CHAMPLAIN HUDSON POWER EXPRESS

PILOT TEST
SUMMARY OF RESULTS

APRIL 2023

EXECUTIVE SUMMARY

CHPE LLC ("CHPE") and the Hudson River Drinking Water Intermunicipal Council ("Hudson 7") developed a set of studies, above and beyond those required by our permits, to determine the potential impact of the Champlain Hudson Power Express project's jet plow installation on the public water systems located within the Hudson River. One of these studies, as requested by the Hudson 7, involved the installation of a pump in the vicinity of the jet plow pre-installation trials in order to simulate conditions public water supply intakes might experience during project construction. The location of the jet plow pre-trial study was selected by CHPE and the Hudson 7 after reviewing multiple potential sites to confirm identify a site that would be appropriately representative of conditions at the Hudson 7 intakes. A pump was placed on a barge located 160 feet from the pre-installation trial, the closest point at which cable installation might occur, in order to simulate a public water supply intake. Water samples were taken the entire length of the testing location during the jet plow operation. The jet plow trial covered a distance of one-half mile and involved operating the jet plow at different rates of installation.

In addition to recommending the initial set of testing protocols used to complete the pilot testing and working with TDI to finalize the protocols that were used. Hudson 7 water operator members joined the testing teams on the testing barge as the pilot testing was underway.

Prior to conducting the jet plow pump study, threshold values for the constituents of concern were defined based on recommendations by the Hudson 7, as well as those contained in the project's Water Quality Certificate. Field and laboratory testing found that the values for turbidity, pH, total organic compounds, and volatile organics were well below the threshold levels established. Existing state guidance, including state drinking water standards, indicate that the findings for semi-volatile organics, metals, and PCBs are within the acceptable range of values. CHPE will reach out to public water system plant operators to discuss these results and next steps as we work toward construction and mitigating impacts on their systems.

1. INTRODUCTION

In early 2022, CHPE LLC ("CHPE"), the permittee for the Champlain Hudson Power Express project ("Project") and the Hudson River Drinking Water Intermunicipal Council ("Hudson 7" or "Council") initiated a series of discussions related to the potential impact of the Project construction on the five drinking water plants which relied upon water from the Hudson River. This conversation focused on the Hudson 7's "Proposed Testing & Monitoring Protocols to Prepare for Cable Installation in the Hudson River near Drinking Water Intakes." One area of interest was the development of studies that built upon the Article VII-required pre-installation testing of the jet plow that would be utilized to install the cables during project construction. Those studies were incorporated into a preliminary work plan (see Appendix 1). This report provides a summary of the results of the Pilot Testing portion of these protocols. A second report will be developed to discuss the outcome of the Sediment Sampling section.

2. METHODOLOGY

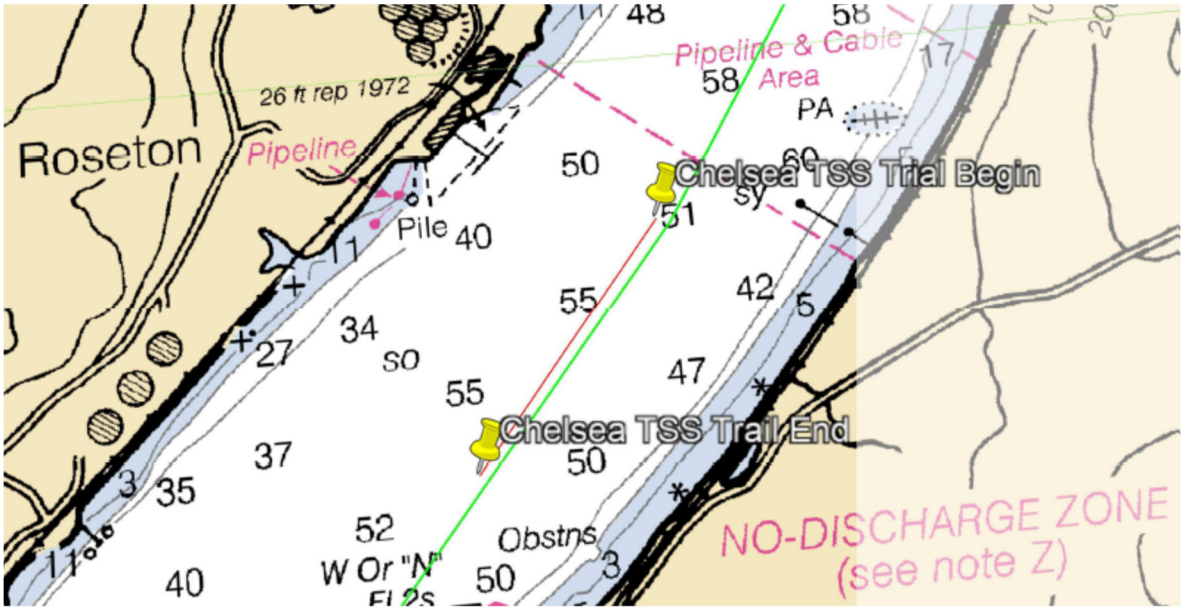
As the complete methodology for the study is provided in the protocols (Appendix 1), this section is intended to provide a summary for ease of review of the results.

a. Selection of Pilot Study Location

The location of the jet plow pilot study was selected after reviewing multiple potential sites in collaboration with the Hudson 7. The original preferred location was in the vicinity of the Rhinebeck intake due to its water storage capacity but existing underwater infrastructure was located in this area. Similarly, testing in the vicinity of Poughkeepsie was also considered but ultimately rejected due to the same constraints. The Hudson 7 and CHPE agreed that a pump could be used to simulate the operation of a public water system intake during the jet plow operation. This approach provides a safe, reliable method for understanding the potential impacts of the jet plow without posing any risk to or inconveniencing the operation of a public water system.

The Hudson 7 requested that the pilot test be conducted in an area where sediment samples had previously been completed and sediment conditions were similar to what would be expected at the intakes for the five water treatment plants. After reviewing multiple sites, the selected location of the test was chosen in the town of Chelsea, south of Poughkeepsie (see Figure 1). Sediment sampling had occurred as part of the Marine Route Survey completed in 2010, which would allow for a correlation between the results of this portion of the study and the Sediment Sampling being completed as a separate phase. The Hudson 7's technical consultant concurred that the available sediment would be representative of conditions at the Hudson 7 water treatment plants.

