

Using WQS Variances to Implement an Adaptive Management Approach to Nutrient Source Control



Greg Currey
Clair Meehan

Tetra Tech, Inc.

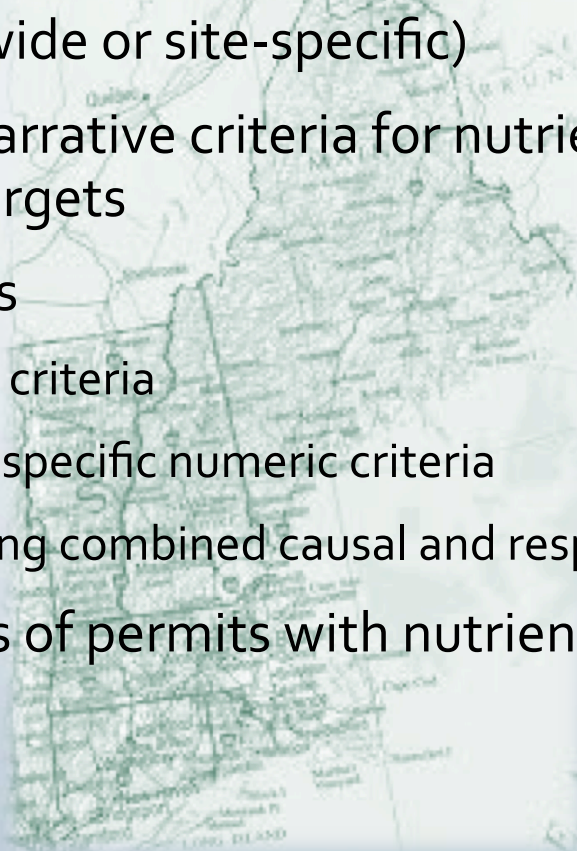
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Nutrient Pollution

- For assessed waters nationwide, nutrients are:
 - 3rd leading cause of impairment in river and stream miles
 - 2nd leading cause of impairment in lakes, reservoirs, and pond acres
- States have identified over 11,000 nutrient-related impairments



Nutrient Criteria in WQS

- Some states have numeric criteria total nitrogen and total phosphorus (statewide or site-specific)
 - Most states have narrative criteria for nutrients—interpreted through numeric targets
 - New England states
 - All have narrative criteria
 - Several have site-specific numeric criteria
 - Maine is developing combined causal and response variable criteria
 - Increasing numbers of permits with nutrient monitoring and limits
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Example: Anytown WWTF

