Iowa Conservation Reserve Enhancement Program (CREP)
2018 Annual Performance Report

Preface

The Iowa Conservation Reserve Enhancement Program (CREP) is a performance-based water quality program focusing on the reduction of nitrate loads to surface waters through the restoration of strategically designed and located wetlands that intercept tile drains from cropped lands.

The following narrative and illustrated report details annual and cumulative performance accomplishments including a brief background, executive summary, accomplishments, and monitoring data. Table 1 and Table 2 summarize financial and active site data. Table 3 is a cumulative program summary.

Background:

Approved on August 17, 2001, the Iowa CREP is available in thirty-seven counties in the tile-drained region of North-Central Iowa (Figure 1). Wetland restoration is one of the most effective strategies for reducing nitrate (N) transport to water resources from row-cropped lands; and research conducted at Iowa State University has demonstrated that strategically located and properly sized wetlands remove 40-90% of the nitrate from cropland tile drainage. The effect of wetlands on watershed scale nitrate reduction is largely determined by the watershed's total nitrate load that the wetlands intercept.

Practices eligible are wetland restoration (CP-23) and erosion control structures (CP-7), when needed as part of the wetland establishment.

Federal incentives include:

- 15 annual rental payments of 150% of the weighted average soil rental rate
- 50% cost-share for eligible costs of establishing conservation practices
- Practice Incentive Payment (PIP) up to 40% of the total eligible cost of practice installation.

State incentives include:

- Market based incentive payment for a 30-year or permanent easement (one-time payment)
- 10% cost-share for restoration costs
- Survey, engineering, design, permitting, oversight, public bidding, title services

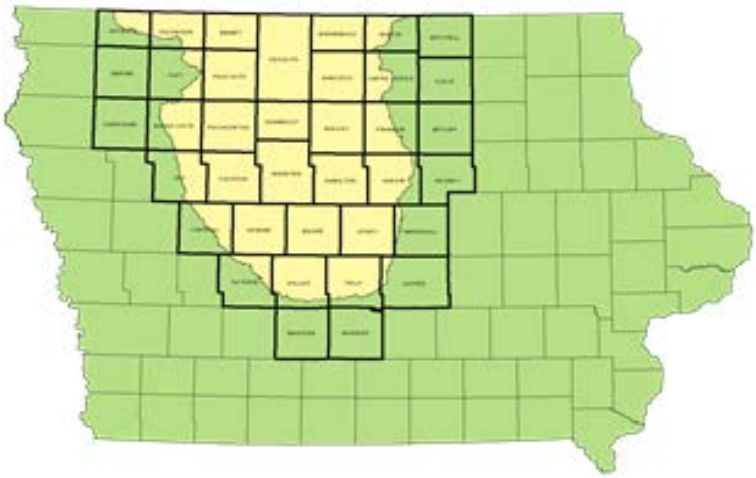

Figure 1. Counties Eligible for Iowa CREP

2018 Executive Summary

Landowner interest in the Iowa Conservation Reserve and Enhancement Program remains strong. However, the 4:1 Federal to State ratio of costs for the Iowa CREP remain unachieved. This is due to continued high land values, the CRP landowner $50,000 payment limitation cap applied to annual CREP payments under the program, and the increased cost out-sourced engineering consultants and other technical services.

Farmland Values Survey for 2018 show that land values remain high. The average value of Iowa farmland in 2018 was reported as 0.8% lower than land values one year ago. However, the 2018 values are still 3.8 times higher than the value in 2001 at the inception of the CREP program.

Construction was completed on one (1) wetland during 2018 bringing the total wetlands restored to 87. These wetlands have a combined total of 795 acres of wetland pool and 2,599 acres of buffer plantings. These wetlands protect 107,651 acres of drainage area by removing an estimated 89,483 tons of N over their lifetimes at an average cost of $3.07 per acre of protected drainage area.

There are 13 wetlands under development. Collectively these 13 projects represent and estimated 195.6 acres of wetland surrounded by an estimated 617.4 acres of buffer which will treat over 17,000 watershed acres by removing an estimated 21,740 tons of N over their lifetimes.

Partnerships and collaboration continue to provide support to the program and increase the number of sites completed. These partners currently include the State of Iowa Water Quality Initiative, The Nature Conservancy and the Lake Panorama Association. Recent partners include Ducks Unlimited and the National Fish and Wildlife Foundation Monarch Butterfly Conservation Fund.

Over the past 16 years of CREP, progress in successful designs and program implementations have been made through continued collaboration with the engineering consultants that design CREP wetlands and scientists at Iowa State University that monitor and evaluate water quality. Ongoing design adjustments have increased flood storage capacity, improved wetland longevity, and reduced costs while improving performance and maximizing nutrient removal. There has been varying success for wetland vegetation establishment. Although vegetation has a minimal effect on nutrient reduction, its success greatly enhances the habitat value and aesthetics of the wetlands.

