STRUCTURE GEOTECHNICAL REPORT
ILLINOIS ROUTE 31 OVER
UNNAMED TRIBUTARY TO FOX RIVER
EXISTING SN 056-0227, PROPOSED SN: 056-0105
MCHENRY COUNTY, ILLINOIS

For
AES Services, Inc.
111 S. Wacker Drive, Suite 3910
Chicago, IL 60606

Submitted by
Wang Engineering, Inc.
1145 North Main Street
Lombard, IL 60148

Original Report: September 24, 2018

Technical Report Documentation Page

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185 / 02</td><td>7. Existing Structure Number(s)
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SN 056-0105</td></tr>
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11. Abstract

The existing 10.0-foot wide by 4.0-foot high, concrete south box culvert cell carrying Illinois Route 31 over an unnamed tributary to Fox River at Station 444+46 will be removed and replaced with a 12.5-foot wide by 5.0-foot tall box culvert. No additional fill will be palced and the roadway grade is anticipated to remain the same. This report provides geotechnical recommendations for the design and construction of the proposed culvert.

The pavement structure consists of 3.5 to 5.0 inches of asphalt pavement over 7.0 to 10.0 inches of concrete pavement or 13.0 inches of full-depth asphalt pavement. Beneath the surface, the lithologic profile includes up to 4.0 feet of loose sandy gravel fill followed by 2.5 to 5.0 feet of soft to medium stiff organic silty clay to silty clay loam over foundation soils consisting of medium dense to very dense saturated sandy gravel to gravelly sandy loam. The soils below the base of the culvert are saturated and the design groundwater elevation is estimated at a depth of 8.0 feet below the ground surface (elevation of 747 feet).

Design scour elevations are not required for closed bottom culverts. A layer of soft to medium stiff organic silty clay to silty clay loam was encountered at or near the proposed base of the culvert and recommendations are provided for removal and replacement of the unstable foundation materials. A total settlement of less than 1.0 inch is estimated. Wingwalls could be designed based on a maximum factored bearing resistance of 3,000 psf. The wingwalls are estimated to have a factor of safety against global instability meeting the IDOT minimum requirement of 1.5. A tested top slab core from the nroth culvert cell revealed a compressive strength of 7,230 psi.

Temporary Soil Retention Systems will be required to support the excavations for the culvert replacement. Recommended parameters for the design of the retention systems are provided in the report.

12. Path to archived file

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1145 North Main Street
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ILLINOIS ROUTE 31 OVER
UNNAMED TRIBUTARY TO FOX RIVER
EXISTING SN 056-0227, PROPOSED SN 056-0105
MCHENRY COUNTY, ILLINOIS
FOR
AES SERVICES, INC.

1.0 INTRODUCTION

This report presents the results of the subsurface investigation, laboratory testing, geotechnical evaluations, and recommendations to support the removal and replacement of the south cell of the box culvert (SN 056-0227) carrying Illinois Route 31 (IL 31) over an unnamed tributary to Fox river at Station 444+46, in McHenry County, Illinois. A *Site Location Map* is presented as Exhibit 1.

The purpose of this investigation was to characterize the site soil and groundwater conditions, perform geotechnical analyses, and provide recommendations for the design and construction of the proposed south and north box culvert cellss.

1.1 Proposed Structure

Based on the *General Plan and Elevation Drawing* and *Plan and Profile* (Appendix E) provided by AES Services, Inc. (AES) on August 8, 2018, Wang Engineering, Inc. (Wang) understands the existing 10-foot wide by 4-foot high south cell of box culvert EX SN 056-0227 will be removed and replaced with a new box culvert (PR SN 056-0105) with a 12.5-foot wide by 5.0-foot high box culvert cell. The south box culvert will be cast-in-place and will be imbedded 12 inches into the natural creek bed and will have upstream and downstream invert elevations of 748.8 and 748.7 feet, respectivley. No change in the existing roadway grade is anticipated. The north cell culvert will remain as is. However, we understand that during construction, it may be determined that the north culvert is to be removed or filled and left in place.

Construction of the culvert cells will be performed in stages while maintaining traffic along IL 31.

1.2 Existing Structure

The existing structure is a two-cell reinforced concrete box culvert. The north and south culvert cells are 10-foot wide by 4-foot high and 4-foot wide by 1.5-foot high, respectively, and are seperated by 6.0 feet with shared wingwalls between them. It is unknown when the original box culvert sections were constructed. In 1985, the culvert was lengthened by 10.0 feet on each end and the culvert headwalls were combined with a retaining wall between each single cell box culvert, creating a two-cell culvert. A larger 11.5-foot wide by 4.0-foot high opening was used to extend the south culvert cell and a 4.0-foot wide by 1.5-foot high opening was used on the north cell extension on the west side. The culvert extensions on the east side were the same size as the original culvert. The box culvert has an end-to-end length of 66.0 feet.

2.0 METHODS OF INVESTIGATION

The following sections outline the subsurface and laboratory investigations performed by Wang.

2.1 Field Investigation

The subsurface investigation consisted of five soil borings, designated as CB-01 to CB-05, drilled by Wang in August and September of 2018. Borings CB-01 and CB-02 were drilled along IL 31 near the east and west ends of the south box culvert cell, respectivley. Borings CB-03 and CB-04 were drilled along IL 31 in the area between the two culvert cells whereas Boring CB-05 was drilled just north of the north culvert cell. The borings were drilled from elevations of 755.3 to 755.6 feet and were advanced to depths of 25.0 to 35.0 feet below the ground surface (bgs).

To determine the existing pavement structure and thickness along IL 31, Wang collected two pavement cores, designated as PC-01 and PC-02, from the existing northbound and southbound lanes. To determine the north and south culvert top slab thicknesses and unconfined compressive strength, Wang obtained four concrete cores from the top slab of the north and south culvert barrels, designated as CC-01 to CC-04. The as-drilled northings, eastings, and elevations were acquired with a mapping-grade GPS unit. Stations and offsets were measured from drawings provided by AES. Boring location data are presented in the *Boring Logs* (Appendix A) and the as-drilled locations are shown in the *Boring and Coring Location Plan* (Exhibit 2).

A combination of ATV- and truck-mounted drilling rigs, equipped with hollow stem augers, was used to advance and maintain open boreholes. Soil sampling was performed according to AASHTO T206, *"Penetration Test and Split Barrel Sampling of Soils."* The soil was sampled at 2.5-foot intervals to the boring termination depths. Soil samples from each sampling interval were placed in sealed jars and transported to the laboratory for further examination and laboratory testing. Four-inch diameter pavement and slab cores were obtained with hand-operated coring equipment.

Field boring logs, prepared and maintained by Wang geologists, include lithological descriptions, visual-manual soil (IDH Textural) classifications, results of Rimac and pocket penetrometer unconfined compressive strength tests, and results of Standard Penetration Tests (SPT) recorded as blows per 6 inches of penetration. The composition of the pavement cores and culvert slab cores was described, the thickness of each layer was measured, and the cores were photographed (Appendixes C and D).

Groundwater levels were measured while drilling and at completion of each boring. For safety considerations each borehole was backfilled upon completion with soil cuttings and/or bentonite chips. Coreholes were backfilled and capped with quick setting, non-shrink grout and restored as close as possible to their original condition.

2.2 Laboratory Testing

The soil samples were tested in the laboratory for moisture content (AASHTO T265). Atterberg limits (AASHTO T89 and T90), particle size (AASHTO T88) analyses, and organic content (ASTM D2974) tests were performed on selected samples. The culvert slab core samples tested for compressive strength. Field visual descriptions of the soil samples were verified in the laboratory. Laboratory test results are shown in the *Boring Logs* (Appendix A) and in the *Laboratory Test Results* (Appendix B).

3.0 INVESTIGATION RESULTS

Detailed descriptions of the soil conditions encountered during the subsurface investigation are presented in the attached *Boring Logs* (Appendix A) and in the *Soil Profiles* (Exhibit 3). Please note that strata contact lines represent approximate boundaries between soil types. The actual transition between soil types in the field may be gradual in horizontal and vertical directions.

3.1 Surface Characterization

The pavement cores and borings revealed the existing pavement structure along IL 31 consists of 3.5 to 5.0 inches of asphalt over 7.0 to 10.0 inches of concrete pavement. Pavement core PC-02 taken along southbound IL 31 revealed 13.0 inches of full-depth asphalt pavement. The pavement composition and thicknesses as uncovered by our investigation are summarized in Table 1 and pavement core photographs are presented in *Appendix C*.

Table 1: Existing Pavement Structure Composition Summary

Roadway Alignment	Boring/Pavement Core ID	Pavement Structure (inches)	
		Asphalt	Concrete
IL 31	PC-01	3.5	9.0
	PC-02	13.0	0.0
	CB-01	5.0	7.0
	CB-02	4.0	8.0
	CB-03	5.0	8.0
	CB-04	4.0	8.0
	CB-05	5.0	10.0

3.2 Lithological Profile

In descending order, the general lithologic succession encountered beneath the pavement includes: 1) man-made ground (fill); 2) soft to medium stiff organic silty clay to silty clay loam; and 3) medium dense to very dense sandy gravel to gravelly sandy loam.

1) Man-made ground (fill)

Beneath the pavement, Boring CB-04 sampled up to 4.0 feet of loose, brown sandy gravel fill. The granular fill has an SPT N value of 9 blows per foot and a moisture content value of 9%. Borings CB-01 to CB-03 and CB-05 did not sample fill.

2) Soft to medium stiff organic silty clay to silty clay loam

Beneath the pavement structure, Borings CB-01 to CB-03 and CB-05, sampled 2.5 to 5.0 feet of soft to medium stiff, black organic silty clay to silty clay loam with moisture contents of 49 to 114%, unconfined compressive strength (Q_u) values of 0.2 to 0.8 tsf, and organic contents of 13.5 to 22.9%. Laboratory index testing on a sample from this layer shows L_L and P_L values of 68 and 25%, respectively.

3) Medium dense to very dense sandy gravel to gravelly sandy loam

At an elevation of 748 to 750 feet, the borings augured through medium dense to very dense, brown to gray, moist to saturated sandy gravel to gravelly sandy loam extending to their termination depths. The granular soil has N-values of 8 to more than 58 blows per 3 inches and moisture content values of 6 to 21%. This soil unit is saturated and water bearing.

At elevations of 746 to 747 feet, Borings CB-01, CB-02, and CB-05 sampled a 1.0- to 2.5-foot thick layer of stiff to very stiff sandy clay and silty loam with Q_u values of 1.3 to 2.2 tsf and moisture contents of 8 to 14%. Laboratory index testing on samples from this layer shows L_L and P_L values of 17 to 20% and 11 to 12%, respectively. According to the AASHTO Soil Classification System, the soil belongs to the A-4 group.

3.2 Groundwater Conditions

Groundwater was encountered while drilling within the sandy gravel layer beneath the culvert base at approximate elevations of 747 to 749 feet (6.0 to 8.0 feet bgs). At the completion of drilling, groundwater was measured at elevations of 727 to 751 feet (4.5 to 28.0 feet bgs). The design groundwater elevation is estimated to lie within the sandy soils at an average elevation of 747 feet. Excavations into these soils will encounter groundwater infiltration if advance provisions are not made for the control of groundwater.

It should be noted that groundwater levels might vary with seasonal rainfall patterns and long-term climate fluctuations or be influenced by local site conditions.

4.0 FOUNDATION ANALYSIS AND RECOMMENDATIONS

Geotechnical evaluations and recommendations for the culvert and wingwalls are included in the following sections.

The proposed south culvert cell will have upstream and downstream invert elevations of 748.7 and 748.8 feet, respectively. Wang has performed bearing capacity, settlement, and global stability analyses for the proposed culvert replacement and wingwalls. The results of our analysis including scour considerations are discussed in the following sections.

4.1 Scour Considerations

Our subsurface investigation shows the streambed soils are comprised primarily of loose to medium dense saturated sandy gravel. As per the *All Brige Designers Memo 14.2-Revised Scour Design Policy*, design scour elevations are not required for closed bottom culverts.

To prevent local erosion, we recommend placing stone riprap or a concrete apron at the ends of the culvert; this will be particularly important if precast sections are used. This will also prevent sediments from entering and accumulating in the culvert, minimize long term maintenance, and provide protection to the streambed at the interface.

4.2 Bearing Capacity

The subsurface investigation indicates that the foundation soils generally consist of medium dense to dense sand to sandy gravel which will provide sufficient bearing resistance and a stable working platform for the culvert replacement. However, Borings CB-01, CB-02, CB-03, and CB-05 revealed soft to medium stiff organic silty clay to silty clay loam with high moisture contents and high organic contents at or near the base of the proposed culvert. If encountered during construction, we recommend removing the compressible and organic soil layer and replacing it with compacted aggregate conforimg to IDOT specifications. The replacement material should extend a mimum of two feet beyond each side of the box (IDOT 2016). Table 2 summarizes the foundation soil concerns and treatment recommendations. The actual extent of the removal and replacement should be determined in the field during construction.