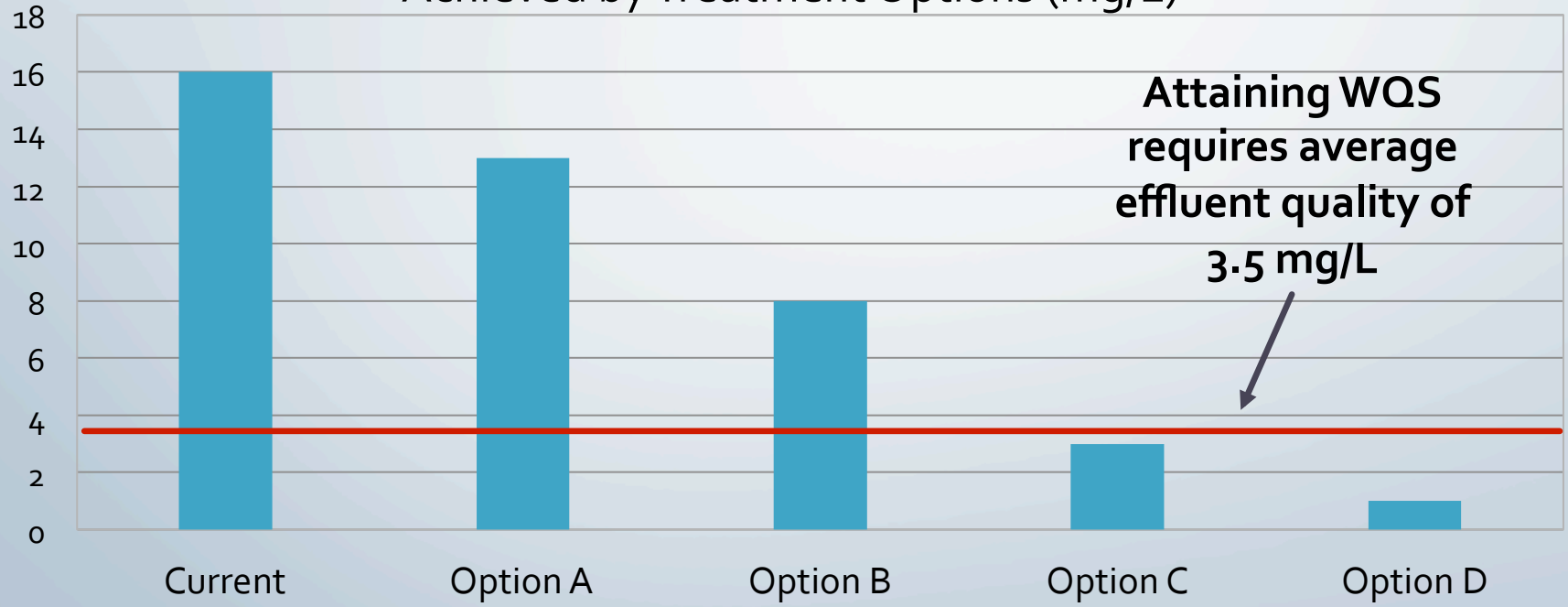
- **Conventional activated sludge system**
- **NPDES requires TN and TP monitoring**
 - Average effluent TN concentration = 16 mg/L
 - Average effluent TP concentration = 3.7 mg/L
- **Effluent flow**
 - Maximum weekly average = 2.4 MGD
 - Design = 3.8 MGD
- **Anticipating new, seasonal effluent limitations for TN and TP based on achieving average concentrations of:**
 - 3.5 mg/L TN
 - 0.25 mg/L TP

Evaluate Options for Attaining WQS—TN

Option	Target Effluent Concentration (TEC)	Treatment Technology Options
A	13 mg/L TN	Optimize existing process (e.g., aeration control)
B	8.0 mg/L TN	Configuration modifications (e.g., create anoxic zone), install new mixers and blowers, upgrade control system
C	3.0 mg/L TN	Upgrade to biological nitrogen removal (BNR) (e.g., nitrification/denitrification via anoxic/oxic zone or cycle retrofits; denitrification filter)
D	< 1.0 mg/L TN	Reverse osmosis (RO)

Meeting WQS Could Require Significant Improvement in Effluent Quality...

Total Nitrogen (TN) Effluent Concentrations Achieved by Treatment Options (mg/L)

