McDowell Creek Watershed Management Plan

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Storm Water Services

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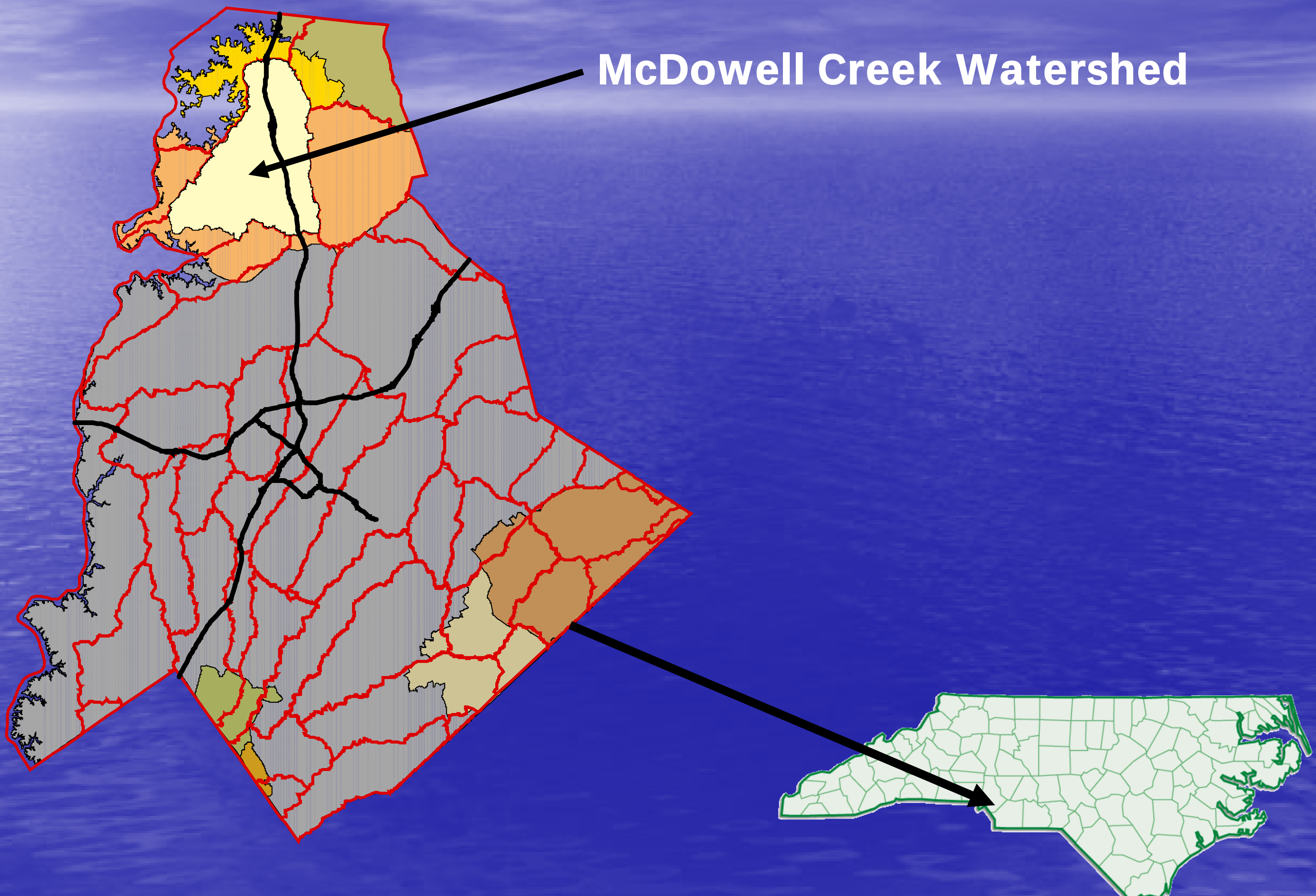
McDowell Creek Watershed



11-115-(1)
11-115-2-(1)
11-115-(1.5)a
MC4
11-115-4
11-115-(1.5)b
11-115-(5)

History

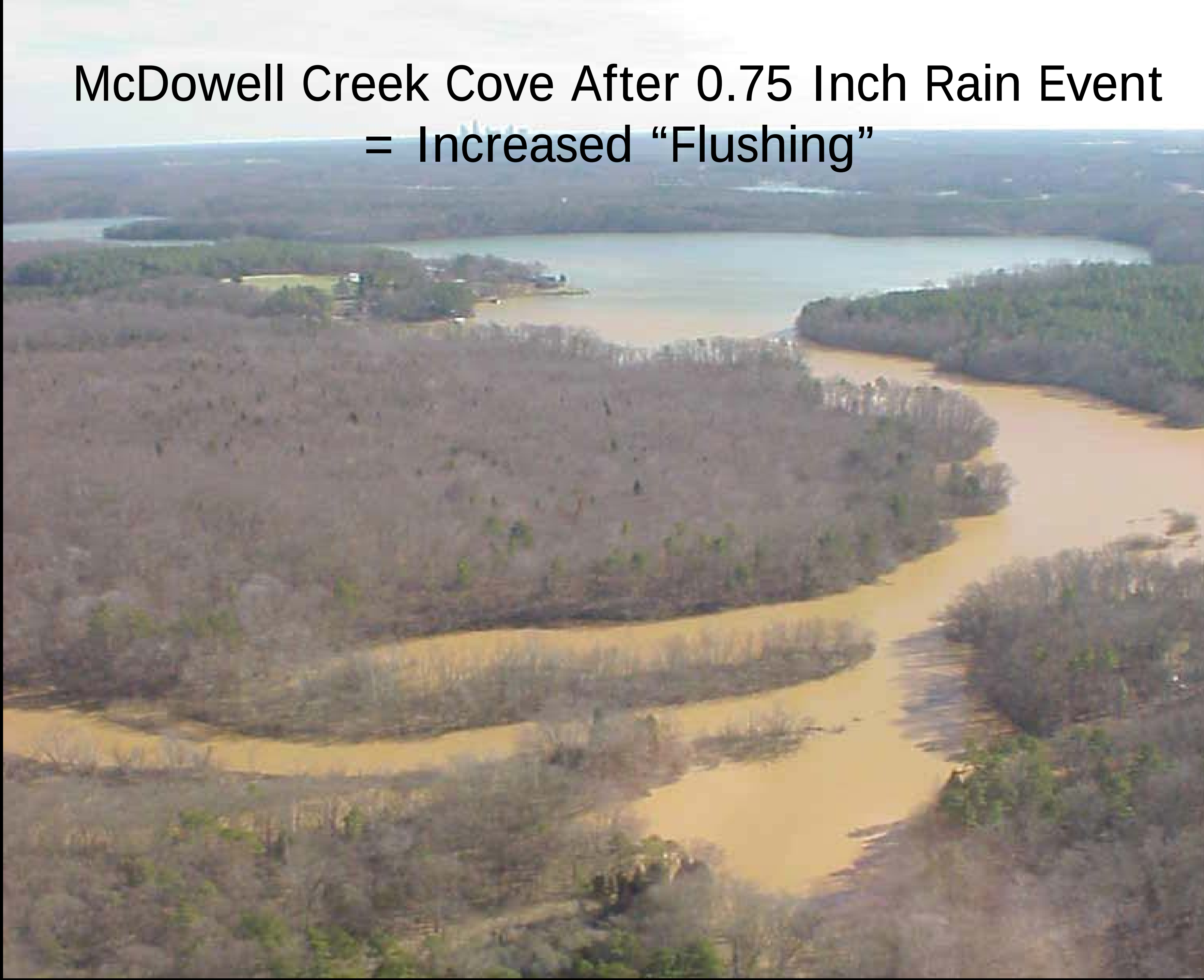
- Historically, watershed was agricultural
- Government “linearization” of streams in early 1900’s
  - Malaria Control
  - More land for agriculture
- Strong development pressure in the past 20 years
- Designated as water supply watershed in the 1980s

Historic Stream 'Work'

History Cont'd

- In 1999 SWIM buffers extended to all creeks in McDowell
- In 2003 Huntersville Adopted a Low Impact Design Ordinance
  - Zoning ordinance requiring open space also very beneficial
- In 2006 McDowell Creek Watershed Plan and CIP Plan were Completed
- In 2007 Implementation of the Plans underway
- In 2008 McDowell recategorized from Cat 5 for macroinvertebrate impairment to Cat 4b

McDowell Creek Cove After 0.75 Inch Rain Event = Increased “Flushing”



What did we know about McDowell before we started?

