



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Arthur R. Marshall
Loxahatchee National Wildlife Refuge
10216 Lee Road
Boynton Beach, FL 33437



January 9, 2007

Jess D. Weaver
Regional Hydrologist, Southeastern Region
U. S. Geological Survey
3850 Holcomb Bridge Road, Suite 160
Norcross, Georgia 30092-2202

Dear Jess,

I want to sincerely thank you for the time, effort, and expertise that USGS brought forward to the peer review of our Enhanced Water Quality Monitoring and Modeling Program's Annual Report. Callie Oblinger, Paul Conrads, and Wade Bryant each provided a detailed review of the report, clearly reflecting the significant effort they put into the review. The final version of the Annual Report has been greatly improved as a result. I have attached a matrix that describes how we considered and addressed every comment raised by the peer review.

As we anticipated at the beginning of this process, we found that a number of comments were valuable in providing guidance for our efforts in the future. Several comments strengthened the presentation of the science in the report, which will prove valuable in our efforts to publish the research in peer-reviewed journals. In addition, there were some comments that although we did not address explicitly in the final version of the report, we will explore further. One in particular was the value of having a greater discussion on the use of $\frac{1}{2}$ MDL values in water quality analyses. There are technical (as brought to our attention by the peer review) and regulatory-related issues on this topic and we hope to explore the subject further in a larger forum including scientists from other agencies that work with water quality data. We look forward to USGS involvement in that effort.

Although it delayed the initial peer-review schedule, I believe it was worth the effort to have the entire report ready for review at one time. The cumulative review by USGS clearly reflected the value of having all components of the report at the same time. This was important to us given the high profile nature of the Enhanced Water Quality

Program, especially as it relates to the federal consent decree. As you observed at the briefing at DOI Headquarters in late November, it is the sum total of the report's findings that lend themselves to laying out tangible management recommendations.

The USGS review is another great example of the partnership between our agencies and USGS support of our Refuge programs. For the Department, it is also a great example of the excellent science being done by its bureaus. Again, your efforts were much appreciated.

Sincerely,

A handwritten signature in cursive script that reads "Mark J. Musaus". The signature is written in black ink and is positioned below the word "Sincerely,".

Mark J. Musaus
Refuge Manager

A.R.M. Loxahatchee National Wildlife Refuge, Enhanced Water Quality Monitoring and Modeling Annual Report: 2004-2005

Comment/Response Table to USGS Peer Review

Commenter	Page	Line	Comment	How is the Comment Addressed/Resolved
General				
Callie Oblinger			Thank you for the opportunity to review the subject report. It is clear from the report that the water-quality, conductance, and stage network are providing significant information to Refuge managers for resource management decision making. Recommendations made in section III of the report are reasonable given the data analysis presented. The recommendation for additional sampling to characterize the floc layer and better understand the role of floc in the phosphorus budget is an important one.	Thank you.
Callie Oblinger			My general comments concern statistical measures and tests used and units of measure. Many of the statistical tests used are unspecified. Parametric statistical tests were probably used when non-parametric tests are more appropriate for these water-quality data which are not likely to be normally distributed and are right skewed. A good illustration of this is in table 1-3 where mean TP for 2004 is 33.3 mg/L but the median is 6.6 mg/L. Use of non-parametric methods such as median and median absolute difference as measures of central tendency and variance will provide results that are less influenced by outliers.	The final report provided clarification on unspecified statistical tests. Responses about some of those tests are detailed below in the more specific comments, including a discussion about the choice of mean versus median, and a discussion about 1/2 MDL substitution. It is these types of technical review comments that have proved invaluable to our efforts to present the best information possible.
Callie Oblinger			Likewise, hypothesis tests for differences between means that assume a normal distribution are not appropriate for these data; instead a rank based test should be used. Such tests often eliminate the need to substitute for censored data. The method chosen for handling censored values (they were set at 1/2 the detection level) is the least defensible of the substitution methods (Helsel, 2005) and can bias results. Methods have been developed to handle data that include values that are below laboratory detection levels without substituting an arbitrarily selected number.	
			<i>Helsel, D.R., 2005. Nondetects and data analysis: statistics for censored environmental data, John Wiley and Sons, Inc., 250 p.</i>	We purchased the book
Callie Oblinger			The report mixes SI and English units of measure throughout. Discharge is in cfs, volumes in acre-ft, precipitation in inches, stage in feet, loads in metric tons, and distance in kilometers. I suggest reporting all values in SI units, although reporting flow in cfs is customary in many USGS reports. In one paragraph in the first chapter, mixed units were used to describe a single calculation (p. 51, 29% of 0.12 m = 11.42 in.). Most importantly, a volume unit should be substituted for cfs-d (which is not a measure that makes good physical sense) to describe discharge volume per day.	Mixing of units is a classic challenge in South Florida, with hydrological units often reported in feet/inches, and water quality parameters measured in both English and metric - often driven by the multiple scientific and lay audiences for technical reports. In the final version, SI and English units are both presented for each calculation.
Paul Conrads			Thank you for the opportunity to review the draft report "Enhanced Water Quality Monitoring and Modeling Annual Report: (2004-2005)." I generally found the report to be well written. It represents a tremendous amount of effort in monitoring, modeling, and analysis. I do have a few specific comments.	Thank you.
Paul Conrads			The report would benefit from using similar formats for each of the chapters and a table of contents.	Noted - a global tech edit was done before finalizing
Paul Conrads			Thanks again for the opportunity to review the report. If you or any of the authors have any questions or comments about my review, please feel free to contact me.	Thank you.
Wade Bryant			Thank you for the opportunity to review this report... The efforts to acquire the data and complete the analysis are to be commended. ... Please feel free to call or contact with specific questions or issues.	Thank you.
Wade Bryant			Very long and repetitive in places, an editorial review focused on reducing repeated statements and shorten will make the document easier to read and follow.	Noted - a global tech edit was done before finalizing
Section I				
Paul Conrads	2	32	Change S-10s (not found on figure 1) to S-10 structures.	corrected
Paul Conrads	3	1,2	Reference change in flora and fauna occurring with TP>10 parts per billion -Payne and Weaver, 2004?	Section I was intended for a broad audience, and as a result, we chose to not have citations in this section. However, you are correct that Payne & Weaver and Richardson are appropriate citations (and are used elsewhere in the report)
Paul Conrads	5	2nd para	Reference? Richardson et al, 1990?	good suggestion
Paul Conrads	5	5th para	consider moving to 2nd paragraph, p. 2	
Wade Bryant			Section I in particular, could use an editorial review.	Noted - a global tech edit was done before finalizing
Section II: Chapter 1				
Callie Oblinger			The two figures showing the study area were confusing and hard to read. On figure 1-1, I was unable to reconcile the 53 marsh network sites and 14 EVPA stations mentioned in the text with the number of sites shown on the figure.	We now present a figure with clear distinction between symbols used to identify the different networks and hope this provides more clarity.
Callie Oblinger			In table 1-2, the means and minimums for TN are equal or nearly equal implying a high detection level that does not match the detection levels shown in table 1-1 for TKN and nitrate plus nitrite from which I assume TN was calculated.	The level of aggregation applied did not provide strong resolution, however we did not collapse the data in the manner purely for TN, we were more interested in TP, CL, and other parameters with the strong spatial gradients. Also, we move the TN to the bottom of the table to reflect it hierarchical importance in this analysis.
Callie Oblinger			Figure 1-2 is the only place in the report where medians and percentiles are used rather than mean and standard deviation. These are the statistics that should be in table 1-2.	We now reflect both median and mean values for each of the tables. But our discuss remains focused on the means as we feel that the ecosystem flora and fauna are more likely to be influenced by the level of nutrient supplied (average) rather than the middle of the distribution of the nutrients (median) supplied.

