WALLBRIDGE GILBERT AZTEC

Southern Launch

Southern Launch Whaler's Way

STORMWATER MANAGEMENT PLAN

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Appendices

EXECUTIVE SUMMARY

This report outlines the stormwater management strategy for a parcel of land located in Whaler's Way which is to be developed by Southern Launch Space Pty Ltd (Southern Launch), for a proposed orbital launch facility. This strategy has adopted a risk-based stormwater management approach to address potential impacts on the downstream receiving environment. This report addresses rainfall and runoff management and does not cover off management associated with operations water. Management of operations water is presented in report, *Design Stage (Water) Environmental Management Plan (WEMP)* prepared by Enviro Advice see Appendix A.

There are total of 4 sites included as part of the overall project. This report provides a strategy for each of the 4 sites within the orbital launch facility. Each of the sites incorporate various stormwater management interventions that have been assigned according to the risk they pose to the receiving environment.

In summary, the adopted strategies for each site are described below.

Launch Facilities (Sites A and B)

- Surface cut off drains at the upstream interface of the site to intercept any overland flow from upstream catchments
- Open drainage swale drains sized to intercept and convey all site-based stormwater runoff up to the 1% AEP storm event to an onsite retention basin
- Site based underground stormwater drainage systems to convey flows up to the 10% AEP storm event (discharging into the open drainage swale and retention basin)
- All of site generated runoff is directed to a retention basin which has been sized using 16 years of climatic data (as well as monthly 10-year average wet year climatic averages), to demonstrate no net overflow or discharge to the receiving environment, and
- The retention basins have been checked to ensure that runoff volume resulting from a 100-year ARI (1% AEP) 1-hour storm can be captured, intercepted and retained with the basin with no overflow. This assumes the basins are at 50% capacity.
- High risk parts of the site including fuel storage and handling areas are isolated from the general stormwater system. (i.e. earth bunds and site grading). The internal stormwater runoff generated from within these areas will be directed to a Class 1 Separator (SPEL Puraceptor) prior to discharging into open drainage swales. The Class 1 separator accommodates spill volume (without discharge) equivalent to a fuel tank within its chamber in addition to stormwater treatment. The Puraceptor P.060 provides a treatment flow in excess of the 100-year ARI (1% AEP) peak flow from the isolated area.

Storage Dam (Site D)

- Surface cut off drains at the upstream interface of the site to intercept any overland flow from upstream catchments
- All of site generated runoff is directed to a retention basin which has been sized using 16 years of climatic data (as well as monthly 10-year average wet year climatic averages), to demonstrate no net overflow or discharge to the receiving environment

Operations Facility (Site E)

- Surface cut off drains at the upstream interface of the site to intercept any overland flow from upstream catchments
- All of site generated runoff is directed to a retention basin which has been sized using 16 years of climatic data (as well as monthly 10-year average wet year climatic averages), to demonstrate no net overflow or discharge to the receiving environment
- All roof runoff to be directed to rainwater tanks to provide onsite non potable reuse

This stormwater management strategy offers a prudent approach that addresses environmental risk by ensuring all stormwater runoff is contained on site (I.e.no discharge to the receiving environment). This has been demonstrated by providing a robust modelling approach that not only considers 16 years of climatic data sets, it also includes consideration of the 10-year wet year averages. Based on the modelling results, there will be shortfall in availability of water to be reused as part of the site's operations. Hence for the purpose of this report, it demonstrates appropriate management outcomes to ensure that the receiving environment is not impacted by stormwater pollution.

It is noted that this report shall be read in conjunction with the WEMP in Appendix A, which presents the management of water from the operational perspective.

1 INTRODUCTION

1.1 BACKGROUND

Wallbridge Gilbert Aztec (WGA) has been engaged by Southern Launch Space Pty Ltd (Southern Launch) to prepare a stormwater management strategy for a proposed orbital launch complex located at Whaler's Way (Development), approximately 30km south west from Port Lincoln. The purpose of this strategy is to ensure that stormwater generated from the development is managed in an environmentally responsible manner that appropriately addresses identified risks.

The complex at Whaler's Way is proposed to be used as a launch facility to enable rocket launching of satellites into orbit. The complex has been sited at Whaler's Way as it is considered an ideal location for launching small satellites due to its close proximity to rocket support infrastructure, good year-round weather and ascent trajectory that passes across low unpopulated areas with low density air and nautical traffic. The location of Whaler's Way is shown in **Figure 1.1** below, an aerial satellite image of the site locality is shown in **Figure 1.2**.

Figure 1.1 – Whaler's Way location ***Source: Southern Launch***

Figure 1.2 - Whaler's Way Site Locality ***Source: Locations SA***

1.2 SCOPE

The strategy proposed in this report applies to the management of stormwater runoff from the surfaces of the proposed launch sites within the launch complex. It does not apply to wastewater management.

This report addresses the management of rainfall and stormwater runoff and does not cover off management associated with operations water. Management of operations water is presented in report, *Design Stage (Water) Environmental Management Plan (WEMP)* prepared by Enviro Advice see Appendix A.

This stormwater management strategy report has been prepared as part of an Environmental Impact Statement for the proposed development. The stormwater management strategy aims to adopt sustainable management principles where all water generated on site will be retained and managed to avoid environmental risk.

The intent of this report is to provide an outline of the management principles as they relate to the following:

- A general overview of the stormwater internal network drainage design (for each complex of sites)
- Preliminary sizing of retention basins for each site within the complex (where proposed)
- Management of stormwater runoff during the construction and operational phases
- The incorporation of all above elements within a Total Surface Water Cycle Management (TSCM) Framework
- This report shall be read in conjunction with the report, *Design Stage (Water) Environmental Management Plan (WEMP)* prepared by Enviro Advice. This report is included in Appendix A.

The stormwater management strategy presented within this report is intended to demonstrate responsive performance outcomes. This is supported by relevant calculations and a concept layout.

2 CATCHMENT AREA OVERVIEW

2.1 EXISTING SITE AND CATCHMENTS

The site of the proposed orbital launch complex is located at Whaler's Way as shown in **Figure 2.1**. The site is accessible from an existing public access road located to the north east of the site.

Figure 2.1 - Typical Photo of Whaler's Way Site

The site is largely undeveloped and is populated by low lying dryland vegetation. There are several existing access tracks located to the south of the site that run roughly parallel with the coastline. The existing access tracks delineate the approximate boundary of the launch complex.

The topography of the site grades towards the centre where there is an existing low point. The existing gradient across the site is approximately 3%. Levels at the northern boundary are approximately 80m AHD (Australian Height Datum) to 20m AHD at the low point within the site. Levels at the southern boundary, along the coastal access road, range from 130m AHD in the south eastern corner to 50m AHD in the south western corner.

Figure 2.2 below depicts the existing site contours and shows the approximate location of the existing low point within the site.

Figure 2.2 - General Site Contours and Catchment Area ***Source: Nature Maps SA***

2.1.1 Regional Geology

The geology of the lower Eyre Peninsula is made up of three distinct geological units, the Semaphore Sand, Bridgewater Formation, and the Carnot Gneiss.

The Semaphore Sand member (of the Saint Kilda Formation) is the youngest geological unit and is made up of unconsolidated quartz-carbonate sand of modern beaches and dunes (Cann & Gostin, 1985) within the region.

Underlying the Semaphore Sand is the Bridgewater Formation which dominates much of South-eastern Australia's coastline, as seen in limestone cliffs from the Great Ocean road through to the Great Australian Bight. The Bridgewater Formation is a poorly consolidated yellow-pinkish brown fine to coarse calcareous sand/calcarenite, locally capped by Calcrete (Brown & Stephenson, 1991).

The oldest geological unit is the Carnot Gneiss (of the Archean Sleaford Complex) which underlays much of the southern Eyre peninsula. It is only visible at the base of coastal Limestone cliffs and is a thinly layered quartzofeldspathic gneiss (Fanning, 1981).

2.1.2 Groundwater Setting

The site is elevated above sea level in the range of 20m AHD along the coast, approximately 10m AHD at a localised low point within the site and approximately 120m AHD to the south east of the site. Based on the site's location, the regional groundwater level in the area is expected to be related to the nearby sea level.

2.2 THE DEVELOPMENT

The proposed Whaler's Way Launch facility will consist of several localised sites, each site will contain its own stormwater management strategy, which are detailed within this report. The localised sites within the facility are outlined in the following sections.

2.2.1 Site A and Site B

Two proposed launch sites comprising:

- Total site area of 4.3ha.
- Assembly shed.
- Concreted launch pad area.
- Fuel and tank storage areas.
- Retention basin.
- Paved areas including access roads, paths, carparking area and a helicopter landing pad.
- Compacted gravel areas, and
- Grassed areas.

2.2.2 Site D

A lined storage dam area comprising:

- Total site area of 6.3ha.
- Retention basin, and
- Workshop, shed and storage facility areas.

2.2.3 Site E

A proposed viewing facility comprising:

- Total site area of 0.6ha.
- A single storey operations facility.
- Paved areas including access roads, paths and carparking area.
- Storage tanks, and
- Retention basin.

Overall site layout drawings, for each site, is provided in Appendix B.

3 IDENTIFICATION OF RISKS AND MANAGEMENT

3.1 RISK MANAGEMENT

This risk management process aims to determine the potential nature, scale and likelihood of any impacts on water quality, erosion and degradation of the receiving environment during the design, construction and operational phases of the development. This process is undertaken to assist in identifying appropriate management strategies to manage the project impacts and / or determine if intervention is required to manage risks. This risk assessment is undertaken within the context of rainfall and runoff management at the site and does not include operations phase water management.

The main steps in the risk management process are:

- Identify risks – as determined by the site and its characteristics;
- Analyse risks – how likely is it to happen, what are the likely consequences;
- Evaluate risks – against the likelihood and consequence matrix and;
- Treat risks – prioritise, address, and mitigate identified risks through the adoption of mitigating strategies

The Risk Management process covers the proposed development, with more detail focused on using the proposed stormwater management systems to manage risks.

Following a review of the site and relevant studies, the risk assessment has been prepared for the design, construction, and operational phases of the project. This is presented in **Table 3.2**, **Table 3.3** and **Table 3.4**.

The likelihood and consequence matrix is provided in **Table 3.1**.

Table 3.1 - Likelihood and Consequence Matrix

	CONSEQUENCE		
LIKELIHOOD	**Low** Minor adverse social or environmental impact	**Medium** Measurable adverse environmental or social impact. Will result in annoyance or nuisance to community.	**High** Significant damage or impact on environmental systems and local community.
Low The event could occur only rarely, or is unlikely to occur	Low Risk	Low Risk	Medium Risk
Medium The event will occur occasionally or could occur	Low Risk	Medium Risk	High Risk
High The event will occur often or is most likely to occur	Medium Risk	High Risk	High Risk

Table 3.2 - Design Phase Risk Management Process

DESIGN PHASE							
No.	**Issue**	**Potential Impact**	**Likelihood**	**Consequence**	**Level of Risk**	**Response / Management Measure**	**Notes**
1	Overland flooding – upstream catchments	Increased flooding potential on site due to increase in impervious areas	Low	High	Medium	On site drainage systems (including any underground stormwater drains, culverts and open drains shall cater for the 10% AEP storm event at a minimum. The 1% AEP storm event will be checked for overland flooding through designated flow paths. As each site is proposed to be fully self-contained, the stormwater systems for each site will be designed to divert potential upstream overland flows away from each site.	The internal drainage network will be designed to separate drainage from the fuelling areas from the rest of the site generated stormwater runoff.
2	Flooding – on site	Flooding due to overland flooding from impervious areas within the site	Low	Low	Low	Design of the internal stormwater network within each site to cater for the 10% AEP storm event flow to discharge into the proposed retention basin. The retention basin will be sized to store all stormwater runoff with no overflow from the basin to be permitted.	Water balance assessment using climatic data sets over long period.
3	Retention basin – Deep water	Safety hazard to site personnel	Low	High	High	All deep-water areas to be designed with safety bench bank profiles and or fencing to be defined in design. These profiles will be graded to recognized Australian practice reference guides. As all basins will be poly lined, safety fencing will be provided around all basins.	
4	Erosion of open drains	Scouring and erosion associated with velocities and peak stormwater volumes	Medium	High	High	Flow velocities to be assessed as part of the design process to determine appropriate treatments. Where required, swales may be designed to incorporate pool and riffle systems to control flow velocities.	Velocity limits: • 1.6 m/s maximum safe flow velocity in swales
5	Accidental spills and debris from site operations discharging to beach and ocean	Contamination of groundwater and local marine environment leading to degradation of marine quality	High	High	High	Site will be designed to contain all surface water runoff, via a combination of bunded storage areas, surface grading and open drainage channels. Additional bunds / surface grading to be provided around high-risk fuel storages to prevent spill and cross contamination of otherwise clean stormwater.	Special high-risk fuels identified as: • Liquified Natural Gas; and • RP1 (Pure form of Kerosene)
6	Fuel Spills contaminating the onsite water supply	Contamination of onsite water storage leading to compounding effects in the water network	High	High	High	Special high-risk fuels will be stored in tanks that will be contained within bunded areas and surface grading, from the remainder of the launch site. The surface water in these areas will all be directed towards a Class 1 Separator which will be designed and sized to provide spill containment for one full container.	