Figure 1: Pilot Study Location



b. Jet Plow Procedures

Caldwell Marine International ("CMI") transported and operated the jet plow. In accordance with the protocols, the agreed-upon length of the trial would be one-half mile or 2640 feet in length. The target speeds were 300 ft/hour for the first and last 1/8 of a mile and 600 ft/hour for the middle section of the trial to reflect a maximum speed that would be higher than those planned to be utilized during actual cable installation and to use this higher speed close to the "intake" with a goal of simulating an overly conservative scenario for cable installation. Typical plow speeds for cable installation might range from 100 to 400 feet per hour, depending on riverbed soil conditions.

c. Water Quality Sampling

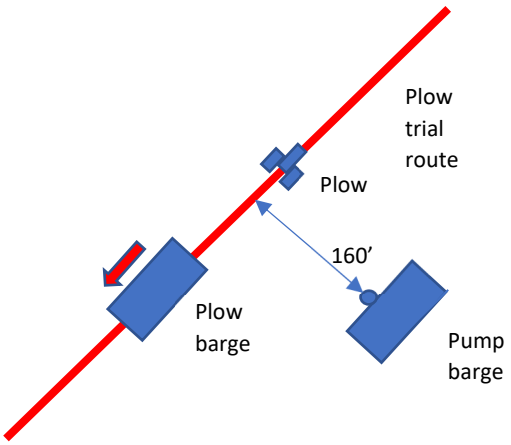
In-River Sampling

Hudson River water was collected from five locations on September 9, 2022. These five samples were collected by Aqua Survey Incorporated ("ASI") in a small vessel situated approximately five hundred (500) feet down river from the jet plow. The first location was a quarter mile upstream of the intake pump (see below), then worked downstream to an eighth of a mile upstream, then nearest the intake pump, an eighth of a mile downstream and lastly a quarter mile downstream of the intake pump. Sampling commenced at the first upstream site just prior to the jet plow trial start. Water was collected into a clean HDPE container prior to recording readings and/or placing in laboratory-provided labeled containers. Water samples were placed in coolers on ice, transported to the ASI laboratory the same day as the trial and picked up by Alpha Analytical couriers on September 12, 2022, following chain of custody procedures.

Intake Pump Sampling

CMI set up a stationary second barge within 160-feet of the pilot trial route and mobilized a pump capable of a maximum pumping speed of 2000 gallons per minute to simulate a H7 water intake (see Figure 2). Piping was extended to approximately four (4) feet off of the river bottom. A valve was attached to the pump so that water quality samples could be collected on the barge. Hudson 7 representatives were present onboard the pumping barge for the initial portion of the trials to witness the sampling activities.

Figure 2: Representation of Pump Sampling Layout



Two tasks occurred on the barge during this trial. First, water samples were supposed to be collected for analytical analysis every 30 minutes. Water samples for the pump sampling were collected, stored, and processed in the same manner as for the In-River Sampling. For the second task, water quality readings were recorded every 15 minutes using a YSI 6920 multiparameter meter. Turbidity (NTU) and pH were the parameters recorded.

d. Laboratory analysis

Water samples from both the In-River and Intake Pump tasks were analyzed for total suspended solids ("TSS") and chemical parameters. The selected parameters for testing are listed in the protocols provided in Appendix 1, including Table 1 of the 5-1.52 Tables of Subpart 5-1 of the NYCRR.

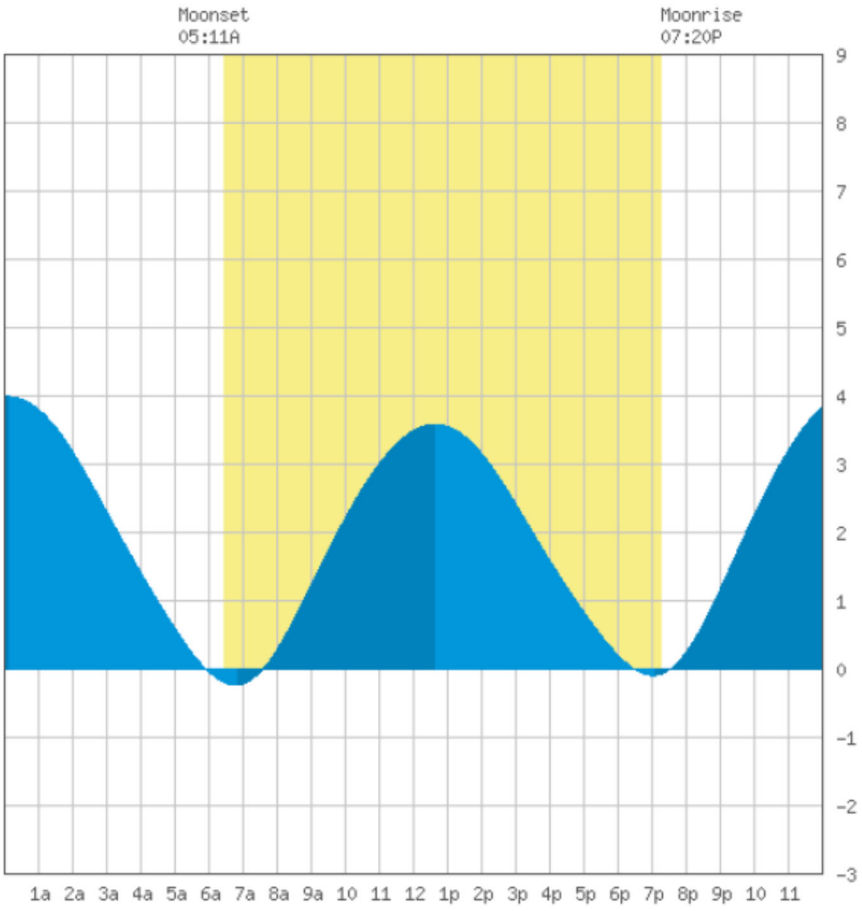
3. RESULTS

CMI arrived at the testing site on September 7th, 2022. While conducting an equipment check, CMI determined that there was an issue with the operating software and the trial did not start until Friday, September 9, 2022. The following describes the work as completed.

a. Site Conditions

Mobilization began in early hours of September 9th. Weather conditions were fair, with recorded air temperatures ranging from 55 F at 0453[1] to 82 F at 1753. Based on tidal charts (see Figure 3), the low tide period was at 0647 and 1902, with the high tide at 1236.

