TECHNICAL MEMORANDUM

FEMA Building Resilient Infrastructure and Communities Grant Program

Hickory Wastewater Treatment Facility Hardening and Stream Restoration

Benefit-Cost Analysis Methodology

January 19, 2020

TECHNICAL MEMORANDUM

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City of Hickory, NC

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1. PROJECT OVERVIEW

This technical memorandum identifies the data and methodology used to complete a benefit cost analysis (BCA) for the Hickory Wastewater Treatment Facility Hardening and Stream Restoration project, which will protect a variety of assets against flooding and erosion.

The avoided losses from precipitation flooding and erosion were quantified for the purposes of this BCA. The following methodology outlines the steps that were taken to calculate a benefit cost ratio (BCR) of 2.34, with $7,213,396 in project costs (including $1,920 per year in maintenance) and $16,906,176 in benefits.

1.1 Project Background

The City of Hickory's Northeast Wastewater Treatment Facility (NE WWTF) is located at 310 Cloninger Mill Road NE, Hickory, NC 28601. Directly east of the NE WWTF across Cloninger Mill Road NE is the NE WWTF Influent Pump Station (IPS) which feeds wastewater into the NE WWTF facility. The facility itself has been identified by the City of Hickory as serving approximately 26,195 customers and is rated to treat 6 million gallons per day (MGD) of wastewater from the surrounding service area. The location of the facility is described in Table 1.

Table 1. Northeast Wastewater Treatment Facility Location

Facility Name	Location Description	Latitude	Longitude
Northeast Wastewater Treatment Facility	310 Cloninger Mill Road NE, Hickory, NC 28601	35.788283	-81.307406

The NE WWTF IPS is located in the FEMA Special Flood Hazard Area (SFHA). For the flood map exported from the FEMA Map Service Center, see Appendix B. The City of Hickory has indicated that the NE WWTF IPS has flooded at least three times in the past ten years. The NE WWTF IPS experiences flooding from severe precipitation events, as well as flooding from the nearby Falling Creek, which is approximately 25 feet southeast of the pump station. This historic flooding at the pump station has resulted in loss of wastewater service and required costly repairs to pump station equipment.

In addition to potential flooding, erosion of the creekbanks adjacent to the NE WWTF could potentially cause catastrophic damage to the NE WWTF operations. Raw sewage and liquid chlorine chemicals could potentially discharge into streets, homes, and businesses in the service area or directly into the river. Without sufficient operational capability and capacity, the local populations may continue to suffer severe consequences including high public health and safety risk, damage to critical infrastructure and potential damage to commercial and residential properties, disruption of government critical infrastructure function, and environmental degradation impacts. It has also been assumed within this analysis that the loss of a structure due to erosion at the NE WWTF would result in a significant loss of service time. This is further discussed in the erosion section found in Section 7.

1.2 Proposed Mitigation Action and Level of Protection

1.2.1 Cascading Impacts

The proposed mitigation project consists of two major components: First, a protective berm will be constructed around the Northeast Wastewater Treatment Facility (NE WWTF) influent pump station. The berm will tie into the existing hillside and driveway in a manner to prevent floodwaters from reaching the pump station. The second component of the mitigation effort will be the installation of natural and environmentally sensitive stream restoration and bank stabilization measures along approximately 2,000 feet of Falling Creek. This mitigation project necessitates that both mitigation actions be completed in order to ensure a wholistic mitigation solution for the NE WWTF. Without both actions being completed, the site remains vulnerable to one or both of the hazards aforementioned.

If for example the floodwall was not implemented and only the erosion control and streambank restoration was completed, the NE WWTF influent pump station would still remain susceptible to severe creek swelling and potential infiltration of floodwaters therefore rendering the station inoperable. This asset provides all influent wastewater into the NE WWTF and therefore would ultimately render the entire facility inoperable until bypass pumping measures could be implemented.

Similarly, if only the floodwall portion of the scope was implemented and the erosion control and streambank stabilization measures were not completed, then the encroaching streambank would continue to erode along the southern portion of the NE WWTF putting multiple buildings and assets at this facility in danger. If this erosion continued near the facility, it can be presumed that eventually the facility, and more specifically the Chlorine Contact Chamber, would experience a “catastrophic failure” and the facility would not be able to properly treat wastewater for any of its service population.

1.2.1 Northeast Wastewater Treatment Facility Influent Pump Station - Floodwall

The design approach for the mitigation of the NE WWTF influent pump station centers around the construction of a berm feature surrounding the existing station location. The top of the berm will be constructed to an elevation of 962 feet (NAVD88) or approximately 2 feet about the 500-year flood elevation. This natural berm will tie into the existing hillside of the driveway from Cloninger Mill Road NE and wrap around the south side of the pump station. On the far southeast corner of the site, Falling Creek encroaches too closely upon the pump station to allow an appropriate amount of room for a berm to be constructed. Therefore, a concrete floodwall will tie the western berm to the eastern berm. The eastern berm will then continue from the concrete floodwall, along the east side of the pump station location and tie back into the existing grade near the northeast corner of the site.

1.2.2 Northeast Wastewater Treatment Facility – Stream Restoration and Erosion Control

Regarding the stream restoration and bank stabilization measures, the design approach will emphasize nature-based solutions and materials and recommend a combination of floodplain benching, bank regrading, bio-engineered structural enhancements, natural fiber matting surface stabilization, and intensive revegetation with the appropriate native riparian plant species. This nature-based approach will achieve greater stability within the reach of the Falling Creek stream banks and will reduce the severity of erosion and encroachment from future flood events on the NE WWTF and NE WWTF influent pump station. The primary goal of this project is to ensure future encroachment upon the NE WWTF, and more specifically the Chlorine Contact Chamber, is minimized due to the forces of erosion.

A large, excavated terraced floodplain bench is proposed upstream of Cloninger Mill Road. The bench will extend from the top of the channel bank to created widths as great as 120 feet to increase hydraulic storage within the reach and reduce stream velocities during high flow events (relative to the currently confined channel). The banks of the channel will be reinforced with bank protection structures to provided long term bank stability. The structures will vary in hardness and complexity, including woody structures and toe boulders depending on the expected risk from shear stress in each location. Rock vanes would also be constructed in the channel bed where appropriate to direct hydraulic force away from the banks to reduce erosion risk in those locations.

The stream restoration and bank stabilization approach in the stream segment downstream of Cloninger Mill Road will also include excavation of a floodplain bench on the right bank (the bank opposite from the pump station). However, the floodplain bench is limited to a maximum width of approximately 40 feet in this reach because the valley wall rises rapidly in the overbank, which limits the lateral distance available to create a floodplain bench affordably.

2. FEMA GUIDANCE AND SOFTWARE

The following narrative provides the methodology used to obtain the City of Hickory Northeast Wastewater Treatment Facility Flood Mitigation Upgrades BCR. Following the FEMA BCA Reference Guide and Supplement, this analysis uses a combination of historical flood events and erosion rates and modeled expected damages to calculate the damages before and after this mitigation project. The modeled scenarios use engineering assessments, statistical determinations of likely occurrence, and associated damages during expected events. This is consistent with FEMA's expected damages approach as detailed in the FEMA BCA Reference Guide. The BCA for this project was primarily guided by FEMA's BCA Reference Guide and Supplement and the BCA Toolkit Version 6.0.

This project mitigates two hazards: erosion and flooding. The project also protects two primary utilities: the NE WWTF and the NE WWTF IPS. Therefore, the BCA Toolkit is split into two separate mitigation actions, one to represent each of these hazards being mitigated. The benefits from these two BCAs are aggregated to determine the overall project BCR.

3. HISTORIC EVENTS

In accordance with the FEMA BCA Reference Guide and Supplement, historical loss data can be used to calculate benefits to be used in the BCA. Alternatively, expected losses associated with modeled events may be used in the BCA Toolkit. The City of Hickory has a long history with precipitation-based flood events at the NE WWTF IPS and a history of severe erosion at the NE WWTF but lacks documentation sufficient for using historical events as the basis for the BCA. Instead BCA analysts used point precipitation event frequencies, outage times, and elevations provided by the City of Hickory to calculate the BCR based on expected events (Appendix C). With regard to erosion, analysts used engineering estimates of erosion over time to determine an assumed rate of erosion and a number of years before a loss occurs.

Despite this BCA being based on expected damages, it is important to understand the severity of flooding that has occurred at the pump station in the past. The pump station has experienced chronic flooding due to heavy rainfall events leading to swelled riverine flooding. In the past seven years, three known events

have been captured with identified flood elevations in the station and outage times. A record of captured historic precipitation flooding events can be seen in **Error! Reference source not found.** below. A more detailed discussion regarding the use of these events can be found in Section 8.

Table 2. Northeast Wastewater Treatment Facility Influent Pump Station Historic Flooding Events

Event	Rainfall Duration (Days)	Rainfall (Inches)	Flood Depths at NE WWTF IPS (NAVD88)
07/27/13	1.0	6.00	959.50 ft
06/07/19 – 06/09/19	3.0	8.50	959.80 ft
08/14/20 – 08/15/20	2.0	4.17	959.30 ft

4. PROJECT AND MAINTENANCE COSTS

The total project and annual maintenance costs for implementing the proposed mitigation project is provided in Table 3 below. Maintenance costs for the project were calculated as $1,920 per year for the flood mitigation and erosion control measures. These maintenance costs include costs associated operational berm and floodwall maintenance, bi-annual testing, and grounds maintenance and security.

Table 3. Mitigation Project and Maintenance Costs

Mitigation Activity	Project Cost	Annual Maintenance Cost
Hickory Wastewater Treatment Facility Hardening and Stream Restoration	$7,186,899	$1,920

5. PROJECT USEFUL LIFE

According to the FEMA 2009 BCA Reference Guide – Project Useful Life Table (Appendix D), a project useful life of 50 years should be applied to major infrastructure, (minor localized flood reduction projects). As such a useful life of 50 years was used for the City of Hickory Northeast Wastewater Treatment Facility Flood Mitigation Upgrades in the BCA Toolkit.

6. SERVICE POPULATION

Utility benefits were calculated in the BCA Toolkit based on service populations. The City of Hickory staff has indicated that the NE WWTF and NE WWTF IPS are rated to treat approximately 6 million gallons per day (MGD) of wastewater on average and the facility handles a daily flow of an estimated 3.2 MGD (Appendix E).

For the purposes of this assessment, BCA analysts utilized the total number of miles contained within the NE WWTF service area (Appendix F) and compared this mileage to the 2010 total population per square mile provided by the United States Census Bureau (Appendix G) resulting in a total service population of approximately 26,195 customers (Table 4).

Table 4. NE WWTF Customers Served and Utility Properties

Utility Properties	Value
Number of Square Miles Served	19.45
Population per Square Mile	1,346.8
Number of Customers Served	26,195
Type of Service	Wastewater
Value of Unit of Service ($/person/day)	$58
Total Value of Service Per Day ($/day)	**$1,519,310**

7. LOSS OF FUNCTION - EROSION

The primary threat facing the NE WWTF is erosion along the north bank of Falling Creek due to heavy rain events and significant increase in creek discharges and flow volume. Over the last several years, erosion has occurred at an exponentially higher rate due to increased severity of storms in the region and increased rainfall frequencies. Figure 1 below provides a series of photographs indicating the clear signs of erosion overtime and providing contextual analysis of the creek's increased erosion. The methodology described below is in line with the FEMA Supplemental Guidance for Conducting a Benefit-Cost Analysis (BCA) for a Floodplain and Stream Restoration Project (Appendix H).

Figure 1. Photographs of Erosion at Falling Creek Near the NE WWTF

7.1 Rate of Erosion

Although the rate varies with the number of significant storm events each year and the specific location along the creek, it is clear that erosion has continued to accelerate and damages to the facility will occur in the next several years if no mitigation action is taken. More specifically, erosion to the creekbank continues to encroach upon the Chlorine Contact Chamber structure located at the far south end of the facility.

For the purposes of this assessment, BCA analysts examined drawings completed in 2009 and compared these drawings to Google Earth imagery to determine a base erosion rate over time. Figure 2 below provides a visual of the Chlorine Contact Chamber in relation to Falling Creek from a 2009 Site Plan Grading and Erosion Control drawing (Appendix I). The graphic scale provided in the drawing indicates that the detail of the rendering is a 1-inch to 50-foot scale. Using this unit of measure, it is apparent that when the engineered drawing was completed in 2009, the Chlorine Contact Chamber was approximately 50 feet away from the Falling Creek north bank. Figure 3 presents an overhead view of the site provided by Google Earth in 2019. Using the measurement tool provided by Google Earth, analysts were able to identify that due to swelling of the creek during severe storms and erosion over time, the creekbank is now within approximately 36 feet of the Chlorine Contact Chamber. This means that over a 10-year period (2009-2019), the creekbank has eroded approximately 14 feet and drawn closer to the facility's edge. This is approximately equivalent to an average erosion rate of 1.4 feet per year.

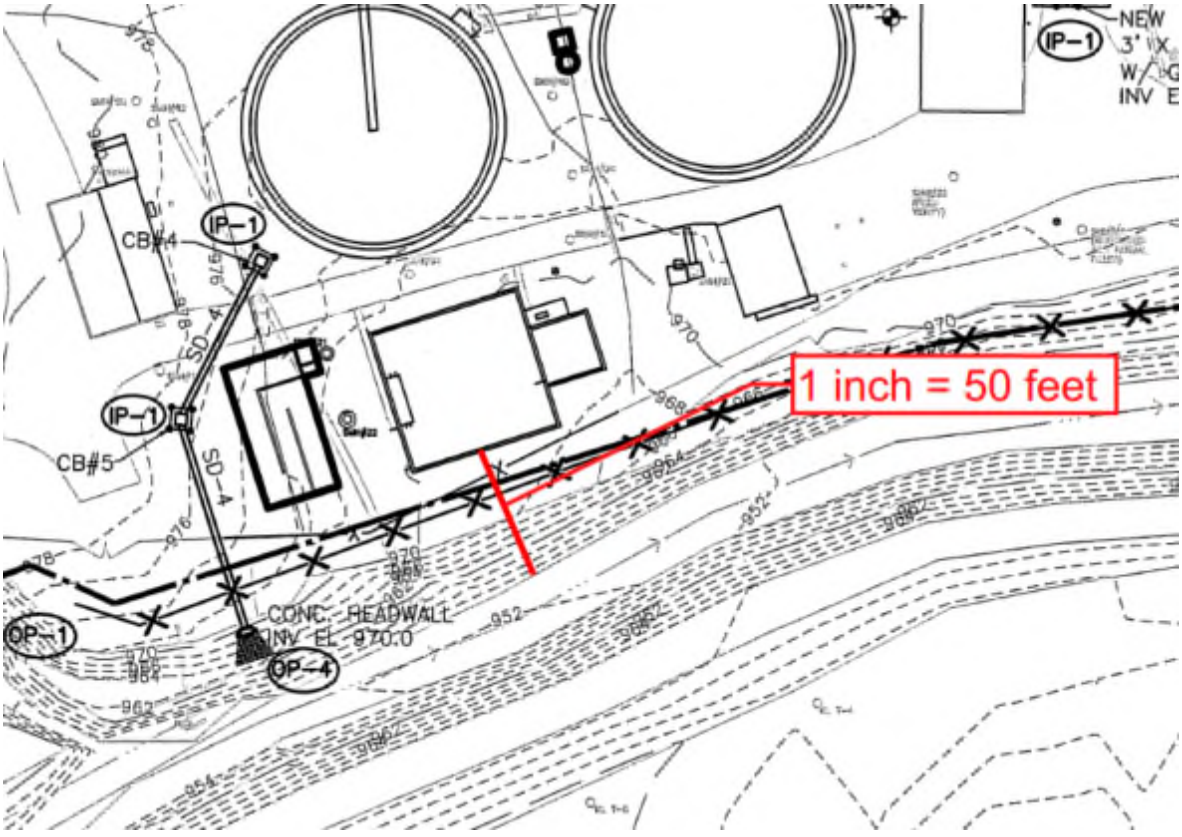


Figure 2. Chlorine Contact Chamber Distance to Falling Creek per Site Plan Grading and Erosion Control Drawing (2009)

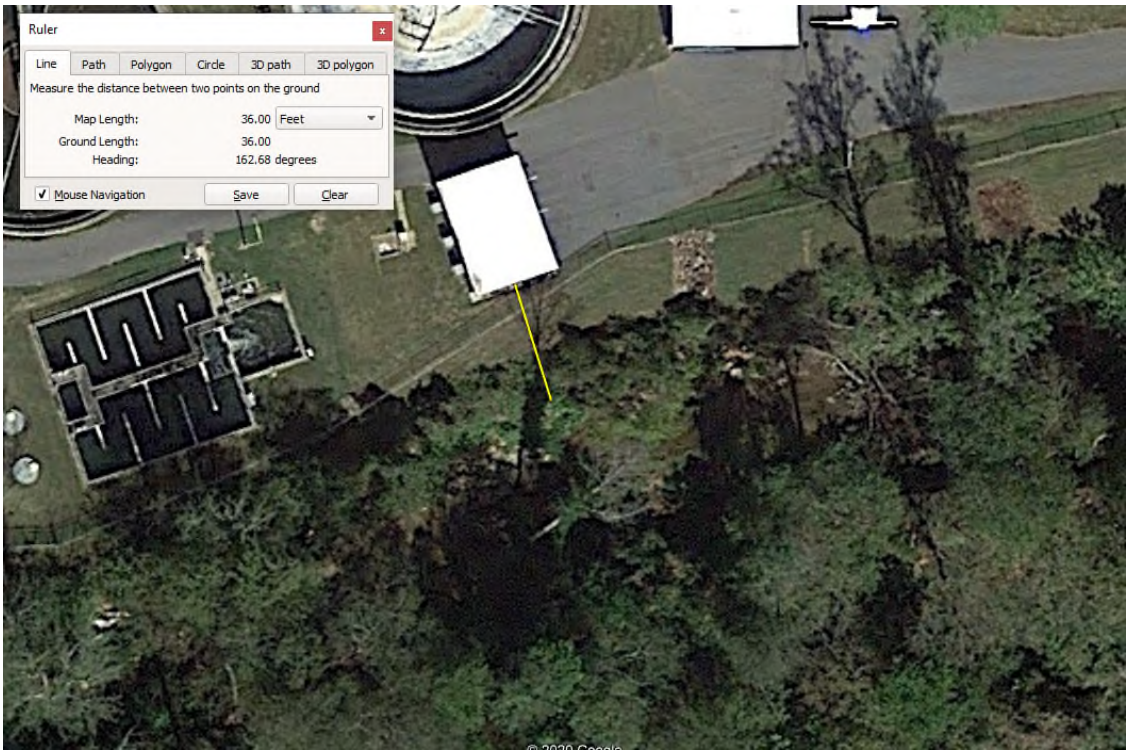


Figure 3. Chlorine Contact Chamber Distance to Falling Creek per Google Earth Imagery (2019)

7.2 Erosion Catastrophic Failure Assessment

Based on the assessment provided in the previous section, analysts estimate that by using the rate of erosion the Chlorine Contact Chamber may experience "catastrophic failure" or full loss in approximately 26 years (Table 5). This BCA is conducted based on the assumption that before-mitigation damages caused by erosion can be expected at a recurrence interval equal to the time period at which damage occurs based on the erosion rate. This creekbank stabilization and erosion control project is assumed to protect against erosion for the full length of its project useful life of 50 years.

Table 5. Erosion Analysis for Falling Creek and the Chlorine Contact Chamber

Assessment	Outcome
Proximity of Chlorine Contact Chamber to Falling Creekbank per Drawing (2009)	50 feet
Proximity of Chlorine Contact Chamber to Falling Creekbank per Google Earth Imagery (2019)	36 feet
Number of Years	10 years
Amount of Identifiable Creekbank Erosion (2009-2019)	14 feet
Identifiable Creekbank Erosion per Year	1.4 feet/yr
Estimated Number of Years before "Catastrophic Failure"	**26 years**

7.3 Loss of Functional Downtime

Engineers have indicated that if a "catastrophic loss" scenario was to occur to the Chlorine Contact Chamber, an absolute minimum of 30 days of loss of function would be expected at the NE WWTF. This time would not only allow for staging of temporary equipment but would provide staff enough time to ensure temporary liquid chlorine systems could be identified, ordered, and properly tested to meet water quality and disinfectant permit needs for wastewater discharge. This should be considered an extremely conservative estimate of loss of function as the reality of a "catastrophic loss" to the Chlorine Contact Chamber would likely result in a much longer facility outage. Furthermore, this assessment does not consider the severe environmental and public health hazard of raw liquid chlorine being injected into the natural environment or spilling into Falling Creek should the structure be damaged or collapse due to erosion. However, for the purposes of this analysis and to remain conservative, BCA analysts applied a 30-day outage time to the determined recurrence interval as discussed above (Table 6).

Table 6. Northeast Wastewater Treatment Facility Years Before Asset is at Risk due to Erosion and Loss of Service

Structure	Number of Years Before Asset is at Risk (Years)	Loss of Service after "Catastrophic Loss" (Days)	Damages ($)
NE WWTF Chlorine Contact Chamber	26	30	$55,680,000

8. LOSS OF FUNCTION - FLOODING

The following section contains the data sources, information, and calculations used to determine loss of wastewater service and physical damages for expected flood events at the NE WWTF IPS. The NE WWTF IPS is located directly east of the NE WWTF across Cloninger Mill Road NE. The station is located in the FEMA SFHA (Appendix B) and experiences flooding from both severe precipitation events and the swelling elevations of the nearby Falling Creek, which is approximately 25 feet southeast of the pump station. Figure 4 shows satellite imagery of the pump station in relation to the creek.

The pump station is currently constructed partially at ground level and partially subgrade with a finished floor elevation (FFE) of 959.0 feet NAVD88 (Appendix J). The half of the structure at grade contains the majority of the station's critical electrical equipment (SCADA sensors, control panels, etc.). The other half of the structure below grade contains the station's pump motors, bar screen motors, and automatic bar screens. Though much of the equipment is located off the ground, severe precipitation events and swelling of Falling Creek can cause significant flood elevations within the station impacting the station's ability to run at full capacity.

Figure 4. Satellite Imagery of the NE WWTF IPS, Google Maps

8.1 Source of Flooding

The NE WWTF IPS has experienced past flooding from severe precipitation events and the nearby Falling Creek. During flood events, water enters the pump station through the doors located primarily at grade. Since this pump station is located only slightly above grade, most of the flooding occurs due to surface waters. Once water enters the station, pump motors and supporting equipment can become quickly overwhelmed and fail completely as will be shown during the 2019 and 2020 events. It should be noted that the speed of repair at this pump station is hypercritical to the functioning of the NE WWTF and therefore is oftentimes considered a high priority asset to be repaired when taken out of service.

8.2 Determining Recurrence Intervals

The recurrence intervals used for the NE WWTF IPS were based on the July 2013, June 2019, and August 2020 precipitation events as these historic events were well documented with both flood elevation data and outage times. Rainfall and event data were based upon United States Geological Survey (USGS) daily precipitation totals from the nearest rain gauge to the project location (USGS 354616081085145 rain gauge at Oxford RS NR Claremont, NC). Rainfall data from this gauge was compared to the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Point Precipitation Frequency Estimates seen below in Figure 5 (see Appendix C for tabular information) at the latitude and longitude specified for the NE WWTF pump station project. Although the rain gauge used in this analysis is approximately 9.02 miles

from the project location, this gauge provided the closest information to the project site and served as the best determination of precipitation experienced at the facility. Table 7 shows these historic events, and the associated rainfall and recurrence intervals established.

Table 7. NE WWTF IPS Historic Flooding Events and Associated Recurrence Intervals

Event	Rainfall Duration (Days)	Rainfall (Inches)	Recurrence Interval (Years)	Flood Depth in NE WWTF IPS (Feet)
07/27/13	1.00	6.00	25	0.50
06/07/19 – 06/09/19	3.00	8.50	50	0.80
08/14/20 – 08/15/20	2.00	4.17	2	0.30

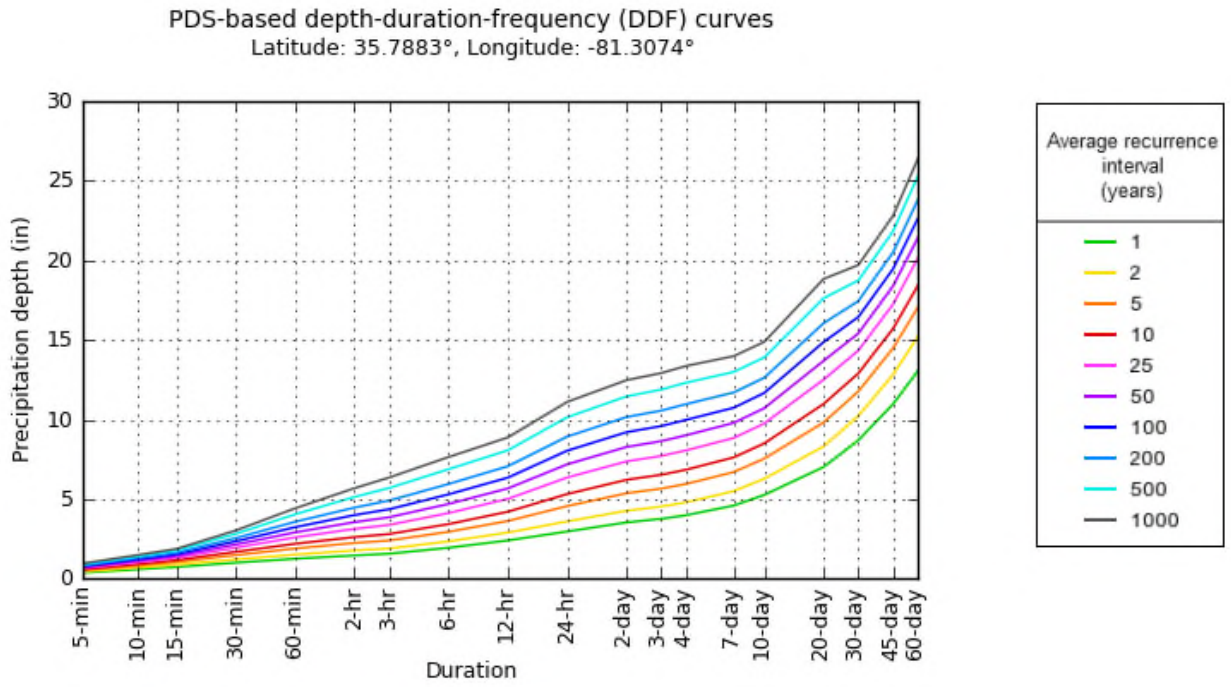


Figure 5. PDS-Based Depth Duration Frequency Curves

8.3 Physical Damages

Historically, flood events at the NE WWTF IPS have required equipment to be replaced or repaired due to damage caused by flooding. The City of Hickory has provided records of damages to the NE WWTF IPS after the 2019 precipitation event and the costs to replace damaged equipment (Appendix K) identified in Table 8.

Table 8. NE WWTF IPS Damages in Dollars per Precipitation Event

Event	Damages ($)
07/27/13	No record of damages provided
06/07/19 – 06/09/19	$13,917.74
08/14/20 – 08/15/20	No record of damages provided

The City of Hickory Department of Public Utilities (DPU) staff indicated that during each of the precipitation events, flood inundation was significant enough that the NE WWTF IPS became overwhelmed and was placed out of service for several hours. During these events, DPU staff worked efficiently and effectively to bring the pump station back online in a matter of hours.

8.4 Loss of Service

The City of Hickory has provided recorded outage information for each of the three precipitation flood events at the NE WWTF IPS. When loss of service occurs, the City of Hickory must wait for flood waters to recede, then let the equipment dry out before being able to determine whether it can resume functioning or if it will need repairs. As mentioned previously, the NE WWTF IPS is considered a high-priority asset and is often one of the first to receive repair due to its critical nature and proximity to a major wastewater treatment facility. Additionally, city staff has indicated that the facility has been extremely fortunate in that the flooding that has entered the facility has never exceeded a foot above the finished floor elevation where much of the facility's critical electric equipment is located. It is likely that if flood depths were to reach 1 or more feet, that outages would be significantly longer than previously experienced. Table 9 provides the loss of function information collected during each of the previous storm events.

Table 9. Loss of Function per Event at NE WWTF IPS

Event	Recurrence Interval (Years)	Loss of Function (Hours)	Loss of Function (Days)
07/27/13	25	4.00	0.17
06/07/19 – 06/09/19	50	2.00	0.08
08/14/20 – 08/15/20	2	1.50	0.06

9. LEVEL OF PROTECTION

The below narrative provides an analysis on the post-mitigation level of protection for both erosion and flood impacts of the Falling Creek to the NE WWTF and NE WWTF IPS.

9.1 Level of Protection – Erosion

After mitigation, the NE WWTF and the Chlorine Contact Chamber will be protected via creekbank stabilization measures from current and future erosion. To ensure a conservative analysis, it has been

assumed that the creekbank stabilization measures will last at least until the end of its identified project useful life of 50 years. This would mean that at the end of the useful service life of the erosion stabilization measures, erosion will have continued as normal along the Falling Creek banks.

Therefore, analysts assumed that the 26 year erosion time would still be required before the Chlorine Contact Chamber was again threatened by erosion meaning a total of 76 years would need to pass before a potential "catastrophic loss" could be considered to occur. This should be deemed a conservative estimate as it relies on the predication that the City of Hickory and NE WWTF staff would ignore continued maintenance and future improvements of the creekbank erosion stabilization measures implemented. A 76-year failure event was included in the post-mitigation erosion assessment and similar damages and outage times were applied.

9.2 Level of Protection – Flooding

After mitigation, the NE WWTF IPS will be protected by a flood berm and wall with a design flood elevation of 962 feet (NAVD88). This is 2 feet above the 500-year riverine flood event and approximately 2.2 feet above the highest recorded precipitation flood elevation. To maintain a conservative assessment, BCA analysts assumed the facility would remain protected only slightly past the 50-year precipitation inundation event. This is reflected in the BCA analysis post-mitigation assessment as the 51-year event.

10. RESULTS

The benefit-cost ratio for the project is listed in Table 10 below. Costs provided in the determination of the BCR include maintenance costs over the project useful life of the mitigation project. The total project BCR is 2.34 which demonstrates that the mitigation project is a cost-effective solution. The BCA Report is provided in Appendix A and the BCA Excel Spreadsheet is attached to the project application.

Table 10. Hickory Wastewater Treatment Facility Hardening and Stream Restoration Project Benefit-Cost Ratio

Description	Benefits	Costs	BCR
Hickory Wastewater Treatment Facility Hardening and Stream Restoration	$16,906,176	$7,213,396	2.34

Appendix A

Benefit Cost Analysis Toolkit Export

Appendix B

Northeast Wastewater Treatment Facility Influent Pump Station Flood Insurance Rate Map (FIRM)

Appendix C

NOAA Point Precipitation Frequency Estimates

Appendix D

FEMA 2009 BCA Reference Guide – Project Useful Life Table

Appendix E

Northeast Wastewater Treatment Facility Annual Wastewater Quality Report

Appendix F

Northeast Wastewater Treatment Facility Service Area Map

Appendix G

US Census Bureau 2010 Population per Square Mile – Hickory, NC

Appendix H

FEMA Supplemental Guidance for Conducting a Benefit Cost Analysis (BCA) for a Floodplain and Stream Restoration Project

Appendix I

Northeast Wastewater Treatment Facility Site Plan Grading and Erosion Control Plan – 2009

Appendix J

Northeast Wastewater Treatment Facility Influent Pump Station As-Built

Appendix K

Historic Damage Records at Northeast Wastewater Treatment Facility

Appendix A

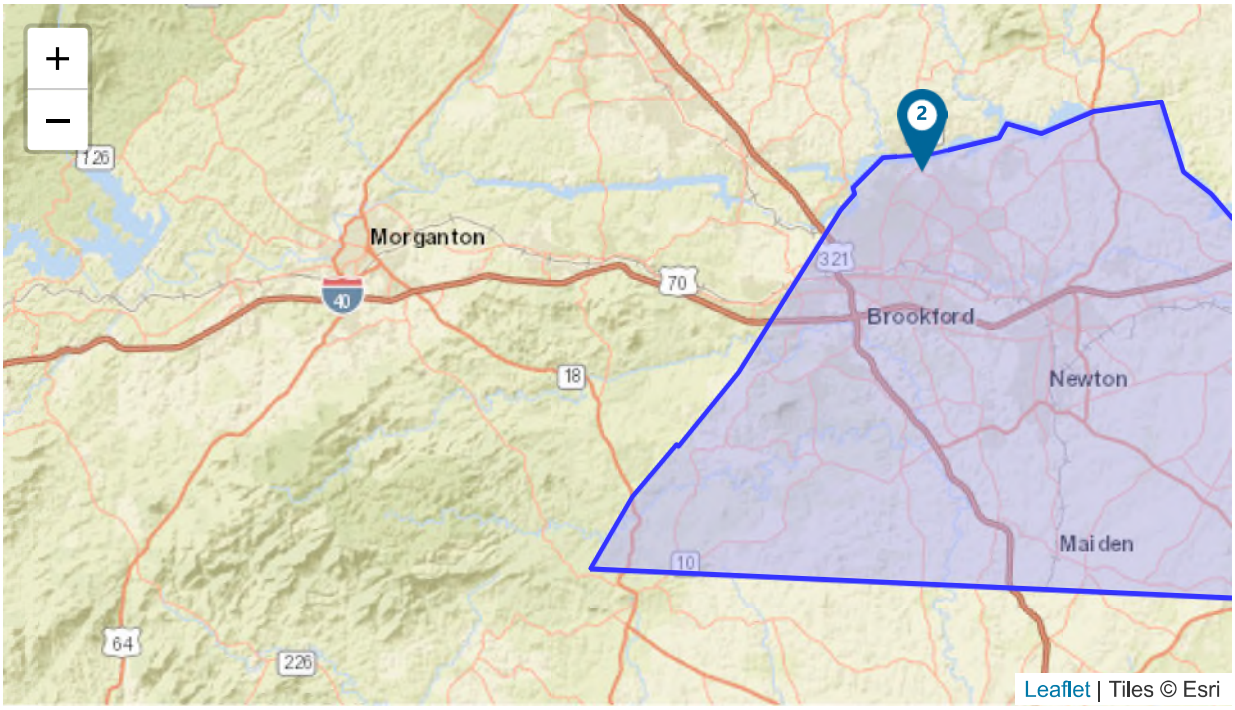
Benefit Cost Analysis Toolkit Export

FEMA Benefit-Cost Calculator

V.6.0 (Build 20210108.2038)

Benefit-Cost Analysis

Project Name: Hickory Wastewater Treatment Facility Hardening and Stream Restoration



Map Marker	Mitigation Title	Property Type	Hazard	Benefits (B)	Costs (C)	BCR (B/C)
1	Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601		DFA - Riverine Flood	$ 989,472	$ 7,213,396	0.14
2	Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601		DFA - Riverine Flood	$ 15,916,704	$ 0	0.00
TOTAL (SELECTED)				**$ 16,906,176**	**$ 7,213,396**	**2.34**
TOTAL				**$ 16,906,176**	**$ 7,213,396**	**2.34**

Property Configuration

Property Title:	Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601
Property Location:	28601, Catawba, North Carolina
Property Coordinates:	35.788656, -81.307274
Hazard Type:	Riverine Flood
Mitigation Action Type:	Floodproofing Measures
Property Type:	Utilities
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Project Useful Life (years):	50
Project Cost:	$7,186,899
Number of Maintenance Years:	50 Use Default:Yes
Annual Maintenance Cost:	$1,920

Damage Analysis Parameters - Damage Frequency Assessment

Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Year of Analysis Conducted:	2020
Year Property was Built:	2013
Analysis Duration:	10 Use Default:Yes

Utilities Properties

Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Type of Service:	Wastewater
Number of Customers Served:	26,195
Value of Unit of Service ($/person/day):	$49 Use Default:Yes

Professional Expected Damages Before Mitigation

Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

	WASTEWATER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	Pump Station Damages($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
2	0.06	0	0	0	0	0	91,159
25	0.17	0	0	0	0	0	258,283
50	0.08	13,918	0	0	0	0	135,463

Annualized Damages Before Mitigation

Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
2	91,159	70,584
25	258,283	3,741
50	135,463	2,709
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	484,904	77,034

Professional Expected Damages After Mitigation

Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

	WASTEWATER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	Pump Station Damages($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
51	0.17	13,918	0	0	0	0	272,201

Annualized Damages After Mitigation

Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
51	272,201	5,337
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	272,201	5,337

