TECHNICAL MEMORANDUM

To: Sarah Garza - Port of Corpus Christi Authority

Date: June 24, 2021

From: Parsons Environment and Infrastructure, Inc.

Cc: Earnest Wotring, John Muir, Esqs.; Baker Wotring, LLP

Subject: Field Sampling Technical Memorandum for Port of Corpus Christi Draft TPDES Permit No. WQ0005253000

Introduction

The Texas Commission on Environmental Quality (TCEQ) issued an Interim Order on May 26, 2021 in the matter of the Application of the Port of Corpus Christi Authority of Nueces County (Applicant) for a Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0005253000 and related Proposal for Final Decision (PFD). As a result of this interim order Parsons Environment & Infrastructure (Parsons) was contracted to collect site specific ambient velocity, bathymetry, and water quality data related to this application and draft TPDES permit. This Technical Memorandum details the findings from water velocity, bathymetry, and water quality data collected during the week of June 7 to June 10, 2021.

The following sections describe the goals, tasks and summary of this data collection.

Summary of Tasks Performed

The goal of this assessment is to provide additional site-specific data to TCEQ related to the permit application and draft TPDES permit listed above. The data collection included the following investigations:

- Water depths (Bathymetry) in the vicinity of the proposed discharge location,
- Vertical-downward-looking Acoustic Doppler Current Profiler (ADCP) transects at 5 locations across the Corpus Christi Ship Channel in the vicinity of the proposed discharge location,
- Horizontal-looking ADCP velocity collection focused in the “deep hole” and the proposed discharge area,
- Assessment of tide level including collection of local data and incorporation of NOAA tide data,
- Water quality sample collection of routine field parameters such as pH, water temperature, conductivity, and dissolved oxygen in the area of the proposed discharge location,
- Water quality sample collection of routine field parameters such as pH, water temperature, conductivity, and dissolved oxygen in the area of the proposed intake,
- Water quality sample collection in the area of the proposed intake location for parameters listed in the permit application, as applicable.

Study Area

The study area is a portion of the Corpus Christi Ship Channel between Harbor Island and Port Aransas, part of Segment 2481 (Corpus Christi Bay) listed in Texas Surface Water Quality Standards. The Corpus Christi Ship Channel is an approximately 34-mile-long channel between the Corpus Christi Inner Harbor and the Gulf of Mexico. It is currently dredged to a minimum depth of 47 feet. In the study area, the dredged portion of the channel varies in width but is approximately 600 feet wide, and the total width is approximately 1200 feet. The proposed discharge from the desalination facility is on the north side of the channel (Harbor Island) at the location of a former Tank Terminal Facility. The tank farms have been removed and the area is now vacant. A bathymetric “deep hole” with a maximum depth of approximately 95 feet occurs on the south (channel) side of the proposed discharge location. The proposed water intake for the desalination facility is in the Gulf of Mexico on the north side of the north jetty. Figure 1 shows the waterway, land masses, proposed intake and proposed discharge locations.

FIGURE 1. STUDY AREA

Investigation Methods

The field investigation was conducted Monday, June 7, 2021 to Thursday, June 10, 2021 by staff from Parsons and T. Baker Smith, L.L.C., who provided and operated the survey vessel, collected bathymetry data, and installed the fixed horizontal ADCP. Parsons staff deployed and operated the ADCPs and tide gage as well as collected water quality measurements and samples at the proposed intake location in the Gulf of Mexico.

The meteorological conditions were typical for the area in June, with winds from the south-southeast at 5 to 15 knots and daytime air temperatures from 81 to 88 degrees Fahrenheit. Freshwater inflows to the bay system had recently been elevated due to 2.1 inches of rain in the previous week and 10.83 inches in May (at Corpus Christi). Daily flows in the

Nueces River at Calallen peaked at 700 cubic feet per second (cfs) on June 5, but declined to 40 to 50 cfs from June 7 to June 10. The long-term average flow at this gage in June is 301 cfs.

Table 1. Meteorological Summary at Port Aransas, TX

		June 7	June 8	June 9	June 10
High Temp	Degrees F	87	87	88	87
Low Temp	Degrees F	82	81	81	81
Precipitation	Inches	0.00	0.00	0.00	0.00
Max Wind Speed	Miles/Hour	21	20	18	17

Source: https://www.wunderground.com/history/daily/us/tx/port-aransas/KRAS/

SURVEY DATA

The survey was conducted in the Texas State Plane Coordinate System North American Datum of 1983 (NAD 83), Texas South Zone. The vertical datum was NAVD 88. The hydrographic data was collected and processed using HYPACK software. Real time kinematic global positioning system (GPS-RTK) survey equipment was used for positioning and tide corrections. A single-beam echo sounder at a nominal frequency of 200kHz was used to perform the bathymetric survey of the sea floor in the survey area. The echo sounder calibration, including bar check, was verified using manual lead line measurements on site. The data was later reduced to a spacing of 10 feet along transects.

WATER VELOCITY MEASUREMENTS

Two Acoustic Doppler Current Profilers (ADCPs) were employed to measure water velocities in the study area. An ADCP is a hydroacoustic current meter, similar to sonar, that measures water current velocities over a depth range using the Doppler effect of sound waves scattered back from particles within the water column. The term ADCP is used synonymously for all kind of acoustic current meters, although the abbreviation originates from the name of an instrument series developed by Teledyne. ADCPs contain multiple piezoelectric oscillators to transmit and receive sound signals. The traveling time of sound waves gives an estimate of the distance, and the frequency spectral shift can then be converted to a velocity. In order to measure 3-dimensional velocities at least three vector components have to be estimated. A micro-processor evaluates the sound velocity at the instrument position using the water equation of state based on integrated temperature and pressure sensors and user-supplied salinity to estimate the velocities and create an acoustic Doppler Velocity Log.

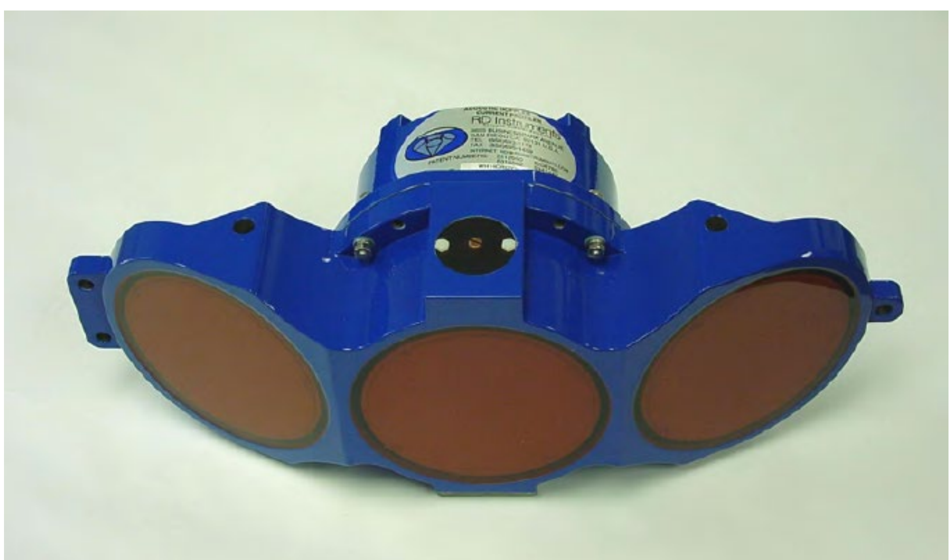


FIGURE 2. HORIZONTAL ADCP

Two kinds of ADCPs were utilized in this study. A Teledyne RD Instruments Workhorse Horizontal 300 kHz ADCP was mounted in a fixed position at roughly 5 feet deep on a piling near the north bank and aimed south-southwest across the “deep hole” and channel. The ADCP was also oriented downward at an angle of 8.3 degrees to avoid surface interference from vessels. The measurement range extended from 4 meters to 204 meters from the ADCP. The signals were time-averaged for 60 seconds per reported reading in 50 distance “bins” of 4 meters each. High waves and currents prevented safe installation of the fixed horizontal ADCP in the vicinity of the discharge location until the afternoon of June 8. This fixed horizontal ADCP was then operated continuously with a battery pack and internal data storage for approximately 48 hours from June 8th to June 10th. Horizontal ADCP data were collected by and processed using WinH-ADCP software (Teledyne RD Instruments, Poway, California).

A second ADCP, a Teledyne RD Instruments Workhorse Sentinel 600 kHz ADCP was mounted in a downward-looking vertical position on an aluminum post attached to the side of the survey boat. For vertical boat-mounted ADCPs, sound waves bouncing off the streambed are used to determine the velocity vector of the device transducer over the bottom. Combining this with a compass heading and data from the acceleration sensors (typically by use of a Kalman Filter), the relative position of the ADCP transducer can be determined in a process referred to as "bottom-tracking". To collect velocity measurements, the boat was navigated slowly along transects across the channel, perpendicular to the water flow path. The ADCP measures the water depth, northing and easting components of the current velocity vector and the vertical component for numerous "ensembles" or vertical profiles averaged each second as the boat travels along the transect. Approximately 350 ensembles comprise a typical transect. Each ensemble can also be subdivided vertically into horizontal "bins" of 0.5 m vertical thickness. The individual ensemble and bin velocities can be spatially averaged, weighted by bottom track distance traveled and total depth, to produce a composite average channel velocity and flow estimate. It should be mentioned that the water velocity is not measured in approximately the upper 1 meter nor the lower 2-3 meters of the water column, nor do transects extend to shallow near-bank areas. Water velocities in these margins are estimated in the data processing software based on pre-established power functions. Fortunately, these margins represent only a minor portions of the overall channel cross-sectional area.

FIGURE 3. BOAT-MOUNTED (DOWN-LOOKING) ADCP

For the boat-mounted ADCP, five primary transect locations were established, as shown in Figure 4. Transect 1 extended through the channel "deep hole". Transects 2 and 4 were approximately 200 feet upstream and downstream, respectively, of transect 1. Transect 3 was approximately 300 feet downstream of transect 2. Transect 5 was approximately 200 feet upstream of transect 4. Here, upstream is used to indicate the direction towards Corpus Christi Bay, and downstream indicates direction toward the Gulf of Mexico. Current profiles were measured along transects two or three times each day over the four-day study period, including a variety of tide conditions. Current data were collected by and processed using WinRiver II software (Teledyne RD Instruments, Poway, California).

TIDE LEVEL MEASUREMENTS

An In Situ Troll 700 water level data-logger was installed near the north bank to continuously record pressure (water depth) and water temperature. This data provided water level measurements during the study at the discharge location.

WATER QUALITY SAMPLING AND MEASUREMENTS

Water quality vertical profiles were collected each day at the "deep hole" adjacent to the proposed discharge location. These measurements were collected using a YSI (Yellow Springs Instruments) Model 6920 multi-parameter water quality sonde. The YSI sonde was calibrated before use each day following manufacturer's recommended procedures for dissolved oxygen, pH and specific conductance. Before each use, the device was turned on, the protective cage was installed and the unit was allowed to acclimate the sensors in ambient water. The sonde was then deployed to a safe near-bottom depth, leaving greater than or equal to 5-feet of space between the sonde and the substrate bottom to prevent the sensors from being affected by or fouled by the substrate material. The sonde measurements were allowed to reach a steady state and measurements were documented. The sonde was then raised 5-feet and another round of measurements were documented when a steady state was measured. This was continued towards the water surface in 5-foot increments. The sonde was stored in the shade with the water-tight cup installed (the collection cage was removed) with water in the cup to maintain a moist environment for probe care.

The vessel was kept in position over the sampling point, with continuous monitoring of the water depth and in a manner to minimize horizontal vector of the sonde cable/sonde position (maintaining the sonde directly under the bow of the vessel).

Water quality vertical profiles were also collected at the proposed intake location each day that water sampling was performed (June 9 and 10). The procedure was the same as for in the deep hole (above).

Because the YSI was initially mistakenly shipped with only a 30-foot cable, the vertical profiles collected on June 7 and 8 only extend to that depth. After a 100-foot cable was received, the profiles on June 9 and 10 extended to the bottom of the deepest areas adjacent to the proposed discharge location. Also note that the waves in the Gulf were too high to access the intake location on June 7 and 8, thus no water quality measurements were collected those days.

Water quality grab samples were collected at the intake location on June 9 and June 10. Significant waves were still present on these days but to a lesser extent than June 7 and 8. Quality control samples for field blanks and field duplicate samples were also collected for quality control purposes.

The sample location GPS target coordinates was verified using the vessel's Trimble GeoXT GPS unit coordinates. Water depth was measured with a weight and rope line and verified with the boat's calibrated water depth transducer. Samples were collected using a 12-volt battery-powered peristaltic pump with new tubing for each day's sample collection. The tubing intake was positioned at half of the total water depth to keep the tubing intake away from the bottom and to get a representative sample of the water column. A small rigid plastic-coated weight was securely zip-tied 3-feet above the tubing intake to keep the intake end at mid water column depth. Due to high winds and large waves, the boat motor had to be run continuously to hold position while sampling.

The sample team donned a pair of new, clean, powder-free laboratory-grade nitrile gloves for each person before sampling activities. Volatile sample vials were filled first, with no headspace. Low level metals samples were collected next using the "clean hands – dirty hands" procedure. The sample tubing was firmly clamped to the boat railing to provide a constant stream of water flowing with no need to turn a pump off/on and no need to hold the tubing discharge end. Both team members donned two pair of new, clean, powder-free laboratory-grade nitrile gloves. Dirty hands only touched and opened the zip-lock bags. Clean hands only touched the sample containers, filled them and closed the lids. All remaining sample jars were filled by both samplers wearing new, clean, powder-free laboratory-grade nitrile gloves.

Sample labels were completed and samples were immediately placed in coolers on ice. Chain of Custody forms were filled out and secure custody of the samples was maintained thru receipt of the samples at the analytical laboratory. Samples for chemical analysis were shipped via overnight courier to ALS Labs in Houston, Texas and Holland, Michigan.

Results

BATHYMETRY AND CURRENT VELOCITY

Figure 4 illustrates the measured bathymetric survey. Results were generally consistent with and within 0.5 feet of previous surveys.

Figure 5 illustrates the results of the fixed horizontal ADCP and the tide gage. Note that this ADCP measures both horizontal (upstream/downstream) velocities and vertical (up/down) velocities. The horizontal velocities are much larger than the vertical and ranged between +1.25 m/s and – 1.2 m/s. The horizontal velocities are of primary interest. These velocities represent the average channel velocity over the roughly 200-meter portion of the channel measured by this ADCP. For comparison purposes, the figure also displays the point-in-time average velocity measurements from transects by the boat-mounted ADCP. It indicates excellent agreement between fixed and boat-mounted ADCP velocity measurements.

Figure 6 offers a comparison of ADCP velocity measurements (both boat-mounted and fixed) from this study with nearby ADCP measurements retrieved from the National Oceanic and Atmospheric Administration website (https://tidesandcurrents.noaa.gov). One ADCP (station cc0601) is mounted on a pier at the University of Texas Marine Science Institute Fisheries and Marine Lab, west of the Texas Department of Transportation ferries, and its beam extends a reported 130 meters from the south shore at a depth of 4.5 meters. The second ADCP (station cc0301) is located downstream, in the Aransas Pass main channel (closer to the Gulf of Mexico) and its beam extends about 90 meters from the west shore and at a depth of 3.9 meters. The velocities measured in this project agreed very well with those measured upstream of the ferries. Agreement with the downstream ADCP in Aransas Pass was also strong, though higher peak velocities were noted there, probably due to channel dimensions and additional sources of flow such as Aransas Bay.

Table 2 provides a summary of ADCP current profile measurements for each transect. Depictions of the currents measured in each individual transect are included in Appendix A. Bad ensembles and bins were typically caused by loss of bottom tracking due to vessel pitch and roll; they show as white space for missing data in the profiles. Transects with less than 20% data loss were deemed acceptable.

Table 2. Summary of Boat-Mounted ADCP Velocity Measurements Transects

End Date/Time	Transect	Velocity (m/s)	Bad Ensembles (%)	Bad Bins (%)	Total Flow (m^3/s)	Cross-Section Area (m^2)
6/7/21 13:34	1	0.194	0.00%	0.56%	1,077	5,798
6/7/21 13:40	1	0.199	0.00%	0.67%	1,067	5,761
6/7/21 13:48	2	0.194	0.20%	0.20%	1,253	6,277
6/7/21 13:55	2	0.223	0.00%	0.63%	1,340	6,380
6/7/21 14:03	3	0.223	1.26%	1.24%	1,432	6,339
6/7/21 14:08	3	0.245	2.98%	1.11%	1,442	6,370
6/7/21 14:19	4	0.303	1.19%	0.45%	1,617	5,691
6/7/21 14:23	4	0.312	2.61%	1.52%	1,652	5,670
6/7/21 14:31	5	0.329	0.00%	0.78%	1,708	5,368
6/7/21 14:37	5	0.345	0.60%	0.30%	1,766	5,419
6/7/21 16:41	5	0.632	5.65%	7.04%	3,382	5,330
6/7/21 16:46	5	0.659	7.96%	1.17%	3,426	5,490
6/7/21 16:52	4	0.669	7.40%	2.85%	3,469	5,641
6/7/21 16:55	4	0.680	3.49%	1.68%	3,507	5,594
6/7/21 17:03	1	0.651	5.12%	3.32%	3,567	5,715
6/7/21 17:07	1	0.674	4.24%	1.87%	3,578	5,934
6/7/21 17:14	2	0.628	3.06%	1.76%	3,591	6,193
6/7/21 17:18	2	0.674	2.21%	1.36%	3,619	6,220
6/7/21 17:24	3	0.585	4.39%	0.96%	3,609	6,073
6/7/21 17:27	3	0.702	1.19%	0.29%	3,772	6,032
6/8/21 8:13	5	-0.570	0.00%	0.08%	(2,842)	5,242
6/8/21 8:17	5	-0.569	0.00%	0.17%	(2,898)	5,492
6/8/21 8:23	4	-0.490	0.00%	0.33%	(2,666)	5,675
6/8/21 8:28	4	-0.514	0.00%	0.22%	(2,731)	5,601
6/8/21 8:34	1	-0.502	0.00%	0.70%	(2,604)	5,780
6/8/21 8:39	1	-0.423	0.00%	2.00%	(2,413)	5,676

End Date/Time	Transect	Velocity (m/s)	Bad Ensembles (%)	Bad Bins (%)	Total Flow (m^3/s)	Cross-Section Area (m^2)
6/8/21 8:47	2	-0.420	0.00%	0.00%	(2,312)	5,850
6/8/21 8:52	2	-0.425	0.00%	0.00%	(2,328)	5,857
6/8/21 9:18	3	-0.380	1.93%	0.00%	(1,903)	5,913
6/8/21 9:22	3	-0.367	0.00%	0.00%	(1,906)	5,827
6/8/21 13:16	5	0.187	0.00%	0.00%	938	5,162
6/8/21 13:20	5	0.190	1.58%	3.00%	938	5,212
6/8/21 14:48	2	0.299	9.38%	0.17%	2,002	6,276
6/8/21 14:56	2	0.381	4.61%	0.18%	2,199	6,277
6/8/21 15:03	3	0.401	1.23%	1.84%	2,169	6,108
6/8/21 15:09	3	0.393	3.74%	0.14%	2,182	5,826
6/8/21 15:17	4	0.464	2.43%	0.05%	2,411	5,584
6/8/21 15:25	4	0.482	1.35%	0.16%	2,492	5,591
6/8/21 15:31	1	0.477	6.49%	0.34%	2,525	5,852
6/8/21 15:49	1	0.480	2.80%	0.00%	2,671	5,532
6/9/21 11:00	5	-0.232	0.00%	0.14%	(1,210)	5,519
6/9/21 11:05	4	-0.241	0.24%	0.31%	(1,203)	5,592
6/9/21 11:11	1	-0.207	5.64%	0.41%	(1,200)	5,771
6/9/21 11:17	2	-0.174	0.64%	0.47%	(899)	6,178
6/9/21 11:22	2	-0.171	1.23%	0.27%	(824)	6,139
6/9/21 11:33	3	-0.160	1.55%	0.58%	(852)	5,962
6/9/21 13:57	3	0.101	0.57%	1.04%	595	6,156
6/9/21 14:03	2	0.139	0.26%	0.87%	836	6,203
6/9/21 14:07	1	0.155	5.57%	0.42%	852	5,714
6/9/21 14:15	4	0.189	0.83%	0.50%	983	5,602
6/9/21 14:20	5	0.178	1.23%	0.25%	933	5,356
6/9/21 15:23	5	0.342	5.12%	1.08%	1,751	5,437
6/9/21 15:30	4	0.350	3.85%	1.20%	2,010	6,055
6/9/21 15:47	1	0.386	14.14%	15.72%	2,270	5,339
6/9/21 15:52	2	0.347	9.62%	17.03%	1,980	6,305
6/9/21 15:58	3	0.409	7.25%	6.02%	2,369	6,038
6/10/21 12:15	3	-0.252	0.48%	1.20%	(1,316)	6,116
6/10/21 12:19	2	-0.262	14.84%	0.74%	(1,483)	6,353
6/10/21 12:27	1	-0.264	0.49%	0.90%	(1,216)	6,041
6/10/21 12:32	4	-0.261	0.28%	0.31%	(1,117)	5,632
6/10/21 12:37	5	-0.238	1.10%	0.52%	(1,237)	5,451
6/10/21 14:34	5	0.080	2.26%	0.23%	416	5,453
6/10/21 14:38	4	0.090	0.36%	0.39%	465	5,666
6/10/21 14:43	1	0.109	0.29%	0.14%	578	5,784
6/10/21 14:50	3	0.115	0.00%	0.45%	653	6,196
6/10/21 14:55	2	0.144	0.00%	0.34%	827	6,291

FIELD PARAMETERS

Tables 3 and 4 present water quality field parameters measured from June 7 to 10 for the proposed discharge location and intake location, respectively.

Table 3. Field Water Quality Profile Measurements from Deep Hole near the Proposed Discharge Location

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
6/7/2021 15:15 - Flow toward GOM at ~ 0.4 m/s (5 hours since flow reversal)						
	5	8.08	27.10	5.27	44,080	28.52
	10	8.04	26.80	5.27	44,800	29.04
	15	8.04	26.80	5.20	45,400	29.47
	20	8.01	26.56	4.74	45,400	29.47
	25	8.00	26.30	4.42	45,450	29.51
	29	8.01	26.50	4.47	45,485	29.54
6/7/2021 17:36 - Flow toward GOM at ~ 0.9 m/s (7.3 hours since flow reversal)						
	5	8.23	27.70	5.77	44,175	28.59
	10	8.19	27.50	5.61	44,444	28.78
	15	8.18	27.50	5.45	44,570	28.88
	20	8.14	27.30	5.23	44,600	28.90
	25	8.14	27.20	5.23	44,400	28.75
	30	8.13	27.10	5.13	44,700	28.97
6/8/2021 10:48 - Flow toward CC Bay at ~ 0.26 m/s (9.7 hours since flow reversal)						
	5	7.86	25.80	3.65	47,350	30.88
	10	7.86	25.50	3.30	47,998	31.35
	15	7.84	25.30	2.76	49,353	32.33
	20	7.83	25.20	2.60	50,090	32.86
	25	7.83	25.10	2.49	50,020	32.81
	30	7.83	25.10	2.44	50,218	32.95
6/8/2021 15:35 - Flow toward GOM at 0.58 m/s (4 hours since flow reversal)						
	5	8.04	27.00	5.74	48,070	31.40
	10	8.03	27.10	5.37	48,200	31.50
	15	8.02	27.00	5.33	48,380	31.63
	20	7.99	26.80	4.82	48,729	31.88
	25	7.99	26.70	5.00	48,339	31.60
	30	7.96	26.60	4.63	48,651	31.82
6/9/2021 11:43 - Flow toward CC Bay at 0.25 m/s (11.3 hours since flow reversal)						
	5	8.02	27.21	3.38	44,033	28.49
	10	8.01	27.02	2.48	42,321	27.25
	15	8.00	26.93	2.79	42,425	27.33
	20	7.99	26.92	2.70	41,978	27.00
	25	7.99	26.72	2.68	43,661	28.22
	30	7.97	26.23	2.47	44,658	28.94

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
	35	7.94	26.23	2.93	41,972	27.00
	40	7.94	26.18	2.81	45,033	29.21
	45	7.94	26.16	2.42	42,606	27.46
	50	7.94	26.15	2.43	42,196	27.16
	55	7.93	26.14	2.47	43,600	28.17
	60	7.93	26.13	2.53	40,551	25.97
	65	7.93	26.13	2.50	41,818	26.89
	70	7.93	26.16	2.27	42,791	27.59
	75	7.92	26.09	2.82	44,628	28.92
6/9/2021 14:35 - Flow toward GOM at 0.18 m/s (1.8 hours since flow reversal)						
	5	8.13	27.91	5.61	43,682	28.23
	10	8.13	27.86	5.38	44,132	28.56
	15	8.12	27.57	5.68	43,211	27.89
	20	8.11	27.71	8.35	42,560	27.42
	25	8.11	27.42	6.75	43,961	28.44
	30	8.12	27.38	6.98	44,404	28.76
	35	8.11	27.30	6.56	44,663	28.94
	40	8.10	27.15	6.01	44,889	29.11
	45	8.09	26.73	4.77	44,252	28.65
	50	8.06	26.63	4.29	44,312	28.69
	55	8.07	26.61	6.65	45,111	29.27
	60	8.06	26.46	4.54	43,489	28.09
	65	8.06	26.40	5.30	44,976	29.17
	70	8.06	26.40	4.70	44,195	28.60
	75	8.06	26.45	5.79	40,287	25.78
	80	8.07	26.53	6.65	41,199	26.44
6/9/2021 16:04 - Flow toward GOM at 0.52 m/s (3.2 hours since flow reversal)						
	1	8.10	27.83	7.30	39,792	25.43
	5	8.07	27.85	4.30	41,555	26.70
	10	8.08	27.75	4.65	41,519	26.67
	15	8.08	27.77	4.70	41,416	26.60
	20	8.08	27.71	4.55	39,964	25.55
	25	8.07	27.60	4.59	41,423	26.60
	30	8.06	27.36	4.35	39,371	25.12
	35	8.04	27.32	4.39	39,892	25.50
	40	8.04	27.16	4.47	39,330	25.09
	45	8.03	27.07	4.63	39,962	25.55
	50	8.02	27.02	4.68	39,510	25.22
	55	8.01	26.96	4.29	40,568	25.99
	60	8.04	27.53	4.80	39,702	25.36

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
	65	8.01	26.92	4.54	39,973	25.56
	70	8.01	27.34	4.96	39,982	25.56
	75	8.01	26.76	5.12	39,044	24.89
	80	7.98	26.72	4.76	39,872	25.48
	85	7.98	26.90	6.83	38,927	24.80
6/10/2021 12:44 - Flow toward CC Bay at 0.42 m/s (>11 hours since flow reversal)						
	1	8.17	27.78	9.17	43,062	27.79
	5	8.17	27.76	9.19	43,034	27.77
	10	8.17	27.57	9.13	43,086	27.80
	15	8.16	27.50	8.99	42,046	27.05
	20	8.15	27.52	8.99	43,251	27.92
	25	8.15	27.50	8.94	43,162	27.86
	30	8.15	27.52	8.98	43,116	27.83
	35	8.15	27.51	8.91	43,110	27.82
	40	8.15	27.44	8.94	42,168	27.14
	45	8.15	27.40	8.87	42,684	27.51
	50	8.14	27.45	8.62	43,086	27.80
	55	8.15	27.43	8.89	43,187	27.88
	60	8.14	27.37	8.46	43,689	28.24
	65	8.14	27.40	8.28	43,089	27.81
	70	8.14	27.40	0.43	43,068	27.79
	75	8.14	27.37	0.07	43,106	27.82
	80	8.14	27.39	0.62	43,331	27.98
6/10/2021 14:58 - Flow toward GOM at 0.21 m/s (< 1 hour since flow reversal)						
	1	8.18	28.19	8.35	42,990	27.73
	5	8.18	28.18	9.32	42,906	27.67
	10	8.18	28.16	9.14	42,612	27.46
	15	8.18	28.12	9.09	43,091	27.81
	20	8.18	27.82	8.60	42,902	27.67
	25	8.17	28.09	8.45	42,170	27.14
	30	8.17	27.70	1.79	42,986	27.73
	35	8.14	27.38	0.00	43,658	28.22
	40	8.12	27.30	0.00	43,726	28.27
	45	8.11	27.26	0.00	43,562	28.15
	50	8.11	27.41	0.34	43,631	28.20
	55	8.12	27.30	0.08	43,503	28.10
	60	8.11	27.28	0.51	43,619	28.19
	65	8.11	27.22	0.95	43,163	27.86
	70	8.11	27.36	1.51	42,796	27.59
	75	8.12	27.39	2.24	43,712	28.26

Table 4. Field Water Quality Profile Measurements from the Proposed Intake Location

	Depth (ft)	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (ppt)
6/9/2021 08:24						
	5	8.09	27.37	8.33	36,297	22.90
	10	8.08	27.31	6.03	39,919	25.52
	15	8.02	27.21	5.64	39,214	25.01
6/10/2021 11:09						
	1	8.20	27.92	9.64	42,164	27.14
	5	8.20	27.86	9.38	42,396	27.31
	10	8.18	27.57	8.55	42,461	27.35
	15	8.13	27.66	8.92	42,626	27.47

Table 5. Analytical Laboratory Results

Port of Corpus Christi Desalination Industrial Wastewater Permit Application
Intake Samples - Gulf of Mexico
Validated Result Summary for Samples Collected June 2021

