SESI
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Geotechnical
Environmental
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ISS Pilot Study Work Plan Addendum
For

Ossining Gas Works DPW Site
BCP No. C360172
30 Water Street
Ossining, Westchester County, NY

Prepared for:

WB 30 Water Street, LLC

April 2025

SESI Project No:
11498

CERTIFICATIONS

I, Fuad Dahan, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this ISS Pilot Study Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10)

Fuad Dahan	04/23/2025	
NYS Professional Engineer (# 090531)	Date	Signature

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education

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LIST OF ACRONYMS

Acronym	Definition
add-ISS-PSWP	Addendum to ISS Pilot Study Work Plan
ASTM	American Society for Testing and Material
BCP	Brownfield Cleanup Program
BMM	Bucket Mixing Method
GGBFS	Ground Granulated Blast Furnace Slag
ISS	In Situ Solidification
ISS-PSWP	In Situ Solidification Pilot Study Work Plan
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PC	Portland Cement
RAWP	Remedial Action Work Plan
UCS	Unconfined Compressive Strength
WM	Waste Management

1.0 INTRODUCTION AND PURPOSE

WB 30 Water Street, LLC (the "Volunteer") entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) on April 8, 2024 to investigate and remediate a portion of the Former Ossining Works Site, Operable Unit 1 (OU-1), which is now known as the Former Ossining Gas Works DWP BCP Site No. C360172 (hereinafter referred to as the "Site" or "BCP Site"). The Site, along with the remainder of OU-1 and Operable Units OU-2 and OU-3, has previously been subject to Consent Order No. CO 0-20180516-519 with Consolidated Edison Company of New York, Inc. ("Con Edison"). The Site has been removed from the Consent Order in order for the Site to enter the Brownfield Cleanup Program (BCP) but the remainder of OU-1, OU-2 and OU-3 remain subject to the Con Edison Consent Order.

This is an addendum to the in-situ solidification (ISS) pilot study workplan (ISS-PSWP, Add-ISS-PSWP) to address the corrective measures that were requested in the Department letter dated April 3, 2025. The ISS-PSWP was submitted to the Department in January 2025 and approved on January 24, 2025.

2.0 OBJECTIVES, SCOPE AND RATIONALE

The Scope of work of this Add-ISS-PSWP is to implement the corrective measures as requested by the Department for the two (2) cells Pilot Cell -D and Pilot Cell-J(A). The cells will be treated to the required treatment depth per the Remedial Action Work Plan (RAWP). The contractor is proposing three (3) corrective measure treatment alternatives:

Option 1 – Remove and Replace: Under this option, the Contractor will apply foam and then break and pulverize the failed ISS cell monolith into pieces no larger than two (2) feet in size. This material will be excavated and removed down to the designed treatment depth. To control airborne dust and potential contaminants during this process, adequate amounts of foam and/or water will be utilized.

Once pulverized, the material will be loaded and transported off-site to the Waste Management ("WM") Fairless facility for disposal. Any free product encountered during excavation will be removed and transported to a NYSDEC-approved facility for disposal and/or treatment.

Following confirmation that the excavation is free of contamination, NYSDEC-approved clean backfill material (either stone or earth) will be imported and placed in 12-inch lifts.

To prevent cross contamination of adjacent, untreated cells into the newly excavated Pilot Cell area, Renova—the Project's ISS Contractor—recommends that this corrective measure be implemented only after the adjacent cells have undergone ISS treatment and the monoliths have sufficiently stabilized.

Option 2 - Pulverize and Remix: In Option 2, the Contractor will foam, break and pulverize the failed cells' monolith into pieces small enough to filter through the excavator's skeleton bucket. Once the existing monolith is broken down, the cell will be remixed using the same reagents prescribed within the RAWP and in conformance with the additional corrective means and methods outlined below.

Option 3: ISS Treatment of adjacent cells Pilot C and Pilot J(1) (Figure 1) as explained in this workplan, and future treatment of Pilot Cell -D and Pilot Cell-J(A) with either Option 1 or 2 above.

The mixing will extend to the treatment depths specified in the RAWP, using the survey methodology described herein. Once curing is complete, the remediated cell will be tested for unconfined compressive strength (UCS) and permeability, with core samples collected at seven-day intervals until all remedial objectives are met.

3.0 TREATMENT AGENT

The selected mix for this study is Mix #2 (6% Holcim Portland Cement [PC] and 2% Holcim Ground Granulated Blast Furnace Slag [GGBFS]) per Section 3.2 and the July 2024 Treatability Testing Report (Appendix A of the ISS-PSWP). Based on the testing results, this mix provides high UCS values and passes the permeability test.

The mix of 6 % Holcim PC and 2 % Holcim GGBFS will be used in the Pilot-C (near Pilot D) (Figure 1).

A mix of 9% Holcim PC and 2% Holcim GGBFS will be tested in Pilot-J(B) (near Pilot-J[A]) during this corrective measure testing to determine if increasing the dose of applied PC would result in the required permeability, UCS and core testing recovery in high moisture area.

