April 14, 2016

HOVMSD
2015 Annual Flow Summary

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Sustainability Plan Goal

- Maintain or extend the longevity of the WWTP and interceptor capacity by not increasing the existing level of clear water and decreasing clear water where possible

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Performance Indicator Sources

- HOVMSD plant observations
- Antecedent moisture model analysis
- Member community CMAR
- Community observations completed by HOV

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HOVMSD Plant Observations

HOVMSD Observations

YEAR	PLANT FLOW (million gallons)	ANNUAL REPORTED PRECIPITATION (inches)	NUMBER OF SECONDARY TREATMENT DIVERSIONS	VOLUME OF DIVERTED FLOW (million gallons/ year)
2010	2,391.172	32.25	3	14.258
2011	2,359.297	30.08	1	3.998
2012	1,844.606	17.89	0	0
2013	2,014.113	27.14	1	0.562
2014	2,079.438	29.34	2	3.549
2015	1,887,988	29.93	3	2.185

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Secondary Treatment Diversions

DATE	PLANT FLOW (million gallons)	VOLUME OF DIVERTED FLOW (million gallons/event)
July 14, 2010	30.824	12.304
July 15, 2010	21.535	1.954
August 11, 2010	19.408	2.360
April 26, 2011	27.177	3.998
April 10, 2013	22.526	0.562
April 14, 2014	21.435	1.718
May 28, 2014	21.958	1.831
June 15, 2015	15.934	0.800
September 8, 2015	15.346	0.027
December 14, 2015	30.390	1.358

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Storm Event Comparison

JULY 2010 AND DECEMBER 2015

LOCATION	JULY 14, 2010	JULY 15, 2010	JULY 2010 EVENT TOTAL	DECEMBER 13, 2015	DECEMBER 14, 2015	DECEMBER 2015 EVENT TOTAL
Plant Rainfall	2.39 in	0.66 in	3.05 in	1.41 in	1.31 in	2.72 in
Kimberly Rain	2.92 in	0.35 in	3.27 in	1.25 in	1.50 in	2.75 in
Kaukauna Rain	2.76 in	0.45 in	3.21 in	0.95 in	1.33 in	2.18 in
Little Chute Rain	3.28 in	0.34 in	3.62 in	1.00 in	1.68 in	2.68 in
Combined Locks and Darboy Rain	2.63 in	0.43 in	3.06 in	1.09 in	1.58 in	2.67 in
Total Plant Flow	30.824 mgd	21.535 mgd	52.359 mgd	15.603 mgd	30.390 mgd	45.993 mgd
Secondary Treatment Diversion	12.304 mgd	1.954 mgd	14.258 mgd	0 mgd	1.358 mgd	1.358 mgd

AMM Analysis

Antecedent Moisture Model

- Modeled results versus measured flow
  - Modeled result is predicted based on calibrated model
  - Measured result is based on meter station data
  - Diagonal, heavy solid line

    Modeled = Measured

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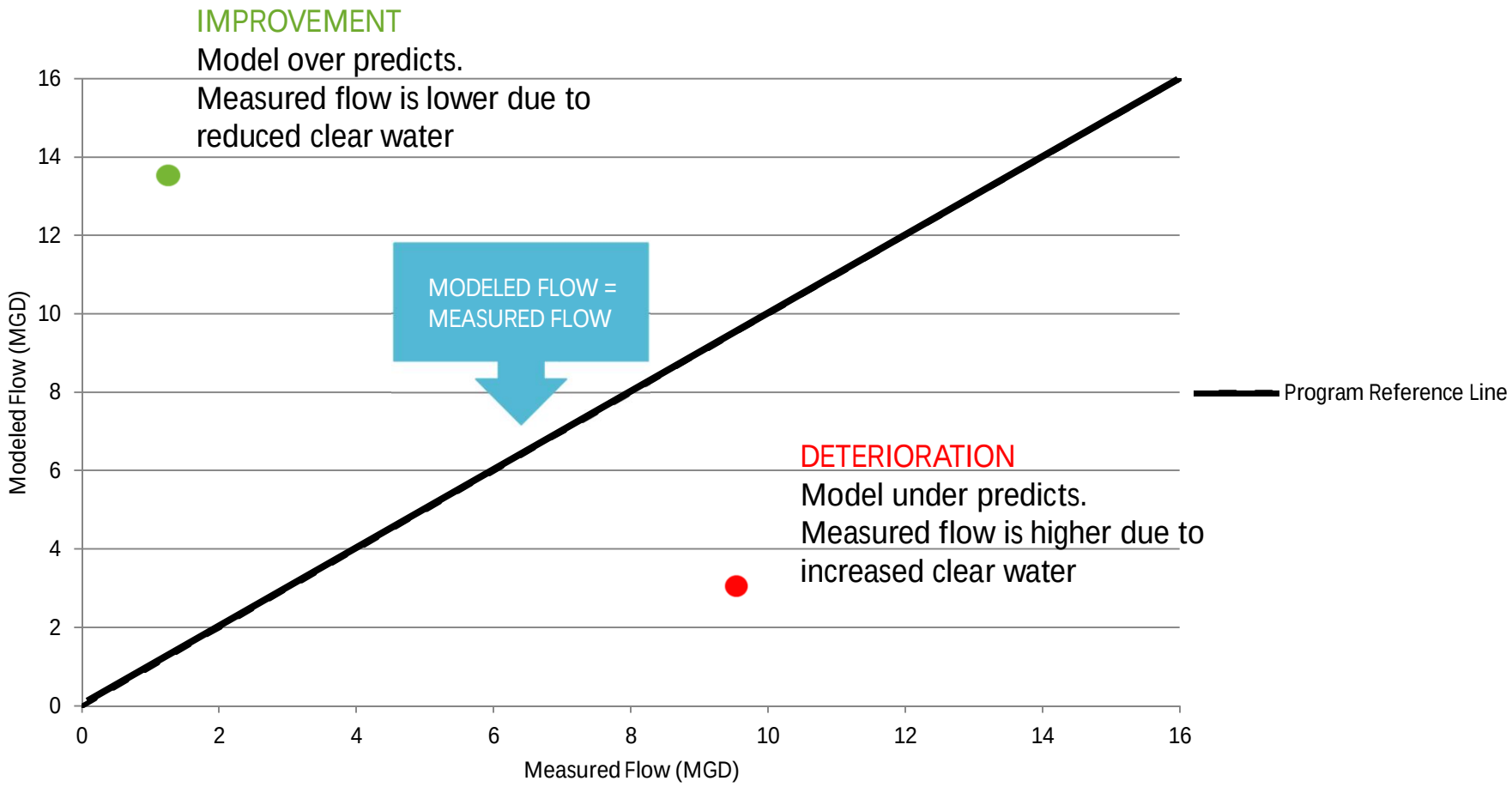
Modeled vs. Measured Flow



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Trend Line

- Annual trend line summarizes all the storms analyzed in a calendar year
- Ideally trend lines would always be increasing over the baseline

