



PROGRESS REPORT #49
PHASE 2
ASSOCIATION OF CENTRAL OKLAHOMA GOVERNMENTS (ACOG)
CANADIAN RIVER WASTELOAD ALLOCATION STUDY
Guernsey
July 2014

Red Italics = completed or recent, relevant past activities
Red Bold = current reporting month activities

This report represents the 49th Progress Report for Phase 2 of this project. A summary of the scope, by task, and completed activities is presented below.

Guernsey is addressing Phase 2 of the study. Progress on the tasks associated with Phase 2 follows:

- Task 1: Pre-planning, Coordination and Kick-off Meeting (*completed; kick-off meeting occurred July 30, 2010*)
- Task 2: Address Sampling Site Access and Contact Public Officials (*completed; about 94% of the access locations were secured*)
- Task 3: Conduct Preliminary Field Reconnaissance and First Field Study (*completed August 7-13, 2010*)
- Task 4: Conduct Second Field Study (*completed September 12-17, 2010*)
- Task 5: Compile and Analyze Field Data and Prepare Data Summary Interim Report (*submitted the report on November 24, 2010*)
- Task 6: Set-up, Calibrate, and Verify Water Quality Model and Prepare an Interim Modeling Report. *Draft Report 100% complete; submittal on April 7, 2011; received review comments from ACOG/ODEQ on the report on May 13; had two requests for clarification submitted to ACOG on May 13: (1) The comment on the first page about modeling options that increase the confidence of the Moore tributary predictions -- we can look at that situation and come up with some possible options can submit those to ACOG with a recommendation of which option to pursue. We need some feedback from the commenter (and ODEQ because they have to approve everything in the end) before we submit the revised calibration and validation, and (2) The sixth comment on the second page*

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that objected to plotting minimum DO + 1 mg/L -- we need ACOG to clarify what is being requested.

We did receive a response from ACOG on June 6 that ODEQ said to call for clarification on the two comments. That was accomplished.

Subsequent to June 6, the comments were being addressed and the final report was being developed. There is still more to accomplish and the final interim report should be ready by July 20 or so.

The final report and response to comments was submitted on July 20, 2011. There was an issue with one of the appendices and updated info for an appendix was submitted to ACOG on July 21.

On July 28, 2011, GUERNSEY asked John Harrington if having EPA review the interim report would be a good idea. John responded on July 29 that he thought it would be prudent to do so and would most likely save time on the back side of things, but he desired to check with ODEQ first. John sent out a request to ODEQ on July 29 about their thoughts on the issue. There was no reply from ODEQ in July.

Even though the following events occurred in August, the status of the ODEQ communications will be addressed. On August 10, ODEQ responded and requested a meeting. John has identified August 18 as a potential meeting date. As of the date of this report preparation, there has been no meeting date identified.

A meeting was held with ODEQ on August 18 in ODEQ offices that included John Harrington, Mark Derischweiler, Paul Yue, Philip Masirrer, and Ken Senour. ODEQ, after the final submittal of the report, came up with more comments that they wanted to be addressed. Additionally, the determination of whether to submit to EPA at this point was discussed, but not resolved. The meeting minutes from that meeting were previously submitted to ACOG.

It was later determined that the previous Interim Final Modeling Report would now be submitted to EPA to avoid further later delays. Getting their reaction/input now is critical to timely completion. Comments from ODEQ are being addressed and another version will be prepared for submittal to EPA.

Progress was made in addressing the newest/recent ODEQ comments and preparing a "revised" final report. A preliminary version was prepared/completed in late September 2011 for internal review/editing and the

process was initiated to prepare a revised final. It is anticipated the revision will be submitted to ACOG in early October.

The revised, "final" version of the Interim Modeling Report was submitted to ACOG on October 7, 2011. ACOG then submitted the report to ODEQ on October 10, 2011. At the end of October, there had been no response from ODEQ on the revised report.

At the end of November there had been no response from ODEQ regarding the final version mentioned above; therefore there was no further progress on the project. We are awaiting further instruction from ODEQ and /or EPA.

ACOG received information from ODEQ on Friday, December 2, 2011, that the Interim Modeling Report was submitted to EPA for their review. There have been no further updates on the status of EPA's review.

