

Surcharge Rate Updates...

Avoid Undercharging (or Overcharging)

Your Industrial Users

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AGENDA

- Background
- Methodology for Updating Surcharge Rates
- Case Study
- Discussion



BACKGROUND

STRENGTH SURCHARGES

- Utility wastewater billings to industrial users can include:
 - Service charge
 - Volume charge
 - Strength surcharge
- Strength surcharges used to recover costs to treat more concentrated wastes
- Strength surcharges are not penalties or fines, and do not replace enforcement for limit exceedances

APPLICABILITY

- Strength surcharges generally focus on:
 - BOD₅
 - TSS
 - Total P
 - Ammonia-N (or TKN where appropriate)
- Not recommended for FOG
- Not appropriate for toxics



HISTORY

- Strength surcharges began in 1972 with Clean Water Act
- Part of construction grant requirements
- Intent was to recover O&M costs
due to industrial users
- Exclude non-O&M costs (depreciation,
debt service, etc.)



STRENGTH SURCHARGE BASIS

- Threshold concentration (mg/L)
- Surcharge rate (\$/lb)

Example

Assume 200 mg/L threshold and \$0.50/lb rate. If user discharges 0.015 MGD at 400 mg/L:

0.015	MGD
* (400-200)	mg/L
* 8.34	
<hr/>	
25	lb/day
* \$0.50	/lb
<hr/>	
\$12.50	/day

THRESHOLD CONCENTRATIONS

- Should represent median-to-high domestic waste
- Typically set based on literature values, but can use site-specific background data if available:

Parameter	Literature Medium-to-High Strength mg/L*	Michigan POTWs**		
		Mean mg/L	Mean+1σ (68%) mg/L	Mean+2σ (95%) mg/L
BOD ₅	300	200	280	360
TSS	300	160	240	320
Total P	10	4	6	8
Ammonia-N (TKN)	35 (55)	20 (32)	26 (42)	32 (52)

*Metcalf & Eddy, Inc., *Wastewater Engineering*, 3rd Edition, 1991

**MWEA IPP Committee Survey, 2012

σ – standard deviation

SURCHARGE RATES

- Should represent treatment cost difference between high strength waste and normal domestic waste
- May be inaccurate (high or low) if not specific to the POTW and/or not based on current O&M costs
- Traditional calculation methods
 - Survey of other POTWs
 - General rule-of-thumb
 - Estimated distribution factors



METHODOLOGY FOR UPDATING SURCHARGE RATES

OPTION A -- SURVEY OF OTHER POTW_s

- Wide range of values
- Unknown when/how calculations performed

Example

Parameter	POTW _s Surcharging	Average Rate \$/lb	Range \$/lb
BOD ₅	100%	0.19	0.01-0.50
TSS	98%	0.17	0.01-0.73
Total P	31%	0.41	0.14-4.98
Ammonia-N (TKN)	86%	1.51	0.27-4.79

Compiled by Mr. Jack Keys for MWEA IPP Committee, ca. 2000

OPTION B – GENERAL RULE-OF-THUMB

- Standard factors to distribute the total O&M cost
→ **What is a “standard” POTW?**
- Origin unknown; most likely came from USEPA

Parameter	Distribution
Flow	30%
BOD ₅	25%
TSS	30%
Total P	5%
Ammonia-N (TKN)	10%
Total	100%

OPTION C – ESTIMATED DISTRIBUTION FACTORS

- Generally developed for a particular POTW
- More complicated to apply and keep current

Example

Treatment Process	Process Allocation*	Parameter Distribution**					Total
		Flow	BOD ₅	TSS	Total P	Ammonia-N	
Raw Sewage Pumping	5%	100%	--	--	--	--	100%
Preliminary Treatment	5%	90%	--	10%	--	--	100%
Primary Treatment	15%	34%	33%	33%	--	--	100%
Secondary Treatment	25%	17%	33%	17%	--	33%	100%
Phosphorus Removal	5%	25%	--	--	75%	--	100%
Secondary Clarifier	10%	34%	33%	33%	--	--	100%
Disinfection	5%	80%	10%	10%	--	--	100%
Sludge Handling	20%	20%	20%	40%	--	20%	100%
Administration	10%	--	25%	25%	25%	25%	100%
Total	100%						