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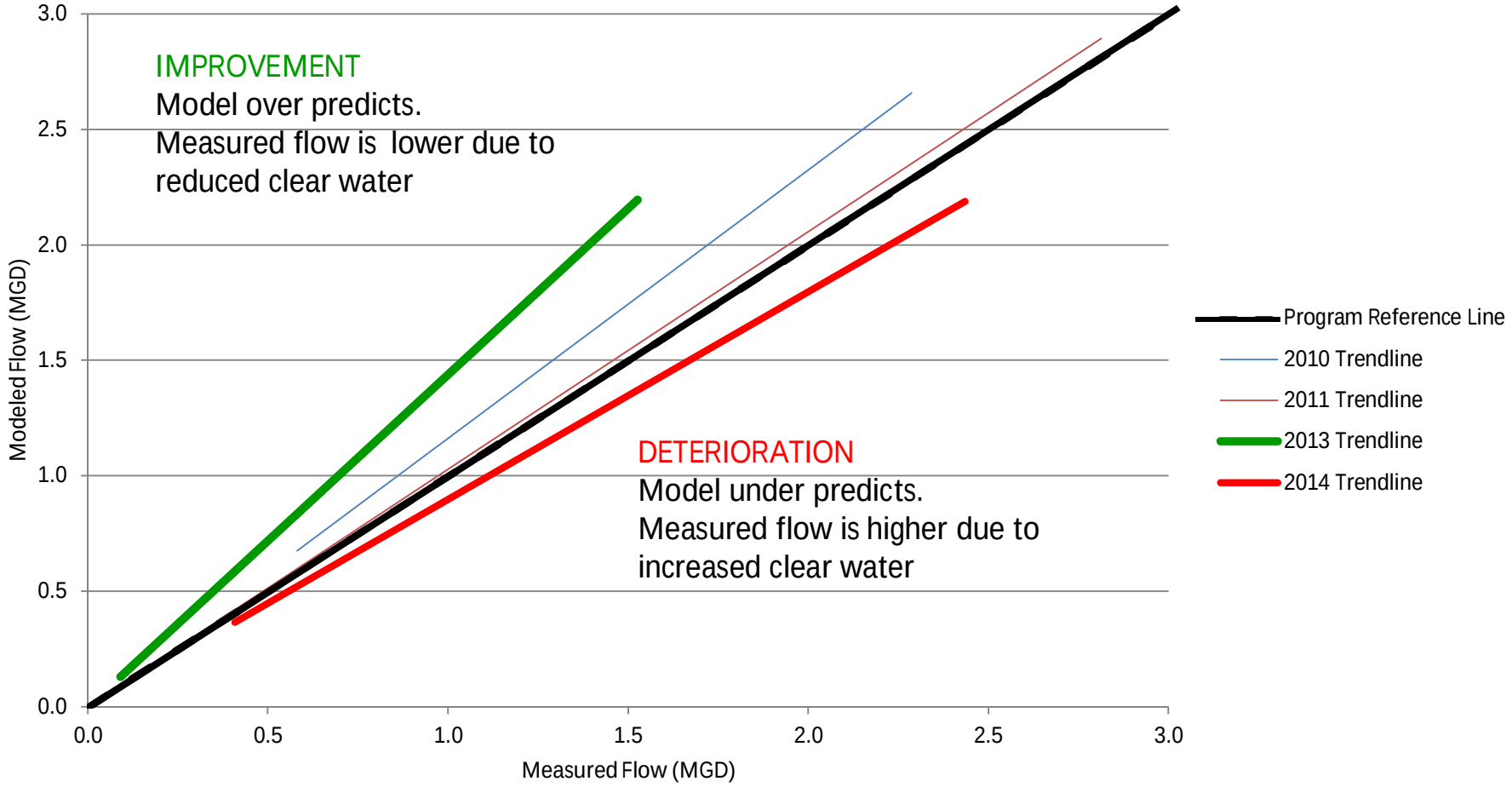
Trend Lines



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AMM Summary

- Kimberly
  - Annual peak shows substantial improvement
  - 3-year rolling average is showing continued improvement but is generally consistent

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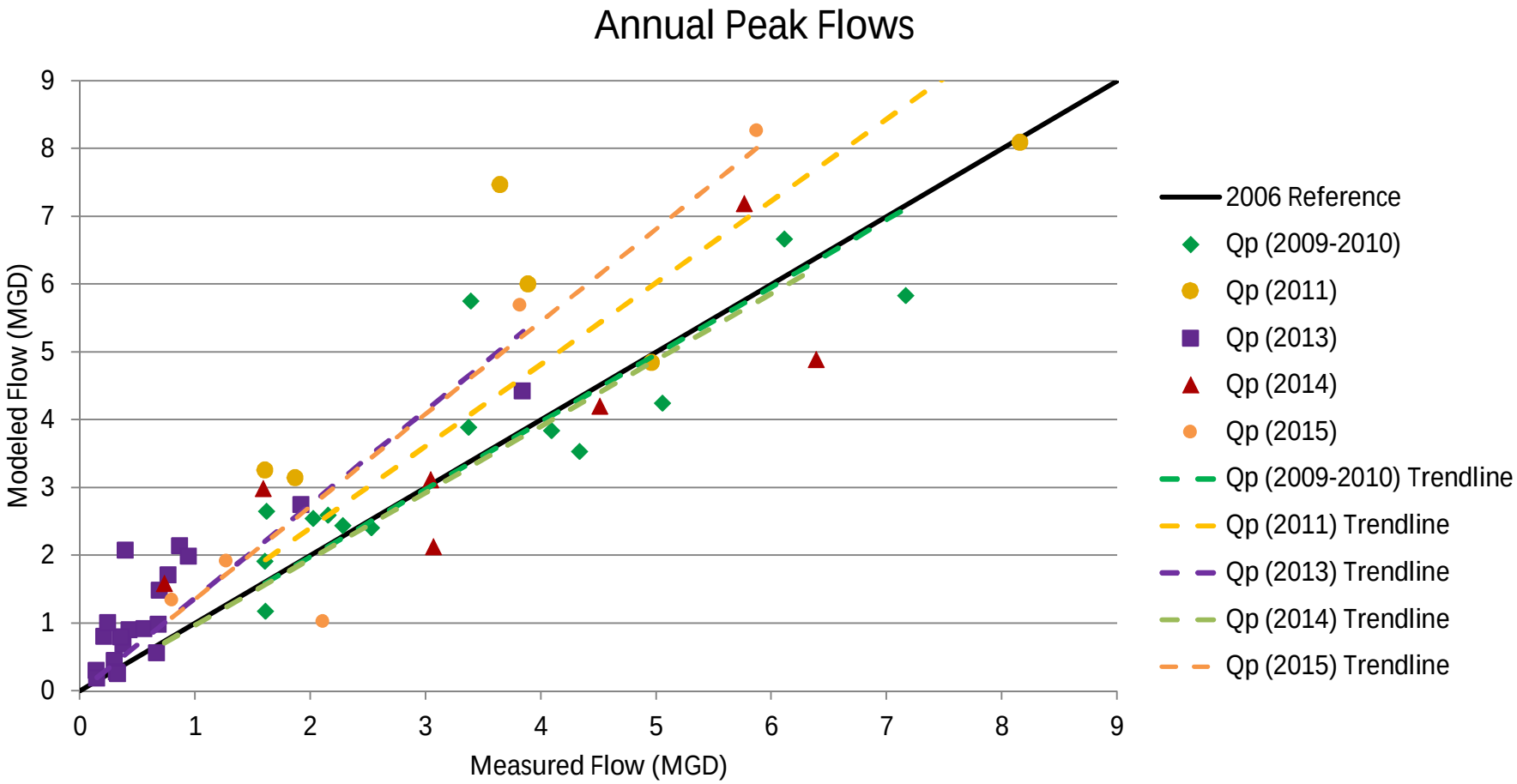
Kimberly



