

Evaluation of Nitrogen and Phosphorus Levels in Sediments Deposited in the Laguna de Santa Rosa

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Abstract

The water in the Laguna de Santa Rosa has unhealthy levels of sediment, temperature, dissolved oxygen, nitrogen, phosphorus, and mercury. Copeland Creek is a tributary of the Laguna de Santa Rosa that flows through the Sonoma State University campus. This research project evaluates the levels of nitrogen and phosphorus in fine grain sediments deposited along Copeland Creek and the Laguna de Santa Rosa. We sampled sediment deposits starting upstream at the Fairfield Osborn Preserve and as the creek passed vineyards and urban drainage areas. Downstream sampling sites included the Laguna de Santa Rosa and a drainage ditch on a dairy farm. We found that as sediment flows from Sonoma Mountain down through agricultural, and then urban areas, that the nitrogen and phosphorus levels increased. These results indicate that the creation of sediment settlement basins upstream could limit the amount of nitrogen and phosphorus reaching the Laguna de Santa Rosa.

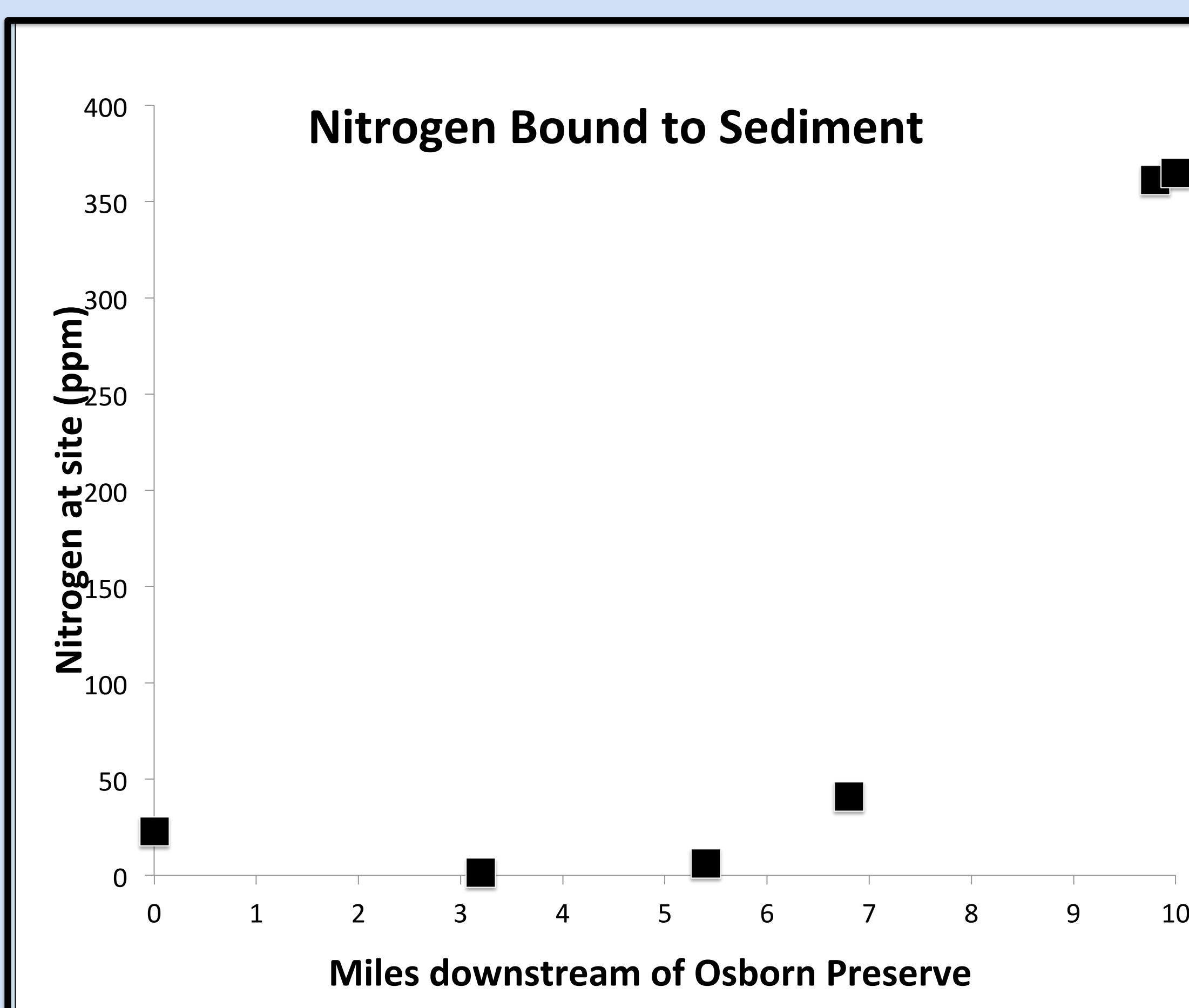
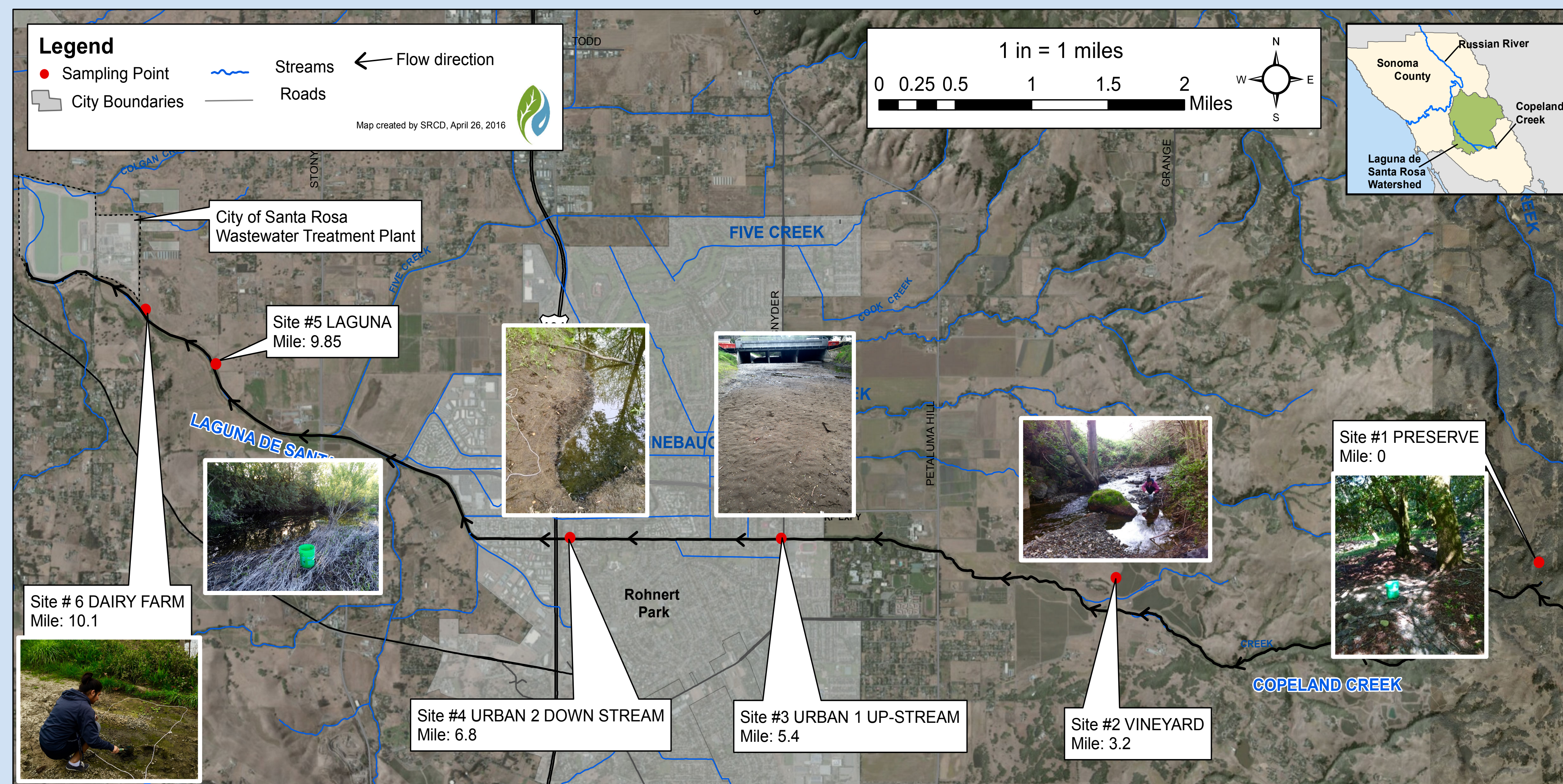
Experimental Design

