Robert G. O'Dette

M.S., P.E. BCEE

WEF Fellow

Division of Water Resources

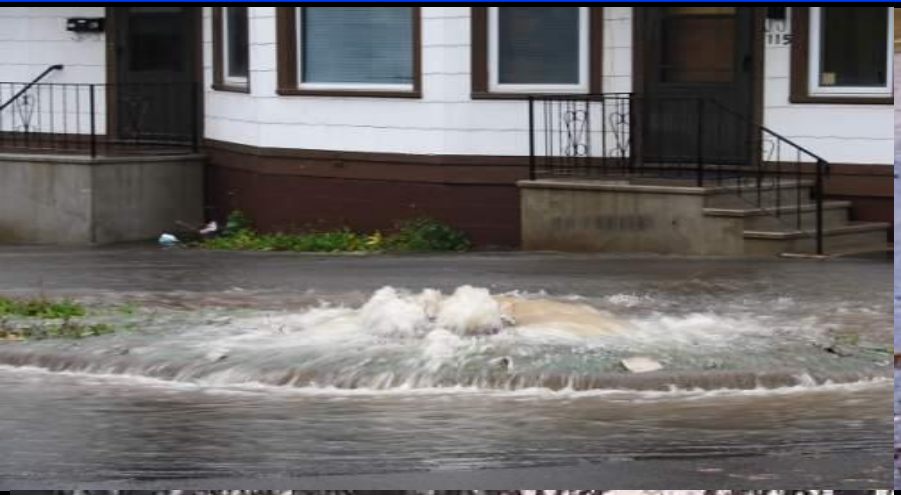
TN Department of Environment & Conservation

UCT The Underground Utilities Event
Underground Construction Technology | January 28-30, 2020 | Fort Worth, TX

Municipal Collection System Metrics in Tennessee


SANITARY SEWER
OVERFLOW
AVOID PHYSICAL
CONTACT WITH AREA.
EXPOSURE TO WATER
MAY CAUSE A
HEALTH RISK.

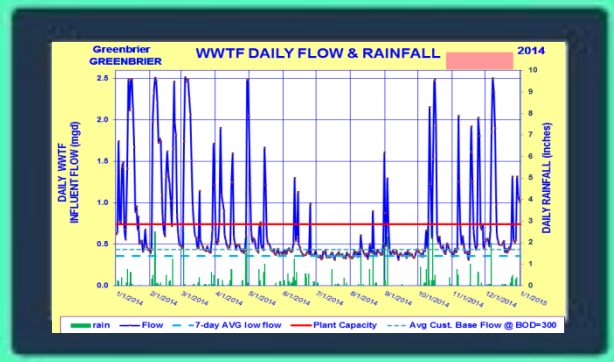
SEWER SYSTEM OVERFLOWS (SSO'S) AND/OR RELEASES

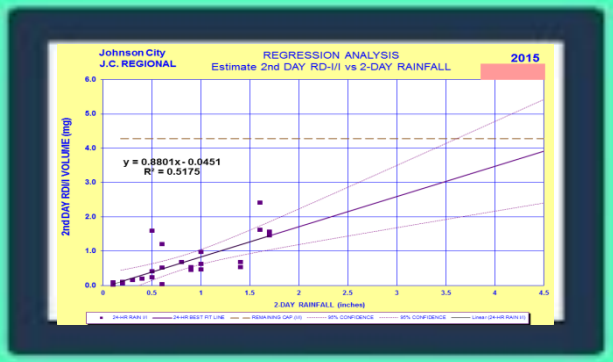


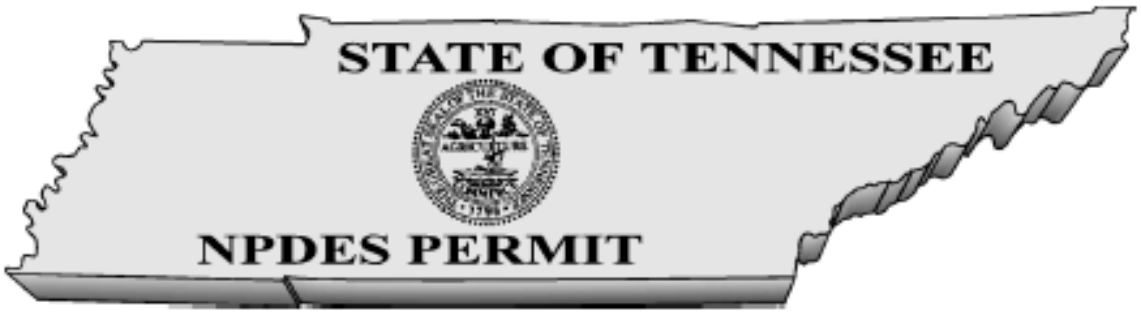
Collection Systems

Metrics

Regulators ❤ Metrics







No. TN0021067

Authorization to discharge under the
National Pollutant Discharge Elimination System (NPDES)

Issued By

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

Under authority of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101 et seq.) and the delegation of authority from the United States Environmental Protection Agency under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251, et seq.)

Discharger:	**Millington Wastewater Treatment Plant**
is authorized to discharge:	**treated municipal wastewater from Outfall 001**
from a facility located:	**in Millington, Shelby County, Tennessee**
to receiving waters named:	**Big Creek at mile 6.9**

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on:	**July 1, 2017**
This permit shall expire on:	**June 30, 2022**
Issuance date:	**July 1, 2017**

for Tisha Calabrese Benton
Director

NPDES PERMIT

Municipal NPDES Permits

OLD

1.0. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1.1. NUMERIC AND NARRATIVE EFFLUENT LIMITATIONS

The City of Millington is authorized to discharge treated municipal wastewater from Outfall 001 to the Big Creek. Discharge 001 consists of municipal wastewater from a treatment facility with a design capacity of 5.8 MGD. Discharge 001 shall be limited and monitored by the permittee as specified below:

Description : External Outfall, Number : 001, Monitoring : All Weather, Season : All Year							
Code	**Parameter**	**Qualifier**	**Value**	**Unit**	**Sample Type**	**Frequency**	**Statistical Base**
80998	Bypass of Treatment	Report		occur/mo	Occurrences	Monthly	Monthly Total
Description : External Outfall, Number : 001, Monitoring : Dry Weather, Season : All Year							
Code	**Parameter**	**Qualifier**	**Value**	**Unit**	**Sample Type**	**Frequency**	**Statistical Base**
74062-U	Overflow use, occurrences	Report		occur/mo	Occurrences	Monthly	Monthly Total

Monitoring : All Weather

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
51929	Bypass of Treatment Facility	Report		occur/mo	Occurrences	Continuous	Monthly Total
51929	Bypass of Treatment Facility	Report		gal/mo	Estimate	Continuous	Monthly Total

Monitoring : Dry Weather

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
51925	SSO, Dry Weather	Report		gal/mo	Estimate	Continuous	Monthly Total
51925	SSO, Dry Weather	Report		occur/12 Mo Cumulative Total	Calculated	Continuous	Total
51925	SSO, Dry Weather	<=	0	occur/mo	Occurrences	Continuous	Monthly Total
51927	Release [Sewer], Dry Weather	Report		occur/mo	Occurrences	Continuous	Monthly Total
51927	Release [Sewer], Dry Weather	Report		gal/mo	Estimate	Continuous	Monthly Total

Monitoring : Wet Weather

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
51926	SSO, Wet Weather	Report		gal/mo	Estimate	Continuous	Monthly Total
51926	SSO, Wet Weather	Report		occur/12 Mo Cumulative Total	Calculated	Continuous	Total
51926	SSO, Wet Weather	<=	0	occur/mo	Occurrences	Continuous	Monthly Total
51928	Release [Sewer], Wet Weather	Report		gal/mo	Estimate	Continuous	Monthly Total
51928	Release [Sewer], Wet Weather	Report		occur/mo	Occurrences	Continuous	Monthly Total

Municipal NPDES Permits

NEW

DEFINITIONS

"Discharge" **or** ***"Discharge of a Pollutant"***

The addition of pollutants to waters from a source.

