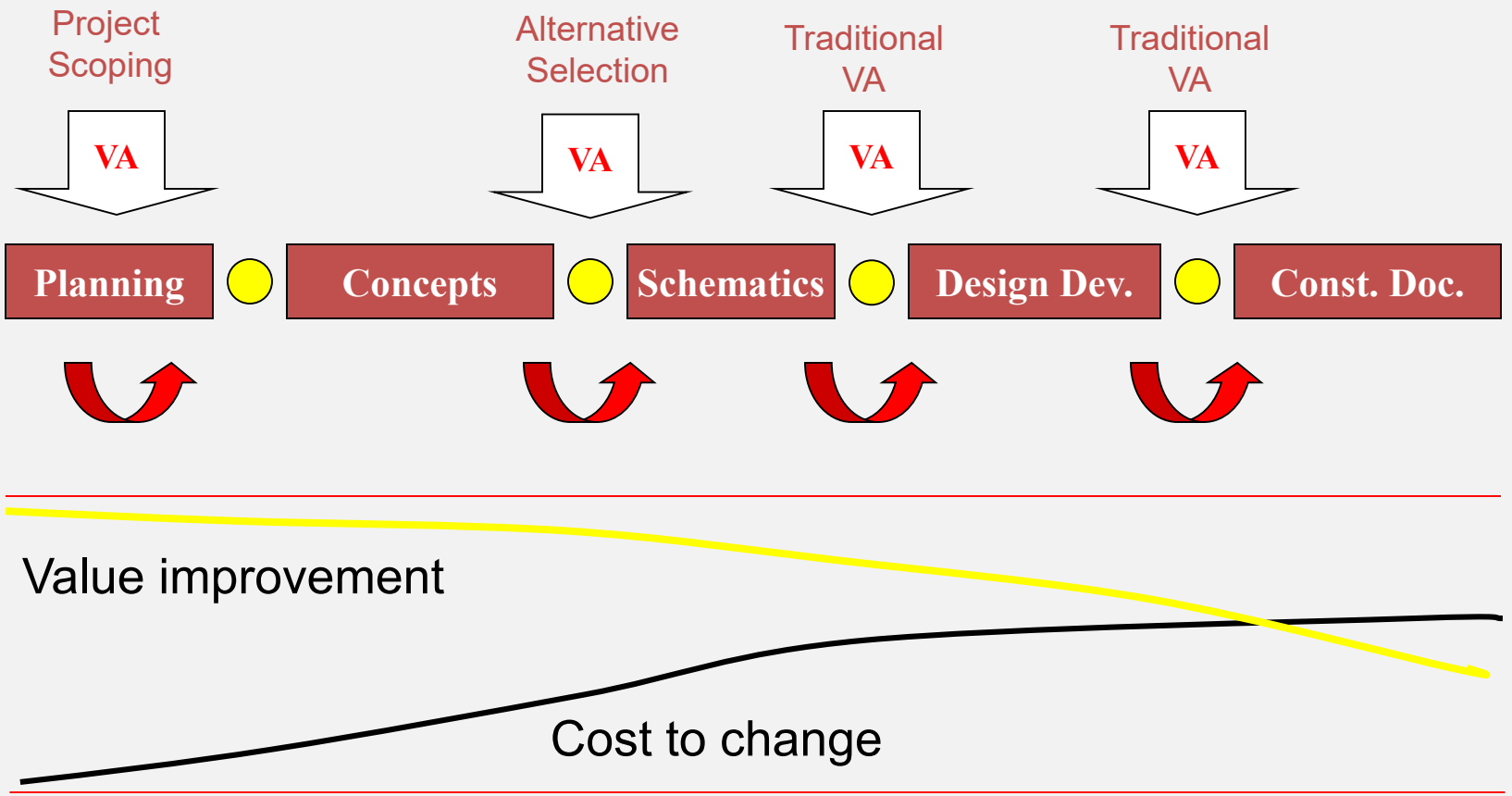
Legend: Major Interest (3); Moderate Interest (2); Minor Interest (1)	STAKEHOLDERS									
Interested in:	Environmentalist	County (Gov't At Large, Incl Drain Office)	Township / Village / City	Road Commission	Landowners	Consulting Engineers / Surveyors	Attorneys	Contractor	Local Utilities (Electric, Gas, Telephone, Fiber, Sanitary, Water)	Emergency Services
Landscapes (Restoration)	0	0	1	1	3	2	0	1	0	0
Local Cultural Issues	0	1	3	0	0	0	0	0	0	0
Local Business/Enterprise Issues	0	0	0	0	0	0	0	0	0	0
Environmental - Lakes and Streams	3	2	1	0	2	1	0	0	0	0
Environmental - Wetlands	0	0	0	0	0	0	0	0	0	0
Environmental - Threatened/Endangered	3	2	1	0	0	1	0	0	0	0
Environmental - Fish Passage	3	2	1	0	1	0	0	0	0	0
Schedule - Design	0	1	3	0	3	3	0	0	0	0
Schedule - Construction (when/duration)	1	1	3	2	3	3	0	3	2	3
Public Education (transparency, onsite poster board, maps for municips, etc.)	0	1	1	0	3	2	0	0	0	0
Operation and Maintenance	0	3	3	0	2	2	0	0	0	0
Transportation Safety	0	2	1	1	2	2	0	0	0	3
Landowner Safety	0	2	3	0	2	3	0	0	0	0
Capital Cost	0	3	3	3	3	2	0	0	0	0
End Product Performance (Level of Service)	2	3	3	2	3	3	0	0	0	0
Aesthetics	2	1	1	0	3	2	0	0	0	0
Flexability/Expandability	0	1	1	0	0	0	0	0	0	0
Constructability (Ease/Risk)	0	2	2	1	0	3	0	3	0	0
Easement Acquisition	0	2	0	0	1	3	3	0	0	0
SUM	14	29	31	10	31	32	3	7	2	6
RANK	5	4	2	6	2	1	9	7	10	8

Stakeholders & Interests Model to Determine Participants

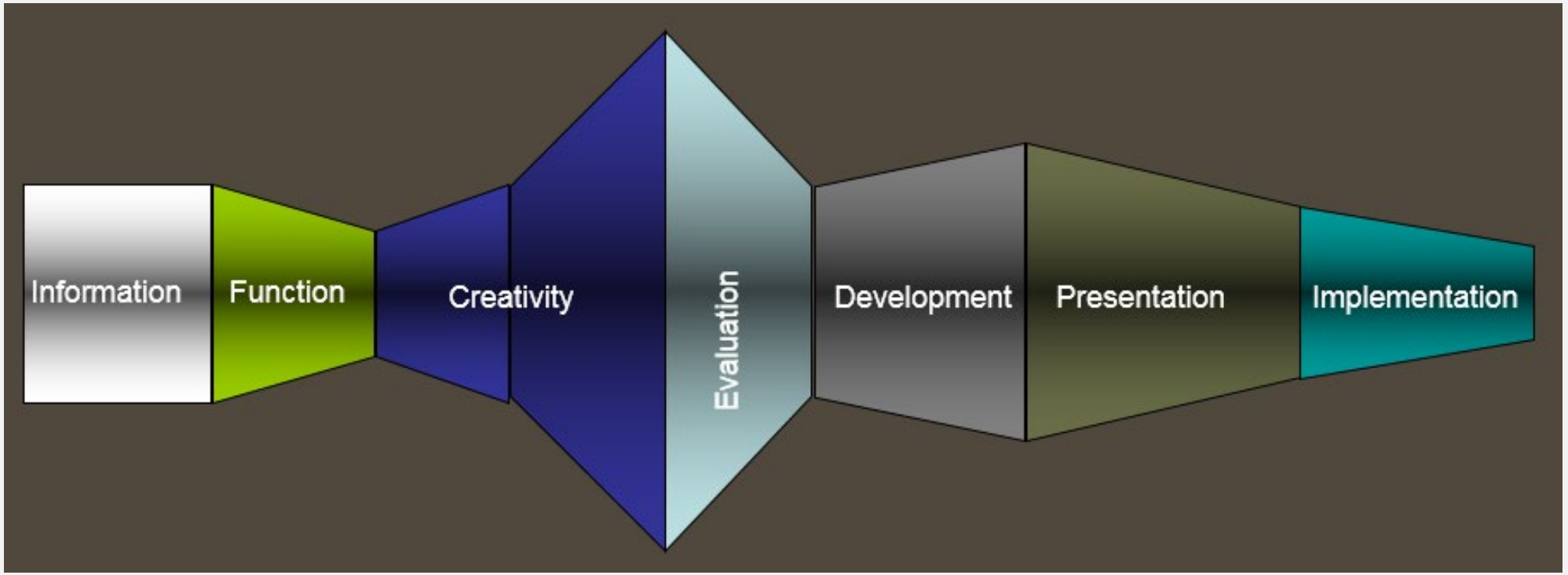
Three Types of Value Analysis Applications

1. **Scoping New Project**
   - ✓ Team of Stakeholders (Including Design Engineer)
   - ✓ Project Goals, Function Analysis for Project Scope
   - ✓ Recommendations for Project Direction, Concepts & Budget
2. **Selection of Preferred Alternative**
   - ✓ Team of Stakeholders + Independent Review Specialists
   - ✓ Choosing By Advantages, Recommended Alternative & Cost Savings
3. **Traditional Value Analysis**
   - ✓ Team of Stakeholders + Independent Review Specialists
   - ✓ Value Models, Function Inspired Ideas
   - ✓ Recommendations for Performance Improvements & Cost Savings