The current field support staff level is at three (3) part time positions through an existing service contract with the Iowa Drainage District Association. The field personnel are and remain a proven essential component to carry out the processes involved with CREP.

Program Cost Justification

The current method of valuing state easement payments continues to be an effective means of providing fair value compensation to landowners enrolling in CREP. Without the approach of basing easement payments on the ISU Farmland Values Survey, CREP enrollment would be notably lower. The costs of the State easements remain high due to its reflection of the current land values in Iowa. This has a negative effect on the targeted 4:1 federal to state ratio of total project costs for the Iowa CREP. The targeted ratio has yet to be achieved due to high easement payments combined with the increased cost of out-sourced engineering and the state coverage of CRP payment limitations cap overages.

FSA soil rental rates were adjusted in 2018 which reduced the number of soil rental rate categories to three and in general lowered the FSA soil rental rates offered. However, the 150% incentive rate over regular CRP rental rates still makes this program enticing to landowners. The current soil rental rates were adopted in June 2018. According to the 2018 Farmland Value Survey conducted by Iowa State University, the state average for all grades of land was estimated to be $7,264 per acre, a decrease of 0.8% from 2017. However, the average land value change varied by Crop Reporting District from a -3.6% change in Southeast Iowa to a 3.8% increase in the South Central Crop Reporting District. The primary factor for increasing land value was a limited land supply, while lower commodity prices was the primary factor decreasing land value Several factors were noted in the report that could affect land value in the near term including a rise in interest rates, trade negotiations/trade disruptions, policy changes from a new Farm Bill and future land sales due to increased interest in selling land due to improved farm income or more stressed sales from financially stressed producers

For medium to high grade land typical in the Des Moines Lobe, the farmland value ranged from -2.7% in the Central Crop Reporting District to 4.0% in the South Central Crop Reporting District. The average dollar value range is $4,244 to $10,767 per acre. Since inception of the CREP in 2001, the statewide average land value has risen from $1,926/acre to $7,264/acre, representing an increase of 3.8 times the value in 2001. (*Zhang, 2018*.)

Interest in Iowa CREP remains strong with a continued majority of landowners pursuing permanent easements. To date, all of the state funds that have been appropriated for CREP State FY2018 are currently obligated. Of the 37 eligible Iowa counties, CREP wetlands are present in 29 to date.

In 2013 there was an expected five year wait for state funds to become available. We are now anticipating a three year wait for new applicants for state funds. The goal for CREP is to maintain a wait time of no longer than two years. We have found that landowners become inpatient and frustrated with the longer wait time and have a higher likelihood of withdrawing their application.

The shorter wait time for project completion has been achieved partly by pushing the process from application to construction at a faster pace in tasks that CREP has control. However the commitment of partnerships with other programs and conservation groups is primary to stretch our budget and increase the number of wetlands installed per year. Highlighted in local, state and national media, public awareness of CREP's role in water quality improvement has increased, prompting more frequent inquiry for participation.

The current field support staff level is at three part time positions through an existing service contract with the Iowa Drainage District Association. The field personnel remain instrumental in helping to carry out the processes involved with CREP. They are the first contact with landowners and continue as liaisons between the landowner, CREP agencies, engineering consultants, and contractors throughout the entire process.

Accomplishments

2018 Wetland Restorations

Iowa CREP started construction on one site during calendar year 2018. This site has 11.5 acres of wetland pool and 38.45 acres of buffer plantings and will protect 1,343 acres of drainage area by removing an estimated 1,294 tons of N over its lifetime. Table 1 also lists six projects whose FSA contributions were paid in FFY2018. Their environmental impacts were reported in the 2017 report and are repeated in this report.

This brings the total wetlands restored up to 87 wetlands**.** The estimated annual N removal capacity of all wetlands**,** completed and in construction or development, is over 1,468,000 pounds per year with N removal costs remaining at an average $0.26/lb. Without the CREP wetlands, landowners in north central Iowa would need to permanently retire an estimated 51,000 to 89,000 acres of cropland to obtain an equivalent nitrogen reduction.

Additionally, there are 13 wetlands under development. Collectively these 13 projects represent an estimated 195.6 acres of wetland including a total estimated 617.4 acres of buffer. These wetlands will treat over 17,000 watershed acres by removing an estimated 21,740 tons of N over their lifetimes. See Table 2 for additional details.

Of the thirteen wetlands under development, four (4) wetland projects have a CRP contract starting October 2018 and are planned to bid in January 2019 for construction completion in calendar year 2019. Four (4) other wetlands under development are planned for a CRP contract starting October 2019. Additional wetlands may also be ready for CRP contracts if additional partner funds are leveraged.

