

Attachment A: Project Description

To understand hydrokinetic energy (tidal energy) potential within Isanotski Strait, obtaining Acoustic Doppler Current Profiler (ADCP) data is essential for verifying tidal flows and optimizing layout for a future hydrokinetic device deployment location (if flows and other site parameters are determined to be viable).

ORPC proposes to temporarily deploy up to two bottom-mounted Workhorse Sentinel ADCPs at selected sites within Isanotski Strait near False Pass, AK (Figure 1). The final ADCP installation sites will be chosen based off surface ADCP surveys that will be conducted prior to the deployments to determine final locations that warrant further investigation. A map of the proposed ADCP surface survey area is included in Figure 1.



Figure 1. Isanotski Strait survey area

The bottom-mounted ADCP devices will each be deployed at a single location for a full tidal cycle (approximately 35 days). Each bottom mount ADCP deployment will consist of a gravity-based anchor, ADCP with associated bottom mount structure, and an attached mooring

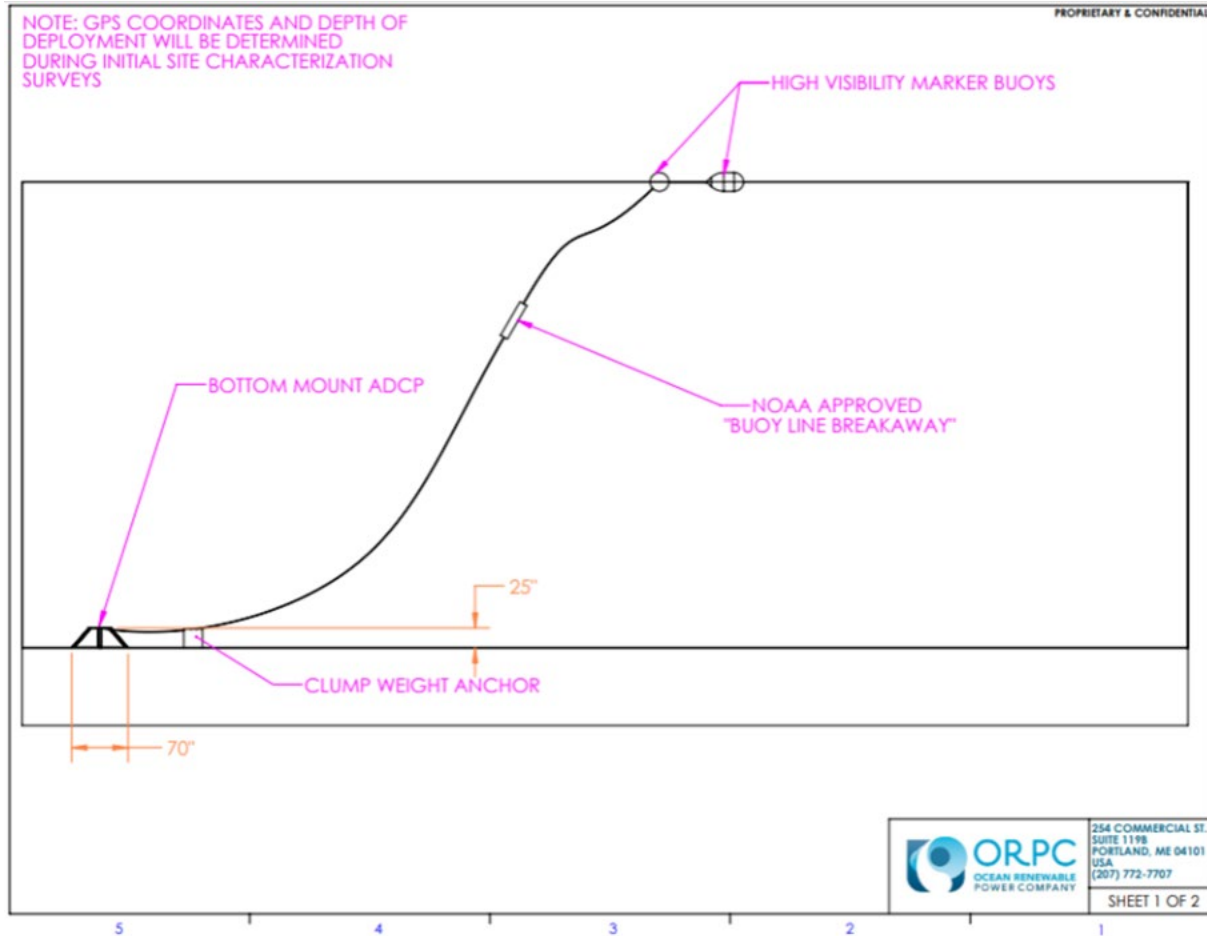
line with high-visibility surface buoy to mark the device location. The single mooring line will be kept as taut as possible and include a NOAA Fisheries-approved in-line “buoy line breakaway” to mitigate any risk of entanglement. The footprint of each bottom-mount ADCP device will be approximately 1.35 square meters (~36 square feet). The total footprint for each ADCP deployment will be ~90 square feet (~180 square feet total for both ADCP installations), this footprint includes both the bottom-mounted ADCP, the clump weight anchor, and associated mooring line. ADCP layout diagrams and device specifications are included in Attachments B., C., and D.