				SAMPLE ID:	**POCC - INTAKE-1**			**POCC - INTAKE-2**			**POCC - INTAKE-2-DUP**		
				DATE SAMPLED:	**6/9/2021**			**6/10/2021**			**6/10/2021**		
				LAB SAMPLE ID:	**HS21060521-01**			**HS21060616-01**			**HS21060616-02**		
Analytical Method	**MAL (1)**	**Unit**	**CAS Number**	**Analyte**									
Worksheet 2 Table 1													
SM5210 B	--	mg/L	NA	BOD (5-day)	<	2.00		<	2.00		<	2.00	
SM5210 B	--	mg/L	NA	CBOD (5-day)	<	2.00			**2.18**		<	2.00	
E410.4	--	mg/L	NA	Chemical oxygen demand		**60.0**			**55.0**			**53.0**	
E415.1	--	mg/L	NA	Total organic carbon		**2.09**			**2.08**			**2.02**	
SM4500 NH3-B-F	--	mg/L	7664-41-7	Ammonia nitrogen	<	0.050		<	0.050		<	0.050	
M2540D	--	mg/L	NA	Total suspended solids		**8.40**			**6.70**			**7.00**	
E300	--	mg/L	14797-55-8	Nitrate nitrogen	<	10.0		<	5.00		<	5.00	
M4500-N C	--	mg/L	NA	Total organic nitrogen	<	0.50		<	0.50		<	0.50	
E365.3	--	mg/L	7723-14-0	Total phosphorus	<	0.0500		<	0.0500		<	0.0500	
E1664A	--	mg/L	NA	Oil and grease		**3.00**			**2.58**		<	2.00	
M2540C	--	mg/L	NA	Total dissolved solids		**33,400**			**33,800**			**34,000**	
E300	--	mg/L	14808-79-8	Sulfate		**2,340**			**2,350**			**2,360**	
E300	--	mg/L	16887-00-6	Chloride		**16,400**			**16,200**			**17,000**	
E300	--	mg/L	16984-48-8	Fluoride	<	10.0		<	5.00		<	5.00	
SM2320B	--	mg/L	NA	Total alkalinity (mg/L as CaCO3)		**118**			**119**			**120**	
Worksheet 2 Table 2													
E200.8	2.5	µg/L	7429-90-5	Aluminum, total		**74.6**	J		**122**			**183**	
E200.8	5.0	µg/L	7440-36-0	Antimony, total	<	5.30		<	5.30		<	5.30	
E200.8	0.50	µg/L	7440-38-2	Arsenic, total		**3.01**	J	<	2.50			**3.28**	J

				SAMPLE ID:	POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP		
				DATE SAMPLED:	6/9/2021			6/10/2021			6/10/2021		
				LAB SAMPLE ID:	HS21060521-01			HS21060616-01			HS21060616-02		
Analytical Method	MAL (1)	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
E200.8	3.0	µg/L	7440-39-3	Barium, total		**19.9**	J		**20.8**	J		**21.0**	J
E200.8	0.50	µg/L	7440-41-7	Beryllium, total	<	0.910		<	0.910		<	0.910	
E200.8	1.0	µg/L	7440-43-9	Cadmium, total	<	0.770		<	0.770		<	0.770	
E200.8	3.0	µg/L	7440-47-3	Chromium, total	<	2.51		<	2.51		<	2.51	
M3500-Cr B	3.0	µg/L	18540-29-9	Chromium, hexavalent	<	20.0		<	20.0		<	20.0	
Calculation	--	µg/L	16065-83-1	Chromium, trivalent	<	10.0		<	10.0		<	10.0	
E200.8	2.0	µg/L	7440-50-8	Copper, total		**1.82**	J		**1.80**	J		**2.34**	J
OIA 1677-09	2.0/10	µg/L	NA	Cyanide, available	<	2.0		<	2.0		<	2.0	
E200.8	0.50	µg/L	7439-92-1	Lead, total	<	1.20		<	1.20		<	1.20	
E1631E	0.0050/0.00050	µg/L	7439-97-6	Mercury, total		**0.00058**			**0.00066**			**0.00065**	
E200.8	2.0	µg/L	7440-02-0	Nickel, total		**1.63**	J		**1.69**	J		**2.37**	J
E200.8	5.0	µg/L	7782-49-2	Selenium, total	<	8.60		<	8.60		<	8.60	
E200.8	0.50	µg/L	7440-22-4	Silver, total	<	0.440		<	0.440		<	0.440	
E200.8	0.50	µg/L	7440-28-0	Thallium, total	<	2.50		<	2.50		<	2.50	
E200.8	5.0	µg/L	7440-66-6	Zinc, total	<	10.0		<	10.0		<	10.0	
Worksheet 2 Table 3													
E624	50	µg/L	107-13-1	Acrylonitrile	<	10.0		<	10.0		<	10.0	
E625	10	µg/L	120-12-7	Anthracene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	71-43-2	Benzene	<	5.00		<	5.00		<	5.00	
E625	50	µg/L	92-87-5	Benzidine	<	5.00		<	5.00		<	5.00	
E625	5.0	µg/L	56-55-3	Benzo(a)anthracene	<	5.00		<	5.00		<	5.00	
E625	5.0	µg/L	50-32-8	Benzo(a)pyrene	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	111-44-4	Bis(2-chloroethyl)ether	<	5.00		<	5.00		<	5.00	

				SAMPLE ID:	POCC - INTAKE-1	POCC - INTAKE-2	POCC - INTAKE-2-DUP
				DATE SAMPLED:	6/9/2021	6/10/2021	6/10/2021
				LAB SAMPLE ID:	HS21060521-01	HS21060616-01	HS21060616-02
Analytical Method	**MAL [1]**	**Unit**	**CAS Number**	**Analyte**			
Worksheet 2 Table 1							
E625	10	µg/L	117-81-7	Bis(2-ethylhexyl)phthalate	< 5.00	< 5.00	< 5.00
E624	10	µg/L	75-27-4	Bromodichloromethane [Dichlorobromomethane]	< 5.00	< 5.00	< 5.00
E624	10	µg/L	75-25-2	Bromoform	< 5.00	< 5.00	< 5.00
E624	2.0	µg/L	56-23-5	Carbon tetrachloride	< 5.00	< 5.00	< 5.00
E624	10	µg/L	108-90-7	Chlorobenzene	< 5.00	< 5.00	< 5.00
E624	10	µg/L	124-48-1	Chlorodibromomethane [Dibromochloromethane]	< 5.00	< 5.00	< 5.00
E624	10	µg/L	67-66-3	Chloroform	< 5.00	< 5.00	< 5.00
E625	5.0	µg/L	218-01-9	Chrysene	< 5.00	< 5.00	< 5.00
E625	10	µg/L	106-44-5	m-Cresol [3-Methylphenol]	< 5.00	< 5.00	< 5.00
E625	10	µg/L	95-48-7	o-Cresol [2-Methylphenol]	< 5.00	< 5.00	< 5.00
E625	10	µg/L	106-44-5	p-Cresol [4-Methylphenol]	< 5.00	< 5.00	< 5.00
E624	10	µg/L	106-93-4	1,2-Dibromoethane	< 5.00	< 5.00	< 5.00
E624	10	µg/L	541-73-1	m-Dichlorobenzene [1,3-Dichlorobenzene]	< 5.00	< 5.00	< 5.00
E624	10	µg/L	95-50-1	o-Dichlorobenzene [1,2-Dichlorobenzene]	< 5.00	< 5.00	< 5.00
E624	10	µg/L	106-46-7	p-Dichlorobenzene [1,4-Dichlorobenzene]	< 5.00	< 5.00	< 5.00
E625	5.0	µg/L	91-94-1	3,3'-Dichlorobenzidine	< 5.00	< 5.00	< 5.00
E624	10	µg/L	107-06-2	1,2-Dichloroethane	< 5.00	< 5.00	< 5.00
E624	10	µg/L	75-35-4	1,1-Dichloroethene [1,1-Dichloroethylene]	< 5.00	< 5.00	< 5.00
E624	20	µg/L	75-09-2	Dichloromethane [Methylene chloride]	< 10.0	< 10.0	< 10.0
E624	10	µg/L	78-87-5	1,2-Dichloropropane	< 5.00	< 5.00	< 5.00
E624	10	µg/L	542-75-6	1,3-Dichloropropene [1,3-Dichloropropylene]	< 5.00	< 5.00	< 5.00
E625	10	µg/L	105-67-9	2,4-Dimethylphenol	< 5.00	< 5.00	< 5.00
E625	10	µg/L	84-74-2	Di-n-Butyl phthalate	< 5.00	< 5.00	< 5.00
E624	10	µg/L	100-41-4	Ethylbenzene	< 5.00	< 5.00	< 5.00

				SAMPLE ID:	**POCC - INTAKE-1**			**POCC - INTAKE-2**			**POCC - INTAKE-2-DUP**		
				DATE SAMPLED:	**6/9/2021**			**6/10/2021**			**6/10/2021**		
				LAB SAMPLE ID:	**HS21060521-01**			**HS21060616-01**			**HS21060616-02**		
Analytical Method	**MAL (1)**	**Unit**	**CAS Number**	**Analyte**									
Worksheet 2 Table 1													
E300	500	µg/L	16984-48-8	Fluoride	<	10,000		<	5,000		<	5,000	
E625	5.0	µg/L	118-74-1	Hexachlorobenzene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	87-68-3	Hexachlorobutadiene	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	77-47-4	Hexachlorocyclopentadiene	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	67-72-1	Hexachloroethane	<	5.00		<	5.00		<	5.00	
E624	50	µg/L	78-93-3	Methyl ethyl ketone	<	10.0		<	10.0		<	10.0	
E625	10	µg/L	98-95-3	Nitrobenzene	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	55-18-5	N-Nitrosodiethylamine	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	924-16-3	N-Nitroso-di-n-butylamine	<	5.00		<	5.00		<	5.00	
E625	333	µg/L	84852-15-3	Nonylphenol	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	608-93-5	Pentachlorobenzene	<	5.00		<	5.00		<	5.00	
E625	5.0	µg/L	87-86-5	Pentachlorophenol	<	5.00		<	5.00		<	5.00	
E625	10	µg/L	85-01-8	Phenanthrene	<	5.00		<	5.00		<	5.00	
E608	0.20	µg/L	12674-11-2	Polychlorinated biphenyls (PCBs)	<	0.0125		<	0.0125		<	0.0125	
E625	20	µg/L	110-86-1	Pyridine	<	5.00		<	5.00		<	5.00	
E625	20	µg/L	95-94-3	1,2,4,5-Tetrachlorobenzene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	79-34-5	1,1,2,2-Tetrachloroethane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	127-18-4	Tetrachloroethene [Tetrachloroethylene]	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	108-88-3	Toluene	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	71-55-6	1,1,1-Trichloroethane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	79-00-5	1,1,2-Trichloroethane	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	79-01-6	Trichloroethene [Trichloroethylene]	<	5.00		<	5.00		<	5.00	
E625	50	µg/L	95-95-4	2,4,5-Trichlorophenol	<	5.00		<	5.00		<	5.00	
E624	10	µg/L	NA	TTHM (Total trihalomethanes)	<	5.00		<	5.00		<	5.00	

				SAMPLE ID:		POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP	
				DATE SAMPLED:		6/9/2021			6/10/2021			6/10/2021	
				LAB SAMPLE ID:		HS21060521-01			HS21060616-01			HS21060616-02	
Analytical Method	MAL [1]	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
E624	10	µg/L	75-01-4	Vinyl chloride	<	2.00		<	2.00		<	2.00	
Worksheet 2 Table 6													
E300	400 (ug/L)	mg/L	24959-67-9	Bromide		**48.3**			**49.8**			**51.2**	
SM2120B	--	PCU	NA	Color (PCU)		**15.0**			**15.0**			**15.0**	
E300	--	mg/L	NA	Nitrate-Nitrite (as N)	<	20.0		<	10.0		<	10.0	
SM4500 S2-D	--	mg/L	18496-25-8	Sulfide (as S)	<	0.050		<	0.050		<	0.050	
SM5540C	--	mg/L	NA	Surfactants	<	0.050		<	0.050		<	0.050	
E200.8	20 (ug/L)	mg/L	7440-42-8	Boron, total		**3.57**			**3.71**			**3.95**	
E200.8	0.30 (ug/L)	mg/L	7440-48-4	Cobalt, total	<	0.00040		<	0.00040		<	0.00040	
E200.8	7.0 (ug/L)	mg/L	7439-89-6	Iron, total	<	0.500		<	0.500		<	0.500	
E200.8	20 (ug/L)	mg/L	7439-95-4	Magnesium, total		**1,060**			**1,060**			**1,160**	
E200.8	0.50 (ug/L)	mg/L	7439-96-5	Manganese, total		**0.00478**	J		**0.00829**	J		**0.00705**	J
E200.8	1.0 (ug/L)	mg/L	7439-98-7	Molybdenum, total		**0.00886**	J		**0.00927**	J		**0.00982**	J
E200.8	5.0 (ug/L)	mg/L	7440-31-5	Tin, total	<	0.00058		<	0.00058		<	0.00058	
E200.8	30 (ug/L)	mg/L	7440-32-6	Titanium, total	<	0.00390			**0.00666**	J	<	0.00390	
Other Reported Analytes													
E200.8	--	µg/L	7440-70-2	Calcium		**345,000**			**352,000**			**382,000**	
E200.8	--	µg/L	7440-09-7	Potassium		**318,000**			**320,000**			**347,000**	
E200.8	--	µg/L	7440-23-5	Sodium		**9,490,000**			**9,780,000**			**9,520,000**	
E300	--	mg/L	14797-65-0	Nitrogen, Nitrite (As N)	<	10.0		<	5.00		<	5.00	
M4500 NH3 D	--	mg/L	7727-37-9	Nitrogen, Total Kjeldahl	<	0.50		<	0.50		<	0.50	
SM2320B	--	mg/L	NA	Alkalinity, Bicarbonate (As CaCO3)		**118**			**119**			**120**	

SAMPLE ID:					POCC - INTAKE-1			POCC - INTAKE-2			POCC - INTAKE-2-DUP		
DATE SAMPLED:					6/9/2021			6/10/2021			6/10/2021		
LAB SAMPLE ID:					HS21060521-01			HS21060616-01			HS21060616-02		
Analytical Method	MAL (1)	Unit	CAS Number	Analyte									
Worksheet 2 Table 1													
SM2320B	--	mg/L	NA	Alkalinity, Carbonate (As CaCO3)	<	5.00		<	5.00		<	5.00	
SM2320B	--	mg/L	NA	Alkalinity, Hydroxide (As CaCO3)	<	5.00		<	5.00		<	5.00	

QA NOTES AND DATA QUALIFIERS:

" (NO CODE) - Confirmed identification

J - Analyte detected, estimated concentration

Detections are bolded."

NOTES:

[1] Minimum Analytical Level
mg/L - milligrams per liter
µg/L - micrograms per liter
PCU - platinum-cobalt units
su - standard pH units

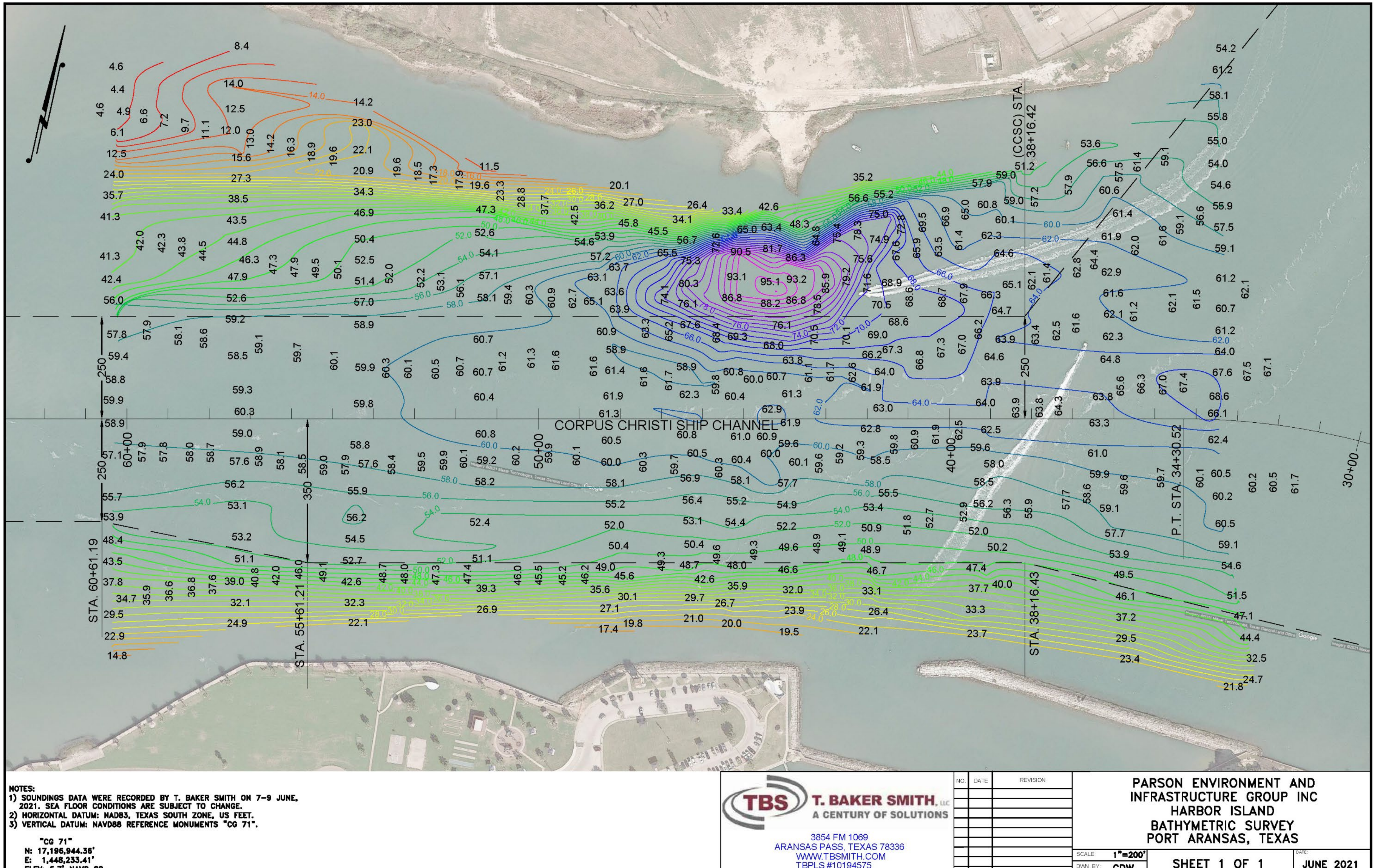


FIGURE 4. MEASURED BATHYMETRY

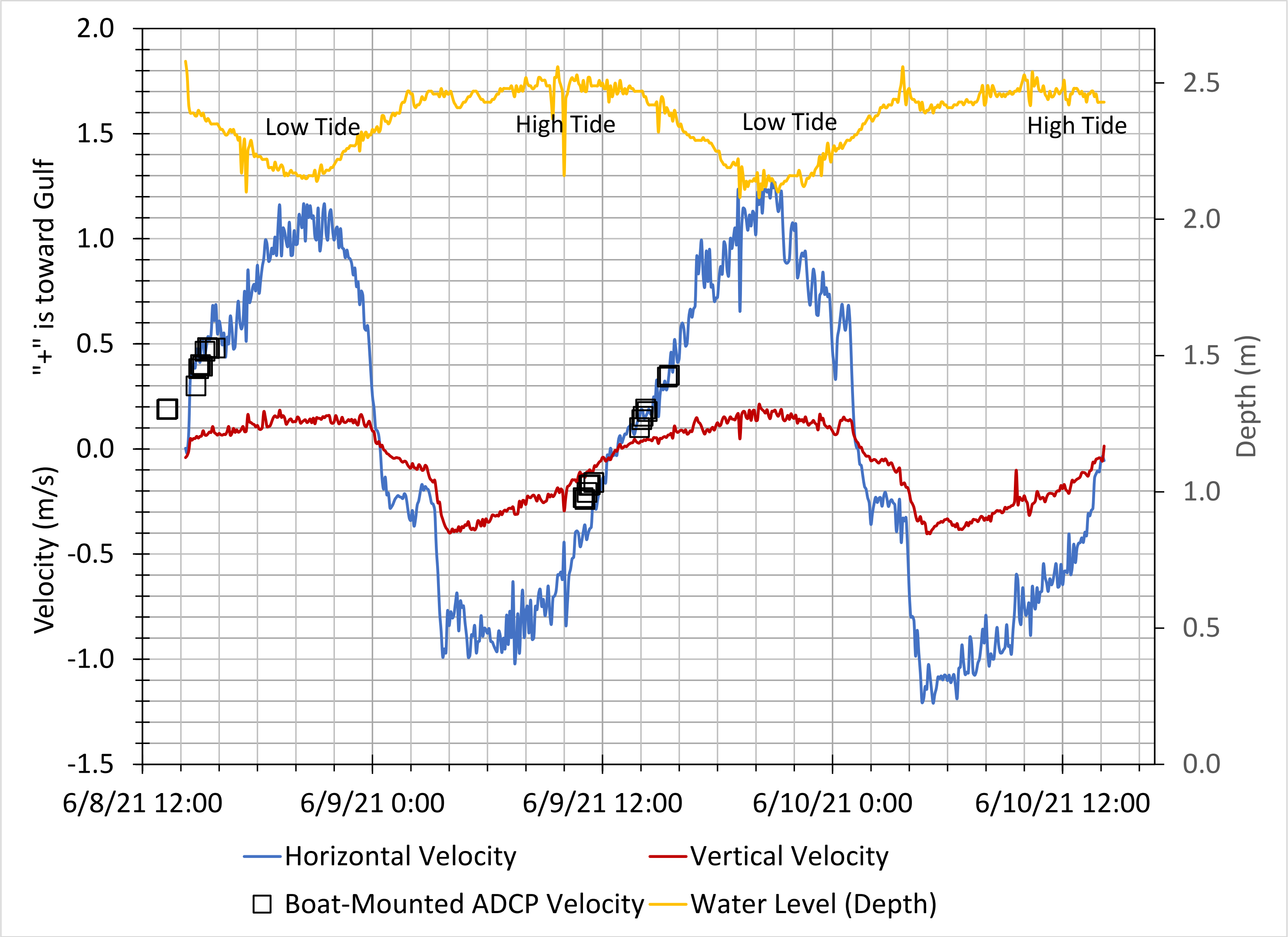


FIGURE 5. ACOUSTIC DOPPLER CURRENT PROFILER MEASUREMENTS

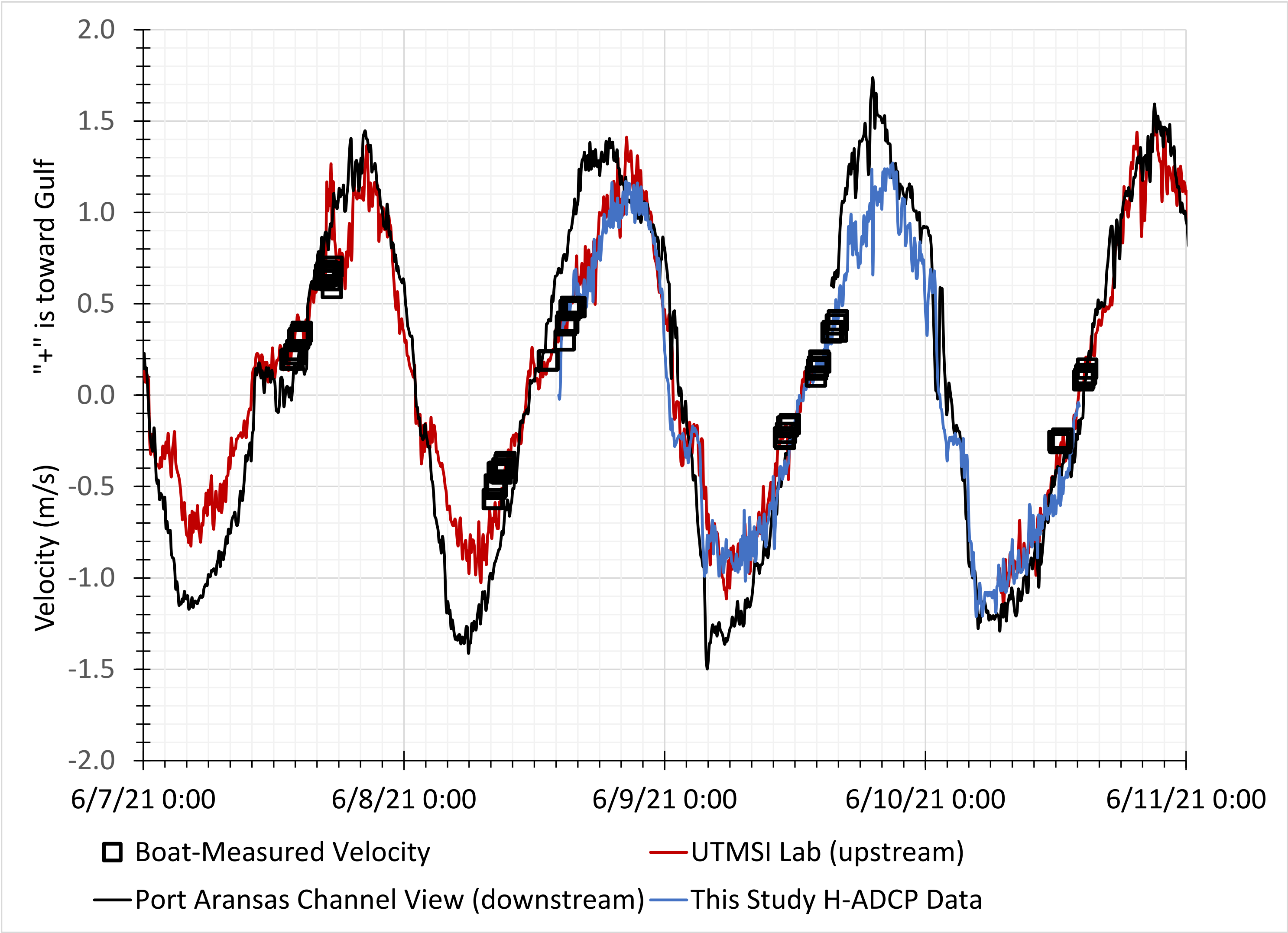
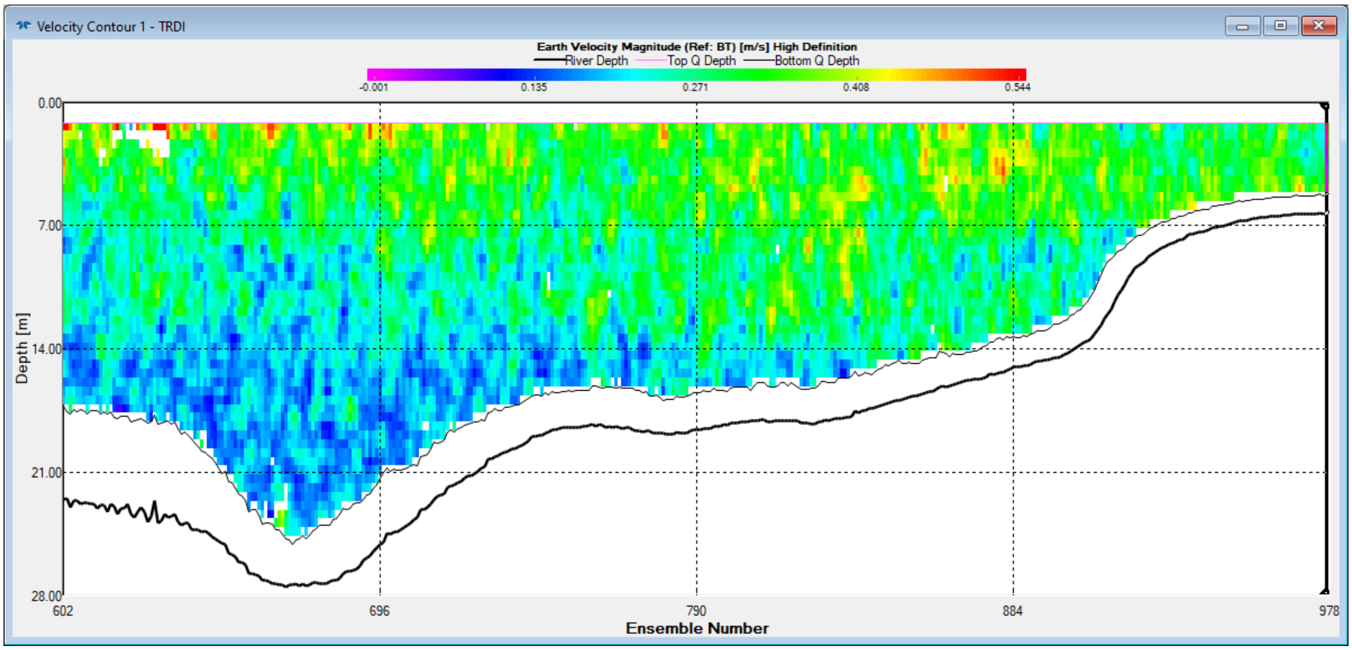


FIGURE 6. COMPARISON OF ADCP CURRENT PROFILE MEASUREMENTS WITH NEARBY SITES

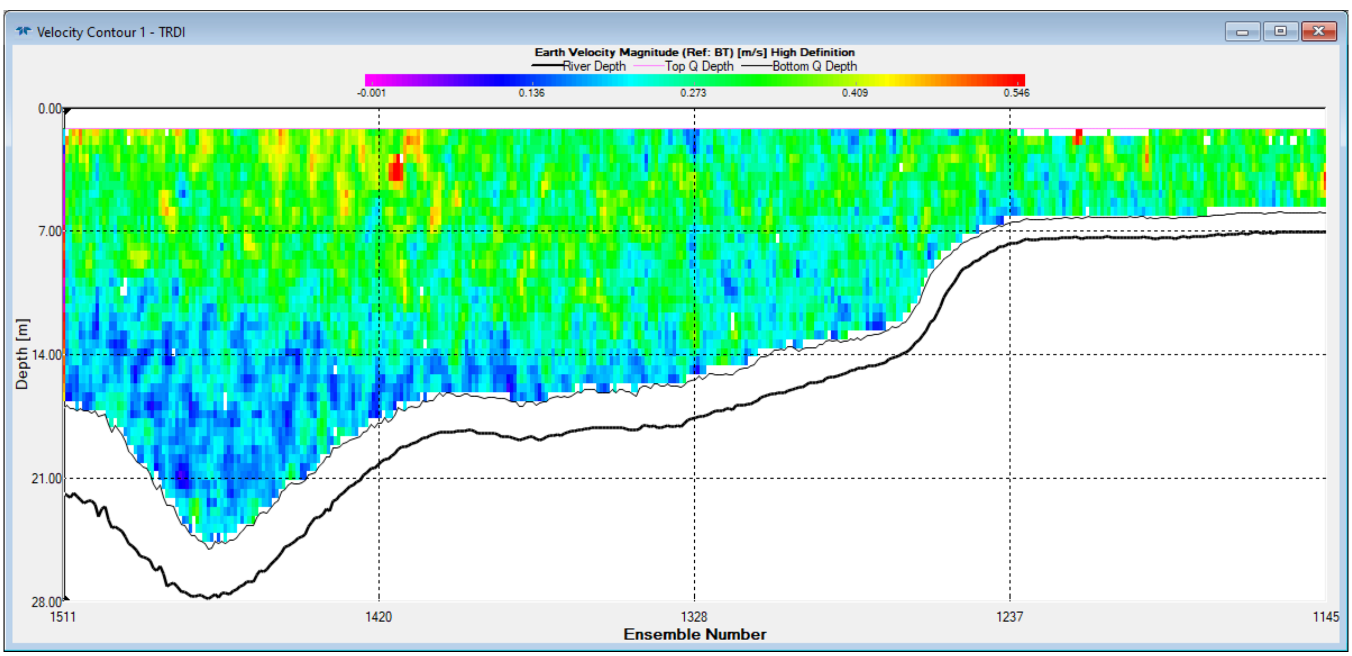
APPENDIX A
ADCP Velocity Transects

The north bank (Harbor Island) is always on left. The colors depict absolute velocity without respect to direction. The calculated channel average velocity includes areas at bottom, top, and sides of channel. A power curve is applied to estimate the un-measured velocities at the top and bottom of the cross-section, and a triangular cross-sectional area is assumed for unmeasured portions of the cross-section on either bank. Also note that the x-axis is not distance but ensemble number. Although we tried to maintain boat speed at a slow and constant pace, at times channel traffic forced us to stop the boat during a transect and extra ensembles were recorded in a limited area. This should not affect the velocity or flow calculations. Finally, although an effort was made to exactly reproduce each transect, in any transect there were small deviations in boat course, start, and end points. We attempted to correct for these using the software.