Table 2: Summary of Foundation Treatment Recommendations

Structure	Treatment Type/Base Elevation	Reference Boring/Subgrade Concerns
IL 31 South Culvert Cell	Removal and Replacement to Elevation 749.9 feet	Boring CB-01 (Q_u=0.49 tsf and MC=73%)
IL 31 South Culvert Cell	Removal and Replacement to Elevation 749.8 feet	Boring CB-02 (Q_u=0.5 tsf, MC=114%, and organic content=22.9%)
IL 31 South Culvert Cell	Removal and Replacement to Elevation 747.8 feet	Boring CB-03 (Q_u=0.25 to 0.49 tsf and MC=49 to 51%)
IL 31 North Culvert Cell	Removal and Replacement to Elevation 748.5 feet	Boring CB-05 (Q_u=0.25 to 0.82 tsf, MC=45 o 61%, and organic content=13.5%)

Due to the high groundwater condition that will exist beneath the culvert, we recommend bedding the barrel with a minimum of 12 inches of coarse aggregates as per IDOT specifications.

The culvert wingwalls could be constructed as horizontal cantilever walls if they are less than 16 feet in length and the wingwall locations can be adequately dewatered (IDOT 2017). Horizontal cantilever walls should be designed based on the structural guidelines provided in Section 4.2 of the IDOT *Culvert Manual* (2017). Horizontal cantilever wingwalls should be founded at a minimum depth of 3.0 feet below the culvert invert elevations. If longer walls are required, L-type cantilever wingwalls may be used. We recommend the wingwall footings be deigned for a maximum factored bearing resistance of 3,000 psf calculated with a resistance factor of 0.45 (AASHTO 2017).

4.3 Settlement

The foundation soils generally consist of medium dense to dense, saturated sandy gravel. The existing grade will be maintained and no new fill material will be added. The settlement is anticipated to be less than 1.0 inch which is acceptable for the construction of the culvert.

4.4 Global Stability

No additional fill will be placed behind the wingwalls and/or around the culvert. We estimate the wingwalls will have a factor of safety meeting the IDOT minimum requirement of 1.5 (IDOT 2015).

4.5 Cast-In-Place Versus Precast Culvert Considerations

The results of the settlement and global stability analysis indicate that with the recommended bedding, both cast-in-place and precast culvert options are feasible at the site. In addition, for precast end sections, we recommend considering either a concrete apron or riprap armoring to protect against scour and erosion that could undermine the precast end section.

4.6 Culvert Top Slab Cores

Cores CC-01 to CC-04 were obtained from the top slabs of the north and south culvert barrels. The culvert slab cores show 3.5 to 6.0 inches of asphalt pavement directly on top of the culvert slab which is 7.0 to 8.0 inches thick. The culvert slab cores from CC-01, CC-02, and CC-04 were deemed not suitable for compressive strength testing since they did not contain sound concrete meeting the minimum length requirement. The slab cores from CC-03 has a compressive strength of 7,320 psi. The laboratory testing results are presented in Appendix B.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Site Preparation

The existing culvert should be removed and any vegetation, surface topsoil, pavement, and debris should be cleared and stripped where the new culvert and wingwalls will be placed. If unstable or unsuitable materials are exposed during excavation, they should be removed and replaced with compacted structural fill as described in Section 5.3.

The Contractor should create sufficient runoff drainage during site preparation to prevent excess pooling of precipitation and facilitate runoff to avoid construction delays. Proper surface grading of the exposed subgrade is of significant importance to remove any water accumulations and minimize the pooling of water and prevent soil softening.

5.2 Excavation, Dewatering, and Utilities

Excavations should be performed in accordance with local, state, and federal regulations. The potential effect of ground movements upon nearby utilities should be considered during construction. Excavated material should not be stockpiled immediately adjacent to the top of slopes, nor should equipment be allowed to operate too closely to open excavations. Temporary slopes along the roadway should be graded at a slope of no steeper than 1:2 (V: H).

The groundwater elevation along the culvert alignment was encountered as high as 749 feet within the saturated sand to sandy gravel, which is above the proposed invert elevations (748.7 and 748.8 feet) of the culvert. The proposed barrel and wingwalls will be established at an average elevation of 748.7 feet and the undercuts recommended will extend to elevations of 747.8 which are below the encountered groundwater elevation. Therefore, temporary dewatering of the excavations will be required. Any water that accumulates in open excavations by seepage or runoff should be immediately removed. Depending upon prevailing climatic conditions and the time of the year when the culvert construction takes place, control runoff and maintenance of existing flows may require temporary water diversion and control.

Based on the drawings provided by AES, staged construction will be utilized for the construction of the proposed culvert. The excavation depth from the top of the roadway to the invert elevation will be about 7.5 to 9.0 feet. Therefore, temporary support will be required to retain this excavation and support the roadway. Based on the soil conditions, we estimate that cantilever steel sheet piling designed in accordance with the IDOT *Design Guide 3.13.1* is not feasible for the necessary retained height and the IDOT pay item *Tempoaray Soil Retention System* will be required. We also understand that during construction, if determined to be necessary, the north culvert may be removed. The removal of the north cuvlert will require excavations of up to 6.0 feet which will require support with a *Temporary Soil Retention System*. The design parameters recommended for the design of the soil retention systems near the south and north culverts are summarized in Table 3.

Table 3: Soil Parameters for Lateral Earth Pressure Analysis
Borings: CB-01 to CB-05

Soil Description Approximate Elevations	Effective Unit Weight, γ' (pcf)	Undrained Shear Strength Properties		Earth Pressure Coefficients (Straight Backfill)	
		Cohesion, c' (psf)	Friction Angle, ϕ' (°)	Active Pressure, k_a	Passive Pressure, k_p
Soft to M Stiff ORGANIC SI CLAY to SI CL LOAM Existing Grade to EL 748 feet*	110	400	0	1.00	1.00
Loose to M Dense SAND to SA GRAVEL EL 748 to 745 feet	53	0	30	0.33	3.00
M Dense to Dense SA GRAVEL EL 745 to 730 feet	53	0	33	0.29	3.39
Dense to V Dense LOAM to GR LOAM EL 730 to 720 feet	58	0	36	0.26	3.85

* Groundwater Elevation

5.3 Filling and Backfilling

The materials used to backfill around, and to a level at least 1 foot over the top of the culvert box, should be porous granular material conforming to the requirements specified in the IDOT Recurring Special Provision, *Granular Backfill for Structures*. Backfill material should be placed and compacted in accordance with the Special Provision.

Fill used as embankment material and for replacement of any unstable and/or unsuitable soils encountered during construction should be pre-approved by the Engineer.

5.4 Earthwork Operations

The required earthwork can be accomplished with conventional construction equipment. Moisture and traffic will cause deterioration of exposed subgrade soils. Precautions should be taken by the

Contractor to prevent water erosion of the exposed subgrade. A compacted subgrade will minimize water runoff erosion.

Earth moving operations should be scheduled to not coincide with excessive cold or wet weather (early spring, late fall or winter). Any soil allowed to freeze or soften due to the standing water should be removed. Wet weather can cause problems with subgrade compaction.

It is recommended that an experienced geotechnical engineer be retained to inspect the exposed subgrade, monitor earthwork operations, and provide material inspection services during the construction phase of this project.

6.0 QUALIFICATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the borings drilled at the locations shown on the boring logs and in Exhibit 3. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until the course of construction. In the event that any changes in the design and/or location of the structure are planned, we should be timely informed so that our recommendations can be adjusted accordingly.

It has been a pleasure to assist AES Services, Inc.. and the Illinois Department of Transportation on this project. Please call if there are any questions, or if we can be of further service.

Respectfully Submitted,

WANG ENGINEERING, INC.

Mohammed (Mike) Kothawala, P.E., D.GE
Project Manager

Azza Hamad, E.I.T.
Project Engineer

Corina Farez, P.E., P.G.
QC/QA Reviewer

MOHAMMED A KOTHAWALA
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PROFESSIONAL
ENGINEER
OF
ILLINOIS

License expires:
11-30-19

REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (2017) "AASHTO LRFD Bridge Design Specifications." United States Depart of Transportation, Washington, D.C.

IDOT (2012) *Bridge Manual.* Illinois Department of Transportation.

IDOT (2015) *Geotechnical Manual.* Illinois Department of Transportation.

IDOT (2016) *Standard Specifications for Road and Bridge Construction.* Illinois Department of Transportation. 1098 pp.

IDOT (2017) *Culvert Manual.* Illinois Department of Transportation.

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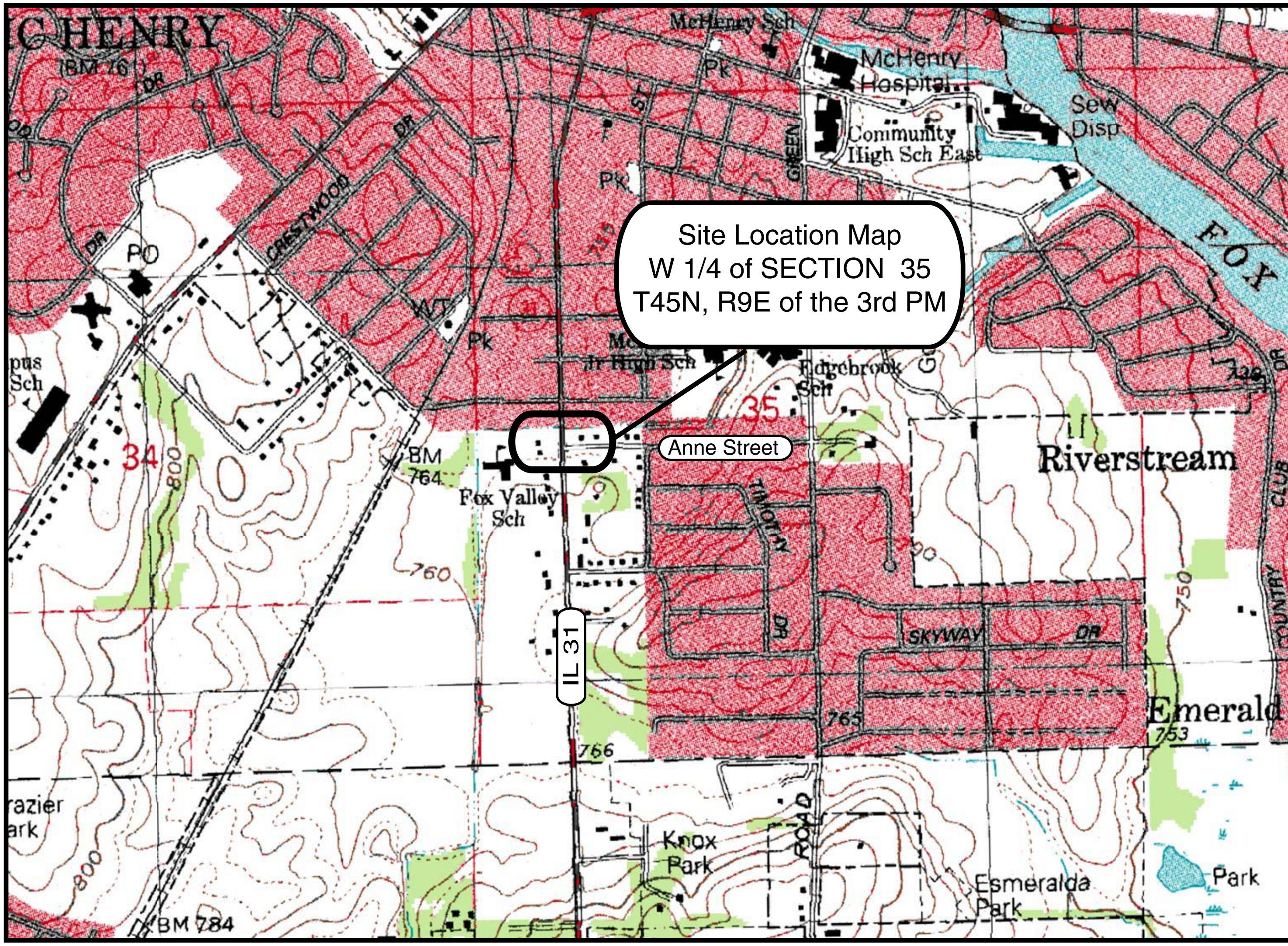
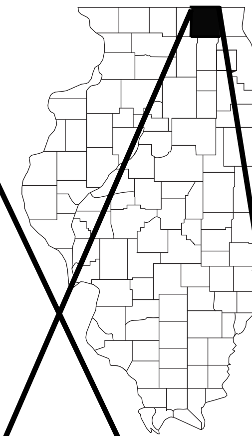
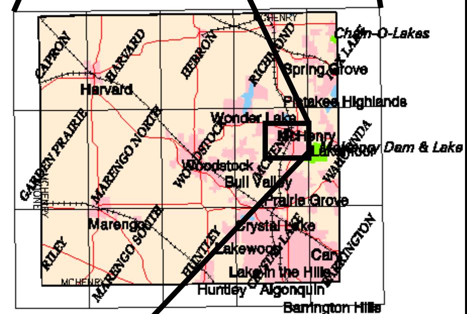
EXHIBITS







McHenry County

Scale

0 0.5 1.0 Mile

SITE LOCATION MAP: ILLINOIS ROUTE 31 OVER UNNAMED TRIBUTARY TO FOX RIVER, MCHENRY COUNTY, ILLINOIS		
SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: A. Hamad CHECKED BY: M. Kothawala
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AES SERVICES, INC.		199-02-04

Benchmark: "□" in SE corner of concrete base of traffic signal in NW corner of IL 31 and Lillian St.