Table 3.3 - Construction Phase Risk Management Process

CONSTRUCTION PHASE							
No.	**Issue**	**Potential Impact**	**Likelihood**	**Consequence**	**Level of Risk**	**Response / Management Measure**	**Notes**
1	Site erosion and sedimentation downstream	Sedimentation impacts on receiving water quality. Increase in turbidity / total suspended solids / total dissolved solids to aquatic ecosystems by reducing light and smothering organisms	High	Medium	High	SEDMP	Excavate proposed retention basin during early stages of construction and direct all site generated runoff into the basins to trap sediment
2	Vegetative Matter	Increase in natural organic matter impacts on the receiving water quality including an increase in Nitrogen / Phosphorous levels and reduced Oxygen levels. Consequences include: • Algae outbreaks and eutrophication; and • Visual / Surface scum	Low	Medium	Medium	CEMP and SEDMP	Incorporate screen to trap vegetative matter and reduce the risk of mobilisation into flows during construction
3	Gross Pollution (Litter)	Negatively impacts on receiving environment and waters including: • Impacts to visual / aesthetic environment; • Decreased water quality; and • Impacts on wildlife	Medium	Low	Medium	CEMP Waste recycling and reuse	
4	Accidental Spills (including any hazardous materials) Release of contaminated soil into groundwater systems	Negative impacts on receiving environment and water quality including: • Increased toxicity; • Aquatic flora death / breakdown and increases in organic matter; and • Aquatic fauna death / breakdown and increases in organic matter • Contamination of groundwater	Low	High	High	CEMP	
5	Hydrocarbons	Negative impacts to water quality including: • Increased toxicity; • Algae outbreaks and eutrophication; and • Visual / surface scum	Low	High	High	CEMP	
6	Temporary changes in direction and flow of surface water and groundwater	Pooling of surface water in undesirable areas, including within excavations	Medium	Low	Low	CEMP	
7	Increased volume of surface water flow	Increased turbidity levels in the receiving coastal environment leading to excessive sediment accumulation	Medium	Medium	Medium	CEMP Temporary drainage systems required during construction of the works. Diversion drains and sedimentation basin required to intercept all flows.	

Table 3.4 - Operations (Post Construction) Phase Risk Management Process

No.	Issue	Potential Impact	Likelihood	Consequence	Level of Risk	Response / Management Measure	Notes
OPERATIONS PHASE							
1	Site generated stormwater pollution	Impacts to water quality including: • Increased toxicity; • Accumulation in aquatic sediments	High	Medium	High	Project based treatment design e.g. vegetated swales and retention basin to contain all site generated runoff. Maintenance and monitoring of system to achieve design outcomes.	
2	Hydrocarbons	Impacts to water quality including: • Increased toxicity; • Algae outbreaks and eutrophication; and • Visual / surface scum	High	High	High	No runoff from any part of the project shall be discharged out of the development boundary unless it is intercepted by the stormwater system and retention pond. All high-risk areas are not connected to external drainage and are retained within the site and within bunded areas.	
3	Sediment	Negative impacts on the receiving water quality: • Increase in turbidity / total suspended solids / total dissolved solids; • Impacts to aquatic ecosystems by reducing light and smothering organisms; and • Release of associated metals and nutrients	High	Medium	High	Project based treatment design e.g. vegetated swale / retention basin Maintenance and monitoring of system to achieve design outcomes	
4	Nutrients	Negative impacts on the receiving water quality: • Increase in Nitrogen / Phosphorous and reduced oxygen levels; • Aquatic flora death / breakdown and increase in organic matter; and • Aquatic fauna death / breakdown and increase in organic matter	High	Medium	High	Project based treatment design e.g. vegetated swale / retention basin Maintenance and monitoring of system to achieve design outcomes	
5	Vegetative matter, dust and stormwater runoff from high-risk fuelling areas	Increase in natural organic matter impacts on receiving environment water quality including: • Increase in Nitrogen / Phosphorous and reduced oxygen levels; • Algae outbreaks and eutrophication; • Visual / surface scum; and • Weed growth in downstream water systems	High	High	High	Project based treatment design e.g. vegetated swale / retention basin Maintenance and monitoring of system to achieve design outcomes	
6	Gross Pollution (litter)	Negative impacts on receiving environment including: • Visual / aesthetic appeal; and • Decreased water quality	Medium	Medium	Medium	Grade the surface of the launch site to be contain all surface water runoff. Clean up launch site area – maintenance following each launch	Launch site operations to incorporate maintenance regime into its operations.
7	Increased runoff volumes	Occurs due to increased impermeable surface areas. Impact to flow regimes and function of receiving waters.	High	Medium	High	All site generated runoff is to be retained within the site retention basin such that there is no release to the environment.	Water balance assessment using climatic data set for >10years. Also evaluate using wet year monthly averages.

4 TOTAL SURFACE WATER CYCLE MANAGEMENT FRAMEWORK

4.1 DESIGN BASIS

The design basis behind the Total Surface Water Cycle Management (TSCM) for each of the sites is based on the principle design philosophy that no site generated surface runoff will be permitted to leave each site. All sites will incorporate a retention basin designed to capture and store all site generated runoff. The design basis behind each basin and any other stormwater management element is outlined in this section.

4.2 STORMWATER MANAGEMENT ELEMENTS

The TSCM will incorporate the following stormwater management elements within each site:

- Retention Basins
- Onsite stormwater re-use
- Open drainage swales
- Spill management (where required), and
- Surface grading throughout each site.

4.2.1 Retention Basins

The design approach is based on intercepting all site generated surface water runoff. Of note is water runoff from the launch pad areas, which may contain pollutants that could harm the receiving environment. The following principles will apply:

- Intercept stormwater runoff from all onsite sources. Retain stormwater with the site retention basin without discharge,
- Prevent infiltration loss through the base of the retention basin and therefore the potential to contaminate groundwater by providing an impermeable liner,
- Intercept debris that enter stormwater by incorporating traps at source,
- Manage high risk areas of the site such that they can be isolated in the event of spill, and
- Utilise stormwater runoff captured in the retention basin for onsite irrigation (to maintain open grassed area, mitigation of dust, hardstand washdown, and rocket launch cooling – deluge water)

4.2.2 Spill Management

Spill management will be required within Sites A and B to manage the high-risk fuelling areas. Though there are several designated fuelling areas within the site, spill management is only required in the areas shown in **Figure 4.1** below.

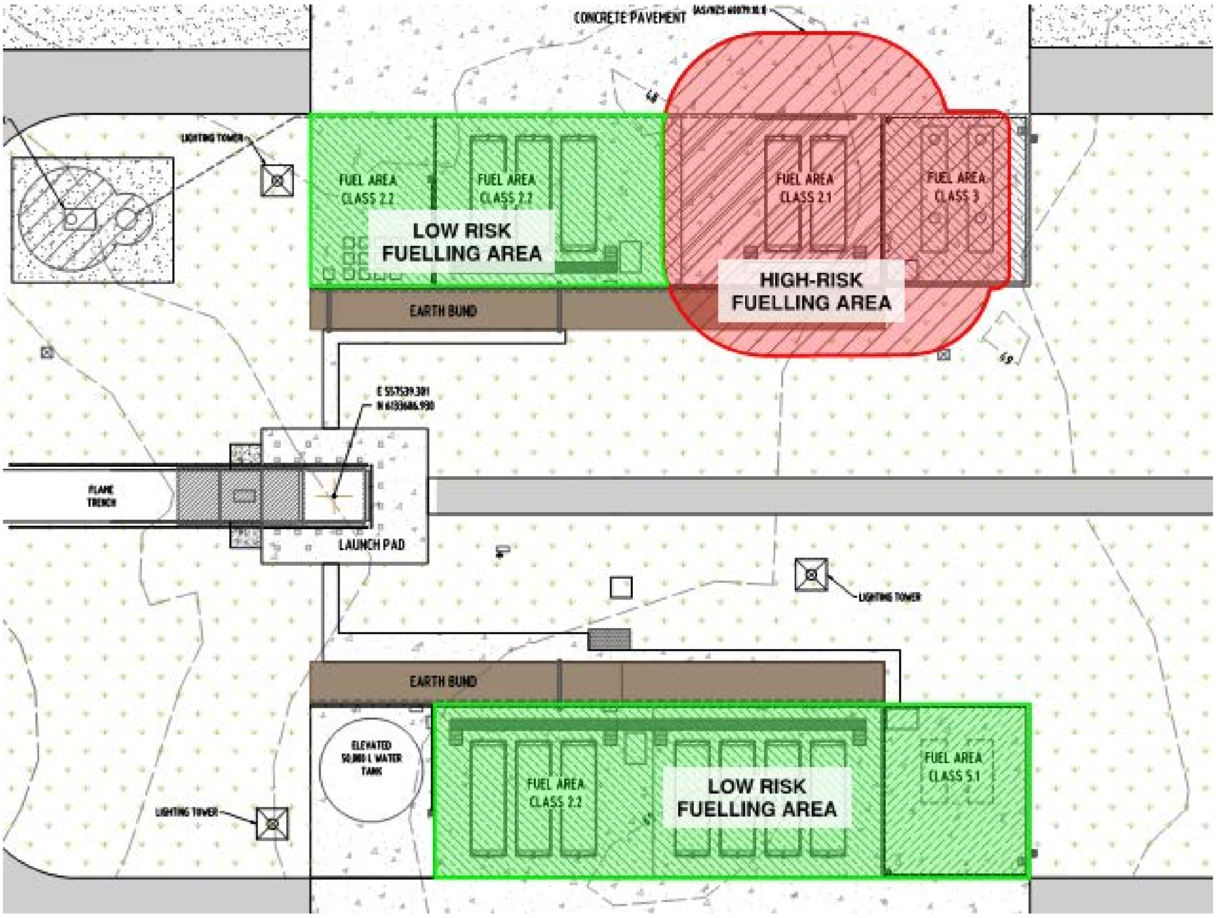

Figure 4.1 - Designation of High-Risk Fuelling Areas – Sites A and B

The fuelling areas within the launch sites have been separated into low and high-risk areas according to the type of fuels being stored or handled in each area. Fuels that are stored in the low-risk areas include liquid nitrogen and liquid oxygen. These fuels are considered low risk as they will evaporate as soon as they are exposed to the atmosphere and will therefore pose no risk to stormwater contamination.

Fuels in the high-risk area include liquefied natural gas and LP1 (kerosene) which will pose a significant risk to stormwater contamination if a spill occurs. These areas will be managed separately from the remainder of the site and will be treated via a Class 1 separator to ensure no contamination of stormwater runoff.

Class 1 Separator (SPEL Puraceptor)

As outlined above, the approach regarding placement and utilisation of the SPEL Puraceptor is to intercept high-risk pollutants and manage spills onsite. The high-risk fuel areas will be separated from all other site areas using bunding and grading, to mitigate the risk of contamination of other areas.

Advice from the supplier of the SPEL Puraceptor was sought to determine an appropriate size to ensure that trapping performance, spill containment volume, sediment, oil and gross pollutant trapping performance meets EPA guidelines for permitted concentrations to be discharged to stormwater. The SPEL Puraceptor P.060 can treat up to 60L/s peak flow rate. This flow rate exceeds the estimated peak flow from the fuel storage area during a 100-year ARI (1% AEP) event.

In the event of a major fuel spill, the SPEL Puraceptor will be required to capture and contain the volume within its chamber. Provision of spill volume equivalent to one full storage fuel tank has been provided. This volume equates to approximately 10,00L. The selection of the Puraceptor model P.060.L.C1.2C.A will accommodate a spill capacity of 10,700L.

The SPEL Puraceptor includes the following key features:

- Flame trap
- Probe with alarm activation to alert the maintenance operations to clean the unit when the oil storage reaches 10% of the available storage volume. This allows for volume for spill containment
- Spill containment volume 10,000L
- Treatment and separation of oils, grease and hydrocarbons
- Trapping of sediment and gross pollutants
- A coalescer to enhance treatment performance and oil trapping
- Performance that exceeds the EPA requirements for stormwater discharge, and
- Certified to BS EN 858-1 2002 “Separation systems for Light Liquids (Oil and Petrol)”

SPEL Puraceptor information (including drawings) have been included within Appendix C.

4.2.3 Open Drainage Swales

Open drainage swales are proposed at the launch sites to intercept all site generated surface runoff from general surface areas including paths and roadways. These swales will be located along the boundary of both sites and will be sized to intercept and convey flows up to and including the 1% AEP event flows. These swales will discharge stormwater flows directly into the retention basin.

4.2.4 Onsite Stormwater Re-Use

Rainwater tanks have been notionally sized and are proposed to be used at Sites A, B and E. All roof runoff from within each site will be directed to a rainwater tank. This runoff will be held for no potable re-use such as toilet flushing.

4.3 RETENTION BASIN SIZING

A water balance assessment has been undertaken, for all sites, to define the size of the retention storage required to retain on site surface runoff volumes. Water balance assessments have been undertaken using a spreadsheet with continuous historical daily rainfall data, spanning approximately 16 years (2004 – present) from the Port Lincoln rainfall gauge.

The following assumptions have been made when undertaking the water balance assessment:

- Water balance assessment for both daily and monthly runoff volumes has been undertaken.
  - Note that there are large gaps in the data for years 2014 and 2015. For the purposes of the water balance, the data from these years has been removed as they do not provide an accurate analysis of existing conditions.
- Evaporation losses have been estimated based on daily and monthly evapotranspiration data available from the Bureau of Meteorology (BOM) website from 2019.
- Basin volumes have been checked to accommodate a site runoff volume from a 100-year ARI (1% AEP) 1-hour storm, assuming the basin is at 50% available capacity.
- Utilises an estimated pan evaporation loss factor of 0.80.
- Infiltration losses have been set to zero (the basin will be lined to ensure there is no contamination of the groundwater within the receiving environment).
- Site generated runoff based on utilising a weighted coefficient method to determine the site runoff coefficient.
- Estimated annual launch totalling 36 (or an average of 3 launches per month).
  - As outlined within the attached Water Quality report (refer Appendix A), there is an estimated deluge volume of 50kL required per launch.
- Assumed irrigation season of grassed area to occur over the warmer months of October to April only.
  - The required irrigation volume to maintain the grassed areas is assumed to be approximately 200mm depth across the entire irrigated area during the irrigation season.
  - At Sites A and B, new groundwater bores will be installed to supplement supply to the launch sites with additional water to meet any shortfalls in demand. It is proposed that these bores will be used to top up the retention basin when required for irrigation / deluge purposes.
    - For the purposes of this report, bore top up has not been allowed for in the water balance assessment. This approach demonstrates that there is no net expected stormwater release i.e. all site generated runoff is retained and or re-used on site as part of the operations and or is lost to evaporation.

Plots of the fluctuating basin storage level for each site, over this period, are depicted below in **Figure 4.2** through **Figure 4.4**.

