MEMORANDUM

TO:	Nathan Pence and Rick Illgner
FROM:	Ed Oborny (BIO-WEST)
DATE:	August 30, 2013
SUBJECT:	EA HCP Bio-monitoring Update – Week 3

Gentlemen,

BIO-MONITORING TO DATE

Comal System:

A combined (Comprehensive/Critical Period) full sampling event was conducted in April/May on the Comal system when total Comal spring flow declined below 200 cfs (April 27 and May 28 memorandums to EAA).

Comprehensive Summer dip net sampling conducted in mid-July.

Critical Period Full Sampling Event – 150 cfs trigger – ***Completed (8/16, 8/23, 8/30 memos.)***
Fountain Darter species specific sampling – 150 cfs trigger – ***Completed (8/16 memo.)***

Present – Weekly habitat evaluations will continue to occur until total spring flow increases above 150 cfs. No additional critical period sampling is scheduled until total springflow declines below 120 cfs (Comal Springs riffle beetle) or below 100 cfs (full Critical Period sampling event). The present total discharge at Comal Springs is ≈ 128 cfs.

San Marcos System:

A combined Comprehensive/Critical Period) full sampling event was conducted in April/May on the San Marcos system when total San Marcos spring flow declined below 100 cfs (May 28 memorandum to EAA).

Comprehensive Summer dip net sampling conducted in mid-July. Comprehensive full system mapping of Texas wild-rice was completed in August.

In addition, four Texas wild-rice physical habitat measurements Critical Period (<120 cfs) sampling events occurred as flows declined from 120 to below 100 cfs (2/21, 4/24, 5/14, 5/24).

Species specific sampling - NONE

Present - No critical period sampling is scheduled until total springflow declines below 95 cfs (Texas wild-rice physical measurements) or below 85 cfs (full Critical Period sampling event). The present total discharge at San Marcos is ≈ 108 cfs.

WEEK 3 CONDITIONS AND ACTIVITIES:

Comal: The present total discharge at Comal Springs is ≈ 128 cfs. BIO-WEST initiated the full Critical Period sampling effort on Comal on August 9th and concluded activities this week with the 2-week retrieval of Comal Springs riffle beetle cotton lures. The following components and schedule were accomplished:

- Water quality – 1st week.
- Thermisters – 2nd week.
- Aquatic vegetation mapping of 4 study reaches – 1st week.
- Fixed station photography – 2nd week.
- Fountain darter specific sampling
    - 50 sites Dipnet – 1st week
    - Timed Dipnet surveys – 2nd week..
    - Dropnet 3 study reaches – 1st week.
    - SCUBA transects – 2nd week.
- Fish Community sampling
    - SCUBA mesohabitat and microhabitat – 1st week.
    - Seine – 1st week.
- Comal Spring salamander sampling – 1st week.
- Comal Springs discharge measurements – August 9th and August 23rd.
- Comal Springs invertebrate sampling – Lure retrieval – August 26th, 28th, and Sept 1st.

RESULTS:

As of this memorandum, all Critical Period field sampling activities have been completed with the following observations. We start this memorandum by presenting the water quality grab sample results collected on August 12th. We follow that with up to date thermister data from select stations along the Comal River. We then conclude with several visual observations conducted this week and our interpretation of present conditions in the Comal system.

On August 12th, water quality samples were collected from the following 12 sites:

Blieders Creek (Heidelberg lodges Number 1),
Heidelberg Main Channel (Heidelberg lodges Number 2),
Island Park, Far Channel (Booneville Avenue Number 1),
Island Park, Near Channel (Booneville Avenue Number 2),
Spring Run 1 Number 1,
Spring Run 2,
Spring Run 3,
New Channel, upstream (Number 1),
New Channel, downstream (Number 2),
Old Channel, upstream (Number 2),
Old Channel, downstream (Number 1), and
Union Avenue (tube take-out; replaces The Other Place).

A summary of water quality data for the summer 2013 critical period water quality sampling event is presented in Tables 1 and 2.

Table 1. Summary of Comal River ecosystem physical water quality measurements from the summer 2013 critical period sampling event.

