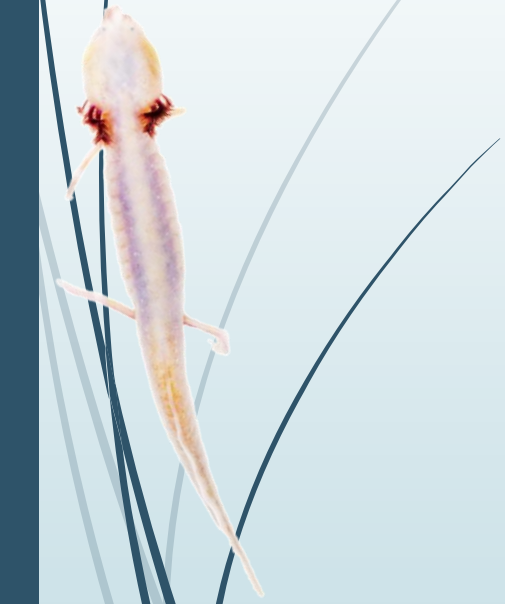
2016 EAHCP
Water Quality Work Group
Meeting #4

May 11, 2016

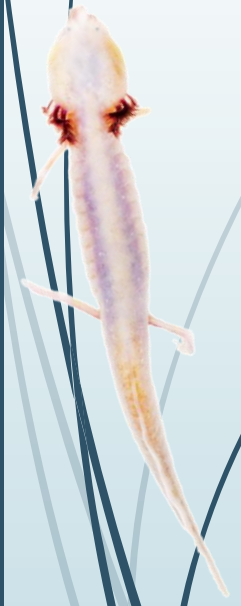
Public comments or questions?



At Meeting #3, we…

- Approved Alternative #3, with additions
- Agreed on Nutrients of Concern – nitrate, ammonia, and soluble reactive phosphorus (SRP)
- Requested to look into possibly reducing detection limits for SRP
  - Before action taken, WG requested discussion of
    - Breakdown of results and table showing gradation of costs as detection limit is decreased
    - Staff will formulate a recommendation

Operational Guidelines



Consensus-approved ..... yes? ☐ no? ☐

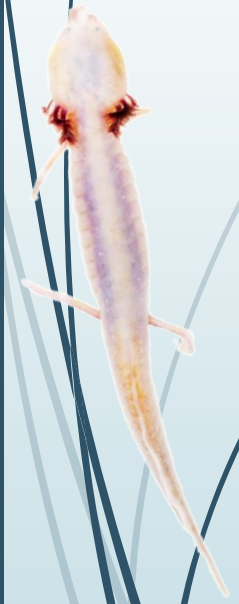
Steward dollars (no increase in budget)..... yes? ☐ no? ☐

Species-driven ..... yes? ☐ no? ☐

Supports Habitat Conservation Plan
Biological Goals & Objectives..... yes? ☐ no? ☐

Points to Consider

- Does it eliminate duplication?
- Does it enable long-term trend analysis?
- 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?

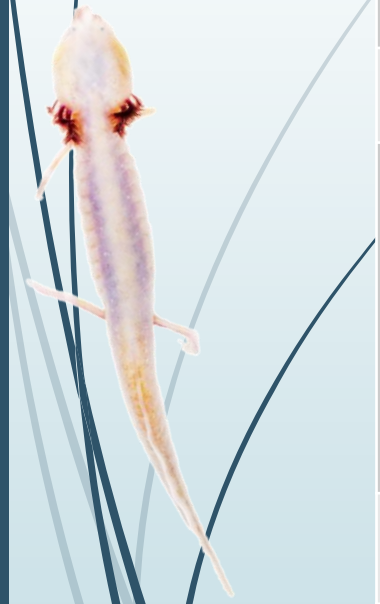


Recap: Work Group Approval of Alternative #3

Goal & Approach

- *Maintain existing monitoring, where appropriate, to build the baseline;*
- *Continue proactive monitoring program;*
- *Reduce frequency where prudent; &*
- *Collect new data to determine impacts.*

Recap: Work Group Approval of Alternative #3



WQ Program Sampling Methods	Revised WQ Program Sampling - Alternative #3	
	Odd Years – 2017	Even Years - 2018
Surface water	Remove	Remove
Sediment	Remove	Continue even year-sampling; Reduce to once/year
Real-time	Add +1 station per system	Add +1 station per system
Stormwater	Reduce to one sampling/year Test only IPMP-listed chemicals **& atrazine; add two samples to the rising limb of the hydrograph for a total of 5 samples/location; priority given to locations at tributary outflows**	Reduce to one sampling/year; **add two samples to the rising limb of the hydrograph for a total of 5 samples/location; priority given to locations at tributary outflows**
PDS	Add PPCP membrane; PPCP only at bottom of channel	Add PPCP membrane; PPCP only at bottom of channel
Groundwater	Remove	Remove
Fish tissue	Conducted once/year in odd years	Not conducted in even years

Nutrient Sampling Through EAHCP & Other Programs Within the Systems

NAS *Report 1* and NAS WG Recommendations

NAS *Report 1*	NAS Work Group	EAHCP Staff
Enhanced sampling for nutrients is recommended.	Determining whether enhanced sampling for nutrients…is needed.	To be reviewed via the WG

NAS' recommendation: "*If the detection limits for phosphorus species, NO3/NO2, and total nitrogen were* ***reduced to 2, 10, and 50 micrograms/ liter, respectively****…this would enable identification of nutrient concerns in both spring systems.*"

Recap: Nutrients of Concern within Spring Systems

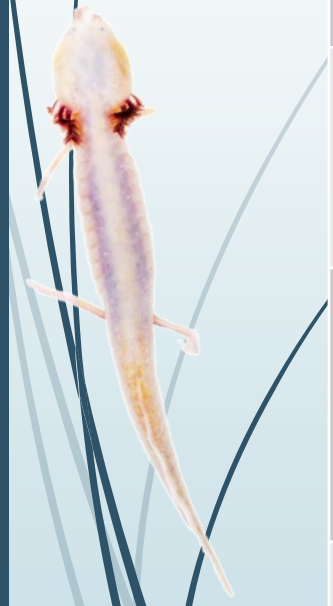
At the April 27 meeting, the Work Group agreed that the following three nutrients were the only priority 3 that EAHCP needed to sample:

- ***Nitrate*** *is of concern because it is a readily available plant nutrient*
- ***Ammonia*** *is of concern because it is readily converted to NO_3…can also be toxic to aquatic organisms (0.6 – 2.0 mg/l).*
- ***Soluble reactive phosphorus (SRP)*** *is of concern because it is the limiting nutrient in the San Marcos and Comal aquatic ecosystems.*

[Source: Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers & Streams; Ohio EPA Technical Bulletin MAS/1991-1-1]

Nutrient Sampling Through EAHCP & Other Programs

Current Detection Limits:



Analytes	Results	EAHCP WQ		EAHCP BioMP		CRP	
	Detection level comments	Tested?	Method Detection Limit	Tested?	Method Detection Limit	Tested?	Ambient Water Reporting Limit
Nitrate	Minimum **110-180 µg/L** CS, SM	Yes	25 µg/L	Yes	50 µg/L	Yes	50 µg/L
Ammonia	Ammonia detection limits meet TCEQ approval	No	-	No	-	Yes	100 µg/L
SRP	**~95% non-detects**	No	-	Yes	50 µg/L	No	-

Nutrient Sampling – Soluble Reactive Phosphorus

- EAHCP staff consulted with subject matter experts concerning prevailing nutrient conditions within both spring systems
- EAHCP staff determined that setting minimum detection limits for SRP to 3-5 µg/L would also cover the Comal system
- Comal SRP levels tend to be slightly higher than what is found in the San Marcos

Nutrient Sampling – Soluble Reactive Phosphorus

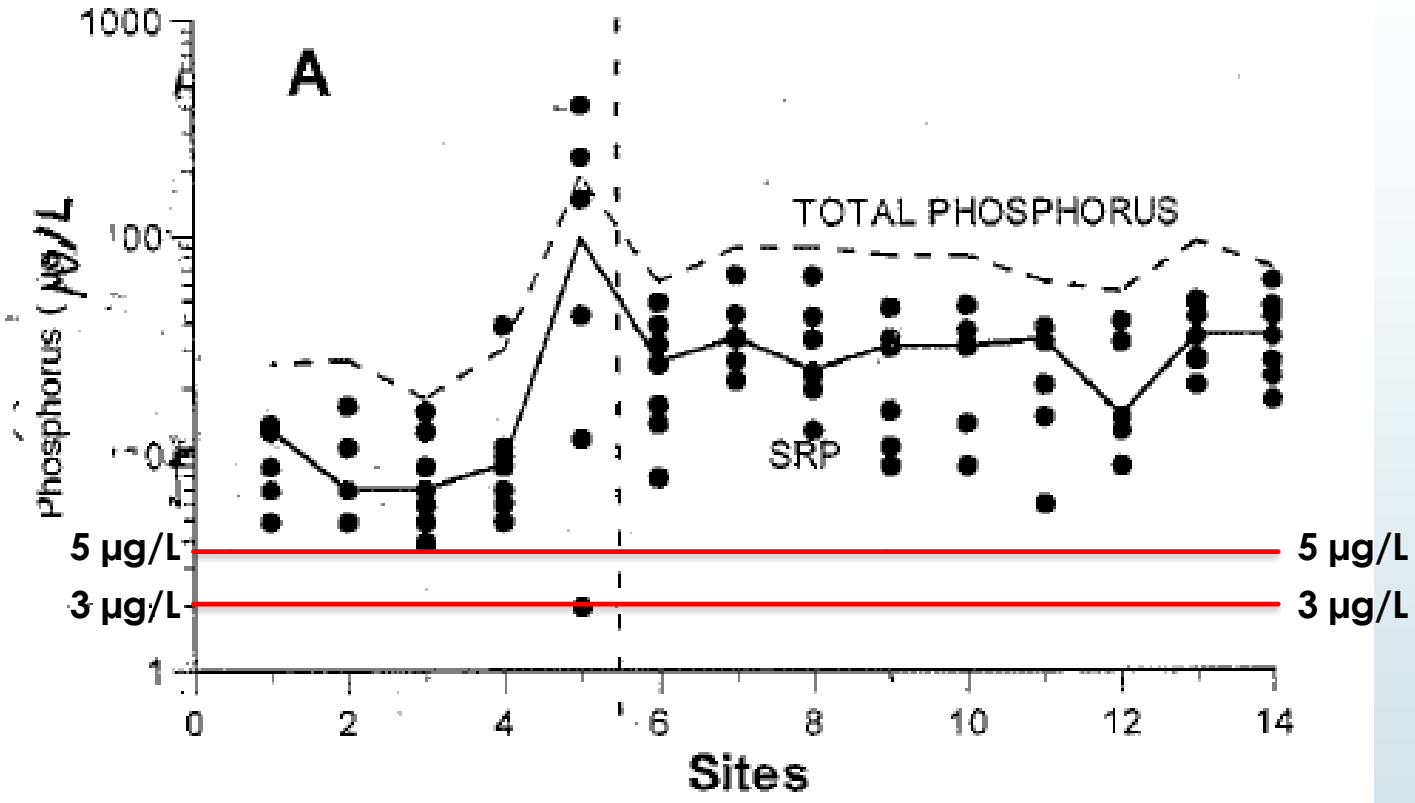
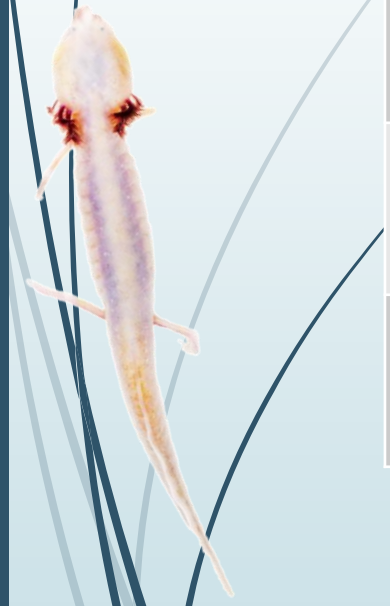


Figure 5. Phosphorus (A), nitrate-N (B), and ammonium-N (C) concentrations on seven dates at sites along the San Marcos River. The vertical dotted line is the confluence with the Blanco River. In A, the points represent SRP concentrations and the solid line is the SRP median concentration. The dotted horizontal line is the median concentration of total phosphorus.

Source: Groeger, Brown, Tietjen, & Kelsey, 1997, p. 288

Cost for Lowering SRP Detection Limits



Detection Level	Cost
50 µg/L	Same price.
10 µg/L	
3-5 µg/L	

EAHCP Staff Recommendation:

Drop nutrient sampling from EAHCP Expanded WQ Monitoring Program.

- *Nutrients will continue to be sampled at adequate detection limits through the EAHCP Bio-monitoring program (low-flows) and GBRA's Clean Rivers Program.*

Lower soluble reactive phosphorus (SRP) detection limit within EAHCP Bio-monitoring program (high- and low-flows) to 3-5 µg/L to enhance monitoring.

Synergies Between the Water Quality and Biological Monitoring Work Groups

Synergies Discussion

Water Quality Monitoring Program

?

