NOVA SCOTIA

MARINE RENEWABLE-ENERGY PERMIT

Province of Nova Scotia
Marine Renewable-energy Act

PERMIT HOLDER:	Jupiter Hydro Inc.
PERMIT NUMBER:	2019-003
EFFECTIVE DATE:	July 3, 2019
EXPIRY DATE:	July 2, 2024

Pursuant to Section 38 of the *Marine Renewable-energy Act*, as amended from time to time, this Demonstration Permit granted to the Permit Holder is subject to the Terms and Conditions attached to and forming part of this Permit, for the following activity:

Construction, installation, operation and decommissioning of up to two (2) generators on a short-term demonstration basis with an aggregate nameplate capacity of two (2) megawatts at Jupiter Hydro Inc. Permit Area within the Fundy Area of Marine Renewable-energy Priority.

For greater certainty, the activity authorized under this Permit and its terms and conditions is subject to the *Marine Renewable-energy Act* and its regulations.

Derek Mombourquette
Minister

July 3/2019
Date Signed

NOVA SCOTIA

MARINE RENEWABLE-ENERGY PERMIT

TERMS AND CONDITIONS

Province of Nova Scotia

Marine Renewable-energy Act

PERMIT HOLDER:	Jupiter Hydro Inc.
PERMIT TYPE:	Demonstration Permit (Connected Generator)
PERMIT NUMBER:	2019-003
EFFECTIVE DATE:	July 3, 2019
EXPIRY DATE:	July 2, 2024

Terms and Conditions of Permit Approval

This approval is subject to the following conditions as well as obtaining all other necessary approvals, permits or authorizations required by municipal, provincial and federal acts, regulations and by-laws before constructing, installing, operating and decommissioning any device in the Jupiter Hydro Inc. Permit Area.

The following schedules are attached to and form part of this Permit:

- Schedule "A" Survey of Jupiter Hydro Inc. Permit Area;
- Schedule "B" The Technical Description submitted by Jupiter Hydro Inc.;
- Schedule "C" The Application Document.
- Schedule "D" Insurance Requirements.

The terms and conditions of this Permit document shall prevail over the Schedules.

Definitions:

"Aggregate Name Plate Capacity" means the maximum installed capacity permitted under the demonstration permit of the units forming the Generation Facility;

"Application Document" means the marine renewable-energy permit application submitted by the Permit Holder to the Nova Scotia Department of Energy and Mines and deemed complete on April 8, 2019;

"Commercial Operation" means the completion of the design, construction and commissioning of at least one (1) device of the Generating Facility, and the Permit Holder has provided written notice to NSPI that they are ready for Commercial Operation. Commercial Operation must be reached on or before the Final In-Service Date;

"Commercial Operation Date" means the first day of the calendar month following Commercial Operation;

"Decommissioning, Abandonment and Rehabilitation Plan" means the decommissioning, abandonment and rehabilitation plan required by subsection 44(2) of the *Marine Renewable-energy Act* and provided to the Minister in accordance with Sections 19 and 20 of the *Marine Renewable-energy General Regulations*;

"Deployment" means the placement of a device or associated equipment in position ready for use;

"Effective Date" means the date that this Permit is effective, as noted at the head of this document;

"Fees Regulations" means the *Marine Renewable-energy Fees Regulations*;

"Final In-Service Date" shall be three (3) years from the Effective Date;

"Generation Facility" means one or more device(s) described in the Technical Description and Schedule B, together with all protective and other associated equipment and improvements as may be modified from time to time pursuant to the terms of this Permit;

"Generator(s)" as defined in the *Marine Renewable-energy* Act;

"Incremental Energy Rate" means the rate in $/MWh which is equal to NSPI's cost of generating or purchasing one more MWh of energy from sources other than the Generating Facility as calculated by NSPI averaged over the twelve (12) month period immediately preceding the relevant time and set out in the Power Purchase Agreement (PPA);

"Jupiter Hydro Inc. Permit Area" or "Permit Area" means the area of submerged land for which the specific location has been determined by survey by the Permit Holder as described in the Application Document and described in Schedule A of this Permit;

"Minister" means the Minister of Energy and Mines for the Province of Nova Scotia;

"MRE Act" means the *Marine Renewable-energy Act*;

"NSPI" means Nova Scotia Power Incorporated;

"Permit Holder" means Jupiter Hydro Inc.;

"Program Administrator" means a representative of the Nova Scotia Department of Energy and Mines who has been assigned to receive information on the Department's behalf with respect to this Permit;

"Regulations" means the *Marine Renewable-energy General Regulations*;

"Socio-economic Matters" include, but are not limited to, issues relating to employment, job-creation, and community relations;

"Technical Description" means the description contained in Schedule B of this Permit.

1.0 Scope of Approval

1.1 *Project Details*. This Permit is limited to the project as described in the schedules attached to and forming part of this Permit.

1.2 *Project Technology*. The Permit for the project is limited to the technology as described in the schedules attached to and forming part of this Permit and limited 2 megawatt aggregate nameplate capacity.

1.3 *Permit Area.* The Permit Area is 22.26 hectares as set out in Schedule A. Generator(s) authorized under this Permit shall be constructed, installed and operated within the Permit Area.

1.4 *Development and Operation.* The Permit Holder shall develop and operate the project as described in the Project Plan attached to and forming part of this Permit.

1.5 *Precedence of legislation.* In the event of a conflict between the MRE Act and its regulations and the terms and conditions of this Permit, the MRE Act and its regulations shall prevail.

2.0 General Terms and Conditions

2.1 This Permit is valid for a term of five (5) years from the Effective Date.

2.2 *Renewal and extension eligibility.* This Permit expires on July 2, 2024. To be eligible to renew the term, the Permit Holder must have fulfilled its obligations under this Permit, MRE Act and its regulations, and shall submit and receive written approval of a new project plan for the coming renewed term.

2.3 In accordance with Section 42(1C)of the MRE Act, the maximum aggregate of terms for this permit is 18 years.

2.4 *Other Approvals, Permits and Authorizations.* This Permit is subject to the terms and conditions herein, and the Permit Holder obtaining and maintaining all other necessary approvals, permits or authorizations under municipal, provincial and federal acts, regulations and by-laws.

3.0 Commercial Operation Date / Final In-Service Date

3.1 The Permit Holder shall, within three (3) years of the Effective Date, reach Commercial Operation on the project.

3.2 The full Generation Facility as described in the Technical Description (Schedule B) shall be constructed and operational within three (3) years of the Effective Date of this Permit. This is also the Final In-Service Date. The Final In-Service Date shall not be extended by the Minister.

4.0 Power Purchase Agreement

4.1 Energy produced by the Permit Holder will be paid in accordance with the Power Purchase Agreement (PPA) between the Permit Holder and NSPI.

4.2 The term of the PPA shall end on the earlier of:

a. the date on which the Demonstration Permit expires; or
b. is revoked, or 15 years after the Commercial Operation Date.

4.3 The Permit Holder shall be paid an energy rate of $500 per megawatt hour (MWh) of energy generated up to an annual cap of 5,256 MWh, then the Incremental Energy Rate above this cap, in accordance with the PPAs.

5.0 Rent Payments

5.1 The Permit Holder shall pay the first annual rent payment of $2,493.04, no later than sixty (60) days after the Effective Date, and $5,000 on or before January 31 of each subsequent year during the term of the Permit. The rent payment is calculated on the basis of a calendar year and is equal to the greater of two thousand five hundred dollars ($2,500) per megawatt (MW) of installed capacity under the Permit or twenty dollars ($20.00) per hectare in the Permit Area.

5.2 Rent payments shall be made payable to the "Minister of Finance" and are non-refundable.

5.3 If rent is not paid on or before the deadline for payment, the Permit Holder shall pay an additional late fee in an amount equivalent to 10% of the full owed.

If rent remains in arrears for more than 120 days after the deadline the Minister may suspend the Permit until rent owing is paid in full.

5.4 The Permit Holder shall notify the Minister in writing no later than sixty (60) calendar days before the next rent payment is due if the megawatts of installed capacity authorized under the Permit or the hectares of the Permit Area change such that it may impact annual rental fees.

6.0 Environmental Monitoring Plan

6.1 The environmental monitoring plan (EMP) must be developed using relevant baseline data and identify appropriate environmental effects indicators. The plan shall consider project effects on, but not limited to, the following:

- fish and lobster;
- marine birds;
- marine mammals;
- acoustics;
- physical oceanography;
- currents and waves; and
- benthic environment.

The EMP shall include contingencies to be implemented as alternative courses of action in the event mitigation and/or monitoring activities cannot be implemented, are not functioning as designed or do not provide expected results.

6.2 Unless otherwise approved, the Permit Holder shall submit an EMP to the Program Administrator for review and approval by the Minister at least thirty (30) days prior to deployment.

6.3 The Permit Holder shall update and revise the EMP to reflect best available and economic practices, methods, and technologies respecting environmental monitoring; changes in the Project Plan and circumstances of the project; and changes in the knowledge of, or actual changes in the physical, ecological, and environmental circumstances and impacts of the project.

6.4 The Permit Holder shall submit an initial status report on environmental monitoring equipment functionality to the Program Administrator prior to turbine operation and shall notify the Program Administrator of any malfunction or non-functioning of the equipment within twenty-four (24) hours.

6.5 Environmental effects monitoring reports shall be submitted in writing to the Minister at a schedule to be determined by the Nova Scotia Department of Energy and Mines.

6.6 Upon knowledge of serious harm to marine mammals, fish, marine invertebrates, and marine birds, the Permit Holder shall, without

unreasonable delay, notify the Program Administrator and the Department of Fisheries and Oceans Canada.

7.0 Engagement Requirements

7.1 *Mi'kmaq Engagement Plan.* The Permit Holder shall not construct or install a generator, cable or other equipment or structure in the Permit Area until the Permit Holder has submitted, and the Minister has approved a Mi'kmaq Engagement Plan. The plan shall outline ongoing and proposed engagement activities with the Mi'kmaq of Nova Scotia and shall include, as a minimum, a description and general schedule of activities under the authority of the Permit. The Permit Holder shall implement the plan following approval. The plan shall be updated and resubmitted annually to the Minister for approval on or before January 31st throughout the term of this Permit.

7.2 The Permit Holder shall support the Province of Nova Scotia in its future and ongoing consultation processes with the Mi'kmaq of Nova Scotia, share information the Minister considers necessary or advisable, with the Mi'kmaq of Nova Scotia, and consider implementing mitigation and accommodation measures to address any issues raised through consultation.

7.3 *Stakeholder Communication and Engagement Plan.* The Permit Holder shall not install any generator, including any cable or any other equipment or structure owned by the Permit Holder and used or intended to be used with the generator, before submitting a stakeholder communication and engagement plan to the Minister for approval. The plan shall outline ongoing and proposed engagement activities with stakeholders and shall include, as a minimum, a description and general schedule of activities under the authority of the Permit. The Permit Holder shall implement the plan following approval. The plan shall be updated and resubmitted annually to the Minister for approval on or before January 31, throughout the term of this Permit.

8.0 Reporting Requirements

8.1 *Deployment Notice.* The Permit Holder shall notify the Program Administrator at a minimum, thirty (30) days prior to the Deployment or the testing of generator(s) or equipment under the authority of the Permit.

8.2 *Deadlines for Activity Reports.* In accordance with Section 13 of the Regulations, the Permit Holder, throughout the term of the Permit, shall submit quarterly written reports ("Activity Reports") to the Minister detailing the activities carried on under the authority of the Permit, on or before the following deadlines:

a. by January 31, for activities between November 1 and January 31;
b. by April 30, for activities between February 1 and April 30;
c. by July 31, for activities between May 1 and July 31; and
d. by October 31, for activities between August 1 and October 31.

8.3 *Content of Activity Reports.* At a minimum, the Activity Reports shall include:

a. Detailed and up-to-date project schedule;
b. Status update on operational aspects of the project;
c. Operational capacity factor for each generator and calculation methodology;
d. Progress updates on the activities outlined in the project schedule;
e. Detailed and up-to-date procurement schedule;
f. Amended procurement deadlines;
g. Summary of any entities procured for goods/services;
h. Financial statements related to procurement, construction, operations, and monitoring activities, with audited financial statements included at least once per calendar year;
i. Data relating to socio-economic matters;
j. Lessons learned deemed beneficial to the sector; and
k. Any changes to the corporate structure of the Permit Holder or its major shareholders, including but not limited to changes of domicile, management, and corporate governance.

8.4 *Event notification.* The Permit Holder shall notify the Program Administrator within ten (10) business days upon reaching the following milestone(s):

a. Receipt of any federal, provincial, or municipal regulatory approvals;
b. Approval of additional funding or grants;
c. Completion of any NSPI grid interconnection activities;
d. Connection to the transmission or distribution grid;
e. Issuance of any manufacturing or fabrication contracts;

f. Installation of a generator and any cable or other equipment or structure used or intended to be used with a generator;
g. Reaching commercial operation under the power purchase agreement;
h. Achieving 7.5% capacity factor;
i. Achieving 30% capacity factor;
j. Commencement of decommissioning activities; and
k. Completion of decommissioning and rehabilitation activities.

8.5 *Press release notification.* The Permit Holder shall notify the Program Administrator at least one (1) business day prior to any press release related to the activities authorized under the Permit.

9.0 Incident Reporting

9.1 The Permit Holder shall provide the Program Administrator, within seventy-two (72) hours, a report of any significant adverse environmental effects, accident or near miss, generator malfunction or impact to human health or safety together with a description of the response.

9.2 The Permit Holder shall notify the Program Administrator in advance of publicly sharing any statements related to an incident or near-miss.

9.3 The Permit Holder shall ensure that:

a. Any incident or near-miss is investigated, its root cause and causal factors identified where possible and corrective action taken where applicable; and
b. Any incident or near-miss is investigated, its root cause, causal factors and corrective action taken must be submitted in writing to the Program Administrator no later than thirty (30) days after the day on which the incident or near-miss occurred.

10.0 Risk Management Plan

10.1 The Permit Holder shall not construct or install a generator, cable or other equipment or structure authorized by this Permit, until the Permit holder has submitted, and the Minister has approved, a Risk Management Plan. The Permit Holder shall implement and adhere to the Risk Management Plan following approval.

10.2 Unless otherwise approved, the Permit Holder shall submit a Risk Management Plan to the Program Administrator for review and approval at least six (6) months prior the construction or installation of a generator or cable, within the Permit area, or other equipment or structure authorized by this Permit.

10.3 The Risk Management Plan must be developed using relevant project information and shall contain all the information listed in Section 18 of the Regulations.

10.4 The Risk Management Plan shall be updated and resubmitted annually by the Permit Holder to the Minister on or before January 31, throughout the term of the Permit.

11.0 Decommissioning, Abandonment and Rehabilitation Plan

11.1 In accordance with Section 19 of the Regulations, the Permit Holder shall not construct or install a generator or cable within the Permit area, or other equipment or structure authorized by this Permit until the Permit Holder has submitted and the Minister has approved a Decommissioning, Abandonment and Rehabilitation Plan.

11.2 Unless otherwise approved, the Permit Holder shall submit a Decommissioning, Abandonment and Rehabilitation Plan to the Program Administrator for review and approval at least six (6) months prior to the construction or installation of a generator or cable, or other equipment or structure authorized by this Permit.

11.3 The Decommissioning, Abandonment and Rehabilitation Plan shall be developed using relevant project information, shall contain all decommissioning activities, and all of the information listed in Section 20 of the Regulations.

11.4 The Permit Holder shall update and revise the Decommissioning, Abandonment and Rehabilitation Plan to reflect best available and economic practices, methods, and technology of decommissioning, abandonment and rehabilitation; changes in the Project Plan and circumstances of the project; and changes in the, or knowledge of the, physical, ecological, and environmental circumstances and impacts of the project.

12.0 Financial Security and Insurance

12.1 *Insurance.* The Permit Holder shall provide proof of liability insurance to the satisfaction of the Minister prior to the construction or installation of a generator or cable, or other equipment or structure authorized by this Permit.

12.2 *Coverage.* The Permit Holder shall maintain its insurance coverage in full force and effect for the term of the Permit.

12.3 The Permit Holder shall provide financial security on terms and conditions acceptable to the Minister and at a minimum, sixty (60) days prior to the construction or installation of a generator or cable, or other equipment or structure authorized by this Permit. The Minister will provide written notice of the amount required, and any terms or conditions, prior to receiving financial security from the Permit Holder.

12.4 The Permit Holder shall ensure that any security provided is kept in effect throughout the Permit term. Unless otherwise required, the Permit Holder shall renew security on an annual basis and provide proof of financial security annually on or before January 31, throughout the term of the Permit.

12.5 Permissible forms of security include:

a. Electronic transfer, cash deposit, or cheques made payable to the Minister of Finance, which the Province in its absolute discretion may cash at any time;
b. Government guaranteed bonds, debentures, term deposits, certificates of deposit, trust certificates or investment certificates assigned to the Minister of Finance; or
c. Irrevocable letters of credit, irrevocable letters of guarantee, performance bonds or surety bonds in a form acceptable to the Minister.

The Minister may impose additional terms and conditions for this financial security upon review and approval of the Decommissioning, Abandonment and Rehabilitation Plan.

13.0 Project Milestones

13.1 (a) The Permit Holder shall obtain a Letter of Intent from the Fundy Ocean Research Centre for Energy (FORCE) on or before December 31, 2019, that demonstrates the Permit Holder is negotiating access to the Nova Scotia electricity grid via FORCE infrastructure; or

(b) On or before December 31, 2019, the Permit Holder shall demonstrate Jupiter Hydro Inc. has submitted an Interconnection Request pertaining to a Generating Facility to Nova Scotia Power Inc.

13.2 The Permit Holder shall provide a Project Plan on or before December 31, 2019 for review and approval.

13.3 The Permit Holder shall achieve the following financial goals:

a. Secured 50% of Capital Expenditures on or before December 31, 2019; and
b. Secured 100% of the Capital Expenditures on or before June 30, 2020.

13.4 The Project Plan will be used to track material progress relating to project development. The Permit Holder shall implement and adhere to Project Plan.

13.5 The Permit Holder shall provide final technical design drawings of the Generation Facility stamped by a licensed professional engineer to the Program Administrator no later than ninety (90) days prior to Deployment

13.6 The Permit Holder shall notify the Program Administrator within ten (10) business days following completion of a project milestone.

14.0 Performance Requirements

14.1 The Permit Holder shall provide final as-constructed drawings of the Generation Facility and all associated infrastructure to the Program Administrator no later than ninety (90) days upon reaching Commercial Operation.

14.2 The Permit Holder is subject to the following performance targets:

a. Capability of deployed generators(s) to be operated and controlled with consistency following installation;
b. Deployed generators operating and being controlled consistently;
c. Capability of turbines, blades, and other spinning or moving components representing a risk to human or wildlife health of being stopped, halted and braked when and if required; and
d. Maintenance of an annual average capacity factor of at least 7.5% for each generator under the authority of the Permit.

14.3 The Permit Holder shall provide performance reports to the Program Administrator no later than January 31 of each year through the term of this Permit. At a minimum, the report must include the following for each generator installed:

a. Amount of energy generated;
b. Date(s) energy was generated;
c. Peak generation;
d. Capacity factor achieved and calculation methodology;
e. Number and date(s) of days deployed;
f. Number and date(s) of operating days;
g. Number and date(s) of maintenance days (planned and unscheduled);
h. The type of maintenance required; and,
i. A summary of operational issues impacting energy production or safe operation of the Generation Facility.