"Sanitary Sewer Overflow (SSO)"

An unpermitted discharge of pollutants from the collection or transmission system owned or operated by the permittee other than through a permitted outfall.

DEFINITIONS

"Release"

The flow of sewage from any portion of the collection or transmission system owned or operated by the permittee other than through permitted outfalls that does not add pollutants to waters.

Moratorium


METRICS
IMPLEMENT
GOAL
COMPANY
PLAN
BUSINESS
IMPROVE
METRICS
PROGRESS
DASHBOARD
STRATEGY
GROWTH
COMMUNICATION
IDEA
DIRECTION
BUSINESS
MEASURE
MANAGE
IMPROVEMENTS
ACHIEVE
RESULTS
NUMBERS
OBJECTIVES
COACHING
PROGRESS
STRATEGIC
SYSTEM
IDEA
IMPORTANT
DATA
SALES
REVIEW
INDICATOR
PERFORMANCE
DATA
DEFINED
TIME

HOW TO GET ON A MORATORIUM

Chronic (>5)
SSO's + Releases
at any location.

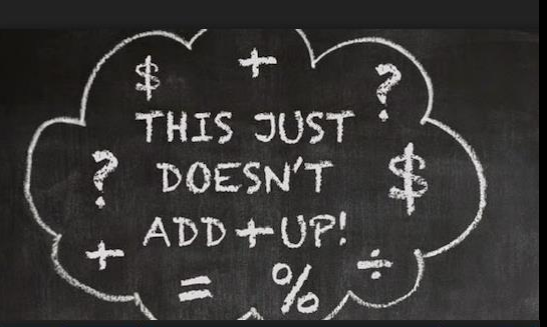
Effluent Violations

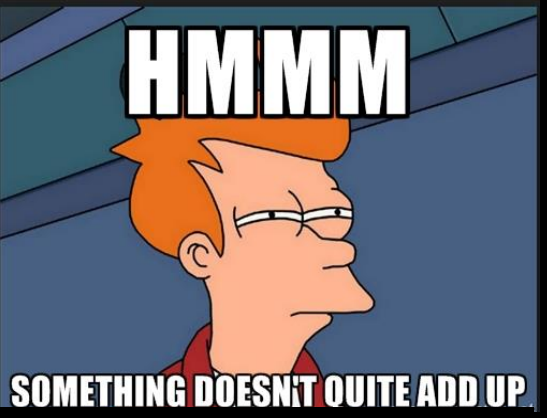

How to measure
SUCCESS?
SEWER
SEWER

HOW TO GET OFF A MORATORIUM

Reduce or Eliminate "Reported" SSO's + Releases

Requirement	Penalty	Amt Due	Due Date
Submit CAP/ER	Contingent	$20,000.00	20-MAY-11
Initiate CAP/ER within 45d of approval	Contingent	$10,000.00	15-MAR-11
Complete CAP/ER	Contingent	$20,000.00	31-DEC-16
Implement SORP within 90 days of written approval	Contingent	$20,000.00	10-MAY-11
Submit CMOM Program	Contingent	$20,000.00	12-AUG-11
Submit 1st Annual CMOMs Report	Contingent	$5,000.00	01-AUG-12
Submit 2nd Annual CMOMs Report	Contingent	$5,000.00	01-AUG-13
Maintain capacity, collection, and treatment protocols	Contingent	$20,000.00	14-FEB-12
Complete all requirements of the Order	Contingent	$20,000.00	31-JUL-17
Submit List of Legally Obligated Sewer Taps	Contingent	$20,000.00	15-MAR-11
Submit Current List of Legally Obligated Sewer Taps	Contingent	$20,000.00	15-MAR-11
Moratorium on new connections	Contingent	$20,000.00	31-JUL-17
Upfront Civil Penalty	Upfront	$0.00	15-MAR-11
		$200,000.00	





IF THE WORDS DON'T ADD UP, ITS USUALLY BECAUSE THE TRUTH WASN'T INCLUDED IN THE EQUATION.

%I/I

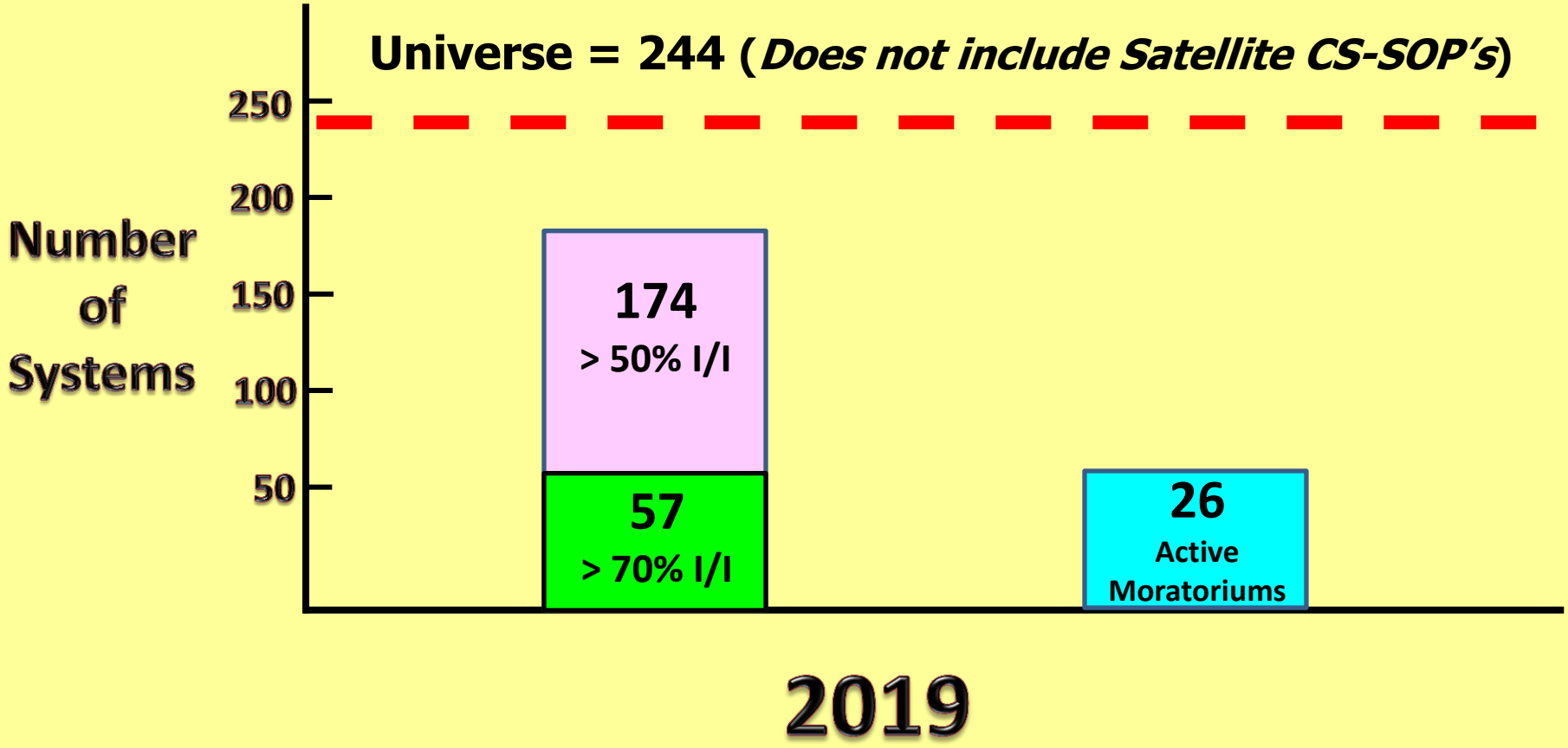
vs.