Biological Monitoring Program

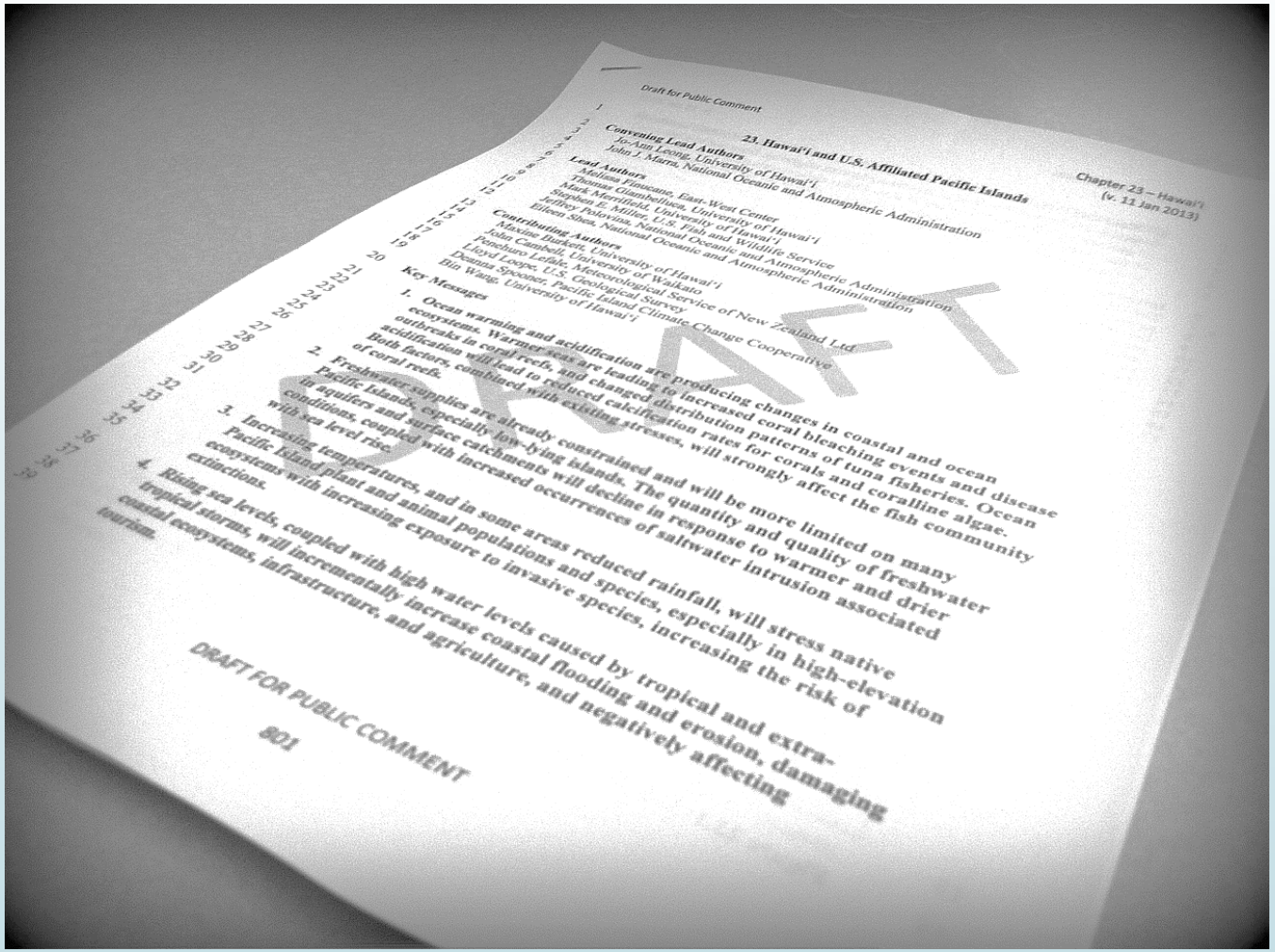
Possible synergies?
Staff recommendations

1. Using rapid bio-assessments (EAHCP Bio-Monitoring) to help identify toxic WQ impairments
2. Using WQ data from Bio-Monitoring to measure nutrient impairments, such as SRP
3. Analyzing data from Water Quality, Biological, EAA Well Sampling & 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