Three Types of Value Analysis Applications



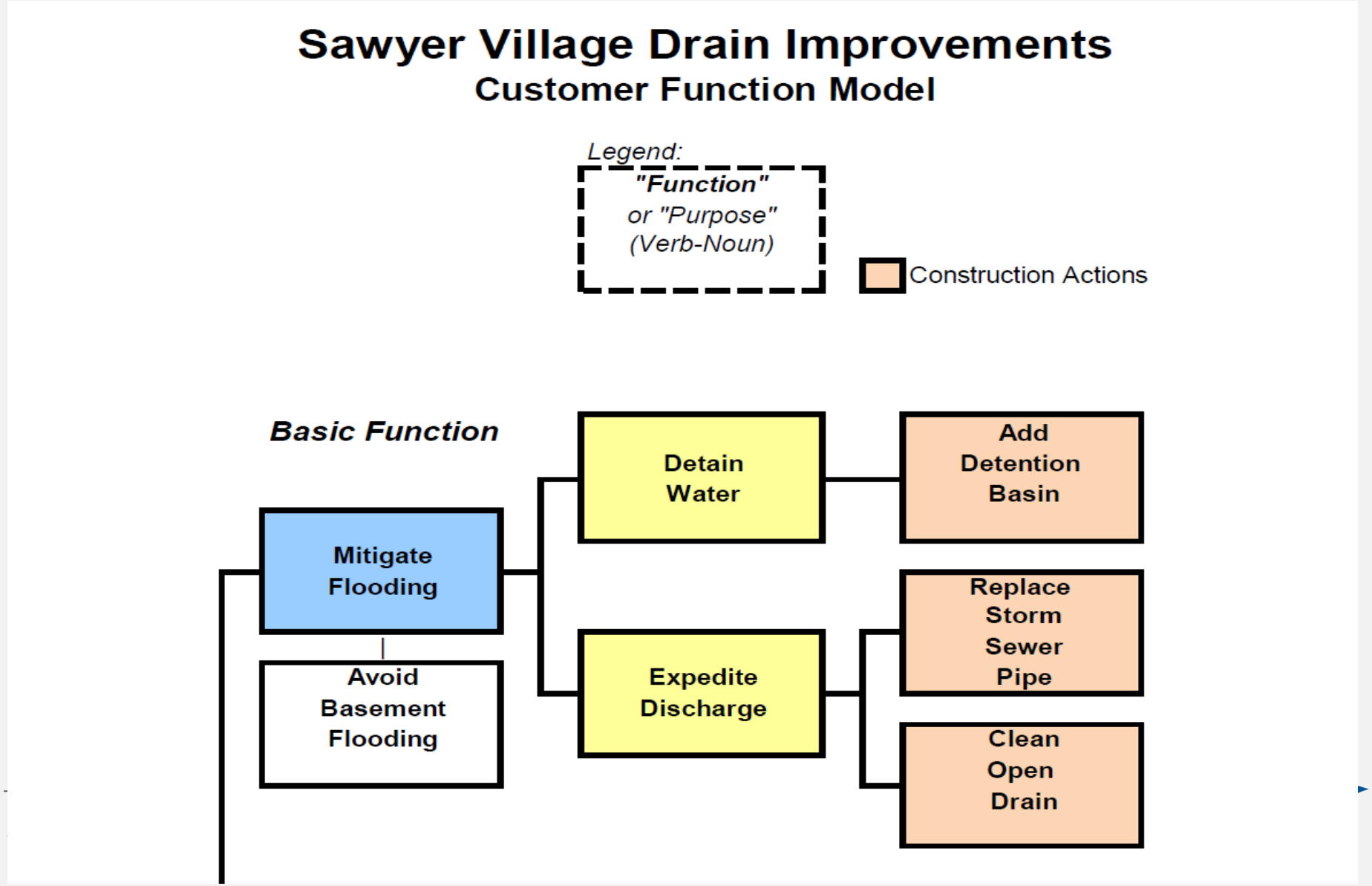
VA Workshop Process



Customer Function Model

How?

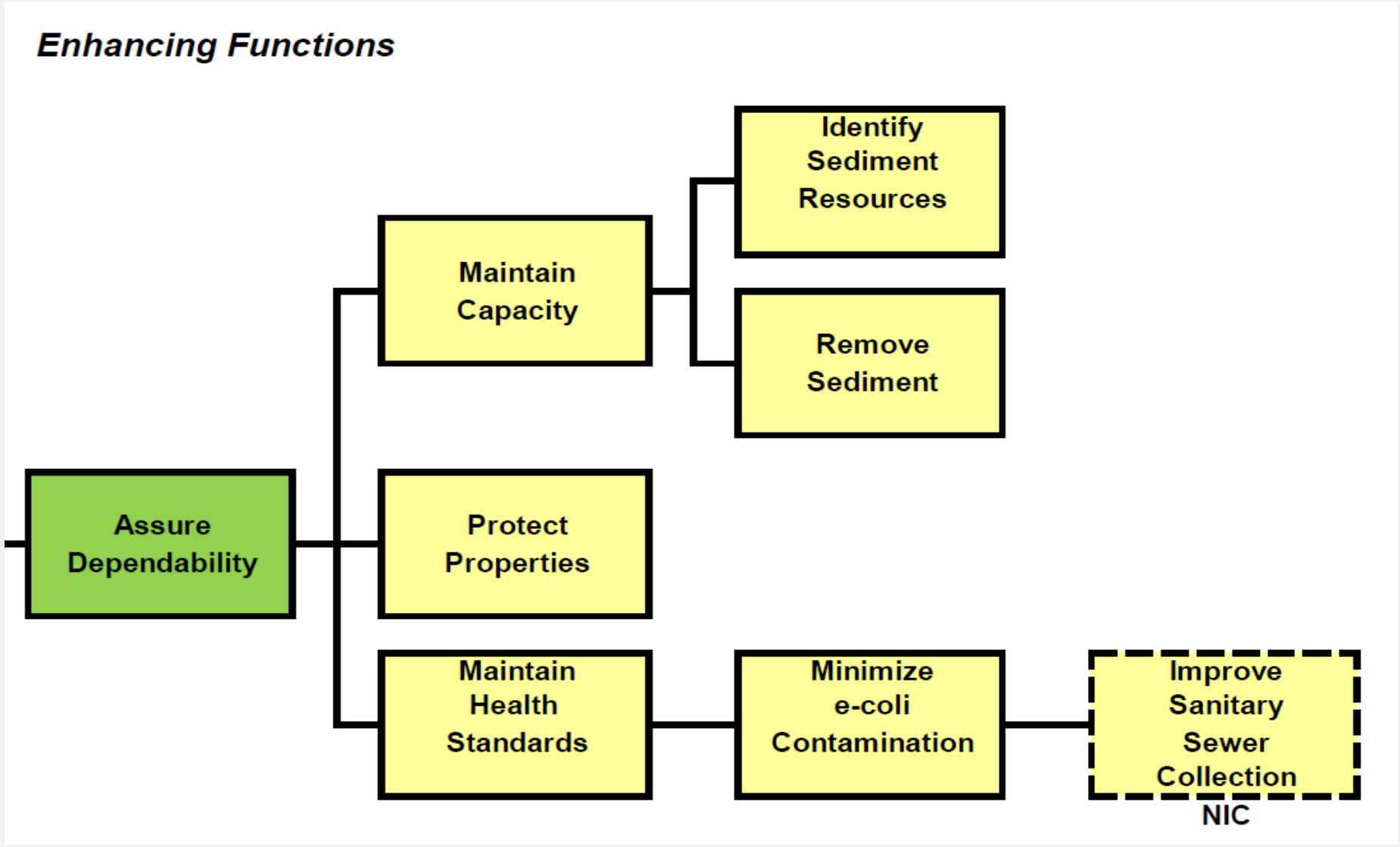
Why?



Function Analysis Model

How?