Figure 3: Tide Charts for Poughkeepsie on September 9, 2022



[1] Military time will be utilized throughout this report (e.g., 4:45 am = 0445; 3:00 PM = 1500)

b. Jet Plow Procedure

On September 9th, 2022, the barge carrying the jet plow began the trial by moving into the launch position with kedge[2] (bow) and stern anchors placed with assistance of a tug. The jet plow was moved to the stern of the vessel where all necessary connections (i.e., hydraulics, plow umbilical and the tow wire) were made and a systems check completed. The plow was then lowered to the river bottom and divers confirmed the condition of the plow, the connections, and the river bottom. After deploying the jet plow's blade, the barge was then pulled forward through the use of the anchors.[3] Technical issues involving both the software and positioning the jet plow were resolved following a two-hour delay.

The pilot test began at 0935, with a jet plow burial depth of approximately 7.6 feet and plow speed of approximately 300 ft/hour. At the 1/8 mile mark, the installation speed increased to approximately 600 ft/hour. Soon afterward, CMI reported the following:

> "hard bottom conditions were encountered from 950' mark to the 1550' mark along the route. During this period the blade was graded up/down in order to obtain forward progress. At the 1310' mark 50' prior to the simulated water intake, the plow encountered particularly hard bottom to which the plow blade was graded completely out momentarily. This allowed CMI to negotiate an unknown obstacle hindering the plow and resume with operations at the trials require burial depth."

A post-trial investigation by divers found the hard bottom location to have multiple rocks and large timbers buried in the riverbed.

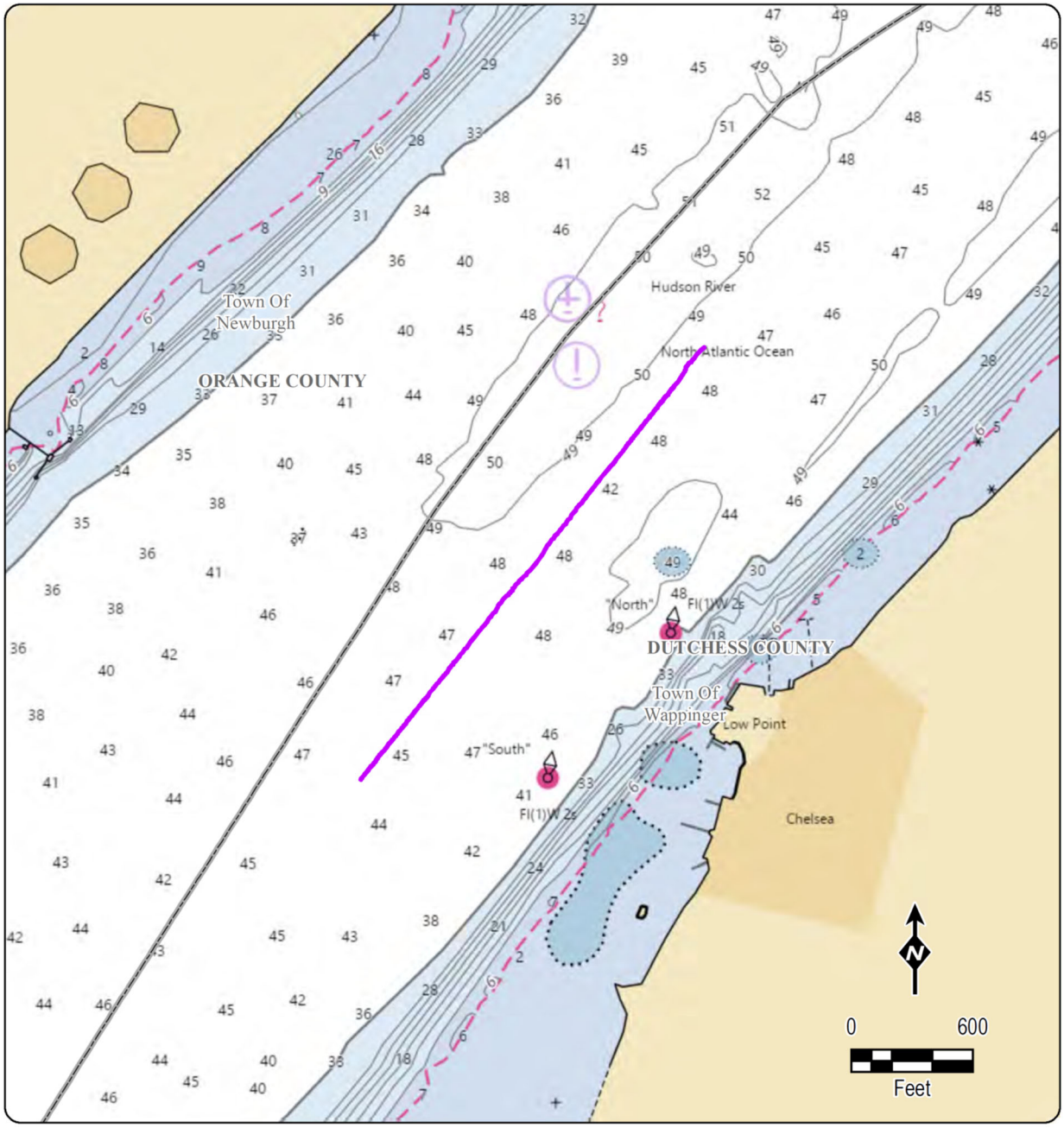
Following this interruption, the jet plow continued forward with an installation speed of approximately 600 feet /hour and burial depth of approximately 7.6 feet. For the final 1/8 mile, the speed was reduced to approximately 300 feet /hour. The final routing for the jet plow trial is provided in Figure 4.

