Appendices

Appendix A - Stakeholder Consultation

From: Ingrid Ilias [mailto:Ingrid.Ilias@planning.nsw.gov.au]
Sent: Tuesday, 13 September 2011 11:47 AM
To: Lucy Baker; Paul Jerogin
Cc: 201467 Terminal 3; Alex P James; Ryan Smith
Subject: Re: Sydney Port Botany Terminal No. 3 PKG-17.1 Planning Section 96 (1A) Modification Operations Building and Maintenance Building

Hi Lucy/Paul

Thanks for your email. Please be advised that the modification application and supporting documentation should refer to the modification being assessed under section 75W not section 96 as the transitional provisions of the EP&A Regulation apply, specifically 8J(8).

A modification application form for section 75W should therefore be completed - these are available on our website.

regards
Ingrid

Ingrid Ilias
Environmental Planning Officer, Infrastructure Projects
Major Development Assessment Unit
NSW Department of Planning & Infrastructure | GPO Box 39 | SYDNEY NSW 2001
T 02 9228 6411 F 9228 6366 E ingrid.ilias@planning.nsw.gov.au

NSW GOVERNMENT | Planning & Infrastructure

Contact: Ingrid Ilias
Phone: 02 9228 6411
Fax: 02 9228 6366
Email: ingrid.ilias@planning.nsw.gov.au

Our ref: 09/03481-3

Mr Matt Coetzee
Executive
Community Development and Infrastructure
Aurecon
Level 2, 116 Military Road
NEUTRAL BAY NSW 2089

Dear Mr Coetzee

Port Botany Expansion (DA-494-11-2003-i) - Proposed changes to surface drainage

I refer to a meeting held at the Department's offices on 25 May 2011 regarding proposed changes to surface drainage infrastructure associated with the abovementioned project. The Department understands that the surface drainage for the terminal is proposed be changed from a first flush containment system, as outlined in the Environmental Impact Statement, to the implementation of a Stormwater Quality Improvement Device (SQID) system.

The Department considers that the proposed changes are not consistent with the development consent and would therefore require consideration as part of a formal modification request in accordance with Section 75W of the *Environmental Planning and Assessment Act, 1979.* The modification request should outline the reasons for the requested change as well as the potential operational and environmental impacts, including but not limited to the potential improvements to water quality. The whole site, including the area proposed to be leased by Patricks, should be addressed, including how the stormwater management systems of each lease area will operate and meet appropriate environmental standards.

In preparing the assessment, consultation should be undertaken with the Office of Environment and Heritage, NSW Maritime and Department of Primary Industries.

If you have any queries, please do not hesitate to contact Ingrid Ilias on 9228 6411 or via email at ingrid.ilias@planning.nsw.gov.au.

Yours sincerely

16/6/11

Daniel Keary
Director
Infrastructure Projects

Nicola Weimann

From: Hanemann Jacinta <Jacinta.HANEMANN@environment.nsw.gov.au>
Sent: Monday, 8 August 2011 6:58 PM
To: Lucy Baker
Cc: Jansons Mark
Subject: 201467 Terminal 3 - Proposed changes to first flush system

Hi Lucy,

I apologise for the delay in responding to your request for comment on the proposed change from a first flush system to SQIDs at the Port Botany Expansion Project being undertaken by SPC. The Office of Environment and Heritage (OEH) has reviewed the proposal. As you are aware, OEH is focussed on ensuring environmental objectives, such as for water quality, are achieved rather than prescribing or endorsing a specific method. OEH has no concerns regarding the proposed SQIDs and is pleased to note that it is anticipated to achieve better water quality outcomes than the first flush system originally proposed.

Please contact Mark Jansons on 9995 6829 if you have any further questions.

Regards,
Jacinta Hanemann
Unit Head Metroplitan Infrastructure

From: Lucy Baker
Sent: Monday, 4 July 2011 5:06 PM
To: 'Jacinta.hanemann@environment.NSW.gov.au'
Cc: 'Jones.Philip@hph.com'; 'McGowan.JohnO@hph.com'; Alex James; 'gallagher.john@hutchisonports.com.au'; 'Ryan Smith'; Matt Coetzee; 201467 Terminal 3; 'paul.jerogin@lendlease.com.au'; pengelen@sydneyports.com.au; Merilyn Gilbert
Subject: RE: 201467 Terminal 3 - Proposed changes to first flush system

Dear Jacinta,

Please find attached letter in relation to the modification of the first flush system and respective drawings and a brochure on one alternative system. Matt Coetzee can be contacted readily on Ph: +61 2 9465 5611 | Fax: +61 2 9465 5598 | Mob: +61 437 686 651. I would appreciate it if you can nominate a few dates and times that you are available so that we can meet up to discuss the proposed changes.
Cheers,

Lucy Baker | Senior Project Leader - Environment and Sustainability | Aurecon
Ph: +61 2 9465 5822 | Fax: +61 2 9465 5598 | Mob: +61 488 158 649
Email: BakerL@ap.aurecongroup.com<mailto:BakerL@ap.aurecongroup.com>
PO Box 538, Sydney (Neutral Bay) | NSW 2089 | Australia http://www.aurecongroup.com
http://www.aurecongroup.com/apac/groupentity/

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

Our reference: 2007/03834

Ms Lucy Baker
Senior Project Leader
Environment and Sustainability
Aurecon
PO Box 538
NEUTRAL BAY NSW 2089

Dear Ms Baker

Re: Modification to Stormwater First Flush System for Port Botany Expansion (EPBC 2002/543)

Thank you for your e-mail of 10 January 2012 regarding modifications to the Stormwater First Flush System (SFFS) for the Sydney Ports Corporation's Port Botany Expansion.

I wish to advise that the Department does not consider the modifications to the SFFS necessitate any variations to the conditions of approval for the Port Botany Expansion under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC 2002/543).

In March 2012 condition 6 of the project's approval requires resubmission of the Penrhyn Estuary Habitat Enhancement Plan (PEHEP) for departmental approval. It is requested that the updated PEHEP reflect the modifications to the SFFS, where relevant.

Please do not hesitate to contact Sam Wagstaff on (02) 6274 2741 should you require any further information.

Yours sincerely

Mike Smith
Director
Monitoring and Audit Section
Compliance & Enforcement Branch
Environment Assessment and Compliance Division
8 February 2012

Lucy Baker

From: marcel.green@industry.nsw.gov.au
Sent: Wednesday, 14 September 2011 6:18 PM
To: Lucy Baker
Cc: carla.ganassin@industry.nsw.gov.au
Subject: Re: TRIM: INW11/25652 - RE: Port Botany Expansion Project - construction and operation of a new container terminal known as Sydney Terminal 3

G'day Lucy,

Thanks for the offer to comment on the proposed change from a "first flush system" to SQIDs. As discussed earlier, SQIDs seem to be the preferred method of stormwater treatment by the majority of local councils, particularly in Sydney, and the proposed change to SQIDs at Port Botany Terminal 3 should complement water quality improvements already installed by those councils. SQIDs reportedly produce significantly better water quality outcomes than "first flush systems", which will reduce the potential for water quality related impacts in Penrhyn Estuary and the broader Botany Bay, and therefore DPI-Fisheries commends their proposed use.

If you have any further queries, please call me on 8437 4933

Cheers,
Cel

Marcel Green | Senior Environmental Assessments Officer
Aquaculture, Conservation & Marine Parks | NSW Department of Primary Industries - Fisheries
12 Shirley Rd, Wollstonecraft NSW 2065 | T: 02 8437 4933 | M: 0410 459 959
E: marcel.green@industry.nsw.gov.au | W: www.industry.nsw.gov.au | www.dpi.nsw.gov.au

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Lucy Baker

From: Robert Toohey <Robert.Toohey@maritime.nsw.gov.au>
Sent: Tuesday, 27 September 2011 11:43 AM
To: Lucy Baker
Subject: PROPOSED MODIFICATION OF DEVELOPMENT APPROVAL No. DA-494-11-2003i - PORT BOTANY EXPANSION PROJECT KNOWN AS SYDNEY TERMINAL 3

Good morning Lucy,

I refer to your email of Wednesday 14 September, 2011 in relation to the abovementioned property.

It is noted that you are proposing to install Stormwater Quality Improvement Devices (SQIDs) as an alternative to the originally approved "first flush system".

NSW Maritime has reviewed the information that you supplied and raises no objection to the proposed modification.

It is also acknowledged that you will be applying to Modify the Minister's original approval pursuant to Section 75W of the Environmental Planning & Assessment Act, 1979.

Should you wish to discuss this matter further please contact me on 9563 8824.

Regards

Robert Toohey
Assessments Officer
Planning, Environment & Spatial Information Branch

NSW | Maritime

T: 02 9563 8824 | F: 02 9563 8530
Locked Bag 5100 | Camperdown NSW, 1450
www.maritime.nsw.gov.au

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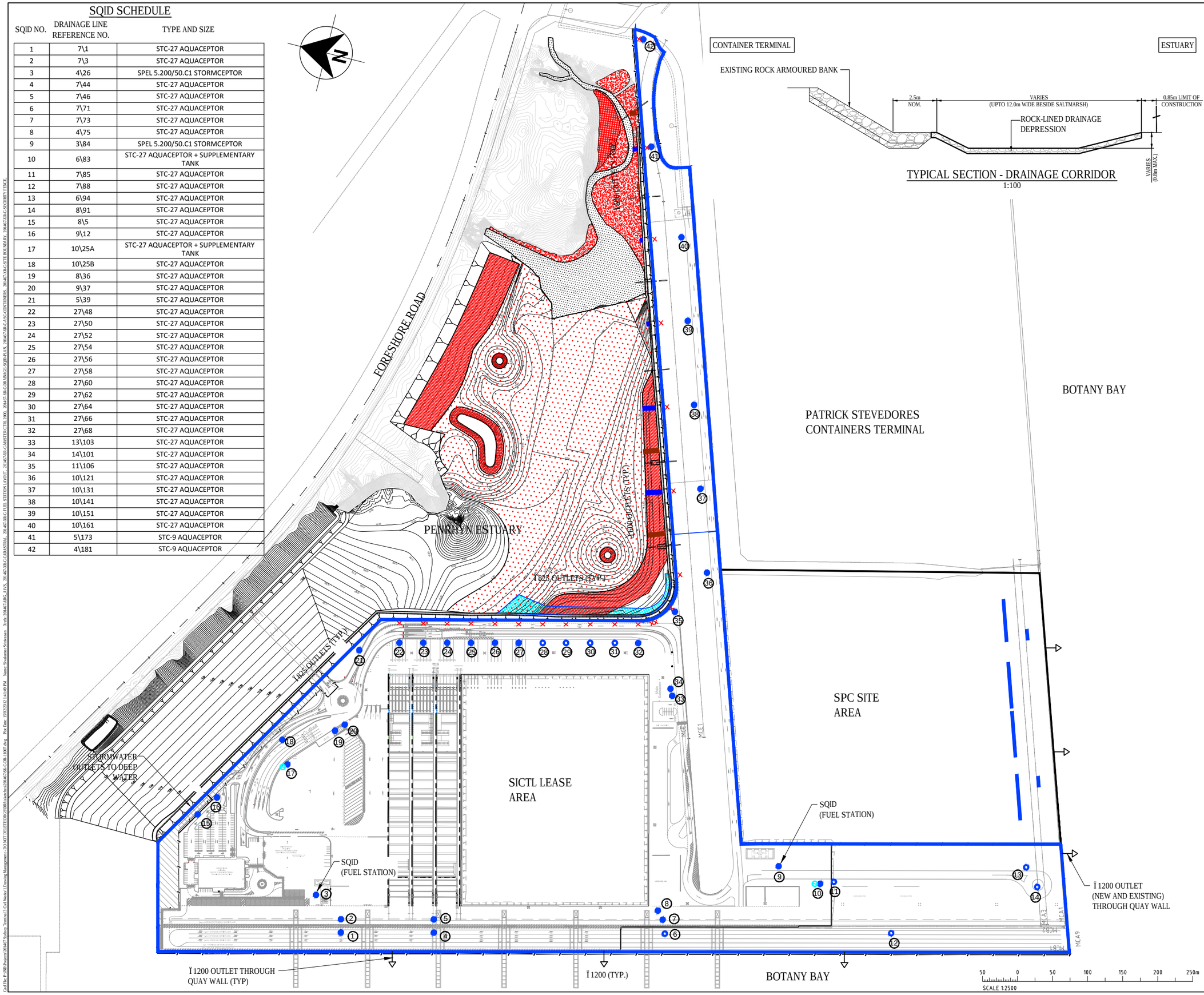
Appendix B - Drawings

SQID SCHEDULE

SQID NO.	DRAINAGE LINE REFERENCE NO.	TYPE AND SIZE
1	7\1	STC-27 AQUACEPTOR
2	7\3	STC-27 AQUACEPTOR
3	4\26	SPEL 5.200/50.C1 STORMCEPTOR
4	7\44	STC-27 AQUACEPTOR
5	7\46	STC-27 AQUACEPTOR
6	7\71	STC-27 AQUACEPTOR
7	7\73	STC-27 AQUACEPTOR
8	4\75	STC-27 AQUACEPTOR
9	3\84	SPEL 5.200/50.C1 STORMCEPTOR
10	6\83	STC-27 AQUACEPTOR + SUPPLEMENTARY TANK
11	7\85	STC-27 AQUACEPTOR
12	7\88	STC-27 AQUACEPTOR
13	6\94	STC-27 AQUACEPTOR
14	8\91	STC-27 AQUACEPTOR
15	8\5	STC-27 AQUACEPTOR
16	9\12	STC-27 AQUACEPTOR
17	10\25A	STC-27 AQUACEPTOR + SUPPLEMENTARY TANK
18	10\25B	STC-27 AQUACEPTOR
19	8\36	STC-27 AQUACEPTOR
20	9\37	STC-27 AQUACEPTOR
21	5\39	STC-27 AQUACEPTOR
22	27\48	STC-27 AQUACEPTOR
23	27\50	STC-27 AQUACEPTOR
24	27\52	STC-27 AQUACEPTOR
25	27\54	STC-27 AQUACEPTOR
26	27\56	STC-27 AQUACEPTOR
27	27\58	STC-27 AQUACEPTOR
28	27\60	STC-27 AQUACEPTOR
29	27\62	STC-27 AQUACEPTOR
30	27\64	STC-27 AQUACEPTOR
31	27\66	STC-27 AQUACEPTOR
32	27\68	STC-27 AQUACEPTOR
33	13\103	STC-27 AQUACEPTOR
34	14\101	STC-27 AQUACEPTOR
35	11\106	STC-27 AQUACEPTOR
36	10\121	STC-27 AQUACEPTOR
37	10\131	STC-27 AQUACEPTOR
38	10\141	STC-27 AQUACEPTOR
39	10\151	STC-27 AQUACEPTOR
40	10\161	STC-27 AQUACEPTOR
41	5\173	STC-9 AQUACEPTOR
42	4\181	STC-9 AQUACEPTOR



CONTAINER TERMINAL

ESTUARY

EXISTING ROCK ARMOURED BANK

TYPICAL SECTION - DRAINAGE CORRIDOR
1:100

PATRICK STEVEDORES CONTAINERS TERMINAL

BOTANY BAY

LEGEND

- FIRST FLUSH STORAGE TANKS
- PROPOSED SQIDS
- DRAINAGE CLOSURE DEVICE (PIPE BUNGS)
- SICTL SITE BOUNDARY
- SPC SITE BOUNDARY
- PROPOSED STORMWATER OUTLET
- EXISTING STORMWATER OUTLET
- SUPPLEMENTARY SPILL CONTAINMENT TANKS ARE 20,000 LITRES EACH
- EXISTING SALTMARSH COMMUNITY TO BE RETAINED. PROTECT IN PLACE DURING ALL OTHER ESTUARY WORKS.
- SALTMARSH TRANSPLANT RECIPIENT SITE PROTECT IN PLACE DURING ALL OTHER ESTUARY WORKS.
- NEW SALTMARSH PLANTING AREA LOCATED BETWEEN THE 1.4m & 2.0m CONTOUR - REFER TO PR 528 FOR DETAILS, SET OUT & SCHEDULES
- EXISTING INTERTIDAL HABITAT - LOCATED BETWEEN THE 0.5m & 1.4m CONTOUR NEW
- INTERTIDAL HABITAT - LOCATED BETWEEN THE 0.3m & 1.4m CONTOUR
- DRAINAGE CORRIDOR

NOTES

1. STORMWATER QUALITY IMPROVEMENT DEVICES (SQIDS) AS SUPPLIED BY HUMES (AQUACEPTORS) OR SPEL (STORMCEPTORS)
2. ALL AQUACEPTOR SQIDS WILL PROVIDE FOR 3000 TO 4000 LITRE PETROLEUM HYDROCARBON SPILL CONTAINMENT, UPGRADED TO 20000 LITRES IN AREAS OF HIGHER RISK
3. WATER QUALITY SOLUTION NOT DOCUMENTED FOR PATRICK STEVEDORES CONTAINER TERMINAL

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www.aurecongroup.com

EMPLOYER

Sydney International Container Terminals Pty Limited

REV	DATE	REVISION DETAILS	APP
07	15.02.12	TYP.SECTION DRAINAGE CORRIDOR ADDED	AJ
06	25.01.12	SALTMARSH AREA ADJUSTED, PIPE BUNGS ADDED	AJ
05	16.12.10	REVISED CONCEPT DESIGN	AJ
04	18.10.11	REVISED CONCEPT DESIGN	AJ
03	23.09.11	REVISED CONCEPT DESIGN	AJ
02	30.08.11	REVISED CONCEPT DESIGN	AJ
01	15.06.11	CONCEPT DESIGN	AJ

PROJECT

SYDNEY PORT BOTANY TERMINAL 3

TITLE

STORMWATER TREATMENT WITH SQIDS SITE LAYOUT

DRAWN	DESIGNED
D.EGITTO	D.WIGNELL

CHECKED: H.CHUA

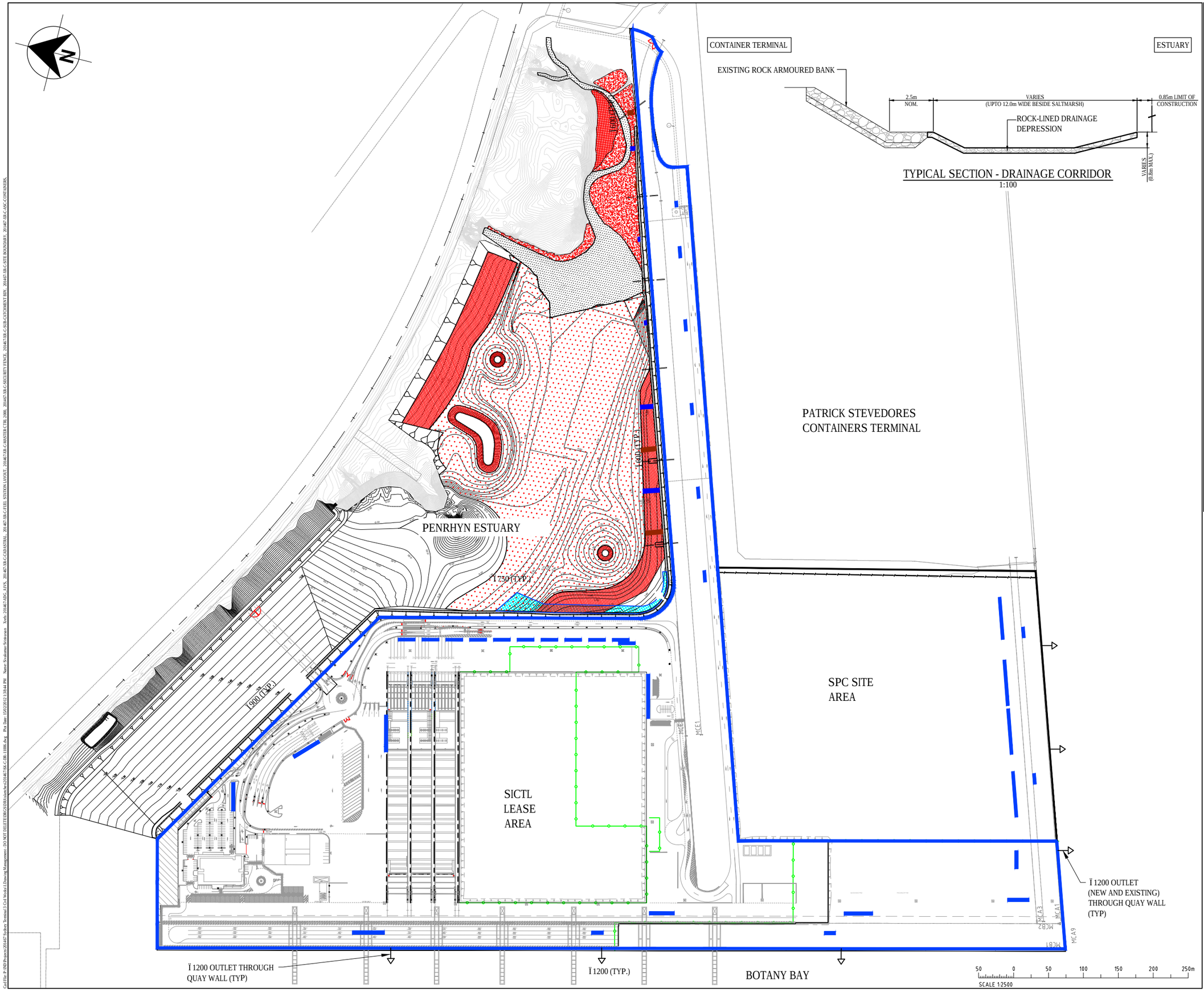
APPROVED: DATE 16.12.11 — A.JAMES

PRELIMINARY NOT FOR CONSTRUCTION

PROJECT No.: 201467

SCALE	SIZE
1:2500	A1

DRAWING No.: SK-C-DR-11007 REV 07



LEGEND

- FIRST FLUSH STORAGE TANKS
- SICTL SITE BOUNDARY
- SPC SITE BOUNDARY
- PROPOSED STORMWATER OUTLET
- EXISTING STORMWATER OUTLET
- EXISTING SALTMARSH COMMUNITY TO BE RETAINED. PROTECT IN PLACE DURING ALL OTHER ESTUARY WORKS.
- SALTMARSH TRANSPLANT RECIPIENT SITE PROTECT IN PLACE DURING ALL OTHER ESTUARY WORKS.
- NEW SALTMARSH PLANTING AREA LOCATED BETWEEN THE 1.4m & 2.0m CONTOUR - REFER TO PR 528 FOR DETAILS, SET OUT & SCHEDULES
- EXISTING INTERTIDAL HABITAT - LOCATED BETWEEN THE 0.5m & 1.4m CONTOUR NEW
- INTERTIDAL HABITAT - LOCATED BETWEEN THE 0.3m & 1.4m CONTOUR
- DRAINAGE CORRIDOR

NOTES

1. FIRST FLUSH STORAGE TANKS 4000 INTERNAL WIDTH WITH NOMINAL 1500 STORAGE DEPTH
2. WATER QUALITY SOLUTION NOT DOCUMENTED FOR PATRICK STEVEDORES CONTAINERS TERMINAL.

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www.aurecongroup.com

EMPLOYER

Sydney International Container Terminals Pty Limited

REV	DATE	REVISION DETAILS	APP
06	15.02.12	TYP.SECTION DRAINAGE CORRIDOR ADDED	AJ
05	27.01.12	REVISED SALTMARSH	AJ
04	16.12.11	REVISED CONCEPT DESIGN	AJ
03	18.10.11	REVISED CONCEPT DESIGN	AJ
02	23.09.11	REVISED CONCEPT DESIGN ISSUE	AJ
01	15.06.11	CONCEPT DESIGN	

PROJECT

SYDNEY PORT BOTANY TERMINAL 3

TITLE

STORMWATER TREATMENT WITH FIRST FLUSH SYSTEM SITE LAYOUT

DRAWN	DESIGNED
D.EGITTO	D.WIGNELL

CHECKED: H.CHUA

APPROVED: A.JAMES

DATE: 16.12.11

PRELIMINARY
NOT FOR CONSTRUCTION

PROJECT No.: 201467

SCALE: 1:2500

SIZE: A1

DRAWING No.: SK-C-DR-11006

REV: 06

Appendix C – Ecological Assessment

Assessment of the modification of stormwater management on migratory shorebirds and the general ecology of Penrhyn Estuary

Summary

Sydney Ports Corporation is seeking a modification under Section 75W of the Environmental Planning and Assessment Act 1979 to alter the stormwater first flush systems to address safety risks and operational constraints associated with first flush tanks previously planned for the Port Botany Expansion, now known as the Sydney Port Botany Expansion Container Terminal: (T3). As a result of this the Department of Sustainability, Environment, Water, Population and Communities have requested that the Sydney Ports Corporation (SPC) Port Botany Expansion Penrhyn Estuary Habitat Enhancement (PEHE) Plan be updated and resubmitted to the Department to demonstrate the negligible impact to protected matters from the modification to the stormwater first flush system.

The modification provides an optimum environmental protection system for the port expansion project. The proposed modification applies to the whole site, as the stormwater quality improvement devices (SQIDs) are located towards the end of each drainage line discharging from the site.

As a result of the modification there will be an improvement to the water quality discharging into Penrhyn Estuary. The assessment demonstrates that the proposed modification would involve minimum environmental impact, as it will remain substantially the same development as that granted consent in October 2005 by the Minister for Planning.

This assessment demonstrates that the proposed modification would have no negative impact on shorebirds and other waterbirds, the saltmarsh communities on benthic organisms in Penrhyn Estuary. The modification would in fact provide improved environmental conditions compared with the previous proposal to install a first flush system.

Penrhyn Estuary

Penrhyn Estuary, located north of T3, is recognised as a significant habitat for shorebirds. It provides important feeding and roosting areas for the birds and has been recognised as the most important site in Botany Bay for shorebird species such as the Red-necked Stint, Curlew Sandpiper, Red Knot, Pacific Golden Plover, Double-banded Plover and Sharp-tailed Sandpiper that are now sparse or absent from other parts of the Bay. Prior to the PEHE construction phase the area of shorebird habitat was very small and was impacted by the spread of mangroves across important mudflat feeding habitat as well as industrial pollution.

