

# Geronimo and Alligator Creeks Watershed Steering Committee Meeting

GBRA River Annex

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# How Much Load Reduction is Necessary? An Introduction to Load Duration Curves

Ward Ling  
AgriLife Extension



# Water Quality Issues

- Geronimo and Alligator Creeks
  - Elevated nitrogen
    - Screening level
  - Elevated *E. coli*
    - Contact recreation criteria



# Water Quality Conditions

- Geronimo Creek listed on the 2006 303(d) list for not supporting its contact recreation use
  - Listed again in 2008 and 2010
- Geronimo Creek first identified in 2000 for concern for nutrient enrichment
  - 2008 assessment, all 60 samples exceeded 1.95 mg/L nitrate-nitrogen



# Our Goal

- Reduce loading of bacteria to meet the water quality standard for contact recreation
  - 126 cfu/100mL *E. coli*
- Reduce loading of nitrate-nitrogen to meet the water quality standard for nitrate-nitrogen
  - 1.95 mg/L nitrate-nitrogen

# How can we estimate the reduction that is needed to achieve our water quality goals?

- Simple math equation
- Load Duration Curve

# Simple Math

- Example: Geomean for our creek is at 165 cfu/100ml
  - Water quality standard is a geomean of 126cfu/100ml
  - $165 - 126 = 39$
- $39/165 = 23.6\%$  Overall reduction

# Simple Math Pros and Cons

- Pros
  - Quick and simple
- Cons
  - Does not look at full range of flow conditions
  - May oversimplify a complex situation
  - May be misleading
  - May not result in achieving goal, because loading may be greater (or lesser) at different flow conditions
  - Provides no insight into pollutant sources



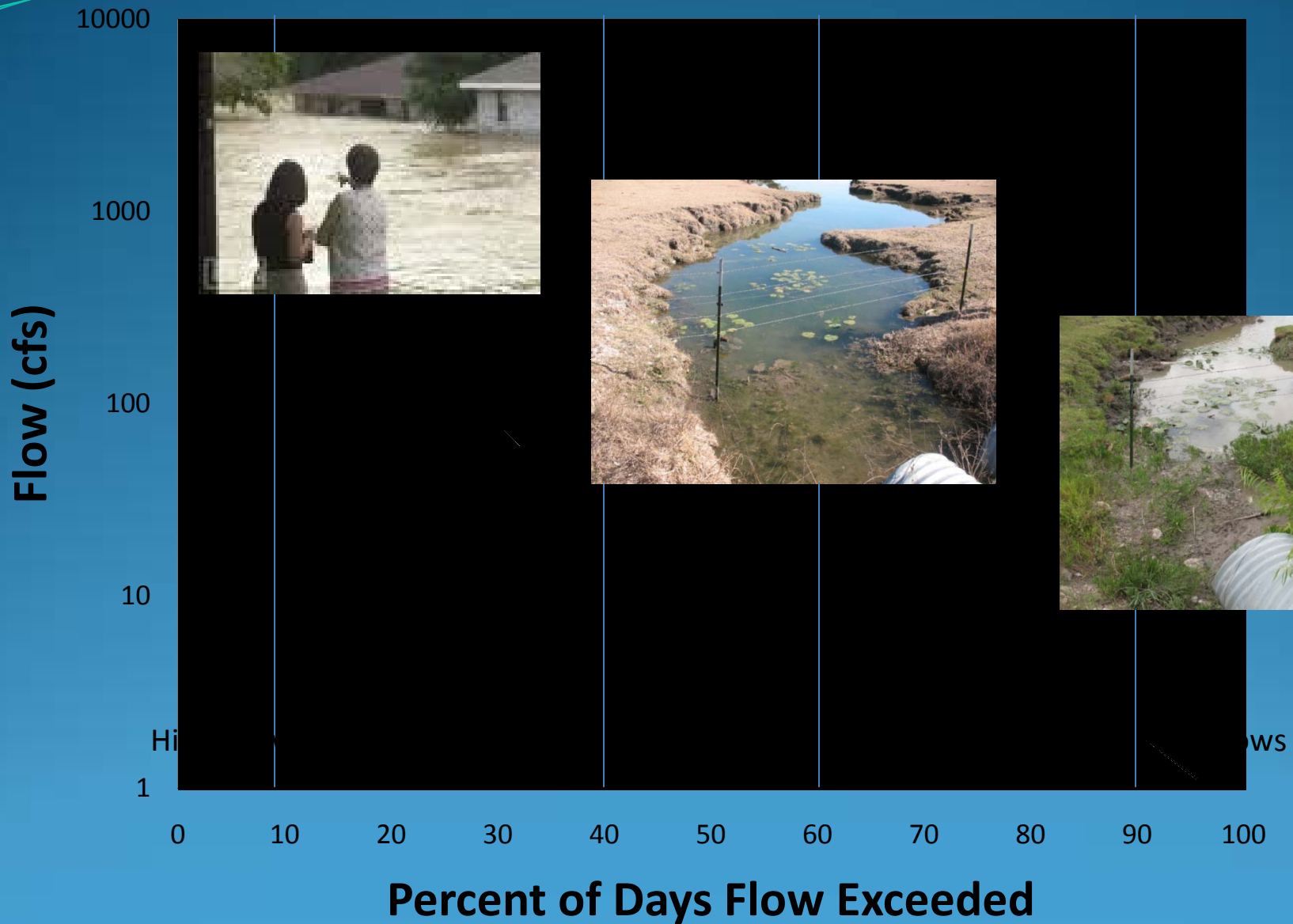
# Load Duration Curves

- A good combination of moderately complex calculations, with a somewhat easy to understand output
- Recommended by EPA as a valid tool
- An improvement over the simple math approach
  - Looks at water quality over the full range of flows that a creek experiences
- Identifies the flow at which impairments occur most frequently