- At each site, eight samples of approximately 500 mL of surface sediment randomly collected from a plot size of approximately 1 m² were combined to create a composite sample for each site.
- After drying and weighing the composite sample, organic material was removed and it was ground up to remove clumps. The sediment was then passed through a series of 9 sieves.
- The finest grain particles (passed through a sieve with a mesh size of 63 microns) were analyzed by the Laguna Treatment plant for total nitrogen and total phosphorus levels.

Results

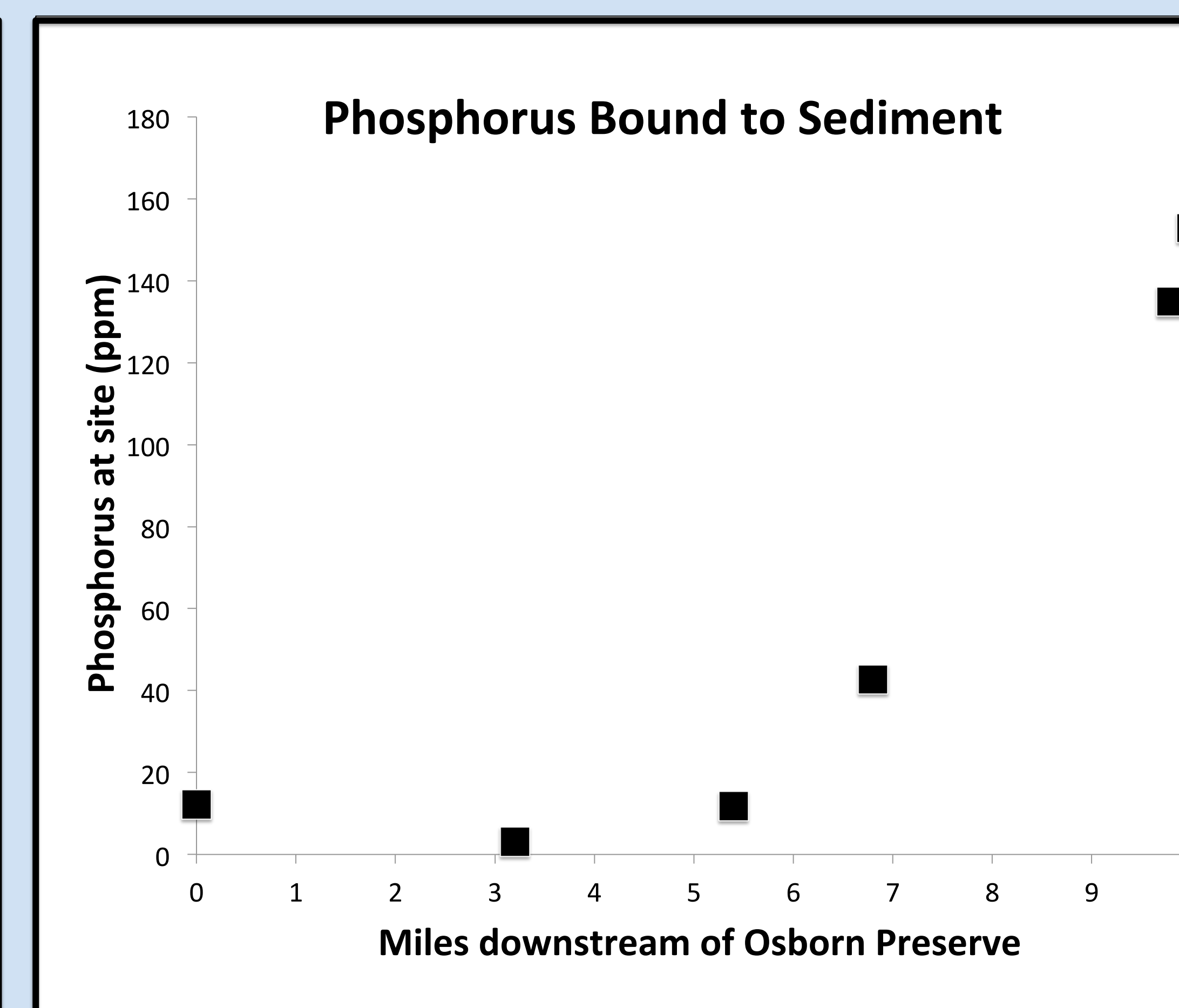
Site	Total sample weight	Fine grain weight	% fine grain sediment	Miles from Osborne Preserve
Osborn Preserve	817.5	15.5	1.9	0
Vineyard	2480.4	10	0.4	3.2
Urban 1 upstream	2298.5	36.1	1.57	5.4
Urban 2 downstream	822.5	54.9	6.67	6.8
Main stem Laguna de Santa Rosa	174	32.2	18.51	9.85
Dairy farm drain	690.4	148.1	21.45	10.1