3.1 SITE-SPECIFIC PERFORMANCE STANDARDS

Based on results of the Treatability Study, remedial objectives, and geotechnical considerations, the Site-specific performance standards have been determined to be:

- Achieving a UCS of 50 psi or greater for every test; and
- Achieving a permeability equal to, or less than, 1×10^{-6} cm/sec for every test.

3.2 ISS IMPLEMENTATION

The mixing will extend to the treatment depths specified in the RAWP plus one (1) foot, using the survey methodology described herein.

The Contractor will reposition the excavator multiple times throughout the mixing operation to access and mix each cell from various angles. Typically, the Contractor employs a checkerboard mixing pattern, allowing the excavator to approach all four (4) sides of a cell. However, certain site conditions—such as cells adjacent to the Sing Sing Kill retaining walls—may limit access to only two or three sides.

Additionally, the Contractor will mix each cell to a depth approximately one (1) foot below the target depth as prescribed in the RAWP. The Contractor will use a skeleton bucket during the mixing operation. Any large rocks, cobbles, or debris retained in the bucket during this process will be set aside, decontaminated, and/or properly transported off-site to a NYSDEC-approved disposal facility. All materials removed from the treatment cell will be staged on polyethylene sheeting and remain properly covered until they are either transported or approved for reuse.

Soil mixing will be performed to the specified treatment depth in the RAWP plus one (1) foot for each ISS area used during the pilot test, using the bucket-mixing method (BMM). ISS operations will utilize a Scheltzke grout batch plant as the primary batch plant, two 40-ton silos, two 100-ton pigs, and a series of pumps for the grout preparation operation. The mixing plants, silos, pigs, and pumps will be located on the north side of the Sing Sing Kill.

The STS MPC 030-160D Mix Pump System mixing tanks are suspended from load cells, allowing the precise metering of the reagents into the mixing tank. The weigh cell measurements are used to automatically create each batch of grout with the correct amounts of reagents as required in the Mix 2 and described in **Table 1**. The batch plant automatically records the information for each batch of grout. The batch plant operator and Project Engineer will program the plant to deliver the correct amount of Portland cement and GGBFS. Then, dry reagents (Portland cement and slag) will be metered into the batch tank using the silo screw conveyor to deliver the specified weight of reagent. Once the grout is initially mixed it will be transferred to the agitator storage tank. The batch number, quantities of Portland cement and slag cement will be recorded on a Grout Log. The plant operator will collect samples of the grout once per shift and upon any grout mix changes to determine its density to ensure proper mixing proportions. This will also be recorded on the Grout Log. Each silo will be equipped with a baghouse to eliminate dusting during reagent filling, with one (1) for Portland cement and one for blast furnace slag. Each silo will be equipped with a 10-inch diameter screw auger to transfer the reagent to a batch plant.

Portland cement and GGBFS will be pneumatically off-loaded into one of the two (2) 100-ton guppies, while slag cement will be off-loaded into the other.

A grout pump, suitable to transfer the grout from the grout plant to the ISS drill rigs through a 2-inch hose, will be connected to the grout holding tank. The grout pump is equipped with a variable speed motor to vary delivery rates, as required. A pre-determined grout volume (number of batches) will be pumped to the treatment column based on the soil density, reagent admixture ratio, and the column volume as described in **Table 1**. A grout injection chart will be generated for the QA/QC technician in the field to easily communicate the reagents and water needed to the batch plant operator. The batch plant operator would then pump the required grout volume to the ISS drill rig.

The estimated mix quantities per area that will be used and tracked by the automated batch plant are presented in **Table 1** below. **Figure 1** provides additional details as to the locations and volumes of each pilot cell.

The ISS pilot cells were shaped to be rectangular. If the rectangular shapes the cells overlayed mixing areas of varying required mixing depth, then the deeper mixing depth will be chosen for the entirety of each cell as the treatment depth.

The elevation of each cell was based on the survey conducted in February 2025 (**Appendix A** of this document). The survey of February 2025 shows elevation survey shots at each corner of the mixing cells; the lowest elevation in the cell was used to calculate the mixing bottom elevation in **Figure 1**.

Table 1. Estimated Batch Quantities

	Mix	Surface Area	Depth from Grade per RAWP + 1 ft	Depth (ft) After 5 ft Cut	Existing Grade Elevation	Bottom Elevation	Mix Volume*	Total Mix**	PC	GGBFS
		SF	ft-bgs	ft-bgs	ft-amsl	ft-amsl	CY	Tons	Tons	Tons
Pilot - C	No. 2 (6% PC2, 2% GGBFS2)	771	12.5	7.5	16.1	3.6	214	321	19.3	6.4
Pilot -J(B)	No. 2 (9% PC2, 2% GGBFS2)	425	17	12	17	0	189	283	25.5	5.7

**This estimate is based on an assumed mix volume, taking into account a 5' cut before ISS and adding 1 ft of mixing depth.*

***Using a factor of 1.5 for the conversation of cubic yards to tons.*

Following soil mixing, samples will be collected for verification testing to assess the performance of the ISS treatment. The samples will be analyzed for UCS and permeability. Details of the sampling protocol and testing methods are provided in the following section.