All equipment associated with the project is temporary and does not require permanent infrastructure. After data collection has occurred for a period of 35 days after deployment, ORPC will return to retrieve the bottom-mounted ADCPs. The bottom-mounted ADCP platforms and marker buoy/mooring line are designed to be temporary in nature. A local vessel with a standard line hauler will be utilized to both deploy and retrieve the ADCPs and the clump weights from Isanotski Strait. ORPC will retrieve all equipment associated with the project, leaving no remaining equipment in the project area after survey efforts are completed.

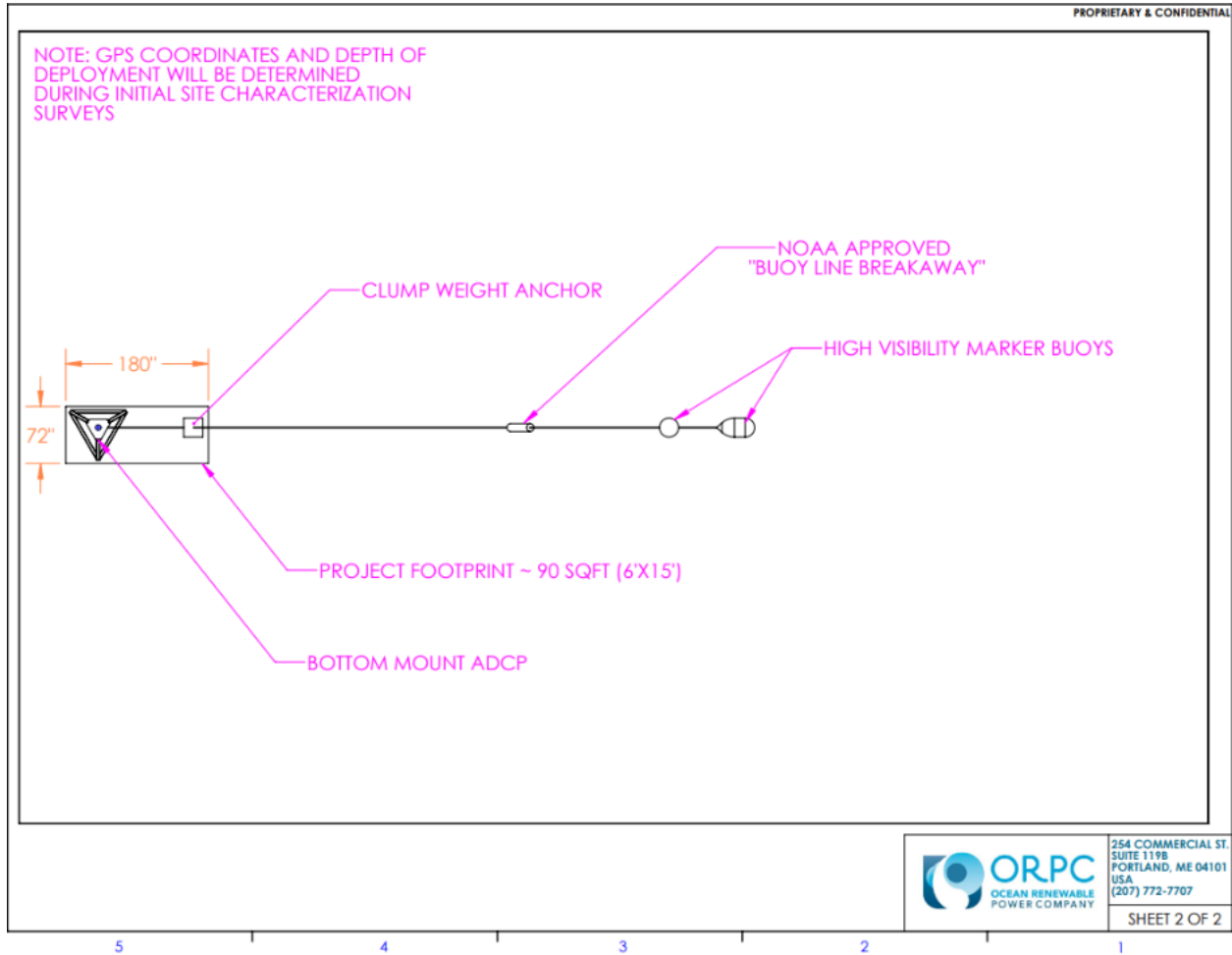
Upon retrieval of all survey equipment, the deployment site will be restored to its pre-deployment condition. Total removal of the device and associated equipment will take less than one day for full site restoration.