Benefits-Costs Summary

Floodproofing Measures @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Total Standard Mitigation Benefits:	$989,472
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$989,472
Total Mitigation Project Cost:	$7,213,396
Benefit Cost Ratio - Standard:	0.14
Benefit Cost Ratio - Standard + Social:	0.14

Property Configuration

Property Title:	Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601
Property Location:	28601, Catawba, North Carolina
Property Coordinates:	35.788656, -81.307274
Hazard Type:	Riverine Flood
Mitigation Action Type:	Floodplain and Stream Restoration
Property Type:	Utilities
Analysis Method Type:	Professional Expected Damages

Cost Estimation

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Project Useful Life (years):	50
Project Cost:	$0
Number of Maintenance Years:	50 Use Default:Yes
Annual Maintenance Cost:	$0

Damage Analysis Parameters - Damage Frequency Assessment

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Year of Analysis Conducted:	2020
Year Property was Built:	2010
Analysis Duration:	11 Use Default:Yes

Utilities Properties

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Type of Service:	Wastewater
Number of Customers Served:	26,195
Value of Unit of Service ($/person/day):	$49 Use Default:Yes

Professional Expected Damages Before Mitigation

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

	WASTEWATER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
26	30	0	0	0	0	0	45,579,300

Annualized Damages Before Mitigation

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
26	45,579,300	1,753,045
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	45,579,300	1,753,045

Professional Expected Damages After Mitigation

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

	WASTEWATER	OPTIONAL DAMAGES			VOLUNTEER COSTS		TOTAL
Recurrence Interval (years)	Impact (days)	Category 1 ($)	Category 2 ($)	Category 3 ($)	Number of Volunteers	Number of Days	Damages ($)
76	30	0	0	0	0	0	45,579,300

Annualized Damages After Mitigation

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Annualized Recurrence Interval (years)	Damages and Losses ($)	Annualized Damages and Losses ($)
76	45,579,300	599,723
	Sum Damages and Losses ($)	Sum Annualized Damages and Losses ($)
	45,579,300	599,723

Standard Benefits - Ecosystem Services

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Total Project Area (acres):	0
Percentage of Green Open Space:	0.00%
Percentage of Riparian:	0.00%
Percentage of Wetlands:	0.00%
Percentage of Forests:	0.00%
Percentage of Marine Estuary:	0.00%
Expected Annual Ecosystem Services Benefits:	$0

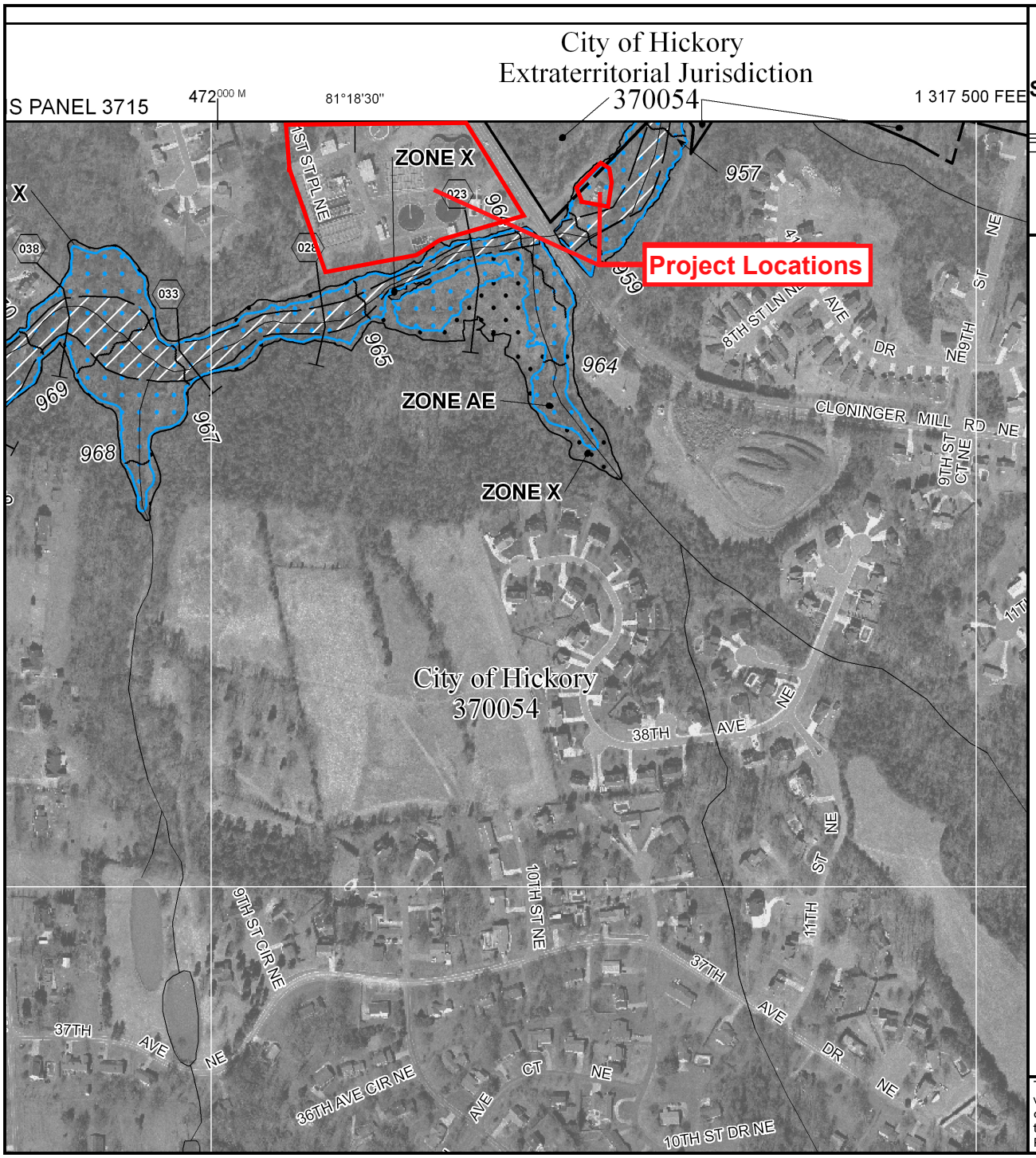
Benefits-Costs Summary

Floodplain and Stream Restoration @ 310 Cloninger Mill Rd NE, Hickory, North Carolina, 28601

Total Standard Mitigation Benefits:	$15,916,704
Total Social Benefits:	$0
Total Mitigation Project Benefits:	$15,916,704
Total Mitigation Project Cost:	$0
Benefit Cost Ratio - Standard:	0
Benefit Cost Ratio - Standard + Social:	0

Appendix B

Northeast Wastewater Treatment Facility Influent Pump Station Flood Insurance Rate Map (FIRM)



GRID NORTH

SCALE 1" = 500' (1 : 6,000)

250 500 750 1,000 FEET

METERS

PANEL 3714J

FIRM

FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 3714

(SEE LOCATOR DIAGRAM OR MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	CID No.	PANEL	SUFFIX
CATAWBA COUNTY	370050	3714	J
HICKORY, CITY OF	370054	3714	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

EFFECTIVE DATE **MAP NUMBER**

SEPTEMBER 5, 2007 **3710371400J**

State of North Carolina
Federal Emergency Management Agency

Appendix C

NOAA Point Precipitation Frequency Estimates

NOAA Atlas 14, Volume 2, Version 3
Location name: Hickory, North Carolina, USA*
Latitude: 35.7883°, Longitude: -81.3074°
Elevation: 979.09 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.366 (0.338-0.399)	0.434 (0.400-0.474)	0.513 (0.471-0.560)	0.574 (0.524-0.625)	0.650 (0.589-0.710)	0.706 (0.634-0.773)	0.763 (0.678-0.838)	0.818 (0.718-0.906)	0.889 (0.766-0.995)	0.945 (0.801-1.07)
10-min	0.585 (0.539-0.637)	0.694 (0.640-0.758)	0.822 (0.754-0.897)	0.918 (0.838-1.00)	1.04 (0.938-1.13)	1.13 (1.01-1.23)	1.21 (1.08-1.33)	1.30 (1.14-1.44)	1.41 (1.21-1.57)	1.49 (1.26-1.68)
15-min	0.731 (0.674-0.797)	0.873 (0.804-0.953)	1.04 (0.954-1.13)	1.16 (1.06-1.26)	1.31 (1.19-1.43)	1.42 (1.28-1.56)	1.53 (1.36-1.68)	1.64 (1.44-1.81)	1.77 (1.53-1.98)	1.87 (1.58-2.11)
30-min	1.00 (0.924-1.09)	1.21 (1.11-1.32)	1.48 (1.36-1.61)	1.68 (1.54-1.83)	1.94 (1.76-2.12)	2.15 (1.93-2.35)	2.35 (2.09-2.58)	2.55 (2.24-2.82)	2.82 (2.43-3.15)	3.03 (2.56-3.42)
60-min	1.25 (1.15-1.36)	1.51 (1.39-1.65)	1.89 (1.74-2.07)	2.19 (2.00-2.39)	2.59 (2.35-2.83)	2.91 (2.61-3.18)	3.23 (2.87-3.55)	3.57 (3.14-3.96)	4.04 (3.48-4.52)	4.42 (3.74-4.99)
2-hr	1.46 (1.34-1.59)	1.77 (1.62-1.93)	2.24 (2.04-2.44)	2.61 (2.37-2.84)	3.13 (2.82-3.42)	3.55 (3.17-3.89)	3.99 (3.53-4.40)	4.46 (3.89-4.95)	5.13 (4.38-5.75)	5.68 (4.76-6.43)
3-hr	1.57 (1.44-1.72)	1.89 (1.74-2.08)	2.40 (2.19-2.63)	2.80 (2.55-3.08)	3.38 (3.04-3.72)	3.86 (3.44-4.26)	4.36 (3.84-4.84)	4.91 (4.26-5.48)	5.69 (4.83-6.44)	6.35 (5.30-7.26)
6-hr	1.94 (1.79-2.12)	2.34 (2.15-2.56)	2.94 (2.70-3.22)	3.43 (3.13-3.74)	4.12 (3.73-4.50)	4.69 (4.21-5.14)	5.30 (4.70-5.83)	5.94 (5.21-6.59)	6.87 (5.89-7.69)	7.64 (6.43-8.63)
12-hr	2.40 (2.22-2.61)	2.90 (2.67-3.16)	3.62 (3.33-3.95)	4.20 (3.86-4.58)	5.01 (4.56-5.46)	5.67 (5.12-6.17)	6.35 (5.67-6.93)	7.06 (6.24-7.74)	8.06 (7.01-8.89)	8.87 (7.61-9.84)
24-hr	2.96 (2.75-3.22)	3.59 (3.33-3.91)	4.56 (4.21-4.95)	5.31 (4.90-5.76)	6.35 (5.84-6.89)	7.18 (6.57-7.80)	8.04 (7.32-8.73)	8.93 (8.08-9.71)	10.1 (9.12-11.1)	11.1 (9.94-12.1)
2-day	3.53 (3.26-3.84)	4.27 (3.95-4.64)	5.36 (4.96-5.83)	6.21 (5.72-6.74)	7.37 (6.76-7.99)	8.27 (7.56-8.98)	9.20 (8.38-10.0)	10.2 (9.20-11.1)	11.5 (10.3-12.5)	12.5 (11.2-13.6)
3-day	3.76 (3.48-4.06)	4.53 (4.20-4.90)	5.66 (5.23-6.12)	6.53 (6.02-7.06)	7.71 (7.09-8.34)	8.64 (7.91-9.35)	9.59 (8.75-10.4)	10.6 (9.60-11.5)	11.9 (10.7-12.9)	12.9 (11.6-14.1)
4-day	3.98 (3.70-4.29)	4.79 (4.45-5.17)	5.95 (5.51-6.41)	6.84 (6.32-7.38)	8.06 (7.42-8.69)	9.01 (8.26-9.72)	9.97 (9.12-10.8)	11.0 (9.99-11.9)	12.3 (11.2-13.3)	13.4 (12.1-14.5)
7-day	4.59 (4.29-4.93)	5.50 (5.13-5.90)	6.70 (6.25-7.18)	7.62 (7.09-8.17)	8.84 (8.20-9.48)	9.79 (9.05-10.5)	10.7 (9.90-11.5)	11.7 (10.8-12.6)	13.0 (11.9-14.0)	14.0 (12.8-15.1)
10-day	5.26 (4.94-5.61)	6.28 (5.89-6.69)	7.54 (7.07-8.04)	8.50 (7.95-9.06)	9.75 (9.10-10.4)	10.7 (9.97-11.4)	11.7 (10.8-12.5)	12.6 (11.7-13.5)	13.9 (12.8-14.9)	14.9 (13.7-15.9)
20-day	7.02 (6.63-7.44)	8.31 (7.84-8.81)	9.82 (9.25-10.4)	11.0 (10.3-11.6)	12.5 (11.7-13.3)	13.7 (12.8-14.5)	14.9 (13.9-15.8)	16.1 (15.0-17.1)	17.6 (16.4-18.8)	18.8 (17.4-20.1)
30-day	8.69 (8.29-9.12)	10.2 (9.74-10.7)	11.8 (11.2-12.3)	12.9 (12.3-13.5)	14.3 (13.6-15.1)	15.4 (14.6-16.2)	16.4 (15.6-17.3)	17.4 (16.5-18.4)	18.7 (17.7-19.8)	19.7 (18.6-20.8)
45-day	11.0 (10.5-11.5)	12.8 (12.3-13.4)	14.5 (13.9-15.1)	15.7 (15.0-16.4)	17.2 (16.5-18.0)	18.4 (17.6-19.2)	19.5 (18.6-20.4)	20.5 (19.5-21.5)	21.8 (20.7-22.9)	22.8 (21.6-23.9)
60-day	13.0 (12.5-13.6)	15.2 (14.6-15.8)	17.0 (16.3-17.7)	18.4 (17.6-19.2)	20.1 (19.3-21.0)	21.4 (20.5-22.3)	22.6 (21.6-23.6)	23.8 (22.7-24.9)	25.3 (24.1-26.4)	26.4 (25.1-27.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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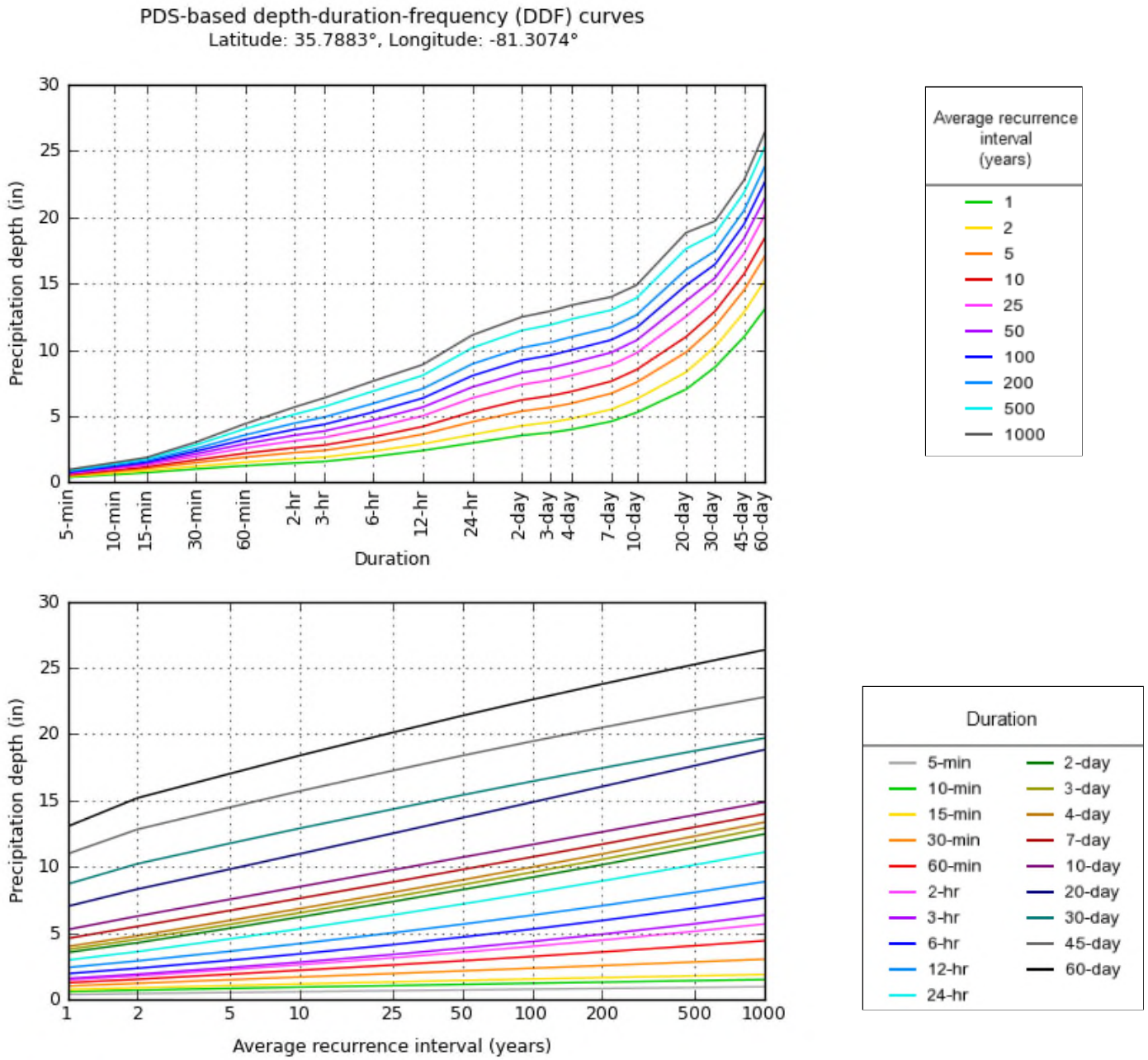
PF graphical



NOAA Atlas 14, Volume 2, Version 3 Created (GMT): Fri Dec 18 03:04:25 2020

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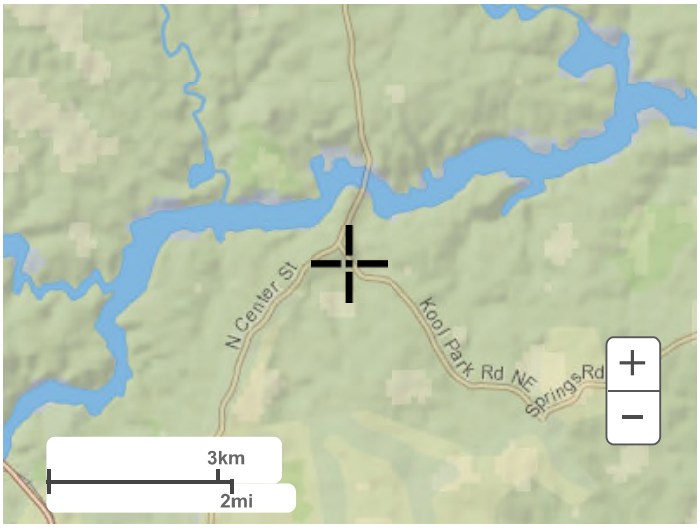
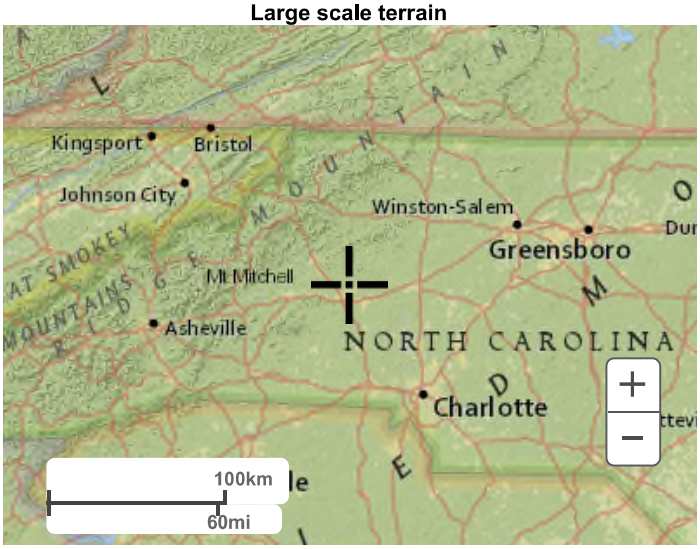
Maps & aerials

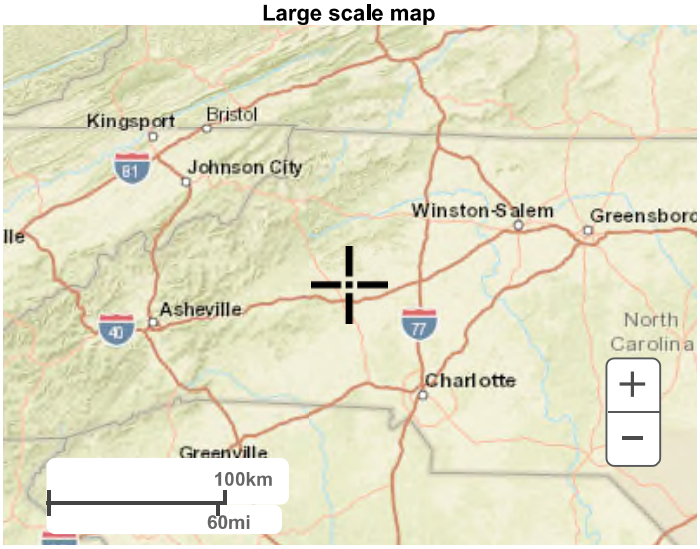
Small scale terrain



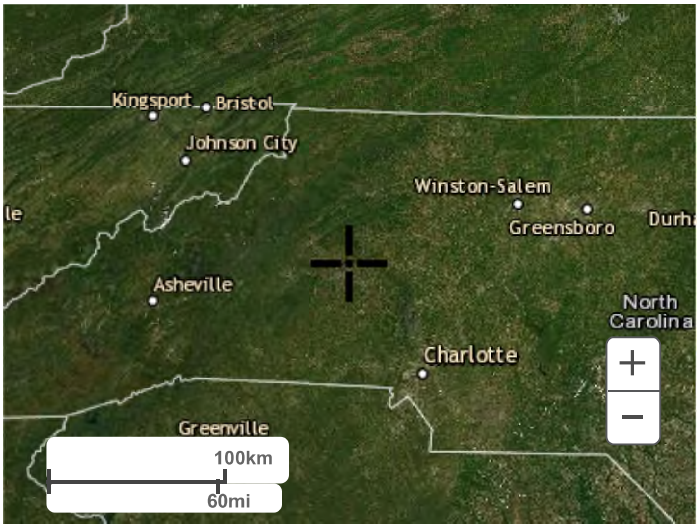
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix D

FEMA 2009 BCA Reference Guide – Project Useful Life Table

APPENDIX D

Project Useful Life Summary

Project Type	Useful Life (years)		Comment
	Standard Value	Acceptable Limits (documentation required)	
Acquisition/Relocation			
All Structures	100	100	
Elevation			
Residential Building	30	30–50	
Non-Residential Building	25	25–50	
Public Building	50	50–100	
Historic Buildings	50	50–100	
Structural/Non-Structural Building Project			
Residential Building Retrofit	30	30	
Non-Residential Building Retrofit	25	25–50	
Public Building Retrofit	50	50–100	
Historic Building Retrofit	50	50–100	
Roof Diaphragm Retrofit	30	30	Roof hardening and roof clips
Tornado Safe Room – Residential	30	30	
Tornado Safe Room – Community	30	30–50	Retrofit or small community safe room ≤ 16 people (30 yr), New (50 yr)
Non-Structural Building Elements	30	30	Ceilings, electrical cabinets, generators, parapet walls, or chimneys
Non-Structural Major Equipment	15	15–30	Elevators, HVAC, sprinklers
Non-Structural Minor Equipment	5	5–20	Generic contents, racks, shelves
Infrastructure Projects			
Major Infrastructure (minor localized flood reduction projects)	50	35–100	
Concrete Infrastructure, Flood Walls, Roads, Bridges, Major Drainage System	50	35–50	
Culverts (concrete, PVC, CMP, HDPE, etc.)	30	25–50	Culvert **with** end treatment (i.e., wing walls, end sections, head walls, etc.)
	10	5–20	Culvert **without** end treatment (i.e., wing walls, end sections, head walls, etc.)
Pump Stations, Substations, Wastewater Systems, or Equipment Such as Generators	50	50	Structures
	5	5–30	Equipment
Hurricane Storm Shutters	15	15–30	Depends on type of storm shutter
Utility Mitigation Projects	50	50–100	Major (power lines, cable, hardening gas, water, sewer lines, etc.)
	5	5–30	Minor (backflow values, downspout disconnect, etc.)

Project Type	Useful Life (years)		Comment
	Standard Value	Acceptable Limits (documentation required)	
Miscellaneous Equipment Projects			
Equipment Purchases	2	2–10	Small, portable equipment (e.g., computer)
	30	5–30	Heavy equipment
Wildfire Mitigation Projects			
Defensible Space/Hazardous Fuels Reduction	4	2–4	Brush – Depends on drought conditions
Vegetation Management	1	1	Grass – Depends on geographic location and precipitation
	20	3–20	Forest canopy – Must be maintained every 3 years
Ignition-Resistant Construction	10	10–30	Depends on type of construction and materials used

Appendix E

Northeast Wastewater Treatment Facility Annual Wastewater Quality Report

The City of Hickory's Public Utilities Division is pleased to present you, our customers, with this year's Annual System Performance Report. This report is required by House Bill 1160, the Clean Water Act of 1999. The purpose of this report is to display the past year's wastewater treatment performance. The following data includes average concentrations discharged into streams and any events of permit noncompliance. The City of Hickory owns and operates three (3) wastewater treatment facilities and 501 miles of collection system lines. The Northeast Wastewater Treatment Facility and the Henry Fork Wastewater Treatment Facility are staffed 24 hours a day with state certified operators and the Hickory Wastewater Treatment Facility in the Town of Catawba is staffed with two state certified operators. These facilities and the collection system were designed and constructed to properly transport wastewater and then treat the wastewater to meet stringent discharge requirements. During the past year, our Facilities collected and treated 2.15 Billion gallons of wastewater. The effluent discharge from all plants is disinfected prior to entering the receiving streams. As this report indicates, we are committed to protecting our most valuable resources, water and people.

HICKORY
North Carolina
Life. Well Crafted.

ANNUAL WASTEWATER QUALITY REPORT

JULY 1, 2019 TO JUNE 30, 2020

Mission Statement: *To promote and protect the environment, health and natural resources of our customers through responsible stewardship in the treatment of wastewater returned to our streams and lakes.*

NORTHEAST WASTEWATER TREATMENT FACILITY

City of Hickory

Northeast Wastewater Treatment Facility

310 Cloninger Mill Road Hickory, NC 28601

NPDES Permit Number: NC0020401

Operator in Responsible Charge: Keith Rhyne, WWT-4

Telephone Number: (828) 322-5075

The Northeast Wastewater Treatment Facility is located at 310 Cloninger Mill Road, Hickory NC. It is a 6.0 MGD wastewater treatment system which accepts and treats wastewater from locations in Northern Hickory, portions of Eastern Caldwell County, and portions of Southern Alexander County.

The facility is an advanced secondary treatment process that utilizes Carrousel Oxidation Ditch Technology that's capable of removing BOD, nitrogen and phosphorus. The effluent is chlorinated to remove pathogenic bacteria that might be present and then dechlorinated to remove the residual chlorine left before it is discharged into the receiving stream. The Bio-solids residuals removed as part of the treatment process are transported to the Regional Compost Facility for processing into Class A-EQ compost.

PERMIT PARAMETERS	Limits			Actual Monthly Average July 1, 2019 to June 30, 2020											
	Monthly	Weekly	Daily	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
Flow (MGD)	6 MGD	-	-	2.6	2.5	2.4	2.7	2.6	3.2	3.3	4.4	2.9	3.0	3.6	3.3
BOD	30mg/l	45mg/l	-	4.1	3.7	3.4	4.2	4.9	12	3.9	6.2	4.3	3.2	4.0	5.4
NH3-N	6mg/l	18mg/l	-	0.24	0.11	0.02	0.03	0.08	0.01	0.12	0.13	0.08	1.4	0.19	0.67
TSS (solids)	30mg/l	45mg/l	-	7.6	5.8	3.5	7.1	4.6	14.8	5.8	5.9	7.1	5.6	4.7	8.3
Fecal Coliform	200/100ml	400/100ml	-	1.6	2.5	1.7	1.5	1.6	1.3	1.5	4.7	1.4	1.4	3.5	2.7
pH	-	-	6-9	6.4	6.4	6.6	6.5	6.5	6.5	6.5	6.4	6.6	6.6	6.4	6.3
Total Chlorine	-	-	28ug/l	0	0	0	0	0	0	0	0	0	0	0	
Toxicity	Quarterly Pass or Fail			PASS			PASS			PASS			PASS		

Noncompliance Violations				
Date	**Violation**	**Actual**	**Reason**	**Environmental Impact**
Jan. 2, 2020	Bypass	7,000 gal.	RAS manhole flooded due to pump malfunction	None
Feb. 6, 2020	Bypass	50,400 gal.	IPS flooded due to extensive rainfall	None

HENRY FORK WASTEWATER TREATMENT FACILITY

City of Hickory

NPDES Permit Number: NC0040797

Henry Fork Wastewater Treatment Facility — Operator in Responsible Charge: Robert Shaver, WWT-4

4014 River Road Hickory, NC 28602 — Telephone Number: (828) 294-0861

The Henry Fork Wastewater Treatment Facility is located at 4014 River Road, Hickory, NC. It is a 9.0 MGD Wastewater Treatment System which accepts and treats wastewater from locations in SE and SW Hickory, Hildebran, portions of Eastern Burke County, and Longview.

The facility is an advanced secondary treatment biological nutrient removal (BNR) system with oxic/anoxic stages of treatment. Chlorine gas disinfection and Sulfur Dioxide gas dechlorination are utilized. Cascade post aeration is also used. The facility is constructed as two treatment trains that can be operated independently of one another. The Bio-Solids residuals removed as part of the treatment process are transported to the Regional Composting Facility for processing into Class A-EQ compost.

Noncompliance Violations

Date	Violation	Environmental Impact
NONE	NONE	

Parameters	Monthly	Weekly	Daily	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
Flow (MGD)	9MGD	-	-	2.5	2.5	2.3	2.5	2.6	2.9	2.9	3.6	2.5	2.3	3.1	3.0
BOD Summer	19mg/l	28.5mg/l	-	3.85	3.9	3.3	3.6	-	-	-	-	-	3.7	3.8	4.2
BOD Winter	30mg/l	45mg/l	-	-	-	-	-	4.7	6.2	6.7	5.1	4.9	-	-	-
NH3 Summer	2.5mg/l	7.5mg/l	-	0.06	0.04	0.01	0.12	-	-	-	-	-	0.10	0.12	0.03
NH3 Winter	6.2mg/l	18.6mg/l	-	-	-	-	-	0.07	0.03	5.5	0.09	0.04	-	-	-
TSS (solids)	30mg/l	45mg/l	-	5.6	4.7	3.7	5.0	6.4	8.1	11.3	7.2	6.0	5.8	4.5	4.8
DO	-	-	Over 5	7.7	7.7	7.8	8.2	9.1	9.7	9.8	10.1	9.8	9.1	9.1	8.1
Fecal Coliform	200/100ml	400/100ml	-	7.1	4.8	3.3	3.4	4.6	4.7	2.8	2.7	2.2	3.5	3.1	5.5
pH	-	-	6-9	6.5	6.6	6.8	6.7	6.8	6.8	6.9	6.7	6.7	6.7	6.8	6.7
Toxicity	Quarterly Pass or Fail			PASS			PASS			PASS			PASS		
Bis(2-ethylhexyl) phthalate Quarterly	28.5ug/l	-	28.5ug/l	0	0	0	0	0	0	0	0	0	0	0	0
Total Chlorine	-	-	28ug/l	0	0	0	0	0	0	0	0	0	0	0	0
Total Copper	27.06ug/l		34.65ug/l	11.5	20.7	9.1	8.6	13.5	5.9	7.0	6.7	4.5	11.9	9.9	8.6

CITY OF HICKORY-HICKORY COLLECTION SYSTEM

City of Hickory — NPDES Permit Number: WQCS00020

Hickory Collection System — Operator in Responsible Charge: Kevin Hutchison, CS-4

76 North Center St. Hickory, NC 28601 — Telephone Number: (828) 323-7427

The Hickory Collection System generally consists of 501 miles of utility lines; 479 miles of gravity sewers and 22 miles of pressurized or force mains. 50 Duplex pumping stations and 1 simplex pumping station ensure that service is available to the low points in the system. The Hickory Collection System serves the greater Hickory area and parts of Catawba County, parts of Burke County and the Bethlehem Community of Alexander County.

Reportable Collection System Failures			
Date	**Location**	**Spill**	**Cause**
Oct. 18, 2019	1200 7th St SW	19,700 gal.	Pipe Failure
Feb. 6, 2020	333 23rd Ave Pl NE	70,000 gal.	Severe Natural Conditions (Flooding)
Feb. 6, 2020	89 Wildlife Access Rd.	2,000 gal.	Severe Natural Conditions (Flooding)
Apr. 13, 2020	1845 9th St Ct NW	42,000 gal.	Power Outage
May 13, 2020	89 Wildlife Access Rd.	99,000 gal.	Construction Activities

Wastewater collection systems are designed to handle **only** three things – used water, human body waste and toilet paper. It is very important to keep all foreign materials, such as grease and other household debris from entering the system, as these can cause blockages. Most sewer backups occur between the house and the City's sewer main. The property owner is responsible for correcting this problem.

Many disinfecting wipes and baby wipes are touted as disposable, and some are even labeled as "flushable", but both contribute to sanitary sewer overflows (SSOs) throughout the sanitary sewer system. Their cloth-like material doesn't break down in the sanitary sewer system like toilet paper. Instead, they block sewer lines and clog pumps throughout the system, which increases maintenance and repair costs. Please help the city protect the environment and reduce costs by disposing of these items in the trash, not down the drain.

Property owners are responsible for the care and maintenance of service lines from their homes or businesses to the sanitary sewer mains in the street. The Hickory City Code also prohibits property owners from planting trees, shrubs and other vegetation on sewer lines and easements, covering manholes, erecting fences or permanent structures on sewer lines and easements, or damaging sewer lines in any manner.

Significant achievements by Collection System Staff for this year include;

- SSO rate of 0.009 per mile of collection system, or 1 spill for every 100.2 miles of collection system
- 100% of high priority sewers inspected at least once every 6 months or after large rain events of 1" or more
- Performed repairs or replaced 10 sewer creek crossings
- 51 creek crossings inspected and maintained

The City of Hickory is committed to protecting the quality of the Catawba River and the environment. The water returned to the Catawba River from the NPDES permitted wastewater treatment plants is higher quality water by most parameters than when it was removed for drinking water treatment from Lake Hickory.

While grease continues to be a significant concern, you can help the City of Hickory Public Services Department reduce the number of overflows by following these simple steps.

- Collect grease, fats and oils from cooking in a container and dispose of it in the garbage instead of pouring it down the drain.

- Place a wastebasket in each bathroom for the disposal of items such as disposable diapers, baby wipes, disinfecting wipes, condoms and personal hygiene products. These products **DO NOT** belong in the sewer system.
- Call Public Services at (828) 323-7427 to report sewer overflows. By promptly reporting the overflow, the City is able to minimize the impact of the overflow to the environment.
- Report illegal dumping by calling Public Services at (828) 323-7427. Grease and other materials illegally dumped can lead to sanitary sewer overflows (SSOs), which are a public health, environmental and regulatory concern.
- Do not flush old/outdated medication or prescription drugs down the toilet. Take medication to one of the area drop off locations for proper disposal.

MEDICATION DISPOSAL: Catawba County Law Enforcement Agencies, in partnership with Foothills Coalition Operation Pill Stoppers, provide drop boxes at their facilities throughout the County for safe and proper disposal of medications and prescription drugs. Drop Box Locations: Catawba County Sheriff's Office, Claremont, Conover, Hickory, Newton and Maiden Police Departments.