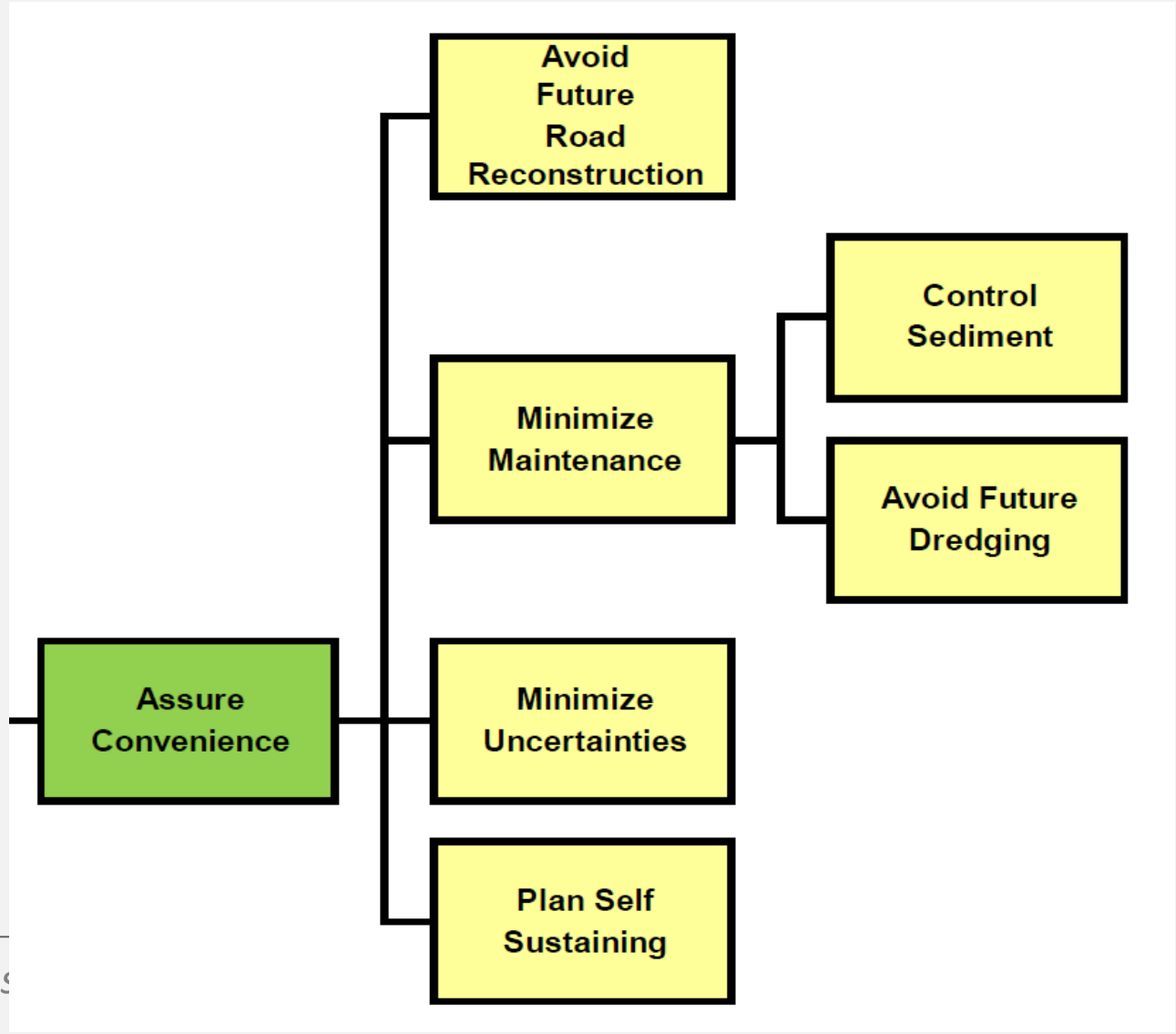
Why?



Function Analysis Model

How?

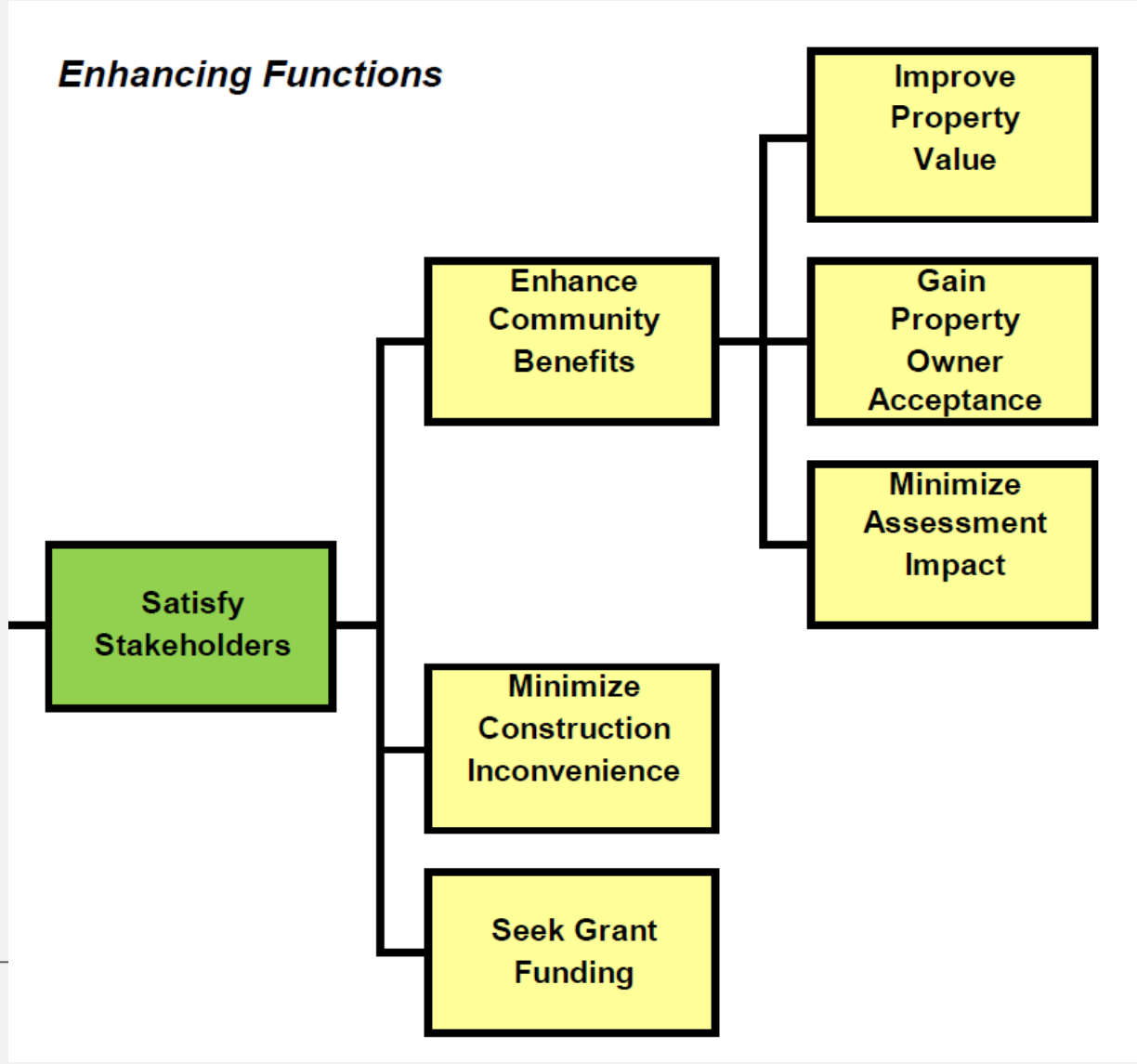
Why?



Function Analysis Model

How?

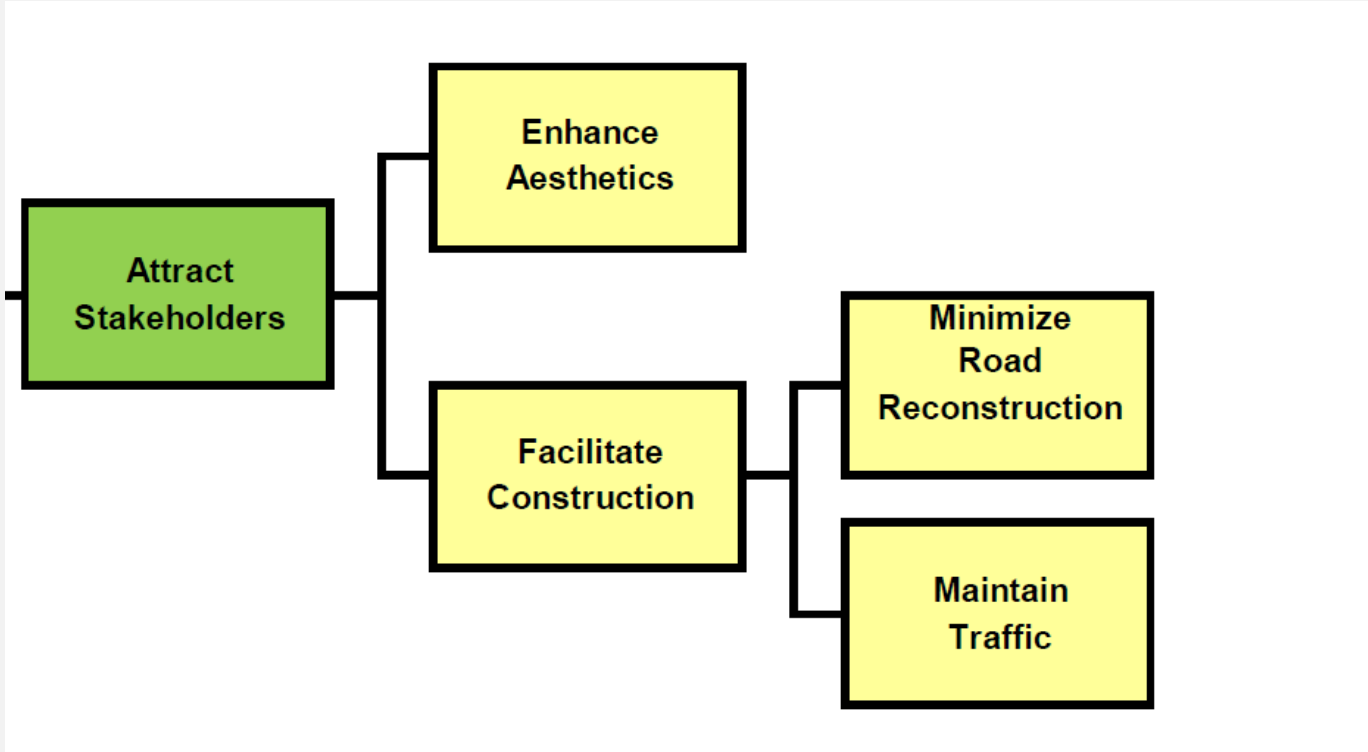
Why?