Existing Structure: S. No. 056-0227 is a two-cell reinforced concrete box culvert. The culvert cells are 10'x4' and 4'x1.5', respectively, from the south and are separated by 6' with shared wingwall between them. It is unknown when the original box culvert sections were constructed. In 1985 the culvert was lengthened 10 feet on each end and the culvert headwalls were combined with a retaining wall between each single cell box culvert creating a two-cell culvert. A larger 11.5'x4' opening was used to extend the south culvert cell and a 4' x 1.5' opening was used on the north cell extension on the west side. The culvert extensions on the east side were the same size as the original culvert. The box culvert has an end to end length of 66 feet.

The exisitng south cell will be removed and replaced with a 12.5'x5' cell.

Construction will be performed in stages while maintaining two lanes of traffic, one in each direction and a sidewalk.

No Salvage.

Precast option is not allowed.

HIGHWAY CLASSIFICATION

F.A.P. 336A - IL Rte. 31
Functional Class: Other Prinicpal Arterial
ADT: 18,800 (2017); 29,000 (2040)
ADTT: 725 (2017); 1,740 (2040)
DHV: 1,790 (2017); 3,099 (2040)
Design Speed: 35 m.p.h.
Posted Speed: 35 m.p.h.
Two-Way Traffic
Directional Distribution:

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

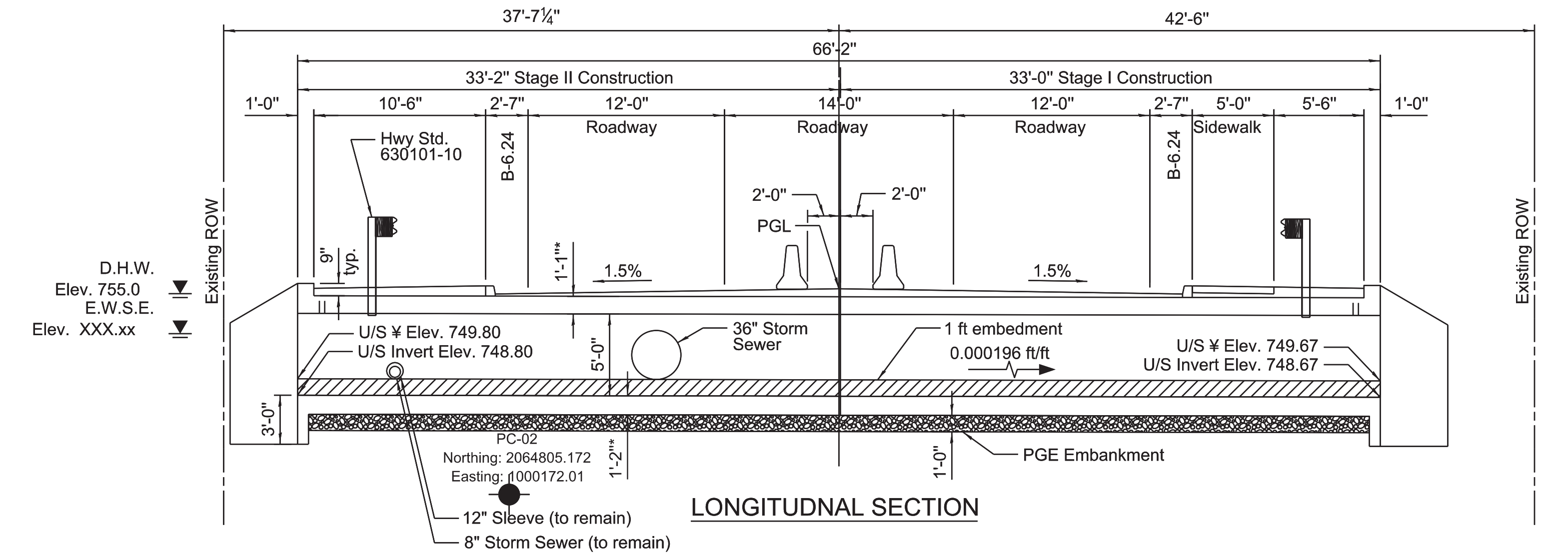
2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 Interims

DESIGN STRESSES

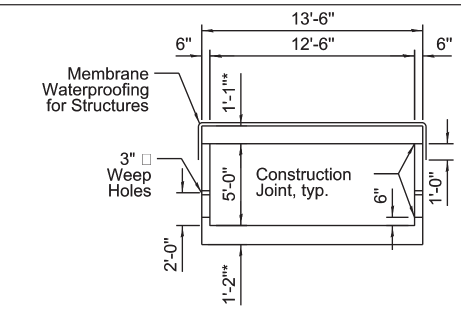
FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

PROFILE GRADE



LONGITUDNAL SECTION



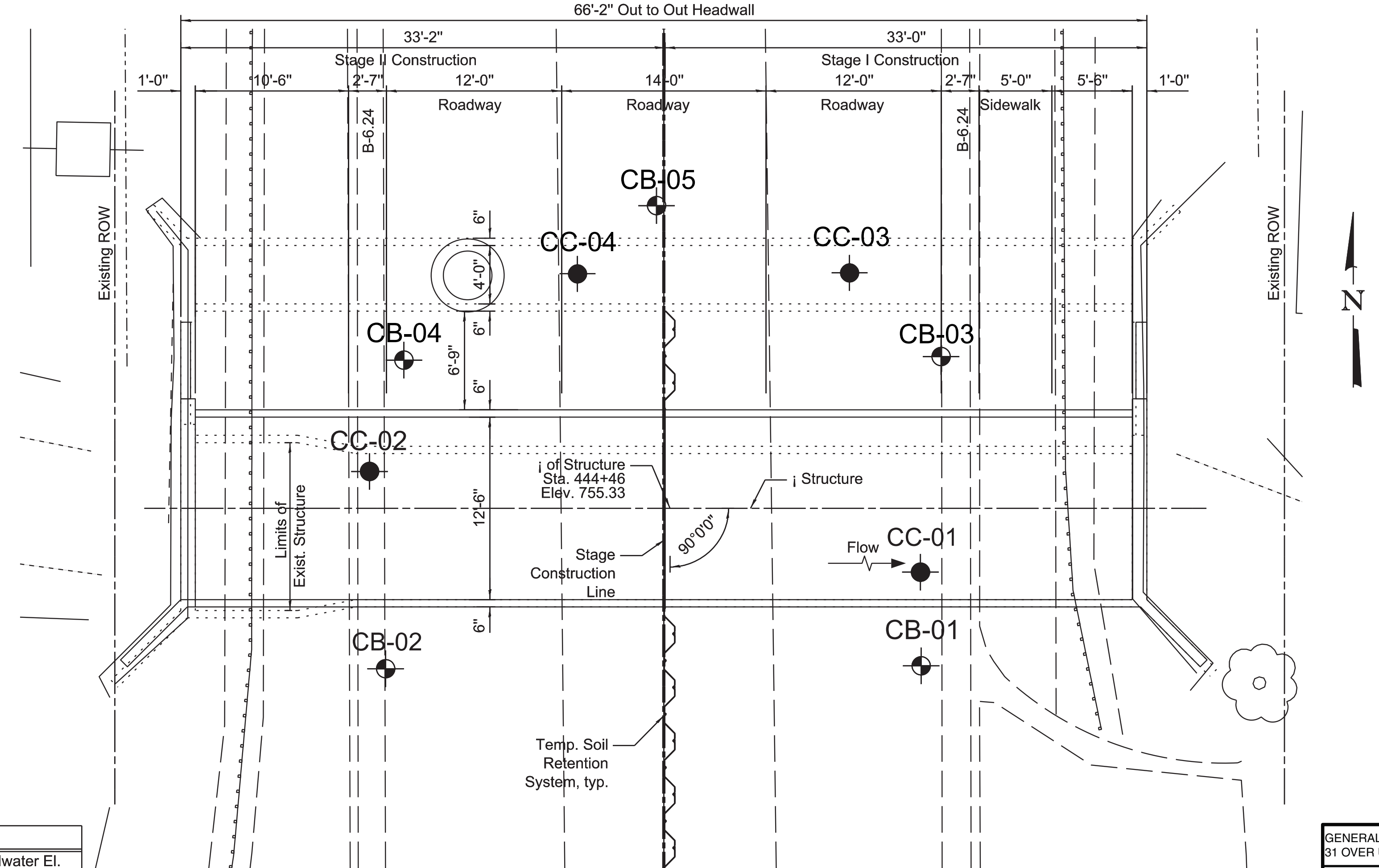
SECTION THROUGH BARREL

* Slab thickness is subject to refinement during final design.

STATION 444+46
BUILT 2019 BY
STATE OF ILLINOIS
FAP ROUTE 336A
SECTION 2018-056-DR-1
LOADING HL-93
STRUCTURE NO. 056-0105

NAME PLATE

See Std. 515001

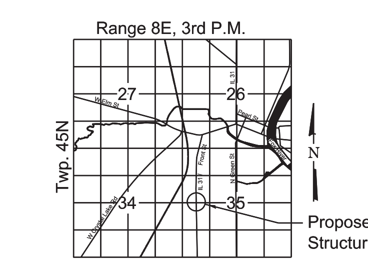


PLAN

Boring Location

Core Location

PC-01
Northing: 2064907.914
Easting: 1000134.085



LOCATION SKETCH

WATERWAY INFORMATION

Drainage Area = 2.82 sq. mi. Low Grade Elev. - @ Sta. -

Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	432	46.0	55.6	754.4	0.4	0.4	754.8	754.8
Design	50	840	46.0	55.6	755.0	0.1	0.1	755.1	755.1
Base	100	1151	46.0	55.6	755.3	0.1	0.1	755.4	755.4
Ex. Overtop	2	235	46.0	55.6	753.9	0.6	0.5	754.5	754.4
Pr. Overtop	2	235	46.0	55.6	753.9	0.6	0.5	754.5	754.4
Max. Calc.	500	2300	46.0	55.6	756.7	0.0	0.0	756.7	756.7

GENERAL PLAN AND ELEVATION/BORING AND CORING LOCATION PLAN: ILLINOIS ROUTE 31 OVER UNNAMED TRIBUTARY TO FOX RIVER, MCHENRY COUNTY, ILLINOIS

SCALE: GRAPHICAL | EXHIBIT 2 | DRAWN BY: A. Hamad | CHECKED BY: M. Kothawala

Wang Engineering
1145 N. Main Street
Lombard, IL 60148
www.wangeng.com

FOR AES SERVICES, INC. | 199-02-04

AES ENGINEERS & SURVEYORS
111 S. Wacker Drive, Suite 3910
Chicago, IL 60606
Ph: 312-235-6783

USER NAME =	DESIGNED - AWM	REVISED -
	CHECKED - MS	REVISED -
PLOT SCALE =	DRAWN - AWM	REVISED -
PLOT DATE =	CHECKED - MS	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