Here is a list of drop off locations:

- Catawba County Sheriff's Office 100 E. Government Drive Newton, NC 28658
- Terrell Satellite Office- Catawba Co Sheriff 8456 Sherrills Ford Road Sherrills Ford, NC 28673
- Claremont Police Department 3301 E. Main St. Claremont, NC 28610
- Catawba Police Department 107 S. Main St. Catawba, NC 28609
- Conover Police Department 115 2nd Ave. NE Conover, NC 28613
- Newton Police Department 411 N. Main Ave. Newton, NC 28658
- Hickory Police Department 347 2nd Ave. SW Hickory, NC 28602
- Maiden Police Department 201 W. Main St. Maiden, NC 28650
- Brookford Police Department 1700 S. Center St. Hickory, NC 28602
- Longview Police Department 2404 1st Ave. SW Hickory, NC 28602

HICKORY-CATAWBA WASTEWATER TREATMENT FACILITY

(TOWN OF CATAWBA)

City of Hickory

Hickory-Catawba Wastewater Treatment Facility

NPDES Permit Number: NC0025542

Operator in Responsible Charge: David Archambault, WWT-4

104 6th Avenue NW Catawba, NC 28609 Telephone Number: (828) 323-7427

The facility is a 1.5 MGD wastewater treatment system that accepts and treats wastewater from locations in the Town of Catawba and Southeast Catawba County.

The wastewater plant is an advanced secondary treatment process that utilizes oxidation ditch technology to treat wastewater. The effluent is chlorinated to remove pathogenic bacteria that might be present and then dechlorinated before it is discharged into the receiving stream. The Bio-solids residuals removed as part of the treatment process are transported to the Regional Compost Facility for processing into Class A-EQ compost.

Permit Parameters	Limits			Actual Monthly Average July 1, 2019 to June 30, 2020											
	Monthly	Weekly	Daily	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20
Flow (MGD)	**1.5 MGD**	-	-	**.06**	**.05**	**.05**	**.07**	**.08**	**.12**	**.13**	**.16**	**.08**	**.08**	**.13**	**.11**
BOD	10mg/l	15mg/l	-	**1.2**	**2.7**	**2.7**	**.71**	**1.8**	**.41**	**1.7**	**2.4**	**3.4**	**1.6**	**.48**	**1.4**
NH3-N	2mg/l	6mg/l	-	**0**	**0**	**0**	**0**	**.16**	**2.0**	**2.3**	**5.2**	**2.8**	**1.6**	**0**	**0**
TSS (solids)	30mg/l	45mg/l	-	**.25**	**1.3**	**.84**	**.32**	**.53**	**0**	**.20**	**1.6**	**2.1**	**.21**	**0**	**.19**
DO			>6 mg/l	**6.5**	**6.6**	**6.8**	**6.9**	**8.1**	**8.9**	**7.9**	**8.8**	**8.3**	**8.3**	**8**	**7**
Fecal Coliform	**200/100ml**	**400/100ml**	-	**1.4**	**1.2**	**1.3**	**3.4**	**1**	**1.1**	**1.2**	**1.5**	**1**	**1**	**1**	**1.1**
pH	-	-	**6-9**	**6.9**	**7**	**6.9**	**6.9**	**6.7**	**6.9**	**6.9**	**6.7**	**6.9**	**6.8**	**6.8**	**6.8**
Total Chlorine	-	-	**28ug/l**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Toxicity	**Quarterly Pass or Fail**			**PASS**			**PASS**			**PASS**			**PASS**		

Noncompliance Violations				
Date	**Violation**	**Actual**	**Reason**	**Environmental Impact**
Jan. 2020	NH3	2.3 mg/l	Cold Weather	None
Feb. 2020	NH3	5.2 mg/l	Cold Weather	None
Mar. 2020	NH3	2.8 mg/l	Cold Weather	None
Mar. 25, 2020	Bypass	900 gal.	Pump station malfunction	None

CITY OF HICKORY-CATAWBA COLLECTION SYSTEM

City of Hickory NPDES Permit Number: WQCS00020

Catawba Collection System Operator in Responsible Charge: Kevin Hutchison, CS-4

The Catawba Collection System generally consists of 40 miles of utility lines; 19 miles of gravity sewers and 21 miles of pressurized or force mains. 14 Duplex pump stations ensure that service is available to the low points in the system. The Catawba Collection System serves the Town of Catawba and Southeastern Catawba County.

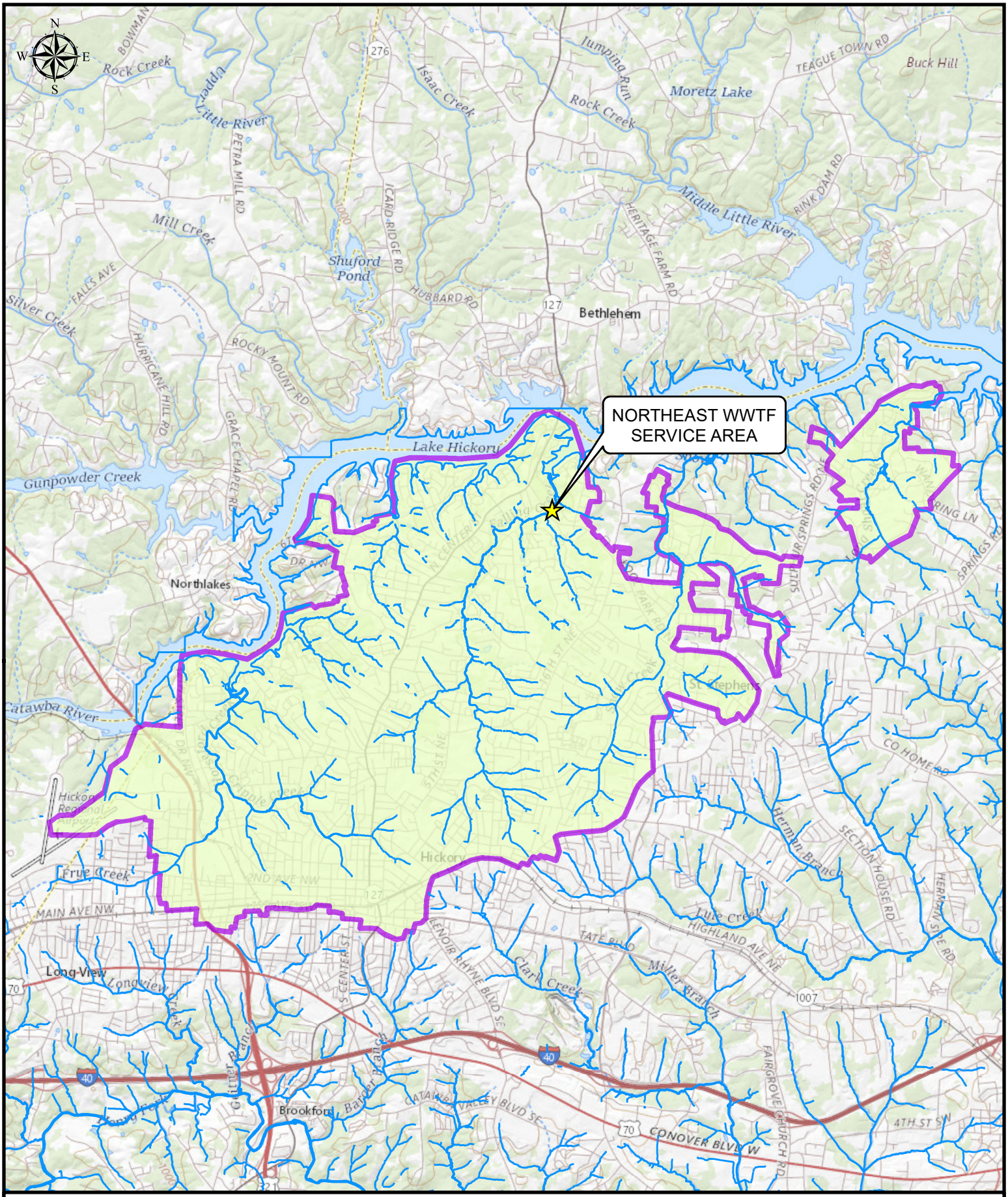
Reportable Collection System Failures			
Date	**Location**	**Spill**	**Cause**
NONE			

In the preceding tables you will find many terms and abbreviations you might not be familiar with. To help you better understand these terms we have provided the following definitions:

- **mg/L** – Milligrams per liter or parts per million
- **ug/L** – Micrograms per liter or parts per billion
- **DO** – Dissolved Oxygen. DO is the molecular (atmospheric) oxygen dissolved in water or wastewater.
- **BOD** – The rate at which organisms use the oxygen in wastewater while stabilizing decomposable organic matter under aerobic conditions. In decomposition, organic matter serves as food for the bacteria and energy results from its oxidation. BOD measurements are used as a measure of the organic strength of wastes in water.
- **TSS** – Total suspended residue in wastewater
- **MGD** – Million gallons per day
- **NH3 as N** – Ammonia
- **Fecal Coliform** – Indicator organisms used to measure the effectiveness of the disinfection process
- **Summer Months** – April 1st to October 31st
- **Winter Months** – November 1st to March 31st

Appendix F

Northeast Wastewater Treatment Facility Service Area Map



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A KCI COMPANY
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SERVICE AREA
NORTHEAST WWTF
CITY OF HICKORY, NORTH CAROLINA

Appendix G

US Census Bureau 2010 Population per Square Mile – Hickory, NC

QuickFacts

Hickory city, North Carolina; United States

QuickFacts provides statistics for all states and counties, and for cities and towns with a ***population of 5,000 or more.***

Table

PEOPLE		
Population		
Population estimates, July 1, 2019, (V2019)	**41,171**	**328,239,523**
Population estimates base, April 1, 2010, (V2019)	40,035	308,758,105
Population, percent change - April 1, 2010 (estimates base) to July 1, 2019, (V2019)	2.8%	6.3%
Population, Census, April 1, 2010	40,010	308,745,538
Age and Sex		
Persons under 5 years, percent	⚠ 5.2%	⚠ 6.0%
Persons under 18 years, percent	⚠ 22.3%	⚠ 22.3%
Persons 65 years and over, percent	⚠ 16.9%	⚠ 16.5%
Female persons, percent	⚠ 52.7%	⚠ 50.8%
Race and Hispanic Origin		
White alone, percent	⚠ 71.1%	⚠ 76.3%
Black or African American alone, percent (a)	⚠ 12.6%	⚠ 13.4%
American Indian and Alaska Native alone, percent (a)	⚠ 0.0%	⚠ 1.3%
Asian alone, percent (a)	⚠ 5.1%	⚠ 5.9%
Native Hawaiian and Other Pacific Islander alone, percent (a)	⚠ 0.0%	⚠ 0.2%
Two or More Races, percent	⚠ 2.8%	⚠ 2.8%
Hispanic or Latino, percent (b)	⚠ 12.8%	⚠ 18.5%
White alone, not Hispanic or Latino, percent	⚠ 67.0%	⚠ 60.1%
Population Characteristics		
Veterans, 2015-2019	2,485	18,230,322
Foreign born persons, percent, 2015-2019	9.0%	13.6%
Housing		
Housing units, July 1, 2019, (V2019)	X	139,684,244
Owner-occupied housing unit rate, 2015-2019	54.8%	64.0%
Median value of owner-occupied housing units, 2015-2019	$168,600	$217,500
Median selected monthly owner costs -with a mortgage, 2015-2019	$1,188	$1,595
Median selected monthly owner costs -without a mortgage, 2015-2019	$424	$500
Median gross rent, 2015-2019	$734	$1,062
Building permits, 2019	X	1,386,048
Families & Living Arrangements		
Households, 2015-2019	16,690	120,756,048
Persons per household, 2015-2019	2.35	2.62
Living in same house 1 year ago, percent of persons age 1 year+, 2015-2019	82.7%	85.8%
Language other than English spoken at home, percent of persons age 5 years+, 2015-2019	16.1%	21.6%
Computer and Internet Use		
Households with a computer, percent, 2015-2019	87.7%	90.3%
Households with a broadband Internet subscription, percent, 2015-2019	82.0%	82.7%
Education		
High school graduate or higher, percent of persons age 25 years+, 2015-2019	88.1%	88.0%
Bachelor's degree or higher, percent of persons age 25 years+, 2015-2019	33.3%	32.1%
Health		
With a disability, under age 65 years, percent, 2015-2019	9.1%	8.6%
Persons without health insurance, under age 65 years, percent	⚠ 14.7%	⚠ 9.5%
Economy		
In civilian labor force, total, percent of population age 16 years+, 2015-2019	62.1%	63.0%
In civilian labor force, female, percent of population age 16 years+, 2015-2019	54.1%	58.3%

Total accommodation and food services sales, 2012 ($1,000) (c)	210,443	08,138,598
Total health care and social assistance receipts/revenue, 2012 ($1,000) (c)	D	2, 40,441,303
Total manufacturers shipments, 2012 ($1,000) (c)		
Total merchant wholesaler sales, 2012 ($1,000) (c)	3,196,134	5,208,023,478
Total retail sales, 2012 ($1,000) (c)	1,934,170	4,219,821,871
Total retail sales per capita, 2012 (c)	$48,242	$13,443
Transportation		
Mean travel time to work (minutes), workers age 16 years+, 2015-2019	19.6	26.9
Income & Poverty		
Median household income (in 2019 dollars), 2015-2019	$47,652	$62,843
Per capita income in past 12 months (in 2019 dollars), 2015-2019	$29,727	$34,103
Persons in poverty, percent	⚠ 17.1%	⚠ 10.5%

BUSINESSES

Businesses		
Total employer establishments, 2018	X	7,912,405
Total employment, 2018	X	130,881,471
Total annual payroll, 2018 ($1,000)	X	7,097,310,272
Total employment, percent change, 2017-2018	X	1.8%
Total nonemployer establishments, 2018	X	26,485,532
All firms, 2012	5,415	27,626,360
Men-owned firms, 2012	3,152	14,844,597
Women-owned firms, 2012	1,402	9,878,397
Minority-owned firms, 2012	557	7,952,386
Nonminority-owned firms, 2012	4,425	18,987,918
Veteran-owned firms, 2012	433	2,521,682
Nonveteran-owned firms, 2012	4,470	24,070,685

GEOGRAPHY

Geography		
Population per square mile, 2010	1,346.8	87.4
Land area in square miles, 2010	29.71	3,531,905.43
FIPS Code	3731060	1

Appendix H

FEMA Supplemental Guidance for Conducting a Benefit Cost Analysis (BCA) for a Floodplain and Stream Restoration Project

Supplemental Guidance For Conducting a Benefit-Cost Analysis (BCA) for a Floodplain and Stream Restoration Project

1. Purpose

According to the FY2016 Pre-Disaster Mitigation (PDM) program Notice of Funding Opportunity (NOFO), Climate Resilient Mitigation Activities are eligible for PDM funding. The NOFO lists the Floodplain and Stream Restoration (FSR) project type as one of these eligible project types. Because the benefits that could be applicable to an FSR project have not yet been incorporated into the BCA Tool, this document was developed to assist users of FEMA's BCA Tool in performing a benefit cost analysis for an FSR project. The process for conducting a BCA may involve inputting data in existing data fields in the BCA Tool, using a FEMA-created spreadsheet, and/or calculating losses manually and then entering them into new loss category fields in the BCA Tool.

2. Floodplain and Stream Restoration Project Type

An FSR project is used primarily to reduce flood risk and erosion by providing stable reaches, but it also can be used to help mitigate drought. FSR projects typically encompass the restoration of the stream's active channel and streambanks, as well as the adjacent floodplain and riparian zones by deflecting, redirecting, or retarding flows. They restore the soil, hydrology and vegetation conditions in the project area and mimic the pre-development, or pre-alteration, natural channel/floodplain connectivity. FSR projects result in providing baseflow recharge, water supply augmentation, floodwater storage, water quality renovation, terrestrial and aquatic wildlife habitat, and recreation opportunities.

3. BCA Tool Modules Used to Conduct a BCA

The first step in completing a cost effectiveness analysis for an FSR project is to determine the type of damages and losses that would be mitigated by the proposed project. Then determine which module of the BCA Tool should be used to conduct the BCA.

- Use the **Flood Module** if all of the following conditions are met:
  - The proposed project will lower flood levels to existing, floodprone structures.
  - Structure-specific data are available, such as the square footage and first floor elevation for each structure.
  - A detailed study of the effectiveness of the proposed project has been completed, such as a hydrology and hydraulics ("H&H") study. Such a study will identify how much the proposed project would reduce the flood depths for each structure.

- Use the **Damage Frequency Assessment (DFA) Module** if the proposed project would result in mitigating any of the following categories of losses:

- Loss of function of public infrastructure (i.e., roads and bridges)
- Loss of function of utilities
- Loss of function of critical facilities, i.e., police stations, hospitals, or fire stations
- Agricultural and crop losses

It is possible to use **both** modules to analyze one project. The Flood Module would be used to assess the avoided damages to structures, and the DFA Module would be used to assess the avoided losses to public infrastructure, utilities, critical facilities, or crops.

Section 4 describes common data that will need to be inputted no matter which BCA Tool Module is used. Section 5 provides guidance on entering data used in the Flood Module, and Section 6 provides guidance on entering data used in the DFA Module.

4. Common Data Inputs

The following BCA Tool data are required to be entered no matter whether the Flood Module, DFA Module, or both modules are used to conduct an analysis:

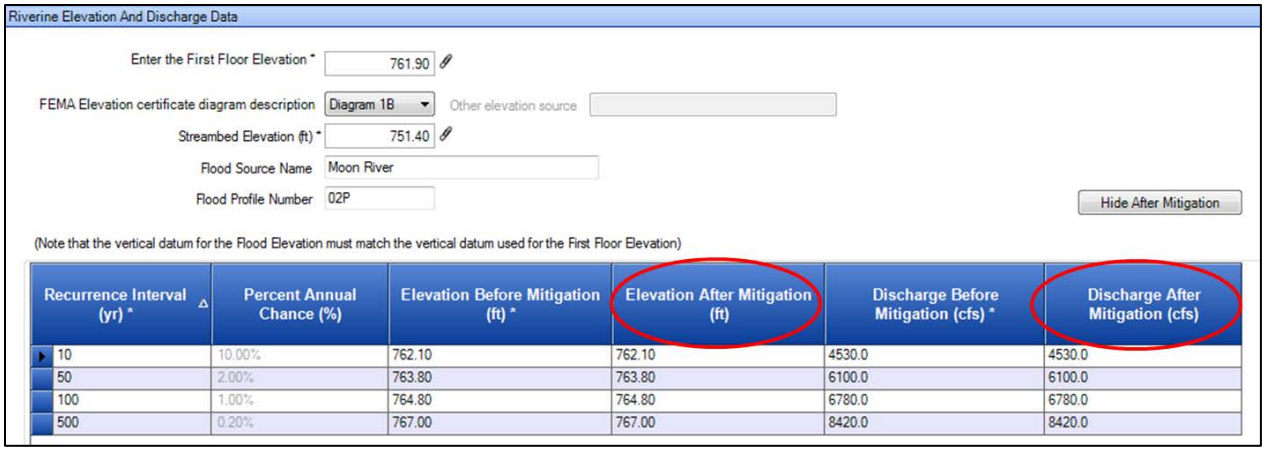
- **Project Useful Life**: The FEMA standard value for the project useful life of an FDS project is 30 years. If a user enters a different value, supporting documentation from an expert should be provided.
- **Mitigation Project Cost**: The project cost estimate must be developed by a licensed professional and must meet the same programmatic requirements as for any hazard mitigation project. For more information about the requirements developing a cost estimate, refer to Section H.4.3 (p. 64) of FEMA's FY15 *Hazard Mitigation Assistance Guidance*.
- **Annual Project Maintenance Cost**: Annual operation and maintenance costs generally range from 0.5% to 1% of the construction costs and can include labor costs (for system operation and maintenance, regulatory requirements, and administration) and material and equipment costs (e.g., fencing, trails, equipment, parts replacement, inlet/outlet controls, and scour protection). Like the project costs, these estimates must be developed and documented by a licensed professional.

5. Flood Module Data Inputs

The data required to be entered when using the Flood Module to conduct a BCA are associated with elevations and discharges before and after mitigation and data needed to calculate environmental/ecosystem benefits.

5.1 Elevations and Discharges After Mitigation

On the Riverine Elevation and Discharge Data screen, first select the "Show After Mitigation" button to change the data entry table. In the table associated with each structure (see screen capture below), enter the flood elevations after mitigation and the discharges after mitigation for each recurrence interval.


Riverine Elevation And Discharge Data

Enter the First Floor Elevation * 761.90

FEMA Elevation certificate diagram description Diagram 1B Other elevation source

Streambed Elevation (ft) * 751.40

Flood Source Name Moon River

Flood Profile Number 02P

Hide After Mitigation

(Note that the vertical datum for the Flood Elevation must match the vertical datum used for the First Floor Elevation)

Recurrence Interval (yr) *	Percent Annual Chance (%)	Elevation Before Mitigation (ft) *	Elevation After Mitigation (ft)	Discharge Before Mitigation (cfs) *	Discharge After Mitigation (cfs)
10	10.00%	762.10	762.10	4530.0	4530.0
50	2.00%	763.80	763.80	6100.0	6100.0
100	1.00%	764.80	764.80	6780.0	6780.0
500	0.20%	767.00	767.00	8420.0	8420.0

5.2 Benefit-Cost Ratio from Mitigation of Structures

Environmental benefits are applicable to any project that would create or restore wetlands, estuaries, riparian areas, or green open space. Current BCA policy (Section I.6, p. 66, of FEMA's FY15 *Hazard Mitigation Assistance Guidance*) states that a project must have a benefit cost ratio (BCR) ≥ 0.75 calculated from avoided damages/losses to structures before environmental benefits can be included. Therefore, after all structures have been analyzed, check to see if the project BCR is ≥ 0.75 on the Project Inventory screen. If the BCR is < 0.75, environmental benefits will not be added. (Note that even if the analysis below is conducted and submitted, FEMA will not approve the added benefits.) If the BCR ≥ 0.75, complete the analysis below to calculate the environmental benefits, add them to the existing benefits, and calculate a new BCR.

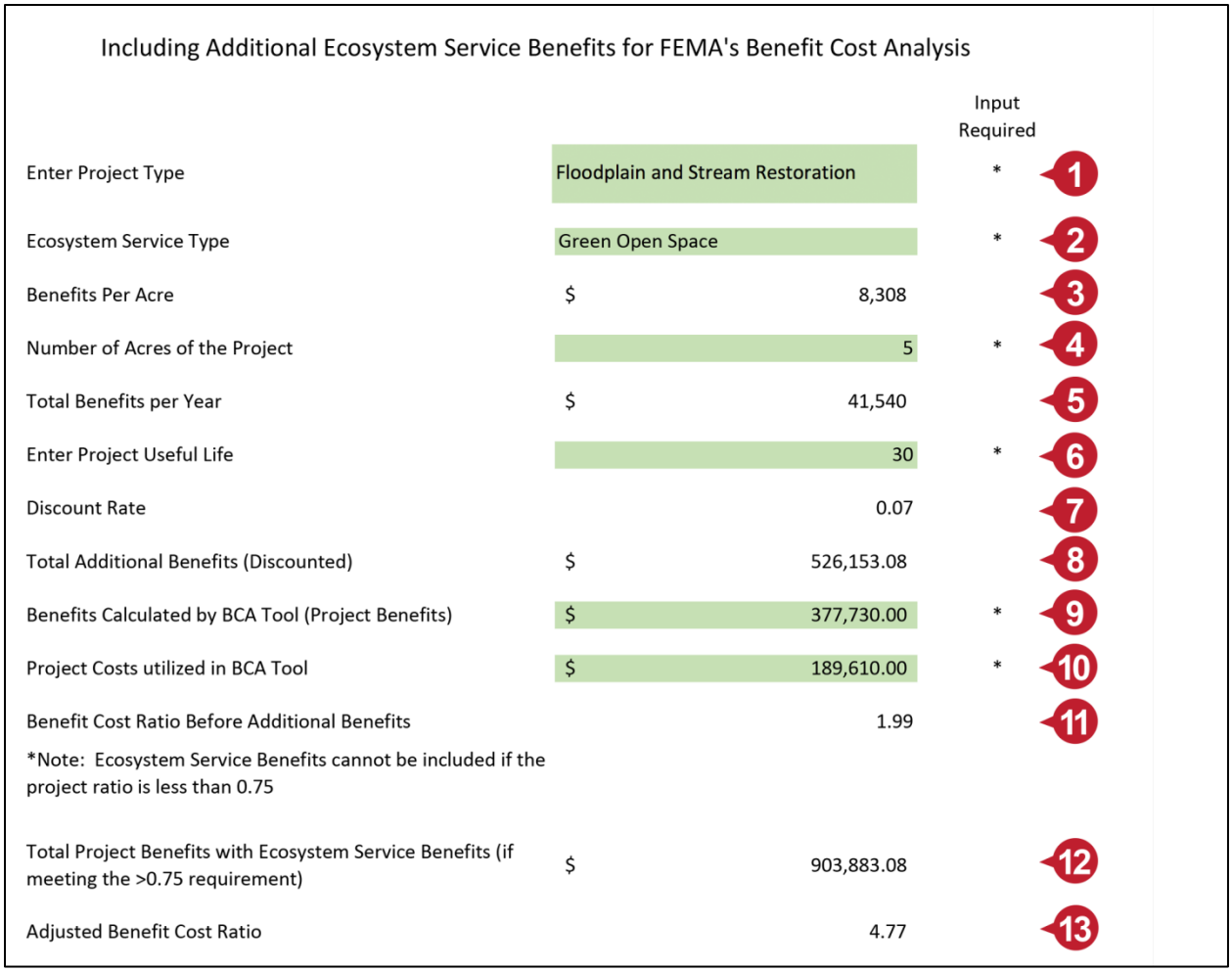
5.3 Environmental/Ecosystem Benefits

Because the new and updated environmental benefits have not yet been programmed into the BCA Tool, the Ecosystem Services Benefits Calculator spreadsheet was created to use as a workaround. Along with the exported Flood Module BCA, the completed spreadsheet is required to be submitted with the subapplication as cost effectiveness documentation.

The Ecosystem Services Benefits Calculator spreadsheet is available by contacting your FEMA Region or by calling the BC Helpline at 1-855-540-6744. The format of the spreadsheet is shown in the graphic below. There are thirteen data fields in the spreadsheet. An asterisk (*) is used to denote whether the user must input the data. The rest of the data fields are either pre-populated or calculated fields. For each numbered data field, an explanation is provided to aid in completing the spreadsheet.

#1. **Enter Project Type**. *Input required. Enter "Floodplain and Stream Restoration."

#2. **Ecosystem Service Type**. *Input required. By clicking in the shaded cell, a drop-down menu appears and offers the selections of Forest, Green Open Space, Marine, Estuary and Marine, Riparian, or Wetland. Select the ecosystem service type that matches the anticipated land use after the project is completed.



Including Additional Ecosystem Service Benefits for FEMA's Benefit Cost Analysis

			Input Required	
Enter Project Type	Floodplain and Stream Restoration		*	1
Ecosystem Service Type	Green Open Space		*	2
Benefits Per Acre	$	8,308		3
Number of Acres of the Project		5	*	4
Total Benefits per Year	$	41,540		5
Enter Project Useful Life		30	*	6
Discount Rate		0.07		7
Total Additional Benefits (Discounted)	$	526,153.08		8
Benefits Calculated by BCA Tool (Project Benefits)	$	377,730.00	*	9
Project Costs utilized in BCA Tool	$	189,610.00	*	10
Benefit Cost Ratio Before Additional Benefits		1.99		11
*Note: Ecosystem Service Benefits cannot be included if the project ratio is less than 0.75				
Total Project Benefits with Ecosystem Service Benefits (if meeting the >0.75 requirement)	$	903,883.08		12
Adjusted Benefit Cost Ratio		4.77		13

#3. **Benefits Per Acre**: This is the default economic value associated with the benefits per acre of land for the Ecosystem Service Type selected in #2. This value cannot be modified.

#4. **Number of Acres of the Project**: *Input required. From the design or other documentation included in the subapplication, enter the number of acres of restored ecosystem. Documentation should be included with the analysis to demonstrate that the project will result in improved and more functional ecosystem services.

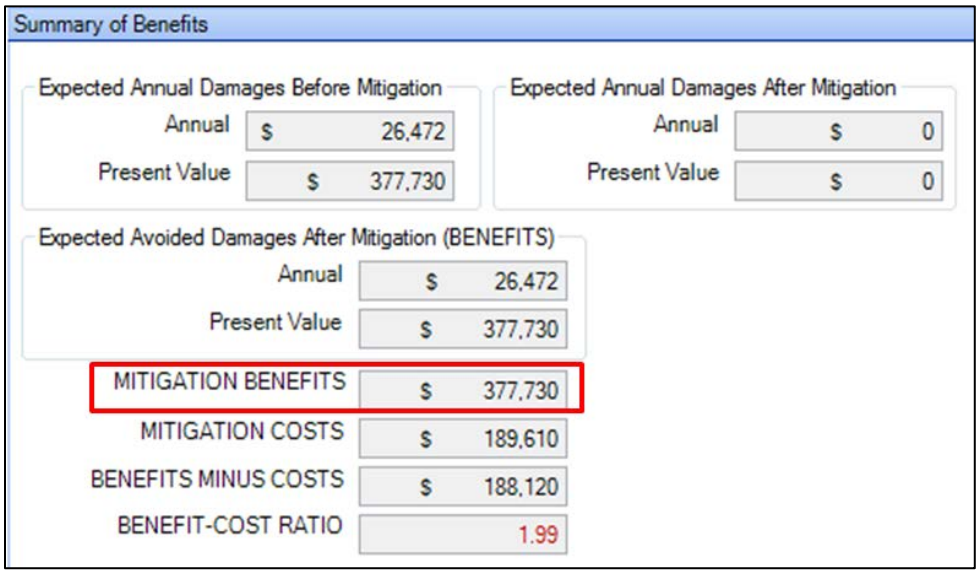
#5. **Total Benefits per Year**: This economic value is automatically calculated as Benefits Per Acre (#3) multiplied by Number of Acres of the Project (#4).

#6. **Enter Project Useful Life**: *Input required. The FEMA standard value for the useful life of an FDS project is 30 years. If a user enters a different value, supporting documentation from an expert should be provided. The value entered here in the spreadsheet should be the same value as entered in the BCA Tool as stated in Section 1.

#7. **Discount Rate**: A discount rate of 7%, or 0.07, is currently required by the Office of Management and Budget. This value cannot be modified.

#8. **Total Additional Benefits (Discounted)**: This economic value is automatically calculated using the Total Benefits per Year (#5), the Project Useful Life (#6), and applying the annual Discount Rate (#7).

#9. **Benefits Calculated by BCA Tool (Project Benefits)**: *Input required. This economic value is calculated by the Flood Module in the BCA Tool and must be transferred to the spreadsheet. On the Summary of Benefits screen (see screen capture below), the economic value for Mitigation Benefits are the Project Benefits for your project. Enter this value for #9.



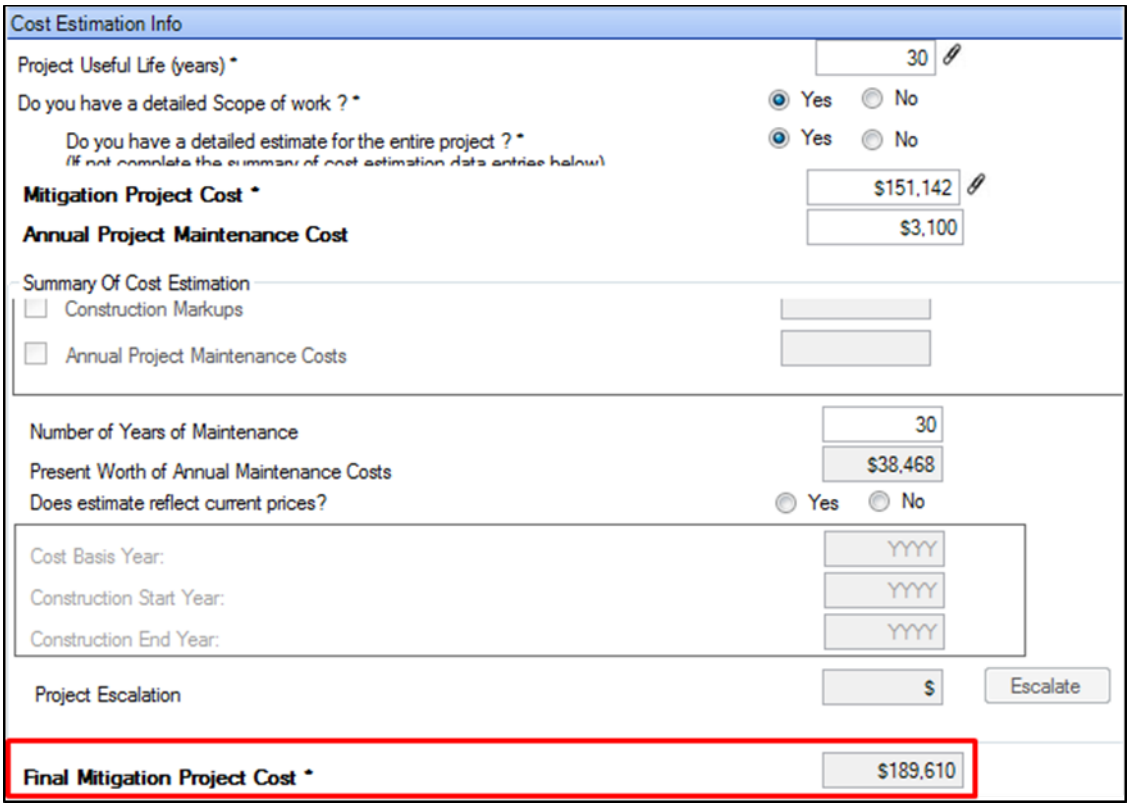
#10. **Project Costs utilized in BCA Tool**: *Input required. This value of Project Costs is the same as the value for Final Mitigation Project Cost found at the bottom of the Cost Estimation Info screen of the BCA Tool as shown in the screen capture below. Note that this value includes annual project maintenance costs.

#11. **Benefit Cost Ratio Before Additional Benefits**: This value for BCR is automatically calculated by dividing Benefits Calculated by BCA Tool (Project Benefits) (#9) by Project Costs utilized in BCA Tool (#10). This calculated value for BCR should be the same as the Benefit-Cost Ratio value calculated in the Flood Module and shown on the Summary of Benefits screen.

#12. **Total Project Benefits with Ecosystem Service Benefits**: If the BCR in #11 is ≥ 0.75, then this economic value is automatically calculated by adding the Total Additional Benefits (#8) and Benefits Calculated by BCA Tool (#9). This value becomes the new value for total project benefits. If the BCR in #11 is ≥ 0.75, then this value is equal to the value of Benefits Calculated by BCA Tool (Project Benefits) in #9, and the additional environmental benefits calculate in #8 are not included in the total.

#13. **Adjusted Benefit Cost Ratio**: This value is automatically calculated as the new project BCR. It is calculated by dividing the Total Project Benefits with Ecosystem Service Benefits (#12) by the Project Costs utilized in BCA Tool (#10).

If the Adjusted Benefit Cost Ratio (#13) is > 1, then export the Flood Module BCA, and submit both that BCA and the spreadsheet with the subapplication.



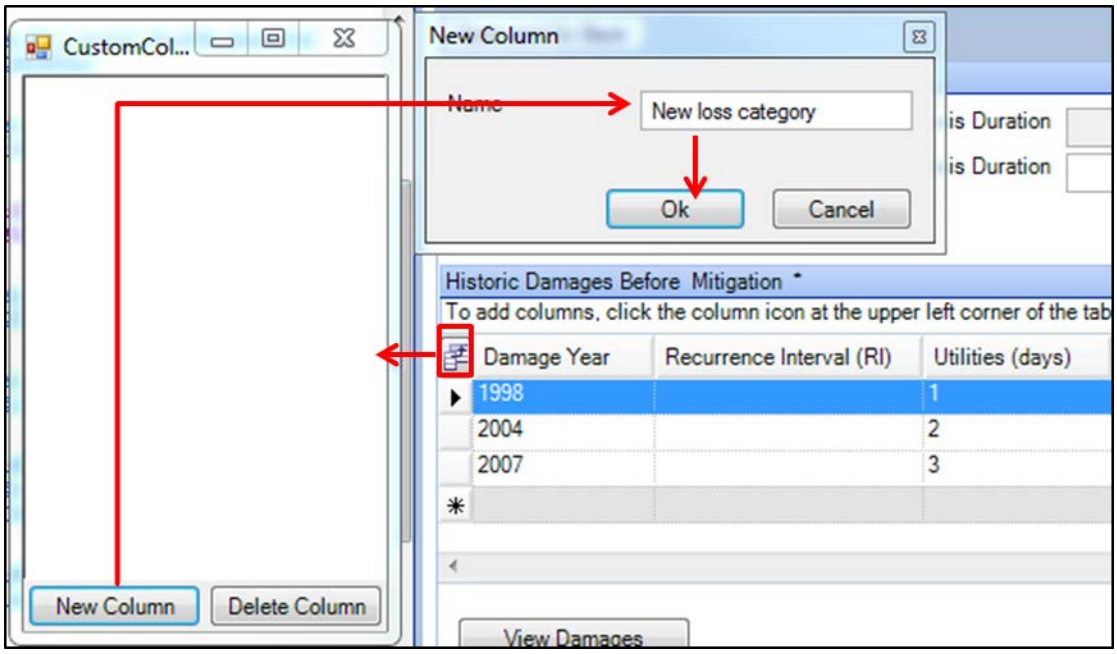
6. DFA Module

One of the following methods is used in the DFA Module as a basis for calculating cost effectiveness:

- **Historic Damages**, which requires information about the frequency (i.e., dates) and severity (i.e., the amount of damage and losses caused) of actual, past flood events.
- **Expected Damages**, which requires an analysis of how much damage and losses would be experienced in the future if flood events of a known frequency (i.e., recurrence interval) were to occur.

