

Oso Creek/Oso Bay Numerical Modeling

Presented to the Oso Creek/Oso Bay
TMDL Stakeholders Meeting (3)

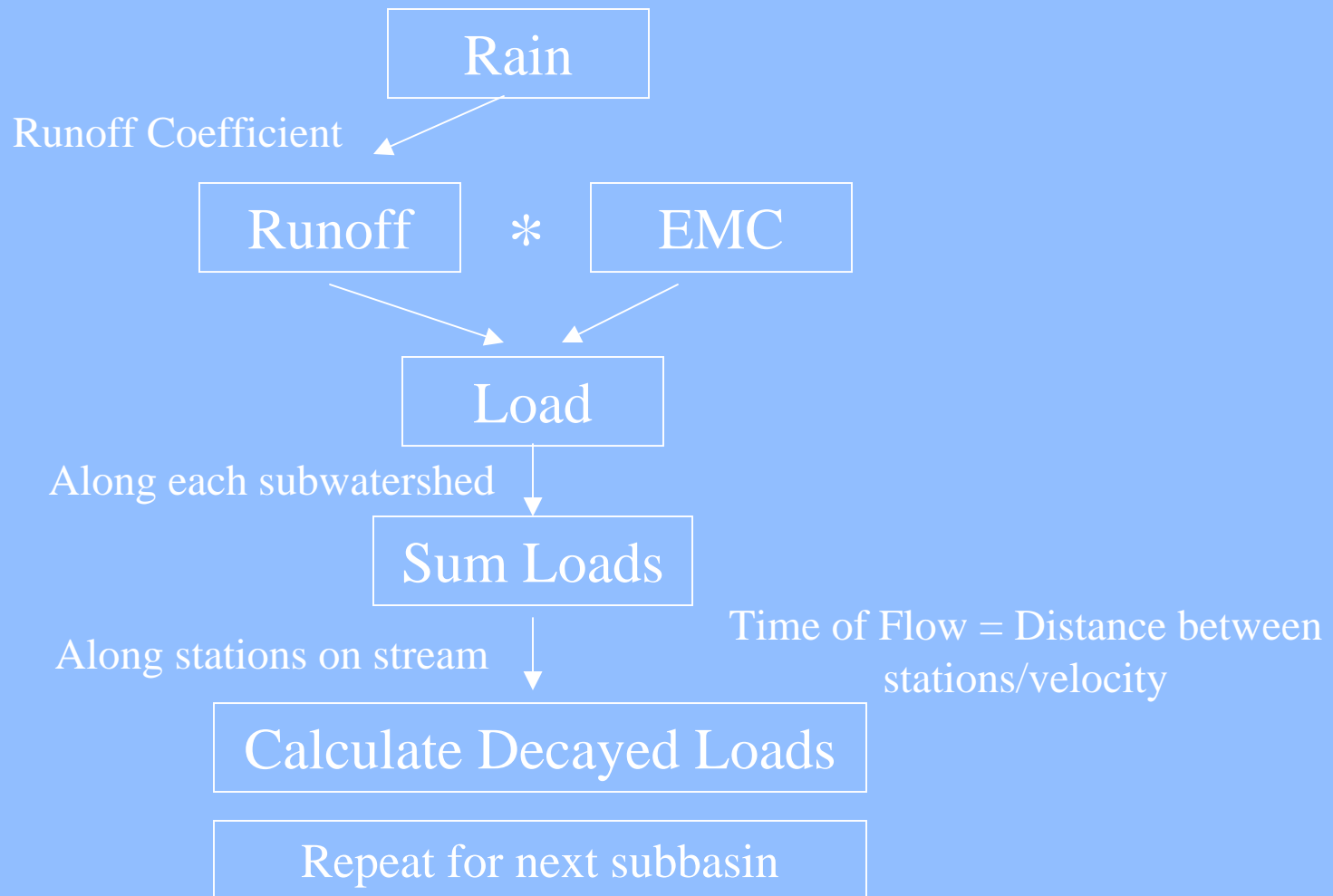
By

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Modeling Process



Daily Model Set-up

- Calibration period.
 - 10/01/1999 – 09/31/2000.
- Inputs.
 - Precipitation (NEXRAD).
 - Hourly grids combined into 1 daily grid.
 - Runoff.
 - Bacteria loadings for each sub-basin.
 - Initial bacteria input for each station.
- 12 time step intervals.
 - Look at decay process every 2 hours.
- Time of flow.
 - Nontidal stations.
 - Calculate velocity.
 - Tidal stations.
 - Calculate residence times.
- Bacteria from upstream station depends on:
 - Flow of water from station.
 - Volume of water in stream.



Volumes

- Main channel volumes.
 - Inputs.
 - Upstream flow.
 - Runoff.
 - Additional sources (Robstown, Greenwood, Oso WWTPs, and Barney Davis power plant).
- Constant channel volumes.
 - Determines amount of water that moves to the next station.



Initial Daily Model Runs

- Moves water through basin efficiently.
- Reasonable decay rate of bacteria load.
- Under predicts runoff events.
- Under predicts dry events.
- Suggests EMC grid concentrations low



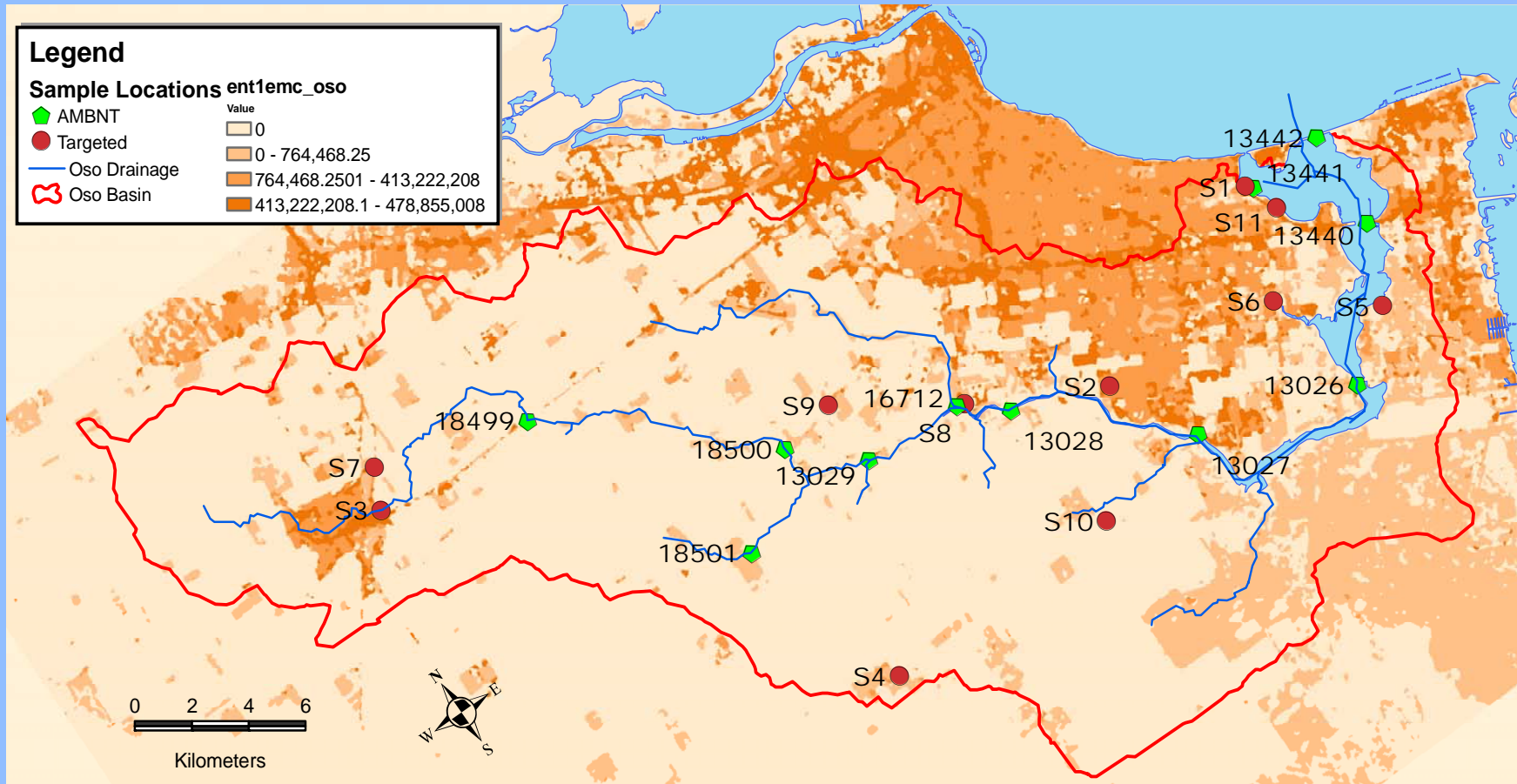
Computed *Enterococci* EMC Values

- Used total *enterococci* concentration data for 1st rain event in targeted S6 basin.
- Computed EMCs based on:
 - Total volume of runoff.
 - Area distribution of each land use.
 - Ratio of fecal coliform concentrations for each land use in basin draining to targeted site S6.
 - S6 subbasin selected because of size and presence of all LULC categories.
- Effectively doubled EMC grid values.