Pilot C will be mixed an additional 1.5 ft for a total depth of 14 ft-bgs from existing grade for structural purposes.

<u>Survey methods</u>

The Contractor has procured a GPS (**Appendix B**) that will be mounted to the excavator prior to the corrective actions being taken.

In addition to the use of the GPS, the following process will be followed to ensure the ISS mixing will be completed to the prescribed treatment depths included in the approved RAWP. The attached table (**Appendix C**) will be updated daily and sent to the NYSDEC with the daily report.

InSite Surveying, a NY licensed surveyor, will be performing all site survey work, including the documentation of both the existing (current) grade and pre-mix elevations.

- The survey of February 2025 of the corner of each mixing cell will be used to determine the elevation of the existing grade elevation per the NAVD88 (Column B of the attached table). The lowest elevation in each cell will be used as the start elevation for each cell.
- The elevation of the target mix depth in ft-amsl (Column D) will be calculated as follows:

  [Existing ground elevation (ft-amsl)] – [Target mix depth per the RAWP (ft) + 1 ft] or

  [Column B] – [Column C]
- The grade of the mixing cell will be surveyed post excavation of the 5-ft and prior to the start of mixing (Column E).
- The target mix elevation will be tracked using the GPS unit during the mixing operations.
- Additionally, the target mix depth may be calculated as follows:

  [Ground elevation post 5-ft excavation] – [Target mix depth elevation] or

  [Column E] – [Column D]

The target mix depth is for field verification only, if needed. This value must take into consideration the added elevation as a result of the volume of the added reagent slurry. ADD UP TO 1 FOOT to the depth for field verification.

- The mixed cell will be surveyed after mixing and backfilling at the location of the proposed coring. The proposed coring depth (Column H) will be calculated as follows:

  [Ground elevation prior to Coring (ft-amsl)] – [Target mix elevation (ft-amsl)] or

  [Column G] – [Column D]

- Coring depth will be targeted to the calculated depth in Column.

3.3 VERIFICATION SAMPLING

SESI or the ISS contractor will obtain two (2) sets of samples of the treated material within each study area. Each set of samples will be collected from different depth of the treated area.

The samples will be placed into either 2- inch x 4-inch or 3-inch x 6-inch molds, capped, and cured at 100% relative humidity on-site for a minimum of 72-hours. The contractor will then ship the samples to designated geotechnical laboratories for analysis. Each sample will be analyzed for UCS (ASTM D2166 or ASTM D4832 or ASTM D1633), and Permeability or Hydraulic Conductivity (ASTM D5084) at intervals of 7 and 28 days. The verification sample summary is presented in **Table 2** below.

Table 2 Pilot Study Verification Samples for Each Pilot Test Area

Area	Sample No.	Target Depth (feet bgs)	Analytes	Testing Interval
Pilot-J(B)	1	6 to 8	UCS (ASTM D2166 or ASTM D4832 or ASTM D1633) and Permeability (ASTM D5084)	7 and 28 days
	2	12 to 14		
Pilot-C	1	6 to 8	UCS (ASTM D2166 or ASTM D4832 or ASTM D1633) and Permeability (ASTM D5084)	7 and 28 days
	2	12 to 14		

4.0 QA/QC PROTOCOLS

The collection of QA/QC samples will be completed after the pilot study and as part of the remedial action verification. These samples are collected in accordance with the ISS QA/QC Guidance Document included as Appendix D in the ISS Pilot Study Work Plan approved in January 24, 2025. Sample results will be checked against the site-specific performance standards detailed in the previous section.

Coring will be collected at 7-day intervals following the ISS Pilot Study implementation. At least one (1) core will be collected per area and the data will be included with the pilot study report.

5.0 HEALTH AND SAFETY PROTOCOLS

Air monitoring will be performed during the implementation of the pilot study actions to protect the health and safety of Site workers and to confirm that air impacts from Site-related activities are not migrating off-Site. The monitoring program will include monitoring for vapor, odors, and dust.

Vapors will be monitored during the pilot study activities in accordance with the Community Air Monitoring Plan (CAMP) and the Health and Safety Plan (HASP). The CAMP and HASP are included as Appendix E and Appendix F, respectively, of the ISS-PSWP approved in January 2025.

6.0 GOVERNING DOCUMENTS

The following appendices are included in the approved ISS-PSWP and applicable to this pilot study work plan addendum:

- Health and Safety Plan
- Soil Erosion and Sediment Controls Plan (SESCP)
- Community Air Monitoring Plan
- Citizen Participation Plan (CPP)
- ISS QA/QC Guidance Document

7.0 REPORTING AND SCHEDULE

Electronic reports will be submitted to NYSDEC and New York State Department of Health (NYSDOH) Project Managers daily before the close of business on the following day during active remedial action and day. Upon completion of the pilot study, SESI will submit a pilot study report summarizing findings and recommendations for full-scale applications.

