



Police & Crime Commissioner of North Wales

**Eastern Command and Custody Facility
Proposed Drainage Strategy**

Planning Submission

July 2015

B1305210/CE/870.001

Revision – P0

Job Number B1305210

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1**Introduction**

The purpose of this document is to outline the strategy for the proposed foul and surface water drainage that is to be provided as part of the development to construct a new Eastern Command and Custody Facility in Wrexham for North Wales Police.

The strategy will form part of the submission to the Local Authority at Planning and Building Control stages. It will also be submitted to Welsh Water and the Environment Agency Wales (if relevant) as part of the consultation and statutory approvals process.

2

Description of Site

The site forms part of the Llay Industrial Estate situated to the North East of Wrexham, North Wales. The site is bound by Davy Way to the North West and industrial units to the south and west of the site.

The existing site consists of marshland / grass to the east and a disused factory unit with access roads, car parking and concrete slab area to the west.



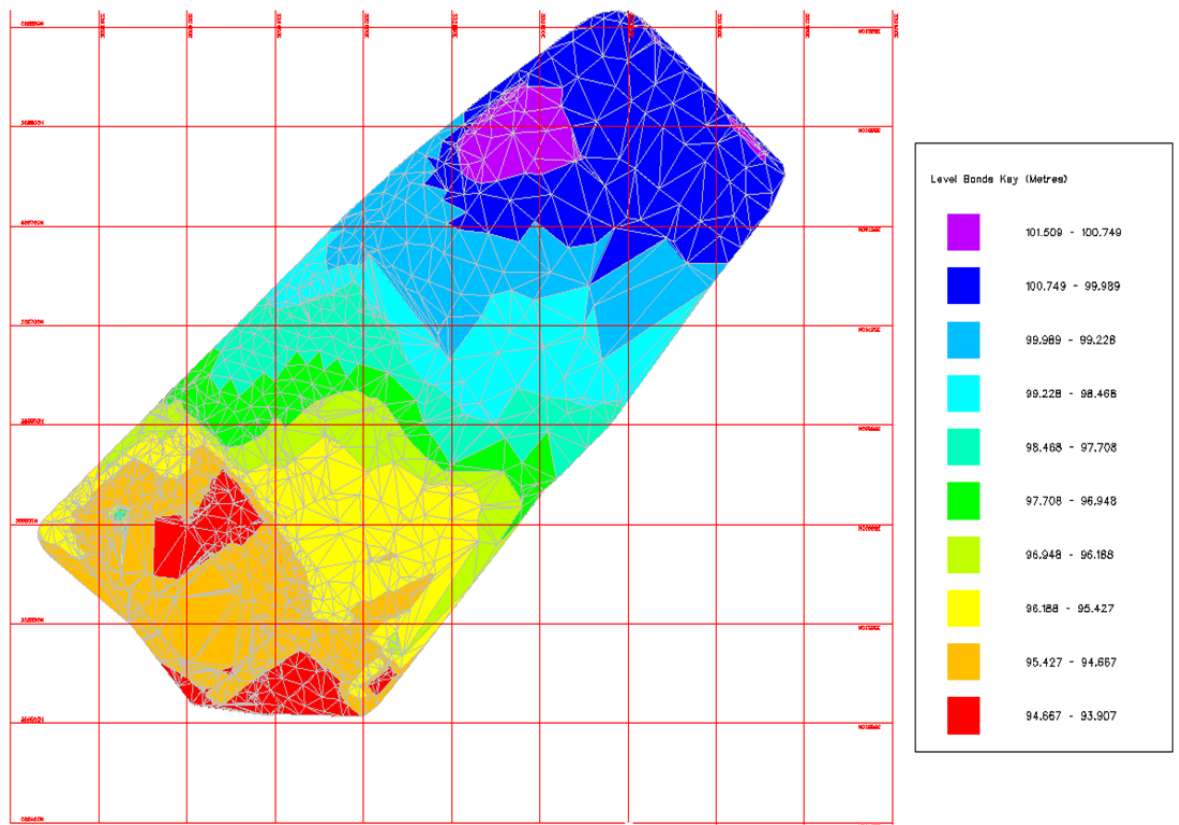
A topographic survey has been undertaken on the site which reveals that the levels over the site area vary from approximately 99.9m to 93.9m above survey datum with the existing site split into two distinct areas.

The current developed area is generally lower than that of the undeveloped area to the north east of the site. Surface levels along Davy Way fronting the site vary along with those at the southern and western property boundary.

The site is of a fairly regular shape, which covers approximately 4.1ha as shown bound by red below:



The coloured plan below details the levels of the existing site grouped into high to low level bands:



3 Existing Infrastructure Drainage

Information with regard to both surface, foul and combined drainage systems, location of pipes and manholes, inverts, pipe sizes, availability of the network and any restrictions have been requested from Welsh Water.

Plans detailing the location and type of the existing sewer network within and adjacent to the proposed site have been obtained. As constructed drawings of the original factory and hard standing areas have also been obtained from Wrexham Council Building Control. Copies of these plans are contained within Appendix A of this report.

From the existing site data and plans it can be seen that both foul and surface water drainage systems reside along Davy Way and Miners Road. Existing adopted foul and surface water sewers also extend into the site from Miners Road. It is proposed that both foul and surface water from the site are connected to the sewer system that extends into the site by means of the existing site sewer connections located along the south east boundary.

There is an existing watercourse that bisects the development site. Investigations into the status of the watercourse are ongoing with the Environment Agency Wales. However currently the proposals do not intend to use or interfere with this watercourse as part of the proposed development.

A pond exists to the west of the site. This pond is not directly affected by the development and it is not currently intended to be used as part of the drainage proposals.

No information is currently available on the condition of any of the sewers within, and external to, the general site area.

4**Development Proposals**

The proposed development will comprise of a new headquarters, custody suite, staff car parking, operational parking, emergency mustering parking, secure entrance, footpaths, grassed landscapes and hard surfaced courtyards.

The total area of the site is 4.1 ha.

An approximate summary of the developed site areas is given below and a sketch plan of the proposals is contained in Appendix C of this report.

No major earthworks remodelling is anticipated for the site other than a re-grading exercise to provide suitable platforms on which development can take place such as for the new car park to the east of the site.

Minor retaining structures are proposed as part of the development. These retaining structures are not proposed to be provided with positive drainage.

It is proposed to provide the following as part of the new development:

- Separate foul and surface water systems within the site boundary;
- Foul water to be discharged into the adopted Welsh Water sewer local to the site boundary.
- Surface water to incorporate SUDS measures where possible which will also connect into the adopted Welsh Water sewer (the majority of the surface water over and above that discharged from the existing site ie the new car park area will be disposed of by infiltration – subject to percolation testing).
- Land drainage (if required) that will discharge to a soakaway, subject to acceptable percolation testing.

In preliminary discussions with the scheme client and various related statutory bodies it has been decided to adhere to the following design guidance for the proposed foul and surface water drainage system serving the proposed site.