The applicable categories of losses/damages should be reflected on the Damages Before Mitigation screen table. The partial screen capture below shows how to add a loss/damage category to the Historic Damages Before Mitigation table. First, click the column icon in the top, left corner of the table. This will open a new window to the left of the table. Select the "New Column" button to create a new column titled "New loss category." Type the name of the loss category, click "OK," and the new column will be added to the Historic Damages Before Mitigation table. Repeat this process to add all applicable loss categories.

All categories that are entered into the Damages Before Mitigation table will be automatically displayed in the Damages After Mitigation table on the next screen, Damages After Mitigation. This enables the Tool to calculate the impact of the project on reducing losses.



6.1 Increased Embankment Stabilization

An FSR project would mitigate the erosion of embankments, which would potentially reduce structural damage to facilities in the vicinity of the project. Since damage has not occurred in the past, an Expected Damages assessment would be completed. As described above, a new loss category would be added to the Damages Before Mitigation table. To complete an Expected Damages assessment, a critical input is the length of time (in years) before the asset to be protected by the project (i.e., road/bridge, building, etc.) would be at risk due to erosion. This value could be provided by a licensed professional. Alternatively, the rate of erosion would need to be determined. One method for determining the rate of erosion is using historic aerial photographs or orthophotos to measure the annual rate of erosion. The erosion rate could then be projected forward to determine the length of time before the erosion would impact the asset. Subapplicants should recognize that the duration of time before damage to the asset would occur should be less than the Project Useful Life; otherwise, the BCA Tool will not calculate significant benefits. Regardless of how it is determined, this documented duration of time becomes the recurrence interval (RI), which should be entered in the Damages Before Mitigation table. A licensed professional would need to estimate the value of damage expected to occur to the asset for that RI before mitigation and estimating the value of damage expected to occur after mitigation for that same RI value. The damage values would be entered in the Damages Before Mitigation table and Damages After Mitigation table, respectively.

6.2 Reduced Agricultural/Crop Losses

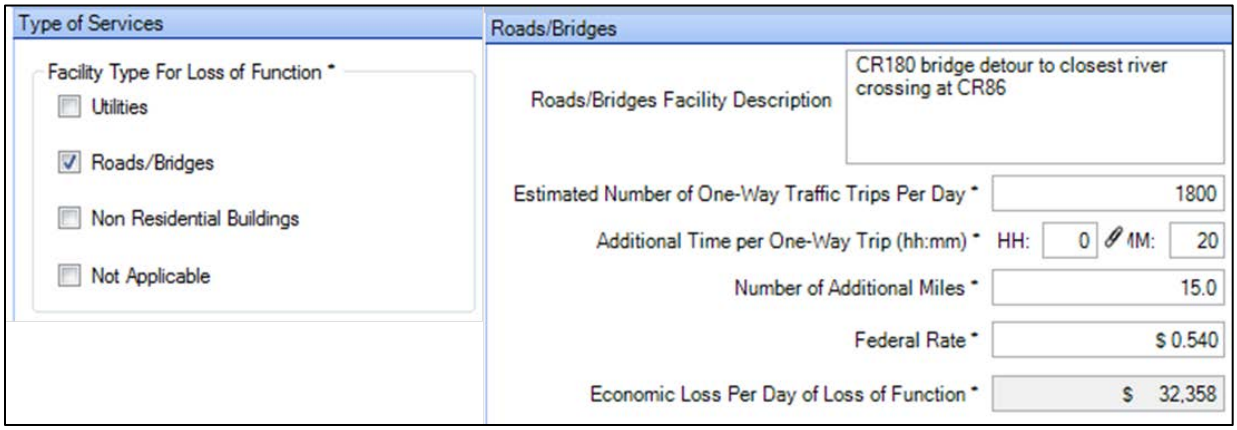
An FSR project may mitigate losses from crops. To estimate Historic Damages of crops, a farmer may be able to provide documented damage from past flood events, possibly from insurance payments. In the absence of documentation, an estimate of how much damage occurred due to past events could be completed by determining the number of acres impacted by an event and then documenting assumptions for the yield per acre and the market price for the crop grown. To estimate Expected Damages to crops, the same procedure could be followed, making sure that the documentation is included so a reviewer can determine whether the

calculations are accurate and the assumptions are reasonable. The same erosion forecasting technique described in Section 6.1 for Increased Embankment Stabilization could be used for estimating future agricultural/crop losses.

To enter the estimated damages in the BCA Tool, the user would add a new loss/damage category named "Crop Damage" (or similar descriptor) to the Historic Damages Before Mitigation table. Then the user would enter the documented value of crop damage for each historic event. In the Damages After Mitigation table, the user would enter the values of expected damages for each expected event.

6.3 Reduced Loss of Function of Roadways

An FSR project may mitigate the loss of function of roadways that are located within the project area through reduced water surface elevations. The loss of function parameters are entered on the Type of Services (left) portion of the screen (see screen capture below). For each roadway, select "Roads/Bridges" as the Facility Type for Loss of Function, and then enter the roadway description on the Roads/Bridges (right) portion of the screen. Enter the required parameters for the loss of function of that roadway: traffic count (one-way trips per day), the additional time of the detour, number of additional miles, and the current Federal mileage Rate (for 2016, the Internal Revenue Service has set this at $0.54 per mile).



The BCA Tool calculates the Economic Loss Per Day of Loss of Function and automatically carries that value over to the Damages Before Mitigation table. The user would enter the loss of function for a roadway in number of days that function is lost. In this example, the Tool would calculate the value of damages as $32,358 lost per day of loss of function multiplied by the number of days of loss of function. Similarly, to estimate expected Damages After Mitigation, the user would enter the number of days of loss of function for the roadway after mitigation. The same process should be followed for each Historic Damages event and each Expected Damages event.

6.4 Avoided Costs of Stormwater Conveyance and Treatment Infrastructure

If an FSR project would result in increased groundwater infiltration and, therefore, increased water supply, including drought resiliency, then the benefit category of Avoided Costs of Stormwater Conveyance and Treatment Infrastructure is eligible. Reducing stormwater runoff may help avoid investment in expensive stormwater systems. A standard economic value for

avoided costs of stormwater conveyance and treatment infrastructure is $101 per one million gallons of stormwater.

To enter avoided damages from stormwater conveyance and treatment infrastructure into the BCA Tool, the user must manually calculate the total economic value based on the project's design documentation and/or a relevant professional. For example, if the documentation demonstrates that a project would result in storing an additional three million gallons of stormwater, the benefit, or value of avoided damages, would be calculated as:

$$\text{Avoided Damages} = \frac{\$101}{1 \text{ million gallons stormwater}} \times 3 \text{ million gallons stormwater}$$

$$= \$303$$

This value would be entered in the Damages Before Mitigation table, either for every event in a Historic Damages assessment or for every recurrence interval in an Expected Damages assessment. A value of $0 should be entered for every recurrence interval in the Damages After Mitigation table.

6.5 Avoided Costs of Providing Alternative Drinking Water Sources

An FSR project would result in recharged water that becomes available for human consumption, and there would be a benefit, i.e., avoided costs, associated with not having to construct alternative water supplies because of compromised potable water supply. For drought mitigation, a standard economic value for the avoided cost of building infrastructure of alternative public drinking water supplies is $3,455 per one million gallons of water.

To enter avoided damages from building infrastructure of alternative public drinking water supplies into the BCA Tool, the user must manually calculate the total economic value based on the project's design documentation and/or a relevant professional. For example, if the documentation demonstrates that a project would result in not having to construct infrastructure to store three million gallons of alternative water supply, the benefit, or value of avoided damages, would be calculated as:

$$\text{Avoided Damages} = \frac{\$3{,}455}{1 \text{ million gallons water}} \times 3 \text{ million gallons water}$$

$$= \$10{,}365$$

This value would be entered in the Damages Before Mitigation table, either for every event in a Historic Damages assessment or for every recurrence interval in an Expected Damages assessment. A value of $0 should be entered for every recurrence interval in the Damages After Mitigation table.

6.6 Reduced Damages Associated with Subsidence

An FSR project may result in aquifer recharge and water table stabilization, which can help slow or lessen land subsidence, which, in turn, would potentially reduce structural damage to facilities in the vicinity of the project. There are currently no standard values in the BCA Tool for this

type of benefit. If a subapplicant wishes to include this benefit, the subapplicant would need to quantify the benefits and provide proper documentation for inclusion in the BCA. The documentation must include information so a reviewer could determine whether the calculations are accurate and the assumptions are reasonable. For assistance with specific questions, users are encouraged to contact the BC Helpline.

As described for the other categories of avoided losses/damages, this loss category would be added to the Damages Before Mitigation table. Actual or calculated losses from past events would be entered in the Historic Damages Before Mitigation table, and the reduced values of losses reflecting the impact of the project would be entered in the Damages After Mitigation table.

6.7 Avoided Costs Associated with Loss of Business for Water-Dependent Sectors

An FSR project could result in a benefit of reducing the loss of business for businesses in water-dependent sectors. Examples of such benefits include reduced unemployment benefits or reduced losses of tax revenue from businesses. There are currently no standard values in the BCA Tool for this type of benefit. If a subapplicant wishes to include this benefit, the subapplicant would need to quantify the benefits and provide proper documentation for inclusion in the BCA. Per OMB Circular A-94, care should be taken to avoid the use of economic multipliers and to make sure any damage values are directly tied to the project. The documentation must include information so a reviewer could determine whether the calculations are accurate and the assumptions are reasonable.

As described for the other categories of avoided losses/damages, this loss category would be added to the Damages Before Mitigation table. Actual or calculated losses from past events would be entered in the Historic Damages Before Mitigation table, and the reduced values of losses reflecting the impact of the project would be entered in the Damages After Mitigation table.

6.8 Environmental/Ecosystem Benefits

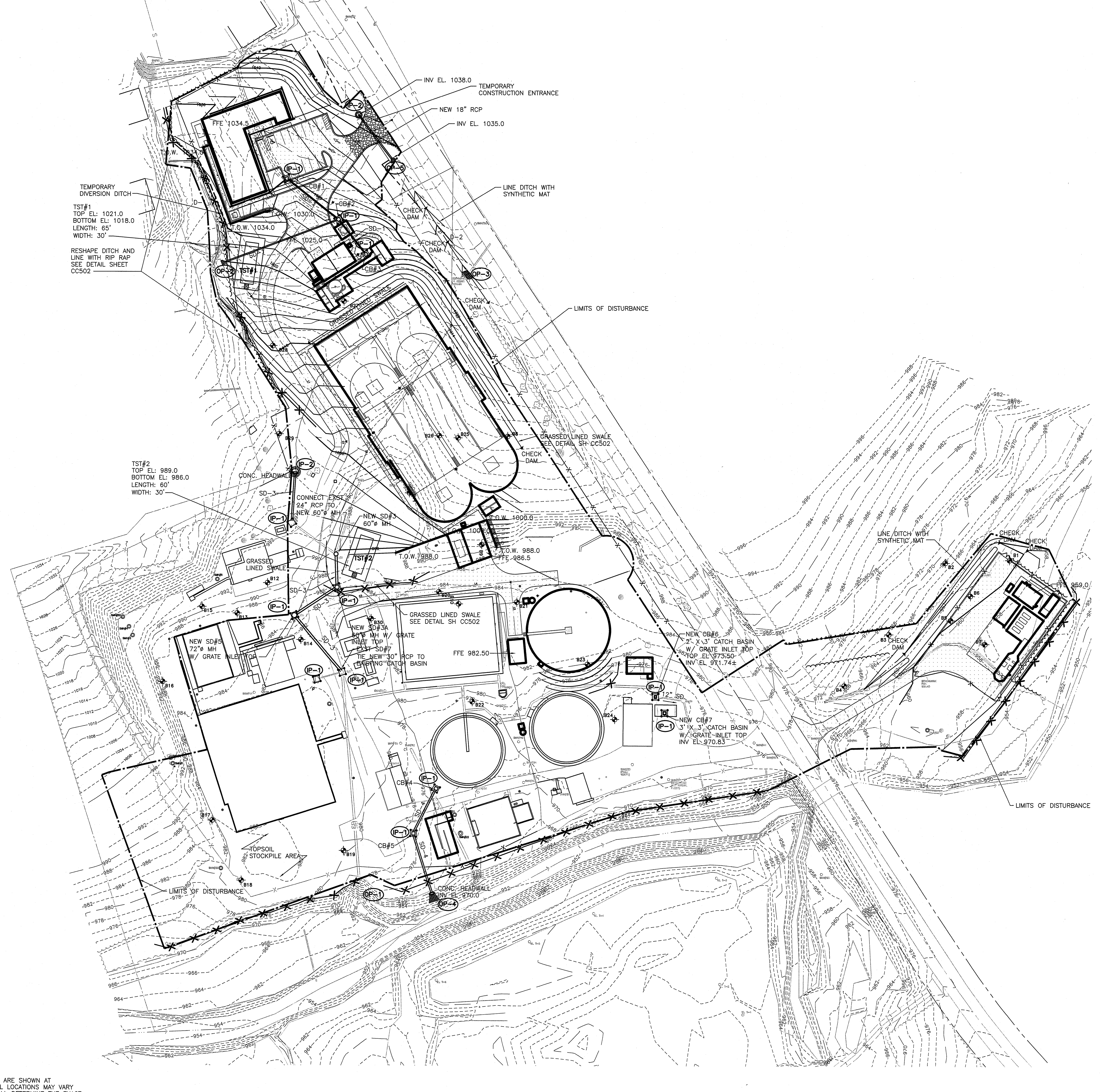
To calculate Environmental/Ecosystem Benefits using the DFA Module, follow the same process described in Section 5.1, Environmental/Ecosystem Benefits, for the Flood Module.
If project benefits are calculated using **both** the DFA Module and the Flood Module, then the benefits calculated by each module will need to be combined. The value of the Benefits Calculated by BCA Tool (Project Benefits) (#9 in spreadsheet) should be the sum of project benefits calculated by each module. An export of both the Flood Module analysis and the DFA Module analysis would be required as documentation for the reviewer to validate.

Appendix I

Northeast Wastewater Treatment Facility Site Plan Grading and Erosion Control Plan – 2009

NOTES THIS SHEET:

1. ALL CATCH BASINS SHALL BE 4'X4' WITH GRATED INLET TOPS UNLESS NOTED OTHERWISE.
2. SILT SACKS SHALL BE INSTALLED IN ALL CATCH BASIN INLETS. SEE DETAIL ON SHEET CC503.
3. STONE OUTLETS SHALL BE PLACED AT SILT FENCE LOW POINTS. SEE DETAIL ON SHEET CC503.
4. INLET PROTECTION SHALL BE PROVIDED FOR ALL INLETS LOCATED IN THE WORKING AREA AND SHALL BE MAINTAINED UNTIL THE SITE IS FULLY STABLIZED.
5. SILT FENCE SHALL BE PLACED JUST BELOW SOIL STOCKPILE AREAS.
6. DIVERSION DITCHES/BERMS MAY BE REQUIRED TO FULLY UTILIZE TST#2.



EXISTING UNDERGROUND UTILITIES ARE SHOWN AT APPROXIMATE LOCATIONS. ACTUAL LOCATIONS MAY VARY SIGNIFICANTLY. CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. CONTRACTOR AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES THAT RESULT FROM HIS FAILURE TO EXACTLY LOCATE AND PROTECT ANY AND ALL UNDERGROUND UTILITIES.

1"=50' — 50' 25' 0 50' 100'

GRAPHIC SCALES

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
0	3/30/10	SES	SES	ISSUED FOR BIDS AND CONSTRUCTION
B	03/17/10	SES	SES	FINAL DRAWING, NOT RELEASED FOR CONSTRUCTION
A	11/13/09	SES	SES	NCDENR ATC REVIEW SUBMITTAL

REVISIONS

AECOM
AECOM USA, INC.
10 PATEWOOD DRIVE, BUILDING VI
SUITE 500
GREENVILLE, SC 29615
(864) 234-3000
LICENSE NO. F-0552

NORTH CAROLINA PROFESSIONAL SEAL 032288 ENGINEER SCOTT E. SNYDER 3/17/10

NORTHEAST WASTEWATER TREATMENT PLANT IMPROVEMENTS
CITY OF HICKORY, NORTH CAROLINA

SITE PLAN GRADING, DRAINAGE AND EROSION CONTROL

PROJECT NO:	60102850
CAD DWG FILE:	CG101
DESIGNED BY:	KDS
DRAWN BY:	KDS
DEPT CHECK:	DSS
PROJ CHECK:	SES
DATE:	NOVEMBER, 2009
SCALE:	AS NOTED

CG101

SHEET 31 OF 2

Appendix J

Northeast Wastewater Treatment Facility Influent Pump Station As-Built

STRUCTURAL NOTES

ALL DETAILS AND NOTES ON S001 AND S002 ARE TYPICAL AND EXCLUSIVE FOR THE INFLUENT PUMP STATION (PB), OXIDATION DITCHES No. 1&2 (A1), CLARIFIER No. 3 (C3), CHLORINE CONTACT TANK (CC), SPLITTER BOX (S3) AND SLUDGE STORAGE IMPROVEMENTS (D1). INCORPORATE INTO PROJECT AT APPROPRIATE LOCATIONS WHERE CONDITIONS ARE SIMILAR.

DESIGN CRITERIA

1. NORTH CAROLINA BUILDING CODE, 2009.
2. ASCE 7-05 MINIMUM DESIGN LOADS FOR BUILDINGS. AND OTHER STRUCTURES.
3. AISC MANUAL OF STEEL CONSTRUCTION, ALLOWABLE STRESS DESIGN THIRTEENTH EDITION.
4. ACI 318-05, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, BY THE AMERICAN CONCRETE INSTITUTE.
5. ACI 350-06, CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES, BY THE AMERICAN CONCRETE INSTITUTE.

LOADINGS

1. FLOOR LIVE LOAD: INDICATED ON PLANS
2. ROOF LIVE LOAD: INDICATED ON PLANS
3. ROOF SNOW LOAD:
   - GROUND SNOW LOAD (Pg): 15 PSF
   - FLAT ROOF SNOW LOAD (Pf): 12 PSF
   - SNOW EXPOSURE FACTOR (Ce): 1.00
   - SNOW LOAD IMPORTANCE FACTOR (Is): 1.10
   - SNOW THERMAL FACTOR (Ct): 1.00
4. WIND LOAD:
   - BASIC WIND SPEED: 90 MPH (3 SECOND GUST)
   - WIND LOAD IMPORTANCE FACTOR (Iw): 1.15
   - OCCUPANCY CATEGORY: III
   - EXPOSURE CATEGORY: C
5. SEISMIC LOAD:
   - SEISMIC IMPORTANCE FACTOR (Ie): 1.25
   - OCCUPANCY CATEGORY: III
   - MAPPED SPECTRAL RESPONSE COEFFICIENTS
   - S(s): 0.282 S(1): 0.096
   - SPECTRAL RESPONSE COEFFICIENTS
   - S(Ds): 0.226 S(D1): 0.108
   - SITE CLASS: CLASS C
   - SEISMIC DESIGN CATEGORY: B

COORDINATION

1. ELEVATIONS ARE TO ACTUAL FINISH ELEV. SEE CIVIL DRAWINGS FOR FINISH GRADE ELEV.
2. SHORING REQUIRED FOR THE STABILITY OF THE UNCOMPLETED STRUCTURE OR FOR INSTALLATION OR MODIFICATION OF STRUCTURAL MEMBERS SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
3. SHORING AND RESHORING OF ELEVATED STRUCTURAL SLABS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
4. CONTRACTOR TO SUBMIT DOCUMENTS SHOWING METHOD OF SHORING TO THE ENGINEER FOR THE ENGINEER'S RECORDS.
5. CONTRACTOR TO VERIFY ALL EXISTING CONDITIONS, DIMENSIONS AND ELEVATIONS PRIOR TO START OF CONSTRUCTION. NOTIFY ENGINEER OF ANY DISCREPANCIES OR CONFLICTS FOUND IN CONTRACT DOCUMENTS AND/OR FIELD CONDITIONS. COORDINATE ALL REQUIRED OPENINGS WITH MECHANICAL, ELECTRICAL, AND PLUMBING CONTRACTORS.
6. COORDINATE FINAL SIZE AND LOCATION OF ALL OPENINGS WITH THE ACTUAL EQUIPMENT SUPPLIED, PROJECT REQUIREMENTS, AND WITH FIELD CONDITIONS.
7. THE ENGINEER OF RECORD PERMITS NO OPENINGS OR ALTERATIONS THROUGH BEAMS OR COLUMNS UNLESS DETAILED ON THE STRUCTURAL DRAWINGS OR APPROVED IN WRITING. SHOP DRAWINGS SHALL BE FURNISHED FOR REVIEW BEFORE ANY FABRICATION AND ERECTION IS STARTED. POORLY EXECUTED SHOP DRAWINGS SHALL BE REJECTED AND RESUBMITTED.
8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FOUNDATIONS UNDER MECHANICAL EQUIPMENT AND SHALL COORDINATE SIZE AND LOCATION OF FOUNDATIONS.

EXCAVATION AND EARTHWORK

1. REFERENCE GEOTECHNICAL REPORT, BY S&ME INC., DATED JANUARY 10, 2006 FOR SITE EXCAVATION, FILL, AND BACKFILL RECOMMENDATIONS.
2. REFER TO SPECIFICATIONS FOR ADDITIONAL SITE PREPARATION AND FOUNDATION SUPPORT REQUIREMENTS.
3. LOCATE ANY EXISTING UTILITY LINES AND OR APPURTENANCES AND ADVISE ENGINEER OF ANY CONFLICTS WITH NEW STRUCTURES PRIOR TO THEIR CONSTRUCTION. DO NOT DESTROY ANY EXISTING UNDERGROUND STRUCTURES WITHOUT WRITTEN AUTHORIZATION.

FASTENERS AND ANCHORAGE

1. ADHESIVE ANCHORING SYSTEM FOR CONCRETE AND GROUT FILLED CMU: USE HILTI "HIT-RE 500-SD" ADHESIVE ANCHORING SYSTEM WITH MINIMUM 3/4" DIAMETER, UON.
2. ADHESIVE ANCHORING SYSTEM FOR HOLLOW CMU: USE HILTI "HIT HY 20" ADHESIVE ANCHORING SYSTEM WITH MINIMUM 1/2" DIAMETER, UON.
3. EXPANSION BOLTS SHALL BE MINIMUM 3/4" DIAMETER, UON.

FOUNDATIONS

1. ALLOWABLE BEARING PRESSURE:
   - FOR WELL COMPACTED FILL: 2000 PSF
   - FOR PARTILLY WEATHERED ROCK: 4000 PSF
   - FOR EXSITING FILL: 2000 PSF
2. FOUNDATION PREPARATION:
   (A) BUILDING AREAS SHALL BE COMPLETELY STRIPPED OF VEGETATION, PAVEMENTS, WALLS, AND SOFT OR MUDDY AREAS.
   (B) FOUNDATIONS: FOUNDATIONS SHALL BE PLACED ON EXCAVATED SOILS. EXPOSED SUBGRADE SHALL BE SCARIFIED 6" AND COMPACTED TO A MINIMUM OF 98% OF MODIFIED PROCTOR DENSITY (ASTM D1557). AREAS OF LOOSE MATERIALS ENCOUNTERED WITHIN FOUNDATION EXCAVATIONS SHALL BE REMOVED AND RECOMPACTED TO 98% OF MODIFIED PROCTOR DENSITY.
   (C) ON GRADE CONCRETE FLOOR SLABS: FLOOR SLABS SHALL BE BASED ON NON-FROST SUSCEPTIBLE MATERIAL OVER COMPACTED SUBGRAGE.
3. BACKFILLS: BACKFILL SHALL COMPACTED TO AT LEAST 95% RELATIVE COMPACTION AND TESTED BY SOILS ENGINEER. SOILS SHALL BE THOROUGHLY MIXED WITHIN OPTIMUM MOISTURE (+2%)
4. SITE DRAINAGE:
   (A) POSITIVE SURFACE DRAINAGE AWAY FROM BOTH EXISTING STRUCTURES AND NEW FOUNDATION EXCAVATIONS SHALL BE PROVIDED DURING CONSTRUCTION.
   (B) CONTRACTOR SHALL BE RESPONSIBLE FOR DEWATERING.
5. DO NOT PLACE FOUNDATION CONCRETE IN WATER OR ON FROZEN OR DISTURBED GROUND.
6. PLACE EXTERIOR SLABS, PLATFORMS AND WALKS ON 12 INCHES OF NON-FROST SUSCEPTIBLE MATERIAL (SELECT BORROW, SCREENED GRAVEL OR CRUSHED STONE BACKFILL HAVING NOT MORE THAN 5% BY WEIGHT PASSING A NO. 200 SIEVE).
7. STRUCTURE BUOYANCY: STRUCTURES ARE DESIGNED TO BE NON-BUOYANT AFTER ALL COMPONENTS OF THE STRUCTURE ARE CONSTRUCTED AND BACKFILL IS IN PLACE. THE STRUCTURE MAY BE BUOYANT DURING CONSTRUCTION. CONTRACTOR SHALL PROTECT ALL STRUCTURES (NEW AND EXISTING) FROM FLOTATION DURING CONSTRUCTION REGARDLESS OF GROUNDWATER LEVELS.

CONCRETE AND REINFORCING

1. CAST-IN-PLACE CONCRETE (UNIT WT. = 150 PCF) f'c = 4500 PSI @ 28 DAYS (AIR ENTRAINED)
2. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615 GRADE 60.
3. ALL SPLICES SHALL BE CLASS B, TENSION LAPS UNLESS NOTED ON PLANS.
4. DO NOT WELD OR TACK WELD REINFORCING STEEL.
5. REINFORCING BARS SHALL HAVE MATCHING CORNER BARS.
6. BEAM TOP BARS THAT ARE NOTED AS "CONT" MAY BE SPLICED AT THE MID-SPAN ONLY.
7. BEAM BOTTOM BARS THAT ARE NOTED AS "CONT" MAY BE SPLICED AT SUPPORTS ONLY.
8. CONDUITS AND PIPES MAY BE EMBEDDED WITHIN A SLAB, WALL, OR BEAM ONLY IF CONSTRUCTED TO COMPLY WITH THE REQS OF SECTION 6.3 OR ACI 318-05, BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, PUBLISHED BY ACI.
9. HORIZONTAL JOINTS ARE NOT PERMITTED IN WALLS, EXCEPT WHERE SHOWN ON DRAWINGS. LOCATE VERTICAL JOINTS IN WALLS AT POINTS OF MINIMUM SHEAR AT APPROVED LOCATIONS.
10. CONST JTS SHOWN ON THE DWGS HAVE BEEN LAID OUT TO ENSURE PROPER STRUCTURAL PERFORMANCE AND STRUCTURAL SERVICEABILITY. THE CONTRACTOR MAY NEED TO ADD TO OR ALTER THE CONST JT LAYOUT TO ENABLE PROPER CONC FINISHING. SUBMIT FOR REVIEW THE LOCATION OF PROPOSED CONSTRUCTION JOINTS THAT ARE NOT SHOWN ON THE DRAWINGS.
11. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY LEAKS IN WATER BEARING STRUCTURES UTILIZING EPOXY INJECTION MATERIAL.

STRUCTURAL STEEL

1. MATERIALS SHALL CONFORM TO THE STANDARDS LISTED:
   - -W-SHAPES — ASTM A992
   - -SHAPES (EXCEPT W-SHAPES) AND PLATES — ASTM A36
   - -TUBES — ASTM A500, GRADE B
   - -STEEL PIPES — ASTM A53, GRADE B
   - -HEADED SHEAR STUDS — ASTM A108, GRADE B
   - -ANCHOR BOLTS — ASTM F1554 GALV
   - -STRUCTURAL BOLTS — ASTM A325
   - -NON-STRUCTURAL BOLTS — ASTM A307, GRADE A
2. BOLTED CONNECTIONS UNLESS NOTED OTHERWISE:
   - -STRUCTURAL: 3/4" DIAMETER MIN., TYPE N (TENSION CONTROL), 2 BOLTS MIN.
   - -ANCHOR BOLTS: 3/4" DIAMETER MIN,
   - -NON-STRUCTURAL: 5/8" DIAMETER, MIN.
3. ALL WELDING SHALL BE DONE BY CERTIFIED WELDERS AND SHALL BE IN ACCORDANCE WITH THE LATEST STANDARDS OF THE AWS AND AISC. INSPECT ALL WELDING IN ACCORDANCE WITH THE SPECIFICATIONS.
4. DO NOT PAINT STEEL TO BE ENCASED IN CONCRETE, CONTACT SURFACES OF FRICTION TYPE CONNECTIONS, AREAS WITHIN 2 INCHES OF FIELD WELDS, MACHINE FINISHED SURFACES AND TOP FLANGES OF BEAMS TO RECEIVE SHEAR STUD CONNECTORS.
5. DO NOT FIELD CUT OR ALTER STRUCTURAL MEMBERS WITHOUT ENGINEER'S ACCEPTANCE.
6. SPACE HEADED SHEAR STUDS EVENLY UNLESS OTHERWISE NOTED.
7. CAMBER BEAMS AS SHOWN ON THE DRAWINGS. PLACE NATURAL CAMBER OF BEAMS UPWARD.

CLEAR CONCRETE COVER FOR CAST-IN-PLACE CONCRETE OVER REINFORCEMENT (INCHES)

MEMBER	EXPOSURE CONDITIONS				
	AIR	WEATHER	AIR OVER LIQUID	EARTH OR STONE	LIQUIDS
FOOTINGS AND FOUNDATION MATS	2"*	2"*	–	2" * 3" ●	2"*
PILE CAPS ■	2"*	2"*	–	2" *	2"*
WALLS	2"	2"	2"	2"	2"
JOISTS, BEAM STIRRUPS AND COLUMN TIES	1 1/2"	2"	2"	2" * 3" ●	2"
FRAMED SLABS-EACH FACE	1"	2"	2"	2"▲	2"
SLABS ON GROUND	1"	2"	–	2"▲	2"

* TOP FACE AND SIDES

● BOTTOM FACE

▲ WHEN PLACED ON SAND-GRAVEL, WELL DRAINED COMPACTED FILL

■ BOTTOM COVER IS INDICATED ON DRAWINGS

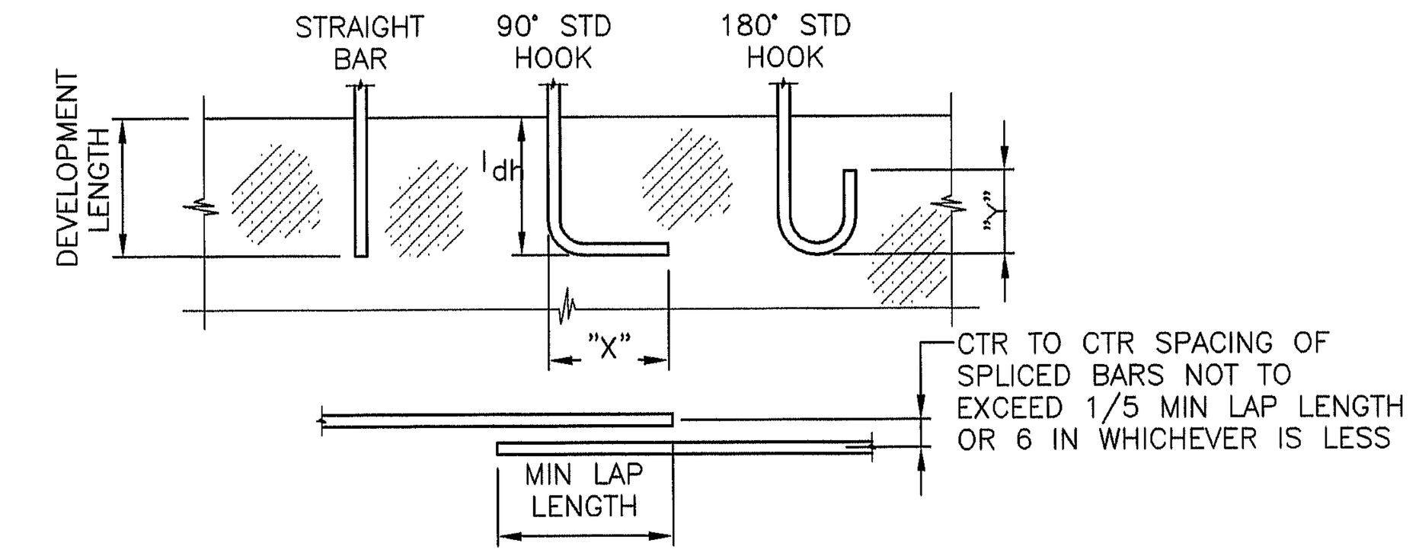
CONCRETE COVER FOR CAST-IN-PLACE CONCRETE OVER REINFORCEMENT

NO SCALE

STRUCTURAL ABBREVIATIONS AND SYMBOLS

AL	ALUMINUM
ACI	AMERICAN CONCRETE INSTITUTE
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AISI	AMERICAN IRON AND STEEL INSTITUTE
ASTM	AMERICAN SOCIETY OF TESTING MATERIALS
AWS	AMERICAN WELDING SOCIETY
B/	BOTTOM OF
BLDG	BUILDING
BOT	BOTTOM
CLR	CLEAR/ CLEARANCE
COL	COLUMN
CONC	CONCRETE
CONT	CONTINUOUS
CMU	CONCRETE MASONRY UNIT
COORD	COORDINATE
CONST	CONSTRUCTION
CSJ	CONSTRUCTION JOINT
DIA	DIAMETER
DIM	DIMENSION
DWLS	DOWELS
DWG	DRAWING
DIAG	DIAGONAL
EA	EACH
EF	EACH FACE
EW	EACH WAY
EL, ELV	ELEVATION
EQ SP	EQUAL SPACING
EXP	EXPANSION
EXT	EXTERIOR
FNDN	FOUNDATION
FF	FINISH FLOOR
FTG	FOOTING
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
HORIZ	HORIZONTAL
HT	HEIGHT
INT	INTERIOR
IF	INSIDE FACE
JT	JOINT
KWY	KEYWAY
LOC	LOCATIONS
MFR	MANUFACTURER
MAX	MAXIMUM
MIN	MINUMUM
MISC	MISCELLANEOUS
MPH	MILES PER HOUR
NTS	NOT TO SCALE
NO	NUMBER
OC	ON CENTER
OPNG	OPENING
OF	OUTSIDE FACE
PCJ	PARTICAL CONTRACTION JOINT
PEN	PENETRATION
PVC	POLYVINYL CHLORIDE
PROJ	PROJECTION
REINF	REINFORCEMENT
REQ'D	REQUIRED
SCJ	SAW CUT JOINT
SCHED	SCHEDULE
SPECS	SPECIFICATIONS
SQ	SQUARE
SS	STAINLESS STEEL
STD	STANDARD
STL	STEEL
STRUCT	STRUCTURAL
SIM	SIMILAR
T&B	TOP AND BOTTOM
T/	TOP OF
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
VERT	VERTICAL
WWF	WELDED WIRE FABRIC
W/	WITH
@	AT
#	NUMBER
℄	CENTERLINE
ø	DIAMETER