An estimated schedule of completion is included in **Table 3** below.

Table 3. Estimated Pilot Study Schedule of Completion

Task	Duration
Excavation/Cut (per Area)	2 days
Mixing (per Area)	1 day
Sampling (per Area)	1 day
QA/QC Coring (per Area)	1 day
Pilot Study Report	2 weeks

8.0 CONTACT INFORMATION

The following **Table 4** includes the contact information of the personnel associated with the pilot study work to be completed:

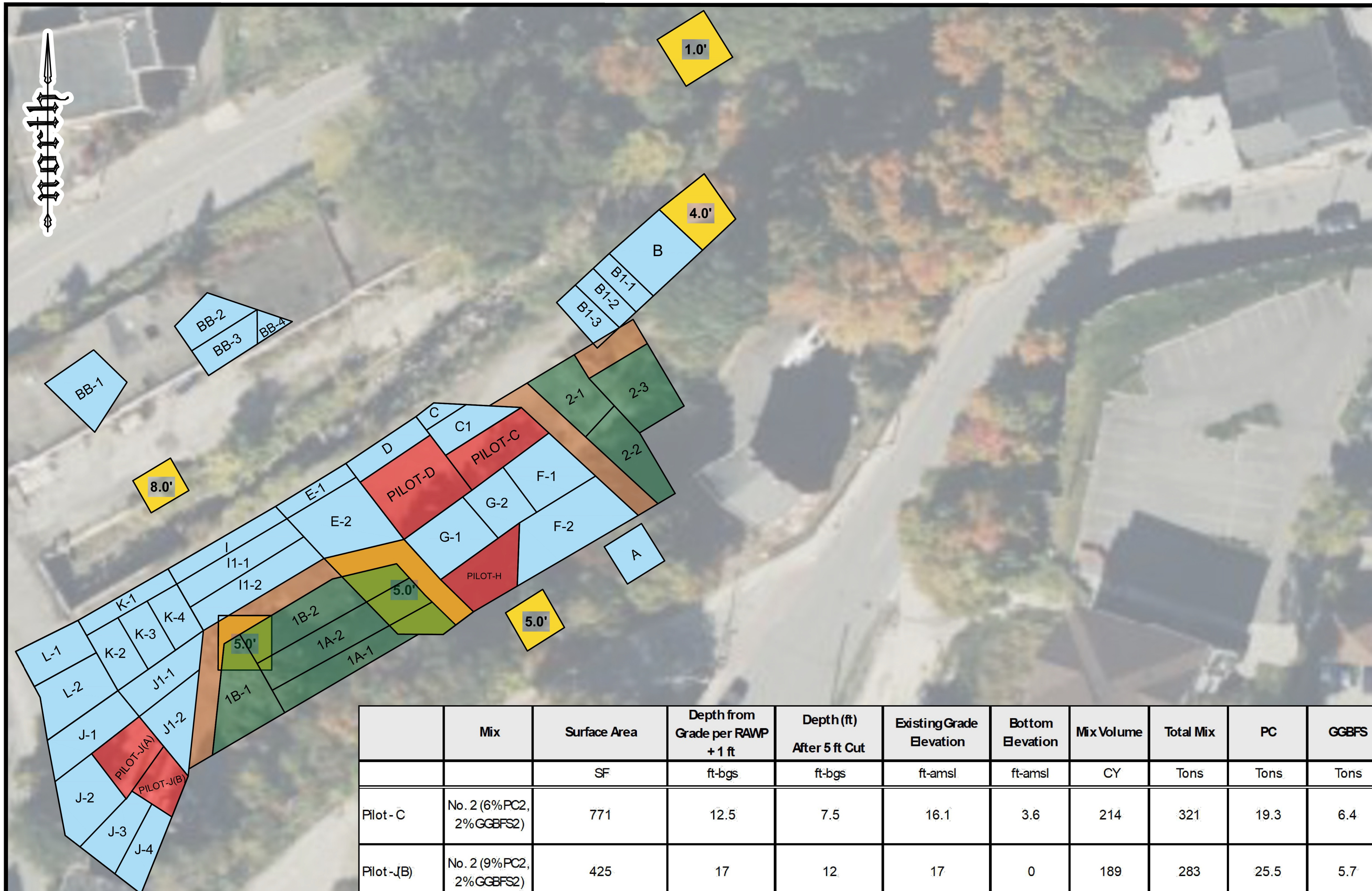
Table 4. Contact Information

Agency/Individual	Contact Number
James Seliga, Vice President of Operations* Renova Environmental Co.	(732) 659-1000
Fuad Dahan, Remedial Engineer SESI Consulting Engineers	(973) 808-9050
Jose Rodriguez, Geotechnical Engineer SESI Consulting Engineers	(973) 808-9050
Christopher Malvicini, Asst Project Manager SESI Consulting Engineers	(973) 808-9050
Craig Malkin, President Griffon Construction	(845) 278-0301
Michael Burke, Project Manager Griffon Construction	(845) 745-0219
James Wendling, Volunteer Representative WB 30 Water Street LLC	(914) 610-3647
Caroline Jalanti, Project Manager NYSDEC	(518) 402-9650
Anthony Perretta, Project Manager NYSDOH	(518) 402-7860

