DEP Agreement No.: G0024

Grantee Name: University of Florida, Department of Agricultural and Biological Engineering

Grantee Address: PO Box 110570, Rogers Hall, University of Florida, Gainesville Florida 32611-0570

Grantee's Grant Manager: Wendy Graham

Quarterly Reporting Period: March 31- 2005- June 30, 2005

Project Title: Demonstration of Water Quality Best Management Practices for Beef Cattle Ranching in the Lake Okeechobee Basin

Provide a summary of project accomplishments (Include a comparison of actual accomplishments to the objectives established for the period. If goals were not met provide reasons why)

1) Task 1: The Project work plan is complete.

2) Task 2: Identification of cooperators is complete.

3) Task 3: Nutrient Management Assessments have been obtained from NRCS and DACS.

4) Task 4: Selecting specific sites for BMP demonstration is complete.

4) Task 5: Site Instrumentation and Baseline Monitoring.

Surface and Ground Water Monitoring

Flume water stage and weather data collection is ongoing. During the last quarter it was agreed that to maximize the scientific utility of the dataset being collected at Pelaez Ranch the pre-BMP period will be extended through October 2005. This is necessary because due to the adverse weather conditions (drought then 4 hurricanes) that occurred during 2004 we did not get a representative or reliable pre-BMP data set.

Within the current budget the post-BMP period will run from October 2005 through April 2006. If further funds can be acquired the post-BMP period will be extended through October 2006, and the total project period through the end of December 2006.

Locations of the surface and ground water monitoring lcoations are shown in Figures 1 and 2, respectively. The flow data collected at the Flume 1 through Flume 5 for the March-June periods are shown in Figures 3 to 20. Maximum observed flow rate for the five flumes varied from 14.6 cfs for flume 5 to 3.9 cfs for flume 4. The flow contributing area for flume 5 includes the entire ranch.

Water Quality Data

Monthly ground water quality samples were taken during the monitring period and were shipped to UF-IFAS lab in Gainesville. Depending on the flow conditions, surface water grab samples were also taken. Flow-based water quality samples were also taken during the period. Once the water quality analyses data is available, it will be combined with the flow data to generate the nutrient (N and P) loading and discussed in the next quartelry report. The available ground water quality data between flumes 5 and 2-3 and the two wetlands are shown in Figures 23 through 26. The water quallity data for the March – June period is expected to be processed and available within the next 3 months. Actual nutrient ldicharges for the period will be included in the next quarterly report.

We plan to deploy the passive flux meters (PFMs) in all wells in Fall 2005 to directly measure groundwater and phosphorus flux. Each well will receive a PFM the length of the well screen. The PFMs will use an anion exchange resin with alcohol tracers. The resins are designed to sorb phosphorus and slowly release tracers as a function of the groundwater velocity moving through the device. The mass of alcohol released at each well is less than ounce and since these are degraded in the environment we expect they will persist for a short period of time after leaving the well. The PFMs will be deployed for a period of one month then extracted for sampling. The resins will be tested for phosphorous and tracers. The results will be used to calculate the local groundwater flow velocity and the phosphorous mass flux over the one month period.

Ditch P Retention Study

Improved pastures in the Okeechobee Basin contain extensive drainage ditch networks. In addition to facilitating drainage for cow-calf production, these drainage networks provide a means to reduce phosphorus (P) loading from pastures through biological and chemical retention. The effect of storing water in drainage ditches under varying runoff P concentrations was evaluated using in-situ benthic mesocosms (Figure 27). Nutrient concentrations of the water inside the mesocosms were altered to promote P flux across the sediment-water interface. Four treatments (representing four P concentrations levels) were tested in triplicate across two drainage ditches near Flume 4 and 5 sites (figure 27). Nutrient concentrations in the water-column were monitored over 7 days. Results indicate that drainage ditch sediments possess a high P-retention capacity, closely related to sediment aluminum and iron contents. Soluble reactive phosphorus (SRP) retention over 7 days varied from 13 to 55% of the starting water-column concentration (Collins, 2005). Results indicated that P uptake is greater and releases more rapidly in drainage ditches with organic sediment compared to ditches with mostly mineral sediment. Results show that retaining ditch water for at least 4 days can be an effective BMP for reducing net discharge of P from cow-calf operations. Since the study was done in standing water column and did not include the reductions in P discharge due to reducing the drainage volumes, the actual reductions due to water retention under field conditions may be higher than those reported here.

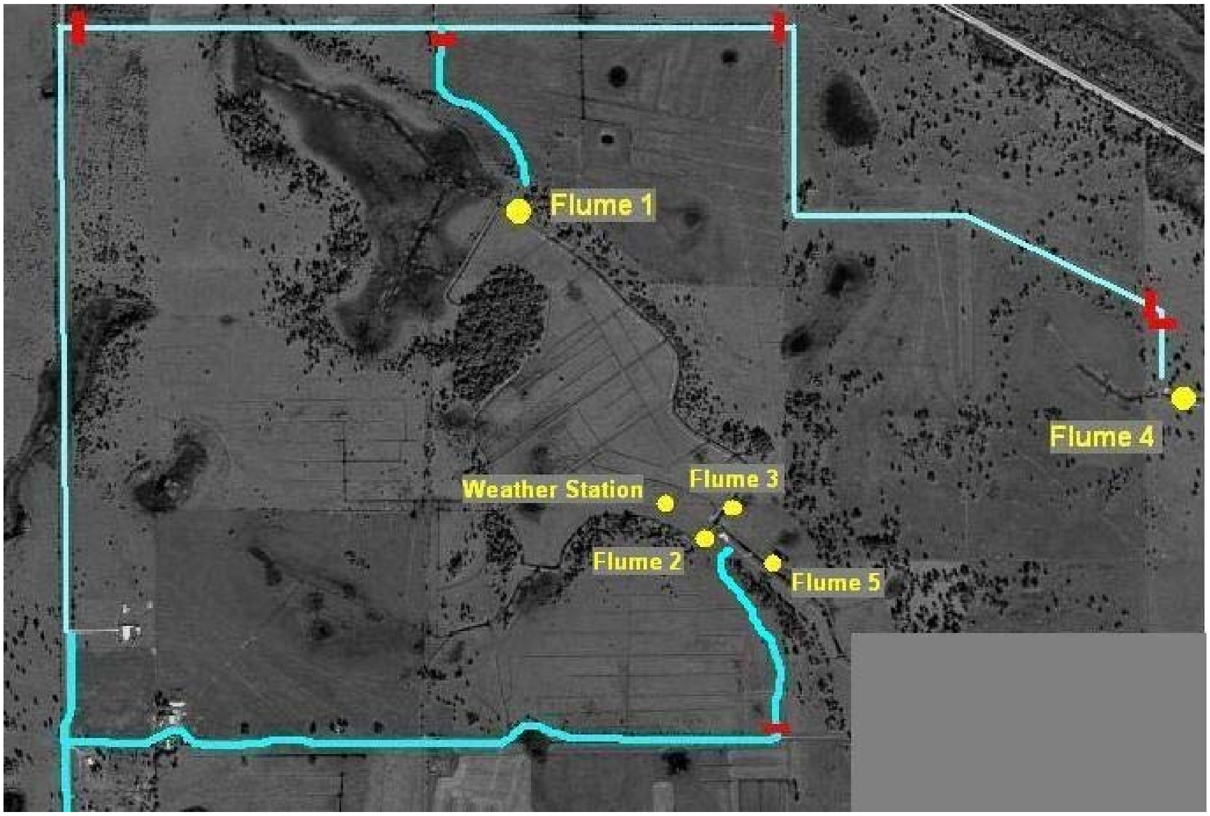

Figure 1. Locations of surface water quantity and quality and weather monitoring stations.

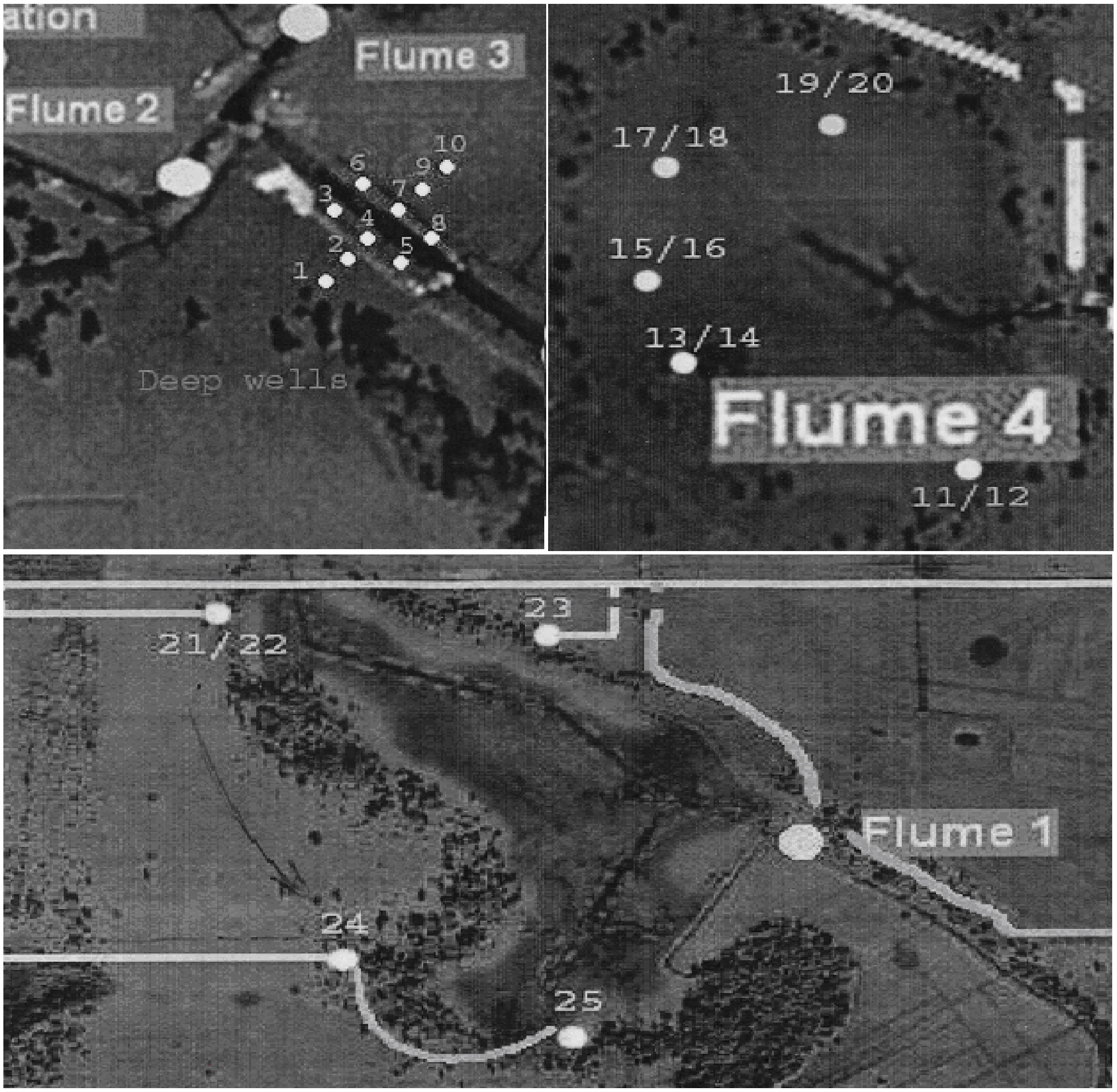

Figure 2. Locations of the ground water wells.