The PEHE Project has created a greatly increased area of habitat for migratory shorebirds, saltmarsh habitat and is enabling the establishment of areas seagrass meadow. The Estuary is influenced by daily tidal flows from Botany Bay as well as stormwater draining from local catchments via Floodvale and Springvale Drains, as well as drains from the existing Port Botany facilities. The construction of the T3 port expansion will result on an increase in the amount of water entering the Estuary via drains being constructed as part of the Port expansion. These impacts have been the subject of previous approvals for the construction of the T3 port extension.

The Estuary has been greatly enlarged and improved as part of the PEHE and will be protected from noise and the visual impact of traffic movements from the adjacent port facilities. It was previously planned to protect the estuary from pollutants carried by stormwater runoff from the T3 Port Expansion using a first flush system.

While freshwater flows are a natural part of estuary ecology pollutants could result in major environmental damage to saltmarsh and seagrass vegetation and benthic organisms that are relied upon by migratory shorebirds and other fauna. The first flush system proposed by SPC was designed to minimise the affect of pollutants on Penrhyn Estuary.

A proposed modification of the handling of stormwater includes the installation of a series of SQIDs along the shores of the Estuary adjacent to the T3 Port Expansion. Whilst the proposed modification is for safety concerns for the operation of the SQIDs the installation of the SQIDs would also greatly improve the water quality entering the Estuary during all rain events and especially in the capacity of the SQIDs' capacity for spill containment in case of accidental spills on site.

The modification would be a distinct advantage in safeguarding the ecology of the Estuary including migratory shorebirds, saltmarsh and seagrass habitat and benthic infauna.

An assessment of significance is attached for nine species of shorebirds and one species of tern listed under the TSC Act as Threatened. All of these except Black-tailed Godwit and Broad-billed Sandpiper have been observed during the PEHE Shorebird Monitoring Program.

Phil Straw
Consultant Avian and Wetlands Ecologist

ASSESSMENT OF SIGNIFICANCE

An assessment of significance has previously been carried as part of the assessment for the expansion of Port Botany. However Sydney Ports Corporation is seeking a modification under Section 75W of the Environmental Planning and Assessment Act 1979 to alter the stormwater first flush systems, resulting in this additional assessment of significance.

Penrhyn Estuary is an important site for 16 species of migratory shorebirds, and six species of non-migratory shorebirds including six species listed as Threatened under the TSC Act (Table 1). In additional one species of migratory tern that is listed as threatened (Little Tern) also occurs at the site. This assessment considers the changes to water quality on shorebirds using Penrhyn Estuary as well as the saltmarsh community within the Estuary. No marine species or mammals are assessed because no habitat exists on Terminal 3.

Prior to the commencement of the Penrhyn Estuary Habitat Enhancement (PEHE) Project areas of saltmarsh habitat were identified within the Estuary. During the construction period the area of saltmarsh was greatly increased through propagation and planting. Coastal Saltmarsh is considered an Endangered Ecological Community in the South East Corner Bioregion of NSW and is therefore included in this assessment.

Table 1: Shorebird species present before and during construction phase

Species	Dec 2006 - Apr 2008	Apr 2008 – Mar 2011	EPBC	TSC
Bar-tailed Godwit#	*	*	M	
Eastern Curlew+	*	*	M	
Common Greenshank+	*	*	M	
Common Sandpiper+	*		M	
Terek Sandpiper+		*	M	V
Grey-tailed Tattler	*	*	M	
Ruddy Turnstone+	*		M	
Great Knot+	*	*	M	V
Red Knot#	*	*	M	
Sanderling+	*	*	M	V
Red-necked Stint#	*	*	M	
Sharp-tailed Sandpiper	*	*	M	
Curlew Sandpiper#	*	*	M	
Pacific Golden Plover#	*	*	M	
Double-banded Plover#	*	*	M	
Lesser Sand Plover+		*	M	V
Little Tern	*	*	M	E
Non-migratory species				
Pied Oystercatcher	*	*		E
Sooty Oystercatcher+	*			V
Black-winged Stilt	*	*		
Red-capped Plover	*	*		
Black-fronted Dotterel+	*			
Masked Lapwing	*	*		

EPBC = Species protected under the EPBC Act (migratory species).
TSC = Species protected under the Threatened Species Conservation Act
V (Vulnerable), E (Endangered).
= Key species during this study.
\+ = Infrequent visitors to the north side of Botany Bay.

MAKING AN ASSESSMENT OF SIGNIFICANCE

The threatened species Assessment of Significance should not be considered as a "pass or fail test". Instead, the heads of consideration are used to inform the decision-making process of the likelihood of significant effect, and where necessary, to trigger further assessment in

the form of a Species Impact Statement. All factors should be considered as well as any other information deemed relevant to the assessment. The Assessment of Significance should not be used as a substitute for a Species Impact Statement. Where it is difficult to determine whether a significant impact is likely, a Species Impact Statement should be prepared in accordance with the precautionary principle.

Mitigating, ameliorative or compensatory measures proposed as part of the action, development or activity should not be considered in determining the degree of the effect on threatened species, populations or ecological communities, unless the measure has been proven successful for that species in a similar situation. In many cases where complex mitigating, ameliorative or compensatory measures are required, such as translocation, bush restoration, purchase of land, further assessment through the Species Impact Statement process is likely to be required.

In determining the nature and magnitude of an impact, it is important to consider matters such as:

- Pre-construction, construction and occupation/maintenance phases,
- All on-site and offsite impacts, including location, installation, operation and maintenance of auxiliary infrastructure and fire management zones,
- All direct and indirect impacts,
- The frequency and duration of each known or likely impact/action,
- The total impact which can be attributed to that action over the entire geographic area affected, and over time,
- The sensitivity of the receiving environment, and
- The degree of confidence with which the impacts of the action are known and understood.

Recovery and threat abatement plans, priorities action statements and threatened species profiles may provide further guidance on whether an action/activity is likely to be significant.

Application of the precautionary principle requires that a lack of scientific certainty about the potential impacts of an action does not itself justify a decision that the action is not likely to have a significant impact. If information is not available to conclusively determine that there will not be a significant impact on a threatened species, population or ecological community, or its habitat, then it should be assumed that a significant impact is likely.

Threatened species impact assessment is an integral part of environmental impact assessment. The objective of s. 5A of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the *assessment of significance*, is to improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure that the consideration is transparent.

The *Threatened Species Conservation Amendment Act 2002* revised the factors that need to be considered when assessing whether an action, development or activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats, previously known as the '8-part test.' The changes affect s. 5A EP&A Act, s. 94 *Threatened Species Conservation Act 1995* (TSC Act) and s. 220ZZ *Fisheries Management Act 1994* (FM Act).

These revised *factors of assessment* maintain the earlier intent of the legislation but focus particularly on likely impacts to the **local** rather than the **regional** environment. The reason for the shift to a local focus is that the long-term loss of biodiversity at all levels arises mainly from the accumulation of losses and depletions of populations at a local level. This is the broad principle underpinning the TSC Act, state and federal biodiversity strategies, and international agreements.

The consideration of impacts at a local level is also designed to make it easier for local

government to assess, and easier for applicants and consultants to undertake the assessment of significance because there is no longer a need to research regional and state-wide information.

The assessment of significance is the first step in considering potential impacts. When a significant effect is likely, further consideration is required and is more appropriately carried out when preparing a *species impact statement.*

Section 94A of the TSC Act and s. 220ZZA of the FM Act provides that the Minister for Climate Change, Environment and Water and the Minister for Primary Industries, with the concurrence of the Minister for Planning, may prepare *assessment guidelines* to assist in the interpretation and application of the factors of assessment.

These guidelines have been prepared to help applicants/proponents of a development or activity with interpreting and applying the factors of assessment. The aim of the guidelines is to help ensure that a consistent and systematic approach is taken when determining whether an action, development or activity is likely to significantly affect threatened species, populations or ecological communities, or their habitats either directly or indirectly.

Making determinations requires technical expertise, and knowledge of species and their habitats. The guidelines assume that those undertaking an assessment of significance have sufficient knowledge and experience to do so.

These guidelines clarify the specific terminology of the relevant legislation and provide clear interpretations of the factors of assessment. Further guidance, including examples and case studies will be provided in a supplementary document.

The assessment of significance should not be considered a ‘pass or fail’ test but a system allowing applicants/proponents to undertake a qualitative analysis of the likely impacts, and ultimately, whether further assessment needs to be undertaken through a species impact statement. All factors must be considered and an overall conclusion must be drawn from all factors in combination. Where there is reasonable doubt regarding the likely impacts, or where detailed information is not available, a species impact statement should be prepared. Other issues not specifically addressed by the factors of assessment should be included and discussed in the broader impact assessment process, for example, in a review of environmental factors or an environmental impact statement.

Listed threatened species

The assessment of significance is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the FM Act. The applicant/proponent should develop a list of threatened species, populations and ecological communities that may be affected directly or indirectly by the proposed action, development or activity. Adequate reasons should be provided to show how the list was derived.

A species does not have to be considered as part of the assessment of significance if adequate surveys or studies have been carried out that clearly show that the species:

Does not occur in the study area, or will not use on-site habitats on occasion, or will not be influenced by off-site impacts of the proposal.

Otherwise all species likely to occur in the study area (based on general species distribution information), and known to use that type of habitat, should be considered in the rationale that determines the list of threatened species, populations and ecological communities for the assessment of significance.

Consultants for proponents/applicants need to be aware that any 'Final Determination' to list a species, population or ecological community as 'Critically Endangered' or 'Endangered' made after lodgement of a s. 91 TSC Act or s. 220ZW FM Act licence, development application or activity proposal needs to be included in the consideration of impacts and the application of the assessment of significance. Therefore applicants/proponents are advised to give due consideration to Preliminary Determinations made by the Scientific Committees. Vulnerable species listed after lodgement are not subject to impact assessment so long as the application is determined within 12 months of lodgement (s. 113C TSC Act, ss. 105A and. 110D EP&A Act). The NSW legislation website (www.legislation.nsw.gov.au/) provides the most up-to-date information on what is listed in the schedules.

To assist the assessment process, the Department of Environment and Climate Change NSW (DECC)* and the NSW Department of Primary Industries (DPI) have prepared species profiles for a number of threatened species. Consultants are advised to refer to these and other fact sheets for baseline information on species morphology, behaviour, habitat and threats.

Terminology

Throughout this guideline the terms *subject site* and *study area* are used. It is important to have a thorough understanding of these terms as they apply to the assessment.

Subject site means the area directly affected by the proposal.

Study area means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. The study area should extend as far as is necessary to take all potential impacts into account.

Direct impacts are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.

The Factors of Assessment

An assessment of ten species of birds, listed as Threatened under the TSC Act, are included here. These are Black-tailed Godwit, Terek Sandpiper, Great Knot, Sanderling, Broad-billed Sandpiper, Lesser Sand Plover, Pied Oystercatcher, Sooty Oystercatcher and Little Tern. All except Black-tailed Godwit and Broad-billed Sandpiper have been observed at Penrhyn Estuary within the past ten years.

In the case of – Black-tailed Godwit Limosa limosa

a. in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Black-tailed Godwit is associated with tidal mudflats or inland wetlands. There are very few records of this species in Botany Bay. However, using the precautionary principle it should be considered possible for the species to occur there based on records in similar habitat in other parts of coastal NSW and past rare sightings in Botany Bay.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality.

The result of the development is not likely to have an adverse effect on the life cycle of the Black-tailed Godwit such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Black-tailed Godwit is a vulnerable species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the*

long-term survival of the species, population or ecological community in the locality,

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e. whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for the Black-tailed Godwit.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Black-tailed Godwit in vicinity of Port Botany.

In the case of – Terek Sandpiper

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Terek Sandpiper is associated with tidal mudflats of the central to northern coasts of Australia down as far as Sydney on the east coast. Numbers decline further south in NSW and few birds are recorded south of Sydney. Numbers have declined in recent years in Botany Bay. At Penrhyn Estuary a single sighting of one bird was made during the study.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality.

The result of the development is not likely to have an adverse effect on the life cycle of the Terek Sandpiper such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Terek Sandpiper is a vulnerable species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological

community, whether the action proposed:

- *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for the Terek Sandpiper.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Terek Sandpiper in vicinity of Port Botany.

In the case of – Great Knot

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Great Knot is associated with tidal mudflats of the central to northern coasts of Australia down as far as Sydney on the east coast. Numbers decline further south and few birds are recorded south of

Sydney. Numbers have declined in recent years in Botany Bay with one or two birds recorded most years. At Penrhyn Estuary a single sighting of one bird was made during the study.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality.

The result of the development is not likely to have an adverse effect on the life cycle of the Great Knot such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Great Knot is a vulnerable species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for the Great Knot.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Great Knot in vicinity of Port Botany.

In the case of – Sanderling

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Sanderling is associated with tidal mudflats and especially ocean beaches along the coast of Australia. Usually occur in small numbers at sites along the NSW coast. Occurs in Botany Bay, usually at Penrhyn Estuary with records of up to three birds for short periods most years.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality. However, The result of the development is not likely to have an adverse effect on the life cycle of the Sanderling such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Sanderling is a vulnerable species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or

threat abatement plan,

A recovery plan has not been prepared for the Sanderling.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Sanderling in vicinity of Port Botany.

In the case of – Broad-billed Sandpiper

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Broad-billed Sandpiper is associated with the coasts of Australia generally, but very scarce and irregular. No recent records in Botany Bay. However, using the precautionary principle it should be considered likely for the species to occur there based on previous records. Predicted key impacts from the proposal on this species comprise marginal changes to feeding but no changes to roosting habitat.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality. However, The result of the development is not likely to have an adverse effect on the life cycle of the Broad-billed Sandpiper such that a viable local population is likely to be placed at risk of extinction.

The result of the development is not likely to have an adverse effect on the life cycle of the Broad-billed Sandpiper such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Broad-billed Sandpiper is a vulnerable species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for the Broad-billed Sandpiper.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Broad-billed Sandpiper in vicinity of Port Botany.

In the case of – Lesser Sand Plover

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Lesser Sand Plover is associated with tidal mudflats of the coasts of Australia but more numerous in central and northern coasts. This species used to be a relatively common bird in Sydney but is now a rare visitor, usually single birds. Up to eight birds were observed at Penrhyn Estuary and two birds at Quibray Bay during the construction phase of the PEHE Shorebird Monitoring Program, the firs observations in Botany Bay for many years.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality. However, The result of the development is not likely to have an adverse effect on the life cycle of the Lesser Sand Plover such that a viable local population is likely to be placed at risk of extinction.

The result of the development is not likely to have an adverse effect on the life cycle of the Lesser

Sand Plover such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Lesser Sand Plover is a vulnerable species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for the Lesser Sand Plover.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Lesser Sand Plover in vicinity of Port Botany.

In the case of – Pied Oystercatcher

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Pied Oystercatcher is associated with tidal mudflats of Australia including Botany Bay. Numbers have increased in recent years in the Bay. However the species has recently been listed as Endangered in NSW, previously listed as Vulnerable. Prior works associated with the PEHE Project the Pied Oyster was rarely observed in the Estuary. However the Pied Oystercatcher has been observed on a regular basis since the commencement of the Port Expansion and has commenced nesting in the Estuary.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality. However, The result of the development is not likely to have an adverse effect on the life cycle of the Pied Oystercatcher such that a viable local population is likely to be placed at risk of extinction.

The result of the development is not likely to have an adverse effect on the life cycle of the Pied Oystercatcher such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Pied Oystercatcher is an Endangered species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or

threat abatement plan,

A recovery plan has not been prepared for the Pied Oystercatcher.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Pied Oystercatcher in vicinity of Port Botany.

In the case of – Sooty Oystercatcher

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The Sooty Oystercatcher is listed as part of the Taren Point Endangered Ecological Community and is also listed as a threatened species under the TSC Act.

Field Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Sooty Oystercatcher is associated with rocky coasts and occasionally tidal round Australia. Commonly recorded at Boat Harbour, on the ocean side of Kurnell, it is rarely observed inside Botany. Observed at Penrhyn Estuary during the pre-construction monitoring period of the PEHE 2006-2008.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality. However, The result of the development is not likely to have an adverse effect on the life cycle of the Sooty Oystercatcher such that a viable local population is likely to be placed at risk of extinction.

The result of the development is not likely to have an adverse effect on the life cycle of the Sooty Oystercatcher such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Sooty Oystercatcher is a vulnerable species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for the Sooty Oystercatcher.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Sooty Oystercatcher in vicinity of Port Botany.

In the case of – Little Tern

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The Little Tern is listed as Endangered under the TSC Act.

Field surveys of the tidal mudflats and tidal waters in the vicinity of the development site were conducted on foot with the aid of binoculars to visually scan the area at low tide as well as high tide, to determine which species of shorebirds, and other waterbirds, utilised the site and nearby tidal flats. These surveys were conducted as part of a five year Shorebird Monitoring Program by Sydney Ports Corporation in addition to data collected as part of other studies of the site over the past ten years (NSW Wader Study Group data).

The Little Tern breeds in Botany Bay as well as having a non-breeding population. Frequently observed at Penrhyn Estuary in small numbers throughout the PEHE Monitoring Project, occasionally nesting within the Estuary.

Predicted key impacts from the proposed changes on this species comprise potential marginal changes to the water quality of stormwater draining from the surface area of Sydney Port Botany Expansion Container Terminal (T3) in that there will be an improvement in the water quality. However,

The result of the development is not likely to have an adverse effect on the life cycle of the Little Tern such that a viable local population is likely to be placed at risk of extinction.

The result of the development is not likely to have an adverse effect on the life cycle of the Little Tern such that a viable local population is likely to be placed at risk of extinction.

b. in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

The Little Tern is an Endangered species, not an endangered population.

c. in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

No endangered ecological population has been listed for the site

d. in relation to the habitat of a threatened species, population or ecological community:

- *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
- *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
- *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

No habitat will be removed as part of the development.

The area is not likely to become fragmented or isolated from other areas of habitat as a result of the proposed redevelopment.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

The habitat found in the study area or subject site is not listed as critical habitat.

f. whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for the Little Tern.

g. whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The changes to the proposed redevelopment of not listed as a key threatening process.

Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Little Tern in vicinity of Port Botany.

In the case of Coastal Saltmarsh in the NSW North Coast – South East Corner Bioregion

a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Coastal Saltmarsh in Botany Bay is an Endangered Ecological Community.

b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,

Coastal Saltmarsh in Botany Bay is an Endangered Ecological Community.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

> *i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
>
> *ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,*

Coastal Saltmarsh in Botany Bay is an Endangered Ecological Community that occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea (DEC 2005). Characteristic plants include *Baumea juncea*, *Juncus krausii*, *Sarcocornia quinqueflora*, *Sporobolus virginucus*, *Triglochin striata*, *Isolepis nodosa*, *Samolus repens*, *Selliera radicans*, *Suaeda australis* and *Zoysia macrantha* (DEC 2005). Occasionally mangroves are scattered through the saltmarsh.

The extent of saltmarsh at Penrhyn Estuary has been greatly enlarged as a result of the Penrhyn Estuary Habitat Enhancement Project.

There will be no direct impacts on Coastal Saltmarsh arising from the proposed modification to the planned stormwater first flush system.

There is not likely to be any adverse effect on the extent of the Coastal Saltmarsh community or its composition. On this basis, the proposed development is not likely to place the Coastal Saltmarsh community at risk of extinction or even reduce its extent of occurrence.

d) in relation to the habitat of a threatened species, population or ecological community:

> *i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
>
> *ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*
>
> *iii) the importance of the habitat to be removed, modified, fragmented or isolated to the longterm survival of the species, population or ecological community in the locality,*

As stated above, altered hydrological regimes may theoretically indirectly impact the Coastal Saltmarsh ecological community. This is not considered likely given that the water quality will be improved. Hence, no habitat of the Coastal Saltmarsh community will be removed or modified as a result of the proposed works.

e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

There is no critical habitat listed as occurring in the study area occupied by saltmarsh.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

There is no recovery plan for the Coastal Saltmarsh ecological community.

g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

The stormwater first flush system or its modification to improve water quality is not listed as a key threatening process or is likely to increase the impact of any other key threatening processes. Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands is listed as a key threatening process.

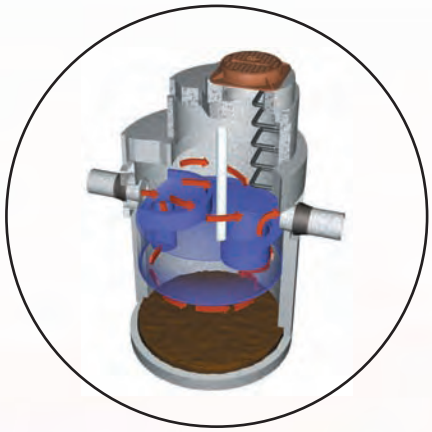
Conclusion
Based on the above investigation, we do not consider it necessary to conduct further impact assessment on the impacts of the proposed development on the Coastal Saltmarsh in the Botany Bay ecological community.

Appendix D - Humeceptor Technical Manual

Humes™
WATER SOLUTIONS

Humeceptor™

Technical Manual



Humeceptor™

Hydrocarbon and Fine Sediment Hydrodynamic Separator

Technical Manual

Australian Patent No. 693164
New Zealand Patent No. 314646
Australian Patent Application 63621/98

Part of the Humes Water Solutions Treatment Train

ABN 90 000 001 276
www.humes.com.au

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1. Summary

Hume*ceptor* ™ is manufactured under licence to Imbrium Systems Inc. **Hume***ceptor* ™ is a patented stormwater quality improvement device (SQID) that operates as an Hydrodynamic Separator in a stormwater drainage system. **Hume***ceptor* ™ removes hydrocarbons and suspended solids from stormwater, preventing spills and minimising non-point source pollution entering downstream waterways.

A summary of the key benefits related to the implementation of a **Hume***ceptor* ™ is as follows :

- Capable of removing up to 80% of the total sediment load when properly applied as a source control for small areas
- Removes up to 98% of free oil from stormwater
- Will not scour or re-suspend trapped pollutants even during peak flows
- Can be implemented as part of a treatment train (e.g. prevents groundwater contamination in recharge measures, extends the maintenance period for other stormwater quality measures)
- Excellent spill control device for commercial and industrial developments
- Simple to design and specify
- Cost Effective compared to other stormwater quality measures
- Easy to install in new or retrofit situations
- Easy to maintain (vacuum truck)
- Can be used as a junction
- Pre-engineered for traffic loading
- Does not require a large drop in storm drain elevation for implementation (25 mm)
- **Hume***ceptor* ™ clearly marked on the cover (Excluding the STC2 Inlet model)

Although the* Humeceptor™ *is extremely versatile, users of this document should keep in mind several key constraints :

- The STC2 “Inlet” **Hume***ceptor* ™ and the **Multi***ceptor*™ units can be used as a storm drain inlet
- Treatment is dependent on head differential between the Inlet and Outlet of the treatment chamber, therefore, care should be taken when designing in tidal zones
- The difference between the inlet pipe invert elevation and the outlet pipe elevation must be 25 mm
- The invert level difference between the inlet and outlet on the STC2 Unit and **Multi***ceptor*™ units is 75mm.
- The largest standard inlet/outlet size that can be accommodated without customisation is 1050 mm RCP (STC18-60 models) and 450 mm RCP (STC2 Inlet model)
- **Hume***ceptor*™ can accommodate several inlet pipes, but they must be considered in the overall context of the unit diameter and structural integrity.

2. Overview

Hume*ceptor* ™ is a pollution prevention device that efficiently removes hydrocarbons and sediment from stormwater. **Hume***ceptor* ™ is compatible with standard infrastructure components. The key advantage of **Hume***ceptor* ™ compared to other stormwater quality controls is the patented bypass which prevents the re-suspension and scour of settled material during subsequent storm events. Accordingly, **Hume***ceptor* ™ will not release pollutants between servicing, even during infrequent events (i.e. 5 year or 10 year storm).

Hume*ceptor* ™ follows the philosophy of treating pollution at its source. Treating pollution at the source is the preferred methodology for water quality control since the dilution of pollutants in stormwater becomes problematic in terms of effective treatment as the drainage area increases. A study by Bannerman et al., (1993) indicated that the application of stormwater quality controls to 14% of the residential land and 40% of the industrial lands could reduce a region's total contaminant loading by 75%, indicating that cost-effective water quality control can be implemented by targeting certain "hot spots". In this study, streets were critical in all land uses, and parking lots were critical for industrial and commercial land uses.

3. Water Sensitive Urban Design

Water Sensitive Urban Design (WSUD) is a framework for, or way of thinking about, the planning and design of urban environments that takes into account the many demands and opportunities for water and environmental protection (ARQ, 2006). The four main objectives of WSUD include;

- Reducing potable water demand
- Minimising wastewater generation and reusing treated wastewater
- Treating urban stormwater to meet water quality objectives
- Preserving the natural hydrology of catchments

To achieve the treatment of urban stormwater objective, it is necessary to implement a "treatment train" of measures that can address the variety of pollutants and their wide range of particle sizes (ARQ, 2006). It is widely acknowledged that there is no single device whether natural, constructed or manufactured that can achieve all of the water quality objectives desired for urban stormwater.

The **Hume***ceptor* ™ solution is designed to be an integral part of the WSUD Treatment Train for improving urban stormwater quality, specifically in the fine sediment (5,000 μm – 10μm) and hydrocarbon areas. Figure 1 is adapted from ARQ (2006) to demonstrate the treatment range for the **Hume***ceptor* ™ device.

