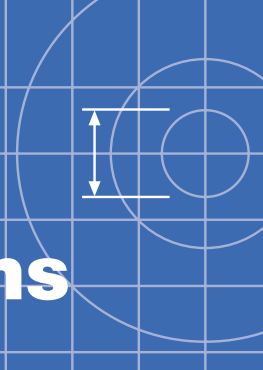


# Humeceptor™ stormwater treatment systems





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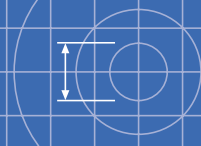
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**Humeceptor™** is the leading proprietary stormwater quality management product across Australia and worldwide because:

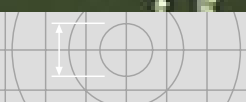
- **Humeceptor™** is a source control product focussed on removing the most ecologically damaging stormwater contaminants:
  - Fine suspended solids (10 - 60  $\mu\text{m}$ )
  - Hydrocarbons/petroleum products
  - Sorbed contaminants – heavy metals, hydrocarbons
- Will not scour and re-suspend previously accumulated material.
- Over 2,000 installations across Australia.
- In excess of 13,500 successful installations worldwide.
- Specified on the basis of achieving a water quality outcome/objective, rather than the diversion of an event based flow which has no nexus with water quality outcomes.
- Retains 75 - 95% of the TOTAL Suspended Solids load.
- Retains fine material between 10 - 60  $\mu\text{m}$  that dominate the suspended solids mass load.

(Continued over leaf)





- Retains entrained hydrocarbons during both dry weather emergency spills and wet weather rainfall events.
- Can be configured to capture up to 60,000 litres of petroleum products from emergency spill incidents.
- Generally limits hydrocarbon concentrations under field conditions as follows:
  - <1 ppm for influent concentrations up to 5 ppm
  - <2 ppm for influent concentrations up to 10 ppm
  - <5 ppm for influent concentrations up to 100 ppm
  - <10 ppm for influent concentrations up to 2000 ppm
  - At least 98% retention for influent concentration greater than 2000 ppm
- Performance is based on real hydrologic and pollutant export conditions under field conditions.
- Performance is extensively verified/certified by regulatory authorities under field conditions.
- The performance is not based on flawed fluid mechanics principles that plague the applicability of laboratory generated data from scaled down model tests.
- Excellent ability to control operational flow rates, even during peak runoff conditions.
- Very low operational velocity (<0.007 m/s), which compares with a scouring velocity for 16  $\mu\text{m}$  particles of 0.06 m/s.
- Sized using a continuous simulation pollutant export model using historical rainfall records.
- Minimum 50 year design life.



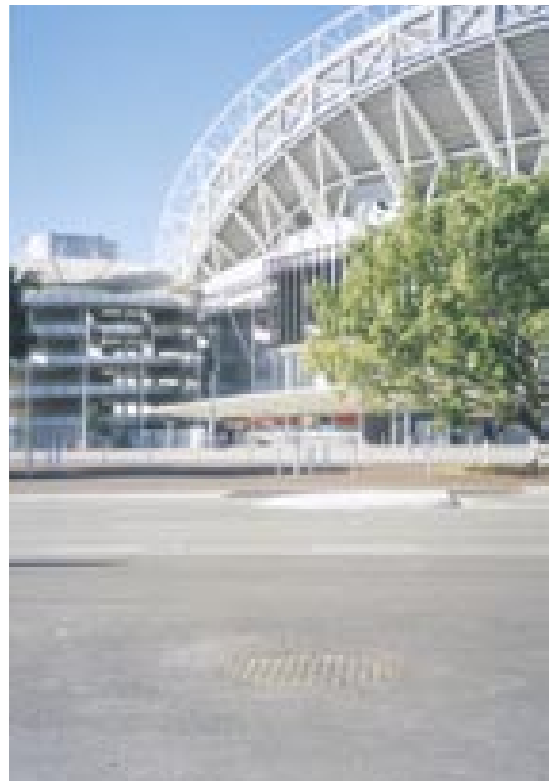


## Water Quality Management from Impervious Surfaces

**Humeceptor™** is a hydrodynamic source control device for the capture and retention of a range of contaminants from stormwater runoff generated from impervious surfaces such as car parks, industrial and commercial sites, roads and highways, marinas, airport facilities, sea port facilities, petrol stations, defence establishments, high/medium density residential developments and similar impervious/hardstand surfaces. These contaminants include free and floating oils, grease, hydrocarbon and petroleum products, fine suspended solids, including the fine fraction between 10 – 100 µm that typically dominate the total suspended solids load and a range of sorbed contaminants that are transported by the fine suspended solids such as heavy metals, hydrocarbon and petroleum products. **Humeceptor™** is a unique product, since it provides careful control of flow rates and operational velocities to prevent the resuspension and loss of fine suspended solids material and emulsification of collected hydrocarbons during infrequent high flow rates.



**Humeceptor™** delivers water quality outcomes to a range of development activities



**Humeceptor™** is a simple, compact and proven technology for retaining a range of entrained stormwater contaminants.

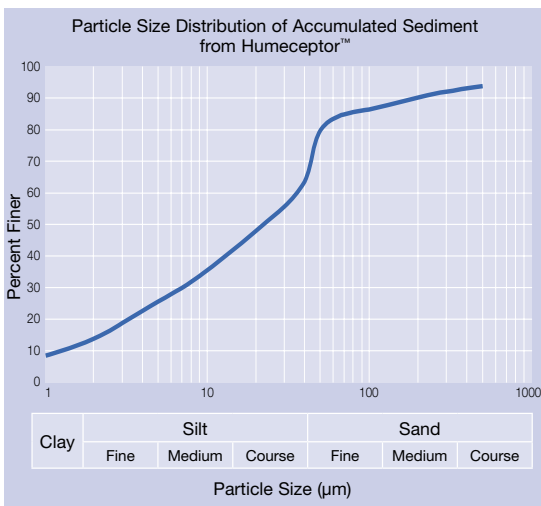
**Humeceptor™** is generally designed using a calibrated continuous rainfall and pollutant export simulation based on actual rainfall data to remove 75%-95% of the total suspended solids load. The design is focussed on delivering a water quality outcome, rather than simply diverting a flow rate. The latter is considered by Humes to be poor performance indicator for a water quality improvement device, as it has little or no nexus with water quality outcomes.

