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VIA EMAIL

April 1, 2022
Revised, September 28, 2022

Lynne Hooper
Urban Hydrologist, Boone County Resource Management (BCRM)
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Subject: Proposal for Hinkson Creek Continuous Water Quality Monitoring

Dear Ms. Hooper:

This revised proposal addresses the clarifications and decisions made regarding the April 1, 2022 proposal submitted by Geosyntec Consultants, Inc. (Geosyntec) to conduct continuous water quality monitoring on Hinkson Creek. The clarifications include selection of the number of stations, duration of monitoring, and coordination with Dr. Zeiger's ongoing water quality monitoring of Hinkson Creek.

INTRODUCTION AND PURPOSE

In 2019, Geosyntec assisted the Hinkson Creek Collaborative Adaptive Management (CAM) process by performing an *Environmental Analysis Study: Hinkson Creek Macroinvertebrate Data Mining Project.* Through this project, Geosyntec identified chloride as an aquatic life stressor in Hinkson Creek. Publicly available water quality data indicate attainment of in-stream chloride water quality standard protective of Missouri's aquatic life. However, based on when historic chloride data were collected and other scientific research, chloride data were not believed indicative of potential elevated concentrations during critical periods (winter season). In addition, chloride concentrations in Hinkson Creek were noted to correlate with instream specific conductance. Therefore, continuous specific conductance is a candidate surrogate for continuous chloride monitoring to characterize frequency, magnitude, duration, and travel time of chloride stressors in Hinkson Creek and its tributaries.

Geosyntec provides this proposal to perform continuous water level, water temperature and specific conductance monitoring at six (6) to be determined Hinkson Creek or tributary stations.

New Solinst Levelogger 5 level, temperature and conductivity (LTC) instrumentation are proposed for continuous monitoring and will become property of the project's funding entity for subsequent use. **Attachment A** includes the specifications of the Solinst Levelogger 5 LTC instrumentation.

SCOPE OF WORK

The following tasks of field reconnaissance, station deployment, monthly station maintenance and data acquisition, instrumentation removal, and project reporting are proposed for monitoring water quality of Hinkson Creek and its tributaries.

Task 1. Reconnaissance

Objective: Geosyntec will visit proposed monitoring station locations to evaluate suitability for instrumentation and the resources (e.g., hardware) for developing semi-fixed continuous water quality monitoring station network in Hinkson Creek or its tributaries.

Activities:

- Document suitability, specific location, and necessary hardware to establish a semi-fixed water quality monitoring station network.
- Evaluate specific conductance variability of the stream cross-sections (distance and depth).
- One (1) meeting with the Hinkson CAM to finalize selected monitoring stations.
- Procure and prepare necessary instrumentation and installation hardware for Task 2.

Deliverables:

- Provide field data and site images for each station evaluated for the Hinkson CAM site selection meeting.

Assumptions

- Prior to reconnaissance, BCRS or Hinkson CAM will select six (6) Hinkson Creek or tributary monitoring stations.
- Budget includes three (3) extra, for a total of nine (9) Solinst Levelogger 5 LTC instruments.
- Recon up to 6 stations in one 8-hour day.
- Two (2) Geosyntec staff per day for station recon.
- New Solinst Levelogger 5 LTC instrumentation will become property of the project's funding entity.

Task 2. Station Installation and Instrumentation Deployment

Objective: In accordance with field reconnaissance data, Geosyntec will deploy six (6) water quality monitoring stations in Hinkson Creek or tributaries with Solinst Levelogger 5 LTC instruments to continuously (every 15-minutes) monitor water temperature, water level and specific conductance. This data collection frequency is consistent with Dr. Zeiger's five (5) monitoring stations in Hinkson Creek.

Activities:

- Calibration of Solinst Levelogger 5 LTC instruments.
- After calibration, compare one (1) Solinst Levelogger 5 LTC instrument to one (1) of Dr. Zeiger's HOBO onset conductivity sensors for confirmation of conductivity values.
- Water quality station installation and instrumentation deployment.

Deliverables:

- If requested, provide field notes and images of each station deployed.

