maximizes the exposure of the perlite media within each cartridge filter and produces the lowest possible flux rate / hydraulic loading rate (gpm/ft^2 or gpm/cartridge). This operational design aspect of the float controlled valve ensures that media bed is loaded no faster than the storm inflow to the system.

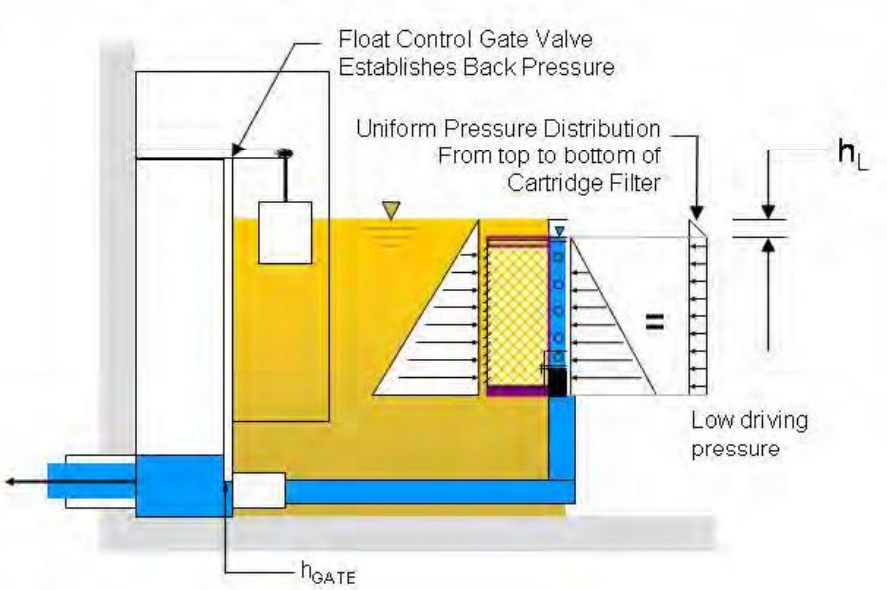


Figure 6. Uniform Vertical pressure distribution produced across each cartridge in an MFS unit by the float control valve

When storm water runoff flow recedes, the float controlled slide gate will close until the next triggering runoff event. At the end of the storm event, the remaining water is slowly released at ≤ 3-gpm through each cartridge and the slide gate, until the vault is drained to the outlet pipe's invert level. This ≤ 3-gpm/cartridge drain down is an engineered process that has been designed into the slide gate and is referred as the "leakage". This operation of the slide gate assures that media are not exposed to shocking, hammering and/or abrupt hydraulic forces that can destabilize and/or induce channelization through the media. The result of this design operation is high quality filtered water due to the overall low hydraulic loading rate (gpm/cart or gpm/ft^2) on the media filled cartridges.

Cartridges are positioned 21-in (533-mm) above the vault floor providing a volume for settling larger, heavier sediments below the cartridges, therefore preventing occlusion of the media resulting from rapid sediment buildup. The system when operating at 9-gpm/cartridge (34-Liter per minute /cartridge) design loading rate has a maximum upflow velocity of approximately 2-mm/sec t/sec). At this upflow velocity, particles greater than 63-micron (µm) with a specific gravity of 2.65 will settle in the area beneath the cartridges removing the majority mass of solids found in storm water runoff. This design feature makes it easier to maintain the system and negates the need to thoroughly clean the entire vault structure each time it is necessary to exchange/recharge the cartridge media.

Storm Water Treatment Applications

The **Media Filtration System** has been developed for a wide variety of applications where control of fine particles and achievement of the 80% TSS removal has been established as a regulatory requirement. These requirements have generally been imposed on new and redevelopment projects and include such applications as:

- Parking lots at commercial and industrial sites
- Medium and high density residential areas
- Maintenance facilities and corporation yards
- Transportation – roadways, bridges and transit facilities

The **Media Filtration System** has a small footprint, is underground and can be installed with traffic bearing cover that virtually eliminates land requirements.

Volumetric Control of Runoff Design

The MFS unit can be designed to provide increased detention volume. This additional volume of water is detained using volumetric controls allowing the water to be treated over a longer duration of time.

Vector Control

The MFS unit can also be configured to completely drain down the entire vault to control mosquitoes.

Media Selection for Physical Filtration

The effectiveness of perlite as a media for fine particle TSS, Total phosphorous and Heavy Metals removal in the laboratory and in field applications has been documented. Varieties of filter media have been developed for removal of specific pollutants from drinking water and waste water and can be applied in the CDS MFS cartridges. Each media has its own characteristic to remove specific pollutants. CDS engineers will assist in evaluating use of other types of media where site-specific conditions require removal of pollutants that are not addressed through removal of fine solids. Alternative medias other than Perlite will be tested during the remainder of 2006- 07 and results available.

Design Criteria

The regulatory requirements for the design of storm water treatment BMPs varies from entity to entity and may specify removal efficiency for a specific pollutant (solids, metals or phosphorous), reflect a water quality volume or water quality flow rate from a design storm event that must be treated.

The Washington Department of Ecology typically uses the Western Washington Continuous Simulation Hydrology Model (WWHM) and allows the use of the more conservative Santa Barbara Urban Hydrograph (SBUH) an instantaneous run off model to estimate the water quality runoff flow. Typically flow rates per cartridge range from 9-gpm to 20-gpm depending on the chosen Hydrology model. Once the runoff flow or runoff volume and drain down time is determined, the number of cartridges can be determined based on the specified design treatment flow and the estimated sediment loading capacity of each cartridge. Bypass system (either internal or external) will be designed for bypassing the flow exceeding the design treatment flow.

Cartridges can be provided in various heights ranging from 12 to 22-inches requiring 17 to 27-inches of head differential between the inlet and outlet to operate the system at its peak treatment loading rate.

Design Features

The **Media Filtration System** couples several unique design features that provides for enhanced solids removal and ease of maintenance. These features include:

- A large underbay (forebay) for pretreatment that is located under the cartridges
- An adjustable level float control valve that assures a uniform pressure distribution across the entire height of the media cartridge filters
- An adjustable level float control valve that ensures the lowest possible hydraulic loading rate (gpm/ft^2 or gpm/cartridge) will respond to low rate loadings for filtration at the lowest possible rate allowed by the storm event
- An adjustable level float control valve that ensures the smooth possible hydraulic loading of the filter cartridges, eliminating artificial shock loadings that cause break-through of the media bed and reduce filtration performance

- Alternative internal bypass features to eliminate the need for additional structures for flow regulation
- Patented filter cartridge support system that facilitate easy maintenance and cartridge replacement
- A slip connection with an o-ring gasket at the bottom of the cartridge which secures the cartridge on the support rack - eliminating threads and fragile plastic machining - making the system robust to the rigors of maintenance
- A fail safe baffle system for control of floatables, including free oil and grease
- Multiple configurations - inlet trench, manhole, vault, box culvert and cast-in-place to best meet the filtration needs of various potential site applications

Pretreatment – Primary Clarification

The **Media Filtration System** with its vault treatment capability will function with no need for pretreatment in most applications. In most storm water applications, vegetation, trash and debris loadings and/or oil and grease loadings are to be expected. A Continuous Deflective Separation (CDS) indirect screening unit used as a pre-treatment structure will create a more effective treatment train, better suited to process the wide range of water quality constituents transported in storm water runoff. Pretreatment increases filter run time and life, reduces the necessary maintenance frequency and the associated costs by trapping coarser particulate associated pollutants prior to filtration. Additionally, oil and grease in storm water runoff have been found to be largely associated with sediments and attached to trash and debris, and its removal may be desired to extend the media cartridge operation.

Construction and Installation

The precast **Media Filtration System** is most often delivered to the job site ready for installation. CDS staff readily provides assistance as needed during installation. The vault can be operated as a sedimentation tank prior to final completion of the project (site stabilization, paving, cleaning of the storm drains and landscaping) and prior to final installation of the cartridges and float control system. Operation of the vault system as a sedimentation tank pending project completion can provide opportunities for control of pollutants during the construction erosion control plan phase of the project.

PERLITE MEDIA SPECIFICATIONS

The present media tested in the laboratory and field evaluations is an inert perlite. This type of coarse perlite is readily available from multiple manufacturers around the United States.

The size of the media ranges from 0.125 to 0.375-inches (3.2 to 9.5-mm). The dry bulk density ranges from 4.5 to 6.5-lbs per cubic foot. The following table shows a typical particle size distribution of the coarse perlite media.

Sieve Analysis of the Coarse Perlite Media:

US Sieve No.	Sieve Opening		% Retained by Volume
	(mm)	(µm)	
4	4.76	4760	35 - 50
8	2.36	2360	75 - 99
16	1.18	1180	98 - 100
30	0.60	600	99 - 100
50	0.30	300	99 - 100
100	0.15	150	99 - 100

ADVANCES & BENEFITS COMPARED TO OTHER MEDIA SYSTEMS

This summary is intended to provide a basis to evaluate the benefits of the CDS MFS in relation to other cartridge filter media systems that may appear to be similar to the CDS MFS system.