A plan and profile drawing of the installation is provided as Figure 5. The plow was at the required depth for the entire length except twice for a short time due to the hard bottom described above.

[2] A kedge anchor is dropped some distance off the bow of the vessel and is used to draw a vessel forward by hauling in on the cable of this anchor.

[3] During actual installation, the barge would be self-propelled but that was not possible given the relatively short distance of the pilot test (one-half mile).

Figure 4: Jet Plow Trial Route as Completed



Plan View - Hudson River Jet Plow

1922100X 1922600X 1921100X

270.86 270.90 271 271.10 271.20 271.30 271.37

BEGIN TURBIDITY TEST
N15096433.59
E1922079.97

PLOW BLADE
FULLY DEPLOYED
N15096387.76
E1922032.40

⅛ MILE (660')
AVE. SPEED 4.3'/MIN
N15095914.53
E1921456.98

HARD BOTTOM
RAISE PLOW BLADE 2'
N15095642.32
E1921456.98

END TRENCH
N15095307.07
E1921189.65

HIGH TOW TENSION
RAISING PLOW BLADE TO 1,5'
N15095422.22
E1921285.23

WATER INTAKE FOR
TURBIDITY TEST
4' OFF BOTTOM
115' OFFSET PLOW LINE
N15095318.22
E1921348.93

¾ MILE (1320')
AVE SPEED 7.2'/MIN
N15095396.38
E1921261.92

BEGIN TRENCH
N15095464.25
E1921320.95

9/10/22 DIVER INVESTIGATION
HIGH PLOW TOW TENSION
9'-12' DEEP TRENCH

BOW ANCHOR 9-7_3:12
N15094888,42
E 1920854.10

⅞ MILE (1980')
AVE. SPEED 8.4'/MIN
N 15094878.23
E 1920853.12

PLOW "WET STORED"
- LEFT ON BOTTOM
WITH BLADE DOWN
N15094295.13
E1920392.64

END TURBIDIY TEST
AVE. SPEED 5.2'/MIN
N15094349.04
E1920441.51

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 26+97

DEC EXCLUSION ZONE

END TRENCH
N15095262.95
E1921094.32

8/24-27/22 DIVER INVESTIGATION
9'-12' DEEP TRENCH

BEGIN TRENCH
N15095951.22
E1921627.19

END TRENCH
N15094991.94
E1920906.57

8/28-29/22 DIVER INVESTIGATION
9'-12' TRENCH

BEGIN TRENCH
N15094991.94
E1920906.57

BEGIN TRENCH
N15094849.35
E1920751.96

8/2829/22 DIVER INVESTIGATION
9'-12' TRENCH

CONTINUE TRENCHING
N15094592.91
E1920751.96

END TRENCH ENDING
N15094499.87
E1920474.47

8/30/22 DIVER INVESTIGATION
9'-12' DEEP TRENCH

DEC EXCLUSION ZONE

DEC EXCLUSION ZONE

1509650OY 1509600OY 1509550OY 1509500OY

Profile View - Hudson River Jet Plow

MEASURED DEPTH -20 -40 -50 -60 -70 -80 -90

MEASURED PRESSURE 80 70 60 50 40 30 20 10

PLOW BLADE ANGLE =16.8°

PLOW BLADE ANGLE =61.2°

PLOW BLADE BURIAL GREATER THAN 7.0' (TYPICAL)

4' OFF BOTTOM

WATER INTAKE TURBIDITY TEST 4' OFF BOTTOM N15095318.22 E1921348.93

PLOW BLADE ANGLE =56.0°

PLOW BLADE ANGLE =61.2°

PLOW BLADE ANGLE =40.6°

205' HIGH PLOW TOW TENSION INVESTIGATED BY DIVERS 9'-12' TRENCH FOUND TIMBERS

HARD BOTTOM

PLOW BLADE TOE DEPTH GREATER THAN 9' (TYPICAL)

PLOW "WET STORED"

PLOW BLADE ANGLE =61.2°

PROFILE LEGEND

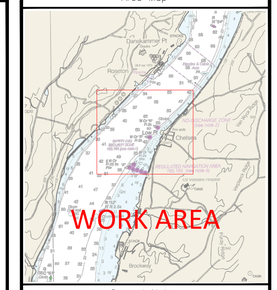
- CHAMBER 1 PORT (psi)
- CHAMBER 2 BOW (psi)
- CHAMBER 3 STARBOARD (psi)
- MANIFOLD 3 PRESSURE (psi)
- PLOW DEPTH (ft)
- PLOW BLADE BURIAL DEPTH (ft)
- PLOW BLADE TOE DEPTH (ft)
- DIVE INVESTIGATION

270.86 270.90 271.10 271.10 271.20 271.37

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 26+97.11

Station

Area Map



General Notes

PLAN VIEW LEGEND

- PROPOSED CABLE ROUTE
- PLOW TRACK
- DIVER JETTED TRENCH
- NEW ALIGNMENT FOR PLOW TRIAL
- 271.10 PROPOSED CABLE ROUTE WITH MP FROM ORIGINAL PLANS
- 271 UTILITY INVESTIGATION ITEM NAMED BY MP FROM ORIGANAL PLANS
- MULTIBEAM SURVEY BATHYMETRIC CONTOURS AT TWO FOOT INTERVALS ABOVE NAVD88

GEODETIC INFORMATION
HORIZONTAL DATUM: NAD83
PROJECTION: UTM ZONE 18N, US FT.
VERTICAL DATUM IS NAVD88

No.	Revision/Issue	Date

Caldwell Marine International, A DMS company
Marine International, LLC.
1333 Campus Parkway
Wall Township, NJ 07753
732.557.6100

Project Name & Location
Champlain Hudson Power Express - TSS Trials
Upper &Lower Lake Champlain, Hudson River
New York
Jet Plow Trials - Hudson River

Client	NKT	Sheet	3 of 3
Date	October 2022		
Scale	1"=100'		