* fraction of variable O&M costs applicable to each treatment process

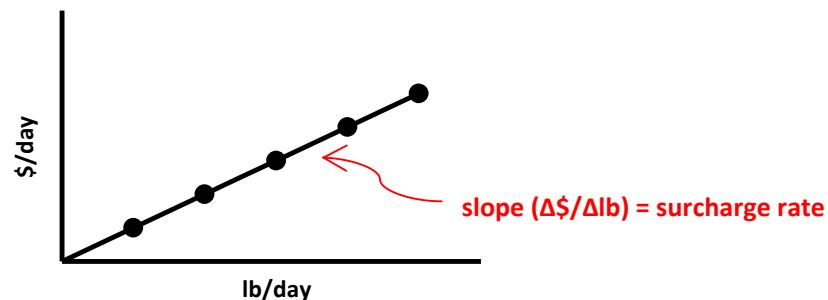
** fraction of treatment process cost applicable to each parameter

OPTION D (NEW) -- COMPUTER SIMULATION

- Run O&M costing software with increasing pollutant load:



- Plot incremental O&M cost vs. incremental load to yield \$/lb rate:



O&M COSTING SOFTWARE

- 1970s EXEC (U.S. Environmental Protection Agency)
Executive Digital Computer Program for Preliminary Design of Wastewater Treatment Systems
- 1980s CAPDET (U.S. Army Corps of Engineers)
Computer Assisted Procedure for the Design and Evaluation of Wastewater Treatment Systems
- 1990s CAPDET-PC[®] (Hydromantis, Inc.)
Rewritten version of CAPDET for personal computers
- 2000s CapdetWorks[®] (Hydromantis, Inc.)
Updated CAPDET-PC for Windows

CAPDEWORKS® FEATURES:

- Fast, friendly, and accurate
- Powerful
 - Models for typical wastewater unit operations
 - Models for typical biosolids unit operations
 - Steady-state mass balance analysis (with recycle streams)
 - Automatic cost index updates
 - Highly detailed O&M cost data



CASE STUDY

LAKEWOOD WASTEWATER AUTHORITY

- Rural facility with very large industrial component:
 - 50% of flow
 - 95% of BOD₅ load
 - 75-85% of other compatible loads
- Unique design
 - Dissolved Air Flotation + Oxidation Ditch
 - Biosolids storage lagoon (no disposal)

→ **Definitely not a “standard” POTW**



PERFORMANCE/COST DATA

- Pollutant Removals:

Parameter	Removal lb/year
BOD ₅	1,570,000
TSS	828,000
Total-P	17,600
TKN	180,000

Total for CY2014

- O&M Costs:

Item	Annual Cost
Labor and Benefits	\$347,795
Materials/Supplies	174,800
Repairs	144,300
Chemicals	54,000
Utilities	203,500
Fuel	28,000
Sludge Disposal	0
Administration	299,827
Total	\$1,252,222

Budget for FY2015

OPTION A – SURVEY OF OTHER POTW's

- Based on most recent survey of Michigan POTW's:

Parameter	Average Rate ca. 2000 \$/lb	Average Rate July 2015 \$/lb*
BOD ₅	0.19	0.14
TSS	0.17	0.15
Total P	1.51	1.90
Ammonia-N (TKN)	0.41	0.53

*Compiled by Mr. Kurt Anderson for MWEA IPP Committee, July 2015

OPTION B – GENERAL RULE-OF-THUMB

- Based on factors for “standard” POTW:

Parameter	Total O&M Costs (\$/year)	Treatment Cost (\$/year)		Pollutant Removal (lb/year)	Surcharge Rate (\$/lb)
Flow	1,252,222	30%	375,666	--	--
BOD ₅		25%	313,056	1,570,000	0.20
TSS		30%	375,667	828,000	0.45
Total-P		5%	62,611	17,600	3.56
Ammonia-N (TKN)		10%	125,222	180,000	0.70