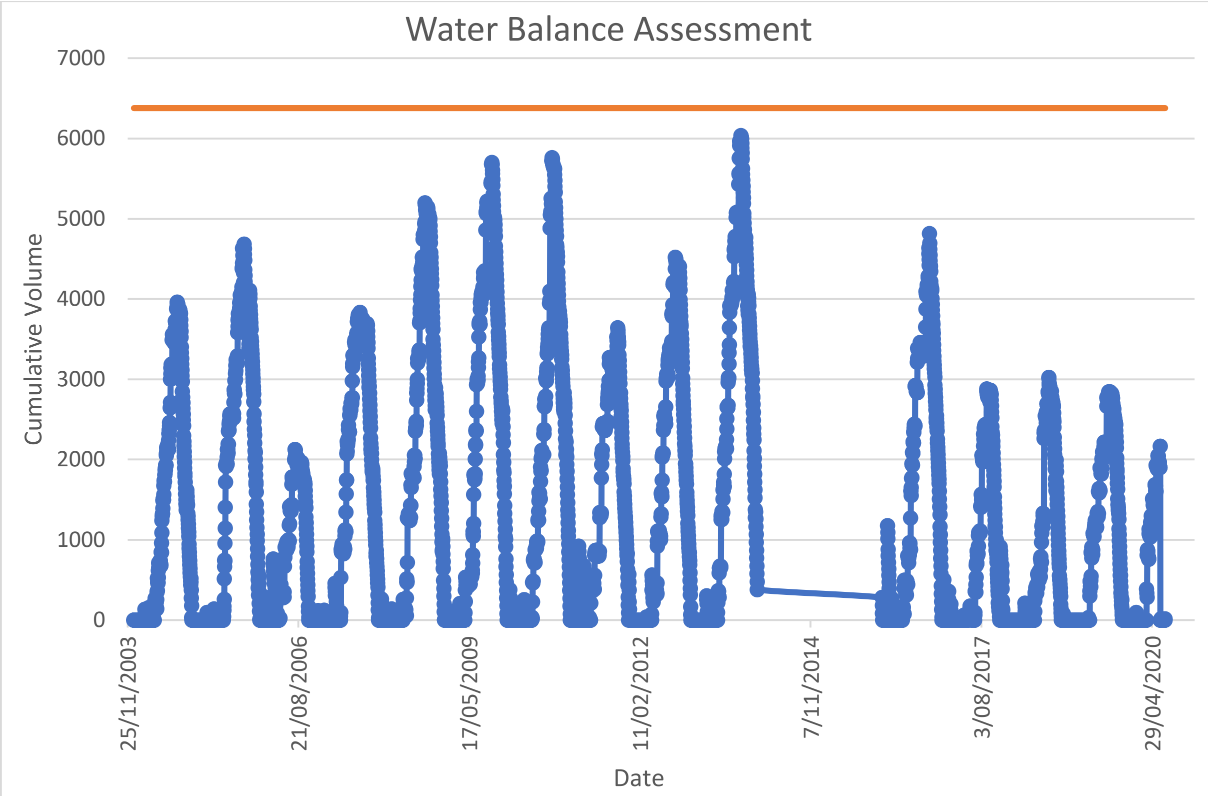

Figure 4.2 – Water Balance Assessment for Retention Basin (Sites A and B)

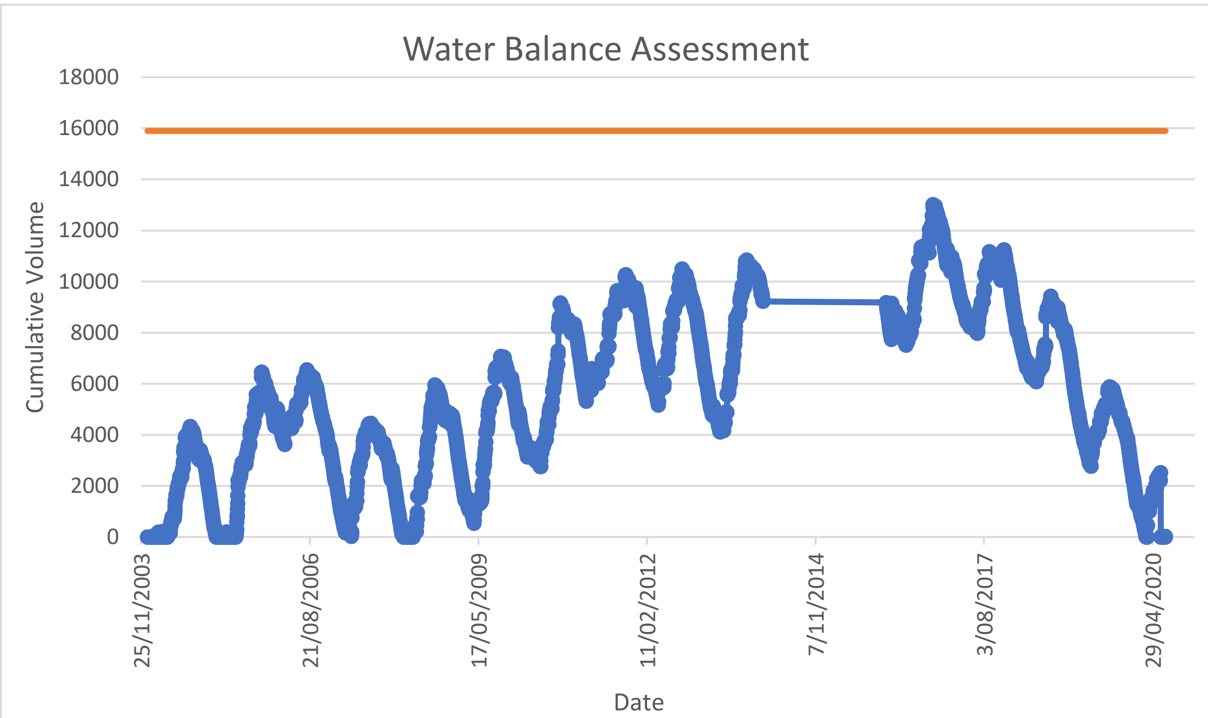

Figure 4.3 - Water Balance Assessment for Retention Basin (Site D)

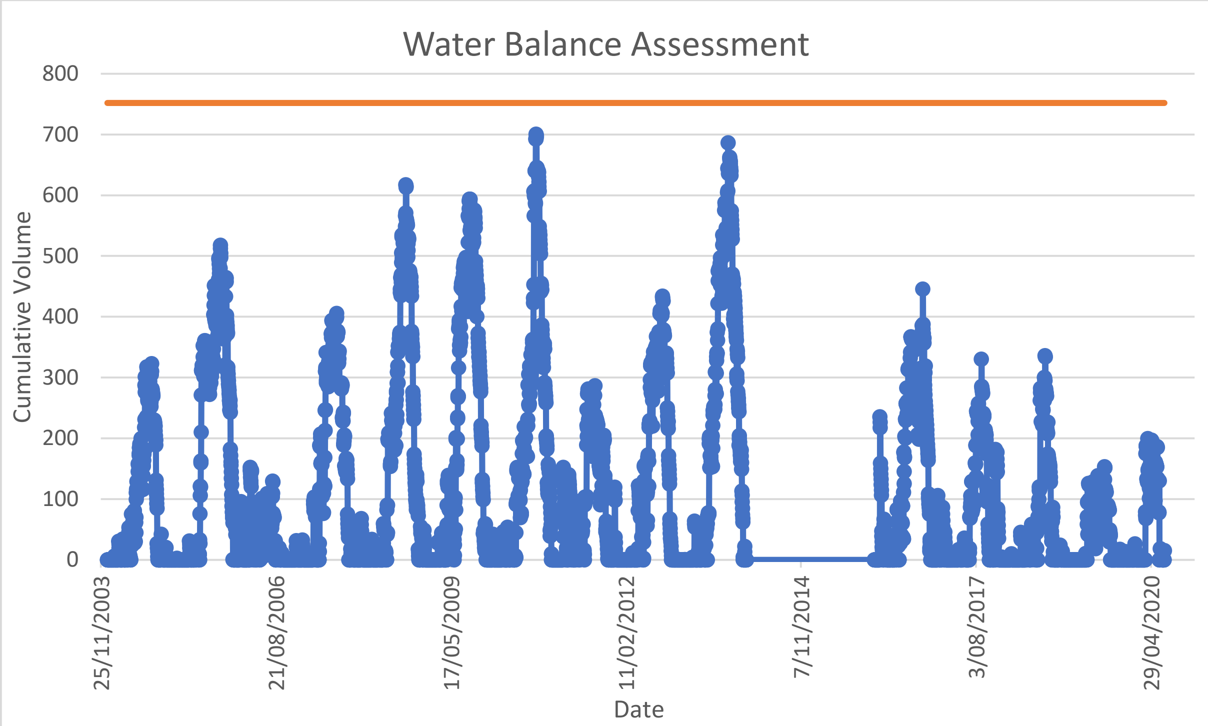

Figure 4.4 - Water Balance Assessment for Retention Basin (Site E)

The water balance assessment for each site reveals that the basin will dry out annually for all sites except Site D. Sites A, B and E are the larger sites with a high demand for water reuse. These sites also exhibit the greatest risks on the environment. It is therefore summarised that the environmental risk has been appropriately addressed with regards stormwater management. However, in addition a storm runoff volume from these sites resulting from a 100 year (1% AEP) 1-hour event was assessed assuming 50% available capacity. Refer to **Table 4.1 for a** summary of these results.

Table 4.1 - Runoff Volumes for 100-Year ARI (1% AEP) 1 Hour Event

Site Reference	Basin Maximum Volume (m^3)	Basin 50% Volume (m^3)	100-year ARI (1% AEP) 1-hour Event Volume (m^3)
Site A	6,380	3,190	500
Site B	6,380	3,190	500
Site D	15,895	7,948	510
Site E	585	293	91

4.4 SUMMARY OF STORMWATER MANAGEMENT ELEMENTS

Table 4.2 below summarises the localised stormwater treatment elements applicable to each site. It also provides an indication on the required retention basin sizes required to prevent site generated surface runoff from entering the receiving environment.

Sketches of the proposed stormwater management plan at each site are included within Appendix A..

Table 4.2 - Summary of Stormwater Management Elements

Location	Stormwater Management Elements	Retention Basin Surface Area (m^2)	Retention Basin Volume (m^3)	Comments
Sites A and B	• Surface cut off drains at the upstream interface of the site to intercept any overland flow from upstream catchments • Open drainage swale drains sized to intercept and convey stormwater runoff up to the 1% AEP storm event to discharge into the retention basin • Internal underground stormwater drainage system to convey flows up to the 10% AEP storm event (discharging into the open drainage swale) • All site areas to be directed to proposed retention basin sized to prevent any overflow from occurring, therefore holds all annual runoff • Surface treatment (i.e. earth bunds) to isolate high-risk fuelling storage and handling areas from remainder of the site – The internal stormwater within these areas to convey runoff and spills to Class 1 Separator prior to discharging into open drainage swales • All roof runoff to be directed to rainwater tanks to enable onsite stormwater non potable reuse	4,800	6,380	• Water held in retention basins to be used for two purposes: – Deluge water during launches; or – Irrigation of grassed areas within the launch sites • 1.6 m/s maximum flow velocity in swales • Class 1 Separator to be a SPEL Puraceptor (or approved equivalent) • Special high-risk fuels identified as: – Liquified Natural Gas; and – RP1 (Pure form of Kerosene)
Site D	• Surface cut off drains at the upstream interface of the site to intercept any overland flow from upstream catchments • All site areas to be directed to proposed retention basin / storage dam sized to prevent any overflow from occurring, therefore holds all annual runoff	7,500	15,900	• Note area of developed areas on this site are minimal and considered negligible given the size of the catchment and soil conditions
Site E	• Surface cut off drains at the upstream interface of the site to intercept any overland flow from upstream catchments • All site areas to be directed to proposed retention basin sized to prevent any overflow from occurring, therefore holds all annual runoff • All roof runoff to be directed to rainwater tanks to enable onsite stormwater reuse	800	750	• Stormwater runoff to be held within retention basin – Water in basin will not be used for any other purposes

5 STORMWATER RUNOFF - QUALITY MANAGEMENT

5.1 DESIGN BASIS

The stormwater management strategy is centred on ensuring that all site generated rainfall and runoff is captured within the TSCM framework detailed in Section 4. Therefore, the primary focus of the stormwater quality management basis is to prevent any potential pollutants in stormwater from entering the receiving environment.

5.2 STORMWATER QUALITY MANAGEMENT PLAN

The operations of water quality management is outlined within the report, *Design Stage (Water) Environmental Management Plan (WEMP)*, which is included in Appendix A.

This report shall be read in conjunction with the WEMP report, which outlines the key elements listed below:

- Potential deluge water contamination; and
- Design stage water quality monitoring plan and management of this water

The stormwater management strategy (detailed within this report) and the WEMP together form the overall Stormwater Strategy for this development.

6 ON SITE CONSTRUCTION MANAGEMENT

6.1 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP)

The CEMP will be developed to mitigate the risks associated with construction and to address risks as appropriate to avoid impacts to the land and marine environments. A CEMP is not within the scope of this strategy; however, it is noted that it will form part of the Planning approval submission. As a guide, the CEMP is expected to have contents similar to that listed as follows:

- Overview
- Introduction
- Project Scope
- Purpose
- Roles and Responsibilities
- Project Environmental Process
- Environmental Management System
- Induction and Training
- Contractor and Subcontractor Management
- Communication
- Feedback and Enquiries
- Document Control
- Monitoring, Inspection and Audits
- Emergency Preparedness and Response
- Incidents/Non-Compliance Reporting
- Reporting and Review
- Environmental Control Planning
- Project Environmental Objectives
- Key Environmental Risks and Controls
- Noise and Vibration
- Air Quality
- Water Quality – Sediment, Erosion and Drainage Management
- Waste Management
- Dangerous Goods Storage
- Energy Use and Greenhouse Gas Emission/Sustainability

The Construction Environment Management Plan will be prepared by the Construction Contractor (for each stage of the development) and will be submitted for approval prior to construction. The CEMP will incorporate a SEDMP, which will form an important part of the site management during the construction phase. It is expected that the SEDMP will be developed using a risk-based approach that considers all contributing site physical factors that contribute soil erosion. The CEMP will be prepared by the Construction Contractor and therefore not covered in this report. A preliminary SEDMP is not covered in this report in detail, however guidance is provided in Section 6.2 which shall be considered in the preparation of the SEDMP.

6.2 MANAGEMENT OF CONSTRUCTION SEDIMENT LOADS

6.2.1 Overview and Context Setting

During the construction phase of the development a Soil Erosion and Drainage Management Plan (SEDMP) shall be implemented in accordance with the Environment Protection Act 1993. A plan will be prepared to meet the requirements in accordance with the Code of Practice for the Construction and Building Industry (1999) as part of the construction documentation for the development.

