

Texas Commission on Environmental Quality

Edwards Aquifer Application Cover Page

Our Review of Your Application

The Edwards Aquifer Program staff conducts an administrative and technical review of all applications. The turnaround time for administrative review can be up to 30 days as outlined in 30 TAC 213.4(e). Generally administrative completeness is determined during the intake meeting or within a few days of receipt. The turnaround time for technical review of an administratively complete Edwards Aquifer application is 90 days as outlined in 30 TAC 213.4(e). Please know that the review and approval time is directly impacted by the quality and completeness of the initial application that is received. In order to conduct a timely review, it is imperative that the information provided in an Edwards Aquifer application include final plans, be accurate, complete, and in compliance with [30 TAC 213](#).

Administrative Review

1. [Edwards Aquifer applications](#) must be deemed administratively complete before a technical review can begin. To be considered administratively complete, the application must contain completed forms and attachments, provide the requested information, and meet all the site plan requirements. The submitted application and plan sheets should be final plans. Please submit one full-size set of plan sheets with the original application, and half-size sets with the additional copies.

To ensure that all applicable documents are included in the application, the program has developed tools to guide you and web pages to provide all forms, checklists, and guidance. Please visit the below website for assistance: <http://www.tceq.texas.gov/field/eapp>.

2. This Edwards Aquifer Application Cover Page form (certified by the applicant or agent) must be included in the application and brought to the administrative review meeting.
3. Administrative reviews are scheduled with program staff who will conduct the review. Applicants or their authorized agent should call the appropriate regional office, according to the county in which the project is located, to schedule a review. The average meeting time is one hour.
4. In the meeting, the application is examined for administrative completeness. Deficiencies will be noted by staff and emailed or faxed to the applicant and authorized agent at the end of the meeting, or shortly after. Administrative deficiencies will cause the application to be deemed incomplete and returned.

An appointment should be made to resubmit the application. The application is re-examined to ensure all deficiencies are resolved. The application will only be deemed administratively complete when all administrative deficiencies are addressed.

5. If an application is received by mail, courier service, or otherwise submitted without a review meeting, the administrative review will be conducted within 30 days. The applicant and agent will be contacted with the results of the administrative review. If the application is found to be administratively incomplete, it can be retrieved from the regional office or returned by regular mail. If returned by mail, the regional office may require arrangements for return shipping.
6. If the geologic assessment was completed before October 1, 2004 and the site contains “possibly sensitive” features, the assessment must be updated in accordance with the *Instructions to Geologists* (TCEQ-0585 Instructions).

Technical Review

1. When an application is deemed administratively complete, the technical review period begins. The regional office will distribute copies of the application to the identified affected city, county, and groundwater conservation district whose jurisdiction includes the subject site. These entities and the public have 30 days to provide comments on the application to the regional office. All comments received are reviewed by TCEQ.
2. A site assessment is usually conducted as part of the technical review, to evaluate the geologic assessment and observe existing site conditions. The site must be accessible to our staff. The site boundaries should be

clearly marked, features identified in the geologic assessment should be flagged, roadways marked and the alignment of the Sewage Collection System and manholes should be staked at the time the application is submitted. If the site is not marked the application may be returned.

3. We evaluate the application for technical completeness and contact the applicant and agent via Notice of Deficiency (NOD) to request additional information and identify technical deficiencies. There are two deficiency response periods available to the applicant. There are 14 days to resolve deficiencies noted in the first NOD. If a second NOD is issued, there is an additional 14 days to resolve deficiencies. If the response to the second notice is not received, is incomplete or inadequate, or provides new information that is incomplete or inadequate, the application must be withdrawn or will be denied. Please note that because the technical review is underway, whether the application is withdrawn or denied **the application fee will be forfeited**.
4. The program has 90 calendar days to complete the technical review of the application. If the application is technically adequate, such that it complies with the Edwards Aquifer rules, and is protective of the Edwards Aquifer during and after construction, an approval letter will be issued. Construction or other regulated activity may not begin until an approval is issued.

Mid-Review Modifications

It is important to have final site plans prior to beginning the permitting process with TCEQ to avoid delays.

Occasionally, circumstances arise where you may have significant design and/or site plan changes after your Edwards Aquifer application has been deemed administratively complete by TCEQ. This is considered a “Mid-Review Modification”. Mid-Review Modifications may require redistribution of an application that includes the proposed modifications for public comment.

If you are proposing a Mid-Review Modification, two options are available:

- If the technical review has begun your application can be denied/withdrawn, your fees will be forfeited, and the plan will have to be resubmitted.
- TCEQ can continue the technical review of the application as it was submitted, and a modification application can be submitted at a later time.

If the application is denied/withdrawn, the resubmitted application will be subject to the administrative and technical review processes and will be treated as a new application. The application will be redistributed to the affected jurisdictions.

Please contact the regional office if you have questions. If your project is located in Williamson, Travis, or Hays County, contact TCEQ’s Austin Regional Office at 512-339-2929. If your project is in Comal, Bexar, Medina, Uvalde, or Kinney County, contact TCEQ’s San Antonio Regional Office at 210-490-3096

Please fill out all required fields below and submit with your application.

1. Regulated Entity Name: Heritage Grove Warehouse Development					2. Regulated Entity No.: N/A this Entity does not yet have a Regulated Entity No.				
3. Customer Name: EastGroup Properties LP					4. Customer No.: N/A this Customer does not yet have a Customer No.				
5. Project Type: (Please circle/check one)	New		Modification		Extension		Exception		
6. Plan Type: (Please circle/check one)	WPAP	CZP	SCS	UST	AST	EXP	EXT	Technical Clarification	Optional Enhanced Measures
7. Land Use: (Please circle/check one)	Residential		Non-residential			8. Site (acres):		44.4 Acres	
9. Application Fee:	\$8,000		10. Permanent BMP(s):			Two [WQ Wet Pond and Raingarden/Bioretenention]			
11. SCS (Linear Ft.):	N/A		12. AST/UST (No. Tanks):			N/A			
13. County:	Williamson		14. Watershed:			Upper Brushy Creek Watershed			

Application Distribution

Instructions: Use the table below to determine the number of applications required. One original and one copy of the application, plus additional copies (as needed) for each affected incorporated city, county, and groundwater conservation district are required. Linear projects or large projects, which cross into multiple jurisdictions, can require additional copies. Refer to the “Texas Groundwater Conservation Districts within the EAPP Boundaries” map found at:

http://www.tceq.texas.gov/assets/public/compliance/field_ops/eapp/EAPP%20GWCD%20map.pdf

For more detailed boundaries, please contact the conservation district directly.

Austin Region			
County:	Hays	Travis	Williamson
Original (1 req.)	—	—	<u>X</u>
Region (1 req.)	—	—	<u>X</u>
County(ies)	—	—	<u>X</u>
Groundwater Conservation District(s)	<u>—</u> Edwards Aquifer Authority <u>—</u> Barton Springs/ Edwards Aquifer <u>—</u> Hays Trinity <u>—</u> Plum Creek	<u>—</u> Barton Springs/ Edwards Aquifer	NA
City(ies) Jurisdiction	<u>—</u> Austin <u>—</u> Buda <u>—</u> Dripping Springs <u>—</u> Kyle <u>—</u> Mountain City <u>—</u> San Marcos <u>—</u> Wimberley <u>—</u> Woodcreek	<u>—</u> Austin <u>—</u> Bee Cave <u>—</u> Pflugerville <u>—</u> Rollingwood <u>—</u> Round Rock <u>—</u> Sunset Valley <u>—</u> West Lake Hills	<u>—</u> Austin <u>—</u> Cedar Park <u>—</u> Florence <u>—</u> Georgetown <u>—</u> Jerrell <u>X</u> Leander <u>—</u> Liberty Hill <u>—</u> Pflugerville <u>—</u> Round Rock

San Antonio Region					
County:	Bexar	Comal	Kinney	Medina	Uvalde
Original (1 req.)	—	—	—	—	—
Region (1 req.)	—	—	—	—	—
County(ies)	—	—	—	—	—
Groundwater Conservation District(s)	<u>—</u> Edwards Aquifer Authority <u>—</u> Trinity-Glen Rose	<u>—</u> Edwards Aquifer Authority	<u>—</u> Kinney	<u>—</u> EAA <u>—</u> Medina	<u>—</u> EAA <u>—</u> Uvalde
City(ies) Jurisdiction	<u>—</u> Castle Hills <u>—</u> Fair Oaks Ranch <u>—</u> Helotes <u>—</u> Hill Country Village <u>—</u> Hollywood Park <u>—</u> San Antonio (SAWS) <u>—</u> Shavano Park	<u>—</u> Bulverde <u>—</u> Fair Oaks Ranch <u>—</u> Garden Ridge <u>—</u> New Braunfels <u>—</u> Schertz	NA	<u>—</u> San Antonio ETJ (SAWS)	NA

I certify that to the best of my knowledge, that the application is complete and accurate. This application is hereby submitted to TCEQ for administrative review and technical review. Emily Mahoney, Langan Engineering and Environmental Services	
Print Name of Customer/Authorized Agent 	04/06/2023
Signature of Customer/Authorized Agent	Date

FOR TCEQ INTERNAL USE ONLY			
Date(s) Reviewed:		Date Administratively Complete:	
Received From:		Correct Number of Copies:	
Received By:		Distribution Date:	
EAPP File Number:		Complex:	
Admin. Review(s) (No.):		No. AR Rounds:	
Delinquent Fees (Y/N):		Review Time Spent:	
Lat./Long. Verified:		SOS Customer Verification:	
Agent Authorization Complete/Notarized (Y/N):		Fee Check:	Payable to TCEQ (Y/N):
Core Data Form Complete (Y/N):			Signed (Y/N):
Core Data Form Incomplete Nos.:			Less than 90 days old (Y/N):

Contributing Zone Plan Application

Texas Commission on Environmental Quality

for Regulated Activities on the Contributing Zone to the Edwards Aquifer and Relating to 30 TAC §213.24(1), Effective June 1, 1999

To ensure that the application is administratively complete, confirm that all fields in the form are complete, verify that all requested information is provided, consistently reference the same site and contact person in all forms in the application, and ensure forms are signed by the appropriate party.

Note: Including all the information requested in the form and attachments contributes to more streamlined technical reviews.

Signature

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. This **Contributing Zone Plan Application** is hereby submitted for TCEQ review and Executive Director approval. The application was prepared by:

Print Name of Customer/Agent: Emily Mahoney, Langan Engineering and Environmental Services

Date: 04/06/2023

Signature of Customer/Agent:



Regulated Entity Name: Heritage Grove Warehouse Development

Project Information

1. County: Williamson
2. Stream Basin: Upper Brushy Creek
3. Groundwater Conservation District (if applicable): N/A
4. Customer (Applicant):

Contact Person: Reid Dunbar

Entity: EastGroup Properties LP

Mailing Address: 6565 N MacArthur Blvd, Suite 255

City, State: Irving, TX

Zip: 75039

Telephone: 972-386-8700

Fax: _____

Email Address: reid.dunbar@eastgroup.net

5. Agent/Representative (If any):

Contact Person: Emily Mahoney

Entity: Langan Engineering and Environmental Services

Mailing Address: 9606 N. Mopac Expy., Suite 110

City, State: Austin, TX

Zip: 78759

Telephone: 713-825-6102

Fax: 281-675.7901

Email Address: emahoney@langan.com

6. Project Location:

- ☒ The project site is located inside the city limits of Leander.
- ☐ The project site is located outside the city limits but inside the ETJ (extra-territorial jurisdiction) of _____.
- ☐ The project site is not located within any city's limits or ETJ.

7. ☒ The location of the project site is described below. Sufficient detail and clarity has been provided so that the TCEQ's Regional staff can easily locate the project and site boundaries for a field investigation.

The site is bounded by Capital Metro R.O.W. to the North, Heritage Grove Rd to the South, undeveloped area to the East, and residential area to the West

8. ☒ **Attachment A - Road Map.** A road map showing directions to and the location of the project site is attached. The map clearly shows the boundary of the project site.
9. ☒ **Attachment B - USGS Quadrangle Map.** A copy of the official 7 ½ minute USGS Quadrangle Map (Scale: 1" = 2000') is attached. The map(s) clearly show:
- ☒ Project site boundaries.
 - ☒ USGS Quadrangle Name(s).
10. ☒ **Attachment C - Project Narrative.** A detailed narrative description of the proposed project is attached. The project description is consistent throughout the application and contains, at a minimum, the following details:
- ☒ Area of the site
 - ☒ Offsite areas
 - ☒ Impervious cover
 - ☒ Permanent BMP(s)
 - ☒ Proposed site use
 - ☒ Site history

- ☒ Previous development
☒ Area(s) to be demolished

11. Existing project site conditions are noted below:

- ☐ Existing commercial site
☐ Existing industrial site
☒ Existing residential site
☒ Existing paved and/or unpaved roads
☒ Undeveloped (Cleared)
☒ Undeveloped (Undisturbed/Not cleared)
☐ Other: _____

12. The type of project is:

- ☐ Residential: # of Lots: _____
☐ Residential: # of Living Unit Equivalents: _____
☐ Commercial
☒ Industrial
☐ Other: _____

13. Total project area (size of site): 44.4 Acres

Total disturbed area: 37.3 Acres

14. Estimated projected population: N/A non-residential

15. The amount and type of impervious cover expected after construction is complete is shown below:

Table 1 - Impervious Cover

<i>Impervious Cover of Proposed Project</i>	<i>Sq. Ft.</i>	<i>Sq. Ft./Acre</i>	<i>Acres</i>
Structures/Rooftops	599310.0	÷ 43,560 =	13.8
Parking	168565.1	÷ 43,560 =	3.9
Other paved surfaces	599515.6	÷ 43,560 =	13.8
Total Impervious Cover	1367390.7	÷ 43,560 =	31.4

Total Impervious Cover 31.4 ÷ Total Acreage 44.4 X 100 = 71% Impervious Cover

16. ☒ **Attachment D - Factors Affecting Surface Water Quality.** A detailed description of all factors that could affect surface water quality is attached. If applicable, this includes the location and description of any discharge associated with industrial activity other than construction.

17. ☒ Only inert materials as defined by 30 TAC 330.2 will be used as fill material.

For Road Projects Only

Complete questions 18 - 23 if this application is exclusively for a road project.

☒ N/A

18. Type of project:

- ☐ TXDOT road project.
☐ County road or roads built to county specifications.
☐ City thoroughfare or roads to be dedicated to a municipality.
☐ Street or road providing access to private driveways.

19. Type of pavement or road surface to be used:

- ☐ Concrete
☐ Asphaltic concrete pavement
☐ Other: _____

20. Right of Way (R.O.W.):

Length of R.O.W.: _____ feet.

Width of R.O.W.: _____ feet.

$L \times W = \text{_____ Ft}^2 \div 43,560 \text{ Ft}^2/\text{Acre} = \text{_____ acres.}$

21. Pavement Area:

Length of pavement area: _____ feet.

Width of pavement area: _____ feet.

$L \times W = \text{_____ Ft}^2 \div 43,560 \text{ Ft}^2/\text{Acre} = \text{_____ acres.}$

Pavement area _____ acres $\div$ R.O.W. area _____ acres $\times 100 = \text{_____ \%}$ impervious cover.

22. ☐ A rest stop will be included in this project.

☐ A rest stop will not be included in this project.

23. ☐ Maintenance and repair of existing roadways that do not require approval from the TCEQ Executive Director. Modifications to existing roadways such as widening roads/adding shoulders totaling more than one-half (1/2) the width of one (1) existing lane require prior approval from the TCEQ.

Stormwater to be generated by the Proposed Project

24. ☒ **Attachment E - Volume and Character of Stormwater.** A detailed description of the volume (quantity) and character (quality) of the stormwater runoff which is expected to occur from the proposed project is attached. The estimates of stormwater runoff quality and quantity are based on area and type of impervious cover. Include the runoff coefficient of the site for both pre-construction and post-construction conditions.

Wastewater to be generated by the Proposed Project

25. ☐ Wastewater is to be discharged in the contributing zone. Requirements under 30 TAC §213.6(c) relating to Wastewater Treatment and Disposal Systems have been satisfied.

☒ N/A

26. Wastewater will be disposed of by:

☐ On-Site Sewage Facility (OSSF/Septic Tank):

☐ **Attachment F - Suitability Letter from Authorized Agent.** An on-site sewage facility will be used to treat and dispose of the wastewater from this site. The appropriate licensing authority's (authorized agent) written approval is attached. It states that the land is suitable for the use of private sewage facilities and will meet or exceed the requirements for on-site sewage facilities as specified under 30 TAC Chapter 285 relating to On-site Sewage Facilities.

☐ Each lot in this project/development is at least one (1) acre (43,560 square feet) in size. The system will be designed by a licensed professional engineer or registered sanitarian and installed by a licensed installer in compliance with 30 TAC Chapter 285.

☒ Sewage Collection System (Sewer Lines):

The sewage collection system will convey the wastewater to the Leander 2243 Wastewater (name) Treatment Plant. The treatment facility is:

☒ Existing.

☐ Proposed.

☐ N/A

Permanent Aboveground Storage Tanks(ASTs) ≥ 500 Gallons

Complete questions 27 - 33 if this project includes the installation of AST(s) with volume(s) greater than or equal to 500 gallons.

☒ N/A

27. Tanks and substance stored:

Table 2 - Tanks and Substance Storage

<i>AST Number</i>	<i>Size (Gallons)</i>	<i>Substance to be Stored</i>	<i>Tank Material</i>
1			
2			
3			

<i>AST Number</i>	<i>Size (Gallons)</i>	<i>Substance to be Stored</i>	<i>Tank Material</i>
4			
5			

Total x 1.5 = _____ Gallons

28. ☐ The AST will be placed within a containment structure that is sized to capture one and one-half (1 1/2) times the storage capacity of the system. For facilities with more than one tank system, the containment structure is sized to capture one and one-half (1 1/2) times the cumulative storage capacity of all systems.

☐ **Attachment G - Alternative Secondary Containment Methods.** Alternative methods for providing secondary containment are proposed. Specifications showing equivalent protection for the Edwards Aquifer are attached.

29. Inside dimensions and capacity of containment structure(s):

Table 3 - Secondary Containment

<i>Length (L)(Ft.)</i>	<i>Width(W)(Ft.)</i>	<i>Height (H)(Ft.)</i>	<i>L x W x H = (Ft3)</i>	<i>Gallons</i>

Total: _____ Gallons

30. Piping:

- ☐ All piping, hoses, and dispensers will be located inside the containment structure.
- ☐ Some of the piping to dispensers or equipment will extend outside the containment structure.
- ☐ The piping will be aboveground
- ☐ The piping will be underground

31. ☐ The containment area must be constructed of and in a material impervious to the substance(s) being stored. The proposed containment structure will be constructed of: _____.

32. ☐ **Attachment H - AST Containment Structure Drawings.** A scaled drawing of the containment structure is attached that shows the following:

- ☐ Interior dimensions (length, width, depth and wall and floor thickness).
- ☐ Internal drainage to a point convenient for the collection of any spillage.
- ☐ Tanks clearly labeled
- ☐ Piping clearly labeled

- ☐ Dispenser clearly labeled
33. ☐ Any spills must be directed to a point convenient for collection and recovery. Spills from storage tank facilities must be removed from the controlled drainage area for disposal within 24 hours of the spill.
- ☐ In the event of a spill, any spillage will be removed from the containment structure within 24 hours of the spill and disposed of properly.
- ☐ In the event of a spill, any spillage will be drained from the containment structure through a drain and valve within 24 hours of the spill and disposed of properly. The drain and valve system are shown in detail on the scaled drawing.

Site Plan Requirements

Items 34 - 46 must be included on the Site Plan.

34. ☒ The Site Plan must have a minimum scale of 1" = 400'.
Site Plan Scale: 1" = 100'.
35. 100-year floodplain boundaries:
- ☐ Some part(s) of the project site is located within the 100-year floodplain. The floodplain is shown and labeled.
- ☒ No part of the project site is located within the 100-year floodplain.
The 100-year floodplain boundaries are based on the following specific (including date of material) sources(s): FEMA FIRM 48491C0455F Effective date December 20, 2019.
36. ☒ The layout of the development is shown with existing and finished contours at appropriate, but not greater than ten-foot contour intervals. Lots, recreation centers, buildings, roads, etc. are shown on the site plan.
- ☐ The layout of the development is shown with existing contours at appropriate, but not greater than ten-foot contour intervals. Finished topographic contours will not differ from the existing topographic configuration and are not shown. Lots, recreation centers, buildings, roads, etc. are shown on the site plan.
37. ☒ A drainage plan showing all paths of drainage from the site to surface streams.
38. ☒ The drainage patterns and approximate slopes anticipated after major grading activities.
39. ☒ Areas of soil disturbance and areas which will not be disturbed.
40. ☒ Locations of major structural and nonstructural controls. These are the temporary and permanent best management practices.
41. ☒ Locations where soil stabilization practices are expected to occur.
42. ☒ Surface waters (including wetlands).
☐ N/A

43. ☐ Locations where stormwater discharges to surface water.
☒ There will be no discharges to surface water.
44. ☐ Temporary aboveground storage tank facilities.
☒ Temporary aboveground storage tank facilities will not be located on this site.
45. ☐ Permanent aboveground storage tank facilities.
☒ Permanent aboveground storage tank facilities will not be located on this site.
46. ☒ Legal boundaries of the site are shown.

Permanent Best Management Practices (BMPs)

Practices and measures that will be used during and after construction is completed.

47. ☒ Permanent BMPs and measures must be implemented to control the discharge of pollution from regulated activities after the completion of construction.
☐ N/A
48. ☒ These practices and measures have been designed, and will be constructed, operated, and maintained to insure that 80% of the incremental increase in the annual mass loading of total suspended solids (TSS) from the site caused by the regulated activity is removed. These quantities have been calculated in accordance with technical guidance prepared or accepted by the executive director.
☒ The TCEQ Technical Guidance Manual (TGM) was used to design permanent BMPs and measures for this site.
☐ A technical guidance other than the TCEQ TGM was used to design permanent BMPs and measures for this site. The complete citation for the technical guidance that was used is: _____.
☐ N/A
49. ☒ Owners must insure that permanent BMPs and measures are constructed and function as designed. A Texas Licensed Professional Engineer must certify in writing that the permanent BMPs or measures were constructed as designed. The certification letter must be submitted to the appropriate regional office within 30 days of site completion.
☐ N/A
50. Where a site is used for low density single-family residential development and has 20 % or less impervious cover, other permanent BMPs are not required. This exemption from permanent BMPs must be recorded in the county deed records, with a notice that if the percent impervious cover increases above 20% or land use changes, the exemption for the whole site as described in the property boundaries required by 30 TAC §213.4(g) (relating to Application Processing and Approval), may no longer apply and the property owner must notify the appropriate regional office of these changes.

- ☐ The site will be used for low density single-family residential development and has 20% or less impervious cover.
- ☐ The site will be used for low density single-family residential development but has more than 20% impervious cover.
- ☒ The site will not be used for low density single-family residential development.

51. The executive director may waive the requirement for other permanent BMPs for multi-family residential developments, schools, or small business sites where 20% or less impervious cover is used at the site. This exemption from permanent BMPs must be recorded in the county deed records, with a notice that if the percent impervious cover increases above 20% or land use changes, the exemption for the whole site as described in the property boundaries required by 30 TAC §213.4(g) (relating to Application Processing and Approval), may no longer apply and the property owner must notify the appropriate regional office of these changes.

- ☐ **Attachment I - 20% or Less Impervious Cover Waiver.** The site will be used for multi-family residential developments, schools, or small business sites and has 20% or less impervious cover. A request to waive the requirements for other permanent BMPs and measures is attached.
- ☐ The site will be used for multi-family residential developments, schools, or small business sites but has more than 20% impervious cover.
- ☒ The site will not be used for multi-family residential developments, schools, or small business sites.

52. ☒ **Attachment J - BMPs for Upgradient Stormwater.**

- ☒ A description of the BMPs and measures that will be used to prevent pollution of surface water, groundwater, or stormwater that originates upgradient from the site and flows across the site is attached.
- ☐ No surface water, groundwater or stormwater originates upgradient from the site and flows across the site, and an explanation is attached.
- ☐ Permanent BMPs or measures are not required to prevent pollution of surface water, groundwater, or stormwater that originates upgradient from the site and flows across the site, and an explanation is attached.

53. ☒ **Attachment K - BMPs for On-site Stormwater.**

- ☒ A description of the BMPs and measures that will be used to prevent pollution of surface water or groundwater that originates on-site or flows off the site, including pollution caused by contaminated stormwater runoff from the site is attached.
- ☐ Permanent BMPs or measures are not required to prevent pollution of surface water or groundwater that originates on-site or flows off the site, including pollution caused by contaminated stormwater runoff, and an explanation is attached.

54. ☒ **Attachment L - BMPs for Surface Streams.** A description of the BMPs and measures that prevent pollutants from entering surface streams is attached.

☐ N/A

55. ☒ **Attachment M - Construction Plans.** Construction plans and design calculations for the proposed permanent BMPs and measures have been prepared by or under the direct supervision of a Texas Licensed Professional Engineer, and are signed, sealed, and dated. Construction plans for the proposed permanent BMPs and measures are attached and include: Design calculations, TCEQ Construction Notes, all proposed structural plans and specifications, and appropriate details.

☐ N/A

56. ☒ **Attachment N - Inspection, Maintenance, Repair and Retrofit Plan.** A site and BMP specific plan for the inspection, maintenance, repair, and, if necessary, retrofit of the permanent BMPs and measures is attached. The plan fulfills all of the following:

- ☒ Prepared and certified by the engineer designing the permanent BMPs and measures
- ☒ Signed by the owner or responsible party
- ☒ Outlines specific procedures for documenting inspections, maintenance, repairs, and, if necessary, retrofit.
- ☒ Contains a discussion of record keeping procedures

☐ N/A

57. ☐ **Attachment O - Pilot-Scale Field Testing Plan.** Pilot studies for BMPs that are not recognized by the Executive Director require prior approval from the TCEQ. A plan for pilot-scale field testing is attached.

☒ N/A

58. ☐ **Attachment P - Measures for Minimizing Surface Stream Contamination.** A description of the measures that will be used to avoid or minimize surface stream contamination and changes in the way in which water enters a stream as a result of the construction and development is attached. The measures address increased stream flashing, the creation of stronger flows and in-stream velocities, and other in-stream effects caused by the regulated activity, which increase erosion that result in water quality degradation.

☒ N/A

Responsibility for Maintenance of Permanent BMPs and Measures after Construction is Complete.

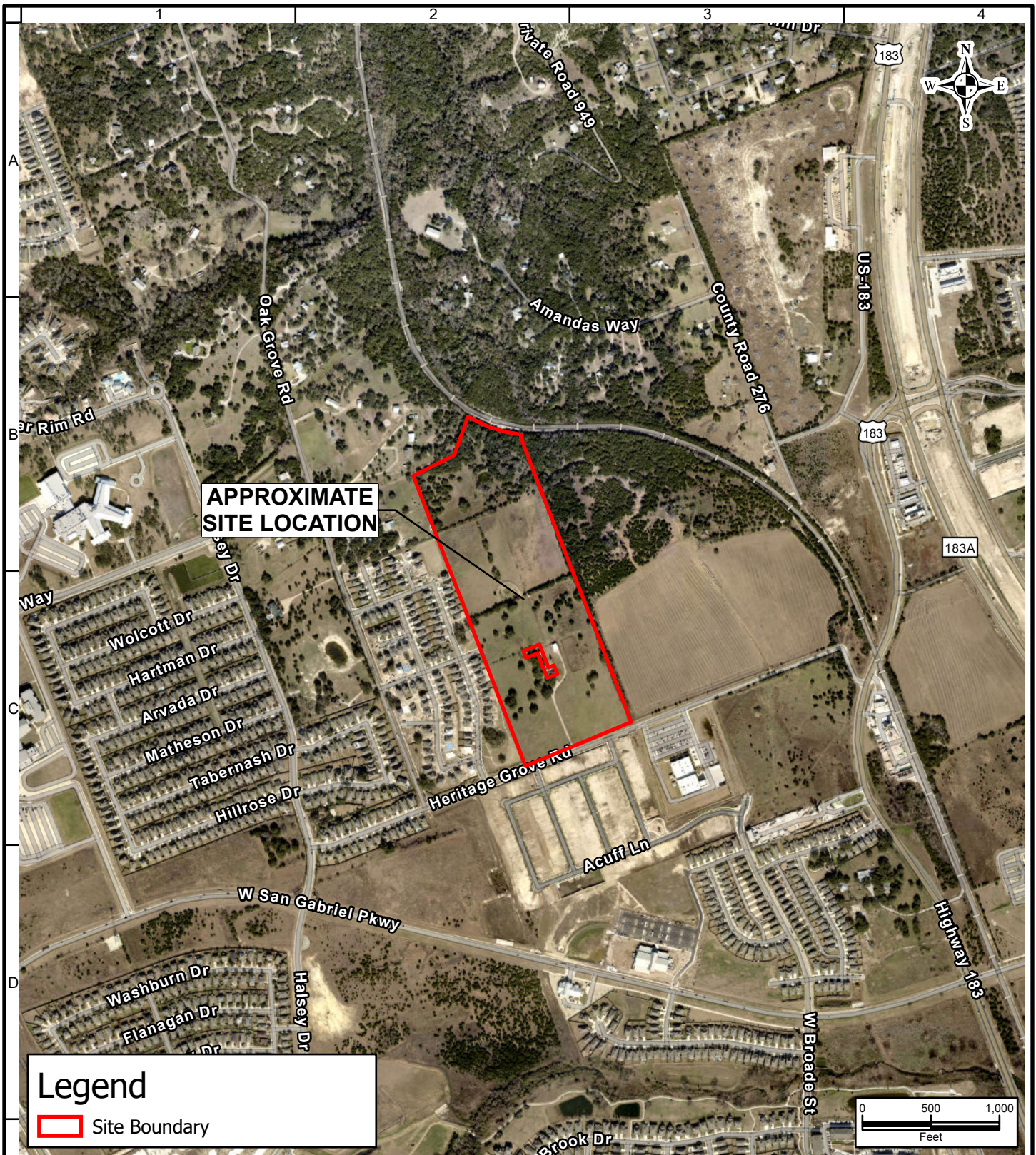
59. ☒ The applicant is responsible for maintaining the permanent BMPs after construction until such time as the maintenance obligation is either assumed in writing by another entity having ownership or control of the property (such as without limitation, an owner's association, a new property owner or lessee, a district, or municipality) or the ownership of the property is transferred to the entity. Such entity shall then be

responsible for maintenance until another entity assumes such obligations in writing or ownership is transferred.

60. ☒ A copy of the transfer of responsibility must be filed with the executive director at the appropriate regional office within 30 days of the transfer if the site is for use as a multiple single-family residential development, a multi-family residential development, or a non-residential development such as commercial, industrial, institutional, schools, and other sites where regulated activities occur.

Administrative Information

61. ☒ Submit one (1) original and one (1) copy of the application, plus additional copies as needed for each affected incorporated city, groundwater conservation district, and county in which the project will be located. The TCEQ will distribute the additional copies to these jurisdictions.
62. ☒ Any modification of this Contributing Zone Plan may require TCEQ review and Executive Director approval prior to construction, and may require submission of a revised application, with appropriate fees.
63. ☒ The site description, controls, maintenance, and inspection requirements for the storm water pollution prevention plan (SWPPP) developed under the EPA NPDES general permits for stormwater discharges have been submitted to fulfill paragraphs 30 TAC §213.24(1-5) of the technical report. All requirements of 30 TAC §213.24(1-5) have been met by the SWPPP document.
- ☒ The Temporary Stormwater Section (TCEQ-0602) is included with the application.



Esri Community Maps Contributors, City of Austin, County of Williamson, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Williamson County TX, Maxar; Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

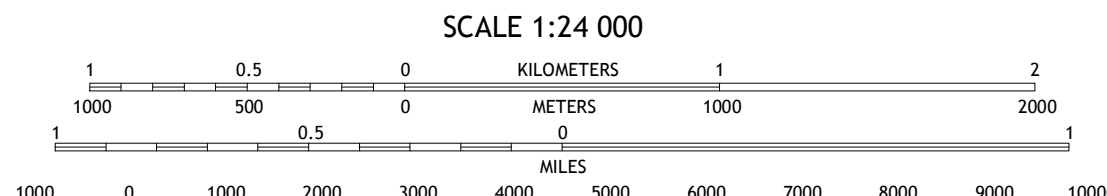
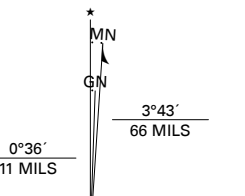
LANGAN 11801 Domain Blvd Austin, TX 78758 T: 800.952.6426 www.langan.com Langan Engineering & Environmental Services, Inc. Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. Langan International Collectively known as Langan	Project HERITAGE GROVE ROAD LEANDER COUNTY WILLIAMSON TEXAS	Drawing Title ATTACHMENT A ROAD MAP	Project No. Date 1/19/2023 Scale 1:1,000 Drawn By Site Analyzer Submission Date 01/19/2023	Figure 1 Sheet 1 of 1
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Produced by the United States Geological Survey

North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid/Universal Transverse Mercator, Zone 14R.
This map is not a legal document. Boundaries may be
generalized for this map scale. Private lands within government
reservations may not be shown. Obtain permission before
entering private lands.

Imagery.....NAIP, Census 2016 - November 2016
Roads.....U.S. Census Bureau, 2015
Names.....GNS, 1979 - 2018
Hydrography.....National Hydrography Dataset, 2002 - 2018
Contours.....National Elevation Dataset, 2002
Boundaries.....Multiple sources; see metadata file 2016 - 2017
Wetlands.....FWS National Wetlands Inventory 1982



CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988
This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.18



1	2	3
4	5	6
7	8	9

ADJOINING QUADRANGLES

ROAD CLASSIFICATION	
Expressway	Local Connector
Secondary Hwy	Local Road
Ramp	4WD
Interstate Route	US Route
	State Route

LEANDER, TX
2019



General Information Form TCEQ Form 0587
Attachment C – Project Description

Refer to the included Post Construction Stormwater Management (PCSM) Report for additional details.

EastGroup Properties LP is proposing to construct seven office/warehouse buildings totaling +/- 599,310 SF on a 44.4 acre tract located in the City of Leander, Williamson County, TX. The site is located to the west of the intersection of Heritage Grove Rd and N US HWY 183, east of Oak Grove Rd, and north of San Gabriel Pkwy (See Figure 1). There is an existing residential area, two existing upland ponds, one swale, and an existing ephemeral stream within the site. The topography of the site to the south generally slopes to the north to the existing ponds

The neighboring development to the west, Haven Oaks, currently directs their stormwater discharge to the subject property. A vegetated swale has been provided to route this offsite upgradient stormwater flow around the proposed water quality wet pond and downstream to the ephemeral stream at the property boundary.

Included in the development plans is the construction of a water quality wet pond with extended detention, a raingarden/bioretention area, and an underground stormwater conveyance system to provide for drainage of the site. The impervious cover proposed for the post-construction site is 31.4 acres, or 71% of the site.

CZP Application TCEQ Form 10257
Attachment D – Factors Affecting Surface Water Quality

The potential factors affecting **construction period surface water quality** from this site are: sediment runoff from disturbed areas, petroleum products runoff from drips from construction equipment, pesticides and fertilizers from landscaping activities, and high pH washwater from concrete and masonry cleanup/washout facilities. Sediment runoff will be significantly reduced during construction by the use of onsite temporary sedimentation basins and perimeter BMPs. The high pH washwater potential will be controlled by requiring the use of appropriately sized, plastic-lined containment areas for concrete and masonry cement washout and cleanup activities. The petroleum and pesticide/fertilizer sources will be minimized by the use of good housekeeping procedures and inspections by trained personnel to ensure that all construction activities follow the procedures of the Storm Water Pollution prevention Plan prepared for the site.

The potential factors affecting **post-construction surface water quality** from this site are: pesticide and fertilizer runoff from vegetated areas, petroleum products runoff from parking areas and drives. Sediment runoff from the site will be significantly reduced by the action of the water quality/detention ponds. Pesticide/fertilizer runoff will be minimized by education of the facility employees or outside landscaping firm relative to acceptable landscaping practices after construction activities are completed.

CZP Application TCEQ Form 10257

Attachment E – Volume and Character of Stormwater

Refer to the included Post Construction Stormwater Management (PCSM) Report for more details on the information presented below.

Stormwater Management Design

The City of Leander has adopted the City of Austin Drainage Criteria Manual. In accordance with the City of Austin Drainage Criteria Manual, this study was prepared using the soil-cover-complex methodology. The design storms used for the analysis of peak rate discharges from the site are the 2, 10, 25, and 100-year storms. Hydrographs for the existing and proposed watersheds were developed using the NRCS TR-55 method. The TR-55 method simulates a watershed as a series of overland flows, channel flows, and inflow and outflow structures for its contribution to runoff. A value for area, curve number (CN), and time of concentration (Tc) was calculated for each watershed.

The curve number (CN) is a land sensitive coefficient that dictates the relationship between total rainfall depth and direct storm runoff. Based on the coverage of soil groups and land use in the area, an average CN was determined for each watershed for existing and proposed conditions. Existing non-forested pervious areas shall be considered "meadow" in good condition. Using the Soil Conservation Service (SCS) Soil Survey for Williamson County the soils within the watershed were divided into hydrologic soil groups. The SCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have the lowest runoff potential and "D" soils have the greatest runoff potential. Soils within the watershed are classified as soils with a group designation of "D" (see Figure 2).

The following table summarizes the Runoff Curve Numbers used in calculating the existing and proposed peak rate of runoff for the stormwater management system.

Table 1 Summary of Runoff Curve Numbers

Land Use	Hydrologic Soil Group	Runoff Curve Number
Wooded, Good Condition	D	77
Meadow, Good Condition	D	78
Grass, Good Condition	D	80
Impervious	D	98

The time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest. Values of the time of concentration were determined for existing and proposed conditions based on the land cover and slope of the flow path using methods described in USDA Soil Conservation Service Publication TR-55 "Urban Hydrology for Small Watersheds." The TR-55 procedure simulates a watershed as a series of overland flows, channel flows, and inflow and outflow structures for its contribution to runoff. The length of initial sheet flow was limited to 100 feet. For the proposed conditions, the majority

of the site is paved and results in small times of concentration. A minimum time of concentration of 5 minutes has been used.

The design storm used for the TR-55 study is the 24 hour SCS Type II cumulative rainfall distribution. Twenty-four hour rainfall depths were obtained from NOAA Atlas 14, Volume 11, Version 2.

Rainfall hydrographs developed from TR-55 methods were then routed through the proposed stormwater management basin using level pool routing techniques.

Existing Site Description

The 44 +/- acre tract is located in the City of Leander, Williamson County, TX. The site is located to the west of the intersection of Heritage Grove Rd and N US HWY, east of Oak Grove Rd, and north of San Gabriel Pkwy. There is an existing residential area, two existing upland ponds, one swale, and an existing ephemeral stream within the site. The topography of the site to the south generally slopes to the north to an existing ponds.

Proposed Development

The proposed development consists of the construction of seven office/warehouse buildings totaling +/- 559,310 SF and associated site improvements, on the 44 +/- acre parcel. A system of catch basins and underground conduits will collect stormwater and convey it to the proposed on-site detention and wet ponds.

TABLE 2 - SUMMARY OF EXISTING PEAK DISCHARGES FROM OFF-SITE WATERSHEDS FROM RESIDENTIAL PROPERTY WEST OF THE SITE

Storm (YR)	PR DA-2 (CFS)	PR DA-3 (CFS)
2	2.2	1.8
10	3.9	3.2
25	5.1	4.2
100	7.1	5.8

TABLE 2 - SUMMARY OF EXISTING PEAK DISCHARGES FROM ON-SITE WATERSHEDS AT POINTS OF ANALYSIS

Storm (YR)	EX-1 (POA#1) (CFS)	EX-2 (POA#2) (CFS)
2	12.3	52.5
10	24.7	105.0
25	33.5	142.5
100	48.8	207.3

TABLE 3 - SUMMARY OF PROPOSED PEAK DISCHARGES FROM WATERSHEDS – POA1

Storm (YR)	PR-1 (CFS)
2	0.1
10	0.2
25	0.3
100	0.4

TABLE 4 - SUMMARY OF PROPOSED PEAK DISCHARGES FROM WATERSHEDS – POA2

Storm (YR)	PR-2A (CFS)	PR-2B (CFS)	PR-2C (CFS)
2	10.8	195.5	13.7
10	19.4	304.9	27.2
25	25.2	379.3	36.8
100	35.2	506.9	53.2

TABLE 5 - SUMMARY OF POND ROUTING – BIORETENTION

Storm (YR)	Peak Inflow (CFS)	Peak Outflow (CFS)	Maximum elevation In pond (FT)	Maximum storage Volume in pond (AC FT)
2	10.8	2.1	988.2	0.4
10	19.4	3.0	988.6	0.6
25	25.2	3.6	988.9	0.7
100	35.2	4.4	989.4	1.1

TABLE 6 - SUMMARY OF POND ROUTING – WET POND

Storm (YR)	Peak Inflow (CFS)	Peak Outflow (CFS)	Maximum elevation In pond (FT)	Maximum storage Volume in pond (AC FT)
2	199.4	44.1	967.6	5.3
10	311.5	94.1	968.8	7.8
25	387.9	128.4	969.5	9.4
100	518.6	184.4	970.5	11.9

**TABLE 7 - COMPARISON OF EXISTING VERSUS PROPOSED DISCHARGE RATES
POA #1**

Storm (YR)	EXISTING (CFS)	PROPOSED (CFS)
2	12.3	0.1
10	24.7	0.2
25	33.5	0.3
100	48.7	0.4

**TABLE 8 - COMPARISON OF EXISTING VERSUS PROPOSED DISCHARGE RATES
POA #2**

Storm (YR)	EXISTING (CFS)	PROPOSED (CFS)
2	52.5	47.9
10	105.0	103.3
25	142.5	142.4
100	207.3	207.2

**Permanent Stormwater Management Practices TCEQ Form 10257
Attachment J– BMPs for Upgradient Stormwater**

There is an existing ephemeral stream within the site. The neighboring development to the west, Haven Oaks, currently directs their stormwater discharge to the subject property and this ephemeral stream. A vegetated swale has been provided to route this offsite upgradient stormwater flow around the proposed water quality wet pond and downstream to the ephemeral stream at the property boundary.

Permanent Stormwater Management Practices TCEQ Form 10257

Attachment K – BMPs for On-Site Stormwater

Refer to the included Post Construction Stormwater Management (PCSM) Report for all the required details.

Stabilization practices for this site include:

1. Land clearing activities shall be done only in areas where earthwork will be performed and shall progress as earthwork is needed
2. Frequent watering of excavation and fill areas to minimize wind erosion during construction
3. Permanent seeding and planting of all unpaved areas
4. Use of stabilization fabric for all slopes having a slope of 3H:1V or greater
5. For all disturbed areas where construction activities have temporarily or permanently ceased for more than 14 days, stabilization activities shall commence no later than the 14th day after cessation of construction activities.

Structure practices for this site include:

1. Inlet protection using block and gravel filled bags and silt fence
2. Perimeter fencing using silt fencing and/or erosion control logs
3. Stabilized construction exit point
4. Temporary sediment basins with faircloth skimmer and emergency overflow weir outlet structures for dewatering. The sediment basins are to be installed in same siting and orientation as permanent pond BMPs, which have been sized for the 100 year 24-hr storm event. Therefore, they are adequately sized for the 2 year 24-hr storm event.
5. Contractor shall provide sufficient velocity dissipation devices in the form of rock rip rap for velocity dissipation at areas with existing or potential channelized flow.

Permanent BMPs

Wet Pond: Pond-1 is designed as a wet basin. A wet basin is a facility that removes sediment, organic nutrients, and trace metals from stormwater runoff. This is accomplished by detaining stormwater using an in-line permanent pool or pond resulting in settling of pollutants. Biological processes occurring in the permanent pool aid in reducing the amount of soluble nutrients present in the water. The wet ponds have been designed in accordance with the TCEQ Edwards Aquifer Compliance Technical Guidance Manual on Best Management Practices.

Bioretention: Pond-2 is designed as bioretention basin or rain garden. A bioretention basin contains landscaping features adapted to provide on-site treatment of storm water runoff. They are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. During storms, stormwater runoff is collected and then percolates through the plant, mulch, and soil layers of this system. Runoff from larger storms is generally diverted past the facility to the storm drain system. The remaining runoff filters through the mulch and prepared soil mix

**Permanent Stormwater Management Practices TCEQ Form 10257
Attachment L – BMPs for Surface Streams**

Refer to the included Post Construction Stormwater Management (PCSM) Report for all the required details.

A wet pond will be constructed as part of this proposed project. Storm water runoff that originates on site will be routed to the wet pond. The storm water runoff will be treated by the wet pond and the required 80% of the total suspended solids will be removed before the storm water runoff that originates on the site is released off of the site. This will prevent pollution of surface streams and the aquifer. Additionally, silt fence will be installed on the downstream end of the site during construction which will further prevent pollutants from entering surface streams or the aquifer.

**Permanent Stormwater Management Practices TCEQ Form 10257
Attachment M – Construction Plans**

Refer to the provided drawings for all required details.

**Permanent Stormwater Management Practices TCEQ Form 10257
Attachment N – Inspection, Maintenance, Repair, and Retrofit Plan**

The Owner shall implement the following inspection, maintenance, repair, and record keeping procedures for the wet ponds designed to serve the site.

Routine Maintenance

1. *Mowing*
 - a. The side-slopes, embankment, and emergency spillway of the basin should be mowed at least twice a year to prevent woody growth and control weeds.
2. *Inspections*
 - a. Wet basins should be inspected at least twice a year (once during or immediately following wet weather) to evaluate facility operation. When possible, inspections should be conducted during wet weather to determine if the basin is functioning properly.
 - b. There are many functions and characteristics of these BMPs that should be inspected.
 - i. The embankment should be checked for subsidence, erosion, leakage, cracking, and tree growth.
 - ii. The condition of the emergency spillway should be checked. The inlet, barrel, and outlet should be inspected for clogging.
 - iii. The adequacy of upstream and downstream channel erosion protection measures should be checked.
 - iv. Stability of the side slopes should be checked.
 - v. Modifications to the basin structure and contributing watershed should be evaluated.
 - c. During semi-annual inspections, replace any dead or displaced vegetation. Replanting of various species of wetland vegetation may be required at first, until a viable mix of species is established.
 - d. Cracks, voids and undermining should be patched/filled to prevent additional structural damage.
 - e. Trees and root systems should be removed to prevent growth in cracks and joints that can cause structural damage.
 - f. The inspections should be carried out with as-built pond plans in hand.
3. *Debris and Litter Removal*
 - a. As part of periodic mowing operations and inspections, debris and litter should be removed from the surface of the basin.
 - b. Particular attention should be paid to floatable debris around the riser, and the outlet should be checked for possible clogging.
4. *Erosion Control*
 - a. The basin side slopes, emergency spillway, and embankment all may periodically suffer from slumping and erosion. Corrective measures such as regrading and revegetation may be necessary.

- b. Similarly, the riprap protecting the channel near the outlet may need to be repaired or replaced.
- 5. *Nuisance Control*
 - a. Most public agencies surveyed indicate that control of insects, weeds, odors, and algae may be needed in some ponds. Nuisance control is probably the most frequent maintenance item demanded by local residents. If the ponds are properly sized and vegetated, these problems should be rare in wet ponds except under extremely dry weather conditions.
 - b. Twice a year, the facility should be evaluated in terms of nuisance control (insects, weeds, odors, algae, etc.). Biological control of algae and mosquitoes using fish such as fathead minnows is preferable to chemical applications.

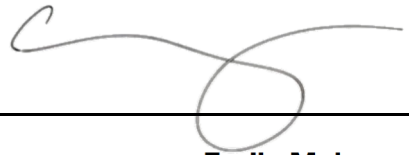
Non-routine maintenance

- 1. *Structural Repairs and Replacement*
 - a. Eventually, the various inlet/outlet and riser works in the wet basin will deteriorate and must be replaced. Some public works experts have estimated that corrugated metal pipe (CMP) has a useful life of about 25 yr, while concrete barrels and risers may last from 50 to 75 yr. The actual life depends on the type of soil, pH of runoff, and other factors. Polyvinyl chloride (PVC) pipe is a corrosion resistant alternative to metal and concrete pipes. Local experience typically determines which materials are best suited to the site conditions. Leakage or seepage of water through the embankment can be avoided if the embankment has been constructed of impermeable material, has been compacted, and if anti-seep collars are used around the barrel. Correction of any of these design flaws is difficult.
- 2. *Sediment Removal*
 - a. Wet ponds will eventually accumulate enough sediment to significantly reduce storage capacity of the permanent pool. As might be expected, the accumulated sediment can reduce both the appearance and pollutant removal performance of the pond.
 - b. Sediment accumulated in the sediment forebay area should be removed from the facility every two years to prevent accumulation in the permanent pool.
 - c. Dredging of the permanent pool should occur at least every 20 years, or when accumulation of sediment impairs functioning of the outlet structure.
- 3. *Harvesting*
 - a. If vegetation is present on the fringes or in the pond, it can be periodically harvested and the clippings removed to provide export of nutrients and to prevent the basin from filling with decaying organic matter.

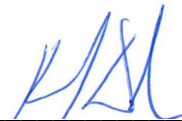
Record Keeping

1. The owner's representative shall prepare a signed, written record of each inspection performed and actions performed as a result of the inspection observations, shall maintain those records in the Owner's office for a period of 5 years, and shall, upon request, make those records available to TCEQ personnel and other agencies with jurisdiction over the site.

**Langan Engineering & Environmental Services
9606 N. Mopac Expressway, Suite 110
Austin, TX 78759
TBPE FIRM REG. #F-13709**



**Emily Mahoney
LEED AP BD+C, CPESC, CAPM**



Owner

Reid Dunbar, EastGroup Properties, LP
Printed Name

04/06/2023

Date

Temporary Stormwater Section

Texas Commission on Environmental Quality

for Regulated Activities on the Edwards Aquifer Recharge Zone and Relating to 30 TAC §213.5(b)(4)(A), (B), (D)(I) and (G); Effective June 1, 1999

To ensure that the application is administratively complete, confirm that all fields in the form are complete, verify that all requested information is provided, consistently reference the same site and contact person in all forms in the application, and ensure forms are signed by the appropriate party.

Note: Including all the information requested in the form and attachments contributes to more streamlined technical reviews.

Signature

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. This **Temporary Stormwater Section** is hereby submitted for TCEQ review and executive director approval. The application was prepared by:

Print Name of Customer/Agent: Emily Mahoney, Langan Engineering and Environmental Services

Date: 04/06/2023

Signature of Customer/Agent:



Regulated Entity Name: Heritage Grove Warehouse Development

Project Information

Potential Sources of Contamination

Examples: Fuel storage and use, chemical storage and use, use of asphaltic products, construction vehicles tracking onto public roads, and existing solid waste.

1. Fuels for construction equipment and hazardous substances which will be used during construction:

☐ The following fuels and/or hazardous substances will be stored on the site: _____

These fuels and/or hazardous substances will be stored in:

☐ Aboveground storage tanks with a cumulative storage capacity of less than 250 gallons will be stored on the site for less than one (1) year.

- ☐ Aboveground storage tanks with a cumulative storage capacity between 250 gallons and 499 gallons will be stored on the site for less than one (1) year.
- ☐ Aboveground storage tanks with a cumulative storage capacity of 500 gallons or more will be stored on the site. An Aboveground Storage Tank Facility Plan application must be submitted to the appropriate regional office of the TCEQ prior to moving the tanks onto the project.
- ☒ Fuels and hazardous substances will not be stored on the site.
- 2. ☒ **Attachment A - Spill Response Actions.** A site specific description of the measures to be taken to contain any spill of hydrocarbons or hazardous substances is attached.
- 3. ☐ Temporary aboveground storage tank systems of 250 gallons or more cumulative storage capacity must be located a minimum horizontal distance of 150 feet from any domestic, industrial, irrigation, or public water supply well, or other sensitive feature.
- 4. ☒ **Attachment B - Potential Sources of Contamination.** A description of any activities or processes which may be a potential source of contamination affecting surface water quality is attached.

Sequence of Construction

- 5. ☒ **Attachment C - Sequence of Major Activities.** A description of the sequence of major activities which will disturb soils for major portions of the site (grubbing, excavation, grading, utilities, and infrastructure installation) is attached.
 - ☒ For each activity described, an estimate (in acres) of the total area of the site to be disturbed by each activity is given.
 - ☒ For each activity described, include a description of appropriate temporary control measures and the general timing (or sequence) during the construction process that the measures will be implemented.
- 6. ☒ Name the receiving water(s) at or near the site which will be disturbed or which will receive discharges from disturbed areas of the project: N/A The site will not discharge to open surface waters

Temporary Best Management Practices (TBMPs)

Erosion control examples: tree protection, interceptor swales, level spreaders, outlet stabilization, blankets or matting, mulch, and sod. Sediment control examples: stabilized construction exit, silt fence, filter dikes, rock berms, buffer strips, sediment traps, and sediment basins. Please refer to the Technical Guidance Manual for guidelines and specifications. All structural BMPs must be shown on the site plan.

- 7. ☒ **Attachment D – Temporary Best Management Practices and Measures.** TBMPs and measures will prevent pollution of surface water, groundwater, and stormwater. The construction-phase BMPs for erosion and sediment controls have been designed to retain sediment on site to the extent practicable. The following information is attached:

- ☒ A description of how BMPs and measures will prevent pollution of surface water, groundwater or stormwater that originates upgradient from the site and flows across the site.
 - ☒ A description of how BMPs and measures will prevent pollution of surface water or groundwater that originates on-site or flows off site, including pollution caused by contaminated stormwater runoff from the site.
 - ☒ A description of how BMPs and measures will prevent pollutants from entering surface streams, sensitive features, or the aquifer.
 - ☒ A description of how, to the maximum extent practicable, BMPs and measures will maintain flow to naturally-occurring sensitive features identified in either the geologic assessment, TCEQ inspections, or during excavation, blasting, or construction.
8. ☒ The temporary sealing of a naturally-occurring sensitive feature which accepts recharge to the Edwards Aquifer as a temporary pollution abatement measure during active construction should be avoided.
- ☐ **Attachment E - Request to Temporarily Seal a Feature.** A request to temporarily seal a feature is attached. The request includes justification as to why no reasonable and practicable alternative exists for each feature.
- ☒ There will be no temporary sealing of naturally-occurring sensitive features on the site.
9. ☒ **Attachment F - Structural Practices.** A description of the structural practices that will be used to divert flows away from exposed soils, to store flows, or to otherwise limit runoff discharge of pollutants from exposed areas of the site is attached. Placement of structural practices in floodplains has been avoided.
10. ☒ **Attachment G - Drainage Area Map.** A drainage area map supporting the following requirements is attached:
- ☒ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a sediment basin will be provided.
 - ☐ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a smaller sediment basin and/or sediment trap(s) will be used.
 - ☐ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a sediment basin or other equivalent controls are not attainable, but other TBMPs and measures will be used in combination to protect down slope and side slope boundaries of the construction area.
 - ☐ There are no areas greater than 10 acres within a common drainage area that will be disturbed at one time. A smaller sediment basin and/or sediment trap(s) will be used in combination with other erosion and sediment controls within each disturbed drainage area.

☐ There are no areas greater than 10 acres within a common drainage area that will be disturbed at one time. Erosion and sediment controls other than sediment basins or sediment traps within each disturbed drainage area will be used.

11. ☒ **Attachment H - Temporary Sediment Pond(s) Plans and Calculations.** Temporary sediment pond or basin construction plans and design calculations for a proposed temporary BMP or measure have been prepared by or under the direct supervision of a Texas Licensed Professional Engineer. All construction plans and design information must be signed, sealed, and dated by the Texas Licensed Professional Engineer. Construction plans for the proposed temporary BMPs and measures are attached.

☐ N/A

12. ☒ **Attachment I - Inspection and Maintenance for BMPs.** A plan for the inspection of each temporary BMP(s) and measure(s) and for their timely maintenance, repairs, and, if necessary, retrofit is attached. A description of the documentation procedures, recordkeeping practices, and inspection frequency are included in the plan and are specific to the site and/or BMP.
13. ☒ All control measures must be properly selected, installed, and maintained in accordance with the manufacturer's specifications and good engineering practices. If periodic inspections by the applicant or the executive director, or other information indicate a control has been used inappropriately, or incorrectly, the applicant must replace or modify the control for site situations.
14. ☒ If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize offsite impacts to water quality (e.g., fugitive sediment in street being washed into surface streams or sensitive features by the next rain).
15. ☒ Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been reduced by 50%. A permanent stake will be provided that can indicate when the sediment occupies 50% of the basin volume.
16. ☒ Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from becoming a pollutant source for stormwater discharges (e.g., screening outfalls, picked up daily).

Soil Stabilization Practices

Examples: establishment of temporary vegetation, establishment of permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, or preservation of mature vegetation.

17. ☒ **Attachment J - Schedule of Interim and Permanent Soil Stabilization Practices.** A schedule of the interim and permanent soil stabilization practices for the site is attached.

18. ☒ Records must be kept at the site of the dates when major grading activities occur, the dates when construction activities temporarily or permanently cease on a portion of the site, and the dates when stabilization measures are initiated.
19. ☒ Stabilization practices must be initiated as soon as practicable where construction activities have temporarily or permanently ceased.

Administrative Information

20. ☒ All structural controls will be inspected and maintained according to the submitted and approved operation and maintenance plan for the project.
21. ☒ If any geologic or manmade features, such as caves, faults, sinkholes, etc., are discovered, all regulated activities near the feature will be immediately suspended. The appropriate TCEQ Regional Office shall be immediately notified. Regulated activities must cease and not continue until the TCEQ has reviewed and approved the methods proposed to protect the aquifer from any adverse impacts.
22. ☒ Silt fences, diversion berms, and other temporary erosion and sediment controls will be constructed and maintained as appropriate to prevent pollutants from entering sensitive features discovered during construction.

**Temporary Stormwater Management Practice TCEQ Form 0602
Attachment A – Spill Response Actions****SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN**

SPECIFIC REPORTABLE QUANTITIES SHALL BE PER TCEQ STANDARDS AS SPECIFIED AT THE FOLLOWING LINK:

(https://www.tceq.texas.gov/response/spills/spill_rq.html)

1. MATERIALS COVERED

The following materials or substances with known hazardous properties are expected to be present onsite during construction:

- Concrete
- Detergents
- Paints
- Paint Solvents
- Fertilizers
- Soil Stabilization Additives
- Cleaning Solvents
- Petroleum Based Products
- Pesticides
- Acids
- Concrete Additives

2. MATERIAL MANAGEMENT PRACTICES

The following are the material management practice that will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff.

a. Good Housekeeping

The following good housekeeping practices will be followed onsite during the construction project.

- i. An effort will be made to store only enough product required to do the job
- ii. All materials stored onsite will be stored in a neat, orderly manner and, if possible, under a roof or other enclosure
- iii. Products will be kept in their original containers with the original manufacturer's label in legible condition
- iv. Substances will not be mixed with one another unless recommended by the manufacturer
- v. Whenever possible, all of a product will be used up before disposing of the container
- vi. Manufacturer's recommendations for proper use and disposal will be followed
- vii. The job site superintendent will be responsible for daily inspections to ensure proper use and disposal of materials

b. Hazardous Products

These practices will be used to reduce the risks associated with hazardous materials

- i. Products will be kept in original containers with the original labels in legible condition
 - ii. Original labels and material safety data sheets (MSDS's) will be procured and used for each material
 - iii. If surplus product must be disposed of, manufacturers or local/state/federal recommended methods for proper disposal will be followed
 - iv. A spill control and containment kit (containing, for example, absorbent such as kitty litter or sawdust, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided at the storage site
 - v. All of the product in a container will be used before the container is disposed of. All such containers will be triple rinsed with water prior to disposal. The rinse water used in these containers will be disposed of in a manner in compliance with state and federal regulations and will not be allowed to mix with stormwater discharges.
- c. Product Specific Practices
 - i. Petroleum Products

All onsite vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products will be stored in tightly sealed containers which are clearly labeled. Any petroleum storage tanks used onsite will have a dike or berm containment structure constructed around it to contain any spills which may occur. Any asphalt substances used onsite will be applied according to the manufacturer's recommendations.
 - ii. Fertilizers

Fertilizers will be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer will be worked in the soil to limit exposure to stormwater. Storage will be in a covered shed. The contents of any partially used bags of fertilizer will be transferred to a sealable plastic bin to avoid spills.
 - iii. Paints, Paint Solvents, and Cleaning Solutions

All containers will be tightly sealed and stored when not in use. Excess paint and solvents will not be discharged to the storm sewer system but will be properly disposed of according to manufacturer's instructions or state and federal regulations
 - iv. Concrete Trucks

The CGP authorized the land disposal of wash out water from concrete trucks at construction sites that are regulated under the CGP, as long as the discharge is in compliance with the restrictions given in Section 3.02.4.B of this SWPPP. This authorization is limited to the land disposal of wash out water from concrete trucks only. Any other direct discharge of concrete production waste water is not authorized by the CGP and must be authorized under a separate TCEQ General Permit or individual permit.
- d. Spill Prevention Practices

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup

- i. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.
- ii. Materials and equipment necessary for spill cleanup will be kept in the material storage area onsite in spill control and containment kit (containing, for example, absorbent such as kitty litter or sawdust, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.)
- iii. All spills will be cleaned up immediately after discovery
- iv. The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with the hazardous substances
- v. Spills of toxic or hazardous materials will be reported to the appropriate federal, state, and/or local government agency, regardless of the size of the spill. Spills of amounts that exceed Reportable Quantities of certain substances specifically mentioned in federal regulations (40 CFR 302 list and oil) will be immediately reported to the TCEQ National Response Center, telephone 1-800-832-8224. Reportable Quantities of some substances which may be used at the job site are as follows:
 - Oil – appearance of a film or sheen on water
 - Pesticides – usually 1 lb
 - Acids – 5000 lb
 - Solvents, flammable – 100 lb
- vi. The SPCC plan will be adjusted to include measures to prevent this type of spill from recurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included. If the spill exceeds a Reportable Quantity, all federal regulations regarding reports of the incident will be complied with
- vii. The job site superintendent will be the spill prevention and cleanup coordinator. He will designate the individuals who will receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of these personnel will be posted in the material storage area and in the office trailer onsite.

Temporary Stormwater Management Practice TCEQ Form 0602
Attachment B – Potential Sources of Contamination

The following are the potential pollutants and their sources which may occur at this construction site: offsite vehicle tracking of mud from vehicle traffic through inadequate construction exit, petroleum based products from vehicle/equipment leaks and drips (maintenance and petroleum storage areas will not be allowed on the construction site), pesticide and fertilizers from landscaping activities, and high pH washwater from concrete and masonry cleanup/washout facilities.

Temporary Stormwater Management Practice TCEQ Form 0602

Attachment C – Sequence of Major Activities

Sequence of construction

1. All earth disturbance activities shall proceed in accordance with the sequence provided on the plan drawings. Deviation from that sequence must be approved by the city of Leander and TCEQ prior to implementation. Each step shall be completed before proceeding to the next step, except where noted. Construction may overlap into a subsequence stage as long as all erosion control measures have been installed in the previous stage. (44.4 Ac Site)
2. All blasting activity, if required, shall be done in accordance with the local, state, and federal regulations. Contractor shall notify owner and all regulatory agencies in writing prior and obtain any necessary permits prior to any blasting activities. (44.4 Ac Site)
3. Install rock construction entrance immediately before initial disturbances at site access point, as shown on drawing 7. Rock construction entrances shall be underlain by filter fabric as indicated on the detail. All construction activity shall use only this area of ingress and egress. As conditions warrant, these locations may be modified with the prior approval from the city of Leander and TCEQ. (44.4 Ac Site)
4. Installation of construction fencing and tree fencing shall be installed prior to any earth disturbance to avoid permanent impacts. (44.4 Ac Site)
5. Install silt fence and perimeter controls as shown on drawing 7. Install inlet protection for any existing inlets. (44.4 Ac Site)
6. Water pumped from work areas must be treated for sediment removal prior to discharging to a surface water. (44.4 Ac Site)
7. Limit clearing and grubbing to access the sediment basin areas. All sediment basin areas must be cleared and grubbed first and these erosion control measures installed before the tributary areas to these basins can be cleared and grubbed. If additional fill is necessary for the sediment basin installation, the borrow fill shall be taken from areas immediately upstream of the basin location in order to minimize disturbance. Clear and grub area of proposed disturbed area for each appropriate construction section one at a time.
 - a. Wet Pond clear and grub area = 2.5 Acres
 - b. Bioretention clear and grub area = 0.6 Acres
8. Sediment basins shall be installed where permanent pond BMPs are to be constructed. Sediment ponds shall be excavated to the permanent pool elevation for permanent wet ponds. (See Step 7 Areas)
9. Sediment basins shall remain functional until all upslope contributing drainage areas are stabilized. (44.4 Acre Site)
 - a. Wet Pond Drainage Area = 37.2 Acres
 - b. Bioretention Drainage Area = 2.7 Acres
10. Rough grade the site as identified on drawing 9. As permanent slopes are completed, install erosion control matting on all slopes 3:1 or greater. Install storm sewer conveyance system. The storm drainage system must be installed from downstream point of discharge to upstream points. Advance trench excavation should be limited to the length of the pipe that can be completed in the same day. Install inlet protection per detail provided. Inlet protection is to remain in place until

- the pavement has received the final wearing course. (44.4 Acre Site, conveyance trenching 1,332 LF)
11. Construct the on-site utilities. Advance trench excavation shall be limited to the length of pipe that can be completed in the same day. On the day following utility installation, the trench area shall be graded to subgrade elevation. (44.4 Acre Site)
 12. Place pavement subbase. Construct buildings and associated structures. (44.4 Acre Site)
 13. Complete final site grading and landscaping of all appropriate areas. Stabilize with permanent seed and mulch as per TCEQ requirements. (44.4 Acre Site)
 14. Construction entrance, silt fence, tree protection fence, inlet protection, silt fence, and sediment basins shall be maintained until all improvements to the site are completed, road areas are paved, and 70% perennial vegetative cover or other permanent non-vegetative cover with a density sufficient to resist accelerated erosion has been establish. (44.4 Acre Site)
 15. Once all permanent measures have been installed, clean out accumulated silt from the sediment basin.
 - a. Wet Pond Footprint = 2.5 Acres
 - b. Bioretention Footprint = 0.6 Acres
 16. Convert the sediment basins to the proposed water quality wet pond and extended detention basins.
 - a. Wet Pond Footprint = 2.5 Acres
 - b. Bioretention Footprint = 0.6 Acres
 17. Remove perimeter and temporary BMPs. (44.4 Acre Site)

Temporary Stormwater Management Practice TCEQ Form 0602
Attachment D – Temporary Best Management Practices and Measures

The following temporary best management practices will be used on the construction site

Stabilization Practices

1. Land clearing activities shall be done only in areas where earthwork will be performed and shall progress as earthwork is needed
2. Frequent watering of excavation and fill areas to minimize wind erosion during construction
3. Use of stabilization fabric for all slopes having a slope of 3H:1V or greater
4. Permanent seeding and planting of all unpaved areas
5. For all disturbed areas where construction activities have temporarily or permanently ceased for more than 14 days, stabilization activities shall commence no later than the 14th day after cessation of construction activities or after final grades have been achieved

Temporary Stormwater Management Practice TCEQ Form 0602
Attachment F – Structural Practices

The following structural best management practices will be used on the construction site

1. Inlet protection using gravel filled bags and silt fence
2. Perimeter protection using silt fencing and/or erosion control logs
3. Stabilized construction exit point
4. Temporary sediment basin with Faircloth skimmer and emergency overflow weir outlet structures for dewatering
5. Temporary concrete washout area
6. Use of rock rip rap for velocity dissipation at areas with existing or potential channelized flow

**Temporary Stormwater Management Practice TCEQ Form 0602
Attachment G – Drainage Area Map**

Refer to drawings 10 and 11 for existing and proposed drainage area maps. TBMPs are proposed in the same siting as permanent BMPs. Therefore, the permanent BMP drainage areas delineated on these Drawings is accurate for the TBMPs.

Temporary Stormwater Management Practice TCEQ Form 0602

Attachment H – Temporary Sediment Pond(s) Plans and Calculations

The proposed sediment basins shall be installed in the same siting and orientation as the permanent wet basins and detention basin. Detailed calculations for these basins are provided in the included Post Construction Stormwater Management (PCSM) Report. As the permanent ponds have been designed to manage the 100-yr flow, they shall be adequately sized to manage the 2-YR/24-HR storm required for temporary sediment basins.

A summary of proposed sediment basin peak rates and pond routings is below. Refer to drawings 7 to 16 for detailed Sediment Basin Plans and Drainage Areas.

WET BASIN SUMMARY TABLE				
Storm Event	Inflow (cfs)	Max Elevation	Max Storage (acre ft)	Outflow (cfs)
2-YR (Required)	199.4	967.6	5.3	44.1
100-YR (Max Provided)	518.6	970.5	11.9	184.4

Three 8" diameter Faircloth Skimmer Dewatering Device with a 6.7" diameter orifice will be used to release the detained stormwater over a period of 36-48 hours.

BIORETENTION SUMMARY TABLE				
Storm Event	Inflow (cfs)	Max Elevation	Max Storage (cu ft)	Outflow (cfs)
2-YR (Required)	10.8	988.2	0.4	2.1
100-YR (Max Provided)	35.2	989.4	1.1	4.4

A 4" diameter Faircloth Skimmer Dewatering Device with a 3.6" diameter orifice will be used to release the detained stormwater over a period of 36-48 hours.

Temporary Stormwater Management Practice TCEQ Form 0602
Attachment I – Inspection and Maintenance for BMPs**Rip Rap Outlet Structures**

1. Inspect riprap outlet structures after heavy rains to see if any erosion around or below the riprap has taken place or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

Stabilized Rock Construction Entrance

1. The entrance should be maintained in a condition, which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or cleanout of any measures used to trap sediment.
2. All sediment spilled, dropped, washed or tracked onto public rights-of-way should be removed immediately by contractor.
3. When necessary, wheels should be cleaned to remove sediment prior to entrance onto public right-of-way.
4. When washing is required, it should be done on an area stabilized with crushed stone that drains into an approved sediment trap or sediment basin.
5. All sediment should be prevented from entering any storm drain, ditch or water course by using approved methods.

Silt Fence

1. Inspect all fencing weekly, and after any rainfall.
2. Remove sediment when buildup reaches 6 inches.
3. Replace any torn fabric or install a second line of fencing parallel to the torn section.
4. Replace or repair any sections crushed or collapsed in the course of construction activity. If a section of fence is obstructing vehicular access, consider relocating it to a spot where it will provide equal protection, but will not obstruct vehicles. A triangular filter dike may be preferable to a silt fence at common vehicle access points.
5. When construction is complete, the sediment should be disposed of in a manner that will not cause additional siltation and the prior location of the silt fence should be revegetated. The fence itself should be disposed of in an approved landfill.

Inlet Protection

1. Inspection should be made weekly and after each rainfall. Repair or replacement should be made promptly as needed by the contractor.
2. Remove sediment when buildup reaches a depth of 3 inches. Removed sediment should be deposited in a suitable area and in such a manner that it will not erode.
3. Check placement of device to prevent gaps between device and curb.
4. Inspect filter fabric and patch or replace if torn or missing.
5. Structures should be removed and the area stabilized only after the remaining drainage area has been properly stabilized.

Sediment Basins

1. Inspection should be made weekly and after each rainfall. Check the embankment, spillways, and outlet for erosion damage, and inspect the embankment for piping and settlement. Repair should be made promptly as needed by the contractor.
2. Trash and other debris should be removed after each rainfall to prevent clogging of the outlet structure.
3. Accumulated silt should be removed and the basin should be re-graded to its original dimensions at such point that the capacity of the impoundment has been reduced to 75% of its original storage capacity.
4. The removed sediment should be stockpiled or redistributed in areas that are protected from erosion.

Temporary Stormwater Management Practice TCEQ Form 0602
Attachment J – Schedule of Interim and Permanent Soil Stabilization Practices

Temporary Vegetation

1. Temporary vegetation should be inspected weekly and after each rain event to locate and repair any erosion.
2. Erosion from storms or other damage should be repaired as soon as practical by regrading the area and applying new seed.
3. If the vegetated cover is less than 80%, the area should be reseeded.
4. Bare soils should be seeded or otherwise stabilized within 14 calendar days after final grading or where construction activity has temporarily ceased for more than 21 days.

Hydraulic Mulches

1. Mulched areas should be inspected weekly and after each rain event to locate and repair any damage.
2. Areas damaged by storms or normal construction activities should be regraded and hydraulic mulch reapplied as soon as practical.

Sod

1. Sod should be inspected weekly and after each rain event to locate and repair any damage.
2. Damage from storms or normal construction activities such as tire ruts or disturbance of swale stabilization should be repaired as soon as practical.

Dust Control

1. When dust is evident during dry weather, reapply dust control BMPs.

Agent Authorization Form
For Required Signature
Edwards Aquifer Protection Program
Relating to 30 TAC Chapter 213
Effective June 1, 1999

I Reid Dunbar
Print Name

Senior Vice President
Title - Owner/President/Other

of EastGroup Properties LP
Corporation/Partnership/Entity Name

have authorized Emily Mahoney
Print Name of Agent/Engineer

of Langan Engineering and Environmental Services
Print Name of Firm

to represent and act on the behalf of the above named Corporation, Partnership, or Entity for the purpose of preparing and submitting this plan application to the Texas Commission on Environmental Quality (TCEQ) for the review and approval consideration of regulated activities.

I also understand that:

1. The applicant is responsible for compliance with 30 Texas Administrative Code Chapter 213 and any condition of the TCEQ's approval letter. The TCEQ is authorized to assess administrative penalties of up to \$10,000 per day per violation.
2. For those submitting an application who are not the property owner, but who have the right to control and possess the property, additional authorization is required from the owner.
3. Application fees are due and payable at the time the application is submitted. The application fee must be sent to the TCEQ cashier or to the appropriate regional office. The application will not be considered until the correct fee is received by the commission.
4. A notarized copy of the Agent Authorization Form must be provided for the person preparing the application, and this form must accompany the completed application.
5. No person shall commence any regulated activity on the Edwards Aquifer Recharge Zone, Contributing Zone or Transition Zone until the appropriate application for the activity has been filed with and approved by the Executive Director.

SIGNATURE PAGE:

[Signature]
Applicant's Signature

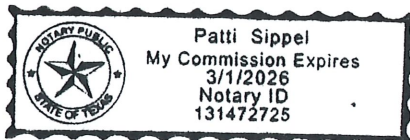
4/4/23
Date

THE STATE OF Texas §

County of Dallas §

BEFORE ME, the undersigned authority, on this day personally appeared _____ known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that (s)he executed same for the purpose and consideration therein expressed.