*On January 24, 2012, ACOG requested that **Guernsey**/FTN provide input and output files of the WASP model to EPA. On January 25 that information was provide to Paul Yue with ODEQ for ultimate transmittal to EPA. Through the end of January (and the date of this progress report below), we have not heard any further information from ODEQ or EPA.*

There are no changes to this report from last month. We are awaiting a response from EPA. The interim report has been with EPA since December 2011.

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*On April 11, 2012 notice was received from ACOG that ODEQ and EPA had identified the same issue regarding the manual input of hydraulics. It was identified by the **Guernsey** team that there might an issue with the model. After further investigation and strategizing, EPA Region 4 (Tim Wool) was contacted on April 18, 2012 about the modeling issue. Mr. Wool responded on April 24, 2012 that they had indeed identified the problem with the model and re-enabled the "aQb" functionality so that we could continue with our efforts. Further confirmation of the output is required and will be performed in early May. A new schedule was being reviewed.*

A new schedule was outlined and provided to ACOG on May 1. After submittal of the schedule, continued work on the model identified another issue that was brought to the attention of Tim Wool with EPA Region 4. A response from Mr. Wool was slow in developing during May, so results of his troubleshooting were not available for the May report. The issue was that the DO that was being consumed from nitrification was not being subtracted from the DO mass budget. In other words, nitrification was effectively consuming no oxygen. Mr. Wool indicates the problem has been corrected.

The aforementioned information became available in early June and was presented in the May 2012 report. We now know that the model results from last fall were somewhat erroneous because of the “bug;” we will need to revise the calibration and validation simulations with our current version of the model (the bug has already been fixed by EPA). The good news is that nitrification is only a small part of the DO budget for everything except the unnamed tributary that receives the City of Moore’s effluent (they had ammonia concentrations of almost 20 mg/L). A significant adjustment of the kinetic rates will be required for the Moore tributary and possibly for the tributaries that receive effluent from Oklahoma City and from Newcastle. For the other tributaries and the main stem, only a very minor adjustment of sediment oxygen demand should be necessary. (Actually, we had already plotted the output from the previous model and the current model on top of each other and the differences between the two sets of output are hardly distinguishable for most of the main stem and for several tributaries.) A proposed solution was identified. The resolution will include revised model information and a new schedule.

A new model run and an addendum to the interim report are being currently addressed

A revised schedule was submitted to ACOG on June 28th for review and approval.

An updated schedule for the remainder of the project was submitted to ACOG on July 10.

Because of the issues created by the “bug” in the model, a newer model version was run to work through the issues. An Addendum to the interim report was prepared and submitted to ACOG on July 18. ACOG subsequently submitted the Addendum to ODEQ and EPA.

No comments received from any organization on the Addendum.

Task 7: Run Model Projections and Calculate Loads

August 2012: Projections are being addressed. A white paper/memo will be submitted to ACOG on September 7 on model projections and allowable point source loads.

We continued to work on the model projections throughout August.

September 2012: A preliminary modeling report/projections simulation was submitted to ACOG on September 19, 2012, for review.

Comments on the projections simulation were provided by ODEQ to ACOG on September 28th and subsequently provided by ACOG to Guernsey on October 3rd.

October 2012: A project review meeting was held on October 9th to discuss the preliminary modeling report/projections simulation. Much of the discussion focused on comments provided by ODEQ (referenced above) regarding issues relating to data needed from the municipalities. The meeting resulted in data requirements, being requested by ODEQ, from several municipalities for review, and ultimate approval by ODEQ. Meeting minutes were provided to ACOG on October 17th by Guernsey. A proposed schedule for projected future activities was identified as follows:

- October 23: new engineering data from municipalities regarding flow rates to be submitted to ODEQ*
- November 6-15: responses/comments from ODEQ due regarding new engineering data and flow rates*
- November 30: responses from municipalities regarding ODEQ comments, and ODEQ final approval of flow rates*
- December 20: Guernsey/FTN will provide a memo to ACOG regarding revised projection simulations, including new calculations and analyses, and written responses to ODEQ comments on the preliminary projections (dated September 28, 2012)*
- January 2013: ACOG will schedule another CRPG meeting to discuss the revised projection simulations*

Various data sets were provided during October to ACOG and ODEQ, by the municipalities, in response to the needs identified above.

