MEMORANDUM

TO:	Chad Furl, Jamie Childers
FROM:	Ed Oborny (BIO-WEST)
DATE:	**August 5, 2022**
SUBJECT:	EA HCP Critical Period Habitat Evaluation – 100 cfs – Comal System

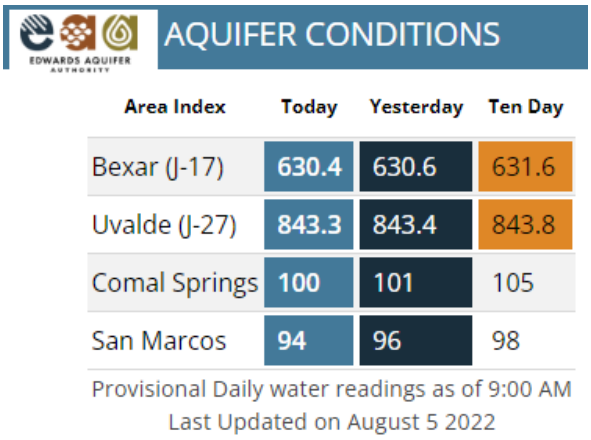
100 cfs Habitat Evaluation

COMAL SYSTEM:

The Spring 2022 Comprehensive Biological Monitoring effort for the Comal System was completed in May 2022. As total system discharge continued to decline, the 150 cfs full Critical Period monitoring trip was triggered and completed in late June. As of this memorandum, all activities associated with Comal Critical Period Biological Monitoring (**Task 2**) < 150 cfs event have been completed:

- Aquatic vegetation mapping of the four (Upper Spring Run, Landa Lake, Old Channel, and upper New Channel) study reaches.
- Comal Salamander surveys (Spring Run 1, Spring Run 3, and Spring Island).
- Thermister downloads and zebra mussel lure assessment.
- Fixed-station photography.
- Fountain Darter presence/absence and timed dip netting.
- Fountain Darter drop netting in the four study reaches.
- Fountain Darter visual surveys in Landa Lake.
- Fish Community sampling via SCUBA and seine.
- Comal Springs Riffle Beetle cotton lure sampling (Spring Run 3, Western Shoreline, and Spring Island).
- Suite I and II water quality sampling.

The 100 cfs Habitat Evaluation was completed on July 27th. Habitat evaluations for the Comal System are triggered at 100 cfs and required for every 10 cfs decline (not to exceed weekly) putting the next scheduled evaluation at 90 cfs. Preliminary observations and photo documentation associated with the full system Critical Period event completed in June and the 100 cfs Habitat Evaluation conducted on July 27th are presented below. As of this memorandum, the total system discharge in the Comal Springs system ≈ 100 cfs (see Figure to the right).



Key ecological information regarding study reaches and full-system sampling are included herein relative to the Spring 2022 routine and June Critical Period sampling for comparison. Water temperature is a key component system-wide as it supports spring-related aquatic assemblages.

Recent 7-day trends in water temperature (°C) for July Critical Period sampling were assessed using temperature data loggers (HOBO Tidbit v2 Temp Loggers) at 13 permanent monitoring stations in the Comal Springs/River. A location map is purposely not included in this memorandum to avoid tampering with sensitive and expensive equipment. July water temperature data are currently not available at stations in Landa Lake; therefore, assessments are based on the most up-to-date data available (i.e., May) and Critical Period analyses will be conducted for these stations in the near future. Data for each monitoring station are based on 10-minute intervals and dates for recent trends extended from the last day that each data logger was downloaded to 7 days prior. All 7-day trends were examined from 7/23 – 7/29, except for Blieders (6/30 – 7/6), Landa Lake Upper (5/6 – 5/12), and Landa Lake Lower (5/6 – 5/12). Recent 7-day trends were compared to long-term water temperature data measured at 4-hour intervals in July (May for Landa Lake stations) from 2001 – 2021 or to the greatest temporal extent available. For analysis, 7-day trends were compared to long-term trends using boxplots to visualize differences in central tendency (i.e., median) and variation (e.g., range, interquartile range).