- McDowell Enters Mountain Island just upstream of Drinking Water Intake
  - Very ‘muddy’ water entering cove
- 303(d) listed for fish and macroinvertebrate impairment
  - Turned out be a factor on future NPDES Ph II permits
  - We believe habitat loss is the primary stressor
    - Sediment
      - Stream Bank Erosion
      - Upland runoff
    - Increased Flow volume and velocity

What did we know about McDowell before we started?

- Water Chemistry
  - Relatively low nutrient levels (at least upstream of WWTP)
    - CMU committed to capping nutrient (TP) levels from WWTP
  - Relatively low bacteria levels
  - High turbidity/TSS/SSC levels during runoff events

Assessment

- In-stream Assessment
  - Rosgen methodology of stream classification
- Stream Corridor
  - Analysis of the composition of the near stream environment
- Upland Assessment
  - Amount of pollution coming of existing developed areas
    - TP, TN, TSS and impervious area were used
- TSS used as our indicator/surrogate
  - 0.3 tons/acre/year in-stream
  - 0.22 tons/acre/year up-land

In Stream Assessment….

- Field Work to identify the following:
  - Stream Classification (Rosgen)
  - Bank Erosion (BEHI, NBS & Erosion Rate)
  - Channel Evolution (Simon)
  - Channel Evaluation (habitat, vegetation, human impacts and incision)
- Accumulative Score (from 0-20 assigned)

The Good...

The Bad

The Ugly (aka "Silt Happens")

Stream Corridor (Floodplain)

- Utilized remotely sensed American Forest's Tree Canopy data set
- Intersected data set with FEMA floodplain and local buffers
- Un-forested buffers were identified for re-forestation
  - Public parcels (such as parks) are the low hanging fruit

Upland Assessment

- Watershed was partitioned into catchments
- Catchments were partitioned into individual land-uses
- Pollutant loading rates were assigned by land-use and totaled over the catchment
  - These rates were established from the results of earlier HSPF model…so essentially we built a model using the results of a model
    - I don't even want to think about the level of error
    - Results were only used to identify areas relative to one another – not used in absolute sense

Load Rates Utilized for Upland Assessment

Table 12: Upland Pollutant Loading Rates by Land-Use.

LAND-USE	TN (lbs/ac/year)	TP (lbs/ac/year)	TSS (tons/ac/year)
AG	5.06	0.32	0.33
COMM-H	19.44	2.85	0.76
COMM-L	12.44	1.88	0.69
FRST	2.5	0.4	0.15
GC	5.17	0.83	0.47
HDR	8.73	1.4	0.47
HMFR	11.67	1.83	0.34
HMX	16.82	2.49	0.71
IND	16.12	2.39	0.71
INS	8.63	1.39	0.48
INTERSTATE	7.81	1.25	0.4
LDR	4.1	0.66	0.28
MDR	7.61	1.24	0.52
MEADOW	2.39	0.38	0.13
MFR	10.65	1.68	0.39

