

**ENVIRONMENTAL MANAGEMENT PLAN FOR MACQUARIE HARBOUR SALMONID
AQUACULTURE – WASTE MANAGEMENT
Rev 4 – September 20th 2017**

PART A – PROPONENT INFORMATION

Tassal is a publicly listed fish farming company established in Tasmania in 1986, and is the proponent for this activity. Tassal's company registered address is:

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The contact person for this project is:

Mark Ryan
MD and CEO

Tassal is a publicly listed company on the Australian Stock Exchange and formally releases financial results every six months. The most recent financial results published were for the six months ended 30 June 2017 and can be obtained from the ASX web address www.asx.com.au.

PART B – PROPOSAL/PROJECT INFORMATION

1.0 Objective of the project

The objectives for treatment of under pen fish waste are:

1. Separation of under pen waste sludge into biosolids & filtrate
2. Minimise all risk to the environment, salmon stock and stakeholders

Tassal have previous approval for capture and collection of under pen waste from marine farming leases within Macquarie Harbour. Waste capture has been successfully implemented since June 2017.

This associated EMP is for treatment of raw waste sludge, onboard a dedicated vessel, onsite at the marine farm. The waste treatment is aimed at separating the raw sludge into a compostable biosolid & a filtrate that can be returned to the marine environment.

2.0 Waste volumes

Waste capture volumes achieved from June 2017 through Aug 2017 are averaging [REDACTED] per pen. Forward projections based on extrapolating this figure with consideration of monthly biomass increase, have been listed in Table 1 below:

Month/ Year	Total Closing Biomass (t)	Number of liners required (calc on % of 49 cages)	Average daily extraction amount (kL)	Total monthly extraction amount (kL)	Average daily solids (m ³)	Average daily supernatant (kL)
Jul-17	[REDACTED]	6	6	192	2	4
Aug-17	[REDACTED]	11	13	400	4	9
Sep-17	[REDACTED]	16	21	642	7	15
Oct-17	[REDACTED]	25	30	914	10	21
Nov-17	[REDACTED]	29	37	1098	12	25
Dec-17	[REDACTED]	32	41	1243	13	28
Jan-18	[REDACTED]	35	42	1249	13	28
Feb-18	[REDACTED]	29	31	936	10	21
Mar-18	[REDACTED]	0	0	0	0	0
Grand Total				6675		
Biomass Cap (t)	[REDACTED]					
% Solids on extraction	4.8%					

Table1: Revised waste volume projection

3.0 Dedicated treatment & storage vessel – The Wallaby

The proposed treatment process will occur above deck, onboard a dedicated vessel – the Wallaby.



Figure 1: Dedicated waste treatment vessel - The Wallaby

The Wallaby is a 38m ex-navy water/fuel lighter. The vessel has been specifically designed to transport & deliver to other vessels diesel fuel oil, fresh water & demineralized water and to receive and hold oily bilge water and sullage from other ships. It is self-propelled, with propulsion units forward & aft making it highly maneuverable, particularly at low speeds. The vessel is constructed from 10mm thick corrugated steel plate.

Refer to **Attachment 1** for a General Arrangement of the Wallaby (as used by the Navy)

Tassal will use the Wallaby for:

- Separation of raw waste sludge into biosolids & filtrate
- Storage for both waste streams until they can be offloaded/discharged

The Wallaby will remain within Macquarie Harbour for the duration of the EPA approved waste treatment. Once approvals are in place, the Wallaby will moor at the farm site(s) and receive waste sludge from a collection vessel the Sea Hauler. The Sea Hauler will travel to each of the pens fitted with waste capture liners & once its 14 kL holding tank is at capacity it will then deliver the contents to the Wallaby for treatment.

3.1 Deck bunding:

Due to its previous use as a fuel lighter, the working deck of the Wallaby is fully bunded to capture any spillage. All spills are directed to two onboard sullage holds. For the proposed waste treatment process, any spills of either raw sludge, biosolids or filtrate will be contained on board the vessel, within the deck bund. In addition, a wash down regime will be implemented to ensure there is no buildup of solid waste on the working deck to eliminate any risk of these wastes drying and becoming airborne. Once again, the wash water will be directed to the sullage holds. Effective containment of all materials ensures there will be no impacts to the broader environment, from the waste treatment process on board the Wallaby.

