

DRAINAGE OUTFALL DETAILS AND POSITIONING BY OTHERS.  
 E = 611764.588  
 N = 275192.154  
 INVERT LEVEL = 42.170m AOD.

DRAINAGE OUTSIDE SITE BOUNDARY DESIGNED AND INSTALLED BY OTHERS.  
 150 I.D. / 178 O.D. TWINWALLED PIPE  
 INVERT LEVEL AT REDLINE BOUNDARY = 43.575m AOD.  
 EXISTING GROUND LEVEL = 44.860m AOD (TO BE CHECKED ON SITE)  
 E = 611750.358  
 N = 275047.438

### DRAINAGE PHILOSOPHY

**NORMAL SUBSTATION OPERATION**

THE GREEN FIELD SITE AREA LOST TO NEW DEVELOPMENT HAS BEEN CALCULATED AS 9,000m<sup>2</sup>.

AS A MINIMUM THE SURFACE WATER DRAINAGE SYSTEM WILL FULLY MANAGE SURFACE WATER FLOWS RESULTING FROM THE DEVELOPED SITE, UP TO THE 100 YEAR RETURN PERIOD PEAK RAINFALL EVENT, PLUS A MINIMUM OF 45% TO ALLOW FOR THE IMPACTS OF CLIMATE CHANGE.

THE PREDEVELOPED GREENFIELD SITE FALLS TOWARDS A NEARBY WATERCOURSE. AN ANALYSIS HAS IDENTIFIED THE FLOWS FROM THE GREEN FIELD SITE (THE AREA INSIDE THE SUBSTATION SECURITY PERIMETER) AS 2.6 l/s DURING A 1 IN 100 YEAR RETURN PERIOD STORM. (MEAN ANNUAL FLOOD FLOW, Q<sub>100</sub>), THIS RISES UP TO 3.4 l/s DURING A 100 YEAR EVENT.

THE PROPOSAL IS TO UNDERTAKE A CUT AND FILL OF THE EXISTING GROUND IN ORDER TO FORM A LEVEL PLATFORM PRIOR TO UNDERTAKING THE CONSTRUCTION OF THE SUBSTATION. FOLLOWING COMPLETION OF THE DEVELOPMENT, IT IS PROPOSED TO LIMIT THE MAXIMUM FLOW TO DOWNSTREAM WATERCOURSES TO 2.3 l/s BY MEANS OF A HYDRO-BRAKE. THIS IS LESS THAN Q<sub>100</sub> AND SIGNIFICANTLY LESS THAN THE EXISTING GREENFIELD RUNOFF RATE DURING A 1 IN 100 YEAR EVENT OF 3.4 l/s. CALCULATIONS DEMONSTRATE THAT IN ORDER TO ACHIEVE THIS IT WILL BE NECESSARY TO PROVIDE AN ATTENUATION VOLUME OF 240m<sup>3</sup>. THE PROPOSAL IS TO CONSTRUCT A WETLAND/ATTENUATION BASIN CAPABLE OF CONTAINING THIS VOLUME WITH AN ADDITIONAL 300mm OF FREEBOARD (WHICH WILL PROVIDE AN ADDITIONAL 75m<sup>3</sup> OF STORAGE VOLUME).

**SURFACE WATER - SUBSTATION PLATFORM**

HISTORICALLY SUBSTATION PLATFORMS FOR ELECTRICAL SUBSTATIONS WERE MADE UP OF 300mm OF COMPACTED TYPE 1 MOT STONE WITH A LAYER OF 75mm SINGLE SIZED STONE CHIPPINGS ON TOP. THE TYPE 1 LAYER WAS LARGELY IMPERVIOUS AND THUS RAINFALL WOULD TEND NOT TO PENETRATE BELOW THE CHIPPING LAYER. MORE RECENTLY IT HAS BECOME COMMON PRACTICE TO REPLACE THE TYPE 1 STONE LAYER WITH A FREE DRAINING STONE SUCH AS TYPE 3. THIS IS THE MOST USED SUB-BASE WHERE SUDS IS REQUIRED. IT WILL ACT AS A 'DRAINAGE BLANKET' AND ALLOW PAVED AREAS TO DRAIN DIRECTLY INTO THE PLATFORM. THE PLATFORM WILL HAVE THE CAPACITY TO ABSORB OVER 500m<sup>3</sup> OF RAINFALL. IT SHOULD BE NOTED THAT EVEN DURING THE MOST INTENSE 100 YEAR RAINFALL EVENT ONLY HALF OF THE STORAGE IN THE DRAINAGE BLANKET WILL BE UTILISED. ALTHOUGH FILTER DRAINS ARE PROVIDED AROUND THE PERIMETER OF THE SUBSTATION IT WILL TAKE SOME TIME FOR RAINFALL TO PASS THROUGH THE STONE LAYER BEFORE REACHING THESE DRAINAGE ROUTES. PARTICULARLY AS IT IS A HORIZONTAL SURFACE. AS AN EXAMPLE, A 100 YEAR RAINFALL EVENT WILL TAKE AT LEAST 7 DAYS TO DRAIN THROUGH THE SYSTEM AND INTO THE DETENTION BASIN. THIS WILL PRODUCE A FLOW RATE FROM THE PLATFORM OF ONLY 0.3 l/s AND WILL ONLY COMMENCE SOMETIME AFTER THE RAINFALL EVENT HAS FINISHED. IN REALITY SOME OF THIS VOLUME WILL SOAK INTO THE UNDERLYING STRATA AND SOME WILL EVAPORATE SO THIS FLOW RATE IS CONSERVATIVE.