14.4 In the event any generator fails to meet the annual performance standard detailed in 14.2, the Permit Holder must submit a report to the Minister outlining a reasonable time-line and plan for restoration of the generator(s) to either render it fully functional or provide details for removing the generator(s) from the Permit Area. The Permit Holder must implement the restoration as submitted; any change is subject to prior approval of the Minister. The Permit Holder cannot invoke this provision within three years of it being previously invoked, and not more than twice overall during the maximum term of this Permit.

15.0 Officer's and Director's Certificates.

15.1 The Permit Holder, upon request from the Minister, shall provide an officer's or director's certificate attesting to the truth, accuracy and

completeness of any report and submission required under this Permit, or attesting to matters of compliance with this Permit.

16.0 Notice to Minister and Program Administrator

16.1 Notice, documents and other information required to be sent to the Minister of the Nova Scotia Department of Energy and Mines, shall be in writing and may be served by personal service or fax, addressed as follows:

Attention: Minister of Energy and Mines

Nova Scotia Department of Energy and Mines
Joseph Howe Building
1690 Hollis Street
Po Box 2664
Halifax, NS B3J 3J9

Phone: (902) 424-4575
Fax: (902) 424-0528

16.2 Notice and/or information required to be sent to the Program Administrator shall be in writing and sent via email to: marinerenewables@novascotia.ca

17.0 Notice to NSPI

17.1 In the event that the Permit expires, is suspended or revoked, the Minister will notify NSPI in a timely manner.

18.0 Standards

18.1 The Permit Holder must comply with industry standards for marine renewable energy conversion systems as they exist at the time of the issuance of this Permit and as amended, such as, but not limited to the International Electrotechnical Commission (IEC) Technical Committee (TC) 114.

18.2 At a minimum, the Permit Holder shall conduct itself with prudence and due diligence and with appropriate regard for matters of health, safety, and environment.

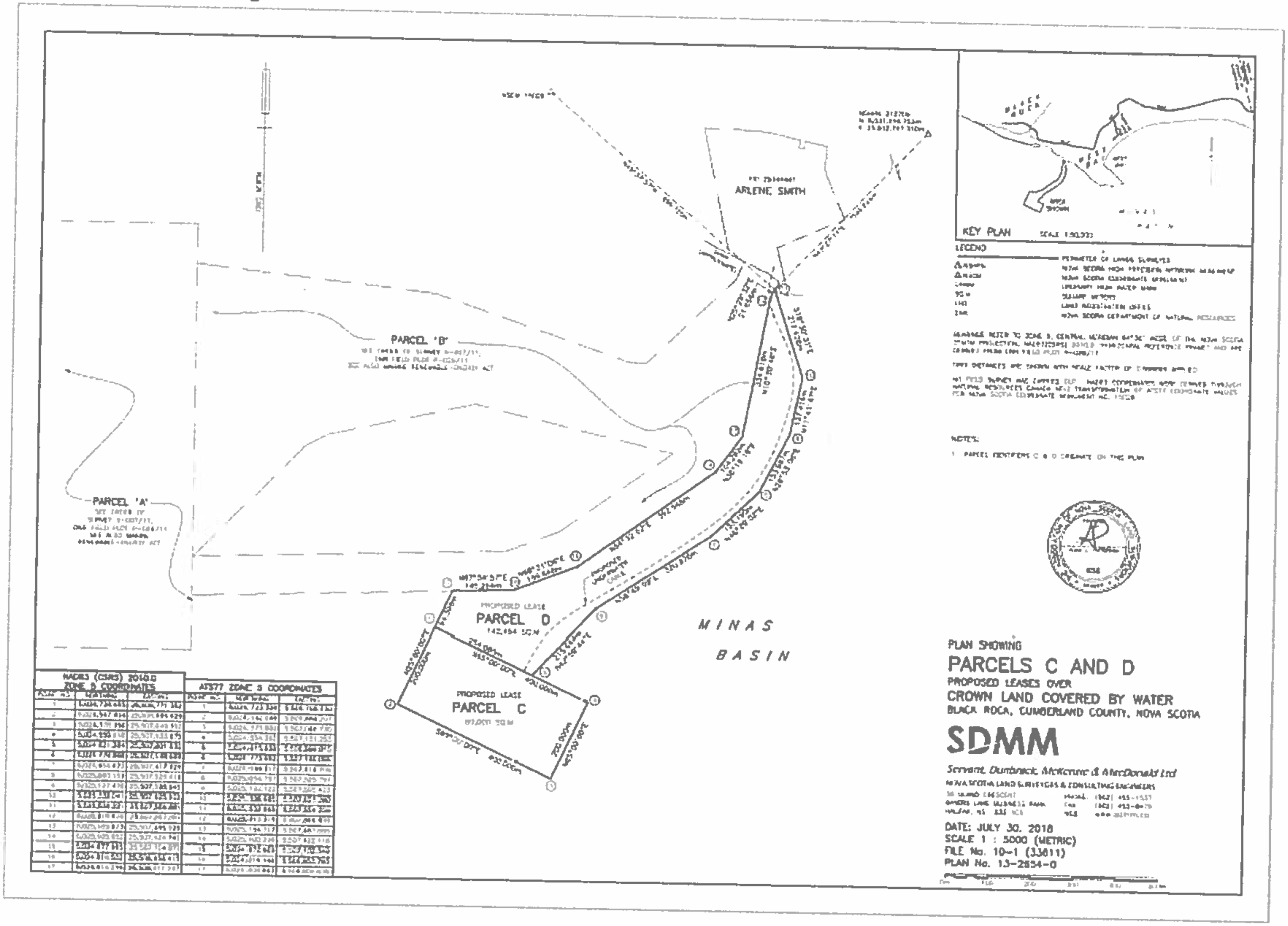
19.0 Director's Liability

19.1

Schedule A – Jupiter Hydro Inc. Permit Area

Schedule B – Technical Description

Schedule A - Location of Proposed Activities



6.0 TECHNICAL COMPONENTS

6.1 Intellectual property - TRL

6.1.1 The Jupiter core technology, utilizing an Archimedes screw (helical turbine or helical screw) is the basis of our deployment technology.

6.1.2 Currently TRL 6, TRL 9 Post deployment.

6.1.3 Patents:

6.1.3.1 Allowed:

6.1.3.1.1 Canada (to be issued under patent # **2,807,876,** pending registration)

6.1.3.2 Issued:

6.1.3.2.1 United States

6.1.3.2.2 European Union

6.1.3.2.3 Australia

6.1.3.2.4 China

6.1.3.2.5 Korea

6.1.3.2.6 New Zealand

6.1.3.2.7 Philippines

6.1.3.2.8 South Africa

6.1.3.2.9 Japan

6.1.3.2.10 Mexico

6.2 Component descriptions

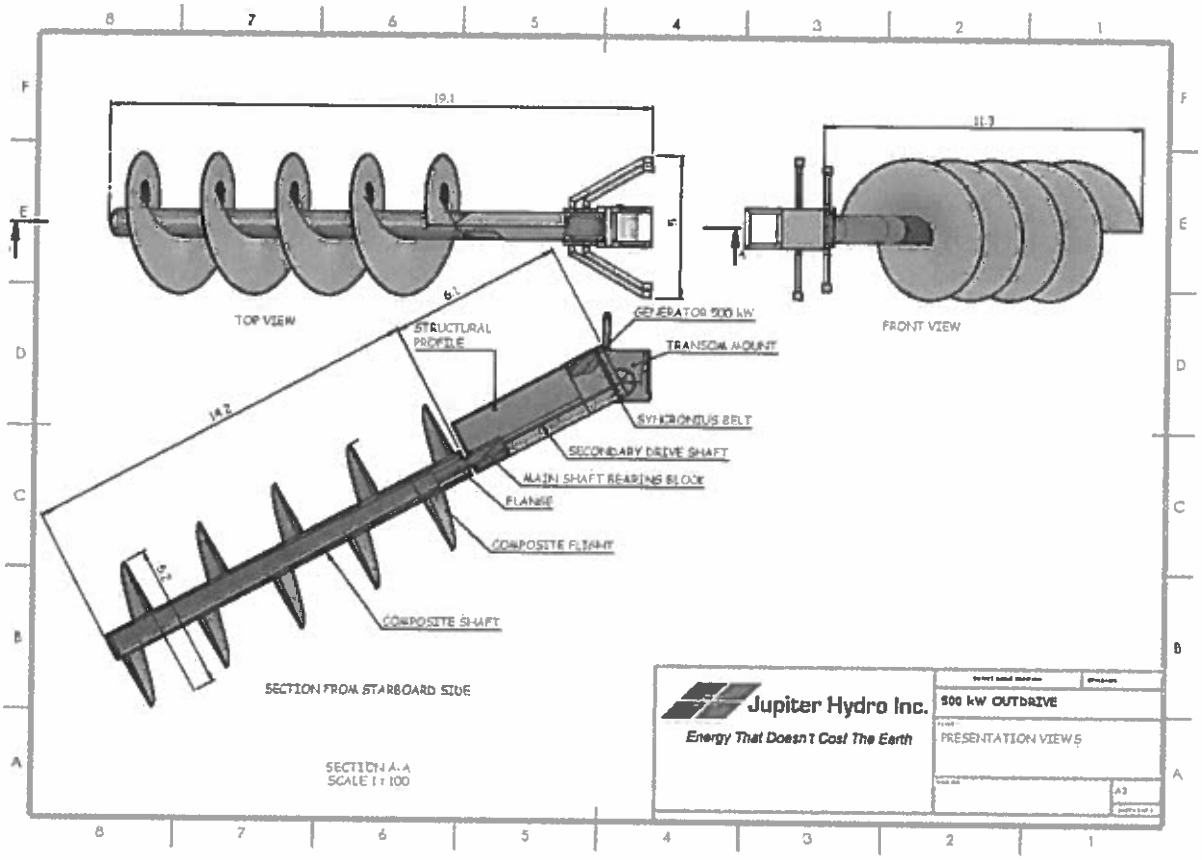
6.2.1 Outdrive

6.2.1.1 Function

The outdrive configuration applies the Jupiter technology in a fashion analogous to marine outboard motors facilitating the attachment of the helical turbine to the transom of an existing barge hull, a modular barge hull or a special purpose hull.

The rotating components, including the generator are all located in a swing arm which pivots on the transom bracket.

Feathering is achieved by trimming the outdrive up from its 30 degree operating angle (where the turbine achieves its maximum efficiency), or by



tilting the unit so the turbine is clear of the water.

6.2.1.1.1 Outdrive drawing

6.2.1.2 Mounting

6.2.1.2.1 The transom bracket mounts to a steel transom plate and, if required, for existing barges, an external load spreading structure.

6.2.1.2.2 Mounting and in particular any load spreading structure is to be determined in

conjunction with a qualified marine surveyor, naval engineer or architect and the prime consultant Hatch, Inc.

6.2.1.3 Bearings

Bearings are off the shelf guide and thrust bearings installed in an on the water serviceable bearing block and split bearing configuration.

6.2.1.4 Power transmission

6.2.1.4.1 A rotating shaft connects the main bearing block and shaft to the belt drive.

6.2.1.4.2 A synchronous belt drive system facilitates adjustment of the gear ratio between the turbine and the generator.

6.2.1.4.3 A hydraulic service brake and mechanical service lock are provided to prevent shaft rotation during servicing.

6.2.1.5 Hydraulic tilt/trim

6.2.1.5.1 Standard marine hydraulics are used to provide 'trim' adjustment between 32 degrees down (maximum operating angle) and 0 degrees; 'lift' adjustment from 0 degrees to 30 degrees up angle facilitates service, anchor load reduction if required, dry-docking or beaching.

6.2.1.5.2 Environmentally friendly hydraulic fluid will be used.

6.2.2 Turbines

The helical turbines are constructed of a composite shaft mated to composite turbine blade sections and chemically bonded into a single unit.

Outdrives are fitted in pairs with counter rotating turbines to facilitate load balancing. The 3200 mm diameter turbines (phase 1A) have a capacity rating of 150 kW each.

In phase 1B these turbines will be replaced with 5500 mm diameter with a capacity rating of 500 kW each. The actual generators have a capacity rating of 500 kW in all phases and will be operated at reduced capacity in phase 1A.

Phase	Turbine capacity rating (each)	Total turbine capacity rating	Generator capacity rating (each)	Total generator capacity rating
1A	150 kW	300 kW	500 kW	1 MW
1B	500 kW	1 MW	500 kW	1 MW
2	500 kW	2 MW	500 kW	2 MW
3	500 kW	2 MW	500 kW	2 MW

The capacity factor for all phases is 30%, reflecting the periodic tidal flow. See 11.4 & 11.5.

6.2.2.1 3200 mm turbine & 5500 mm turbine rotation Under load (2.1 TSR)

Flow rate M/s	Annual hours of flow	RPM 3.2 m turbine 2.1 TSR	RPM 5.5 m turbine 2.1 TSR
-	20.67	0	0
0.1	119.67	1.3	0.7
0.2	141.67	2.5	1.5
0.3	215.83	3.8	2.2
0.4	198.67	5.0	2.9
0.5	183.17	6.3	3.6
0.6	176.67	7.5	4.4
0.7	179.00	8.8	5.1
0.8	185.00	10.0	5.8
0.9	177.17	11.3	6.6
1.0	189.00	12.5	7.3
1.1	185.17	13.8	8.0

1.2	191.33	15.0	8.8
1.3	205.00	16.3	9.5
1.4	204.00	17.5	10.2
1.5	213.17	18.8	10.9
1.6	243.17	20.1	11.7
1.7	257.83	21.3	12.4
1.8	270.83	22.6	13.1
1.9	274.50	23.8	13.9
2.0	282.83	25.1	14.6
2.1	288.00	26.3	15.3
2.2	290.00	27.6	16.0
2.3	302.83	28.8	16.8
2.4	305.33	30.1	17.5
2.5	291.67	31.3	18.2
2.6	278.67	32.6	19.0
2.7	271.33	33.8	19.7
2.8	239.33	35.1	20.4
2.9	228.00	36.3	21.1
3.0	220.17	37.6	21.9
3.1	195.33	38.9	22.6
3.2	200.33	40.1	23.3
3.3	185.50	41.4	24.1
3.4	179.17	42.6	24.8
3.5	175.67	43.9	25.5
3.6	159.17	45.1	26.3
3.7	145.67	46.4	27.0
3.8	114.33	47.6	27.7
3.9	96.00	48.9	28.4
4.0	82.00	50.1	29.2
4.1	69.00	51.4	29.9
4.2	62.67	52.6	30.6

4.3	57.27	53.9	31.4
4.4	50.33	55.1	32.1
4.5	47.00	56.4	32.8
4.6	42.00	57.7	33.5
4.7	31.00	58.9	34.3
4.8	26.67	60.2	35.0
4.9	10.50	61.4	35.7
5.0	0.50	62.7	36.5

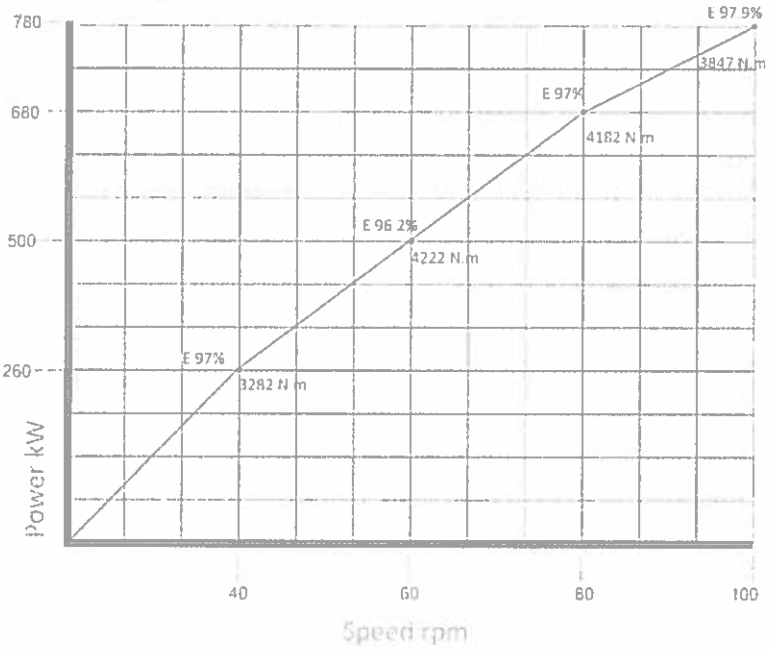
6.2.3 Generator

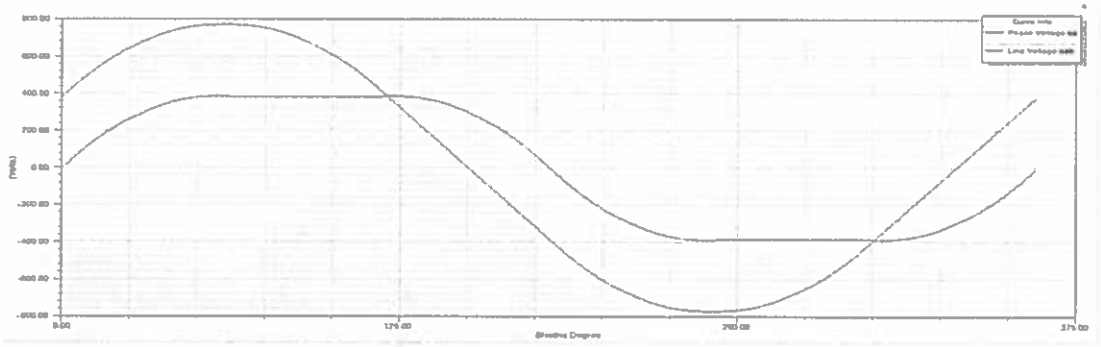
6.2.3.1 2 X 500 kW @ 60RPM permanent magnet variable speed generators 400 VAC, one per outdrive are mounted above the drive shaft. Enerset PMG 500PH or equal. The same generator is used in all phases, operating at reduced capacity in phase 1A.

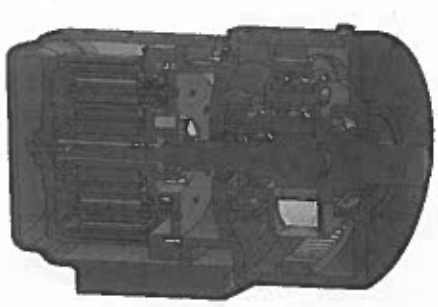
6.2.3.2 Generator specification

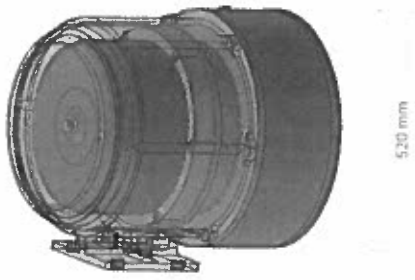
Low speed Permanent Magnet Generator | PMG 500PH

	PMG 500PH
Power (kW)	500
Speed (rpm)	60
Voltage (V)	400
Short Circuit Current (A)	1405
THD	1.22
Power factor	0.93
Weight (kg)	390
Efficiency (100% load)	96.2
Efficiency (75% load)	95.6
Efficiency (50% load)	95.8
Efficiency (25% load)	95
Protection class	IP54
Insulation class	F
Thermal class	B
Torque (N.m)	4222
Cooling	Air-to-liquid









PMG 500PH

6.2.4 Power conversion

6.2.4.1 The 400VAC generators feed into a hull mounted rectifier/inverter/transformer to transmit 13.6 kV AC power ready to be fed into the grid.

