DESIGN CRITERIA

1. APPLICABLE CODE: 2009 INTERNATIONAL BUILDING CODE (IBC), AS AMENDED BY THE COMMONWEALTH OF VIRGINIA AND ALL OTHER APPLICABLE LOCAL AGENCIES. THE LOCALLY ADOPTED CODE IS THE VIRGINIA CONSTRUCTION CODE/2009

2. REFER TO THE DRAWINGS FOR ADDITIONAL AND SPECIFIC STRUCTURE LOADINGS AND REQUIREMENTS.

3. ROOF LOADS:

GROUND SNOW LOAD, Pg	= 30 PSF
TERRAIN CATEGORY	= B
Ce	= 1.0
Ct	=1.2 (STORAGE TANK)
I	= 1.10
STORAGE TANK ROOF SNOW LOAD, Pf	= 27.7 PSF MIN

ROOF LIVE LOAD = 30 PSF

STRUCTURE HAS NOT BEEN DESIGNED FOR REDUCED ROOF LIVE LOADS IN ACCORDANCE WITH THE IBC.
DEFLECTION CRITERIA FOR ROOF FRAMING MEMBERS:

TOTAL LOAD	L/240
LIVE LOAD	L/360
SNOW LOAD	L/360
MONORAIL BEAMS	L/800

WHERE L IS THE MEMBER'S SPAN LENGTH

4. FLOOR LIVE LOADS:

PROCESS FLOOR	300 PSF
CORRIDORS, EXITS, STAIRS	100 PSF
WALKWAYS AND ELEVATED PLATFORMS	100 PSF

5. WIND LOAD:

ASCE 7 METHOD	1, 2a, 2b
EXPOSURE	= B
OCCUPANCY CATEGORY	= III
WIND IMPORTANCE FACTOR	= 1.15
BASIC WIND SPEED (3-SECOND GUST)	= 90 MPH
BASIC VELOCITY PRESSURE Pz	= 18.65 PSF
ENCLOSURE CATEGORY	= ENCLOSED
INTERNAL PRESSURE COEFFICIENT FOR ABOVE LISTED BUILDINGS	= +/- 0.18

6. SEISMIC LOAD:
MAPPED SPECTRAL RESPONSE ACCELERATIONS

S_s	= 0.28 g
S_1	= 0.07 g

6. SEISMIC DESIGN FACTORS FOR STORAGE TANK PER AWWA D110:

SEISMIC ZONE	= 1
IMPORTANCE FACTOR	= 1.0
SOIL PROFILE TYPE	= A

9. SOIL DESIGN PARAMETERS:

A.	MAIN SUPPORT FOR NEW STRUCTURES: STORAGE TANKS: SLAB ON GRADE WITH THICKENED WALL FOOTINGS	
B.	VERTICAL SURCHARGE:	EQUIVALENT 2.0 FEET OF SOIL
C.	SUBGRADE MODULUS:	150 KCF
D.	ALLOWABLE SOIL BEARING CAPACITY:	3000 PSF
E.	FROST DEPTH:	18 INCHES
F.	GROUND WATER ELEVATION:	EL xxx'

GENERAL INFORMATION

1. FOR ABBREVIATIONS NOT LISTED, SEE ASME Y14.38 "ABBREVIATIONS AND ACRONYMS: PUBLICATION AS DISTRIBUTED BY THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME).

2. DESIGN DETAILS ARE INTENDED TO BE TYPICAL AND SHALL APPLY TO SIMILAR SITUATIONS OCCURRING THROUGHOUT THE PROJECT, WHETHER OR NOT THEY ARE INDIVIDUALLY CALLED OUT.

3. DETAILING AND DIMENSIONS OF EXISTING STRUCTURES SHOWN ARE BASED ON AS-BUILT DESIGN DRAWINGS, AND DO NOT NECESSARILY REPRESENT THE AS-CONSTRUCTED CONDITIONS. THE CONTRACTOR SHALL FIELD VERIFY DIMENSIONS AND DETAILING OF THE EXISTING STRUCTURES PRIOR TO FABRICATION OF ADJACENT FRAMING OR CONNECTIONS OR SUPPORTS THAT ARE AFFECTED BY THE EXISTING STRUCTURE.

4. VERIFY FINAL OPENING DIMENSIONS IN WALLS, SLABS, AND DECKS WITH OTHER DISCIPLINE DRAWINGS PRIOR TO CONSTRUCTION OF THESE ELEMENTS.

5. FOR NUMBER, TYPE, SIZE, ARRANGEMENT, AND/OR LOCATION OF EQUIPMENT PADS SEE OTHER DISCIPLINE DRAWINGS. COORDINATE WITH EQUIPMENT SUPPLIER PRIOR TO PLACING SLABS, WALLS AND FOUNDATIONS. COORDINATE PIPING OPENINGS WITH OTHER DISCIPLINE DRAWINGS.