Moratoriums

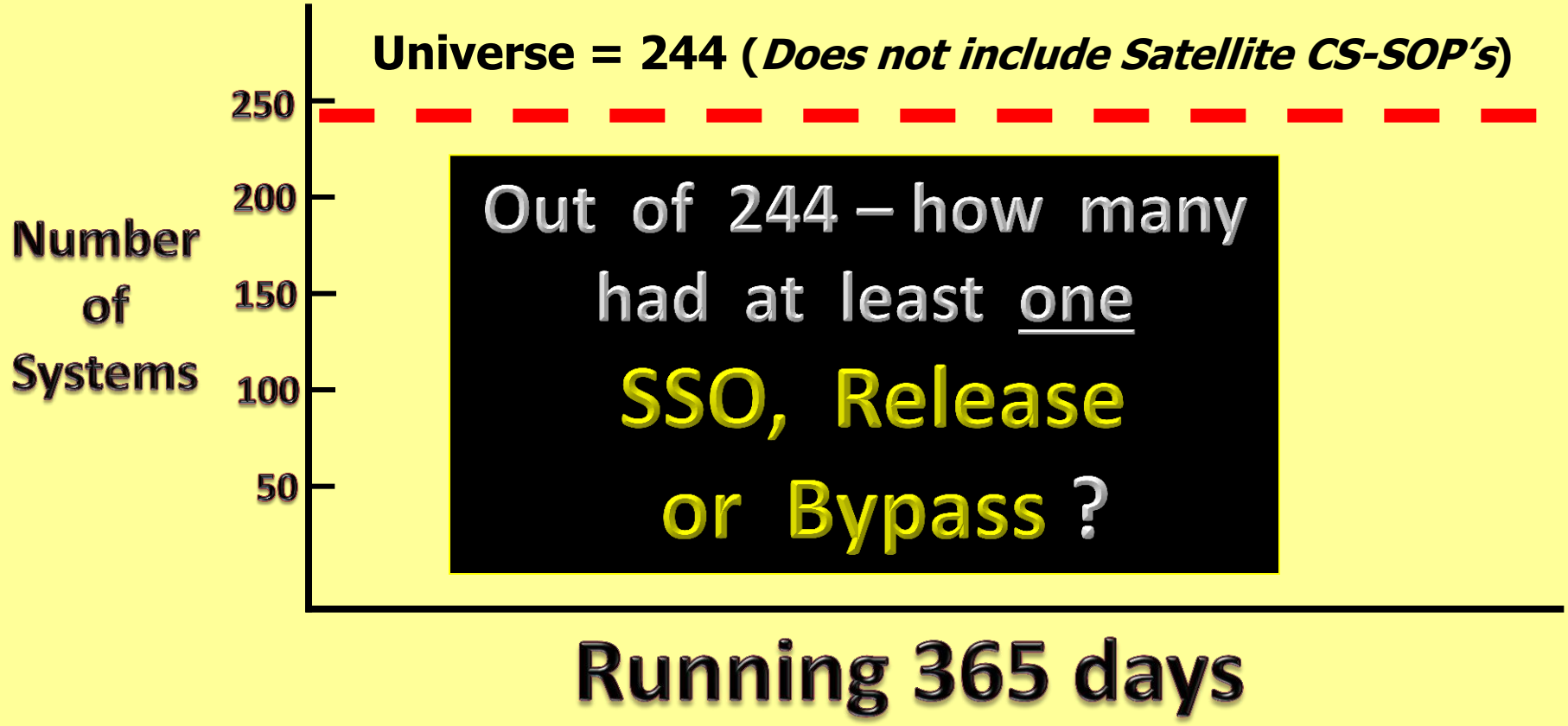
vs.

SSO's + Releases

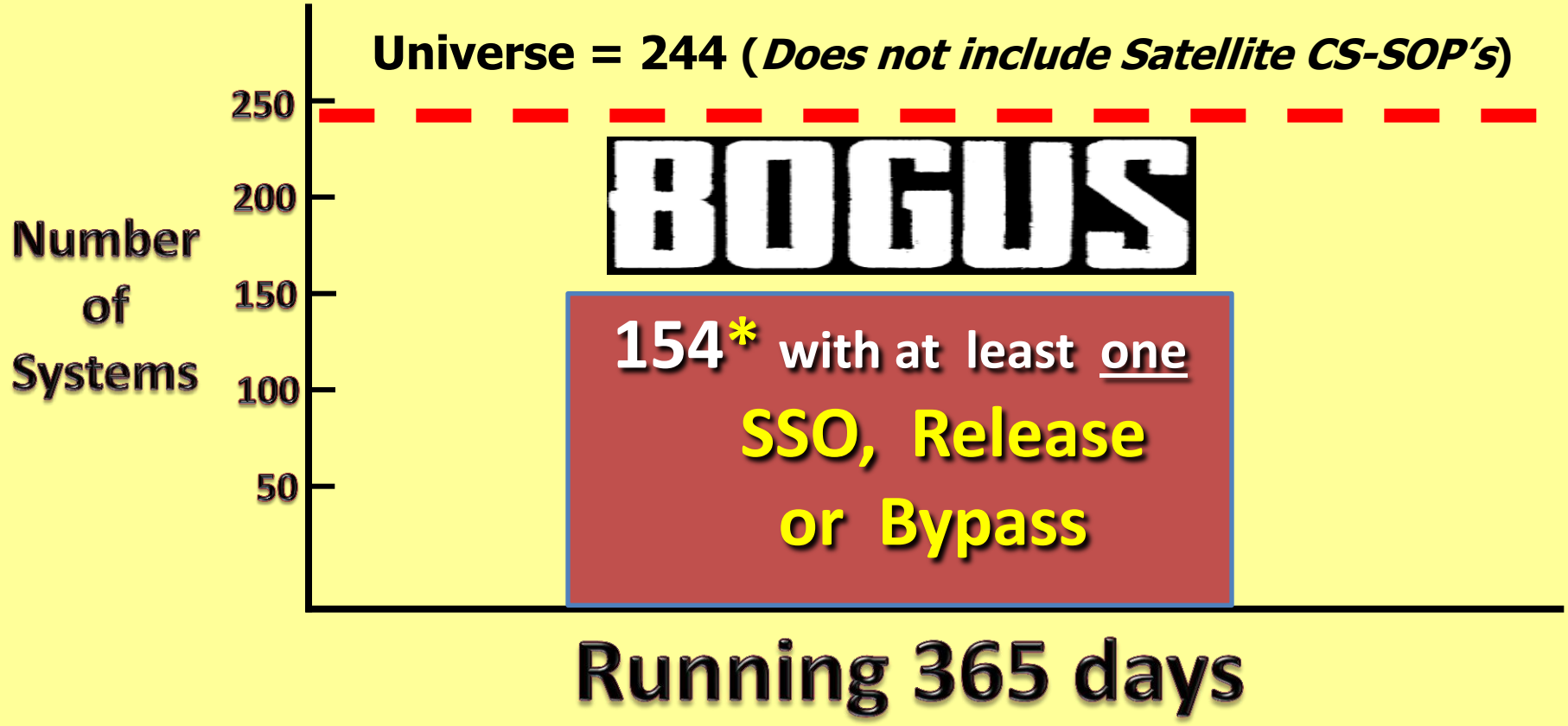
Collection Systems Status
Tennessee



Collection Systems Status
Tennessee



Collection Systems Status
Tennessee



* Total = 3,124; AVG = 23; Median = 5

If a tree falls in the woods and no one is there to tweet about it, did it really happen?