6.2.5 Anchoring buoy and cable riser

6.2.5.1 NB: As a preferred alternate the anchor pivot and cable riser may be incorporated into a hull section.

6.2.5.2 Body

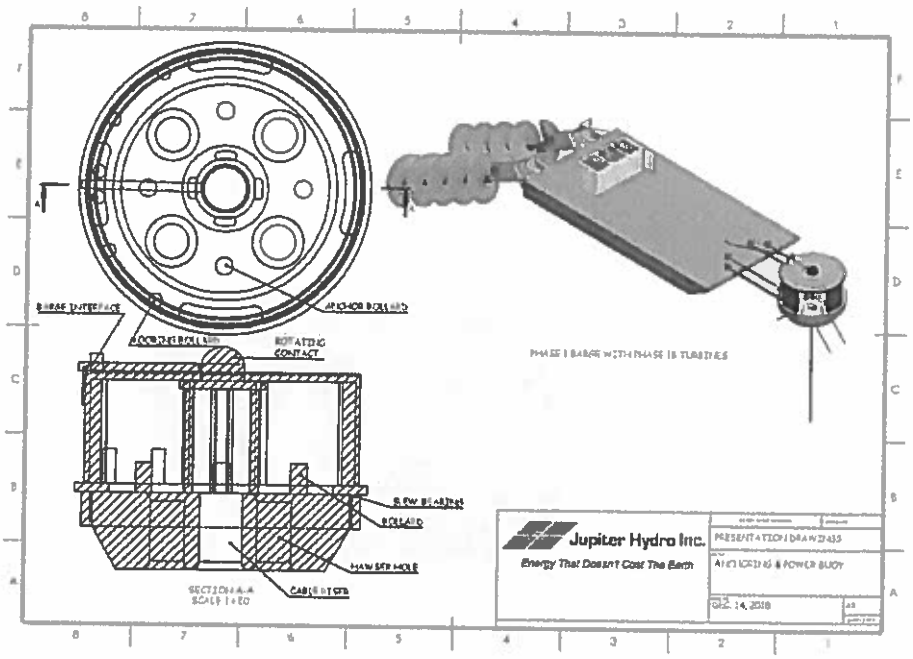
6.2.5.2.1 Typical of Buoy construction, a circular composite or steel float with 4 hawser holes and associated fairleads and bollards.

6.2.5.2.2 Non rotating anchor and cable body

6.2.5.2.3 Central cable hole feeds submarine cable(s) through a parallel bus and into a rotating barge connection.

6.2.5.2.4 Slew bearing transition from non-rotating anchor and cable riser body to rotating mooring and service connection.

6.2.5.2.5 Buoy drawings



6.2.5.3 Anchoring hawser

6.2.5.3.1 600mm reinforced to 200% of single anchor load.

6.2.5.3.2 Fairleads and bollards as required.

6.2.5.4 Cable riser

6.2.5.4.1 Composite wall.

6.2.5.4.2 Minimum cable capacity 3 X 15 kVA cables.

6.2.5.4.3 Cable clamps & bus with disconnect.

6.2.5.5 Rotating barge connection

6.2.5.5.1 4 Conductor rotating interface sized as per final engineering drawings.

6.2.5.5.2 Disconnect at barge and buoy ends.

6.2.5.5.3 Quick connect plug at buoy end.

6.2.5.5.4 Cable clamps and cable carrier.

6.2.6 Submarine cable

6.2.6.1 3C/4.0-15 KV 133% submarine cable.

6.2.6.2 Additional armouring 35M each end.

6.2.7 Hull

6.2.7.1 TBD based on availability.

6.2.7.2 Standard barge hull; steel; additional bracing as required.

6.2.7.3 Hull/buoy design facilitates ease of installation and maintenance with surface connections.

6.2.8 Safety equipment

6.2.8.1 All safety equipment required by regulations to be provided.

6.2.9 Environmental monitoring equipment

A full suite of monitoring equipment will be provided as noted in the Draft Environmental Monitoring Plan.

6.3 Performance characteristics

6.3.1 3200 mm turbine (150 kW each, 300 kW total)

6.3.1.1 Generator performance

Turbine:	Jupiter 3200 X4.5			
# of turbines	**2**			
Diameter	10.50	Feet	3.20	M
Turns	4.50			
Area	13.82	M2 for calculation		
Efficiencies (100% if N/A):				
Turbine		40.00%		
External Gear if requ.		100.00%		
Generator		95.00%		
Rectifier, Inverter and Transformer		97.00%		

Flow rate M/S	Flow rate KMPH	RPM	Torque per shaft (N.m.)	Input Watts per shaft	Net Output Watts
0.50	1.80	4.70	900	354	653
0.70	2.52	6.58	1,763	972	1,791
0.90	3.24	8.46	2,915	2,066	3,808
1.10	3.96	10.34	4,354	3,772	6,952
1.30	4.68	12.22	6,082	6,226	11,475
1.50	5.40	14.10	8,097	9,564	17,627
1.70	6.12	15.98	10,400	13,923	25,660
1.90	6.84	17.86	12,991	19,438	35,824
2.10	7.56	19.74	15,870	26,245	48,369
2.30	8.28	21.62	19,037	34,480	63,547
2.50	9.00	23.50	22,491	44,280	81,608
2.70	9.72	25.38	26,234	55,780	102,803
2.90	10.44	27.26	30,264	69,116	127,382
3.10	11.16	29.14	34,583	84,425	155,596
3.30	11.88	31.02	39,189	101,843	187,696

3.50	12.60	32.90	44,083	121,504	223,932
3.70	13.32	34.78	49,265	143,547	264,556
3.90	14.04	36.66	54,735	168,105	309,818
4.10	14.76	38.54	60,493	195,317	359,968
4.30	15.48	40.42	66,539	225,316	415,258
4.50	16.20	42.30	72,872	258,241	475,938
4.70	16.92	44.18	79,494	294,226	542,259
4.90	17.64	46.06	86,403	333,408	614,471

6.3.2 5500 mm turbine (500 kW each, total 1MW phase 1B, 2 MW phases 2 & 3.

Turbine: Jupiter 5500 X4.5
of turbines **2**

Diameter	18.05	Feet	5.50	M
Turns	4.50			
Area	40.84	M2 for calculation		

Efficiencies (100% if N/A):

Turbine	40.00%
External Gear if requ.	100.00%
Generator	95.00%
Rectifier, Inverter and Transformer	97.00%

Flow rate M/S	Flow rate KMPH	RPM	Torque per shaft (N.m.)	Input Watts per shaft	Net Output Watts
0.50	1.80	6.56	4,568	1,046	1,929
0.70	2.52	9.19	8,953	2,871	5,292
0.90	3.24	11.81	14,800	6,103	11,248
1.10	3.96	14.44	22,109	11,143	20,536
1.30	4.68	17.06	30,879	18,393	33,898
1.50	5.40	19.69	41,111	28,254	52,073
1.70	6.12	22.31	52,805	41,130	75,803

1.90	6.84	24.94	65,960	57,421	105,828
2.10	7.56	27.56	80,577	77,530	142,888
2.30	8.28	30.19	96,656	101,858	187,725
2.50	9.00	32.81	114,197	130,808	241,078
2.70	9.72	35.44	133,200	164,780	303,689
2.90	10.44	38.07	153,664	204,177	376,298
3.10	11.16	40.69	175,590	249,401	459,646
3.30	11.88	43.32	198,977	300,853	554,473
3.50	12.60	45.94	223,826	358,936	661,519
3.70	13.32	48.57	250,137	424,051	781,526
3.90	14.04	51.19	277,910	496,600	915,234
4.10	14.76	53.82	307,145	576,985	1,063,383
4.30	15.48	56.44	337,841	665,608	1,226,715
4.50	16.20	59.07	369,999	762,870	1,405,969
4.70	16.92	61.69	403,618	869,174	1,601,887
4.90	17.64	64.32	438,700	984,921	1,815,209

6.4 Anchoring

Anchoring is anticipated to utilize a grid of grouted steel pile anchors.

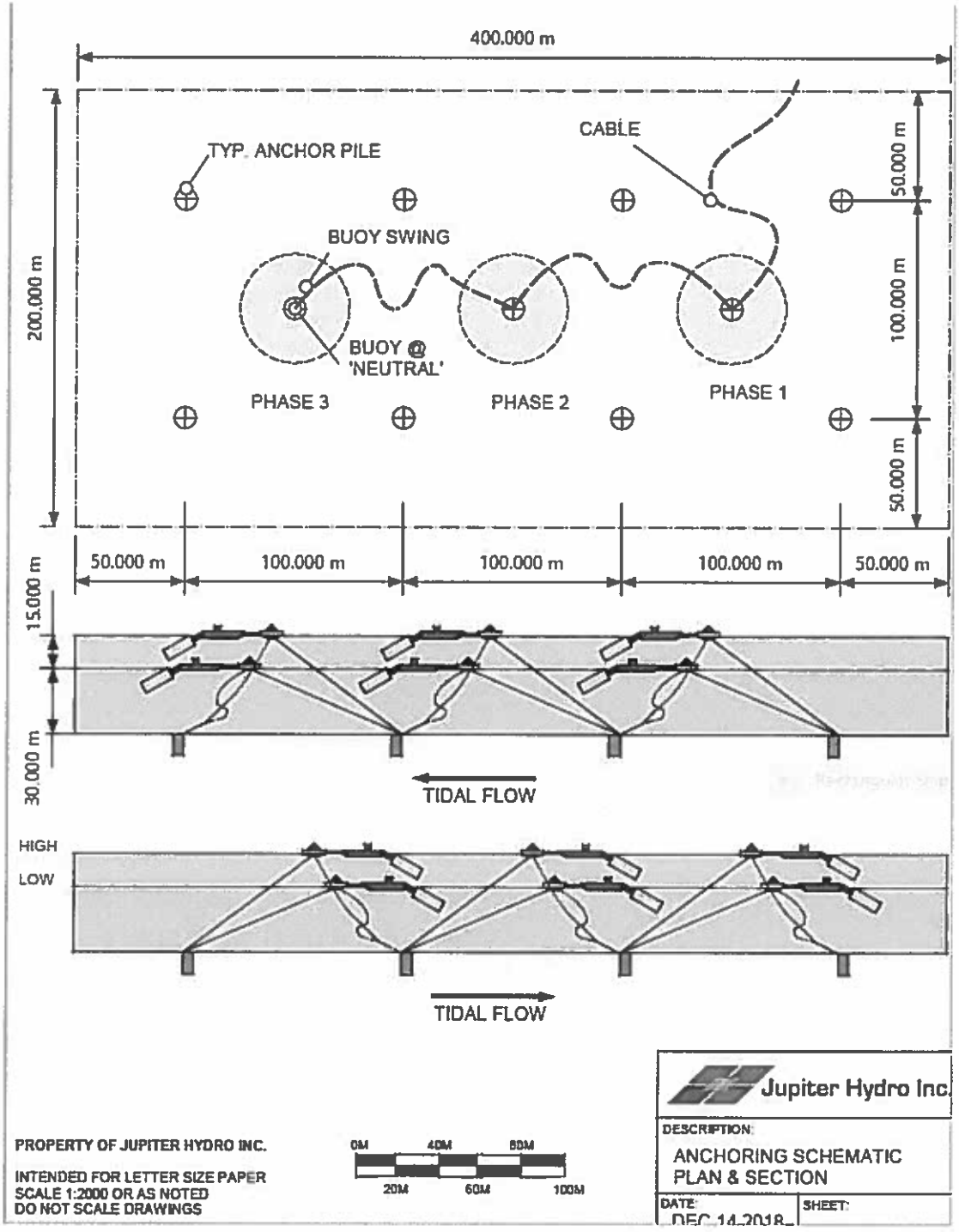
6.4.1 Phase 1

4 anchors to accommodate first platform.

6.4.2 Phases 2 & 3

4 additional anchors to accommodate second two platforms.

6.4.3 Plan and section



6.5 Grid hook up

6.5.1 Description

The submarine cable is semi permanently installed to the anchoring buoys (or integral riser).

6.5.2 Cable specification

15 KV Submarine Cable 3C-4/0

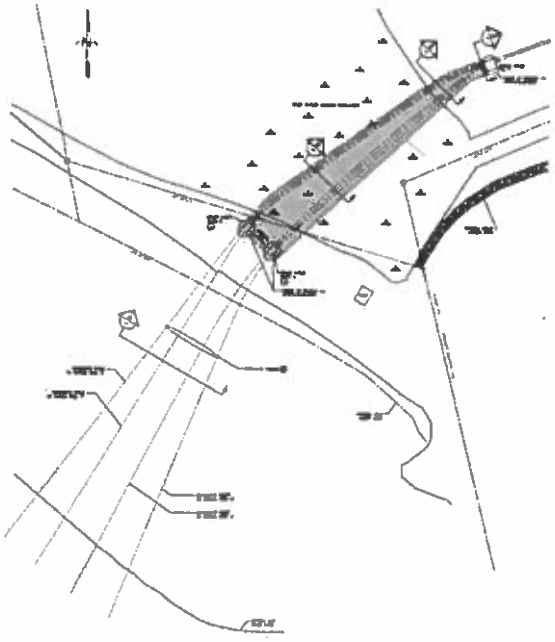
Item	Description	Units	Data
1	Material of Conductor	---	Copper
2	Number of Cores	---	3
3	Nominal Voltages	kV	15KV
4	Conductor size	AWG	4/0
5	Thickness of Conductor Screen	mm	0.6
6	Thickness of XLPE Insulation	mm	5.5
7	Thickness of Insulation Screen	mm	0.7
8	Semi-conductive Water Blocking Tape	mm	0.3
9	Copper Tape Screen	mm	0.1
10	Water Blocking Tape	mm	0.3
11	HDPE Inner Sheath	mm	1.4
12	Filler Material	Water Blocking Filler	
13	Non-woven Tape	mm	0.2
14	PE Bedding	mm	2
15	Single layer of round Galvanized Steel Wire Armour		
	Armour Wire Diameter	mm	3.15
16	Type of Outer Sheath	Black HDPE	
17	Min. Thickness of HDPE Sheath	mm	4
18	Over diameter of the finished Cable	mm	88.2
19	Approximate Weight	Kg/km	11000
20	Calculate DC Resistance at 25°C	Ohm/km	0.167
21	Type of drum	Iron-wooden drums	
22	Applicable Standards	IEC 60502-2 IEC 60228	

6.5.3 Cable landing

6.5.3.1 Jupiter cable corridor is adjacent to the FORCE cable corridor to facilitate access to unused conduit, cable and vault space.

6.5.3.2 Equivalent specification to FORCE landing.

6.5.3.3 FORCE landing drawing



SCHEDULE C – PROJECT PLAN

Schedule C – Application Document

SCHEDULE D – Insurance Requirements

Commercial General Liability Insurance

Comprehensive General Liability Insurance for liabilities arising out of property damage, personal injury and bodily injury including death resulting from any activity connected with the existence, management, maintenance and operation of Jupiter Hydro Inc. tidal energy project in the Permit Area. All such policies shall name as Additional Insureds Nova Scotia, their successors and assigns, and their respective directors, officers and employees. This insurance will include the following provisions:

- policy limit of liability of $5 million per occurrence (can be structured as primary plus supplementary layers or primary plus Umbrella and/or Excess);
- annual aggregate limits permitted for Products Hazard & Completed Operations, Pollution coverage and Employee Benefits liability coverage; no other policy aggregates permitted;
- Products Hazard and Completed Operations, Pollution coverage subject to separate annual aggregate limits equal to the policy limit of liability;
- Sudden & Accidental Pollution coverage for all insured perils;
- nil deductible for Bodily Injury;
- maximum deductible all other occurrences of $100,000 per occurrence, except Sudden & Accidental Pollution ($1.0 million each claim);
- no hazardous operations exclusion permitted (i.e. excavation, pile driving, shoring, blasting, under-pinning or demolition);
- owners' and contractors' protective liability;
- blanket written and oral contractual liability;
- contingent employers' liability;
- personal injury liability;
- broad form occurrence property damage; and
- fire fighting expense liability.

Environmental Impairment Liability Insurance

Environmental Insurance insuring Jupiter Hydro Inc., all contractors, subcontractors, suppliers, and tradesmen while working on site, engineers, architects, consultants and subcontractors, Nova Scotia, their successors and assigns and their respective directors, officers, employees, agents and servants.

The insurance shall include the following provisions:

- policy limit of $5 million per occurrence (can be structured as Primary plus Supplementary, Layered or Primary plus Umbrella and/or Excess);

- Claims made form permitted;
- Extended reporting period of 24 months, as required;
- Minimum of 24 months completed operations coverage;
- Cross liability and separation of interest with respect to each Insured;
- Nova Scotia and their respective directors, officers and employees included as Additional Insureds;
- Breach of any of the terms or conditions of the policy, or any negligence or willful act or omission or false representation by an Insured or any other person, shall not invalidate the insurance with respect to Nova Scotia; and
- Primary insurance without right of contribution of any other insurance carried by Nova Scotia.

Marine - Hull & Machinery And P&I (Protection & Indemnity)

Insuring the machinery equipment vessels and other marine property of contractors and subcontractors not insured under any other water craft provisions found in the course of construction policies.

The insurance shall include the following provisions:

- policy limit of liability Hull & Machinery of $5 million per occurrence; and
- Protection & Indemnity (P&I) limit of liability as defined by Canadian Marine Underwriting Standards.

Documentation Required

The general insurance documentation to be produced by Jupiter Hydro Inc shall meet the following requirements. No other documentation is required. For general insurance purposes, Jupiter Hydro Inc, may elect to have separate letters produced for the construction period and the operating phase, or may combine these into one letter from one broker covering both the construction period and the operating phase.

General Insurance – Construction Period

For the general insurance program covering the construction period, Jupiter Hydro Inc must produce by at the latest four months prior to deployment a letter from its insurance broker appointed for the project, on the broker's letterhead, dated and signed by an authorized representative of the insurance broker, stating:

- that the broker has been appointed by Jupiter Hydro Inc. as its insurance broker for the construction period of the Jupiter Hydro Inc tidal energy project;
- that the broker has examined the general insurance requirements included in this document, identified as the Insurance Requirements;

- the estimated total amount of the insurance premiums for the full construction period, including any coverage extension periods beyond completion of Jupiter Hydro Inc tidal energy project and confirming that all of the general insurance requirements set out in the Insurance Requirements have been included in this estimated cost;
- that in the opinion of the broker, the estimated total insurance premium cost is its best estimate as of the date of its letter;
- that in the opinion of the broker, that there is no known impediment as of the date of its letter to producing general insurance policies meeting all of the Insurance Requirements with coverage to take effect from the date of the signing of the Agreement.