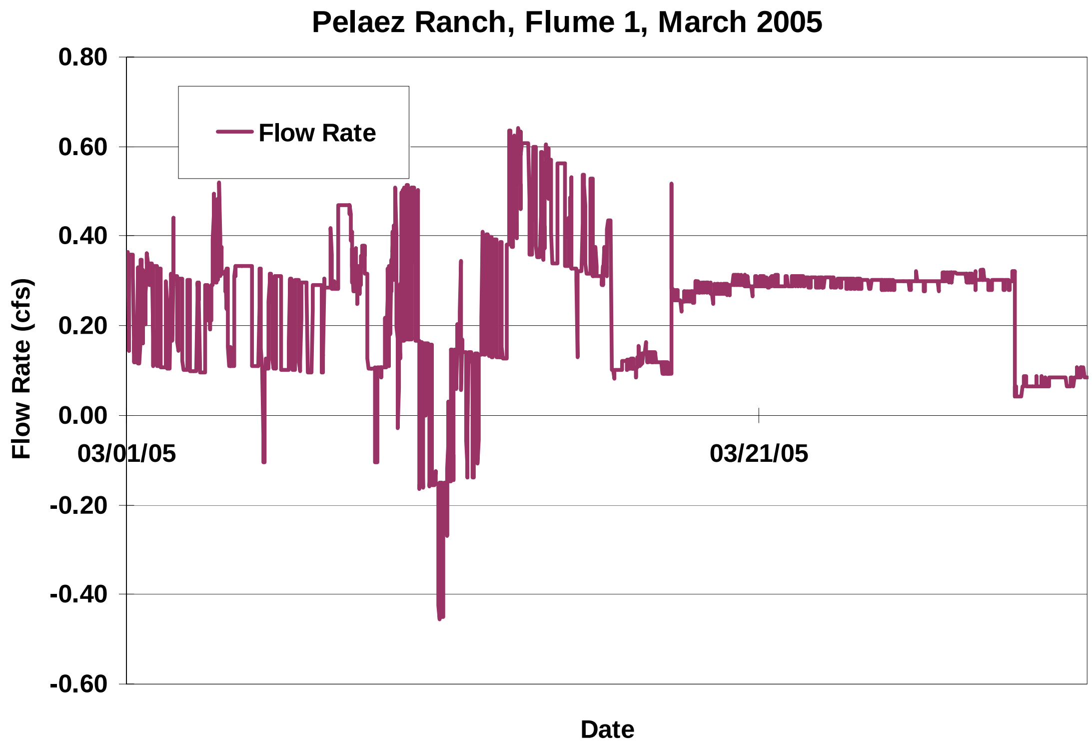

Figure 3. Flow rate (cfs) during March 2005 as measured at Pelaez ranch flume 1.

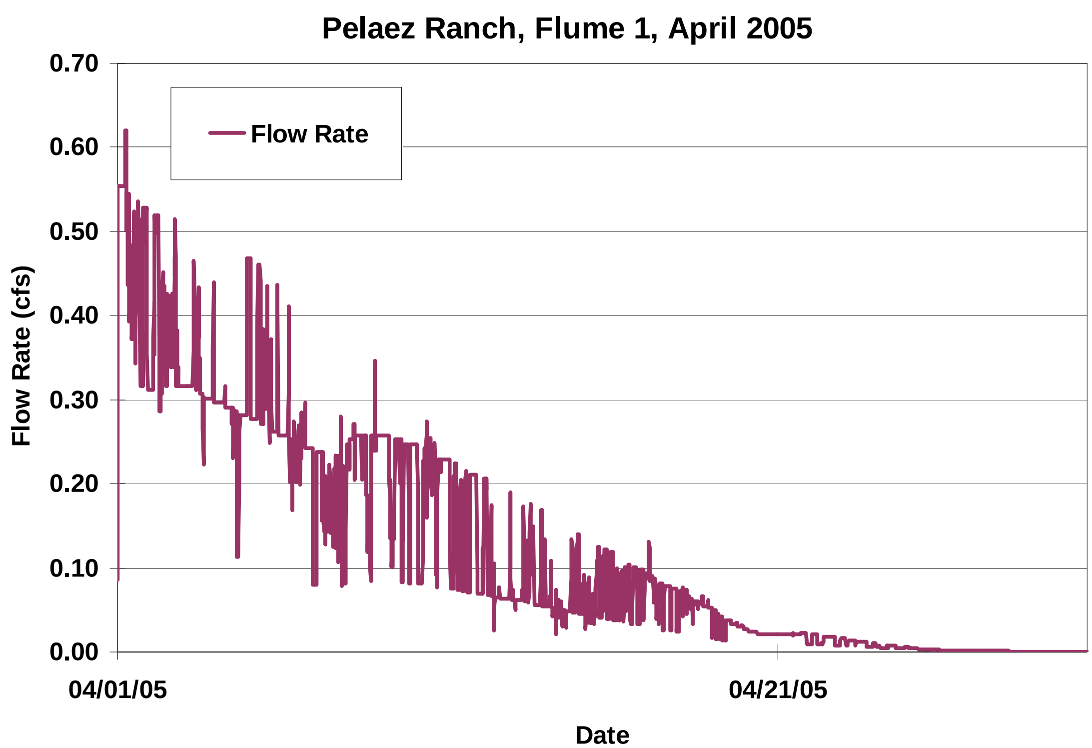

Figure 4. Flow rate (cfs) during April 2005 as measured at Pelaez ranch flume 1.

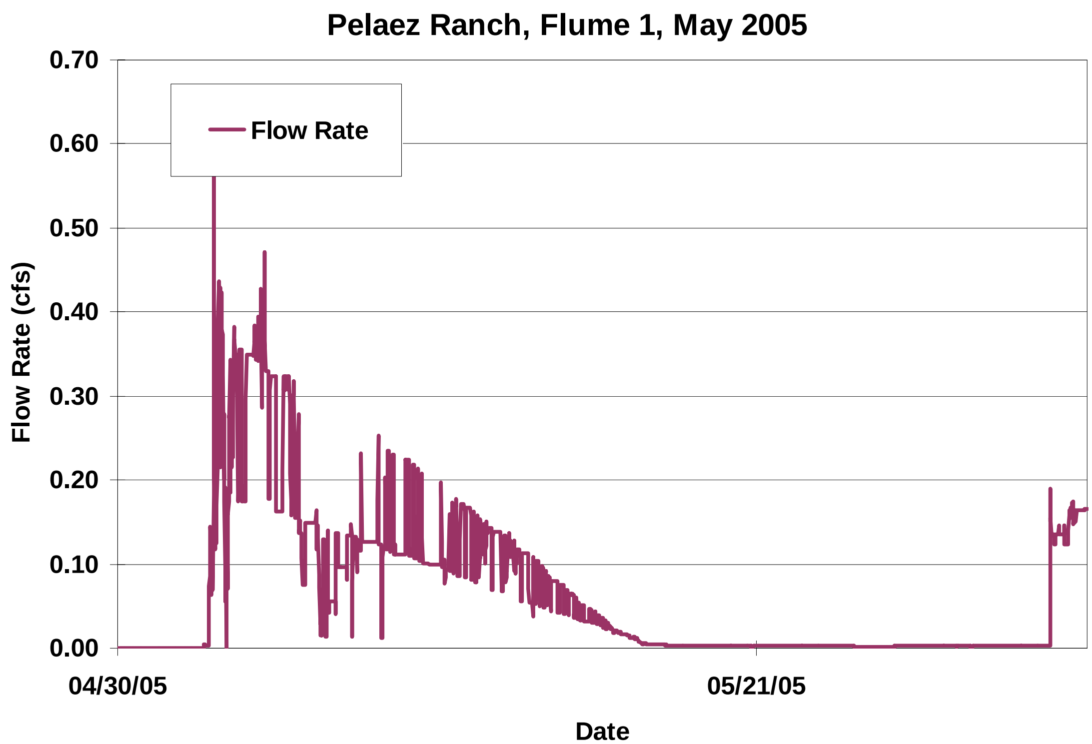

Figure 5. Flow rate (cfs) during May 2005 as measured at Pelaez ranch flume 1.

