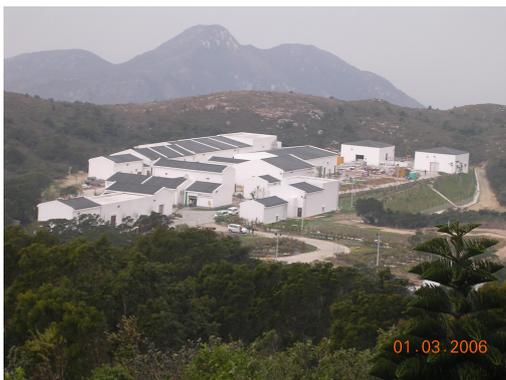




**Government of the Hong Kong
Special Administrative Region
Drainage Services Department**



**Guidelines on Aesthetic Design of
Pumping Station Buildings**

**Working Group on
Guidelines on Aesthetic Design of Pumping Station Buildings**

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1. Foreword

These design guidelines provide guidance on aesthetic design of pumping station buildings which are operated and maintained by Drainage Services Department (DSD). The guidelines form part of DSD's commitment to deliver world class quality drainage and sewerage facilities to the public by promoting the construction of aesthetically pleasing buildings.

These design guidelines aim at providing a framework for the designers as a general guide to good aesthetic design of pumping station buildings. They do not negate the need to refer to the relevant standards and practice notes nor seeking specialist advice from an architect or a landscape architect.

The document was prepared by the Working Group on Guidelines on Aesthetic Design of Pumping Station Buildings whose members comprising representatives from various divisions in DSD and as shown below:

Chairman	Mr. K.F. TAM	Senior Engineer	Drainage Projects Division
Members	Mr. K.T. LAM	Senior Engineer	Sewerage Projects Division
	Mr. W.C. WONG	Senior Engineer	E&M Projects Division
	Mr. H.K. TUNG	Senior Engineer	BCM Unit, HK&I Division
	Mr. C.S. TSE	Senior Engineer	Sewage Treatment (before 1 February Division 1 2006, Mr S M Yu)
Secretary	Mr. K.C. YIP	Engineer	Drainage Projects Division

Users are welcome to direct their comments on these design guidelines to members of the Working Group.

2. Introduction

2.1 Background

Since Drainage Services Department (DSD) was established in 1989, people in Hong Kong have witnessed the improvements and success in wastewater treatment and flood relieves over the years and today, people are turning their focus from quick-fix solutions to quality of the drainage and sewerage infrastructures. Designers of new pumping station buildings, for instance, are needed to integrate sustainability consideration into their design to achieve a balance in terms of environmental, economic, functional and social performance.

Designers must be sensitive towards the specific functional and practical needs of the pumping station, while creating an architecturally distinctive identity that will become an integrated part of the community. Designers should recognize that good aesthetic design enhances better services by ensuring that the pumping station buildings meet the needs of those who will operate , manage or maintain them, and satisfy the local people who will see them everyday.

2.2 Scope

In the context of these design guidelines, pumping station buildings include all pumping station buildings, above-ground ancillary buildings in sewage treatment facilities and flood protection schemes and other above-ground installations that are visible to public.

These design guidelines apply to in-house and consultant design of new pumping station buildings, and retrofitting works to existing pumping station buildings. These design guidelines also apply to design of pumping station buildings which are built by other parties and will be taken over by DSD for operation and maintenance such that consistent design standard could be adopted in all DSD operated and maintained pumping stations.

These design guidelines supplement the Stormwater Design Manual and the Sewerage Manual in the aspect of balancing design between optimum building sizes and operational efficiency.

Users may refer to other references where appropriate in applying the

design guidelines and to seek architectural or landscape architectural advice. A list of references listed in Section 9 may be referred to for specific topics.

3. Objectives and Principles of Aesthetic Design

3.1 Objectives

The design for pumping station is in the least to get acceptance of the public about the existence of the pumping station within their community, yet without compromising its functionality and ease of maintenance. The designer should take every opportunity to make use of the pumping station to beautify the landscape of the area where the pumping station is located.

