










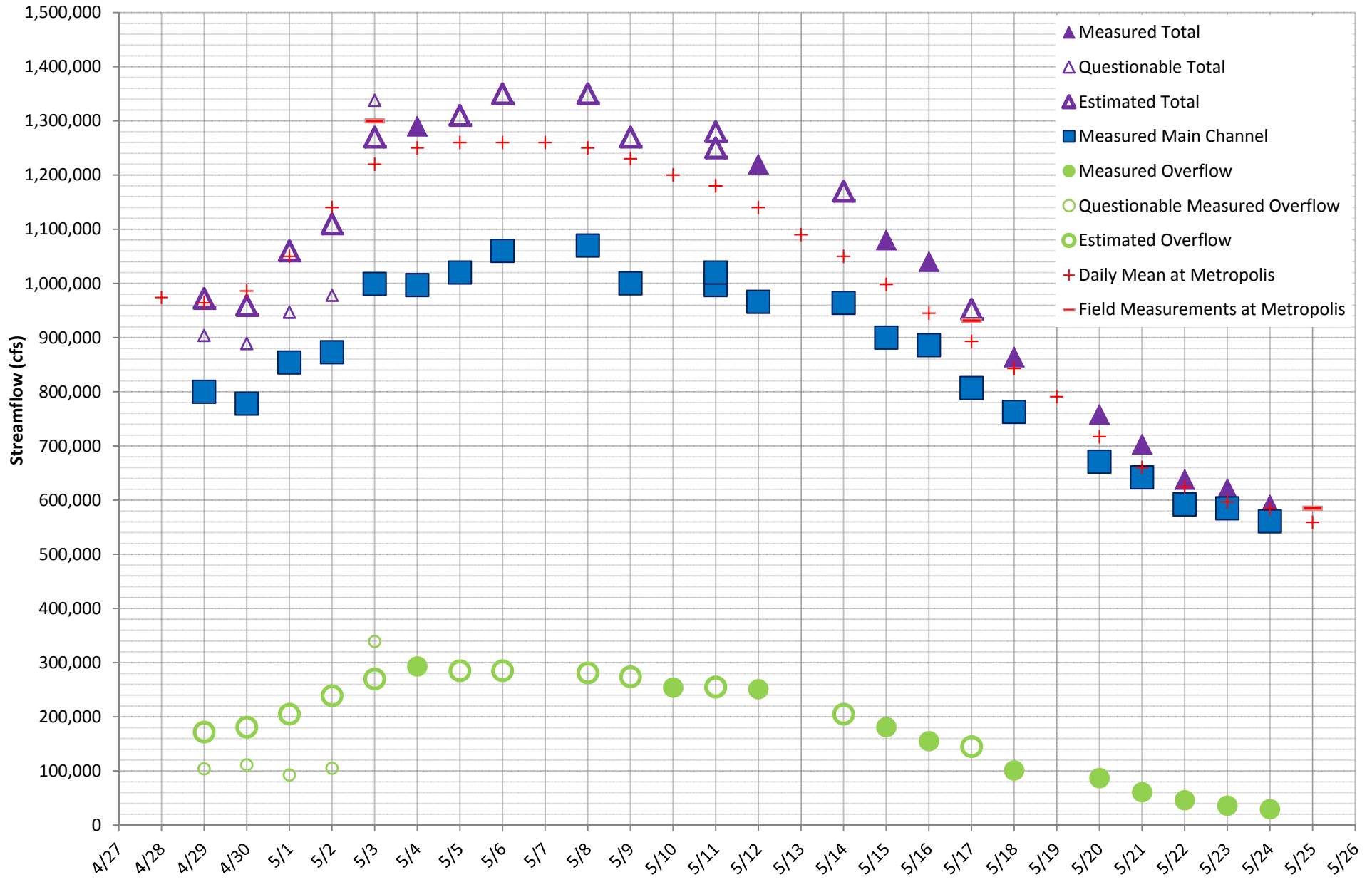
| Date      | Ohio River near Cairo (365939089084601)   |   |   |   |   | Ohio R @ Metropolis  |   | Ohio R @ Cairo Estimates  |   |           | Ohio R Qm's reported in NWIS |          |            |
|-----------|---|---|---|---|---|--|---|---|---|-----------|------------------------------|----------|------------|
|           |  |  |  |  |  |  |  |  |  |           |                              |          |            |
|           | Measured<br>Main<br>Channel   | Measured<br>Overflow  | Questionable<br>Measured<br>Overflow  | Measured<br>Total   | Questionable<br>Total   | Daily Mean<br>at<br>Metropolis   | Field<br>Measure-<br>ments at<br>Metropolis   | Estimated<br>Overflow   | Estimated<br>Total  | (rounded) | Main Flow                    | Overflow | Total Flow |
| 4/28/2011 |   |   |   |   |   | 974,000  |   |   |   |           |                              |          |            |
| 4/29/2011 | 800,000   |   | 104,000   |   | 904,000   | 964,000  |   | 172,000   | 972,000   | 972,000   | 800,000                      | 172,000  | 972,000    |
| 4/30/2011 | 778,000   |   | 111,000   |   | 889,000   | 986,000  |   | 181,000   | 959,000   | 959,000   | 778,000                      | 181,000  | 959,000    |
| 5/1/2011  | 854,000   |   | 92,600  |   | 946,600   | 1,050,000  |   | 205,000   | 1,059,000   | 1,060,000 | 854,000                      | 205,000  | 1,060,000  |
| 5/2/2011  | 873,000   |   | 105,000   |   | 978,000   | 1,140,000  |   | 239,000   | 1,112,000   | 1,110,000 | 873,000                      | 239,000  | 1,110,000  |
| 5/3/2011  | 999,000   |   | 339,000   |   | 1,338,000   | 1,220,000  | 1,300,000   | 270,000   | 1,269,000   | 1,270,000 | 999,000                      | 270,000  | 1,270,000  |
| 5/4/2011  | 997,000   | 293,000   |   | 1,290,000   |   | 1,250,000  |   |   |   |           | 997,000                      | 293,000  | 1,290,000  |
| 5/5/2011  | 1,020,000   |   |   |   |   | 1,260,000  |   | 285,000   | 1,305,000   | 1,310,000 | 1,020,000                    | 285,000  | 1,310,000  |
| 5/6/2011  | 1,060,000   |   |   |   |   | 1,260,000  |   | 285,000   | 1,345,000   | 1,350,000 | 1,060,000                    | 285,000  | 1,350,000  |
| 5/7/2011  |   |   |   |   |   | 1,260,000  |   |   |   |           |                              |          |            |
| 5/8/2011  | 1,070,000   |   |   |   |   | 1,250,000  |   | 281,000   | 1,351,000   | 1,350,000 | 1,070,000                    | 281,000  | 1,350,000  |