November 2012: On November 7th, the City of Oklahoma City sent a letter to ODEQ regarding their flow from the South Canadian facility and their comments on the City of Moore situation.

On November 26th and 30th John Harrington provided a summary of status on the model input. The summary table from the November 30th email from John is provided below.

ISSUE	STATUS	COMMENTS
Norman WWTP Flow. Model Rate was 17 MGD; ODEQ only approved 16 MGD.	Approved design flow will remain 16 MGD	
Moore Phase 1 flows for 2027 is only 9 MGD. Model flow was 12 MGD.	Moore sent ODEQ report justifying 12 MGD for 20 year projection.	Still some questions and comments on the 12 MGD.
Minco flow of 0.215 MGD not to increase for next 20 years.	Minco design flow 0.215 MGD	Minco contacted - okay with 0.215 MGD
Lexington flow of 0.261 MGD not to increase for next 20 years.	Lexington design flow 0.261 MGD	Lexington contacted - okay with 0.261 MGD
Noble flow of 0.76 MGD not to increase for next 20 years.	ACOG contact Noble - confirm flow.	Noble contacted; no reply. Will use 0.76 MGD if no reply by 11/30/2012
Oklahoma City request 10 MGD	Approved design flow for 8.66 MGD	
Purcell request 0.78 MGD	Approved design flow 0.78 MGD	
Newcastle request 0.852 MGD	Approved design flow 0.852 MGD	

There has been no resolution or any updates on this activity since November 30th. The previously agreed upon schedule is no longer possible. A new schedule will be developed upon clarification of the required data needs.

December 2012: Various discussions continued throughout December involving the approval of data by ODEQ regarding the municipal discharges. On December 31, a chart was provided by ACOG reflecting final approved flow projections. Some additional questions were identified and subsequently submitted to ACOG/ODEQ in early January for response.

Even though this December 2012 report now gets into January activities, it can reported that resolution was accomplished in early January, and the revised projection simulation memo will be submitted at the end of January.

January 2013: Review of new data continued in January with the provision of more information and response to additional questions by ACOG and ODEQ. Early in the month it was decided that a revised memo could be submitted to ACOG by Thursday, January 31st. This did not occur due to other conflicts. The revised memo was actually submitted to ACOG on Tuesday, February 5th.

February 2013: As indicated above, the revised memo was submitted to ACOG on February 5th. ACOG distributed the memo to the CRPG and ODEQ for review. ACOG began trying in late February to set up a meeting with the CRPG and ODEQ to discuss the revised memo. A meeting was ultimately scheduled for Friday, March 15th.

March 2013: As previously indicated, the revised memo was submitted to ACOG on February 5th. A CRPG meeting was scheduled for March 15th to discuss the revisions. Thru the early part of March, no comments had been received on the revised memo from anyone dating back to February 5th, and there was concern that by having the meeting without ODEQ comments, the meeting would not be beneficial. A chronology of events is provided below regarding acquiring ODEQ comments and coming to resolution on the meeting and further discussions.

- March 11th: ODEQ contacted by ACOG regarding availability of comments based on revised memo*
- March 13th: Comments received from ODEQ*
- March 15th: The scheduled CRPG meeting was cancelled due to lack of time to adequately respond to ODEQ comments; having the meeting would not have been beneficial*
- March 26th: Responses to ODEQ were submitted to ODEQ/ACOG for review*
- March 31st: Through the end of March, there was no further reaction from ODEQ on the responses (a response was ultimately received on April 3rd—not officially part of the March report).*

April 2013: As indicated above, a response was received from ODEQ on April 3rd. We were able to set up a call with ODEQ on April 8th to discuss their responses and get some resolution. The main issue is the predicted DO violations upstream of Mustang. The effort now is focused on providing another revision to the February memo. Specific activities in this regard are identified below:

- April 17th: Various thoughts identified and documented in response to the ODEQ discussion and shared with ACOG*
- April 22nd: Further internal communication regarding the challenges in correcting the model*
- April 23rd: It was identified that there was an error in the temperature correction factor for reaeration and correcting it caused the reaeration to increase enough*

for predicted DO values upstream of Mustang to be met without any changes to the calibration. Most water quality models automatically calculate the reaeration temperature correction factor internally, but because we are using WASP and because we are using reaeration equations that are not already programmed into WASP (per request), we have to make adjustments like this manually. This activity is actually good news and allows us to move forward. We are in the process of updating the revised memo again for submittal sometime in May.