Collection Systems Status
Tennessee

Permit No	Permittee Name	Parameter	Condition	Season	Sum Total
		Bypass	Wet Weather	All Year	331
		Overflow	Wet Weather	All Year	225
		Overflow	Dry Weather	All Year	139
		Overflow	Dry Weather	All Year	132
		Overflow	Dry Weather	All Year	121
		Overflow	Wet Weather	All Year	112
		Overflow	Wet Weather	All Year	74
		Overflow	Dry Weather	All Year	58
		Overflow	Wet Weather	All Year	56

Should we cancel our trip to China now that the state has placed us on a total sewer moratorium ?

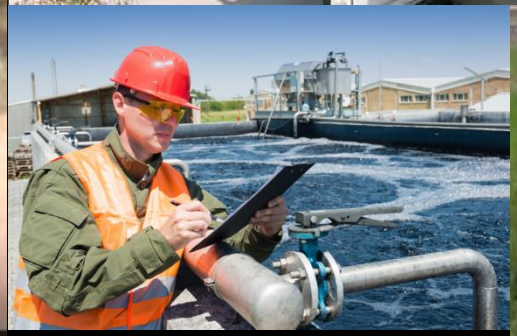
Sometimes people demand Moratorium Relief

*"It is a capital mistake to theorize before one has **data**. Insensibly one begins to twist facts to suit theories, instead of theories to suit **facts** . . ."*

Sherlock Holmes

"A Scandal in Bohemia"

DMR'S AND MOR'S DATA WWTP OPERATORS COLLECT ON A DAILY BASIS



Monthly Operation Reports (MORs)

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

DIVISION OF WATER RESOURCES

REPORT OF OPERATION ON WASTEWATER TREATMENT

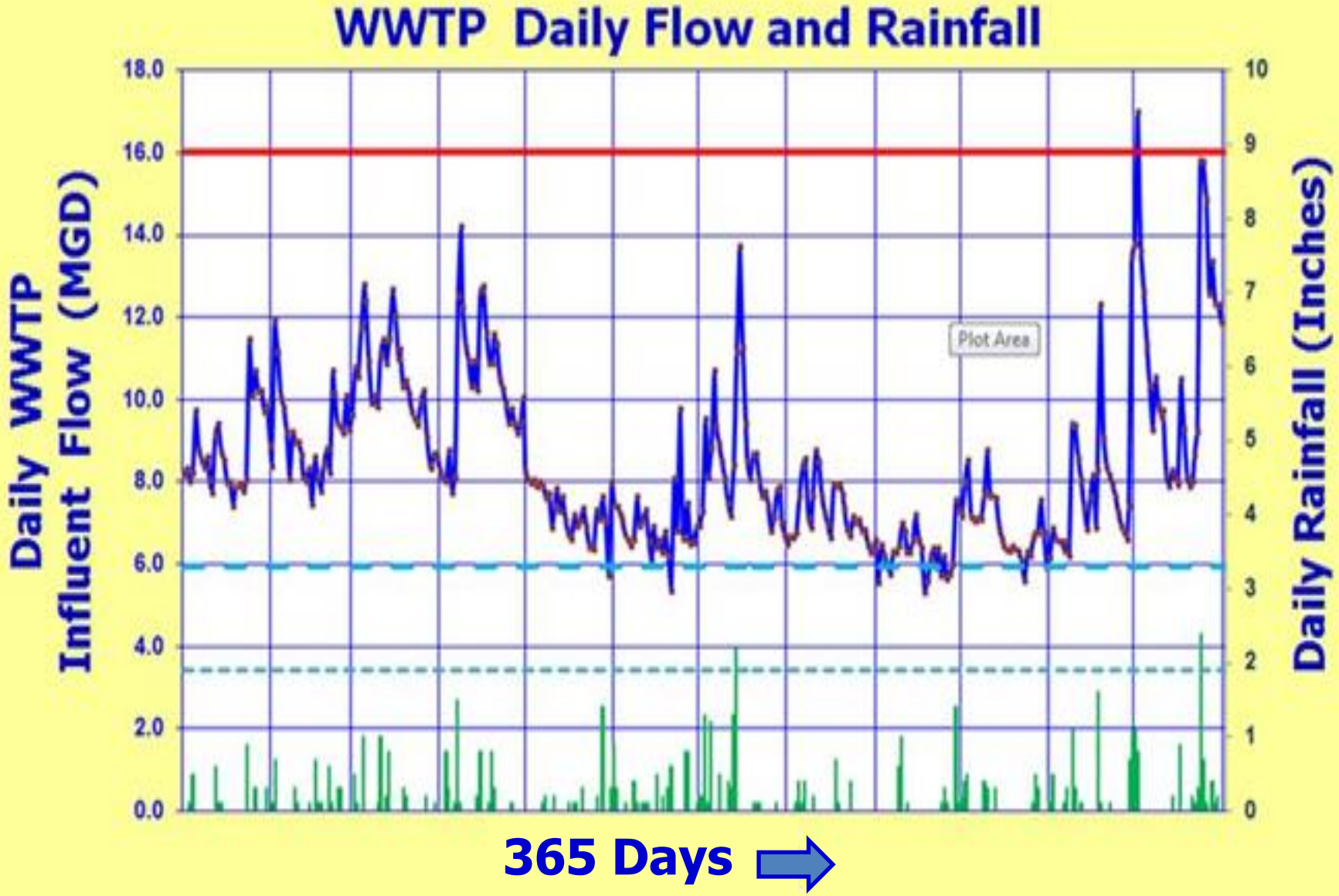
PLANT _____

COUNTY _____

MONTH OF _____ YEAR _____

DATE	RAINFALL (0.1")	INFLUENT FLOW (MGD)	INFLUENT MAX FLOW (MGD)	EFFLUENT FLOW (MGD)	HOURS BYPASSED	TEMPERATURE INFLUENT (C)	TEMPERATURE EFFLUENT (C)	5 DAY CBOD / BOD			
								INFLUENT (mg/L)	EFFLUENT (mg/L)	EFFLUENT (POUNDS)	PERCENT REMOVAL
1	2	3	4	5	6	7	8	9	10	11	12
1											
2											
3											
4											
5											
6											