- The CDS MFS is designed with a single float gate to control the rate of flow through the cartridge. This float gate responds to the flow rate in the inlet pipe and the corresponding depth of water in the vault. The float gate is designed to allow up to 3-gpm/cartridge treatment flow rate while the water is rising in the vault. This allows the cartridges to become fully submerged during treatment at higher flow rates. When the water level reaches1" below the top of the cartridge, the float gate begins to rise and opens the control orifice. At this point the treatment flow rate begins to increase up to the maximum (design cartridge flux rate) 9-gpm/cartidge .

  Example: A singe CDS MFS cartridge sized at 9 gpm/ cartridge

  A single Siphon Actuated cartridge sized at 7.5gpm/ cartridge

  Actual Water Quality flow rate maximum = 6 gpm/ cartridge

  In this example, once both cartridges are fully submerged with 1" of water above the cartridges, the CDS MFS cartridge float gate would have only

risen 2" allowing a portion of the control orifice to be used, thus regulating the flow to 6 gpm/ cartridge. The siphon actuated cartridge float would have risen to the top of the cartridge completely exposing the control disk at the bottom of the cartridge and treating at the full 7.5 gpm / cartridge. A siphon valve is either in the full open or closed position and can only batch process the influent at its constant, peak operating rate. The CDS MFS actually allows for 1.25-times the contact time with the media compared to the siphon actuated system.

- The CDS MFS uses a single float controlled slide gate to regulate its flow through the filters. No siphon valve is required in each cartridge as is presently deployed in other cartridge systems. This single float controlled slide gate eliminates the demand for hoods over the cartridges, because a siphon operated system demands that a hood be placed over the filter to seal the flow path and prevent an air break in the siphon.

  Algal growth may occur when the media is not exposed to the air between storm water events. Open cartridges promote a drier, aerobic environment that will not support algal growth that may foul the media.

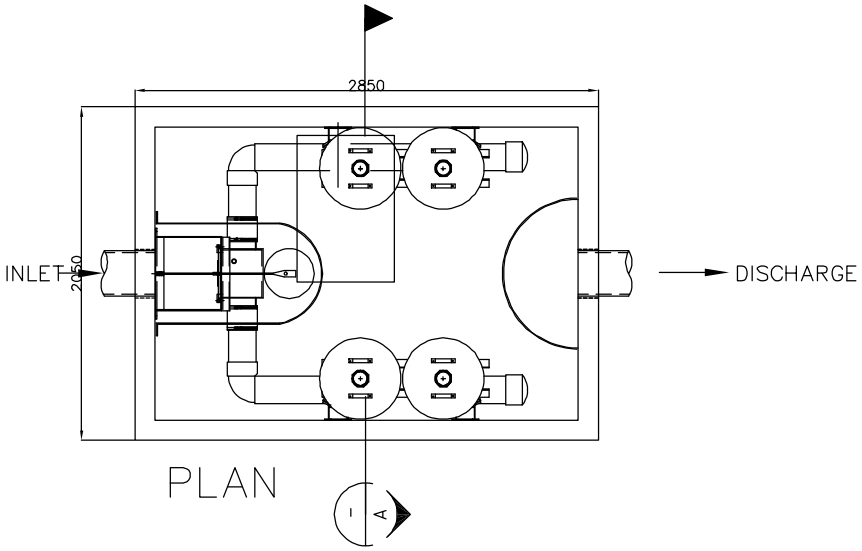
- The CDS MFS utilizes a standard height 22-inch tall cartridge filter. This provides approximately 22% more volume of media than currently designed systems. More media equates to higher volumes of water treated.

  Using a 22-inch tall cartridge at 9-gpm, equates to 1-gpm of treatment for each 2.44-inches of vertical height of media; for 18-gpm, 2-gpm of treatment for each 2.44-inches of vertical of height of media is used. CDS has cartridge heights available from 12 to 22-inches, allowing for flexibility in low head applications. The same ratio of 1-gpm per 2.44-inches for WWHM design, or 2-gpm per 2.44-inches for SBUH designs, of media height will be followed for all installations in Washington.

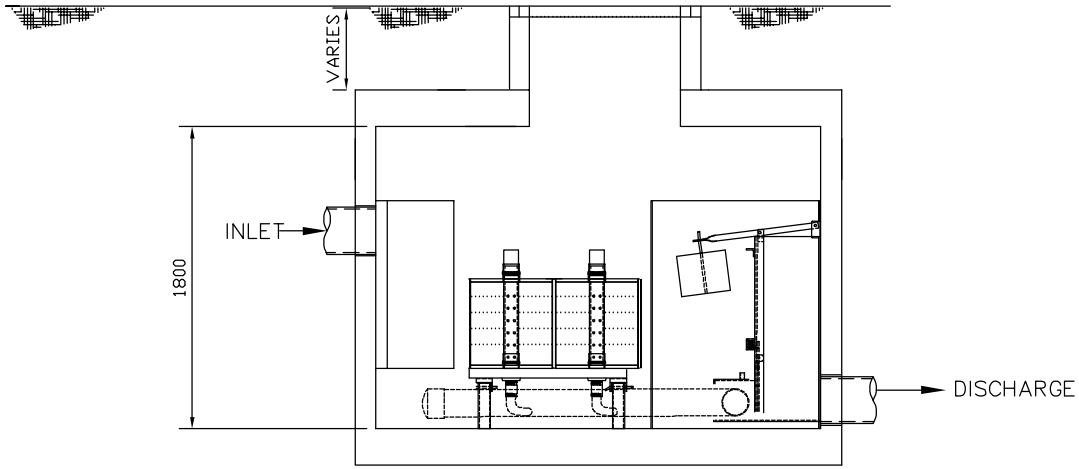
- Maintenance of the CDS MFS does not require special equipment or proprietary media. CDS™ Technologies Inc. will provide media manufacturers and exact gradation of filter media to municipalities who wish to perform their own maintenance or contract with readily available commercial maintenance services. Contracts for service from CDS will always be available if desired.

WARRANTY

CDS warranties all of the storm water product installations against defects for a period of 1-year (12-months). The product improvement warranty has been upheld on all CDS MFS installations in Washington and Oregon.



PLAN



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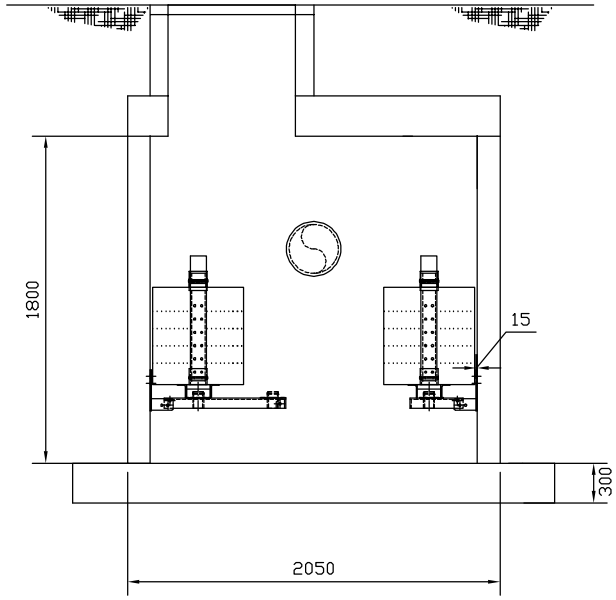


SECTION
A–A

REV	DATE		BY	CHK	CIVIL/STRUCTURAL	HYDRAULIC
0	3/8/06	STANDARD DRAWING	LH	LH	PW	LH
					APPROVED	

REFERENCE

DRG NUMBER TITLE

CONTRACT No.	TYPICAL	
DESIGNED	LH	
DRAWN	LH	3/8/06
CHECKED	DP	3/8/06
CIV & STRUCT DESIGN APPR.	PW	3/8/06
HYDRAULIC DESIGN APPR.	LH	3/8/06
PROCESS DESIGN APPR.		

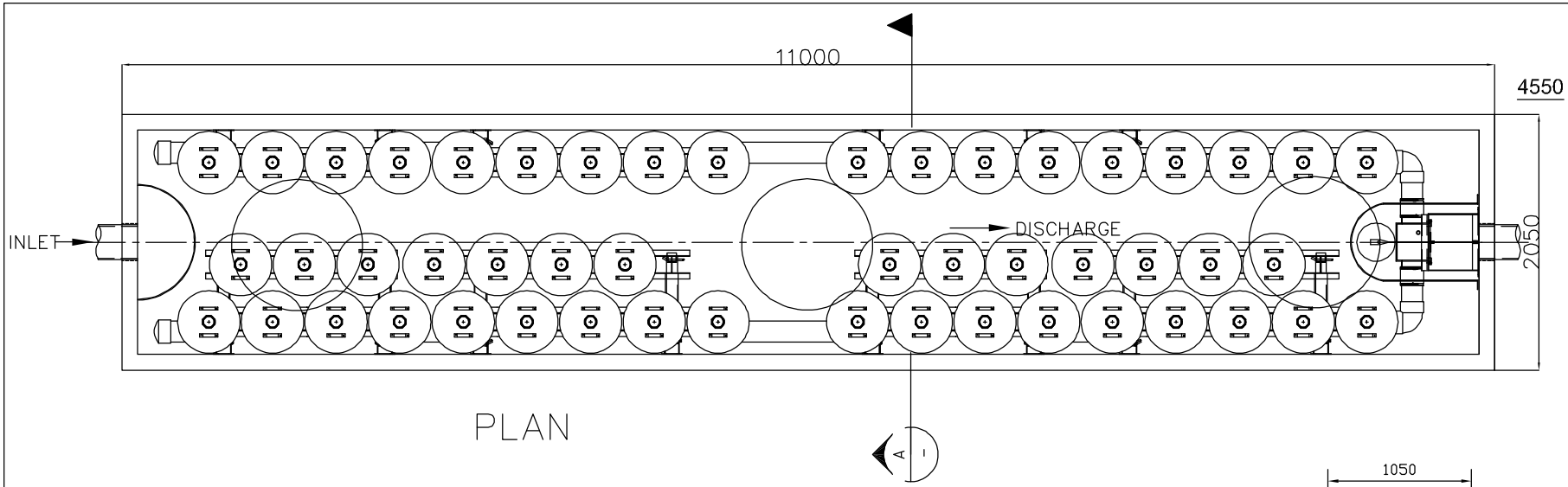
COPA WATER PTY LTD
16 GRAZIANI ROAD
AUBURN, NSW, 2144. AUSTRALIA
PO. BOX 1175
Ph. +61 (0) 2 9645 8000
Fax. +61 (0) 2 9645 8001
www.copawater.com.au