Whilst the two sullage tanks have a combined capacity of 110 kL, to ensure there is sufficient capacity to receive spills, at least once per shift the contents of the sullage hold will be directed to the above deck holding tanks for inclusion in the waste treatment process.

3.2 Wallaby holding capacity:

The hull of the Wallaby is divided into a series of eleven service tanks as follows:

- Four diesel fuel tanks – combined capacity of 560 kL
- Two fresh water tanks – 100 kL
- Two demineralized water tanks – 100 kL
- Two sullage tanks – 110 kL
- One backwater ballast tank – 80 kL

- Total capacity 950 kL

3.3 Arrangement of processing equipment:

The initial treatment process will require installation of the following major items of equipment onto the deck of the Wallaby:

- 2 x 11kL above deck holding tanks
- [REDACTED] Centrifuge, c/w discharge conveyor
- Circulating pumps

Refer figure 2 below for the arrangement of treatment equipment on the deck of the Wallaby.



Figure 2: Arrangement of treatment equipment onboard the Wallaby

3.4 Raw sludge holding tanks:

In addition to the below deck holds, the Wallaby has been fitted with two new above deck 11 kL poly holding tanks, which will receive the raw waste sludge from the Sea Hauler. The two holding tanks will be interconnected to act as a single holding vessel, however there will be operational flexibility to operate from either holding tank individually depending on daily requirements.

Unless an unplanned event requires the holding tanks to be emptied, the waste sludge will remain above deck in the holding tanks until treatment in the centrifuge. If the holding tanks are required to be emptied, the contents will be directed to the below deck sullage holds.

In the event of an overflow, or spillage, or failure of the holding tanks, the contents will be contained within the bunded deck of the Wallaby and once again directed to the backwater ballast hold then into the Sullage Hold. The combined capacity of the backwater ballast & two sullage holds is 190 kL, which provides adequate safety margin to hold the full 22 kL volume of the holding tanks.

The two holding tanks will be connected to a circulating pump. This pump will be used as needed to assist with agitation of the raw sludge to prevent settlement of solids in the holding tank.

3.5 Filtrate Storage:

The intention is to store filtrate in the four “Dieso Tank” holds, which have a combined capacity of 560 kL.

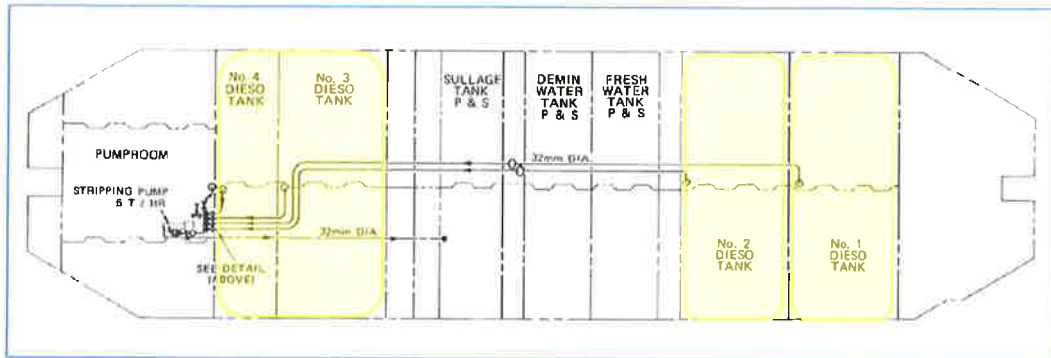


Figure 3: Filtrate storage holds

As needed, the filtrate can be transferred from one hold to another via the existing piping network & pumps. If the capacity of the diesel hold is exceeded the filtrate will overflow to the sullage tanks.

