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Consulting Engineers & Scientists

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FROM: Tom Allen, P.E.
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DATE: May 31, 2018

SUBJECT: CDOT Project Code 19378 – US 550 S Connection to US 160
Excavation Materials and Volumes

The Colorado Department of Transportation (CDOT) has proposed a realignment of a segment of US 550 at its southern intersection with US 160, south of Durango. Yeh and Associates (Yeh) performed a geotechnical investigation to identify surface and subsurface conditions along the proposed alignment. The purpose of the investigation was to obtain information to be included in a Geotechnical Data Report (GDR) for use as a reference document in the Design-Build process to construct the proposed realignment. The GDR will be issued at a later date.

This memo presents a summary of the subsurface conditions encountered in seventy-four (74) borings drilled within the proposed alignment and at proposed structure locations. The borings were drilled between November 2017 and May 2018 within existing CDOT Right-of-Way and on private properties in the proposed project area. This memo provides estimates of earthwork volumes and geotechnical considerations for use of excavated materials based on evaluations of engineering properties of the soils and bedrock encountered in the borings.

Proposed Construction

Based on preliminary plans provided by CDOT (Post-FIR dated 12-05-16), we understand the project consists of approximately 10,000 feet of highway reconstruction and realignment beginning at approximate US 550 Mile Post 14.953 at the south and proceeding north to join with an existing bridge spanning US 160. The current two-lane configuration of US 550 will be upgraded to include four lanes with intermittent auxiliary lanes and sections of frontage road. Proposed grading consists of relatively shallow cuts and fills of less than about 15 feet at the south end where the new alignment ties to the existing highway embankment and deep cuts of as much as about 120 feet near the north end where the alignment will meet the existing bridge. The realignment of US 550 will incorporate two new bridges, Bridge 1 and Bridge 2, which cross Gulch A and Gulch B, respectively. Other proposed structures include cut and fill retaining walls and wildlife/cattle crossings.

Geologic Setting

The project area is located in La Plata County at the northwestern corner of Florida Mesa, approximately 4 miles south of downtown Durango. The project site is underlain by the Upper member of the Animas Formation. This bedrock unit consists primarily of sandstone, shale, and conglomerate, and contains abundant volcanic and arkosic detritus. The strata dip to the southeast, due to uplift of the San Juan and La Plata Mountains to the north and northwest.

Overlying the bedrock is a terrace alluvium deposit. The geologic reports describe these deposits as “poorly sorted, clast-supported, locally bouldery, pebble, and cobble gravel in a sandy matrix…Clasts are mainly subround to round and are composed of varied lithologies that reflect the diverse rock types in drainage basins.” (Colorado Geologic Survey, Durango East Quadrangle, 1999). Results of our subsurface investigation indicate that the upper surface of this deposit is generally planar, while the contact with the underlying bedrock is uneven, with significant undulations likely, even across short distances.

The upper surface of Florida Mesa is largely covered with a layer of fine clayey soil, identified as Falfa clay loam by the Natural Resources Conservation Service (NRCS). Areas of this soil type have historically been tapped for agricultural use and tend to be irrigated. Borings indicate that the thickness of this soil layer varies with the surface topography, increasing in depth with increases in elevation. The contact with the underlying terrace alluvium tends to be a relatively smooth, planar surface.

The soils on the side slopes of the mesa consist of fine soil mixed with varying amounts of sand, gravel, cobble, and occasionally boulders transported by erosion from upper regions of the mesa onto the slopes (slope wash). Within the project area, these surfaces tend to be vegetated with native pinyon-juniper growth.

Subsurface Investigation

Subsurface exploration was performed by drilling at intervals along the alignment (Roadway Borings), where deep excavation is proposed (Excavation Borings) and at proposed structure locations (Structure Borings and Wall Borings). The locations of the borings are shown on the Boring Location plan sheets in Appendix A. Subsurface conditions at the locations of the proposed wildlife/cattle crossings and for miscellaneous fill retaining walls (Walls D, E and F) are not discussed in this memo because the data is of minor importance to the discussion of earthwork volumes and material properties.

Hollow stem auger was suitable for drilling through the clayey surface soils. Downhole hammer (ODEX), air-rotary drilling and wire-line coring was needed to penetrate the cobbles, boulders and gravel of the terrace alluvium. Where bedrock was encountered, air-rotary and wire-line coring methods were used to penetrate the interlayered claystone/shale and sandstone of the Animas Formation. Portable drilling rigs placed by helicopter used wire-line coring to drill at bridge foundations locations on steep slopes. Samples were obtained from the auger, ODEX and air-rotary borings at selected intervals. Continuous core samples were obtained in the bedrock

and partial samples of terrace alluvium were obtained from coring operations by the portable rigs.

Test pits were excavated near the north end of the project in the terrace alluvium. The purpose of the pits was to obtain bulk samples that are more representative of the deposit than can be recovered samples from relatively small diameter borings.

The general subsurface conditions encountered in the borings are presented below in Tables 1 through 5. The thickness of the clayey soil and underlying alluvium and depth to bedrock are also depicted on the Cross-Section Plan Sheets in Appendix B. The cut or fill depths shown are the approximate depths at the boring locations and cut/fill depths at centerline may be different.

Roadway Borings

Borings south of the Webb Ranch (R-1 through R-6) were drilled within the travel lanes or shoulders of existing US 550 and some are not within the proposed alignment. The borings within the Webb Ranch property (R-7 through R-13) were located in the proposed alignment. Borings R-10 and R-11 were drilled in the far right of the alignment in anticipation of a possible retaining wall at this location.

Table 1 Summary of Roadway Borings

Boring	Station	Offset	Total Depth (ft)	Approx. Fill (F)/Cut (C) (ft)	Depth to Gravel (ft)	Depth to Bedrock (ft)
R-01	954+11	69' LT	20.5	3 F	n/a	n/a
R-02	964+42	88' LT	20.5	3 C	n/a	n/a
R-03	969+58	85' LT	20.5	8 C	n/a	n/a
R-04	974+57	30' LT	20.0	15 C	n/a	n/a
R-05	979+51	103' RT	20.5	8 C	n/a	n/a
R-06	984+16	55' RT	20.5	8 C	n/a	n/a
R-07	991+05	48' RT	14.5	3 C	13.0	n/a
R-08	995+13	11' LT	21.5	11 C	21.0	n/a
R-09	1002+94	27' LT	23.5	20 C	22.0	n/a
R-10	1008+72	129' RT	35.0	8 C	20.0	n/a
R-11	1009+60	127' RT	35.0	5 C	19.5	n/a
R-12	1009+68	19'LT	29.5	10 C	5.0	n/a
R-13	1034+32	35' RT	112.6	103 C	0	61.5

Structure P-05-AZ (Bridge 1) Borings

The preliminary layout for Bridge 1 shows a structure approximately 518 feet long, with north and south abutments and three piers. Borings were drilled at each abutment and each pier. The south abutment borings are located in a proposed roadway cut and the north abutment is located on the canyon side slope. The gravel encountered at the ground surface in Borings B1-02 through B1-12 consists of erosional deposits, i.e. slope wash.

