Spatially Explicit Load Enrichment Calculation Tool (SELECT) and Load Duration Curve (LDC) Analysis: Little Brazos River Tributaries Bacteria Assessment Project

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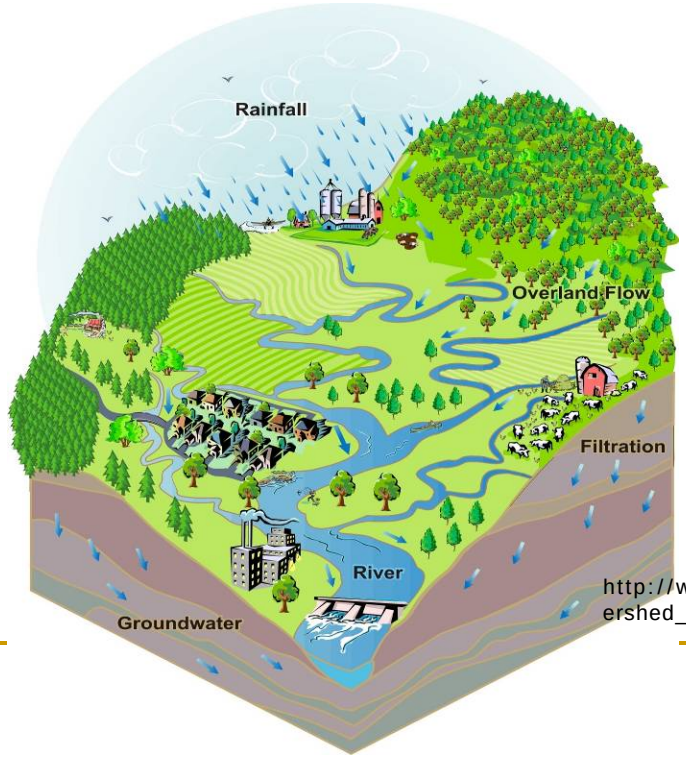
Land Use Analysis

- Use of aerial or satellite imagery to characterize the vegetation, water, natural surface, and cultural features on the land surface
- Several national datasets are available, but they are dated (1992 or 2001)
- TAMU Spatial Sciences Lab is using recent imagery to develop current dataset for entire middle Brazos River and Navasota River watersheds

Spatially Explicit Load Enrichment Calculation Tool (SELECT)

Purpose of SELECT

- Spatially explicit analysis of LULC, animals in watershed, etc. to assess/determine potential sources of bacteria



http://www.awag.org/Education/Watershed_diagram.jpg

Methodology

- Determine Potential Load
  - Spatially distribute source populations for appropriate habitats
  - Apply fecal production rate
  - Aggregate to level of interest
- Develop a Qualitative Assessment of Pollutant Connectivity
  - Pollution Indicator
  - Run-off Indicator
  - Distance Indicator

Potential Sources

Images from:
www.know-thy-builder.com
www.campbowwowusa.com
www.obebeef.com.au
www.exzooberance.com