- Building Regulations Part H
- Planning Policy Statement 25
- Sewers for Adoption 6th Edition (for adopted connections)
- BS EN 752:2008, Drainage & Sewer Systems Outside Buildings
- BS EN 12056:200, Gravity Drainage Inside Buildings
- EA Pollution Prevention Guidelines
- Various Home Office Design Documents
- BRE Digest 365 Soakaway Design

Specific design criteria for the system will also include:

- Piped system design is to prevent flooding in any part of the site for the critical duration, 1:100 year return storm event. Including allowance of 30% for climatic change (sewers can surcharge during this return period)
- Surface water drainage to be designed for runoff from roofs, roads and other hard-standing areas.
- Soakaways and permeable paving are to be designed in accordance with Building Regulations and BRE Digest 365 requirements (in 1 in 10 year storm event)
- Comparison of pre and post development Greenfield / Brownfield runoff.
- Check design for the 1:100 +30% year to ensure properties on and off site are not subject to flooding.
- Design event rainfall based on the use of the most recent version of the 'Flood Estimation Handbook' with an enhancement of 30% to account for climate change.
- Design surface water attenuation to accommodate the above modelled events using allowable discharge rates based on existing site flows to the Welsh Water system.
- Incorporate a risk assessment to ensure risks to both the local community and operators of the drainage system are minimised.
- The viability of rainwater harvesting will be explored, and is subject to further consideration. However it is not intended to use rainwater harvesting as part of the proposals at this time.

- Discharge of surface water to be comparable with pre-development runoff rate.

Consultations with Welsh Water, Environment Agency Wales and Wrexham Council have been initiated to discuss and agree the drainage strategy for the site. Minimal response has been received with regard to the proposals at the time of writing this report.

Welsh Water have agreed in email correspondence dated week commencing the 20th July 2015 that surface water flows from the site into their existing surface water system can be accommodated at a rate comparable with that of the existing site.

Welsh Water have agreed in email correspondence dated week commencing the 20th July 2015 that foul water flows from the site into their existing foul water system can be at a rate as calculated in Section 7 of this report. I.e. 8 litres / second of peak flow.

Welsh Water have not stated that upgrade or reinforcement of their apparatus will be required as a result of the development proposals.

A copy of this correspondence with Welsh Water is available upon request.

It is to be noted that Welsh Water may require part of their existing apparatus within the development site to be abandoned as a result of the proposed alterations to the existing layout. This will be confirmed as part of the detailed design of the development.

Consultations with the Environment Agency and Wrexham Council will remain ongoing; however it is unlikely that these organisations will have any comments that will affect the development drainage strategy as proposed.

Information on the location of the any existing foul sewer within area shown as the proposed outfall on the drainage strategy has been requested from Welsh Water. The information returned on the sewers within the site and surrounding area is contained within Appendix A of this report.

The external foul water drainage system for the site has been designed to outfall into the adopted sewer network. A Section 106 application will be negotiated with Welsh Water in this regard if one exists at the connection point shown on the drainage strategy.

The proposed foul water system for the development is depicted on the Site Drainage Strategy Plan contained within Appendix C of this report.

The anticipated foul water discharge rate for the site into the surrounding network is in the order of 104 cubic metres per day with a peak discharge of 8 litres a second (6 x DWF). This estimation has been calculated using flow calculations for similar developments and will be confirmed when the full design requirements of the facility are known and agreed. This flow will discharge to the existing sewer network by means of existing connection from the site. Dining facilities are proposed within the building therefore a grease interceptor or enzyme dosing system will be proposed to serve the kitchen areas.

Due to the layout of the existing foul system within the building and the number of new foul connections and requirements extensive trenching of the existing internal and external floor slab will be required. The existing network with the building will then be required to be abandoned and grouted up.

A limit of discharge of foul water into the existing sewer network has been agreed with Welsh Water at a rate and volume as stated above, however Section 106 connection agreements will need to be established for each connection into the adopted sewer system. The need for offsite reinforcement of the network will also need to be formally agreed with Welsh Water. However the need for reinforcement is unlikely as the flows and connection points to the sewers remain similar to that of the existing situation.

The proposed car wash and any oil or fuel store areas will discharge in to a silt / petrol interceptor; flows from these areas may require an element of attenuation in order to ensure that the agreed peak flow rate for the site is not exceeded. Currently this attenuation is proposed to be accommodated in the manhole and pipe system of that area.

The appointed contractor will submit their proposals for the control of any temporary foul or surface water to Welsh Water and must seek and obtain their approval prior to commencement of any site work or temporary connection into their existing system.

8.1 General

This proposed surface water system is depicted on the Site Drainage Strategy Plan contained within Appendix C of this report.

The development proposes to use as much of the existing surface water infrastructure as possible, however due to the proposed layout of the building and hard standing areas the re-use of existing systems is likely to be minimal. (Use of existing systems will be subject to satisfactory CCTV drainage condition surveys and confirmation of use on detailed design)

For new construction within green field areas (such as that for the car park) a new system of surface water disposal will be required. It is proposed to provide a permeable car park surface which incorporates an underground storage and infiltration soak away type system. (Refer to Surface Water Strategy). These areas will not connect to the Welsh Water Sewer.

Provision of this system will be subject to infiltration testing of the ground areas within the proposed new car park.

Appropriate attenuation of surface water flows will be provided within the permeable paving construction of the car park areas in order to accommodate the required design storm event.

A rate of discharge has not been stipulated by Welsh Water for surface water flow into their system from the west end of the site. However Welsh Water has confirmed that the flow into their system from the development should not be more than that of the current pre developed site. Accordingly the existing surface water sewer has been modelled and a flow for a 1 in 30 critical duration storm identified. (This storm return period of 1 in 30 years being that for which the capacity of adopted sewers are normally designed). On modelling the value of this discharge was found to be 151 litres per second peak flow.

This value of discharge has been reduced by approximate 30% to 100 litres per second (in accordance with standard planning requirements for Brownfield sites). Accordingly the discharge rate into the existing surface water system that has been adopted within the design and used in the calculation of surface water attenuation for the west of the site is **100 litres** per second maximum discharge. This discharge will be limited by means of a hydrobrake type flow control device.

The detailed design of the surface water drainage system to serve a new development must consider both water treatment and on-site attenuation in accordance with CIRIA C697.

Where practical, SUDS aim to emulate the natural drainage system of the site through attenuation of flows and natural percolation. This has the added benefit of alleviating water quality issues associated with urban drainage runoff.

To mimic the natural catchments process, the SUDS manual provides a management train for consideration with new developments, as given in the table below:

Management Train	Design Considerations
1. Prevention	Layout; Water Harvesting; Surface Materials
2. Source Control	Infiltration; Surface Materials
3. Site Control	Attenuation
4. Regional Control	Wetlands

Table 8-A – SUDS Management Train & Design Considerations

Based on current proposed and existing site information an assessment into the use of SUDS has been undertaken for the proposed site. The results of this evaluation are contained in Appendix D of this report.

It is understood that infiltration tests have been carried out in accordance with BRE digest 365 at strategic points in order to identify the suitability of infiltration systems for use in the final design. As such the proposed car park area to the east of the site will infiltrate to ground as detailed on the drainage strategy plan.

8.2 Details of Proposed Infiltration and Attenuation

It has been estimated that the site will be constructed as approximately 53% impermeable therefore attenuation for the impermeable area of 2.28 Ha with a discharge equivalent to that of 70% (reduction of 30% of the existing flow as the existing site is classed as brownfield) of the existing site under a 1:30 year storm event will be incorporated within the development proposals.

Assessment of the flood flow paths for 1 in 100 and 1 in 100 (+ 30% Climate change uplift) year return periods will be carried out on detailed design of the proposals.

Filter drains will be sighted at the foot of major embankments to collect land drainage that will discharge to a soakaway. This method of infiltration is subject to satisfactory percolation results in that area.

Any new connection into the adopted sewer will be subject to a Section 106 agreement from Welsh Water.