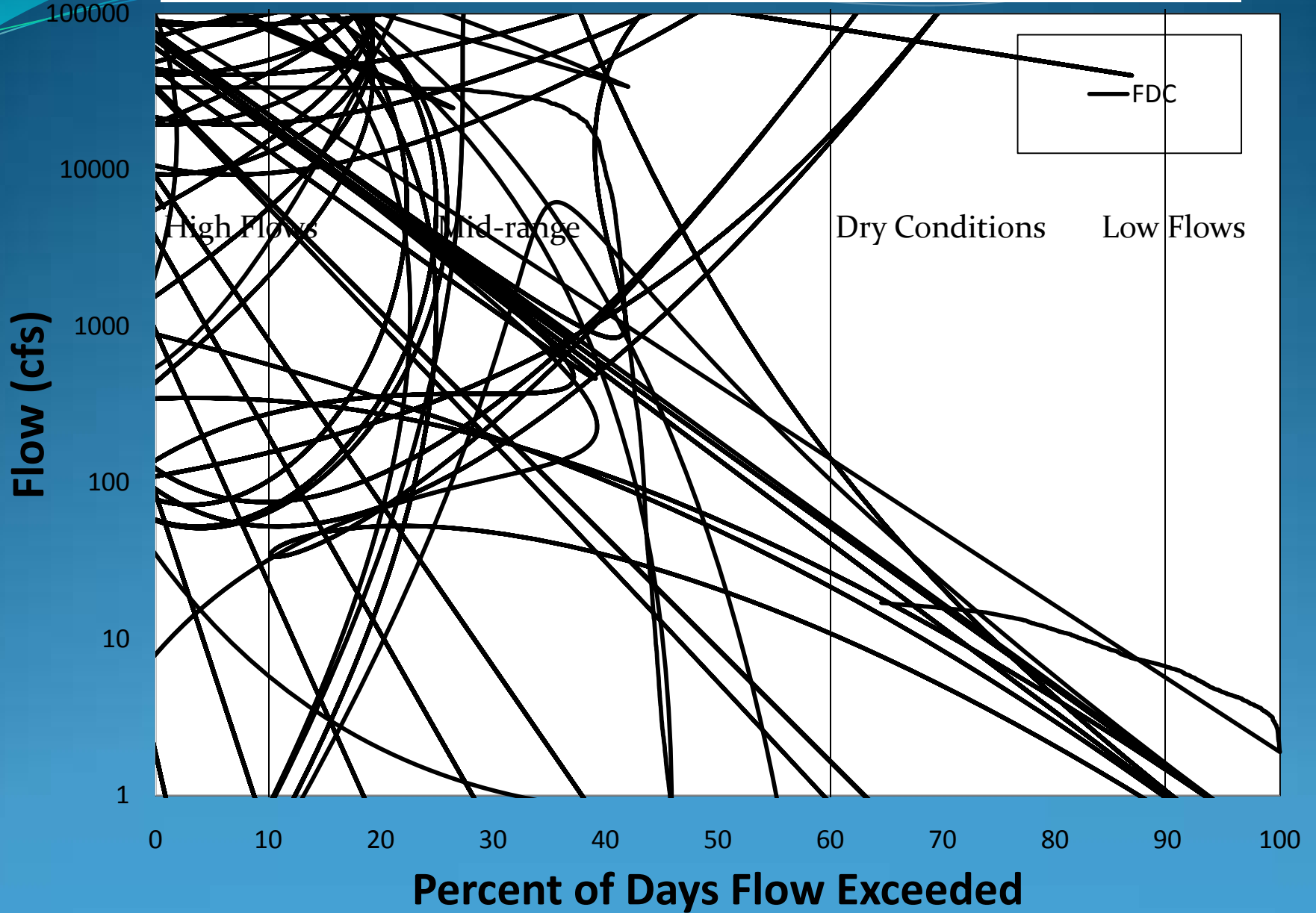
# LDC Introduction

- Begin with constructing a Flow Duration Curve
  - The curved line demonstrates the frequency of flows in a stream over time
    - Highest volume flows are on the left
    - Lowest volume flows are on the right
    - Frequency of the flows is given along the X axis