| 5/9/2011  | 1,000,000   |   |   |   |   | 1,230,000  |   | 274,000   | 1,274,000   | 1,270,000 | 1,000,000                    | 274,000  | 1,270,000  |
| 5/10/2011 |   | 254,000   |   |   |   | 1,200,000  |   |   |   |           |                              |          |            |
| 5/11/2011 | 997,000   |   |   |   |   | 1,180,000  |   | 255,000   | 1,252,000   | 1,250,000 | 997,000                      | 255,000  | 1,250,000  |
| 5/11/2011 | 1,020,000   |   |   |   |   | 1,180,000  |   | 255,000   | 1,275,000   | 1,280,000 | 1,020,000                    | 255,000  | 1,280,000  |
| 5/12/2011 | 966,000   | 251,000   |   | 1,220,000   |   | 1,140,000  |   |   |   |           | 966,000                      | 251,000  | 1,220,000  |
| 5/13/2011 |   |   |   |   |   | 1,090,000  |   |   |   |           |                              |          |            |
| 5/14/2011 | 964,000   |   |   |   |   | 1,050,000  |   | 205,000   | 1,169,000   | 1,170,000 | 964,000                      | 205,000  | 1,170,000  |
| 5/15/2011 | 900,000   | 181,000   |   | 1,080,000   |   | 998,000  |   |   |   |           | 900,000                      | 181,000  | 1,080,000  |
| 5/16/2011 | 886,000   | 155,000   |   | 1,040,000   |   | 945,000  |   |   |   |           | 886,000                      | 155,000  | 1,040,000  |
| 5/17/2011 | 807,000   |   |   |   |   | 893,000  | 931,000   | 145,000   | 952,000   | 952,000   | 807,000                      | 145,000  | 952,000    |
| 5/18/2011 | 763,000   | 101,000   |   | 864,000   |   | 843,000  |   |   |   |           | 763,000                      | 101,000  | 864,000    |
| 5/19/2011 |   |   |   |   |   | 791,000  |   |   |   |           |                              |          |            |
| 5/20/2011 | 671,000   | 86,800  |   | 758,000   |   | 717,000  |   |   |   |           | 671,000                      | 86,800   | 758,000    |
| 5/21/2011 | 642,000   | 60,800  |   | 703,000   |   | 660,000  |   |   |   |           | 642,000                      | 60,800   | 703,000    |
| 5/22/2011 | 592,000   | 46,100  |   | 638,000   |   | 624,000  |   |   |   |           | 592,000                      | 46,100   | 638,000    |
| 5/23/2011 | 585,000   | 36,000  |   | 621,000   |   | 597,000  |   |   |   |           | 585,000                      | 36,000   | 621,000    |
| 5/24/2011 | 561,000   | 29,500  |   | 591,000   |   | 584,000  |   |   |   |           | 561,000                      | 29,500   | 591,000    |
| 5/25/2011 |   |   |   |   |   | 559,000  | 585,000   |   |   |           |                              |          |            |