Location	Temperature (°C)	pH	Conductivity (µS/cm)	Dissolved Oxygen (mg/l)
Blieders Creek	28.10	7.46	565	7.63
Heidelberg, Main Channel	26.22	7.28	565	6.35
Island Park, Far Channel	25.79	7.26	572	7.53
Island Park, Near Channel	24.44	7.20	570	4.64
Spring Run 1	23.48	7.15	596	5.32
Spring Run 2	23.96	7.21	593	5.00
Spring Run 3	23.46	7.22	598	5.25
New Channel, upstream	26.13	7.48	576	9.22
New Channel, downstream	25.79	7.77	577	7.88
Old Channel, upstream	26.01	7.55	573	8.02
Old Channel, downstream	25.60	7.56	574	7.52
Union Avenue (tube take-out)	23.40	7.89	548	7.51

Table 2. Summary of Comal River ecosystem water quality analytical results from the summer 2013 critical period sampling event.

Location	TSS (mg/l)	Alkalinity (mg/l)	Ammonium (mg/l)	Nitrate (mg/l)	Total N (mg/l)	SRP (mg/l)	Total P (mg/l)
Blieders Creek	5.2	240	0.0524	1.4	2.05	<0.05	<0.02
Heidelberg, Main Channel	<4	250	0.0331	1.67	2.09	<0.05	<0.02
Island Park, Far Channel	<4	250	0.0262	1.58	1.81	<0.05	<0.02
Island Park, Near Channel	<4	260	0.0634	1.72	1.92	<0.05	<0.02
Spring Run 1	<4	240	0.0827	1.73	2.15	<0.05	<0.02
Spring Run 2	<4	240	0.0634	1.7	2.04	<0.05	<0.02
Spring Run 3	<4	250	0.0923	1.78	2.15	<0.05	<0.02
New Channel, upstream	<4	250	0.0193	1.55	2.04	<0.05	<0.02
New Channel, downstream	<4	260	0.0606	1.59	2.09	<0.05	<0.02
Old Channel, upstream	<4	280	0.0868	1.55	1.95	<0.05	<0.02
Old Channel, downstream	<4	260	0.143	1.54	1.89	<0.05	<0.02
Union Avenue (tube take-out)	<4	260	0.0882	1.62	1.83	<0.05	<0.02

Generally, an upstream to downstream pattern in standard parameter values was not observed during the summer water quality sampling. Values remained fairly constant throughout the system or fluctuated minimally from site to site. Temperatures varied minimally between sites excepting Blieders creek during the water quality sampling event (Table 1). However, continuously sampled temperature thermister data being collected in the river (presented later in this memorandum) provides a more detailed data set than the snap shot of temperature data collected with these summertime water quality grab samples.

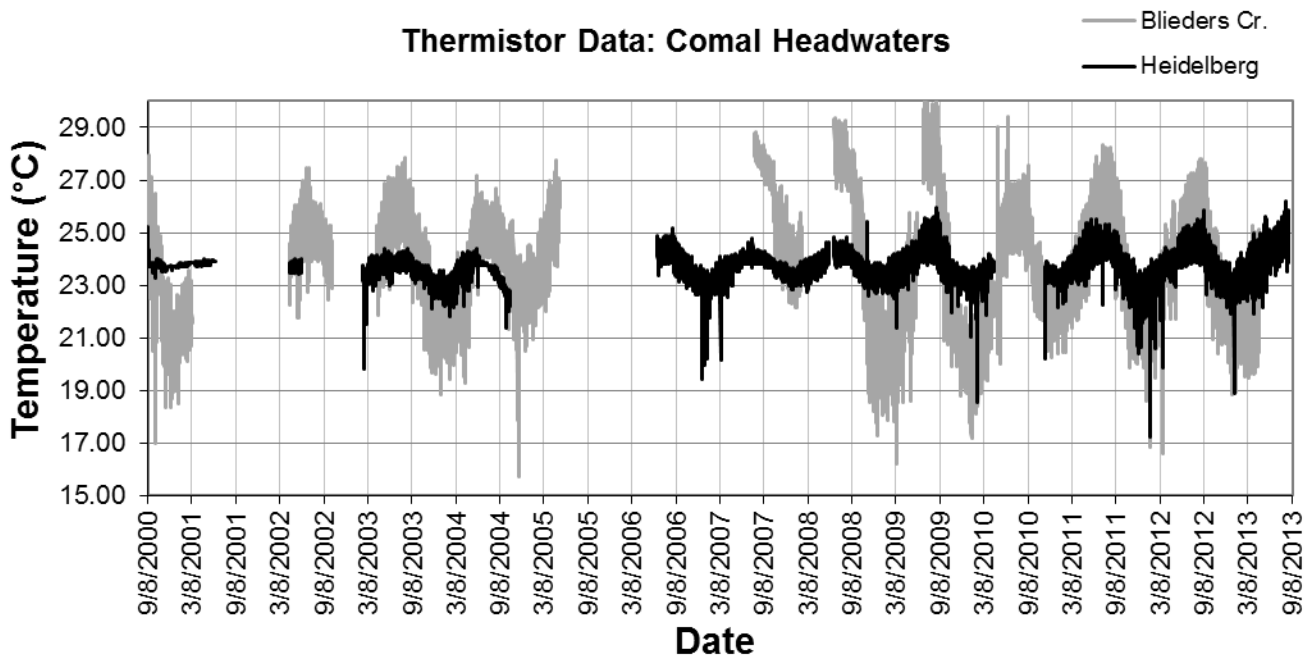
Dissolved oxygen (DO) concentrations met the water quality standard of 5.0 milligrams per liter (mg/l) at eleven of the twelve Comal River sample sites during the summer critical period sampling event. A dissolved oxygen concentration of 4.64 mg/l was measured at a shallow water spring outflow (6 inch depth) at the Island Park, Near Channel (river left side) site. As typical, DO concentrations recorded at the sites located in the spring run sites were lower than concentrations recorded at other sites (Table 1).