Overall Results

Resulted in Focus Areas

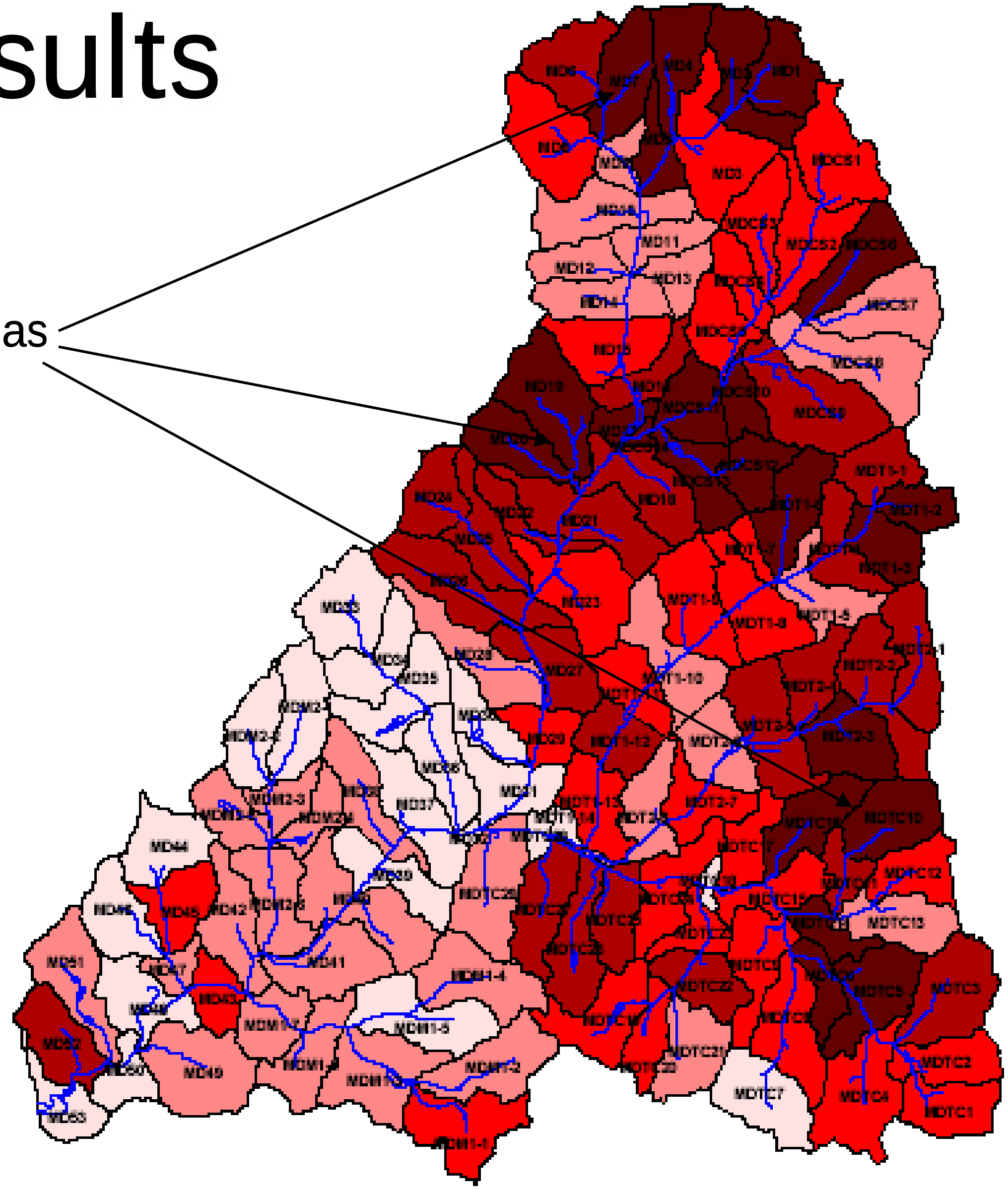
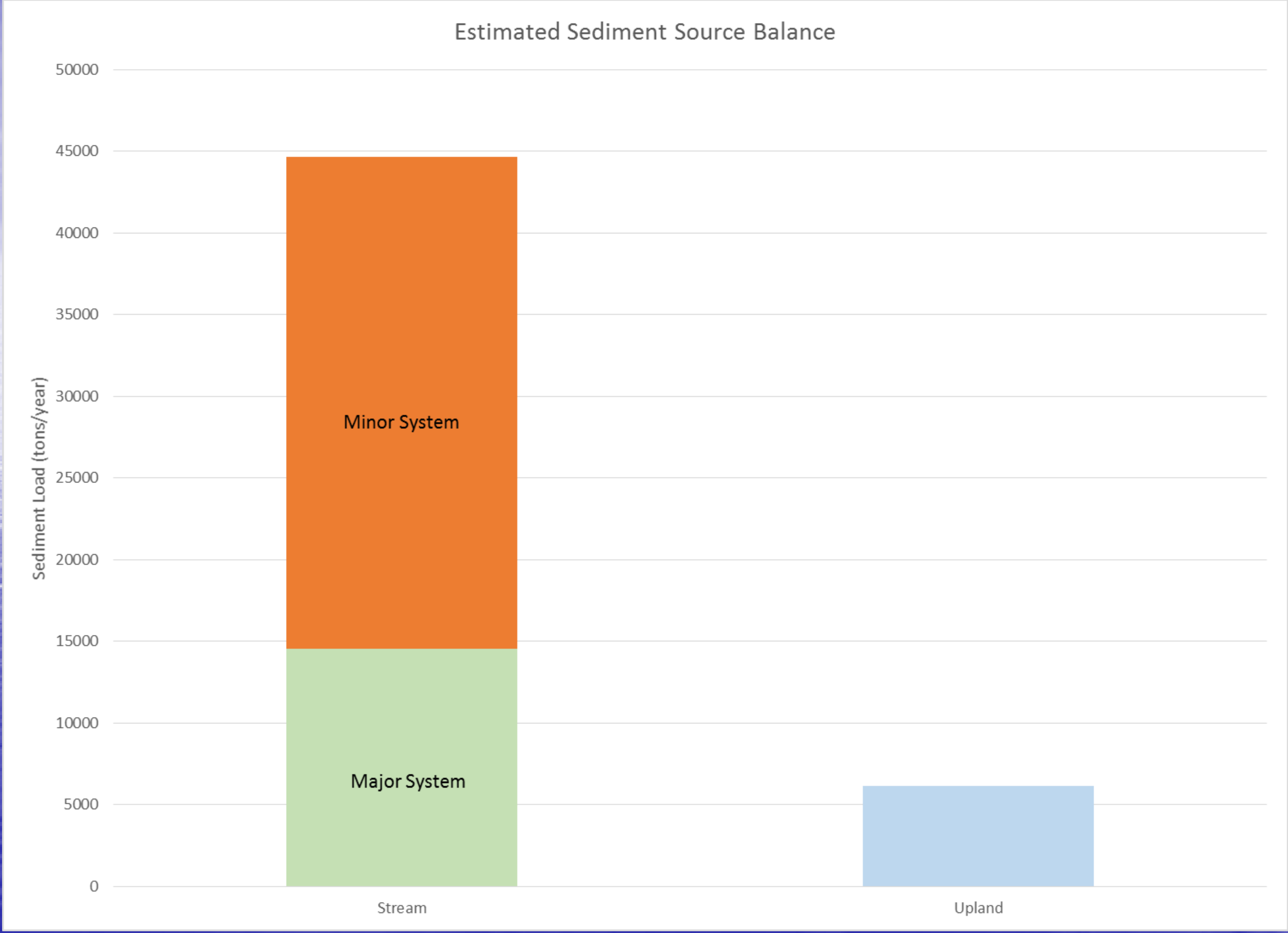


Figure 25: Overall Impairment (based upon upland pollutant load).

Source Identification from Assessment

System	Total Length (miles)	Estimated Annual Sediment Load (tons)	Percent Breakdown
Major Stream System	30.4	14568.7	29%
Minor Stream System	93.0	30060.0	59%
Upland	NA	6162.61	12%
Total		50791.3	100%


Estimated Sediment Source Balance
Sediment Load (tons/year)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Minor System
Major System
Stream
Upland

Implementation

- Obviously, we have a fixed budget and need the most bang for our buck
- Cost analysis was assembled and normalized to reflect cost on a per pound removed basis

Cost Analysis

- Cost of stream restoration and BMPs

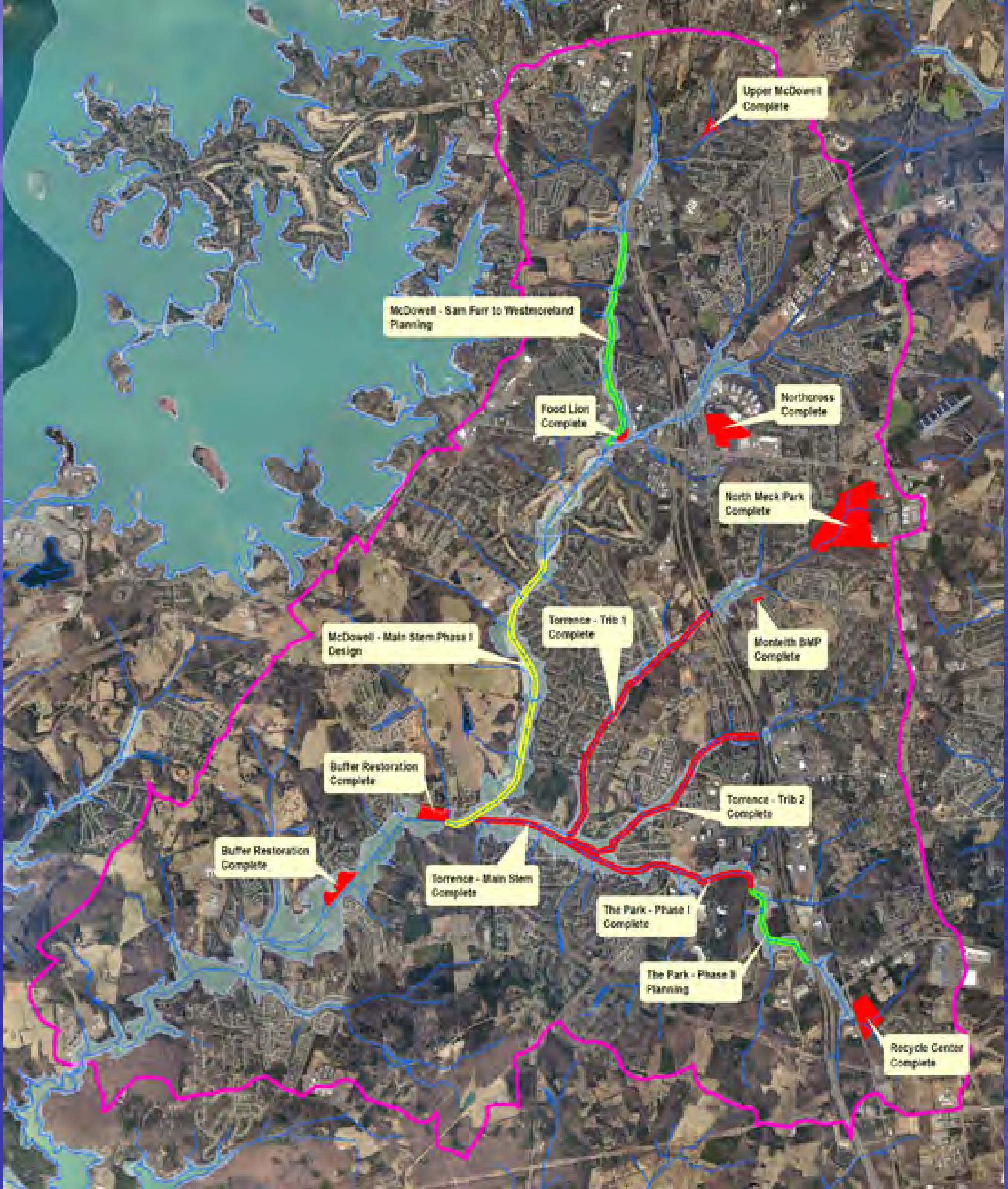
System	Assessed Length (feet)	Assessed Sediment Load (tons)	Assessed Sediment Load (tons/LF)	Cost of Stream Restoration/LF	Cost per pound of sediment removed
Major	62811.6	5704.8	0.0908	$300	$1.65
Minor	93083.5	8458.0	0.0909	$300	$1.65