www.turkeyandturkeyhunting.com

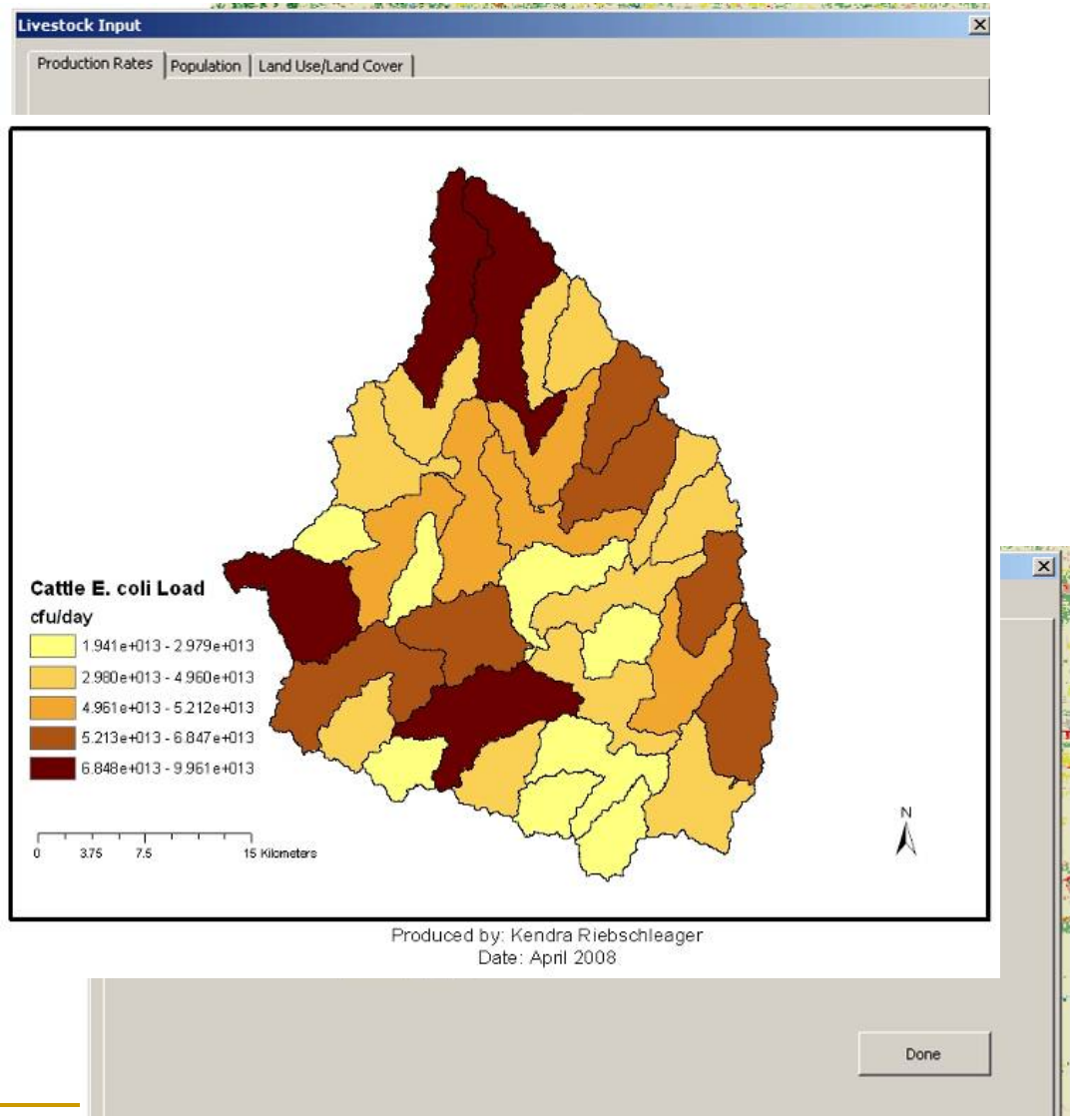
- Livestock
  - Cattle
  - Other (Sheep, Goats, Swine, Horses)
- Wildlife
  - Deer
  - Other (Raccoons, Birds, Rodents)
- Feral Hogs
- Domestic
  - Septic Systems
  - Pets
- Wastewater Treatment Facilities