# Geronimo Creek at SH 123 Flow Duration Curve



# Geronimo Creek at Haberle Road Flow Duration Curve



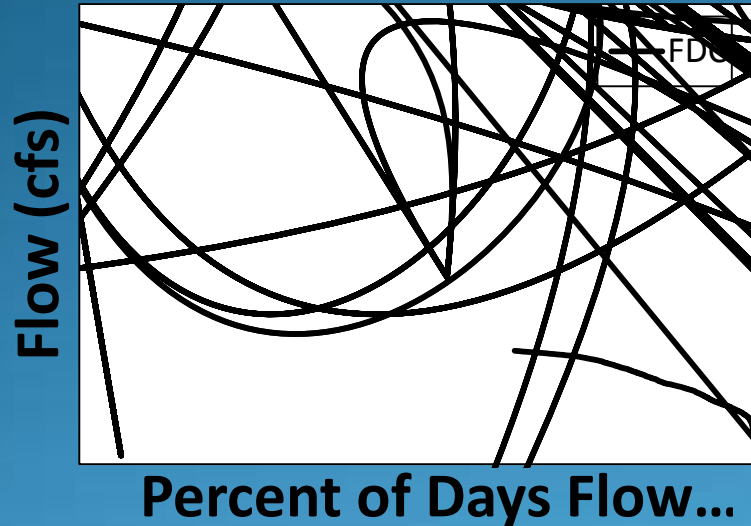
# Flow Duration Curves then Converted to Load Duration Curves

- This is what allows us to see what reduction is necessary
- Load duration curves are simply flow duration curves converted to show a concentration (load) of a given constituent
- To convert a FDC to a LDC, simply multiply the FDC by the concentration of the parameter of concern

# Conversion from FDC to LDC

- To create a bacteria LDC, multiply the FDC by the water quality standard
  - Geomean of 126 cfu/100mL
  - At this time, you build in a Margin of Safety
    - Typically 10% less than the water quality standard
- The line now demonstrates how much bacteria can be in the stream at any given flow, and still meet the water quality standard

# Creating LDCs from FDCs



**X** Contact Recreation Standard

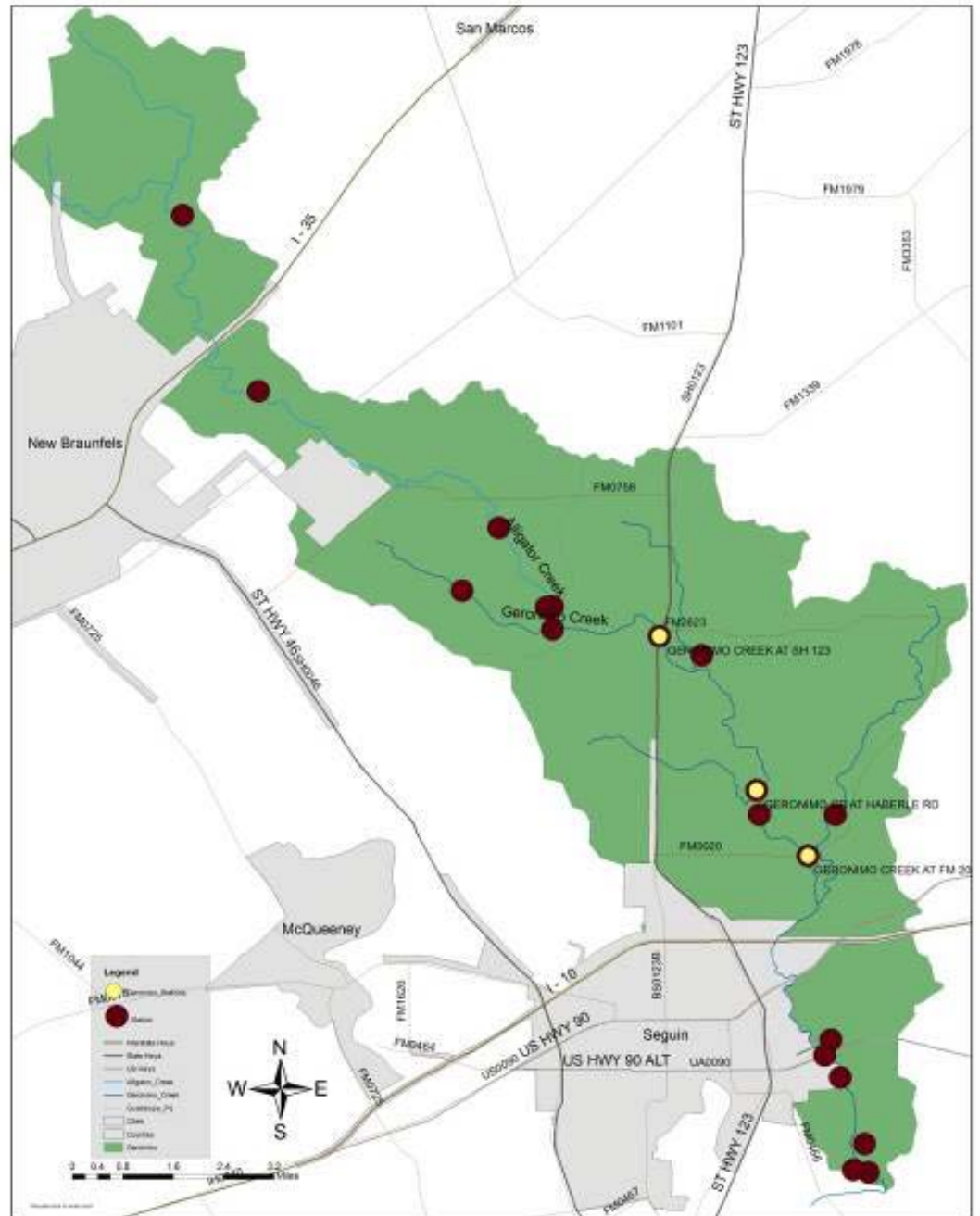
# Geronimo and Alligator Creek

- Flow duration curves were developed for the two historic sampling locations on Geronimo Creek
  - SH 123
  - Haberle Road
- High flow frequency is to the left, and low flow frequency is to the right