Assumptions:

- Final monitoring station selection will be agreed upon and finalized by BCRM or the Hinkson CAM.
- Data are not transmitted real-time and require manual download (monthly interval).
- Water levels are relative and not established for development of flow rating curve.
- For health and safety purposes, two (2) Geosyntec staff per day of deployment.
- Instrumentation deployment will occur during base flow conditions approximately at the start of the water year (October 1st, 2023).
- Dr. Zeiger or representative will be available for Solinst Levelogger 5 LTC and HOBO onset conductivity sensor comparison.
- Monitoring duration will be three (3) years from deployment.

Task 3. Station Maintenance and Data Acquisition

Objective: Station maintenance (instrumentation cleaning and calibration) and data retrieval from each station will occur monthly. Downloaded data will be compiled in a continuous database for each station.

Activities:

- Monthly station maintenance (cleaning, calibration/checks) and download data.
- Monthly data compilation and review.

- Monthly drift corrections, as applicable; quality assurance and quality control reviews; and data validation.

Deliverables:

- Monthly maintenance (calibration) data sheets will be provided.
- Quarterly summary report will be provided per station.

Assumptions:

- Maintain up to six (6) stations in an 8-hour day.
- Replacement of instruments stolen or damaged from vandalism or flooding will be the responsibility of the funding entity.

Task 4. Station Removal

Objective: Removal of water quality monitoring instrumentation and installation hardware.

Activities:

- Equipment removal and restoration of site to pre-existing conditions.

Deliverables:

- No deliverable associated with station removal.

Assumptions:

- Remove up to six (6) monitoring stations in an 8-hour day.

Task 5. Project Reporting and Management

Objective: Database and PowerPoint presentation to the Hinkson Creek CAM summarizing continuous water quality (temperature, level, and specific conductance) data collected.

Activities:

- Final raw and validated database.
- Summary of water quality parameters data statistics for the period of monitoring.
- Quarterly and annual timeseries figures of water quality parameters.
- PowerPoint presentation to the Hinkson CAM.
- Monthly project management.

Deliverables:

- PowerPoint presentation to Hinkson CAM.
- Raw and validated (formulas/code removed) database.

Assumptions:

- One (1) Hinkson CAM PowerPoint presentation.
- Electronic water quality database transmittal.

SCHEDULE

The project will be performed starting approximately October 1, 2023, for a duration of three (3) years.

PROJECT SUMMARY ESTIMATE

The estimated cost to complete the proposed scope of work is **$124,500** This estimate was developed using projected labor rates and direct costs. Geosyntec has attempted to provide this as a not-to-exceed estimate; however, it may be modified at the time of contracting due to unforeseen circumstances. The project work will be conducted on a time-and-materials basis.

Should you have any questions, please contact Cody Luebbering.

Sincerely,
Geosyntec Consultants

Cody Luebbering

Cody Luebbering
Senior Scientist

ATTACHMENTS

A: Solinst Levelogger 5 LTC Specifications
B: Example Water Quality Calibration Sheet and Instrumentation Servicing Sheet

Levelogger 5 LTC

Level, Temperature, Conductivity

The Levelogger® 5 LTC logs water level, temperature, and conductivity. It combines a datalogger, 8-year battery, Hastelloy® pressure sensor, temperature detector, and conductivity sensor within a small waterproof housing, 22 mm x 208 mm (7/8" x 8.2"). A baked-on coating using polymerization technology protects the body against corrosion, abrasion and high temperatures. The conductivity sensor is a 4-electrode platinum sensor, with autoranging capabilities. The minimal-maintenance, sealed Levelogger 5 LTC is simple to clean and calibrate, even in the field.