Table 2 Summary of Bridge 1 Borings

Boring	Station	Offset	Total Depth (ft)	Approx. Cut (ft)	Depth to Gravel (ft)	Depth to Bedrock (ft)
B1-1B	1013+18	36’ LT	79.0	20	16.5	66.5
B1-2A	1013+38	31’ RT	89.2	30	27	79.0
B1-1A	1013+80	17’ RT	122.0	17	18	100.4
B1-01	1013+94	24’ LT	106.0	9	9	89.0
B1-02	1014+08	29’ RT	101.0	7	0	88.0
B1-03	1014+68	24' RT	48.5	n/a	0	35.0
B1-04	1015+09	1' RT	55.0	n/a	0	1.5
B1-05	1015+39	20' LT	45.0	n/a	0	9.0
B1-06	1015+60	24' RT	32.7	n/a	0	10.3
B1-07	1015+72	41' LT	40.0	n/a	0	21.0
B1-08	1016+11	0'	70.0	n/a	0	7.0
B1-09	1016+55	0'	70.0	n/a	0	5.0
B1-10	1017+80	1' LT	70.0	n/a	0	6.7
B1-11	1019+17	21' LT	70.2	n/a	0	15.2
B1-12	1019+20	25' RT	60.0	n/a	0	13.0

Wall Borings

The Post-FIR plans show three walls retaining the proposed deep cut between the two bridges. Walls A and C are located left of centerline and Wall B is located on the right. The walls are intended to retain gravel and claystone/shale bedrock materials and the maximum heights shown on the plans range from 25 to 30 feet. Boring WB-10 did not encounter gravel but was drilled through slightly gravelly sandy clay slope wash to encounter bedrock at 4.5 feet.

Table 3 Summary of Wall Borings

Boring	Station	Offset	Total Depth (ft)	Approx. Cut (ft)	Depth to Gravel (ft)	Depth to Bedrock (ft)
WA-01	1019+74	92' LT	64.0	37	2.0	49.7
WA-02	1020+97	86' LT	67.0	43	1.5	52.0
WA-03	1022+07	84' LT	69.5	41	3.0	52.0
WB-01	1020+41	67' RT	69.8	38	3.5	54.0
WB-02	1021+09	96' RT	71.2	38	6.5	51.5
WB-03	1021+81	71' RT	69.5	45	11.0	54.0
WB-04	1023+08	100'RT	69.5	54	16.0	56.5
WB-05	1024+06	82' RT	70.0	57	21.0	55.0
WB-06	1025+09	108' RT	69.0	63	24.5	56.0
WB-07	1026+08	90' RT	69.2	60	17.5	44.0
WB-08	1026+99	93' RT	67.8	69	25.0	52.0
WB-09	1027+88	65' RT	68.2	70	25.5	49.8
WB-10	1029+10	72' RT	50.0	29	n/a	4.5
WC-01	1026+24	84' LT	61.8	35	1.0	33.0
WC-02	1027+61	84' LT	53.5	45	1.0	30.3
WC-03	1028+50	74' LT	67.6	46	1.5	29.0

Structure P-05-BA (Bridge 2) Borings

The Post-FIR plans show Bridge 2 as a two-span structure with an overall length of approximately 240 feet. The abutments are located on the canyon side slopes and the single pier is located in the bottom of the drainage. Borings B2-01, B2-03 and B2-04 were drilled at the south abutment, pier and north abutment, respectively. Boring B2-02 was drilled on the canyon side slope below the south abutment to investigate subsurface conditions at a suspected landslide. The gravel soils encountered in these borings consists of slope wash deposits.

Table 4 Summary of Bridge 2 Borings

Boring	Station	Offset	Total Depth (ft)	Approx. Cut (ft)	Depth to Gravel (ft)	Depth to Bedrock (ft)
B2-01	1029+55	3' RT	58.8	n/a	n/a	5.0
B2-02	1030+32	0'	70.2	n/a	n/a	7.8
B2-03	1030+88	3' LT	69.0	n/a	n/a	4.0
B2-04	1032+19	2' RT	69.9	n/a	n/a	7.2

Excavation Borings

These borings were drilled to identify subsurface conditions in the area of the deep cut near the north end of the project. The locations were selected to avoid archeologically sensitive zones. Borings E-04 and E-08 were drilled in the existing cut for the CDOT-Knaggs property driveway where bedrock was exposed at the ground surface.

Table 5 Summary of Excavation Borings

Boring	Station	Offset	Total Depth (ft)	Approx. Cut (ft)	Depth to Gravel (ft)	Depth to Bedrock (ft)
E-01	1035+18	195' RT	119.4	100	7.0	70.0
E-02	1036+88	198' RT	147.6	90	7.0	50.0
E-03	1038+62	200' RT	91.0	120	12.0	45.0
E-04	1039+11	172' RT	69.9	60	n/a	0.0
E-05	1036+94	257' RT	69.3	90	15.0	62.0
E-06	1037+92	334' RT	103.0	70	15.0	55.0
E-07	1038+90	403' RT	100.0	60	18.0	38.0
E-08	1039+49	307' RT	69.8	65	n/a	0.0
E-09	1039+09	485' RT	80.0	35	22.0	48.0
E-10	1039+45	580' RT	76.5	8	35.0	46.5

Properties of Materials Encountered

Laboratory testing was performed on selected samples from the borings to classify the materials in accordance with the American Association of State Highway and Transportation Officials (AASHTO) classification system and the Unified Soil Classification System (USCS); and to evaluate engineering properties. A discussion of the classification and properties of the predominant materials encountered is provided below.

Surficial Soils

Bulk samples and relatively undisturbed samples of the Falfa clay loam soils were tested in the Yeh Durango laboratory. The AASHTO Classification for these surficial soils was generally A-6 or A-7-6, with group indices ranging from 3 to 23. Lean clay, CL, was the typical classification according to the USCS. Unconfined compressive strength of samples from three locations was measured: Borings A-1 (7,063 psf), A-3 (8,357 psf), and WB-06 (1,472 psf). The soils may be corrosive to buried metal because of relatively low resistivity values, although pH; water soluble sulfates and chlorides contents indicate they will not be aggressive to buried concrete. Some samples showed a moderate to high potential for expansion when wetted under light loads.

Terrace Alluvium

This deposit is extremely coarse in size, composed of cobbles (3-12 inch diameter) in a sand and gravel matrix, with boulders (>12 inch diameter) common. Drilling operations resulted in fragmentation of the coarser portions, but at some locations cores were taken from this layer, shedding light on both the size and lithology of the larger fraction. Three test pits were dug on the CDOT-Knaggs parcel. These produced unfragmented bulk samples of the material for laboratory analysis. After screening off the over-sized (>3") material, gradations showed an average of 70% gravel, 23% sand, and 2-10% fines. The AASHTO classification is A-1-a (0), and the USCS classification is GP. Point load tests were performed on ten clasts of assorted sedimentary and igneous/metamorphic lithologies. Point load compressive strengths ranged from 7,250 psi to 35,760 psi.

