Trinity River Sub-basin Environmental Flows Data Report for Quality Assured Data Collected between September 1, 2014 and June 30, 2015

Final Report

August 1, 2015

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Prepared by:
Trinity River Authority of Texas in collaboration with the Texas Instream Flows Program (TIFP).

PREPARED IN COOPERATION WITH THE
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

The preparation of this report was financed in part through funding from the Texas Commission on Environmental Quality under Agreement No. 582-14-40097.

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Introduction

The 77th Texas Legislature passed Senate Bill 2 (SB 2) in 2001 which created the Texas Instream Flow Program (TIFP). This program is administered jointly by the Texas Commission on Environmental Quality (TCEQ), Texas Parks and Wildlife Department (TPWD), and Texas Water Development Board (TWDB). The Program's charge is to determine how much water Texas rivers need to maintain a sound ecological environment. The middle Trinity River was identified by the TIFP as a priority sub-basin in the Texas Instream Flow Studies Programmatic Work Plan (TPWD, TCEQ & TWDB, 2002).

The contractual objective of this report (Contract Number 582-14-40097, Amendment 1) is to:

1. Acquire the available processed and quality assured data between the start of the TIFP sampling efforts in the Trinity River basin (anticipated June 2014) and May 31, 2015 from TCEQ, TPWD, and the TWDB;
2. Create data summary and methodology report; and
3. Provide an electronic data appendix.

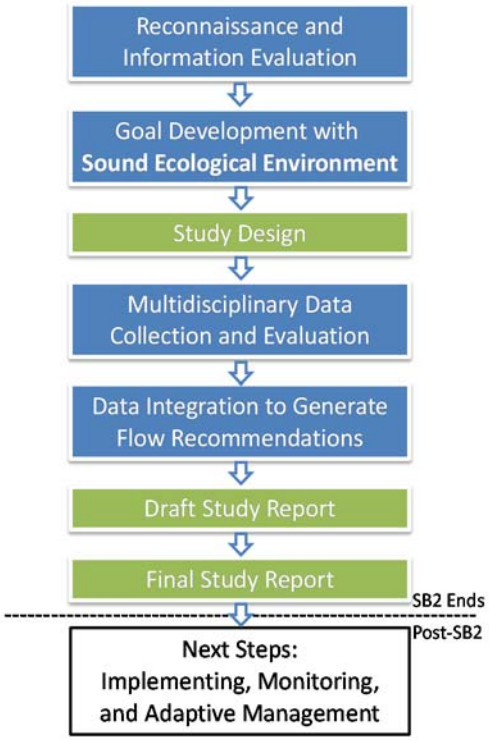

Figure 1. Steps in sub-basin studies of the Texas Instream Flow Program (Adapted from TWDB, 2008).

Instream Flow Studies

The TIFP adopted an approach for studying the entire riverine ecosystem and have defined a *sound ecological environment* as a "resilient, functioning ecosystem characterized by intact, natural processes and a balanced, integrated, and adaptive community of organisms comparable to that of the natural habitat of the region" (TWDB, 2008). Multidisciplinary studies are needed in order to understand the hydrology, geomorphology, biology, water quality, and connectivity of aquatic ecosystems. Components of instream flow studies are thoroughly reviewed and explained in the *Texas Instream Flow Studies Technical Overview Report 369* (TWDB, 2008) and are well documented in the discipline's literature. In general, the SB2 process follows the steps outlined in Figure 1.

Trinity River Reconnaissance Studies

In late 2012, the TIFP and Trinity River Authority of Texas (TRA) began working on the reconnaissance and information evaluation phase of the project. A large biological data gap was identified and a supplemental biological data collection study was initiated to obtain recent biological data along the middle Trinity River. The TIFP and TRA selected six sites spatially distributed between Dallas County and Lake Livingston. Each of these sites were sampled twice by the TRA and TIFP between August and November of 2012 for fish and benthic organisms. These data were reported in the *Supplemental Biological Data Collection, Middle Trinity River Priority Instream Flow Study, Final Report* (TRA and TWPD, 2014). For the fisheries data, the results showed the upper four sites clustered together and the lower two sites clustered together (TRA and TWPD, 2014). Additional data collected and analyzed in the report included mussels, benthic macroinvertebrates, mesohabitat types, substrates, depths and velocities.

Methodology

Once the Reconnaissance and Information Evaluation phase of the study was complete, Goal Development began during three stakeholder workshops that took place in the spring of 2013. From those meetings, the *Instream Flow Study of the Middle Trinity River Draft Study Design* (TIFP and TRA, 2014, under review) was created which identified the stakeholders' agreed upon vision for "a sustainable functioning, resilient ecosystem, with diverse habitats and biotic communities that is adaptive and capable of meeting today's needs while maintaining future generation's opportunities (TIFP and TRA, 2014, under review)." During the stakeholder workshops, the TRA and TIPF staff led the attendees through:

1. An explanation of the instream flow study methodology;
2. A thorough review of the available data;
3. Study goal development for the middle Trinity ;
4. Site selection;
5. Flow target selection; and
6. Indicator species selection.

