

GENERAL NOTES

- IT IS TO BE NOTED THAT THESE STANDARD DRAWINGS ARE INTENDED TO SERVE AS REFERENCE AND GUIDE FOR THE CONSULTANT TO FURTHER DEVELOP THE DETAILED DESIGN OF THE PROPOSED WORKS. THE CONSULTANT SHALL ASSESS AND REVIEW THESE DRAWINGS, MAKE SUCH DESIGN CHANGES AND MODIFICATIONS AS NECESSARY AND APPROPRIATE, WHICH SHALL TAKE INTO ACCOUNT THE ACTUAL SITE CONDITIONS AND CONSTRAINTS AT THE PARTICULAR LOCATION.
- WHERE THERE ARE DEVIATIONS OR MODIFICATIONS NECESSARY, TO BE MADE TO THE STANDARD DRAWINGS, SO AS TO FIT THE PREVAILING SITE CONDITIONS OR CONSTRAINTS, CONDITIONS AND REQUIREMENTS SET BY ANY AUTHORITY, THE CONSULTANT SHALL SUBMIT HIS PROPOSAL TO THE BOARD FOR APPROVAL, PROVIDING THE RATIONALE FOR MAKING SUCH DEVIATIONS, CHANGES AND MODIFICATIONS.
- HORIZONTAL DATUM BASED ON SVY21 SYSTEM.
- REDUCED LEVEL IS BASED ON SINGAPORE HEIGHT DATUM +0.000M.
- METRIC UNITS USED THROUGHOUT AND ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONSULT THE RELEVANT AUTHORITIES AND OBTAIN ALL THE NECESSARY APPROVALS BEFORE COMMENCEMENT OF WORKS.
- BOUNDARY LINES/ROAD RESERVES SHOWN IN THE DRAWINGS ARE INDICATIVE ONLY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ACQUIRE ALL NECESSARY DRAWINGS FROM THE RELEVANT STATUTORY AUTHORITIES AND VERIFY THE LIMITS OF THE BOUNDARY BEFORE SETTING OUT THE WORKS. THE CONTRACTOR SHALL NOT UNDER ANY CIRCUMSTANCES, ENTER OR UNDERTAKE ANY WORKS WITHIN ANY PROPERTY, NOTWITHSTANDING WHETHER IT IS PRIVATELY OR PUBLICLY OWNED, WITHOUT THE WRITTEN APPROVAL OF THE BOARD AND RELEVANT PARTY.
- EXISTING SERVICES, TOPOGRAPHICAL AND HYDRO-GEOGRAPHICAL INFORMATION SHOWN IN THE DRAWINGS ARE INDICATIVE AND FOR THE CONTRACTOR'S REFERENCE ONLY. THE CONTRACTOR SHALL ACQUIRE DRAWINGS OF EXISTING SERVICES AND UTILITIES FROM THE RELEVANT AUTHORITIES AND VERIFY THE ACTUAL LOCATION AND LEVELS OF THESE SERVICES AND UTILITIES ON SITE, BY APPROPRIATE METHODS, BEFORE COMMENCEMENT OF ANY WORKS.
- THE CONTRACTOR SHALL ACCURATELY AND POSITIVELY IDENTIFY ALL SERVICES AND UTILITIES, IN THE AREA OF THE WORKS, BEFORE UNDERTAKING ANY EXCAVATION WORKS. DO NOT ASSUME THAT THERE ARE NO SERVICES OR UTILITIES PRESENT IF THEY CANNOT BE FOUND, AT THE LOCATIONS SHOWN IN THE DRAWINGS ACQUIRED FROM THE RELEVANT AGENCIES. THE CONTRACTOR SHALL CONTACT THE RELEVANT AGENCY FOR THEIR ASSISTANCE AND ADVICE BEFORE PROCEEDING WITH ANY EXCAVATION WORKS.
- FOR EASE OF REFERENCE, EXISTING TOPOGRAPHY, STRUCTURES AND SITE FEATURES ARE SHOWN SCREENED AND/OR LIGHT-LINED WHILST THE PROPOSED FINISH GRADE, STRUCTURES AND SITE FEATURES ARE SHOWN HEAVY-LINED.
- ALL EXISTING STRUCTURES AFFECTED BY THE CONSTRUCTION WORKS SHALL BE REINSTATED TO THE ORIGINAL CONDITION UPON THE COMPLETION OF THE WORKS AND TO THE COMPLETE SATISFACTION OF THE RELEVANT AUTHORITY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FORMALLY AND OFFICIALLY HAND-OVER THE COMPLETED REINSTATEMENT WORKS TO THE RELEVANT AUTHORITY, AND UNDERTAKE ANY REPAIR WORKS OR DEFECT RECTIFICATIONS AS REQUIRED BY THE RELEVANT AUTHORITY DURING THE DEFECTS LIABILITY PERIOD AS DEFINED BY THE AUTHORITY.