The total amount of attenuation for the western half of the site has been calculated as 500m³ for a 1 in 100+30% storm. This attenuation will be achieved using underground storage as shown on the strategy plan.

The attenuation for the car park to the east of the site will be within the permeable sub-base of the car park – the exact amount of attenuation within this area will be subject to detailed design proposals.

8.3 Details of Treatment

In addition to attenuation, the proposals allow for 'at source' treatment of surface water as noted below.

8.3.1 Car Park Area (New Construction)

Two stage water treatment will be achieved using porous paver parking bays. The main car park levels are set to fall into the porous paved parking bays, which act as follows:

Stage 1 - Surface water will be filtered by both a bedding course and a pervious geotextile layer of Inbitex. This membrane optimises the cleansing of water and aids the development of naturally occurring microbes, providing them with refuge in times of drought.

Stage 2 - The water is further filtered by the granular sub-base, within which microbial action also takes place. The sub-base is tanked by an permeable membrane which allows storm water to be attenuated and released into ground in a controlled manner.

8.3.2 Petrol / Silt Interceptors

Interceptors will be strategically placed within the proposed drainage system before surface water is discharged into the sewer system.

The proposed drainage strategy has been provide with trapped gullies and an appropriately sized petrol interceptor upstream of the proposed connection to the Welsh Water sewer in order to accommodate and spills that may result within areas of existing / proposed hardstanding at the west of the site.

All wash down and fuel / oil filling and storage areas will be provided with appropriate interceptors before being discharged into the foul sewer network.

8.3.3 Rainwater Harvesting / Irrigation

Rainwater harvesting for the development is not proposed at this time.

The proposed surface water system for the site is depicted on the Site Drainage Strategy Plan contained within Appendix C of this report.

9**Drainage Modelling**

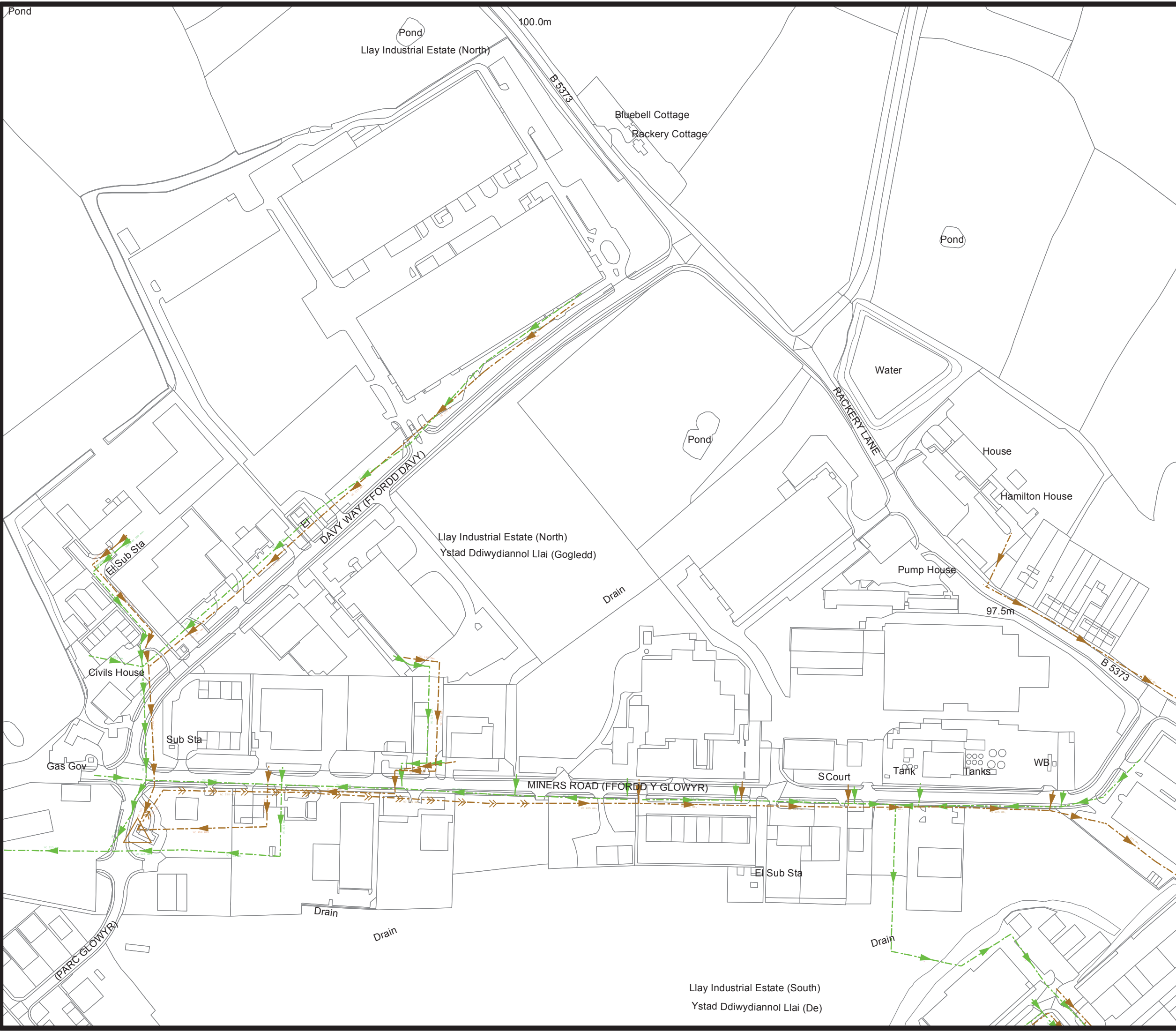
Modelling of the surface water drainage system will be carried out using WinDes software at detailed design. Separate networks will be modelled for both foul and surface water.

No modelling is anticipated to be undertaken on any existing Welsh Water Sewer network.

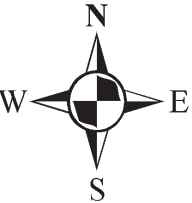
- *It is anticipated that the drainage system inside the development boundary will be private and not adopted.*
- *Storm Drainage: to be maintained by North Wales Police management contract.*
- *Foul Drainage: to be maintained by North Wales Police management contract.*
- *The Tank manufacturers will provide the jetting specification for the attenuation tanks.*
- *It is recommended that a visual inspection of all the manholes and chambers be carried out once a year; preferably in the autumn season.*
- *It is recommended that all rain water gutters and gullies be cleaned once a year; preferably in the autumn season,*

It is to be noted that the facility management will need to maintain the private drainage system as far as the connection with any adopted system located at the south of the proposed site.