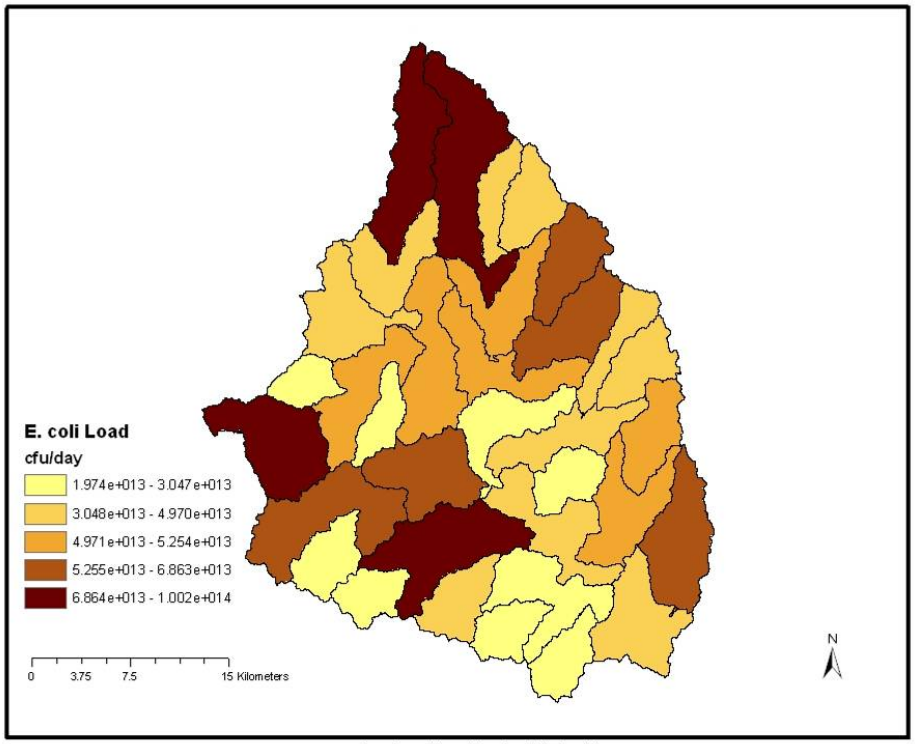


Input Parameters - Cattle

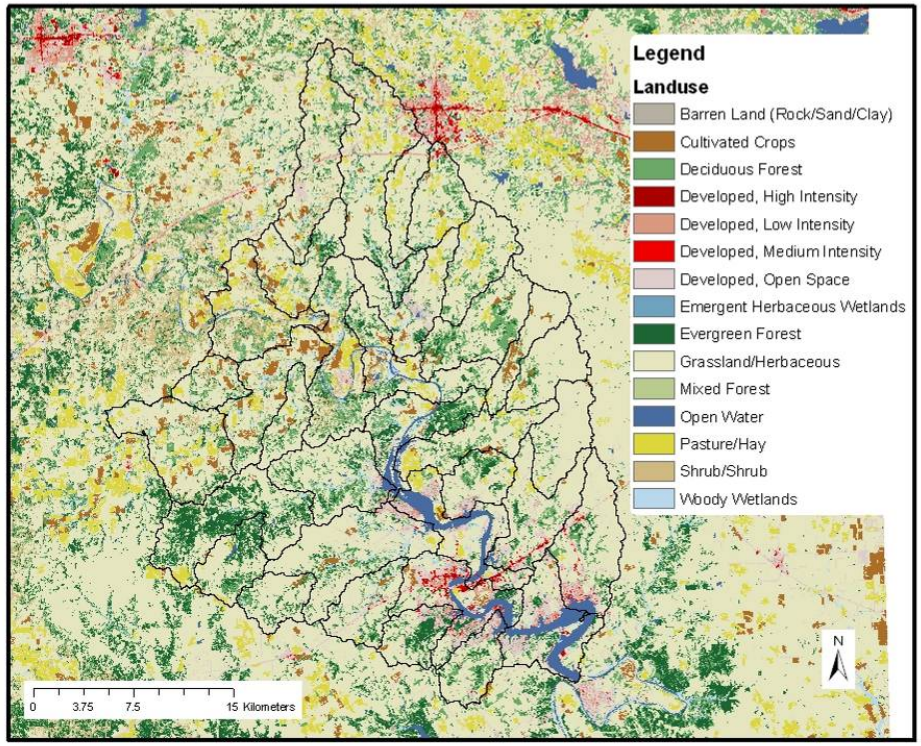
- Data Sources
  - National Agricultural Statistics Service (NASS) - Livestock Populations per County
  - Landuse data
  - Counties Shapefile
- Assume
  - evenly distributed on grasslands (71) and pasture/hay (81)
  - Fecal Production Rate (USEPA, 2000)
    - 10 x 10^{10} cfu/animal*day



Total Potential *E. coli* Load



Produced by: Kendra Riebschleager
Date: April 2008

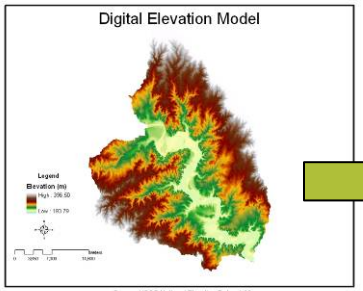


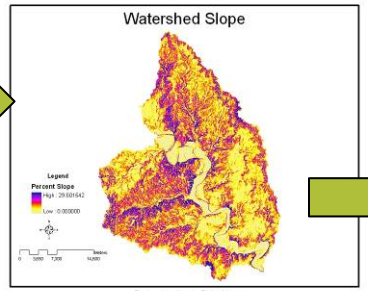
Pollutant Connectivity Factor

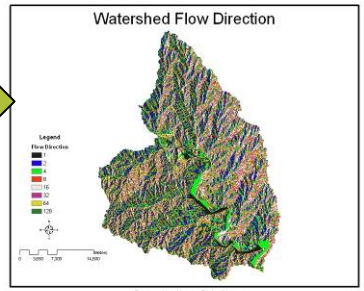
- Contribution of Contaminant based on
  - Total pollutant loading
  - Fate and Transport driven by
    - runoff
    - travel distance
  - Growth and decay