GIVEN under my hand and seal of office on this 4th day of April, 2023



[Signature]
NOTARY PUBLIC

Patti Sippel
Typed or Printed Name of Notary

MY COMMISSION EXPIRES: 3/1/2026

Application Fee Form

Texas Commission on Environmental Quality

Name of Proposed Regulated Entity: EastGroup Properties LP

Regulated Entity Location: 6565 N. MacArthur Blvd, Suite 255

Name of Customer: EastGroup Properties LP

Contact Person: Reid Dunbar

Phone: 972-386-8700

Customer Reference Number (if issued): CN N/A

Regulated Entity Reference Number (if issued): RN N/A

Austin Regional Office (3373)

☐ Hays

☐ Travis

☒ Williamson

San Antonio Regional Office (3362)

☐ Bexar

☐ Medina

☐ Uvalde

☐ Comal

☐ Kinney

Application fees must be paid by check, certified check, or money order, payable to the **Texas Commission on Environmental Quality**. Your canceled check will serve as your receipt. **This form must be submitted with your fee payment.** This payment is being submitted to:

☒ Austin Regional Office

☐ San Antonio Regional Office

☐ Mailed to: TCEQ - Cashier

☐ Overnight Delivery to: TCEQ - Cashier

Revenues Section

Mail Code 214

P.O. Box 13088

Austin, TX 78711-3088

12100 Park 35 Circle

Building A, 3rd Floor

Austin, TX 78753

(512)239-0357

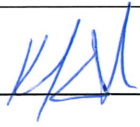
Site Location (Check All That Apply):

☐ Recharge Zone

☒ Contributing Zone

☐ Transition Zone

Type of Plan	Size	Fee Due
Water Pollution Abatement Plan, Contributing Zone Plan: One Single Family Residential Dwelling	Acres	\$
Water Pollution Abatement Plan, Contributing Zone Plan: Multiple Single Family Residential and Parks	Acres	\$
Water Pollution Abatement Plan, Contributing Zone Plan: Non-residential	44.4 Acres	\$ 8,000
Sewage Collection System	L.F.	\$
Lift Stations without sewer lines	Acres	\$
Underground or Aboveground Storage Tank Facility	Tanks	\$
Piping System(s)(only)	Each	\$
Exception	Each	\$
Extension of Time	Each	\$

Signature: 

Date: 4/4/23

Application Fee Schedule

Texas Commission on Environmental Quality

Edwards Aquifer Protection Program 30 TAC Chapter 213 (effective 05/01/2008)

Water Pollution Abatement Plans and Modifications

Contributing Zone Plans and Modifications

<i>Project</i>	<i>Project Area in Acres</i>	<i>Fee</i>
One Single Family Residential Dwelling	< 5	\$650
Multiple Single Family Residential and Parks	< 5	\$1,500
	5 < 10	\$3,000
	10 < 40	\$4,000
	40 < 100	\$6,500
	100 < 500	\$8,000
	≥ 500	\$10,000
Non-residential (Commercial, industrial, institutional, multi-family residential, schools, and other sites where regulated activities will occur)	< 1	\$3,000
	1 < 5	\$4,000
	5 < 10	\$5,000
	10 < 40	\$6,500
	40 < 100	\$8,000
	≥ 100	\$10,000

Organized Sewage Collection Systems and Modifications

<i>Project</i>	<i>Cost per Linear Foot</i>	<i>Minimum Fee- Maximum Fee</i>
Sewage Collection Systems	\$0.50	\$650 - \$6,500

Underground and Aboveground Storage Tank System Facility Plans and Modifications

<i>Project</i>	<i>Cost per Tank or Piping System</i>	<i>Minimum Fee- Maximum Fee</i>
Underground and Aboveground Storage Tank Facility	\$650	\$650 - \$6,500

Exception Requests

<i>Project</i>	<i>Fee</i>
Exception Request	\$500

Extension of Time Requests

<i>Project</i>	<i>Fee</i>
Extension of Time Request	\$150



TCEQ Use Only

TCEQ Core Data Form

For detailed instructions regarding completion of this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission (If other is checked please describe in space provided.)		
☒ New Permit, Registration or Authorization (Core Data Form should be submitted with the program application.)		
☐ Renewal (Core Data Form should be submitted with the renewal form)	☐ Other	
2. Customer Reference Number (if issued)	Follow this link to search for CN or RN numbers in Central Registry**	3. Regulated Entity Reference Number (if issued)
CN		RN

SECTION II: Customer Information

4. General Customer Information		5. Effective Date for Customer Information Updates (mm/dd/yyyy)	
☒ New Customer		☐ Update to Customer Information	
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)		☐ Change in Regulated Entity Ownership	
The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).			
6. Customer Legal Name (If an individual, print last name first: eg: Doe, John)		If new Customer, enter previous Customer below:	
EastGroup Properties LP			
7. TX SOS/CPA Filing Number	8. TX State Tax ID (11 digits)	9. Federal Tax ID (9 digits)	10. DUNS Number (if applicable)
0009778111	17213682812	13-2711135	
11. Type of Customer:	☒ Corporation	☐ Individual	Partnership: ☐ General ☐ Limited
Government: ☐ City ☐ County ☐ Federal ☐ State ☐ Other	☐ Sole Proprietorship	☐ Other:	
12. Number of Employees		13. Independently Owned and Operated?	
☐ 0-20 ☒ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher		☐ Yes ☒ No	
14. Customer Role (Proposed or Actual) – as it relates to the Regulated Entity listed on this form. Please check one of the following			
☒ Owner ☐ Operator ☐ Owner & Operator			
☐ Occupational Licensee ☐ Responsible Party ☐ Voluntary Cleanup Applicant ☐ Other:			
15. Mailing Address:	6565 N MacArthur Blvd		
	City	Irving	State TX ZIP 75039 ZIP + 4
16. Country Mailing Information (if outside USA)		17. E-Mail Address (if applicable)	
18. Telephone Number	19. Extension or Code	20. Fax Number (if applicable)	
(972) 386-8700		() -	

SECTION III: Regulated Entity Information

21. General Regulated Entity Information (If 'New Regulated Entity' is selected below this form should be accompanied by a permit application)	
☒ New Regulated Entity ☐ Update to Regulated Entity Name ☐ Update to Regulated Entity Information	
The Regulated Entity Name submitted may be updated in order to meet TCEQ Agency Data Standards (removal of organizational endings such as Inc, LP, or LLC).	
22. Regulated Entity Name (Enter name of the site where the regulated action is taking place.)	
Heritage Grove Warehouse Development	

23. Street Address of the Regulated Entity: (No PO Boxes)	500 Heritage Grove Dr							
	City	Leander	State	TX	ZIP	78641	ZIP + 4	
24. County	Williamson							

Enter Physical Location Description if no street address is provided.

25. Description to Physical Location:								
26. Nearest City					State	Nearest ZIP Code		
27. Latitude (N) In Decimal:	30.599930			28. Longitude (W) In Decimal:	-97.869170			
Degrees	Minutes	Seconds		Degrees	Minutes	Seconds		
29. Primary SIC Code (4 digits)	30. Secondary SIC Code (4 digits)		31. Primary NAICS Code (5 or 6 digits)		32. Secondary NAICS Code (5 or 6 digits)			
6798			53531					
33. What is the Primary Business of this entity? (Do not repeat the SIC or NAICS description.)								
Warehouse/ Office Construction								
34. Mailing Address:	500 Heritage Grove Dr							
	City	Leander	State	TX	ZIP	78641	ZIP + 4	
35. E-Mail Address:	reid.dunbar@eastgroup.net							
36. Telephone Number	37. Extension or Code		38. Fax Number (if applicable)					
(972) 386-8700			() -					

39. TCEQ Programs and ID Numbers Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

☐ Dam Safety	☐ Districts	☒ Edwards Aquifer	☐ Emissions Inventory Air	☐ Industrial Hazardous Waste
☐ Municipal Solid Waste	☐ New Source Review Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS
☐ Sludge	☐ Storm Water	☐ Title V Air	☐ Tires	☐ Used Oil
☐ Voluntary Cleanup	☐ Waste Water	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:

SECTION IV: Preparer Information

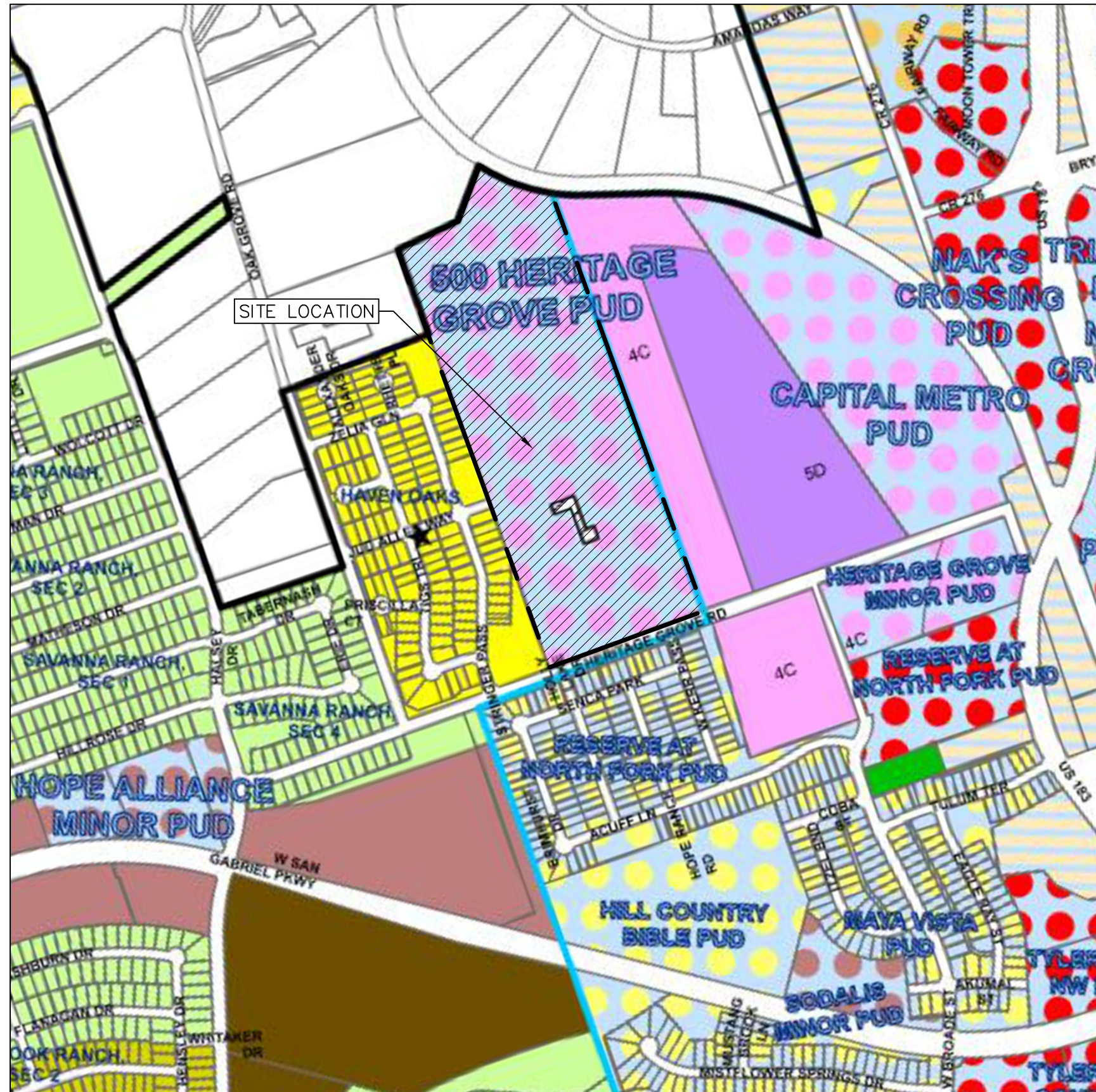
40. Name:	Emily Mahoney	41. Title:	Project Manager
42. Telephone Number	43. Ext./Code	44. Fax Number	45. E-Mail Address
(713) 825-6102		(281) 675-7901	emahoney@langan.com

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

Company:	Langan Engineering and Environmental Services	Job Title:	Project Manager / Sustainability Leader
Name (In Print):	Emily Mahoney	Phone:	(713) 825- 6102
Signature:		Date:	04/06/2023

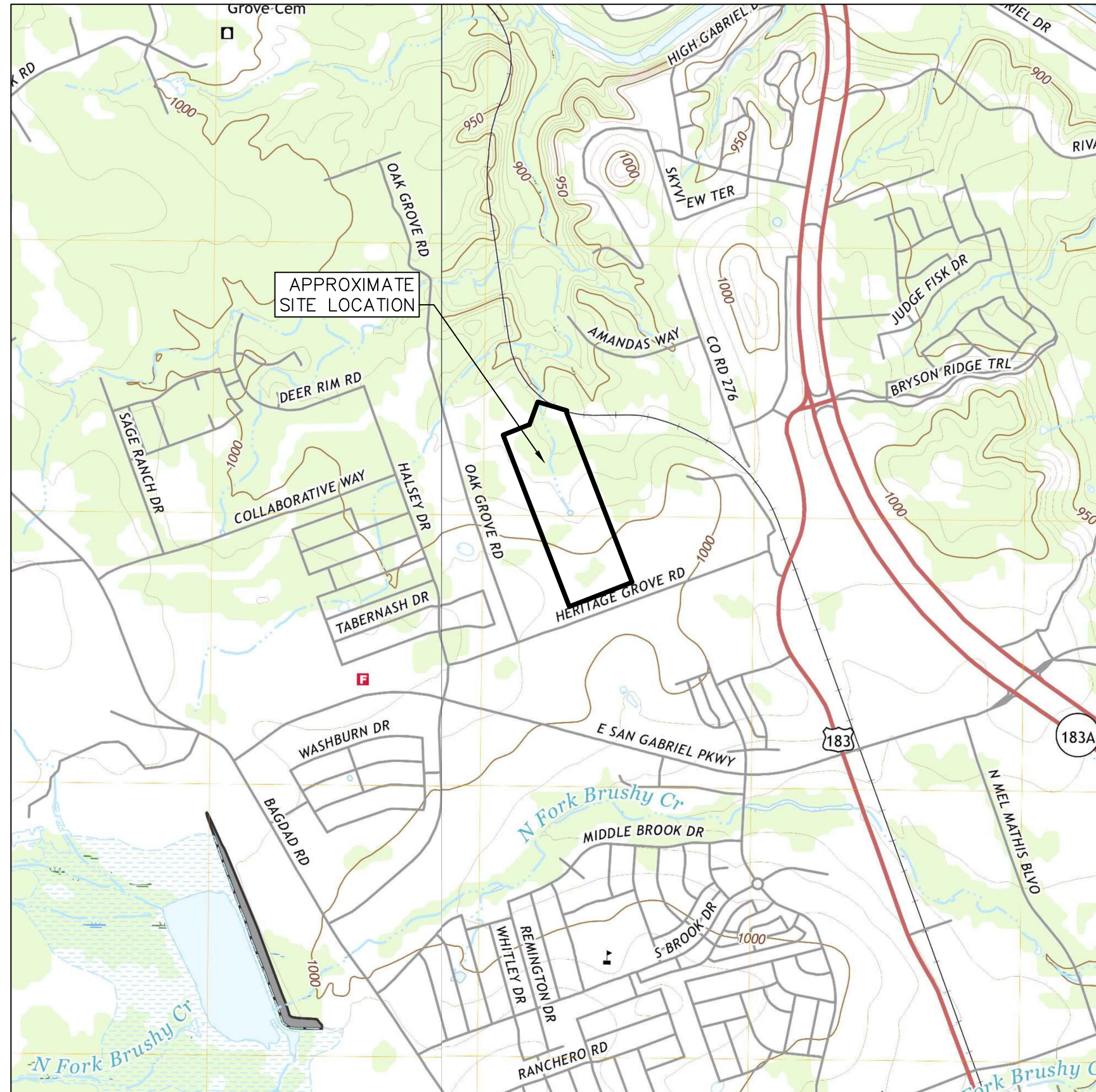
SITE DEVELOPMENT DRAWINGS
FOR
HERITAGE GROVE ROAD WAREHOUSE DEVELOPMENT
500 HERITAGE GROVE ROAD
LEANDER, TEXAS 78641



ZONING MAP



AERIAL MAP
1" = 400'



LOCATION MAP
1" = 150'

CONTACTS

City of Leander Development Services
201 N. Brushy St.
Leander, TX 78641
Phone: (512) 528-2733

Electric
REC
10625 West Highway 29
Liberty Hill, TX 78642
Phone: (800) 868-4791

Water & Wastewater
City of Leander
201 N. Brushy St.
Leander, TX 78641
Phone: (512) 259-1142

Prepared by:

LANGAN

c/o: Emily Mahoney, PE
9606 NORTH MOPAC HIGHWAY #110
AUSTIN, TX 78759
(281) 675-7900



ONE-CALL NOTIFICATION SYSTEM
CALL BEFORE YOU DIG!!!
1-800-245-4545

Owner/Prepared for:

EASTGROUP
PROPERTIES

EASTGROUP PROPERTIES, L.P.
MACARTHUR BLVD, SUITE 255
IRVING, TX 75039
(972) 386-8700

Surveyor:



GBI PARTNERS
LAND SURVEYING CONSULTANTS
7696 183A BUILDING 2, STE. A
LEANDER, TX 78641
(281) 499-4539

REVISION #	DESCRIPTION	APPROVAL

DRAWING LIST			
DRAWING NO.	DRAWING TITLE	ISSUE DATE	DATE REVISED
1	COVER SHEET	4/6/2023	
2	GENERAL NOTES	4/6/2023	
3	SITE DEMOLITION PLAN	4/6/2023	
4	OVERALL SITE PLAN	4/6/2023	
5	SITE PLAN	4/6/2023	
6	SITE PLAN	4/6/2023	
7	OVERALL GRADING AND DRAINAGE PLAN	4/6/2023	
8	GRADING AND DRAINAGE PLAN	4/6/2023	
9	GRADING AND DRAINAGE PLAN	4/6/2023	
10	EXISTING DRAINAGE AREA PLAN	4/6/2023	
11	PROPOSED DRAINAGE AREA MAP	4/6/2023	
12	CATCH BASIN DRAINAGE AREA MAP	4/6/2023	
13	BASIN CROSS-SECTIONS	4/6/2023	
14	STORMWATER CALCULATIONS	4/6/2023	
15	STORMWATER CALCULATIONS	4/6/2023	
16	25-YR STORM SEWER CALCULATIONS	4/6/2023	
17	100-YR STORM SEWER CALCULATIONS	4/6/2023	
18	SOIL EROSION AND SEDIMENT CONTROL PLAN	4/6/2023	
19	SOIL EROSION & SEDIMENT CONTROL DETAILS	4/6/2023	
20	SOIL EROSION & SEDIMENT CONTROL DETAILS	4/6/2023	
21	SITE DETAILS	4/6/2023	
22	SITE DETAILS	4/6/2023	
23	SITE DETAILS	4/6/2023	
24	SITE DETAILS	4/6/2023	
25	SITE DETAILS	4/6/2023	
26	SITE DETAILS	4/6/2023	
27	SITE DETAILS	4/6/2023	
28	SITE DETAILS	4/6/2023	
SUPPLEMENTAL DRAWINGS			
29	ALTA/NSPS LAND TITLE SURVEY	8/8/2022	

CITY OF LEANDER ZONING TABLE					
ZONING DISTRICT: PUD - HEAVY COMMERCIAL					
	ITEM	PERMITTED	PROPOSED	REFERENCE	CONDITIONS
SITE	Land Use	Warehousing and Distribution	Warehousing and Distribution		C
	Building Height	35 FT	35 FT	ARTICLE VIII SECTION 8	C
BUILDING	Maximum Impervious Coverage	90%	71%	ARTICLE V SECTION 1	C
	Minimum Yards/Setbacks:				
	Min. Front yard	35 FT	97 FT	ARTICLE VI SECTION 6	C
	Min. Side Yard	15 FT	65/97 FT		
PARKING AND ACCESS	Min. Rear Yard	15 FT	339 FT		
	Min. Number of Car Parking Spaces			ARTICLE VI SECTION 3	C
	Warehouse (one space per 600 SF GFA)	1,001	1,034	ARTICLE VI SECTION 3	C
	ADA Parking Spaces	38	42		C
NOTES	Min. Parking Aisle Width (Two-Way) ⁽²⁾	30 FT	26 FT		C
	Max. Driveway Width ⁽²⁾	45 FT	40 FT		C
	(1) Data referenced from Composite Zoning Ordinance from City of Leander				
	(2) Data referenced from Site Development Permit Application & Checklist from City of Leander				

RELEASE DATES

DATE	ISSUED FOR
04/06/2023	TCEQ SUBMISSION

GENERAL NOTES

- ALL TOPOGRAPHIC, PROPERTY LINE, AND UTILITY INFORMATION TAKEN FROM PLAN ENTITLED "ALTA/NSPS LAND TITLE SURVEY", PREPARED BY GB PARTNERS LAND SURVEYING CONSULTANTS, DATED NOVEMBER 2, 2022.
1. PROPOSED SITE WORK IMPROVEMENTS SHALL CONFORM TO THE STANDARD DETAILS AND SPECIFICATIONS OF THE CITY OF LEANDER. IN THE ABSENCE OF LOCAL STANDARDS, SITE WORK SHALL CONFORM TO THE REQUIREMENTS OF TEXAS DEPARTMENT OF TRANSPORTATION STANDARD DETAILS.
2. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING TEXAS 811 (1-800-545-6005, WWW.TXAS811.COM) OR LONE STAR 811 (1-800-469-4334) PRIOR TO ANY EXCAVATION, EXCAVATION TEST HOLES, PERFORMANCE OF ANY OTHER WORK, OR PERFORMING WHATEVER ADDITIONAL INVESTIGATION NECESSARY TO PROTECT AND MAINTAIN ALL EXISTING UTILITIES TO REMAIN THROUGHOUT THE CONSTRUCTION PERIOD. ANY CONFLICTS BETWEEN EXISTING UTILITIES AND PROPOSED UTILITIES DISCOVERED DURING CONSTRUCTION SHALL BE PROMPTLY REPORTED TO THE PROJECT ENGINEER.
3. ALL IMPROVEMENTS CONSTRUCTED IN THE PUBLIC RIGHT-OF-WAY SHALL COMPLY WITH THE CITY OF LEANDER DETAILS AND STANDARD SPECIFICATIONS.
4. FOR AREAS OUTSIDE THE PROPERTY LINES, REPAIR AND/OR REPLACE ALL DAMAGE DONE TO EXISTING ELEMENTS (SIDEWALKS, PAVING, LANDSCAPING, ETC) AS REQUIRED BY OWNER AND/OR GOVERNING AUTHORITY.
5. CONTRACTOR TO REPAIR/REPLACE ANY EXISTING SIDEWALK THAT IS DAMAGED PRIOR TO OR DURING CONSTRUCTION.
6. ALL SIGNS AND PAYMENT MARKINGS SHALL CONFORM TO THE LATEST EDITION OF THE TMDOT.
7. ALL RADI ARE 3'0" EXCEPT WHERE NOTED. ALL DIMENSIONS SHOWN ARE FACE OF CURB TO FACE OF CURB.
8. CONTRACTOR SHALL PREVENT DUST, SEDIMENT AND DEBRIS FROM EXITING THE SITE AND SHALL BE RESPONSIBLE FOR CLEANUP, REPAIR AND CORRECTIVE ACTION IF SUCH OCCURS. ADJOINING STREETS AND PROPERTIES TO BE KEPT FREE OF DEBRIS AND SHALL BE CLEANED ON A DAILY BASIS AS NECESSARY. DUST CONTROL TREATMENTS SHALL BE APPLIED AS NECESSARY TO CONTROL AND REDUCE THE AMOUNT OF DUST WHICH MAY CAUSE OFF-SITE DAMAGE, BE A HEALTH HAZARD TO HUMANS, WILDLIFE AND PLANT LIFE, OR POSE A HAZARD TO TRAFFIC SAFETY.
9. THE LOCATION OF EXISTING UNDERGROUND UTILITIES SHOWN HEREIN IS TAKEN FROM DESIGN PLANS, AS-BUILT SKETCHES, EXISTING UTILITY COMPANY RECORDS, AND OTHER SOURCES OF INFORMATION AND IS NOT TO BE CONSTRUED AS AN ACCURATE "AS-BUILT" SURVEY AND IS SUBJECT TO SUCH CORRECTIONS THAT A MORE ACCURATE SURVEY MAY DISCLOSE.
10. THE EXISTING UTILITIES INDICATED HEREON MAY NOT BE LOCATED AS SHOWN. IN ADDITION, OTHER UTILITIES NOT SHOWN HEREON MAY BE PRESENT. ANY DISCREPANCIES DISCOVERED DURING THE COURSE OF CONSTRUCTION SHALL BE PROMPTLY REPORTED TO THE PROJECT ENGINEER.
11. ALL UTILITY WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS AND SPECIFICATIONS/DETAILS OF THE UTILITY COMPANY HAVING AUTHORITY OVER THE PROPOSED WORK. ALL PROPOSED UTILITY WORK SHALL BE RESPONSIBLE IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL ORDINANCES/REQUIREMENTS GOVERNING THE PROPOSED WORK.
12. ANY UTILITY EASEMENTS REQUIRED BY ANY OF THE VARIOUS UTILITY COMPANIES SHALL BE OBTAINED, EXECUTED, AND RECORDED PRIOR TO ANY OF THE AFFECTED UTILITY WORK BEING PERFORMED.
13. ALL PROPOSED UTILITIES WILL BE LOCATED UNDERGROUND.
14. CONTRACTOR TO COORDINATE GAS MAIN, ELECTRIC, AND TELEPHONE INSTALLATION WITH APPROPRIATE UTILITY COMPANIES.
15. THE CONTRACTOR MUST VERIFY THE LOCATION, SIZE, AND SERVICEABILITY OF THE EXISTING WATER MAINS PRIOR TO BEGINNING ANY SITE OR BUILDING CONSTRUCTION.
16. RESET ALL EXISTING SANITARY AND DRAINAGE STRUCTURES TO TEXAS STATE STANDARDS AND AS REQUIRED BY REPAIRING, MILLING OR OVERLAYING.
17. CONTRACTOR SHALL MAINTAIN A MINIMUM OF 4 FEET OF COVER FOR ALL UNDERGROUND ELECTRIC, TELEPHONE AND GAS UTILITIES.
18. WHERE THE SANITARY SEWER LINE PASSES ABOVE THE WATER LINES, ENCASE SEWER IN 6" THICK CONCRETE FOR A DISTANCE OF 10 FEET ON EACH SIDE OF THE CROSSING, OR SUBSTITUTE RUBBER GASKETED PRESSURE PIPE FOR THE PIPE BEING USED FOR THE SAME DISTANCE.
19. FOR SANITARY SEWER AND WATER LINE CROSSINGS REFER TO LOCAL ORDINANCE. IN ABSENCE OF SPECIFIC GUIDANCE WITHIN LOCAL ORDINANCE, REFER TO LATEST TCEQ REGULATIONS REGARDING THE SEPARATION OF WATER AND SEWER LINES.
20. ALL NEW WATER LINES SHALL BE PRESSURE TESTED AND LEAKAGE TESTED IN ACCORDANCE WITH THE LATEST EDITION OF AWWA STANDARD C600.
21. ALL NEW WATER MAINS SHALL BE DISINFECTED IN ACCORDANCE WITH AWWA STANDARD C651.
22. ALL RIMS AND STRUCTURES SHALL ACCOMMODATE H2O LOADING.
23. CONTRACTOR TO PROVIDE ALL NECESSARY WATER MAIN BENDS AND FITTINGS AS REQUIRED TO AVOID EXISTING AND PROPOSED UTILITIES.
24. COORDINATE ALL SERVICE LATERAL LOCATIONS AND ELEVATIONS WITH MEP/ARCHITECTURAL DRAWINGS.
25. THE CONTRACTOR IS SPECIFICALLY CAUTIONED THAT THE LOCATION AND/OR ELEVATION OF EXISTING UTILITIES AS SHOWN ON THESE PLANS IS BASED ON RECORDS OF THE VARIOUS UTILITY COMPANIES, AND WHERE POSSIBLE MEASUREMENTS TAKEN IN THE FIELD. THE INFORMATION IS NOT TO BE RELIED UPON AS BEING EXACT OR COMPLETE. THE CONTRACTOR MUST CALL THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATION OF UTILITIES. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RELOCATE ALL UTILITIES WHICH CONFLICT WITH THE PROPOSED IMPROVEMENTS SHOWN ON THE PLANS. ANY DISCREPANCIES DISCOVERED DURING THE COURSE OF CONSTRUCTION SHALL BE PROMPTLY REPORTED TO THE PROJECT ENGINEER.
26. CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS AND SPECIFICATIONS FOR ACTUAL LOCATIONS OF ALL UTILITY ENTRANCES TO INCLUDE SANITARY SEWERS, DOMESTIC AND FIRE PROTECTION WATER SERVICE, ELECTRICAL, TELEPHONE AND GAS SERVICE. CONTRACTOR SHALL COORDINATE INSTALLATION OF UTILITIES IN SUCH A MANNER AS TO AVOID CONFLICTS AND TO ENSURE PROPER DEPTHS ARE ACHIEVED AS WELL AS COORDINATING WITH THE UTILITY COMPANIES AS TO LOCATION OF AND SCHEDULING OF CONNECTIONS TO THEIR FACILITIES.
27. LOCATIONS AND ELEVATIONS OF ROOF LEADERS SHOULD BE COORDINATED WITH ARCHITECTURAL DRAWINGS PRIOR TO CONSTRUCTION.
28. CLEANOUTS SHALL BE PROVIDED FLUSH TO GRADE AT ALL LOCATIONS OF ROOF DRAIN INTERSECTIONS, BENDS AND UPSTREAM ENDS.
29. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY SIZING ALL DRAINAGE STRUCTURES AND SUBMITTING SHOP DRAWINGS TO ENGINEER FOR REVIEW.
30. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PAYMENT REPAIRS REQUIRED AS A RESULT OF ANY UTILITY WORK.
31. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY UTILITY DISCONNECT PERMITS AND COORDINATION THE NECESSARY RECORDINGS PRIOR TO COMMENCING BUILDING DEMOLITION.
32. ALL ABANDONED UTILITIES SHALL BE TERMINATED AT THE APPROPRIATE MAIN OR STRUCTURE.
33. ALL SIGNS WITHIN THE STATE RIGHT-OF-WAY SHALL BE INSTALLED PER TxDOT STANDARDS AND SPECIFICATIONS.
34. CONTRACTOR TO MATCH EXISTING CURB AT GUTTER AND NEXT CONSTRUCTION JOINT IN ORDER TO PROVIDE A CLEAN TRANSITION.
35. ALL WORK PERFORMED WITHIN THE PUBLIC RIGHT-OF-WAY SHALL BE DONE IN ACCORDANCE WITH THE CITY OF LEANDER OR TxDOT STANDARD CONSTRUCTION SPECIFICATIONS. PRIOR TO DOING ANY WORK IN THE IN THE CITY RIGHT-OF-WAY, THE CONTRACTOR SHALL CALL THE ENGINEERING DEPARTMENT.
36. ALL SIGNS TO BE APPROVED BY THE CITY OF LEANDER ENGINEERING DEPARTMENT.
37. REFER TO PRELIMINARY GEOTECHNICAL ENGINEERING REPORT PROVIDED BY PROFESSIONAL SERVICE INDUSTRIES, INC. ON OCTOBER 07, 2022 FOR RECOMMENDATIONS.

THIS CONSTRUCTION PROJECT IS SUBJECT TO THE CONDITIONS GIVEN IN THE EDWARDS AQUIFER PROTECTION PLAN (EAPP) APPROVED AND ISSUED FOR THIS SITE BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ). NO CONSTRUCTION ACTIVITIES MAY COMMENCE UNTIL THOSE PLANS HAVE BEEN ISSUED BY THE TCEQ. CONTRACTOR SHALL COMPLY WITH ALL REQUIRED PUBLIC NOTICE POSTINGS RELATED TO THIS TCEQ PERMIT PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

CONTRACTOR AND OWNER SHALL ALSO OBTAIN COVERAGE FOR STORMWATER DISCHARGES RELATED TO CONSTRUCTION ACTIVITIES UNDER THE TEXAS GENERAL PERMIT FOR 100,000. CONTRACTOR SHALL COMPLY WITH ALL REQUIRED PUBLIC NOTICE POSTINGS RELATED TO THIS TCEQ PERMIT PRIOR TO COMMENCEMENT OF CONSTRUCTION ACTIVITIES.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY CONTRIBUTING ZONE PLAN GENERAL CONSTRUCTION NOTES

1. A written notice of construction must be submitted to the TCEQ regional office at least 48 hours prior to the start of any ground disturbance or construction activities. This notice must include:
 - the name of the approved project;
 - the activity start date; and
 - the contact information of the prime contractor.
2. All contractors conducting regulated activities associated with this project should be provided with complete copies of the approved Contributing Zone Plan (CZP) and the TCEQ letter indicating the specific conditions of its approval. During the course of these regulated activities, the contractor(s) should keep copies of the approved plan and approval letter on-site.
3. No hazardous substance storage tank shall be installed within 150 feet of a water supply source, distribution system, well, or sensitive feature.
4. Prior to beginning any construction activity, all temporary erosion and sedimentation (E&S) control measures must be properly installed and maintained in accordance with the manufacturers specifications. If inspections indicate a control has been used inappropriately, or inoperably, the applicant must replace or modify the control for site situations. These controls must remain in place until the disturbed areas have been permanently stabilized.
5. Any sediment that escapes the construction site must be collected and properly disposed of before the next rain event to ensure it is not washed into surface streams, sensitive features, etc.
6. Sediment must be removed from the sediment traps or sedimentation basins when it occupies 50% of the basin's design capacity.
7. Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from being discharged offsite.
8. All excavated material that will be stored on-site must have proper E&S controls.
9. If portions of the site will have a cease in construction activity lasting longer than 14 days, soil stabilization in those areas shall be initiated as soon as possible prior to the 14th day of inactivity. If activity will resume prior to the 21st day, stabilization measures are not required. If drought conditions or inclement weather prevent action by the 14th day, stabilization measures shall be initiated as soon as possible.
10. The following records should be maintained and made available to the TCEQ upon request:
 - the dates when major grading activities occur;
 - the dates when construction activities temporarily or permanently cease on a portion of the site; and
 - the dates when stabilization measures are initiated.
11. The holder of any approved CZP must notify the appropriate regional office in writing and obtain approval from the executive director prior to initiating any of the following:
 - A. any physical or operational modification of any best management practices (BMPs) or structure(s), including but not limited to temporary or permanent ponds, dams, berms, silt fences, and diversionary structures;
 - B. any change in the nature or character of the regulated activity from that which was originally approved;
 - C. any change that would significantly impact the ability to prevent pollution of the Edwards Aquifer; or
 - D. any development of land previously identified as undeveloped in the approved contributing zone plan.

AUSTIN REGIONAL OFFICE
12100 PARK 35 CIRCLE, BUILDING A
AUSTIN, TEXAS 78738-1008
PHONE (512) 339-2929
FAX (512) 339-3755

SAN ANTONIO REGIONAL OFFICE
14250 JORDON ROAD
SAN ANTONIO, TEXAS 78233-4480
PHONE (214) 499-3896
FAX (214) 545-4329

CITY OF LEANDER GENERAL NOTES

- CITY CONTACTS:
ENGINEERING MAIN LINE: 512-528-2766
PLANNING DEPARTMENT: 512-528-2750
PUBLIC WORKS MAIN LINE: 512-259-2640
STORMWATER INSPECTIONS: 512-285-0055
ELECTRIC MAIN LINE: 512-259-1142
UTILITIES ON-CALL: 512-690-4760
UTILITY LOCATE REQUESTS LOCATES@LEANDERTX.GOV
1. THE CONTRACTOR SHALL VERIFY ALL DEPTHS AND LOCATIONS OF EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. ANY DISCREPANCIES WITH CONSTRUCTION SHALL BE PROMPTLY REPORTED TO THE ATTENTION OF THE ENGINEER.
 2. THE CONTRACTOR SHALL CONTACT THE TEXAS EXCAVATION SYSTEM AT 1-800-344-8377 FOR EXISTING UTILITY LOCATIONS 48 HOURS PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR SHALL VERIFY THE LOCATIONS OF ALL UTILITIES THAT ARE TO BE EXTENDED, TIED TO, CROSSED, OR ALTERED; OR SUBJECT TO DAMAGE/INCONVENIENCE BY THE CONSTRUCTION OPERATIONS.
 3. CONTACT THE CITY OF LEANDER PUBLIC WORKS DEPARTMENT FOR EXISTING WATER AND WASTEWATER LOCATIONS 48 HOURS PRIOR TO CONSTRUCTION.
 - 3.A. LOCATE REQUESTS MUST INCLUDE A COPY OF YOUR 811 TICKET. THE CITY OF LEANDER IS ALLOWED UP TO 48 HOURS TO COMPLY WITH YOUR REQUEST, EXCLUDING WEEKENDS AND DESIGNATED CITY HOLIDAYS.
 - 3.B. REFRESH ALL LOCATES BEFORE 14 DAYS LOCATE REFRESH REQUESTS MUST INCLUDE A COPY OF YOUR 811 TICKET. SUBMIT ALL REQUESTS TO LOCATES@LEANDERTX.GOV. TEXAS PIPELINE DAMAGE PREVENTION LAWS REQUIRE THAT A LOCATE REFRESH REQUEST BE SUBMITTED BEFORE 14 DAYS, OR IF LOCATION MARKERS ARE NO LONGER VISIBLE.
 - 3.C. REPORT PIPELINE DAMAGE IMMEDIATELY - IF YOU WITNESS OR EXPERIENCE PIPELINE EXCAVATION DAMAGE, PLEASE CONTACT THE CITY OF LEANDER BY PHONE AT 512-259-2640.
 4. ANY CHANGES OR REVISIONS TO THESE PLANS MUST FIRST BE SUBMITTED TO THE CITY BY THE DESIGN ENGINEER FOR REVIEW AND WRITTEN APPROVAL PRIOR TO CONSTRUCTION OF THE REVISION.
 5. A TRAFFIC CONTROL PLAN, IN ACCORDANCE WITH THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, SHALL BE SUBMITTED TO THE CITY FOR REVIEW AND APPROVAL PRIOR TO ANY PARTIAL OR COMPLETE ROADWAY CLOSURES. TRAFFIC CONTROL PLANS SHALL BE SITE SPECIFIC AND SEALED BY A REGISTERED PROFESSIONAL ENGINEER. LANE CLOSURES ON ARTERIALS AND ANY FULL ROAD CLOSURES REQUIRE MANAGER BOARDING NOTIFICATION TO THE PUBLIC ONE WEEK PRIOR TO THE CLOSURE.
 6. NO WORK IS TO BE PERFORMED BETWEEN THE HOURS OF 9:00 P.M. AND 7:00 A.M. THE CITY INSPECTOR RESERVES THE RIGHT TO REQUIRE THE CONTRACTOR TO UNCOVER ALL WORK PERFORMED WITHOUT INSPECTION FURTHER, THERE IS A NOISE ORDINANCE IN EFFECT FOR CONSTRUCTION ACTIVITIES BETWEEN THE HOURS OF 9:00 P.M. AND 7:00 A.M. REQUESTS FOR EXCEPTIONS TO THE ORDINANCE MUST BE MADE TO LEANDER CITY COUNCIL.
 7. CONTACT THE CITY INSPECTOR 4 DAYS PRIOR TO WORK TO SCHEDULE ANY INSPECTIONS ON WEEKENDS OR CITY HOLIDAYS.
 8. NO STREET LIGHTS OR SIGNS OF ANY KIND ARE TO BE PLACED WITH ANY SIDEWALKS.
 9. NO BLASTING IS ALLOWED.
 10. ANY EXISTING UTILITIES, PAVEMENT, CURBS, SIDEWALKS, STRUCTURES, TREES, ETC., THAT ARE DAMAGED OR REMOVED SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT NO COST TO THE OWNER.
 11. THE CONTRACTOR SHALL GIVE THE CITY OF LEANDER 48 HOURS NOTICE BEFORE BEGINNING EACH PHASE OF CONSTRUCTION. CONTACT ASSIGNED CITY INSPECTOR.
 12. A PRE-CONSTRUCTION CONFERENCE SHALL BE HELD WITH THE CONTRACTOR, DESIGN ENGINEER/PERMIT APPLICANT AND THE CITY OF LEANDER REPRESENTATIVES PRIOR TO INSTALLATION OF EROSION/SEDIMENTATION CONTROLS AND TREE PROTECTION MEASURES AND PRIOR TO ANY EXCAVATION. THE CITY OF LEANDER WILL NOTIFY THE CITY OF LEANDER PLANNING DEPARTMENT PLANNING COORDINATOR AT LEAST THREE (3) DAYS PRIOR TO THE MEETING DATE.
 13. THE CONTRACTOR AND ENGINEER SHALL KEEP ACCURATE RECORDS OF ALL CONSTRUCTION THAT DEVIATES FROM THE PLANS. THE ENGINEER SHALL FURNISH THE CITY OF LEANDER ACCURATE RECORD DRAWINGS FOLLOWING THE COMPLETION OF ALL CONSTRUCTION. THESE RECORD DRAWINGS SHALL MEET THE SATISFACTORY OF THE ENGINEERING DEPARTMENTS PRIOR TO FINAL ACCEPTANCE.
 14. WHEN CONSTRUCTION IS BEING CARRIED OUT WITHIN EASEMENTS, THE CONTRACTOR SHALL CONFINE HIS WORK TO WITHIN THE PERMANENT AND TEMPORARY EASEMENTS. PRIOR TO ACCEPTANCE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ALL TRASH AND DEBRIS WITHIN THE PERMANENT EASEMENTS. CLEANUP SHALL BE TO THE SATISFACTION OF THE ENGINEER.
 15. CONTRACTOR TO LOCATE, PROTECT, AND MAINTAIN BENCHMARKS, MONUMENTS, CONTROL POINTS AND PROJECT ENGINEERING REFERENCE POINTS. RE-ESTABLISH DISTURBED OR DESTROYED ITEMS BY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF TEXAS, AT NO ADDITIONAL COST TO OWNER.
 16. THE CONTRACTOR SHALL PROTECT ALL EXISTING FENCES. IN THE EVENT THAT A FENCE MUST BE REMOVED, THE CONTRACTOR SHALL REPLACE SAID FENCE OR PORTION THEREOF WITH THE SAME TYPE OF FENCING TO A QUALITY OF EQUAL OR BETTER THAN THE ORIGINAL FENCE.
 17. ALL CONSTRUCTION OPERATIONS SHALL BE ACCOMPLISHED IN ACCORDANCE WITH APPLICABLE REGULATIONS OF THE U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA). OSHA STANDARDS MAY BE PURCHASED FROM THE GOVERNMENT PRINTING OFFICE. INFORMATION AND RELATED REFERENCE MATERIALS MAY BE PURCHASED FROM OSHA, 1033 LA POSADA DR, SUITE 375, AUSTIN, TEXAS 78752-3832.
 18. ALL MATERIALS AND CONSTRUCTION PROCEDURES WITHIN THE SCOPE OF THIS CONTRACT WHERE NOT SPECIFICALLY COVERED IN THE PROJECT SPECIFICATIONS SHALL CONFORM TO ALL CITY OF LEANDER DETAILS AND CITY OF AUSTIN STANDARD SPECIFICATIONS.
 19. PROJECT SPECIFICATIONS TAKE PRECEDENCE OVER PLANS AND SPECIAL CONDITIONS GOVERN OVER TECHNICAL SPECIFICATIONS.
 20. HOT MIX ASPHALTIC CONCRETE PAVEMENT SHALL BE MINIMUM THICKNESS OF 2 INCHES WITH NO RECYCLED ASPHALT SHINGLES CONTENT.
 21. CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER OF ANY QUESTIONS THAT MAY RISE CONCERNING THE INTENT, PLACEMENT, OR LIMITS OF DIMENSIONS OR GRADES NECESSARY FOR THE CONSTRUCTION OF THIS PROJECT.
 22. CONTRACTOR SHALL BE RESPONSIBLE FOR ACQUIRING ALL PERMITS, TESTS, APPROVALS AND ACCEPTANCES REQUIRED TO COMPLETE CONSTRUCTION OF THIS PROJECT.
 23. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COORDINATION BETWEEN HIMSELF AND OTHER CONTRACTORS AND UTILITIES IN THE PROJECT. THE CITY OF LEANDER ELECTRIC DEPARTMENT SHALL BE APPLIED. AT A MINIMUM, CONSTRUCTION FOR PUBLIC WATER SYSTEMS MUST ALWAYS MEET TCEQ'S "RULES AND REGULATIONS FOR PUBLIC WATER SYSTEMS".
 24. ALL NEWLY INSTALLED PIPES AND RELATED PRODUCTS MUST CONFORM TO AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/NATIONAL STANDARD #1 AND BE CERTIFIED BY AN ORGANIZATION ACCREDITED BY ANSI (ISO24044/41).
 25. PLASTIC PIPE FOR USE IN PUBLIC WATER SYSTEMS MUST BEAR THE NSF INTERNATIONAL SEAL OF APPROVAL. NSF-IPR AND HAVE AN AUSTIN DESIGN PRESSURE RATING OF AT LEAST 100 PSI OR A STANDARD DRAINAGE RATING OF 30 OR LESS (SDR44/46/48).
 26. NO PIPE WHICH HAS BEEN USED FOR ANY PURPOSE OTHER THAN THE CONVEYANCE OF DRINKING WATER SHALL BE ACCEPTED OR RELOCATED FOR USE IN ANY PUBLIC DRINKING WATER SUPPLY (SDR44/46/48).
 41. ALL WATER LINE CROSSINGS OF WASTEWATER MAINS SHALL BE PERPENDICULAR (SDR44/46/48).
 42. WATER TRANSMISSION AND DISTRIBUTION LINES SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. HOWEVER, THE TOP OF THE WATER LINE MUST BE LOCATED BELOW THE FROST LINE AND IN NO CASE SHALL THE TOP OF THE WATER LINE BE LESS THAN 24 INCHES BELOW GROUND SURFACE (SDR44/46/48).
 27. THE MAXIMUM ALLOWABLE LEAK CONTENT OF PIPES, PIPE FITTINGS, PLUMBING FITTINGS, AND FITTINGS IS 0.25 PERCENT (SDR44/46/48).
 28. THE CONTRACTOR SHALL INSTALL APPROPRIATE AIR RELEASE DEVICES WITH VENT OPENINGS TO THE ATMOSPHERE COVERED WITH 16-MESH OR FINER, CORROSION RESISTANT SCREENING MATERIAL OR AN ACCEPTABLE EQUIVALENT (SDR44/46/48).
 29. THE CONTRACTOR SHALL NOT PLACE THE PIPE IN WATER OR WHERE IT CAN BE FLOODED WITH WATER OR SEWAGE DURING THE STORAGE OR INSTALLATION (SDR44/46/48).
 30. WHEN WATERLINES ARE Laid UNDER ANY FLOWING OR INTERMITTENT STREAM OR SEMIPERMANENT BODY OF WATER THE WATERLINE SHALL BE INSTALLED IN A SEPARATE WATERRIGHT PIPE ENCASEMENT. VALVES MUST BE PROVIDED ON EACH SIDE OF THE CROSSING WITH FACILITIES TO ALLOW THE UNDERWATER PORTION OF THE SYSTEM TO BE ISOLATED AND TESTED (SDR44/46/48).
 31. PURSUANT TO 30 TAC (SDR44/46/48), THE HYDROSTATIC LEAKAGE RATE SHALL NOT EXCEED THE AMOUNT ALLOWED OR RECOMMENDED BY THE MOST CURRENT AWWA FORMULAS FOR PVC PIPE, CAST IRON AND DUCTILE IRON PIPE. INCLUDE THE FORMULAS IN THE NOTES ON THE PLANS.
 32. THE HYDROSTATIC LEAKAGE RATE FOR POLYVINYL CHLORIDE (PVC) PIPE AND APPURTENANCES SHALL NOT EXCEED THE AMOUNT ALLOWED OR RECOMMENDED BY FORMULAS IN AMERICA WATER WORKS ASSOCIATION (AWWA) C600 AS REQUIRED IN 30 TAC (SDR44/46/48). PLEASE ENSURE THAT THE FORMULA FOR THIS CALCULATION IS CORRECT AND MOST CURRENT FORMULA IS IN USE.
 33. $Q = LDP(1.95)(1/4)(1000)$
 34. WHERE:
 - Q = THE QUANTITY OF MAKEUP WATER IN GALLONS PER HOUR.
 - L = THE LENGTH OF THE PIPE SECTION BEING TESTED, IN FEET.
 - D = THE NOMINAL DIAMETER OF THE PIPE IN INCHES, AND
 - P = THE AVERAGE TEST PRESSURE DURING THE HYDROSTATIC TEST IN POUNDS PER SQUARE INCH (PSI).
 35. THE CONTRACTOR SHALL MAINTAIN A MINIMUM SEPARATION DISTANCE IN ALL DIRECTIONS OF NINE FEET BETWEEN THE PROPOSED WATERLINE AND WASTEWATER COLLECTION FACILITIES INCLUDING MANHOLES. IF THIS DISTANCE CANNOT BE MAINTAINED, THE CONTRACTOR MUST IMMEDIATELY NOTIFY THE PROJECT ENGINEER FOR FURTHER DIRECTION, SEPARATION DISTANCES, INSTALLATION METHODS, AND MATERIALS UTILIZED MUST MEET (SDR44/46/48).
 36. THE SEPARATION DISTANCE FROM A POTABLE WATERLINE TO A WASTEWATER MAIN OR LATERAL MANHOLE OR CLEANOUT SHALL BE A MINIMUM OF NINE FEET. WHERE THE NINE-FOOT SEPARATION DISTANCE CANNOT BE ACHIEVED, THE POTABLE WATERLINE SHALL BE ENCASED IN A JOINT OF AT LEAST 100 PSI PRESSURE CLASS PIPE AT LEAST 18 FEET LONG AND TWO NOMINAL SIZES LARGER THAN THE NEAR CONVEYANCE, THE SPACE AROUND THE CARRIER PIPE SHALL BE SUPPORTED AT ONE-FOOT INTERVALS WITH SPACERS OR BE FILLED TO THE SPRINGLINE WITH WASHED SAND. THE ENCASEMENT PIPE SHALL BE CENTERED ON THE CROSSING AND BOTH ENDS SEALED WITH CEMENT GROUT OR MANUFACTURED SEALANT (SDR44/46/48).
 37. FIRE HYDRANTS SHALL NOT BE INSTALLED WITHIN NINE FEET VERTICALLY OR HORIZONTALLY OF ANY WASTEWATER LINE, WASTEWATER LATERAL, OR WASTEWATER SERVICE LINE REGARDLESS OF CONSTRUCTION (SDR44/46/48).
 38. SUCTION MAINS TO PUMPING EQUIPMENT SHALL NOT CROSS WASTEWATER MAINS, WASTEWATER LATERALS, OR WASTEWATER SERVICE LINES. RAW WATER SUPPLY LINES SHALL NOT BE INSTALLED WITHIN FIVE FEET OF ANY TILE OR CONCRETE WASTEWATER MAIN, WASTEWATER LATERAL, OR WASTEWATER SERVICE LINE (SDR44/46/48).
 39. WATERLINES SHALL NOT BE INSTALLED CLOSER THAN TEN FEET TO SEPTIC TANK DRAINFIELDS (SDR44/46/48).
 40. THE CONTRACTOR SHALL DRESS THE END WATERLINES IN ACCORDANCE WITH AWWA STANDARD C651-14 OR MOST RECENT, THEN FLUSH AND SAMPLE THE LINES BEFORE BEING PLACED INTO SERVICE. SAMPLES SHALL BE COLLECTED FOR MICROBIOLOGICAL ANALYSIS TO CHECK THE EFFECTIVENESS OF THE DISINFECTION PROCEDURE WHICH SHALL BE REPEATED IF CONTAMINATION PERSISTS. A MINIMUM OF ONE SAMPLE FOR EACH 1,000 FEET OF COMPLETED WATERLINE WILL BE REQUIRED UP AT THE NEXT AVAILABLE SAMPLING POINT BEYOND 1,000 FEET AS DESIGNATED BY THE DESIGN ENGINEER (SDR44/46/48).
 41. DECHLORINATION OF DISINFECTING WATER SHALL BE IN STRICT ACCORDANCE WITH CURRENT AWWA STANDARD C650-14 OR MOST RECENT.

TOTAL WATER DISTRIBUTION SYSTEM GENERAL CONSTRUCTION NOTES

1. THIS WATER DISTRIBUTION SYSTEM MUST BE CONSTRUCTED IN ACCORDANCE WITH THE CURRENT TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) RULES AND REGULATIONS FOR PUBLIC WATER SYSTEMS TO TEXAS ADMINISTRATIVE CODE (TAC) CHAPTER 290 SUBCHAPTER 9, WHEN CONFLICTS ARE NOTED WITH LOCAL ORDINANCES, THE MORE STRINGENT REQUIREMENT SHALL BE APPLIED. AT A MINIMUM, CONSTRUCTION FOR PUBLIC WATER SYSTEMS MUST ALWAYS MEET TCEQ'S "RULES AND REGULATIONS FOR PUBLIC WATER SYSTEMS".
2. ALL NEWLY INSTALLED PIPES AND RELATED PRODUCTS MUST CONFORM TO AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)/NATIONAL STANDARD #1 AND BE CERTIFIED BY AN ORGANIZATION ACCREDITED BY ANSI (ISO24044/41).
3. PLASTIC PIPE FOR USE IN PUBLIC WATER SYSTEMS MUST BEAR THE NSF INTERNATIONAL SEAL OF APPROVAL. NSF-IPR AND HAVE AN AUSTIN DESIGN PRESSURE RATING OF AT LEAST 100 PSI OR A STANDARD DRAINAGE RATING OF 30 OR LESS (SDR44/46/48).
4. NO PIPE WHICH HAS BEEN USED FOR ANY PURPOSE OTHER THAN THE CONVEYANCE OF DRINKING WATER SHALL BE ACCEPTED OR RELOCATED FOR USE IN ANY PUBLIC DRINKING WATER SUPPLY (SDR44/46/48).
5. ALL WATER LINE CROSSINGS OF WASTEWATER MAINS SHALL BE PERPENDICULAR (SDR44/46/48).
6. WATER TRANSMISSION AND DISTRIBUTION LINES SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. HOWEVER, THE TOP OF THE WATER LINE MUST BE LOCATED BELOW THE FROST LINE AND IN NO CASE SHALL THE TOP OF THE WATER LINE BE LESS THAN 24 INCHES BELOW GROUND SURFACE (SDR44/46/48).
7. THE MAXIMUM ALLOWABLE LEAK CONTENT OF PIPES, PIPE FITTINGS, PLUMBING FITTINGS, AND FITTINGS IS 0.25 PERCENT (SDR44/46/48).
8. THE CONTRACTOR SHALL INSTALL APPROPRIATE AIR RELEASE DEVICES WITH VENT OPENINGS TO THE ATMOSPHERE COVERED WITH 16-MESH OR FINER, CORROSION RESISTANT SCREENING MATERIAL OR AN ACCEPTABLE EQUIVALENT (SDR44/46/48).
9. THE CONTRACTOR SHALL NOT PLACE THE PIPE IN WATER OR WHERE IT CAN BE FLOODED WITH WATER OR SEWAGE DURING THE STORAGE OR INSTALLATION (SDR44/46/48).
10. WHEN WATERLINES ARE Laid UNDER ANY FLOWING OR INTERMITTENT STREAM OR SEMIPERMANENT BODY OF WATER THE WATERLINE SHALL BE INSTALLED IN A SEPARATE WATERRIGHT PIPE ENCASEMENT. VALVES MUST BE PROVIDED ON EACH SIDE OF THE CROSSING WITH FACILITIES TO ALLOW THE UNDERWATER PORTION OF THE SYSTEM TO BE ISOLATED AND TESTED (SDR44/46/48).
11. PURSUANT TO 30 TAC (SDR44/46/48), THE HYDROSTATIC LEAKAGE RATE SHALL NOT EXCEED THE AMOUNT ALLOWED OR RECOMMENDED BY THE MOST CURRENT AWWA FORMULAS FOR PVC PIPE, CAST IRON AND DUCTILE IRON PIPE. INCLUDE THE FORMULAS IN THE NOTES ON THE PLANS.
12. THE HYDROSTATIC LEAKAGE RATE FOR POLYVINYL CHLORIDE (PVC) PIPE AND APPURTENANCES SHALL NOT EXCEED THE AMOUNT ALLOWED OR RECOMMENDED BY FORMULAS IN AMERICA WATER WORKS ASSOCIATION (AWWA) C600 AS REQUIRED IN 30 TAC (SDR44/46/48). PLEASE ENSURE THAT THE FORMULA FOR THIS CALCULATION IS CORRECT AND MOST CURRENT FORMULA IS IN USE.
13. $Q = LDP(1.95)(1/4)(1000)$
14. WHERE:
 - Q = THE QUANTITY OF MAKEUP WATER IN GALLONS PER HOUR.
 - L = THE LENGTH OF THE PIPE SECTION BEING TESTED, IN FEET.
 - D = THE NOMINAL DIAMETER OF THE PIPE IN INCHES, AND
 - P = THE AVERAGE TEST PRESSURE DURING THE HYDROSTATIC TEST IN POUNDS PER SQUARE INCH (PSI).
15. THE CONTRACTOR SHALL MAINTAIN A MINIMUM SEPARATION DISTANCE IN ALL DIRECTIONS OF NINE FEET BETWEEN THE PROPOSED WATERLINE AND WASTEWATER COLLECTION FACILITIES INCLUDING MANHOLES. IF THIS DISTANCE CANNOT BE MAINTAINED, THE CONTRACTOR MUST IMMEDIATELY NOTIFY THE PROJECT ENGINEER FOR FURTHER DIRECTION, SEPARATION DISTANCES, INSTALLATION METHODS, AND MATERIALS UTILIZED MUST MEET (SDR44/46/48).
16. THE SEPARATION DISTANCE FROM A POTABLE WATERLINE TO A WASTEWATER MAIN OR LATERAL MANHOLE OR CLEANOUT SHALL BE A MINIMUM OF NINE FEET. WHERE THE NINE-FOOT SEPARATION DISTANCE CANNOT BE ACHIEVED, THE POTABLE WATERLINE SHALL BE ENCASED IN A JOINT OF AT LEAST 100 PSI PRESSURE CLASS PIPE AT LEAST 18 FEET LONG AND TWO NOMINAL SIZES LARGER THAN THE NEAR CONVEYANCE, THE SPACE AROUND THE CARRIER PIPE SHALL BE SUPPORTED AT ONE-FOOT INTERVALS WITH SPACERS OR BE FILLED TO THE SPRINGLINE WITH WASHED SAND. THE ENCASEMENT PIPE SHALL BE CENTERED ON THE CROSSING AND BOTH ENDS SEALED WITH CEMENT GROUT OR MANUFACTURED SEALANT (SDR44/46/48).
17. FIRE HYDRANTS SHALL NOT BE INSTALLED WITHIN NINE FEET VERTICALLY OR HORIZONTALLY OF ANY WASTEWATER LINE, WASTEWATER LATERAL, OR WASTEWATER SERVICE LINE REGARDLESS OF CONSTRUCTION (SDR44/46/48).
18. SUCTION MAINS TO PUMPING EQUIPMENT SHALL NOT CROSS WASTEWATER MAINS, WASTEWATER LATERALS, OR WASTEWATER SERVICE LINES. RAW WATER SUPPLY LINES SHALL NOT BE INSTALLED WITHIN FIVE FEET OF ANY TILE OR CONCRETE WASTEWATER MAIN, WASTEWATER LATERAL, OR WASTEWATER SERVICE LINE (SDR44/46/48).
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21. DECHLORINATION OF DISINFECTING WATER SHALL BE IN STRICT ACCORDANCE WITH CURRENT AWWA STANDARD C650-14 OR MOST RECENT.

CITY OF LEANDER EROSION CONTROL NOTES

1. THE CONTRACTOR SHALL INSTALL EROSION/SEDIMENTATION CONTROLS AND TREE PROTECTIVE FENCING PRIOR TO ANY WORK (CLEARING, GRUBBING OR EXCAVATION). CONTACT STORMWATER INSPECTOR FOR ON SITE INSPECTION PRIOR TO BEGINNING CONSTRUCTION.
2. THE CONTRACTOR IS REQUIRED TO INSPECT THE CONTROLS AND FENCES AT WEEKLY INTERVALS AND AFTER SIGNIFICANT RAINFALL EVENTS TO ENSURE THAT THEY ARE FUNCTIONING PROPERLY. THE PERSON(S) RESPONSIBLE FOR MAINTENANCE OF CONTROLS AND FENCES SHALL IMMEDIATELY MAKE ANY NECESSARY REPAIRS TO DAMAGED AREAS. SILT ACCUMULATION AT CONTROLS MUST BE REMOVED WHEN THE DEPTH REACHES SIX (6) INCHES.
3. THE TEMPORARY SPILLS DISPOSAL SITE IS TO BE SHOWN IN THE EROSION CONTROL MAP.
4. ANY ON-SITE SPILLS DISPOSAL SHALL BE REMOVED PRIOR TO ACCEPTANCE UNLESS SPECIFICALLY SHOWN ON THE PLANS. THE DEPTH OF SPILL SHALL NOT EXCEED 10 FEET IN ANY AREA.
5. ALL AREAS DISTURBED OR EXPOSED DURING CONSTRUCTION SHALL BE RESTORED WITH A MINIMUM OF 6 INCHES OF TOPSOIL AND COMPOST BLEND. TOPSOIL ON SINGLE FAMILY LOTS MAY BE INSTALLED WITH HOME CONSTRUCTION. THE TOPSOIL AND COMPOST BLEND SHALL CONSIST OF 75% TOPSOIL AND 25% COMPOST.
6. SEEDING FOR REESTABLISHING VEGETATION SHALL COMPLY WITH THE AUSTIN GROW GREEN GUIDE OR WILLIAMSON COUNTY'S PROTOCOL FOR SUSTAINABLE ROADSIDES (SPEC 164--W001 SEEDING FOR EROSION CONTROL). RESEEDING VARIETIES OF BERMAUDA SHALL NOT BE USED.
7. STABILIZED CONSTRUCTION ENTRANCE IS REQUIRED AT ALL POINTS WHERE CONSTRUCTION TRAFFIC IS EXITING THE PROJECT ONTO EXISTING PAVEMENT. LINEAR CONSTRUCTION PROJECTS MAY REQUIRE SPECIAL CONSIDERATION. ROADWAYS SHALL REMAIN OPEN TO TRAFFIC AT ALL TIMES.
8. TEMPORARY STOP SIGNS SHOULD BE INSTALLED AT ALL CONSTRUCTION ENTRANCES WHERE A STOP CONDITION DOES NOT ALREADY EXIST.
9. IN THE EVENT OF INCLEMENT WEATHER THAT MAY RESULT IN A FLOODING SITUATION, THE CONTRACTOR SHALL REMOVE INLET PROTECTION MEASURE UNTIL SUCH TIME AS THE WEATHER EVENT HAS PASSED.

CITY OF LEANDER STREET AND DRAINAGE NOTES

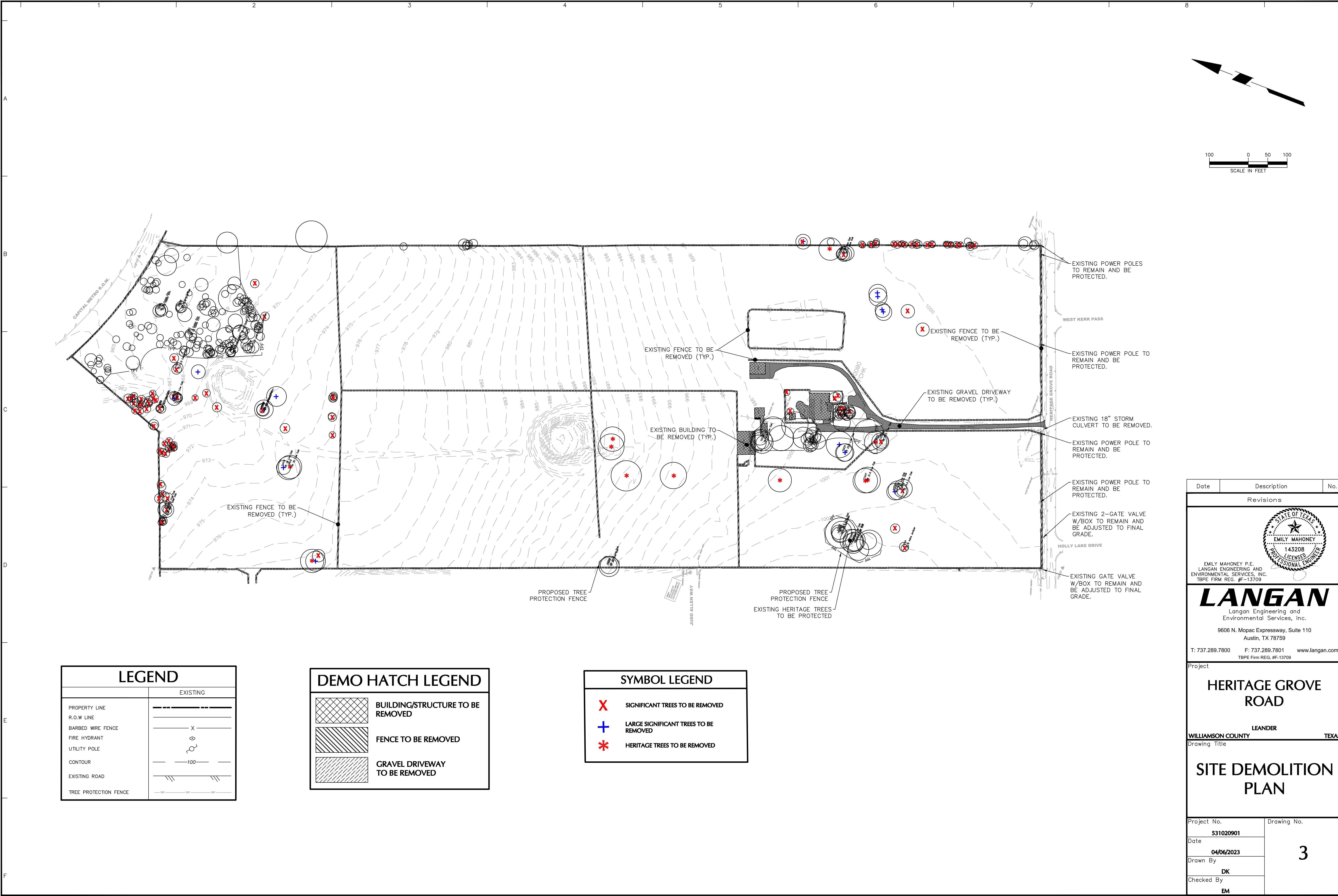
1. ALL SIDEWALKS SHALL COMPLY WITH THE AMERICANS WITH DISABILITIES ACT. THE CITY OF LEANDER HAS NOT REVIEWED THESE PLANS FOR COMPLIANCE WITH THE AMERICANS WITH DISABILITIES ACT, OR ANY OTHER ACCESSIBILITY LEGISLATION, AND DOES NOT WARRANT OR APPROVE THESE PLANS FOR ANY ACCESSIBILITY STANDARDS.
2. PRIOR TO ACCEPTANCE THE ENGINEER SHALL SUBMIT DOCUMENTATION THAT THE IMPROVEMENTS WERE INSPECTED BY TDR OR A REGISTERED ACCESSIBILITY SPECIALIST (RAS) AND ARE IN COMPLIANCE WITH THE REQUIREMENTS OF THE TABA.
3. CONTRACTOR SHALL PROVIDE QUALITY TESTING FOR ALL INFRASTRUCTURES TO BE ACCEPTED AND MAINTAINED BY THE CITY OF LEANDER. AFTER COMPLETION, THE CONTRACTOR SHALL NOTIFY THE CITY OF LEANDER ENGINEERING DEPARTMENT AT 528-2700 NO LESS THAN 48 HOURS PRIOR TO ANY TESTING.
4. BACKFILL BEHIND THE CURB SHALL BE COMPACTED TO OBTAIN A MINIMUM OF 95% MAXIMUM DENSITY TO WITHIN 8" OF TOP OF CURB. MATERIALS USED FOR BACKFILL SHALL BE OF THE HIGHEST QUALITY AVAILABLE. IN THE GREATEST DEPTH, THE REMAINING 8" SHALL BE CLEAN TOPSOIL FREE FROM ALL CLODS AND SUITABLE FOR SUSTAINING PLANT LIFE.
5. A MINIMUM OF 6" OF TOPSOIL SHALL BE PLACED BETWEEN THE CURB AND RIGHT-OF-WAY AND IN ALL DRAINAGE CHANNELS EXCEPT CHANNELS OUT IN STABLE ROCK.
6. DEPTH OF COVER FOR ALL CROSSINGS UNDER PAVEMENT, INCLUDING GAS, ELECTRIC TELEPHONE, CABLE TV, ETC., SHALL BE A MINIMUM OF 30" BELOW SURFACE.
7. STREET RIGHT-OF-WAY SHALL BE GRADED AT A SLOPE OF 1/4" PER FOOT TOWARD THE CURB UNLESS OTHERWISE INDICATED. HOWEVER, IN NO CASE SHALL THE WIDTH OF RIGHT-OF-WAY AT X-PER FOOT SLOPE BE LESS THAN 10 FEET UNLESS A SPECIFIC REQUEST FOR AN ALTERNATE GRADING SCHEME IS MADE TO AND ACCEPTED BY THE CITY OF LEANDER PUBLIC WORKS DEPARTMENT.
8. BARRICADES BUILT TO THE CITY OF LEANDER STANDARDS SHALL BE CONSTRUCTED ON ALL DEAD-END STREETS AND AS NECESSARY DURING CONSTRUCTION TO MAINTAIN JOB AND PUBLIC SAFETY.
9. ALL REINFORCED CONCRETE PIPE SHALL BE MINIMUM CLASS III OF TONQUE AND GROOVE OR O-RING JOINT DESIGN.
10. THE CONTRACTOR IS TO NOTIFY THE ENGINEERING INSPECTOR 48 HOURS PRIOR TO THE FOLLOWING TESTING: PROOF ROLLING SUB-GRADE AND EVERY LIFT OF ROADWAY EMBANKMENT, IN-PLACE DENSITY TESTING OF EVERY BASE COURSE, AND ASPHALT CORES. ALL OF THIS TESTING MUST BE WITNESSED BY A CITY OF LEANDER REPRESENTATIVE.
11. THE CONTRACTOR MUST PROVIDE A PNEUMATIC TRUCK PER TxDOT SPEC FOR PROOF ROLLING.
12. AT INTERSECTIONS WHICH HAVE VALLEY DRAINAGE, THE CROWNS OF THE INTERSECTING STREETS WILL CULMINATE IN A DISTANCE OF 40 FEET FROM INTERSECTING CURB LINE UNLESS OTHERWISE NOTED.
13. AT THE INTERSECTION OF TWO 44-STREETS OR LARGER, THE CROWNS OF THE INTERSECTING STREETS WILL CULMINATE IN A DISTANCE OF 40 FEET FROM INTERSECTING CURB LINE UNLESS OTHERWISE NOTED.
14. A CURB LAYDOWN IS REQUIRED AT ALL POINTS WHERE THE PROPOSED SIDEWALK INTERSECTS THE CURB.
15. ALL STRIPING, WITH THE EXCEPTION OF STOP BARS, CROSS WALKS, WORDS AND ARROWS, IS TO BE TYPE II (WATER BASED). STOP BARS, CROSS WALKS, WORDS AND ARROWS REQUIRE TYPE I THERMOPLASTIC.
16. MANHOLE FRAMES, COVERS, VALVES, CLEAN-OUTS, ETC. SHALL BE RAISED TO GRADE PRIOR TO FINAL PAVEMENT CONSTRUCTION.
17. CONTRACTOR SHALL NOTIFY THE LEANDER ENGINEERING DEPARTMENT AT 528-2700 AT LEAST 48 HOURS PRIOR TO THE INSTALLATION OF ANY DRAINAGE FACILITY WITHIN A DRAINAGE EASEMENT OR STREET ROW. THE METHOD OF PLACEMENT AND COMPACTING OF BACKFILL IN THE CITY'S ROW MUST BE APPROVED PRIOR TO THE START OF BACKFILL OPERATIONS.
18. A STOP BAR SHALL BE PLACED AT ALL STOP SIGN LOCATIONS.
19. A MINIMUM OF SEVEN DAYS OF CURE TIME IS REQUIRED FOR HMAc PRIOR TO THE INTRODUCTION OF PUBLIC VEHICULAR TRAFFIC TO ANY STREETS.
20. THE GEOTECHNICAL ENGINEER SHALL INSPECT THE SUBGRADE FOR COMPLIANCE WITH THE DESIGN ASSUMPTIONS MADE DURING PREPARATION OF THE SOILS REPORT. ANY ADJUSTMENTS THAT ARE REQUIRED SHALL BE MADE THROUGH REVISIONS OF THE CONSTRUCTION PLANS.
21. GEOTECHNICAL INVESTIGATION INFORMATION AND PAVEMENT RECOMMENDATIONS WERE PROVIDED BY PROFESSIONAL SERVICE INDUSTRIES, INC. PAVEMENT RECOMMENDATIONS ARE AS FOLLOWS:
 - 21.1. LOW TRAFFIC CONDITION: PARKING AREA EXPECTED TO RECEIVE ONLY PASSENGER VEHICLES AND LIGHT PICKUP TRUCK TRAFFIC.
 - 21.2. MEDIUM TRAFFIC CONDITION: SECONDARY DRIVE AREAS AND/OR PARKING AREAS EXPECTED TO RECEIVE DELIVERY VANS OR LIGHT TRUCKS.
 - 21.3. HIGH TRAFFIC CONDITION: PARKING AND DRIVE AREAS WITH HEAVY TRAFFIC, FIRE LANES, TRASH PICKUP AREAS, MAIN ACCESS DRIVEWAY.
- 21.3.1. MINIMUM ROAD PAVEMENT SECTION FOR:
 - 21.3.1.1. FOR 26 18-WHEELER TRUCK PASSES PER DAY: 7.0 INCHES OF PORTLAND CEMENT CONCRETE, AT LEAST 12 INCHES OF SELECT FILL AND THE UPPER 8 INCHES OF PAVEMENT SUBGRADE SOIL BE LIME STABILIZED.
 - 21.3.1.2. MEDIUM DESIGN THICKNESS: 6.0 INCHES OF PORTLAND CEMENT CONCRETE, AT LEAST 12 INCHES OF SELECT FILL AND THE UPPER 8 INCHES OF PAVEMENT SUBGRADE SOIL BE LIME STABILIZED.
 - 21.3.1.3. HIGH DESIGN THICKNESS: 7.0 INCHES OF PORTLAND CEMENT CONCRETE, AT LEAST 12 INCHES OF SELECT FILL AND THE UPPER 8 INCHES OF PAVEMENT SUBGRADE SOIL BE LIME STABILIZED.
- 21.3.2. MINIMUM ROAD PAVEMENT SECTION FOR TRUCK TRAFFIC AREAS:
 - 21.3.2.1. FOR 26 18-WHEELER TRUCK PASSES PER DAY: 7.0 INCHES OF PORTLAND CEMENT CONCRETE, AT LEAST 12 INCHES OF SELECT FILL AND THE UPPER 8 INCHES OF PAVEMENT SUBGRADE SOIL BE LIME STABILIZED.
 - 21.3.2.2. FOR 50 18-WHEELER TRUCK PASSES PER DAY: 8.0 INCHES OF PORTLAND CEMENT CONCRETE, AT LEAST 12 INCHES OF SELECT FILL AND THE UPPER 8 INCHES OF PAVEMENT SUBGRADE SOIL BE LIME STABILIZED.
 - 21.3.2.3. FOR 100 18-WHEELER TRUCK PASSES PER DAY: 9.0 INCHES OF PORTLAND CEMENT CONCRETE, AT LEAST 12 INCHES OF SELECT FILL AND THE UPPER 8 INCHES OF PAVEMENT SUBGRADE SOIL BE LIME STABILIZED.
- 21.3.3. MINIMUM ROAD PAVEMENT SECTION FOR TRUCK TRAFFIC AREAS:
 - 21.3.3.1. FOR 26 18-WHEELER TRUCK PASSES PER DAY: 7.0 INCHES OF PORTLAND CEMENT CONCRETE, AT LEAST 12 INCHES OF SELECT FILL AND THE UPPER 8 INCHES OF PAVEMENT SUBGRADE SOIL BE LIME STABILIZED.
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CITY OF LEANDER TRENCH SAFETY NOTES

1. TRENCH SAFETY SYSTEMS TO BE UTILIZED FOR THIS PROJECT ARE DESCRIBED IN ITEM 509S "TRENCH SAFETY SYSTEMS" OF THE CITY OF AUSTIN STANDARD SPECIFICATIONS AND SHALL BE IN ACCORDANCE WITH THE LAWS OF THE STATE OF TEXAS AND THE U.S. OCCUPATION SAFETY AND HEALTH ADMINISTRATION REGULATIONS.