Bedrock

Unconfined compressive strength was measured for selected core samples recovered from borings at Bridge 1; Walls A, B and C; and the Excavation area. Strengths ranged from approximately 1,000 psi to 10,000 psi. Samples of the weak claystone/shale bedrock encountered in the upper layers of the strata were usually weathered and fractured to the extent that suitable core samples for compressive strength testing could not be obtained. Crushed samples of the claystone/shale had low to medium plasticity. Corrosivity tests indicate the bedrock may not be aggressive to buried concrete but low resistivity values indicate a potential to corrode buried metal.

Geotechnical Considerations for Excavation and Grading

The plans show that earthwork for this project will consist mostly of excavation. Where embankments are planned, fill slopes should be constructed at 2 Horizontal to 1 Vertical (2:1) or flatter. All cut and fill slopes should be revegetated to reduce erosion potential. Guidance for grading cut slopes and other geotechnical considerations for the materials encountered within the project limits is provided below.

Surficial Soils

Unretained cut slopes in the lean clay (CL) soils are expected to perform well if graded at 3:1 or flatter. Steeper slopes may tend to erode in rills that could develop into erosion gullies with time. Establishing vegetation to mitigate erosion will be more successful on flatter slopes. These soils are prevalent as subgrade for paved roads in many locations on the Florida Mesa. However, the

A-6 and A-7-6 AASHTO classifications are indicators of poor pavement support characteristics. Where these soils are encountered at subgrade, replacement with 2 to 3 feet of granular material such as Aggregate Base Course (ABC) Class 3 (Pit Run) will help reduce the initial and long term costs of pavements. When placed as compacted fill, the surficial soils are expected to have a shrinkage factor of 0.92. The soils are expected to bulk by a factor of 1.15 when excavated and placed in an uncompacted stockpile. This material may be suitable for use as topsoil if amended with plant nutrients and fertilizers.

Terrace Alluvium

Excavation of the dense cobble/boulder/gravel mixture may require special techniques that increase the cost of removal. Large cobbles and boulders in a dense gravel matrix are difficult to excavate using conventional mass load/haul equipment such as scrapers. Estimates of excavation costs for this material should consider the relatively slow progress and expense of the hydraulic excavator, loader, trucking operation that may be required. Cut slopes in the dense gravel are expected to remain stable if graded at 2:1 or flatter. The potential for rockfall due to weathering of the gravel matrix that supports large boulders on slopes above the road should be mitigated. A relatively thick topsoil cover and established vegetation that includes grasses, trees and shrubs will help reduce rockfall potential. The alluvium is a high quality pavement subgrade material. The deposit can be processed by screening and crushing to produce aggregates for highway construction. Nearby gravel pit operations produce marketable materials from similar terrace deposits. The in-place terrace alluvium is generally dense to very dense and should be expected to bulk by a factor of 1.20 when excavated. Shrinkage below the pre-excavation volume should not be expected when this material is compacted as fill, except that screening to remove unsuitable large cobbles and boulders will result in some loss of excavated volume.

Bedrock

The upper layers of the bedrock are weak and weathered and are expected to be rippable for excavation. Hard shale and sandstone will be encountered in deep areas of excavation near the north end of the project. Although excavation in this area for the existing interchange was accomplished without blasting, it may be required for some of the harder layers of bedrock. The materials derived from excavating the claystone/shale are expected to have poor pavement support characteristics and may be prone to long term settlement if used as embankment fill. The weak bedrock fragments degrade over time to clay soil and the loss of structure results in consolidation. Placement of this material in the bottom of embankment fills may be acceptable if the thickness of the bedrock derived materials is limited to less than about one third of the total fill height and is processed and placed in accordance with CDOT specifications (2017) for non-durable bedrock for embankment fill. When placed and compacted with adequate moisture, the material will have low permeability and may be suitable for constructing impoundments. Unretained cut slopes in the bedrock should be sloped at 3:1 or flatter. The rock face may stand in a near vertical cut for a short time but exposure to the environment will cause slaking and surface raveling within a few days. A bulking factor of 1.30 should be expected for stockpiled bedrock materials. Shrinkage should not be expected when the excavated material is placed as fill and a bulking factor of 1.10 of pre-excavation volume may be a reasonable estimate even with proper compaction.

Earthwork Volumes

Cross sections included with the Post-FIR plans indicate that significant volumes of excavation will be produced where the roadway descends from Florida Mesa to connect at a roundabout and the existing bridge structure spanning US 160. As discussed above, materials to be excavated, from surface downward, will consist of native clay soil; terrace alluvium deposits; and bedrock of the Animas Formation: weathered claystone or shale underlain by interbedded shale and sandstone.

The estimated cross section areas for each material type are shown on the Cross Section Plan Sheets in Appendix B. The depths of the materials are based on projections from exploratory boring locations. These cross-section areas were used to estimate the materials volumes discussed below using Inroads Software. Figures showing the approximate location of subgrade materials transitions along the alignment are provided in Appendix C. The figures are generated from Geographic Information System (GIS) mapping methods. The GIS mapping incorporated data from all of the Yeh exploratory borings and from nearby water wells where data was available. The GIS figures provide an alternate means to estimate the materials transitions using more data than estimates that only consider a few nearby borings.

The proposed alignment can be divided into four zones with distinct earthwork characteristics. South of where the proposed alignment enters the Webb Ranch property are sections of cut and fill. Upon entering Webb Ranch, a continuous cut section of increasing depth extends to the south abutment of Bridge 1. Between Bridges 1 and 2, soil nail walls have been proposed to retain anticipated deep cuts in bedrock. North of Bridge 2 to the roundabout, a large cut is planned which will have slopes laid back to intercept natural ground. The four “Zones” of interest are further described below.

Zone 1 – Approximate Sta. 940+23 to Sta. 991+00 - BOP to Enter Webb Ranch

The roadway profile alternates between shallow cuts and fills through this area. Roadway borings R-01 through R-06 and four borings for a proposed wildlife underpass were advanced in this zone. The net volume of excess material that will be excavated from Zone 1 is estimated to be 157,942 cubic yards. Roadway and structure borings from this area indicate that all roadway cuts will be confined to the layer of surficial soil.

Zone 2 – Approximate Sta. 991+00 to Sta. 1014+50 - Webb Ranch to Bridge 1

This section begins approximately as the roadway enters the Webb Ranch property, where the profile begins a gradually deepening cut below the existing ground surface. Roadway borings R-07 through R-12 were located in this area, as well as three borings for proposed wildlife crossing A. Beginning at Sta. 991+00, excavation occurs in the surficial soil layer until the terrace alluvium is first encountered at approximate Sta. 1000+00. No cut into bedrock is anticipated for Zone 2. At Sta. 1013+00, a maximum depth of cut of approximately 30 feet is anticipated. Estimated volumes of excavation generated from Zone 2 include 300,055 cubic yards of surficial soil and 39,926 cubic yards of terrace alluvium.

