Appendix 4-A: Methodology Statement for Submarine Cable Installation

METHODOLOGY STATEMENT

Champlain Hudson Power Express
Submarine Cable Installation
(Harlem River Segment)

SUBMITTED TO:

NKT HV CABLES AB.

SUBMITTED BY:

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CALDWELL MARINE INTERNATIONAL LLC. 1333 Campus Parkway, Wall Township, New Jersey 07753 **PROJECT QUALITY ASSURANCE**	**Type:** Methodology Statement **Prepared By:** Dominic Palermo **Document #:** CHPE HARLEM RIVER INSTALLATION METHODOLOGY-NKT-REV0.7-20250110.docx **Date**: 10 January 2025 **Revision No:** 0.7

DOCUMENT TITLE: Methodology Statement – Submarine Cable Installation (Harlem River Segment)

APPROVALS:

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Rev.	Description	Date	Approval
0.0	Issued for draft EM&CP submittal	9 September 2024	TU
0.1	Revision per NKT comment draft EM&CP submittal	13 September 2024	TU
0.2	Revision per NKT comment draft EM&CP submittal	20 September 2024	TU
0.3	Revision per Harlem Installation Strategy Finalization meeting	7 October 2024	TU
0.4	Revision per CHPE comment draft EM&CP submittal	11 October 2024	TU
0.5	Revision per further CHPE comment draft EM&CP submittal	17 October 2024	TU
0.6	Revision per USCG (SECNY & D1), USACE comments	11 December 2024	TU
0.7	Revision per TDI comment final EM&CP submittal	10 January 2025	TU

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LIST OF ACRONYMS

ABS	American Bureau of Shipping
AC	Alternating Current
BAS	Burial Assessment Study
CHPE, LLC	Champlain Hudson Power Express, LLC
CMI	Caldwell Marine International, LLC
CPS	Cable Protection Systems
DC	Direct Current
DGPS	Differential Global Positioning System
DoW	Depth of Water
DP	Dynamic Positioning
DWT	Deadweight Tonnage
ECR	Equipment Calibration Record
EM&CP	Environmental Monitoring and Construction Plan
FAS	Feasibility Assessment Study
FO	Fiber Optic
HDPE	High Density Polyethylene
HP	Horsepower
HPU	Hydraulic Power Unit
IMO	International Maritime Organization
ITP	Inspection and Test Plan
LCE	Linear Cable Engine
MOP	Method of Procedure
MP	Mile (Statute) Post (measured from origin, along planned cable route)
NY	New York
OBC	Overboard Chute
OSI	Ocean Surveys Inc.
OTDR	Optical Time Domain Reflectometer
QA	Quality Assurance
RPL	Route Position List
SLD	Simultaneous Lay and Burial
TBD	To Be Determined

UNITS USED IN THIS DOCUMENT

This document uses primarily US Customary Units. The following table presents the units, abbreviations, and conversion factors to Metric units.

US Customary Unit		Metric Unit	Equivalent US Unit
Foot	ft	Meter	3.2803 ft
Inch	in	Centimeter	0.3937 in
Pound	lb	Kilogram	2.2046 lbs
Ton (short)	ton	Tonne	1.1023 ton
Mile (Statute)	mi	Kilometer	0.62137 mi
Pound force	lbf	KiloNewton	224.8089 lbf
Pounds/inch^2	psi	KiloPascal	0.145 psi

1 Introduction

Transmission Developers Inc. (*TDI),* a Blackstone Group portfolio company are the Developers for the Champlain Hudson Power Express (*CHPE)* Project. CHPE LLC and CHPE Properties, Inc. plan to construct, operate and maintain a new 1250 MW high-voltage direct current ("HVDC") underwater/underground electric transmission facility ("HVDC Transmission System") of clean hydro-electric power from Quebec, Canada to the New York City power market.

The CHPE route has been carefully designed to minimize its impact on the environment. Burying the cables keeps it out of sight and protects it from extreme weather. Within the US, the cable route will be comprised of both land and submarine cable segments. Two five-inch power cables and a smaller fiber optic cable will be installed underwater or underground and run approximately 339 miles from the U.S. – Canadian border, south through Lake Champlain, along and under the Hudson and Harlem Rivers to eventually terminate at a DC / AC electrical converter station that will be built in Astoria, Queens.

NKT HV Cables AB *(NKT)* have been selected as the cable supplier for the CHPE Project. *NKT* have subcontracted the following Project tasks to Caldwell Marine International LLC. (*CMI):*

1. **CIVIL INFRASTRUCTURE:** Land-to-Water duct installation for:
    a. Lake Champlain Segment (southern landing only) (Segment 17 EM&CP)
    b. Upper Hudson River Segment (northern & southern landings) (Segment 16 EM&CP)
    c. Lower Hudson River Segment (northern landing) (Segment 16 EM&CP)
    d. Harlem River Segment Bulkhead Penetration (southern landing only) (Segment 20A EM&CP)
2. **SUBMARINE CABLE INSTALLATION:**
    a. Lake Champlain Segment (Segment 18B EM&CP)
    b. Harlem River Segment (Segment 20B EM&CP)

This document details the methodologies that will be employed during CMI's installation of submarine cabling for the Harlem River Segment only. Methodology statements for CMI civil infrastructure works are provided under the approved Segment 20A EM&CP.

2 Executive Overview

The Harlem River Cable Segment will connect the southern end of the CHPE Hudson River submarine cable route to the Harlem River Yard (HRY) site located in the South Bronx, NY, just north of Willis Avenue Bridge. The route will lie within New York State waters for its entire length.

CMI's cable installation activities will commence at the bulkhead penetration as an initial cable landing through (2) HPDE pipes installed via open cut methods. The cable bundle will be surface laid on the riverbed with a cable protection system (CPS) installed over its entire length. Post-lay/remedial work to improve/stabilize cable landing and minimize cable free span lengths if required from Post Lay Survey findings will be executed including the installation of concrete mattresses, grout bags, rock bags, and/or diver lowering, or similar. The installation route proceeds North under 12 bridges, both fixed and movable (swing/lift). The cable will then be installed under the Spuyten Duyvil Railroad Bridge and laid on the riverbed for future connection and splicing by Others.

Figure 1 - Harlem River Submarine Cable Installation Segment

The following listing provides an overview of the installation parameters for the CHPE Harlem River Segment. See also ***Figure 1*** above**.**

Harlem River Route Origin Location:	Bulkhead Penetration at Waste Management Property
Harlem River Route Termination:	Hudson/Harlem River @ Spuyten Duyvil Rail Bridge
Harlem River Route Length:	~6.2 Statute Miles
Harlem River Route Water Depth Range:	0ft *(0m)* – ~40ft *(~12m)*
Installation Cable Bundle:	2 x DC Power Cables (400kV) + 1 x Fiber Optic Cable (48 fibers (24 pairs))
Cable Segment:	1 segment

Cable Bundle Protection Types:	
Cable Protection System (CPS)	Primary installation method to be surface laid for ~6.2 miles
Utility Crossings	CPS per CHPE Permits / Crossing Agreement
Post-Lay/Remedial Protections	Concrete mattresses, grout bags, rock bags, and/or diver lowering, or similar
HRY Landing, Bronx, NY	Encasement in 2 x High Density Polyethylene (HDPE) ducts
Segment Route Utility Crossing Count:	Per finalized CHPE, LLC listings
Time of Year (ToY) Restrictions:	Submarine cable installation is permitted May 15th to November 30th per Article VII permit and June 1st to January 14th per USACOE permit.

iv. Within the Harlem River, where obstructions, such as existing underwater infrastructure (e.g., electric cables, gas pipelines, water and sewer mains, telecommunication cables and conduits, movable bridge control cables, etc.) are encountered, and an obstruction prevents the submarine power cable from being installed to the above-specified burial depths, the cable pair may be installed over the obstacle, provided that sufficient protective armament covering, such as articulated concrete mattress or articulated pipe, is installed at the same time, subject to the specific approval of this office.