3.2 Principles

The design of the pumping station building shall seek to achieve the following principles:

- *Avoid monotonous development*
- *Avoid infrastructure which create visual and physical barrier*
- *Adopt high quality architectural design building facade*
- *Provide focal landmark features*
- *Minimize footprint to maximize open space*
- *Maximize planting in open space*
- *Reserve more ground level spaces and setback for tree planting*
- *Harmony with the surroundings now and through the life of the structure*
- *Lowering of building height where appropriate to maintain views and accessibility*
- *Optimum balance between capital construction cost and long term maintenance and running costs*

4. Aesthetic Elements

The following elements may help enhance the appearance of the pumping station, thus obtaining the public's acceptance of locating the pumping station within their community:

- Site context – Careful study of the environment of the proposed pumping station so as to identify a location for the pumping station not conflicting the site context (e.g. not to locate the pumping station close to shrine, ancestral worshipping hall, ... etc.), or contrasting prominently with other buildings (e.g. pumping station building taller than the surrounding village houses) when taking consideration of land availability and minimum land resumption requirements.

- Structural form – Buildings of infrastructure project are usually of pragmatic structural form (or mostly of rectangular footprint and box shape), which often give dull and mediocre image to the public. If space permits, variation in structural forms should be chosen so as to mitigate the said undesirable image.

- Façade – External elevations of the building for the pumping station should be designed to give aesthetic pleasing looks and in harmony with the environment. This can be achieved by incorporating some features (such as louvres, strips, windows, openings ... etc.) or by exposing the structural elements of the building so as to create some interesting geometrical/vivid effects and to break the monotonous appearance caused by the extensive/ massive walls. It is most desirable if the architectural design of the pumping station can match with the surrounding premises or environment. In addition, it is considered necessary to avoid installing utilities/facilities (such as pipelines, ducts, conduits, cat-ladders, railings ... etc.) on the external walls of the building where possible. Furthermore, the façade of the building should be designed to facilitate future maintaining and cleaning by ordinary means of access.

- Greening – Green vegetation and colourful flowers give people some sense of nature and have the feeling of vigour and vitality. Vegetation also provides some beneficial screening of the building structures. Besides, provision of trees/shrubs within the pumping station compound or roof the building helps soften the stiff and cold effects caused by the building structures. The landscape design of a pumping station should aim to give an impression of a garden, yet without affecting the operation of the pumping station. Garnishing the roof of the pumping station with vegetation, particularly roof garden, is encouraged. Where inspection and maintenance of waterproofing on the roof are a cause for concern, the use of potted plant may be an alternative to planting walls or insitu tree-planting.
- Choice of Material – To facilitate future maintaining, commonly available construction materials, which can be easily purchased from the market, should be used for constructing the pumping station. In the selection of cladding/painting/finishes for the building, cladding/painting/ finishes which have long lasting new appearance should be used so as to reduce the cleaning frequency as far as possible.
- Colour – The use of colour to clothe the pumping station building needs special attention. Owing to cultural preferences, some sensitive colours (such as blue, red and yellow) should be used with care. Warm tone colour may be used to dress the pumping station building as far as possible so as to avoid giving the building a cold appearance in the community. Colour scheme which gives harmony to the environment is mostly preferred.
- Culture – Designer should pay respect to local culture and tradition in the design and construction of building in rural areas. Consultation of the concerned rural committees and local representatives on response in respect of this issue, amongst others, should be made as soon as preliminary design of the pumping station is completed.

Scale and Proportion – where appropriate, all exterior elements such as facade, doors, sills, canopy, windows and louvres shall be proportionate to each other.

5. Components of Pumping Station Affecting Aesthetics.

5.1 E&M equipment

5.1.1 Pumps

The types and numbers of pumps are normally the determining factor of the footprint of the pumping station. In addition to the design guidelines as stipulated in the Sewage Manual and the Stormwater Drainage Manual, the project designer should pay particular attention to the space requirement for equipment installation and future operation and maintenance during selection of different pump types. While adequate space is essential for maintaining proper functions of the pumps, excessive space and headroom allowance should be avoided in order not to unnecessarily increase the overall height of the plant room.

Size and headroom of the pumping station building should allow for lifting/transversing of the pumps for maintenance purpose. Type/Number of the pumps in association with the dry/wet well arrangement will affect the size and headroom of the pumping station building.

A standby pump is essential and indispensable in the operation of most pumping stations. For pumping stations using submersible pumps and where the available site area is severely limited, without compromising the design standard of the drainage or sewage projects, consideration may be given to provide on site one standby pump only and to store off-site the remaining standby pump(s) as spare units, which could be quickly transported to site to replace the defective pump in emergency. In these circumstances, all accessories including power cables should be provided with the off-site standby pump to facilitate quick replacement.

