Adaptive Management Science Committee of the Edwards Aquifer Habitat Conservation Plan

Scientific Evaluation Report:
Nonroutine Adaptive Management Proposal to Substitute the Sedimentation Ponds Prescribed in the EAHCP for the Minimizing Impacts of Contaminated Runoff Recovery Measure

March 8, 2017

OVERVIEW

This Scientific Evaluation Report[1] is issued in response to the Nonroutine Adaptive Management (AMP) proposal submitted by the HCP Program Manager dated March 6, 2017. The proposal calls for the substitution of the sedimentation ponds called for under the "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4) Recovery Measure in the EARIP HCP ("EAHCP;" EARIP, 2012) with two replacement ponds considered "advantageous alternatives" (p. 2). The following sections in this report summarize the Adaptive Management Science Committee's ("Science Committee") evaluation of this Nonroutine AMP proposal.

Once approved by the Chair and Vice-Chair or other designee of the Science Committee following the March 8, 2017 Science Committee meeting, this Scientific Evaluation Report will be presented for consideration by the Stakeholder Committee at its meeting on March 16, 2017.

SCIENTIFIC EVALUATION

The evaluation of this Nonroutine AMP proposal is based on the Science Committee's analysis of (1) whether enough information, of sufficient quality, exists to properly ascertain that the proposed modifications meet the basic EAHCP objective for this Measure ("to help reduce the amount of contaminated materials that enters the river as a result of rain events"); and (2) whether, also based on the review of the information provided, the modifications reasonably represent an improvement over the current provisions for the "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4) Measure in the EAHCP. Here, "improvement" refers to both a relative increase in reducing contamination associated with stormwater runoff (the basic HCP objective), as well as a relative increase to the ecological benefit to the upper San Marcos River aquatic ecosystem.

Proposal

- *Current provision*

[1] According to the Funding and Management Agreement (2012), the Adaptive Management Science Committee is tasked with evaluating all Nonroutine Adaptive Management proposals. These evaluations result in a "Scientific Evaluation Report" for presentation to the Stakeholder Committee. The Stakeholder Committee considers this report in their decision whether to recommend the Nonroutine AMP proposal to the Implementing Committee for final approval.

The current provision for the "Minimizing Impacts of Contaminated Runoff" Measure in the EAHCP prescribes the following locations for the construction of two sedimentation ponds to help reduce the amount of contaminated stormwater runoff into the San Marcos River:

(1) One sedimentation pond to be located in Veramendi Park, beside Hopkins Street bridge ("Veramendi Pond"); and

(2) A second sedimentation pond to be located alongside Hopkins St. to consist of widened extant drainage ditches running parallel to either side of Hopkins ("Hopkins Pond").

- *Proposed replacement*
  The Nonroutine AMP proposal calls for the Veramendi Pond and the Hopkins Pond to be replaced, in respective order, by the following two pond projects:

  (1) A drainage system upgrade to a preexisting sedimentation pond ("Downtown Pond"), located at the corner of N. C.M. Allen Parkway and E. Hutchison St. (202 N. C.M. Allen Pkwy); and

  (2) An unfinished sedimentation pond ("City Park Pond") located in City Park, adjacent to the San Marcos Recreation Hall parking lot (also the Lions Club Tube Rental location; 170 Charles Austin Dr.).

Evaluation of Information Provided

Below, *Table 1* displays the performance metrics and accompanying data furnished in the proposal in support of the proposed replacement.

Table 1

PERFORMANCE METRIC	**SWAP 1**		**SWAP 2**	
	VERAMENDI POND	**DOWNTOWN POND**	**HOPKINS POND**	**CITY PARK POND**
Drainage Area	15 acres	30.24 acres	9.67 acres	20.86 acres
% Impervious Cover in Drainage Area	66.0%	81.3%	72.4%	59.4%
TSS Removed/Year	5,035 lbs.	6,910 lbs.	3,679 lbs.	8,197 lbs.

In terms of the performance of the replacement ponds (Downtown and City Park) versus the current ponds in the EAHCP (Veramendi and Hopkins), the data indicate that the proposed replacements will in both "swaps" (1) drain more than double the area than their intended predecessors, as well as (2) remove more than double the quantity of total suspended solids (TSS) per year than their intended predecessor sedimentation ponds.

CONCLUSION

By these measures, relying on the recommendations of the design and engineering professionals who estimated these figures, as well as on the comprehensive analysis undertaken through the water quality protection planning exercise from which this proposed adaptive management originated (John Gleason LLC, 2017), the Science Committee finds that the proposed modifications meet the basic EAHCP objective for this Measure ("to help reduce the amount of contaminated materials that enters the river as a result of rain events"). Additionally, the Science Committee finds that the modifications represent an improvement over the current provisions for the "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4) Measure in the EAHCP, at least in terms of the basic performance of the sedimentation ponds.