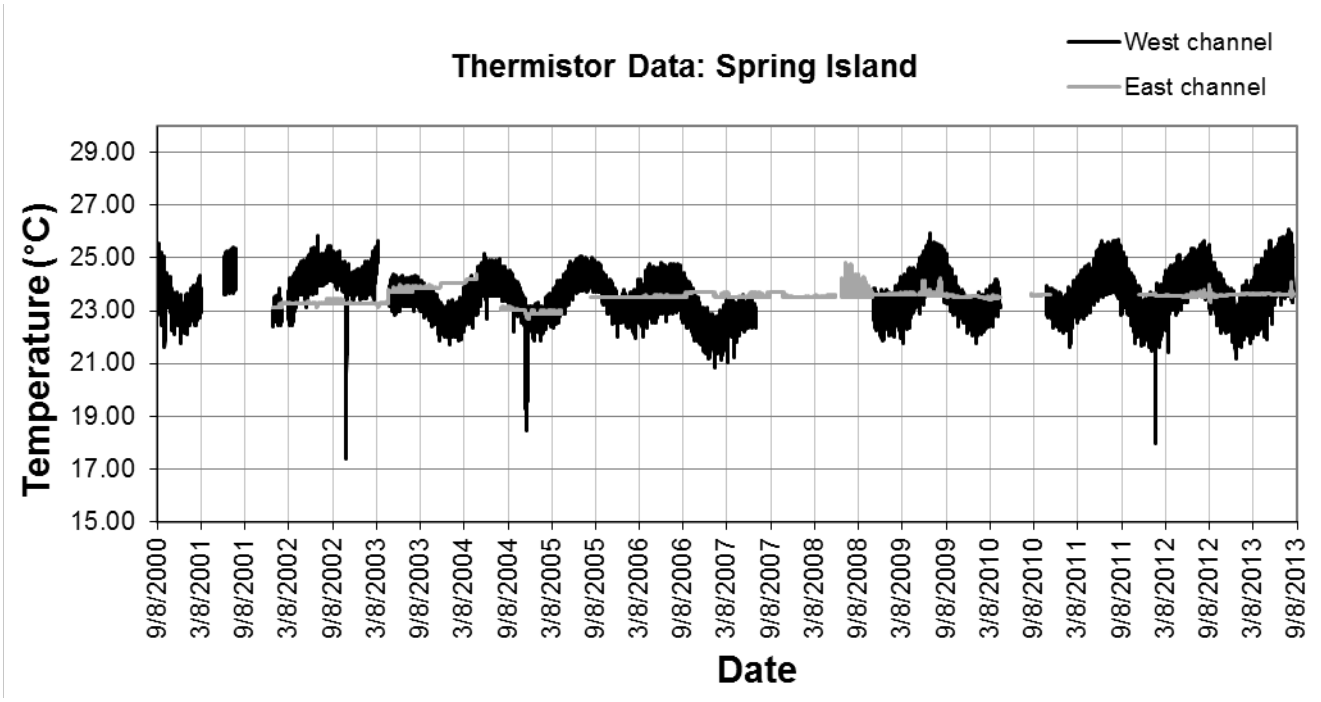
The TSS values were very low at all of the sites in the river (most below 4 mg/l), reflecting the clear water quality of this spring system. Alkalinity was consistent between sites during the summer 2013 sampling (Table 2), with values similar to those measured in 2011 (BIO-WEST 2012). The SRP concentrations and TP concentrations on the Comal River were below laboratory detection limits (<0.05 mg/l and <0.02 mg/l, respectively), which are also well below the TCEQ's screening values of 0.1 mg/l and 0.2 mg/l respectively (Table 2). Similarly, only low concentrations of TP were measured in 2011 (0.021 to 0.107 mg/l; BIO-WEST 2012), in 2009 (0.023 to 0.026 mg/l; BIO-WEST 2010) and in 2000-2002 (0.027 to 0.030 mg/l; BIO-WEST 2003).