BMP Type	Cost/ac Treated	TSS Removal Efficency	Average $/lb TSS removed
Sand Filter	$20,000	85%	$24.43
Wet Pond	$22,000	65%	$35.15
Wetland	$31,500	65%	$50.33
Rain Garden	$16,000	85%	$19.55
Extended Detention	$31,500	47%	$69.60
WQ Swale	$3,000	80%	$3.89
Filter Strip	$3,000	50%	$6.23
Pond Retrofit	$6,700	35%	$19.88

Example Stream Restoration Project List

RANK (NEED & FEASIBILITY)	REACH	RECOMMENDATION	FEASIBILITY	ASSESSED LENGTH (ft)	RANK (NEED)	BASIN	Sediment Load Removed (tons/year)	Approximate Cost
1	I3a	Restoration	Minimal	1,200	1	I	115.3	$360,000
2	M1	Restoration / Fence out cattle	Minimal	1,430	10	M	153	$429,000
3	N13d	Restoration	Minimal	654	13	N	32	$196,200
4	I11a	Restoration	Minimal	844	14	I	62.1	$253,200
5	M8b	Restoration / Fence out cattle	Minimal	1,006	16	M	162.8	$301,800
6	B18a_B19a	Enhancement II	Minimal	603	18	B	48.6	$30,150
7	E15a	Restoration	Minimal	2,655	30	E	110.48	$796,500
8	P15b	Restoration	Minimal	707	31	P	707.6	$212,100
9	B21a	Enhancement II	Minimal	1,020	35	B	92	$51,000
10	B11a	Restoration	Minimal	680	37	B	64.3	$204,000
11	P17a	Restoration	Minimal	1,196	38	P	83.11	$358,800
12	M9	Enhancement II	Minimal	2,029	41	M	142.7	$101,450
13	N13b	Restoration	Minimal	577	46	N	10.1	$173,100
14	A8a	Enhancement II	Minimal	820	48	A	14.46	$41,000
15	U10	Restoration	Minimal	1,196	51	U	72.4	$358,800
16	M6	Restoration / Fence out cattle	Moderate	1,617	5	M	117.3	$485,100
17	A5b	Enhancement II	Minimal	844	52	A	46.42	$42,200
18	B9b_B10a	Enhancement II	Minimal	1,034	55	B	95.3	$51,700
19	A13b_A16a	Bank Stabilization	Minimal	348	56	A	21.22	