Appendix A - Site Topographical Survey & Sewer Plans



Wrexham



LEGEND(Representative of most common features)

Waste network:		
NB: Sewer symbol colour indicates the type.		
RED	- Combined	
GREEN	- Surface Water	
BROWN	- Foul	
Purple	- Former S24 sewers (for indicative purposes only)	

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dŵr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

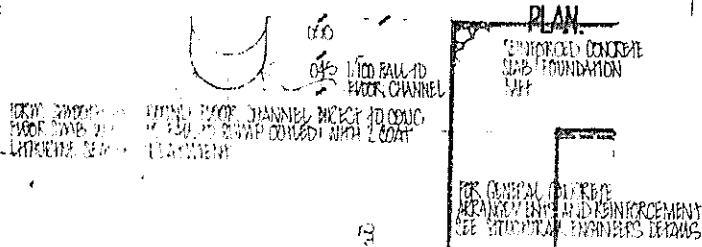
Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

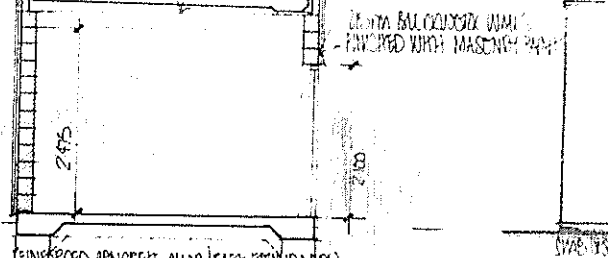
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NUMBER: ASPHALT PAVT REST SEE DETAILED SPECIFICATIONS FOR
SPECIFICATION



CROSS SECTION B-B ENGINEER'S DETAILS FOR REINFORCEMENT

SOUTH
NORTH

DETAILED SECTION C-C



1154

DRAINAGE

CONTRACT

DATE: _____

1941.1300

TAKENAKI
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6 CHESTERFIELD
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Figure 1 consists of three schematic diagrams labeled (a), (b), and (c), illustrating the experimental setup for a quantum system. Each diagram shows a grid of sites (represented by circles) and a central site labeled '1/250 II'.
 (a) A 1D lattice with sites 1 to 10 and a central site labeled '1/250 II'.
 (b) A 2D lattice with sites 1 to 10 and a central site labeled '1/250 II'.
 (c) A 3D lattice with sites 1 to 10 and a central site labeled '1/250 II'.

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6/14/92

precast concrete

7. SECTIONS TO COMPLY WITH THE REQUIREMENTS OF ASSH PART I
THREE RINGS DIAMETER AS PER SCHEDULE, JOINTED WITH
STEP JOINTS TO BS 5177 (ALTERNATIVELY APPROVED EQUIVALENT)
AND SPACED 300mm MINIMUM
IN BELOW THE SLOPE, GRADE CROP CONCRETE (PRECAST)
TO BE IN PLACE, FIRST PIPE OUT 4 MINIMUM NOT TO EXCEED 600mm
AND ABOUT CHAMBER TO HAVE 4 WALL FINISHED WITH
GRADE PRECAST SECTIONS SURROUNDED WITH 150mm CONCRETE
TO BS 5177, 976 AS PER SCHEDULE, SLOPES ON 2 OR
LONGER CLASS B BRICKWORK ALL IN CLASS 1 MORTAR
KEYS TO BE PROVIDED TO SUIT FOR EACH TYPE OF COIL
OR THRU 250mm TO 300mm OF PIPES TO HAVE ACCESS
AND SLAB OR TAPER SECTION WITH 675mm DIA SHORT
TO THRU 250mm TO SUIT OF PIPES TO HAVE ACCESS
IN ON REDUCING SLAB
HOLES OF OVER 3250mm TO ACCOMMODATE A FLAT
BS 4211 AND DISTANCE FROM WALL 600mm AND MAX
FROM COVER LEVEL TO FIRST LUNG
WE MUST HAVE THE RUCKER OR ARTICULATED ARM, AWAY FROM
WALL NOT IN EXCEED 0.75m (750mm) AND PIPES UP TO 450mm DIA
(1000mm) FOR PIPES UP TO 750mm DIA

FRAME BUILT & FINISHED
TO BACKSUPPORT WITH
CLASS 1 MORTAR

PRECAST CONCRETE
SECTIONS FINISHED
WITH CLASS 1 MORTAR
STEP JOINTS TO BS 5177

BRICKWORK IN 9 WALL
GRAVELLITE SCORED
FINISH

CAST IRON COVER & FRAME
TO BS 5177, 976

2 OR 3 COURSES CLASS B
ENGINEERING BRICKWORK

HEAVY DUTY REINFORCED CONCRETE
COVER SLAB (65mm)
THICK AS AN ALTERNATIVE
DEPENDANT ON DEPTH.

150mm GRADE CROP
CONCRETE SURROUND

GRADE CROP CONCRETE
BASE 75mm DEEP BRICK
ARE LAYED.

brickwork

IS B ENGINEERING BRICKWORK BUILT IN ENGLISH BOND BRICKS SET IN
EXPOSED WORK SHALL BE FLUSH JOINTED AS THE WORK PROCEEDS NO
TEAR SHALL BE MORE THAN 40mm ABOVE EACH COURSE LAYED
BE UNIFORM 10mm BRICKS WITH SINGLE PRODS AND UNFINISHED BRICKWORK
ONLY NO BARS OR BROKEN BRICKS TO BE USED UNLESS INDICATED FOR BAND
AND NOT EXCEED 20mm MAXIMUM NO MATERIALS THE BRICKWORK TO BE USED
IN BELOW IS BELOW 30
PROVIDED BY PIPES OVER 150mm DIA
SLAB 225mm THICK GRADE CROP REINFORCED WITH 20mm MILD STEEL BARS 125mm COVER
5m OF SLAB COVER 40mm MINIMUM DETAILS AS PRECAST CONC
AS PER SCHEDULE BASE 150mm THICK UP TO 150mm DEPTH 125mm GREATER DEPTHS,
CROP

TO BE NOTIFICATION ON COMPLETION

Land Drains

30mm DIA FIBROUS OR REINFORCED PIPES COMPLYING
WITH EITHER BS 1194 OR BS 1195
NORTH OR REDUCED 600mm PIPES LAYED TO
MANUFACTURER'S INSTRUCTIONS
TECHNICAL TO BE FILLED TO WITHIN 100mm OF SURFACE
WITH APPROVED GRANULAR MATERIAL CAREFULLY
LAYING AROUND PIPES & LIGHTLY COMPACTING IN
25mm LAYERS

IN DEPTH
IS B ENGINEERING BRICKWORK BUILT IN ENGLISH BOND BRICKS SET IN CLASS 1
MORTAR AS MINIMUMS ABOVE IN 11 IN INTERNAL DIMENSIONS 1155 x 1155
SLAB AS MINIMUMS ABOVE 9 WIRE SLAB
AS 107, 976 SEE SCHEDULE
WALLS BELOW WELT & 200mm TO BASE 600mm BELOW OUTLET INVERT
TO 450 CHAMBER 100mm

Inspection Chambers

COVER & FRAME TO BS 5177, 976, PL 1
SLOPE AS PER SCHEDULE, SLOPES IN
BUILDINGS, 600mm x 450mm CLEAR OPENING

FRAME BUILT & FINISHED
ON CLASS 1 MORTAR

1 OR 2 COURSES CLASS B
ENGL. BRK. IN CLASS 1 MORTAR

MIN 150mm CONCRETE
GRADE CROP

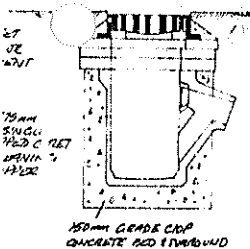
150mm INVERT BASE
GRADE CROP

PRECAST CONCRETE CHAMBER
SECTIONS TO BS 5177
40mm x 45mm MINIMUM
STEP JOINTS TO BS 5177
ALTERNATIVELY APPROVED EQUIVALENT
LITTLE IF 300mm NOT SPACED

ALTERNATIVE 225mm
ENGL. BRK. CLASS B EXCELLENT
BOND SAME DIMENSIONS

BRICKWORK FINISHED IN
GRAVELLITE SCORED IN 9

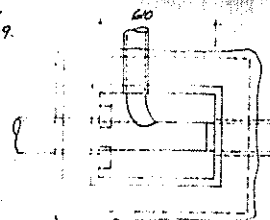
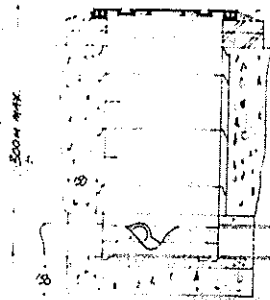
150mm DIA MAX.