The SEDMP encompasses surface stormwater management practices that shall be implemented during the construction phase by the constructor. The SEDMP provides a guide to the constructor to plan site management measures that should be implemented in order to prevent the mobilisation of sediment and pollutant exports to receiving environment during construction. Whilst the site's conditions will change as the construction progresses, it is the environmental duty of the constructor to ensure that the site SEDMP is progressively maintained and upgraded to suit changing site conditions and stages of construction.

The SEDMP will be prepared to include several techniques to be implemented during the land division construction phase. Typical techniques include (but are not limited to), sediment traps / basins, silt fences, diversion swales to control site flow, single site access point with shaker pad and other measures as deemed necessary. It is noted that the SEDMP will not be limited to the adoption of sediment basins within development area, the SEDMP will require a sequence of management techniques to work collectively.

The Contractor shall consider other techniques that form part of the SEDMP strategy to address the following principal outcomes such as:

- The minimisation of cleared land to minimise exposure to wind and rain.
- Focussing efforts on minimising soil loss resulting from surface erosion.
- Minimise the generation of airborne dust and other potential nuisances to the environment and nearby residences; and
- Trap debris and vegetative matter and sediment at source and prevent its mobilisation downstream.

It should be noted that the proposed retention basin and swale system could be constructed during the early phase of construction and can function as sediment capture basins during the major earthworks and civil works construction phases. In this regard these basins will ensure that all site-generated runoff will pass through sediment interception system. Upon completion of the construction works, these sediment intercepts / basins will be reinstated, completed and landscaped in accordance with the design documentation to meet their ultimate operational function of stormwater treatment. This approach provides a fundamental SEDMP strategy that uses operational phase treatment systems, which would be adapted and used to facilitate construction phase sediment interception.

The SEDMP will form a key component of the CEMP that will be developed and submitted prior to construction.

6.2.2 Development of the SEDMP During the Design Phase

During the design phase, the SEDMP would be developed to consider the following key points:

- Site and area characteristics.
- Soil types (in particular if dispersive characteristics have been identified).
- Land slope, and topography.
- Flow paths – to be considered as this needs to be managed on site.
- Sensitivity of receiving environments (Downstream marine).
- Use where possible the design phase stormwater retention systems during construction phase. Upon completion of the construction these systems are completed to address operational phase stormwater treatment.
- Slope lengths – to minimise the potential for rill erosion; and
- Environmental assets and areas that may require specific protection (Trees and downstream rocky beach).

6.2.3 General Management Approach – Construction Phase

The SEDMP would include, but not be limited to the implementation of the following techniques such as:

- Perimeter site fencing to compound.
- Flagging areas of the site that may be sensitive, need to be protected, or where vegetation (grass) should not be stripped.
- Bunting around trees and their root zones (tree protection zones) to be protected.
- Location of soil stockpiles at an appropriate location, away from flow paths, and protected to minimise mobilisation of airborne dust.
- Sediment traps and incorporate debris traps.
- Sediment capture – the proposed retention basin and other WSUD treatment systems could be excavated early and used to trap sediments and provide treatment of stormwater during the construction phase. This is an example where construction phase treatment measures can revert to providing stormwater treatment for the life of the development. This approach is considered the appropriate and best means to facilitate construction phase treatment, in particular to trap sediment loads;
- Swales – diversion swales proposed as part of the stormwater network system can be constructed early to intercept, divert and convey surface stormwater to the sediment capture basins.
- Silt fences and hay bales.
- Diversion swales to control site flow around work sites.
- Single site access point with shaker pad and other measures as deemed necessary to prevent sediment entering Council roadways; and
- Dust management techniques, including:
  - cover stockpiles with mulch if they are to remain over the long term
  - maintain adequate moisture levels to all site access tracks and earthworks areas
  - adoption of a proactive approach to dust control by remaining informed of forecast weather conditions

- Hydro seeding and or hydro mulching areas left exposed for periods of time.

These elements shall be considered, and where appropriate they would be included as part of the design of the SEDMP. It is understood that the SEDMP would be prepared as part of the contractor's CEMP or as part of the detailed design phase.

6.2.4 Dust Control

During the construction phase of the development, an Environmental Management Plan (EMP) will be prepared by the constructor and implemented in accordance with the Environment Protection Act 1993 and its associated regulations (2009). The plan shall also be prepared to meet the requirements in accordance with the Code of Practice for the Construction and Building Industry (1999).

The contractor shall implement measures to minimise and manage nuisance issues associated with the mobilisation of dust resulting from earthworks and construction activities undertaken on the project site during the construction phase. Measures to control dust shall be implemented and maintained at all times. Measures will include but not be limited to the following:

- Minimise the area of land that is cleared and exposed to wind at any given time during the construction phase.
- Perimeter dust filter screen attached to fencing.
- Covering stockpiles with mulch.
- Maintain adequate moisture levels to all site access tracks and earthworks areas.
- Adopting a proactive approach to dust control by remaining informed of forecast weather conditions and preparing strategies in advance of high-risk days; and
- Hydro seeding areas left exposed for periods of time.

APPENDIX A

DESIGN STAGE (WATER) ENVIRONMENTAL MANAGEMENT PLAN

Design Stage (Water)
Environmental Management Plan

Whalers Way Orbital Launch Complex

Version:	03
Prepared for:	Southern Launch Space Pty Ltd
Document reference:	P0020-03
Date:	13/07/2020

enviro advice

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Environmental Advice Pty Ltd (EA) was engaged by Southern Launch Space Pty Ltd (SLS) to prepare this Design Stage (Water) Environmental Management Plan (DWEMP) for the Whalers Way Orbital Launch Complex (WWOLC) proposed for construction at Whalers Way, on the southern tip of Eyre Peninsula, South Australia (the project site) approximately 1,200 ha in area. Initially a single 4 ha launch facility will be constructed, with a second launch site, an infrastructure site including a 13 ML dam and a range operations centre including and office / visitor centre to be constructed to complete WWOLC.

The WWOLC will offer launch services to a range of clients who operate launch vehicles ranging in size from small sounding rockets to small and medium lift orbital launch vehicles weighing up to 60 tonnes (at launch). During launches of larger rockets approximately 50 kL of deluge water will be released at high flow into the rocket exhaust from a 70 kL overhead tank to adsorb sound and heat energy, which might otherwise damage the rocket or the launch facility.

The aim of this plan was to estimate the potential types and levels of contamination which may occur in the deluge water and provide recommendations for monitoring of potential impacts to water at and near the site.

A review of existing literature indicated that the key chemicals of environmental concern were hydrogen chloride (which forms hydrochloric acid when dissolved in water), carbon black (which may contain traces of polycyclic aromatic hydrocarbons) and aluminium oxide. Solid aluminium oxide and soot produced at launch are suspended in a heated “ground cloud” of exhaust gasses with atomised and vaporised deluge water that rises from the launch site to fall/rain out at some distance from the launch site. Other chemicals of concern present at lower concentrations with the potential to impact the deluge water include metals which may be present in propellants, organic compounds which may form in the rocket exhaust and oxides of nitrogen which may form in the rocket exhaust and by ‘after burning’ in air.

Conservative estimates of concentration for key contaminants (HCl, PAH and Al) in deluge water were made. These estimates indicated that levels of these materials in water during operation of the WWOLC pose a low risk to human health and nearby receiving (marine) waters. A design stage program of baseline testing and ongoing monitoring of surface water, soil and groundwater (if present) was outlined for development as the project moves to the construction and operation phases.

1. INTRODUCTION

Environmental Advice Pty Ltd (EA) was engaged by Southern Launch Space Pty Ltd (SLS) to prepare this Design Stage (Water) Environmental Management Plan (DWEMP) for the Whalers Way Orbital Launch Complex (WWOLC) proposed for construction at Whalers Way, on the southern tip of Eyre Peninsula, South Australia (the project site), see Figure 1.

Figure 1 - Site Location Map

Source SLS Pty Ltd
Source Property SA Website

2. OBJECTIVE

The aim of this plan was to estimate the potential types and levels of contamination which may occur in the deluge water (used to adsorb sound during launch of larger rockets) and provide recommendations for monitoring of potential impacts to water at and near the site.

3. APPROVALS PROCESS

On 29 August 2019, the Minister for Planning declared the WWOLC to be assessed as a Major Development pursuant to Section 46 of the Development Act 1993 (the Act). Accordingly, the approving authority for the complex development is the Governor of South Australia on the advice of the Minister for Planning and State Planning Commission (SPC). In draft Assessment Guidelines provided to Southern Launch on 20 April 2020, it was indicated the specialist technical reports required to support the proposal would include:

- A Fauna and Flora Assessment and Management Plan,
- A Marine and Coastal Environment Management Plan, (including consideration of potential impacts on marine organisms from launch activities (including water quality) and impacts on the marine environment from spent (discarded) launch vehicles,
- An Air Quality Assessment report,
- A Waste Management and Minimisation Plan (for construction and operation),
- A Noise Report and Vibration Report,
- A Soil Erosion and Drainage Management Plan (SEDMP),
- A Construction Environmental Management Plan (CEMP),
- An Operational Environmental Management Plan (OEMP), and
- A Sustainability and Climate Change Report.

This plan will also address some items required for the SEDMP (at the design/concept stage), including a description of the site characteristics (existing topography and runoff characteristics) and plans for retention, reuse and monitoring of water quality during the operation phase of the project and drainage management to prevent contamination of groundwater on site. The conceptual plans presented in this report will be developed during the detailed engineering design of pavements and stormwater works. Water monitoring plans and measures proposed to prevent soil erosion and contaminated runoff from leaving the site during construction will be further developed and included in the CEMP and ongoing water quality monitoring will be further developed in the OEMP.

4. METHODOLOGY

The scope of work proposed included the following tasks:

- Project management, including time for liaison with project team members;
- A brief review of existing literature relating to rocket deluge water contamination;
- A review of the environmental setting of the site including local geology and hydrogeology, rainfall and evaporation, and receiving (marine) waters;
- Identification of key chemicals present and produced during launch, preliminary mass balance calculation to estimate the types and amounts of materials generated (e.g. on an annual basis);
- Initial water balance calculations and discussion of water influent makeup, onsite storage/treatment and effluent (volumes, sources and fate);
- Estimates of contaminant concentrations in deluge water and onsite storages comparison to human health and ecologically based risk screening threshold values;
- Preparation of the DWEMP (report) including a (Draft/Design Stage) water monitoring program; and
- External technical review.

5. PROJECT DESCRIPTION

Project Overview

SLS plan to offer launch services to a range of clients operating small to medium lift vehicles. The complex will be constructed within 1,200 ha of land at the southern tip of Eyre Peninsula. Elements of the complex are planned for construction at four sites within this larger area, designated Site A, B, D and E, see Figure 2.

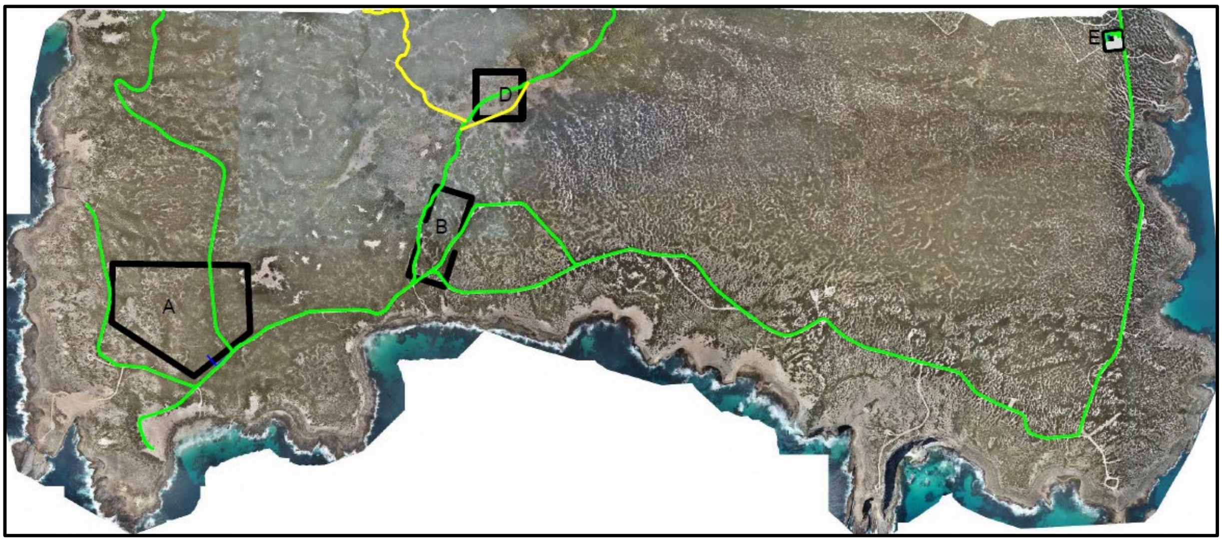

Figure 2 – Launch Complex – Planned facility locations

Source SLS Pty Ltd

Launch pads are planned for construction at Site A and B, each launch site will have a retention pond to capture spent deluge water and run off from the launch site (each estimated to be around 2 ML). A 30 ML dam is planned for Site D. This will harvest runoff from surrounding undeveloped land to supply water to the launch sites and the office building planned for Site E.

SLS have advised that the primary demand for water for the operations will be for irrigation of landscaped areas, with a lesser amount used for deluge water and fire-fighting water, and a small amount for potable use. Concept drawings showing the general arrangement of the launch sites and supporting facilities comprising the planned complex are included in Appendix A.

5.1 Launch Site Layout

Work at the site will proceed in stages with a single launch facility to be constructed and become operational prior to completion of the remainder of the complex. Initially a single launch facility will be constructed in the area designated Site B. A 3D rendering of the concept launch site layout is show in Figure 3.