May 2013: The second revision of the projections memo was delivered to ACOG on May 30th, 2013. Based on the discussions above and conversations with ODEQ, various issues were resolved enabling the second revision to be made and submitted.

June 2013: Options memo, on June 24th. Guernsey/FTN responded formally to those comments to ACOG on July 30th. The availability of the responses will be beneficial for the August 1st meeting at ACOG.

July 2013: As indicated above, the July effort was focused on developing a response to ODEQ comments. Additionally, coordinating the meeting for August 1st was addressed.

August 2013: A meeting was held with CRPG on August 1st to discuss the responses to the ODEQ comments and to develop a plan in moving forward. ODEQ indicated they were satisfied to the responses and were ready to continue on. There were issues requiring additional attention from Newcastle, Oklahoma City, and Moore regarding discharge location and plant upgrades. Dates were identified for submittal of information to ODEQ for approval. John Harrington provided a schedule for future activities as show below.

CANADIAN RIVER PROJECT TIMETABLE		
Date	Task	Organization Doing Task
15-Aug	Letter to OG&E regarding permit modification based on CRPG study.	ACOG
21-Oct	Location of discharge points finalized for final report.	CRPG Members
1-Nov	Effluent concentrations table generated for final draft.	Guernsey/FTN
4-Nov	CRPG Meeting	ACOG

Subsequent to the meeting and the provision of the schedule above, the City of Tuttle expressed two concerns regarding the report. The first concern was regarding the projection memo which did not document discharge limitations for Tuttle. Because there was no change to the discharge limitation and no impact on the water quality of the Canadian River, the Tuttle information was not reported in any of the projection memos or revisions. The August 2013 inquiry from Tuttle was the first indication there was an issue. After discussion with Tuttle it was determined that Guernsey/FTN can easily include a table showing no change to the existing limits for Tuttle.

Tuttle also has expressed a desire that they reflect that their future discharge may be directly to the Canadian River from the discharge from a new mechanical treatment plant. A feasibility study was performed in 2009 indicating the potential new location for such a plant with a discharge to either Worley Creek or the Canadian River. A meeting was held at ACOG on August 30th with the City of Tuttle to address the potential new plant. It was determined that Tuttle will provide to ODEQ the location of the new plant discharge and must await ODEQ review/approval. Upon approval, Tuttle will be modeled with the new plant location. Predicted date for resolution is October 21, 2013.

September 2013: There are no major updates for the month of September.

October 2013: John Harrington received a call from Oklahoma City (OKC). A list of questions regarding the possible plant locations that OKC sent to ODEQ apparently got lost at ODEQ. ODEQ did not get responses back to OKC until late September. OKC indicates it will miss the October deadline. Although trying to position for the end of November, most likely they will not be able to respond before January 1st.

Newcastle provided documentation that the City Council approved their new discharge location near Fox Lane and the Canadian River.

Several members of the CRPG notified John Harrington that they will be unable to meet the deadlines concerning the location of their effluent discharge. After discussion, John revised the timetable to adjust to their situations.

CANADIAN RIVER PROJECT TIMETABLE (Revised 10-15-2013)		
Date	Task	Organization Doing Task
01/06/13	Location of discharge points finalized for final report	CRPG Members
01/21/13	Effluent concentrations table generated for final draft	Guernsey/FTN
01/24/13	CRPG Meeting	ACOG

November 2013: There are no major updates for the month of November.

December 2013: There are no major updates for the month of December.

January 2014: On January 14th notification was received from ACOG that all municipalities had provided input regarding discharge location status. There were some clarifications required from the City of Tuttle on existing and future activities. Those were resolved in late January. The results will enable Guernsey/FTN to re-run the model with all updated data.