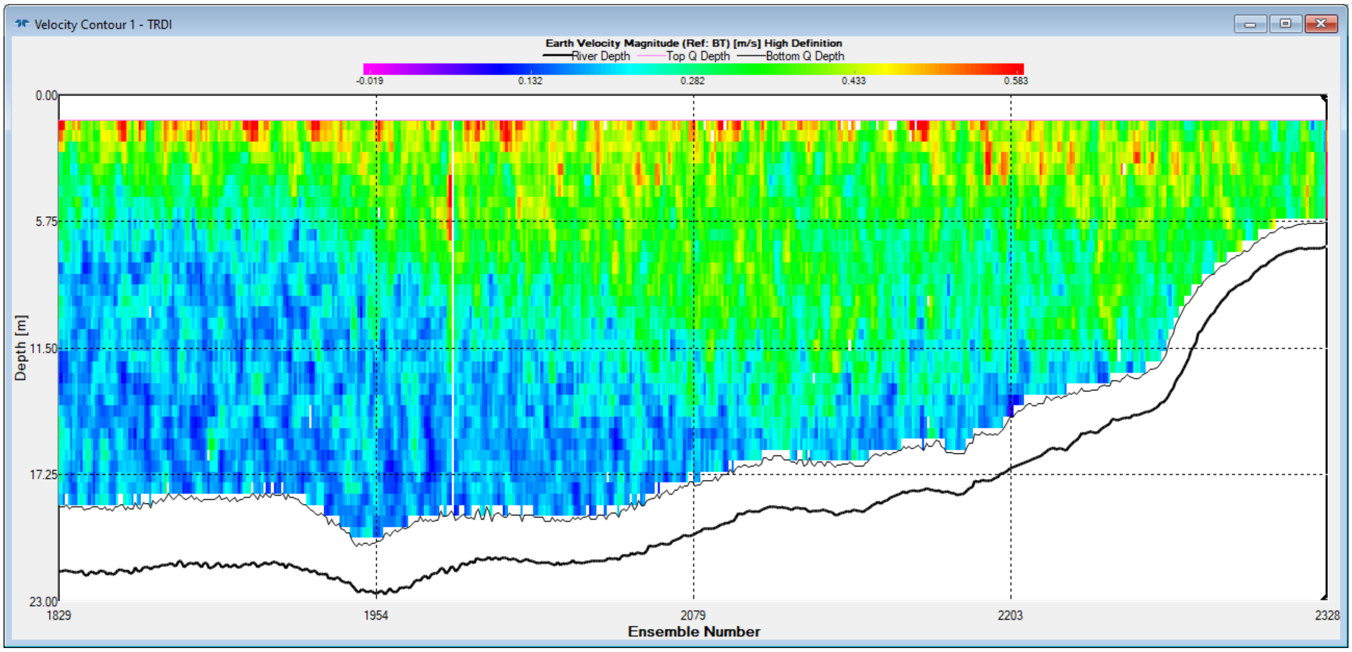
Transect 1, June 7 13:30 – 13:34, Channel Average Velocity = 0.194 m/s



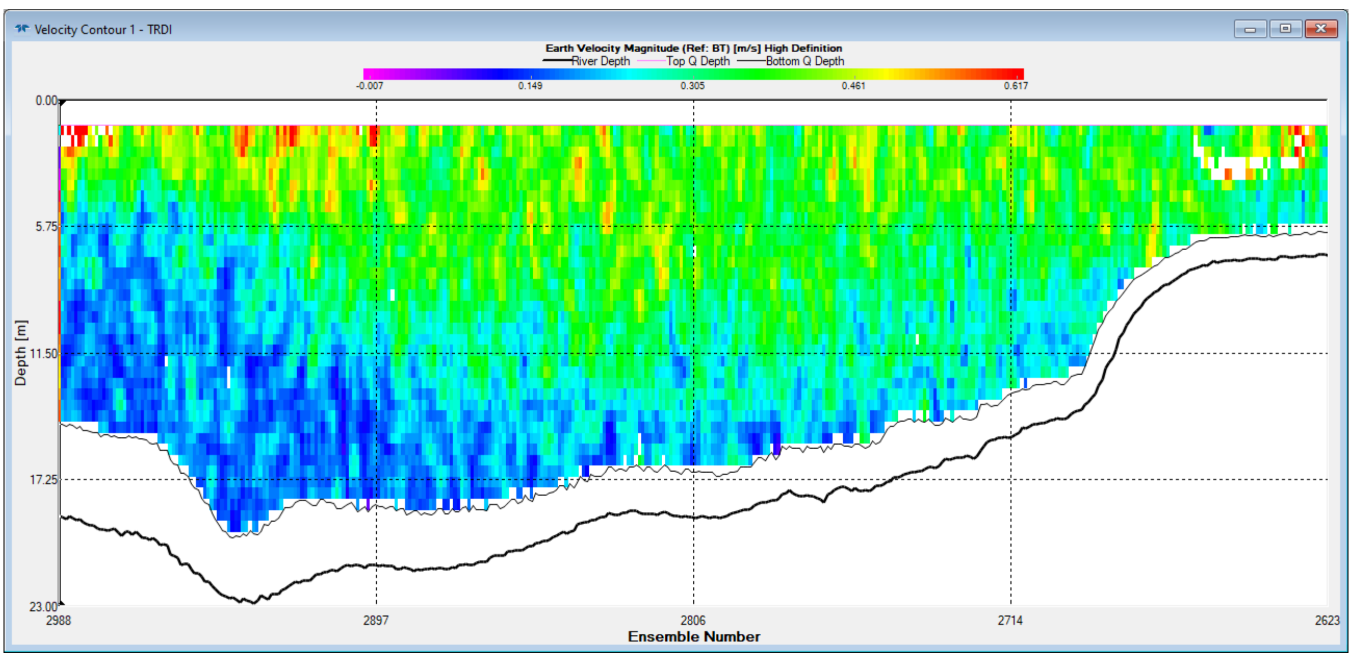
Transect 1, June 7 13:36 – 13:40, Channel Average Velocity = 0.199 m/s



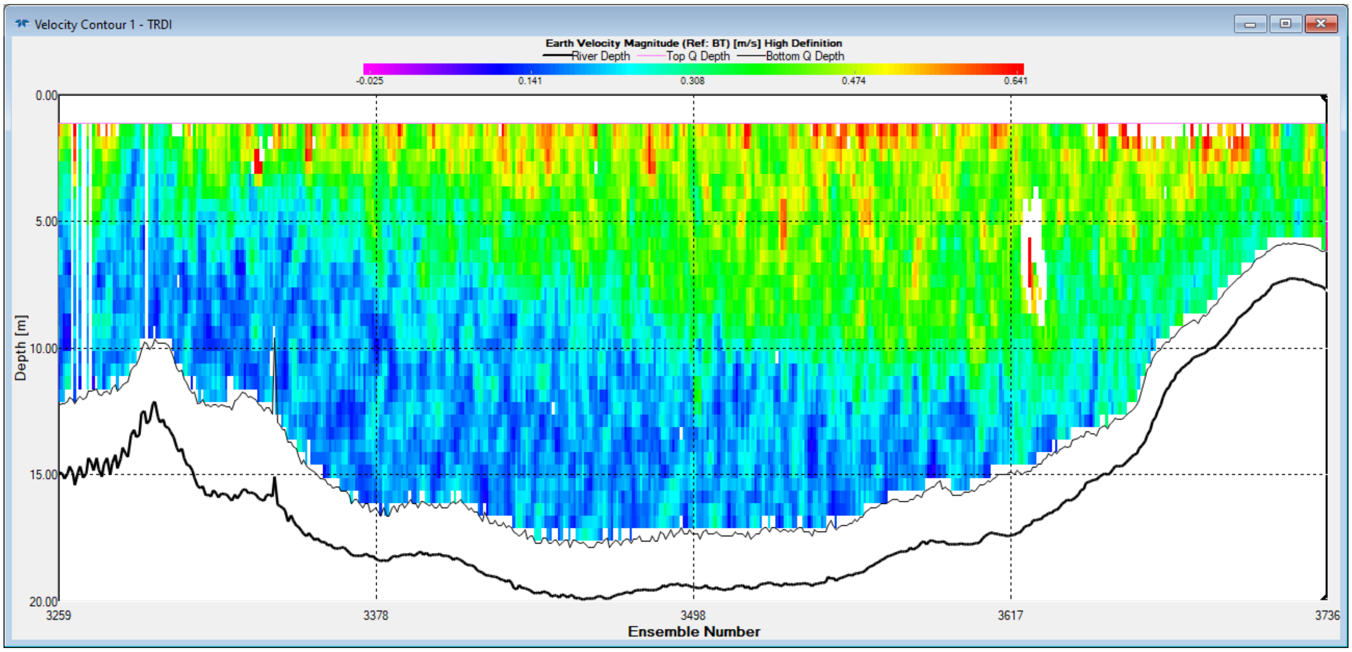
Transect 2, June 7 13:43 – 13:48, Channel Average Velocity = 0.194 m/s



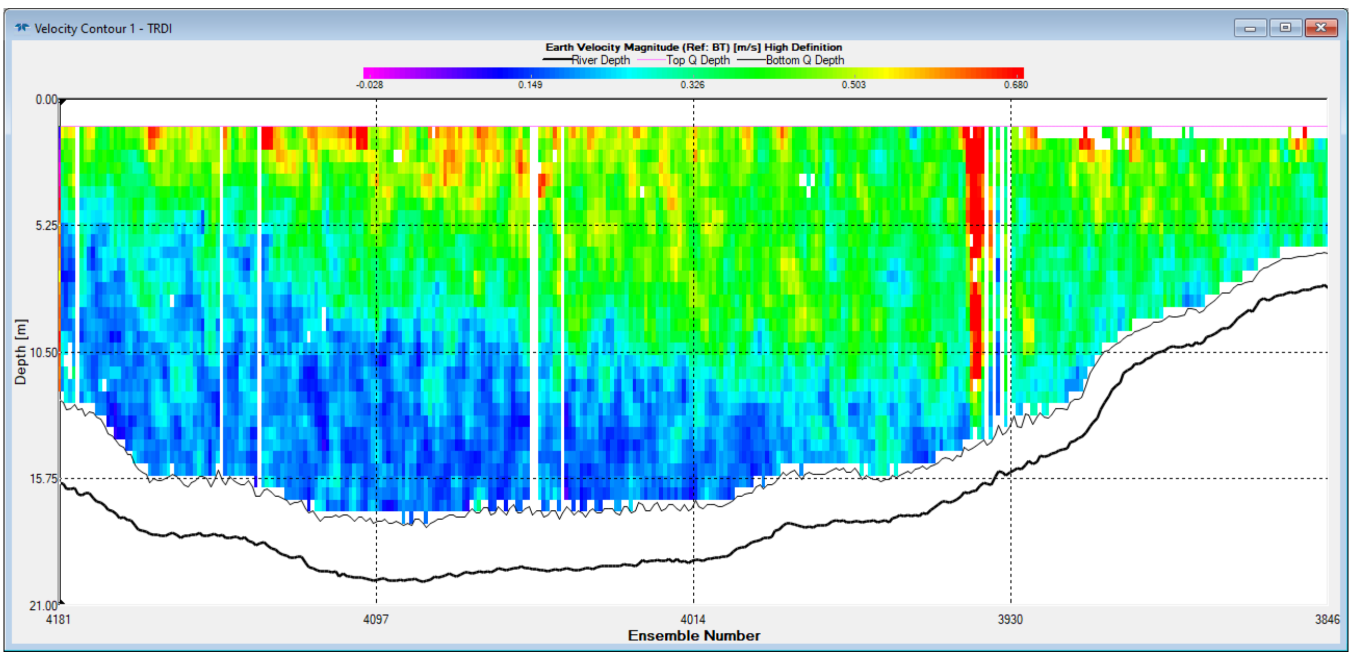
Transect 2, June 7 13:51 – 13:55, Channel Average Velocity = 0.223 m/s



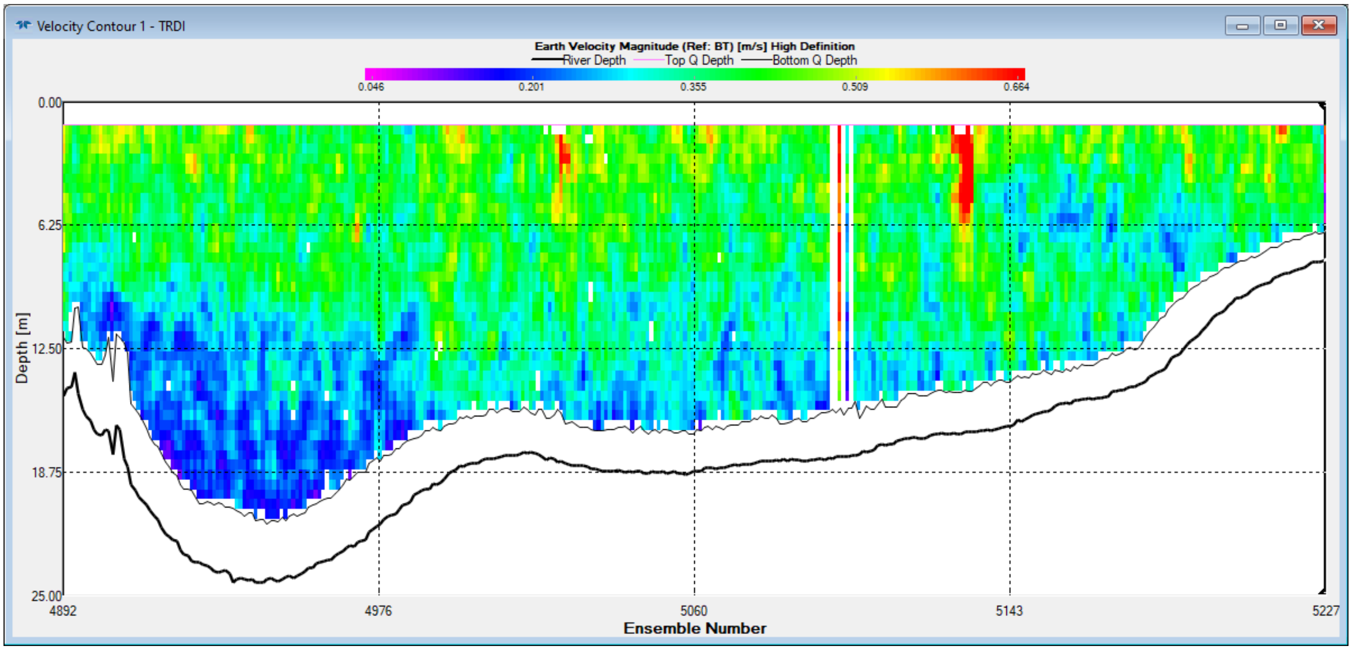
Transect 3, June 7 13:58 – 14:03, Channel Average Velocity = 0.223 m/s



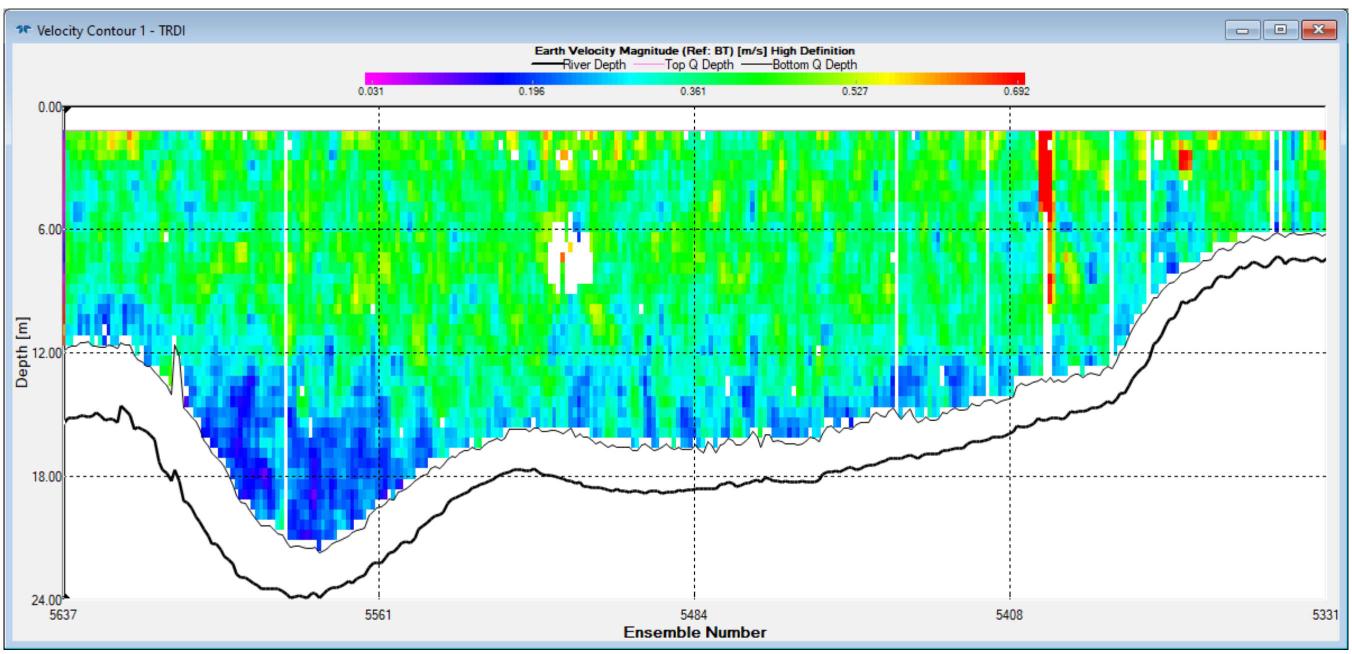
Transect 3, June 7 14:04 – 14:08, Channel Average Velocity = 0.245 m/s



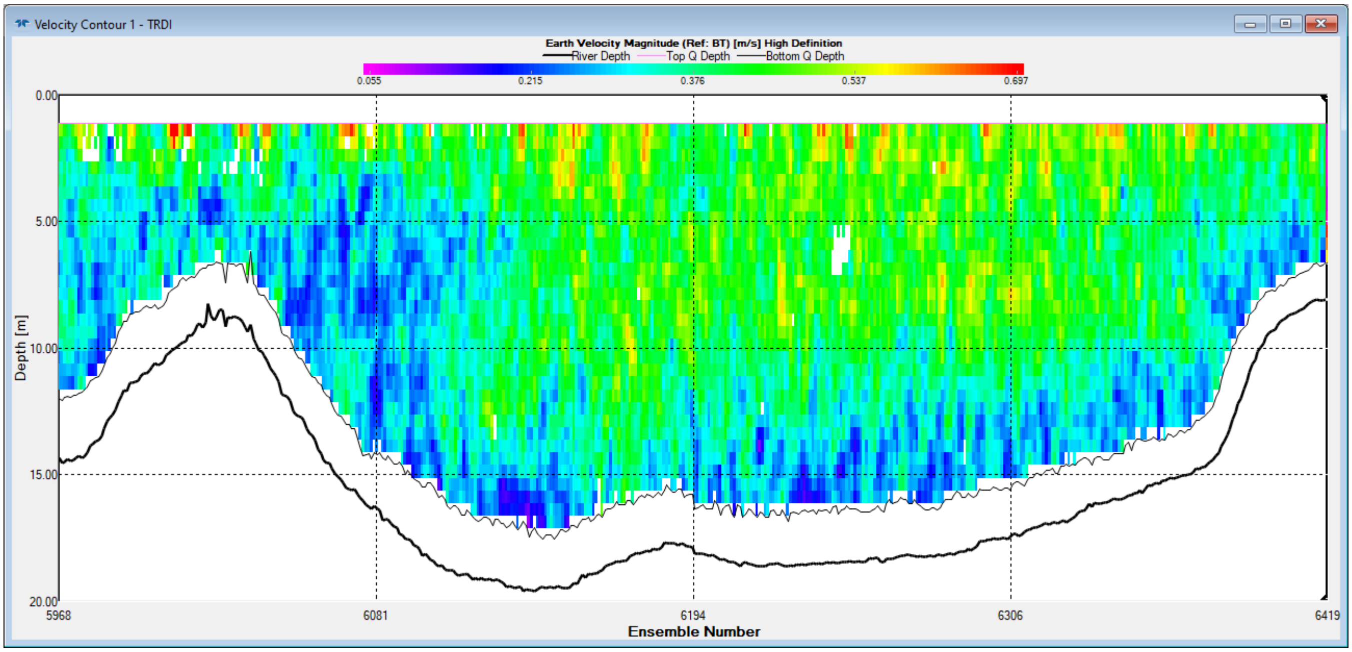
Transect 4, June 7 14:15 – 14:19, Channel Average Velocity = 0.303 m/s



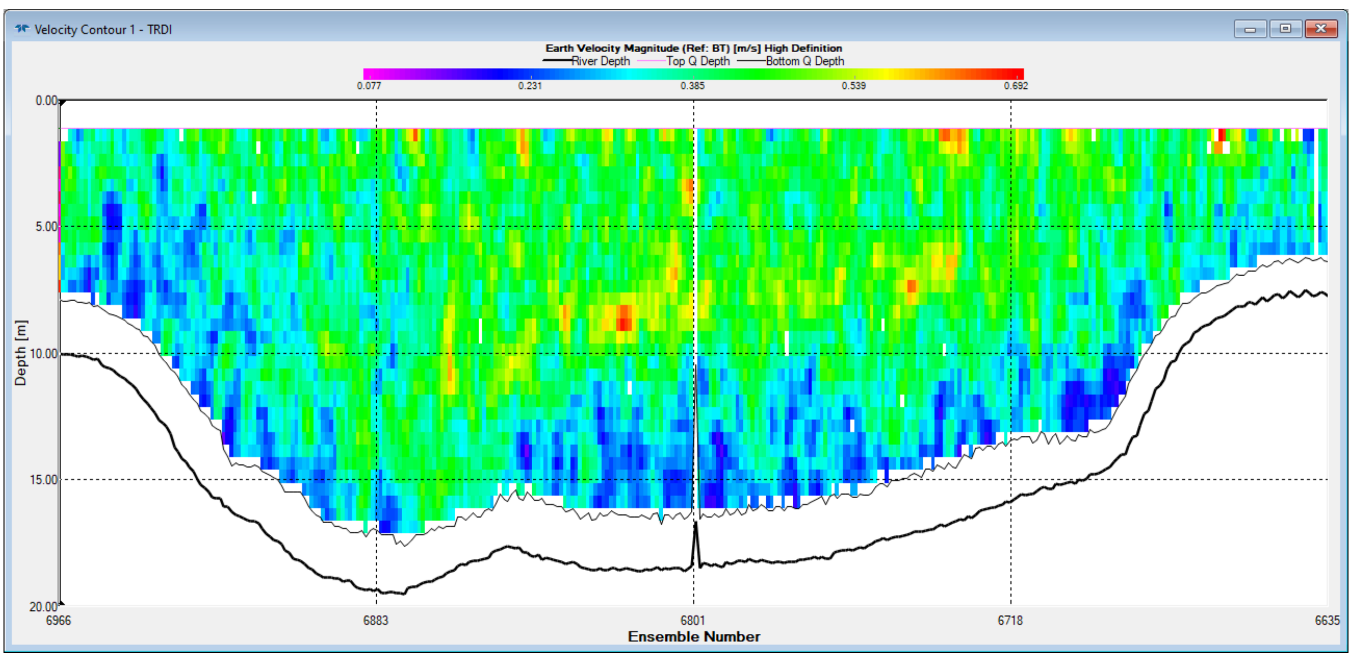
Transect 4, June 7 14:19 – 14:23, Channel Average Velocity = 0.312 m/s



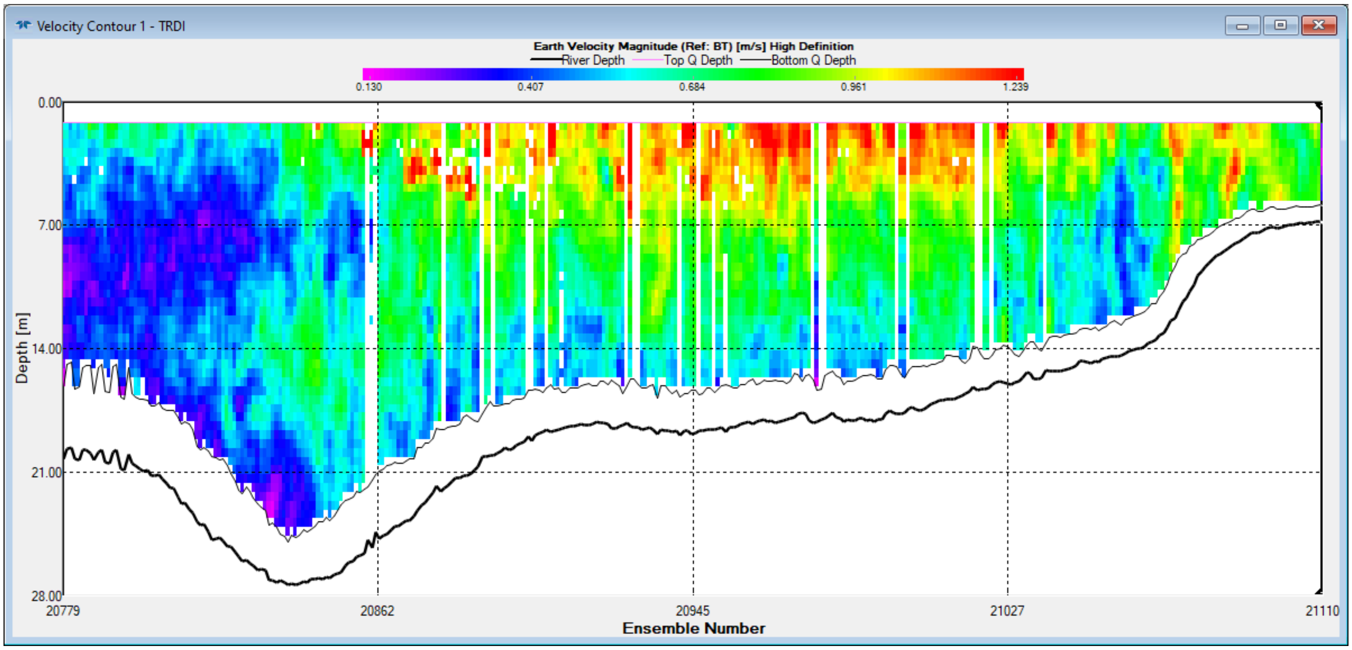
Transect 5, June 7 14:26 – 14:31, Channel Average Velocity = 0.329 m/s