The ultimate goal of an instream flow study is to relate flow with biology. One technique used to establish these *flow/ecology relationships* involves sampling biological components in specific mesohabitat/substrate combinations at different flow rates. These data are used to create habitat suitability curves (HSC) by fish species or guild for substrate, velocity, and depth. These curves are input into a 2D hydraulic model which calculates weighted usable area curves for various flow rates. In other words, the inputs are used to determine which flows provide the most habitat of a certain value for a specific fish species or guild. Additional information is described in the *Instream Flow Study of the Lower San Antonio River and Lower Cibolo Creek, Interim Progress Report and Instream Flow Recommendations* report (TIFP and SARA, 2011)

Site Selection

Site selection was a tiered process that took into account the need for widely to narrowly focused studies. The middle Trinity River was divided into "Study Areas", "Study Reaches", and "Study Sites", ranging from longer to shorter distances respectively (Table 1). The site selection process is explained in detail in the draft study design document (TIFP and TRA, 2014, under review).

Table 1. Site selection components used for the middle Trinity River instream flow study (TIFP and TRA, 2014, under review).

Tier	Name	Length Range (mi.)	Selection Factors
1	Study Area	12 - >100	Significant geologic features Ecoregions *2011 Longitudinal Study* (TRA & RPS Espey Consultants Inc., 2013) Recent and historical biological data
2	Study Reach	29.5 - 65	USGS gages Diversions Fish and mussel data Aerial photography Geomorphic data Water quality sampling sites
3	Study Site	0.5 – 2	Bathymetry Reconnaissance studies Mesohabitat availability Riparian habitat

Six study reaches were proposed and four representative sites were selected from those reaches. The study sites are designated by the river basin "080" and the river mile "###" (TRA, 2012) with river mile 0 at Trinity Bay. The sites are 080223, 080295, 080344, and 080423 (Figure 2).

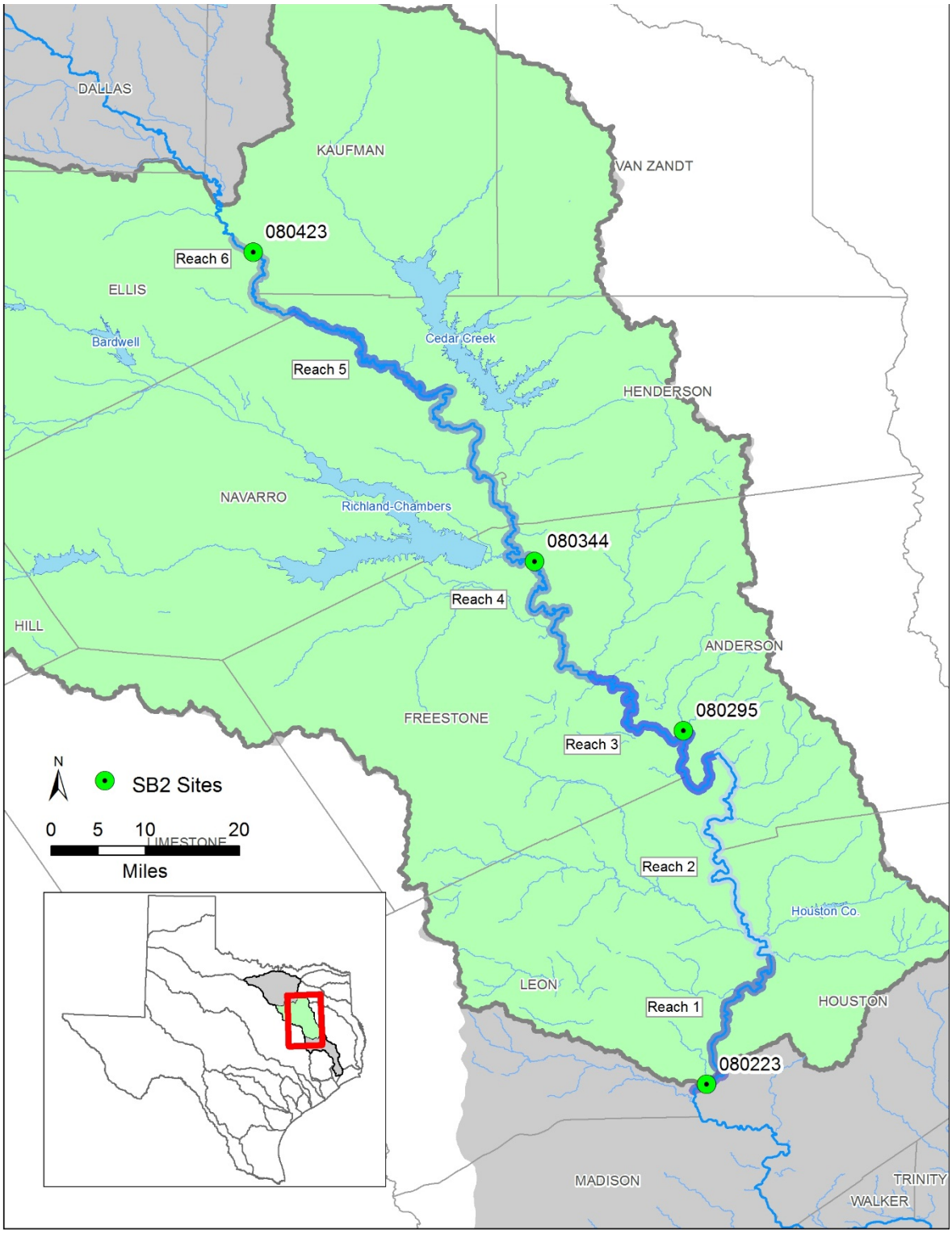

Figure 2. Map of the middle Trinity River Sub-basin reaches and study sites.