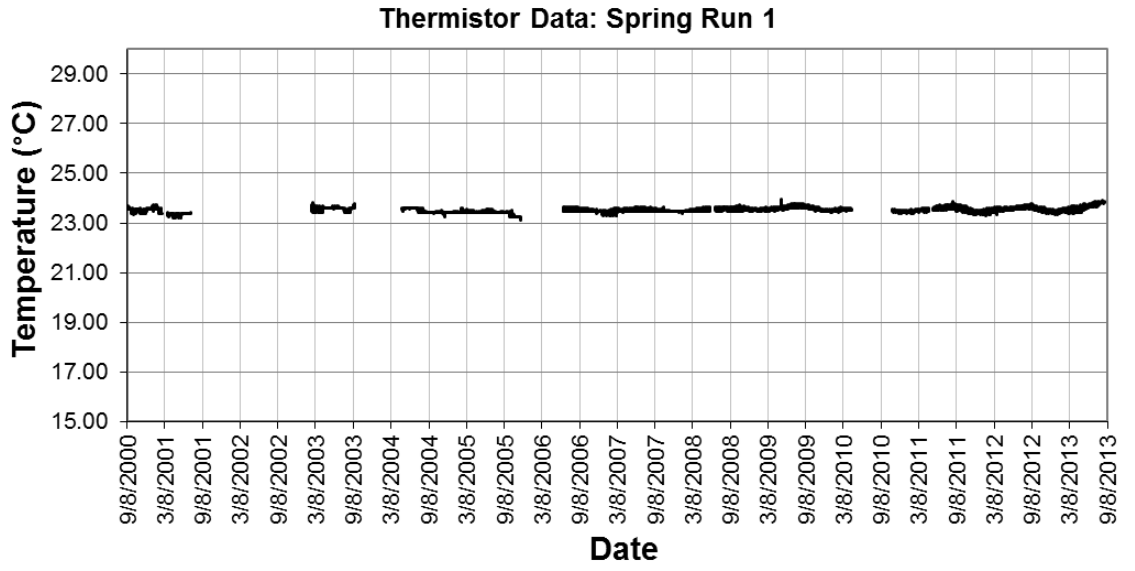
Nitrate values exceeded the water quality standards screening level of 1.0 mg/l in most cases, whereas, ammonium values were well below the screening level of 1.0 mg/l (Table 2). The TN values for the Comal River are influenced by the high nitrate concentrations. These high values are not the result of anthropogenic inputs to the immediate surface waters. The spring flow is the most likely source of high nitrate values found at all sites in the Comal River system. The median concentration of nitrate in the Edward's Aquifer ranges from 1.4 to 1.7 mg/l (Bush et al. 1998). Nitrate values in the Comal River were fairly constant throughout the river during this summer low flow critical period sampling event, and were similar to values in 2011 (1.49 to 1.92 mg/l; BIO-WEST 2012), in 2009 (1.0 to 1.64 mg/l; BIO-WEST 2010a) and in 2000-2002 (1.3 to 2.5 mg/l; except at two sites during the August 2000 when nitrate values reported were near 6.0 mg/l at the Other Place and Island Park; BIO-WEST 2003). In contrast, ammonium concentrations varied among sites (0.0262 to 0.143 mg/l, Table 2), at levels well below the screening level, lower than values measured in 2011 (0.054 to 0.370 mg/l; BIO-WEST 2012) and similar to values measured in 2009 (0.037 to 0.122 mg/l; BIO-WEST 2010a).

The following set of figures depict long-term water temperature data collected via thermisters deployed near the water quality stations discussed above. Temperature data is ranges from fall 2000 through present. Gaps in data represent tampering or equipment malfunction over the course of the past 13 years. The charts are fairly self explanatory with the areas furthest from direct springs reflecting the greatest daily fluctuations in water temperature (Blieders Creek, Old Channel). Areas with considerable horizontal or upwelling flow (spring runs, spring island east outfall, Landa Lake bottom) have shown for the past 13 years and continue under present conditions to report near constant conditions. Even in areas within the system with daily fluctuation, water temperatures have stayed below 27 °C at all times.