6. STRUCTURAL MEMBERS SHALL NOT BE CUT OR MODIFIED FOR PIPES, DUCTS, ETC, UNLESS SPECIFICALLY DETAILED OR APPROVED IN WRITING BY THE ENGINEER.

7. VISITS TO THE JOB SITE BY THE ENGINEER TO OBSERVE THE CONSTRUCTION DO NOT IN ANY WAY MEAN THAT ENGINEER IS GUARANTOR OF CONSTRUCTOR'S WORK, NOR RESPONSIBLE FOR THE COMPREHENSIVE OR SPECIAL INSPECTIONS, COORDINATION, SUPERVISION, OR SAFETY AT THE JOB SITE.

SPECIAL INSPECTION, OBSERVATIONS AND TESTING

1. SPECIAL INSPECTION (OWNER FURNISHED) IS REQUIRED IN ACCORDANCE WITH IBC SECTIONS 109 AND 1704 AS INDICATED IN THE STATEMENT OF SPECIAL INSPECTIONS PLAN ON DRAWINGS S-0002, S-0003.

2. SPECIFIED CONCRETE TESTING DURING CONSTRUCTION WILL BE OWNER FURNISHED.

3. STRUCTURAL OBSERVATIONS (OWNER FURNISHED) IS NOT REQUIRED FOR THIS PROJECT.

FOUNDATIONS

1. REFER TO GEOTECHNICAL DATA REPORT BY DRAPER ADEN ASSOCIATES, DATED APRIL 4, 2014

2. EXCAVATIONS SHALL BE SHORED TO PREVENT SUBSIDENCE OR DAMAGE TO ADJACENT EXISTING STRUCTURES, STREETS, UTILITIES, ETC.

3. SEE GEOTECHNICAL REPORT FOR SUBGRADE REQUIREMENT FOR FOUNDATIONS.

4. ALL FOUNDATION BEARING SURFACES SHALL BE OBSERVED BY A GEOTECHNICAL ENGINEER OR HIS DESIGNEE PRIOR TO PLACEMENT OF FORMING OR REINFORCING STEEL THE OBSERVATION SHALL VERIFY THAT THE ACTUAL EXPOSED SUBGRADE IS AS ANTICIPATED BY THE SITE SPECIFIC BORINGS, TEST PITS, TESTING AND DATA REPORTS.

5. NO BACKFILL SHALL BE PLACED BEHIND WALLS UNTIL THE WALLS HAVE ATTAINED 100 PERCENT OF IT'S SPECIFIED COMPRESSIVE STRENGTH AND TOP SUPPORTING SLAB'S CONCRETE HAVE ATTAINED 80 PERCENT OF THEIR SPECIFIED COMPRESSIVE STRENGTH UNLESS OTHERWISE NOTED.

6. NO BACKFILL SHALL BE PLACED BEHIND CANTILEVERED, FREE TOP WALLS UNTIL THE CONCRETE HAS ATTAINED100 PERCENT OF ITS SPECIFIED COMPRESSIVE STRENGTH.

7. USE UTMOST CARE TO AVOID DAMAGE TO EXISTING STRUCTURES WHEN PERFORMING EXCAVATING ACTIVITIES.

CONCRETE REINFORCING

1. REINFORCING STEEL:

TYPICAL	ASTM A615, GRADE 60
WELDED	ASTM A706, GRADE 60 (WELDING IS ONLY PERMITTED WITH WRITTEN PERMISSION OF ENGINEER)

2. FABRICATION AND PLACEMENT OF REINFORCING STEEL SHALL BE IN ACCORDANCE WITH CRSI MSP-1 "MANUAL OF STANDARD PRACTICE" AND ACI 301 "SPECIFICATIONS FOR STRUCTURAL CONCRETE".

3. FOR REINFORCED CONCRETE FRAME MEMBERS AND DESIGNATED BOUNDARY ELEMENTS OF CONCRETE SHEAR WALL STRUCTURES, REINFORCING STEEL SHALL MEET THE FOLLOWING REQUIREMENTS:
   A. ACTUAL YIELD STRENGTH BASED ON MILL TESTS SHALL NOT EXCEED SPECIFIED YIELD STRENGTH BY MORE THAN 18,000 PSI. (RETESTS SHALL NOT EXCEED THIS VALUE BY MORE THAN AN ADDITIONAL 3000 PSI.)
   B. RATIO OF HTE ACTUAL ULTIMATE TENSILE STRESS TO ACTUAL TENSILE YIELD STRENGTH SHALL NOT BE LESS THAN 1.25.