Final recommendations

That said, the Science Committee also recommends the following additional considerations be taken under account, should the proposed adaptive management action be implemented. These additional recommendations should be viewed as protective, or precautionary measures intended to ensure that the replacement sedimentation ponds not only meet the basic stated objective in the EAHCP, but also take advantage of reasonable opportunities to increase wider ecological benefit for the upper San Marcos River aquatic ecosystem associated with the construction of these ponds:

- ***Future options***
  The Committee expressed concern that the Hopkins and Veramendi ponds not be abandoned altogether despite being replaced under the proposed Nonroutine AMP action; the Committee is reassured that the Hopkins and Veramendi ponds (as well as other possible additional future BMPs) will continue to be considered and potentially pursued through the WQPP process outside the EAHCP.

- ***Site constraints***
  The Committee expressed concern that the runoff capture efficiency for the Downtown Pond relative to the downtown catchment area is low, but understands that for this particular BMP, the site is highly constrained and thus is limited in attaining a higher capture efficiency on its own; for this reason, the Committee is highly supportive of future initiatives to be undertaken by the City of San Marcos to increase additional BMP actions within this downtown catchment area in order to mitigate the impacts of contaminated stormwater runoff from downtown.

- ***More metrics***
  Noting that there was some information lacking from the Nonroutine AMP proposal itself, the Committee felt that it was important for the full array of performance and cost efficiency metrics included in the evaluation of all

sedimentation ponds be included in the supporting documentation provided as part of this Nonroutine AMP process. For this reason, additional metric tables displaying this information are appended to this report.

- ***Native species encouraged***
  The Committee is supportive of the use of native plants whenever possible for the landscaping needs associated with the sedimentation ponds to be built under the proposed Nonroutine AMP action. Particular care needs to be taken that any non-native plants species selected for landscaping purposes will not have harmful ecological impacts on the San Marcos ecosystem, especially the potential for invasion within the aquatic ecosystem.

REFERENCES

- Edwards Aquifer Authority, City of New Braunfels, City of San Marcos, City of San Antonio, acting by and through its San Antonio Water System Board of Trustees, and Texas State University – San Marcos. 2012. *Funding and Management Agreement…to Fund and Manage the Habitat Conservation Plan for the Edwards Aquifer Recovery Implementation Program*. http://www.eahcp.org/files/uploads/Funding_and_Management_Agreement_(Appendix_R).pdf

- Edwards Aquifer Recovery Implementation Program (EARIP). 2012. *Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan*. http://www.eahcp.org/files/uploads/ Final%20HCP %20November%202012.pdf

- John Gleason LLC. 2017. *Water Quality Protection Plan for the City of San Marcos and Texas State University*. Prepared for the City of San Marcos.

ATTACHMENTS

- Attachment 1: Nonroutine Adaptive Management proposal dated March 6, 2017

- Attachment 2: Draft minutes from the March 8, 2017 Science Committee Meeting

- Attachment 3: Table 2 – Full Array of Performance and ROI Metrics Taken Under Consideration in Evaluating the Proposed Nonroutine AMP Action (John Gleason LLC, 2017)

ATTACHMENT 1: NONROUTINE ADAPTIVE MANAGEMENT PROPOSAL DATED MARCH 6, 2017

EAHCP Staff | Attachment 14 | March 6, 2017

Edwards Aquifer Habitat Conservation Plan
Nonroutine Adaptive Management Proposal

All relevant reports, citations, and analysis can be found at www.eahcp.org.

To: EAHCP Committees
From: Nathan Pence, HCP Program Manager
Date: March 6, 2017
Re: Proposed Advantageous Substitution of Sedimentation Ponds Prescribed for "Minimizing Impacts of Contaminated Runoff" Recovery Measure (HCP §5.7.4)

PREAMBLE

The Edwards Aquifer Habitat Conservation Plan (EAHCP) calls for the City of San Marcos to "construct two sedimentation ponds along the [San Marcos] river to help reduce the amount of contaminated materials that enters the river as a result of rain events" as a commitment under the "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4) Recovery Measure. The EAHCP prescribes two site-specific sedimentation ponds to be constructed under this measure; (1) one sedimentation pond to be located in Veramendi Park, beside Hopkins Street bridge ("Veramendi Pond"); and (2) a second sedimentation pond to be located alongside Hopkins St. to consist of widened extant drainage ditches running parallel to either side of Hopkins ("Hopkins Pond").

This document presents a formal proposal for a Nonroutine Adaptive Management action ("Nonroutine AMP;" Funding & Management Agreement, "FMA" §7.6.2) involving the substitution of the Veramendi and Hopkins sedimentation ponds prescribed by the EAHCP for "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4). This proposal is submitted by the HCP Program Manager on behalf of the City of San Marcos (COSM); the development of this proposal was a collaborative effort by both parties. Below, a brief background is provided describing the process leading to this proposal, followed by the proposed Nonroutine AMP action, accompanied by a detailed description and justifications for the proposed Nonroutine AMP. Additional technical specifications and other supporting documentation associated with the proposal is included here as an appendix.