If more than one insurance broker has been appointed by Jupiter Hydro Inc with each broker responsible for a portion of the construction period insurance program, each of the brokers shall produce a letter meeting the above requirements. Each of these letters shall clearly identify the elements of the construction period general insurance program that have been assigned to the respective brokers. Each broker's letter will deal solely with the elements of the construction period insurances that have been assigned to it.

General Insurance – Operating Phase

For the general insurance program covering the operating phase, Jupiter Hydro Inc must produce a letter from its insurance broker appointed for the project, on the broker's letterhead, dated and signed by an authorized representative of the insurance broker, stating:

- that the broker has been appointed by Jupiter Hydro Inc as its insurance broker for the operating phase of the Jupiter Hydro Inc tidal energy project;
- that the broker has examined the general insurance requirements included in this document, identified as the Insurance Requirements;
- the estimated total amount of the insurance premiums for the first full year of the operating phase after completion of Jupiter Hydro Inc tidal energy project, and confirming that all of the general insurance requirements set out in the Insurance Requirements have been included in this estimated cost;
- that in the opinion of the broker, the estimated total insurance premium cost is its best estimate as of the date of its letter;
- in the opinion of the broker, that there is no known impediment as of the date of its letter to producing general insurance policies meeting all of the Insurance Requirements with coverage to take effect from the date of the signing of the Agreement.

If more than one insurance broker has been appointed by Jupiter Hydro Inc, with each broker responsible for a part of the operating phase insurance program, each of the brokers shall clearly identify the elements of the operating phase insurance program that have been assigned to the respective brokers. Each broker's letter will deal solely with the elements of the operating phase insurances that have been assigned to it.

NOVA SCOTIA

MARINE RENEWABLE-ELECTRICITY PERMIT

ENERGY PAYMENT

Under section 49A of the *Marine Renewable-energy Act*, where a demonstration permit is issued, the Minister of Energy has the authority to determine the price that the public utility shall procure all electricity under the power purchase agreement.

For energy generated under the Jupiter Hydro Inc. demonstration permit (Permit Number 2019-003), the price to be paid for energy produced shall be $500 per megawatt hour of energy generated.

Derek Mombourquette
Minister

~~June 3/2019~~
Date Signed
July 3/2019

NOVA SCOTIA

MARINE RENEWABLE-ENERGY PERMIT

Province of Nova Scotia
Marine Renewable-energy Act

PERMIT HOLDER:	Jupiter Hydro Inc.
PERMIT NUMBER:	2019-002
EFFECTIVE DATE:	July 3, 2019
EXPIRY DATE:	July 2, 2022

Pursuant to Section 38 of the *Marine Renewable-energy Act*, as amended from time to time, this Permit granted to the Permit Holder is subject to the Terms and Conditions attached to and forming part of this Permit, for the following activity:

Construction, installation, operation and decommissioning of one (1) unconnected generator with an aggregate nameplate capacity of one (1) megawatts at Jupiter Hydro Inc. Permit Area within the Fundy Area of Marine Renewable-electricity Priority.

For greater certainty, the activity authorized under this Permit and its terms and conditions is subject to the *Marine Renewable-energy Act* and its regulations.

Derek Mombourquette
Minister

July 3/2019
Date Signed

NOVA SCOTIA

MARINE RENEWABLE-ENERGY PERMIT

TERMS AND CONDITIONS

Province of Nova Scotia

Marine Renewable-energy Act

PERMIT HOLDER:	Jupiter Hydro Inc.
PERMIT TYPE:	Unconnected Generator
PERMIT NUMBER:	2019-002
EFFECTIVE DATE:	July 3, 2019
EXPIRY DATE:	July 2, 2022

Terms and Conditions of Permit Approval

This approval is subject to the following conditions and obtaining all other necessary approvals, permits or authorizations required by municipal, provincial and federal acts, regulations and by-laws before constructing, installing, operating and decommissioning any device in the Jupiter Hydro Inc. Permit Area.

The following schedules are attached to and form part of this Permit:

- Schedule A – Survey of Jupiter Hydro Inc. Permit Area;
- Schedule B – Technical description submitted in Jupiter Hydro Inc.'s Application Document; and
- Schedule C – Project Plan as submitted by Jupiter Hydro Inc. in their Application Document.

The terms and conditions of this Permit document shall prevail over the Schedules.

Definitions:

"Aggregate Name Plate Capacity" means the maximum installed capacity permitted under the permit of the units forming the Generation Facility;

"Application Document" means the marine renewable-energy permit application submitted by the Permit Holder to the Nova Scotia Department of Energy and Mines and deemed complete on April 8, 2019;

"Jupiter Hydro Inc. Permit Area" or "Permit Area" means the area of submerged land for which the specific location has been determined by survey by the Permit Holder as described in the Application Document and is contained in Schedule A of this Permit;

"Decommissioning, Abandonment and Rehabilitation Plan" means the decommissioning, abandonment and rehabilitation plan required by subsection 44(2) of the *Marine Renewable-energy Act* and provided to the Minister in accordance with Sections 19 and 20 of the *Marine Renewable-energy General Regulations*;

"Deployment" means the placement of a device or associated equipment in position ready for use;

"Generator(s)" as defined in the *Marine Renewable-energy Act*;

"Effective Date" means the date that this Permit is effective, as noted at the head of this document;

"Generation Facility" means one or more device(s) described in the Technical Description and Schedule B, together with all protective and other associated equipment and improvements as may be modified from time to time pursuant to the terms of this Permit;

"Fees Regulations" means the *Marine Renewable-energy Fees Regulations*;

"Minister" means the Minister of Energy and Mines for the Province of Nova Scotia;

"MRE Act" means the *Marine Renewable-energy Act*;

""Permit Holder" means Jupiter Hydro Inc.;

"Program Administrator" means a representative of the Nova Scotia Department of Energy and Mines who has been assigned to receive information on the Department's behalf with respect to this Permit;

"Regulations" means the *Marine Renewable-energy General Regulations*;

"Project Plan" means the project plan attached as Schedule C;

"Socio-economic Matters" include, but are not limited to, issues relating to employment, job-creation, and community relations; and

"Technical Description" means the description contained in Schedule B.

1.0 Scope of Approval

1.1 *Project Details.* This Permit is limited to the project as described in the schedules attached to and forming part of this Permit.

1.2 *Project Technology.* The Permit for the project is limited to the technology as described in the schedules attached to and forming part of this Permit.

1.3 *Permit Area.* The Permit Area is **22.26** hectares as set out in Schedule A. Generator(s) authorized under this Permit shall be constructed, installed and operated within the Permit Area.

1.4 *Development and Operation.* The Permit Holder shall develop and operate the project as described in the Project Plan.

1.5 *Precedence of legislation.* In the event of a conflict between the MRE Act and its regulations and the terms and conditions of this Permit, the MRE Act and its regulations shall prevail.

2.0 General Terms and Conditions

2.1 *Renewal and extension eligibility.* To be eligible to renew the term, the Permit Holder must have fulfilled its obligations under this Permit, MRE Act and its regulations and shall submit and receive written approval of a new project plan for the coming renewed term.

2.2 *Other Approvals, Permits and Authorizations.* This Permit is subject to the terms and conditions herein, and the Permit Holder obtaining and maintaining all other necessary approvals, permits or authorizations under municipal, provincial and federal acts, regulations and by-laws.

3.0 Rent Payments

3.1 The Permit Holder shall pay the first annual rent payment of $1,243.21, no later than sixty (60) days after the Effective Date, and $2,500 on or before January 31 of each subsequent year during the term of the Permit. The rent payment is calculated on the basis of a calendar year and is equal to $48.08 for every week of the Permit and a prorated daily rate (if application).

3.2 Rent payments shall be made payable to the Minister of Finance and are non-refundable.

3.3 If rent is not paid on or before the deadline for payment, the Permit Holder shall pay an additional late fee in an amount equivalent to 10% of the full amount stated in 3.1;

If rent remains in arrears for more than 120 days after the deadline the Minister may suspend the Permit until rent owing is paid in full.

4.0 Term of the Permit

4.1 This Permit is valid for a term of three (3) years from the Effective Date.

5.0 Environmental Monitoring Plan

6.1 The environmental monitoring plan (EMP) must be developed using relevant baseline data and identify appropriate environmental effects indicators. The plan shall consider project effects on, but not limited to, the following:

- fish and lobster;
- marine birds;
- marine mammals;
- acoustics;
- physical oceanography;

- currents and waves; and
- benthic environment.

The EMP shall include contingencies to be implemented as alternative courses of action in the event mitigation and/or monitoring activities cannot be implemented, are not functioning as designed or do not provide expected results.

6.2 Unless otherwise approved, the Permit Holder shall submit an EMP to the Program Administrator for review and approval by the Minister at least thirty (30) days prior to the installation of a generator, cable or other equipment or structure authorized by this Permit.

6.3 The Permit Holder shall update and revise the EMP to reflect best available and economic practices, methods, and technologies respecting environmental monitoring; changes in the Project Plan and circumstances of the project; and changes in the knowledge of, or actual changes in the physical, ecological, and environmental circumstances and impacts of the project.

6.4 The Permit Holder shall submit an initial status report on environmental monitoring equipment functionality to the Program Administrator prior to turbine operation and shall notify the Program Administrator of any malfunction or non-functioning of the equipment within twenty-four (24) hours.

6.5 Environmental effects monitoring reports shall be submitted in writing to the Minister at a schedule to be determined by the Department of Energy and Mines.

6.6 Upon knowledge of serious harm to marine mammals, fish, marine invertebrates, and marine birds, the Permit Holder shall, without unreasonable delay, notify the Program Administrator and the Department of Fisheries and Oceans Canada.

6.0 Engagement Requirements

6.1 *Mi'kmaq Engagement Plan*. The Permit Holder shall not construct or install a generator, cable or other equipment or structure in the Permit Area until the Permit Holder has submitted, and the Minister has approved a Mi'kmaq Engagement Plan. The plan shall outline ongoing and proposed engagement activities with the Mi'kmaq of Nova Scotia and shall include, as a minimum, a description and general schedule of activities under the authority of the Permit. The Permit Holder shall implement the plan

following approval. The plan shall be updated and resubmitted annually to the Minister for approval on or before January 31st throughout the term of this Permit.

6.2 The Permit Holder shall support the Province of Nova Scotia in its future and ongoing consultation processes with the Mi'kmaq of Nova Scotia, share information the Minister considers necessary or advisable, with the Mi'kmaq of Nova Scotia, and consider implementing mitigation and accommodation measures to address any issues raised through consultation.

6.3 *Stakeholder Communication and Engagement Plan.* The Permit Holder shall not install any generator, including any cable or any other equipment or structure owned by the Permit Holder and used or intended to be used with the generator, before submitting a stakeholder communication and engagement plan to the Minister for approval. The plan shall outline ongoing and proposed engagement activities with stakeholders and shall include, as a minimum, a description and general schedule of activities under the authority of the Permit. The Permit Holder shall implement the plan following approval. The plan shall be updated and resubmitted annually to the Minister for approval on or before January 31, throughout the term of this Permit.

7.0 Reporting Requirements

7.1 *Deployment Notice.* The Permit Holder shall notify the Program Administrator at a minimum, thirty (30) days prior to the Deployment or the testing of generator(s) or equipment under the authority of the Permit.

7.2 *Deadlines for Activity Reports.* In accordance with Section 13 of the Regulations, the Permit Holder, throughout the term of the Permit, shall submit quarterly written reports ("Activity Reports") to the Minister detailing the activities carried on under the authority of the Permit:

a. by January 31, for activities between November 1 and January 31;
b. by April 30, for activities between February 1 and April 30;
c. by July 31, for activities between May 1 and July 31; and
d. by October 31, for activities between August 1 and October 31.

7.3 *Content of Activity Reports.* At a minimum, the Activity Reports shall include:

a. Detailed and up-to-date project schedule;
b. Status update on operational aspects of the project;
c. Operational capacity factor for each generator and calculation methodology;
d. Progress updates on the activities outlined in the project schedule;
e. Detailed and up-to-date procurement schedule;
f. Amended procurement deadlines;
g. Summary of any entities procured for goods/services;
h. Financial statements related to procurement, construction, operations, and monitoring activities, with audited financial statements included at least once per calendar year;
i. Data relating to socio-economic matters;
j. Lessons learned deemed beneficial to the sector; and
k. Any changes to the corporate structure of the Permit Holder or its major shareholders, including but not limited to changes of domicile, management, and corporate governance.

7.4 *Press release notification.* The Permit Holder shall notify the Program Administrator at least one (1) business day prior to any press release related to the activities authorized under the Permit.

8.0 Incident Reporting

8.1 The Permit Holder shall provide the Program Administrator, within seventy-two (72) hours, a report of any significant adverse environmental effects, accident or near miss, generator malfunction or impact to human health or safety together with a description of the response.

8.2 The Permit Holder shall notify the Program Administrator in advance of publicly sharing any statements related to an incident or near-miss.

8.3 The Permit Holder shall ensure that:

a. Any incident or near-miss is investigated, its root cause and causal factors identified where possible and corrective action taken where applicable; and
b. Any incident or near-miss is investigated, its root cause, causal factors and corrective action taken must be submitted in writing to the Program Administrator no later than thirty (30) days after the day on which the incident or near-miss occurred.

9.0 Risk Management Plan

9.1 The Permit Holder shall not construct or install a generator, cable or other equipment or structure authorized by this Permit, until the Permit holder has submitted, and the Minister has approved, a Risk Management Plan. The Permit Holder shall implement and adhere to the Risk Management Plan following approval.

9.2 Unless otherwise approved, the Permit Holder shall submit a Risk Management Plan to the Program Administrator for review and approval at least three (3) months prior to construction or installation of a generator, cable or other equipment or structure authorized by this Permit.

9.3 The Risk Management Plan must be developed using relevant project information and shall contain all the information listed in Section 18 of the Regulations.

9.4 The Risk Management Plan shall be updated and resubmitted annually by the Permit Holder to the Minister on or before January 31, throughout the term of the Permit.

10.0 Decommissioning, Abandonment and Rehabilitation Plan

10.1 In accordance with Section 19 of the Regulations, the Permit Holder shall not install a generator, cable or other equipment or structure authorized by this Permit, until the Permit holder has submitted, and the Minister has approved a Decommissioning, Abandonment and Rehabilitation Plan.

10.2 Unless otherwise approved, the Permit Holder shall submit a Decommissioning, Abandonment and Rehabilitation Plan to the Program Administrator for review and approval at least three (3) months prior to taking any action authorized by this Permit.

10.3 The Decommissioning, Abandonment and Rehabilitation Plan shall be developed using relevant project information, shall contain all decommissioning activities, and all of the information listed in Section 20 of the Regulations.

10.4 The Permit Holder shall update and revise the Decommissioning, Abandonment and Rehabilitation Plan to reflect best available and

economic practices, methods, and technology of decommissioning, abandonment and rehabilitation; changes in the Project Plan and circumstances of the project; and changes in the, or knowledge of the, physical, ecological, and environmental circumstances and impacts of the project.

11.0 Financial Security and Insurance

11.1 *Insurance.* The Permit Holder shall provide proof of liability insurance to the satisfaction of the Minister prior to construction or installation of a generator, cable or other equipment or structure authorized by this Permit.

11.2 *Coverage.* The Permit Holder shall maintain its insurance coverage in full force and effect for the term of the Permit.

11.3 The Permit Holder shall provide financial security on terms and conditions acceptable to the Minister and at a minimum, sixty (60) days prior to installation of a generator, cable or other equipment or structure authorized by this Permit.

11.4 The Permit Holder shall ensure that any security provided is kept in effect throughout the Permit term. Unless otherwise required, the Permit Holder shall renew security on an annual basis and provide proof of financial security annually on or before January 31, throughout the term of the Permit.

11.5 Permissible forms of security include:

a. Electronic transfer, cash deposit, or cheques made payable to the Minister of Finance, which the Province in its absolute discretion may cash at any time;
b. Government guaranteed bonds, debentures, term deposits, certificates of deposit, trust certificates or investment certificates assigned to the Minister of Finance; or
c. Irrevocable letters of credit, irrevocable letters of guarantee, performance bonds or surety bonds in a form acceptable to the Minister.

11.6 The Minister may impose additional terms and conditions for this financial security upon review and approval of the Decommissioning, Abandonment and Rehabilitation Plan.

12.0 Performance Requirements

12.1 The Permit Holder is subject to the following performance targets:

a. Capability of deployed generators(s) to be operated and controlled with consistency following installation;
b. Deployed generators operating and being controlled consistently; and
c. Capability of turbines, blades, and other spinning or moving components representing a risk to human or wildlife health of being stopped, halted and braked when and if required.

12.2 The Permit Holder shall provide performance reports to the Program Administrator no later than January 31 of each year through the term of this Permit. At a minimum, the report must include the following for each generator installed:

a. Amount of energy generated;
b. Date(s) energy was generated;
c. Peak generation;
d. Capacity factor achieved and calculation methodology;
e. Number and date(s) of days deployed;
f. Number and date(s) of operating days;
g. Number and date(s) of maintenance days (planned and unscheduled);
h. The type of maintenance required; and,
i. A summary of operational issues impacting energy production or safe operation of the Generation Facility.

13.0 Officer's and Director's Certificates.

13.1 The Permit Holder shall provide an officer's or director's certificate attesting to the truth, accuracy and completeness of any report and submission required under this Permit or attesting to matters of compliance with this Permit.