February 2014: Another revision to the projection simulations was submitted to ACOG on February 24, 2014 (the memo was actually dated February 19, 2014). Schedule

conflicts delayed the hand-delivery until February 24th. The revision was needed because of requirements relating to discharge relocations from several municipalities.

In late February, ACOG was notified by ODEQ that they wished to revisit the limits for the OG+E discharge. We had originally been directed to use OKC discharge limits for the OG+E discharge because they reuse OKC effluent for their cooling water requirements. ODEQ reaffirmed a need to now know water-quality based limits for OG+E.

In late February and early March new model runs were made that ultimately resulted in changes to the OG+E limits for Scenario D.

March 2014: A meeting was held with the CRPG on March 14th to review the final projection simulations for the study. Highlights of this meeting are provided below:

- *The City of Newcastle questioned the summer limits for Scenario D. It was determined those were the correct limitations.*
- *The Oklahoma Department of Environmental Quality (ODEQ) requested the modeling files be submitted to them prior to the development of the WLA report so they can begin reviewing the model input and output.*
- *The process to be implemented for the WLA report approval follows:*
 - *The draft WLA report will be submitted to ACOG for review by the CRPG.*
 - *After addressing CRPG comments (if any), Guernsey will submit the report to ACOG, who will then submit it to ODEQ. ODEQ will submit the report to the US Environmental Protection Agency (USEPA) for a technical review.*
 - *Guernsey/FTN will address technical comments from USEPA and revise the WLA report if necessary.*
 - *After EPA issues a technical approval of the WLA report, ODEQ will begin the public review process for updating the Water Quality Management Plan (WQMP) to incorporate the effluent limits in the WLA report.*
 - *After the specified time period for receiving public comments on the WQMP update, ODEQ will respond to those comments.*
 - *The WLA report will then be resubmitted to USEPA for final approval.*
 - *Once the WLA report receives final approval from EPA, the process for the WLA study will be complete (i.e., all tasks in the scope of work for Guernsey/FTN will be 100% complete).*
 - *ODEQ will then begin addressing the details of incorporating the new effluent limits that are in the WLA report (and the WQMP) into discharge permits. ODEQ will consider expiration dates of current permits and will include compliance schedules in permits for facilities that need time to make plant changes/upgrades to comply with the new effluent limits.*
 - *The schedule for the preparation of the draft report was discussed. The report should be available in two to three months. Ken Senour will review the scope, report outline, and identify the timeline for completion.*

Guernsey/FTN began compiling project data and previous files to assist in the preparing the WLA report.

Task 8: Prepare Preliminary Draft WLA Report

April 2014: Guernsey/FTN began developing the preliminary report. Communication with ACOG verified needs and the philosophy needed in preparing the report.

May 2014: In reviewing the modeling files and checking various things, it was discovered that a few of the input values were missing for several of the simulations. Through testing, it was discovered if you specify coefficients for the Phytoplankton Type 2 (the algae in tributaries), the model will duplicate those values in the Sediment Oxygen Demand group of coefficients. During development of the input files for the projections, it was noticed those "extra" input values in the Sediment Oxygen Demand group that we did not specify, and they were deleted. However, it was not known that when the input values are deleted in the Sediment Oxygen Demand group, the model software also deleted the values that had been input for the Phytoplankton Type 2 coefficients. This is clearly an error in the model software.

Based on our previous experience with the source code for the DOS version of WASP, it is conjectured that the software is trying to store values for both groups of coefficients using the same elements of a large array. The Phytoplankton Type 2 constants do not have a huge impact on results for the main stem of the river, but the model software did the same thing with the nitrification rate (which affects results in all streams). The model software took the value specified as the nitrification rate and duplicated it for one of the dissolved organic carbon (DOC) light extinction multipliers. Again, during development of the projections, the stray input value for the DOC light extinction multiplier was identified and deleted it, but our modelers had no idea that the model software would then also delete the nitrification rate.

Because we didn't make any changes to the nitrification rate going from the calibration/validation to the projections, we were not observing that input value and had no idea that we needed to check to see if it was still there. In 25 years of modeling, FTN have never had model software do something like this.