BACKGROUND

As with all Measures in the EAHCP, best available information was used to inform the selection of sedimentation ponds for construction under the EAHCP's "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4) Recovery Measure. For this Measure, the best available contemporaneous information derived from an HCP planning process undertaken by the COSM in 2004 (COSM, 2004). Although this initiative was ultimately not implemented, the resulting draft HCP document identified both Veramendi Pond and the Hopkins Pond for water quality protection along the San Marcos River. Subsequently,

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the Edwards Aquifer Recovery Implementation Program (EARIP) referred to this same information to determine COSM's commitment under "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4), hence the current EAHCP prescription also identifying the Veramendi and Hopkins ponds for implementation.

That said, since implementation of the EAHCP began in 2013, the COSM has carried out a research and development (R&D) process related to water quality protection. This R&D process supported the production of a water quality protection planning document to be used as the basis of COSM's implementation of a separate but related Recovery Measure calling for for the establishment of a comprehensive program "to protect water quality and reduce the impacts of impervious cover."[1]. In the culmination of this effort, the final *Water Quality Protection Plan for the City of San Marcos and Texas State University* (WQPP) was published in 2015. A revision was published in 2017, and serves as the document of record for this proposal (John Gleason LLC, 2017).

Considerable research and technical analysis concerning the Spring Lake and Upper San Marcos River watershed, and how to best protect water quality in this watershed, went into the WQPP. Through this R&D exercise, the WQPP identifies and recommends an array of structural elements, design features, and planning mechanisms to provide a comprehensive water quality protection program that will contribute to the likelihood of the survival and recovery of the Covered Species (see "Measures that Specifically Contribute to Recovery," EAHCP §5.7).

Among the various water quality protection projects contemplated in the WQPP, both the Veramendi Pond and the Hopkins Pond[2] were evaluated and included, along with other sedimentation ponds that would provide benefit to water quality protection in the upper San Marcos River. The information featured in the WQPP concerning the sedimentation ponds represents an advancement over the information available at the time of the writing of the HCP, and thus this information serves as the basis for this Nonroutine AMP proposal.

[1] This program is carried out pursuant to COSM's commitment under the "Impervious Cover/Water Quality Protection" (HCP §5.7.6) Recovery Measure.
[2] Through the WQPP process it was determined that the only feasible site to construct the prescribed Hopkins Pond would be at the western side of the E. Hopkins St. bridge at river left (see Figure 1). Henceforth all metrics and discussion associated with the Hopkins Pond refer to this site.

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Proposed Nonroutine Adaptive Management Action

Overview

In the course of reviewing the WQPP to inform the implementation of COSM/TXST's water quality protection commitments, COSM identified two potential advantageous alternatives to the Veramendi and Hopkins sedimentation ponds prescribed in the EAHCP for the "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4) Recovery Measure. These advantageous alternatives are:

(1) A preexisting sedimentation pond ("Downtown Pond") drainage system upgrade, located on COSM property at the corner of N. C.M. Allen Parkway and E. Hutchison St. (202 N. C.M. Allen Pkwy); and

(2) An unfinished sedimentation pond ("City Park Pond") located on COSM property in City Park, adjacent to the San Marcos Recreation Hall parking lot (also the Lions Club Tube Rental location; 170 Charles Austin Dr.).

Figure 1

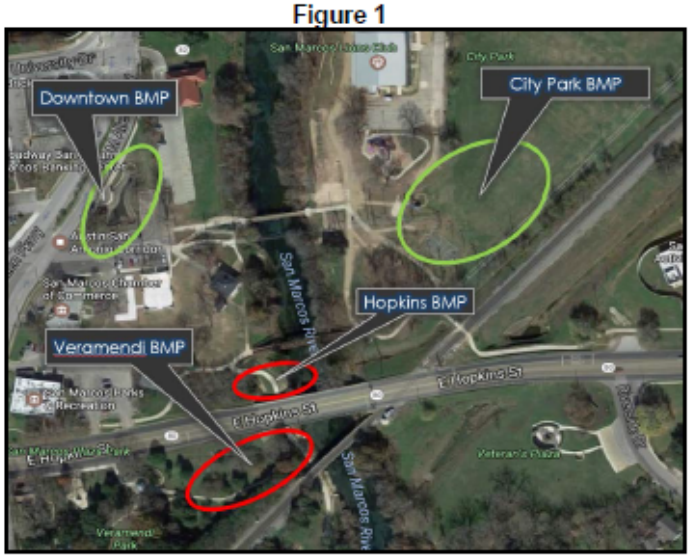

Figure 1 displays the approximate locations of each of the four sedimentation ponds in relation to one another in the COSM.

The COSM, in coordination with the HCP Program Manager, took into account several metrics in evaluating the Downtown and City Park sedimentation ponds as potential substitutions for the Veramendi and Hopkins sedimentation ponds, respectively. The following subsections ("Performance Comparison," "Return on Investment Comparison," and "Fiscal Impact") detail the analyses conducted in support of this proposal.