A1

STANDARD DRAWING

FILTERNATOR 0305
OPTIONAL LAYOUT
STANDARD DRAWING

Scale	DRAWING No.	REV.
NTS	FILTER 0305	0



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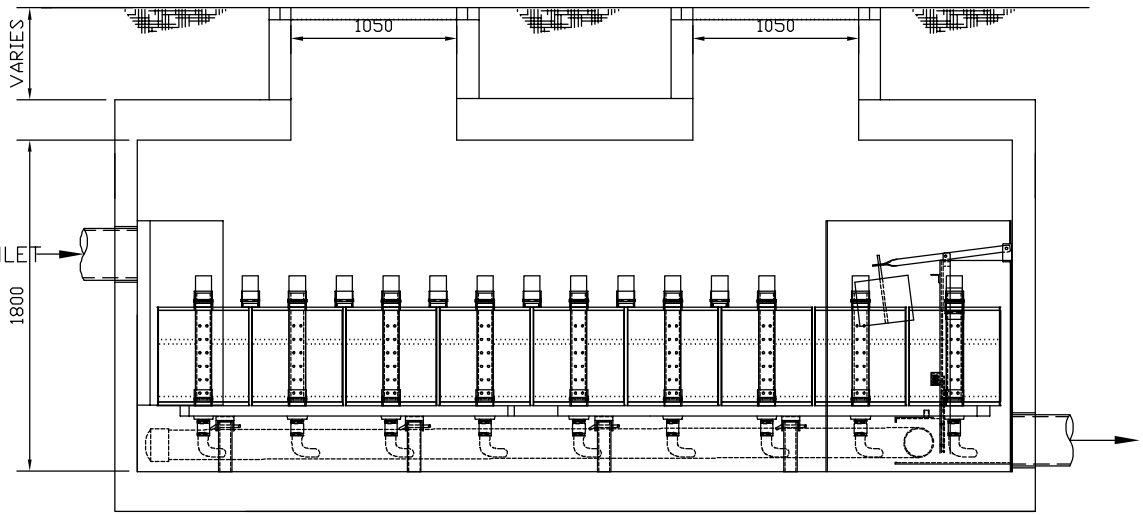
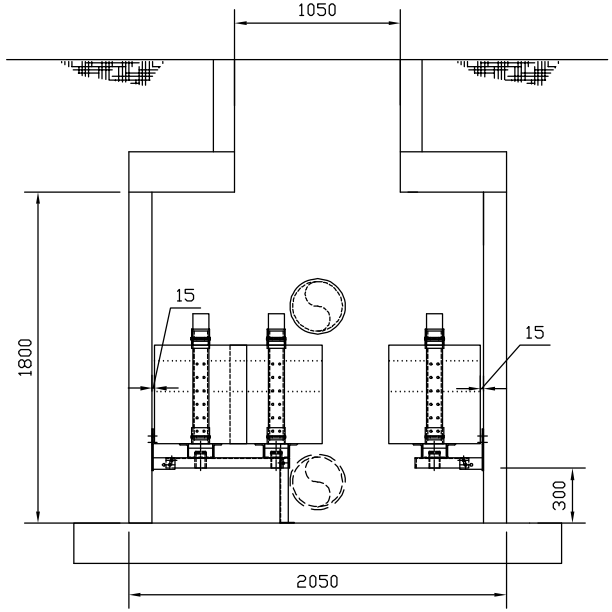


ELEVATION (TYPICAL)



SECTION
A–A

REV	DATE		BY	CHK	CIVIL/STRUCTURAL	HYDRAULIC
0	27/4/06	STANDARD DRAWING	LH	LH	PW	LH
					APPROVED	

REFERENCE

DRG NUMBER TITLE

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CHECKED	DP	27/4/06
CIV & STRUCT DESIGN APPR.	PW	27/4/06
HYDRAULIC DESIGN APPR.	LH	27/4/06
PROCESS DESIGN APPR.		

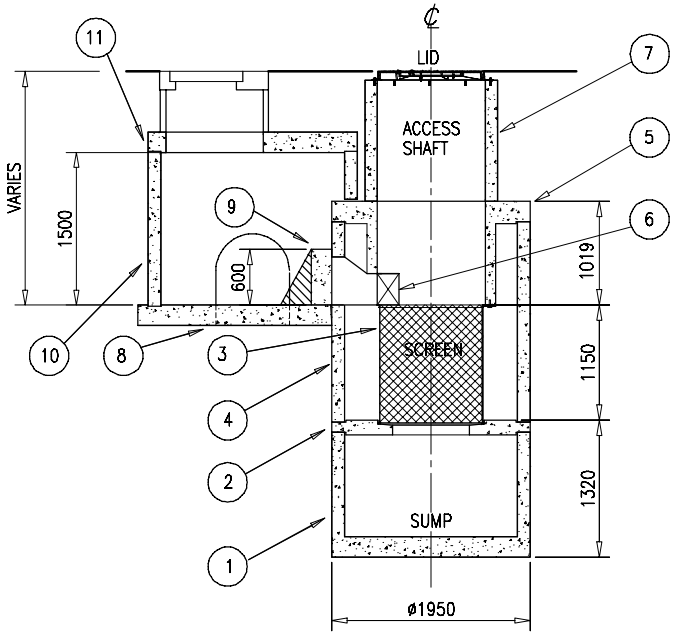
COPA WATER PTY LTD
16 GRAZIANI ROAD
AUBURN, NSW, 2144. AUSTRALIA
PO. BOX 1175
Ph. +61 (0) 2 9645 8000
Fax. +61 (0) 2 9645 8001
www.copawater.com.au

A1

STANDARD DRAWING

FILTERNATOR 4550
STANDARD DRAWING

Scale	DRAWING No.	REV.
NTS	FILTER 4550	0



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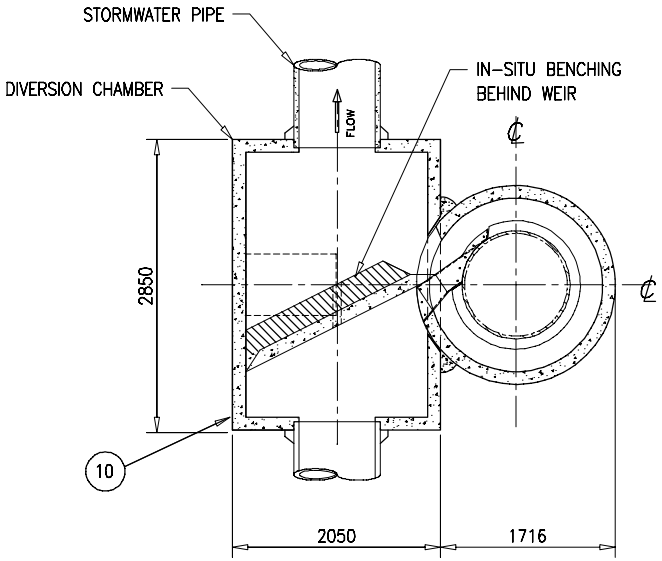

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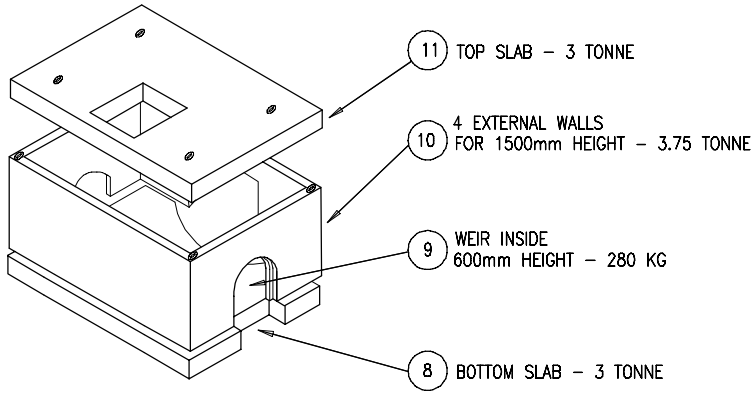
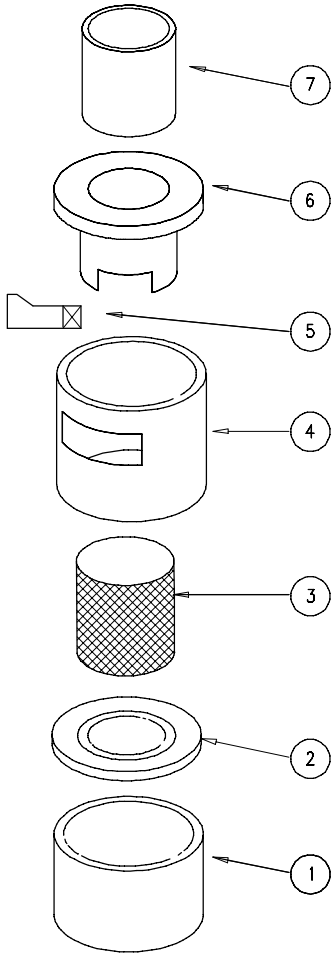