The performance of the **Humeceptor™** product to deliver a water quality outcome has been extensively verified by independent third party regulatory authorities under field conditions. These conditions implicitly take into consideration the varying hydrologic, hydraulic and pollutant export conditions that exist in the real world. Therefore Humes, consultants, local authorities and customers can proceed with development proposals with a high degree of confidence regarding the water quality outcomes from specifying and using the **Humeceptor™** product.



## Key Benefits / Features

**Humeceptor™** is a unique stormwater management product which can demonstrate superior performance in terms of the capture and retention of hydrocarbons and total suspended solids. Most proprietary products are gross pollutant traps and are therefore focussed on the capture of large litter items. These products are generally unsuitable for the typical **Humeceptor™** applications, since they fail to adequately control flow rates and operational velocities which are required to be minimised to firstly capture fine suspended solids and hydrocarbons and then retain these over a range of subsequent hydrologic conditions. The main features of the **Humeceptor™** product which provide this superior level of performance include the following:



From field validation monitoring the total suspended solids load exported from urbanised catchments, commonly comprise 80% of material with a particle size less than 60 µm.

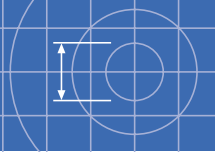
**Table 1: Scouring velocities for various sediment particle sizes**

Description of sediment		Particle Diameter (µm)	Scouring Velocity (m/s)
Coarse	Pebbles	2000	0.72
	Course Sand	1000	0.51
	Medium Sand	500	0.36
		250	0.25
Fine	Fine Sand	125	0.18
	Coarse Silt	62	0.13
		31	0.09
	Medium Silt	16	0.06

Metcalfe and Eddy, 1991. "Wastewater Engineering: Treatment Disposal and Reuse"

### **Humeceptor™ effectively captures and retains total suspended solids and petroleum hydrocarbons**

- **Humeceptor™** is generally sized to capture and retain 75-95% of the total suspended solids load.
- The average maximum velocity generated within the treatment chamber of **Humeceptor™** at the maximum nominated treatment flow rate is less than 0.007 m/s.
- This very low velocity facilitates the capture and retention of very fine suspended solids with typical sediment samples containing 80% of particles less than 60 µm in size.
- The table below indicates how this operational velocity compares with published scouring velocities for various sediment particle sizes. In many cases gross pollutant traps generate excessive operational velocities between 0.30 – 1.5 m/s, which facilitates the capture of large visual litter items, but leads to relatively poor performance with respect to the total suspended solids load.
- The very fine suspended solids have been identified as the most damaging to ecological health within waterways and estuaries and act as a primary carrier for contaminants such as heavy metals and hydrocarbon products.
- During peak flow events, **Humeceptor™** continues to carefully control flow rates by a unique orifice which guarantees the retention of previously deposited fine material.
- **Humeceptor™** has been proven under independent testing to retain 98% of the free (floating) oil concentration and has been shown under field conditions to achieve 99.6% removal and limit outlet hydrocarbon concentrations to 10ppm (depending on input concentrations) during rainfall events.
- **Humeceptor™** is effective at intercepting and capturing emergency spills, can be configured to collect up to 60,000 litres of petroleum products and has been proven to achieve this outcome in many real world spill situations.



## The performance of Humeceptor™ has been extensively verified.

- Humeceptor™ performance has been independently verified across a total of some 50 individual rainfall events with rainfall intensities varying from 1 to 131 mm/hr and flows varying up to six times (500%) the nominated treatment flow rates for the units (i.e. units in bypass under high flow conditions) – in other words across a wide range of hydrologic conditions.
- Where regulatory agencies operate independent environmental technology verification (ETV) programs, Humeceptor™ has been tested by the authorities and the performance verified and certified by the regulatory authorities.
- Laboratory testing that is utilised to demonstrate the performance of the product has been completed on full scale models at full treatment flow rates to alleviate issues associated with scaling results from small scaled down laboratory model testing.
- Complete test reports, test summaries and raw data for these performance validation tests are available upon request.



Full scale research and development hydraulics laboratory with full time laboratory technicians developing the next advancement in the Humeceptor™ product and continually evolving the current product range.

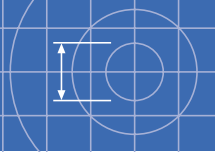
## Humeceptor™ reduces overall municipal costs by capturing contaminants at source.

- Humeceptor™ is a source control product and is often installed within individual private commercial and industrial properties.
- A distributed stormwater management approach across a catchment, treating contaminants at source alleviates the burden of local authorities at the end of pipe.
- Requiring private entities to manage their runoff within their site is a more cost effective management tool for the community and local authorities.
- Where utilised in conjunction with ponds and wetlands, Humeceptor™ will extend the service life of the wetland by capturing the majority of the particulate matter, thus allowing the wetland to focus more on dissolved pollutants and extending the frequency of dredging/removing sediment accumulation within a wetland environment.
- Humeceptor™ is inexpensive to service and maintain.



The use of Humeceptor™ as a source control device on high risk land use activities across the catchment will often lead to cost effective outcomes for municipal authorities charged with the responsibility of managing downstream water quality.