Zone 3 – Approximate Sta. 1019+50 to Sta. 1029+50 – Between Bridges 1 and 2

Cut depths in Zone 3 range from 45 feet to as much as 70 feet. Terrace alluvium was encountered near the surface across much of this area. The thickness of this deposit to be excavated ranges from 45 feet at the south to just 25 feet near Bridge 2. At approximate Sta. 1024+00, the excavation is expected to encounter bedrock. As the roadway approaches Bridge 2, the cut depth into bedrock increases to approximately 20 feet. A series of soil-nail retaining walls are proposed for Zone 3, based on early assumptions about the top of bedrock elevations. The extent of walls needed may warrant reconsideration based on current data. Estimated volumes of excavation generated from Zone 3, using the wall configurations shown on the Post-FIR plans, include 73,324 cubic yards of surficial soil, 194,124 cubic yards of terrace alluvium, and 34,351 cubic yards of bedrock.

Zone 4 – Approximate Sta. 1032+50 to Sta. 1039+50 –Bridge No. 2 to Roundabout

The proposed roadway will pass through two properties northeast of Bridge 2: the CDOT-Knaggs parcel, and an area owned by Webb Ranch that has been identified as archaeologically significant. Eleven borings (E-01 through E-10 and R-13) were drilled across Zone 4, but to avoid disturbing the archaeological area, those initially planned for the Webb parcel were shifted to CDOT property, resulting in limited subsurface information near the proposed centerline for much of the roadway cut. Northeast of Bridge 2, at approximate Sta. 1033+00, the roadway enters a 100-foot cut. That height increases to approximately 150 feet by approximate Sta. 1039+00. The major portion of the excavation will be in terrace alluvium and bedrock; surficial soil volumes are predicted to be small by comparison. Post-FIR cross sections show a continuous 3:1 cut slope, through all three materials. As discussed above, steeper cut slopes would be acceptable in bedrock (if retained) and gravel. However, we understand that the current configuration may have been selected in order to maximize the amount of sunlight that can reach the roadway surface during winter months. Estimated volumes of excavation generated from Zone 4 include 128,633 cubic yards of surficial soil, 392,079 cubic yards of terrace alluvium, and 522,661 cubic yards of bedrock.

Table 6 Summary of Estimated Excavation Materials and Volumes

Zone	Description	From Station	To Station	Surficial Soil (CY)	Terrace Alluvium (CY)	Bedrock (CY)	Total Excavation (CY)
1	BOP to Enter Webb Property	940+23	991+00	157,942	0	0	157,942
2	Enter Webb Property to Bridge 1	991+00	1014+50	300,055	39,926	0	339,981
3	Between Bridges 1 and 2	1019+50	1029+50	73,324	194,124	34,351	301,799
4	Bridge 2 to Roundabout	1032+50	1039+50	128,633	392,079	522,661	1,043,373
Total	**Post-FIR Project Limits**	**940+23**	**1039+50**	**659,954**	**626,129**	**557,012**	**1,843,095**

Appendices – (3)

Appendix A

SITE MAP and BORING LOCATIONS

LEGEND

WX-## or WX##-## = WILDLIFE CROSSING BORING
R-## = ROADWAY BORING
W*-## = WALL BORING
A-## = ANIMAL CROSSING BORING
B**-##? = BRIDGE BORING

* = WALLS A THROUGH F
** = BRIDGE NUMBER
= BORING NUMBER
? = SUPPLIMENTAL BORING

Print Date: 5/31/2018	Sheet Revisions			Colorado Department of Transportation
File Name: 001_Excavation Volumes Memo_US 160-550-PlanSheet 1.dgn	Date:	Comments	Init.	3803 North Main Avenue Suite 200 Durango, CO 81301 Phone: 970-385-1440 FAX: 970-385-8365
Horiz. Scale: 1:100 Vert. Scale: As Noted				Region 5 DRV
Unit Information Unit Leader Initials				
Yeh and Associates, Inc. Consulting Engineers & Scientists				

As Constructed	US 160/550 PLAN CONNECTION SO. BORING LOCATIONS		Project No./Code
No Revisions:			NHPP 5501-029
Revised:	Designer:	Structure Numbers	22420
Void:	Detailer:		Sheet Number
	Sheet Subset: BOLO	Subset Sheets: 1 OF 8	

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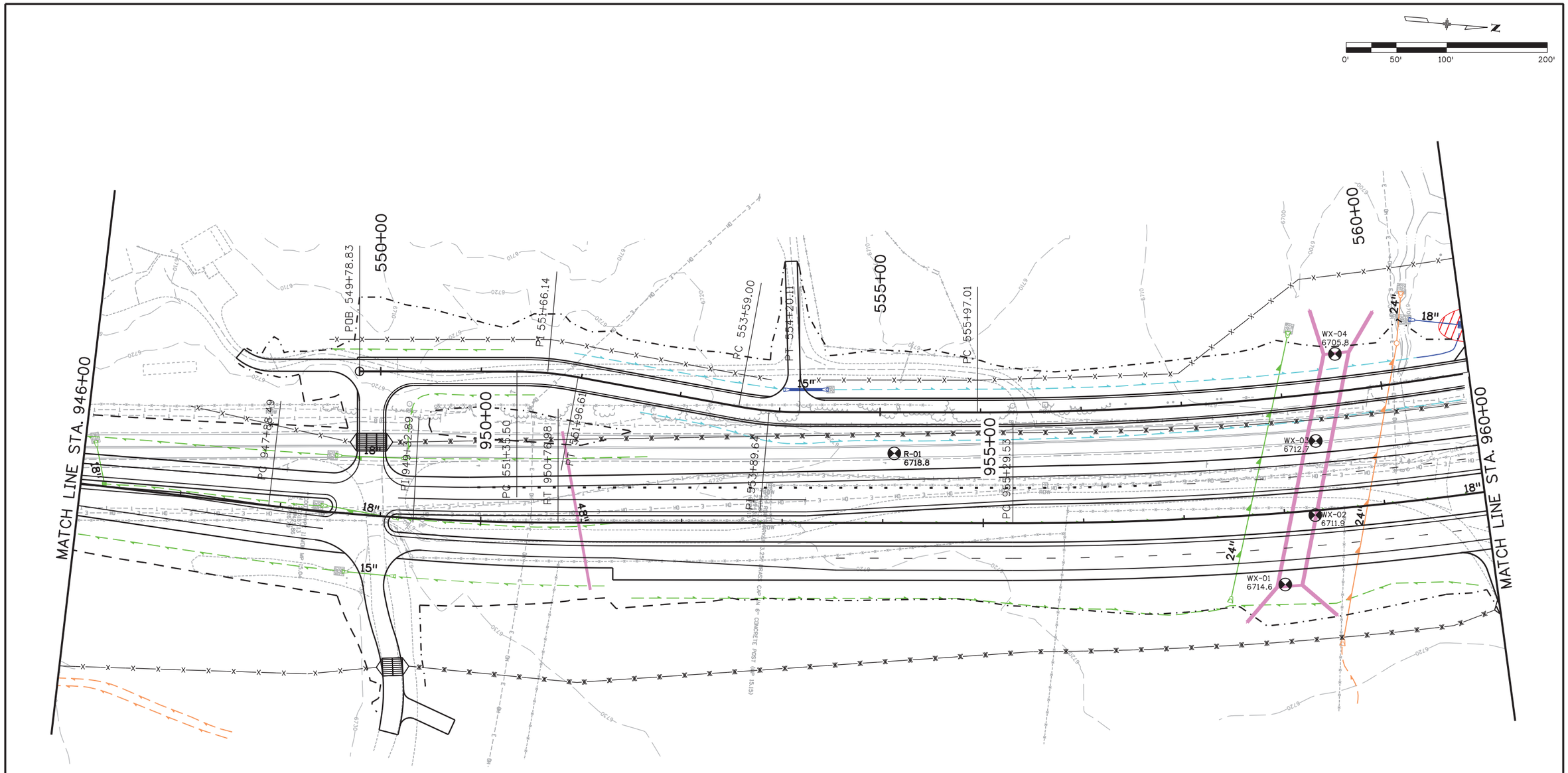