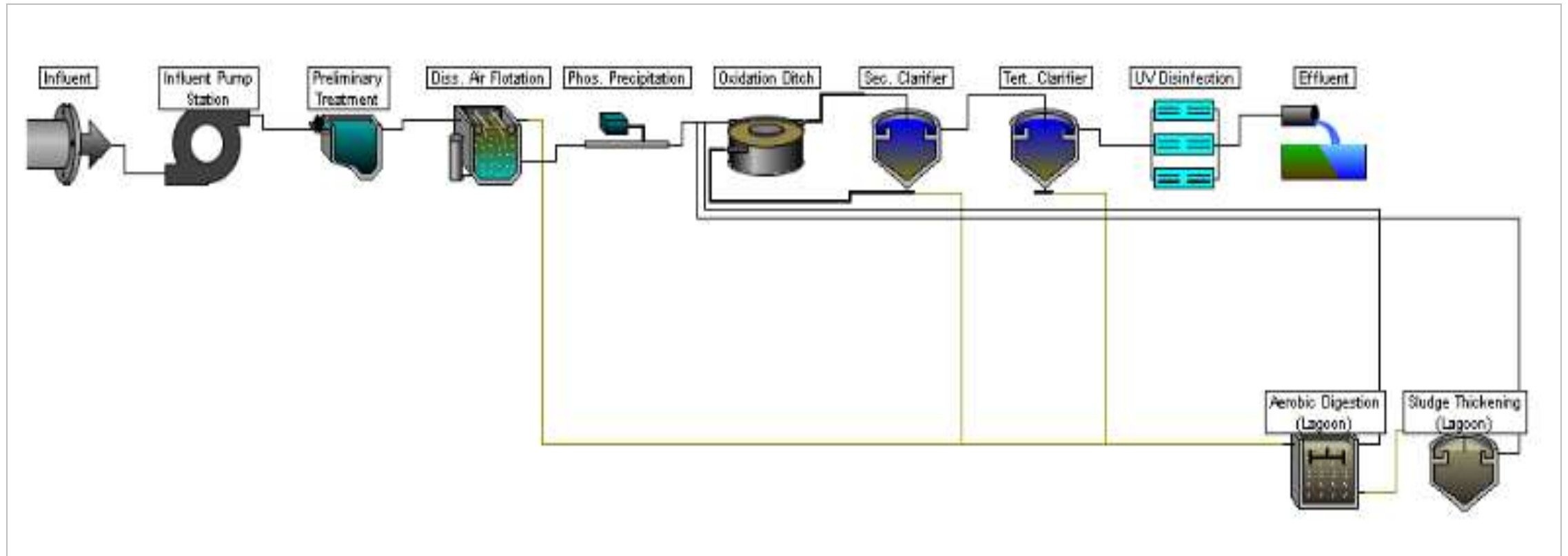
OPTION C – ESTIMATED DISTRIBUTION FACTORS

- Based on example:

WWTP Operation	Variable O&M Cost* \$/year	Process Distribution \$/year	Parameter Distribution, \$/year									
			Flow		BOD ₅		TSS		Total-P		Ammonia-N (TKN)	
Raw Sewage Pumping	\$416,000	5% \$20,800	100%	\$20,800	--	--	--	--	--	--	--	--
Preliminary Treatment		5% 20,800	90%	18,700	--	--	10%	\$2,100	--	--	--	--
Primary Treatment		15% 62,400	34%	21,200	33%	\$20,600	33%	20,600	--	--	--	--
Secondary Treatment		25% 104,000	17%	17,700	33%	34,300	17%	17,700	--	--	33%	\$34,300
Phosphorus Removal		5% 20,800	25%	5,200	--	--	--	--	33%	\$15,600	--	--
Secondary Clarifier		10% 41,600	34%	14,200	33%	13,700	33%	13,700	--	--	--	--
Disinfection		5% 20,800	80%	16,600	10%	2,100	10%	2,100	--	--	--	--
Sludge Handling		20% 83,200	20%	16,700	20%	16,600	40%	33,300	--	--	20%	16,600
Direct Administration		10% 41,600	--	--	25%	10,400	25%	10,400	25%	\$10,400	25%	10,400
Treatment Cost (\$/year)			131,100		97,700		99,900		26,000		61,300	
Pollutant Removal (lb/year)			--		1,570,000		828,000		17,600		180,000	
Unit Rate (\$/lb)			--		0.06		0.12		1.48		0.34	