## Humeceptor™ is easy to design

- Humeceptor™ Expert Design System Software (available on CD) enables a specifier to size the unit on the basis of local hydrology (historical rainfall records).
- The Expert Design System utilises a continuous rainfall – runoff simulation similar to other popular pollutant export and catchment modelling packages such as XP-AQUALM<sup>1</sup> (WP Software) and MUSIC<sup>2</sup> (CRC for Catchment Hydrology, 2002). Continuous runoff modelling is more appropriate to analysing water quality solutions than adopting a design event flow rate approach, which has no nexus with water quality outcomes.
- Humeceptor™ is sized to achieve a water quality outcome, expressed as a percentage of total suspended solids removal and is therefore directly comparable to regulatory water quality outcomes or objectives.
- The performance of Humeceptor™ is easily incorporated within MUSIC modelling following use of the Expert Design System to assess the performance of an overall stormwater management solution, within which Humeceptor™ operates in conjunction with other best management practices.



## Humeceptor™ is easy to install

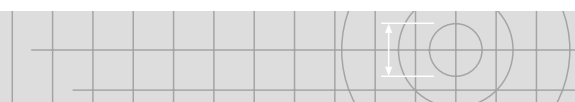
- The modular precast concrete construction facilitates easy and rapid installation.
- The Kor-N-Seal® rubberised boots provide a flexible connection between the inlet and outlet pipes taking up any tolerances in invert levels and facilitating rapid installation without the need to mortar in the pipes. The boots are an additional unique feature of Humeceptor™.
- The product is suitable for new and retrofit projects.

## A proven performance record

- Humeceptor™ is the market leader – with over 13,500 units installed worldwide and almost 2,000 units installed within Australia.
- Extensively adopted across the United States, Canada and Australia
- Humeceptor™ has a certified 50 year design life with all components complying with relevant New Zealand Standards.



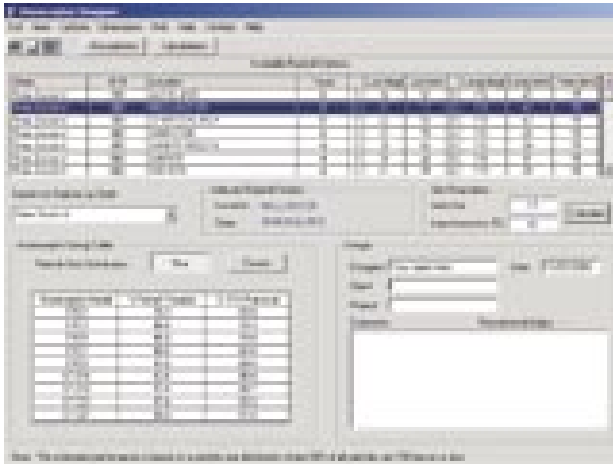
STC18 Humeceptor™ ready for back filling and pipe connection. Note Kor-N-Seal® boots ready to accommodate inlet/outlet pipes.



## Model Selection and Performance

### Humeceptor™ Design Software

The **Humeceptor™** product is designed and specified using a calibrated continuous rainfall/runoff pollutant export model supplied by Humes. The software operates similar to commercially available models such as MUSIC<sup>2</sup> (CRC for Catchment Hydrology, 2002) and XP-AQUALM<sup>1</sup> (WP Software, 1992). **Humeceptor™** is sized to achieve a water quality outcome as reflected by the percentage of total suspended solids (by mass) that is retained. This approach allows a more direct comparison of the performance from the various **Humeceptor™** units with the water quality outcomes required by regulatory authorities. The product may be designed to achieve up to 98% retention of the total suspended solids load, but generally, regulators worldwide are targeting the removal of 75-85% of the total suspended solids load. **Humeceptor™** is not sized using hydraulic design event considerations such as treatment flow rates, since this parameter provides little nexus with water quality outcomes.



**Humeceptor™** Design Software is simple to use and comes complete with historical rainfall records from throughout New Zealand.

The adoption of a continuous simulation approach is the recommended approach for the modelling of water quality and stormwater management systems as reflected in the commercially available modelling packages. The software is packaged with historical rainfall data from locations throughout New Zealand covering the major metropolitan and regional centres and may be updated with site-specific rainfall data (for example from a mine site) if available.

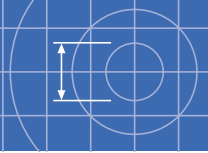
The software parameters (hydrology and pollutant export) have been calibrated against field data generated from typical **Humeceptor™** applications. Across all monitoring sites, the correlation coefficient between the software results and the field data is 95%. Consultants, local authorities and customers can therefore proceed with development proposals with a high degree of confidence regarding the likely water quality outcomes from the **Humeceptor™** product.

### Humeceptor™ Performance

The performance of the **Humeceptor™** product to deliver a water quality outcome has been extensively verified under field conditions and in many cases certified by regulatory authorities under Environmental Technology Verification (ETV) programs. These conditions implicitly take into consideration the varying hydrologic, hydraulic and pollutant export conditions that exist in the real world. (Note: **Humeceptor™** is marketed across North America as Stormceptor®.)



Certification of **Humeceptor™** Performance by Environment Canada in Accordance with the Canadian Environmental Technology Verification (ETV) Program.



## Total Suspended Solids

**Humeceptor™** is primarily designed using total suspended solids (TSS) as an indicator of overall ecological health. Regulators that have specified the mass removal of TSS are generally targeting the retention of 75-85% of the total suspended solids load. It is important to note that TOTAL Suspended Solids considers all particle sizes as noted below. Caution should be exercised where data is presented that only considers a certain range of particle sizes, since this is not a true measure of total suspended solids, nor is it a true measure of the water quality outcomes desired by regulators.