CITY OF LEANDER GRADING NOTES

1. POSITIVE DRAINAGE SHALL BE MAINTAINED ON ALL SURFACE AREAS WITHIN THE SCOPE OF THIS PROJECT. CONTRACTOR SHOULD TAKE PRECAUTIONS NOT TO ALLOW ANY PONDING OF WATER.
2. THE CONTRACTOR SHALL CONSTRUCT EARTHEN EMBANKMENTS WITH SLOPES NO STEEPER THAN 3:1 AND COMPACT SOIL TO 95% OF MAXIMUM DENSITY IN ACCORDANCE WITH THE CITY OF AUSTIN STANDARD SPECIFICATIONS.
3. AREAS OF



LEGEND

	EXISTING
PROPERTY LINE	---
R.O.W LINE	---
BARBED WIRE FENCE	---
FIRE HYDRANT	X
UTILITY POLE	⊕
CONTOUR	100
EXISTING ROAD	---
TREE PROTECTION FENCE	---

DEMO HATCH LEGEND

	BUILDING/STRUCTURE TO BE REMOVED
	FENCE TO BE REMOVED
	GRAVEL DRIVEWAY TO BE REMOVED

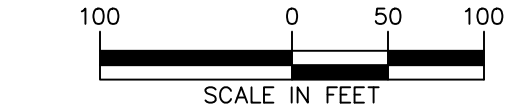
SYMBOL LEGEND

X	SIGNIFICANT TREES TO BE REMOVED
+	LARGE SIGNIFICANT TREES TO BE REMOVED
*	HERITAGE TREES TO BE REMOVED

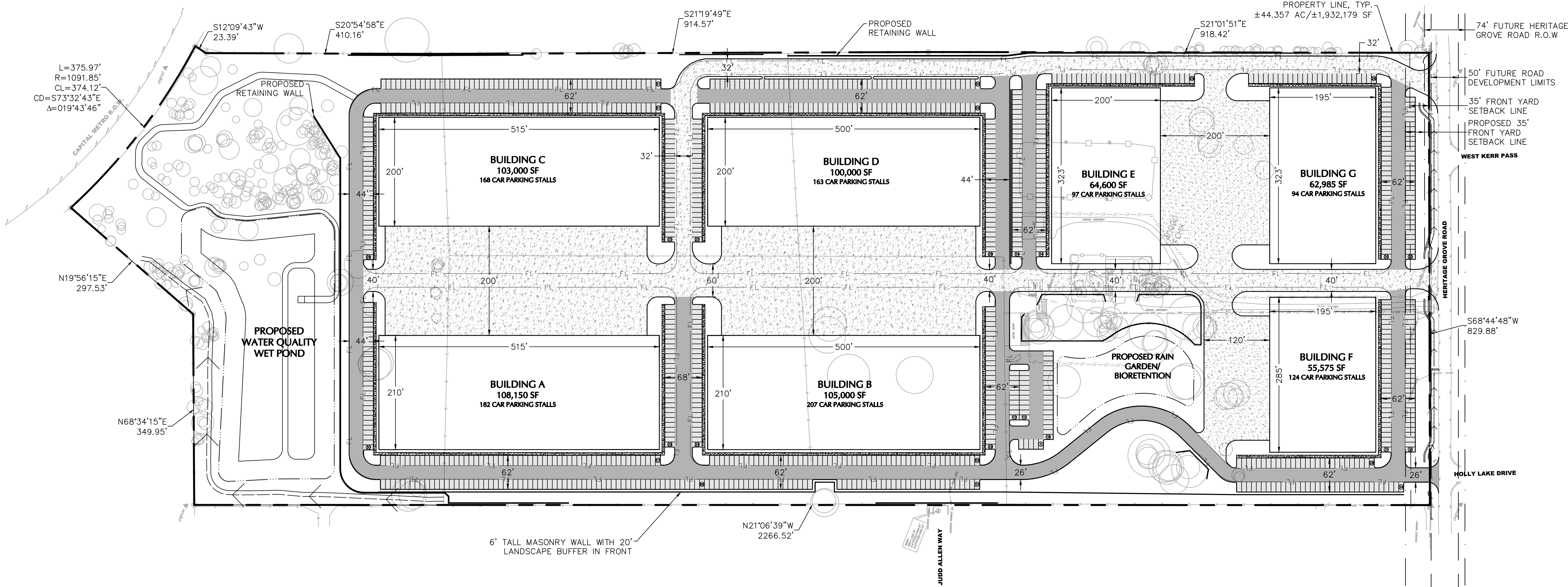
Date	Description	No.
Revisions		
EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. T&PE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com T&PE FIRM REG. #F-13709		
Project		
HERITAGE GROVE ROAD		
LEANDER TEXAS		
Drawing Title		
SITE DEMOLITION PLAN		
Project No.	3	
531020901		
Date		
04/06/2023		
Drawn By		
DK		
Checked By		
EM		

	CITY OF LEANDER ZONING TABLE				
	ZONING DISTRICT: PUD - HEAVY COMMERCIAL				
SITE	ITEM	PERMITTED	PROPOSED	REFERENCE	CONDITIONS
	Land Use	Warehousing and Distribution	Warehousing and Distribution		C
BUILDING	Building Height	35 FT	35FT	ARTICLE VIII SECTION 8 ARTICLE V SECTION 1	C
	Maximum Impervious Coverage	90%	71%		C
	Minimum Yards/Setbacks:				
	Min. Front yard	35 FT	97FT	ARTICLE VI SECTION 6	C
	Min. Side Yard	15 FT	65/97FT		
	Min. Rear Yard	15 FT	339FT		
PARKING AND ACCESS	Min. Number of Car Parking Spaces			ARTICLE VI SECTION 3 ARTICLE VI SECTION 3	
	Warehouse (one space per 600 SF GFA)	1,001	1,034		C
	ADA Parking Spaces	38	42		C
	Min. Parking Aisle Width (Two-Way) ⁽²⁾	30 FT	26FT		C
	Max. Driveway Width ⁽²⁾	45 FT	40FT		C
NOTES	(1) Data referenced from Composite Zoning Ordinance from City of Leander				
	(2) Data referenced from Site Development Permit Application & Checklist from City of Leander				
	Condition Abbreviations: C - Compliance				

Warehouse Parking								
	Building A	Building B	Building C	Building D	Building E	Building F	Building G	Combined
GFA	108,150	105,000	103,000	100,000	64,600	55,575	62,985	599,310
Total Parking Required (1 space / 600 SF)	181	175	172	167	108	93	105	1,001
Total Parking Provided	182	206	168	163	97	124	94	1,034



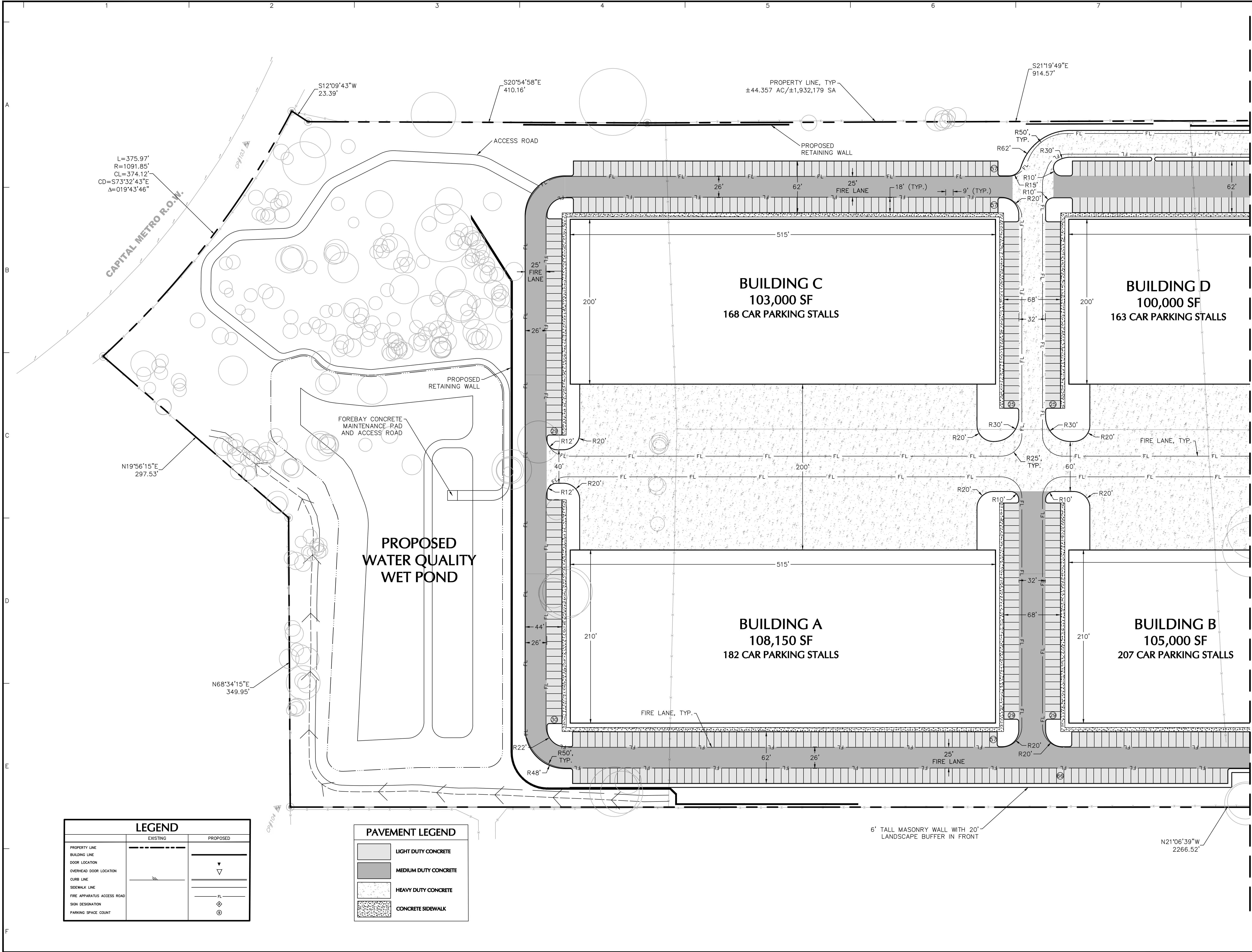
- NOTES:
- ALL EASEMENTS OF RECORD AS INDICATED ON THE MOST RECENT SURVEY (DATED: NOVEMBER 2, 2022, CONDUCTED BY GB) FOR THIS PROPERTY ARE SHOWN ON THIS SITE PLAN.
 - ALL SITE UTILITY LINES ARE PROPOSED TO BE LOCATED UNDERGROUND.
 - EXTERIOR LIGHTING SHALL BE SHIELDED SUCH THAT THE LIGHT SOURCE IS NOT DIRECTLY VISIBLE FROM THE PUBLIC ROW OR ADJACENT RESIDENTIAL DISTRICTS OR USES AT THE PROPERTY LINE. UN SHIELDED "WALL PACK" LIGHTING IS NOT PROPOSED.
 - AL CLAWSON DISPOSAL, INC. SHALL BE THE SOLE PROVIDER OF WASTE HAULING FOR THIS SITE AFTER CONSTRUCTION.
 - AIR CONDITIONING UNITS ARE NOT PROPOSED FORWARD THE FRONT WALL OF THE BUILDING.
 - GARBAGE DUMPSTERS ARE LOCATED NO CLOSER TO A ROADWAY THAN THE FRONT WALL OF THE PRINCIPAL STRUCTURE LOCATED CLOSEST TO THE ROADWAY. GARBAGE DUMPSTERS ARE SCREENED BY A WALL (COMPRISED OF MASONRY COMPATIBLE WITH THE STRUCTURE OR WOODCRETE) AT LEAST AS HIGH AS THE CONTAINER. THE OPEN SIDE TO THE DUMPSTER OR OTHER TRASH RECEPTACLE IS A GATE CONSTRUCTED OF SOLID WOOD OR METAL. THE DUMPSTER IS ORIENTED FOR PICKUP BY A FRONT LOAD GARBAGE TRUCK.
 - FOR 90 GALLON ROLL OUT CONTAINER STORED OUTSIDE, IT IS REQUIRED TO BE ENCLOSED BY PRIVACY FENCE.



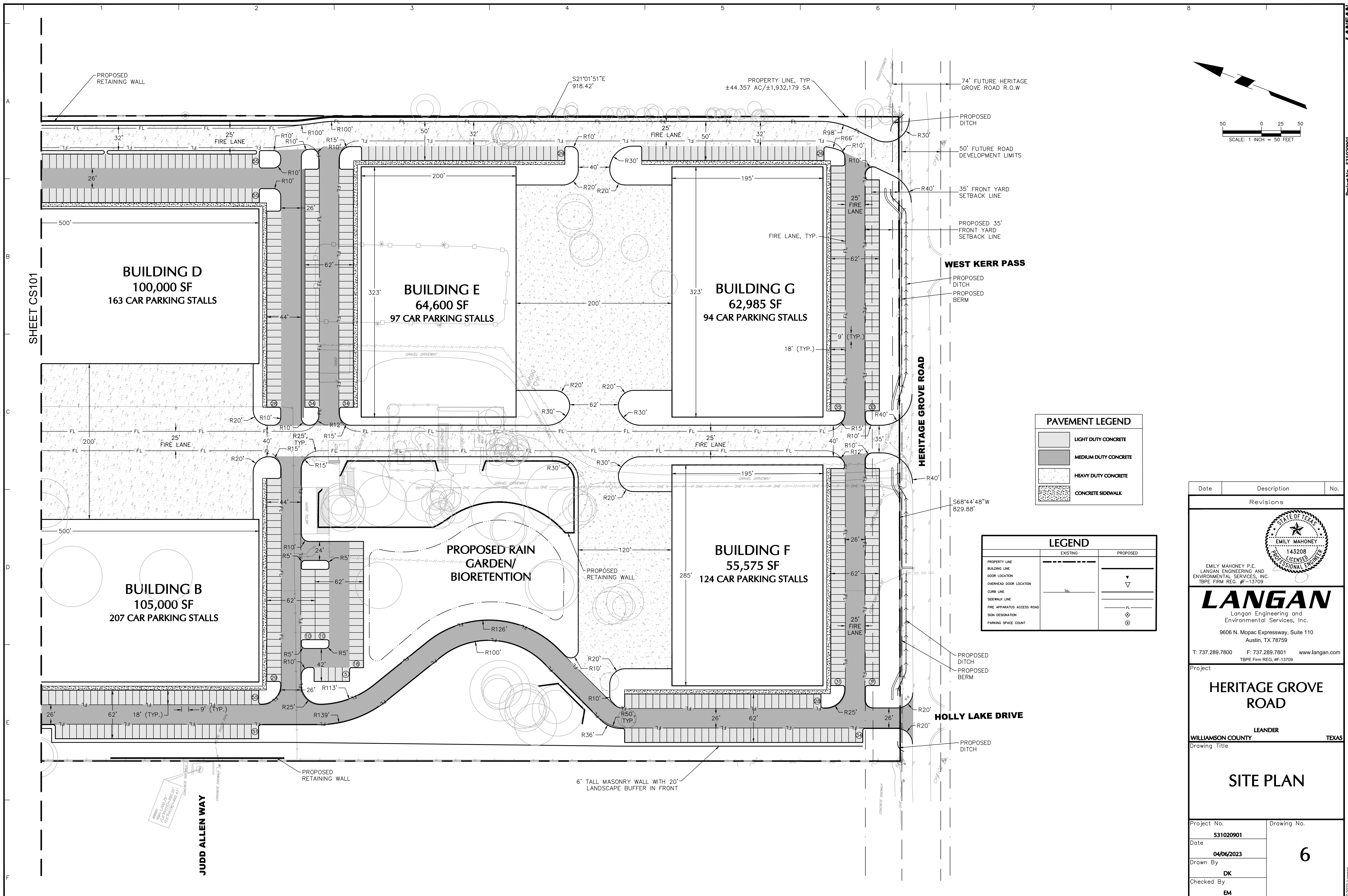
LEGEND		
	EXISTING	PROPOSED
PROPERTY LINE	---	---
BUILDING LINE	---	---
DOOR LOCATION		▼
OVERHEAD DOOR LOCATION		▽
CURB LINE	---	---
SIDEWALK LINE	---	---
FIRE APPARATUS ACCESS ROAD	---	---
SIGN DESIGNATION		◆
PARKING SPACE COUNT		⊙

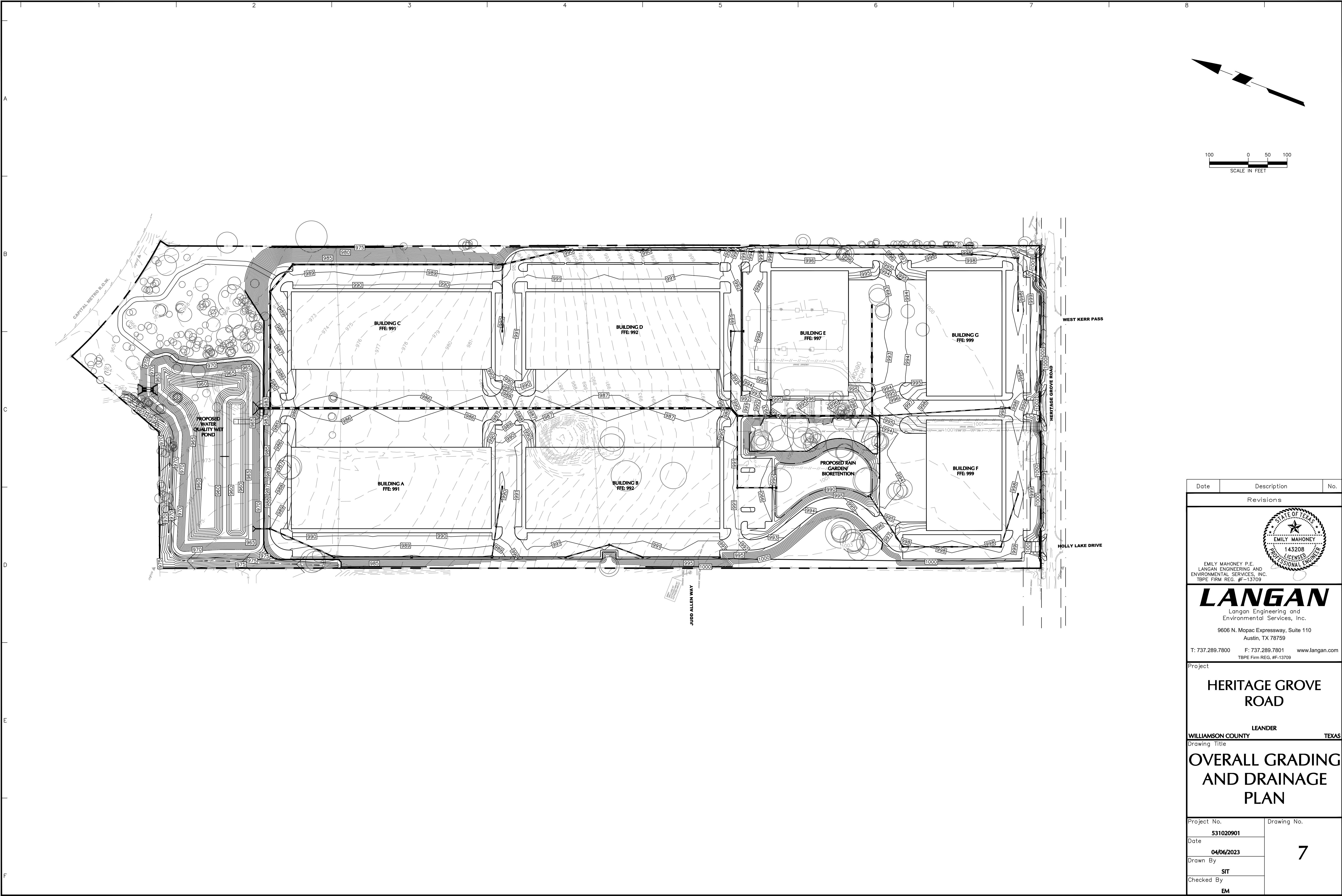
PAVEMENT LEGEND	
[Pattern]	LIGHT DUTY CONCRETE
[Pattern]	MEDIUM DUTY CONCRETE
[Pattern]	HEAVY DUTY CONCRETE
[Pattern]	CONCRETE SIDEWALK

Date	Description	No.
Revisions		
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DK		Checked By
EM		

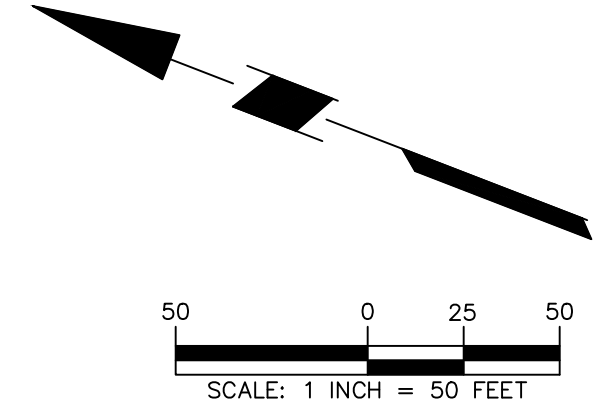
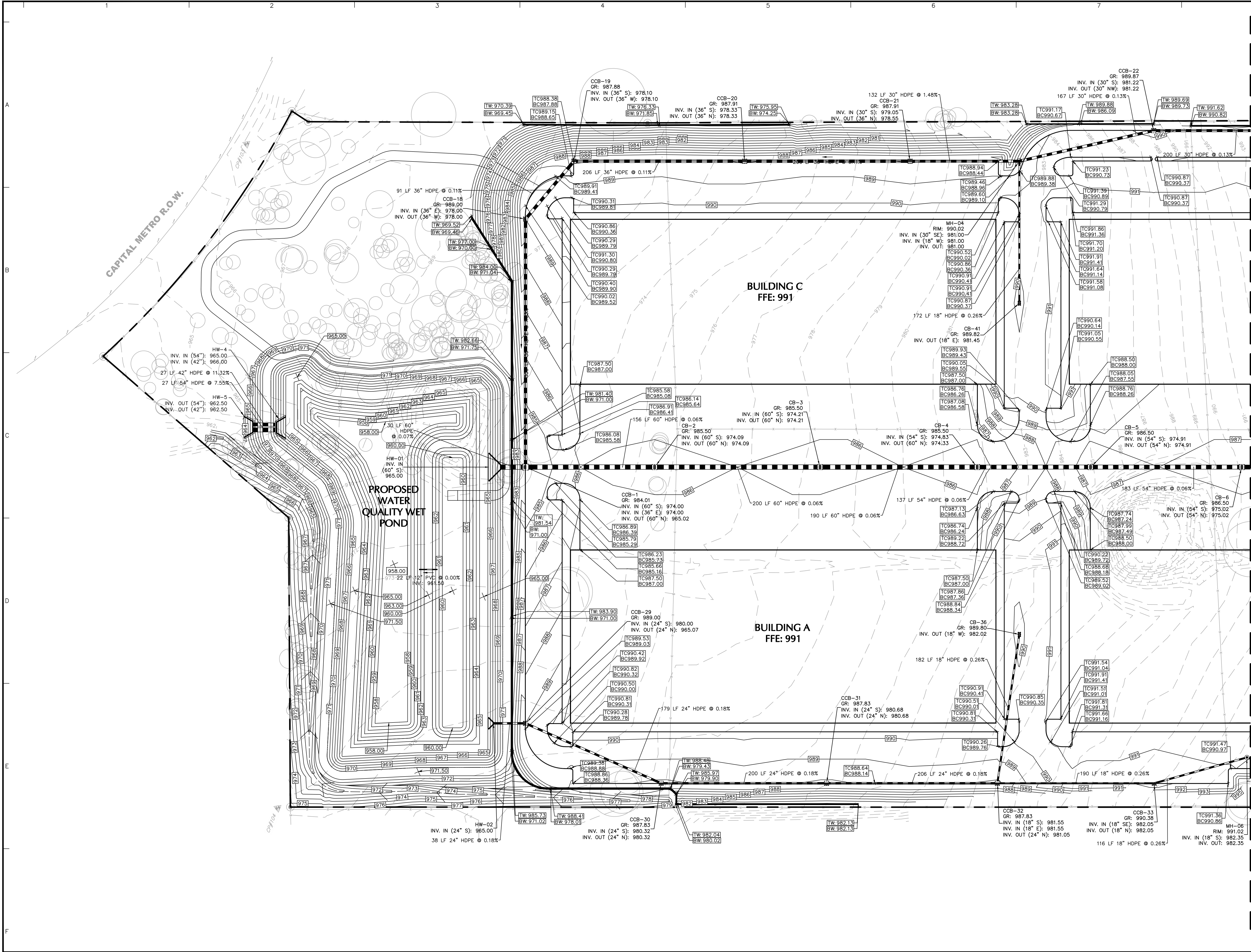


Date	Description	No.
Revisions		
STATE OF TEXAS EMILY MAHONEY 143208 LICENSED PROFESSIONAL ENGINEER EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709		
Project		
HERITAGE GROVE ROAD LEANDER WILLIAMSON COUNTY TEXAS Drawing Title		
SITE PLAN		
Project No.		Drawing No.
531020901		
Date		
04/06/2023		
Drawn By		
DK		5
Checked By		
EM		



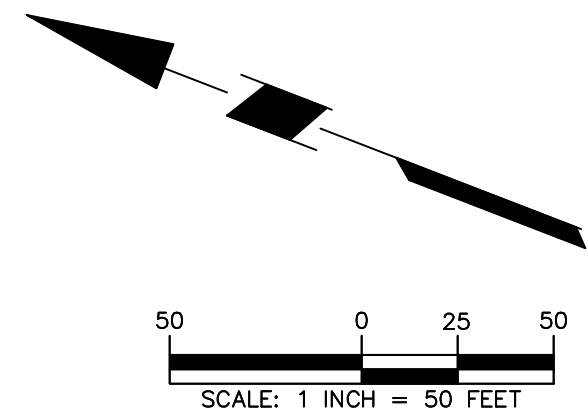
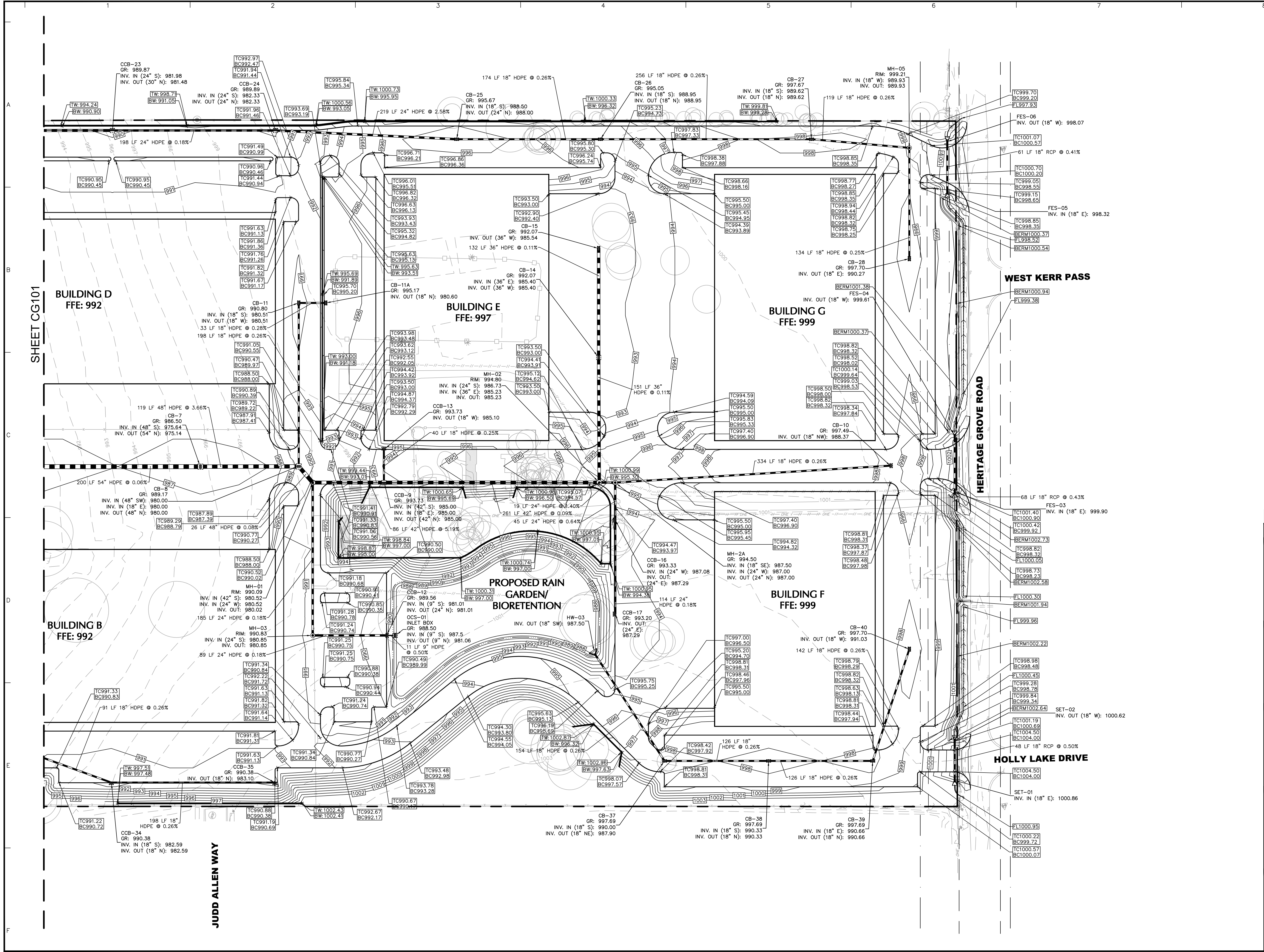


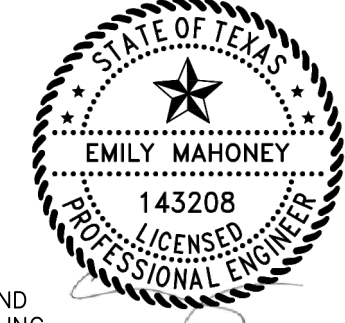
Date	Description	No.
Revisions		
STATE OF TEXAS EMILY MAHONEY 143208 LICENSED PROFESSIONAL ENGINEER EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709		
Project		
HERITAGE GROVE ROAD		
LEANDER		
WILLIAMSON COUNTY TEXAS		
Drawing Title		
OVERALL GRADING AND DRAINAGE PLAN		
Project No.	7	
531020901		
Date		
04/06/2023		
Drawn By		
SIT		
Checked By		
EM		

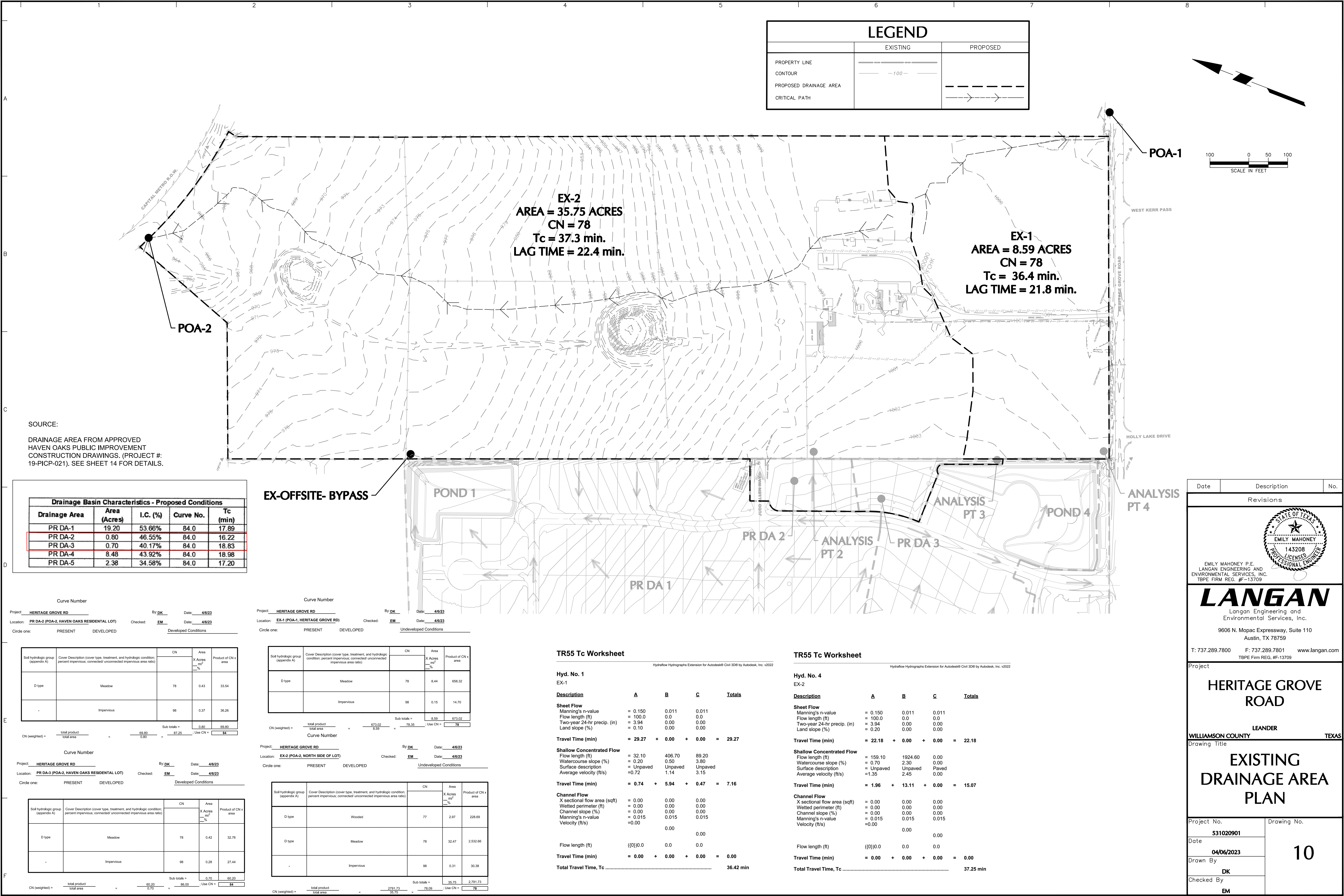


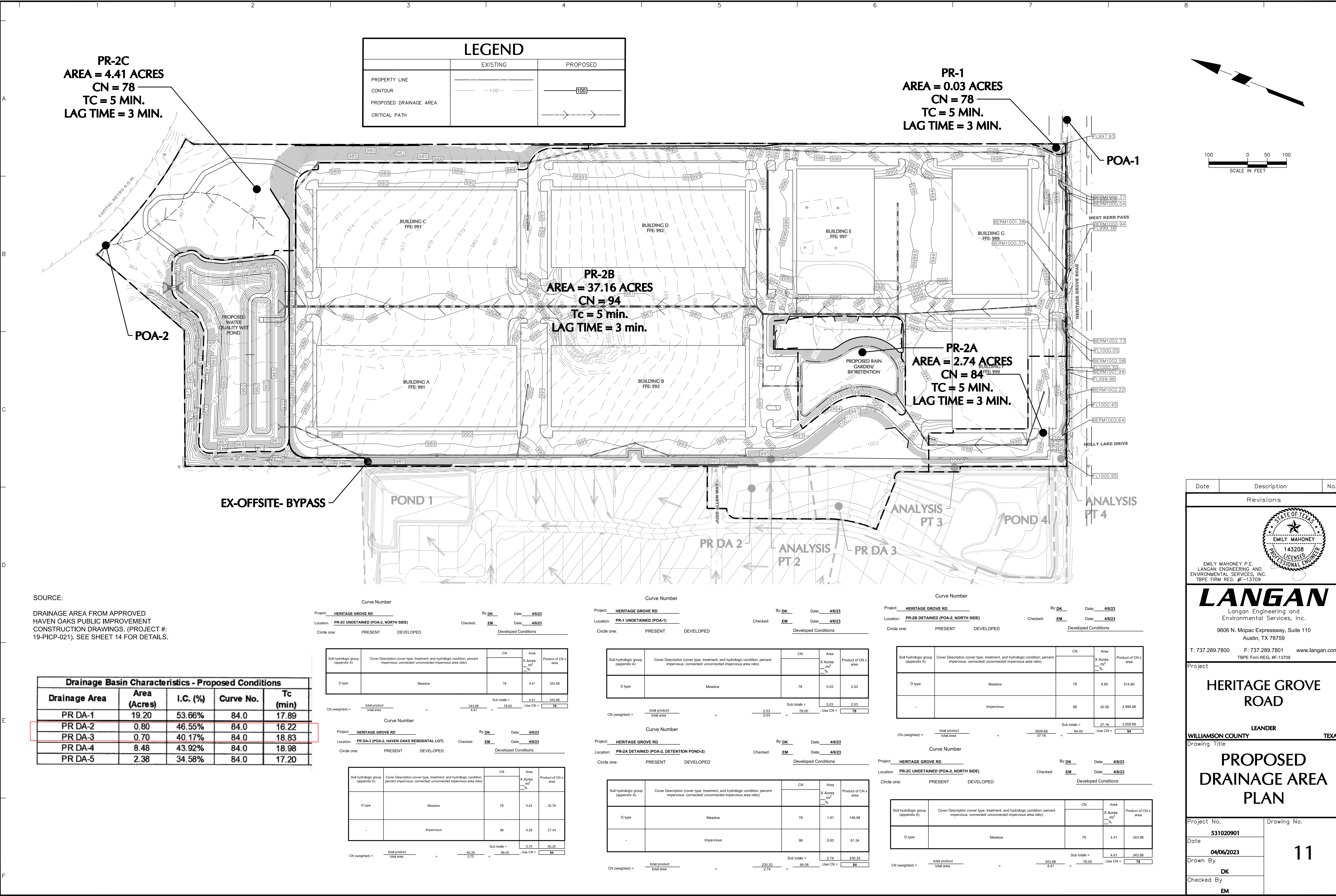
SHEET CG102

Date	Description	No.
Revisions		
STATE OF TEXAS EMILY MAHONEY 143208 LICENSED PROFESSIONAL ENGINEER EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709		
Project		
HERITAGE GROVE ROAD		
LEANDER TEXAS		
Drawing Title		
GRADING PLAN AND DRAINAGE PLAN		
Project No.		Drawing No.
531020901		8
Date		
04/06/2023		
Drawn By		SIT
Checked By		EM



Date	Description	No.
Revisions		
 EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. T&PE FIRM REG. #F-13709		
 Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com T&PE FIRM REG. #F-13709		
Project HERITAGE GROVE ROAD		
LEANDER TEXAS		
Drawing Title GRADING PLAN AND DRAINAGE PLAN		
Project No. 531020901		Drawing No. 9
Date 04/06/2023		
Drawn By SIT		
Checked By EM		





SOURCE:
DRAINAGE AREA FROM APPROVED
HAVEN OAKS PUBLIC IMPROVEMENT
CONSTRUCTION DRAWINGS. (PROJECT #:
19-PICP-021). SEE SHEET 14 FOR DETAILS.

Drainage Basin Characteristics - Proposed Conditions				
Drainage Area	Area (Acres)	I.C. (%)	Curve No.	Tc (min)
PR DA-1	19.20	53.66%	84.0	17.89
PR DA-2	0.80	46.55%	84.0	16.22
PR DA-3	0.70	40.17%	84.0	18.83
PR DA-4	8.48	43.92%	84.0	18.98
PR DA-5	2.38	34.58%	84.0	17.20

Curve Number				
Project:	HERITAGE GROVE RD	By DK	Date:	4/6/23
Location:	PR-2C UNDETAINED (POA-2, NORTH SIDE)	Checked:	EM	Date: 4/6/23
Circle one:	PRESENT	DEVELOPED	Developed Conditions	

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/unconnected impervious area ratio)	CN	Area X Acres mi ² %	Product of CN x area
D type	Meadow	78	4.41	343.98
Sub totals =			4.41	343.98
CN (weighted) =			total product / total area = 343.98 / 4.41 = 78.00	Use CN = 78

Curve Number				
Project:	HERITAGE GROVE RD	By DK	Date:	4/6/23
Location:	PR DA-3 (POA-2, HAVEN OAKS RESIDENTIAL LOT)	Checked:	EM	Date: 4/6/23
Circle one:	PRESENT	DEVELOPED	Developed Conditions	

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/unconnected impervious area ratio)	CN	Area X Acres mi ² %	Product of CN x area
D type	Meadow	78	0.42	32.76
-	Impervious	98	0.28	27.44
Sub totals =			0.70	60.20
CN (weighted) =			total product / total area = 60.20 / 0.70 = 86.00	Use CN = 84

Curve Number				
Project:	HERITAGE GROVE RD	By DK	Date:	4/6/23
Location:	PR-1 UNDETAINED (POA-1)	Checked:	EM	Date: 4/6/23
Circle one:	PRESENT	DEVELOPED	Developed Conditions	

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/unconnected impervious area ratio)	CN	Area X Acres mi ² %	Product of CN x area
D type	Meadow	78	0.03	2.53
Sub totals =			0.03	2.53
CN (weighted) =			total product / total area = 2.53 / 0.03 = 78.00	Use CN = 78

Curve Number				
Project:	HERITAGE GROVE RD	By DK	Date:	4/6/23
Location:	PR-2A DETAINED (POA-2, DETENTION POND-2)	Checked:	EM	Date: 4/6/23
Circle one:	PRESENT	DEVELOPED	Developed Conditions	

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/unconnected impervious area ratio)	CN	Area X Acres mi ² %	Product of CN x area
D type	Meadow	78	1.91	148.98
-	Impervious	98	0.83	81.34
Sub totals =			2.74	230.32
CN (weighted) =			total product / total area = 230.32 / 2.74 = 84.06	Use CN = 84

Curve Number				
Project:	HERITAGE GROVE RD	By DK	Date:	4/6/23
Location:	PR-2B DETAINED (POA-2, NORTH SIDE)	Checked:	EM	Date: 4/6/23
Circle one:	PRESENT	DEVELOPED	Developed Conditions	

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/unconnected impervious area ratio)	CN	Area X Acres mi ² %	Product of CN x area
D type	Meadow	78	6.80	514.80
-	Impervious	98	30.56	2,994.88
Sub totals =			37.16	3,509.68
CN (weighted) =			total product / total area = 3509.68 / 37.16 = 94.45	Use CN = 94

Curve Number				
Project:	HERITAGE GROVE RD	By DK	Date:	4/6/23
Location:	PR-2C UNDETAINED (POA-2, NORTH SIDE)	Checked:	EM	Date: 4/6/23
Circle one:	PRESENT	DEVELOPED	Developed Conditions	

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/unconnected impervious area ratio)	CN	Area X Acres mi ² %	Product of CN x area
D type	Meadow	78	4.41	343.98
Sub totals =			4.41	343.98
CN (weighted) =			total product / total area = 343.98 / 4.41 = 78.00	Use CN = 78

Date	Description	No.
Revisions		

STATE OF TEXAS
EMILY MAHONEY
143208
LICENSED PROFESSIONAL ENGINEER

EMILY MAHONEY P.E.
LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
TBPE FIRM REG. #F-13709

LANGAN

Langan Engineering and Environmental Services, Inc.

9606 N. Mopac Expressway, Suite 110
Austin, TX 78759

T: 737.289.7800 F: 737.289.7801
www.langan.com
TBPE Firm REG. #F-13709

Project

HERITAGE GROVE ROAD

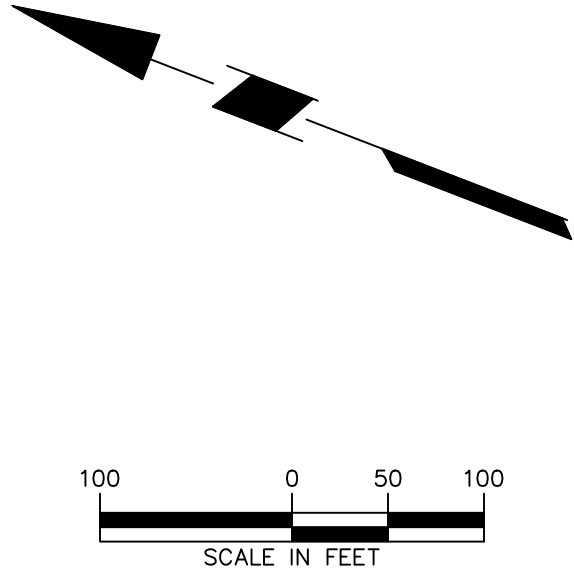
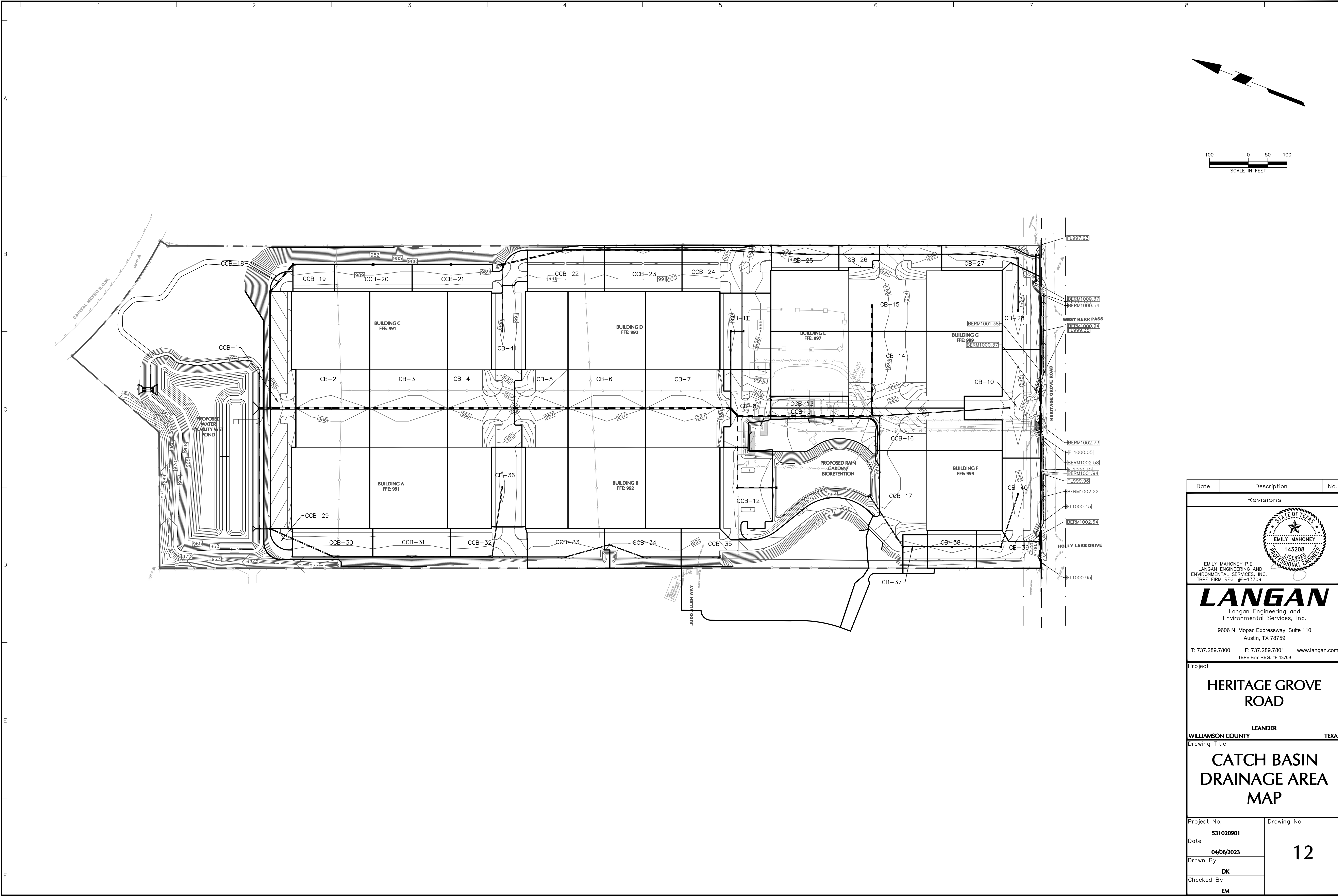
LEANDER
WILLIAMSON COUNTY TEXAS

Drawing Title

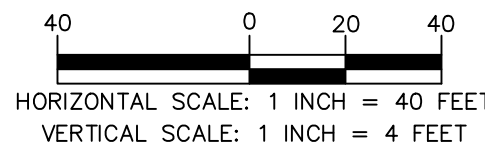
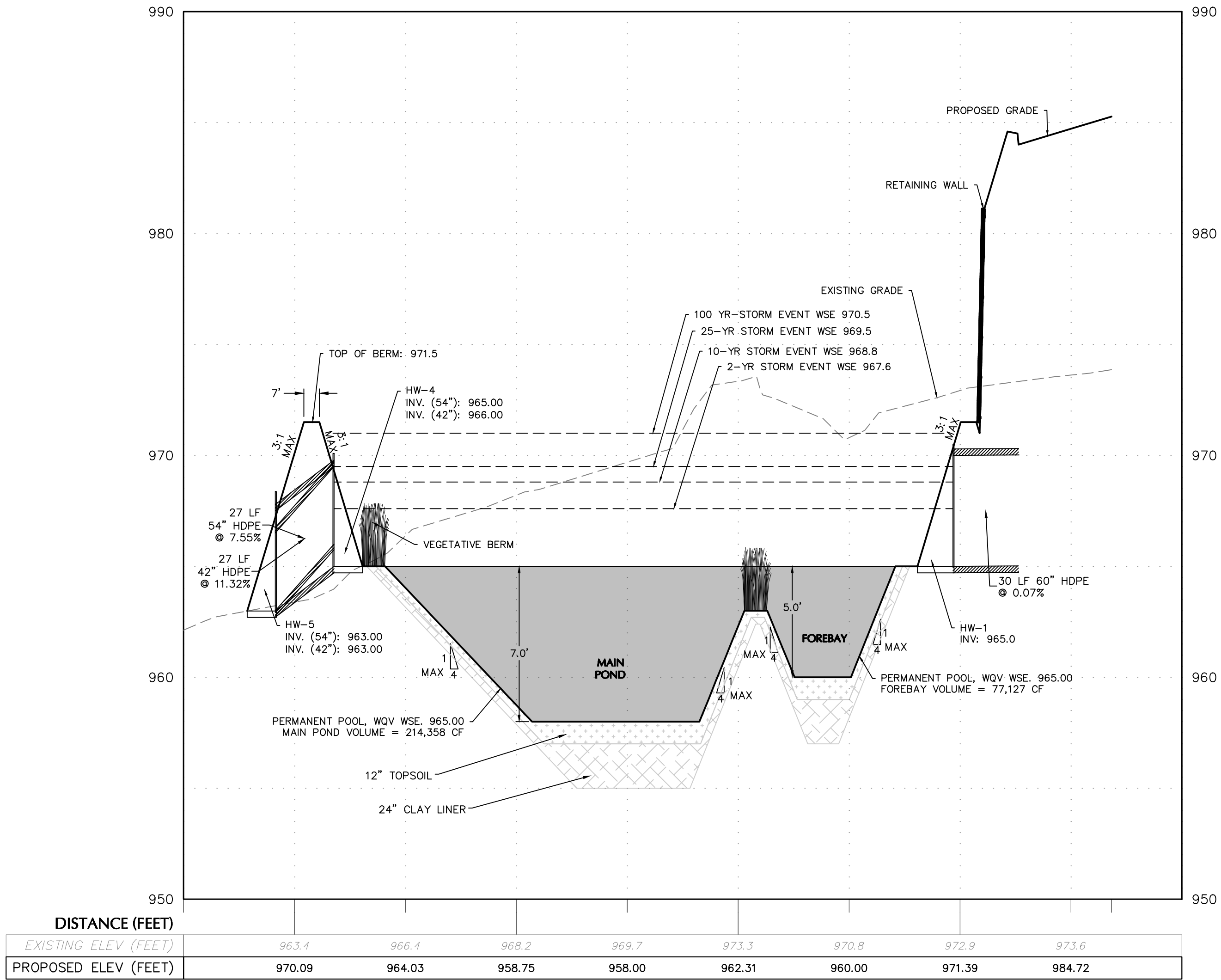
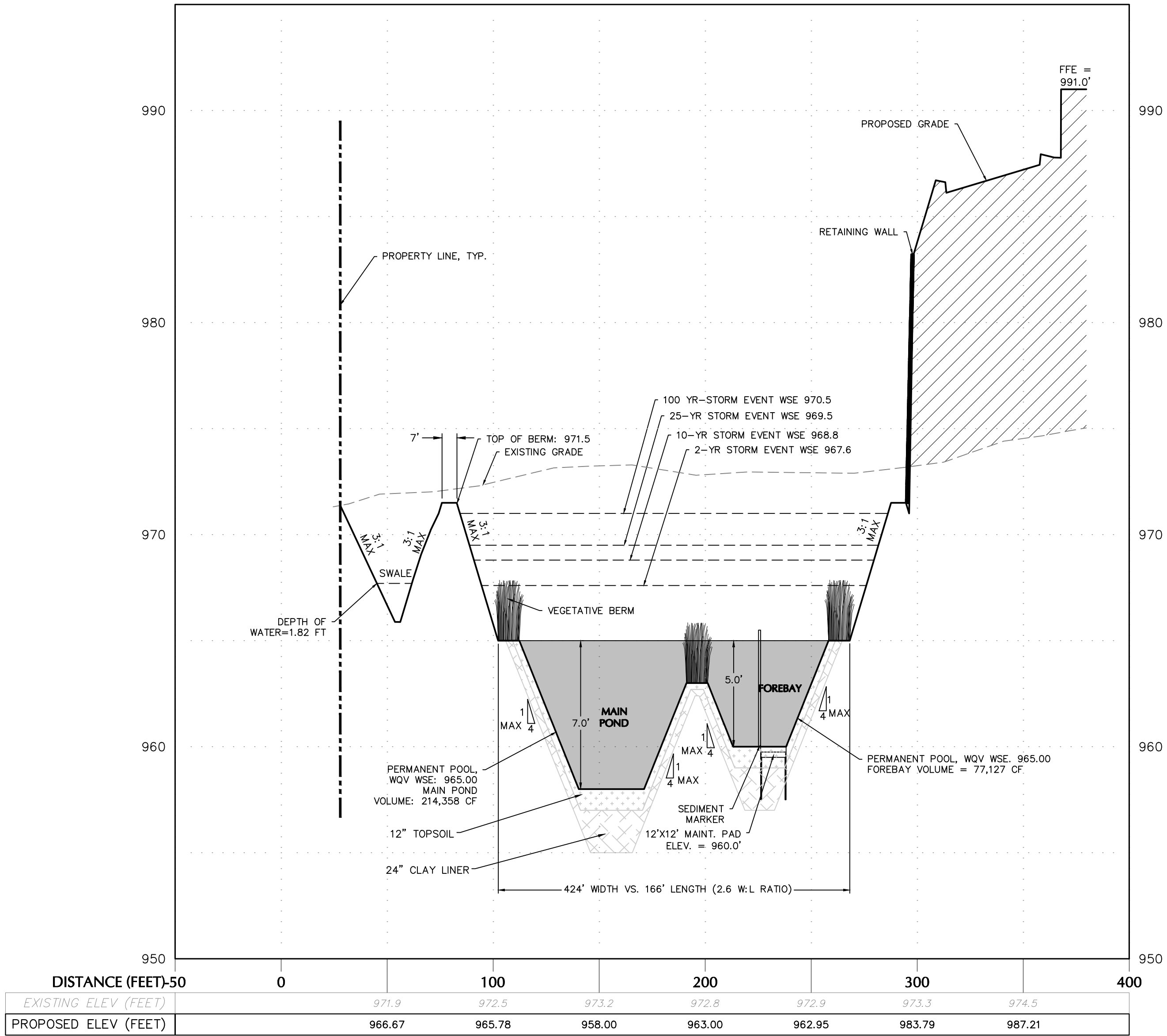
PROPOSED DRAINAGE AREA PLAN

Project No.	Drawing No.
531020901	11
Date	
04/06/2023	
Drawn By	
Checked By	DK
	EM

Date: 4/24/2023 Time: 14:47 User: dklm Style Table: Langan.sbt Layout: CG104 Document Code: 531020901-0101-CG104-0101



Date	Description	No.
Revisions		
STATE OF TEXAS EMILY MAHONEY 143208 LICENSED PROFESSIONAL ENGINEER EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709		
Project		
HERITAGE GROVE ROAD		
LEANDER TEXAS		
Drawing Title		
CATCH BASIN DRAINAGE AREA MAP		
Project No.		Drawing No.
531020901		
Date		
04/06/2023		
Drawn By		12
DK		
Checked By		EM



Date	Description	No.
Revisions		

EMILY MAHONEY P.E.
LANGAN ENGINEERING AND
ENVIRONMENTAL SERVICES, INC.
T&E FIRM REG. #F-13709

LANGAN
Langan Engineering and
Environmental Services, Inc.
9606 N. Mopac Expressway, Suite 110
Austin, TX 78759
T: 737.289.7800 F: 737.289.7801 www.langan.com
T&E FIRM REG. #F-13709

Project

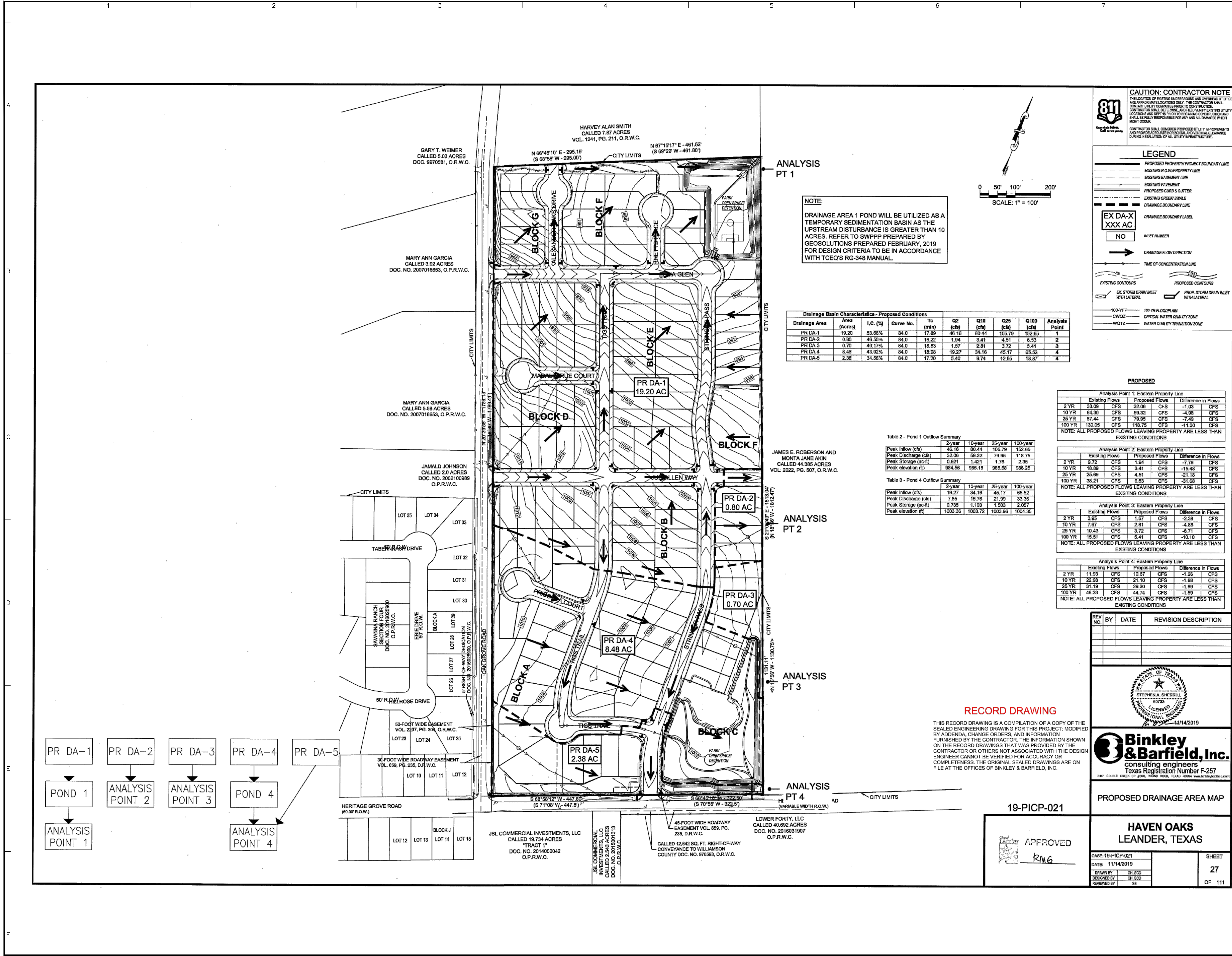
HERITAGE GROVE ROAD

LEANDER
WILLIAMSON COUNTY TEXAS

Drawing Title

BASIN CROSS-SECTIONS

Project No.	Drawing No.
531020901	13
Date	
04/06/2023	
Drawn By	
SIT	
Checked By	
EM	



ANALYSIS
PT 1

NOTE:
DRAINAGE AREA 1 POND WILL BE UTILIZED AS A TEMPORARY SEDIMENTATION BASIN AS THE UPSTREAM DISTURBANCE IS GREATER THAN 10 ACRES. REFER TO SWPPP PREPARED BY GEOSOLUTIONS PREPARED FEBRUARY, 2019 FOR DESIGN CRITERIA TO BE IN ACCORDANCE WITH TCEQ'S RG-348 MANUAL.

Drainage Basin Characteristics - Proposed Conditions									
Drainage Area	Area (Acres)	I.C. (%)	Curve No.	Tc (min)	Q2 (cfs)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)	Analysis Point
PR DA-1	19.20	53.66%	84.0	17.89	46.16	80.44	105.79	152.65	1
PR DA-2	0.80	46.55%	84.0	16.22	1.94	3.41	4.51	6.53	2
PR DA-3	0.70	40.17%	84.0	18.83	1.57	2.81	3.72	5.41	3
PR DA-4	8.48	43.92%	84.0	18.98	19.27	34.16	45.17	65.52	4
PR DA-5	2.38	34.58%	84.0	17.20	5.40	9.74	12.95	18.87	4

Table 2 - Pond 1 Outflow Summary

	2-year	10-year	25-year	100-year
Peak Inflow (cfs)	46.16	80.44	105.79	152.65
Peak Discharge (cfs)	32.06	59.32	79.95	118.75
Peak Storage (ac-ft)	0.921	1.421	1.76	2.35
Peak elevation (ft)	984.56	985.18	985.58	986.25

Table 3 - Pond 4 Outflow Summary

	2-year	10-year	25-year	100-year
Peak Inflow (cfs)	19.27	34.16	45.17	65.52
Peak Discharge (cfs)	7.85	15.76	21.99	33.36
Peak Storage (ac-ft)	0.735	1.190	1.503	2.067
Peak elevation (ft)	1003.36	1003.72	1003.96	1004.35

ANALYSIS
PT 2

ANALYSIS
PT 3

ANALYSIS
PT 4

RECORD DRAWING

THIS RECORD DRAWING IS A COMPILATION OF A COPY OF THE SEALED ENGINEERING DRAWING FOR THIS PROJECT, MODIFIED BY ADDENDUM, CHANGE ORDERS, AND INFORMATION FURNISHED BY THE CONTRACTOR. THE INFORMATION SHOWN ON THE RECORD DRAWINGS THAT WAS PROVIDED BY THE CONTRACTOR OR OTHERS NOT ASSOCIATED WITH THE DESIGN ENGINEER CANNOT BE VERIFIED FOR ACCURACY OR COMPLETENESS. THE ORIGINAL SEALED DRAWINGS ARE ON FILE AT THE OFFICES OF BINKLEY & BARFIELD, INC.

19-PICP-021

APPROVED
RMG

CAUTION: CONTRACTOR NOTE
THE LOCATION OF EXISTING UNDERGROUND AND OVERHEAD UTILITIES ARE APPROXIMATE LOCATIONS ONLY. THE CONTRACTOR SHALL CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION. CONTRACTOR SHALL ESTIMATE, AND FIELD VERIFY EXISTING UTILITY LOCATIONS AND DEPTHS PRIOR TO BEGINNING CONSTRUCTION AND SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT OCCUR.
CONTRACTOR SHALL CONSIDER PROPOSED UTILITY IMPROVEMENTS AND PROVIDE ADEQUATE HORIZONTAL AND VERTICAL CLEARANCE DURING INSTALLATION OF ALL UTILITY INFRASTRUCTURE.

LEGEND

- PROPOSED PROPERTY PROJECT BOUNDARY LINE
- EXISTING R.O.W./PROPERTY LINE
- EXISTING EASEMENT LINE
- EXISTING PAVEMENT
- PROPOSED CURB & GUTTER
- EXISTING CREEK SWALE
- DRAINAGE BOUNDARY LINE
- DRAINAGE BOUNDARY LABEL
- INLET NUMBER
- DRAINAGE FLOW DIRECTION
- TIME OF CONCENTRATION LINE
- EXISTING CONTOURS
- PROPOSED CONTOURS
- EX. STORM DRAIN INLET WITH LATERAL
- PROP. STORM DRAIN INLET WITH LATERAL
- 100-YRFP
- 100-YR FLOODPLAIN
- CWQZ
- CRITICAL WATER QUALITY ZONE
- WQTZ
- WATER QUALITY TRANSITION ZONE

PROPOSED

Analysis Point 1: Eastern Property Line

	Existing Flows	Proposed Flows	Difference in Flows
2 YR	33.09 CFS	32.06 CFS	-1.03 CFS
10 YR	64.30 CFS	59.32 CFS	-4.98 CFS
25 YR	87.44 CFS	79.95 CFS	-7.49 CFS
100 YR	130.05 CFS	118.75 CFS	-11.30 CFS

NOTE: ALL PROPOSED FLOWS LEAVING PROPERTY ARE LESS THAN EXISTING CONDITIONS

Analysis Point 2: Eastern Property Line

	Existing Flows	Proposed Flows	Difference in Flows
2 YR	9.72 CFS	1.94 CFS	-7.78 CFS
10 YR	18.89 CFS	3.41 CFS	-15.48 CFS
25 YR	25.69 CFS	4.51 CFS	-21.18 CFS
100 YR	38.21 CFS	6.53 CFS	-31.68 CFS

NOTE: ALL PROPOSED FLOWS LEAVING PROPERTY ARE LESS THAN EXISTING CONDITIONS

Analysis Point 3: Eastern Property Line

	Existing Flows	Proposed Flows	Difference in Flows
2 YR	3.95 CFS	1.57 CFS	-2.38 CFS
10 YR	7.67 CFS	2.81 CFS	-4.86 CFS
25 YR	10.43 CFS	3.72 CFS	-6.71 CFS
100 YR	15.51 CFS	5.41 CFS	-10.10 CFS

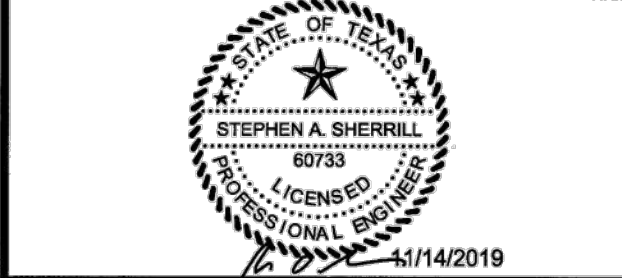
NOTE: ALL PROPOSED FLOWS LEAVING PROPERTY ARE LESS THAN EXISTING CONDITIONS

Analysis Point 4: Eastern Property Line

	Existing Flows	Proposed Flows	Difference in Flows
2 YR	11.93 CFS	10.67 CFS	-1.26 CFS
10 YR	22.98 CFS	21.10 CFS	-1.88 CFS
25 YR	31.19 CFS	29.30 CFS	-1.89 CFS
100 YR	46.33 CFS	44.74 CFS	-1.59 CFS

NOTE: ALL PROPOSED FLOWS LEAVING PROPERTY ARE LESS THAN EXISTING CONDITIONS

REV NO.	BY	DATE	REVISION DESCRIPTION



Binkley & Barfield, Inc.
consulting engineers
Texas Registration Number F-257
2401 DOUBLE CREEK DR #200, ROUND ROCK, TEXAS 78664 www.binkleybarfield.com

PROPOSED DRAINAGE AREA MAP

HAVEN OAKS
LEANDER, TEXAS

CASE: 19-PICP-021	SHEET
DATE: 11/14/2019	27
DRAWN BY: CH, SCD	OF 111
DESIGNED BY: CH, SCD	
REVIEWED BY: SS	

SOURCE:
APPROVED HAVEN OAKS PROPOSED DRAINAGE AREA MAP, APPROVED 11/20/2019 BY THE CITY OF LEANDER AS PART OF THE HAVEN OAKS PUBLIC IMPROVEMENT CONSTRUCTION DRAWINGS. (PROJECT #: 19-PICP-021)

Date	Description	No.
Revisions		
FOR REFERENCE ONLY		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709		
Project		
HERITAGE GROVE ROAD		
LEANDER		
WILLIAMSON COUNTY TEXAS		
Drawing Title		
STORMWATER CALCULATIONS		
Project No.	Drawing No.	
531020901	14	
Date	04/06/2023	
Drawn By	DK	
Checked By	EM	

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

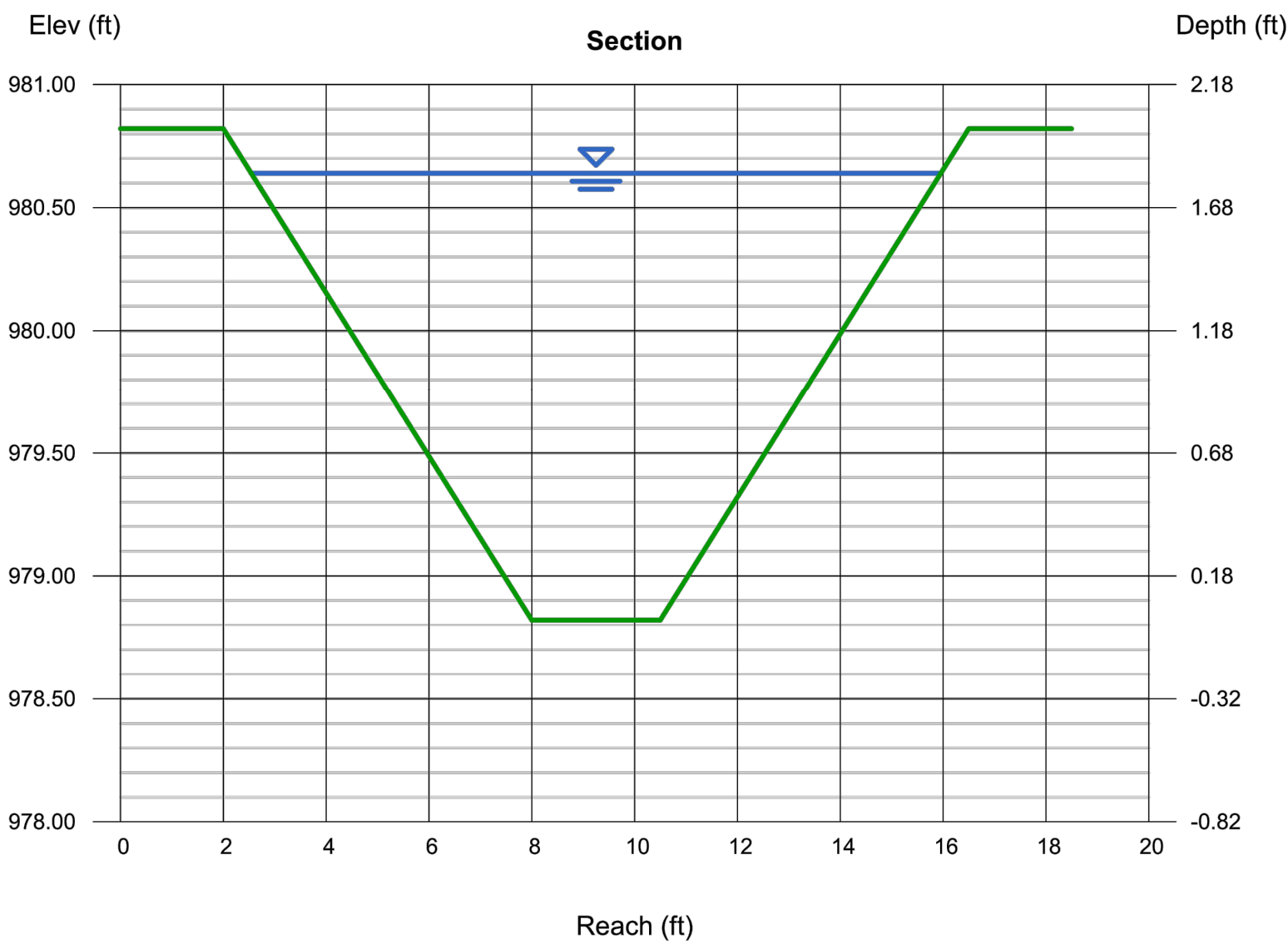
Tuesday, Apr 4 2023

Heritage Grove

Trapezoidal
Bottom Width (ft) = 2.50
Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 2.00
Invert Elev (ft) = 978.82
Slope (%) = 2.00
N-Value = 0.026

Highlighted
Depth (ft) = 1.82
Q (cfs) = 118.75
Area (sqft) = 14.49
Velocity (ft/s) = 8.20
Wetted Perim (ft) = 14.01
Crit Depth, Yc (ft) = 2.00
Top Width (ft) = 13.42
EGL (ft) = 2.86

Calculations
Compute by: Known Q
Known Q (cfs) = 118.75



Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Heritage Grove
Date Prepared: 4/6/2023

Additional information is provided for cells with a red triangle in the upper right corner. Place the cursor over the cell. Text shown in blue indicate location of instructions in the Technical Guidance Manual - RG-348. Characters shown in red are data entry fields. Characters shown in black (Bold) are calculated fields. Changes to these fields will remove the equations used in the spreadsheet.

1. The Required Load Reduction for the total project

Calculations from RG-348

Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_d = 27.2(A_p \times P)$

where:
 L_d TOTAL PROJECT = Required TSS removal resulting from the proposed development = 80% of increased load
 A_p = Net increase in impervious area for the project
 P = Average annual precipitation, inches

Site Data: Determine Required Load Removal Based on the Entire Project
County = Williamson
Total project area included in plan = 44.40 acres
Predevelopment impervious area within the limits of the plan = 0.60 acres
Total post-development impervious area within the limits of the plan = 31.39 acres
Total post-development impervious cover fraction = 0.71
 P = 32 inches

L_d TOTAL PROJECT = 26800 lbs.

* The values entered in these fields should be for the total project area.

Number of drainage basins / outfalls areas leaving the plan area = 2

2. Drainage Basin Parameters (This information should be provided for each basin)

Drainage Basin/Outfall Area No. = 2

Total drainage basin/outfall area = 2.74 acres
Predevelopment impervious area within drainage basin/outfall area = 0.00 acres
Post-development impervious area within drainage basin/outfall area = 0.83 acres
Post-development impervious fraction within drainage basin/outfall area = 0.30
 L_d THIS BASIN = 722 lbs.

3. Indicate the proposed BMP Code for this basin

Proposed BMP = Bioretention
Removal efficiency = 89 percent

4. Calculate Maximum TSS Load Removed (L_d) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_d = (BMP \text{ efficiency}) \times P \times (A_p \times 34.6 + A_p \times 0.54)$

where:
 A_p = Total On-Site drainage area in the BMP catchment area
 A_i = Impervious area proposed in the BMP catchment area
 A_o = Pervious area remaining in the BMP catchment area
 L_d = TSS Load removed from this catchment area by the proposed BMP

A_p = 2.74 acres
 A_i = 0.83 acres
 A_o = 1.91 acres
 L_d = 847 lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired L_d THIS BASIN = 722 lbs.

F = 0.85

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area

Calculations from RG-348

Pages 3-34 to 3-36

Rainfall Depth = 1.32 inches
Post Development Runoff Coefficient = 0.26
On-site Water Quality Volume = 3409 cubic feet

Calculations from RG-348
Pages 3-36 to 3-37
Off-site area draining to BMP = 0.00 acres
Off-site impervious cover draining to BMP = 0.00 acres
Impervious fraction of off-site area = 0
Off-site Runoff Coefficient = 0.00
Off-site Water Quality Volume = 0 cubic feet

Total Capture Volume (required water quality volume(s) $\times 1.20$) = 4090 cubic feet
The following sections are used to calculate the required water quality volume(s) for the selected BMP. The values for BMP Types not selected in cell C45 will show N/A.

10. Bioretention System

Designed as Required in RG-348

Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin = 4090 cubic feet

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Heritage Grove
Date Prepared: 4/6/2023

Additional information is provided for cells with a red triangle in the upper right corner. Place the cursor over the cell. Text shown in blue indicate location of instructions in the Technical Guidance Manual - RG-348. Characters shown in red are data entry fields. Characters shown in black (Bold) are calculated fields. Changes to these fields will remove the equations used in the spreadsheet.

1. The Required Load Reduction for the total project

Calculations from RG-348

Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_d = 27.2(A_p \times P)$

where:
 L_d TOTAL PROJECT = Required TSS removal resulting from the proposed development = 80% of increased load
 A_p = Net increase in impervious area for the project
 P = Average annual precipitation, inches

Site Data: Determine Required Load Removal Based on the Entire Project
County = Williamson
Total project area included in plan = 44.40 acres
Predevelopment impervious area within the limits of the plan = 0.60 acres
Total post-development impervious area within the limits of the plan = 31.39 acres
Total post-development impervious cover fraction = 0.71
 P = 32 inches

L_d TOTAL PROJECT = 26800 lbs.

* The values entered in these fields should be for the total project area.

Number of drainage basins / outfalls areas leaving the plan area = 2

2. Drainage Basin Parameters (This information should be provided for each basin)

Drainage Basin/Outfall Area No. = 1

Total drainage basin/outfall area = 37.16 acres
Predevelopment impervious area within drainage basin/outfall area = 0.00 acres
Post-development impervious area within drainage basin/outfall area = 30.58 acres
Post-development impervious fraction within drainage basin/outfall area = 0.82
 L_d THIS BASIN = 26079 lbs.

3. Indicate the proposed BMP Code for this basin

Proposed BMP = Wet Basin
Removal efficiency = 93 percent

4. Calculate Maximum TSS Load Removed (L_d) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_d = (BMP \text{ efficiency}) \times P \times (A_p \times 34.6 + A_p \times 0.54)$

where:
 A_p = Total On-Site drainage area in the BMP catchment area
 A_i = Impervious area proposed in the BMP catchment area
 A_o = Pervious area remaining in the BMP catchment area
 L_d = TSS Load removed from this catchment area by the proposed BMP

A_p = 37.16 acres
 A_i = 30.58 acres
 A_o = 6.60 acres
 L_d = 31574 lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired L_d THIS BASIN = 26079 lbs.

F = 0.83

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area

Calculations from RG-348

Pages 3-34 to 3-36

Rainfall Depth = 1.20 inches
Post Development Runoff Coefficient = 0.66
On-site Water Quality Volume = 166191 cubic feet

Calculations from RG-348
Pages 3-36 to 3-37
Off-site area draining to BMP = 1.50 acres
Off-site impervious cover draining to BMP = 1.63 acres
Impervious fraction of off-site area = 0.44
Off-site Runoff Coefficient = 0.32
Off-site Water Quality Volume = 2118 cubic feet

Total Capture Volume (required water quality volume(s) $\times 1.20$) = 129936 cubic feet
The following sections are used to calculate the required water quality volume(s) for the selected BMP. The values for BMP Types not selected in cell C45 will show N/A.

11. Wet Basins

Designed as Required in RG-348

Pages 3-66 to 3-71

Required capacity of Permanent Pool = 129936 cubic feet
Required capacity at WQV Elevation = 226097 cubic feet

Permanent Pool Capacity is 1.20 times the WQV. Total Capacity should be the Permanent Pool Capacity plus a second WQV.