Projects in McDowell, Torrence, Trib1, Trib2, & McDowell

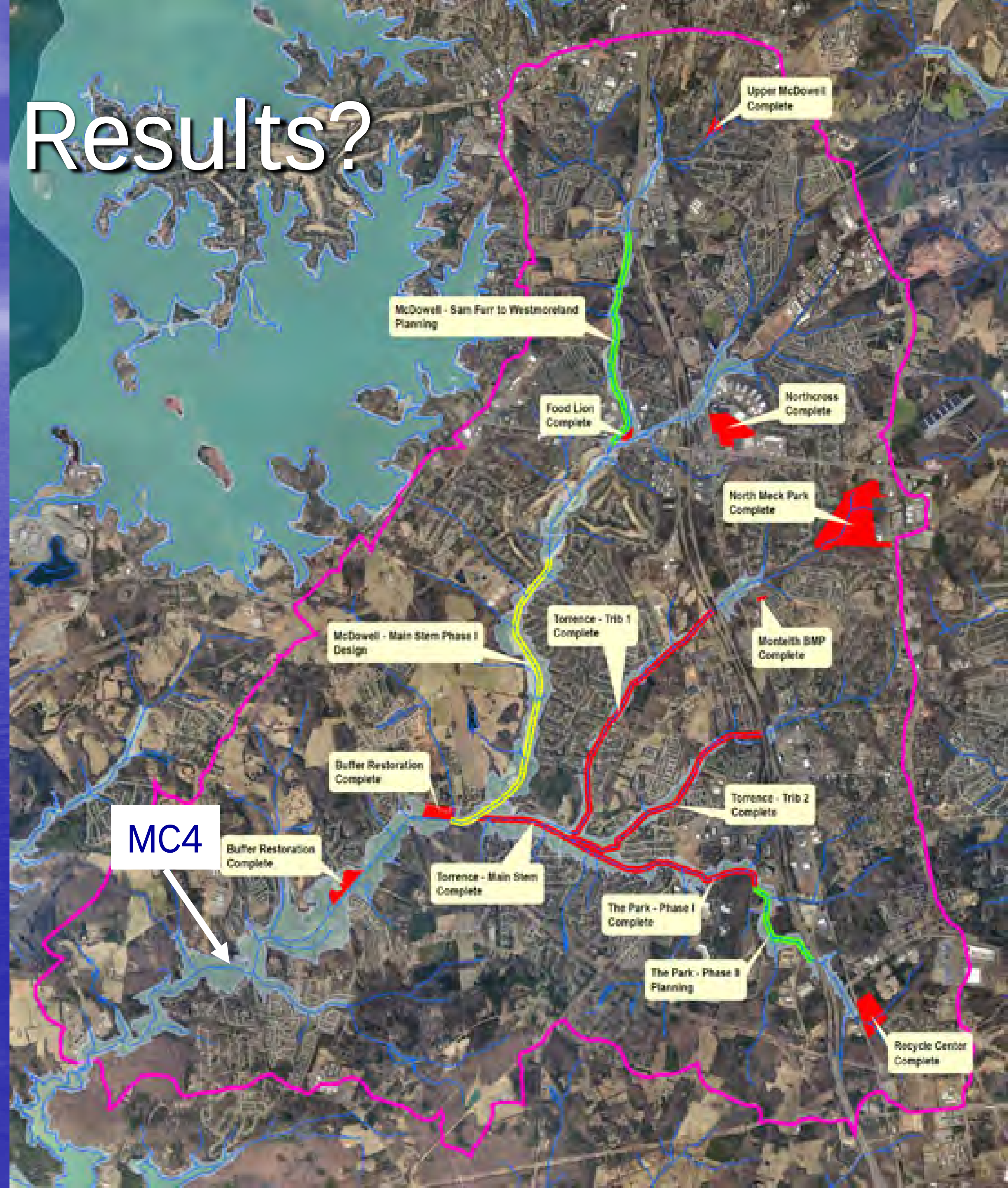


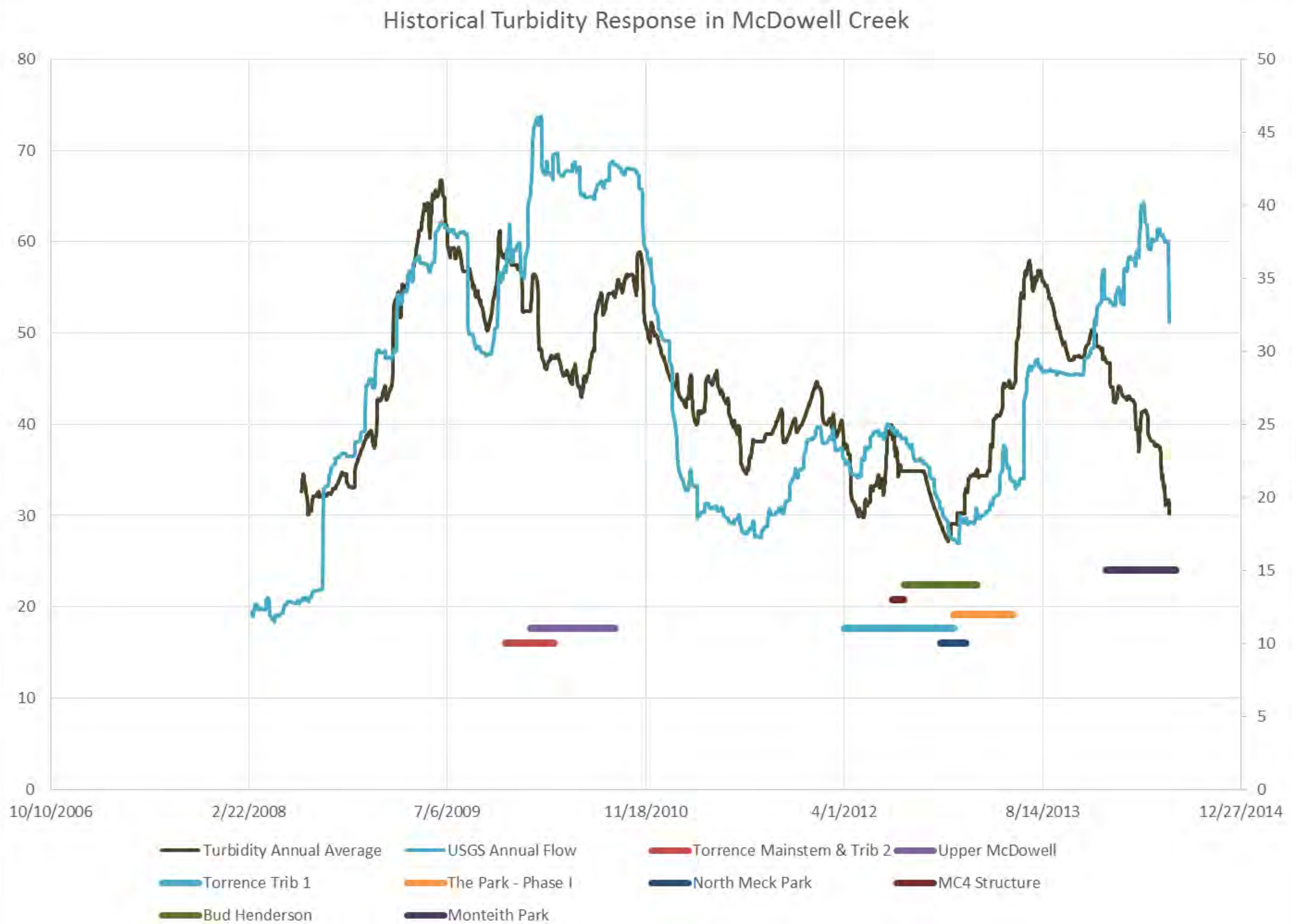
Estimated Load Reduction

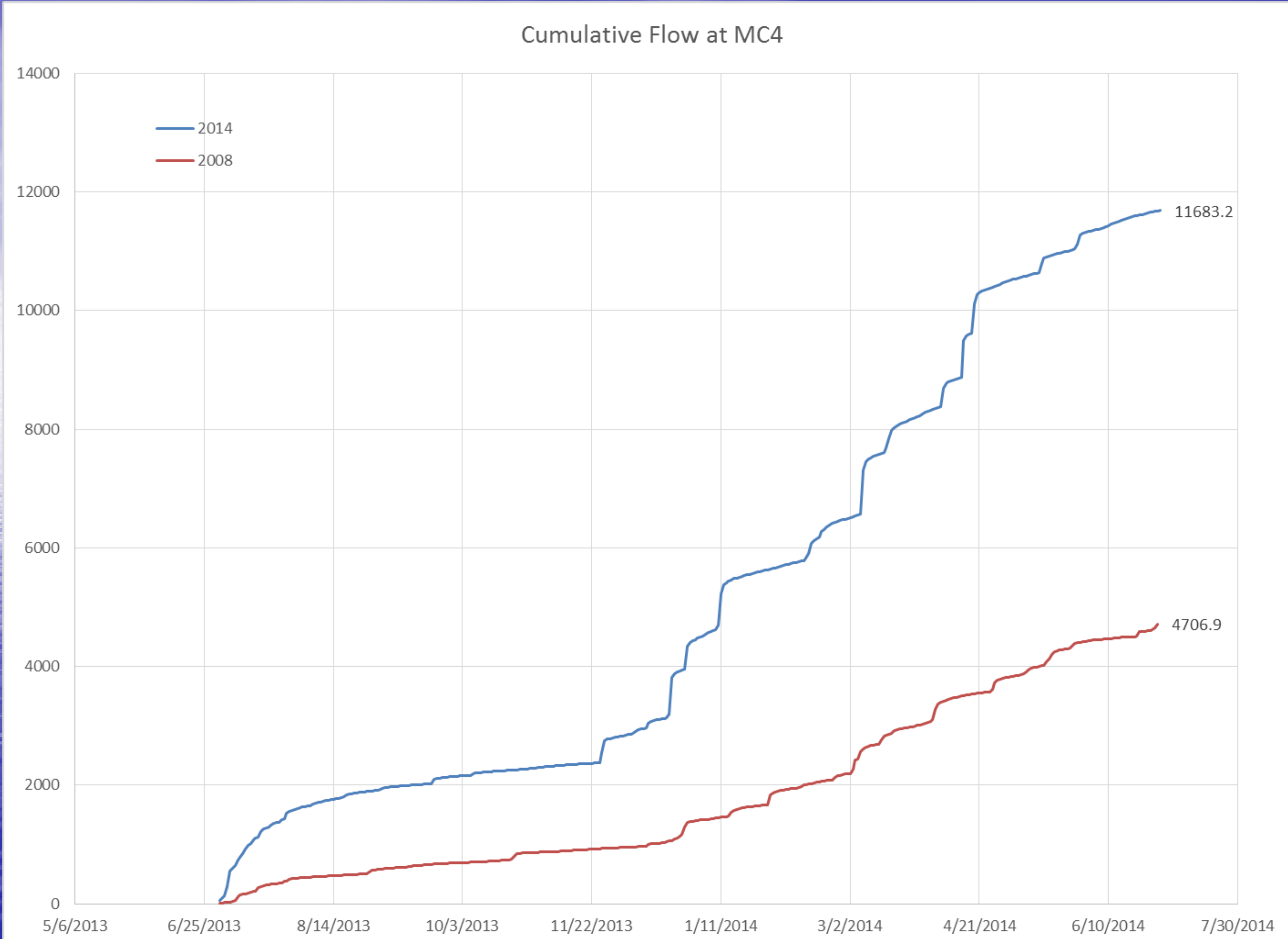
- We estimate that a total sediment load reduction of 45,000 tons/year will be needed to achieve fully supporting
- More than 4100 tons/year have been removed/stabilized (estimated by geomorphic analysis)
- Represents almost 10% of the estimated total reduction needed

Measureable Results?