FNAME REVDATE USER

c. Water Quality Sampling

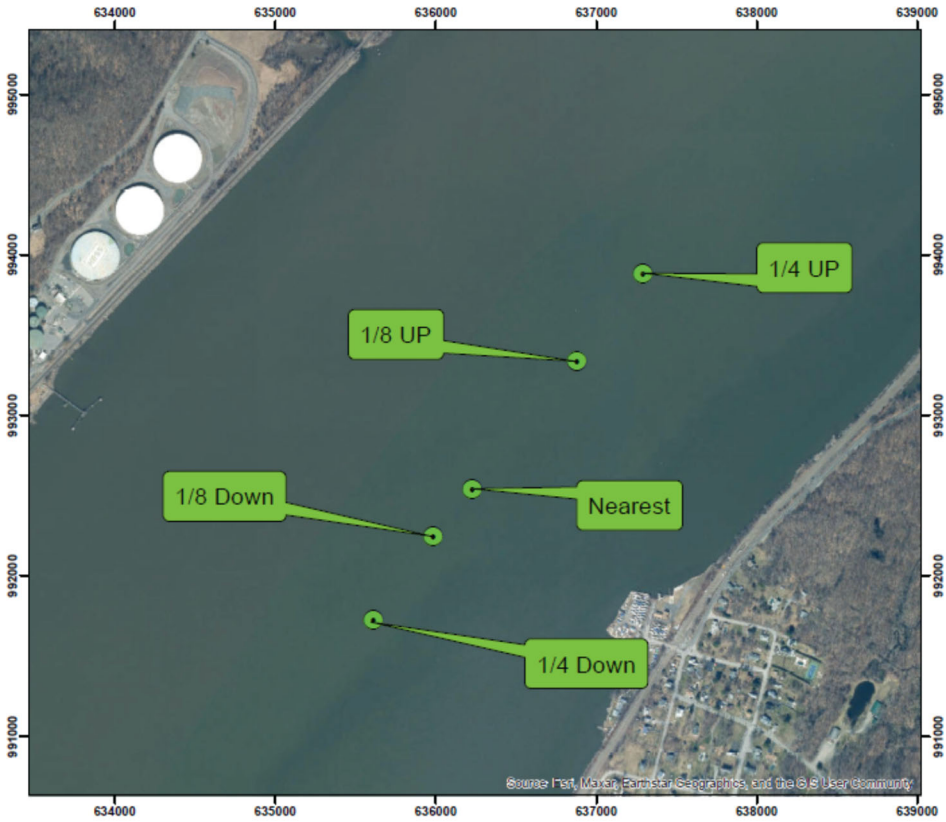
River Sampling

Hudson River water was collected from five locations on September 9, 2022 (see Table 1). There was a delay in communicating to the sampling vessel that the jet plow barge was at the nearest point to the intake pump, which was attributed to the CMI focusing on reestablishing the forward movement of the jet plow. As shown in Figure 6, the resulting distance between the second and third sampling event is greater than between the other sampling events.

Table 1. In-River Sampling Locations

Location	Date	Time	Northings	Eastings
1/4 Mile Upstream	9/9/22	0815	993880.9	637287.8
1/8 Mile Upstream	9/9/22	1210	993339.3	636877.0
Nearest Intake	9/9/22	1414	992538.9	636222.7
1/8 Mile Downstream	9/9/22	1500	992243.5	635982.4
1/4 Mile Downstream	9/9/22	1708	991719.4	635606.6

Figure 6: In-River Sampling Locations



Intake Pump Sampling

Sampling was planned to start an hour before the trial started and continue for two (2) hours post trial. Due to the delays in starting the trial, sampling took place for approximately two (2) hours ahead of the trial start, then continued as planned.

Water samples to be submitted for laboratory analysis were supposed to be collected for analytical analysis every 30 minutes. However, due to the previously described issues encountered by the jet plow, there were a few occasions where sampling was halted to not collect samples during jet plow inactivity or reduced speeds. Table 2 provides the sampling times for the samples collected from the pump to be submitted for laboratory analysis. Table 3 provides the field-measured pH and turbidity values collected at 15-minute intervals.

Table 2. Intake Pump Water Sample Collection Times

Sample ID	Date	Time
1st Pre-Trial	9/9/22	700
2nd Pre-Trial	9/9/22	730
3rd Pre-Trial	9/9/22	800
4th Pre-Trial	9/9/22	830
IP-0 Hr Trial	9/9/22	920
IP-30 Min Trial	9/9/22	950
IP-1 Hr Trial	9/9/22	1020
IP-1 Hr 30 Min Trial	9/9/22	1050
IP-2 Hr Trial	9/9/22	1120
IP-2Hr 30 Min Trial	9/9/22	1220
IP-3 Hr Trial	9/9/22	1250
IP-3 Hr 30 Min Trial	9/9/22	1320
IP-4 Hr Trial	9/9/22	1420
IP-4 Hr 30 Min Trial	9/9/22	1435
IP-5 Hr Trial	9/9/22	1455
IP-5 Hr 30 Min Trial	9/9/22	1530
IP-6 Hr Trial	9/9/22	1600
IP-6 Hr 30 Min Trial	9/9/22	1630
IP-30 Min Post Trial	9/9/22	1735
IP-1 Hr Post Trial	9/9/22	1805
IP-1 Hr 30 Min Post Trial	9/9/22	1835
IP-2 Hr Post Trial	9/9/22	1905
*Trial started at 0920 and ended at 1705		

.