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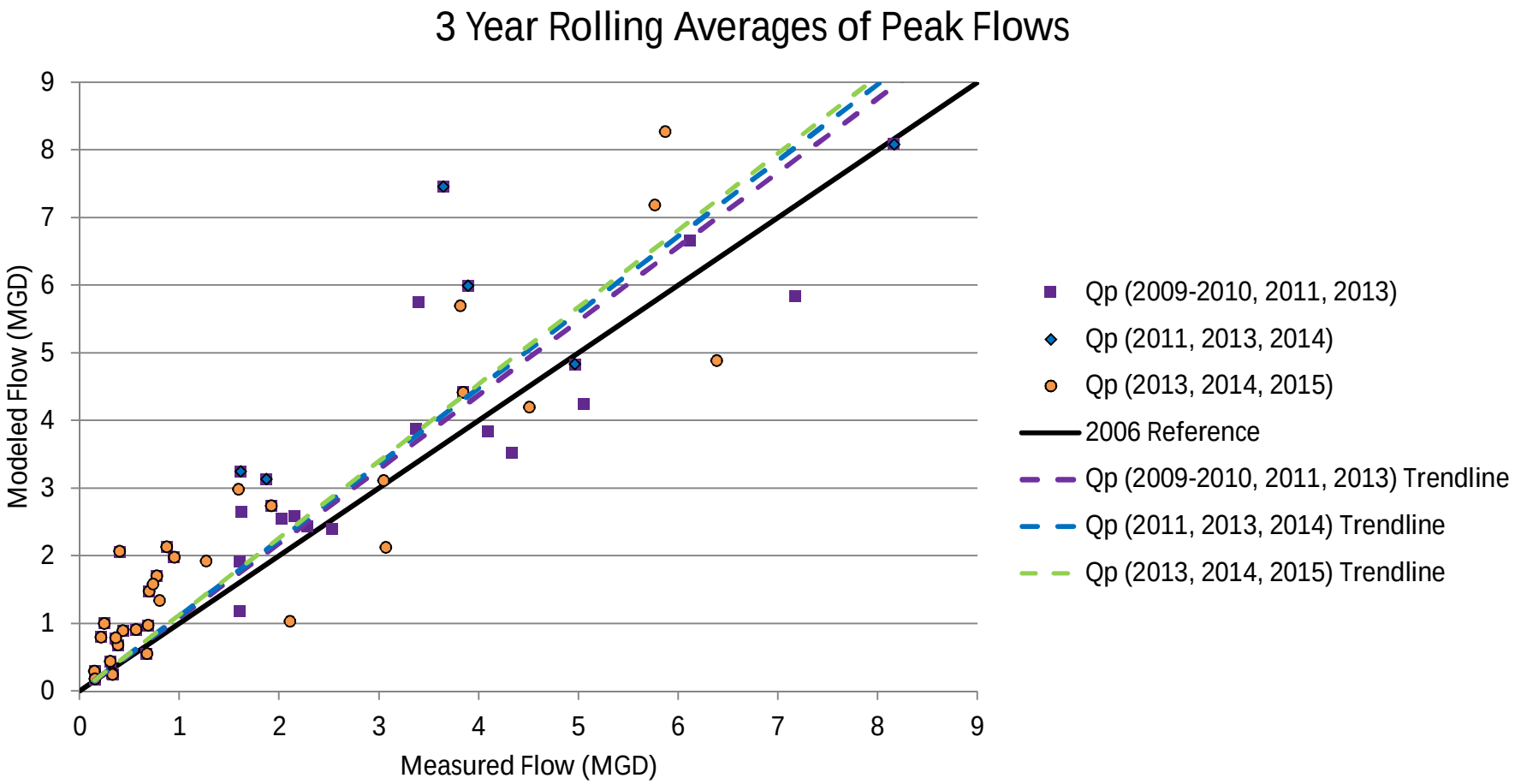
Kimberly



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AMM Summary

- Darboy
  - Annual peak flows are similar to last year
  - 3-year rolling average shows substantial improvement

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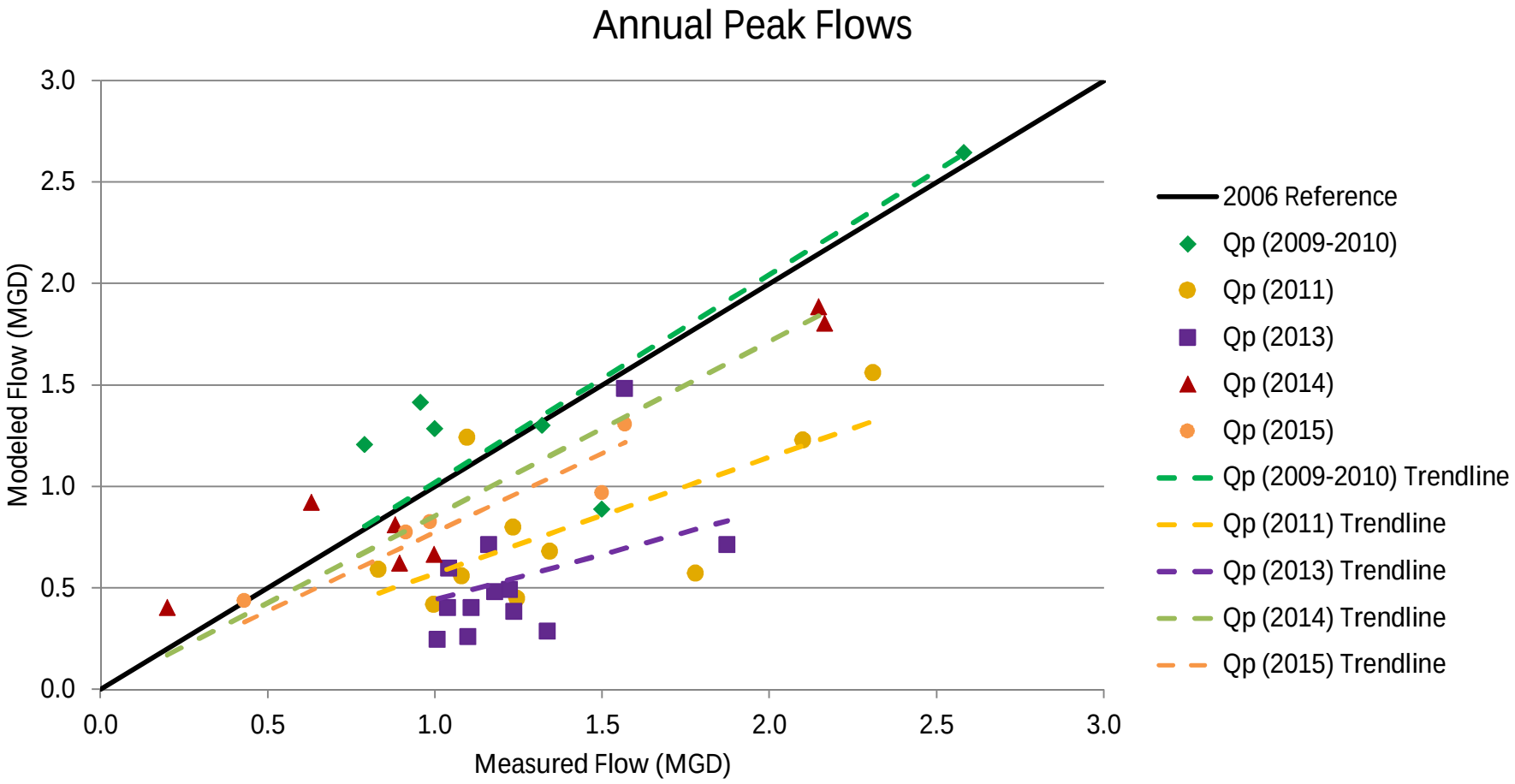
Darboy