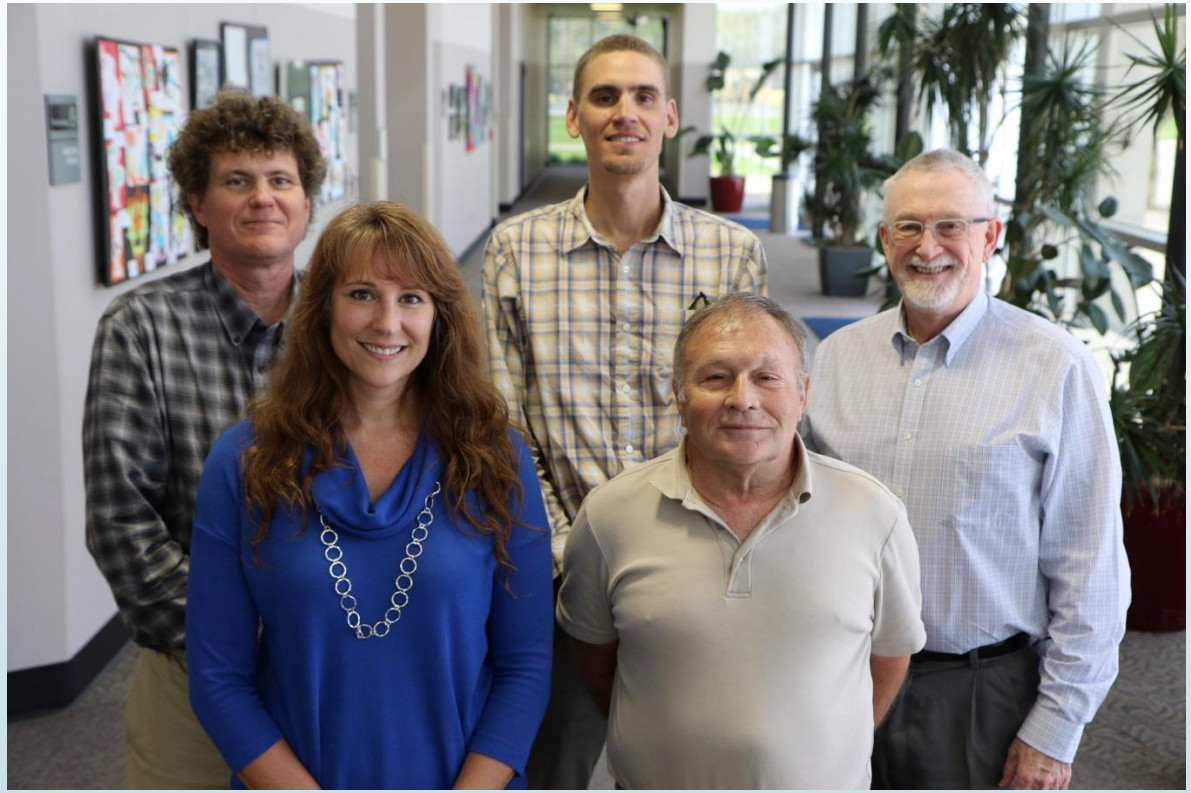
Other possible synergies

6. Explore the feasibility of coordinating sampling at the same locations and/or times.
7. Others?

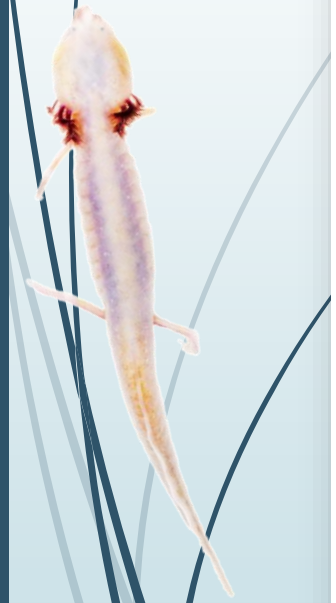
Review Draft Report of the Work Groups



Review Draft Report of the Work Groups



Draft Report – Completed Drafted for Review ☑



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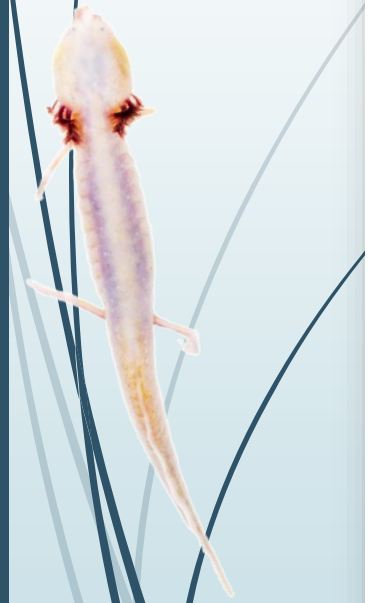
Draft Report – Sections in Progress



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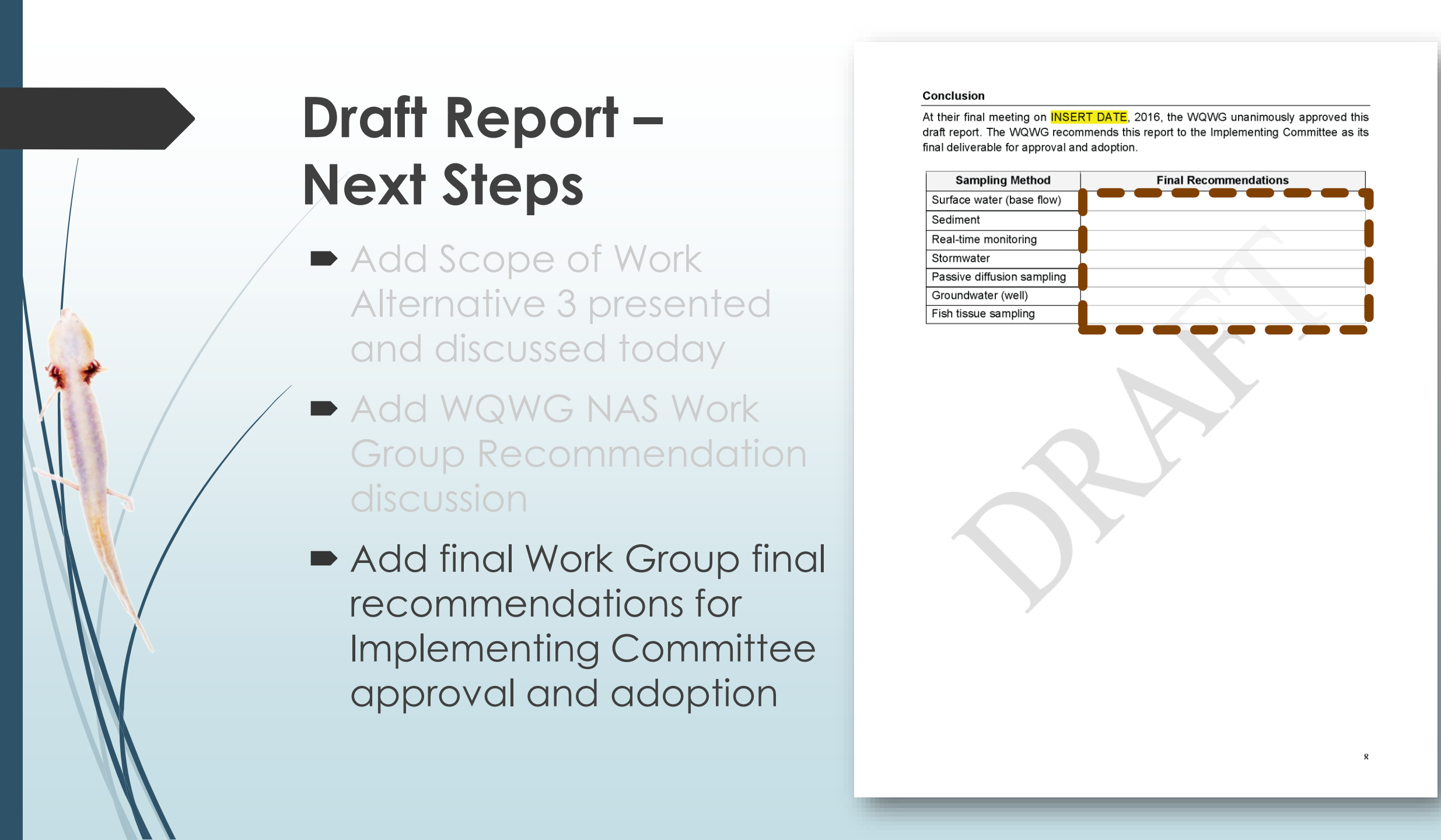
Draft Report – Next Steps

- Add Scope of Work Alternative 3 presented and discussed today
- Add WQWG NAS Work Group Recommendation discussion
- Add final Work Group final recommendations for Implementing Committee approval and adoption



Next Steps: Water Quality WG

Meeting	Tasks	Dates	Location
#4-Consensus building	• Achieve consensus on SOW • Present final recommendations • Review draft report	May 11	San Marcos Activity Center
#5-Reporting	Discuss synergy and efficiencies Presentation of final report	May 20	San Marcos Activity Center

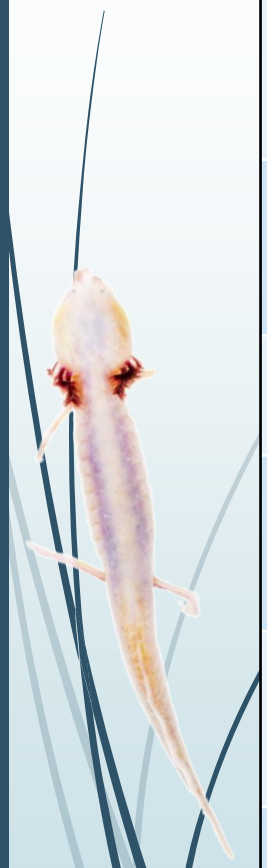
Review of final report	Task	Date	Medium
#1	Revised final report will be sent to WG	May 27	E-Mail
#2	Deadline for final WG comments	June 10	E-Mail

Questions or comments?