HYDROGRAPH / HYETOGRAPH



DATA REQUIRED FOR HYDROGRAPH & HYETOGRAPH

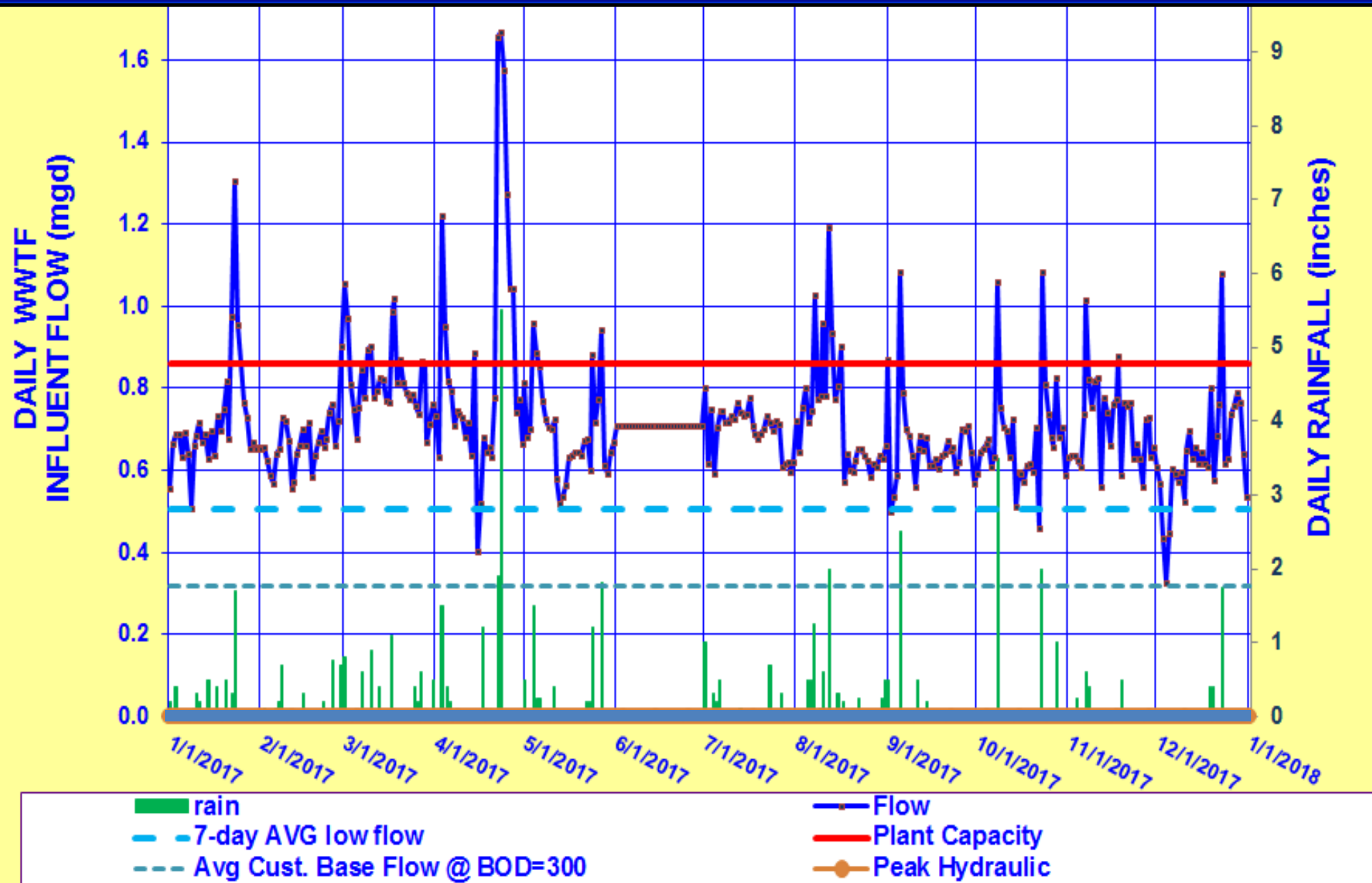
ELEMENT	DEFINITION	SOURCE
Daily WWTP Influent Flow	Daily Average Flow	MOR's
Daily Rainfall	Daily Recorded Rainfall in closest proximity to sewershed.	MOR's
7-Day AVG Low Flow (7 to 14 Days)	Wastewater flow data at the WWTP during a dry weather period of 7 to 14 days.	MOR's
Base Flow	The portion of wastewater which includes domestic, commercial, institutional, and industrial sewage and specifically excludes infiltration and inflow.	MOR's & PT
Permitted WWTP Capacity	WWTP flow via the NPDES Permit	NPDES Permit
Hydraulic WWTP Capacity	Maximum flow WWTP capable of handling without a ByPass	Permittee
Time	Calendar Year, Running 365-Day, or November 1st through April 30th	MOR's

WWTP Daily Flow and Rainfall

Any flow greater than "Base Sanitary Flow" is caused by I/I

FACTORS IN INDUSTRIAL FLOWS

INDUSTRIAL FLOW IMPACTS



analytics
predictive
Predictive
models
model
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edit
used
customer
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techniques
variable
variables
series
distribution
decision
customers
analysis
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set
patterns
complex
well
credit
now
detection
Regression
Bayes
examples
information
independent
applications
likelihood
financial
future
functions
identify
methods
modeling
order
dependent
using
networks
hazard
relationship
based
example
sample
Data
splines
different
training
products
classification
statistical
Logistic
also
function
predict
management
Descriptive
tools
behavior
applied
normal
results
systems
logit
risk
marketing
predicting
probit
conditional
logistic
collection
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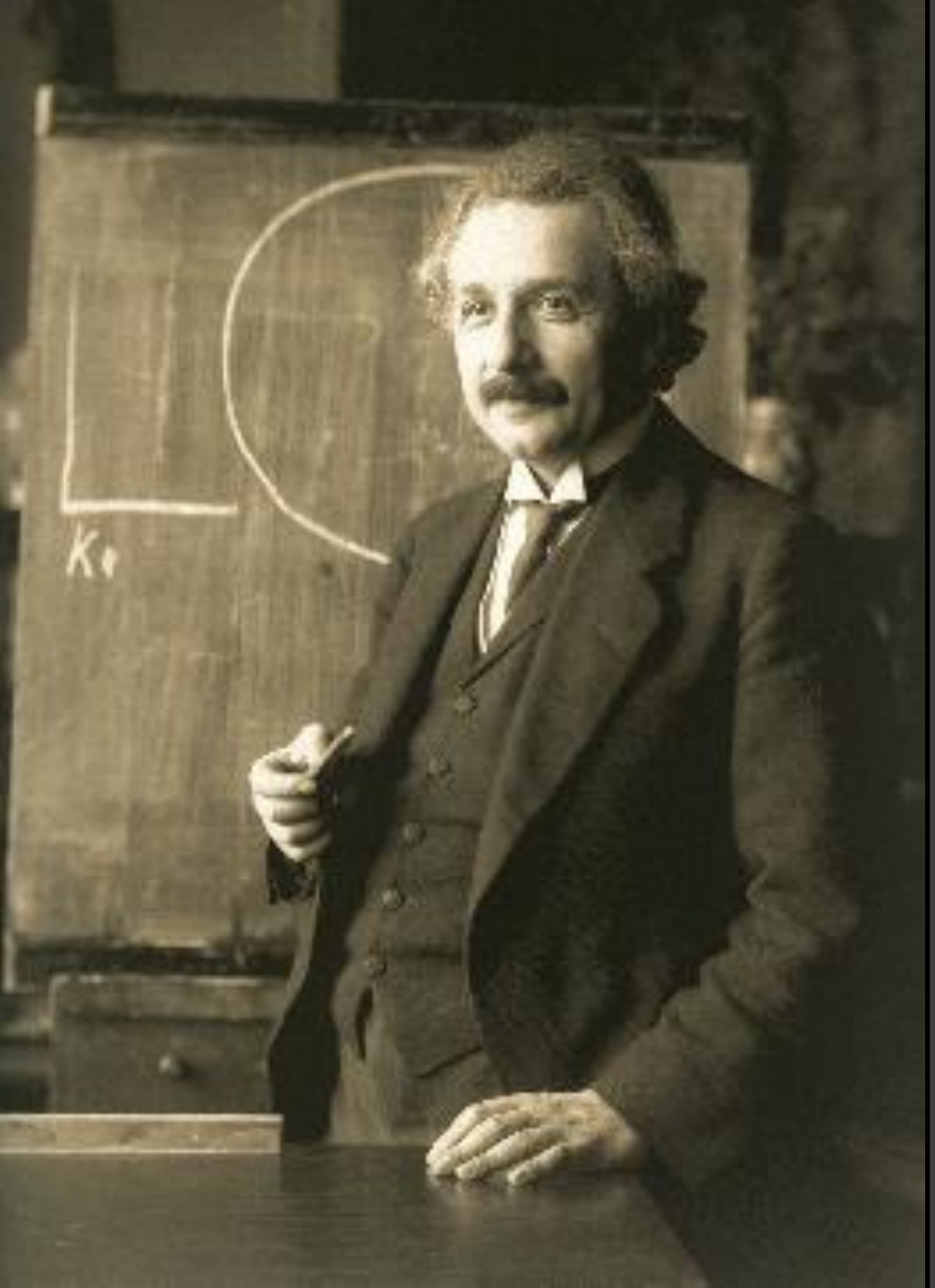
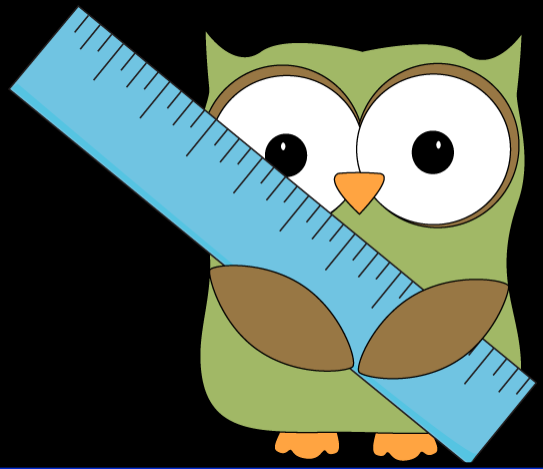
binary
neighbours
number
basis



All models are wrong, but some are useful.