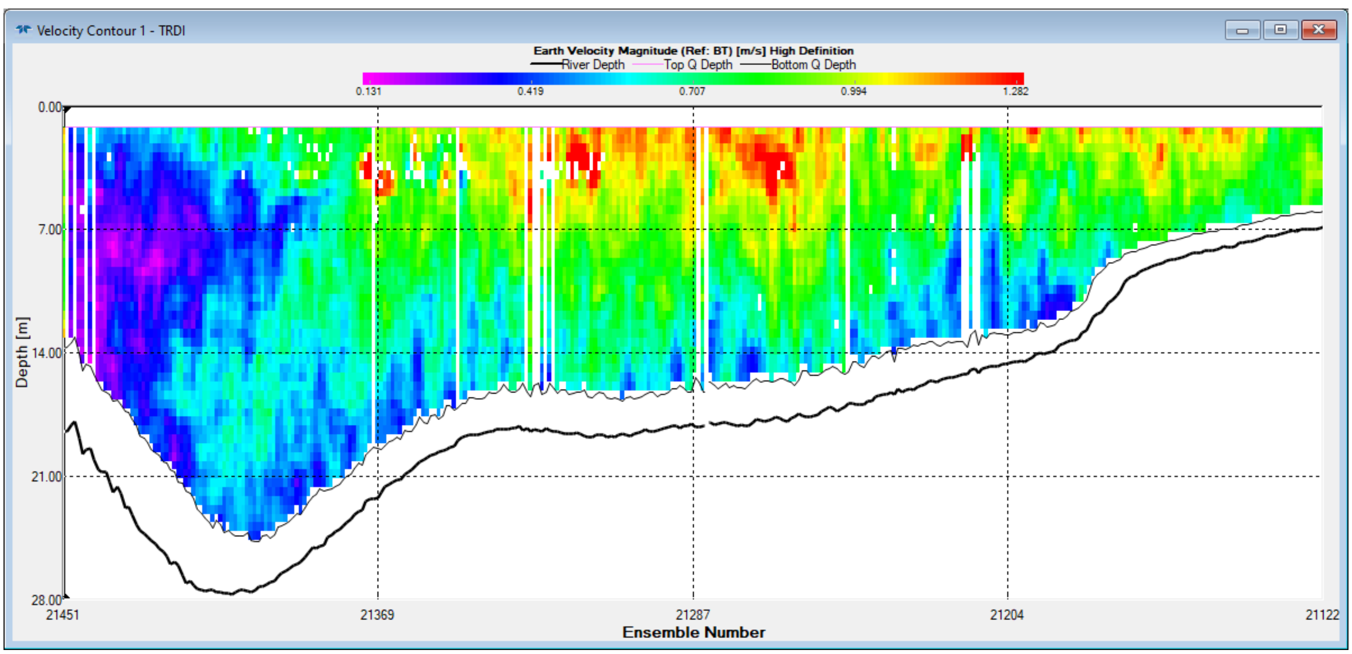
Transect 5, June 7 14:33 – 14:37, Channel Average Velocity = 0.345 m/s



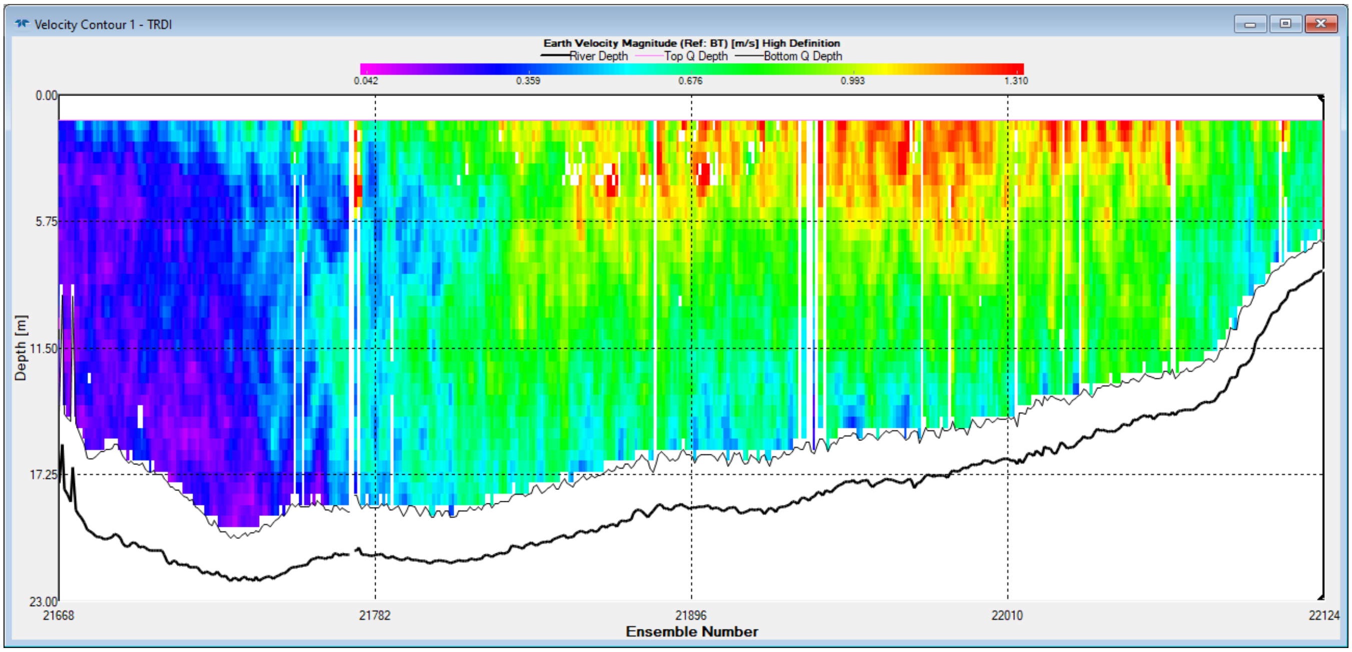
Transect 1, June 7 16:59 – 17:03, Channel Average Velocity = 0.651 m/s



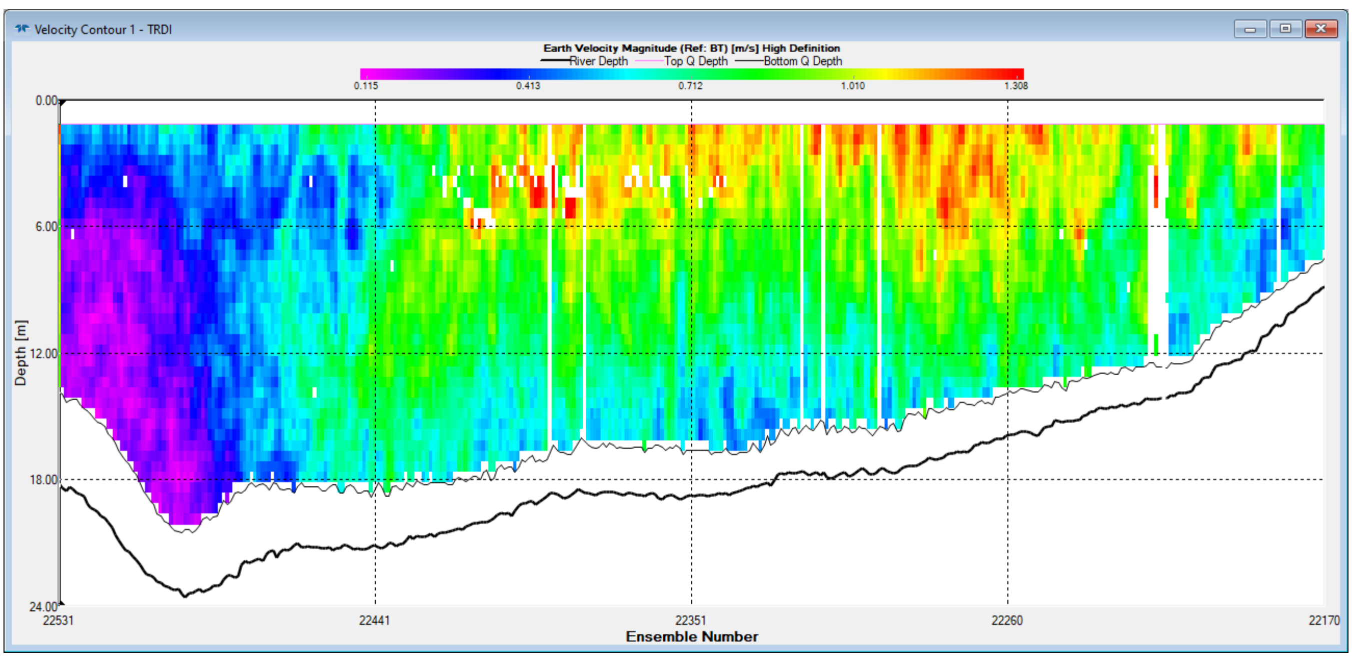
Transect 1, June 7 17:03 – 17:07, Channel Average Velocity = 0.674 m/s



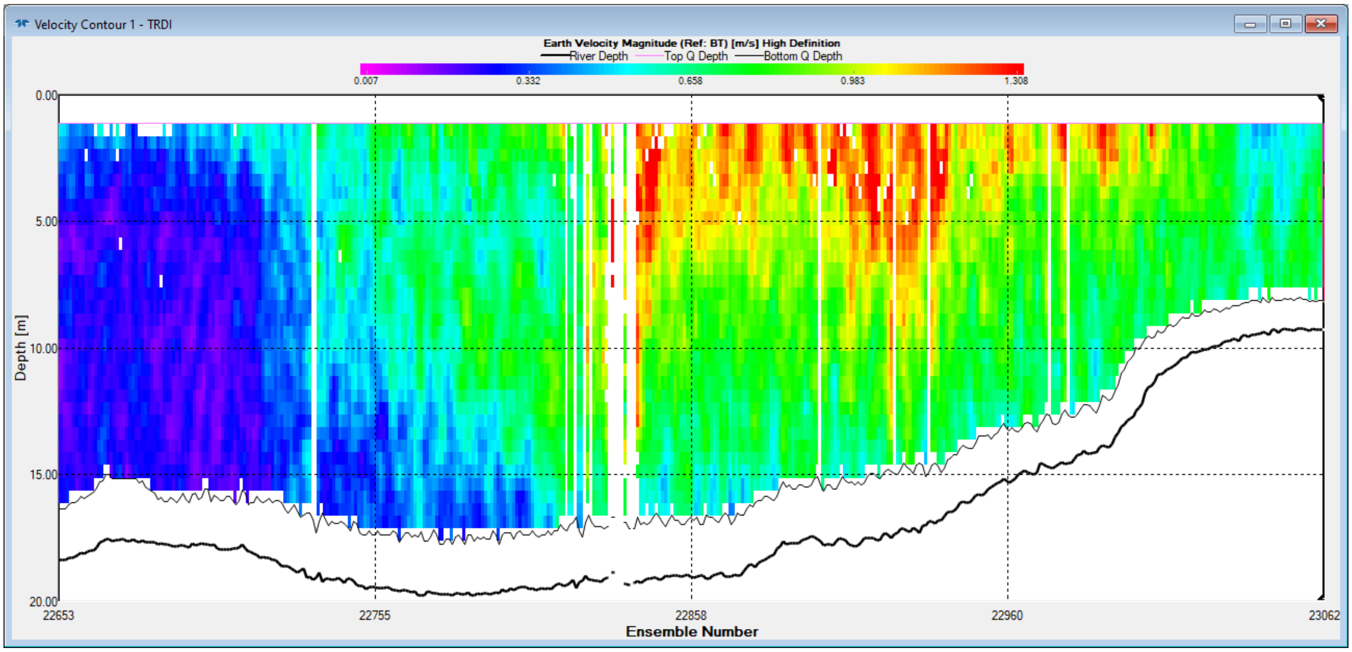
Transect 2, June 7 17:09 – 17:14, Channel Average Velocity = 0.628 m/s



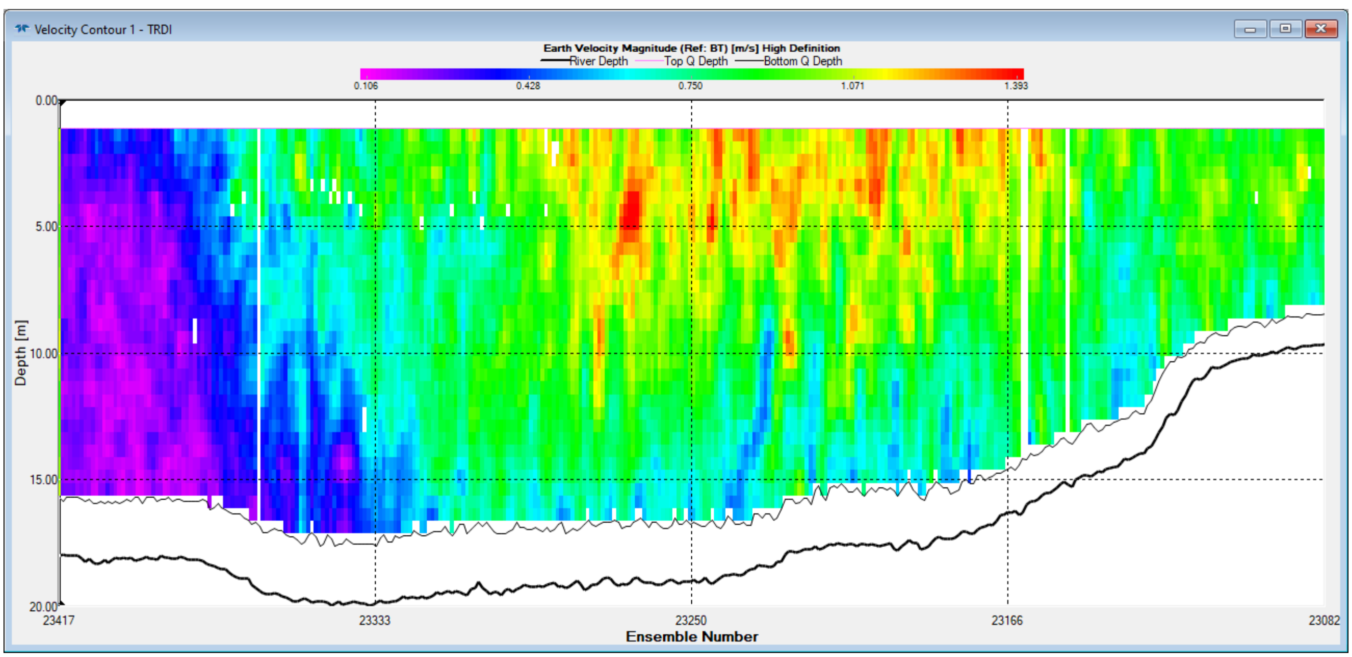
Transect 2, June 7 17:14 – 17:18, Channel Average Velocity = 0.674 m/s



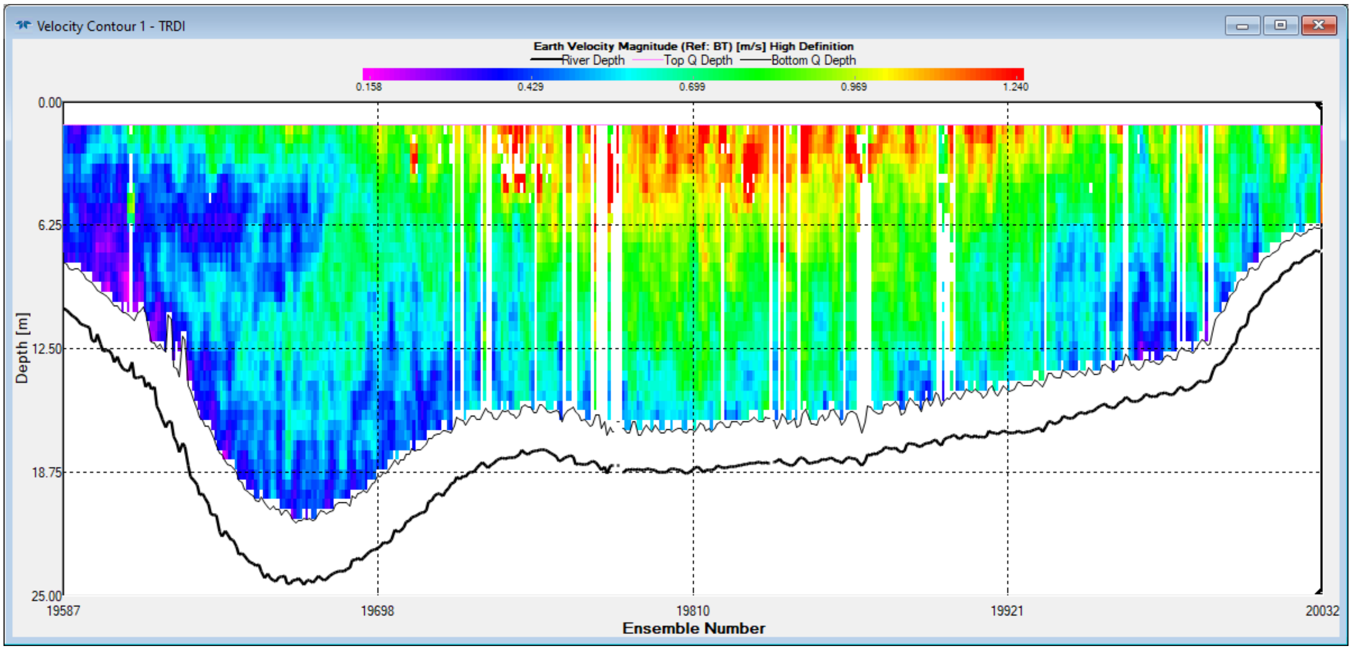
Transect 3, June 7 17:19 – 17:24, Channel Average Velocity = 0.585 m/s



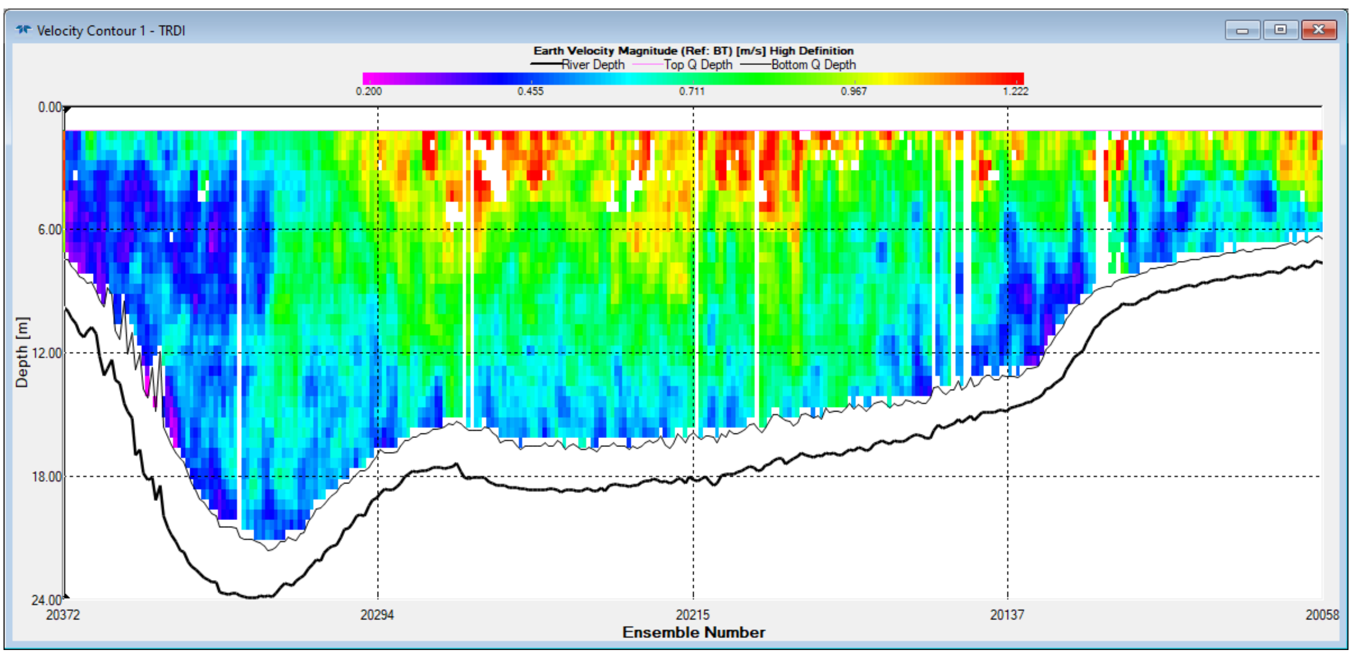
Transect 3, June 7 17:24 – 17:27, Channel Average Velocity = 0.702 m/s



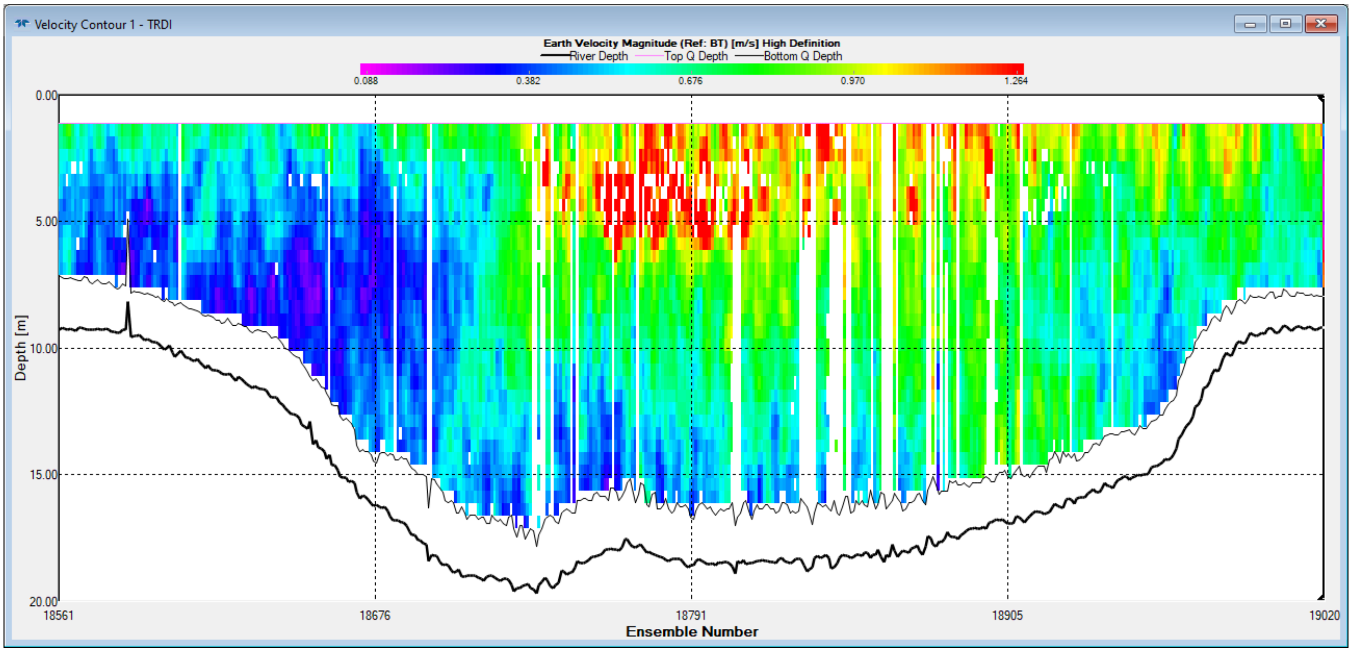
Transect 4, June 7 16:47 – 16:52, Channel Average Velocity = 0.669 m/s



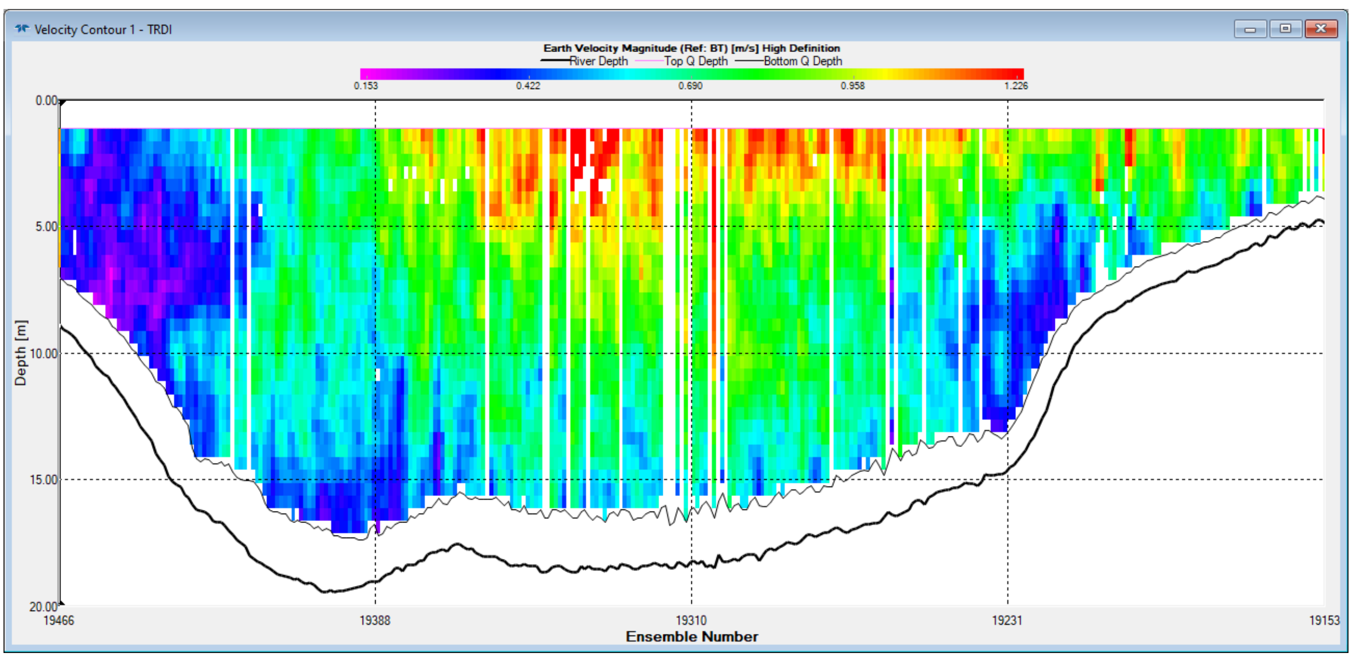
Transect 4, June 7 16:52 – 16:55, Channel Average Velocity = 0.680 m/s



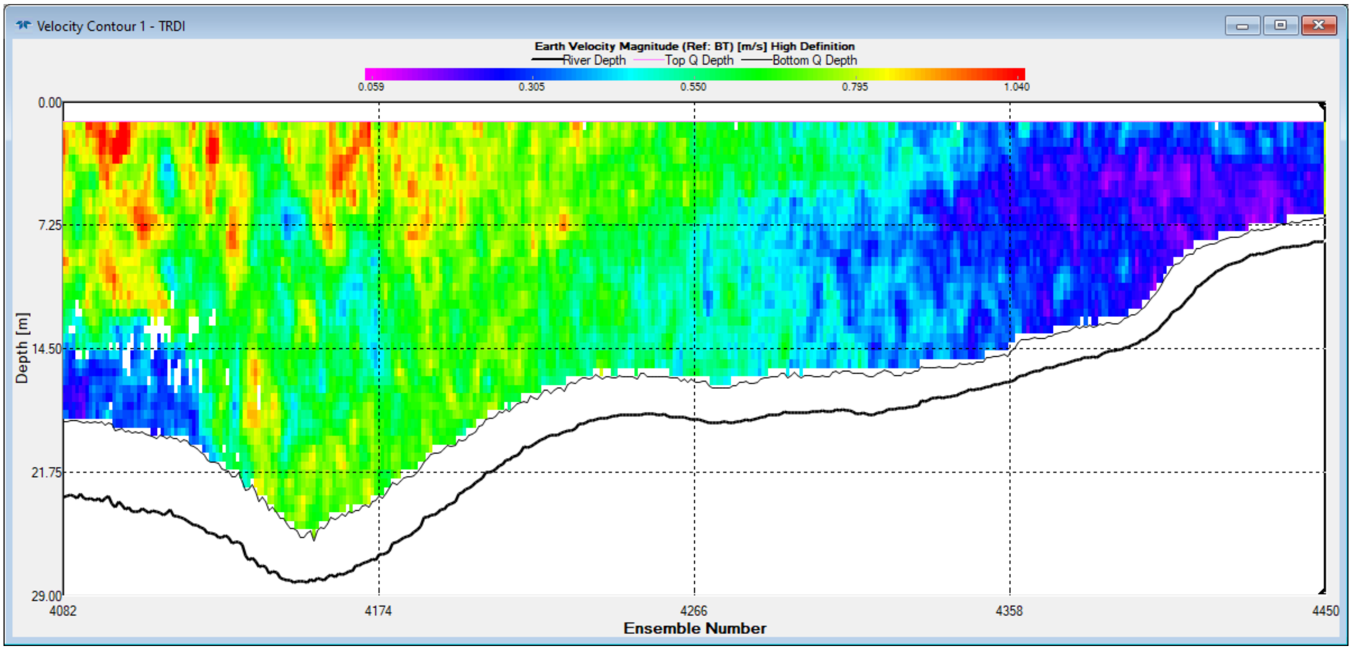
Transect 5, June 7 16:36 – 16:41, Channel Average Velocity = 0.632 m/s