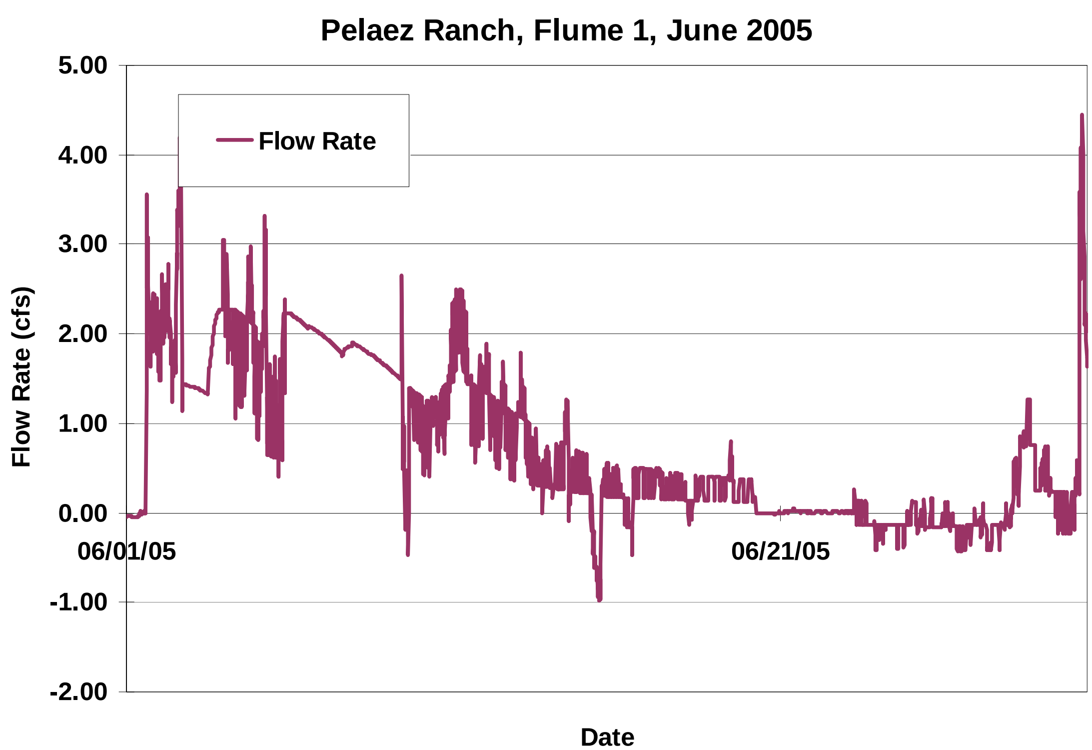

Figure 6. Flow rate (cfs) during June 2005 as measured at Pelaez ranch flume 1.

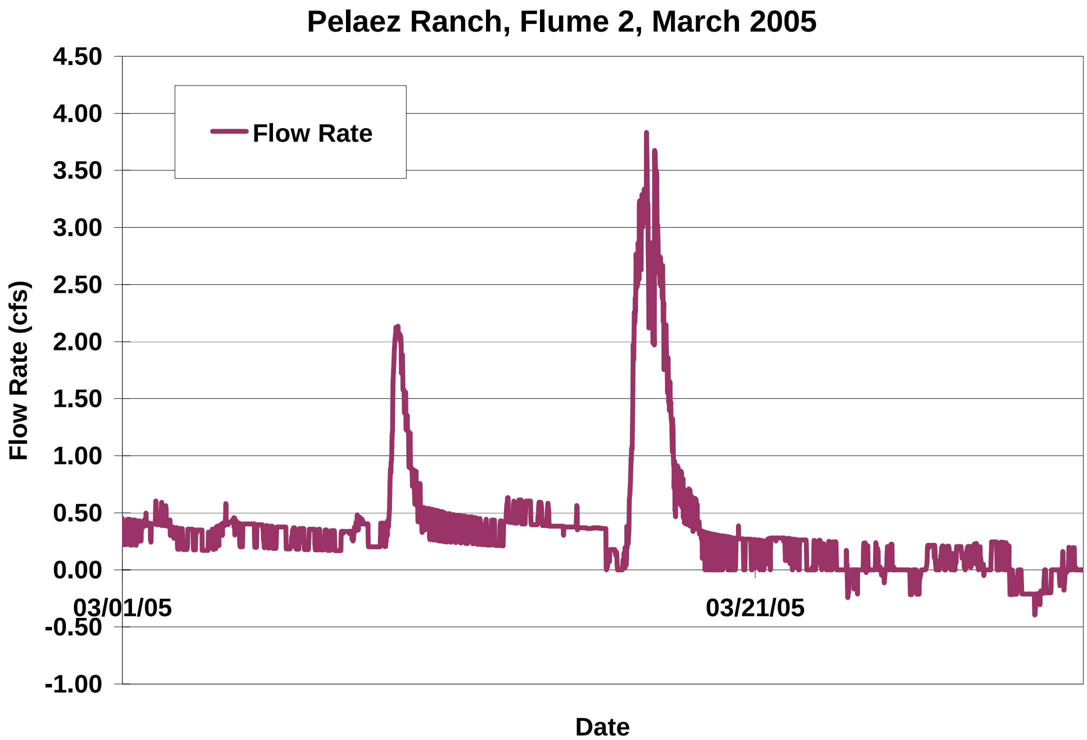

Figure 7. Flow rate (cfs) during March 2005 as measured at Pelaez ranch flume 2.

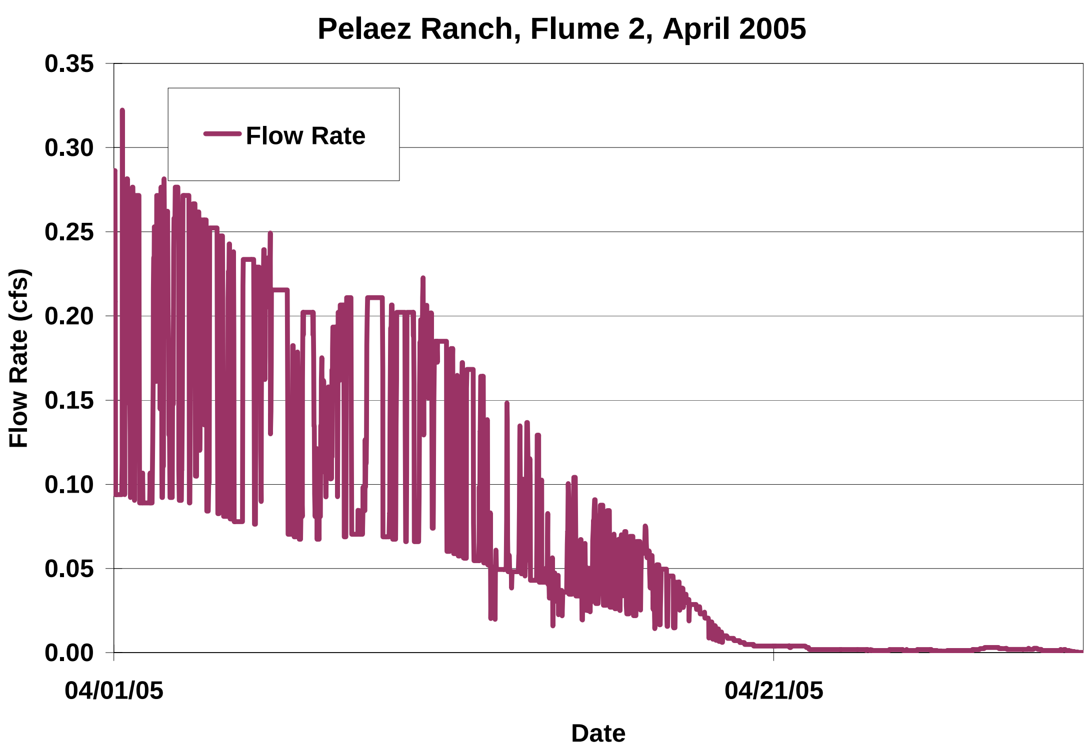

Figure 8. Flow rate (cfs) during April 2005 as measured at Pelaez ranch flume 2.

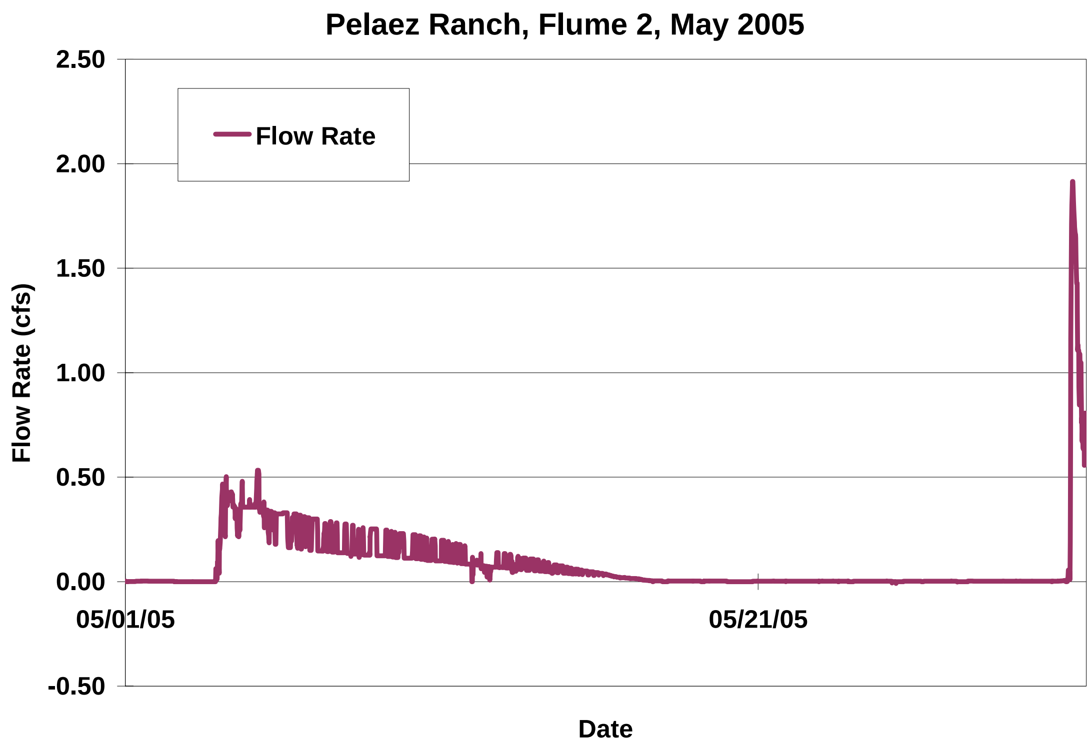

Figure 9. Flow rate (cfs) during May 2005 as measured at Pelaez ranch flume 2.