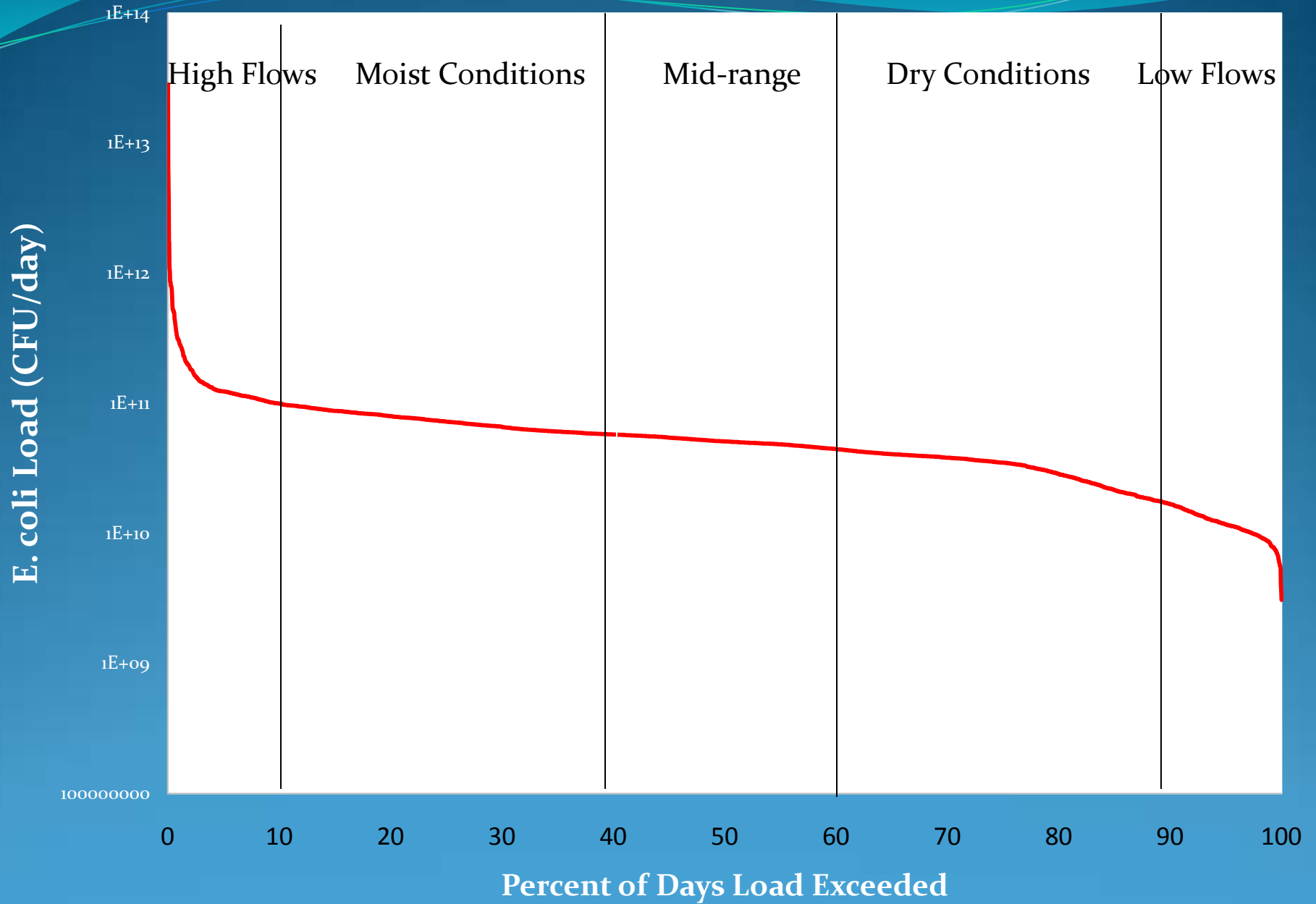


# Water Quality Sites on Geronimo and Alligator Creeks

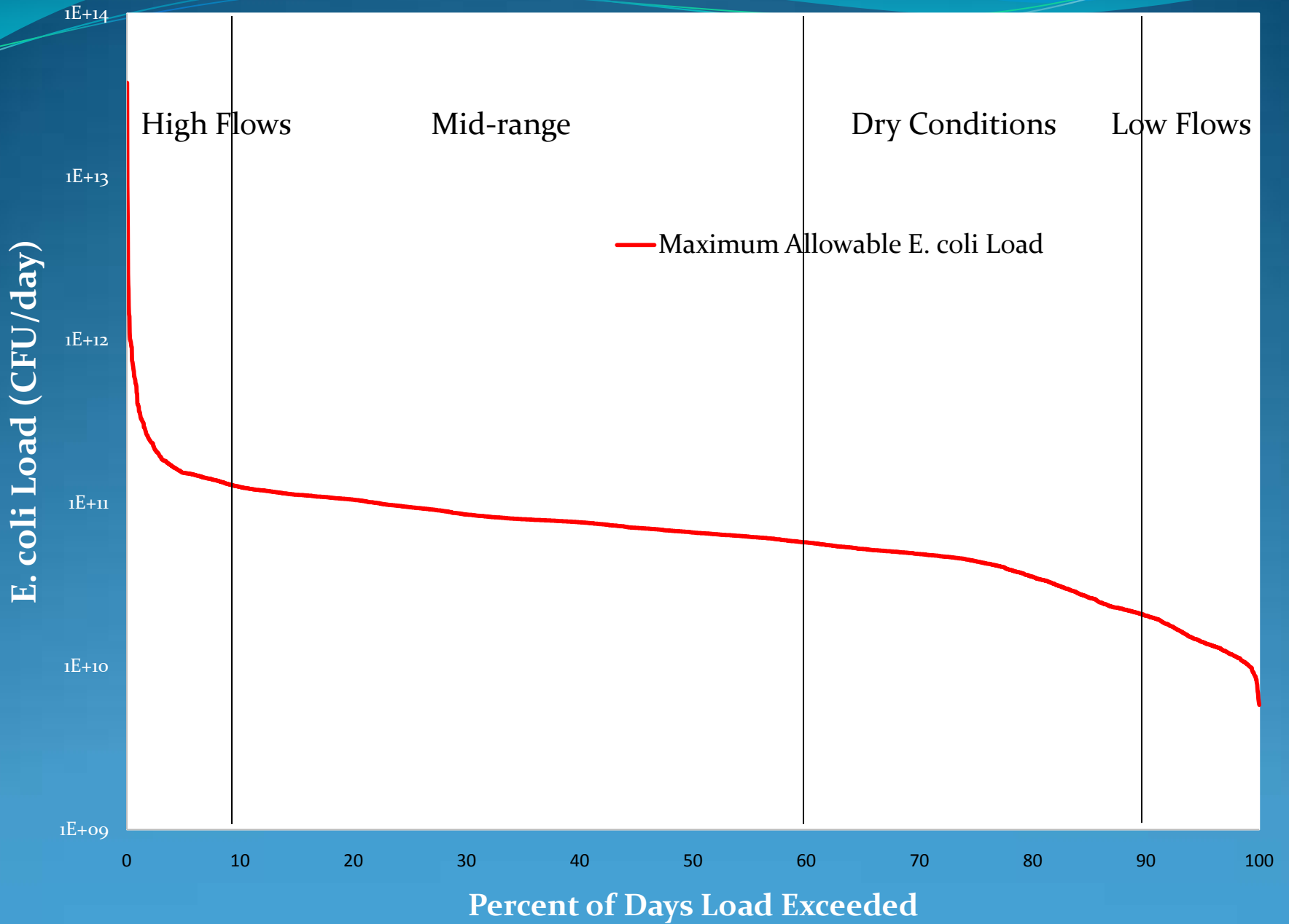
## Geronimo and Alligator Creeks Watershed