Callie Oblinger	23		No explanation is given for the number that follows the mean here (5.1±4.3) and elsewhere in this chapter. The numbers could be mean ± sd (as in chapter 2, p. 67) or a confidence interval. If it is the latter, the percent confidence should be stated and it should be determined for the median or a transformation of the mean. The coefficient of variation for floe depth is given as 0.74 and 0.77 for the north and south, respectively, however if it is the mean and sd that are provided in the next paragraph, I calculate the CV to be 0.82 and 0.53 for north and south. It isn't clear how the dashed line in figure 1-5 was determined. If it is a least squares fit, the coefficient of determination must be quite low.	First, we made sure it was clarified that it was indeed mean and 1 standard deviation. Second, the coefficients were correct, but the mean and standard deviations were transcribed incorrectly, we fixed those problems (thanks for catching this). Third, the line is an Excel linear trend line with origin forced to zero - we wanted to show that floe depth is variable but often a significant portion of the DCS. The last sentence in the Fig. 1-5 caption was revised to read: "The dashed line is the Excel generated linear trend line with the origin forced to zero."
Callie Oblinger	52		In the last paragraph there are the conflicting statements that rainfall was normal in 2005 and that there were dry conditions in 2005.	We removed the ambiguity by removing '... dry conditions in 2005...'
Callie Oblinger			Several figures refer to a grey box that didn't appear on my copy.	We fixed the grey box issue.
Paul Conrads			The four zones are presented in Chapter 1. It would be helpful to present graphs that show how the delineations of the zones were made. For example a plot of specific conductance versus distance to canal may show why breaks between the zones (2.5 and 4.5 km) were chosen.	The zones were delineated by a series of approaches. First, we visually examined data from all sites plotted as conductivity verses distance from the canal. From that we observed that the spread on the data points decreased from the perimeter to the interior. Then we did box plot analyses to delineate the zones that showed the clearest distinction in medians and ranges of percentiles between zones. Finally, Mann-Whitney U analyses confirmed the classification. The revised text clarifies this, and includes a new summary statistics table for these conductivity-driven zone classification.
Paul Conrads	11	11	i.e. should probably be e.g.,	We changed i.e. to e.g.,
Paul Conrads	14	29	hard to tell in fig. 1-1 the 14 EVPA stations. Include description of station naming convention (LOX##) and move explanation of network on figure 1-1 (lower right) to the explanation box (upper right).	We created a new map with clearer symbols and moved LOX and LOXA definitions to legend box
Paul Conrads	14	last para	include total number of LOXA sites.	We added the number of stations to the paragraph
Paul Conrads	17	1st para	spell out first use of parameter names and put abbreviations in parenthesis.	We added full names of parameter followed by abbreviations for first appearance of each parameter
Paul Conrads	17	24-25	should it be "S-39A" to be consistent with fig. 1-1?	We changed the Figure 1-1 notation to S-39
Paul Conrads	18	8-9	unclear where the data is "highlighted with shading" occurs. Is it in the figures or appendix?	The shading for the figures is on the figures in the text and not appendix. We have fixed the problem
Paul Conrads	18	33	should it be table 1-2, not table 1-1?	Changed the Table 1-1 reference to Table 1-2.
Paul Conrads	20	figure 1-2 caption	the figure doesn't delineate the marsh zones. The figure shows the distribution of conductivity for the four zone classifications. A plot showing conductivity vs. distance to canal may shed some light on the delineation.	The caption now reads: "Figure 1-2. Box-whisker plot showing conductivity verses distance to canal for the four zones: boundary canal; perimeter (from canal to 2.5 km into marsh; transition (2.5 to 4.5 km into marsh); interior (more than 4.5 km into marsh). The horizontal line in each box is the median, the top and bottom of the box represents the 75th and 25th percentile, respectively, and the whiskers define the 5th and 95th percentile observations."
Paul Conrads	23	figure explanation	decrease the font to be consistent with other figures.	We fixed font size in the figure