In summary, no red flags regarding water quality have been raised based on water quality samples collected during the first week of critical period sampling, continuous thermister data, or visual observations over the course of this critical period event.



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23.00
21.00
19.00
17.00
15.00
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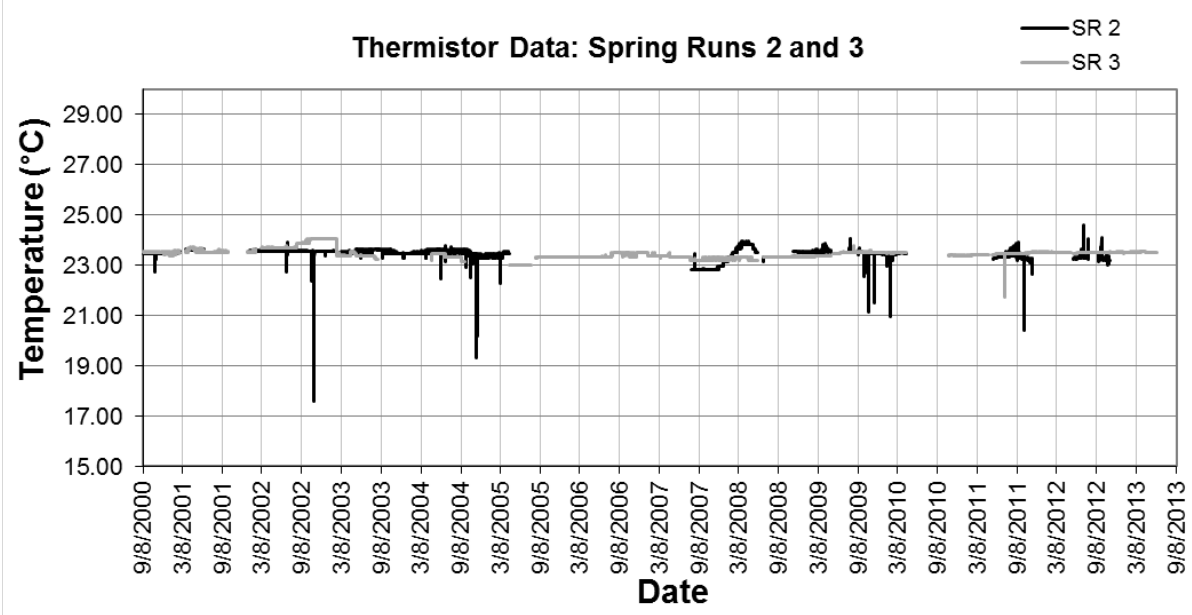
Thermistor Data: Spring Runs 2 and 3
SR 2
SR 3
Temperature (°C)