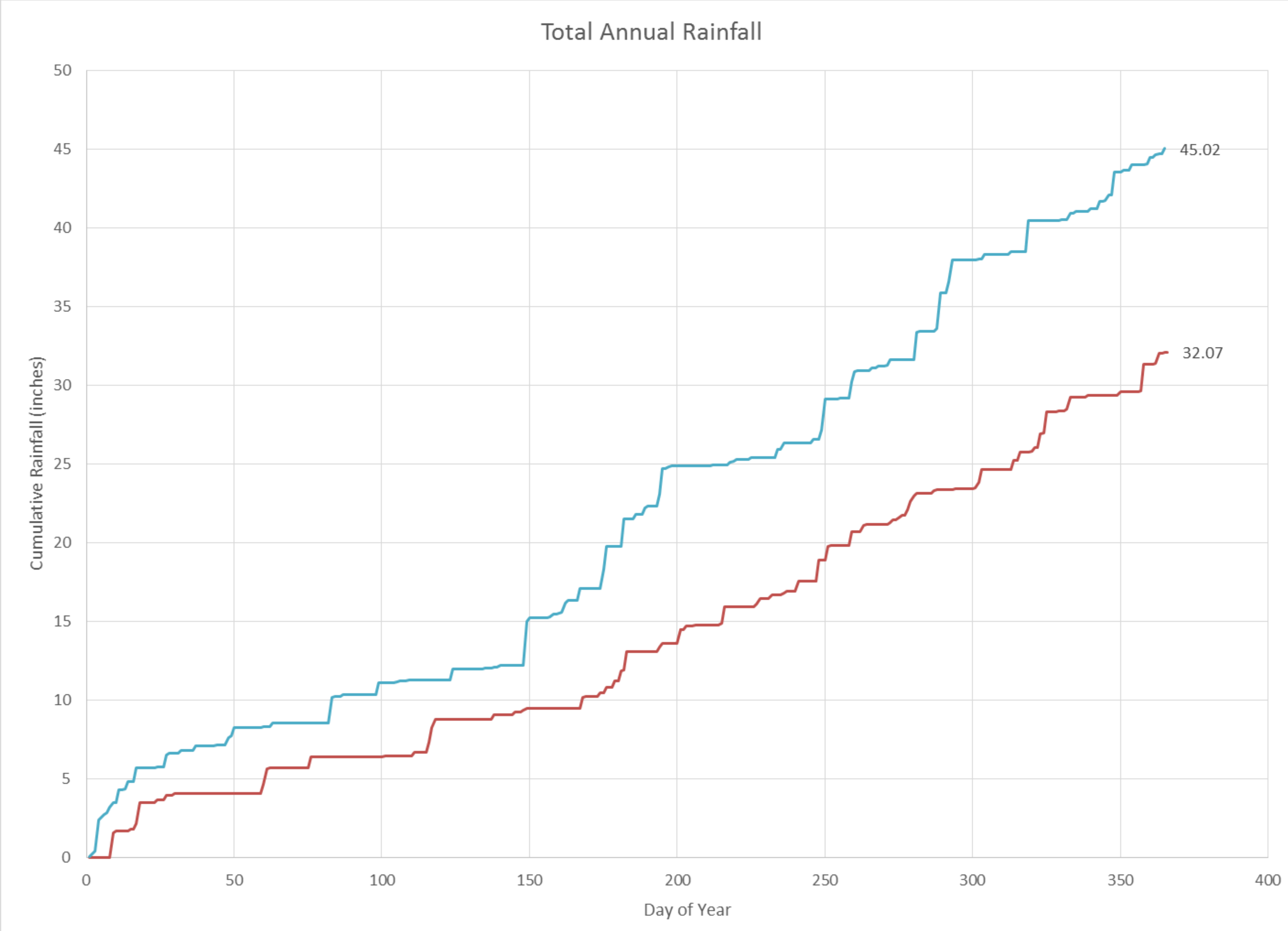
Flow and Turbidity at MC4

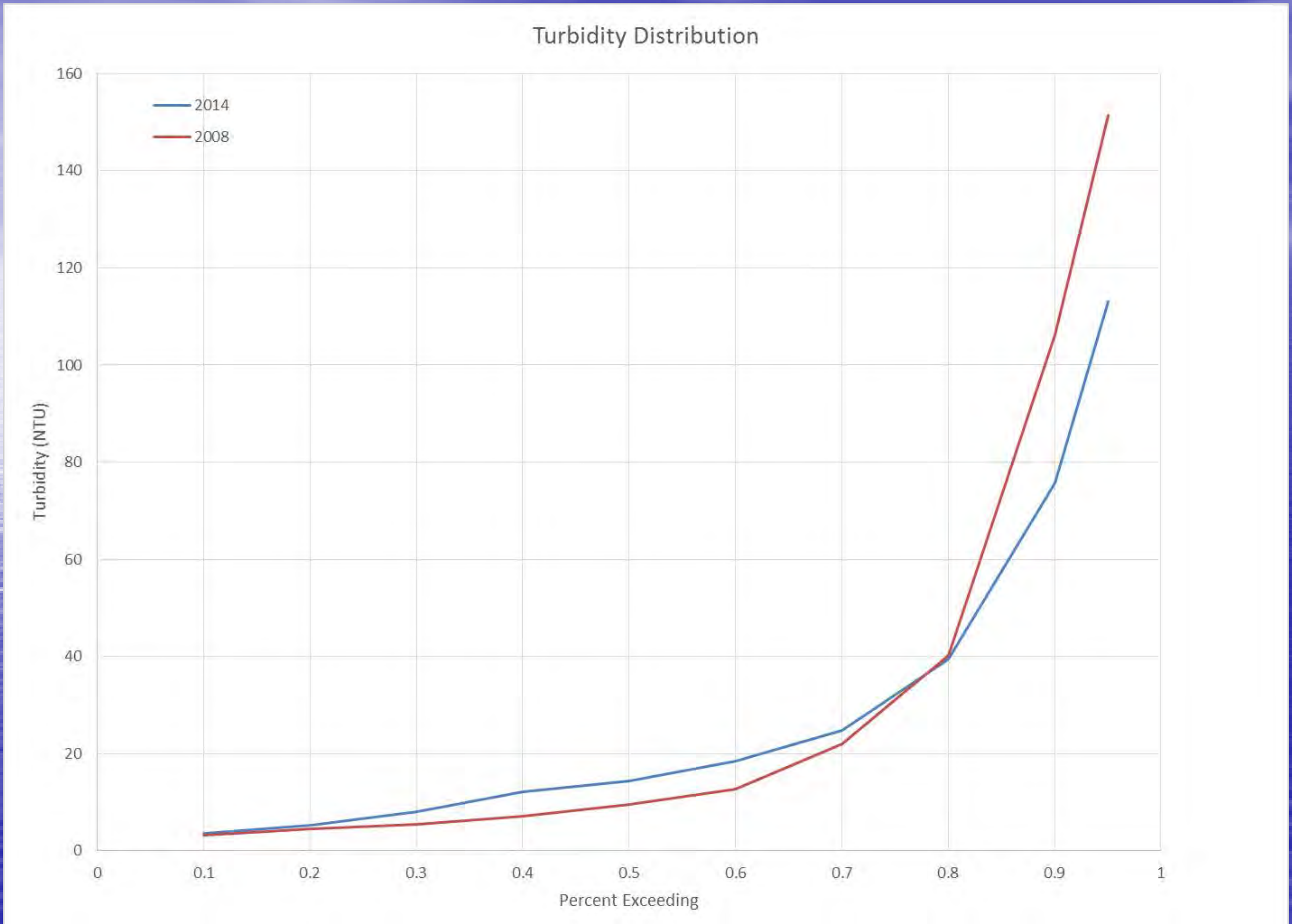



Historical Turbidity Response in McDowell Creek
80
70
60
50
40
30
20
10
0
50
45
40
35
30
25
20
15
10
5
0
10/10/2006
2/22/2008
7/6/2009
11/18/2010
4/1/2012
8/14/2013
12/27/2014
Turbidity Annual Average
USGS Annual Flow
Torrence Mainstem & Trib 2
Upper McDowell
Torrence Trib 1
The Park - Phase I
North Meck Park
MC4 Structure
Bud Henderson
Monteith Park