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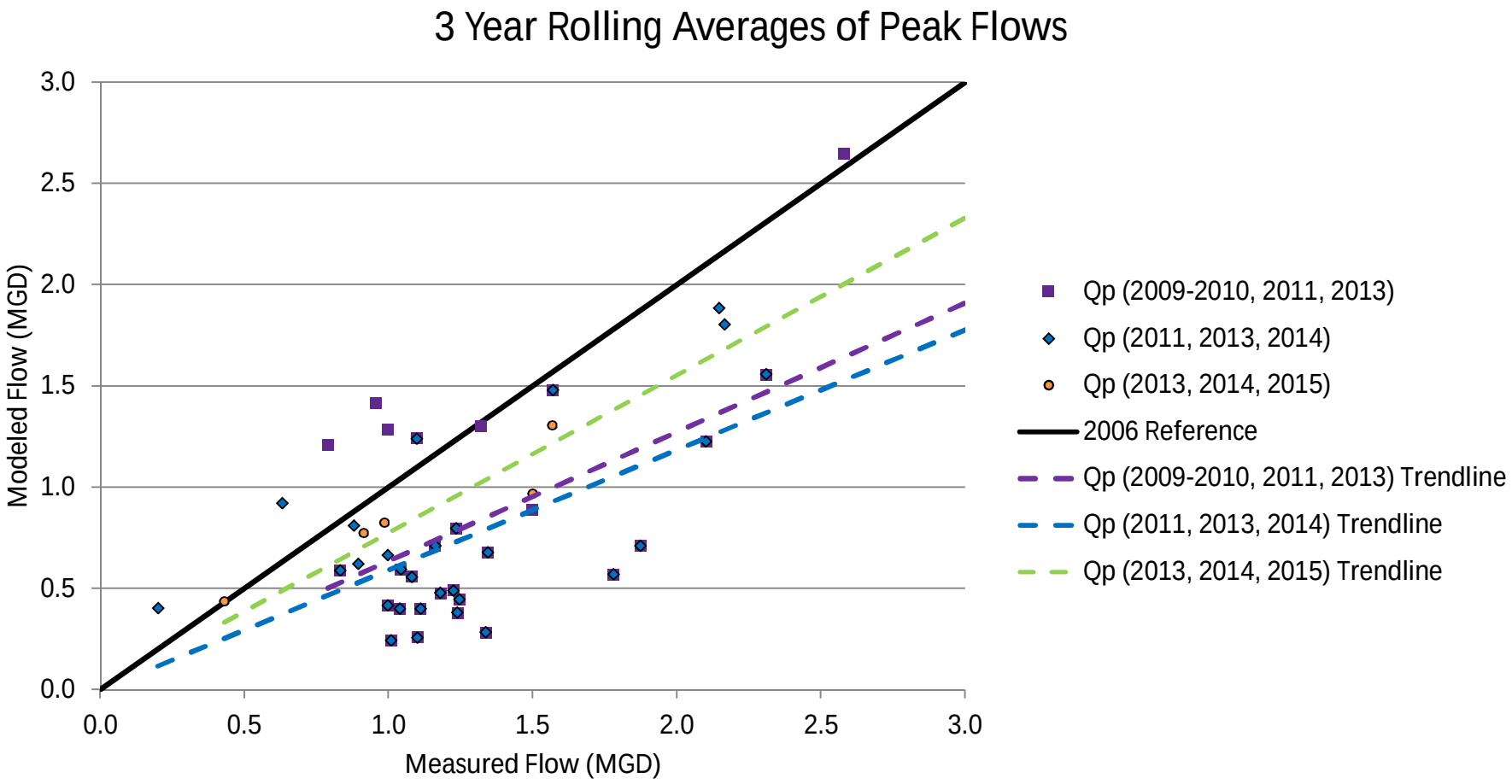
Darboy



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AMM Summary

- Little Chute
  - Annual peak flows are nearly identical to last year
  - 3-year average peak flow deteriorated slightly from last year