- Estimate influence of driving forces using weighted overlay

Pollutant Connectivity Factor







Soil/Landuse Intersection

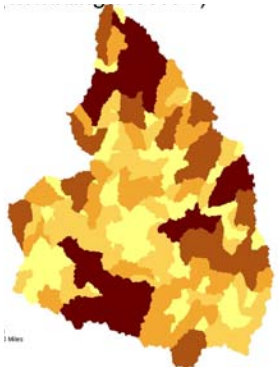
NRCS Curve Number Lookup Table

Pollutant Indicator

Runoff Indicator

Distance Indicator

Wp *



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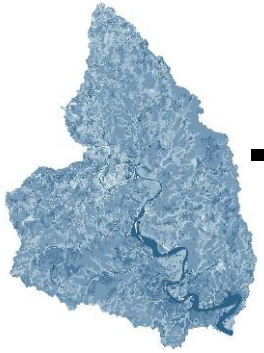
Wr *



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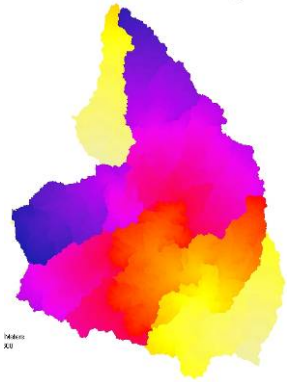
Wd *