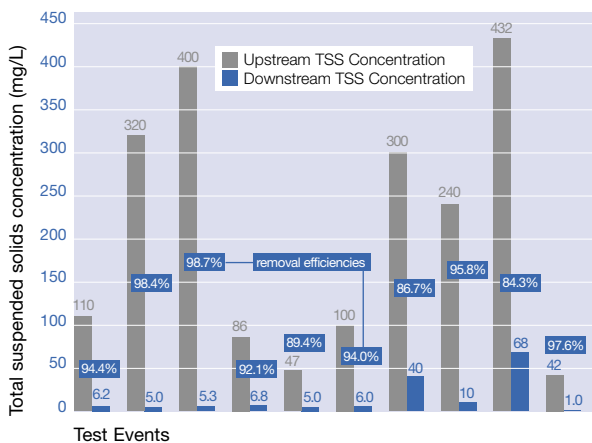
The performance of **Humeceptor™** across a wide range of hydrologic conditions is indicated in the following graph, which shows the concentration of total suspended solids upstream and downstream of various **Humeceptor™** units during rainfall events, sampled using automatic samplers. The mass removal efficiency is also indicated, which demonstrates the ability of the product to deliver a superior water quality outcome.

### Total Suspended Solids

The performance of **Humeceptor™** is primarily based on retaining TOTAL Suspended Solids over a long term period across a range of hydrologic conditions. The term total suspended solids refers to the total mass of particulate matter which may be removed from solution by filtration, usually specified as the matter which is retained on a 0.45 µm pore-diameter filter. Total suspended solids is therefore a measurement of all particle sizes that are present within the sample.

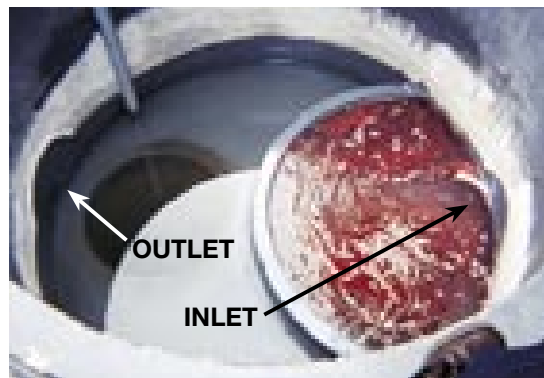
In order to achieve high removal efficiencies of TSS, products must be able to capture and retain fine particles less than 60 µm in diameter, since these generally comprise the majority of the mass load in stormwater runoff. Products marketed on the ability to remove a certain percentage of material down to 150 µm (say) will not perform in terms of a Total Suspended Solids measure. All monitoring data for **Humeceptor™** reports true Total Suspended Solids and for this reason will out perform many other products.

### Performance of Humeceptor™ to retain total suspended solids during field validation testing by regulatory authorities



## Oil/Total Petroleum Hydrocarbon Capture

The performance of the **Humeceptor™** product to capture and retain floating oils and petroleum/hydrocarbon products has been demonstrated under both full scale/full flow laboratory verification testing and data collected by regulators under field conditions. **Humeceptor™** is the only product available that can demonstrate the capture of total petroleum hydrocarbons (TPH) under field conditions during wet weather events.



Total Petroleum Hydrocarbon Capture at Full Treatment Flow Rate at Coventry University in Accordance with the European Standard EN 858-1:1994.

## Dry Weather Capture Versus Hydrocarbon Removal During Rainfall Events

An important distinction exists between the capture of petroleum hydrocarbons during dry weather and during wet weather events. Dry weather capture reflects the ability of products to capture emergency spills under no flow conditions (i.e. no rainfall occurring at the time of the spill) as opposed to retaining hydrocarbon products being flushed from a catchment during rainfall. In general, it is relatively easy to capture dry weather spill events provided sufficient storage capacity has been provided. However, the removal of oils and petroleum hydrocarbons during rainfall and from runoff is more difficult and requires careful attention to operational velocities and turbulence generated within proprietary devices.

Several proprietary devices are marketed on the ability to capture oils and petroleum hydrocarbons from data generated during dry weather spill events. However, the majority are unable to replicate this capture performance during rainfall, since excessive operational velocities will emulsify collected oils and transport/export them out of the unit.

**Humeceptor™** will catch and retain dry weather emergency spills of oils and hydrocarbon/petroleum products and may be configured for highway/freeway and industrial applications to provide capture of products from tanker incidents and other emergency spill situations with capacities to cater for spills ranging between 20,000-60,000 litres.

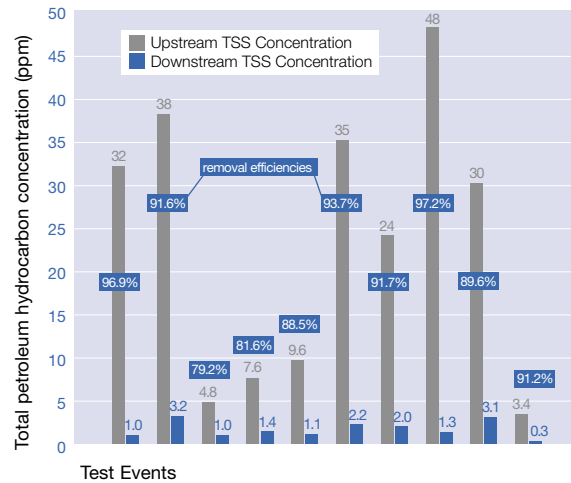
### Capture and Retention of Oils/Petroleum Hydrocarbons During Wet Weather

Unlike many alternative solutions, **Humeceptor™** will also capture oils and petroleum hydrocarbons during wet weather events and retain this material within a protected storage zone until subsequent cleaning of the unit. This ability is primarily the result of carefully controlled flow rates, very low operational velocities and the provision of the secure storage zone removed from the active flow path through the unit, where oils and petroleum hydrocarbons will be retained under quiescent conditions.

The following graph shows a range of field verifications where regulators have tested the performance of the **Humeceptor™** product to capture and retain oils and petroleum hydrocarbons during rainfall events. As shown, **Humeceptor™** has the ability to limit the outlet concentrations under 10 ppm for “normal” concentrations exported from urbanised land uses. Where influent concentrations reduce below 10 ppm, **Humeceptor™** will further retain sufficient hydrocarbons to achieve an outlet concentration generally below 1 ppm. Duncan (1999)<sup>3</sup> reports concentrations of hydrocarbons (oil and grease) from various land uses ranging from 0.5 ppm to 200 ppm, with the higher concentrations being generated from transportation activities.