Event Mean Concentration

Enterococci – 1st rain event

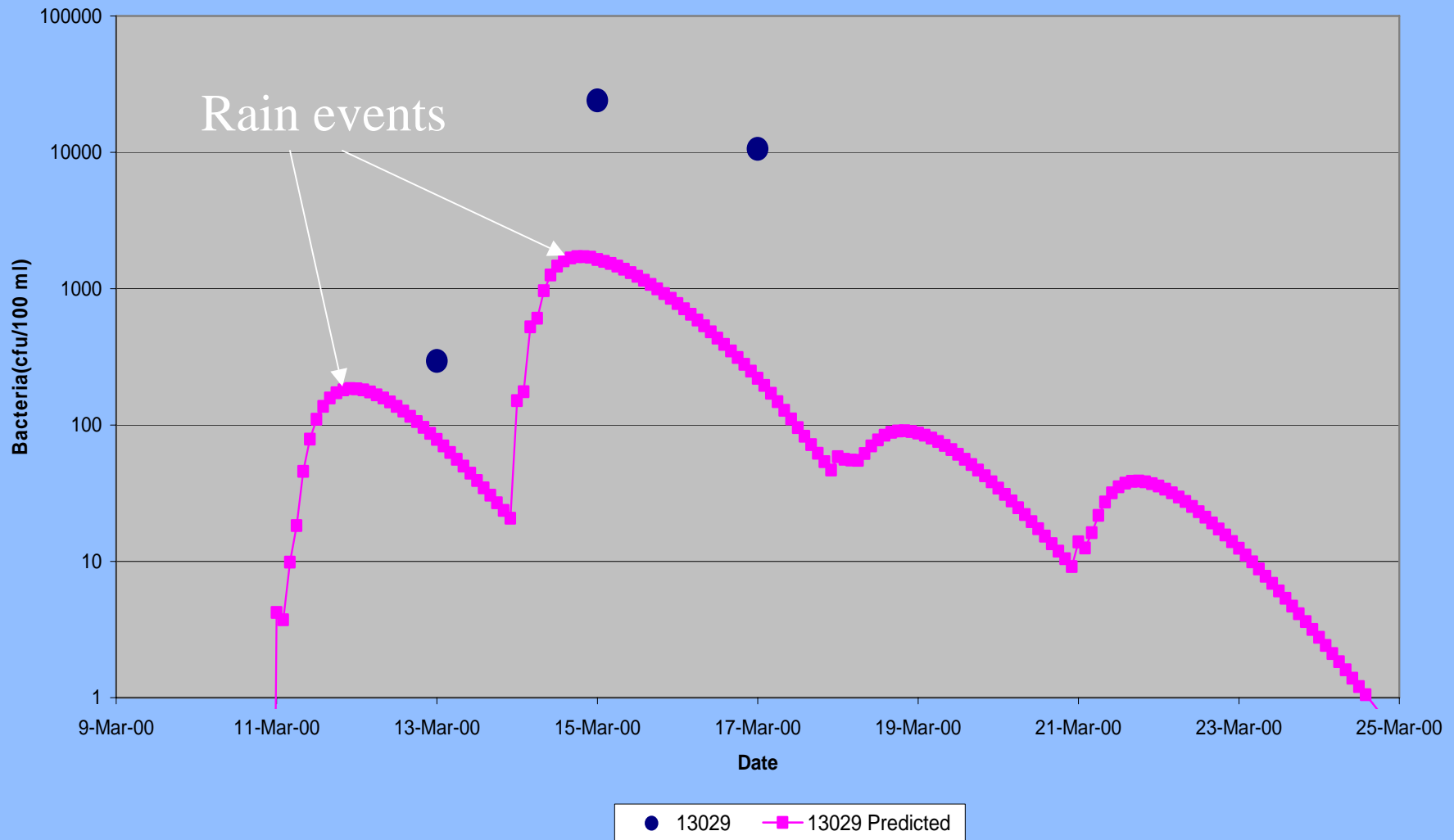


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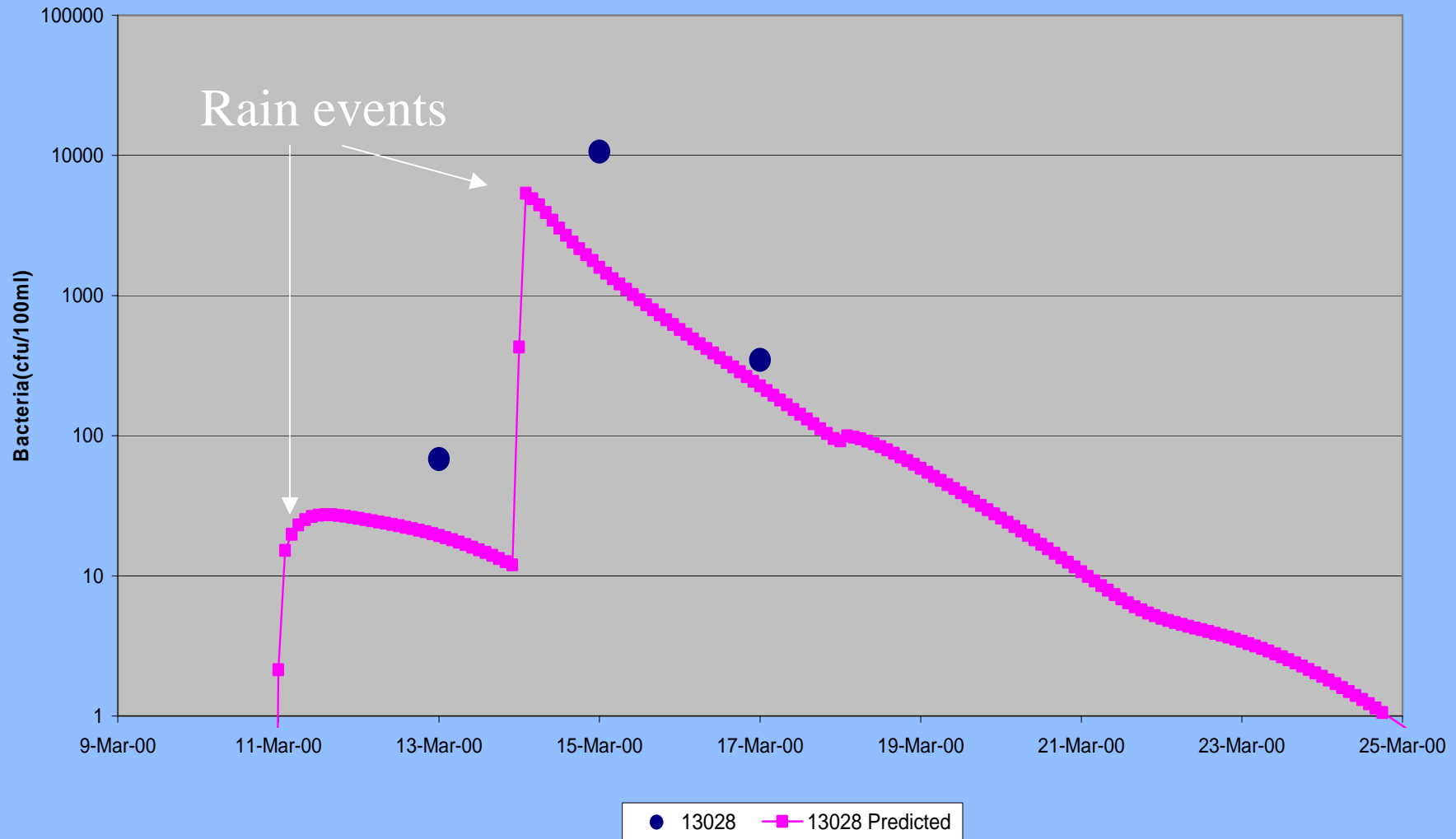
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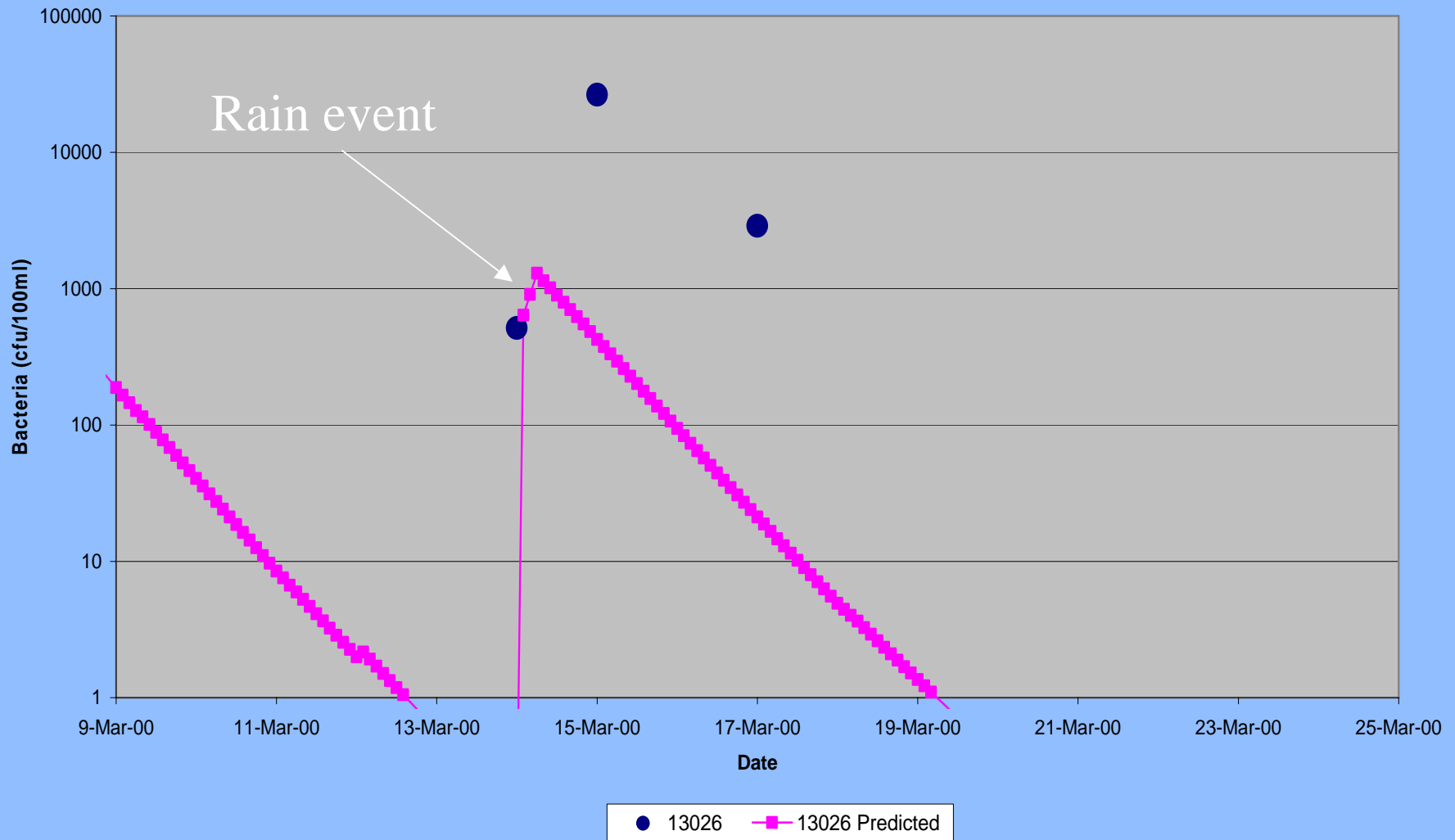
Model v. Measured at 13029