WATER QUALITY SUMMARY TABLE	
Required TSS Removal	26,800 LBS
Proposed TSS Removal Total	26,800 LBS
Proposed TSS Removal Bioretention	722 LBS
Proposed TSS Removal Wet Pond	26,078 LBS
Wet Pond	
Required Capacity of Permanent Pool	129,936 CF
Required Capacity at WQV Elevation	236,097 CF
Proposed Capacity of Permanent Pool	291,485 CF
Proposed Capacity of Forebay	77,127 CF
Proposed Capacity of Wet Pond	214,358 CF
Bioretention	
Required Capacity at WQV Elevation	4,090 CF
Proposed Capacity of Bioretention	47,999 CF

DRAINAGE AREA PEAK RATE SUMMARY TABLE						
Storm Event	EX-1 (cfs)	EX-2 (cfs)	PR-1 (cfs)	PR-2A (cfs)	PR-2B (cfs)	PR-2C (cfs)
2-YR	12.3	52.5	0.1	10.8	195.5	13.7
10-YR	24.7	105.0	0.2	19.4	304.9	27.2
25-YR	33.5	142.5	0.3	25.2	379.3	36.8
100-YR	48.8	207.3	0.4	35.2	506.9	53.2

OVERALL POA-1 PEAK RATE SUMMARY TABLE		
Storm Event	EXISTING (cfs)	PROPOSED (cfs)
2-YR	12.3	0.1
10-YR	24.7	0.2
25-YR	33.5	0.3
100-YR	48.8	0.4

OVERALL POA-2 PEAK RATE SUMMARY TABLE		
Storm Event	EXISTING (cfs)	PROPOSED (cfs)
2-YR	52.5	47.9
10-YR	105.0	103.3
25-YR	142.5	142.4
100-YR	207.3	207.2

BIORETENTION SUMMARY TABLE				
Storm Event	Inflow (cfs)	Max Elevation	Max Storage (ac ft)	Outflow (cfs)
2-YR	10.8	988.2	0.4	2.1
10-YR	19.4	988.6	0.6	3.0
25-YR	25.2	988.9	0.7	3.6
100-YR	35.2	989.4	1.1	4.4

WET POND SUMMARY TABLE				
Storm Event	Inflow (cfs)	Max Elevation	Max Storage (ac ft)	Outflow (cfs)
2-YR	199.4	967.6	5.3	44.1
10-YR	311.5	968.8	7.8	94.1
25-YR	387.9	969.5	9.4	128.4
100-YR	518.6	970.5	11.9	184.4

EXISTING DRAINAGE AREA PEAK RATE SUMMARY TABLE		
Storm Event	PR DA-2 (cfs)	PR DA-3 (cfs)
2-YR	2.2	1.8
10-YR	3.9	3.2
25-YR	5.1	4.2
100-YR	7.1	5.8

Project Information

Project: Heritage Grove Rd
Job No.: 531020901
System: STORM
Designed: DK Date: 4/6/2023
Checked: EM Date: 4/6/2023

Design Criteria

Starting	Min Cover (ft):	<u>2</u>
HGL Elev. (ft):	Match C or F:	<u>C</u>
	Min. Tc (min):	<u>5</u>
Williamson	Default n:	<u>0.012</u>
Design Storm:	Junction K:	<u>0.3</u>
	Peaking Factor:	<u>1</u>
b =		
d =		
e =		

Downstream MH/Inlet	Downstream Flowline	Upstream MH/Inlet	Upstream Flowline	Pipe Length (ft)	Round or Box	Pipe Rise (in or ft)	Pipe Span (ft)	No. of Pipes	Pipe Material	n	Min Slope (%)	C	I (in/hr)	Area (Acres)	Roof Area (sf)	Branch Area (Acres)	Cum. Area (Acres)	Tc (min)	Flow Cap. (cfs)	Roof Flow Cap. (cfs)	Branch Flow Cap. (cfs)	Cum. Flow Cap. (cfs)	Design Cap. (cfs)	Flow Velocity (ft/s)	Upstream TG (ft)	HGL (ft)
HW-03	987.50	CB-37	987.90	154.03	Round	18		1	CONC	0.012	0.26%	0.7352	12.04	0.12			1.19	5.00	1.10	0.00		10.29	5.82	5.82	997.69	990.81
CB-37	987.50	CB-38	990.33	126.03	Round	18		1	CONC	0.012	0.26%	0.753	12.04	0.28			1.07	5.00	2.53	0.00		9.19	5.82	5.20	997.69	991.83
CB-38	990.33	CB-39	990.66	126	Round	18		1	CONC	0.012	0.26%	0.6754	12.04	0.31			0.79	5.00	2.50	0.00		6.65	5.82	3.76	997.69	992.32
CB-39	990.66	CB-40	991.03	142.38	Round	18		1	CONC	0.012	0.26%	0.7149	12.04	0.48			0.48	5.00	4.15	0.00		4.15	5.82	2.35	997.70	992.54

Project Information

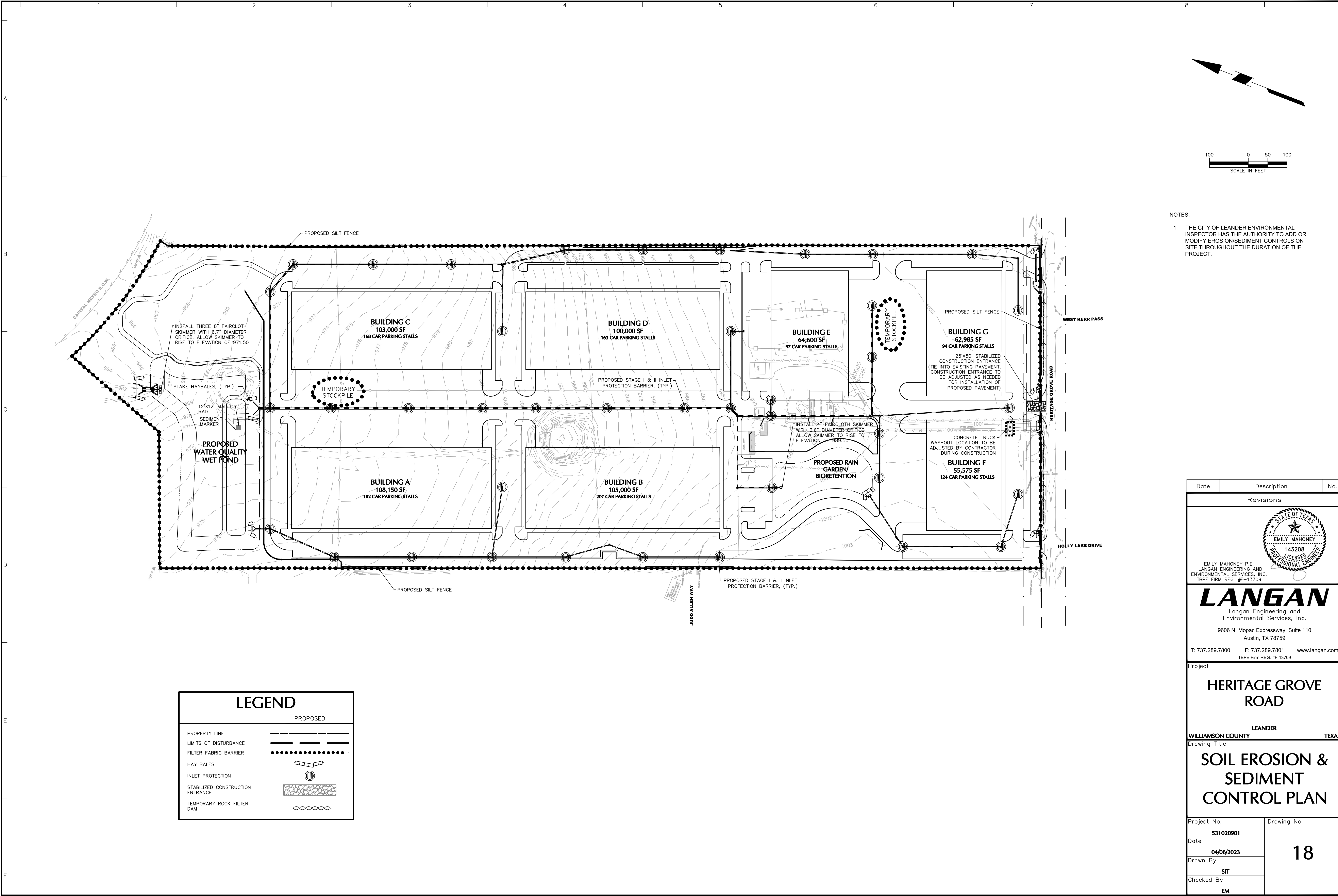
Project: Heritage Grove Rd
Job No.: 531020901
System: STORM
Designed: DK Date: 4/6/2023
Checked: EM Date: 4/6/2023

Design Criteria

Starting		Min Cover (ft):	<u>2</u>
HGL Elev. (ft):	<u>970.50</u>	Match C or F:	<u>C</u>
		Min. Tc (min):	<u>5</u>
Williamson		Default n:	<u>0.012</u>
Design Storm:	<u>100 yr</u>	Junction K:	<u>0.3</u>
b =	<u>155.59</u>	Peaking Factor:	<u>1</u>
d =	<u>17.40</u>		
e =	<u>0.8232</u>		

Downstream MH/Inlet	Downstream Flowline	Upstream MH/Inlet	Upstream Flowline	Pipe Length (ft)	Round or Box	Pipe Rise (in or ft)	Pipe Span (ft)	No. of Pipes	Pipe Material	n	Min Slope (%)		I (in/hr)	Area (Acres)	Roof Area (sf)	Branch Area (Acres)	Cum. Area (Acres)	Tc (min)	Flow (cfs)	Roof Flow (cfs)	Branch Flow (cfs)	Cum. Flow (cfs)	Design Cap. (cfs)	Flow Velocity (ft/s)	Upstream TG (ft)	HGL (ft)
HW-1	965.00	CCB-1	965.02	29.61	Round	60		1	CONC	0.012	0.06%	0.8417	12.04	0.81		4.83	26.97	5.00	8.22	0.00	43.62	314.73	69.30	16.03	984.01	972.06
CCB-1	974.00	CB-2	974.09	156	Round	60		1	CONC	0.012	0.06%	0.9	12.04	2.77			21.33	5.00	30.04	0.00		262.89	69.30	13.39	985.50	979.09
CB-2	974.09	CB-3	974.21	200	Round	60		1	CONC	0.012	0.06%	0.9	12.04	2.80			18.55	5.00	30.33	0.00		232.85	69.30	11.86	985.50	981.10
CB-3	974.21	CB-4	974.33	190	Round	60		1	CONC	0.012	0.06%	0.8679	12.04	1.89			15.75	5.00	19.78	0.00		202.51	69.30	10.31	985.50	982.57
CB-4	974.33	CB-5	974.91	137	Round	54		1	CONC	0.012	0.06%	0.8596	12.04	1.62			13.86	5.00	16.75	0.00		182.73	52.32	11.49	986.50	984.19
CB-5	974.91	CB-6	975.02	183	Round	54		1	CONC	0.012	0.06%	0.9	12.04	2.80			12.24	5.00	30.34	0.00		165.98	52.32	10.44	986.50	985.80
CB-6	975.02	CB-7	975.14	200	Round	54		1	CONC	0.012	0.06%	0.8848	12.04	2.76			9.44	5.00	29.38	0.00		135.65	52.32	8.53	986.50	986.95
CB-7	975.64	CB-8	980.00	119	Round	48		1	CONC	0.012	0.07%	0.7948	12.04	0.43		0.59	6.68	5.00	4.11	0.00	6.27	106.27	41.28	8.46	989.17	987.83
CB-8	980.00	MH-01	980.02	25.83	Round	48		1	CONC	0.012	0.07%	0	12.04	0.00		1.35	5.66	5.00	0.00	0.00	10.17	95.89	41.28	7.63	990.09	988.20
MH-01	980.52	CCB-9	985.00	86.26	Round	42		1	CONC	0.012	0.09%	0.7557	12.04	0.12		0.14	4.31	5.00	1.13	0.00	1.52	85.72	32.79	8.91	993.73	989.10
CCB-9	985.00	MH-02	985.23	260.57	Round	42		1	CONC	0.012	0.09%	0	12.04	0.00		2.49	4.05	5.00	0.00	0.00	50.19	83.08	32.79	8.64	994.80	990.96
MH-02	986.73	MH-02A	987.00	19.3	Round	24		1	CONC	0.012	0.18%	0	12.04	0.00		0.79	1.56	5.00	0.00	0.00	25.79	32.89	10.43	10.47	994.50	991.81
MH-02A	987.50	CB-10	988.37	333.6	Round	18		1	CONC	0.012	0.26%	0.7691	12.04	0.77			0.77	5.00	7.10	0.00		7.10	5.82	4.02	997.49	993.18
CB-8	980.00	CB-11	980.51	197.96	Round	18		1	CONC	0.012	0.26%	0.8817	12.04	0.59			0.59	5.00	6.27	0.00		6.27	5.82	3.55	990.80	988.49
CB-11	980.51	CB-11A	980.60	32.66	Round	18		1	CONC	0.012	0.26%	0	12.04	0.00			0.00	5.00	0.00	0.00		0.00	5.82	0.00	989.56	988.49
MH-01	980.52	MH-03	980.85	185.04	Round	24		1	CONC	0.012	0.18%	0	12.04	0.00			1.35	5.00	0.00	0.00		10.17	10.43	3.24	990.83	988.57
MH-03	980.85	CCB-12	981.01	89.17	Round	24		1	CONC	0.012	0.18%	0.8403	12.04	0.65			1.35	5.00	6.57	0.00		10.17	10.43	3.24	989.56	988.77
CCB-12	987.45	OCS-01	987.50	10.7	Round	9		1	CONC	0.012	0.75%	0	12.04	0.00			0.70	5.00	0.00	0.00		3.60	1.55	8.15	988.50	989.51
CCB-9	985.00	CCB-13	985.10	40	Round	18		1	CONC	0.012	0.26%	0.9	12.04	0.14			0.14	5.00	1.52	0.00		1.52	5.82	0.86	993.73	989.11
MH-02	985.23	CB-14	985.40	151.47	Round	36		1	CONC	0.012	0.11%	0.8724	12.04	2.49			2.49	5.00	26.13	0.00		50.19	24.03	7.10	992.07	991.92
CB-14	985.40	CB-15	985.54	132	Round	36		1	CONC	0.012	0.11%	0.8362	12.04	2.39			2.39	5.00	24.06	0.00		24.06	24.03	3.40	992.07	992.12
MH-02A	987.00	CCB-16	987.08	45.4	Round	24		1	CONC	0.012	0.18%	0.8372	12.04	0.79			0.79	5.00	7.97	0.00		25.79	10.43	8.21	993.33	992.63
CCB-16	987.08	CCB-17	987.29	113.79	Round	24		1	CONC	0.012	0.18%	0.7894	12.04	1.88			1.88	5.00	17.82	0.00		17.82	10.43	5.67	993.20	993.37
HW-02	965.00	CCB-29	965.07	38.49	Round	24		1	CONC	0.012	0.18%	0.7595	12.04	0.06			2.00	5.00	0.55	0.00		19.27	10.43	6.13	989.00	970.91
CCB-29	980.00	CCB-30	980.32	179.23	Round	24		1	CONC	0.012	0.18%	0.9	12.04	0.34			1.94	5.00	3.72	0.00		18.71	10.43	5.96	987.83	982.32
CCB-30	980.32	CCB-31	980.68	200	Round	24		1	CONC	0.012	0.18%	0.9	12.04	0.33			1.59	5.00	3.61	0.00		14.99	10.43	4.77	987.83	983.17
CCB-31	980.68	CCB-32	981.05	206.5	Round	24		1	CONC	0.012	0.18%	0.8435	12.04	0.34			1.26	5.00	3.42	0.00		11.38	10.43	3.62	987.83	983.68
CCB-32	981.55	CCB-33	982.05	189.67	Round	18		1	CONC	0.012	0.26%	0.7101	12.04	0.48			0.92	5.00	4.08	0.00		7.96	5.82	4.51	990.38	984.70
CCB-33	982.05	MH-06	982.35	116.32	Round	18		1	CONC	0.012	0.26%	0	12.04	0.00			0.45	5.00	0.00	0.00		3.88	5.82	2.20	991.02	984.85
MH-06	982.35	CCB-34	982.59	91.46	Round	18		1	CONC	0.012	0.26%	0.7242	12.04	0.45			0.45	5.00	3.88	0.00		3.88	5.82	2.20	990.36	984.98
CCB-34	982.59	CCB-35	983.10	198	Round	18		1	CONC	0.012	0.26%	0.3953	12.04	2.69			2.69	5.00	12.81	0.00		12.81	5.82	7.25	990.36	987.72
CCB-32	981.55	CB-36	982.02	182.08	Round	18		1	CONC	0.012	0.26%	0.9	12.04	0.41			0.41	5.00	4.49	0.00		4.49	5.82	2.54	989.80	983.99
CCB-1	974.00	CCB-18	978.00	300	Round	36		1	CONC	0.012	0.11%	0.7609	12.04	0.06			4.83	5.00	0.54	0.00		43.62	24.03	6.17	989.00	981.00
CCB-18	978.00	CCB-19	978.10	91.17	Round	36		1	CONC	0.012	0.11%	0.9	12.04	0.17			4.77	5.00	1.86	0.00		43.09	24.03	6.10	987.88	981.50
CCB-19	978.10	CCB-20	978.33	206.5	Round	36		1	CONC	0.012	0.11%	0.9	12.04	0.32			4.60	5.00	3.51	0.00		41.23	24.03	5.83	987.81	982.32
CCB-20	978.33	CCB-21	978.55	200	Round	36		1	CONC	0.012	0.11%	0	12.04	0.47			4.28	5.00	0.00	0.00		37.72	24.03	5.34	987.91	983.00
CCB-21	979.05	MH-04	981.00	132.08	Round	30		1	CONC	0.012	0.13%	0.8781	12.04	0.49		0.43	3.80	5.00	5.13	0.00	4.56	37.72	16.06	7.68	990.02	984.22
MH-04	981.00	CCB-22	981.22	166.58	Round	30		1	CONC	0.012	0.13%	0.8487	12.04	0.51			2.89	5.00	5.22	0.00		28.03	16.06	5.71	989.87	985.03
CCB-22	981.22	CCB-23	981.48	200	Round	30		1	CONC	0.012	0.13%	0.8183	12.04	0.55			2.38	5.00	5.40	0.00		22.81	16.06	4.65	989.87	985.66
CCB-23	981.98	CCB-24	982.33	197.5	Round	24		1	CONC	0.012	0.18%	0.7809	12.04	0.64			1.83	5.00	6.01	0.00		17.41	10.43	5.54	989.89	986.79
CCB-24	982.33	CB-25	988.00	219.42	Round	24		1	CONC	0.012	0.18%	0.8347	12.04	0.26			1.19	5.00	2.61	0.00		11.40	10.43	3.63	995.67	990.00
CB-25	988.50	CB-26	988.95	174	Round	18		1	CONC	0.012	0.26%	0.826	12.04	0.13			0.93	5.00	1.33	0.00		8.79	5.82	4.97	995.05	991.15
CB-26	988.95	CB-27	989.62	255.58	Round	18		1	CONC	0.012	0.26%	0.8359	12.04	0.33			0.79	5.00	3.32	0.00		7.46	5.82	4.22	997.67	992.32
CB-27	989.62	MH-05	989.93	118.8	Round	18		1	CONC	0.012	0.26%	0	12.04	0.00			0.46	5.00	0.00	0.00		4.13	5.82	2.34	999.21	992.50
MH-05	989.93	CB-28	990.27	134.2	Round	18		1	CONC	0.012	0.26%	0.7409	12.04	0.46			0.46	5.00	4.13	0.00		4.13	5.82	2.34	997.70	992.70
MH-04	981.00	CB-41	981.45	171.79	Round	18		1	CONC	0.012	0.26%	0.8763	12.04	0.43			0.43	5.00	4.56	0.00		4.56	5.82	2.58	989.82	984.53

Date	Description	No.
Revisions		
 EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709		
Project		
HERITAGE GROVE ROAD LEANDER WILLIAMSON COUNTY TEXAS Drawing Title 100-YR STORM SEWER CALCULATIONS		
Project No.		Drawing No.
531020901		
Date		
04/06/2023		
Drawn By		
DK		17
Checked By		
EM		



- NOTES:
- THE CITY OF LEANDER ENVIRONMENTAL INSPECTOR HAS THE AUTHORITY TO ADD OR MODIFY EROSION/SEDIMENT CONTROLS ON SITE THROUGHOUT THE DURATION OF THE PROJECT.

LEGEND	
	PROPOSED
PROPERTY LINE	---
LIMITS OF DISTURBANCE	---
FILTER FABRIC BARRIER	
HAY BALES	
INLET PROTECTION	⊗
STABILIZED CONSTRUCTION ENTRANCE	▨
TEMPORARY ROCK FILTER DAM	~~~~~

Date	Description	No.
Revisions		
STATE OF TEXAS EMILY MAHONEY 143208 LICENSED PROFESSIONAL ENGINEER		
EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709		

Project

HERITAGE GROVE ROAD

LEANDER
WILLIAMSON COUNTY TEXAS

Drawing Title

SOIL EROSION & SEDIMENT CONTROL PLAN

Project No.	Drawing No.
531020901	18
Date	
04/06/2023	
Drawn By	
SIT	
Checked By	
EM	

EROSION CONTROL NOTES (ECM APPENDIX P-1)

1. CONTRACTOR SHALL INSTALL EROSION/SEDIMENTATION CONTROLS, TREE/NATURAL AREA PROTECTIVE FENCING, AND CONDUCT "PRE-CONSTRUCTION" TREE FERTILIZATION (IF APPLICABLE) PRIOR TO ANY SITE PREPARATION WORK (CLEARING, GRUBBING OR EXCAVATION).
2. THE PLACEMENT OF EROSION/SEDIMENTATION CONTROLS SHALL BE IN ACCORDANCE WITH THE ENVIRONMENTAL CRITERIA MANUAL AND THE APPROVED EROSION AND SEDIMENTATION CONTROL PLAN. THE CITY OF LEANDER ESC PLAN SHALL BE CONSULTED AND USED AS THE BASIS FOR A TPDES REQUIRED SWPPP. IF A SWPPP IS REQUIRED, IT SHALL BE AVAILABLE FOR REVIEW BY THE CITY OF LEANDER ENVIRONMENTAL INSPECTOR AT ALL TIMES DURING CONSTRUCTION, INCLUDING AT THE PRE-CONSTRUCTION MEETING. THE CHECKLIST BELOW CONTAINS THE BASIC ELEMENTS THAT SHALL BE REVIEWED FOR PERMIT APPROVAL BY CITY OF LEANDER EV PLAN REVIEWERS AS WELL AS CITY OF LEANDER EV INSPECTORS.
- PLAN SHEETS SUBMITTED TO THE CITY OF LEANDER MUST SHOW THE FOLLOWING:
- DIRECTION OF FLOW DURING GRADING OPERATIONS.
 - LOCATION, DESCRIPTION, AND CALCULATIONS FOR OFF-SITE FLOW DIVERSION STRUCTURES.
 - AREAS THAT WILL NOT BE DISTURBED; NATURAL FEATURES TO BE PRESERVED.
 - DELINEATION OF CONTRIBUTING DRAINAGE AREA TO EACH PROPOSED BMP (E.G., SILT FENCE, SEDIMENT BASIN, ETC.).
 - LOCATION AND TYPE OF E&S BMPs FOR EACH PHASE OF DISTURBANCE.
 - CALCULATIONS FOR BMPs AS REQUIRED.
 - LOCATION AND DESCRIPTION OF TEMPORARY STABILIZATION MEASURES.
 - LOCATION OF ON-SITE SPOILS, DESCRIPTION OF HANDLING AND DISPOSAL OF BORROW MATERIALS, AND DESCRIPTION OF ON-SITE PERMANENT SPOILS DISPOSAL AREAS, INCLUDING SIZE, DEPTH OF FILL, AND REVEGETATION PROCEDURES.
 - DESCRIBE SEQUENCE OF CONSTRUCTION AS IT PERTAINS TO ESC INCLUDING THE FOLLOWING ELEMENTS:
 - 1. INSTALLATION SEQUENCE OF CONTROLS (E.G. PERIMETER CONTROLS, THEN SEDIMENT BASINS, THEN TEMPORARY STABILIZATION, THEN PERMANENT, ETC.)
 - 2. PROJECT PHASING IF REQUIRED (LOC GREATER THAN 25 ACRES)
 - 3. SEQUENCE OF GRADING OPERATIONS AND NOTATION OF TEMPORARY STABILIZATION MEASURES TO BE USED
 - 4. SCHEDULE FOR CONVERTING TEMPORARY BASINS TO PERMANENT WO CONTROLS
 - 5. SCHEDULE FOR REMOVAL OF TEMPORARY CONTROLS
 - 6. ANTICIPATED MAINTENANCE SCHEDULE FOR TEMPORARY CONTROLS
- CATEGORIZE EACH BMP UNDER ONE OF THE FOLLOWING AREAS OF BMP ACTIVITY AS DESCRIBED BELOW:
- 3.1 MINIMIZE DISTURBED AREA AND PROTECT NATURAL FEATURES AND SOIL
- 3.2 CONTROL STORMWATER FLOWING ONTO AND THROUGH THE PROJECT
- 3.3 STABILIZE SOIL
- 3.4 PROTECT SLOPES
- 3.5 PROTECT STORM DRAIN INLETS
- 3.6 ESTABLISH PERIMETER CONTROLS AND SEDIMENT BARRIERS
- 3.7 RETAIN SEDIMENT ON-SITE AND CONTROL DEWATERING PRACTICES
- 3.8 ESTABLISH STABILIZED CONSTRUCTION EXITS
- 3.9 ANY ADDITIONAL BMPs
- NOTE THE LOCATION OF EACH BMP ON YOUR SITE MAP(S).
- FOR ANY STRUCTURAL BMPs, YOU SHOULD PROVIDE DESIGN SPECIFICATIONS AND DETAILS AND REFER TO THEM.
- FOR MORE INFORMATION, SEE CITY OF LEANDER ENVIRONMENTAL CRITERIA MANUAL 1.4.
3. THE PLACEMENT OF TREE/NATURAL AREA PROTECTIVE FENCING SHALL BE IN ACCORDANCE WITH THE CITY OF LEANDER STANDARD NOTES FOR TREE AND NATURAL AREA PROTECTION AND THE APPROVED GRADING/TREE AND NATURAL AREA PLAN.
4. A PRE-CONSTRUCTION CONFERENCE SHALL BE HELD ON-SITE WITH THE CONTRACTOR DESIGN ENGINEER/PERMIT APPLICANT AND ENVIRONMENTAL INSPECTOR AFTER INSTALLATION OF THE EROSION/SEDIMENTATION CONTROLS, TREE/NATURAL AREA PROTECTION MEASURES AND "PRE-CONSTRUCTION" TREE FERTILIZATION (IF APPLICABLE) PRIOR TO BEGINNING ANY SITE PREPARATION WORK. THE OWNER OR OWNER'S REPRESENTATIVE SHALL NOTIFY THE DEVELOPMENT SERVICES DEPARTMENT, 512-974-2278 OR BY EMAIL AT ENVIRONMENTALINSPECTION@LEANDERTX.GOV AT LEAST THREE DAYS PRIOR TO THE MEETING DATE. CITY OF LEANDER APPROVED ESC PLAN AND TPDES SWPPP (IF REQUIRED) SHOULD BE REVIEWED BY CITY OF LEANDER EV INSPECTOR AT THIS TIME.
5. ANY MAJOR VARIATION IN MATERIALS OR LOCATIONS OF CONTROLS OR FENCES FROM THOSE SHOWN ON THE APPROVED PLANS WILL REQUIRE A REVISION AND MUST BE APPROVED BY THE REVIEWING ENGINEER, ENVIRONMENTAL SPECIALIST OR CITY ARBORIST AS APPROPRIATE. MAJOR REVISIONS MUST BE APPROVED BY AUTHORIZED CITY OF LEANDER STAFF. MINOR CHANGES TO BE MADE AS FIELD REVISIONS TO THE EROSION AND SEDIMENTATION CONTROL PLAN MAY BE REQUIRED BY THE ENVIRONMENTAL INSPECTOR DURING THE COURSE OF CONSTRUCTION TO CORRECT CONTROL INADEQUACIES.
6. THE CONTRACTOR IS REQUIRED TO PROVIDE A CERTIFIED INSPECTOR THAT IS EITHER A LICENSED ENGINEER (OR PERSON DIRECTLY SUPERVISED BY THE LICENSED ENGINEER) OR CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL (CPESC OR CPESC-IT), CERTIFIED EROSION, SEDIMENT AND STORMWATER INSPECTOR (CESSM OR CESSM - IT) OR CERTIFIED INSPECTOR OF SEDIMENTATION AND EROSION CONTROLS (CISEC OR CISEC - IT) CERTIFICATION TO INSPECT THE CONTROLS AND FENCES AT WEEKLY OR BI-WEEKLY INTERVALS AND AFTER ONE-HALF (½) INCH OR GREATER RAINFALL EVENTS TO INSURE THAT THEY ARE FUNCTIONING PROPERLY. THE PERSON(S) RESPONSIBLE FOR MAINTENANCE OF CONTROLS AND FENCES SHALL IMMEDIATELY MAKE ANY NECESSARY REPAIRS TO DAMAGED AREAS. SILT ACCUMULATION AT CONTROLS MUST BE REMOVED WHEN THE DEPTH REACHES SIX (6) INCHES OR ONE-THIRD (⅓) OF THE INSTALLED HEIGHT OF THE CONTROL WHICHEVER IS LESS.
7. PRIOR TO FINAL ACCEPTANCE BY THE CITY, HAUL ROADS AND WATERWAY CROSSINGS CONSTRUCTED FOR TEMPORARY CONSTRUCTION SHOULD NOT BE REMOVED, ACCUMULATED SEDIMENT REMOVED FROM THE WATERWAY AND THE AREA RESTORED TO THE ORIGINAL GRADE AND REVEGETATED. ALL LAND CLEARING DEBRIS SHALL BE DISPOSED OF IN APPROVED SPOIL DISPOSAL SITES.
8. ALL WORK MUST STOP IF A VOID IN THE ROCK SUBSTRATE IS DISCOVERED WHICH IS: ONE SQUARE FOOT IN TOTAL AREA; BLOWS AIR FROM WITHIN THE SUBSTRATE AND/OR CONSISTENTLY RECEIVES WATER DURING ANY RAIN EVENT, AT THIS TIME IT IS THE RESPONSIBILITY OF THE PROJECT MANAGER TO IMMEDIATELY CONTACT A CITY OF LEANDER ENVIRONMENTAL INSPECTOR FOR FURTHER INVESTIGATION.
9. TEMPORARY AND PERMANENT EROSION CONTROL: ALL DISTURBED AREAS SHALL BE RESTORED AS NOTED BELOW.
- A. ALL DISTURBED AREAS TO BE REVEGETATED ARE REQUIRED TO PLACE A MINIMUM OF SIX (6) INCHES OF TOPSOIL [SEE STANDARD SPECIFICATION ITEM NO. 601S.3(A)], DO NOT ADD TOPSOIL WITHIN THE CRITICAL ROOT ZONE OF EXISTING TREES. TOPSOIL SALVAGED FROM THE EXISTING SITE IS ENCOURAGED FOR USE, BUT IT SHOULD MEET THE STANDARDS SET FORTH IN 601S. AN OWNER/ENGINEER MAY PROPOSE USE OF ONSITE SALVAGED TOPSOIL WHICH DOES NOT MEET THE CRITERIA OF STANDARD SPECIFICATION 601S BY PROVIDING A SOIL ANALYSIS AND A WRITTEN STATEMENT FROM A QUALIFIED PROFESSIONAL IN SOILS, LANDSCAPE ARCHITECTURE, OR AGRONOMY INDICATING THE ONSITE TOPSOIL WILL PROVIDE AN EQUIVALENT GROWTH MEDIA AND SPECIFYING WHAT, IF ANY, SOIL AMENDMENTS ARE REQUIRED. SOIL AMENDMENTS SHALL BE WORKED INTO THE EXISTING ONSITE TOPSOIL WITH A DISC OR T-ILLER TO CREATE A WELL-BLENDED MATERIAL. THE VEGETATIVE STABILIZATION OF AREAS DISTURBED BY CONSTRUCTION SHALL BE AS FOLLOWS:
- TEMPORARY VEGETATIVE STABILIZATION:
1. FROM SEPTEMBER 15 TO MARCH 1, SEEDING SHALL BE WITH OR INCLUDE A COOL SEASON COVER CROP: (WESTERN WHEATGRASS (PASCOPYRUM SMITHII) AT 5.6 POUNDS PER ACRE, OATS (Avena SATIVA) AT 4.0 POUNDS PER ACRE, CEREAL RYE GRAIN (A SECALE CEREALE) AT 45 POUNDS PER ACRE. CONTRACTOR MUST ENSURE THAT ANY SEED APPLICATION REQUIRING A COOL SEASON COVER CROP DOES NOT UTILIZE ANNUAL RYEGRASS (L. LOLIUM MULTIFLORUM) OR PERENNIAL RYEGRASS (L. LOLIUM PERENNE). COOL SEASON COVER CROPS ARE NOT PERMANENT EROSION CONTROL. 2. FROM MARCH 2 TO SEPTEMBER 14, SEEDING SHALL BE WITH MULLED BERMUDA AT A RATE OF 45 POUNDS PER ACRE OR A NATIVE PLANT SEED MIX CONFORMING TO ITEM 604S OR 609S.
- A. FERTILIZER SHALL BE APPLIED ONLY IF WARRANTED BY A SOIL TEST AND SHALL CONFORM TO ITEM NO. 606S, FERTILIZER. FERTILIZATION SHOULD NOT OCCUR WHEN RAINFALL IS EXPECTED OR DURING SLOW PLANT GROWTH OR DORMANCY. CHEMICAL FERTILIZER MAY NOT BE APPLIED IN THE CRITICAL WATER QUALITY ZONE. B. HYDROMULCH SHALL COMPLY WITH TABLE 1, BELOW. C. TEMPORARY EROSION CONTROL SHALL BE ACCEPTABLE WHEN THE GRASS HAS GROWN AT LEAST 1½ INCHES HIGH WITH A MINIMUM OF 95% TOTAL COVERAGE SO THAT ALL AREAS OF A SITE THAT RELY ON VEGETATION FOR TEMPORARY STABILIZATION ARE UNIFORMLY VEGETATED, AND PROVIDED THERE ARE NO BARE SPOTS LARGER THAN 10 SQUARE FEET. D. WHEN REQUIRED, NATIVE PLANT SEEDING SHALL COMPLY WITH REQUIREMENTS OF THE CITY OF LEANDER ENVIRONMENTAL CRITERIA MANUAL, AND STANDARD SPECIFICATION 604S OR 609S.

TABLE 1: HYDROMULCHING FOR TEMPORARY VEGETATIVE STABILIZATION

MATERIAL	DESCRIPTION	LONGEVITY	TYPICAL APPLICATIONS	APPLICATION RATE
100% OR ANY BLEND OF WOOD, GULLOSE, STARW, AND/OR COTTON PLANT MATERIAL (EXCEPT NO MULCH SHALL EXCEED 30% PAPER)	70% OR GREATER WOOD/STRAW 30 OR LESS PAPER OR NATURAL FIBERS	0-3 MONTHS	MODERATE SLOPES FROM FLAT TO 3:1	1,500 TO 2,000 LBS PER ACRE

PERMANENT VEGETATIVE STABILIZATION:

1. FROM SEPTEMBER 15 TO MARCH 1, SEEDING IS CONSIDERED TO BE TEMPORARY STABILIZATION ONLY. IF COOL SEASON COVER CROPS EXIST WHERE PERMANENT VEGETATIVE STABILIZATION IS DESIRED, THE GRASSES SHALL BE MOWED TO A HEIGHT OF LESS THAN ONE-HALF (½) INCH AND THE AREA SHALL BE RE-SEEDED IN ACCORDANCE WITH TABLE 2 BELOW. ALTERNATIVELY, THE COOL SEASON COVER CROP CAN BE MIXED WITH BERMUDAGRASS OR NATIVE SEED AND INSTALLED TOGETHER, UNDERSTANDING THAT GERMINATION OF WARM-SEASON SEED TYPICALLY REQUIRES SOIL TEMPERATURES OF 60 TO 70 DEGREES.
2. FROM MARCH 2 TO SEPTEMBER 14, SEEDING SHALL BE WITH MULLED BERMUDA AT A RATE OF 45 POUNDS PER ACRE WITH A PURITY OF 95% AND A MINIMUM PURE LIVE SEED (PLS) OF 0.83. BERMUDA GRASS IS A WARM SEASON GRASS AND IS CONSIDERED PERMANENT EROSION CONTROL. PERMANENT VEGETATIVE STABILIZATION CAN ALSO BE ACCOMPLISHED WITH A NATIVE PLANT SEED MIX CONFORMING TO ITEM 604S OR 609S.
- A. FERTILIZER USE SHALL FOLLOW THE RECOMMENDATION OF A SOIL TEST. SEE ITEM 606S, FERTILIZER. APPLICATIONS OF FERTILIZER (AND PESTICIDE) ON CITY-OWNED AND MANAGED PROPERTY REQUIRES THE YEARLY SUBMITTAL OF A PESTICIDE AND FERTILIZER APPLICATION RECORD, ALONG WITH A CURRENT COPY OF THE APPLICATOR'S LICENSE. FOR CURRENT COPY OF THE RECORD TEMPLATE CONTACT THE CITY OF LEANDER'S IPM COORDINATOR.
- B. HYDROMULCH SHALL COMPLY WITH TABLE 2, BELOW.
- C. AFTER THE SEEDED AREA IS IMMEDIATELY AFTER INSTALLATION TO ACHIEVE GERMINATION AND A HEALTHY STAND OF PLANTS THAT CAN ULTIMATELY SURVIVE WITHOUT SUPPLEMENTAL WATER, APPLY THE WATER UNIFORMLY TO THE PLANTED AREAS WITHOUT CAUSING DISPLACEMENT OR EROSION OF THE MATERIALS OR SOIL. MAINTAIN THE SEEDBED IN A MOIST CONDITION FAVORABLE FOR PLANT GROWTH. ALL WATERING SHALL COMPLY WITH CITY CODE CHAPTER 6-4 (WATER CONSERVATION), AT RATES AND FREQUENCIES DETERMINED BY A LICENSED IRRIGATOR OR OTHER QUALIFIED PROFESSIONAL, AND AS ALLOWED BY THE LEANDER WATER UTILITY AND CURRENT WATER RESTRICTIONS AND WATER CONSERVATION INITIATIVES.
- D. PERMANENT EROSION CONTROL SHALL BE ACCEPTABLE WHEN THE GRASS HAS GROWN AT LEAST 1½ INCHES HIGH WITH A MINIMUM OF 95 PERCENT FOR THE NON-NATIVE MIX, AND 95 PERCENT COVERAGE FOR THE NATIVE MIX SO THAT ALL AREAS OF A SITE THAT RELY ON VEGETATION FOR STABILITY MUST BE UNIFORMLY VEGETATED, AND PROVIDED THERE ARE NO BARE SPOTS LARGER THAN 10 SQUARE FEET.
- E. WHEN REQUIRED, NATIVE PLANT SEEDING SHALL COMPLY WITH REQUIREMENTS OF THE CITY OF LEANDER ENVIRONMENTAL CRITERIA MANUAL, ITEMS 604S AND 609S.

TABLE 2: HYDROMULCHING FOR PERMANENT VEGETATIVE STABILIZATION

MATERIAL	DESCRIPTION	LONGEVITY	TYPICAL APPLICATIONS	APPLICATION RATE
BONDED FIBER MATRIX (BFM)	80% ORGANIC DEBRIDATED FIBERS 10% TACKIFIER	6 MONTHS	ON SLOPES UP TO 2:1 AND EROSION SOIL CONDITIONS	2,500 TO 4,000 LBS PER ACRE (SEE MANUFACTURER'S RECOMMENDATIONS)
FIBER REINFORCED MATRIX (FRM)	65% ORGANIC DEBRIDATED FIBERS 25% REINFORCING FIBERS OR LESS 10% TACKIFIER	UP TO 12 MONTHS	ON SLOPES UP TO 1:1 AND EROSION SOIL CONDITIONS	3,000 TO 4,500 LBS PER ACRE (SEE MANUFACTURER'S RECOMMENDATIONS)

10. DEVELOPER INFORMATION:

OWNER _____
PHONE # _____
ADDRESS _____

OWNER'S REPRESENTATIVE RESPONSIBLE FOR PLAN ALTERATIONS:

PHONE # _____

PERSON OR FIRM RESPONSIBLE FOR EROSION/SEDIMENTATION CONTROL MAINTENANCE: _____
PHONE # _____

PERSON OR FIRM RESPONSIBLE FOR TREE/NATURAL AREA PROTECTION MAINTENANCE: _____
PHONE # _____

11. THE CONTRACTOR SHALL NOT DISPOSE OF SURPLUS EXCAVATED MATERIAL FROM THE SITE WITHOUT NOTIFYING THE DEVELOPMENT SERVICES DEPARTMENT AT 512-974-2278 AT LEAST 48 HOURS PRIOR WITH THE LOCATION AND A COPY OF THE PERMIT ISSUED TO RECEIVE THE MATERIAL.

APPENDIX P-6: REMEDIAL TREE CARE NOTES

AS A COMPONENT OF AN EFFECTIVE REMEDIAL TREE CARE PROGRAM PER ENVIRONMENTAL CRITERIA MANUAL SECTION 3.5.4, PRESERVED TREES WITHIN THE LIMITS OF CONSTRUCTION MAY REQUIRE SOIL AERATION AND SUPPLEMENTAL NUTRIENT. SOIL AND/OR FOLIAR ANALYSIS SHOULD BE USED TO DETERMINE THE NEED FOR SUPPLEMENTAL NUTRIENTS. THE CITY ARBORIST MAY REQUIRE THESE ANALYSES AS PART OF A COMPREHENSIVE TREE CARE PLAN. SOIL PH SHALL BE CONSIDERED WHEN DETERMINING THE FERTILIZATION COMPOSITION AS SOIL PH INFLUENCES THE TREE'S ABILITY TO UPTAKE NUTRIENTS FROM THE SOIL. IF ANALYSES INDICATE THE NEED FOR SUPPLEMENTAL NUTRIENTS, THEN HUMATE/NUTRIENT SOLUTIONS WITH MYCORRHIZAE COMPONENTS ARE HIGHLY RECOMMENDED. IN ADDITION, SOIL ANALYSIS MAY BE NEEDED TO DETERMINE IF ORGANIC MATERIAL OR BENEFICIAL MICROORGANISMS ARE NEEDED TO IMPROVE SOIL HEALTH. MATERIALS AND METHODS ARE TO BE APPROVED BY THE CITY ARBORIST (512-974-1876) PRIOR TO APPLICATION. THE OWNER OR GENERAL CONTRACTOR SHALL SELECT A FERTILIZATION CONTRACTOR AND ENSURE COORDINATION WITH THE CITY ARBORIST.

PRE-CONSTRUCTION TREATMENT SHOULD BE APPLIED IN THE APPROPRIATE SEASON, IDEALLY THE SEASON PRECEDING THE PROPOSED CONSTRUCTION. MINIMALLY, AREAS TO BE TREATED INCLUDE THE ENTIRE CRITICAL ROOT ZONE OF TREES AS DEPicted ON THE CITY APPROVED PLANS. TREATMENT SHOULD INCLUDE, BUT NOT LIMITED TO, FERTILIZATION, SOIL TREATMENT, MULCHING, AND PROPER PRUNING.

POST-CONSTRUCTION TREATMENT SHOULD OCCUR DURING FINAL REVEGETATION OR AS DETERMINED BY A QUALIFIED ARBORIST AFTER CONSTRUCTION. CONSTRUCTION ACTIVITIES OFTEN RESULT IN A REDUCTION IN SOIL MACRO AND MICRO PORES AND AN INCREASE IN SOIL BULK DENSITY. TO AMELIORATE THE DEGRADED SOIL CONDITIONS, AERATION VIA WATER AND/OR AIR INJECTED INTO THE SOIL IS NEEDED OR BY OTHER METHODS AS APPROVED BY THE CITY ARBORIST. THE PROPOSED NUTRIENT MIX SPECIFICATIONS AND SOIL AND/OR FOLIAR ANALYSIS RESULTS NEED TO BE PROVIDED TO AND APPROVED BY THE CITY ARBORIST PRIOR TO APPLICATION (FAX # 512-974-3010). CONSTRUCTION WHICH WILL BE COMPLETED IN LESS THAN 90 DAYS MAY USE MATERIALS AT ½ RECOMMENDED RATES. ALTERNATIVE ORGANIC FERTILIZER MATERIALS ARE ACCEPTABLE WHEN APPROVED BY THE CITY ARBORIST. WITHIN 7 DAYS AFTER FERTILIZATION IS PERFORMED, THE CONTRACTOR SHALL PROVIDE DOCUMENTATION OF THE WORK PERFORMED TO THE CITY ARBORIST. PLANNING AND DEVELOPMENT REVIEW DEPARTMENT. P.O. BOX 1088, LEANDER, TX 78767. THIS NOTE SHOULD BE REFERENCED AS ITEM #1 IN THE SEQUENCE OF CONSTRUCTION.

EROSION CONTROL NOTES (ECM APPENDIX P-2)

1. ALL TREES AND NATURAL AREAS SHOWN ON PLAN TO BE PRESERVED SHALL BE PROTECTED DURING CONSTRUCTION WITH TEMPORARY FENCING. PROTECTIVE FENCES SHALL BE ERECTED ACCORDING TO CITY OF LEANDER STANDARDS FOR TREE PROTECTION.
2. PROTECTIVE FENCES SHALL BE INSTALLED PRIOR TO THE START OF ANY SITE PREPARATION WORK (CLEARING, GRUBBING OR GRADING), AND SHALL BE MAINTAINED THROUGHOUT ALL PHASES OF THE CONSTRUCTION PROJECT.
3. EROSION AND SEDIMENTATION CONTROL BARRIERS SHALL BE INSTALLED OR MAINTAINED IN A MANNER WHICH DOES NOT RESULT IN SOIL BUILD-UP WITHIN TREE DRIP LINES.
4. PROTECTIVE FENCES SHALL SURROUND THE TREES OR GROUP OF TREES, AND WILL BE LOCATED AT THE OUTERMOST LIMIT OF BRANCHES (DRIP LINE) , FOR NATURAL AREAS, PROTECTIVE FENCES SHALL FOLLOW THE LIMIT OF CONSTRUCTION LINE. IN ORDER TO PREVENT THE FOLLOWING:
- A. SOIL COMPACTION IN THE ROOT ZONE AREA RESULTING FROM VEHICULAR TRAFFIC OR STORAGE OF EQUIPMENT OR MATERIALS;
 - B. ROOT ZONE DISTURBANCES DUE TO GRADE CHANGES (GREATER THAN 6 INCHES CUT OR FILL), OR TRENCHING NOT REVIEWED AND AUTHORIZED BY THE CITY ARBORIST;
 - C. WOUNDS TO EXPOSED ROOTS, TRUNK OR LIMBS BY MECHANICAL EQUIPMENT;
 - D. OTHER ACTIVITIES DETRIMENTAL TO TREES SUCH AS CHEMICAL STORAGE, CEMENT TRUCK CLEANING, AND FIRES.
- EXCEPTIONS TO INSTALLING FENCES AT TREE DRIP LINES MAY BE PERMITTED IN THE FOLLOWING CASES:
- A. WHERE THERE IS TO BE AN APPROVED GRADE CHANGE, IMPERMEABLE PAVING SURFACE, TREE WELL, OR OTHER SUCH SITE DEVELOPMENT, ERECT THE FENCE APPROXIMATELY 2 TO 4 FEET BEYOND THE AREA DISTURBED;
- B. WHERE PERMEABLE PAVING IS TO BE INSTALLED WITHIN A TREE'S DRIP LINE, ERECT THE FENCE AT THE OUTER LIMITS OF THE PERMEABLE PAVING AREA (PRIOR TO SITE GRADING SO THAT THIS AREA IS GRADED SEPARATELY PRIOR TO PAVING INSTALLATION TO MINIMIZED ROOT DAMAGE);
- C. WHERE TREES ARE CLOSE TO PROPOSED BUILDINGS, ERECT THE FENCE TO ALLOW 6 TO 10 FEET OF WORK SPACE BETWEEN THE FENCE AND THE BUILDING;
- D. WHERE THERE ARE SEVERE SPACE CONSTRAINTS DUE TO TRACT SIZE, OR OTHER SPECIAL REQUIREMENTS, CONTACT THE CITY ARBORIST AT 974-1876 TO DISCUSS ALTERNATIVES. SPECIAL NOTE: FOR THE PROTECTION OF NATURAL AREAS, NO EXCEPTIONS TO INSTALLING FENCES AT THE LIMIT OF CONSTRUCTION LINE WILL BE PERMITTED. WHERE ANY OF THE ABOVE EXCEPTIONS RESULT IN A FENCE BEING CLOSER THAN 4 FEET TO A TREE TRUNK, PROTECT THE TRUNK WITH STRAPPED-ON PLANKING TO A HEIGHT OF 8 FT (OR TO THE LIMITS OF LOWER BRANCHING) IN ADDITION TO THE REDUCED FENCING PROVIDED. TREES APPROVED FOR REMOVAL SHALL BE REMOVED IN A MANNER WHICH DOES NOT IMPACT TREES TO BE PRESERVED.
9. ANY ROOTS EXPOSED BY CONSTRUCTION ACTIVITY SHALL BE PRUNED FLUSH WITH THE SOIL. BACKFILL ROOT AREAS WITH GOOD QUALITY TOP SOIL AS SOON AS POSSIBLE. IF EXPOSED ROOT AREAS ARE NOT BACKFILLED WITHIN 2 DAYS, COVER THEM WITH ORGANIC MATERIAL IN A MANNER WHICH REDUCES SOIL TEMPERATURE AND MINIMIZES WATER LOSS DUE TO EVAPORATION.
10. ANY TRENCHING REQUIRED FOR THE INSTALLATION OF LANDSCAPE IRRIGATION SHALL BE PLACED AS FAR FROM EXISTING TREE TRUNKS AS POSSIBLE.
11. NO LANDSCAPE TOPSOIL DRESSING GREATER THAN 4 INCHES SHALL BE PERMITTED WITHIN THE DRIP LINE OF TREES. NO SOIL IS PERMITTED ON THE ROOT FLARE OF ANY TREE.
12. PRUNING TO PROVIDE CLEARANCE FOR STRUCTURES, VEHICULAR TRAFFIC AND EQUIPMENT SHALL TAKE PLACE BEFORE DAMAGE OCCURS (RIPPING OF BRANCHES, ETC.).
13. ALL FINISHED PRUNING SHALL BE DONE ACCORDING TO RECOGNIZED, APPROVED STANDARDS OF THE INDUSTRY (REFERENCE THE NATIONAL ARBORIST ASSOCIATION PRUNING STANDARDS FOR SHADE TREES AVAILABLE ON REQUEST FROM THE CITY ARBORIST).
14. DEVIATIONS FROM THE ABOVE NOTES MAY BE CONSIDERED ORDNANCE VIOLATIONS IF THERE IS SUBSTANTIAL NON-COMPLIANCE OR IF A TREE SUSTAINS DAMAGE AS A RESULT.

EROSION CONTROL NOTES (ECM APPENDIX P-3)

1. IF DISTURBED ARE IS NOT TO BE WORKED ON FOR MORE THAN 14 DAYS, DISTURBED AREA NEEDS TO BE STABILIZED BY REVEGETATION, MULCH, TARP OR REVEGETATION MATTING. [ECM 1.4.4.B.3, SECTION 5.1]
2. ENVIRONMENTAL INSPECTOR HAS THE AUTHORITY TO ADD AND/OR MODIFY EROSION/SEDIMENTATION CONTROLS ON SITE TO KEEP PROTECT IN-COMPLIANCE WITH THE CITY OF LEANDER RULES AND REGULATIONS. [LDC 25-8-185]
3. CONTRACTOR SHALL UTILIZE DUST CONTROL MEASURES DURING SITE CONSTRUCTION SUCH AS IRRIGATION TRUCKS AND MULCHING AS OER ECM 1.4.5(A), OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR
4. THE CONTRACTOR WILL CLEAN UP SPOILS THAT MIGRATE ONTO THE ROADS A MINIMUM OF ONCE DAILY. [1.4.4.D.4]

EROSION CONTROL NOTES

1. GENERAL CONTRACTOR MUST OBTAIN COVERAGE UNDER THE TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM (TPDES) GENERAL PERMIT FOR CONSTRUCTION ACTIVITIES (TXR150000) BY USING ON OF THE FOLLOWING PROCEDURES:
- A. FOR A LARGE SITE (DISTURBED AREA ≥5 ACRES) FILING A NOTICE OF INTENT FORM WITH THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) WEBSITE USING THE STEERS SYSTEM AND POSTING ON-SITE THE NOTICE OF COVERAGE FORM (RECEIVED AFTER FILING THE NOI) AND A COMPLETED LARGE CONSTRUCTION SITE NOTICE.
- B. FOR SMALL SITE (DISTURBED AREA <5 ACRES) COMPLETING, SIGNING, AND POSTING A SMALL CONSTRUCTION SITE NOTICE.
- COPIES OF THESE NOTICES MUST ALSO BE PROVIDED TO THE OPERATOR OF ANY MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) THAT RECEIVED STORMWATER RUNOFF FROM THE SITE.
2. THE GENERAL CONTRACTOR, (AND ALL SUBCONTRACTORS INVOLVED WITH ANY CONSTRUCTION ACTIVITY RELATED TO EARTHWORK, EROSION CONTROL,, ETC., OR WHICH UTILIZE POSSIBLE POLLUTANTS AS DEFINED IN THE TPDES GENERAL PERMIT) MUST BE FAMILIAR WITH THE CONTENTS OF THE STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AS WELL AS ALL THE REQUIREMENTS SET FORTH IN THE TPDES GENERAL PERMIT AND ANY APPLICABLE LOCAL PERMIT REQUIREMENTS. AND SHALL COMPLY WITH ALL SUCH REQUIREMENTS DURING ALL CONSTRUCTION ACTIVITIES.
3. THE CONTRACTOR SHALL ADHERE TO THE SEQUENCE OF OPERATIONS FOR EROSION CONTROL IMPLEMENTATION SHOWN HEREON. ANY DEVIATION FROM THIS SEQUENCE DEEMED NECESSARY BY THE CONTRACTOR MAY REQUIRE THAT THE STORMWATER POLLUTION PREVENTION PLAN BE MODIFIED IN ACCORDANCE WITH THE NPDES GENERAL PERMIT GUIDELINES AND SECTION 1.01 F OF THE STORM WATER POLLUTION PREVENTION PLAN. THE CONTRACTOR SHALL MODIFY THIS PLAN TO SHOW LOCATIONS OF TEMPORARY WASHDOWN AREAS, PORTABLE TOILETS, EQUIPMENT MAINTENANCE/REPAIR AREAS, STOCKPILE AREAS, FUEL STORAGE AREAS, CONCRETE WASH-OUT PITS, AND POLLUTANT CONTROLS FOR EACH, AS SOON AS POSSIBLE. THE GENERAL PERMIT AUTHORIZES THE LAND DISPOSAL OF WASH OUT WATER FROM CONCRETE TRUCKS THAT ARE ASSOCIATED WITH OFF-SITE PRODUCTION FACILITIES, AS LONG AS THE DISCHARGE IS INTO SPECIFICALLY DESIGNATED DIKED AREAS WHICH HAVE BEEN PREPARED TO PREVENT CONTACT BETWEEN THE CONCRETE AND/OR WASH OUT WATER AND STORMWATER WHICH WILL BE DISCHARGED FROM THE SITE, TO PREVENT DIRECT DISCHARGE TO SURFACE WATERS (SEE CONCRETE WASHOUT DETAIL SHOWN IN PLANS). DIRECT DISCHARGE OF CONCRETE TRUCK WASH OUT WATER TO SURFACE WATERS IN THE STATE, INCLUDING DISCHARGE TO STORM SEWERS, IS PROHIBITED BY THE GENERAL PERMIT. IF A CONCRETE PLANT IS LOCATED AT CONSTRUCTION SITE, CONTRACTOR SHALL OBTAIN COVERAGE UNDER AND COMPLY WITH GENERAL PERMIT TXG110000 OR INDIVIDUAL PERMIT.
5. THE GENERAL CONTRACTOR SHALL PERFORM ALL REQUIRED INSPECTIONS OF STORMWATER CONTROLS AND PRACTICES AT FREQUENCIES GIVEN IN THE NPDES GENERAL PERMIT, AND SHALL COMPLETE AND SEND APPROPRIATE INSPECTION FORMS (AS PROVIDED IN THE SWPPP).
6. OIL AND GREASE ABSORBING MATERIALS SHALL BE READILY AVAILABLE ON-SITE AND SHALL BE PROMPTLY USED TO CONTAIN AND/OR CLEAN UP ALL FUEL OR CHEMICAL SPILLS OR LEAKS.
7. DUST CONTROL SHALL BE COMPLETED BY WATERING DRY, EXPOSED AREAS ON A REGULAR BASIS. SPRAYING OF PETROLEUM BASED OR TOXIC LIQUIDS FOR THIS PURPOSE IS PROHIBITED.
8. DISTURBED AREAS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE CEASED FOR AT LEAST FOURTEEN DAYS SHALL BE TEMPORARILY STABILIZED WITH VEGETATION AND MULCH.
9. DISTURBED AREAS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE PERMANENTLY CEASED SHALL BE PERMANENTLY SEEDED WITHIN FOURTEEN DAYS PER SEEDING OR LANDSCAPING SPECIFICATIONS.
10. ALL VEHICLES SHALL BE CLEANED AT THE CONSTRUCTION EXIT POINTS ACCORDING TO NOTES SHOWN ON THE DETAIL THEREOF. IF THE MAJORITY OF MUD OR DIRT IS NOT REMOVED FROM EXITING TRAFFIC, HOSE BIBS SHALL BE PROVIDED AT CONSTRUCTION TRAFFIC EXIT POINTS, AND VEHICLE TIRES SHALL BE WASHED BEFORE EXITING ONTO PUBLIC ROADS. SILT FROM THIS WASHING OPERATION SHALL BE INTERCEPTED AND TRAPPED BEFORE WASHWATER IS ALLOWED TO BE DISCHARGED OFF-SITE.
11. ALL MATERIALS SPILLED, DROPPED, WASHED OR TRACKED ONTO ADJACENT ROADWAYS BY VEHICLES EXITING THE SITE SHALL BE CLEANED OR REMOVED IMMEDIATELY.
12. CONTRACTOR SHALL PREVENT ANY SILTATION FROM ENTERING THE STORM SEWER SYSTEM. ALL INLETS AND INLET OPENINGS SHALL BE FULLY ENCIRCLED WITH APPROPRIATE INLET PROTECTION DEVICES.
13. CONTRACTOR SHALL REMOVE ALL ACCUMULATED SILT IN ANY TEMPORARY OR PERMANENT DETENTION PONDS, STORM SEWER INLETS AND PIPES, AND ALONG SILT FENCES, WITHIN 48 HOURS AFTER INSPECTION OF DEVICES REVEALS THE PRESENCE OF EXCESSIVE SILTATION (AS SPECIFIED IN SECTION 5.02 OF THE SWPPP).
14. SILT FENCES SHALL BE PLACED AROUND ANY STOCKPILES USED ON THIS SITE.
- THE CONTRACTOR IS ADVISED TO CONSTRUCT TEMPORARY OR PERMANENT FENCING AROUND DETENTION PONDS AND SEDIMENT BASINS AT THE EARLIEST POSSIBLE TIME TO PREVENT ACCIDENTAL ACCESS BY PERSONS OR ANIMALS.
16. ANY ADDITIONAL EROSION CONTROL MEASURES REQUIRED TO ENSURE COMPLIANCE WITH THE TPDES GENERAL PERMIT OR LOCAL PERMIT REQUIREMENTS SHALL BE IMPLEMENTED BY THE CONTRACTOR, AT NO ADDITIONAL EXPENSE TO THE OWNER.
17. ALL TEMPORARY EROSION CONTROL MEASURES SHALL BE REMOVED AND PROPERLY DISPOSED OF OFF-SITE WITHIN THIRTY DAYS AFTER STABILIZATION OF ALL SURFACES.
18. THE CONTRACTOR SHALL ASSUME LIABILITY FOR DAMAGE TO ADJACENT PROPERTIES AND/OR PUBLIC RIGHT-OF-WAY RESULTING FROM FAILURE TO FULLY IMPLEMENT AND EXECUTE ALL EROSION CONTROL PROCEDURES SHOWN AND NOTED IN THESE PLANS.
19. WHENEVER DIRT, ROCK, OR OTHER MATERIALS ARE IMPORTED OR EXPORTED ON THE PRIMARY CONSTRUCTION SITE, CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR COMPLIANCE WITH ALL TCEQ STORMWATER REQUIREMENTS FOR THE REMOTE SITE. CONTRACTOR SHALL FURNISH THE ENGINEER AND THE OWNER'S CONSTRUCTION MANAGER WITH DOCUMENTATION OF COVERAGE FOR THE BORROW OR FILL SITE UNDER A NPDES PERMIT FOR STORMWATER DISCHARGES AND OF A WRITTEN AGREEMENT WITH THE LANDOWNER OF THE REMOTE SITE INDICATING EROSION CONTROL MEASURES HAVE BEEN IMPLEMENTED THEREON. AT A MINIMUM, EROSION CONTROL MEASURES MUST CONSIST OF PERIMETER CONTROLS (SILT FENCES) ON ALL DOWN SLOPES AND SIDE SLOPE BOUNDARIES OF ANY DISTURBED AREA, PLUS PROVISIONS FOR RE-VEGETATION AFTER THE FILL MATERIALS ARE IN PLACE.
20. ALL SLOPES ON SITE WHICH ARE 3:1 OR STEEPER SHALL BE STABILIZED BY TRACK WALKING (TRAVERSING UP AND DOWN THE SLOPE WITH A TRACKED VEHICLE) FOLLOWED BY INSTALLATION OF EROSION CONTROL BLANKET INSTALLED IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. EROSION CONTROL BLANKET SHALL BE NORTH AMERICAN GREEN S150 OR APPROVED EQUAL.

BMP IMPLEMENTATION SCHEDULE

BMP
SILT FENCE
INLET PROTECTION
CONSTRUCTION EXIT
ROCK CHECK DAM
INLET PROTECTION OF NEW PIPES/MANHOLES
PERMANENT VEGETATIVE STABILIZATION

WHEN IMPLEMENTED

PRIOR TO CLEARING/GRUBBING
PRIOR TO CLEARING/GRUBBING
PRIOR TO CLEARING/GRUBBING
AFTER DETENTION POND HAS BEEN GRADED
DURING UTILITY INSTALLATION
AFTER FINAL GRADING AND PAVING

Date	Description	No.
------	-------------	-----

Revisions



EMILY MAHONEY P.E.
LANGAN ENGINEERING AND
ENVIRONMENTAL SERVICES, INC.
TBPE FIRM REG. #F-13709

LANGAN

Langan Engineering and
Environmental Services, Inc.

9608 N. Mopac Expressway, Suite 110
Austin, TX 78759

T: 737.289.7800 F: 737.289.7801 www.langan.com
TBPE Firm REG. #F-13709

Project

HERITAGE GROVE
ROAD

LEANDER

TEXAS

WILLIAMSON COUNTY

Drawing Title

SOIL EROSION &
SEDIMENT
CONTROL DETAILS

Project No.	Drawing No.
-------------	-------------

531020901

Date

04/06/2023

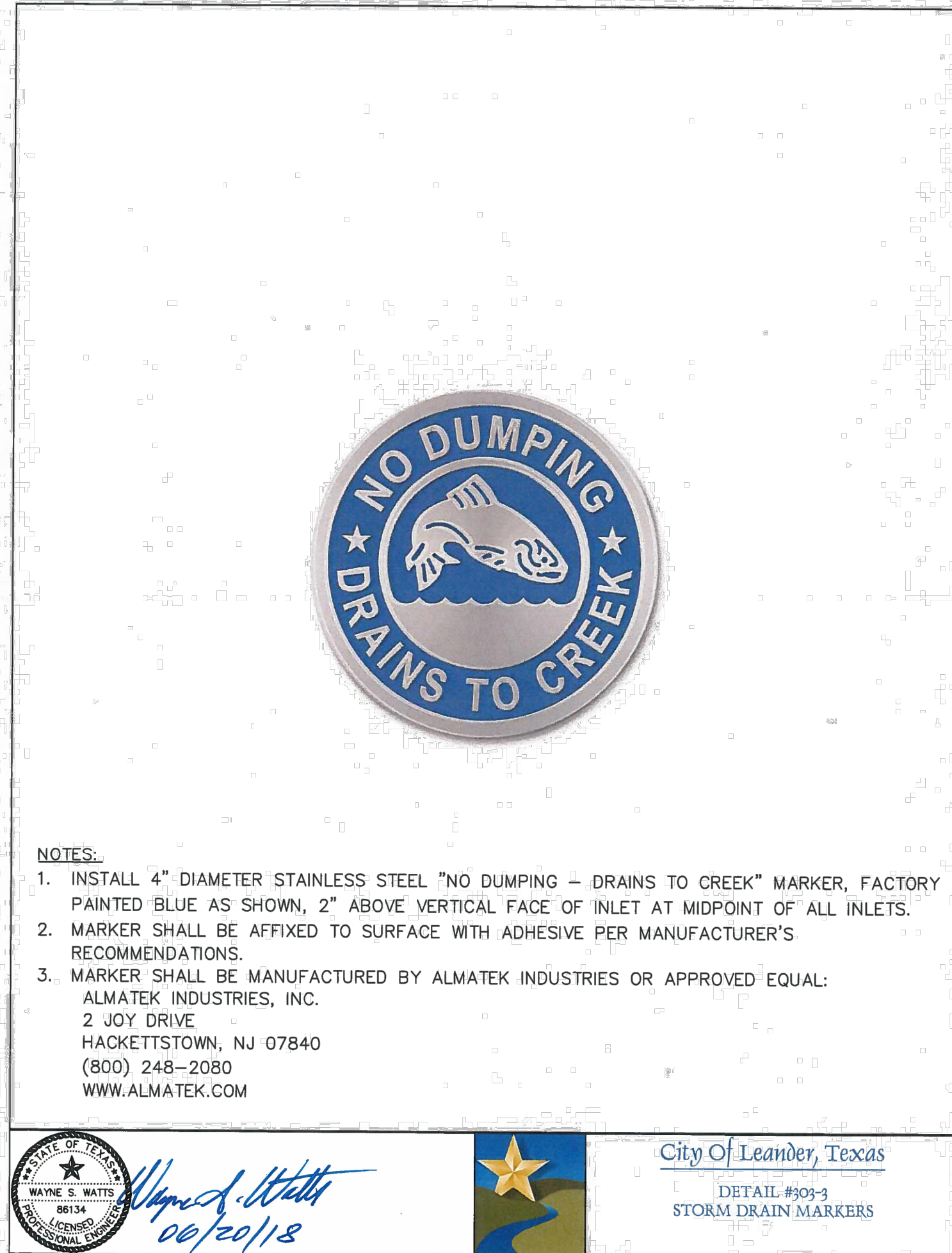
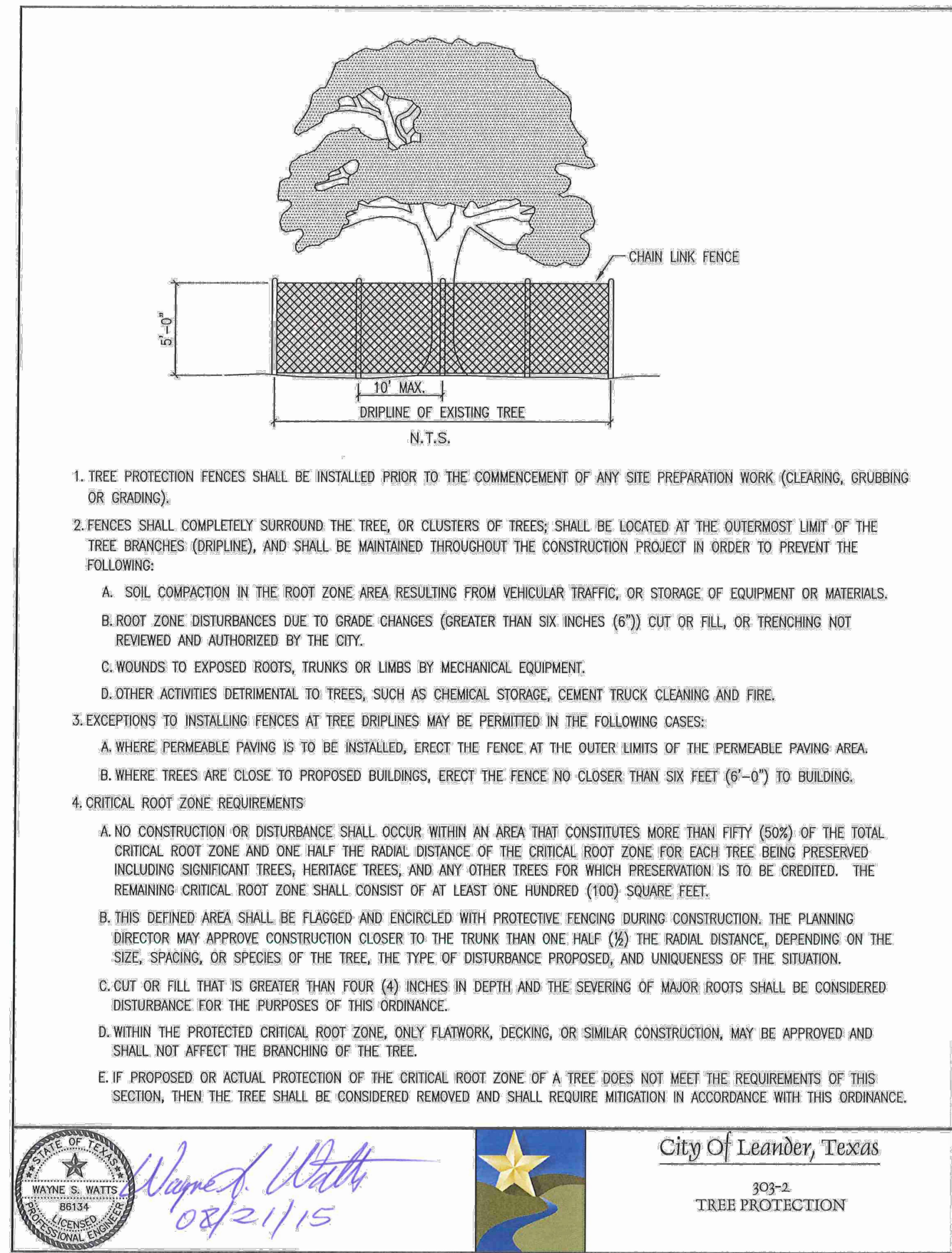
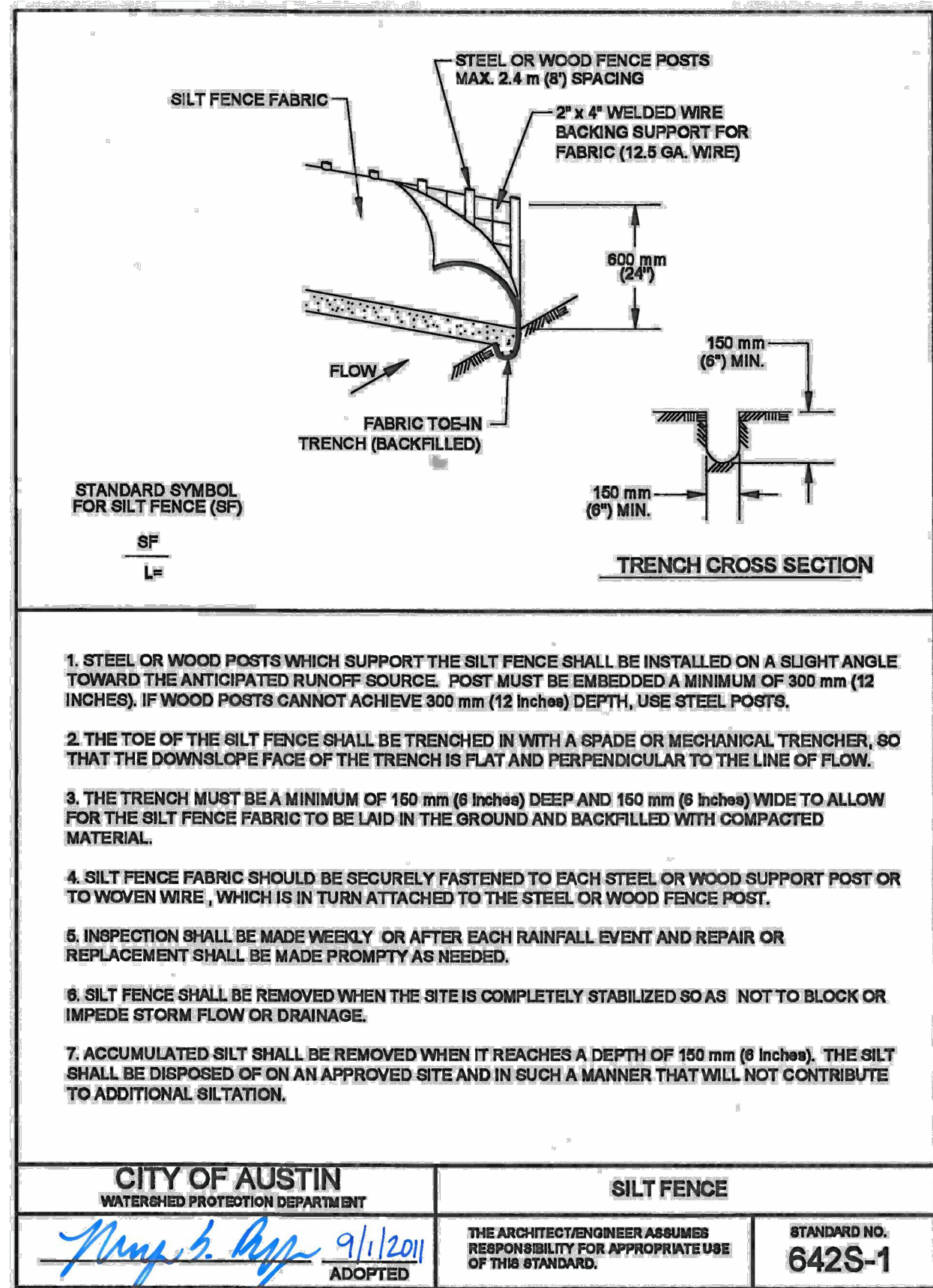
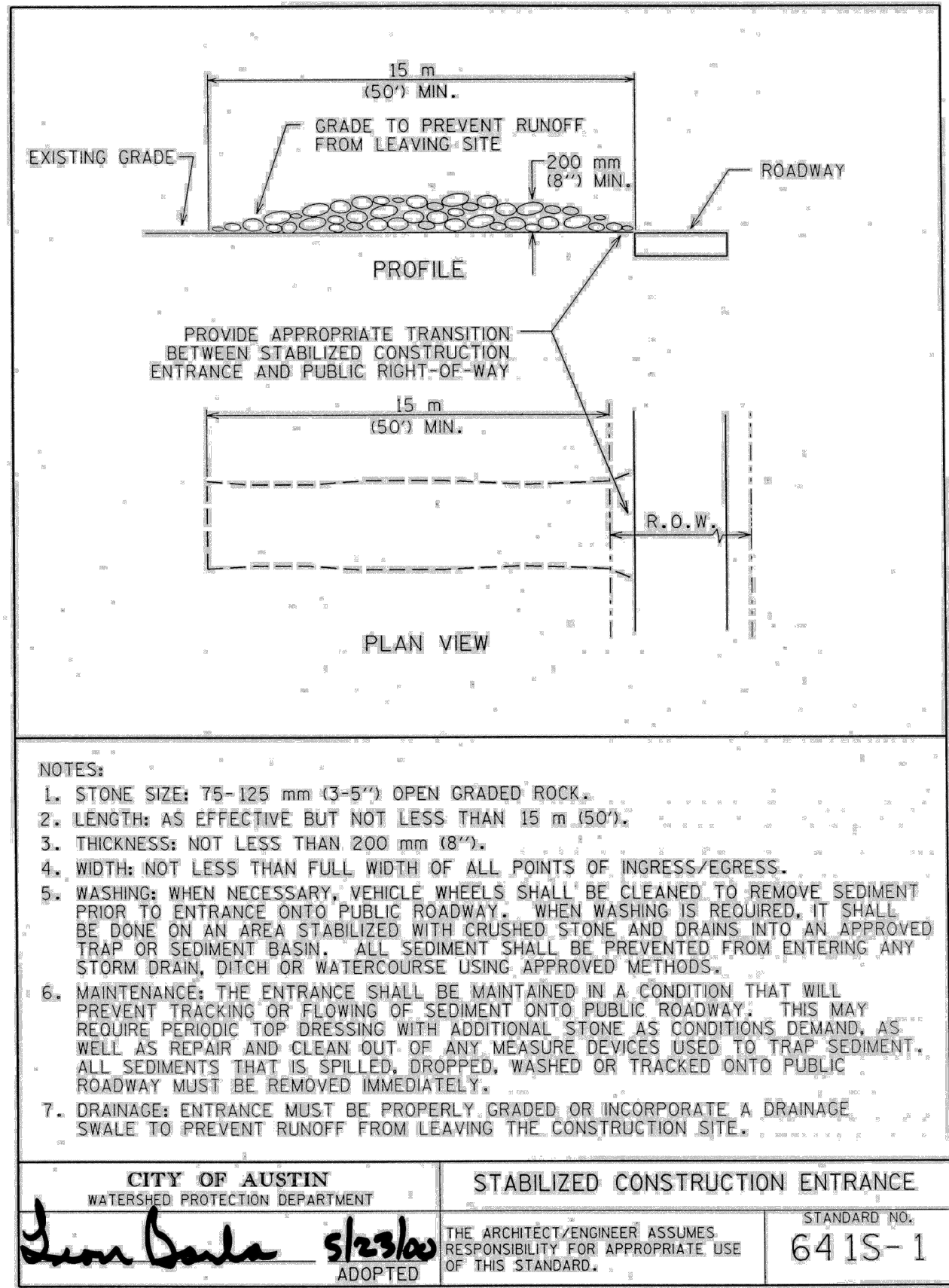
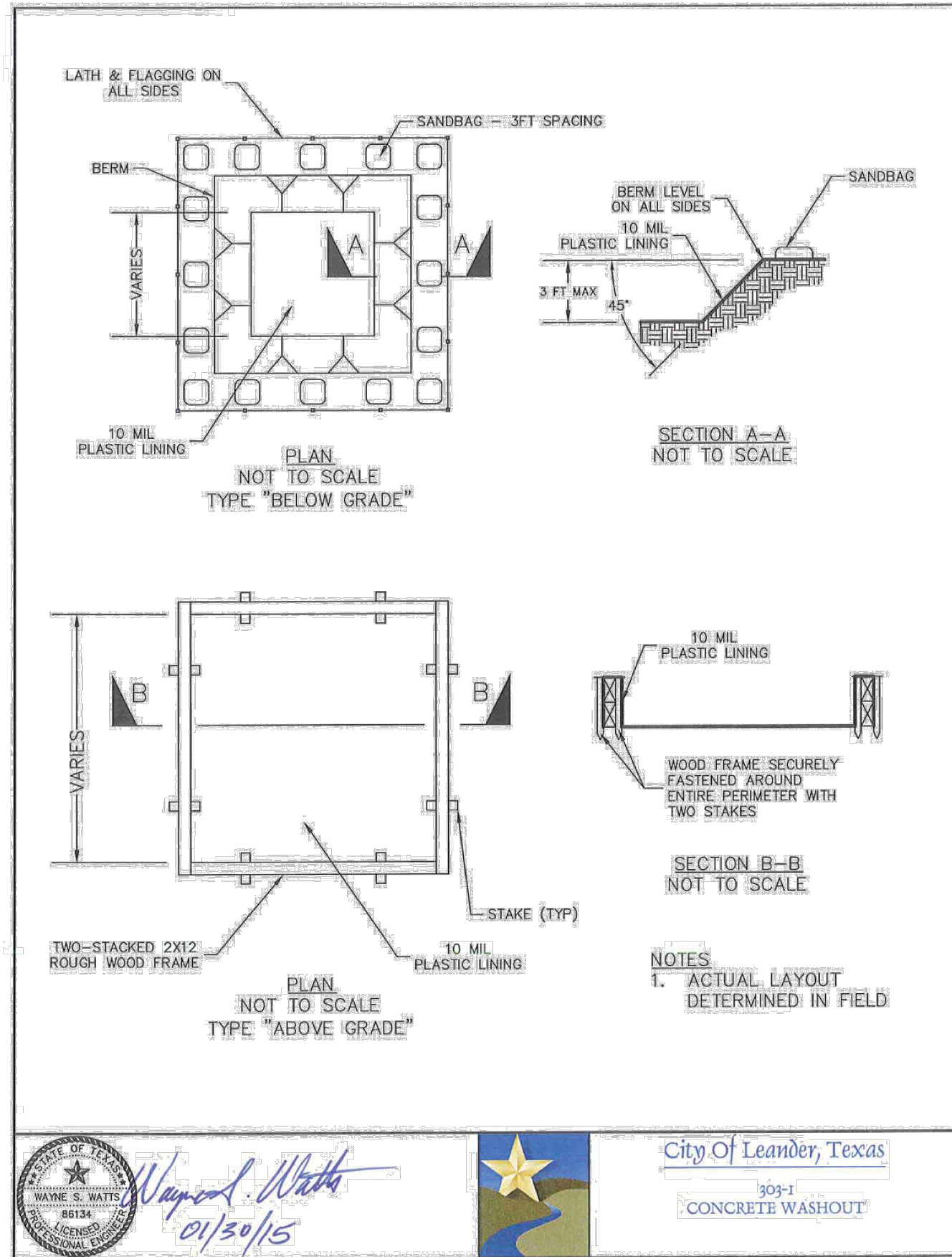
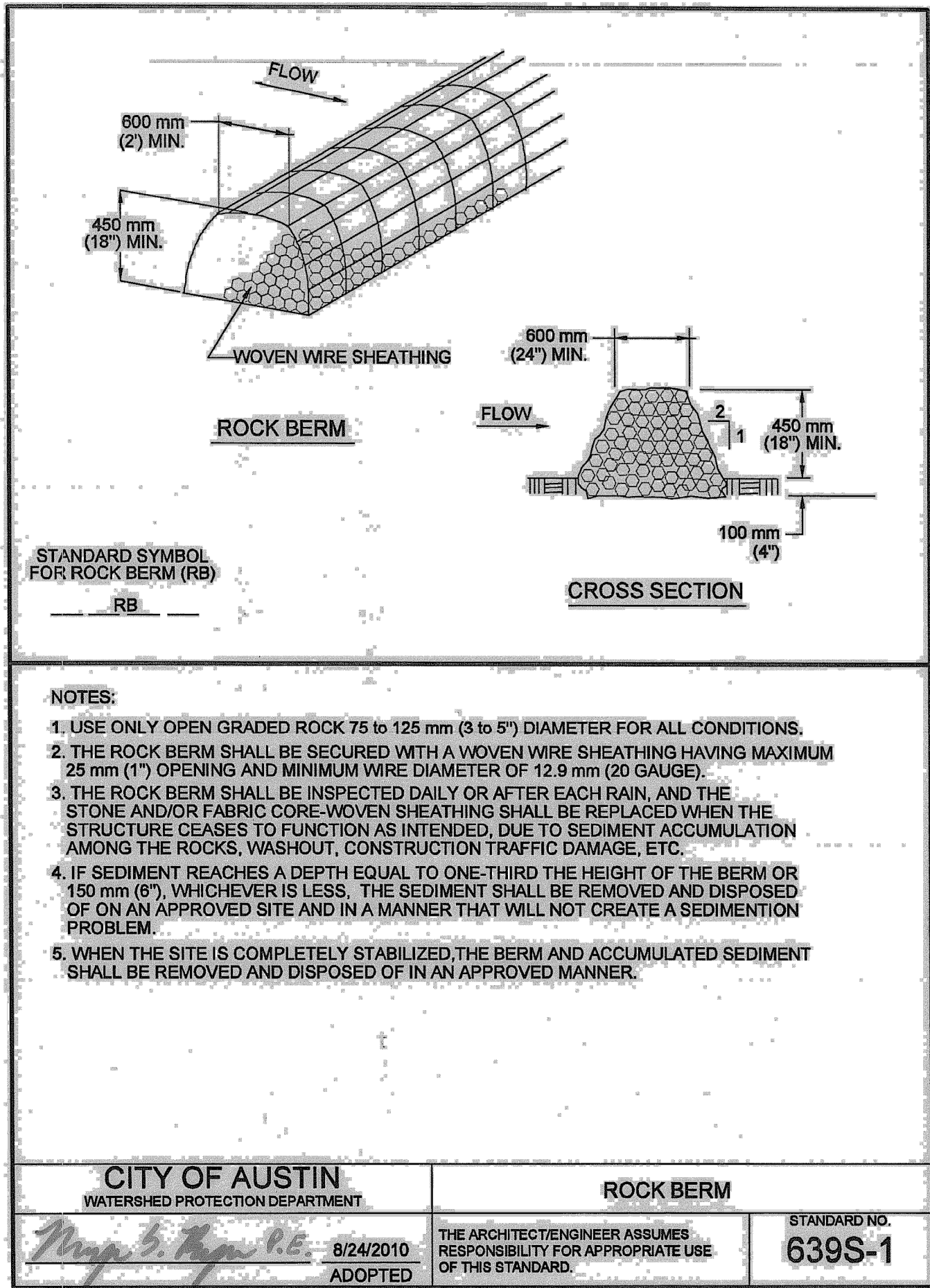
Drawn By

