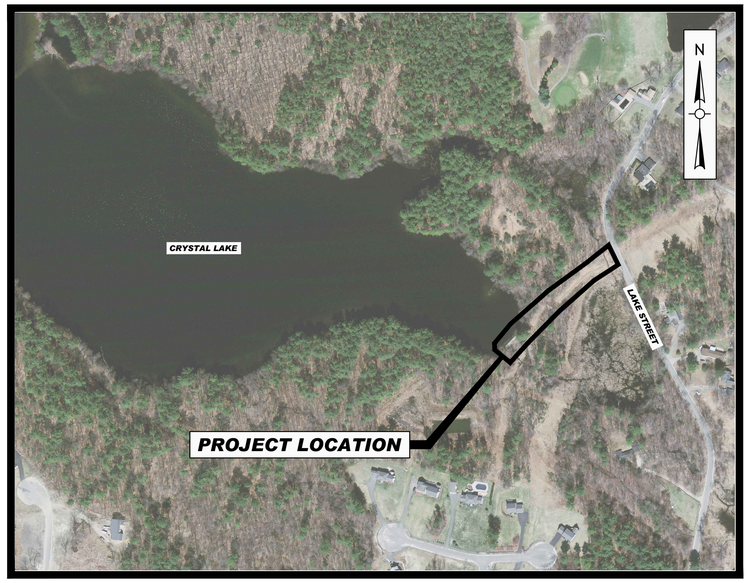



LOCUS MAP
SCALE: N.T.S.

# CITY OF HAVERHILL, MASSACHUSETTS

# CRYSTAL LAKE DAM REHABILITATION

## IN HAVERHILL, MASSACHUSETTS

**MASSACHUSETTS OFFICE OF DAM SAFETY ID NO. 5-5-128-1**
**NATIONAL DAM ID NO. MA01140**

**SIZE CLASSIFICATION: INTERMEDIATE**
**HAZARD POTENTIAL: SIGNIFICANT**

DRAWING INDEX


| SHEET | TITLE |
|---|---|
| G-1 | ABBREVIATIONS, NOTES, AND LEGEND |
| C-1 | EXISTING SITE CONDITIONS |
| C-2 | SITE PREPARATION AND DEMOLITION PLAN |
| C-3 | SITE ENTRANCE PREPARATION PLAN |
| C-4 | PROPOSED SITE CONDITIONS |
| D-1 | DETAILS I |
| D-2 | DETAILS II |
| S-1 | GENERAL NOTES AND TYPICAL DETAILS |
| S-2 | PLAN VIEW |
| S-3 | SECTIONS AND DETAILS |


## SEPTEMBER 2016

COMMONWEALTH OF MASSACHUSETTS
FRANCIS M. RICCIARDI
CIVIL
No. 41688
REGISTERED PROFESSIONAL ENGINEER

9/2/16

Weston & Sampson

Five Centennial Drive, Peabody, Massachusetts 01960-7985

**FOR PERMITTING ONLY**

File No. - - - - -

COPYRIGHT 2016 WESTON & SAMPSON

G:\Haverhill, MA\Crystal Lake Dam Rehabilitation\CAD\Design\Cover.dwg

# LEGEND

| DESCRIPTION | EXISTING | PROPOSED |
|---|---|---|
| TEMPORARY WATER | | |
| STORM DRAIN | —— D —— | |
| GAS | —— G —— | |
| ELECTRIC | —— E —— | |
| TELEPHONE | —— T —— | |
| STORM DRAIN MANHOLE | Ⓓ | |
| ELECTRICAL MANHOLE | Ⓔ | |
| TELEPHONE MANHOLE | Ⓣ | |
| WATER MANHOLE | Ⓦ | |
| WATER VALVE | WV | WV |
| BLIND FLANGE/PIPE DISCONNECTION | | |
| CATCH BASIN | □ | |
| HYDRANT | | |
| UTILITY POLE | | |
| GUY POLE | | |
| LIGHT POST | | |
| EDGE OF PAVEMENT | | |
| EDGE OF UNPAVED ROAD | | |
| CURB | | |
| STONE WALL | | |
| RETAINING WALL | RET WALL | RET WALL |
| FENCE | —x—x— | —x—x— |
| INDIVIDUAL DECIDUOUS TREE | | |
| TREE TO BE REMOVED | | |
| TREE LINE | | |
| SURVEY MARKER | | |
| PROPERTY LINE | — — ℙ — — | |
| EASEMENT LINE | | |
| LIMIT OF WORK | | |
| SPOT ELEVATIONS | x 141.5 | x 141.5 |
| CONTOUR LINES | —56— | —56— |
| DEPRESSION CONTOUR LINES | | |
| WETLAND | | |
| WETLAND FLAGS | 1 · · 2 | |
| RIPRAP | | |
| SIGN | | |
| TEMPORARY BENCH MARK (TBM) | BM–1 | |
| BORING (B–)/MONITORING WELL (M–)/GRAB SAMPLE (G–) | | |
| STRAW BALES | | |
| STRAW WATTLES | | |
| ROCK OUTCROP | | |
| DRAINAGE DITCH / SWALE | | |
| SILT CURTAIN | | |

## GENERAL NOTES

1. THE CONTRACTOR SHALL CALL DIGSAFE AT 1–888–344–7233 AT LEAST 72 HOURS, SATURDAYS, SUNDAYS, AND HOLIDAYS EXCLUDED, PRIOR TO EXCAVATING AT ANY LOCATION. A COPY OF THE DIGSAFE PROJECT REFERENCE NUMBER(S) SHALL BE GIVEN TO THE OWNER AND ENGINEER PRIOR TO EXCAVATION.
2. LOCATIONS OF EXISTING PIPES, CONDUITS, UTILITIES, FOUNDATIONS AND OTHER UNDERGROUND OBJECTS ARE NOT WARRANTED TO BE CORRECT. CONTRACTOR SHALL VERIFY UNDERGROUND STRUCTURE/OBJECT LOCATIONS AND DEPTHS USING TEST PITS PRIOR TO CONSTRUCTION. TEST PITS SHALL BE CONSIDERED INCIDENTAL TO THE WORK.
3. ALL PAVEMENT DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPLACED IN ACCORDANCE WITH THE REQUIREMENTS OF THE CITY OF HAVERHILL.
4. ALL AREAS DISTURBED BY THE CONTRACTOR BEYOND THE LIMIT OF WORK SHALL BE RESTORED TO MATCH PRE–CONSTRUCTION CONDITIONS AT NO ADDITIONAL COST TO THE OWNER.
5. THE CONTRACTOR SHALL NOT STORE ANY APPARATUS, MATERIALS, SUPPLIES, OR EQUIPMENT ON DRAINAGE STRUCTURES OR WITHIN 100 FEET OF WETLANDS. ALL STAGING AND STOCKPILE AREAS SHALL BE PROTECTED FROM EROSION AND CONTAMINATION INTO ANY RESOURCE AREA BY EROSION AND SEDIMENTATION CONTROL AS SHOWN ON THESE DRAWINGS.
6. THE BASE PLAN IS BASED ON A GLOBAL POSITIONING SYSTEM (GPS) AND A TOTAL STATION SURVEY CONDUCTED BY WESTON & SAMPSON IN OCTOBER 2008 AND APRIL 2016.
7. THE VERTICAL DATUM IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 1988). ELEVATIONS ARE IN FEET. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM OF 1983 (NAD 1983).
8. PROPERTY LINE AND EASEMENT INFORMATION IS BASED ON INFORMATION PROVIDED BY OTHERS AND IS APPROXIMATE.
9. SEE SHEET C–1 FOR BENCHMARK INFORMATION.
10. WETLAND AREAS WERE DELINEATED BY A WESTON & SAMPSON CERTIFIED WETLAND SCIENTIST IN APRIL 2015. THE WETLAND FLAGS WERE LOCATED VIA TOTAL STATION AND GPS SURVEY.
11. EXISTING TOPOGRAPHIC CONDITIONS ARE BASED PRIMARILY ON THE REFERENCED TOPOGRAPHIC SURVEY. CURRENT CONDITIONS MAY VARY FROM THOSE SHOWN ON THE DRAWINGS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VISIT THE SITE TO INSPECT THE CURRENT CONDITIONS PRIOR TO SUBMITTING BID DOCUMENTS. ANY VARIATIONS FROM THE CONDITIONS SHOWN, WHICH WILL IMPACT THE CONSTRUCTION COST OR METHOD SHOULD BE BROUGHT TO THE ENGINEER'S ATTENTION IN WRITING AND SHOULD BE INCLUDED IN THE BID PRICE. NO ADDITIONAL COMPENSATION WILL BE APPROVED DUE TO OBSERVABLE SURFICIAL SITE CONDITIONS NOT SHOWN ON THE DRAWINGS.
12. RIGHT AND LEFT ARE REFERENCED AS THOUGH STANDING IN CRYSTAL LAKE FACING DOWNSTREAM TOWARD THE DAM.
13. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING THROUGHOUT CONSTRUCTION, AND THEN REMOVING AT COMPLETION, ALL EROSION AND SEDIMENTATION CONTROLS AS SHOWN ON THESE DRAWINGS.
14. THE SITE SHALL BE MADE SECURE AND SAFE DURING THE DURATION OF CONSTRUCTION BY THE CONTRACTOR INCLUDING NON–WORKING HOURS.
15. PLAN AND CONDUCT ALL CONSTRUCTION ACTIVITIES TO ACCOMMODATE DISCHARGE FROM DAM TO DOWNSTREAM CHANNEL INCLUDING ALL STORM FLOWS DURING CONSTRUCTION. THE INFLOW STAGE RELATIONSHIP TABLE PROVIDED ON THIS SHEET IS PROVIDED SOLELY AS A GUIDE TO ESTIMATE FLOWS DURING CONSTRUCTION.
16. THE CONTRACTOR IS RESPONSIBLE FOR ALL CONSTRUCTION DEWATERING AND SURFACE WATER CONTROL TO ACHIEVE FIRM, DRY EXCAVATION SUBGRADE CONDITIONS AND ALLOW ALL CONSTRUCTION IN–THE–DRY. MAINTAIN GROUNDWATER LEVEL 24–INCHES BELOW THE EXCAVATION/BACKFILL LEVEL AT ALL TIMES. A DEWATERING SEDIMENT BASIN SHALL BE USED AS NEEDED TO PREVENT CONVEYING SEDIMENTS INTO THE DOWNTREAM CHANNEL.
17. THE PROJECT IS IN PROXIMITY TO RESIDENTIAL NEIGHBORHOODS. PREVENT WINDBLOWN DUST FROM LEAVING THE SITE AT ALL TIMES DURING THE WORK. REFER TO SPECIFICATION SECTION 01568 FOR ADDITIONAL INFORMATION.
18. THE CONTRACTOR SHALL MAINTAIN SIDE SLOPES AND DRAINAGE SWALES DURING CONSTRUCTION TO PREVENT PONDING AND EROSION.
19. THE CONTRACTOR SHALL MAINTAIN EXCAVATION SLOPES DURING CONSTRUCTION IN ACCORDANCE WITH THE MINIMUM AND MAXIMUM SLOPES SPECIFIED IN THE CONTRACT AND AS REQUIRED BY STATE OR FEDERAL EXCAVATION SAFETY REGULATIONS. ANY LATERAL SUPPORT SYSTEM USED IN THE FIELD SHALL BE INCIDENTAL TO THE APPROPRIATE WORK ITEM AND CONFORM TO SPECIFICATION 02300.
20. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING AND PROPERLY DISPOSING OF EXCESS FILL, TREES, PAVEMENT, EXISTING DEBRIS ON THE GROUND AND DEMOLITION DEBRIS RESULTING FROM CONSTRUCTION ACTIVITIES AT A PROPER OFF–SITE AREA IN ACCORDANCE WITH SPECIFICATION 02300 AND 02230.
21. CONTRACTOR SHALL COORDINATE ACTIVITY WITH RESPECTIVE UTILITY COMPANIES, EMERGENCY SERVICES, AND WATER DEPARTMENT.
22. COMPLY WITH ANY CITY OF HAVERHILL NOISE ORDINANCE AT ALL TIMES DURING THE WORK. REFER TO SPECIFICATION SECTION 01140 FOR ADDITIONAL INFORMATION.
23. IF A POLICE DETAIL IS REQUIRED DUE TO CONTRACTOR ACTIVITIES, THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING AND PAYING FOR POLICE DETAILS THROUGHOUT THE PROJECT. NO ADDITIONAL PAYMENTS WILL BE MADE FOR DELAYS RELATED TO LACK OF POLICE DETAIL COVERAGE.