5.1.2 Trash Screening and Removal

Trash screens are normally installed at the inlet of the pumping station for screenings removal and to protect the pumps from damage and clogging by huge foreign objects. There are several types of screens commonly used, namely hand raked, mechanical raked, basket screen, etc. In view of the trend of reduction in human resources available for operation and maintenance and the raised requirement for hygiene and safety at works, automatic mechanical raked screens are normally adopted for new plants. Some screens serving deep influent channel may be rather high but properly designed plant room can comfortably accommodate the screens. Ceiling openings may be made available in the plant room for the initial installation and future maintenance in case removal of the whole set of screen is required to optimize the headroom requirements.

Proper access should be allowed in the plant room for removal of container holding the screenings, otherwise screw conveyors should be provided for transfer of screenings to elsewhere convenient for proper collection and subsequent disposal.

In providing the above facilities, particular attention should also be paid to optimize the headroom and space requirements.

Screenings removal facilities including the parking space for screenings handling vehicle should be located indoor, under cover, shielded or screened through architectural features, landscaping or plantation. If large volume of screenings is expected, equipment to wash screenings and to reduce screenings volume should be provided.

5.1.3 Lifting Appliances

Lifting appliances such as mobile cranes will normally be installed in the pump house to facilitate maintenance of heavy equipment. Maintenance access and platforms are sometimes provided for maintaining (i) the associated E&M equipment of the cranes and (ii) ceiling mounted E&M equipment such as smoke/heat detectors for fire fighting and high bay lighting. The designer should select the type of the lifting appliances to facilitate the maintenance of E&M

equipment which would require minimum vertical clearance. To improve the outlook and optimize the overall headroom of the plant room, the designer should consider provision of alternatives such as mobile elevated platform for access to the equipment installed at height. From a safety viewpoint, the maintenance platform of the mobile cranes should not be used for accessing the ceiling mounted equipment for service and maintenance. Properly fixed or mobile working platform should be provided.

5.1.4 Internal and External Lighting

5.1.4.1 Internal Lighting

Although high bay lighting can provide better illumination for the plant room, excessive headroom will unavoidably be required to accommodate the high bay lighting. Provision of alternative lighting such as wall-mounted floodlight and fluorescent light tubes should be the first consideration during the design stage. Cabling for the lighting or other building services equipment should be installed in concealed conduit as far as practicable.

5.1.4.2 External Lighting

In addition to normal external lighting such as street lighting for general illumination, provision of lighting for improving the aesthetic effect of the exterior of the pumping station during nighttime should be considered. The external lightings, in particular floodlights where these are used, should be so located and orientated to avoid inducing glare affecting the neighbourhood or nearby road users. Two levels of external lightings should be provided, i.e. general lighting for security purpose and task lighting for particular O&M activities. Timer control, remote control, photo-sensor and bypass switches for the external lightings should be provided as appropriate. The cabling for the external lighting should be accommodated inside the building or concealed as far as practicable.

5.1.5 Power Supply

Diesel generators for emergency electricity back-up would have special requirements on the general layout of pumping station and

therefore would have significant impact on the appearance and footprints of pumping stations. Dual-feed electricity supply is preferable for pumping stations as it has less land intake requirement. Dangerous goods store for the diesel fuel and the exhaust air vent associated with emergency generator set further place dual power supply option more favourable in terms of aesthetic design. In accordance with para 14.6.3 in the Stormwater Drainage Manual, for floodwater pumping stations, emergency power generator should be provided. However, the designer should balance between the capital cost for provision of dual feed power supply and the benefits on minimizing the land intake requirements and benefits to the aesthetic appearance of the pumping station as well as the reliability of the dual power supply in the region where the pumping station is to be built. If the emergency generator is eventually selected, particular attention is required on the construction details to minimize the visual intrusion caused by the exhaust gas vent and the noise nuisance caused to the public by the operation of the diesel engine.

5.1.6 Ventilation and Air-conditioning

Equipment such as roof-mounted or wall-mounted ventilation fans and air conditioners normally exposed should be provided with aesthetic features to reduce any potential adverse impact.

Air ductwork, if any, should be located inside the pumping station building as far as practicable. Air intake/exhaust of the ventilation system should be installed on the building faces/walls not facing the public as far as practicable. Silencers and louvres should be provided as appropriate. Where it is unavoidable to expose the air ducts/stacks to public view, the choices of their shape and colour requires careful consideration in order to tune down their intrusive effect.

5.1.7 Odour Treatment Facilities

Different types of deodourising equipment such as biofilters, wet scrubbers, carbon filter have different height, footprint requirement and outlook. These factors should be taken into consideration during equipment selection.