DK

Checked By

EM

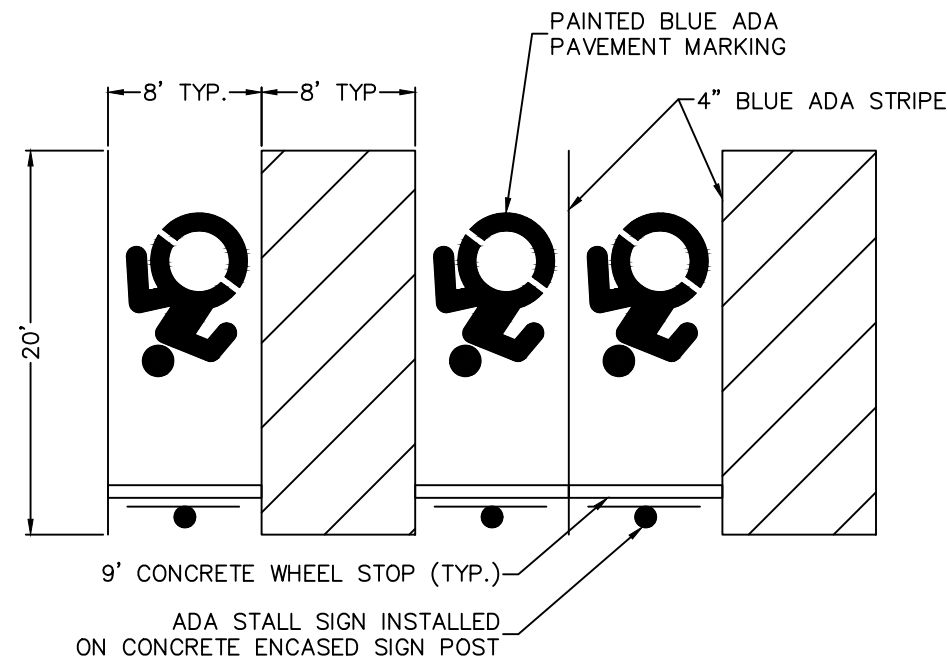
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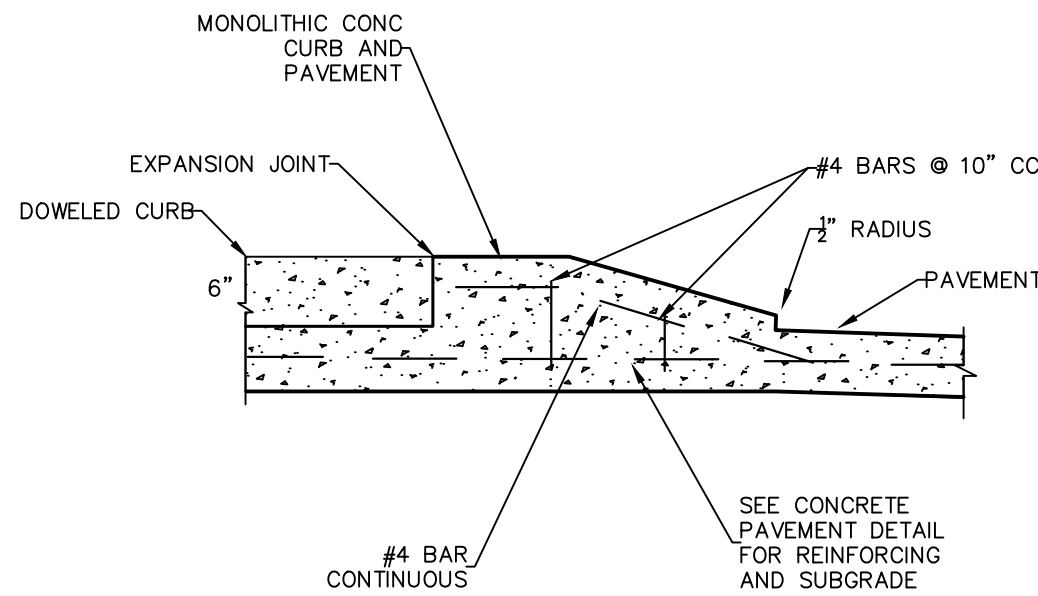
Date	Description	No.
Revisions		
 EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709 LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE FIRM REG. #F-13709		
Project		
HERITAGE GROVE ROAD LEANDER WILLIAMSON COUNTY TEXAS		
Drawing Title		
SOIL EROSION & SEDIMENT CONTROL DETAILS		
Project No.		Drawing No.
531020901		
Date		
04/06/2023		
Drawn By		
DK		20
Checked By		
EM		

NOTES:
Refer to the following City of LEANDER Details per the most current City of LEANDER Standards Manual:

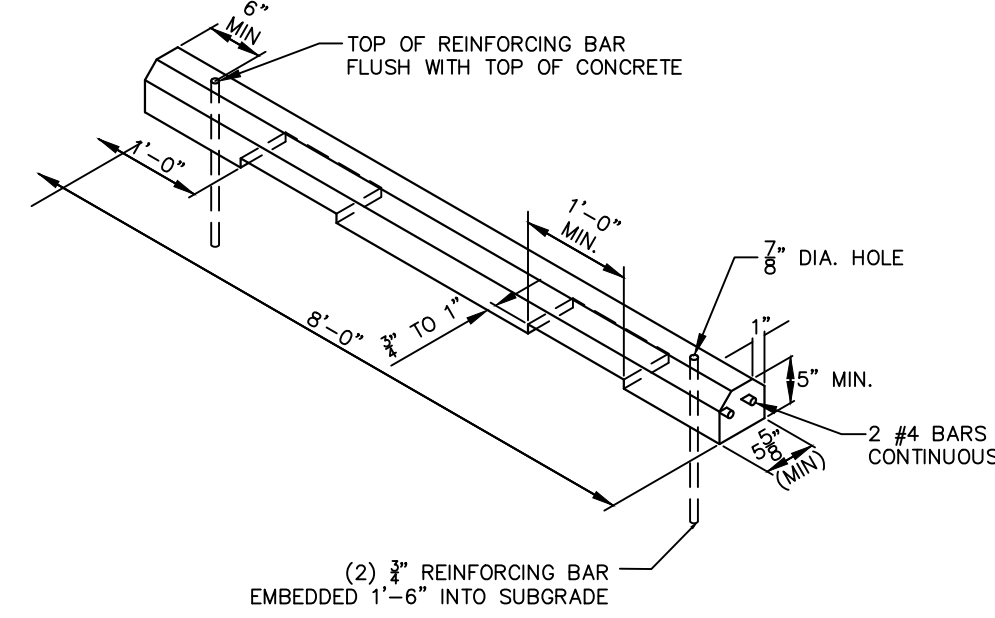
- Series 100 PIPE AND APPURTENANCES
- Series 200 CONCRETE, STRUCTURES & ROADWAY
- Series 300 ENVIRONMENTAL
- Series 400 TRAFFIC CONTROL
- Series 500 FIRE PROTECTION



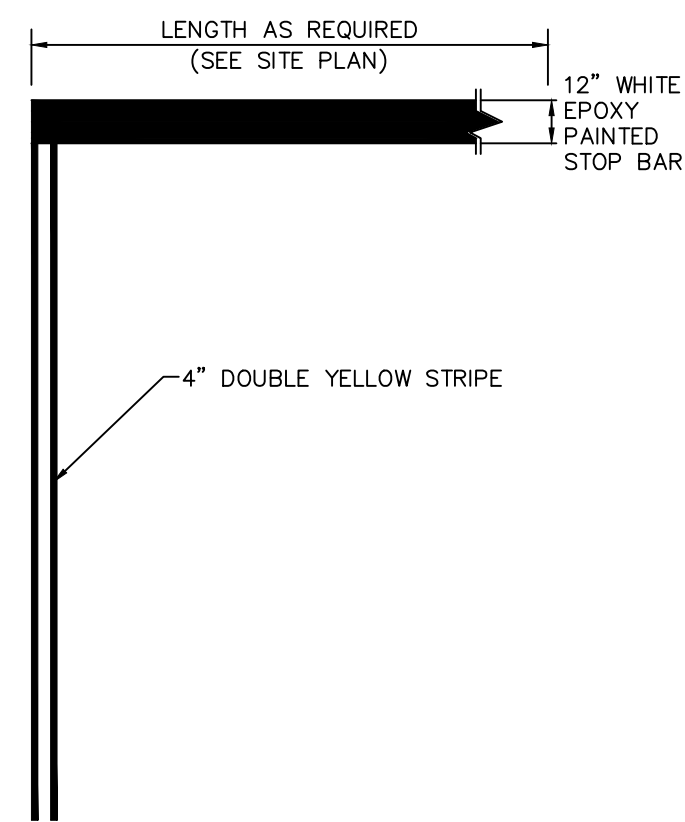
1 ACCESSIBLE PARKING STALL DETAIL
N.T.S.



2 CURB TAPER
N.T.S.



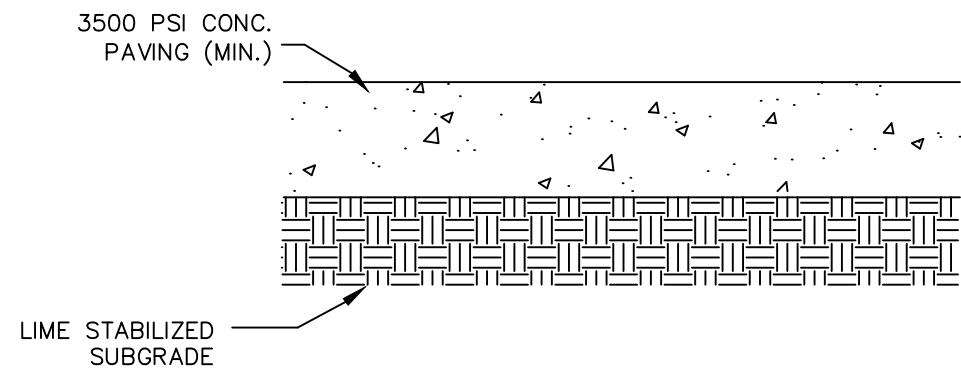
3 PASSENGER CAR WHEEL STOP
N.T.S.



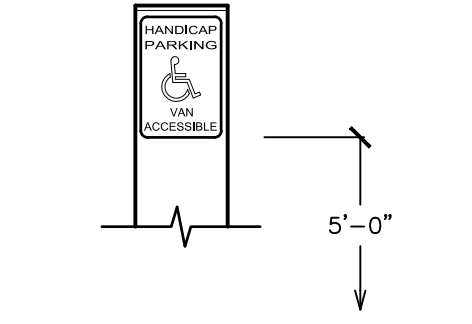
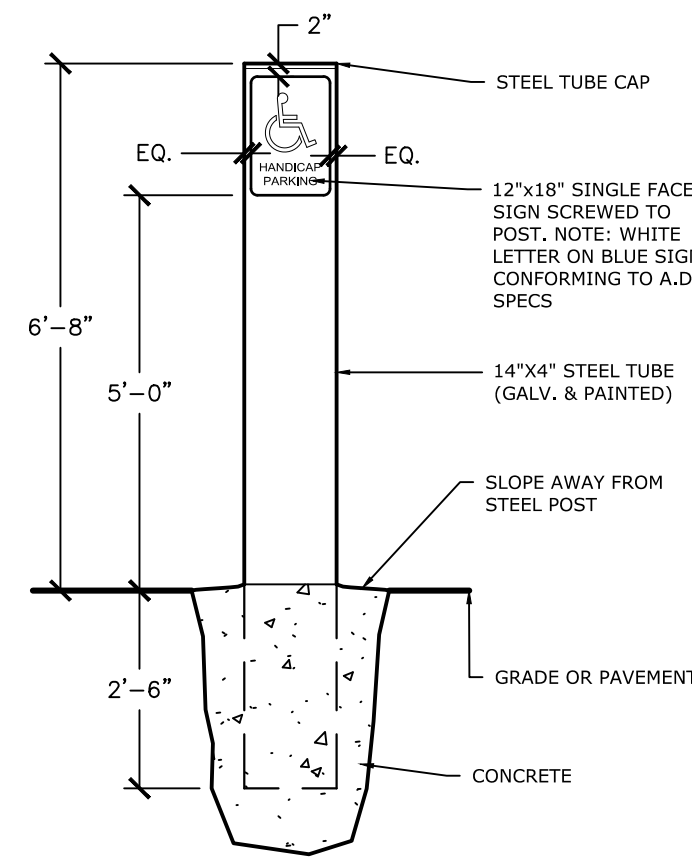
4 STOP BAR
N.T.S.

RIGID PAVEMENT RECOMMENDED THICKNESS (INCHES)			
PAVEMENT MATERIALS	LIGHT DUTY CONCRETE	REGULAR DUTY CONCRETE	HEAVY DUTY CONCRETE
PORTLAND CEMENT CONCRETE f' _c =3,500psi	5	6	7
LIME STABILIZED SUBGRADE	8	8	8

NOTES:
DIMENSION INFORMATION PROVIDED BY THE GEOTECHNICAL EVALUATION OF SUBSURFACE CONDITIONS PROVIDED BY PROFESSIONAL SERVICE INDUSTRIES, INC. PROVIDED ON OCTOBER 7, 2022.
LIGHT DUTY PAVEMENT TO HAVE #3 BARS SPACED ON 24-INCH INTERVALS OR 12X12 - W5 X W5 WELDED WIRE FABRIC
REGULAR DUTY PAVEMENT TO HAVE #3 BARS SPACED ON 18-INCH INTERVALS OR 12X12 - W6 X W6 WELDED WIRE FABRIC
HEAVY DUTY PAVEMENT TO HAVE #3 BARS SPACED ON 18-INCH INTERVALS OR 12X12 - W6.5 X W6.5 WELDED WIRE FABRIC



5 CONCRETE PAVEMENT
N.T.S.



NOTE: FOR USE AT PARKING SPACES NOTED ON PLAN AS "VAN ACCESSIBLE"

6 ACCESSIBLE PARKING SIGN
N.T.S.

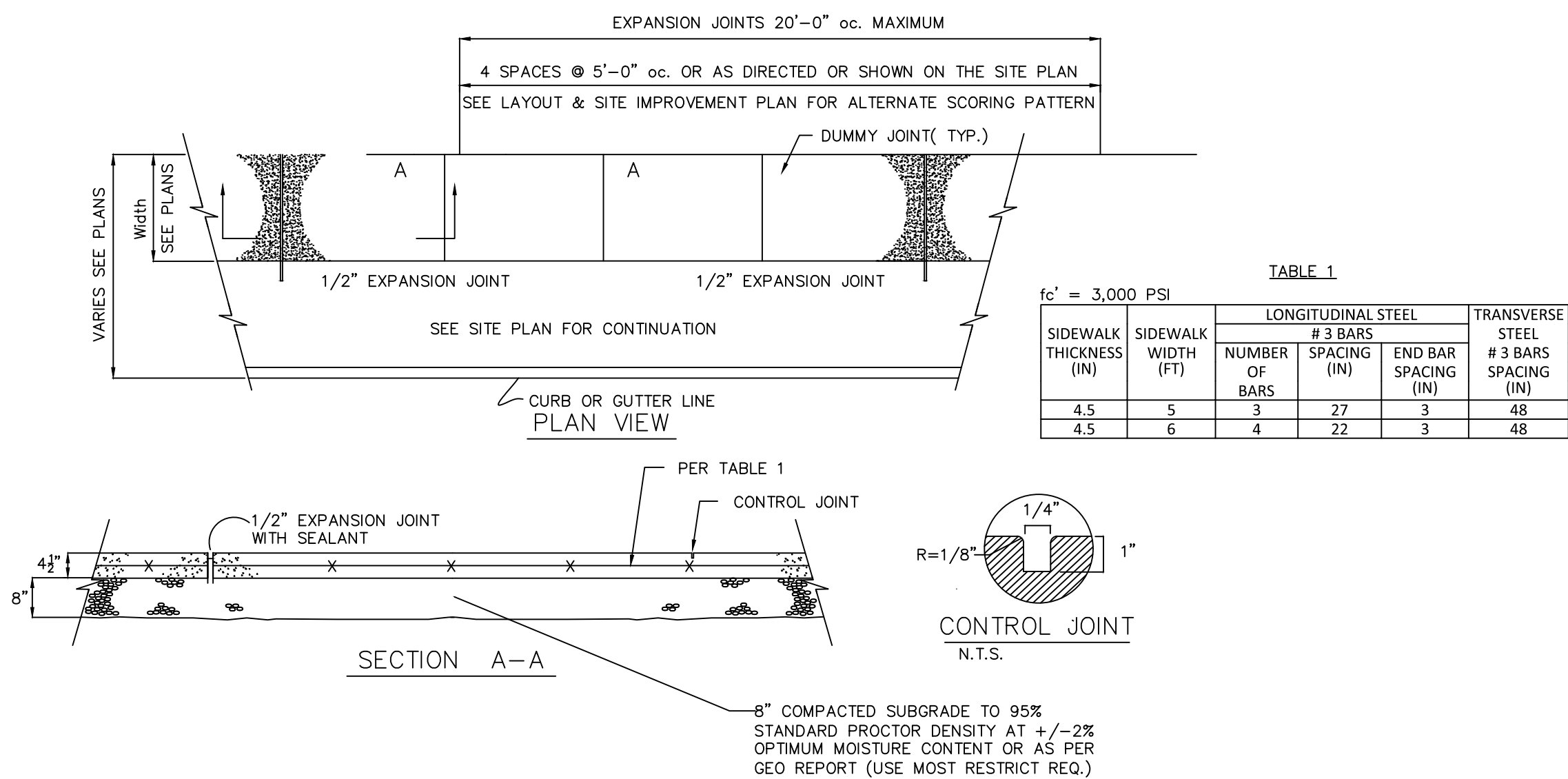
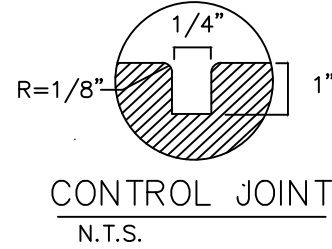
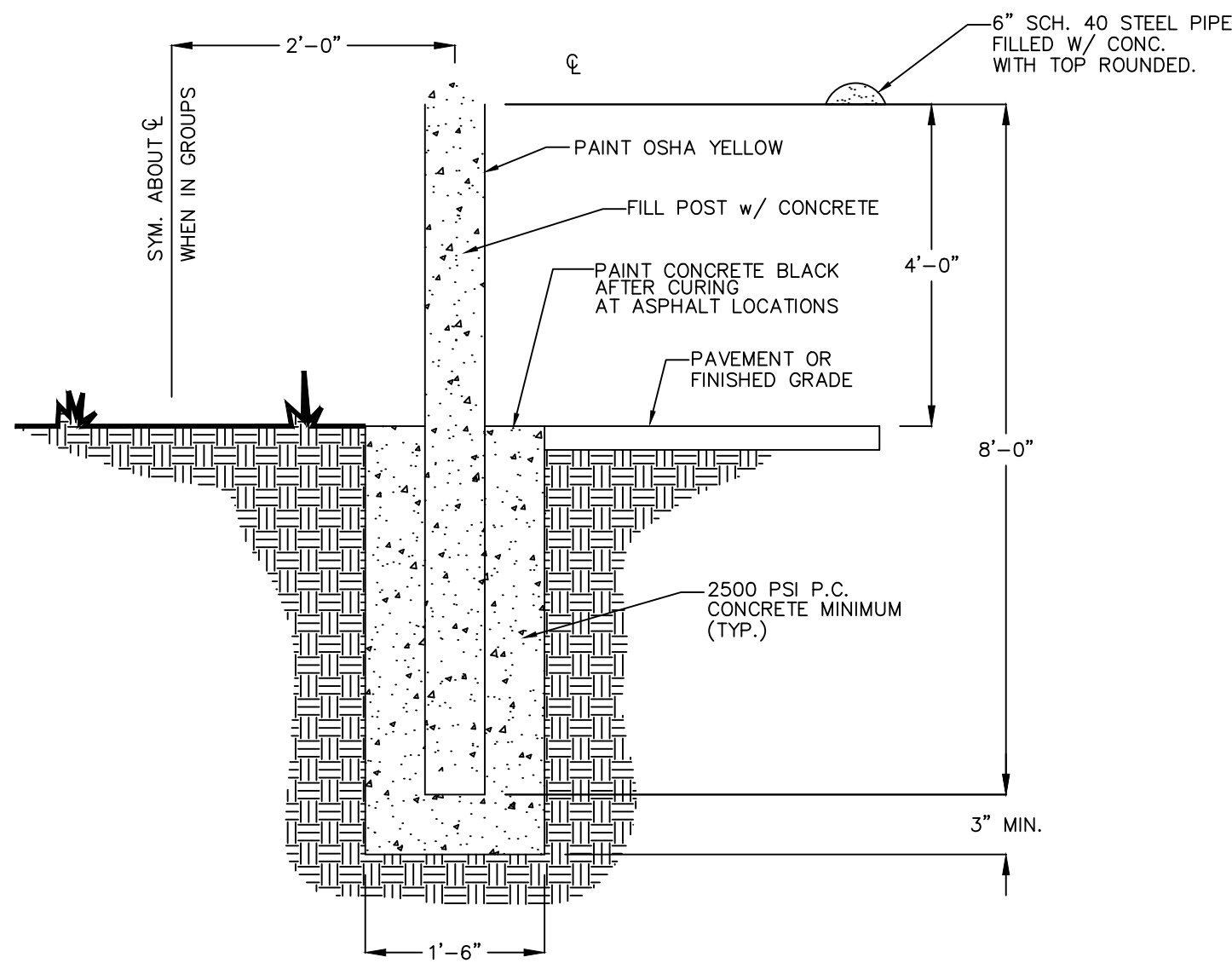


TABLE 1					
SIDEWALK THICKNESS (IN)	SIDEWALK WIDTH (FT)	LONGITUDINAL STEEL #3 BARS			TRANSVERSE STEEL #3 BARS
		NUMBER OF BARS	SPACING (IN)	END BAR SPACING (IN)	SPACING (IN)
4.5	5	3	27	3	48
4.5	6	4	22	3	48

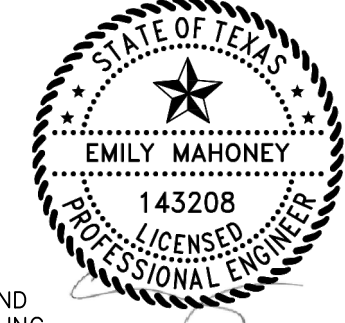


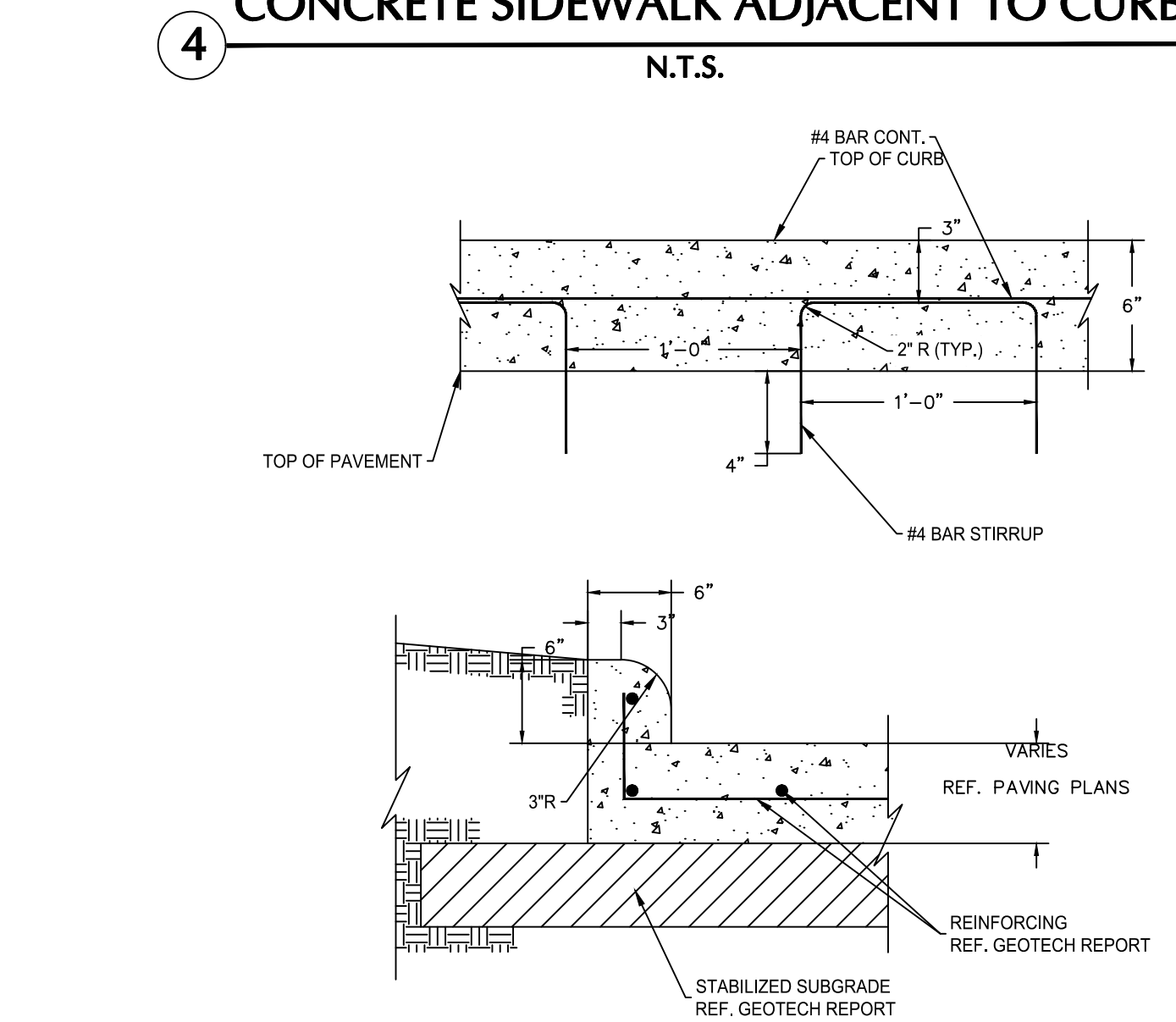
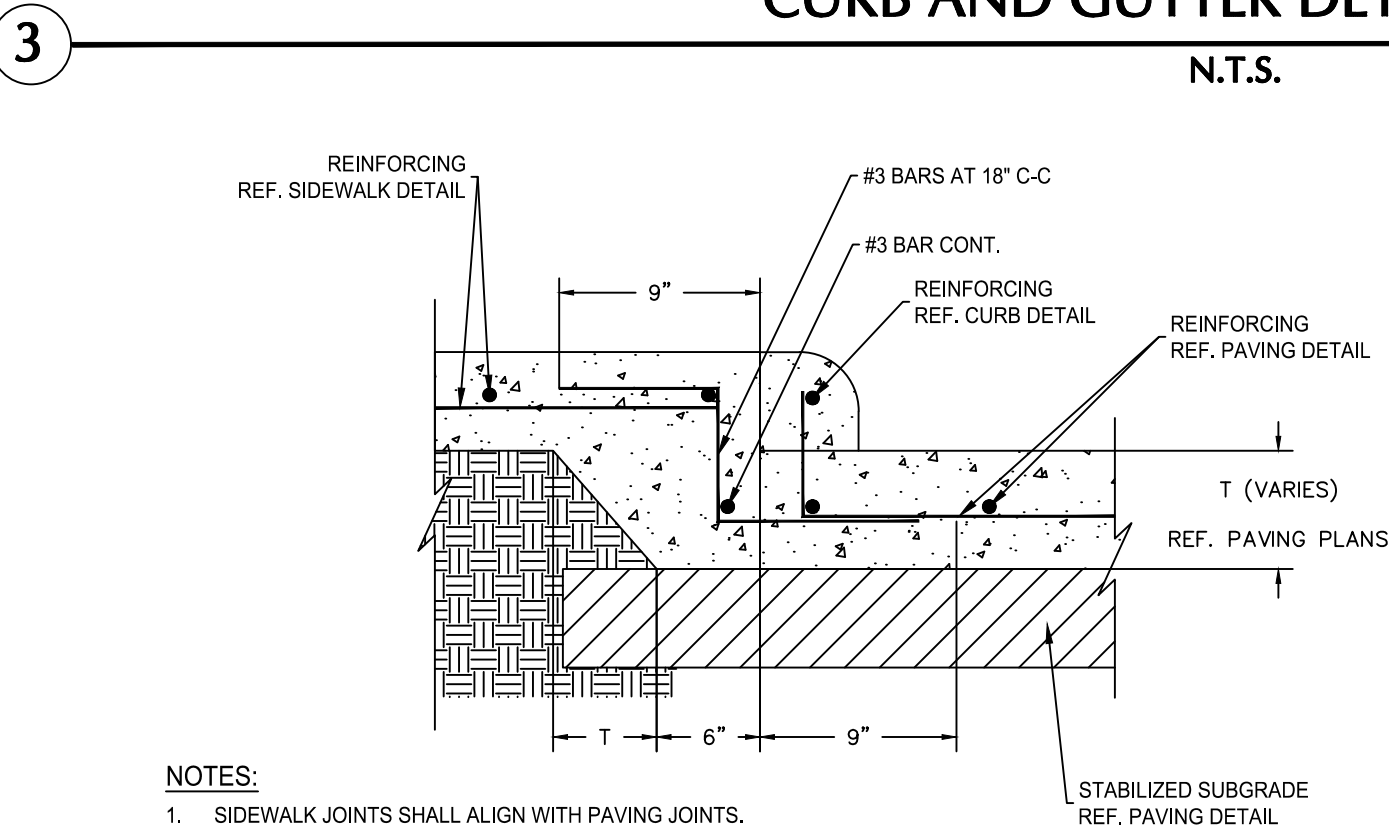
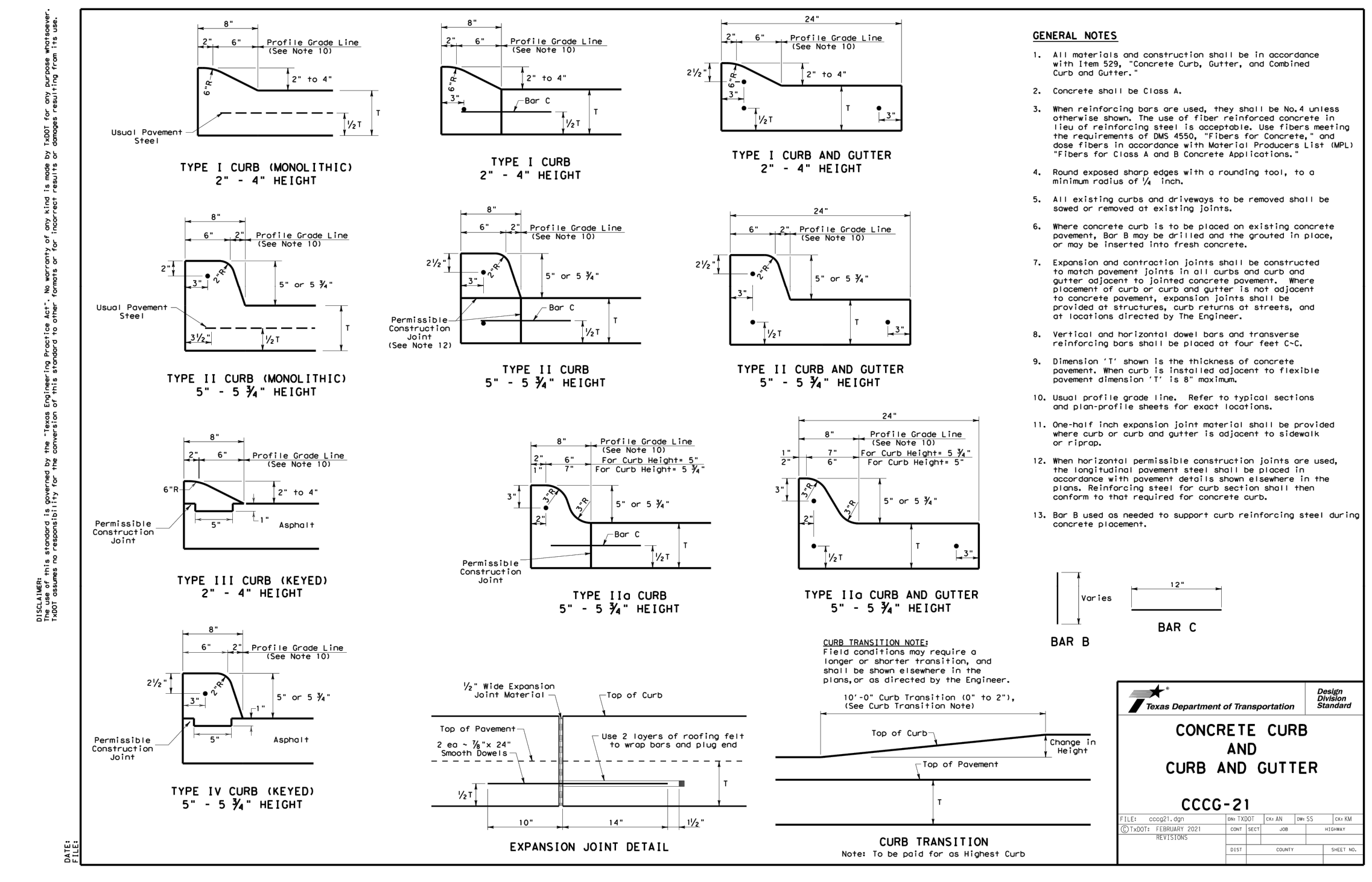
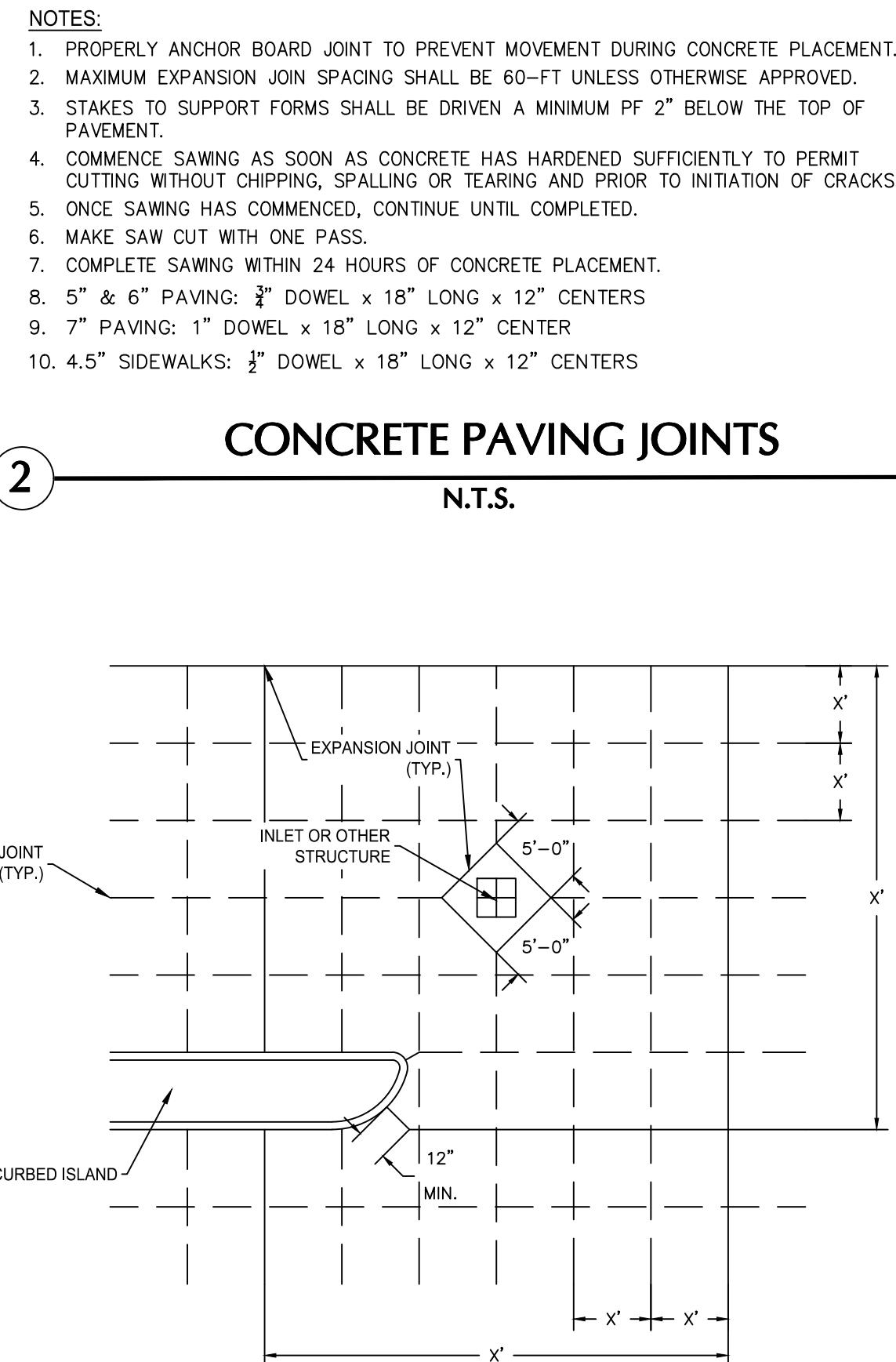
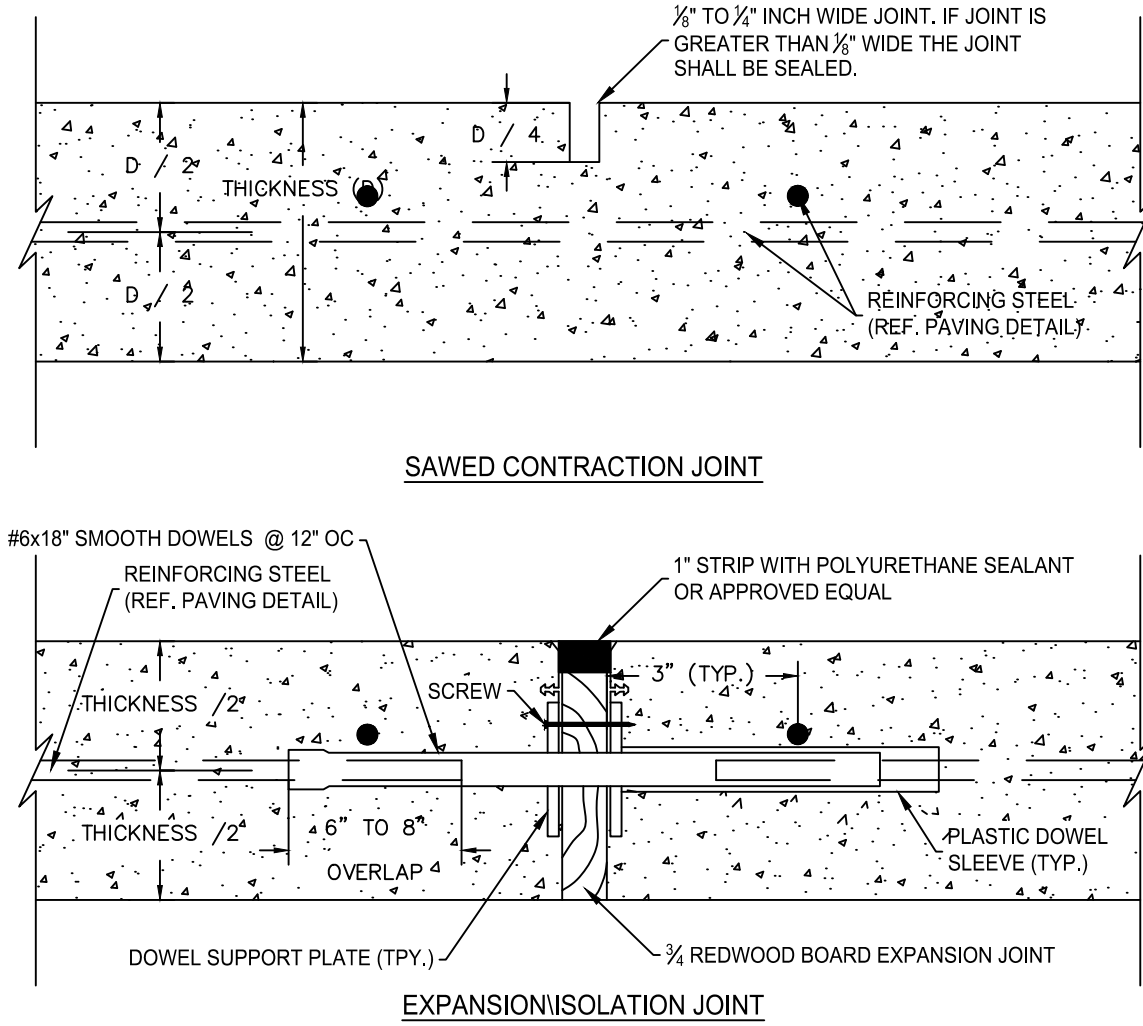
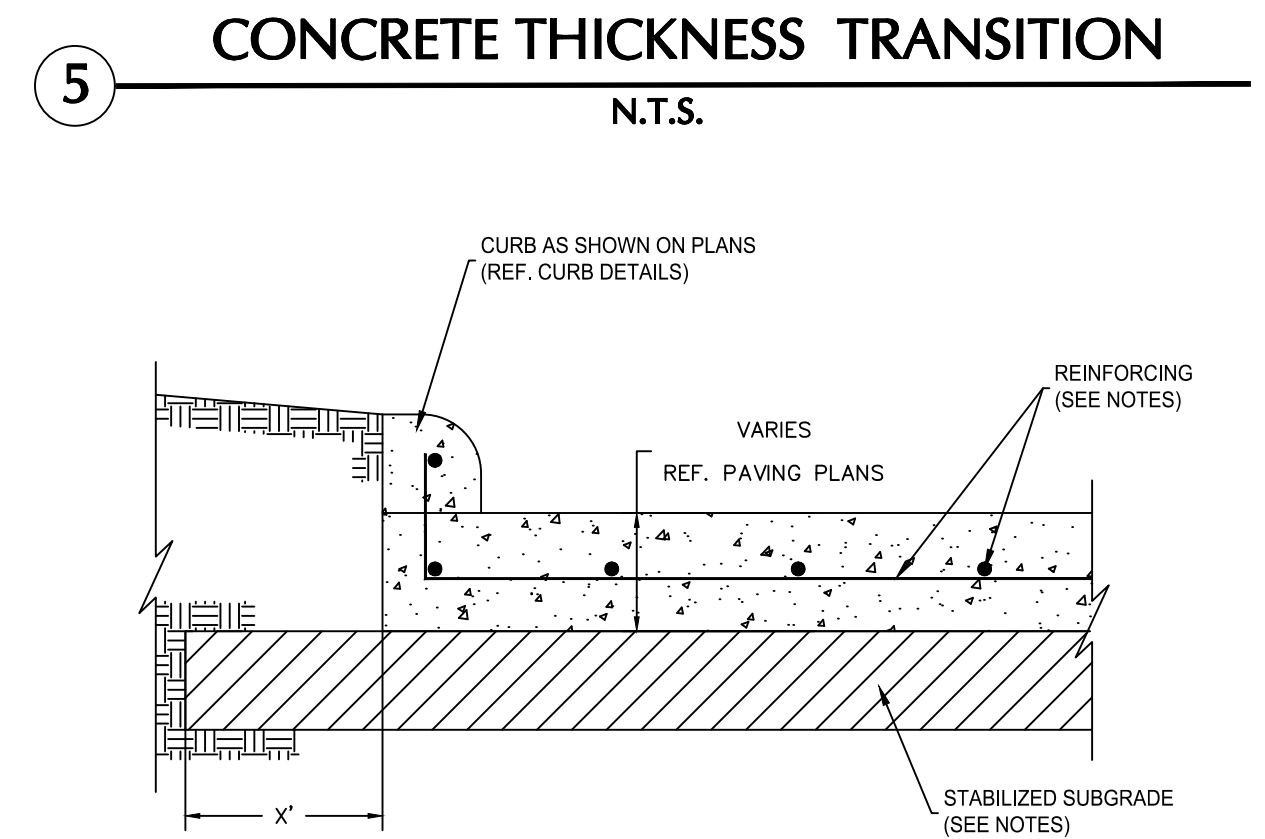
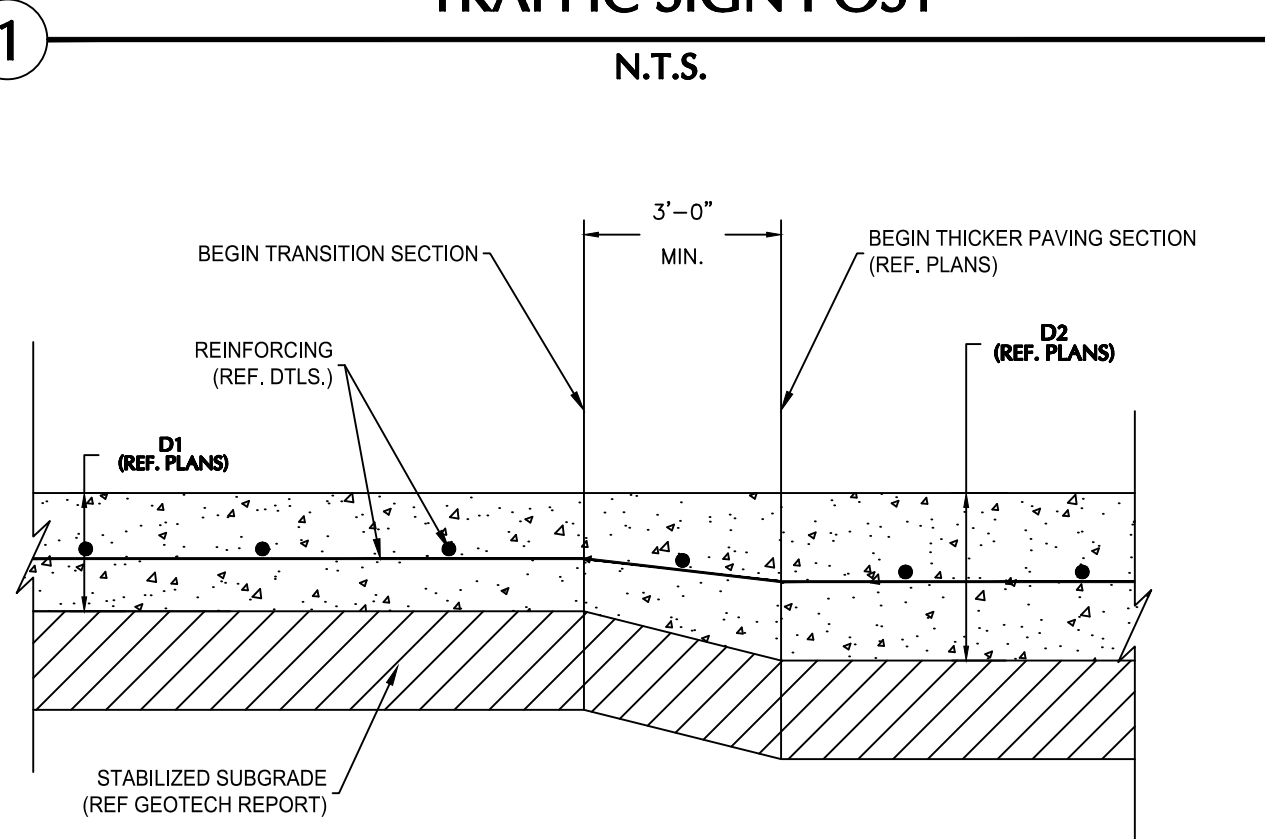
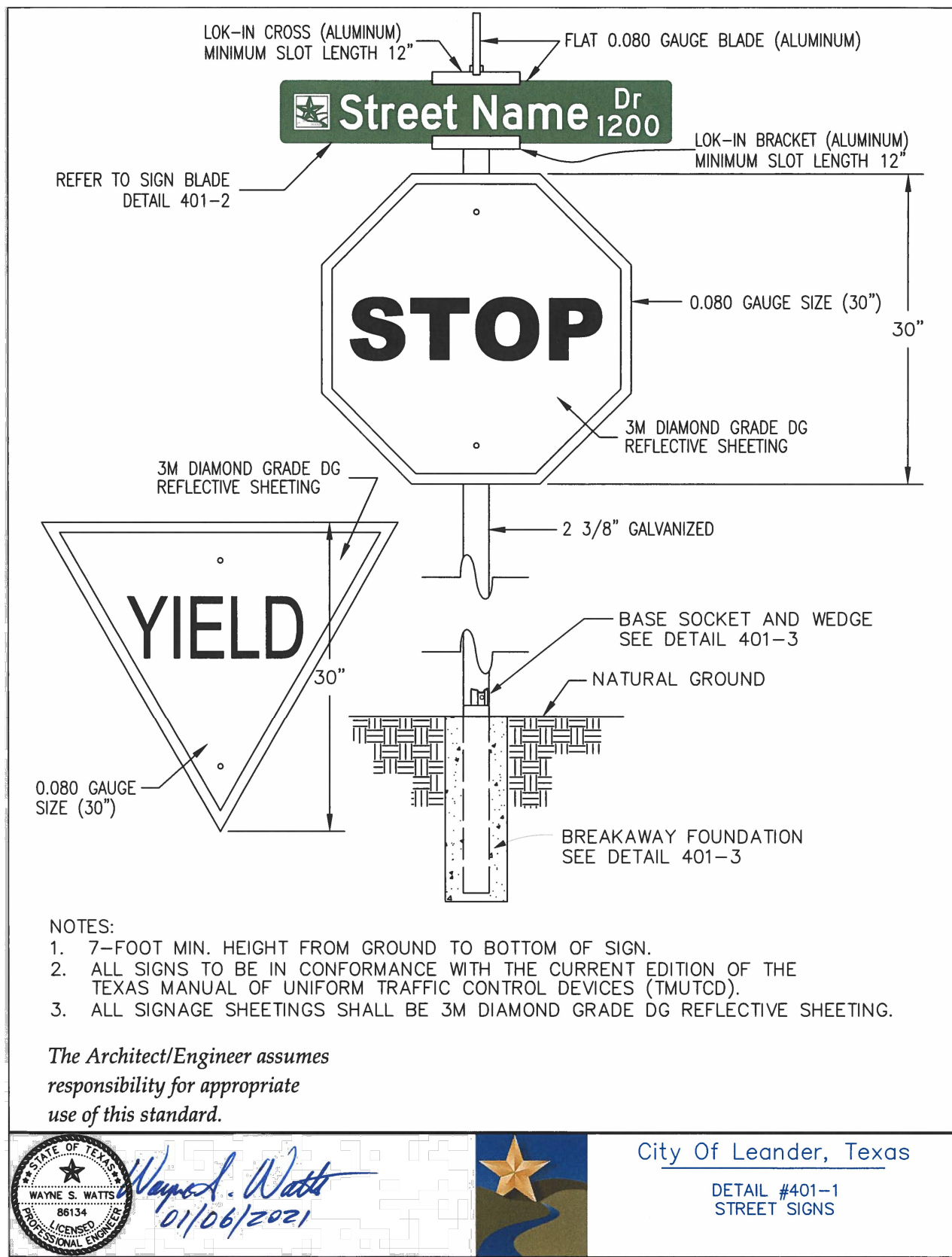
7 CONCRETE SIDEWALK/LANDING
N.T.S.

- NOTE:
- CONTROL JOINTS IN HEAVY DUTY CONCRETE PAVEMENT TO BE PLACED BETWEEN 15 AND 45 FEET FROM EDGE OF BUILDING AND/OR 65 FEET FROM EDGE OF BUILDING.
 - LONGITUDINAL CONTROL JOINTS IN HEAVY DUTY CONCRETE PAVEMENT TO ALIGN WITH STAIRS ALONG BUILDING WHEN POSSIBLE.

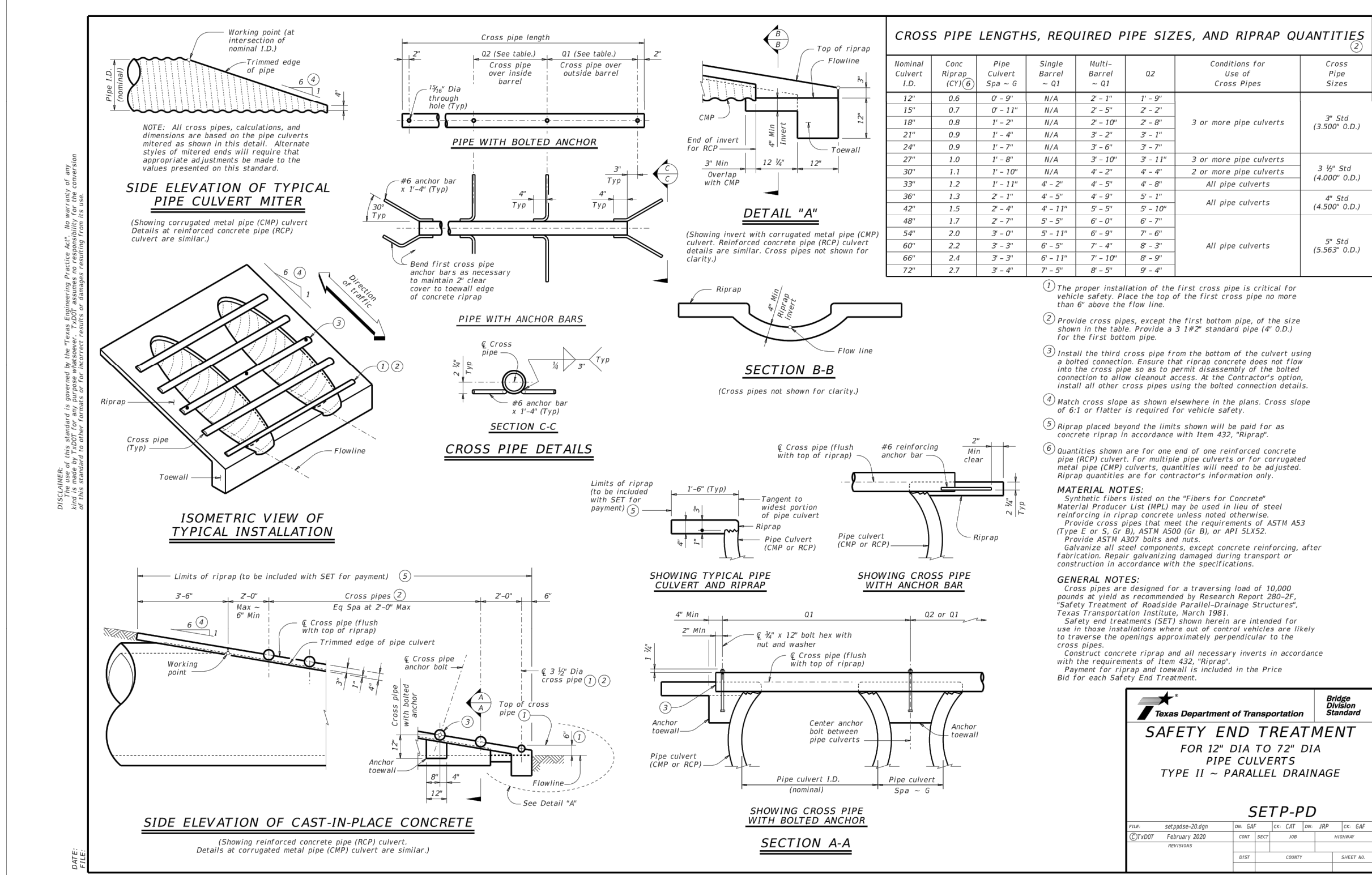


8 BOLLARD
N.T.S.

Date	Description	No.	
Revisions			
 EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709			
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE FIRM REG. #F-13709			
Project HERITAGE GROVE ROAD LEANDER WILLIAMSON COUNTY TEXAS Drawing Title			
Project No. 531020901		21	
Date 04/06/2023			
Drawn By DK			
Checked By EM			

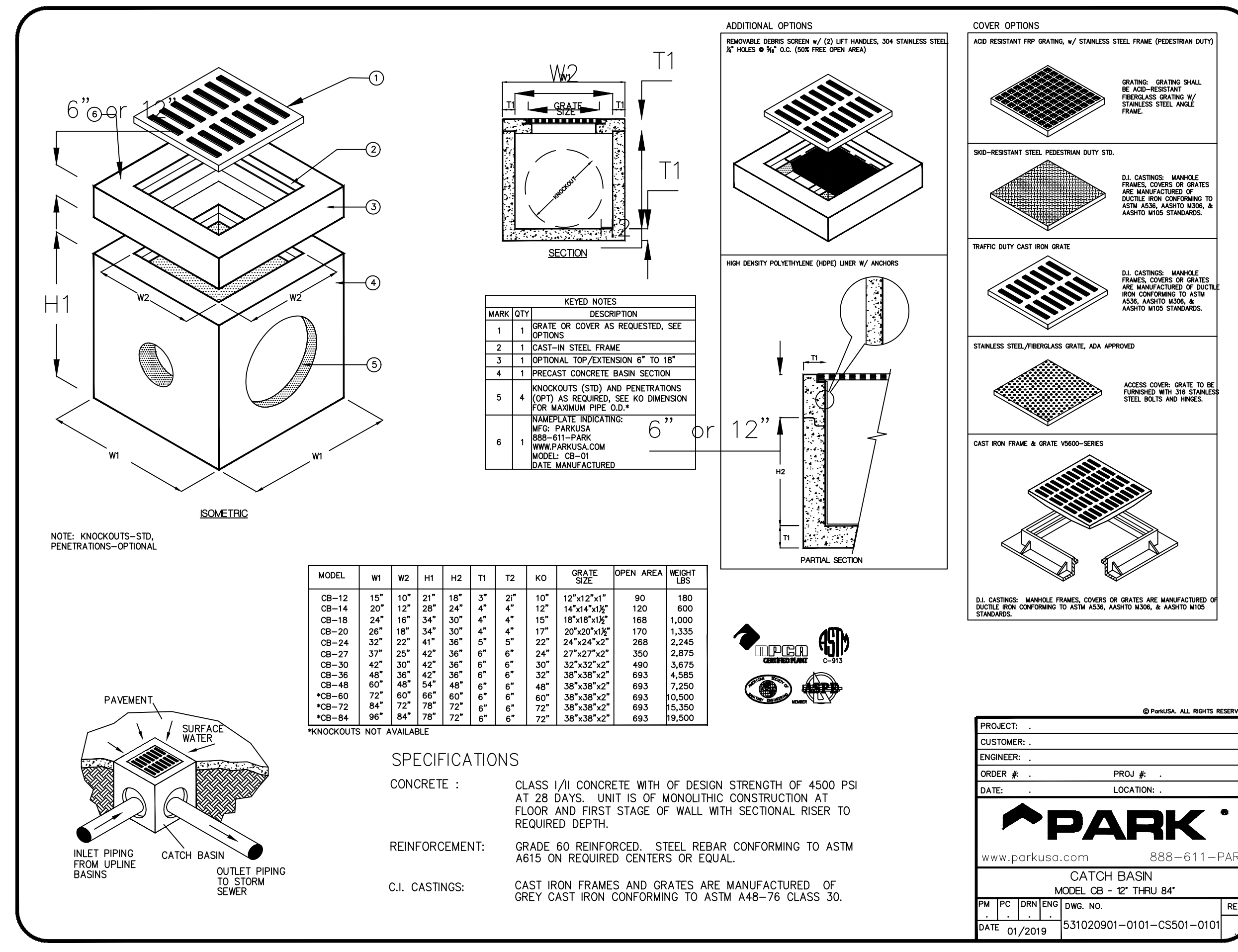


Date	Description	No.
Revisions		
STATE OF TEXAS EMILY MAHONEY 143208 LICENSED PROFESSIONAL ENGINEER		
EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE FIRM REG. #F-13709		
Project		
HERITAGE GROVE ROAD		
LEANDER		
WILLIAMSON COUNTY TEXAS		
Drawing Title		
SITE DETAILS		
Project No.	Drawing No.	
531020901	22	
Date		
04/06/2023		
Drawn By		
DK		
Checked By		
EM		



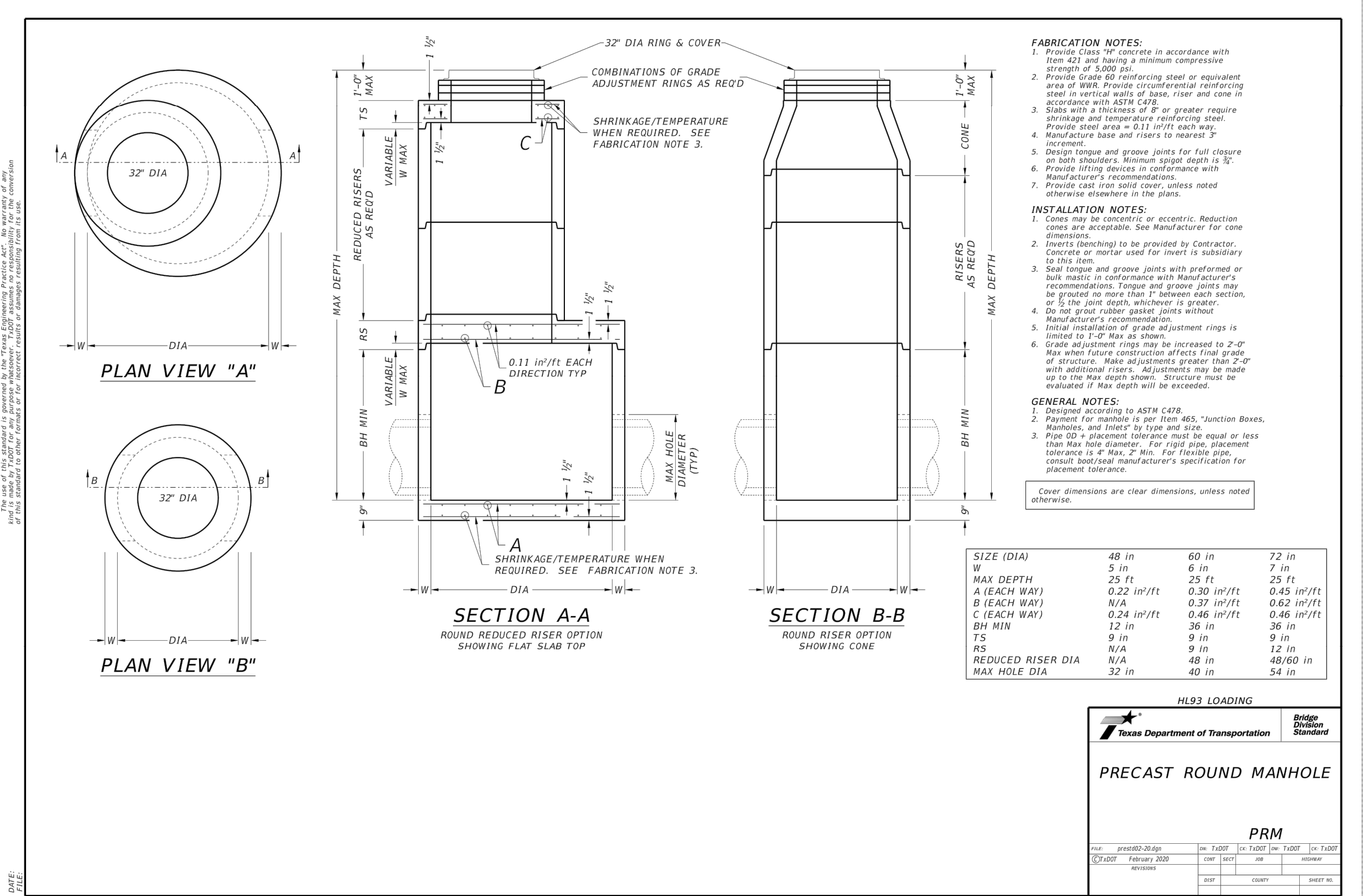
SAFETY END TREATMENT (TXDOT)

N.T.S.



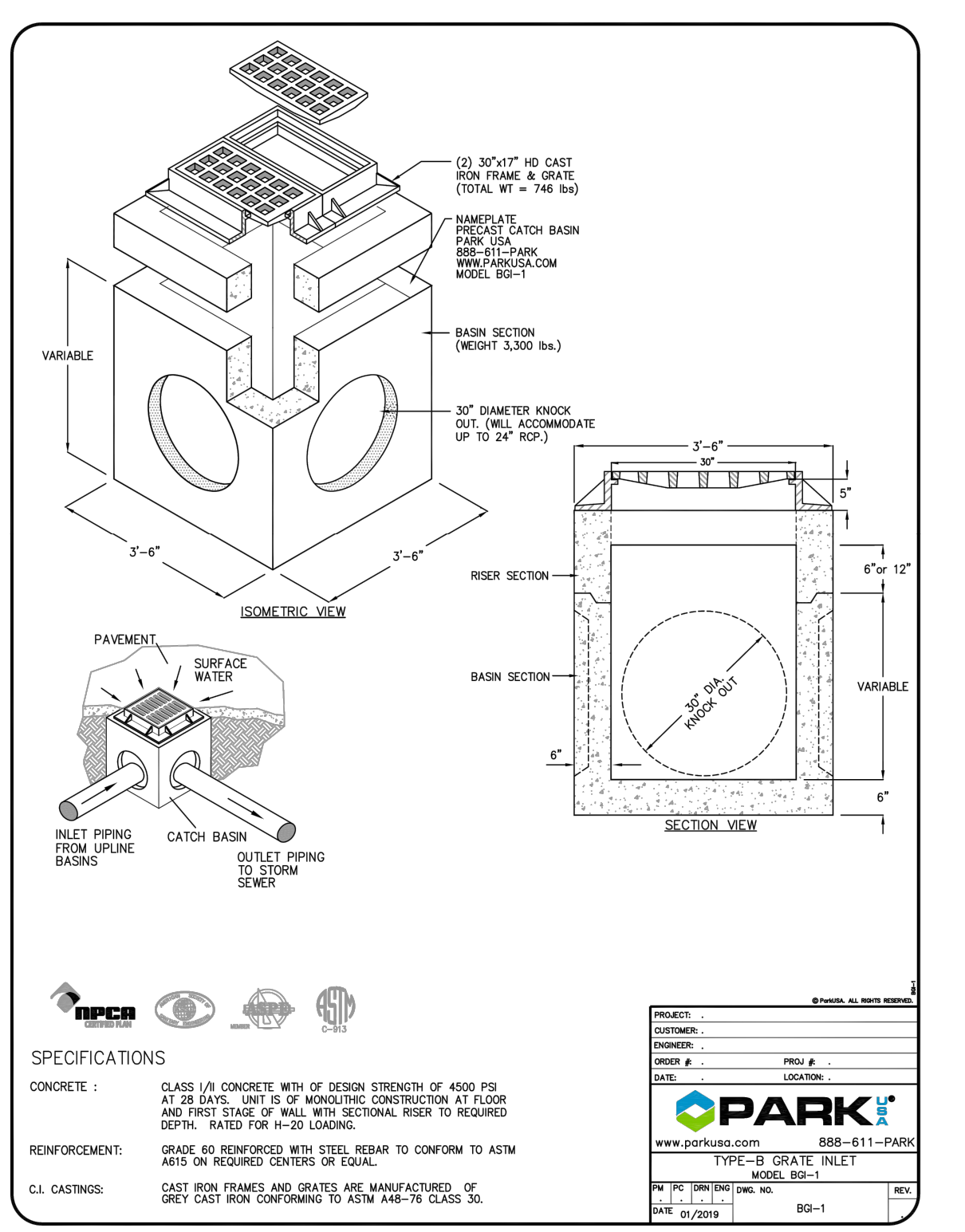
CATCH BASIN

N.T.S.



STORM MANHOLE

N.T.S.



DOUBLE CATCH BASIN

N.T.S.

Project details and specifications for the catch basin project, including project name, location, and drawing title.