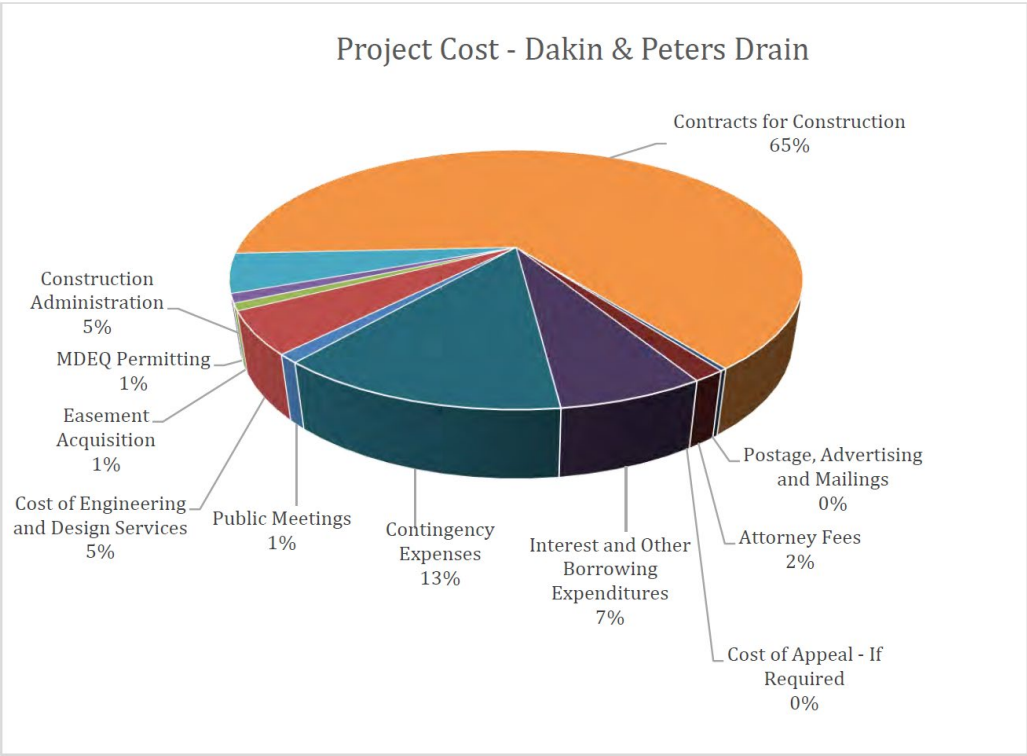
Function Analysis Model

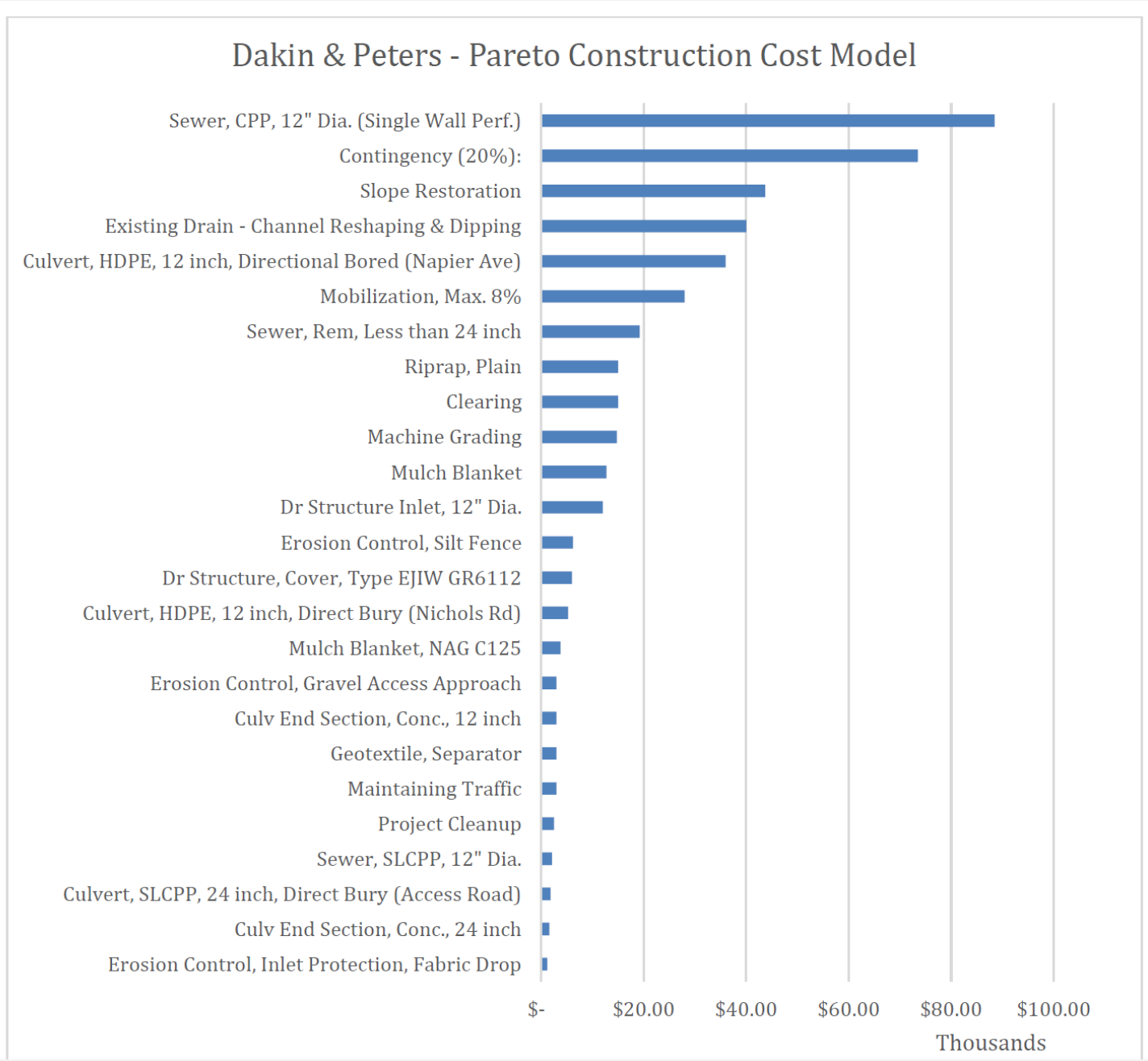
How?

Why?