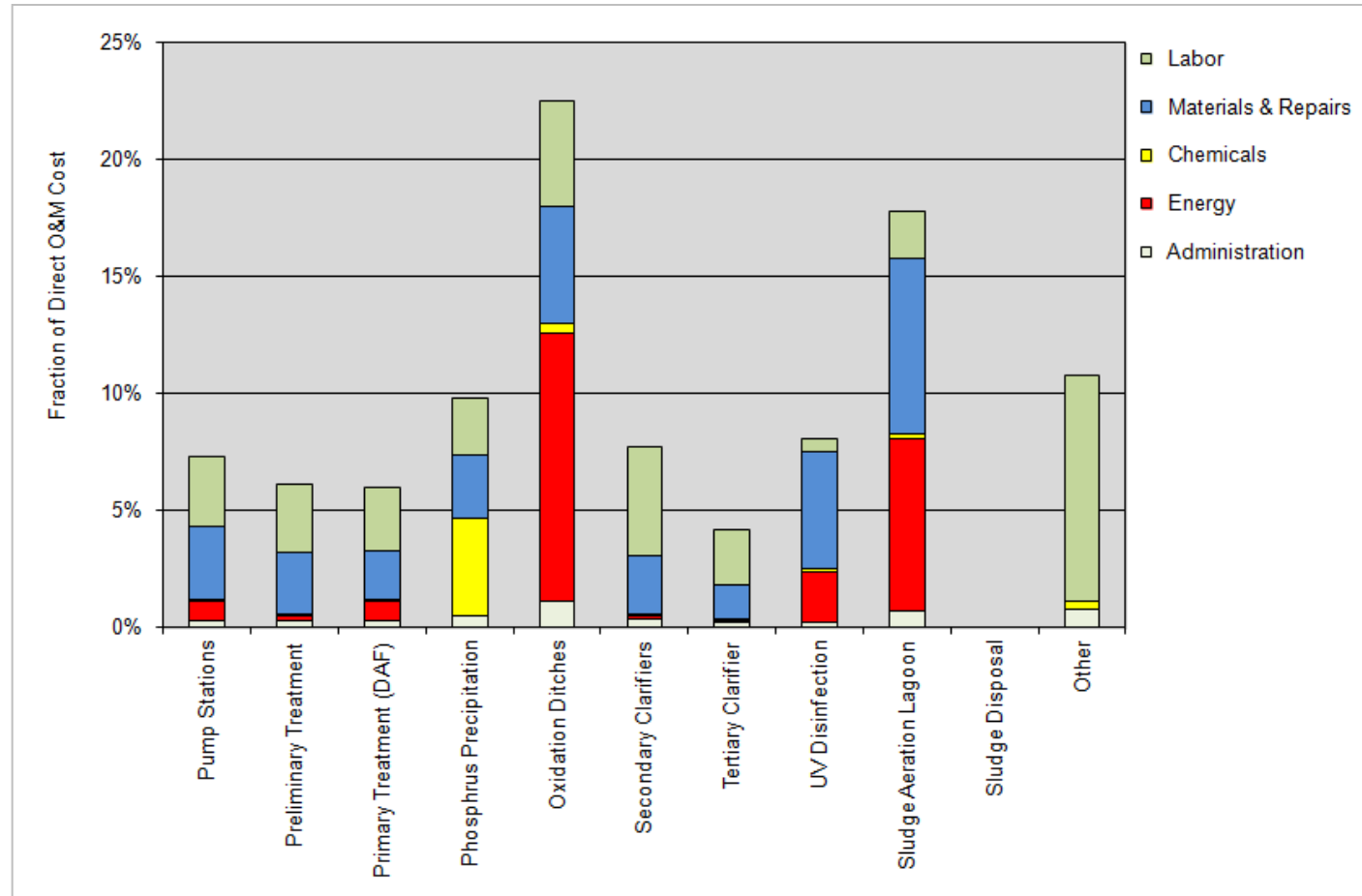
* assumed to be approximately 33% of total O&M costs