Paul Conrads	26	Fig 1-8	don't see grey box (see comment # 10). Can't see it subsequent figures.	The shading for the figures is on the figures in the text and not appendix. We have fixed the problem
Paul Conrads	27	7	sentence is a bit awkward. Perhaps rewrite to "There were no clear distinctions in the arithmetic means of TN data between marsh zones."	We made the addition of arithmetic means to the TN distinction across zone statement
Paul Conrads	32	9-10	Move figure reference to the end of the preceding sentence. Figure 1-14 (and 1-15) show daily net flows, not average net flows over a specified period.	We moved Figure 1-14 reference in line 10 to the end of the previous sentence
Paul Conrads	32	33	should the figure reference be for figure 1-14 instead of 1-16?	We changed reference to Figure 1-17 to Figure 1-16 and reference to Figure 1-16 to Figure 1-14
Paul Conrads		figures 1-14 & 1-15	tick marks for the months are distracting. Consider moving to axis crossing the minimum y-axis value.	We tried moving tick marks, but concluded that the present location was most appropriate for a general audience to be able to reference date to data
Paul Conrads	37	8	change heading to "Overall Hydrologic Inputs and Outputs."	We changed the heading to "Overall Hydrologic Inputs and Outputs"
Paul Conrads	42	2nd para	the transects have not been described. They appear to be a pairing of flow structure with water-quality sampling site.	We changed the reference to the transects to canal stations and the passage now reads: Prolonged inflows from STA-1W resulted in sustained high canal TP concentrations for several months at the STA-1W canal station (Figure 1-21). This pattern was also observed in the canal station at the S-6 canal station (Appendix 1-3) even though STA-1W canal station is more than 10 km from the S-6 canal station (Figure 1-1).
Paul Conrads	42	27	change relationships to relations.	We considered changing relationship to relation, but decided to keep relationships
Paul Conrads	43	25	capitalize hurricanes.	When hurricane and tropical storm were used as a proper noun we capitalized them, other wise we allowed them to remain lower cased
Paul Conrads	44	figure 1-22	resize top plot to be the same as the lower two.	We resized canal, perimeter, transition, and interior zone individual parameter graphs so they line up
Paul Conrads	45	8	capitalize tropical storms and hurricane.	When hurricane and tropical storm were used as a proper noun we capitalized them, other wise we allowed them to remain lower cased
Paul Conrads	51	floc section	this section seems out of place. The previous discussions were on the characterization of the various zones. The discussion on the need for additional floc monitoring and analysis may be more appropriate in the Summary section of this Chapter or in Section 3 of the report.	This section follows the brief discussion on depth, which is used to calculate floc. As a result, we decided to keep the sequence as it was in the original document, but chose to move the bullet list of open questions for future research to Section III to help with the flow. Thank you for your input.
Paul Conrads	54		the McPherson and Halley (1996) and Orem (2004) reference were not found in the text.	We deleted references
Paul Conrads	55		the Surratt (2005), Thomann (1972), and Walker (1995) references were not found in the text.	
Wade Bryant			The organization of section 1 is difficult to follow. Comparison of zones, inflow/et, then discussion of zone characteristics. Suggest the following order for "results": Canal/inflow/et/rainfall first - i.e. the forcing functions to set the context and put the constituent number in perspective (P concentration in rainfall vs canal, timing an delivery of water. Follow this with the material presented starting at pg 51 Characterization of the zones, and interrelationships between constituent values within a zone. Last, Comparison of the zones and canal over time (presented first in the draft) with integration of the material presented for the canals/rainfall et....	Thank you for your input on reorganizing the chapter. As we developed this chapter over time, we have tried several different organizations, including the approach you suggested. Because the primary purpose of this Chapter was to characterize the water quality condition in the Refuge we decided to start off with the summary of water quality conditions in the zones, then follow that with the hydrology, and finalize with zone characterization.
Wade Bryant			Substitution of ½ detection limit – MOST IMPORTANT:	

