

**Conservation Innovation Grant Final Report**  
**Award Identifying # - 68-7217-14-017**

**To:**

**USDA NRCS**

**Louisiana State Office**

**3737 Government St.**

**Alexandria, LA 71302**

**From:**

**The Nature Conservancy**

**Louisiana Chapter**

**December 16, 2016**

## **Introduction**

The Nature Conservancy was awarded a Conservation Innovation Grant from the Natural Resources Conservation Service (NRCS) in late 2014 to develop a water quality hot spot targeting tool to aid in the selection of 12 digit sub-watersheds in Louisiana for mitigation strategies. The main functional requirement of the application would be to identify “hot spots” where there are relatively high concentrations of selected water quality traits that represent potential problem areas. Supplemental data such as land cover and soils data would also be included to elucidate contributing factors to the “hot spot”. The “hot spot” analysis would be accomplished using readily available existing sample data from EPA and LDEQ. These sample data would be interpolated within 8 digit sub-basins (HUC 8) to create heat maps. This would allow users to evaluate 12 digit sub-watersheds based on relative concentrations of water quality traits within the HUC 8 and the supplemental data.

## **Application Scoping**

Louisiana staff from The Nature Conservancy met with NRCS staff on February 27, 2015 to scope out the functional specifications for the tool. Based on the joint discussion from that meeting, three 8 digit sub-basins were chosen to pilot the project: Boeuf, Tangipahoa and Mermentau. It was also decided that the following water quality traits would be assessed: dissolved oxygen, turbidity, total dissolved solids, total suspended solids, nitrogen and phosphorus. Yearly heat maps would be developed for each trait for each of the three pilot watersheds to allow the user to explore the spatial distribution of trait concentrations. It was decided that 20 years of sampling data would be sufficient to get a snapshot of the spatial concentrations in watersheds. Heat maps would be developed for the years 1995 – present and updated yearly as new data is made available. In addition, we also committed to creating a graphing function that would display temporal trends for each trait for each of the sampling stations. NRCS also requested that we include land cover and soils data in addition to the 8 and 12 digit watersheds boundaries.

## Beta Application

The functional specifications laid out in the February meeting guided the development of the beta version of the application. The beta version included a simple user interface that and gave the user the ability to select from available traits and years to display heat maps for the three pilot watersheds. There was also an option to turn on the water quality sampling stations which could then be clicked to produce a temporal graph. The graphing function displayed monthly mean values for each month of a given year as well as yearly means for all available years. Upon completion of the beta version we again met with NRCS staff to review our progress make revisions to the application. Based on NRCS feedback, the following enhancements were proposed for development:

1. Assess additional water quality traits ammonia, inorganic nitrogen, nitrate and orthophosphate.
2. Add named streams to the supporting data
3. Add mitigation banks to the supporting data
4. Create map symbology to represent the sampling frequency of each water quality station so that the user can more readily find data rich stations.
5. Include a map visualization of 303d impaired watersheds.
6. Add "standard" values for each trait to the temporal graph.

For enhancement 1 we went back to the STORET and LDEQ datasets and extracted samples for the additional traits. Heat maps were then generated for each new trait and monthly and yearly means were calculated as with the original six traits. Enhancements 2 and 3 were completed by working with NRCS staff to locate the desired data layers and adding them to the supporting data within the application. With enhancement 4, we ran a frequency analysis on each sampling station to calculate the total number of samples for that station. We then symbolized the stations so that stations with less samples have the smaller, lighter colored symbols while stations with more samples have larger and darker colored symbols. For enhancement 5 we downloaded LDEQ's 2014 Water Quality Inventory Integrated Report Appendix G: Louisiana's Final 2014 Section 303(d) List as an Excel file. This table cataloged listed impairments for basin sub-segments within Louisiana and the causes, sources and priorities for each. Many of the sub-segments had multiple impairments and therefore had multiple rows in the table. We aggregated all impairments for each sub-segment into a single row which made it possible to display the impairments as a grid. The final result is an LDEQ sub-segment map layer that is categorized as "High", "Medium" or "Low" TMDL priority or "no listing." When the user clicks on a sub-segment, the impairment grid displays in the application window so that all impairments and causes can be seen simultaneously.

Enhancement 6 will not be completed in this version of the application. The main reason for incompleteness is that there are not published standards for most of the selected traits. Dissolved oxygen is the only one of the selected traits that LDEQ publishes limits for and those limits are specific to the location and time of year. Because of the lack of accepted standards for the other traits and the complexity of the dissolved oxygen standards, we were unable to add the standard values to the graph with the available funding. If we can identify commonly accepted values for the other traits, we would be interested in adding this functionality to a future version of the application.

## **Production Application**

The production version of this application has three user workflows that allow the user to explore spatial concentrations, temporal trends or impaired watersheds. The spatial concentration workflow displays heat maps in the same way as the beta version but with the addition of new water quality traits, nitrate, phosphate, ammonia and inorganic nitrogen. We also added named streams and mitigation banks layers to the supporting data. The temporal trends workflow displays all of the sampling station and allows users to click on a station to view trends for the selected traits. Improvements made to this workflow move the graph into the application dialog window rather than using a free floating window. This provides a more compact interface and frees up more of the map space. A user can toggle between the spatial and temporal workflows to by clicking the tabs at the top of the app window. The selected sub-basin will persist with this workflow change. The third workflow is the impaired watersheds workflow. Because the impaired watersheds workflow uses LDEQ sub-segments instead of HUC sub-basins, the user must click the home button to go back to the initial screen and then select "Explore Impaired Watersheds." This brings up a map of all of the sub-segments in Louisiana symbolized by TMDL priority. Sub-segments in green have no listed impairment while listed sub-segments are colored yellow for "low priority", orange for "medium priority" and red for "high priority". The user can then click on the sub-segment to view the grid of impairments, causes and sources.

In addition to the original three pilot watersheds, The Nature Conservancy has elected to expand the application to include all 57 HUC 8 watersheds in Louisiana. The spatial analysis has been extended to all watersheds except those where is possible to interpolate certain watersheds because there either were not enough sample points or where the shape of the watershed is too narrow and sinuous to create a heat map. The temporal analysis has been extended to all watersheds along with all available supporting data. A final meeting is scheduled for December 21<sup>st</sup>, 2016 to demonstrate the application capabilities for NRCS staff.