3.6 Sullage & backwater ballast holds:

The Wallaby has two below deck sullage holds, one each side of the centerline of the vessel and a backwater ballast hold. These holds have a combined capacity of 190 kL and will be used:

- To receive spillage from the deck of the vessel
- As emergency storage of raw sludge in the event the above deck holding tanks need to be emptied

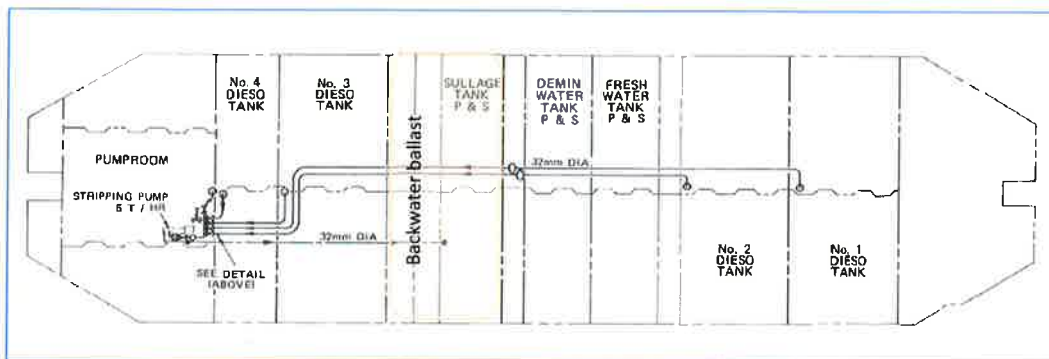


Figure 4: Sullage holds

4.0 Waste Treatment process:

The initial waste treatment is a single stage process using a centrifuge for separation of the raw sludge into a biosolid & a filtrate.

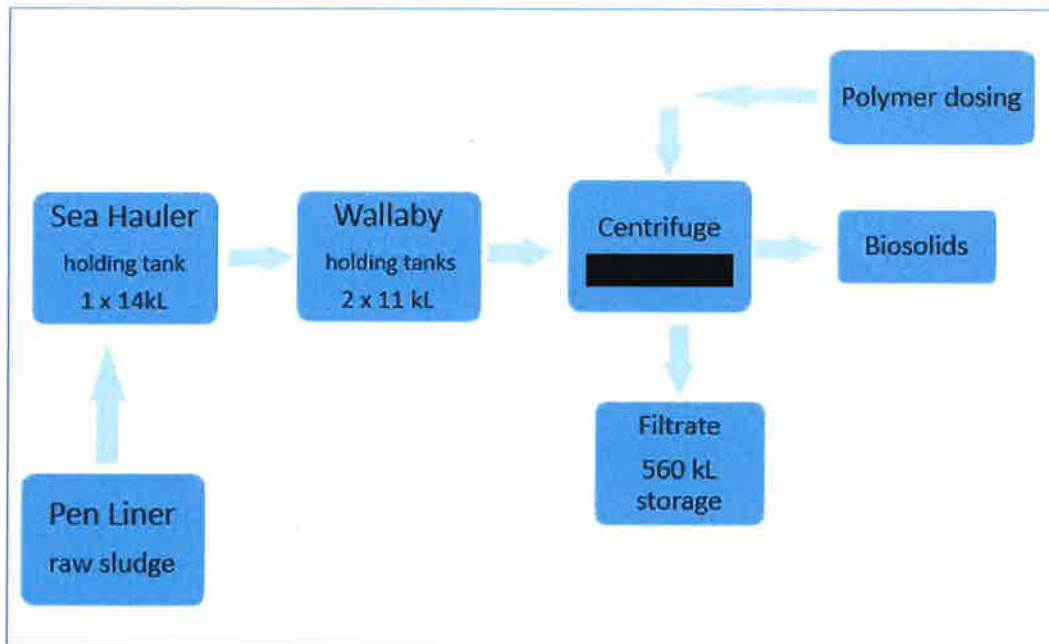


Figure 5: Process Flow Diagram

Raw waste sludge will be received from the Sea Hauler and held in the above deck holding tanks on board the wallaby. From the holding tanks the raw sludge will be pumped to a [REDACTED] centrifuge for dewatering. Whilst the design capacity of the centrifuge is [REDACTED] trials to date indicate the achievable throughput for treatment of under pen waste will be in the range of [REDACTED].

Successful operation of the centrifuge requires addition of polymer flocculent. Through consultation with suppliers and field trials, [REDACTED] has been identified as an effective polymer for this salt water application.

Dewatered solids will exit the centrifuge via a discharge chute onto a conveyor, which will then empty the solids into 1,000L bulka bags within range of the onboard crane. As they are filled, the solids bags will be distributed on the deck of the Wallaby for storage. The bulka bags will be watertight to prevent leakage and ingress of rain.