Indicator Species

Based on historical and recent fish data collections, ten species or groups were proposed as possible key species based on their historic and current abundance in the middle Trinity River, habitat use, life history, tolerance to change (flow and water quality), and, when appropriate, sport value. The fish include: freshwater drum (*A. grunniens*), alligator gar (*A. spatula*), blue catfish (*I. furcatus*), white bass (*M.chrysops*), smallmouth buffalo (*Ictiobus bubalus*), ghost shiner (*Notropis buchanani*), silverband shiner (*N. shumardi*), *Percina* species, and paddlefish (*P. spathula*) (TIFP and TRA, 2014, under review). Additional details are available in TIFP and TRA, 2014, under review.

Hydrology

The Draft Study Design statistically derived a high, mid, and low baseflow target for each of the four sites. The intention of the study was to sample each site once at each flow to see the differences in the indicator species or mesohabitat guilds. Because the Trinity River does not generally sustain a mid baseflow for the length of time it takes for the biology to stabilize after a pulse event, flow targets and stabilization times were adjusted to include only low and high baseflow (Table 2). Additional information on flow targets is available in the Draft Study Design and are currently being further analyzed by the TIFP and TRA.

Table 2. Target baseflows for the middle Trinity River Instream Flow Study.

Site	High Baseflow (cfs)	Low Baseflow (cfs)
080423	1280	795
080344	1400	845
080295	1750	891
080223	2020	1010

Field Data Collection

Water Quality

Water quality parameters are an important aspect of instream flow studies. Biological organisms have tolerance ranges for parameters like dissolved oxygen and temperature. To better characterize the expected ranges of pH, dissolved oxygen, specific conductance, and temperature that occur in the middle Trinity River, TRA staff assisted TCEQ staff with the installation of six water quality sondes at three sites (Figure 3). See Table 4 for additional information.

Figure 3. TRA staff deploying water quality sonde on the middle Trinity River near US Hwy 287.

Figure 4. Sediment collected at one site along the middle Trinity River and categorized as small gravel according to the modified Wentworth Substrate Scale.

Sediment Mapping

A differentially corrected GPS datalogger was used to map sediment in the field. Depending on conditions, the substrate was observed by sight or feel and points, polylines, or polygons were used to delineate one sediment type from another. Sediment was observed by using a dredge or pole with scoop attached when water depths required (Figure 4). Sediment was categorized based on a modified Wentworth Substrate Scale as described in TIFP and SAFA, 2011.

Fish and Habitat

Between June 1, 2014 and June 30, 2015, only one of eight events (low baseflow for site 080223) scheduled for fish sampling was completed. The remainder of the scheduled sampling events were cancelled due to high flows, lack of stabilization time after a pulse event, or the water temperature being too low to assume fish were in a *normal* pattern (Figure 5). A list of the completed field activities is shown in Table 3.