ORPC understands that specific bottom mounted ADCP deployment locations will need to be permitted. ORPC proposes to inform Alaska Department of Natural Resources, Division of Mining, Land and Water (ADNR DMLW) of the final selected sites of deployment (GPS coordinates) immediately after surface ADCP surveys have been conducted and final analysis is completed to select the two final deployment sites for bottom-mount ADCPs.

Attachment B: Bottom-Mount ADCP Deployment in Isanotski Strait, AK (Site Development Diagram-Side View)



Attachment C: Bottom-Mount ADCP Deployment in Isanotski Strait, AK (Site Development Diagram-Overhead View)



Attachment D: Bottom-Mount ADCP Specifications



Workhorse Sentinel

SELF-CONTAINED 1200, 600, 300 kHz ADCP

The Global Leader in High-accuracy Data Collection



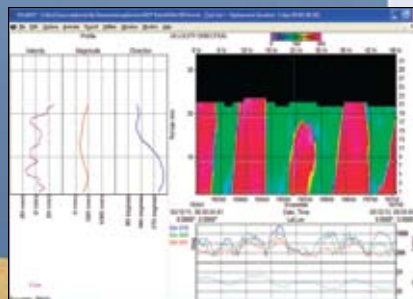
The Workhorse Sentinel offers:

- *Versatility:* Direct reading or self contained, moored or moving, the Sentinel provides precision current profiling data when and where you need it most.
- *A solid upgrade path:* The Sentinel has been designed to grow with your needs. Easy upgrades include pressure, bottom tracking, and directional wave measurement.
- *Precision data:* Teledyne RDI's patented BroadBand signal processing delivers very low-noise data, resulting in unparalleled data resolution and minimal power consumption.
- *A four-beam solution:* Teledyne RDI's patented 4-beam design improves data reliability by providing a redundant data source in the case of a blocked or damaged beam; improves data quality by delivering an independent measure known as error velocity; and improves data accuracy by reducing variance in your data.

The self-contained **Sentinel** is Teledyne RD Instruments' most popular and versatile Acoustic Doppler Current Profiler (ADCP) configuration, boasting thousands of units in operation in over 50 countries around the world.

By providing profiling ranges from 1 to 165m, the high-frequency Sentinel ADCP is ideally suited for a wide variety of applications. Thanks to Teledyne RDI's patented Broadband signal processing, the Sentinel also offers unbeatable precision, with unmatched low power consumption, allowing you to collect more data over an extended period.

The lightweight and adaptable Sentinel is easily deployed on buoys, boats, or mounted on the seafloor. Real-time data can be transmitted to shore via a cable link or acoustic modem, or data can be stored internally for short or long-term deployments. The Sentinel is easily upgraded to include pressure, bottom tracking, and/or directional wave measurement—for the ultimate data collection solution.