- Albert Einstein

MORATORIUM METRICS



Kurzian Regression Model

Using MOR Data.

REFERENCES

Simple Method for Estimating I/I Using Treatment Plant Flow Monitoring Reports A Self Help Tool for Operators

by

George E. Kurz, P.E., DEE

Greg Ballard, P.E.

Brett Ward

Method to Verify I/I Reduction to Obtain Moratorium Relief

by

George E. Kurz, P.E., DEE

Kevin Colvett, P.E.

REGRESSION ANALYSIS

Effects of RD-I/I (rainfall derived I/I) and long-term dry weather infiltration.

RD-I/I is estimated by linear regression of I/I quantity compared to rainfall depth for discrete events.

Reference: *George E. Kurz, P.E., DEE*

REGRESSION ANALYSIS

TDEC-DWR is using a regression analysis "Model" for analyzing the statistical relationship between the 2nd day RD-I/I and two-day rainfall event.

.

Reference: George E. Kurz, P.E., DEE et al

WWTF INFLUENT MONITORING DATA ANALYSES

for

TN EXAMPLE #1

ANALYSIS PERIOD

JANUARY 01, 2015, to DECEMBER 31, 2015

I/I as a Percent of Annual Flow:

34%

Calculated by BOD dilution

Estimated Annual I/I Cost: $510,000

Years to Payback: 10.5

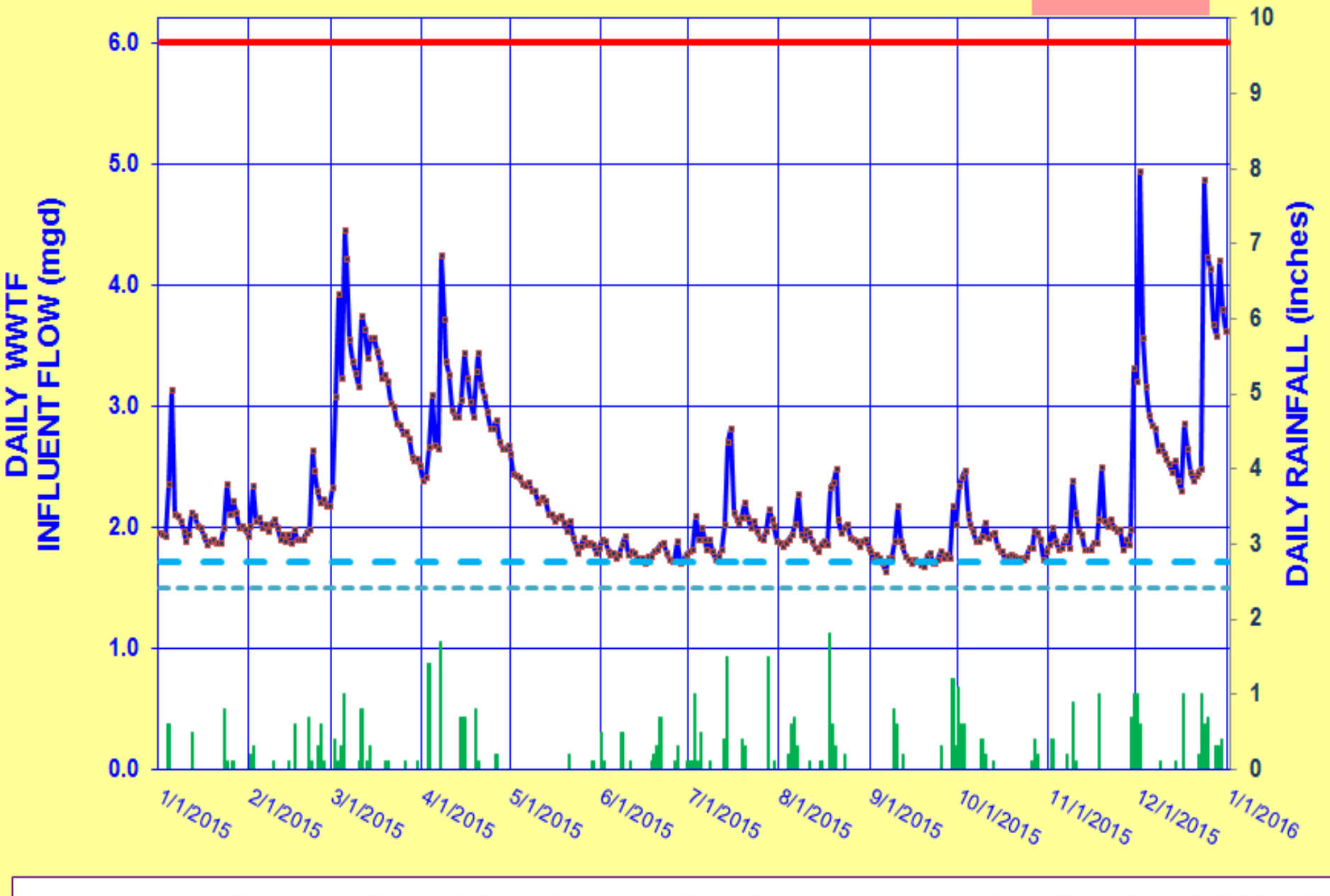
(After 50% Reduction)