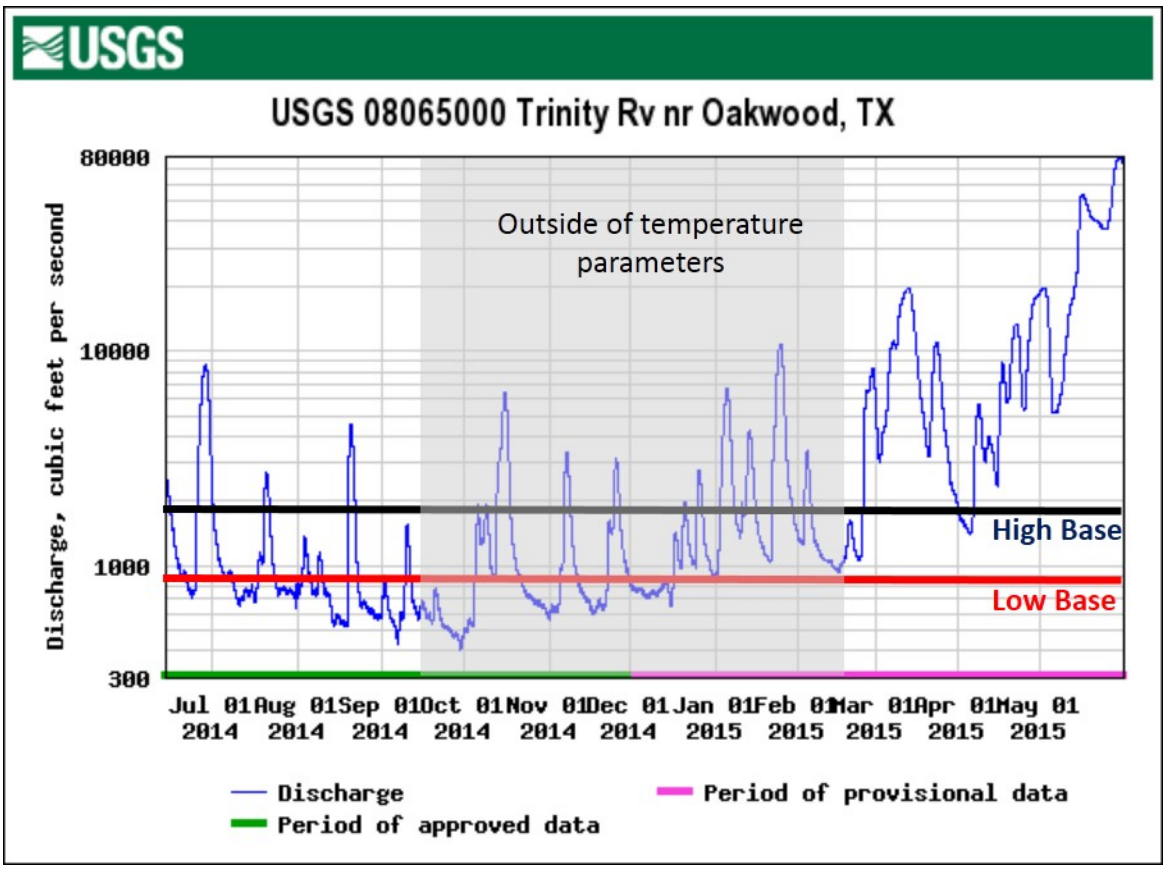

Figure 5. Data from the USGS gage Trinity River near Oakwood between July 15, 2014 and May 31, 2015.

Table 3. Summary of field data for the middle Trinity River instream flow study. Preliminary data collection consist of data needed prior to the scheduling biological sampling events.

SB2 Site	Site Name	SB2 Task	Type	Date(s)
080223	Crockett	Fish Collection	Biological	9/29-10/1/2014
080223	Crockett	Sediment mapping	Preliminary Biology	4/3/2014
080295	Oakwood	Sediment mapping	Preliminary Biology	9/17/2014
080344	Hwy 287	Sediment mapping	Preliminary Biology	7/23/2013
080423	Grass Farm	Sediment mapping	Preliminary Biology	8/6/2013
080295	Oakwood	Sonde deployment	Water Quality	8/28/2014
080295	Oakwood	Sonde retrieval	Water Quality	9/24/2014
080344	Hwy 287	Sonde deployment	Water Quality	8/29/2014
080344	Hwy 287	Sonde retrieval	Water Quality	9/24/2014
080423	Grass Farm	Sonde deployment	Water Quality	8/29/2014
080423	Grass Farm	Sonde retrieval	Water Quality	9/24/2014

Single Event Completion – Site 080223 at Low Baseflow

For the completed biological sampling event at site 080223, workflow consisted of the following:

1. GPS sediment mapping (Figure 6);
2. GPS mesohabitat mapping (Figure 7);
3. GIS overlay of sediment and mesohabitat (Figure 8);
4. Stratified random selection of 30-40 fish sampling locations (Figure 9);
5. Fish sampling within each 10x20 ft^2 (approximately) box using seine or backpack/boat electrofishing equipment;
6. Collection of field water quality parameters and hydraulic parameters (depth and velocity) in the middle and at the four corners of the box (Figure 10).