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Performance Comparison

Aspects of the estimated performance of the different sedimentation ponds were compared as part of the analysis conducted in support of this proposal. Specific performance metrics calculated and evaluated included drainage area (i.e., the extent of area from which runoff drains into the pond), percent impervious cover in drainage area, and total suspended solids (TSS) removed per year. TSS is understood to be a contributing factor to water quality impairment, with deleterious effects for aquatic ecosystems. Below, *Tables 1* and *2* illustrate the results of this comparative performance analysis in terms of drainage area, percent impervious cover in drainage area, and TSS between the original ponds prescribed in the EAHCP (Veramendi and Hopkins Proxy) and the Nonroutine AMP proposed replacement ponds (Downtown and City Park), respectively.

Table 1

PERFORMANCE METRIC	VERAMENDI POND	DOWNTOWN POND
Drainage Area	15 acres	30.24 acres
% Impervious Cover in Drainage Area	66.0%	81.3%
TSS Removed/Year	5,035 lbs.	6,910 lbs.

Table 2

PERFORMANCE METRIC	HOPKINS POND	CITY PARK POND
Drainage Area	9.67 acres	20.86 acres
% Impervious Cover in Drainage Area	72.4%	59.4%
TSS Removed/Year	3,679 lbs.	8,197 lbs.

Return on Investment Comparison

Relative to Veramendi and Hopkins sedimentation ponds, the Downtown and City Park sedimentation ponds presented opportunities to increase efficiency of EAHCP return on investment (ROI). Generally speaking, here, COSM defined ROI as function of EAHCP dollars spent relative water quality protection benefits obtained by the sedimentation ponds. Below, *Tables 3* and *4* illustrate the results of this comparative ROI analysis in terms of total capital cost estimate, cost per pound of TSS removed, EAHCP cost, and EAHCP cost per pound of TSS removed.

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Table 3

ROI METRIC	VERAMENDI POND	DOWNTOWN POND
Total Capital Cost Estimate	$192,360	$93,000
Cost Per Pound of TSS Removed	$3.13	$1.22
EAHCP Cost	$192,360	$8,000
EAHCP Cost Per Pound of TSS Removed	$3.13	$0.07

Table 4

ROI METRIC	HOPKINS POND	CITY PARK POND
Total Capital Cost Estimate	$111,504	$324,245
Cost Per Pound of TSS Removed	$2.99	$2.68
EAHCP Cost	$111,504	$142,000
EAHCP Cost Per Pound of TSS Removed	$2.99	$1.20

Fiscal Impact

From the beginning of this evaluation, this exercise was designed to take into account the funding limitations for EAHCP program activities established by the FMA and Table 7.1 of the EAHCP. Adoption of this proposal will not result in any deviations from the funding allowances prescribed in Table 7.1 of the EAHCP. Furthermore, as a collaborative effort between and among the EAHCP, the COSM, and TXST, the proposed Nonroutine AMP action represents considerable cost efficiencies and savings in the service of stewarding EAHCP public funding compared to what would otherwise be possible implementing ponds currently contemplated by the EAHCP. The proposed Nonroutine AMP action achieves said efficiencies and savings by:

(1) Leveraging the existing investment made by the COSM, through the Engineering & Capital Improvements Department, in funding the original design and construction of the Downtown Pond;

(2) Incorporating TXST's pledge, through the Meadows Center for Water and the Environment 319 grant, to fund the design and construction of a repaired drainage system for the Downtown Pond ($85,000); and

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(3) Incorporating the COSM's pledge, through the Engineering & Capital Improvements Department, to partially fund the construction of the City Park Pond ($178,000).

NONROUTINE AMP PROPOSAL

With the foregoing justifications stated, the HCP Program Manager, on behalf of the COSM, proposes the Downtown and City Park sedimentation ponds be substituted via the Nonroutine AMP (FMA §7.6.2) to stand in place of the Veramendi and Hopkins sedimentation ponds, respectively, in fulfillment of COSM's commitment under the "Minimizing Impacts of Contaminated Runoff" (HCP §5.7.4) Recovery Measure.

REFERENCES

All relevant reports, citations, and analysis can be found at www.eahcp.org.

- City of San Marcos. 2004. *Environmental Assessment/Habitat Conservation Plan for Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit for the Incidental Take of the Fountain Darter (Etheostoma fonticola), San Marcos salamander (Eurycea nana), and the Comal Springs riffle beetle (Heterelmis comalensis) During the Implementation of Projects in the Upper San Marcos River, San Marcos, Hays County, Texas.*

- Edwards Aquifer Authority, City of New Braunfels, City of San Marcos, City of San Antonio, acting by and through its San Antonio Water System Board of Trustees, and Texas State University – San Marcos. 2012. *Funding and Management Agreement…to Fund and Manage the Habitat Conservation Plan for the Edwards Aquifer Recovery Implementation Program.* http://www.eahcp.org/files/uploads/Funding_and_Management_Agreement_(Appendix_R).pdf

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- Edwards Aquifer Recovery Implementation Program (EARIP). 2012. *Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan*. http://www.eahcp.org/files/uploads/Final%20HCP %20November%202012.pdf

- John Gleason LLC. 2017. *Water Quality Protection Plan for the City of San Marcos and Texas State University*. Prepared for the City of San Marcos.