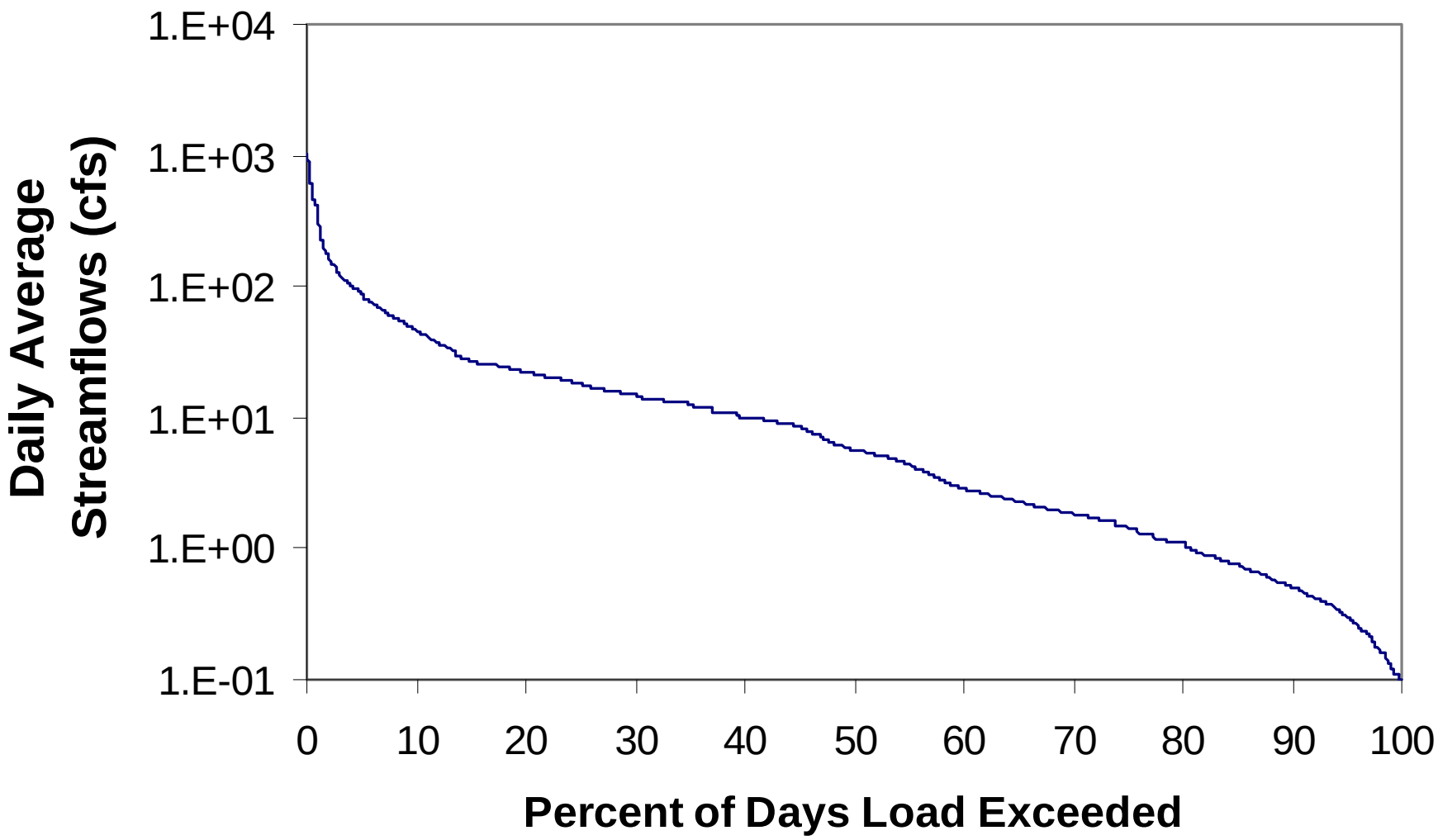


Load Duration Curve (LDC) Analysis

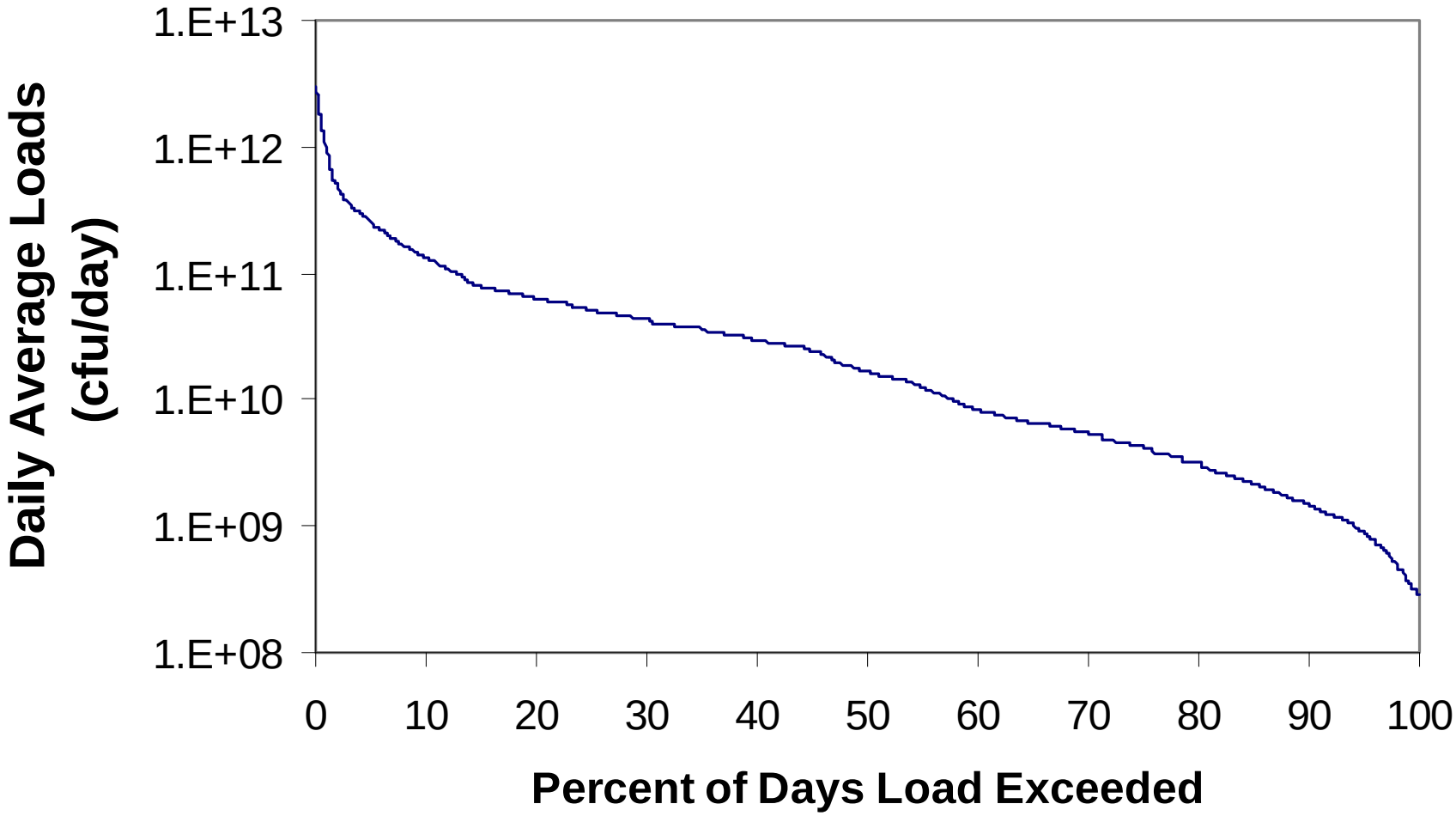
What is an LDC?