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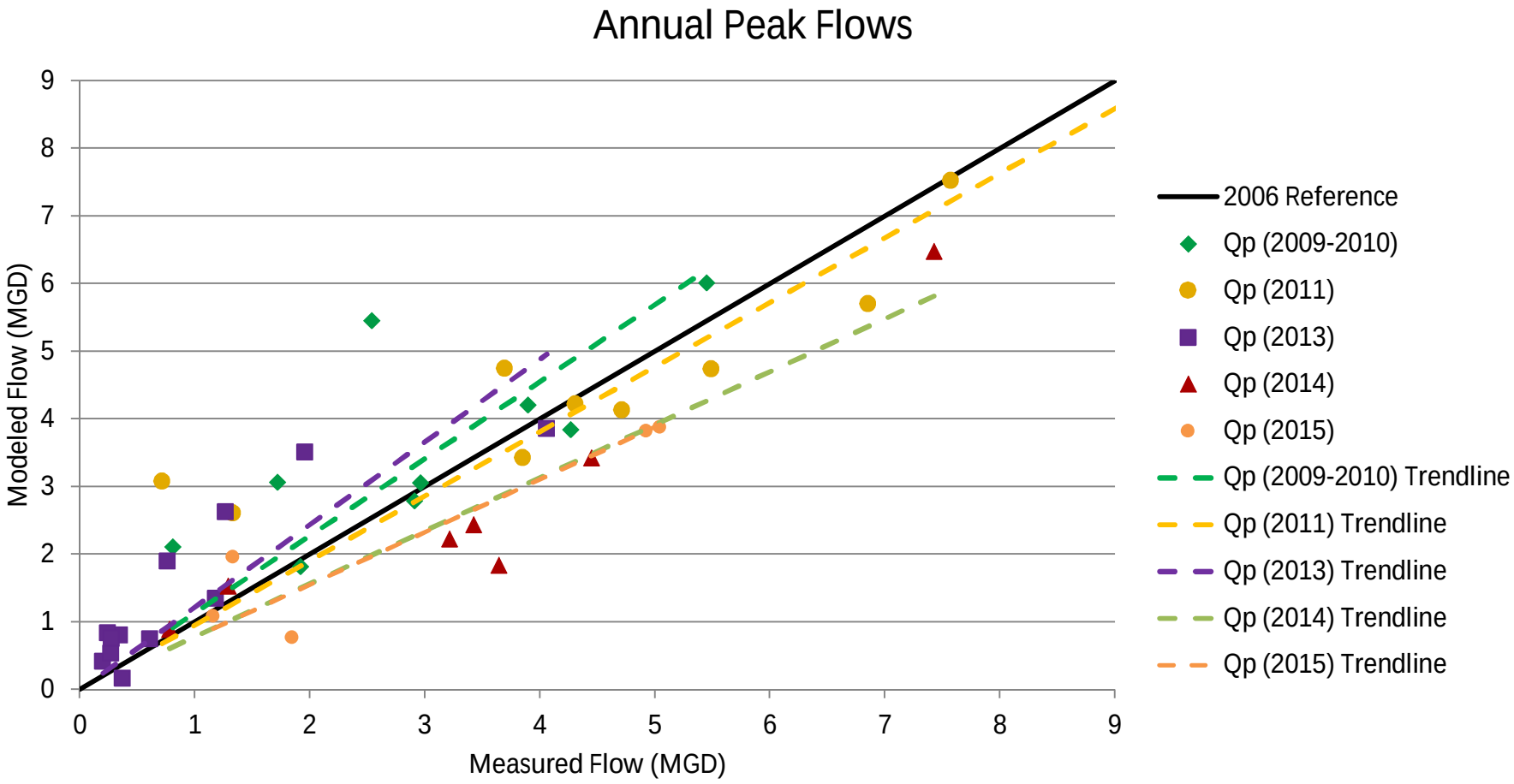
Little Chute



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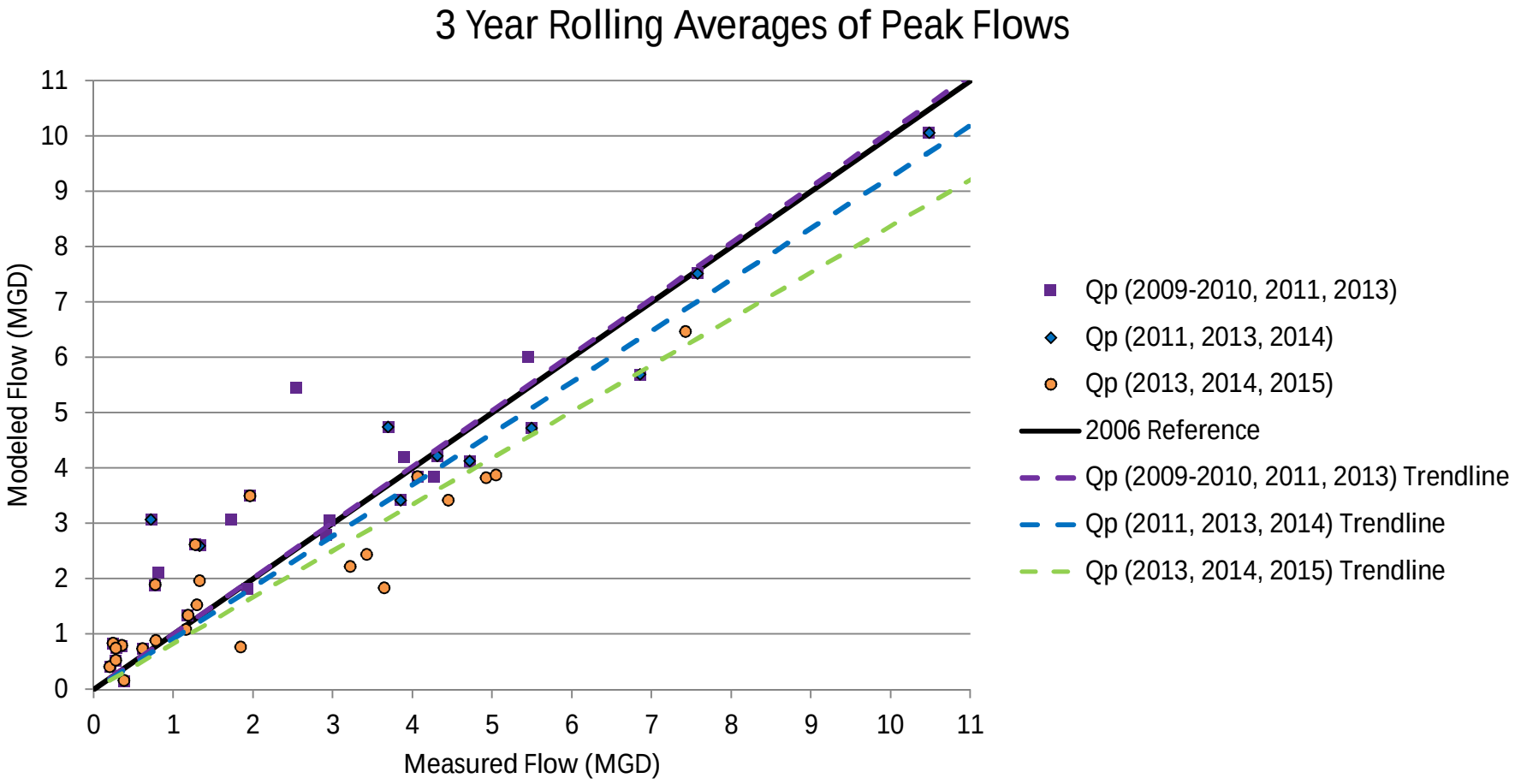
Little Chute