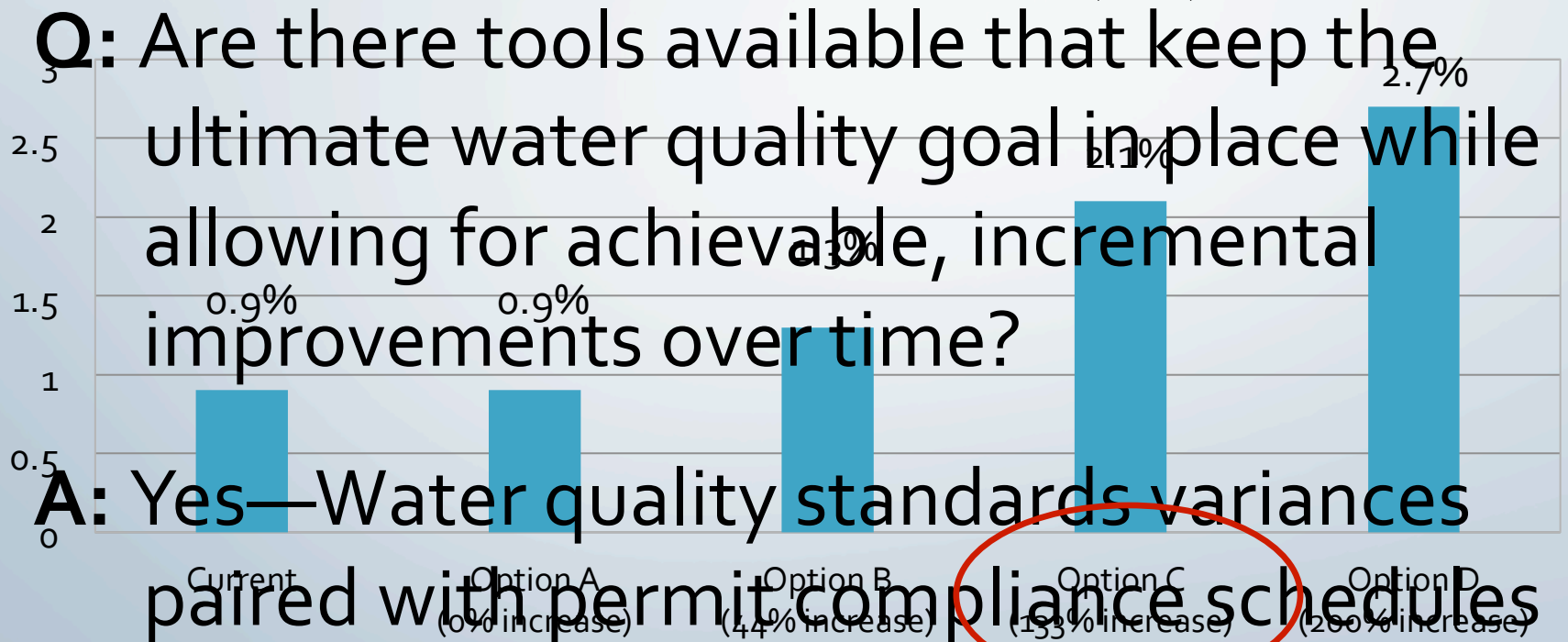


Implement Option C to attain WQS

Attaining WQS requires average effluent quality of 3.5 mg/L

...but Achieving the Required Effluent Quality Might not be Feasible

Annual Pollution Control Costs per Household
as % of Median Household Income (MHI)