**SURFACE WATER - BUILDINGS**

RUN OFF FROM BUILDING ROOFS WILL BE DIRECTED INTO THE FILTER DRAINS. THE CALCULATIONS HAVE ASSUMED THAT THE ROADS AND PAVED AREAS WILL ALSO DRAIN INTO THE SYSTEM. ALTHOUGH A TIME OF CONCENTRATION OF 30 MINUTES HAS BEEN ALLOWED. THE CALCULATIONS HAVE ASSUMED THAT THE FLOW WILL PASS QUICKLY INTO THE DETENTION BASIN HOWEVER IN REALITY THIS WILL BE CONSIDERABLY SLOWED AS FLOWS WILL BE ABSORBED INTO THE FILTER DRAIN STONE AND TO SOME DEGREE INTO THE STONE PLATFORM.

IN ADDITION, IT IS A REQUIREMENT OF THE ENVIRONMENT AGENCY TO FOLLOW THE PRINCIPALS SET OUT IN THE SUDS MANUAL IN PROVIDING LEVELS OF TREATMENT TO SURFACE WATER FLOWS, WHILE AT THE SAME TIME PROVIDING A NATURAL AND STABLE HABITAT FOR PLANTS AND WILDLIFE. FLOWS FROM THE SITE WILL BE INITIALLY GIVEN SOME FILTRATION WHEREBY FLOWS PASS THROUGH A GEOTEXTILE MEMBRANE PRIOR TO PASSING INTO A PERFORATED LAND DRAINAGE SYSTEM. THIS WILL REMOVE SILTS AND OTHER SUSPENDED CONTAMINANTS. FLOWS FROM BUILDINGS, WHERE OILS MAY BE PRESENT, ARE FIRSTLY PROTECTED BY INTELLIGENT PUMPING SYSTEMS WHICH WILL DETECT THE PRESENCE OF OIL AND IF SO CEASE OPERATION. IN ADDITION, FLOWS FROM THESE LOCATIONS WILL PASS THROUGH AN OIL SEPARATOR, BEFORE PASSING DOWNSTREAM.

THE OUTGOING INVERT LEVEL FROM THE POND WILL BE SET 300mm ABOVE THE POND BASE. THIS WILL PROVIDE AN ENVIRONMENT FOR WILDLIFE AND PLANTS. AS FLOWS PASS THROUGH THE WETLAND POND, THEY WILL GET FURTHER TREATMENT WITH THE INTERACTION OF SELECTED PLANTS WHICH WILL ASSIST IN REMOVING DISSOLVED CONTAMINANTS. THE AREA OF THE POND WILL BE SIZED SO DURING THE MOST INTENSE STORM THE WATER LEVEL IN THE POND WILL RISE BY APPROXIMATELY 0.9m. THE POND WILL RETURN BACK TO ITS NORMAL LEVEL IN APPROXIMATELY 29 HOURS.

THE ABOVE PROPOSAL IS A RECOGNISED STANDARD WAY OF ACHIEVING THE PRINCIPALS OUTLINED IN THE SUDS MANUAL.