Table 3. Intake Pump Field Sampling Results

IDs	Time	pH	Turbidity (NTUs)
IP-2 Hr Pre-Trial	0700	7.04	23.6
IP-1 Hr 45 Min Pre-Trial	0715	7.36	11.5
IP-1 Hr 30 Min Pre-Trial	0730	7.88	17.3
IP-1 Hr 15 Min Pre-Trial	0745	7.83	19.1
IP-1 Hr Pre-Trial	0800	7.86	17.1
IP-45 Min Pre-Trial	0815	7.85	14.0
IP-30 Min Pre-Trial	0830	7.83	14.6
IP-15 Min Pre-Trial	0845	7.84	18.1
IP-0 Hr Pre-Trial	0900	7.87	22.3
IP-0 Hr Trial	0920	7.60	18.9
IP-15 Min Trial	0935	7.56	18.9
IP-30 Min Trial	0950	7.74	20.7
IP-45 Min Trial	1005	7.88	17.2
IP-1 Hr Trial	1020	7.89	14.8
IP-1 Hr 15 Min Trial	1035	7.87	19.4
IP-1 Hr 30 Min Trial	1050	7.87	20.7
IP-1 Hr 45 Min Trial	1105	7.86	19.2
IP-2 Hr Trial	1120	7.98	18.6
IP-2 Hr 15 Min Trial	1135	7.88	18.0
IP-2 Hr 30 Min Trial	1150	8.01	18.8
IP-2 Hr 45 Min Trial	1205	7.78	16.7
IP-3 Hr Trial	1220	7.60	20.0
IP-3 Hr 15 Min Trial	1235	7.52	18.2
IP-3 Hr 30 Min Trial	1250	7.17	25.9
IP-3 Hr 45 Min Trial	1305	7.08	23.1
IP-4 Hr Trial	1320	7.08	19.4
IP-4 Hr 15 Min Trial	1335	7.10	15.1
IP-4 Hr 30 Min Trial	1350	7.05	13.6
IP-4 Hr 45 Min Trial	1405	7.14	12.4
IP-5 Hr Trial	1420	7.20	13.9
IP-5 Hr 15 Min Trial	1435	7.36	14.4
IP-5 Hr 30 Min Trial	1450	7.38	18.1
IP-5 Hr 45 Min Trial	1500	7.42	13.8
IP-6 Hr Trial	1515	7.48	13.5
IP-6 Hr 15 Min Trial	1530	7.34	18.1
IP-6 Hr 30 Min Trial	1545	7.45	18.5
IP-6 Hr 45 Min Trial	1600	7.31	16.7
IP-7 Hr Trial	1615	7.36	15.8
IP-7 Hr 15 Min Trial	1630	7.36	13.1
IP-7 Hr 30 Min Trial	1645	7.32	10.7
IP-7 Hr 45 Min Trial	1700	7.34	10.1
IP-15 Min Post-Trial	1715	7.41	10.2
IP-30 Min Post-Trial	1735	7.23	13.7
IP-45 Min Post-Trial	1750	7.32	13.2
IP-1 Hr Post-Trial	1805	7.45	14.1
IP-1 Hr 15 Min Post-Trial	1820	7.39	13.6
IP-1 Hr 30 Min Post-Trial	1835	7.30	13.6
IP-1 Hr 45 Min Post-Trial	1850	7.42	13.9
IP-2 Hr Post-Trial	1905	7.34	13.6
*Trial started at 0920 and ended at 1705.			

d. Laboratory analysis

The analysis was performed by Alpha Analytical Laboratories. Tabulated river sampling analysis results (Alpha Analytical reports L2249449) are provided in Appendix 2. For the intake pump sampling (Alpha Analytical reports L2249449), the tabulated results provided in Appendix 3 only show those cases where there was a reported value (i.e, the laboratory did not report "non-detect") for a constituent for ease of review. Results of all the analytical testing can be found in Appendix 4. For reference, "MDL" stands for Method Detection Limit and is the lowest concentration that can be detected using a particular procedure. The "RL" is the Reporting Limit, which is the MDL times a safety factor selected by the laboratory to ensure day-to-day variations in the laboratory instruments are considered.

4. DISCUSSION

In their original suggested protocols, the Hudson 7 identified four parameters of concern: turbidity, pH, Total Organic Carbon ("TOC"), and hydrocarbons. In addition, laboratory analysis for metals and polychlorinated biphenyls ("PCBs"), organochlorine pesticides, and dioxane was also requested, although there were no reported values above "non-detect" for organochlorine pesticides and dioxane. The following discussion is intended to provide a high-level summary with the understanding that CHPE and the Hudson 7 will engage in a more detailed review of the results at a later date.

As agreed with the Hudson 7 prior to the trial, special consideration was to be given to situations where the level of a contaminant during the trial exceeded background levels by a factor of 1.5 or higher. However, there are cases where the pre-trial values are "non-detect" so it is not possible to calculate this difference. A "non-detect" simply means that the compound was not detected by laboratory analysis. However, in every instance, it met the standard for finished drinking water and in all cases returned to a "non-detect" level within two hours. In short, these events are temporary and meet the standards of safe drinking water. Furthermore, we will have the ability to work with water operators to shut off valves for the very brief period we are nearby to further mitigate any potential concern.

In addition, there are situations where the reported values are significantly lower than existing standards and guidance. In the tables below, CHPE is providing a "Comparison Value" to offer context for the results. Where available, the Comparison Value is the value provided in the Project's Water Quality Certificate[4]. Where a contaminant is not included the Water Quality Certificate, CHPE reviewed the promulgated State of New York water quality standards[5]. If a value was not available in the state water quality standards, CHPE consulted the Division of Water Technical and Operational Guidance Series (1.1.1)[6], which provides guidance values. As was approved in the Water Quality Certificate, the "Health (Water Source)" standard was applied if available. If not, the Fish Survival (A(A)) standard was provided

[4] The Water Quality Certificate was part of the Joint Proposal of Settlement agreed upon by state agencies, including the Department of Public Service, Department of Environmental Conservation, and Department of State, and non-governmental agencies including Scenic Hudson, Riverkeeper, and Trout Unlimited.
[5] 6 NYCRR Part 703 at https://govt.westlaw.com/nycrr/Browse/Home/NewYork/NewYorkCodesRulesandRegulations?guid=I070d30d0b5a111dda0a4e17826ebc834&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)
[6] https://www.dec.ny.gov/docs/water_pdf/togs111.pdf

due to the short-term nature of the impacts.[7] CHPE also anticipates consultation with the Hudson 7 and the plant operators on their existing standards.

In reviewing this material, it is important to keep in mind that the pump station has been designed to represent most restrictive conditions. The pump intake is located approximately 160 feet from the trial, which is the current separation distance for the current routing from the Poughkeepsie water treatment plant. Based on the current routing, the next closest distance would be the Port Ewan plant, which is approximately 500 feet from the routing. The remaining three water treatment plants are over 1,000 feet from the route as currently designed. In addition, the riverbed is relatively level for the locations of the jet plow trial and the pump intake. The permitted route is generally located towards the central portion of the river relative to the water treatment plant intakes, so that any suspended sediments would start at a lower elevation than the intake. When considered in this light, we believe that the results below represent a "worse case" and likely exaggerate what could be experienced at the water treatment plants.