Wade Bryant		Substituting 1/2 the detection limit, although used by many for so long, IS BIASED, and should not be used. Especially in this context, where the number of <reporting limits for important constituents may be very different between zones. Dennis Helsel and others are on the leading edge of alternative approaches. There is free ware available that is relatively easy to use (R-Code) and S-PLUS modules developed by USGS for this purpose. The latest version of SAS has some methods built into survival analysis. Substitution and associated bias seems very important as related to SO4 and more of an issue in the marsh interior compared to the canal (more values <mdl). Without seeing the frequency of <s for each zone the magnitude of the problem is unknown. Given the sensitivity of this work, the known statistical issues with substitution, and the ease of alternative and more sound statistical approaches, if this was to be published as a USGS report or in a journal I would reject it on the basis of 1/2 substitution method.	This is a very interesting point that we wish to pursue further down the road. For the purposes of this annual report, and to remain consistent with regulatory-based data presentation for Florida (e.g., SFWMD and FDEP reports) we chose to continue reporting values below MDL as 1/2 MDL. We have purchased Helsel's book and are examining this issue in greater detail. One scenario would be to have a larger audience discussion on this issue as it pertains to WQ data reporting in South Florida - we would be interested in USGS' participation in this type of exercise. For purposes of future publications in a peer reviewed journal, we are considering changing the our current approach.
Wade Bryant		If you have data in excel format with values below the detection limit easily identified I will be glad to calculate descriptive stats using the methods outlined in Dennis's book to allow compare with the 1/2 detection limit substitution used. Perhaps for th SO4 data first or the data with the most <s values.	
Wade Bryant		Buy this book, not because Dennis is a friend and colleague and could use the royalties, but because it is easy to understand and provides an up to date review of nondetects and analysis: Helsel, D.R., 2005, Nondetects and data analysis: statistics for censored environmental data, John Wiley and Sons	Excellent suggestion - we purchased the book.
Wade Bryant		Include a table of sites, with period of record, monitoring program (EVAP, LOXA), distance from canal, and zone (canal, perimeter). Are the codes used in figure 1-1 the same as in dbhydro? If not, suggest providing the exact code used in dbhydro.	We added a table that captures all the sites, distance from canal, monitoring program, zone, and periods of record.
Wade Bryant	16	Provide details on the filtration process (pg 16, membrane, pore size,...	We added a citation to the information on sample processing.
Wade Bryant		Suggest providing more detail on "flagged data". Are the only "flagged data" from the May and June 2005. Which of the 29 parameters have flagged values? Do all sites have flagged values?	In the report we state that we do not use flagged data. In addition, we added the statement: "Additionally, no flagged data from DBHYDRO were used in analyses presented here and for additional information on flagged data for the period of record analyzed here visit DBHYDRO."
Wade Bryant		I understand the zones, and conductivity box-plot but I can not determine from the methods exactly how (statistics used) a specific site was classified into one of the 4 zones. I assume "based upon variability in conductivity data" means an analysis of coefficient of variation was done or some type of clustering algorithm was used to classify sites based on conductivity measurements from June2004-December 2005.	We did not apply cluster analysis because different processes control water chemistry through out the marsh, we were specifically interested in where canal water was located through out the marsh and for that reason focusing specifically on the conductivity parameter proved more useful for dividing the Refuge into zones
Wade Bryant		I do not understand what "changes in conductivity as a function of distance from the perimeter canal" means in the context of site classification as no details are provided.	We added the word 'median' to create the statement ...changes in median conductivity...
Wade Bryant		The process used to classify sites into one of the four zones is extremely important given the similarity between transition and interior in figure 1-2. Based on an eyeball analysis the medians and interquartile ranges are not significantly different between transition and interior. Based on the importance of the interior as an endpoint for management, the characterization and sites include is very important. Also, include on figure 1-2 the number of sites in each category.	We added number of sites for each component of the boxplot and updated the entire box plot analysis to reflect every sample from the period of record, instead of the collapsed median for each month