2016 EAHCP
Water Quality Work Group
Meeting #4

May 11, 2016

Supplementary Slides



Current WQ Program Sampling	Revised WQ Program Sampling - Alternative #3	
	Odd Years – 2017	Even Years - 2018
Surface water	Remove Collected externally thru CRP Collected internally thru BioMP	Remove Collected externally thru CRP Collected internally thru BioMP
Sediment	Remove	Continue even year-sampling; Reduce to once/year
Real-time	Add +1 station per system	Add +1 station per system
Stormwater	Reduce to one sampling/year Test only IPMP-listed chemicals	Reduce to one sampling/year
PDS	Add PPCP membrane; PPCP only at bottom of channel	Add PPCP membrane; PPCP only at bottom of channel
Groundwater	Remove Done through EAA	Remove Done through EAA
Fish tissue	Conducted once/year in odd years	Not conducted in even years

Surface water (base flow) sampling

Summary:

- **Purpose:** Surface water sampling provides WQ data for surface waters of each spring system and river reach of concern.
- **Results:** No PCBs, no organophosphorus pesticides, no herbicides
- No metals detected above Drinking Water Standards (MCLs)
- Of metals detected, selected metals were compared to Aquatic Life Protection standards and found to be significantly less
- VOC, SVOC, and organochlorine pesticides were isolated detections below PCL

- BioMP collects surface water quality at low-flow
- CRP collects surface water quality at frequent, regular intervals in both systems

Recommendation: Remove from Program

CRP Detailed Parameters *(2016-2017 GBRA QAPP)*

Table A7.1 - 2016-2017 QAPP Parameters	Units	Method	Parameter Code	AWRL	LOQ	LOQ Check Sample %Rec	Precision (RPD of LCS/LCSD)	Bias %Rec. of LCS	Lab
Specific Conductance	uS/cm	SM 2510 B	00095	NA	NA	NA	NA	NA	GBRA****
Residue, Total Nonfiltrable (Mg/L)	mg/L	SM 2540 D.	00530	5	1***	NA	NA	NA	GBRA****
Turbidity,lab Nephelometric	NTU	SM 2130 B.	82079	0.5	0.5	NA	NA	NA	GBRA****
Sulfate (Mg/L As So4)	mg/L	EPA 300.0 Rev. 2.1 (1993)	00945	5	1	70-130	20	80-120	GBRA****
Chloride (Mg/L As Cl)	mg/L	EPA 300.0 Rev. 2.1 (1993)	00940	5	1	70-130	20	80-120	GBRA****
Chlorophyll-a Ug/L	ug/L	SM 10200- H4	32211	3	1	NA	20	80-120	GBRA****
Pheophytin-a Ug/L	µg/L	SM 10200- H4	32218	3	1	NA	NA	NA	GBRA****
E. coli	MPN/100 mL	Colilert-18	31699	1	1	NA	0.5**	NA	GBRA
Nitrogen, Ammonia, Total (Mg/L as N)	mg/L	SM 4500-NH3 D.	00610	0.1	0.1	70-130	20	80-120	SARA
Nitrogen, Ammonia, Total (Mg/L As N)	mg/L	EPA 350.1 Rev. 2.0 (1993)	00610	0.1	0.1	70-130	20	80-120	GBRA****
Hardness, Total (Mg/L As Caco3)*	mg/L	SM 2340 C.	00900	5	5	NA	20	80-120	GBRA****
Nitrate Nitrogen, Total (Mg/L As N)	mg/L	EPA 300.0 Rev. 2.1(1993)	00620	0.05	0.05	70-130	20	80-120	GBRA****
Phosphorus, Total, Wet (Mg/L As P)	mg/L	EPA 365.3	00665	0.06	0.02	70-130	20	80-120	GBRA****
Nitrogen, Kjeldahl, Total (Mg/L As N)	mg/L	EPA 351.2 Rev. 2 (1993)	00625	0.2	0.2	70-130	20	80-120	GBRA****

Surface (Base Flow) Parameters
Current

		EAHCP WQ	EAHCP BioMP Low flows	CRP
		Tested?	Tested?	Tested?
Chemistry	"General chemistry" ($CaCO_3$, Cl, SO_4, Br, Fl, TDS, TSS, Ca, Mg, Na, K, Si, Sr, CO_3)	Yes	Only TSS & $CaCO_3$	Only $CaCO_3$, Cl, SO_4
	"Conventional parameters" – *not otherwise subsumed* (Conductance, Total Nonfiltrable Residue)	No	No	Yes
	Field parameters (DO, pH, Cond., Temp, Turbidity)	Yes	Yes	Yes
Toxics/PCPP/Pathogens	VOCs & SVOCs	Yes	No	No
	Organochlorine Pesticides	Yes	No	No
	Polychlorinated Biphenyls (PCBs)	Yes	No	No
	Organophosphorus Pesticides	Yes	No	No
	Herbicides	Yes	No	No
	Metals (Al, Sb, As, Ba, Be, Cd, Cr (total), Cu, Fe, Pb, Mn, Hg, Ni, Se, Ag, Tl, and Zn)	Yes	No	No
	Caffeine	Yes	No	No
	Bacteria (*E. coli*)	Yes	No	Yes
Nutrients	Nitrate Nitrogen (NO_3)	Yes	Yes	Yes
	Ammonia Nitrogen	No	No	Yes
	Ammonium	No	Yes	No
	Total Kjeldahl Nitrogen (TKN)	Yes	No	Yes
	Total Nitrogen	No	Yes	No
	Potassium (K)	Yes	No	No
	Soluble Reactive Phosphorus	No	Yes	No
	Total Phosphorus	Yes	Yes	Yes
	Chlorophyll-a	No	No	Yes
	Pheophytin	No	No	Yes
	Total Organic Carbon (TOC)	Yes	No	No
	Dissolved Organic Carbon (DOC)	Yes	No	No

Current Parameters Analyzed in EAHCP WQ Monitoring, EAHCP Biological Monitoring and GBRA's Clean Rivers Program