The filtrate will be discharged from the centrifuge mounted on deck, into a gravity feed drain to the below deck diesel holds.

During peak production in January, daily waste capture & treatment volumes will be up to 42 kL, thus:

- A minimum of 3 transfers from the Sea Hauler to the Wallaby of up to 14 kL per transfer will be needed per shift. (Typically it takes up to 4 hours to collect 14 kL of waste from the pens, ie an equivalent of 3.5 kL/hr)
- At [REDACTED] the centrifuge will need to operate for a minimum of [REDACTED] on a continuous basis. However, as the waste collection is the bottleneck continuous treatment is unlikely to be achieved.
- As the waste collection is slower than waste treatment there will always be adequate buffer in the above deck holding tanks to receive up to 14 kL of raw sludge.
- With 560 kL of storage capacity in the Diesel holds alone, at 42 kL per day there is in excess of 13 days storage capacity on board the Wallaby.
- If, excluding sullage holds, all remaining below deck holds are utilised for filtrate storage, then the total storage capacity is 760 kL. So at peak volumes of 42 kL per day this equates to 18 days storage.

5.0 Hours of Operation:

The intent is for waste to be treated the same day it is collected from the pen and treatment will be performed at the farm site.

Based on the daily volumes of under pen waste captured to date and with consideration of biomass increases for the remainder of the project, the *daily operation of the centrifuge will vary from 2 hours per day in September, up to 6 hours per day in January.

**Note: This is on the basis the centrifuge will treat raw sludge at [REDACTED] which is within a range achieved with two trials performed to date.*

Daily durations for operating the treatment equipment on board the Wallaby, have been summarized for each month in *Table 3* below.

Month	Total (marine) waste vol [kL/day]	centrifuge treatment rate [kL3/hr]	daily centrifuge operating time [hrs]
Sep	13.8	[REDACTED]	2.0
Oct	23.9	[REDACTED]	3.4
Nov	30.4	[REDACTED]	4.3
Dec	36.8	[REDACTED]	5.3
Jan	42.3	[REDACTED]	6.0
Feb	30.6	[REDACTED]	4.4

Table 2: Waste treatment plant daily operating duration

With consideration of the above table, all waste treatment operations will be performed during day light hours. This includes travel to & from the farm site, collection & transfer of waste to the Wallaby, waste treatment on the Wallaby & unloading waste at the Strahan aquaculture hub.

6.0 Waste characterisation

To date two land based centrifuge trials have been performed at [REDACTED] using underpen waste collected from Macquarie Harbour farms. Due to the time required to first collect, then transport the waste from the farm to the trial site, the waste will have developed different characteristics by the time it enters the centrifuge. With consideration of this, the filtrate quality achieved during these trials is indicative only. It is expected there will be some differences in the filtrate produced once treatment commences at the farm site.

[REDACTED]

[REDACTED]

7.0 Waste disposal:

The two waste streams that will be generated from the treatment process described in this EMP are:

- filtrate, which consists mostly of Macquarie Harbour seawater
- biosolids

During the initial phase of waste treatment, all biosolids and filtrate generated will be held onboard the vessel until laboratory analysis has been completed, which is expected to take up to 2 weeks.

Once analysis has been completed, filtrate will be held onboard for further treatment and/or disposed of [REDACTED] although with the added benefit of having had solids removed.

The biosolids will be retained at the aquaculture hub subject to further approvals for disposal at [REDACTED]

Prior to transport, bulka bags will be emptied at the Aquaculture hub into a 15 m3 hook bin fitted with a rain cover and a water seal on the tail gate. The empty bulka bags which have been contaminated with biosolids will be placed into a separate waste bin and disposed of at the [REDACTED]

8.0 Monitoring:

8.1 Characterisation of biosolids & filtrate:

For the first month of operation, to prove the treatment process can produce consistent results, Tassal propose to analyse filtrate & biosolids on a minimum weekly basis. Once the process is proven, analysis of filtrate and biosolids would continue at a reduced frequency of once per month.