14.0 Notice to Minister and Program Administrator

14.1 Notice, documents and other information required to be sent to the Minister of the Nova Scotia Department of Energy and Mines, shall be in writing and may be served by personal service or fax, addressed as follows:

Attention: Minister of Energy and Mines

Nova Scotia Department of Energy and Mines
Joseph Howe Building
1690 Hollis Street
Po Box 2664
Halifax, NS B3J 3J9

Phone: (902) 424-4575
Fax: (902) 424-0528

14.2 Notice and/or information required to be sent to the Program Administrator shall be in writing and sent via email to: marinerenewables@novascotia.ca

15.0 Standards

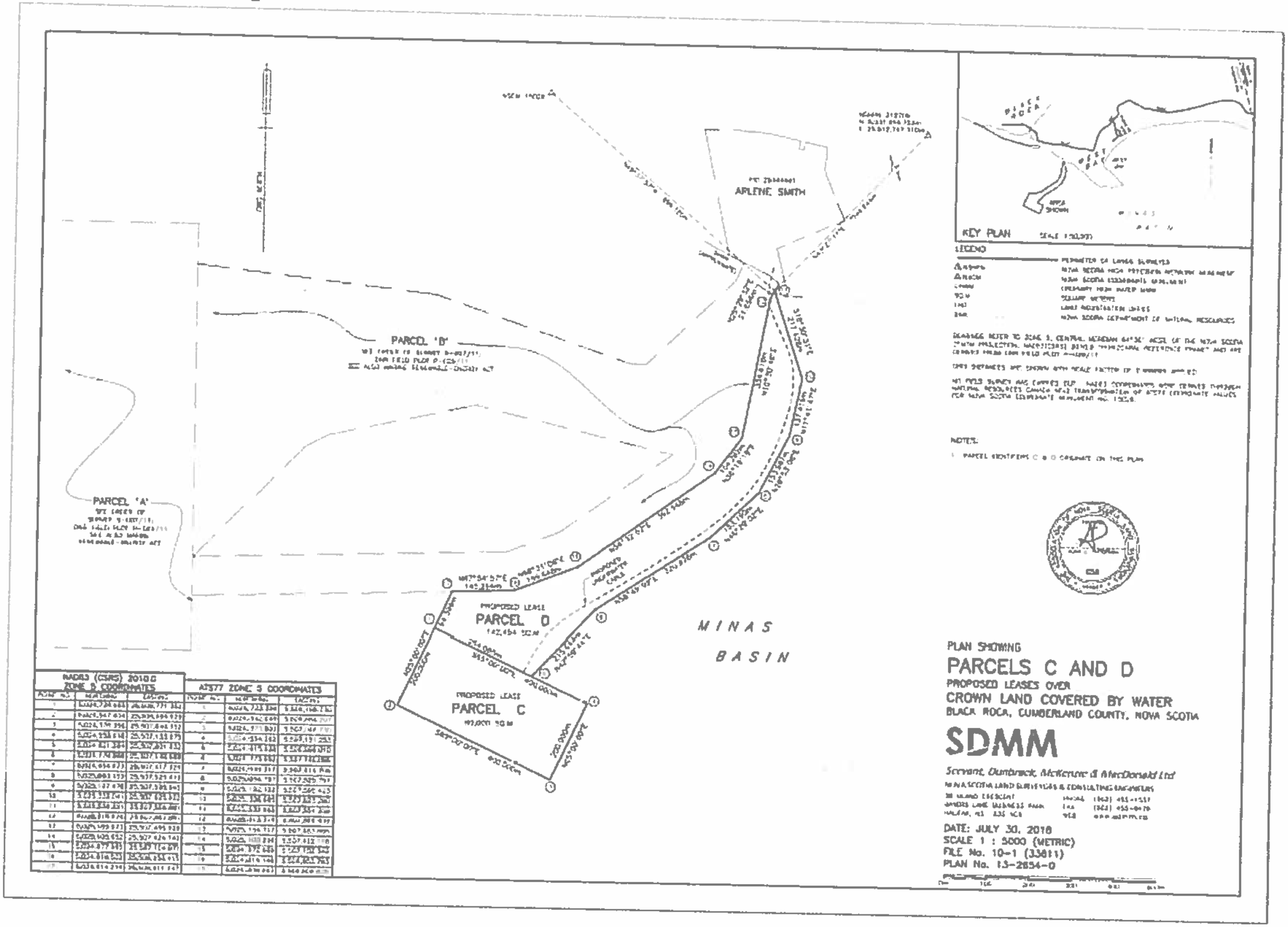
15.1 The Permit Holder must comply with industry standards for marine renewable energy conversion systems as they exist at the time of the issuance of this Permit and as amended, such as, but not limited to the International Electrotechnical Commission (IEC) Technical Committee (TC) 114.

15.2 At a minimum, the Permit Holder shall conduct itself with prudence and due diligence and with appropriate regard for matters of health, safety, and environment.

SCHEDULE A – SURVEY OF JUPITER HYDRO INC. PERMIT AREA

SCHEDULE B – TECHNICAL DESCRIPTION

Schedule A - Location of Proposed Activities



6.0 TECHNICAL COMPONENTS

6.1 Intellectual property - TRL

6.1.1 The Jupiter core technology, utilizing an Archimedes screw (helical turbine or helical screw) is the basis of our deployment technology.

6.1.2 Currently TRL 6, TRL 9 Post deployment.

6.1.3 Patents:

6.1.3.1 Allowed:

6.1.3.1.1 Canada (to be issued under patent # **2,807,876,** pending registration)

6.1.3.2 Issued:

6.1.3.2.1 United States

6.1.3.2.2 European Union

6.1.3.2.3 Australia

6.1.3.2.4 China

6.1.3.2.5 Korea

6.1.3.2.6 New Zealand

6.1.3.2.7 Philippines

6.1.3.2.8 South Africa

6.1.3.2.9 Japan

6.1.3.2.10 Mexico

6.2 Component descriptions

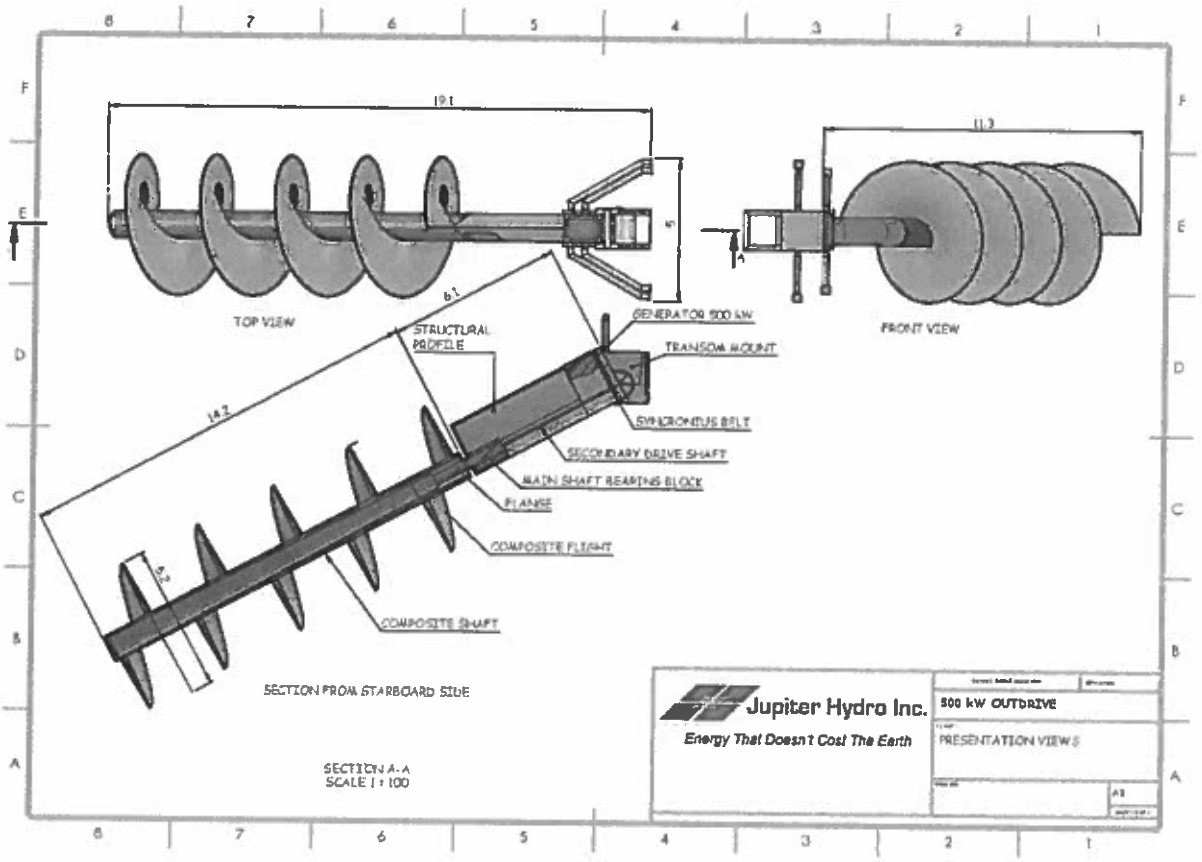
6.2.1 Outdrive

6.2.1.1 Function

The outdrive configuration applies the Jupiter technology in a fashion analogous to marine outboard motors facilitating the attachment of the helical turbine to the transom of an existing barge hull, a modular barge hull or a special purpose hull.

The rotating components, including the generator are all located in a swing arm which pivots on the transom bracket.

Feathering is achieved by trimming the outdrive up from its 30 degree operating angle (where the turbine achieves its maximum efficiency), or by



tilting the unit so the turbine is clear of the water.

6.2.1.1.1 Outdrive drawing

6.2.1.2 Mounting

6.2.1.2.1 The transom bracket mounts to a steel transom plate and, if required, for existing barges, an external load spreading structure.

6.2.1.2.2 Mounting and in particular any load spreading structure is to be determined in

conjunction with a qualified marine surveyor, naval engineer or architect and the prime consultant Hatch, Inc.

6.2.1.3 Bearings

Bearings are off the shelf guide and thrust bearings installed in an on the water serviceable bearing block and split bearing configuration.

6.2.1.4 Power transmission

6.2.1.4.1 A rotating shaft connects the main bearing block and shaft to the belt drive.

6.2.1.4.2 A synchronous belt drive system facilitates adjustment of the gear ratio between the turbine and the generator.

6.2.1.4.3 A hydraulic service brake and mechanical service lock are provided to prevent shaft rotation during servicing.

6.2.1.5 Hydraulic tilt/trim

6.2.1.5.1 Standard marine hydraulics are used to provide 'trim' adjustment between 32 degrees down (maximum operating angle) and 0 degrees; 'lift' adjustment from 0 degrees to 30 degrees up angle facilitates service, anchor load reduction if required, dry-docking or beaching.

6.2.1.5.2 Environmentally friendly hydraulic fluid will be used.

6.2.2 Turbines

The helical turbines are constructed of a composite shaft mated to composite turbine blade sections and chemically bonded into a single unit.

Outdrives are fitted in pairs with counter rotating turbines to facilitate load balancing. The 3200 mm diameter turbines (phase 1A) have a capacity rating of 150 kW each.

In phase 1B these turbines will be replaced with 5500 mm diameter with a capacity rating of 500 kW each. The actual generators have a capacity rating of 500 kW in all phases and will be operated at reduced capacity in phase 1A.

Phase	Turbine capacity rating (each)	Total turbine capacity rating	Generator capacity rating (each)	Total generator capacity rating
1A	150 kW	300 kW	500 kW	1 MW
1B	500 kW	1 MW	500 kW	1 MW
2	500 kW	2 MW	500 kW	2 MW
3	500 kW	2 MW	500 kW	2 MW

The capacity factor for all phases is 30%, reflecting the periodic tidal flow. See 11.4 & 11.5.

6.2.2.1 3200 mm turbine & 5500 mm turbine rotation Under load (2.1 TSR)

Flow rate M/s	Annual hours of flow	RPM 3.2 m turbine 2.1 TSR	RPM 5.5 m turbine 2.1 TSR
-	20.67	0	0
0.1	119.67	1.3	0.7
0.2	141.67	2.5	1.5
0.3	215.83	3.8	2.2
0.4	198.67	5.0	2.9
0.5	183.17	6.3	3.6
0.6	176.67	7.5	4.4
0.7	179.00	8.8	5.1
0.8	185.00	10.0	5.8
0.9	177.17	11.3	6.6
1.0	189.00	12.5	7.3
1.1	185.17	13.8	8.0

1.2	191.33	15.0	8.8
1.3	205.00	16.3	9.5
1.4	204.00	17.5	10.2
1.5	213.17	18.8	10.9
1.6	243.17	20.1	11.7
1.7	257.83	21.3	12.4
1.8	270.83	22.6	13.1
1.9	274.50	23.8	13.9
2.0	282.83	25.1	14.6
2.1	288.00	26.3	15.3
2.2	290.00	27.6	16.0
2.3	302.83	28.8	16.8
2.4	305.33	30.1	17.5
2.5	291.67	31.3	18.2
2.6	278.67	32.6	19.0
2.7	271.33	33.8	19.7
2.8	239.33	35.1	20.4
2.9	228.00	36.3	21.1
3.0	220.17	37.6	21.9
3.1	195.33	38.9	22.6
3.2	200.33	40.1	23.3
3.3	185.50	41.4	24.1
3.4	179.17	42.6	24.8
3.5	175.67	43.9	25.5
3.6	159.17	45.1	26.3
3.7	145.67	46.4	27.0
3.8	114.33	47.6	27.7
3.9	96.00	48.9	28.4
4.0	82.00	50.1	29.2
4.1	69.00	51.4	29.9
4.2	62.67	52.6	30.6

4.3	57.27	53.9	31.4
4.4	50.33	55.1	32.1
4.5	47.00	56.4	32.8
4.6	42.00	57.7	33.5
4.7	31.00	58.9	34.3
4.8	26.67	60.2	35.0
4.9	10.50	61.4	35.7
5.0	0.50	62.7	36.5

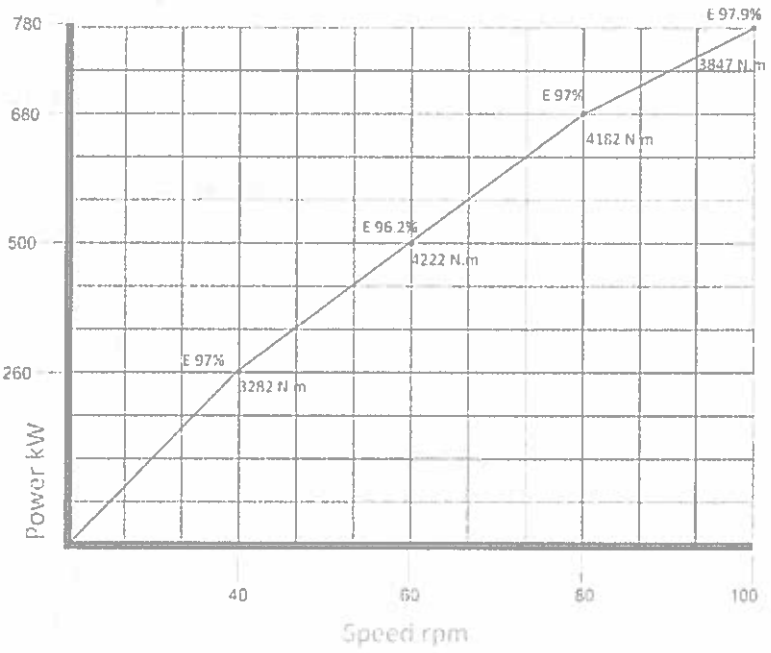
6.2.3 Generator

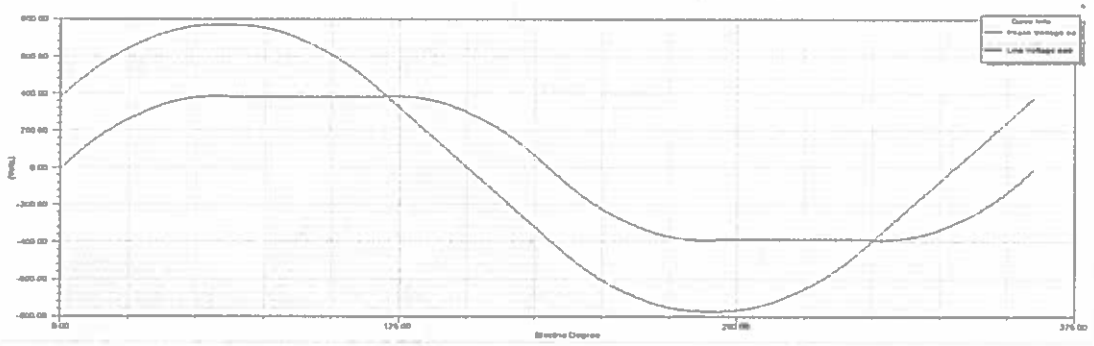
6.2.3.1 2 X 500 kW @ 60RPM permanent magnet variable speed generators 400 VAC, one per outdrive are mounted above the drive shaft. Enerset PMG 500PH or equal. The same generator is used in all phases, operating at reduced capacity in phase 1A.

6.2.3.2 Generator specification

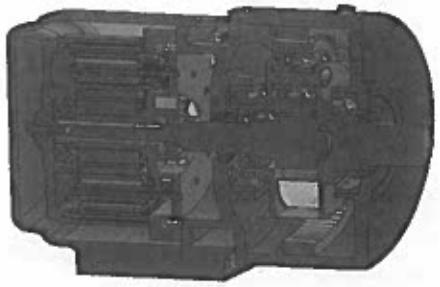
Low speed Permanent Magnet Generator | PMG 500PH

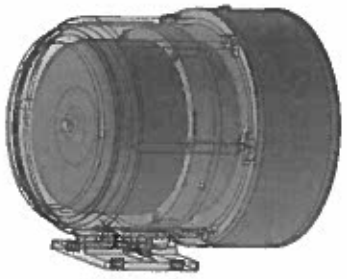
	PMG 500PH
Power [kW]	500
Speed [rpm]	60
Voltage [V]	400
Short Circuit Current [A]	1405
THD	1.22
Power factor	0.93
Weight [kg]	390
Efficiency [100% load]	96.2
Efficiency [75% load]	95.6
Efficiency [50% load]	95.8
Efficiency [25% load]	95
Protection class	IP54
Insulation class	F
Thermal class	B
Torque [N.m]	4222
Cooling	Air-to-liquid





985 mm





530 mm

PMG 500PH

6.2.4 Power conversion

6.2.4.1 The 400VAC generators feed into a hull mounted rectifier/inverter/transformer to transmit 13.6 kV AC power ready to be fed into the grid.

6.2.5 Anchoring buoy and cable riser

6.2.5.1 NB: As a preferred alternate the anchor pivot and cable riser may be incorporated into a hull section.

6.2.5.2 Body

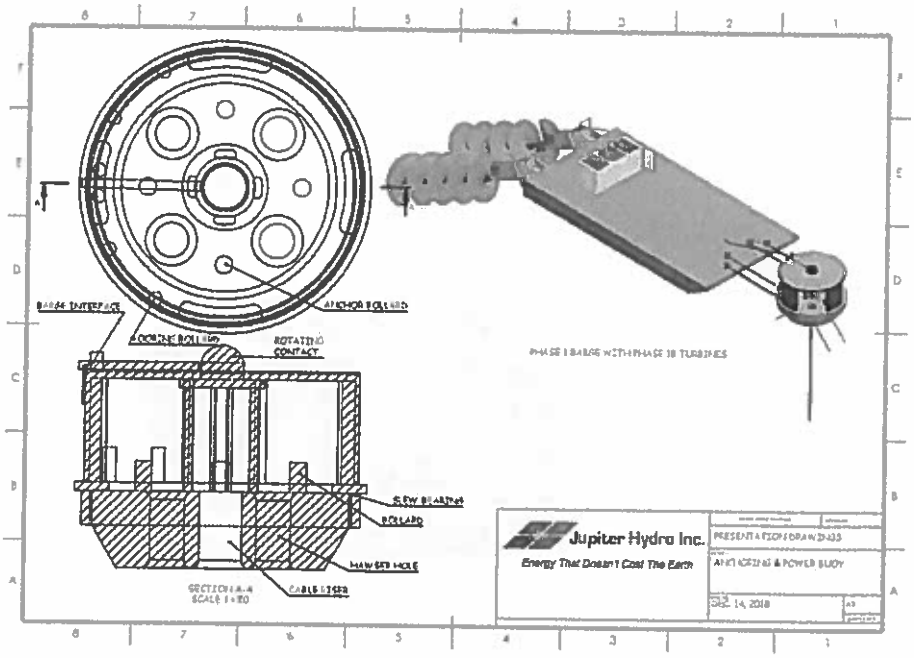
6.2.5.2.1 Typical of Buoy construction, a circular composite or steel float with 4 hawser holes and associated fairleads and bollards.

6.2.5.2.2 Non rotating anchor and cable body

6.2.5.2.3 Central cable hole feeds submarine cable(s) through a parallel bus and into a rotating barge connection.

6.2.5.2.4 Slew bearing transition from non-rotating anchor and cable riser body to rotating mooring and service connection.

