



Edwards Aquifer Habitat Conservation Plan
2016 Expanded Water Quality Monitoring Program
Work Group

**Report of the 2016 Expanded Water Quality
Monitoring Program Work Group**

DRAFT

May 16, 2016

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Abbreviations and Acronyms

Adaptive Management Process	AMP
Biological Monitoring Program Work Group	BioMWG
Biological Monitoring Program	BioMP
Clean Rivers Program	CRP
Dissolved Oxygen	DO
Edwards Aquifer Authority	EAA
Edwards Aquifer Habitat Conservation Plan	EAHCP
Expanded Water Quality Monitoring Program Work Group.....	WQWG
Expanded Water Quality Monitoring Program	WQP
Hydrogen Potential.....	pH
Integrated Pest Management Plan	IPMP
National Academy of Sciences.....	NAS
Passive Diffusion Sampling.....	PDS
Water Quality	WQ

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Introduction

The *Edwards Aquifer Habitat Conservation Plan* (2012) (EAHCP) calls for the Expanded Water Quality Monitoring Program (WQP) to:

- (1) provide early detection of water quality impairments associated with the San Marcos and Comal Spring and River systems that may negatively impact the Covered Species, and
- (2) identify the point and nonpoint sources of those impairments, supporting Covered Species protection by allowing for investigation and adoption of any necessary measures through the Adaptive Management Process (AMP) to address the source(s) of the concerning indicators (§5.7.2).

As WQP components, the EAHCP provides for stormwater, surface, and groundwater sampling (§5.7.2). Since the start of the program, the EAHCP Science and Implementing Committees supported the addition of sediment and passive diffusion sampling to the WQP. For all sampling, the EAHCP provides flexibility for the determination of frequency, sampling time, and location parameters (§5.7.2).

In 2015, the EAHCP received the *National Academy of Sciences (NAS) Report 1* (2015), containing recommendations for all EAHCP programs, including the WQP. From *Report 1*, a list of water quality monitoring-related recommendations was presented to the NAS Recommendation Review Work Group (NAS Work Group). Based on the NAS Work Group assessment (2015), at its February 18, 2016 meeting, the Implementing Committee approved the creation of the 2016 EAHCP Expanded Water Quality Monitoring Program Work Group (WQWG) whose charge is to carry out a holistic review of the WQP, taking into account the recommendations of NAS and the NAS Work Group, and the input of the Science Committee, the Permittees, and subject matter experts. The purpose of the Work Group is the production of this final report for review by the Implementing Committee, developed through a consensus decision-making process.

On February 18, 2016, the Implementing Committee assigned the following members to the Expanded Water Quality Monitoring Program Work Group and approved its charge: Ken Diehl (San Antonio Water System), Melani Howard (City of San Marcos/Texas State University), Charles Kreidler (EAHCP Science Committee), Steven Raabe (EAHCP Stakeholder Committee/San Antonio River Authority), Benjamin Schwartz (Texas State University), and Michael Urrutia (Guadalupe-Blanco River Authority). The Work Group held meetings from March to May 2016. To help coordinate and lead efforts, Steven Raabe was appointed as joint Chair of both the WQWG and the Biological Monitoring Work Group (BioMWG). Meetings were held as open forums where attendees actively participated in the discussion and provided valuable input. The charge, agendas and minutes from each meeting are included in the Appendix.

Operational Principles and Guidelines

In its first meeting, the WQWG identified basic operational principles and guidelines to ensure a holistic review and focused discussion regarding any possible modifications to the Scope of Work for the existing EAHCP Expanded Water Quality Monitoring Program. The WQWG unanimously approved four guidelines at its March 29 meeting, which are listed below, along with a short description.

1. Consensus-approved

Formulating recommendations, through group discussion and consensus, to ensure that everyone has a voice in the process.

2. Stewards dollars (no increase in budget)

Prioritizing modifications to the Scope of Work that may have impacts on the allocation of finite program resources. Some Work Group members maintained that this consideration, while important, should not compromise science-based decision-making; this advice was heeded over the course of both Work Group processes.

3. Species-driven

Confirming sampling methods are reliable, valid measures of conditions that have a potential impact on the health of the species.

4. Supports Habitat Conservation Plan Biological Goals and Objectives

Ensuring recommendations relate to habitat conservation, consistent with Biological Objectives and Goals.

Six additional points to consider were agreed upon as important, but not required, as the group performed its duties. These points are listed below.

- Does it eliminate duplication?
- Does it enable the evaluation of long-term trends?
- Does it integrate data collected by the EAHCP water quality monitoring program, EAHCP biological monitoring program and other monitoring programs?
- Does it contribute to an understanding of the effectiveness of conservation measures?
- Does it consider point and non-point sources?
- Does it demonstrate an awareness of strategies employed by others?

Alternatives for a Revised Scope of Work for EAHCP Water Quality Monitoring

The Work Group followed a thoughtful, deliberative process over the course of considering possible modifications to the existing EAHCP Expanded Water Quality Monitoring Program. Each meeting featured a great deal of productive discussion by Work Group members. Work Group meetings were facilitated by EAHCP staff, as well Design Workshop, a facilitation firm retained to assist with the meetings.

The Work Group process began with presentations of revised Scopes of Work (SOW) for the EAHCP Expanded Water Quality Monitoring Program for consideration by the Work Group members. These revised SOW were designed to incorporate different blendings of the recommendations that have been made by the National Academy of Sciences, the EAHCP Science Committee, and various other entities since the EAHCP's inception. EAHCP developed the initial SOW based on the input of a wide variety of stakeholders, including the EAA's Aquifer Science Department, Work Group members, the Science Committee, and the US Fish & Wildlife Service. The revised SOW which resulted from this process are "Alternatives 1 and 2," presented in **Table W1** below.

At the work session meeting on Mar 29, 2016, Alternatives 1 and 2 provided sounding boards for the Work Group members to discuss water quality monitoring issues as related to EAHCP requirements, and to identify what additional information they needed to proceed with carrying out their charge. The Work Group requested for EAHCP staff to provide additional information concerning results to-date within sampling methods proposed to be suspended (e.g., surface water), and to provide comparisons between the EAHCP WQ program and other programs, such as the Clean Rivers Program (CRP), that would provide surrogate information in the event the Work Group decided to recommend discontinuing certain current sampling methods within the EAHCP.

The Work Group also emphasized that whatever changes are pursued, should, to the extent practicable and appropriate, build on the existing dataset to create a running baseline. This would steward dollars, ensuring investment in the existing baseline would be added to over coming years, providing a useful dataset for the evaluation of trends in water quality, changes in water quality, or any other applied analyses appropriate and consistent with the EAHCP. The Work Group also brought up point-source contamination related to the golf courses, as well as non-point source contamination associated with urbanization of the spring system watersheds. They recommended that any changes to the monitoring programs would need to account for these potential sources of water quality impairments.

For presentation at the April 27 meeting, the EAHCP Program Manager developed a third revised SOW, "Alternative 3," in response to issues identified by the Work Group with Alternatives 1 and 2. Alternative 3, also presented in **Table W1** below, combined certain elements of Alternatives 1 and 2 that the Work Group agreed to, and introduced new elements that were not previously presented. At the April 27 meeting, the Work Group

approved Alternative 3, with the condition that the following modification and contingency be incorporated:

- The addition of two stormwater samples at each existing stormwater sampling location to the initial rise of the hydrograph, while keeping the same 3 original samples as identified (onset, peak, and tail) in the original SOW, for a total of 5 samples per location.
- It is understood that due to timing and logistics, 5 samples at each location may not be feasible. Therefore, the 5 samples, rather than just 3, should be prioritized for locations near tributary outflows (making Sessoms and Purgatory creeks the first priorities).

Table W1.

At the March 29 and April 27, 2016 meetings of the Work Group, the EAHCP Program Manager presented a matrix outlining options for modifying the EAHCP WQ Monitoring Scope of Work based upon input received as described in the WQWG charge. Each alternative, and a description of the rationale for each, is below.