Results are provided in Table 1 and graphically depicted in Figures 1, 2, and 3. Overall, it is clear we are in a lower flow, summer time condition and water temperatures are elevated to the point of Fountain Darter impacts in the stagnant Blieders Creek area. Locations further downstream from the spring flow orifices (Figure 3) are at or approaching the 26°C interest point and will be important to monitor as drought and summer-time continues to coincide.

Table 1. Summary of boxplot descriptive statistics comparing recent 7-day and long-term trends in water temperature (°C) at 10 monitoring stations in the Comal Springs/River.

Station	Period	Min	Lower Box	Median	Upper Box	Max	Interquartile Range	Range
Blieders	7-day	27.63	28.92	29.37	29.97	31.10	1.06	3.48
Blieders	Long-term	23.09	24.90	25.68	26.92	29.94	2.02	6.85
Heidelberg	7-day	23.74	23.83	23.98	24.39	25.16	0.56	1.43
Heidelberg	Long-term	23.41	23.81	23.92	24.09	24.51	0.28	1.10
Booneville Near	7-day	23.67	23.67	23.69	23.76	23.91	0.10	0.24
Booneville Near	Long-term	23.47	23.52	23.59	23.64	23.82	0.12	0.35
Booneville Far	7-day	23.57	23.74	24.05	24.99	26.74	1.26	3.18
Booneville Far	Long-term	22.63	23.68	23.92	24.39	25.44	0.71	2.81
Landa Lake Upper	7-day	23.52	23.79	23.88	24.03	24.22	0.24	0.70
Landa Lake Upper	Long-term	23.30	23.63	23.76	23.85	24.18	0.22	0.88
Spring Run 1	7-day	23.67	23.69	23.71	23.74	23.79	0.05	0.12
Spring Run 1	Long-term	23.42	23.52	23.57	23.59	23.71	0.07	0.28
Spring Run 2	7-day	23.52	23.57	23.59	23.62	23.69	0.05	0.17
Spring Run 2	Long-term	23.26	23.33	23.44	23.61	23.89	0.28	0.63
Spring Run 3	7-day	23.50	23.50	23.50	23.50	23.50	0.00	0.00
Spring Run 3	Long-term	23.16	23.32	23.47	23.52	23.69	0.20	0.53
Landa Lake Lower	7-day	23.81	23.88	23.91	23.93	24.00	0.05	0.19
Landa Lake Lower	Long-term	23.57	23.79	23.86	23.93	24.15	0.15	0.58
Old Channel	7-day	23.74	24.07	24.56	25.74	26.92	1.66	3.18
Old Channel	Long-term	22.64	23.84	24.19	25.06	26.50	1.22	3.86
New Channel Upstream	7-day	23.64	23.95	24.56	25.57	26.43	1.62	2.79
New Channel Upstream	Long-term	23.14	23.67	23.92	24.53	25.81	0.87	2.67
New Channel Downstream	7-day	24.00	24.46	25.23	26.23	26.82	1.77	2.82
New Channel Downstream	Long-term	23.08	24.07	24.69	25.67	28.05	1.60	4.97
The Other Place	7-day	24.56	25.19	25.89	26.39	26.99	1.20	2.43
The Other Place	Long-term	23.03	23.92	24.46	25.23	26.67	1.32	3.64