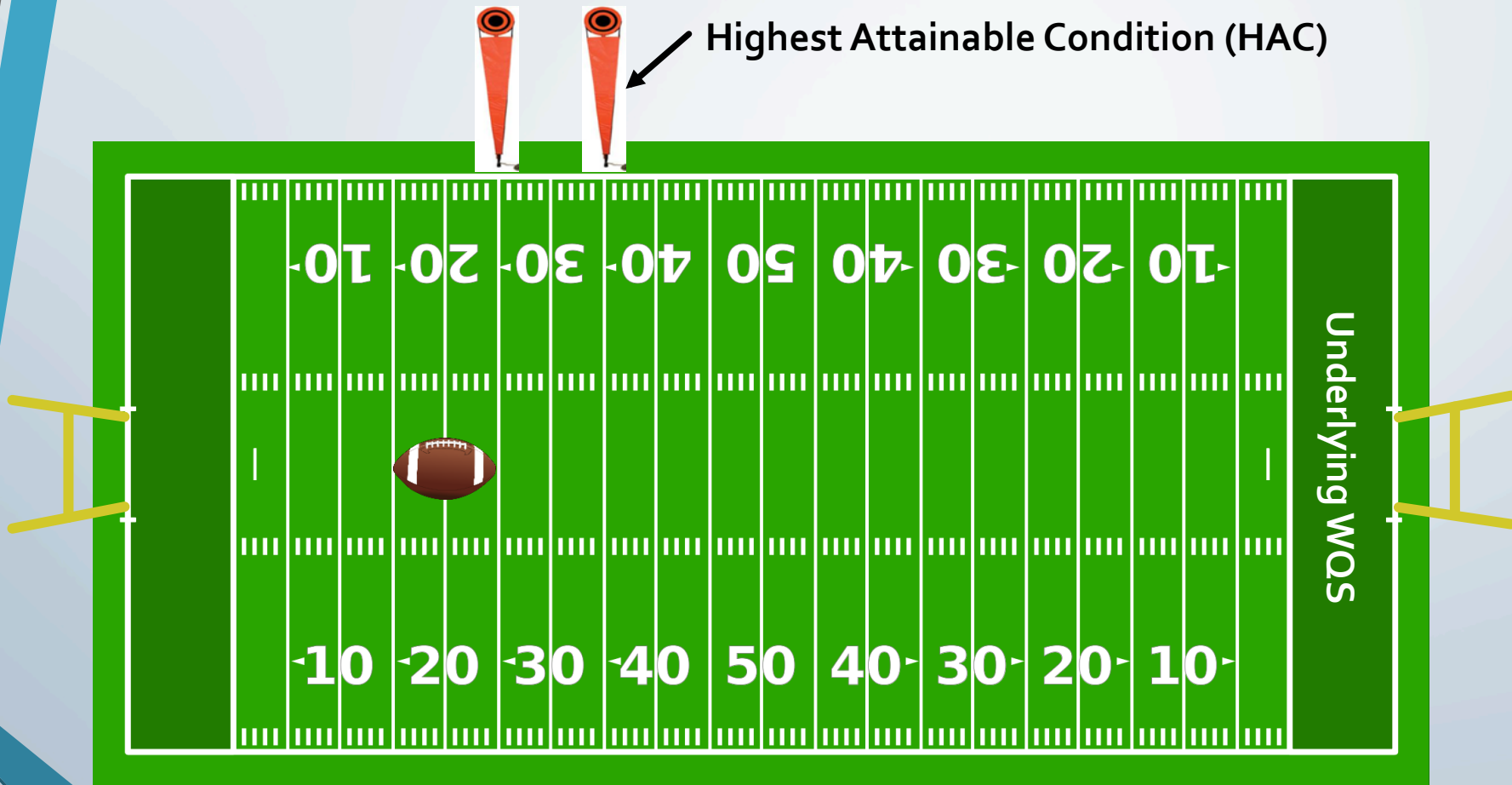


Water Quality Standards Variances— 40 CFR 131.14

A **water quality standards variance for a discharger(s)**.

- Time-limited designated use and criterion for a specific pollutant(s) or water quality parameter(s)
- Can be an effective tool for adaptive management
 - Temporary change to WQS (requires EPA approval)
 - Specifies highest attainable condition (HAC) that applies for duration of variance
 - Duration is the time justified as needed to achieve HAC
 - Upon expiration, the discharger must meet requirements based on the underlying WQS or apply for a new variance

Using Variances to Achieve Incremental Progress



Why Variances?



- **For the regulatory authority:**
 - Avoids punting on an important water quality concern
 - Allows progress when ability to attain WQS is not certain
 - Where underlying WQS are not attainable, provides time to determine what is attainable
- **For the discharger:**
 - Focuses resources on working with the regulatory authority to make improvement vs. fighting new requirements
 - Provides time to put nutrient control in the context of an overall game plan for facility improvements and upgrades
 - Cost effective investment—small expenditure of resources now for better decision-making in the future

How Do You Get a Variance?—Justification

- Justification based on one of seven factors outlined in federal regulations at 40 CFR 131.10(g) (as required by 40 CFR 131.14(2)(i))
- Most common justification is that “*Controls more stringent than those required by sections 301(b) and 306 of the Act would result in **substantial and widespread economic and social impact***”