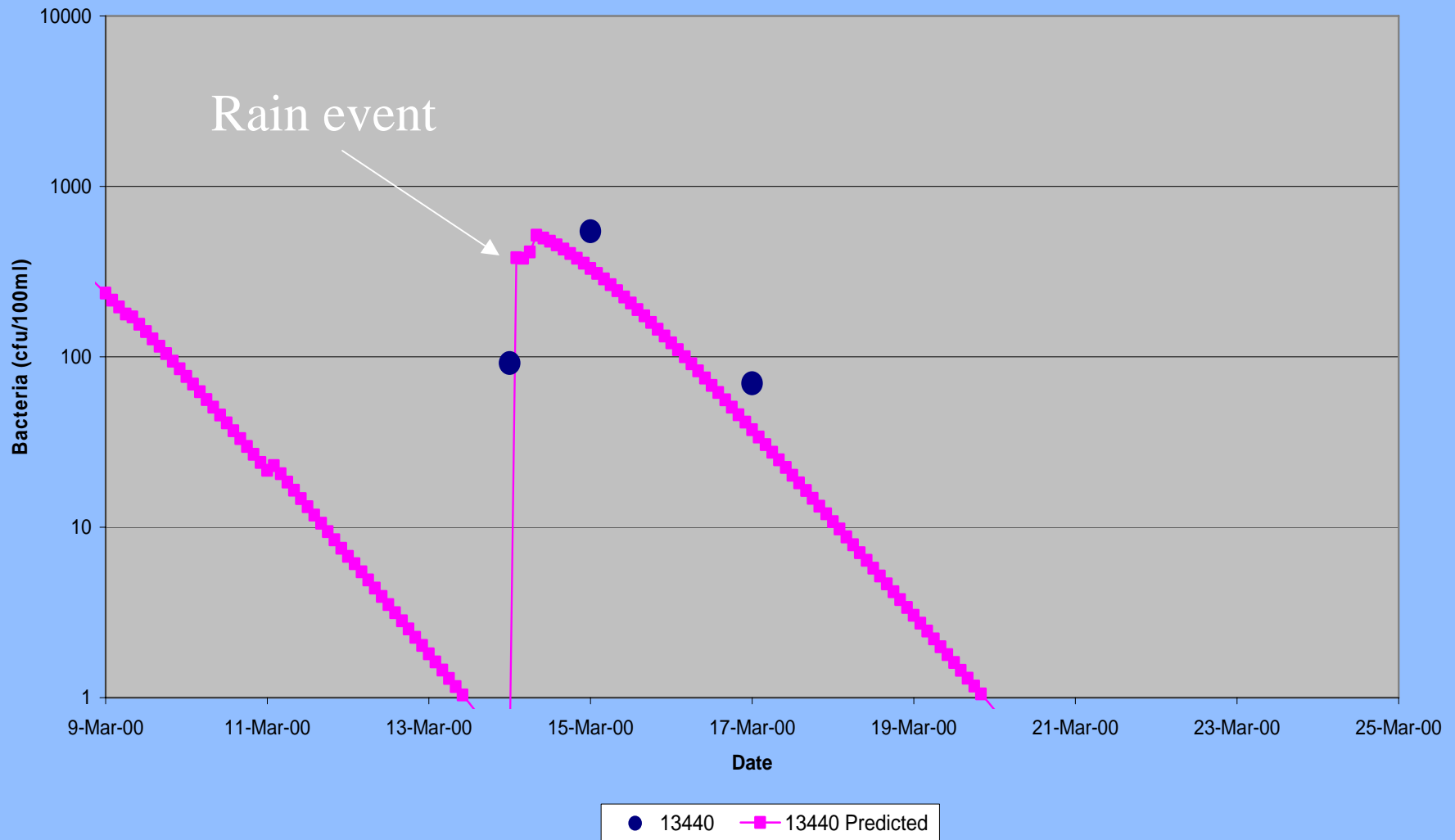
Model v. Measured at 13028



Model v. Measured at 13026



Model v. Measured at 13440



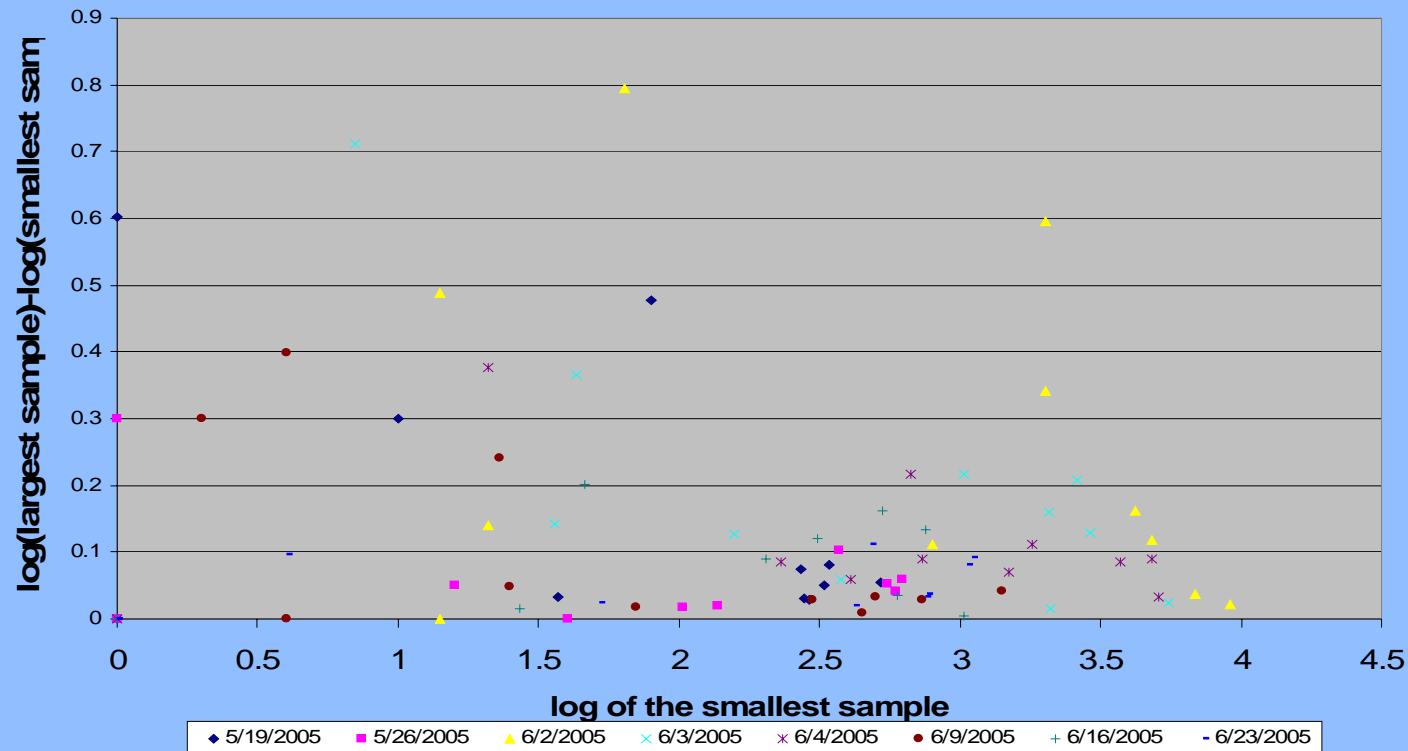
Model Results with New EMC

- Still under predicts bacteria concentrations for storm events.
 - EMC grids based on mean concentrations
 - Maximum values recorded in original EMC development exceed 100,000 cfu/100ml
 - Maximum EMC value 53,000 cfu/100ml
 - Model iterating at 2 hour intervals
 - Greater definition of event than input data warrants
- Better predictions in Oso Bay.
- Concentration decays to very low values between runoff events.
- How close does the model have to be?



Model Evaluation (Variance Between Splits)

- Collected data meets all precision and QA/QC requirements of the analytical method.
- Some splits had values that differed by over 0.7 log



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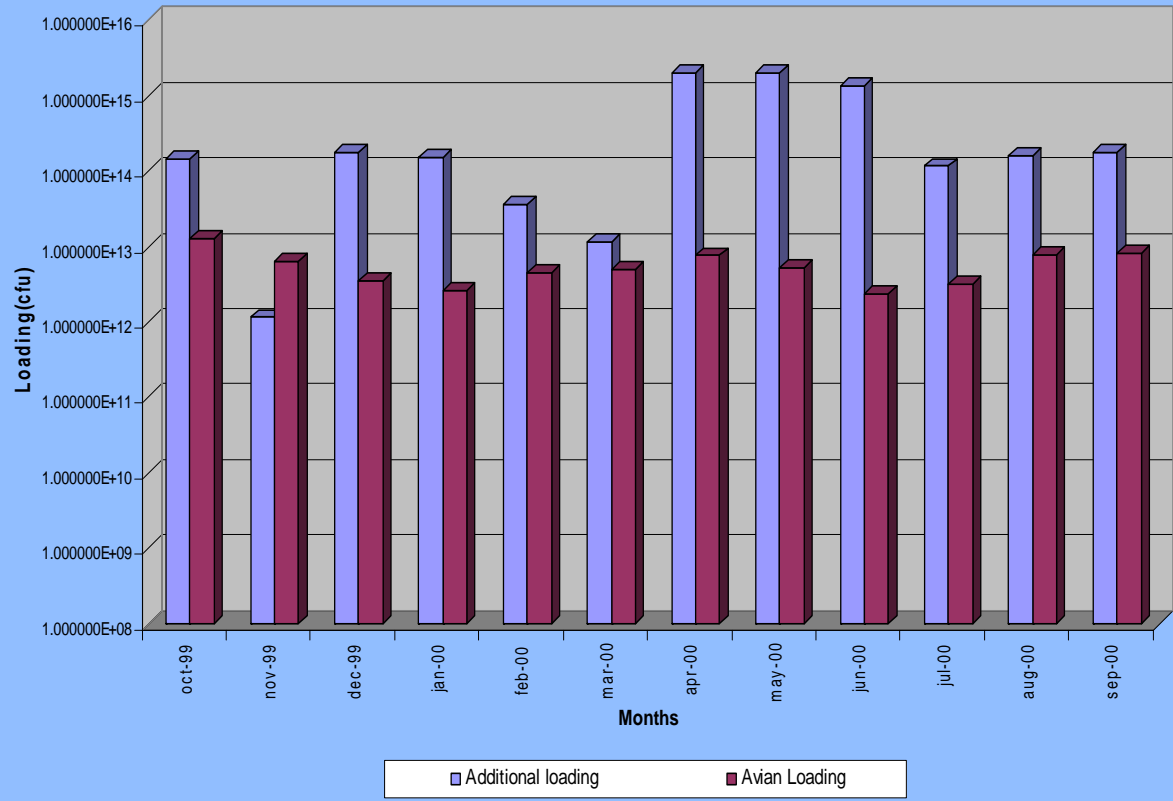
Extra Loadings ?

- Modeled vs. measured values indicate the presence of additional loadings in parts of the bay that are not traditional points sources
- Other sources
 - Avian loading as additional input.
 - Illicit discharges



Difference between modeled and measured loadings at 13441 (1999-2000) and expected loadings due to bird populations based on observation in the Blind Oso from 2002-2003.

Additional Loadings(Avian)



Birds in the Bay

- Laughing gulls.
 - 1/2 the size of herring gulls.
 - 1/2 of the laughing gulls make contact with the water.
 - Spend 1/2 of the day in the bay.
- Shore birds.
 - 1/4 the size of herring gulls.
 - 1/2 of the shore birds make contact with the water.