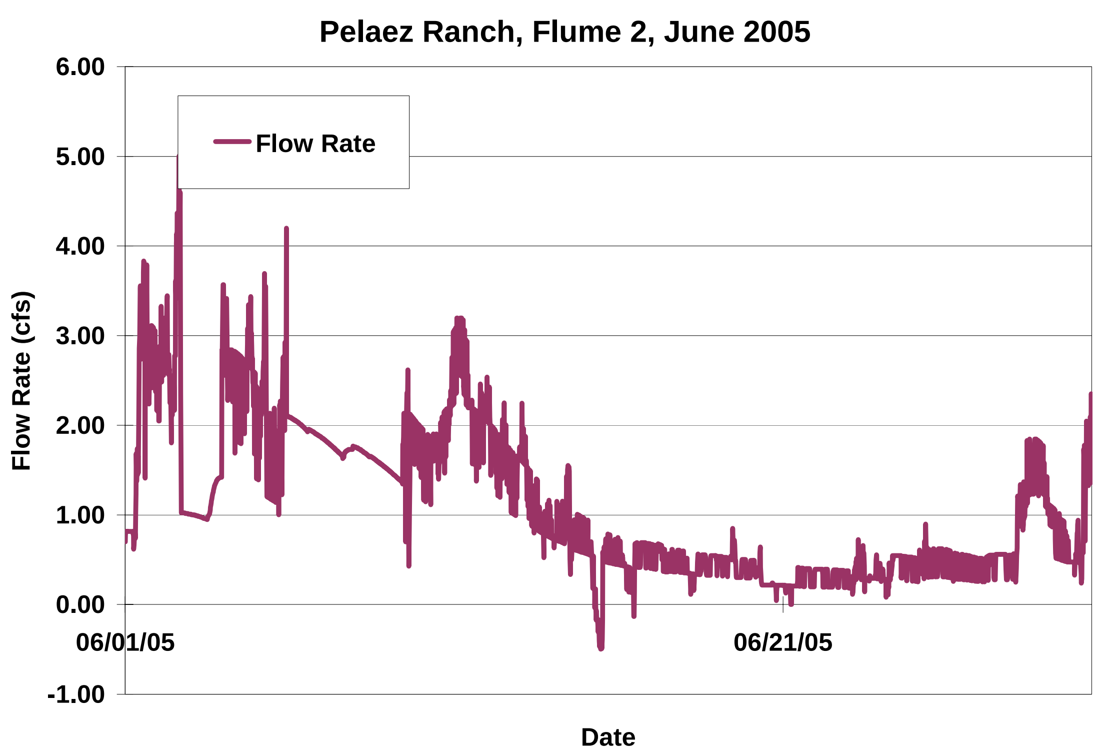

Figure 10. Flow rate (cfs) during June 2005 as measured at Pelaez ranch flume 2.

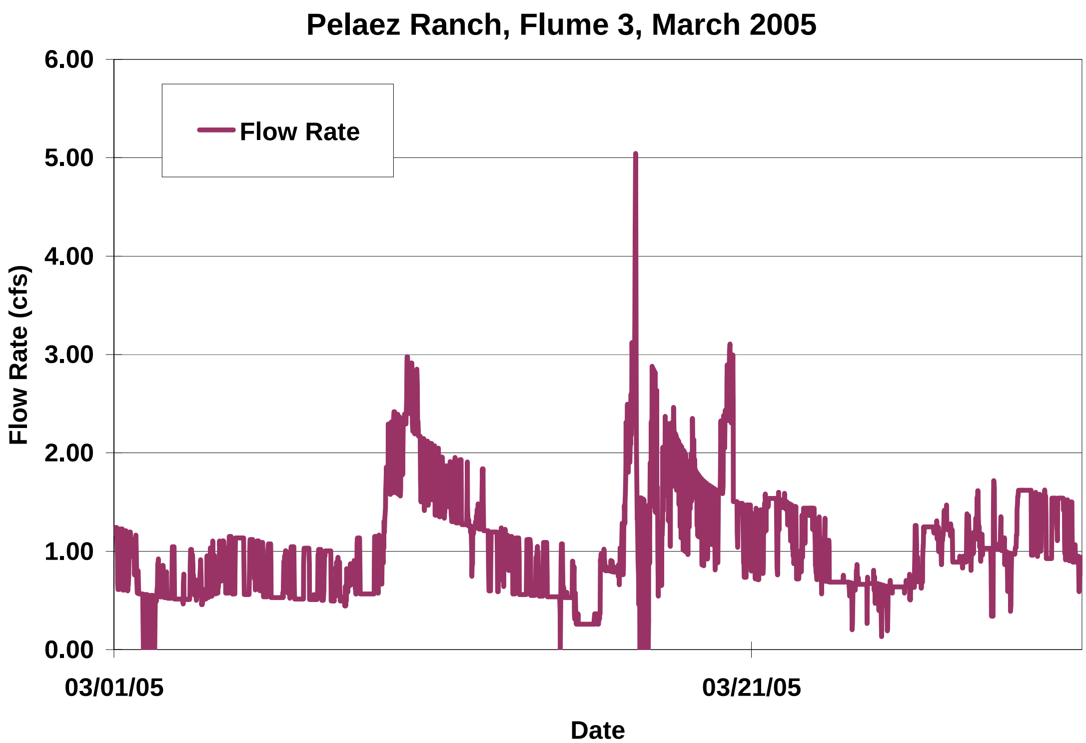

Figure 11. Flow rate (cfs) during March 2005 as measured at Pelaez ranch flume 3.

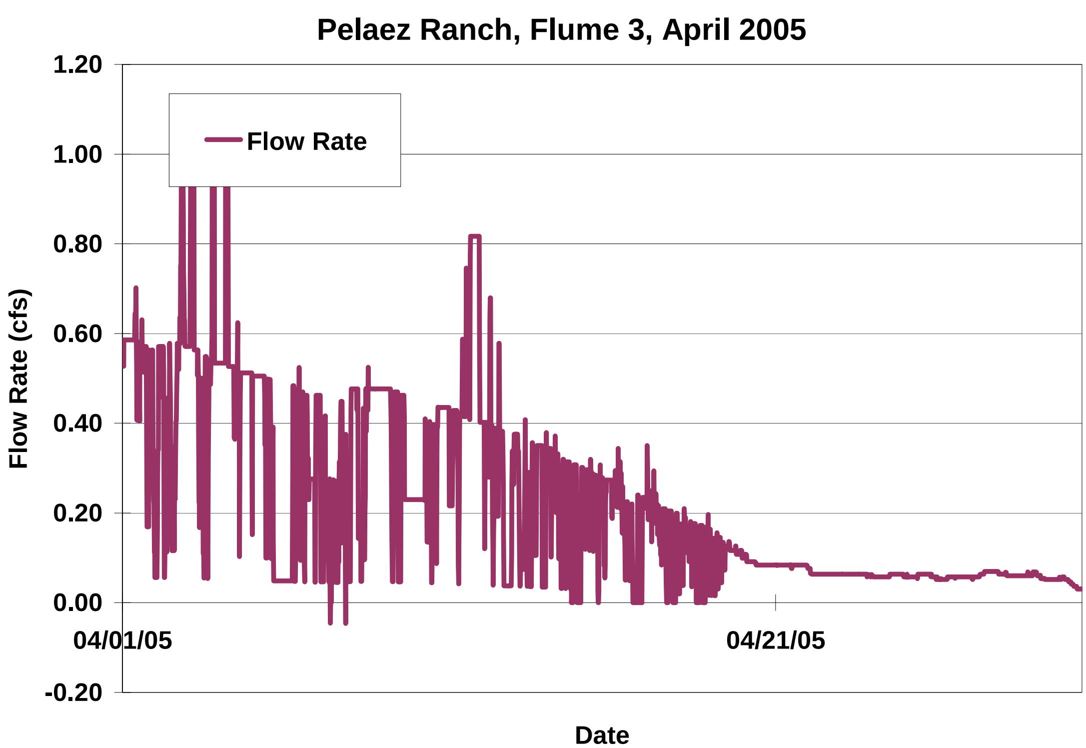

Figure 12. Flow rate (cfs) during April 2005 as measured at Pelaez ranch flume 3.

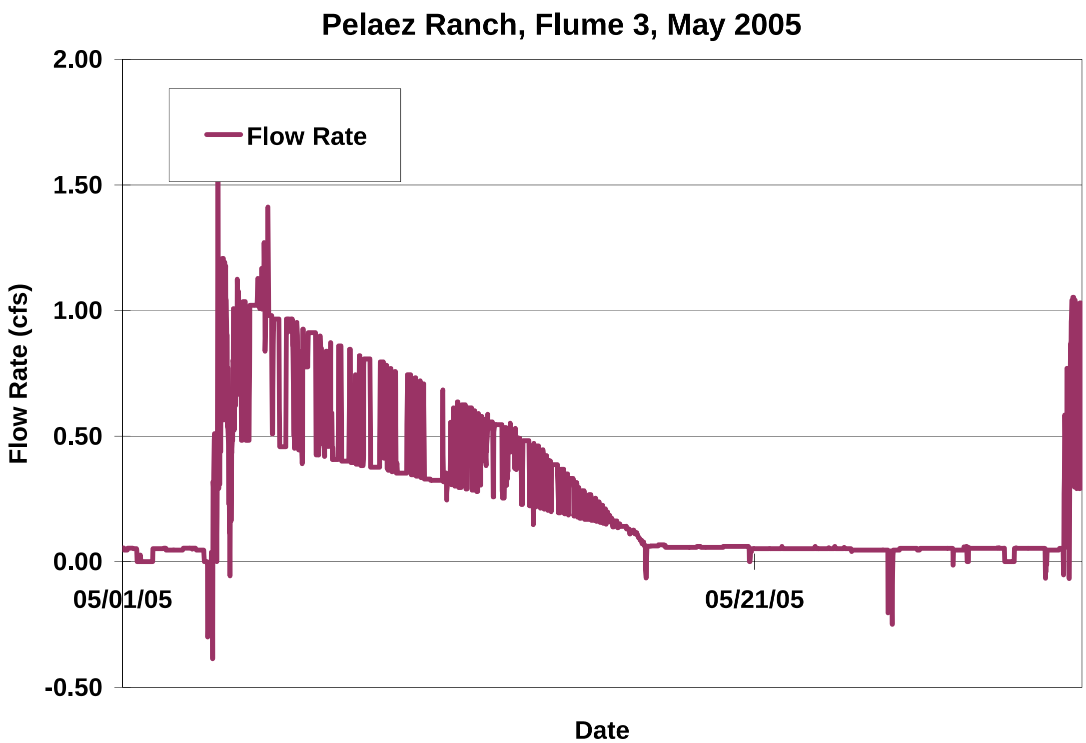

Figure 13. Flow rate (cfs) during May 2005 as measured at Pelaez ranch flume 3.