EAHCP Surface WQ Parameters Suspended as Part of Alt. 3

Surface (Base Flow) Parameters Parameters Dropped		EAHCP WQ	EAHCP BioMP *Low flows*	CRP	Justification
		Tested?	Tested?	Tested?	Monitored: Storm, Sediment, & EAA Spring Sampling
Chem	"General chemistry" (TDS, Br, Fl, Ca, Mg, Na, K, Si, Sr, CO_3)	Yes	No	No	
Toxics/PCPP/Pathogens	VOCs & SVOCs	Yes	No	No	Monitored: Stormwater, Sediment, EAA Spring Sampling, *PDS (*only a subset)
	Organochlorine Pesticides	Yes	No	No	
	Polychlorinated Biphenyls (PCBs)	Yes	No	No	
	Organophosphorus Pesticides	Yes	No	No	
	Herbicides	Yes	No	No	
	Metals (Al, Sb, As, Ba, Be, Cd, Cr (total), Cu, Fe, Pb, Mn,Hg, Ni, Se, Ag, Tl, and Zn)	Yes	No	No	
	Caffeine	Yes	No	No	
Nutrient	Total Organic Carbon (TOC)	Yes	No	No	Drinking WQ; EAA Spring Sampling
	Dissolved Organic Carbon (DOC)	Yes	No	No	Drinking WQ

Tissue sampling

Summary:

- **Purpose:** Tissue sampling detects ecologically relevant water contamination; provides index to the extent of penetration to the biota
- Not currently conducted through EAHCP
- Not required by EAHCP

Recommendation: Replaces sediment sampling in odd years.

- Obtain advice from Permittees and subject matter experts to establish methodologies for sampling
- Likely 2 locations per system; 3 species per system

Sediment sampling
Summary:

- **Purpose:** Sediment sampling helps ascertain potential effects on species via direct or indirect exposure
- **Results:**
  - Total PAH (SM), lead (SM), cadmium (C), chlordane (SM) were only detections above Probable Effect Concentration
- No EAHCP biological results to date suggest that the Covered Species are at-risk due to chemicals in the habitat

Recommendation: Continue; improve efficiency by sampling once during even years

Real-time monitoring

Summary:

- **Purpose:** Real-time monitoring provides a valuable source of continuous information that is highly ecologically relevant
- **Results:** Field parameters collected every 15 minutes: DO, conductivity, turbidity, temp, pH over 3 years

Recommendation: Add 1 station per system

- Obtain advice from Permittees and subject matter experts to establish additional locations

Stormwater Sampling

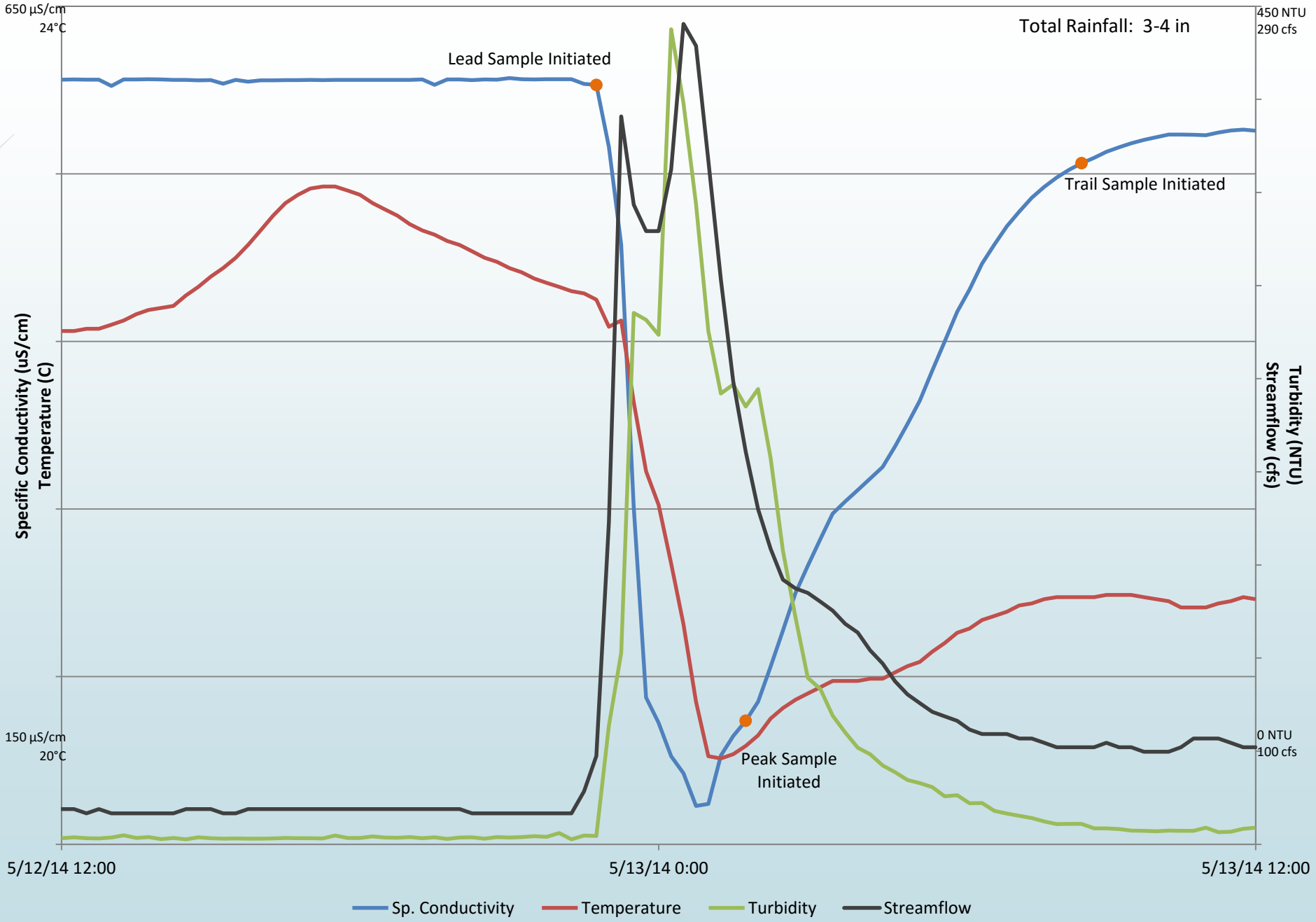
Summary:

- **Purpose:** Stormwater sampling assesses potential contaminants present in storm surface water runoff.
- **Results:**
  - Only one detection for arsenic (SM), below the Aquatic Life Protection criteria
  - One detection in SM for chlordane (SM) above chronic criterion for Aquatic Life Protection
- No EAHCP biological results to date suggest the Covered Species are at-risk due to chemicals in the habitat

Recommendation: Continue and improve efficiency by sampling once a year.