The Water Quality Initiative Program (WQI) through the North Raccoon River Watershed Project partnered with the CREP Program on three projects to be completed in 2019. This brings the total of CREP/WQI partnership projects to six. We look to further partnership with WQI in their priority watersheds within the CREP eligible counties.

The Nature Conservancy continues to obtain grants from Coca Cola, the Greater Cedar Rapids Community Foundation and other sources to partner with CREP projects within the Middle Cedar River Basin area. Plans are for them to apply for additional grants for projects in the near and extended future.

The Lake Panorama Association-Rural Improvement Zone (LPA-RIZ) has completed construction on a second CREP wetland project on the east shoreline of the Lake Panorama in Guthrie County. The LPA-RIZ plans to continue working in partnership with CREP to complete similar projects in the future.

Policy Interpretation for Stream Mitigation When Constructing CREP Wetlands on Identified Stream Channels

This last year a policy interpretation by the U.S. Army Corps of Engineers (ACOE) started requiring mitigation of stream channel wetlands where CREP wetlands were being created in their stead.

This change in policy interpretation caused the CREP staff to re-evaluate which potential wetland projects would move forward toward implementation. All the potential wetland sites under development were evaluated as to the presence or absence of permanent streams identified as “blue line” streams on standard United States Geologic Service (USGS) topographic maps. Several projects under development were placed on hold and other potential projects which did not have blue line streams were moved up in the list for further development. This change in procedure stopped projects nearing completion. These projects were not let for bid or construction in 2018 resulting in a reduced number of projects able to be bid and constructed in 2018. Staff time was re-directed to develop projects not as far along in development.

CREP staff and IDALS administrators and managers held multiple meetings, teleconferences and field tours with partners and ACOE staff explaining how this policy interpretation was affecting the CREP implementation strategy and would increase costs to the program to mitigate for stream channel wetland habitat when a CREP wetland was creating quality wetland habitat. Those interactions with ACOE have provided some clarity on which projects will require compensatory mitigation under current laws, and IDALS has adjusted our selection criteria in the near term to minimize the likelihood of encountering mitigation-related delays in the future. Over the long run, we are hoping to negotiate a solution at the national level that expands opportunities for CREP projects without the additional cost and administrative burden of compliance with stream mitigation requirements.

Another policy shift occurred regarding the methodology used for completing cultural resource assessments. Previously, cultural resource assessments were completed only where soil disturbance would occur in and near the structure locations and any soil borrow areas. The new policy paradigm requires a cultural resource assessment being completed on the entire wetland pool area. This change is estimated to increase the cost of completing cultural resource assessment of two to threefold depending upon the wetland pool size.

Tile Zone Wetland Design

A new wetland design called "Tile Zone Wetlands" is being researched and moving to field trial application at Iowa State University. This type of wetland is suited to pothole, low-gradient landscapes. To create a wetland using this design, existing tile lines are intercepted by a newly installed tile line which re-directs drainage water to surface outlet to a pothole lower in the landscape. After this drainage water is treated by flowing though the wetland, it is collected and re-deposited into the same tile line that it originated from further downslope in the landscape, or to another suitable outlet. This type of wetland design has several advantages. First, the amount of surface water entering the wetland is greatly reduced since primarily only tile drainage water is directed to the wetland. Secondly, since the wetland is a naturally-formed pothole, the earthwork cost for a structure and berm are eliminated or minimal. Third, the easement area necessary for this type of wetland could be much smaller since the volume of water treated and size of the wetland would also be smaller. Researchers at Iowa State University are actively identifying sites which may work for this type of design. The Water Quality Initiative Program intends to fund some of these sites in 2019 and monitor their effectiveness. Sites will also be evaluated using CREP criteria and potentially incorporated into the CREP with concurrence of program partners.

The State has also moved forward with new design concepts that help to provide temporary flood storage benefits while maintaining the high level of water quality performance already in place. IDALS has engaged in a collaborative process with the engineering consultants that design CREP sites and scientists at Iowa State University to further enhance the water quality performance of CREP sites by identifying and incorporating design features that improve hydraulic efficiency, maximize wetland area, and increase the overall habitat value. Results from these minor structural modifications to the designs indicate that significant improved nutrient removal performance is being achieved.

Program Evaluation

Tables 1 through 3 highlight CREP site data, costs, and projected nitrate reductions. Cost per pound for N removed remains below the current cost per pound of fertilizer application to cropland, and considerably below reported cost per pound of N removal by municipal treatment plants. Data from ISU monitoring indicate Iowa CREP wetlands are a highly cost effective method for removing nitrate from tile-drained landscapes thus improving water quality in local streams, drinking water supplies, and the Gulf of Mexico.