	<u>Alternative 1</u>	<u>Alternative 2</u>	<u>Alternative 3</u>
Current WQP Sampling Method	Proposed Modification and Rationale		
Surface water (base flow)	Remove from program <ul style="list-style-type: none"> • Sampled by CRP • No significant detects • EAA BioMP collects field and nutrients WQ at low and high-flow 	Remove from program <ul style="list-style-type: none"> • Sampled by CRP • No significant detects • EAA BioMP collects field and nutrients WQ at low and high-flow 	Remove from program <ul style="list-style-type: none"> • Sampled by CRP • No significant detects • EAA BioMP collects field and nutrients WQ at low and high-flow
Sediment	Reduce to biennial <ul style="list-style-type: none"> • Also covered through PDS • Biological monitoring data do not suggest impact to Covered Species 	Remove from program <ul style="list-style-type: none"> • Replace with PDS and tissue sampling • Biological monitoring data do not suggest impact to Covered Species 	Remove in odd years, reduce to once per year, only even years <ul style="list-style-type: none"> • Data will change little throughout the year • Biological monitoring data do not suggest impact to Covered Species • Provides information on trends in toxic parameters
Real-time monitoring	Add one sampling station per system	Add one sampling station per system	Add one sampling station per system

	<u>Alternative 1</u>	<u>Alternative 2</u>	<u>Alternative 3</u>
Current WQP Sampling Method	Proposed Modification and Rationale		
	<ul style="list-style-type: none"> Valuable source of continuous information that is ecologically relevant Field parameters collected every 15 minutes: DO, conductivity, turbidity, temperature, pH 	<ul style="list-style-type: none"> Valuable source of continuous information that is ecologically relevant Field parameters collected every 15 minutes: DO, conductivity, turbidity, temperature, pH 	<ul style="list-style-type: none"> Valuable source of continuous information that is ecologically relevant Field parameters collected every 15 minutes: DO, conductivity, turbidity, temperature, pH
Stormwater	<p>Reduce to one sampling event per year, test only for IPMP chemicals</p> <ul style="list-style-type: none"> Turnover rate, dilution Lack of significant detects 	<p>Remove from program</p> <ul style="list-style-type: none"> Turnover rate; dilution Untraceable Lack of significant detects 	<p>Reduce to one sampling event each year; Test only for IPMP chemicals in odd years, test full suite in even years as currently done, add two samples to the rising limb of the hydrograph for a total of 5 samples/location; priority given to locations at tributary outflows</p> <ul style="list-style-type: none"> Turnover rate, dilution Lack of significant detects
Passive diffusion sampling	<p>Add PPCP membrane</p> <ul style="list-style-type: none"> PDS provides a sensitive index for contamination in the spring systems 	<p>Add PPCP membrane</p> <ul style="list-style-type: none"> PDS provides a sensitive index for contamination in the spring systems 	<p>Add PPCP membrane only at bottom of channel</p> <ul style="list-style-type: none"> PDS provides a sensitive index for contamination in the spring systems
Groundwater (well)	<p>Remove from program</p> <ul style="list-style-type: none"> Purpose is to detect movement of bad water line Already sampled by EAA 	<p>Remove from program</p> <ul style="list-style-type: none"> Purpose is to detect movement of bad water line Already sampled by EAA 	<p>Remove from program</p> <ul style="list-style-type: none"> Purpose is to detect movement of bad water line Already sampled by EAA
Tissue sampling	Not discussed	<p>Add to program</p> <ul style="list-style-type: none"> Represents direct link to Covered Species 	<p>Add to program, one sample in odd years</p>

	<u>Alternative 1</u>	<u>Alternative 2</u>	<u>Alternative 3</u>
Current WQP Sampling Method	Proposed Modification and Rationale		
		<ul style="list-style-type: none"> Parameters to be established (work with experts) Provides new information and data Largemouth Bass, Asian Clams, Fountain Darter to be sampled 	<ul style="list-style-type: none"> Represents direct link to Covered Species Parameters and species to be established (work with experts) Provides new information and data Species to be sampled will be determined in consultation with experts

Table W2, below, summarizes the EAHCP surface WQ parameters suspended as part of Alternative 3. The Work Group carefully evaluated the implications of dropping each of the surface parameters. The below list features only those elements which, once dropped from the EAHCP WQ program, would no longer be monitored within either of the springs system by either the EAHCP Biological Monitoring Program, which includes some water quality elements, or the Clean Rivers Program as conducted by the Guadalupe-Blanco River Authority (GBRA) or the Texas Commission on Environmental Quality (TCEQ).

As shown in the “Justification” column of **Table W2**, some dropped parameters would continue to be monitored through other sampling methodologies (e.g., stormwater), or were drinking water quality-oriented. It should be noted that surface water results will not be dropped entirely from the EAHCP WQ monitoring program, as going forward, EAHCP will use Clean Rivers Program surface water quality data instead (see also *Regular Review and Analysis of EAHCP WQ Data*, p. 13).

Table W2.

Suspended WQ Parameters		
Surface (Base Flow) Parameters		Justification
Chem	“General chemistry” (TDS, Br, Fl, Ca, Mg, Na, K, Si, Sr, CO3)	Monitored: stormwater, sediment and EAA spring sampling
Toxics /PCPP /Patho gens	VOCs & SVOCs	Monitored: stormwater, sediment, PDS, EAA spring sampling
	Organochlorine Pesticides	

	Polychlorinated Biphenyls (PCBs)	
	Organophosphorus Pesticides	
	Herbicides	
	Metals (Al, Sb, As, Ba, Be, Cd, Cr (total), Cu, Fe, Pb, Mn, Hg, Ni, Se, Ag, Tl, and Zn)	
	Caffeine	
Nutrients	Total Organic Carbon (TOC)	Drinking WQ concern; Monitored: EAA spring sampling
	Dissolved Organic Carbon (DOC)	Drinking WQ concern

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Methodology for Determining Historic Water Quality Conditions in the Spring Systems

The EAHCP sets Key Management Objectives for the Covered Species, stating that daily average WQ conditions should remain within 10 percent deviation (daily average) of the long-term historical average (§4.1.1). The EAHCP indicates that the data set from which long-term historical averages are to be calculated is the EAA Variable Flow Study, however, the original 15 locations originally monitored within that study were dropped after two years of highly consistent data (2000-2002).

Nevertheless, since the beginning of the Variable Flow study in 2000, water quality parameters have been collected through other components of the program. This issue was revisited by the Work Group in order to obtain their recommendation on what datasets would be appropriate to use for the purpose of calculating long-term historical averages (2000-2012), against which daily average water quality conditions are to be compared in accordance with the EAHCP Key Management Objectives (see also *Regular Review and Analysis of EAHCP WQ Data*, p. 13).

At the March 29, 2016 meeting, the WQWG agreed by consensus to recommend the following datasets, presented in **Table W3**, to calculate the historic water quality conditions (long-term averages of field parameters: DO, pH, temperature, conductivity) in the Comal River and San Marcos River ecosystems.

Table W3.

Species Type	Data Source	Comal River Ecosystem	San Marcos River Ecosystem	Justification
Fountain Darter	<i>Variable Flow study Fountain Darter Drop-net Sampling, 2000-2012 (biannual)</i>	<ul style="list-style-type: none"> • Upper Spring Run • Landa Lake • Old Channel Reach • New Channel Reach 	<ul style="list-style-type: none"> • IH-35 • City Park • Spring Lake Dam initiated in 2013 	<ul style="list-style-type: none"> • Long-term • Consistent with EAHCP • Measurements taken at multiple water column levels, including sediment-interface, which is to be used for Fountain Darter analysis.
Comal Springs Riffle Beetle, Comal Springs Dryopid	<i>EAA monitoring data of Comal spring openings</i>	<ul style="list-style-type: none"> • Spring Run 1 • Spring Run 3 • Spring Run 7 		<ul style="list-style-type: none"> • Long-term

Beetle, Peck's Cave Amphipod				
Texas Blind Salamander	<i>EAA monitoring data of Spring Lake spring openings</i>		<ul style="list-style-type: none"> • Deep Spring • Hotel Spring 	<ul style="list-style-type: none"> • Long-term

Criteria for Analytical Limits for EAHCP Water Quality Data

Since its inception, the EAHCP Expanded Water Quality Monitoring Program has been implemented using Drinking Water Quality Standards (30 TAC Chapter 290) as the criteria for comparison of whether water quality results were below, at, or in exceedance of regulatory limits. Due to the fact that the WQ is intended for protection of the Covered Species and their habitat, however, the Work Group determined that drinking water quality standards were not well-suited.

For this reason, at the March 29, 2016 meeting, the WQWG agreed by consensus on the following recommendations (**Table W4**) for changes to analytical limits for EAHCP Expanded Water Quality data. In instances where a parameter on the Aquatic Life Protection criteria is not currently included within the standard EAHCP parameters, it will be added; conversely, current EAHCP parameters not included within Aquatic Life Protection criteria will be maintained. Parameters not listed on the Aquatic Life Protection will be compared against drinking water quality standards consistent with current practice.