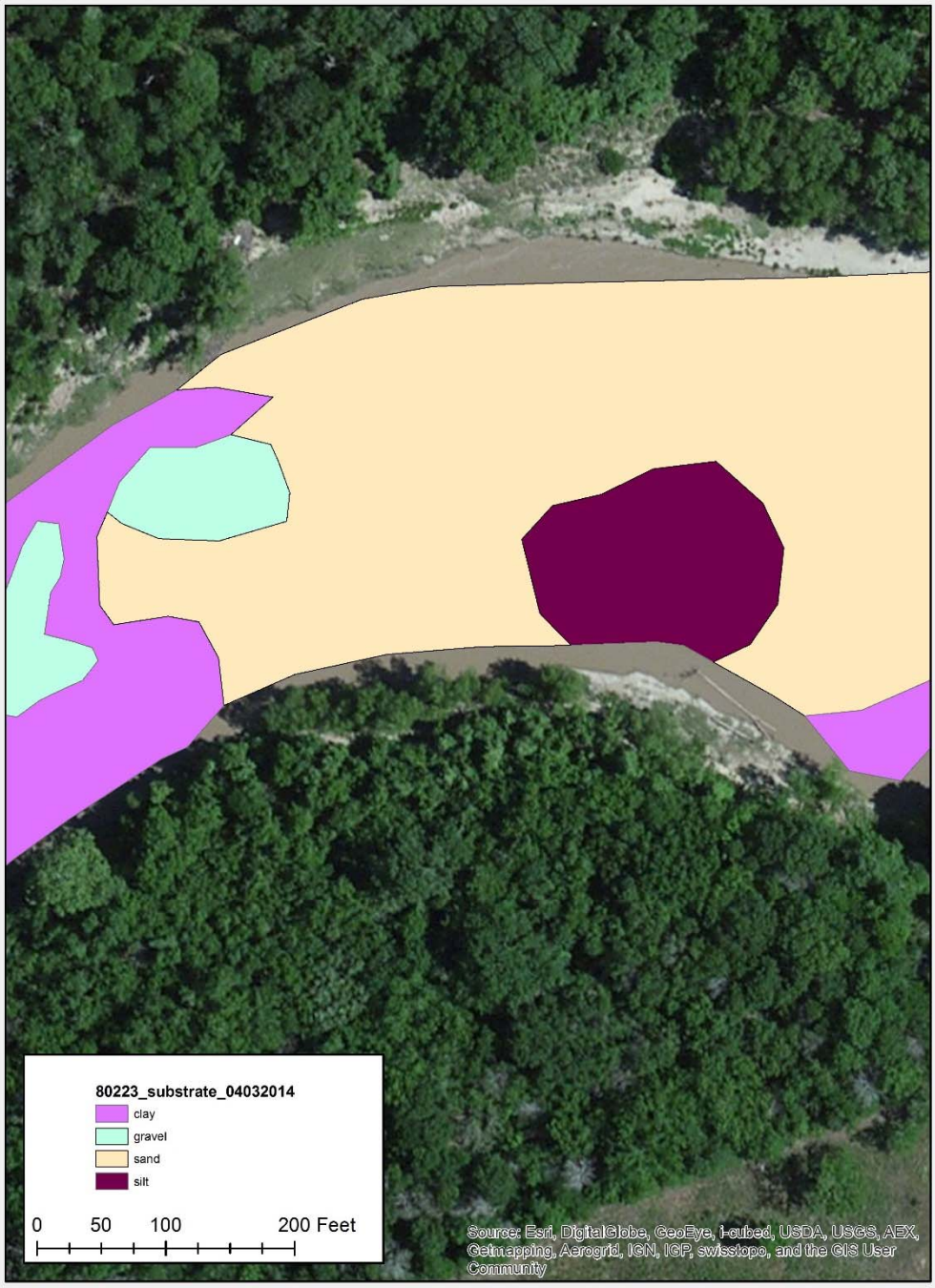

Figure 6. Map of site 080223 showing the substrate mapping.

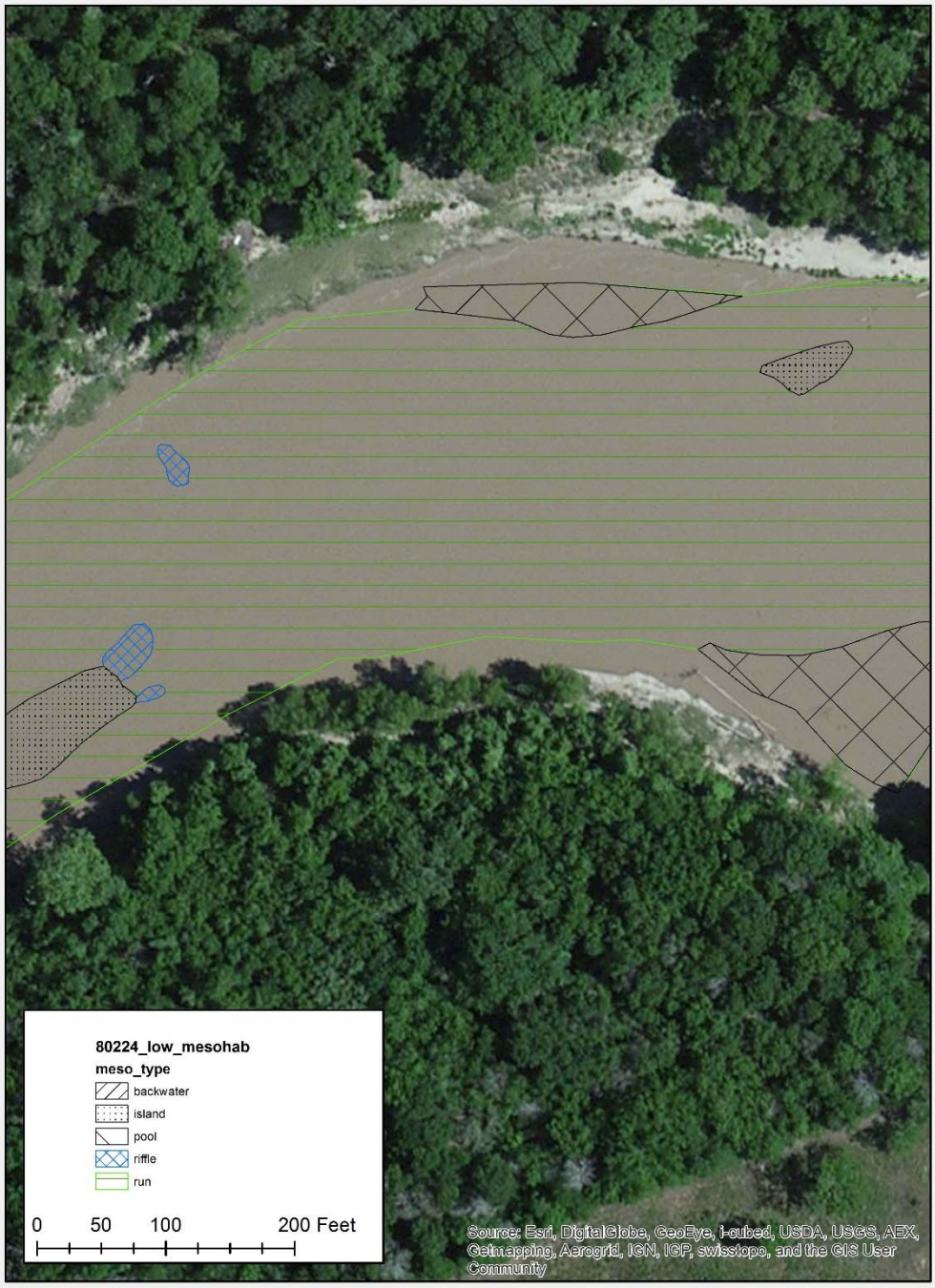

Figure 7. Map of site 080223 showing the mesohabitat mapping.