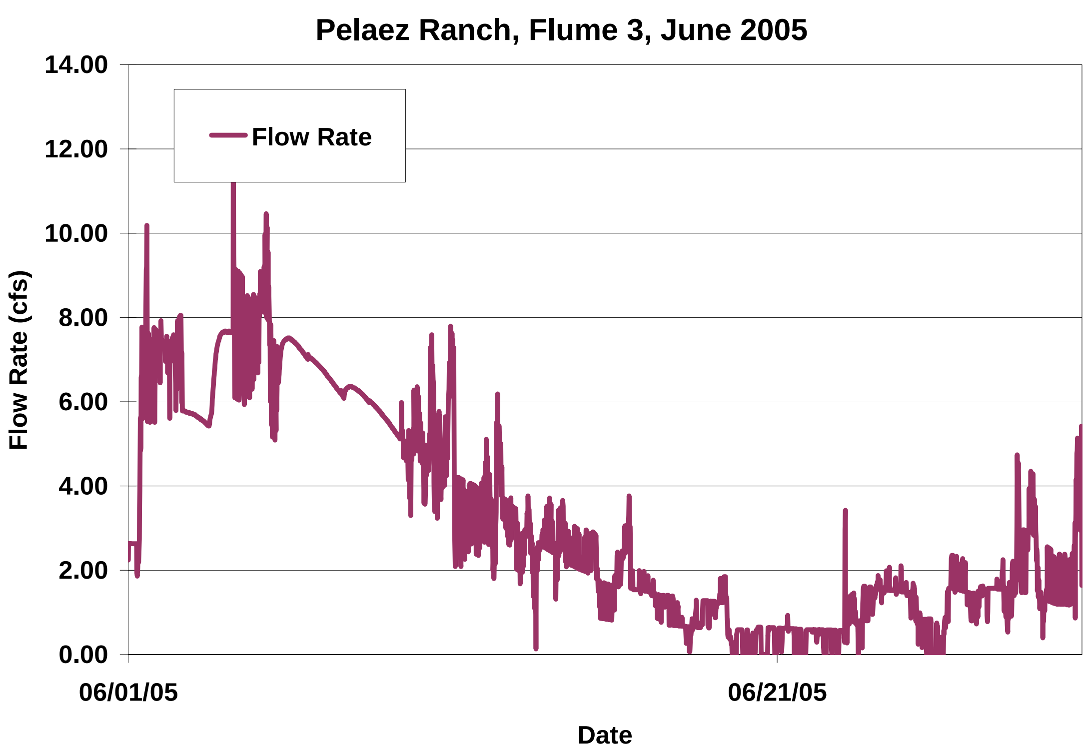

Figure 14. Flow rate (cfs) during June 2005 as measured at Pelaez ranch flume 3.

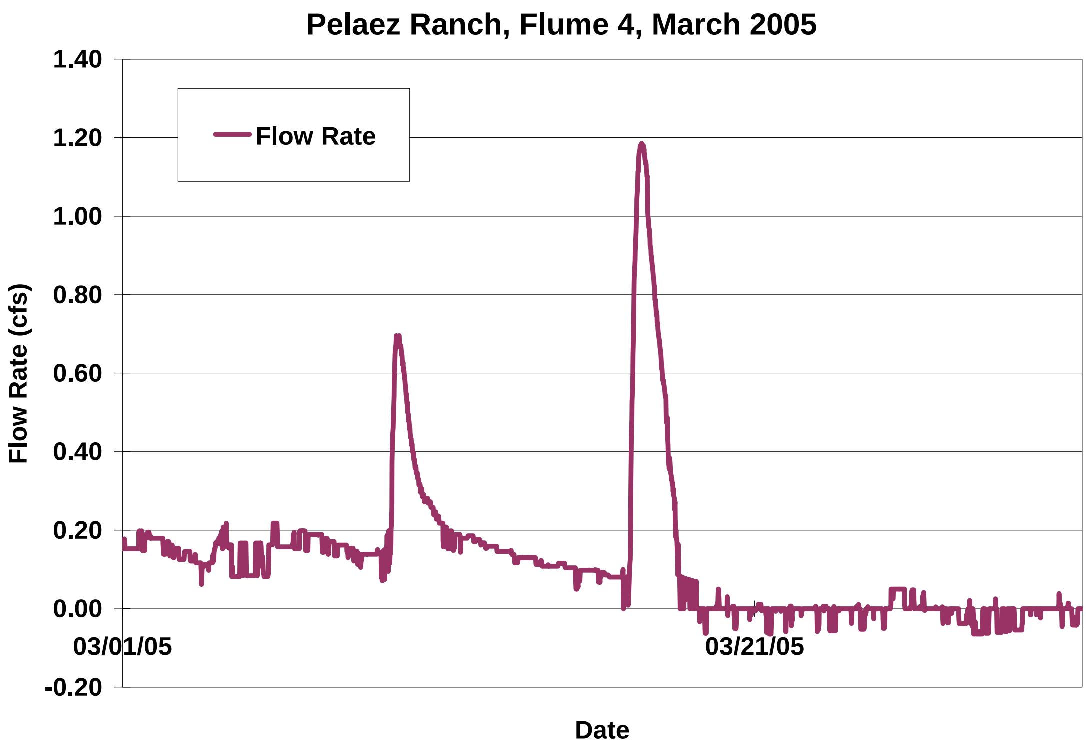

Figure 15. Flow rate (cfs) during March 2005 as measured at Pelaez ranch flume 4.

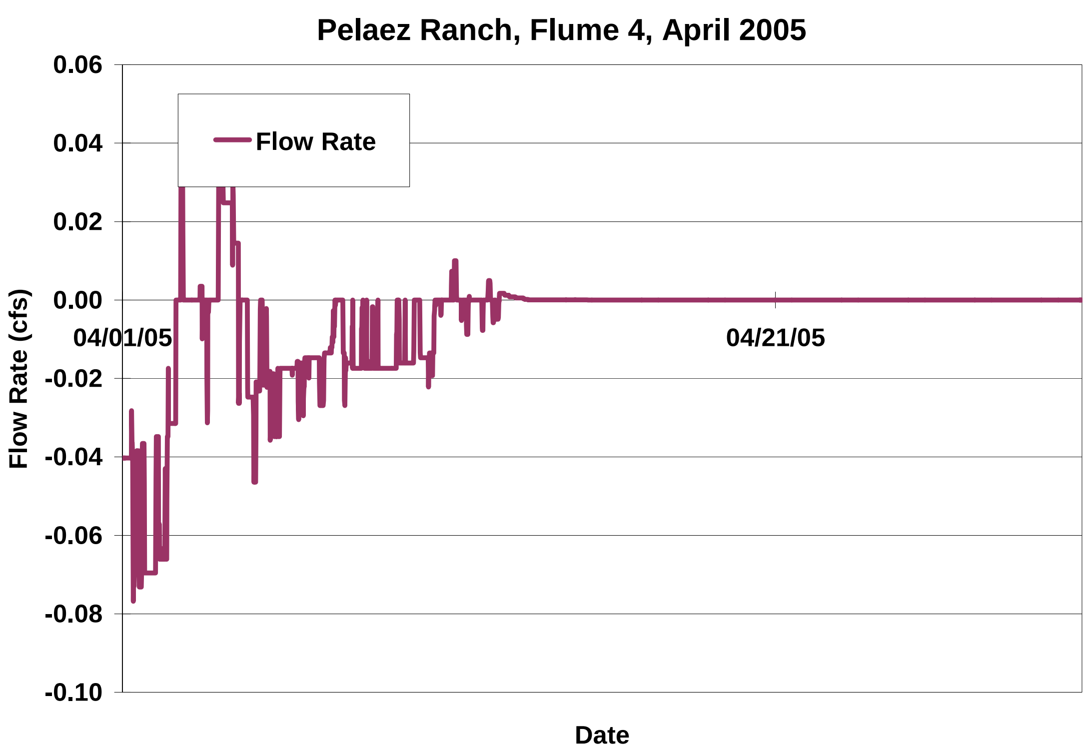

Figure 16. Flow rate (cfs) during April 2005 as measured at Pelaez ranch flume 4.