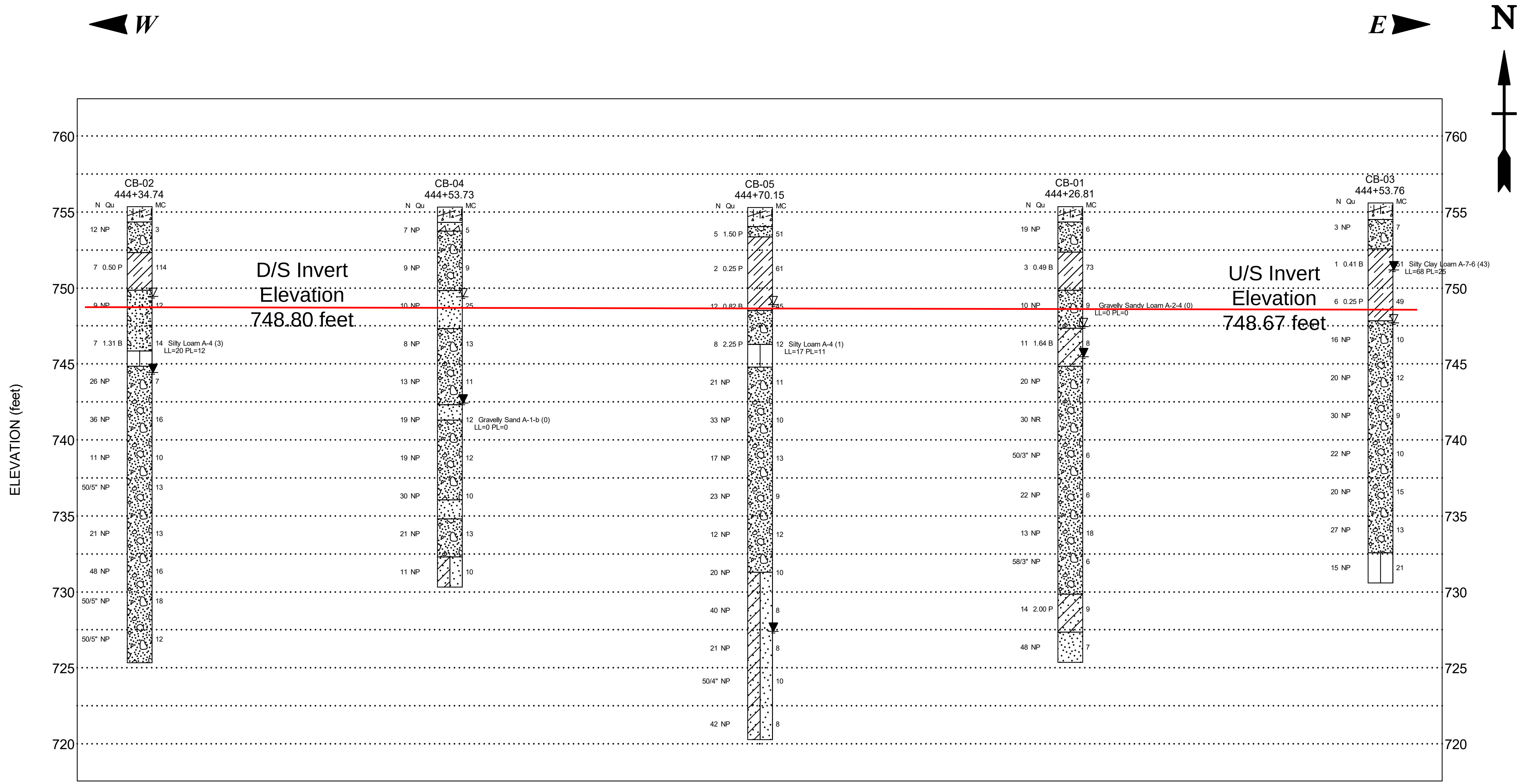
GENERAL PLAN AND ELEVATION
STRUCTURE NO.: 056-0105

SHEET OF S-- SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
336A	2018-056-DR-1	MCHENRY	XX	

CONTRACT NO. 62G48

ILLINOIS | FED. AID PROJECT



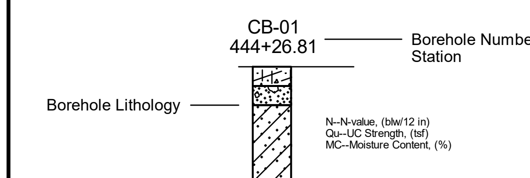
DISTANCE ALONG PROFILE (feet)

Lithology Graphics

- Pavement
- Gravelly sand, sandy gravel
- USCS High Plasticity Organic silt or clay
- IDH Sandy Clay, Sandy Clay Loam
- IDH Sand, Sandy Loam
- Coarse sand
- IDH Silt, Silty Loam
- Crushed stone
- IDH Loam

Site Map Scale 1 inch equals 15 feet

Explanation:



Water Level Reading at time of drilling.

Water Level Reading 24-hr after drilling or at end of drilling

Horizontal Scale (feet)

Vertical Exaggeration: 0.5x

Wang Engineering, Inc.
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Lombard, IL 60148

IL 31 Culverts
Soil Profile

Illinois Route 31 Over Innamed Tributary to Fox River
McHenry County, Illinois

JOB NUMBER	PLATE NUMBER
199-02-04	EXHIBIT 3

WEI SINCE 1982

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APPENDIX A

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BORING LOG CB-01

WEI Job No.: 199-02-03

Client: **AES Services, Inc.**
Project: **Illinois Route 31 Over Innamed Tributary to Fox River**
Location: **McHenry County, Illinois**

Datum: NAVD 88
Elevation: 755.35 ft
North: 2064837.60 ft
East: 1000168.47 ft
Station: 444+26.81
Offset: 15.95 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
754.4	5-inch thick, ASPHALT over 7-inch thick CONCRETE --PAVEMENT--					
752.4	Medium dense, light gray, moist SANDY GRAVEL --BASE COURSE--		1	9, 10, 9	NP	6
749.9	Soft, black organic SILTY CLAY --RDR 2--	5	2	1, 1, 2	0.49 B	73
747.4	Medium dense, gray, moist to wet GRAVELLY SANDY LOAM --RDR 2-- --L_L(%)=NP, P_L(%)=NP-- --%Gravel=26.5-- --%Sand=53.2-- --%Silt=17.3-- --%Clay=3.0-- --A-2-4 (0)--		3	4, 6, 4	NP	9
744.9	Stiff, dark brown SANDY CLAY, trace gravel --RDR 2--	10	4	3, 5, 6	1.64 B	8
	Medium dense to very dense, brown to gray, moist to saturated SANDY GRAVEL, same coarse SAND --RDR 2--		5	11, 11, 9	NP	7
		15	6	8, 14, 16	NR	
	--RDR 3--		7	28, 33, 50/3"	NP	6
		20	8	30, 11, 11	NP	6
	--RDR 2--		9	19, 7, 6	NP	18
729.9	--RDR 3--	25	10	58/3"	NP	6
727.4	Very stiff, gray SANDY CLAY, trace gravel --RDR 3--		11	15, 9, 5	2.00 P	9
725.4	Dense, gray, medium to coarse, saturated SAND --RDR 3--	30	12	12, 30, 18	NP	7
	Boring terminated at 30.00 ft					

GENERAL NOTES

Begin Drilling: **08-01-2018** Complete Drilling: **08-01-2018**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D50 ATV [88%]**
Driller: **N & J** Logger: **R. KC** Checked by: **C. Marin**
Drilling Method: **2.25" HSA; boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **8.00 ft**
At Completion of Drilling: **10.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG CB-02

WEI Job No.: 199-02-04

Client: **AES Services, Inc.**
Project: **Illinois Route 31 Over Innamed Tributary to Fox River**
Location: **McHenry County, Illinois**

Datum: NAVD 88
Elevation: 755.34 ft
North: 2064844.87 ft
East: 1000133.32 ft
Station: 444+34.74
Offset: 19.06 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	4-inch thick, ASPHALT over 8-inch thick, CONCRETE --PAVEMENT--					
754.3	Medium dense, reddish brown, moist GRAVELLY SAND --BASE COURSE--		1	8 7 5	NP	3
752.3	Medium stiff, black organic SILTY LOAM --RDR 2-- --Organic Content=22.9%--	5	2	2 2 5	0.50 P	114
749.8	Loose, brown to dark brown, wet, coarse SAND --RDR 2--		3	4 4 5	NP	12
		10	4	2 4 3	1.31 B	14
745.8	Stiff, brown to gray, wet SILTY LOAM, trace gravel --L_L(%)=20, P_L(%)=12-- --%Gravel=6.7-- --%Sand=21.4-- --%Silt=56.1-- --%Clay=15.9--		5	11 13 13	NP	7
744.8	Medium dense to very dense, gray, saturated, GRAVELLY medium to coarse SAND --RDR 2-- --Hard drilling at 13'-- --RDR 3--	15	6	12 21 15	NP	16
			7	5 3 8	NP	10
		20	8	50/5"	NP	13
	--RDR 2--	25	9	9 10 11	NP	13
			10	33 41 7	NP	16
	--RDR 3--		11	50/5"	NP	18
			12	50/5"	NP	12
725.3	Boring terminated at 30.00 ft	30				

GENERAL NOTES

Begin Drilling: **08-01-2018** Complete Drilling: **08-01-2018**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D50 ATV [88%]**
Driller: **N & J** Logger: **R. KC** Checked by: **C. Marin**
Drilling Method: **2.25" HSA; boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **6.00 ft**
At Completion of Drilling: **11.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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BORING LOG CB-03

WEI Job No.: 199-02-04

Client: **AES Services, Inc.**
Project: **Illinois Route 31 Over Innamed Tributary to Fox River**
Location: **McHenry County, Illinois**

Datum: NGVD
Elevation: 755.58 ft
North: 2064864.62 ft
East: 1000171.32 ft
Station: 444+53.76
Offset: 19.32 RT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
754.5	5-inch thick, ASPHALT over 8-inch thick, CONCRETE --PAVEMENT--					
752.6	Loose, gray and brown, dry to wet SANDY GRAVEL --BASE COURSE-- --RDR 3--		1	5, 2, 1	NP	7
747.8	Soft to medium stiff, black to gray, wet SILTY CLAY LOAM, some organic matter --RDR 2-- --L_L(%)=68, P_L(%)=25-- --%Gravel=0.0-- --%Sand=10.0-- --%Silt=61.2-- --%Clay=28.8--	5	2	0, 0, 1	0.41 B	51
			3	4, 3, 3	0.25 P	49
	Medium dense to dense, gray, wet to saturated SANDY GRAVEL, trace cobbles --RDR 2--	10	4	5, 8, 8	NP	10
			5	14, 10, 10	NP	12
	--possible cobbles--	15	6	3, 12, 18	NP	9
	--heaving sand, from 15.5 to 23.0 feet--		7	6, 10, 12	NP	10
		20	8	20, 10, 10	NP	15
732.6			9	4, 11, 16	NP	13
730.6	Medium dense, gray, wet SILT; some fine sand seams --RDR 2--	25	10	4, 8, 7	NP	21
	Boring terminated at 25.00 ft	30, 35, 40				

GENERAL NOTES

Begin Drilling **09-07-2018** Complete Drilling **09-07-2018**
Drilling Contractor **Wang Testing Services, Inc.** Drill Rig **CME55 TMR [85%]**
Driller **K & J** Logger **M. Ciapas** Checked by **C. Marin**
Drilling Method **2.2" HSA; boring backfilled upon completion**

WATER LEVEL DATA

While Drilling **8.00 ft**
At Completion of Drilling **4.50 ft**
Time After Drilling **NA**
Depth to Water **NA**

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BORING LOG CB-04

WEI Job No.: 199-02-04

Client: **AES Services, Inc.**
Project: **Illinois Route 31 Over Innamed Tributary to Fox River**
Location: **McHenry County, Illinois**

Datum: NGVD
Elevation: 755.31 ft
North: 2064863.91 ft
East: 1000135.51 ft
Station: 444+53.73
Offset: 16.49 LT

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	4-inch thick, ASPHALT over 8-inch thick CONCRETE --PAVEMENT--					
754.3	7-inch thick, gray, dry SANDY GRAVEL --BASE COURSE--		1	3 3 4	NP	5
753.7	Loose, brown, damp to wet SANDY GRAVEL, trace cobbles --FILL-- --RDR 2 to 3--	5	2	3 3 6	NP	9
749.8	Medium dense, moist to wet, fine SAND --RDR 2--		3	2 2 8	NP	25
747.3	Loose to medium dense, gray, wet to saturated GRAVELLY SAND --RDR 2--	10	4	5 5 3	NP	13
			5	2 4 9	NP	11
742.3	Gray, saturated, fine SAND					
741.3	Medium dense to dense, gray, saturated GRAVELLY SAND --RDR 2-- --%Gravel=31.2-- --%Sand=65.3-- --%Silt=2.9-- --%Clay=0.6-- --heaving sands, 15 to 23 feet--	15	6	4 6 13	NP	12
			7	1 9 10	NP	12
736.1	Gray, saturated, very fine SAND	20	8	12 12 18	NP	10
734.8	Dense, gray, saturated GRAVELLY SAND		9	7 11 10	NP	13
732.3	Medium dense, pinkish gray, moist to wet LOAM, trace gravel --RDR 2--	25	10	4 5 6	NP	10
730.3	Boring terminated at 25.00 ft					

GENERAL NOTES

Begin Drilling: **09-07-2018** Complete Drilling: **09-07-2018**
Drilling Contractor: **Wang Testing Services, Inc.** Drill Rig: **CME55 TMR [85%]**
Driller: **K & J** Logger: **M. Ciapas** Checked by: **C. Marin**
Drilling Method: **2.2" HSA; boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **6.00 ft**
At Completion of Drilling: **13.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

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BORING LOG CB-05

WEI Job No.: 199-02-04

Client: **AES Services, Inc.**
Project: **Illinois Route 31 Over Innamed Tributary to Fox River**
Location: **McHenry County, Illinois**