DESIGN WORKS BY CONSULTANT

- THE DESIGN OF ALL PERMANENT WORKS ARE TO BE UNDERTAKEN BY THE CONSULTANT, ENGAGED FOR THE PROVISION OF PROFESSIONAL ENGINEERING SERVICES.
- FOR AVOIDANCE OF DOUBT, PERMANENT WORKS ARE DEFINED AS WORKS OF A PERMANENT NATURE WHICH ARE TO BE EXECUTED BY A CONTRACTOR TO BE APPOINTED UNDER A CONSTRUCTION CONTRACT AND THOSE WORKS RELATED TO OR FORMING PART OF THE FINAL CONSTRUCTION WORKS, THAT WILL REMAIN IN POSITION FOR THE ENTIRETY OF ITS LIFE.
- THE CONSULTANT SHALL BE RESPONSIBLE FOR THE DESIGN OF ALL PERMANENT WORKS, EXCEPT FOR THE FOLLOWING ITEMS:
 - EXTERNAL CLADDING AND PIPE SLEEVES FOR JACKING PIPES AND
 - ANY OTHER PERMANENT WORKS, SO SPECIFIED AND DESCRIBED IN THE SCOPE OF CONSULTANCY SERVICES TO BE DESIGN AND BUILD BY CONTRACT.
- SOIL STRENGTHENING OR IMPROVEMENT WORKS, FOUNDATIONS AND PILING WORKS ARE ALSO TO BE CONSIDERED AS PERMANENT WORKS.
- THE CONSULTANT SHALL ACT AS A QP (DESIGN) AND QP (SUPERVISION) FOR ALL PERMANENT WORKS. THE QP SHALL LIAISE WITH ACCREDITED CHECKER (AC) ENGAGED BY THE BOARD TO MAKE THE NECESSARY SUBMISSIONS TO BCA FOR APPROVAL.
- THE DESIGN OF ALL PERMANENT WORKS SHALL FIRST BE CLEARED BY THE BOARD BEFORE THE CONSULTANT PROCEEDS TO MAKE SUBMISSIONS TO BUILDING AND CONSTRUCTION AUTHORITY (BCA).
- FOR PIPES LESS THAN 1000MM DIAMETER, WHERE BCA SUBMISSIONS ARE NOT REQUIRED, THE DESIGN OF THE PERMANENT WORKS SHALL BE SUBMITTED TO BOARD FOR APPROVAL.

