

DEP SPECIFICATION

**DRAINAGE SYSTEMS AND PRIMARY TREATMENT
FACILITIES**

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DESIGN AND ENGINEERING PRACTICE

DEM1



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design and engineering of onshore open and closed gravity based drainage systems and primary treatment facilities.

The importance of well designed, constructed, managed and maintained drainage and primary treatment facilities cannot be overstressed. Shortcomings in drainage and primary treatment systems and management can have significant impact on process safety and the environment and can result in significant and unnecessary expenditure for the installation of secondary water treatment facilities and their operating costs.

This DEP is intended to provide the user with a specification that will improve standards for good design and engineering practice for drainage and primary treatment facilities whilst emphasizing the importance of integrating these facilities with secondary/tertiary treatment facilities such as flocculation flotation units (FFU) and biotreaters. It is not written for parts of modular facilities where drainage is incorporated in the module, or for permafrost regions.

Guidelines relating to safety and the typical requirements during various project development phases are included so that these aspects can be accommodated during the design stage.

Although this DEP is intended for new construction projects, it is equally applicable to any extensions of existing facilities. It is not intended for revamp work and/or upgrading works, but may be consulted to comply with all required safety and environmental standards.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 - Application of Technical Standards.

This is a revision of the DEP of the same number dated February 2011; see (1.5) regarding the changes.

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This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this DEP as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
Primary treatment	is the step of water purification process based on the difference in density of the polluting substance and the medium carrying it, the former being removed either by rising or settling over a given time. It is also called gravity-based treatment, and used primarily to remove 'free floating oil' droplets from effluent streams.
Secondary treatment	comprises complex steps of water purification based on chemical and/or biological action or enhanced gravity separation. It is used to further remove unwanted suspended solids, oil and grease and dissolved contaminants from effluent streams.
Tertiary treatment	includes levels of treatment beyond secondary treatment. Tertiary treatment could include suspended solid removal, dissolved solid removal (such as phosphorous and nitrogen compounds) or removal of toxic chemicals and heavy metals. Tertiary treatment is also called "polishing". It is typically applied to improve the water quality such that the effluent can be reused.
Effluent	Effluents are aqueous streams, containing 98+% water, which can be contaminated with hydrocarbons, solids, chemicals. Effluents are discharged via drains within a facility that may or may not require treatment before they are either reused or discharged to public water. .
Sump/ collection pit/ catch basin	In this DEP, sumps, collection pits and catch basins are all considered the same: an area containing a number of drainage networks that have a common discharge point, e.g., an outfall to public water.

1.3.3 Abbreviations

Term	Definition
AC	Accidentally Contaminated
BOD	Biological Oxygen Demand
BOD₅	Biological Oxygen Demand [measured after 5 days at 20 °C (68 °F)]
CC	Continuously Contaminated
CDF	Controlled Discharge Facility
COD	Chemical Oxygen Demand
CPI	Corrugated Plate Interceptor
CR	Clear Rainwater
CW	Cooling water
FF	First Flush
FFB	First Flush Basin
FFU	Flocculation-Flotation Unit

Term	Definition
FFW	Fire Fighting Water
HSE	Health, Safety and Environment
HSSE	Health, Safety, Security and Environment
IDF	Intensity - Duration - Frequency
ODD	Oil Drip and Drain
POB	Peak Overflow Basin
TDS	Total Dissolved Solids
WMP	Water Master Plan

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (10).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a full revision of the DEP of the same number dated February 2011. The following are the main, non-editorial changes.

Section/Clause	Change
All	Feedback from the DEP feedback system is incorporated.
All	The DEP is restructured to improve readability.
All	A result of this restructuring is that SHALL [PS] statements have been reduced as some are combined.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swwww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (Other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL REQUIREMENTS

2.1 HEALTH, SAFETY AND ENVIRONMENT (HSE) IN DESIGN

1. Drainage systems at operating facilities shall be designed and installed in accordance with Shell standards and the Shell HSSE & SP Control Framework. This approach shall ensure that plant safety is not impaired by the drainage systems, e.g., the propagation of fire or gas from one area to another shall be prevented.
2. Safety in design is enhanced by attention to detail in pipe-to-pipe joints, joints of pipes to sumps, and in the covers of open channels and sumps. If further reference or clarity is needed on a specific issue not covered by this DEP, the Principal shall be consulted.
3. Area classification drawings shall be consulted.
4. Primary water treatment facilities SHALL [PS] be considered as hydrocarbon containing equipment.
5. The location of primary water treatment facilities SHALL [PS] be subject to the minimum safety distances as per IP 15 (referenced in DEP 80.00.10.10-Gen.).
6. Sumps and manholes that may contain flammable liquid or hydrocarbon SHALL [PS] maintain minimum safety distance of 15.0 m (50 ft) from any ignition source.
7. Prevailing winds and meteorological conditions shall be taken into consideration when choosing the location and orientation of the treatment facility. e.g. the treatment facility shall be located downwind of ignition sources.
8. Specific requirements for spill control shall be determined in conjunction with the Principal.