ATTACHMENT 2: DRAFT MINUTES FROM THE MARCH 8, 2017 SCIENCE COMMITTEE MEETING

EAHCP Staff March 10, 2017

HABITAT CONSERVATION PLAN EDWARDS AQUIFER

MARCH 8, 2017 MEETING MINUTES

1. **Call to order.**
   Dr. Arsuffi called the meeting to order at 9:05 a.m. Members present included Tom Arsuffi, Jacquelyn Duke, Charlie Kreitler, Conrad Lamon, Glenn Longley, Doyle Mosier, Chad Norris, and Jackie Poole. Janis Bush, Robert Mace, and Floyd Weckerly advised prior to the meeting that they would be unable to attend.

2. **Public comment.**
   None.

3. **Approval of November 10, 2017 Science Committee meeting minutes.**
   Mr. Mosier motioned to approve the minutes as written; Dr. Kreitler seconded. No opposition.

   Dr. Arsuffi inquired the process followed by staff for attending to "action items" as identified in the minutes. Nathan Pence (Program Manager) replied that action items are followed up by staff internally. Dr. Arsuffi asked specifically about action items corresponding to Dr. Thom Hardy's presentation from the previous meeting. Dr. Chad Furl (Chief Science Officer) replied that staff addressed these action items with Dr. Hardy, and that Dr. Hardy's report was revised to incorporate input received at the last Committee meeting. Dr. Furl stated he would get back to the Committee to apprise them of said revisions.

4. **Receive report from the Program Manager.**

   - **Spring Systems Hydrologic Update**
     Dr. Furl provided a presentation to the Committee on recent hydrology associated with the spring systems.

     Dr. Lamon asked Dr. Furl's thoughts with respect to the 90-day rolling average, commenting that it might be appropriate for the window widths used to be reexamined. Dr. Furl stated he would consider Dr. Lamon's suggestion.

   - **Update on EAA-USFWS Refugia**
     Dr. Furl provided a presentation to the Committee updating the status of the EAA-USFWS Refugia Measure.

     Dr. Arsuffi asked what measures are in place to ensure collection rates do not have an adverse effect on in-situ populations of the Covered Species given the lack of understanding of several species' population abundance. Dr. Furl replied that one of the strategies used to avoid overcollection is to collect from multiple sites to avoid

overcollection. Dr. Arsuffi asked whether there was any contingency built-in to the collection program—for example, whether sites are systematically analyzed to assess whether collection counts are diminishing over time. Dr. Furl replied that efforts are made to ensure the proper documentation of which springs sites are being collected from, and that staff work closely with Mr. Randy Gibson (USFWS) to identify and to ration springs collected. Mr. Pence added that as part of the cotton-lure SOP, GPS coordinates and locations for collections are being recorded in the database, enabling the visualization of collection sites on a map. Mr. Norris recommended documenting landmarks to supplement GPS coordinates; Mr. Bob Hall (EAA) replied that landmark information is being collected as part of the cotton-lure SOP.

Dr. Kreitler asked whether the theft of species created a problem related to collection, and more specifically, whether this event created a difficult position for the species. Mr. Pence explained that because the event occurred prior to executing the contract, it technically it had no effect; however, given the fact that once the contract began, existing stock rolled over into contract stock numbers, the theft event nevertheless did impact the baseline stock for the EAA-USFWS Refugia program. Mr. Pence went on to update the group that USFWS and FBI are still involved in an active investigation. The SMARC facility has undergone a security evaluation. Old keys no longer work. Cameras are being installed. Different buildings have different locks. Upgrade was needed. With regards to the welfare of the species, Mr. Pence stated that if we were in a drought period, we would be very concerned; however, given current springflow rates, we have at least a couple of years to build up stock in anticipation of a possible future trigger.

- **2016 EAHCP Disturbance/Take, Salvage Refugia, Applied Research, & Monitoring Reports**

  Mr. Hall provided an update concerning the 2016 net disturbance/incidental take assessment results; Dr. Furl provided the update concerning the remaining reports.

  Following Mr. Hall's presentation on take, Dr. Longley stated it does not make sense not to retain any salamander that comes out of the spring openings or from a well for collection; given that those salamanders are for all intents and purposes lost to the surface anyway; they are going to be eaten. Dr. Longley recommended that this issue be discussed with USFWS to bring about a more reasonable policy concerning this issue.