## ABBREVIATIONS

| | |
|---|---|
| BM | BENCHMARK |
| CONC | CONCRETE |
| DIA | DIAMETER |
| ELEV, EL. | ELEVATION |
| EXIST | EXISTING |
| FT | FEET, FOOT |
| MIN | MINIMUM |
| MISC | MISCELLANEOUS |
| N | NORTH |
| ℙ | PROPERTY LINE |
| SECT | SECTION |
| SPEC | SPECIFICATION |
| TYP | TYPICAL |
| W/ | WITH |
| W/O | WITHOUT |
| WF | WETLAND FLAG |
| B–1, BR–1, BRW–1 | TEST BORING/MONITORING WELL |
| ACM | ASBESTOS CONTAINING MATERIAL |
| CDF | CONTROLLED DENSITY FILL |
| PMF | PROBABLE MAXIMUM FLOOD |
| BVW | BORDERING VEGETATED WETLAND |
| TOB | TOP OF BANK |
| WV | WATER VALVE |
| CB | CATCH BASIN |
| P–1 | TEST PROBE LOCATION/DESIGNATION |
| CI | CAST IRON |
| DI | DUCTILE IRON |
| RCP | REINFORCED CONCRETE PIPE |
| LLO | LOW LEVEL OUTLET |
| SDF | SPILLWAY DESIGN FLOOD |
| CMP | CORRUGATED METAL PIPE |
| DWG | DRAWING |
| D | DRAIN |
| INV | INVERT OF PIPE |
| UD | UNDERDRAIN |

## PROJECT COMPONENTS INCLUDE:

1. DELINEATE THE LIMIT OF WORK AT THE DAM, ALONG THE ACCESS ROAD, AND AT THE STAGING AREAS AS INDICATED ON DRAWINGS C–2 THROUGH C–4 AND REVIEW WITH THE ENGINEER.
2. INSTALL AND MAINTAIN PERIMETER EROSION AND SEDIMENTATION CONTROLS ALONG THE LIMIT OF WORK.
3. CUT ALL TREES, REMOVE STUMPS AND ROOT SYSTEMS, AND CLEAR AND GRUB THE GROUND SURFACE WITHIN THE LIMIT OF WORK.
4. INSTALL THE PERMANENT SITE ACCESS ROAD AND STREAM CROSSING AS INDICATED ON SHEET.
5. MANAGE RESERVOIR LEVELS DURING CONSTRUCTION IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. RESERVOIR LEVELS SHALL BE DRAWDOWN TO ALLOW DEMOLITION, CONCRETE, CONSTRUCTION, AND GRADING TO OCCUR IN–THE–DRY. PROVIDE SUPPLEMENTAL DEWATERING AS NECESSARY.
6. COMPLETE ALL EXCAVATION, CONSTRUCTION, AND GRADING INDICATED IN THE CONTRACT DOCUMENTS WHILE MANAGING FLOW FROM THE RESERVOIR.
7. DEMOLISH, REMOVE AND PROPERLY DISPOSE OFF SITE EXISTING FEATURES OF THE DAM AND SITE SUFFICIENT FOR CONSTRUCTING THE PROPOSED REINFORCED CONCRETE ELEMENTS OF THE DAM AS INDICATED ON THESE DRAWINGS.
8. CONDUCT REINFORCED CONCRETE CONSTRUCTION PER THESE DRAWINGS.
9. CLEAR, GRUB EARTHEN SURFACES WITHIN THE LIMIT OF WORK WHERE PROPOSED GRADES ARE INDICATED. REMOVE ALL ORGANIC MATTER AND DEBRIS FROM THE SITE FOR OFF SITE DISPOSAL. BOULDERS MAY BE REUSED AS RIPRAP.
10. INSTALL MINERAL SOIL FILTER LAYERS AND RIPRAP SLOPE/CHANNEL PROTECTION ON THE DOWNSTREAM SIDE OF THE DAM, AS INDICATED ON DRAWING C–4.
11. LOAM AND SEED ALL OTHER SOIL SURFACES WITHIN THE LIMIT OF WORK. NEW CONCRETE CONSTRUCTION WHERE PROPOSED GRADING IS INDICATED ON DRAWING C–4.
12. RESTORE OTHER DISTURBED AREAS TO MATCH EXISTING.

## CRYSTAL LAKE INFLOW–STAGE RELATIONSHIP

| STORM EVENT | INDEX PRECIPITATION (IN./24 HOURS) | PEAK INFLOW (CFS) | PEAK STAGE ASSUMING STARTING WATER LEVEL EL. 149.0+/– | INCREMENTAL WATER SURFACE ELEVATION INCREASE ABOVE EL. 149.0 (FT.) |
|---|---|---|---|---|
| 2–YEAR | 3.11 | 630 | EL. 149.7 | 0.7 |
| 5–YEAR | 3.95 | 810 | EL. 150.0 | 1.0 |
| 10–YEAR | 4.74 | 990 | EL. 150.3 | 1.3 |
| 25–YEAR | 6.03 | 1,295 | EL. 150.9 | 1.9 |
| 50–YEAR | 7.25 | 1,595 | EL. 151.5 | 2.5 |
| 100–YEAR | 8.71 | 1,955 | EL. 152.1 | 3.1 |

NOTES:

1. THE TABLE ABOVE IS PROVIDED TO AID THE CONTRACTOR IN PREPARING THE POND LEVEL MANAGEMENT PLAN. PEAK INFLOWS AND STAGE VALUES ARE ESTIMATED BASED ON COMPUTER MODELING OF THE WATERSHED HYDROLOGY AND THE HYDRAULICS OF THE EXISTING SPILLWAY BY WESTON & SAMPSON. THIS INFORMATION IS PROVIDED AS A GUIDELINE ONLY. THE CHARACTERISTICS OF LARGE STORMS, POND SURFACE ELEVATION, AND POND OUTFLOW CAPACITY DURING CONSTRUCTION MAY DIFFER FROM THE ASSUMPTIONS USED TO DEVELOP THIS TABLE.

**FOR PERMITTING ONLY**

COPYRIGHT 2016 WESTON & SAMPSON

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900 800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|

APPROVED 9/2/16

REGISTERED PROFESSIONAL ENGINEER — DATE

COMMONWEALTH OF MASSACHUSETTS
FRANCIS M. RICCIARDI
CIVIL
No. 41689
REGISTERED PROFESSIONAL ENGINEER

CITY OF HAVERHILL, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS

CRYSTAL LAKE DAM REHABILITATION

ABBREVIATIONS, NOTES AND LEGEND

| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| G-1 | NOTED | | 2160199 | - | - | - | - |