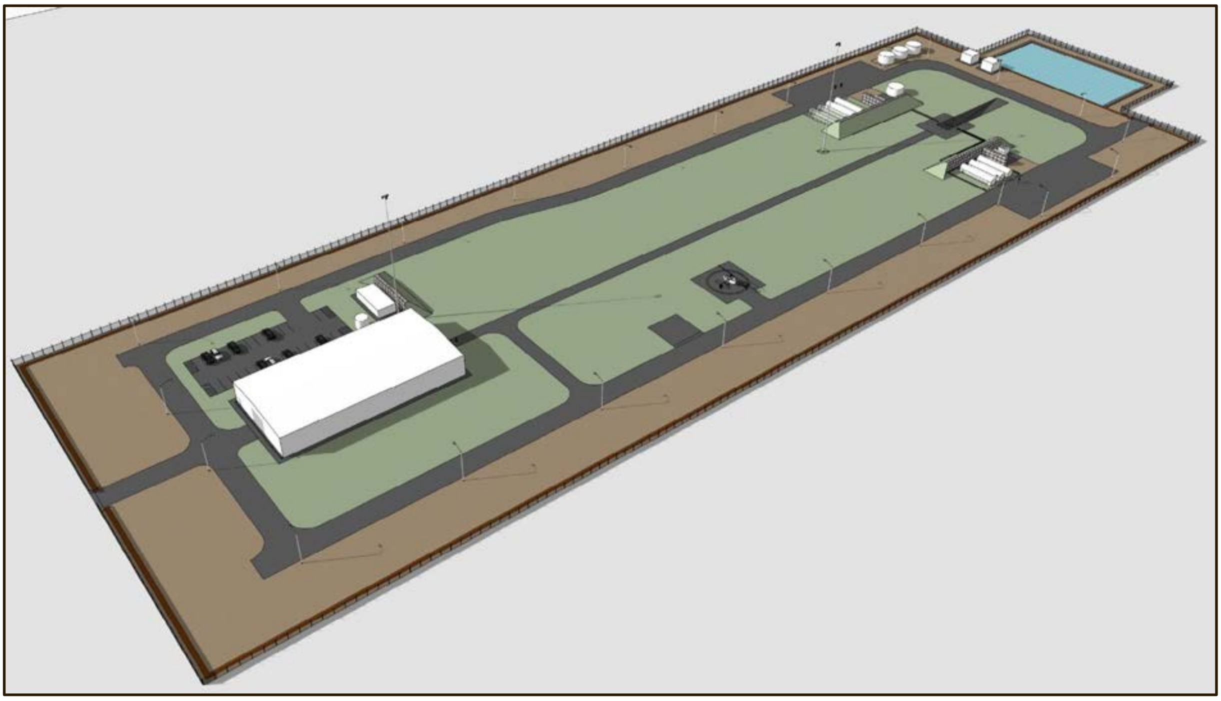

Figure 3 - Concept Site Layout

Source SLS Pty Ltd

Launch facility A will be constructed on a rectangular site approximately 4 ha in area:

- a perimeter fence, swale and concrete lined stormwater drain,
- irrigated landscaping and hardstands (comprising compacted rubble area and paved road),
- buildings and other structures for rocket assembly,
- tanks for storage of fuels, oxidisers and other materials used to prepare the rockets for launch,
- tanks for water storage including a 70kL overhead deluge water tank then gravity feed the deluge water spray nozzles,
- a concrete lined flame diverter trench, 35 m long by 5 m wide, max depth 5 m (capacity 430 m^3) and, and
- a launch site stormwater detention basin (approximately 2 ML).

5.2 Water Deluge

During launches of larger rockets (low and medium lift orbital launch vehicles) deluge water will be released at high flow from an overhead tank and sprayed into the rocket exhaust for the period between rocket ignition and the rocket clearing the launch structures to adsorb sound and heat energy, which might otherwise damage the rocket or the launch facility. Many of the smaller (e.g. sounding rockets) will not require a water deluge on launch.

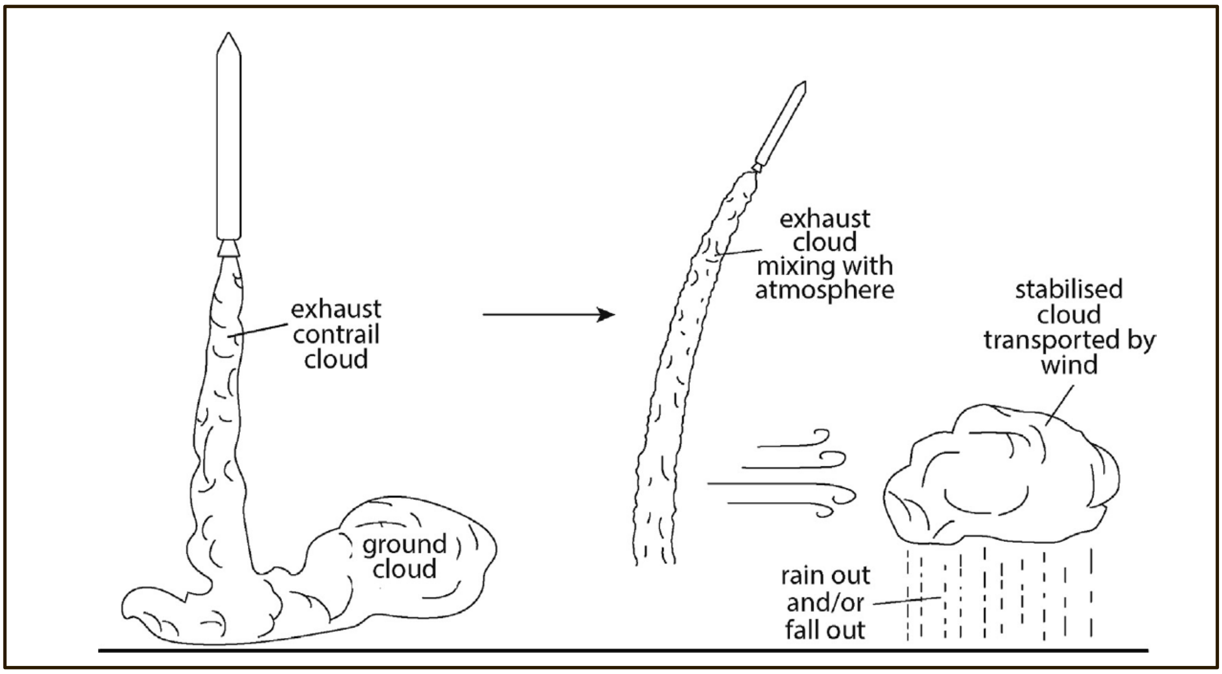

Figure 4 – Ground Cloud Schematic

Source .JA. Dallas et al. / Journal of Cleaner Production 255 (2020) 120209SLS Pty Ltd

When deluge is required, around 50 kL of water will be released from an overhead tank through spray nozzles. It was estimated that the deluge water will be in contact with the exhaust gasses from the first stage rocket for a period approximately five seconds after ignition. A portion of the deluge water will evaporate and mix with exhaust gasses with atomised droplets to form a heated “ground cloud”, which rise (left hand portion of Figure 4). The ground cloud will then migrate some distance from the launch site, depending on weather conditions, before its contents and rain/fall out some time after launch (right hand portion of Figure 4).

The bulk of the deluge water is expected to flow under gravity into the flame diverter trench. After launch water in the trench may be tested and treated, or pumped directly the launch site stormwater detention basin. Some chemicals present in the rocket exhaust may be transferred to the deluge water, potentially causing contamination of water collected in the launch site stormwater detention basin. The project is not at a stage where it is possible to predict a specific launch schedule, however, it is estimated that up to 36 launches (requiring deluge water) will occur per annum at each launch site once the complex is fully operational.

5.3 Client Rockets

It is understood that SLS's client list will change and develop as the project moves into the construction and operation phase. However, it is understood the client's rockets will range in size from small sounding rockets to medium lift vehicles, capable of placing small to medium-sized satellites into sun synchronous or polar orbits, with launch mass up to approximately 60 tonnes. Details of rocket exhaust composition for specific launch vehicles were not available during the preparation of this plan. However, propellant (fuel + oxidiser) type and load data for three of the largest rockets which may be launched from the complex were provided by SLS. Selected data relating to the first stage of these vehicles is summarised in Table 1.

Table 1 - Medium Lift Vehicles - Stage 1 Propellants

<table>
<tr><th>Data</th><th>Units</th><th>HAPITH-V</th><th>Vega Light</th><th>TBA</th></tr>
<tr><td>Client</td><td>-</td><td>Tispace</td><td>Arianespace</td><td>Rocket Factory Augsburg</td></tr>
<tr><td>Wet Mass</td><td>(kg)</td><td>35,000</td><td>41,362</td><td>58,400</td></tr>
<tr><td>Stage 1 Fuel Type</td><td>-</td><td>SBR</td><td rowspan="3">HTPB/Aluminium Perchlorate/Al Powder</td><td>RP-1</td></tr>
<tr><td>Stage 1 Fuel Load</td><td>(kg)</td><td>3,325</td><td>6,000</td></tr>
<tr><td>Stage 1 Oxidiser Type</td><td>-</td><td>N_2O</td><td>LOX</td></tr>
<tr><td>Stage 1 Oxidiser Load</td><td>(kg)</td><td>23,275</td><td>26,000</td><td>36,000</td></tr>
<tr><td>Burn Time</td><td>(s)</td><td>100 (estimate)</td><td>77</td><td>100 (estimate)</td></tr>
</table>

Source – SLS

Notes,
RP-1 = refined kerosene liquid rocket fuel
LOX = liquid oxygen
HTPB = hydroxyl terminated polybutadiene solid rocket fuel
STB - styrene butadiene rubber hybrid rocket fuel

6. LOCAL GEOLOGY AND HYDROGEOLOGY

Information was sourced from SARIG and the AUSGIN Geoscience Portal and indicated that surface soils at the site can be expected to comprise shallow (or absent) Holocene aeolian sand deposits over fresh to moderately weathered bed rock comprising Paleoproterozoic Predominantly sedimentary rocks. This includes sedimentary rocks of low metamorphic grade and diapiric breccias. These sedimentary rocks are expected to be underlain by Metasediment; metabasalt, sills, dykes; augen gneiss, granulite facies and amphibolite facies of the Sleaford Complex, which occur at the surface nearer the eastern and western coast, darker shaded regions on Figure 5.

Figure 5 - Geological Units (Lithology)

Source AUSGIN Geoscience Portal

Mapping provided by Geoscience Australia also indicates the karstic conditions, leading to possible voids in the rock, or caves, may occur within the project site.

7. LOCAL HYDROGEOLOGY

The DEW, SA Water Connect web site shows a single well located around 1km inland (to the north) of the site (Unit Number 6028-5073), near the planned 30 ML storage dam (Site D) (see Figure 6).

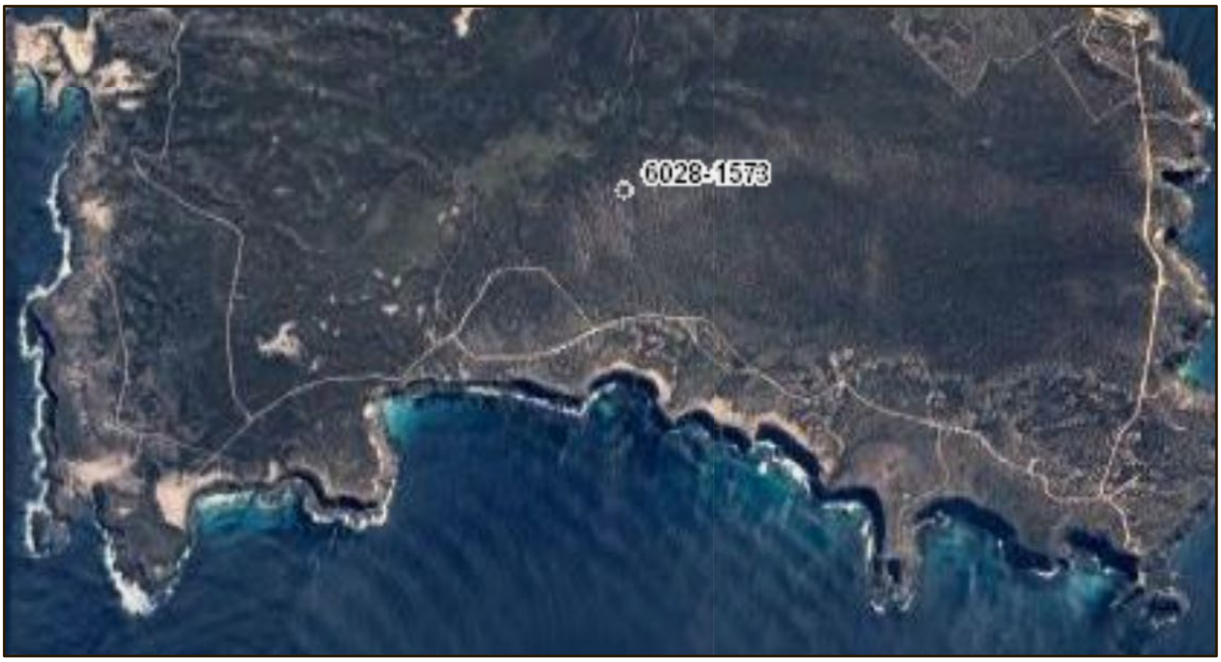

Figure 6 – Well Location Plan

Source SA Water Connect

This well was drilled in 1983 to a depth of 30 m and is shown as an operational well used for irrigation although anecdotal information indicated the well is now disused. When operational it produced groundwater with a TDS of 1233 mg/L at a rate of 1.12 L/s from a production zone between 24 m and 30 m below the local ground level of around 30 m AHD. Although no lithological log was provided for Unit Number 6028-5073, it is assumed to access groundwater occurring in fractured and possibly karstic sedimentary bed rock. No evidence that the well has been properly decommissioned was identified. Groundwater conditions at proposed launch sites A and B, located closer to the coast, are unknown.

8. RAINFALL AND EVAPORATION

Rainfall data collected at the Westmere Station were obtained from the Bureau of Meteorology (BoM) web site. The Westmere Station is located approximately 10 km to the north east of the site. Monthly total rainfall data has been collected for each year from 1906 The average (arithmetic mean) and 90th percentile monthly and annual rainfall calculated from data collected between 1961 and 1990 is summarised in Table 2. Monthly average pan evaporation data interpolated from maps provided on the BoM web site are also included in Table 2.