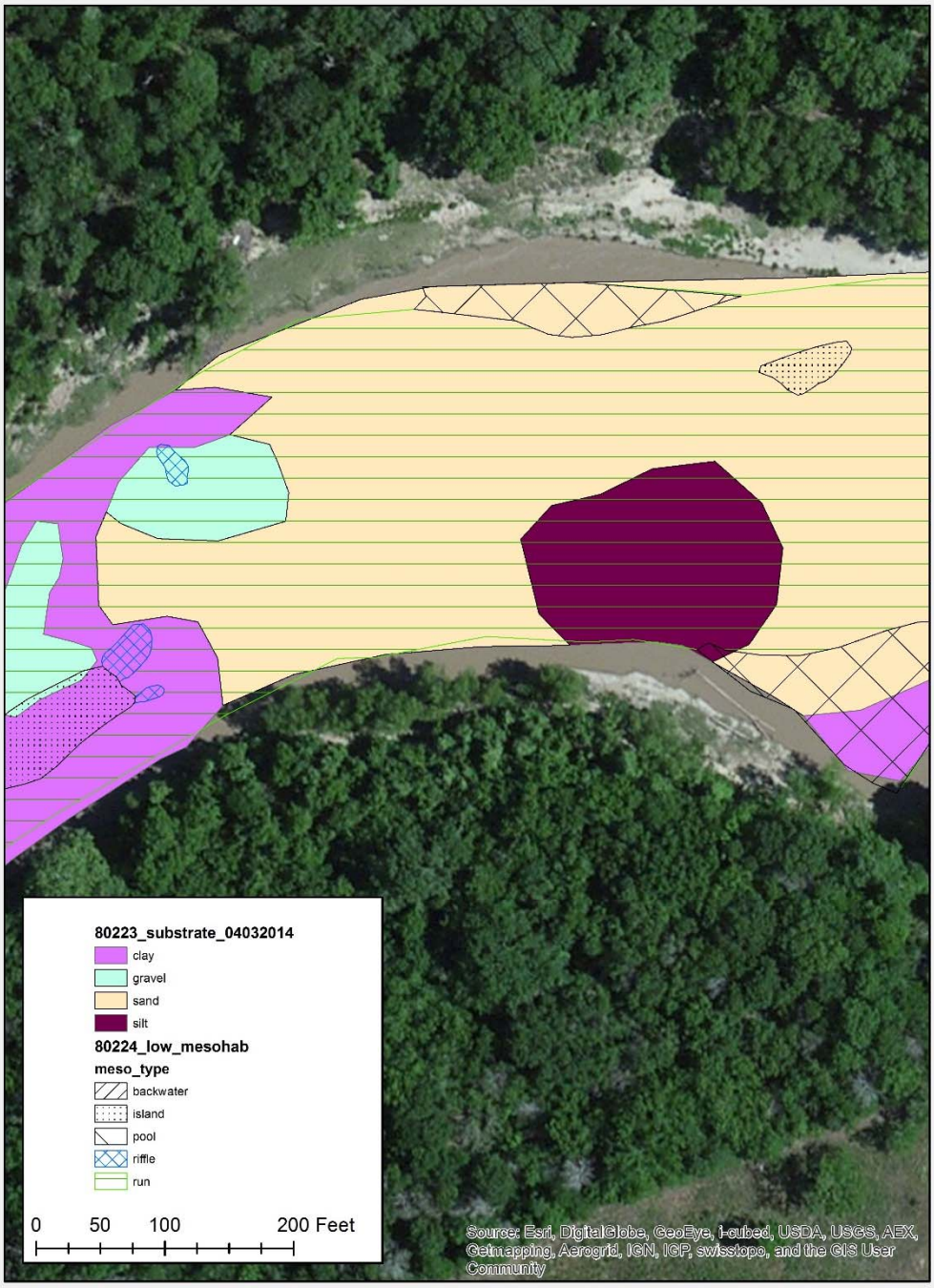

Figure 8. Map of site 080223 showing the mesohabitat overlaid on the substrate mapping.