notes:

Questionable overflow values were measured during long transects (2+ hrs) with frequent direction changes through trees which greatly reduced the accuracy of the measurement

Estimated Overflow is calculated as  $[0.381 * Q_{\text{Metropolis}} - 195,000]$ , which is the equation of the Overflow\_vs\_Metropolis trendline.

## Ohio River near Cairo (365939089084601)



**Problem:****TAK: 2/7/2012**

26 measurement days were assigned for the Ohio River at Cairo between 4/29 and 5/24 of 2011.

Of those 26, only 10 had valid, verifiable measurements for both the main channel and the overflow channel.

There were 13 valid, verifiable main-channel measurements with no corresponding overflow measurement.

Due to the difficulty of making overflow Qm's, the field crews intended to make overflow measurements every other day and interpolate between them.

However, the first five days of measuring produced unreliable results, and valid results were found only on 5/4, 5/10, and then more consistently after that.

A method was needed to estimate the overflows that were missing, despite the lack of measurements at the beginning.

**Solution:**

- 1 . I plotted the existing 11 verifiable overflow Qm's against Metropolis mean daily Q and found a strong correlation (Regr chart).
- 2 . I used this relationship to estimate 13 new overflow Q values for the missing days (green values on Data sheet).
- 3 . I added the estimated overflow values to their respective measured main Q values to get 13 new total Q values (purple values on Data sheet).
- 4 . I plotted the estimated total Q values and the measured total Q values together on the EstStreamflow chart.  
Also included are the questionable measurements that were originally thrown out and the Metropolis mean daily streamflow graph.
- 5 . As a check, I plotted the total measured streamflow at Cairo against the Metropolis gage ( $R^2=0.991$ ) as shown on QA chart.
- 6 . I then plotted the estimated total flows at Cairo on this same chart to see how the estimated flows fit. They were within 10% of the expected values.
- 7 . As a final check, on the Data sheet, I computed the standard error of prediction for my known overflows to test the method used to estimate overflow.