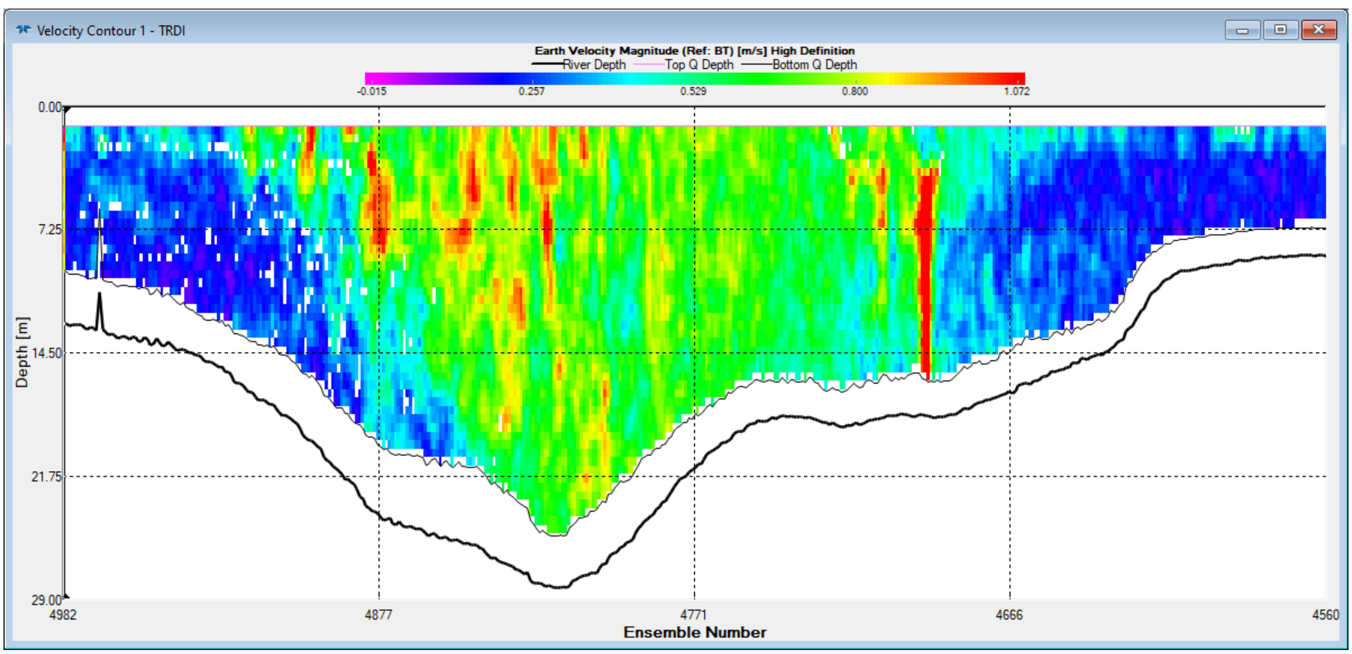
Transect 5, June 7 16:42 – 16:46, Channel Average Velocity = 0.659 m/s



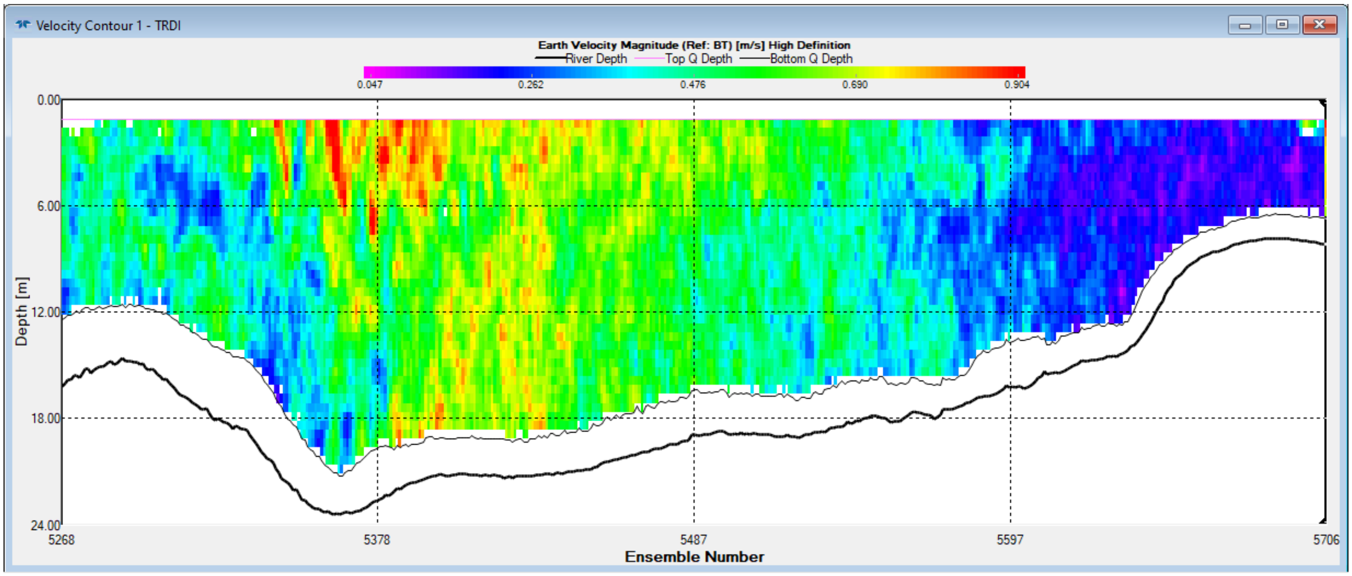
Transect 1, June 8 8:29 – 8:34, Channel Average Velocity = -0.502 m/s



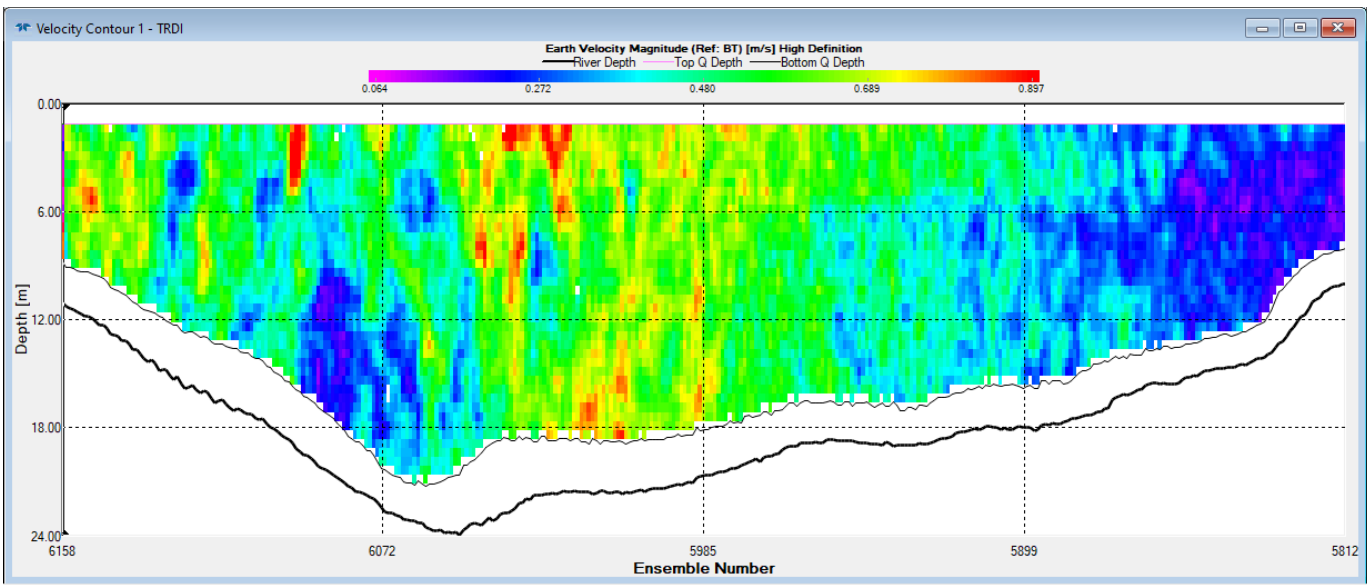
Transect 1, June 8 8:34 – 8:39, Channel Average Velocity = -0.423 m/s



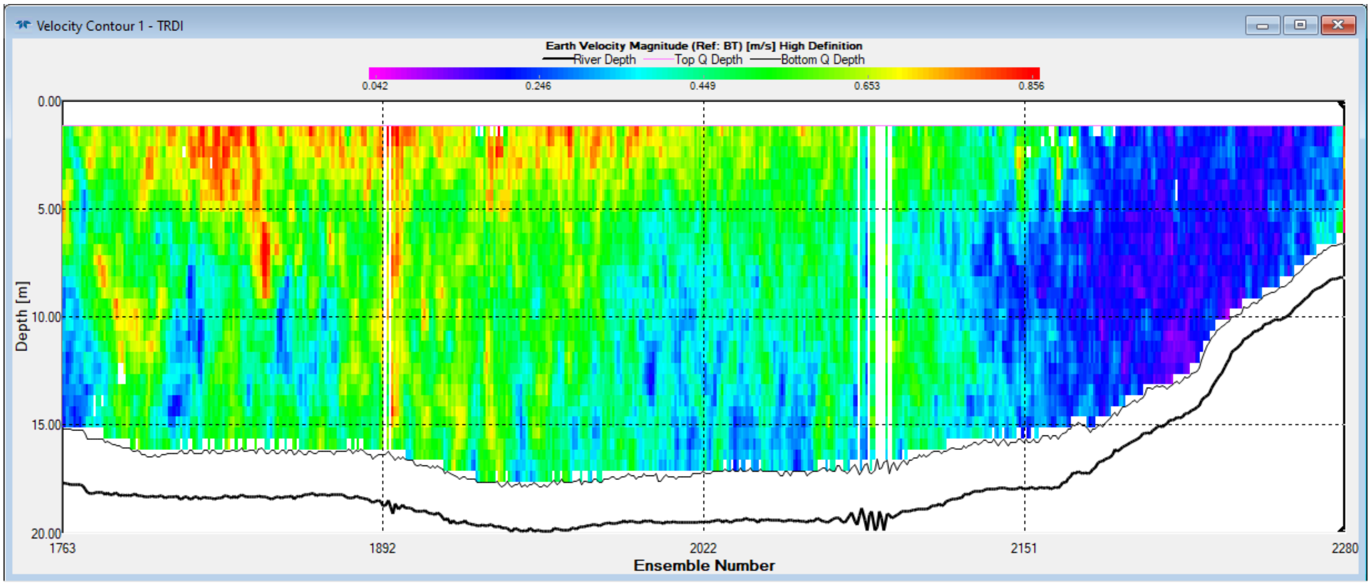
Transect 2, June 8 8:42 – 8:47, Channel Average Velocity = -0.420 m/s



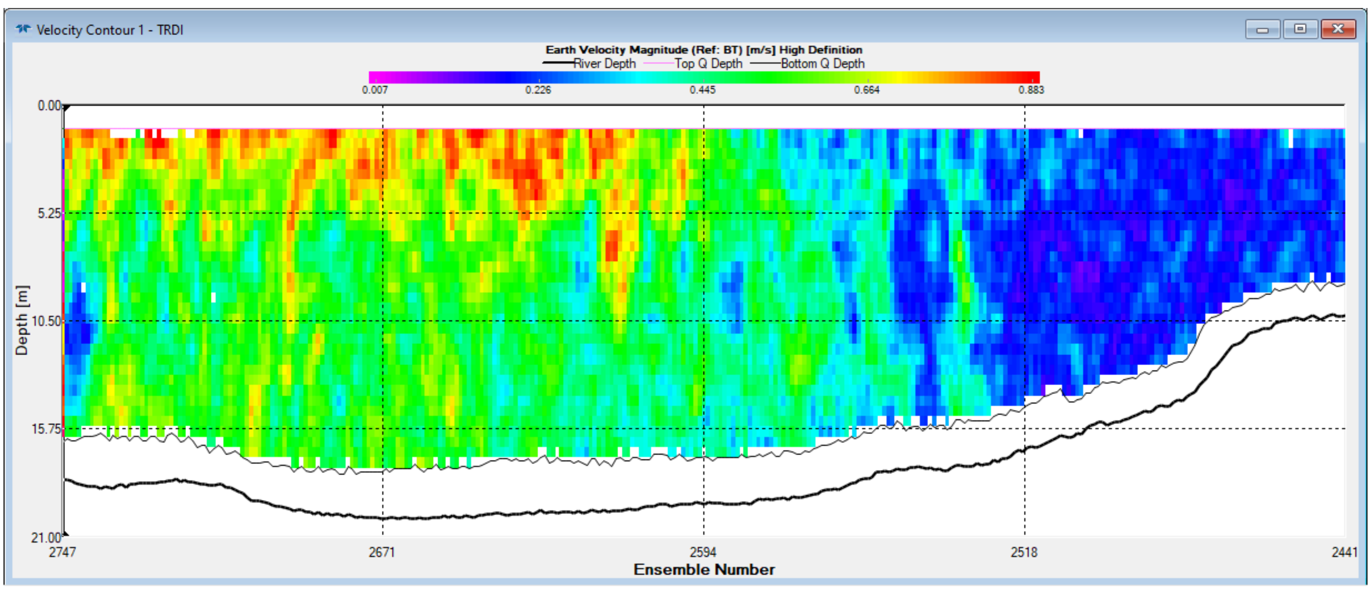
Transect 2, June 8 8:47 – 8:52, Channel Average Velocity = -0.425 m/s



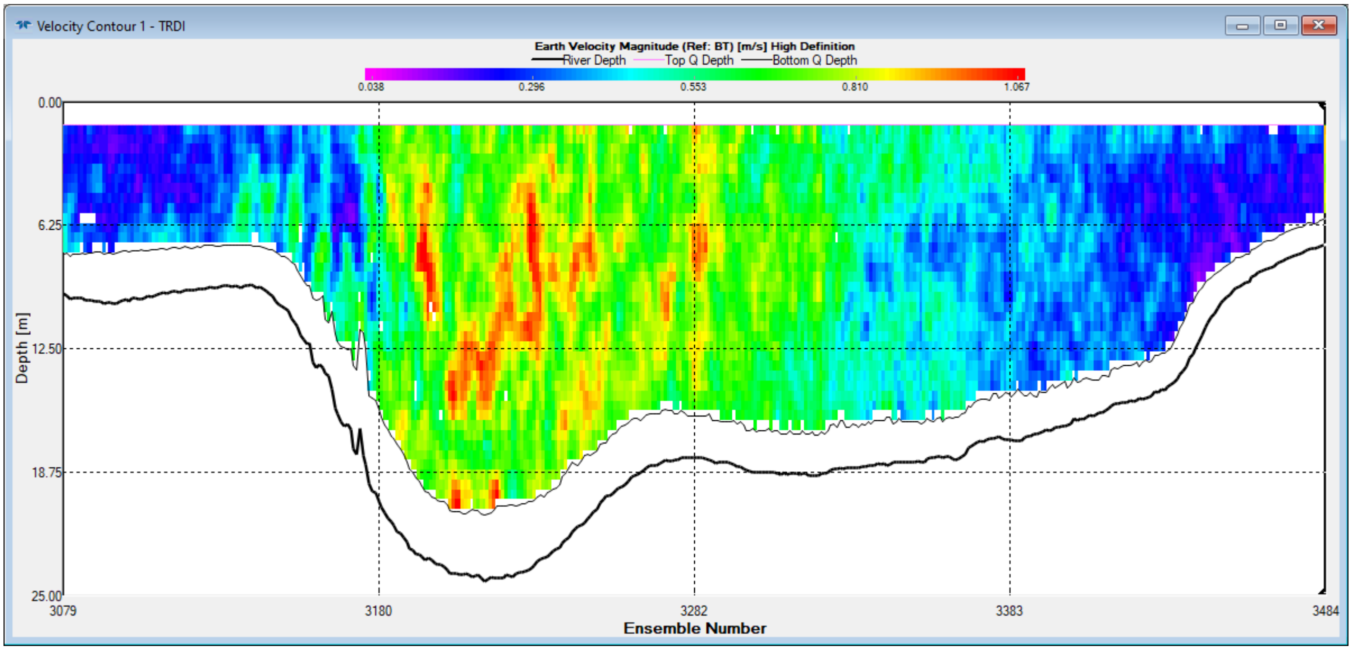
Transect 3, June 8 9:11 – 9:18, Channel Average Velocity = -0.380 m/s



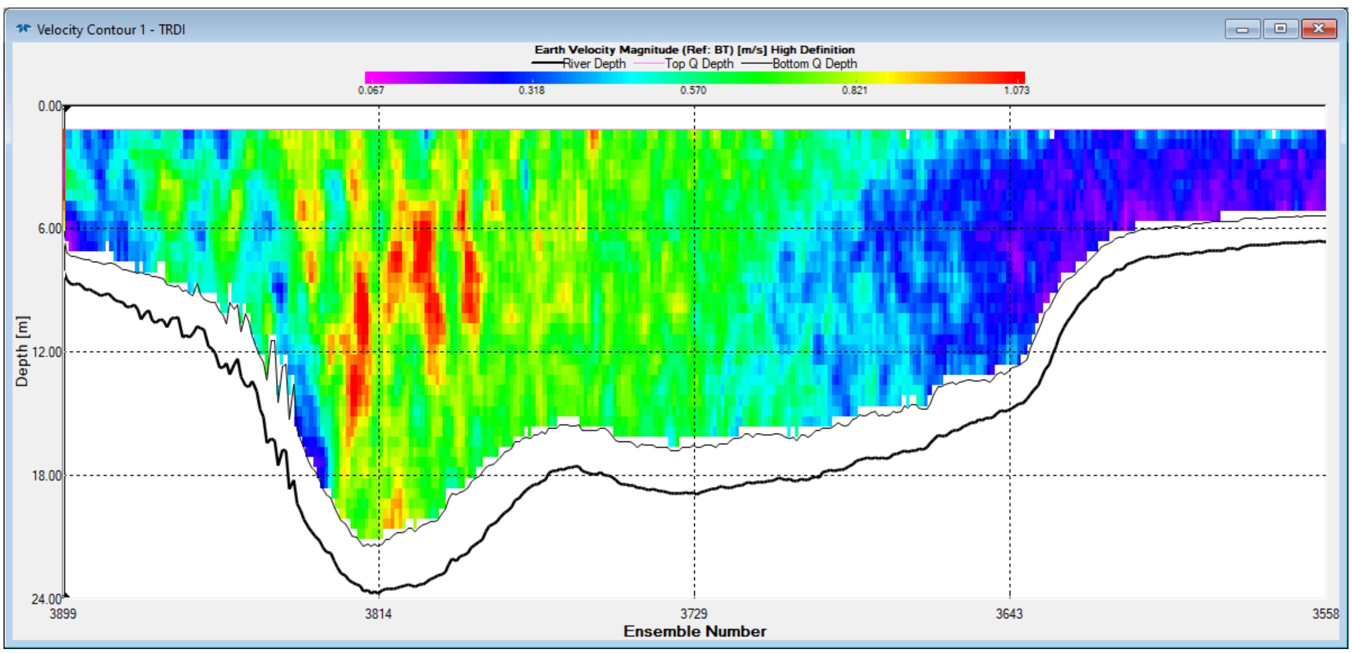
Transect 3, June 8 9:18 – 9:22, Channel Average Velocity = -0.367 m/s



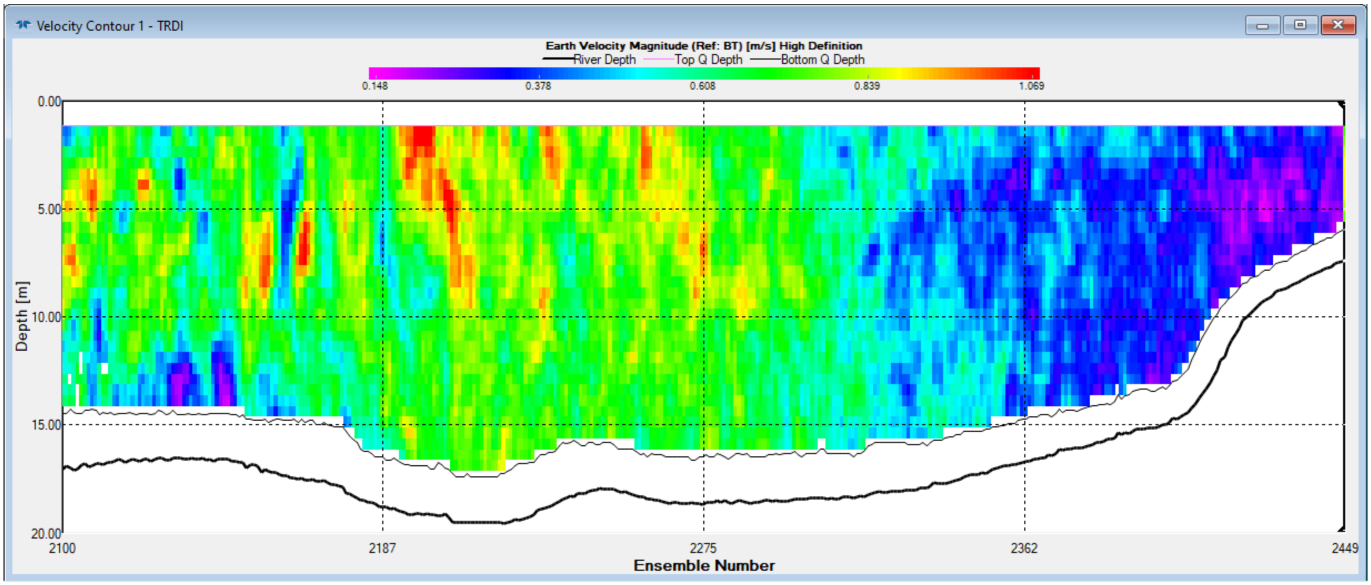
Transect 4, June 8 8:19 – 8:23, Channel Average Velocity = -0.490 m/s



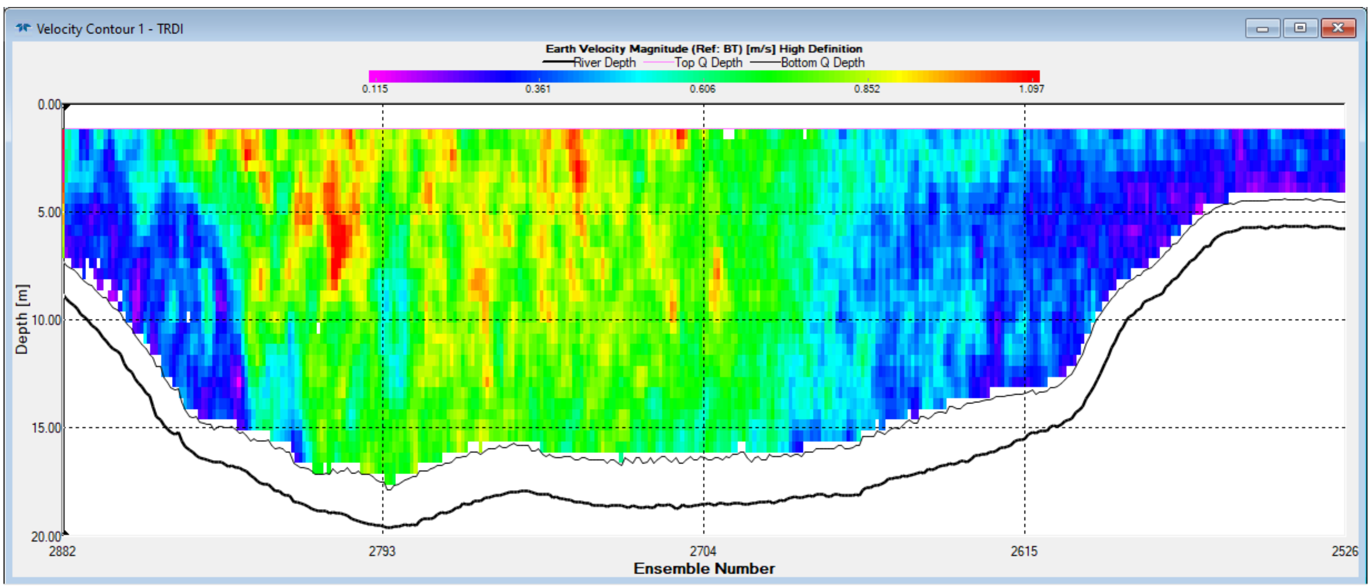
Transect 4, June 8 8:24 – 8:28, Channel Average Velocity = -0.514 m/s



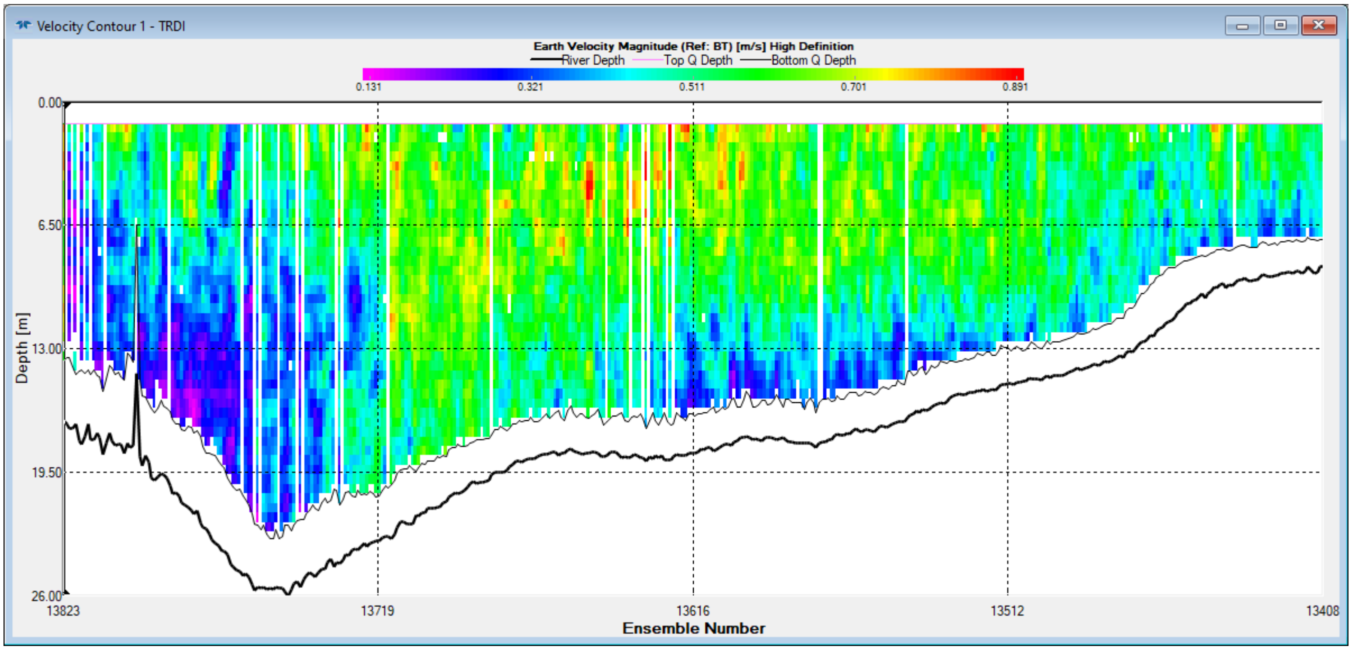
Transect 5, June 8 8:09 – 8:13, Channel Average Velocity = -0.570 m/s



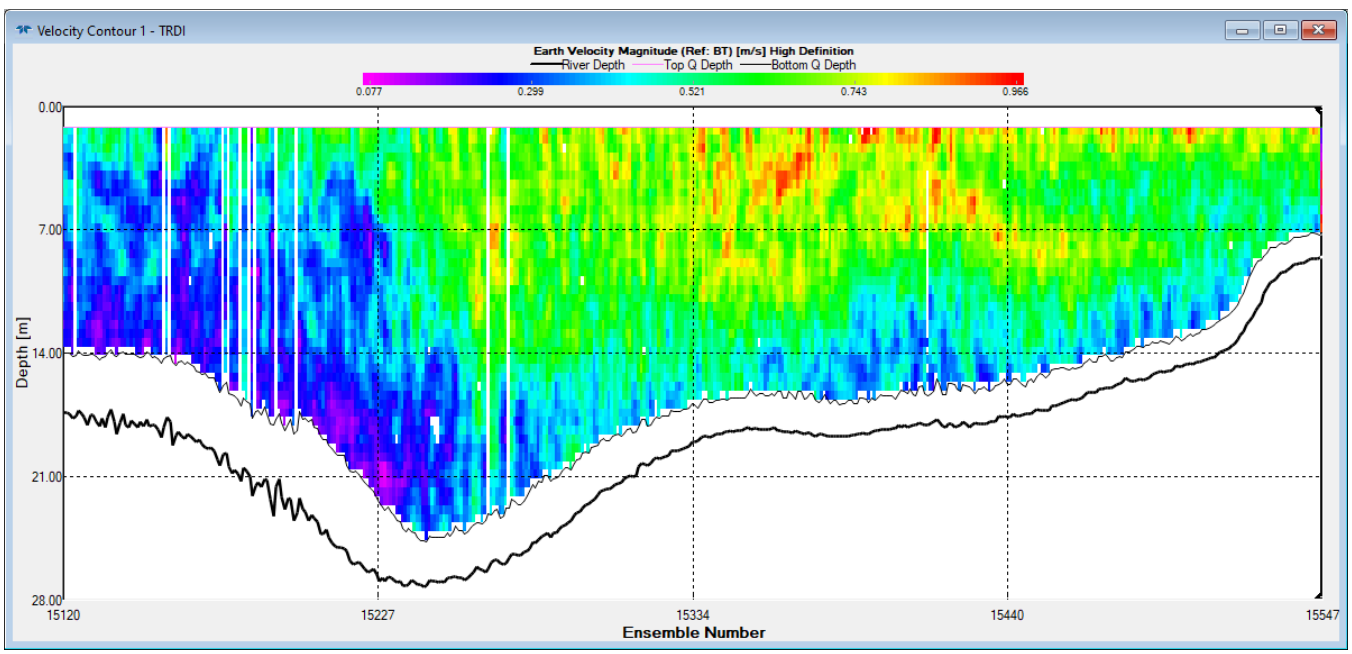
Transect 5, June 8 8:13 – 8:17, Channel Average Velocity = -0.570 m/s