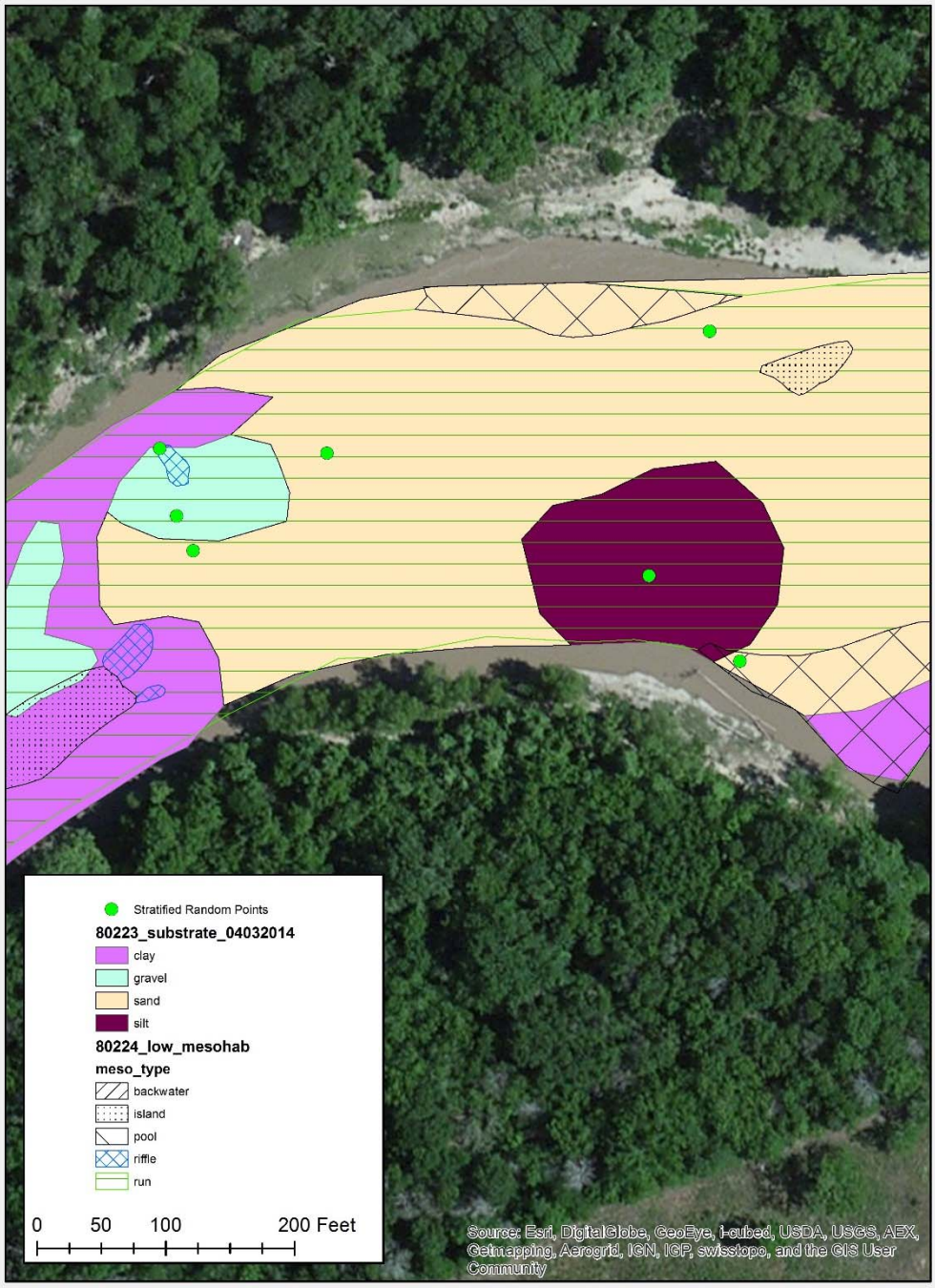

Figure 9. Map of site 080223 showing six of the thirty-four stratified random sampling locations.