# Geronimo Creek at SH 123 Load Duration Curve



# Geronimo Creek at Haberle Road Load Duration Curve



E. coli Load (CFU/day)

High Flows

Mid-range

Dry Conditions

Low Flows

Maximum Allowable E. coli Load

Percent of Days Load Exceeded

# Next...

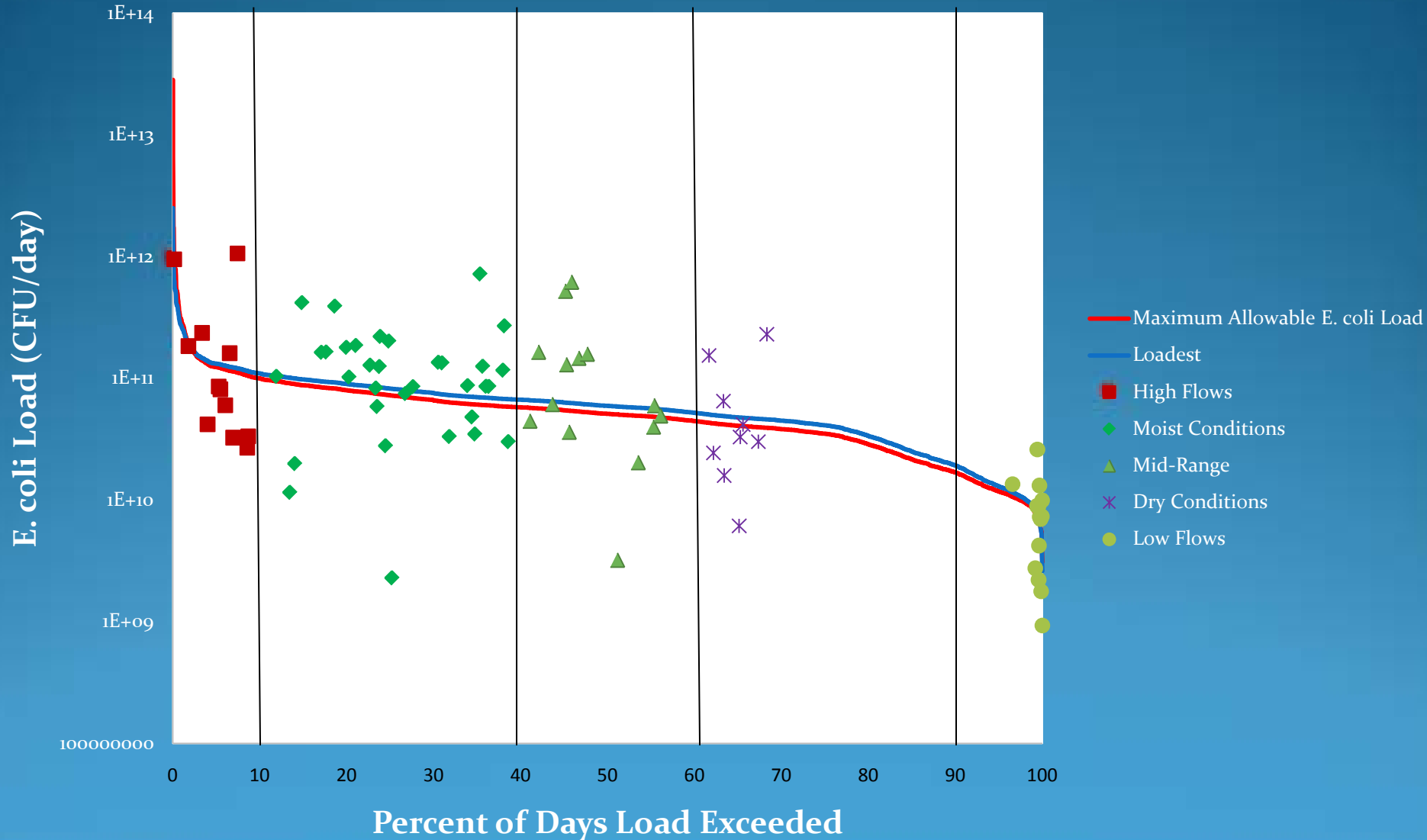
- Plot the data collected from the creek
- These individual data points will be scattered on the graph
- A “best fit” line will be on the graph to demonstrate the trend of the collected data

# How do you read a FDC?

- Data points above the red line (Maximum allowable load) are above the standard
- Data points below the line are below the water quality standard
  - The “best fit” blue line demonstrates where our data are falling