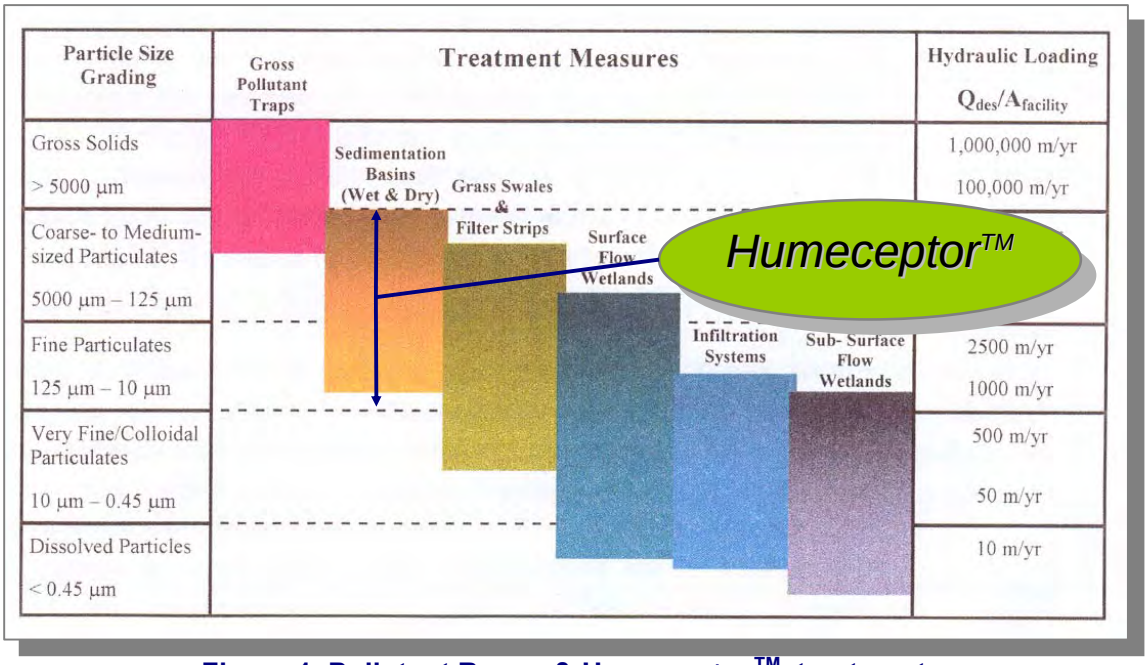


Figure 1. Pollutant Range & Hume*ceptor*™ treatment

4. Applications

Hume*ceptor*™ is applicable in a variety of development situations including :

- stormwater quality retrofits for existing development
- industrial and commercial parking lots
- automobile service stations
- airports
- areas susceptible to spills of hydrocarbons (bus depots, transfer stations, etc.)
- new residential developments (as part of a treatment train)
- re-development in urban areas.

4.1 Existing Development Retrofits

Existing development can comprise up to 80% of a watershed's tributary drainage area. These areas are often overlooked since the large area of uncontrolled runoff is overwhelming. By targeting "hot spot" areas however, cost-effective water quality control can be implemented for existing developed areas.

Existing developed areas generally provide numerous constraints to the implementation of water quality enhancement. Surrounding properties define the grading of the development (or else bunds and expensive retaining walls are required) and existing stormwater inverts and locations define the minor system drainage route. These constraints generally limit the number and type of options available to the stormwater management professional with respect to water quality enhancement. In these situations, **Hume*ceptor*™** is an attractive solution due to its low cost, ease of installation and maintenance, and compatibility with the existing drainage system.

4.2 Emergency Spill Areas

Parking lots, highways, motorways, and industrial areas where transfer of deleterious materials occur, are potential spill areas. Generally, the area of land draining to the stormwater in these instances is small. **Hume***ceptor* ™ is recommended for these types of land use regardless of whether other water quality control techniques are proposed. The spills protection provided by **Hume***ceptor* ™ prevents creeks from damaging spills which have toxic effects on the instream aquatic resources. Additional "Emergency Spill Storage" tanks can be connected with **Hume***ceptor* ™ units to increase the capture volume.

4.3 Redevelopment

Redevelopment can be classified as new construction on an existing developed area. This can be an addition to an existing development, or the replacement of the entire development with a similar or new type of land use. In these situations, natural, surface treatment techniques are generally not feasible, meaning that any treatment system must conform to the existing stormwater network. The implementation of large underground systems (such as tanks, underground sand filters, etc.) is also generally problematic due to the proximity of other underground utilities, the configuration of the existing stormwater system, and long term maintenance.

Most redevelopment situations typically occupy relatively small areas. Surface stormwater quality techniques for these areas would result in a loss of developable land which could jeopardise the economic feasibility of small high density development areas. In these situations **Hume***ceptor*™ is sometimes the only feasible solution.

4.4 New Residential Subdivisions

Hume*ceptor*™ is not intended to replace natural, constructed, stormwater management system solutions (bioretention, wetlands) for large residential subdivisions. **Hume***ceptor*™ can be used, however, as part of the treatment train approach in these subdivisions. For small subdivisions, in which ponds or wetlands are not feasible (i.e. < 2 ha), and for large developments (> 10 ha) that would result in numerous small ponds within a tributary area, the use of **Hume***ceptor*™ as part of the treatment train approach (i.e. numerous **Hume***ceptor*™ units in conjunction with a Gross Pollutant Trap, eg. **Hume***gard*™) is a cost-effective solution which will lessen the maintenance burden of municipalities who will have the ultimate responsibility for stormwater quality systems. A **Hume***ceptor* ™ upstream of a bioretention area (rain garden) will also extend the lifespan through minimising the amount of sediment trapped on the bioretention media and thereby maximise the duration before clogging occurs.

The use of **Hume***ceptor*™ for street drainage helps to mitigate long term maintenance costs by centralising the capture and retention of sediment in the unit instead of being distributed across the entire treatment area of the receiving wetlands or bioretention basin.

5. Humeceptor™ Design and Operation

Humeceptor™ can be divided into two components:

- treatment chamber
- bypass chamber

Stormwater flows into the inlet weir area of the bypass chamber. Design flows are diverted into the treatment chamber by a weir and drop pipe arrangement (Figure 2). The drop pipe is configured to discharge water tangentially along the treatment chamber wall. Water flows through the treatment chamber to the decant pipe which is submerged similar to the drop inlet pipe. Water flows up through the decant pipe based on the head differential at the inlet weir, and is discharged back into the bypass chamber downstream of the weir. The downstream section of the bypass chamber is connected to the outlet stormwater pipe.

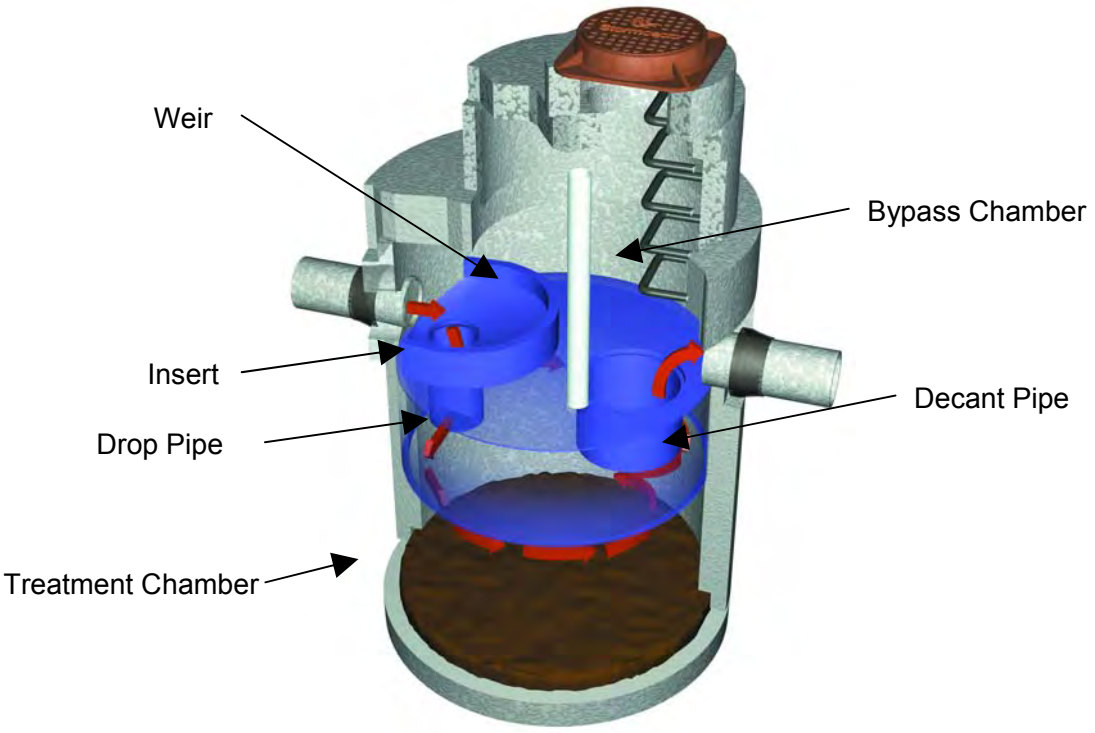


Figure 2. Humeceptor™ Operation During Design Flow Conditions

Hydrocarbons and other entrained substances with a specific gravity less than water (e.g. cigarette butts) will rise in the treatment chamber and become trapped beneath the fibreglass insert since the decant pipe is submerged. Sediment will settle to the bottom of the chamber by gravity forces. The circular design of the treatment chamber assists in preventing turbulent eddy currents and promoting settling.

During high flow conditions, stormwater in the bypass chamber will overtop the weir and be conveyed to the stormwater outlet directly (Figure 3). Water which overflows the weir

creates a backwater effect on the outlet pipe (head stabilisation between the inlet drop pipe and outlet decant pipe) ensuring that excessive flow will not be forced into the treatment chamber which could scour or re-suspend the settled material. The bypass is an integral part of the **Hume***ceptor*™ since other oil/grit separators have been noted to scour during high flow conditions (Schueler and Shepp, 1993).

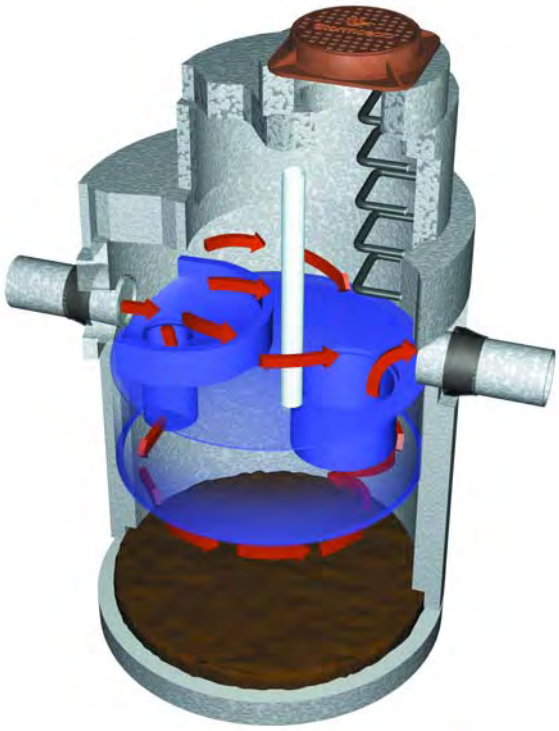


Figure 3. Hume*ceptor*™ Operation During High Flow Conditions

Hume*ceptor*™ comes "ready-to-assemble" to the job site with its own frame and cover (grate for the STC2). The cover has the name **Hume*ceptor*™** clearly embossed on it to allow easy identification of the unit in the field for maintenance. The inlet and outlet openings are clearly marked and can have Kor-n-seal Boots to facilitate easy connection to the stormwater pipes.

6. Product Range

Depending upon the catchment characteristics and the desired WQOs a wide range of potential **Hume*ceptor*** ™ sizes are available. Table 1 presents the standard units and their Sediment Capacity, Oil Storage Volume and the Total Storage Volume. As noted earlier, the Oil Storage Capacity can be expanded through the addition of "Emergency Spill Storage" tanks upon request.

Table 1. Humeceptor™ Product Range

Humeceptor™ Model	Sediment Capacity (m^3)	Oil Capacity (l)	Total Holding Capacity (l)
STC 2 (Inlet)	1	350	1,740
STC 3	2		3,410
STC 5	3		4,550
STC 7	5	1,020	6,820
STC 9	6	1,900	9,090
STC 14	10		13,640
STC 18	14		18,180
STC 23	18	2,980	22,730
STC 27	20	4,290	27,270

7. Variants

A number of additional innovations have been made to the **Humeceptor** ™ units to facilitate their effective operation in a wider range of applications;

- **Aquaceptor**™ has been designed to operate under submerged or high tailwater conditions
- **Duoceptor**™ has been designed to treat stormwater runoff from catchments ~2Ha or greater
- **Multiceptor**™ has been designed to incorporate multiple inlet pipes into the unit for treatment and thereby replace junction pits

7.1 Aquaceptor™

The **Aquaceptor**™ has been designed with a weir extension to increase the level at which flows bypass the treatment chamber and accommodate downstream tailwater levels or periodic inundation (eg. Tidal situations). **This weir extension is provided in standard heights of 100mm intervals up to a maximum of 500mm**.

To maintain the hydrocarbon capture capabilities, an additional “high level” inlet pipe is also fitted. This facilitates the formation of the surface vortex from the bypass chamber into the treatment chamber and draws floating hydrocarbons into the unit.

Selection of the appropriate weir extension height is undertaken in conjunction with the downstream engineering design and/or tidal range charts for the specific location. Figure 4 displays the **Aquaceptor**™ unit. The **Aquaceptor**™ units are available in the same range of sizes as the standard **Humeceptor** ™ units (refer Table 1 above).

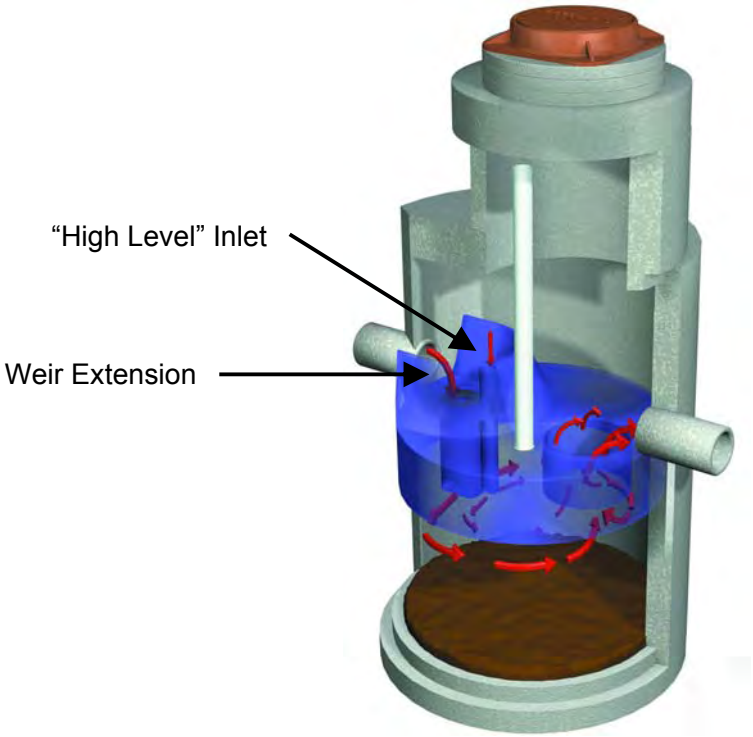


Figure 4. Aqua*ceptor*™ treatment device

7.2 Duoceptor™

The **Duo***ceptor*™ unit has been developed to treat larger catchments (>2Ha) as some developments are optimally treated with a single large device instead of several smaller devices. Figure 5 displays the **Duo***ceptor*™ unit and Table 2 details the range of capacities available. The unit operates by splitting the flow and treating half of the design flowrate through the first chamber. The untreated half of the design flow bypassed from the first chamber then passes through the split connection pipe into the second chamber for treatment. Treated flow from the first chamber exits and flows through the other half of the split connection pipe and bypasses the second chamber to join the treated flow from the second chamber at the outlet of the **Duo***ceptor*™.

Table 2. Duo*ceptor*™ capacities

Duoceptor Model	Sediment Capacity (m^3)	Oil Capacity (l)	Total Holding Capacity (l)
STC40	27	10,585	42,370
STC50	35	10,585	50,525
STC60	42	11,560	60,255

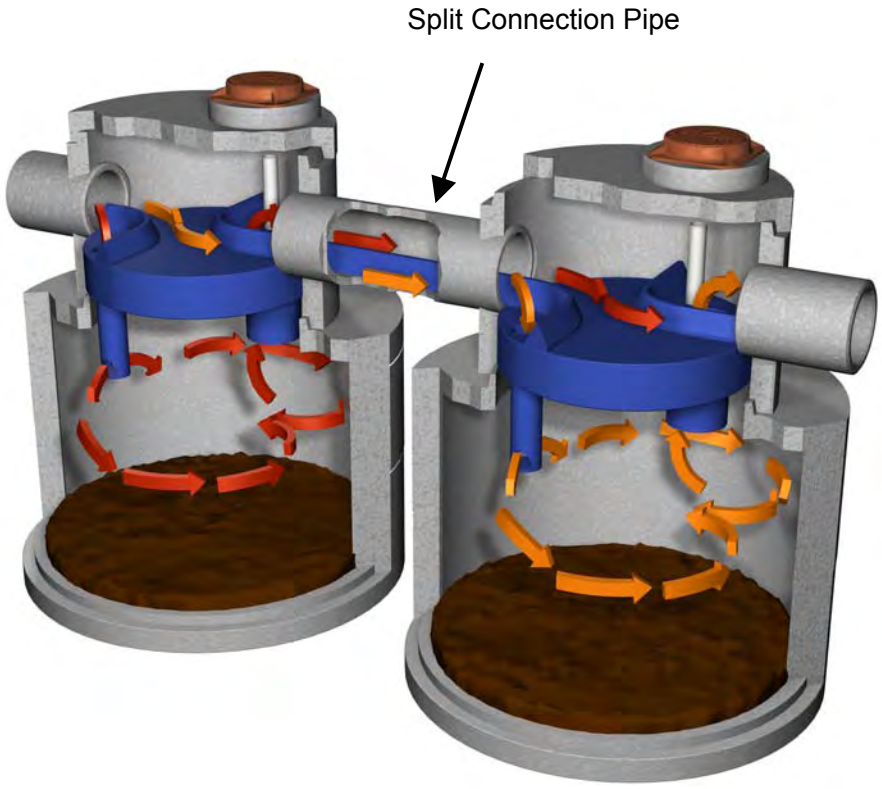


Figure 5. Duo*ceptor*™ Unit

7.3 Multiceptor™

The **Multi***ceptor*™ has been developed to facilitate the replacement of junction pits as well as providing the treatment abilities of the traditional **Hume***ceptor* ™ device. These units reverse the weir structure to allow for;

- Change of pipe direction
- Multiple inlet pipes
- Differing invert levels of multiple inlet pipes
- Grated Inlets

Multi*ceptor*™ units are available in the same capacities as the standard **Hume***ceptor* ™ units (refer Table 1). The potential inlet locations are demonstrated in Figure 6.

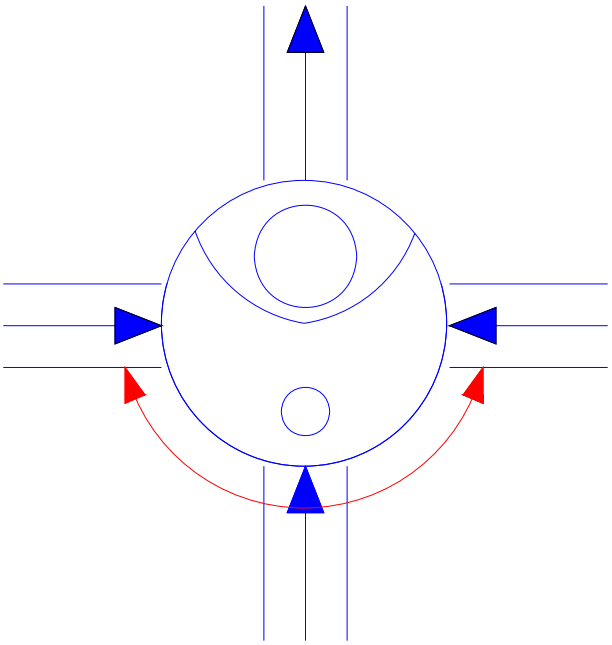


Figure 6. Potential inlet locations for the Multi*ceptor*™ range

8. Construction Materials

- **Hume***ceptor*™ is manufactured in precast concrete.
- The weir inserts are manufactured in fibreglass.
- The Oil Inspection pipe is PVC.
- **Hume***ceptor*™ is designed to be fully structural and withstand highway loading.
- It has a design life of 50 years and is manufactured according to the Rinker Group ISO9001 Quality Assurance System.

9. Research & Testing

Extensive studies have been conducted on the **Hume***ceptor*™ system including:-

- The National Water Research Institute (1993, 1994) and University of Coventry (1996) laboratory testing.
- Marshall Macklin Monaghan Limited (1994) - computer modelling of the **Hume***ceptor*™.
- Stormceptor Canada Inc. - sediment monitoring of 21 installed units in the Greater Toronto Area (GTA).
- Field monitoring in Edmonton, Alberta; Westwood, Massachusetts; Como Park; Minnesota; and Madison, Wisconsin. Detailed reports from these studies are available from Humes Water Solutions.
- City of Indianapolis – full scale testing
- New Jersey TARP Program – full scale testing

The major findings of these studies can be summarised as follows:

- The site monitoring indicated that 50% of the sediment collected by the **Hume***ceptor*™ was smaller than 10 μm in size.
- The National Water Research Institute, Canada laboratory testing proved the non-scouring design of the **Hume***ceptor*™ units under high flow conditions.
- Conventry Unveristy, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- New Jersey TARP Program – full scale testing of an STC3 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The only technology to follow the NJDEP protocol.
- City of Indianapolis – full scale testing of an STC3 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour
- Full size tests to European Standards showed free oil removal rate of 97.8% at full treatment flow.
- For high inflows, the risk of washing out the treatment chamber is reduced since the flowrate through the unit reduces (up to 20%).
- The headloss through the **Hume***ceptor*™ unit is approximately the same as a 60° bend at a pit (loss coefficient K ~1.3).
- The TSS removal rate for the unit monitored in Edmonton (1996) was consistent with the sizing guidelines (52%)
- 400 litres of oil was captured in an Edmonton **Hume***ceptor*™
- The TSS removal rate for the unit in Westwood, Massachusetts (1997) was consistent with the sizing guidelines (82%)
- **Hume***ceptor*™ removed 18% of the Total Phosphorus and dissolved Phosphorus in Madison, Wisconsin
- 450 litres of oil was captured in the Madison, Wisconsin **Hume***ceptor*™ after 1 year of operation
- A review of **Hume***ceptor*™ laboratory testing and field monitoring (Massachusetts's STEP Program) concluded that **Hume***ceptor*™ can provide TSS removal rates consistent with the sizing guidelines.
- The laboratory testing (with synthetic sand) indicated that 90% removal would be achieved at a flowrate of ~6 L/s.
- The theoretical modelling indicated that an annual cleanout would be sufficient based on the estimated annual sediment removal rates.
- The site monitoring indicated a strong relationship between upstream drainage area, **Hume***ceptor*™ storage volume and treatment efficiency.

Graph of the test results are presented in Figures 7 to 12 following.

The performance of the **Hume***ceptor* ™ device has been certified under the Canada ETV and US NJCAT verification programs.