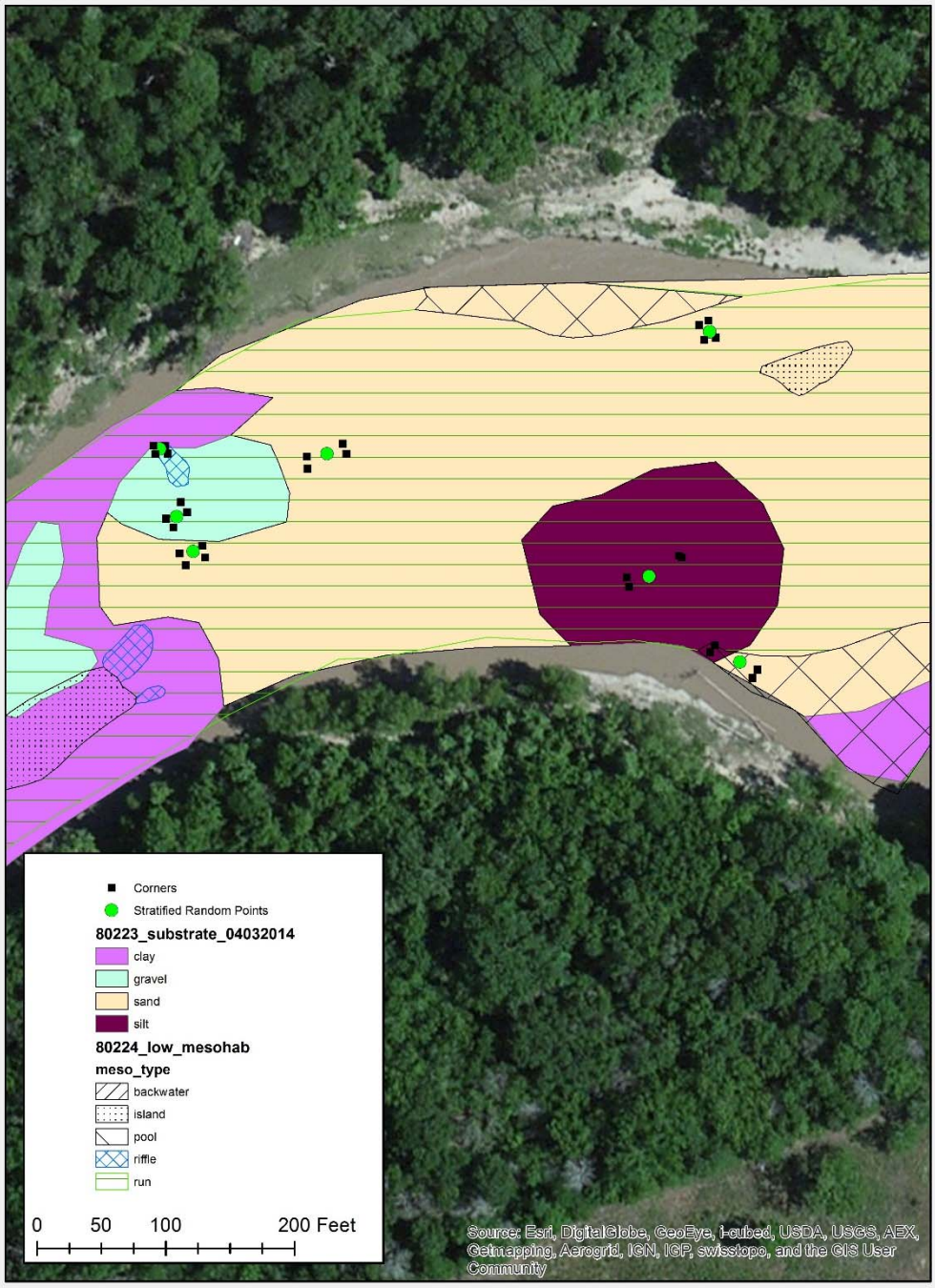

Figure 10. Map of site 080223 showing the sampling locations and box corners where depth, velocity, and field water quality parameters were collected.

Additional specific detail relating to the sampling methodology is thoroughly explained in the breadth of instream flow literature and the following documents specific to Texas instream flow studies:

1. *TIFP Technical Overview* (TWDB, 2008);
2. *Instream Flow Study of the Lower San Antonio River and Lower Cibolo Creek, Interim Progress Report and Instream Flow Recommendations* (TIFP and SARA, 2011); and
3. *Instream Flow Study of the Middle Trinity River, Draft Study Design* (TIFP and TRA, 2014, under review).

All of the processed and quality assured data is outlined in the Field Data Appendix and included in the appropriate electronic format on the accompanying DVD.

Future Data Collection Activities

In the spring of 2015, the north Texas area received historic rainfall which filled many north Texas reservoirs to at or above their flood pool elevations. This extended event caused high flows throughout the basin and significant overland storage in backwaters and sloughs (Figure 11). As of August 1, 2015, reservoir managers continue to release water from the flood pools of north Texas reservoirs. As such, the TIFP was unable to sample in early 2015 and current flows are not expected to return to the TIFP high and low baseflow target levels until after the 2015 fall sampling temperature window closes. As of August 1, 2015, the TIFP and TRA are working to adapt the sampling regime and/or timing of sampling events in order to compete the study by the legislatively mandated deadline of December 1, 2016.

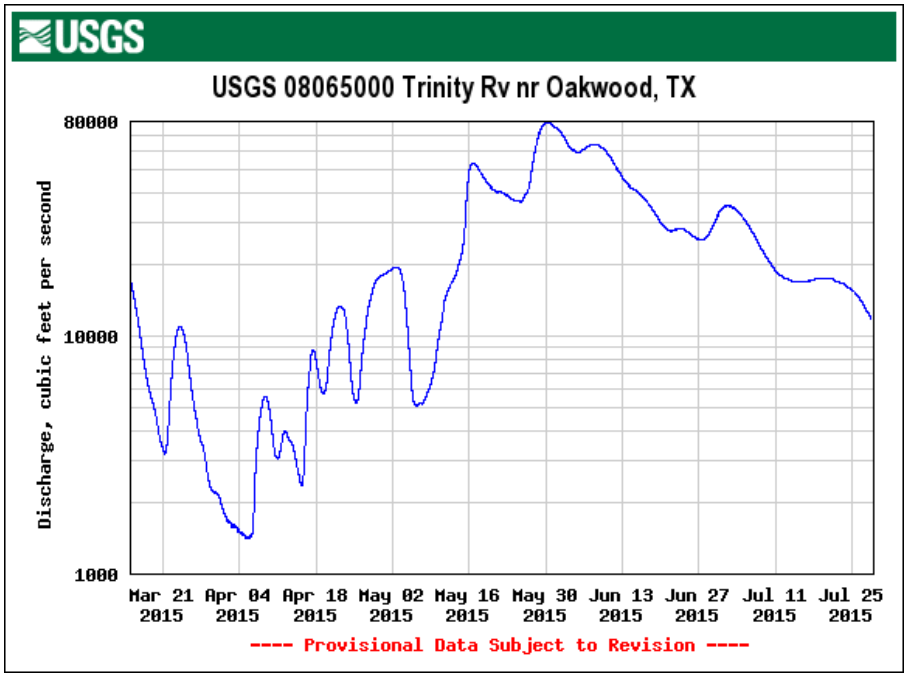

Figure 11. USGS gage at the Trinity River near Oakwood showing extended high flows.

Field Data Appendix

Table 4. Field data appendix description.

Folder	Source	Site	Data Type	Comments
Fish	TPWD	80223	.xls	Processed fish data from the low baseflow event at site 080223
Habitat	TPWD	080223, 080295, 080344, 080423	.shp	Substrate mapping for all sites
Habitat	TPWD	80223	.shp	Mesohabitat, field water quality, hydrology
Water Quality	TCEQ	SH 287, SH 34, US 79/84	.xls	30-day sonde deployments along the Trinity River for water quality model (not tied to specific sites)

See attached accompanying DVD for quality assured and processed data.

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