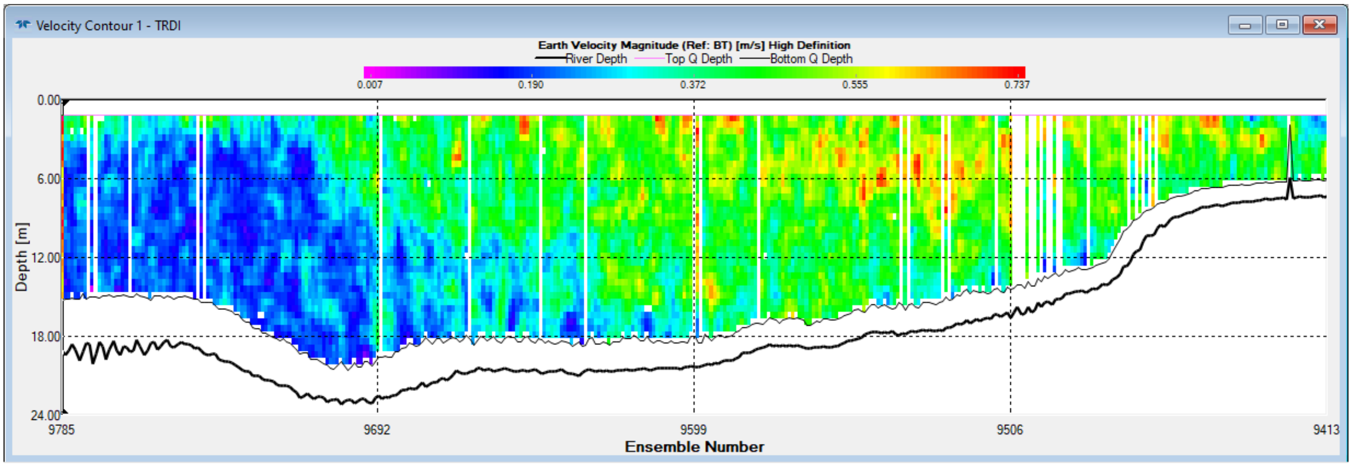
Transect 1, June 8 15:26 – 15:31, Channel Average Velocity = 0.477 m/s



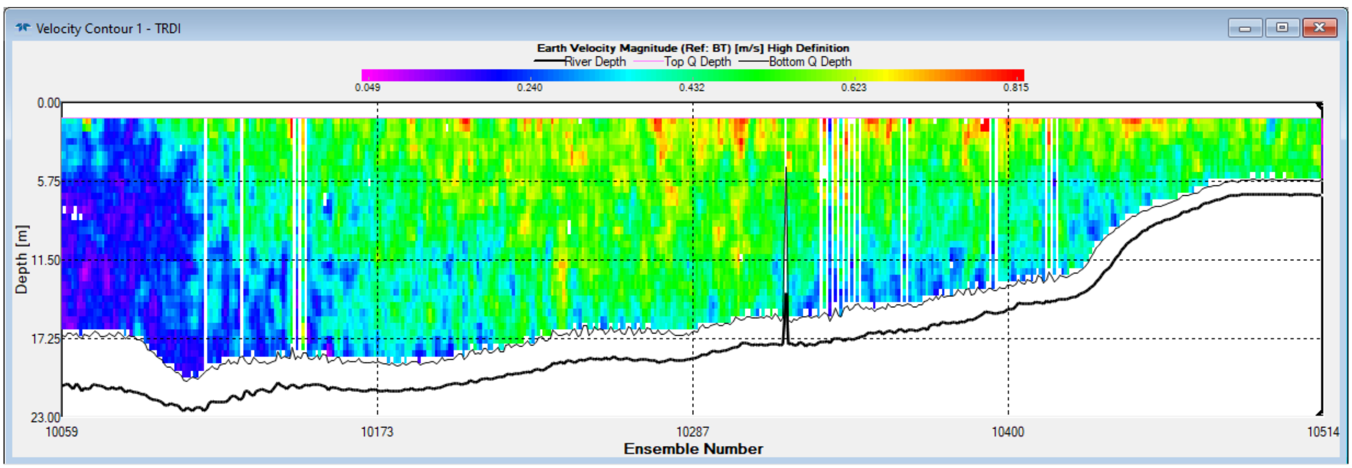
Transect 1, June 8 15:44 – 15:49, Channel Average Velocity = 0.480 m/s



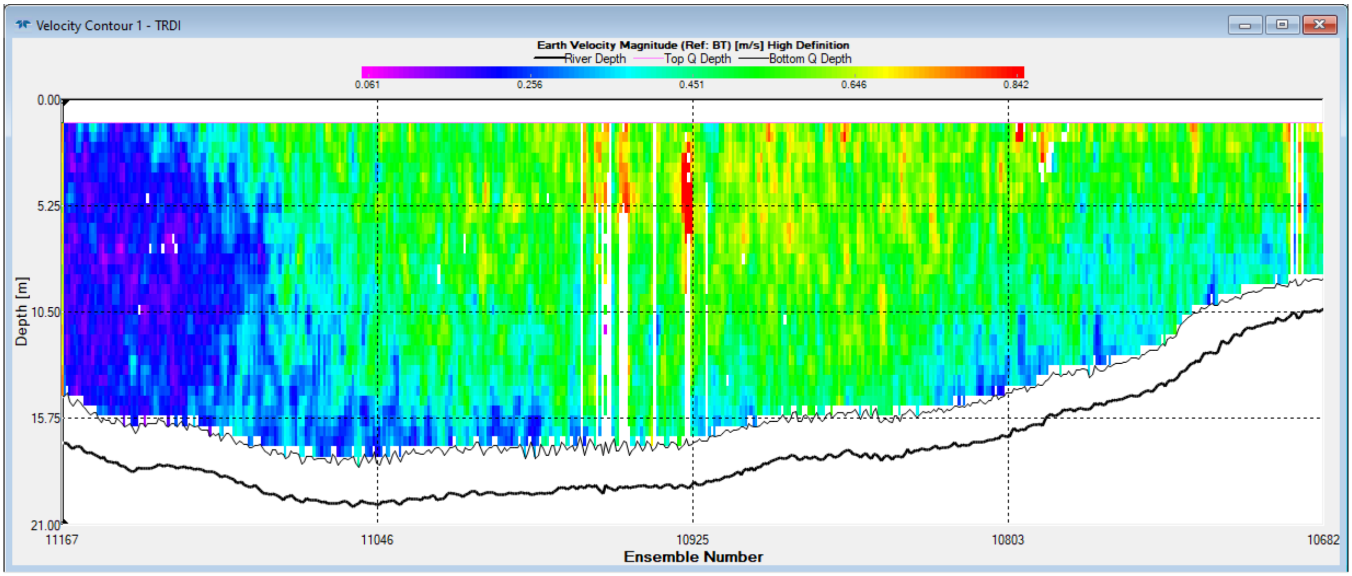
Transect 2, June 8 14:44 – 14:48, Channel Average Velocity = 0.299 m/s



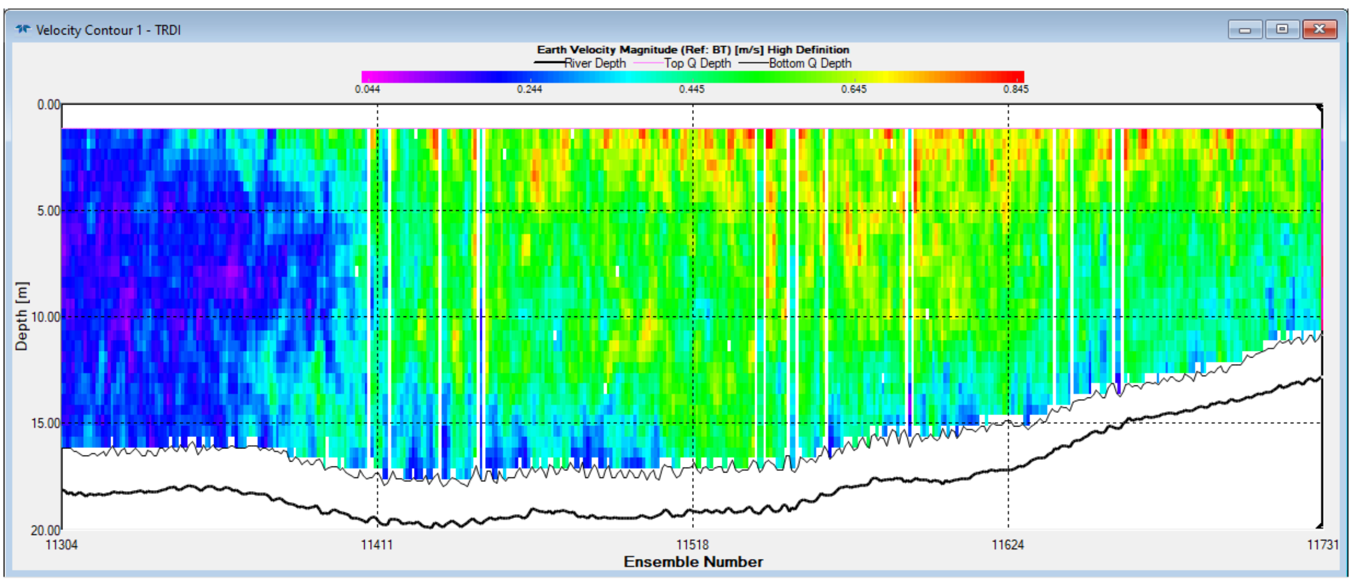
Transect 2, June 8 14:51 – 14:56, Channel Average Velocity = 0.381 m/s



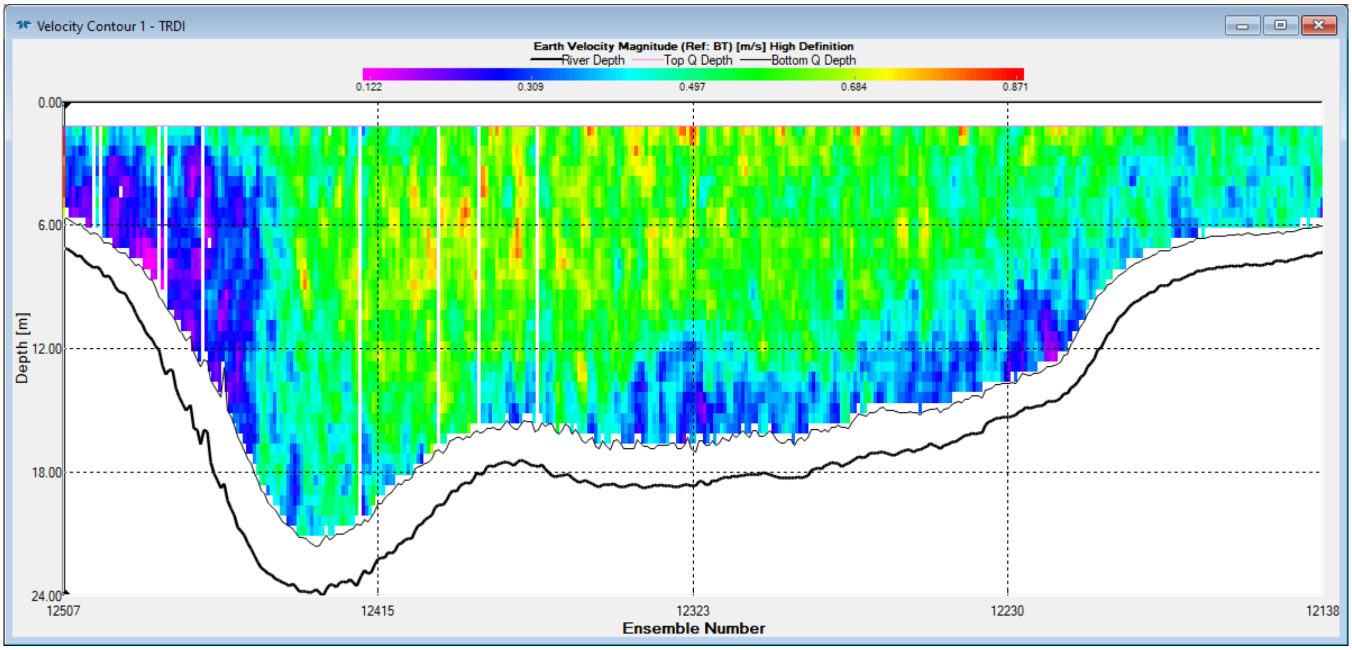
Transect 3, June 8 14:57 – 15:03, Channel Average Velocity = 0.401 m/s



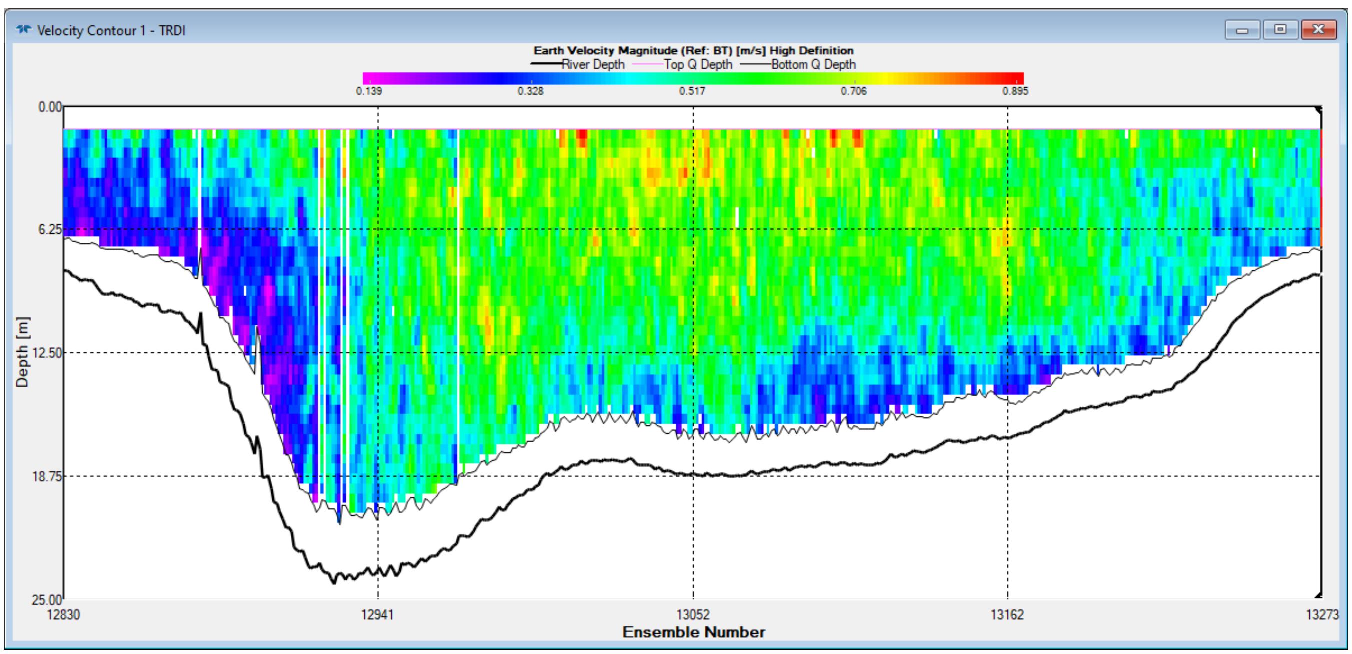
Transect 3, June 8 15:04 – 15:09, Channel Average Velocity = 0.393 m/s



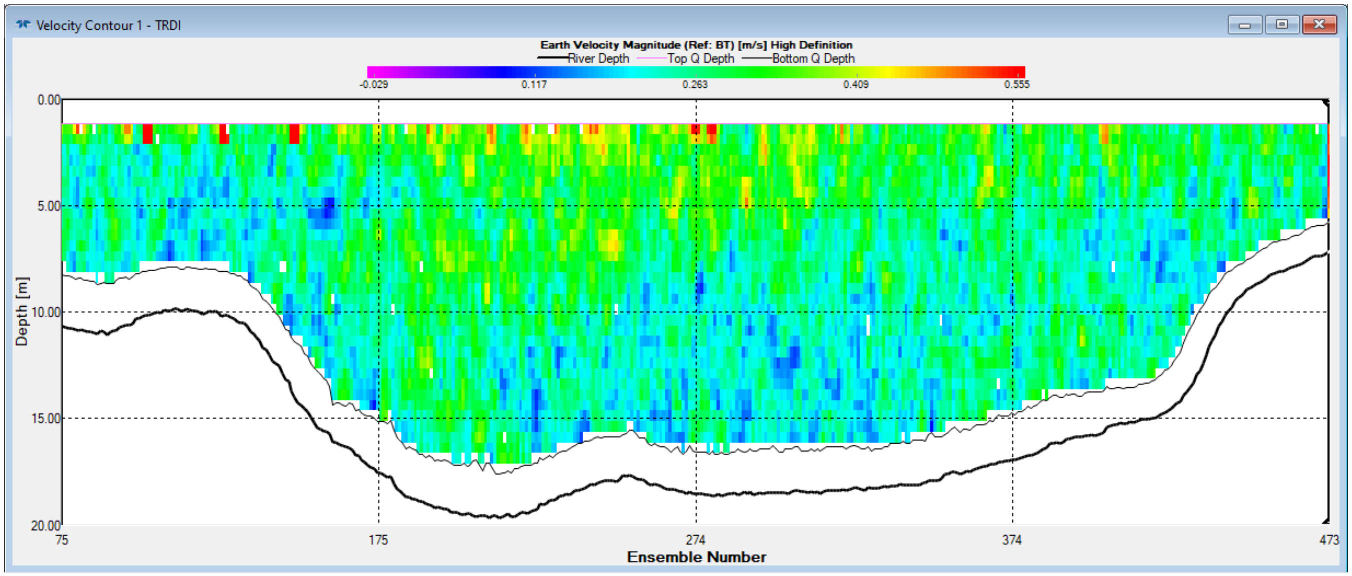
Transect 4, June 8 15:12 – 15:17, Channel Average Velocity = 0.464 m/s



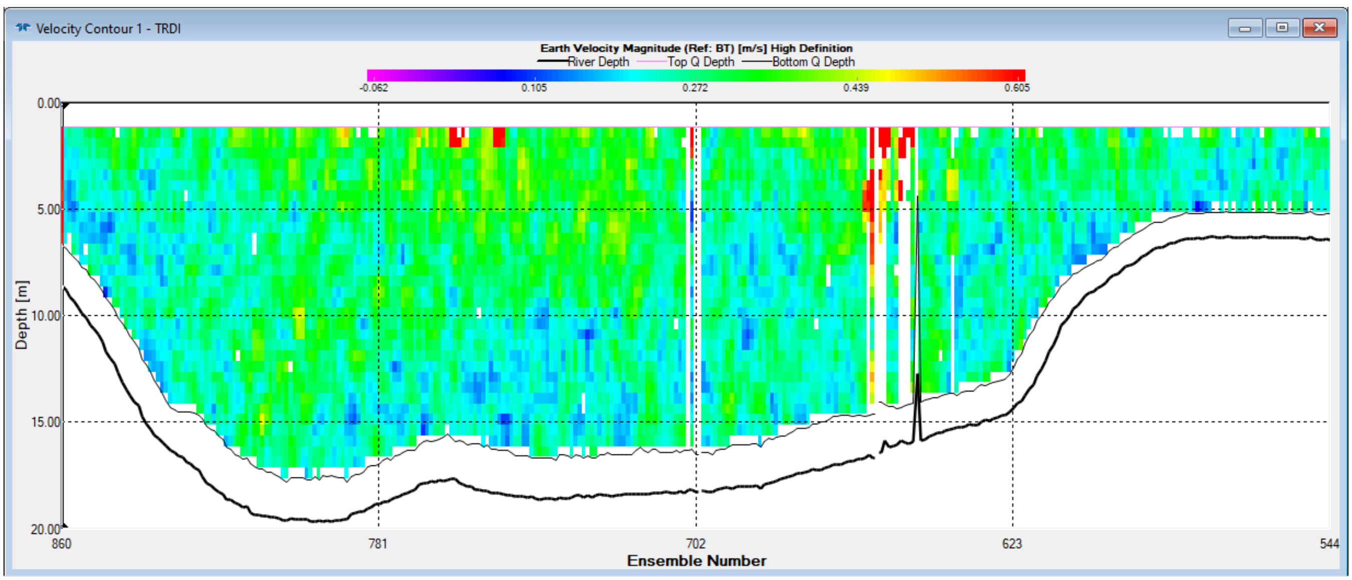
Transect 4, June 8 15:20 – 15:25, Channel Average Velocity = 0.482 m/s



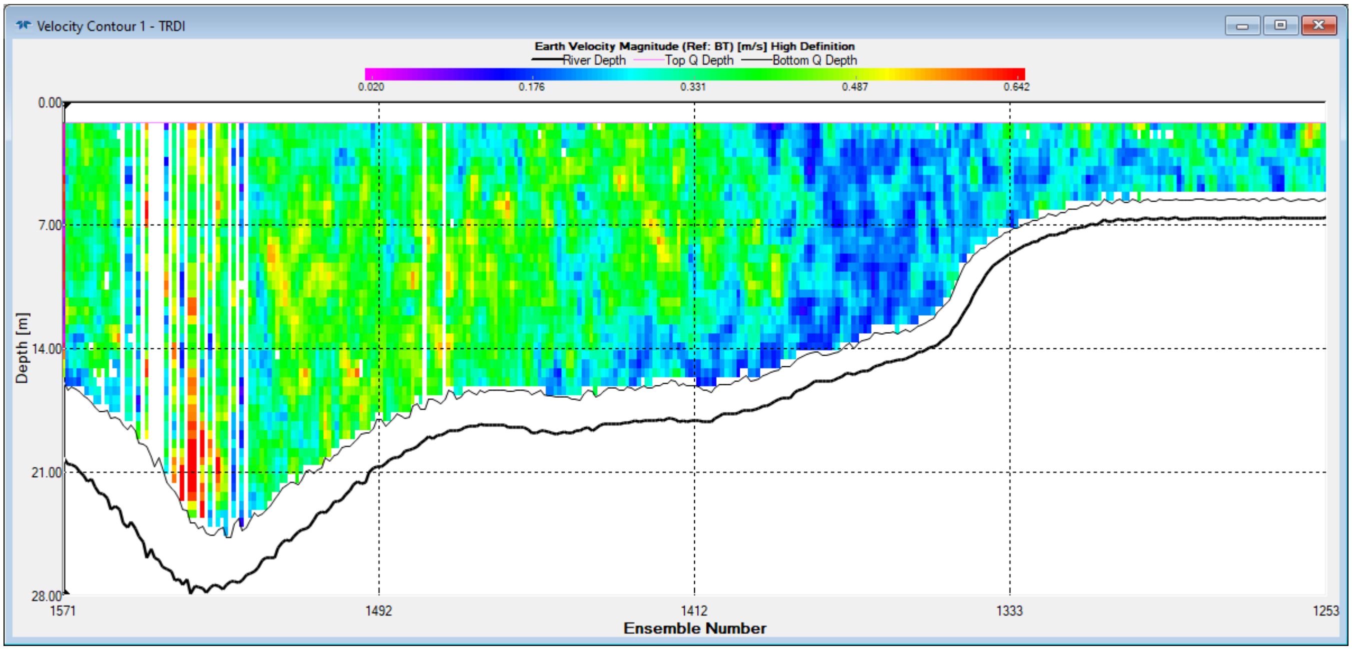
Transect 5, June 8 13:11 – 13:16, Channel Average Velocity = 0.187 m/s



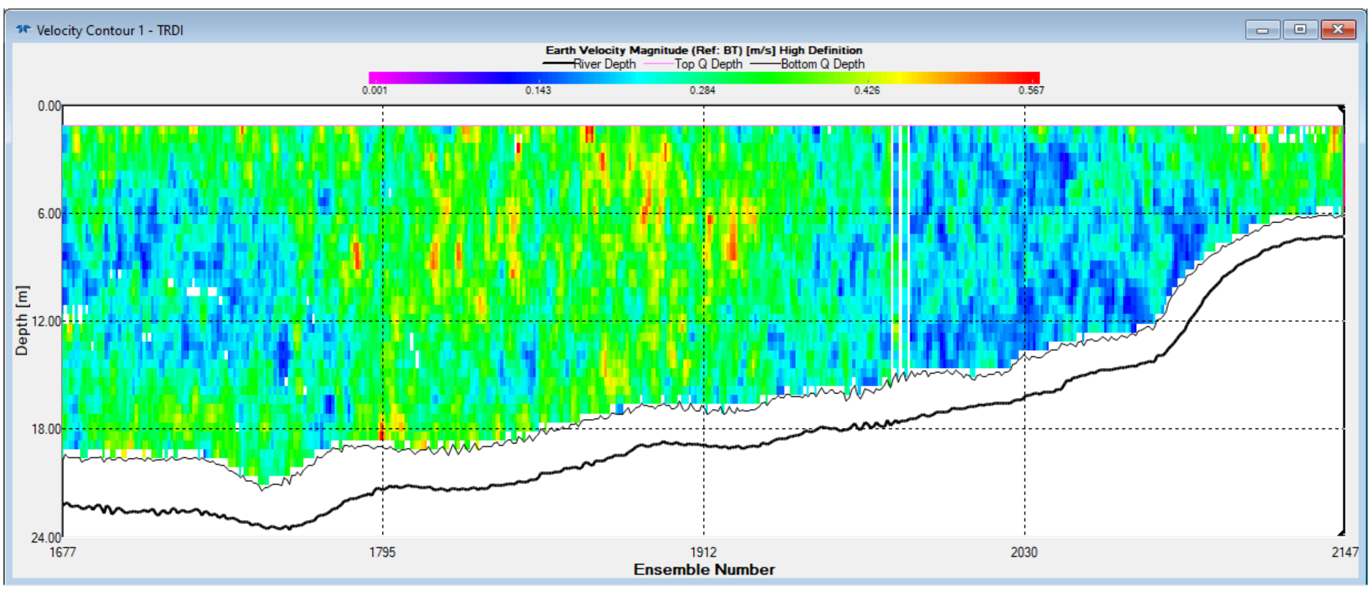
Transect 5, June 8 13:16 – 13:20, Channel Average Velocity = 0.190 m/s



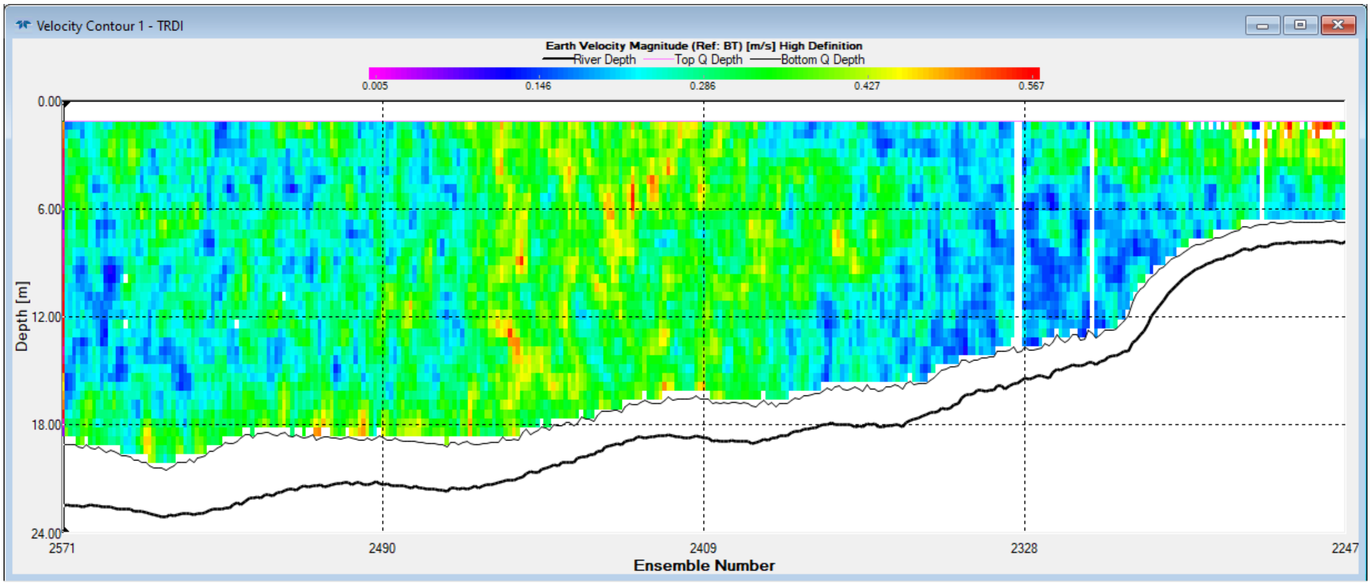
Transect 1, June 9 11:08 – 11:11, Channel Average Velocity = -0.207 m/s