**TELEDYNE
RD INSTRUMENTS**

A Teledyne Technologies Company

MEASURING WATER IN MOTION IN WATER

Workhorse Sentinel

SELF-CONTAINED 1200, 600, 300 kHz ADCP



Technical Specifications

Water Profiling						
Depth	Typical Range ² 12m		Typical Range ² 50m		Typical Range ² 110m	
Cell Size ¹	1200kHz		600kHz		300kHz	
Vertical Resolution (m)	Range ³ (m)	Std. Dev. ⁴ (cm/s)	Range ³ (m)	Std. Dev. ⁴ (cm/s)	Range ³ (m)	Std. Dev. ⁴ (cm/s)
0.25m	11–14	12.9				
0.5m	13–16	6.1	39	12.9	see note ¹	
1m	14–18	3.0	43	6.1	92–71	12.8
2m	15–20 ²	2.0	47	3.0	102–78	6.1
4m	see note ¹		52 ²	2.0	113–86	3.0
8m					126–95 ²	2.0

¹ User's choice of depth cell size is not limited to the typical values specified.

² Longer ranges available.

³ Profiling range based on temperature values at 5°C and 20°C, salinity = 35ppt.

⁴ BroadBand mode single-ping standard deviation (Std. Dev.).

Long Range Mode

	Range (m)	Depth Cell Size (m)	Std. Dev. (cm/s)
1200kHz	24	2	3.8
600kHz	70	4	4.2
300kHz	165	8	4.2

Profile Parameters

Velocity accuracy:

- **1200, 600:** 0.3% of the water velocity relative to the ADCP ± 0.3 cm/s
- **300:** 0.5% of the water velocity relative to the ADCP ± 0.5 cm/s

Velocity resolution: 0.1cm/s

Velocity range: ± 5 m/s (default)
 ± 20 m/s (maximum)

Number of depth cells: 1–128

Ping rate: 2Hz (typical)

Echo Intensity Profile

Vertical resolution: Depth cell size

Dynamic range: 80dB

Precision: ± 1.5 dB

Transducer and Hardware

Beam angle: 20°

Configuration: 4-beam, convex

Internal memory: Two PCMCIA card slots; one memory card included

Communications: Serial port selectable by switch for RS-232 or RS-422. ASCII or binary output at 1200–115,400 baud.

Standard Sensors

Temperature (mounted on transducer):

Range: -5° to 45°C

Precision: ± 0.4 °C

Resolution: 0.01°

Tilt: Range: ± 15 °

Accuracy: ± 0.5 °

Precision: ± 0.5 °

Resolution: 0.01°

Compass (fluxgate type, includes built-in field calibration feature):

Accuracy: ± 2 °⁵

Precision: ± 0.5 °⁵

Resolution: 0.01°

Maximum tilt: ± 15 °

⁵ $< \pm 1.0$ ° is commonly achieved after calibration

Power

External DC input: 20–50VDC

Internal battery voltage: 42VDC new;
28VDC depleted

Battery capacity: @0°C: 450 watt hours

Environmental

Standard depth rating:

200m; optional to 6000m

Operating temperature: -5° to 45°C

Storage temperature*: -30° to 60°C

Weight in air: 13.0kg

Weight in water: 4.5kg

* Without batteries

Software

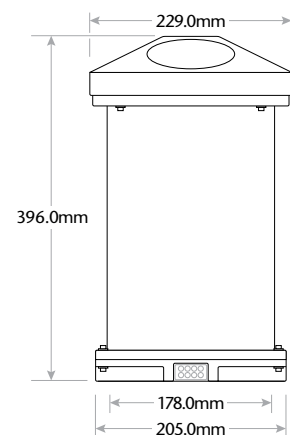
Teledyne RDI's Windows™-based software included:

- WinSC—Data Acquisition
- WinADCP—Data Display and Export

Available Options

- Memory: 2 PCMCIA slots, total 4GB
- Pressure sensor
- External battery case
- High-resolution water-profiling modes
- Bottom tracking
- AC/DC power converter, 48VDC output
- Pressure cases for depths up to 6000m
- Directional Wave Array