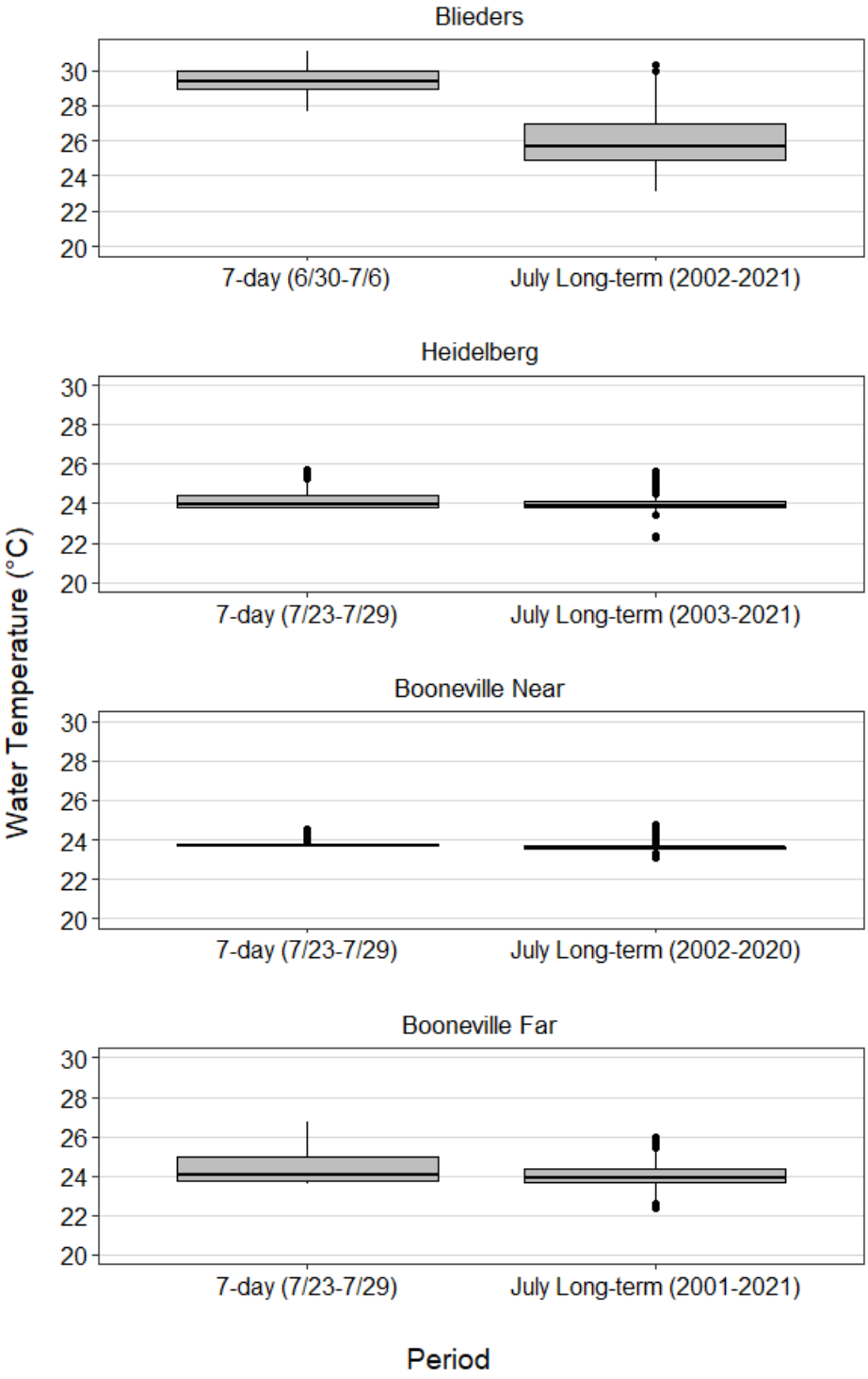


Figure 1. **Boxplots comparing recent 7-day and long-term water temperature trends at four monitoring stations from Blieders to Booneville Far. The thick horizontal line in each box is the median, x represents the mean, and the upper/lower bounds of each box represents the interquartile range. Whiskers represent minimum/maximum values up to 1.5 times the interquartile range, and outliers beyond this are designated with solid black circles.**