  Dr. Lamon asked about how the method of calculating take is determined, and whether it can be changed. Mr. Pence replied that it's set in an approved protocol with USFWS and that changes can potentially be made. For example, in the second year of the EAHCP, changes were made to some methods that proved problematic. Dr. Lamon asked whether there is a plan to use statistical analysis of data to inform the take assessment methodology. Dr. Furl replied it's a good point and something for staff to take under consideration. Dr. Lamon stated that using habitat as a proxy for counts may prove to be a weak link in the current calculation methodology. Mr. Pence offered to provide a presentation at the next Committee meeting on how calculations are made,

and to revisit this conversation again then with a view to making possible improvements. Mr. Mosier emphasized that making changes to this methodology is not a dynamic thing that can be changed overnight; Dr. Lamon replied that in the event some change turns out to be needed, having a peer-reviewed article in our hand would put us in a strong position to approach such a hypothetical conversation with USFWS.

With regards to the 2016 Salvage Refugia and Monitoring reports, Mr. Norris asked whether full presentations would be given. Dr. Furl replied that there will not be; however, the three 2016 Applied Research projects on the Comal Springs riffle beetle would be presented at the next meeting of the Committee. Mr. Norris asked whether there wasn't also a report that looked at the Comal Springs dryopid beetle; Dr. Furl replied that the dryopid beetle was examined in the Salvage Refugia report. Mr. Norris asked whether any follow up on reports is being undertaken, or whether the reports are simply being filed away. Dr. Furl replied that for all the reports a process is followed whereby the raw data collected in support of a given project is added to the database and the results of the report are reviewed internally.

- **Demo of EAHCP AQUARIUS Samples Database**
  This presentation on this item was skipped in the interest of time.

Separately, Mr. Pence and Dr. Furl provided a brief update concerning the status of the hydrologic and ecological models. Mr. Pence stated the hydrologic model is done being built; it is now in-house at EAA and under a process of validation and calibration for use. Mr. Pence acknowledged that the National Academies of Sciences (NAS) had specific recommendations for a validation data set to be used for this process and this is now part of the validation exercise being conducted. Additionally, over the next 6 months, the hydrologic model will go through a 2-step peer review process. A group of groundwater modeling experts will be convened to produce a report covering the science of the hydrologic model. Mr. Pence identified a few of the anticipated Work Group members to impress to the group the caliber of the experts to be involved. The second part of the hydrologic model peer review will consist of a group of stakeholders (some Science Committee members included) to go through the expert technical document produced by the Work Group and produce recommendations for how the EAHCP program should be able to begin using the model to inform Phase 2 and answering ASR questions. Dr. Kreitler asked how this process would interface with the NAS review. Mr. Pence replied that the NAS recommendations will be discussed; some of NAS' validation recommendations are already being implemented, so there is some overlap there—but noted that many of NAS' recommendations also concern issues of how to build the model—and EAA is effectively done building the model at this point, and now it's time to use the model. Suggestions for continued development of the model are valuable and will be kept on hand to be considered in later phases. Dr. Kreitler asked whether EAA would not officially be reviewing the NAS recommendations. Nathan replied that this would be covered in an upcoming presentation at this meeting.

Regarding the ecological model, Dr. Furl updated the Committee that the expected ETA for final eco model report would be around mid-March and staff training will be

taking place sometime in April. The Committee will receive a full presentation on the outcome of this either in May or August, depending on these pending deliverables.

5. **Presentation of Summary of the National Academy of Science's *Report 2* Review of the EAHCP.**
Mr. Pence provided this presentation to the Committee summarizing the National Academy of Science's Report 2 Review of the EAHCP. Mr. Pence explained that both a presentation by NAS Chair Dr. Danny Reible is upcoming, and a Report 2 public workshop, and encouraged the Committee to attend both for additional information and engagement with the Report 2 evaluation.

Dr. Kreitler asked if any NAS had any comments on the FEFLOW hydrologic model; Mr. Pence replied that NAS appreciates EAA going to one model under MODFLOW, and that lessons learned from FEFLOW should be incorporated into MODFLOW.

Regarding the ecological model, Dr. Lamon cautioned that before we talk about using the model, there are still some significant hurdles before us (uncertainty analysis, validation, etc.); Dr. Lamon is sensitive to language suggesting that this is said and done, when it isn't.

Mr. Norris asked whether there were not also some recommendations by NAS concerning monitoring. Mr. Pence replied that there were recommendations made concerning population size of the Comal Springs riffle beetle, but that this is another instance of something that isn't required for compliance with the HCP. Mr. Norris replied that issues of Covered Species distribution, abundance and population size represent basic information, and that he would just leave it at that.

Dr. Arsuffi asked about the meaning of forbearance. Given that this term is not in common parlance, Dr. Longley advised that this term should be defined whenever it is used.

6. **Presentation and discussion of the proposed methodology for the 2017 Applied Research study: *Statistical analysis of the San Marcos & Comal Springs aquatic ecosystems biomonitoring dataset* (BIO-WEST).**
Dr. Furl provided a brief overview of the strategy being followed in 2017 for this Applied Research project, namely retaining three separate contractors to study different aspects of the biomonitoring dataset. Dr. Furl welcomed Dr. Josh Perkin presenting on behalf of the BIO-WEST team. Dr. Perkin presented BIO-WEST's statistical analysis project.