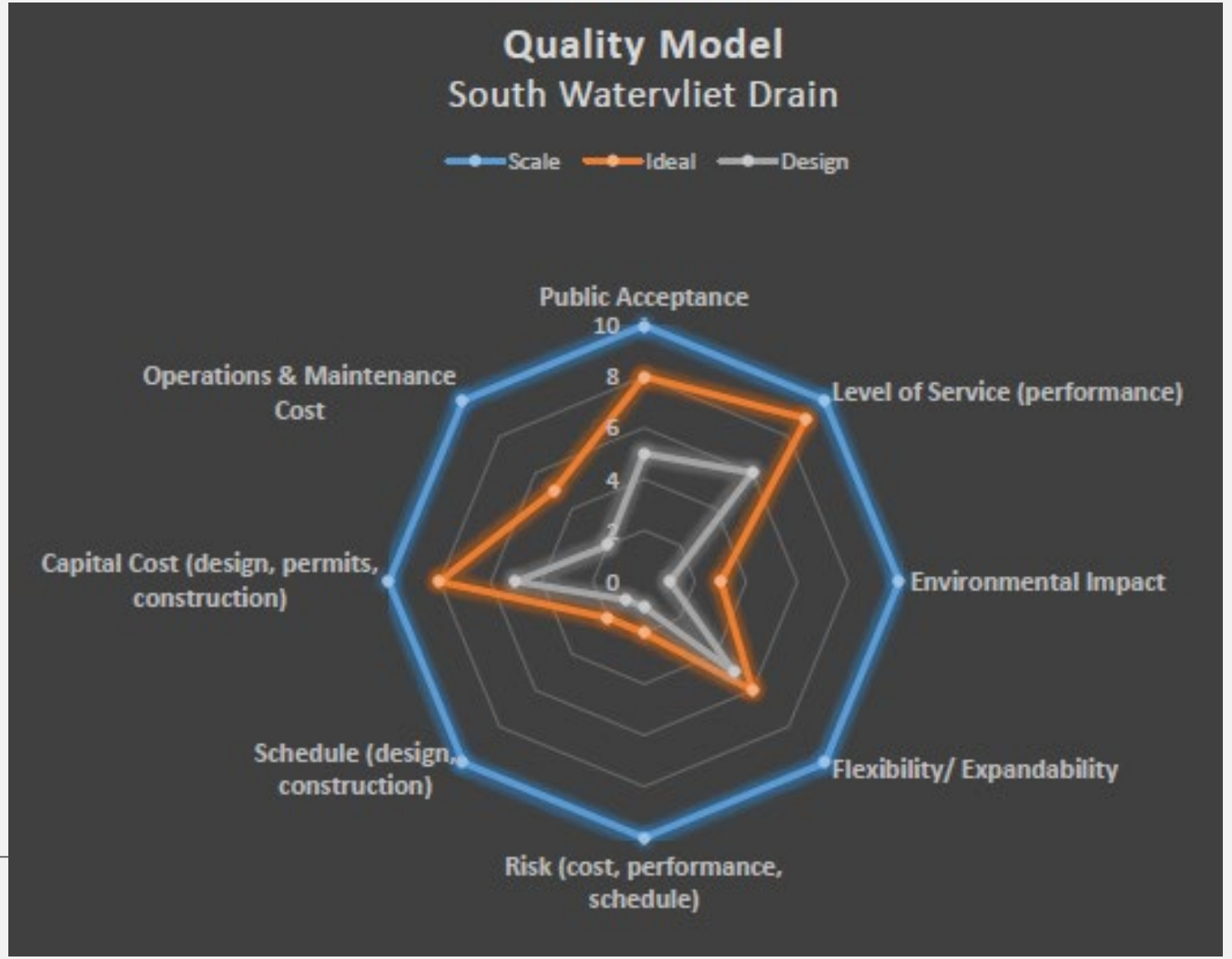


Cost Model Pareto 20/ 80

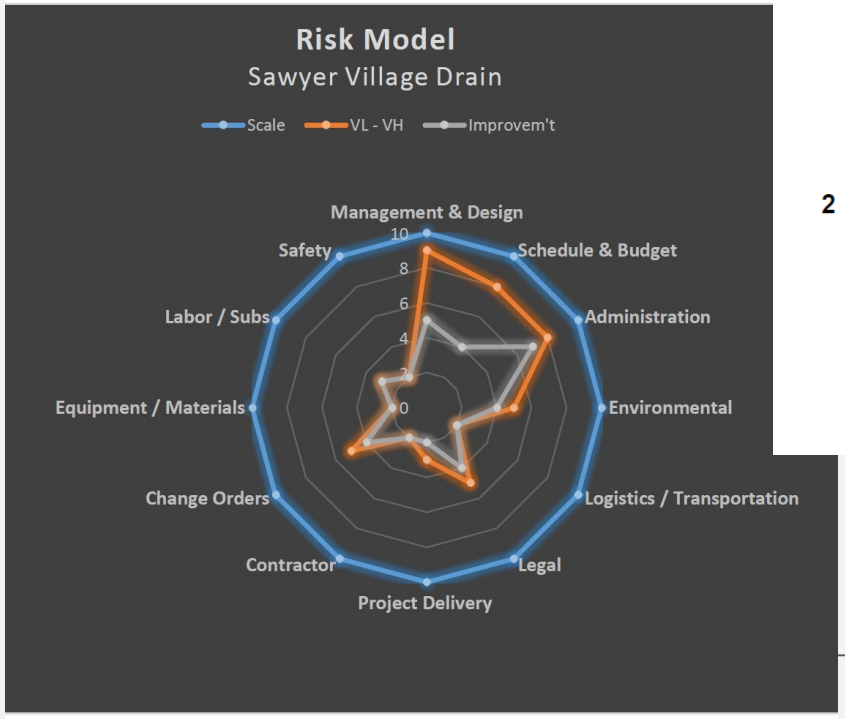




Performance/ Quality Model



Risk Model



Risk Model Identification

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Figure 4.4A

Project: **Sawyer Village Drain Improvements**

Location: **Berrien County, MI**

Date: **30-Aug-18**

Key: Low Risk / Medium Risk / High Risk

Project Controls

		Comment:	Low	Medium	High
1	**Management & Design**				
	Purpose & Need (Scope)	budget for e-coli testing & solution			
	Adequate Project Information (utilities)	MDOT storm sewer inform., depth of force main Terry Lane			
	Change In Gov't Regulations (wetlands)	MDEQ not restrictive			
	Changes in Project Scope	Basin location & number			
	Public and Political Perspectives	Owner acceptance			
	Changes in Market Conditions	Active constructor market, price variations			
2	**Schedule & Budget**				
	Schedule (Design, Bid, Const., Startup)	Seasonal for open ditch			
	Budget Limitations	No budget established with community			
	Estimate Accuracy	estimate uncertainty due to scope not fully defined			
	Contingencies (Cost, Schedule)	contingency of 15%			

LCC DATABASE

No	Item	Unit	Annual Maintenance					Replacement Cost		
			Description	Labor Equipment	Hours	Cost		Year		% Replaced
						Low	High	Low	High	
	Inlet Grate	Ea	Clean off top of inlet structure 1x/year	$60.00	1	$60.00		100	100	100
	Inlet Grate	Ea	Clean off top of inlet structure 2x/year	$60.00	2		$120.00			
	Inlet, Side Grate	Ea	Clean grate at inlet 1x/year	$220.00	4	$880.00		25	50	100
	Inlet, Side Grate	Ea	Clean grate at inlet 2x/year	$220.00	8		$1,760.00			
	Inlet Sump	Ea	Clean 2' sump with vac truck	$210.00	0.5	$105.00		100	100	100
	Inlet Sump	Ea	Clean 2' sump with vac truck	$210.00	1		$210.00			
	Pipe, New	Lft	Jet Cleaning every 20 years	$210.00	0.005	$1.05		50		
	Pipe, New	Lft	Jet Cleaning every 5 years	$210.00	0.005	$1.05				
	Pipe, Old	Lft	Jet Cleaning, 400 ft	$210.00	8	$1,680.00				
	Pipe, Old	Lft	Jet Cleaning, 400 ft	$210.00	16		$3,360.00			
	Pipe, Old	Lft	Root Cutting, 400 ft	$310.00	8	$2,480.00				
	Pipe, Old	Lft	Root Cutting, 400 ft	$310.00	16		$4,960.00			
	Open Ditch	Lft	Clean Channel every 5 years			$1.00	$3.00	100	100	100
	Open Ditch	Lft	Herbicide Spray every 5 years			$0.15	$0.25			
	Open Ditch	Lft	Clear Trees every 5 years, 40 ft easement			$4.00	$8.00			
	Open Ditch	Lft	Restoration, 40 ft easement, $3/syd			$13.30				
	Open Ditch	Lft	Restoration, 40 ft easement, $5/syd				$22.25			
	Culvert	Lft	Jet Cleaning every 5 years, avg 40 ft	$210.00		$10.00		25	50	100
	Culvert	Lft	Jet Cleaning every 15 years, avg 40 ft	$210.00			$10.00			
	Culvert	Ea	Restoration at inlet/outlet, every 5 years			$1,000.00				
	Culvert	Ea	Restoration at inlet/outlet, every 15 years				$1,000.00			
	Pond	Ea	Mowing every year			$1,000.00	$2,000.00	100	100	100
	Pond	Syd	1' sediment rem hauled away, every 5 years			$5.00	$20.00			
	Pond	Syd	1' sediment rem hauled away, every 15 years			$5.00	$20.00			
	Rain Garden	Syd	Cleaning, weeding, restore dead plantings			$7.00	$13.50	25	50	
	Level Cont Str	Ea	Clean Inlet Pipe, remove debris, 2x/year			$1,000.00	$2,000.00	100	100	

LCC ANALYSIS

LIFE CYCLE COST ANALYSIS (LCCA)

Project/Location: **Baushke & Brado Drain Improvements**
Idea: **Options for Mitigating Flooding**
Function: **Convey Stormwater**

VA No. **C-0**

Description:				Alternative 1		Alternative 2		Alternative 3/ 4		Alternative 5		Alternative 12		Alternative 14	
Project Life Cycle = 50 Years				Raise road profile at Duncan Road and Benton Center Road intersection, clean ditch, re-shape channel		Drain cleanout and regular maintenance program (restore "last established") – limited to channel upstream of the Sarett Nature Center		Add upstream and-mid-channel sediment control features and capture sediment along I-196. Add in-line sediment trap in the channel.		Increase Benton Center Road culvert velocity by replacing with smaller diameter (say 36") culvert		Add drainage channel on north side of Duncan Road & use existing pond for settlement.		Purchase affected properties, convert Duncan Road. to natural stream.	
Discount Rate = 3.00%															
Present Time = Date of Occupancy															
INITIAL COSTS	**Quantity**	**UM**	**Unit Price**	**Est.**	**PW**	**Est.**	**PW**	**Est.**	**PW**	**Est.**	**PW**	**Est.**	**PW**	**Est.**	**PW**
	1	LS	177,000	177,000	177,000	0	0	0	0	0	0	0	0	0	0
	1	LS	16,000	0	0	16,000	16,000		0		0		0		0
	1	LS	110,000					110,000	110,000	0	0				
	1	LS	64,000							64,000	64,000				
	1	LS	128,000									128,000	128,000		
	1	LS	1,200,000											1,200,000	1,200,000
					0		0		0		0		0		0
Total Initial Cost					**177,000**		**16,000**		**110,000**		**64,000**		**128,000**		**1,200,000**
REPLACEMENT COST/ SALVAGE VALUE															
Description	**Year**	**PW Factor**													
Channel maintenance	5	0.8626			0	16,000	13,801	8,000	6,901	16,000	13,802	24,000	20,702	0	0
	10	0.7441			0	16,000	11,905	8,000	5,953	16,000	11,906	24,000	17,858	0	0
	15	0.6419		16,000	10,269	16,000	10,269	8,000	5,135	16,000	10,270	24,000	15,404	0	0
	20	0.5537			0	16,000	8,858	8,000	4,429	16,000	8,859	24,000	13,288	0	0
	25	0.4776			0	16,000	7,641	8,000	3,821	16,000	7,642	24,000	11,462	0	0
	30	0.4120		16,000	6,591	16,000	6,591	8,000	3,296	16,000	6,592	24,000	9,887	0	0
	35	0.3554			0	16,000	5,686	8,000	2,843	16,000	5,686	24,000	8,529	0	0
	40	0.3066			0	16,000	4,904	8,000	2,452	16,000	4,905	24,000	7,357	0	0
	45	0.2644		16,000	4,231	16,000	4,231	8,000	2,116	16,000	4,231	24,000	6,346	0	0
Salvage Value					0		0				0		0		0
Total Replacement/Salvage Costs					**21,000**		**74,000**		**37,000**		**74,000**		**111,000**		**0**
ANNUAL COSTS															
Description	**Escl. %**	**PWA**													
	0.0%	25.730			0		0		0		0		0		0
	0.0%	25.730			0		0		0		0		0		0
Total Annual Costs (Present Worth)					**0**		**0**		**0**		**0**		**0**		**0**
Total Life Cycle Costs (Present Worth)					**198,000**		**90,000**		**147,000**		**138,000**		**239,000**		**1,200,000**
Total Life Cycle Costs (Annualized)	**PP Factor**	**0.0389**		**7,695**	**Per Year**	**3,498**	**Per Year**	**5,713**	**Per Year**	**-**	**Per Year**	**9,289**	**Per Year**	**46,639**	**Per Year**