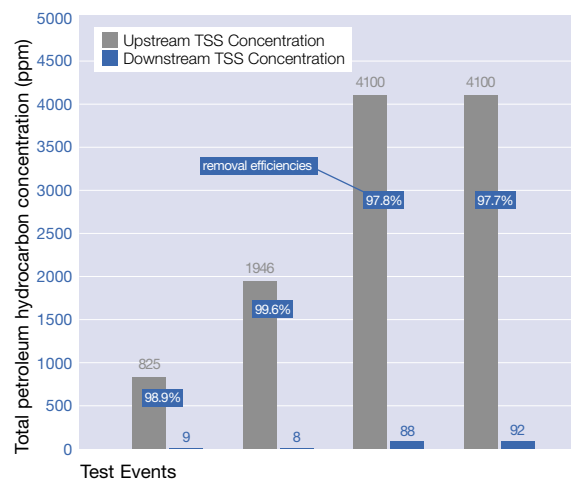
Minton (2002)<sup>4</sup> further reports mean concentrations ranging from 0.57 ppm to 69 ppm. As shown below, under these “normal” influent concentrations, **Humeceptor™** will limit the outlet concentrations below 10 ppm retaining in excess of 90% of the total hydrocarbon load during wet weather events.

**Performance of Humeceptor™ to retain total petroleum hydrocarbons during field validation testing by regulatory authorities**



The following chart shows the performance of **Humeceptor™** to retain hydrocarbons in situations containing very high influent concentrations. As shown, up to an influent concentration about 2000 ppm, **Humeceptor™** will continue to limit the outlet concentrations below 10 ppm and achieve very high retention efficiencies around 99%. The last two results also indicate very high retention efficiencies around 98% from a full-scale laboratory test. These results were generated with a very high hydrocarbon influent concentration as shown, introduced to the unit constantly with a continuous full (maximum) treatment flow rate, which reflects relatively extreme field conditions.

**Performance of Humeceptor™ to retain high concentrations of total petroleum hydrocarbons during field validation testing by regulatory authorities**



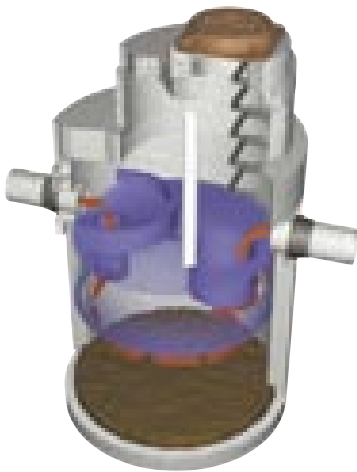
## Product Range

### In-Line Humeceptor™

The most commonly installed unit is the In-Line Humeceptor™. It is designed with single or multiple inlets and a single outlet, and is available in eight different unit sizes, ranging from 3,000 to 27,000 litre storage capacities. Each unit is constructed from precast concrete components and a patented fibreglass insert that separates the upper (by-pass) and lower (separation/holding) chambers. In areas where oil or hydrocarbon/petroleum spills accumulate in substantial volume between cleaning, the fibreglass insert provides dual wall containment to ensure trapped hydrocarbons are safely stored inside the treatment chamber.

#### Normal Operating Conditions

Under normal (frequent) operating conditions (more than 85% of all storm events), stormwater flows into the upper by-pass chamber and is diverted by a semi circular weir, down into the separation/holding chamber. Flow entering the lower chamber is carefully controlled by an orifice plate to prevent excessive operational velocities, and maximise capture and retention of hydrocarbons and suspended solids. This downward flow is directed, by right-angle outlets, tangentially around the circular walls of the chamber to maximise the flow path and detention time. Flow continues around the circumference of the unit, exits the lower chamber through the riser pipe and rejoins the piped drainage system. Fine and coarse suspended solids settle to the floor of the chamber, under very low velocity quiescent conditions, while the petroleum products rise and become trapped beneath the fibreglass insert.



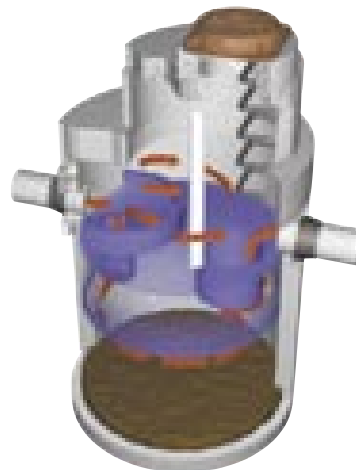
Normal flow conditions

### By-Pass Operating Conditions

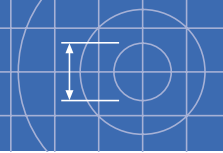
During infrequent high flow events (less than 15% of all storm events), peak stormwater flows will pass over the diverting weir and continue through the by-pass chamber into the downstream stormwater system. This by-pass activity creates pressure equalisation across the by-pass chamber, between the inlet and outlet, causing a slight throttling or reduction of the flow entering the lower treatment chamber which guarantees retention of fine material previously deposited. A portion of incoming suspended solids continues to be diverted by the weir into the lower chamber where it is stored, along with previously collected solids and hydrocarbons. Humeceptor™ is unique in the market place since it is the only product which places emphasis on carefully controlling flow rates and operational velocities during all hydrologic conditions, thus preventing scouring, resuspension and ultimate loss of suspended solids during high flows.

The In-Line Humeceptor™ has been proven in full scale laboratory and field validation tests to capture and retain over:

- 80% of total suspended solids, including the fine fraction classified as material having a particle size less than 60 µm, which has been shown to comprise the majority of the total mass load.
- 98% of free and floating oils, grease, hydrocarbons and petroleum products under both dry weather, emergency spill situations and during wet weather rainfall periods.
- Removal and retention of a range of contaminants sorbed or attached to the fine suspended solids, material including hydrocarbons, petroleum products and heavy metals.