4. MINIMUM REINFORCING FOR ALL CONCRETE WALLS AND SLABS SHALL BE AS FOLLOWS:

WALL THICKNESS	REINF EACH WAY	LOCATION
6"	#4@12"	CENTERED
8"	#5@12"	CENTERED
10"	#4@12"	EACH FACE
12"	#5@12"	EACH FACE

PROVIDE LARGER SIZES AND MORE REINFORCING IN SECTIONS OF CONCRETE WHERE REQUIRED BY THE DETAILS ON THE DRAWINGS OR BY THE SPECIFICATIONS.

5. CLEARANCE FOR REINFORCEMENT BARS, UNLESS SHOWN OTHERWISE, SHALL BE:

WHEN PLACED ON GROUND:	3"
EXPOSED TO OZONE OR OZONATED WATER:	3"
INTERIOR, DRY, HUMIDITY CONTROLLED AREAS:	
WALLS, SLABS AND JOISTS	3/4"
BEAM STIRRUPS AND COLUMN TIES	11/2"
ALL OTHER CONCRETE SURFACES	2"

6. REFER TO WALL CORNER AND WALL INTERSECTION REINFORCING DETAIL 0330-003. WALL CORNER REINFORCING SIZES AND SPACINGS SHALL BE AS SHOWN ON THE DRAWINGS AND REFERENCED TO THIS DETAIL. TYPICAL HORIZONTAL WALL REINFORCING SHALL LAP WITH THE CORNER HORIZONTAL REINFORCING.

7. 90 DEGREE BENDS, UNLESS OTHERWISE SHOWN, SHALL BE ACI 318 STANDARD HOOKS.

8. WALL CORNER AND WALL INTERSECTION REINFORCEMENT BARS SHALL BE CONTINUOUS AROUND CORNERS AND THROUGH COLUMNS OR PILASTERS. REINFORCEMENT SHALL BE EXTENDED INTO CONNECTING WALLS AND LAPPED ON THE OPPOSITE FACE OF THE CONNECTING WALLS, AS INDICATED IN DETAIL 0330-003.

9. LAP VERTICAL WALL BARS WITH DOWELS FROM BASE SLABS AND EXTEND INTO TOP FACE OF ROOF SLABS AND LAP WITH TOP SLAB REINFORCEMENT. PROVIDE A MINIMUM OF FOUR FULL HEIGHT VERTICAL BARS WITH MATCHING DOWELS AT WALL ENDS, CORNERS AND INTERSECTIONS WITH SIZE TO MATCH TYPICAL VERTICAL REINFORCING STEEL SHOWN OR REQUIRED BY NOTES ABOVE.

10. LOCATE ELEVATED SLAB AND BEAM TOP BAR SPLICES AT MIDSPAN AND BOTTOM BAR SPLICES AT SUPPORTS.

11. REFER TO OPENING REINFORCEMENT DETAILS 0330-001 AND 0330-002

12. REINFORCEMENT BENDS AND LAPS, UNLESS OTHERWISE NOTED, SHALL SATISFY THE FOLLOWING MINIMUM REQUIREMENTS:

CONCRETE DESIGN STRENGTH = 4,000 PSI **		GRADE 60 REINFORCING STEEL								
BAR SIZE		#3	#4	#5	#6	#7	#8	#9	#10	#11
LAP SPLICE LENGTH										
SPACING<6"	TOP BAR *	1'-4"	2'-0"	3'-0"	4'-0"	5'-10"	6'-8"	7'-7"	8'-6"	9'-5"
	OTHER BAR	1'-4"	1'-7"	2'-4"	3'-1"	4'-6"	5'-2"	5'-10"	6'-7"	7'-3"
SPACING≥6"	TOP BAR *	1'-4"	1'-5"	2'-0"	2'-5"	3'-6"	4'-0"	5'-0"	6'-2"	7'-5"
	OTHER BAR	1'-4"	1'-4"	1'-7"	1'-10"	2'-9"	3'-1"	3'-10"	4'-9"	5'-8"
EMBEDMENT LENGTH										
SPACING<6"	TOP BAR *	1'-0"	1'-7"	2'-4"	3'-1"	4'-6"	5'-2"	5'-10"	6'-7"	7'-3"
	OTHER BAR	1'-0"	1'-3"	1'-9"	2'-5"	3'-6"	4'-0"	4'-6"	5'-1"	5'-7"
SPACING≥6"	TOP BAR *	1'-0"	1'-3"	1'-7"	1'-10"	2'-9"	3'-1"	3'-10"	4'-9"	5'-8"
	OTHER BAR	1'-0"	1'-0"	1'-3"	1'-5"	2'-1"	2'-5"	3'-0"	3'-8"	4'-5"

* TOP BARS SHALL BE DEFINED AS ANY HORIZONTAL BARS PLACED SUCH THAT MORE THAN 12 INCHES OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR IN ANY SINGLE POUR. HORIZONTAL WALL BARS ARE CONSIDERED TOP BARS.
** WHERE 3000 PSI CONCRETE IS USED, INCREASE ABOVE LENGTHS BY 15 PERCENT