Figure 2 - USACOE Cable Protection for Surface Lay Requirements

3 CMI Scope of Work

3.1 Submarine Cable Installation – Preparation Works

3.1.1 Route Survey, Engineering & Consents

- Marine Route Survey Addendum Report - Harlem River Investigations 2023 *(completed December 2022)*
- Harlem River Utility Locate Survey by ST Hudson & CMI *(completed May 2023)*
- Harlem River route engineering including determination of cable length values
- Cable landing pull tension calculations (Bronx Landing)
- Obtain documentation related to permits required to be obtained by the Contractor in accordance with the tender stage documents and required to execute the Works
- Bridge Clearance Survey *(completed April 2023)*

3.1.2 Loading & Transport of Submarine Cables

3.1.2.1 Power Cables

- Performance of barge loading tasks during cable transfer including coordination with NKT Freighter Offload Team
- Cable will be transpooled to the carousel/turntable on the Cable Lay Barge
- Reporting and documentation of power cable loading and transport activities

3.1.2.2 Fiber Optic

- Power reel on Cable Lay Barge
- Fabrication of FO lay highway on Cable Lay Barge
- FO Transport Barge receipt of pre-loaded fiber optic reel at a NY Port
- Optical Time Domain Reflectometer (OTDR) acceptance test pre-transfer of FO cable
- Reel transfer of FO cable to Cable Lay Barge
- OTDR acceptance test post-transfer of FO cable
- Reporting and documentation of FO cable transfer, testing and transport activities

3.1.3 Land Site Preparation

- HRY Transfer Station Bulkhead Penetration- South Bronx, NY (Segment 20A EM&CP)
    - Mobilization and demobilization of HRY cable landing assets
    - Cleaning, proofing, threading & preparation of pre-installed landing ducts including marine exit points
    - Restoration of work site
    - Reporting and documentation (as applicable) of all tasks listed above

3.2 Submarine Cable Installation – Cable Lay Works

3.2.1 Vessel Mobilization

- Mobilization & trials of DP2 controlled modular Cable Lay Barge spread – see ***Figure 10***.
- Mobilization of crew boat – 'Alexis' (55' x 16' x 7' 3") or similar
- Mobilization of truck-able work vessels
- Mobilization of Material Transport Barges (CPS supply)

3.2.2 Cable Lay & Protection

- Lay & protection of two HVDC Power Cables and one Fiber Optic Cable from cable landing at HRY Bulkhead Penetration to NKT provided splice location at Hudson/Harlem River border including:
    - Surface lay cable lay with CPS installed on bundle for entire route
    - ROV cable bundle touchdown monitoring
    - Laydown of 'blind' capped cable ends at Hudson/Harlem River border location
    - OTDR monitoring of fiber optic cable during cable installation period
    - Marine transportation for field personnel to marine spreads during cable operations
    - Reporting and documentation (as applicable) of all tasks listed above

3.2.3 Cable Landing at HRY Bulkhead Penetration

- 'Initial' type landing (Segment 20A EM&CP):
    - Floated pull-in of Cable A into Duct 1A
    - Floated pull-in of Cable B + FO cable into Duct 1B
    - Remedial mattress protection of area between HDPE pipe exit and start of CPS encased cable bundle
    - OTDR testing of installed segment
    - Reporting and documentation (as applicable) of all tasks listed above

3.2.4 Cable Installation to Hudson River Splice

- 'Final' type landing:
    - Cable A cable & Cable B + FOC bundled with CPS system installed through Spuyten Duyvil Bridge
    - Record location of end of cable for recovery with Survey and subsea or surface marker buoy for recovery of cable end
    - Remedial mattress protection if required in the area of Spuyten Duyvil Rail Bridge
    - OTDR testing of installed segment
    - Reporting and documentation (as applicable) of all tasks listed above

3.3 Submarine Cable Installation – Post-Lay Tasks

3.3.1 Vessel Mobilization

- Mobilization of Crane Support Barge (CSB) spread – This vessel will be the primary operational platform for post lay/remedial works. Provisional dimensions for this barge are Length 165' x Beam 43.5' x Depth 12' (See ***Figure 3****).*

3.3.2 Post-Lay/Remedial Protections

- Improve/stabilize cable landing and minimize cable free span lengths if required from Post Lay Survey findings via concrete mattresses, grout bags, rock bags, and/or diver lowering, or similar
- Cable bundle stabilization as required utilizing concrete mattresses
- Preparation, review & issuance of 'As-Built' documentation

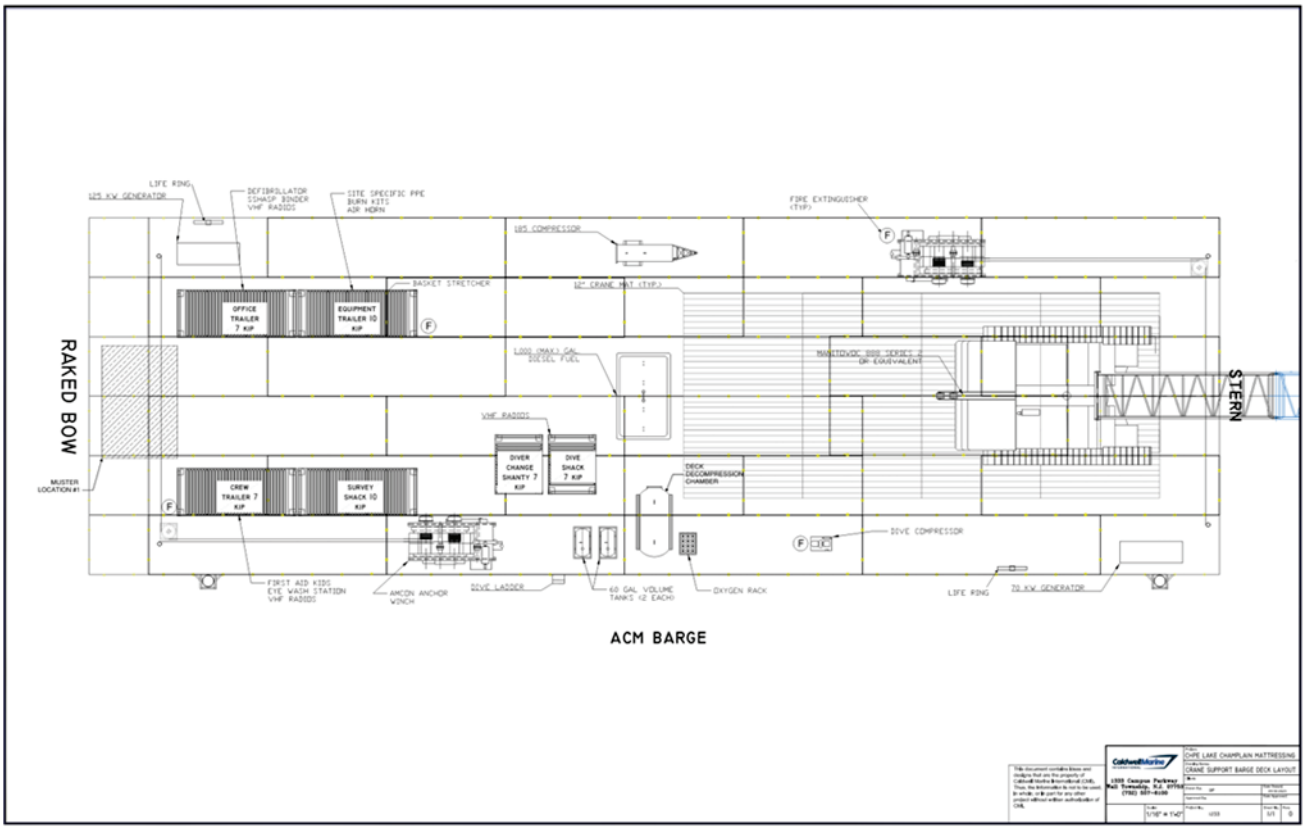

Figure 3 - CSB Deck Layout (preliminary)