Wade Bryant		I assume TP is total dissolved phosphorus... total in the filtered water and not a total digestion of unfiltered water (clarify in methods). (Same for TN) In the methods "transferred ... after being filtered and preserved". Be very specific and consistent on the use of terms.	TP was just total phosphorus. We clarified that all samples were not necessarily filtered in the text by stating that samples were filtered when appropriate and we added a reference to the SFWMD field sample quality assurance manual. For TN, we provided additional information on how we determined TN by adding a parenthetical statement: "summed NOx and Total Kjaldhel Nitrogen".
Wade Bryant	Table 1-2	report summary stats to the same level or precision as the method reporting limit (TN mean 2 mg/l vs. mdl of 0.05 mg/l.	We decided not to report the summary statistics to the precision of the MDLs because we are considering the aggregated values instead of single point values and as such we can not claim certainty in precision down to MDL.
Wade Bryant	Table 1-2	suggest using same units for TP and TN and putting N first in the table to allow N/P ratio to be easily visualized.	For the purpose of maintaining consistency in TP reporting across agencies we maintain the use of µg L-1 for our TP concentration presentation.
Wade Bryant		Use the same time period on the x axis for all graphs even if data for floc depth was not available from Jan04-Aug04. This would make it easier to compare all of the data presented in the graphs (overlay)	We made the floc graph represent the same time line as the other graphs (Jan04-Dec05)
Wade Bryant	Figure 1-8 TP	no methods are presented prior to presenting the data for the flow-weighted mean from g-310 and g-251. Number and frequency of sampling and the establishment of the flow/concentration relationship required for calculating a flow weighted mean are not presented. Why is the flow weighted mean presented with the zones, given you have the canal data. Suggest moving the flow-weighted mean plots to a separate graph with canal to illustrate canal/inflow relations and have a separate graph of 4 zones to illustrate relations between the zones.	Data for flow-weighted means of discharge structures were presented in the Everglades Consolidated Report/South Florida Environmental Reports of 2005-2007. We include citations to those sources for the FWM calculations. FWM data were presented with zones to provide the reader with the ability to examine potential relationships between explicit discharges (and not just canal WQ information) and WQ in the marsh. Appendix 1-3 shows relationships between structure discharges and canal WQ.
Wade Bryant	Figure 1-8 TP	I like to see confidence intervals on plots of means over time, but with all of the stations presented on one graph this is not possible. Given the importance both "average" and "variability", presenting confidence intervals would help visualize the information in the appendix.	This is a good suggestion that we will likely pursue in future publication specifically focusing on zone differences. However, as this chapter of the annual report has a broader audience, we are providing an overview of the data.
Wade Bryant		Add a short statement regarding denitrification and wetland biogeochemistry in the Nitrogen section	Following the paragraph TN we added the statement: "Neither TN or SO4 would be expected to act as conservative substances. Nitrogen is affected by nitrification and denitrification and other processes, while SO4 is affected by SO4 reduction which appears most evident in the marsh interior."
Wade Bryant		Sulfate - 0.1 mg/L mdl but 0.36 and 0.05 min values shown in table 1-2. The mean in the interior is the reporting limit and the minimum value 0.05 is below the reporting limit. Given the interrelated role of sulfate reduction and methylation of mercury combined with the sensitive nature of the mercury issue... extreme care and attention to statistical procedures is warranted. The frequency / number of SO4 samples below the detection limit are not given, but documented biased introduced by substitution methods appear to be very important in calculating summary stats for SO4.	At the end of the SO4 paragraph we added the statement: "Sulfate levels were reduced to or below detection limits in the interior zone, mostlikely because of higher SO4 reduction in the interior zone."
Wade Bryant		As with Nitrogen, some mention / reference to sulfate reduction would help most readers understand the data.	Following the paragraph TN we added the statement: "Neither TN or SO4 would be expected to act as conservative substances. Nitrogen is affected by nitrification and denitrification and other processes, while SO4 is affected by SO4 reduction which appears most evident in the marsh interior."
Wade Bryant	Table 1-3	how can the N be 12 in 2004, 10 in 2005 and only 12 between 1999-2005?	We corrected the number column from the table to reflect the entire dataset of rainfall nutrient data and added a caption explaining how we aggregated down from raw data to monthly values
Wade Bryant	Table 1-3	provide a source / reference for the data not collected during this study (1999-2005).	All data available for the period were collected and used.