The WQWG suggested it be noted that interpreting stormwater results in comparison with Aquatic Life Protection (ALP) criteria should take into account dilution and flow-through; stormwater results largely represent ephemeral water quality conditions, and duration of exceedance of criteria should be taken into account. In instance where ALP minimum criteria are less than current criteria, current criteria will not be lowered to conform with ALP criteria, in order to maintain comparability in the dataset over time.

Table W4.

Sampling Method	Current	WQWG Approved Limits
Surface (base flow)	Drinking WQ standards <i>30 TAC Chapter 290</i>	Aquatic life protection <i>30 TAC Ch. 307 Rule Section 307.6</i>
Stormwater	Drinking WQ standards <i>30 TAC Chapter 290</i>	Aquatic life protection <i>30 TAC Ch. 307 Rule Section 307.6</i>

Real-time monitoring	Historical long-term averages	Historical long-term averages
Sediment	<i>MacDonald, Ingersoll, and Berger (2000) & Texas Commission on Environmental Quality (2014)</i>	<i>MacDonald, Ingersoll, and Berger (2000) & Texas Commission on Environmental Quality (2014)</i>
Passive diffusion sampling	None	Create baseline
Tissue sampling	None	Create baseline

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Regular Review and Analysis of EAHCP WQ Data

Throughout its meetings, the WQWG recommended that the regular review and analysis of all WQ data be proceduralized, including data incorporated under the EAHCP Expanded Water Quality Monitoring Program and other programs, such as the EAHCP Biological Monitoring Program and the Clean Rivers Program, in cases where data from those other programs has been identified as appropriate to be included (such as surface water (base flow) sampling).

The Work Group recommends collaboration with other programs conducting water quality monitoring within the spring systems, namely, the Clean Rivers Program (CRP), currently conducted by GBRA and TCEQ in the Comal and San Marcos rivers, respectively, as well as the Biological Monitoring program, which is a component of the EAHCP (see also, *Synergies between the Monitoring Work Groups*, p. 17), and the EAA Aquifer Science Department, which conducts groundwater and spring orifice-sampling programs. Results from these complementary programs will be obtained by EAHCP staff once they are available; review and analysis of results will be conducted as contemplated by the plan developed to proceduralize the regular review and analysis of EAHCP WQ data.

As part of the review and analysis procedure, the Work Group also recommended that, in the event of changes to land-use within either of the spring system watersheds, a contingent re-evaluation of whether stormwater sampling methodologies should be modified should be conducted (e.g., if the Texas State University Golf Course was decommissioned and converted to some other use).

Further, the Work Group recommended that the regular review and analysis of data should include results from past years, so that trends associated with any impairments to the systems can be identified. Through the analysis of stormwater data in particular, this exercise would help develop a better understanding of flood events, and their impact on the two systems.

Overall, the purpose for recommending a more systematic, regular procedure for the review and analysis of the WQ data was to ensure that monitoring findings are duly taken under consideration to inform the ongoing management of the EAHCP, in accordance with the purpose for this program as it is written into the EAHCP.

National Academy of Sciences *Report 1* and NAS Work Group Recommendations

In 2015, the EAHCP received the *National Academy of Sciences (NAS) Report 1* (2015), containing recommendations for all EAHCP programs, including the WQP. From *Report 1*, a list of water quality monitoring-related recommendations was presented to the NAS Recommendation Review Work Group (NAS Work Group). The NAS Work Group deferred certain NAS recommendations associated with water quality monitoring for consideration by this Work Group. At the March 29, 2016 meeting, the WQWG considered both the recommendations from the National Academy of Sciences' *Review of the Edwards Aquifer Habitat Conservation Plan: Report 1* (2015), as well as the *Final Report* of the National Academy of Sciences Work Group (2015), with their final recommendations presented below in **Table W5**.

Table W5.

NAS Report 1	NAS Work Group	WQWG Recommendation
Sampling not randomized; cannot extrapolate. Expand reaches to system-wide sampling.	If a reason to scale results to the entire spring system is identified, then consider through by work group.	No. Continue to utilize Intensive Study Reaches; extrapolation unnecessary.
Consider household chemicals, personal care products, & residential herbicides.	Determining whether enhanced sampling for nutrients and household/personal care products is needed.	Agreed. Alternative #3 – Golf course IPMP sampling Alternatives #3– PCPP PDS sampling
Reduce frequency/locations if no significant concentrations of given contaminant are observed.	None	Agreed. Alternative #3 – Surface water quality, nutrients, others (see Table W2)
Increased coordination/integration of the monitoring activities is needed.	None	Agreed. To be accomplished through WGs
Nutrients detection limits should be reduced to enhance detection of possible WQ impairments.	Nutrients play an important role in the systems; re-evaluate.	Drop nutrient sampling from the EAHCP Expanded Water Quality Monitoring Program; Recommend nitrate, ammonia, and soluble reactive phosphorus as the primary nutrients of

		<p>concern within the spring systems;</p> <p>Lower soluble reactive phosphorus detection limits employed by the EAHCP Biological Monitoring Program to at least 5 micrograms/Liter to enhance detection of possible impairments associated with this nutrient; and</p> <p>Ammonia to be discussed at May 20 joint work group meeting.</p>
None	WQP should focus on parameters and limits used for Covered Species protection and for watersheds, rather than mimicking standard WQPs.	Agreed. Operational Guidelines
None	PDS might be a more cost-effective alternative to comprehensive grab sampling.	Agreed. Alternatives #3 - PDS

With regards to NAS' recommendation concerning nutrients, the Work Group requested additional information concerning current sampling, detection limits, and the relationship between various nutrients and ecosystem functioning be presented at their April 27 meeting.

This exercise resulted in **Table W6**, which compares nutrient analytes monitored between each of the three programs operating in the springs systems, along with detection limits used for each analyte.

Table W6.

Analytes	Results	EAHCP WQ	EAHCP BioMP	CRP
	<i>Detection level comments</i>	<i>Method Detection Limit</i>	<i>Method Detection Limit</i>	<i>Ambient Water Reporting Limit</i>
Nitrate	Minimum 110-180 µg/L	25 µg/L	50 µg/L	50 µg/L

	CS, SM, respectively			
Ammonia	Ammonia detection limits meet TCEQ approval	Not tested	Not tested	100 µg/L
SRP	~95% non-detects	Not tested	50 µg/L	Not tested

Additionally, staff analyzed existing WQ data to compare against recommended detection limits. Among primary nutrients of concern, it was found that:

- The vast majority of the time, nitrate levels were well *above* NAS-recommended limits; and
- Soluble reactive phosphorus analysis resulted in 95% non-detects at the current detection limits.

Based on this presentation, and additional research presented to the Work Group at the May 11, 2016 meeting, Work Group recommended:

- Dropping nutrient sampling from the EAHCP Expanded Water Quality Monitoring Program;
- Acknowledgement of nitrate, ammonia, and soluble reactive phosphorus as the primary nutrients of concern within the spring systems;
- Lowering soluble reactive phosphorus detection limits employed by the EAHCP Biological Monitoring Program to 3-5 micrograms/Liter to enhance detection of possible impairments associated with this nutrient; and
- Obtaining information on ammonia levels from the Clean Rivers Program.

Synergies between the Monitoring Work Groups

While the NAS in its first report recognized that the EAHCP monitoring programs have provided a wealth of information on the physical, chemical, and biological characteristics of the springs ecosystems, they recommended an increase in the coordination between the monitoring programs to more fully assess the systems' environmental conditions.

Throughout their meetings, the WQWG and the BioMWG discussed the importance of integrating the two programs in order to improve overall effectiveness and efficiencies the EAHCP monitoring efforts. They also discussed how monitoring data can assist in implementing some of the habitat restoration measures.

At their final meeting on May 20, 2016, the WQWG and the BioMWG explored specific interactions of activities between the programs that if implemented, will be beneficial to the implementation of the EAHCP. These synergies are presented below:

1. Using rapid bio-assessments (EAHCP Bio-Monitoring) to help identify toxic water quality impairments
2. Using water quality data collected through the Bio-Monitoring program to measure nutrient impairments, such as SRP
3. Analyzing data from the Expanded Water Quality program, Bio-Monitoring program, EAA Well Sampling program and Clean Rivers Program, collectively
4. Collecting more real-time water quality data because it is more biologically-relevant
5. Requiring monitoring of riparian conditions as a part of Permittees' Work Plans
6. Exploring the feasibility of coordinating sampling at the same locations and/or times.