Table 2 - Rainfall Data and Pan Evaporation

Month	Average Rainfall (mm)	Average Pan Evaporation (mm)	10th Percentile Rainfall (mm)	Median Rainfall (mm)	90th Percentile Rainfall (mm)
Jan	11.3	250	2.2	5.2	19.7
Feb	14.7	200	1.3	11.1	28.2
Mar	25.0	150	2.0	14.5	53.4
Apr	49.1	100	12.8	34.6	100.7
May	72.9	80	31.2	70.7	105.3
Jun	84.9	50	43.5	76.4	120.7
Jul	112.4	80	63.4	101.9	158.6
Aug	88.4	80	53.8	80.1	126.7
Sep	58.2	100	21.7	56.4	100.3
Oct	37.9	150	15.9	32.2	58.9
Nov	22.5	200	6.1	19.5	39.7
Dec	21.4	250	5.6	17.4	44.1
Annual	**598.8**	**1,690**	**454.8**	**564.9**	**745.7**

Source BoM

9. SITE TOPOGRAPHY AND RUNOFF

It is understood that launch sites will be enclosed by bunds and constructed stormwater drains and will be graded to direct stormwater runoff and deluge water into launch area detention ponds approximately 2 ML in volume and 1000 m^2 in area at each launch area. Water for deluge will be drawn from these ponds and pumped up to the deluge tank (70 kL) in preparation for each deluge, nominally up to three times per month. After each deluge (50 kL), the bulk of the deluge water will return to the pond, excepting water leaving the site via the ground cloud and other losses (estimated as up to 30%).

Simplified runoff calculations were made for the 4 ha launch site based on the average rainfall and evaporation data presented in Table 2 and an very conservative (low) estimate for the runoff coefficient of 0.3 (for mixed hardstands and very permeable landscaped areas with assumed mostly low rainfall intensity rainfall events). Pond evaporation was estimated to be equal to pan evaporation (actual pond evaporation is likely to be less). Results from these calculations are presented in Table 3.

Table 3 – Launch Site Runoff Estimates

Month	Runoff from Site (kL)	Evaporation Loss (kL)	Deluge Water Loss	Net Water Collected	90th Percentile Rainfall
Jan	135.6	250	45	-272.68	19.7
Feb	176.4	200	45	-190.92	28.2
Mar	300	150	45	-65	53.4
Apr	589.2	100	45	149.24	100.7
May	874.8	80	45	325.56	105.3
Jun	1018.8	50	45	438.36	120.7
Jul	1348.8	80	45	578.36	158.6
Aug	1060.8	80	45	424.76	126.7
Sep	698.4	100	45	207.48	100.3
Oct	454.8	150	45	17.56	58.9
Nov	270	200	45	-141	39.7
Dec	256.8	250	45	-208.04	44.1
Annual	7185.6	1690	540	1264.32	**745.7**

Table 3 suggests that deluge water demands for the year should easily be supplied by stormwater harvested from within the launch site in the winter months and that without other onsite uses, in an average year, at least 1.3 ML excess water would need to be released from the pond. In practice it is understood that this water would be used for irrigation of landscaped areas within the site and that makeup water would be pumped via a rising main from the planned 30 ML storage in area D.

10. LITERATURE REVIEW

The scope of work included a brief review of relevant published information. Environmental reports relating to the Rocket Lab Launch Complex (RLLC) on the Mahia Peninsula, Hawkes Bay, New Zealand were reviewed (NIWAR 2017, ZNME 2018). The liquid fuel (RP-1/LOX) Electron Rocket is launched from the RLLC. The Electron Rocket is a small lift orbital launch vehicle with a wet mass of 12,500 kg. In its two-stage configuration it is designed to launch a 150 to 225 kg payload to a 500 km Sun-synchronous orbit (WP 2020). Environmental reports for the RLLC focused on the effects of rocket debris (including batteries used to drive the fuel and oxidiser pumps) on the marine environment. Deluge water is not used at the RLLC site, but it is located in a similar southern costal location to the WWOLC with similar perimeter fencing and drainage into a local retention basin, see Figure 7.

Figure 7 - Rocket Lab NZ Launch Complex 1

Source NZME 2018

An environmental assessment report was completed by Environment Australia (now the Department for Agriculture Water and the Environment) in 2000 for a proposed orbital launch facility on the southern point of Christmas Island (EvAus 2000). The assessment report was prepared in response to a draft environmental impact statement (EIS) submitted by Asia Pacific Space Centre Pty Ltd (APSC).

Although the APSC proposal was for much larger rockets than proposed at the WWOLC and although the EIS report could not be located, some useful information was provided in the Environment Australia assessment report. The launch plume from combustion of kerosene and liquid oxygen in the rocket engines produces water, carbon dioxide, carbon monoxide, smaller amounts of hydrogen, nitrogen and oxygen (EvAus 2000). Solid fuel rockets (such as the boosters used on the Space Shuttle) produce hydrochloric acid and aluminium oxides (EvAus 2000).

In a recent review of literature related to environmental effects of space launches (J.A. Dallas, et. al. 2020) summarised the exhaust products and key environmental impacts of commonly used rocket propellants, information adapted from this summary and other reference material is included in Table 4.

Table 4 – Major Constituents of Rocket Exhaust

Propellants	Main Exhaust Products
Solid Fuel e.g. hydroxyl terminated polybutadiene (HTPB), Ammonium Perchlorate (Al NH_4ClO_4))/Al Powder	HCl, H_2O, CO_2, CO, NO_x, AL_2O_3, Soot
Hybrid e.g. hydroxyl terminated polybutadiene (HTPB), Liquid Oxygen (LOX)	H_2O, CO_2, CO, NO_x, OH, Soot
Liquid Hydrocarbon Fuel e.g. 'Kerosene' (DP-1) and Liquid Oxygen (LOX)	H_2O, CO_2, CO, NO_x, OH, Soot
Cryogenic Hydrogen Fuel Liquid Hydrogen (LH_2), Liquid Oxygen LOX),	H_2O, CO_2, NO_x, OH

Most of the literature relating to impacts of rocket emissions on the environment reviewed by JA Dallas, et al focused on upper atmosphere impacts. Where effects to surface were investigated, they were focused on accumulation of metals and acidification of water or soil near the launch sites.

To estimate potential for deluge water contamination detailed and quantitative data relating to the rocket exhaust and ground cloud/spent deluge water interaction was required. These will depend on specific fuel and oxidiser composition, rocket engine configuration and many other factors. It is understood that some rocket manufacturers may have test data, but this remains confidential at this stage. Exhaust composition may be estimated from propellant composition using thermodynamic/chemical models.

Early modelling of rocket exhaust and ground cloud composition was carried out for NASA by the University of Michigan by Cicerone, et. al. in 1973. They estimated the composition of the exhaust from the shuttles HTPB/Ammonium Perchlorate/Al Powder solid rocket boosters (SRBs) and the liquid hydrogen/LOX orbiter engines (which produced only water with some excess hydrogen) at different stages of the shuttle's ascent. The results ofore recent modelling of rocket exhaust modelling were presented in a study prepared by NASA in 2011 including products from and "average" RP-1/LOX motor (NASA 2011). The percent by weight rocket exhaust products calculated from these sources are presented in Table 5 (rocket exhaust before dilution with air).

Table 5 - Solid and Liquid Fuel Exhaust Composition

Rocket	Shuttle SRB	Average RP1 - LOX
Exhaust Compound	**% w/w**	**%w/w**
Water, H_2O	10.351	29.05
Carbon dioxide, CO_2	4.324	45.85
Carbon monoxide, CO	24.372	25.85
Hydrogen Chloride, HCl	20.899	0.00
Chlorine, Cl_2	0.060	0.00
Aluminium III Oxide, Al_2O_3	28.368	0.00
Iron III Chloride, $FeCl_3$	0.970	0.00
Aluminium III Chloride, $AlCL_3$	0.020	0.00
Nitrogen, N_2	8.504	0.00
Hydrogen, H_2	2.111	0.01
Oxygen, O_2	0.00	0.01
Free radicals, H+/OH-	0.020	0.00

Sources (NASA 1973, 2011)

Observation from Table 4 include the significant quantities of hydrogen chloride (HCl) produced by the HTPB/Ammonium Perchlorate/Al Powder solid rocket. HCl has a high affinity for water and is readily absorbed into water droplets in the ground cloud, some references suggest that only a small proportion of the HCl migrates into deluge water runoff. Significant quantities of carbon monoxide (CO) are also generated by both solid and liquid fuels, references generally suggest that most of the CO and unspent fuel are largely converted to carbon dioxide (CO_2) by afterburning in atmospheric oxygen (O_2). The modeling results also do not show any soot (carbon and carbon rich organic compounds) or any oxides of nitrogen, produced by reactions with atmospheric nitrogen.

A comparison of model results with results from analytical test data of samples of exhaust gasses collected from bench scale (0.28 inch throat diameter, 1.0 inch exit diameter) rocket motors was conducted by the Oak Ridge National laboratories for the US Army in 1991 (Jenkins, et.al 1991). Four solid rocket fuels were selected including “Compound L” which comprised ammonium perchlorate (73.93% w/w) by weight, polyvinyl chloride 11.67% w/w, di (2 ethyl hexyl) adipate 11.67% w/w, other additives 2.73% w/w. Analytical data from testing of exhaust gasses produced from 25 g of propellant L (internal rocket pressure 2500 psi) summarised in Table 6.

Table 6 - Solid Fuel Test Rocket Exhaust

Exhaust Compound	Result mg/m3	Estimated %w/w
Water, H_2O	Not tested	10.000%
Carbon dioxide, CO_2	154	21.313%
Carbon monoxide, CO	344	47.608%
Hydrogen Chloride, HCl	114	15.777%
Particulates (soot)	30	4.152%
Alumina, Aluminium III Oxide, Al_2O_3	3.5	0.484%
Nitric Oxide (NO)	0.75	0.104%
Hydrogen Cyanide HCN	Not Detected	0.00
Nitrogen, N_2	8.504	1.177%
Hydrogen, H_2	2.111	0.292%
Oxygen, O_2	0.00	0.000%
Free radicals, H+/OH-	0.020	0.003%

Source Jenkins et.al 1991

Further analysis of test rocket ‘L’ exhaust for trace organics identified only the relatively low risk compound octamethyl cyclotetrasiloxane above background levels (other fuel formulations produced a wide range of trace organics including higher risk compounds trichloroethene (TCE) and benzene). Analysis of the soot identified trace amounts of polycyclic aromatic hydrocarbons PAH. Total PAH concentrations in the soot from the type L fuel was less than 10 μg/kg and benzo-a-pyrene concentrations were less than 0.5 μg/kg.

11. POTENTIAL DELUGE WATER CONTAMINATION

The key chemicals of environmental concern identified in the literature review were HCl (which form hydrochloric acid when dissolved in water, carbon black (which may contain a traces of PAHs) and aluminum oxide (Al_2O_3). HCl and Al_2O_3 are only produced by solid fuel rockets. Soot is expected to be produced by solid fuel, hybrid and liquid fueled rockets. Although some published data relating to these emissions and other (lower level) contaminants present rocket exhaust were identified in the literature, no quantitative information regarding the portioning of exhaust products between vapors and (aqueous) liquid phase was found in the literature, with exception of comments that most of the HCl produced by the shuttle SRBs on launch was expected to be absorbed into atomized water droplets suspended in the ground cloud (NASA 1973). Most of the dissolved HCl and an unknown proportion of the soot (carbon black) produced are expected to migrate with the ground cloud and fall/rain out at some distance from the launch site.

The possible impacts to deluge water during a single HTPB/Aluminium Perchlorate/Al Powder propellant, Arianespace Vega Light launch were estimated based on the available data (adapted from Tables 1, 5 and 6), an assumption of constant burn rates, and other estimates included in Table 7.

Table 7 - Vega Light Launch – Single Deluge

Quantity Estimated	Units	Estimate
Exhaust / deluge contact period	s	5
Concentration of HCl in exhaust w/w	%	20
Proportion HCL dissolved in deluge w/w/	%	20
Concentration of Al_2O_3 in exhaust w/w	%	10
Proportion Al_2O_3 dissolved in deluge w/w	%	5
Soot production w/w	%	5
Proportion PAH in soot	μg/kg	10
Estimated Proportion PAH dissolved in deluge w/w	%	5
Total deluge	L	50,000
Estimated Concentrations in Spent Deluge	**Units**	**Estimate**
Estimated $[Al^{3+}]_{aq}$	mg/L	3.7
Estimated $[HCl]_{aq}$ w/w	%	0.134
Estimated [PAH]	μg/L	0.0025

Hydrogen chloride gas produced from the solid fuels may result in acidification of the deluge water. Some pH correction of water captured in the flame trench after launches of the Vega Light may be required depending on water monitoring results. In practice the changes in pH may be sufficiently adjusted alkalinity of stormwater from the launch site, and additional water being pumped up from the Site D storage for irrigation, via the launch site pond(s).

Table 7 suggested that a single launch of the Vega Light is not likely to produce significant PAH contamination of the deluge water. There was insufficient data to develop ANZECC 2000 threshold values and most PAHs for marine waters, the 99% trigger values for naphthalene is 50 μg/L, well above the estimate in Table 7 for total PAH.

Assuming the launch site is operated as a closed system with deluge water being recycled through the launch site pond only, contamination can be expected to accumulate over time. Assuming a year with 12 launches of each of the three rockets described in Table 1 and applying the same estimates and assumption in Table 7 estimates launch site pond concentrations at the end of the year can be made, see Table 8.

Table 8 - Potential Contaminant Accumulation in Launch Site Detention Basin

Estimate / Assumptions	Units	Annual Total
Total Stage 1 - Solid Rocket Propellant Burnt	kg	300,000
Total Liquid and Hybrid Rocket Propellants	kg	700,000
Annual total propellant consumption	kg	1000,000
50% launch site stormwater detention basin volume	L	1,000,000
Quantities Calculated from Estimated	**Units**	**Annual Total**
Estimated Launch Site Pond $[Al^{3+}]_{aq}$	mg/L	6.6
Estimated Launch Site Pond $[HCl]_{aq}$ w/w	%	0.0008
Estimated Launch Site Pond [PAH]	μg/L	0.05

In Table 8 the total annual propellant burn estimated in Table 1 may produce around 2.5 tonnes of soot near the flame trench (from the first five seconds of each launch). Depending on how much of the soot stays within the launch site, a process of soot removal collection, storage, classification and appropriate disposal may be required, so that it does not accumulate in the ponds.