CDS DIVERSION CHAMBER

ACCESS SHAFT 1200mm HIGH	1330 KG
TOP SLAB OF DIVERSION CHAMBER WITH CYLINDER	2230 KG
INLET TUBE	50 KG
SEPARATION CHAMBER	2650 KG
SEPARATION SCREEN ø1000 316 STAINLESS STEEL MESH	20 KG
SEPARATION CHAMBER BOTTOM SLAB (SHEAR CONE)	780 KG
SUMP	3320 KG
TOTAL WEIGHT	10380 KG



ASSEMBLY

DRG. No.	SUBJECT
	REFERENCE DRAWINGS

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DO NOT SCALE THIS DRAWING, USE WRITTEN DIMENSIONS ONLY

STANDARD DRAWING

COPA WATER Pty Ltd
A CDS GROUP COMPANY
ABN 27 066 909 591
16 RAGLAN ROAD
AUBURN, NSW. 2144
Ph: (02) 9645 8000
Fax: (02) 9645 8001
Email: info@copawater.com.au

MATERIAL:	DESIGNED:	DATE:	SIGNATURE:
AS SHOWN	D.M.	29/8/5	
SCALE: 1:25	DRAWN: S.M.	29/8/5	
SHEET SIZE: A3	CHECKED:		
	APPROVED:		

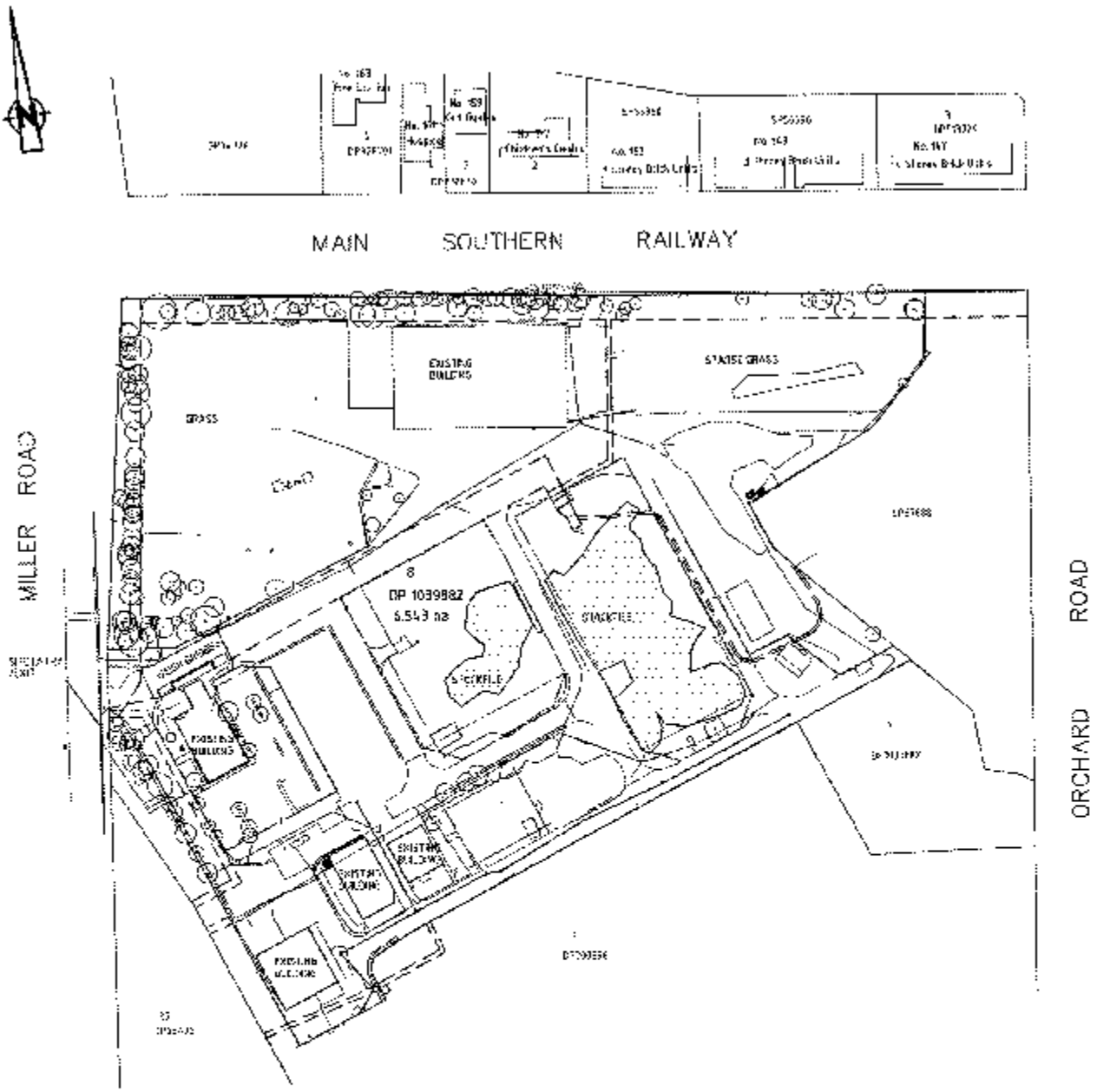
CLIENT:

PROJECT NAME / ADDRESS:
CDS P1012R UNIT
STORMWATER TREATMENT

DRAWING TITLE:
PRECAST DIVERSION CHAMBER (18 x 15)
GENERAL ARRANGEMENT

PROJECT NUMBER	REVISION:
CDS P1012R	A

APPENDIX C
DRAWINGS



PLAN

SCALE 1:2500 [@A4 SIZE]

LEGEND

PROPERTY BOUNDARY

EASEMENT

STOCKPILE

25 0 25 50 75 100m

SCALE OF METRES
[2500 IAT A4 SIZE]

WADE CONSULTING GROUP
Civil & Structural Engineers
10th Floor, 144 Queen St
GPO Box 2765
Brisbane Qld 4001 Australia
Ph (07) 3229 1185
Fax (07) 3221 4401
E-mail mail@wadeconsult.com

FIRST FLUSH STUDY
MATERIAL RECYCLING FACILITY
EXISTING SITE LAYOUT

DESIGNED	AMT	22.08.06	DRAWING No. 0600/002-P01
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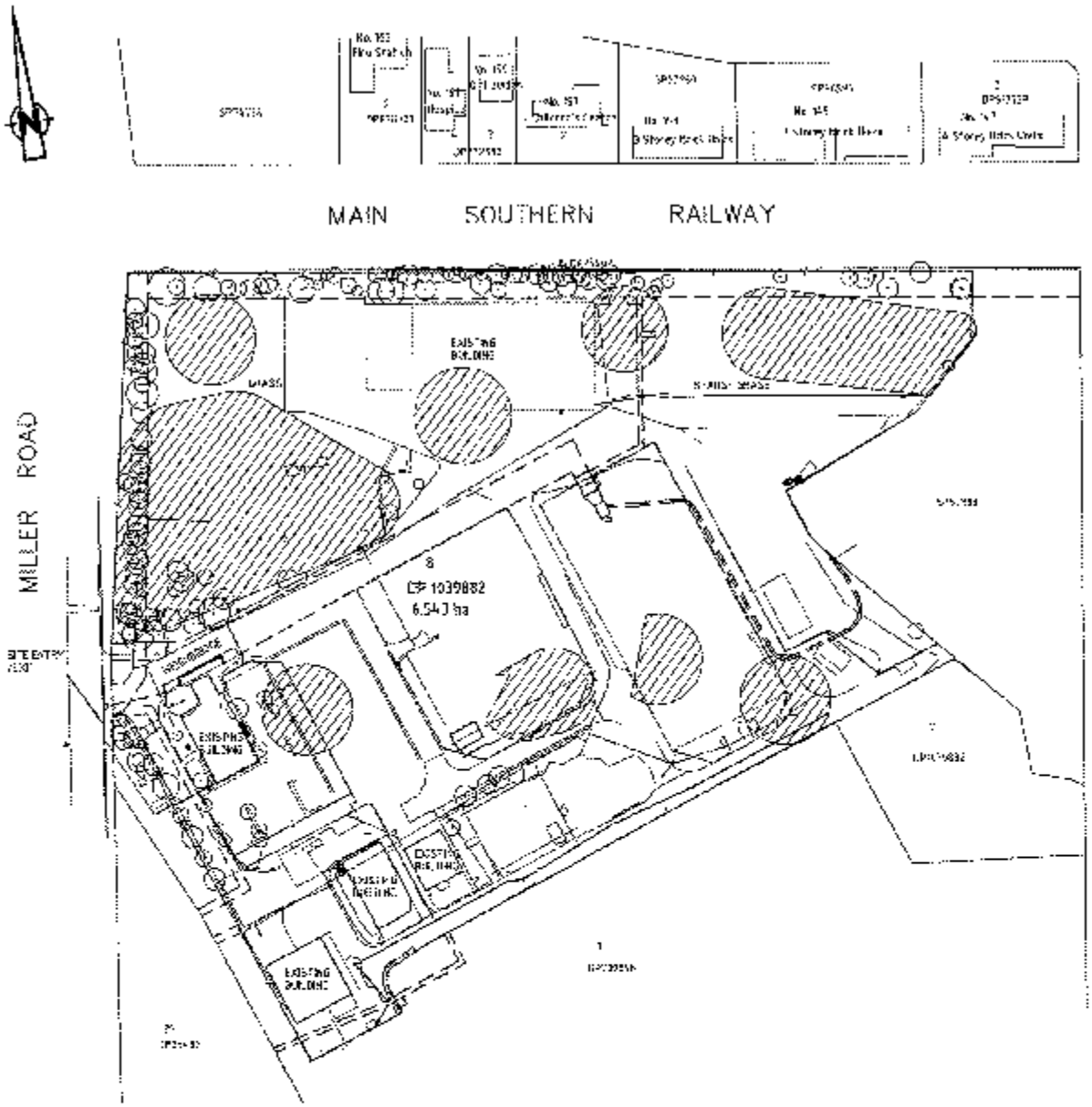
CAD FILE			