Project Name: HERITAGE GROVE ROAD

Location: LEANDER, TEXAS

Drawing Title: SITE DETAILS

Project No: 531020901

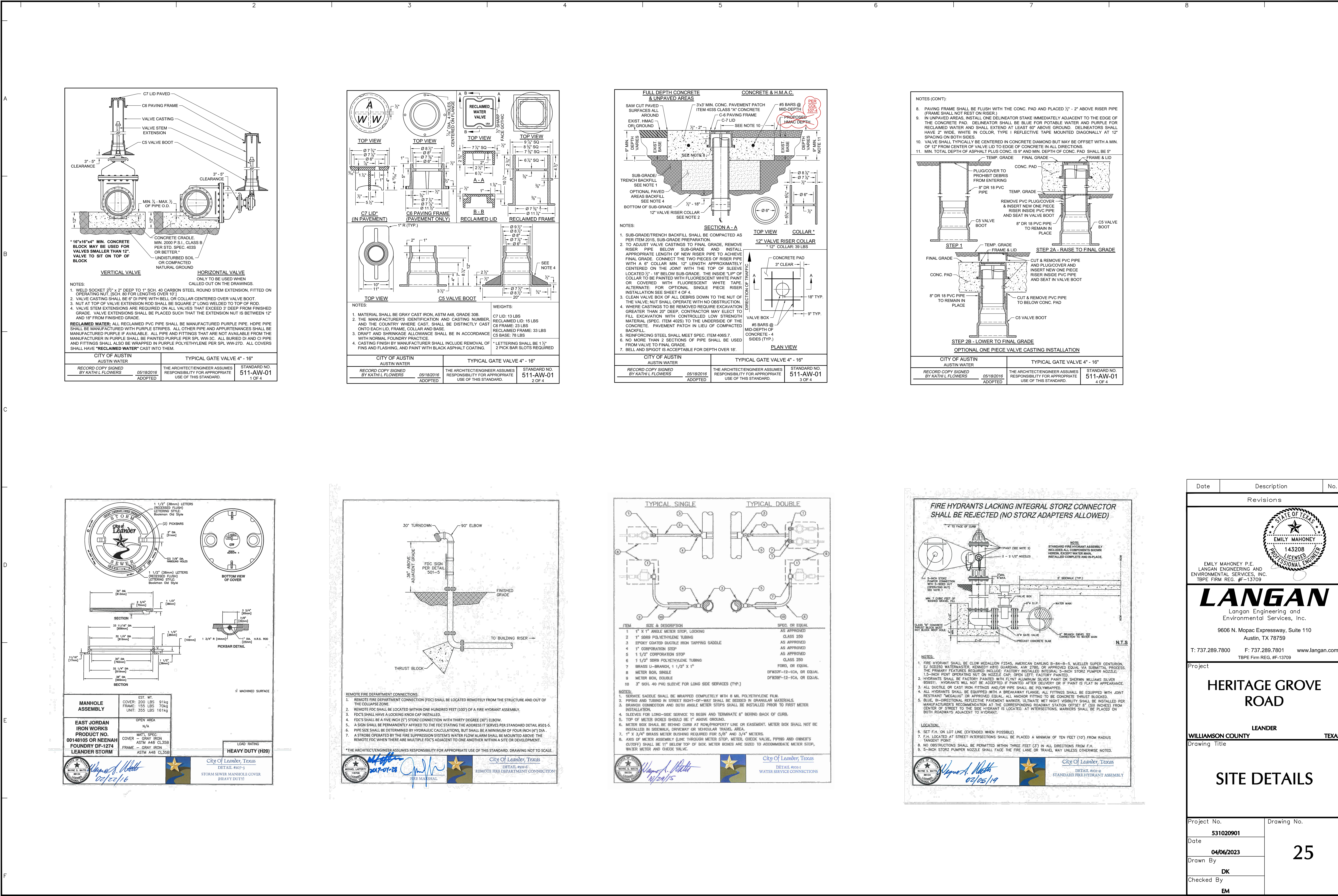
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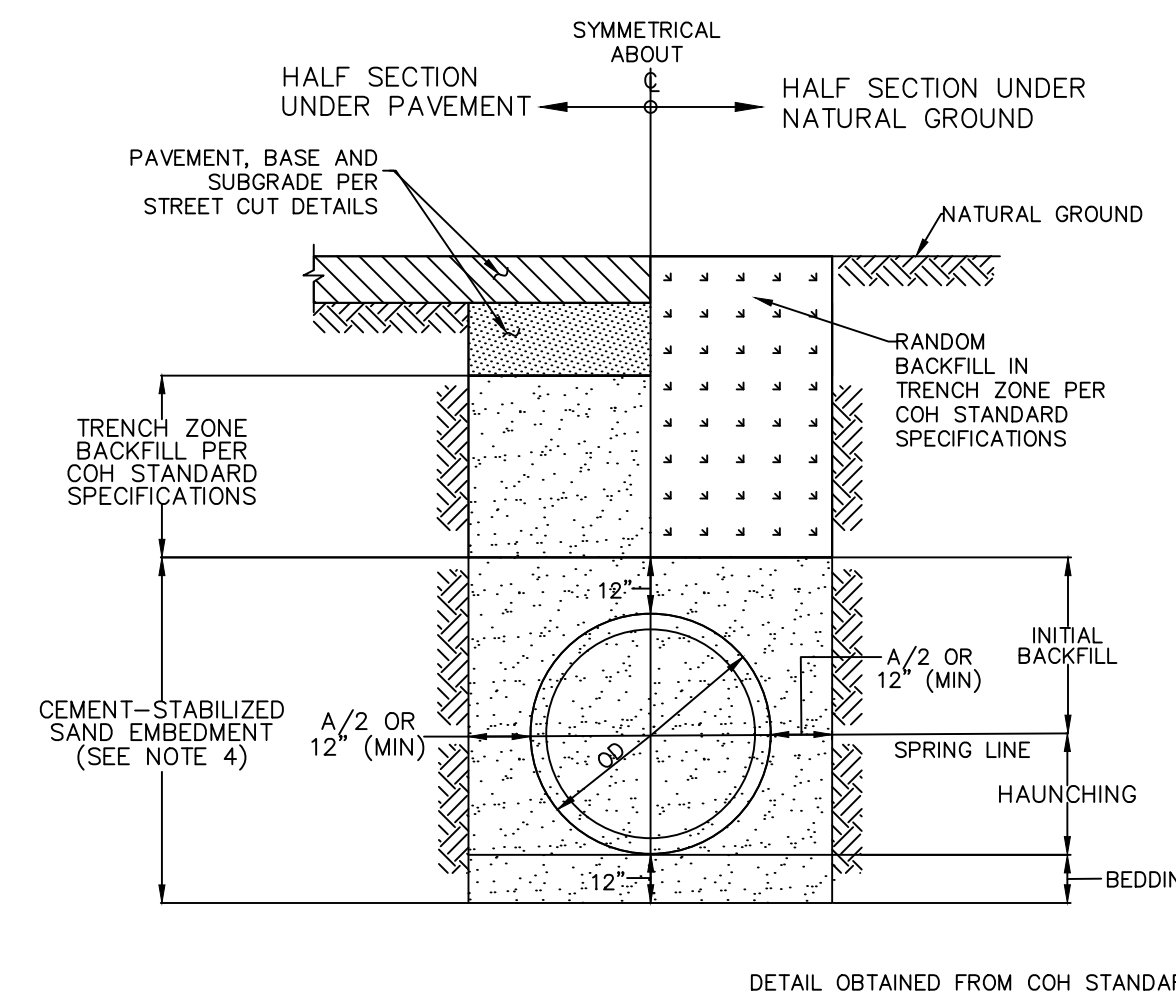
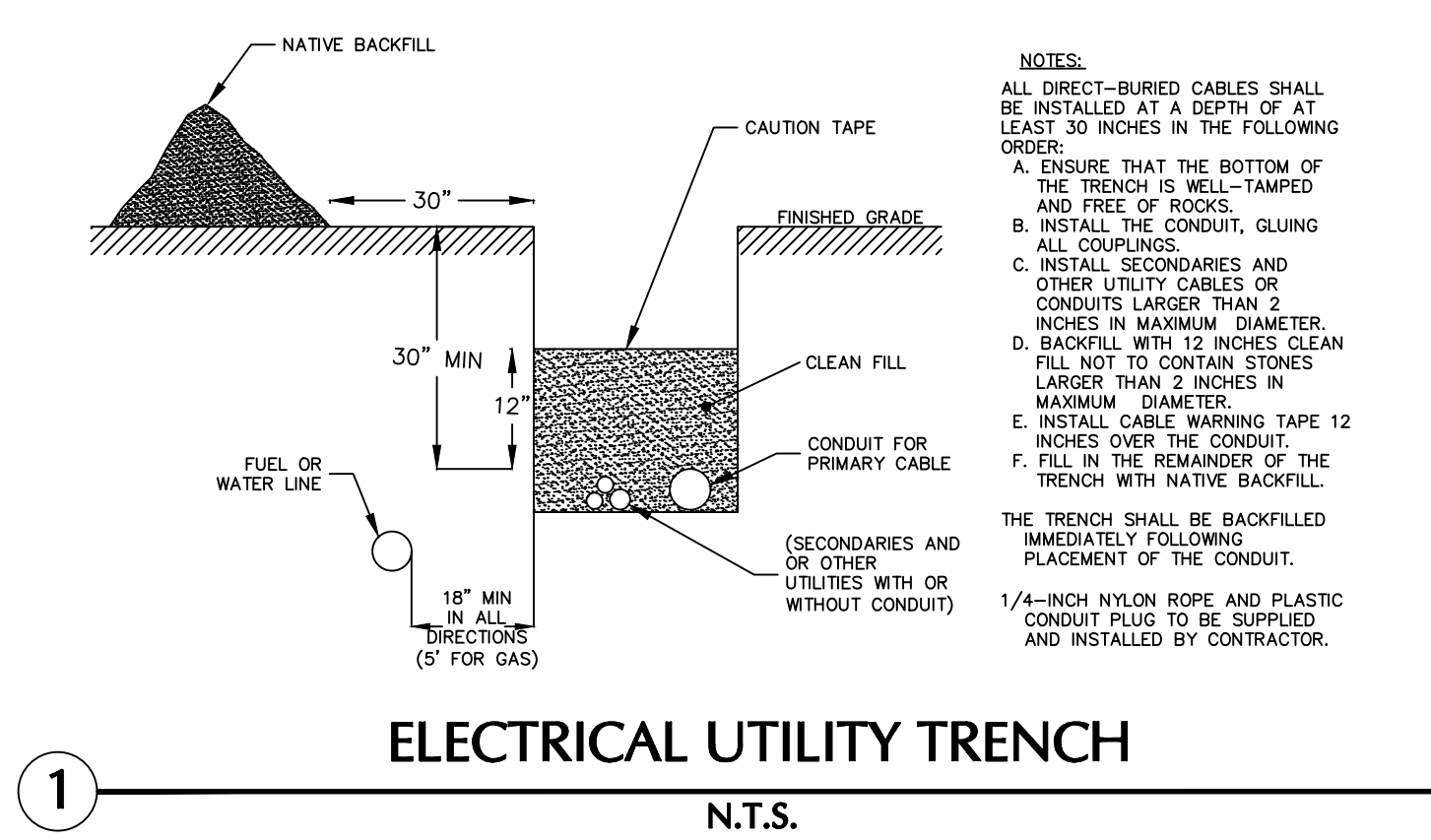
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Checked By: EM

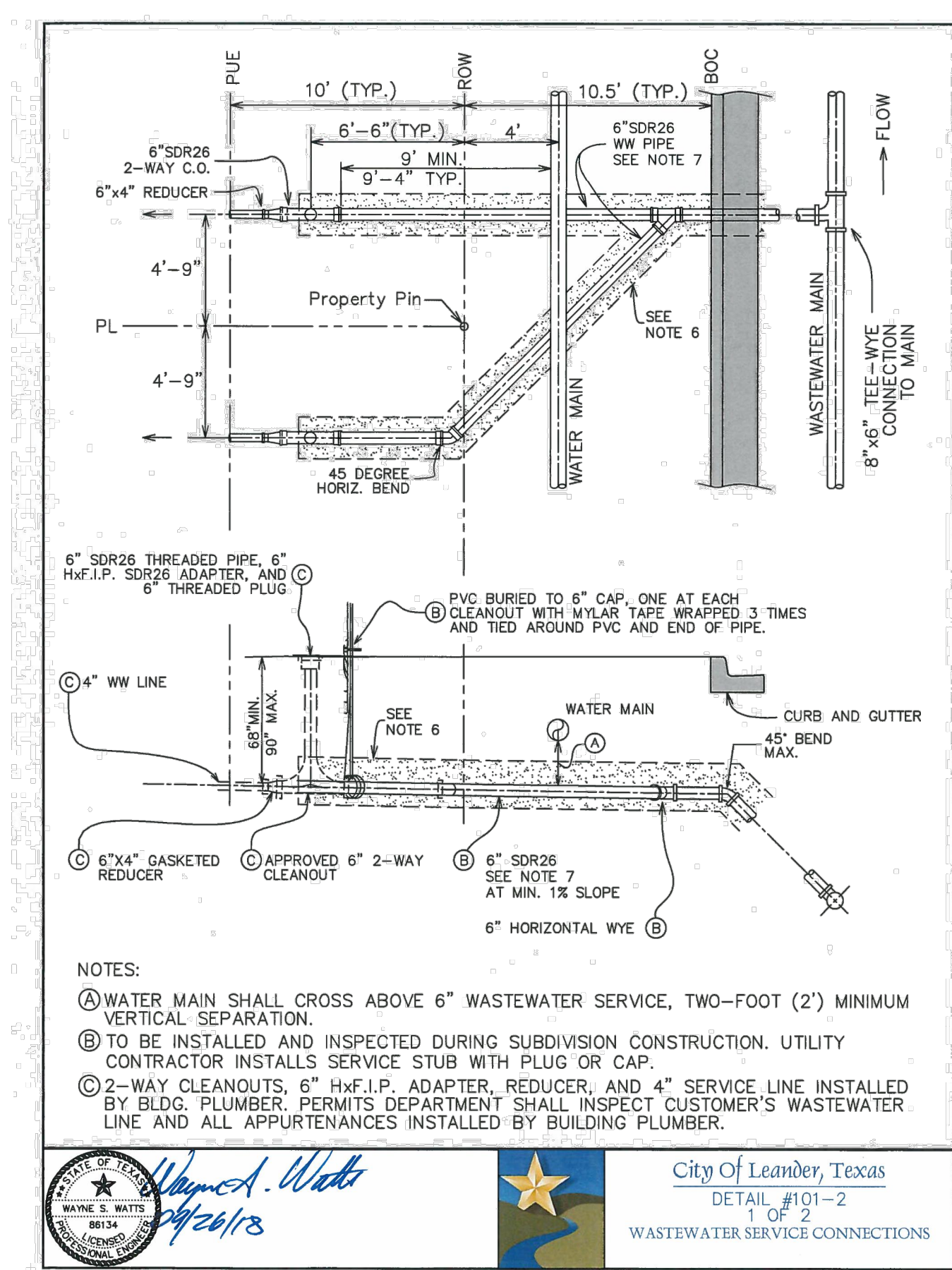
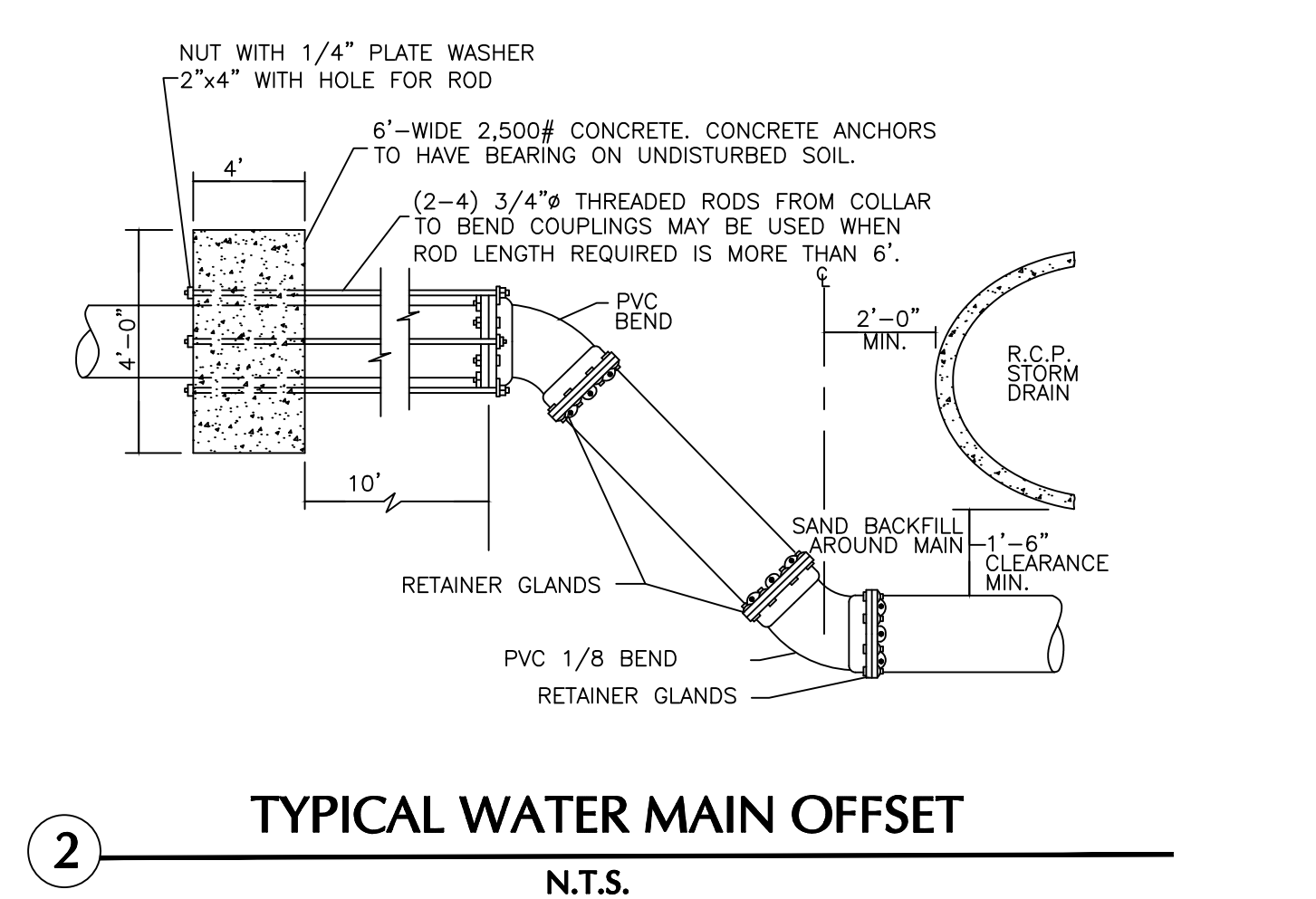
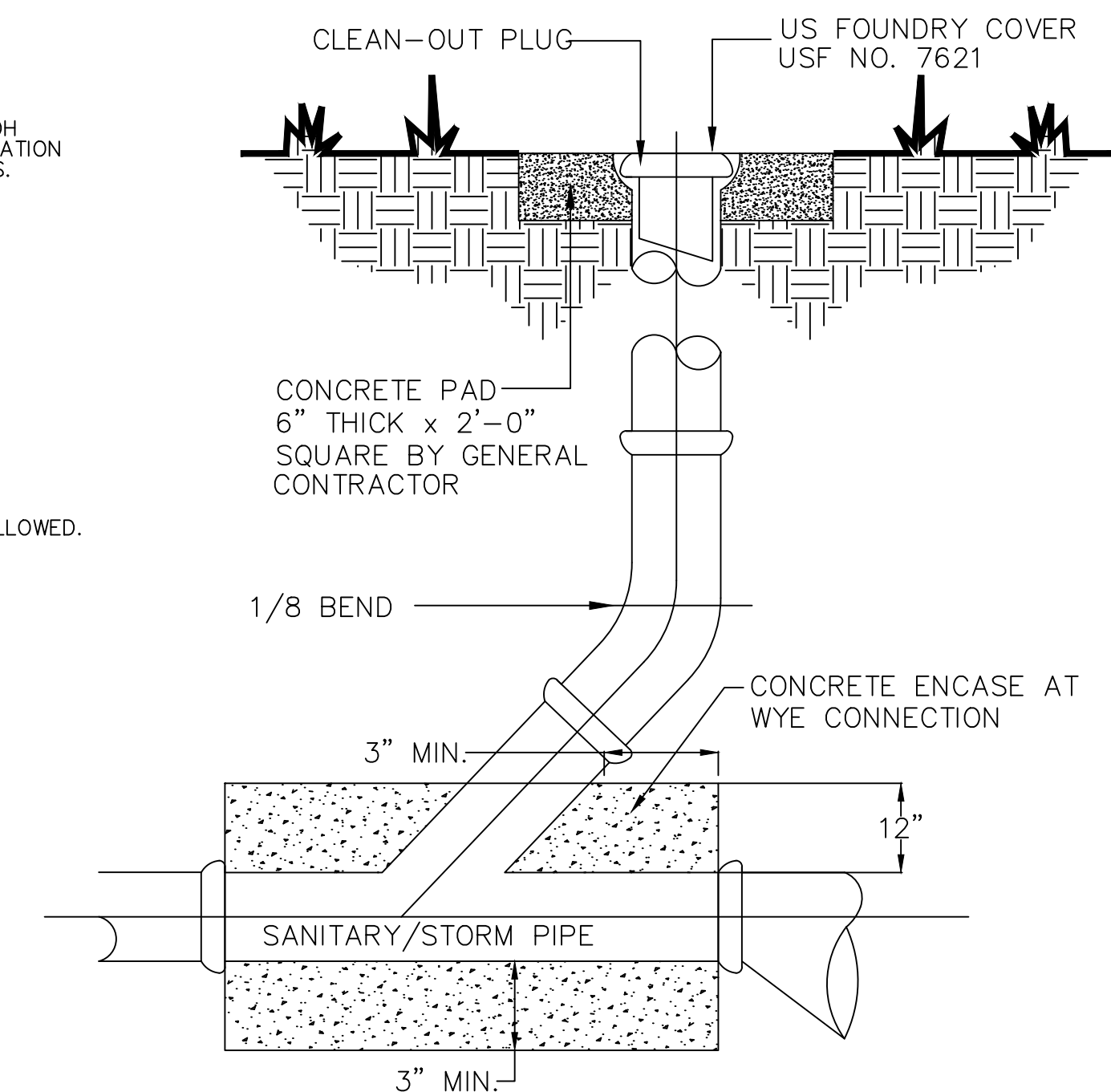


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- NOTES:
1. THIS DETAIL MAY BE USED ONLY FOR DRY STABLE TRENCH CONDITIONS PER COH STANDARD. SEE COH STANDARD SPECIFICATION FOR REQUIREMENTS IN OTHER CONDITIONS.
 2. MIN TRENCH WIDTH SHALL BE PIPE OD PLUS AN ALLOWANCE "A" FOR THE NOMINAL PIPE SIZE:
- | NOMINAL PIPE SIZE | "A" |
|-------------------|-----|
| 18" TO 30" | 24" |
| OVER 30" | 36" |
3. MAX TRENCH WIDTH SHALL BE NOT GREATER THAN MIN TRENCH WIDTH PLUS 24 INCHES, UNLESS OTHERWISE NOTED.
 4. ALTERNATIVE EMBEDMENT BACKFILL MATERIALS FOR FORCE MAINS MAY BE ALLOWED. SEE COH STANDARD SPECIFICATIONS.



- NOTES:
1. DURING SUBDIVISION CONSTRUCTION, UTILITY CONTRACTOR INSTALLS WASTEWATER CONNECTION TO MAIN, 6\"/>
 2. CUSTOMER REMOVES PLUG FROM 6\"/>
 3. CUSTOMER IS RESPONSIBLE FOR PUBLIC PIPING SYSTEM UNTIL WASTEWATER IS CONNECTED. ANY MISSING OR DAMAGED PARTS SHALL BE REINSTALLED BY CUSTOMER WHO SHALL GUARANTEE, FOR A PERIOD OF TWO (2) YEARS FROM DATE OF ACCEPTANCE, THAT CONNECTIONS TO CITY SYSTEMS ARE FREE FROM DEFECTS IN WORKMANSHIP OR MATERIAL. CUSTOMER ALSO HAS THE RESPONSIBILITY TO ASSURE THAT ALL 2-WAY-CLEANOUTS REMAIN CLEAR OF SIDEWALKS AND OTHER OBSTRUCTIONS.
 4. CITY OF LEANDER ACTIVITY IS LIMITED TO INSPECTION OF CONNECTIONS TO THE CITY'S WASTEWATER SYSTEM. FOR MAINTENANCE PURPOSES, THE CITY'S RESPONSIBILITY ENDS AT THE CUSTOMER'S WASTEWATER CONNECTION TO THE 2-WAY-CLEANOUT.
 5. PIPING AND TUBING IN STREET RIGHT-OF-WAY AND IN EASEMENT AREA SHALL BE BEDDED IN GRANULAR MATERIALS AS REQUIRED BY CITY OF AUSTIN STANDARD SPECIFICATION SECTION 510.3 (14) UNLESS OTHERWISE NOTED ON THIS DETAIL. MATERIALS SHALL BE AS SPECIFIED IN 510.2 (2)(A) AND (3)(B); BACKFILL ABOVE THE GRANULAR BEDDING SHALL BE AS REQUIRED BY SECTION 510.3 (25). SERVICE LINES IN THESE AREAS SHALL HAVE A MINIMUM COVER BELOW FINAL STREET GRADE OF 42\"/>
 6. ALL SANITARY SEWER PIPE WITHIN 9\"/>
 7. PIPE MATERIAL FOR WASTEWATER SERVICES SHALL BE 6\"/>
 8. NO METER BOX OR CLEAN OUT SHALL BE SET IN SIDEWALK OR DRIVEWAY AREA WITHOUT WRITTEN APPROVAL FROM THE CITY ENGINEERING DEPT.
 9. NO JOINTS SHALL BE PERMITTED BETWEEN THE 6\"/>

Date	Description	No.
Revisions		
EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709		
Project HERITAGE GROVE ROAD LEANDER WILLIAMSON COUNTY TEXAS Drawing Title SITE DETAILS		
Project No. 531020901	Drawing No. 26	
Date 04/06/2023		
Drawn By DK		
Checked By EM		

A
B
C
D
E
F

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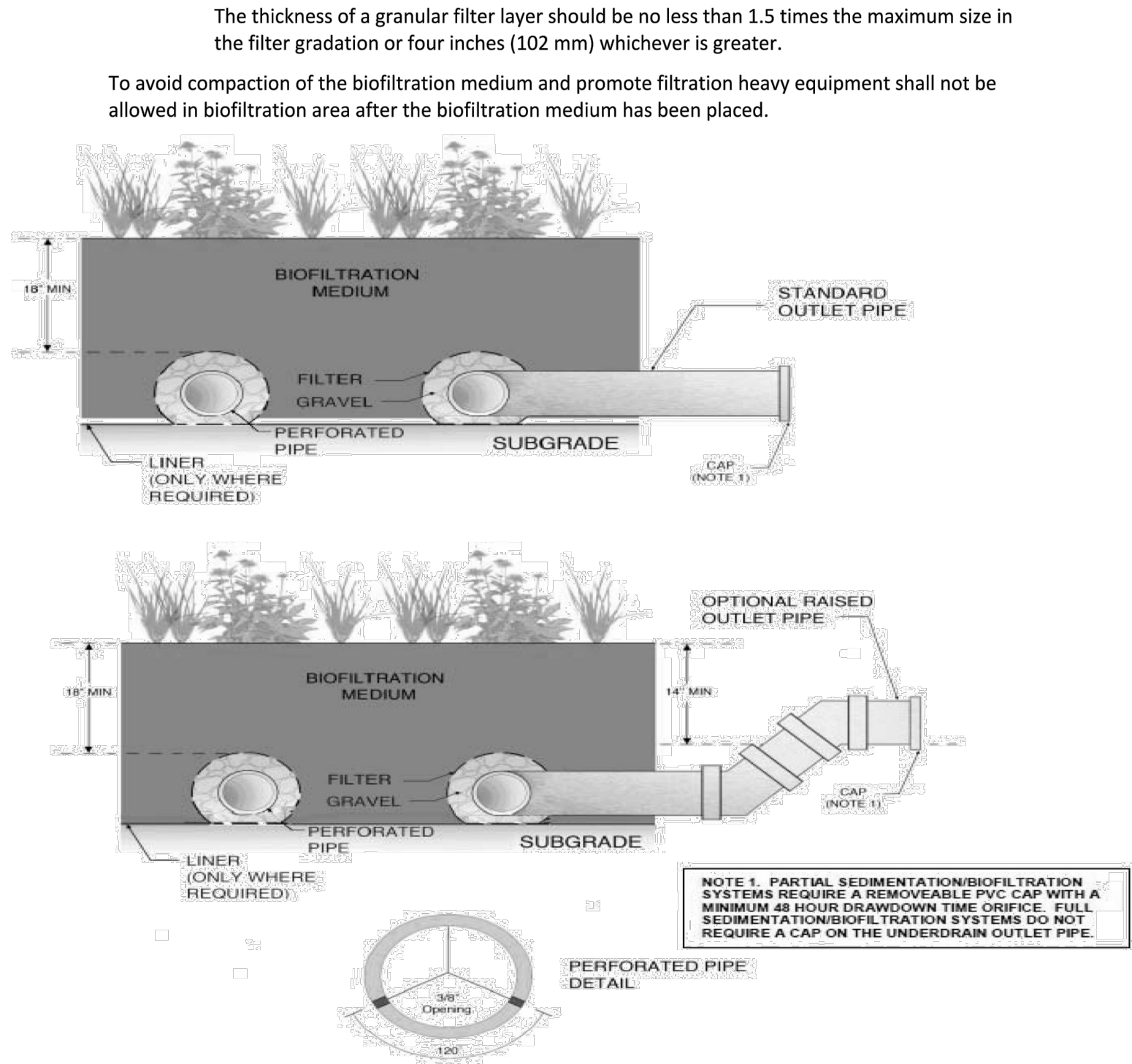
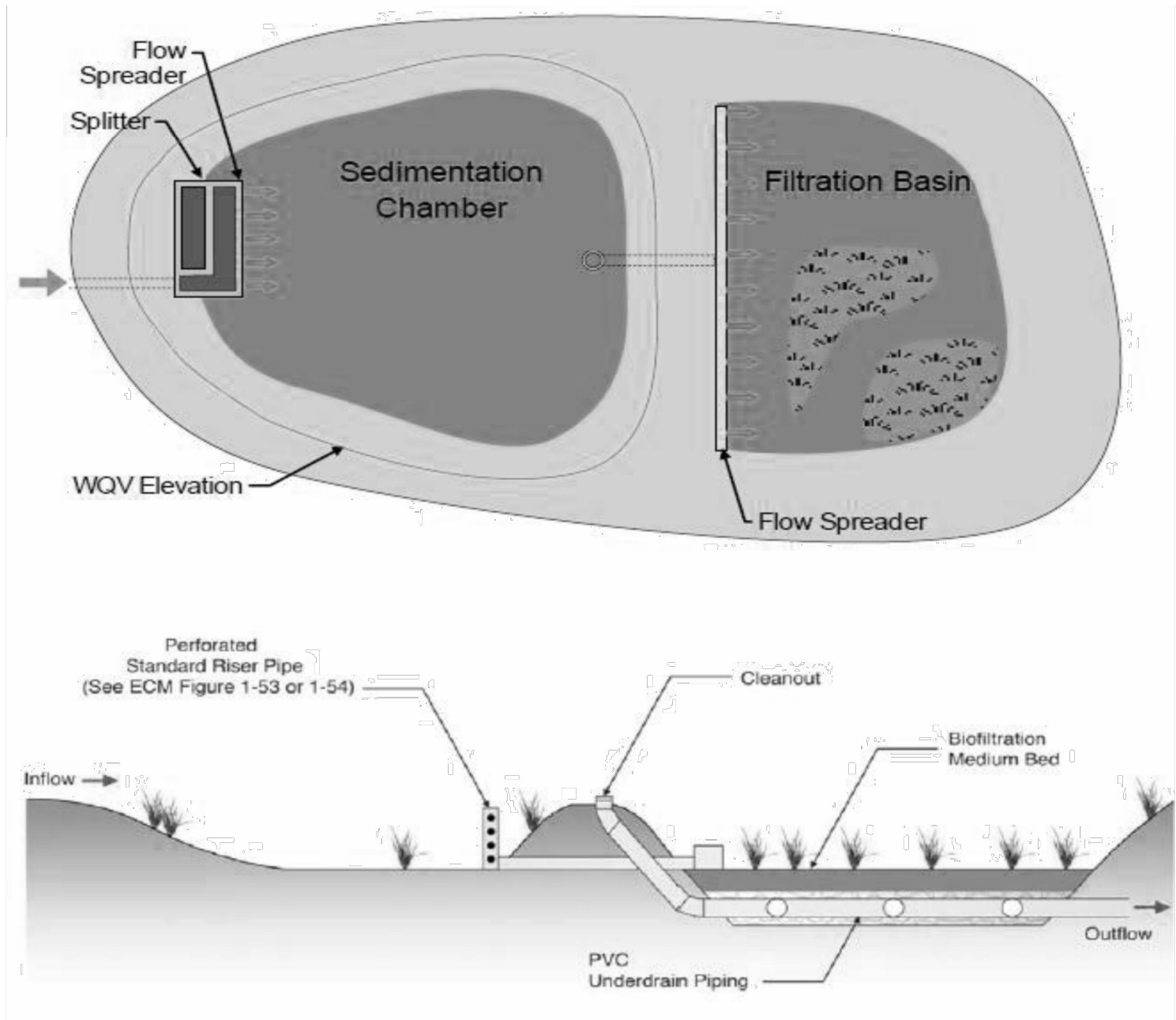


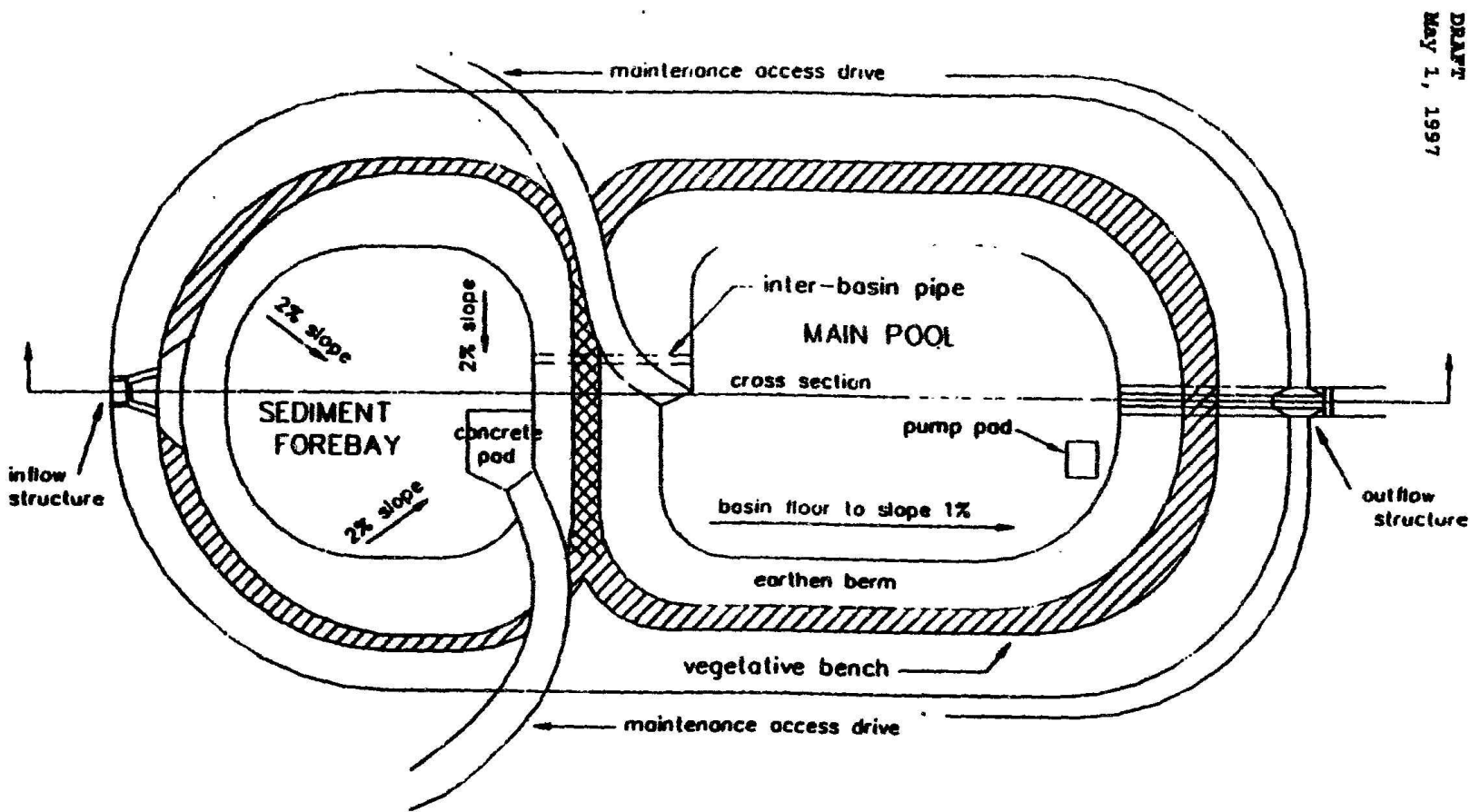
Figure 1.6.7.C-3: Biofiltration medium bed with underdrain system.

Access must be provided for cleaning all underdrain piping. Cleanouts with a removable PVC cap are required at the ends of laterals and at every bend outside the water quality SCM (cleanouts outside of the SCM shall be set above the water quality elevation). In order to minimize damage to these cleanouts due to maintenance

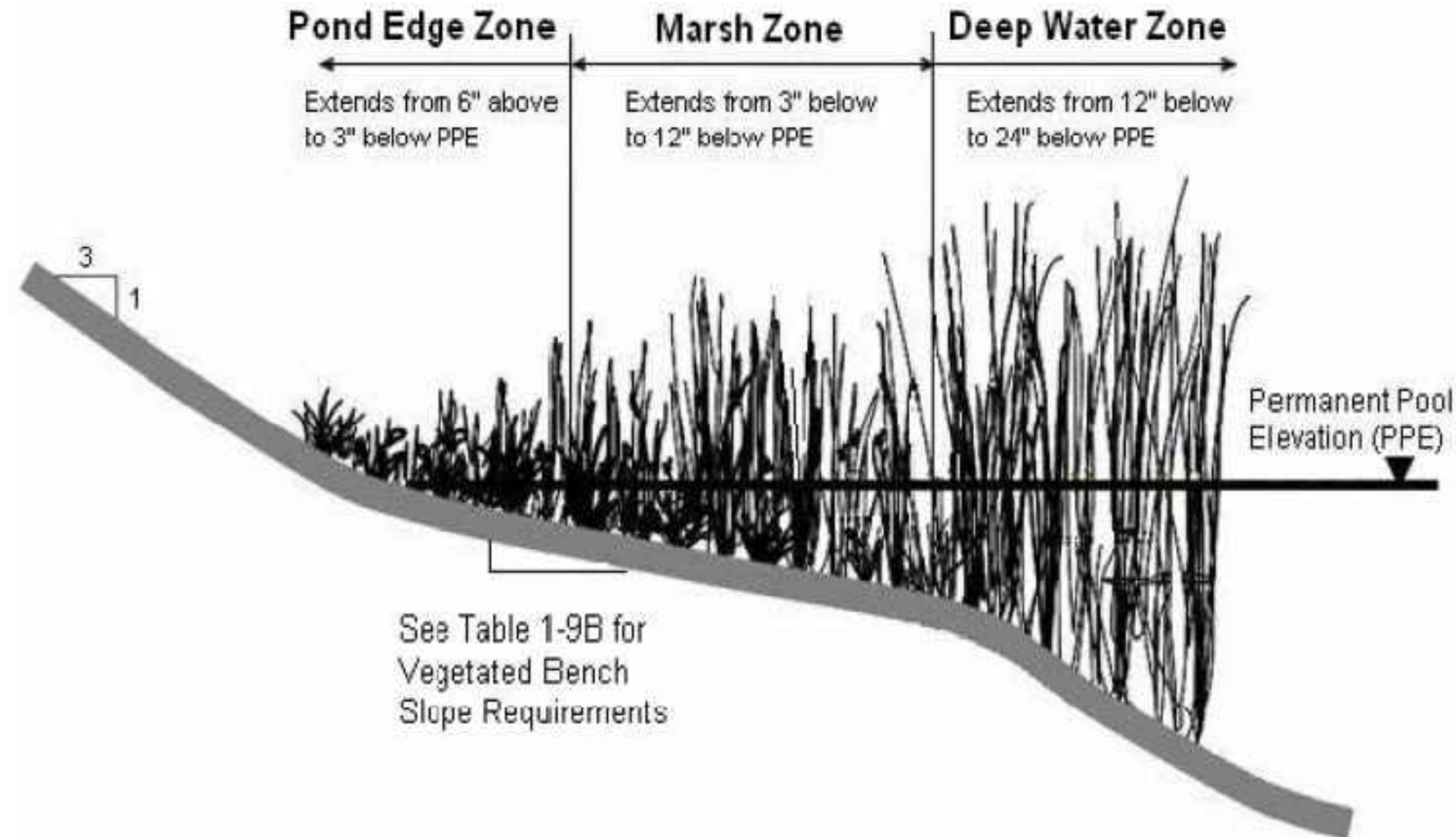
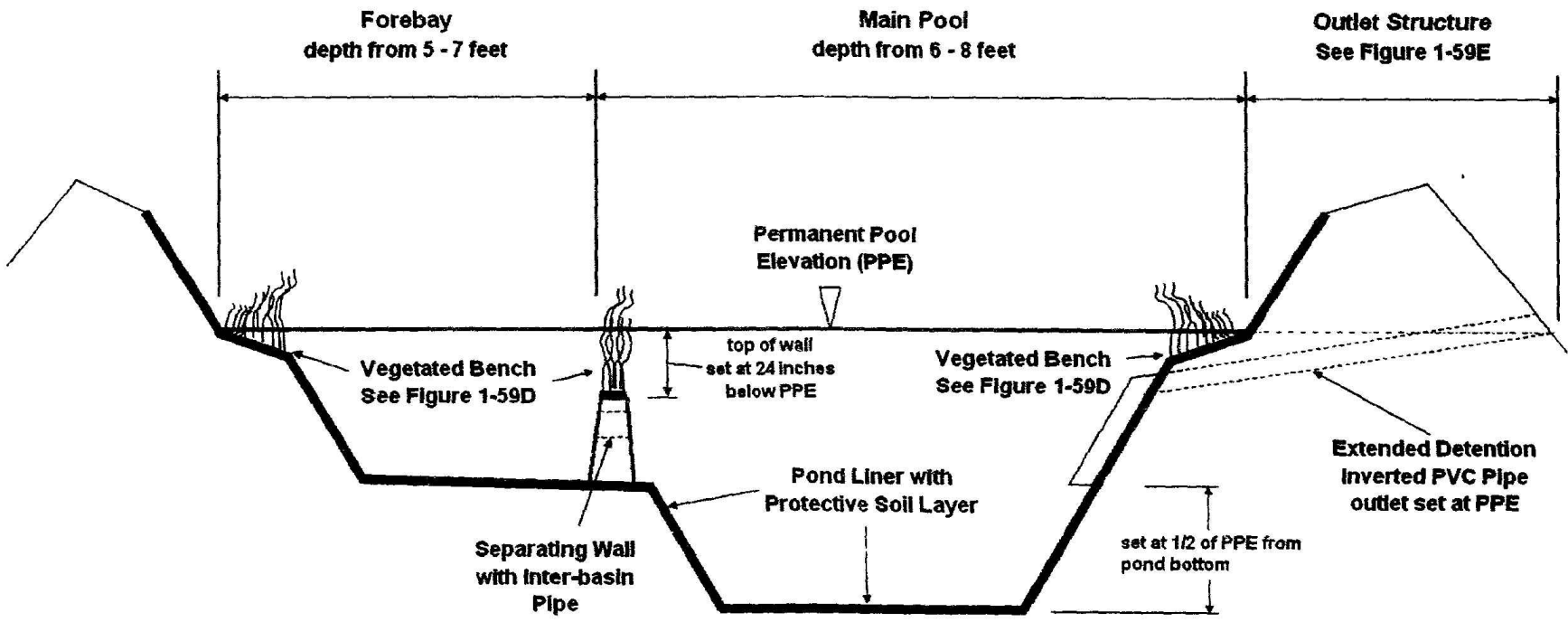
BIOFILTRATION DETAILS

1

N.T.S.



DATE: May 1, 1997



WET BASIN DETAILS

Date	Description	No.
Revisions		
 STATE OF TEXAS EMILY MAHONEY 143208 PROFESSIONAL ENGINEER EMILY MAHONEY P.E. LANGAN ENGINEERING AND ENVIRONMENTAL SERVICES, INC. TBPE FIRM REG. #F-13709		
LANGAN Langan Engineering and Environmental Services, Inc. 9606 N. Mopac Expressway, Suite 110 Austin, TX 78759 T: 737.289.7800 F: 737.289.7801 www.langan.com TBPE Firm REG. #F-13709 Project HERITAGE GROVE ROAD LEANDER WILLIAMSON COUNTY TEXAS Drawing Title SITE DETAILS		
Project No.	531020901	27
Date	04/06/2023	
Drawn By	DK	
Checked By	EM	

STANDARD NOTES

BASIN LINER (WET POND TO HAVE 24" CLAY LINER)

- IMPERMEABLE LINER MUST BE CLAY.
CLAY LINERS SHALL MEET THE FOLLOWING SPECIFICATIONS:

WET POND LINER RECOMMENDATION

1. SELECTION OF FILL MATERIAL SHOULD BE GUIDED BY THE FOLLOWING CRITERIA**:

- A. MINIMUM PLASTICITY INDEX: >30
B. MINIMUM LIQUID LIMIT: >50
C. MINIMUM PASSING #200 SIEVE: >60%
D. NO STONES LARGER THAN 1"
E. FREE OF ORGANIC MATERIAL AND DEBRIS, SUCH AS LIMBS, BARKS, LEAVES, ETC.

2. COMPACTION SHOULD BE 95 PERCENT OF MAXIMUM LABORATORY DENSITY DETERMINED IN ACCORDANCE WITH AMERICAN SOCIETY

OF TESTING MATERIALS, METHOD ASTM D 698, USING A COMPACTIVE EFFORT OF 7.16 FT.LBS/CU.IN.

3. PLACEMENT SHOULD BE IN LIFTS NOT EXCEEDING EIGHT INCHES AFTER COMPACTION. EACH COMPACTED LIFT SHOULD BE INSPECTED FOR DENSITY COMPLIANCE BY THE GEOTECHNICAL ENGINEER PRIOR TO PLACING THE NEXT LIFT. THE COMPACTED FILL MOISTURE CONTENT SHALL FALL WITHIN A RANGE BETWEEN OPTIMUM AND 4 PERCENT ABOVE OPTIMUM MOISTURE CONTENT DURING COMPACTION.

4. TESTING AND QUALIFICATION OF RAW FILL MATERIAL, PLACEMENT, AND COMPACTION SHALL BE PERFORMED BY THE GEOTECHNICAL ENGINEER. A 110 LB. SAMPLE OF PROPOSED FILL MATERIAL SHOULD BE SUBMITTED TO GEOTECHNICAL ENGINEER FOR APPROVAL, AND FOR DETERMINATION OF MOISTURE-DENSITY RELATIONSHIP, IN ADVANCE OF FILLING AND COMPACTION OPERATIONS TO PERMIT INSPECTION AND TESTING AS FILL IS PLACED. (NOT LESS THAN ON FIELD DENSITY TEST PER 2000 SQ.FT. OR MINIMUM OF 3 PER LIFT IS REQUIRED. (CALL 873-8208 EXT. 1220 FOR INSPECTION COORDINATION.)

5. DEVIATIONS FROM THE ABOVE CRITERIA MAY BE PERMITTED ONLY UPON APPROVAL OF THE GEOTECHNICAL ENGINEER ON AN INDIVIDUAL BASIS.

GENERAL:

1. MICROBIAL INITIATION - A SUBSTANTIAL PORTION OF THE POLLUTANT REMOVAL IN WET PONDS IS DUE TO BIOLOGICAL PROCESSES. BACTERIA IN THE POND SUBSTRATE REMOVE NUTRIENTS THROUGH A PROCESS OF DENITRIFICATION. THESE MICROBIAL PROCESSES REQUIRE AN ORGANIC FOOD SOURCE, SUCH AS DECAYING PLANT LITTER. BECAUSE IT IS THE SUPPLY OF ORGANIC CARBON THAT DETERMINES NUTRIENT REMOVAL - MORE THAN UPTAKE BY LIVING PLANTS. DENITRIFICATION CAN BE EXPECTED TO CONTINUE EVEN DURING COLD-WEATHER PLANT DORMANCY. IN MATURE PONDS WITH ABUNDANT VEGETATION, AQUATIC PLANTS SUPPLY THE NECESSARY LITTER LAYER AND AEROBIC ZONE FOR MICROBIAL ACTIVITY. HOWEVER, SINCE NEW PONDS LACK A SUFFICIENT SOURCE OF ORGANIC MATTER, AN APPROPRIATE AMOUNT OF CARBON (STRAW, HAY, LEAF CLIPPINGS, SOIL, AND OTHER NON-WOODY MATERIAL) SHALL BE INSTALLED DURING CONSTRUCTION. AFTER THE POND LINER IS IN PLACE, YET PRIOR TO ALLOWING THE POND TO BE FILLED, SPREAD THE PLANT LITTER EVENLY ON THE SIDES OF THE POND (BELOW THE PERMANENT POOL LEVEL). TREAT THE ENTIRE SHALLOW WATER BENCH IN THIS MANNER, AND ALL POND SLOPES (RANGING FROM 3:1 TO 10:1). THE MINIMUM REQUIRED AMOUNT OF PLANT LITTER IS 45 POUNDS PER 1,000 SQUARE FEET OF SLOPE. WHEN USING COASTAL HAY, THIS REQUIREMENT CAN BE EXPRESSED AS 1-5 BALES AT 30 LB./BALE. ENSURE THAT THE PLANT LITTER WILL NOT FLOAT BY ATTACHING THE LITTER TO THE SLOPES (WITH STAPLES OR OTHER APPROPRIATE METHODS). COVER A MINIMUM OF 40 PERCENT OF THE SLOPE SURFACE AREA.

2. INTEGRATED PEST MANAGEMENT - AS WITH ANY LANDSCAPE, THERE IS A NEEDS FOR PEST MANAGEMENT IN WET PONDS. TO THE EXTENT POSSIBLE, THESE CRITERIA ARE DESIGNED TO MINIMIZE THE POTENTIAL FOR PESTS WITHIN A WET POND.

ALGAE - HIGH NUTRIENT LOADS IN WET PONDS MAY CAUSE ALGAE BLOOMS TO OCCUR. PUNGENT ODOR IS OFTEN ASSOCIATED WITH THESE ALGAE BLOOMS. HOWEVER, TREATING WITH AN ALGAEICIDE IS NOT RECOMMENDED BECAUSE BLOOMS ARE FLOATING SHORT LIVED AND ARE CONSIDERED DESIRABLE FOR NUTRIENT REMOVAL. THE USE OF SUBMERGENTS AND FLOATING-LEAFED AQUATICS CAN REDUCE THE EXTENT OF ALGAE BLOOMS BY REDUCING NUTRIENT LOADS AND SHADING THE WATER.

WILDLIFE - WILDLIFE SUCH AS NUTRIA AND DEER ARE OCCASIONALLY A PEST OF WET PONDS IN THE AUSTIN AREA. EVALUATION OF THE POTENTIAL OF SUCH WILDLIFE INHIBITING OR BEING ATTRACTED TO THE PROPOSED POND SITE IS REQUIRED. WHEN THERE IS A POTENTIAL FOR SUCH ACTIVITY, FENCING OR SIMILAR EXCLUSIONARY METHOD MUST BE PROVIDED.

MOSQUITO CONTROL - MOSQUITOES ARE PROBLEMATIC IN URBAN AREAS. THERE IS THE POTENTIAL FOR STANDING WATER IN WET PONDS TO BECOME IDEAL BREEDING LOCALITIES. THE WET POND SHOULD BE STOCKED WITH THE LOCAL NATIVE FISH SPECIES GAMBUSIA AFFINS AS A BIOLOGICAL CONTROL FOR MOSQUITOES. GAMBUSIA PROVIDE EFFECTIVE CONTROL FOR MOSQUITOES, ELIMINATING THE NEED FOR CHEMICAL CONTROL. GAMBUSIA SHOULD BE STOCKED AT THE INITIAL DENSITY OF 200 INDIVIDUALS PER SURFACE AREA.

C. DOMESTIC WATERFOWL - DOMESTIC WATERFOWL, INCLUDING GESE AND SWANS CAN DESTROY VEGETATION AND INCREASE POLLUTANT LOADING IN WET POND SYSTEMS. IN ADDITION, WATERFOWL CAN BECOME NUISANCES TO PROPERTY OWNERS NEAR THE POND. FOR THESE REASONS, DOMESTIC WATERFOWL SHOULD NOT BE INTRODUCED INTO THESE SYSTEMS.

CARP AND GOLDFISH - CARP AND GOLDFISH ARE BOTTOM-FEEDERS THAT CAN CAUSE TURBIDITY AND OTHER PROBLEMS. THEY SHOULD NOT BE INTRODUCED INTO A WET POND.

3. WATER - AFTER THE POND LINER IS COMPLETED, THE BASIN MUST FILL UP WITH WATER WITHIN A REASONABLE TIME PERIOD, PREFERABLY WITHIN ONE WEEK. SAFETY CONCERNS AND POND LINER INTEGRITY CONCERNS MUST BE PROPERLY ADDRESSED DURING POND CONSTRUCTION.

AERATION AND RECIRCULATION UNIT (OPTIONAL) - PRIVATELY MAINTAINED WET PONDS MAY INCLUDE SOME TYPE OF AERATION DEVICE (SUCH AS A FOUNTAIN) WHICH COULD ENHANCE THE DISSOLVED OXYGEN CONCENTRATION. INCREASED DISSOLVED OXYGEN PREVENTS THE POND FROM BECOMING ANAEROBIC, HENCE MINIMIZING PROBLEMS WITH ODOR FROM BACTERIAL DECOMPOSITION.

MAKE-UP WATER - A NEARBY SOURCE FOR MAKE-UP (SUPPLEMENTAL) WATER IS RECOMMENDED AS A WAY TO MAINTAIN AN ADEQUATE PERMANENT POOL LEVEL SHOULD THE LEVEL DROP TO A SEVERE DROUGHT. THIS COULD INCLUDE A WELL, A HOSE BIB, OR A NEARBY FIRE HYDRANT. DEMONSTRATE THAT THE QUALITY OF THE MAKE-UP WATER IS IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS AND WILL NOT HARM THE POND BIOLOGY.

4. SOIL LINER MATERIAL MINIMUM PHYSICAL REQUIREMENTS

REPRESENTATIVE SAMPLES OF THE SOILS TO BE USED FOR LINERS MUST FIRST BE TESTED, IN ACCORDANCE WITH THE FOLLOWING STANDARDS, IN A GEOTECHNICAL LABORATORY TO ENSURE THAT THEY MEET THE FOLLOWING MINIMUM REQUIREMENTS SET FORTH IN THE MSWR. TABLE I AT THE END OF THIS HANDBOOK LISTS THE REQUIRED QUALITY CONTROL TESTING AND MINIMUM REQUIREMENTS.

- A. SIEVE ANALYSIS - ASTM D 422 OR ASTM D 1140 - AT LEAST 60% PASSING THE #200 MESH SIEVE.
B. ATTERBERG LIMITS - ASTM D 4318 - LIQUID LIMIT (LL) OF GREATER THAN 50 AND PLASTICITY INDEX (PI) OF GREATER THAN 30.
C. COEFFICIENT OF PERMEABILITY - APPENDIX VII OF THE CORPS OF ENGINEERS MANUAL EM 1110-2-1906 OR ASTM D 5084 - 1x10-6CM/SEC. OR LESS.

SOILS FOR CONSTRUCTED LINERS MOISTURE/DENSITY (M/D) TESTING

IN ADDITION TO THE MINIMUM TEST REQUIREMENTS IN 2.2, ABOVE, A MOISTURE/DENSITY RELATIONSHIP MUST BE DETERMINED FOR EACH SOIL BORROW SOURCE. TO BE USED IN SOIL LINER CONSTRUCTION, THIS MOISTURE/DENSITY (M/D) COMPACTION CURVE MUST INCLUDE A ZERO-AIR-VOIDS LINE BASED UPON AN ESTIMATED OR MEASURED SPECIFIC GRAVITY OF THE COMPACTED SOIL. THE TWO ACCEPTABLE STANDARD MOISTURE/DENSITY RELATIONSHIP TEST PROCEDURES ARE:

- A. ASTM D 698 (STANDARD PROCTOR) - 12,400 FT-LBF/FT³ (FOR LIGHT-WEIGHT EQUIPMENT), OR
B. ASTM D 1557 (MODIFIED PROCTOR) - 56,000 FT-LBF/FT³ (FOR HEAVY EQUIPMENT)
IN ORDER TO DETERMINE THAT THE PROPOSED SOIL IS SUITABLE FOR USE AS LINER MATERIAL, PERMEABILITY TESTS MUST BE CONDUCTED ON SAMPLES COMPACTED UNDER THE ABOVE-LISTED COMPACTIVE-EFFORT TEST PROCEDURES. THESE SOILS SHALL BE PREPARED AND TESTED AS NEXT DESCRIBED.

SOIL LINER MATERIAL MINIMUM PHYSICAL REQUIREMENTS CONT.

A. THERE SHOULD BE NO CONSTRUCTED LINERS PARALLEL TO SIDE SLOPES WITH GREATER THAN 3:1 SLOPE ANGLE (3 HORIZONTAL TO 1 VERTICAL) DUE TO BOTH THE INHERENT LACK OF STABILITY OF THE COMPACTION EQUIPMENT ON THESE STEEP SLOPES AS WELL AS THE COMPACTION INEFFICIENCY. IT SHOULD BE REALIZED THAT SOIL LINERS CONSTRUCTED PARALLEL TO SIDE SLOPES HAVE INHERENT CONSTRUCTION PROBLEMS BECAUSE THE FULL COMPACTIVE FORCE OF THE COMPACTION EQUIPMENT IS NOT PERPENDICULAR TO THE SLOPE. THE ECCENTRIC WEIGHT OF THE EQUIPMENT (TENDENCY TO SLIDE UPDOWN THE SLOPE) MAY SHEAR THE UPPER PORTION OF THE LIFT UNDER COMPACTION NEAR ITS SURFACE. THE OVERALL UNIFORMITY OF THE PROCESSING AND COMPACTING EFFORT ON A SLOPE IS USUALLY OF LOWER QUALITY THAN ON AN ESSENTIALLY-FLAT SECTION. ACCORDINGLY, THE LARGE-SCALE HYDRAULIC CONDUCTIVITY TESTS PERFORMED ON A PRIMARILY-HORIZONTAL TEST PAD WILL NOT BE REPRESENTATIVE OF THE PROBABLE WORST-CASE LINER-CONSTRUCTION CONDITIONS WHERE SLOPED LINERS ARE INVOLVED.

B. A KEYWAY FOR CONSTRUCTED SIDEWALLS IS REQUIRED UNLESS ALTERNATE CONSTRUCTION PROCEDURES HAVE PRIOR WRITTEN APPROVAL BY THE EXECUTIVE DIRECTOR. THE CONSTRUCTED KEYWAY AT THE TOE OF THE SIDEWALL MAY BE ELIMINATED FOR THOSE SIDEWALLS CONSTRUCTED ON A SLOPE ANGLE OF 4:1 OR FLATTER; THOSE CONSTRUCTED WITH THE FLOOR AS ONE UNIT (MONOLITHICALLY); OR SIDEWALL PLACES IN HORIZONTAL LIFTS A MINIMUM OF 10 FT. IN WIDTH AND HAVING THE FIRST SIX INCH LIFT OF THE SIDEWALL COMPLETELY BONDED WITH THE TOP OF THE FLOOR LINER.

C. PLACEMENT OF CONSTRUCTED LINERS (CLAY-TYPE MATERIAL) SHOULD BE IN ACCORDANCE WITH THE FOLLOWING:

1. ALL SURFACE AREAS SHOULD BE PROPERLY SCARIFIED A MINIMUM OF SIX INCHES AND PREPARED TO RECEIVE THE LINER.
2. THE TOP OF EACH LIFT SHOULD BE ROUGHENED TO A SHALLOW DEPTH PRIOR TO THE PLACEMENT OF THE NEXT LIFT OF SOIL FOR COMPACTION.
3. NO LOOSE LIFT SHOULD BE THICKER THAN THE PADS OF THE COMPACTOR SO THAT COMPLETE BONDING WITH THE TOP OF THE PREVIOUS LIFT IS ACHIEVED.
4. EQUIPMENT AND SAFETY LIMITATION PROHIBIT FINISHED GRADES WITH SLOPES GREATER THAN 3:1 IF THE LINER IS CONSTRUCTED PARALLEL TO THE SURFACE. FOR AN EXCAVATED WALL WITH STEEPER THAN 3:1 SIDE SLOPES, THE SIDEWALL LINER MUST BE CONSTRUCTED IN SUCCESSIVE HORIZONTAL LIFTS.
5. THE TOP SURFACE OF THE COMPLETED SOIL LINER MUST BE PROOF ROLLED WITH A SMOOTH-WHEEL ROLLER, PRIOR TO FINAL LINER-THICKNESS SURVEYING WHEN PLACEMENT OF A GEOMEMBRANE LINER IS REQUIRED.
6. IT IS RECOMMENDED THAT THE SURFACE OF A SOIL LINER BE PROOF ROLLED WHEN CONSTRUCTION IS SHUT DOWN FOR MORE THAN 24 HOURS TO MITIGATE THE EFFECTS OF DESICCATION. IT IS FURTHER RECOMMENDED THAT IT BE DONE ON A ROUTINE BASIS DURING THE SUMMER MONTHS AT THE END OF EACH DAY'S LINER CONSTRUCTION.

2.3.2 CONSTRUCTED SOIL LINERS

THESE CONSTRUCTED SOIL LINERS INCLUDE THOSE OF OVER-EXCAVATED AND RECOMPACTED IN SITU SOILS AND SOILS FROM A BORROW SOURCE. FOR ADDITIONAL SPECIFIC INFORMATION ON BENTONITE-AMENDED SOILS SEE SECTION 2.5.

CLOD AND ROCK SIZE

THE MAXIMUM CLOD SIZE OF THE COMPACTED LINER SOILS SHALL BE APPROXIMATELY ONE INCH IN DIAMETER BUT IN ALL CASES SOIL CLODS SHALL BE REDUCED TO THE SMALLEST SIZE NECESSARY TO ACHIEVE THE COEFFICIENT OF PERMEABILITY REPORTED BY THE TESTING LABORATORY AND TO DESTROY ANY MACROSTRUCTURE EVIDENCE AFTER THE COMPACTION OF THE CLODS UNDER DENSITY-CONTROLLED CONDITIONS. (\$330.205(C), MSWR) THE LINER SOIL MATERIAL SHALL CONTAIN NO ROCKS OR STONES LARGER THAN ONE INCH IN DIAMETER OR THAT TOTAL MORE THAN 10% BY WEIGHT. (\$330.205(H), MSWR). ONE-HUNDRED PERCENT OF THE MATERIAL USED IN THE SOIL LINER MUST PASS THE 1-INCH SCREEN, THE FINAL LIFT FOR COMPOSITE LINERS SHOULD NOT CONTAIN ANY ROCKS OR ANY OTHER MATERIALS THAT CAN CAUSE DAMAGE TO THE FML.

2. IT IS STRONGLY RECOMMENDED THAT THE TAMPING FEET HAVE A FACE AREA NOT LESS THAN SEVEN NOR MORE THAN TEN SQUARE INCHES. SELF-PROPELLED ROLLERS WITH TAMPING FEET SURFACE AREAS GREATER THAN 10 BUT LESS THAN 30 SQUARE INCHES CAN BE UTILIZED PROVIDED THE FEET HAVE TAPERED HEADS THAT ADD TO THE COMPACTIVE EFFORT.

16 COMPACTIVE EFFORT (SOILS COMPACTION)

ALL CONSTRUCTED SOIL LINERS MUST BE COMPACTED WITH A PAD/TAMPING-FOOT (PREFERABLE) OR PRONGFOOT ROLLER (\$330.205(G), MSWR). NO OTHER TYPE OF EQUIPMENT IS SUITABLE FOR THE COMPACTION OF CONSTRUCTED SOIL LINERS.

2. THE LIFT THICKNESS SHALL BE CONTROLLED SO THAT THERE IS TOTAL PENETRATION THROUGH THE LOOSE LIFT UNDER COMPACTION INTO THE TOP OF THE PREVIOUSLY COMPACTED LIFT; THEREFORE, THE COMPACTED LIFT THICKNESS MUST NOT BE GREATER THAN THE PAD OR PRONG LENGTH. THIS IS NECESSARY TO ACHIEVE ADEQUATE BONDING BETWEEN LIFTS AND REDUCE SEEPAGE PATHWAYS. ADEQUATE CLEANING DEVICES MUST BE IN PLACE AND MAINTAINED ON THE COMPACTION ROLLER SO THAT THE PRONGS OR PAD FEET DO NOT BECOME CLOGGED WITH CLAY SOILS TO THE POINT THAT THEY CANNOT ACHIEVE FULL PENETRATION DURING INITIAL COMPACTION. THE FOOTED ROLLER IS NECESSARY TO ACHIEVE BONDING AND TO REDUCE THE INDIVIDUAL CLODS AND ACHIEVE A BLENDING OF THE SOIL MATRIX THROUGH ITS KNEADING ACTION. IN ADDITION TO THE KNEADING ACTION, WEIGHT OF THE COMPACTION EQUIPMENT IS IMPORTANT. WHEN USING ASTM TEST METHOD D 698 (STANDARD PROCTOR) DENSITY, THE MINIMUM WEIGHT OF THE COMPACTION EQUIPMENT SHOULD BE 1500 POUNDS PER LINEAR FOOT OF DRUM LENGTH. A MINIMUM OF EIGHT PASSES IS RECOMMENDED FOR THE COMPACTION PROCESS. COMPACTION EQUIPMENT THAT DEVELOPS A COMPACTIVE EFFORT EQUAL TO ASTM D 1557 (MODIFIED PROCTOR) WILL RESULT IN GREATER COMPACTION, LOWER COEFFICIENT OF PERMEABILITY DUE TO DECREASED VOID SPACE, AND A LOWER OPTIMUM MOISTURE CONTENT NECESSARY TO ACHIEVE THE MAXIMUM DRY DENSITY. THIS LOWER OPTIMUM MOISTURE CONTENT MAY HELP IN CONTROLLING THE DESICCATION CRACKING OF HIGHLY PLASTIC CLAYS FREQUENTLY USED FOR LINER SOIL. ADEQUATE COMPACTION CANNOT BE ACHIEVED BY TRACK-TYPE (BULLDOZER) OR PNEUMATIC COMPACTORS. BULLDOZERS ARE BY THE NATURE OF THEIR WEIGHT DISTRIBUTION DESIGNED TO "FLOAT" ON THE SURFACE, RESULTING IN GREATLY DIMINISHED COMPACTION BY TRACK CONTACT AND THEREFORE SHOULD NOT BE USED TO COMPACT LINER SOILS. IN ADDITION, THE USE OF TRACKS OR RUBBER TIRES FOR COMPACTION DOES NOT ALLOW THE KNEADING ACTION REQUIRED TO REDUCE AND BLEND SOIL CLODS AS IS REALIZED BY PAD-FOOTED ROLLERS.

COMPACTION EQUIPMENT

THE COMPACTION OF SOIL LINERS MUST BE WITH APPROPRIATE EQUIPMENT.

1. PAD/TAMPING-FOOT ROLLERS, OR
2. PRONG-FOOT (SHEEP-FOOT) ROLLERS

THE FOLLOWING EQUIPMENT TYPES ARE EXAMPLES OF THAT WHICH IS NOT PERMITTED OR APPROPRIATE FOR THE COMPACTION OF SOIL LINERS.

1. BULLDOZER
2. RUBBER-TIRED (PNEUMATIC) ROLLERS
3. FLAT-WHEELED ROLLERS
4. RUBBER-TIRED SCRAPERS OR BELLY DUMPS

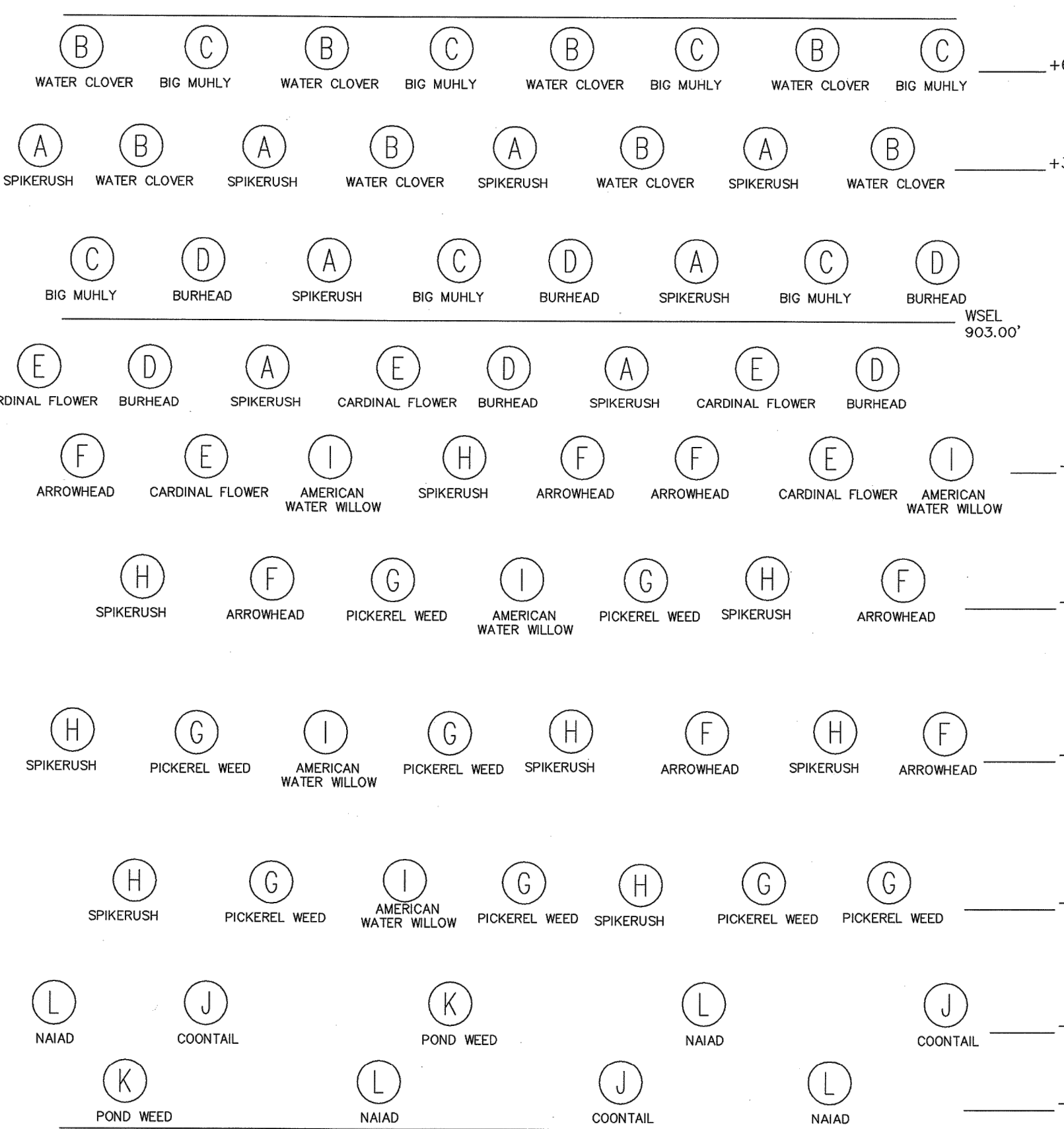
2.3.2.5 SOIL PLASTICITY

QUALITY CONTROL OF THE SOIL PLASTICITY SHOULD BE CLOSELY ADHERED TO AND MAINTAINED DURING MATERIAL SELECTION FOR LINER CONSTRUCTION. TESTING OF THE ATTERBERG LIMITS AND GRADATION SHOULD BE CONTINUALLY CHECKED SO THAT ANY CHANGES IN EITHER PHYSICAL PROPERTY CAN BE DETECTED AND ADDITIONAL APPROPRIATE LABORATORY TESTING PERFORMED. ANY TIME THE LL OR PI CHANGES BY MORE THAN 10 POINTS, A NEW COMPACTION SERIES SHOULD BE RUN IN THE LABORATORY TO DETERMINE THE VARIABILITY OF THE SOIL USED FOR LINER CONSTRUCTION. IT IS STRONGLY RECOMMENDED THAT ALL LINER SOIL BORROW SOURCES BE THOROUGHLY TESTED PRIOR TO USE TO ESTABLISH THEIR ATTERBERG LIMITS AND COMPACTIONS PARAMETERS. THIS MAY REQUIRE DRILLING AUGER HOLES AT THE BORROW SOURCE TO RETRIEVE ADEQUATE SAMPLES TO DETERMINE THESE FACTORS. DUE TO THE HIGH SHRINK/SWELL AND DESICCATION CRACKING CHARACTERISTICS OF HIGHLY-PLASTIC CLAYS, THE PI OF CLAY LINER SOILS SHOULD BE GREATER THAN 30.

18 QUALITY ASSURANCE AND TESTING FREQUENCY FOR SOIL LINERS

EACH IN SITU OR CONSTRUCTED LINER SIDEWALL AND FLOOR AREA DEVELOPED AS A SEPARATE SEGMENT (NON-MONOLITHICALLY) MUST BE CONSIDERED AS SEPARATELY EVALUATED AREAS INDEPENDENT OF EACH OTHER FOR THE PURPOSE OF CALCULATING DIMENSIONS TO DETERMINE THE REQUIRED NUMBER OF SAMPLES. THOSE SIDEWALL AND FLOOR AREAS CONSTRUCTED OR EXCAVATED MONOLITHICALLY MAY BE ADDED TOGETHER FOR THE DETERMINATION OF THEIR TESTING FREQUENCY AND LOCATIONS. ALL HOLES DUG OR CREATED DURING ANY SAMPLING AND/OR TESTING SHALL BE BACKFILLED WITH A MIXTURE OF AT LEAST 20% BENTONITE-ENRICHED LINER SOIL AND COMPACTED BY HAND TAMPING OR FILLED WITH AN APPROPRIATE BENTONITE GROUT.

TYPICAL WET POND SPACING



- Ⓐ SPIKERUSH (SHORT) PLANT 3-6 FEET ON CENTER
Ⓑ WATER CLOVER
Ⓒ BIG MUHLY
Ⓓ BUR HEAD
Ⓔ CARDINAL FLOWER
Ⓕ ARROWHEAD PLANT 3 FEET ON CENTER
Ⓖ PICKEREL WEED
Ⓗ SPIKERUSH (TALL)
Ⓘ AMERICAN WATER WILLOW
Ⓢ COONTAIL
Ⓚ POND WEED
Ⓛ WATER NAIAD

NOTE: ALL WETLAND PLANTS WHICH FULFILL THE MINIMUM LANDSCAPE REQUIREMENTS SHALL BE PROPAGATED OR HARVESTED FROM THE REGIONALLY ADAPTED STOCK (WHEN POSSIBLE). THESE ARE PLANT SPECIES OR GENOTYPES WHICH ARE NATIVE TO A RANGE OF WITHIN 250 MILES OF THE PROJECT SITE.

WET POND J PLANTING PLAN

Surface Area of Permanent Pool = 1.03 ACRES
44834/2 x 0.03= 672 number of plants required (minimum)

PLANT LIST EDGE ZONE	RATIO	MINIMUM NO. OF PLANTS	PROVIDED NO. OF PLANTS	MINIMUM SIZE
TOTAL REQUIRED = 672 x .40 = 269				
A. SPIKERUSH (SHORT)	20%	54	54	LINER
B. WATER CLOVER	30%	80	80	LINER
C. BIG MUHLY	20%	54	54	1 GAL.
D. BURHEAD	20%	54	54	1 GAL.
E. CARDINAL FLOWER	10%	27	27	LINER
TOTAL		269	269	

PLANT LIST MARSH ZONE	RATIO	MINIMUM NO. OF PLANTS	PROVIDED NO. OF PLANTS	MINIMUM SIZE
TOTAL REQUIRED = 672 x .30 = 201				
F. ARROWHEAD	40%	81	81	2 GAL.
G. PICKEREL WEED	20%	40	40	1 GAL.
H. SPIKE RUSH (TALL)	20%	40	40	1 GAL.
I. AMERICAN WATER WILLOW	20%	40	40	1 GAL.
TOTAL		201	201	

PLANT LIST DEEP WATER ZONE	RATIO	MINIMUM NO. OF PLANTS	PROVIDED NO. OF PLANTS	MINIMUM SIZE
TOTAL REQUIRED = 672 x .30 = 201				
J. COONTAIL	30%	60	60	1 GAL.
K. POND WEED	30%	60	60	1 GAL.
L. WATER NAIAD	40%	81	81	1 GAL.
TOTAL		201	201	

WETLAND PLANT LIST

Pond Edge Zone - The pond edge zone is an area of saturated soil surrounding the perimeter of the pond. The extends from an elevation 6" above the permanent pool level to an elevation 3" below the permanent pool level. portion of this zone is above the elevation of the vegetated bench, plants listed in Table 1-9E that are installed in area will count towards fulfilling the required minimum number of plants. Use at least four of the following species in this zone. Species noted as required must be included in this zone.

Table 1-9E Pond Edge Zone Plants	Common Name	Latin Name	Height	Required	Comments and Planting Information (Permanent Pool Elevation = 0')
Big muhly	Muhlenbergia indheimeri		3'	x	0' to +6", clump grass
Burhead	Echinodorus cordifolius (rostrata)		2'	x	-3' to 0", foliage similar to Arrowhead
Burr marigold	Bidens laevis		3'		-3' to 0", yellow flowers
Bushy bluestem	Andropogon glomeratus		3'		0' to +3", clump grass
Cardinal flower	Lobelia cardinalis		3'	x	-3' to 0", red flowers
Caric-sedge	Carex Frankii (hystrix, cherokeensis)		2'		-3' to +3", ornamental sedge
Orinum	Orinum americanum		3'		-3' to 0", white flowers
Easterngama grass	Tripsacum dasyphyllus		4'		0' to +6", clump grass
Emory sedge	Carex Emoryi (microstata)		2'		0' to +6", grass-like foliage
Flatsedge	Cyperus odoratus (ochreus, alternifolius, pseudovegetus)		2'		-3' to +3" planting depth
Horned rush	Rhynchospora corniculata (colorata)		18"		-3' to 0", ornamental rush
Horsetail	Equisetum laevigatum (hyemale)		2'		-3' to +3", deer-resistant
Inland sea oats	Chasmanthium latifolium		2'		0' to +3", grass, takes shade
Jamican saw grass	Cladium mariscus ssp. jamaicense		7'		-3' to 0", dense evergreen, sharp leaf edges
Mallow	Hibiscus lasiocarpus (lancea), Kostelezkyia virginica		3'		-3' to 0", pink flowers
Obedient plant	Physostegia angustifolia		4'		0' to +3", pink flowers
Palmetto	Sabal minor		6'		-3' to 0", tropical evergreen
Soft rush	Juncus effusus		4'		-3' to +3", evergreen clump
Spikerush (short)	Eleocharis macrostachya (palustris, montivirens)		1'	x	-3' to +3", colonizes for shoreline erosion control
Umbrella sedge	Fuirena simplex		2'		-3' to 0", ornamental sedge
Water clover	Marsilea macropoda (tenuifolia)		6"	x	-3' to +6", clover-like fern
Water daisy	Splianthes americana		6"		-3' to +6", yellow flowers

Marsh Zone - The marsh zone is the shallow water area within the pond. The zone extends from an elevation 3" below the permanent pool level to an elevation 12" below the permanent pool level. Use at least four of the following species in the marsh zone. Species noted as required must be included in this zone.