Wade Bryant	43		'higher inflows conditions were driven by structure operations related to hurricanes Frances and Jeanne" Table 1-2.	We removed the reference to Table 1-2
Wade Bryant	43		There is nothing in Table 1-2 related to hurricanes.	
Wade Bryant	43		The time Figure 1-21 does not allow resolution of the Sept04-Oct04 time period suggest a separate graph with that time period expanded / cut out. If draining the ag and water treatment areas and overall operation of the water control structure is important .. and it appears that it is in terms of both concentration and inflow/stage likely to move water into the marsh	To Figure 1-21 we decided to add reference to hurricane and tropical storm events that would have initiated management to make changes to structure operations
Wade Bryant	43		The last paragraph on page 43 and the implications for water management and potential movement of water into the marsh is the most important information contained in section 1 and should be highlighted.	We decided not to delve too deeply into the implications of the findings for this chapter in the report. The big-picture implications are presented in Section III of the report. That being said, we recognize that future peer-reviewed publications will require ensuring that big-picture implications do get attention.
Wade Bryant	49		Given the importance of the interior as a management endpoint the discussion on pg 49 seems limited.	
Wade Bryant			The mixing of the use of parametric and non-parametric statistics across the sections is confusing in that no explanation is given as to why and no discussion on the data meeting assumption required for parametric analysis is included in the methods.	We now present both mean and median values in the tables, although we still discuss the means. We feel that ecosystem flora and fauna are more responsive to how much they receive (average) rather than the middle of the possible values for the nutrient they receive, so we kept our discussion focused on the mean values. Further, we do provide some non-parametric approaches, particularly the Mann-Whitney U that we applied to determine the statistical difference between the zones. One reference to support the use of the means for ecosystems analysis is presented by Mayer, T.D. 2005. WATER-QUALITY IMPACTS OF WETLAND MANAGEMENT IN THE LOWER KLAMATH NATIONAL WILDLIFE REFUGE, OREGON AND CALIFORNIA, USA, Wetlands, v25, i3 p697-712. As this work moves towards publication in a peer-reviewed forum, we will continue to examine this, and other valuable comments from the USGS review.
Section II: Chapter 2				
Callie Oblinger			In figure 2-1, I would like to have seen the transects on figure 2-1. Two sites are labeled LOXA130 (no LOXA136) and I was unable to find LOXWS.	We added the transects, fixed the site labeling issues and added all the weather stations used to determine rainfall.
Callie Oblinger	67		Although the period of record is different, historic rainfall is given as 50.1 inches in Chapter 1 and 46.7 inches here. I suggest choosing one of these periods of record as the average rainfall benchmark. The point, in this last paragraph, was not clear to me. It seems to me that it is the low inflow volume that is "notable" not the low rainfall which was still greater than inflow.	We decided for the purpose of this report it was essential to present the rainfall separately for each chapter as both chapters covered slightly different periods of records. We felt that it was necessary for the analysis to be consistent through out for each chapter and the goals and objectives defined in that chapter.
Callie Oblinger			Figures 2-6 to 2-9 would be more effective if all of the conductivity were shown on the same y-axis so that sites could be easily compared. LOXA104 conductivity is shown in figure 2-6 not 2-7 (p. 68 3rd paragraph). Figure 2-10 y-axis is incorrectly labeled as Km; it is in meters.	We attempted presenting the time-series conductivity for each transect on one graph, but the robust nature of the data overwhelmed the graph and made the graph presentation unlegible. We will continue to report the separate sondes on individual graphs, thank you for your input.
Callie Oblinger	69		A non-parametric test of whether mean conductivity is different between two sites is more appropriate for these data. Also, if the numbers of observations of the two sets of data being tested are 369 and 398, then the degrees of freedom are 369+398-2= 765 rather than 812.	This was an excellent suggestion and we applied the Mann-Whitney (U) to substitute for the t-test. The results were similar to those produced by the t-test. Further we added median and 25 and 75 percentiles for each comparison.
Callie Oblinger			Canal discharges are expressed in cfs d-1. The unit cfs-d (not cfs d-1) has been used by USGS in data reports when tables of daily discharge are summed but it isn't a very meaningful way of expressing a volume. Instead, be consistent with measures of volume per day preferably using acre-ft d-1 or cubic meters d-1. For example, in the top paragraph on p. 79, give both discharge and precipitation in acre-ft d-1 so that the volumes can be compared.	We changed all of the cfs-d presentation to cfs. In some cases, where most appropriate, we use the acre-ft convention instead of the cfs.
Callie Oblinger			Figures 2-11 to 2-17 would be much easier to interpret if isopleths were illustrated on a map of the study area showing also the location of the conductivity sondes upon which the isopleths are based.	We chose to present the isopleths in a transformed coordinate system because of the limitation on producing contours, particularly at convex corners of the Refuge. We found that the higher conductivity contours, which we expect to be near the canal, would move away from the canals in the convex corners and as such we moved away from the crude contouring approach.
Callie Oblinger			It would be interesting to sample the floc layer and analyze for constituents such as synthetic organics, trace metals, and mercury to determine if pesticides or other agricultural chemicals from canal water are sequestered in these fine materials during periods of intrusion.	This is beyond the scope of this body of work.
Callie Oblinger			Because the conductivity data are presented as a series of snapshots, the reader is given no sense of what proportion of the period of record is represented by each of these conditions. Some assessment of the frequency of occurrence of the different scenarios presented would be helpful.	Unfortunately, the hydrologic conditions present during the period of analysis did not lend themselves to the full spectrum of the types of intrusion events. Here, we captured those intrusion events that did extend beyond baseline using the three approaches applied in the text, and look forward to the future ability to really determine what proportion of a longer period of record is represented by different intrusion conditions.
Paul Conrads			The critical information in the report is the conductivity intrusion analysis found in Section 2, Chapter 2. Although the chapter is full of good analysis of intrusions by three different methods, my concerns is that the message of the Chapter (and of the report) will be missed because of the depth of detail presented, especially in the Results Section. One recommendation would be to combine the discussion of the results from Method 1 and Method 2 (Approach 1) and present the results for each transect. In other words, the transects would be described and the results from the two analyzes would follow.	This is a good suggestion and we will pursue it for a publication submission to a peer reviewed journal. For the purpose of this report we wanted to provide the detail. To deal with the overwhelming nature of the results we present them along with the discussion of each point. And then we conclude with a brief summary of the major take home points. Thank you for the input.
Paul Conrads	58	41, 42	consider moving sentence "Treated waters can...treatment areas (STAs)" to the first sentence of the paragraph.	We considered moving the sentence, but we decided to keep the flow of the original text.
Paul Conrads	59	19	delete "conductivity or"	We removed "conductivity or"
Paul Conrads	59	35	delete reference to DMSTA model	We removed the DMSTA model statement
Paul Conrads	61	5 & 6	don't understand why "interior" and "around" are in parentheses.	We removed the interior and around from parentheses and said ... and positions around the canal...
Paul Conrads	61	1st para	may want to include a short discussion on the limits of the analysis to the northern portion of the Refuge.	To the end of the first paragraph we add the statement: All of the analysis methods applied in this paper were limited to the northern portion of the Refuge because of the lack of sondes in the southern portion of the Refuge.