BAR SIZE	DIAMETER (d_b) (INCHES)	DEVELOPMENT LENGTH (l_d)(INCHES) "TOP" BARS	DEVELOPMENT LENGTH OTHER	CLASS B LAP SPLICE (INCHES) "TOP" BARS	CLASS B LAP SPLICE OTHER	90° STD HOOK (INCHES) HOOK "X"	90° STD HOOK l_{dh}	180° STD HOOK "Y"
		REINFORCING BARS IN TENSION						
#3	0.375	18	14	24	18	6	6	6
#4	0.5	25	19	32	25	8	7	6
#5	0.625	31	24	40	31	10	9	6
#6	0.75	37	28	48	37	12	10	6
#7	0.875	54	42	70	54	14	12	7
#8	1.0	62	47	80	62	15	14	8
#9	1.125	70	54	90	70	17	15	9
#10	1.25	78	60	102	78	20	17	10.2
#11	1.375	87	67	113	87	22	19	11.3
#14	1.75	104	80	136	104	26	32	13.5
		REINFORCING BARS IN COMPRESSION						
#3	0.375	8		12		HOOKED BARS SHALL NOT BE USED IN COMPRESSION		
#4	0.5	9		15				
#5	0.625	12		19				
#6	0.75	14		23				
#7	0.875	17		26				
#8	1.0	19		30				
#9	1.125	21		34				
#10	1.25	24		38				
#11	1.375	27		42				
#14	1.75	32		51				

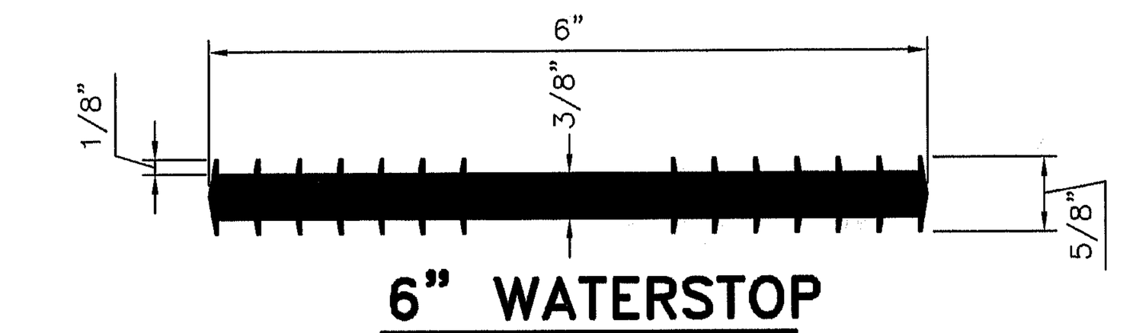


NOTES:

1. "TOP" BARS SHALL BE HORIZONTAL REINFORCEMENT PLACED SO THAT MORE THAN 12" OF FRESH CONCRETE IS CAST IN THE MEMBER BELOW THE DEVELOPMENT LENGTH OR SPLICE.
2. CLEAR SPACING OF BARS BEING DEVELOPED OR SPLICED SHALL A) NOT BE LESS THAN d_b, HAVE CLEAR COVER NOT LESS THAN d_b, AND STIRRUPS OR TIES THROUGHOUT l_d NOT LESS THAN THE CODE MINIMUM OR; B) CLEAR SPACING OF BARS BEING DEVELOPED OR SPLICED NOT LESS THAN $2d_b$ AND CLEAR COVER NOT LESS THAN d_b.
   WHERE d_b=DIAMETER OF REINFORCING BAR AND l_d=DEVELOPMENT LENGTH.
3. FOR SPECIAL SPLICE REQUIREMENTS FOR COLUMNS AND END BEARING SPLICES IN COMPRESSION SEE ACI 318 CHAPTER 12.
4. f'_c = 4500 psi

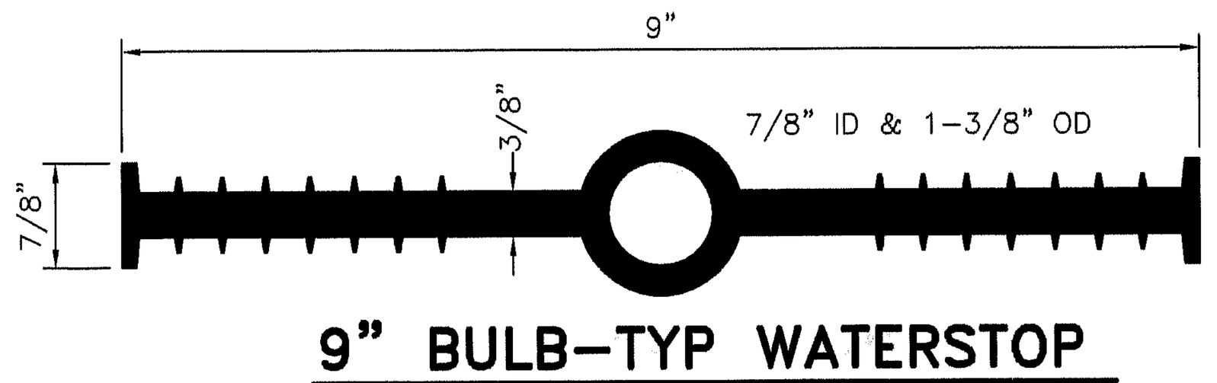
STANDARD HOOK AND REINF LAP SPLICE

NO SCALE



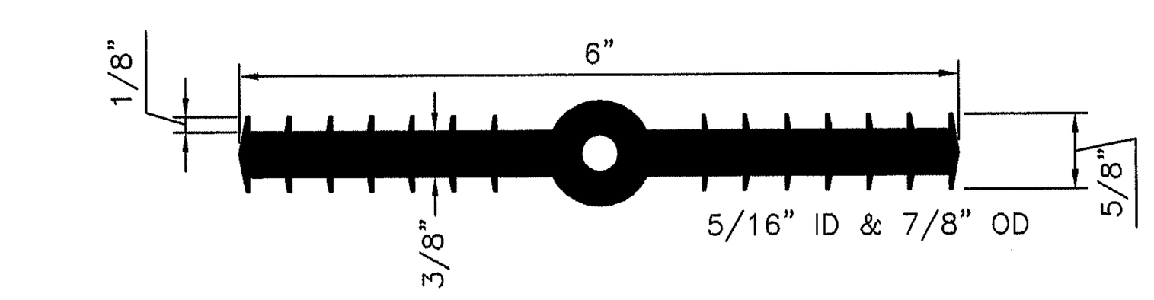
6" WATERSTOP

NO SCALE



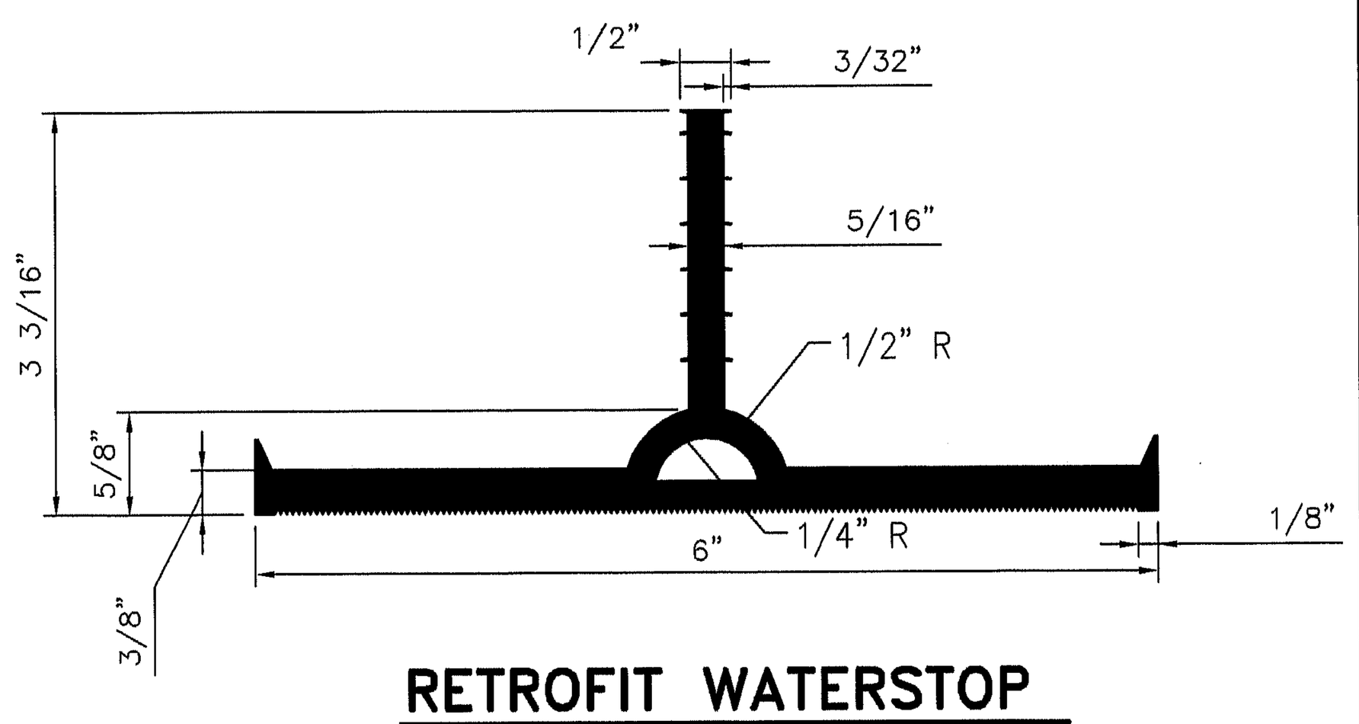
9" BULB-TYP WATERSTOP

NO SCALE



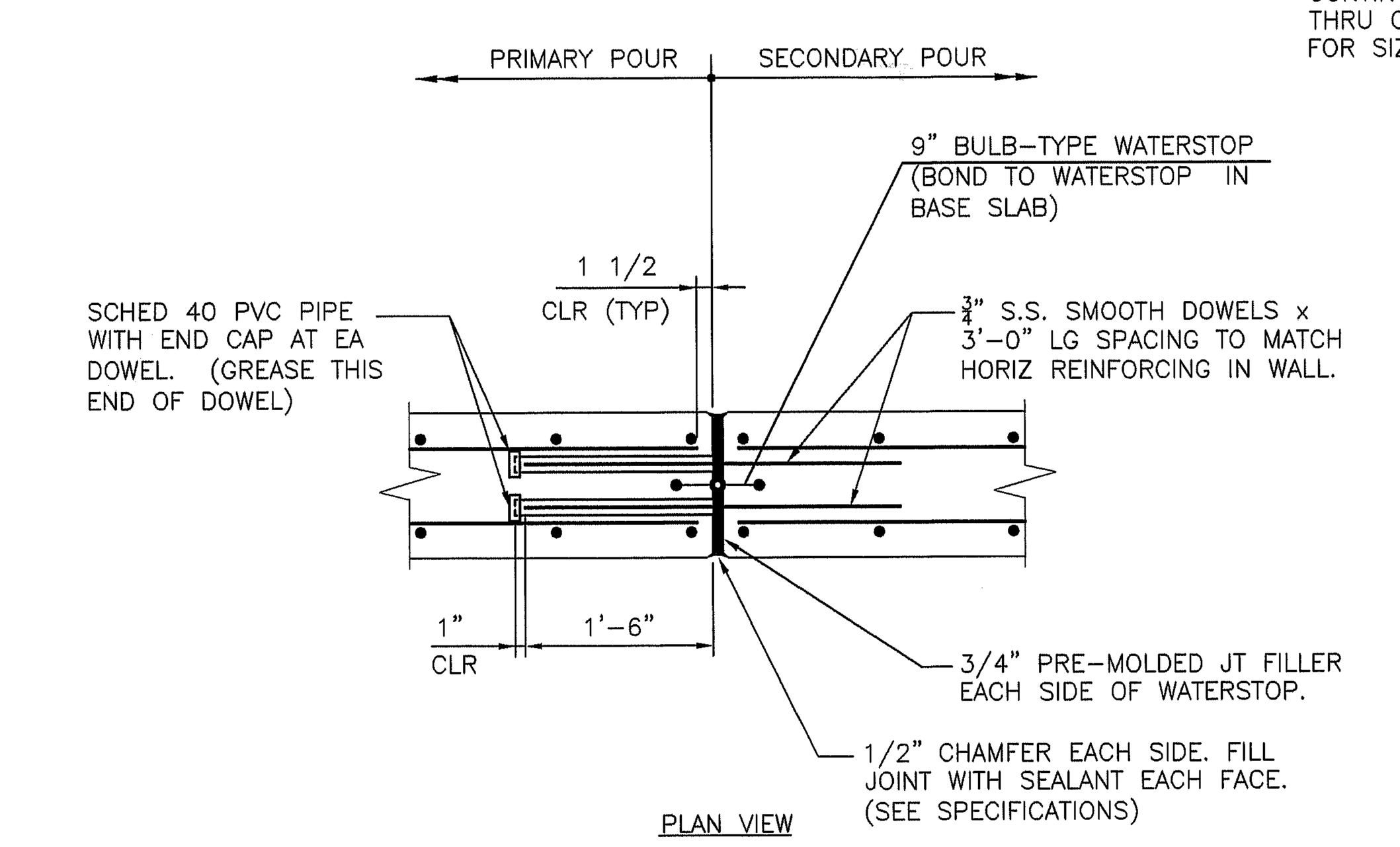
6" BULB-TYP WATERSTOP

NO SCALE



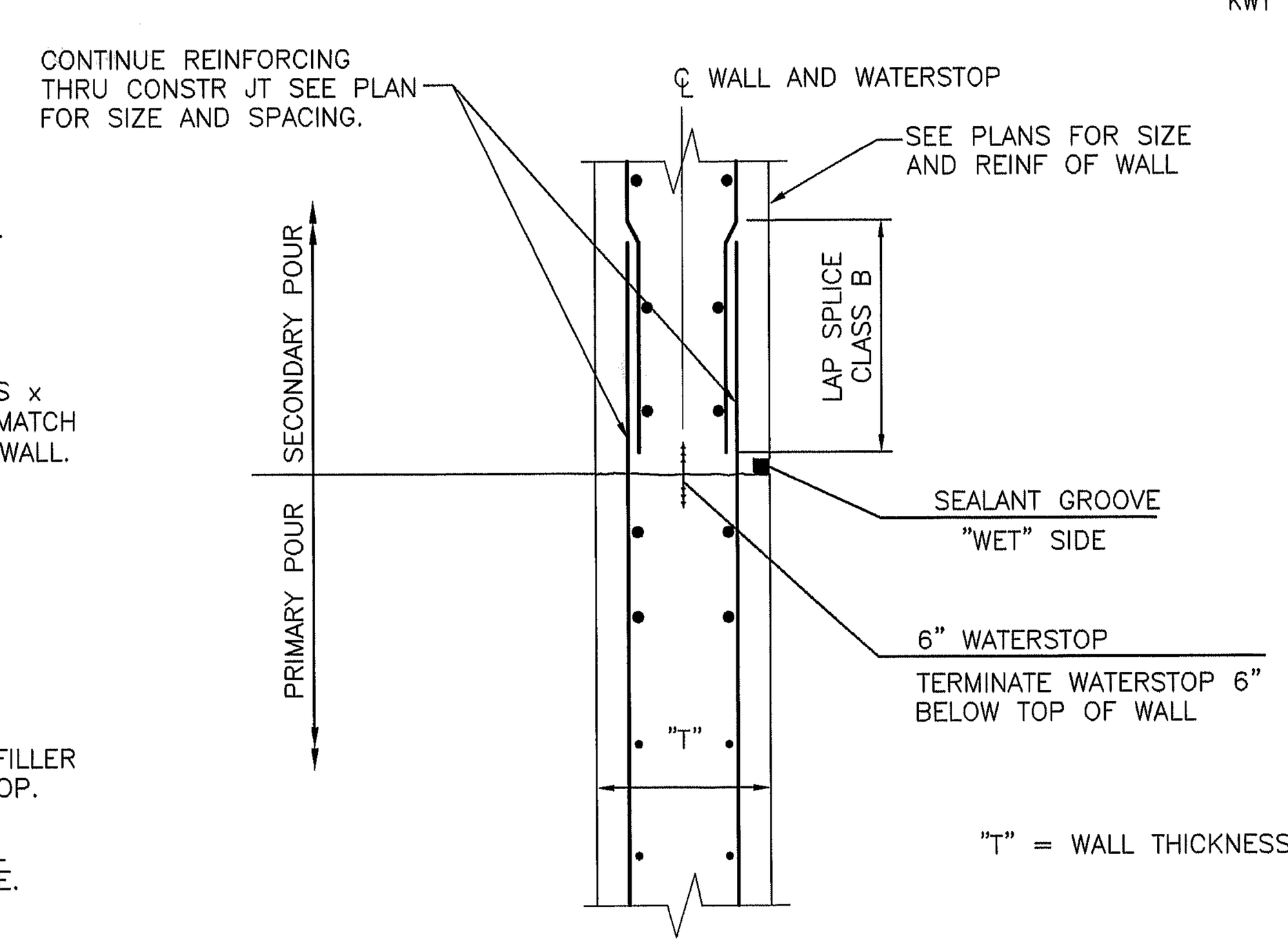
RETROFIT WATERSTOP

NO SCALE



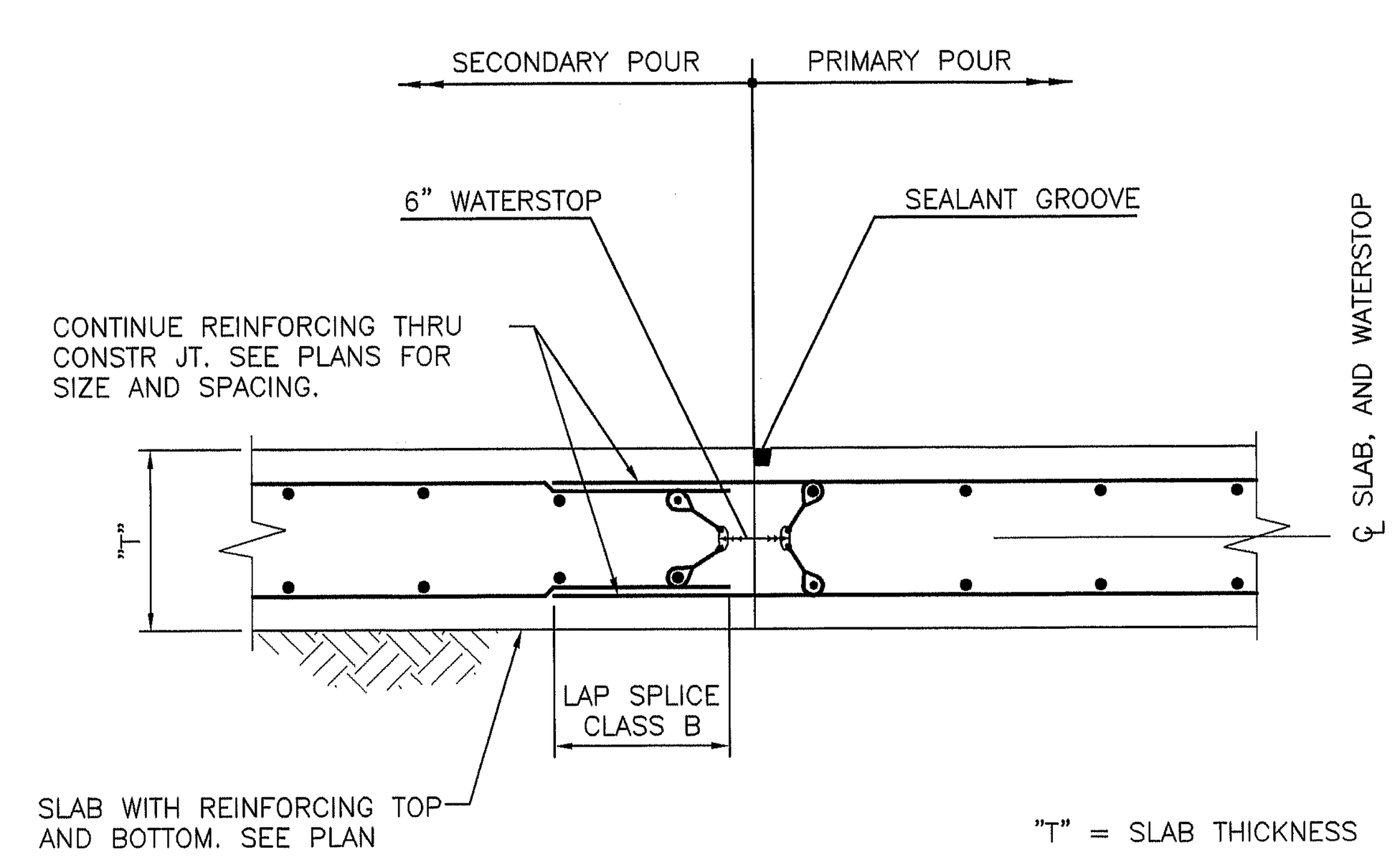
WALL EXPANSION JOINT

NO SCALE



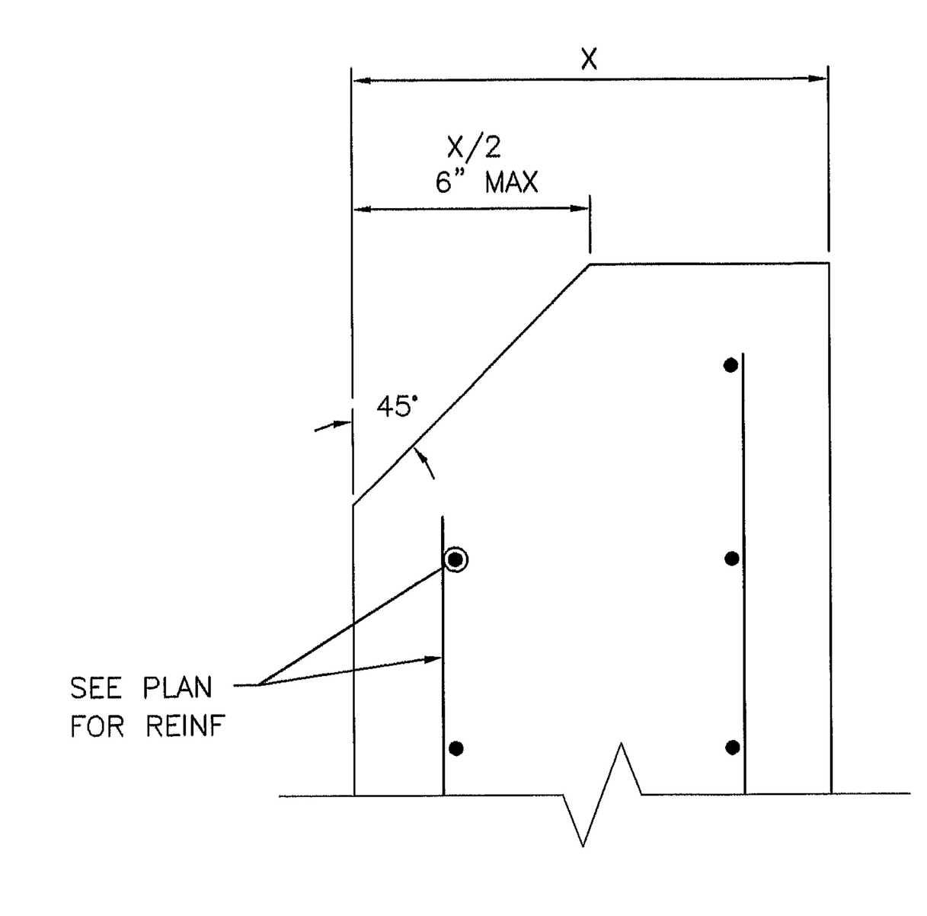
CONSTRUCTION JOINT WALL TO WALL (CSJ)

NO SCALE



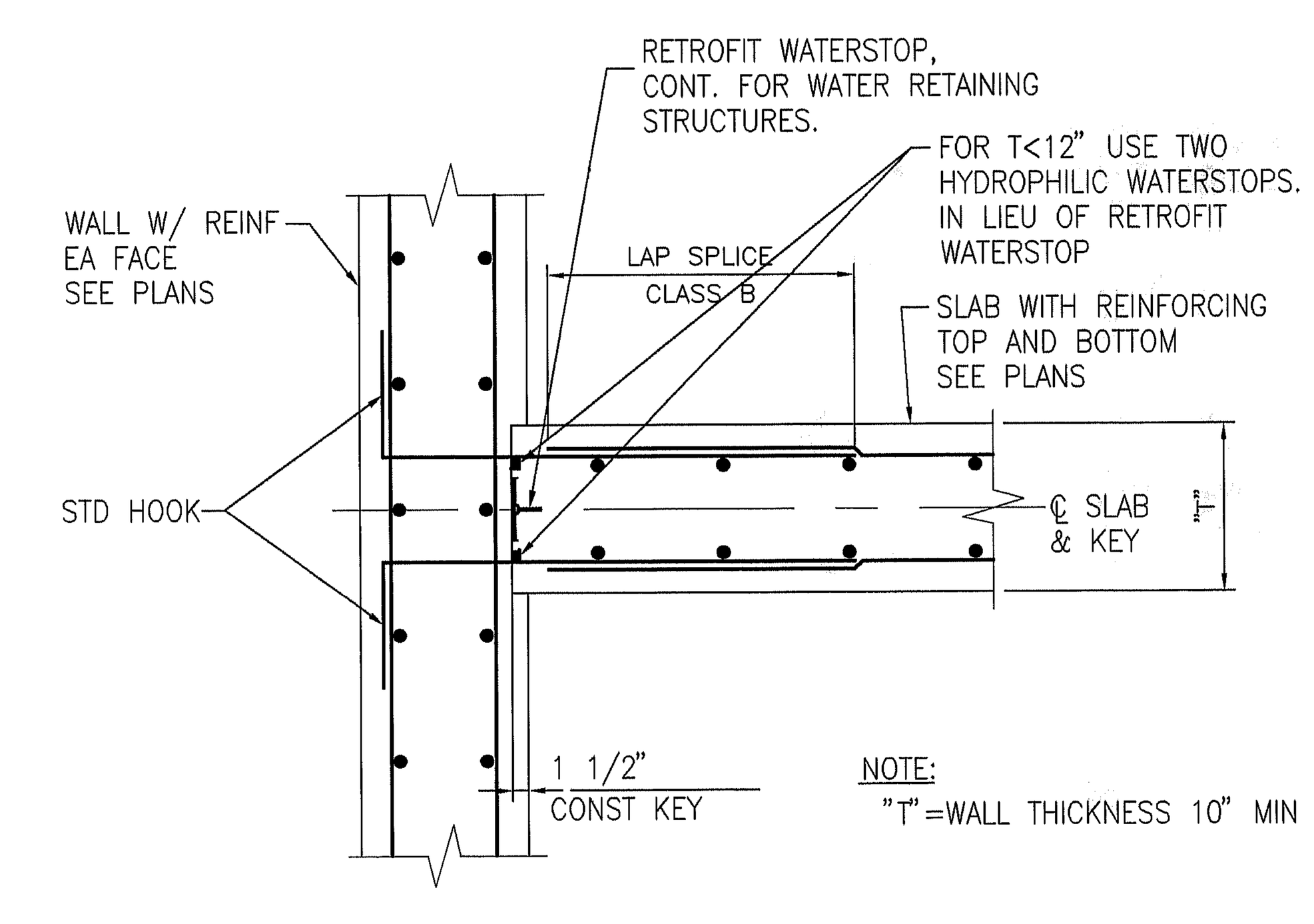
SLAB CONSTRUCTION JOINT (CSJ)

NO SCALE



WEIR WALL

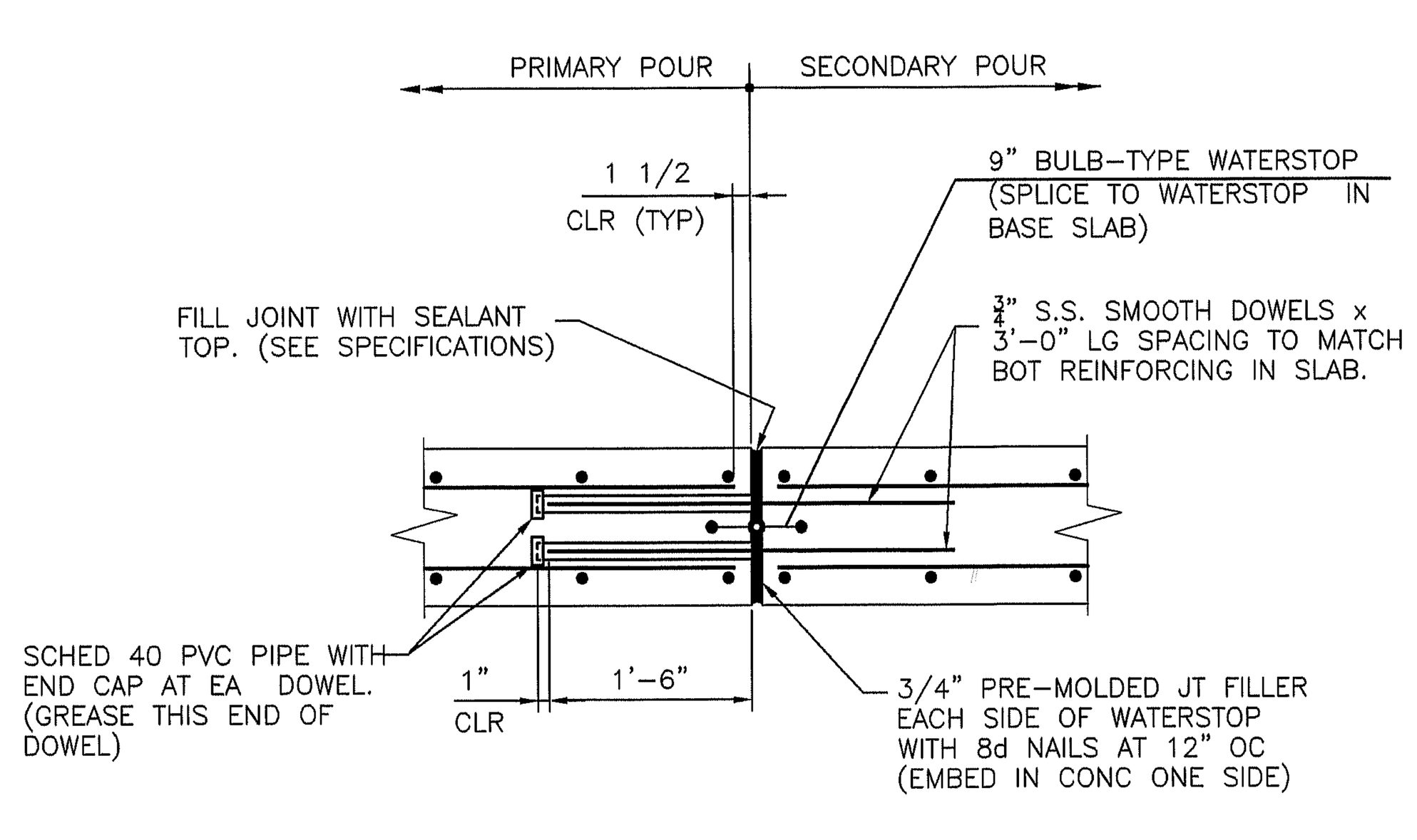
NO SCALE



NOTE:
"T"=WALL THICKNESS 10" MIN

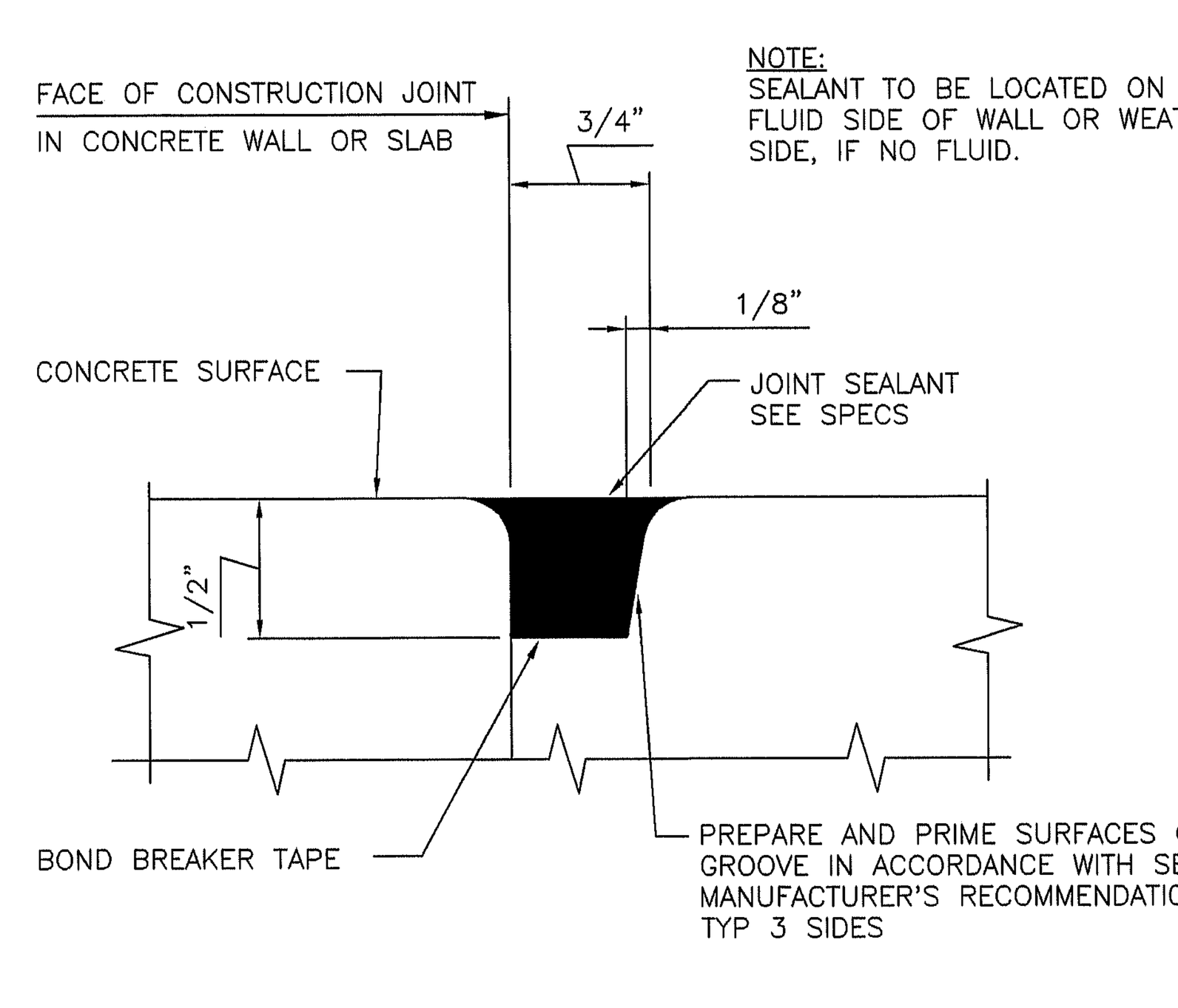
CONSTRUCTION JOINT SLAB TO WALL

NO SCALE



SLAB EXPANSION JOINT

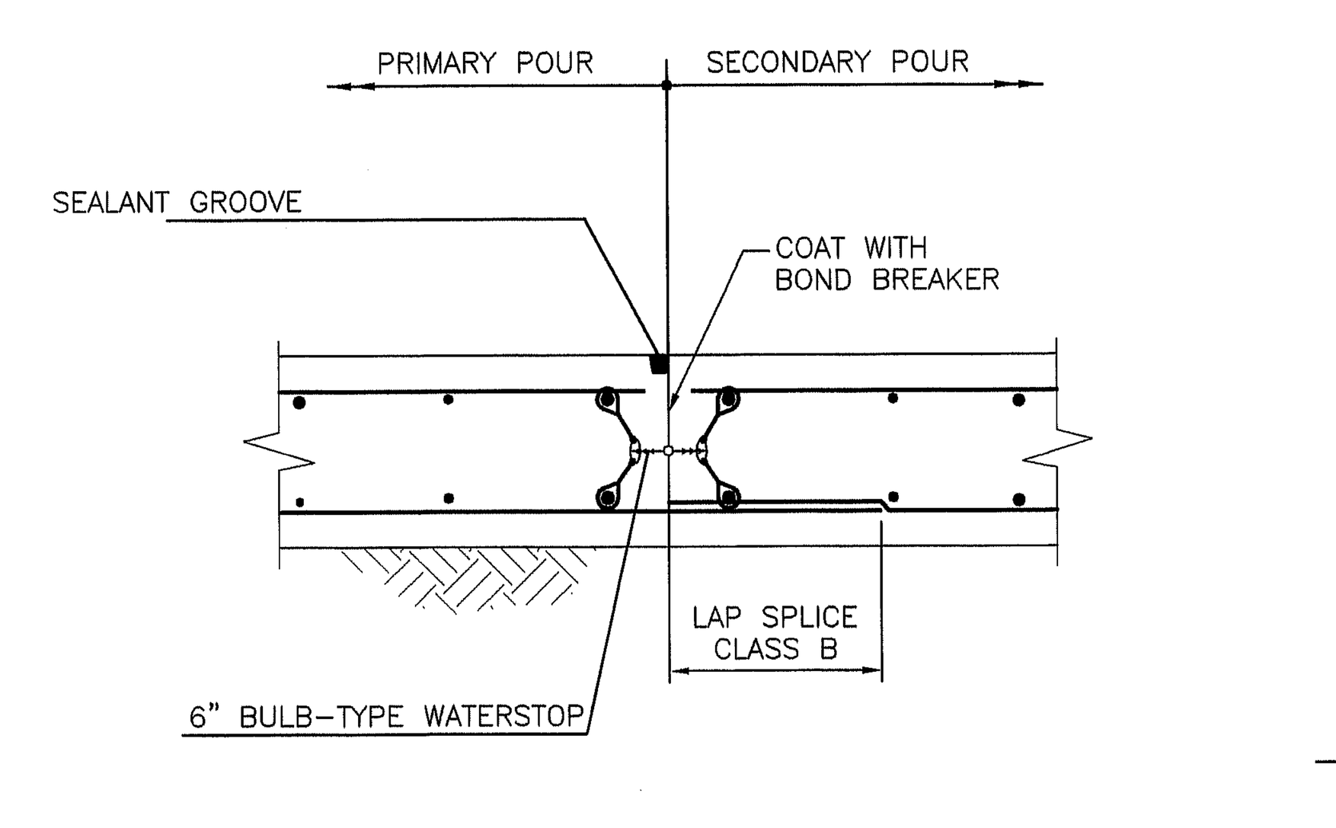
NO SCALE



NOTE:
SEALANT TO BE LOCATED ON FLUID SIDE OF WALL OR WEATHER SIDE, IF NO FLUID.