DESIGN WORKS BY CONTRACTOR

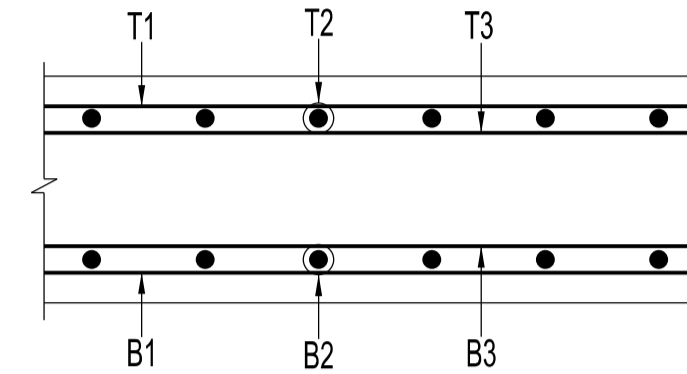
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN OF ALL TEMPORARY WORKS ARE UNDER THE CONSTRUCTION CONTRACT.
- UNLESS OTHERWISE SPECIFIED, THE DESIGN OF ALL TEMPORARY WORKS ARE TO BE UNDERTAKEN BY THE CONTRACTOR. THE TEMPORARY WORKS SHALL INCLUDE BUT LIMITED TO:
 - ALL TEMPORARY EARTH RETAINING OR STABILISING STRUCTURES FOR OPEN CUT EXCAVATION WORKS;
 - SHEET PILED SHAFTS OR CAISSONS FOR PIPE-JACKING AND TUNNELLING WORKS;
 - JACKING PIPE INCLUDING CLADDING OR PIPE SLEEVES;
 - SUPPORTS, PROPPING AND PROTECTION FOR UNDERGROUND SERVICES AND UTILITIES AFFECTED BY THE WORKS;
 - TRAFFIC DECKING;
 - SLOPE FORMATION OR STABILISING WORKS AND GROUND IMPROVEMENT WORKS;
 - GROUND INSTRUMENTATION FOR MONITORING OF THE WORKS INCLUDING SETTING OF ALERT AND WORK STOP LEVELS;
- THE CONTRACTOR SHALL MAKE REFERENCE TO THE SCOPE OF WORKS OF THE CONTRACT FOR THE WORKS TO BE UNDERTAKEN BY HIM.
- THE CONTRACTOR SHALL ENGAGE A QUALIFIED PERSON (QP) (DESIGN) FOR THE DESIGN OF TEMPORARY WORKS WHO SHALL SUBSEQUENTLY ACT AS THE QP (SUPERVISION) FOR THE SUPERVISION OF THE TEMPORARY WORKS. THE QP (DESIGN) SHALL LIAISE WITH ACCREDITED CHECKER (AC) ENGAGED BY THE BOARD TO MAKE THE NECESSARY SUBMISSIONS TO BUILDING AND CONSTRUCTION AUTHORITY (BCA) FOR APPROVAL.

STRUCTURAL WORKS

- ALL CONCRETE WORKS AND MIX DESIGNS SHALL COMPLY WITH BS EN 1992-1-1:2004+A1:2014
- THE GRADE OF CONCRETE MIX TO BE USED FOR THE CONTRACT SHALL BE IN ACCORDANCE WITH THE FOLLOWING, UNLESS OTHERWISE STATED:

<input type="checkbox"/> ALL REINFORCED CONCRETE ELEMENTS	-C40/50
<input type="checkbox"/> EXTERNAL CONCRETE CLADDED PIPE AND EXTERNAL CONCRETE (USED WITH PORTLAND BLAST FURNACE CEMENT (PBFCE)) CLADDED PIPE TO BE LAID BY OPEN CUT	-C40/50
<input type="checkbox"/> EXTERNAL CONCRETE (USED WITH PORTLAND BLAST FURNACE CEMENT (PBFCE)) CLADDED PIPE FOR PIPE-JACKING	-C50/60
<input type="checkbox"/> CHAMBER COVER SLAB AND FOUNDATION	-C40/50
<input type="checkbox"/> HAUNCHING AROUND PIPES / MANHOLE FRAMES	-C40/50
<input type="checkbox"/> R.C. PILES	-C40/50
<input type="checkbox"/> CONCRETE BLINDING FOR SUBSTRUCTURES	-C20/25
<input type="checkbox"/> MASS CONCRETE	-C20/25