Step 1: Evaluate Option(s) for Attaining WQS

Determine whether upgrading to attain WQS is feasible now or through enforceable sequence of events

- Estimate ***cost of the technology***
 - Planning level analysis using literature values to calculate capital and O&M costs
 - Annualized costs (Interest rate = i %; Term = n years)
- Justify variance based on showing that impact on the community will be ***substantial*** and ***widespread*** ["factor 6" in 40 CFR 131.10(g)]

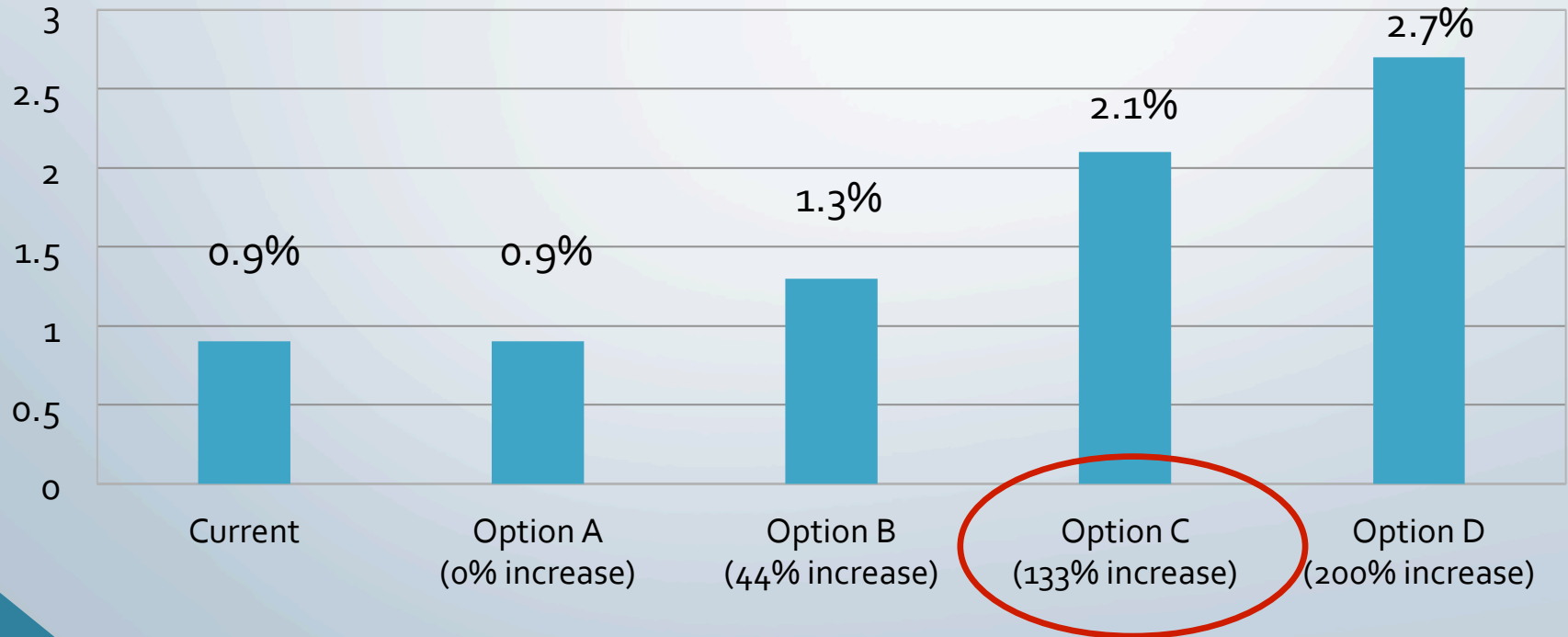
Substantial Economic and Social Impact Analysis

Substantial Economic and Social Impact Analysis: after estimating annualized treatment costs to achieve WQS, assess magnitude of cost burden with respect to the community's income and other relevant indicators of financial capability