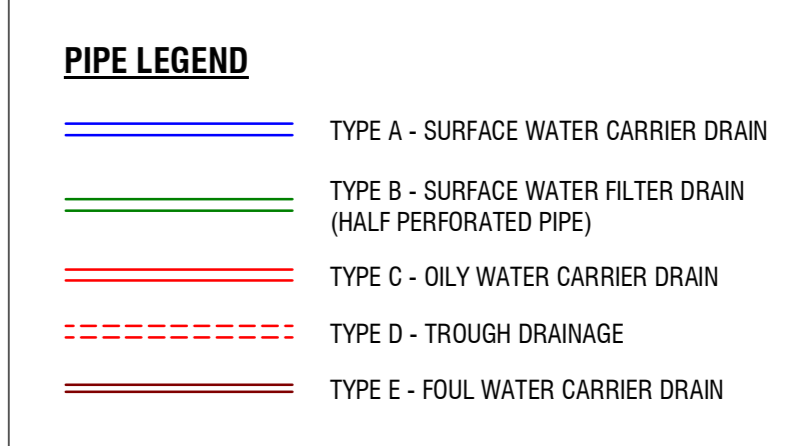
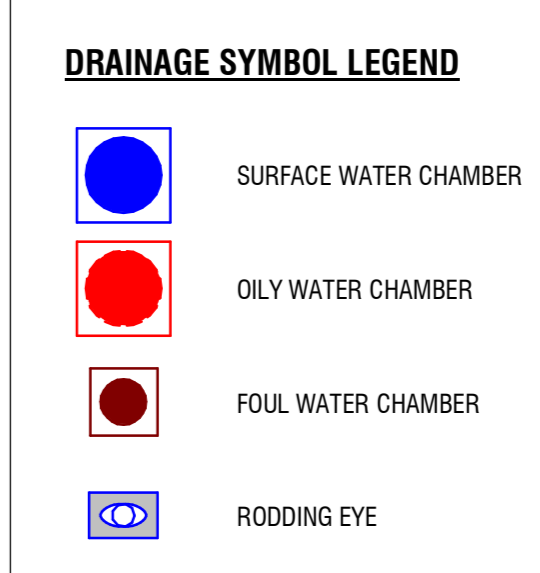
**FOUL WATER**

ALL FOUL WATER WILL BE GRAVITY DRAINED TO A 9,000 LITRE CESS PIT WHICH WILL HAVE A HIGH-LEVEL ALARM. THE CESS PIT WILL REQUIRE MANUAL EMPTYING AND DISCHARGE OFF SITE.

**DRAINAGE MANAGEMENT DURING THE CONSTRUCTION PHASE**

IT IS PROPOSED THAT THE WETLAND/ATTENUATION POND IS CONSTRUCTED AT AN EARLY STAGE SO THAT IT CAN BE USED AS A MEANS TO CONTROL SILT FLOWS TO THE WATERCOURSE. IT IS RECOMMENDED THAT CUT-OFF DITCHES ARE CONSTRUCTED WHICH WILL DIRECT FLOWS DURING CONSTRUCTION INTO THE POND. THE POND WILL HAVE A MINIMUM DEPTH OF 300mm WHICH WILL PROVIDE SUFFICIENT ROOM FOR SILTS TO SETTLE. THE POND WILL BE SUBJECT TO REGULAR INSPECTION TO ENSURE THAT ANY BUILDUP OF SILTS ARE REMOVED PROMPTLY. WITH THIS MITIGATION IN PLACE, THE WATER BEING DISCHARGED WILL REMAIN IN COMPLIANCE WITH THE ENVIRONMENTAL QUALITY STANDARD FOR SURFACE WATER, I.E. 40 mg/l OF SEDIMENT. IN ADDITION TO THE ABOVE, AN OIL ABSORPTION AND DEBRIS BOOM WILL BE PLACED IN FRONT OF THE POND OUTFALL.

A MONITORING REGIME WILL BE DEVELOPED FOR THE WATER BEING DISCHARGED IN ORDER TO TRACK TURBIDITY, pH AND OVERALL QUALITY. IN THE EVENT THAT QUALITY DECREASES FURTHER, TREATMENT MEASURES CAN THEN BE PUT IN PLACE.