1104 Berwick Trail
Madison, TN 37115-4909
george.kurz@comcast.net
615-714-6120

TN #1

WWTF DAILY FLOW & RAINFALL

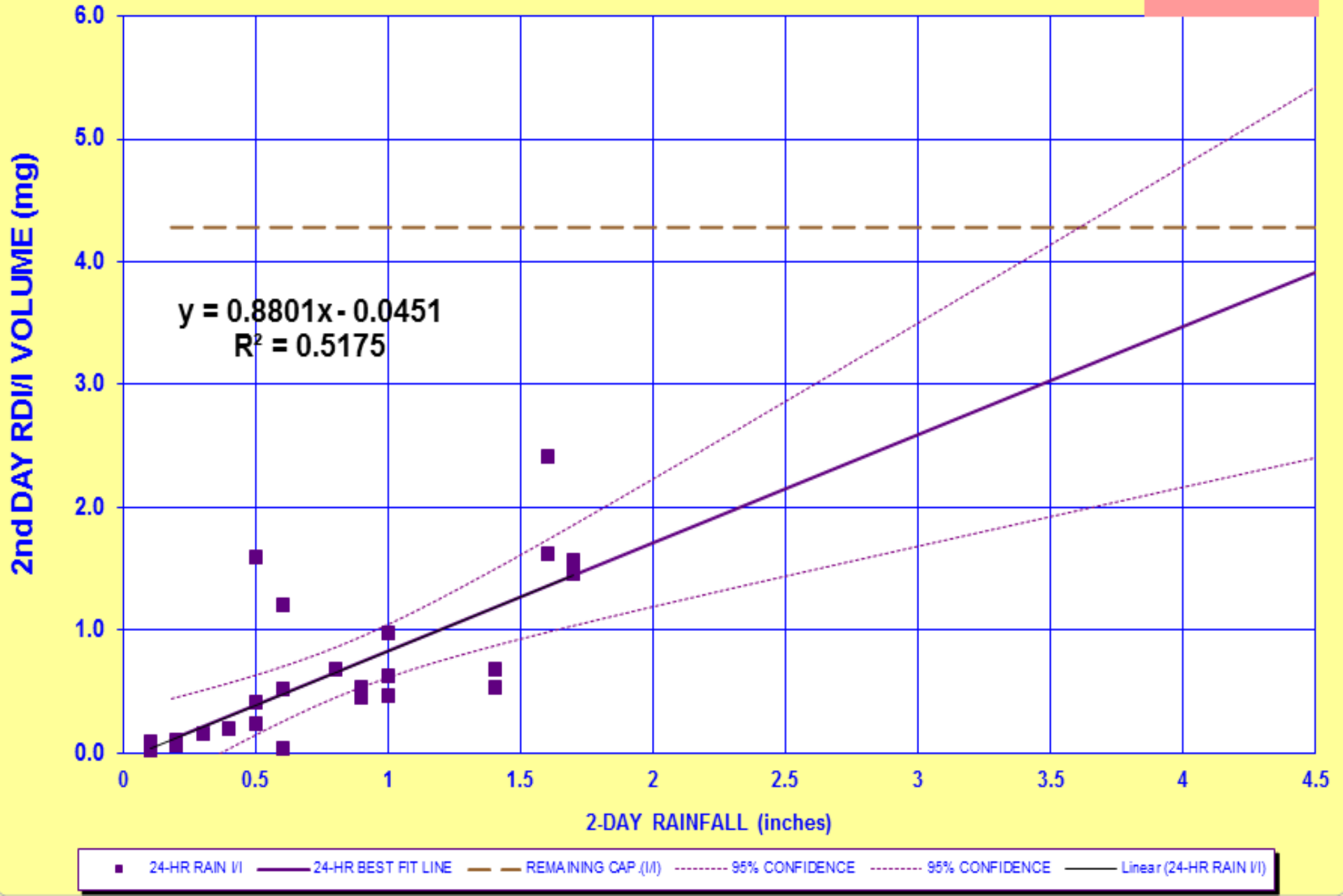
2015



TN #1

REGRESSION ANALYSIS
Estimate 2nd DAY RD-I/I vs 2-DAY RAINFALL

2015



WWTF INFLUENT MONITORING DATA ANALYSES

for

TN EXAMPLE #2

FLOW METER LIKELY PEGGED AT 2.5 MGD

ANALYSIS PERIOD

JANUARY 01, 2014, to DECEMBER 31, 2014

I/I as a Percent of Annual Flow:

52%

Calculated using ADDWF - 7-day low flow

Estimated Annual I/I Cost: $260,000

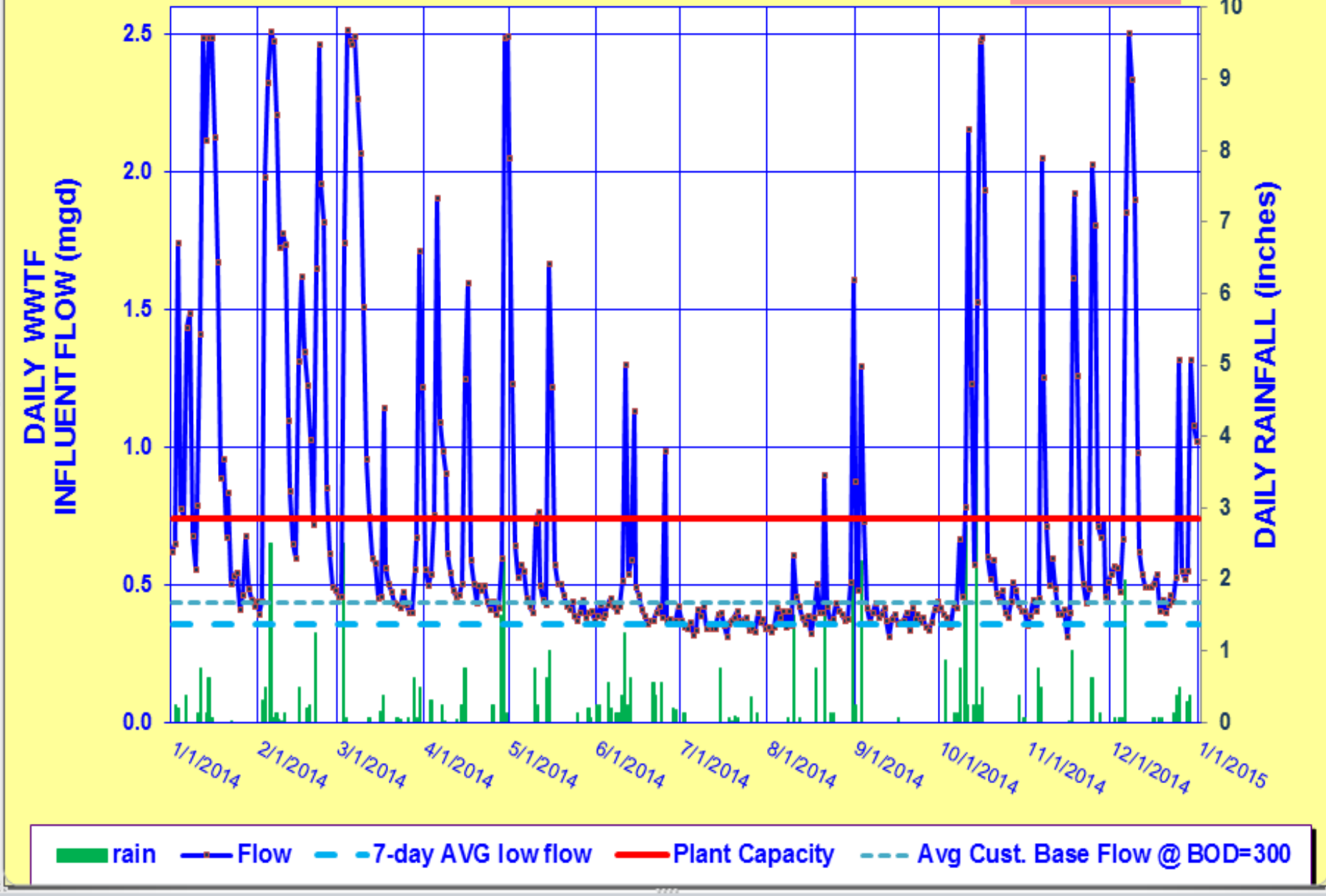
Years to Payback: 10.5

(After 50% Reduction)