Datum: NGVD
Elevation: 755.28 ft
North: 2064880.61 ft
East: 1000150.40 ft
Station: 444+70.15
Offset: 1.29 LT

Elevation (ft)	Soil and Rock Description	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	5-inch thick, ASPHALT over 10-inch thick, CONCRETE --PAVEMENT--					
754.0	Gray, dry SANDY GRAVEL --BASE COURSE-- --RDR 3--		1	2, 2, 3	1.50 P	51
753.4	Soft to stiff, black SILTY CLAY LOAM, trace to little organic matter --RDR 2-- --Organic Content=13.5%--	5	2	2, 1, 1	0.25 P	61
			3	4, 5, 7	0.82 B	45
748.5	Medium dense, gray, saturated SANDY GRAVEL --RDR 2--					
746.3	Very stiff, gray SILTY LOAM, trace gravel --RDR 2-- --L_L(%)=17, P_L(%)=11-- --%Gravel=3.6-- --%Sand=22.6-- --%Silt=60.9-- --%Clay=13.0--	10	4	8, 5, 3	2.25 P	12
744.8	Medium dense, gray, saturated SANDY GRAVEL --RDR 2-- --heaving sands, 13 to 23 feet--		5	3, 10, 11	NP	11
		15	6	6, 11, 22	NP	10
			7	4, 8, 9	NP	13
		20	8	6, 11, 12	NP	9
			9	3, 5, 7	NP	12
731.3	Medium dense to dense, gray to pinkish gray, moist to wet LOAM to GRAVELLY LOAM --RDR 2--	25	10	11, 10, 10	NP	10
			11	11, 20, 20	NP	8
		30	12	5, 10, 11	NP	8
	--possible cobbles--		13	25, 50/4"	NP	10
720.3		35	14	10, 23, 19	NP	8
	Boring terminated at 35.00 ft	40				

GENERAL NOTES

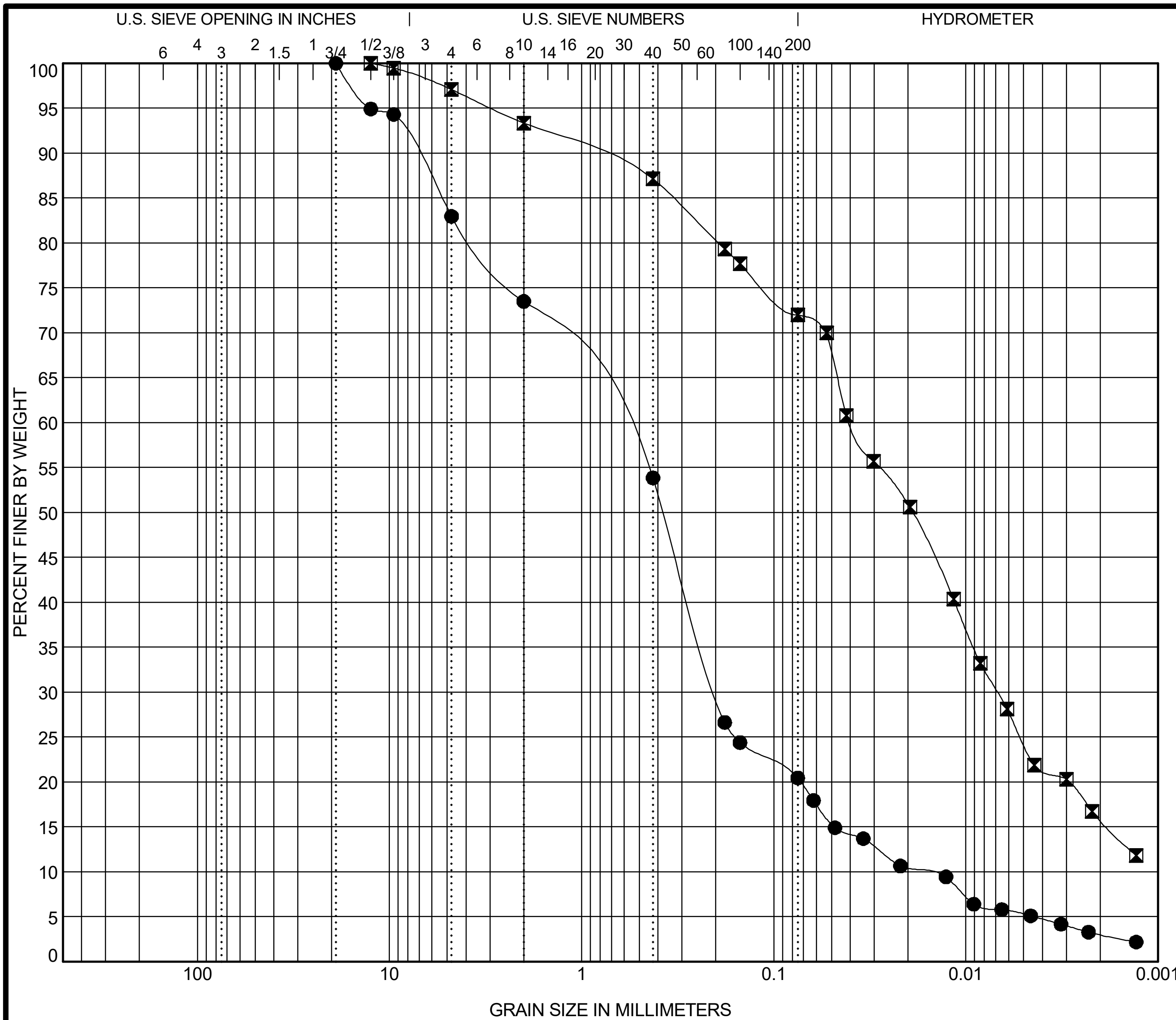
Begin Drilling **09-07-2018** Complete Drilling **09-07-2018**
Drilling Contractor **Wang Testing Services, Inc.** Drill Rig **CME55 TMR [85%]**
Driller **K & J** Logger **M. Ciapas** Checked by **C. Marin**
Drilling Method **2.2" HSA; boring backfilled upon completion**

WATER LEVEL DATA

While Drilling ▽ **6.50 ft**
At Completion of Drilling ▼ **28.00 ft**
Time After Drilling **NA**
Depth to Water ▼ **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

	Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
●	**CB-01#3**	**6.0 ft**	**Gravelly Sandy Loam**	**NP**	**NP**	**NP**	**3.55**	**42.23**
⧗	**CB-02#4**	**8.5 ft**	**Silty Loam**	**20**	**12**	**8**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**CB-01#3**	**6.0 ft**	**19**	**0.69**	**0.2**	**0.016**	**26.5**	**53.2**	**17.3**	**3.0**
⧗	**CB-02#4**	**8.5 ft**	**12.5**	**0.04**	**0.007**		**6.7**	**21.4**	**56.1**	**15.9**

WEI GRAIN SIZE IDH 1990203.GPJ US LAB.GDT 8/10/18

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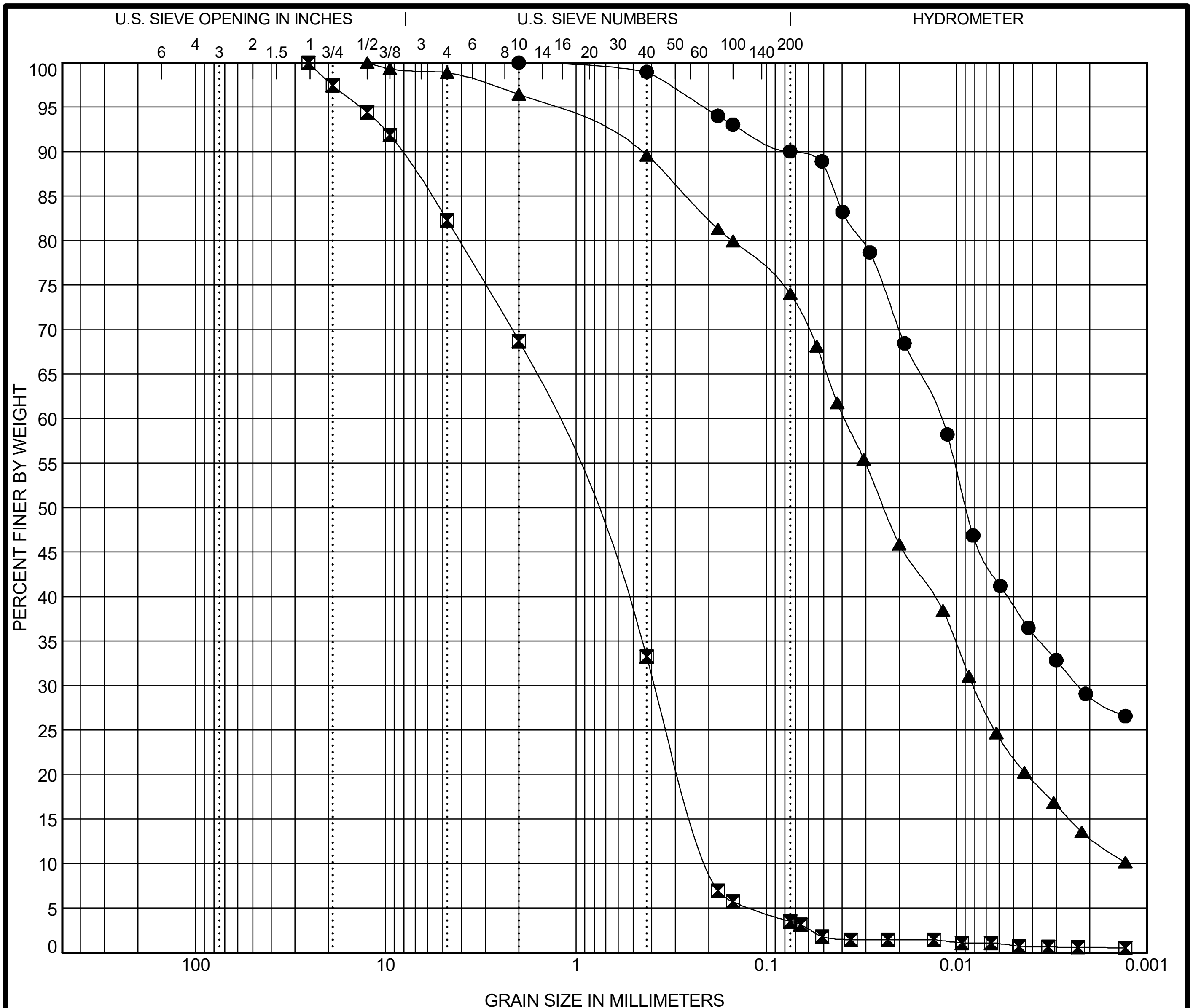
GRAIN SIZE DISTRIBUTION

Project: Illinois Route 31 over Unnamed Tributary to Fox River

Location: McHenry County, Illinois

Number: 199-02-03



COBBLES	GRAVEL	SAND coarse	SAND fine	SILT AND CLAY

	Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
●	CB-03#2	3.5 ft	**Silty Clay Loam**	68	25	43		
⧗	CB-04#6	13.5 ft	**Gravelly Sand**	NP	NP	NP	0.54	6.87
▲	CB-05#4	8.5 ft	**Silty Loam**	17	11	6		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CB-03#2	3.5 ft	2	0.012	0.002		0.0	10.0	61.2	28.8
⧗	CB-04#6	13.5 ft	25.4	1.365	0.382	0.199	31.2	65.3	2.9	0.6
▲	CB-05#4	8.5 ft	12.5	0.039	0.008		3.6	22.6	60.9	13.0