CLASS 1 MORTAR
TO FINISH
2 OR 3 COURSES CLASS
B ENGINEERING BRICKWORK
IN CLASS 1 MORTAR

ALL GULLY CONNECTIONS TO BE
150mm DIA. SURROUNDED WITH
150mm CONCRETE GRADE CROP
WHERE COVER LESS THAN 150mm
FLEXIBLE MATERIAL OR APPROVED
TO BE USED AT ALL JOINTS.

TO BE SPECIFIED ON DRAINAGE LAYOUT DRAWING
IN ACCORDANCE WITH MANUFACTURER'S



1/1250 II	1/100	1/5	1/50	1/20	1/10	1/5	1/2	1/1	1/1/2	1/1/4	1/1/8	1/1/16	1/1/32	1/1/64	1/1/128	1/1/256	1/1/512	1/1/1024	1/1/2048	1/1/4096	1/1/8192	1/1/16384	1/1/32768	1/1/65536	1/1/131072	1/1/262144	1/1/524288	1/1/1048576	1/1/2097152	1/1/4194304	1/1/8388608	1/1/16777216	1/1/33554432	1/1/67108864	1/1/134217728	1/1/268435456	1/1/536870912	1/1/1073741824	1/1/2147483648	1/1/4294967296	1/1/8589934592	1/1/17179869184	1/1/34359738368	1/1/68719476736	1/1/137438953472	1/1/274877906944	1/1/549755813888	1/1/1099511627776	1/1/2199023255552	1/1/4398046511104	1/1/8796093022208	1/1/17592186044416	1/1/35184372088832	1/1/70368744177664	1/1/140737488355328	1/1/281474976710656	1/1/562949953421312	1/1/1125899906842624	1/1/2251799813685248	1/1/4503599627370496	1/1/9007199254740992	1/1/18014398509481984	1/1/36028797018963968	1/1/72057594037927936	1/1/144115188075855872	1/1/288230376151711744	1/1/576460752303423488	1/1/1152921504606846976	1/1/2305843009213693952	1/1/4611686018427387904	1/1/9223372036854775808	1/1/18446744073709551616	1/1/36893488147419103232	1/1/73786976294838206464	1/1/147573952589676412928	1/1/295147905179352825856	1/1/590295810358705651712	1/1/1180591620717411303424	1/1/2361183241434822606848	1/1/4722366482869645213696	1/1/9444732965739290427392	1/1/18889465931478580854784	1/1/37778931862957161709568	1/1/75557863725914323419136	1/1/151115727451828646838272	1/1/302231454903657293676544	1/1/604462909807314587353088	1/1/1208925819614629174706176	1/1/2417851639229258349412352	1/1/4835703278458516698824704	1/1/9671406556917033397649408	1/1/19342813113834066795298816	1/1/38685626227668133590597632	1/1/77371252455336267181195264	1/1/154742504910672534362390528	1/1/309485009821345068724781056	1/1/618970019642690137449562112	1/1/1237940039285380274899124224	1/1/2475880078570760549798248448	1/1/4951760157141521099596496896	1/1/9903520314283042199192993792	1/1/19807040628566084398385987584	1/1/39614081257132168796771975168	1/1/79228162514264337593543950336	1/1/158456325028528675187087900672	1/1/316912650057057350374175801344	1/1/633825300114114700748351602688	1/1/1267650600228229401496703205376	1/1/2535301200456458802993406410752	1/1/5070602400912917605986812821504	1/1/10141204801825835211973625643008	1/1/20282409603651670423947251286016	1/1/40564819207303340847894502572032	1/1/81129638414606681695789005144064	1/1/162259276829213363391778010288128	1/1/324518553658426726783556020576256	1/1/649037107316853453567112041152512	1/1/1298074214633706907134224082305024	1/1/2596148429267413814268448164610048	1/1/5192296858534827628536896329220096	1/1/10384593717069655257073792658440192	1/1/20769187434139310514147585316880384	1/1/41538374868278621028295170633760768	1/1/83076749736557242056590341267521536	1/1/166153499473114484113180682535043072	1/1/332306998946228968226361365070086144	1/1/664613997892457936452722730140172288	1/1/1329227995784915872905445460280344576	1/1/2658455991569831745810890920560689152	1/1/5316911983139663491621781841121378304	1/1/10633823966279326983243563682242756608	1/1/21267647932558653966487127364485513216	1/1/42535295865117307932974254728971026432	1/1/85070591730234615865948509457942052864	1/1/170141183460469231731897018915884105728	1/1/340282366920938463463794037831768211456	1/1/680564733841876926927588075663536422912	1/1/1361129467683753853855176151327072845824	1/1/2722258935367507707710352302654145691648	1/1/5444517870735015415420704605308291383296	1/1/10889035741470030830841409210616582766592	1/1/21778071482940061661682818421233165533184	1/1/43556142965880123323365636842466331066368	1/1/87112285931760246646731273684932662132736	1/1/174224571863520493293462547369853242665472	1/1/348449143727040986586925094739706485330944	1/1/696898287454081973173850189479412970661888	1/1/1393796574908163946347700378958825941323776	1/1/2787593149816327892695400757917651882647552	1/1/5575186299632655785390801515835303765295104	1/1/11150372599265311570781603031670607530590208	1/1/22300745198530623141563206063341215061180416	1/1/44601490397061246283126412126682430122360832	1/1/89202980794122492566252824253364860244721664	1/1/1784059615882449851325056485067297204894432	1/1/3568119231764899702650112970134594409788864	1/1/7136238463529799405300225940269188819577728	1/1/14272476927059598810600451880538377639155456	1/1/28544953854119197621200903761076755278310912	1/1/57089907708238395242401807522153510556621824	1/1/114179815416476790484803615044307021113243648	1/1/228359630832953580969607230088614042226487296	1/1/456719261665907161939214460177228084452974592	1/1/913438523331814323878428920354456168905949184	1/1/1826877046663628647756857840708912337811898368	1/1/3653754093327257295513715681417824675623796736	1/1/7307508186654514591027431362835649351247593472	1/1/14615016373309029182054862725671298702495186944	1/1/29230032746618058364109725451342597404990373888	1/1/58460065493236116728219450902685194809980747776	1/1/116920130986472233456438901805370389619961495552	1/1/233840261972944466912877803610740779239922991104	1/1/4676805239458889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General

ALL DRAINAGE CONSTRUCTION TO COMPLY WITH THE STATUTORY REQUIREMENTS OF THE BUILDING REGULATIONS, 1974 AND LATEST REVISIONS AND RECOMMENDATIONS OF THE BSE CODES OF PRACTICE CP 301 & CP 2005
ALL EXISTING GROUND LEVELS SHOWN AND EXISTING DRAIN & SEWER CONNECTION (H/W) LEVELS ARE TO BE VERIFIED PRIOR TO ANY DRAINAGE CONSTRUCTION

Pipe Testing

ALL PIPE LINES ARE TO BE TESTED IN ACCORDANCE WITH THE PERMITTED WATER OR AIR TEST AND ACHIEVE NORMAL TEST STANDARDS AT THE FOLLOWING STAGES -

- A 1/2" SAND AFTER INITIAL TRENCH BACKFILL.
B INTER LAYING AND COMPACTING OF HARD CORE BASE CONSTRUCTION
C FINALLY AFTER COMPLETION OF FINAL SURFACING OF FLOOR SLAB.