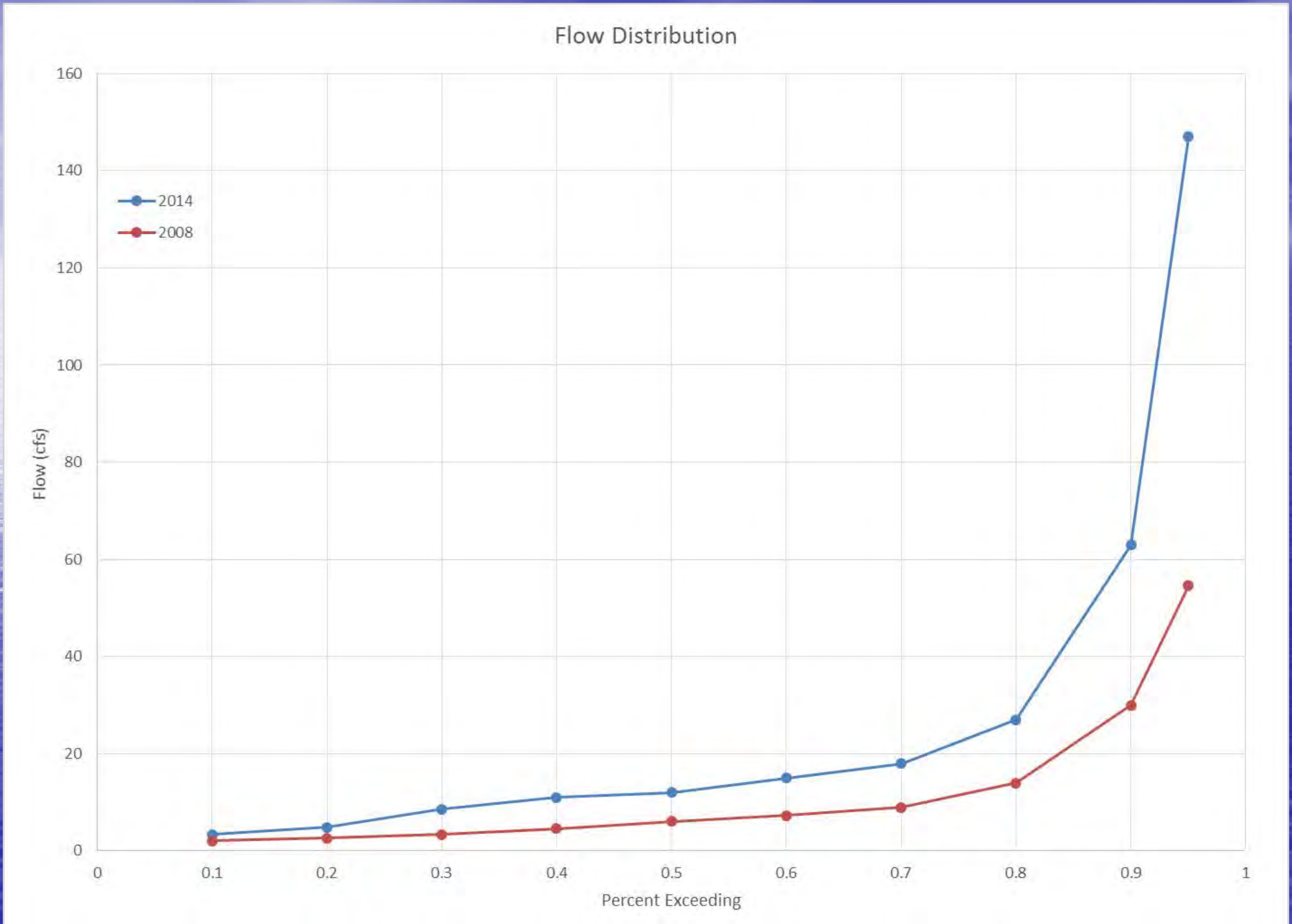


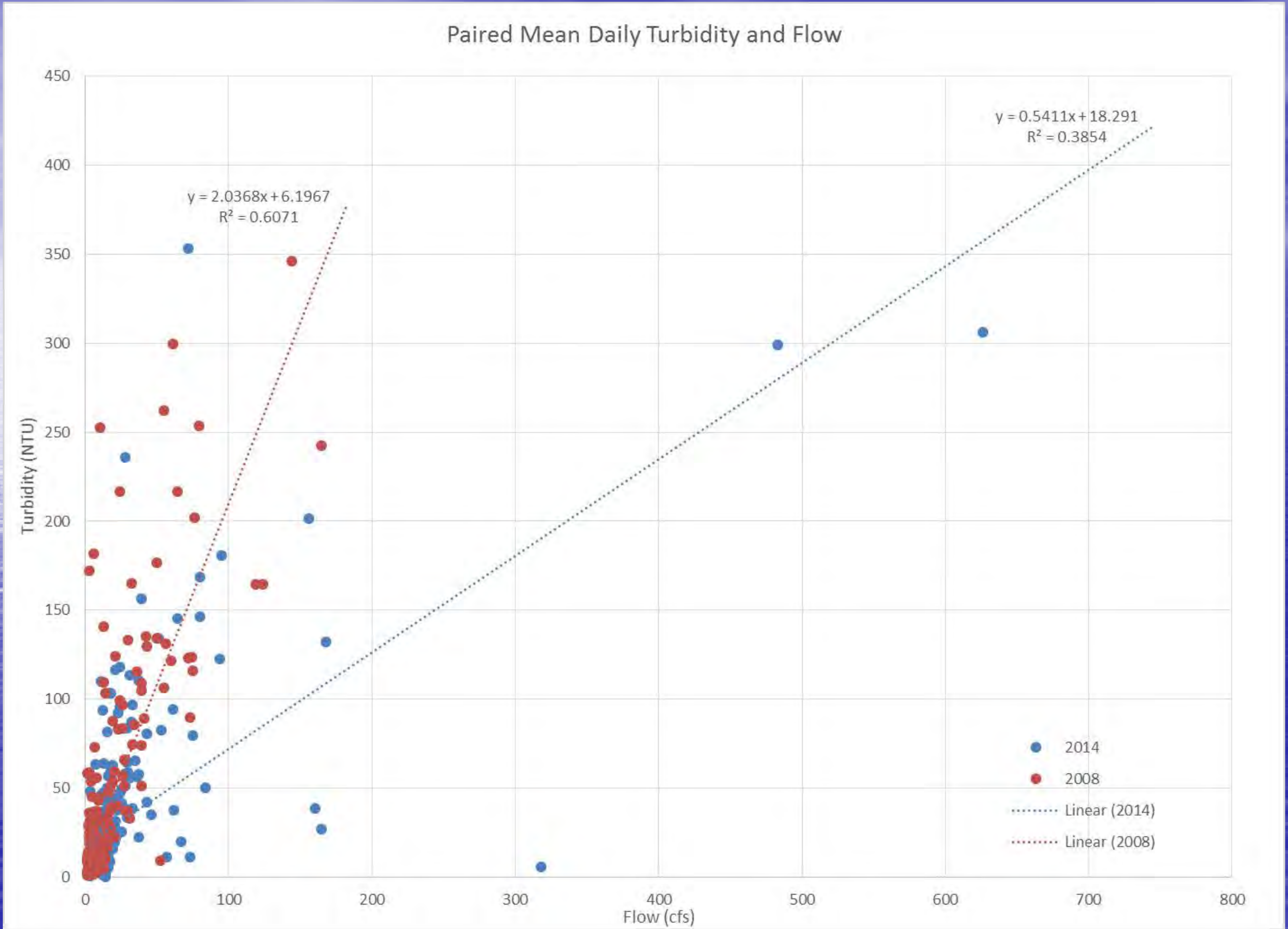
Cumulative Flow at MC4
2014
2008
11683.2
4706.9
14000
12000
10000
8000
6000
4000
2000
0
5/6/2013
6/25/2013
8/14/2013
10/3/2013
11/22/2013
1/11/2014
3/2/2014
4/21/2014
6/10/2014
7/30/2014