FILE NO. -

G-1

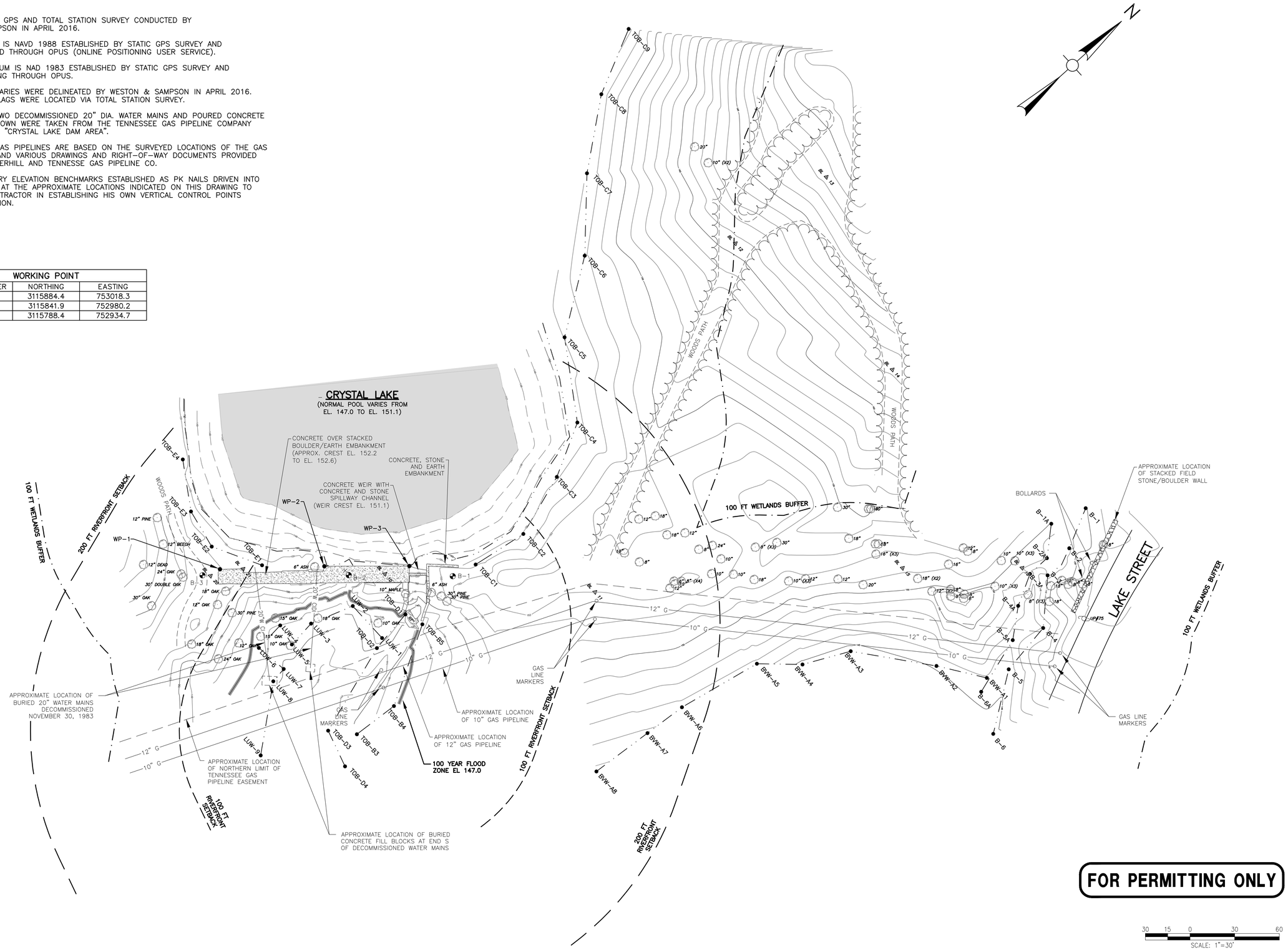


O:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\G-1.dwg

## NOTES:

1. PLAN BASED ON GPS AND TOTAL STATION SURVEY CONDUCTED BY WESTON & SAMPSON IN APRIL 2016.
2. VERTICAL DATUM IS NAVD 1988 ESTABLISHED BY STATIC GPS SURVEY AND POST PROCESSED THROUGH OPUS (ONLINE POSITIONING USER SERVICE).
3. HORIZONTAL DATUM IS NAD 1983 ESTABLISHED BY STATIC GPS SURVEY AND POST PROCESSING THROUGH OPUS.
4. WETLAND BOUNDARIES WERE DELINEATED BY WESTON & SAMPSON IN APRIL 2016. THE WETLAND FLAGS WERE LOCATED VIA TOTAL STATION SURVEY.
5. LOCATIONS OF TWO DECOMMISSIONED 20" DIA. WATER MAINS AND POURED CONCRETE FILL BLOCKS SHOWN WERE TAKEN FROM THE TENNESSEE GAS PIPELINE COMPANY DRAWING TITLED, "CRYSTAL LAKE DAM AREA".
6. LOCATIONS OF GAS PIPELINES ARE BASED ON THE SURVEYED LOCATIONS OF THE GAS LINE MARKERS AND VARIOUS DRAWINGS AND RIGHT-OF-WAY DOCUMENTS PROVIDED BY CITY OF HAVERHILL AND TENNESSE GAS PIPELINE CO.
7. THREE TEMPORARY ELEVATION BENCHMARKS ESTABLISHED AS PK NAILS DRIVEN INTO EXISTING TREES AT THE APPROXIMATE LOCATIONS INDICATED ON THIS DRAWING TO ASSIST THE CONTRACTOR IN ESTABLISHING HIS OWN VERTICAL CONTROL POINTS FOR CONSTRUCTION.

| WORKING POINT | | |
|---|---|---|
| POINT NUMBER | NORTHING | EASTING |
| WP-1 | 3115884.4 | 753018.3 |
| WP-2 | 3115841.9 | 752980.2 |
| WP-3 | 3115788.4 | 752934.7 |




COPYRIGHT 2016 WESTON & SAMPSON

O:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\Crystal Lake Plan.dwg

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900
800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | A | P | P | R O V E D |

9/2/16
DATE

REGISTERED PROFESSIONAL ENGINEER

COMMONWEALTH OF MASSACHUSETTS
FRANCIS M. RICCIARDI
No. 41166
REGISTERED PROFESSIONAL ENGINEER

CITY OF HAVERHILL, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION

# EXISTING SITE CONDITIONS

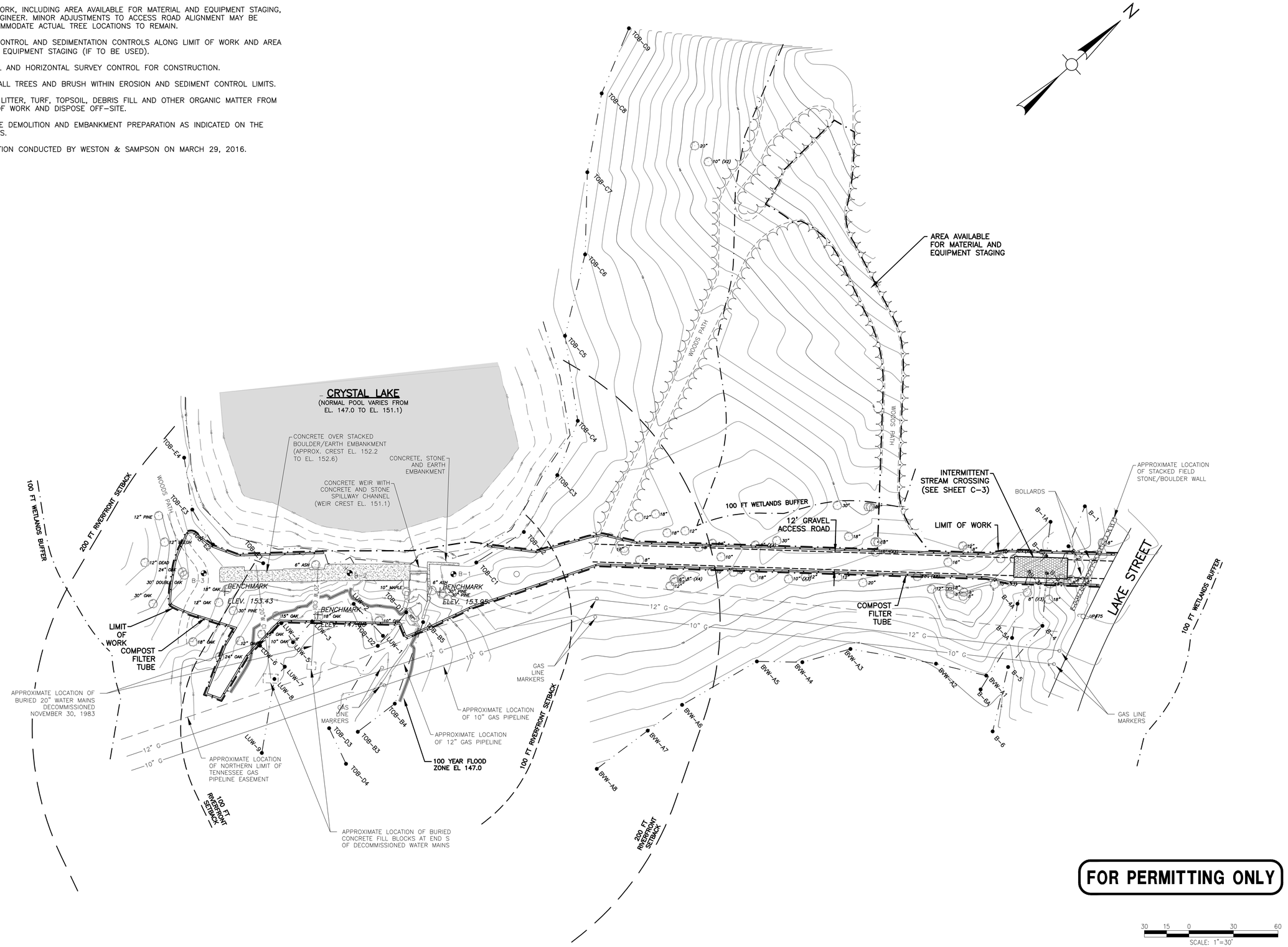
| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| CRYSTAL LAKE PLAN | NOTED | | 2160199 | - | - | - | - |

FILE NO. -

C-1

## SITE PREPARATION AND DEMOLITION NOTES:

1. LAYOUT LIMIT OF WORK, INCLUDING AREA AVAILABLE FOR MATERIAL AND EQUIPMENT STAGING, FOR REVIEW BY ENGINEER. MINOR ADJUSTMENTS TO ACCESS ROAD ALIGNMENT MAY BE REQUIRED TO ACCOMMODATE ACTUAL TREE LOCATIONS TO REMAIN.
2. INSTALL EROSION CONTROL AND SEDIMENTATION CONTROLS ALONG LIMIT OF WORK AND AREA FOR MATERIAL AND EQUIPMENT STAGING (IF TO BE USED).
3. ESTABLISH VERTICAL AND HORIZONTAL SURVEY CONTROL FOR CONSTRUCTION.
4. CLEAR AND GRUB ALL TREES AND BRUSH WITHIN EROSION AND SEDIMENT CONTROL LIMITS.
5. STRIP ALL FOREST LITTER, TURF, TOPSOIL, DEBRIS FILL AND OTHER ORGANIC MATTER FROM WITHIN THE LIMIT OF WORK AND DISPOSE OFF-SITE.
6. CONDUCT CONCRETE DEMOLITION AND EMBANKMENT PREPARATION AS INDICATED ON THE CONTRACT DRAWINGS.
7. WETLANDS DELINEATION CONDUCTED BY WESTON & SAMPSON ON MARCH 29, 2016.