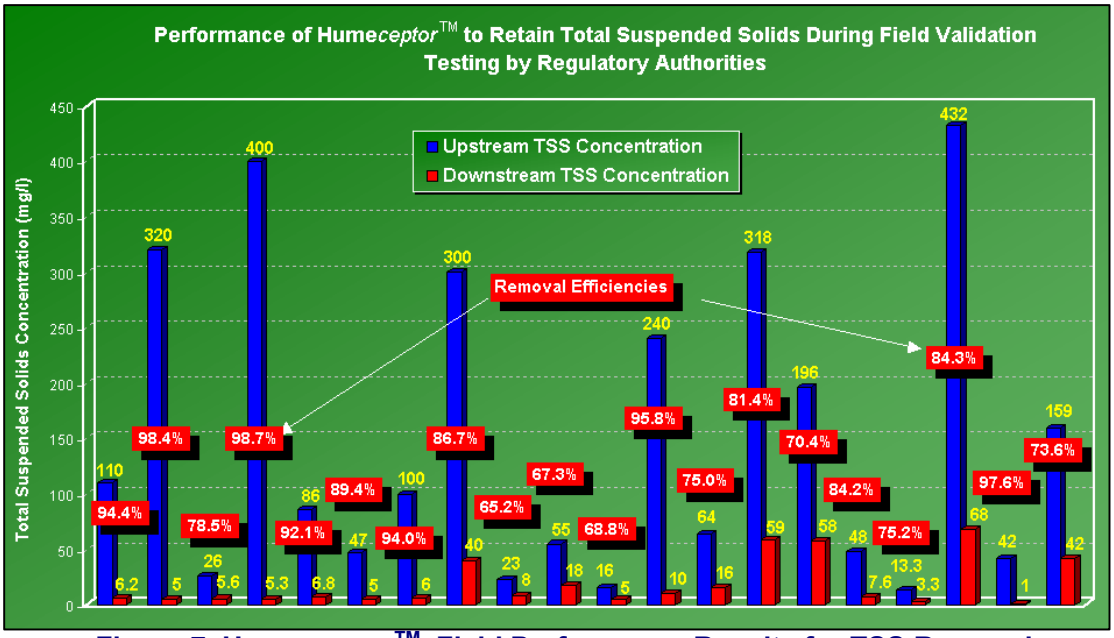


Figure 7. Humeceptor™ Field Performance Results for TSS Removal

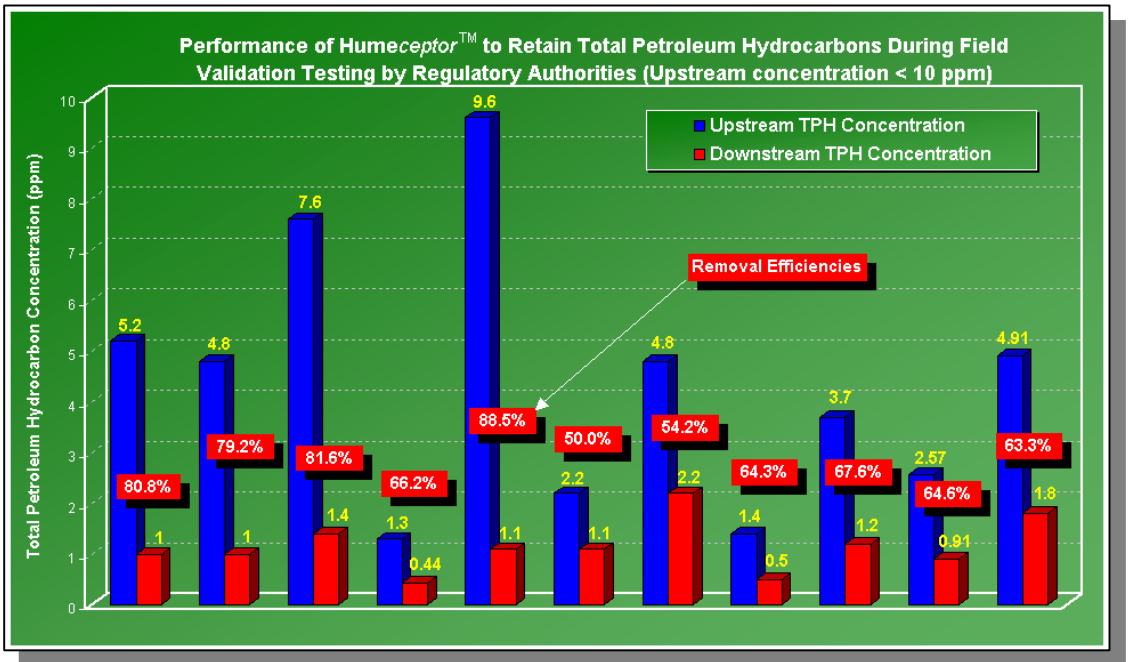


Figure 8. Humeceptor™ Field Performance for TPH Removal for Influent Concentration <10ppm

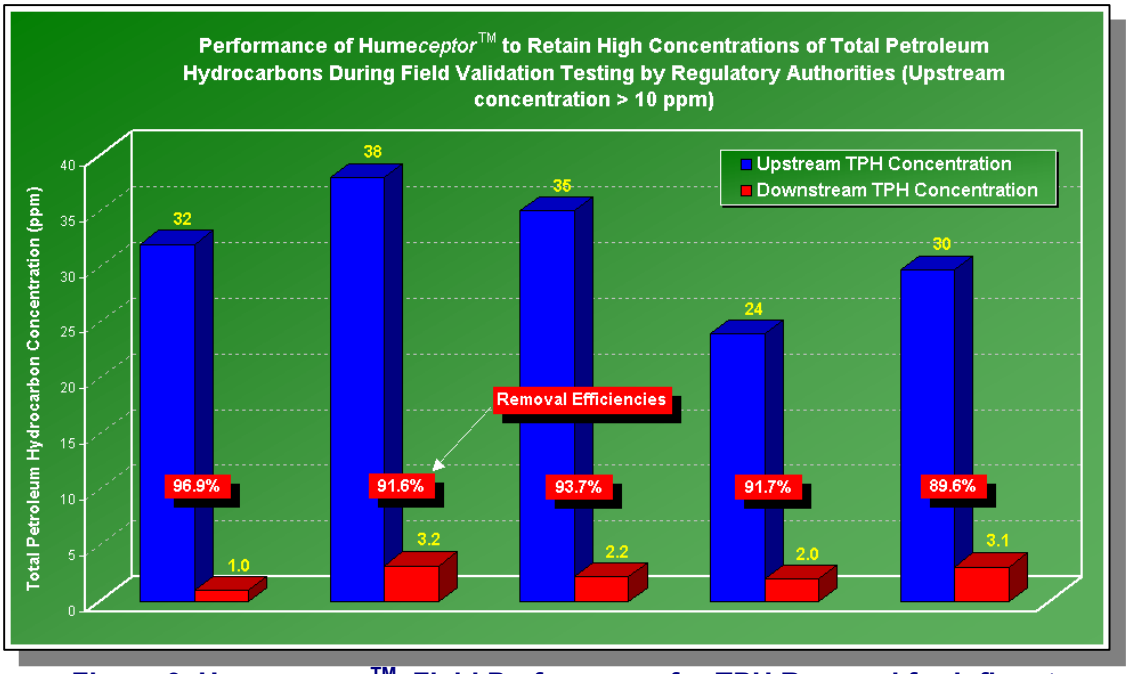


Figure 9. Humeceptor™ Field Performance for TPH Removal for Influent Concentration >10ppm

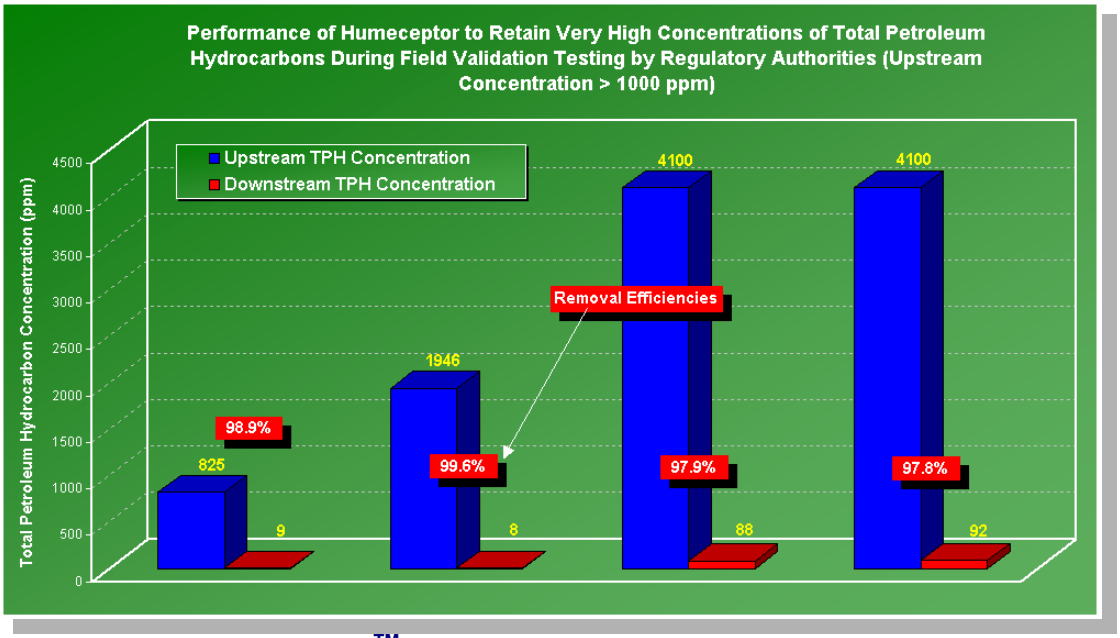


Figure 10. Humeceptor™ Field Performance for TPH Removal for Influent Concentration >1000ppm

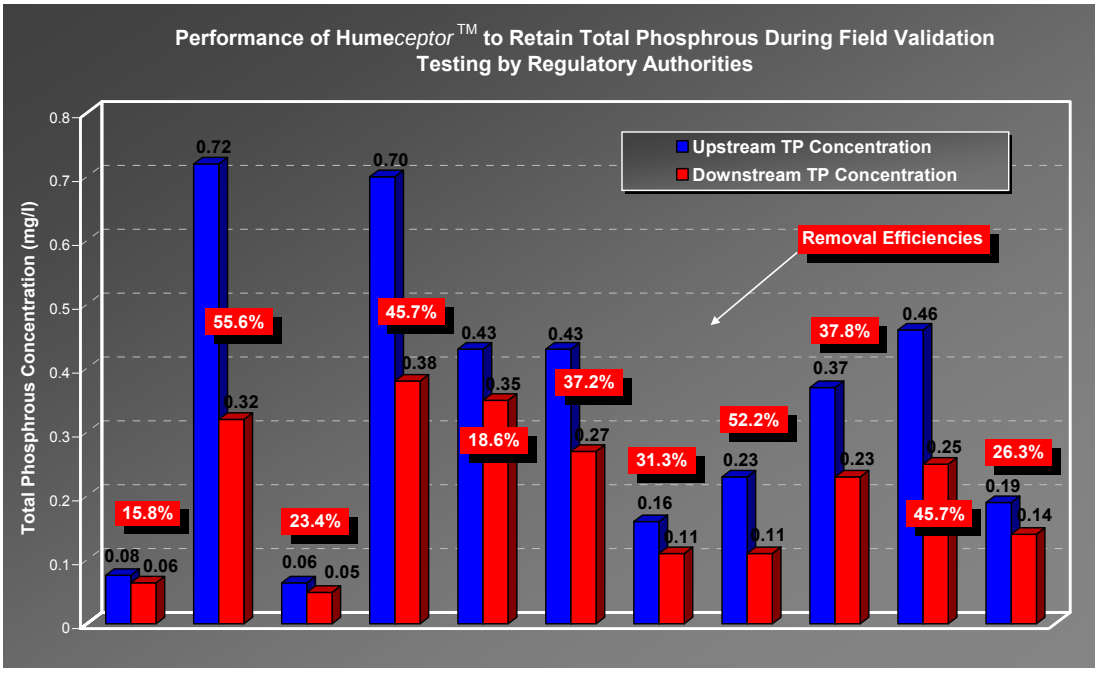


Figure 11. Humeceptor™ Field Performance for TP Removal

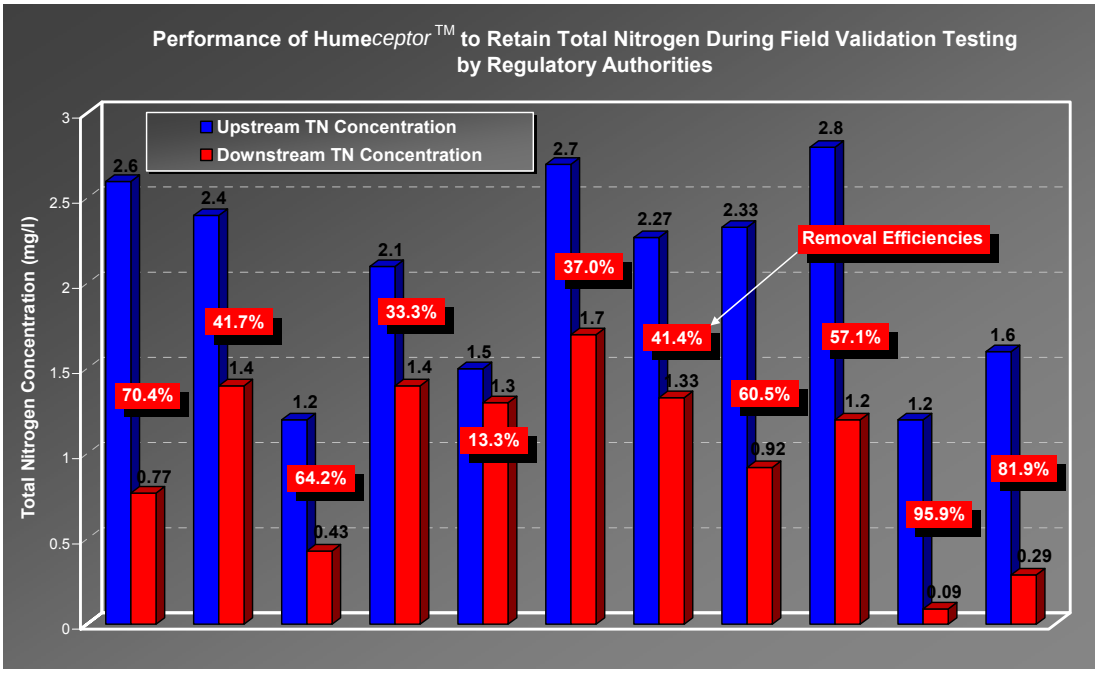


Figure 12. Humeceptor™ Field Performance for TN Removal

10. MUSIC Inputs for Humeceptor™

Whilst Field Testing can produce a wide variety of results, as indicated in the previous figures, on average, the performance against the Total Annual Pollutant Load can be modelled in MUSIC using the following input parameters.

Table 3. MUSIC Removal Efficiencies for Humeceptor™

Parameter	Removal Efficiency
TSS	80%
TN	30%
TP	30%

11. Design Information

The design of **Hume***ceptor*™ involves reviewing the configuration of the stormwater system, the location and purpose of other stormwater management controls for the proposed development, and the impervious area of the proposed development.

11.1 Configuration of the Stormwater System

The configuration of the stormwater system is important since **Hume***ceptor*™ works most efficiently for small drainage areas.

11.1.1 Inlet Configuration (STC2 & Multi*ceptor*™ Units)

The **Hume***ceptor*™ unit is designed to replace a conventional inlet pit or access chamber, depending upon the size of the chosen unit. The smallest STC2 unit and **Multi***ceptor*™ units can be configured to have a grated inlet at the surface (Figure 13). All other sizes from STC3 through to STC27 are designed with a horizontal inlet pipe.

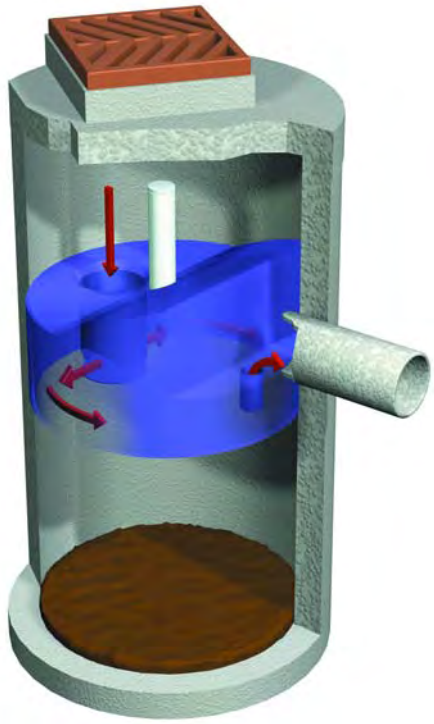


Figure 13. Grated Inlet Configuration of an STC2 Unit

11.1.2 Bypass Chamber

The bypass chamber is 1.2 m diameter for the STC2 Inlet model and 1.8 m diameter for the other models. The largest pipe that can currently be accommodated in the 1800 mm ϕ **Hume***ceptor*™ insert is a 1050 mm diameter reinforced concrete pipe.

Whilst this diameter pipe can physically fit into the **Hume***ceptor*™, it is considerably larger than the pipe sizes which are recommended by the sizing software. Pipes greater than 1050 mm ϕ require customisation of the **Hume***ceptor*™ insert. In these cases, seek assistance from Humes Water Solutions.

11.1.3 Location in the Stormwater System

Hume*ceptor*™ is designed to accommodate 80% of the Annual Runoff Volume and remove 80% Total Suspended Solids (TSS). The frequency of the magnitude of a flowrate is dependent on the upstream drainage area and the level of imperviousness of that drainage area, therefore the selection of a 3mth ARI, for example, may not be necessary to achieve the desired WQOs.

Accordingly, the recommended design approach is that the **Hume***ceptor*™ be implemented at or close to the source on local or lateral drains rather than trunk drainage for new development application. Humes Water Solutions are available to work closely with stormwater designers to select the appropriate location for **Hume***ceptor*™**.**

The implementation of a **Hume***ceptor*™ in retrofit and redevelopment applications is important, however, since they can provide significant enhancement (i.e. to remove stormwater bedload) at a small cost in situations where there are few economical options for treatment.

11.2 Sizing the Hume*ceptor*™ *System*

The **Hume***ceptor* ™ System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the **Hume***ceptor*™ model to meet the challenges in an efficient and cost-effective manner.

PCSWMM for **Hume***ceptor*™ is the decision support tool used for identifying the appropriate **Hume***ceptor*™ model. In order to size a unit, it is recommended that the user follow the 7 design steps in the software. The steps are as follows:

11.2.1 STEP 1 – Project Details & WQOs

Enter the Project Details in the appropriate cells. The next step prior to sizing the **Hume***ceptor*™ System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution. In most Australian situations, this WQO is for 80% TSS Removal, but a Particle Size Distribution (PSD) is not defined. This can be determined from relevant research data or from site monitoring.

11.2.2 STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

11.2.3 STEP 3 – Upstream Detention/Retention

The **Hume***ceptor*™ System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a **Hume***ceptor*™ unit upstream of a detention facility. By placing the **Hume***ceptor*™ unit upstream of a detention structure, the sediment load is reduced and the maintenance interval between cleaning is maximised.

In some installations, the **Hume***ceptor* ™ is installed downstream of detention structures which alter the hydrology of the catchment and will therefore also influence the size of the **Hume***ceptor* ™ selected by the software.

11.2.4 STEP 4 – Particle size distribution

It is critical that the PSD be defined as part of the WQOs. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for **Hume***ceptor*™. The default particle size distribution is the Fine Distribution (Table 4);

Table 4. Default PSD (Fine)

Particle Size (microns)	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is for the long term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site. Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

11.2.5 STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the Bureau of Meteorology. The rainfall data provided with PCSMM for **Hume***ceptor*™ provides an accurate estimation of storm hydrology by modelling actual historical storm events including duration, intensities and peaks.

11.2.6 STEP 6 – Summary

At this point, the software may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each **Hume***ceptor*™ unit. Based on the water quality objective identified in Step 1, the recommended **Hume***ceptor*™ System will be highlighted.

11.3 PCSWMM for **Hume***ceptor*™

The **Hume***ceptor*™ System has been developed in conjunction with *PCSWMM for* **Hume***ceptor*™ as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal. *PCSWMM for* **Hume***ceptor*™ is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids

removal. The model has been calibrated to field monitoring results from **Hume***ceptor*™ units that have been monitored. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the **Hume***ceptor*™ (settling and discharge)

The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:

1. the hydrology of the local area is properly and **accurately** incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back to back storms, inter-event times)
2. the distribution of TSS with the hydrology is properly and **accurately** considered in the sizing
3. particle size distribution is properly considered in the sizing
4. the sizing can be optimized for TSS removal
5. the cost benefit of alternate TSS removal criteria can be easily assessed
6. the program assesses the performance of all **Hume***ceptor*™ models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding *PCSWMM for* **Hume***ceptor*™, please contact your local **Hume***ceptor*™ representative, or visit www.humes.com.au to download a free copy of the program.

11.3.1 Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time, and wash off with the next rainfall. When rainfall patterns are taken into consideration, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device. This Buildup/Washoff Algorithm unique to PCSWMM for **Hume***ceptor* ™ more closely models natural storm events and pollutant generation than other Pollutant Export Models (eg. MUSIC) which do not model these algorithms.

11.3.2 Typical Sites

For standard site design of the **Hume***ceptor*™ System, *PCSWMM for* **Hume***ceptor*™ is utilised to accurately model the unit's performance. As an integral part of the products design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non–erodible surfaces.

11.3.3 Unstable Sites

While standard sites consist of stable concrete or asphalt, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as “unstable”. These types of sites do not exhibit first flush characteristics, are erodible, have different sediment loading characteristics and must therefore be modelled more carefully. Please contact you local **Hume***ceptor*™ representative for assistance in selecting the proper unit size.

11.4 Dimensions

Hume*ceptor*™ dimensions vary with the size of unit that is specified. Dimensions of the standard **Hume***ceptor*™ and **Duo***ceptor*™ units are provided in Table 5.

Table 5. Hume*ceptor*™ Dimensions *

Model	Treatment Chamber Diameter (mm)	Depth from Pipe Invert (m)
STC2	1200	1.7
STC3	1800	1.68
STC5	1800	2.13
STC7	1800	3.03
STC9	2440	2.69
STC14	2440	3.69
STC18	3060	3.44
STC23	3060	4.04
STC27	3060	3.84
STC40	3060	3.44
STC50	3060	4.04
STC60	3060	3.84

*** Depths are approximate**

11.5 Design Parameters

There are some standard design parameters that must be provided in any stormwater design with a **Hume***ceptor*™ installation.

11.5.1 Inlet Pipe Grade

Hume*ceptor*™ units should be located on a pipe system with a slope less than 10%, preferably less than 5%.

11.5.2 Inlet / Outlet Elevation Difference

- There is a **25 mm difference** in elevation between the inlet invert and the outlet invert in **Hume*ceptor*™, Aqua*ceptor*™** and **Duo*ceptor*™** units from **STC3 to STC60**.
- There is a **75mm difference** in elevation between the inlet pipe invert and the outlet pipe invert in the **STC2 Hume*ceptor*™** unit and **Multi*ceptor*™** units.
- Stormwater designs must accommodate this elevation difference.

11.5.3 Influent and Effluent Pipe

Epoxy grouting or Flexible rubber (Kor-n-Seal) boots can be utilised to facilitate the installation of the inlet/outlet pipes to the **Hume*ceptor*™**.

11.5.4 Head Loss

The measured head loss through the **Hume*ceptor*™** is approximately the same as a 60° bend at a stormwater pit. An appropriate K value to use in calculating minor losses through the stormwater system for a **Hume*ceptor*™** unit would be 1.3 (Minor Loss = 1.3 $v^2/2g$).

11.5.5 Installation Depth

There is a minimum inlet obvert (inside top of pipe) to surface level depth required to physically implement the **Hume*ceptor*™** due to the modular construction of the structure. **Generally the minimum obvert to Surface Level elevation is 500 mm**. For situations where the minimum obvert to grade is less than 500 mm, contact Humes Water Solutions for advice.

The maximum installation depth for the **Hume*ceptor*™** is 10 metres. The dimensions (i.e. depth of treatment chambers) for various **Hume*ceptor*™** units are given in Table 3 (previous). **Hume*ceptor*™** installations at depths greater than those noted above will require custom manufacturing. Humes Water Solutions should be consulted for recommendations in these instances.

12. Installation Procedures

The installation of **Hume*ceptor*™** should conform in general to Local Authorities' Specification for the construction of stormwater pits. Detailed installation instructions are dispatched with each unit.

12.1 Construction Sequence

Hume*ceptor*™ is installed in sections in the following sequence:

1. geotextile
2. aggregate base
3. treatment chamber section with base slab
4. treatment chamber section(s) (if required)

5. transition slab (if required)
6. bypass chamber
7. fit inlet drop pipe and decant pipe (if required)
8. connect inlet and outlet pipes as required
9. transition slab
10. maintenance access chamber section (if required)
11. frame and access cover (grate for the STC2)

The treatment chamber with base slab should be placed level at the specified RL. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with Humes Water Solutions recommendations.

Adjustment of the **Hume***ceptor*™ can be performed by lifting the upper sections free of the excavated area, re-leveling the base treatment chamber. Damaged sections and gaskets should be repaired or replaced as necessary.

12.2 Fitting the Inlet Drop Pipe, Orifice Plates and Outlet Riser (Decant) Pipe

Once the bypass section has been attached to the treatment chamber, the inlet drop pipe, orifice plate and outlet riser (decant) pipe can be inserted. Models up to and including STC7 will have these fitted prior to delivery. Other models will have easy to follow instructions for installation of the components. Where these parts are required to be fitted on site, installation occurs from above the insert i.e. there is no requirement to enter the chamber below.

12.3 Inlet and Outlet Pipes

Inlet and outlet pipes should be securely set into the bypass chamber using Kor-n-Seal boots so that the structure is watertight. The Kor-n-Seal boots are typically installed at the Humes plant prior to transport. The boots are applicable for pipes up to and including 1050 mm SRCP with an outside diameter up to 1194 mm. Installation of the flexible rubber connectors should follow the manufacturer's recommendations. The following procedure should be followed to attach the inlet and outlet pipes:

1. Lubricate the outside of the pipe and/or inside of the boot if the pipe outside diameter is the same as the inside diameter of the boot
2. Insert the pipe, centering it in the boot opening
3. Position the pipe clamp in the groove of the boot with the screw at the top
4. Tighten the pipe clamp screw to 7 Newton metres
5. On minimum outside diameter installations lift the boot such that it contacts the bottom of the pipe while tightening the pipe clamp to ensure even contraction of the rubber.
6. Move the pipe horizontally and/or vertically to bring it to grade

Where Kor-n-Seal boots are not fitted, epoxy grout the inlet and outlet joints.

12.4 Frame and Cover Installation

Precast concrete adjustment units are used to set the frame and cover at the required elevation. Humes Water Solutions should be advised at the time of ordering if a precast surround is not required for the frame e.g. if asphalt is to be laid up to the frame edge.

13. Maintenance Procedures

Maintenance of the **Hume***ceptor*™ is performed using vacuum trucks. Normally no entry into the unit is required for maintenance. Costs to clean the **Hume***ceptor*™ vary based on the size of unit and transportation distances.

13.1 STC2 Units

The smaller STC2 units must be maintained through the inlet opening into the treatment chamber. This is achieved by removing the orifice plate and the drop tee using the PVC handle affixed to the drop tee. The eduction hose can then be inserted into the base of the treatment chamber to educt the captured sediment and hydrocarbons. Where sediment has accumulated and consolidated in the base due to infrequent maintenance, a water hose can be inserted into the decant pipe opening and used to jet the sediment towards the eduction hose.

13.2 STC3 to STC60 Units

The STC3 to STC60 units are maintained through the larger decant pipe openings. The eduction hose can be inserted into the base of the treatment chamber to educt the captured sediment and hydrocarbons. Where sediment has accumulated and consolidated in the base due to infrequent maintenance, a water hose can be inserted into the drop tee opening or the oil inspection pipe and used to jet the sediment towards the eduction hose.

13.3 Maintenance Costs

A typical cleaning cost (equipment and personnel) will vary based on unit location and size. Disposal costs will vary depending on land use and local government requirements. Economies of scale are expected where there are multiple units for a given location. The time taken to clean the **Hume***ceptor*™ is approximately 15 – 60 minutes, depending on the size of the unit, excluding transportation.

13.4 Maintenance Frequency

If the **Hume***ceptor*™ is sized based on the guidelines discussed in Section 10.2, annual maintenance is recommended, however, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required biannually; conversely once the site has stabilised, maintenance may only be required once every two or three years).

13.5 Spills

Hume*ceptor*™ is often implemented in areas where the potential for spills is great. **Hume***ceptor*™ should be cleaned immediately after a spill occurs by a licensed liquid waste management company. The Regulatory Authority should also be notified in the event of a spill.

13.6 Disposal

Waste products collected in the **Hume***ceptor*™ should be removed by a licensed waste management company, similar to any other stormwater treatment device.

13.7 Inspection

Hume*ceptor*™ can be easily inspected from the surface by removing the maintenance cover. The presence of oil in the interceptor can be determined by inserting a dipstick in the 150 mm oil sample port. Similarly, the depth of sediment can be measured from the surface without entry into the **Hume***ceptor*™ via a sediment depth measurement device (Sludge Judge™). Maintenance should be performed once the sediment depth exceeds the guideline values provided in Table 4.