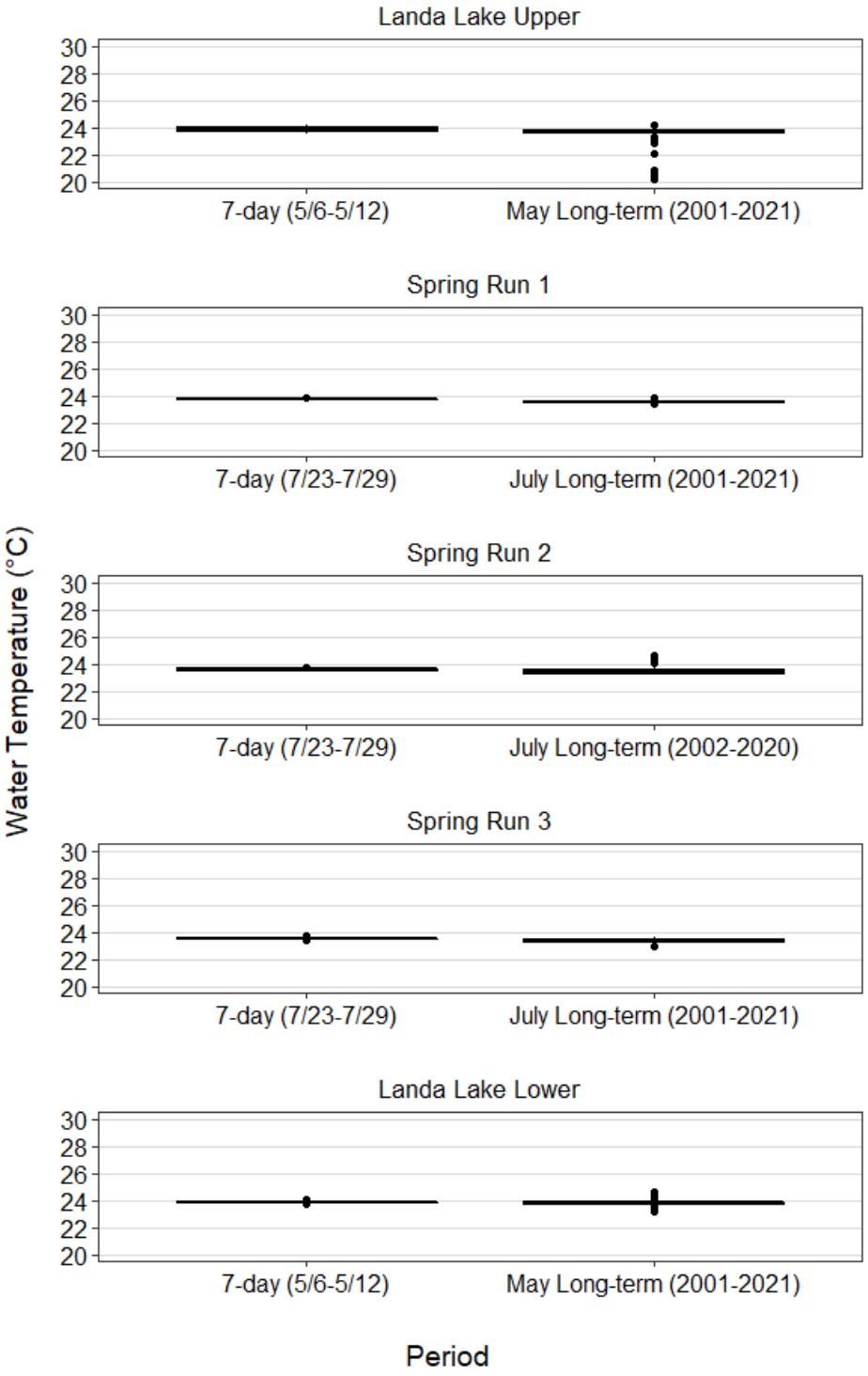


Figure 2. **Boxplots comparing recent 7-day and long-term water temperature trends at five monitoring stations from Landa Lake Upper to Landa Lake Lower. The thick horizontal line in each box is the median, x represents the mean, and the upper/lower bounds of each box represents the interquartile range. Whiskers represent minimum/maximum values up to 1.5 times the interquartile range, and outliers beyond this are designated with solid black circles.**