- Work Boat(s) – The CSB will carry support work boat(s) that will be available for general support of operations. These vessels are typically outboard powered skiffs with a length of around 25'. The work boat(s) will be mobilized at the same time as the CSB and will be transported to site aboard the CSB
- Mobilization of CSB Support Tug – This tug will be a licensed, insured, and USCG inspected vessel that is dedicated to the operational support of the CSB. It will have adequate bollard pull / horsepower rating to competently maneuver the CSB and will feature anchor handling capability
- Crew Boat – This vessel will be a licensed, insured, and USCG inspected vessel that is dedicated to the operational support of the CSB. The crew boat will be USCG certified to carry a defined number of operational personnel and Client observers
- Mobilization of Material Feeder Barge (MFB) spread – The mattress/grout/rock bag stock aboard the CSB will be regularly replenished by a Material Feeder Barge. This replenishment service will serve to optimize the operational efficiency of the 'fully crewed' CSB. Provisional dimensions for this barge are Length 180' x Beam 40' x Depth 12' (See ***Figure 4***)

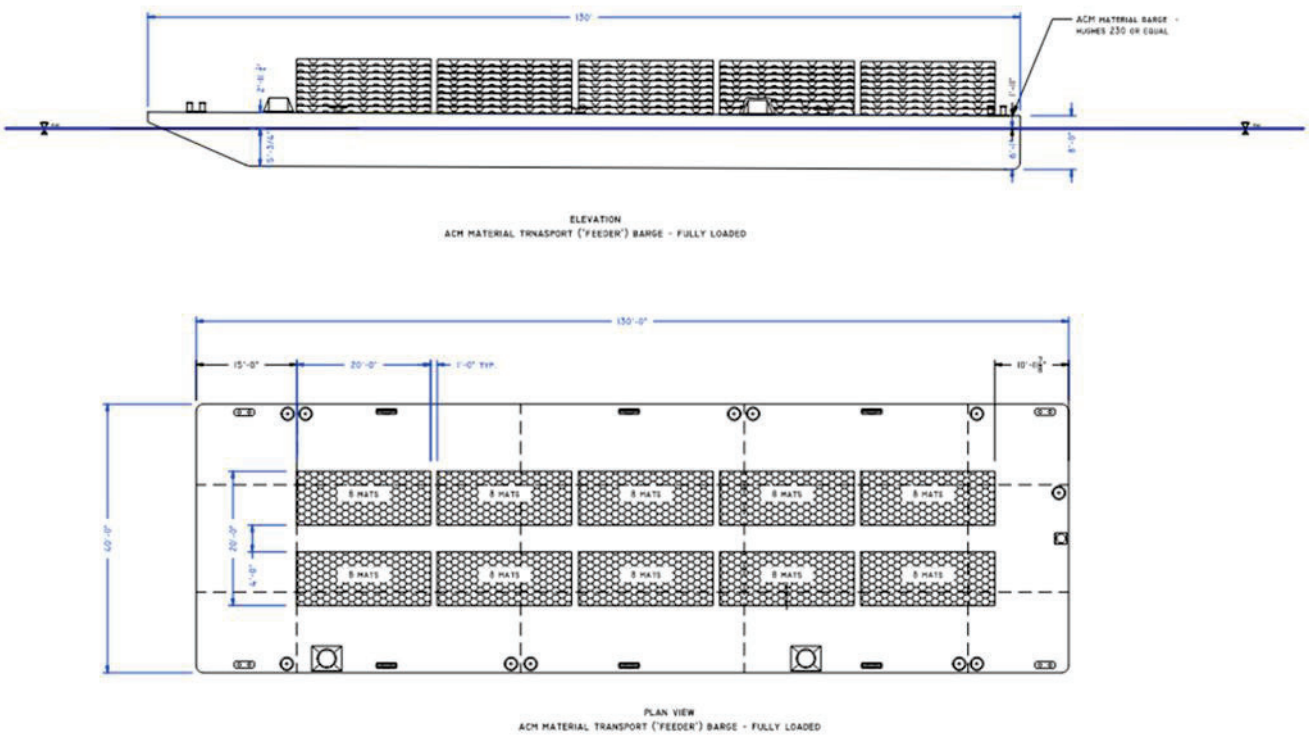

Figure 4 - MFB Deck Layout (preliminary)

- Mobilization of MFB Support Tug – This tug will be a licensed, insured, and USCG inspected vessel that is dedicated to the operational support of the MFB. It will have an adequate bollard pull / horsepower rating to competently maneuver the MFB

4 Task Methodologies

4.1 Submarine Cable Installation – Preparation Works

4.1.1 Harlem River Utility Locate Survey

CHPE, LLC has completed this survey in 2022/2023 to confirm Co-located Infrastructure to finalize Crossing Agreements.

4.1.2 Feasibility Assessment Study (FAS) by Cable Manufacturer

NKT has completed a feasibility assessment study for cable protection system such as poly-type protective duct to be installed on the cable bundle and placed per CHPE Permits and/or Crossing Agreement(s).

4.1.3 Route Survey, Engineering & Consents

4.1.3.1 Marine Route Survey – Harlem River

In 2022, Ocean Surveys Inc. were subcontracted to survey the revised CHPE cable installation route for Harlem River water.

OSI used the following reference datums for their survey operations:
Horizontal Datum: UTM Zone 18N, NAD83 with US feet as survey units
Vertical Datum: NAVD88 with soundings in Feet

Route development was conducted as required to avoid identified hazards and to optimize the route for cable installation and protection. Survey documentation & data will be used as follows:

- Utilized as reference for CMI route engineering, operational planning, & cable installation operations
- Inputted into CMI navigation computers during cable installation
- On completion of Harlem River cable installation, CMI will overlay recorded 'as-laid' data onto 'Planning' charts to generate 'As-Built' charting.

Bridge Clearance Surveys were also performed to determine the limiting dimensions for Cable Lay Barge size and equipment selection. CMI is confirming the operational status of the swing/lift bridges:

- Network Mapping performed a Lidar Survey of the Harlem River for Bridge clearances *(completed June 2012)*
- ST Hudson performed an additional bridge clearance survey *(completed April 2023)*

4.1.3.2 Harlem River Route Engineering

AutoCAD Map 3D for route engineering. Information from the OSI 2022 survey charting (Plans and Profiles), NOAA navigational charts, and Utility Crossing survey have been considered and overlayed onto the proposed route. The route has been engineered to optimize cable installation whilst avoiding and mitigating obstacles and third-party property/assets.

4.1.3.3 Utility Crossing Designs

Utility crossing protection designs for each site are subject to:

1. Compliance with site specific Crossing Agreements that have been negotiated between CHPE, LLC & respective utility owners / operators.
2. Use of cable protection system (CPS) - polyurethane protective duct will be installed on the cable bundle

4.2 Transport of Submarine Cables

4.2.1 Power Cables

The weight and volume of power cables precludes the use of road transportation to the Harlem River. Therefore, the cables used for Harlem River installation will be shipped to a NY Port and loaded to Cable Lay Barge for transport to Harlem River. Cable transportation will be performed by water with vessel access to Harlem River.

4.2.2 FO Cable

Transportation of CHPE FO cables will be delivered for the Harlem River segment in one continuous length. A liftable basket or reel with adequate capacity will be shipped and delivered to a NY Port. Upon arrival, the FO cable will be transferred to the FO tank constructed on the CLB.

4.3 Land Site Mobilization & Preparation

4.3.1 Caldwell Marine Yard (Staten Island, NY)

CMI will utilize its waterfront property on Staten Island, NY as an operational base – see ***Figure 5.*** This location has served as CMI's operational base for previous marine projects. CMI will mobilize equipment to this location in the early phases of the CHPE Project. The base will serve multiple support functions including:

- Mobilization and support of Harlem River CLB
- Mobilization of & support of CMI operational vessels for Utility Crossing protection, ROV support
- Fiber optic cable transfer
- Personnel transfer staging point (primary)
- Emergency personnel transfer point.
- Exchange / clean-out service point for sanitation equipment (Porta-Pottis, Construction Waste, etc.)