FOR PERMITTING ONLY

COPYRIGHT 2016 WESTON & SAMPSON

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900 800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | | | | |

APPROVED
9/2/16
DATE
REGISTERED PROFESSIONAL ENGINEER

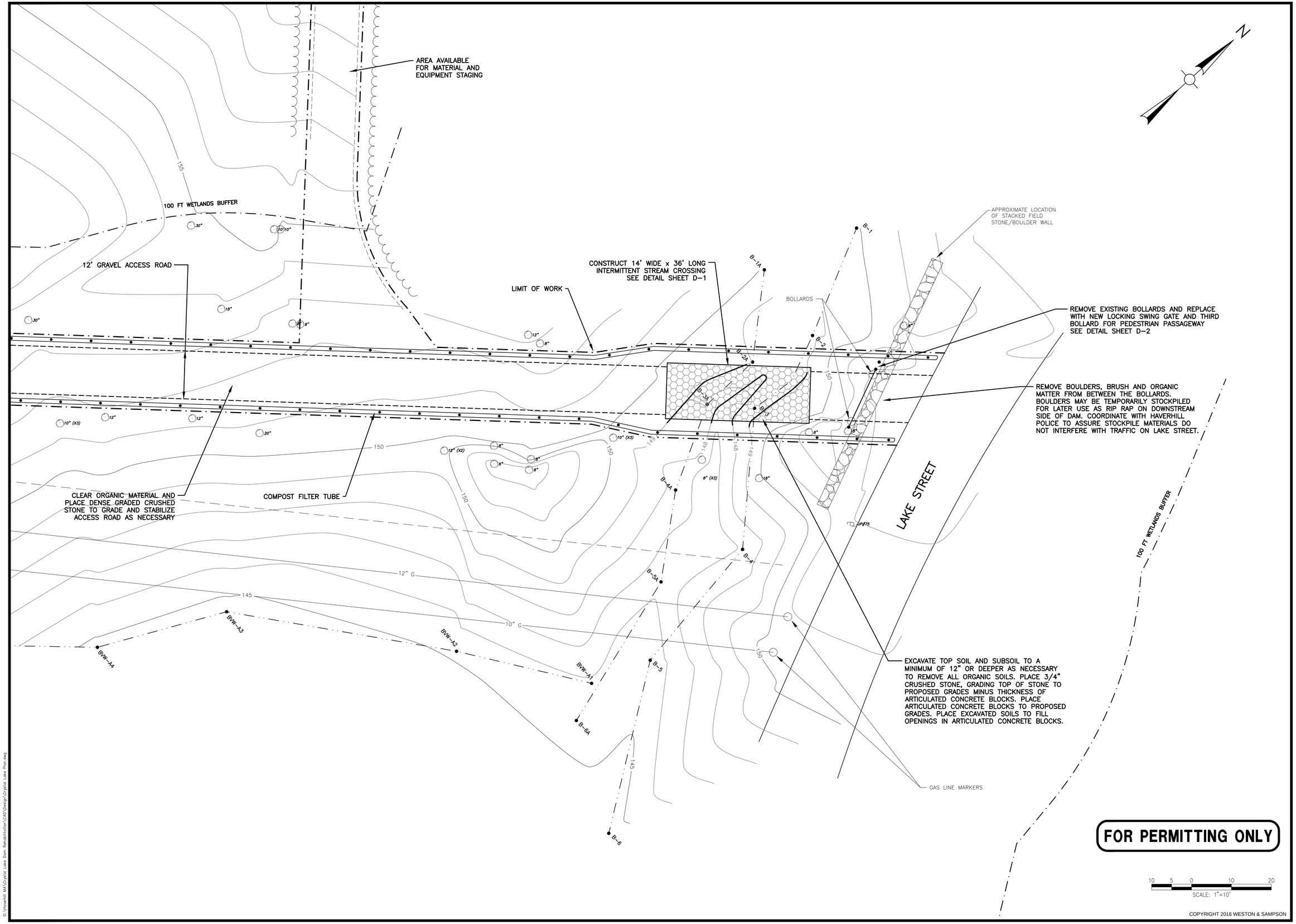
CITY OF HAVERHILL, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION

SITE PREPARATION AND DEMOLITION PLAN

| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| CRYSTAL LAKE PLAN | NOTED | | 2160199 | - | - | - | - |

FILE NO. -

C-2




FOR PERMITTING ONLY

10 5 0 10 20
SCALE: 1"=10'

COPYRIGHT 2016 WESTON & SAMPSON

O:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\Crystal Lake Plan.dwg

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900 800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | | | | |

A P P R O V E D

REGISTERED PROFESSIONAL ENGINEER

9/2/16
DATE

COMMONWEALTH OF MASSACHUSETTS
FRANCIS M. RICCIARDI
CIVIL
No. 41689
REGISTERED PROFESSIONAL ENGINEER

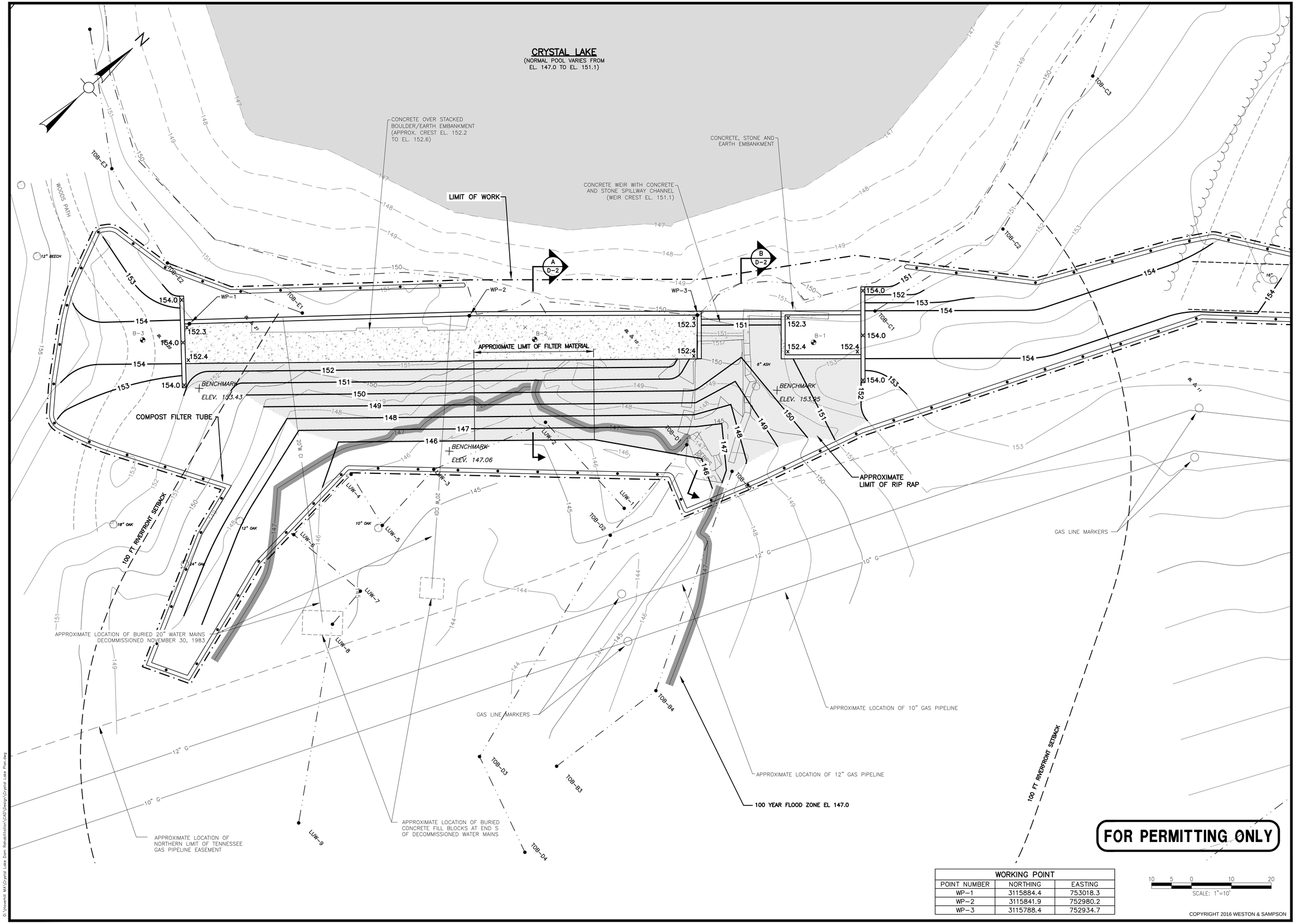
CITY OF HAVERHILL, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION

# SITE ENTRANCE PREPARATION PLAN

| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| CRYSTAL LAKE PLAN | NOTED | | 2160199 | - | - | - | - |

FILE NO. -

C-3




| WORKING POINT | | |
|---|---|---|
| POINT NUMBER | NORTHING | EASTING |
| WP-1 | 3115884.4 | 753018.3 |
| WP-2 | 3115841.9 | 752980.2 |
| WP-3 | 3115788.4 | 752934.7 |

COPYRIGHT 2016 WESTON & SAMPSON

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900 800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | | | | |

APPROVED
9/2/16
DATE
REGISTERED PROFESSIONAL ENGINEER

COMMONWEALTH OF MASSACHUSETTS
FRANCIS M. RICCIARDI
CIVIL
No. 41689
REGISTERED PROFESSIONAL ENGINEER

CITY OF HAVERHILL, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION

# PROPOSED SITE CONDITIONS

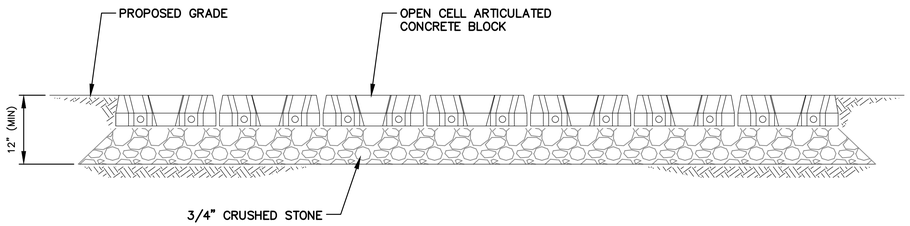
| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| CRYSTAL LAKE PLAN | NOTED | | 2160199 | - | - | - | - |

FILE NO. -

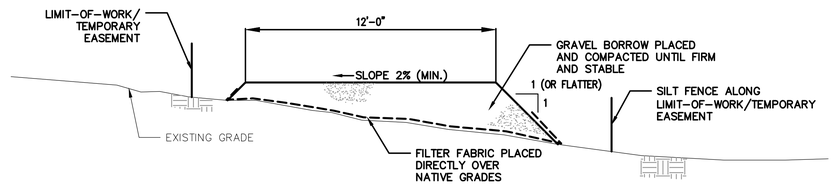
C-4

SHEET 6 OF 11

O:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\Crystal Lake Plan.dwg




CROSS SECTION DETAIL
SCALE: N.T.S.