After this discovery, we re-entered the missing coefficient values into the WASP input files and re-ran the simulations for Scenario D. Before moving forward, though, we are checking all the other inputs to make sure no other inputs got deleted or altered by the model software. We are not quite finished with that process, but right now it looks like several of the effluent concentrations for the projections will be slightly more stringent.

ACOG (John Harrington) was notified of the issue. Depending on the magnitude and location of the changes, we maybe can email the change out to the members, hopefully get a quick approval without having a meeting. Finalizing the modeling exercise is currently being addressed.

June 2014: Upon further review regarding the QA/QC process, two additional issues were discovered: 1) the WASP software doesn't display a lot of the inputs such as boundary concentrations on one screen at one time (it displays the boundary concentrations one at a time), and 2) a lot of the inputs such as flow rates, hydraulic coefficients, and reaeration coefficients are being calculated outside the model in spreadsheets.

In addition, John Harrington had a concern regarding the need to upgrade the WASP model. We checked the EPA website soon after we discovered the situation with the software deleting certain inputs. It was discovered that EPA published an updated version of WASP dated November 2013. That version was downloaded and installed onto a different computer (to avoid losing the version we had been using) and tried to make a test run to see if it would give us the same results and also to see if it still had the same problem with deleting input values. When we tried to make a test run, the first thing we identified is that the model could not simulate more than 480 segments (we have 601 segments in the main model and 51 segments in the Moore tributary model). It was puzzling why a newer version of the model would have a lower limitation on the number of segments.

We then decided to make a test run with just the Moore tributary model by itself and we found that the DO values predicted by the new (November 2013) version of the model were slightly higher (i.e., up to 0.5 mg/L higher) than the values predicted by the version we have been using. Because this was a significant difference, we contacted Tim Wool at EPA asking him what changes had been made in the model and telling him about the problem trying to run the main stem model with 601 segments. Tim provided a new DLL file to simulate a larger number of segments, but he never responded to the question about changes in the model.

We installed the new file (Multi-Algae.DLL) and made another test run with the main stem model, but this time got a different error message (related to an entry point in the subroutine). We sent that info to Tim and he sent us a second DLL file (SOD.DLL), so we installed that one and again made another test run, but got the same error message. At that point we gave up on Tim and his attempts to fix the software to run with 600+ segments. However, we were still able to verify that the new version of the software does not create "stray" inputs nor does it delete the nitrification rate or the Phytoplankton Type 2 inputs when the user deletes other inputs.

We continued to encounter problems and further investigated the output and comparing simulated values from the new version and the version we have been using; our goal was to see if we could determine why the results were different. We found that the two versions were predicting different values of algae in the water column (Phytoplankton Type 2) and benthic algae; both of these obviously have a direct effect on DO. We continued reviewing and discovered the output showed that the two versions of the model were predicting different values for the light limitation of the growth rate for algae in the water column. We set up a spreadsheet to manually

calculate the light limitation factor according to the equation in the User Manual and our calculations agreed with the version of the model that we have been using. The newer version was calculating a light limitation factor that was about 1.7 times as high as the value from the model version that we have been using. Because we used the same input file with each version of the model and got different results, they can't both be correct. Based on the manual calculations, at this point, we believed the model version that we have been using is yielding correct results. The bottom line in response to John's issue about WASP needing an upgrade is the following: there is an updated version available on the EPA website, but it currently won't run more than 480 segments and it gives different results than the version that we have used to establish our calibration and verification for this project.

At the end of June a new memo was prepared with corrected results and was under review as the month closed.

July 2014. On July 3rd, the final revised memo regarding predictions was submitted to ACOG. On July 8th, John Harrington distributed the memo to the CRPG. As of July 17th, John had not received any comments on the memo. In addition, at the end of July, model simulation DVDs and the ACOG contract renewal were being addressed and prepared for ultimate submittal to ACOG.

- Task 9: Attend Preliminary Draft Report Meeting
- Task 10: Address Review Comments from ACOG and the CRPG on the Preliminary Draft WLA Report/Prepare Draft WLA Report
- Task 11: Address Review Comments from ODEQ and EPA to the Draft WLA Report/Prepare Final WLA Report

Prepared by: Ken Senour, Guernsey
Date: August 11, 2014