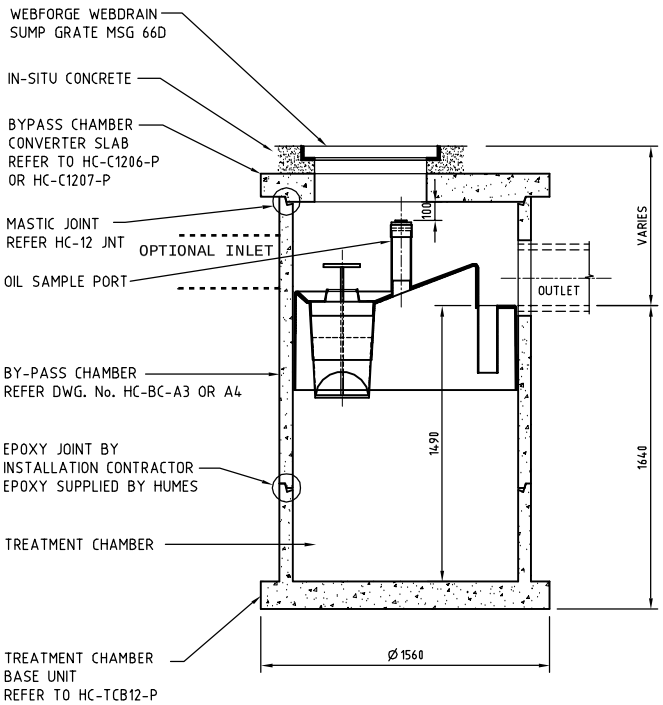
Any potential obstructions at the inlet can be observed from the surface. The insert has been designed as a platform for maintenance personnel in the event that obstructions need to be removed, stormwater flushing needs to be performed, or camera surveys are required.

Table 6. Sediment Depths Indicating Required Maintenance

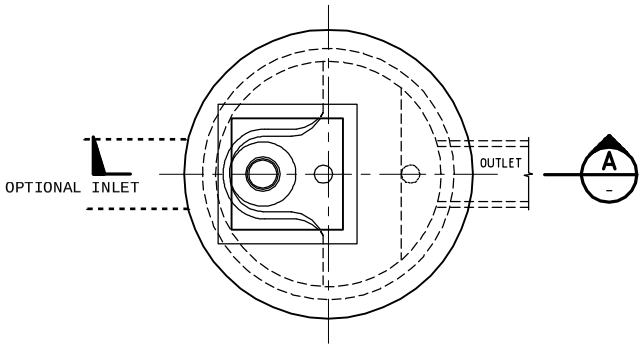
Model	Sediment Depth (mm)
STC2	200
STC3	200
STC5	225
STC7	300
STC9	300
STC14	375
STC18	300
STC23	450
STC27	375
STC40	300
STC50	450
STC60	375

Appendix 1
Humeceptor ™ Drawings
OCTOBER 2007

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	UPDATED AND ISSUED FOR MANUFACTURE	M.Z.	23-01-03	DFW
1	GENERAL UPGRADE	RM	17-08-03	DFW



SECTION A
SCALE 1:20



PLAN
SCALE 1:20

NOTES:

1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS
2. DIMENSIONS INCLUDED ARE STANDARD
3. STORAGE VOLUMES
   TOTAL = 1740 LITRES
   OIL STORAGE VOLUME = 350 LITRES
   SEDIMENT STORAGE VOLUME = 1.34 m3
4. COMPONENT MASSES
   TREATMENT CHAMBER BASE UNIT (INCL. SHAFT) = 1130 kg
   BYPASS CHAMBER = VARIES
   BYPASS CHAMBER CONVERTER SLAB = 575 kg
5. REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. FOR OUTLET PIPE CONNECTION DETAILS
   REFER HC-BC-A3 OR A4 AND KOR-N-SEAL INSTALLATION INSTRUCTIONS
7. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS (REFER PRODUCT DRAWING)
8. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.

Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

DSN.	DFW	23-01-03	
DWN.	M.Z.	23-01-03	
CKD.	DFW	23-01-03	
APP.	DFW	23-01-03	

HUMECEPTOR™
STANDARD DRAWING
STC-2 HUMECEPTOR
ASSEMBLY DRAWING

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
	1:20	A2	HC-STC2-A	1

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
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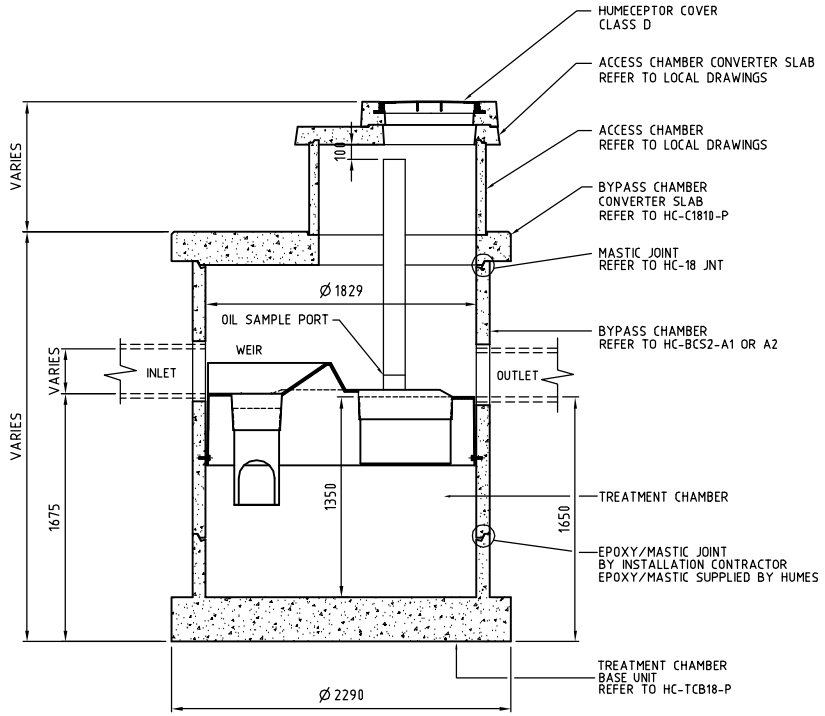
1	STORAGE VOLUMES REVISED	M.Z.	13-09-03	DFW



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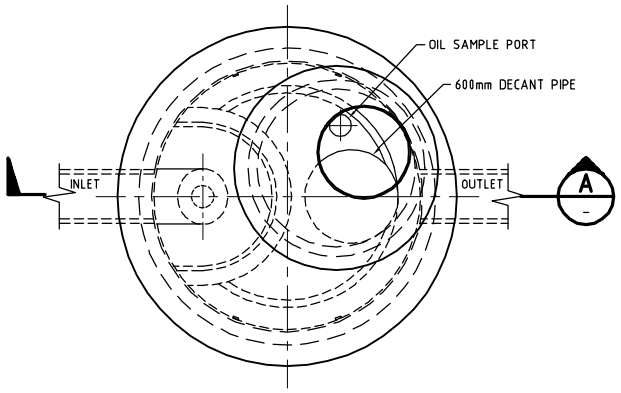

PLAN
SCALE 1:25

NOTES:

1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS
2. DIMENSIONS INCLUDED ARE STANDARD
3. STORAGE VOLUMES
   TOTAL = 3540 LITRES (1)
   OIL STORAGE VOLUME = 1020 LITRES
   SEDIMENT STORAGE VOLUME = 2.20m3 (1)
4. COMPONENT MASSES
   TREATMENT CHAMBER BASE UNIT (INCL. SHAFT) = 3.9 TONNE
   BYPASS CHAMBER = VARIES
   BYPASS CHAMBER CONVERTER SLAB = 1.9 TONNE
5. REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. BYPASS CHAMBER CONVERTER SLAB TO SUIT LOCAL ACCESS CHAMBER UNITS.
7. FOR INLET AND OUTLET PIPE CONNECTION DETAILS REFER HC-BCS2-A1 OR A2 AND KOR-N-SEAL INSTALLATION INSTRUCTIONS
8. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS (REFER PRODUCT DRAWING)
9. NOTE MARKINGS - INLET & OUTLET OVER EACH
10. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.
11. OIL SAMPLE PORT AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

Humes® TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

DSN.	DFW	28-01-03
DWN.	M.Z.	28-01-03
CKD.	DFW	07-08-03
APP.	DFW	07-08-03

HUMECEPTOR™
STANDARD DRAWING
STC-3 HUMECEPTOR
ASSEMBLY DRAWING

SUPERSEDES

PLOT SCALE	SIZE	DRG. NO.	ISSUE
1:25	A2	HC-STC3-A	1

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
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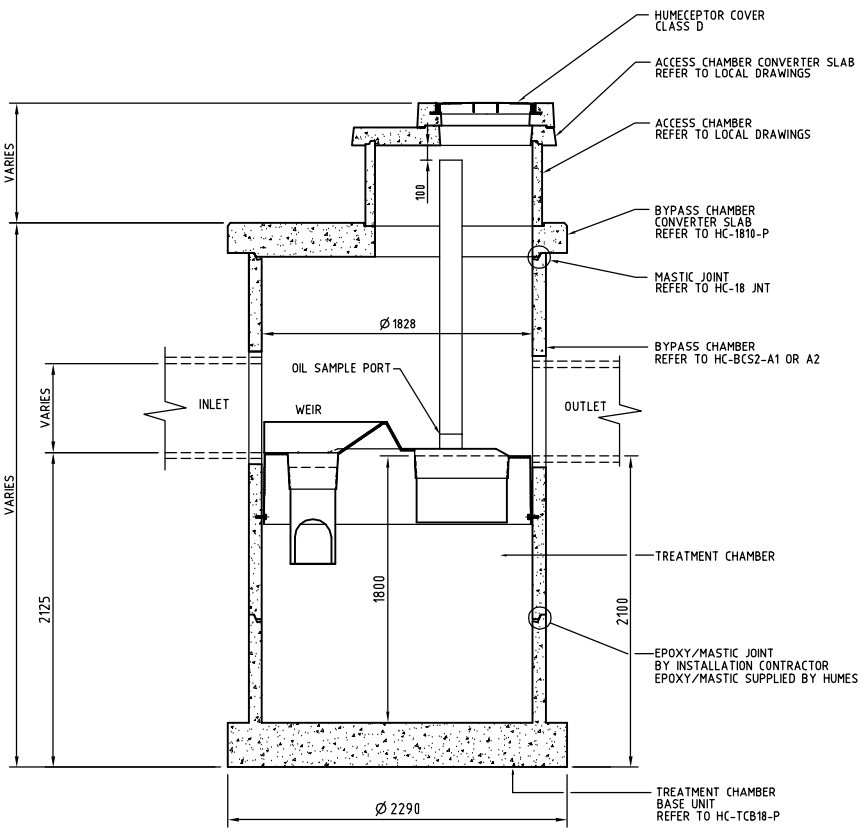
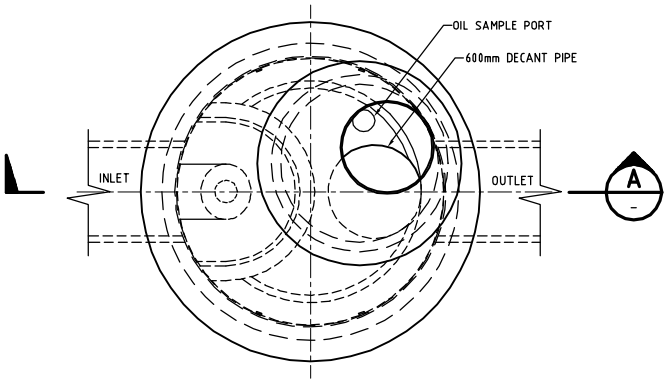


SECTION A
SCALE 1:25



PLAN
SCALE 1:25

NOTES:

1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS
2. DIMENSIONS INCLUDED ARE STANDARD
3. STORAGE VOLUMES
   TOTAL = 4720 LITRES
   OIL STORAGE VOLUME = 1020 LITRES
   SEDIMENT STORAGE VOLUME = 3.38m3
4. COMPONENT MASSES
   TREATMENT CHAMBER BASE UNIT (INCL. SHAFT) = 4.4 TONNE
   BYPASS CHAMBER = VARIES
   BYPASS CHAMBER CONVERTER SLAB = 1.9 TONNE
5. REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. BYPASS CHAMBER CONVERTER SLAB TO SUIT LOCAL ACCESS CHAMBER UNITS.
7. FOR INLET AND OUTLET PIPE CONNECTION DETAILS REFER HC-BCS2-A1 OR A2 AND KOR-N-SEAL INSTALLATION INSTRUCTIONS
8. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS (REFER PRODUCT DRAWING)
9. NOTE MARKINGS - INLET & OUTLET OVER EACH
10. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.
11. OIL SAMPLE PORT AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

DSN.	DFW	28-01-03	
DWN.	M.Z.	28-01-03	
CKD.	DFW	03-09-03	
APP.	DFW	03-09-03	

HUMECEPTOR™
STANDARD DRAWING
STC-5 HUMECEPTOR
ASSEMBLY DRAWING

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
	1:25	A2	HC-STC5-A	0

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
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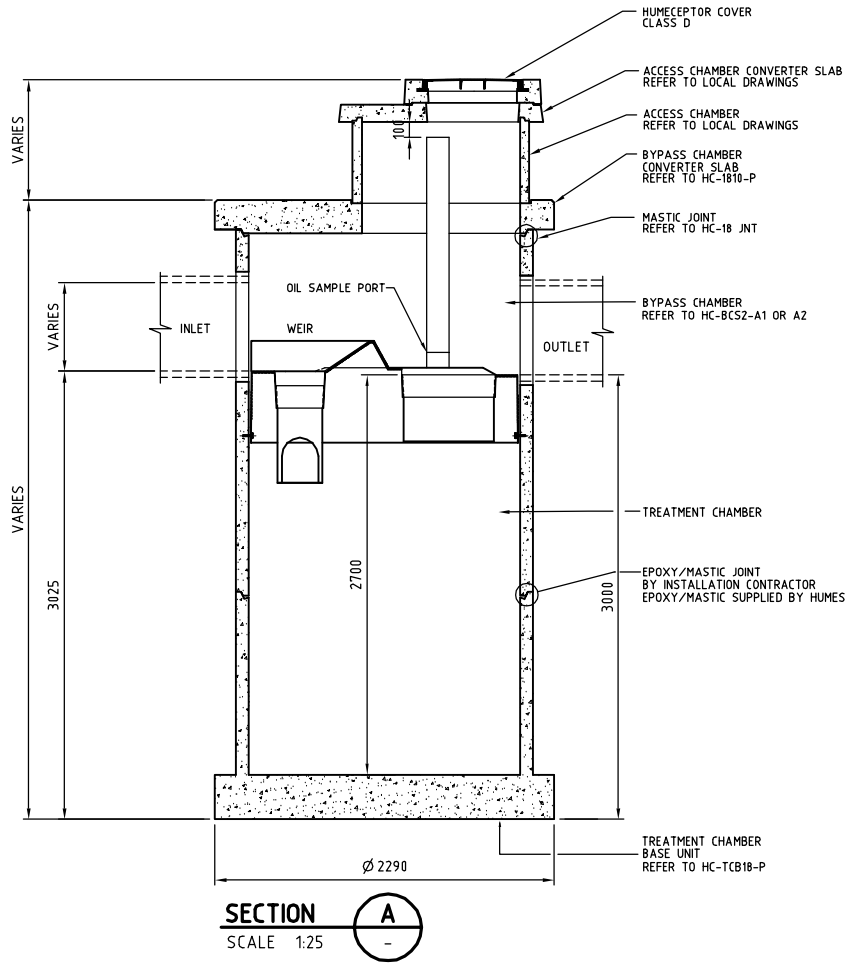

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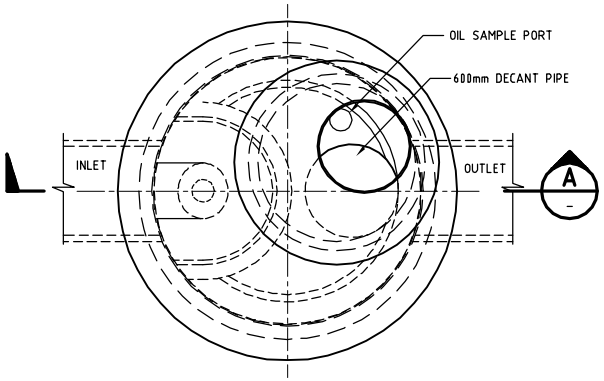
SCALE 1:25



PLAN
SCALE 1:25

NOTES:

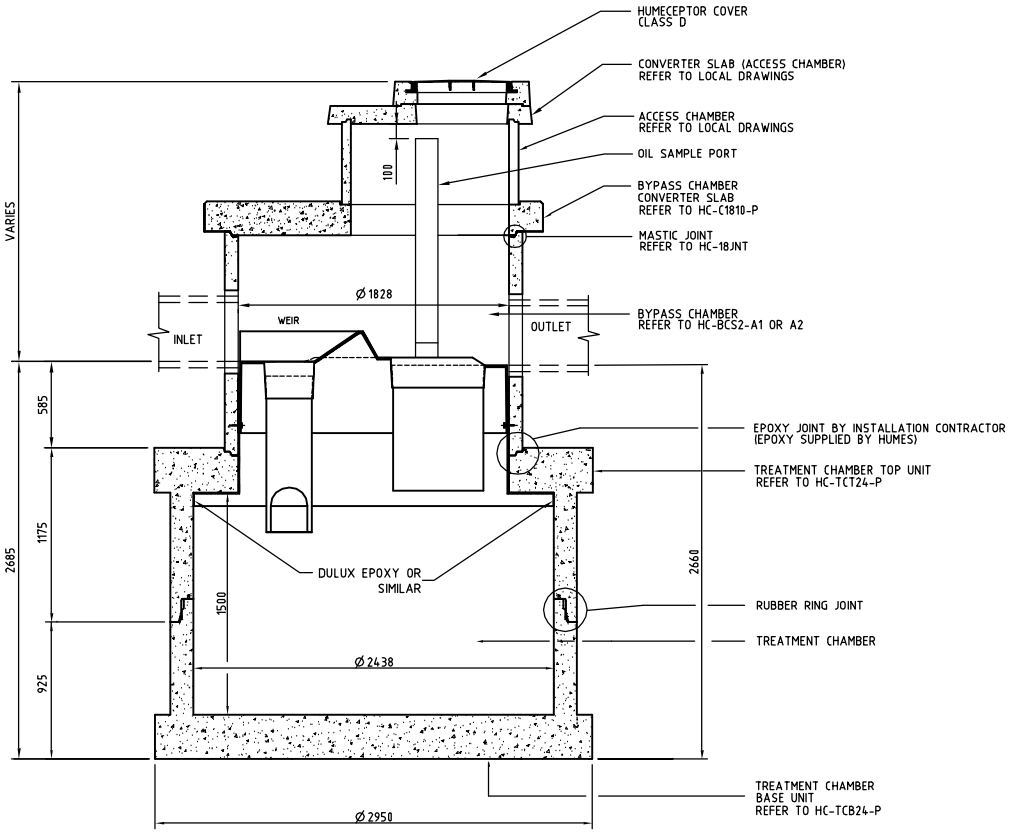
1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS
2. DIMENSIONS INCLUDED ARE STANDARD
3. STORAGE VOLUMES
   TOTAL = 7080 LITRES
   OIL STORAGE VOLUME = 1020 LITRES
   SEDIMENT STORAGE VOLUME = 5.74m3
4. COMPONENT MASSES
   TREATMENT CHAMBER BASE UNIT (INCL. SHAFT) = 5.1 TONNE
   BYPASS CHAMBER = VARIES
   BYPASS CHAMBER CONVERTER SLAB = 1.9 TONNE
5. REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. BYPASS CHAMBER CONVERTER SLAB TO SUIT LOCAL ACCESS CHAMBER UNITS.
7. FOR INLET AND OUTLET PIPE CONNECTION DETAILS REFER HC-BCS2-A1 OR A2 AND KOR-N-SEAL INSTALLATION INSTRUCTIONS
8. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS (REFER PRODUCT DRAWING)
9. NOTE MARKINGS - INLET & OUTLET OVER EACH
10. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.
11. OIL SAMPLE PORT AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

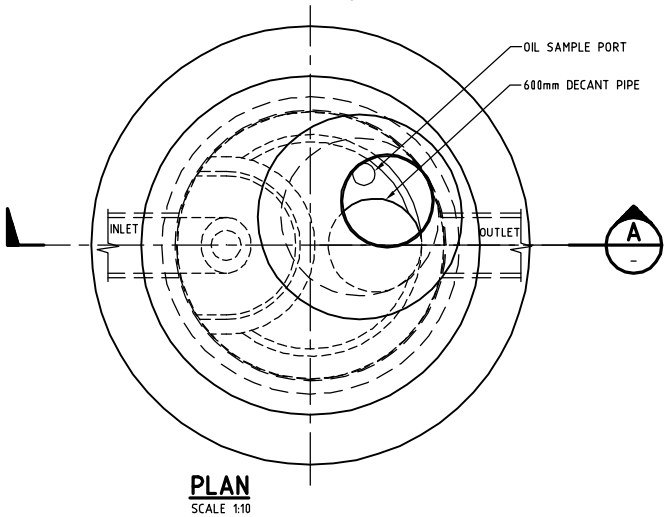
DSN.	DFW	28-01-03	
DWN.	M.Z.	28-01-03	
CKD.	DFW	03-09-03	
APP.	DFW	03-09-03	

HUMECEPTOR™
STANDARD DRAWING
STC-7 HUMECEPTOR
ASSEMBLY DRAWING

SUPERSEDES	PLOT SCALE	SIZE	ORG. NO.	ISSUE
	1:25	A2	HC-STC7-A	0



SECTION A
SCALE 1:25



PLAN
SCALE 1:10

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	UPDATED AND ISSUED FOR MANUFACTURE	M.Z.	03-09-03	DFW

NOTES:

1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS
2. DIMENSIONS INCLUDED ARE STANDARD
3. STORAGE VOLUMES
   TOTAL = 9260 LITRES
   OIL STORAGE VOLUME = 1900 LITRES
   OIL SEDIMENT STORAGE VOLUME = 6.81 m3
4. COMPONENT MASSES
   TREATMENT CHAMBER BASE UNIT (INCL. SHAFT) = 7.7 TONNE
   TREATMENT CHAMBER TOP UNIT (CONV. SLAB + SHAFT) = 6.0 TONNE
   BYPASS CHAMBER = VARIES
5. REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. BYPASS CHAMBER CONVERTER SLAB TO SUIT LOCAL ACCESS CHAMBER UNITS.
7. FOR INLET AND OUTLET PIPE CONNECTION DETAILS REFER HC-BCS2-A1 or A2 AND KOR-N-SEAL INSTALLATION INSTRUCTIONS.
8. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS. (REFER PRODUCT DRAWING)
9. NOTE MARKINGS - INLET AND OUTLET OVER EACH.
10. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.
11. OIL SAMPLE PORT AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

RUBBER RING JOINT SPECIFICATION

MATERIAL	: NITRILE
HARDNESS:	: 43 ± 3 IRHD (AS 1646)
PROFILE	: L25 (REFER Dwg. J1001-01)
ID	: 2225 ± 16mm

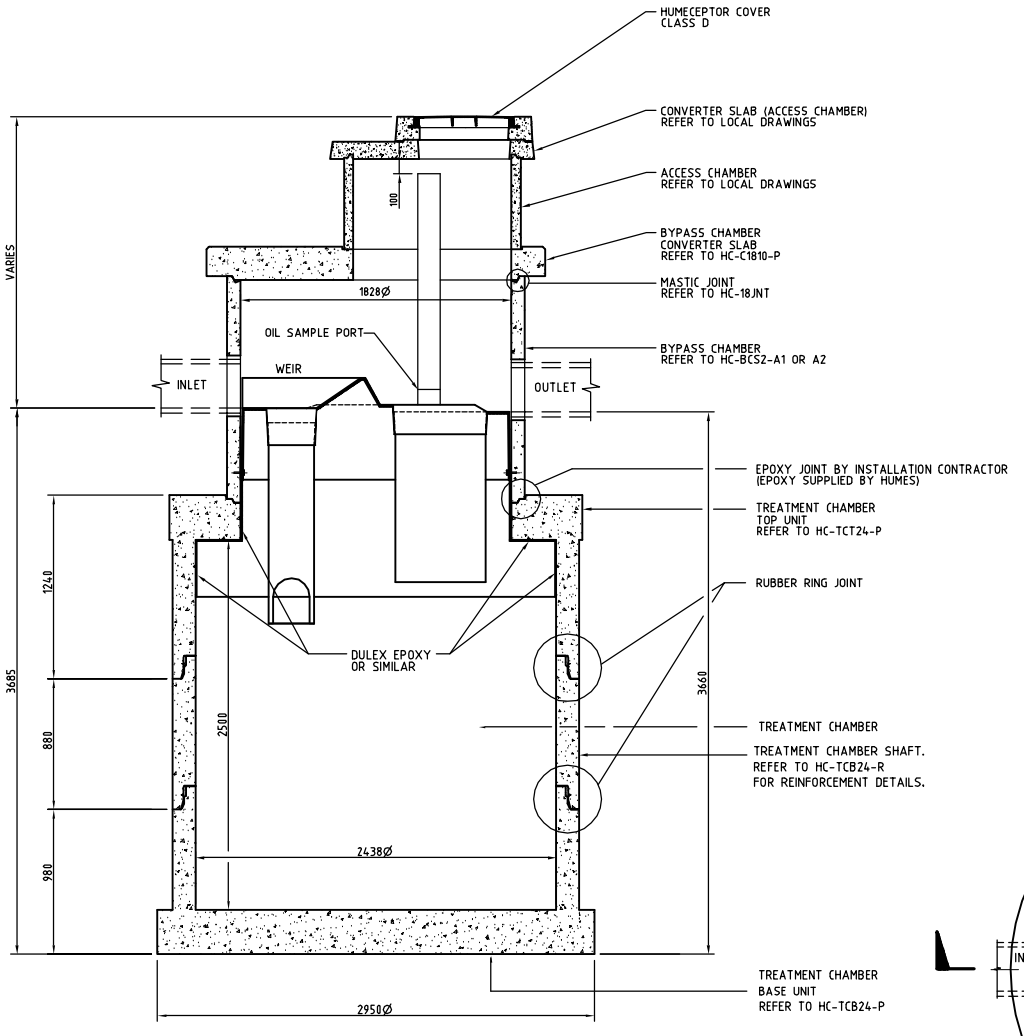
Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