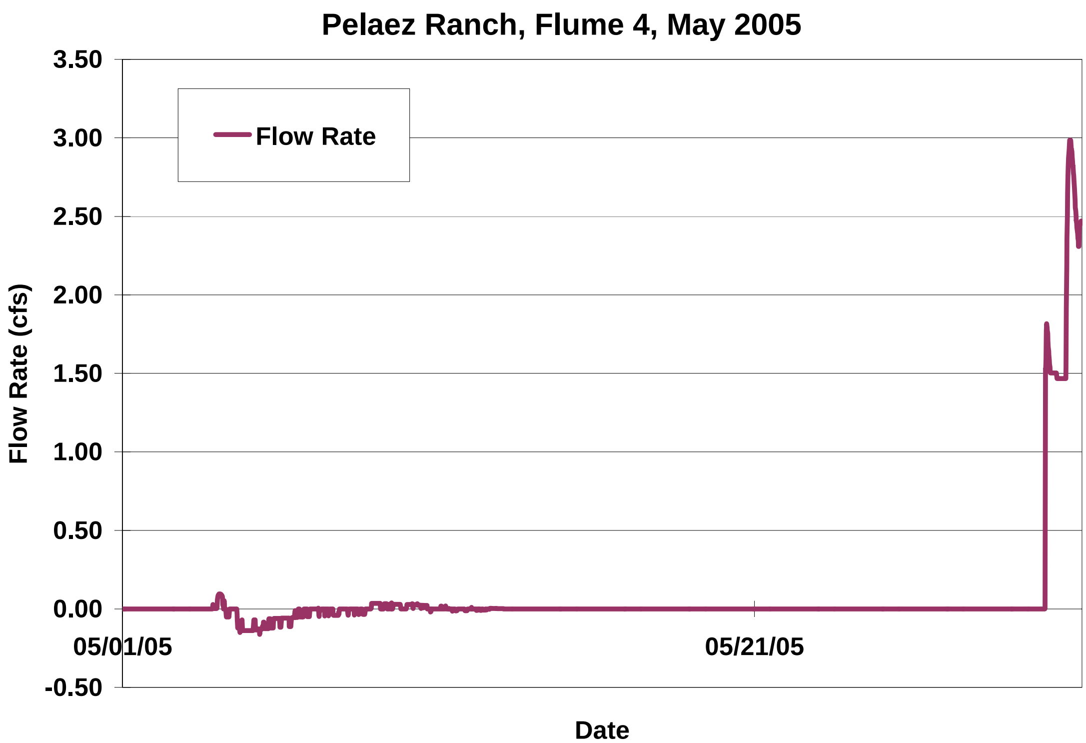

Figure 17. Flow rate (cfs) during May 2005 as measured at Pelaez ranch flume 4.

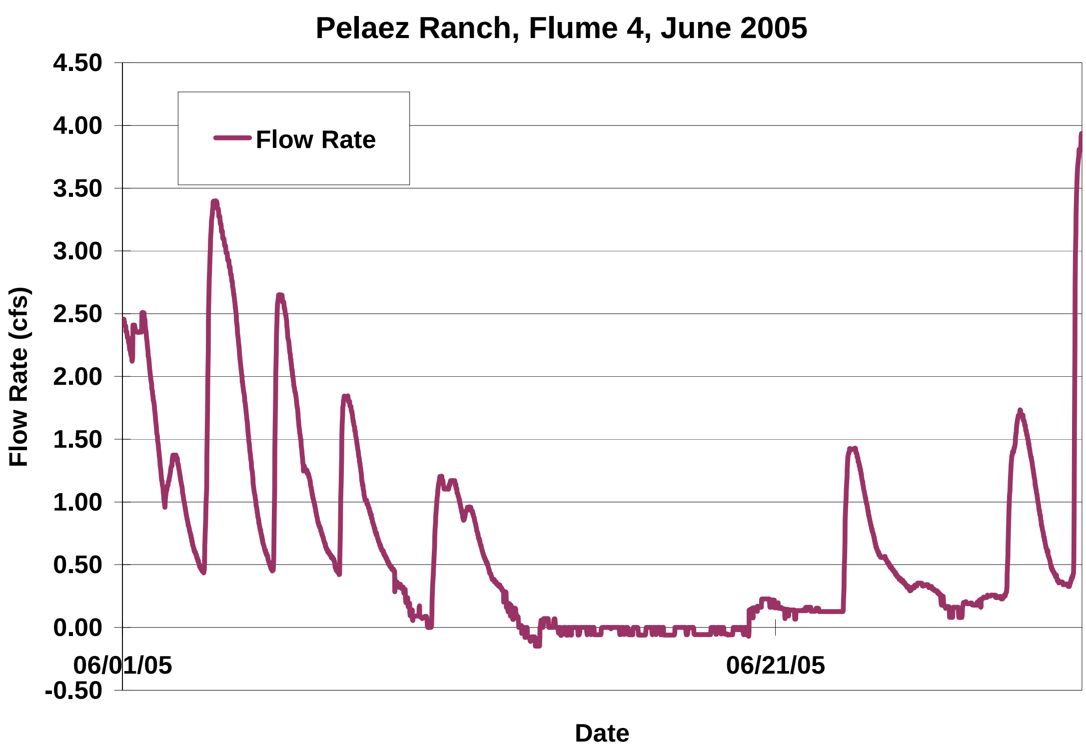

Figure 18. Flow rate (cfs) during June 2005 as measured at Pelaez ranch flume 4.

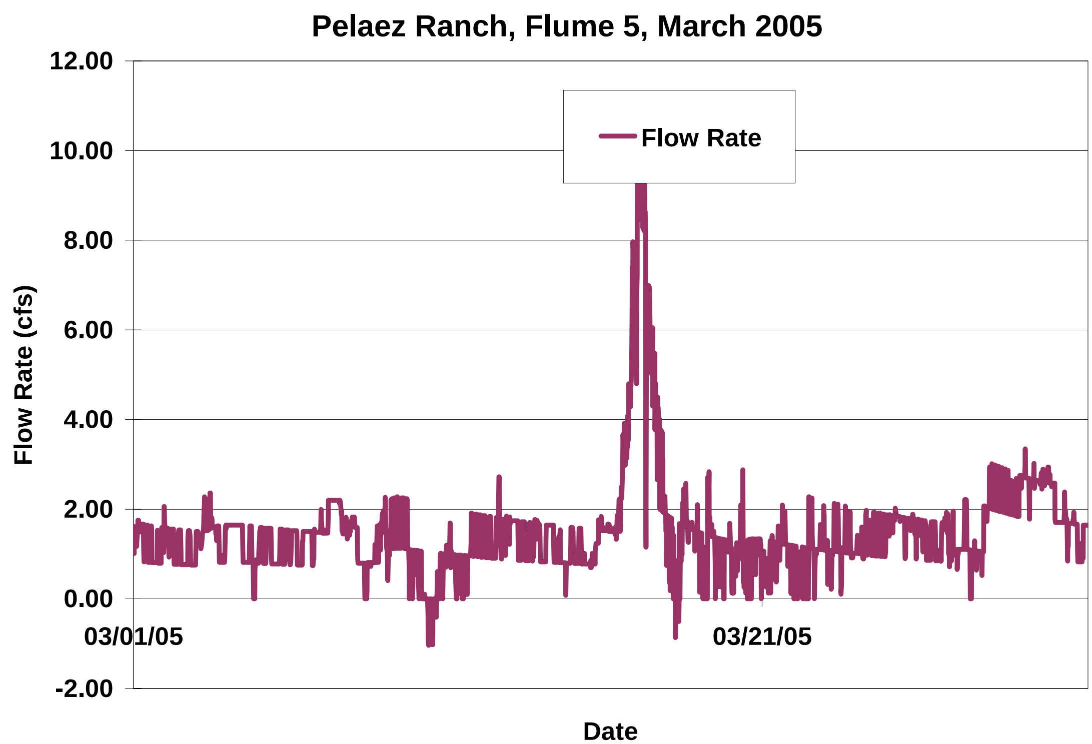

Figure 19. Flow rate (cfs) during March 2005 as measured at Pelaez ranch flume 5.

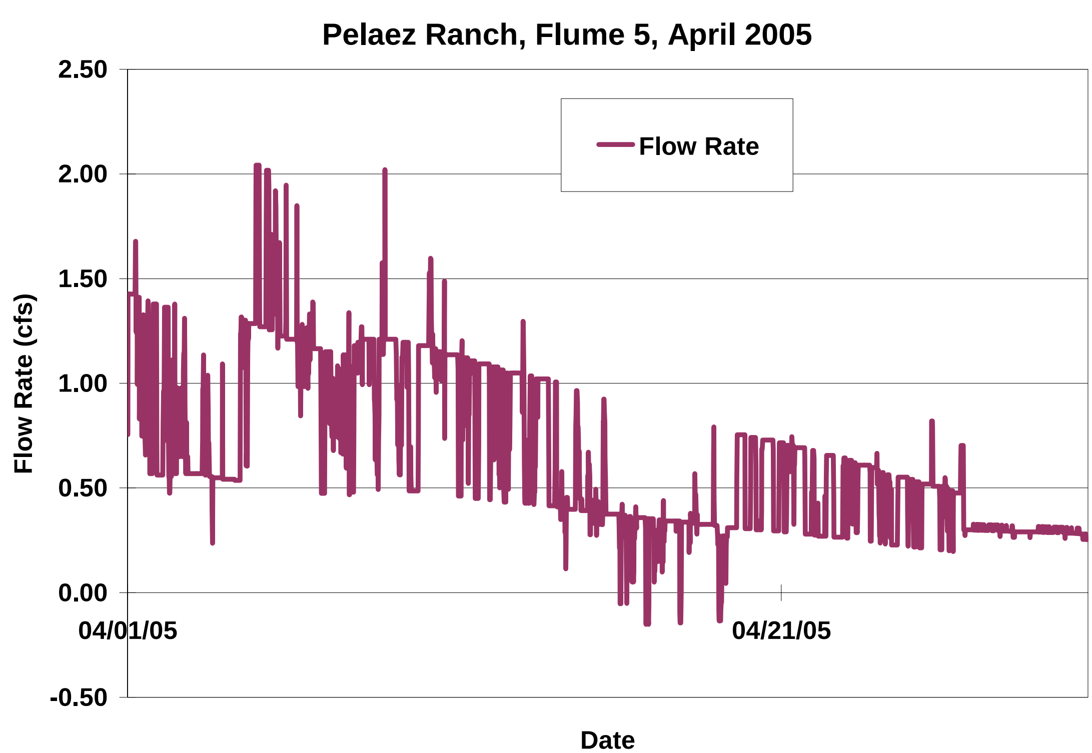

Figure 20. Flow rate (cfs) during April 2005 as measured at Pelaez ranch flume 5.