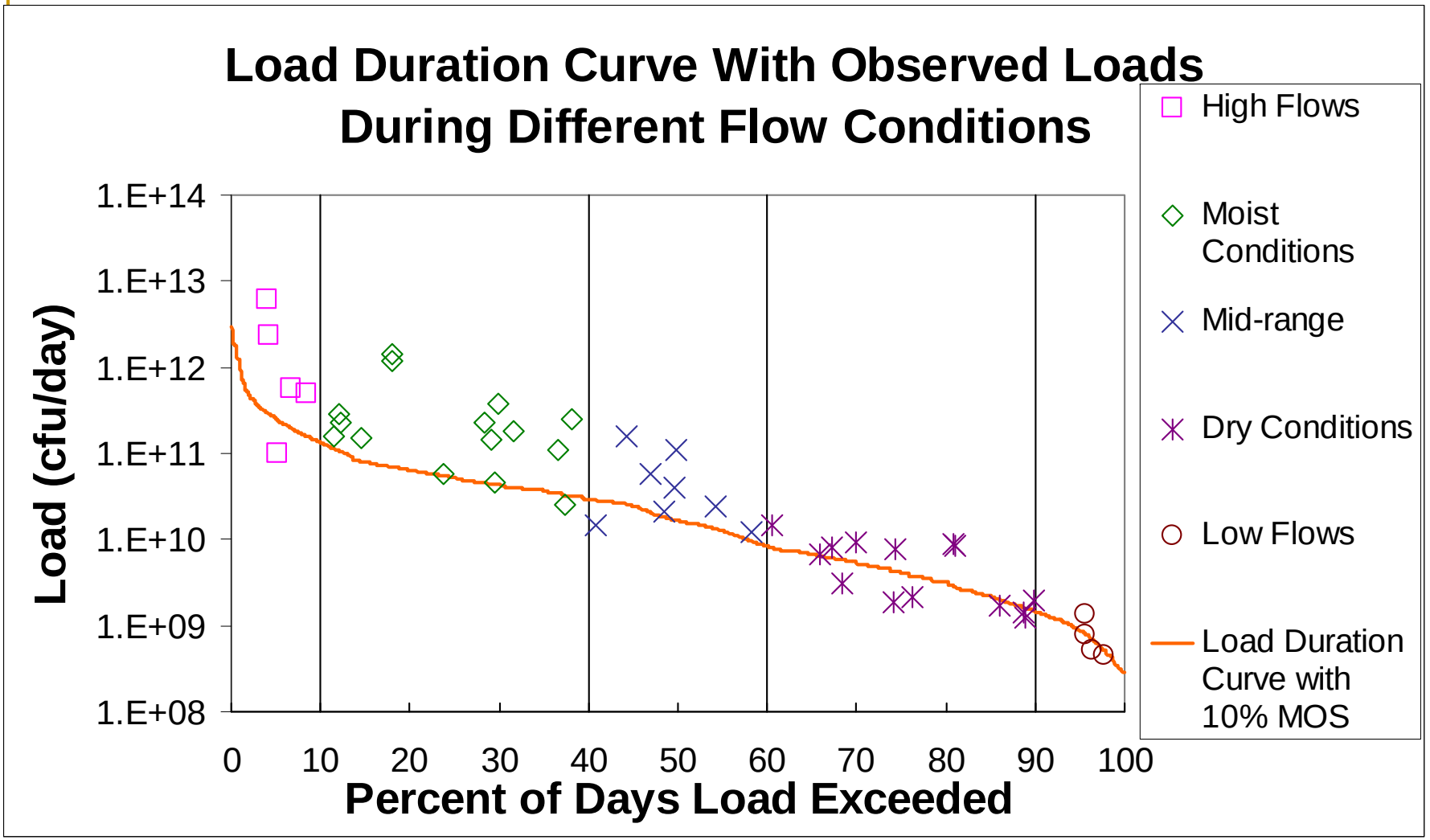
- Graphical representation of streamflow and pollutant loadings
- Real data can be compared to the stream's maximum load to indicate reductions needed
- Can help to identify the type of pollutant load