DSN.	DFW	28-01-03
DWN.	M.Z.	28-01-03
CKD.	DFW	03-09-03
APP.	DFW	03-09-03

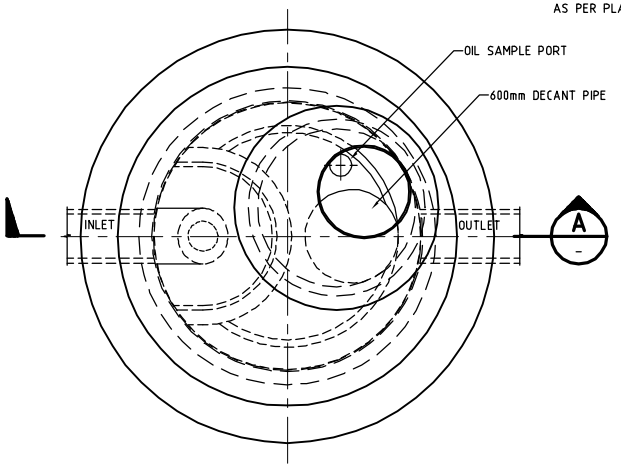
HUMECEPTOR™
STANDARD DRAWING
STC-9 HUMECEPTOR
ASSEMBLY DRAWING

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
	1:25	A2	HC-STC-9-A	0

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	UPDATED AND ISSUED FOR MANUFACTURE	M.Z.	03-09-03	DFW



SECTION A
SCALE 1:25



PLAN
SCALE 1:25

NOTES:

1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS
2. DIMENSIONS INCLUDED ARE STANDARD
3. STORAGE VOLUMES
   TOTAL = 13920 LITRES
   OIL STORAGE VOLUME = 2980 LITRES
   SEDIMENT STORAGE VOLUME = 10.27 m3
4. COMPONENT MASSES
   TREATMENT CHAMBER BASE UNIT (INCL. SHAFT) = 7.9 TONNE
   TREATMENT CHAMBER TOP UNIT (CONV. SLAB + SHAFT) = 6.1 TONNE
   BYPASS CHAMBER = VARIES
   TREATMENT CHAMBER SHAFT = 2.8 TONNE
5. REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. BYPASS CHAMBER CONVERTER SLAB TO SUIT LOCAL ACCESS CHAMBER UNITS.
7. FOR INLET AND OUTLET PIPE CONNECTION DETAILS REFER HC-BCS2-A1 OR A2 AND KOR-N-SEAL INSTALLATION INSTRUCTIONS
8. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS (REFER PRODUCT DRAWINGS)
9. NOTE MARKINGS - INLET AND OUTLET OVER EACH.
10. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.
11. OIL SAMPLE PORT AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

RUBBER RING JOINT SPECIFICATION

MATERIAL : NITRILE
HARDNESS : 43 ± 3 IRHD (AS1646)
PROFILE : L25 (REFER Dwg. J1001-01)
ID : 2225 ± 16mm

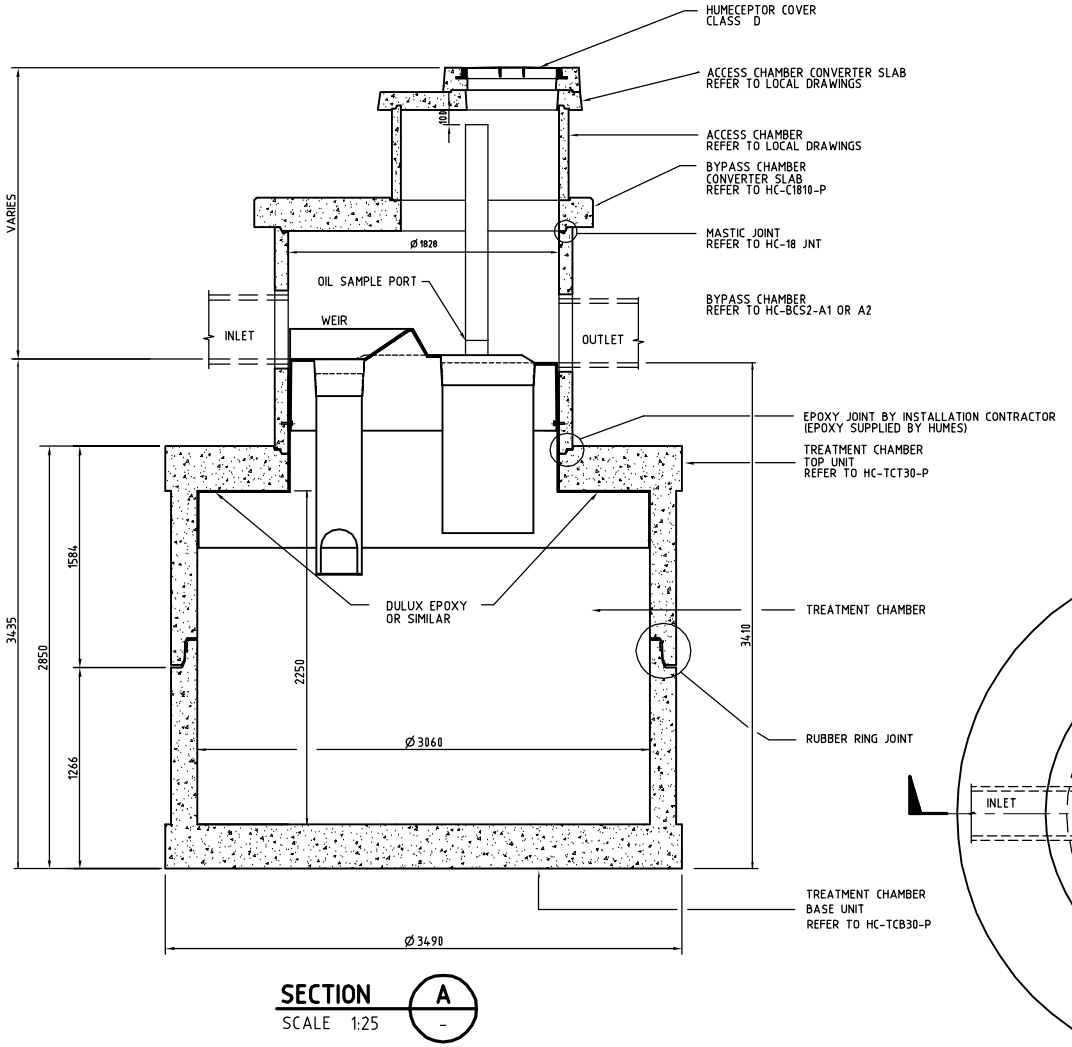
Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

DSN.	DFW	28-01-03
DWN.	M.Z.	28-01-03
CKD.	DFW	03-09-03
APP.	DFW	03-09-03

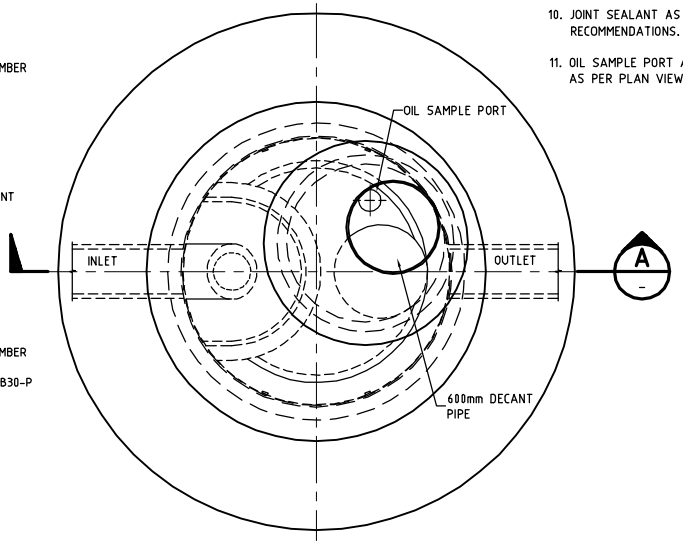
HUMECEPTOR™
STANDARD DRAWING
STC-14 HUMECEPTOR
ASSEMBLY DRAWING

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
	1:25	A2	HC-STC14-A	0

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	UPDATED AND ISSUED FOR MANUFACTURE	M.Z.	03-09-03	DFW



SECTION A
SCALE 1:25



PLAN
SCALE 1:25

NOTES:

1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS
2. DIMENSIONS INCLUDED ARE STANDARD
3. STORAGE VOLUMES
   TOTAL = 18790 LITRES
   OIL STORAGE VOLUME = 2980 LITRES
   SEDIMENT STORAGE VOLUME = 14.04 m3
4. COMPONENT MASSES
   TREATMENT CHAMBER BASE UNIT (INCL.SHAFT) = 12.1 TONNE
   TREATMENT CHAMBER TOP UNIT (CONV. SLAB + SHAFT) = 11.2 TONNE
   BYPASS CHAMBER = VARIES
5. REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. BYPASS CHAMBER CONVERTER SLAB TO SUIT LOCAL ACCESS CHAMBER UNITS.
7. FOR INLET AND OUTLET PIPE CONNECTION DETAILS REFER HC-BCS2-A1 OR A2 AND KOR-N-SEAL INSTALLATION INSTRUCTIONS
8. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS (REFER PRODUCT DRAWINGS)
9. NOTE MARKINGS - INLET AND OUTLET OVER EACH.
10. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.
11. OIL SAMPLE PORT AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

RUBBER RING SPECIFICATION

MATERIAL	: NITRILE
HARDNESS	: 43 ± 3 IRHD (AS1646)
PROFILE	: L25 (REFER Dwg. J1001-01)
ID	: 2775 ± 16mm

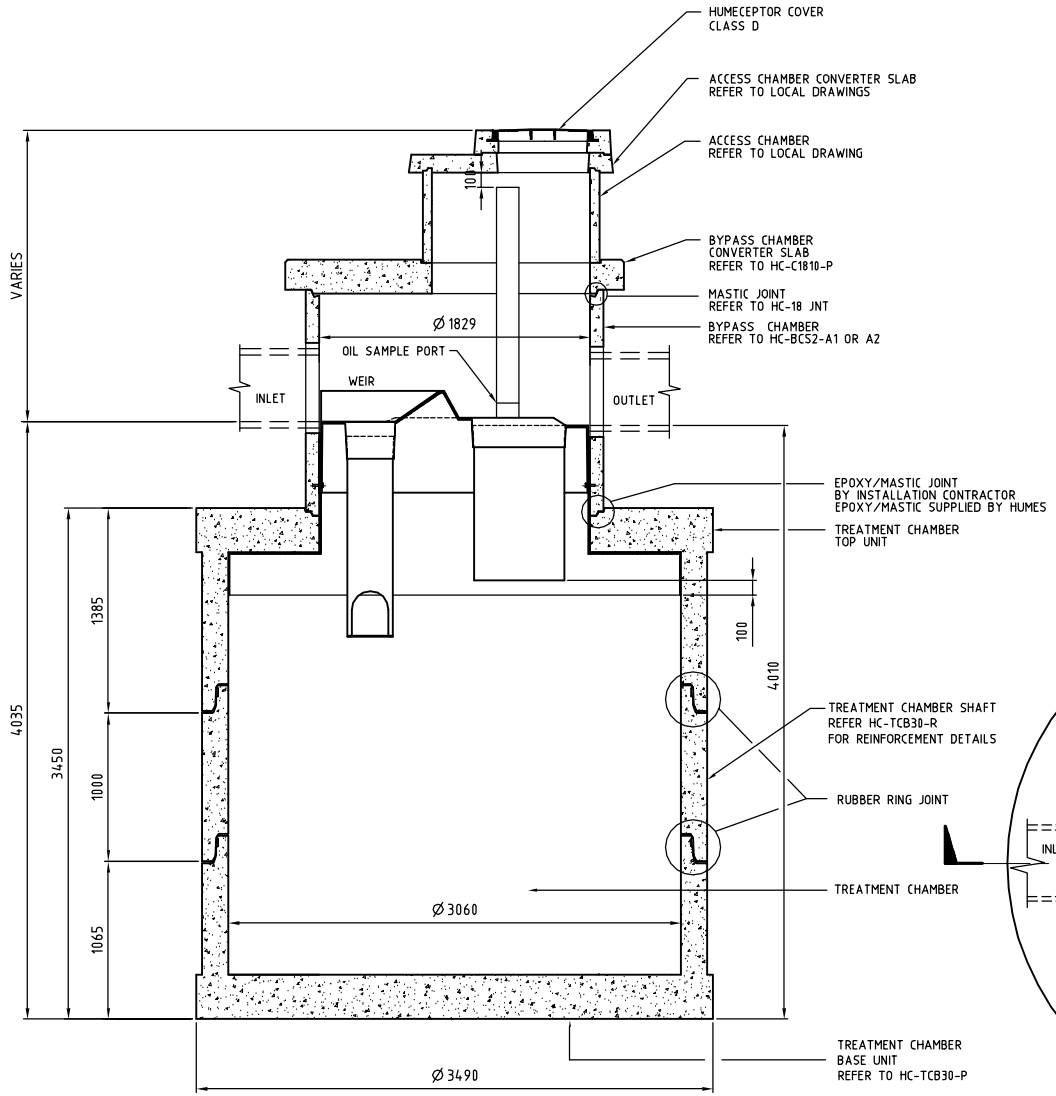
Humes TECHNICAL (DESIGN) SERVICES BRISBANE, QUEENSLAND

DSN.	DFW	28-01-03
DWN.	M.Z.	28-01-03
CKD.	DFW	03-09-03
APP.	DFW	03-09-03

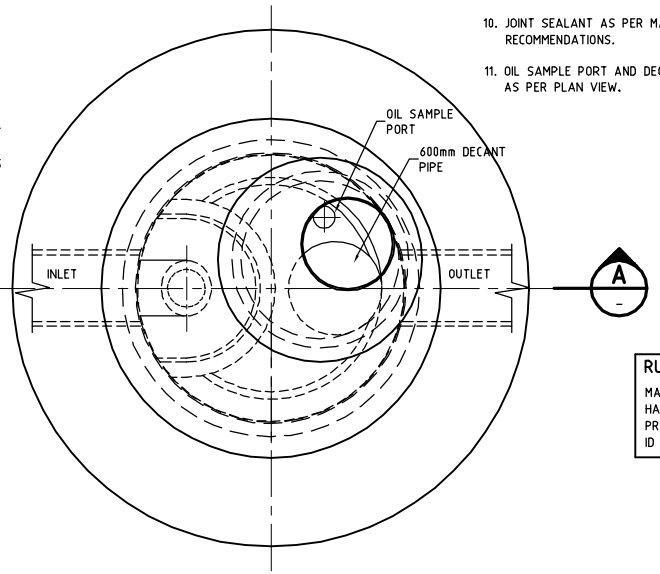
HUMECEPTOR™
STANDARD DRAWING
STC-18 HUMECEPTOR
ASSEMBLY DRAWING

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
	1:25	A2	HC-STC18-A	0

ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	UPDATED AND ISSUED FOR MANUFACTURE	M.Z.	03-09-03	DFW



SECTION A
SCALE 1:25



PLAN
SCALE 1:25

NOTES:

1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS
2. DIMENSIONS INCLUDED ARE STANDARD
3. STORAGE VOLUMES
   TOTAL = 23200 LITRES
   OIL STORAGE VOLUME = 2980 LITRES
   SEDIMENT STORAGE VOLUME = 18.45 m3
4. COMPONENT MASSES
   TREATMENT CHAMBER BASE UNIT (INCL. SHAFT) = 11.2 TONNE
   TREATMENT CHAMBER TOP UNIT (CONV. SLAB + SHAFT) = 10.1 TONNE
   BYPASS CHAMBER = VARIES
   TREATMENT CHAMBER SHAFT = 4.6 TONNES
5. REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. BYPASS CHAMBER CONVERTER SLAB TO SUIT LOCAL ACCESS CHAMBER UNITS.
7. FOR INLET AND OUTLET PIPE CONNECTION DETAILS REFER HC-BCS2-A1 OR A2 AND KOR-N-SEAL INSTALLATION INSTRUCTIONS.
8. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS (REFER PRODUCT DRAWINGS)
9. NOTE MARKINGS - INLET AND OUTLET OVER EACH.
10. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.
11. OIL SAMPLE PORT AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

RUBBER RING SPECIFICATION

MATERIAL	:	NITRILE
HARDNESS	:	43 ± 3 IRHD (AS1646)
PROFILE	:	L25
ID	:	2775 ± 16mm

Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

DSN.	DFW	28-01-03
DWN.	M.Z.	28-01-03
CKD.	DFW	03-09-03
APP.	DFW	03-09-03

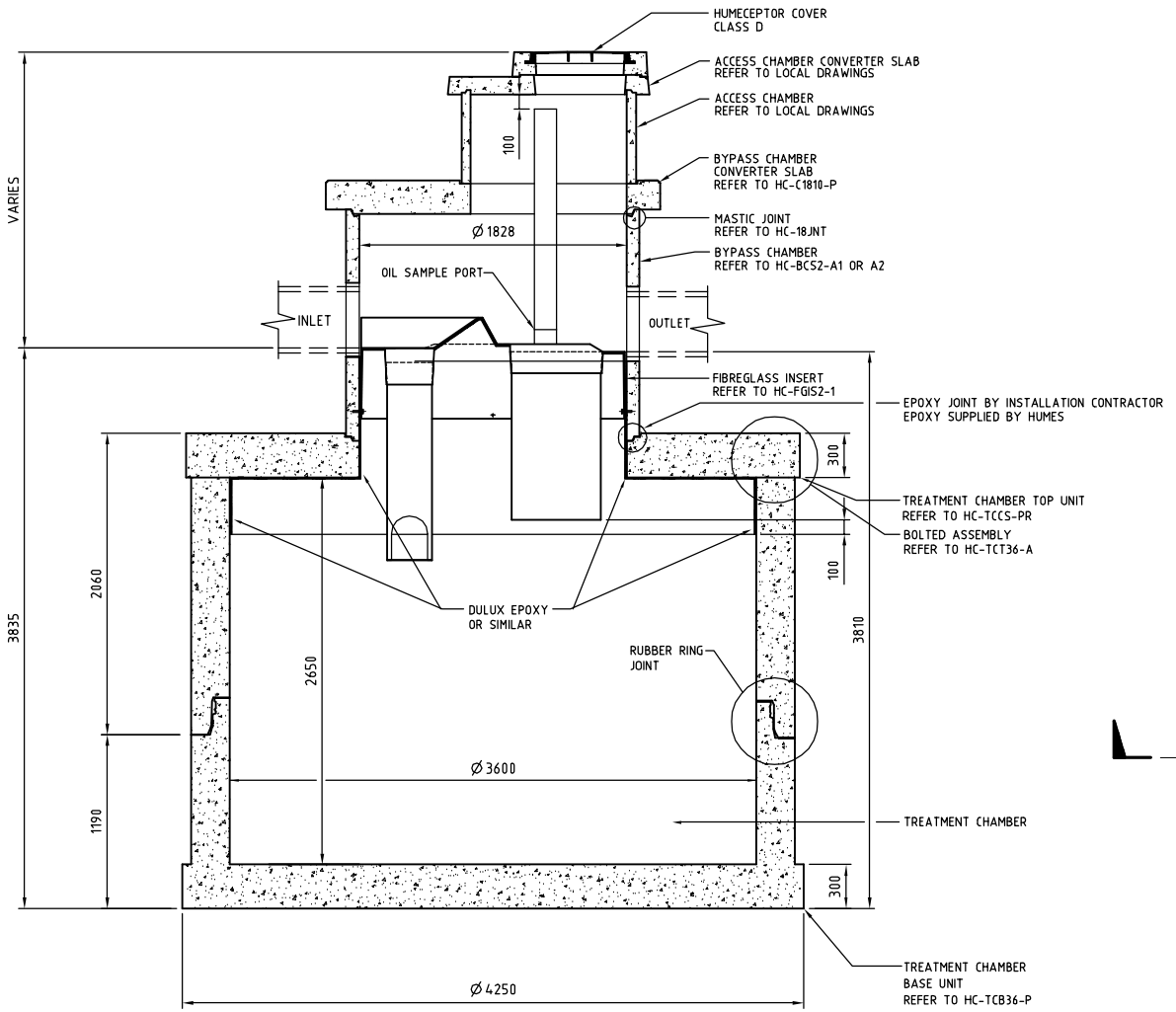
HUMECEPTOR™
STANDARD DRAWINGS
STC-23 HUMECEPTOR
ASSEMBLY DRAWING

SUPERSEDES	PLOT SCALE	SIZE	DRG. NO.	ISSUE
	1:25	A2	HC-STC23-A	0

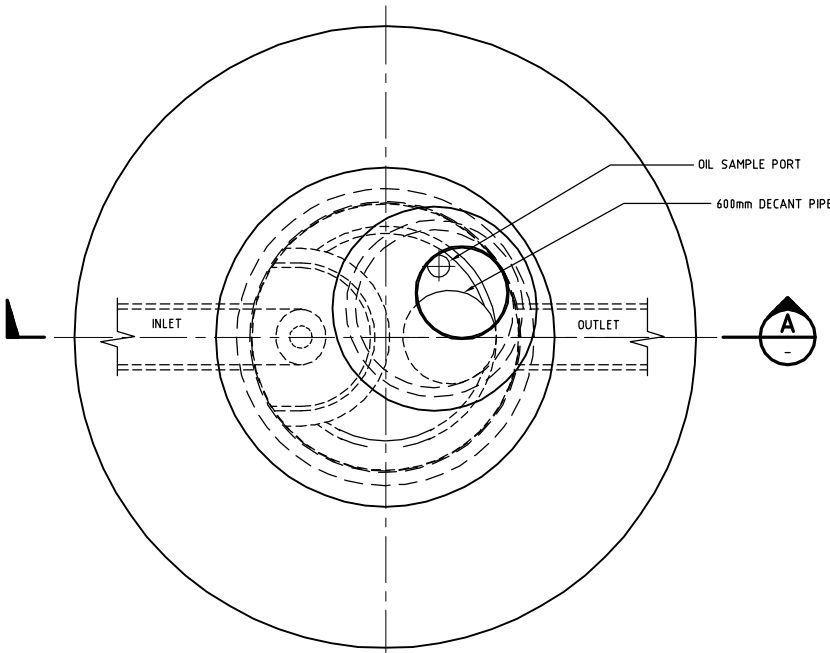
ISSUE	DETAILS OF ALTERATIONS	DWN	DATE	CKD
0	UPDATED AND REISSUED FOR MANUFACTURE	RM	22-04-04	DFW

NOTES:

1. TYPICAL ASSEMBLY DETAIL ONLY - REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS.
2. DIMENSIONS INCLUDED ARE STANDARD.
3. STORAGE VOLUMES TOTAL = 29220 LITRES OIL
   STORAGE VOLUME = 4290 LITRES
   SEDIMENT STORAGE VOLUME = 23.50 m3
4. COMPONENT MASSES TREATMENT CHAMBER BASE UNIT (INCL. SHAFT) = 18.3 t
   TREATMENT CHAMBER TOP UNIT (CONV. SLAB + SHAFT) = 23.2 t
5. BYPASS CHAMBER = VARIES REFER TO BYPASS CHAMBER ASSEMBLY DRAWING FOR FIXING DETAILS FOR FIBREGLASS INSERT.
6. BYPASS CHAMBER CONVERTER SLAB TO SUIT LOCAL ACCESS CHAMBER UNITS.
7. FOR INLET AND OUTLET PIPE CONNECTION DETAILS REFER HC-BCS2-A1 OR A2 AND KOR- N-SEAL INSTALLATION INSTRUCTIONS.
8. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS (REFER PRODUCT DRAWINGS)
9. NOTE MARKINGS - INLET AND OUTLET OVER EACH.
10. JOINT SEALANT AS PER MANUFACTURERS RECOMMENDATIONS.
11. VENT PIPE AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.