Conclusion

At their final meeting on May 20, 2016, the WQWG unanimously approved this draft report, along with the tables below which summarize the following:

- final recommendations to the SOW for EAHCP Expanded Water Quality Monitoring Program (**Table W7**),
- final recommendations on the methodology to be used in determining historic water quality conditions in the Spring systems (**Table W8**),
- final recommendations on the criteria for analytical limits for EAHCP water quality data (**Table W9**),
- final recommendations related to the water quality monitoring program recommendations from the *NAS Report 1* and the NAS Review Recommendations Work Group (**Table W10**), and the
- Expanded Water Quality Monitoring Program synergies with the Bio-Monitoring program. (**Table W11**).

Table W7.

Sampling Method	Final Recommendations
Surface water (base flow)	Remove from program
Sediment	Remove in odd years, reduce to once per year, only even years
Real-time monitoring	Add one sampling station per system
Stormwater	Reduce to one sampling event each year; Test only for IPMP chemicals in odd years, test full suite in even years as currently done, add two samples to the rising limb of the hydrograph for a total of 5 samples/location; priority given to locations at tributary outflows
Passive diffusion sampling	Add PPCP membrane only at bottom of channel
Groundwater (well)	Remove from program
Tissue sampling	Add to program, one sample in odd years

Table W8.

Species Type	Data Source	Comal River Ecosystem	San Marcos River Ecosystem
Fountain Darter	<i>Variable Flow study Fountain Darter Drop-net Sampling, 2000-2012 (biannual)</i>	<ul style="list-style-type: none"> • Upper Spring Run • Landa Lake • Old Channel Reach • New Channel Reach 	<ul style="list-style-type: none"> • IH-35 • City Park • Spring Lake Dam initiated in 2013
Comal Springs Riffle Beetle, Comal Springs Dryopid Beetle, Peck's Cave Amphipod	<i>EAA monitoring data of Comal spring openings</i>	<ul style="list-style-type: none"> • Spring Run 1 • Spring Run 3 • Spring Run 7 	
Texas Blind Salamander	<i>EAA monitoring data of Spring Lake spring openings</i>		<ul style="list-style-type: none"> • Deep Spring • Hotel Spring

Table W9.

Sampling Method	WQWG Approved Limits
Surface (base flow)	Aquatic life protection <i>30 TAC Ch. 307 Rule Section 307.6</i>
Stormwater	Aquatic life protection <i>30 TAC Ch. 307 Rule Section 307.6</i>
Real-time monitoring	Historical long-term averages
Sediment	<i>MacDonald, Ingersoll, and Berger (2000) & Texas Commission on Environmental Quality (2014)</i>
Passive diffusion sampling	Create baseline
Tissue sampling	Create baseline

Table W10.

Recommendations from NAS Report 1	Final Recommendations
Sampling not randomized; cannot extrapolate. Expand reaches to system-wide sampling.	Continue to use Intensive Study Reaches.
Consider household chemicals, personal care products, & residential herbicides.	Include Golf course IPMP sampling in stormwater sampling and include PCPP in PDS sampling
Reduce frequency/locations if no significant concentrations of given contaminant are observed.	Surface water quality, nutrients, others (see Table W2)
Nutrients detection limits should be reduced to enhance detection of possible WQ impairments.	<p>Drop nutrient sampling from the EAHCP Expanded Water Quality Monitoring Program;</p> <p>Recommend nitrate, ammonia, and soluble reactive phosphorus as the primary nutrients of concern within the spring systems;</p> <p>Lower soluble reactive phosphorus detection limits employed by the EAHCP Biological Monitoring Program to at least 5 micrograms/Liter to enhance detection of possible impairments associated with this nutrient; and</p> <p>Ammonia to be discussed at May 20 joint work group meeting.</p>
WQP should focus on parameters and limits used for Covered Species protection and for watersheds, rather than mimicking standard WQPs.	Operational Guidelines of Work Group includes the focus on the Covered Species
PDS might be a more cost-effective alternative to comprehensive grab sampling.	Continue PDS monitoring
Increased coordination and integration of the monitoring activities is needed.	Synergies between monitoring programs are summarized below.

Table W11.

Synergies with the Biological Monitoring Program	
Synergy	Comments
Using rapid bio-assessments (EAHCP Bio-Monitoring) to help identify toxic WQ impairments.	RBAs will be included in the Bio-Monitoring program as a first screening of water quality impairments in the springs' systems.
Using WQ data from Bio-Monitoring to measure nutrient impairments, such as SRP	Modify method detection limit (MDL) for SRP from 50 ug/L to at least 5 ug/L.
Analyzing data from Expanded Water Quality, Biological, EAA Well Sampling & Clean Rivers Program, collectively.	To be discussed at meeting on May 20, 2016.
Collecting more real-time water quality data because it is more biologically-relevant.	One additional data sonde will be installed in each springs system.
Requiring monitoring of riparian conditions as a part of Permittees' Work Plans.	Require monitoring before and after riparian conditions as part of the Permittees' Riparian Work Plans, such as light penetration and potentially other measures - depending on the project footprint and design.
Explore the feasibility of coordinating sampling at the same locations and/or times.	To be discussed at meeting on May 20, 2016.
Other	To be discussed at meeting on May 20, 2016.
Other	To be discussed at meeting on May 20, 2016.
Other	To be discussed at meeting on May 20, 2016.

With these summaries, the WQWG recommends this report to the Implementing Committee as its final deliverable for approval and adoption.

References Cited

UPDATE

DRAFT

Charge of the EAHCP 2016 Expanded Water Quality Monitoring Program Work Group (WQWG)

Overview: The Edwards Aquifer Habitat Conservation Plan (EAHCP) calls for the Expanded Water Quality Monitoring Program (WQP) to:

- (1) provide early detection of water quality impairments associated with the San Marcos and Comal Spring and River systems that may negatively impact the Covered Species, and
- (2) identify the point and nonpoint sources of those impairments, supporting Covered Species protection by allowing for investigation and adoption of any necessary measures through the Adaptive Management Process (AMP) to address the source(s) of the concerning indicators (§5.7.2).

As WQP components, the EAHCP provides for stormwater, surface, and groundwater sampling (§5.7.2). Since the start of the program, the EAHCP Science and Implementing Committees supported the addition of sediment and passive diffusion sampling to the WQP. For all sampling, the EAHCP provides flexibility for the determination of frequency, sampling time, and location parameters (§5.7.2).

Charge: In 2015, the EAHCP received the National Academy of Sciences (NAS) *Report 1*, containing recommendations for all EAHCP programs, including the WQP. From *Report 1*, a list of water quality monitoring-related recommendations was presented to the NAS Recommendation Review Work Group (NAS Work Group). Based on the NAS Work Group assessment, at its February 18, 2016 meeting, the Implementing Committee approved the creation of the 2016 EAHCP Expanded Water Quality Monitoring Program Work Group (WQWG) whose charge is to carry out a holistic review of the WQP, taking into account the recommendations of NAS and the NAS Work Group, and the input of the Science Committee, the Permittees, and subject matter experts. The purpose of the Work Group is to produce a final report for review by the Implementing Committee.

Membership & Meeting Organization: The Implementing Committee will appoint the work group membership at its February 18, 2016 meeting. If desired, the Work Group will nominate and elect a Chair. The Work Group will develop its final report through a consensus decision-making process. The Work Group will hold all meetings from March-May 2016 (see proposed schedule attached). The final draft of the *Report of the 2016 EAHCP Expanded Water Quality Monitoring Program Work Group* will be presented to the Implementing Committee for approval at their June 16, 2016 meeting.

EAHCP Staff

March 15, 2016



NOTICE OF OPEN MEETING

Available at eahcp.org

As requested by the EAHCP Implementing Committee, the **2016 EAHCP Biological Monitoring Program Work Group (BioWG)** and the **2016 EAHCP Expanded Water Quality Monitoring Program Work Group (WQWG)** have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region. An initial joint meeting of both Work Groups is scheduled for **Tuesday, March 15, 2016, at 11 a.m. at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, Texas 78666**. Lunch will be provided. Please RSVP to dlarge@edwardsaquifer.org.

Members of the BioWG include: Tyson Broad (Texas Tech University), Jacquelyn Duke (EAHCP Science Committee/Baylor University), Mark Enders (City of New Braunfels), Rick Illgner (Edwards Aquifer Authority), and Doyle Mosier (EAHCP Science Committee).