Paul Conrads	61	Table 2-1	don't understand the "Distance Around Canal" measurements. I assume that the "Distance from Canal" is the perpendicular distance to the canal. It looks like it assumes that LOXA116 is the starting point for the "around canal" measurement. Is the "distance around canal" measured from the perpendicular connection to the canal? Is the measurement made counter clockwise or clockwise?	This was addressed in the methods section on page 65 last paragraph.
Paul Conrads	61	25	to make the transects more clear, include "transect" in table 2-1 for the ACME 1 and ACME2 labels. May want to list table 2-1 by "transect" and by "area" and-or "other." On figure 2-1 circle and label the transects.	Added transect to ACME-1 and ACME-2 and in Figure 2-1 we added circles and labels for the transects
Paul Conrads	62	12-16	move to last paragraph in this section.	We considered moving these statements around, but we decided to keep the flow of the original text. However, we did correct the statements to reflect midnight values of sonde data and the appropriate metrics (mean, median, standard deviation, min, max, 25th and 75th percentiles).
Paul Conrads	62	Stage Data section	figure 2-2 is never referenced in the text. It looks like an important figure and a discussion of it would be appropriate in this section.	We added discussion of Figure 2-2 in the method section under the stage recorder discussion
Paul Conrads	64		sample calculation – define y2 and ytarget.	Defined y0, y2, and ytarget.
Paul Conrads	66	7	change relationships to relations.	Changed relationships to relations on Line 7 pg 66
Paul Conrads	66	21	capitalize hurricane and tropical storm when referring to a named storm.	Capitalized hurricane and tropical storm through out paper were appropriate
Paul Conrads	66	Table 2-4	may want to list intrusions events from maximum to minimum intrusion.	We considered changing order of the presentation of intrusion event, but we decided to keep the order of the original document so that tables flow followed the flow of the original document
Paul Conrads	67	25 & 26	don't understand what the 3 and 5 percent refers to.	In the parentheses behind the 3 and 5% we add the words coefficient of variation to clarify what these values of variability based on.
Paul Conrads	67	30	change i.e. to e.g.	Converted i.e. to e.g..
Paul Conrads	68	1st para	LOX 5 is listed in table 2-1 but isn't listed in the stations in the STA-1W transect. Should LOX5 be removed from table 2-1?	LOX5 was not used as a part of the transect because of the lack of a sonde located there, so we moved the LOX5 on Table 2.1 to a separate section called OTHER.
Paul Conrads	68	11	not sure why figure 2-7 is referenced. LOXA 104 only shown in figure 2-6.	We removed the reference to Figure 2-7 and now have both flows and conductivity referenced to Figure 2-6
Paul Conrads	68	Fig. 2-6	Change "stag" to "stage" in figure explanation.	Added the e to stage
Paul Conrads	69	2nd full para	LOX 5 is listed in table 2-1 but isn't listed in the stations in the STA-1E transect. Should LOX5 be removed from table 2-1?	LOX5 was not used as a part of the transect because of the lack of a sonde located there, so we moved the LOX5 on Table 2.1 to a separate section called OTHER.
Paul Conrads	72	1st full para	LOX 11 is listed in table 2-1 but isn't listed in the stations in the S-6 Transect. Should it be removed from table 2-1?	LOX11 was not used as a part of the transect because of the lack of a sonde located there, so we removed it from Table 2-1.
Paul Conrads	75	1st para	may want to remark on the incompleteness of the data set due to missing record. The 350 μ S isopleth maximum intrusion probably occurred during one of these missing periods.	We considered making the assertion that intrusion events may have occurred during periods of missing data, but there is nothing to back these assertions up with and because the highly contentious nature of the work, we chose to leave the text as its original flow.
Paul Conrads	76	Approach 2	I'm confused between the dates listed in the text for the scenarios and the dates in table 2-4 that is referenced in tables 2-5 and 2-6. What am I missing?	Removed reference to Table 2-4 from Table 2-5 and 2-6 captions
Paul Conrads	76	tables 2-5 and 2-6	consider combining the two tables.	We considered combining Table 2-5 and Table 2-6, but decided to keep them separate for simplicity. In submission for journal article publication the two tables likely will be combined.
Paul Conrads	77	table 2-7	consider including the inflow/outflow structure operation (Ih-OI, Ih-Oh, etc) in the table.	We added structure operation set (Ih-OI, etc.) to table 2-7
Paul Conrads	78	figures 2-11 and 2-12	what is the value of the light blue line?	Conductivity values were added for each of the lines in these graphs
Paul Conrads	79	figures 2-13 and 2-14	what are the values of the light blue and red lines?	
Paul Conrads	80	figure 2-15	what is the value of the purple line?	
Paul Conrads	81	figure 2-16	what is the value of the light blue line?	
Paul Conrads	84	1st full para	this is the first discussion of figure 2-2. May want to have a similar discussion in the Stage Data section of the Chapter.	We added discussion of Figure 2-2 in the method section under the stage recorder discussion
Paul Conrads	87		did not find the Abtew (2005) and Massey (2004) references in the text of the Chapter.	Deleted reference to Abtew and Massey
Wade Bryant			Draw transects on Fig 2-1, or include reference to table 2-1 in methods (pg 63).	Added circles and labels for transects to Figure 2-1
Wade Bryant	62		a little confusing – "only daily... values at midnight were used" followed by "summary statistics reflect all data"	Replaced confusing statement with: "Summary statistics presented in this chapter (e.g., average, standard deviation, median, minimum, maximum, 25th and 75th percentiles) reflect mid-night values for all data available from the sondes over the POR."
Wade Bryant	62		provide details on exactly what "small adjustments were made" perhaps a table of the correction factors and information on exact time or data used to make stage correction calculations.	We added the information about the adjustment to the G-94C that we applied for this report. In short we added 0.093 ft to the entire G-94C data set. The adjustment was based on difference analysis between the 1-7 and G-94C gage, when both gages were above 17 ft (a flat pool condition for the Refuge).
Wade Bryant			Give dates in methods (included in results) and show individual data points on figure 2-3 or another figure that shows each scenario. If an exponential model was fit give the statistics for goodness of fit. How was the "best" fit determined. Show the model equations.	We consider placing the resulting dates for the analysis in the method section, but they do not go in that section as the selected dates were a result of the conditions for date selection defined in the method section. Figure 2-3 is a conceptual diagram of the process for determining water movement across the canal-interior gradient and as such we do not provide any actual data points. We did adjust the text to reflect this last statement and it follows as: "A simple exponential trend model was fit to the data set and the generated model was applied as the baseline for comparisons and simple conceptual diagram was presented in Figure 2-3." In a previous internal review, a directive was issued to remove the r2, slope, and intercept information for these exponential trend fits on the bases that the information they provided was limited and the creation of extra tables for this information was unnecessary.
Wade Bryant			Give exact dates for the time periods used to represent the four scenarios (pg 65) Fig 2-1 does not show scenarios as referenced in the text.	Dates were provided for each example in the text in the results section (and not in the methods to minimize repetitiveness). Figure 2-1 was intended to show the spatial distribution of WQ stations, and the portion of the Refuge that was being captured in the analysis, but not present the dates of the events examined in the chapter. As a result, no dates are presented in that figure.
Section II: Chapter 3				
Callie Oblinger			no comments	