Foul Drains

PIPES SHALL BE CLAYWARE BRITISH STANDARD PIPES MANUFACTURED IN ACCORDANCE WITH BS 45, BS 550 WITH TYPE 1 SOCKETS SUPPLIED WITH MANUFACTURES FLEXIBLE JOINT TO BE LAID IN BEDDING AS SPECIFIED HEREFTER. ALL PIPES IN VEHICLE AREAS WITH LESS THAN 100MM COVER TO HAVE 150MM CONCRETE CONCRETE SURROUND WITH APPROVED FLEXIBLE MATERIAL, E.G. POLYMER, TO ALL JOINTS. CHANGES IN DIAMETER TO BE LAID SOFFIT TO SOFFIT UNLESS STATED OTHERWISE. ALL CLAYWARE PIPES SHALL BE EXTRA STRENGTH AND LAID IN ACCORDANCE WITH DRAINAGE CURVES OF THE LOCAL WATER AUTHORITY'S STANDARD SPECIFICATION.

Surface Water Drains

2. APES TO BE BRITISH STANDARD OR AS SURFACE WATER APES MANUFACTURED ACCORDING TO
BS 681, 4.3.50 WITH TYPE 1 SOCKET SUPPLIED WITH MANUFACTURED FLEXIBLE JOINT TO BE LAD
IN A DRAINAGE DRAINAGE. HEREINAFTER ALL APES IN VEHICLE APERTURES WITH LESS THAN 120MM
COVER TO HAVE 150MM DRAIN OR CLAY PIPES TO BE EXIST FROM THE STRENGTH OF CONCRETE
ED. MARKED, TO ALL JOINTS. CLAY PIPES TO BE EXIST FROM THE STRENGTH OF CONCRETE
TO ACCEPTED RESISTANCE AND CLASS L UP TO AND INC. 300MM STRENGTH OF CONCRETE
SIZES IN DIAMETER TO BE LAD TO FIT TO SOCKET UNLESS OTHERWISE STATED. ALL APES AND
CONFORMANCE WITH DRAINAGE CURVES OF THE LOCAL WATER AUTHORITY'S STANDARD SPECIFICATION.

Pipe Bedding

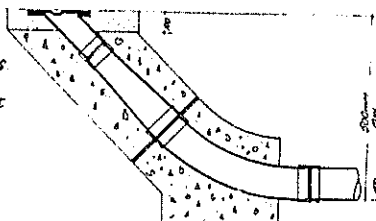
UNLESS BUCKET SURROUND ALL APES TO BE BEDDED
AT 100MM OR $1/16"$ OUTSIDE APE DIAMETER WHICH GIVE THE
GREATER THE A CIRCULAR MATERIAL AND PRODUCE HALF BRILL
EACH BOTTOM IS TO BE FREE FROM ALL LOOSE MATERIAL
LUMP, LUMPS, STONES ETC BEFORE PLACING BEDDING
BEDDING SHALL BE SPREAD EVENLY OVER TRAY AND
COMPACTED AND DEPTH BELOW APE INCREASED TO 100MM
WHILE ON EACH END OF THE LAYERS.

TO BE BACKFILLED WITH TYPE 3 FILL MATERIAL
AS APPROVED BY ENGINEER. MATERIAL TO BE IMPORTED
F HICKORY, COMPACTED IN 225MM LAYERS
PIPS SLOW BUILDING, BEDDING AS ABOVE PLS 75M
CONCRETE SLAB FOR FULL TENCH WIDTH



Rodding Eye

ESTATE 262 SS
 ADDING POINT EXTERNALLY
 HERE 262 SS WITH
 AIRTIGHT SEAL INSIDE BUILDING
 TO 100mm - 150mm DIA TAPER
 PIPE
 SET IN GRADE CROP CONCRETE
 SURROUND 150mm THICK.
 RAYBOLD FLEXIBLE MATTING.
 E.G. RAYBOLD AT PIPE JOINT.



NB

1. JACOBS PASSING THROUGH WALLS TO BE PROTECTED WITH LINCOLN OVER ANY DOWN PASSING THROUGH FOUNDATION TO BE WRAPPED WITH 50mm APPROVED CLASS FBGL PIPE NOT TO BE IN CONTACT WITH CONCRETE
2. INTERNAL STIRRS TO CONNECT INTO CLAY COLLARS SET 50mm BELOW FFL AND COURED IN ACCESS PLATE TO BE PROVIDED AT BASE OF ALL STACKS.
3. ALL JACOBS AND JOLTS ADJACENT BUILDINGS WHERE TRENCH CONDITIONS INFLUENCE FOUNDATIONS TO BE APPROVED BY ENGINEER AND ANY EXTRA MEASURES OR RESTRICTIONS AS MAY BE FOUND NECESSARY TAKEN AS DICTATED BY THE ENGINEER.

Manholes precast concrete

PRECAST CONCRETE SECTIONS TO CORRAL WITH THE REQUIRED REINFORCED WITH 2#08 BARS. MAXIMUM AS BEING 12" IN DIAMETER. 1" MAXIMUM. TO BE KEPT TO BE PLACED APPROXIMATELY IN 750MM CORNER TO CORNER AND SPACED 300MM VERTICALLY WITH 1#08 275MM BELOW PIPE SPACED GRADE TO TOP OF EACH CIRCLE CHANNELS TO WELDS, FIRST PIPE OUT OF MANHOLE TO JOINTS BEING ABOUT CHANNEL TO HAVE 1 IN 4 FRA GRADUOLITHIC SLOPED. PRECAST SECTIONS SURROUNDING COVER & PAVING TO BE 497 97% AS PER SCHEDULE C-3 CURVES OF ROADBEDDING CLASS B. BE CHECKED AS A SET OF COVER KEYS TO BE PROVIDED TO SUIT FOR 1" MANHOLLS DEEPER THAN 2500MM TO SORT OF PIPES TO SHUNT ON REDUCING SLAB OR TAPER SECTION WITH 1" MANHOLLS DEEPER THAN 3500MM TO SORT OF PIPES TO STAFF 900MM DIA ON REDUCING SLAB.

K9, ALSO AT MANHOLLS OVER 3500 DIA TO INCORPORATE RUBB LINDER (BS 421) WITH DISTANCE FROM RAIL TO 750MM DISTANCE FROM COVER LEVEL TO FIRST CURV.

1. THE LENGTH OF THE RAIL PIPE, THE COVER OR ARTICULATED THE STRUCTURE SHALL NOT BE GREATER 0.75 METER (750MM) R AND ONE METRE (1000MM) FOR PIPES UP TO 750MM DIA.

Manholes brickwork

LESS THAN 12" CLASS B ENGINEERING ROCKWORK BUILT & PLACED IN PLACE. EXPOSED ROCK SHALL BE FLUSH WITH GROUND SURFACE. ALL EXPOSED ROCK RISE MORE THAN 40mm VERTICAL DOWNS TO BE EXPOSED. 10mm. BEHIND WITH 50mm TO RISE UNIFORMELY. NO BITS OF ROCK BACKS TO BE OVERLAP. COARSELY NOT EXCEED 30mm PER COURSE WHEN AMOUNT OF PROPOSED ROCK IS LESS THAN 1/2 12" MIN. EXPOSURE AREA TO BE PROVIDED ON PILES OVER CONCRETE COVER SLAB. LESS THAN 12" GRADE COOP. REE BOTHWAYS IN BOTTOM OF EXPOSURE 40mm. PROPOSED MATERIAL SIZES MS AND SCHEDULE BRICK 1/2" 50% CONCRETE GRADE COOP.