CONCRETE

1. 28-DAY CAST-IN-PLACE CONCRETE STRENGTHS:

TYPICAL:	4000 PSI
STRUCTURAL:	4000 PSI (4500 PSI AT 56-DAYS)
CONCRETE FILL:	2500 PSI
CURBS AND SIDEWALKS:	3000 PSI
CONDUIT ENCASEMENTS:	3000 PSI
PIPE ENCASEMENTS NOT INTEGRAL WITH FOUNDATIONS:	3000 PSI

2. CONTINUOUS WATERSTOP AS SPECIFIED SHALL BE INSTALLED IN ALL CONSTRUCTION JOINTS IN WALLS OF WATER HOLDING BASINS, CHANNELS, AND BELOW GRADE STRUCTURES, EXCEPT WHERE SPECIFICALLY NOTED OTHERWISE.

3. CONSTRUCTION JOINTS INDICATED ARE SUGGESTED LOCATIONS. CONTRACTOR MAY REVISE LOCATION OF JOINTS, SUBJECT TO SPECIFIED REQUIREMENTS. ADDITIONAL CONSTRUCTION JOINT LOCATIONS, INCLUDING ADDITIONAL REQUIRED FOR CONSTRUCTION, SHALL BE SUBMITTED FOR REVIEW BY ENGINEER.

4. ROUGHEN AND CLEAN CONSTRUCTION JOINTS IN WALLS AND SLABS AS SPECIFIED PRIOR TO PLACING ADJACENT CONCRETE.

5. THE CONTRACTOR SHALL COORDINATE PLACEMENT OF OPENINGS, CURBS, DOWELS, SLEEVES, CONDUITS, BOLTS AND INSERTS PRIOR TO PLACEMENT OF CONCRETE.

6. NO ALUMINUM CONDUIT OR PRODUCTS CONTAINING ALUMINUM OR ANY OTHER MATERIAL INJURIOUS TO THE CONCRETE SHALL BE EMBEDDED IN THE CONCRETE.

7. CONDUIT SHALL NOT BE PLACED PARALLEL WITH BEAM OR COLUMN REINFORCEMENT UNLESS SPECIFICALLY INDICATED IN DRAWINGS.

DEFERRED SUBMITTALS

1. DEFERRED SUBMITTALS ARE THOSE PORTIONS OF THE DESIGN WHICH ARE NOT SUBMITTED AT THE TIME OF PERMIT APPLICATION AND WHICH ARE TO BE SUBMITTED TO THE PERMITTING AGENCY FOR ACCEPTANCE PRIOR TO INSTALLATION OF THAT PORTION OF THE WORK.

2. THE FOLLOWING IS A LIST OF DEFERRED SUBMITTALS PER IBC SECTION 106.3.4.2 THAT ARE EXPECTED TO CONTAIN STRUCTURAL CALCULATIONS OR SAFETY RELATED SYSTEM INFORMATION FOR REVIEW TO MEET BUILDING PERMITTING REQUIREMENTS FOR DESIGNED SYSTEMS. PRIOR TO INSTALLATION OF THE INDICATED STRUCTURAL ELEMENT, EQUIPMENT, DISTRIBUTION SYSTEM, OR COMPONENT OR ITS ANCHORAGE, THE CONTRACTOR SHALL SUBMIT THE REQUIRED CALCULATIONS AND SUPPORTING DATA AND DRAWINGS FOR REVIEW AND ACCEPTANCE BY THE ENGINEER. ADDITIONALLY, ACCEPTANCE INDICATED ON THE ENGINEER'S COMMENT FORM, ALONG WITH THE COMPLETED, FINAL SUBMITTAL SHALL THEN BE FILED BY THE CONTRACTOR AND ACKNOWLEDGED AS ACCEPTED BY THE PERMITTING AGENCY PRIOR TO INSTALLATION OF THESE ITEMS.

SPECIFICATION SECTION	ITEM
33 16 13.15	PRESTRESSED CONCRETE RESERVOIR TANK WITH STEEL DIAPHRAGM

COMMONWEALTH OF VIRGINIA
LIN ZHANG
Lic. No. 042864
7-1-2014
PROFESSIONAL ENGINEER

NO.	DATE	DSGN	DR	CHK	APVD	BY	APVD
		L.ZHANG	J.C.HALEC	J.ALLEN	J.ALLEN		
		REVISION					

CRYSTAL SPRING WATER TREATMENT PLANT
CLEARWELL REPLACEMENT
WESTERN VIRGINIA WATER AUTHORITY
CITY OF ROANOKE, VIRGINIA

CH2MHILL

STRUCTURAL

GENERAL NOTES

CONSTRUCTION DOCUMENTS

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2014
PROJ	475481
DWG	S-0001
SHEET	12 of 37