6.2.5.2.5 Buoy drawings



6.2.5.3 Anchoring hawser

6.2.5.3.1 600mm reinforced to 200% of single anchor load.

6.2.5.3.2 Fairleads and bollards as required.

6.2.5.4 Cable riser

6.2.5.4.1 Composite wall.

6.2.5.4.2 Minimum cable capacity 3 X 15 kVA cables.

6.2.5.4.3 Cable clamps & bus with disconnect.

6.2.5.5 Rotating barge connection

6.2.5.5.1 4 Conductor rotating interface sized as per final engineering drawings.

6.2.5.5.2 Disconnect at barge and buoy ends.

6.2.5.5.3 Quick connect plug at buoy end.

6.2.5.5.4 Cable clamps and cable carrier.

6.2.6 Submarine cable

6.2.6.1 3C/4.0-15 KV 133% submarine cable.

6.2.6.2 Additional armouring 35M each end.

6.2.7 Hull

6.2.7.1 TBD based on availability.

6.2.7.2 Standard barge hull; steel; additional bracing as required.

6.2.7.3 Hull/buoy design facilitates ease of installation and maintenance with surface connections.

6.2.8 Safety equipment

6.2.8.1 All safety equipment required by regulations to be provided.

6.2.9 Environmental monitoring equipment

A full suite of monitoring equipment will be provided as noted in the Draft Environmental Monitoring Plan.

6.3 Performance characteristics

6.3.1 3200 mm turbine (150 kW each, 300 kW total)

6.3.1.1 Generator performance

Turbine:	Jupiter 3200 X4.5			
# of turbines	**2**			
Diameter	10.50	Feet	3.20	M
Turns	4.50			
Area	13.82	M2 for calculation		
Efficiencies (100% if N/A):				
Turbine		40.00%		
External Gear if requ.		100.00%		
Generator		95.00%		
Rectifier, Inverter and Transformer		97.00%		

Flow rate M/S	Flow rate KMPH	RPM	Torque per shaft (N.m.)	Input Watts per shaft	Net Output Watts
0.50	1.80	4.70	900	354	653
0.70	2.52	6.58	1,763	972	1,791
0.90	3.24	8.46	2,915	2,066	3,808
1.10	3.96	10.34	4,354	3,772	6,952
1.30	4.68	12.22	6,082	6,226	11,475
1.50	5.40	14.10	8,097	9,564	17,627
1.70	6.12	15.98	10,400	13,923	25,660
1.90	6.84	17.86	12,991	19,438	35,824
2.10	7.56	19.74	15,870	26,245	48,369
2.30	8.28	21.62	19,037	34,480	63,547
2.50	9.00	23.50	22,491	44,280	81,608
2.70	9.72	25.38	26,234	55,780	102,803
2.90	10.44	27.26	30,264	69,116	127,382
3.10	11.16	29.14	34,583	84,425	155,596
3.30	11.88	31.02	39,189	101,843	187,696

3.50	12.60	32.90	44,083	121,504	223,932
3.70	13.32	34.78	49,265	143,547	264,556
3.90	14.04	36.66	54,735	168,105	309,818
4.10	14.76	38.54	60,493	195,317	359,968
4.30	15.48	40.42	66,539	225,316	415,258
4.50	16.20	42.30	72,872	258,241	475,938
4.70	16.92	44.18	79,494	294,226	542,259
4.90	17.64	46.06	86,403	333,408	614,471

6.3.2 5500 mm turbine (500 kW each, total 1MW phase 1B, 2 MW phases 2 & 3.

Turbine: Jupiter 5500 X4.5
of turbines 2

Diameter	18.05	Feet	5.50	M
Turns	4.50			
Area	40.84	M2 for calculation		

Efficiencies (100% if N/A):

Turbine	40.00%
External Gear if requ.	100.00%
Generator	95.00%
Rectifier, Inverter and Transformer	97.00%

Flow rate M/S	Flow rate KMPH	RPM	Torque per shaft (N.m.)	Input Watts per shaft	Net Output Watts
0.50	1.80	6.56	4,568	1,046	1,929
0.70	2.52	9.19	8,953	2,871	5,292
0.90	3.24	11.81	14,800	6,103	11,248
1.10	3.96	14.44	22,109	11,143	20,536
1.30	4.68	17.06	30,879	18,393	33,898
1.50	5.40	19.69	41,111	28,254	52,073
1.70	6.12	22.31	52,805	41,130	75,803

1.90	6.84	24.94	65,960	57,421	105,828
2.10	7.56	27.56	80,577	77,530	142,888
2.30	8.28	30.19	96,656	101,858	187,725
2.50	9.00	32.81	114,197	130,808	241,078
2.70	9.72	35.44	133,200	164,780	303,689
2.90	10.44	38.07	153,664	204,177	376,298
3.10	11.16	40.69	175,590	249,401	459,646
3.30	11.88	43.32	198,977	300,853	554,473
3.50	12.60	45.94	223,826	358,936	661,519
3.70	13.32	48.57	250,137	424,051	781,526
3.90	14.04	51.19	277,910	496,600	915,234
4.10	14.76	53.82	307,145	576,985	1,063,383
4.30	15.48	56.44	337,841	665,608	1,226,715
4.50	16.20	59.07	369,999	762,870	1,405,969
4.70	16.92	61.69	403,618	869,174	1,601,887
4.90	17.64	64.32	438,700	984,921	1,815,209

6.4 Anchoring

Anchoring is anticipated to utilize a grid of grouted steel pile anchors.

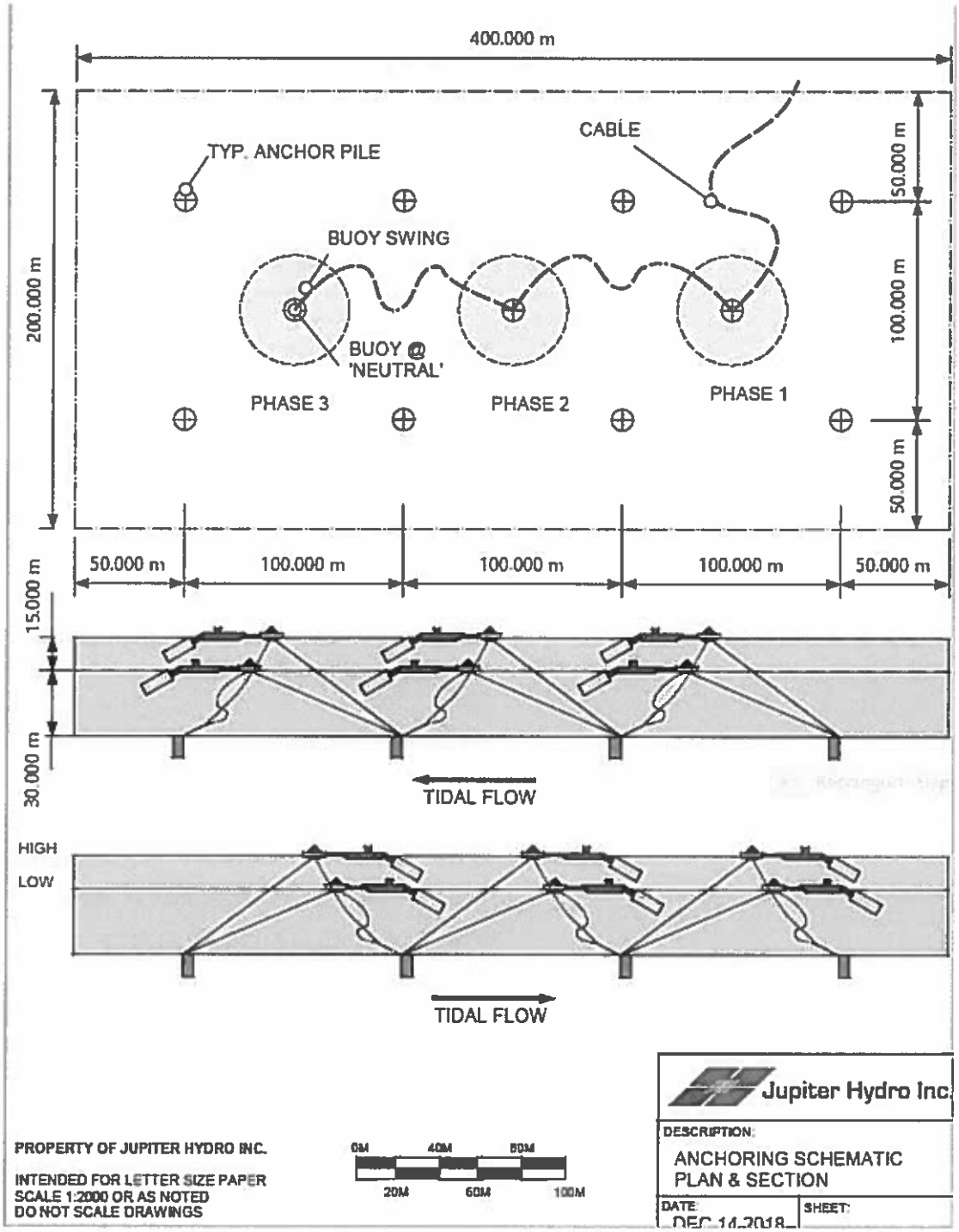
6.4.1 Phase 1

4 anchors to accommodate first platform.

6.4.2 Phases 2 & 3

4 additional anchors to accommodate second two platforms.

6.4.3 Plan and section



6.5 Grid hook up

6.5.1 Description

The submarine cable is semi permanently installed to the anchoring buoys (or integral riser).

6.5.2 Cable specification

15 KV Submarine Cable 3C-4/0

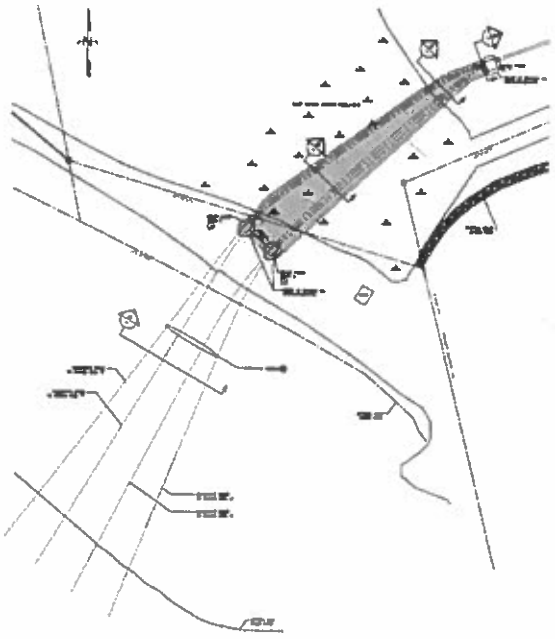
Item	Description	Units	Data
1	Material of Conductor	—	Copper
2	Number of Cores	—	3
3	Nominal Voltages	kV	15KV
4	Conductor size	AWG	4/0
5	Thickness of Conductor Screen	mm	0.6
6	Thickness of XLPE Insulation	mm	5.5
7	Thickness of Insulation Screen	mm	0.7
8	Semi-conductive Water Blocking Tape	mm	0.3
9	Copper Tape Screen	mm	0.1
10	Water Blocking Tape	mm	0.3
11	HDPE Inner Sheath	mm	1.4
12	Filler Material	Water Blocking Filler	
13	Non-woven Tape	mm	0.2
14	PE Bedding	mm	2
15	Single layer of round Galvanized Steel Wire Armour		
	Armour Wire Diameter	mm	3.15
16	Type of Outer Sheath	Black HDPE	
17	Min. Thickness of HDPE Sheath	mm	4
18	Over diameter of the finished Cable	mm	88.2
19	Approximate Weight	Kg/km	11000
20	Calculate DC Resistance at 25°C	Ohm/km	0.167
21	Type of drum	Iron-wooden drums	
22	Applicable Standards	IEC 60502-2 IEC 60228	

6.5.3 Cable landing

6.5.3.1 Jupiter cable corridor is adjacent to the FORCE cable corridor to facilitate access to unused conduit, cable and vault space.

6.5.3.2 Equivalent specification to FORCE landing.

6.5.3.3 FORCE landing drawing



SCHEDULE C – PROJECT PLAN

3.0 PROJECT DESCRIPTION

3.1 This application is for a three stage in-stream tidal demonstration permit totalling 5 MW.

3.1.1 Stage 1A is a 300 kW floating device with twin counter rotating 3200 mm diameter turbines with a length of 4.5 turns (3200 X 0.6 X 4.5 = 8640 mm).

3.1.2 Stage 1B consists of changing out the turbines and replacing them with the larger turbines used in the 1 MW devices (5500 diameter max 5200 mm min subject to performance observations).

3.1.2.1 The device will be carefully examined during the change-over and variance from expected wear or stress will be noted.

3.1.2.2 The 3200 mm turbines will be examined and tested for life cycle costing verification.

3.1.3 Stage two is a 2.0 MW floating device characterized as our production prototype. The device utilizes 4 – 5500 mm diameter turbines mounted on an existing or specially built or modular barge hull.

3.1.4 Stage three is a 2.0 MW production version of the device, and may utilize an existing, specially built or modular barge hull. Stage three device may differ materially from the stage two platform as lessons learned in deployment and operation are applied to the design.

3.2 The technology used is patented by Jupiter Hydro Inc. and can be described as "a helical turbine with a blade pitch equal to 60 percent of the diameter of the turbine and presented to the fluid flow at an angle of 30 degrees".

3.3 The application of the technology is in an 'outdrive' configuration analogous to an outboard motor. This allows the technology to be applied to an existing or custom built platform of sufficient size and strength to withstand the forces generated. The outdrive can be stern or side mounted.

3.4 Grid connection is by way of a 13.8kVA submarine cable routed from the FORCE grid connection vault to the phase 1 device through the cable corridor and distributed to devices 2 & 3 in series.

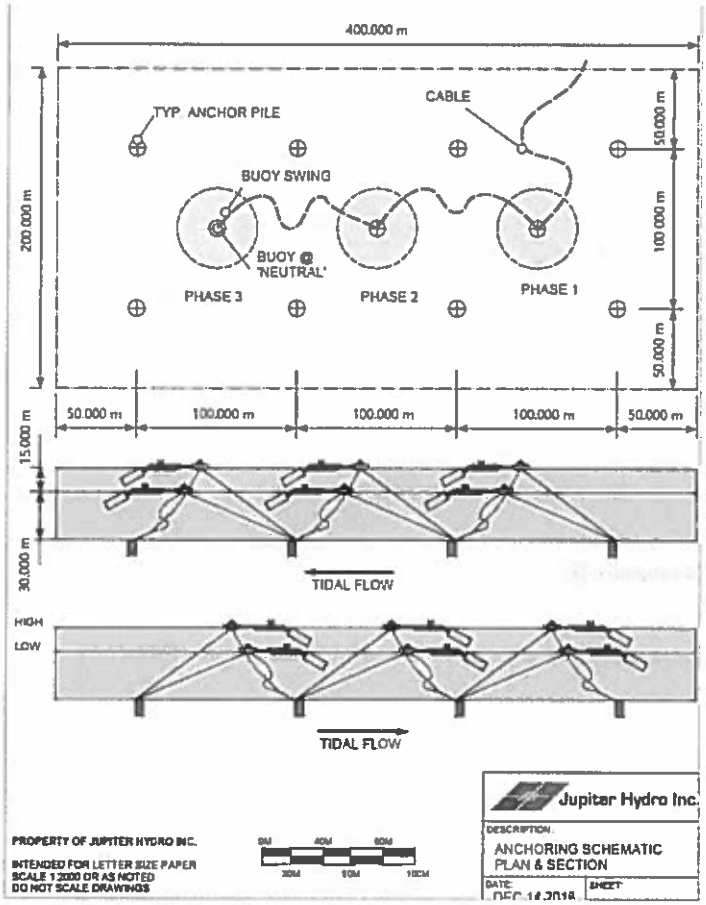
3.5 The anchoring system will utilize a grid of 8 steel piles drilled and grouted into the sea bed.

3.5.1 Each of the platforms will be moored to 4 piles as shown in 3.5.4, with the anchor hawsers connected to a pivoting anchor hawser and cable riser. The pivot will either be in a separate mooring buoy or incorporated into a module of a sectional barge, in which case disconnects will be made by separating the barge modules.

3.5.2 Two anchor hawsers will be under load in each of the flood and ebb tidal phases. The four central most anchors will be under load during both the flood and ebb phases, holding alternate platforms in each phase.

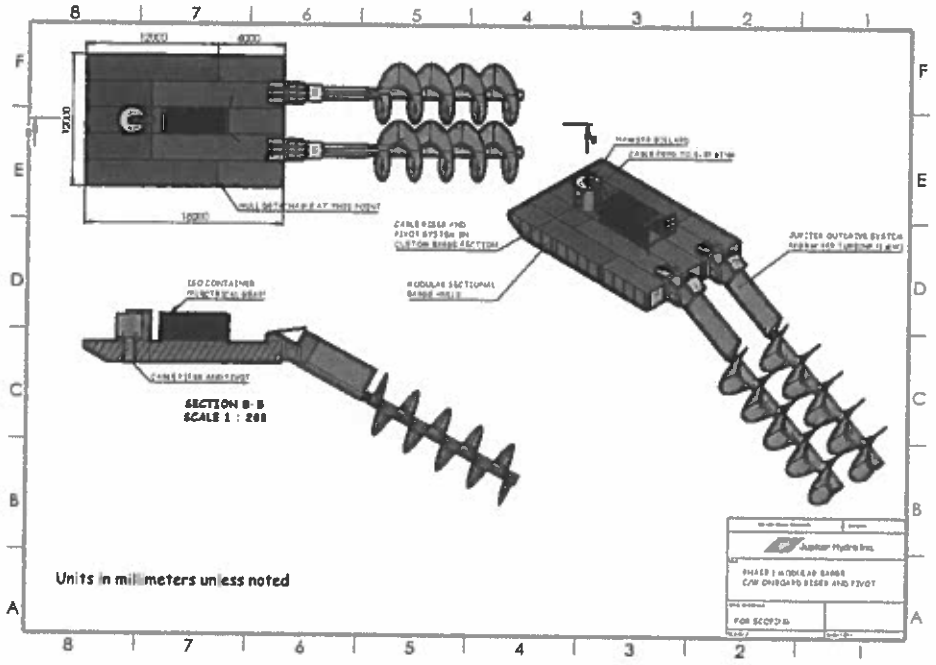
3.5.3 This system provides redundant anchoring. Should a hawser fail 3 additional hawsers are present to maintain the platform in the licensed area until repairs can be made.