Turbidity

Turbidity was measured for samples collected from the pump at fifteen-minute intervals. As shown in Table 3, the pre-trial period turbidity values ranged from 11.5 to 23.6 NTU while those in the post-trial period ranged from 10.2 to 14.1 NTU. Turbidity readings during the jet plow operation ranged from 10.1 to 25.9 NTU, with the peak value occurring three and a half hours into the trial (1250), so the installation peak did not exceed the pre-installation peak by a factor of 1.5 or greater. In addition, the peak occurring at the same time as high tide suggests that river circulation may contribute as much if not more to turbidity as the jet plow operation. This finding would be consistent with modeling efforts that predicted that the majority of sediment redeposition would be within fifty (50) feet of the installation.[8]

pH

As with turbidity, water samples were collected at the pump at fifteen-minute intervals and the results are presented in Table 3. Readings ranged from 7.04 to 8.01. The highest increase or decrease between fifteen-minute intervals is 0.52, which occurred 1 hour, 30 minutes before the trials began. The highest increase or decrease during the jet plow installation trial was 0.35, which occurred at the same time as the peak turbidity value. This shift is less than the pre-established standard that a change of greater than 1 would require additional consideration.

Total Organic Carbon

For the river sampling, the highest TOC value recorded (2.46 mg/L) occurred during the 1/4 mile upstream sampling event or before the jet plow operation had begun.

For the pump sampling, the pre-trial TOC values ranged from 1.85 to 2.14 mg/L. The maximum TOC values during the trials were 2.73 mg/L, which is less than 1.5 of the maximum pre-trial values.

[7] As noted, these values are provided only for context and do not reflect any regulatory obligation.
[8] See the Biological Assessment completed for the Project at: http://chpexpresseis.org/docs/library/esa/CHPE-Revised-Biological-Assessment.pdf

Hydrocarbons

Laboratory analysis was completed for 75 volatile organic and 68 semi-volatile organic constituents. For volatile organics, the reported values were all "non-detect" for river sampling and only one contaminant (1,2,4,5-Tetramethylbenzene) had a detectable value for the pump sampling. The reported value for 1,2,4,5-Tetramethylbenzene (0.43 ug/L) is less than the 2.8 ug/L reported for the pre-trial period. This value suggests that the value is correlated with tidal influences rather than with the jet plow installation.

In terms of semi-volatile organics, for the river sampling there were nine contaminants whose values were above "non-detect" during the jet plow operation. For all of these, the pre-installation values were "non-detect" (see Table 4). The State of New York currently has promulgated water quality standards for only two of these contaminants (Bis(2-ethylhexyl)phthalate and Naphthalene)[9] but has provided guidance values for additional constituents[10].

Table 4. Semi-Volatile Organics with Reported Values at River Sampling

	Pre-Installation Maximum Value (ug/L)	Installation Maximum Value (ug/L)	Ratio	Comparison Value (ug/L)
Bis(2-ethylhexyl)phthalate	ND	2.4	Undefined	5
Fluoranthene	ND	0.02	Undefined	50
Naphthalene	ND	0.09	Undefined	10
Benzo(a)anthracene	ND	0.04	Undefined	NA
Benzo(ghi)perylene	ND	0.04	Undefined	NA
Fluorene	ND	0.02	Undefined	50
Phenanthrene	ND	0.03	Undefined	14
Dibenzo(a,h)anthracene	ND	0.06	Undefined	NA
Indeno(1,2,3-cd)pyrene	ND	0.07	Undefined	NA
2-Methylnaphthalene	ND	0.04	Undefined	42

For the pump sampling, there were values reported for nineteen of the contaminants tested during the jet plow trial but for fourteen of these the pre-installation value was "non-detect." As with the river sampling New York State's guidance values are provided for context and the most conservative value is provided (Table 5). The values reported for Benzo(a)pyrene, Benzo(b)fluoranthene, benzo(k)fluoranthene, Chrysene, and Hexachlorobenzene exceeded the Comparison Value but the values for each of these were "non-detect" within 1.5 hours after the jet plow operation. CHPE believes based on past conversations that this short duration can be accommodated by the water treatment systems but will confirm with the operators.

[9] 6 NYCRR Part 703 at https://govt.westlaw.com/nycrr/Browse/Home/NewYork/NewYorkCodesRulesandRegulations?guid=I070d30d0b5a111dda0a4e17826ebc834&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)

[10] https://www.dec.ny.gov/docs/water_pdf/togs111.pdf

Table 5. Semi-Volatile Organics with Reported Values at Pump Sampling

	Pre-Installation Maximum Value (ug/L)	Installation Maximum Value (ug/L)	Ratio	Comparison Value (ug/L)
Benzoic Acid	ND	11	Undefined	NA
Acenaphthene	ND	0.02	Undefined	20
Fluoranthene	0.02	0.17	8.5	50
Naphthalene	0.24	0.58	Undefined	10
Benzo(a)anthracene	0.05	0.23	4.6	NA
Benzo(a)pyrene	ND	0.2	Undefined	0.002
Benzo(b)fluoranthene	0.01	0.34	34	0.002
Benzo(k)fluoranthene	ND	0.11	Undefined	0.002
Chrysene	ND	0.19	Undefined	0.002
Acenaphthylene	ND	0.03	Undefined	NA
Anthracene	ND	0.02	Undefined	50
Benzo(ghi)perylene	ND	0.23	Undefined	NA
Fluorene	ND	0.02	Undefined	50
Phenanthrene	ND	0.04	Undefined	14
Dibenzo(a,h)anthracene	ND	0.05	Undefined	NA
Indeno(1,2,3-cd)pyrene	ND	0.26	Undefined	NA
Pyrene	ND	0.17	Undefined	50
2-Methylnaphthalene	0.33	0.36	1.09	42
Hexachlorobenzene	ND	0.02	Undefined	0.00003

Metals

Laboratory analysis was completed for 14 metals per the agreed upon protocol.