SECTION A-A
SCALE 1:25



PLAN
SCALE 1:25

Humes TECHNICAL (DESIGN) SERVICES
BRISBANE, QUEENSLAND

IMPORTANT INSTALLATION INFORMATION

1. FOUNDATION REQUIREMENTS - MIN. ALLOWABLE BEARING CAPACITY REQUIRED 200 kPa
2. UNIT TO BE PLACED ON 150mm THICK BED ZONE MATERIAL IN ACCORDANCE WITH AS3725 REQUIREMENTS
3. TREATMENT CHAMBER SHOULD BE FILLED WITH WATER TO 2/3 DEPTH IMMEDIATELY AFTER INSTALLATION (UNIT MAY FLOAT PRIOR TO BACKFILLING)

RUBBER RING JOINT SPECIFICATION

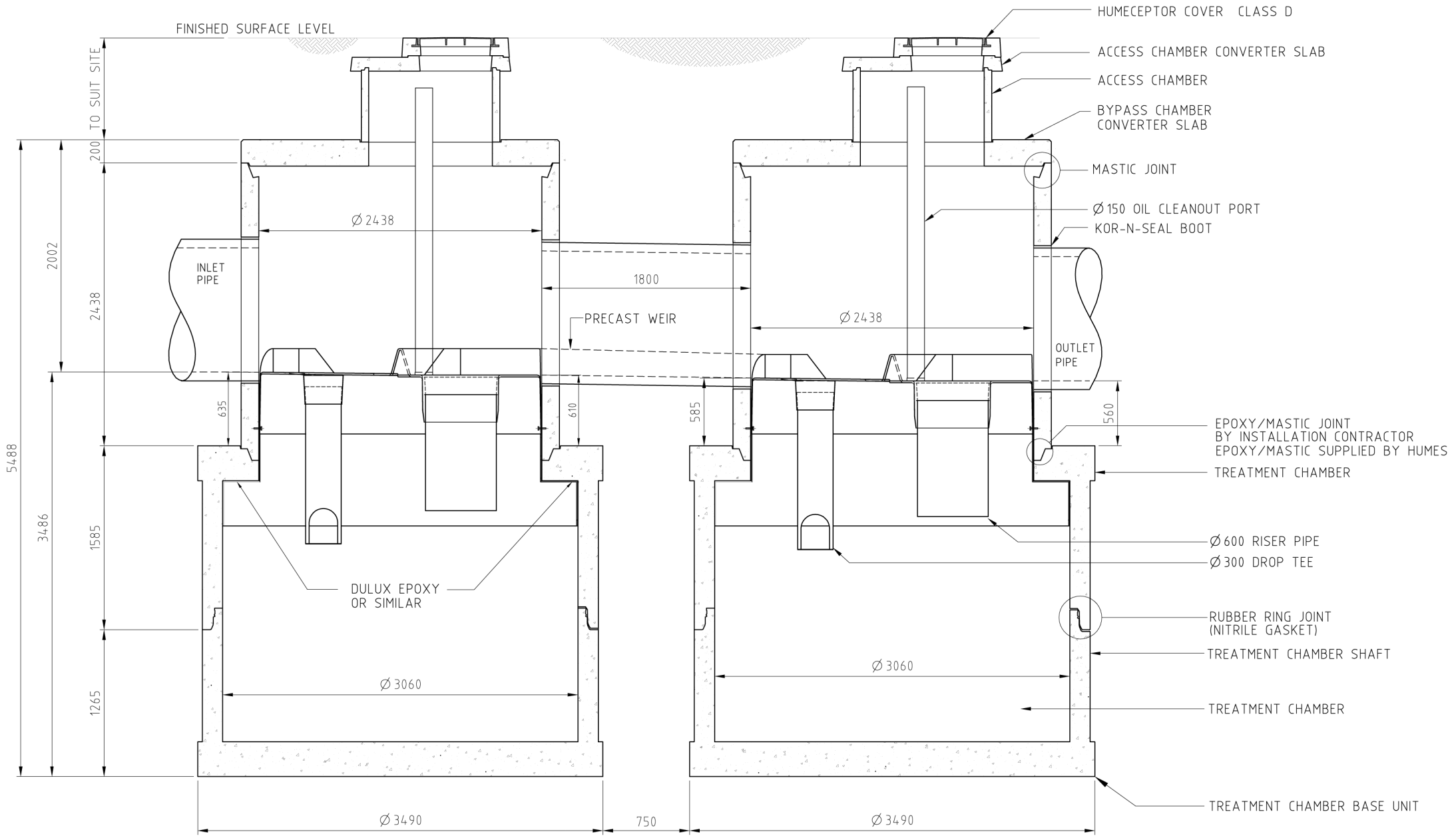
MATERIAL	: NITRILE
HARDNESS	: 43 (± 3) IRHD (AS1646)
PROFILE	: L 38 (REFER Dwg. J1002-01)
ID	: 3400 ± 16mm

DSN.	DFW	19-04-04
DWN.	RM	19-04-04
CKD.	DFW	19-04-04
APP.	DFW	19-04-04

SUPERSEDES

HUMECEPTOR™
STANDARD DRAWING
STC-27 HUMECEPTOR
ASSEMBLY DRAWING

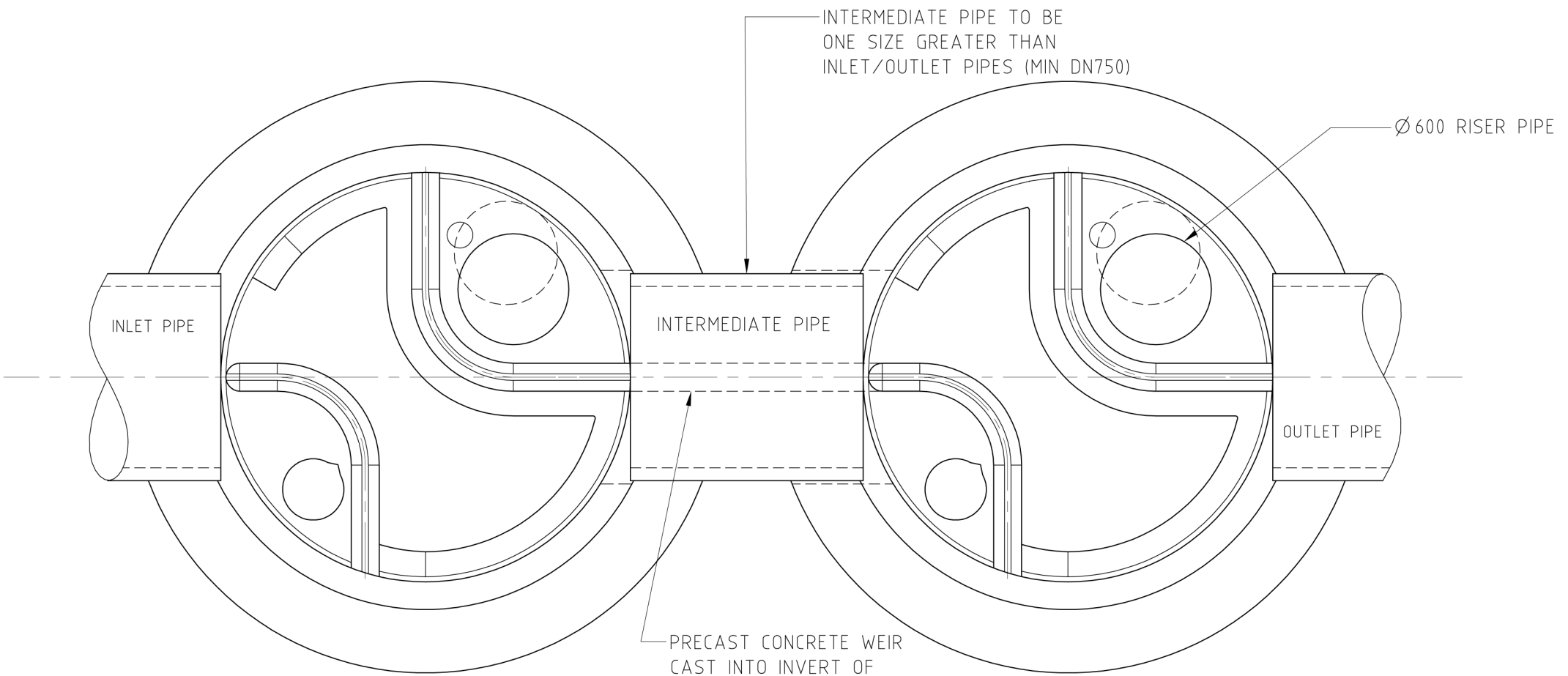
PLOT SCALE	SIZE	DRG. NO.	ISSUE
1:25	A2	HC-STC27-A	0



Duoceptor STC40 Model - General Assembly

SECTION A

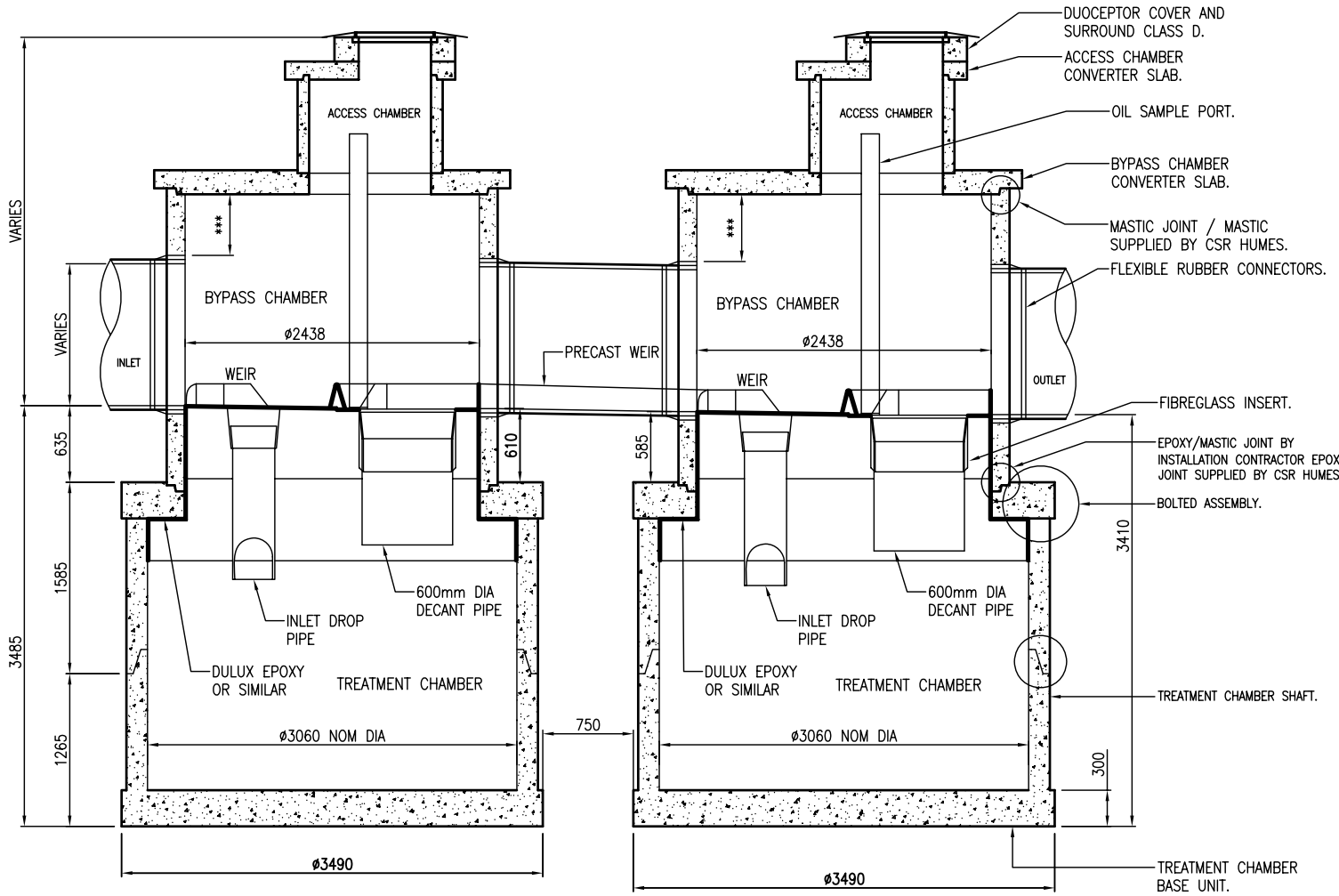
SCALE 1:25



Duoceptor STC40 Model - General Assembly

PLAN

SCALE 1:25



FOR INFORMATION

*150 MIN FOR INLET /OUTLET PIPE < 675 DIA
*300 MIN FOR INLET /OUTLET PIPE > 750 DIA

1. TYPICAL ASSEMBLY DETAIL ONLY – REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS.

2. DIMENSIONS INCLUDED ARE STANDARD.

3. STORAGE VOLUMES
   TOTAL = 42,370 LITRES
   OIL STORAGE VOLUME = 10,585 LITRES
   SEDIMENT STORAGE VOLUME = 27 m3

4. COMPONENT MASSES
   TREATMENT CHAMBER BASS UNIT (INC. SHAFT) = 11.92 TONNE
   TREATMENT CHAMBER TOP UNIT (CONV. SLAB AND SHAFT) = 8.95 TONNE
   BYPASS CHAMBER = 9.74 TONNE

5. REFER TO INSTALLATION GUIDE FOR RECOMMENDED INSTALLATION PROCEDURE.

6. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS THE FOLLOWING SWIFTLIFT KNUCKLES WILL BE REQUIRED:
   6 x 1.3 TONNES
   8 x 2.5 TONNES
   8 x 10.0 TONNES

7. OIL SAMPLE PORT, STEP IRONS AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

8. THE ABOVE WEIGHTS ARE ONLY APPROXIMATIONS OF THE ACTUAL FINAL WEIGHTS OF COMPONENTS AND ARE NOT TO BE USED.

NOT FOR CONSTRUCTION

Humes™ WATER SOLUTIONS

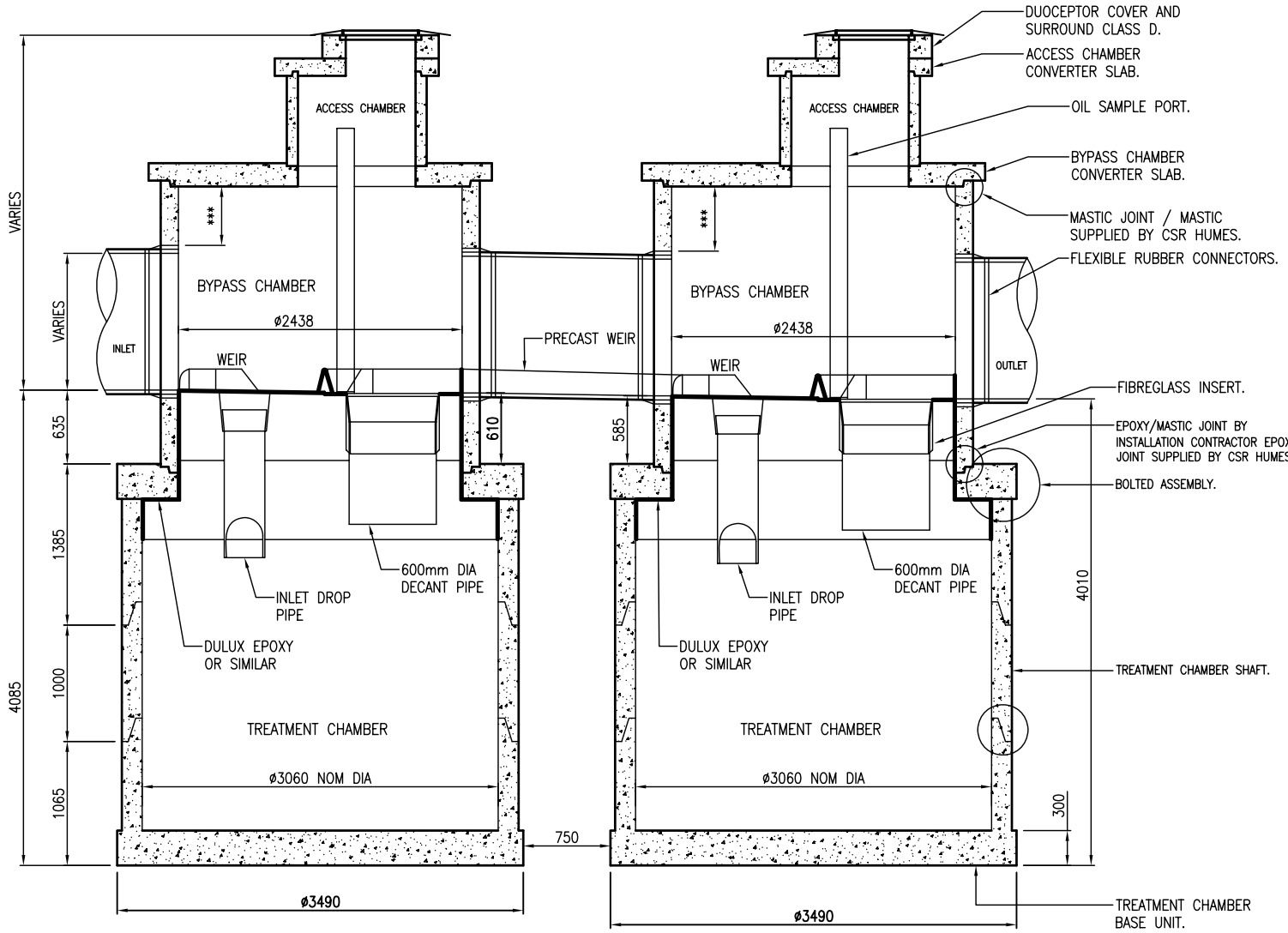
CLIENT: N/A
CLIENT NAME:

ISSUE	REVISION	INITIAL	DATE
A	ISSUE FOR CLIENT INFORMATION	JCM	25/10/07

JOB NAME: DUOCEPTOR STC40
JOB NO. N/A

DRAWING TITTLE: GENERAL ARRANGEMENT
DRAWING NO. BIS-DUO-003

DESIGNED BY:	–		MODEL:	STC60
DRAWN BY:	JCM	25/10/07	SCALE:	1:40
CHECKED BY:	CK	25/10/07	SIZE: A3	REV. A



FOR INFORMATION

*150 MIN FOR INLET /OUTLET PIPE < 675 DIA
*300 MIN FOR INLET /OUTLET PIPE > 750 DIA

1. TYPICAL ASSEMBLY DETAIL ONLY – REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS.

2. DIMENSIONS INCLUDED ARE STANDARD.

3. STORAGE VOLUMES
   TOTAL = 50,525 LITRES
   OIL STORAGE VOLUME = 10,585 LITRES
   SEDIMENT STORAGE VOLUME = 35 m3

4. COMPONENT MASSES
   TREATMENT CHAMBER BASS UNIT (INC. SHAFT) = 11.02 TONNE
   TREATMENT CHAMBER TOP UNIT (CONV. SLAB AND SHAFT) = 12.50 TONNE
   BYPASS CHAMBER = 9.74 TONNE

5. REFER TO INSTALLATION GUIDE FOR RECOMMENDED INSTALLATION PROCEDURE.

6. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS THE FOLLOWING SWIFTLIFT KNUCKLES WILL BE REQUIRED:
   6 x 1.3 TONNES
   8 x 2.5 TONNES
   8 x 10.0 TONNES

7. OIL SAMPLE PORT, STEP IRONS AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

8. THE ABOVE WEIGHTS ARE ONLY APPROXIMATIONS OF THE ACTUAL FINAL WEIGHTS OF COMPONENTS AND ARE NOT TO BE USED.

NOT FOR CONSTRUCTION

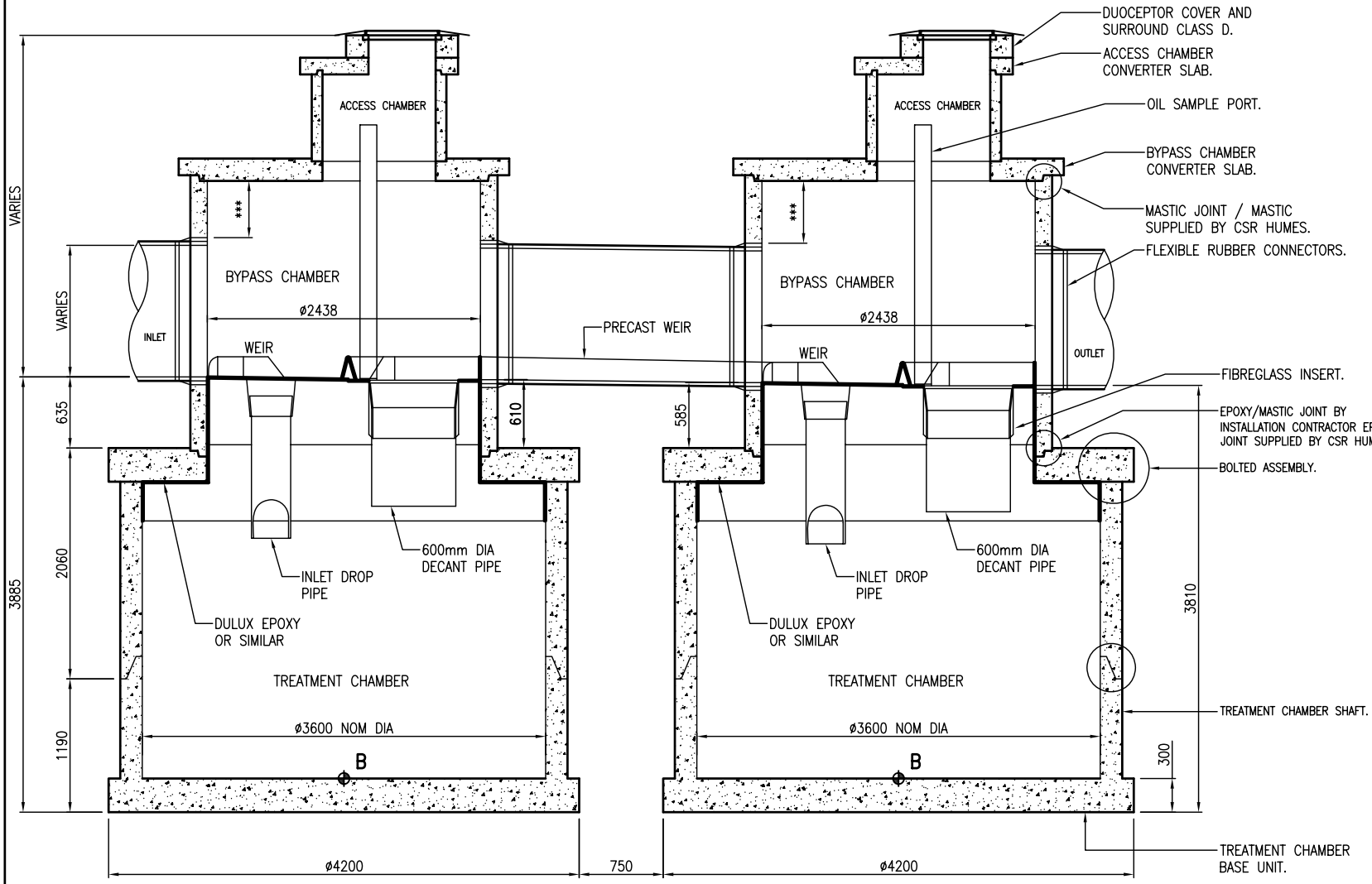
Humes™ WATER SOLUTIONS

CLIENT: N/A
CLIENT NAME:

ISSUE	REVISION	INITIAL	DATE
A	ISSUE FOR CLIENT INFORMATION	JCM	25/10/07

JOB NAME: DUOCEPTOR STC50
JOB NO. N/A

DRAWING TITTLE:	GENERAL ARRANGEMENT			
DRAWING NO.	BIS-DUO-002			
DESIGNED BY:	–		MODEL:	STC60
DRAWN BY:	JCM	25/10/07	SCALE:	1:40
CHECKED BY:	CK	25/10/07	SIZE: A3	REV. A



FOR INFORMATION

*150 MIN FOR INLET /OUTLET PIPE < 675 DIA
*300 MIN FOR INLET /OUTLET PIPE > 750 DIA

1. TYPICAL ASSEMBLY DETAIL ONLY – REFER TO PROJECT DRAWING FOR ACTUAL REQUIREMENTS.

2. DIMENSIONS INCLUDED ARE STANDARD.

3. STORAGE VOLUMES
   TOTAL = 60,255 LITRES
   OIL STORAGE VOLUME = 11,560 LITRES
   SEDIMENT STORAGE VOLUME = 42 m3

4. COMPONENT MASSES
   TREATMENT CHAMBER BASS UNIT (INC. SHAFT) = 16.20 TONNE
   TREATMENT CHAMBER TOP UNIT (CONV. SLAB AND SHAFT) = 12.46 TONNE
   BYPASS CHAMBER = 9.74 TONNE

5. REFER TO INSTALLATION GUIDE FOR RECOMMENDED INSTALLATION PROCEDURE.

6. SWIFTLIFT LIFTING ANCHORS PROVIDED FOR LIFTING ALL COMPONENTS THE FOLLOWING SWIFTLIFT KNUCKLES WILL BE REQUIRED:
   6 x 1.3 TONNES
   8 x 2.5 TONNES
   8 x 10.0 TONNES

7. OIL SAMPLE PORT, STEP IRONS AND DECANT PIPE TO BE VISIBLE AS PER PLAN VIEW.

8. THE ABOVE WEIGHTS ARE ONLY APPROXIMATIONS OF THE ACTUAL FINAL WEIGHTS OF COMPONENTS AND ARE NOT TO BE USED.

NOT FOR CONSTRUCTION

Humes™ WATER SOLUTIONS

CLIENT: N/A
CLIENT NAME:

ISSUE	REVISION	INITIAL	DATE
A	ISSUE FOR CLIENT INFORMATION	JCM	25/10/07

JOB NAME: DOUCEPTOR STC60
JOB NO. N/A

DRAWING TITTLE:	GENERAL ARRANGEMENT		
DRAWING NO.	BIS-DUO-001		
DESIGNED BY:	–	MODEL:	STC60
DRAWN BY:	JCM 25/10/07	SCALE:	1:40
CHECKED BY:	CK 25/10/07	SIZE: A3	REV. A

HEAD OFFICE
18 Little Cribb Street,
Milton. QLD 4064.
Tel: (07) 3364 2800 Fax: (07) 3364 2963
NORTH QUEENSLAND
Ingham Road,
Bohle. QLD 4818.
Tel: 1300 361 601 Fax: (07) 4758 6001
CENTRAL QUEENSLAND
MacLaughlin Street,
Rockhampton. QLD 4701.
Tel: 1300 361 601 Fax: (07) 4926 1837
SOUTH EAST QUEENSLAND
59 Sugarmill Road,
Meeandah. QLD 4008.
Tel: 1300 361 601 Fax: (07) 3866 7101
NEW SOUTH WALES
Cnr Woodstock Ave & Glendenning Rd,
Rooty Hill. NSW 2766.
Tel: 1300 361 601 Fax: (02) 9625 5200
NORTH WEST NEW SOUTH WALES
Showground Road,
Tamworth. NSW 2340.
Tel: 1300 361 601 Fax: (02) 6765 2683
VICTORIA
122a Doherty's Road,
Laverton North. VIC 3028.
Tel: 1300 361 601 Fax: (03) 9360 3887
TASMANIA
19-25 Churchill Park Drive,
Invermay. TAS 7248.
Tel: 1300 361 601 Fax: (03) 6335 6330
SOUTH AUSTRALIA
39-43 Maxwell Road,
Pooraka. SA 5095.
Tel: 1300 361 601 Fax: (08) 8168 4549
WESTERN AUSTRALIA
36-38 Felspar Street,
Welshpool. WA 6106.
Tel: 1300 361 601 Fax: (08) 9351 6944
NORTHERN TERRITORY
1606 Reichardt Road,
Winnellie. NT 0821.
Tel: 1300 361 601 Fax: (08) 8984 1614

For further information please contact your nearest Humes office:

Appendix E – POLLU-PLUG The Anti-Pollution Stopper

PRONAL

L'Ingénierie de l'Elastomère

POLLU-PLUG

The Anti-Pollution Stopper

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Contents

1) Presentation of the Device:

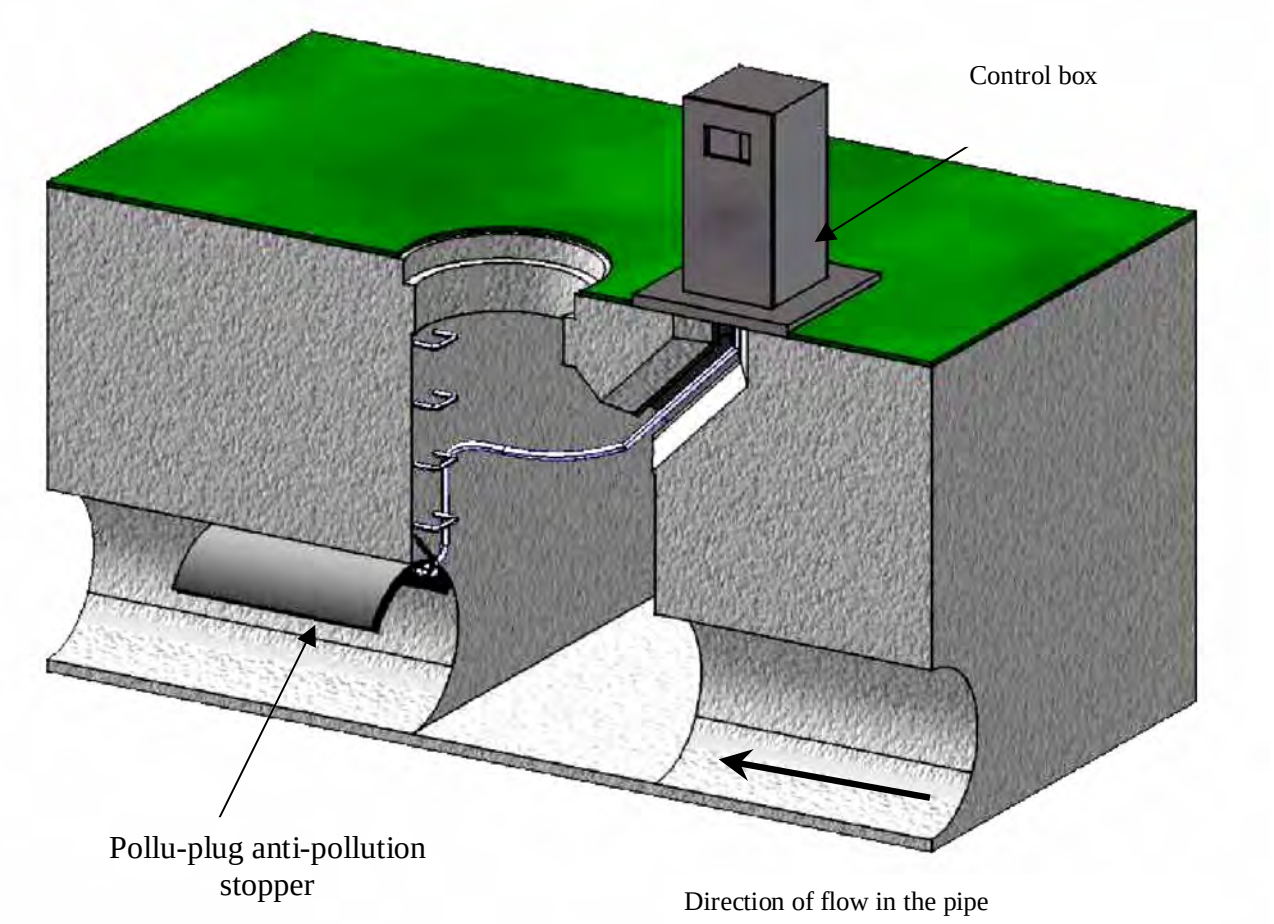
The pollu-plug stopper has been designed to remain permanently inside pipes without disturbing the natural flow of the water. In the event of accidental pollution the stopper merely needs to be inflated via a manual or remote system.