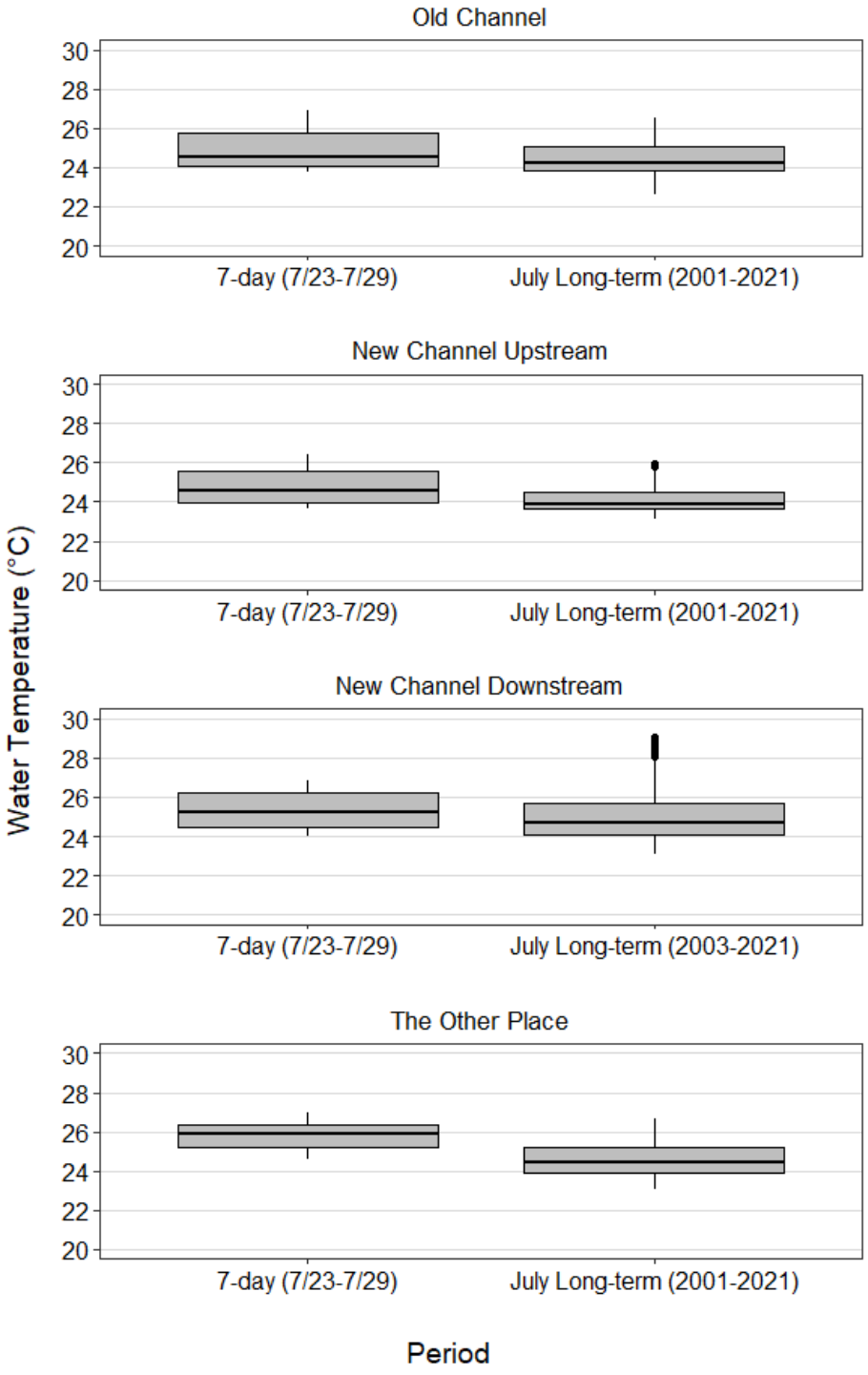


Figure 3. **Boxplots comparing recent 7-day and long-term water temperature trends at four monitoring stations from the Old Channel to the Other Place. The thick horizontal line in each box is the median, x represents the mean, and the upper/lower bounds of each box represents the interquartile range. Whiskers represent minimum/maximum values up to 1.5 times the interquartile range, and outliers beyond this are designated with solid black circles.**

Aquatic vegetation and Fountain Darter dip netting are key monitoring components as they comprise the equation / criteria for Fountain Darter refugia salvage activities described in Section 6.4.3 (**Comal Springs and River Ecosystem Adaptive Management Activities**) in the EAHCP. Those trigger conditions for the Fountain Darter in the Comal system are as follows:

- *Less than 50 percent mean aquatic vegetation (Landa Lake and Old Channel) AND less than 20 percent darter presence system-wide,*

  OR

- *Less than 25 percent mean aquatic vegetation (Landa Lake and Old Channel) AND less than 30 percent darter presence system-wide.*

At present, neither of the above scenarios are close to being triggered. From April through June 2022, the five Comal Study reaches have varied in response to aquatic vegetation coverage. The Upper Spring Run reach remained steady, the Landa Lake reach exhibited a slight decline (<5%), the Old Channel increased in native aquatic vegetation, and the New Channel reaches experienced a > 20% decline in vegetation coverage in the upper reach, which is shallow, and a > 5% decline in the deeper lower reach. Fountain Darter dip netting results remain high with 90% of the sites having darters present in Spring 2022, and 80% of sites in late June. These numbers highlight the quality of Fountain Darter habitat conditions that are persisting in the Comal system this summer.