High flow conditions



## Inlet Humeceptor™

Taking the place of traditional inlet structures, the Inlet **Humeceptor™** is ideal for small drainage areas such as truck loading bays, small car parks, electrical transformer stations and fuel storage pads. Its unique design allows for runoff to enter the structure in several configurations:

- i) Grated inlet with a single outlet pipe at the head of the drainage system.
- ii) Grated inlet with inlet and outlet pipes to form a grated in-line device.
- iii) Small in-line configuration without the grated inlet.

The Inlet **Humeceptor™** is manufactured with a 1200mm diameter precast concrete shaft. Like the conventional In-Line **Humeceptor™**, a sloped fibreglass insert separates the upper (by-pass) and lower (separation/holding) chambers. The insert extends into the treatment chamber providing dual wall containment of free oils, hydrocarbons and petroleum products.

### Normal operating conditions

Under normal (frequent) operating conditions (more than 85% of all storm events), stormwater enters the upper by-pass chamber either via the grated inlet or from an upstream pipe (or both) and is diverted, through the drop pipe into the separation/holding chamber. Flow entering the lower chamber is carefully controlled through a combination of the head and the orifice opening to prevent excessive operational velocities and maximise capture and retention of hydrocarbons and suspended solids. This flow is directed, by a right angle drop pipe configuration tangentially around the circular walls of the chamber.



Normal flow conditions

Flow continues around the circumference of the unit, exits the lower chamber through the riser pipe and rejoins the piped drainage system. Fine and coarse suspended solids settle to the chamber floor, under very low velocity quiescent conditions, while the petroleum products rise and become trapped beneath the fibreglass insert.

### By-pass operating conditions

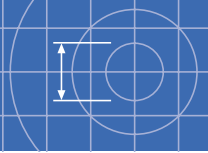
During infrequent high flow events (less than 15% of all storm events), peak stormwater flows will pass over the diverting weir into the downstream drainage system. This by-pass feature creates pressure equalisation across the by-pass chamber, causing a slight throttling or reduction of the flow entering the lower treatment chamber which guarantees retention of fine material previously deposited. A portion of incoming suspended solids will continue to be diverted into the lower chamber. **Humeceptor™** is unique in the market place since it is the only product which places emphasis on carefully controlling flow rates and operational velocities during all hydrologic conditions, thus preventing scouring, resuspension and ultimate loss of suspended solids during high flows.

The Inlet **Humeceptor™** is an excellent alternative to normal drainage practices, as it saves the cost of providing a traditional inlet structure upstream of a conventional treatment device in small drainage areas.



High flow conditions



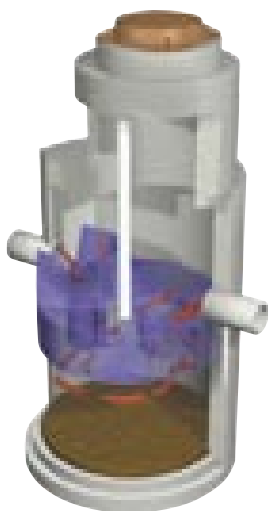


## Submerged Humeceptor™

The Submerged **Humeceptor™** is designed to remove hydrocarbons and suspended solids from stormwater runoff in partially submerged pipes. The primary application for the Submerged **Humeceptor™** is where a relatively permanent tailwater from a downstream wetland, lake, pond, waterway or canal causes the piped drainage system to be partially submerged. The precast concrete sections are manufactured in easily assembled components and available in the same sizes as the In-Line **Humeceptor™** (3,000 to 27,000 litres storage capacity). A customised fibreglass insert (similar to the standard In-Line **Humeceptor™**) separates the upper (by-pass) and lower (separation/holding) chambers.

### Normal operating conditions

The Submerged **Humeceptor™** operates much like the In-Line **Humeceptor™**. The submerged design includes a customised weir height (depending on the average water level in the downstream pipe and annual water level fluctuation) and two inlet drop pipes. The lower drop pipe is always submerged. This drop pipe transports suspended solids and bedload sediment into the separation chamber. The higher drop pipe is located at the average submergence elevation and transports lighter material (free oil/TPH) into the separation chamber by forcing the development of a vortex, which "sucks" floating hydrocarbons into the lower chamber. The Submerged **Humeceptor™** utilises the same flow control features of the standard In-Line units.

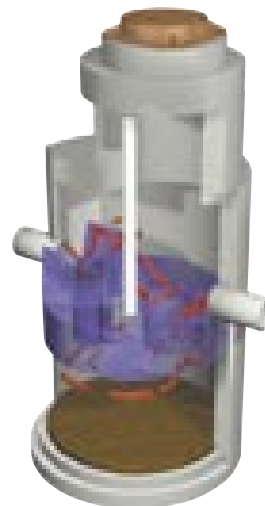


Normal flow conditions

The orifice plate combined with the pressure (head) between the upstream and downstream pipes carefully controls flow entering the lower chamber to prevent excessive operational velocities and maximise capture and retention of hydrocarbons and suspended solids. The Submerged **Humeceptor™** is effective for free oil and suspended solids removal under partially submerged conditions.

### By-pass operating conditions

During infrequent high flow events, water is conveyed over the internal by-pass weir directly to the downstream drainage system. By-passing high flows prevents the generation of high velocities within the lower chamber thus guaranteeing the retention of previously deposited material.



High flow conditions



## Series Humeceptor™

The Series Humeceptor™ is designed to treat runoff from larger drainage areas or on highly disturbed sites where export rates and the mass load of suspended solids is expected to be greater than conventional impervious catchments. Examples of highly disturbed or unstable sites include mining operations, work yards and industrial activities with material stockpiles and similar sites. The Series Humeceptor™ can more than double the treated drainage areas of the In-Line Humeceptor™ System and achieve very high total suspended solids retention. The series models are available in 40,000, 50,000 and 60,000 litre sizes.