# Geronimo Creek at SH 123

## E. Coli bacteria

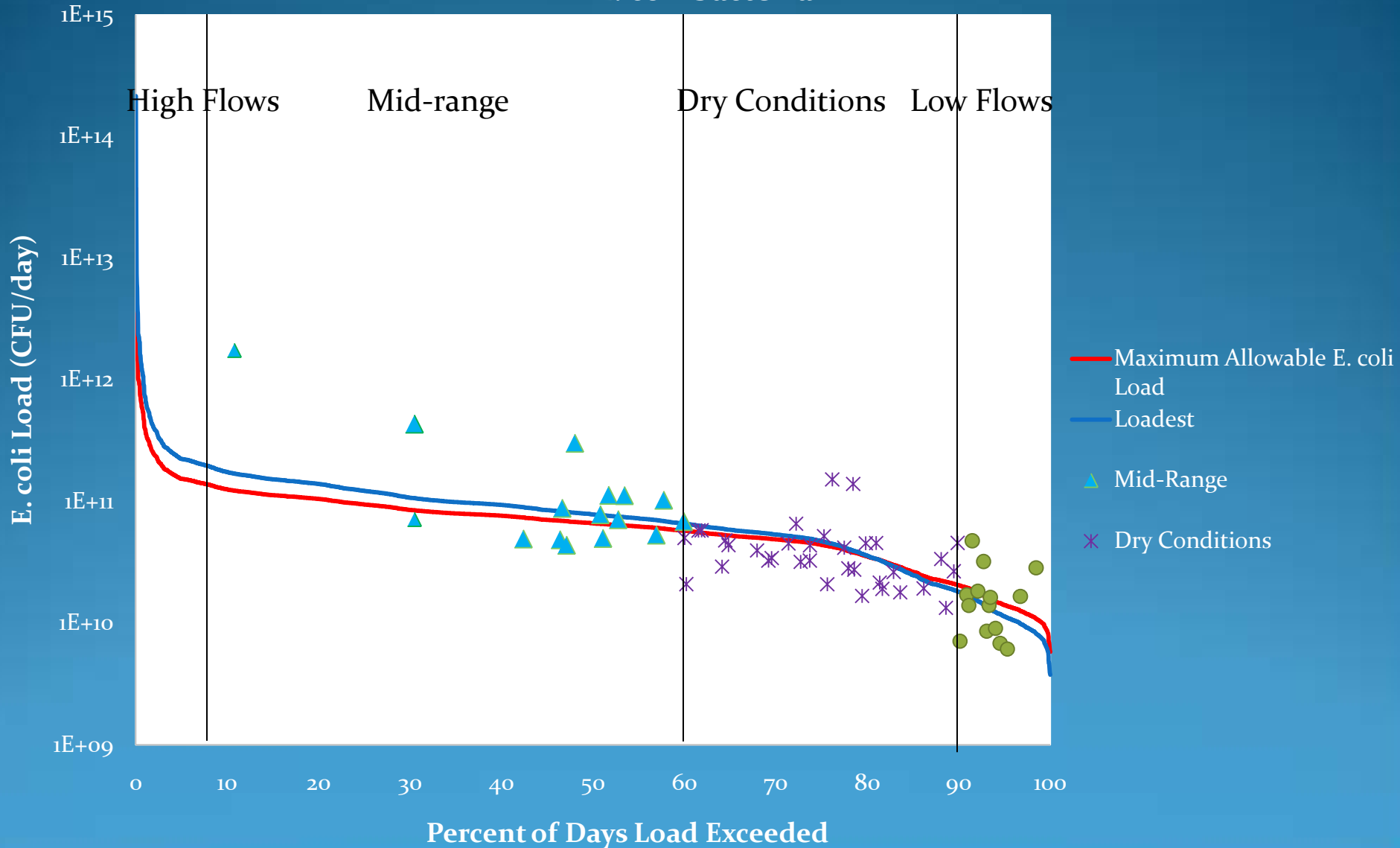


# Geronimo Creek at SH 123

Flow Condition	Reduction Required
High Flows	0
Moist Conditions	12%
Mid-Range	14%
Dry Conditions	14%
Low Flows	8%