In contrast, Comal Spring Riffle Beetle and Comal Springs Salamander habitat throughout each species range is noticeably being reduced as water levels decline. This is most evident in the Upper Spring Run, Spring Runs 1 and 2, and to a lesser degree Spring Run 3, the Western Shoreline, and Spring Island. However, as of July 29th, abundant numbers of Comal Springs salamanders and riffle beetles are being supported in the system. It will be imperative to track both water temperature increases and wetted area reductions in the Comal System as this drought continues. The following pictorial habitat evaluation highlights the current Covered Species habitat conditions throughout the Comal System starting at the upper springs / Blieders Creek confluence and working downstream.

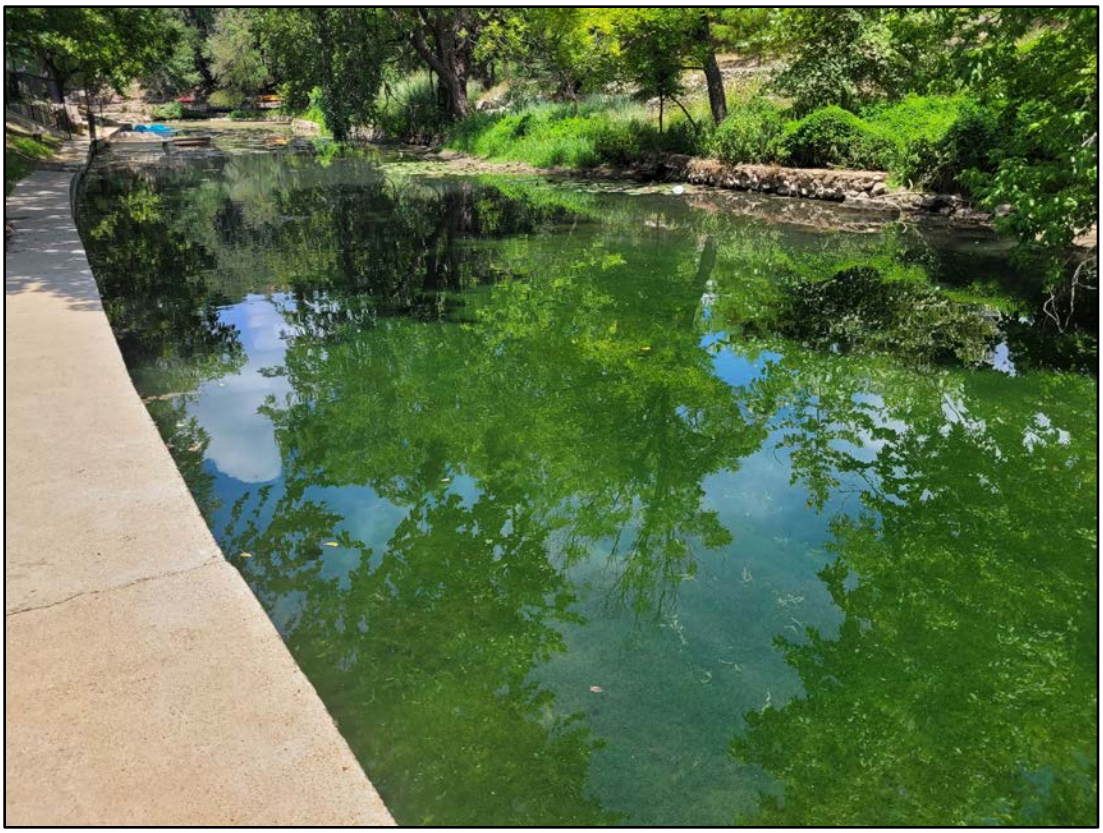


Figure 4: Blieders Creek looking downstream on July 27, 2022 (No visible flow with abundant green algae).

Figure 5: Upper Spring Run reach and Blieders Creek confluence on July 27, 2022 (105 cfs).

Figure 6: Upper Spring Run reach Fountain Darter habitat on July 27, 2022 (105 cfs).