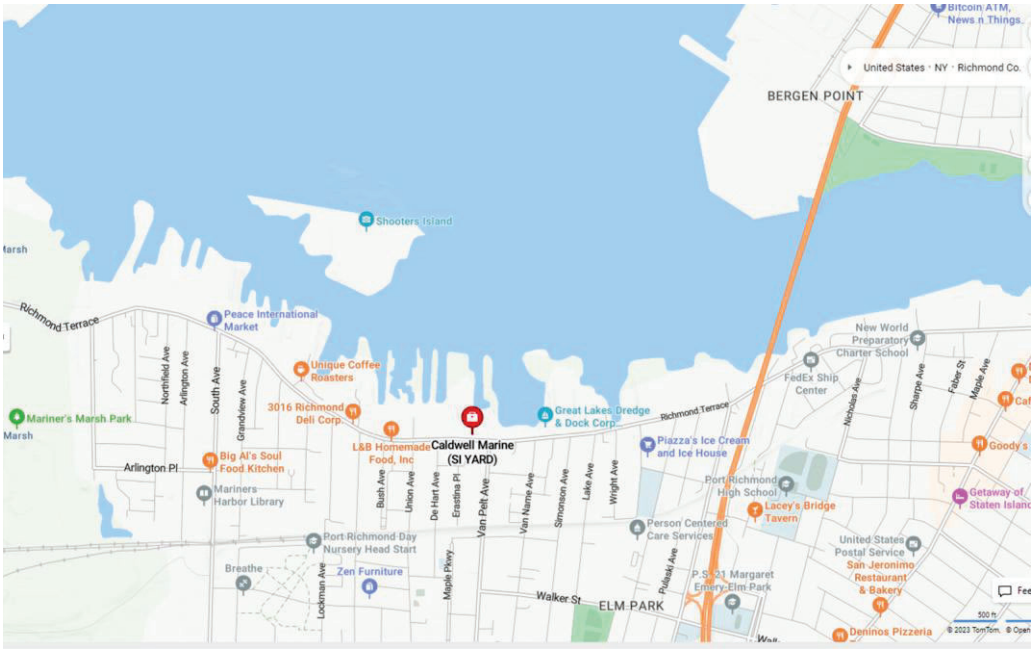

Figure 5 - Caldwell Marine Yard, Staten Island, NY

Additional marinas will be used as crew and small equipment/materials transfer. CMI will privately arrange and secure the locations and review to ensure fit for purpose. Please see Appendix 4 for identified locations.

4.3.2 HRY Bulkhead Penetration Landing Point

The landing site is located at Harlem River Yard Transfer Station, Bronx, NY which lies at the southern end of the Harlem River installation route. It will be conducted as an 'Initial' type landing at the beginning of CMI's cable lay tasks. Project cables (2 x Power + 1 x FO) will be landed to shore via two pre-installed HDPE ducts. The HDPE ducts will be installed via open cut trench then backfilled with clean fill. Methodology related to CMI's civil works at the HRY Bulkhead Penetration Landing Point are covered under the approved Segment 20A EM&CP. Project tasks at Harlem River Yard Transfer Station include:

- Establish Harlem River Yard work site compound (with Waste Management consent provided)
- Installation of two 'land-to-water' HDPE ducts

- Mobilization of cable landing assets
- Duct proving / cleaning
  NOTE: *Ducts will be proven and cleaned on completion of the bulkhead penetration and repeated prior to cable landing to confirm readiness of this infrastructure. This task will require marine assistance. Barge equipment details are provided accordingly.*

4.3.2.1 HRY Bulkhead Penetration Duct Proving / Cleaning

On completion of cleaning / proving, the ducts will be left:

1. Threaded end-to-end with adequate length of messenger wire to reach the working deck of the support barge.
2. Capped temporary caps to minimize the risk of subsequent duct contamination with foreign materials.
   NOTE: *These tasks are described in CMI's Civil Works documentation.*

Prior to cable landing operations, the ducts are proven and cleaned again. This work will require the use of both land-based and marine-based assets.

4.4 Submarine Cable Installation – Cable Lay Works

4.4.1 Operating Hours

CMI expects to be working extended hours, including nights, weekends, and state/federal holidays to maintain and complete the project operations on time per the following:

- CLB Mobilization – (1) 12-hour shift per day, 7 days per week
- Cable Lay & Protection – 24 hours per day ((2) 12-hour shifts), 7 days per week
- Post-Lay/Remedial Works – (1) 12-hour shift per day, 7 days per week

4.4.2 Harlem River Conditions / Operational Weather Limits

Marine Weather Conditions

The following meteorological factors apply to Harlem River waters:

Location:	River waters are categorized as 'inland'.
Tidal effect:	River water levels are effects by tides (~4.5' between High and Low Tide)
Current strength / Direction:	Under normal conditions, current flow direction and strength dependent on incoming or outgoing tide (~3 knots ±) .

Monitoring of Site Weather Conditions & Forecasts

During the operational periods for the Barge, the Barge Superintendent / appointed alternate will monitor the current and forecast weather conditions for operational work sites and vessel transit routes. The Barge Superintendent will notify the attending NKT Representative if a temporary suspension of project activities is required due to weather (actual or forecast).

The Superintendent's primary weather forecast resource will be NOAA Marine Weather.com (Governmental). The Superintendent will typically also review web-based, non-governmental resources which may include:

- https://www.windy.com
- https://www.buoyweather.com/
- https://www.windalert.com
- https://climeradar.com

Recording of Site Weather Conditions

Site weather conditions will be recorded in a dedicated section of the Barge Daily Report. Recorded values will either be derived from:

a. Local observation, or
b. Download from a local registered NOAA weather observation station (airport or similar)

Operational Weather Limits

Wind:	OSHA safety rules for crane operations dictate a maximum wind strength of 25mph.
Current Strength:	Maximum current strength 2 knots for diving operations outside of temporary cofferdams, trenches, or structures.
Sea / Swell Height:	Cable Lay Operations: Work may be delayed / suspended at the discretion of Barge Superintendent & Dive Supervisor. These parties will use a wave height of 3 ft to 5 ft as a guideline reference limit.

4.4.3 Cable Lay Barge (CLB) Marine Mobilization / Sea Trials

4.4.3.1 CLB Mobilization

Navigational constraints of the Harlem River dictate that the Cable Lay Barge (CLB) will be designed and assembled to accommodate these waters. CLB mobilization will be conducted at CMI's operational base in Staten Island, NY.

The completed dimensions of the CLB will be approximately 200' L x 80' W (preliminary).

The principal method of propulsion for the CLB will be four full azimuth thrusters. Thrusters force magnitude and direction will be controlled by a DP (Dynamic Positioning) system. The vessel will also carry a multi-point anchor spread for use in waters that are too shallow to utilize powered thrusters.