9.0 CITIZEN PARTICIPATION ACTIVITIES

Citizen Participation during implementation of the remedial program will proceed in accordance with the Citizen Participation Plan included as Appendix G of the approved ISS-PSWP. The short-term impacts will be addressed by the CAMP, HASP and other measures such as a truck wash at the points of ingress and egress and other odor and dust controls.

Figure



	Mix	Surface Area	Depth from Grade per RAWP +1 ft	Depth (ft) After 5 ft Cut	Existing Grade Elevation	Bottom Elevation	Mix Volume	Total Mix	PC	GGBFS
		SF	ft-bgs	ft-bgs	ft-amsl	ft-amsl	CY	Tons	Tons	Tons
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Pilot - J(B)	No. 2 (9%PC2, 2%GGBFS2)	425	17	12	17	0	189	283	25.5	5.7

3417 SUNSET AVENUE, OCEAN, NJ 07712
PHONE: (732)659-1000
www.renovaenviro.com

LEGEND:

- PILOT MIX AREA
- ISS MIX AREA
- 10' BUFFER
- STRUCTURAL MIX AREA
- EXCAVATION ONLY AREA

SCALE IN FEET: 0 60 120

CELL LAYOUT

30 WATER STREET
OSSINING, NEW YORK

FIGURE X

DATE: 4/22/2025

DRAWN BY: BI

dwg by: AW
chk by: FD
scale: AS NOTED
date: 04/21/2025

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GEOTECHNICAL | ENVIRONMENTAL | SITE CIVIL
959 ROUTE 46E, 3RD FLOOR, PARSIPPANY, NJ 07054 PH: 973.808.9050

project: 30 WATER STREET OSSINING, NY

title: PILOT PLAN - 2

job no: 11498
drawing no:

FIG-1

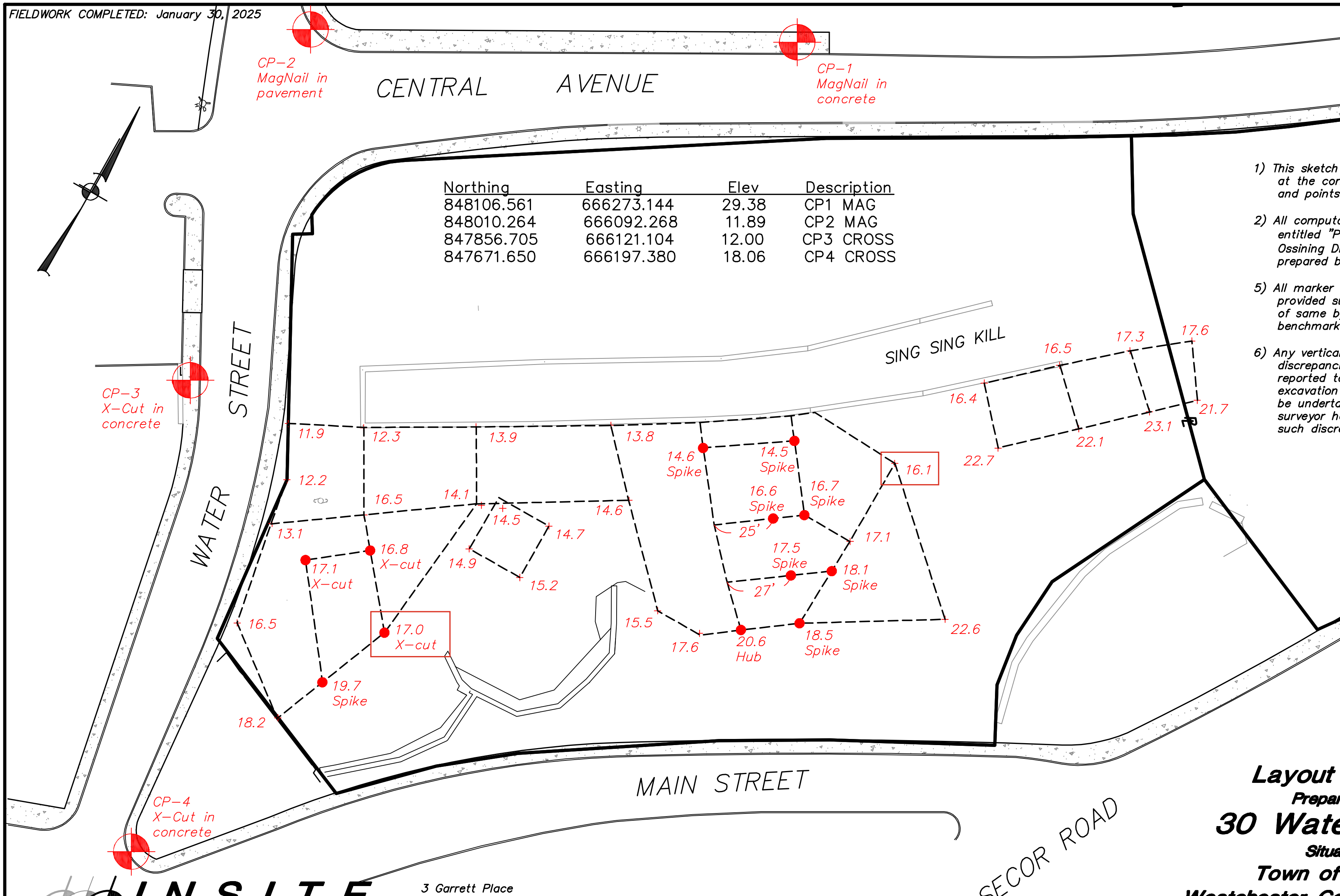
1 of 1

N:\ACAD\11498\CAD\11498.DWG_PILOT_STUDY-2 [4-21-25].DWG 04/23/25 10:20:25AM, pinnacle, LAYOUT: PILOT

Appendix A:

February 2025 Survey

FIELDWORK COMPLETED: January 30, 2025



Northing	Easting	Elev	Description
848106.561	666273.144	29.38	CP1 MAG
848010.264	666092.268	11.89	CP2 MAG
847856.705	666121.104	12.00	CP3 CROSS
847671.650	666197.380	18.06	CP4 CROSS

1) This sketch depicts the existing elevations at the corners of the ISS treatment areas and points set at other areas.

2) All computations derived from a drawing entitled "Proposed Residential Development, Ossining DPW Site, ISS Pilot Test Area" prepared by SESI Consulting Engineers.

5) All marker elevations shown hereon are provided subject to the users verification of same by checking to the furnished benchmark elevations.

6) Any vertical or horizontal alignment discrepancies discovered are to be reported to this surveyor, and no excavation or construction activity should be undertaken until such time as this surveyor has investigated and resolved any such discrepancies.

Layout Sketch
Prepared for
30 Water Street
Situate in
Town of Ossining
Westchester County, New York
Scale 1" = 40'   Date: February 3, 2025

GRAPHIC SCALE
0   40   80   120

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ENGINEERING, SURVEYING &
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3 Garrett Place
Carmel, NY 10512
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20190.100

Appendix B:

GPS Documentation

TOPCON

HIPER VR
VERSATILE GNSS RECEIVER

Complete, Cutting-Edge Performance

- Universal Tracking Channels for all satellites, signals and constellations
- Field-tested, field-ready IP67 design
- Compact form factor ideal for Millimeter GPS and Hybrid Positioning™
- Revolutionary 9-axis IMU and ultra-compact 3-axis eCompass

Better things in smaller packages

The HiPer VR is smaller and lighter, but don't let its small size fool you. It's not only packed with the most advanced GNSS technology, it is also built to withstand the harshest field environments. Built with a rugged housing – not weak plastic – it can take the punishment of the job site.

Using the Topcon advanced GNSS chipset with Universal Tracking Channels™ technology, the receiver automatically tracks each and every satellite signal above – now and into the future.

All signals, all satellites, all constellations — all in a compact, rugged design, with an integrated IMU and eCompass.

TILT™ – Topcon Integrated Leveling Technology

The HiPer VR incorporates a revolutionary 9-axis inertial measurement unit (IMU) and an ultra-compact 3-axis eCompass. This advanced technology compensates for mis-leveled field measurements out of plumb by as much as 15 degrees.

Awkward shots on steep slopes or hard to reach spots are now a breeze with TILT.