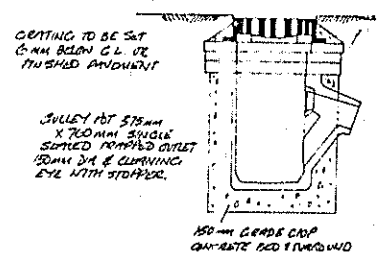
ALL MANHOLES TO BE WATERTIGHT ON COMPLETION

Catchpit

2.000M OR LESS IN DEPTH.
225MM PRICE CLASS B 12" WELDED BRICKWORK BUT
MUST BE ALL REINFORCED AS MINIMUMS ABOVE WITH INTER-
CONCRETE COVER SLAB AS MINIMUMS ABOVE OF 50MM :
CASE OF PLUMBING TO BS 497, 1976-SEE SCHEDULE
OUTLET TO BE 100MM BELOW INLET, & DEPTH TO 6
ALL PIPES TO PROVIDE INTO CHAMBER 50MM.

Gullies

GULLEY GRATING & FRAME TO BSS 197 1976 GRADE
STRAIGHT BAR DOUBLE TRIANGULAR IN CAST IRON
GULLEY DOT TO COMPLY WITH BSS911 PART 2; BSS 65
COATED INTERNALLY WITH TWO COATS OF MILDON, OR E.

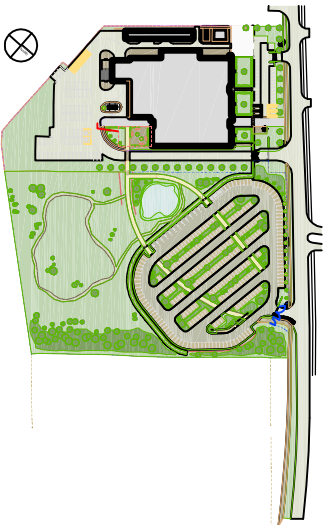
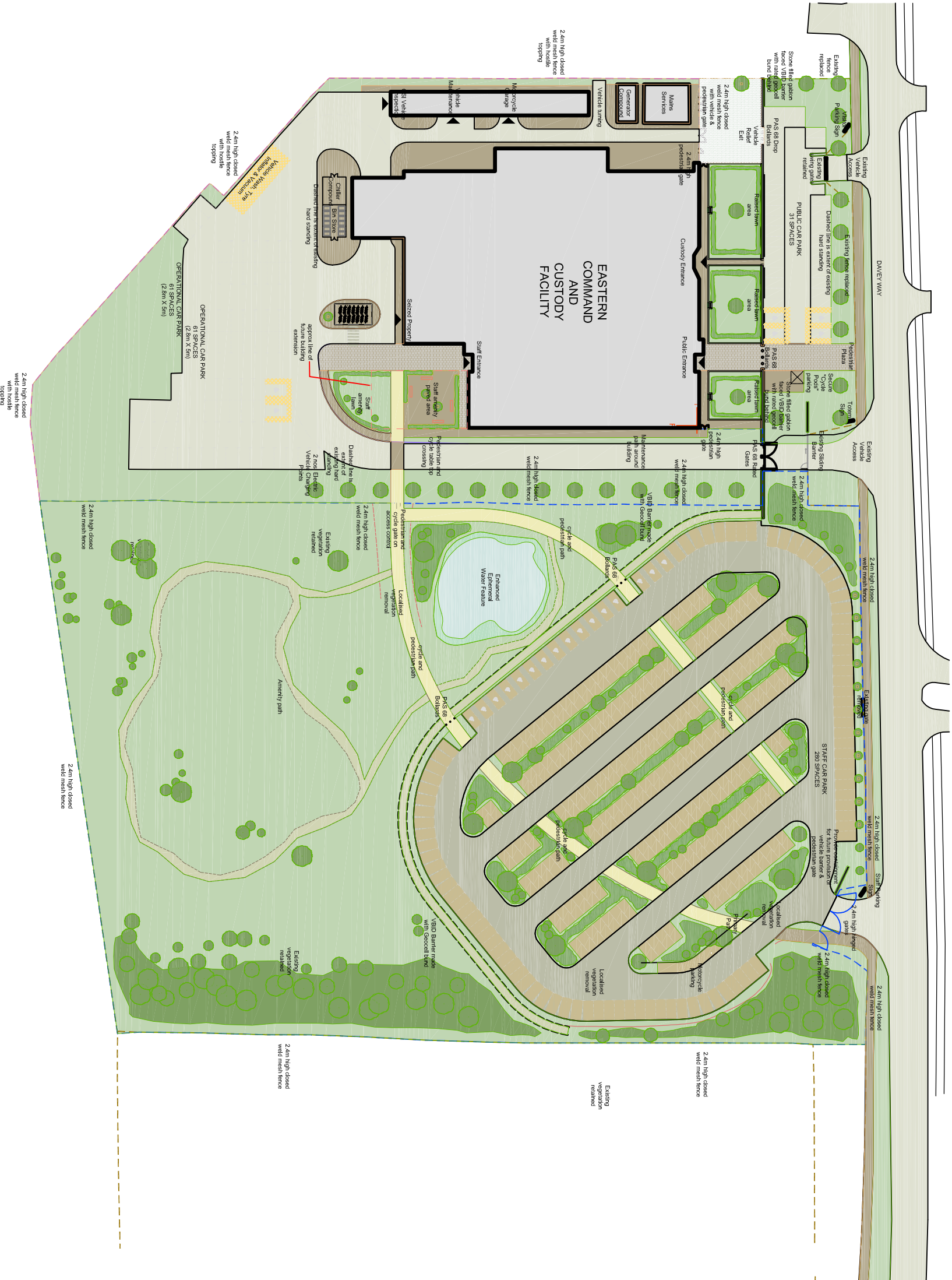


Interceptor

TYPE AND CAPACITY AS SPECIFIED ON DRAINAGE LANDS
INSTALLED AND CONNECTED IN ACCORDANCE WITH MANU-
FACTURER'S INSTRUCTIONS

$1/8$ in = 1 ft
 $1/4$ in = 1 ft
 $1/2$ in = 1 ft
 1 in = 1 ft
 $1/500$ ft
 $1/2500$ ft

Appendix B - Proposed Site Plan



1 Full Site Key Plan
NTS



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following:

CONSTRUCTION MAINTENANCE

DECOMMISSIONING/DEMOLITION

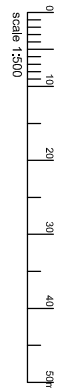
ENVIRONMENT

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved Method Statement.

NOTES:

1. All dimensions are to be checked on site prior to preparing any working or stop drawings or commencing work on site.
2. This drawing is to be read in conjunction with all relevant Architect's, M&E and Structural Engineers' drawings and specifications.

1 Proposed Site Plan
1 : 500



Client			
POLICE AND CRIME COMMISSIONER OF NORTH WALES			
Project			
EASTERN COMMAND AND CUSTODY FACILITY			
Drawing title			
PROPOSED SITE PLAN			
Drawing Status			
PLANNING			
Scale			
1 : 500 @ A1 DO NOT SCALE			
Drawing Number			
B1305210/AR/050.001			
Revision			
PL1			

Appendix C - Proposed Drainage Strategy

Appendix D - Site Suds Evaluation

Site Drainage Evaluation for the use of SUDS

Site Name: Wrexham Police Eastern Command and Custody Facility.