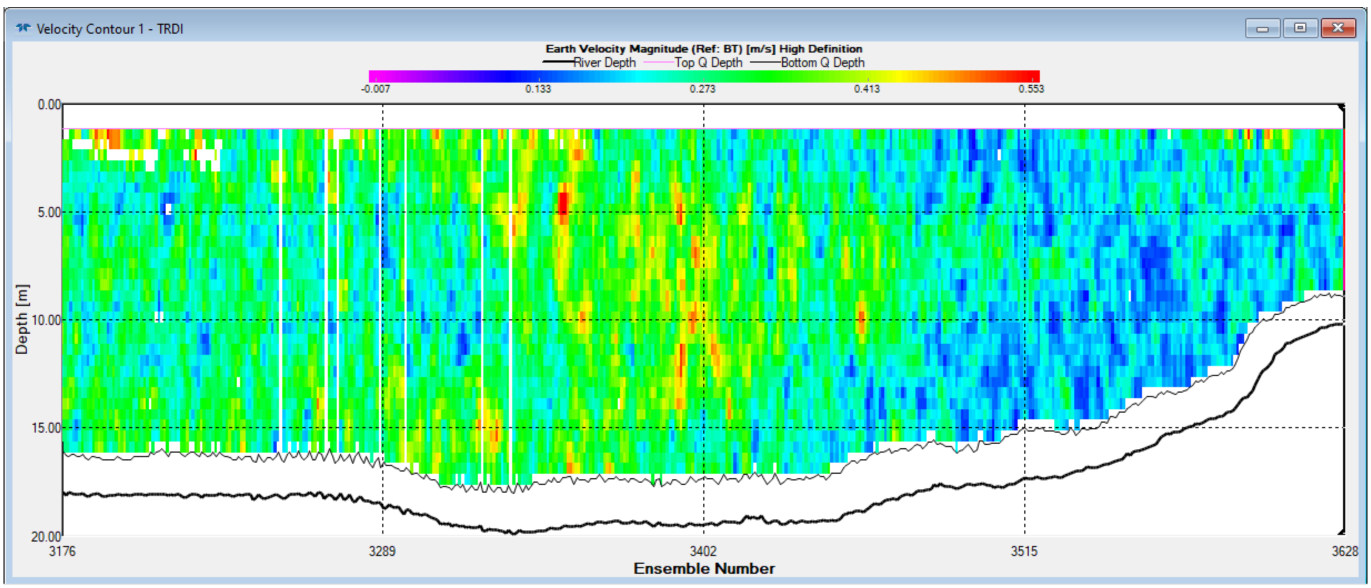
Transect 2, June 9 11:12 – 11:17, Channel Average Velocity = -0.174 m/s



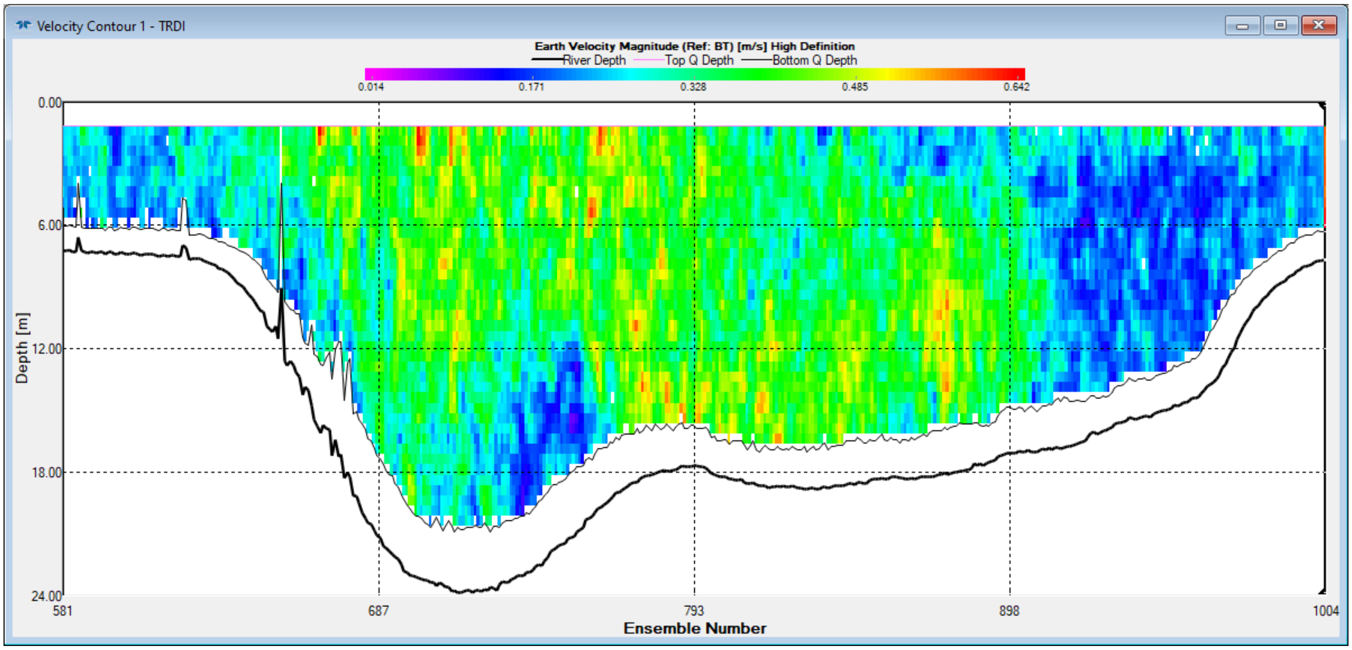
Transect 2, June 9 11:18 – 11:22, Channel Average Velocity = -0.171 m/s



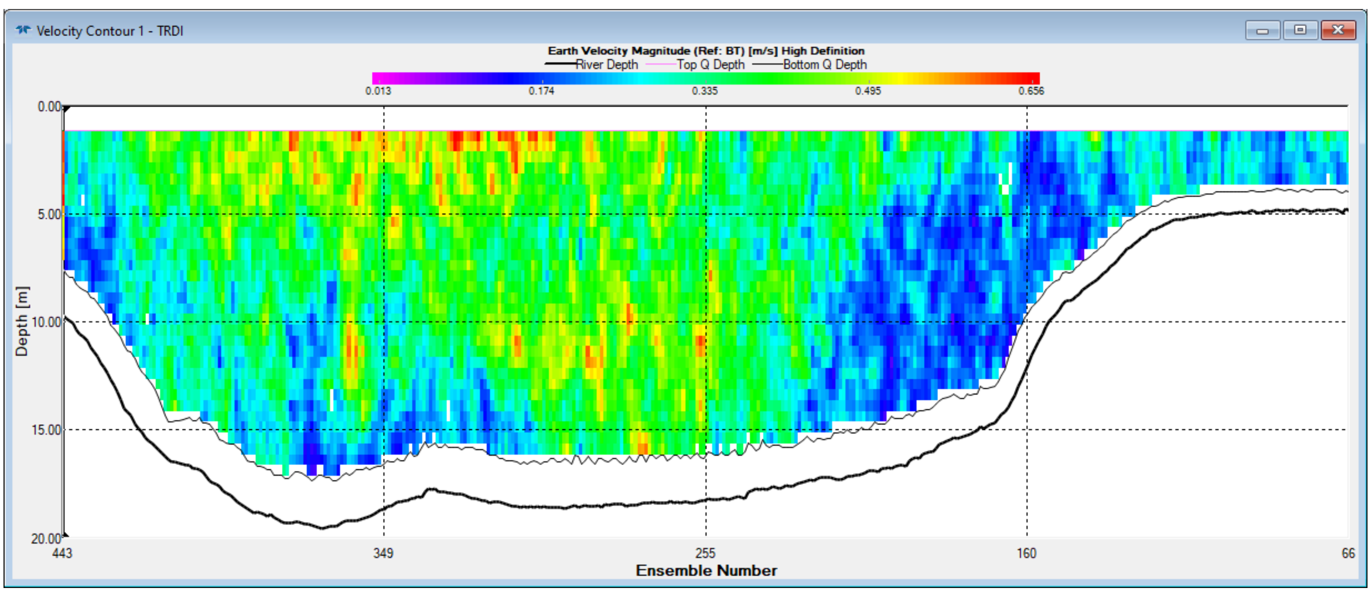
Transect 3, June 9 11:28 – 11:33, Channel Average Velocity = -0.160 m/s



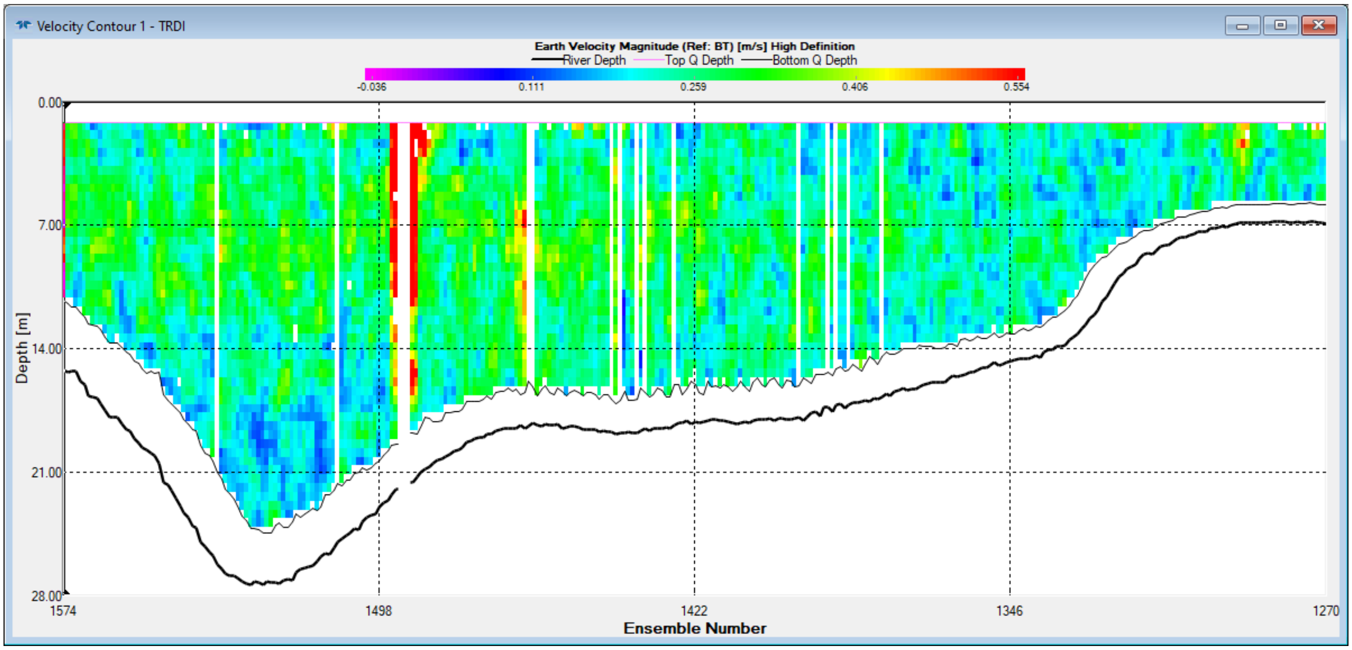
Transect 4, June 9 11:01 – 11:05, Channel Average Velocity = -0.241 m/s



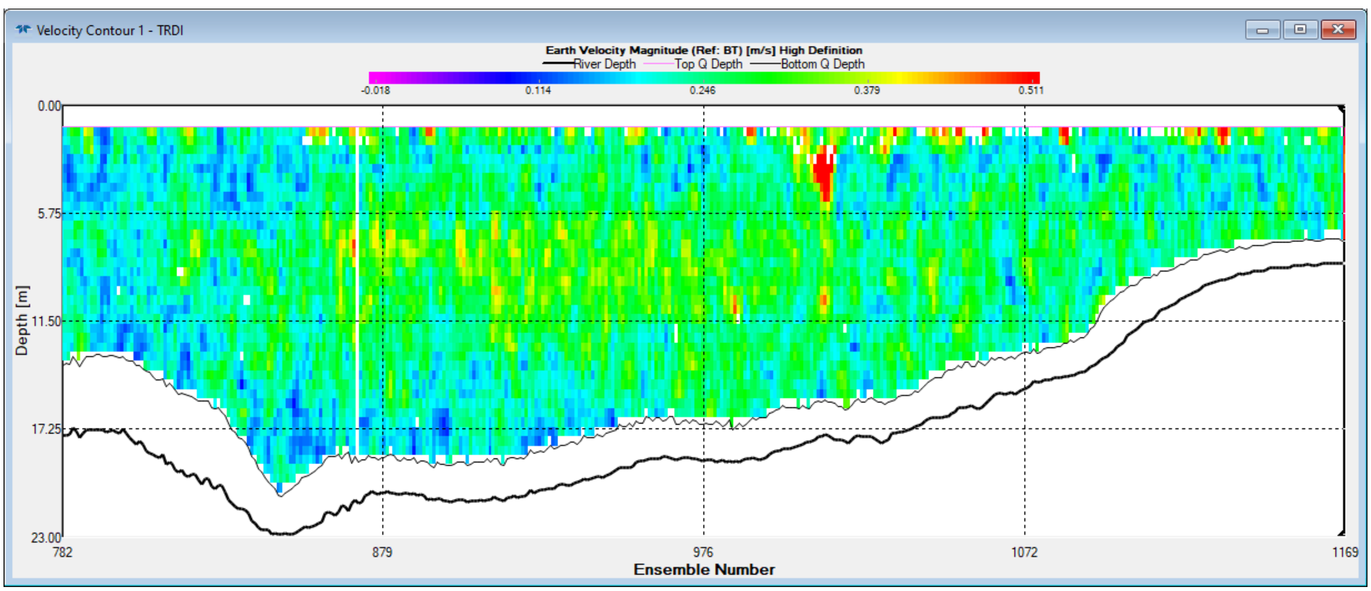
Transect 5, June 9 10:55 – 11:00, Channel Average Velocity = -0.232 m/s



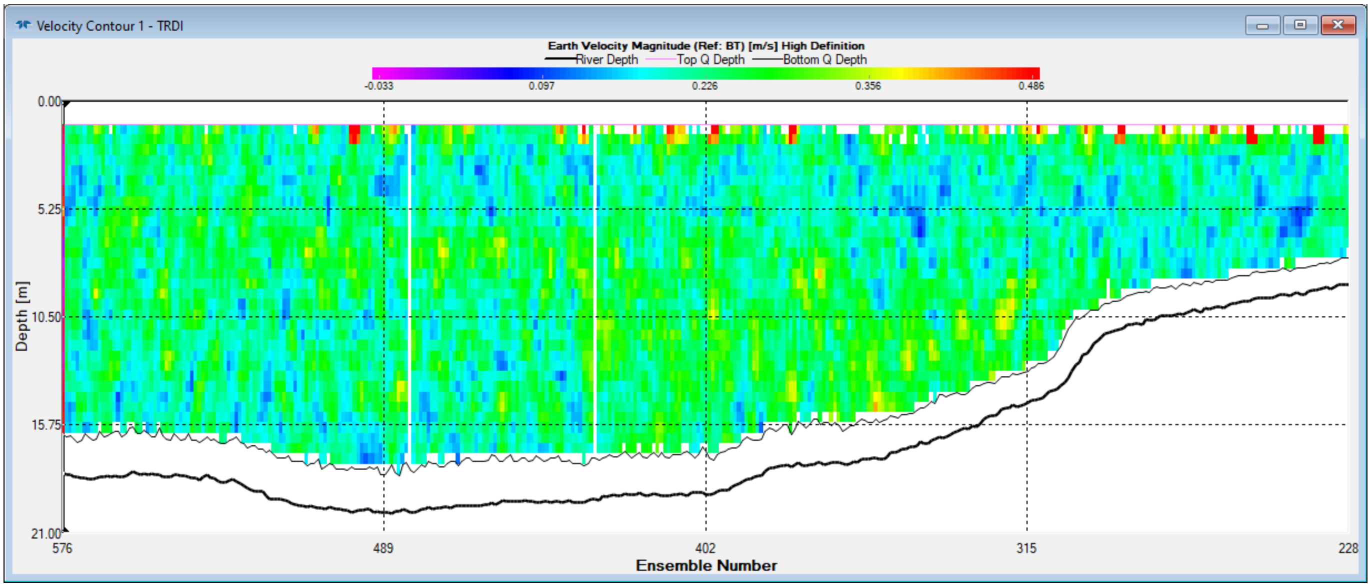
Transect 1, June 9 14:04 – 14:07, Channel Average Velocity = 0.156 m/s



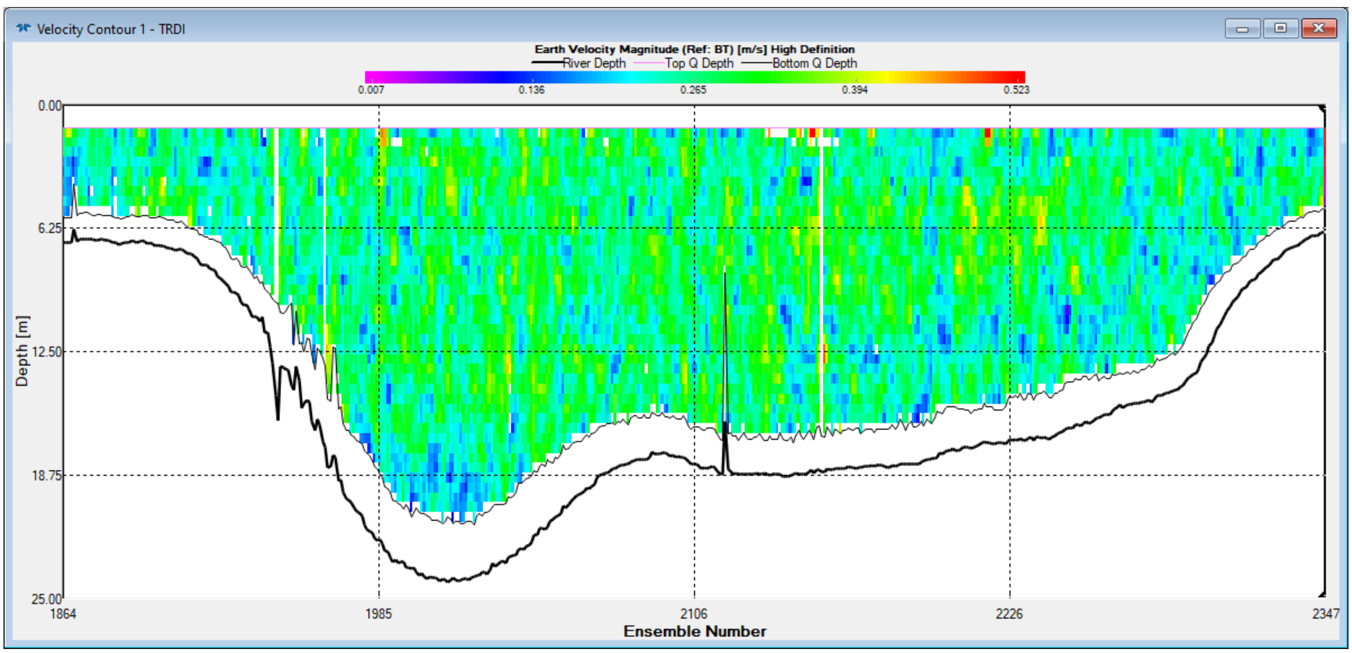
Transect 2, June 9 13:59 – 14:03, Channel Average Velocity = 0.139 m/s



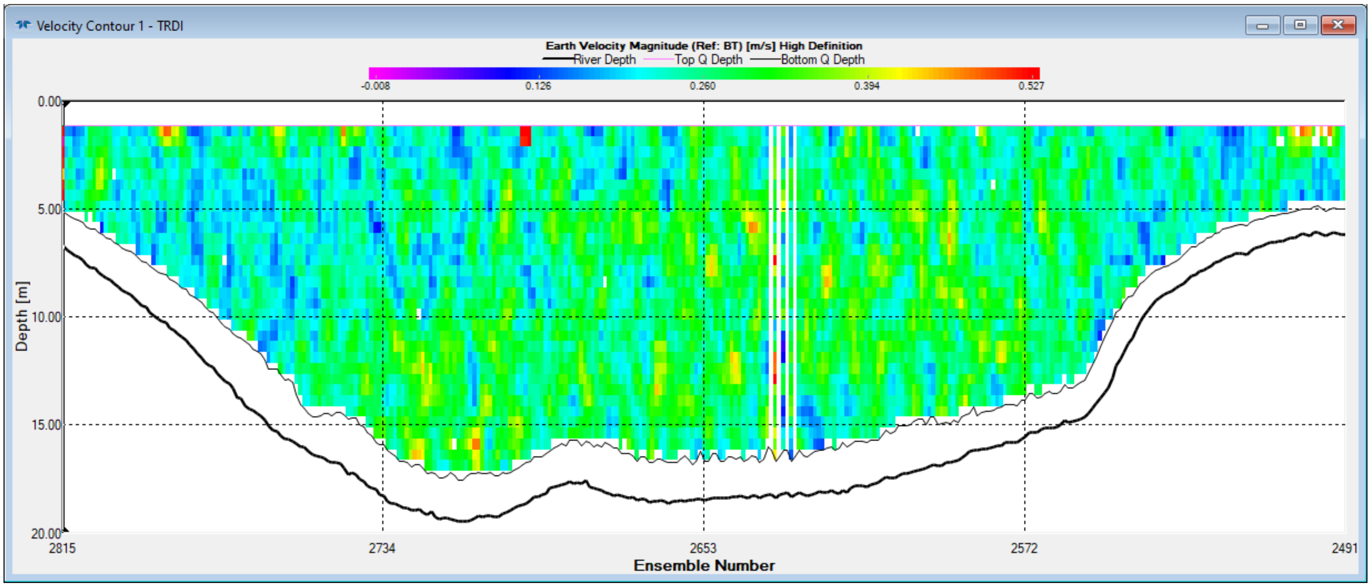
Transect 3, June 9 13:53 – 13:57, Channel Average Velocity = 0.101 m/s



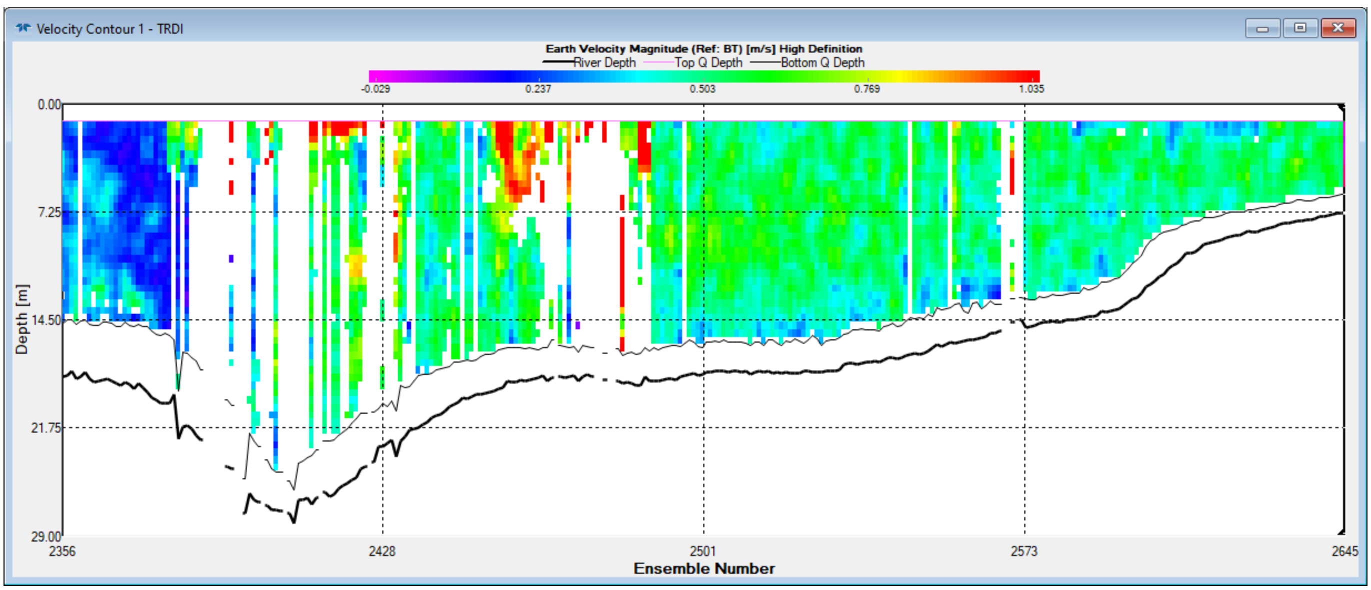
Transect 4, June 9 14:10 – 14:15, Channel Average Velocity = 0.189 m/s



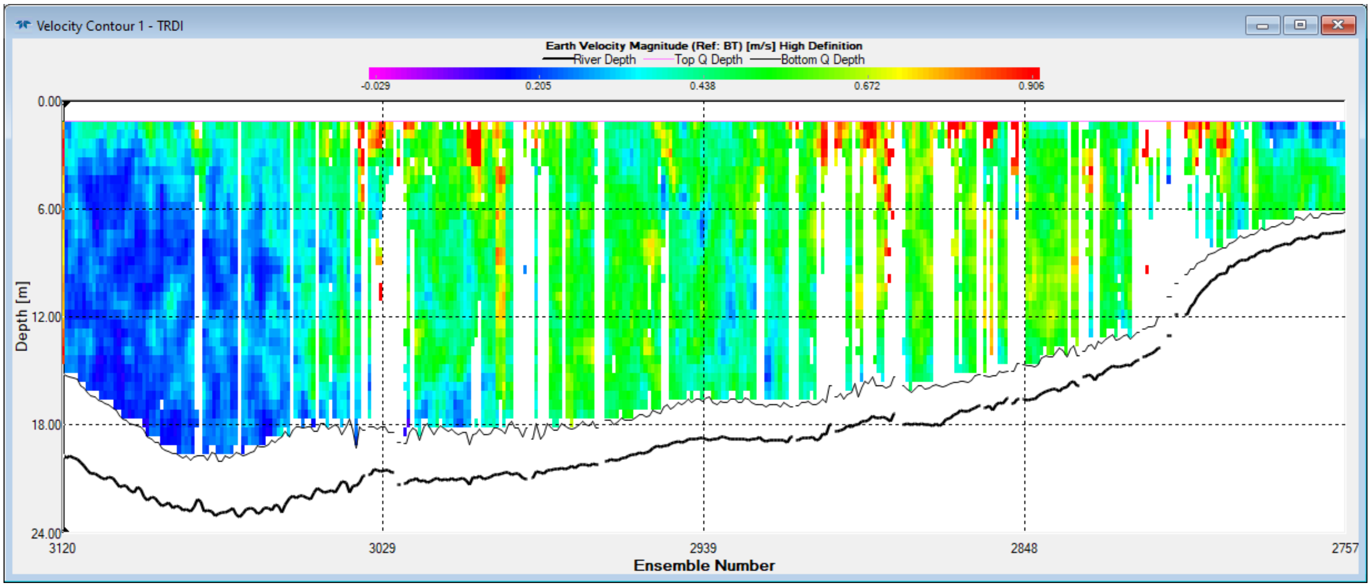
Transect 5, June 9 14:16 – 14:20, Channel Average Velocity = 0.178 m/s



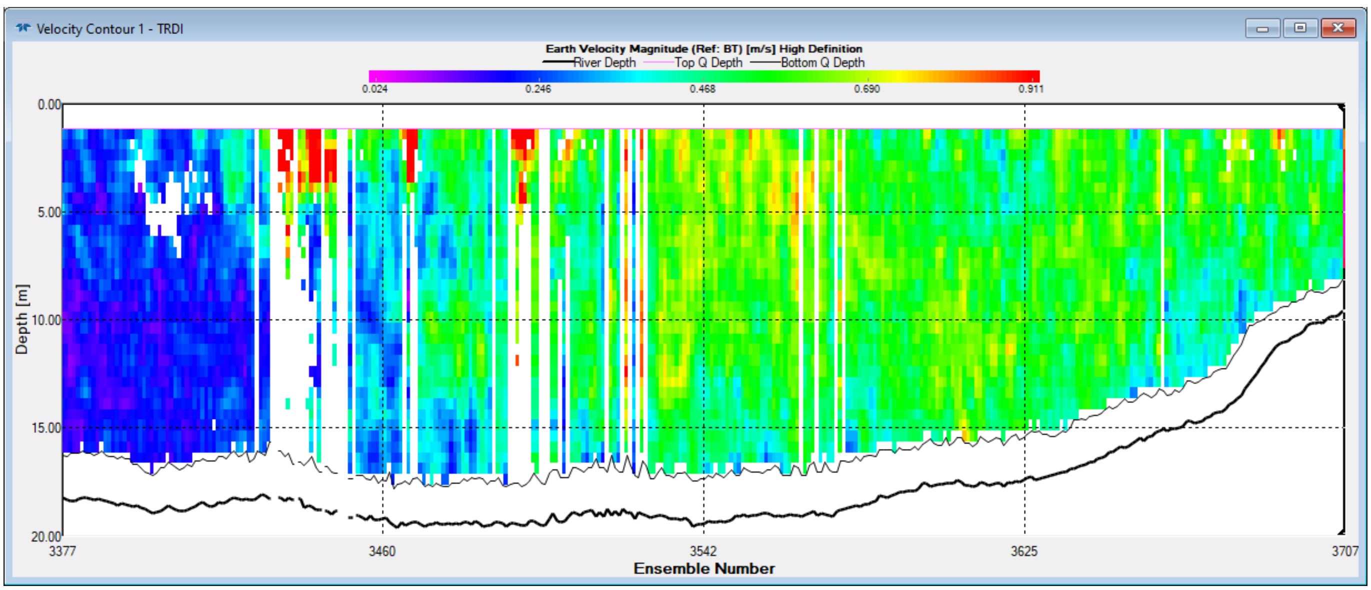
Transect 1, June 9 15:43 – 15:47, Channel Average Velocity = 0.386 m/s