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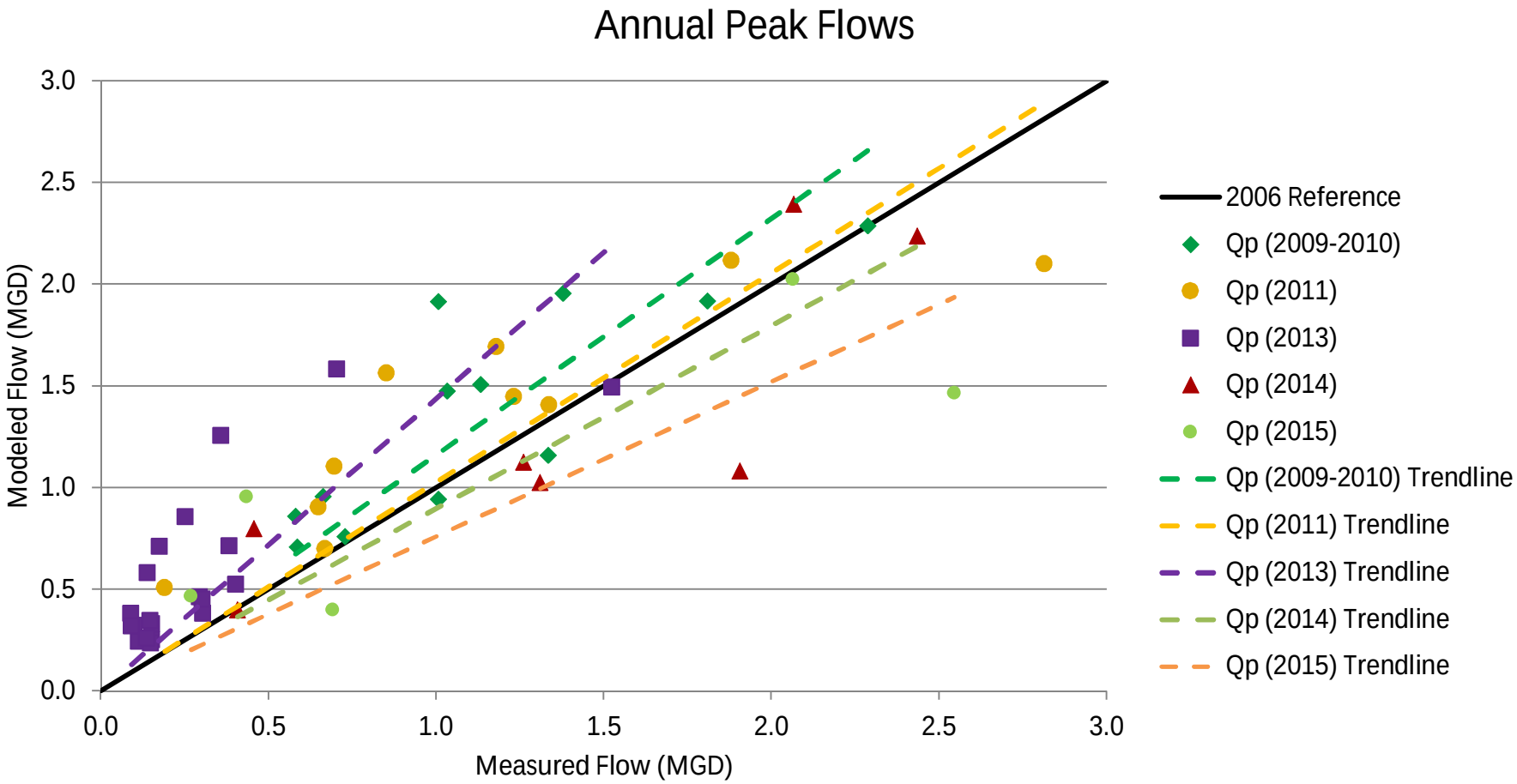
AMM Summary

- Combined Locks
  - Annual peak flow continues to slowly deteriorate
  - 3-year rolling average is generally stable but deteriorating

Combined Locks



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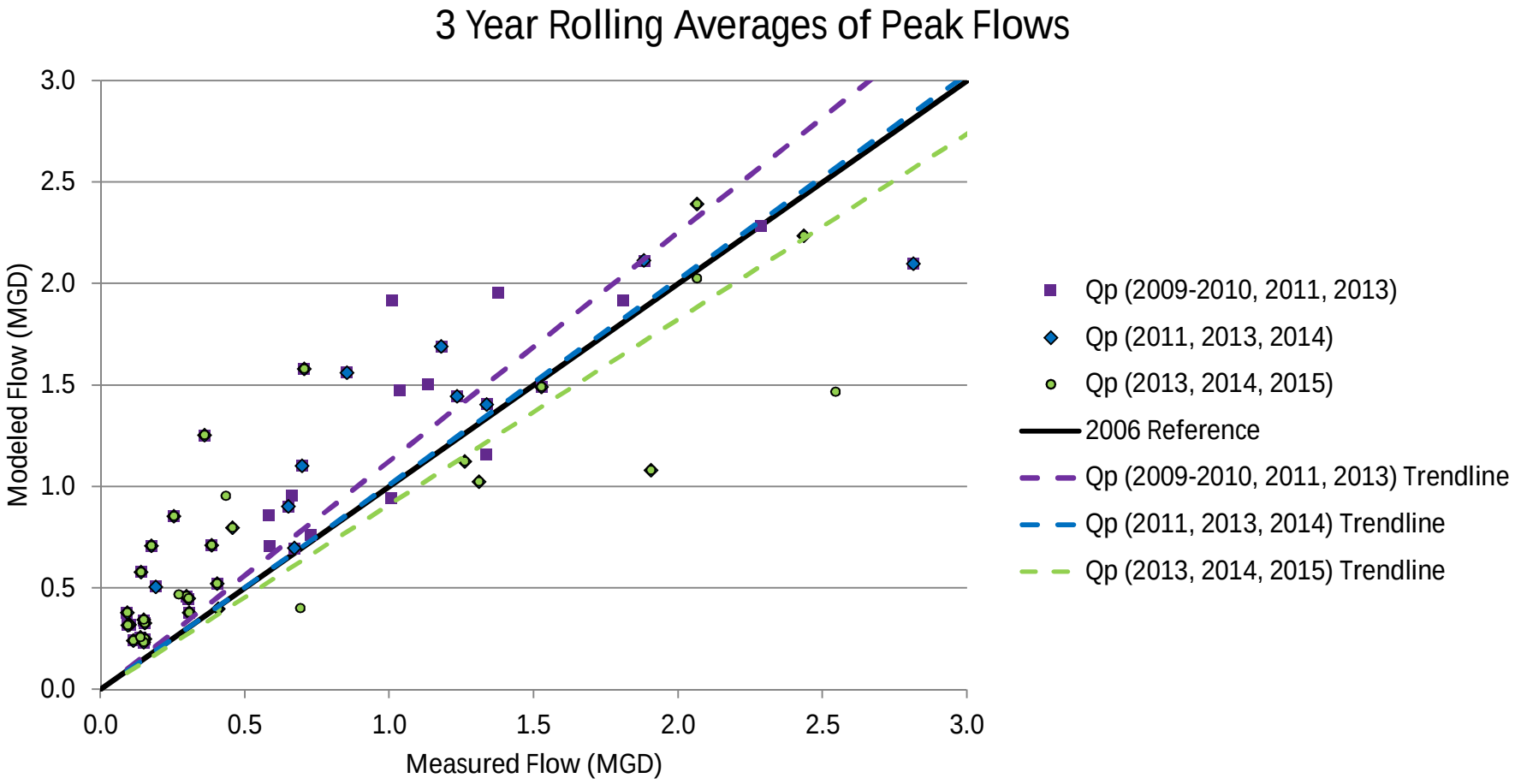
Combined Locks