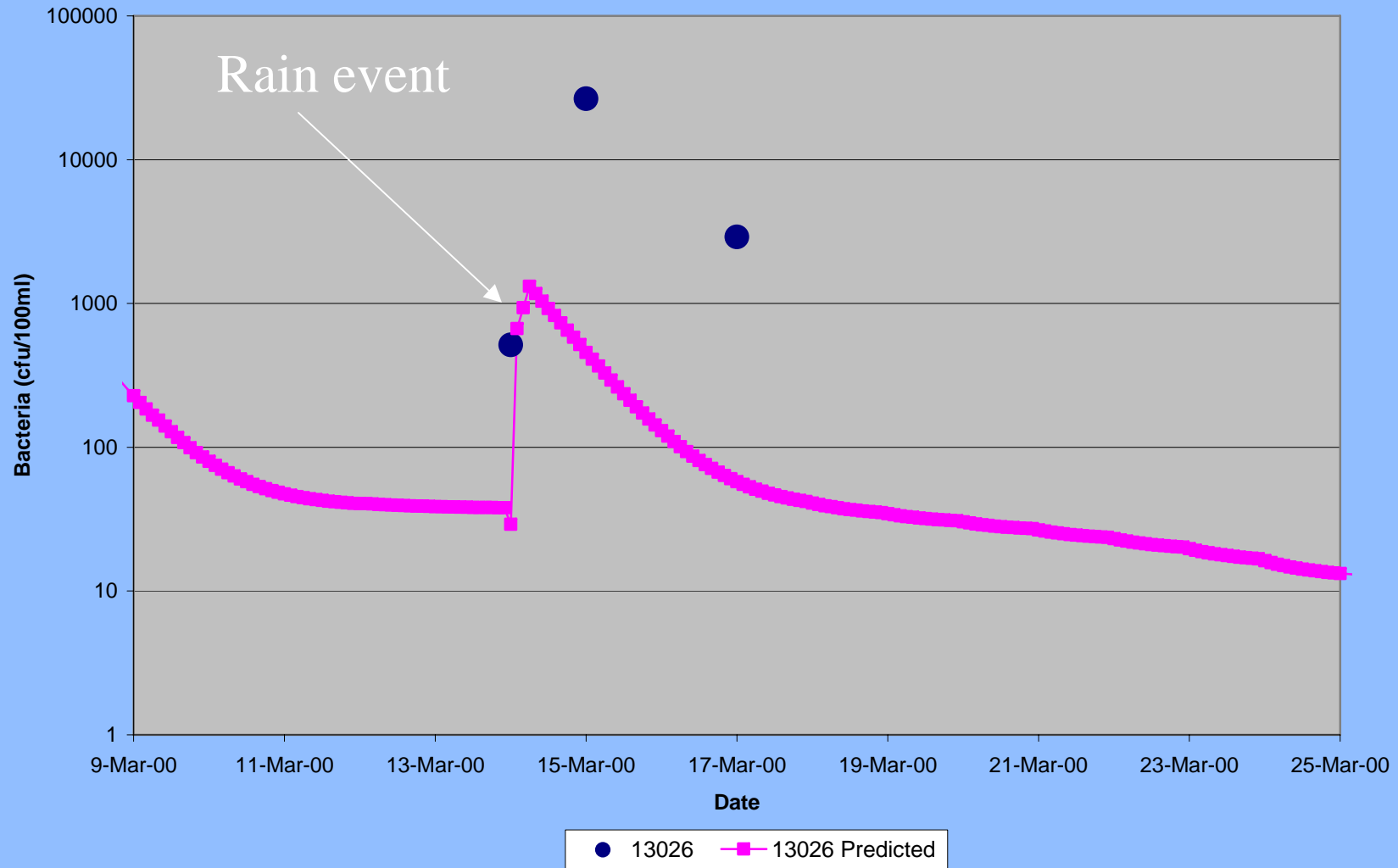


Avian Loading

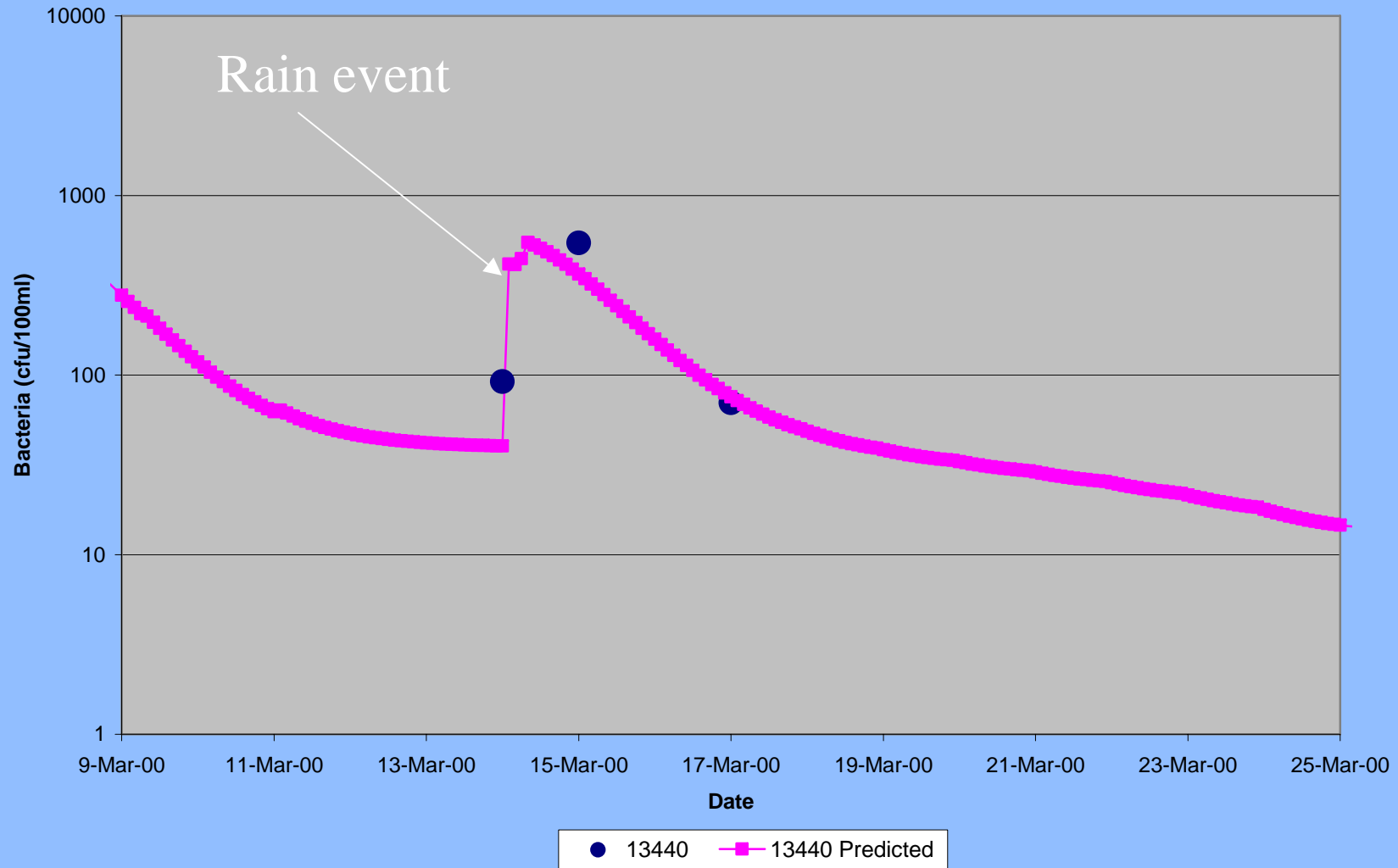
- Total birds = # birds per meter * shoreline length.
(from Blind Oso observations)
- Know load for 1 herring gull.
 - Compute load for 1 laughing gull.
 - Compute load for 1 shore bird.
- Laughing gull load = 1 laughing gull load * total # laughing gulls.
- Shore bird load = 1 shore bird load * total # shore birds.
- Add bird loads to the 3 bay segments.



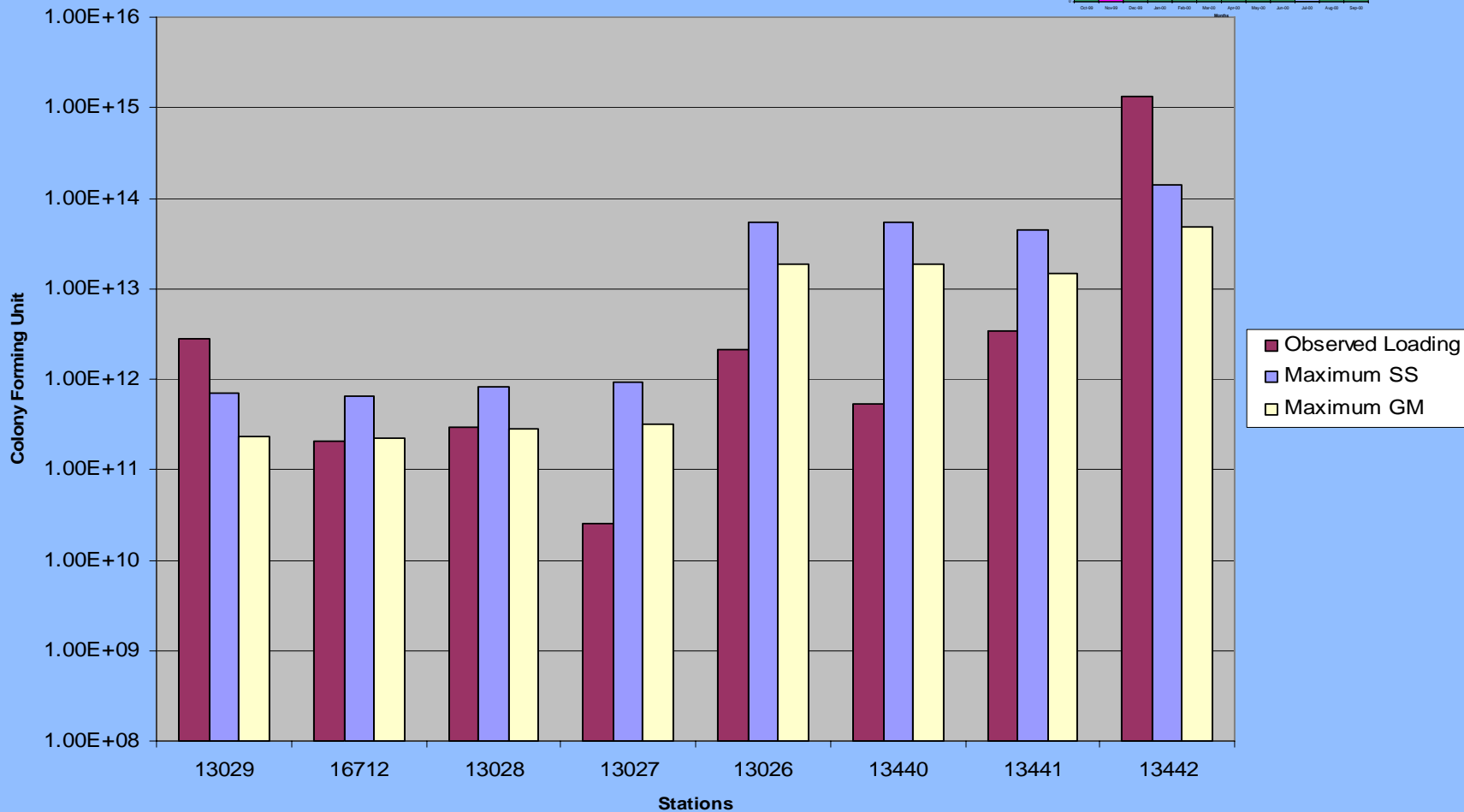
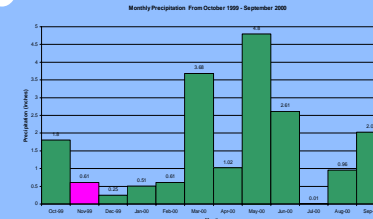
Model(Avian) v. Measured at 13026



Model(Avian) v. Measured at 13440



Observed Average Daily Loading November 1999



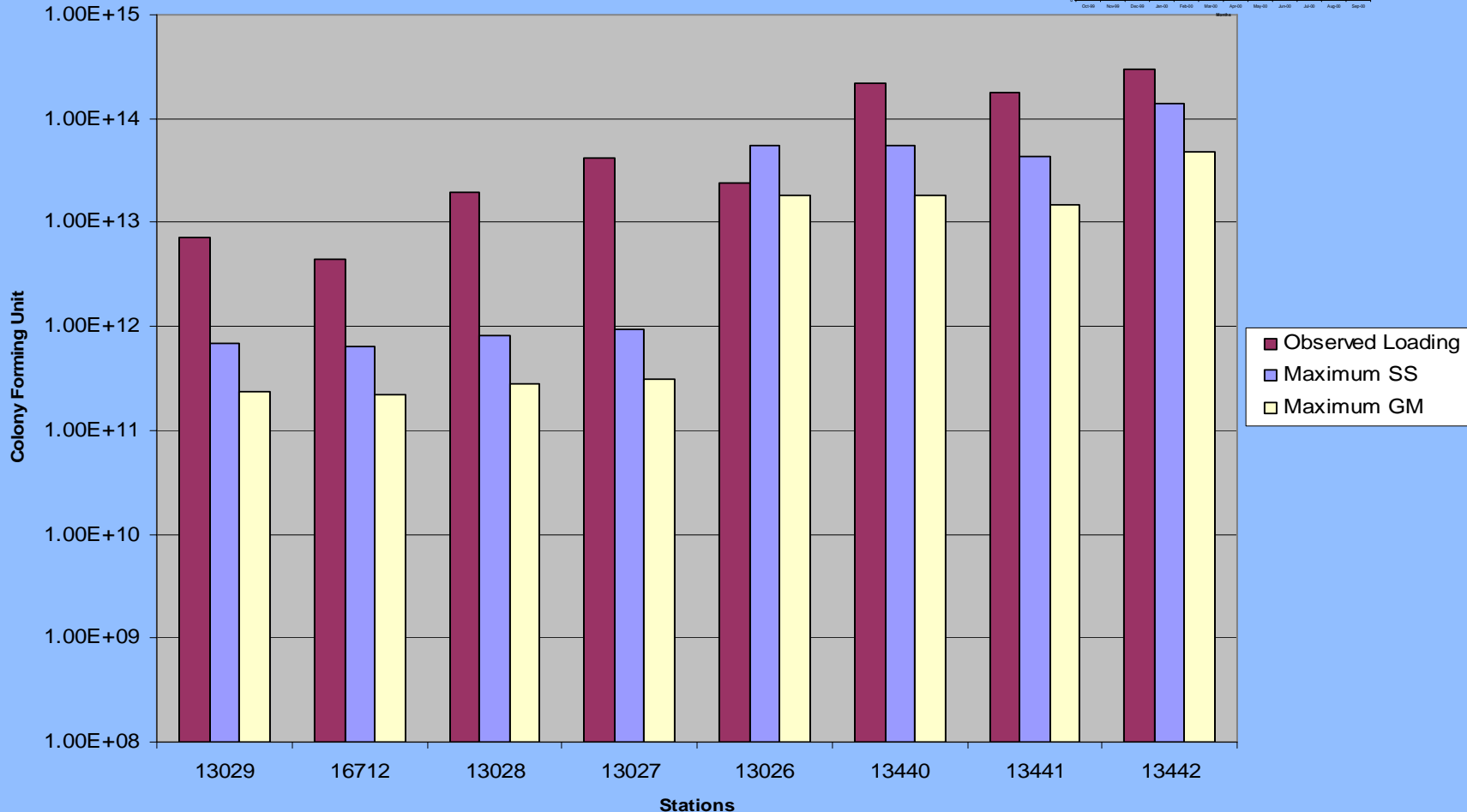
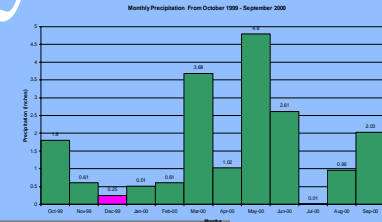
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Observed Average Daily Loading December 1999