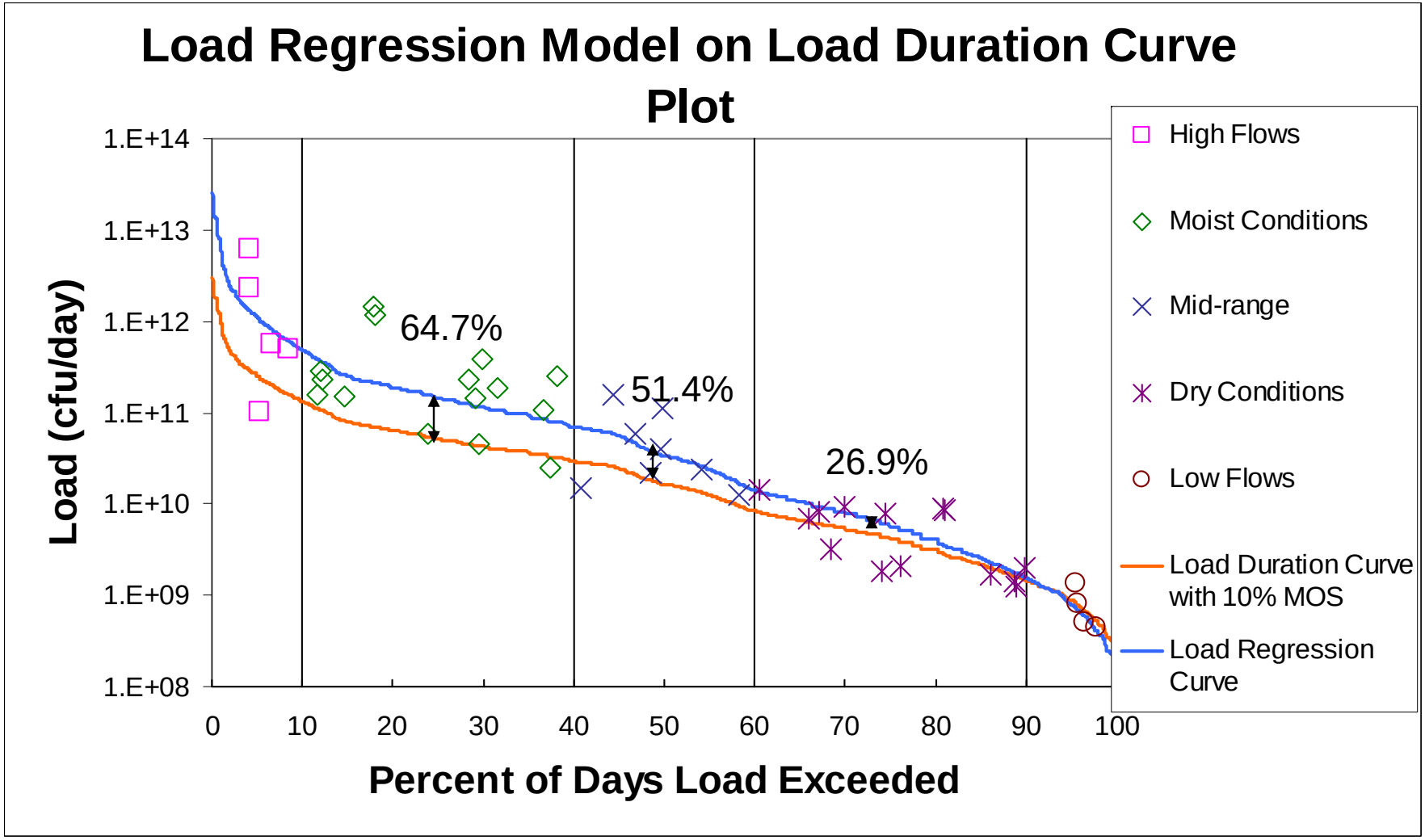
Flow Duration Curve



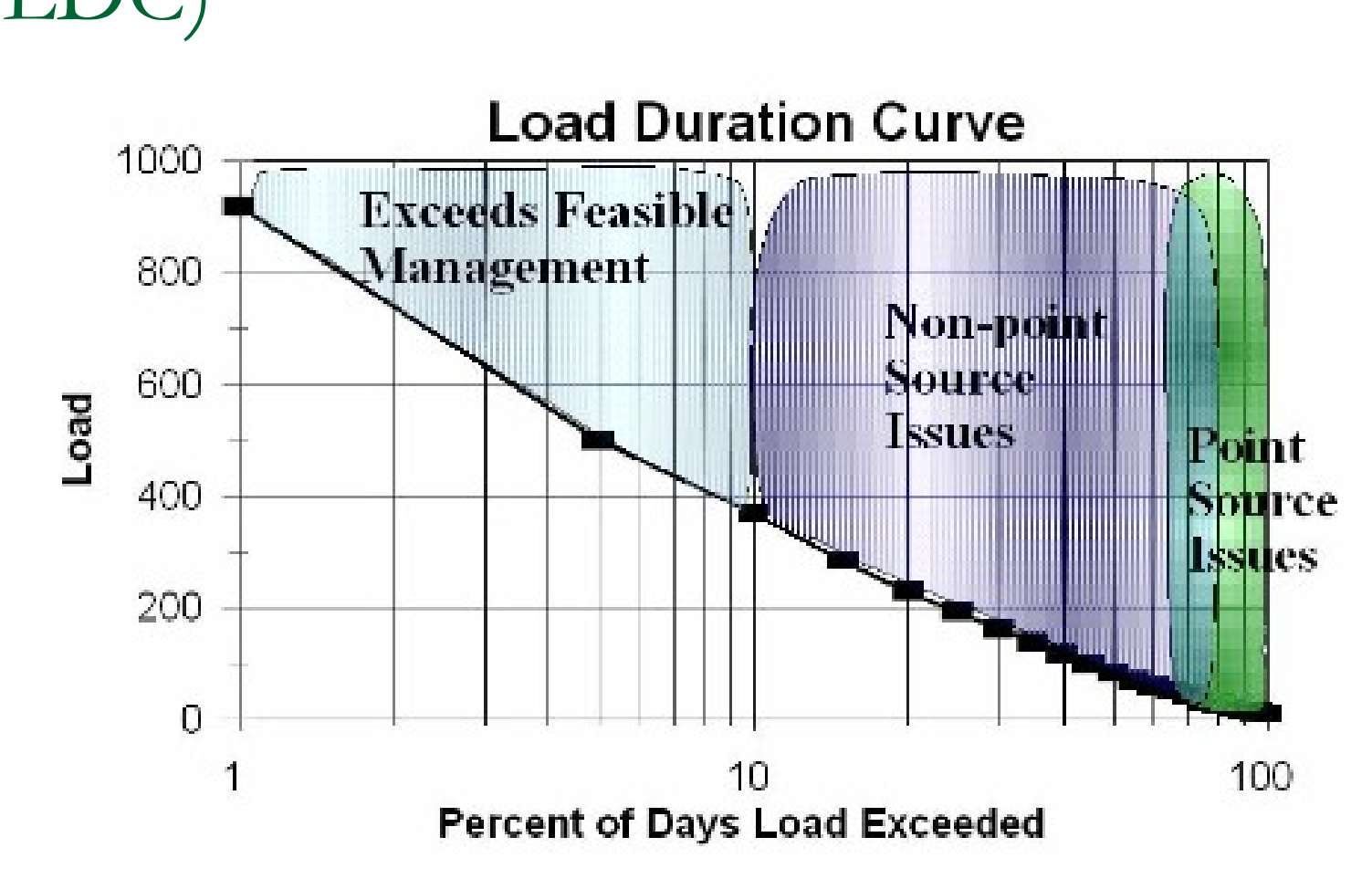
Load Duration Curve




Load Duration Curve With Observed Loads During Different Flow Conditions
Load (cfu/day)
1.E+14
1.E+13
1.E+12
1.E+11
1.E+10
1.E+09
1.E+08
0
10
20
30
40
50
60
70
80
90
100
Percent of Days Load Exceeded
High Flows
Moist Conditions
Mid-range
Dry Conditions
Low Flows
Load Duration Curve with 10% MOS


Load Regression Model on Load Duration Curve Plot
Load (cfu/day)
1.E+14
1.E+13
1.E+12
1.E+11
1.E+10
1.E+09
1.E+08
0
10
20
30
40
50
60
70
80
90
100
Percent of Days Load Exceeded
64.7%
51.4%
26.9%
High Flows
Moist Conditions
Mid-range
Dry Conditions
Low Flows
Load Duration Curve with 10% MOS
Load Regression Curve

LDC Usefulness (source ID based on LDC)



Next Steps for Modeling

- Next meeting is sanitary survey design, will have GIS work significantly completed (Nov or Dec 2008)
- Meeting after that will show LDCs based on historical-only data and have model input questions for stakeholders (Dec 2008 or Jan 2009)
- Meeting after that will show progress on SELECT (May 2009)

Questions?