TOPCON
TOPCON


Fence Antenna®
TOPCON
Power Button
Status
Recording
Bluetooth®
RxTx
Battery

GNSS Tracking	
Channel Count	226 with Topcon's patented Universal Tracking Channels technology.
Signal	
GPS Signals	L1 C/A, L1C* L2C, L2P(Y), L5 *L1C when signal available.
GLONASS	L1 C/A, L1P, L2C/A, L2P, L3C* *L3C when signal available.
Galileo	E1/E5a/E5b/Alt-BOC
BeiDou/BDS	B1, B2
IRNSS	L5
SBAS	WAAS, EGNOS, MSAS, GAGAN (L1/L5*) *L5 when signal available.
L-band	TopNET Global D & C Corrections services
QZSS	L1 C/A, L1C, L1-SAIF, L2C, L5
Positioning Performance	
Static/ Fast Static	H: 3 mm + 0.4 ppm V: 5 mm + 0.5 ppm
RTK	H: 5 mm + 0.5 ppm
RTK, TILT Compensated	H: 1.3 mm/°Tilt; Tilt ≤ 10° H: 1.8 mm/°Tilt; Tilt > 10° Maximum recommended angle for tilt compensation is 15° Subject to successful TILT calibration & operating environment free of magnetic disturbances
DGPS	0.25 m HRMS
L-Band, D Corrections Service	H: < 0.1 m (95%) V: < 0.2 m (95%)
Operational Time	RX mode - 10hr TX mode 1W - 6hr *Use of external 12V battery is recommended when using HiPer VR with internal radio in transmit mode.*
Internal Radios	425-470 MHz UHF radio Max Transmit Power: 1W Range: 5-7 km typical; 15 km in optimal conditions
Memory	Internal Non-removable 8 GB SDHC
Environmental	Ingress Rating – IP67 Operating Temp – -40°C to 70°C Humidity – 100%, condensing Drop and Topple – 1.0 m drop to concrete. 2.0 m pole drop to concrete.
Dimensions	150 x 100 x 150 mm (w x h x d)
Weight	<1.15 kg

Integrated radio and modem options

- 400 MHz UHF TX/RX Radio
- License-free 900 MHz radio, FH915 protocol[1]

L Band Ready Technology

- L Band ready to receive advanced GNSS corrections data set globally

Highly configurable

Designed to grow with you, unique electronic option files empower you to activate available features instantly.

Future proof

The Topcon full wave antenna tracks all GNSS signals currently available and is designed to track the constellations and signals of tomorrow.

* Under nominal observing conditions and strict processing methods, including use of dual frequency GPS, precise ephemerides, calm ionospheric conditions, approved antenna calibration, unobstructed visibility above 10 degrees and an observation duration of at least 3 hours (dependent on baseline length). 1* Check with the regulatory body in your region regarding license free frequency requirements. 2* Contact your Topcon representative regarding availability. 3* Contact your Topcon representative regarding availability and pricing.

** Subject to successful TILT calibration and operating environment free of magnetic disturbances.

*** Varies with terrain and operating conditions.

TOPCON

For more information:
www.topconpositioning.com/hiper-vr

TOPCON

GNSS Receiver

HiPer VR

Better form and function

The HiPer VR is versatile and rugged, designed with the advanced GNSS technology delivering precise measurements in the most challenging of environments.

Topcon patented Universal Tracking Channels™ technology provides the industry's most efficient approach in identifying and using every satellite signal. All constellation signals are tracked automatically from any available channel. Thus, reaching maximum performance with a reduced number of channels.

TILT™

The HiPer VR incorporates a revolutionary 9-axis Inertial Measuring Unit (IMU) and an ultra-compact 3-axis eCompass. Topcon Integrated Leveling Technology compensates for mis-leveled field measurements out of plumb by as much as 15°.

- Compact, lightweight, rugged design
- Field tested, field ready IP67 design
- Compact form factor ideal for Hybrid Positioning
- Revolutionary 9-axis IMU and ultra-compact 3-axis eCompass

GNSS TECHNOLOGIES (SIGNAL TRACKING)	
GPS	L1 C/A, L1C, L1P(Y), L2P(Y), L2C, L5
GLONASS	L1 C/A, L1P, L2C/A, L2P, L3C
Galileo	E1, E5a, E5b, E5 Alt-BOC
BeiDou	B1, B2
IRNSS (NavIC)	SPS-L5
SBAS	WAAS/EGNOS/MSAS
QZSS	L1 C/A, L1C, L2C, L5
L-band	Yes
Universal Tracking Channels™	226 GNSS channels Vanguard Technology™ with Universal Tracking Channels™; 2 reserved for L-band
TILT™	Topcon Integrated Leveling Technology™
GNSS Antenna	Integrated Full wave Fence Antenna™ technology with internal ground plane
POSITIONING PERFORMANCE	
Precision Static	H: 3 mm + 0.1 ppm | V: 3.5 mm + 0.4 ppm
Static/Fast Static*	H: 3 mm + 0.4 ppm | V: 5 mm + 0.5 ppm
RTK	H: 5 mm + 0.5 ppm | V: 10 mm + 0.8 ppm
Code Differential GNSS	H: <0.25 m | V: <0.50 m
RTK, TILT Compensated	H: 1.3 mm/°Tilt; Tilt ≤ 10° | H: 1.8 mm/°Tilt; Tilt > 10° Maximum recommended angle for tilt compensation is 15°**
COMMUNICATIONS	
Internal Radio (Optional)	405–470 MHz UHF or FH915 spread spectrum Max Transmit Power: 1W Range: 5–7 km typical; 15 km in optimal conditions.***
Cellular	Optional 4G internal cellular module
LongLink™	Up to 328.1 m / 1000 ft
Bluetooth™	Yes
Ports	1 Serial, 1 USB, 3 Connectors
DATA FORMAT AND MEMORY	
Data Output	TPS, RTCM, CMR/CMR+, NMEA, BINEX
Internal Memory	8 GB
Update Rate	Up to 20Hz
POWER	
External Power Supply	9.0 – 27.0 V DC
Battery	Li-ion 11,600 mAh, 3.7 V
Operating time with radio	RX mode – 10 hr | TX mode 1W – 6 hr Use of external 12V battery is recommended when using as a base
HARDWARE	
Dimensions (W x H)	14.90 cm x 9.46 cm (5.86 in x 3.72 in)
Weight	1.061 kg (2.33 lb)
Ingress Protection	Dust and water IP67
Vibration	MIL-STD 810G
Drop	Survive 2m pole drop on concrete surface
Operating Temperature	-40° C to +65° C (-40° F to +149° F)
Humidity	100%