# Geronimo Creek at Haberle Road

## E. coli bacteria



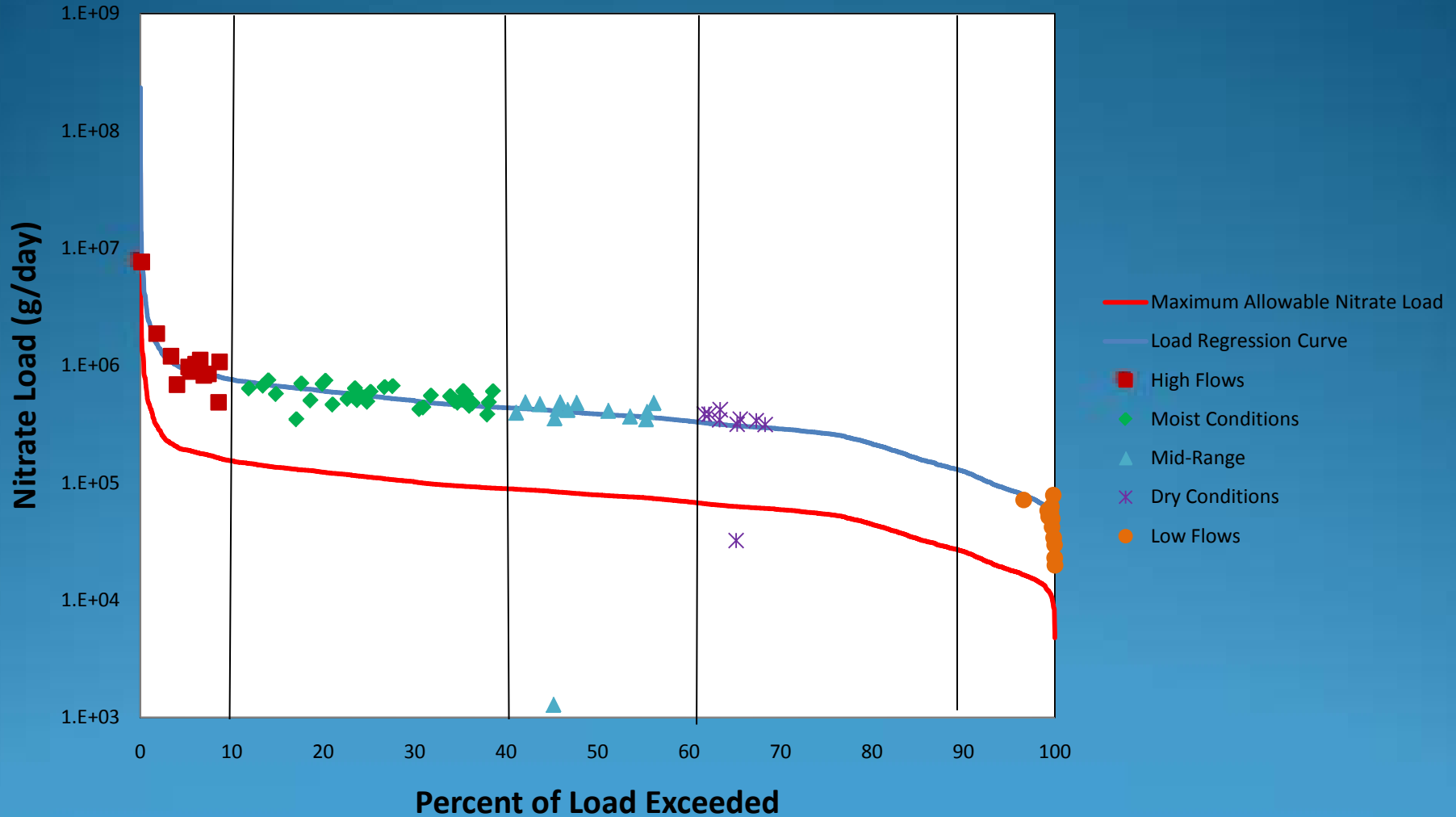


# Geronimo Creek at Haberle Road

Flow Condition	Percent Reduction
High Flows	20%
Mid-Range	16%
Dry Conditions	4%
Low Flows	0