Figure 1: Percent fine grain sediment for each sample was calculated by dividing the fine grain fraction weight by the total sample weight and multiplying by 100.



Site	Nitrogen in fine grain (ppm)	Nitrogen at site (ppm)
Osborn Preserve	1200	22.8
Vineyard	360	1.4
Urban 1 upstream	400	6.3
Urban 2 downstream	615	41.0
Main stem Laguna de Santa Rosa	1950	361.0
Dairy farm drain	1700	364.7

Figure 2: Nitrogen at site was calculated by multiplying the "percent fine grain sediment" value by the "nitrogen in fine grain" value and dividing by 100.



Site	Phosphorus in fine grain (ppm)	Phosphorus at site (ppm)
Osborn Preserve	641	12.2
Vineyard	770	3.1
Urban 1 upstream	754	11.8
Urban 1 downstream	640	42.7
Main stem Laguna de Santa Rosa	729	134.9
Dairy farm drain	713	152.9

Figure 3: Phosphorus at site was calculated by multiplying the "percent fine grain sediment" value by the "phosphorus in fine grain" value and dividing by 100.

Conclusions

- The percentage of fine grain sediment increases proportionally with distance as we move downstream. This was expected because as the sediment is carried downstream, it gets broken into smaller and smaller pieces.
- The amount of nitrogen and phosphorus bound to sediment increases as we move downstream. Possible sources of nutrients are the ponds above the Osborn Preserve, fertilizers, animal manure, and urban runoff.
- Our results indicate that allowing the fine grain particles time to drop out in a settlement basin could prevent accumulation of nitrogen and phosphorus in the Laguna de Santa Rosa.

Future Directions

- Validate results by re-sampling the existing sites.
- Check for seasonal variation by sampling at different times of the year.
- Sample in between sites for indications of where the nutrients are entering the waterway.
- Since the nitrogen level was higher at the Osborn Preserve than in other parts of Copeland Creek, further analysis of sediment from the Osborn Preserve for levels of nitrogen is warranted.



Acknowledgements

- Mike Thompson, Santa Rosa Water Agency
- Rita Miller, Laguna Treatment Plant
- Rachel McCormick, Laguna Treatment Plant
- Kari Wester, Sonoma County Resource Conservation District
- Suzanne DeCoursey, SSU Center for Environmental Inquiry
- Wayne Haydon, California Geological Survey