Table 1-9F Marsh Zone Plants	Common Name	Latin Name	Height	Required	Comments and Planting Information (Permanent Pool Elevation = 0')
American water-willow	Justicia americana		3'	x	-3' to -12", forms solid mass
Arrowhead	Sagittaria platyphylla (lanceolata, latifolia, graminea)		2'	x	-3' to -12", wildlife value, white flowers
Canna lily (native)	Canna flaccida		2.5'		-3' to -12", yellow flowers
Hard-stem bulrush	Schoenoplectus acutus*		6'		-3' to -12"
Iris	Iris (falsa, hexagona, virginica)		3'		-3' to -12", colorful flowers
Pickerelweed	Pontederia cordata		3'	x	-6' to -12", flower spikes
Powdery thalia	Thalia dealbata		5'		-3' to -12", purple flowers
Spikerush (tall)	Eleocharis (rostellata, quadrangulata, cellulosa)		2.5'	x	-3' to -12", colonizing evergreen
Three-square bulrush	Schoenoplectus americanus*		4'		-3' to -12", triangular stems

Deep Water Zone - The deep water zone extends from an elevation 12' below the design pool level down to an elevation 24' below the design pool level. This zone includes submergent plants (which grow underwater), floating-leaved aquatic plants, and tall emergent plants. The list includes a few plants that may be used only in very large ponds (2 acres or greater) due to their aggressive growth habit. Install submergent and floating-leaved aquatic plants throughout the pond to encourage colonization in a variety of locations. Install at least three species of the following:

Deep Water Zone Plants	Common Name	Latin Name	Height	Required	
American waterweed	Elodea canadensis		8'		Submergent oxygenator
Coontail	Ceratophyllum demersum		6"	x	Submergent for nutrients
Fanwort	Cabomba caroliniana		6"		Submergent oxygenator
Giant bulrush	Schoenoplectus* (tabernaemontani, californicus)		6'		Emergent 8 ft. Evergreen; 2 acre min. pond size
Pondweed	Potamogeton pectinatus (nodosus, diversifolia, illinoensis)		4'	x	Floating-leaved aquatic; benefits wildlife
Water lily	Nymphaea (odorata, elegans, mexicana)		6"		Floating-leaved aquatic; 2 acre min. pond size
Water-naiad	Najas guadalupensis		4"	x	Common submergent
Water star grass	Heteranthera dubia (Liebmanni)		6"		Submergent oxygenator

DateDescriptionNo.

Revisions

STATE OF TEXAS
EMILY MAHONEY
143208
LICENSED PROFESSIONAL ENGINEER

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Project

HERITAGE GROVE ROAD

LEANDERTXAS

Drawing Title

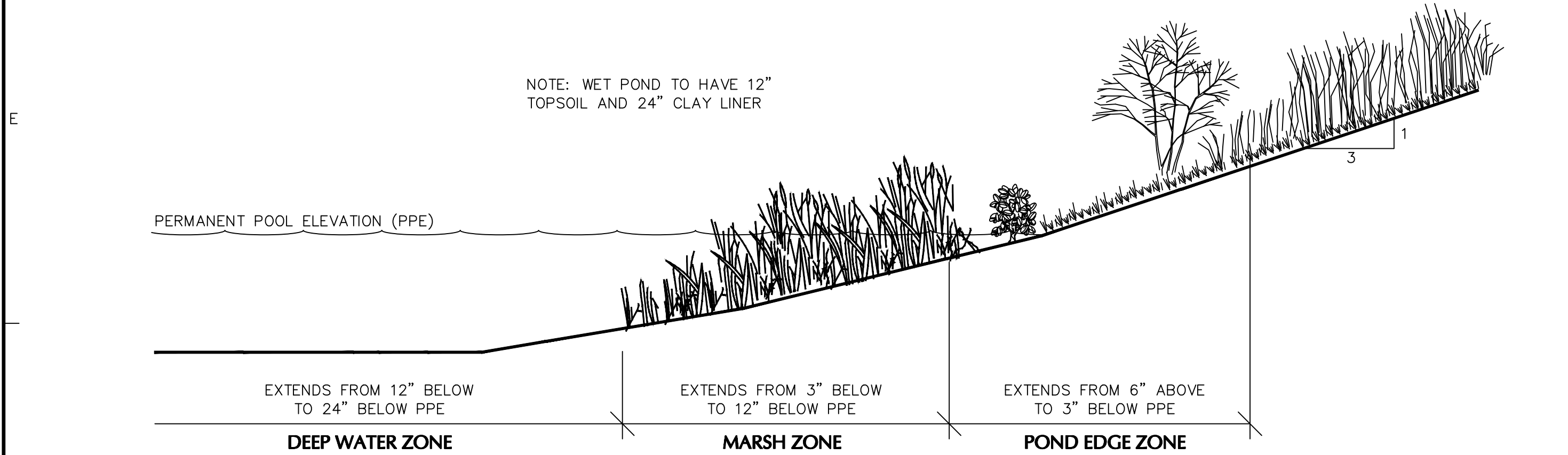
Project No. 531020901

Date 04/06/2023

Drawn By DK

Checked By EM

Drawing No. 28



CROSS SECTION OF A TYPICAL VEGETATED BENCH AREA

NTS

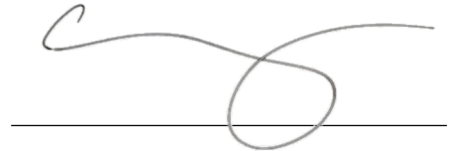
POST-CONSTRUCTION STORMWATER MANAGEMENT (PCSM) NARRATIVE

HERITAGE GROVE

500 Heritage Grove Rd
Leander
Williamson County, Texas

Prepared For:
EastGroup Properties LP
6565 N MacArthur Blvd, Suite 255
Irving, TX

Prepared By:
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Austin, TX 78759
TBPE FIRM REG. #F-13709



Emily Mahoney, Texas P.E. No. 143208
LEED AP BD+C, CPESC, CAPM

April 06, 2023
531020901

LANGAN

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F	Water Quality Calculations
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INTRODUCTION

EastGroup Properties LP is proposing to construct seven office/warehouse buildings totaling +/- 599,310 SF on a 44.4 acre tract located in the City of Leander, Williamson County, TX. The site is located to the west of the intersection of Heritage Grove Rd and N US HWY 183, east of Oak Grove Rd, and north of San Gabriel Pkwy (See Figure 1).

Included in the development plans is the construction of a water quality wet pond with extended detention, a raingarden/bioretenion area, and an underground stormwater conveyance system to provide for drainage of the site. This report addresses the engineering design of the stormwater conveyance and management systems for the site. These facilities have been designed in accordance with the regulations set forth by the City of Leander and the Texas Commission for Environmental Quality (TCEQ).

DESIGN METHODOLOGY

Stormwater Management Design

The City of Leander has adopted the City of Austin Drainage Criteria Manual. In accordance with the City of Austin Drainage Criteria Manual, this study was prepared using the soil-cover-complex methodology. The design storms used for the analysis of peak rate discharges from the site are the 2, 10, 25, and 100-year storms. Hydrographs for the existing and proposed watersheds were developed using the NRCS TR-55 method. The TR-55 method simulates a watershed as a series of overland flows, channel flows, and inflow and outflow structures for its contribution to runoff. A value for area, curve number (CN), and time of concentration (Tc) was calculated for each watershed.

The curve number (CN) is a land sensitive coefficient that dictates the relationship between total rainfall depth and direct storm runoff. Based on the coverage of soil groups and land use in the area, an average CN was determined for each watershed for existing and proposed conditions. Existing non-forested pervious areas shall be considered "meadow" in good condition.

Using the Soil Conservation Service (SCS) Soil Survey for Williamson County the soils within the watershed were divided into hydrologic soil groups. The SCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have the

lowest runoff potential and "D" soils have the greatest runoff potential. Soils within the watershed are classified as soils with a group designation of "D" (see Figure 2).

The following table summarizes the Runoff Curve Numbers used in calculating the existing and proposed peak rate of runoff for the stormwater management system.

Table 1 Summary of Runoff Curve Numbers

Land Use	Hydrologic Soil Group	Runoff Curve Number
Wooded, Good Condition	D	77
Meadow, Good Condition	D	78
Grass, Good Condition	D	80
Impervious	D	98

The time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest. Values of the time of concentration were determined for existing and proposed conditions based on the land cover and slope of the flow path using methods described in USDA Soil Conservation Service Publication TR-55 "Urban Hydrology for Small Watersheds." The TR-55 procedure simulates a watershed as a series of overland flows, channel flows, and inflow and outflow structures for its contribution to runoff. The length of initial sheet flow was limited to 100 feet. For the proposed conditions, the majority of the site is paved and results in small times of concentration. A minimum time of concentration of 5 minutes has been used.

The design storm used for the TR-55 study is the 24 hour SCS Type II cumulative rainfall distribution. Twenty-four hour rainfall depths were obtained from NOAA Atlas 14, Volume 11, Version 2.

Rainfall hydrographs developed from TR-55 methods were then routed through the proposed stormwater management basin using level pool routing techniques.

PAST USES OF SITE

The existing site consists of a residential use comprising a small portion of the site. The remainder of the site has been vacant grassland/wooded area for the last 50 years.

EXISTING CONDITIONS

Existing Site Description

The 44.4 +/- acre tract is located in the City of Leander, Williamson County, TX. The site is located to the west of the intersection of Heritage Grove Rd and N US HWY 183, east of Oak Grove Rd, and north of San Gabriel Pkwy (See Figure 1). There is an existing residential area, two existing upland ponds, one swale, and an existing ephemeral stream within the site. The topography of the site to the south generally slopes to the north to the existing ponds and east to a roadside swale along Heritage Grove Road.

The neighboring development to the west, Haven Oaks, currently directs their stormwater discharge to the subject property. A vegetated swale has been provided to route this offsite upgradient stormwater flow around the proposed water quality wet pond and downstream to the ephemeral stream at the property boundary. See Appendix A for existing offsite residential discharge.

Receiving Watershed

Volume reduction requirements are based on the difference between the pre-development runoff volume and the post-development runoff volume. Proposed BMPs have been designed to reduce the runoff volume discharging to each point of analysis, to a value that is at or below the pre-development condition.

Soil Types

Based on the soil survey for Williamson County, the soils within the watershed were divided into hydrologic soil groups (A, B, C and D). The SCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have the lowest runoff potential and "D" soils have the greatest runoff potential. Soils within the watershed are classified as soils with the group designation of "D". See Figure 2.

Existing Geologic Features

The site is located in the Edwards Aquifer Contributing Zone. If any issues arise during earth moving activities, land clearing activities, construction activities or any associated activities with

developing the site, all work shall immediately cease and TCEQ shall be notified.

Existing Watersheds Description

For purposes of analysis, the existing watersheds are delineated into the following four watersheds, to be managed by the proposed stormwater infrastructure. Refer to Drawing No 10.

Watershed EX-1 consists of approximately 8.44 acres of existing grassland and 0.15 acres of existing impervious residential area which flows to Point of Analysis 1, the existing roadside swale that flows west to east along the southern property line.

Watershed EX-2 consists of approximately 32.5 acres of existing grassland, 2.97 acres of existing wooded area, and 0.31 acres of existing impervious residential area which flows to Point of Analysis 2, the ephemeral stream located at the northern property line.

Watershed PR DA-2 consists of approximately 0.43 acres of existing grassland and 0.37 acres of impervious residential area neighboring west of the site which flows to Point of Analysis 2.

Watershed PR DA-3 consists of approximately 0.42 acres of existing grassland and 0.28 acres of impervious residential area neighboring west of the site which flows to Point of Analysis 2.

Points of Analysis

For purposes of this analysis, there are two general points of analysis (POA) where all discharges from the on-site watersheds flow toward (refer to Drawing No 10 and 11).

POA #1 is located at the southern edge of the property line. This is the existing roadside swale that is on the side of Heritage Grove Road.

POA #2 is an ephemeral stream located along the northern boundary of the site.

Existing Discharges

The soil-cover-complex methodology was used to determine existing runoff hydrographs for the 2, 10, 25, and 100-year Type II, 24-hour storms for the watersheds. The peak discharges are

summarized below and calculations are given in Appendix B.

**TABLE 1A - SUMMARY OF EXISTING PEAK RESIDENTIAL DISCHARGES FROM OFFSITE WATERSHEDS
AT POINTS OF ANALYSIS**

Storm (YR)	PR DA-2 (POA#2) (CFS)	PR DA-3 (POA#2) (CFS)
2	2.2	1.8
10	3.9	3.2
25	5.1	4.2
100	7.1	5.8

**TABLE 1B - SUMMARY OF EXISTING PEAK DISCHARGES FROM ON-SITE WATERSHEDS
AT POINTS OF ANALYSIS**

Storm (YR)	EX-1 (POA#1) (CFS)	EX-2 (POA#2) (CFS)
2	12.3	52.5
10	24.7	105.0
25	33.5	142.5
100	48.8	207.3

**TABLE 2
SUMMARY OF EXISTING PEAK DISCHARGES
AT POINTS OF ANALYSIS**

Storm (YR)	POA#1 (CFS)	POA#2 (CFS)
2	12.3	52.5
10	24.7	105.0
25	33.5	142.5
100	48.8	207.3

The City of Austin Drainage Criteria Manual requires that the proposed peak discharge rates must be equal to or less than the existing peak discharge rates.

PROPOSED CONDITIONS

Proposed Development

The proposed development consists of the construction of seven office/warehouse buildings totaling +/- 599,310 SF and associated site improvements, on the 44.4 +/- acre parcel. A system of catch basins and underground conduits will collect stormwater and convey it to the proposed on-site detention and wet ponds.

Stormwater Conveyance Design

A system of high density polyethylene pipe (HDPE) was designed to accommodate design storm peak discharges resulting from a 25-year and 100-year storm event. The hydraulic grade line of the system is kept below the grate elevation at inlet locations for 25-yr events. In the 100-year storm event, the hydraulic grade line is kept below a 6" surcharge above the grate elevation. Calculations are given in Appendix E.

A value for area, time of concentration, and runoff coefficient was calculated for each contributing sub-area. Values of time of concentration were chosen based on land cover and slope of the flow path from the hydraulically most distance point in the sub-area to the appropriate inlet. An average runoff coefficient was chosen based on the type of land cover in accordance with the City of Austin Drainage Criteria Manual (See Appendix E).

Rainfall intensities were obtained from NOAA Atlas 14, Volume 11, Version 2. Storm drainage pipes were then sized based on calculated flows using Manning's Equation and were verified by solving for the hydraulic grade line.

Proposed Watershed Description

The proposed area is subdivided into several watersheds. Proposed peak discharge calculations are given in Appendix B. Below is a summary of the proposed watersheds.

- Watershed PR-1 consists of approximately 0.03 acres which flows undetained to Point of Analysis 1, the existing drainage channel that flows west to east along the southern property line.

- Watershed PR-2A consists of approximately 2.74 acres and is conveyed to the bioretention/raingarden. The discharge from the bioretention/raingarden is conveyed through the proposed stormwater conveyance system to the wet pond, where it is further detained and ultimately flows to Point of Analysis 2.
- Watershed PR-2B consists of approximately 37.16 acres and is conveyed through the proposed stormwater conveyance system to the wet pond, where it is further detained and ultimately flows to Point of Analysis 2.
- Watershed PR-2C consists of approximately 4.41 acres and flows undetained to Point of Analysis 2.
- Watershed PR DA-2 consists of approximately 0.43 acres of existing grassland and 0.37 acres of impervious residential area neighboring west of the site which flows to Point of Analysis 2.
- Watershed PR DA-3 consists of approximately 0.42 acres of existing grassland and 0.28 acres of impervious residential area neighboring west of the site which flows to Point of Analysis 2.

Proposed Discharges

The soil-cover-complex methodology was used to determine proposed runoff hydrographs for the 2, 10, 25, and 100-year Type II, 24-hour storms for the watersheds. The peak discharges are summarized below and calculations are given in Appendix C.

TABLE 3A - SUMMARY OF PROPOSED PEAK DISCHARGES FROM WATERSHEDS – POA1

Storm (YR)	PR-1 (CFS)
2	0.1
10	0.2
25	0.3
100	0.4

TABLE 3B - SUMMARY OF PROPOSED PEAK DISCHARGES FROM WATERSHEDS – POA2

Storm (YR)	PR-2A (CFS)	PR-2B (CFS)	PR-2C (CFS)
2	10.8	195.5	13.7
10	19.4	304.9	27.2
25	25.2	379.3	36.8
100	35.2	506.9	53.2

Proposed Pond Routings

Proposed stormwater discharges from the site were designed based on the requirements of the City of Austin Drainage Criteria Manual and TCEQ Edwards Aquifer Requirements.

- The proposed peak discharge rates must be equal to or less than the existing peak discharge rates.
- Stormwater basin berms have been designed to provide one foot freeboard above the maximum pool elevation associated with the 100-year runoff event.
- Internal sides of stormwater basins have been designed to be a maximum 3:1 slope.

The following is a summary of the BMP routings:

TABLE 4 - SUMMARY OF POND ROUTING – BIORETENTION

Storm (YR)	Peak Inflow (CFS)	Peak Outflow (CFS)	Maximum elevation In pond (FT)	Maximum storage Volume in pond (AC FT)
2	10.8	2.1	988.2	0.4
10	19.4	3.0	988.6	0.6
25	25.2	3.6	988.9	0.7
100	35.2	4.4	989.4	1.1

TABLE 5 - SUMMARY OF POND ROUTING – WET POND

Storm (YR)	Peak Inflow (CFS)	Peak Outflow (CFS)	Maximum elevation In pond (FT)	Maximum storage Volume in pond (AC FT)
2	199.4	44.1	967.6	5.3
10	311.5	94.1	968.8	7.8
25	387.9	128.4	969.5	9.4
100	518.6	814.4	970.5	11.9

TABLE 6 - COMPARISON OF EXISTING VERSUS PROPOSED DISCHARGE RATES

POA #1		
Storm (YR)	EXISTING (CFS)	PROPOSED (CFS)
2	12.3	0.1
10	24.7	0.2
25	33.5	0.3
100	48.7	0.4

TABLE 7 - COMPARISON OF EXISTING VERSUS PROPOSED DISCHARGE RATES

POA #2		
Storm (YR)	EXISTING (CFS)	PROPOSED (CFS)
2	52.5	47.9
10	105.0	103.3
25	142.5	142.4
100	207.3	207.2

WATER QUALITY

Proposed BMPs

The current TCEQ regulations put emphasis on addressing stormwater quality in addition to addressing quantity (volume and rate) reductions. A number of Best Management Practices (BMPs) are proposed in the stormwater runoff and conveyance design to meet the TCEQ requirements. The plan also minimizes impervious areas, soil compaction, land clearing and grading to the maximum extent practicable. This preserves the integrity of stream channels and protects the physical, biological, and chemical qualities of the receiving stream.

Below is a list of BMPs used to achieve the requirements of City of Leander and TCEQ. Calculations are provided in Appendix D.

Wet Pond: Pond-1 is designed as wet basins. A wet basin is a facility that removes sediment, organic nutrients, and trace metals from stormwater runoff. This is accomplished by detaining stormwater using an in-line permanent pool or pond resulting in settling of pollutants. Biological

processes occurring in the permanent pool aid in reducing the amount of soluble nutrients present in the water.

Bioretention: Pond-2 is designed as bioretention basin or rain garden. A bioretention basin contains landscaping features adapted to provide on-site treatment of storm water runoff. They are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. During storms, stormwater runoff is collected and then percolates through the plant, mulch, and soil layers of this system. Runoff from larger storms is generally diverted past the facility to the storm drain system. The remaining runoff filters through the mulch and prepared soil mix

BMP Maintenance

The proposed stormwater management facilities and Best Management Practices will be owned and maintained by the property owner.

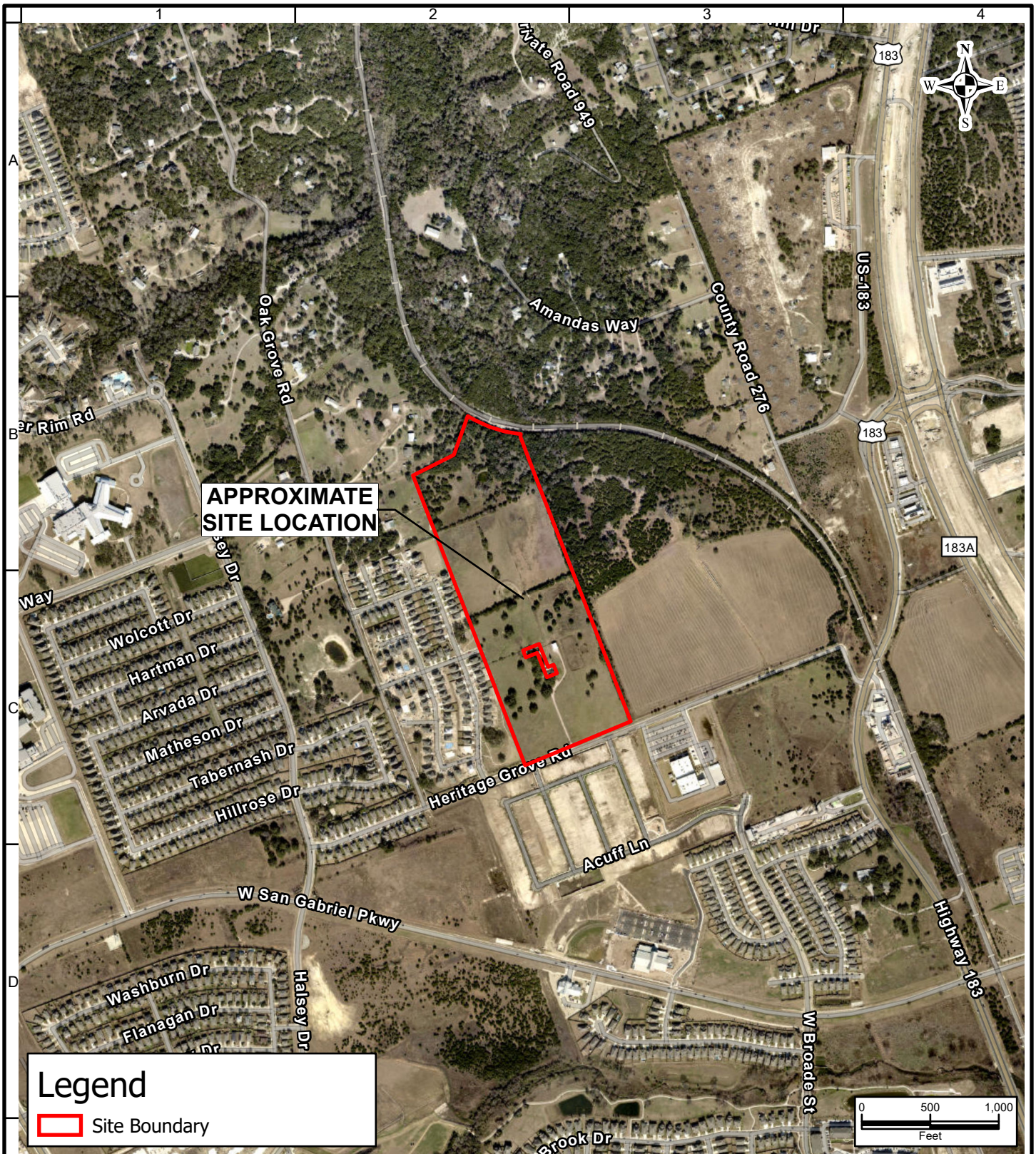
GEOTECHNICAL TESTING

A subsurface geotechnical investigation was performed by Professional Service Industries, Inc. in October 7, 2022. These results are included in Appendix G.

CONCLUSION

The stormwater facilities for this project have been designed in accordance with regulations set forth by the City of Leander and TCEQ.

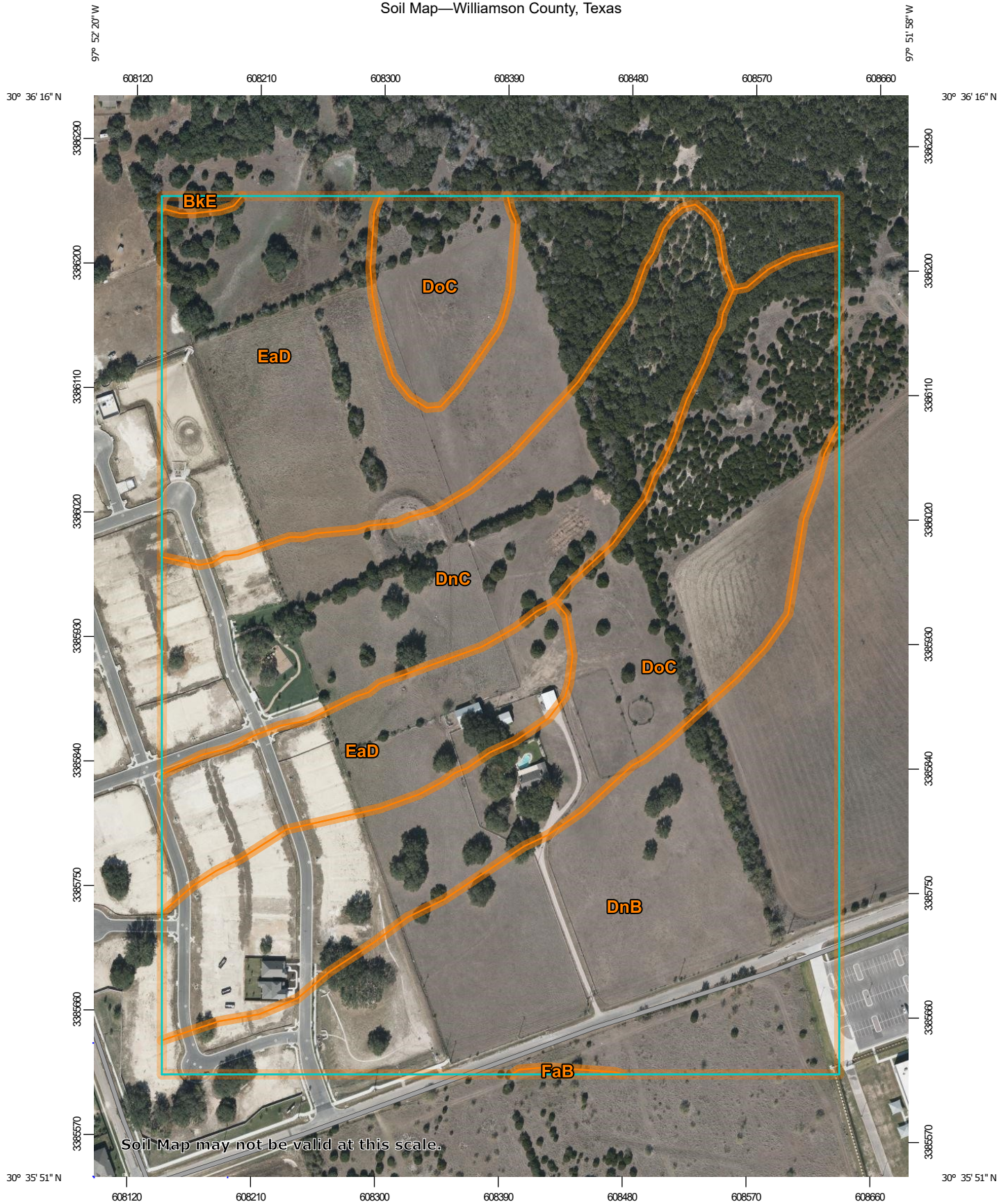
FIGURES



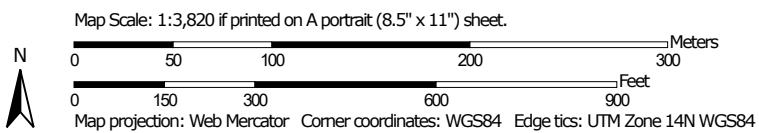
Esri Community Maps Contributors, City of Austin, County of Williamson, Texas Parks & Wildlife, CONANP, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, Williamson County TX, Maxar; Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

LANGAN 11801 Domain Blvd Austin, TX 78758 T: 800.952.6426 www.langan.com Langan Engineering & Environmental Services, Inc. Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. Langan International Collectively known as Langan	Project HERITAGE GROVE ROAD LEANDER COUNTY WILLIAMSON TEXAS	Drawing Title ATTACHMENT A ROAD MAP	Project No. Date 1/19/2023 Scale 1:1,000 Drawn By Site Analyzer Submission Date 01/19/2023	Figure 1 Sheet 1 of 1
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Soil Map—Williamson County, Texas



Soil Map may not be valid at this scale.



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

11/4/2022
Page 1 of 3

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Williamson County, Texas

Survey Area Data: Version 23, Aug 24, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 15, 2020—Dec 1, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BkE	Brackett gravelly clay loam, 3 to 12 percent slopes	0.1	0.2%
DnB	Denton silty clay, 1 to 3 percent slopes	20.6	26.6%
DnC	Denton silty clay, 3 to 5 percent slopes	13.4	17.3%
DoC	Doss silty clay, moist, 1 to 5 percent slopes	20.9	26.9%
EaD	Eckrant cobbly clay, 1 to 8 percent slopes	22.4	28.9%
FaB	Fairlie clay, 1 to 2 percent slopes	0.1	0.1%
Totals for Area of Interest		77.5	100.0%

APPENDIX A

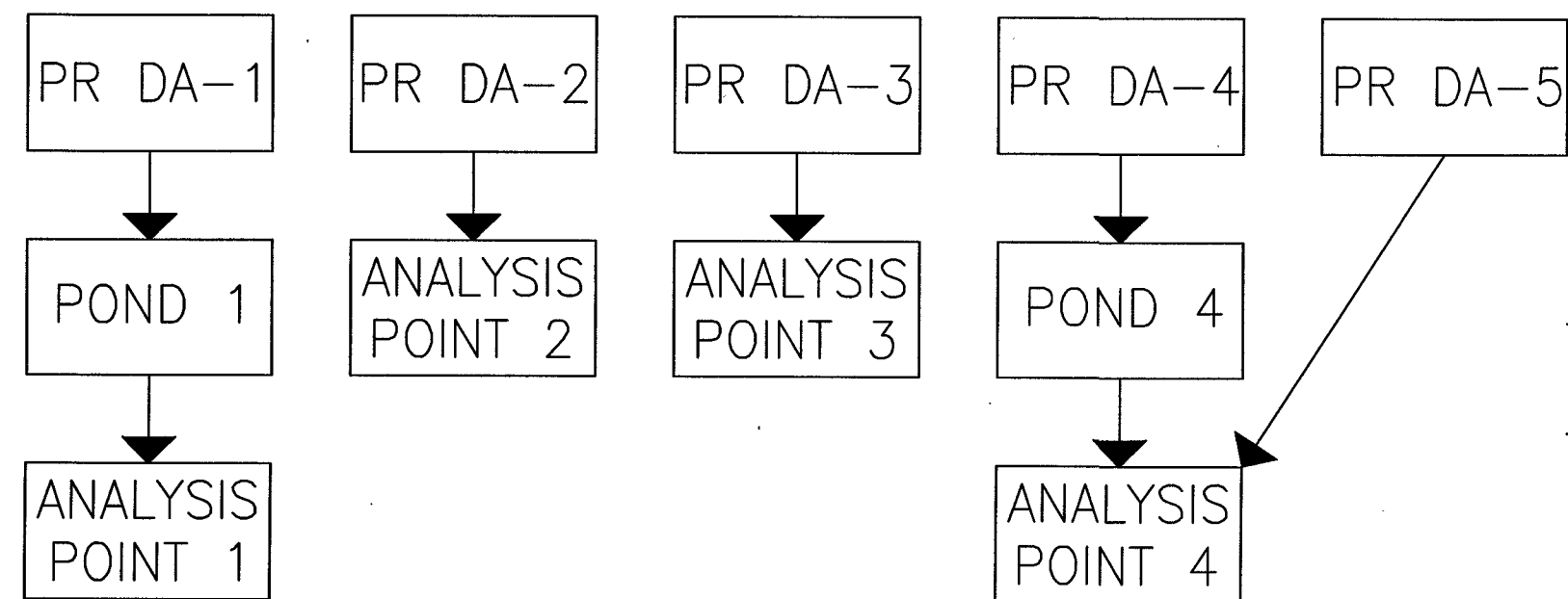
Existing Offsite Residential Discharge Calculations

APPENDIX A
TABLE OF CONTENTS

APPROVED PLAN

CURVE NUMBERS

APPROVED PLAN



ANALYSIS
PT 1

NOTE:
DRAINAGE AREA 1 POND WILL BE UTILIZED AS A
TEMPORARY SEDIMENTATION BASIN AS THE
UPSTREAM DISTURBANCE IS GREATER THAN 10
ACRES. REFER TO SWPPP PREPARED BY
GEOSOLUTIONS PREPARED FEBRUARY, 2019
FOR DESIGN CRITERIA TO BE IN ACCORDANCE
WITH TCEQ'S RG-348 MANUAL.

Drainage Basin Characteristics - Proposed Conditions									
Drainage Area	Area (Acres)	I.C. (%)	Curve No.	Tc (min)	Q2 (cfs)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)	Analysis Point
PR DA-1	19.20	53.66%	84.0	17.89	46.16	80.44	105.79	152.65	1
PR DA-2	0.80	46.55%	84.0	16.22	1.94	3.41	4.51	6.53	2
PR DA-3	0.70	40.17%	84.0	18.83	1.57	2.81	3.72	5.41	3
PR DA-4	8.48	43.92%	84.0	18.98	19.27	34.16	45.17	65.52	4
PR DA-5	2.38	34.58%	84.0	17.20	5.40	9.74	12.95	18.87	4

Table 2 - Pond 1 Outflow Summary

	2-year	10-year	25-year	100-year
Peak Inflow (cfs)	46.16	80.44	105.79	152.65
Peak Discharge (cfs)	32.06	59.32	79.95	118.75
Peak Storage (ac-ft)	0.921	1.421	1.76	2.35
Peak elevation (ft)	984.56	985.18	985.58	986.25

Table 3 - Pond 4 Outflow Summary

	2-year	10-year	25-year	100-year
Peak Inflow (cfs)	19.27	34.16	45.17	65.52
Peak Discharge (cfs)	7.85	15.76	21.99	33.36
Peak Storage (ac-ft)	0.735	1.190	1.503	2.057
Peak elevation (ft)	1003.36	1003.72	1003.96	1004.35

ANALYSIS
PT 2

ANALYSIS
PT 3

ANALYSIS
PT 4

RECORD DRAWING

THIS RECORD DRAWING IS A COMPILATION OF A COPY OF THE
SEALED ENGINEERING DRAWING FOR THIS PROJECT, MODIFIED
BY ADDENDA, CHANGE ORDERS, AND INFORMATION
FURNISHED BY THE CONTRACTOR. THE INFORMATION SHOWN
ON THE RECORD DRAWINGS THAT WAS PROVIDED BY THE
CONTRACTOR OR OTHERS NOT ASSOCIATED WITH THE DESIGN
ENGINEER CANNOT BE VERIFIED FOR ACCURACY OR
COMPLETENESS. THE ORIGINAL SEALED DRAWINGS ARE ON
FILE AT THE OFFICES OF BINKLEY & BARFIELD, INC.

19-PICP-021

APPROVED
RMG



CAUTION: CONTRACTOR NOTE
THE LOCATION OF EXISTING UNDERGROUND AND OVERHEAD UTILITIES
ARE APPROXIMATE LOCATIONS ONLY. THE CONTRACTOR SHALL
CONTACT UTILITY COMPANIES PRIOR TO CONSTRUCTION.
CONTRACTOR SHALL DETERMINE, AND FIELD VERIFY EXISTING UTILITY
LOCATIONS AND DEPTHS PRIOR TO BEGINNING CONSTRUCTION AND
SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH
MIGHT OCCUR.
CONTRACTOR SHALL CONSIDER PROPOSED UTILITY IMPROVEMENTS
AND PROVIDE ADEQUATE HORIZONTAL AND VERTICAL CLEARANCE
DURING INSTALLATION OF ALL UTILITY INFRASTRUCTURE.

LEGEND

- PROPOSED PROPERTY/PROJECT BOUNDARY LINE
- EXISTING R.O.W./PROPERTY LINE
- EXISTING EASEMENT LINE
- EXISTING PAVEMENT
- PROPOSED CURB & GUTTER
- EXISTING CREEK/SWALE
- DRAINAGE BOUNDARY LINE
- DRAINAGE BOUNDARY LABEL
- INLET NUMBER
- DRAINAGE FLOW DIRECTION
- TIME OF CONCENTRATION LINE
- EXISTING CONTOURS
- PROPOSED CONTOURS
- EX. STORM DRAIN INLET WITH LATERAL
- PROP. STORM DRAIN INLET WITH LATERAL
- 100-YFP
- 100-YR FLOODPLAIN
- CWQZ
- CRITICAL WATER QUALITY ZONE
- WQTZ
- WATER QUALITY TRANSITION ZONE

PROPOSED

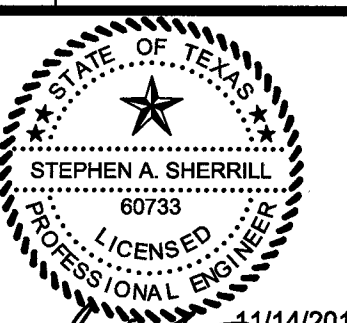
Analysis Point 1: Eastern Property Line					
	Existing Flows	Proposed Flows	Difference in Flows		
2 YR	33.09 CFS	32.06 CFS	-1.03	CFS	
10 YR	64.30 CFS	59.32 CFS	-4.98	CFS	
25 YR	87.44 CFS	79.95 CFS	-7.49	CFS	
100 YR	130.05 CFS	118.75 CFS	-11.30	CFS	
NOTE: ALL PROPOSED FLOWS LEAVING PROPERTY ARE LESS THAN EXISTING CONDITIONS					

Analysis Point 2: Eastern Property Line					
	Existing Flows	Proposed Flows	Difference in Flows		
2 YR	9.72 CFS	1.94 CFS	-7.78	CFS	
10 YR	18.89 CFS	3.41 CFS	-15.48	CFS	
25 YR	25.69 CFS	4.51 CFS	-21.18	CFS	
100 YR	38.21 CFS	6.53 CFS	-31.68	CFS	
NOTE: ALL PROPOSED FLOWS LEAVING PROPERTY ARE LESS THAN EXISTING CONDITIONS					

Analysis Point 3: Eastern Property Line					
	Existing Flows	Proposed Flows	Difference in Flows		
2 YR	3.95 CFS	1.57 CFS	-2.38	CFS	
10 YR	7.67 CFS	2.81 CFS	-4.86	CFS	
25 YR	10.43 CFS	3.72 CFS	-6.71	CFS	
100 YR	15.51 CFS	5.41 CFS	-10.10	CFS	
NOTE: ALL PROPOSED FLOWS LEAVING PROPERTY ARE LESS THAN EXISTING CONDITIONS					

Analysis Point 4: Eastern Property Line					
	Existing Flows	Proposed Flows	Difference in Flows		
2 YR	11.93 CFS	10.67 CFS	-1.26	CFS	
10 YR	22.98 CFS	21.10 CFS	-1.88	CFS	
25 YR	31.19 CFS	29.30 CFS	-1.89	CFS	
100 YR	46.33 CFS	44.74 CFS	-1.59	CFS	
NOTE: ALL PROPOSED FLOWS LEAVING PROPERTY ARE LESS THAN EXISTING CONDITIONS					

REV. NO.	BY	DATE	REVISION DESCRIPTION



4/14/2019



Binkley & Barfield, Inc.
consulting engineers
Texas Registration Number F-257
2401 DOUBLE CREEK DR #200, ROUND ROCK, TEXAS 78664 www.binkleybarfield.com

PROPOSED DRAINAGE AREA MAP

HAVEN OAKS
LEANDER, TEXAS

CASE: 19-PICP-021	SHEET
DATE: 11/14/2019	27
DRAWN BY: CH. SCD	OF 111
DESIGNED BY: CH. SCD	
REVIEWED BY: SS	

CURVE NUMBERS

Curve Number

Project: HERITAGE GROVE RD

By: DK

Date: 4/6/23

Location: PR DA-2 (POA-2, HAVEN OAKS RESIDENTIAL LOT)

Checked: EM

Date: 4/6/23

Circle one:

PRESENT

DEVELOPED

Developed Conditions

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/ unconnected impervious area ratio)	CN	Area	Product of CN x area
			X Acres mi ² %	
D type	Meadow	78	0.43	33.54
-	Impervious	98	0.37	36.26
Sub totals =			0.80	69.80

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{69.80}{0.80} = 87.25; \text{ Use CN} = \boxed{84}$$

Curve Number

Project: HERITAGE GROVE RD

By: DK

Date: 4/6/23

Location: PR DA-3 (POA-2, HAVEN OAKS RESIDENTIAL LOT)

Checked: EM

Date: 4/6/23

Circle one:

PRESENT

DEVELOPED

Developed Conditions

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/ unconnected impervious area ratio)	CN	Area	Product of CN x area
			X Acres mi ² %	
D type	Meadow	78	0.42	32.76
-	Impervious	98	0.28	27.44
Sub totals =			0.70	60.20

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{60.20}{0.70} = 86.00; \text{ Use CN} = \boxed{84}$$

APPENDIX B

Existing Discharge Calculations

APPENDIX B
TABLE OF CONTENTS

DESIGN STORMS

RAINFALL DATA

CURVE NUMBERS

TIME OF CONCENTRATION CALCULATIONS

EXISTING 2 YEAR 24 HOUR STORM

EXISTING 10 YEAR 24 HOUR STORM

EXISTING 25 YEAR 24 HOUR STORM

EXISTING 100 YEAR 24 HOUR STORM

EXISTING DRAINAGE AREAS

See Drawing No. 10 for the existing drainage areas.

DESIGN STORMS

As per the City of Austin Drainage Criteria Manual, the storms used for analysis will be the 2 year, 10 year, 25 year, and 100 year Type II 24-hour storm events.

RAINFALL DATA

The rainfall data has been obtained from City of Leander Drainage Criteria Technical Memorandum 1 and is as follows:

Return Period (year)	24-Hour Rainfall Depth (inch)
2	3.92
10	6.36
25	8.16
100	11.5

CURVE NUMBERS

Curve Number

Project: HERITAGE GROVE RD

By: DK

Date: 4/6/23

Location: EX-1 (POA-1, HERITAGE GROVE RD)

Checked: EM

Date: 4/6/23

Circle one:

PRESENT

DEVELOPED

Undeveloped Conditions

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/unconnected impervious area ratio)	CN	Area	Product of CN x area
			X Acres — mi ² — %	
D type	Meadow	78	8.44	658.32
	Impervious	98	0.15	14.70
Sub totals =			8.59	673.02

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{673.02}{8.59} = 78.35 ; \text{ Use CN} = \boxed{78}$$

Curve Number

Project: HERITAGE GROVE RD

By: DK

Date: 4/6/23

Location: EX-2 (POA-2, NORTH SIDE OF LOT)

Checked: EM

Date: 4/6/23

Circle one: PRESENT DEVELOPED

Undeveloped Conditions

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/ unconnected impervious area ratio)	CN	Area	Product of CN x area
			X Acres __ mi ² __ %	
D type	Wooded	77	2.97	228.69
D type	Meadow	78	32.47	2,532.66
-	Impervious	98	0.31	30.38
Sub totals =			35.75	2,791.73

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{2791.73}{35.75} = 78.09$; Use CN = **78**

TIME OF CONCENTRATION CALCULATIONS

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No. 1

EX-1

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
Sheet Flow							
Manning's n-value	= 0.150	0.011	0.011				
Flow length (ft)	= 100.0	0.0	0.0				
Two-year 24-hr precip. (in)	= 3.94	0.00	0.00				
Land slope (%)	= 0.10	0.00	0.00				
Travel Time (min)	= 29.27	+	0.00	+	0.00	=	29.27
Shallow Concentrated Flow							
Flow length (ft)	= 32.10	406.70	89.20				
Watercourse slope (%)	= 0.20	0.50	3.80				
Surface description	= Unpaved	Unpaved	Unpaved				
Average velocity (ft/s)	=0.72	1.14	3.15				
Travel Time (min)	= 0.74	+	5.94	+	0.47	=	7.16
Channel Flow							
X sectional flow area (sqft)	= 0.00	0.00	0.00				
Wetted perimeter (ft)	= 0.00	0.00	0.00				
Channel slope (%)	= 0.00	0.00	0.00				
Manning's n-value	= 0.015	0.015	0.015				
Velocity (ft/s)	=0.00	0.00	0.00				
Flow length (ft)	((0))0.0	0.0	0.0				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Total Travel Time, Tc				36.42 min			

TR55 Tc Worksheet

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No. 4

EX-2

<u>Description</u>	<u>A</u>	<u>B</u>	<u>C</u>	<u>Totals</u>			
Sheet Flow							
Manning's n-value	= 0.150	0.011	0.011				
Flow length (ft)	= 100.0	0.0	0.0				
Two-year 24-hr precip. (in)	= 3.94	0.00	0.00				
Land slope (%)	= 0.20	0.00	0.00				
Travel Time (min)	= 22.18	+	0.00	+	0.00	=	22.18
Shallow Concentrated Flow							
Flow length (ft)	= 159.10	1924.60	0.00				
Watercourse slope (%)	= 0.70	2.30	0.00				
Surface description	= Unpaved	Unpaved	Paved				
Average velocity (ft/s)	=1.35	2.45	0.00				
Travel Time (min)	= 1.96	+	13.11	+	0.00	=	15.07
Channel Flow							
X sectional flow area (sqft)	= 0.00	0.00	0.00				
Wetted perimeter (ft)	= 0.00	0.00	0.00				
Channel slope (%)	= 0.00	0.00	0.00				
Manning's n-value	= 0.015	0.015	0.015				
Velocity (ft/s)	=0.00	0.00	0.00				
Flow length (ft)	(0)0.0	0.0	0.0				
Travel Time (min)	= 0.00	+	0.00	+	0.00	=	0.00
Total Travel Time, Tc					37.25 min		

EXISTING 2 YEAR 24 HOUR STORM

Project: Heritage Grove Rd Simulation Run: 1 Pre-Development 2 Yr

Start of Run: 01Jan2022, 00:00

Basin Model: Existing

End of Run: 02Jan2022, 00:01

Meteorologic Model: 1-2 YR 24 HR

Compute Time: 05Apr2023, 09:09:09

Control Specifications: 24 Hr Model

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
EX-1	0.0134219	12.3	01Jan2022, 12:25	1.81
POA-1	0.0134219	12.3	01Jan2022, 12:25	1.81
PR DA-2	0.0012500	2.2	01Jan2022, 12:11	2.30
PR DA-3	0.0010940	1.8	01Jan2022, 12:13	2.29
EX-2	0.0558590	50.5	01Jan2022, 12:26	1.81
POA-2	0.0582030	52.5	01Jan2022, 12:25	1.83

EXISTING 10 YEAR 24 HOUR STORM

Project: Heritage Grove Rd Simulation Run: 2 Pre-Development 10 Yr

Start of Run: 01Jan2022, 00:00

Basin Model: Existing

End of Run: 02Jan2022, 00:01

Meteorologic Model: 2-10 YR 24 HR

Compute Time: 05Apr2023, 09:09:10

Control Specifications: 24 Hr Model

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
EX-1	0.0134219	24.7	01Jan2022, 12:24	3.88
POA-1	0.0134219	24.7	01Jan2022, 12:24	3.88
PR DA-2	0.0012500	3.9	01Jan2022, 12:11	4.53
PR DA-3	0.0010940	3.2	01Jan2022, 12:13	4.52
EX-2	0.0558590	101.3	01Jan2022, 12:25	3.88
POA-2	0.0582030	105.0	01Jan2022, 12:24	3.90

EXISTING 25 YEAR 24 HOUR STORM

Project: Heritage Grove Rd Simulation Run: 3 Pre-Development 25 Yr

Start of Run: 01Jan2022, 00:00

Basin Model: Existing

End of Run: 02Jan2022, 00:01

Meteorologic Model: 3-25 YR 24 HR

Compute Time: 05Apr2023, 09:09:10

Control Specifications: 24 Hr Model

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
EX-1	0.0134219	33.5	01Jan2022, 12:24	5.51
POA-1	0.0134219	33.5	01Jan2022, 12:24	5.51
PR DA-2	0.0012500	5.1	01Jan2022, 12:11	6.24
PR DA-3	0.0010940	4.2	01Jan2022, 12:13	6.24
EX-2	0.0558590	137.5	01Jan2022, 12:25	5.51
POA-2	0.0582030	142.5	01Jan2022, 12:24	5.54

EXISTING 100 YEAR 24 HOUR STORM

Project: Heritage Grove Rd Simulation Run: 4 Pre-Development 100 Yr

Start of Run: 01Jan2022, 00:00

Basin Model: Existing

End of Run: 02Jan2022, 00:01

Meteorologic Model: 5-100 YR 24 HR

Compute Time: 05Apr2023, 09:09:10

Control Specifications: 24 Hr Model

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
EX-1	0.0134219	48.8	01Jan2022, 12:24	8.66
POA-1	0.0134219	48.8	01Jan2022, 12:24	8.66
PR DA-2	0.0012500	7.1	01Jan2022, 12:11	9.48
PR DA-3	0.0010940	5.8	01Jan2022, 12:12	9.48
EX-2	0.0558590	200.2	01Jan2022, 12:24	8.66
POA-2	0.0582030	207.3	01Jan2022, 12:24	8.69

APPENDIX C

Proposed Discharge Calculations

APPENDIX C TABLE OF CONTENTS

DESIGN STORMS

RAINFALL DATA

CURVE NUMBERS

PROPOSED 2 YEAR 24 HOUR STORM

PROPOSED 10 YEAR 24 HOUR STORM

PROPOSED 25 YEAR 24 HOUR STORM

PROPOSED 100 YEAR 24 HOUR STORM

PROPOSED DRAINAGE AREAS

See Drawing No. 11 for the proposed drainage areas.

DESIGN STORMS

As per the City of Austin Drainage Criteria Manual, the storms used for analysis will be the 2 year, 10 year, 25 year, and 100 year Type II 24-hour storm events.

RAINFALL DATA

The rainfall data has been obtained from City of Leander Drainage Criteria Technical Memorandum 1 and is as follows:

Return Period (year)	24-Hour Rainfall Depth (inch)
2	3.92
10	6.36
25	8.16
100	11.5

CURVE NUMBERS

Curve Number

Project: HERITAGE GROVE RD

By: DK

Date: 4/6/23

Location: PR-1 UNDETAINED (POA-1)

Checked: EM

Date: 4/6/23

Circle one: PRESENT DEVELOPED

Developed Conditions

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/ unconnected impervious area ratio)	CN	Area	Product of CN x area
			X Acres — mi ² — %	
D type	Meadow	78	0.03	2.53

Sub totals =

0.03

2.53

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{2.53}{0.03} = 78.00 ; \text{ Use CN} = \boxed{78}$$

Curve Number

Project: HERITAGE GROVE RD

By: DK

Date: 4/6/23

Location: PR-2A DETAINED (POA-2, DETENTION POND-2)

Checked: EM

Date: 4/6/23

Circle one:

PRESENT

DEVELOPED

Developed Conditions

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/ unconnected impervious area ratio)	CN	Area	Product of CN x area
			X Acres __ mi ² __ %	
D type	Meadow	78	1.91	148.98
-	Impervious	98	0.83	81.34
Sub totals =			2.74	230.32

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{230.32}{2.74} = 84.06 ; \text{ Use CN} = \boxed{84}$$

Curve Number

Project: HERITAGE GROVE RD

By: DK

Date: 4/6/23

Location: PR-2B DETAINED (POA-2, NORTH SIDE)

Checked: EM

Date: 4/6/23

Circle one:

PRESENT

DEVELOPED

Developed Conditions

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/ unconnected impervious area ratio)	CN	Area	Product of CN x area
			X Acres mi ² %	
D type	Meadow	78	6.60	514.80
-	Impervious	98	30.56	2,994.88
Sub totals =			37.16	3,509.68

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{3509.68}{37.16} = 94.45 ; \text{ Use CN} = \boxed{94}$$

Curve Number

Project: HERITAGE GROVE RD

By: DK

Date: 4/6/23

Location: PR-2C UNDETAINED (POA-2, NORTH SIDE)

Checked: EM

Date: 4/6/23

Circle one: PRESENT DEVELOPED

Developed Conditions

Soil hydrologic group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; connected/ unconnected impervious area ratio)	CN	Area	Product of CN x area
			X Acres — mi ² — %	
D type	Meadow	78	4.41	343.98
Sub totals =			4.41	343.98

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{343.98}{4.41} = 78.00 ; \text{ Use CN} = \boxed{78}$$

PROPOSED 2 YEAR 24 HOUR STORM

Project: Heritage Grove Rd Simulation Run: 5 Post-Development 2 Yr

Start of Run: 01Jan2022, 00:00

Basin Model: Proposed

End of Run: 02Jan2022, 00:01

Meteorologic Model: 1-2 YR 24 HR

Compute Time: 05Apr2023, 09:09:11

Control Specifications: 24 Hr Model

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
PR-1	.000050625	0.1	01Jan2022, 12:04	1.82
POA-1	.000050625	0.1	01Jan2022, 12:04	1.82
PR DA-2	0.0012500	2.2	01Jan2022, 12:11	2.30
Bioretention	0.0042813	2.1	01Jan2022, 12:24	2.30
PR-2B	0.0580625	195.5	01Jan2022, 12:04	3.24
PR-2A	0.0042813	10.8	01Jan2022, 12:04	2.30
PR DA-3	0.0010940	1.8	01Jan2022, 12:13	2.29
Wet Pond	0.0646878	44.1	01Jan2022, 12:21	2.81
PR-2C	0.0068906	13.7	01Jan2022, 12:04	1.82
POA-2	0.0715784	47.9	01Jan2022, 12:17	2.71

PROPOSED 10 YEAR 24 HOUR STORM

Project: Heritage Grove Rd Simulation Run: 6 Post-Development 10 Yr

Start of Run: 01Jan2022, 00:00

Basin Model: Proposed

End of Run: 02Jan2022, 00:01

Meteorologic Model: 2-10 YR 24 HR

Compute Time: 05Apr2023, 09:09:20

Control Specifications: 24 Hr Model

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
PR-1	.000050625	0.2	01Jan2022, 12:04	3.90
POA-1	.000050625	0.2	01Jan2022, 12:04	3.90
PR DA-2	0.0012500	3.9	01Jan2022, 12:11	4.53
Bioretention	0.0042813	3.0	01Jan2022, 12:29	4.53
PR-2B	0.0580625	304.9	01Jan2022, 12:04	5.65
PR-2A	0.0042813	19.4	01Jan2022, 12:04	4.53
PR DA-3	0.0010940	3.2	01Jan2022, 12:13	4.52
Wet Pond	0.0646878	94.1	01Jan2022, 12:17	5.13
PR-2C	0.0068906	27.2	01Jan2022, 12:04	3.90
POA-2	0.0715784	103.3	01Jan2022, 12:14	5.01

PROPOSED 25 YEAR 24 HOUR STORM

Project: Heritage Grove Rd Simulation Run: 7 Post-Development 25 Yr

Start of Run: 01Jan2022, 00:00

Basin Model: Proposed

End of Run: 02Jan2022, 00:01

Meteorologic Model: 3-25 YR 24 HR

Compute Time: 05Apr2023, 09:09:29

Control Specifications: 24 Hr Model

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
PR-1	.000050625	0.3	01Jan2022, 12:04	5.54
POA-1	.000050625	0.3	01Jan2022, 12:04	5.54
PR DA-2	0.0012500	5.1	01Jan2022, 12:11	6.24
Bioretention	0.0042813	3.6	01Jan2022, 12:33	6.24
PR-2B	0.0580625	379.3	01Jan2022, 12:04	7.44
PR-2A	0.0042813	25.2	01Jan2022, 12:04	6.25
PR DA-3	0.0010940	4.2	01Jan2022, 12:13	6.24
Wet Pond	0.0646878	128.4	01Jan2022, 12:16	6.87
PR-2C	0.0068906	36.8	01Jan2022, 12:04	5.54
POA-2	0.0715784	142.4	01Jan2022, 12:11	6.74

PROPOSED 100 YEAR 24 HOUR STORM

Project: Heritage Grove Rd Simulation Run: 8 Post-Development 100 Yr

Start of Run: 01Jan2022, 00:00

Basin Model: Proposed

End of Run: 02Jan2022, 00:01

Meteorologic Model: 5-100 YR 24 HR

Compute Time: 05Apr2023, 09:09:38

Control Specifications: 24 Hr Model

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
PR-1	.000050625	0.4	01Jan2022, 12:04	8.69
POA-1	.000050625	0.4	01Jan2022, 12:04	8.69
PR DA-2	0.0012500	7.1	01Jan2022, 12:11	9.48
Bioretention	0.0042813	4.4	01Jan2022, 12:45	9.48
PR-2B	0.0580625	506.9	01Jan2022, 12:04	10.76
PR-2A	0.0042813	35.2	01Jan2022, 12:04	9.49
PR DA-3	0.0010940	5.8	01Jan2022, 12:12	9.48
Wet Pond	0.0646878	184.4	01Jan2022, 12:15	10.14
PR-2C	0.0068906	53.2	01Jan2022, 12:04	8.69
POA-2	0.0715784	207.2	01Jan2022, 12:09	10.00

APPENDIX D

Pond Routing Calculations

APPENDIX D TABLE OF CONTENTS

PROPOSED POND ROUTING – BIORETENTION/RAIN GARDEN

**2 Year 24 Hour Storm
10 Year 24 Hour Storm
25 Year 24 Hour Storm
100 Year 24 Hour Storm**

PROPOSED POND ROUTING – WET POND

**2 Year 24 Hour Storm
10 Year 24 Hour Storm
25 Year 24 Hour Storm
100 Year 24 Hour Storm**

**PROPOSED POND ROUTING – BIORETENTION/RAIN
GARDEN**

Project: Heritage Grove Rd Simulation Run: 5 Post-Development 2 Yr

Reservoir: Bioretention

Start of Run:	01Jan2022, 00:00	Basin Model:	Proposed
End of Run:	02Jan2022, 00:01	Meteorologic Model:	1-2 YR 24 HR
Compute Time:	05Apr2023, 09:09:11	Control Specifications:	24 Hr Model

Volume Units:IN

Computed Results

Peak Inflow:	10.8 (CFS)	Date/Time of Peak Inflow:	01Jan2022, 12:03
Peak Discharge:	2.1 (CFS)	Date/Time of Peak Discharge	01Jan2022, 12:24
Inflow Volume:	2.30 (IN)	Peak Storage:	0.4 (AC-FT)
Discharge Volume	2.30 (IN)	Peak Elevation:	988.2 (FT)

Project: Heritage Grove Rd Simulation Run: 6 Post-Development 10 Yr

Reservoir: Bioretention

Start of Run:	01Jan2022, 00:00	Basin Model:	Proposed
End of Run:	02Jan2022, 00:01	Meteorologic Model:	2-10 YR 24 HR
Compute Time:	05Apr2023, 09:09:20	Control Specifications:	24 Hr Model

Volume Units:IN

Computed Results

Peak Inflow:	19.4 (CFS)	Date/Time of Peak Inflow:	01Jan2022, 12:03
Peak Discharge:	3.0 (CFS)	Date/Time of Peak Discharge	01Jan2022, 12:29
Inflow Volume:	4.53 (IN)	Peak Storage:	0.6 (AC-FT)
Discharge Volume	4.53 (IN)	Peak Elevation:	988.6 (FT)

Project: Heritage Grove Rd Simulation Run: 7 Post-Development 25 Yr

Reservoir: Bioretention

Start of Run:	01Jan2022, 00:00	Basin Model:	Proposed
End of Run:	02Jan2022, 00:01	Meteorologic Model:	3-25 YR 24 HR
Compute Time:	05Apr2023, 09:09:29	Control Specifications:	24 Hr Model

Volume Units:IN

Computed Results

Peak Inflow:	25.2 (CFS)	Date/Time of Peak Inflow:	01Jan2022, 12:03
Peak Discharge:	3.6 (CFS)	Date/Time of Peak Discharge	01Jan2022, 12:33
Inflow Volume:	6.25 (IN)	Peak Storage:	0.7 (AC-FT)
Discharge Volume	6.24 (IN)	Peak Elevation:	988.9 (FT)

Project: Heritage Grove Rd Simulation Run: 8 Post-Development 100 Yr

Reservoir: Bioretention

Start of Run:	01Jan2022, 00:00	Basin Model:	Proposed
End of Run:	02Jan2022, 00:01	Meteorologic Model:	5-100 YR 24 HR
Compute Time:	05Apr2023, 09:09:38	Control Specifications:	24 Hr Model

Volume Units:IN

Computed Results

Peak Inflow:	35.2 (CFS)	Date/Time of Peak Inflow:	01Jan2022, 12:03
Peak Discharge:	4.4 (CFS)	Date/Time of Peak Discharge	01Jan2022, 12:45
Inflow Volume:	9.49 (IN)	Peak Storage:	1.1 (AC-FT)
Discharge Volume	9.48 (IN)	Peak Elevation:	989.4 (FT)

PROPOSED POND ROUTING – WET POND

Project: Heritage Grove Rd Simulation Run: 5 Post-Development 2 Yr

Reservoir: Wet Pond

Start of Run:	01Jan2022, 00:00	Basin Model:	Proposed
End of Run:	02Jan2022, 00:01	Meteorologic Model:	1-2 YR 24 HR
Compute Time:	05Apr2023, 09:09:11	Control Specifications:	24 Hr Model

Volume Units:IN

Computed Results

Peak Inflow:	199.4 (CFS)	Date/Time of Peak Inflow:	01Jan2022, 12:03
Peak Discharge:	44.1 (CFS)	Date/Time of Peak Discharge	01Jan2022, 12:21
Inflow Volume:	3.15 (IN)	Peak Storage:	5.3 (AC-FT)
Discharge Volume	2.81 (IN)	Peak Elevation:	967.6 (FT)

Project: Heritage Grove Rd Simulation Run: 6 Post-Development 10 Yr

Reservoir: Wet Pond

Start of Run:	01Jan2022, 00:00	Basin Model:	Proposed
End of Run:	02Jan2022, 00:01	Meteorologic Model:	2-10 YR 24 HR
Compute Time:	05Apr2023, 09:09:20	Control Specifications:	24 Hr Model

Volume Units:IN

Computed Results

Peak Inflow:	311.5 (CFS)	Date/Time of Peak Inflow:	01Jan2022, 12:03
Peak Discharge:	94.1 (CFS)	Date/Time of Peak Discharge	01Jan2022, 12:17
Inflow Volume:	5.54 (IN)	Peak Storage:	7.8 (AC-FT)
Discharge Volume	5.13 (IN)	Peak Elevation:	968.8 (FT)

Project: Heritage Grove Rd Simulation Run: 7 Post-Development 25 Yr

Reservoir: Wet Pond

Start of Run:	01Jan2022, 00:00	Basin Model:	Proposed
End of Run:	02Jan2022, 00:01	Meteorologic Model:	3-25 YR 24 HR
Compute Time:	05Apr2023, 09:09:29	Control Specifications:	24 Hr Model

Volume Units:IN

Computed Results

Peak Inflow:	387.9 (CFS)	Date/Time of Peak Inflow:	01Jan2022, 12:03
Peak Discharge:	128.4 (CFS)	Date/Time of Peak Discharge	01Jan2022, 12:16
Inflow Volume:	7.32 (IN)	Peak Storage:	9.4 (AC-FT)
Discharge Volume	6.87 (IN)	Peak Elevation:	969.5 (FT)

Project: Heritage Grove Rd Simulation Run: 8 Post-Development 100 Yr

Reservoir: Wet Pond

Start of Run:	01Jan2022, 00:00	Basin Model:	Proposed
End of Run:	02Jan2022, 00:01	Meteorologic Model:	5-100 YR 24 HR
Compute Time:	05Apr2023, 09:09:38	Control Specifications:	24 Hr Model

Volume Units:IN

Computed Results

Peak Inflow:	518.6 (CFS)	Date/Time of Peak Inflow:	01Jan2022, 12:03
Peak Discharge:	184.4 (CFS)	Date/Time of Peak Discharge	01Jan2022, 12:15
Inflow Volume:	10.63 (IN)	Peak Storage:	11.9 (AC-FT)
Discharge Volume	10.14 (IN)	Peak Elevation:	970.5 (FT)

APPENDIX E

Stormwater Conveyance Calculations

APPENDIX E
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HYDRAULIC CALCULATIONS

25-YEAR STORM EVENT
PROPOSED STORM SEWERS

100-YEAR STORM EVENT
PROPOSED STORM SEWERS

**HYDRAULIC CALCULATIONS
25-YEAR STORM EVENT
PROPOSED STORM SEWERS**

Project Information

Project: Heritage Grove Rd

Job No.: 531020901

System: STORM

Designed: DK

Checked: EM

Date: 4/6/2023

Date: 4/6/2023

Design Criteria

Starting

HGL Elev. (ft): 988.90

Williamson

Design Storm: 25 yr

b = 110.07

d = 15.07

e = 0.8183

Min Cover (ft): 2

Match C or F: C

Min. Tc (min): 5

Default n: 0.012

Junction K: 0.3

Peaking Factor: 1

Downstream MH/Inlet	Downstream Flowline	Upstream MH/Inlet	Upstream Flowline	Pipe Length (ft)	Round or Box	Pipe Rise (in or ft)	Pipe Span (ft)	No. of Pipes	Pipe Material	n	Min Slope (%)	C	I (in/hr)	Area (Acres)	Roof Area (sf)	Branch Area (Acres)	Cum. Area (Acres)	Tc (min)	Flow (cfs)	Roof Flow (cfs)	Branch Flow (cfs)	Cum. Flow (cfs)	Design Cap. (cfs)	Flow Velocity (ft/s)	Upstream TG (ft)	HGL (ft)
HW-03	987.50	CB-37	987.90	154.03	Round	18		1	CONC	0.012	0.26%	0.7352	9.46	0.12			1.19	5.00	0.87	0.00		8.08	5.82	4.58	997.69	989.77
CB-37	990.00	CB-38	990.33	126.03	Round	18		1	CONC	0.012	0.26%	0.753	9.46	0.28			1.07	5.00	1.99	0.00		7.22	5.82	4.08	997.69	991.83
CB-38	990.33	CB-39	990.66	126	Round	18		1	CONC	0.012	0.26%	0.6754	9.46	0.31			0.79	5.00	1.97	0.00		5.23	5.82	2.96	997.69	992.16
CB-39	990.66	CB-40	991.03	142.38	Round	18		1	CONC	0.012	0.26%	0.7149	9.46	0.48			0.48	5.00	3.26	0.00		3.26	5.82	1.84	997.70	992.53

Project Information

Project: Heritage Grove Rd
 Job No.: 531020901
 System: STORM
 Designed: DK
 Checked: EM

Date: 4/6/2023
 Date: 4/6/2023

Design Criteria

Starting Min Cover (ft): 2
 HGL Elev. (ft): 969.50 Match C or F: C
 Min. Tc (min): 5
 Williamson Default n: 0.012
 Design Storm: 25 yr Junction K: 0.3
 b = 110.07 Peaking Factor: 1
 d = 15.07
 e = 0.8183

Downstream MH/Inlet	Downstream Flowline	Upstream MH/Inlet	Upstream Flowline	Pipe Length (ft)	Round or Box	Pipe Rise (in or ft)	Pipe Span (ft)	No. of Pipes	Pipe Material	n	Min Slope (%)	C	I (in/hr)	Area (Acres)	Roof Area (sf)	Branch Area (Acres)	Cum. Area (Acres)	Tc (min)	Flow (cfs)	Roof Flow (cfs)	Branch Flow (cfs)	Cum. Flow (cfs)	Design Cap. (cfs)	Flow Velocity (ft/s)	Upstream TG (ft)	HGL (ft)
HW-1	965.00	CCB-1	965.02	29.61	Round	60		1	CONC	0.012	0.06%	0.8417	9.46	0.81		4.83	26.97	5.00	6.46	0.00	34.28	248.10	69.30	12.64	984.01	970.47
CCB-1	974.00	CB-2	974.09	156	Round	54		1	CONC	0.012	0.06%	0.9	9.46	2.77			21.33	5.00	23.61	0.00		207.36	52.32	13.04	985.50	978.59
CB-2	974.09	CB-3	974.21	200	Round	54		1	CONC	0.012	0.06%	0.9	9.46	2.80			18.55	5.00	23.84	0.00		183.75	52.32	11.55	985.50	980.70
CB-3	974.21	CB-4	974.33	190	Round	54		1	CONC	0.012	0.06%	0.8679	9.46	1.89			15.75	5.00	15.55	0.00		159.92	52.32	10.05	985.50	982.23
CB-4	974.33	CB-5	974.41	137	Round	54		1	CONC	0.012	0.06%	0.8596	9.46	1.62			13.86	5.00	13.16	0.00		144.37	52.32	9.08	986.50	983.24
CB-5	974.41	CB-6	974.52	183	Round	54		1	CONC	0.012	0.06%	0.9	9.46	2.80			12.24	5.00	23.84	0.00		131.21	52.32	8.25	986.50	984.25
CB-6	975.02	CB-7	975.16	200	Round	48		1	CONC	0.012	0.07%	0.8848	9.46	2.76			9.44	5.00	23.09	0.00		107.37	41.28	8.54	986.50	985.54
CB-7	975.66	CB-8	980.00	119	Round	42		1	CONC	0.012	0.09%	0.7948	9.46	0.43	0.59		6.68	5.00	3.23	0.00	4.93	84.28	32.79	8.76	989.17	986.60
CB-8	980.00	MH-01	980.02	25.83	Round	42		1	CONC	0.012	0.09%	0	9.46	0.00	1.35		5.66	5.00	0.00	0.00	8.76	76.13	32.79	7.91	990.09	987.02
MH-01	980.52	CCB-9	985.00	86.26	Round	36		1	CONC	0.012	0.11%	0.7557	9.46	0.12	0.14		4.31	5.00	0.89	0.00	1.19	67.37	24.03	9.53	993.73	988.19
CCB-9	985.00	MH-02	985.29	260.57	Round	36		1	CONC	0.012	0.11%	0	9.46	0.00	3.28		4.05	5.00	0.00	0.00	59.71	65.29	24.03	9.24	994.80	990.70
MH-02	990.00	CB-10	990.92	352.93	Round	18		1	CONC	0.012	0.26%	0.7691	9.46	0.77			0.77	5.00	5.58	0.00		5.58	5.82	3.16	997.49	992.42
CB-8	980.00	CB-11	980.51	197.96	Round	18		1	CONC	0.012	0.26%	0.8817	9.46	0.59			0.59	5.00	4.93	0.00		4.93	5.82	2.79	990.80	987.01
MH-01	980.52	MH-03	981.00	185.04	Round	18		1	CONC	0.012	0.26%	0	9.46	0.00			1.35	5.00	0.00	0.00		8.76	5.82	4.96	990.83	988.22
MH-03	981.00	CCB-12	981.23	89.17	Round	18		1	CONC	0.012	0.26%	0.8403	9.46	0.65			1.35	5.00	5.16	0.00		8.76	5.82	4.96	989.56	988.86
CCB-12	987.45	OCS-01	987.50	10.7	Round	9		1	CONC	0.012	0.75%	0	9.46	0.00			0.70	5.00	0.00	0.00		3.60	1.55	8.15	988.50	989.60
CCB-9	985.00	CCB-13	985.10	40	Round	18		1	CONC	0.012	0.26%	0.9	9.46	0.14			0.14	5.00	1.19	0.00		1.19	5.82	0.67	993.73	988.19
MH-02	984.29	CB-14	984.46	151.47	Round	36		1	CONC	0.012	0.11%	0.8724	9.46	2.49			2.49	5.00	20.54	0.00		39.44	24.03	5.58	992.07	991.29
CB-14	984.46	CB-15	984.60	132	Round	36		1	CONC	0.012	0.11%	0.8362	9.46	2.39			2.39	5.00	18.91	0.00		18.91	24.03	2.67	992.07	991.42
MH-02	984.29	CCB-16	984.38	49.6	Round	24		1	CONC	0.012	0.18%	0.8372	9.46	0.79			0.79	5.00	6.27	0.00		20.27	10.43	6.45	993.33	991.23
CCB-16	984.38	CCB-17	984.58	113.79	Round	24		1	CONC	0.012	0.18%	0.7894	9.46	1.88			1.88	5.00	14.00	0.00		14.00	10.43	4.46	993.20	991.69
HW-02	965.00	CCB-29	965.07	38.49	Round	24		1	CONC	0.012	0.18%	0.7595	9.46	0.06			2.00	5.00	0.43	0.00		15.14	10.43	4.82	989.00	969.75
CCB-29	980.00	CCB-30	980.32	179.23	Round	24		1	CONC	0.012	0.18%	0.9	9.46	0.34			1.94	5.00	2.93	0.00		14.71	10.43	4.68	987.83	982.32
CCB-30	980.32	CCB-31	980.68	200	Round	24		1	CONC	0.012	0.18%	0.9	9.46	0.33			1.59	5.00	2.83	0.00		11.78	10.43	3.75	987.83	982.85
CCB-31	980.68	CCB-32	981.05	206.5	Round	24		1	CONC	0.012	0.18%	0.8435	9.46	0.34			1.26	5.00	2.69	0.00		8.95	10.43	2.85	987.83	983.16
CCB-32	981.55	CCB-33	982.05	189.67	Round	18		1	CONC	0.012	0.26%	0.7101	9.46	0.48			0.92	5.00	3.21	0.00		6.26	5.82	3.54	990.38	983.79
CCB-33	982.05	MH-06	982.35	116.32	Round	18		1	CONC	0.012	0.26%	0	9.46	0.00			0.45	5.00	0.00	0.00		3.05	5.82	1.73	991.02	983.88
MH-06	982.35	CCB-34	982.59	91.46	Round	18		1	CONC	0.012	0.26%	0.7242	9.46	0.45			0.45	5.00	3.05	0.00		3.05	5.82	1.73	990.36	984.09
CCB-34	982.59	CCB-35	983.10	198	Round	18		1	CONC	0.012	0.26%	0.3953	9.46	2.69			2.69	5.00	10.07	0.00		10.07	5.82	5.70	990.36	985.78
CCB-32	981.55	CB-36	982.02	182.08	Round	18		1	CONC	0.012	0.26%	0.9	9.46	0.41			0.41	5.00	3.53	0.00		3.53	5.82	2.00	989.80	983.52
CCB-1	974.00	CCB-18	978.00	300	Round	36		1	CONC	0.012	0.11%	0.7609	9.46	0.06			4.83	5.00	0.42	0.00		34.28	24.03	4.85	989.00	981.00
CCB-18	978.00	CCB-19	978.10	91.17	Round	36		1	CONC	0.012	0.11%	0.9	9.46	0.17			4.77	5.00	1.46	0.00		33.86	24.03	4.79	987.88	981.31
CCB-19	978.10	CCB-20	978.33	206.5	Round	36		1	CONC	0.012	0.11%	0.9	9.46	0.32			4.60	5.00	2.76	0.00		32.40	24.03	4.58	987.91	981.82

CCB-20	978.83	CCB-21	979.09	200	Round	30		1	CONC	0.012	0.13%	0	9.46	0.47			4.28	5.00	0.00	0.00		29.64	16.06	6.04	987.91	982.87
CCB-21	979.59	MH-04	981.00	132.08	Round	24		1	CONC	0.012	0.18%	0.8781	9.46	0.49		0.43	3.80	5.00	4.03	0.00	3.59	29.64	10.43	9.44	990.02	985.21
MH-04	981.00	CCB-22	981.30	166.58	Round	24		1	CONC	0.012	0.18%	0.8487	9.46	0.51			2.89	5.00	4.10	0.00		22.03	10.43	7.01	989.87	986.78
CCB-22	981.30	CCB-23	981.66	200	Round	24		1	CONC	0.012	0.18%	0.8183	9.46	0.55			2.38	5.00	4.24	0.00		17.92	10.43	5.71	989.87	987.99
CCB-23	981.66	CCB-24	982.02	197.5	Round	24		1	CONC	0.012	0.18%	0.7809	9.46	0.64			1.83	5.00	4.72	0.00		13.68	10.43	4.36	989.89	988.69
CCB-24	982.52	CB-25	988.00	219.42	Round	18		1	CONC	0.012	0.26%	0.8347	9.46	0.26			1.19	5.00	2.05	0.00		8.96	5.82	5.07	995.67	990.17
CB-25	988.00	CB-26	988.45	174	Round	18		1	CONC	0.012	0.26%	0.826	9.46	0.13			0.93	5.00	1.05	0.00		6.91	5.82	3.91	995.05	990.87
CB-26	988.45	CB-27	989.12	255.58	Round	18		1	CONC	0.012	0.26%	0.8359	9.46	0.33			0.79	5.00	2.61	0.00		5.86	5.82	3.32	997.67	991.60
CB-27	989.12	MH-05	989.43	118.8	Round	18		1	CONC	0.012	0.26%	0	9.46	0.00			0.46	5.00	0.00	0.00		3.25	5.82	1.84	999.21	991.71
MH-05	989.43	CB-28	989.77	134.2	Round	18		1	CONC	0.012	0.26%	0.7409	9.46	0.46			0.46	5.00	3.25	0.00		3.25	5.82	1.84	997.70	991.84
MH-04	981.00	CB-41	981.45	171.79	Round	18		1	CONC	0.012	0.26%	0.8763	9.46	0.43			0.43	5.00	3.59	0.00		3.59	5.82	2.03	989.82	985.40