CLB Equipment List (Preliminary Listing)

- Regulatory Compliance Measures of Regulation Navigation Lighting:
  - Regulation Life Saving Equipment *(LSE)*
  - Regulation Fire Fighting Equipment
  - Regulation First Aid supplies
  - Spill kits
  - Temporary storage for waste materials
  - Porta-Potti's / Portable wash facilities
  - Safe access ladders
- Barge Propulsion: *NOTE: CLB will be outfitted with both DP and anchor propulsion to enable performance in all anticipated site conditions:*
  - Dynamic Positioning Class controls & sensors – capable of being classed as DP2 under ABS rules and regulations
  - Full azimuth thrusters – fully retractable, 360 degree azimuth thrusters, power packs, hosing & cabling
  - Double-walled fuel storage and transfer system
- Anchor Propulsion:
  - Operator cabin with pneumatic controls
  - Winches & wires

    - Deck turning & over-boarding sheaves
    - Anchors (size & design suited for site conditions and loads)
    - Recovery pennant wires
    - Recovery buoys with marker lights
- Operational Equipment:
    - Deck crane(s) – rated for anticipated loads & working radius
    - Hardwire communications (sound-powered phones)
    - Generators rated for service loads + emergency back-up
    - Compressor(s) & hosing – rated for demand + emergency back-up
    - Fuel storage (double-walled) + equipment refueling system
    - Cutting / Burning equipment & supplies
- Cable Equipment - Fiber Optic Cable:
    - MBR conformant FO cable highway
    - Linear Belt Engine for FO cable loading / recovery
    - Cable sealing supplies & equipment (*Owner supply*)
    - Sized & rated Kellems Grips
    - OTDR monitoring equipment
    - Power Spool for Cable Reel
- Cable Equipment - DC Power Cables:
    - MBR conformant loading arm feeds + power cable highways – see ***Figure 6***.
    - Linear Cable Engines (LCE's) – for DC Power Cable – see ***Figure 7***.
    - Instrumented cable overboard chute – see ***Figure 8***.
    - Cable sealing supplies & equipment (*Owner supply*)
    - Sized & rated Kellums Grips
    - Swivel & low-profile connections
    - Cable stoppers & misc. rigging
    - Cable floats
    - Emergency abandonment supplies:
        - Cable cutter + spare blades / abrasive wheels (as applicable)
        - Shrink caps
        - Kellems grips
        - Clump weights (e.g. mushroom anchors)
        - Laydown rigging
        - Pennant recovery line
        - Recovery buoy + lighting
- Barge Navigation:
    - Fixed DGPS with back-up – Primary & secondary positioning systems
    - Portable RTK DGPS for localized, high accuracy positioning
    - USBL – For tracking of underwater vehicles *(if required)*
    - Cable Lay Software
    - Navigation Software
    - Wired network for distribution of nav / lay data to key barge stations
- Touchdown Monitoring (TDM) - Surface Lay Operations:
    - Follow-up ROV – Electric propelled, Large Observational Class / Light Work Class - Hysub or similar – see ***Figure 9***.
    - Control system
    - USBL tracking beacons

    - Umbilical
    - Launch & Recovery System (LARS)
    - Operational spares
- Diver Protection:
    - Dive Station Control hut
    - System Monitoring Gauges (calibrated)
    - Surface / Diver communication system
    - Video display + recording
    - Umbilical
    - Hyperbaric chamber
    - Compressors + pressurized bottles (back-up supply)
    - Hot water machines
    - Pressure compensated water jetting nozzles
    - Water-Lift (venturi)
    - Air-Lift (venturi)
    - Pumps & hosing
- Containerized Hut Listings:
    - Barge Navigation / DP Control.
    - Winch Control Hut(s)
    - Office(s)
        - Owner / NKT Office(s)
        - CMI
    - Crew Messroom
    - Operator Messroom
    - Diver Changing Room
    - Tool Hut
    - Spares Hut
    - OTDR monitoring hut
        - OTDR monitoring equipment + splice on test leads
        - Fusion splicer + supplies
        - FO cable termination tools
- CPS Installation Barge:
    - Overboard chute
    - Knuckle boom crane
    - Roller trays
    - Tool container
    - Generator
- Material Transport Barge (2-4):
    - Containers with selected CPS supply

Figure 6 - Loading Arm Assembly (typical)

Figure 7 - LCE (typical)

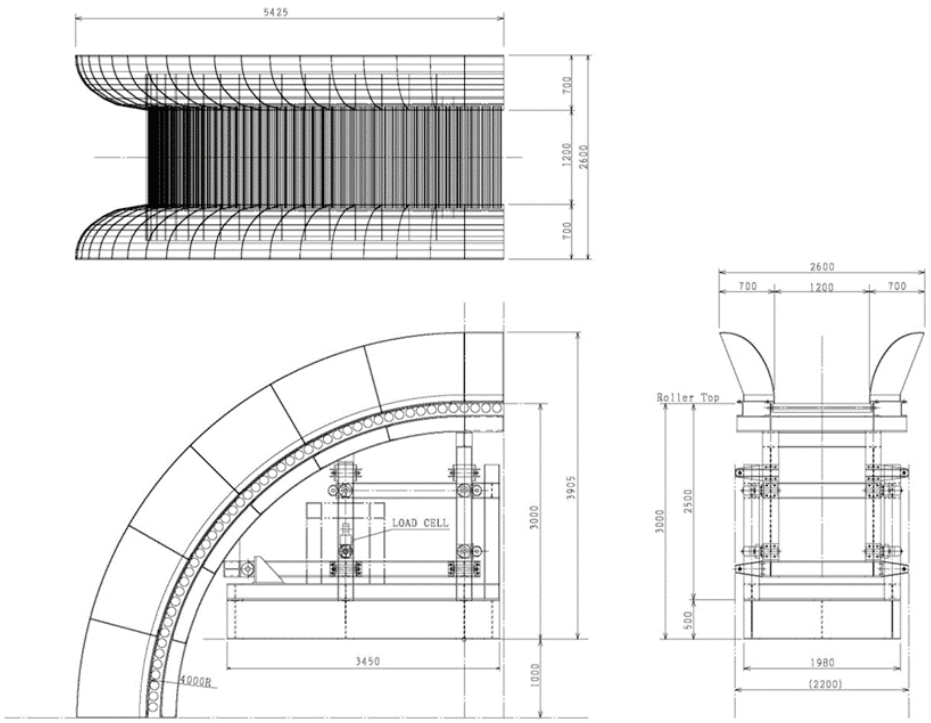

Figure 8 - Instrumented Overboard Chute (OBC) (typical)

Figure 9 - Observational Class ROV (typical)

4.4.3.2 Sea Trials

The CLB mobilization will be subject to a stiff regimen of inspections, tests and trials to verify the full operational readiness of the vessel and her operational systems (preliminary listing):

1. Navigation & positioning
2. Propulsion DP / Anchor
3. Cable handling
4. Dive spread
5. ROV
6. OTDR Monitoring equipment + auto alarm notification system
7. Communications systems (voice / data)
8. Crane & materials handling equipment

Vessel performance will be tested and documented in accordance with applicable US regulatory standards for DP commissioning trials.

For purposes of all trials and cable lay operations CMI will only employ operators that are fully certified and experienced with DP control systems.