PW: Present Worth PWA: PW of Annuity PP: Periodic Payment

ALTERNATIVE RANKING

Ranking Worksheet

Project: Baushke & Brado Drain Improvements
Idea: Options for Mitigating Flooding
Function: *Convey Stormwater*

Performance Criteria Weighting Matrix

Performance Criteria (Factors):		Preference		Preference		Preference		Preference		Preference		Preference	
A.	Mitigate Flooding	A or 4	B	A or 4	C	A or 1	D 1	A or 4	E	A or 4	F	A or 4	G
B.	Self Sustaining	B or 3	C	B or 1	D 1	B or 1	E 1	B or 4	F	B or 3	G		
C.	Minimize Uncertainties	C or	D 4	C or	E 4	C or 4	F	C or 4	G				
D.	Avoid Impacts Endangered Spec	D or 1	E 1	D or 4	F	D or 4	G						
E.	Improve Water Quality	E or 4	F	E or 4	G								
F.	Minimize Schedule	F or 4	G										
G.	Maintain Traffic												

How Important: Major Preference = 4, Medium Preference = 3, Minor Preference = 2, No Preference Each = 1

Alternative Scoring Marrix/ Ranking

		A. Mitigate Flooding		B. Self Sustaining		C. Minimize Uncertainties		D. Avoid Impacts Endangered Spec		E. Improve Water Quality		F. Minimize Schedule		G. Maintain Traffic		Performance Total Score	Life Cycle Cost (000)	Value Score (Performance/LCC Ratio)	Ranking
	Raw Score	21		12		8		15		14		4		0					
	Weight	21		12		8		15		14		4		1					
Alternatives: Clean channel &:		Score	W.S.	Score	W.S.	Score	W.S.	Score	W.S.	Score	W.S.	Score	W.S.	Score	W.S.				
1.	Raise road profile at Duncan Road and Benton Center Road intersection, clean ditch, re-shape channel	4.5	94.5	4.0	48.0	2.00	16.0	3.0	45.0	1.0	14.0	2.0	8.0	1	1.0	226.50	198.00	1.14	4
2.	Drain cleanout and regular maintenance program (restore "last established") – limited to channel upstream of the Sarett Nature Center	1.0	21.0	1.0	12.0	1.00	8.0	4.0	60.0	1.0	14.0	5.0	20.0	4	4.0	139.00	90.00	1.54	2
3/ 4.	Add upstream and-mid-channel sediment control features and capture sediment along I-196. Add in-line sediment trap in the channel.	4.0	84.0	3.0	36.0	4.00	32.0	4.0	60.0	5.0	70.0	3.0	12.0	4	4.0	298.00	147.00	2.03	1
5	Increase Benton Center Road culvert velocity by replacing with smaller diameter (say 36") culvert	1.5	31.5	2.0	24.0	2.00	16.0	4.0	60.0	1.0	14.0	5.0	20.0	3	3.0	168.50	138.00	1.22	3
12	Add drainage channel on north side of Duncan Road & use existing pond for settlement.	4.0	84.0	2.5	30.0	2.00	16.0	1.0	15.0	1.0	14.0	4.0	16.0	3	3.0	178.00	239.00	0.74	5
14	Purchase affected properties, convert Duncan Road. to natural stream.	5.0	105.0	5.0	60.0	3.00	24.0	5.0	75.0	5.0	70.0	1.0	4.0	5	5.0	343.00	1,200.0	0.29	6

Score: Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1

VA RECOMMENDATION

Value Analysis Recommendation

Project: **Baushke & Brado Drain Improvements** VA No. **C-0**
Idea: **Options for Mitigating Flooding**

Function: ***Convey Stormwater***

Description of Preliminary Design Alternatives

Several options were identified by the design engineer LSG for mitigating flooding. In addition the VA team added two more. Options evaluated are the following:
Alternative 1: Raise road profile at Duncan Road and Benton Center Road intersection, clean ditch, re-shape channel
Alternative 2: Drain cleanout and regular maintenance program (restore "last established") – limited to channel upstream of the Sarett Nature Center
Alternative 3/ 4: Add upstream and-mid-channel sediment control features and capture sediment along I-196. Add in-line sediment trap in the channel.
Alternative 5: Increase Benton Center Road culvert velocity by replacing with smaller diameter (say 36") culvert
Alternative 12: Add drainage channel on north side of Duncan Road & use existing pond for settlement.
Alternative 14: Purchase affected properties, convert Duncan Road. to natural stream.

Description of VA Proposed Design

Construct upstream and mid-channel sediment control features. Includes initial channel cleanout and improving cross-section from point of ending downstream to the Benton Center Road crossing and limited excavation of existing open channel west of Benton Center on the Sarett Nature Center (not more than 300 feet downstream of the culvert). MDOT will partner to construct a facility (or, facilities) to capture sediment before leaving the I-196 row and the BCDC will construct a 300 foot long in-line sediment trap in the channel immediately upstream of the Benton Center crossing. Regular cleanout of these facilities will be required (direct observation and experience will yield an appropriate cycle). Some additional ROW will need to be obtained for the cross-section improvement as existing side slope is too steep.

Performance Advantages and Disadvantages of Proposed Design

Advantages:

- Mitigates flooding
- Self sustaining
- Minimizes uncertainties
- Minimizes impacts endangered species
- Improves water quality
- Minimizes schedule
- Maintains traffic

Value Indicator:

Disadvantages:

- Capital cost investment
- Construction disruption
- Risk to endangered species

Value Analysis Recommendation

Project: **Baushke & Brado Drain Improvements** VA No. **C-0**
Idea: **Options for Mitigating Flooding**

Function: ***Convey Stormwater***

Performance and Life Cycle Cost Summary

	Performance Score	Initial Cost	(50 year) Life Cycle Cost
Alternative 1	226.50	177,000	198,000
Alternative 2	139.00	16,000	90,000
Alternative 3/4, Preferred	**298.00**	**110,000**	**147,000**
Alternative 5	168.50	64,000	138,000
Alternative 12	178.00	128,000	239,000
Alternative 14	343.00	1,200,000	1,200,000

Technical Analysis - What is good about the Idea?

Alternative 3/4 offers the best combination of performance and cost. VA team unanimously recommends this alternative for the advantages listed above. See also the Weighted Evaluation worksheet that compares all six alternatives in terms of performance and life cycle cost.

Technical Analysis - What is required to make the idea technically feasible?

Alternative 3/4 is technically feasible.

Technical Analysis - What are the risks associated with this idea (Schedule, etc.)?

Schedule is longer with alternative 3/4 compared with alternative 2.

Technical Analysis - If further study is required, identify which areas?

Refinement of alternative 3/4 is required.

Recommendation: **Needs Further Study:** ☐ **Accept:** ■ **Reject*:** ☐

Approval:

Drain Commissioner:	Signature:	Date:

* If Rejected, Kindly provide the detailed reasons for rejecting the idea.

LIFE CYCLE COSTING & CHOOSING BY ADVANTAGES

LIFE CYCLE COST ANALYSIS (LCCA)