Level Sensor:	Piezoresistive Silicon with Hastelloy Sensor
Ranges:	5, 10, 20, 30, 100, and 200 m
Accuracy:	±0.05% FS
Resolution:	0.001% FS to 0.0006% FS
Units of Measure:	cm, m, ft, psi, kPa, bar (°C, °F)
Normalization:	Automatic Temperature Compensation
Temp Comp. Range:	0°C to 50°C
Temperature Sensor:	Platinum Resistance Temperature Detector (RTD)
Accuracy:	±0.05°C
Resolution:	0.003°C
Conductivity Sensor:	4-Electrode Platinum
Full Range:	0 – 100,000 µS/cm
Calibrated Range:	50 – 80,000 µS/cm
Accuracy:	±1%: 5,000 µS/cm – 80,000 µS/cm; greater of ±2% or 15 µS/cm: 50 µS/cm –5,000 µS/cm
Resolution:	±0.1 µS/cm
Temp Comp. Range:	0°C – 50°C
Normalization:	Specific Conductance @ 25˚C
Battery Life:	8 Years (1 reading every 5 minutes)
Clock Accuracy (typical):	±1 minute/year (-20°C to 80°C)
Operating Temperature:	-20°C to 80°C
Maximum Readings:	100,000 sets of readings
Memory:	Slate or Continuous
Communication:	Optical high-speed: 57,600 bps with USB
Size:	22 mm x 208 mm (7/8" x 8.2")
Weight:	197 grams (6.95 oz)
Corrosion Resistance:	Baked-on coating using polymerization
Wetted Materials:	Platinum, Delrin®, Viton®, 316L Stainless Steel, Hastelloy, Regulator approved PFAS-free PTFE (inside and out)
Sampling Mode:	Linear, Event & User-Selectable with Repeat Mode, Future Start, Future Stop, Real-Time View
Measurement Rates:	2 seconds to 99 hours
Barometric Compensation:	Software Wizard and Barologger 5

Get Quote

LTC Models	Full Scale (FS)	Accuracy	Resolution
M5, C80	5 m (16.4 ft.)	± 0.3 cm (0.010 ft.)	0.001% FS
M10, C80	10 m (32.8 ft.)	± 0.5 cm (0.016 ft.)	0.0006% FS
M20, C80	20 m (65.6 ft.)	± 1 cm (0.032 ft.)	0.0006% FS
M30, C80	30 m (98.4 ft.)	± 1.5 cm (0.064 ft.)	0.0006% FS
M100, C80	100 m (328.1 ft.)	± 5 cm (0.164 ft.)	0.0006% FS
M200, C80	200 m (656.2 ft.)	± 10 cm (0.328 ft.)	0.0006% FS

Upgraded Features

- Increased memory: 100,000 sets of data
- More stable communication: single-eye optical, easy to clean, more scratch resistant
- Stronger, robust design: double o-ring seals for two times over pressurization rating
- Better thermistor and conductivity sensitivity: upgraded platinum RTD and conductivity sensor
- Superior protection in harsh conditions: baked-on coating using polymerization—inside and out

User-Friendly Operation

Software Calibration and Data Wizards guide you through conductivity calibration and barometric compensation, ensuring accurate data sets. The Data Wizard also converts conductivity readings to Specific Conductance (@ 25°C).

Levelogger Software allows you to easily program your preferences, download data, and display data in a graph or table format or export to other programs. Real Time View allows immediate viewing of live water level, conductivity, and temperature readings.

Leveloggers are easy to deploy; install with direct read cables or wireline/cord suspension. The Levelogger 5 LTC is SDI-12 compatible using the Solinst SDI-12 Interface Cable.

Download data in the field using the new Field Reader 5, DataGrabber 5 USB data transfer device, or through *Bluetooth*® using the Levelogger 5 App Interface and your smart device. Integrate the Levelogger 5 LTC with Solinst Telemetry Systems, which use the latest wireless technologies.

Levelogger 5 LTC Applications

- Salt water intrusion and soil salination monitoring
- Plume remediation monitoring and studies
- Leachate monitoring at landfills, mine tailings, waste disposal storage sites, and more
- Agricultural and stormwater runoff monitoring
- Create a historical database for potable water supply monitoring
- Tracer tests

Biofoul Screen

When a Levelogger 5 LTC is deployed for an extended period, there is the risk of biofouling on the pressure sensor and/or conductivity cell, which can compromise their readings.

The Biofoul Screen is designed to reduce the unwanted buildup of microorganisms, plants, algae, or organisms such as barnacles and mussels, on the sensors. The Biofoul Screen consists of a Delrin sleeve wrapped with copper wire. Slip onto the sensor end of a Levelogger 5 LTC, where it is held in place by compression fit.

Using the natural anti-fouling characteristics of copper, the Biofoul Screen is an affordable option to lengthen the time a Levelogger 5 LTC can be deployed. It reduces site visits and time spent cleaning Leveloggers, and improves long-term performance by ensuring accurate sensor measurements.

An optional Biofoul Screen provides extra protection for the Levelogger 5 LTC pressure and conductivity sensors in harsh environments.