- Municipal Preliminary Screener
- Secondary Test

Anytown WWTP— Evaluate Cost of Attaining WQS

Annual Pollution Control Costs per Household
as % of Median Household Income (MHI)



Anytown WWTP

Step 1: Evaluate Option(s) for Attaining WQS

- ***Municipal Preliminary Screener***—costs per household
 - Anytown current pollution control costs = 0.9% of MHI
 - Pollution control costs to meet WQS = 2.1% of MHI
 - <1.0% MHI = little impact—likely not substantial
 - 1.0%-2.0% MHI = mid-range impact—may be substantial
 - > 2.0% MHI = large impact—may be substantial
 - Upgrading to meet WQS may result in ***substantial impact***
 - Move to Secondary Test

Anytown WWTP—Secondary Test

- ***Secondary Test—financial and socioeconomic conditions***
 - Score financial indicators (bond rating; debt indicators)
 - Score socioeconomic indicators (unemployment; MHI vs. state median; property tax revenue; property tax collection rate)
 - Scoring for each indicator: 1=weak; 2=mid-range; 3=strong
- **Anytown Total Secondary Score = 2.0**

Anytown WWTP

Substantial Impact Analysis—Conclusion

- Conclusion:** municipal preliminary screener (MPS) combined with information from the secondary test shows that *impact is likely to be substantial... move to Widespread Analysis*

Assessment of Substantial Impacts Matrix (Table 5-2 from EPA Guidance)			
MPS:	2.1%		
Secondary Test Score:	2.0		
Secondary Test Score	MPS		
	<i>Less than 1.0 Percent</i>	<i>Between 1.0 and 2.0 Percent</i>	<i>Greater than 2.0 Percent</i>
<i>Less than 1.5</i>	?	X	X
<i>Between 1.5 and 2.5</i>	✓	?	X
<i>Greater than 2.5</i>	✓	✓	?

Key:

- ✓ Impact is not likely to be substantial
- X Impact is likely to be substantial
- ? Impact is unclear

Anytown WWTP— Widespread Impacts Analysis

- **Widespread Impacts Analysis:** assess the likelihood that substantial economic and social impacts on the community will be widespread
- **Consider:**
 - Household Income
 - Unemployment rate
 - Poverty rate
 - Vulnerable Industries
 - Property value

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Widespread Impacts Analysis—Conclusions

- Higher sewer rates could make community less attractive (residents and businesses) in the long-term
- Additional burden felt most strongly by poverty-level households
- Substantial impacts community-wide could result in negative changes to broad indicators of community financial health
- ***Conclusion:*** substantial impacts likely to be widespread across the community