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25.00
23.00
21.00
19.00
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15.00
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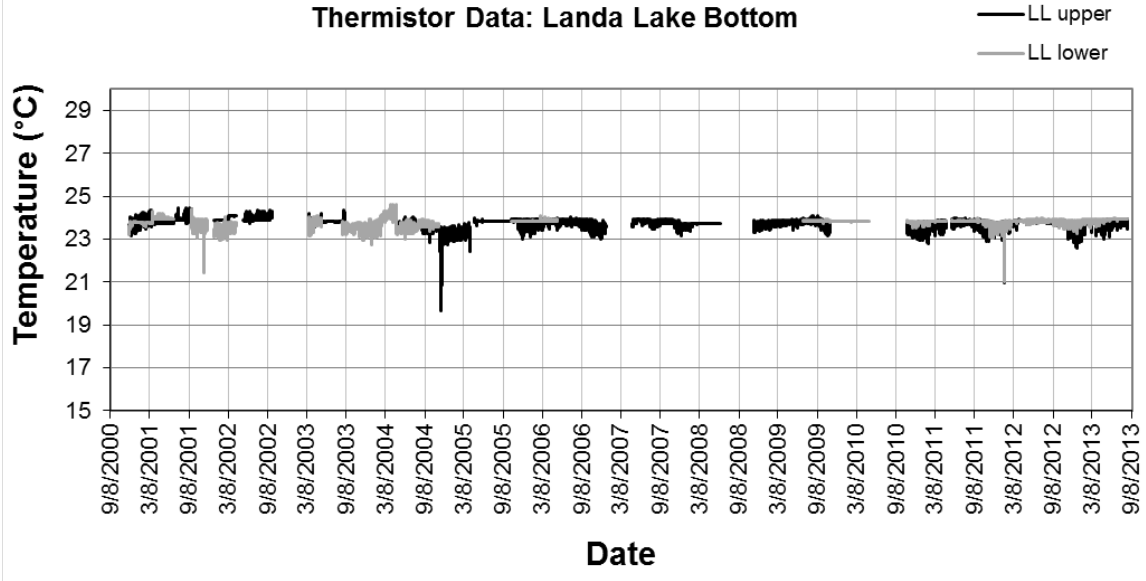
Thermistor Data: Landa Lake Bottom
LL upper
LL lower
Temperature (°C)
29
27
25
23
21
19
17
15
9/8/2000
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9/8/2001
3/8/2002
9/8/2002
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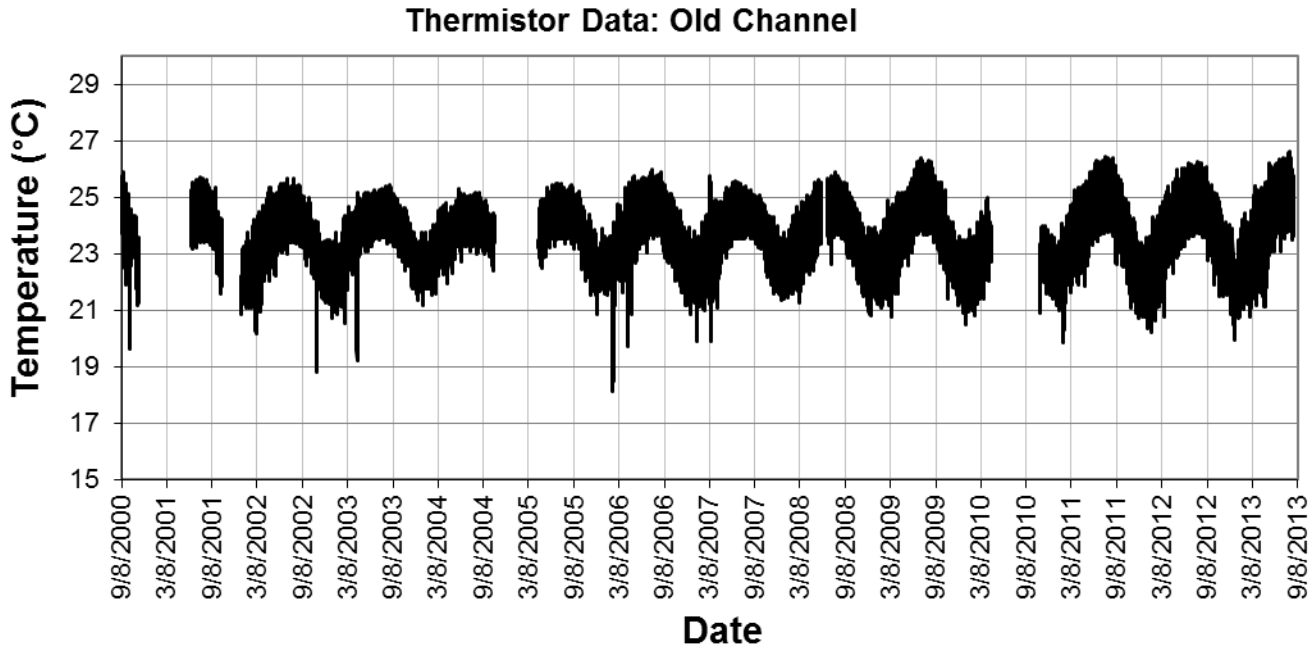