Paul Conrads			In Chapter 3, it is not clear whether the original approach to the modeling effort was to apply two models, the finite-element model FVCOM and finite-difference model MIKE FLOOD, or whether the MIKE FLOOD application was a result of the runtime associated with FVCOM. Finite-difference model typically have better runtimes than finite-element models so hopefully MIKE FLOOD will address some of the runtime issues. It is noted that the utility of the FVCOM model may only be to simulate storm events. Obviously, this is a much smaller use of the model than the original intent. Clarifying the rationale for applying the two models may help to manage the expectations of the modeling effort.	Text was added to clarify the reasons for selecting 2 modeling programs.
Paul Conrads	117	2	would "simulations" or "predictions" be a better word than "projections."	agree
Paul Conrads	118	8	other Sections of the report used 144,000 acres for the area of WCA-1.	Corrected. The confusion results in-part from where one draws the line (levee center, levee toe, canal center, marsh shoreline).
Paul Conrads	120	37	broken link to information on the advisory panel.	The link is correct. Perhaps it was temporarily down.
Paul Conrads	129	Equation 3	define ETobs and Em.	
Paul Conrads	130	equations	equation numbering should continue from previous numbers. Should be equations 6, 7, and 8.	corrected
Paul Conrads	130	15	assume reference to equation 5 is the first equation 5.	correct
Paul Conrads	132	22	would "greater" be a better description of increased variability than "stronger."	agree
Paul Conrads	133	37	reference for Mellor and Yamada.	added
Paul Conrads	133	40	reference for MIKE FLOOD and MIKE 21. In bulleted list of model, may want to only list MIKE FLOOD since MIKE SHE is never discussed. May want to describe the suite of supporting software and models (MIKE ZERO & ECO lab).	Reference to MIKE-SHE removed; Added citation to MIKE-11, MIKE-21, & Eco LAB;
Paul Conrads	134	10	reference for MATISSE software.	
Paul Conrads	136	12	reference for MIKE ZERO software	added
Paul Conrads	136	25	reference for DHI's ECO Lab software.	
Wade Bryant			The remainder of the document is much easier to read and understand.	Thank you.
Section III				
Callie Oblinger			This is an excellent summary of the report findings on water quality and canal discharge intrusions including specific recommendations for managing water discharges in the system and for future data needs.	Thank you
Paul Conrads	146	last paragraph, line 45	this paragraph doesn't seem appropriate for this section on "Water quality characteristics of the fringe marsh." Consider moving it to the end of the "Improved understanding of phosphorous dynamics."	Done
Wade Bryant			The remainder of the document is much easier to read and understand.	Thank you.