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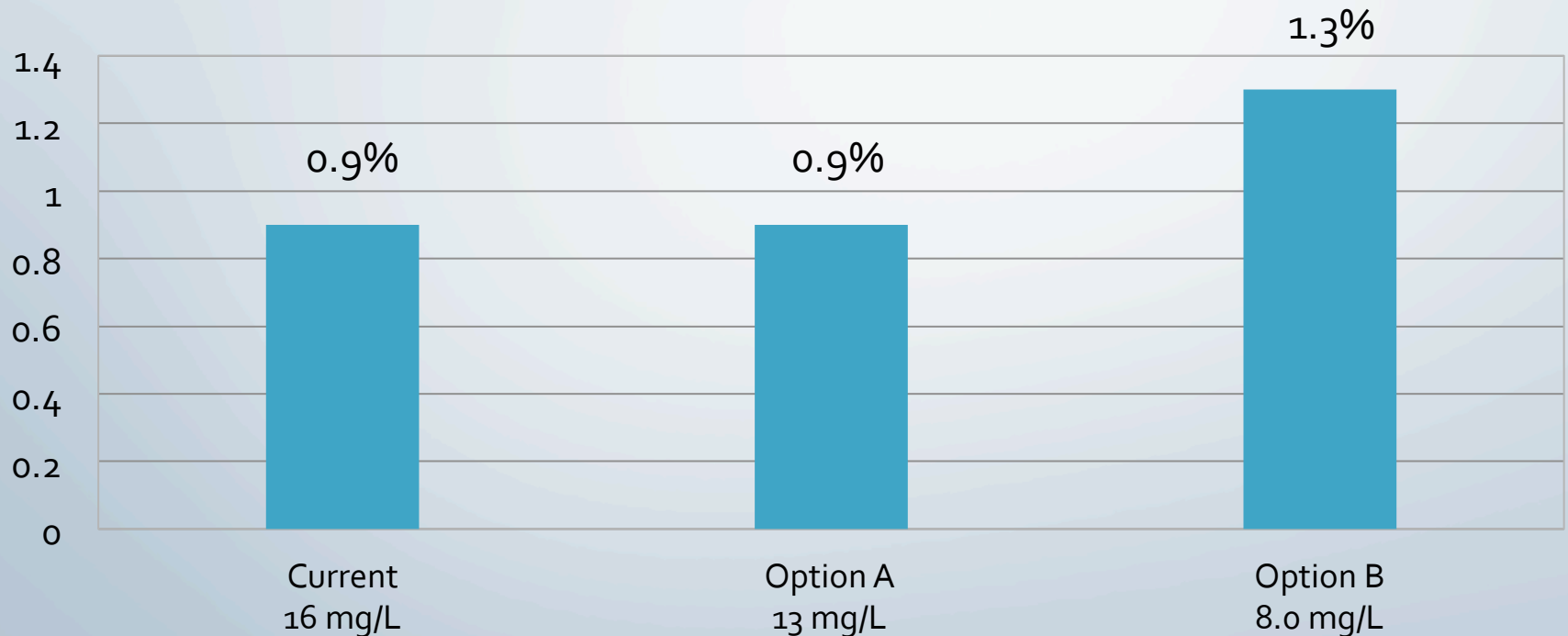
Step 1—Conclusions

- ***Step 1 Conclusions:***
 - Cost of upgrading to meet underlying WQS would lead to substantial and widespread economic and social impact [40 CFR 131.14 and 131.10(g)]
 - Anytown WWTF is eligible for a WQS variance
- ***Next Step:*** Evaluate options for incremental improvements—determine highest attainable condition (HAC)

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Step 2: Evaluate Options for Incremental Improvements—HAC

Annual Pollution Control Costs per Household
as % of Median Household Income (MHI)