- Alternate IPMP chemical and full suite analysis every other year
- IPMP sampling not required by EAHCP
- Obtain advice from subject matter experts to establish parameter analysis

San Marcos Storm Water Quality Graph May 12-13, 2014



Passive diffusion sampling

Summary:

- **Purpose:** PDS sampling measures trace organic constituents in the systems that may indicate more frequent or robust testing regimes
- **Results:** Only tetrachloroethene was commonly detected; chloroform had a few detections

Recommendation: Continue PDS

- Add PPCP membrane – not required by EAHCP
- Membrane at bottom; EAA samples spring orifices for PCPPs
- Obtain advice from subject matter experts and published materials to ensure proper and prioritized parameter analysis

Groundwater sampling

Summary:

- **Purpose:** Groundwater sampling assists the EAHCP in detecting movement of bad water line during critical low-flow periods
- Duplication of efforts within EAA; existing programs satisfy intent of EAHCP sampling

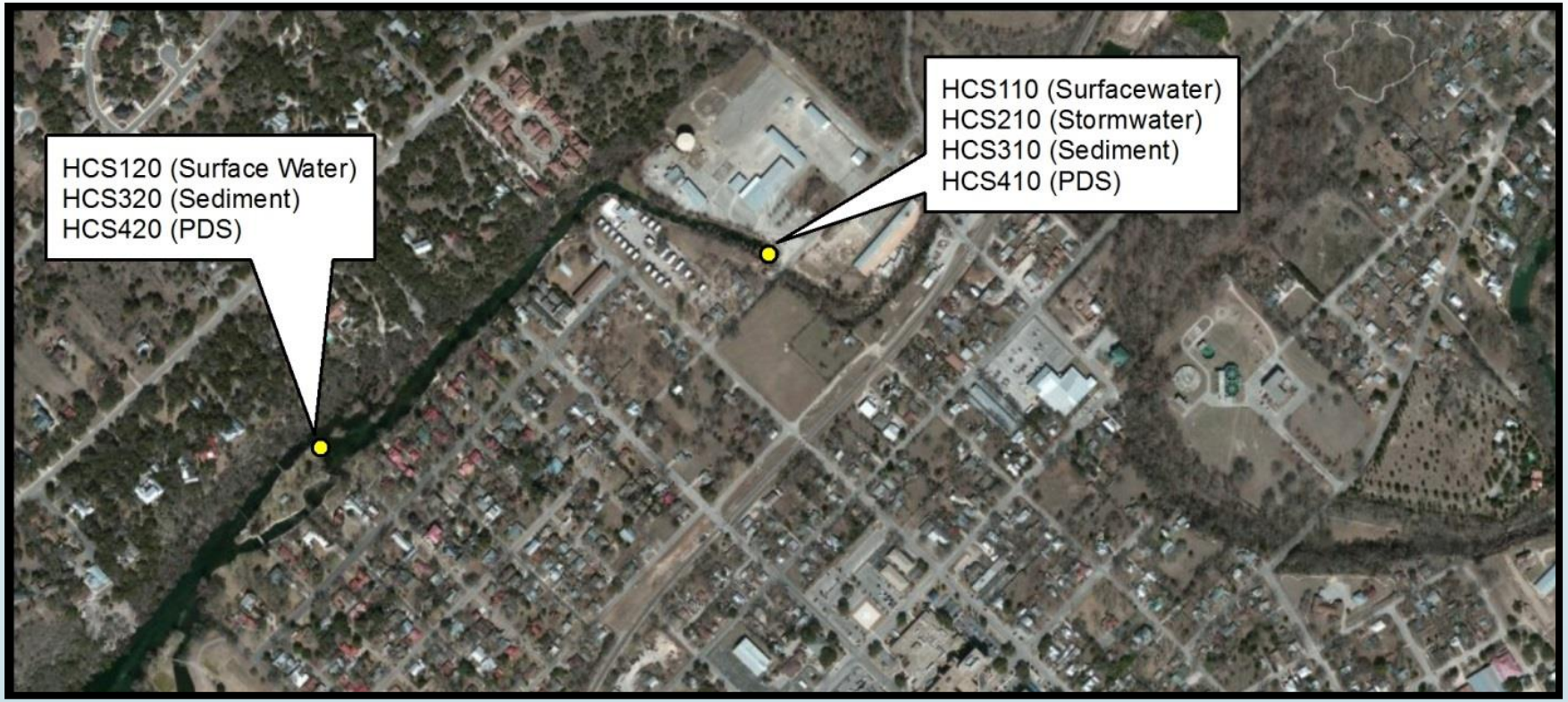
Recommendation: Remove from Program

Comparison of EAHCP vs. EAA Spring/Well Sampling

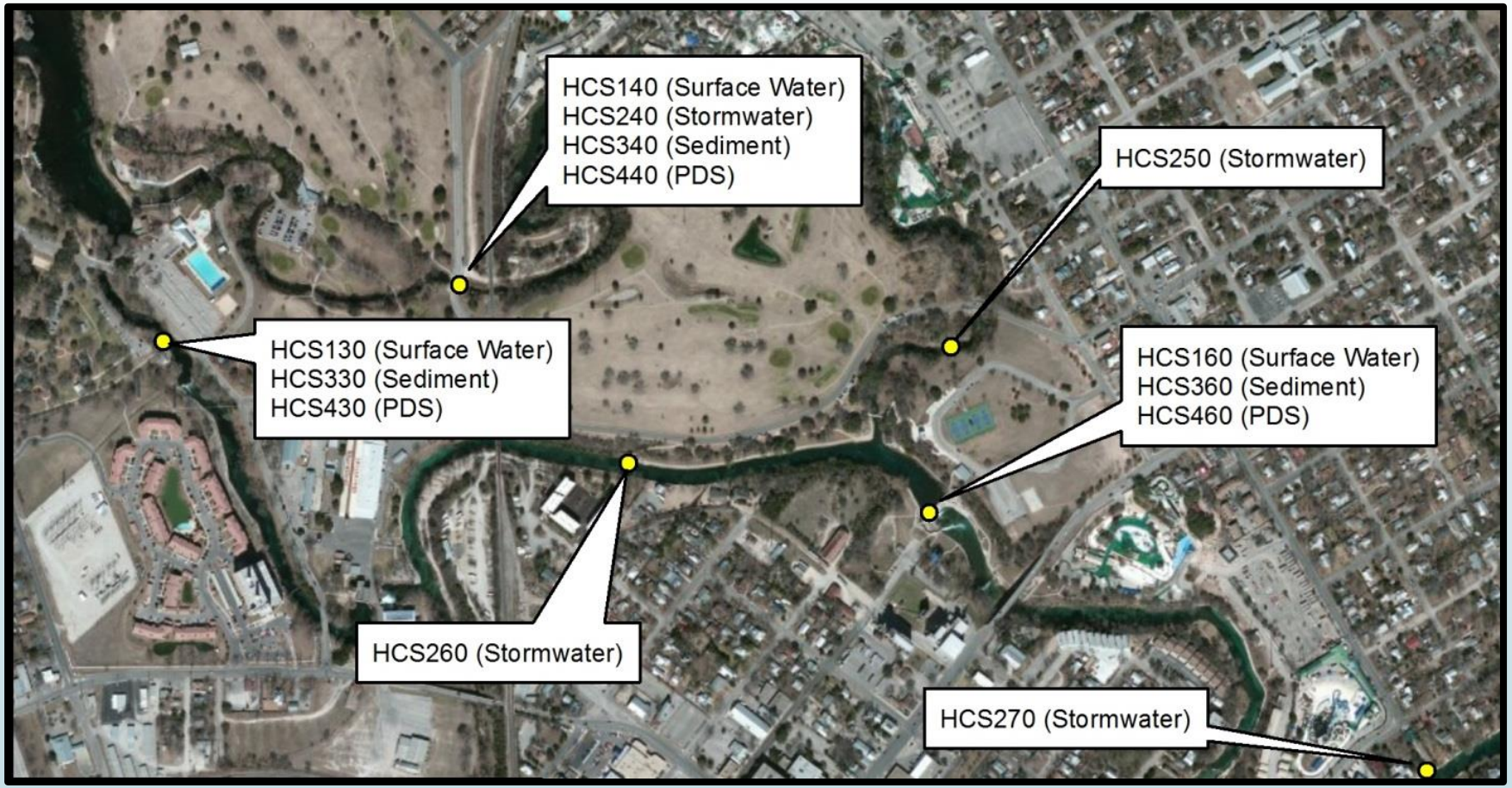
EAHCP Well Sampling Procedure
3 per system - If total springflow at Comal Springs < 30 cfs, three wells will be sampled for DO, conductivity, pH, and temp
3 per system - If total springflow at Comal Springs < 20 cfs, additional parameters are added, which include nutrients, TDS, & TOC
3 per system - If total springflow at San Marcos Springs < 50 cfs, three wells will be sampled for DO, conductivity, pH, and temp
3 per system - If total springflow at San Marcos Springs < 30 cfs, additional parameters are added, which include nutrients, TDS, & TOC