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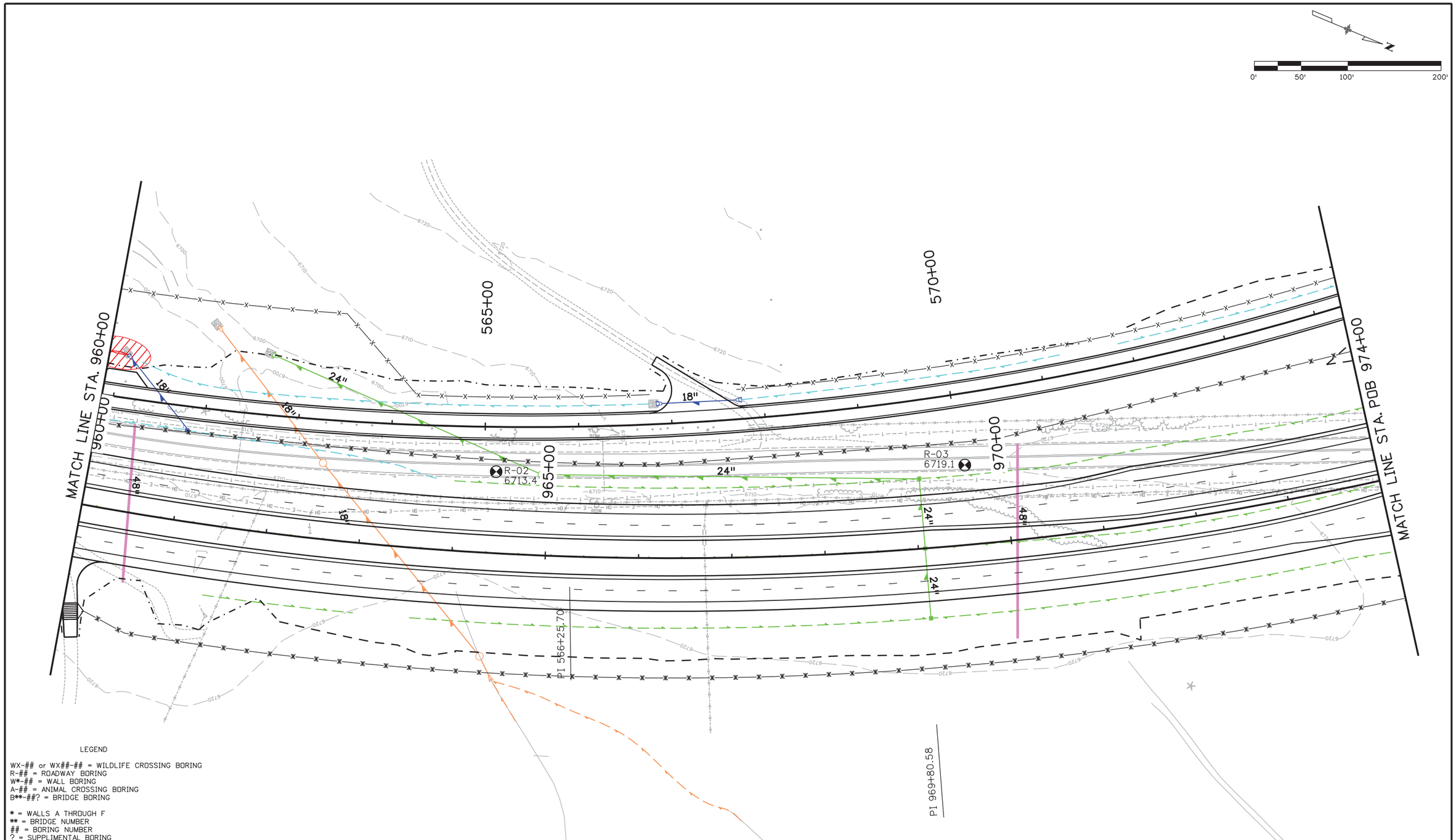
Print Date: 5/31/2018	Sheet Revisions			Colorado Department of Transportation	As Constructed	US 160/550 PLAN CONNECTION SO. BORING LOCATIONS
File Name: 002_Excavation Volumes Memo_US 160-550-PlanSheet 2.dgn	Date:	Comments	Init.	3803 North Main Avenue Suite 200 Durango, CO 81301 Phone: 970-385-1440 FAX: 970-385-8365	No Revisions:	Designer: / Detailer: / Sheet Subset: BOLO
Horiz. Scale: 1:100 Vert. Scale: As Noted				Region 5 DRV	Revised:	Structure Numbers: / Subset Sheets: 2 OF 8
Unit Information Unit Leader Initials					Void:	Project No./Code: NHPP 5501-029
Yeh and Associates, Inc. Consulting Engineers & Scientists						22420
						Sheet Number



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Print Date: 5/31/2018	Sheet Revisions	Colorado Department of Transportation	As Constructed
File Name: 003_Excavation Volumes Memo_US 160-550-PlanSheet 3.dgn	Date: / Comments / Init.	3803 North Main Avenue, Suite 200, Durango, CO 81301	No Revisions:
Horiz. Scale: 1:100 Vert. Scale: As Noted		Phone: 970-385-1440 FAX: 970-385-8365	Revised:
Unit Information Unit Leader Initials		Region 5 DRV	Void:
Yeh and Associates, Inc. Consulting Engineers & Scientists			

US 160/550 PLAN CONNECTION SO. BORING LOCATIONS		Project No./Code
Designer:	Structure Numbers	NHPP 5501-029
Detailer:		22420
Sheet Subset: BOLO	Subset Sheets: 3 OF 8	Sheet Number