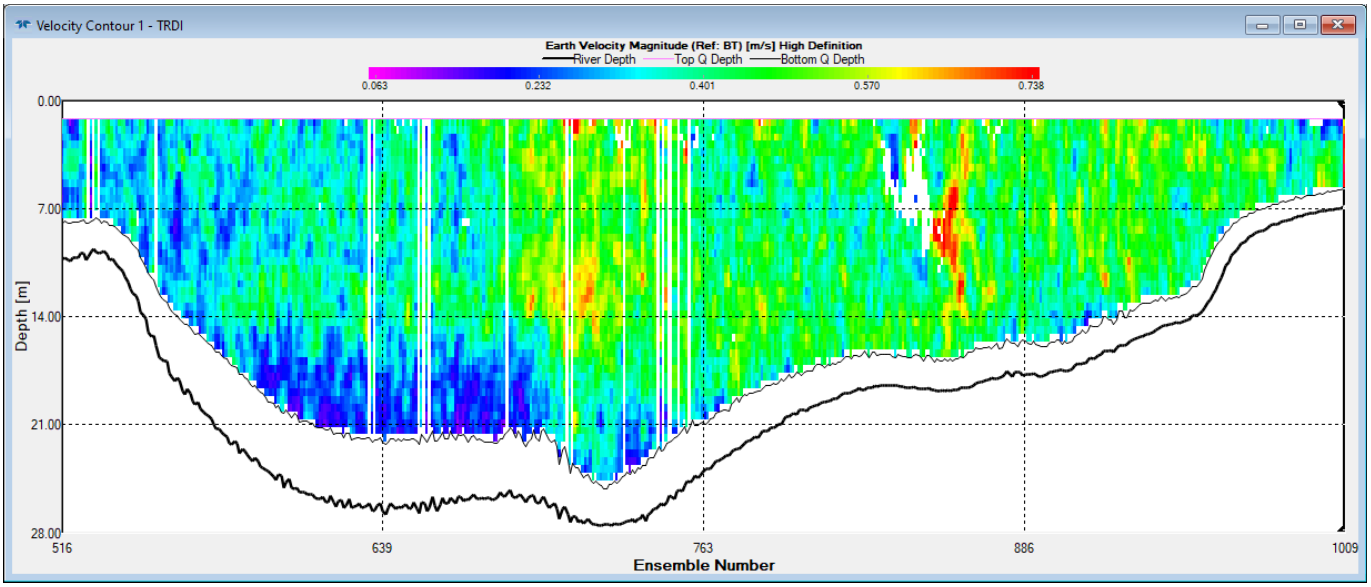
Transect 2, June 9 15:48 – 15:52, Channel Average Velocity = 0.347 m/s



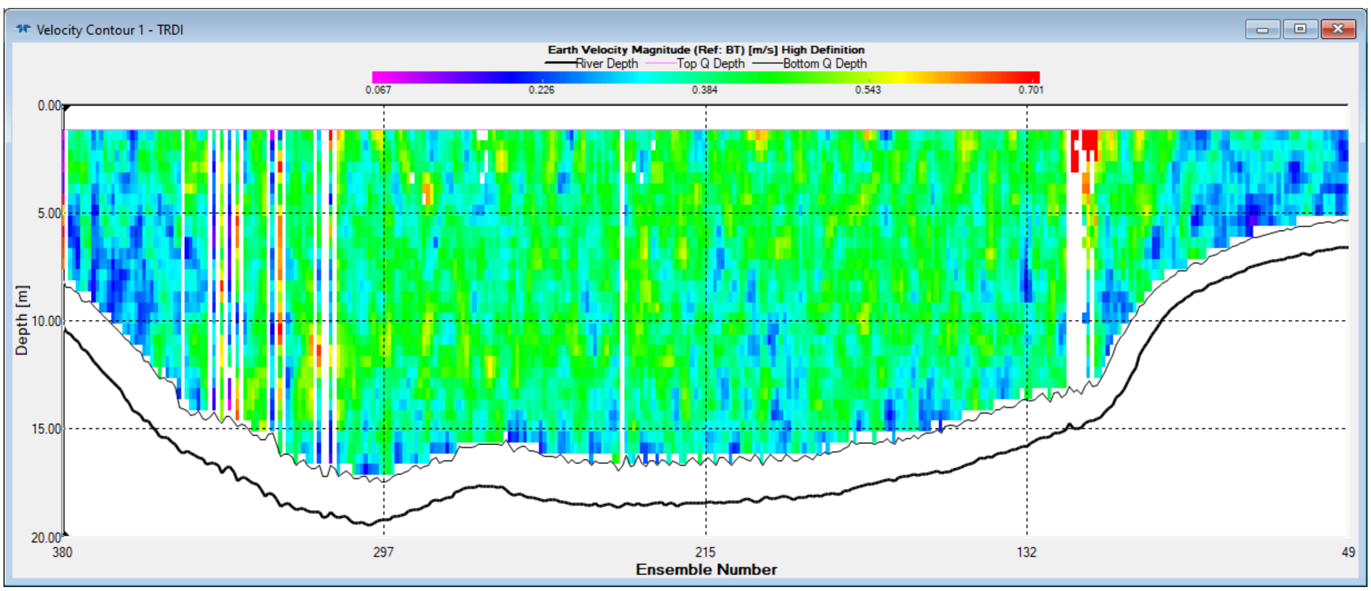
Transect 3, June 9 15:54 – 15:58, Channel Average Velocity = 0.409 m/s



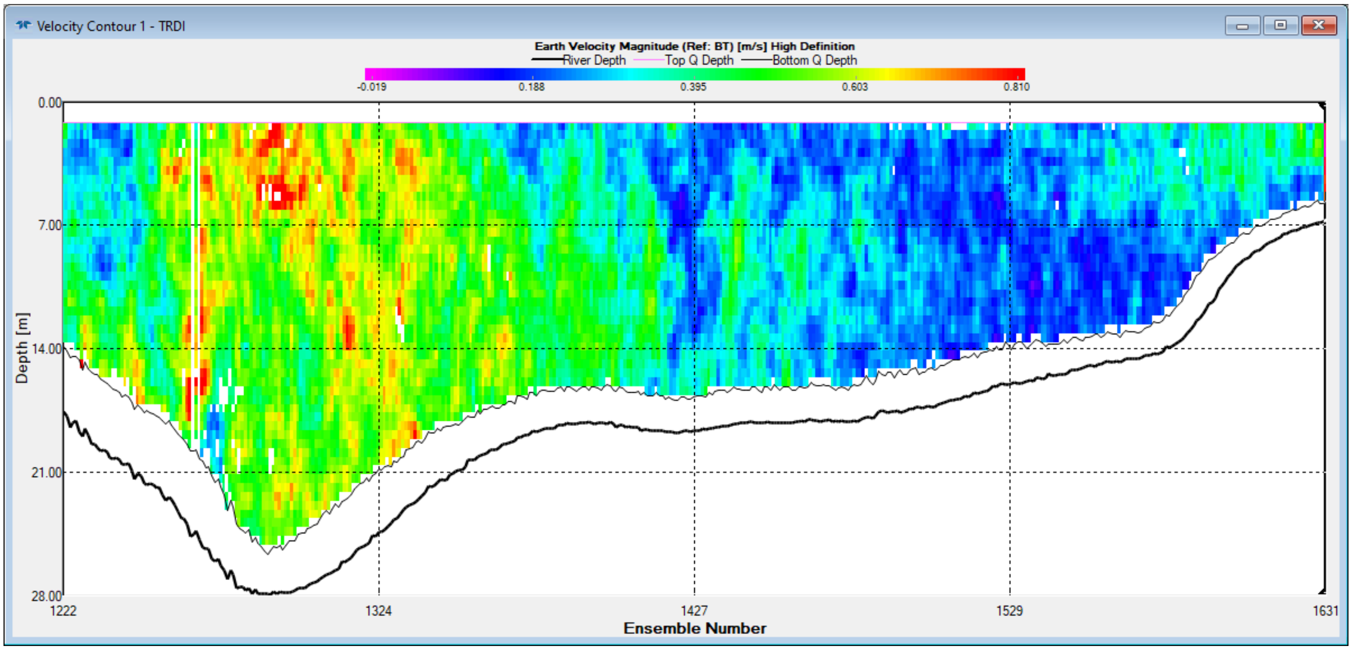
Transect 4, June 9 15:24 – 15:30, Channel Average Velocity = 0.350 m/s



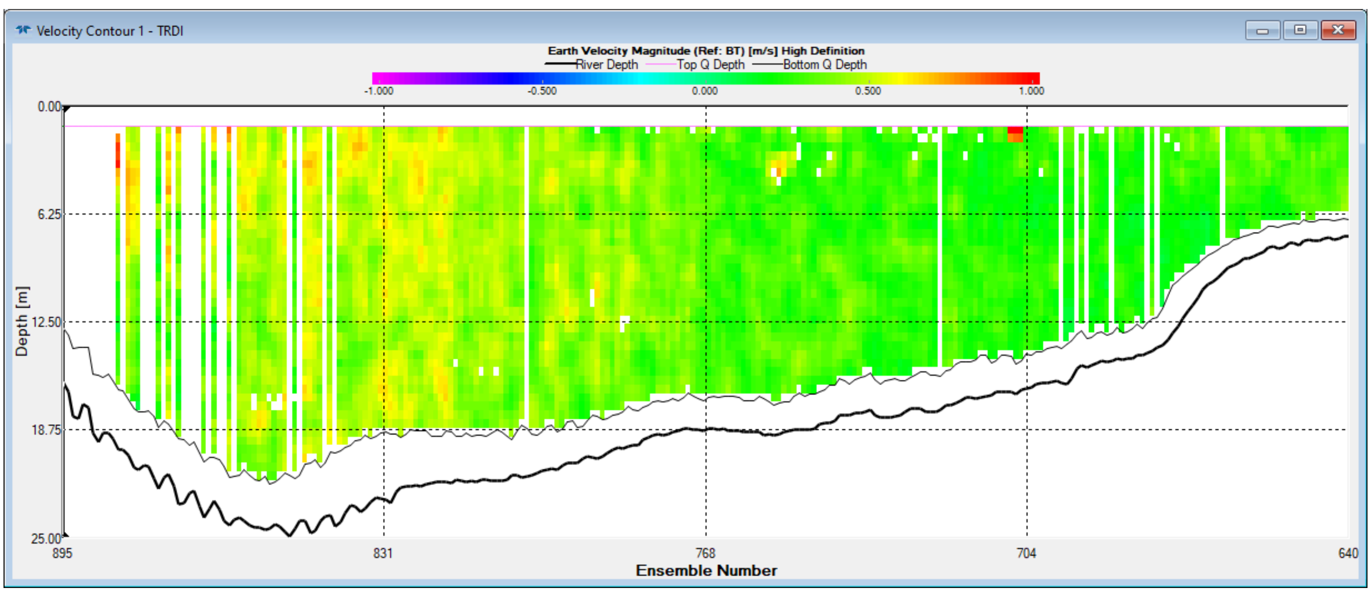
Transect 5, June 9 15:19 – 15:23, Channel Average Velocity = 0.342 m/s



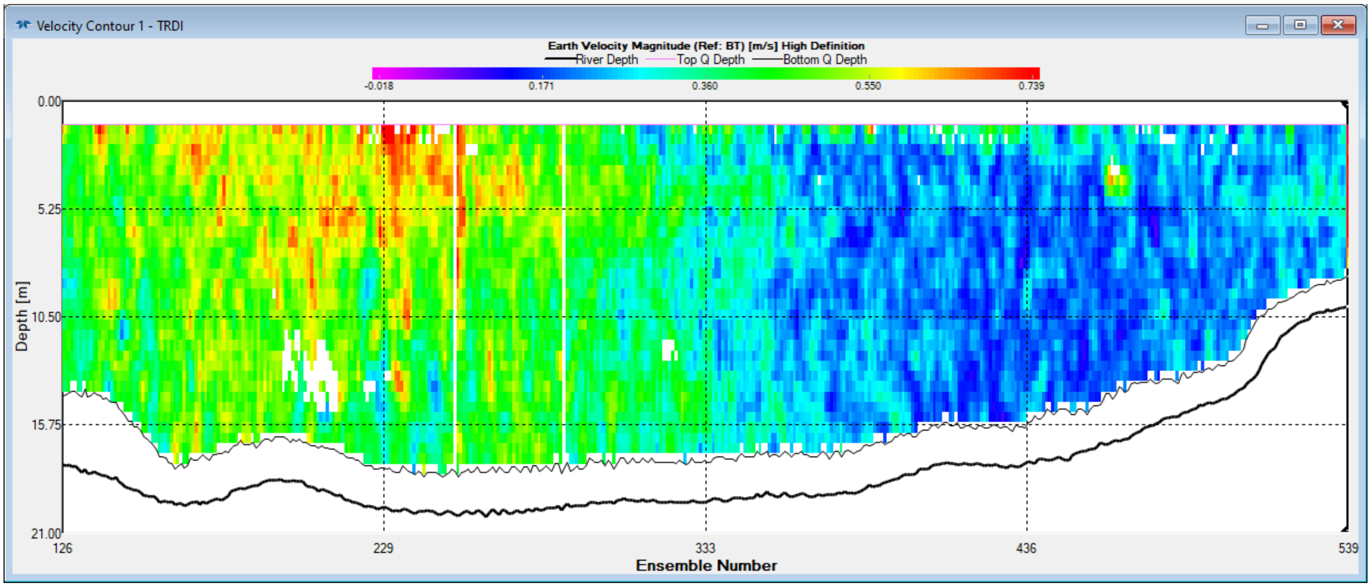
Transect 1, June 10 12:22 – 12:27, Channel Average Velocity = -0.264 m/s



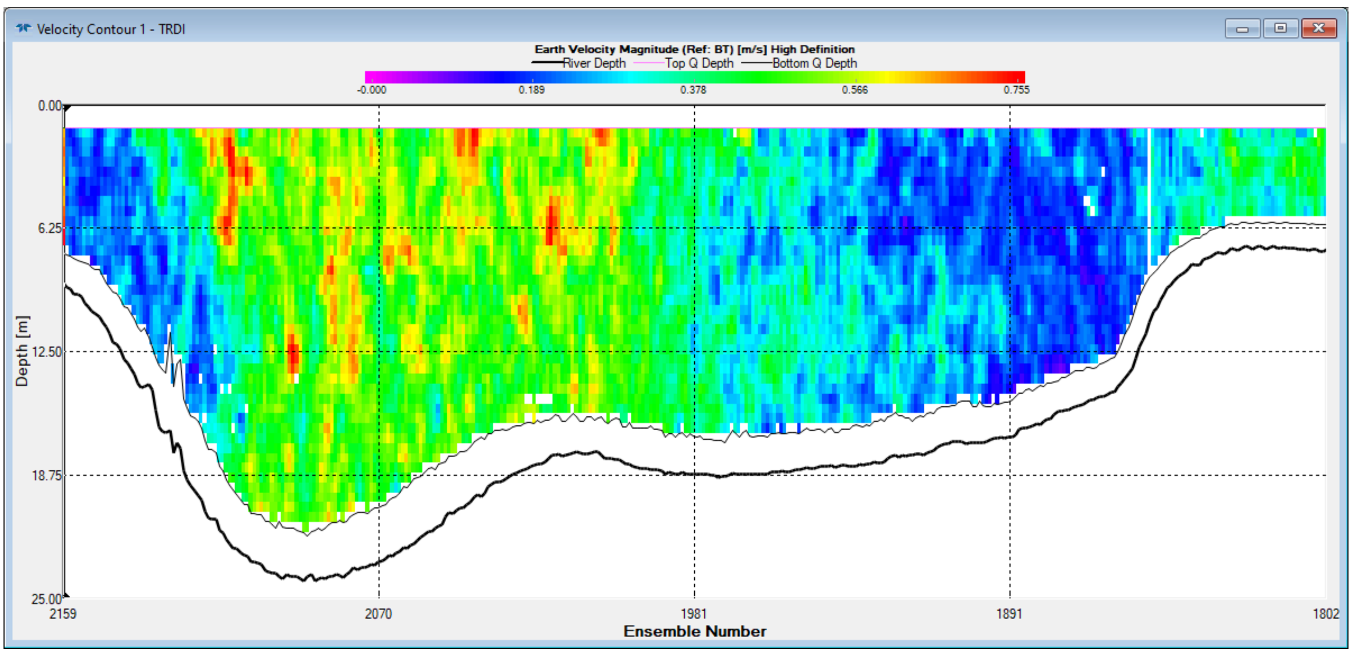
Transect 2, June 10 12:16 – 12:19, Channel Average Velocity = -0.262 m/s



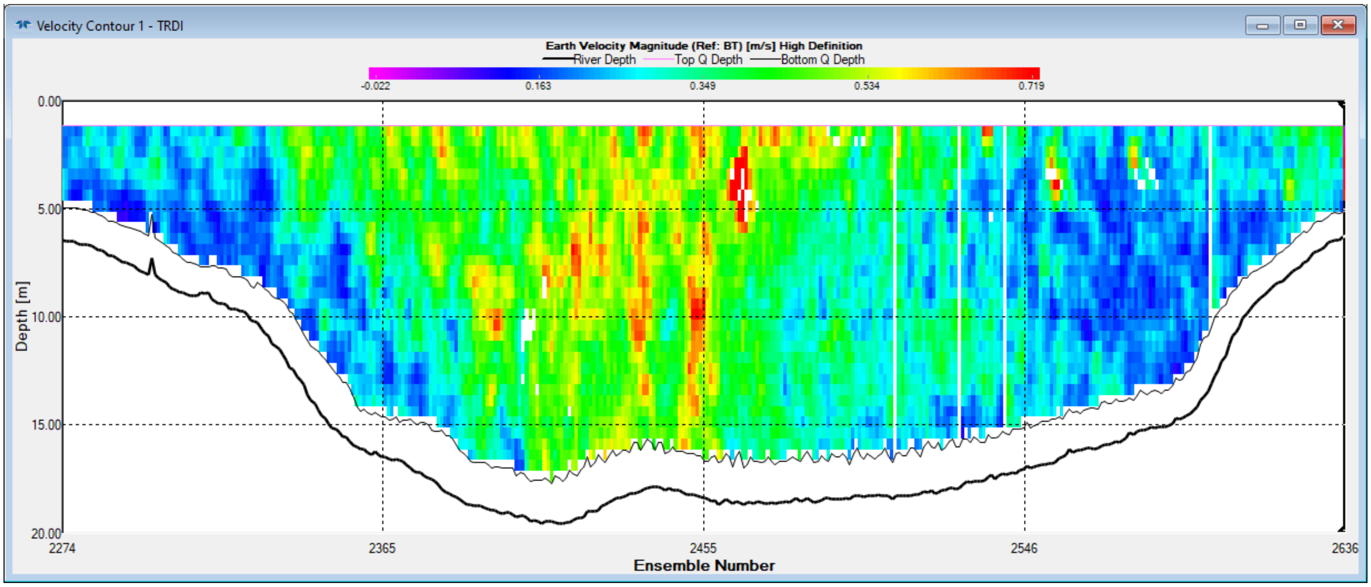
Transect 3, June 10 12:10 – 12:15, Channel Average Velocity = -0.252 m/s



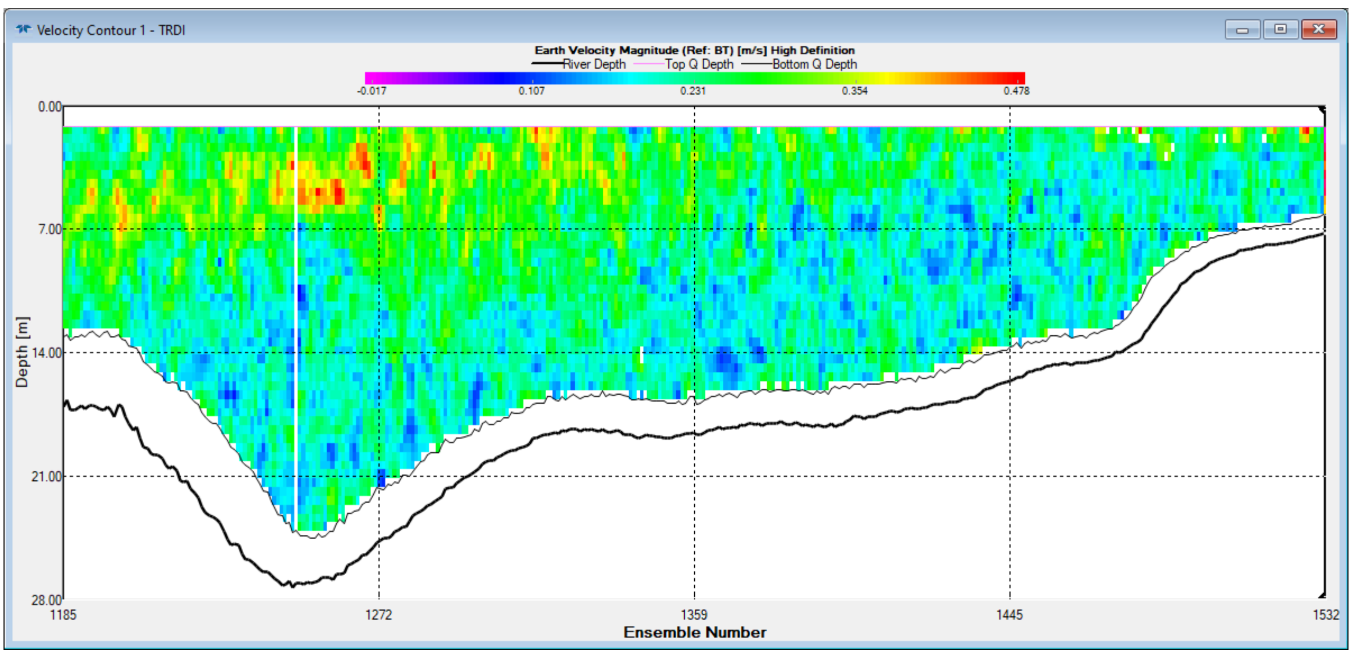
Transect 4, June 10 12:28 – 12:32, Channel Average Velocity = -0.261 m/s



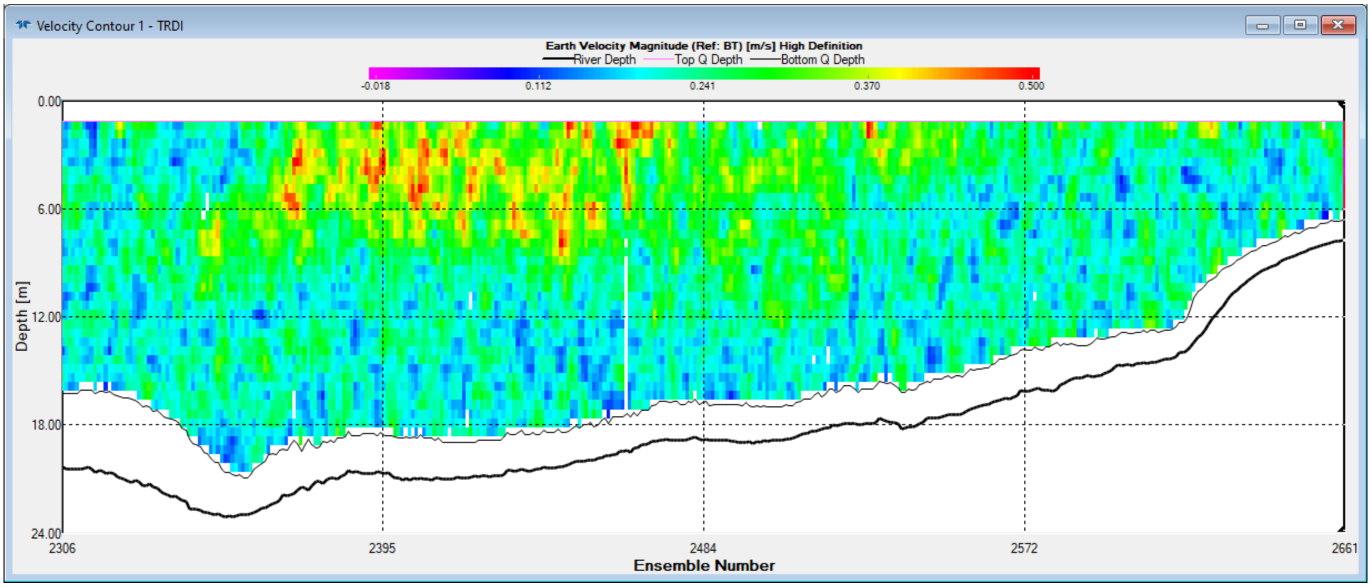
Transect 5, June 10 12:33 – 12:37, Channel Average Velocity = -0.238 m/s



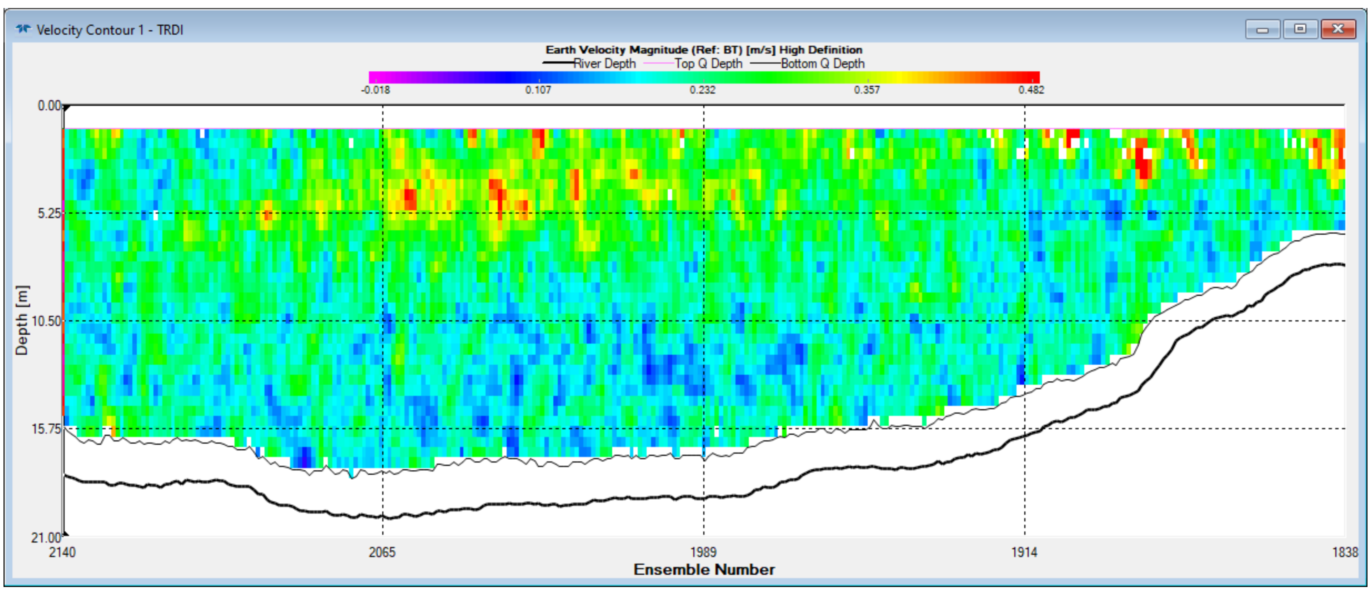
Transect 1, June 10 14:39 – 14:43, Channel Average Velocity = 0.109 m/s



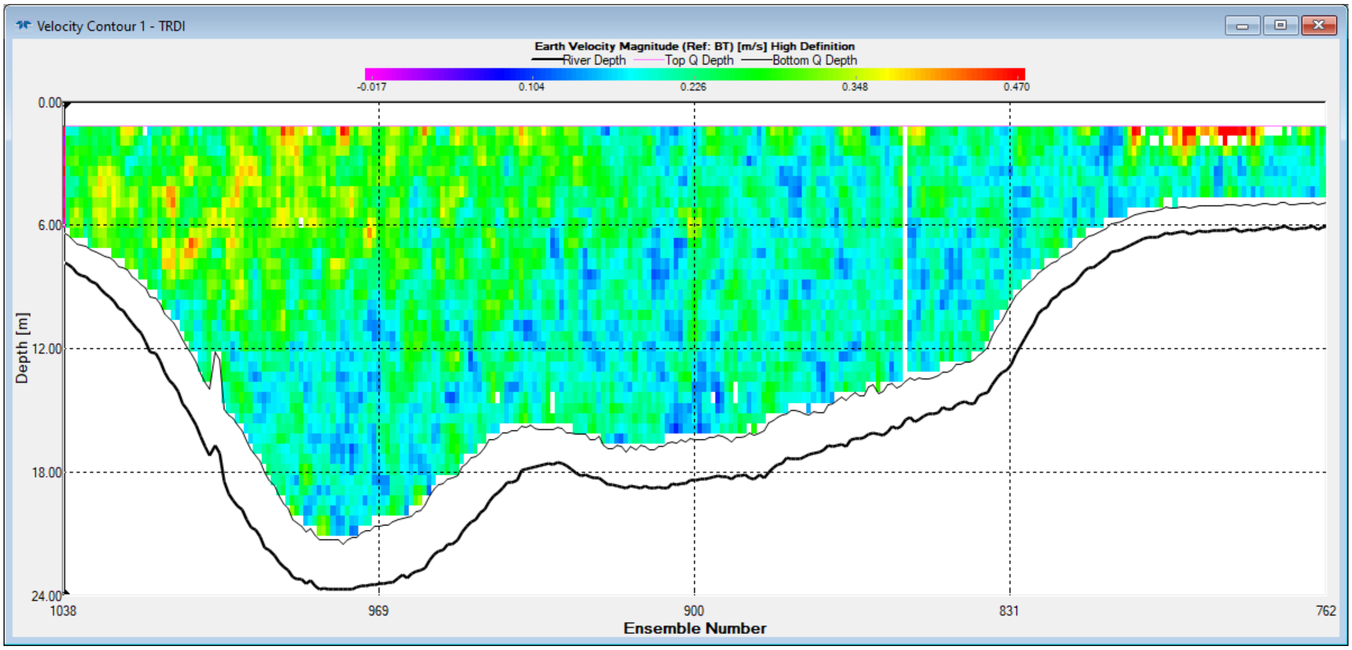
Transect 2, June 10 14:51 – 14:55, Channel Average Velocity = 0.144 m/s



Transect 3, June 10 14:46 – 14:50, Channel Average Velocity = 0.115 m/s



Transect 4, June 10 14:35 – 14:38, Channel Average Velocity = 0.090 m/s



Transect 5, June 10 14:29 – 14:34, Channel Average Velocity = 0.080 m/s