2.2 EFFLUENTS

2.2.1 General

1. Effluents are defined as (contaminated) water streams that are discharged via process drains, equipment drains and surface drains and may or may not require treatment before they are either discharged to public water
2. Dependent upon their source, type and level of contamination, effluents shall be classified into various categories. From each category, the required drainage network and eventual treatment facility shall be determined.
3. The segregation of all effluent streams shall, where possible start at the source, the preference being to reduce contaminant loading upstream in order to minimize treatment requirements downstream.

2.2.2 Effluent sources

1. The following sources of effluents can be identified at operating facilities and shall be considered as applicable, for new designs and or existing upgrades:
 - a. rainwater
 - b. fire fighting water and/or foams
 - c. wash down and/or flush water
 - d. cooling water blowdown and filter backwash tank bottom drains
 - e. floating tank roof drainage
 - f. equipment drains
 - g. sampling points
 - h. desalter drains
 - i. accidental spillages of crude or hydrocarbon products

- j. maintenance operations (e.g., exchanger bundle pulling, pump seal replacement)
- k. domestic sewers
- l. ships' ballast water
- m. cooling water return
- n. steam condensate
- o. water from ground seepages or springs
- p. dewatering systems (e.g., for construction)
- q. groundwater management systems

2.2.3 Effluent classification

1. For new designs effluents SHALL [PS] be classified as belonging to one of the following categories in Table 1.
2. Principal shall be consulted when doubt exists on the eventual classification of any effluent.

Table 1 Effluent classifications

Classification	Typical stream
Clear Rainwater (CR) - CR areas consist exclusively of areas where surface rainwater cannot be contaminated by hydrocarbons or chemicals.	• Surface water run off from clean areas, e.g., roads and car parks • raw water filtration bleed, demin effluent, boiler blow down, cooling water;
Accidentally Contaminated water (AC) - the AC system collects mainly surface water from all areas not designated as CR as well as other water streams, which normally meets the required water effluent specifications but could be on occasion contaminated	• surface water runoff from tank farms, , process areas, • cooling water blowdown;
Continuously Contaminated water (CC) - this includes effluent from continuous sources that contain significant percentage of hydrocarbons which normally do not meet the required water effluent specifications	• low BOD: ballast water, crude tank bottom drainage, surface water runoff from "dirty" process areas; • high BOD: tank bottom drainage from product/slops tanks, Process water containing oil and dissolved contaminants: see process water.
Domestic sewage	• E.g. streams from buildings, canteens
Oil drip systems	• atmospheric system for 'non-hazardous' service; • closed drip system for hazardous services 'hazardous' service;
Process water containing oil and dissolved contaminants as H ₂ S, NH ₃ COD, BOD	• sour water • desalter effluent
High TDS effluents	• spent caustic
Amine contaminated streams	• Amine spills in LNG facilities (Amine unit)

2.2.4 Effluent routing

1. Effluents SHALL [PS] be routed by means of drainage networks to selected treatment facilities and/or discharge points.
2. The selection of the routing for the effluents shall be determined in conjunction with the plant layout requirements and the process and environmental specialists responsible for the water/effluent treatment processes.
3. Typical destinations for effluents are:
 - a. Non-process effluents
 - i. CR: direct to public water without treatment.
 - ii. AC: to a controlled discharge facility with further treatment requirements based on discharge quality requirements.
 - iii. CC: to either a pre-separator, followed by an interceptor (e.g., CPI) to secondary treatment or directly to a buffer tank and a secondary treatment unit or directly to a collection sump.
 - iv. Once through cooling water return: via a controlled discharge facility to public water.
 - v. Domestic sewage: to a dedicated sewage treatment plant or biotreater facility.
 - vi. Open oil drips/drain effluents ('non-hazardous'): to collection sumps and recovery.
 - vii. Ships tanks washings: dependent upon salt content, to buffer tank and secondary treatment
 - b. Process effluent
 - i. Oil drips/drain effluent ('hazardous'): to dedicated recovery vessels and recycling.
 - c. Chemical effluents
 - i. Chemically polluted effluent streams: to dedicated secondary treatment facilities or for recovery and reprocessing in the process streams.
 - ii. Effluent streams contaminated with acids: to a neutralization pit/tank located as near as possible to the source of effluent discharge, with dedicated downstream treatment.
 - iii. Effluent streams containing solids, emulsifying agents, and contaminants that tend to flocculate upon dilution: treated and disposed of separately.
4. For a diagrammatic summary of standard forms of effluent classification and routing, refer to DEP Standard Drawing S 14.050.