Members of the WQWG include: Ken Diehl (San Antonio Water System), Melani Howard (City of San Marcos/Texas State University), Charles Kreidler (EAHCP Science Committee), Steven Raabe (EAHCP Stakeholder Committee/San Antonio River Authority), Benjamin Schwartz (Texas State University), and Michael Urrutia (Guadalupe-Blanco River Authority).

At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
2. Public Comment.
3. Introduction of WG members, EAHCP staff, and facilitators.
Purpose: To introduce the Work Group membership, the EAHCP staff, and the facilitators who will be participating in or supporting the Work Group process.
Action: None required.
4. Nomination and election of the Work Groups Chair.
Purpose: To elect a Work Groups Chair.
Action: To nominate and elect a Work Groups Chair.
5. Presentation of schedule options and determination of a schedule for following Work Group meetings.
Purpose: To provide Work Group members with schedule options and determine their availability to provide set dates for the Work Groups meeting schedule.
Action: To adopt a Work Group meeting schedule.

6. Discussion of the Work Group Charges, general information about the Work Groups, and overview of the Monitoring Programs and their background (Attachments 1 & 2).
Purpose: To inform the Work Groups about their Charges, about the Work Groups more generally, and about the Monitoring Programs.
Action: None required.
7. Discussion of and possible endorsement of the basic operational guidelines and principles which will direct the Work Groups in carrying out their charges.
Purpose: To inform the Work Groups about the proposed basic operational guidelines and principles which are intended to direct the Work Groups' deliberations in carrying out their charges.
Action: To possibly endorse the basic operational guidelines and principles which will direct the Work Groups in carrying out their charges.
8. Presentation of current EAHCP Expanded Water Quality Monitoring Program (WQP) (SWCA, Phil Pearce)
Purpose: To inform the Work Groups concerning the monitoring findings identified to date through the WQP.
Action: To obtain feedback on the WQP findings and answer any questions that Work Group members may have.
9. Presentation of current EAHCP Biological Monitoring Program (BioMP) (BIO-WEST, Ed Oborny)
Purpose: To inform the Work Groups concerning the monitoring findings identified to date through the BioMP.
Action: To obtain feedback on the BioMP findings and answer any questions that Work Group members may have.
10. Presentation of Budget Info related to the WQP and BioMP.
Purpose: To inform the Work Groups concerning budgetary considerations associated with the Monitoring Programs.
Action: To obtain feedback from the Work Groups concerning budgetary considerations and answer any questions that Work Group members may have.
11. Next Steps – timeline and associated list of goals.
Purpose: To inform the Work Groups concerning budgetary considerations associated with the Monitoring Programs.
Action: To obtain feedback from the Work Groups concerning budgetary considerations and answer any questions that Work Group members may have.
12. Consider future meetings, dates, locations, and agendas.
13. Questions and comments from the public.
14. Adjourn.



NOTICE OF OPEN MEETING

Available at eahcp.org

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The second meeting for the **Expanded Water Quality Monitoring Work Group** is scheduled for **Tuesday, March 29, 2016, at 9 a.m. at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, Texas 78666.** Please RSVP to dlarge@edwardsaquifer.org.

Members of the WQWG include: Ken Diehl (San Antonio Water System), Melani Howard (City of San Marcos/Texas State University), Charles Kreidler (EAHCP Science Committee), Steven Raabe (EAHCP Stakeholder Committee/San Antonio River Authority), Benjamin Schwartz (Texas State University), and Michael Urrutia (Guadalupe-Blanco River Authority).

At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
2. Public Comment.
3. Recap of Work Group Meeting #1.
Purpose: To provide an overview of activities and outcomes from the previous meeting.
Action: None required.
4. Review and achieve consensus on revised basic operational principles and guidelines.
Purpose: To confirm how basic operational principles and guidelines were revised based on Meeting #1 discussions.
Action: Achieve consensus on basic operational principles and guidelines, which will direct the work groups in carrying out their charges.
5. Presentation and discussion of draft modifications to the Scope of Work for the EAHCP Water Quality Monitoring Program.
Purpose: To discuss staff-generated proposal modifying the Scope of Work for the EAHCP Water Quality Monitoring Program.
Action: None required.
6. Presentation and possible recommendation of the methodology to calculate the historically-recorded water quality conditions (long-term averages) in the Comal River and San Marcos River ecosystems.

Purpose: To discuss and possibly recommend a methodology to calculate the historically-recorded water quality conditions (long-term averages) that will be used to determine the 10 percent deviation in the Comal River and San Marcos River ecosystems.

Action: To possibly recommend the methodology to calculate the historically-recorded water quality conditions (long-term averages) that will be used to determine the 10 percent deviation in the Comal River and San Marcos River ecosystems.

7. Presentation of and possible recommendation of analytical limits for water quality data that is used for the EAHCP.

Purpose: To identify and possibly recommend appropriate analytical limits for water quality data used for protection of the Covered Species in the EAHCP.

Action: To possibly recommend analytical limits for EAHCP water quality data.

8. Presentation and discussion of National Academy of Sciences (NAS) recommendations.

Purpose: To discuss recommendations from the NAS *Report 1* for the EAHCP Water Quality Monitoring Program.

Action: None required.

9. Presentation and discussion of the Draft Report.

Purpose: To present and discuss a draft of the Work Group's final report.

Action: None required.

10. Consider future meetings, dates, locations, and agendas.

11. Questions and comments from the public.

12. Adjourn.



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The third meeting for the Water Quality Monitoring Work Group is scheduled for **Wednesday, April 27, 2016, at 9 a.m. at the Dunbar Recreation Center, 801 W. Martin Luther King Drive, San Marcos, TX 78666**. Please RSVP to dlarge@edwardsaquifer.org.

At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
2. Public Comment.
3. Recap of Work Group Meeting #2.
Purpose: To provide an overview of activities and outcomes from the previous meeting.
Action: None required.
4. Presentation, discussion and possible recommendation of Scope of Work #3 for the EAHCP Water Quality Monitoring Program.
Purpose: To discuss a staff-generated proposal modifying the Scope of Work for the EAHCP Water Quality Monitoring Program.
Action: To consider and possibly recommend Scope of Work #3 for the program.
5. Presentation and discussion of nutrient monitoring within the Comal and San Marcos systems through the EAHCP and other programs.
Purpose: To discuss current nutrient monitoring within the systems.
Action: None required.
6. Presentation and discussion of the Draft Report.
Purpose: To present and discuss a draft of the Work Group's final report.
Action: None required.
7. Consider future meetings, dates, locations, and agendas.
8. Questions and comments from the public.
9. Adjourn.



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At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
2. Public Comment.
3. Recap of Work Group Meeting #2.
Purpose: To provide an overview of activities and outcomes from the previous meeting.
Action: None required.
4. Presentation and discussion of frequency, parameters, locations and detection limits of the Clean Rivers Program, Habitat Conservation Program and the San Antonio Water System program.
Purpose: To share clarifying data regarding topical questions from Meeting #2.
Action: None required.
5. Presentation and discussion of ongoing nutrients sampling and algae dynamic research.
Purpose: To share clarifying data regarding topical questions from Meeting #2.
Action: None required.
6. Presentation of Science Committee data management system recommendations.
Purpose: To share clarifying data regarding topical questions from Meeting #2.
Action: None required.
7. Presentation of Asian Clam silt filtration research findings.
Purpose: To share clarifying data regarding topical questions from Meeting #2.
Action: None required.
8. Continued presentation and discussion of draft modifications to the Scope of Work for the EAHCP Water Quality Monitoring Program.

Purpose: To discuss staff-generated proposal modifying the Scope of Work for the EAHCP Water Quality Monitoring Program.

Action: To consider and possibly recommend Scope of Work modifications for the program.

9. Presentation and discussion of the Draft Report.

Purpose: To present and discuss a draft of the Work Group's final report.

Action: None required.

10. Consider future meetings, dates, locations, and agendas.

11. Questions and comments from the public.

12. Adjourn.



NOTICE OF OPEN MEETING

Available at eahcp.org

MINUTES

As requested by the EAHCP Implementing Committee, the **2016 EAHCP Biological Monitoring Program Work Group** (BioWG) and the **2016 EAHCP Expanded Water Quality Monitoring Program Work Group** (WQWG) have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region. An initial joint meeting of both Work Groups was held **Tuesday, March 15, 2016, at 11 at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, Texas 78666.**

Members of the BioWG include: Tyson Broad (Texas Tech University), Jacquelyn Duke (EAHCP Science Committee/Baylor University), Mark Enders (City of New Braunfels), Rick Illgner (Edwards Aquifer Authority), and Doyle Mosier (EAHCP Science Committee).