Week 3 biological activities at Comal Springs included retrieving cotton lures at 10 sites each within the Spring Run 3, Western Shoreline, and Spring Island areas. The cotton lures were placed (August 14-16) at spring upwellings or openings to conduits that are known, historically, to be habitat for a variety of beetle species, including Comal Springs riffle beetle (*Heterelmis comalensis*). During collections this week, no cotton lures that were placed two weeks ago were exposed due to declining water levels in Landa Lake. During retrieval this week, we documented several Comal Springs riffle beetles and larvae and the more common Elmid beetle, *Microcylloepus pusillus* and larvae. We also documented several Peck's Cave amphipod (*Stygobromus pecki*), another endangered species that is highly associated with the spring openings in Comal Springs.

The following series of photographs visually document conditions in the Comal system this week (photos taken August 28th). Figures 1-6 document the low-water levels and exposed substrate in Spring runs 1 and 2. Although the main orifice in Spring run 1 has ceased surface flow (Figure 1) and conditions immediately downstream from this area are becoming increasingly exposed (Figure 2), the next downstream segment is still supporting surface flow and bryophytes (Figure 3). Spring run 3 continues to maintain upwelling flow from the headwaters with surface connectivity to the entire spring run (Figures 7-8).

It is visually evident that some flow is still coming from the Upper Spring Run reach. As with the last two week's reports, Spring Run 5 (Figure 9) is still not flowing over the concrete wall. The high level of algae in this reach appears to have subsided a bit, although this may just be a function of summer time recreation. Regardless, a small patch of bryophytes (Figure 10) still remain in the center of the reach which continues to support fountain darters. As noted in previous critical period memorandums this August, the water level throughout the Spring Island area remains quite shallow with exposed sediment bars along the eastern outfall channel of Spring Island. Figure 11 shows the upstream view from Spring Island with several upwelling springs still quite evident. This is the area where cotton lures were placed and recently retrieved. Both the northern and southern springs on Spring Island have gone nearly completely subsurface (Figure 12-13). Figure 14-15 show the eastern outfall channel and western channel, respectively.

Similar to the last two weeks, fountain darter habitat conditions in Landa Lake remain strong with considerable spring upwellings and large patches of bryophytes both on their own and located within other vegetation types. However, the surface vegetation mats continue to build up (Figure 16). If left unattended, these build-ups of surface mats will shade out underlying aquatic vegetation. Fountain darter habitat in the New Channel (Figure 17) and Old Channel (Figures 18-19) remains strong. As per the contract, presence absence dip netting for the fountain darter will occur next in October, or sooner should total discharge decline below 100 cfs.

In summary, the majority of the Comal system continues to maintain quality fountain darter habitat conditions is spite of the extreme summer time conditions. Limited fountain darter habitat remains in the Upper Spring Run reach, but the fact that some flow and habitat still persists is encouraging after three weeks at total system discharge hovering around 130 cfs. Impacts to endangered Comal invertebrate habitat continue to occur in the Spring Island area as well as the main spring runs. However, based on our sampling in the representative areas (Spring run 3, western shoreline, and Spring Island), Comal Springs riffle beetles are still occupying both horizontal and upwelling habitats. Surface and subsurface populations of the Comal invertebrates and potential impacts in Spring runs 1 and 2 remain unknown.

As of this memorandum, all field sampling associated with this critical period event on Comal have been concluded. We will continue to conduct weekly habitat evaluations and provide weekly progress updates until total discharge in the Comal system rebounds to above 150 cfs.

San Marcos

As previously mentioned, no critical period sampling activities have been triggered this summer on the San Marcos system. With San Marcos hovering around 108 cfs, it is considerably above conditions witnessed in 2009. Back in 2009, we went into the year below 100 cfs with flow slowly continuing to decline. In fact, that year total system springflow was below 100 cfs for 243 days. Yet, overall, impacts that year were very minimal (BIO-WEST 2010b). We conducted our summer fountain darter dip netting (presence/absence and timed) in late July with results within the bounds of comprehensive sampling over the years. Additionally, we just completed the annual Texas wild-rice full system mapping. Based on those sampling efforts and visual observations, it is our opinion that we are not approaching conditions anywhere near what was witnessed in 2009. However, that is not to say that the lower than average flow levels are not currently causing some impacts. The City Park reach is almost completely denuded of aquatic vegetation. Present water levels in Sewell Park are creating areas of shallow or exposed sediment. Additionally, floating mats of vegetation are amassing in several reaches. Photographs (taken August 28th) (Figures 20-28) highlight some observations discussed above as well as the quality habitat conditions in Spring Lake. Figure 29 was just included for comic relief in this time of serious drought.

As mentioned, no critical period sampling is scheduled for the San Marcos system until total springflow declines below 95 cfs (Texas wild-rice physical measurements) or below 85 cfs (full Critical Period sampling event). The next comprehensive sampling event will be conducted in mid-October.