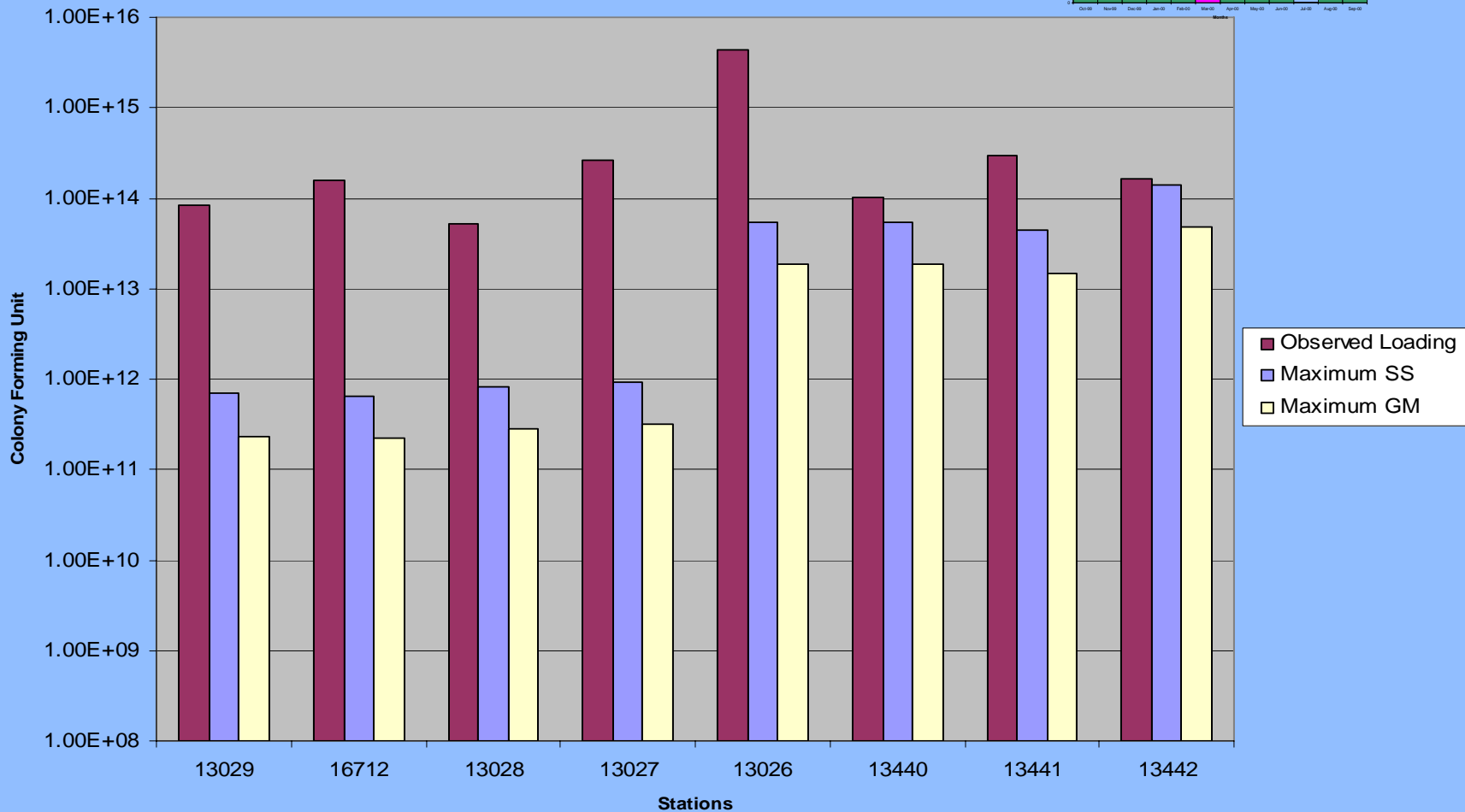
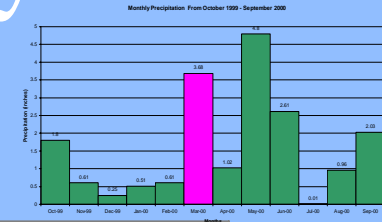


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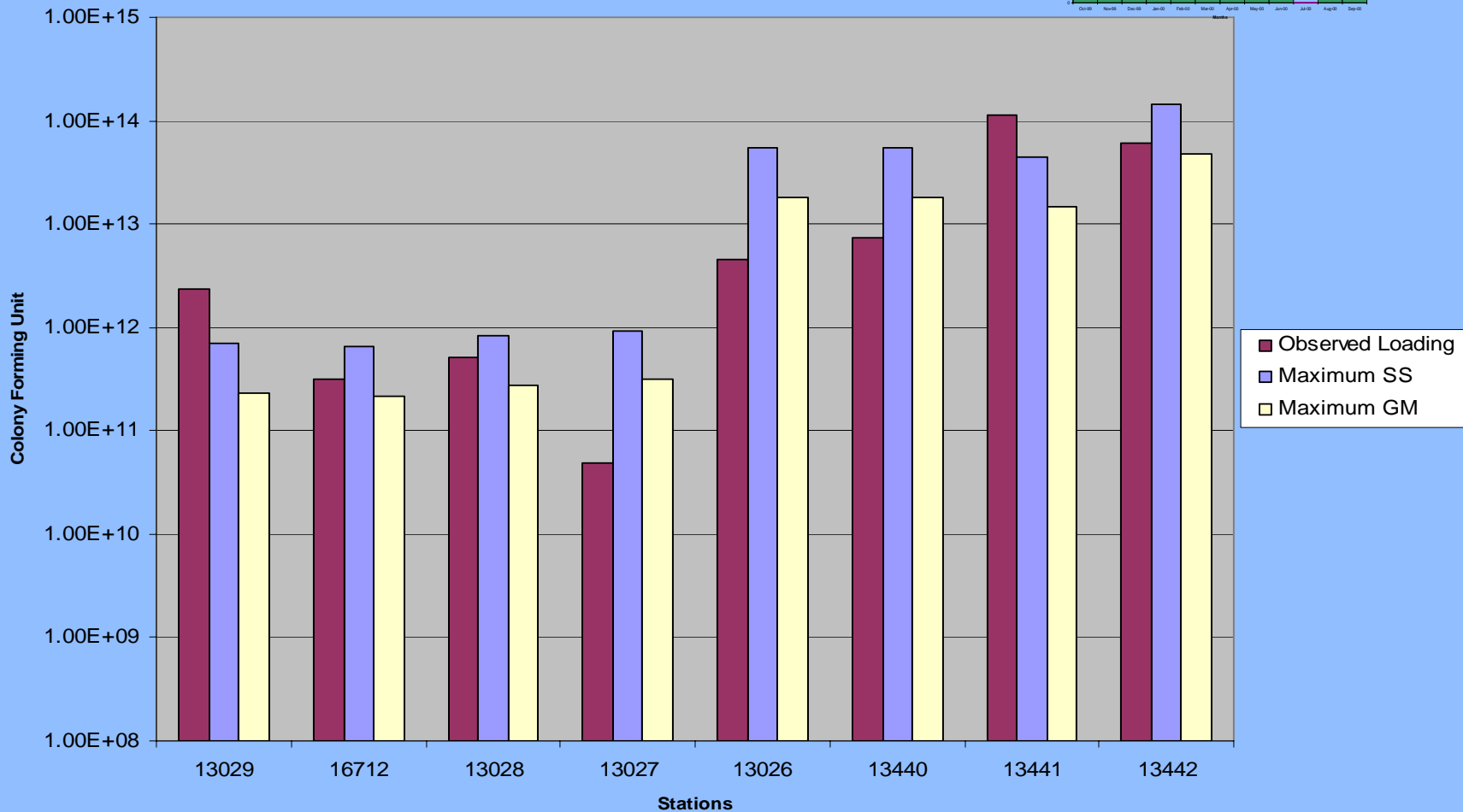
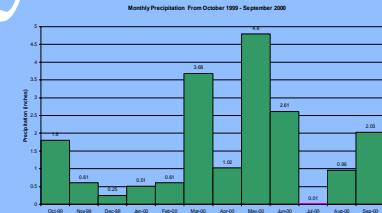
Observed Average Daily Loading