PLAN

SCALE 1:2500 (@A4 SIZE)

LEGEND

PROPERTY BOUNDARY

EASEMENT

CONTAMINATED LAND

75 0 25 50 75 100m

SCALE OF METRES
1:2500 (AT A4 SIZE)

WADE CONSULTING GROUP
Civil & Structural Engineers
GPO Box 2856

FIRST FLUSH STUDY
MATERIAL RECYCLING FACILITY
CONTAMINATED LAND PLAN

DESIGNED	AMT	22.08.06	DRAWING No. 0600/002-P02
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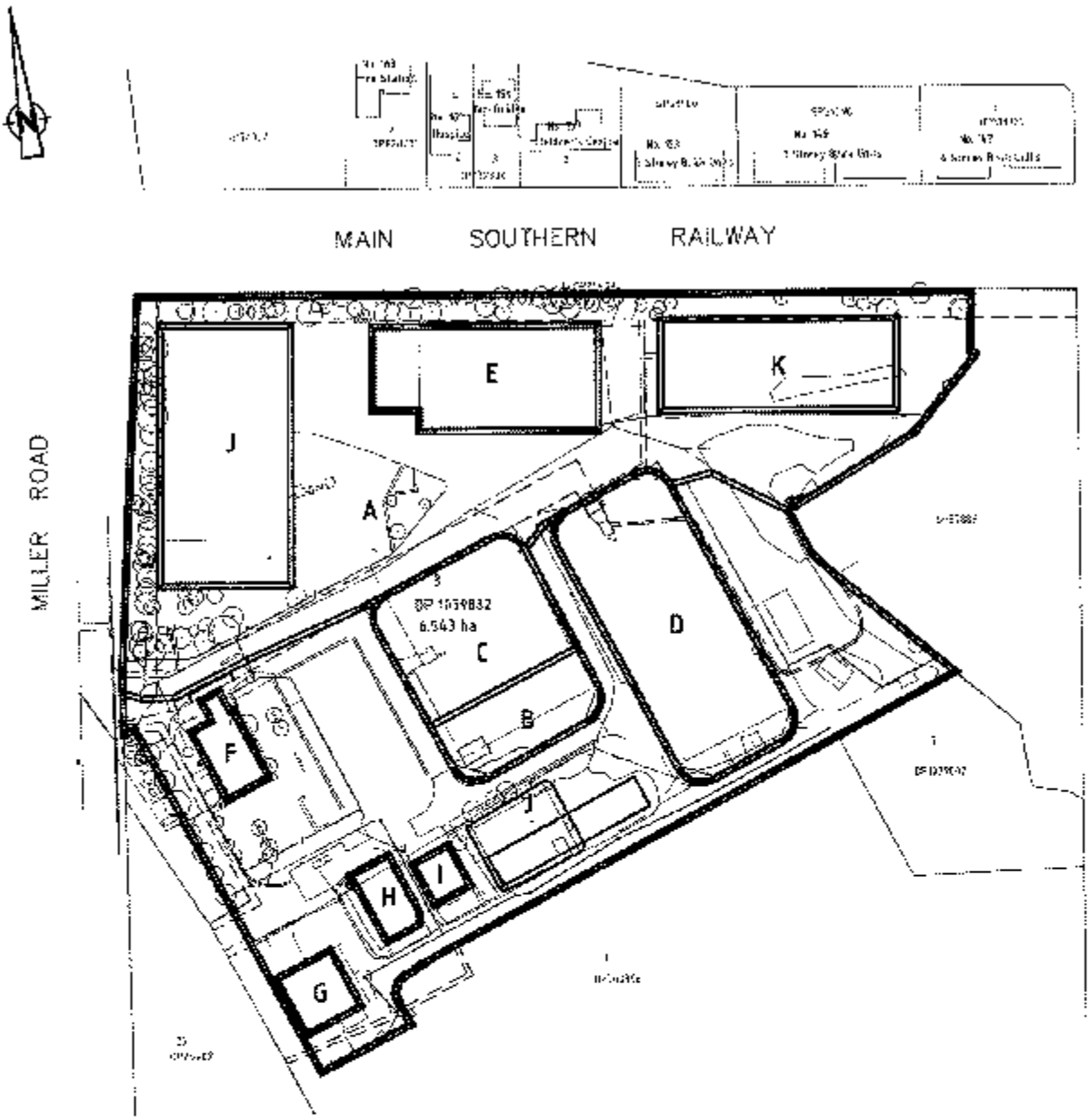

CATCHMENT	AREA (ha)
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C	0.335
D	0.570
E	0.335
F	0.059
G	0.057
H	0.047
I	0.026
J	0.500
K	0.315
TOTAL	6.542

PLAN

SCALE 1:2500 (@A4 SIZE)

LEGEND

PROPERTY BOUNDARY

EASEMENT

CATCHMENT BOUNDARY

25 0 25 50 75 100m

SCALE OF METRES
1:2500 (AT A4 SIZE)

WADE CONSULTING GROUP
Civil & Structural Engineers
12th Floor, 144 Queen St
GPO Box 2454
Brisbane Qld 4001 Australia
Ph (07) 3229 1182
Fax (07) 3211 1696
E-mail: mail@wadeconsult.com

FIRST FLUSH STUDY
STEEL RECYCLING FACILITY
CATCHMENT PLAN

DESIGNED	AMT	22.08.06	DRAWING No. 0600/002-P03
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APPROVED			
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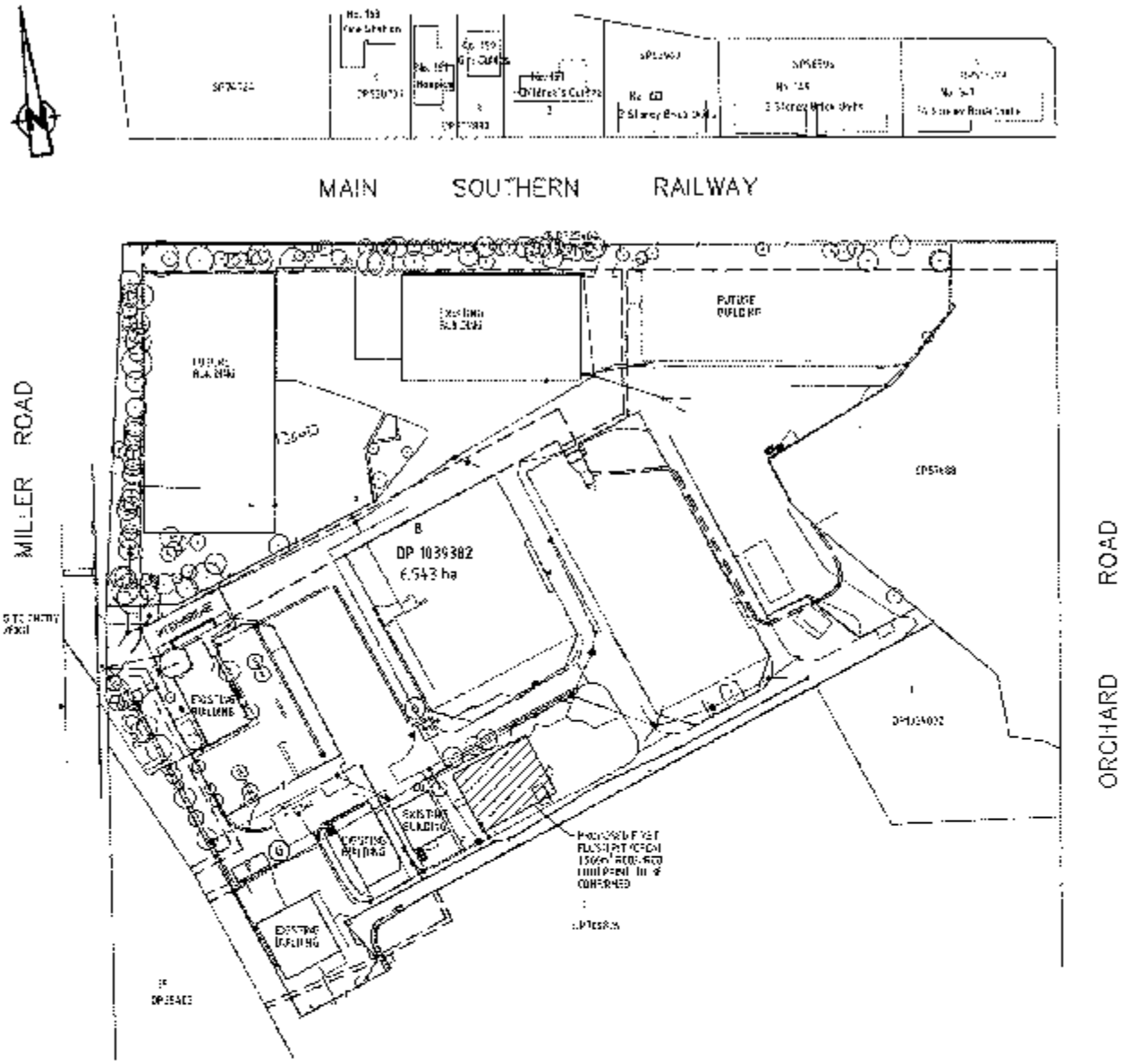
CAD FILE			