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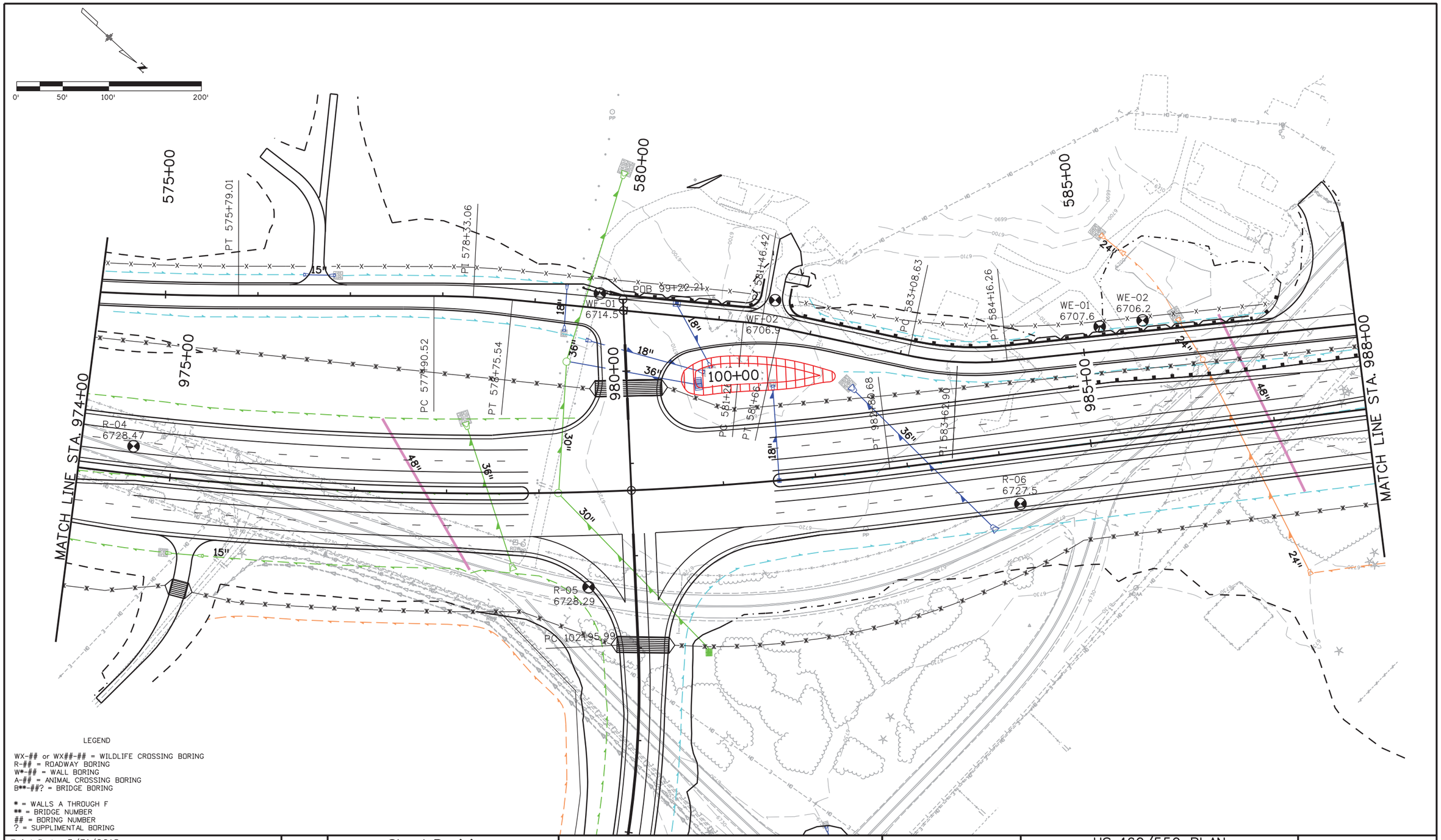


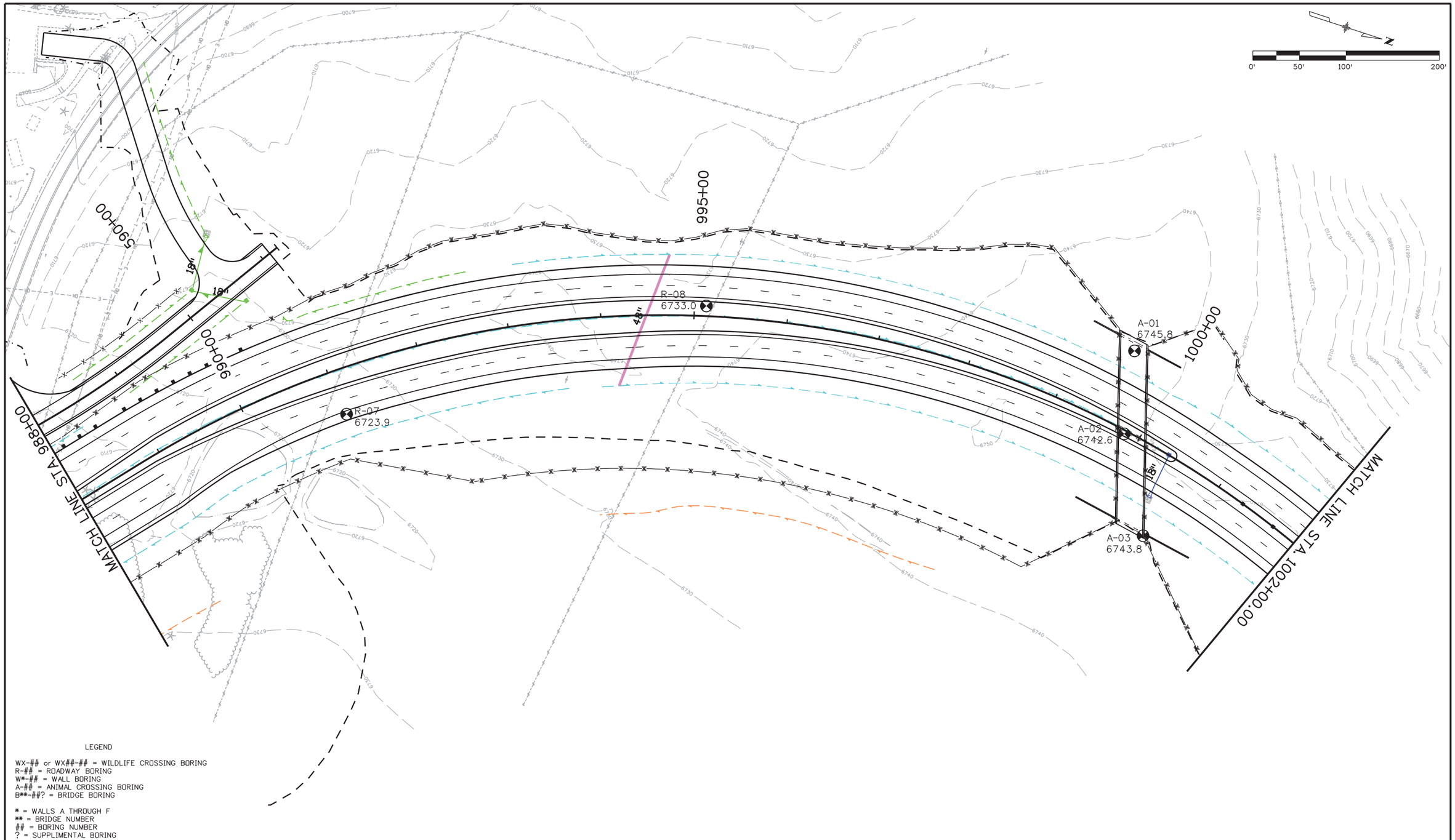
LEGEND

WX-## or WX##-## = WILDLIFE CROSSING BORING
R-## = ROADWAY BORING
W*-## = WALL BORING
A-## = ANIMAL CROSSING BORING
B**-##? = BRIDGE BORING