Figure 3.1D

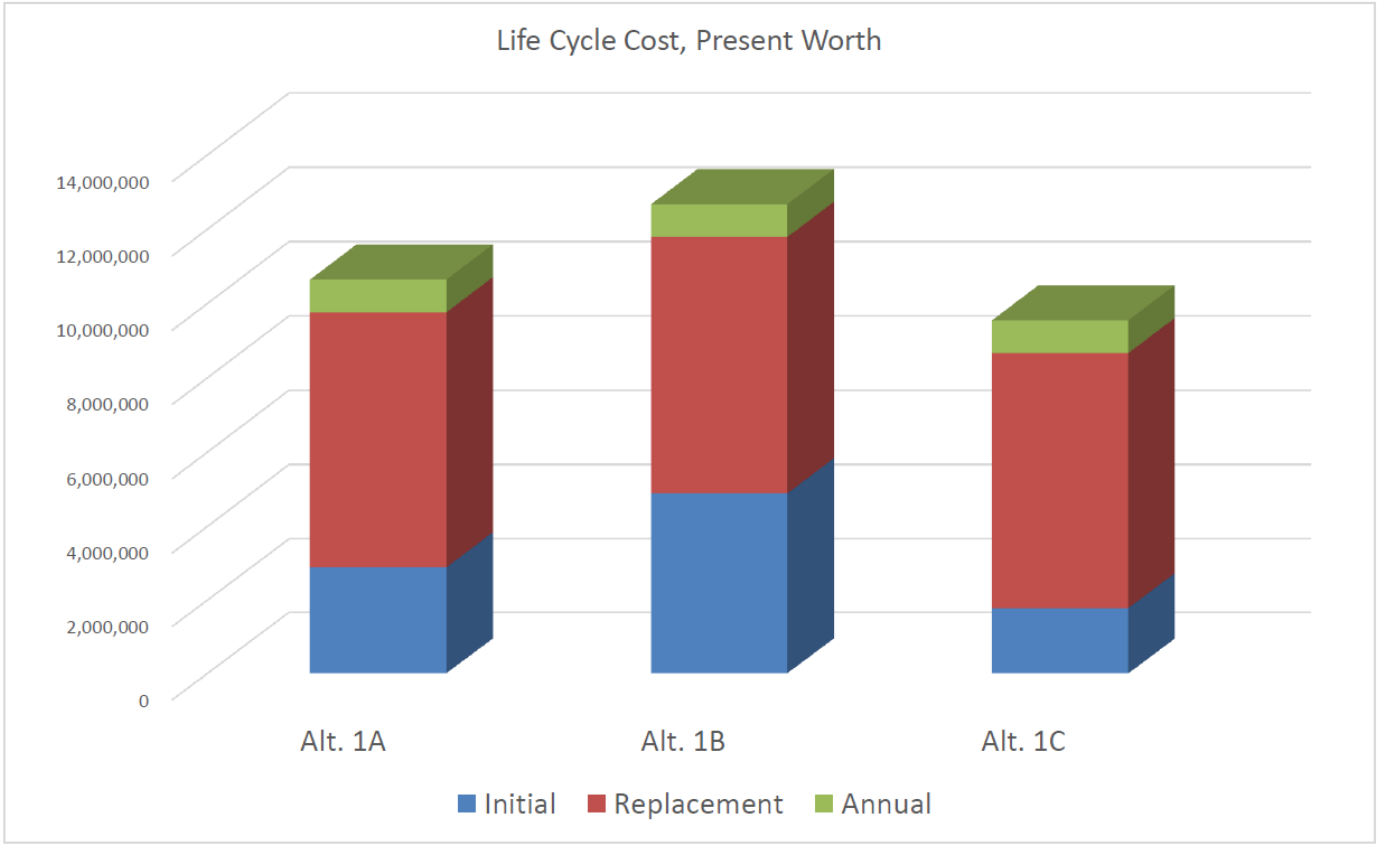
Project/Location: **Kephart Woods Drain, Berrien County, MI**

Subject: **Drain Options**

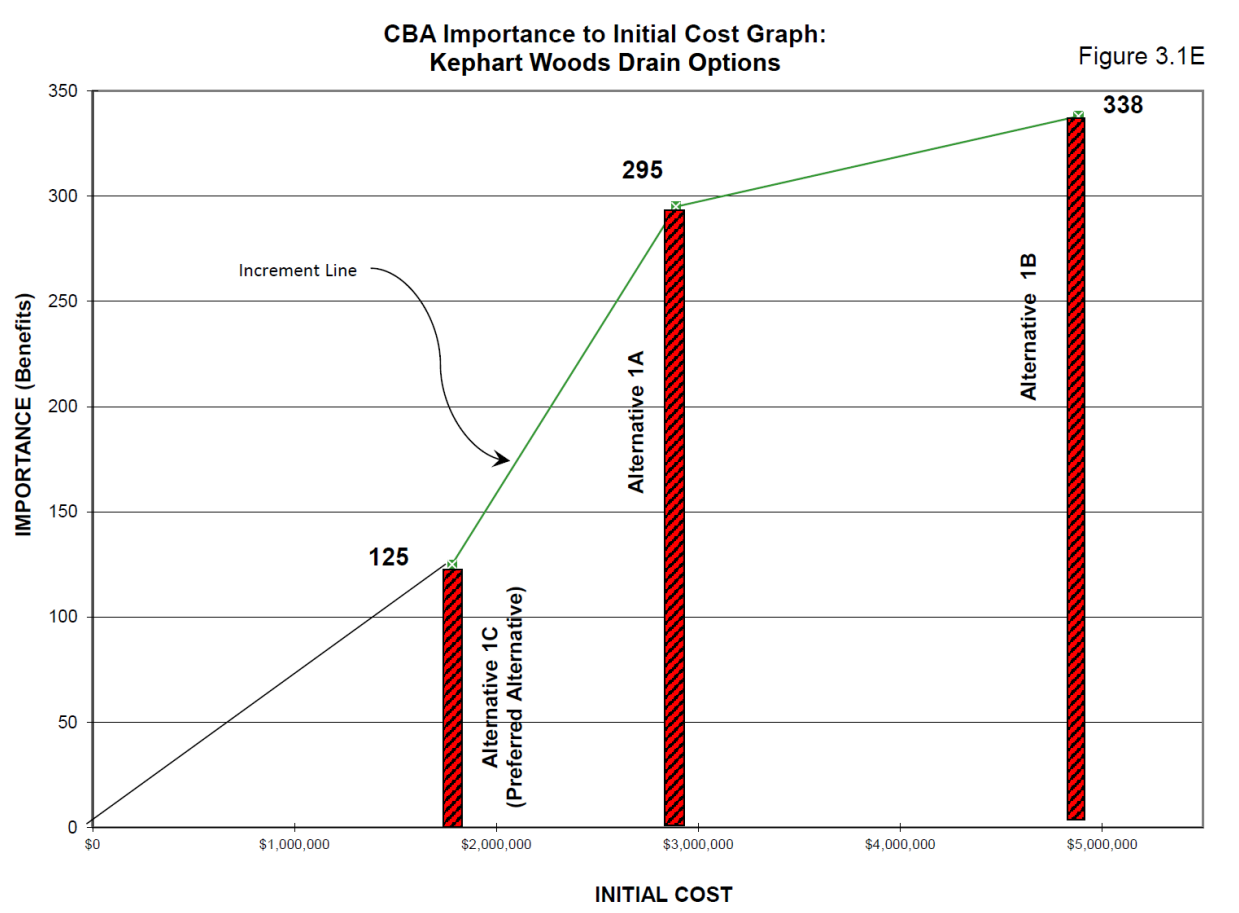
Project Life Cycle : **25 Years**

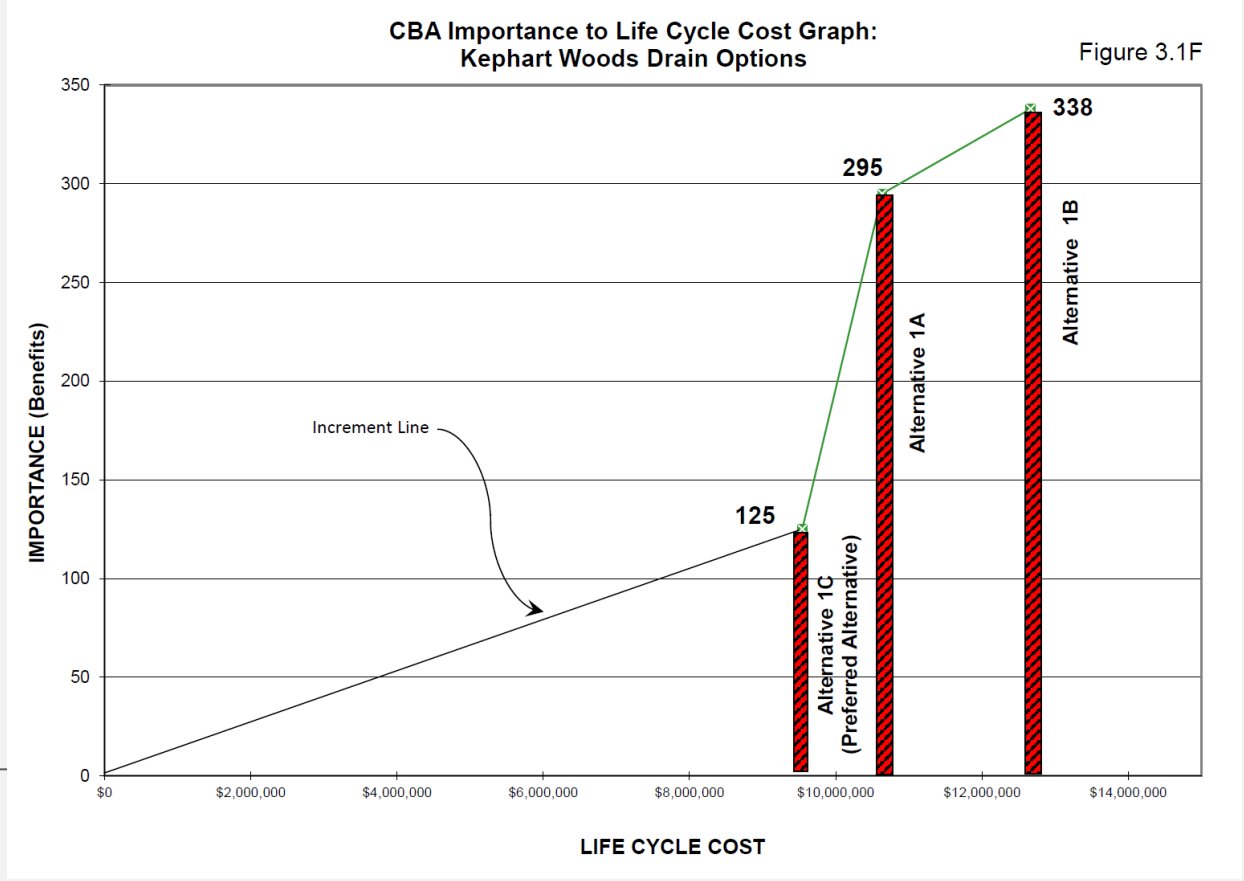
Discount Rate : **3.0%**

Alternative 1A	Alternative 1B	Alternative 1C (Reconsideration)
Ditching and other storm improvements	Drain tile and other storm improvements	Ditching, retain & use existing pipe, simplify driveway & landscape restoration, use leaching basins where sandy soil, and other storm improvements



Choosing By Advantages





How Did It Help the Design Engineer?