8.2 Traceability / flow measurement:

Tassal propose to install flow meters to provide traceability of waste movement. Three flow meters will be needed:

- The first is a flowmeter already fitted to the centrifuge. This will provide a record of the volume of waste treated. This measurement will enable a comparison of the volume of waste captured with the volume of waste treated.
- A second flow meter will be installed on the filtrate discharge line from the centrifuge. This measurement will capture the volume of filtrate generated as a proportion of the volume of waste treated.
- The third & final flow meter will be installed on the discharge line from the Wallaby. This measurement will enable a comparison of filtrate generated with the volume of filtrate discharged.

Flow measurement data for the raw sludge & filtrate will be recorded direct to Tassal servers with local backup onboard the Wallaby.

Biosolids volumes will be recorded by an operator on daily log sheets.

8.3 Reporting:

Once the treatment plant is operational, the following additional waste treatment data will be included in Tassal's weekly / monthly reports:

- the volume of waste treated
- the volume of filtrate generated
- the volume of filtrate discharged/offloaded from the Wallaby
- the volume of filtrate being held on board the Wallaby
- the volume and dry weight of biosolids generated
- the volume and dry weight of biosolids offloaded from the Wallaby
- a summary of weigh dockets (wet weight) and dry weight for biosolid deliveries to composting facilities

9.0 Schedule:

Subject to final survey of the Wallaby & EPA approvals, Tassal will be ready to commence treatment of under pen waste onboard the Wallaby starting Monday 25th September 2017.

10.0 Risk identification & management

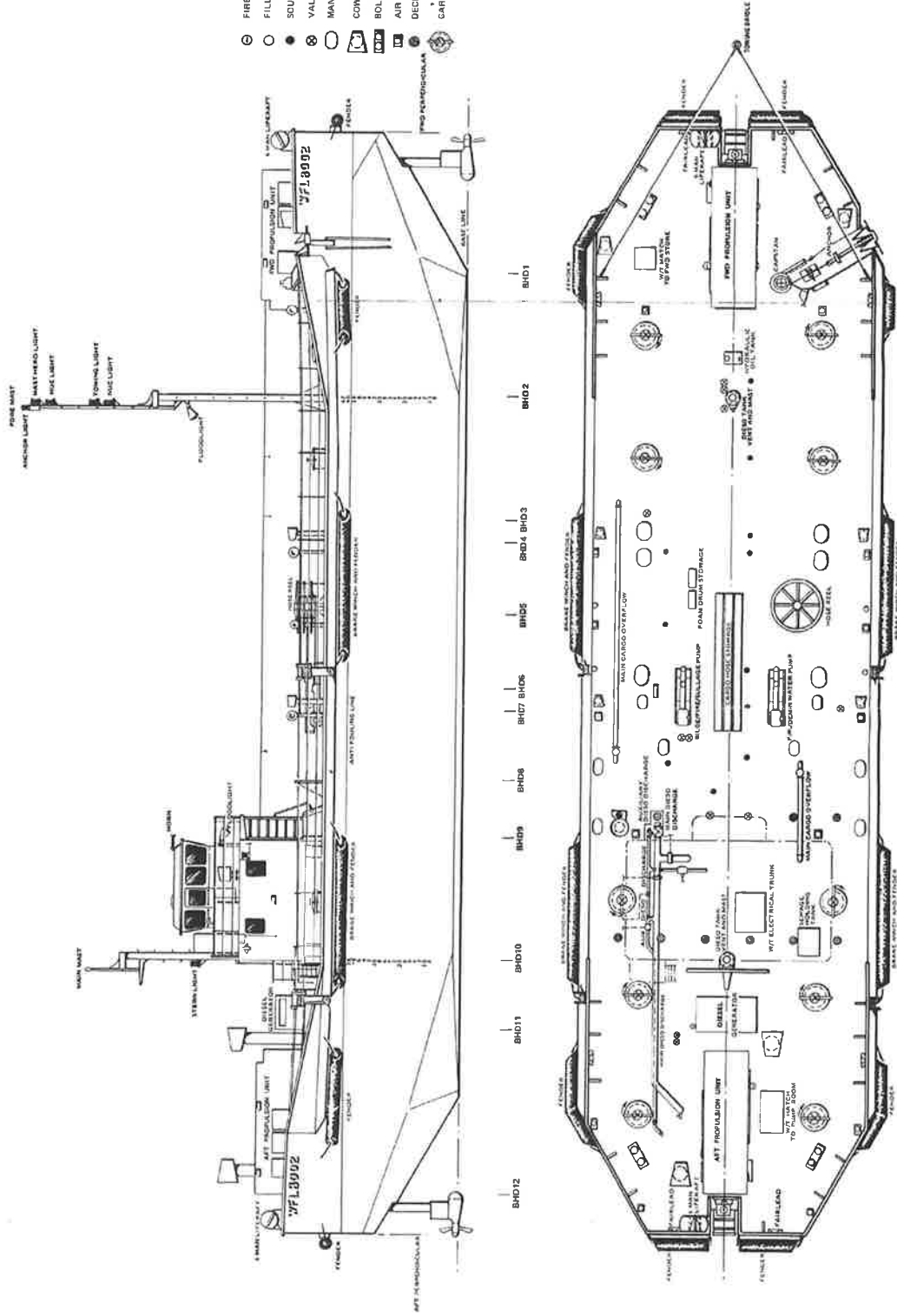
Tassal have conducted an environmental and project risk assessment. A risk register with subsequent mitigations is included in Table 3 below.