* = WALLS A THROUGH F
** = BRIDGE NUMBER
= BORING NUMBER
? = SUPPLIMENTAL BORING

Print Date: 5/31/2018	Sheet Revisions	Colorado Department of Transportation	As Constructed
File Name: 004_Excavation Volumes Memo_US 160-550-PlanSheet 4.dgn	Date: / Comments / Init.	3803 North Main Avenue, Suite 200, Durango, CO 81301	No Revisions:
Horiz. Scale: 1:100 Vert. Scale: As Noted		Phone: 970-385-1440 FAX: 970-385-8365	Revised:
Unit Information Unit Leader Initials		Region 5 DRV	Void:
Yeh and Associates, Inc. Consulting Engineers & Scientists			

US 160/550 PLAN CONNECTION SO. BORING LOCATIONS		Project No./Code
Designer:	Structure Numbers	NHPP 5501-029
Detailer:		22420
Sheet Subset: BOLO	Subset Sheets: 4 OF 8	Sheet Number



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WX-## or WX##-## = WILDLIFE CROSSING BORING
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* = WALLS A THROUGH F
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? = SUPPLIMENTAL BORING

Print Date: 5/31/2018	
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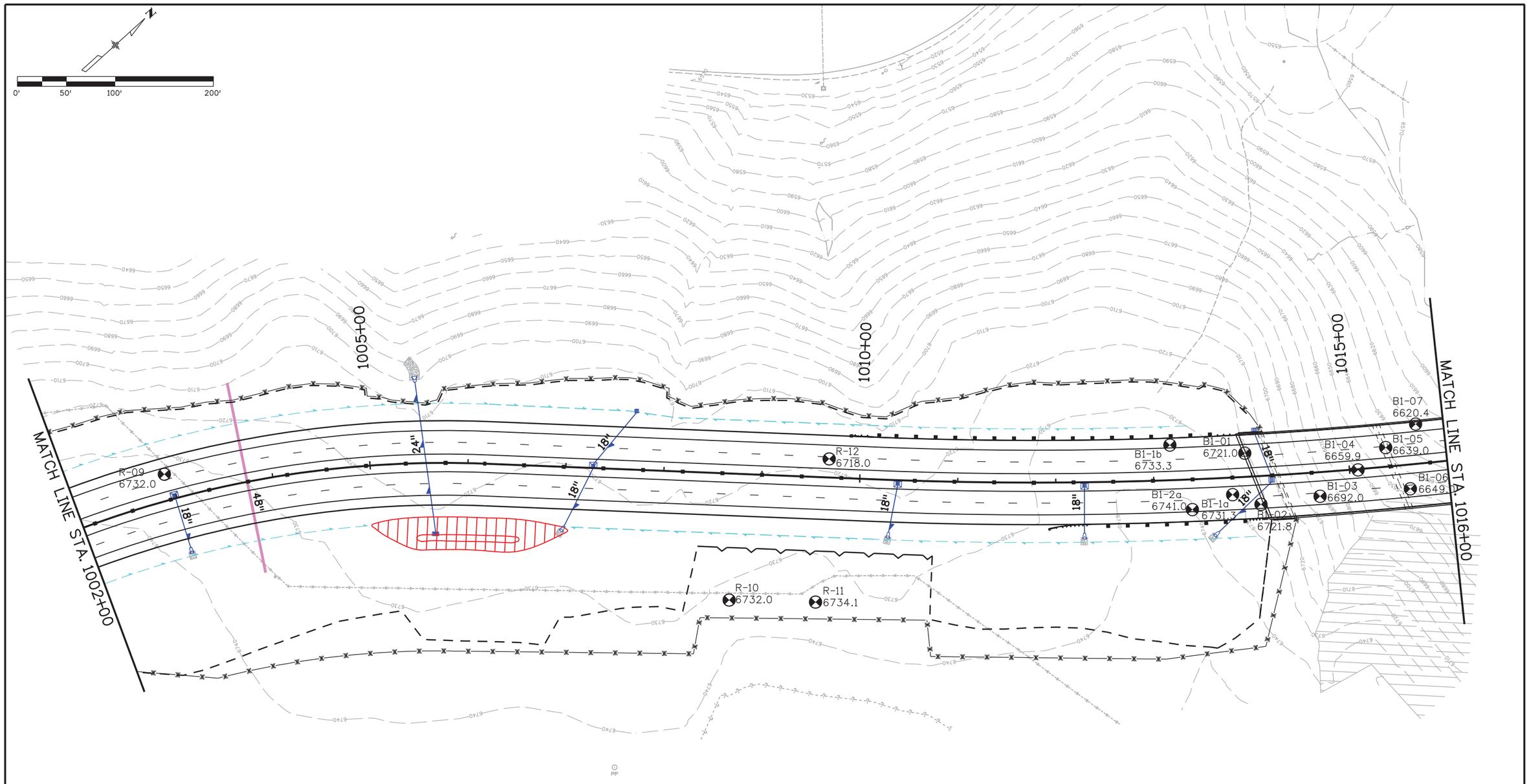
Detailer:			
Sheet Subset:	BOLO	Subset Sheets:	5 OF 8

Project No./Code
NHPP 5501-029
22420
Sheet Number



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* = WALLS A THROUGH F
** = BRIDGE NUMBER
= BORING NUMBER
? = SUPPLIMENTAL BORING