March 2000



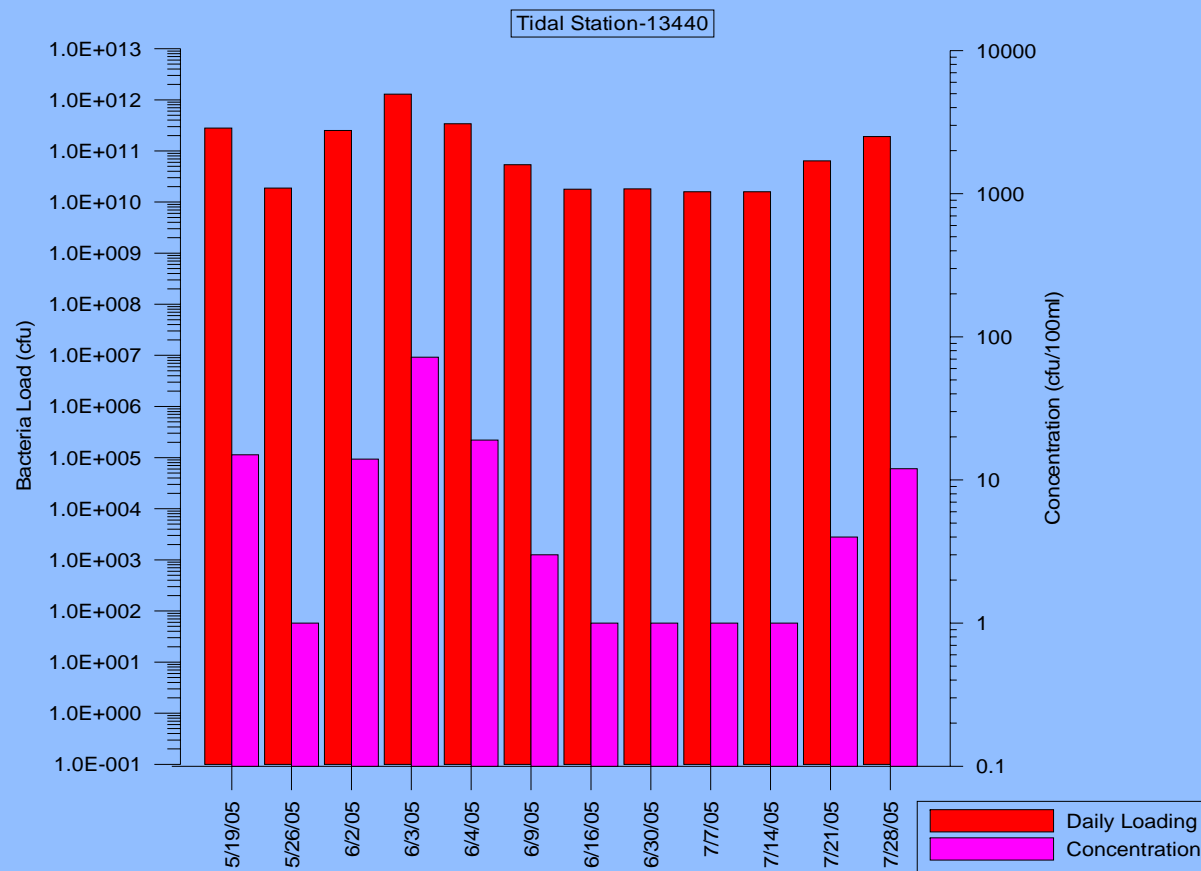
Observed Average Daily Loading

July 2000



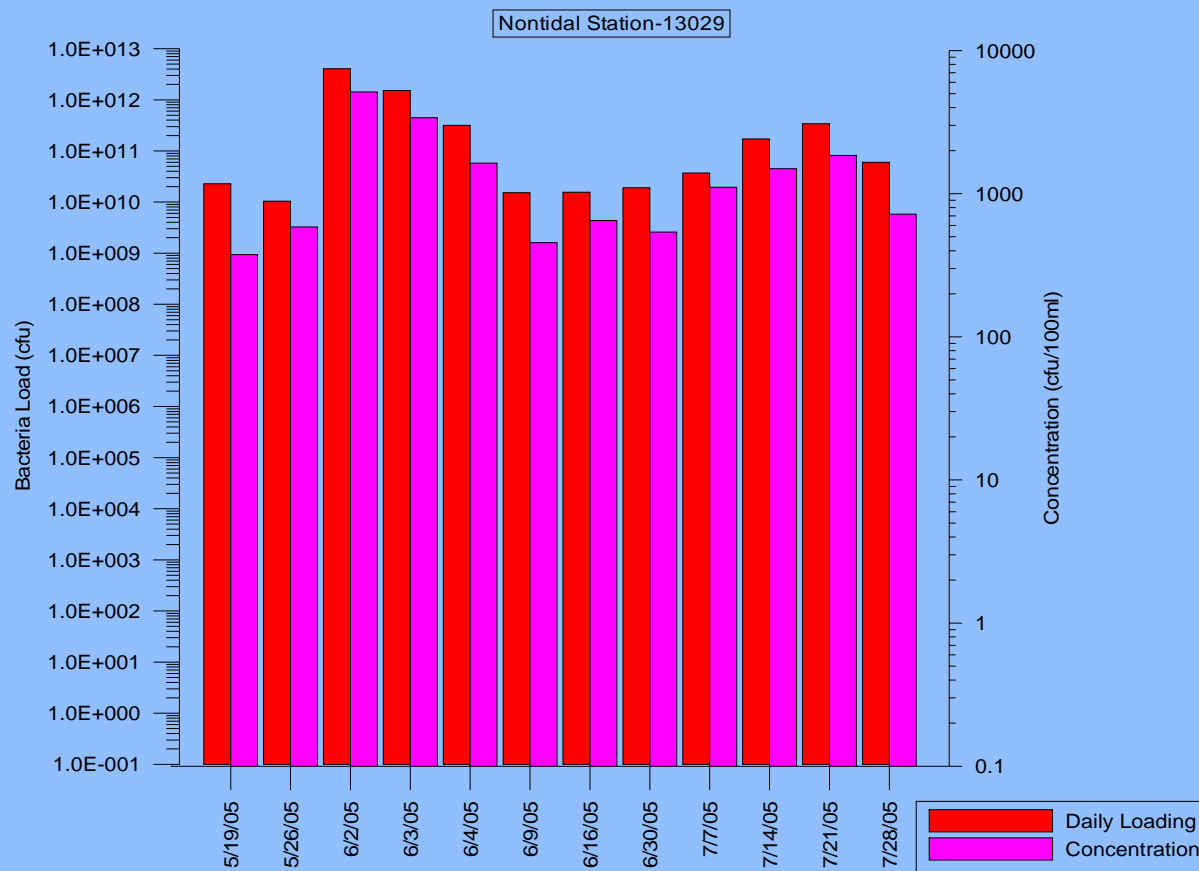
Loading and Concentration 13440

Oso Creek at FM 763



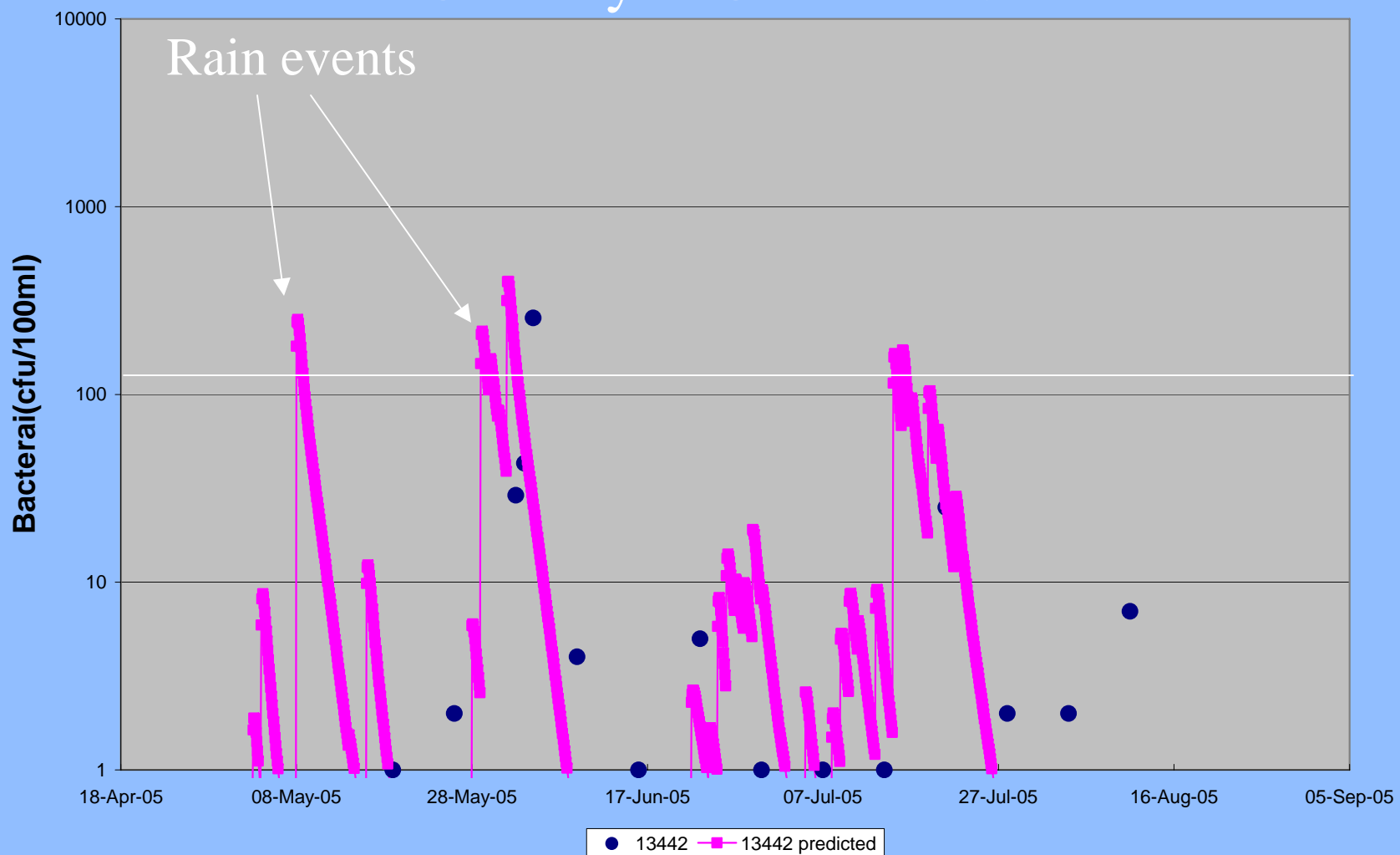
Loading and Concentration 13029

Oso Creek at FM 763



Modeling results 13442

Oso Bay at Ocean Drive



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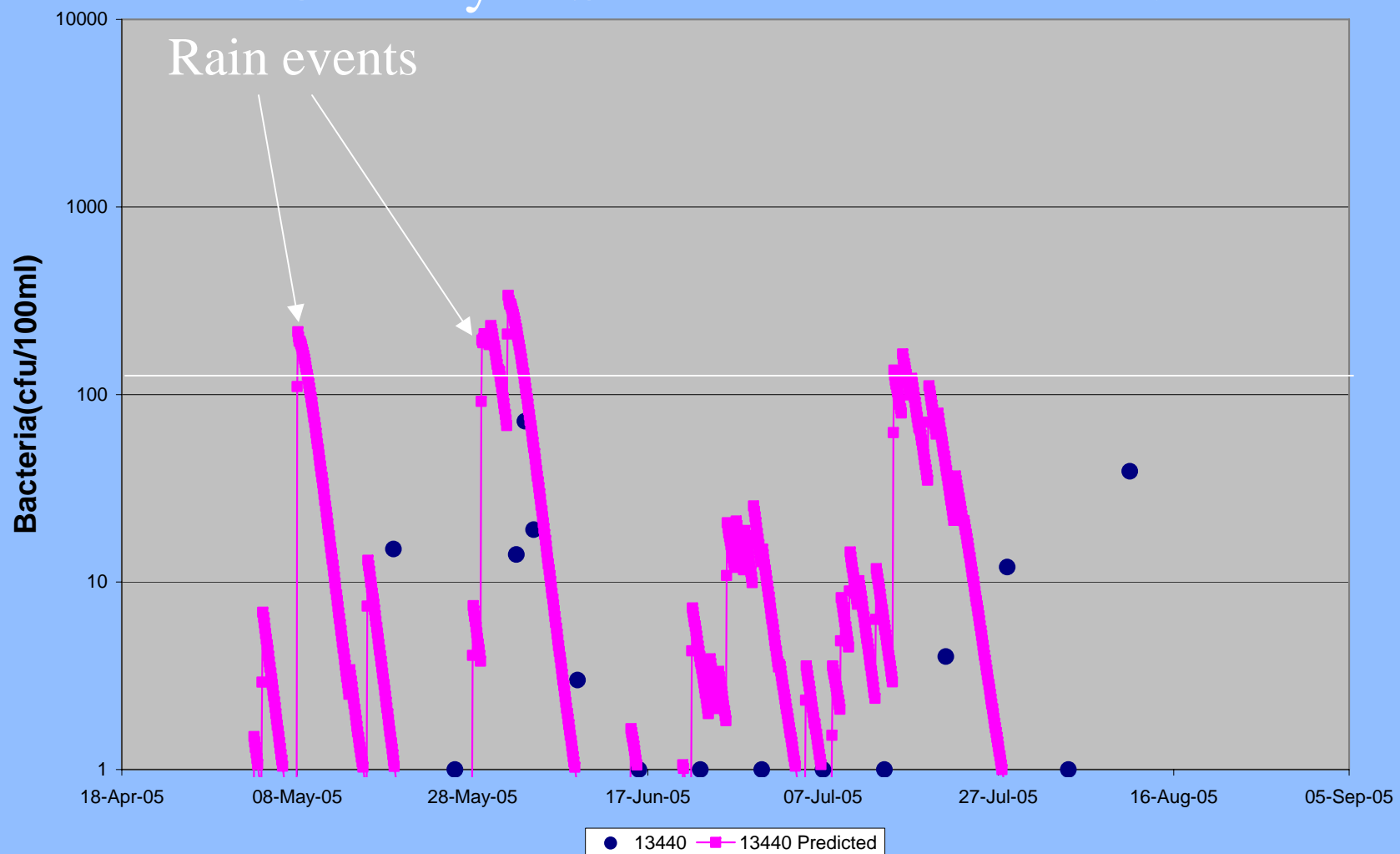
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Modeling results 13440

Oso Bay at South Padre Island Drive



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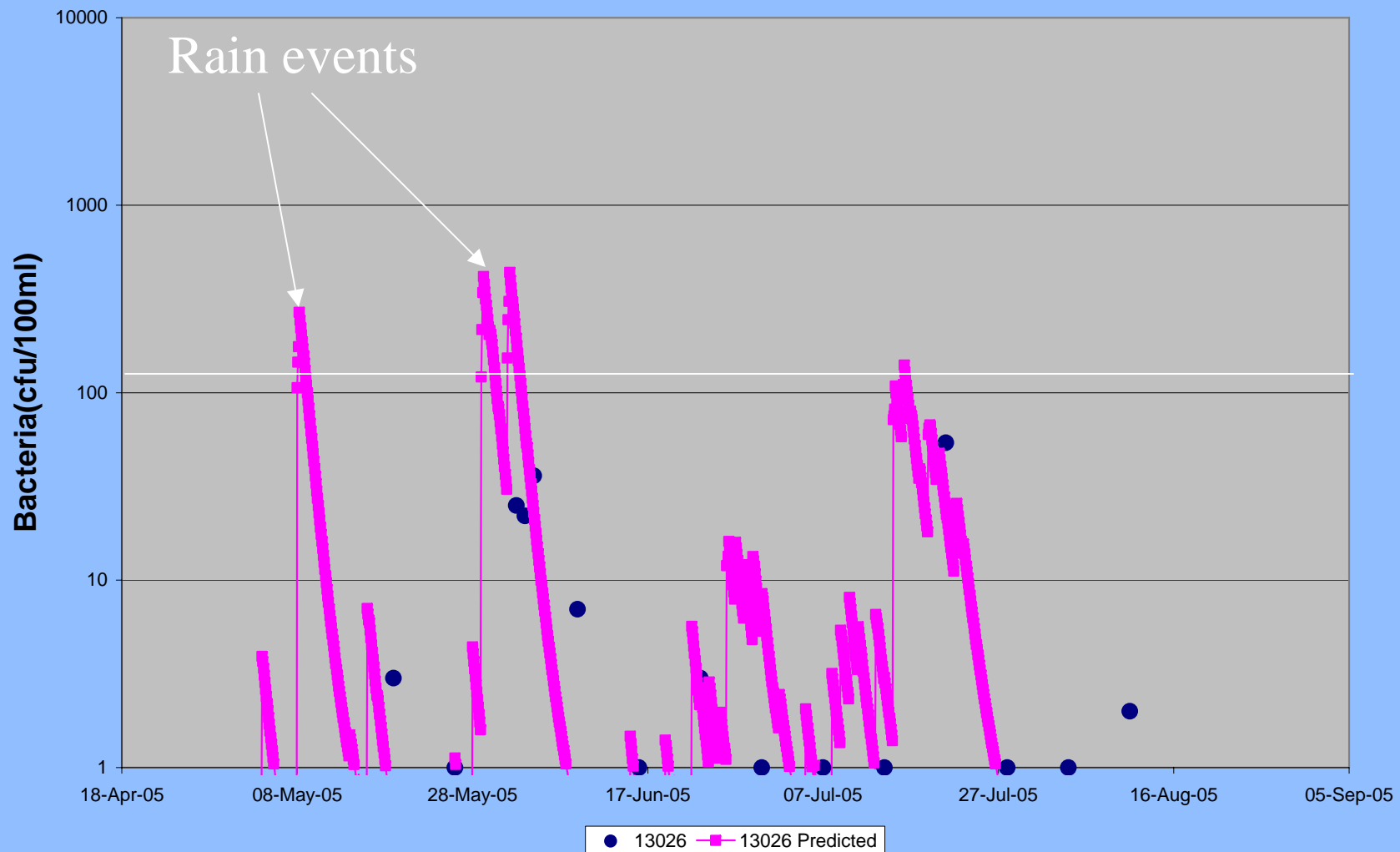
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Modeling results 13026