Members of the WQWG include: Ken Diehl (San Antonio Water System), Melani Howard (City of San Marcos/Texas State University), Charles Kreidler (EAHCP Science Committee), Steven Raabe (EAHCP Stakeholder Committee/San Antonio River Authority), Benjamin Schwartz (Texas State University), and Michael Urrutia (Guadalupe-Blanco River Authority).

All members were present. The following business was considered.

1. Call to Order.
11:06 a.m.
2. Public Comment.
Public attendees introduced themselves. Refer to sign-in sheets for attendees.
3. Introduction of WG members, EAHCP staff, and facilitators.
Nathan Pence, EAHCP Program Manager, introduced the WQWG and BioWG participants, EAA staff members, and Design Workshop (DW) meeting facilitators.
4. Nomination and election of the Work Groups Chair.
The Work Groups unanimously elected Steve Raabe as Work Group chair.
5. Presentation of schedule options and determination of a schedule for following Work Group meetings.
DW proposed a meeting strategy and dates of March 29, April 7, April 27, May 9, May 11 and May 20. All proposed dates were approved by the WG, with the exception that Steve Raabe cannot participate the morning of March 29, Ben Schwartz cannot attend April 7 and Jacquelyn Duke cannot attend April 27. The WQWG will meet in the morning. The BioWG will meet in the afternoon. EAA provided an overview of outreach efforts and requested recommendations for additional entities that the Work Group would like to involve. No additional comments.

6. **Discussion of the Work Group Charges, general information about the Work Groups, and overview of the Monitoring Programs and their background (Attachments 1 & 2).**
Nathan Pence presented the charges of each group. The charge is to carry out a holistic review, take into account the recommendations of the National Academy of Sciences, and produce a final report for review by the Implementing Committee.
7. **Discussion of and possible endorsement of the basic operational guidelines and principles which will direct the Work Groups in carrying out their charges.**
Tyson Broad stated that the group needs to define "holistic" and "species-driven". Charlie Kreidler stated that caffeine detections may affect the species. Ken Diehl inquired if there will be an effort to look at compatibility and long-term trends. Nathan Pence confirmed that fifteen years of data will be shared. There is not yet adequate trend data to determine the long-term effects of caffeine on the species. Doyle Mosier stated that enabling long-term monitoring is an important outcome. Some measures will fluctuate, and others will not. Melani Howard stated that the Work Group should consider ways to minimize duplicative efforts. Nathan Pence states that this means focusing on meeting the goals and objectives of HCP. Ken Diehl states that turbidity, sedimentation and construction impacts on waterways should be considered. Melani Howard states that it would be beneficial for the Work Groups to be aware of watershed protection efforts. Ken Diehl recommends that the Work Group consider MS4 permits. It would be advantageous to eliminate duplicative sampling in certain areas. The Work Groups agree to add "integrate data collection" as an operational guideline. The Work Groups agree to add "support biological goals and objectives of the HCP". Steve Raabe, the Work Group chair, requests that DW simplifies the guidelines. He also requests that they are categorized into "guidelines" versus "strategies". Ken Diehl asks if the Work Group has alternates. Nathan Pence confirms that the Implementing Committee did not approve alternates, but they will note this for future work group efforts.
8. **Presentation of current EAHCP Expanded Water Quality Monitoring Program (WQP) (SWCA, Phil Pearce)**
Phil Pearce provides a summary of annual water quality sampling efforts (for surface water, stormwater, sediment, passive diffusion and groundwater sampling). Tyson Broad asks if groundwater samples are taken at the same locations. Phil Pearce states that samples require close proximity to the springs. If spring flow drops below 30 cfs, additional parameters apply. Ken Diehl asks whether an analysis of sheet flow from the golf course, and entrance into the tributary, maximizes the location of sampling value to constituents. EAA states that sampling locations above Hinman Island Drive are beyond the flow going into the channel. Sampling depths of 18 inches are not arbitrary and were approved by the Science Committee. Phil Pearce states that sampling occurs multiple times during each storm event and in real time. Ben Schwartz states that many samples for DEET organochloride have been gathered. Is that something that the PHB program is analyzing or do HCP samplings need to include? The Work Groups agree that this is a parking lot topic. EAA is to provide DEET sampling protocols and compare to EAA's. EAA is collecting for rivers, and SWCA is collecting for springs. Ben Schwartz asks if there are data points that minimize manmade impacts. EAA states that this human-related topic is the jurisdiction of TCEQ. This effort should focus on species-related data points. The HCP presents data at TCEQ meetings, but it is not formerly reported. Charlie Kreidler inquires if more sampling points are needed. Ed Oborny states that they have gathered 15 years of data.

9. Presentation of current EAHCP Biological Monitoring Program (BioMP) (BIO-WEST, Ed Oborny)

Ed Oborny provides an overview of fifteen years of biological monitoring data. In areas where storms and recreation did not disturb native vegetation, species growth occurred. Aquatic vegetation took a hit during the 2013-2014 droughts, followed by invasive plant growth. With Seasonal HCP restorations, reproduction of the Fountain Darter is occurring. Parking lot: EAA to provide comparisons for how these data points compare to other years. Ed Oborny states that measurements are taken twice a year. This year, due to storm events, Bio-West completed two additional trips in June and November. Bio-West monitors for changes in biological conditions. If there's not enough data or no changes ecologically, they are unable to draw correlations. For invertebrates, immediate changes correlate with spring flow. For vertebrates, changes correlate to vegetation and silt. The addition of real time monitoring stations that pick up turbidity and flows would be beneficial. Nathan Pence states that today EAA operates a total of six stations (three in both systems). EAA has learned from all monitoring consultants that stations produce the most useful data for both programs by far. Ed Oborny states that using the macroinvertebrate rapid bioassessment approach could save budget that could then be reallocated to riparian restoration efforts.

10. Presentation of Budget Info related to the WQP and BioMP.

Nathan Pence provided an overview of the EAHCP program historically budget. Prior to 2013, EAHCP staff performed all sampling and tasks. In 2014, EAHCP staff hired sampling teams, and the budget increase reflects this. Springs communities are currently formulating a 2017 annual work plan that will be implemented starting in January.

11. Next Steps – timeline and associated list of goals.

Future agenda items will include discussing draft modifications to the Scope of Work for the EAHCP Water Quality Monitoring and Biological Monitoring programs.

12. Consider future meetings, dates, locations, and agendas.

Upcoming Work Group meetings will be held on March 29. Location to be determined. DW is to provide each Work Group member with calendar reminders for upcoming meetings.

13. Questions and comments from the public.

None.

14. Adjourn.

3:25 p.m.



MARCH 29, 2016 MEETING MINUTES

Available at eahcp.org

As requested by the Edwards Aquifer Habitat Conservation Plan (EAHCP) Implementing Committee, the 2016 EAHCP Biological Monitoring Program Work Group (BioWG) and the 2016 EAHCP Expanded Water Quality Monitoring Program Work Group (WQWG) have been formed to produce final reports for review by the Implementing Committee providing their assessment of recommendations made for each of the EAHCP Monitoring Programs. The Work Groups are comprised of representatives from throughout the Edwards Aquifer Region. The second meeting for the **Expanded Water Quality Monitoring Work Group** was held **Tuesday, March 29, 2016, at 9 a.m. at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, Texas 78666**. Members of the WQWG present at the meeting included: Ken Diehl (San Antonio Water System), Melani Howard (City of San Marcos/Texas State University), Steven Raabe (EAHCP Stakeholder Committee/San Antonio River Authority), and Michael Urrutia (Guadalupe-Blanco River Authority). Charles Kreitler (EAHCP Science Committee) and Benjamin Schwartz (Texas State University) were not in attendance.

At this meeting, the following business was considered by the Work Group.