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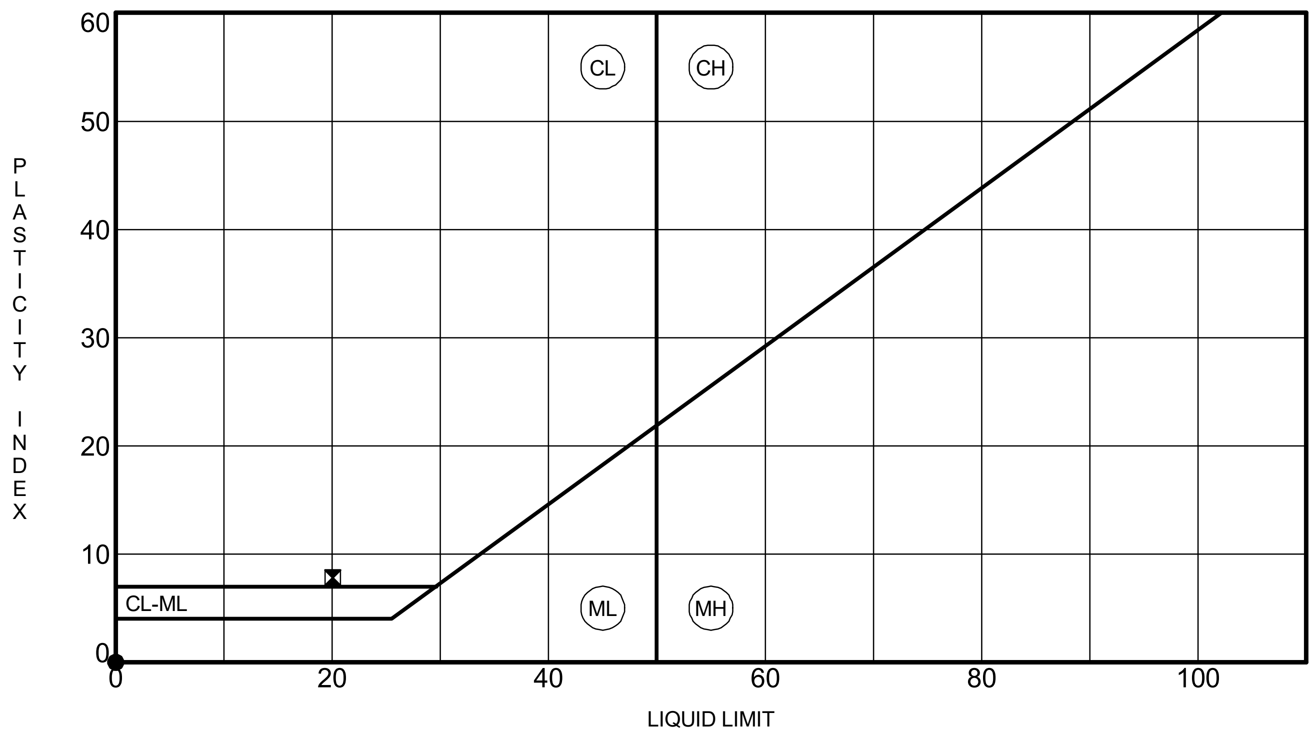
GRAIN SIZE DISTRIBUTION

Project: Illinois Route 31 Over Innamed Tributary to Fox River

Location: McHenry County, Illinois

Number: 199-02-04

WEI GRAIN SIZE IDH 1990204.GPJ US LAB.GDT 9/20/18



	Specimen Identification		LL	PL	PI	Fines	IDH Classification
●	**CB-01#3**	**6.0 ft**	**NP**	**NP**	**NP**	**20**	**Gravelly Sandy Loam**
⧗	**CB-02#4**	**8.5 ft**	**20**	**12**	**8**	**72**	**Silty Loam**

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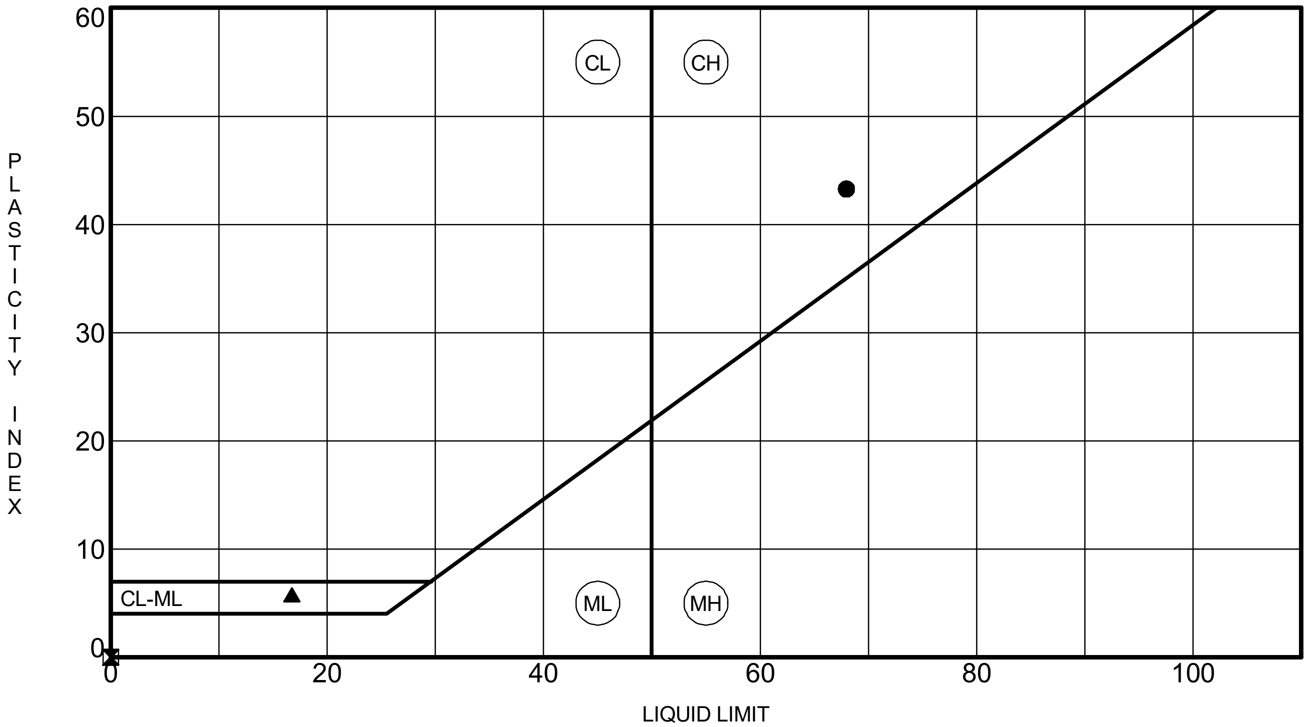
ATTERBERG LIMITS' RESULTS

Project: Illinois Route 31 over Unnamed Tributary to Fox River

Location: McHenry County, Illinois

Number: 199-02-03

WEI ATTERBERG LIMITS IDH 1990203.GPJ US LAB.GDT 8/10/18



	Specimen Identification		LL	PL	PI	Fines	IDH Classification
●	**CB-03#2**	**3.5 ft**	**68**	**25**	**43**	**90**	**Silty Clay Loam**
⧗	**CB-04#6**	**13.5 ft**	**NP**	**NP**	**NP**	**4**	**Gravelly Sand**
▲	**CB-05#4**	**8.5 ft**	**17**	**11**	**6**	**74**	**Silty Loam**

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ATTERBERG LIMITS' RESULTS

Project: Illinois Route 31 Over Innamed Tributary to Fox River

Location: McHenry County, Illinois

Number: 199-02-04

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ORGANIC CONTENT in SOILS by LOSS on IGNITION

ASTM D 2974, Method C

Client:	**AES Services**	**Analyst Name:**	**A. Mohammed**
Project:	**IL 31 Culvert**	**Date Received:**	**8/1/2018**
WEI Job:	**199-02-03**	**Date Tested:**	**8/6/2018**
Type/Condition:	**SS**	**Soil Sample ID:**	**CB-02, No. 2 (3.5-5.0 ft.)**
Testing Furnace Temp °C.:	440	**Sample Description:**	**Black Silty Loam**

Moisture Content	**Wet soil + tare (g)**	**Dry Soil + tare (g)**	**Tare mass (g)**	**w (%)**
oven-dry method	81.9	61.19	42.22	109

Ash Content	**Dry Soil + tare (g)**	**Ash + tare (g)**	**Tare mass (g)**	**Ash Content (%)**
Loss On Ignition	61.19	57.65	42.22	23

Organic Content (%)= 22.9

Prepeared By:____

Reviwed By:____

AASHTO R18

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ORGANIC CONTENT in SOILS by LOSS on IGNITION

ASTM D 2974, Method C

Client:	**AES Services, Inc.**	**Analyst Name:**	**A. Mohammed**
Project:	**IL 31 Culverts Replacement**	**Date Received:**	**9/7/2018**
WEI Job:	**199-02-04**	**Date Tested:**	**9/13/2018**
Type/Condition:	**SS**	**Soil Sample ID:**	**CB-05, No.2 (3.5-5.0 ft.)**
Testing Furnace Temp °C.:	440	**Sample Description:**	**Black Silty Clay**

Moisture Content	**Wet soil + tare (g)**	**Dry Soil + tare (g)**	**Tare mass (g)**	**w (%)**
oven-dry method	82.2	66.46	41.62	63

Ash Content	**Dry Soil + tare (g)**	**Ash + tare (g)**	**Tare mass (g)**	**Ash Content (%)**
Loss On Ignition	66.46	63.1	41.62	86

Organic Content (%)= **13.5**

Prepared by: ______________________ Date: ______________

Checked by: ______________________ Date: ______________

AASHTO R18

Wang Engineering

Compressive Strength of Drilled Concrete Cores

Project: IL 31 Culverts
Client: AES Services, Inc.
WEI Job No.: 199-02-04

Prepared by: Asif Mohammed
Checked by: Mickey Snider
Date: 9/19/2018

Sample ID	Specimen ID	Break Date	Location	Length (in)		Diameter (in)	Total Force (lbs)	L/D	L/D Correction Factor	Compressive Strength (psi)	Fracture Type	Tested By
				Before Capping	After Capping							
CC-03	2507	9/19/2018	North Culvert Cell (East End)	6.34	6.51	3.70	78710	1.76	1.00	7320	3	AM

* Fracture Types:
Type 1 - Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps;
Type 2 - Well-formed cone on one end, vertical cracks running through caps, no well defined cone on other end;
Type 3 - Columnar vertical cracking through both ends, no well-formed cones;
Type 4 - Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1;
Type 5 - Side fractures at top or bottom (occur commonly with unbonded caps);
Type 6 - Similar to Type 5 but end of cylinder is pointed.

Test Methods used
ASTM C42/C42M-18
ASTM C39/C39M-18

Prepared by: [signature] 9.19.18

Checked by: [signature] 9/19/18

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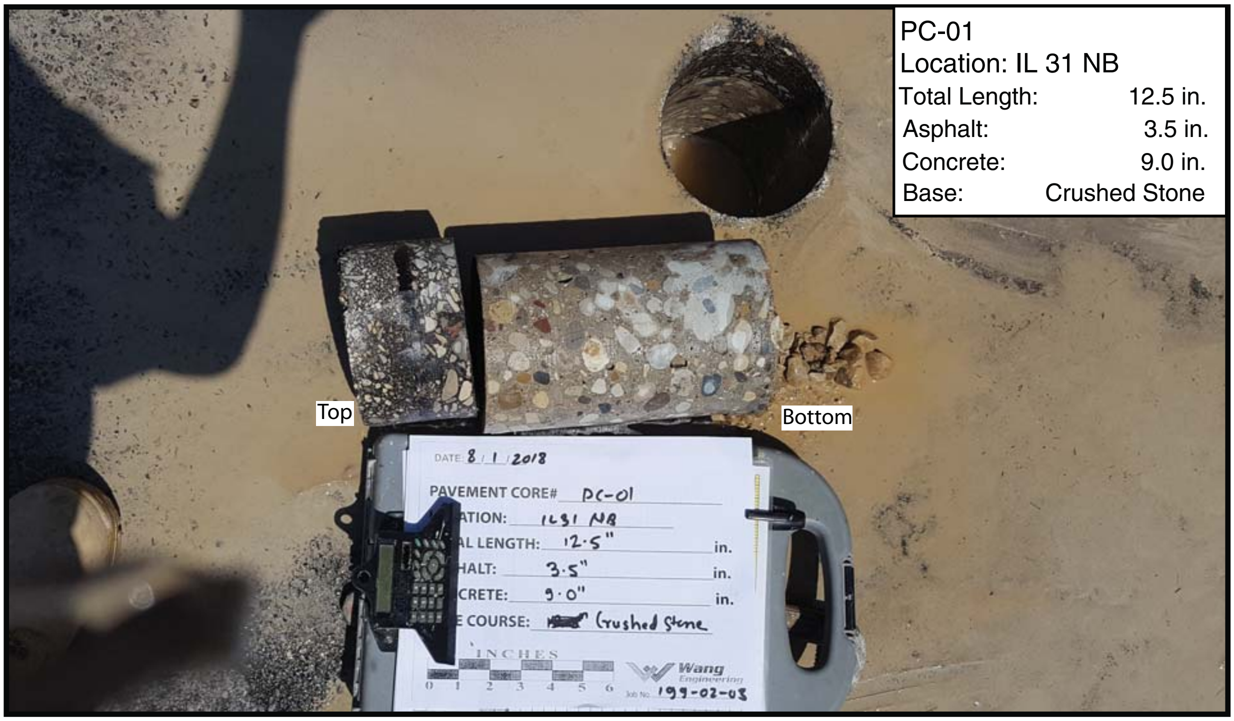
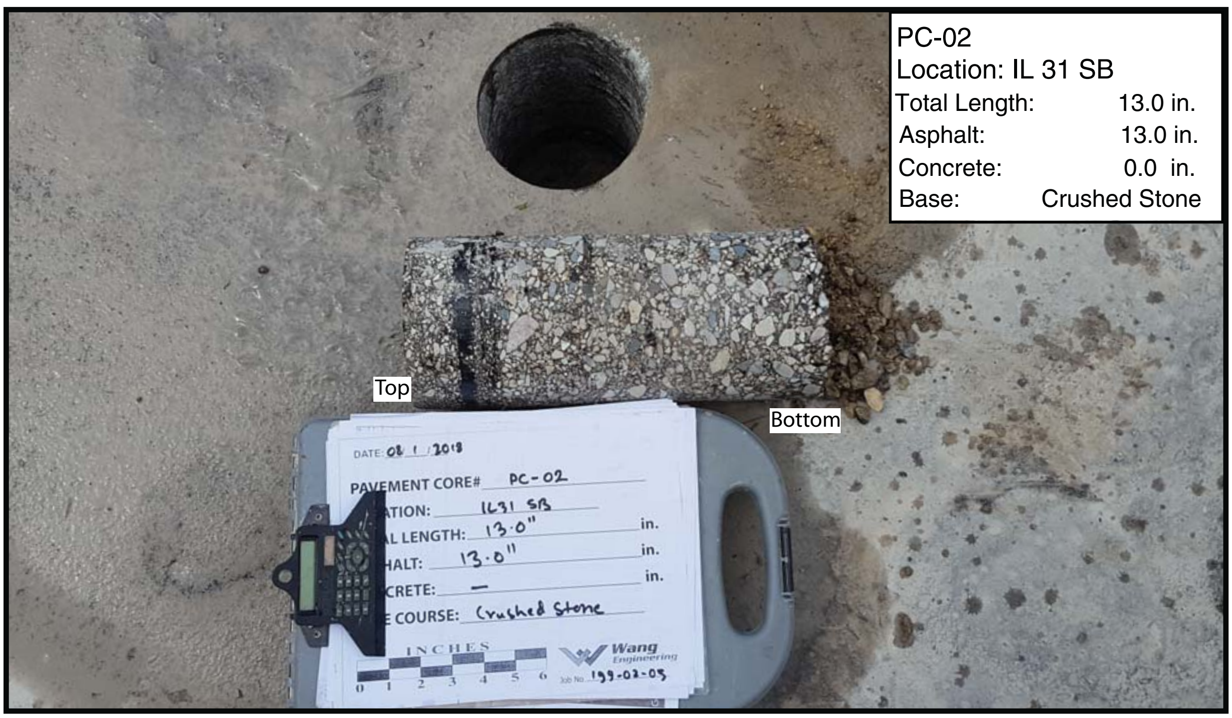
APPENDIX C