Oso Bay at Yorktown



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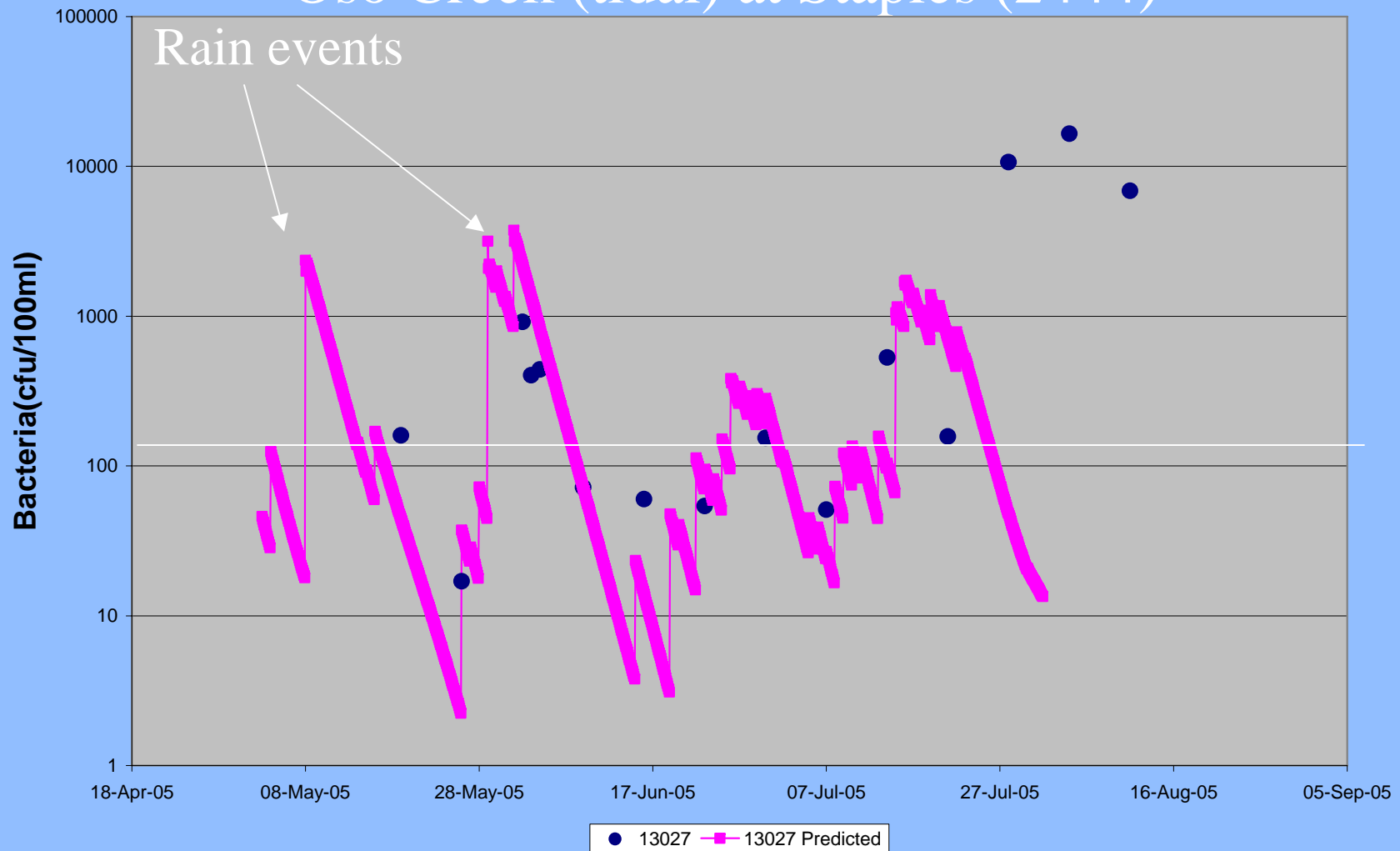
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Modeling results 13027

Oso Creek (tidal) at Staples (2444)



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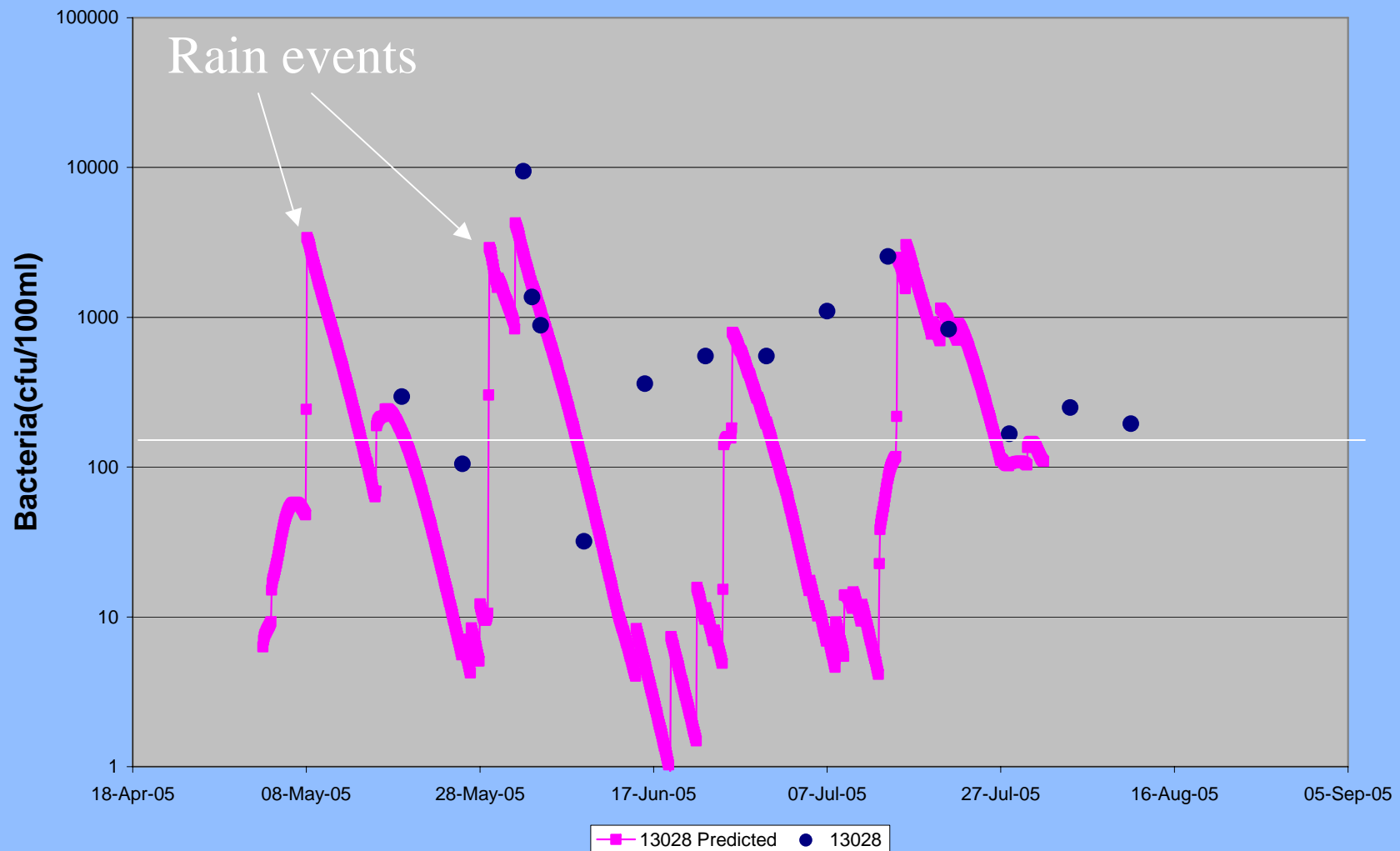
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Modeling results 13028

Oso Creek (tidal) at Ayers (286)



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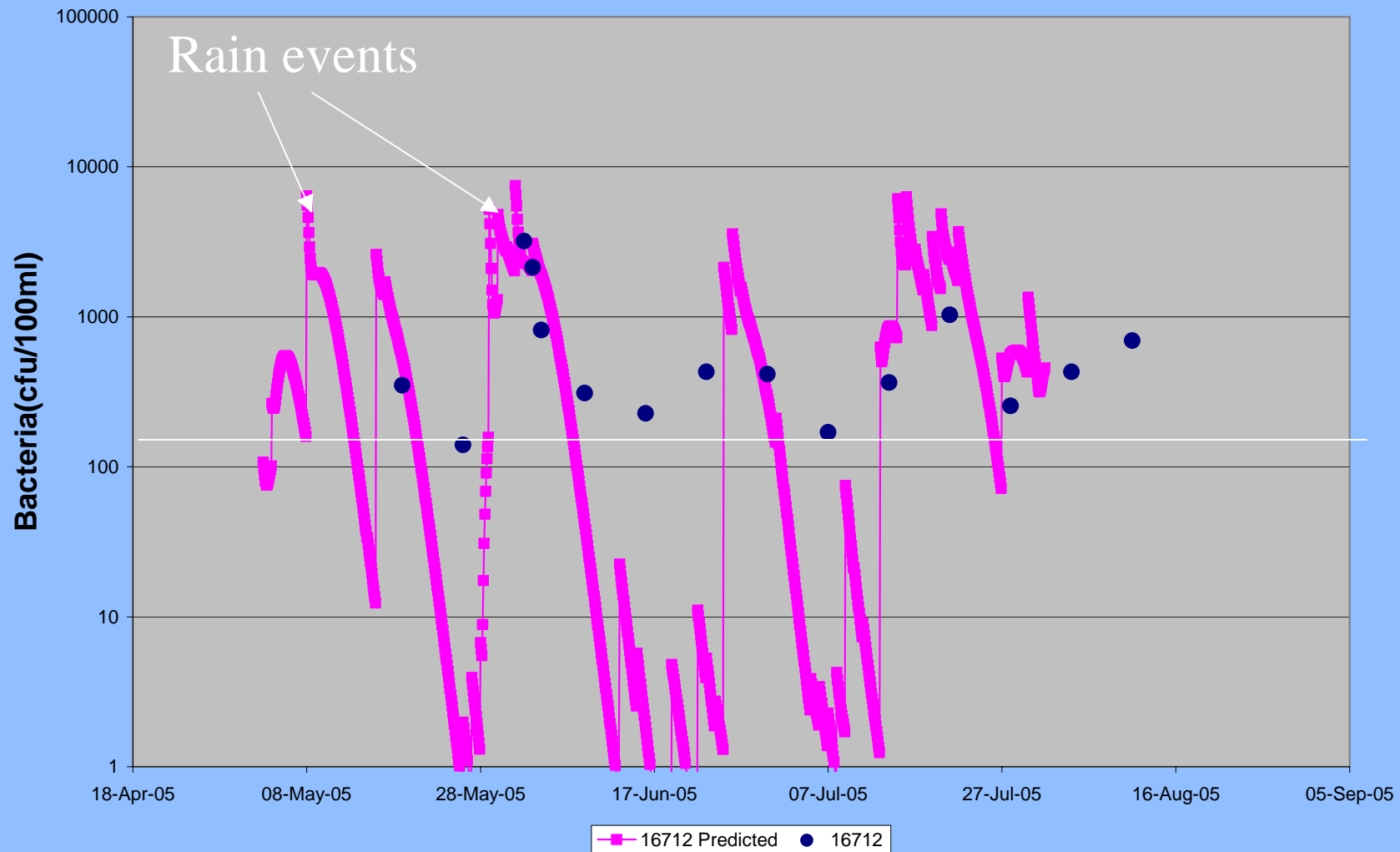
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Modeling results 16712