If you have any questions or concerns, please don't hesitate to contact me at your earliest convenience. Ed

Figure 1: Spring Run 1 orifice

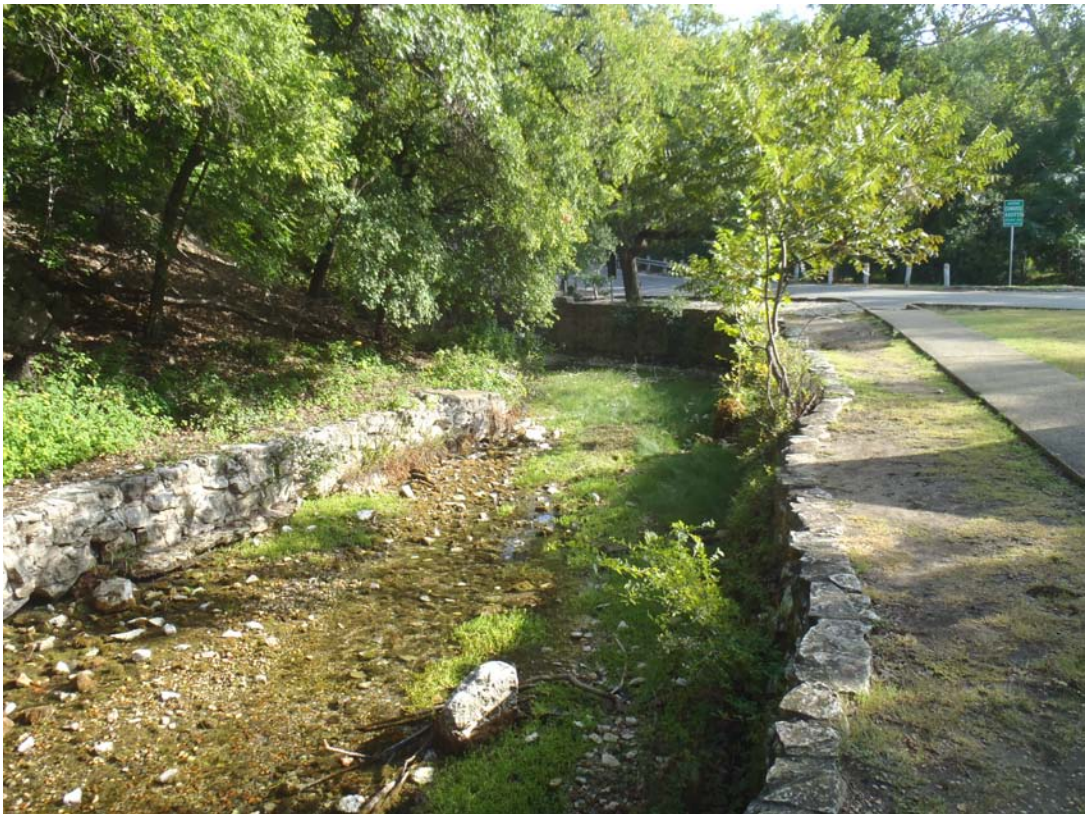

Figure 2: Downstream of Spring Run 1 orifice

Figure 3: Spring Run 1 – Surface flow and bryophytes present / large crayfish

Figure 4: Spring Run 1 – downstream of Landa Drive

Figure 5: Spring Run 2 – Main orifice

Figure 6: Spring Run 2 – looking downstream toward kiddie pool

Figure 7: Spring Run 3 – Headwaters

Figure 8: Spring Run 3 – downstream from headwaters

Figure 9: Spring Run 5 – Upper Spring Run reach

Figure 10: Upper Spring Run reach (August 28) – bubbles are springs and small patch of bryophytes remain in the center of the channel.

Figure 11: Just upstream of Spring Island – numerous upwelling areas – shown by bubbles

Figure 12: Spring Island – Dry Northern spring

Figure 13: Spring Island – nearly dry Southern spring

Figure 14: Spring Island – Eastern outfall

Figure 15: Spring Island – Western Channel – looking downstream toward Landa Lake

Figure 16: Extensive vegetation mats in Landa Lake

Figure 17: New Channel – Full of aquatic vegetation and some early morning tubers

Figure 18: *Cabomba* patch – below Spring fed swimming pool in the Old Channel

Figure 19: Old Channel restored area – and some excellent shadow photography.

SAN MARCOS

Figure 20: Spring Lake – Hotel Area

Figure 21: Salamander sampling site – Hotel Area – high quality habitat

Figure 22: Downstream view towards Bobdog Island – mouth of Sessoms creek to the right

Figure 23: Downstream of University Avenue

Figure 24: Exposed sediment in Sewell Park

Figure 25: Shallow habitat and floating vegetation mats

Figure 26: Texas wild-rice in Sewell Park

Figure 28: Bare substrate in City Park Reach

Figure 29: Morning Break

REFERENCES:

BIO-WEST. 2012. Comprehensive and Critical Period Monitoring Program to Evaluate the Effects of Variable Flow on Biological Resources in the Comal Springs/River Aquatic Ecosystem. 2011 Annual Report. Edwards Aquifer Authority.

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