PLAN
SCALE 1:2500 (@A4 SIZE)

LEGEND

- PROPERTY BOUNDARY
- EASEMENT
- GROSS POLLUTANT TRAP (GPT)
- FILTERNATOR (F)
- FIRST FLUSH PIT

25 0 25 50 75 100m

SCALE OF METRES
1:2500 (AT A4 SIZE)

WADE CONSULTING GROUP
Civil & Structural Engineers
12th Floor, 241 Queen St,
GPO Box 2150
Brisbane Qld 4001 Australia
Ph: (07) 3221 1150
Fax (07) 3221 7388
E-mail: wade@wadeconsulting.com.au

FIRST FLUSH STUDY
MATERIAL RECYCLING FACILITY
INDICITAVE STORMWATER TREATMENT PLAN

DESIGNED	AMT	22.08.06	DRAWING No.
DRAWN	KJB	22.08.06	0600/002-P04
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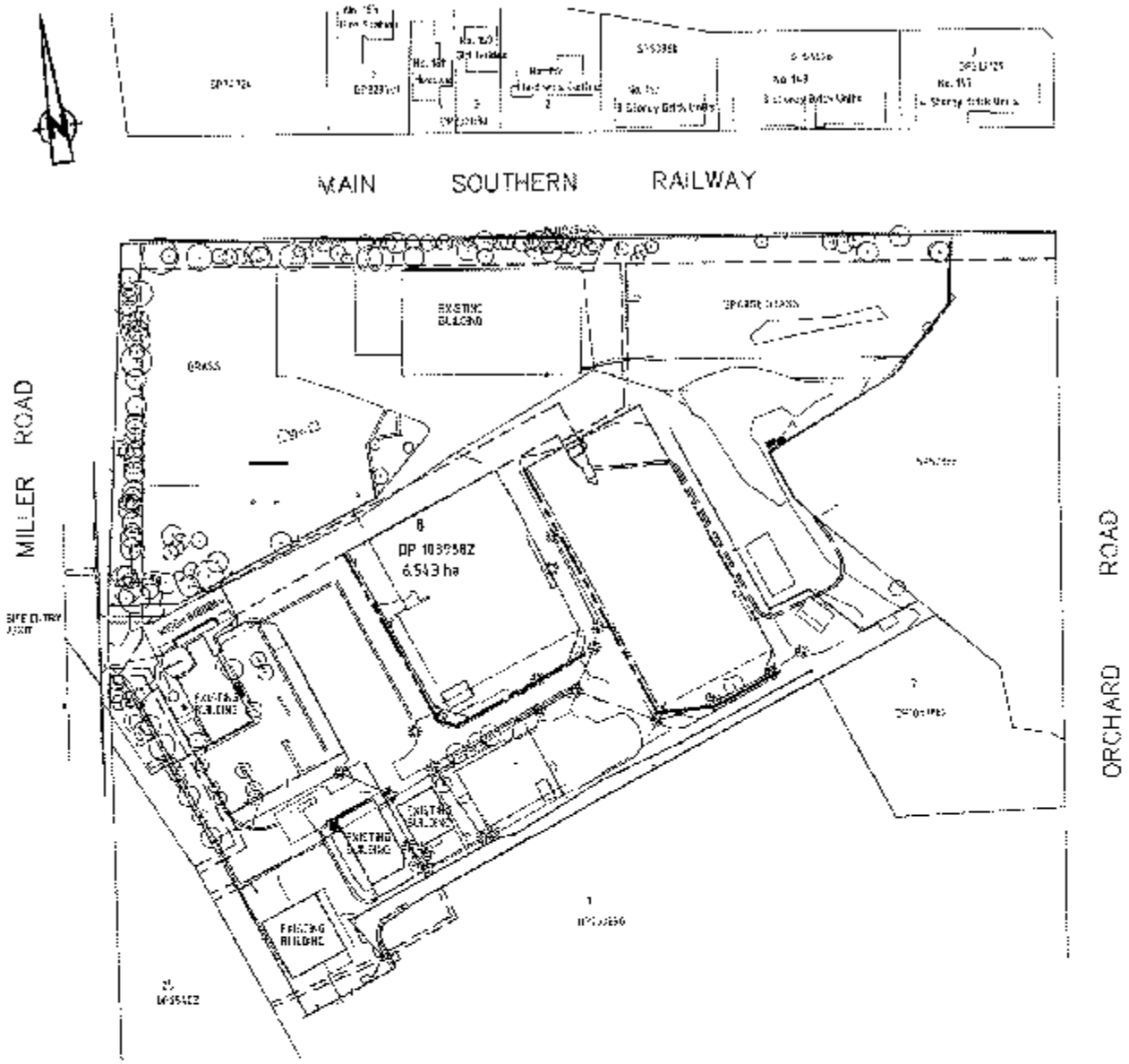

PLAN
SCALE 1:2500 (@A4 SIZE)

LEGEND

- PROPERTY BOUNDARY
- EASEMENT
- SEDIMENT FENCE (CONSTRUCTION PHASE)
- INLET PROTECTION (CONSTRUCTION PHASE)

25 0 25 50 75 100m

SCALE OF METRES
1:2500 (AT A4 SIZE)

WADE CONSULTING GROUP
Civil & Structural Engineers
12th Floor, 141 Queen St,
GPO Box 9156
Brisbane Qld 4001 Australia
Ph. (07) 3221 1153
Fax (07) 3221 7048
E-mail: mail@wadeconsult...com.au

FIRST FLUSH STUDY
MATERIAL RECYCLING FACILITY
INDICATIVE EROSION AND SEDIMENT CONTROL PLAN

DESIGNED	AMT	22.08.06	DRAWING No.
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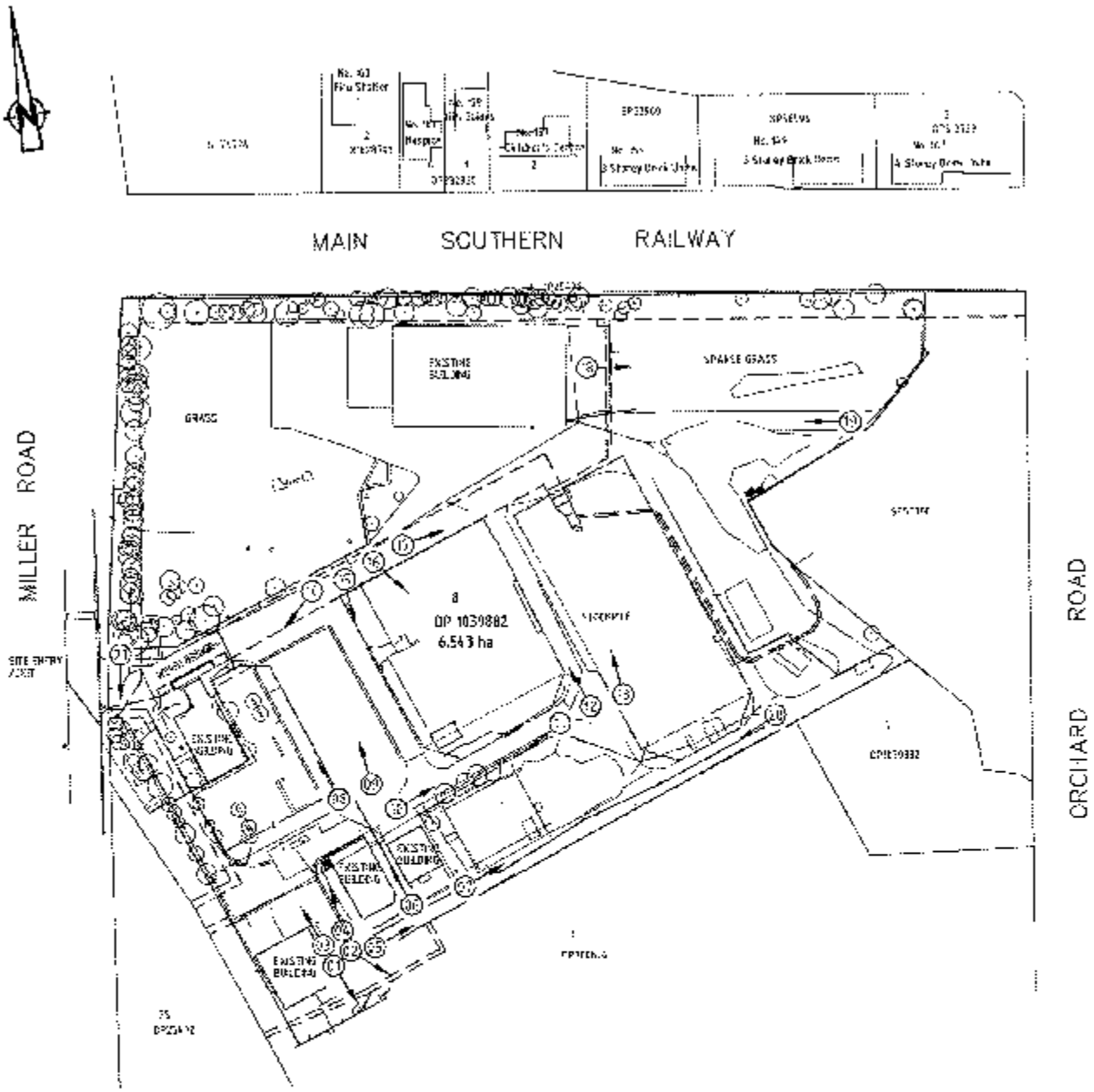
APPROVED			
SCALE	AS SHOWN		AUDT.
CAD FILE			