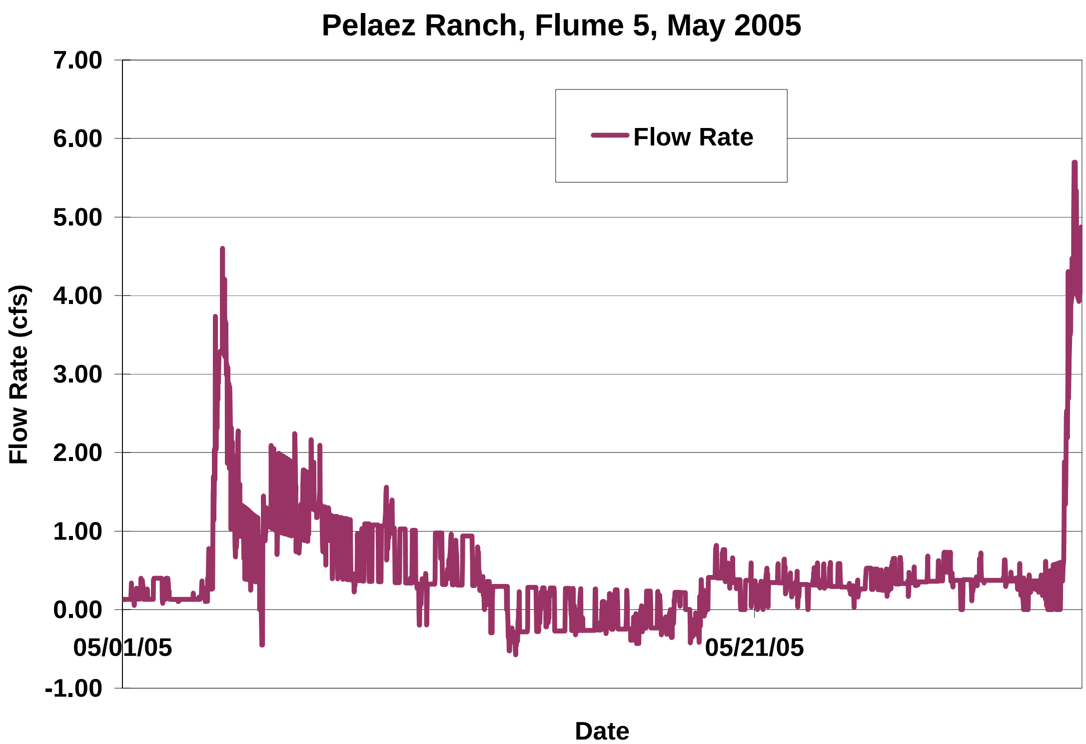

Figure 21. Flow rate (cfs) during May 2005 as measured at Pelaez ranch flume 5.

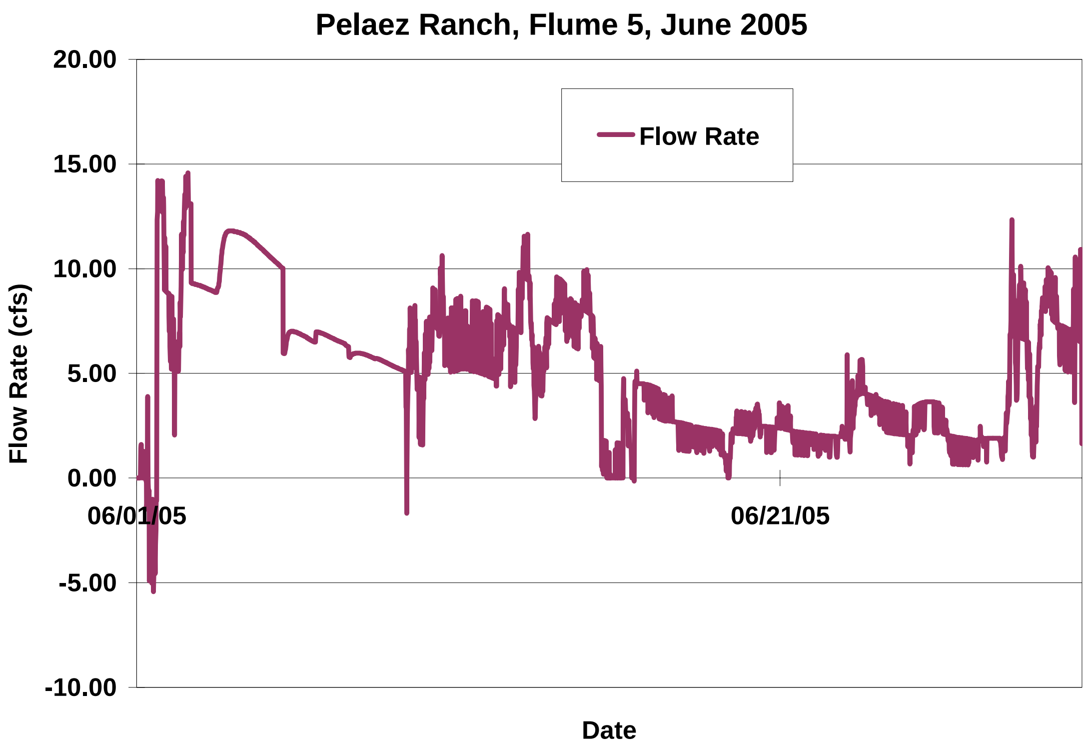

Figure 22. Flow rate (cfs) during June 2005 as measured at Pelaez ranch flume 5.

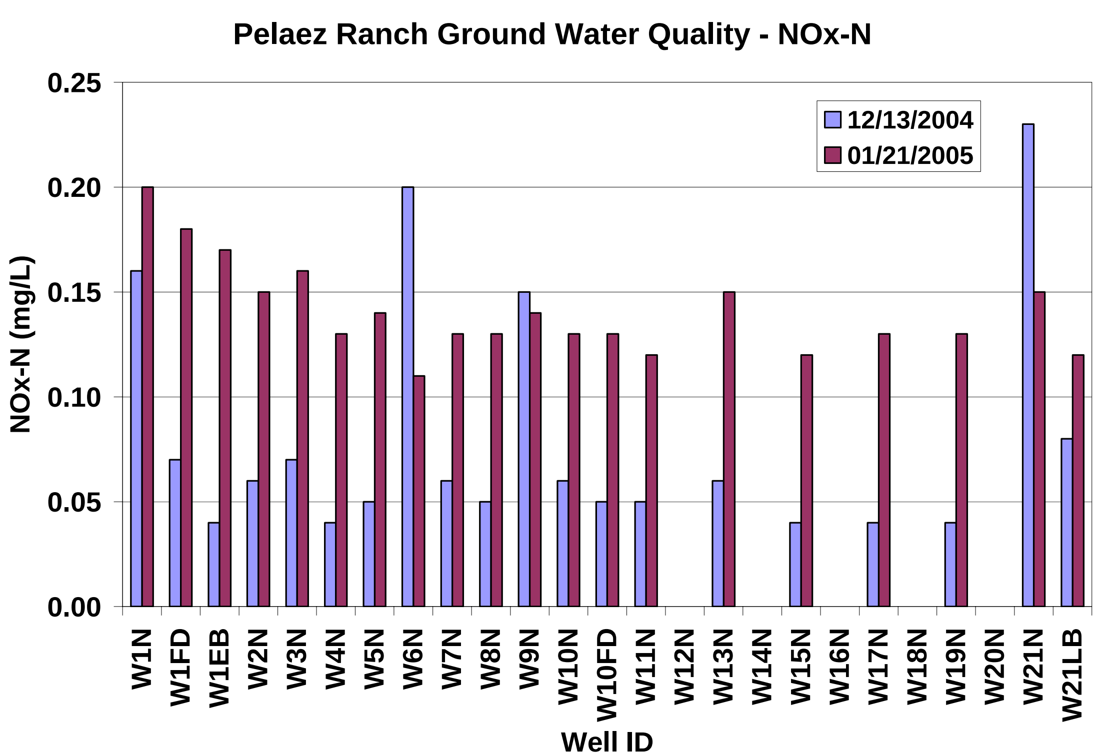

Figure 23. Ground water NOx concentrations (mg/l) for December 2004 and January 2005.

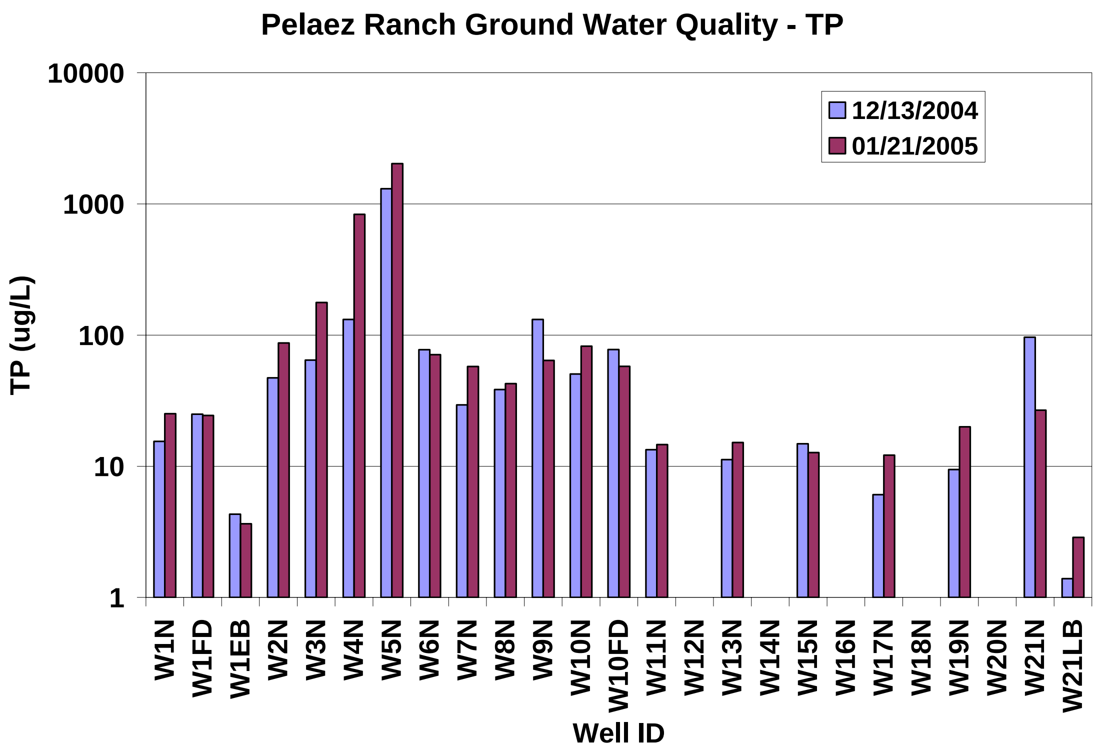

Figure 24. Ground water Total P concentrations (mg/l) for December 2004 and January 2005.