# Geronimo Creek at SH 123

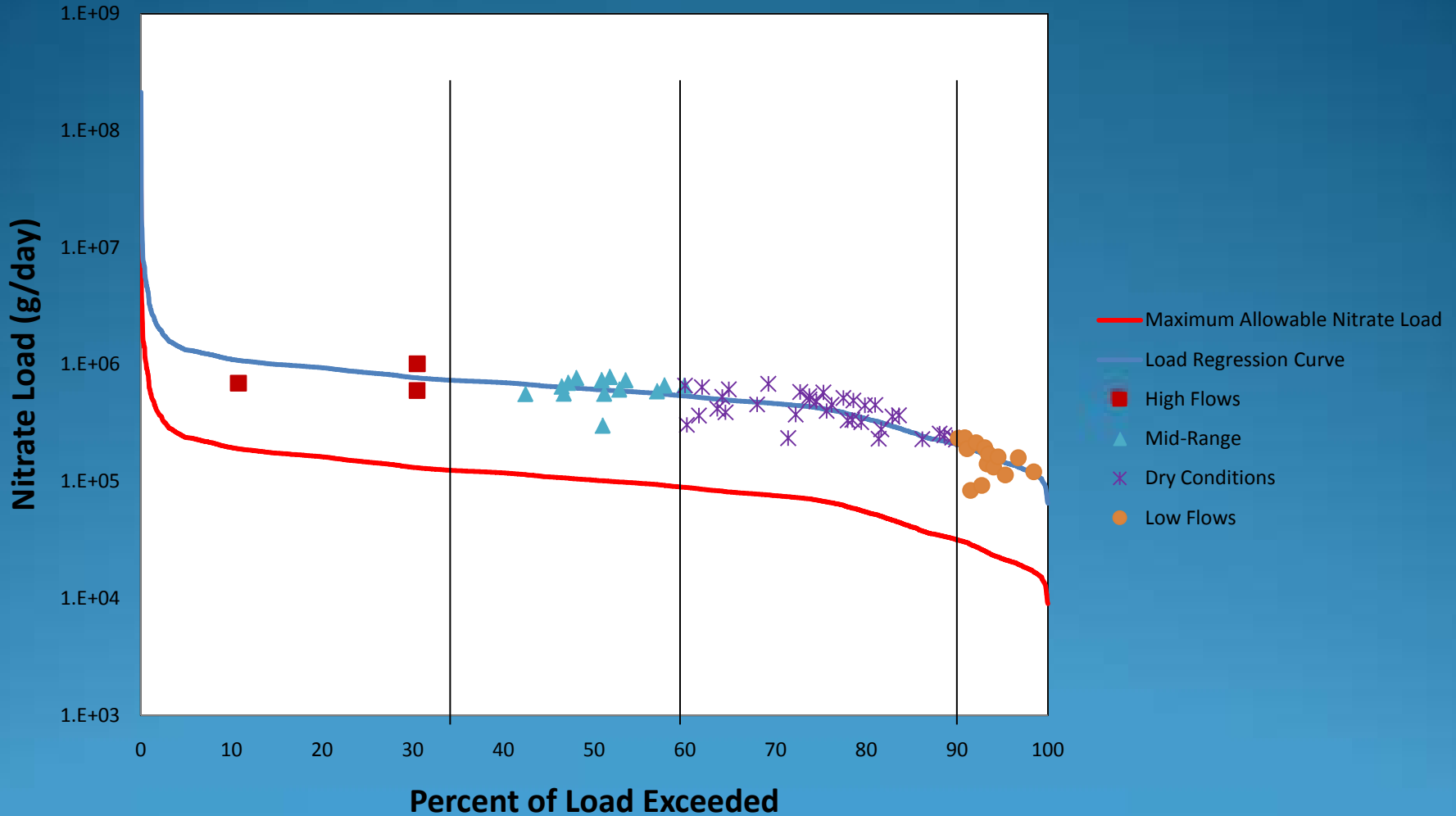
## Nitrate Concentrations



# Geronimo Creek at SH 123 Nitrate Reductions

Flow Condition	Percent Reduction
High Flows	80
Moist Conditions	80
Mid-Range	80
Dry Conditions	79
Low Flows	79

# Geronimo Creek at Haberle Rd Nitrate Concentrations



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# Geronimo Creek at Haberle Rd Nitrate Reductions

Flow Condition	Percent Reduction
High Flows	82
Mid-Range	83
Dry Conditions	84
Low Flows	85

# Geronimo at SH 123 Summary

- Bacteria
  - Exceedances are during moderate to low flows
  - Required reductions are reasonable and achievable
- Nitrates
  - Exceedances are across all flows
  - Further investigation may be required

# Geronimo at Haberle Road

## Summary

- Bacteria
  - Exceedances are mainly during high to mid range flows
  - Required reductions are reasonable and achievable
- Nitrates
  - Exceedances are across all flows
  - Further investigation may be required

# Questions?