References

Zhang, W. *2018. "2018 Iowa Farmland Value Survey: Overview*." Iowa State University Extension and Outreach, CARD working paper #18-WP 586.

Presentations/Publications/Outreach

Iowa CREP remains in the public attention with requests for tours, presentations, and interviews from groups and organization that including ISU Iowa Learning Farm, farm managers and landowners, Iowa local and national leaders, watershed management groups and projects, Iowa and national publication, local, county and state agency cooperation, and the general public. Some of the presentations/publications/activities are listed below:

- 1/18/2018 CREP Presentation - Coon Rapids Rotary Club
- 2/15/2018 CREP Presentation, Community Insurance Company's Annual Customer Appreciation Meeting, Coon Rapids
- 4/11/2018 CREP Presentation, Bock Family Foundation, Perry
- 4/26/2018- Field Tour with EPA, FSA, NRCS, and US Army Corps of Engineers staff to visit CREP sites and discuss Stream Mitigation requirements- Carroll and Greene Counties
- 5/29/2018- Five Year Anniversary Celebration for Iowa Nutrient Reduction Strategy- Bio Century Farm near Iowa State University
- 6/5/2018 CREP Presentation – Izaak Walton League, Des Moines Chapter
- 6/5/2018 NRCS/IDALS Intern CREP Training/ Tour - Minton CREP Wetland, Dallas County
- 6/14/2018 Walmart Wetland Ribbon Cutting – Spencer, IA. CREP was discussed, CREP was the model for the wetland installed at the Spencer Walmart using state SRF Sponsored Project funding
- 8/22/2018 Iowa Learning Farm Edge of Field Event, CREP Wetland Tour, Dallas County
- 8/30/2018 CREP Tour with USDA Secretary of Agriculture Perdue and US Representative David Young, Lake Panorama CREP Wetland, Panora
- 9/11/2018- Tour of Dallas County CREP Sites with EPA Headquarters and Region 7 Staff
- 9/14/2018 CREP Tour, Ralph Phelps CREP Wetland, Guthrie County
- 9/20/2018 CREP Tour with John Norwood, candidate for Polk County SWCD Commissioner, Dallas County CREP Wetland
- 12/6/2018 CREP Field Specialist annual meeting, Fort Dodge, updated field specialist on CREP administration, priorities and wetland designs

Monitoring and Evaluation

A unique aspect of the Iowa CREP is that nitrate reduction is not simply assumed based on wetland acres enrolled, but is calculated based on the measured performance of CREP wetlands. As an integral part of the Iowa CREP, a representative subset of wetlands is monitored and mass balance analyses performed to document nitrate reduction. By design, the wetlands selected for monitoring span the 0.5% to 2.0% wetland/watershed area ratio range approved for Iowa CREP wetlands. The wetlands also span a threefold range in average nitrate concentration. The wetlands thus provide a broad spectrum of those factors most affecting wetland performance: hydraulic loading rate, residence time, nitrate concentration, and nitrate loading rate. In addition to documenting wetland performance, ongoing monitoring and research programs will allow continued refinement of modeling and analytical tools used in site selection, design, and management of CREP wetlands.

Summary of 2018 Monitoring

Fourteen wetlands were monitored in 2018 (Figure 1), including 13 Iowa CREP wetlands and one mitigation wetland (DD15-N).