PLAN
SCALE 1:2500 (@A4 SIZE)

LEGEND

PROPERTY BOUNDARY
EASEMENT
PHOTOGRAPH LOCATION AND DIRECTION

25 0 25 50 75 100m

SCALE OF METRES
1:2500 (AT A4 SIZE)

WADE CONSULTING GROUP
Civil & Structural Engineers
12th Floor, 144 Edward St,
GPO Box 2552
Brisbane Qld 4001 Australia
Ph: (07) 3229 1188
Fax: (07) 3221 7330
E-mail: mail@wadeconsult.com

FIRST FLUSH STUDY
MATERIAL RECYCLING FACILITY
PHOTOGRAPH LOCATIONS

DESIGNED	AMT	22.08.06	DRAWING No. 0600/002-P06
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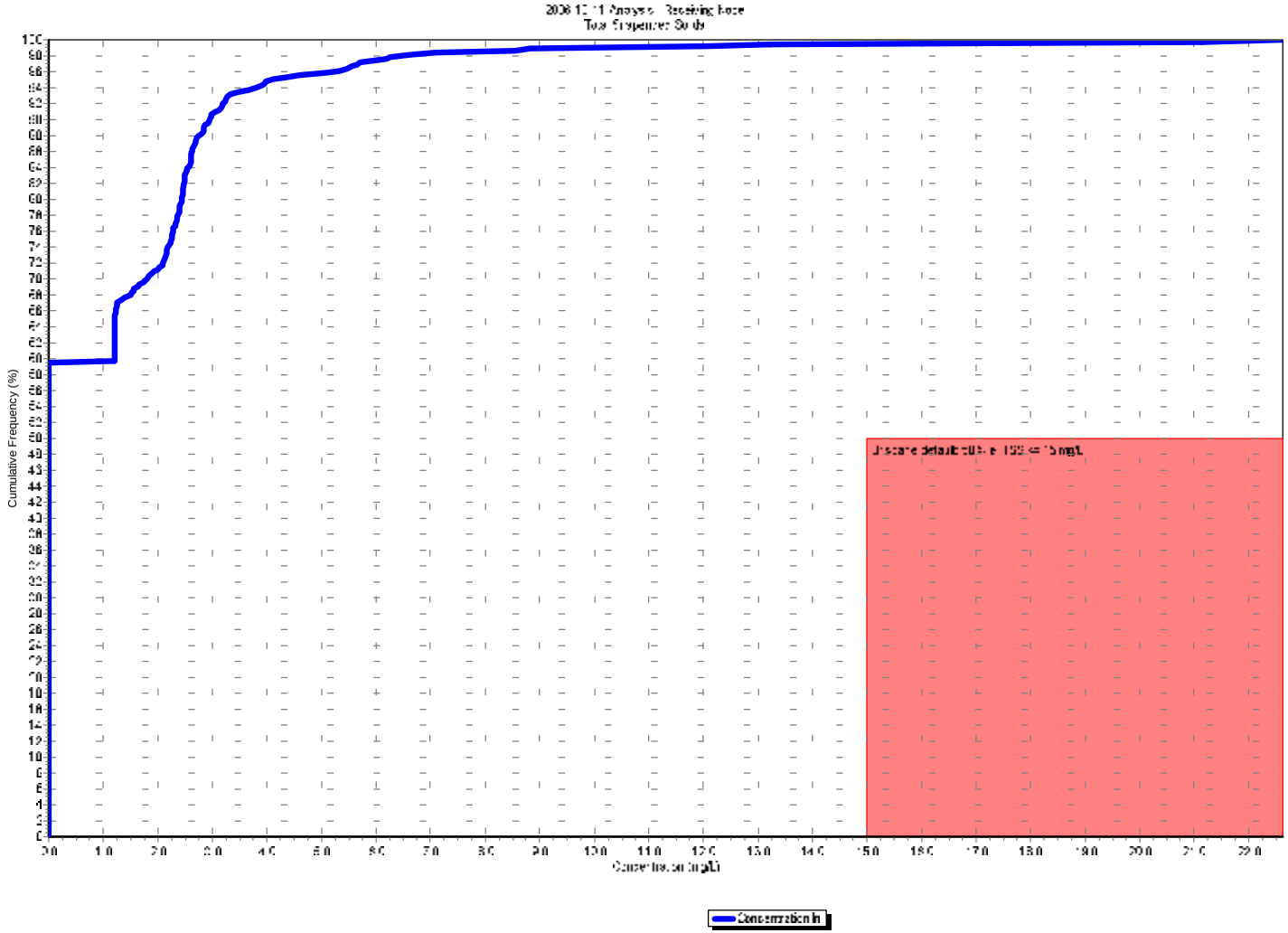
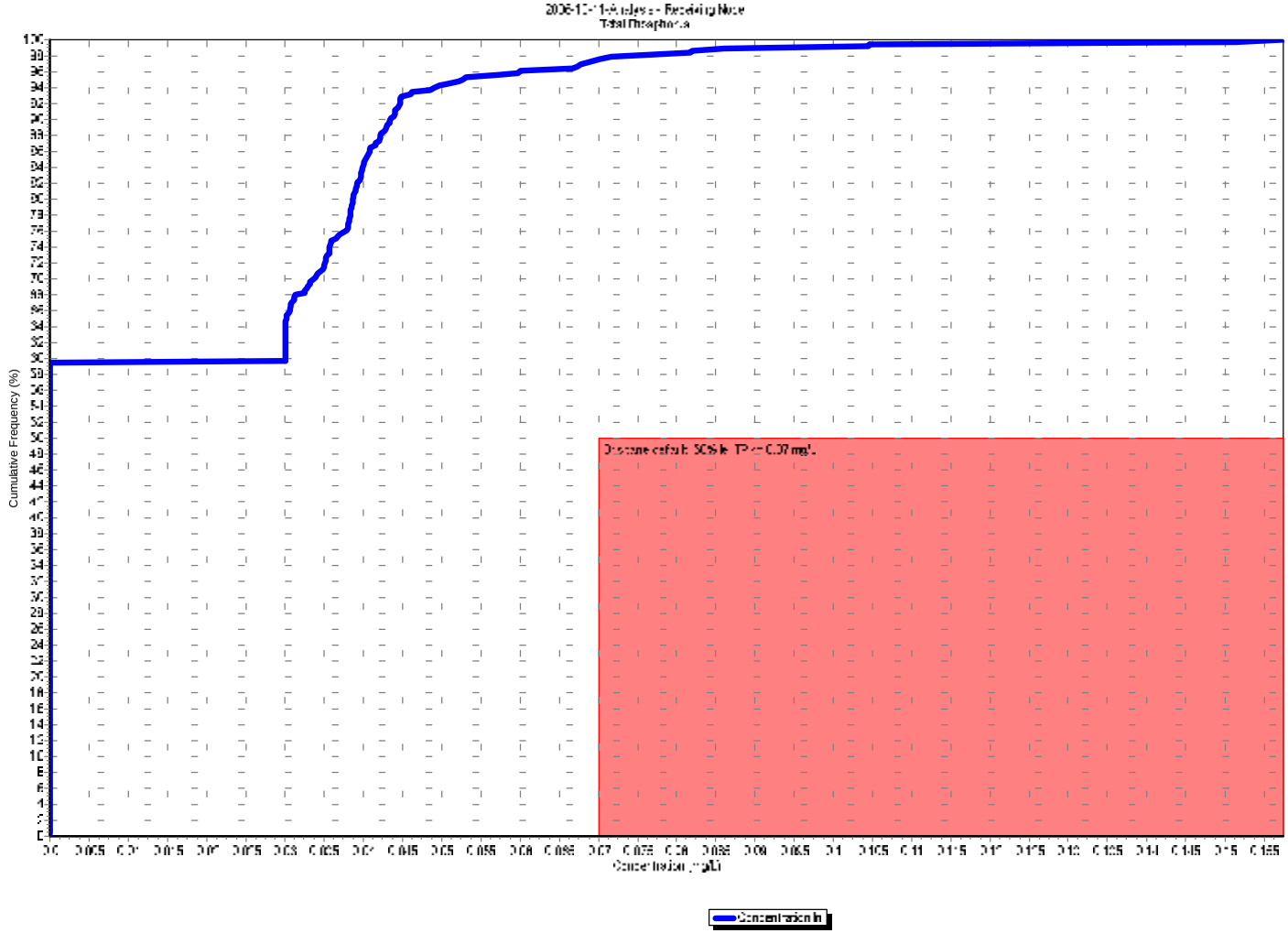
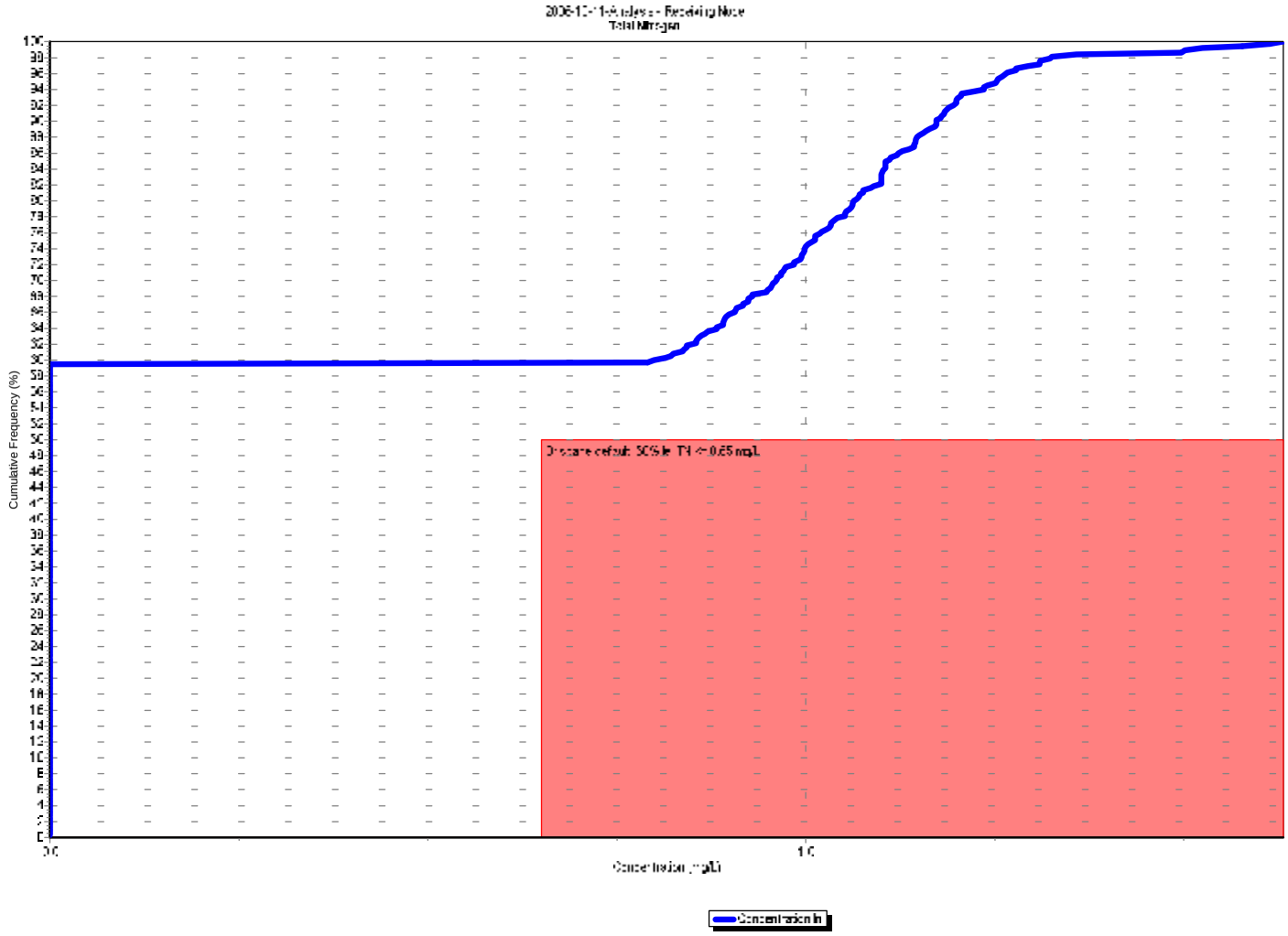
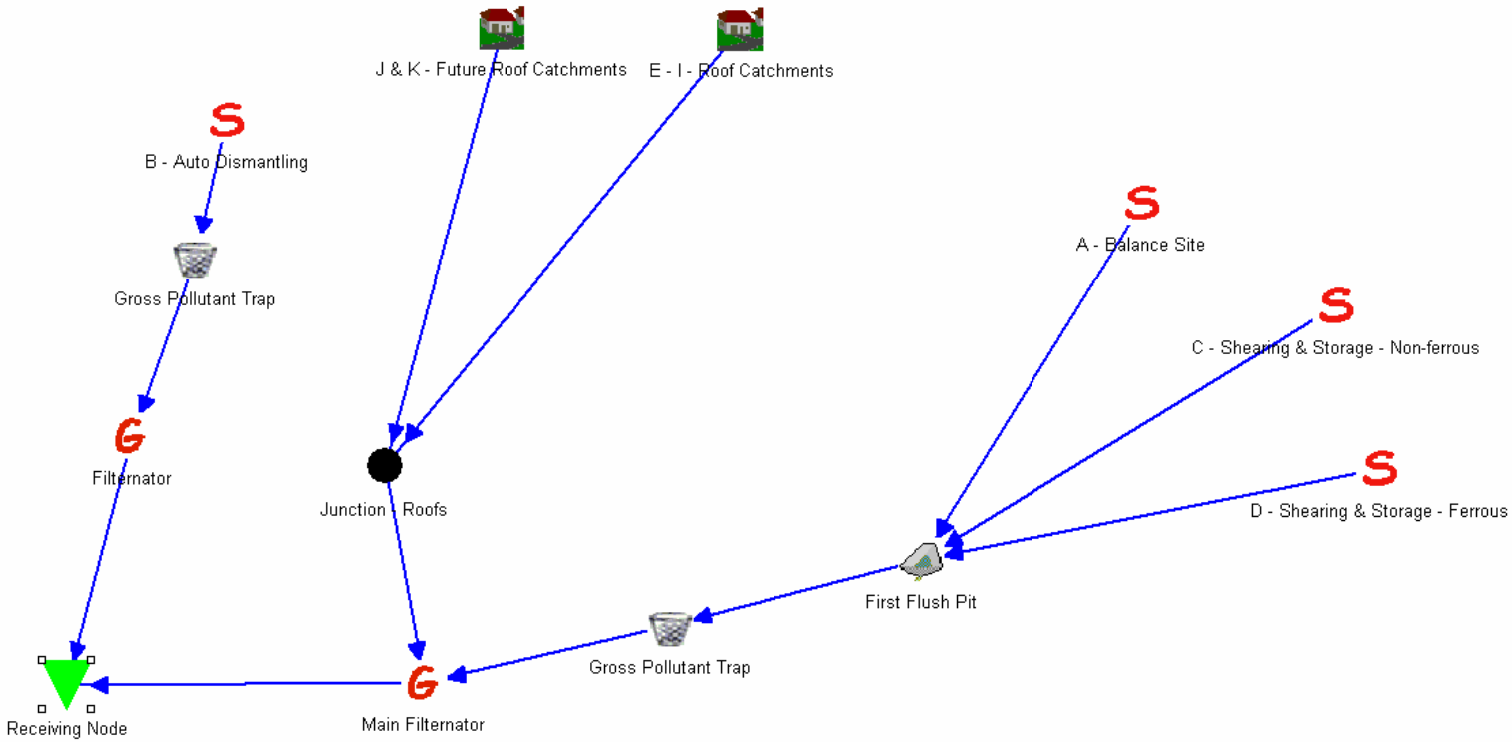
CAD FILE			AMDT.

APPENDIX D
MUSIC DATA


Cumulative Frequency (%)
Concentration (mg/L)
Concentration In


Cumulative Frequency (%)
Concentration (mg/L)
Concentration


Total Nitrogen
Cumulative Frequency (%)
Concentration (mg/L)
Concentration (


J & K - Future Roof Catchments
E - I - Roof Catchments
B - Auto Dismantling
Gross Pollutant Trap
Filternator
A - Balance Site
C - Shearing & Storage - Non-ferrous
D - Shearing & Storage - Ferrous
Junction - Roofs
First Flush Pit
Gross Pollutant Trap
Receiving Node
Main Filternator

APPENDIX E
SITE PHOTOGRAPHS

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

Photo 13

Photo 14

Photo 15

Photo 16

Photo 17

Photo 18

Photo 19

Photo 20

Photo 21