The Series Humeceptor™ consists of two structures which whilst constructed and installed in series, actually operate in parallel. The first structure acts as a flow splitter, diverting half of the flow into the first treatment chamber, and allowing the second half of the flow to travel through the unit to the second treatment chamber. The Series Humeceptor™ units contain essentially the same patented fibreglass insert as the In-Line Humeceptor™ which provides the internal by-pass feature inherent in all Humeceptor™ designs, preventing scour and resuspension during high flows, which have hampered the performance of conventional separator systems.

### Normal operating conditions

Under normal (frequent) operating conditions (more than 85% of all storm events), stormwater enters the upper by-pass chamber of the first structure. Half of the flow is diverted by a semi circular weir into the separation/holding chamber of the first structure. Like the standard In-Line Humeceptor™, flow entering the lower chamber is carefully controlled by an orifice plate to prevent excessive operational velocities and maximise capture and retention of hydrocarbons and suspended solids.



Normal flow conditions

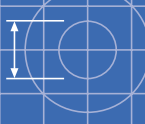
This downward flow is directed, by right-angle outlets, tangentially around the circular walls of the chamber to maximise the flow path and detention time. Flow continues around the circumference of the unit, exits the lower chamber through the riser pipe and rejoins the upper chamber of the combined Series Humeceptor™ arrangement. Fine and coarse suspended solids settle to the floor of the chamber, under very low velocity quiescent conditions, while the petroleum products rise and become trapped beneath the fibreglass insert. The half of the flow which is not diverted in the lower chamber continues through the first structure to the second structure. This remaining flow is diverted into the lower chamber of the second structure, progresses through the second treatment chamber and rejoins the downstream pipe system. Suspended solids and floatables are retained as they are in the first chamber.

### By-pass operating conditions

During infrequent high flow events, peak stormwater flows will pass over the diverting weirs in the first and second chamber and continue through the by-pass chamber into the downstream stormwater system. This by-pass activity creates pressure equalisation across both units, which causes a slight throttling or reduction of the flow entering the lower treatment chamber which guarantees retention of fine material previously deposited. A portion of incoming suspended solids continues to be diverted by the weirs in the first and second structure into the treatment chamber. Humeceptor™ is unique in the market place since it is the only product which places emphasis on carefully controlling flow rates and operational velocities during all hydrologic conditions, thus preventing scouring, resuspension and ultimate loss of suspended solids during high flows.



High flow conditions



## Applications

**Humeceptor™** is an effective hydrodynamic source control device for the capture and retention of a range of contaminants from stormwater runoff generated from impervious surfaces such as:

- Car parks
- Industrial and commercial sites
- Roads and highways
- Marinas
- Airport facilities
- Sea port facilities
- Service stations
- Defence establishments
- High/medium density residential developments
- Similar impervious/hardstand surfaces.

These activities are generally associated with a higher risk in terms of contaminant generation particularly oils, hydrocarbons, petroleum products and a range of contaminants that sorb or attach to the fine silts and clay particles such as heavy metals.

Unlike gross pollutant style products, which are typically employed as an end of line solution for the capture of larger sized visual pollutants such as gross litter items greater than 5 mm in size, as a source control device **Humeceptor™** is suited to the capture of fine contaminants close to the source of generation and will therefore be generally suitable for catchment areas with an impervious area between 0.1 and 8.0 hectares. The following activities represent typical applications for the **Humeceptor™** product.

### Parking areas

- **Oil and suspended solids control in commercial car parks**

Commercial and office parking areas have the potential to generate significant amounts of motor vehicle related contaminants such as oils, hydraulic fluids and heavy metals associated with automotive components.

Car parking areas also generate a surprisingly high load of fine suspended solids which are generally deposited on the hardstand surface from atmospheric deposition and fine particulates from vehicle exhausts. The combination of oils and grease and fine suspended solids will often be interrelated in car parks. The fine suspended solids deposited across



**Humeceptor™** is well suited to retain vehicle related contaminants from car parks.

car parks will often act as a carrier for oils, grease and a range of hydrocarbon products. Therefore, the most appropriate stormwater management solutions from this land use are those that target suspended solids less than 60 µm in size, since the retention of these particles will often result in the removal of a majority of the actual total hydrocarbon loads. Unlike gross pollutant traps, **Humeceptor™** is focussed on fine material and therefore is very suitable for installation in a range of car parking areas. The inlet **Humeceptor™** also enables the grated drainage pits to be incorporated within the stormwater management device, thus providing a very cost effective solution.

### Industrial facilities

- **Protects municipal drainage systems from industrial spills**

The **Humeceptor™** system is a proven spill control device for industrial properties, refuelling areas and gas/petroleum facilities. The design can be specifically tailored to take into consideration the actual specific gravity of the primary spill of concern (for example aviation fuel).



The ability of **Humeceptor™** to completely capture spills during both dry weather and wet weather make it an essential risk management tool for industrial facilities.



**Humeceptor™** can be configured to provide up to 60,000 litres of storage volume. The ability of **Humeceptor™** to capture and retain emergency spills has been demonstrated on numerous sites where actual spills have been completely captured. In these situations, the clean-up of the spill has been rapid which has allowed minimal site down time and proprietors have avoided expensive litigation. **Humeceptor™** is unique in that it is also able to contain moderate spills during wet weather rainfall events. Many alternative products can capture dry weather spills, but are unable to retain this spill or are unable to obtain this same level of performance during wet weather events.