- DO NOT SCALE. WORK TO DIMENSIONS SHOWN. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS SHOWN OTHERWISE.
- THE CONTRACTOR IS RESPONSIBLE FOR THE LOCATION OF ALL EXISTING SERVICES WITHIN THE WORKS AREA AND FOR THE STRUCTURAL STABILITY THROUGHOUT THE WORKS.
- CONTRACTORS ARE TO BE AWARE OF THEIR RESPONSIBILITIES UNDER THE CDM REGULATIONS & COMPLY WITH THEM AT ALL TIMES. NOTE THAT ANY HAZARDS IDENTIFIED ON THE DRAWINGS ARE ONLY THOSE WHICH MAY NOT BE OBVIOUS TO COMPETENT PERSONS OR ARE USUAL OR WHICH MIGHT BE DIFFICULT TO MANAGE.
- WORKING AREAS AND METHODS TO BE AGREED BEFORE WORK COMMENCES.
- THE TERM 'ENGINEER' REFERS TO PATTERSON REEVES & PARTNERS.
- THE TERM 'CONTRACTOR' REFERS TO THE CONTRACTOR RESPONSIBLE FOR THE INDIVIDUAL ELEMENT OF THE WORKS.
- ANY CONTRACTOR RESPONSIBLE FOR THE PLANNING AND EXECUTION OF ANY EXCAVATION WORKS SHOULD BE AWARE OF HSG47 - AVOIDING DANGER FROM UNDERGROUND SERVICES.
- SIEMENS ENERGY ARE RESPONSIBLE FOR SIZING OF DRAWINGS. THE SIZES OFFERED ARE STANDARD CUBES SIZES AND ARE BASED ON THE SIEMENS ENERGY PRIMARY LAYOUT. SIEMENS ENERGY TO REVIEW AND ACCEPT.
- FOR ADDITIONAL CONSTRUCTION NOTES REFER TO D069-SEL-V00-400-DD-C-0027.

DRAWING TITLE	DRAWING No.
OVERVIEW & PHILOSOPHY	D069-SEL-V00-400-LY-C-0016
LAYOUT 1	D069-SEL-V00-400-LY-C-0017
LAYOUT 2	D069-SEL-V00-400-LY-C-0018
LAYOUT 3	D069-SEL-V00-400-LY-C-0019
SCHEDULES	D069-SEL-V00-400-SH-C-0006
DETAILS 1 - GENERAL	D069-SEL-V00-400-DD-C-0027
DETAILS 2 - POND	D069-SEL-V00-400-DD-C-0028
DETAILS 3 - OIL SEPARATOR	D069-SEL-V00-400-DD-C-0029
DETAILS 4 - BUND DRAINAGE	D069-SEL-V00-400-DD-C-0030

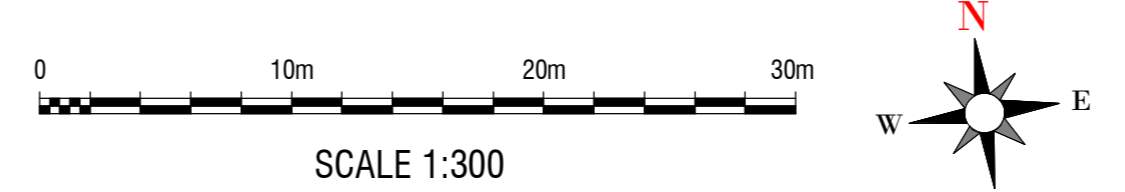
#### DRAWING REFERENCE SCHEDULE

DRAWING STATUS: **FOR COMMENT**

DRAWING TO BE PRINTED IN COLOUR ONLY

Customer	CONRAD ENERGY LTD	Project	EYE 400kW SYNCHRONOUS CONDENSER
Contractor	SIEMENS energy	Title	OVERVIEW & PHILOSOPHY DRAINAGE
Subcontractor	Patterson Reeves & Partners	Contractor Drawing No.	D069-SEL-V00-400-LY-C-0016
Client Drawing No.			
Designed	N.Patterson	Drawn	T.Peeling
Checked	G.Hooper		
Approved	N.Patterson	Date	May 2023
Scale	1:300	Size	A0
Sheet	01	Revision	01
of	01		04

ISSUE	01	02	03	04	PHILOSOPHY UPDATED
DRAWN	T.Peeling 21.07.2023	A.Godding 11.08.2023	A.Godding 13.09.2023	A.Godding 19.10.2023	
CHECKED	G.Hooper 21.07.2023	G.Hooper 11.08.2023	G.Hooper 13.09.2023	G.Hooper 19.10.2023	
APPROVED	N.Patterson 21.07.2023	N.Patterson 11.08.2023	N.Patterson 13.09.2023	N.Patterson 19.10.2023	



THIS DRAWING PROVIDES DETAILED INFORMATION RELATING ONLY TO: **DRAINAGE**

ALL BACKGROUND INFORMATION IS INDICATIVE

**CDM REGULATIONS:**

SIGNIFICANT OR UNUSUAL RESIDUAL HAZARDS HIGHLIGHTED BELOW:

THERE ARE NO RISKS UNFAMILIAR TO A COMPETENT CONTRACTOR

SAFE METHODS OF WORK ARE THE RESPONSIBILITY OF THE CONTRACTOR AND ARE TO BE IDENTIFIED IN THE HEALTH AND SAFETY PLAN.