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No Revisions:			NHPP 5501-029
Revised:	Designer:	Structure Numbers	22420
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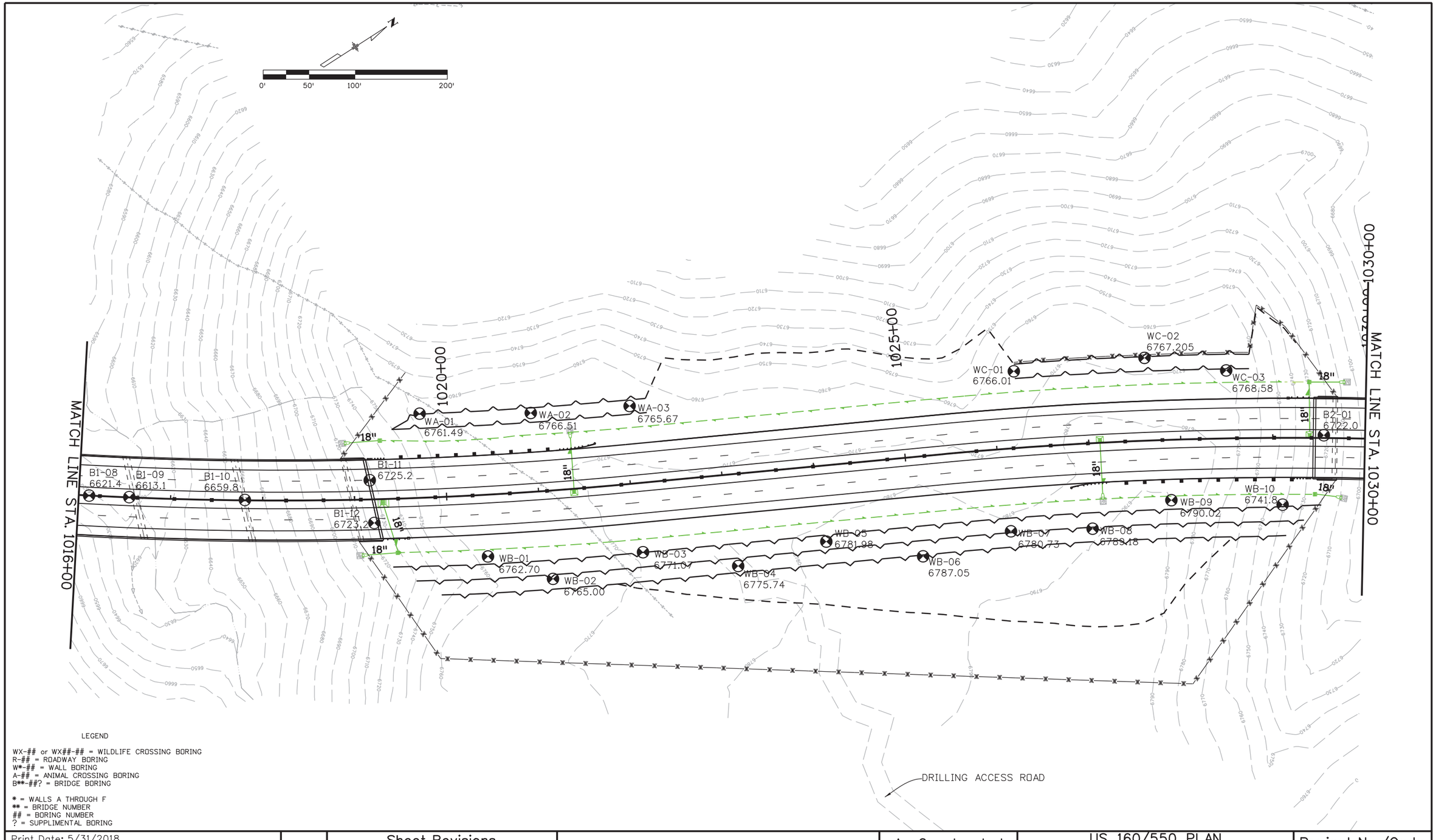

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WX-## or WX##-## = WILDLIFE CROSSING BORING
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W*-## = WALL BORING
A-## = ANIMAL CROSSING BORING
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= BORING NUMBER
? = SUPPLIMENTAL BORING

Print Date: 5/31/2018	Sheet Revisions		
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No Revisions:	Designer:	Structure Numbers:	NHPP 5501-029
Revised:	Detailer:		22420
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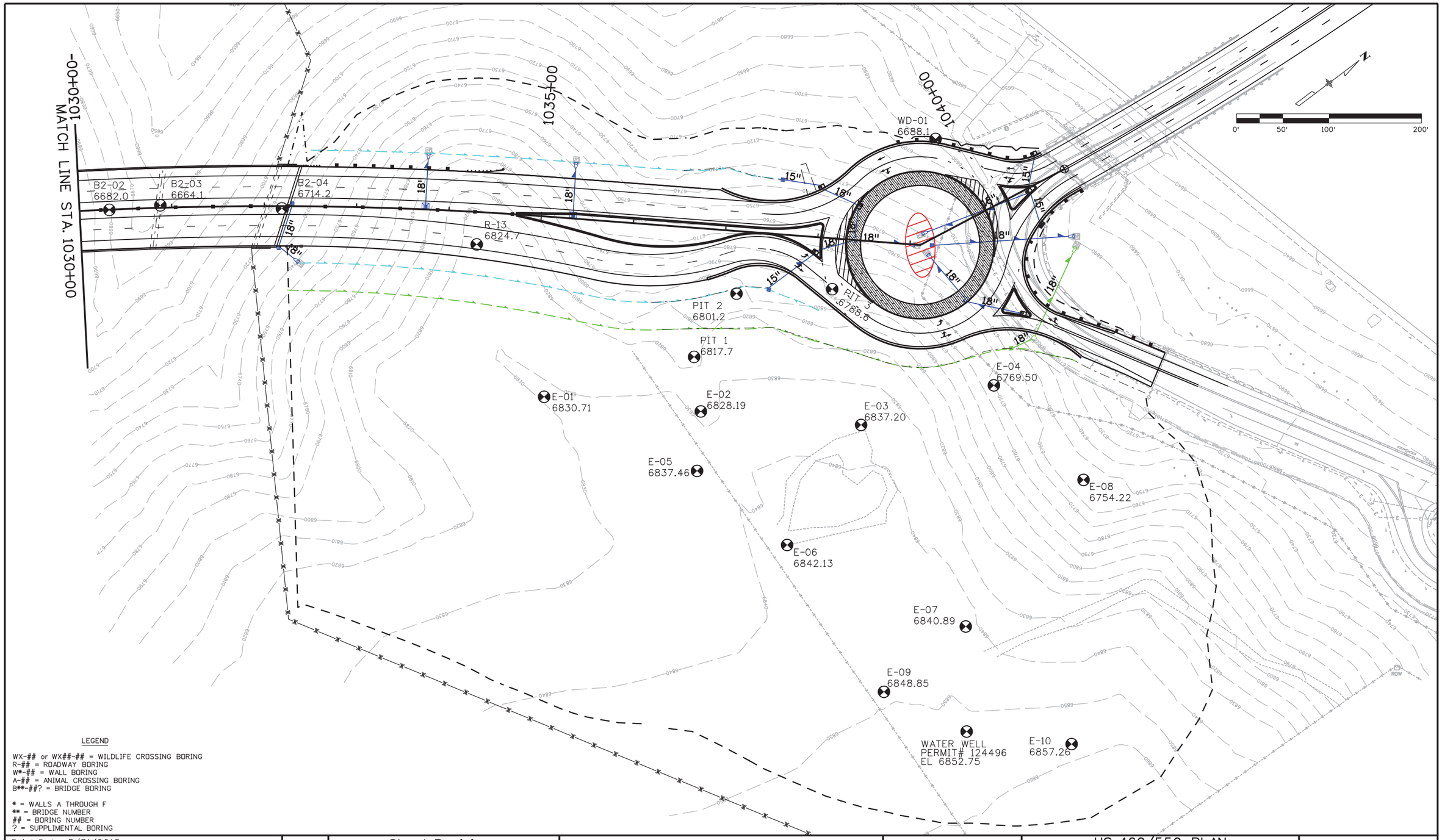

LEGEND

WX-## or WX##-## = WILDLIFE CROSSING BORING
R-## = ROADWAY BORING
W*-## = WALL BORING
A-## = ANIMAL CROSSING BORING
B**-##? = BRIDGE BORING

* = WALLS A THROUGH F
** = BRIDGE NUMBER
= BORING NUMBER
? = SUPPLIMENTAL BORING

Print Date: 5/31/2018
File Name: 008_Excavation Volumes Memo_US 160-550-PlanSheet 8.dgn
Horiz. Scale: 1:100 Vert. Scale: As Noted
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BORING LOCATIONS

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Detailer:
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Structure Numbers:
Subset Sheets: 8 OF 8

Project No./Code
NHPP 5501-029
22420
Sheet Number

Appendix B

ROADWAY CROSS SECTIONS