3. WATER MASTER PLANNING

1. A water master plan (WMP) shall be developed and incorporate the following main topics:
 - a. Surface drainage and primary treatment facilities;
 - b. Process and Utility water integration;
 - c. Secondary treatment facilities;
 - d. Sludge handling and disposal;

- e. Industrial water preparation.
- This DEP deals only with the surface drainage networks and primary treatment facilities and their relation with the other treatment facilities which are an integral part of the Water Master Plan. This DEP focuses on the integration of surface water drainage and primary treatment water facilities with more enhanced secondary treatment facilities, and tertiary treatment (in case of water reuse).
 - A typical integrated flow scheme for a master plan is shown in Figure 1 below.

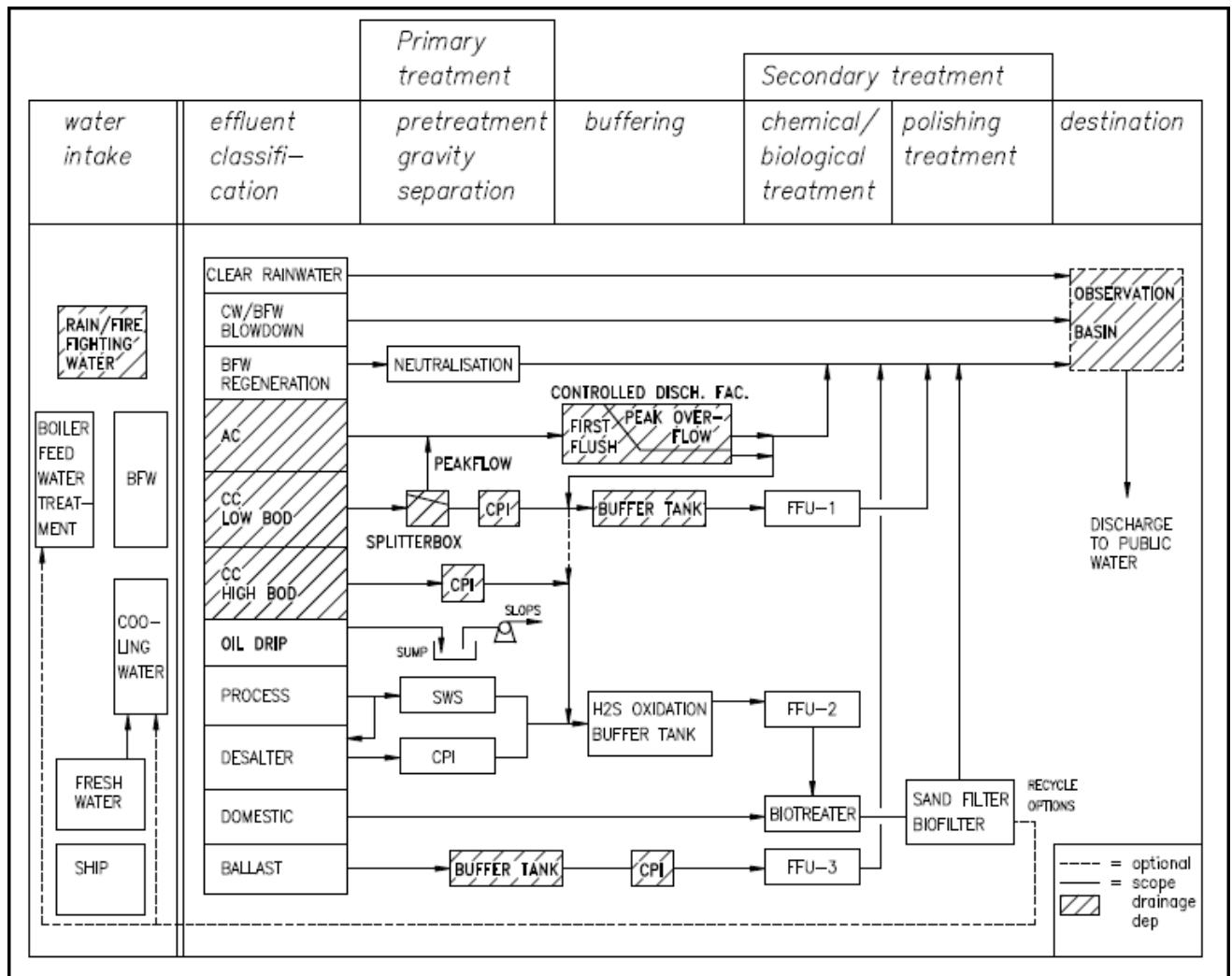


Figure 1 Typical integrated flow scheme (Standard drawing S 14.050)

The objectives for the water master plan activities for drainage and primary treatment are:

- To ensure controlled discharge of surface water is in line with the Shell Global Environmental Standards
- To minimise the amount of effluent to be sent for treatment, by
 - Prevention of pollution at the source;
 - Inventorisation and classification of effluent streams;
 - Segregation of streams.