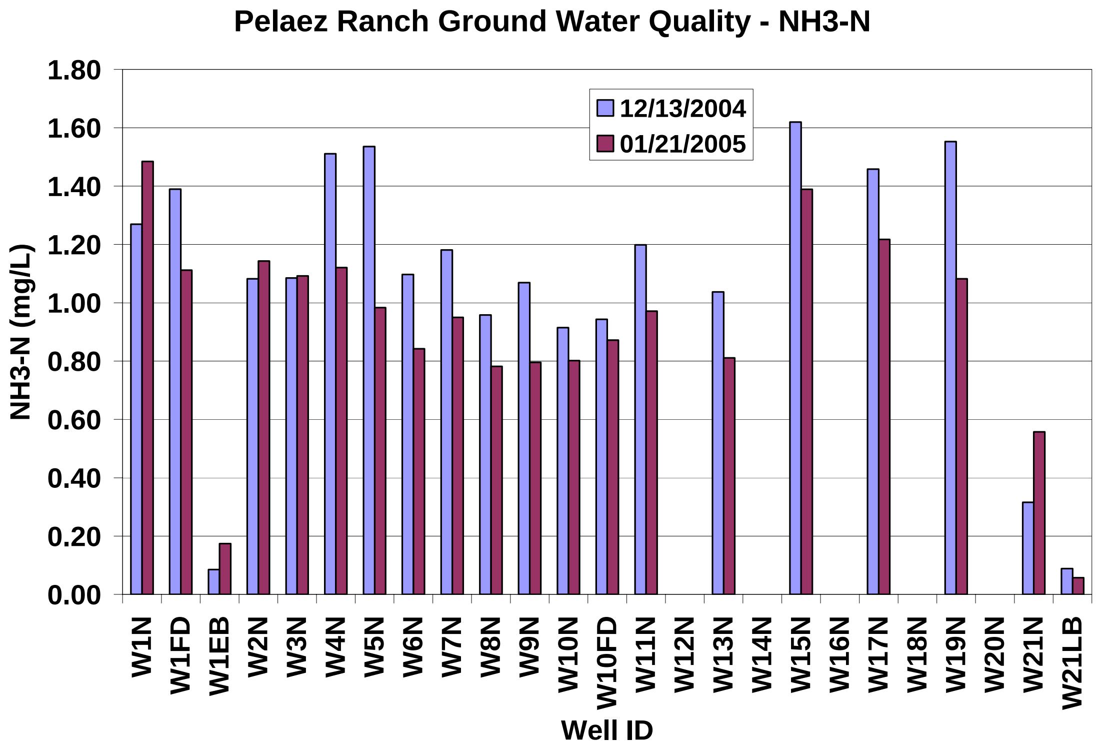

Figure 25. Ground water NH_3-N concentrations (mg/l) for December 2004 and January 2005. 2005.

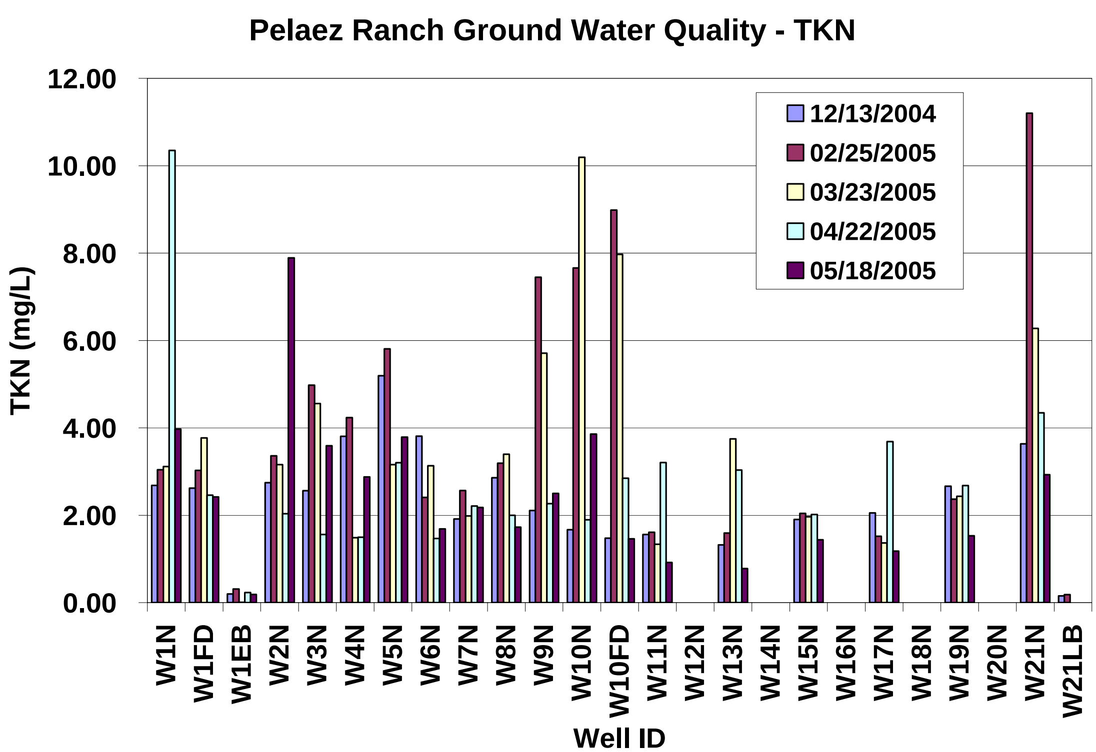

Figure 26. Ground water TKN concentrations (mg/l) for December 2004 to May 2005.

Figure 27. Mesocosm study for quantifying the effect of water retention on P retention in the two drainage ditches at flume sites 5 (left) and 4 (right) at the Pelaez Ranch (Collins, 2005).

6) Task 6: Amendments Evaluation.

Field and lab tests were used to identify phosphorus "hotspots" on Larson Barn 5's spray field during May. Based on these data, a location was selected to obtain bulk soil samples for the rainfall simulation studies. Average water soluble P (WSP) and Mehlich I values were 47.2 and 872.6 ug P/g respectively. Bulk soil samples were collected from 0-10 and 10-20 cm depths on June 16th . Subsequently, soil was air dried, sieved, and packed into a runoff box based on their respective WTR treatment. The WTR was collected on Jun 28th and has been air dried, sieved, and mixed into their respective runoff boxes. The boxes will be ready to begin the rainfall simulation sequence pending grass plug establishment (approximately August 1).

7) Task 7: BMP implementation: To be initiated in October 2005.

8) Task 8: Economic Analyses: To be initiated in October 2005.

9) Task 9: Hydrologic Monitoring of BMP effectiveness: To begin in October 2005

10) Task 10: Hydrologic Model Evaluation:

Continuing advancement is being made for setting up the two models (BRADSS and WAMView) for the Pelaez site. Significant progress has been accomplished in setting up WAMView for the watershed. WAMView defines a watershed as a large catchment that contributes stormwater to a receiving body. The watershed typically consists of primary basins (or sub-watersheds) and each primary basin is divided into several sub-basins as defined by geographic divides or artificial barriers such as berms associated with development.

Based on a field survey conducted during the initial stage of this project and verification of topography by Dr. Sanjay Shukla (UF-IFAS), the research sites at Pelaez ranch have been divided into two primary basins: Site 4 and Site 5. Site 4 is a small wetland site that is hydrologically isolated from the other sites and the flume at Site 5 includes flow from Site_1, Site_2 and Site_3. Therefore, Site 5 has been divided into 3 sub-basins (Site_1, Site_2, Site_3). The discretization of primary basins and sub-basins is essential since this is a required polygon shapefile for the model. Modeling will occur on the primary basin level. The purpose of this coverage is to allow the user to select a primary basin for modeling. Other required coverages of topography, landuse, and soils that were obtained from the GeoPlan Center, University of Florida, have already been modified by performing special procedures and in certain instances, conversion to grids. Currently reaches are being generated, which is a line shapefile of hydrography of the site. At each step, quality control review of source datasets is performed before incorporating any additional information or conducting any analysis.

Apart from water quantity and quality analysis, there is an opportunity to obtain information pertaining to cattle spatial location and movement at the research site. Mr. Scott J. Kuipers (District Conservationist, NRCS-Okeechobee Service Center) has acquired some GPS collars and he has expressed a desire to cooperate in deploying the collars at the Pelaez Ranch. Mr. Kuipers has also communicated with the ranch owner and he has, in principle, approved the use of GPS collars at his ranch. Dr. Mitch Flinchum (UF-IFAS Extension) is collecting information regarding cow-calf operations and ranch management details. Such information will be crucial in deciding collar deployment aspects such as: when, how many, for how long, etc. Intent of current efforts is to install these collars for significant periods during both, pre and post BMP phases.

The spatial information of grazing habits and patterns is an essential component that will aid in developing a comprehensive understanding of the animal-plant-soil system in a ranch setting. This supplemental information, when tied with water quality data will yield useful knowledge related to BMPs and aid in decision making for reducing phosphorus loads to Lake Okeechobee from cow-calf operations in the basin.

11) Task 11: BMP Education:

The following Extension Education Activities were conducted by Mitch Flinchum between March31, 2005 – June 30 , 2005

- Mitch Flinchum met with Ralph Pelaez to continue working on management/economic/modeling data.
- Mitch Flinchum presented poster on Lake Okeechobee BMPs and Wetland Enhancement in two locations at the Beef Cattle shortcourse in Gainesville.
- Mitch Flinchum held Wetland Enhancement Advisory Committee Meeting.
- Mitch Flinchum presented poster on Lake Okeechobee BMPs and Wetland Enhancement at the Florida Cattlemen's Association Annual Meeting in Marco Island.
- Mitch Flincum began work on the 2006 edition of the Wetland Enhancement Resource Guide and BMP Record Book.
- Sanjay Shukla presented preliminary results from this project including the mesocosm study at the UF-IFAS Forage/Beef workshop on May 17, 2005. This workshop was attended by more than 30 people representing the Florida Cattle Industry including the officers from the Florida Cattleman Association (FCA).