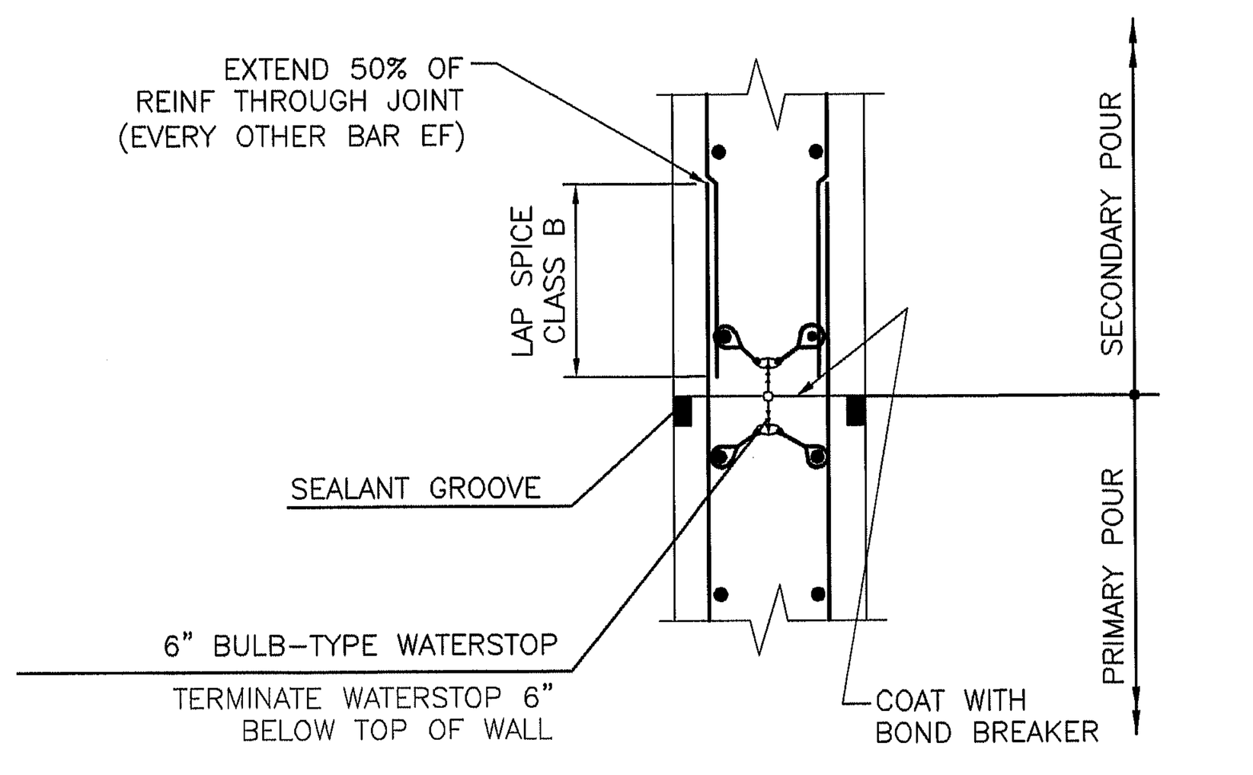
CONSTRUCTION JOINT SEALANT

NO SCALE



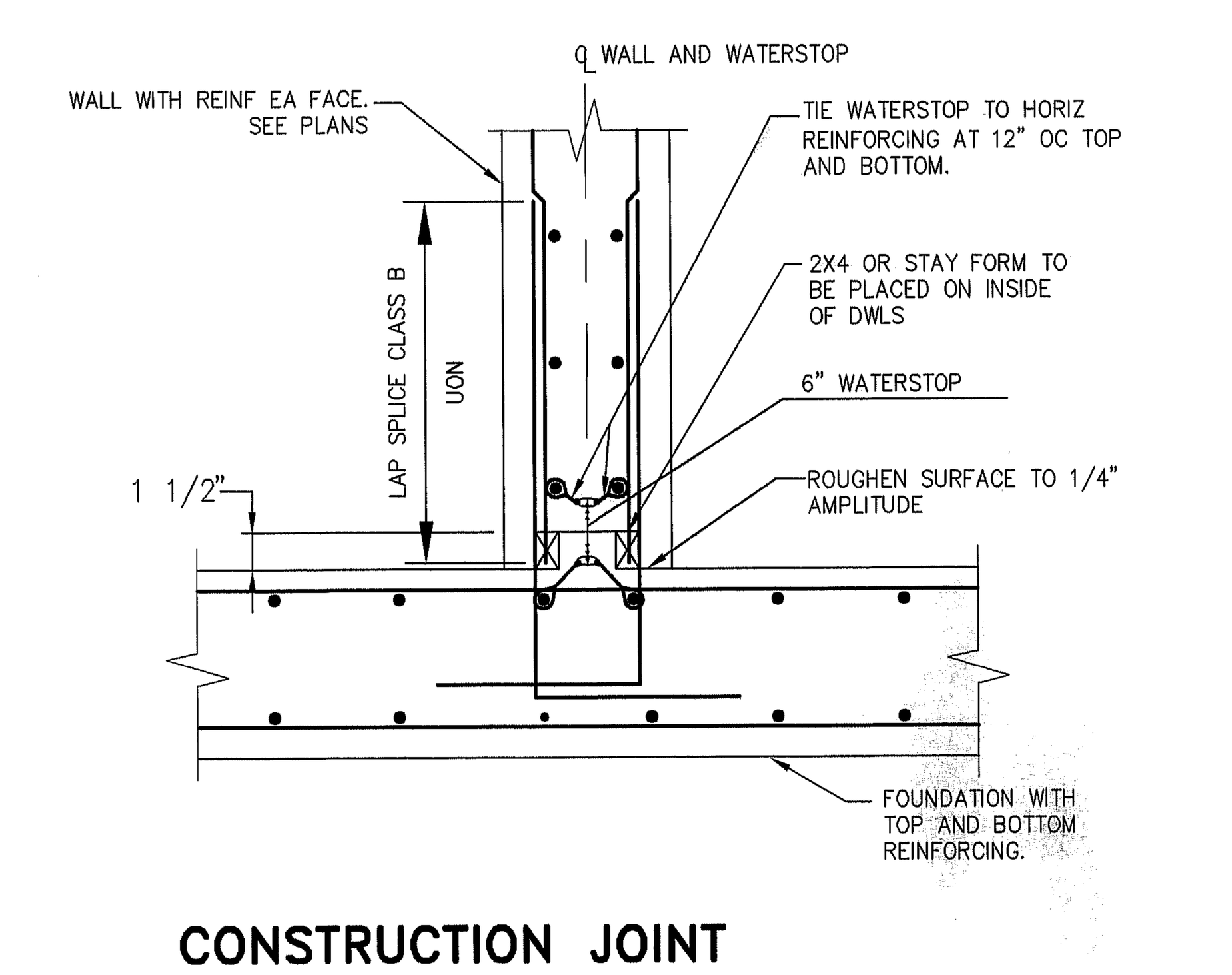
SLAB PARTIAL CONTRACTION JOINT (PCJ)

NO SCALE



WALL PARTIAL CONTRACTION JOINT - WALL TO WALL (PCJ)

NO SCALE



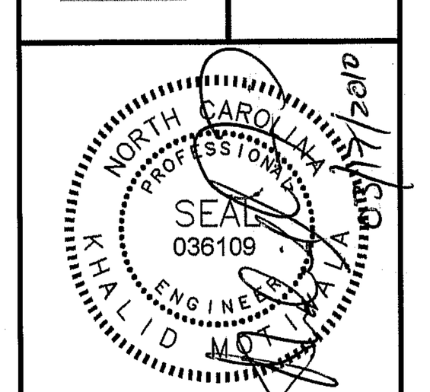
CONSTRUCTION JOINT WALL TO SLAB

NO SCALE FOR WALL GREATER THAN OR EQUAL TO 12"

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
0	03/30/10	SES	SES	ISSUED FOR BIDS AND CONSTRUCTION
B	02/17/10	JM	KM	FINAL DRAWING, NOT RELEASED FOR CONSTRUCTION
A	11/13/09	JM	KM	NCDENR ATC REVIEW SUBMITTAL

REVISIONS

AECOM



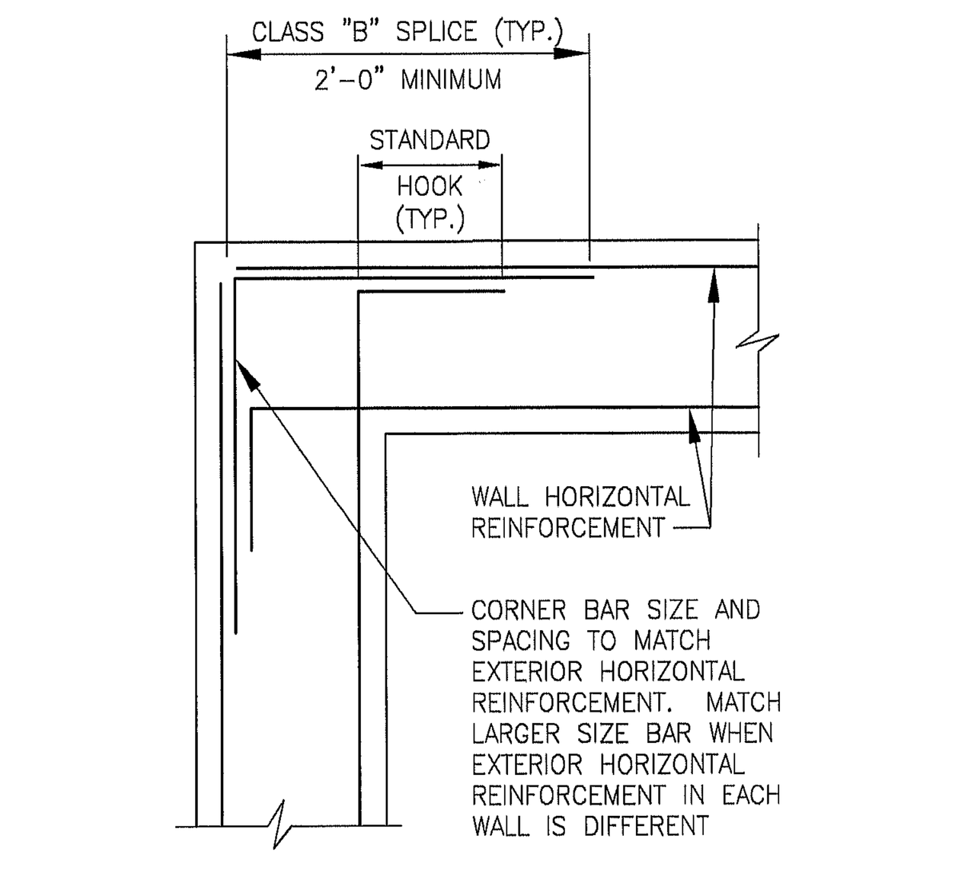
NORTHEAST WASTEWATER TREATMENT PLANT IMPROVEMENTS

CITY OF HICKORY, NORTH CAROLINA

GENERAL NOTES AND STANDARD DETAILS

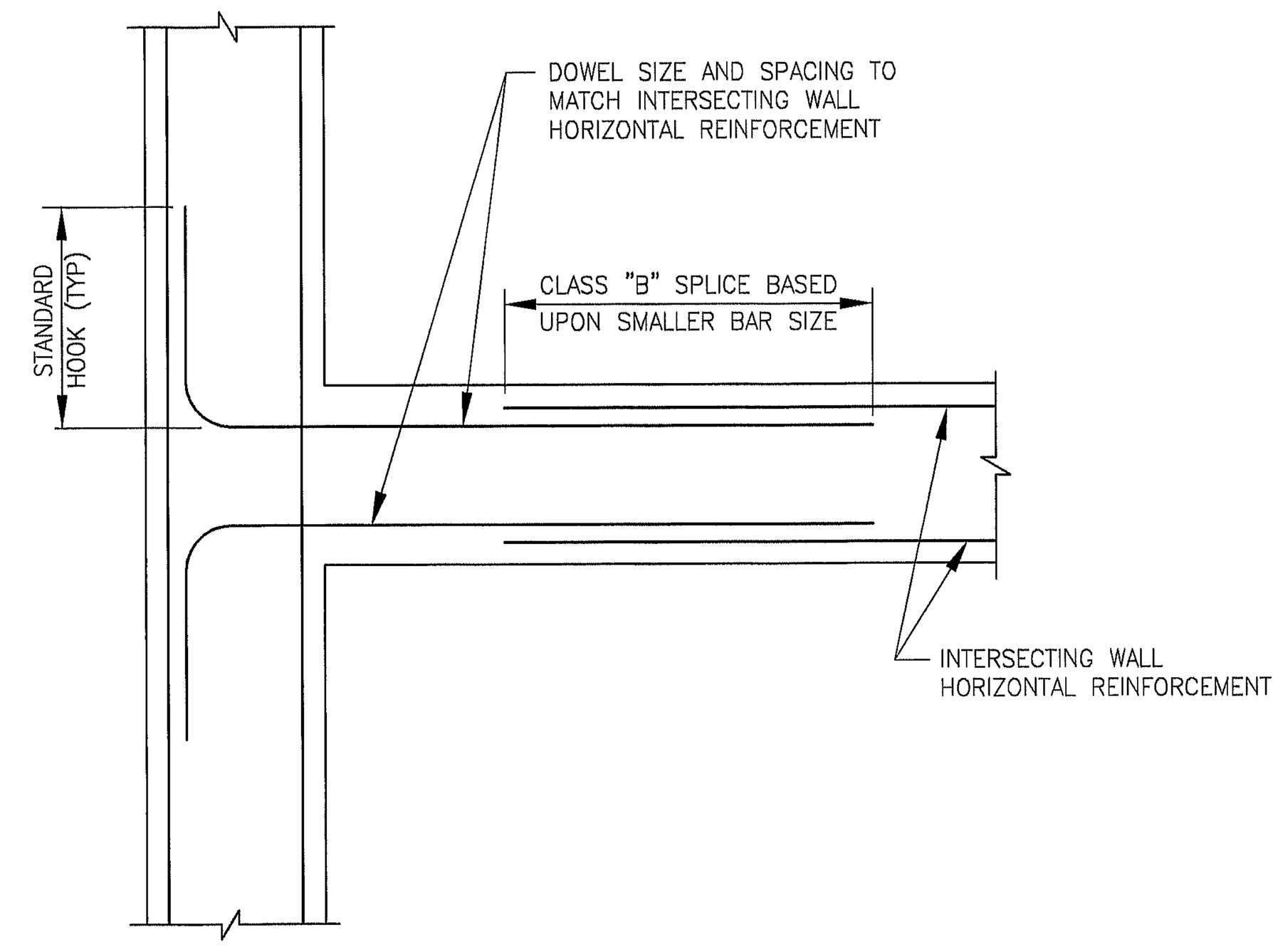
PROJECT NO:	60102850
CAD DWG FILE:	S001
DESIGNED BY:	JM
DRAWN BY:	JM
DEPT CHECK:	KM
PROJ CHECK:	SS
DATE:	NOVEMBER, 2009
SCALE:	AS SHOWN

S001



WALL CORNER REINFORCEMENT

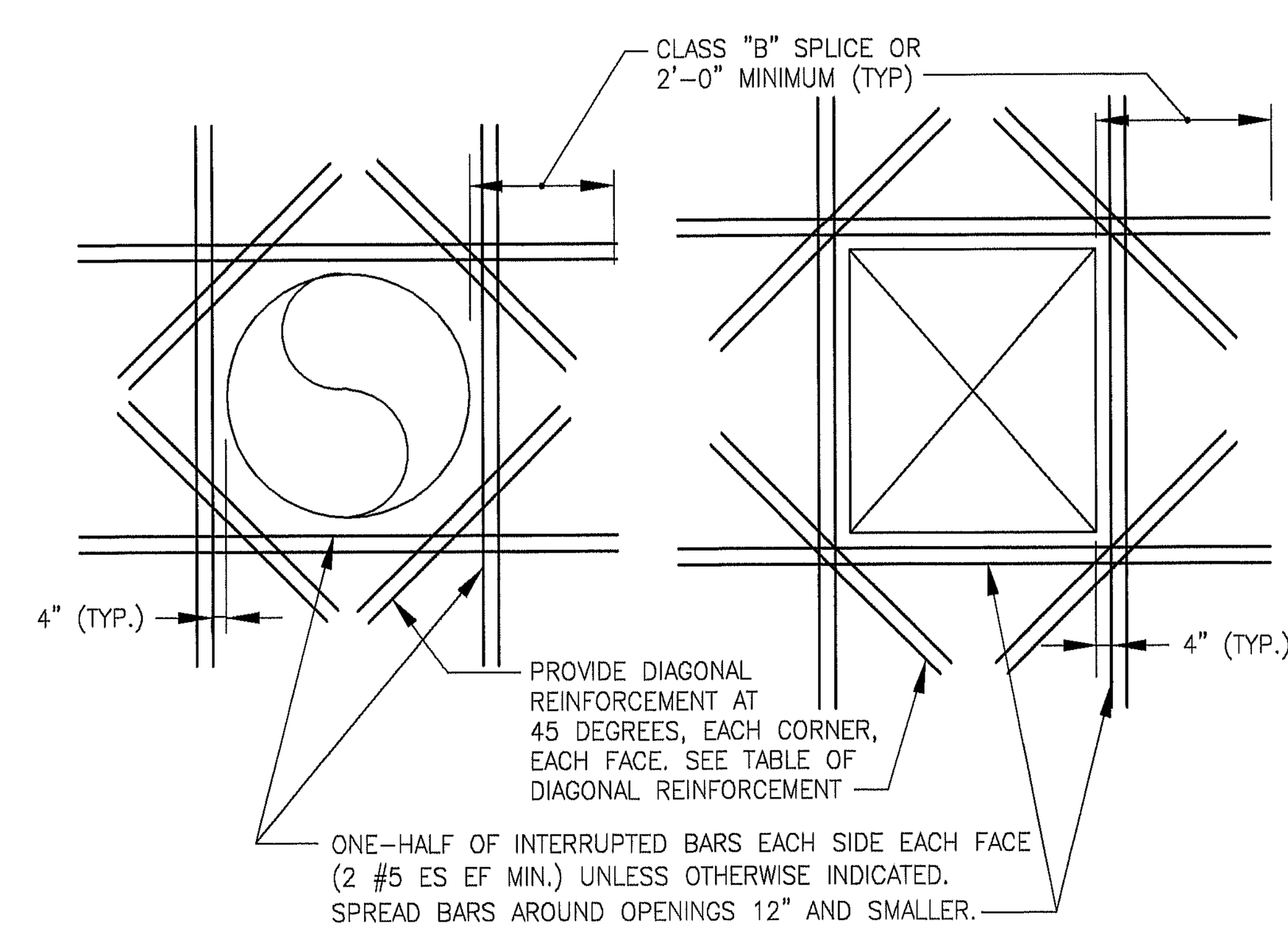
NO SCALE



INTERSECTION OF TWO WALLS WITHOUT CONSTRUCTION JOINT

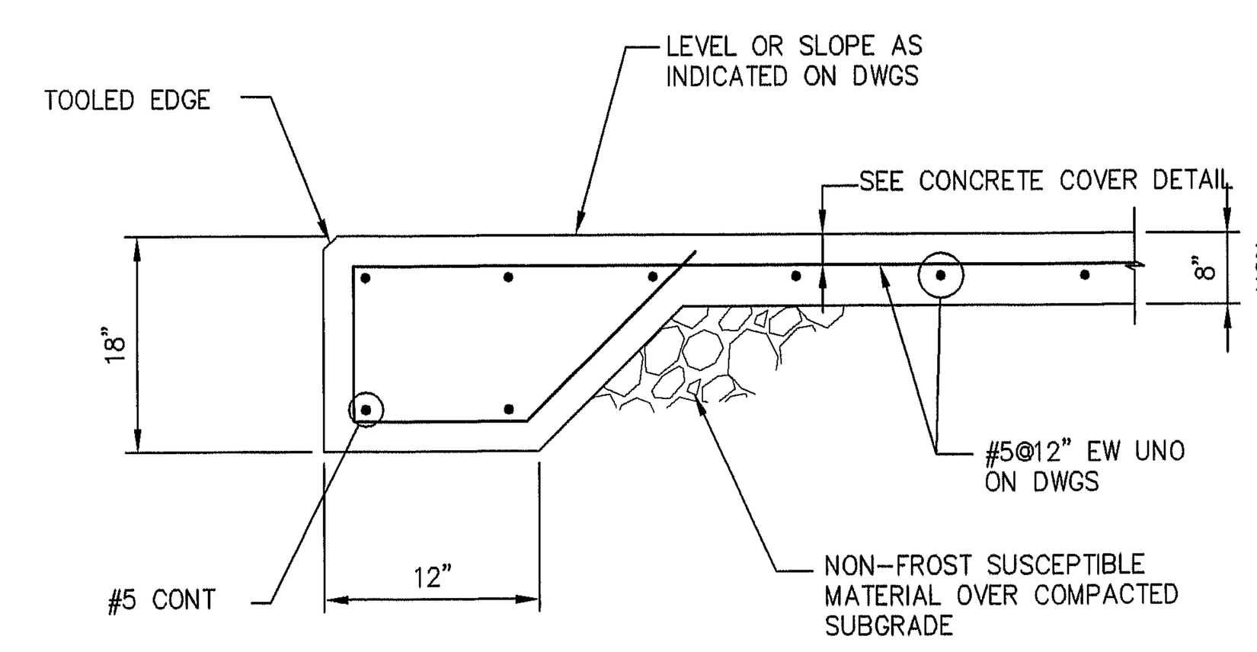
NO SCALE

TABLE OF DIAGONAL REINFORCEMENT					
MEMBER THICKNESS IN INCHES / OPENING SIZE	LARGEST OPENING DIMENSION IN INCHES				
	LESS THAN 24	24 TO 36	36 TO 48	48 TO 60	60 AND LARGER
LESS THAN 16	NONE	NONE	NONE	NONE	NONE
16 TO 32	NONE	2-#6 X 4'-0"	2-#6 X 4'-0"	2-#7 X 4'-6"	2-#7 X 4'-6"
32 TO 48	NONE	2-#6 X 4'-0"	2-#7 X 4'-6"	2-#7 X 4'-6"	2-#8 X 5'-0"
48 TO 60	NONE	2-#7 X 4'-6"	2-#7 X 4'-6"	2-#8 X 5'-0"	2-#8 X 5'-0"
60 AND LARGER	NONE	2-#7 X 4'-6"	2-#8 X 5'-0"	2-#8 X 5'-0"	2-#9 X 6'-0"



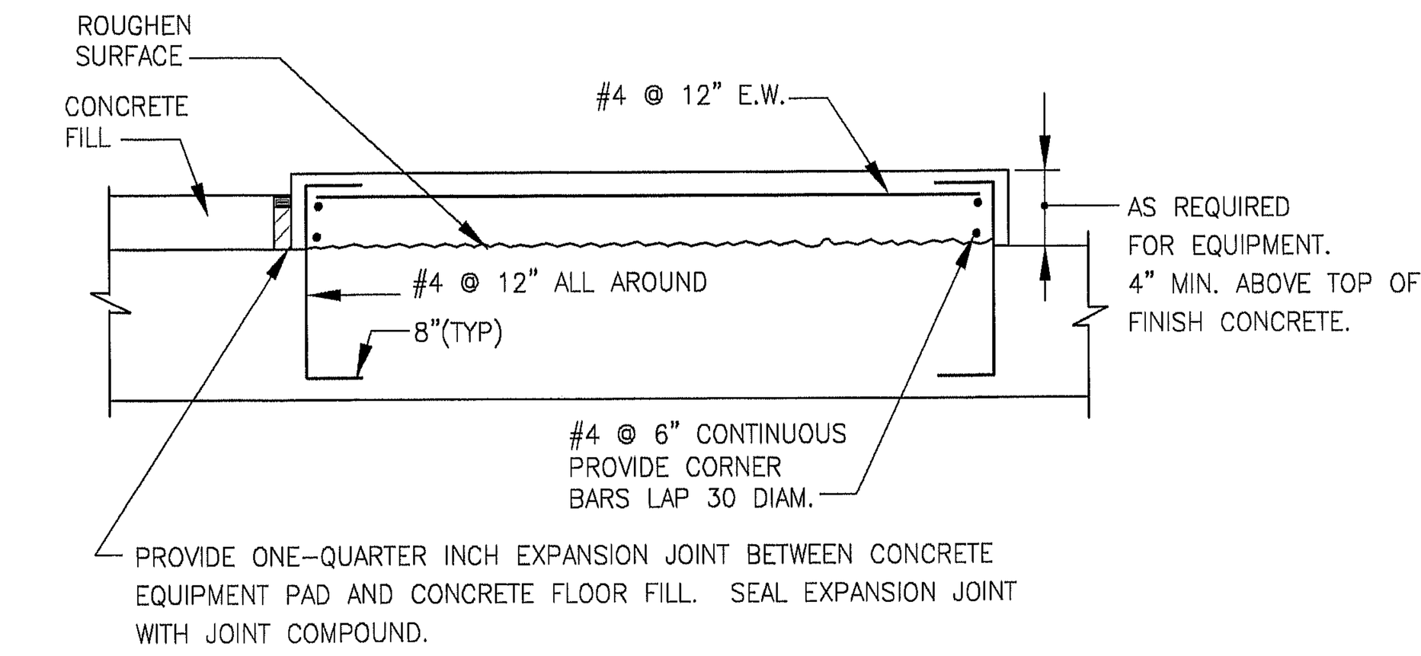
ADDITIONAL REINFORCEMENT FOR ROUND AND RECTANGULAR OPENINGS

NO SCALE



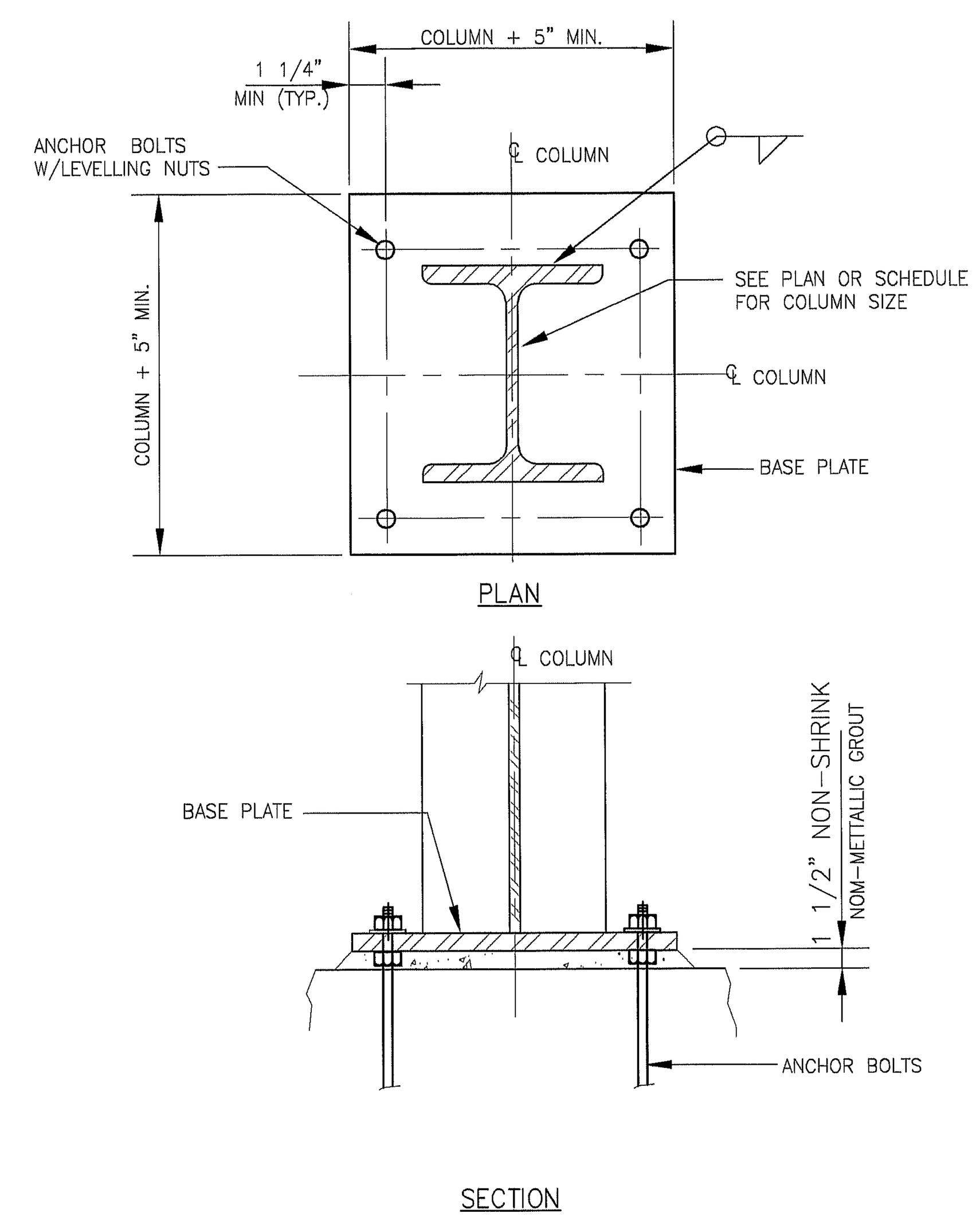
THICKENED SLAB ON GRADE

NO SCALE



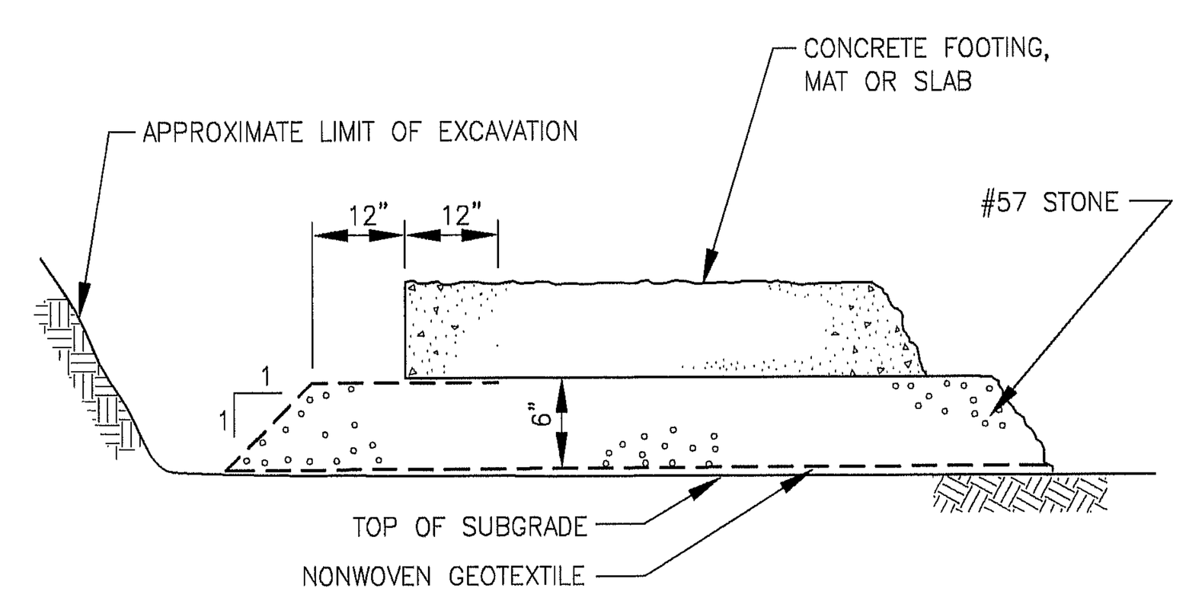
CONCRETE EQUIPMENT PAD FOR NEW CONSTRUCTION

NO SCALE



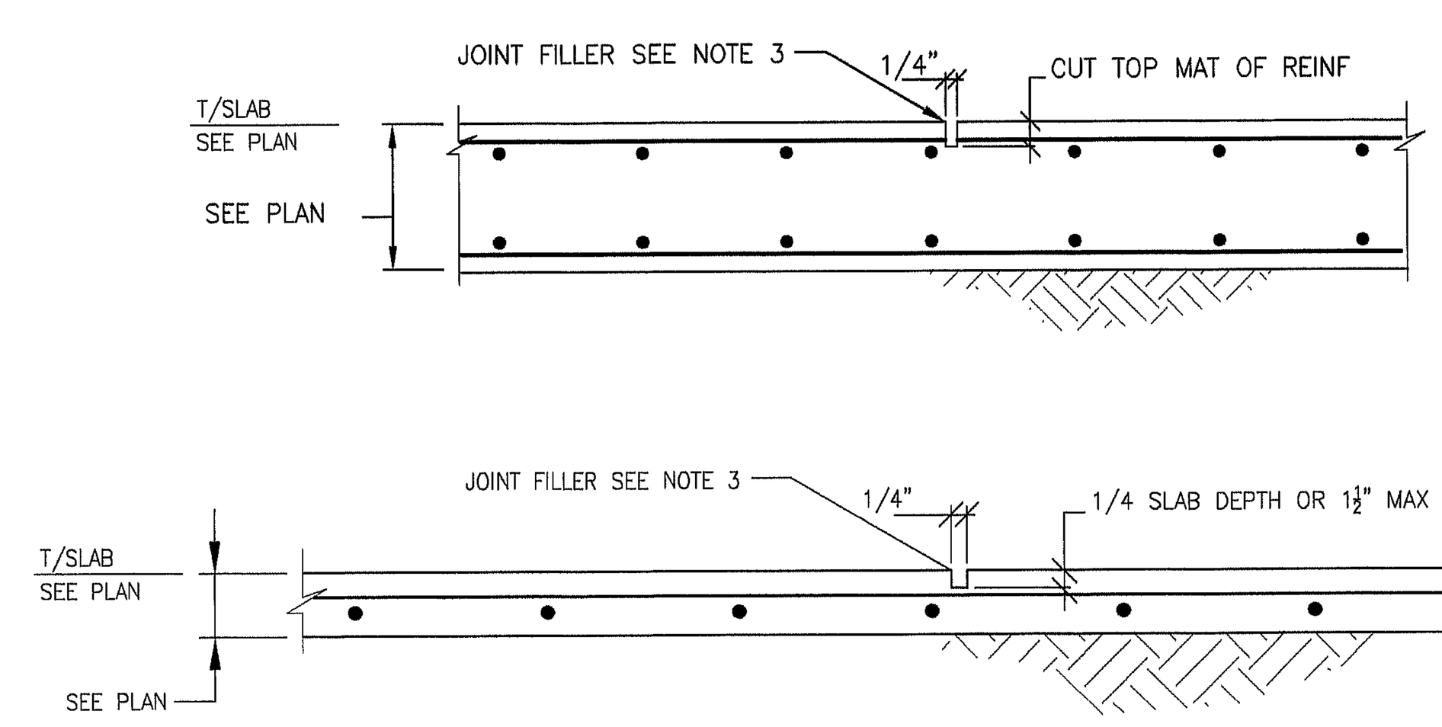
WIDE FLANGE COLUMN BASEPLATE WITH 4 ANCHOR BOLTS (W10 AND SMALLER)

NO SCALE



FOUNDATION PREPARATION WITH GEOTEXTILES

NO SCALE

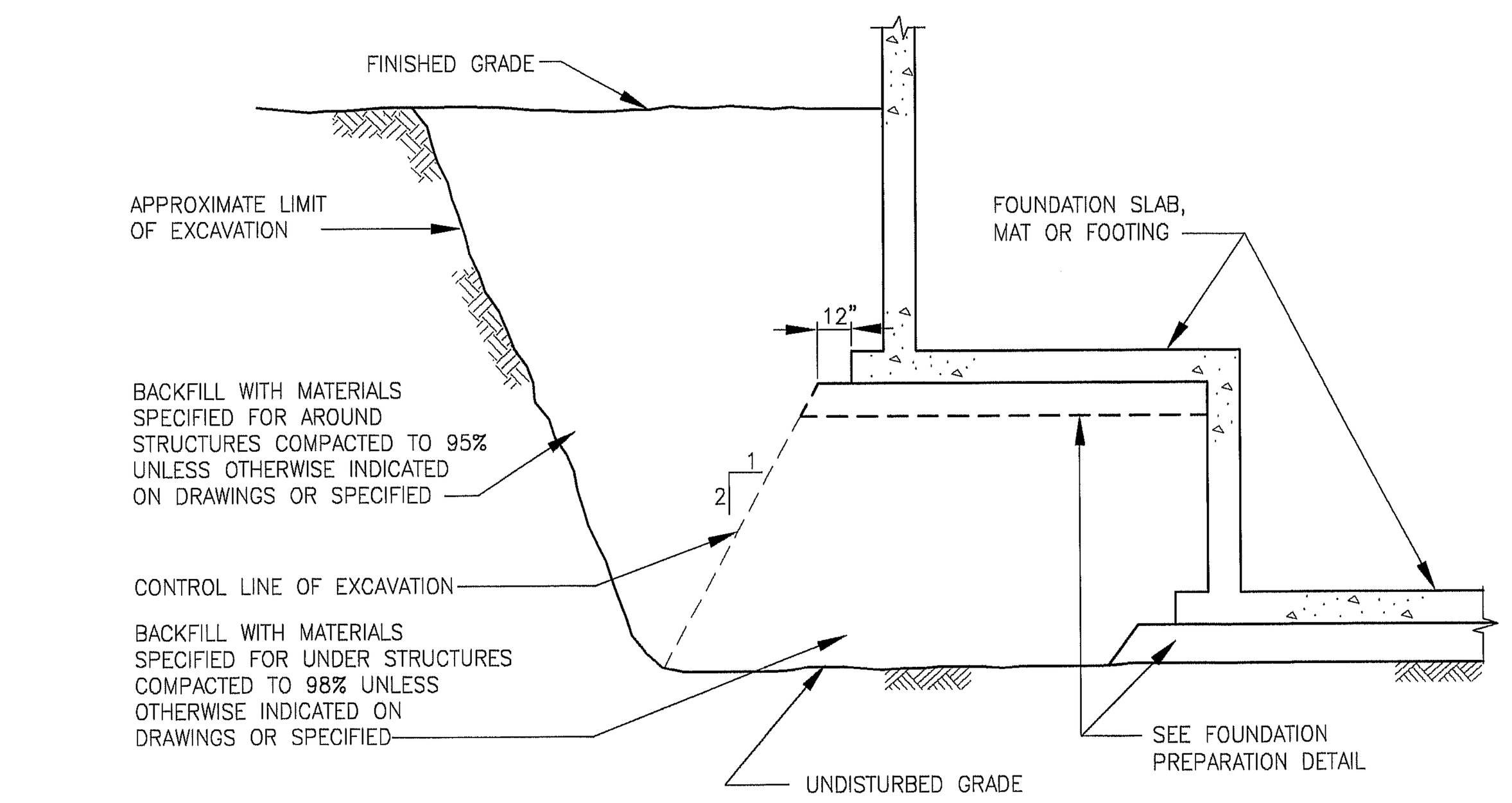


NOTE:

1. AT CONTRACTORS OPTION - CONTROL JOINTS MAY BE TOOLED OR SAWED.
2. MAX 8'-0" UNLESS NOTED ON PLAN
3. FILL WITH EPOXY JOINT SEALANT FOR JOINTS EXPOSED TO TRAFFIC. FILL WITH ELASTOMERIC JOINT SEALANT FOR ALL OTHER JOINTS.