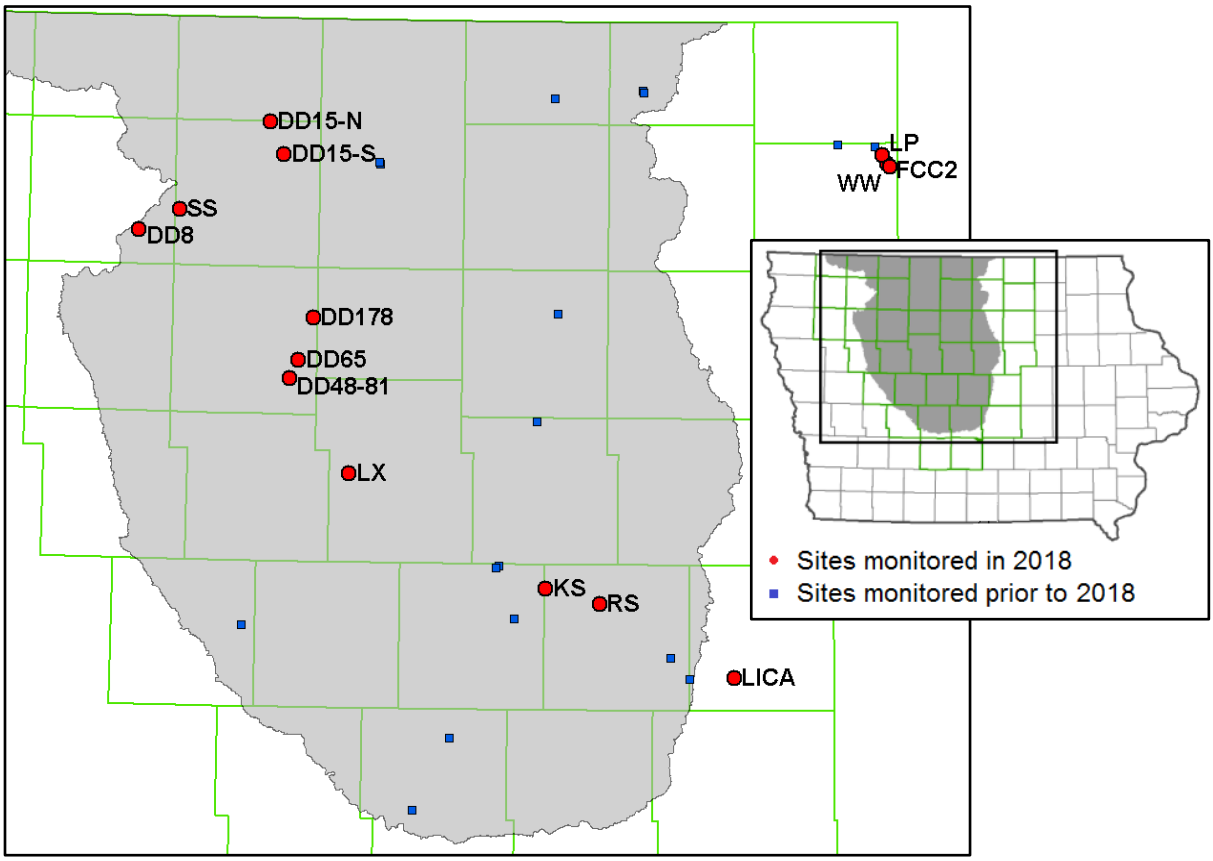

Figure 1. Wetlands monitored in 2018 (red circles, labeled) and additional wetlands monitored in prior years (blue squares). The shaded area represents the Des Moines Lobe in Iowa.

The information summarized below represents preliminary analyses of results through early November and will be updated following additional 2018 data collection and analyses. Wetland monitoring included measurements of wetland inflows, outflows, pool elevations and water temperature, and collection of weekly to biweekly water quality grab samples and daily automated samples. Daily samples were collected using automated samplers programmed to collect a daily sample at wetland inflows and outflows when temperatures were sufficiently above freezing to allow the equipment to function properly. Due to occasional equipment failure, some daily values are missing. Wetland inflow during winter months may be estimated from nearby USGS river monitoring stations scaled to the wetland watershed area.

Wetland inflow and/or outflow channels were instrumented with submerged area velocity (SAV) Doppler flow meters and stage recorders for continuous measurement of flow velocity and stream depth, respectively. The SAV measurements were combined with cross-sectional channel profiles and stream depth to calculate discharge as the product of water velocity and wetted cross-sectional area. Water depth upstream of V-notch weirs is monitored, but water velocity is generally not, and discharge is calculated using a weir equation. Wetland water levels were monitored continuously using stage recorders in order to calculate pool volume, wetland area, and discharge at outflow structures. The discharge equations and SAV based discharge measurements are calibrated using manual velocity-area based discharge measurements collected during prior monitoring years. Manual velocity-area discharge measurements were determined using the mid-section method whereby the stream depth is determined at 10 cm intervals across the stream and the water velocity is measured at the midpoint of each interval. Velocity was measured with a hand held Sontek Doppler water velocity probe using the 0.6 depth method where the velocity at 60% of the depth from the surface is taken as the mean velocity for the interval. The product of velocity and area summed over intervals gives the total discharge. In total, 52 manual discharge measurements were collected during 2018, with at least one measurement at each wetland, to calibrate the SAV and V-notch weir discharge measurements.

On June 21, 2018 a beaver dam was observed on the KS wetland outflow structure causing elevated water depth in the wetland. The KS beaver dam was removed in late August. On May 16, 2018 a beaver dam was observed on the WW wetland outflow structure causing elevated water depth in the wetland. On July 25, 2018 a beaver dam was observed in the inflow stream to the LICA wetland causing elevated water depth and reduced water velocity in the inflow stream. The LICA beaver dam was removed on August 15, 2018 but the dam was back one week later on August 22, 2018. A beaver constructed a dam in the outflow channel downstream of the road culvert containing our flow monitoring equipment below the DD65 outflow spillway during 2017 causing water depth in the culvert to increase. That beaver dam near DD65 was apparently removed during a high flow event and has not returned during 2018.

Due to impending freezing conditions, the water velocity and water level probes and automated sampling equipment were removed from the field during early November 2018.