For the river sampling, detectable levels were reported for the following nine constituents: arsenic, barium, chromium, iron, manganese, mercury, sodium, thallium, and zinc. The ratio of the highest value for chromium (2.51 ug/L), iron (1700 ug/L), manganese (131 ug/L), sodium (417,000), thallium (0.14) and zinc (16.31 ug/L) exceeded the highest background value by a factor greater than 1.5 (Table 6). The values for iron and sodium exceeded the Comparison Value, although the pre-installation reported values also exceeded these metrics.

Table 6. Metals with Reported Values at River Sampling

	Pre-Installation Maximum Value (ug/L)	Installation Maximum Value (ug/L)	Ratio	Comparison Value (ug/L)
Arsenic, Total	0.99	1.35	1.36	36
Barium, Total	32.02	39.22	1.22	1000
Chromium, Total	1.55	2.51	1.62	7.7
Iron, Total	640	1,700	2.66	300
Manganese, Total	56.61	131	2.31	300
Mercury, Total	0.18	0.19	1.06	0.7
Sodium, Total	190,000	417,000	2.19	20,000
Thallium, Total	ND	0.14	Undefined	8
Zinc, Total	3.84	16.31	4.25	NA*

*Calculated based on formula that relies upon measured hardness of water, which was unavailable.

For the pump sampling, the detectible levels were reported for same eight constituents as for the river sampling as well as antimony. For antimony (0.58 ug/L) and thallium (0.19 ug/L), the pre-installation samples were all "non-detect" for these constituents but the highest values were lower than the corresponding Comparison Value. As with the river sampling, the reported maximum values for iron and sodium exceeded their corresponding Comparison Value during the pre-installation and installation phase. The pre-installation maximum value for iron was greater than the installation maximum value, suggesting that this constituent is correlated with tidal activities rather than the jet plow installation. For sodium, the ratio of the highest value for sodium (482,000 ug/L) exceeded the highest background value by a factor greater than 1.5 (Table 7), but decreased reported levels returned to background within two hours of the end of the trial. Again, CHPE believes that this short duration can be accommodated but will confirm with the water treatment operators.

Table 7. Metals with Reported Values at Pump Sampling

	Pre-Installation Maximum Value (ug/L)	Installation Maximum Value (ug/L)	Ratio	Comparison Value (ug/L)
Antimony	ND	0.58	Undefined	3
Arsenic, Total	1.24	1.4	1.13	36
Barium, Total	32.69	36.65	1.12	1000
Chromium, Total	0.89	1.02	1.15	7.7
Iron, Total	1,240	889	0.72	300
Manganese, Total	61.16	88.69	1.45	300
Mercury, Total	0.13	0.15	1.15	0.7
Sodium, Total	250,000	482,000	1.93	20,000
Thallium, Total	ND	0.19	Undefined	8
Zinc, Total	50.42	15.5	0.31	NA*

* Calculated based on formula that relies upon measured hardness of water, which was unavailable.

Polychlorinated biphenyls

Laboratory analysis was completed for 22 PCB congerers.

For the river sampling, the highest value for a PCB congerer at the outset of the trials (1/4 mile upstream) was 0.00195 ug/l. For the five PCB congers where the values were greater than "non-detect", the maximum value reported for that conger was more than 1.5 times the corresponding pre-trial value. However, the maximum value reported (0.00361 ug/L for Cl3-BZ#18) is well below the Project's Water Quality Certificate standard of 0.2 per aroclor.

For the pump sampling, the highest value for a PCB congerer (Cl3-BZ#18) for pre-trial sampling was 0.00265 ug/L. This same congerer has the highest maximum value (0.304 ug/L) of the five PCBs congerers where the values were greater than "non-detect". There was one congerer (Cl5-BZ#101) where it was not possible to calculate the ratio because the pre-trial sampling did not detect this constituent. However, the maximum value for this constituent was 0.000556 ug/L, which is lower than Project's Water Quality Certificate standard of 0.2 per aroclor.

Other Chemicals

Laboratory analysis was completed for chloride, fluoride, and sulfate.

The results for river and pump sampling are provided below in Tables 8 and 9, respectively. The maximum value during the jet plow trial exceeded the pre-trial levels by a factor of 1.5 or more for chloride and sulfate during the river sampling but only for chloride at the pump sampling station. CHPE will review the values for chloride with the Hudson 7 and plant operators to place these reported values within the context of normal operation.

Table 8. Other Chemicals with Reported Values at River Sampling

	Pre-Installation Maximum Value (ug/L)	Installation Maximum Value (ug/L)	Ratio	Comparison Value (ug/L)
Chloride	410,000	890,000	2.17	250,000
Fluoride	110	150	1.36	1,500
Sulfate	65,000	130,000	2	250,000

Table 9. Other Chemicals with Reported Values at Pump Sampling

	Pre-Installation Maximum Value (ug/L)	Installation Maximum Value (ug/L)	Ratio	Comparison Value (ug/L)
Chloride	510,000	870,000	1.71	250,000
Fluoride	130	150	1.15	1,500
Sulfate	85,000	100,000	1.18	250,000

5. CONCLUSION

CHPE LLC and the Hudson 7 developed a set of studies to determine the potential impact of the jet plow installation on the public water systems located within the Hudson River. Based on the guidance thresholds recommended by the Hudson 7 prior to the initiation of the study (see Appendix 1), the values for turbidity, pH, total organic compounds, and volatile organics are below the threshold levels established by the H7 and New York State. The findings for semi-volatile organics, metals, and PCBs also fall within the acceptable range of values according to existing state guidance–including state water quality standards. CHPE and the Hudson 7 both share the goal of taking all precautions to minimize environmental disruption and protecting community water. To help achieve these goals, CHPE LLC will continue to consult with communities and public water system plant operators on any additional feedback they may have regarding this study.

Appendix 1

Initial Proposed Testing & Monitoring Protocols to Prepare for Cable Installation in the Hudson River near Drinking Water Intakes

Appendix 2

Tabulated Laboratory Results for River Sampling

Appendix 3

Tabulated Laboratory Results for Pump Sampling

Excluding "Non-Detect" Constituents

Appendix 4

Laboratory Results