## TEMPORARY ACCESS ROAD SECTION

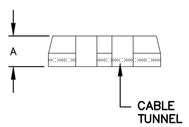
NTS

1. DEMARCATE LIMIT-OF-WORK/TEMPORARY EASEMENT AND INSTALL EROSION AND SEDIMENT CONTROLS.
2. CUT TREES AND BRUSH ALONG ALIGNMENT TO NEAR GROUND SURFACE.
3. RAKE FOREST MAT/LEAVES FROM ROAD ALIGNMENT AND STORE IN ROW ON EAST SIDE OF ALIGNMENT.
4. PLACE FILTER FABRIC ALONG TEMPORARY ACCESS ROAD FOOTPRINT IN ACCORDANCE WITH THE SPECIFICATIONS AND MANUFACTURER'S RECOMMENDATIONS.
5. PLACE AND COMPACT GRAVEL BORROW TO THE LINES AND GRADES SHOWN ON THIS SHEET.
6. INCORPORATE STABILIZED CONSTRUCTION ENTRANCE AT TRANSITION LAKE STREET.
7. MAINTAIN ACCESS ROAD DURING CONSTRUCTION.

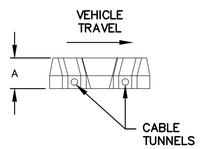
## ACCESS ROAD DESIGN DATA:

| | |
|---|---|
| MINIMUM WIDTH OF TRAVELED WAY | 12 FT. |
| SIDE SLOPES | 1H:1V OR FLATTER |
| BASE/SURFACE TYPE: | M1.03.0 TYPE B GRAVEL BORROW |
| MINIMUM DEPTH OF GRAVEL BORROW: | 12 IN. |
| FILTER FABRIC: | MIRAFI 180N OR APPROVED EQUAL |

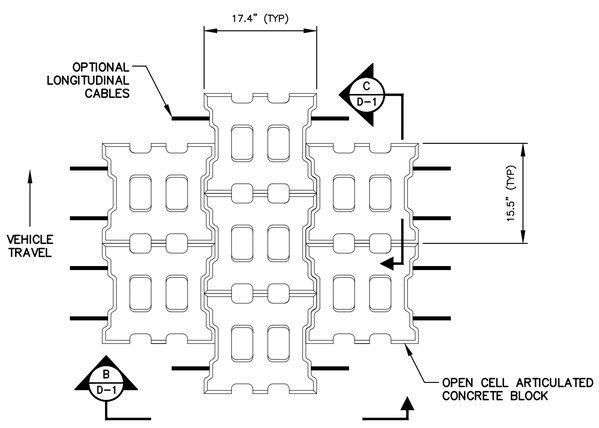
| BLOCK THICKNESS "A" | |
|---|---|
| CLASS 40 | 4.75" |




SECTION B D-1
SCALE: N.T.S.



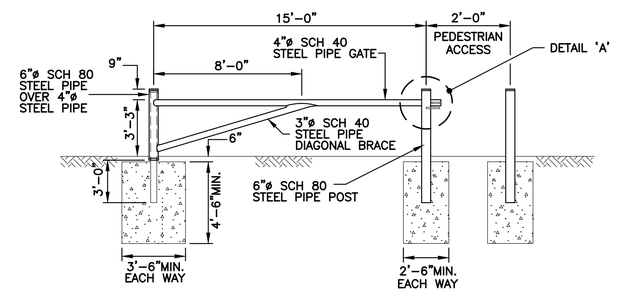

SECTION C D-1
SCALE: N.T.S.




NOTE:
ARTICULATED CONCRETE BLOCKS SHALL BE ARMORFLEX MODEL 40 OPEN CELL TAPERED ARTICULATED CONCRETE BLOCK BY ARMORTEC OF 4301 INDUSTRIAL DRIVE, BOWLING GREEN, KY 42102, TEL. (800) 305-0523 OR APPROVED EQUAL.

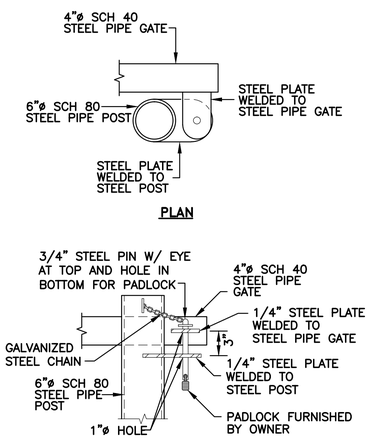
PARTIAL PLAN
SCALE: N.T.S.

ARTICULATED CONCRETE BLOCK DETAIL




NOTE:
ALL EXPOSED PIPE AND APPURTENANCES TO BE PAINTED WITH ZINC RICH PRIMER PLUS ONE COAT OF CATALIZED EPOXY AND A FINISH COAT OF ACRYLIC POLYURETHANE BY TNEMEC CO. OR APPROVED EQUAL. ALL INTERSECTING PIPE JOINTS SHALL BE SHOP FILLET WELDED.

TYPICAL BARRIER GATE
SCALE: N.T.S.




DETAIL 'A'
SCALE: N.T.S.

**FOR PERMITTING ONLY**

COPYRIGHT 2016 WESTON & SAMPSON

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900
800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | A | P | P | R O V E D |

9/2/16
DATE
REGISTERED PROFESSIONAL ENGINEER

COMMONWEALTH OF MASSACHUSETTS FRANCIS M. RICCARDI JR. No. 41169 REGISTERED PROFESSIONAL ENGINEER

CITY OF HAVERHILL MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION
DETAILS I

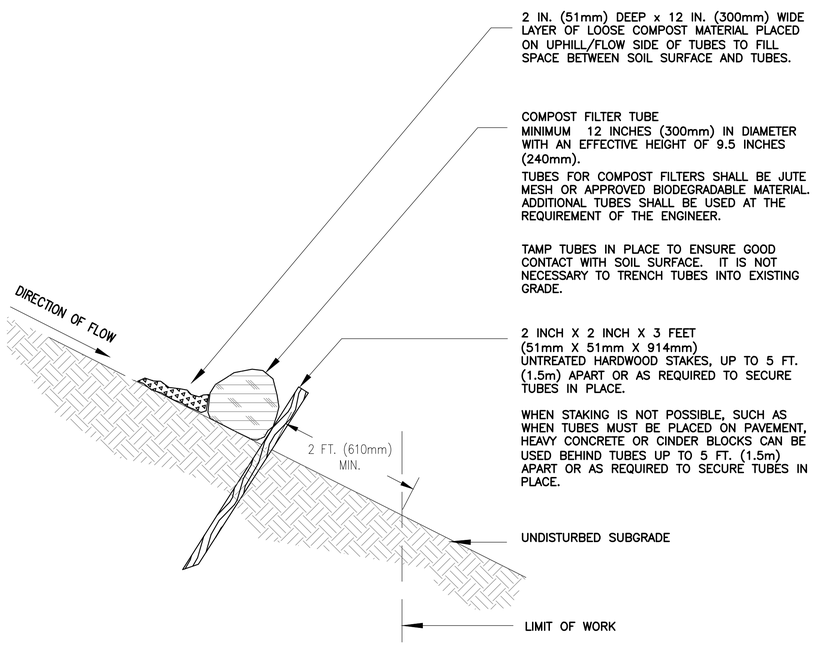
| CADD NO. | SCALE: | CONTRACT: | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|
| DETAILS | NOTED | | JOB NO. 2160199 | - | - | - |

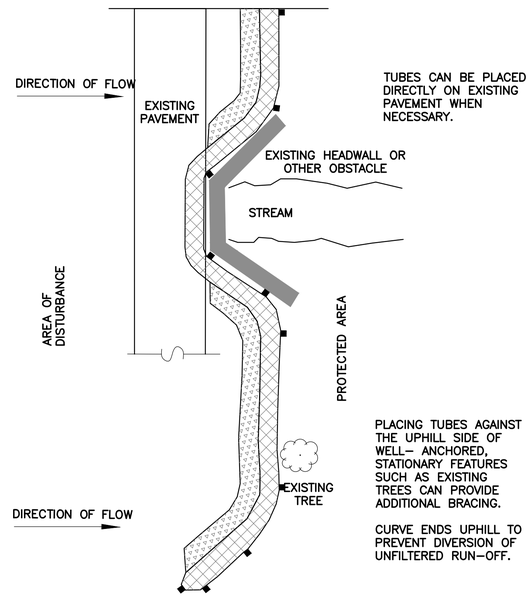
FILE NO. -

D-1

SHEET 7 OF 11

O:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\Details.dwg

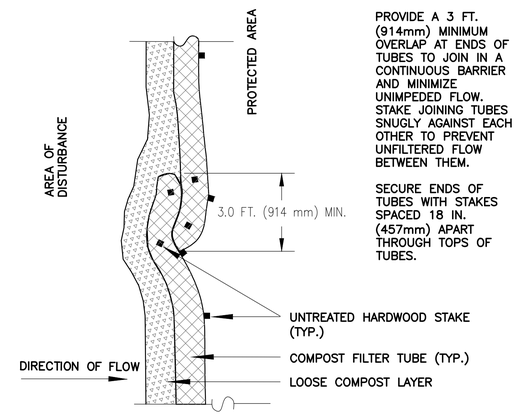



PLAN VIEW

GENERAL NOTES:

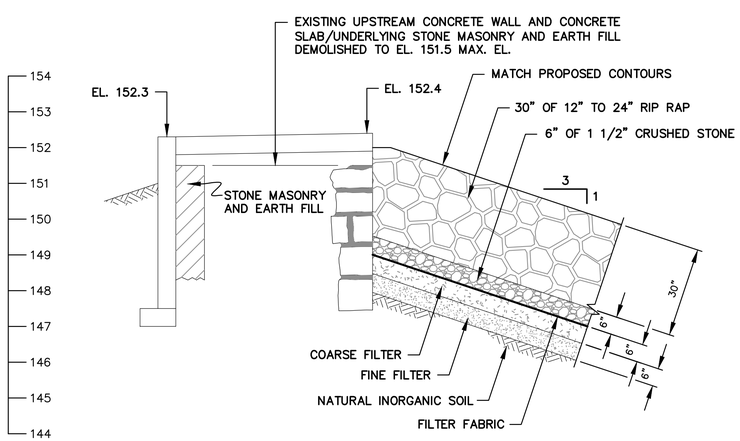
1. PROVIDE A MINIMUM TUBE DIAMETER OF 12 INCHES (300mm) FOR SLOPES UP TO 50 FEET (15.24m) IN LENGTH WITH A SLOPE RATIO OF 3H:1V OR STEEPER. LONGER SLOPES OF 3H:1V MAY REQUIRE LARGER TUBE DIAMETER OR ADDITIONAL COURSING OF FILTER TUBES TO CREATE A FILTER BERM. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR SITUATIONS WITH LONGER OR STEEPER SLOPES.
2. INSTALL TUBES ALONG CONTOURS AND PERPENDICULAR TO SHEET OR CONCENTRATED FLOW.
3. DO NOT INSTALL IN PERENNIAL, EPHEMERAL OR INTERMITTENT STREAMS.
4. CONFIGURE TUBES AROUND EXISTING SITE FEATURES TO MINIMIZE SITE DISTURBANCE AND MAXIMIZE CAPTURE AREA OF STORMWATER RUN-OFF.



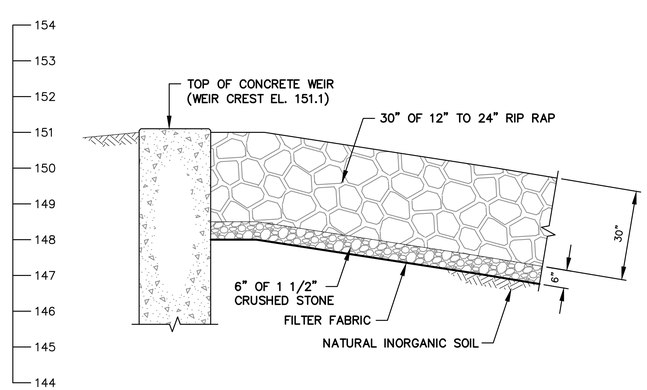

PLAN VIEW – JOIN DETAIL

## SINGLE COMPOST FILTER TUBE DETAIL

NOT TO SCALE




SECTION A C-4
SCALE: N.T.S.




SECTION B C-4
SCALE: N.T.S.

**FOR PERMITTING ONLY**

COPYRIGHT 2016 WESTON & SAMPSON

O:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\Details.dwg

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900
800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | A | P | P | R O V E D |

9/2/16
DATE

REGISTERED PROFESSIONAL ENGINEER

COMMONWEALTH OF MASSACHUSETTS FRANCIS M. RICCIARDI CIVIL No. 45588 REGISTERED PROFESSIONAL ENGINEER

CITY OF HAVERHILL, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION

DETAILS II

| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| DETAILS | NOTED | | 2160199 | - | - | - | - |

D-2

FILE NO. -

## 1.0 - GENERAL

1.01 THE STRUCTURAL DRAWINGS SHALL BE USED IN CONJUNCTION WITH ALL OTHER CONTRACT DRAWINGS AND SPECIFICATIONS. REFER TO CIVIL DRAWINGS FOR LOCATION, DIMENSIONS, AND DETAILS OF OPENINGS, SLEEVES, EMBEDMENTS, INSERTS, PADS, CURBS, DEPRESSIONS, ANCHOR BOLTS, AND OTHER PROJECT REQUIREMENTS NOT SHOWN ON STRUCTURAL DRAWINGS.

1.02 THE CONTRACTOR IS RESPONSIBLE FOR CHECKING, COORDINATING AND VERIFYING ALL DIMENSIONS IN THE FIELD PRIOR TO COMMENCING WORK. THE CONTRACTOR SHALL IMMEDIATELY REPORT ANY DISCREPANCY TO THE ARCHITECT AND ENGINEER.

1.03 THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING IN THE FIELD THE EXISTENCE AND LOCATION OF OVERHEAD, BURIED AND/OR EMBEDDED UTILITIES, AND DETERMINING LOCATIONS OF ALL EMBEDDED MECHANICAL, ELECTRICAL AND PLUMBING SYSTEMS AFFECTED BY THE WORK OF THIS CONTRACT.

1.04 ALL WORK IS TO CONFORM WITH THE FOLLOWING CODES AND STANDARDS:

(A) "780 CMR: MASSACHUSETTS AMENDMENTS" - 8TH EDITION (MSBC)
(B) INTERNATIONAL BUILDING CODE, (IBC 2009)
(C) "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE" - AMERICAN CONCRETE INSTITUTE (ACI 318-05)
(D) "MANUAL OF STEEL CONSTRUCTION" - AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC 360)
(E) "STRUCTURAL WELDING CODE - STEEL" - AMERICAN WELDING SOCIETY (AWS D1.1-92)
(F) "SEISMIC PROVISION FOR STRUCTURAL STEEL BUILDINGS" -AMERICAN INSTITUTE OF STEEL CONSTRUCTION, (AISC)
(G) "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES" - AMERICAN SOCIETY OF CIVIL ENGINEERS, (ASCE 7-05)

FOR ADDITIONAL CODES AND STANDARDS REFER TO SPECIFICATIONS.

1.05 THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF UNANTICIPATED CONDITIONS THAT MAY BE UNCOVERED DURING CONSTRUCTION.

1.06 PERMANENT STRUCTURAL ELEMENTS TO BE DESIGNED IN ACCORDANCE WITH PERFORMANCE SPECIFICATIONS INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING;

(A) PRE-ENGINEERED PEDESTRIAN BRIDGE
(B) PRECAST CONCRETE CHANNEL

FOR PERFORMANCE DESIGN REQUIREMENTS OF ELEMENTS LISTED ABOVE, REFER TO ADDITIONAL NOTES ON THESE SHEETS AND IN THE TECHNICAL SPECIFICATIONS. ALL DESIGN SUBMITTAL DRAWINGS AND CALCULATIONS SHALL BE CERTIFIED, SIGNED AND SEALED BY A PROFESSIONAL STRUCTURAL ENGINEER REGISTERED IN THE STATE OF MASSACHUSETTS.

1.07 DETAILS AND NOTES SHOWN ON STRUCTURAL DRAWINGS SHALL BE APPLICABLE TO ALL PARTS OF THE STRUCTURAL WORK EXCEPT WHERE SPECIFICALLY REQUIRED OTHERWISE BY CONTRACT DOCUMENTS. CONDITIONS NOT SPECIFICALLY SHOWN SHALL BE SIMILAR TO THOSE SHOWN FOR LIKE CONDITIONS AS DETERMINED BY THE ENGINEER.

1.08 TESTING AND INSPECTION OF STRUCTURAL WORK SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR. THE COSTS FOR TESTING AND INSPECTION WILL BE PAID BY THE CONTRACTOR. FOR ADDITIONAL INFORMATION CONCERNING TESTING AND INSPECTION, REFER TO THE TECHNICAL SPECIFICATIONS.

1.09 THE CONTRACTOR SHALL DESIGN AND PROVIDE ALL REQUIRED SHORING AND TEMPORARY BRACING TO RESIST FORCES ON THE STRUCTURE THROUGHOUT THE CONSTRUCTION PERIOD.

1.10 SUBMIT SHOP DRAWINGS, WITH AMPLE TIME FOR ENGINEER'S REVIEW AND APPROVAL, FOR STRUCTURAL ELEMENTS, INCLUDING CONCRETE REINFORCING, PRECAST CONCRETE, MISCELLANEOUS METAL, AND PRE-ENGINEERED PEDESTRIAN BRIDGE.

## 2.0 DESIGN LOADS

LOADS, LOADING CONDITIONS AND COMBINATIONS SHALL BE IN ACCORDANCE WITH THE MASSACHUSETTS STATE BUILDING CODE 8TH EDITION, IBC 2009 AND ASCE 7-05 AS APPLICABLE. LOADS DESIGNATED BY "PSF" ARE UNIFORM LOADS, THOSE DESIGNATED BY "LB" ARE CONCENTRATED LOADINGS AND SHALL BE APPLIED AS REQUIRED BY THE MSBC.

2.01 DEAD LOADS
(A) PEDESTRIAN BRIDGE_____ACTUAL WEIGHT
(B) VAULT_____ACTUAL WEIGHT

2.02 LIVE LOADS
(A) LIVE LOADS
(1) PEDESTRIAN BRIDGE_____90 PSF
(2) VAULT TOP SLAB_____250 PSF

2.03 SNOW LOAD
(A) GROUND SNOW LOAD, PG_____35 PSF
(B) MIN. FLAT ROOF SNOW LOAD_____30 PSF
(C) SNOW EXPOSURE FACTOR, CE_____1.0
(D) SNOW LOAD IMPORTANCE FACTOR, I_____1.0 II
(E) THERMAL FACTOR, CT_____1.0

2.04 WIND DESIGN DATA
(A) BASIC WIND SPEED, V_____105 MPH
(B) WIND IMPORTANCE FACTOR, I_____1.0, II
(C) WIND EXPOSURE_____C

2.05 EARTHQUAKE DESIGN DATA
(A) SEISMIC IMPORTANCE FACTOR, I_____1.0, II
(B) MAPPED SPECTRAL RESPONSE ACCELERATIONS, SS, S1_____0.24G, 0.063G
(C) SITE CLASS_____D

2.06 GEOTECHNICAL INFORMATION
(A) ALLOWABLE NET BEARING PRESSURE_____3000 PSF**
(B) ACTIVE LATERAL EARTH PRESSURE_____35 PSF
(C) AT-REST LATERAL EARTH PRESSURE_____60 PSF
(D) PASSIVE LATERAL EARTH PRESSURE_____240 PSF

SEE GEOTECHNICAL REPORT, PHASE II INSPECTION REPORT BY WESTON & SAMPSON DATED SEPTEMBER 2010, FOR ADDITIONAL DATA AND REQUIREMENTS

**BEARING PRESSURE IS ALLOWED TO BE INCREASED TO 6000 PSF FOR WIND OR SEISMIC LOADINGS PROVIDED LOAD ECCENTRICITIES REMAIN WITHIN THE MIDDLE ⅓ OF THE FOOTING.