SAWCUT CONTROL JOINT SC ON PLANS

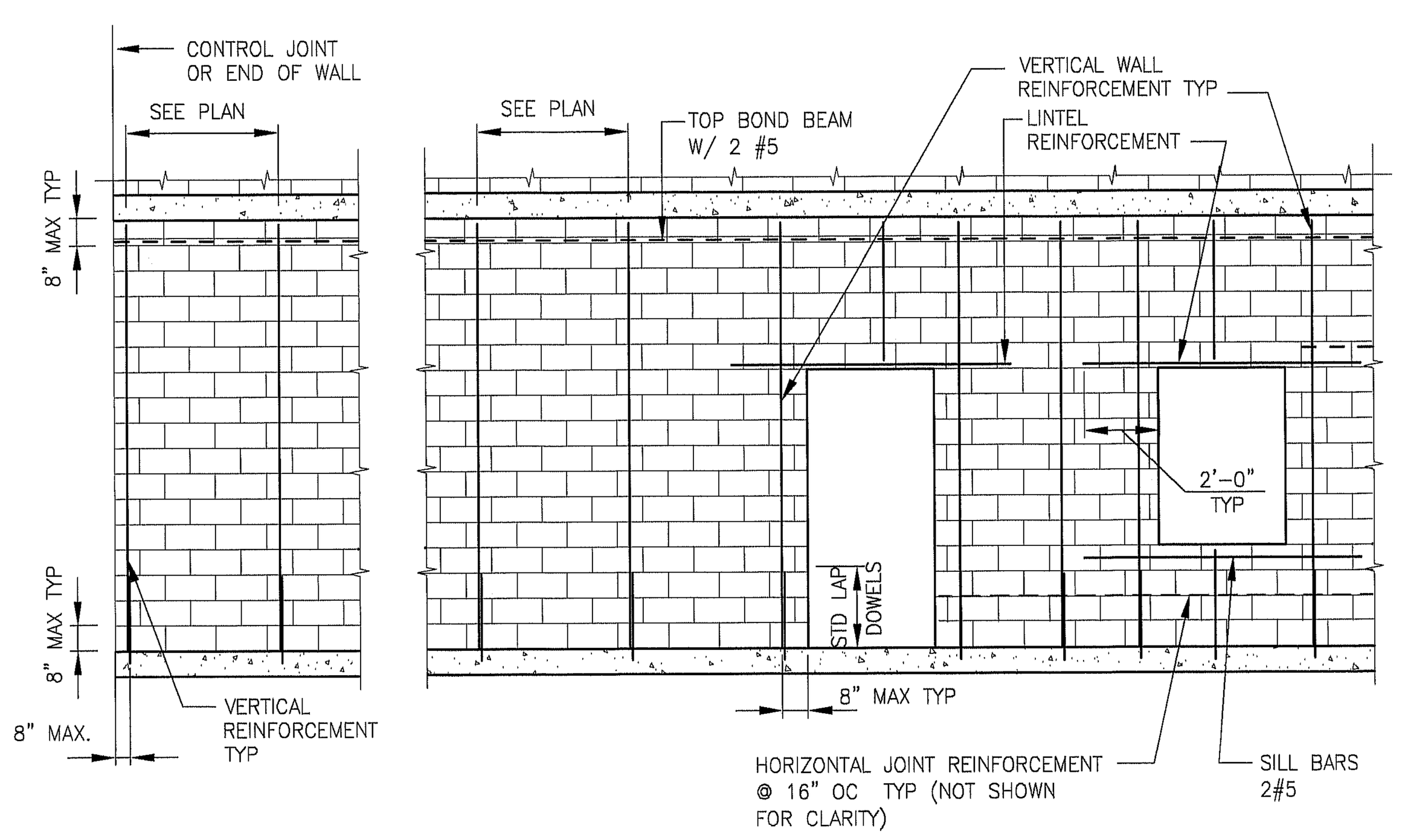
NO SCALE



NOTE:
PERCENT COMPACTION IS THE RATIO OF FIELD DRY DENSITY DETERMINED BY ASTM D-1556 TO MAXIMUM DRY DENSITY DETERMINED BY ASTM D-1557 MULTIPLIED BY 100.

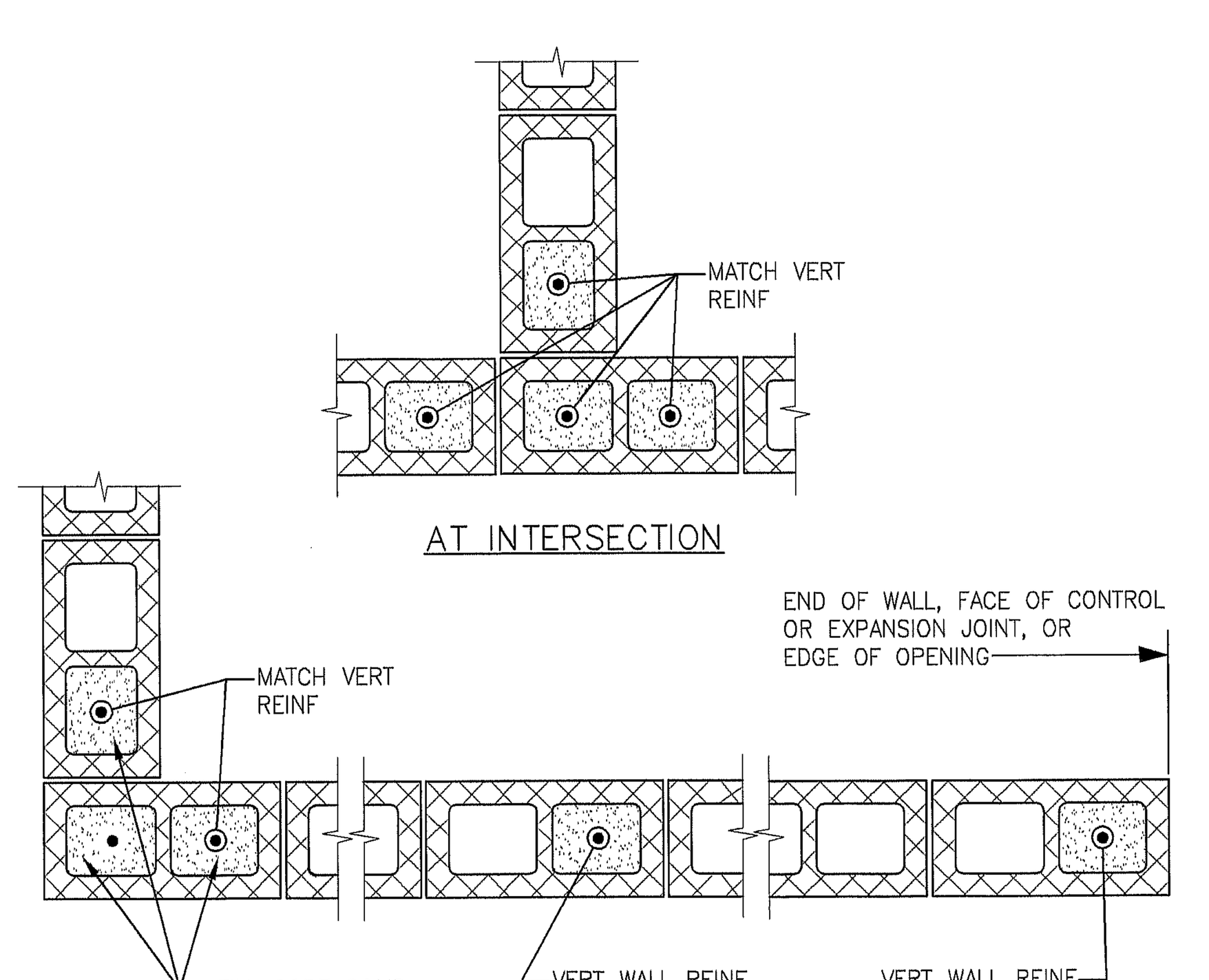
BACKFILL AROUND AND BENEATH STRUCTURES

NO SCALE



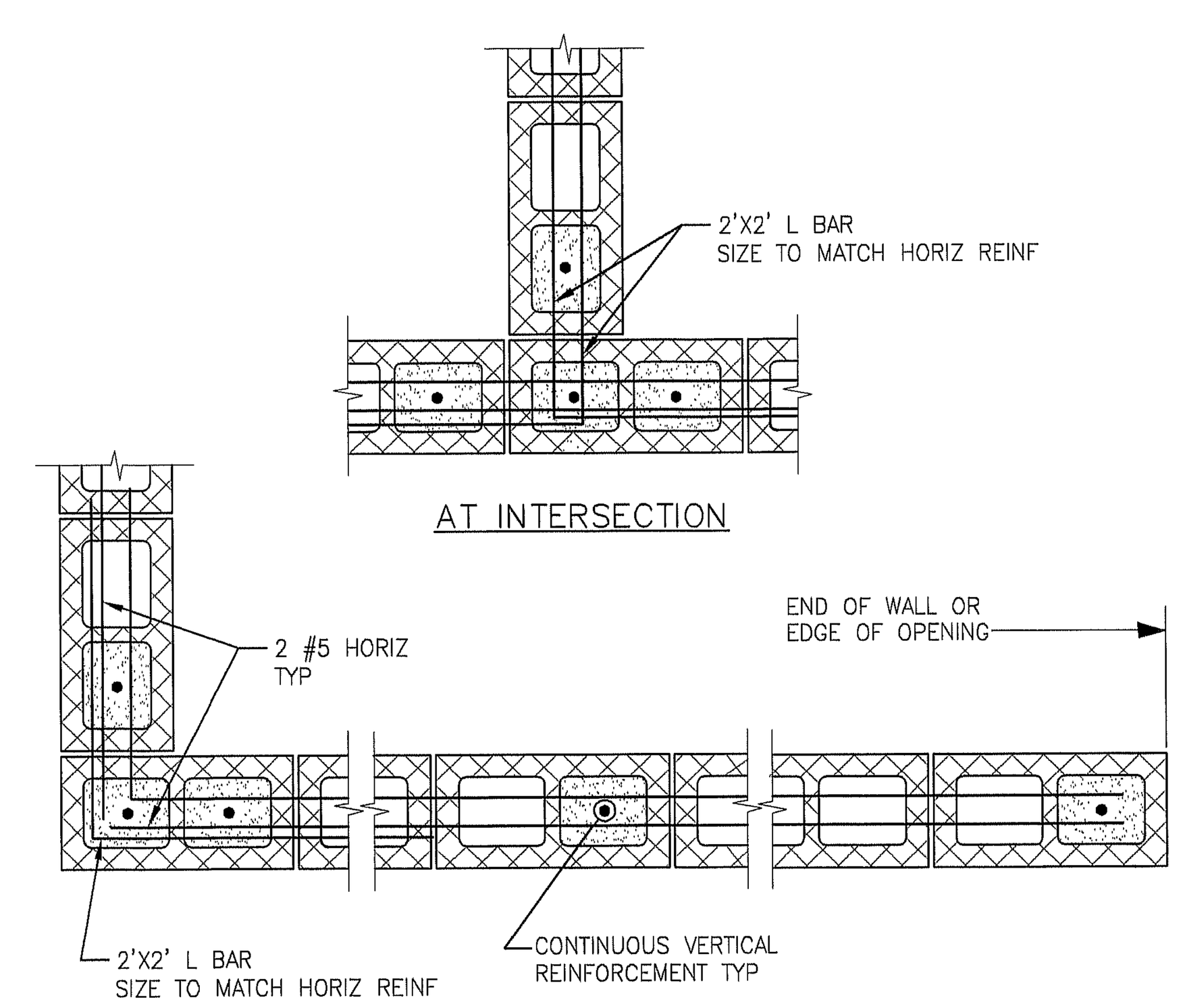
REINFORCING FOR MASONRY WALLS

NTS



VERTICAL REINFORCEMENT FOR MASONRY WALL

NTS

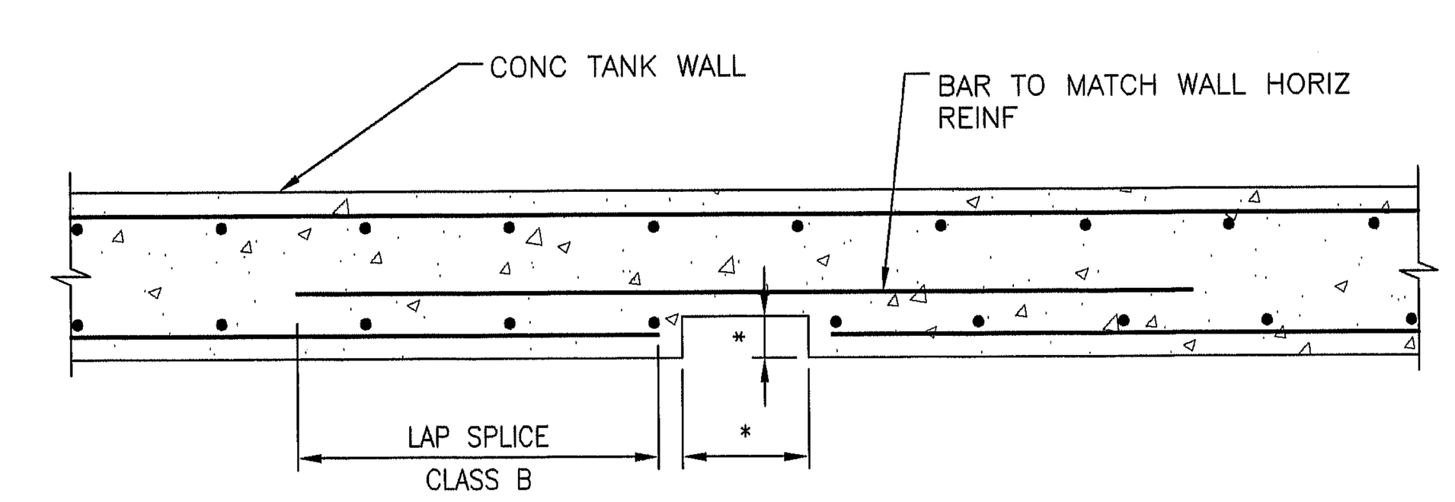


NOTES:

1. BOND BEAM REINF SHALL BE CONTINUOUS AT MCJ.
2. SPACE BOND BEAMS 4'-0" MAX.

MASONRY BOND BEAM

NTS



* COORDINATE OPENING SIZE WITH GATE MFR

SLAB/WALL BLOCK-OUT DETAIL

NO SCALE

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
0	03/30/10	SES	SES	ISSUED FOR BIDS AND CONSTRUCTION
B	03/17/10	JM	KM	FINAL DRAWING, NOT RELEASED FOR CONSTRUCTION
A	11/13/09	JM	KM	NCDENR ATC REVIEW SUBMITTAL

REVISIONS

AECOM

AECOM USA, INC.
10 PATEWOOD DRIVE, BUILDING VI, SUITE 500
GREENVILLE, SC 29615
(864) 234-3000
LICENSE NO. F-0402

SEAL 036109 NORTH CAROLINA PROFESSIONAL ENGINEER

NORTHEAST WASTEWATER TREATMENT PLANT IMPROVEMENTS
CITY OF HICKORY, NORTH CAROLINA

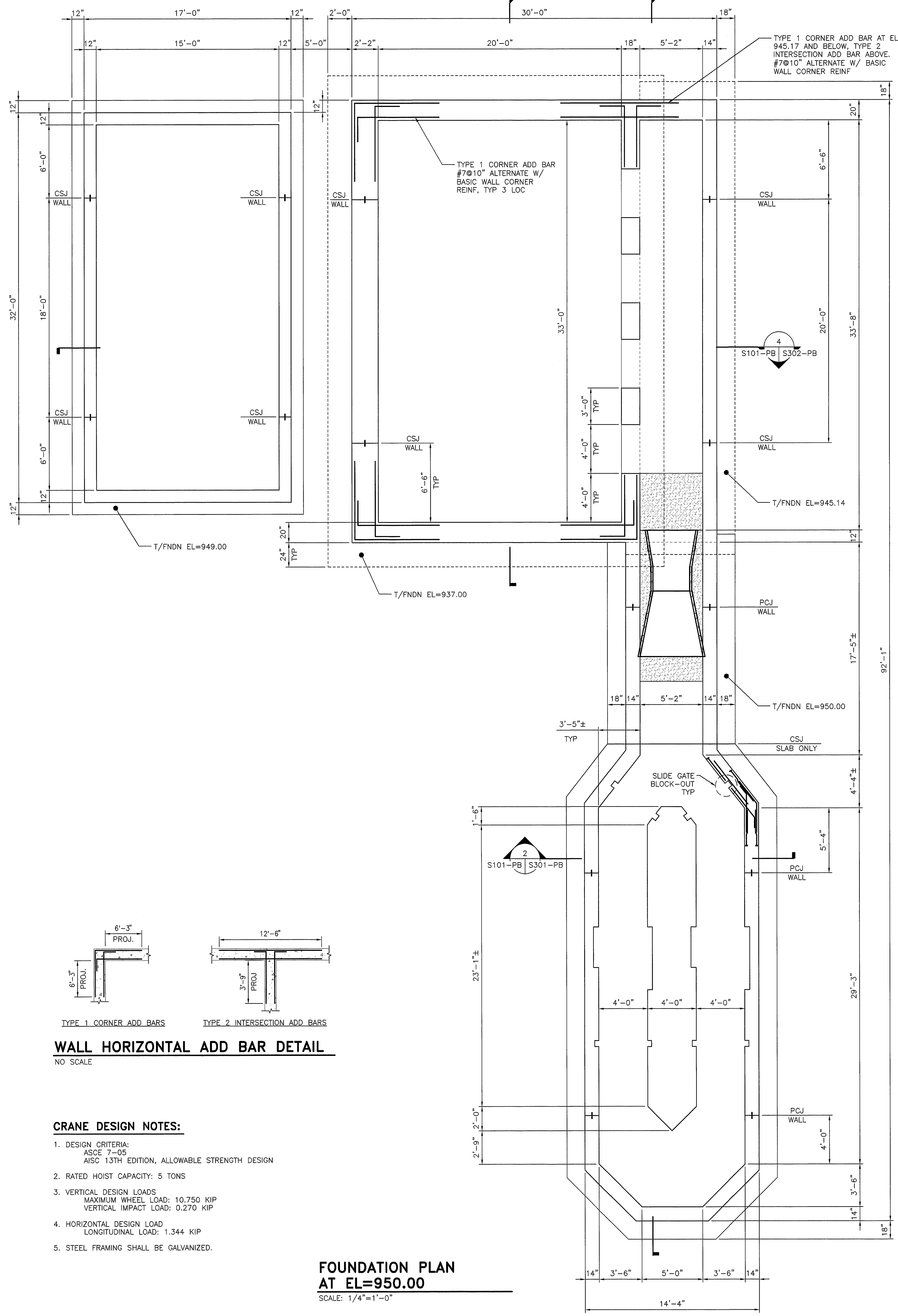
GENERAL NOTES AND STANDARD DETAILS

PROJECT NO:	60102850
CAD DWG FILE:	S002
DESIGNED BY:	JM
DRAWN BY:	JM
DEPT CHECK:	KM
PROJ CHECK:	SS
DATE:	NOVEMBER, 2009
SCALE:	AS SHOWN

S002

SHEET 89 OF 201

ARCH F - 17-Mar-10



FOUNDATION PLAN AT EL=950.00

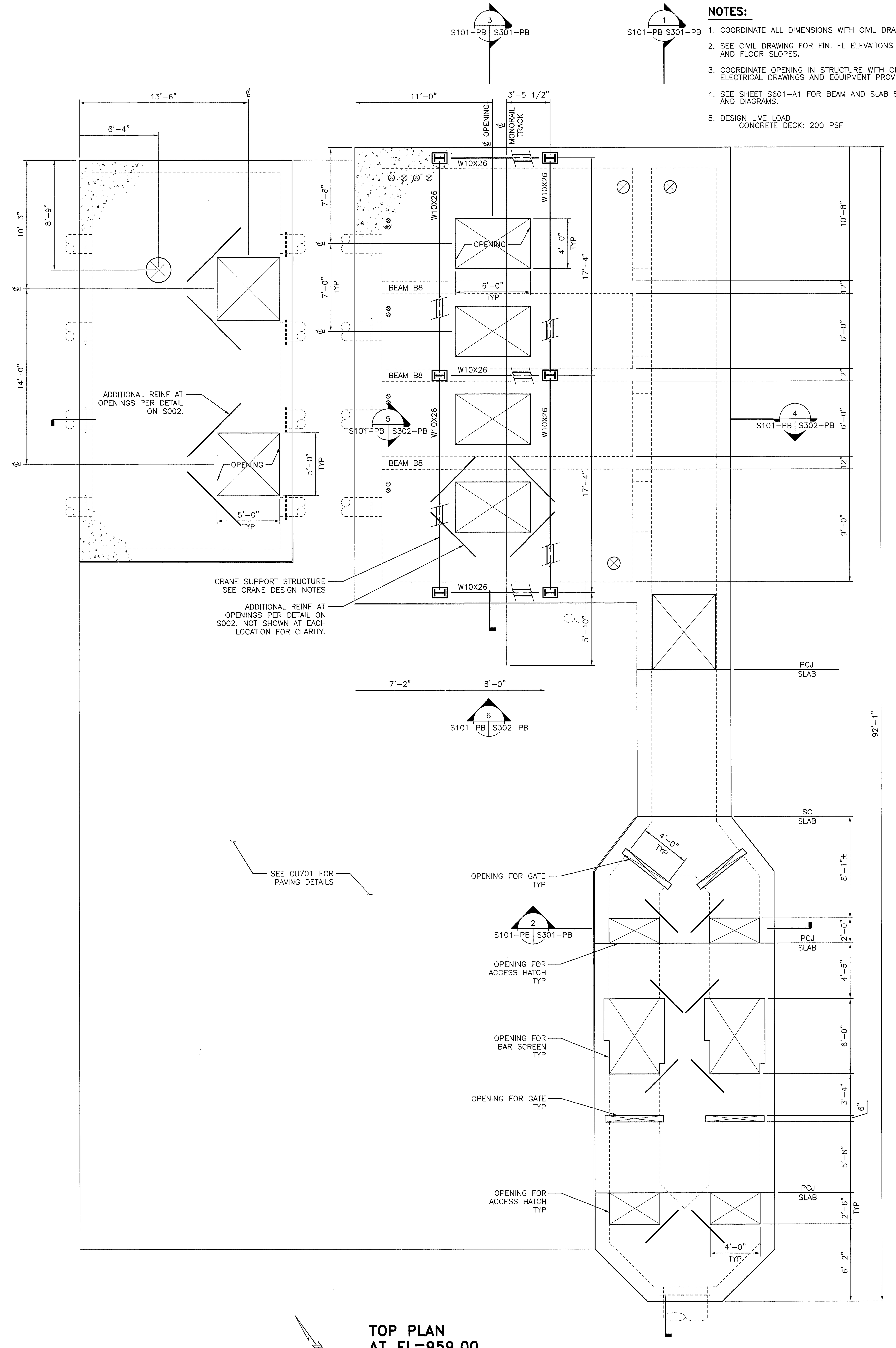
SCALE: 1/4"=1'-0"

WALL HORIZONTAL ADD BAR DETAIL

NO SCALE

CRANE DESIGN NOTES:

1. DESIGN CRITERIA:
   ASCE 7-05
   AISC 13TH EDITION, ALLOWABLE STRENGTH DESIGN
2. RATED HOIST CAPACITY: 5 TONS
3. VERTICAL DESIGN LOADS
   MAXIMUM WHEEL LOAD: 10.750 KIP
   VERTICAL IMPACT LOAD: 0.270 KIP
4. HORIZONTAL DESIGN LOAD
   LONGITUDINAL LOAD: 1.344 KIP
5. STEEL FRAMING SHALL BE GALVANIZED.



TOP PLAN AT EL=959.00

SCALE: 1/4"=1'-0"

NOTES:

1. COORDINATE ALL DIMENSIONS WITH CIVIL DRAWINGS.
2. SEE CIVIL DRAWING FOR FIN. FL ELEVATIONS AND FLOOR SLOPES.
3. COORDINATE OPENING IN STRUCTURE WITH CIVIL AND ELECTRICAL DRAWINGS AND EQUIPMENT PROVIDED.
4. SEE SHEET S601-A1 FOR BEAM AND SLAB SCHEDULE AND DIAGRAMS.
5. DESIGN LIVE LOAD
   CONCRETE DECK: 200 PSF

GRAPHIC SCALES

1/4"=1'-0"

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
0	03/30/10	SES	SES	ISSUED FOR BIDS AND CONSTRUCTION
B	02/17/10	JM	KM	FINAL DRAWING, NOT RELEASED FOR CONSTRUCTION
A	11/13/09	JM	KM	NCDENR ATC REVIEW SUBMITTAL

REVISIONS

AECOM

NORTHEAST WASTEWATER TREATMENT PLANT IMPROVEMENTS
CITY OF HICKORY, NORTH CAROLINA

INFLUENT PUMP STATION - FOUNDATION PLAN

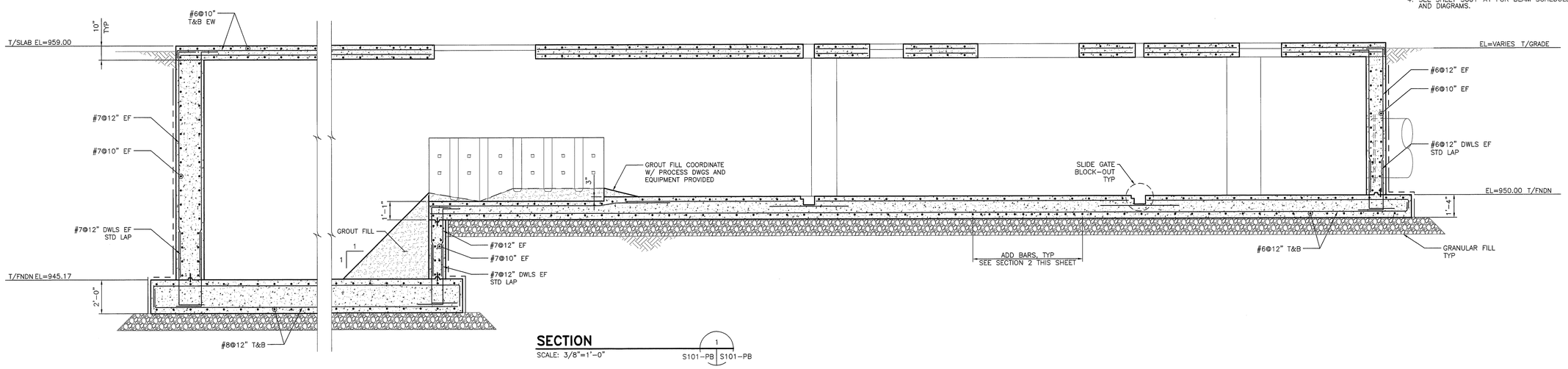
PROJECT NO:	60102850
CAD DWG FILE:	S101-PB
DESIGNED BY:	JC
DRAWN BY:	JC
DEPT CHECK:	KM
PROJ CHECK:	SS
DATE:	NOVEMBER, 2009
SCALE:	1/4"=1'-0"

S101-PB

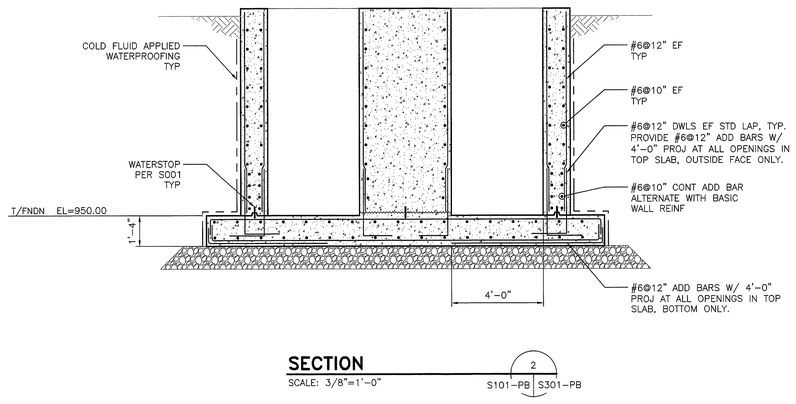
SHEET 90 OF 201

NOTES:

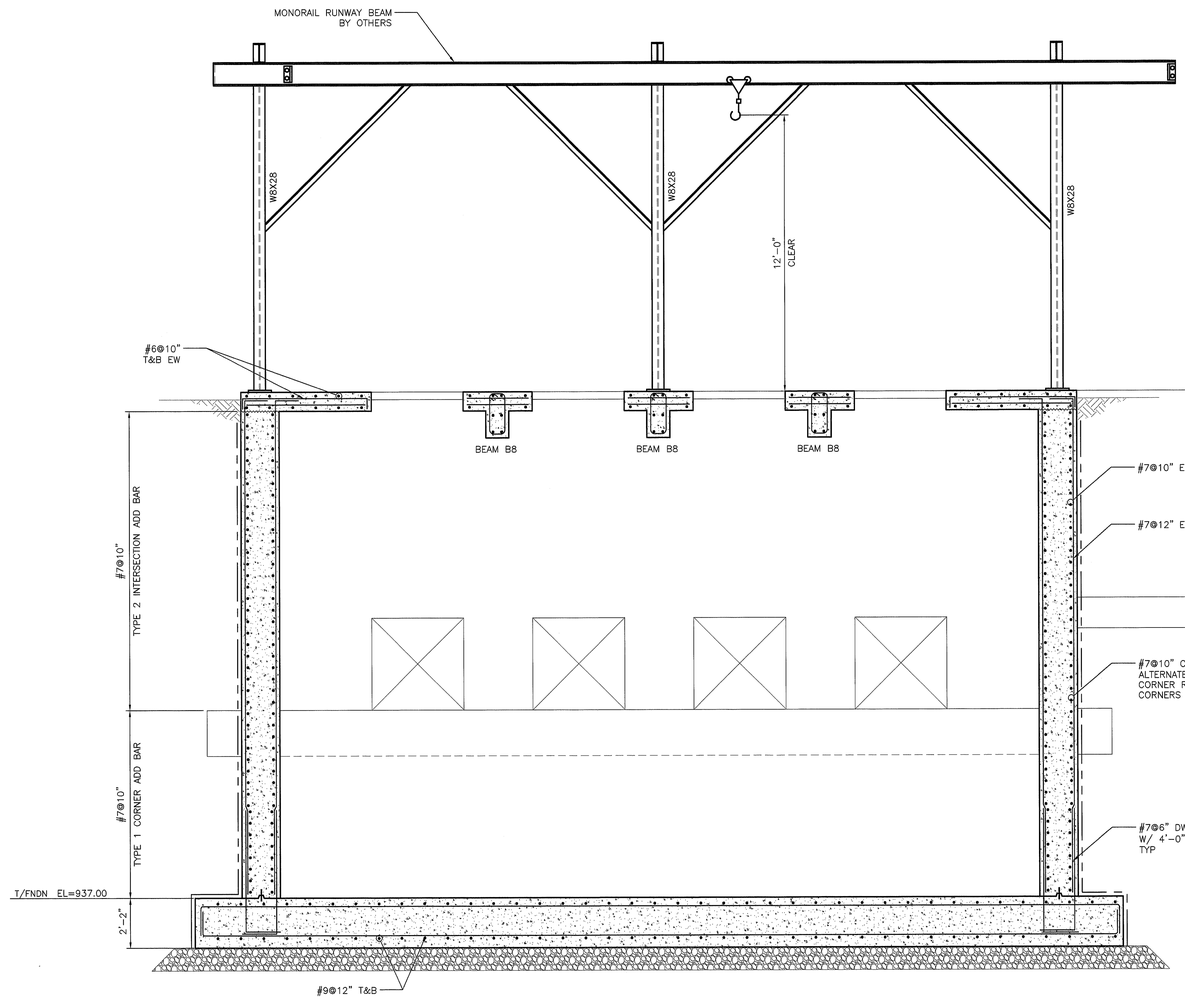
1. COORDINATE ALL DIMENSIONS WITH CIVIL DRAWINGS.
2. SEE CIVIL DRAWING FOR FIN. FL ELEVATIONS AND FLOOR SLOPES
3. COORDINATE OPENING IN SLABS WITH CIVIL DRAWINGS AND EQUIPMENT PROVIDED.
4. SEE SHEET S601-A1 FOR BEAM SCHEDULE AND DIAGRAMS.