* Under nominal observing conditions and strict processing methods, including use of dual frequency GPS, precise ephemerides, calm ionospheric conditions, approved antenna calibration, unobstructed visibility above 10 degrees and an observation duration of at least 3 hours (dependent on baseline length).
** Subject to successful TILT calibration and operating environment free of magnetic disturbances.
*** Varies with terrain and operating conditions (UHF radio only).

www.topconpositioning.com/hiper-vr

TOPCON

X-52x / X-53x

2D / 3D INDICATE CONTROL FOR EXCAVATORS

GX-55 Specifications	
Supply Voltage	9 to 32 VDC
Ports	2x USB Ethernet RS-232 2x CANBus 2x Digital inputs
Display Panel	640x480 Color VGA, enhanced brightness with analog touchscreen
Operating System	Windows® CE
Operating Temp	-40°C to 70°C
Weight	1.26 kg with backpack 1 kg without backpack

MC-X1 Specifications	
Supply Voltage	9 to 32 VDC
Switched Output Power	5A sensor/conditioned output power
Ports	1 ea. port RS232/Digital IO 2 ea. Ethernet 2 ea. CAN
Operating temperature	-40°C (-40°F) to +80°C (+176°F)
Shock	25 g, 11 ms ½, sine wave 6X each axis
Weight	.23 kg (.5 lb)
Dust/Water Rating	IP67

GR-i3 GNSS Receiver	
Channels	226 Universal Tracking Channels
Signals Tracked	GPS: L1, L2, L2C; GLONASS: L1, L2, L2C; BeiDou: B1, B2; Galileo: E1; SBAS: QZSS: L1, L2C
Accuracy	When utilized with RTK H: 5 mm + 0.5 ppm x baseline; V: 10 mm + 0.8 ppm baseline
Ports	CANopen
Wireless	BT 2.0/BLE 4.1
Operating Temperature	-40°C (-40°F) to +80°C (176°F)
Ingress Protection	IP67
Shock Test	25G 11 ms 1/2 sine wave each axis
Salt Fog Test	JDQ 53.3 section 4.1
Vibration Test	10-200 random 7.7 Frms, 8 hours each axis

3D Indicate Control Excavator System

- Cut grade fast and accurately
- Cut flat, vertical and 3D surfaces
- Fully upgradeable
- Improves job safety
- Integrated multi-constellation GR-i3 GNSS receivers

Upgrade now to a 'future-proof' excavating System

Select the X-53x (full 3D system) now or get the X-52x (2D system) and easily upgrade later. Either choice sets you up with future-proof 500kpbs Baud Rate modular components ready for the next generation enhancements. No matter which system you start with, you will greatly enhance your excavating projects. 3D systems show a 30% productivity increase over non-equipped machines.

Get to grade faster

The 2D system ensures you will always cut to the correct grade, while the full 3D system provides even more advanced positioning assistance reducing the need for stakeout, grading and survey personnel. This allows you to work more independently, streamlining your workflow, allowing you to deliver on schedule.

Integrated Components

The X-53x system features fully integrated multi-constellation GR-i3 GNSS receivers for precise positioning of the boom, stick and bucket at all times.

MC-X1

The future-proof, compact and ruggedized MC-X1 GNSS machine controller supports current 2D/3D indicate systems now and future planned enhancements.

TS-i3

Tilt sensors are mounted on the boom, stick and bucket for elevation guidance at any angle.

TOPCON

For more information:
topconpositioning.com/x-52x
topconpositioning.com/x-53x

Appendix C:

Daily Survey Table

Survey Table

Column A	Column B	Column C	Column D	Column E	Column F	Column G	Column H
Mixing Cell	Existing Ground Elevation NAVD88 Per the February 2023 Survey	Target Mix Depth (RAWP +1 ft)	Target Mix Bottom Elevation Calculated Column B - Column C	Ground Elevation Post 5-ft Excavation NAVD88 Measured by Licensed Surveyor	Treatment Depth* Column E - Column D	Ground elevation Prior to Coring NAVD88 Measured by Licensed Surveyor	Target Coring Depth Calculated Column G - Column D
	ft - amsl	ft-bgs	ft-amsl	ft-amsl	ft - bgs	ft-amsl	ft bgs
Pilot - C	16.1	12.5	3.6				
Pilot - J(B)	17.0	17	0				