Dimensions



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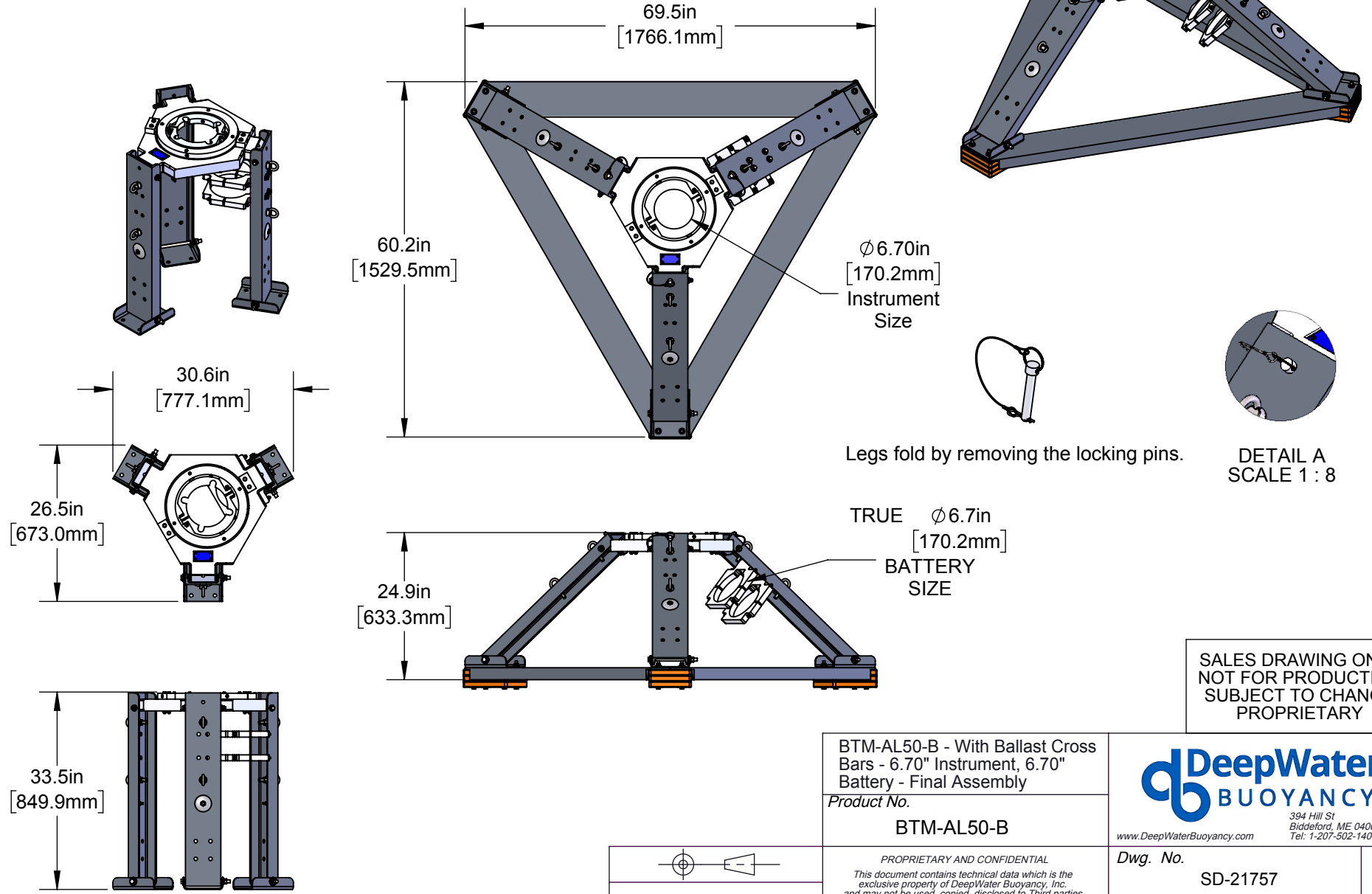
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Notes:

1. Weight in seawater: 148 lbs (67.5 kg), ± 3.0 lbs (1.5 kg)
2. Weight in air: 222 lbs (101 kg), nominal
3. Frame: 5086 Aluminum
4. Hardware: 316 Stainless Steel
5. Labeling: Deepwater Buoyancy Logo



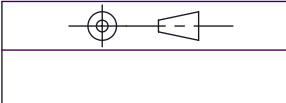
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BTM-AL50-B - With Ballast Cross
Bars - 6.70" Instrument, 6.70"
Battery - Final Assembly

Product No.
BTM-AL50-B



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