SECTION
SCALE: 3/8"=1'-0"
1 S101-PB | S101-PB



SECTION
SCALE: 3/8"=1'-0"
2 S101-PB | S301-PB



SECTION
SCALE: 3/8"=1'-0"
3 S101-PB | S301-PB

3/8"=1'-0" 12"6" 0 1' 2' 3' 4' 5' 6' 7'

GRAPHIC SCALES

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
A	11/13/09	JM	KM	NCDENR ATC REVIEW SUBMITTAL
B	03/17/10	JM	KM	FINAL DRAWING, NOT RELEASED FOR CONSTRUCTION
0	03/30/10	SES	SES	ISSUED FOR BIDS AND CONSTRUCTION

REVISIONS

AECOM
ATKINS USA, INC.
10 PATEWOOD DRIVE, BUILDING VI
SUITE 600
GREENVILLE, SC 29615
LICENSE NO. F-0653

NORTHEAST WASTEWATER TREATMENT PLANT IMPROVEMENTS
CITY OF HICKORY, NORTH CAROLINA

INFLUENT PUMP STATION - SECTIONS

PROJECT NO:	60102850
CAD DWG FILE:	S301-PB
DESIGNED BY:	JC
DRAWN BY:	JC
DEPT. CHECK:	KM
PROJ CHECK:	SS
DATE:	NOVEMBER, 2009
SCALE:	3/8"=1'-0"

S301-PB

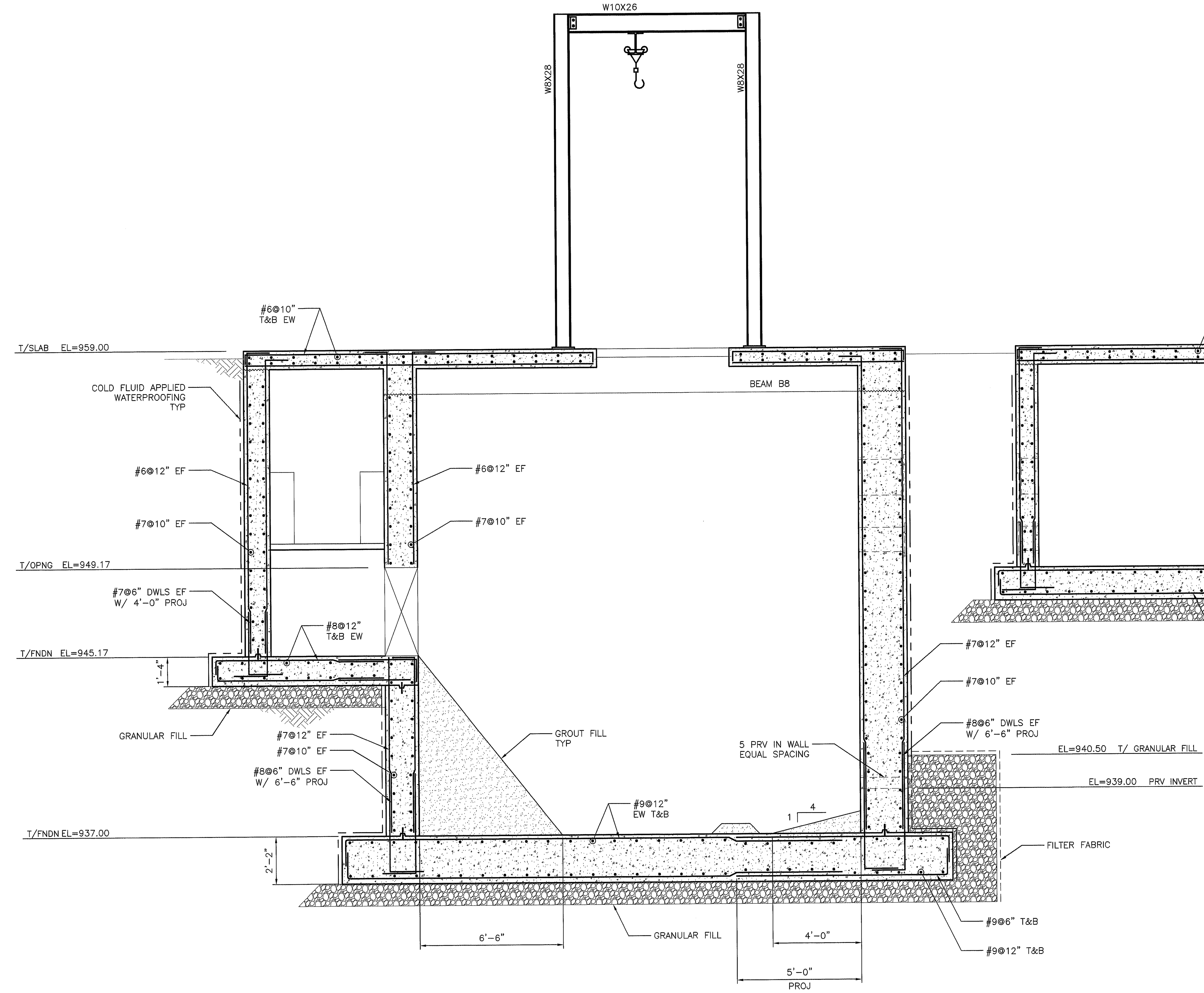
SHEET 91 OF 201

NOTES:

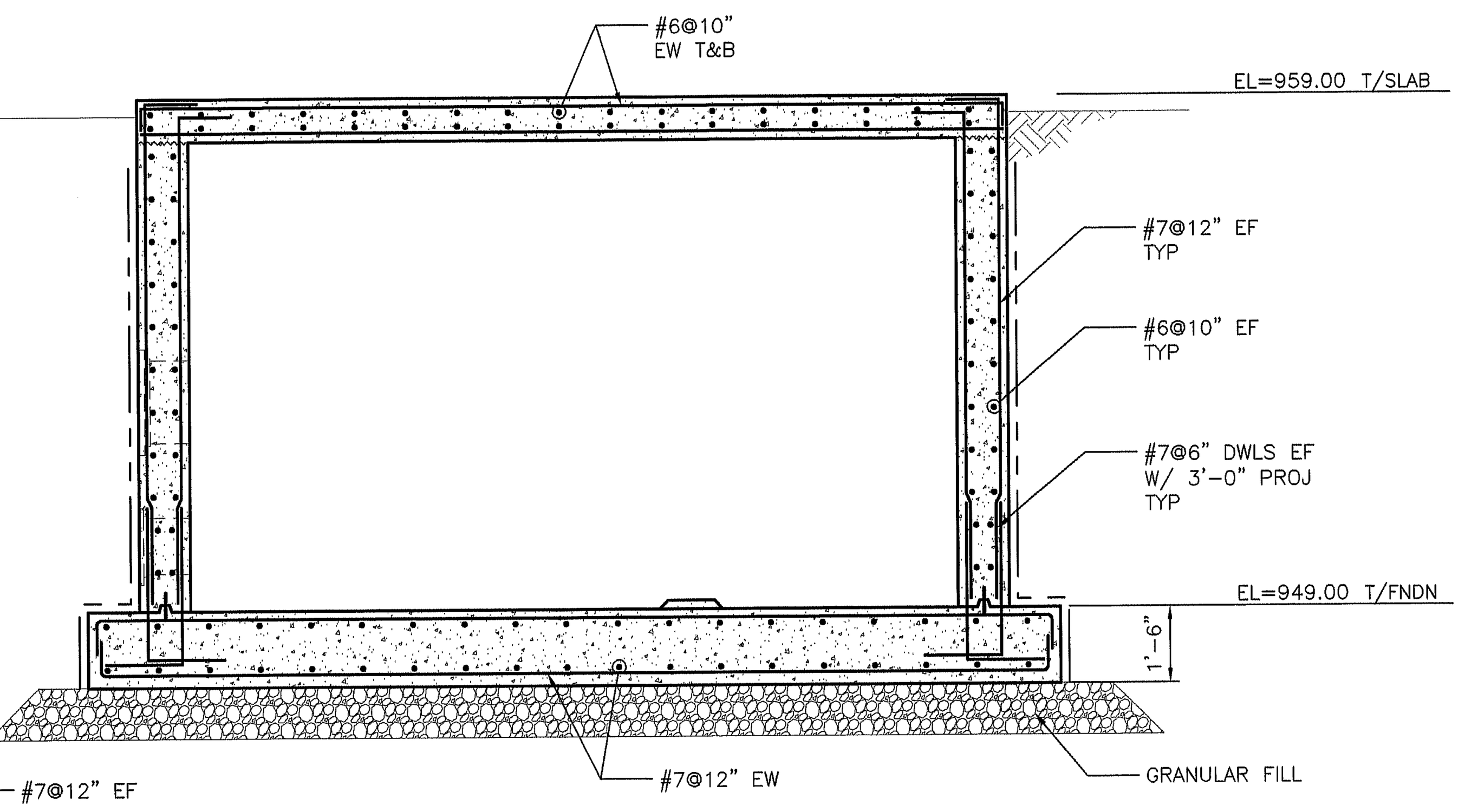
1. COORDINATE ALL DIMENSIONS WITH CIVIL DRAWINGS.
2. SEE CIVIL DRAWING FOR FIN. FL ELEVATIONS AND FLOOR SLOPES
3. COORDINATE OPENING IN SLABS WITH CIVIL DRAWINGS AND EQUIPMENT PROVIDED.
4. SEE SHEET S601-A1 FOR BEAM SCHEDULE AND DIAGRAMS.

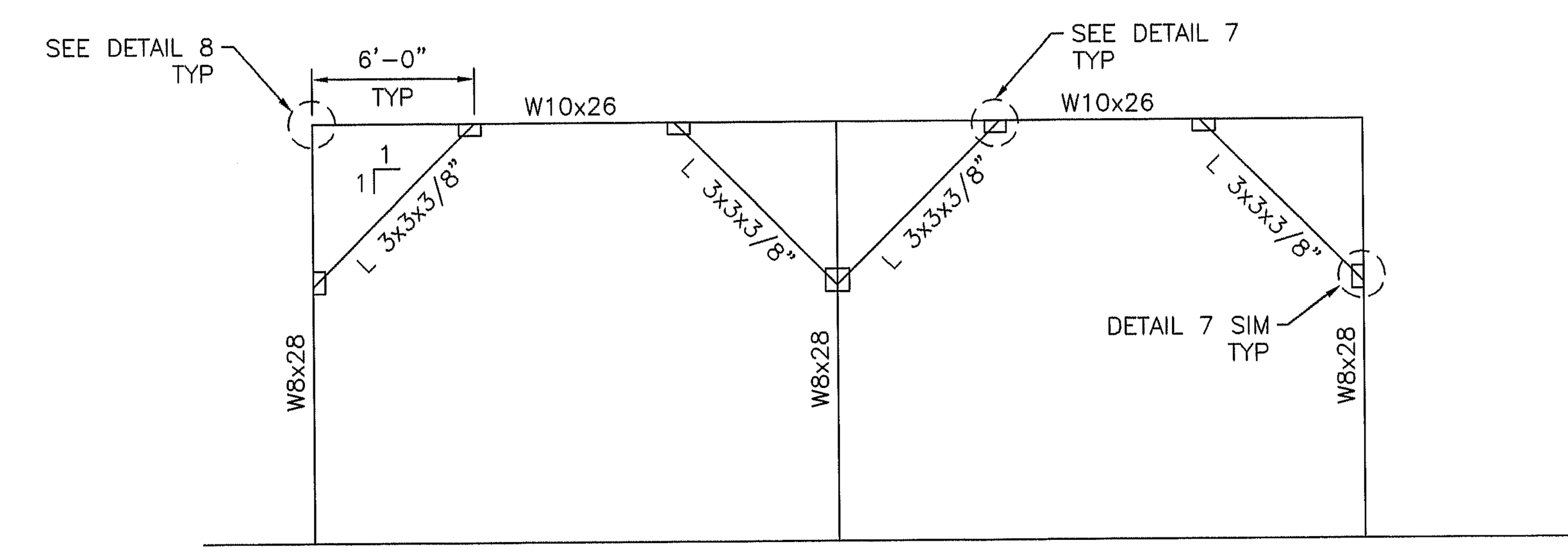
M — DENOTES MOMENT CONNECTION

MOMENT CONNECTION DESIGN LOADS (SERVICE)
DEAD LOADS: 1 KIP-FT (MOMENT)
LIVE LOADS: 5 KIP-FT (MOMENT)
0.5 KIPS (VERTICAL SHEAR)

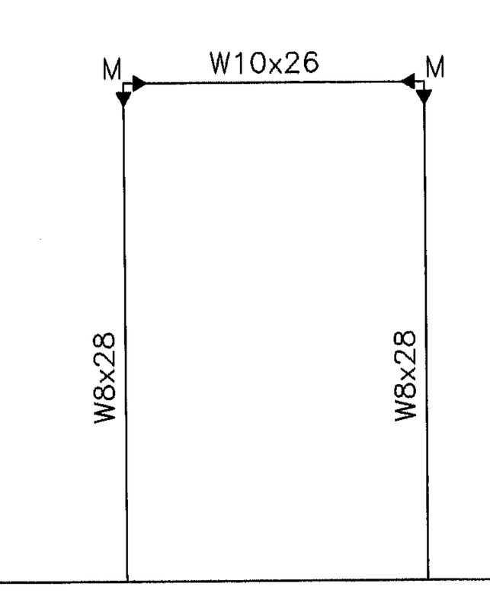


SECTION
SCALE: 3/8"=1'-0"
4 — S101-PB | S302-PB

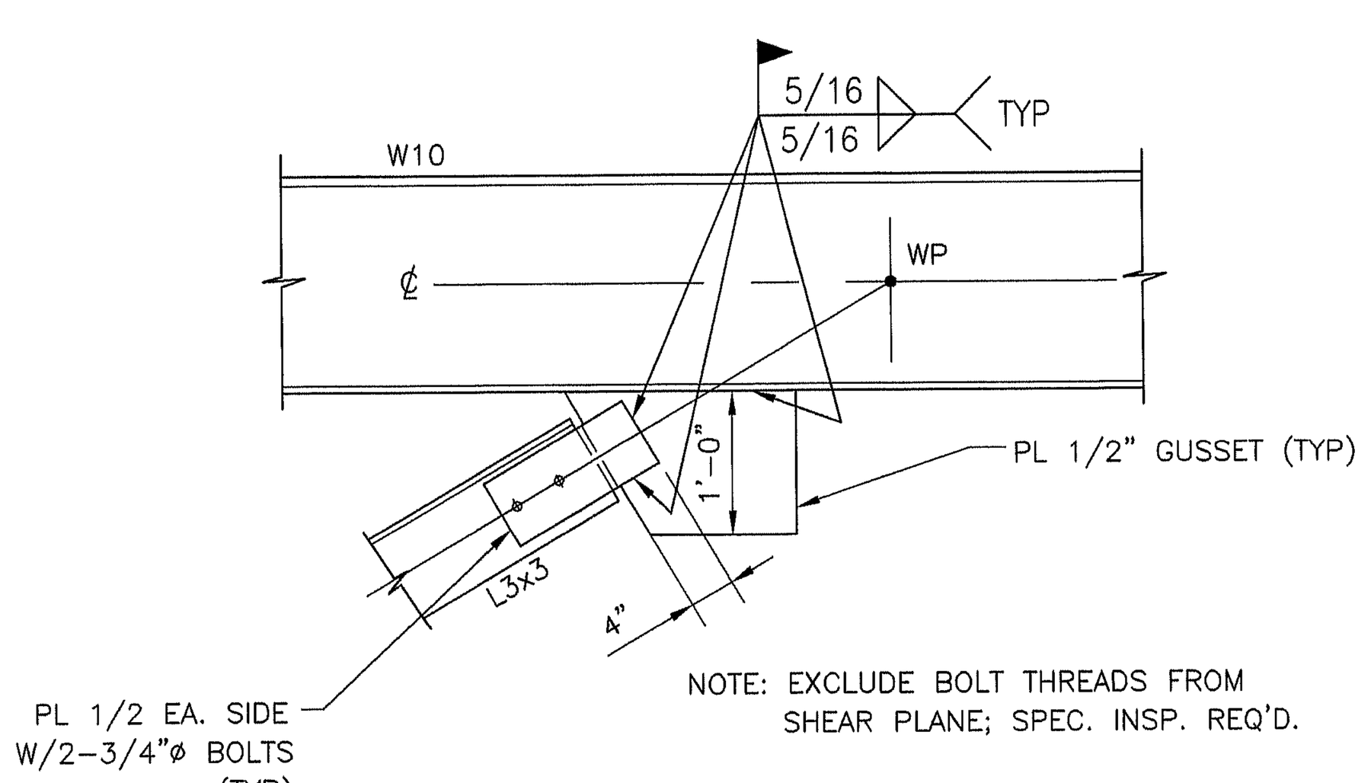




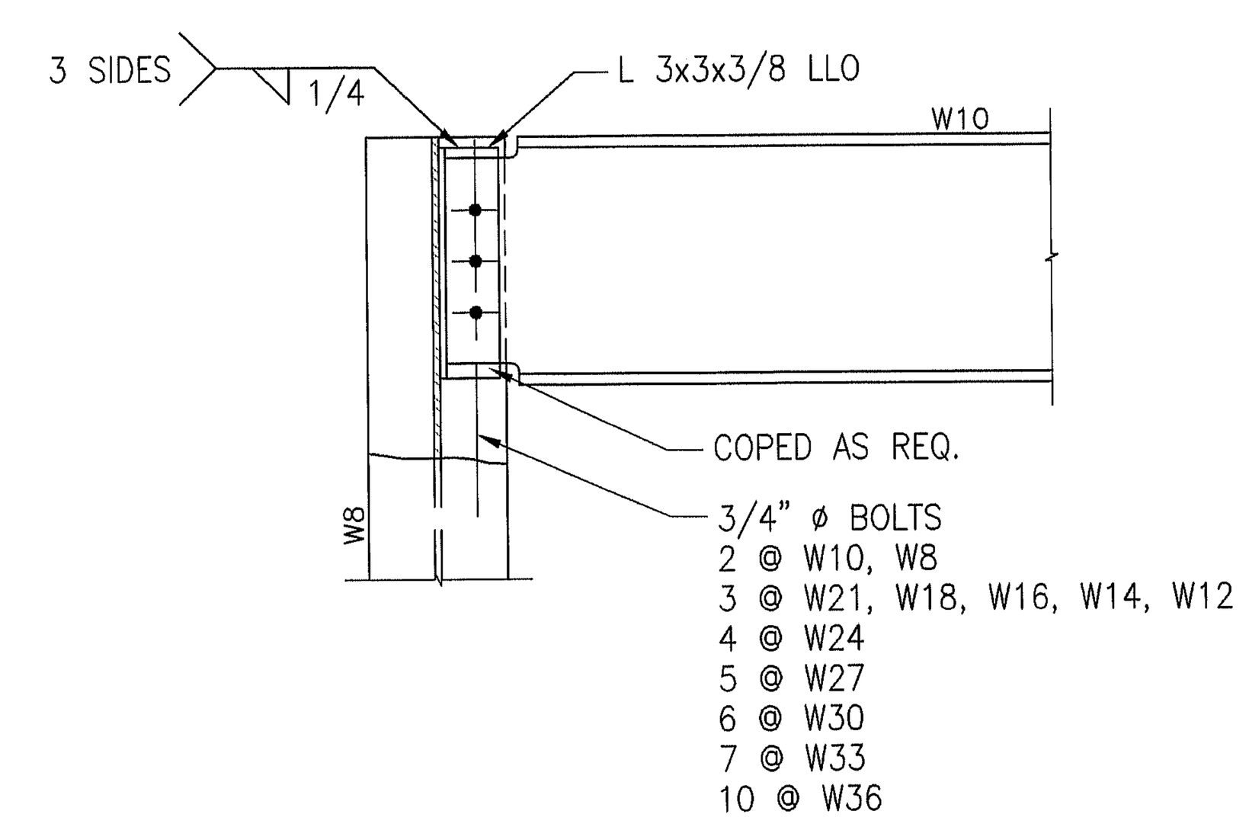
SECTION
SCALE: N.T.S.
5 — S101-PB | S302-PB



SECTION
SCALE: N.T.S.
6 — S101-PB | S302-PB



DETAIL
SCALE: 3/8"=1'-0"
7 — S302-PB | S302-PB



DETAIL
SCALE: 3/8"=1'-0"
8 — S302-PB | S302-PB

3/8"=1'-0" 12"6" 0 1' 2' 3' 4' 5' 6' 7'

GRAPHIC SCALES

MARK	DATE	MADE BY	CHECKED	DESCRIPTION
0	03/30/10	SES	SES	ISSUED FOR BIDS AND CONSTRUCTION
B	03/17/10	JM	KM	FINAL DRAWING, NOT RELEASED FOR CONSTRUCTION
A	11/13/09	JM	KM	NCDENR ATC REVIEW SUBMITTAL

REVISIONS

AECOM

NORTHEAST WASTEWATER TREATMENT PLANT IMPROVEMENTS
CITY OF HICKORY, NORTH CAROLINA

INFLUENT PUMP STATION - SECTIONS

PROJECT NO:	60102850
CAD DWG FILE:	S302-PB
DESIGNED BY:	JC
DRAWN BY:	JC
DEPT CHECK:	KM
PROJ CHECK:	SS
DATE:	NOVEMBER, 2009
SCALE:	3/8"=1'-0"

S302-PB

SHEET 92 OF 201

Appendix K

Historic Damage Records at Northeast Wastewater Treatment Facility

1185 Beaver Ruin Rd
Suite A
Norcross, GA 30093
6783252806
www.MRSystems.com

Invoice

Date	Invoice #
6/28/2019	9001-SG

Bill To
Hickory, NC P.O. Box 398 Hickory, NC 28603

MR Systems Contact Information
Project Manager: Heather Dudek
Controller: Danielle Emmett
Controller Phone: (678) 325-2806
Controller Email: demmett@mrsystems.com

P.O. Number	Terms	Due Date	Project
75841	Net 30	7/28/2019	219308-Hickory, NC-Workstation Repair

Quantity	Description	Rate	Amount
	Hickory, NC - Workstation Repair		
12	PLC Programming Labor (Irvine)	150.00	1,800.00
2	HMI Applications Labor (Ferris)	150.00	300.00
8	Project Manager Labor (Poston)	176.00	1,408.00
480	Mileage	0.58	278.40
1	Workstation Replacement	2,192.50	2,192.50T
1	Customer Appreciation Discount	-300.00	-300.00

ACCT#
PROJ#
PO# 75841
APPROVAL

Please pay within 30 days to avoid finance charge of 1% per month on unpaid balance. Thank you.

Subtotal	$5,678.90
Sales Tax (7.0%)	$153.48
Total	$5,832.38

HICKORY
North Carolina
Life. Well Crafted.

INVOICE TO:
Accounts Payable
PO Box 398
Hickory, NC 28603
(828) 323-7477
mmiller@hickorync.gov

COMPLETED

ACCOUNT INQUIRY:
Purchasing
(828) 323-7466
ahollar@hickorync.gov

PAGE: 1

DATE: 06/14/19 REQ. NO.: 75672 ACCOUNT NO.: 030802254415O2 PO: 075841

06/14/19

VENDOR: 14890
MR SYSTEMS INC
1185 BEAVER RUIN RD SUITE
NORCROSS, GA 30093

SHIP TO: CITY OF HICKORY
NORTHEAST PLANT
310 CLONINGER MILL RD
HICKORY, NC 28601

ATTN: NORTHEAST PLANT

REQUESTED BY: KJOHNSON/KEITH

TERMS: NET

PROJECT NO.:

DELIVER BY: 07/14/19

LINE	QUANTITY	UNITS	ITEM DESCRIPTION	UNIT COST	EXTENDED COST
1	5679.00	EA	FIELD WORK TO TROUBLESHOOT FLOOD DAMAGE TO SCADA COMPUTER AT INFLUENT PUMP STATION PER QUOTE# Q19-219308 DATED 6/13/19	1.0000	5679.00
			SUB-TOTAL		5679.00
			TOTAL		5679.00

E-VERIFY: Employers and their subcontractors with 25 or more employees as defined in Article 2 Chapter 64 of the NC General Statutes must comply with E-Verify requirements to contract with governmental units. E-Verify is a Federal program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law.

IRAN DIVESTMENT ACT: The City only contracts with entities that are not listed on the Iran Final Divestment List ("List") created by the State Treasurer pursuant to N.C.G.S. 147-86.58, Iran Divestment Act ("Act"). Any contract with a company on the list is deemed as a void contract per State statute. The List can be found on the State Treasurer's website and is updated annually

COMPANIES BOYCOTTING ISRAEL ACT: The City only contracts with entities that are not listed on the Companies that Boycott Israel Final Divestment List ("List") created by the State Treasurer pursuant to S.L. 2017-193 (H161). Any contract with a company on the list is deemed as a void contract per State statute. The List can be found on the State Treasurer's website and is updated annually.

IMPORTANT: Additional terms and conditions that govern this purchase order are listed on the City of Hickory website at *www.hickorync.gov/content/purchasing*. This purchase order is a counteroffer and not an acceptance. Vendors are advised to verify all information contained herein and to notify the purchasing division of any discrepancies. Applicable taxes must be stated separately on invoice. Purchase order number and complete Ship To address must appear on all shipping labels and invoice. COD shipments are not acceptable.

THIS INSTRUMENT HAS BEEN PRE-AUDITED IN THE MANNER REQUIRED BY THE LOCAL GOVERNMENT BUDGET AND FISCAL CONTROL ACT.

Melissa Miller
FINANCE OFFICER

Amanda Hollar
PURCHASING TECHNICIAN

P1625I02

CITY OF HICKORY
Purchase Requisition

6/14/19
11:14:36

Number . . . . . : 0000075672
Type . . . . . : 1 PURCHASE REQUISITION
Status . . . . . : REQUISITION APPROVAL
Reason . . . . . : EMERGENCY DUE TO FLOOD - SCADA
By . . . . . : KJOHNSON/KEITH
Date . . . . . : 6/14/19
Vendor . . . . . : 14890 MR SYSTEMS INC
Contract nbr . . . . :
Ship to . . . . . : NE NORTHEAST TREATMENT PLANT
Deliver by date . . . : 7/14/19
Buyer . . . . . :
Fiscal year code . . : C C=Current year, P=Previous year, F=Future year

Type options, press Enter.
5=Display 8=Item extended description

Opt	Line#	Quantity	UOM	Description
_	1	5679.00	EA	FIELD WORK TO TROUBLESHOOT FLOOD DAMAGE TO SCADA COMPUTER AT INFLUENT PUMP STATION PER QUOTE# Q19-219308 DATED 6/13/19

Total: 5679.00

F3=Exit F7=Alternate view F9=Print
F10=Approval info F12=Cancel F20=Comments

MSP 6.14.19

HACH®

Be Right™

INVOICE NUMBER 11528239
DATE: 06/28/2019
Page: 1

TOTAL: $6,805.20

DETACH TOP PORTION AND RETURN WITH PAYMENT TO:

Hach Company
2207 Collection Center Drive
Chicago, IL 60693
Phone: (800) 227-4224

11528234 000315036 00000680520 062819

Have you ordered online ?
Order at WWW.HACH.COM

Sort Seg: 189 Tray: 2 **DETACH HERE** **Original**

SOLD TO
CITY OF HICKORY
ACCTS PAYABLE
PO BOX 398
HICKORY, NC 28603-0398
United States

Received
JUL 10 2019
Public Utilities

SHIP TO
CITY OF HICKORY
310 CLONINGER MILL RD NE
HICKORY, NC 28601-7414
United States

INVOICE NO	11528239	**DATE:**	06/28/2019
PURCHASE ORDER NUMBER	75858		
TERMS	Net 30 Days From Invoice Date		
FREIGHT			
CARRIER	MFA-MFA**Motor Freight-Oversized-Ground		
ACCOUNT	031503		
REF. NO.	315615173-1		

Remit to:
Hach Company
2207 Collections Center Dr
Chicago, IL 60693
Phone: (800) 227-4224

These commodities are sold, packaged, marked, and labeled for destinations in the United States. Exportation of these commodities may require special licensing, packaging, marking or labeling.

LN#	PRODUCT DESCRIPTION	ITEM NO.	QUANTITY	UNIT PRICE	EXT. PRICE
1	AS950 AWRS, 115V W/HTR,5.5GAL POLY	ASA.CXXX2X11XX	1	5,940.00	5,940.00

**TRACKING NUMBERS: H160037636*

ORDER CONTACT:
KEITH RHYNE
8283225075

Notes:

SUBTOTAL	5,940.00
FREIGHT CHARGES	420.00
TAX	445.20
INVOICE TOTAL	6,805.20

ACCT# _____
PROJ# _____
PO# 75858
APPROVAL _____

PURCHASE AND ACCEPTANCE OF PRODUCT(S) SUBJECT TO HACH COMPANY'S TERMS AND CONDITIONS OF SALE, PUBLISHED ON HACH COMPANY'S WEBSITE AT WWW.HACH.COM/TERMS

For order discrepancies or product exchanges please call 800-227-4224 or 970-669-3050 to obtain Return Authorization.

FEDERAL TAX ID # 42-0704420

Environmental Test Systems A HACH Company Brand | OTT Hydromet | SEA-BIRD COASTAL | HACH MARSH MONITEK SIGMA | OTHER BRANDS FROM HACH

HICKORY
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COMPLETED

INVOICE TO:
Accounts Payable
PO Box 398
Hickory, NC 28603
(828) 323-7477
mmiller@hickorync.gov

ACCOUNT INQUIRY:
Purchasing
(828) 323-7466
ahollar@hickory nc.gov

DATE: 06/21/19 REQ. NO.: 75691 ACCOUNT NO.: 030802454415O2 PO: 075858
06/21/19

VENDOR: 11470
HACH COMPANY INC
2207 COLLECTIONS CENTER DR
CHICAGO, IL 60693

FAX# (970) 669-2932

ATTN: NORTHEAST PLANT

SHIP TO: CITY OF HICKORY
NORTHEAST PLANT
310 CLONINGER MILL RD
HICKORY, NC 28601

REQUESTED BY: KJOHNSON/KEITH

TERMS: NET

PROJECT NO.:

DELIVER BY: 07/21/19

LINE	QUANTITY	UNITS	ITEM DESCRIPTION	UNIT COST	EXTENDED COST
1	5940.00	EA	HACH ALL-WEATHER SAMPLER AS950 PER QUOTE# 100462488V2 DATED 6/19/19	1.0000	5940.00
				SUB-TOTAL	5940.00
				TOTAL	5940.00

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FINANCE OFFICER

Amanda Hollar
PURCHASING TECHNICIAN

PI625I02

CITY OF HICKORY
Purchase Requisition

6/21/19
11:53:09

Number . . . . . : 0000075691
Type . . . . . : 1 PURCHASE REQUISITION
Status . . . . . : REQUISITION APPROVAL
Reason . . . . . : EMERGENCY - DUE TO HEAVY RAIN EVENT ON 6/8/19
By . . . . . : KJOHNSON/KEITH
Date . . . . . : 6/21/19
Vendor . . . . . : 11470 HACH COMPANY INC
Contract nbr . . . . :
Ship to . . . . . : NE NORTHEAST TREATMENT PLANT
Deliver by date . . . : 7/21/19
Buyer . . . . . :
Fiscal year code . . : C C=Current year, P=Previous year, F=Future year

Type options, press Enter.
5=Display 8=Item extended description

Opt	Line#	Quantity	UOM	Description
_	1	5940.00	EA	HACH ALL-WEATHER SAMPLER AS950
				PER QUOTE# 100462488V2 DATED 6/19/19

Total: 5940.00

F3=Exit F7=Alternate view F9=Print
F10=Approval info F12=Cancel F20=Comments

American Rewinding of NC. Inc.
1825 N Rocky River Rd
Monroe, NC 28110
UNITED STATES
(704)-289-4177

INVOICE

INVOICE NUMBER	1000009372
INVOICE DATE	6/26/2019
PAGE	1

SOLD TO
HIC076
Hickory, City of
PO Box 398
Hickory, NC 28603

SHIP TO
Hickory, City of
PO Box 398
Hickory, NC 28603

NET DUE 1,280.16

SALES REP	SHIP DATE	SHIP VIA	TERMS	JOB NO	TRANS ID
200			30	00029403	00008872

CUSTOMER PO: 75840 **PO RELEASE:** **MISC NUMBER:**

NAMEPLATE DATA
PUMP MAKE:LIBERTY PUMPS; PUMP MOD#:LE104M2-2; VOLTS:440/480; PUMP SER#:8.75269900 0115

SPECIAL INSTRUCTIONS
No special instructions

ITEM # / DESCRIPTION / NOTES	LINKED JOB ID	UNITS	QUANTITY	UNIT PRICE	EXTENSION
Material Subtotal					1,196.41
Other Subtotal					0.00

ACCT# _____
PROJ# 75840
PO# _____
APPROVAL _____

TAXABLE	NONTAXABLE	FREIGHT	SALES TAX	MISC	TOTAL
1,196.41	0.00	0.00	83.75	0.00	1,280.16
PREPAYMENT	0.00			**NET DUE**	1,280.16

COMPLETED

HICKORY
North Carolina
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INVOICE TO:
Accounts Payable
PO Box 398
Hickory, NC 28603
(828) 323-7477
mmiller@hickorync.gov

ACCOUNT INQUIRY:
Purchasing
(828) 323-7466
ahollar@hickory nc.gov

PAGE: 1

DATE: 06/14/19 REQ. NO.: 75671 ACCOUNT NO.: 030802354415O2 PO: 075840
06/14/19

VENDOR: 15667
AMERICAN REWINDING OF NC INC
C/O MAGNOLIA FINANCIAL IN
PO BOX 16807
ATLANTA, GA 30321-0807

SHIP TO: CITY OF HICKORY
NORTHEAST PLANT
310 CLONINGER MILL RD
HICKORY, NC 28601

ATTN: NORTHEAST PLANT

REQUESTED BY: KJOHNSON/KEITH

TERMS: NET

PROJECT NO.:

DELIVER BY: 07/14/19

LINE	QUANTITY	UNITS	ITEM DESCRIPTION	UNIT COST	EXTENDED COST
1	1196.91	EA	CHLORINE INDUCTION PUMP PER JOB# 00029403	1.0000	1196.91
				SUB-TOTAL	1196.91
				TOTAL	1196.91

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Melissa Miller
FINANCE OFFICER

Amanda Hollar
PURCHASING TECHNICIAN

PI625I02

CITY OF HICKORY
Purchase Requisition

6/14/19
10:59:33

Number	0000075671
Type	1 PURCHASE REQUISITION
Status	REQUISITION APPROVAL
Reason	EMERGENCY - DUE TO FLOOD DAMAGE: CL INDUCTION PUMP
By	KJOHNSON/KEITH
Date	6/14/19
Vendor	15667 AMERICAN REWINDING OF NC INC
Contract nbr	
Ship to	NE NORTHEAST TREATMENT PLANT
Deliver by date	7/14/19
Buyer	
Fiscal year code	C C=Current year, P=Previous year, F=Future year

Type options, press Enter.
5=Display 8=Item extended description

Opt	Line#	Quantity	UOM	Description
_	1	1196.91	EA	CHLORINE INDUCTION PUMP PER JOB# 00029403

Total: 1196.91

F3=Exit F7=Alternate view F9=Print
F10=Approval info F12=Cancel F20=Comments

MSP
6.14.19