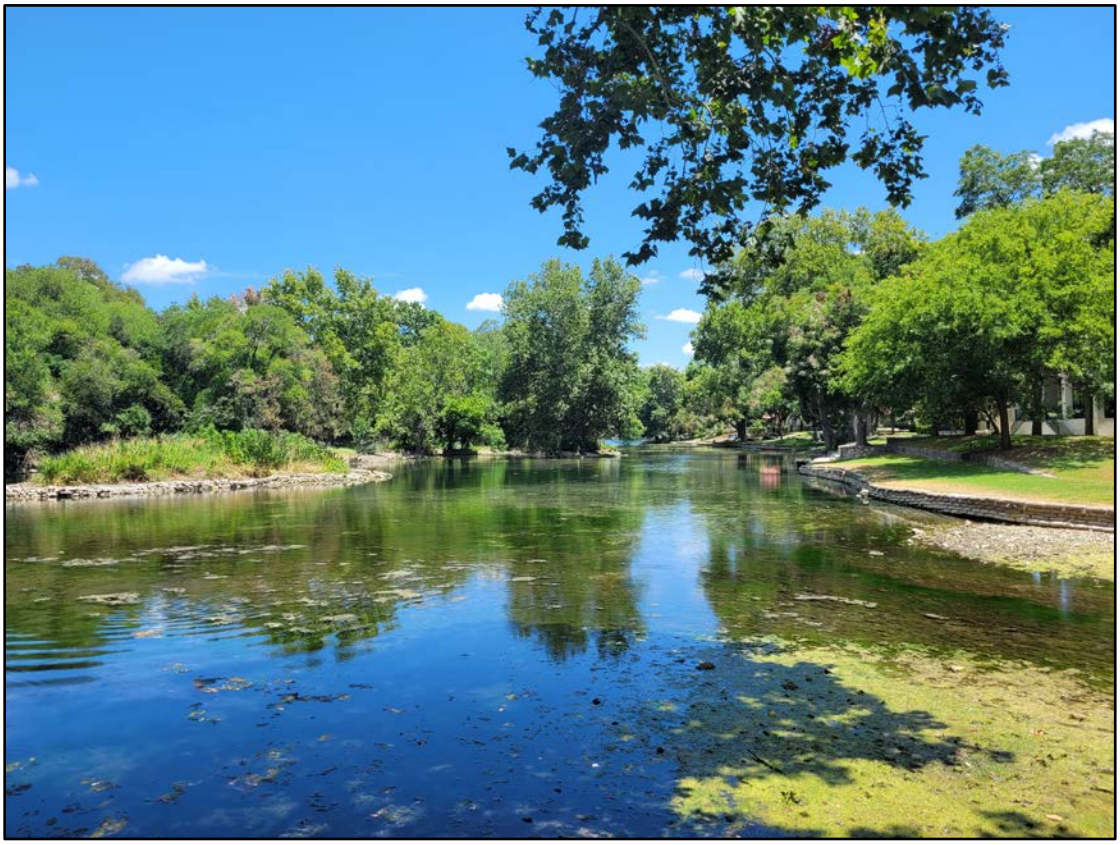


Figure 7: Spring Island Covered Species habitat looking upstream on July 27, 2022 (105 cfs).

Figure 8: Spring Island Spring Run Covered Species habitat on July 27, 2022 (105 cfs).

Figure 9: Landa Lake Floating Vegetation Matts (Left – 135 cfs on June 23) (Right 105 cfs on July 27).

Figure 10: Landa Lake Floating Vegetation Matts looking upstream from Fishing Pier on July 27, 2022.

Figure 11: Spring Run 1 Headwaters on July 27, 2022 (105 cfs).

Figure 12: Spring Run 1 looking downstream from headwaters on July 27, 2022 (105 cfs).

Figure 13: Spring Run 2 kiddie pool looking downstream from bridge on July 27, 2022 (105 cfs).

Figure 14: Spring Run 1 and 2 confluence with Landa Lake on July 27, 2022 (105 cfs).

Figure 15: Spring Run 3 headwaters on July 27, 2022 (105 cfs).

Figure 16: Spring Run 3 looking downstream from headwaters on July 27, 2022 (105 cfs).

Figure 17: Old Channel ERPA looking upstream from Golf Course Bridge on July 27, 2022 (105 cfs).