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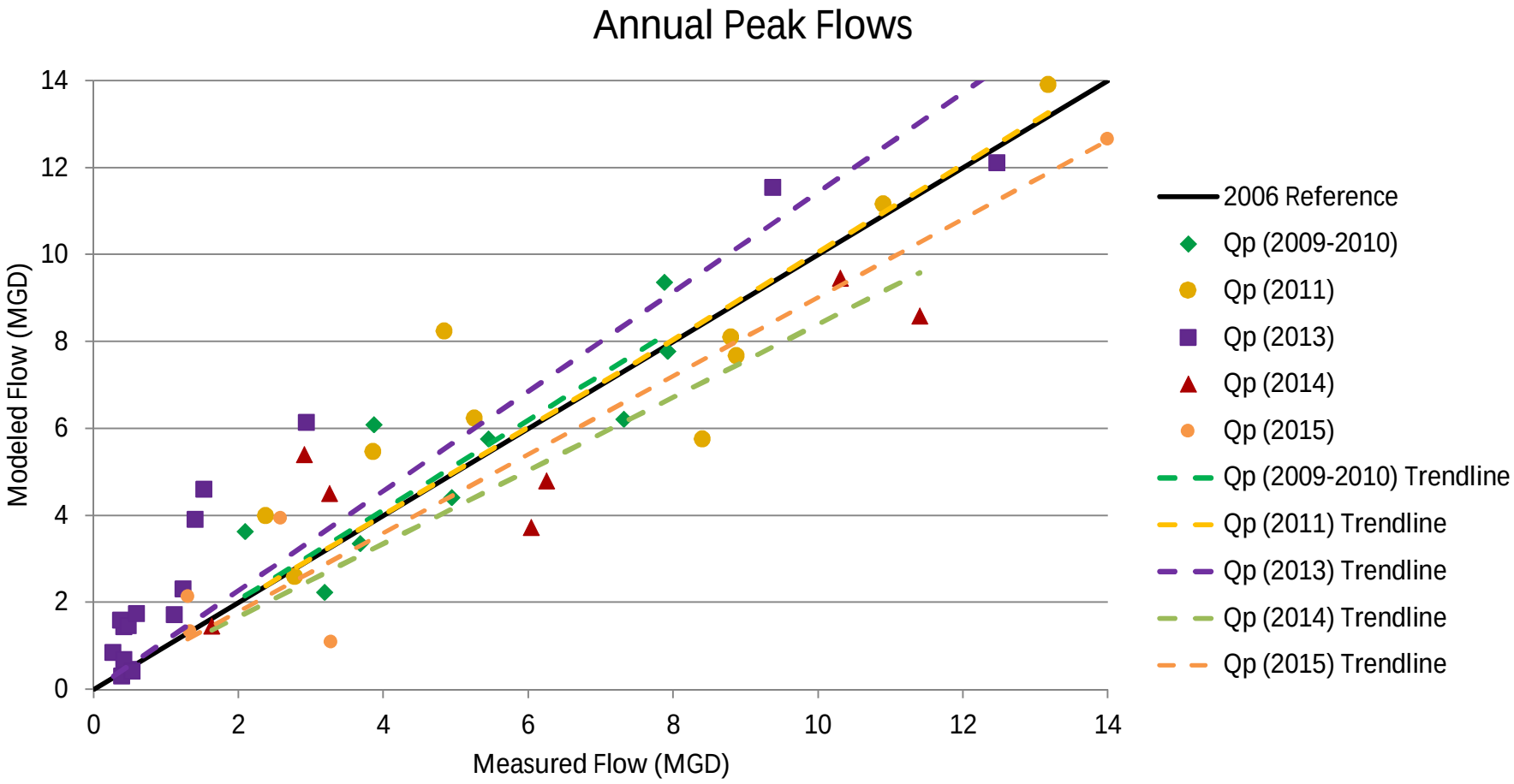
AMM Summary

- Kaukauna
  - Annual peak flow continued to deteriorate over the last three years.
  - 3-year rolling average deteriorated slightly but is very consistent with previous years.

Kaukauna



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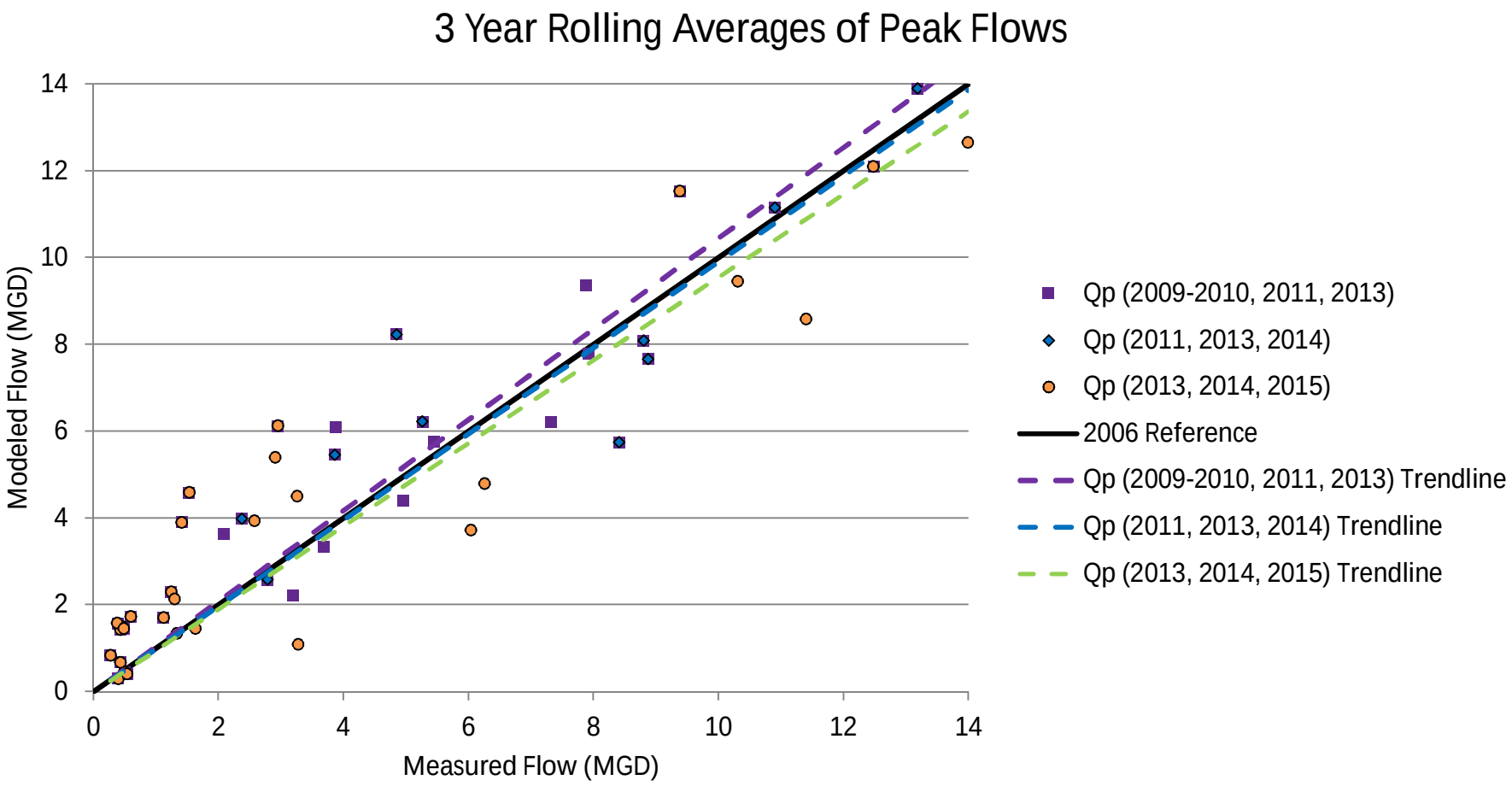
Kaukauna