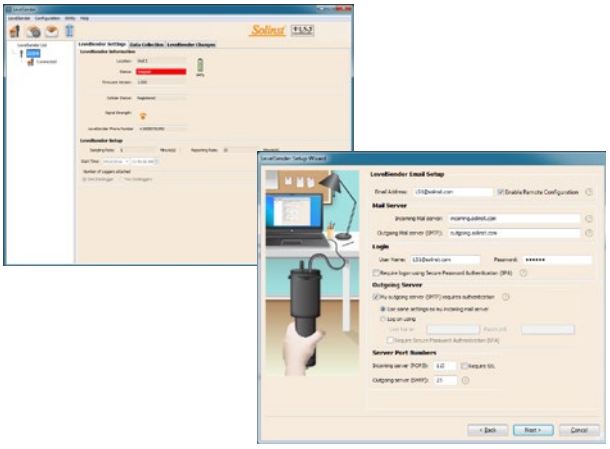
Levelogger 5 App Interface

The Solinst Levelogger App is designed to communicate to Solinst dataloggers via your smart device. Programming options include start/stop, data downloading, linear and real-time sampling, future start/stop, and GPS coordinates.

The Levelogger 5 App Interface uses Bluetooth wireless technology to connect with your smart device running the Solinst Levelogger App. Use our Levelogger 5 App Interface and a Solinst direct read cable to communicate to a downhole Levelogger and email data files right from the field (see Model 3001 Solinst Levelogger 5 App Interface data sheets).

Download on the App Store

GET IT ON Google play



LevelSender 5 Telemetry System

Instantly add cellular telemetry to your Levelogger 5 LTC by connecting to a Model 9500 LevelSender 5. Send data by email or SMS from your remote stations to your desired location. The LevelSender 5 simplifies your telemetry setup, by working with Solinst direct read cables and is compatible with the full Levelogger Series product line (see Model 9500 LevelSender 5 data sheet).

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Water Quality Servicing Data Sheet

Sampling Site: _____
Date: _____

General Information	
Arrival Time: **Departure Time:**	**Barometric Pressure (mmHg):** **Last Site Visit:**
Weather:	**Field Crew Members (name):**
Temp (F) (approx.): **Water Depth (ft) (approx.):**	

Site Information

Sonde Readings	Time	Spec. Cond. (uS/cm)	Water Temp. (°C)	DO (mg/L)	DO %	pH
Field Sonde Reading at Time of Arrival						
QA Sonde Readings						
Field Sonde Reading After Cleaning						
Field Sonde Last Three Logged Readings						
Field Sonde Calibration Reading				Initial DO %	Cal DO %	
Field Sonde Post Calibration Reading						
QA Sonde Readings						

Batteries Replaced: Y N	Voltage:
Sonde Logging Active: Y N NA	
Sonde & Probe Condition:	
Run Mode Exited before Sonde Was Disconnected? Y N NA	Field Crew Initials:
Was Unit Running? Y N NA	
Comments:	

Water Quality Instrumentation Calibration Log

Project Name:

Calibration Prior to Field Activities Handset Model _____ Handset ID # _____

Date: Time: Sonde Model _____ Sonde ID # _____

Person performing calibration:

	Equipment	Standard Solution	Temperature (°C)	Initial Reading	Final Reading	Units
Dissolved Oxygen	YSI	100.0				% saturation
SP Conductivity	Solinst	1.413				mS/cm
pH (1st point - 7.0)*	YSI	7.0 / 0.0 (±50)				pH/mV (0 ±50)
pH (2nd point - 10.0)*	YSI	10 / -180 (±50)				pH / mV = Δ 155 - 180 of pH 7.0

DO Gain:

YSI barometric pressure reading at time of calibration:

End of Day Testing After Completion of Field Activities

Date: Time: YSI barometric pressure reading at time of check:

Personnel performing testing:

	Equipment	Standard Solution	Temperature (°C)	Reading	Difference between standard and reading	Acceptable Range	Units	Out of Range (Y or N)
Dissolved Oxygen	YSI	100.0				90.0-110.0	% saturation	
SP Conductivity	Solinst	1.413				1.342-1.484	mS/cm	
pH (1st point - 7.0)	YSI	7.00				6.8-7.2 / 0.0 ±50	SU	
pH (2nd point - 10.0)	YSI	10.00				9.8-10.2 / Δ 155 - 180 of pH 7.0	SU	

	Standards Lot #	Exp. Date
pH 7.0		
pH 10.0		
SP Conductivity		