## 4.0 - CONCRETE

4.01 CONCRETE WORK SHALL CONFORM TO "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE" (ACI 318-02) AND "SPECIFICATIONS FOR STRUCTURAL CONCRETE FOR BUILDINGS" (ACI 301-99).

4.02 CONCRETE SHALL BE CONTROLLED CONCRETE, PROPORTIONED, MIXED AND PLACED IN THE PRESENCE OF A REPRESENTATIVE OF AN APPROVED TESTING AGENCY.

4.03 UNLESS NOTED OTHERWISE, CONCRETE SHALL BE NORMAL WEIGHT AND HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH AS FOLLOWS:

(A) FOOTINGS, WALLS, AND SLABS : 4500 PSI
(B) PRECAST SECTIONS: 5000 PSI

4.04 THE CONTRACTOR SHALL VERIFY INSTALLATION AND LOCATIONS OF ALL EMBEDDED ITEMS INCLUDING BUT NOT LIMITED TO INSERTS, ANCHOR BOLTS, DOWELS, BLOCKOUTS, SLEEVES, EMBEDDED PIPING, AND EMBEDDED CONDUIT PRIOR TO CONCRETE PLACEMENT.

4.06 FOR STRUCTURAL ELEMENTS, THE LOCATION AND MAXIMUM SPACING OF VERTICAL JOINTS SHALL BE AS FOLLOWS:

| ELEMENT | JOINT TYPE | SPACING, FT. |
|---|---|---|
| WALL | CONSTRUCTION | 30 |
| SLAB | CONSTRUCTION | 30 |

SUBMIT JOINT LOCATIONS AND DETAILS FOR APPROVAL.

4.07 CONCRETE EXPOSED TO WEATHER IN THE FINISHED PROJECT SHALL BE AIR ENTRAINED PER SPECIFICATIONS REQUIREMENTS.

4.08 A MINIMUM OF 72 HOURS SHALL ELAPSE BETWEEN ADJACENT CONCRETE PLACEMENTS.

4.09 CONCRETE SLABS SHALL BE PLACED SO THAT THE SLAB THICKNESS IS AT NO POINT LESS THAN THAT INDICATED ON THE DRAWINGS.

4.10 PROVIDE A ¾" CHAMFER ON ALL VERTICAL AND HORIZONTAL CORNERS EXPOSED TO VIEW UNLESS NOTED OTHERWISE.

4.11 CONCRETE SURFACES SHALL BE FINISHED AS FOLLOWS:

(A) SLABS: STEEL TROWEL FINISH

4.12 ALL CONCRETE SHALL BE WATER CURED UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

## 5.0 - CONCRETE REINFORCEMENT

5.01 REINFORCEMENT DETAILING, FABRICATION, AND ERECTION SHALL CONFORM TO "ACI DETAILING MANUAL" - SP-66, "CRSI MANUAL OF STANDARD PRACTICE".

5.02 STEEL REINFORCEMENT, UNLESS NOTED OTHERWISE, SHALL CONFORM TO THE FOLLOWING:

(A) BARS, TIES, AND STIRRUPS_____ASTM A615 GRADE 60
(B) WELDED WIRE FABRIC_____ASTM A185, FLAT SHEETS FOR FLOOR SLABS.

5.03 REINFORCING STEEL SHALL BE UNCOATED AND DEFORMED.

5.04 MINIMUM CONCRETE PROTECTIVE COVERING FOR REINFORCEMENT, UNLESS REQUIRED FOR FIRE PROTECTION OR NOTED OTHERWISE, SHALL BE AS FOLLOWS:

(A) CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH:___3"
(B) CONCRETE EXPOSED TO EARTH OR WEATHER:
(1) NO. 6 THRU NO. 18 BARS_____2"
(2) NO. 5 BAR, W31 OR D31 WIRE AND SMALLER_____1½"

5.05 REINFORCING STEEL SHALL BE CONTINUOUS THROUGH ALL CONSTRUCTION JOINTS, CORNERS, AND INTERSECTIONS UNLESS OTHERWISE NOTED. REINFORCING SHALL BE LAPPED AT NECESSARY SPLICES OR HOOKED AT DISCONTINUOUS ENDS, UNLESS OTHERWISE NOTED.

5.06 FOR REINFORCING STEEL SPLICE LAP LENGTHS REFER TO THE TABLE PROVIDED UNLESS OTHERWISE INDICATED.

5.07 MECHANICAL SPLICES SHALL BE PERMITTED SUBJECT TO APPROVAL BY THE ENGINEER. MECHANICAL SPLICES SHALL DEVELOP AT LEAST 125 PERCENT OF THE SPECIFIED YIELD STRENGTH OF THE BAR. NO WELDED CONNECTIONS ARE PERMITTED.

5.08 WELDED WIRE FABRIC SHALL BE LAPPED (1) SQUARE PLUS (2) INCHES WHERE REQUIRED AND SHALL BE WIRED TOGETHER AT ALL LAPS. WWF SHALL BE SUPPORTED BY CHAIRS AND/OR CARRYING BARS PRIOR TO CONCRETE PLACEMENT.

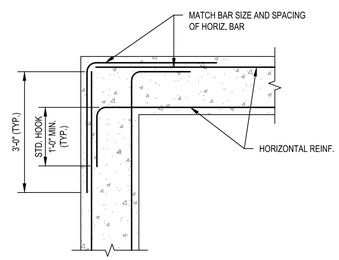
5.09 REINFORCEMENT SHALL NOT BE TACK WELDED.

5.10 NOTIFY THE TESTING LAB AND ENGINEER A MINIMUM OF 48 HOURS PRIOR TO SCHEDULED CONCRETE PLACEMENT IN ORDER TO ACCOMMODATE INSPECTION OF REINFORCEMENT AND CONCRETE TESTING. NO CONCRETE SHALL BE PLACED WITHIN 48 HOURS OF SUCH NOTIFICATION.

5.11 WHERE REINFORCEMENT IS NOT SHOWN ON DRAWINGS, PROVIDE REINFORCEMENT IN ACCORDANCE WITH APPLICABLE DETAILS AS DETERMINED BY THE ARCHITECT AND ENGINEER. IN NO CASE SHALL REINFORCEMENT BE LESS THAN THE MINIMUM REINFORCEMENT PERMITTED BY THE CODES, NOR LESS THAN THE FOLLOWING:.
(A) STRUCTURAL SLABS: .0020 GROSS CONCRETE AREA IN EACH DIRECTION
(B) CONCRETE WALLS: .0025 x GROSS CONCRETE AREA IN EACH DIRECTION

5.12 WHERE REINFORCEMENT IS REQUIRED IN SECTION, REINFORCEMENT IS CONSIDERED TYPICAL WHEREVER THE SECTIONS APPLIES.

5.13 DOWELS SHALL MATCH BAR SIZE, NUMBER AND SPACING, UNLESS NOTED OTHERWISE.




WALL CORNER REINFORCING DETAIL

NOTE(S):
1. VERTICAL REINFORCING NOT SHOWN FOR CLARITY.

**FOR PERMITTING ONLY**

COPYRIGHT 2016 WESTON & SAMPSON

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900
800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | A | P | P | R O V E D |