Deodourizer should be located indoor, under cover, shielded or screened through architectural features, landscape work or plantation.

Ventilation openings and outlets of odour treatment facilities should be oriented in the direction so as not to affect residential premises or pedestrian walkways. Where such openings or outlets facing residential premises or pedestrian walkways are unavoidable due to site constraints, these should be well separated from the sensitive receivers and in these cases, incorporation of ornamental features with these openings may be useful to lessen the visual effects of these openings to the public.

5.1.8 Renewable Energy Equipment

Government is committed to promoting energy efficiency in Hong Kong. Adoption of energy efficient features and installation of renewable energy equipment should be seriously considered during the design stage for new projects pursuant to ETWB TCW No. 16/2005. Potential renewable energy equipment suitable for sewerage or drainage projects will include solar heating, Photovoltaic system, wind turbine, etc. While the space availability and cost effectiveness of these items of equipment should be taken as the selection criteria, architectural treatments to minimise the potential visual impact to the neighbourhood should also be considered. Any use of PV panels or other renewable energy equipment mounted on the roof of the pumping station should be screened/shielded. Any installation of renewable energy equipment on existing pumping station shall be carefully planned to maintain the original aesthetic design.

5.2 Civil and Structural Elements

5.2.1 Boundary Fence and Wall

Visually permeable fence such as metallic fencing with screen planting shall be used to screen the pumping station. Where the operational activities inside the pumping station may create environmental nuisance or are visually intrusive, solid boundary wall with suitable architectural features may be considered.

Boundary wall and fence shall be located carefully to avoid

impairing existing urban/rural landscape elements such as mature trees, and to setback from the site boundary for screen planting where possible.

Choices of materials, details and textures shall be incorporated so as to make the boundary wall and fence to be as visually recessive as possible and in a style that fits with the surrounding environments/buildings. External finishing shall be designed in conjunction with the landscape scheme.

Where metallic fence is used, colour with low chromatic intensity shall be considered to reduce the potential contrast between the structures and their background.

Glass block panels make the solid boundary wall look less massive and allow limited privacy of the buildings. However, they shall be avoided in areas where the works are prone to vandalism such as in remote areas or unmanned pumping stations.

Design of the main gate including colour, material and architectural pattern should match with the boundary fence or wall.

5.2.2 Roof Design (including access to roof)

Roof garden can help to reduce solar heat and soften the building mass when viewed from surrounding tall buildings. Thus, it is an effective means in enhancing greenery and improving the environment. Roof garden shall therefore be implemented on all new pumping stations. Retrofitting of roof gardens in existing pumping stations should also be considered. Consideration should be given in the landscaping design to cater for rehabilitation of the roof water-proofing system and other maintenance requirements. Advice from ArchSD on the design of roof garden may be sought.

The species of the vegetations on the roof garden should be carefully selected. Perennial plant is preferable for the unmanned pumping stations and better appearance in dry season.

The provision of roof garden requires recurrent costs and long-term commitment from the maintenance party. If the roof

garden lacks effective management, it will become environmental/public nuisance. Thus, agreement has to be sought from the maintenance parties during the design stage for the roof garden. Alternatively, potted plant is also acceptable for garnishing the roof of the building if roof garden is not opted due to other constraints.

Roof planting and solid parapet wall can also be used as a tool to minimize the visual impact arisen from exhausted fans, water tanks etc installed on the roof.

The use of sky window can introduce natural light into the interior of the pumping station and when properly designed could be an added attractive feature when viewed from tall developments nearby.

Parapet wall of suitable height/size should be provided. Solid parapet wall may give a disillusion that the building is taller than it should be but it provides a neater line and edge when compared to other types of parapet. Since roof garden will require routine maintenance and attract visitors, solid parapet wall will provide better safety protection for the maintenance personnel and visitors.

Since the management of the roof garden and other maintenance works require frequent access to the roof, provision of proper access is necessary. Cat ladder is considered as visually intrusive and when used, should be installed inside the pumping station instead of external where possible.

5.2.3 *Louvres , Window and Exterior Door Design*

Louvres, windows and other exterior openings are usually of different sizes and at different levels to suit the operational needs. The requirements of these exterior openings shall be determined in the early design stage. Where feasible, all exterior openings shall be provided with the same rectangular ratio as the building (see Section 4 above). The colour of the louvres, windows and doors etc. should match with the global colour scheme of the pumping station.

Exterior openings shall be located away from the local sensitive

receivers (e.g. village houses, residential buildings etc.) where possible.