EAA Spring & Well Sampling Procedure
Monthly sampling of Comal and San Marcos Springs • Triggered by Critical Period, Stage 1 (<660 MSL 10-day rolling average) • Analyzed for full suite Episodic geophysical logging and resistivity tool to observe changes in the vertical location of the freshwater/saline water interface (during extreme low flows) • DX-68-23-304 (LCRA Well near Comal Springs) • LR-67-09-110 (SWT Farms Well near San Marcos Springs)
Annual sampling of 60 – 80 wells across the EAA jurisdiction region - Analyzed for full suite, not DOC or TKN
Quarterly sampling at key wells across the region • Four to five wells – started in August 2014 • DX-68-23-316 (Loop 337 Well in Comal County) • LR-67-01-828 (Artesian Well in Hays County) • LR-67-09-105 (Hunter Road Well in Hays County) • Analyzed for full suite, not DOC or TKN
Logistics such as water depths, may determine the feasibility of sampling wells closet to the springs during ultra low flow conditions at the springs

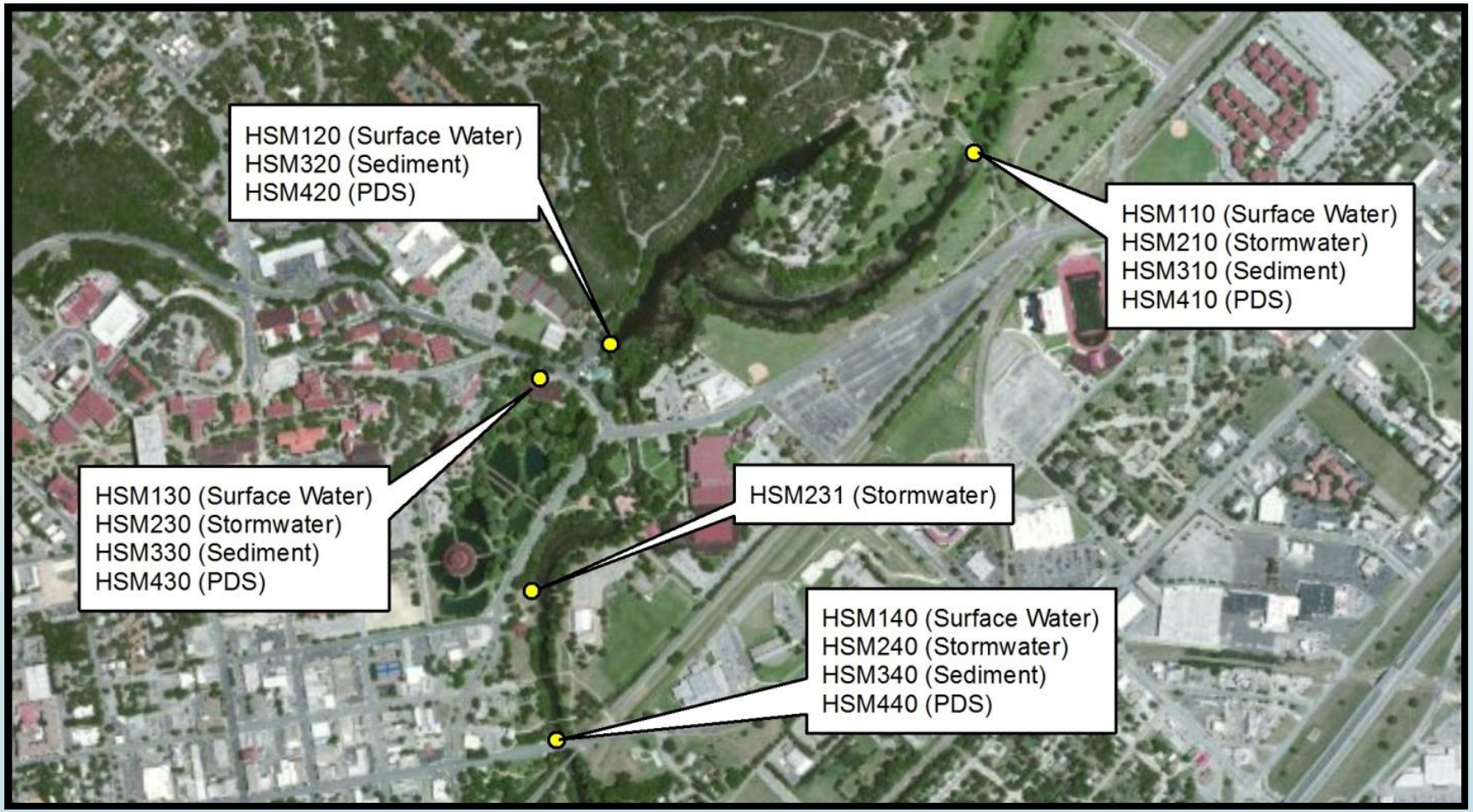
Sample Locations
Comal Springs: 10 and 20



Sample Locations
Comal Springs: 30 - 70



Sample Locations
San Marcos Springs: 10 - 40



Sample Locations
San Marcos Springs: 50 - 70