## Service stations

- **Spill control for petrol stations and other auto services facilities.**

Petrol stations and auto repair shops are primary sources of oil and petrol spills. In addition to the small spills and drips from vehicle fuelling, there is a potential for significant spills to occur as petroleum carriers fill underground storage tanks. **Humeceptor™** has a large capacity for oil capture to accommodate these spills. The fibreglass insert provides double wall containment for the first 1000 litres of spilled materials. These large hardstand areas also generate a high proportion of fine particulate material and suspended solids deposited from vehicles. **Humeceptor™** is effective at removing these contaminants. Many major outlets in Australia have installed **Humeceptor™** units.



Service stations are an obvious high risk land use in terms of exporting oils and petroleum products as well as generating surprisingly high loads of fine particulate matter.



A range of activities from automotive workshops to freight handling facilities and distribution centres are well suited to **Humeceptor™** given the likely priority contaminants.

Auto and truck repair and storage facilities have similar spill potential risks. These can also be effectively treated by the **Humeceptor™** System.

## Roads and highways

- **Protects the natural environment from highway runoff pollution**

**Humeceptor™** is an effective water quality device for highway runoff applications. Runoff from roadways, bus stops, emergency breakdown bays, weighbridges and toll gate houses contain high levels of fine suspended solids contaminated with metals and hydrocarbons.

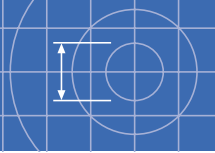


**Humeceptor™** has become the preferred product for various transport/transit projects around Australia.

These applications also have high risk of hydrocarbon spills. **Humeceptor™** has a unique and independently tested ability to deliver tangible water quality benefits, retaining fine suspended solids and oils spills more efficiently than other devices.



Road surfaces from major motorways to residential streets are significant contributors to the overall contaminant load.



## Air, land and sea ports

- Captures spills and removes stormwater pollution at air land, and sea ports.

Air, land and sea ports generate significant pollution loads and are potential sources of petroleum and chemical spills.



The majority of the domestic and international terminals in Australia utilise **Humeceptor™**.

**Humeceptor™** units can be installed in fuelling and loading locations to capture spills. In doing so, **Humeceptor™** provides excellent protection from environmental liability.

**Humeceptor™** is easy to install in port facilities because it can accommodate both shallow and deep installations, as well as space-constrained areas. A bend structure configuration can also be used to minimise the amount of required drainage infrastructure.



Port facilities combine high risk activities, high tailwater levels and surrounding estuarine/marine environs which are particularly suitable for the Submerged **Humeceptor™**.

## Pre-treatment of other stormwater management practices

- Pre-treats infiltration and filtration systems, ponds, and wetlands

**Humeceptor™** is an ideal pre-treatment device for infiltration practices, ponds, filtration systems and wetlands. When used for pre-treatment, **Humeceptor™** units will extend the useful life of other management practices, improve the aesthetics and effectiveness of downstream facilities and reduce the maintenance burden for private owners and municipalities that own these facilities. The use of a **Humeceptor™** in conjunction with other stormwater quality practices (treatment train), is an effective strategy for stormwater management.



**Humeceptor™** works in combination with a wide range of best management practices to minimise maintenance of insitu solutions and operate conjunctively to deliver the required water quality outcomes.



## Installation, Operation and Maintenance

### Installation

**Humeceptor™** is transported to site in pre-cast modular sections and is very simple and cost effective to install. The simplicity of the product facilitates rapid installation and site re-establishment. Every product is provided with a project specific installation guide. If requested, Humes personnel can be available to be present on site to advise with regard to installation in accordance with recommendations.

**Humeceptor™** is supplied with factory fitted Kor-N-Seal® boot connections which provide a flexible water tight connection between the unit and the incoming/outgoing pipes.



The compact and modular design of **Humeceptor™** facilitates simple and rapid installation and is well regarded by civil engineering contractors and plumbers familiar with traditional drainage infrastructure.

### References

- 1 "WP Software, 1992, "XP-AQUALM - Users Manual"
- 2 "Cooperative Research Centre for Catchment Hydrology, 2003, "MUSIC User Guide - Model for Urban Stormwater Improvement Conceptualisation", Version 2.0, MUSIC Development Team, December"
- 3 "Duncan, H.P., 1999, "Urban Stormwater Quality: A Statistical Overview", Cooperative Research Centre for Catchment Hydrology, Australia, Report 99/3, February"
- 4 "Minton, G.R., 2002, "Stormwater Treatment - Biological, Chemical and Engineering Principles", Resource Planning Associates, Washington".

Buyers and users of the products described in this brochure must make their own assessment of the suitability and appropriateness of the products for their particular use and the conditions in which they will be used. All queries regarding product suitability, purpose or installation should be directed to the nearest Humes Sales Centre for service and assistance.  
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The Kor-N-Seal® boot is sized to cater for all pipe materials, wall thicknesses and a range of pipe outside diameters up to a maximum OD of 1,475 mm (generally a maximum ID of 1050 mm). Connection of the pipes to the unit simply requires the pipe to be slotted into the flexible boot without the need to mortar in the pipes. Mortar joints provide a rigid and brittle connection which may crack and shear the pipe should differential settlement occur between the unit and the pipe. The flexible connection also allows for small tolerance in invert levels and is particularly well suited for retrofit situations.

**Humeceptor™** is the only product which utilises this unique connecting methodology.

To identify the product location the cast iron manhole cover is embossed with the **Humeceptor™** motif and is fully trafficable under regulatory load requirements such as HN-HO-72 loads.

### Operation and Maintenance

**Humeceptor™** is generally maintained on an annual basis by eduction (vacuum) trucks. **Humeceptor™** does not use baskets, since their removal and cleaning provides a work place health and safety hazard and is unaesthetic to the surrounding community during cleaning. A full operation and maintenance manual is provided to the product owner for every installation which provides a full description of the recommended maintenance procedures. All maintenance is undertaken from the surface in response to modern confined space regulations and under normal conditions there is no need to enter the unit.

### Manufacturing standards

**Humeceptor™** are manufactured to pipe standards NZS 3107:1978 and precast standards NZS 3109:1997 with surface finishes to NZS 3114:1987