For the sake of security, window guards instead of exterior security bars should be used for the windows at ground level.

5.3 Utility Services and Plumbing

Utility services and plumbing should be accommodated inside the pumping station as far as possible. External pipes and vents shall be concealed for better appearance. It may be necessary to provide reserve utility services ducts or conduits to cater for possible add-on utility services at later stages when the utility services requirements cannot be ascertained in the design stage.

5.4 Landscaping Works

Evergreen plants/trees should be selected. Existing trees shall be reserved and protected as far as possible.

Automatic irrigation facilities should be provided with the landscape works to help maintaining the plants in good conditions at all times.

Consideration should be given to carrying out landscaping works in phases such that some landscaping works could be established at early stages of the pumping station construction to achieve gradual greening effects to the site.

Medium size trees/shrubs, instead of seedlings, should be planted shortly after the completion of the construction stage of the pumping station.

For screen planting, appropriate sizes of trees shall be selected to soften the monolithic effects of the buildings, fences, wall and associated structures. Planting of relatively mature trees instead of young trees may be considered to provide early screening effect. Climbers, flower racks and other vertical greening should be provided to

beautify the external walls of pumping station and to keep the building cool.

6. Architectural Treatment

In general, any operation of the pumping station that may have negative visual impact to general public, e.g. handling of screenings, should be located indoor, under cover, shielded or screened through architectural features, landscaping or plantation.

Any outdoor equipment including the roof-mounted equipment should also be under cover, shield or screened.

Designers should pay attention to detailing to prevent rainwater dripping along the external walls causing staining problem. Construction details for horizontal protruding /external surface should show direction of fall such that rainwater will drain away from the external surface.

7. Administrative Measures

7.1 Vetting Committee on Aesthetic Design of Pumping Station Buildings (VCAB)

The Director of Drainage Services has set up Vetting Committee on Aesthetic Design of Pumping Station Buildings (VCAB) to vet aesthetic design of pumping station buildings. Project proponents are required to submit aesthetic design proposal of pumping station buildings to VCAB for vetting in accordance with DSD TC No. 9/2006 before they circulate the proposal to external departments or parties. The requirement applies to in-house and consultant design projects within DSD and renovation and retrofitting works which significantly alter the disposition or external appearance of pumping station buildings. For those pumping station buildings which are designed and built by others and which will be taken over by DSD for operation and maintenance, Sewage Treatment Division or Building/ Civil Maintenance Team of Hong Kong and Islands Division shall remind the project proponent to follow the requirements in DSD TC No.9/2006. For the purpose of DSD TC No.

9/2006, pumping station buildings include all pumping station buildings, above-ground ancillary buildings in sewage treatment facilities and flood protection schemes and other above-ground installations that are visible to public.

7.2 Design Advisory Panel of Architectural Services Department

ETWB TC(W) No. 8/2005 stipulates that architectural designs of building structures (including pumping stations) from all departments other than those within the ambit of ACABAS (see ETWB TC (W) No. 36/2004) should be forwarded to the Design Advisory Panel of Architectural Services Department (ArchSD) for advice. All submissions shall be vetted by VCAB in accordance with DSD TC No. 9/2006 before the submissions are forwarded to the ArchSD's Design Advisory Panel. These requirements shall apply to designs of all building structures to be operated and managed by DSD. For buildings to be designed and constructed by other parties which will be taken over by DSD for operation and maintenance, the Buildings/ Civil Maintenance Team and Sewage Treatment Division shall draw the attention of the project proponents to the requirements in EWTB TC(W) No. 8/2005.

7.3 Revisions During Construction

Any changes in the disposition and aesthetic design of pumping station buildings during construction may result in resubmissions under Environmental Impact Assessment Ordinance and Town Planning Ordinance, and will inevitably lengthen the construction time and escalate construction cost. Hence it is beneficial that all civil works and electrical and mechanical works requirements can be agreed at the early design stage to minimize the need for substantial design changes during construction or last minute changes before tendering.

Design revisions that would affect the external appearance of the pumping station building should be vetted by Head of the Project Division before issuing the revised construction details to the contractor. Examples of design revisions that fall within this category may include changes in facade detailing, revised wall finishes or colour schemes,

additional exterior openings, ducts or vents etc. Where necessary, the Head of the Project Division may direct that the design revisions be submitted to ArchSD's Design Advisory Panel for advice.