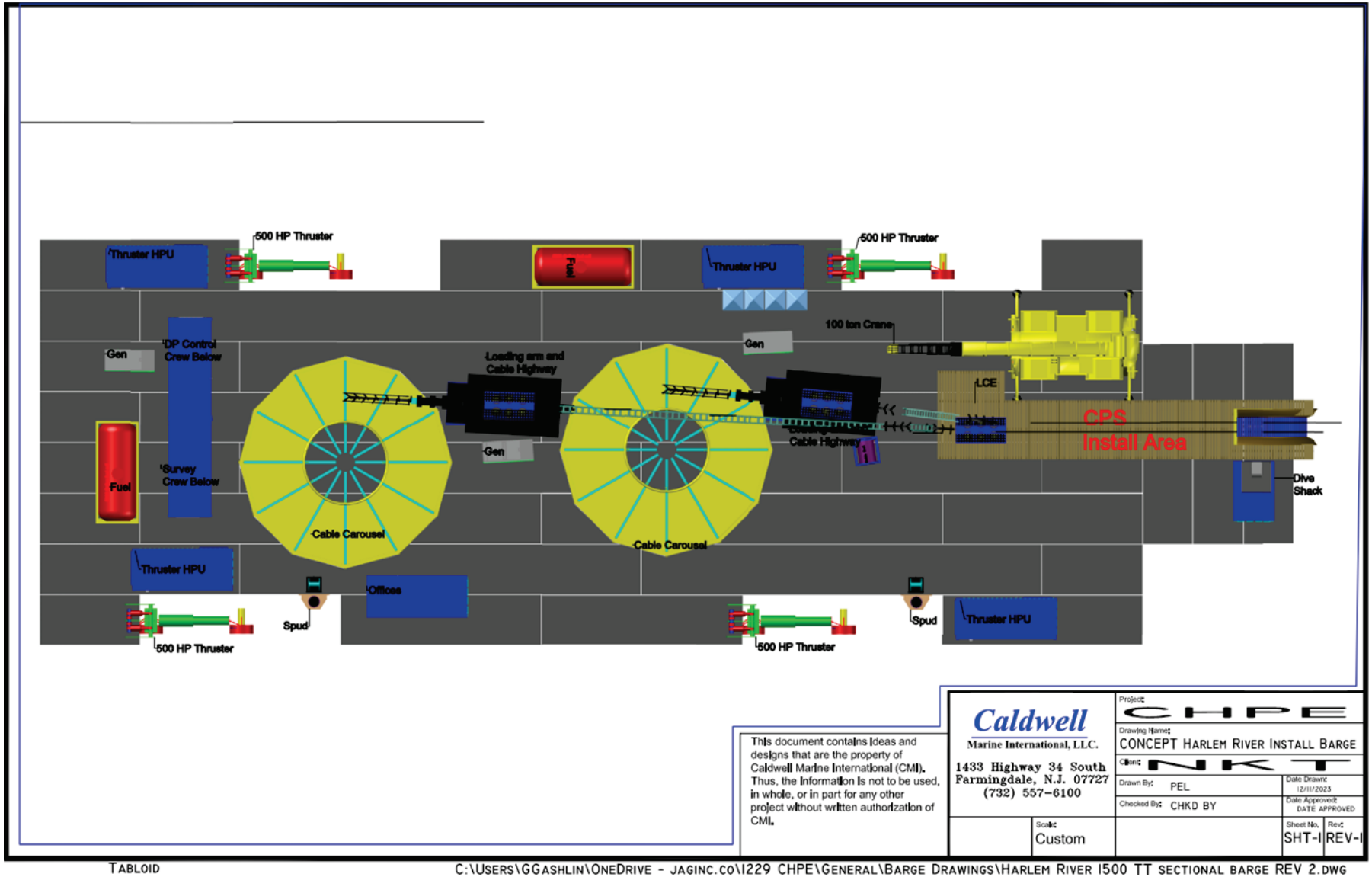

Figure 10 - Harlem River CLB Deck Layout (preliminary)

4.4.4 Cable Lay & Protection

4.4.4.1 Initialize Cable Feed

Cable storage capacity on the Harlem River CLB is limited to a single FO powered reel. Power cable product will be fed to the CLB lay line from two carousels. At the start of lay operations, it will be necessary to initiate cable feed from the carousels through the cable highway to the Overboard Chute on the CLB.

4.4.4.2 Commencement of Cable Landing at HRY Bulkhead Penetration

CMI's designated start of lay is at the Harlem River Yard (HRY) Transfer Station. Access to this lay start position is through the Willis Ave Bridge via East River.

The CLB will set-up just North of the Willis Ave Bridge. Support vessels will be utilized to manage the floating omega – see ***Figure 11***.

Figure 11 - General Arrangement at Start of Lay (HRY)

The 3 CHPE submarine cables will be landed at HRY as follows:

- Duct A: Power Cable A
- Duct B: Power Cable B + FO cable

Land Team & Dive Support Barge Team to conduct following operations prior to Cable Lay Barge arrival:

- Set-up shore winch & holdback
- Establish Dive Support Barge (if required) on spuds close to HDPE pipe exit while still providing unimpeded access for float-in operations
- Remove surficial overburden from HDPE marine exit points
- Install flared extension piece onto HDPE duct for 1st landing – see ***Figure 12***.
- Thread winch wire into HDPE duct that has been selected for 1st landing & mark with riser / float for ease of recovery
- Establish a mark on site at position where minimum acceptable amount of cable has been landed.
- Installation of floats and pull in of Cable A
- Repeat steps above for Cable B + FO cable

NOTE: *Cable termination and cut-off allowances values to be provided by NKT*

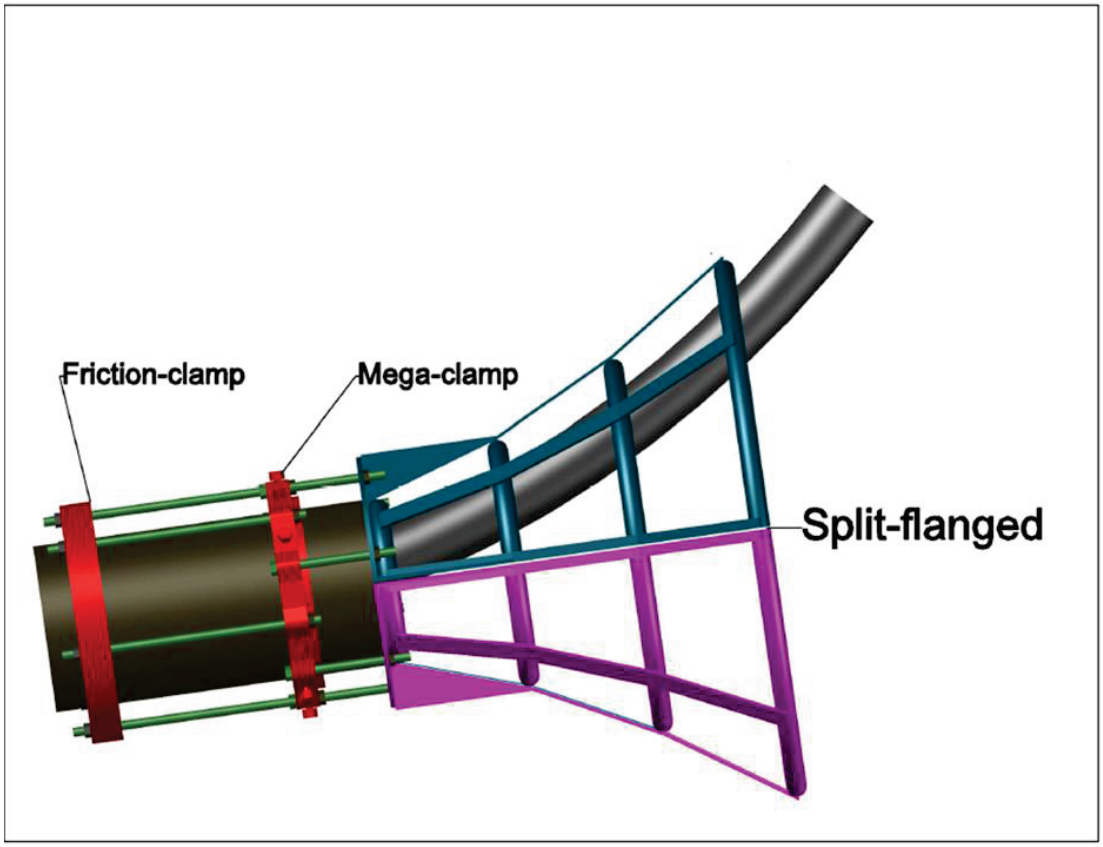

Figure 12 - Flared Extension Piece for HDPE Duct

4.4.4.3 Commence Lay & CPS Installation

CHPE, LLC has chosen a cable protection system (CPS) as the principal cable protection tool – See ***Figure 13***. Please see further details in Appendix 6. For Harlem River cable lay operations and after the initial cable landing to thru HRY Bulkhead Penetration, the CPS will be installed onto the cable bundle just prior to overboarding the CLB. The cable bundle with CPS will be surface laid for the entire route. Post-lay concrete mattresses will also be installed, if required from Post Lay Survey findings, for cable bundle anchoring/stabilization on the riverbed.