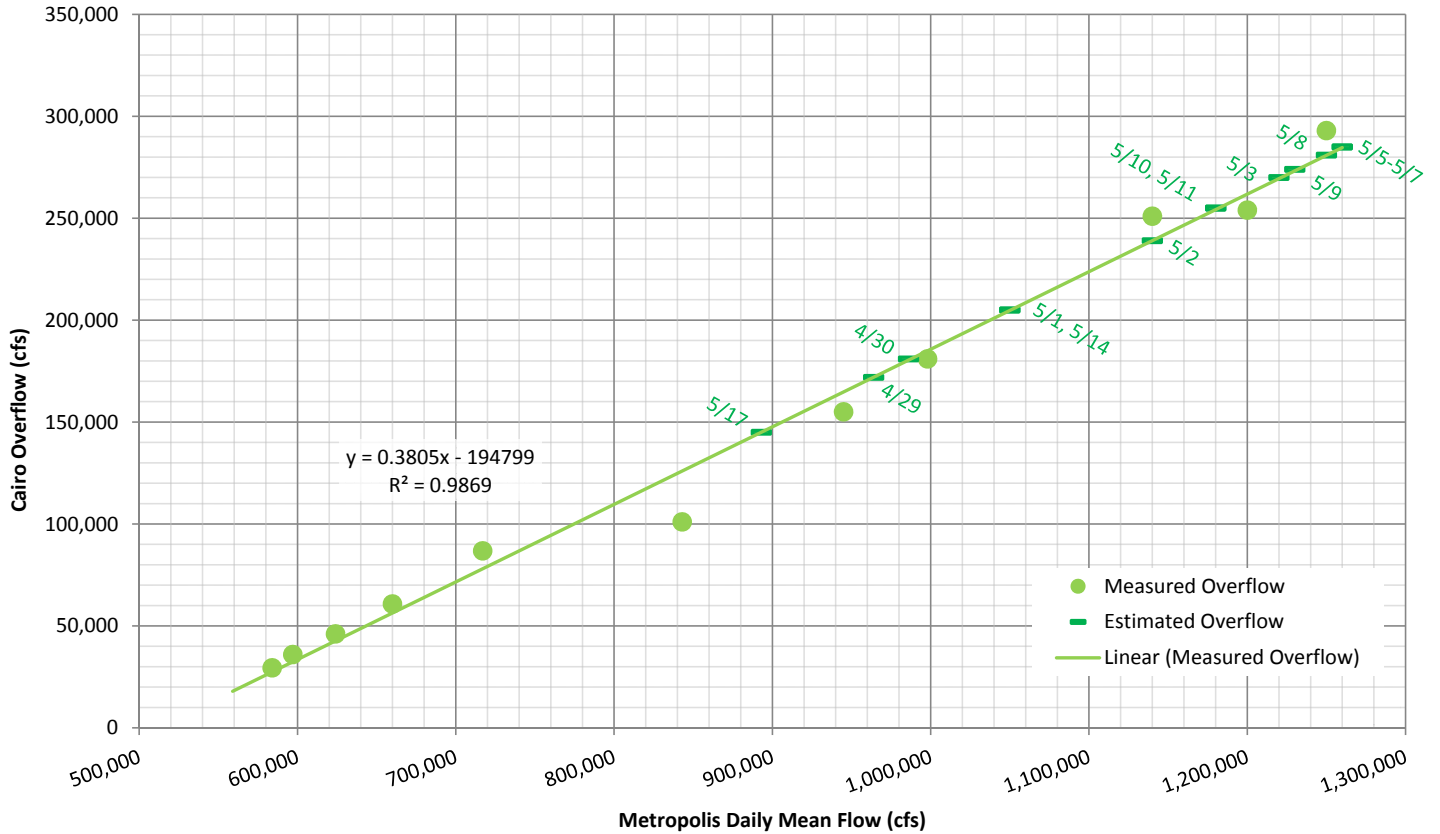
**Comments:**

The graphs show that the variability in the estimated total flows are due almost exclusively to the variability in the main flow measurements.

I was comfortable estimating the overflow measurements in this manner, especially given that the overflow typically represented less than 20% of the total.

I was not comfortable making similar estimates of the main channel flow and saw no need to do so. Thus, four days of 26 remain unmeasured and unestimated.

### Cairo Overflow vs Metropolis Daily Mean Flow



### Cairo Total Flow vs Metropolis Daily Mean Flow