REGISTERED PROFESSIONAL ENGINEER
9/2/16
DATE

COMMONWEALTH OF MASSACHUSETTS
FRANCIS M. RICCIARDI
CIVIL
No. 45188
REGISTERED PROFESSIONAL ENGINEER

CITY OF HAVERHILL, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION

# GENERAL NOTES AND TYPICAL DETAILS

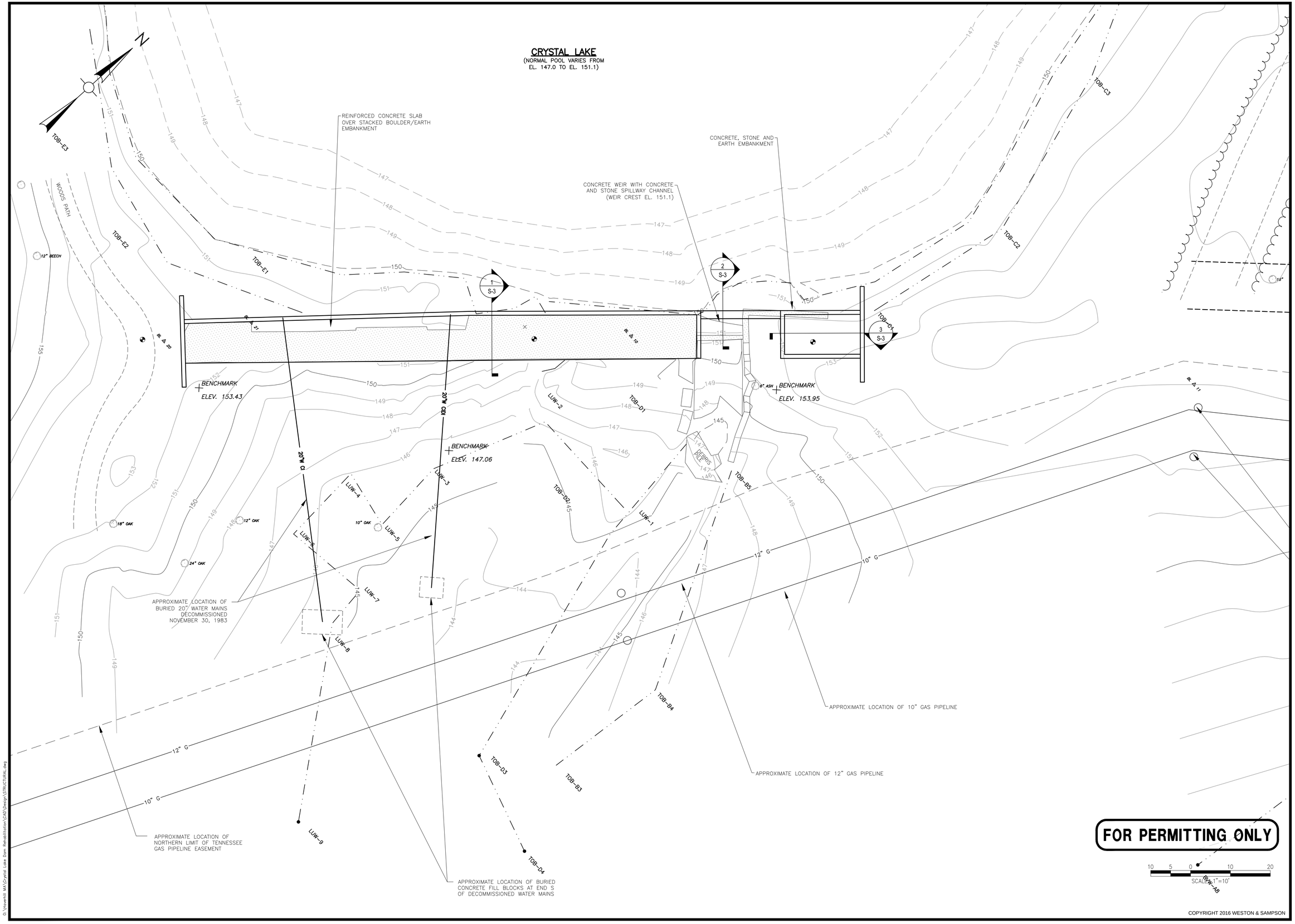
| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| CRYSTAL LAKE PLAN | NOTED | | 2160199 | - | - | - | - |

S-1

FILE NO. -

SHEET 9 OF 11

G:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\STRUCTURAL.dwg




COPYRIGHT 2016 WESTON & SAMPSON

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900 800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | | | | |

APPROVED

REGISTERED PROFESSIONAL ENGINEER

9/2/16
DATE

COMMONWEALTH OF MASSACHUSETTS
FRANCIS M. RICCIARDI
CIVIL
No. 41689
REGISTERED PROFESSIONAL ENGINEER

CITY OF HAVERHILL, MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION

PLAN VIEW

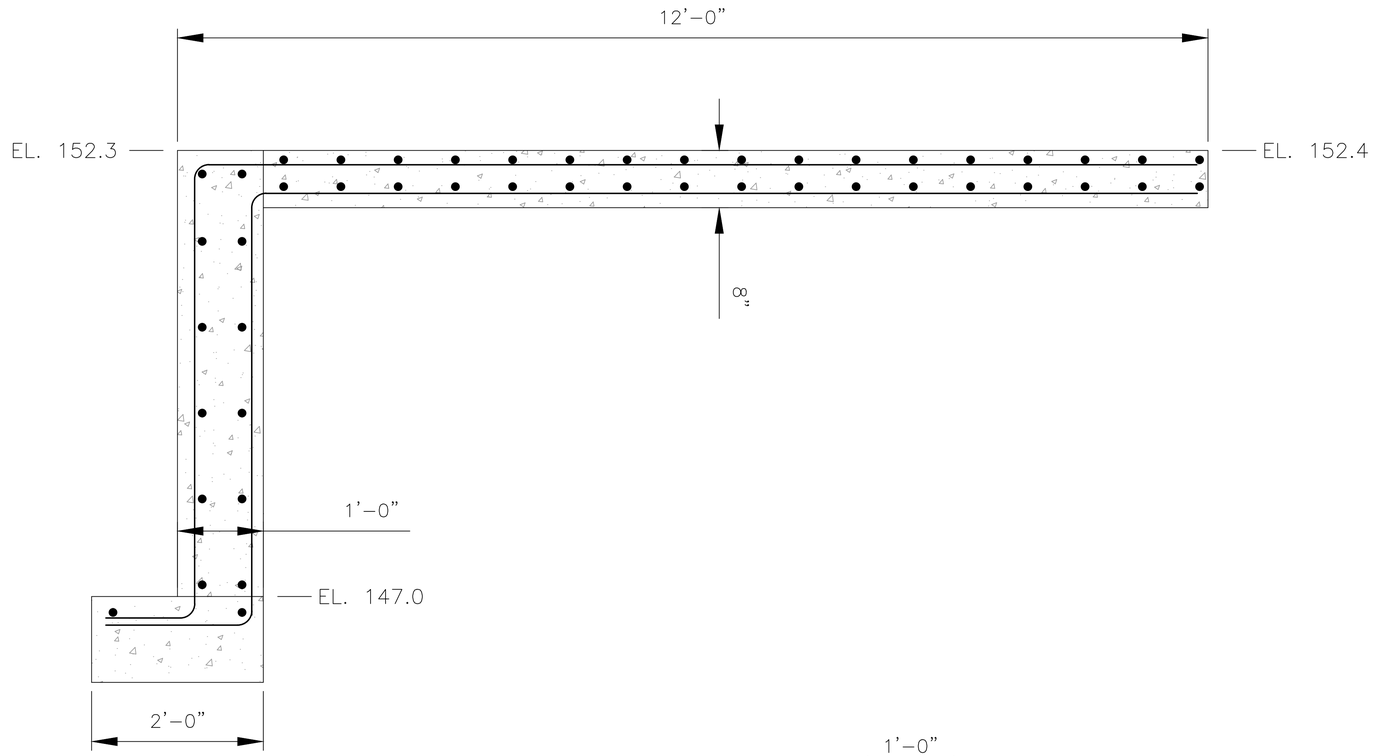
| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| CRYSTAL LAKE PLAN | NOTED | | 2160199 | - | - | - | - |

FILE NO. -

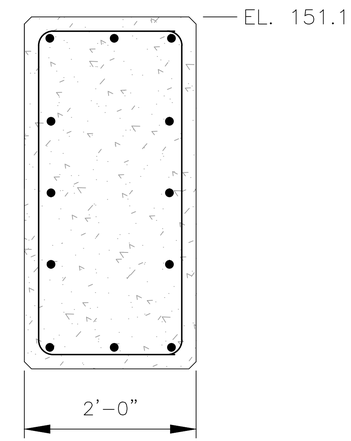
S-2

SHEET 10 OF 11

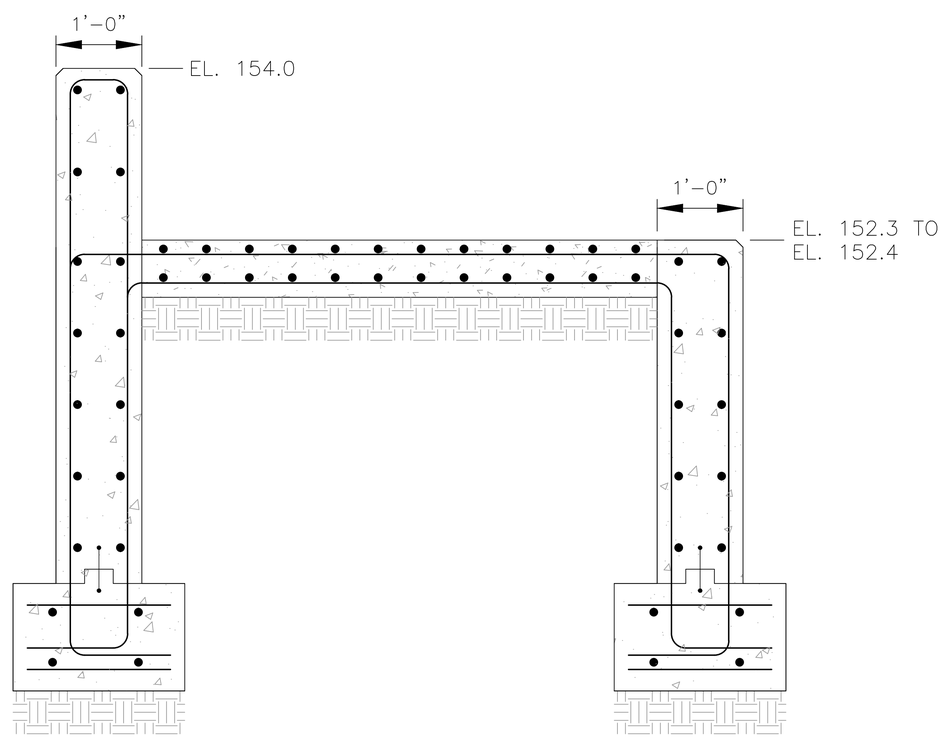
O:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\STRUCTURAL.dwg




1 SECTION




2 SECTION




3 SECTION

**FOR PERMITTING ONLY**

COPYRIGHT 2016 WESTON & SAMPSON

O:\Haverhill MA\Crystal Lake Dam Rehabilitation\CAD\Design\STRUCTURAL.dwg

Weston & Sampson
Five Centennial Drive, Peabody, MA 01960
978.532.1900
800.SAMPSON
www.westonandsampson.com

| No. | Date | Dr.By | Ck.By | App.By | Description |
|---|---|---|---|---|---|
| | | A | P | P | R O V E D |

9/2/16
DATE

REGISTERED PROFESSIONAL ENGINEER

COMMONWEALTH OF MASSACHUSETTS
FRANCIS M. RICCARDI
No. 41169
REGISTERED PROFESSIONAL ENGINEER

CITY OF HAVERHILL MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS
CRYSTAL LAKE DAM REHABILITATION

# SECTIONS AND DETAILS

| CADD NO. | SCALE: | CONTRACT: | JOB NO. | DR.BY | DSN.BY | CHK.BY | APP.BY |
|---|---|---|---|---|---|---|---|
| CRYSTAL LAKE PLAN | NOTED | | 2160199 | - | - | - | - |

FILE NO. -

S-3