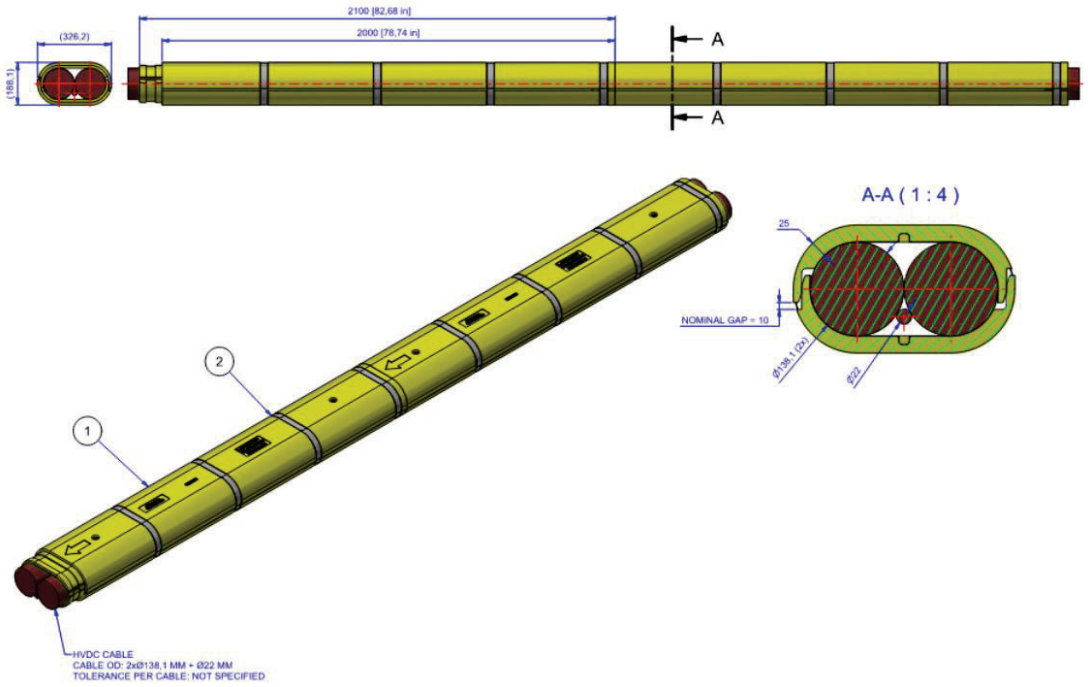

Figure 13 - CPS System Drawing (typical)

Figure 14 Indicates riverbed status of installed Harlem River cabling with & without mattress anchoring.

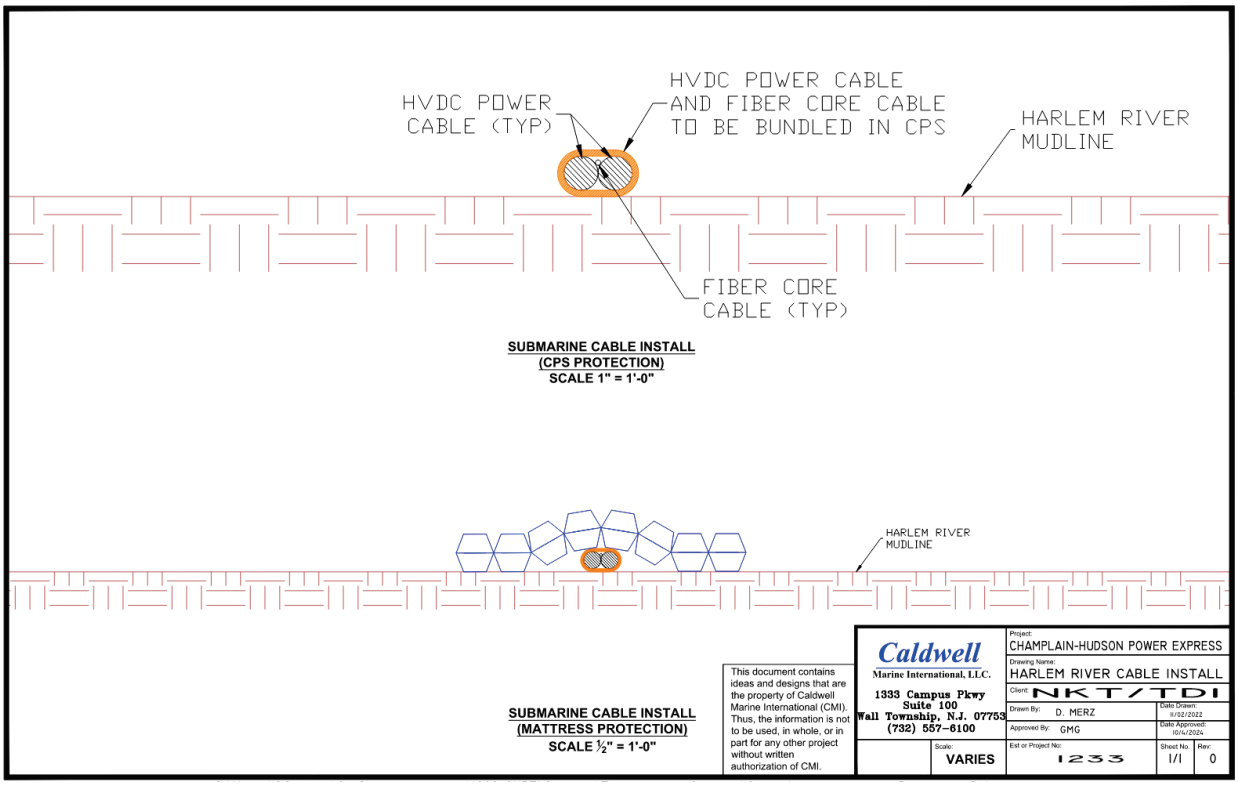

Figure 14 - Cable Bundle Configuration Surface Lay (Harlem River)

4.4.4.4 DP Control System

A dynamic positioning system is a computer-controlled propulsion system allowing the cable lay barge to maintain its position in open waters against wind, waves and current. The system consists of mounted thrusters controlled through a computer that calculates and controls the amount and direction of thrust necessary to counteract wind, wave, and current forces to prevent or correct deviation from the desired position and heading of the CLB. Position reference sensors, combined with wind sensors, current sensors and gyro compasses, provide information to the computer pertaining to the barge's position and the magnitude and direction of environmental forces affecting its position. The computer program contains a mathematical model of the vessel that includes information pertaining to the wind and current drag of the vessel and the location of the thrusters. This knowledge, combined with the sensor information, allows the computer to calculate the required steering angle and thruster output for each thruster. The permitted route will be uploaded to the system for navigation.

4.4.4.5 Cable Lay Survey, Navigation and Monitoring Systems

The survey, navigation, and cable monitoring systems are used to guarantee that the cables are installed in the correct location.

4.4.4.5.1 Route Navigation Setup

The permitted route will be uploaded to the navigation software and shared to both navigation team and DP operators. Data from route surveys and cultural resource reviews will be plotted on screens. An offset will be placed with boundary alarm to notify navigation team when nearing location.
Noteworthy items to be included, but not limited to:

- Permitted Route / Route Position List
- Cultural Resource(s) location and boundary
- Co-location infrastructure crossings
- Significant structures, such as Bridge Abutments, Sewer Outfalls, Water Intakes

4.4.4.5.2 Survey and Navigation Setup

The navigation system consists primarily of a surface and sub-surface positioning system integrated in a navigation program that provides for vessel guidance and data recording via DGPS receiver(s), Gyro, USBL, etc. Data from these components are input to the navigation computer and processed using navigation software. The program integrates the surface and sub-surface systems and displays the vessel position at the navigation station and, on a separate screen, at the DP operator station.

The cable bundle position is calculated using the USBL system on the ROV to determine the position of either a transponder or responder on the ROV. For Surface Lay operations, the calculated catenary length based on water depth, lay speed, etc., is used to determine the horizontal distance from the overboard chute to the cable touchdown point. A direct offset, using the barge heading, is then used to calculate the cable position. Both positions are recorded, the primary positioning method is USBL system.

Navigation data is recorded during all cable operations and at any time that the vessel is operating near existing cables, conduits, structures or in other critical areas.

The cable will be laid with minimal back tension throughout. Between bridges, it will be laid in a manner that induces slack on the riverbed to facilitate future potential requests from the USACE to relocate it for dreading operations.

4.4.4.5.3 Cable Monitoring Software & Sensors

The navigation and cable monitoring system integrates the surface & subsurface navigation system, deck sensors, and instrumentation.