Dr. Arsuffi encouraged all teams to take care to be clear about the ecological theory bases for their analyses, noting that, at least in Dr. Perkin's presentation for BIO-WEST, there was no mention of "disturbance ecology, the thermal equilibrium hypothesis, etc. and that an effort should be made to bridge the basic and theoretical with applied, e.g., comparing results with what would be expected from theory. Dr. Perkins replied that the dataset reflects dynamism, and looking more closely at the expansion and contraction of the habitat template will provide a rich area to apply ecological theory while also producing findings that are relevant to management.

Dr. Arsuffi also suggests the teams take care to mine the long-term ecological research (LTER) literature for lessons and techniques associated long term dataset management, statistical analysis, and trend analysis that would apply in this situation.

Dr. Lamon asked Dr. Perkin a series of question concerning choices of method, technical parameters, assumptions, and the interpretability of results. Dr. Arsuffi intervened, suggesting that in the interest of time, the conversation be deferred to after the meeting, possibly involving writing up Dr. Lamon's suggestions so that the BIO-WEST team can take them under consideration with ample time. Dr. Perkin volunteered to stick around to facilitate this follow-up conversation.

7. **Presentation and discussion of the proposed methodology for the 2017 Applied Research study: *Statistical analysis of the San Marcos & Comal Springs aquatic ecosystems biomonitoring dataset* (Beaver Creek).**
Dr. Furl welcomed Mr. Tony Miller presenting on behalf of the Beaver Creek team. Mr. Miller presented Beaver Creek's statistical analysis project. Mr. Miller emphasized that the choice of statistical techniques focused on by his firm are proven, exploratory methods that lend themselves to addressing applied problems. Beaver Creek specializes in applications related to aquatic restoration projects.

Dr. Kreitler commented that Mr. Miller demonstrates a poor understanding of how the system works, and that there needs to be greater integration in all the statistical analysis project teams of individuals knowledgeable in this area.

8. **Presentation and discussion of the proposed methodology for the 2017 Applied Research study: *Statistical analysis of the San Marcos & Comal Springs aquatic ecosystems biomonitoring dataset* (UTSA).**
Dr. Furl welcomed Dr. Jeffrey Hutchinson and Dr. Julie Foote presenting for the UTSA team. Dr. Hutchinson and Dr. Foote took turns presenting the UTSA statistical analysis project. The theoretical basis for their analysis would rely on the intermediate disturbance hypothesis; Dr. Arsuffi commended the team for this theory choice, saying that he has been saying for years that this should be looked at in conjunction with the systems.

Dr. Kreitler commented that the three separate projects need to be carefully coordinated both to ensure that there is not too much overlap and to ensure that each team properly understands the systems under investigation. Dr. Furl replied that he has been steadily working with all three teams since the contracts were awarded to address questions as they arise and to steer each of the teams to ensure the most productive possible management strategy for the three concurrent investigations.

9. **Presentation and discussion on the possible creation and charge of a Science Committee Work Group ("Research Work Group") to review Refugia research projects and 2018/2019 Applied Research projects.**
Dr. Furl presented on the possible creation and charge of a Science Committee Work Group ("Research Work Group"). Dr. Longley motioned to endorse the creation and charge of this

Science Committee Work Group; Dr. Duke seconded the motion. There was no opposition. Dr. Kreitler asked if there is a need to have EAA representatives on the Work Group; Mr. Pence replied that the Work Group can invite experts if they so choose.

10. **Presentation and discussion regarding the first of two possible Adaptive Management Processes for 2017 associated with the City of San Marcos and Texas State University Water Quality Measures.**
Mr. Pence provided an overview on the first possible 2017 AMP action involving the substitution of sedimentation ponds prescribed in the EAHCP for two advantageous alternative ponds. Mr. John Gleason (John Gleason LLC) provided an overview of the Water Quality Protection Plan (WQPP) that served as the basis for the proposed Nonroutine AMP.

    - *Mr. Mosier asked whether the Downtown and Hopkins ponds shared the same drainage; Mr. Gleason replied that they do not.*
    - *Ms. Jackie Poole asked about the rationale for moving the Hopkins comparison across the river. Mr. Gleason explained that of the original Hopkins measures in the HCP, one is entirely replaced by the City Park Pond (the northern "Hopkins ditch") and the other is unfeasible (the southern "Hopkins ditch").*
    - *Dr. Lamon asked the runoff capture efficiencies for each of the various ponds. Mr. Lee Sherman (a subcontractor to John Gleason LLC in the project) replied that City Park (99%), Hopkins 1 (81%), Veramendi (87%), and Downtown (36%).*
    - *Dr. Longley expressed concerns about maintenance of the ponds, noting upkeep with maintenance has been a major problem in Austin. Mr. Pence replied that in developing this proposal, staff worked with the City of San Marcos Engineering and Capital Improvements Department, which will take on maintenance responsibility for the features.*
    - *Dr. Duke asked if the proposed replacement would be built anyway with or without the infusion of EAHCP funding and management. Mr. Pence replied in the negative; for example, none of this would have been built under the regular MS4 program in the City of San Marcos. Dr. Duke replied that this fact means it's a win-win.*
    - *Ms. Poole expressed concern about scouring flows from runoff associated with the BMPs; Mr. Gleason replied that the ponds would require 24-48 hours to drain, and that in each case, dissipaters are included to lessen the energy of water leaving the system precisely to avoid erosive flows.*