Identified risk	Mitigation
Raw waste sludge spill	<ul style="list-style-type: none"> • Documented procedures will be developed for transferring raw sludge from vessel to vessel, vessel to land and any other waste transfer step, e.g. loading of trucks and tankers • All Tassal vessels are fitted with a spill response equipment & staff are trained in spill response procedures. • Piping arrangements onboard the Wallaby will limit the transfer of raw sludge from the holding tanks to the centrifuge or sillage holds only. • The contents of the sillage holds will only be returned to the holding tanks for incorporation in the waste treatment process. • Any spills onboard the Wallaby, including overflow or failure of the holding tanks will be contained onboard by the fully bunded deck and only directed to the sillage holds. • The two sillage holds have a combined capacity of 110 kL which provides a high level of margin to contain the full volume of the holding tanks should the need arise. • Sillage holds are to be emptied a minimum of once per shift to ensure they always remain at low levels.
Biosolids spill	<ul style="list-style-type: none"> • All Tassal vessels are fitted with a spill response equipment & staff are trained in spill response procedures. • Spills are likely to be low volume, ie less than 1,000L. • Biosolids to be handled onboard the Wallaby in appropriately rated 1,000 L bulka bags with water proof liners to prevent leakage and ingress of rain water. • Biosolids are spadeable so spills ashore will be collected and the area disinfected
Filtrate spill	<ul style="list-style-type: none"> • Any spills above deck will be contained onboard by the fully bunded deck of the Wallaby and only directed to the sillage holds. • The 4 x Diesel holds will be used for storage of filtrate on board the vessel – in the event these are overfilled they will overflow to the sillage hold and from there integrated back into the treatment process. • Documented procedures will be developed for discharging filtrate from the vessel. • All Tassal vessels are fitted with spill response equipment & staff are trained in spill response procedures.
Noise nuisance from waste treatment equipment	<ul style="list-style-type: none"> • Equipment used will be compliant with marine farming licence conditions • The treatment location at the farm site is a significant distance from sensitive receptors
Impacts on high public interest sites	<ul style="list-style-type: none"> • The leases are active marine sites & this activity is aligned with daily operations • No impact to any recreational or natural scenic features is anticipated

Hazardous substances	<ul style="list-style-type: none"> No hazardous substances will be used for waste treatment
Odour from waste	<ul style="list-style-type: none"> The waste treatment location & transport route is a significant distance from any sensitive receptors.
Increase to marine traffic	<ul style="list-style-type: none"> Increase to marine traffic within Macquarie Harbour, from waste treatment activity will be occur primarily at the marine lease. Beyond the lease, marine traffic increases will be limited to daily travel from the aquaculture hub to the lease.
Filtrate contamination	<ul style="list-style-type: none"> Prior to filling with filtrate the Wallaby holds will be tested for diesel residues and will be decontaminated as required.
Adverse Weather	<ul style="list-style-type: none"> Adverse weather will typically impact treatment by preventing collection of raw sludge from the pens, in which case treatment is simply delayed. In the event weather interrupts operation of the treatment equipment, if raw sludge cannot remain inside the holding tanks it will be diverted to the sullage tanks and in this way both raw sludge and filtrate can be safely held below decks. The biosolids will remain on deck in weatherproof bulka bags.
Contamination	<ul style="list-style-type: none"> The waste treatment vessel is to be used only for that purpose Personnel must be dedicated to the waste collection & treatment for the working day and should not move to other operations Personnel should wear appropriate PPE when handling fish faeces due to zoonotic risk. PPE should be disinfected or disposed of at the end of each day
Waste treatment equipment failure	<ul style="list-style-type: none"> Critical spares will be held to minimise down time due to equipment failure If critical equipment fails there is several days storage onboard the Wallaby for both raw sludge and filtrate, whilst equipment is repaired.