The estimates presented in Table 8 could be considered representative of a situation where the residence time of water in the launch site detention pond(s) was around 12 months. It is planned that water be pumped from the ponds for irrigation of landscaped areas within the launch sites, with water made up from winter runoff from the launch site (see Table 2) and from the planned 30 ML main storage dam. Depending on irrigation demand at the launch sites residence time in the launch site ponds may be less than 12 months.

12. DESIGN STAGE WATER QUALITY MONITORING PLAN

Although deluge water and launch site detention pond concentration estimates in Table 7 and 8 are only indicative, they provide a guide to the potential contaminants that should be targeted during water quality monitoring at the site. Although not identified in the limited literature search undertaken, it is possible that deluge water may be impacted by trace metals (other than aluminium) and other additives which may be present in propellants. Trace organic compounds, including chlorinated organic compounds, may also be formed during rocket combustions and after burning or rocket exhausts, e.g. water-soluble oxides of nitrogen which may form nitrates and nitrites in the deluge water. These should also be considered when developing a scope for water monitoring at the site. A broad suite of analysis for water samples is provided in Table 9.

Table 9- Preliminary Water Analysis Suite

Nominal Water Analyses
pH
TDS
Major + and – ions
Total N (all forms), Total P
Total Metals (NEPM 13 + Al)
Total Recoverable Hydrocarbons (TRH)
Volatile Organic Compounds (VOC) Suite (including TCE and Benzene)
Semi Volatile Organic Compounds (SVOC) Suite (including PAHs)

Water monitoring should also include potential contaminants including any fuels, lubricants, cleaners, firefighting foams and other materials handled on the launch site (not considered in this report). Other testing relevant to water treatment (if required) may also be included in the broad suite.

Prior to construction commencing surface water samples could be collected from the sites A, B and D during a storm event to establish initial, baseline conditions at the sites prior to construction commencing. Sampling and analysis of storm water captured in the launch site stormwater detention basin should continue during construction, as part of monitoring under the Construction Environmental Management Plan (CEMP) and to further characterise baseline conditions.

Further investigation of groundwater conditions around sites A, B and D is also recommended prior to construction commencing potentially including installation of groundwater monitoring wells/piezometers around the perimeter of the planned stormwater basis and irrigated areas. If groundwater is present, it should be sampled and analysed to establish baseline groundwater conditions and monitor groundwater conditions during construction and operation (to monitor potential leakage from ponds or infiltration of contamination via irrigation water).

Soils within and in the vicinity of the launch sites may also be impacted by use of deluge water for irrigation and form fall/rain out from launch ground clouds. The prime concern is acidification of soil from HCl generated from solid fuel rockets. In practice this is considered likely to be neutralised by alkaline soils. However, a suitable program of baseline soil sampling and analysis is recommended to confirm this, and ongoing soil sampling may be appropriate to monitor potential identify any accumulation contaminants in these areas.

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14. LIMITATIONS

This report has been prepared with appropriate reference to industry recognised standards and procedures current at the time of the work. The report presents the advice based on the quoted scope of works (unless otherwise agreed in writing) for the specific purposes of the engagement by the Client.

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APPENDIX B

SITE LAYOUT DRAWINGS

LEGEND:

- STORMWATER PIPE
- OPEN DRAINAGE SWALE
- DIRECTION OF FALL TO SURFACE
- GRATED INLET PI
- GRATED DRAIN
- SPEL PURACEPTOR

SCALE BAR (m) 5 2.5 0 5 10

When sheet printed full size, the scale bar is 100mm.
0 50 100mm

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A	10.08.20	PRELIMINARY ISSUE	JJF	HB	HB

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SOUTHERN LAUNCH
WHALERS WAY
STORMWATER CONCEPT SKETCH
SITE PLAN TYPICAL - SHEET 1 OF 2 ©

A1
DOCUMENT NUMBER
Project Number / Sheet No. / Rev.
Design JL
Drawn JJF
WGA181404-SK- CC-0001 A

LEGEND:

STORMWATER PIPE
OPEN DRAINAGE SWALE
DIRECTION OF FALL TO SURFACE
GRATED INLET PI
GRATED DRAIN
SPEL PURACEPTOR

5 2.5 0 5 10
SCALE BAR (m)

When sheet printed full size, the scale bar is 100mm.
0 50 100mm

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SOUTHERN LAUNCH
WHALERS WAY
STORMWATER CONCEPT SKETCH
SITE PLAN TYPICAL - SHEET 2 OF 2

A1 DOCUMENT NUMBER
Project Number Sheet No. Rev.
Design JL Drawn JJF
WGA181404-SK- CC-0002 A

LEGEND:

- STORMWATER PIPE
- OPEN DRAINAGE SWALE
- DIRECTION OF FALL TO SURFACE
- GRATED INLET PI
- GRATED DRAIN
- SPEL PURACEPTOR

When sheet printed full size, the scale bar is 100mm.

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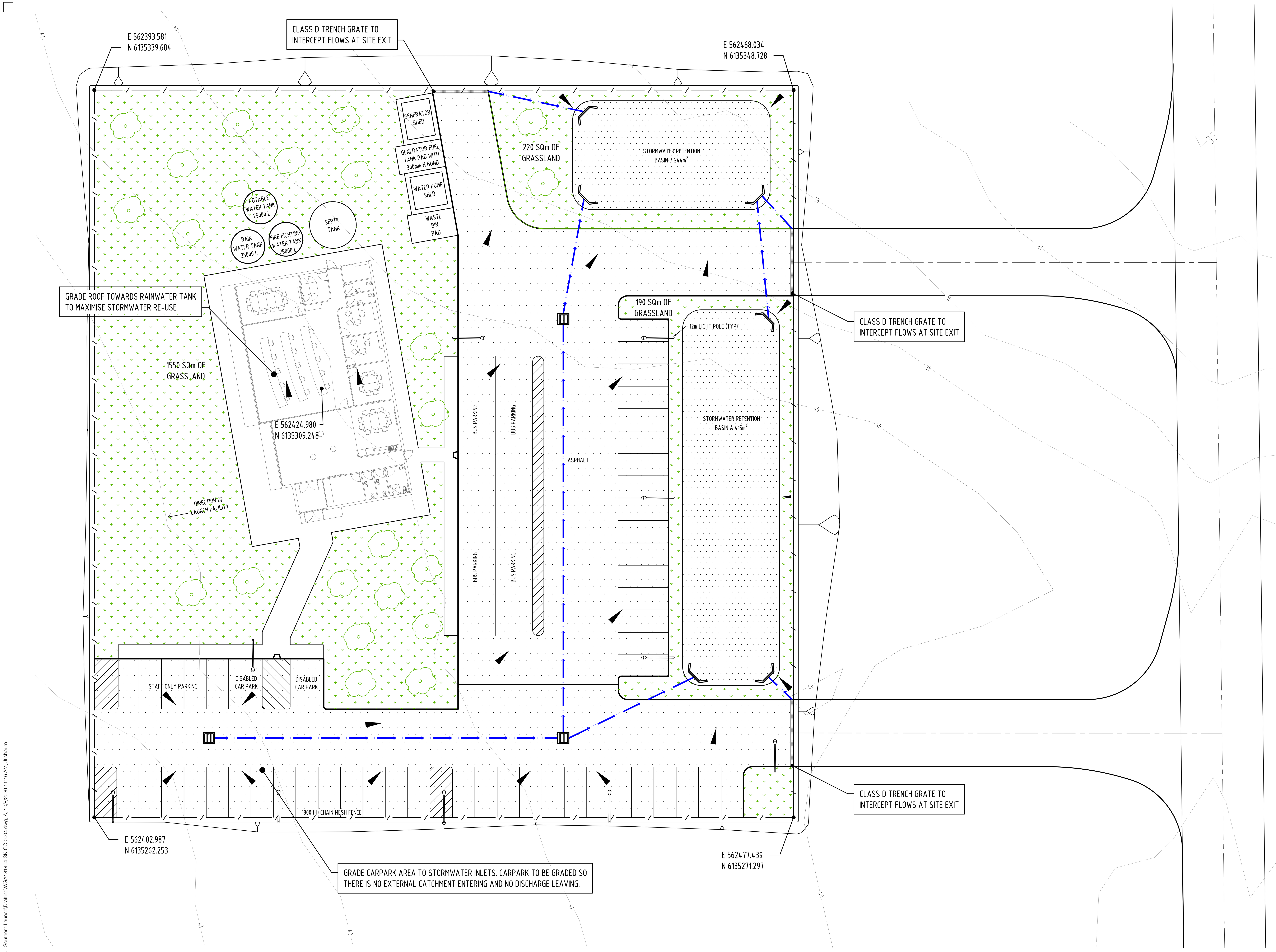
SOUTHERN LAUNCH
WHALERS WAY
STORMWATER CONCEPT SKETCH
SITE D

A1
DOCUMENT NUMBER
Project Number Sheet No. Rev.
Design JL Drawn JJF
WGA181404-SK- CC-0003 A



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When sheet printed full size, the scale bar is 100mm.

0 50 100mm

LEGEND:

	STORMWATER PIPE		GRATED INLET PI
	OPEN DRAINAGE SWALE		GRATED DRAIN
	DIRECTION OF FALL TO SURFACE		SPEL PURACEPTOR

4 2 0 4 8
SCALE BAR (m)

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SOUTHERN LAUNCH
WHALERS WAY
STORMWATER CONCEPT SKETCH
SITE E

A1

DOCUMENT NUMBER
Project Number Sheet No. Rev.

Design JL Drawn JJF

WGA181404-SK- CC-0004 A

APPENDIX C

SPEL PURACEPTOR DETAILS

SPEL Puraceptor™

Petrol Stations - Pollution Prevention
Stormwater Treatment & Hydrocarbon Capture

www.spel.com.au

SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

Standards & Guidelines for Petrol Station Stormwater Pollution Control

There is no Australian Standard for oil/water separators. There are only guidelines for hydrocarbon discharge limits for stormwater discharge.

All State and territory regulating environmental authorities (or EPA) have guidelines with varying terminology stating that hydrocarbons are not to be visual (10ppm) in stormwater and receiving waters.

European Standard

(oil and petrol separators)

In the absence of an Australian Standard, the European British Standard BSEN 858-1:2002 applies when compliance is the regulating issue.

It is the world's most stringent standard for hydrocarbons separation for the use of oil/petrol separators in surface water drainage systems. Prevents the emission of petrol odours.

Australian Runoff Quality

The Australian Runoff Quality A Guide to Water Sensitive Urban Design (Engineers Australia) ISBN 0 85825 852 8 Chapter 9 `Hydrocarbon Management` refers to The Standard and the European Agency UK Oil Separator Selection and Design` for petrol stations.

Non-Compliant Sites

Petrol stations with the following defects.

- Canopy drip line that does not allow for the 10 degree inset
- Fuel hose line that reaches outside the drip line
- Fuel bowsers that have no canopy
- Defective Oil/Water plate separator (Sewer connected)

Picture shows an undersized canopy with fuel pumps outside the canopy dripline

Picture shows a common site at petrol stations - uncovered fuel pumps.

Picture shows a defective forecourt design with oils and fuels discharging directly to the street drain.

Unseemly & highly visible hydrocarbons polluting the stormwater. The concentration in the picture is in excess of 10ppm

Solution for Non-Compliant Petrol Stations

SPEL Puraceptor Class 1 stormwater treatment system is a solution for the treatment, capture and retention of hydrocarbons off petrol stations.

SPEL Puraceptor Class 1 Existing operations can be retro-fitted with the SPEL Puraceptor Class 1 to ensure compliance with relevant environmental guidelines, and capture any potential spills.

SPEL`s Puraceptor Class 1 oil/water separator is connected to the stormwater provides the site with the highest degree of environmental protection; - a protection that complies with council and EPA guidelines.

Petrol forecourt and surrounds at a busy metropolitan petrol station rendered compliant. The catchment consists of a grated drain encompassing the complete perimeter of the under-sized canopy. Surface water and forecourt runoff drains to the Puraceptor located under the two trafficable covers in the foreground.

Puraceptor Certification

Australian Independent Tests

The Puraceptor has been independently tested at the internationally-respected University of South Australia (UNISA) and at the UK`s leading hydraulics research faculty HR Wallingford.

- Water quality analyses at NATA-certified laboratories demonstrated no overall detection (0.032mg/L) of hydrocarbons from inflow concentrations of >5,000ppm

Council Approvals

The compliance of the SPEL Puraceptor with the stringent Class 1 requirements of BSEN 858-1:2002 has been welcomed by many regulators and approvals have been granted for more than 100 installations to date.

In-Situ Testing

NATA analysis of Puraceptors operating at similar applications in Australia reveal `no detection` of hydrocarbons from a captured concentration of >8,000ppm.

Puraceptor Benefits

- Full retention Class 1 treatment oil/water separator. It treats all liquid. There is no bypass.
- Complies with regulating requirements for no visable sheen.
- University tested and certified to independent European Standard BSEN 858-1:2002 for the capture and retention of hydrocarbons with a discharge quality of no visible trace from a tested inflow concentrator of >5,000ppm.
- Capture and contain oil/fuel spillages.
- Can be sized to capture and contain a spill from a refuelling tanker and prevent discharge to stormwater.
- Passive gravity function ensuring treatment is continuous.
- Equipped with an intrinsically safe oil alert probe providing regular detection for oil build-up. Set to alarm when oil hydrocarbons occupy 10% of the chamber`s volume.
- Oil alert probe enables `self-monitoring`, suitable for unmanned and remote locations.
- Equipped with a dipped inlet pipe ensuring fire water is extinguished.
- Equipped with a vapour trap preventing vapours from discharging and preventing the emission of odours.
- Water tight structure.
- 50 year design life.
- Annual maintenance interval using low-cost technology.
- Operations & Maintenance manual with a ledger for accurate recording of maintenance operations.
- Maintenance performed from ground level; no entering of tank is required, satisfying O.H.& S. requirements.