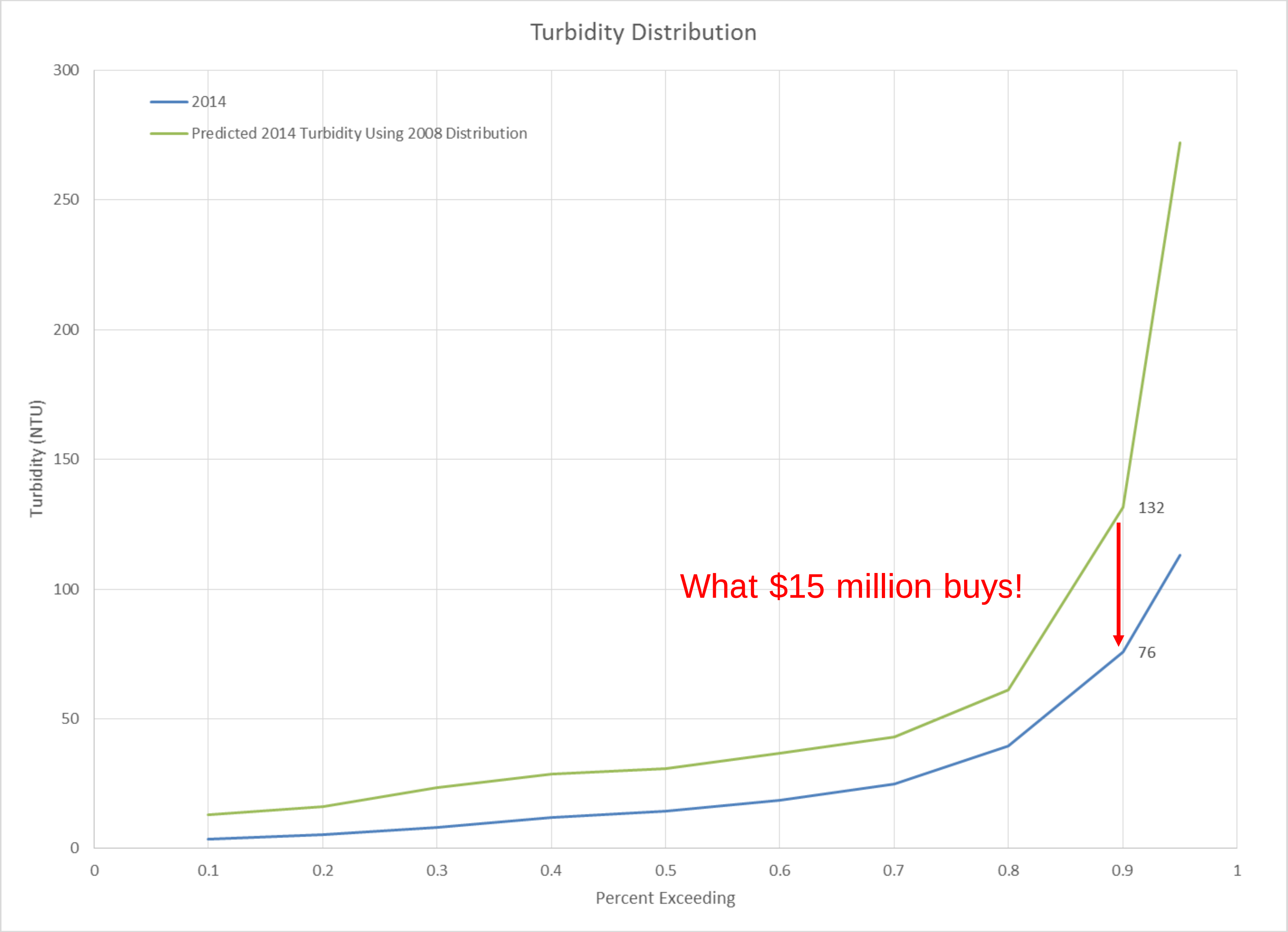

Total Annual Rainfall
Cumulative Rainfall (inches)
Day of Year
50
45
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
45.02
32.07



Turbidity Distribution
2014
2008
Turbidity (NTU)
0
20
40
60
80
100
120
140
160
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Percent Exceeding


Flow Distribution
2014
2008
Flow (cfs)
Percent Exceeding
0
20
40
60
80
100
120
140
160
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


Paired Mean Daily Turbidity and Flow
y = 0.5411x + 18.291
R² = 0.3854
y = 2.0368x + 6.1967
R² = 0.6071
Turbidity (NTU)
Flow (cfs)
0
50
100
150
200
250
300
350
400
450
0
100
200
300
400
500
600
700
800
2014
2008
Linear (2014)
Linear (2008)



Turbidity Distribution
2014
Predicted 2014 Turbidity Using 2008 Distribution
Turbidity (NTU)
300
250
200
150
100
50
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
Percent Exceeding
132
76
What $15 million buys!

Helpful Hints from Heloise

- In McDowell, property is everything
  - We build it but the property owners have to live with it
  - Understand the property dynamics (other utilities
  - Try to preserve open space when rezoning applications are submitted
  - Know the concerns
    - Flooding? Loss of property? Conservation?
    - What has happened in the past (other utilities)
      - Gas Line, I-77, Charlotte Water

Partner whenever you can

- Look for partnerships wherever you can
  - Charlotte Water
  - Park and Recreation
    - Sometimes stream work and greenways do not mix…
  - Private Bankers
  - Commercial land owners
    - They recognize the marketing value of clean water – sometimes they don't like to admit it
  - Conservation minded large landowners
  - Flood mitigation opportunities

Identify Cheerleaders Early

- Who are the people most interested in the project/watershed?
  - Who has the most to gain?
  - Use them as advocates – private parties in support of the project/program are much more convincing than staff
    - They can help bring others to the table – then it is up to you

Develop a Toolkit to 'Sell' your projects

- Know your market
- Document all projects
  - Even less favorable results can be highlighted to show ability to adapt and improve
- Toolkit should include many pre and post project images
- Movies are great!
- Game cameras work really well
  - Keep tabs on contractors as well

Only ask for what you need

- If you only need 50 feet – don’t ask for 100…
- If you want to work on a stream walk it with the landowner
- Identify your critical landowners and start there
- Don’t ask for a conservation easement if another vehicle will work


McDOWELL CREEK
WATERSHED