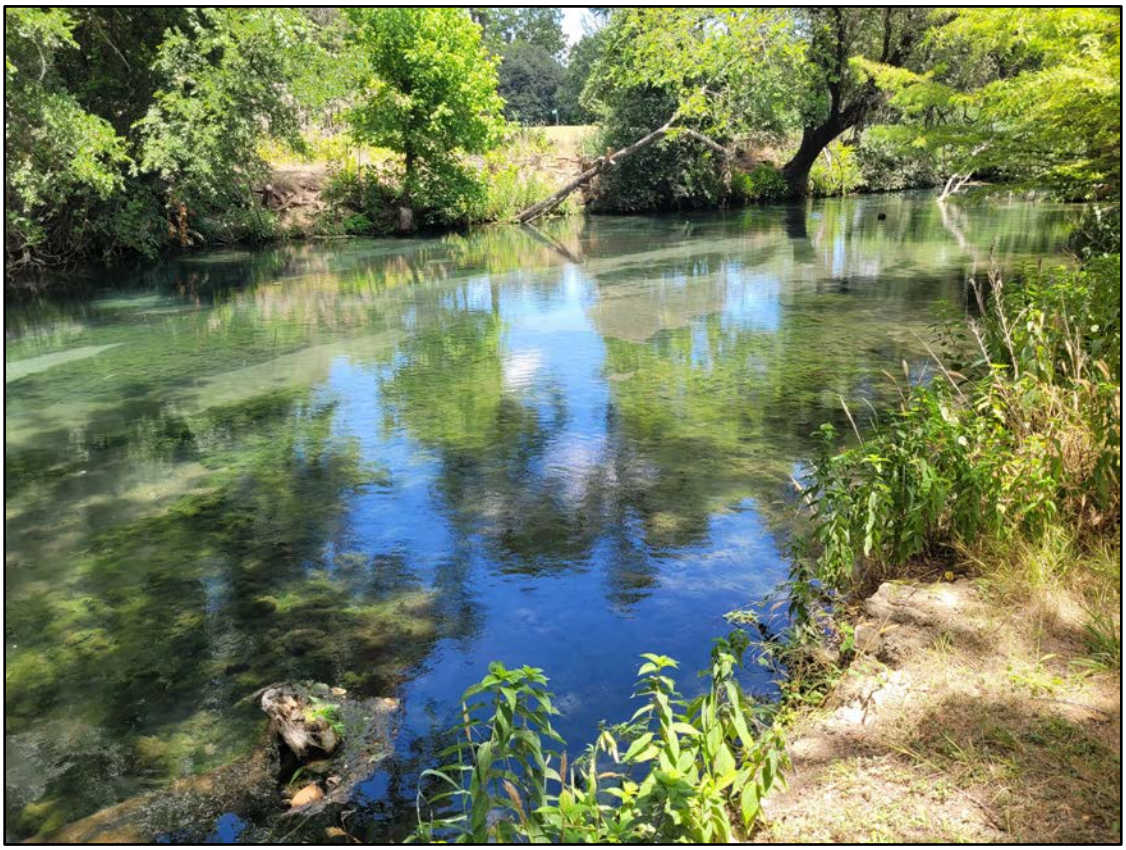


Figure 18: Old Channel Study Area on July 27, 2022 (105 cfs).

In summary, total system discharge in the Comal System has not approached these levels since 2014. As witnessed in 2014, should this downward trend continue, these lower discharges will create worsening surface habitat conditions each week for the Comal Springs invertebrates. The good news is that Comal invertebrates are abundant at this time and the system continues to support quality Fountain Darter habitat throughout most of its range. In fact, the Old Channel ERPA through the Old Channel Study Reach has not seen as high-quality of native habitat conditions since the inception of the biological monitoring program over 20 years ago. Whether the fringes of the system (Blieders Creek and Upper Spring Run) are approaching a tipping point or will continue to hold fast is the exact reason the EAHCP Critical Period biological monitoring program is in place. It is vital to keep tracking the surface-dwelling invertebrates as surface habitat continues to decline at Comal Springs. Finally, it is likely that the <100 cfs full Critical Period Sampling effort for Comal Springs will be initiated in August.

As always, if you have any questions, please don't hesitate to reach out.

Ed