Independently tested for reducing the average annual loads:

- ✔ 97% total suspended solids (TSS)
- ✔ 100% > 5mm gross pollutant solids (GP)
- ✔ 99.9% light liquids (TPH) (certified discharge quality of 5ppm or less, European standard BSEN 858-1:2002
- ✔ >30% particulate specialisation of phosphorus & nitrogen

1 Maintenance

- Designed for high performance and low maintenance over a long life span
- Visible oils (TPH) are skimmed from the surface of the water level
- Easy and safe to access and clean, with access shafts positioned on all chambers.
- Entry of the unit is not required.
- Recommended maintenance intervals are 12 months or after major spills.
- Only oils, sediment and gross pollutants need to be removed. All stormwater does not require removal.
- The cylindrical design ensures sediment collects centrally on the floor of the chambers effecting easy, quick removal. There are no square corners or unreachable cavities and recesses.
- Waste is removed by a vacuum loading truck. (Suction truck)

2 SPEL ® PURACEPTOR

units are glass reinforced plastic vessels made by the technical advanced chop hoop filament winding process (patented) producing circumferential and longitudinal strength complying with AS 2634 1983 for tank design.

3 Stormwater discharge

quality is <0.1mg/L hydrocarbon content exceeding the Environmental Protection Agency (E.P.A.) requirements of 10mg/l hydrocarbon content.

Onsite Testing: The Puraceptor is designed to provide easy access for Site Personnel to collect water samples for regulatory compliance.

4 The AUTOMATIC CLOSURE DEVICE (A.C.D.)

is a precisely engineered device comprising a water-buoyant ball that is sensitive to any change in the water density as a consequence of light liquids build up, thereby automatically activating a process of depressing the A.C.D. to SHUT OFF the separator, preventing pollutants from discharging to drains and waterways.

6 An oil sensing probe

is installed within a protective guard to continually monitor hydrocarbon depth in the Puraceptor. Once the level reaches the pre-determined depth, the alarm is triggered signalling the need for maintenance.

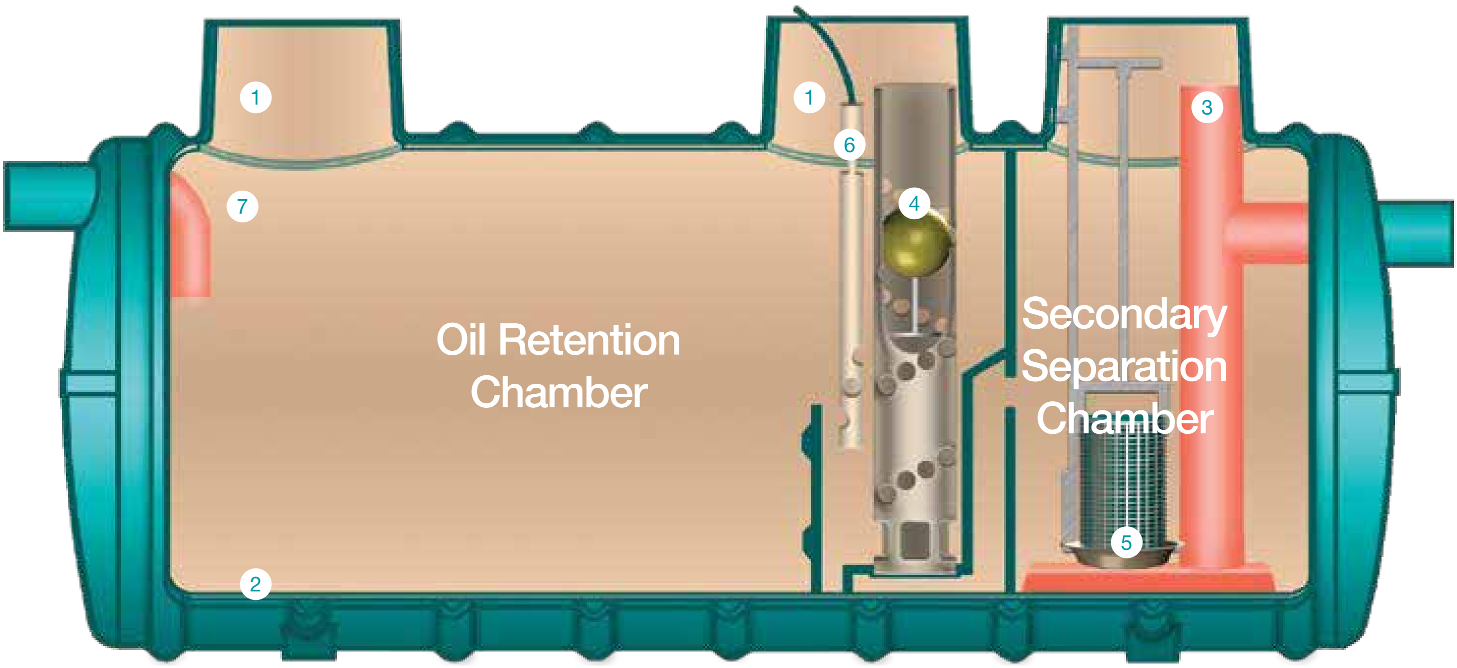
7 SPEL® PURACEPTOR

tanks contain an immersed dipped inlet pipe to extinguish flames and prevent inflammable vapours from passing through to the drainage system. Complies with Section 6.3.4 of BSEN 858-1:2002 SPEL PURACEPTOR can withstand temperatures of up to 140ºC.

5 SPEL PURACEPTOR Class 1

separators incorporate coalescer units. They consist of a quality stainless steel mesh container with an adjustable handle and high volume reticulated foam insert.

The coalescer unit is mounted in the second chamber, providing a coalescence process for the separation of smaller globules of light liquid pollutants before final discharge to stormwater.



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South Australia	61 8 8275 8000
West Australia	61 8 9350 1000
Northern Territory	61 2 8705 0255
New Zealand	64 9 276 9045

www.spel.com.au

0033.8 Puraceptor_Petrolstations

SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

APPROVED................ ☐

NAME...............................

SIGNED............................

DATE........../........../..........

ISSUE FOR APPROVAL

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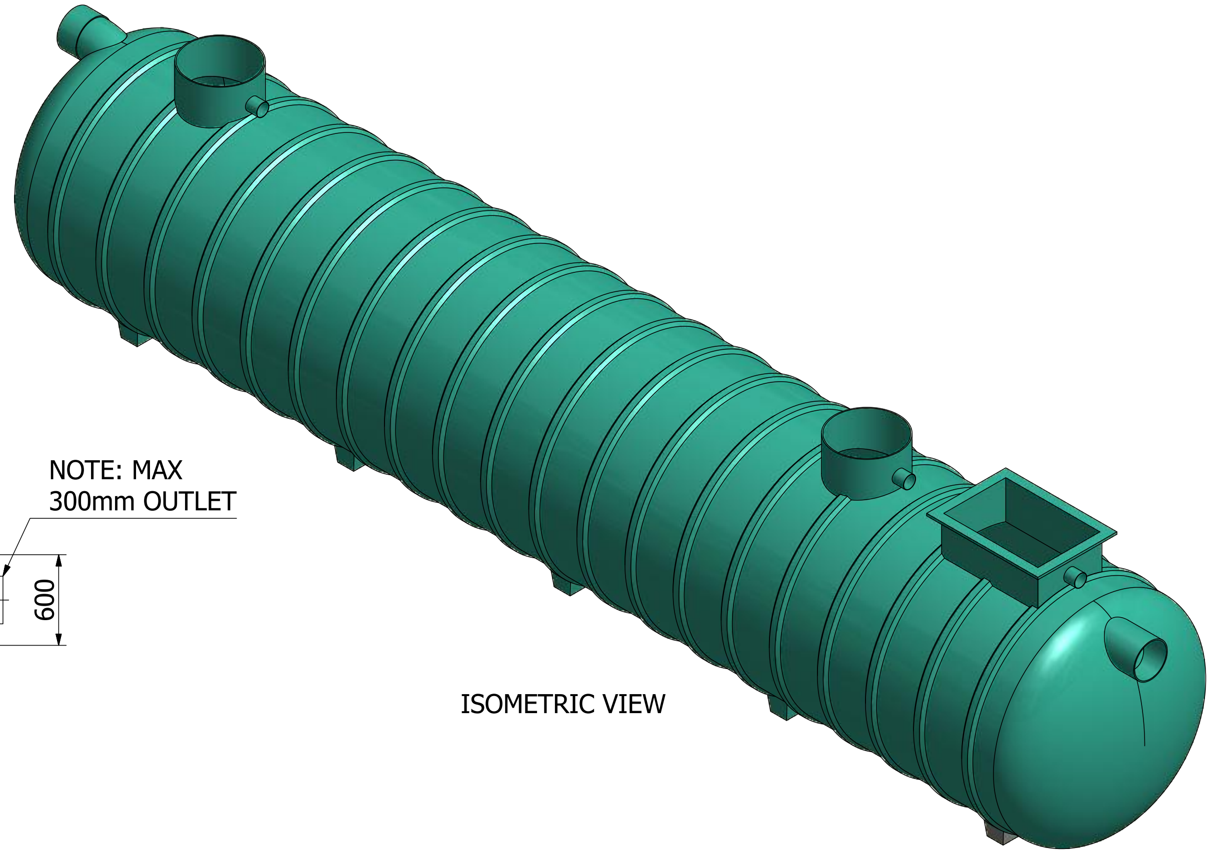
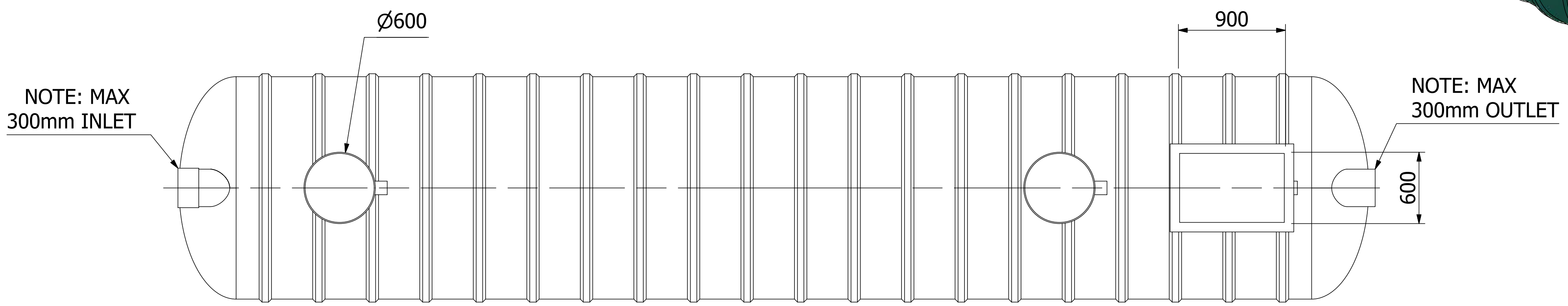
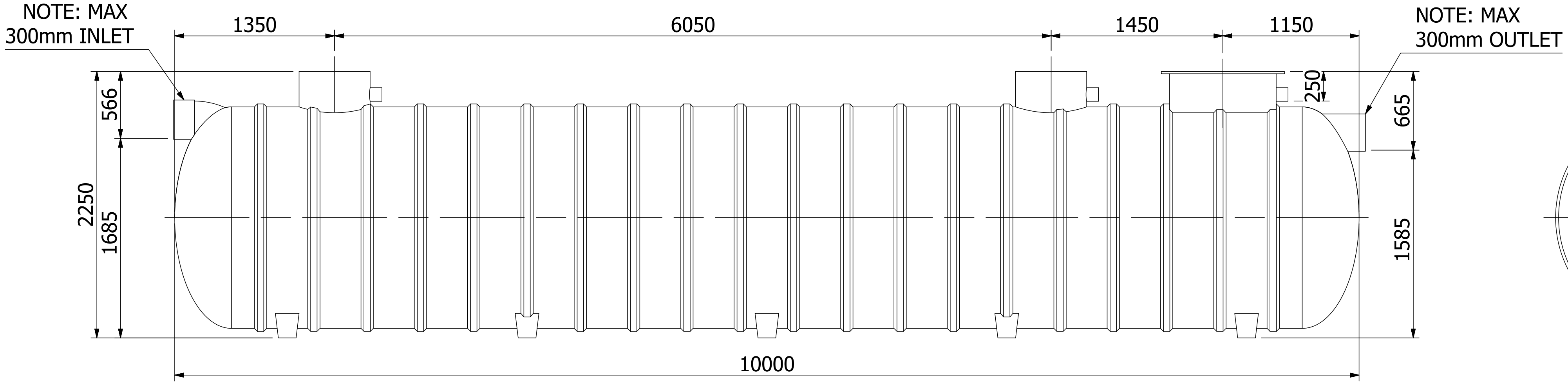
REVISION HISTORY				
REV	DESCRIPTION	DESIGNER	DATE	APPROVED
1		NG	29/09/2014	



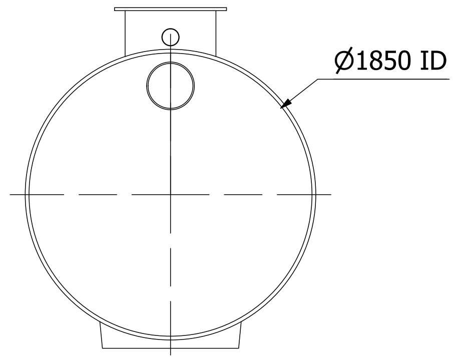
ISOMETRIC VIEW



PLAN VIEW



ELEVATION VIEW



RHS END VIEW

APPROXIMATE:
WORKING CAPACITY = 21600L
SPILL CAPACITY = 10700L
SILT CAPACITY = 5400L
TOTAL MASS = 1550KG
MATERIAL = FIBREGLASS

TOLERANCE: ALL DIMENSIONS ±10mm UNLESS OTHERWISE STATED.

CLIENT:

DRAWN BY: NG	DATE: 5/01/2015
CHECKED BY:	DATE:
VERIFIED BY:	DATE:
APPROVED BY:	DATE:
DRAWING REQUEST NUMBER: D20963	

SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

TITLE:
SPEL PURACEPTOR
P.060.L.C1.2C.A
STD PURACEPTOR
GENERAL ARRANGEMENT

PROJECT NUMBER:	SIZE:	SHEET:	REV:
-	A3	1	1

SCALE:	DWG No:
N.T.S	SP14-PC11290-S

WGA

WALLBRIDGE GILBERT AZTEC

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