1. Call to Order.
9:10 a.m.
2. Public Comment.
Pat Hartigan asked if source tracing is being conducted. Nathan Pence stated that the EAA does not perform source tracing. It does perform dye tracing and flow path research.
3. Recap of Work Group Meeting #1.
Rebecca Leonard provided an overview of activities and outcomes from Meeting #1.
4. Review and achieve consensus on revised basic operational principles and guidelines.
Rebecca Leonard presented how the basic operational principles and guidelines were revised, based on Meeting #1 discussions. The Work Group discussed whether scientific recommendations should be constrained by budget. The Work Group reached unanimous approval of operational principles and guidelines.
5. Presentation and discussion of draft modifications to the Scope of Work for the EAHCP Water Quality Monitoring Program.
*Nathan Pence presented two alternatives for modifying the Scope of Work for the EAHCP Water Quality Monitoring Program. The following are comments from the discussion regarding Alternative 1. Key changes to the Scope of Work, as proposed in Alternative 1, are: remove of surface (base-flow) sampling parameters, suspend sediment sampling, add real-time sampling, suspend stormwater sampling, enhance passive diffusion sampling (PDS), and suspend low-flow well sampling. **HCP staff is to provide additional information regarding the proposed suspensions of sampling methods as referenced in Alternative 1. Each Work Group member is to review and be prepared to discuss at next meeting.** Ken Diehl requested the parameters, frequencies, detection limits, locations under the HCP, and locations under the Clean Rivers Program. **EAA is to coordinate with GRBA to provide the Work***

Group with a list of Clean Rivers Program efforts. Suspending stormwater sampling during 2017-2018 was discussed (excluding sampling for detects of concern near golf courses). Then, after 2018, a full suite of detects could be sampled for so that efforts to gather a baseline data trend continue. Steve Raabe was in favor of this approach. Ken Diehl requested to see sampling locations so that the Work Group can determine if it is appropriate (is data adequately capturing the first flush of stormwater that enters the Comal system?). Nathan Pence stated that there has been past discussion regarding the use of automatic sampling devices, but there has yet to be consensus on the topic. Ken Diehl cited vandalism and damage as challenges to the validity of data captured by automatic sampling devices. Bob Hall stated that stormwater enters and leaves the system so quickly that eutrophication has not been an issue. Ken Diehl stated that the National Academy of Sciences (NAS) has identified nutrients as a concern, however, these are in designated areas. Ken Diehl stated that there may be a middle ground between the NAS recommendations and testing for a full suite of contaminants every time. Nathan Pence stated that enhanced PDS sampling entails adding a membrane that detects the presence/absence of pharmaceutical/personal care products (this membrane would not report concentration nor frequency). Parking lot topic: SAWS has ongoing monitoring efforts that detect the movement of bad water lines. **HCP should explore coordination opportunities with this effort.** San Antonio River Authority had USGS sample for emerging constituents of concern. A report has been published. **HCP staff will review report.**

The following are comments from the discussion regarding Alternative 2. Key changes to the Scope of Work, as proposed in Alternative 2, are: remove surface water (base flow) sampling, suspend sediment sampling, add real-time monitoring, suspend stormwater sampling, enhance PDS sampling, suspend low-flow well sampling, and add fish tissue sampling (largemouth bass, Asian clam, fountain darter). The rationale for this recommendation was that fish tissue sampling is a species-driven sampling approach. Mike Urrutia posed the question: "Does the Asian clam filter the water or sediment?" Bob Hall clarified that the Asian clam filters fine silt. Nathan Pence clarified that the Asian clam tissue sampling would serve in lieu of sediment sampling. It would let us know if there is a contaminant of concern in the sediment that is affecting the species. By doing tissue sampling, the program can focus on detects that have an acute effect on the species. Ken Diehl stated that we need a constituents list from experts, then we can tissue sample. Steve Raabe supported tissue sampling stating "It directly answers questions relating to the species. However, it does not answer everything we need to know about sediment." We must devise a program with an appropriate interval of sampling for the correct things (that the original database included). Then, in coming years, the program can tackle additional parameters. **HCP staff shall consider input from this discussion, and draft an Alternative 3, that marries the benefits of both.** Steve Raabe, Chair of the Work Group, approved the creation of an Alternative 3 that addresses concerns regarding long-term trends and adjusted frequencies.

Each Work Group member shared concluding thoughts regarding each alternative. Mike Urrutia stated that he likes Alternative 1 because it's familiar. He is in agreement with the importance of fish-tissue sampling. GBRA does not do this and it may provide valuable data, particularly related to mercury. Plum Creek samplers are automatic, and operating them is challenging. Steve Raabe liked the species direct testing and is in favor of the ability to have long-term data sets (that build upon variable flow studies and three-year data already gathered by the HCP). Steve Raabe stated that there may be need for shorter term sampling efforts (for personal care products, for example) that can be plugged into the long-term model. Ken Diehl stated that the overall challenge is a lot of data has been collected with little detection. He would like to see all the information in one place before he makes a decision. Ken wants to ensure that we are sampling constituents documented to have an impact on the species. He also noted that a person to review the data is needed. Has the Science Subcommittee made recommendations regarding how to proceed? Nathan Pence clarified that data is being collected, placed into one format, and presented to the Science and Implementing Committee. It will likely be 2018 when statistical analysis will be conducted. **HCP is to provide information all in one place, so that Ken may make a decision regarding what to add or potentially remove from the Scope of Work.**

6. Presentation and possible recommendation of the methodology to calculate the historically-recorded water quality conditions (long-term averages) in the Comal River and San Marcos River ecosystems.
*Nathan Pence provided an overview of a methodology to calculate the historically recorded water quality conditions (long-term averages to determine the 10 percent deviation in the Comal River and San Marcos River ecosystems). Staff proposed using the data from the Variable Flow Study Fountain Darter Drop-net Sampling (2000-2012), which is biannual. U.S. Fish and Wildlife mandates the ten percent requirement. Steve Raabe asked if the Clean Rivers Program has additional data from the last ten years that could be used? Mike Urrutia stated that GBRA does not. Daniel Large stated that the proposed approach incorporates three measurements at different heights of the water column – mid-level, surface-level and high-level, making it more ecologically relevant for the Fountain Darter. The group considered the action. No objections. **The Work Group unanimously agreed on qualified approval of the proposed data methodology for historical analysis. Meeting facilitators are to note this in the report, and HCP staff is to provide data regarding historical limits.***
7. Presentation of, and possible recommendation of analytical limits for water quality data that is used for the EAHCP.
*Alicia Reimmund-Martinez presented an appropriate analytical limit for water quality data used for protection of the Covered Species in the EAHCP. Steve Raabe stated that we are not discussing changing our detection limits. Nathan Pence stated that this is correct, the Work Group is simply considering the limits for reporting. The group considered an action to endorse this limit to water quality data. No objections. **The Work Group unanimously approved the proposed recommendation of analytical limits for water quality data of the protection of the covered species.***
8. Presentation and discussion of National Academy of Sciences (NAS) recommendations.
*Nathan Pence provided a summary of recommendations from the NAS Report 1 for the EAHCP Water Quality Monitoring Program. HCP staff recommended that no changes be made to the reach approach for the HCP. Steve Raabe asked if there is a need for system-wide extrapolation? Nathan Pence stated that only data needed for compliance reporting falls within the current reach. **Meeting facilitators to add to agenda for the next meeting the topic of nutrients. The HCP is to gather data to present at next meeting.***
9. Presentation and discussion of the Draft Report.
Rebecca Leonard presented a draft of the Work Group's final report. No additional comments.
10. Consider future meetings, dates, locations, and agendas.
HCP staff is to contact those not in attendance to share Alternative 1 and 2. The Work Group's next meeting will be held April 27th at the Dunbar Recreation Center, 801 W. MLK, San Marcos, TX 78666.
11. Questions and comments from the public.
No questions or comments.
12. Adjourn.
11:38 a.m. Steve Raabe concludes the meeting.



NOTICE OF OPEN MEETING

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MINUTES

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The third meeting for the Water Quality Monitoring Work Group is scheduled for Wednesday, April 27, 2016, at 9 a.m. at the Dunbar Recreation Center, 801 W. Martin Luther King Drive, San Marcos, TX 78666. Please RSVP to dlarge@edwardsaquifer.org.