OPTION D – COMPUTER SIMULATION

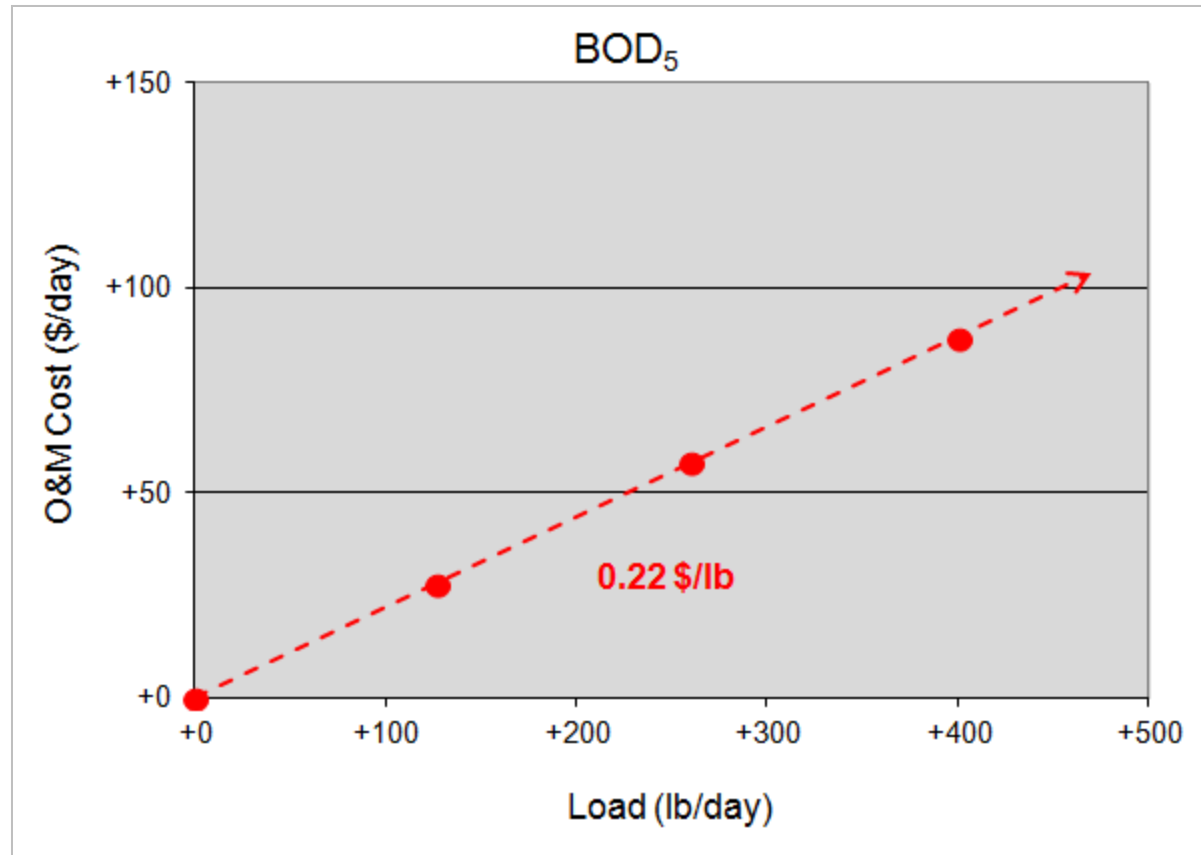


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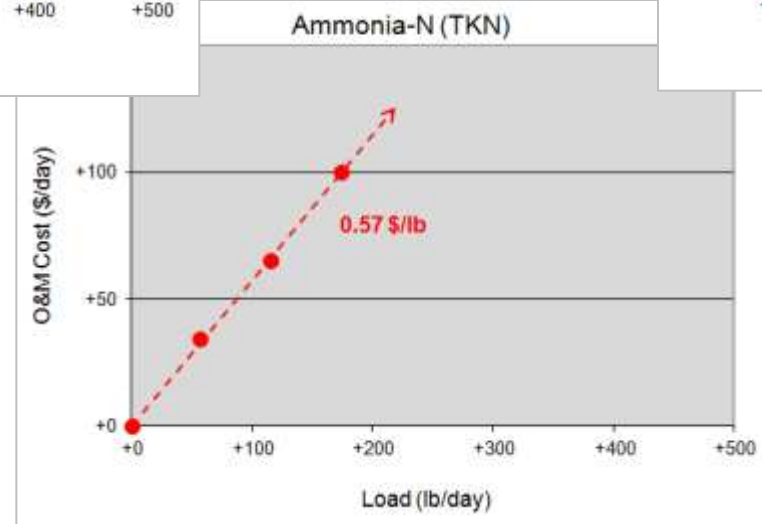
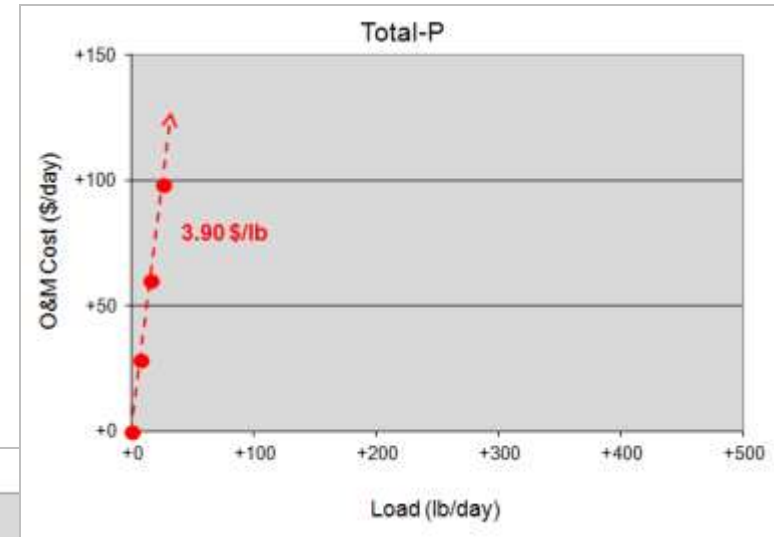
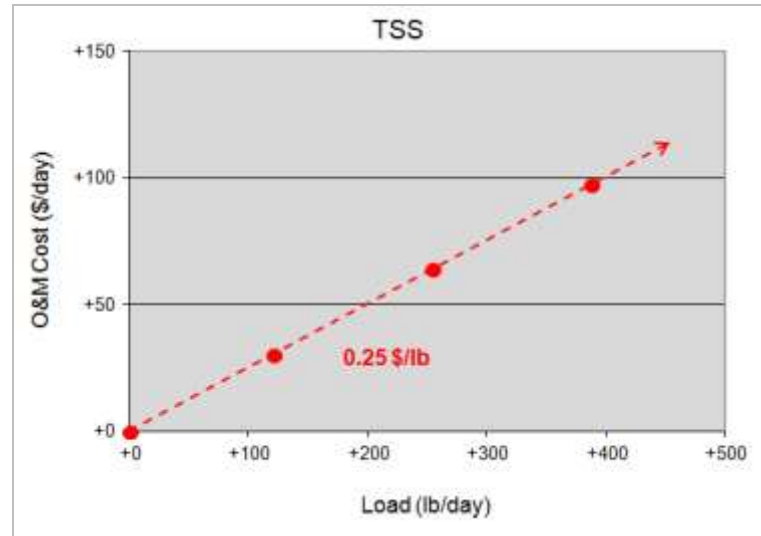
CURRENT O&M COST BREAKDOWN



COST VS. LOAD PLOTS



COST VS. LOAD PLOTS



RESULTS SUMMMARY

Parameter	Current \$/lb	Reevaluated, \$/lb				Recommended \$/lb
		Option A (POTW Survey)	Option B (Rule-of- Thumb)	Option C (Distribution Factors)	Option D (Computer Simulation)	
BOD ₅	0.17	0.14	0.20	0.06	0.22	0.22
TSS	0.22	0.15	0.45	0.12	0.25	0.25
Total P	2.34	1.90	3.56	1.48	3.90	3.90
Ammonia-N (TKN)	1.83	0.53	0.70	0.34	0.57	0.57

PERSPECTIVE

- Strength surcharges key component of O&M cost recovery
- Strive to have appropriate surcharge rates
 - If undercharging, lose justifiable revenues
 - If overcharging, may harm local economy
- Traditional calculation methods vary in accuracy/complexity
- Computer simulation method accurate, straightforward, and relatively inexpensive

Thank You

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LIST OF ACRONYMS & ABBREVIATIONS

- Ammonia-N – ammonia, as nitrogen
- BOD5 – 5-day biochemical oxygen demand
- FOG – fats, oil, and grease
- IPP – industrial pretreatment program
- lb – pound
- mg/L – milligrams per liter
- MGD – million gallons per day
- MWEA – Michigan Water Environment Association
- O&M – operating and maintenance
- POTW – publicly owned treatment works
- TKN – total Kjeldahl nitrogen
- Total P – total phosphorus
- TSS – total suspended solids
- USEPA – U.S. Environmental Protection Agency