8. Public Consultation

Before aesthetic and landscaping design of pumping station buildings are finalized, relevant parties (District Council, Rural Committee, local representatives, etc) shall be consulted where appropriate. All consultation exercises should be properly documented in order to avoid future conflicts.

The views of the local representatives should be solicited and respected on the aesthetic design including the colour scheme before it is adopted in the design, especially in rural areas. Presentation of the proposed scheme by visual aid such as perspective drawings would facilitate better appreciation of the final project by the local representatives, whereas the visual aid could become part of the consultation records. Project engineer should consider the need to consult the local representatives for any subsequent revisions that may lead to substantial changes to the aesthetic design which has been agreed during previous public consultation.

9. References

Technical references can be made to the following standards, circulars and publications:

- (i) ETWB TC (W) No. 34/2003 – Community Involvement in Greening Works
- (ii) ETWB TC (W) No. 11/2004 – Cyber Manual for Greening
- (iii) ETWB TC (W) No. 36/2004 – The Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS)
- (iv) ETWB TC (W) No. 8/2005 – Aesthetic Design of Ancillary Buildings in Engineering Projects
- (v) ETWB TC (W) No. 16/2005 – Adoption of Energy Efficient Features and Renewable Energy Technologies in Government Projects and Installations
- (vi) ETWB TC (W) No. 3/2006 – Tree Preservation
- (vii) DSD TC No. 9/2006 – Vetting Committee on Aesthetic Design of Pumping Station Buildings (VCAB)
- (viii) Sewerage Manual Part 2 – Pumping Station and Rising Mains, Drainage Services Department
- (ix) Stormwater Drainage Manual – Planning, Design and Management, Drainage Services Department
- (x) Hong Kong Planning Standards and Guidelines Section 11 : Urban Design Guidelines
- (xi) Harbour Planning Principles by Harbour-front Enhancement Committee

10 Illustrated Examples



Photo 1

More greening efforts can help to soften this pumping station and to increase its aesthetic quality. Green roof can provide shade, absorb heat and reduce the bareness of the building to the eyes of the public. Architectural and landscape treatments to the eye-catching boundary walls can further enhance the visual variety of the compound.

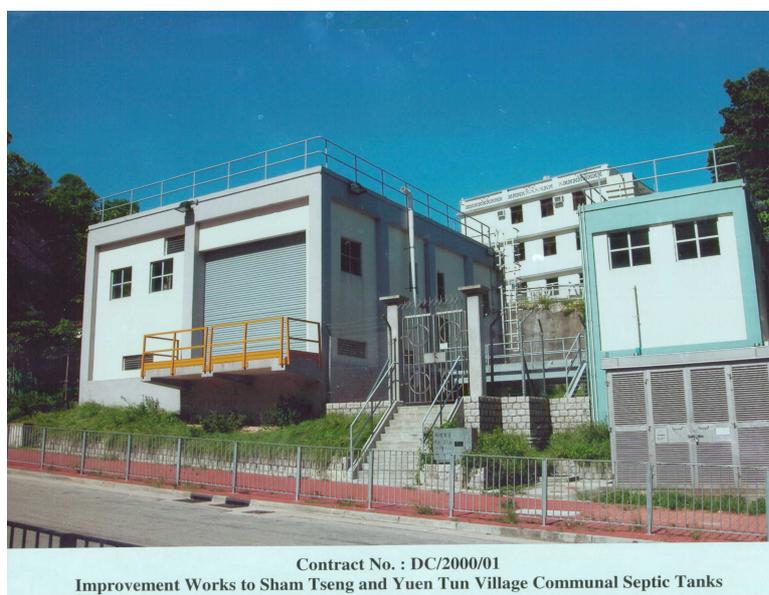


Photo 2

The building height of this structure is set below the buildings behind, maintaining the original visual accessibility of the local residence. Harmonized finishing for the external walls but devalued by railing, cat ladder and pipes.



Photo 3

The diesel generator's exhaust vent and other external services could be suitably designed and installed to reduce their visual impact. The cat ladder fixed on the external wall of the plant house for assessing the roof could be installed inside the plant house to provide a neater appearance.



Photo 4

Most of major structures of this sewage treatment works are underground or covered. Generous planting of native woodland trees screen sensitive views. Traditional Chinese architectural elements and colours make the sewage works emerging smoothly into the landscape character of this mountainous area.



Photo 5

This pumping station adopts a village house type of design, providing a visually harmony with the surrounding rural houses. A sloping roof genuinely hides the roof top water tanks from public view and helps to reduce the visual monotony of the structure.