3.5.4 Anchoring plan

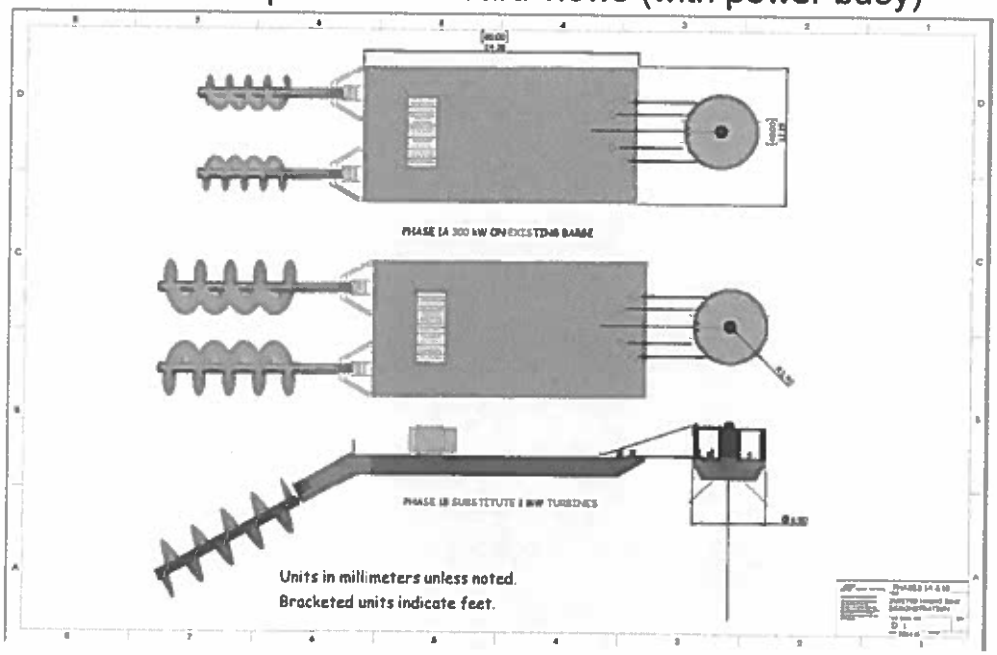


3.5.5 Typical grouted steel anchor pile illustration

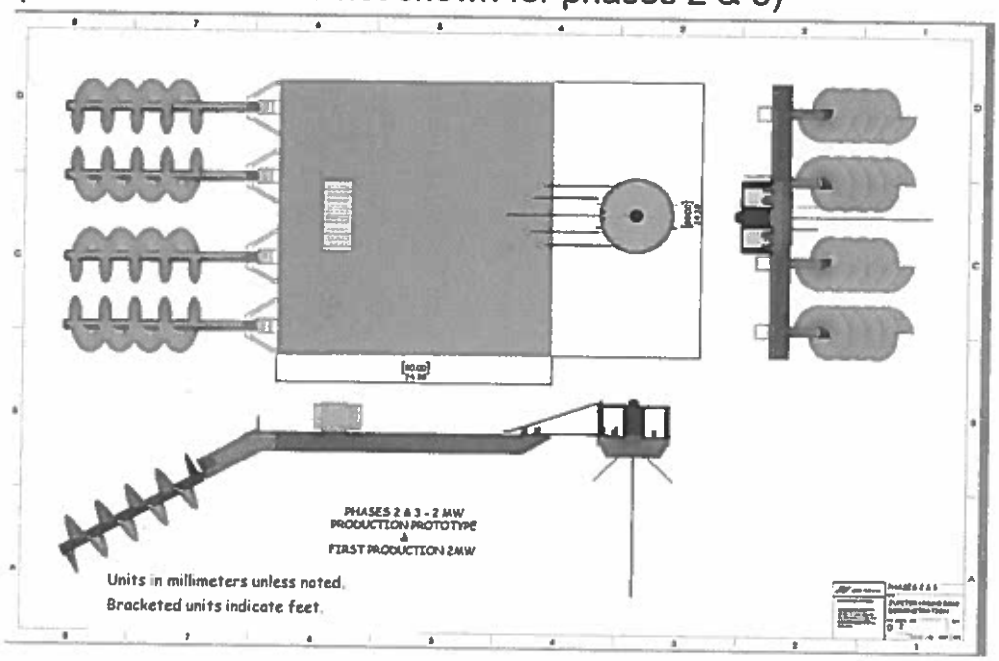
3.6 Phase 1A & 1B with integral mooring pivot (preferred alternate)



3.7 Phase 1A & 1B plan & starboard views (with power buoy)



3.8 Phase 2 & 3 plan & starboard views (with power buoy)
(Preferred alternate not shown for phases 2 & 3)



4.0 SHEDULE OF ACTIVITIES

4.1 The schedule attached has an arbitrary start date of January 15, 2019 and will be adjusted to the actual start date. Date of grid hookup for each phase corresponds to "Grid hookup" or "installation and hookup", tasks 51, 69, 77 & 86.

4.2 Decommissioning and rehabilitation will take place over the 90 days following the end of each PPA.

4.3 Schedule

Simplified schedule showing finish dates only. Full timeline file is attached as "4.0 Jupiter 5mw demonstration project.pod.xml".

ID	Task Name	Finish
1	Phase 1A	Thu 12/26/19 5:00 PM
2	Engineering	Thu 12/26/19 5:00 PM
3	Sub consultant selection	Fri 1/11/19 5:00 PM
4	Finalize specification	Fri 1/18/19 5:00 PM
5	Finalize preliminary drawings	Fri 1/25/19 5:00 PM
6	Finite Element Analysis	Fri 2/8/19 5:00 PM
7	Final composite turbine design	Fri 3/1/19 5:00 PM
8	Working drawings - swing arm	Fri 3/8/19 5:00 PM
9	Working drawings - stern mount	Fri 3/15/19 5:00 PM
10	Working drawings - power transmission	Tue 3/12/19 5:00 PM
11	Working drawings - Electrical	Fri 3/15/19 5:00 PM
12	Working drawings - Hydraulics	Mon 3/18/19 5:00 PM
13	Working drawings - sensors	Tue 3/19/19 5:00 PM
14	Working drawings - buoy	Fri 3/8/19 5:00 PM
15	Existing hull selection	Fri 2/22/19 5:00 PM
16	Existing hull survey	Fri 3/1/19 5:00 PM
17	Working drawings - hull bracing	Fri 3/15/19 5:00 PM
18	Working drawings - subsea cable connection	Fri 3/22/19 5:00 PM
19	Working drawings - anchoring	Fri 4/5/19 5:00 PM
20	Environmental monitoring plan	Fri 4/19/19 5:00 PM
21	Code review	Fri 4/12/19 5:00 PM
22	Contract documents	Wed 4/17/19 5:00 PM
23	Operating manual	Fri 5/3/19 5:00 PM
24	Maintenance manual	Fri 5/3/19 5:00 PM

25	Shop drawings	Wed 5/29/19 5:00 PM
26	Generator dwg	Fri 2/8/19 5:00 PM
27	Steel dwg	Wed 5/29/19 5:00 PM
28	Mold dwg - turbine	Fri 3/22/19 5:00 PM
29	jig dwg - turbine	Fri 3/15/19 5:00 PM
30	shaft dwg - turbine	Fri 3/15/19 5:00 PM
31	Slew bearing dwg	Fri 3/22/19 5:00 PM
32	Power transmission dwg	Tue 4/9/19 5:00 PM
33	Electrical components dwg	Fri 4/12/19 5:00 PM
34	Buoy components dwg	Fri 4/5/19 5:00 PM
35	Misc. component dwg	Wed 5/15/19 5:00 PM
36	Revision cycle	Wed 6/12/19 5:00 PM
37	All drawings	Wed 6/12/19 5:00 PM
38	Fabrication	Wed 9/18/19 5:00 PM
39	Buoy	Wed 7/24/19 5:00 PM
40	Turbine	Wed 8/14/19 5:00 PM
41	Swing arm & bracket	Wed 6/26/19 5:00 PM
42	Hull bracing	Wed 6/26/19 5:00 PM
43	Hull modification	Wed 8/7/19 5:00 PM
44	Final assembly & Commissioning	Wed 9/18/19 5:00 PM
45	Deployment	Tue 8/20/19 5:00 PM
46	Anchoring	Wed 7/31/19 5:00 PM
47	Setting Buoy	Fri 8/2/19 5:00 PM
48	Submarine cable	Fri 8/9/19 5:00 PM
49	Hookup	Mon 8/12/19 5:00 PM
50	Initial testing	Mon 8/19/19 5:00 PM
51	Grid connection	Tue 8/20/19 5:00 PM
52	Operating evaluation	Thu 12/26/19 5:00 PM
53	Test with 3.2m turbines	Tue 12/24/19 5:00 PM
54	Design evaluation & force validation	Wed 12/25/19 5:00 PM
55	Economic evaluation	Wed 12/25/19 5:00 PM
56	R & M preliminary review	Wed 12/25/19 5:00 PM
57	Environmental summary	Wed 12/25/19 5:00 PM
58	Design change recommendations	Thu 12/26/19 5:00 PM
59	Phase 1B	Thu 6/4/20 5:00 PM
60	Engineering	Thu 1/9/20 5:00 PM
61	Turbine and mold for 4.5m turbine	Thu 1/9/20 5:00 PM
62	Fabrication	Thu 3/12/20 5:00 PM
63	Deployment	Thu 1/30/20 5:00 PM

64	Unhook & Transit to shipyard	Fri 1/10/20 5:00 PM
65	Remove turbines and perform in depth maintenance and wear checking	Fri 1/17/20 5:00 PM
66	Install new turbines	Wed 1/22/20 5:00 PM
67	Tow and hookup	Thu 1/23/20 5:00 PM
68	Initial testing	Wed 1/29/20 5:00 PM
69	Grid connection	Thu 1/30/20 5:00 PM
70	Operating evaluation	Thu 6/4/20 5:00 PM
71	Phase 2 - 2 MW prototype	Mon 2/22/21 5:00 PM
72	Engineering revisions	Thu 7/2/20 5:00 PM
73	Fabrication Buoy	Thu 8/27/20 5:00 PM
74	Barge acquisition and modifications	Thu 9/24/20 5:00 PM
75	Anchoring and set buoy	Thu 9/3/20 5:00 PM
76	Final assembly	Thu 10/8/20 5:00 PM
77	Installation and hookup	Mon 10/12/20 5:00 PM
78	Initial testing	Mon 10/19/20 5:00 PM
79	Operating evaluation	Mon 2/22/21 5:00 PM
80	Phase 3 - 2 MW production version	Wed 11/10/21 5:00 PM
81	Engineering revisions	Mon 3/22/21 5:00 PM
82	Fabrication Buoy	Mon 5/17/21 5:00 PM
83	Barge acquisition and modifications	Mon 6/14/21 5:00 PM
84	Anchoring and set buoy	Wed 5/19/21 5:00 PM
85	Final assembly	Mon 6/28/21 5:00 PM
86	Installation and hookup	Wed 6/30/21 5:00 PM
87	Initial testing	Wed 7/7/21 5:00 PM
88	Operating evaluation	Wed 11/10/21 5:00 PM

6.0 TECHNICAL COMPONENTS

6.1 Intellectual property - TRL

6.1.1 The Jupiter core technology, utilizing an Archimedes screw (helical turbine or helical screw) is the basis of our deployment technology.

6.1.2 Currently TRL 6, TRL 9 Post deployment.

6.1.3 Patents:

6.1.3.1 Allowed:

6.1.3.1.1 Canada (to be issued under patent **# 2,807,876,** pending registration)

6.1.3.2 Issued:

6.1.3.2.1 United States

6.1.3.2.2 European Union

6.1.3.2.3 Australia

6.1.3.2.4 China

6.1.3.2.5 Korea

6.1.3.2.6 New Zealand

6.1.3.2.7 Philippines

6.1.3.2.8 South Africa

6.1.3.2.9 Japan

6.1.3.2.10 Mexico

6.2 Component descriptions

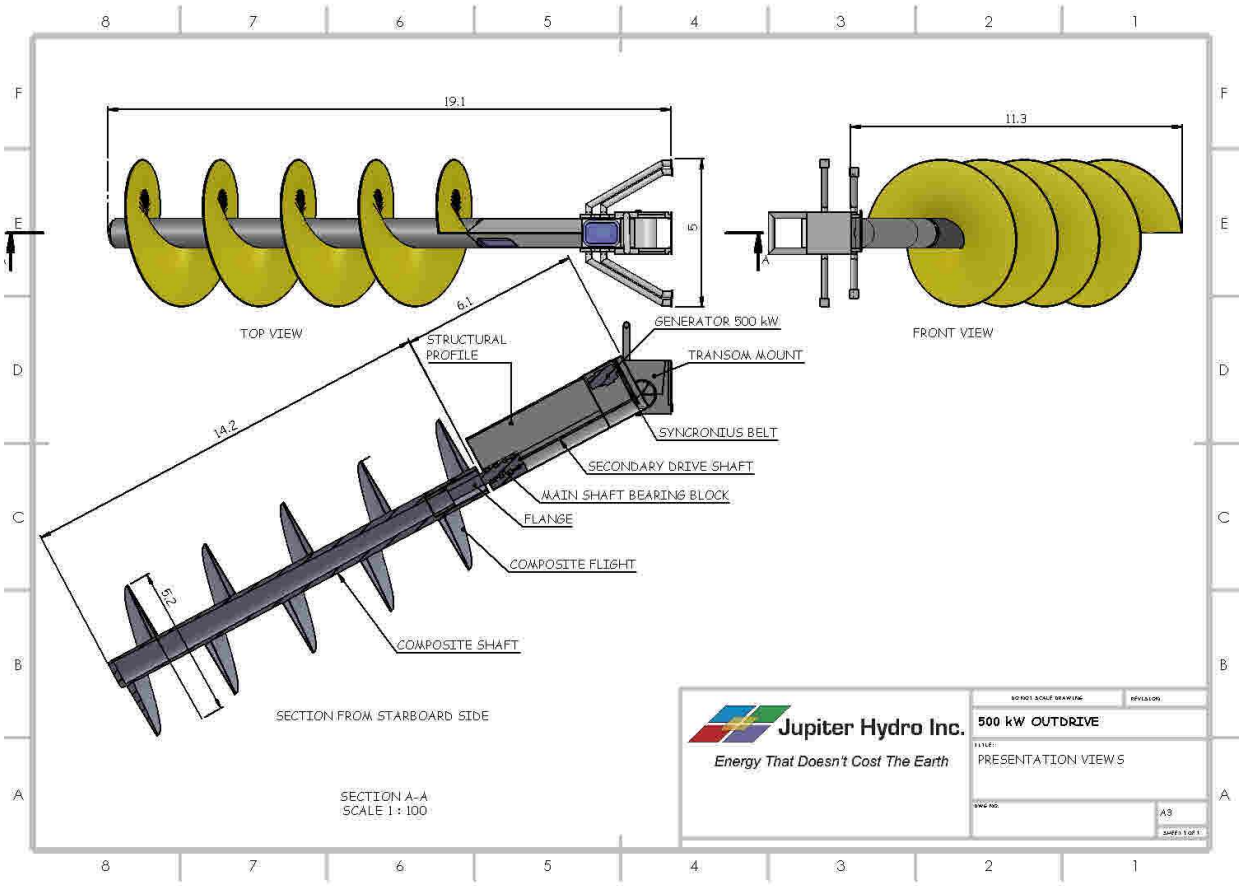
6.2.1 Outdrive

6.2.1.1 Function

The outdrive configuration applies the Jupiter technology in a fashion analogous to marine outboard motors facilitating the attachment of the helical turbine to the transom of an existing barge hull, a modular barge hull or a special purpose hull.

The rotating components, including the generator are all located in a swing arm which pivots on the transom bracket.

Feathering is achieved by trimming the outdrive up from its 30 degree operating angle (where the turbine achieves its maximum efficiency), or by



tilting the unit so the turbine is clear of the water.

6.2.1.1.1 Outdrive drawing

6.2.1.2 Mounting

6.2.1.2.1 The transom bracket mounts to a steel transom plate and, if required, for existing barges, an external load spreading structure.

6.2.1.2.2 Mounting and in particular any load spreading structure is to be determined in

conjunction with a qualified marine surveyor, naval engineer or architect and the prime consultant Hatch, Inc.

6.2.1.3 Bearings

Bearings are off the shelf guide and thrust bearings installed in an on the water serviceable bearing block and split bearing configuration.

6.2.1.4 Power transmission

6.2.1.4.1 A rotating shaft connects the main bearing block and shaft to the belt drive.

6.2.1.4.2 A synchronous belt drive system facilitates adjustment of the gear ratio between the turbine and the generator.

6.2.1.4.3 A hydraulic service brake and mechanical service lock are provided to prevent shaft rotation during servicing.

6.2.1.5 Hydraulic tilt/trim

6.2.1.5.1 Standard marine hydraulics are used to provide ‘trim’ adjustment between 32 degrees down (maximum operating angle) and 0 degrees; ‘lift’ adjustment from 0 degrees to 30 degrees up angle facilitates service, anchor load reduction if required, dry-docking or beaching.

6.2.1.5.2 Environmentally friendly hydraulic fluid will be used.

6.2.2 Turbines

The helical turbines are constructed of a composite shaft mated to composite turbine blade sections and chemically bonded into a single unit.

Outdrives are fitted in pairs with counter rotating turbines to facilitate load balancing. The 3200 mm diameter turbines (phase 1A) have a capacity rating of 150 kW each.

In phase 1B these turbines will be replaced with 5500 mm diameter with a capacity rating of 500 kW each. The actual generators have a capacity rating of 500 kW in all phases and will be operated at reduced capacity in phase 1A.

Phase	Turbine capacity rating (each)	Total turbine capacity rating	Generator capacity rating (each)	Total generator capacity rating
1A	150 kW	300 kW	500 kW	1 MW
1B	500 kW	1 MW	500 kW	1 MW
2	500 kW	2 MW	500 kW	2 MW
3	500 kW	2 MW	500 kW	2 MW

The capacity factor for all phases is 30%, reflecting the periodic tidal flow. See 11.4 & 11.5.