At this meeting, the following business may be considered and recommended for Work Group action:

1. Call to Order.
9:07 a.m.
2. Public Comment.
No comments or questions.
3. Recap of Work Group Meeting #2.
Rebecca Leonard provided an overview of previous Meeting #2 activities. Alicia Reimund-Martinez provided a recap of the datasets for establishing ten percent deviations discussions. The group confirmed no objections, and that there is still consensus on the ten percent deviation methodology. Alicia Reimund-Martinez provided a recap of analytical criteria for water quality outcomes from Meeting #2. Passive diffusion sampling was determined to be beneficial as more species-driven. Ben Schwartz posed the question of whether measurements show that we are exceeding set baselines. EAHCP staff to post clarifying data to the Work Group website.
4. Presentation, discussion and possible recommendation of Scope of Work #3 for the EAHCP Water Quality Monitoring Program.
Nathan Pence provided an overview of the Expanded Water Quality Program and the Scopes of Work (#1 and #2) presented to the Work Group at the second meeting, and the rationales for each option. The third presentation to be discussed today, Scope of Work #3 alternates the frequencies of sampling efforts. Scope of Work #3 also addresses a few techniques that are not required by the Habitat Conservation Plan, such as sampling for Personal Care Products, and how the Implementing Committee may consider accommodating these without increasing the program's

budget. Charlie Kreidler asked for an explanation of why tissue sampling is recommended. Nathan Pence provided an overview of previous efforts and discussions that have led to the tissue sampling recommendation. Charlie Kreidler stated a concern that there has been a lot of data collected, but limited analysis has occurred. Nathan Pence shared with the group, that EAA gathers water quality data that allows for both baseline and trend analysis. EAHCP will be contracting with a team to analyze and share the database that incorporates data from various sources, such as the Clean Rivers Program. Steve Raabe stated that the HCP should engage with other entities, such as GBRA, to ensure monitoring and data collection efforts further the long-term goals of the HCP. As funding remains finite, and data collection becomes more complex and expensive, this coordination will become more important. Key changes to the Scope of Work, as proposed in Scope of Work 3, are: remove of surface (base-flow) sampling parameters, remove sediment sampling, add real-time sampling, reduce stormwater sampling, add passive diffusion sampling (PDS), remove low-flow well sampling, and add tissue sampling. Benjamin Schwartz shared that one golf course in San Marcos might close, due to significant storm damage, and become recreational ball fields, which would have differing integrated pest management considerations. Charlie Kreidler asked the impact to the budget for tissue sampling. Nathan Pence shared that current efforts cost \$520k. Scope of Work 3, includes tissue sampling, which EAHCP staff estimates could provide a savings of approximately \$100k annually. Nathan Pence provided an overview of surface water quality parameters suspended in Scope of Work 3. **Facilitators are to add “EAHCP Surface Water Quality Parameters Suspended in Scope of Work 3” be added as a section in the report.** Potassium is not typically viewed as nutrient by aquatics biology. Ben Schwartz and Melani Howard comment that because EAA already samples for potassium and the other detects on this list, they agree with the recommendation to suspend the surface water (base flow) suite of parameters as proposed in Scope of Work 3. AWRL detection levels differ from what EAHCP is currently doing. The recommendation would be that AWRL procedures are changed to reflect Work Group recommendations. Nathan Pence provided an overview of tissue sampling. There are experts and literature that EAHCP staff are collecting and referencing. To date, the key findings are that two locations per system, with three species tested per system. **Meeting facilitators are to use the term “aquatic tissue sampling” instead of “fish tissue sampling” in final report.** Nathan Pence provided an overview of sediment sampling recommendation to continue this program less frequently. Steve Raabe requested that consistency in data allow for flexibility, but the topic of adding testing for specific constituent needs to be held until a specific issue occurs. Ben Schwartz stated that it's not a static system that you can wait for specific constituent to be in the same location every year. Alicia stated that stormwater sampling will provide the results of the deposition of the storm event. Ken Diehl stated that he agrees with the proposal in Scope of Work 3 and believes that the frequency is okay as proposed, as long as the rest of the group is in consensus. Charlie Kreidler stated that sediment sampling is looking at more gradual, longer-term changes that explore how metals are building up. Ben Schwartz supports the approach of sampling the stormwater, and then if contaminant is detected, go to aquatic tissue sampling to see if it is affecting the species. Ben Schwartz prefers to have the same sites tested at each year. Nathan Pence provided overview of real-time sampling recommendations in Scope of Work 3 and the rationale for the geographical locations of real-time sampling locations. A recommendation for the San Marcos location is pending further input from various program partners. Ben Schwartz stated that USGS is preparing to move their instruments; however in the last storm event there was damage to the Aquarena station. Nathan Pence provided an update that relocation of the instrument is pending determination of a funding source. EAHCP does not have the jurisdiction to mandate this. Nathan Pence provided an overview of stormwater sampling recommendations in Scope of Work 3. Clarification to slide text: “Sampling of IPMP is not required by EAHCP”. Ben Schwartz suggested that five percent data points be linked (through metadata) about flow occurrences in overall watershed. He also recommended that the first flush is captured through sampling, and that EAHCP try to capture more samples earlier and later during each event. Nathan Pence – blue line

is conductivity. First lead sample is pre-peak, during peak, and post-peak. For the most part, there is consistency between hydrographs for when samples are occurring during each event. The red line on the graph indicates temperature. Temperatures drop during storm event. Ben Schwartz recommended that additional samples be conducted more frequently (i.e. six samples instead of three, or one every five minutes as opposed to fifteen, per se) during the rising limb of the hydrograph. Pre-storm samples do not change much from baseline to baseline. Clarification – recommending instead of 3 samples x 7 locations = 21 total; doing 5 samples x 7 locations = 35 total. EAHCP can require in the sampling team's contract, that when the storm event allows, they collect more samples during the peak. Melani Howard stated that the Work Group can make recommendations of certain locations within each system where additional samples during each event should be collected to further the program. Ben Schwartz emphasized that less sites, more samples, and focus on the mouth of the tributary.

Work Group approved alternative #3, with the addition of:

- Add two stormwater samples at each location to the initial rise of the hydrograph, keeping the same 3 original samples as identified (onset, peak, and tail) in the original SOW, for a total of 5 samples per location. It is understood that due to timing, 5 samples at each location may not be feasible; therefore, the 5 samples, rather than just 3, should be prioritized for locations near tributary outflows (making Sessoms and Purgatory the first priorities)

Nathan Pence provided a summary of passive diffusion sampling recommendations in Scope of Work 3. Nathan Pence provided an overview of groundwater sampling recommendation in Scope of Work 3. EAA is doing monthly, quarterly, event sampling. During low flows, neither EAA nor EAHCP is able to pick in advance which wells will be sampled. Real-time conditions and the amount of water in the wells, constrain which ones are capable of being sampled and this cannot be predicted ahead of the event itself. No objections to this recommendation.

Is the work group comfortable with Scope of Work 3 being included as the recommendation that is included in the final report. Charlie Kreidler requested a statement that addresses the concern about how all the data that is being collected will be researched and analyzed. Meeting facilitators to add a recommendation that the data is not just collected, but analyzed in a way that contributes to the body of knowledge regarding how water is moving through the system.

Steve Raabe made motion to approve Scope of Work 3 to be included in report. Charlie Kreidler seconded. Ben Schwartz supported Charlie Kreidler's recommendation that a robust section describing how EAHCP use the data is included, and that efforts go beyond simply capturing the data. No objections to Scope of Work 3. The group agreed by consensus to recommend Scope of Work 3 in the report.

5. Presentation and discussion of nutrient monitoring within the Comal and San Marcos systems through the EAHCP and other programs.

Alicia Reimund-Martinez provided an overview of which nutrients NAS determined to be most important to the species. Bob Hall described characteristics of the system and nutrients affecting species in each. Between EAHCP WQ, BioM, and CRP all three nutrients of concern are being sampled. Recommendation is to drop nutrient sampling from the Water Quality Program because it is being covered by BioM Program and CRP. At the detection limit used, there have been non-detects. Dilemma is that detection limit is too low – are not getting detects. Ben Schwartz suggested that a more reasonable number between 50 mg and 2 mg be considered for testing due to potential additional cost related to testing at 2 mg; also will need to determine if there is a source of the phosphorous that indicates a contamination problem. Does work group agree to specific nutrients of concern? The Work Group requests that the next meeting agenda be to discuss research relating

*to the nutrients of concern. —nitrate, ammonia, and SRP—were agreed to; and further agreed that SRP was the only one worth pursuing further due to species tolerances. However, before an action would be taken, WG asked at next meeting: **Breakdown of SRP results and table showing gradation of costs as detection limit is decreased; staff will meet with Weston to get more details; staff will formulate a recommendation.***

6. Presentation and discussion of the Draft Report.
Work Group members are to review the draft and send comments by end of week, so that report can be revised and an updated report can be presented on May 11.
7. Consider future meetings, dates, locations, and agendas.
The Work Group's next meeting will be held May 11th at the San Marcos Activity Center (Room 1), 501 E. Hopkins, San Marcos, TX 78666.
8. Questions and comments from the public.
No questions or comments.
9. Adjourn.
11:59 a.m. Steve Raabe concluded the meeting.