11. **Presentation, discussion, and possible recommendation of the Nonroutine Adaptive Management proposal related to the "Minimizing Impacts of Contaminated Runoff" Recovery Measure for the City of San Marcos.**
Mr. Pence presented the Nonroutine Adaptive Management proposal related to the "Minimizing Impacts of Contaminated Runoff" Recovery Measure to the Committee. Dr. Arsuffi asked the Committee if more discussion is needed before acting on the proposal.

14. **Presentation and discussion regarding the second of two possible Adaptive Management Processes for 2017 associated with the City of San Marcos and Texas State University Water Quality Measures.**
Mr. Pence provided an overview on the second possible 2017 AMP action involving subsuming the City of San Marcos and Texas State University's sediment removal measures into the Impervious Cover/Water Quality Protection Measure, and targeting the middle Sessom Creek watershed for said water quality protection measure. Mr. John Gleason (John Gleason LLC) provided an overview of the aspects of this proposed action related to the Water Quality Protection Plan (WQPP), which served as the basis for the proposed Nonroutine AMP.

15. **Presentation and discussion on the possible creation and charge of a Science Committee Work Group ("San Marcos Water Quality Protection Work Group") to review the City of San Marcos/Texas State University proposed water quality protection projects.**
Mr. Pence presented the possible creation and charge of a Science Committee Work Group ("San Marcos Water Quality Protection Work Group"). Dr. Kreitler motioned to endorse the creation and charge of this Science Committee Work Group; Mr. Mosier seconded this motion. There was no opposition.

16. **Consider future meetings, dates, locations, and agendas.**
    - **Science Committee Meeting, May 10, 2017, San Marcos Activity Center (Multipurpose Room).**

No comments.

17. **Questions and comments from the public.**
Mrs. Dianne Wassenich commented that "Sessom Creek is a disaster…storm drains have blown out mountains of dirt…taken the streambed down to bedrock…sewer line is a major disaster, ready to happen…in a big flood, the sewer line could just go;" Mrs. Wassenich stated she is encouraged by the proposed action by the EAHCP to look at getting Sessom Creek watershed more under control.

18. **Adjourn.**
Dr. Arsuffi motioned to adjourn the meeting at 2:45 p.m. No opposition.

ATTACHMENT 3: FULL ARRAY OF PERFORMANCE AND ROI METRICS TAKEN UNDER CONSIDERATION IN EVALUATING THE PROPOSED NONROUTINE AMP ACTION (JOHN GLEASON LLC, 2017)

Table 2

Comparing Hopkins Pond to City Park Pond							
Project	**WQV (c.f.)**	**Annual TSS Removed (lbs.)**	**Annual TP Removed (lbs.)**	**Estimated Total Capital Cost**	**Overall Cost Eff.**	**HCP Funding**	**HCP Cost Eff.**
Hopkins	18,584	3,679	5.1	$111,504	$2.99	$111,504	$2.99
City Park	83,869	8,197	18.2	$324,245	$2.68	$142,000*	$1.20

*Non-HCP funds are leveraged $479,845

Table 3

Comparing Veramendi Pond to Downtown Pond							
Project	**WQV (c.f.)**	**Annual TSS Removed (lbs.)**	**Annual TP Removed (lbs.)**	**Estimated Total Capital Cost**	**Overall Cost Eff.**	**HCP Funding**	**HCP Cost Eff.**
Veramendi	32,060	5035	6.99	$192,360	$3.13	$192,360	$3.13
Downtown	15,382	6,910	15.33	$93,000	$1.22	$8,000*	$0.07

*Non-HCP funds are leveraged $437,660

Table 4

Paired Project Analysis Comparing Hopkins/Veramendi Ponds (HCP Ponds) to City Park/Downtown Ponds (Adaptive Management)						
Project	**Annual TSS Removed (lbs.)**	**Annual TP Removed (lbs.)**	**Estimated Total Capital Cost**	**Overall Cost Eff. $/lb.**	**HCP Funding**	**HCP Cost Eff. $/lb.**
Hopkins/Veramendi	8,714	12.09	$303,864	$3.07	$303,864	$3.07
Downtown/City Park	15,107	33.53	$417,245	$1.98	$150,000*	$.58

*Non-HCP funds are leveraged $917,505