6.2.2.1 3200 mm turbine & 5500 mm turbine rotation Under load (2.1 TSR)

Flow rate M/s	Annual hours of flow	RPM 3.2 m turbine 2.1 TSR	RPM 5.5 m turbine 2.1 TSR
-	20.67	0	0
0.1	119.67	1.3	0.7
0.2	141.67	2.5	1.5
0.3	215.83	3.8	2.2
0.4	198.67	5.0	2.9
0.5	183.17	6.3	3.6
0.6	176.67	7.5	4.4
0.7	179.00	8.8	5.1
0.8	185.00	10.0	5.8
0.9	177.17	11.3	6.6
1.0	189.00	12.5	7.3
1.1	185.17	13.8	8.0

1.2	191.33	15.0	8.8
1.3	205.00	16.3	9.5
1.4	204.00	17.5	10.2
1.5	213.17	18.8	10.9
1.6	243.17	20.1	11.7
1.7	257.83	21.3	12.4
1.8	270.83	22.6	13.1
1.9	274.50	23.8	13.9
2.0	282.83	25.1	14.6
2.1	288.00	26.3	15.3
2.2	290.00	27.6	16.0
2.3	302.83	28.8	16.8
2.4	305.33	30.1	17.5
2.5	291.67	31.3	18.2
2.6	278.67	32.6	19.0
2.7	271.33	33.8	19.7
2.8	239.33	35.1	20.4
2.9	228.00	36.3	21.1
3.0	220.17	37.6	21.9
3.1	195.33	38.9	22.6
3.2	200.33	40.1	23.3
3.3	185.50	41.4	24.1
3.4	179.17	42.6	24.8
3.5	175.67	43.9	25.5
3.6	159.17	45.1	26.3
3.7	145.67	46.4	27.0
3.8	114.33	47.6	27.7
3.9	96.00	48.9	28.4
4.0	82.00	50.1	29.2
4.1	69.00	51.4	29.9
4.2	62.67	52.6	30.6

4.3	57.27	53.9	31.4
4.4	50.33	55.1	32.1
4.5	47.00	56.4	32.8
4.6	42.00	57.7	33.5
4.7	31.00	58.9	34.3
4.8	26.67	60.2	35.0
4.9	10.50	61.4	35.7
5.0	0.50	62.7	36.5

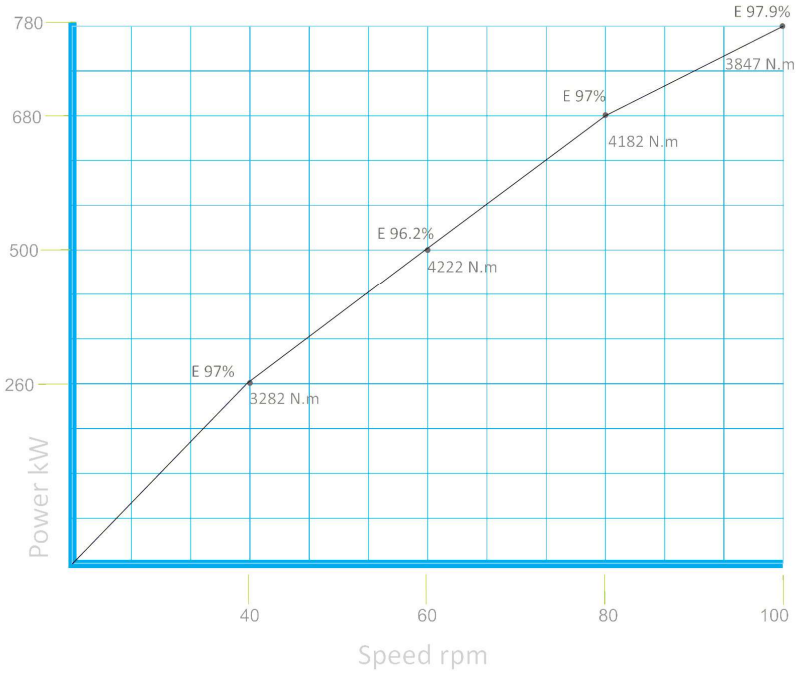
6.2.3 Generator

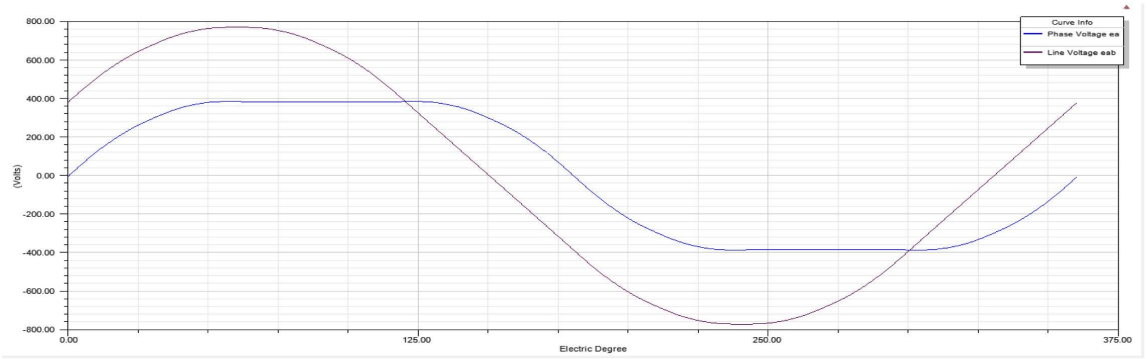
6.2.3.1 2 X 500 kW @ 60RPM permanent magnet variable speed generators 400 VAC, one per outdrive are mounted above the drive shaft. Enerset PMG 500PH or equal. The same generator is used in all phases, operating at reduced capacity in phase 1A.

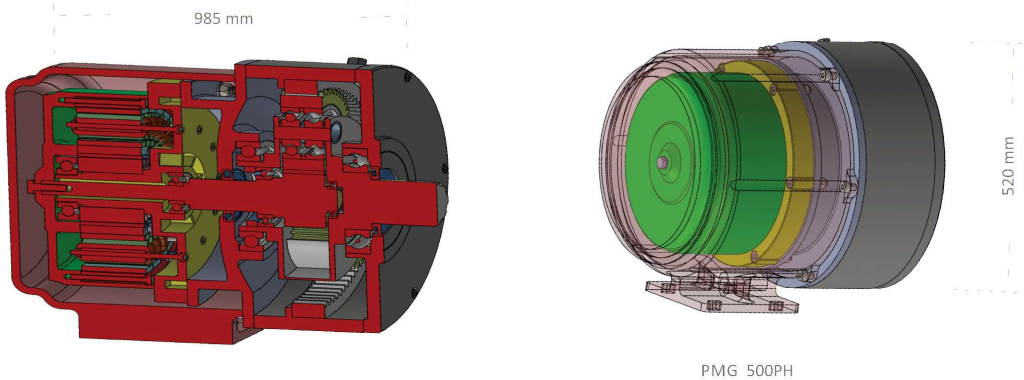
6.2.3.2 Generator specification

Low speed Permanent Magnet Generator | **PMG 500PH**

	PMG 500PH
Power [kW]	500
Speed [rpm]	60
Voltage [V]	400
Short Circuit Current [A]	1405
THD	1.22
Power factor	0.93
Weight [kg]	390
Efficiency [100% load]	96.2
Efficiency [75% load]	95.6
Efficiency [50% load]	95.8
Efficiency [25% load]	95
Protection class	IP54
Insulation class	F
Thermal class	B
Torque [N.m]	4222
Cooling	Air-to-liquid







PMG 500PH

6.2.4 Power conversion

6.2.4.1 The 400VAC generators feed into a hull mounted rectifier/inverter/transformer to transmit 13.6 kV AC power ready to be fed into the grid.

6.2.5 Anchoring buoy and cable riser

6.2.5.1 NB: As a preferred alternate the anchor pivot and cable riser may be incorporated into a hull section.

6.2.5.2 Body

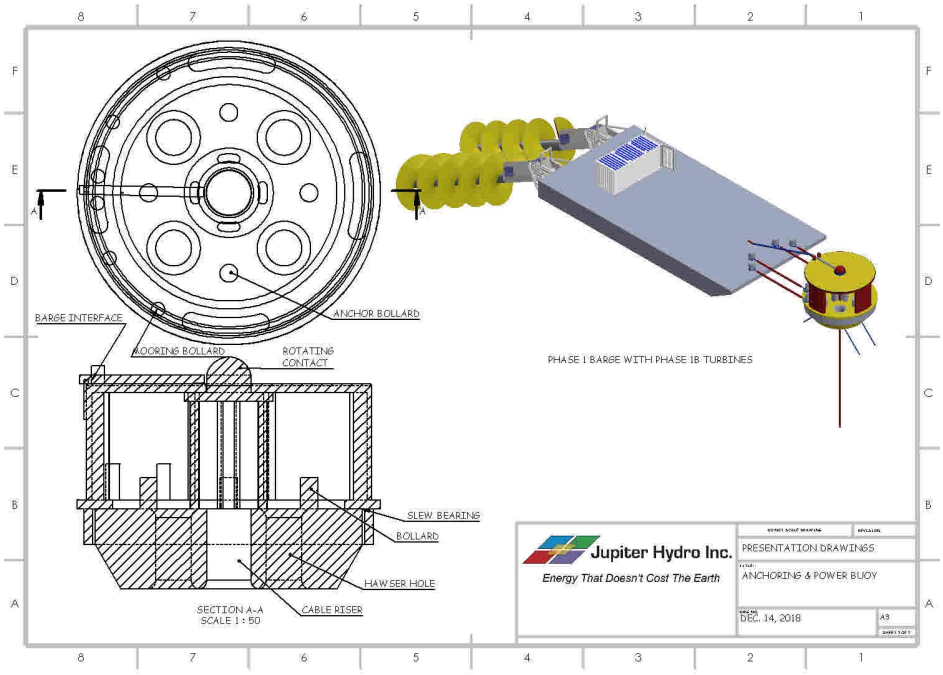
6.2.5.2.1 Typical of Buoy construction, a circular composite or steel float with 4 hawser holes and associated fairleads and bollards.

6.2.5.2.2 Non rotating anchor and cable body

6.2.5.2.3 Central cable hole feeds submarine cable(s) through a parallel bus and into a rotating barge connection.

6.2.5.2.4 Slew bearing transition from non-rotating anchor and cable riser body to rotating mooring and service connection.

6.2.5.2.5 Buoy drawings



6.2.5.3 Anchoring hawser

6.2.5.3.1 600mm reinforced to 200% of single anchor load.

6.2.5.3.2 Fairleads and bollards as required.

6.2.5.4 Cable riser

6.2.5.4.1 Composite wall.

6.2.5.4.2 Minimum cable capacity 3 X 15 kVA cables.

6.2.5.4.3 Cable clamps & bus with disconnect.

6.2.5.5 Rotating barge connection

6.2.5.5.1 4 Conductor rotating interface sized as per final engineering drawings.

6.2.5.5.2 Disconnect at barge and buoy ends.

6.2.5.5.3 Quick connect plug at buoy end.

6.2.5.5.4 Cable clamps and cable carrier.

6.2.6 Submarine cable

6.2.6.1 3C/4.0-15 KV 133% submarine cable.

6.2.6.2 Additional armouring 35M each end.

6.2.7 Hull

6.2.7.1 TBD based on availability.

6.2.7.2 Standard barge hull; steel; additional bracing as required.

6.2.7.3 Hull/buoy design facilitates ease of installation and maintenance with surface connections.

6.2.8 Safety equipment

6.2.8.1 All safety equipment required by regulations to be provided.

6.2.9 Environmental monitoring equipment

A full suite of monitoring equipment will be provided as noted in the Draft Environmental Monitoring Plan.

6.3 Performance characteristics

6.3.1 3200 mm turbine (150 kW each, 300 kW total)

6.3.1.1 Generator performance

Turbine:	Jupiter 3200 X4.5			
# of turbines	**2**			
Diameter	10.50	Feet	3.20	M
Turns	4.50			
Area	13.82	M2 for calculation		
Efficiencies (100% if N/A):				
Turbine		40.00%		
External Gear if requ.		100.00%		
Generator		95.00%		
Rectifier, Inverter and Transformer		97.00%		

Flow rate M/S	Flow rate KMPH	RPM	Torque per shaft (N.m.)	Input Watts per shaft	Net Output Watts
0.50	1.80	4.70	900	354	653
0.70	2.52	6.58	1,763	972	1,791
0.90	3.24	8.46	2,915	2,066	3,808
1.10	3.96	10.34	4,354	3,772	6,952
1.30	4.68	12.22	6,082	6,226	11,475
1.50	5.40	14.10	8,097	9,564	17,627
1.70	6.12	15.98	10,400	13,923	25,660
1.90	6.84	17.86	12,991	19,438	35,824
2.10	7.56	19.74	15,870	26,245	48,369
2.30	8.28	21.62	19,037	34,480	63,547
2.50	9.00	23.50	22,491	44,280	81,608
2.70	9.72	25.38	26,234	55,780	102,803
2.90	10.44	27.26	30,264	69,116	127,382
3.10	11.16	29.14	34,583	84,425	155,596
3.30	11.88	31.02	39,189	101,843	187,696

3.50	12.60	32.90	44,083	121,504	223,932
3.70	13.32	34.78	49,265	143,547	264,556
3.90	14.04	36.66	54,735	168,105	309,818
4.10	14.76	38.54	60,493	195,317	359,968
4.30	15.48	40.42	66,539	225,316	415,258
4.50	16.20	42.30	72,872	258,241	475,938
4.70	16.92	44.18	79,494	294,226	542,259
4.90	17.64	46.06	86,403	333,408	614,471

6.3.2 5500 mm turbine (500 kW each, total 1MW phase 1B, 2 MW phases 2 & 3.

Turbine: Jupiter 5500 X4.5
of turbines **2**

Diameter	18.05	Feet	5.50	M
Turns	4.50			
Area	40.84	M2 for calculation		

Efficiencies (100% if N/A):

Turbine	40.00%
External Gear if requ.	100.00%
Generator	95.00%
Rectifier, Inverter and Transformer	97.00%

Flow rate M/S	Flow rate KMPH	RPM	Torque per shaft (N.m.)	Input Watts per shaft	Net Output Watts
0.50	1.80	6.56	4,568	1,046	1,929
0.70	2.52	9.19	8,953	2,871	5,292
0.90	3.24	11.81	14,800	6,103	11,248
1.10	3.96	14.44	22,109	11,143	20,536
1.30	4.68	17.06	30,879	18,393	33,898
1.50	5.40	19.69	41,111	28,254	52,073
1.70	6.12	22.31	52,805	41,130	75,803

1.90	6.84	24.94	65,960	57,421	105,828
2.10	7.56	27.56	80,577	77,530	142,888
2.30	8.28	30.19	96,656	101,858	187,725
2.50	9.00	32.81	114,197	130,808	241,078
2.70	9.72	35.44	133,200	164,780	303,689
2.90	10.44	38.07	153,664	204,177	376,298
3.10	11.16	40.69	175,590	249,401	459,646
3.30	11.88	43.32	198,977	300,853	554,473
3.50	12.60	45.94	223,826	358,936	661,519
3.70	13.32	48.57	250,137	424,051	781,526
3.90	14.04	51.19	277,910	496,600	915,234
4.10	14.76	53.82	307,145	576,985	1,063,383
4.30	15.48	56.44	337,841	665,608	1,226,715
4.50	16.20	59.07	369,999	762,870	1,405,969
4.70	16.92	61.69	403,618	869,174	1,601,887
4.90	17.64	64.32	438,700	984,921	1,815,209

6.4 Anchoring

Anchoring is anticipated to utilize a grid of grouted steel pile anchors.

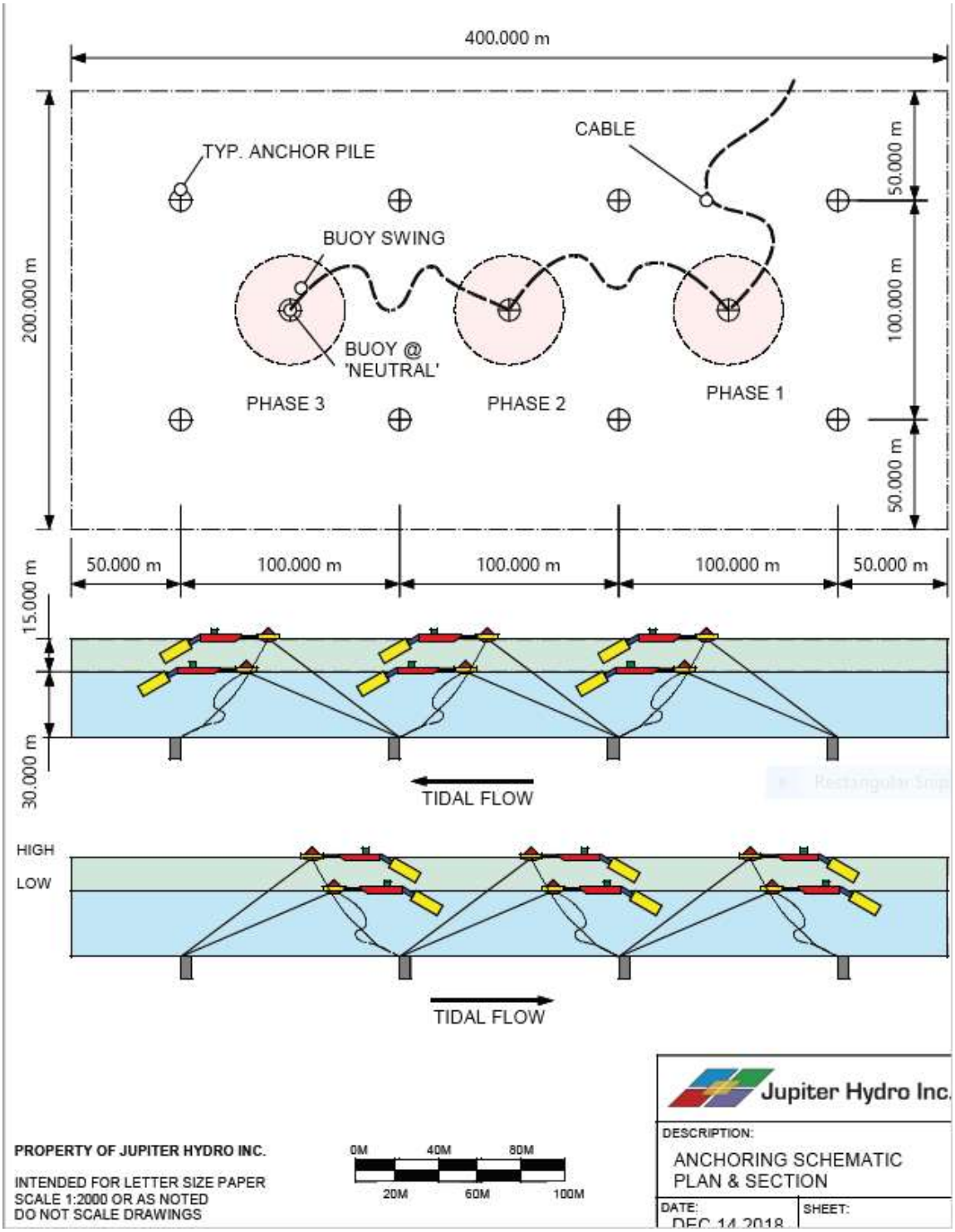
6.4.1 Phase 1

4 anchors to accommodate first platform.

6.4.2 Phases 2 & 3

4 additional anchors to accommodate second two platforms.

6.4.3 Plan and section



6.5 Grid hook up

6.5.1 Description

The submarine cable is semi permanently installed to the anchoring buoys (or integral riser).

6.5.2 Cable specification

15 KV Submarine Cable 3C-4/0

Item	Description	Units	Data
1	Material of Conductor	---	Copper
2	Number of Cores	---	3
3	Nominal Voltages	kV	15KV
4	Conductor size	AWG	4/0
5	Thickness of Conductor Screen	mm	0.6
6	Thickness of XLPE Insulation	mm	5.5
7	Thickness of Insulation Screen	mm	0.7
8	Semi-conductive Water Blocking Tape	mm	0.3
9	Copper Tape Screen	mm	0.1
10	Water Blocking Tape	mm	0.3
11	HDPE Inner Sheath	mm	1.4
12	Filler Material	Water Blocking Filler	
13	Non-woven Tape	mm	0.2
14	PE Bedding	mm	2
15	Single layer of round Galvanized Steel Wire Armour		
	Armour Wire Diameter	mm	3.15
16	Type of Outer Sheath	Black HDPE	
17	Min. Thickness of HDPE Sheath	mm	4
18	Over diameter of the finished Cable	mm	88.2
19	Approximate Weight	Kg/km	11000
20	Calculate DC Resistance at 25°C	Ohm/km	0.167
21	Type of drum	Iron-wooden drums	
22	Applicable Standards	IEC 60502-2 IEC 60228	

6.5.3 Cable landing

6.5.3.1 Jupiter cable corridor is adjacent to the FORCE cable corridor to facilitate access to unused conduit, cable and vault space.

6.5.3.2 Equivalent specification to FORCE landing.

6.5.3.3 FORCE landing drawing