Patterns in Nitrate Concentrations and Loads

Despite significant variation with respect to nitrate concentration and loading rates, the wetlands display similar seasonal patterns and general relationships to discharge (Figure 2). Historically, inflow nitrate concentrations are variable during the winter. However, because winter flows are

typically low, the winter nitrate loading is also low during most years. Snow-melt often results in increased flow during late February or March but nitrate concentrations in the melt water and associated runoff are typically low. Spring flow is usually high and shows the highest nitrate concentrations. Nitrate concentration generally declines through July and August during dry years, but may remain elevated as long as there is sufficient flow during wet years. Nitrate concentration during large summer flow events often declines abruptly with peak flows and is thought to be associated with surface runoff having low nitrate concentration; however, nitrate concentrations often rebound within a few days of these high flow events. These nitrate concentration and flow patterns are consistent with those of CREP wetlands monitored in prior years and represent the likely patterns for future wetlands restored as part of the Iowa CREP.

Wetland Performance (Nitrate mass loss and removal efficiency)

Wetland performance is a function of hydraulic loading rate, hydraulic efficiency, nitrate concentration, temperature, and wetland condition. Of these, hydraulic loading rate (HLR) and nitrate concentration are especially important for CREP wetlands. The range in HLR expected for CREP wetlands is significantly greater than would be expected based on just the four fold range in wetland/watershed area ratio approved for the Iowa CREP. In addition to spatial variation in precipitation (average precipitation declines from southeast to northwest across Iowa), there is large annual variation in both precipitation and water yield. The combined effect of these factors results in annual loading rates to CREP wetlands that vary by more than an order of magnitude, and will to a large extent determine nitrate loss rates for individual wetlands.

Mass balance analysis and modeling were used to calculate observed and predicted nitrate removal, respectively, for each monitored wetland. Wetland bathymetry data were used to characterize wetland volume and area as functions of wetland water depth. Wetland bathymetry has been determined by ISU on the basis of wetland construction plans and/or bathymetric surveys. These bathymetric relationships were used in both numeric modeling of water budgets and nitrate mass balances to calculate nitrate loss, hydraulic loading, and hydraulic residence time. Wetland water depth and temperatures were recorded at five minute intervals for numerical modeling of nitrate loss.

The monitored wetlands generally performed as expected with respect to nitrate removal efficiency (percent removal) and mass nitrate removal (expressed as kg N ha^{-1} $year^{-1}$). Variability in wetland performance is in part due to differences in wetland characteristics and condition and partly due to differences in loading rates and patterns. At a given annual HLR, differences in wetland condition and in timing of loading can result in significant differences in performance. Hydraulic loading rates during 2018 were among the highest observed during the prior years of CREP wetland monitoring as a result of above average precipitation during 2018. As a result, the 2018 percent nitrate loss at most monitored wetlands was low relative to drier years (Figure 3). However, as a result of the elevated HLRs, observed nitrate loads for these same wetlands were higher during 2018 than during 2017. Excluding the LX wetland which had insufficient data in 2017 for this analysis, the higher 2018 loads resulted in greater measured average nitrate mass loss with about 2000 kg N ha^{-1} loss during 2018 versus 1490 kg N ha^{-1} loss during 2017. It is also true that the higher loading in 2018 coupled with lower percent removal compared with 2017 resulted in greater nitrate mass export during 2018 than was measured for 2017.