- BLINDING CONCRETE OF AT LEAST 50MM THICK SHALL BE PROVIDED ON THE GROUND SURFACES FORMING THE UNDERSIDE OF ANY REINFORCED CONCRETE ELEMENTS. THE CONTRACTOR SHALL ALLOW FOR THE INCREASE IN THICKNESS OF LEAN CONCRETE THICKNESS OR STRENGTH DEPENDING ON SOIL CONDITIONS AND SURFACE IRREGULARITIES.
- ALL REINFORCEMENT USED SHALL BE HIGH YIELD DEFORMED BARS, TYPE 2 SPECIFIED CHARACTERISTIC STRENGTH (fyk) OF 500N/mm² (SYMBOL 'H').
- NOMINAL COVER TO OUTERMOST REINFORCEMENT SHALL BE AT LEAST 40mm, UNLESS OTHERWISE STATED.
- ALL STEEL REINFORCEMENT BARS AND MESH SHALL COMPLY WITH THE REQUIREMENTS OF BS EN 1992.
- REINFORCEMENT ANCHORAGE AND LAP LENGTH PROVIDED SHALL BE AT LEAST 45 X BAR DIAMETER, COMPLYING WITH BS EN 1992.
- THE REINFORCEMENT IN THE DRAWING IS TAGGED AS FOLLOWS FOR EASE OF REFERENCE:



PIPEWORKS

- PIPES SHALL BE LAID TO UNIFORM GRADE FROM THE LOW POINT TO THE HIGH POINT ALONG THE PIPELINE PROFILE.
- ALL WELDING SHALL BE TO FULL THROAT THICKNESS, WITHOUT EXCEPTION. THE LEG LENGTH SHALL NOT BE LESS THAN THE THICKNESS OF THE PIPE.
- ALL WELDERS SHALL BE CERTIFIED AND TESTED IN ACCORDANCE WITH SS EN 287-1.
- LOCATION, NUMBER OF PIPE HANGERS/ BRACKETS AND PIPE SUPPORTS/ SADDLES SHOWN IN THE DRAWINGS ARE FOR CONTRACTOR'S REFERENCE ONLY. THE CONTRACTOR SHALL UNDERTAKE THE DETAILED DESIGN OF THE PIPE HANGERS/ BRACKETS AND PIPE SUPPORTS/ SADDLES AND SUBMIT TO THE SUPERINTENDING OFFICER (S.O.) FOR APPROVAL.
- ALL FLANGES FOR PIPES AND FITTINGS SHALL BE PN 16 PRESSURE RATING, UNLESS OTHERWISE SPECIFIED.
- ALL FLEXIBLE CONNECTORS AND COUPLING SHALL BE PROVIDED WITH TIE RODS AND ANCHORS, DESIGNED TO 16 BAR PRESSURE.
- CONCRETE THRUST BLOCKS, ANCHOR BLOCKS AND CONCRETE PADS SHALL BE CAST AGAINST UNDISTURBED GROUND. THE DIMENSIONS OF THE THRUST BLOCKS, ANCHOR BLOCKS AND CONCRETE PADS SHALL BE IN ACCORDANCE WITH DRAWING NO. PUB/WSN/STD/302.
- THE ENDS OF THE PIPES SHALL BE CAPPED OR APPROPRIATELY BLOCKED AT THE END OF EACH WORKING DAY AND DURING BREAKS FROM WORK, TO PREVENT ANY CONTAMINATION AND ENTRY OF VERMIN.
- PIPELINES SHALL BE CHARGED UP AND DRAINED SLOWLY, BASED ON STANDARD OPERATING PROTOCOL. WHERE NECESSARY, MANHOLE COVER AT AIR VALVE CHAMBERS SHALL ALSO BE REMOVED (AND OPENINGS BARRICADED) WHEN CHARGING UP AND DRAINING LARGE DIAMETER PIPELINES, TO PREVENT PRESSURE BUILD UP / VACUUM CONDITIONS ARISING IN THE AIR VALVE CHAMBER.

PILING WORKS

- THE CONSULTANT SHALL UNDERTAKE GEOTECHNICAL ANALYSIS TO ASSESS THE SAFE BEARING CAPACITY OF THE SOIL AND EXPECTED SETTLEMENT OF ALL CHAMBERS AND SUBMIT THE REPORT TO THE BOARD. WHERE THE BEARING CAPACITY IS DEEMED INADEQUATE AND/OR SETTLEMENT IS EXCESSIVE, SUCH CHAMBERS SHALL BE SUPPORTED ON PILES. THE CONSULTANT SHALL DESIGN ALL PILING WORKS AND SUBMIT (IN CONJUNCTION WITH THE ACCREDITED CHECKER APPOINTED BY THE BOARD), TO THE BUILDING AND CONSTRUCTION AUTHORITY (BCA) FOR APPROVAL.
- THE CONSULTANT SHALL UNDERTAKE ALL NECESSARY SOIL INVESTIGATION WORKS AND PLATE BEARING TESTS, IF NECESSARY, TO VERIFY THE SOIL PARAMETERS AND IN-SITU BEARING CAPACITY FOR THE DESIGN OF THE PILING WORKS.
- THE TYPE, NUMBERS AND SPACING OF PILES SHALL BE DESIGNED BY THE P.E. ENGAGED BY THE CONTRACTOR.