Oso Creek (tidal) near Greenwood WWTP



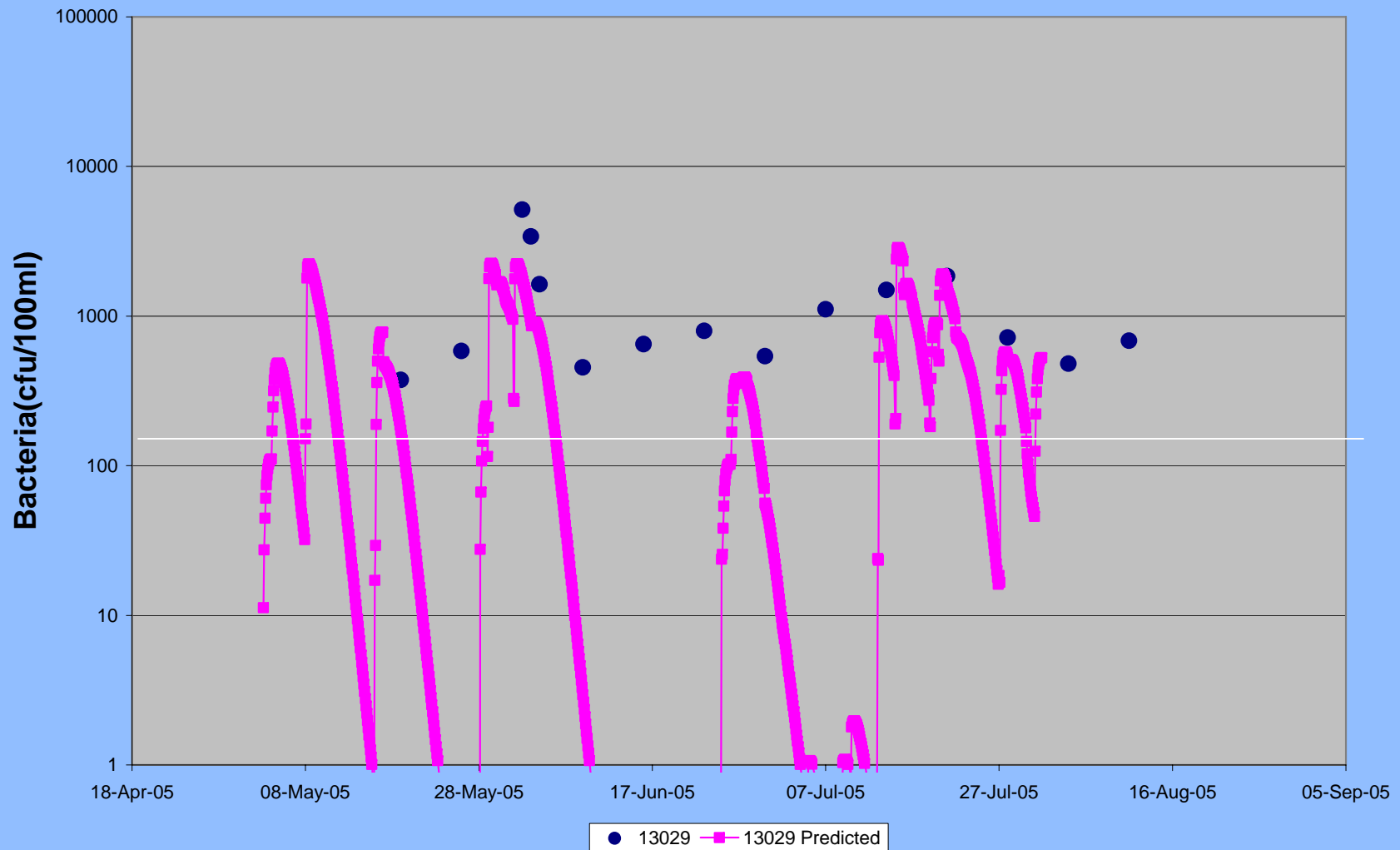
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Modeling results 13029

Oso Creek at FM 763



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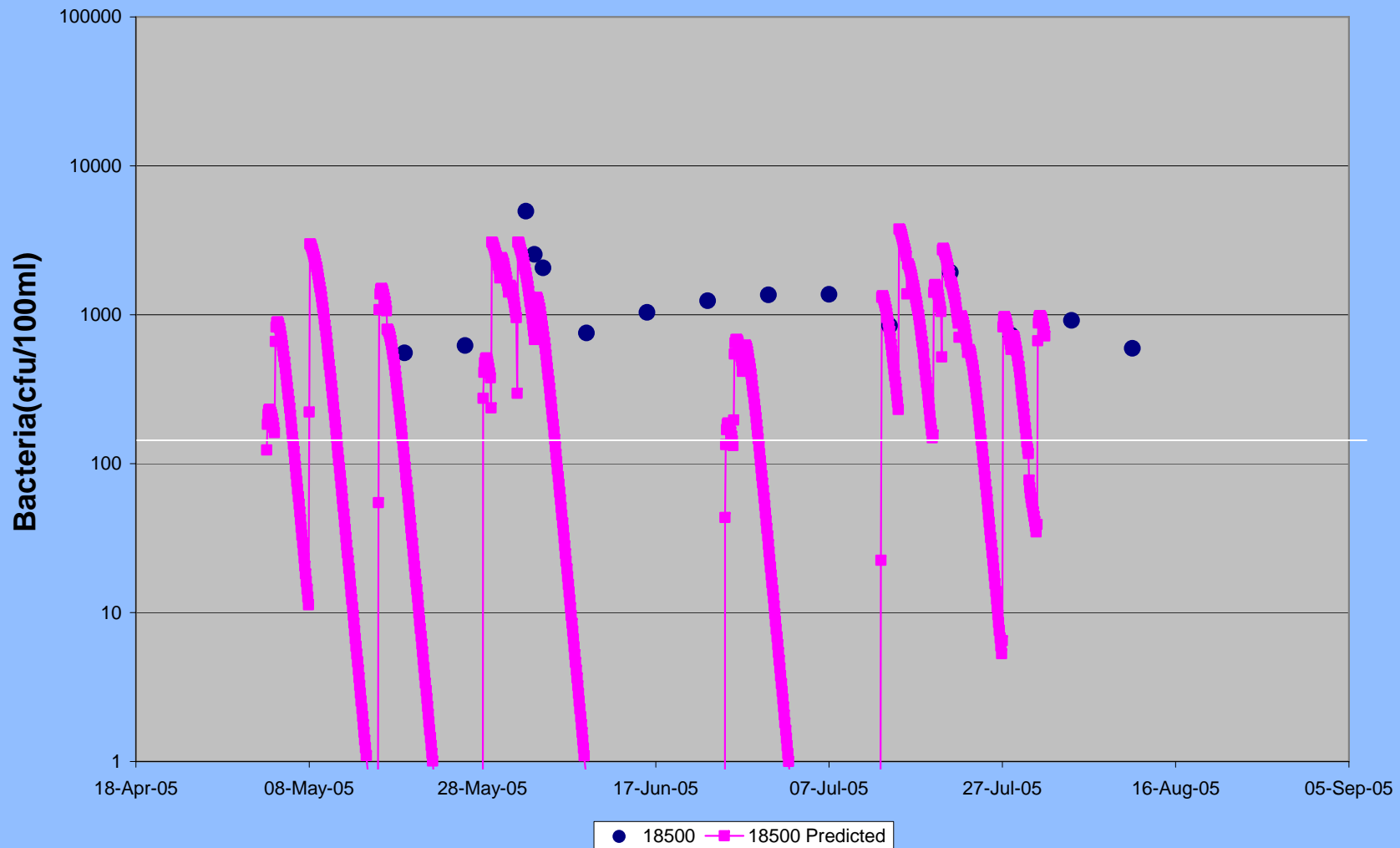
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Modeling results 18500

Oso Creek at FM 665



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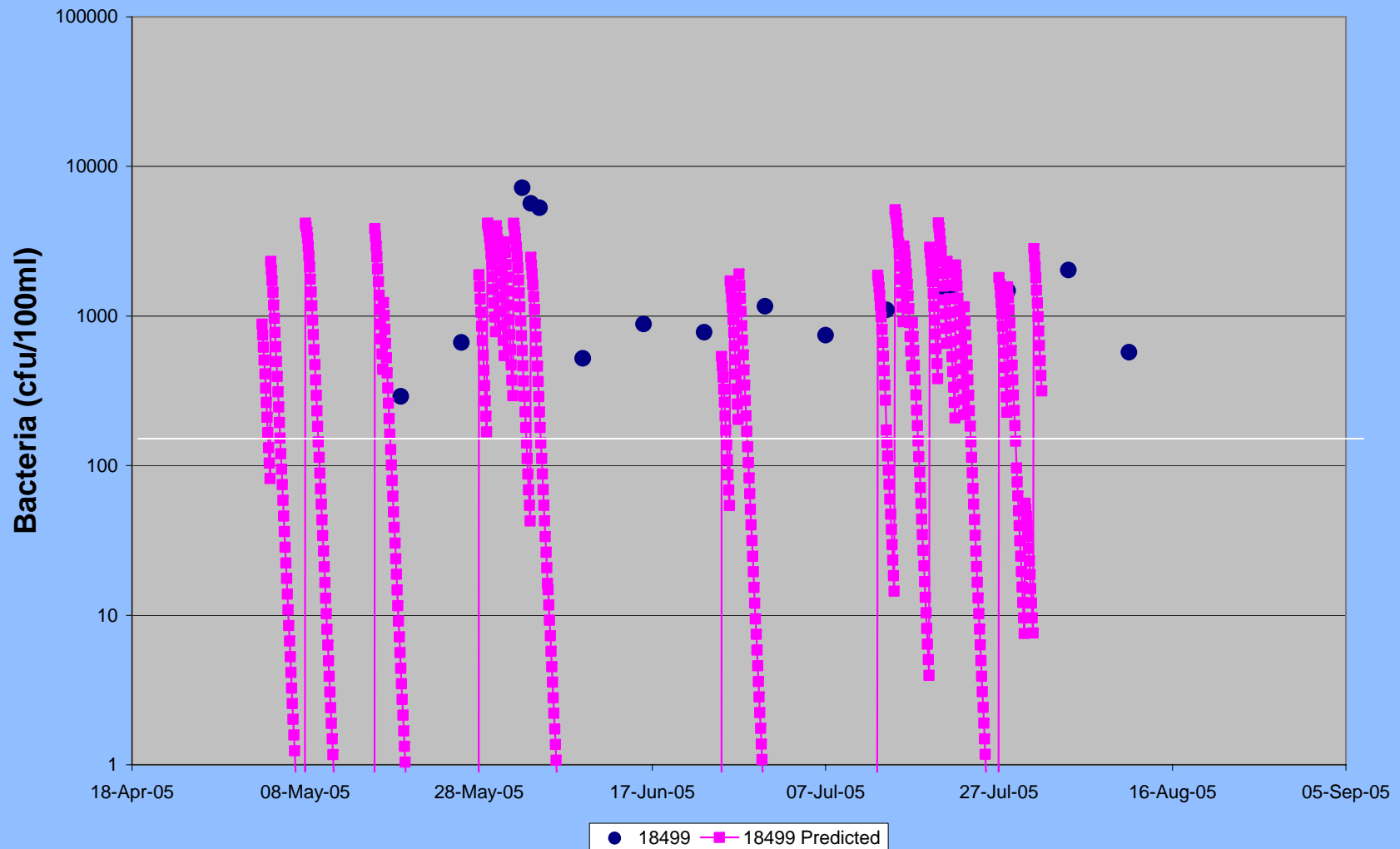
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Modeling results 18499

Oso Creek at SH 44



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Data Gaps

- Measured Concentrations higher than maximum possible using established EMC grids.
- Measured values high with no apparent inputs (runoff).
- Avian Loading.
 - Census and location of avian populations.
- Septic system EMCs.
 - New developments on OSS.
- Groundwater contribution (from septic systems).



Observations

- Model captures runoff event process
- Overall, model forecasts lower concentrations than measured.
- Modeling with new data indicates additional flux of bacteria not related to runoff.
 - Flux is noticeable during dry conditions
 - Probably wouldn't have seen it with out weekly sampling



Observations

- Upstream – nontidal
 - High concentrations without traditional nonpoint source input.
 - Loading increases with runoff.
 - Some concentrations increase without runoff input.
 - Indicates small flux from another source.
 - Groundwater, roosting areas, etc.
- Upstream – tidal.
 - High values without traditional nonpoint source input.



Summary

- Investigate low concentrations throughout model.
 - Adjust bird load inputs.
 - Use higher EMC values.
 - Loading curve to adjust EMC values.
 - Recalculate EMC values by compensating for decay.
- Investigate issues with event mean concentrations.
- Use runoff event data to estimate/adjust EMC's
 - New concentrations for cropland.
 - EMC for septic systems?
 - Back-calculate EMC.
- Model Verification.
 - Run simulation on new data .



Questions?