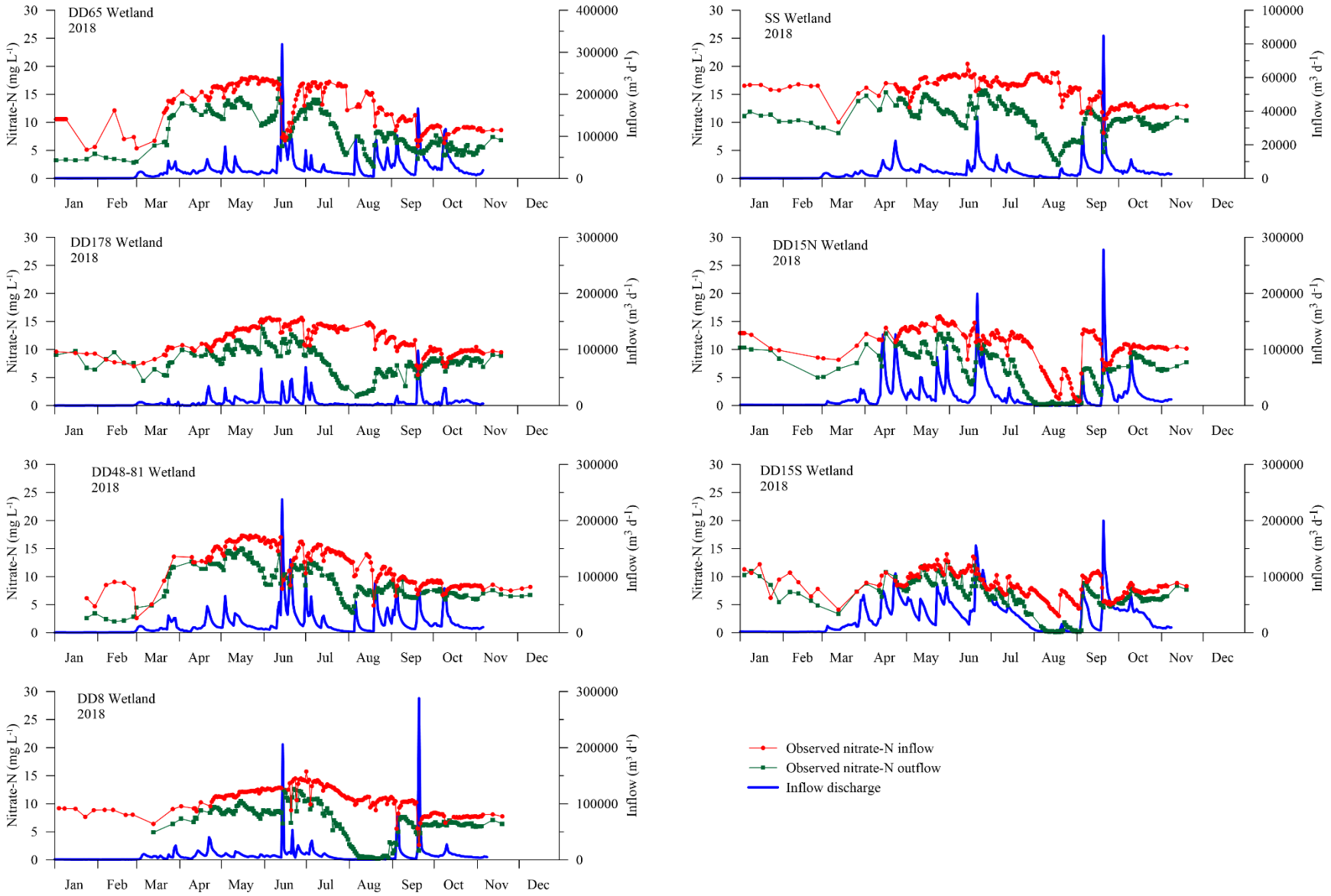

Figure 2. Measured nitrate concentrations and flows for northwest Iowa wetlands monitored during 2018.