1104 Berwick Trail
Madison, TN 37115-4909
george.kurz@comcast.net
615-714-6120

TN #2

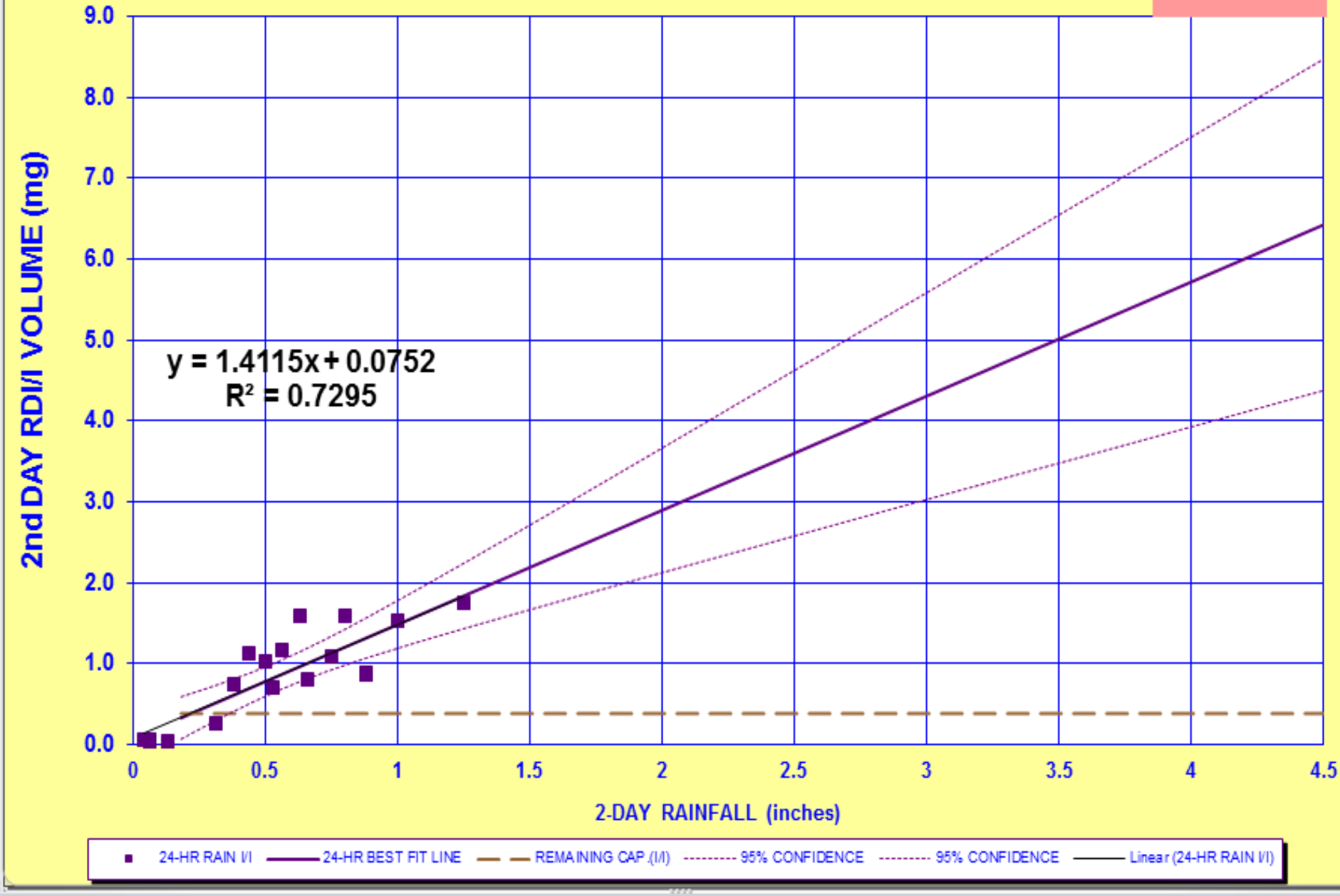
WWTF DAILY FLOW & RAINFALL 2014



TN #2

REGRESSION ANALYSIS
Estimate 2nd DAY RD-I/I vs 2-DAY RAINFALL

2014

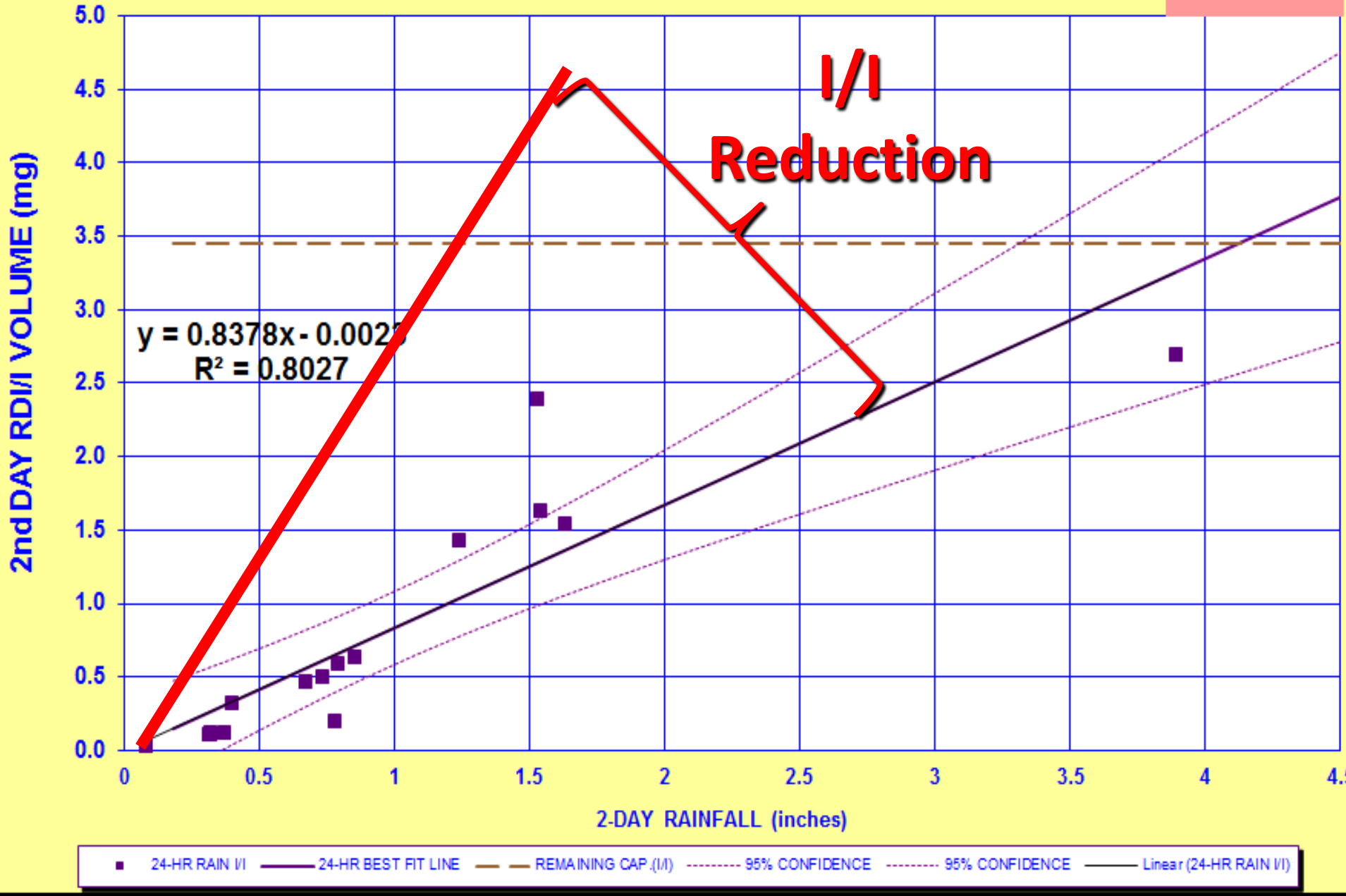


IMPROVEMENT

REGRESSION ANALYSIS

Estimate 2nd DAY RD-I/I vs 2-DAY RAINFALL

2012



Take Home Points

KEY FACTORS FOR MORATORIUM RELIEF

The capacity of the sewer system between the proposed connection and the chronic overflow/release points.

Compliance record for the WWTP – no effluent violations related to I/I.

Using the last 12 months of MOR data does the regression line model shows significant improvement.


MAKE SURE
EACH STEP
YOU TAKE
IS IN
THE
RIGHT
DIRECTION

If you don't Reduce I/I

A lot of Money is going to be flushed down the toilet.

INFILTRATION AND INFLOW

Tennessee

Treatment O&M Cost

@ $1.80/1,000 gallons =

$200,000,000/year*

*** Does not include extra debt service and depreciation on capacity already installed.**

INFILTRATION AND INFLOW

Tennessee

When ALL costs are considered the Total Annual Cost could be :

$1 BILLION

AFRAID OF A DOCTOR'S EXAM ?

WHAT IS THE HEALTH OF YOUR COLLECTION SYSTEM ?

Don't Be Afraid To Find Out !

Thank You

The End


time for questions

Bob O'Dette

Robert.Odette
@TN.GOV

(615) 253-5319

TN Department of Environment & Conservation