- **Deck Sensors for Cable Monitoring:** Deck sensors are used to monitor all parameters relevant to cable operations.
- **Cable Monitoring Software:** The software allows for both numeric and graphical display of ROV, cable, and positioning data. The displays show cable tension and payout speed, as well as a graphic display cable paid out relative to cable remaining aboard.
    - Monitoring system consists of the following deck sensors, ROV sensors, graphic display, and data recording system.
    - Output from the sensors is relayed to the navigation and monitoring stations.
- **Navigation and Cable Data:** Essential data, such as lay barge position and ROV position and status, are recorded and time stamped. Time stamped data are recorded 1 second interval (min.) per CHPE project requirements. During the actual installation, the program records continuous distance-based data at dedicated intervals along the route.

4.4.4.6 Lay Operations at Utility Crossings

Lay operations over utility crossing points are subject to the specific terms of the signed Crossing Agreement for the subject utility. The following methodology assumes the following conditions:

1. Positional 'as-found' details of existing Co-located Infrastructure have been inputted into CLB navigation system
2. CLB is currently installing cable in Surface Lay mode
3. CPS to be installed onto CHPE cable bundle
4. ROV verification of cable touchdown position at Co-located Infrastructure crossing location
5. Notifications have been submitted to owner / operators of subject utilities per requirements of Crossing Agreements

4.4.4.7 Cable Installation to Hudson/Harlem Splice Location

The CLB Team will closely monitor cable consumption and remaining stocks in each carousel. Installation speeds will be reduced prior to depletion of cable stocks. CLB progress and cable payout will be suspended during the final turns of cable in the carousels. CMI to continue cable lay operations through the Spuyten Duyvil Rail Bridge and overboard the end of cable at the proposed Hudson/Harlem splice location. Hudson/Harlem cable splice to be performed by Others.

4.5 Submarine Cable Installation – Post-Lay Works

Actual protection design(s) will be dictated by project stakeholders (TBD).

4.5.1 Concrete Mattress Protection

Concrete mattresses will be installed, if required from Post Lay Survey findings, to improve/stabilize cable landing and minimize cable free span lengths. Concrete mattresses will also be installed, if required from Post Lay Survey findings, for cable bundle anchoring/stabilization.

Utility crossings that require concrete mattress protection will be installed in compliance with site specific Crossings Agreements that have been negotiated between CHPE, LLC. & respective utility owners / operators.

Pattern of protection measures for utility crossings are 'site-specific' and subject to :

- Compliance with Project permitting requirements
- The approval of owners / operators of the underlying utility
- Any further requirements of CHPE, LLC., Project insurers, and NKT

Crossing patterns will be fully defined in site-specific 'Signed Crossing Agreement' documentation as negotiated between CHPE, LLC. & respective utility owners / operators.

Protection materials will be installed at listed sites in accordance with the requirements of respective signed Crossing Agreement.

4.5.2 Grout/Rock Bags

Grout/rock bags will be installed, where required, to improve cable landing and minimize cable free span lengths. Support locations will be determined by accurate surveys providing input to free span analyses performed by NKT and verified by CHPE.

CHPE cable will cross a number of tunnels and pipelines. Where required, grout/rock bags will be installed to provide support to the cable and ensure they can be laid across Co-located Infrastructure without resulting in cable free spans. Support locations will be determined by surveys post-lay providing input to free span analyses performed by NKT and verified by CHPE.

4.5.3 Diver Lowering

For areas as deemed necessary, the cable segment may require lowering by divers to improve/stabilize cable landing and/or minimize cable free span lengths if required from Post Lay Survey findings.

The following suite of tools will be used for remedial cable lowering:

- Diver jetting (fluidization of riverbed material using water delivered via pressurized 'reactionless' nozzle) – Please see ***Figure 15***.
- Water-lifting (venturi educting device) – Please see ***Figure 16***.

Figure 15 - 'Navy type' reactionless jet nozzle (diver operated)

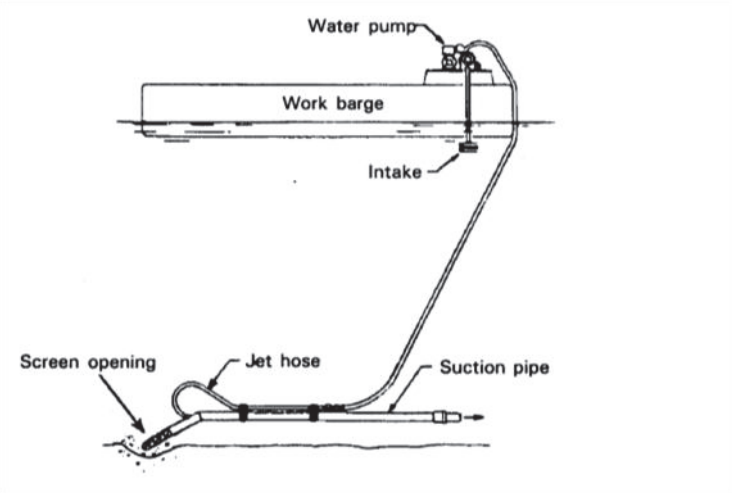

Figure 16 - Water-lift device (diver operated)

4.6 Emergency and Contingency Planning

All CMI operations will be planned using weather forecasts received at regular intervals from multiple independent forecasters to ensure that conditions are within allowable parameters for the operation to be undertaken. This is to ensure the safe and effective installation of the cables throughout the Harlem River installation schedule.

In the event difficulties are experienced, such as with equipment, weather, etc., emergency procedures will be in place on all vessels to ensure the safety of crew, equipment, and environment. All operations are planned in detail with the formation and discussion of a risk assessment to ensure that all potential hazards are accounted for and mitigated as far as possible.

4.6.1 Emergency Field Splice

In the unlikely event CMI must evacuate the project location, the cable will be cut, sealed, and lowered to the river to be wet stored until cable lay operations can resume. Events such as extreme weather, essential equipment failure, etc. would result in suspending cable lay operations. Upon return to site, the cable will be recovered from the riverbed and an additional field splice will be installed.

5 Environmental Protection Measures

5.1 Oil Pollution Prevention

Please see dedicated SOPEP document in Appendix 3 of this document.

An Emergency Notification Flowchart within the SOPEP document provides notification requirements and contact details in the event of emergency situations and incidents:

- The Cable Lay Barge will carry emergency ‘spill kit(s)’.
- The Cable Lay Barge fuel stocks onboard will be kept to a practical minimum.
- The Cable Lay Barge fuel storage vessels will feature double-wall construction.

- As an emergency contingency measure CMI has pre-arranged that Clean Harbors, a US based Oil Spill Removal Organization (OSRO) will be available on 'call-out' basis to provide professional clean-up support. For further details, please see: https://www.cleanharbors.com/

5.2 Solid Waste Management

Disposal of waste into River waters is strictly prohibited by local, State & Federal law.

- Crews and contractors will be notified accordingly at the Project 'Kick-Off Meeting' and daily shift change / TBT meetings.
- New crew members/ contractors will be notified during the project and vessel familiarization processes.

The Cable Lay Barge will be mobilized with waste containment bins, these bins will feature closeable lids and heavy grade, disposable plastic liners. Bin liners will be replaced regularly and filled bags will be transported to shore for proper disposal at an approved facility.

5.3 Wastewater Management

Disposal of untreated wastewater into Harlem River waters is strictly prohibited by local, State & Federal law.

- Crews and contractors will be notified accordingly at the Project 'Kick-Off Meeting' and daily shift change / TBT meetings.
- New crew members/ contractors will be notified during the project and vessel familiarization processes.

The Cable Lay Barge will be equipped with portable toilet units that will be sourced from a local provider.

- Soiled / clean portable toilet units will be transferred by means of crew transfer vessel / work vessels.
- Portable toilet change-out / clean-out service will be performed by the local service provider at the operational base located at Caldwell Marine Yard, Staten Island, NY.