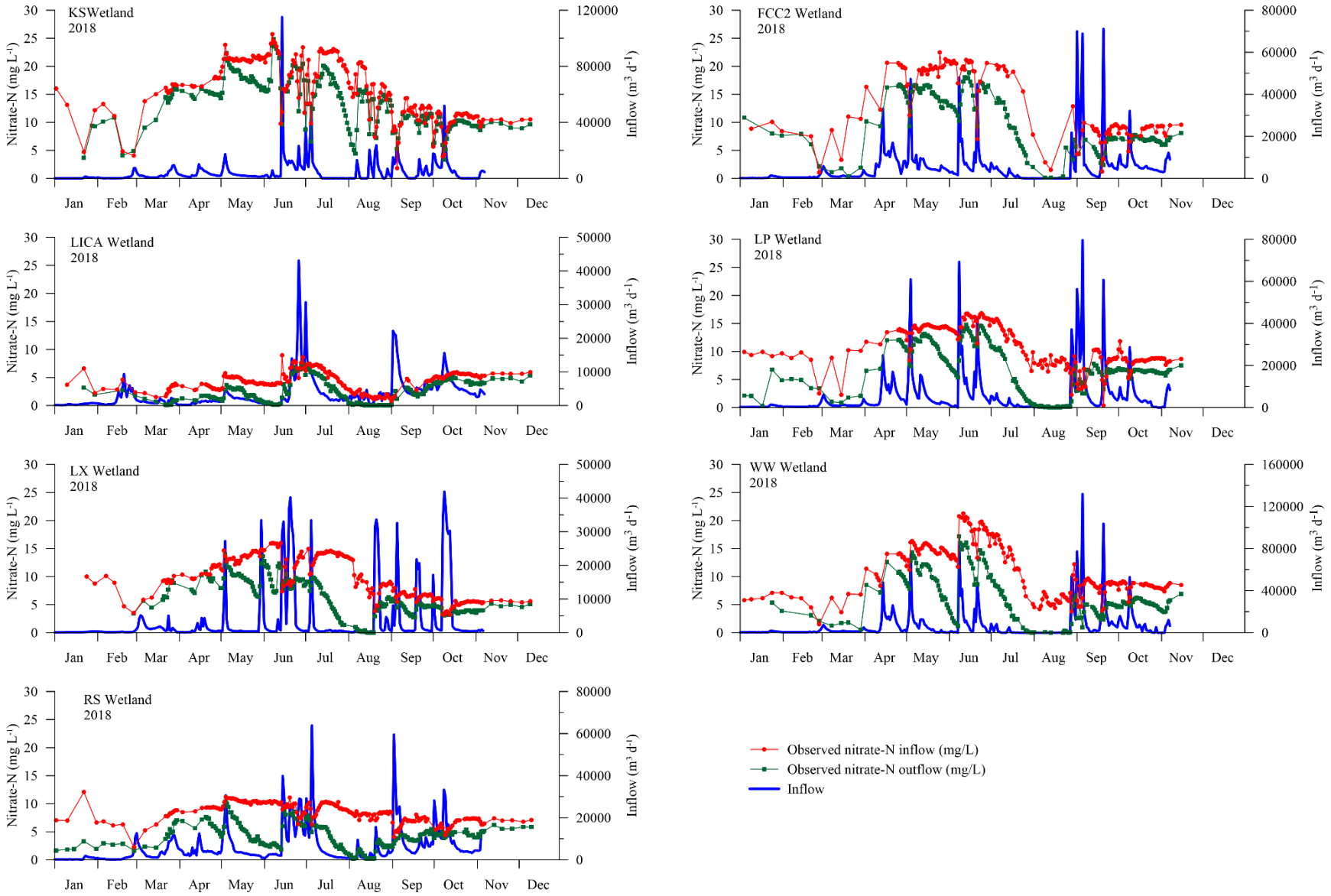

Figure 2. (Continued) Measured nitrate concentrations and flows for central and northeast Iowa wetlands monitored during 2018.

Mass balance analysis and modeling was also used to examine the long term variability in performance of CREP wetlands including the effects of spatial and temporal variability in temperature and loading patterns. In addition to calculating the percent mass removal observed for wetlands monitored from 2004 through 2018, the percent nitrate removal expected for CREP wetlands was estimated based on hindcast modeling over the period from 1980 through 2005. The results illustrate reasonably good correspondence between observed and modeled performance and demonstrate that HLR is clearly a major determinant of wetland nitrate removal performance (Figure 3).

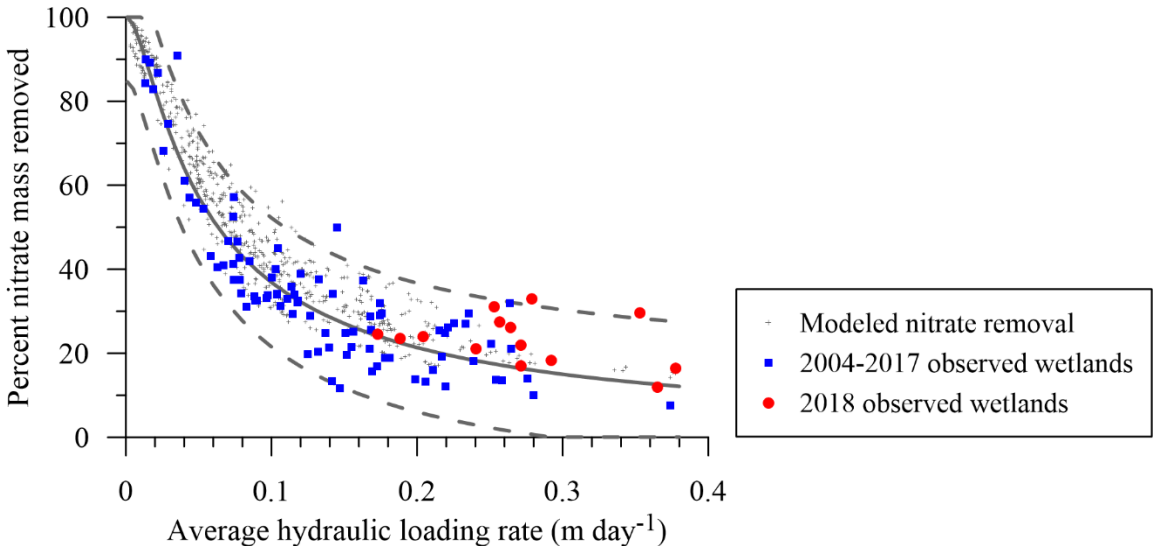

Figure 3. Percent nitrate removal performance for 2018 (January to early November, red circles) and wetlands monitored during prior years (2004-2017, blue squares). The dashed lines indicate the range expected to contain 95% of similar wetlands in Iowa on the basis of the 2004 to 2015 monitored wetlands.