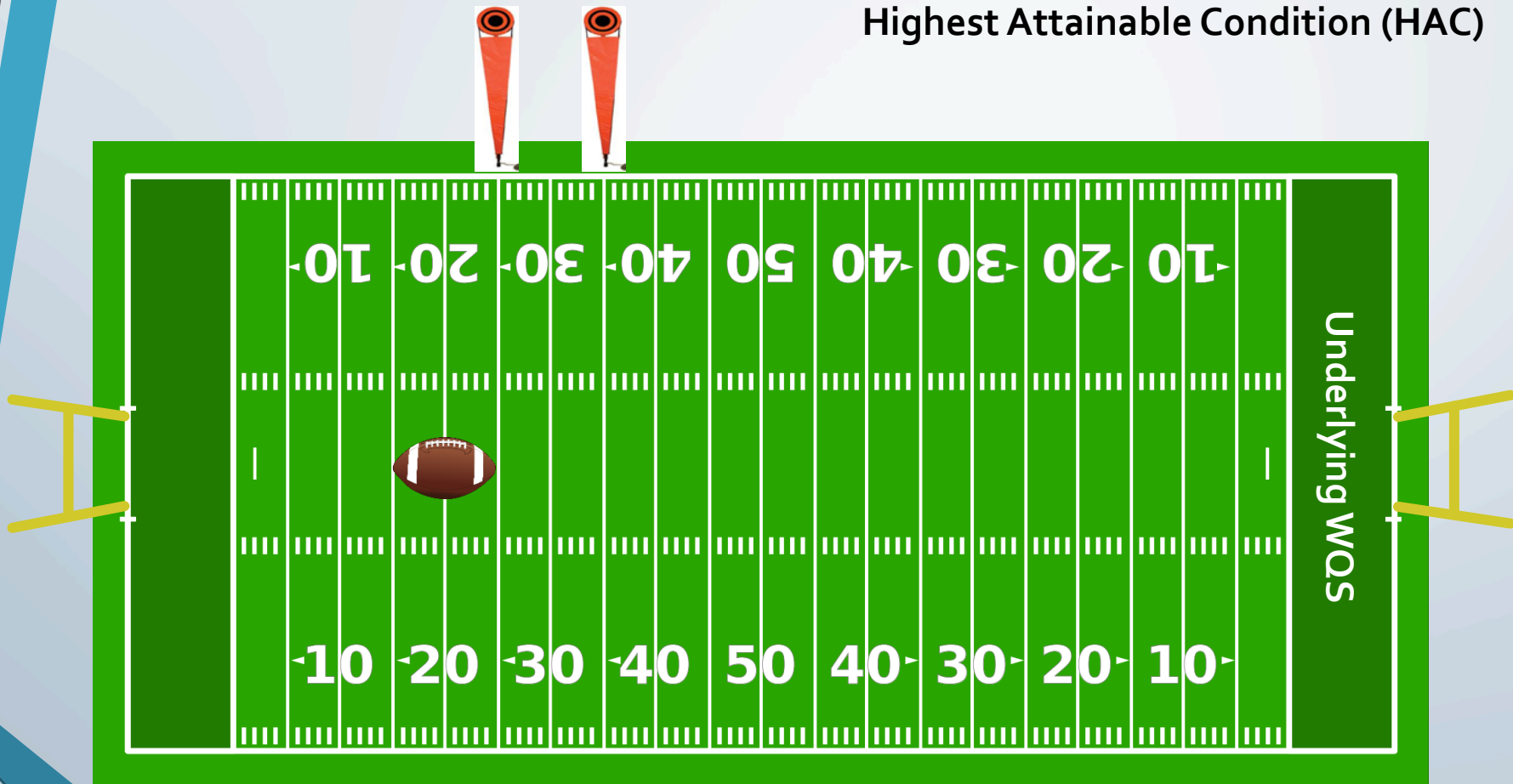
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Step 2: Evaluate Options for Incremental Improvements—HAC

- **Accounting for pollution control costs as % of MHI, rate increase, and other socioeconomic factors:**
 - **Option A:** no impact
 - **Option B:** lower end of “mid-range impact”
- **Previous widespread analysis** showed that substantial impacts likely to be widespread

Establishing HAC to Achieve Incremental Progress

Highest Attainable Condition (HAC)



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Step 2—Conclusions

- ***Step 2 Conclusions:***
 - Propose HAC = average TN of 8.0 mg/L based on Option B
 - better performance than Option A
 - meets objective of incremental improvement
 - affordable based on economic and social impact analysis
 - Need additional time to implement improvements
- ***Next Step:*** Implementation

Anytown WWTP

Step 3: Implementation

- **Variance adoption and approval**
 - Request submitted to regulatory authority for review and adoption
 - EPA review required—applicable under CWA only if approved
- **NPDES permit**
 - HAC in approved variance becomes the WQS for purposes of NPDES permitting
 - *Permit compliance schedule* may be authorized if time needed to attain HAC
- **HAC must be reevaluated if term of variance is > 5 years**
- **After HAC is achieved**
 - meet underlying WQS or
 - new variance adopted and approved

Questions?



Greg Currey

gregory.currey@tetrattech.com

703-385-1303

Clair Meehan

clair.Meehan@tetrattech.com

508-734-5513