Introduction

This is a site specific report to provide outline guidance on drainage and the use of SUDS. HR Wallingford Ltd, the Environment Agency and any local authority are not liable for the performance of any drainage scheme which is based upon these results. It is recommended that detailed design of any scheme is carried out before construction takes place.

The following site characteristics were entered.

- *Site Development Includes:* Commercial;
- *Drainage Ownership:* Private;
- *Site Size:* Between 4 ha and 5 ha.
- *Land Use:* Brownfield / Greenfield Development.
- *Other Characteristics:* None
- *Ground Water:* Greater than 2m below surface (assumed).

General

The general principle behind the use of SUDS for any site is to comply with the following:

- *runoff volumes should be minimised*
- *runoff rates should be minimised*
- *the stormwater effluent is treated appropriately before discharge from the site bearing in mind the requirements of the receiving watercourse*
- *groundwater must be protected*

in addition it is desirable to maximise the amenity potential and ecological benefits where there is an opportunity to provide this.

The various SUDS components should not be treated as individual options, but should be seen as providing a set of drainage features (a treatment train) which are appropriate at various scales. It is always desirable to have a mix of SUDS components across the site to take opportunity of their respective benefits.

SUDS Ownership

Due to institutional and legislative constraints it is possible that the most technically appropriate solution may not be suitable due to ownership and maintenance issues. It is essential that any drainage system will receive appropriate long-term maintenance.

The following table summarises the current position on vesting of SUDS systems in the UK. It should be noted that there will be occasional differences between some organisations, particularly Local Authorities.

Private Owner: Private owners have no constraints on the use of any SUDS component. Careful assessment should be made of the risk of a change to the SUDS component occurring in the property and the impact this might have on the whole system performance.

SUDS Ownership/Maintenance by Drainage Organisation - UK						
SUDS Component	Local Authority	Highways Authorities	Scottish Water	Sewerage Undertaker	NI Water	Service Private owner
Water butts, Stormwater Use Systems	No	No	No	No	No	Yes
Pervious Pavement	No	No	No	No	No	Yes
Filter drains	No	Yes	No	No	No	Yes
Filter Strips	Yes	Yes	No	No	No	Yes
Swales	Yes	Yes	No	No	No	Yes
Detention Ponds	Yes	No	Yes	No	No	Yes
Retention Ponds	Yes	No	No	No	No	Yes
Wetlands	Yes	No	No	No	No	Yes
Detention Basins	Yes	No	Yes	No	No	Yes
Soakaways	No	Yes	No	No	No	Yes
Infiltration Trenches	No	Yes	No	No	No	Yes
Infiltration Basins	Yes	Yes	No	No	No	Yes
Green Roofs	No	No	No	No	No	Yes
Bio-retention Areas	Yes	Yes	No	No	No	Yes
Underground Storage	No	Yes	Yes	Yes	Yes	Yes
Proprietary Drainage Units	No	Yes	Yes	Yes	Yes	Yes
Pipes	Yes	Yes	Yes	Yes	Yes	Yes

Design of SUDS

It is important to be aware of both the opportunities and constraints of using SUDS for providing the most appropriate drainage system for a development. For more in-depth guidance the most appropriate document is the SUDS manual by CIRIA and SUDS for High Density Developments by HR Wallingford. Other SUDS reference documents and manuals are to be found in the references section of this web site.

Construction of SUDS

SUDS are a combination of civil engineering structures and landscaping practice. Due to the limited experience of building SUDS in the water industry, there are a number of key issues which need to be particularly considered as their construction requires a change in approach to some standard construction practices. Detailed guidance on the construction related issues for SUDS is available in the SUDS Manual and the associated Construction Site handbook (CIRIA, 2007).

SUDS Components for Your Site

The following table summarises the SUDS components that might be used:

SuDS Component	Applicability
Ponds	Yes
Basins	no
Pervious Pavements	Yes (subject to infiltration testing)
Swales	Yes
Infiltration Trenches	No
Soakaways	Yes (subject to infiltration testing)
Green Roofs	Yes
Rainwater Harvesting	yes
Bio-retention	yes

The Use of SUDS for Infiltration

Infiltration options are may be possible with this soil type subject to other site considerations.

Treatment Train

In principle, the more SUDS used in a treatment train the better. Ponds and storage should preferably not be used as the first SUDS component for any paved runoff. Treatment will be more effective and hydraulic benefits will also be gained. Where commercial or industrial development is proposed, greater emphasis on the treatment train will be required. It would generally be desirable to separate the systems serving these areas from systems serving residential developments.

Suitable SUDS Components

The following SUDS might be suitable components of the drainage system for the following reasons:

- *Pervious Pavements*

Pervious pavements are suitable for this site.

- *Swales*

Swales are suitable for this site.

The land take of swales is significant except for mini-swales. Although these SUDS components are very effective, their use in high density developments may be precluded due to lack of space. In spite of this issue of land take and adoption difficulties, the use of these SUDS units is very desirable due to their effectiveness in addressing both hydraulic and water quality issues.

- *Green Roofs*

Green roofs are suitable for this site.

The use of green roofs provides a number of benefits including reducing runoff volumes for ordinary rainfall events. However they do not have a significant impact on the sizing of main drainage components unless the rainwater is harvested and used.

- *Rainwater Harvesting*

Rainwater harvesting is suitable for this site.

Warning: Rainwater harvesting for large roof areas may have a higher yield than the demand for the collect water. In this situation stormwater management benefits assumed for extreme storm event management will be limited and require careful analysis.

Rainwater harvesting has benefits in reducing potable water demand and also can have a significant impact in reducing the size of some main drainage components if rainfall storage tanks are large enough. Where water resources are particularly scarce, rainwater harvesting should be positively considered. Depending on proposed usage and yield, guidelines suggest that the volume of storage provided should be around 350 litres per person to ensure reasonable continuity of supply. However where rainwater harvesting is used to obtain stormwater management benefits, this figure should be multiplied by around 3 (1000 l/person). Detailed evaluation of the rainwater harvesting benefits requires the use of time series rainfall data.

- **Ponds**

Ponds are not suitable for this site - subject to infiltration testing.

- **Soakaways**

Soakaways are suitable for this site – subject to infiltration testing.

- ***Bio-retention***

Bio-retention is suitable for this site.

Warning: The use of bio-retention in situations where the groundwater is less than 2m may not be feasible unless the percolation zone depth is kept to a minimum.

Unsuitable SUDS Components

The following SUDS have been excluded as suitable components of the drainage system for the following reasons:

- ***None***

Appendix E - Calculations

Quick Storage Estimate

Micro Drainage

Variables

FSR Rainfall Cv (Summer)
 Return Period (years) Cv (Winter)
 Region Impermeable Area (ha)
 Map M5-60 (mm) Maximum Allowable Discharge (l/s)
 Ratio R Infiltration Coefficient (m/hr)
 Safety Factor
 Climate Change (%)

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 244 m³ and 474 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help

Enter Maximum Allowable Discharge between 0.0 and 999999.0

The proposed drainage strategy uses the maximum storage requirement of 500m³ for the western half of the site. This storage is located within an underground storage structure to the south west. This value will be refined as part of the detailed design process.

The storage required for the permeable paving to the east of the site (which will infiltrate to ground) will be subject detailed design proposals.