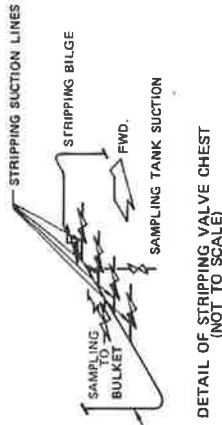
Table 3: Risk identification & management

Attachment 1: Wallaby General Arrangement:

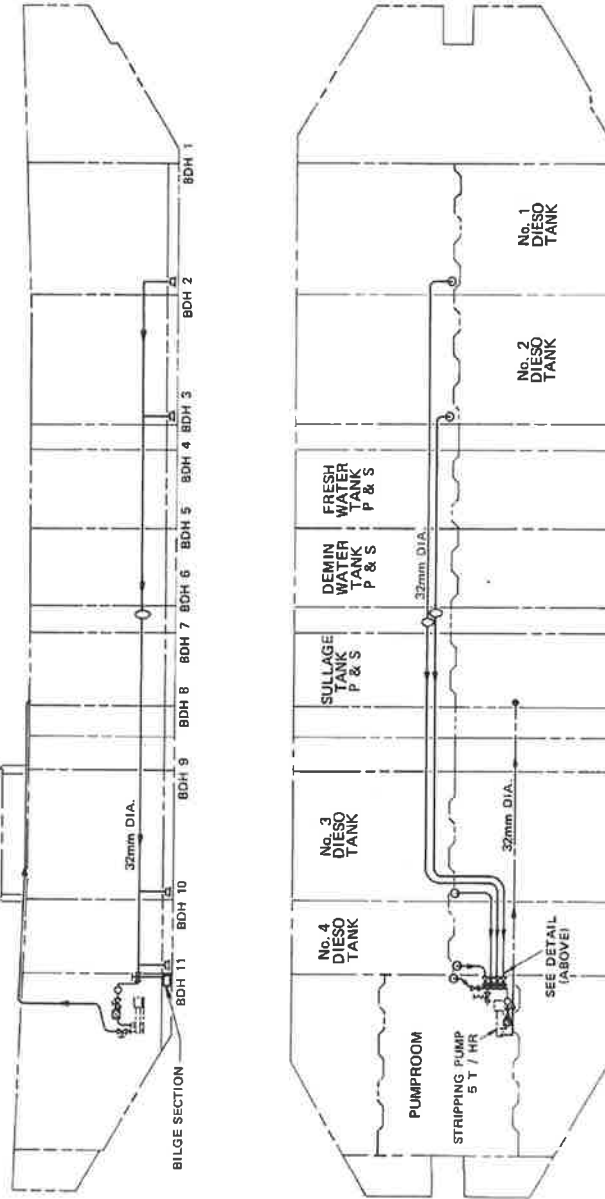


GENERAL ARRANGEMENT

Attachment 2: Arrangement of Wallaby below deck Holding Tanks



DETAIL OF STRIPPING VALVE CHEST
 (NOT TO SCALE)



- BELLMOUTH 38mm D.I.A.
- BUTTERFLY VALVE
- BY-PASS CONTROL VALVE
- CHECK VALVE
- SCREW DOWN NON RETURN VALVE
- STRAINER
- SOUNDING PIPE
- 'L' PORT COCK
- SIGHT FLOW INDICATOR
- AIR ESCAPE
- EXPANSION JOINT
- DISCHARGE VALVE
- HOSE CONNECTION

DIESEL OIL TANK STRIPPING PIPING SYSTEM

[Redacted]

[Redacted]	[Redacted]	[Redacted]	[Redacted]
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[Redacted]			
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