CHAMBERS

- THE DIMENSIONS OF THE VARIOUS CHAMBERS FOR HOUSING OF PIPE APPURTENANCES (SUCH AS BUTTERFLY VALVES, AIR VALVES, WASHOUTS, ETC.) MAY VARY FOR DIFFERENT PIPE DIAMETERS. MINIMUM CLEARANCES SHALL BE PROVIDED AROUND THESE APPURTENANCES, AS SPECIFIED IN THE DRAWINGS.
- THE FORMATION LEVELS OF THE PROPOSED CHAMBERS SHALL BE INSPECTED BY THE SUPERINTENDING OFFICER (S.O.) OR HIS REPRESENTATIVES AND SHALL BE COMPACTED USING VIBRATORY COMPACTOR, BEFORE THE BLINDING CONCRETE LAYER IS PLACED. ANY 'SOFT SPOTS' OR INCOMPETENT SOIL ENCOUNTERED SHALL BE REMOVED AND REPLACED WITH WELL COMPACTED SAND OR OTHER SUITABLE MATERIALS.
- THE CONTRACTOR SHALL ALLOW FOR THE MAKING OF OPENINGS THROUGH THE CAST-IN-SITU WALLS, SLABS ETC TO ACCOMMODATE ALL ELECTRICAL AND MECHANICAL EQUIPMENT. THE SIZES OF OPENINGS SHOWN IN THE DRAWINGS ARE INDICATIVE ONLY. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS WITH BUILT IN PIPES TO THE BOARD FOR APPROVAL.
- THE POSITION OF THE OPENING WITHIN THE COVER SLAB AND MANHOLE COVER OF THE CHAMBER SHALL BE ADJUSTED ON SITE AND LOCATED OUTSIDE THE ROAD CARRIAGEWAY.
- THE CENTRE OF 260MM DIAMETER MANHOLE COVERS SHALL BE ALIGNED WITH THE VALVE SPINDLE LOCATION. IF THERE IS ANY MISALIGNMENT, THE OPENINGS SHALL BE REPAIRED AND NEW HOLES CORED IN THE COVER SLAB.
- THE DRAINAGE PIPE FROM THE CHAMBER TO THE OUTFALL SHALL BE 100MM DIA DUCTILE IRON PIPE.
- STAINLESS STEEL LADDER SHALL BE PROVIDED IN ALL CHAMBERS REGARDLESS OF WHETHER THEY ARE SHOWN IN THE DRAWINGS.
- SAFETY CAGE SHALL BE PROVIDED FOR STAINLESS STEEL LADDERS EXCEEDING 3M HEIGHT.
- INTERMEDIATE PLATFORMS SHALL BE PROVIDED FOR ALL STAINLESS STEEL LADDERS EXCEEDING 9M HEIGHT.

MISCELLANEOUS

- ALL LADDERS INCLUDING STEEL PLATE, GUARD OF SAFETY CAGE, REMOVABLE GRATING, RAILING AND INTERMEDIATE LANDING PLATFORM SHALL BE GRADE 304 STAINLESS STEEL.
- THE STAINLESS STEEL FLANGE WITH 25MM / 50MM BORE, BALL VALVE AND PIPE CONNECTION FOR PRESSURE ACOUSTIC (PA), WATER QUALITY PRESSURE ACOUSTIC (WQPA) AND LEAK DETECTION SENSORS ASSEMBLY SHALL BE GRADE 316.

ISSUED : SEP 2020	SCALE	DRAWING NO.
LAST REVIEWED : AUG 2021	NTS	PUB/WSN/GN/001

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