Made from elastomer-coated fabric which is hot vulcanized in an autoclave, thanks to its integral reinforcement the stopper takes on the shape of the upper part of the pipe.

There are 3 control systems:
- manual
- remote wire control
- remote GSM control

Several stoppers can be started simultaneously via a single control box.

Layout:



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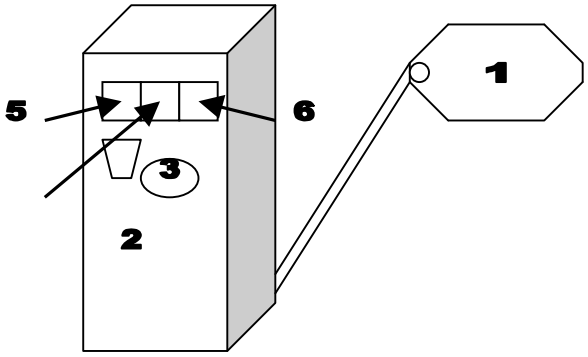
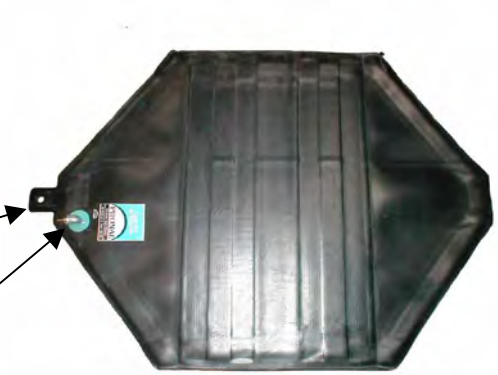


2) Technical Description:

a) Manual Inflation Unit

1) *Pollu-plug* :

Pollu-plug stopper with feed tube ¼" G for a Ø = 600 mm
and ¾" G for a Ø = 700 mm ; fitted with an anchor point for a chain with hook.



2) *Bottle of Nitrogen*:

Independent energy source to inflate the stopper system.
Supply covered by a contract with a specialized company such as Air Liquide.

Bottle supplied for the Ø – 600 mm
Bottle not delivered for the Ø – 700 mm

3) *Bottle Outlet Pressure Reducer*:

Pressure reduction from 200 bar to 8 bar, double pressure gauge displaying the bottle/reduced pressure
Type C inlet, olive outlet for hose Ø 8 / 10 mm.

4) *Distributor*:

Transfer the inflation energy to the stopper system.

5) *Pressure Reducer Distributor Outlet:*

Reduce the 8 bar pressure to the Pollu-plug operating pressure.

6*) 3-way 2 position Valve:*

Position 1: used to manually start inflation of the stopper
Position 2: used to deflate the "exhausted" stopper

7) *Leaktight Cabinets:*

Lock the inflation system to make it safe. Glass to be broken in emergency.

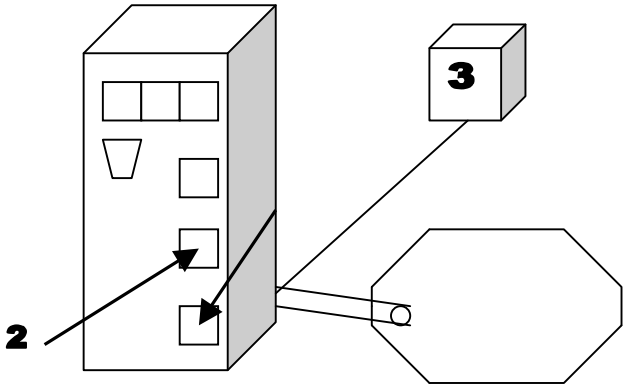
For the Ø = 600 mm, cabinet in red polyethylene (1/4" G feed)
H – 860 mm, L – 350 mm, W – 240 mm

For the Ø = 700 mm, galvanized red cabinet, epoxy quality, thickness 15/10,
H – 1320 mm, L – 455 mm, W – 400 mm.
Standing on 4 feet fixed to ground.

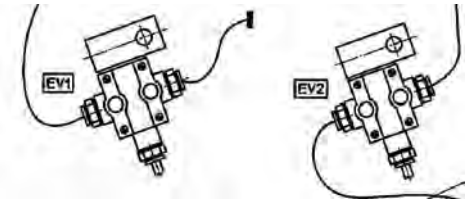
Venturi Effect Option:

After inflation of the stopper enables it to be put back in place by completely and quickly emptying the PAPS by means of an ejector connected to the bottle of nitrogen.

b) Remote Control via Wire Unit

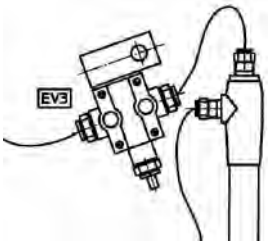


1) *Inflation electrovalve and deflation electrovalve*



Used for remote inflation and deflation.

2) *Venturi Option Electrovalve*



Enables fast remote deflation

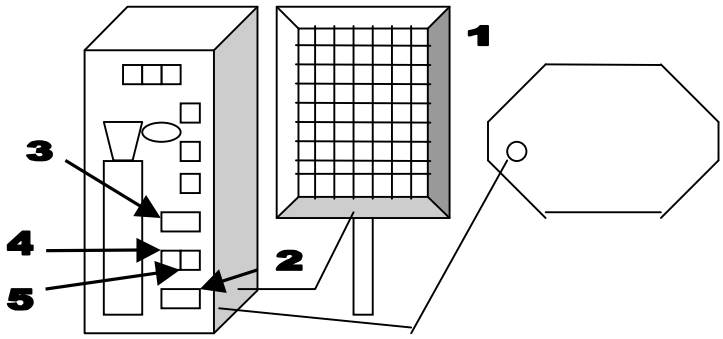
3) *Control Console*

Enables easy inflation and deflation of the Pollu-plug via a remote station of the control box.

4) *Connecting Cable*

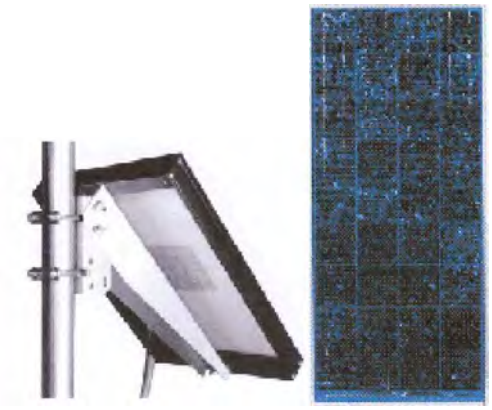
Connects the box to the control console.

b) **Remote Control via GSM**:



1) *Solar Panel*:

Powers the system and ensures independent charging of the batteries.
L – 1110 mm, W – 500 mm, Th – 54 mm
The panel is located on a mast and its dimensions depend upon where it is installed.



2) *Batteries*:

Accumulate the energy needed for global operation, they are located in an insulated compartment of the control box.

3) *Transmitter Receiver*:

Processes and returns information received (Distance-activation)

4) *Modem*:

Telephone link with the various instructing parties.

5) *Switching Regulator*:

Transforms the 12V battery voltage into 24V.

Sensor:

Shows the stopper pressure (option).

3) Installation:

a) Preparation :

The client or installer must have carried out the infrastructure work before the system is installed and must ensure that the working conditions are complied with:

Infrastructure work

- Sheath to route the feed pipe via a grommet
- Slab or concrete covering to stand the control box on

Working Conditions

- Easy access to the pipes to go down into the manhole
- Low water level and clean pipes
- 230V electricity close by to install and use the tools to fix the control box in place

Equipment required

- Drill + bits for concrete, plastic, steel
- Screwdriver, hammer, spanners, Stanley knife, pliers, pincers, saw
- Handling accessories
- Tie-down straps (Pollu-plug Ø>400mm)
- Rope, torch, gas detector
- Safety: gloves, helmet, suit, safety boots or shoes, protective goggles, warning, marker cones

b) Pollu-plug Installation:

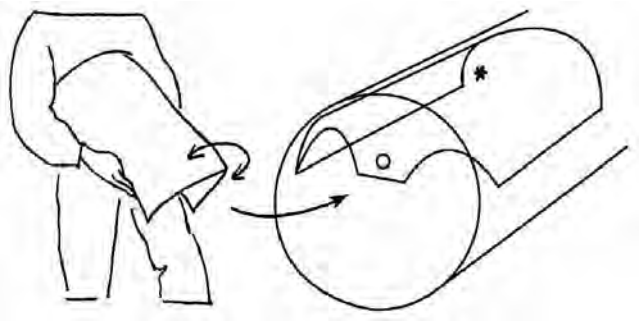
The installer must first check the condition of the manhole and in particular the pipe to be stopped (working conditions). Prior cleaning is strongly recommended.

The direction of flow must be noted to locate the stopper.

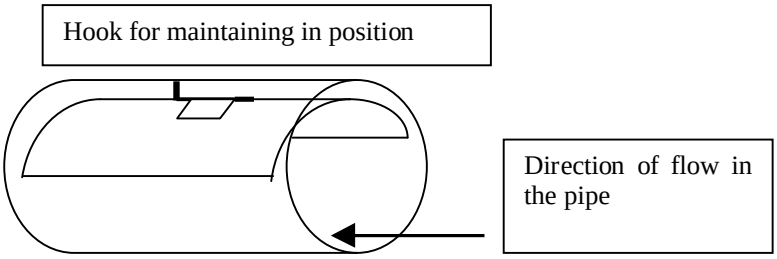
The stopper is to be located in the upper part of the pipe, nozzle and anchor point towards the manhole (depending on the site).

Next the stopper must be bent in an arc along its length to insert it into the pipe.

We recommend the use of tie-down straps for the Ø = 400 mm, so as to facilitate access to the pipe.



* For stoppers with Ø 600 to 1000, a retaining bracket is fixed on top.



c) Installation of Box:

The installation of a control box is specific to the control unit chosen (manual, wire remote, GSM remote). There is however a common procedure:-

Locate the control box as desired on the concrete support and the pre-cut sheath to note the drilling locations (feed pipe and fixings). The box can be hooked to a wall or a vertical support.

Once the pipe has been inserted into the sheath up to the stopper via the grommet, fix the box to the slab or concrete support using screws and plugs.

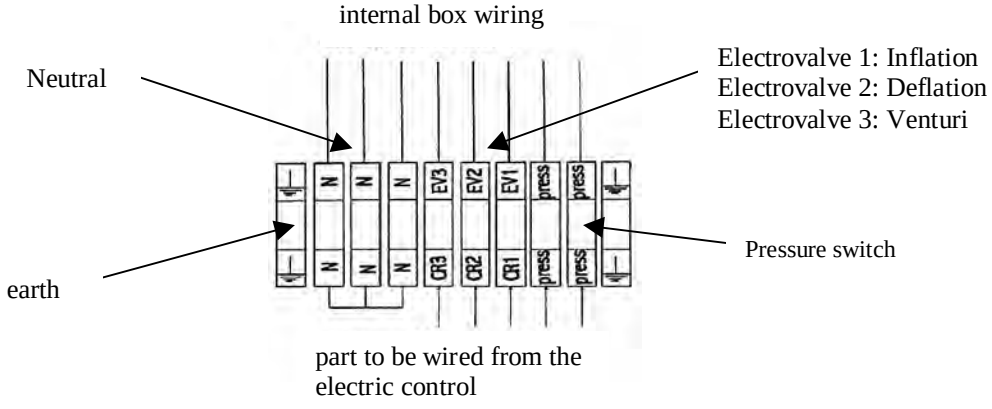
Then connect the feed pipe between the splined end of the stopper and the box, tighten using the collars supplied.

The feed pipe must be fixed in the manhole as well as the stopper chain (using the eye bolt on a wall) as a means of preventive retention.

Note: Put the inflation unit into service and lock the box.

<u>Electric terminal connection (wire remote control unit) :</u>

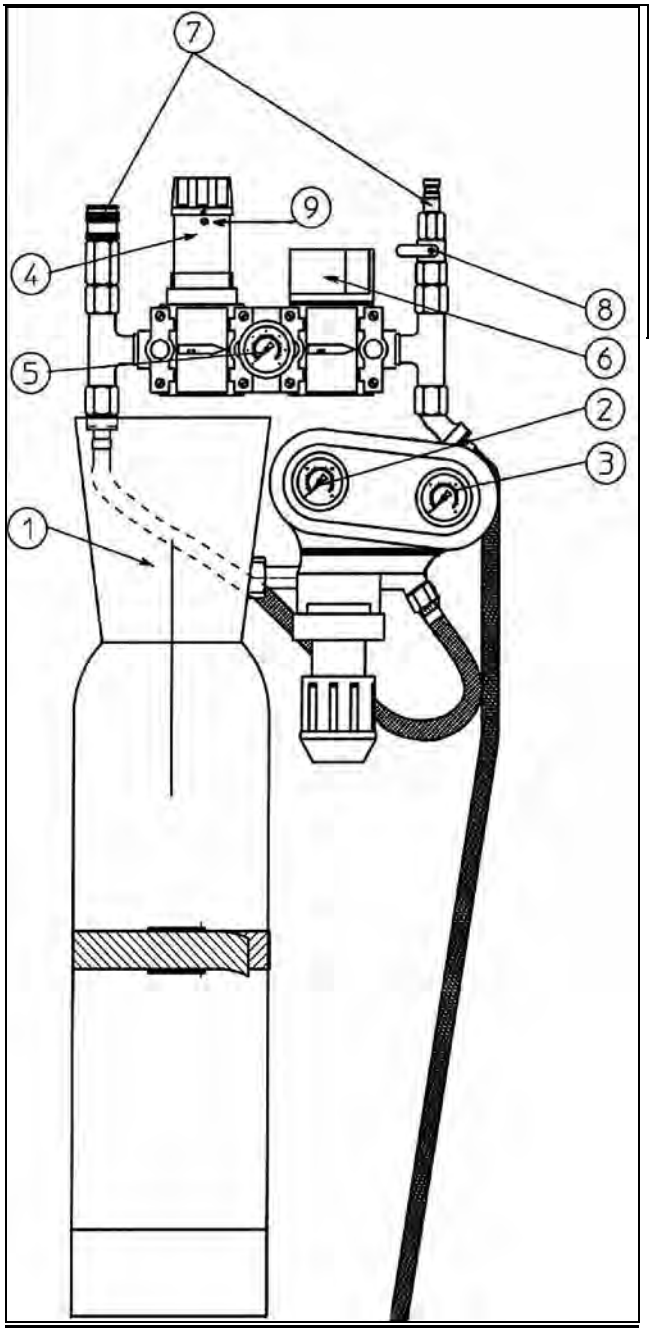
General supply voltage 210V (standard) or 240V



4) Operation :

a) Manual Inflation Box :

To carry out work, break glass



INFLATION Procedure

- Open the bottle (1)
- Open the valve (6)
- Allow the stopper to inflate to its pressure (see table of characteristics of the various models) for maximum plugging.

DEFLATION Procedure

- Close the valve (6)
- Go down into the piping to put the stopper back in place (put it back in position)

Venturi Effect

- To deflate more quickly, it is strongly recommended that a Venturi type ejector be connected (7) (option or manual).

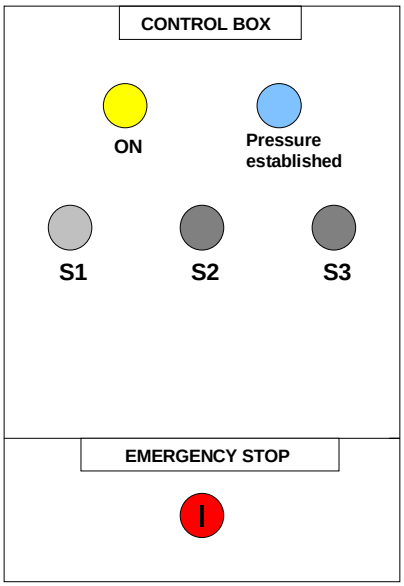
Operating procedure with Venturi effect

=> Only to be used after natural deflation (in open air) of the stopper
- Close the valve (6)
- Close the bottle (1)
- Connect the ejector supplied (option) to 7
- Open 8
- Open the bottle (1)
- Allow the stopper to deflate completely and relocate the levers

b) Wire remote control box with pressure switch:

INFLATION

- Press and keep pressed S1, the stopper inflates
- Once the light has come on, the pressure is established (option)
- Release S1



DEFLATION

- Press and keep pressed S2, the stopper deflates via the exhaust
- Press and keep pressed S3, the stopper deflates with the ejector (Venturi effect)

Note: In order to reduce the nitrogen consumption of the bottle, or use of the Venturi effect, open 2 (diagram below)
manually and allow the Pollu-plug to deflate alone, maintain pressure on S3 to return the Pollu-plug to its initial position.
It is recommended that the pressure in the bottle be checked regularly if it remains open continuously.

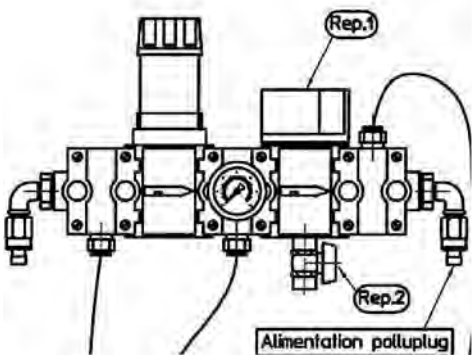
INFLATION

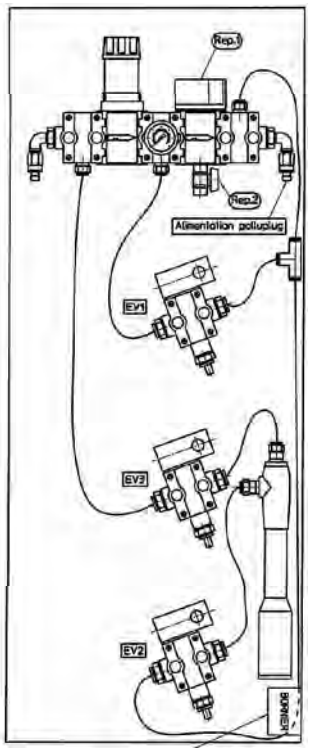
- Check that 2 is in the closed position (perpendicular to the inflation circuit)
- Open 1 (direction of the arrow)

Manual DEFLATION

- Turn 1 to closed (perpendicular to the inflation circuit)
- Open 2

N.B.: The inflation circuit opposite is shown with 1 and 2 open.





c) GSM remote control box

The operating principle of this control system is to be able to start the inflation via a GSM telephone. This action is procured by sending an SMS to the site(s) equipped with this system.

Distribution on site can be done as follows:

- Remote control
- Station by station
- Station selected controlling 10 stations maximum

Programming is carried out during installation of the stations on the site. A table of messages to be sent will be supplied. This table describes the messages and acknowledgements.

- **INFLATION**: send SMS 1
- Receipt acknowledged
- Pollu-plug inflated (pressure established): SMS receipt

- **DEFLATION**: send SMS 2
- Receipt acknowledged
- Pollu-plug deflated: SMS receipt

- **ACKNOWLEDGEMENT**: SMS 3 sent
- Receipt acknowledged
- Reinitialisation: SMS receipt

- **CONSULTATION OF STATE** SMS 4 sent

- System state SMS receipt

The solar panels, bottles of nitrogen and batteries mean that the stopper system can operate completely independently. The safety of each station is ensured via a telephone number and a safety number to avoid all accidental start-ups. Control is via remote control, but in the event of a malfunction, this control can also be ensured manually directly from the control box.
Resetting the distributor after tripping is totally manual.
The 3-way 2 position valve must remain open in normal operation, it must only be closed during maintenance tests.

→ Closed position for maintenance and system test without tripping the stopper

→ Automatic operating position, turn the handle through 90° anti-clockwise

Accessories required: mobile telephone + SIM card with subscription

5) Maintenance

The stopper and its control box being safety materials, it is necessary to regularly check the condition of the stopper system and reset it if it has been triggered.

Point to be verified on assembly of the POLLU-PLUG for maintenance contract

MANUAL CONTROL BOX

MANUAL CONTROL BOX

Points to be checked	States	Diagnostic	Periodicity
Bottle inflation pressure	200 bar		
Pressure reducer pressure	Based on the PAPS diameter See characteristics		
Circuit leak (without PAPS inflation)			
State of the control box	Distortion or leaktightness		
State of the door	Distortion or leaktightness		
Opening state	Oxidation		
State of the glass	Break		
Presence of emergency key			

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Points to be checked	States	Diagnostic	Periodicity
State of the pipe for optimum inflation 95% to 98%	Clean pipe inflation zone		6 months
Visual state of the PAPS without disassembly	Touch the product in place		6 months
State of the feed hose	Porosity or break		6 months
State of the retention chain	Weakness		6 months
Disassembly, PAPS re-assembly expertise			12 months
Actual inflation of the system	Complete check		36 months

REMOTE CONTROL BOX

CONTROL BOX

Points to be checked	States	Diagnostic	Periodicity
Bottle inflation pressure	200 bar		
Pressure reducer pressure	Based on the PAPS diameter See characteristics		
Circuit leak (without PAPS inflation)			
State of the control box	Distortion or leaktightness		
State of the door	Distortion or leaktightness		
Opening state	Oxidation		
State of the glass	Break		
Presence of emergency key			
State of electrovalves	Blockage		
Verification of electrical connections	Re-tightening		
Verification of the pressure relief manometer	State		
Verification of the pressure switch	Value relative to diameter		
Verification of the Venturi effect system			

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Points to be checked	States	Diagnostic	Periodicity
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6) Caracteristics of the various models :

	POLLU-PLUG (mm)												
	100	200	250	300	380	400	500	590	600	700	800	900	1000
CHARACTERISTICS													
Overall width (mm)	150	300	380	450	570	600	750	880	900		1200		1550
Overall length (mm)	515	615	665	700	865	865	1065	1265	1265		1665		2050
Feed type (inch)	¼	¼	¼	¼	¼	¼	¼	¼	¼	¾	¾	¾	¾
Atmospheric pressure volume (m3)	0.001	0.015	0.023		0.072	0.079	0.138	0.246	0.25		0.6		1.2
Pressure use (bar)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1	0.8	0.6	0.5	0.4
Total volume in pressure (m3)	0.024	0.033	0.052		0.157	0.175	0.3	0.492	0.51		0.96		1.7
Nitrogen bottle volume (m3)	1	1	1	1	1	1	1	1	1	3.7	3.7	3.7	3.7
Man. Control box ¼" – 1m3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Remote control box ¼" – 1m3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	no
Man. Control box ¾" – 3.7m3	possible								Yes	Yes	Yes	Yes	Yes
Remote control box ¾" – 3.7m3	possible								Yes	Yes	Yes	Yes	Yes
1m3 bottle supplied	Yesi	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
3.7m3 bottle supplied	No	No	No	No	No	No	No	No	No	No	No	No	No
Man. Inflation speed (min.)									3'+/-		4'+/-		
Auto. Inflation speed (min.)									3'30"+/-		4'30"+/-		
Number of inflations with 1m3 (without venturi)	40	30	19	10	6	5	3	1	1	impossible			
Number of inflations with 1m3 (with venturi)	20	15	9	5	3	2	2	1	1	impossible			
Number of inflations with 3.7m3 (without venturi)	154	112	71		23	21	12	6	7		3		2
Number of inflations with 3.7m3 (with venturi)	72	66	35		11	10	6	4	3		1		1
Deflation speed with use of venturi	20"	25"	39"		2'	2'30"	4'	7'	7'20"		17'		34'

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