PAVEMENT CORES: ILLINOIS ROUTE 31 OVER UNNAMED TRIBUTARY TO FOX RIVER, MCHENRY COUNTY, ILLINOIS		
SCALE: GRAPHICAL	APPENDIX C	DRAWN BY: R. KC CHECKED BY: A. Hamad
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AES SERVICES, INC.		199-02-04

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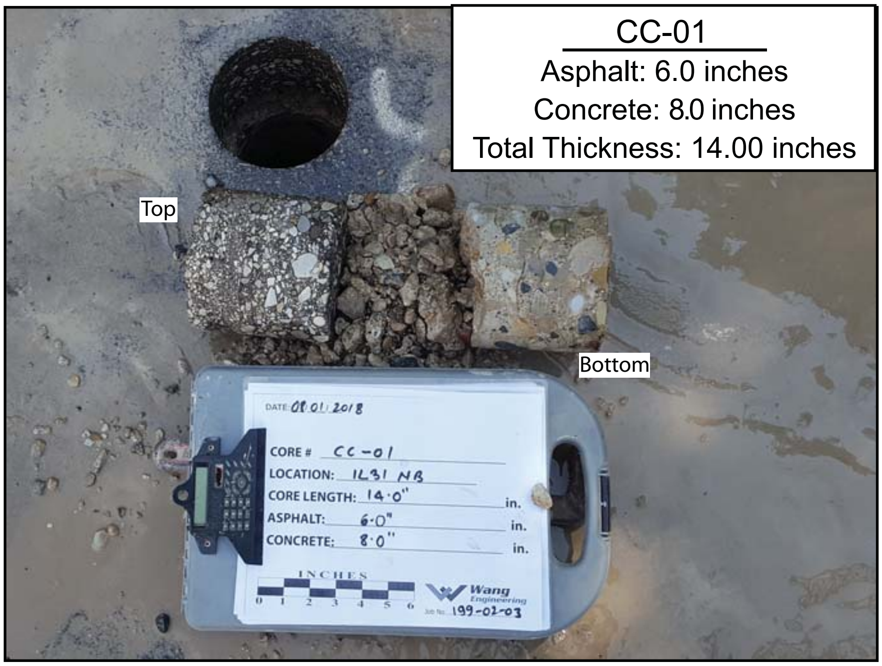
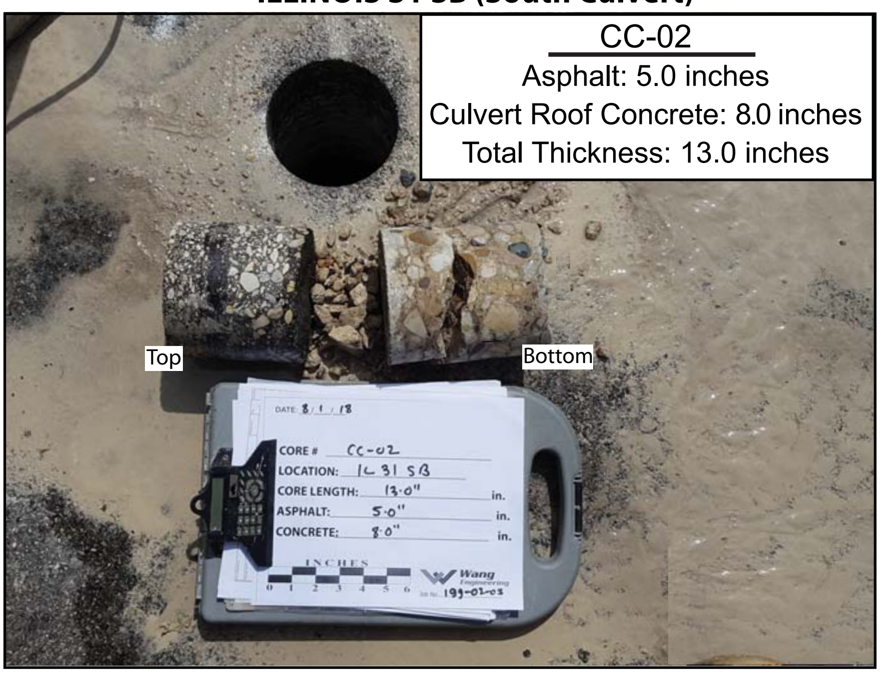
APPENDIX D

Existing Structure Number 056-0227
ILLINOIS 31 NB (South Culvert)

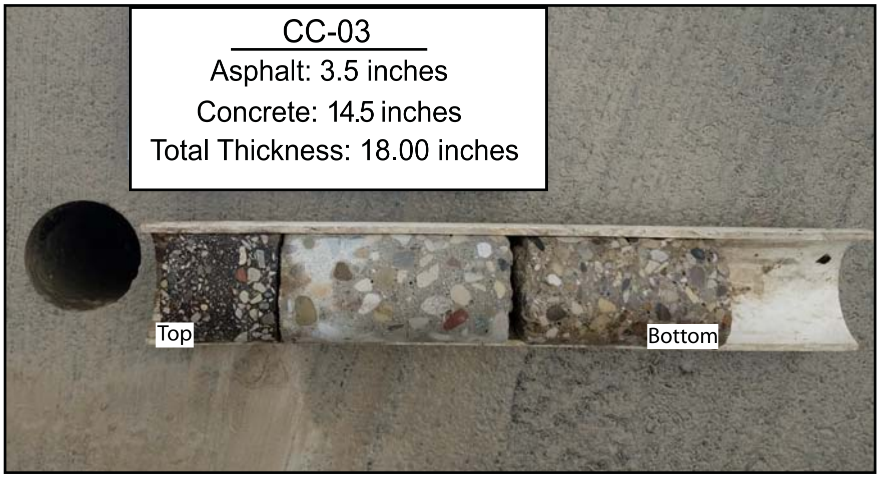


Existing Structure Number 056-0227
ILLINOIS 31 SB (South Culvert)

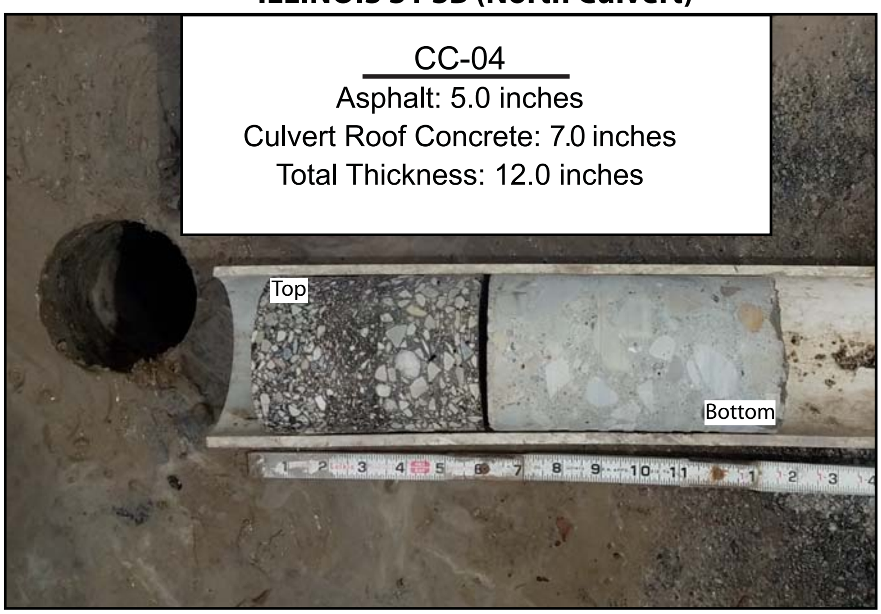


CULVERT SLAB CORES: ILLINOIS ROUTE 31 OVER UNNAMED TRIBUTARY TO FOX RIVER, MCHENRY COUNTY, ILLINOIS		
SCALE: GRAPHICAL	APPENDIX D-1	DRAWN BY: RKC CHECKED BY: A. Hamad
Wang Engineering		1145 N. Main Street Lombard, IL 60148 www.wangeng.com
FOR AES SERVICES, INC.		199-02-04

Existing Structure Number 056-0227
ILLINOIS 31 NB (North Culvert)



Existing Structure Number 056-0227
ILLINOIS 31 SB (North Culvert)



CULVERT SLAB CORES: ILLINOIS ROUTE 31 OVER UNNAMED TRIBUTARY TO FOX RIVER, MCHENRY COUNTY, ILLINOIS

SCALE: GRAPHICAL	APPENDIX D-2	DRAWN BY: A. Hamad CHECKED BY: M. Kothawala

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APPENDIX E

Benchmark: "□" in SE corner of concrete base of traffic signal in NW corner of IL 31 and Lillian St.

Existing Structure: S. No. 056-0227 is a two-cell reinforced concrete box culvert. The culvert cells are 10'x4' and 4'x1.5', respectively, from the south and are separated by 6' with shared wingwall between them. It is unknown when the original box culvert sections were constructed. In 1985 the culvert was lengthened 10 feet on each end and the culvert headwalls were combined with a retaining wall between each single cell box culvert creating a two-cell culvert. A larger 11.5'x4' opening was used to extend the south culvert cell and a 4' x 1.5' opening was used on the north cell extension on the west side. The culvert extensions on the east side were the same size as the original culvert. The box culvert has an end to end length of 66 feet.

The exisitng south cell will be removed and replaced with a 12.5'x5' cell.

Construction will be performed in stages while maintaining two lanes of traffic, one in each direction and a sidewalk.

No Salvage.

Precast option is not allowed.