- Clear direction for the project, scope confirmation early in the project life cycle
- Collaboration with the Drain Commissioner & Community for improved coordination
- Additional technical review by 3rd party engineering consultants involved in the VA workshop
- Improved decision-making exploring multiple alternatives with life cycle cost analysis
- Reduced design engineering time since alternatives are reviewed quickly

Design Approach: A or B?

A

B

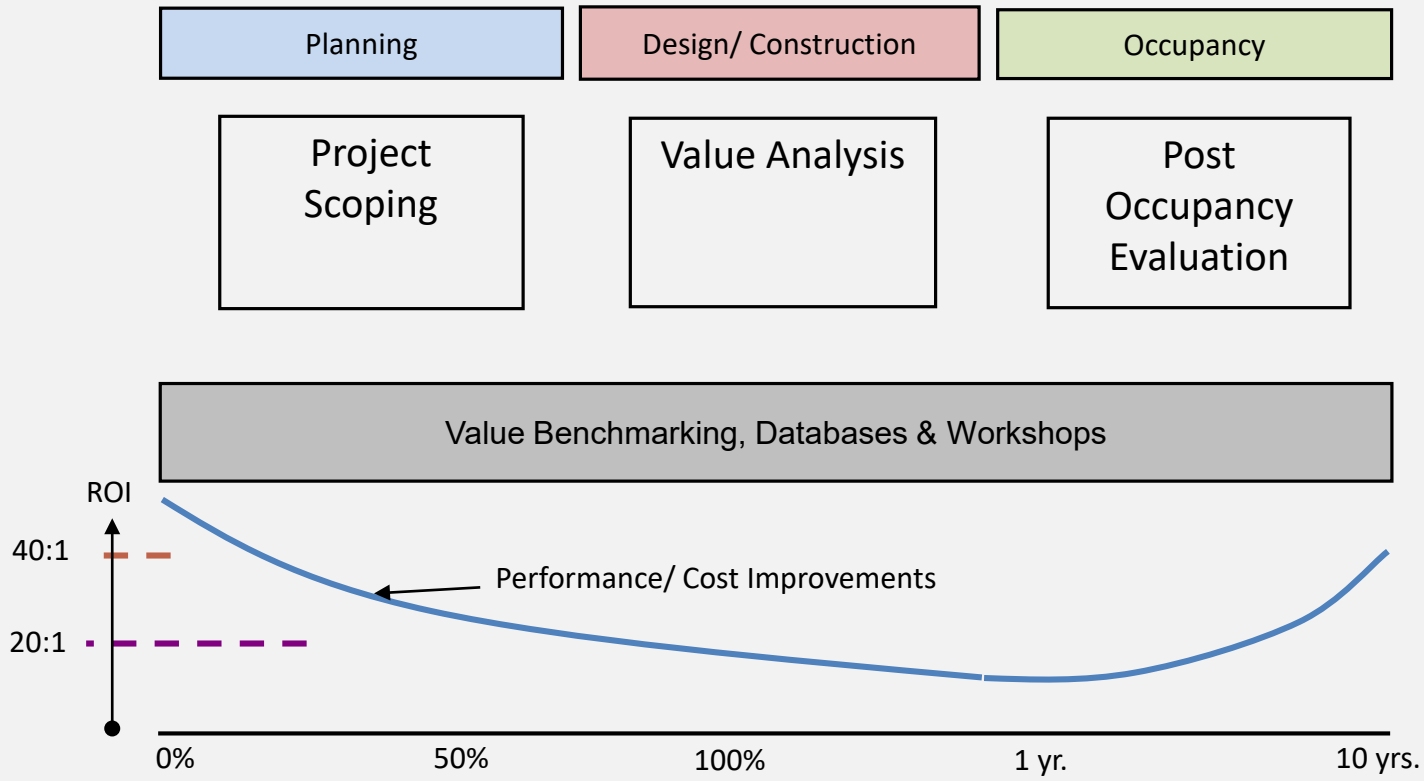
Stakeholders: Inputting Ideas and Values

Scope: Balancing Ideas, Values and Cost

Is VM Cost Effective for Counties?

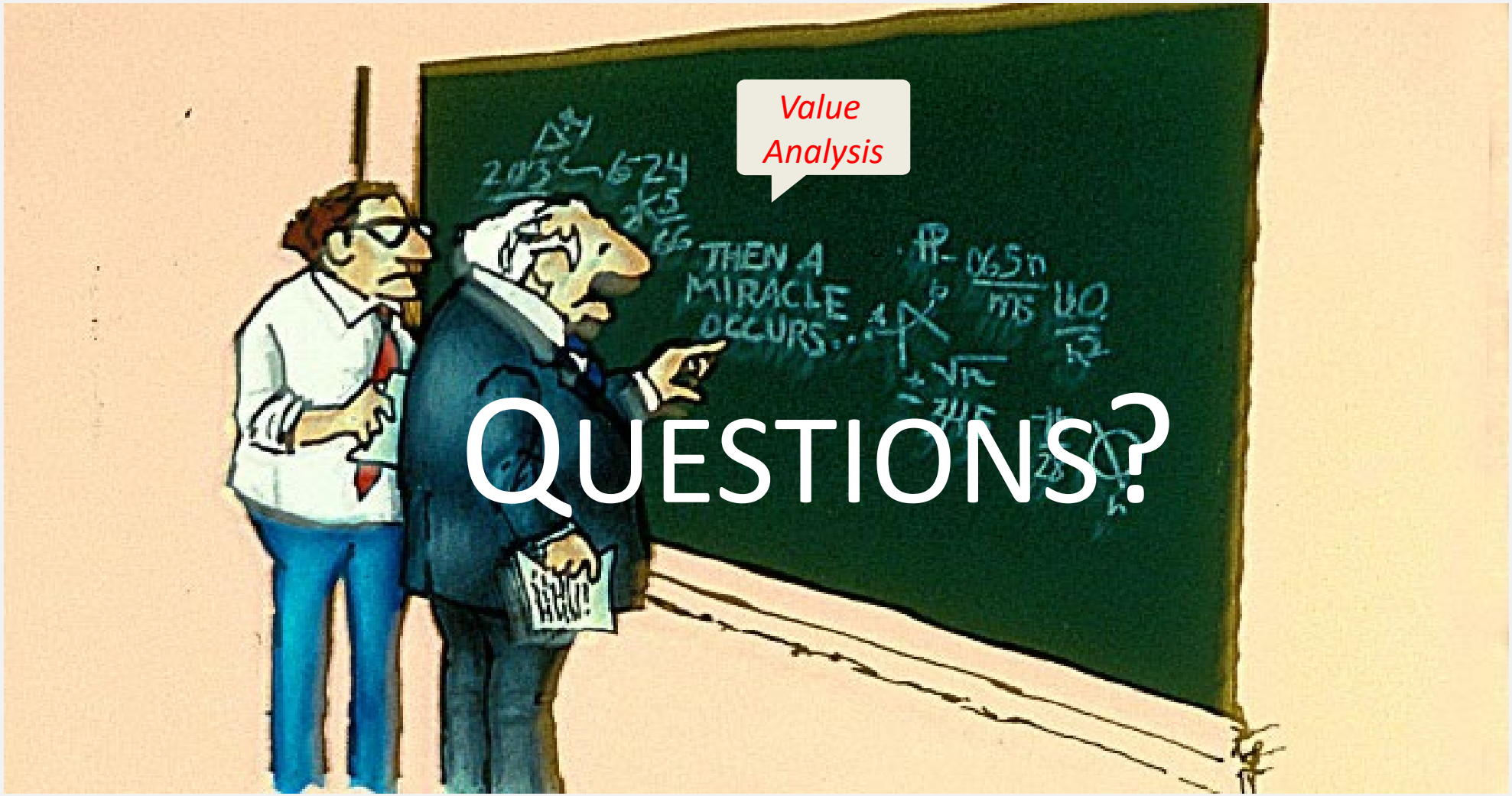
- Most VA Workshops are 1 – 2 days
- Cost is less than $10K for the workshop and report
- Cost savings averages 10 to 30%. For a $1,000,000 project, this is a savings of $100K to $300K
- Return on investment averages 20:1
- Performance Improvements, better project definition, review by independent specialists and stakeholder participation and creative ideas all contribute to better project value for the County

Value Analysis Return on Investment



What Are the Next Steps

- Consider Value Analysis for your next project
  - Project Scoping
  - Selection of Preferred Alternative
  - Traditional VA
- Obtain training in the Value Methodology
  - Awareness Seminar (8 hours)
  - Value Methodology Fundamentals 1 (32 hours)
  - Specialty Seminars on LCC, Risk, etc.
- Establish a VM Program within your organization


Value Analysis
THEN A MIRACLE OCCURS...
QUESTIONS?

For More Information on
The Power of the Value Methodology for Drains
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