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CMAR

CMAR

- WDNR performance indicators
- Section of CMAR addresses clear water
  - System failures
  - Peaking factors

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2015 System Failures

COMMUNITY	NUMBER OF LIFT STATION FAILURES	NUMBER OF SEWER PIPE FAILURES	NUMBER OF BASEMENT BACKUP OCCURRENCES	NUMBER OF COMPLAINTS
Kaukauna	0	0	0	17
Combined Locks	NA	0	0	0
Little Chute	NA	0	0	0
Kimberly	0	0	1	1
Darboy	NA	0	0	0

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2015 Peaking Factors

COMMUNITY	ANNUAL AVERAGE DAILY FLOW (MGD)	PEAKING FACTOR RATIO (MONTHLY: ANNUAL DAILY AVERAGE)	PEAKING FACTOR RATIO (PEAK HOURLY: ANNUAL DAILY AVERAGE)	PEAKING FACTOR RATIO – TOP 10 AVERAGE (PEAK HOURLY: ANNUAL DAILY AVERAGE)
Kaukauna	2.25[1]	1.60	8.93[2]	4.94[2]
Combined Locks	0.31	1.79	12.04[2]	5.72
Little Chute	1.25	1.54	9.33	4.27
Kimberly	0.65[1]	1.46	14.25[2]	5.96
Darboy	0.92[1]	1.14	4.27[2]	2.62

1. 6-year low
2. 6-year high

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CMAR Observations

- Annual average daily flow for Kaukauna, Kimberly, and Darboy was a 6-year low
  - The second lowest for Combined Locks and Little Chute
- Peaking Factor Ratio for all communities except Little Chute was a 6-year high
  - As the annual average daily flow drops, the peaking factors are inflated compared to previous years

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Dry Weather Flow

- Dry weather flow
  - Average flow
  - 7-10 day period without rain
  - During a season of typically high groundwater (March-April-May)
- Non-rain dependent flow

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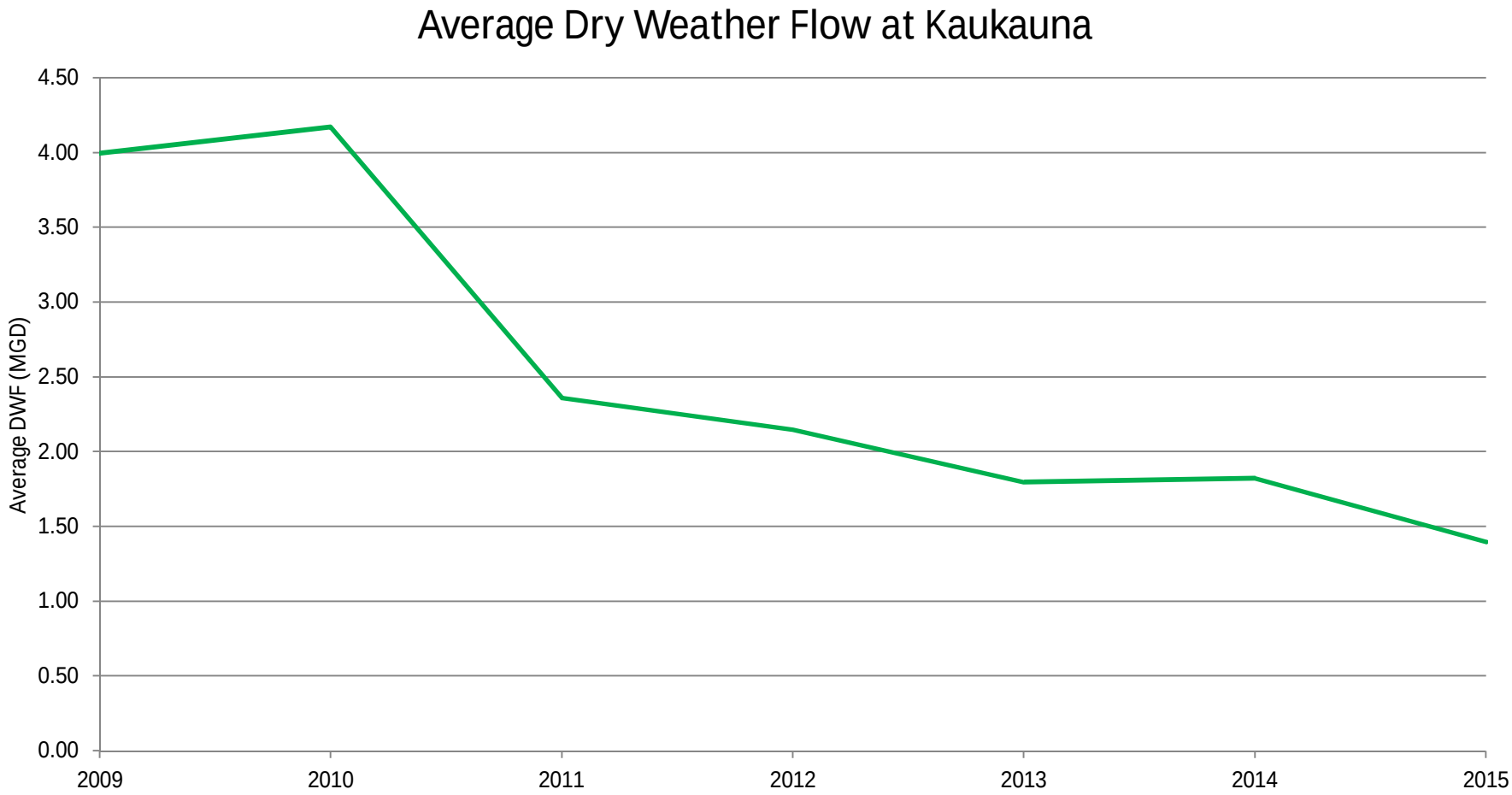
MS5


Average Dry Weather Flow at Kaukauna
Average DWF (MGD)
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
2009
2010
2011
2012
2013
2014
2015

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Impact on Peaks

- MS5
  - Quick analysis of DWF
  - Biggest impact on Kaukauna
- CMAR data and AMM values are impacted by the significant reductions in infiltration (dry weather flow)

$$\frac{\text{PEAK FLOW (NO CHANGE)}}{\text{AVERAGE DAILY} \downarrow} = \text{PEAK FLOW RATIO} \uparrow$$