HIGHWAY CLASSIFICATION

F.A.P. 336A - IL Rte. 31
Functional Class: Other Prinicpal Arterial
ADT: 18,800 (2017); 29,000 (2040)
ADTT: 725 (2017); 1,740 (2040)
DHV: 1,790 (2017); 3,099 (2040)
Design Speed: 35 m.p.h.
Posted Speed: 35 m.p.h.
Two-Way Traffic
Directional Distribution:

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

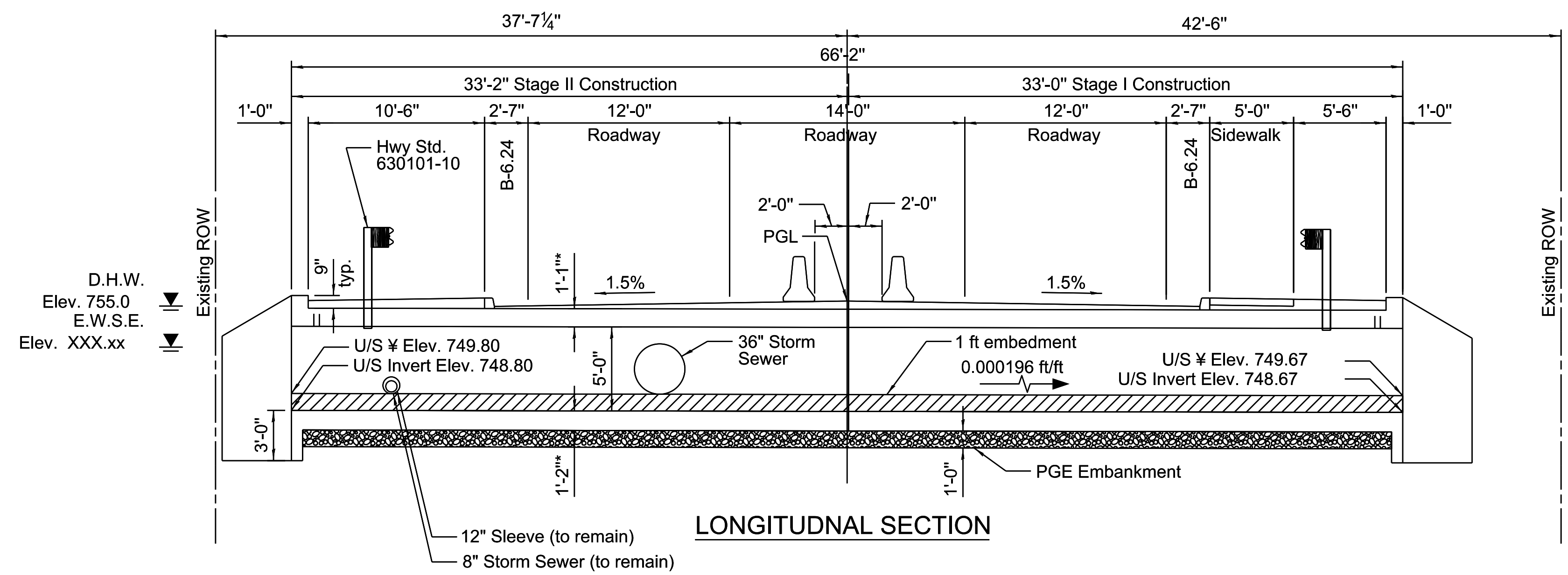
2014 AASHTO LRFD Bridge Design Specifications, 7th Edition with 2015 Interims

DESIGN STRESSES

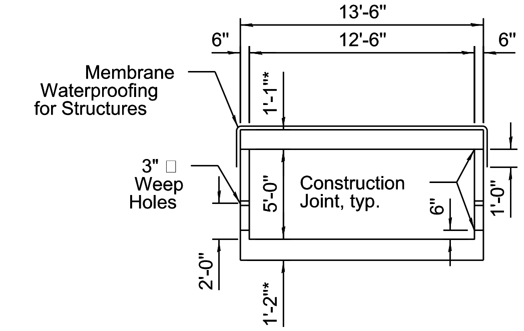
FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

PROFILE GRADE



LONGITUDNAL SECTION



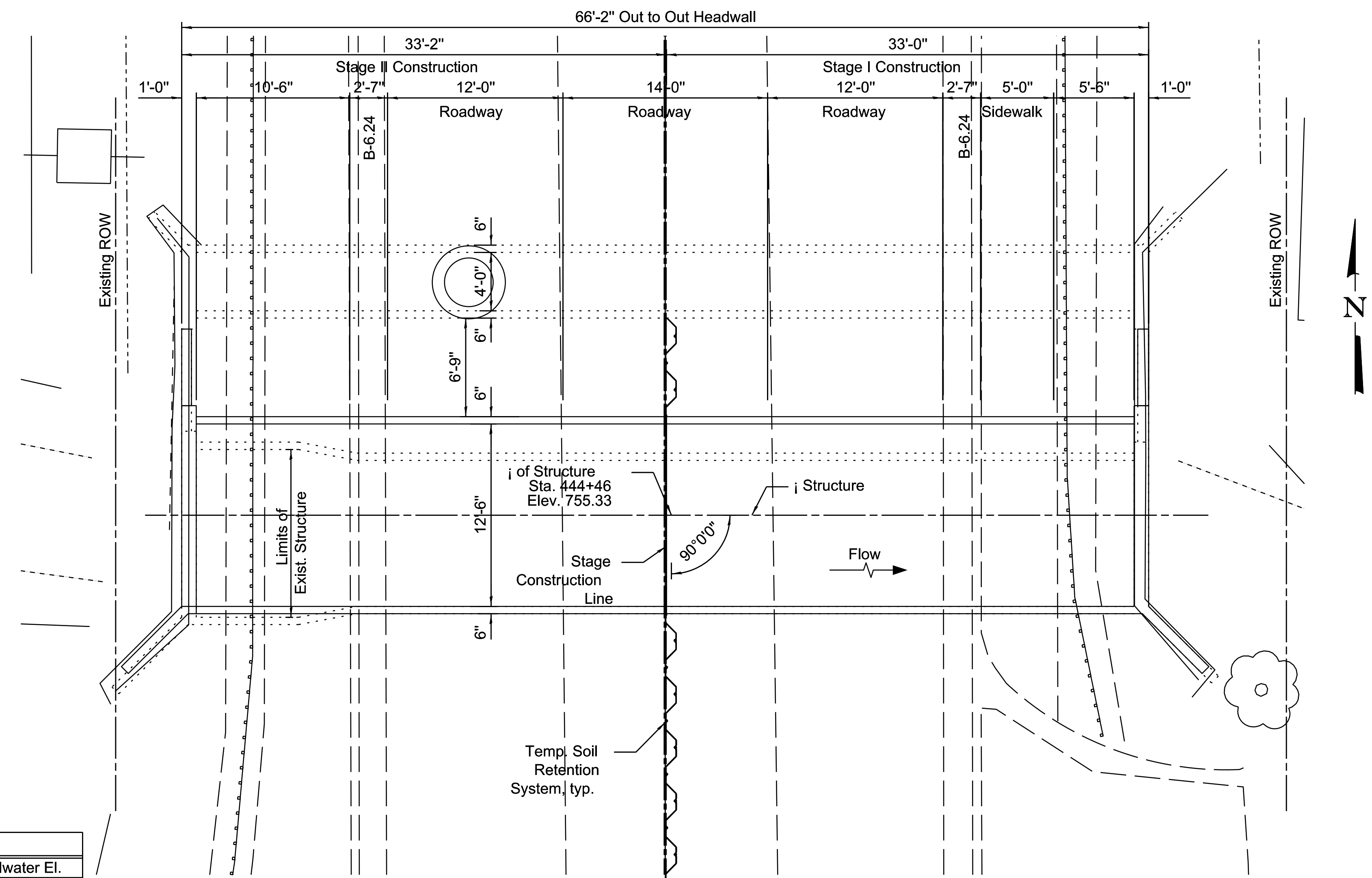
SECTION THROUGH BARREL

* Slab thickness is subject to refinement during final design.

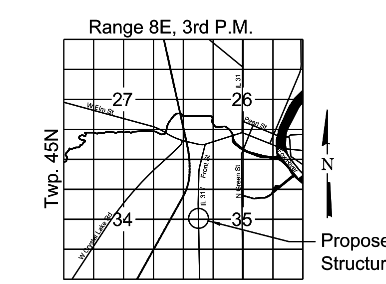
STATION 444+46
BUILT 2019 BY
STATE OF ILLINOIS
FAP ROUTE 336A
SECTION 2018-056-DR-1
LOADING HL-93
STRUCTURE NO. 056-0105

NAME PLATE

See Std. 515001



PLAN



LOCATION SKETCH

GENERAL PLAN AND ELEVATION
IL ROUTE 31 OVER UNNAMED TRIBUTARY TO FOX RIVER
F.A.P. ROUTE 336A
SECTION 2018-056-DR-1
MCHENRY COUNTY
STATION 444+46
STRUCTURE NO. 056-0105

WATERWAY INFORMATION

Drainage Area = 2.82 sq. mi.   Low Grade Elev. - @ Sta. -

Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	432	46.0	55.6	754.4	0.4	0.4	754.8	754.8
Design	50	840	46.0	55.6	755.0	0.1	0.1	755.1	755.1
Base	100	1151	46.0	55.6	755.3	0.1	0.1	755.4	755.4
Ex. Overtop	2	235	46.0	55.6	753.9	0.6	0.5	754.5	754.4
Pr. Overtop	2	235	46.0	55.6	753.9	0.6	0.5	754.5	754.4
Max. Calc.	500	2300	46.0	55.6	756.7	0.0	0.0	756.7	756.7

AES ENGINEERS & SURVEYORS 111 S. Wacker Drive, Suite 3910 Chicago, IL 60606 Ph: 312-235-6783	USER NAME = ____	DESIGNED - AWM	REVISED - ____
	PLOT SCALE = ____	CHECKED - MS	REVISED - ____
		DRAWN - AWM	REVISED - ____
	PLOT DATE = ____	CHECKED - MS	REVISED - ____

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

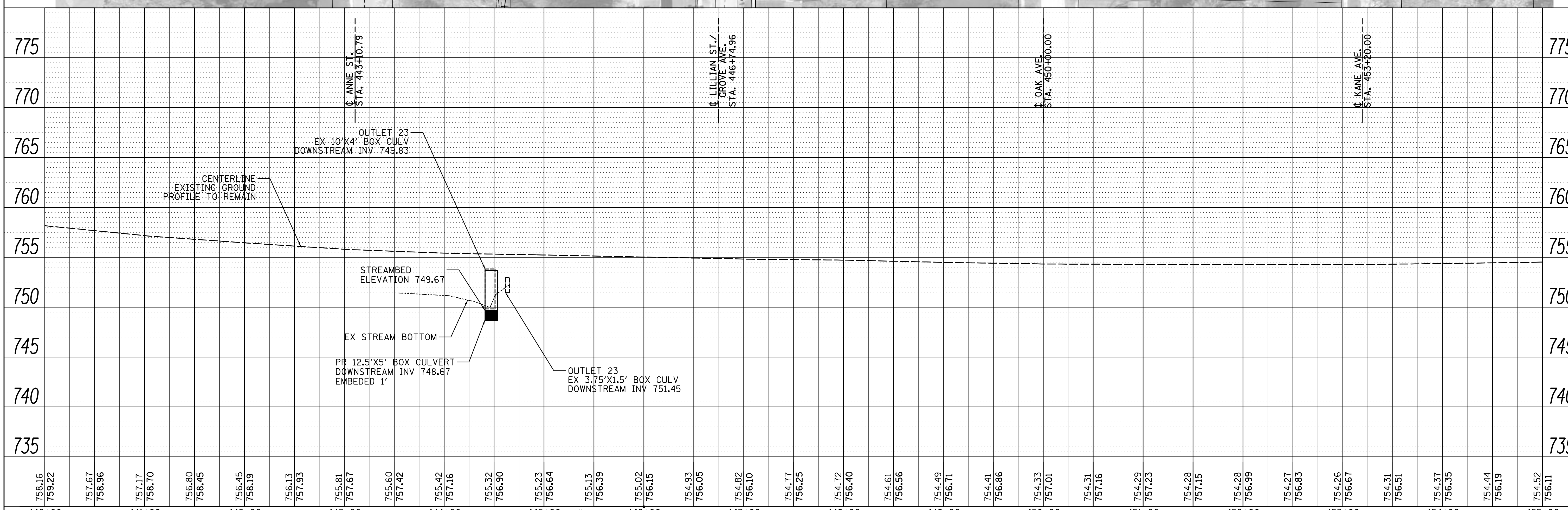
GENERAL PLAN AND ELEVATION
STRUCTURE NO.: 056-0105

SHEET OF S-- SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
336A	2018-056-DR-1	MCHENRY	XX	__

CONTRACT NO. 62G48

ILLINOIS FED. AID PROJECT



PLAN | NOTE BOOK NO. | SURVEYED | PLOTTED | ALIGNMENT CHECKED | R.O.W. CHECKED | CADD FILE NAME | BY | DATE

PROFILE | NOTE BOOK NO. | SURVEYED | PLOTTED | GRADES CHECKED | B.M. NOTED | STRUCTURE NOTATNS CHKD | BY | DATE

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	PLOT SCALE = 100.000 ' / in.	DRAWN -	REVISED -
	PLOT DATE = 5/4/2016	CHECKED -	REVISED -
		DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

ILLINOIS ROUTE 31
ROADWAY PLAN AND PROFILE – 23

SCALE: 1"=50' | SHEET OF SHEETS | STA. TO STA.

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
336		McHENRY	32	23

CONTRACT NO.

ILLINOIS FED. AID PROJECT