**HYDRAULIC CALCULATIONS
100-YEAR STORM EVENT
PROPOSED STORM SEWERS**

Project Information

Project: Heritage Grove Rd

Job No.: 531020901

System: STORM

Designed: DK

Checked: EM

Date: 4/6/2023

Date: 4/6/2023

Design Criteria

Starting

HGL Elev. (ft): 989.40

Williamson

Design Storm: 100 yr

b = 155.59

d = 17.40

e = 0.8232

Min Cover (ft): 2

Match C or F: C

Min. Tc (min): 5

Default n: 0.012

Junction K: 0.3

Peaking Factor: 1

Downstream MH/Inlet	Downstream Flowline	Upstream MH/Inlet	Upstream Flowline	Pipe Length (ft)	Round or Box	Pipe Rise (in or ft)	Pipe Span (ft)	No. of Pipes	Pipe Material	n	Min Slope (%)	C	I (in/hr)	Area (Acres)	Roof Area (sf)	Branch Area (Acres)	Cum. Area (Acres)	Tc (min)	Flow (cfs)	Roof Flow (cfs)	Branch Flow (cfs)	Cum. Flow (cfs)	Design Cap. (cfs)	Flow Velocity (ft/s)	Upstream TG (ft)	HGL (ft)
HW-03	987.50	CB-37	987.90	154.03	Round	18		1	CONC	0.012	0.26%	0.7352	12.04	0.12			1.19	5.00	1.10	0.00		10.29	5.82	5.82	997.69	990.81
CB-37	990.00	CB-38	990.33	126.03	Round	18		1	CONC	0.012	0.26%	0.753	12.04	0.28			1.07	5.00	2.53	0.00		9.19	5.82	5.20	997.69	991.83
CB-38	990.33	CB-39	990.66	126	Round	18		1	CONC	0.012	0.26%	0.6754	12.04	0.31			0.79	5.00	2.50	0.00		6.65	5.82	3.76	997.69	992.32
CB-39	990.66	CB-40	991.03	142.38	Round	18		1	CONC	0.012	0.26%	0.7149	12.04	0.48			0.48	5.00	4.15	0.00		4.15	5.82	2.35	997.70	992.54

Project Information

Project: Heritage Grove Rd
 Job No.: 531020901
 System: STORM
 Designed: DK
 Checked: EM

Date: 4/6/2023
 Date: 4/6/2023

Design Criteria

Starting Min Cover (ft): 2
 HGL Elev. (ft): 970.50 Match C or F: C
 Min. Tc (min): 5
 Williamson Default n: 0.012
 Design Storm: 100 yr Junction K: 0.3
 b = 155.59 Peaking Factor: 1
 d = 17.40
 e = 0.8232

Downstream MH/Inlet	Downstream Flowline	Upstream MH/Inlet	Upstream Flowline	Pipe Length (ft)	Round or Box	Pipe Rise (in or ft)	Pipe Span (ft)	No. of Pipes	Pipe Material	n	Min Slope (%)	C	I (in/hr)	Area (Acres)	Roof Area (sf)	Branch Area (Acres)	Cum. Area (Acres)	Tc (min)	Flow (cfs)	Roof Flow (cfs)	Branch Flow (cfs)	Cum. Flow (cfs)	Design Cap. (cfs)	Flow Velocity (ft/s)	Upstream TG (ft)	HGL (ft)
HW-1	965.00	CCB-1	965.02	29.61	Round	60		1	CONC	0.012	0.06%	0.8417	12.04	0.81		4.83	26.97	5.00	8.22	0.00	43.62	314.73	69.30	16.03	984.01	972.06
CCB-1	974.00	CB-2	974.09	156	Round	60		1	CONC	0.012	0.06%	0.9	12.04	2.77			21.33	5.00	30.04	0.00		262.89	69.30	13.39	985.50	979.09
CB-2	974.09	CB-3	974.21	200	Round	60		1	CONC	0.012	0.06%	0.9	12.04	2.80			18.55	5.00	30.33	0.00		232.85	69.30	11.86	985.50	981.10
CB-3	974.21	CB-4	974.33	190	Round	60		1	CONC	0.012	0.06%	0.8679	12.04	1.89			15.75	5.00	19.78	0.00		202.51	69.30	10.31	985.50	982.57
CB-4	974.83	CB-5	974.91	137	Round	54		1	CONC	0.012	0.06%	0.8596	12.04	1.62			13.86	5.00	16.75	0.00		182.73	52.32	11.49	986.50	984.19
CB-5	974.91	CB-6	975.02	183	Round	54		1	CONC	0.012	0.06%	0.9	12.04	2.80			12.24	5.00	30.34	0.00		165.98	52.32	10.44	986.50	985.80
CB-6	975.02	CB-7	975.14	200	Round	54		1	CONC	0.012	0.06%	0.8848	12.04	2.76			9.44	5.00	29.38	0.00		135.65	52.32	8.53	986.50	986.95
CB-7	975.64	CB-8	980.00	119	Round	48		1	CONC	0.012	0.07%	0.7948	12.04	0.43	0.59		6.68	5.00	4.11	0.00	6.27	106.27	41.28	8.46	989.17	987.83
CB-8	980.00	MH-01	980.02	25.83	Round	48		1	CONC	0.012	0.07%	0	12.04	0.00	1.35		5.66	5.00	0.00	0.00	10.17	95.89	41.28	7.63	990.09	988.20
MH-01	980.52	CCB-9	985.00	86.26	Round	42		1	CONC	0.012	0.09%	0.7557	12.04	0.12	0.14		4.31	5.00	1.13	0.00	1.52	85.72	32.79	8.91	993.73	989.10
CCB-9	985.00	MH-02	985.23	260.57	Round	42		1	CONC	0.012	0.09%	0	12.04	0.00	3.28		4.05	5.00	0.00	0.00	75.98	83.08	32.79	8.64	994.80	990.96
MH-02	990.00	CB-10	990.92	352.93	Round	18		1	CONC	0.012	0.26%	0.7691	12.04	0.77			0.77	5.00	7.10	0.00		7.10	5.82	4.02	997.49	992.42
CB-8	980.00	CB-11	980.51	197.96	Round	18		1	CONC	0.012	0.26%	0.8817	12.04	0.59			0.59	5.00	6.27	0.00		6.27	5.82	3.55	990.80	988.49
MH-01	980.52	MH-03	980.85	185.04	Round	24		1	CONC	0.012	0.18%	0	12.04	0.00			1.35	5.00	0.00	0.00		10.17	10.43	3.24	990.83	988.57
MH-03	980.85	CCB-12	981.01	89.17	Round	24		1	CONC	0.012	0.18%	0.8403	12.04	0.65			1.35	5.00	6.57	0.00		10.17	10.43	3.24	989.56	988.77
CCB-12	987.45	OCS-01	987.50	10.7	Round	9		1	CONC	0.012	0.75%	0	12.04	0.00			0.70	5.00	0.00	0.00		3.60	1.55	8.15	988.50	989.51
CCB-9	985.00	CCB-13	985.10	40	Round	18		1	CONC	0.012	0.26%	0.9	12.04	0.14			0.14	5.00	1.52	0.00		1.52	5.82	0.86	993.73	989.11
MH-02	984.29	CB-14	984.46	151.47	Round	36		1	CONC	0.012	0.11%	0.8724	12.04	2.49			2.49	5.00	26.13	0.00		50.19	24.03	7.10	992.07	991.92
CB-14	984.46	CB-15	984.60	132	Round	36		1	CONC	0.012	0.11%	0.8362	12.04	2.39			2.39	5.00	24.06	0.00		24.06	24.03	3.40	992.07	992.12
MH-02	984.29	CCB-16	984.38	49.6	Round	24		1	CONC	0.012	0.18%	0.8372	12.04	0.79			0.79	5.00	7.97	0.00		25.79	10.43	8.21	993.33	991.82
CCB-16	984.38	CCB-17	984.58	113.79	Round	24		1	CONC	0.012	0.18%	0.7894	12.04	1.88			1.88	5.00	17.82	0.00		17.82	10.43	5.67	993.20	992.56
HW-02	965.00	CCB-29	965.07	38.49	Round	24		1	CONC	0.012	0.18%	0.7595	12.04	0.06			2.00	5.00	0.55	0.00		19.27	10.43	6.13	989.00	970.91
CCB-29	980.00	CCB-30	980.32	179.23	Round	24		1	CONC	0.012	0.18%	0.9	12.04	0.34			1.94	5.00	3.72	0.00		18.71	10.43	5.96	987.83	982.32
CCB-30	980.32	CCB-31	980.68	200	Round	24		1	CONC	0.012	0.18%	0.9	12.04	0.33			1.59	5.00	3.61	0.00		14.99	10.43	4.77	987.83	983.17
CCB-31	980.68	CCB-32	981.05	206.5	Round	24		1	CONC	0.012	0.18%	0.8435	12.04	0.34			1.26	5.00	3.42	0.00		11.38	10.43	3.62	987.83	983.68
CCB-32	981.55	CCB-33	982.05	189.67	Round	18		1	CONC	0.012	0.26%	0.7101	12.04	0.48			0.92	5.00	4.08	0.00		7.96	5.82	4.51	990.38	984.70
CCB-33	982.05	MH-06	982.35	116.32	Round	18		1	CONC	0.012	0.26%	0	12.04	0.00			0.45	5.00	0.00	0.00		3.88	5.82	2.20	991.02	984.85
MH-06	982.35	CCB-34	982.59	91.46	Round	18		1	CONC	0.012	0.26%	0.7242	12.04	0.45			0.45	5.00	3.88	0.00		3.88	5.82	2.20	990.36	984.98
CCB-34	982.59	CCB-35	983.10	198	Round	18		1	CONC	0.012	0.26%	0.3953	12.04	2.69			2.69	5.00	12.81	0.00		12.81	5.82	7.25	990.36	987.72
CCB-32	981.55	CB-36	982.02	182.08	Round	18		1	CONC	0.012	0.26%	0.9	12.04	0.41			0.41	5.00	4.49	0.00		4.49	5.82	2.54	989.80	983.99
CCB-1	974.00	CCB-18	978.00	300	Round	36		1	CONC	0.012	0.11%	0.7609	12.04	0.06			4.83	5.00	0.54	0.00		43.62	24.03	6.17	989.00	981.00
CCB-18	978.00	CCB-19	978.10	91.17	Round	36		1	CONC	0.012	0.11%	0.9	12.04	0.17			4.77	5.00	1.86	0.00		43.09	24.03	6.10	987.88	981.50
CCB-19	978.10	CCB-20	978.33	206.5	Round	36		1	CONC	0.012	0.11%	0.9	12.04	0.32			4.60	5.00	3.51	0.00		41.23	24.03	5.83	987.91	982.32

CCB-20	978.33	CCB-21	978.55	200	Round	36		1	CONC	0.012	0.11%	0	12.04	0.47			4.28	5.00	0.00	0.00		37.72	24.03	5.34	987.91	983.00
CCB-21	979.05	MH-04	981.00	132.08	Round	30		1	CONC	0.012	0.13%	0.8781	12.04	0.49		0.43	3.80	5.00	5.13	0.00	4.56	37.72	16.06	7.68	990.02	984.22
MH-04	981.00	CCB-22	981.22	166.58	Round	30		1	CONC	0.012	0.13%	0.8487	12.04	0.51			2.89	5.00	5.22	0.00		28.03	16.06	5.71	989.87	985.03
CCB-22	981.22	CCB-23	981.48	200	Round	30		1	CONC	0.012	0.13%	0.8183	12.04	0.55			2.38	5.00	5.40	0.00		22.81	16.06	4.65	989.87	985.66
CCB-23	981.98	CCB-24	982.33	197.5	Round	24		1	CONC	0.012	0.18%	0.7809	12.04	0.64			1.83	5.00	6.01	0.00		17.41	10.43	5.54	989.89	986.79
CCB-24	982.33	CB-25	988.00	219.42	Round	24		1	CONC	0.012	0.18%	0.8347	12.04	0.26			1.19	5.00	2.61	0.00		11.40	10.43	3.63	995.67	990.00
CB-25	988.50	CB-26	988.95	174	Round	18		1	CONC	0.012	0.26%	0.826	12.04	0.13			0.93	5.00	1.33	0.00		8.79	5.82	4.97	995.05	991.15
CB-26	988.95	CB-27	989.62	255.58	Round	18		1	CONC	0.012	0.26%	0.8359	12.04	0.33			0.79	5.00	3.32	0.00		7.46	5.82	4.22	997.67	992.32
CB-27	989.62	MH-05	989.93	118.8	Round	18		1	CONC	0.012	0.26%	0	12.04	0.00			0.46	5.00	0.00	0.00		4.13	5.82	2.34	999.21	992.50
MH-05	989.93	CB-28	990.27	134.2	Round	18		1	CONC	0.012	0.26%	0.7409	12.04	0.46			0.46	5.00	4.13	0.00		4.13	5.82	2.34	997.70	992.70
MH-04	981.00	CB-41	981.45	171.79	Round	18		1	CONC	0.012	0.26%	0.8763	12.04	0.43			0.43	5.00	4.56	0.00		4.56	5.82	2.58	989.82	984.53

APPENDIX F

Water Quality Calculations

**APPENDIX F
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TCEQ WORKSHEETS

TCEQ WORKSHEETS

Additional information is provided for cells with a red triangle in the upper right corner. Place the cursor over the cell.

Text shown in blue indicate location of instructions in the Technical Guidance Manual - RG-348.

Characters shown in red are data entry fields.

Characters shown in black (Bold) are calculated fields. Changes to these fields will remove the equations used in the spreadsheet.

1. The Required Load Reduction for the total project

Calculations from RG-348

Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

$L_{M \text{ TOTAL PROJECT}}$ = Required TSS removal resulting from the proposed development = 80% of increased load

A_N = Net increase in impervious area for the project

P = Average annual precipitation, inches

Site Data: Determine Required Load Removal Based on the Entire Project

County = **Williamson**

Total project area included in plan = **44.40** acres

Predevelopment impervious area within the limits of the plan = **0.60** acres

Total post-development impervious area within the limits of the plan = **31.39** acres

Total post-development impervious cover fraction = **0.71**

P = **32** inches

$L_{M \text{ TOTAL PROJECT}}$ = **26800** lbs.

* The values entered in these fields should be for the total project area.

Number of drainage basins / outfalls areas leaving the plan area = **2**

2. Drainage Basin Parameters (This information should be provided for each basin)

Drainage Basin/Outfall Area No. = **2**

Total drainage basin/outfall area = **2.74** acres

Predevelopment impervious area within drainage basin/outfall area = **0.00** acres

Post-development impervious area within drainage basin/outfall area = **0.83** acres

Post-development impervious fraction within drainage basin/outfall area = **0.30**

$L_{M \text{ THIS BASIN}}$ = **722** lbs.

3. Indicate the proposed BMP Code for this basin

Proposed BMP = **Bioretention**

Removal efficiency = **89** percent

4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.

RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_i \times 34.6 + A_p \times 0.54)$

where:

A_C = Total On-Site drainage area in the BMP catchment area

A_i = Impervious area proposed in the BMP catchment area

A_p = Pervious area remaining in the BMP catchment area

L_R = TSS Load removed from this catchment area by the proposed BMP

A_C = **2.74** acres

A_i = **0.83** acres

A_p = **1.91** acres

L_R = **847** lbs

5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area

Desired $L_{M \text{ THIS BASIN}}$ = **722** lbs.

F = **0.85**

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area:

Calculations from RG-348

Pages 3-34 to 3-36

Rainfall Depth = **1.32** inches
Post Development Runoff Coefficient = **0.26**
On-site Water Quality Volume = **3409** cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP = **0.00** acres
Off-site Impervious cover draining to BMP = **0.00** acres
Impervious fraction of off-site area = **0**
Off-site Runoff Coefficient = **0.00**
Off-site Water Quality Volume = **0** cubic feet

Storage for Sediment = **682**

Total Capture Volume (required water quality volume(s) x 1.20) = **4090** cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP!

The values for BMP Types not selected in cell C45 will show NA

10. Bioretention System

Designed as Required in RG-348

Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin = **4090** cubic feet

Additional information is provided for cells with a red triangle in the upper right corner. Place the cursor over the cell.

Text shown in blue indicate location of instructions in the Technical Guidance Manual - RG-348.

Characters shown in red are data entry fields.

Characters shown in black (Bold) are calculated fields. Changes to these fields will remove the equations used in the spreadsheet.

1. The Required Load Reduction for the total project

Calculations from RG-348

Pages 3-27 to 3-30

Page 3-29 Equation 3.3: $L_M = 27.2(A_N \times P)$

where:

 $L_{M \text{ TOTAL PROJECT}}$ = Required TSS removal resulting from the proposed development = 80% of increased load A_N = Net increase in impervious area for the project P = Average annual precipitation, inches

Site Data: Determine Required Load Removal Based on the Entire Project

County = **Williamson**Total project area included in plan = **44.40** acresPredevelopment impervious area within the limits of the plan = **0.60** acresTotal post-development impervious area within the limits of the plan = **31.39** acresTotal post-development impervious cover fraction = **0.71** P = **32** inches $L_{M \text{ TOTAL PROJECT}}$ = **26800** lbs.

* The values entered in these fields should be for the total project area.

Number of drainage basins / outfalls areas leaving the plan area = **2****2. Drainage Basin Parameters (This information should be provided for each basin)**Drainage Basin/Outfall Area No. = **1**Total drainage basin/outfall area = **37.16** acresPredevelopment impervious area within drainage basin/outfall area = **0.60** acresPost-development impervious area within drainage basin/outfall area = **30.56** acresPost-development impervious fraction within drainage basin/outfall area = **0.82** $L_{M \text{ THIS BASIN}}$ = **26077** lbs.**3. Indicate the proposed BMP Code for this basin**Proposed BMP = **Wet Basin**Removal efficiency = **93** percent**4. Calculate Maximum TSS Load Removed (L_R) for this Drainage Basin by the selected BMP Type.**RG-348 Page 3-33 Equation 3.7: $L_R = (\text{BMP efficiency}) \times P \times (A_i \times 34.6 + A_p \times 0.54)$

where:

 A_C = Total On-Site drainage area in the BMP catchment area A_i = Impervious area proposed in the BMP catchment area A_p = Pervious area remaining in the BMP catchment area L_R = TSS Load removed from this catchment area by the proposed BMP A_C = **37.16** acres A_i = **30.56** acres A_p = **6.60** acres L_R = **31574** lbs**5. Calculate Fraction of Annual Runoff to Treat the drainage basin / outfall area**Desired $L_{M \text{ THIS BASIN}}$ = **26078** lbs. F = **0.83****6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area:**

Calculations from RG-348

Pages 3-34 to 3-36

Rainfall Depth = **1.20** inchesPost Development Runoff Coefficient = **0.66**On-site Water Quality Volume = **106161** cubic feet

Calculations from RG-348 Pages 3-36 to 3-37

Off-site area draining to BMP = **1.50** acresOff-site Impervious cover draining to BMP = **0.65** acresImpervious fraction of off-site area = **0.44**Off-site Runoff Coefficient = **0.32**Off-site Water Quality Volume = **2118** cubic feetStorage for Sediment = **21656**Total Capture Volume (required water quality volume(s) x 1.20) = **129936** cubic feet

The following sections are used to calculate the required water quality volume(s) for the selected BMP

The values for BMP Types not selected in cell C45 will show NA

11. Wet Basins

Designed as Required in RG-348

Pages 3-66 to 3-71

Required capacity of Permanent Pool = **129936** cubic feetRequired capacity at WQV Elevation = **236097** cubic feet

Permanent Pool Capacity is 1.20 times the WQV

Total Capacity should be the Permanent Pool Capacity plus a second WQV.

APPENDIX G

Geotechnical Report

**GEOTECHNICAL ENGINEERING
REPORT – Revision 1**

**Proposed Leander Heritage
Grove
0.5 mile to the West of US 183
and Heritage Grove Rd
Leander, Texas 78641**

PSI Project No. 03031632

PREPARED FOR:

**Waterloo Real Estate
Investments, Inc.
21108 Needles Cove
Lago Vista, Texas 78605**

October 7, 2022

BY:

**PROFESSIONAL SERVICE
INDUSTRIES, INC.
2600 McHale Court, Suite 125
Austin, Texas 78758
Phone: (512) 491-0200
Fax: (512) 491-0221**



**GEOTECHNICAL, CONSTRUCTION
MATERIALS TESTING, &
ENVIRONMENTAL SERVICES**

October 7, 2022

Waterloo Real Estate Investments, Inc.
21108 Needles Cove
Lago Vista, Texas 78605

Attn: Mr. John Ghiselli

RE: GEOTECHNICAL ENGINEERING REPORT – REVISION 1
PROPOSED LEANDER HERITAGE GROVE
0.5 MILE TO THE WEST OF US 183 AND HERITAGE GROVE RD
LEANDER, TEXAS 78641
PSI Project No. 03031632

Dear Mr. Ghiselli:

Professional Service Industries, Inc. (PSI), an Intertek company, is pleased to submit this Geotechnical Engineering Report for the referenced project. This report includes the results from the field and laboratory investigation along with recommendations for use in preparation of the appropriate design and construction documents for this project.

PSI appreciates the opportunity to provide this Geotechnical Engineering Report and looks forward to continuing participation during the design and construction phases of this project. If there are questions pertaining to this report, or if PSI may be of further service, please contact us at your convenience.

PSI also has great interest in providing materials testing and inspection services during the construction of this project.

Respectfully submitted,

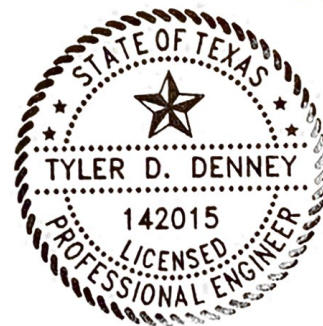
PROFESSIONAL SERVICE INDUSTRIES, INC.
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1.0 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Professional Service Industries, Inc. (PSI), an Intertek company, has completed a field exploration and geotechnical evaluation for the proposed Leander Heritage Grove project. Mr. John Ghiselli, representing Waterloo Real Estate Investments, Inc., authorized PSI's services on "July 27th, 2022" by signing PSI Proposal No. 374012 (Revision 1). PSI's proposal contained a proposed scope of work, lump sum fee, and PSI's General Conditions.

1.2 PROJECT DESCRIPTION

Based on information provided by the Client, PSI's review of a site plan titled "INDUSTRIAL Project", dated May 24th, 202 and prepared by ARCO/Murray, and the results of this geotechnical investigation, a summary of the proposed project is provided below in the following table.

TABLE 1.1: GENERAL PROJECT DESCRIPTION

Project Description	(Seven) single-story warehouse buildings with a total of 557,650 square feet of warehouse building construction Building A and B: 102,900 square feet, each Building C: 98,000 square feet Building D: 94,000 square feet Building E and G: 56,000 square feet Building F: 47,850 square feet With 18-wheeler driveways, docking areas, and parking Spaces Detention Pond
Building Construction Type	It is anticipated to be tilt wall construction with metal truss roof and interior columns.
Existing Grade Change within Building Pad	± 3 to 12 feet estimate (Google Earth Pro Data)
Existing Grade Change within Project Site	± 31 feet estimate (Google Earth Pro Data)
Finished Floor Elevation	It is anticipated to be within 4 feet of existing grade.
Anticipated Foundation Type	Drilled Shafts with ground supported floor slab
Anticipated Maximum Column Loading	250 kips
Anticipated Maximum Wall Loading	10 kips per lineal foot
Pavement for Parking and Drives	Flexible Asphalt (HMAC) and/or Rigid Concrete Pavement

The geotechnical recommendations presented in this report are based on the available project information, structure locations, and the subsurface materials encountered during the field investigation. If the noted information or assumptions are incorrect, please inform PSI so that the recommendations presented in this report can be amended as necessary. PSI will not be responsible for the implementation of provided recommendations if not notified of changes in the project.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this study is to evaluate the subsurface conditions at the site and develop geotechnical engineering recommendations and guidelines for use in preparing the design and other related construction documents for the proposed project. The scope of services included drilling borings, performing laboratory testing, and preparing this geotechnical engineering report.



This report briefly outlines the available project information, describes the site and subsurface conditions, and presents the recommendations regarding the following:

- General site development and subgrade preparation recommendations;
- Estimated potential soil movements associated with shrinking and swelling soils and methods to reduce these movements to acceptable levels;
- Recommendations for site excavation, fill compaction, and the use of on-site and imported fill material under pavements and the structures;
- Recommendations for building pad preparation for ground supported slabs having a maximum movement potential, due to heave or settlement, of 1-inch;
- Recommendations for the design of foundations for supporting the proposed structures, including drilled shaft/pier design criteria including end bearing and skin friction values, as well as LPILE design values for lateral load analysis;
- Seismic design site classification per the International Building Code 2015;
- Recommendations for the design of flexible asphaltic and rigid concrete pavement systems for the proposed parking and drive areas; and
- Recommendations for the design of proposed project detention ponds and water quality features

The scope of services for this geotechnical exploration did not include an environmental, mold nor detailed seismic/fault assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.



2.0 SITE AND SUBSURFACE CONDITIONS

2.1 SITE DESCRIPTION

The following table provides a generalized description of the existing site conditions based on visual observations during the field activities, as well as other available information.

TABLE 2.1: SITE DESCRIPTION

Site Location	Latitude: 30.6012°; Longitude: -97.8696°
Site History	Mostly undeveloped and vacant ranch land with a residence, storage structures, and existing unpaved driveway, and stock tanks/ponds
Existing Site Ground Cover	Grass with Sparse trees
Existing Site Features	Gently sloping
Existing Grade/Elevation Changes	Sloping down to the north approximately 31 feet at a 2 to 3% decline
Site Boundaries	North: Undeveloped Land East: Undeveloped Land South: Heritage Grove Rd West: String Pass Street
Ground Surface Soil Support Capability	Firm Enough for Field Equipment, if Dry

2.2 FIELD EXPLORATION

Field exploration for the project consisted of drilling a total of twenty-eight (28) borings. As of report date, twenty-four borings have been drilled with four borings — B-01, B-07, D-01 and D-02 — being inaccessible. The boring design element, boring labels, and approximate depths are provided in the following table.

TABLE 2.2: FIELD EXPLORATION SUMMARY

Design Element	Boring Label	Boring Location	Approx. Depth of Boring (Feet)
Buildings	B-01	Lat:30.6034°, Long: -97.8709°	10
	B-02	Lat:30.6026°, Long: -97.8712°	20
	B-03	Lat:30.6022°, Long: -97.8704°	20
	B-04	Lat:30.6017°, Long: -97.8708°	20
	B-05	Lat:30.6013°, Long: -97.8700°	20
	B-06	Lat:30.6005°, Long: -97.8703°	20
	B-07	Lat:30.6036°, Long: -97.8696°	10
	B-08	Lat:30.6031°, Long: -97.8700°	15
	B-09	Lat:30.6026°, Long: -97.8693°	20
	B-10	Lat:30.6021°, Long: -97.8696°	20
	B-11	Lat:30.6017°, Long: -97.8688°	20
	B-12	Lat:30.6009°, Long: -97.8690°	20



Design Element	Boring Label	Boring Location	Approx. Depth of Boring (Feet)
	B-13	Lat:30.6002°, Long: -97.8690°	20
	B-14	Lat:30.6007°, Long: -97.8684°	20
	B-15	Lat:30.5995°, Long: -97.8687°	20
	B-16	Lat:30.5993°, Long: -97.8678°	20
	B-17	Lat:30.5989°, Long: -97.8688°	20
	B-18	Lat:30.5990°, Long: -97.8697°	20
Pavement	P0-01	Lat:30.5998°, Long: -97.8699°	6
	P0-02	Lat:30.6010°, Long: -97.8696°	6
	P0-03	Lat:30.6022°, Long: -97.8700°	6
	P0-04	Lat:30.6033°, Long: -97.8704°	6
	P0-05	Lat:30.6033°, Long: -97.8693°	6
	P0-06	Lat:30.6000°, Long: -97.8684°	6
	P0-07	Lat:30.5995°, Long: -97.8693°	6
	P0-08	Lat:30.6010°, Long: -97.8707°	6
Detention Pond	D-01	Lat:30.6043°, Long: -97.8710°	10
	D-02	Lat:30.6037°, Long: -97.8714°	10

The boring locations were selected by PSI personnel and located in the field using a recreational-grade GPS system. Elevations of the ground surface at the boring locations were not provided and should be surveyed by others prior to construction. The references to elevations of various subsurface strata are based on depths below existing grade at the time of drilling. The approximate boring locations are depicted on the Boring Location Plan provided in the Appendix.

TABLE 2.3: FIELD EXPLORATION DESCRIPTION

Drilling Equipment	Truck Mounted Drilling Equipment
Drilling Method	Continuous Flight Auguring, Air Rotary
Drilling Procedure	Applicable ASTM and PSI Safety Manual
Field Testing	Standard Penetration Test (ASTM D1586), Rock Quality Designation (ASTM D6032), Rock Core Recovery
Sampling Procedure	Soils: ASTM D1587/1586 Rock Coring: ASTM D2113 (NWD4 Core Barrel)
Sampling Frequency	Continuously to a Depth of 10 Feet and at 5-foot Intervals Thereafter
Frequency of Groundwater Level Measurements	During and After Drilling
Boring Backfill Procedures	Soil Cuttings



During field activities, the encountered subsurface conditions were observed, logged, and visually classified (in general accordance with ASTM D2487). Field notes were maintained to summarize soil types and descriptions, water levels, changes in subsurface conditions, and drilling conditions.

2.3 **LABORATORY TESTING PROGRAM**

PSI supplemented the field exploration with a laboratory testing program to determine additional engineering characteristics of the subsurface soils encountered. The laboratory testing program included:

- Visual Classification (ASTM D2488),
- Moisture Content Tests (ASTM D2216),
- Atterberg Limits (ASTM D4318),
- Material Finer than No. 200 (ASTM D1140), and
- Rock Compression Strength Test¹ (ASTM D7012).

The laboratory testing program was conducted in general accordance with applicable ASTM Test Methods. The results of the laboratory tests are provided on the Boring Logs in the Appendix. Portions of samples not altered or consumed by laboratory testing will be discarded 60 days from the date shown on this report.

2.4 **SITE GEOLOGY**

As shown on the Geologic Atlas of Texas, Waco Sheet, reprinted in 1979, the site is located in an area where the **Walnut Clay (Kwa)** formation is present at or near the ground surface. The Walnut Clay consists of clay, limestone, and shale. The clay is calcareous while the limestone is chalky and marly with some hard seams. Texigryphaea fossils are common in the lower part of this formation. The thickness of the Walnut Clay ranges from 125 to 175 feet.

2.5 **SUBSURFACE CONDITIONS**

The results of the field and laboratory investigation have been used to generalize a subsurface profile at the project site. The following subsurface descriptions provide a highlighted generalization of the major subsurface stratification features and material characteristics.

¹ Does not meet the requirements of Practice D4543; results reported may differ from those obtained on a test specimen that meets the requirements of Practice D4543



TABLE 2.4: GENERALIZED SOIL PROFILE

Stratum	Depth of Layer (ft)		Soil Type	ω (%)	LL (%)	PI	% Pass. #200
	Top	Bot.					
I	0	2 to 6	Fat Clay to Lean Clay with varying amounts of limestone, becoming greater with depth	6 to 23	53 to 87	35 to 60	56 to 96
				3 to 13	29 to 41	13 to 27	52 to 84
II	2 to 6	10 to 15	Marl with intermittent and discontinuous limestone seams and layers (Keys Valley Marl)	–	–	–	–
III	10 to 15	20 to 25	Limestone, hard, fractured, with marl seams (Cedar Park Limestone)	–	–	–	–

The boring logs included in the Appendix should be reviewed for specific information at individual boring locations. The boring logs include soil descriptions, stratifications, locations of the samples, and field and laboratory test data. The descriptions provided in the logs only represent the conditions at that actual boring location; the stratifications represent the approximate boundaries between subsurface materials. The actual transitions between strata may be more gradual and less distinct. Variations will occur and should be expected across the site.

2.5.1 GROUNDWATER INFORMATION

Water level measurements were performed during drilling and after completion of drilling. Specific information concerning groundwater is noted on each boring log presented in the Appendix of this report. Groundwater **was not** encountered during the field investigation of this site.

Groundwater levels fluctuate seasonally as a function of rainfall, proximity to creeks, rivers and lakes, the infiltration rate of the soil, seasonal and climatic variations and land usage. In relatively pervious soils, such as sandy soils, the indicated depths are a relatively reliable indicator of groundwater levels. In relatively impervious soils, water levels observed in the borings may not provide a reliable indication of groundwater elevations, even after several days. If a detailed water level evaluation is required, observation wells or piezometers can be installed at the site to monitor water levels.

The groundwater levels presented in this report were measured at the time of PSI field activities. The contractor should determine the actual groundwater levels at the site before construction activities.



3.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

3.1 GEOTECHNICAL DISCUSSION

Based upon the information gathered from the soil borings and laboratory testing, the clay soils encountered at this site within the seasonally active zone have a high potential for expansion. PSI recommends the expansive potential (i.e. “Potential Vertical Movement” or PVM) of these soils be addressed in the design and construction of this project to reduce the potential for foundation movements and foundation distress.

Based on the provided information, it is anticipated that the proposed buildings will be of tilt wall construction with interior columns. For this type of structure, the floor slab can be placed on a properly prepared subgrade with drilled straight shaft piers to support the walls and columns. Alternatively, the building can be supported on a shallow foundation system on properly prepared building subgrade.

An improved foundation pad must be constructed under soil supported floor slab and foundation elements due to the presence of expansive foundation soils. Several methods are available to reduce the PVM of the foundation soil beneath a grade supported foundation or floor slab. PSI recommends excavating and moisture conditioning onsite or imported select fill for use as density and moisture controlled engineered fill.

The following design recommendations have been developed based on the previously described project characteristics and subsurface conditions encountered. If there are changes in the project criteria, PSI should be retained to determine if modifications in the recommendations will be required. The findings of such a review would be presented in a supplemental report. Once final design plans and specifications are available, a general review by PSI is recommended to observe that the conditions assumed in the project description are correct and verify that the earthwork and foundation recommendations are properly interpreted and implemented within the construction documents.

3.2 POTENTIAL VERTICAL MOVEMENT OF EXPANSIVE SOILS

The soils encountered at the soil boring locations exhibit a high potential for volumetric changes, due to fluctuations in soil moisture content. PSI has conducted laboratory testing on the soils to estimate the expansive soil potential with soil moisture variations. These soil moisture variations are based on historical climate change data for a particular site detailed in the Thornthwaite Moisture Index Maps. Determining the soil potential for shrinking and swelling, combined with historical climate variation, aids the engineer in quantifying the soil movement potential of the soils supporting the floor slab and shallow foundations. Various shrink/swell movement procedures, including and two soil modeling systems, the Post Tensioning Institute’s (PTI) “Design of Post-Tensioned Slabs-on-Ground, 3rd Edition” and Texas Department of Transportation (TxDOT) method TEX-124-E, were used to approximate the Potential Vertical Movement (PVM) for this location.

3.2.1 SHRINK/SWELL MOVEMENT (PVM) ESTIMATE

Based on laboratory testing results, including the TEX-124-E and the PTI methods, the potential vertical movement within the proposed project area was estimated to be approximately **1 ½ to 2 ½ inches**.

It is not possible to accurately quantify actual soil moisture changes and resulting shrink/swell movements. The PVM and referenced structural movements values provided should not be



considered absolute values that could occur in the field but approximate values based on industry standard practice and experience. Extreme soil moisture variations could occur due to unusual drought severity, leaking water or sewer lines, poor drainage (possibly due to landscape changes after construction), irrigation line breaks, perched groundwater infiltration, springs, soil desiccation from large trees located adjacent to the building or previously underneath the building, downspouts directing roof discharge under the foundation, etc. Therefore, because of these unknown factors, the shrink/swell potential of soils in Texas can often be significantly underestimated using the previously mentioned methods of evaluating PVM.

The unknown factors previously mentioned cannot be determined at the time of the geotechnical study. Therefore, estimated shrink/swell movements are calculated only in consideration of historical climate data related to soil moisture variations for a particular area. Movements in excess of these assumed variations should be anticipated and regular maintenance should be provided to address these issues throughout the life of the structure.

3.2.2 DESIGN PVM CONSIDERATIONS

Grade supported floor slabs and foundations should be expected to undergo some vertical movements, including differential, due to the action of expansive soils and possible soil settlement. In this general area, most owners, architects, structural and geotechnical engineers consider a value of one inch or less to be within acceptable movement tolerances for grade supported floor slabs or foundations. This generally accepted tolerance for movement has been used by PSI in developing the recommendations for preparing the foundation pad for this project.

The amount of structural movement associated with a PVM magnitude of 1-inch may not be considered acceptable per “operational” or “aesthetic” performance criteria, which often occur at less movement than the magnitude of the PVM which is based on “structural” considerations. Cracking in the foundation and walls and sticking doors, which requires periodic maintenance, will likely occur for foundations designed using an allowable 1-inch PVM. This should be understood by the Owner and Design Team.

PSI recommends that the Owner discuss allowable movement tolerances with the structural engineer, architect, and all other members of the Design Team prior to commencement of the final design to make certain that appropriate movement tolerances are developed and used for this project. If design PVM values other than 1-inch is desired, PSI should be contacted to review and revise the recommendations presented in this report as necessary to meet the project requirements.

If the risk of grade-supported foundation and floor slab movements is not acceptable, or if the required foundation pad preparation costs for a soil supported foundation are determined to be excessive, it is our opinion that a drilled pier foundation with a structurally suspended floor slab should be used. We would be pleased to provide geotechnical recommendations for this foundation type if desired.

A potential for vertical movement greater than 1-inch is above the value considered acceptable by most structural and geotechnical engineers in this area. Therefore, foundation pad improvement is recommended to reduce the PVM to an acceptable value for the grade supported floor slabs and shallow foundations proposed for this project.



3.3 SLAB-ON-GRADE EARTHWORK RECOMMENDATIONS

A ground supported slab can be constructed provided the movements associated with shrinking and swelling soils are reduced to a tolerable level and the owner understands the risk associated with such movements. Typically, it is the industry practice to consider one-inch soil movement as the tolerable level. In order to reduce the soil movements, it has been the industry practice to provide engineered soil layers below the ground supported slab system. The following options for subgrade preparation are provided to reduce the soil movements.

TABLE 3.1: FOUNDATION BUILDING PAD PREPARATION REQUIREMENTS

Foundation Type	Building Pad Preparation Requirements
Conventional Spread Footings or Continuous Footings	Undercut and Replace with Select Fill Only (Section 3.3.1) [Reconditioning Option should NOT be performed]
Drilled Shaft Foundations	Select Fill or Moisture Conditioning (Option 1 or Option 2)

3.3.1 OPTION 1 - UNDERCUT AND REPLACE WITH SELECT FILL

PSI recommends that the building foundation be improved using the Undercut and Replace Method. The following illustrations and tables provide general recommendations for the installation of a foundation pad utilizing the *Undercut and Replace* Method that should provide a reduced potential for vertical movement and a structurally improved foundation system.

TABLE 3.2: UNDERCUT AND REPLACEMENT RECOMMENDATIONS

Application	Conventional Shallow Foundation System or Floor slab preparation for a drilled shaft foundation
Site Stripping Removal	Upper 6 inches of organics and deleterious material including debris to expose clean subgrade
Foundation Improvement Method	Remove and replace existing soils with select fill
Improved Site Condition PVM	Less than 1 inch
Minimum Over-Excavation	4 feet or less when encountering shallow marl
Horizontal Undercut Extent	Below all slab areas and at least 5 feet beyond the slab perimeter and extending the full width of flatwork that may be sensitive to movement
Proof-Rolling	Proof-roll subgrade with rubber tired 20-ton (loaded) construction equipment Alternate Equipment can be used with Geotechnical Engineer Approval Remove rutting or excessively deflecting soils Replace failing soils with compacted select fill material
Exposed Subgrade Treatment	Proof-roll then scarify, moisture condition, and compact 9 inches natural subgrade
Select Fill Thickness	At least 4 feet minimum or as required to achieve finish floor in shallow marl areas.



Select Fill Material	TxDOT Item 247 (Crushed Limestone Material) Type A or B Grade 1, 2, or 3
Select Fill Material Alternative (Other low plasticity materials may be used pending review and approval from PSI)	Pit Run (On-Site or Imported) Free of organics, trash, or other deleterious material Liquid Limit <40% Plasticity Index 7 to 20 Max Particle Size < 3" Percent Material Passing 200 Sieve > 35%
Structural Common Fill	Clean on-site materials having: Allowable PI from 12 to 35 Percent Passing No. 200 Sieve > 50% Max Particle Size < 3"
Vapor Retarder Material	Vapor Retarder approved by Architect/Structural Engineer
Maximum Loose Lift Thickness	8 inches
Time Between Subgrade Prep. and Select Fill Placement	Less than 48 hours



FIGURE 3.1: SELECT FILL PAD IMPROVEMENT

3.3.2 RECONDITIONING METHOD

The following illustrations and tables provide general requirements for the installation of a foundation pad that should provide a PVM magnitude of 1 inch or less using the *Reconditioning Method*.

TABLE 3.3: RECONDITIONING METHOD RECOMMENDATIONS

Application	Floor slab preparation for a drilled shaft foundation or for a small post-tensioned slab on ground foundation
Site Stripping Removal	Upper 6 inches of organics and deleterious material including debris to expose clean subgrade
Foundation Improvement Method	Remove and replace existing soils with moisture conditioned soil and/or select fill
Improved Site Condition PVM	Less than 1 inch
Minimum Over-Excavation	4 feet
Horizontal Undercut Extent	Below all slab areas and at least 5 feet beyond the slab perimeter and extending the full width of flatwork that may be sensitive to movement
Subgrade Proof-Rolling	Proof-roll subgrade with rubber tired 20-ton (loaded) construction equipment Alternate Equipment can be used with Geotechnical

	Engineer Approval Remove rutting or excessively deflecting soils Replace failing soils with compacted select fill material
Exposed Subgrade Treatment	Proof-roll then scarify, moisture condition, and compact 9 inches subgrade below base of undercut
Select Fill Thickness	At least 1 ½ feet minimum
Select Fill Material	TxDOT Item 247 (Crushed Limestone Material) Type A or B Grade 1, 2 or 3
Select Fill Material Alternative (Other low plasticity materials may be used pending review and approval from PSI)	Pit Run Free of organics, trash, or other deleterious material Liquid Limit <40% Plasticity Index 7 to 20 Max Particle Size < 3" Percent Material Passing 200 Sieve > 35%
Reconditioned Fill Minimum Thickness	2 ½ feet
Reconditioned Fill	On site or imported materials having: Allowable PI from 12 to 35 Percent Passing No. 200 Sieve > 50% Max Particle Size < 3"
Structural Common Fill	Clean on site materials having: Allowable PI from 12 to 45 Percent Passing No. 200 Sieve > 35% Max Particle Size < 3"
Vapor Retarder Material	Vapor Retarder approved by Architect/Structural Engineer
Maximum Loose Lift Thickness	8 inches
Time Between Reconditioned Fill and Select Fill Placement	Less than 48 hours

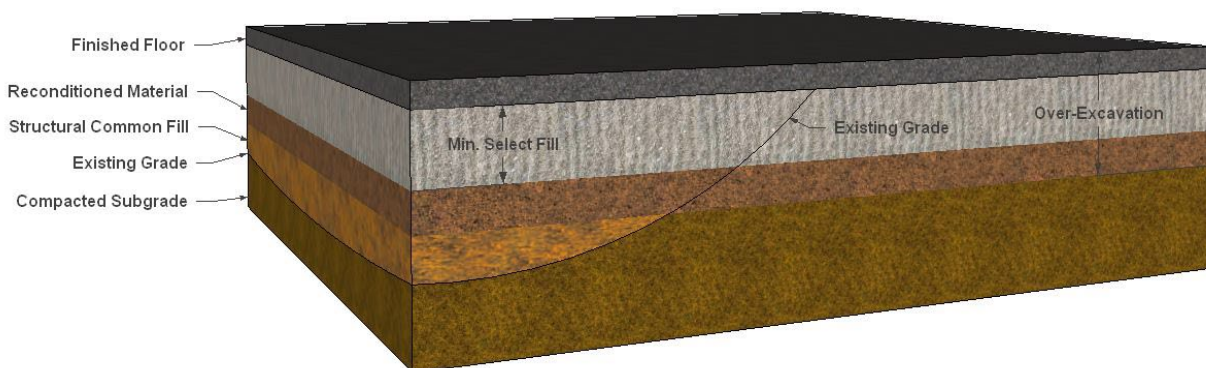


FIGURE 3.2: RECONDITIONING METHOD PAD IMPROVEMENT

3.3.3 COMPACTION AND TESTING RECOMMENDATIONS FOR FOUNDATION PAD AREAS

The following table outlines foundation pad compaction recommendations in consideration of appropriate vertical movement reduction method.

TABLE 3.4: COMPACTION RECOMMENDATIONS RECONDITIONING METHOD

Location	Material	Density Test Method	Plasticity Index	Percent Compaction	Optimum Moisture Content	Testing Frequency
Foundation Pad Areas	Subgrade, Reconditioned Fill, Structural Common Fill	ASTM D 698	PI ≥ 25	94% to 98%	≥ +2%	1 per 5,000 SF; min. 3 per lift
			PI < 25	≥ 95%	0 to +4%	
	Select Fill (Item 247 or Pit Run)	ASTM D 698	PI ≤ 20	≥ 95%	-1 to +3%	

Notes: If weathered limestone is encountered at the subgrade, only a proof-roll is recommended.

3.4 DESIGN MEASURES TO REDUCE CHANGES IN SOIL MOISTURE

The following recommended measures can reduce possible moisture fluctuations of the soils under the floor slab. Movements of the foundation soil can be effectively reduced by providing horizontal and/or vertical moisture barriers around the edge of the slab. Typically, the moisture barriers would consist of concrete flatwork or asphalt or concrete pavement placed adjacent to the edge of the building, a clay cap over poly, and/or a deepened perimeter grade beam or vertical trench filled with flowable fill.

Although subgrade modification is recommended to reduce potential soil-related foundation movements, the design and construction of a grade-supported foundation should also include the following elements:

Roof drainage should be controlled by gutters and carried well away from the structure.

The ground surface adjacent to the building perimeter should be sloped and maintained a minimum of 5% grade away from the building for 10 feet to result in positive surface flow or drainage away from the building perimeter. In areas adjacent to the building controlled by ADA, concrete flatwork slopes should not be more than 2% within 10 feet of the building.

- Hose bibs, sprinkler heads, and other external water connections should be placed well away from the foundation perimeter such that surface leakage cannot readily infiltrate into the subsurface or compacted fills placed under the proposed foundations and slabs.
- No trees or other vegetation over 6 feet in height shall be planted within 15 feet of the structure unless specifically accounted for in the foundation design.
- Utility bedding should not include gravel near the perimeter of the foundation. Compacted clay or flowable fill trench backfill should be used in lieu of permeable bedding materials between 2 feet inside the building to 4 feet beyond the exterior of the building edge to reduce the potential for water to infiltrate within utility bedding and backfill material.
- Paved areas around the structure are helpful in maintaining soil moisture equilibrium. It will be very beneficial to have pavement, sidewalks or other flatwork located immediately adjacent to the building to both reduce intrusion of surface water into the more permeable select fill and to reduce soil moisture changes along the exterior portion of the floor due to soil moisture changes from drought, excessive rainfall or irrigation, etc. The use of a clay cap over poly sheeting (horizontal barrier) or impervious geosynthetic liner or concrete (vertical barrier) is recommended in those areas not covered with asphalt or concrete pavement or flatwork.



- Flower beds and planter boxes should be piped or watertight to prevent water infiltration under the building.
- Experience indicates that landscape irrigation is a common source of foundation movement problems and pavement distress. Repairing irrigation lines as soon as possible after leakage commences will benefit foundation performance greatly.
- Foundation pad and pavement subgrade should be protected and covered within 48 hours to reduce changes in the natural moisture regime from rainfall events or excessive drying from heat and wind.

3.5 FOUNDATION DESIGN RECOMMENDATIONS

3.5.1 DRILLED PIER RECOMMENDATIONS

Drilled shafts are the recommended foundation system for this project. The axial load carrying capacity of a drilled shaft can be computed using the static method of analysis. According to this method, axial capacity, Q , at a given penetration is taken as the sum of the skin friction on the side of the shaft, Q_f , and the end or point bearing at the shaft tip, Q_{eb} , so that:

$$Q = Q_f + Q_{eb} = f \cdot A_s + q \cdot A_p$$

where A_s and A_p represent, respectively, the embedded surface area and the end area of the shaft; f and q represent, respectively, the unit skin friction and the unit end or point bearing.

The total allowable axial capacity in compression will be the summation of the allowable frictional capacity and the allowable end bearing capacity. The total allowable axial capacity in tension will be the allowable frictional capacity alone neglecting end bearing component.

3.5.1.1 STRAIGHT DRILLED PIER

PSI recommends that the warehouse buildings be supported on deep straight shaft drilled piers to minimize the potential for undesirable settlement and to reduce potential foundation movements as the structure support will be based below the seasonal active zone. The following illustrations and tables outline the requirements for drilled shaft design and construction considerations for support of these structures.



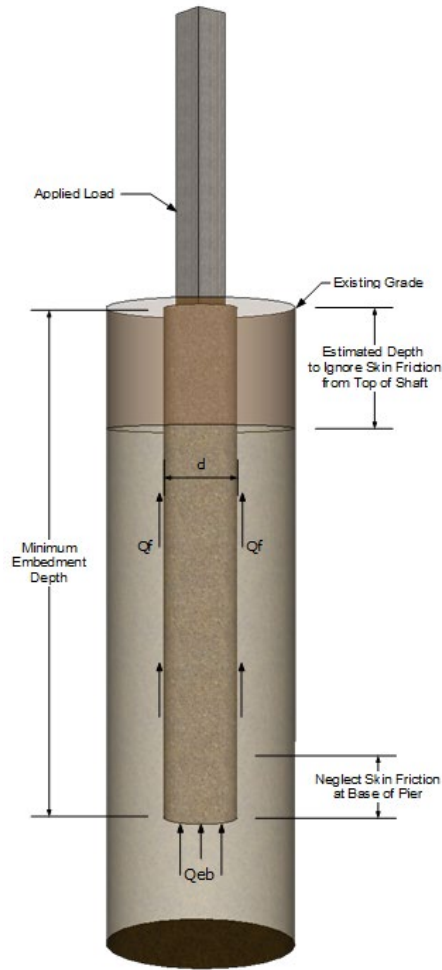


FIGURE 3.3: STRAIGHT DRILLED PIER

TABLE 3.5: PARAMETERS FOR AXIAL DESIGN

Stratum	Depth, feet	Allowable Unit Skin Friction, psf (F.S. = 2)	Allowable Unit End Bearing, psf (F.S. = 3)	Uplift Force of Soil, kips
Marl/Limestone	5 to 20	4,000	33,300	8d; where d is the shaft diameter in feet

TABLE 3.6: CONSTRAINTS FOR STRAIGHT SHAFT DESIGN

Neglect Skin Friction from Top of Shaft	5 feet
Minimum Penetration Depth	5 feet into Limestone
Minimum Shaft Diameter, d	18 inches
Uplift Resistance	Pier Weight + Dead Load + Allowable Skin Friction Below Active Zone
Minimum Shaft Spacing (center to center)	3 Shaft Diameters (3·d)
Possible Group Effect	If spacing < 3d consult Geotechnical Engineer

Min. Pier Vertical Reinforcing Steel	1% of gross cross-sectional area and as needed to resist uplift forces
Pier Tensile Reinforcing Steel	As Per ACI Code
Estimated Settlement	
Total Settlement	Less than 1 inch
Differential Settlement	Less than 0.5 inch

Notes: Detailed Settlement Analysis is outside project scope

The minimum embedment depth was selected to locate the pier base below the depth of seasonal moisture change and within a specified desired stratum. Actual pier depths may need to be deeper depending upon the actual compressive loads on the pier.

3.5.1.2 LPILE DESIGN CRITERIA

Piers having lateral loads should be designed utilizing the following LPILE input parameters for this project.

TABLE 3.7: PARAMETERS FOR LATERAL DESIGN USING LPILE

'p-y' Criteria	Depth, feet	γ_e , pcf	c, psf	q_u , psi	ϕ , Deg.	k_s or k , pci	k_c , pci	E, psi (10^6)	RQD, %	ϵ_{50} or k_{rm}
Fill/Recondition	0 to 5	105	900	-	0	225	100	-	-	0.009
Stiff Clay	5 to 15	110	4,000	-	0	1,000	400	-	-	0.005
Weak Rock	Below 15	145	-	700	-	-	-	0.14	35	0.0005
Note: γ_e: Effective Soil Unit Weight c: Undrained Cohesion for Clay q_u: Uniaxial Compression Strength for Rock ϕ: Friction Angle for Sand ($\phi = (12N)^{0.5} + 15 \leq 32$; Dunham (1954)) k_s: Clay Static Loading Modulus of Subgrade Reaction (LPILE Manual Table 3-3) k_c: Clay Cyclic Loading Modulus of Subgrade Reaction (LPILE Manual Table 3-3) k: Sand Modulus of Subgrade Reaction (LPILE Manual Table 3-6 and 3-7) E: Initial Modulus of Rock Mass (LPILE Manual Figure 3-45) RQD: Rock Quality Designation ϵ_{50}: Axial Strain Factor for Soil (LPILE Manual Table 3-2 and 3-4) k_{rm}: Axial Strain Factor for Rock (0.0005 Recommended)										

3.5.1.3 GENERAL PIER CONSTRUCTION RECOMMENDATIONS

TABLE 3.8: DRILLED PIER INSTALLATION CONSIDERATIONS

Recommended Installation Procedure	FHWA-NHI-10-016, May 2010
High-Torque Drilling Equipment Anticipated	Yes
Groundwater Anticipated	Not Anticipated
Verification of Groundwater before Installation	Yes
Temporary Casing Anticipated	Not Anticipated
Concrete Placement after Drilling	Same Day as drilling. If concrete cannot be poured the same day as excavation, temporary casing or slurry may be needed to maintain an open excavation.



	Concrete should not be allowed to ricochet off the pier reinforcing steel nor off the side walls of excavation.
Concrete Slump	7 inches $\pm$ 1 inch
Permissible Water Accumulation in Excavation	Less than 2 inches
Concrete Installation Method for Water Infiltration	Tremie or pump to displace water
Reinforcing and Excavation to Cage Separation	3 times maximum size of coarse aggregate
Centralizers Recommended for Reinforcement	Yes
Cross Bracing within Reinforcement Cage	Not Recommended
Quality Assurance Monitoring by Geotechnical Engineer or Representative	Observe drilling of all piers During drilling, record tip of shaft depth Observe base material and cleanliness of base Observe placement of reinforcement

3.5.1.4 PIER SLAB-ON-GRADE DIFFERENTIAL AND TOTAL VERTICAL MOVEMENT

Where movement sensitive flatwork will be constructed adjacent to the building, PSI recommends that the previously recommended building pad improvement be extended to include these locations. This action will reduce the PVM value in the flatwork areas and consequently reduce differential movements, associated with reversed drainage, door jamming, tripping hazards, etc. In addition, doweling the flatwork to the building foundation at common openings can further help reduce the potential for differential movements and trip hazards. However, when doweling grade-supported flatwork to more stable structures, movements of the flatwork can cause cracking in the flatwork itself. Grade-supported flatwork dowelled to more stable foundations should have connections designed to rotate and be flexible.

If the floor layout design allows for a one inch vertical movement tolerance, as in an open warehouse layout, then interior stiffening beams would not be required. In layouts with interior walls, a waffle slab designed in accordance with WRI or PTI parameters should be incorporated into the design to provide additional stiffness to the floor system. In all cases where vertical movement is anticipated, foundation beams should be placed under the walls, especially if the interior walls are CMU or other brittle material. The walls should incorporate sufficient vertical joints such that floor movement induced wall cracking is minimized. If the waffle slab design is not utilized, the building pad must be designed to only allow a one-half inch PVM and interior walls would still require beam support.

The foundation improvement for adjacent flatwork should extend the full width of the flatwork or at a minimum of at least 5 feet beyond the building parameter. Proper drainage around grade-supported sidewalks and flatwork is vital to reduce potential movements. Providing rapid, positive drainage away from the building will reduce moisture variations within underlying expansive soils, and reduce the potential that the design PVM occurs.



3.5.2 SPREAD FOOTING FOUNDATION RECOMMENDATIONS

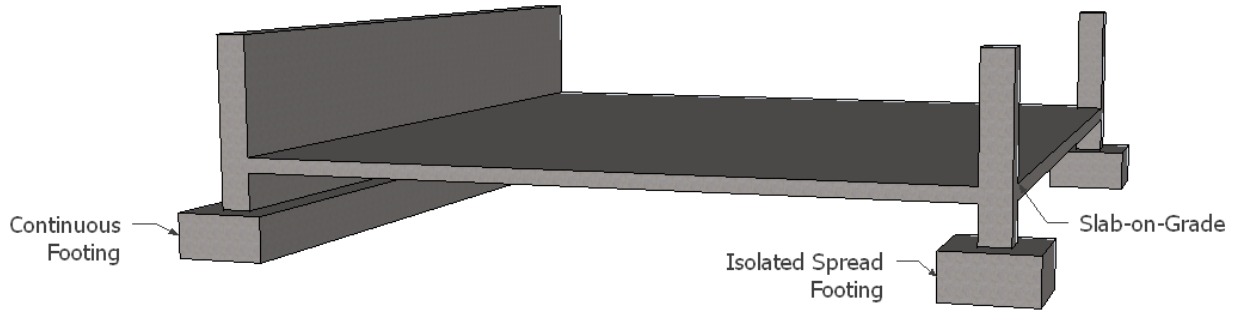


FIGURE 3.4: SPREAD FOOTING SYSTEMS

TABLE 3.9: SPREAD FOOTING DESIGN PARAMETERS

Allowable Design Site PVM	Approximately ½ inch
Footing Foundation Depth Range	2 feet below final adjacent grade
Allowable Bearing Pressure	3,500 psf
Factor of Safety	3.0
Approximate Settlement	Less than 1 inch
Modulus of Subgrade Reaction (k_1)	125 pci
Sliding Resistance (ultimate)	Utilize a coefficient of friction of 0.35 between the base of the foundation element and underlying material
Passive Resistance (ultimate)	An equivalent fluid weighing 360 pcf may be used to resist lateral forces
Uplift Resistance (ultimate)	Utilize the weight of the foundation concrete and the soil above it. The ultimate uplift resistance can be based on effective unit weights of 110 and 150 pcf for soil and concrete, respectively
Footing Exposed Subgrade Treatment	Free of soft/loose soil, wet materials, and debris. Geotechnical Engineer's representative should observe bearing surface prior to forming footings.
Adjacent Foundations Minimum Spacing	Min. Spacing = $4 \cdot W + L$ Where; W = Width of Largest Footings L = Difference in Bottom of Footing Elevation

* Spread footings should bear on similar material for a given building, i.e. either entirely on marl/weathered limestone or on at least 18 inches of compacted fill materials.

3.6 TILT WALL CONSIDERATIONS

Based on our previous experience, foundations that support the tilt-up wall panels may experience some amount of immediate settlement. Based on our observations during construction, a settlement of about 2 inches occurred within a day or two after the tilt-up wall panels are lifted on to the foundations. The foundation settlements are sporadic and may not happen to all the foundations or at all the foundation locations. Our experience leads us to believe that these settlements could occur for several reasons, such as, the dead load of the tilt-up wall panels that get transferred to the piers immediately, localized discontinuities in the soil such as the presence of localized soft soils, loose

gravelly calcareous material, and, possibly loose bearing soils prior to placement of concrete in the piers. If foundations were found to settle during construction, it is recommended that the panels be shimmed and leveled as required.

In addition, due to the immediate settlement and loading pattern continuous footings or grade beams may see large shear forces between the portion of the loaded and unloaded areas of footings or grade beams resulting in possible crack to the foundation. Appropriate shear reinforcement between the panel joints or expansion footing joints in the continuous footing or grade beams should be considered. If foundations were found to settle during construction, it is recommended that the panels be shimmed and leveled as required.

During construction, pour strip areas typically collect water and the foundation soils may become soft. It is recommended that the pour strip areas be kept well drained during construction and water should not be allowed to collect within the pour strip excavations. Furthermore, it is difficult to compact back-fill materials within the pour strip area. Therefore, if the pour strip area is too narrow to properly compact the fill materials as specified in Section 3.3, then the backfill within these areas should consist of self-compacting or self-setting materials such as flowable fill in accordance with Item 401 of TXDOT specifications; or low strength concrete; or, cement stabilized sand. If the fill within the pour strips can be properly compacted and appropriate materials (PI 10-20 with at least 35% fines) then density testing can be performed and the fill can be placed as specified in Section 3.3.

3.7 SIDEWALKS AND FLATWORK

For sidewalks or other flatwork located adjacent to grade-supported foundations, the undercutting and select fill placement operations for the building should extend beyond the perimeter of the building and pavements to at least the width of the adjacent sidewalk or flatwork.

Any other sidewalks or flatwork not adjacent to buildings should be placed on an improved subgrade meeting or exceeding the pavement subgrade improvement methods previously recommended. If the sidewalk subgrade consists of material with a plasticity index of 25 or greater, a 12-inch-thick layer of material satisfying the requirements of select fill provided in Section 3.3 must be placed below the sidewalk. The material should be compacted to 95% or greater than the maximum dry unit weight and contain a moisture content between -1 and +3% optimum moisture content.

Proper drainage around grade-supported sidewalks and flatwork is also very important to reduce potential movements. Elevating the sidewalks where possible and providing rapid, positive drainage away from them will reduce moisture variations within the underlying soils and will therefore provide valuable benefit in reducing the full magnitude of potential movements from being realized.

3.8 SITE SEISMIC DESIGN RECOMMENDATIONS

For the purposes of seismic design, based on the encountered site conditions and local geology, PSI interpreted the subsurface conditions to satisfy the **Site Class C** criteria for use at this site as defined by the International Building Code (IBC). The site class is based on the subsurface conditions encountered at the soil borings, the results of field and laboratory testing, experience with similar projects in this area, and considering the site prepared as recommended herein. The table below provides recommended seismic parameters for the project based on the 2015 edition of the IBC.



TABLE 3.10: RECOMMENDED DESIGN SEISMIC PARAMETERS

Seismic Parameter	IBC 2015
0.2 sec (S_s)	0.061g
1.0 sec (S_1)	0.034g
Site Coefficient 0.2sec, F_a	1.2
Site Coefficient 1.0 sec, F_v	1.7
0.2 sec (S_{DS})	0.049g
1.0 sec (S_{D1})	0.039g



4.0 PAVEMENT RECOMMENDATIONS

4.1 SUBGRADE SOIL PREPARATION

For proposed parking and driveway areas, PSI recommends that at least the upper 8 inches of the pavement subgrade soils be lime stabilized. In lieu of 8 inches of lime stabilization, at least 12 inches of select fill or 6 inches flexible base should be placed below the pavement. Fill materials should be placed and compacted as provided in Section 3.3: Site Preparation and Fill Materials of this report.

TABLE 4.1: COMPACTION AND TESTING RECOMMENDATIONS FOR PAVEMENT AREAS

Location	Material	Density Test Method	Soil Type	Percent Compaction	Optimum Moisture Content	Testing Frequency
Pavement Areas	Subgrade General Fill Soil Low PI Material	ASTM D 698	PI $\geq$ 25	94% to 98%	0 to +4%	1 per 10,000 SF; min. 3 tests
			PI < 25	$\geq$ 95%	0 to +4%	
	Base Material	ASTM D 1557	Item 247	$\geq$ 95%	$\pm$ 3%	1 per 5,000 SF; min. 3 per lift
		TEX-113-E	Item 247	$\geq$ 100%	$\pm$ 2%	

Notes: Flexible Base for concrete pavement should be placed at $\geq$ 95% D698 and within +3% of OMC

4.2 PAVEMENT SECTION

4.2.1 PARKING AND PASSENGER VEHICLE TRAFFIC AREAS

AASHTO design methodology can be used to design the pavements. According to AASHTO design methodology, the pavement design thickness primarily depends on strength of the subgrade soils and type of traffic. Traffic includes several types of vehicles with various magnitudes of axle loads that may be subjected to the pavement during its service life. The design involves a traffic analysis that converts various types of vehicles with various magnitudes axle loads to a number of 18-kip equivalent single axle load (ESAL) repetitions. The design engineer should perform the traffic analyses to compute the number of ESALs repetitions that would be subjected to the pavement during its service life or design life. Based on the computed ESALs, an economical and appropriate pavement can be designed accordingly.

AASHTO low volume design methodology can also be used to design pavements. The low volume design methodology depends on typical subgrade conditions for 6 different U.S climatic zones and provides minimum thickness for 3 different levels of traffic.

Based on AASHTO low volume design and our previous experience, we have provided pavement thickness for both a rigid and a flexible pavement system in the tables below. The tables below include thickness design corresponding to 3 levels of traffic (low, medium and high). It is recommended that the pavement design thicknesses correspond to following:

Low traffic condition: Parking areas expected to receive only passenger vehicles and light pickup truck traffic.

Medium traffic condition: Secondary drive areas and/or parking areas expected to receive delivery vans or light trucks.

High traffic condition: Parking and drive areas with heavy traffic, fire lanes, trash pickup areas, main access driveways. This also includes areas expected to receive light duty construction machinery.



TABLE 4.2: MINIMUM RIGID PAVEMENT SECTION

Pavement Material(s)	Design Thickness		
	Low	Medium	High
Portland Cement Concrete	5.0 inches	6.0 inches	7.0 inches
Pavement Subgrade	As Discussed in Section 4.1		

TABLE 4.3: MINIMUM FLEXIBLE PAVEMENT SECTION

Pavement Material(s)	Design Thickness		
	Low	Medium	High
Hot Mix Asphalt Concrete TxDOT Item 340. Type D	2.0 inches	2.5 inches	3.0 inches
Flexible Base Material TxDOT Item 247. Type A or D, Grade 1 or 2	6.0 inches	8.0 inches	8.0 inches
Pavement Subgrade	As Discussed in Section 4.1		

Large front-loading garbage trucks frequently impose concentrated front-wheel loads on pavements during loading. This type of loading typically results in rutting of the pavement and ultimately, pavement failures. Therefore, it is recommended that the pavement in trash pickup areas consist of a minimum 7-inch thick, reinforced concrete slab.

4.2.2 TRUCK/TRACTOR PAVEMENT AREAS

The following pavement sections were developed for a design life of 20 years, and 25, 50, or 100 passes of 18-wheeler trucks (40 ton) per day. These recommendations apply to heavy construction machinery and construction trucks.

TABLE 4.4: MINIMUM RIGID PAVEMENT SECTION FOR TRUCK TRAFFIC AREAS

Pavement Material(s)	Design Thickness for 25 18-Wheeler Truck Passes per Day	Design Thickness for 50 18-Wheeler Truck Passes per Day	Design Thickness for 100 18-Wheeler Truck Passes per Day
Portland Cement Concrete	7.0 inches	8.0 inches	9.0 inches
Pavement Subgrade	As Discussed in Section 4.1		

4.2.3 DESIGN AND CONSTRUCTION CONSIDERATIONS

During the construction phase of this project, site grading should be kept in such a way that the water drains freely off the site.

Proper finishing of concrete pavements requires the use of sawed and sealed joints. Construction joints should be designed in accordance with current Portland Cement Association guidelines. Joints should be sealed to reduce the potential for water infiltration into pavement joints and subsequent infiltration into the supporting soils. Joint spacing is recommended at 15-foot intervals. Dowel bars should be used to transfer loads at the transverse joints. Normal periodic maintenance will be required.



The design of steel reinforcement should be in accordance with accepted codes. The concrete should have a minimum compressive strength of 3,500 psi at 28 days. Pavement materials and construction procedures should conform to TXDOT or appropriate city and county requirements.

Surface water infiltration to the pavement subgrade layers may soften the subgrade soils. Considering several factors in the pavement design can reduce surface infiltration. The following are some of the factors that need to be emphasized in order to maintain proper drainage.

1. Appropriate slopes should be provided to drain the water freely from the pavement surface.
2. Joints should be properly sealed and maintained.
3. Side drains or sub drains along a pavement section may be provided.
4. Proper pavement maintenance programs such as sealing surface cracks, and immediate repair of distressed pavement areas should be adopted.
5. During and after the construction, site grading should be kept in such a way that the water drains freely off the site and off any prepared or unprepared subgrade soils. Excavations should not be kept open for a long period of time.



5.0 POND LINER RECOMMENDATIONS

Impermeable layers such as roadways, parking areas, and roof tops can lead to excessive water runoff during storm events. The water runoff may be too large for the local stormwater system to control or a certain amount of the runoff may need to be treated due to contamination. A retention, detention, or water quality pond may be required to provide site sufficient drainage and treatment control. The following tables provide a summary of recommendations for wet ponds constructed with clay or geomembrane liners.

TABLE 5.1: IMPERMEABLE BASIN/POND LINER RECOMMENDATIONS

Allowable Types of Liner	Concrete, Geosynthetic Clay Liner (GCL), Geomembrane, Clay Liner, or other upon approval
Allowable Pond Side Slope	4H:1V or less upon approval
Liner Location	Below Sedimentation/Filtration Basin and Gabions
Liner Subgrade	Suitable smooth compacted material
Geomembrane Liner	Minimum thickness of thirty (30) mils Ultraviolet resistant Geotextile protection above and below Rock installation requires additional protective material
Minimum Geotextile Protection	Unit weight of 8 oz/yd ² Puncture strength of 125 lbs Mullen burst strength of 400 psi
Clay Liner	Minimum thickness of twelve (12) inches Coefficient of permeability of 1×10^{-7} cm/sec or Less Plasticity index equal to or greater than 15 Liquid limit equal to or greater than 30% Clay percent passing no. 200 sieve greater than 30% Maximum particle size of 1 inch Percent Passing No. 200 Sieve > 85%
Liner Protection (Includes 6" Topsoil)	Clay Liner – 12" protective soil layer Geomembrane or CGL – 24" soil layer Upon approval 24" soil layer can be reduced to 12"
Additional Clay Liner Protection	If overlain by a drainage layer, geotextile protection
Additional Liner Protection (Includes 6" Topsoil)	Clay Liner – 12" protective soil layer Geomembrane or CGL – 24" soil layer Upon approval 24" soil layer can be reduced to 12"

TABLE 5.2: IMPERMEABLE BASIN/POND LINER CONSTRUCTION ITEMS

Liner Subgrade	Proof-roll subgrade and evaluate for voids. Weak areas should be removed and replaced with suitable fill material. The subgrade should be smooth and contain no particles with a diameter greater than 0.375 inches.
Geomembrane Liner	The designer must demonstrate liner's impermeability, the method of liner protection to be used during maintenance and sediment removal operations. Individuals installing geomembrane liners must be trained and/or certified by the liner manufacturer.

Clay Liner	Soil sampling and testing must be conducted on the borrow source and installed liner samples as applicable. In-situ materials may be used if liner parameters are met. Liner material should be processed and compacted with footed rollers. Lifts should not exceed 6 inches compacted.
Rock Subgrade	If a geomembrane or GCL liner is placed over excavated rock a protection material must be installed to prevent liner damage.
Liner Installation Quality Assurance and Control	A Soils and Liner Evaluation Report (SLER), Geosynthetic Clay Liner Evaluation Report (GCLER), or a Geomembrane Liner Evaluation Report (GLER) should be prepared by an independent licensed engineer with experience in geotechnical engineering.

TABLE 5.3: COMPACTION AND TESTING RECOMMENDATIONS FOR CLAY LINER

Location	Material	Density Test Method	Percent Compaction	Optimum Moisture Content	Testing Frequency
Basin/Pond Liner	Clay Liner Material	ASTM D 698	≥ 95%	0 to +4%	1 per 5,000 SF; min. 3 tests
		ASTM D 1557	≥ 90%	-1 to +3%	



6.0 CONSTRUCTION CONSIDERATIONS

Geotechnical Engineer Involvement at the Time of Construction – Foundation pad preparation requirements on expansive clay sites depend on the soil moisture condition due to the prevailing climate at the time of construction in addition to the expansive properties of the clay. It is recommended that the foundation pad recommendations presented in this report be confirmed immediately prior to construction by a Geotechnical Engineer. Wetter climate conditions near the time of construction can lead to a significant reduction in pad preparation requirements which are often a substantial percentage of site development cost.

Having a Geotechnical Engineer retained to review the earthwork recommendations in the Contract Documents and be an active participant in team meetings near the time of construction can often result in project cost savings. Therefore, PSI recommends that an AASHTO accredited 3rd party laboratory with qualified professional engineers who specialize in geotechnical engineering be retained to provide observation and testing of construction activities involved in the foundations, earthwork, pavements and related activities of this project. As the Geotechnical Engineer of Record, PSI's services can be retained as the 3rd party laboratory. PSI's participation would be advantageous to project flow and value engineering during construction.

The geotechnical engineer can assess soil conditions at the time of construction more accurately by knowing the location of the building, surrounding flatwork, pavements, planned landscaping, and drainage features often resulting in less risk and project cost savings.

PSI cannot accept responsibility for conditions which deviate from those described in this report, nor for the performance of the foundations or pavements if not engaged to also provide construction observation and materials testing for this project. The PSI geotechnical engineer of record must also be engaged by the Design Team, even if periodic on-call testing is contracted with PSI Construction Services.

6.1 INITIAL SITE PREPARATION CONSIDERATIONS

6.1.1 *SUBGRADE PREPARATION FOR SITE WORK OUTSIDE BUILDING PAD AND PAVEMENT AREAS*

Grade adjustments outside of the foundation pad and pavement areas can be made using select or general fill materials. The clean excavated onsite soils may also be reused in areas not sensitive to movement.

TABLE 6.1: SUBGRADE PREPARATION FOR NON-STRUCTURAL - GENERAL FILL

Minimum Undercut Depth	4 inches or as needed to remove roots, organic and/or deleterious materials
Exposed Subgrade Treatment	Proof-roll subgrade with rubber tired 20-ton (loaded) construction equipment Alternate Equipment can be used with Geotechnical Engineer Approval
Proof-Rolled Pumping and Rutting Areas	Excavate to firmer materials and replace with compacted general or select fill under direction of a representative of the Geotechnical Engineer
General Fill Type	Any clean material free of roots, debris and other deleterious material with a maximum particle size of 4 inches
Maximum General Fill Loose Lift Thickness	8 inches



TABLE 6.2: FILL COMPACTION RECOMMENDATIONS OUTSIDE OF BUILDING AND PAVEMENT AREAS

Location	Material	Test Method for Density Determination	Plasticity Index	Percent Compaction	Optimum Moisture Content	Testing Frequency
Outside of Structure / Pavement Areas	General Fill	ASTM D 698	PI ≥ 25	94% to 98%	0 to +4%	1 per 10,000 SF; min. 3 per lift
			PI < 25	≥ 95%	0 to +4%	

6.1.2 EXISTING SITE CONDITIONS

The following table outlines construction considerations in consideration of demolition of existing structures, demolition of existing paving, procedures for abandoning old utility lines and removing trees.

TABLE 6.3: CONSIDERATIONS FOR DEMOLITION

Existing Structures	
Foundations of former structure(s) located below new structure	Impact of foundation of former structures should be evaluated on a case by case basis
Foundations for former structure(s) located below new paving	Cut off at least 3 feet below finished paving grade
Existing Pavement	
Former paving located within footing of proposed structure(s)	Remove concrete and/or HMA surface course and base entirely or review impact on case by case basis
Former paving located within footprint of proposed new paving	Remove concrete and/or HMA surface course and evaluate if base can be reused
Abandoned Utilities	
Utilities of former structure(s) located within new foundation pad/footprint of proposed structure	Remove pipe, bedding and backfill and then replace with select fill placed using controlled compaction
Utilities of former structure(s) located outside of foundation pad footprint	Abandon in place using a grout plug
Tree Removal	
Trees located within proposed building footprint; roadways, parking, and sidewalk areas; and 5 feet of building area	Remove root system for full vertical and lateral extent and extend removal for at least 3 feet beyond presence of root fragments and replace void with compacted general fill or flowable fill

6.2 MOISTURE SENSITIVE SOILS/WEATHER RELATED CONCERNS

Soils are sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork, foundation, and construction activities during dry weather. A relatively all-weather compacted crushed limestone cap having a thickness of at least 6 inches should be provided as a working surface.



6.3 EXCAVATION OBSERVATIONS

Excavations should be observed by a representative of PSI prior to continuing construction activities in those areas. PSI needs to assess the encountered materials and confirm that site conditions are consistent with those discussed in this report. This is especially important to identify the condition and acceptability of the exposed subgrades under foundations and other structures that are sensitive to movement. Soft or loose soil zones encountered at the bottom of the excavations should be removed to the level of competent soils as directed by the Geotechnical Engineer or their representative. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with compacted select fill or lean concrete.

After opening, excavations should be observed and concrete should be placed as quickly as possible to avoid exposure to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. Excavations left open for an extended period of time (greater than 24 hours) should be protected to reduce evaporation or entry of moisture.

6.4 DRAINAGE CONSIDERATIONS

Water should not be allowed to collect in foundation excavations, on foundation surfaces, or on prepared subgrades within the construction area during or after construction. Proper drainage around grade supported sidewalks and flatwork is important to reduce potential movements. Excavated areas should be sloped toward one corner to facilitate removal of collected rainwater, groundwater, or surface runoff. Providing rapid, positive drainage away from the building reduces moisture variations within the underlying soils and will aid in reducing the magnitude of potential movements.

6.5 EXCAVATIONS AND TRENCHES

It should be noted that excavation equipment capabilities and field conditions may vary. Geologic processes are erratic and large variations can occur in small vertical and/or lateral distances. Details regarding “means and methods” to accomplish the work (such as excavation equipment and technique selection) are the sole responsibility of the project contractor. The comments contained in this report are based on small diameter borehole observations. The performance of large excavations may differ as a result of the differences in excavation sizes.

The Occupational Safety and Health Administration (OSHA) Safety and Health Standards (29 CFR Part 1926, Revised October 1989), require that excavations be constructed in accordance with the current OSHA guidelines. Furthermore, the State of Texas requires that detailed plans and specifications meeting OSHA standards be prepared for trench and excavation retention systems used during construction. PSI understands that these regulations are being strictly enforced, and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and Federal safety regulations.

PSI is providing this information as a service to the client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and Federal safety or other regulations. A trench safety plan was beyond the scope of our services for this project.



7.0 REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI and design details furnished by the client for the proposed project. If there are revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not notified of such changes, PSI will not be responsible for the impact of those changes on the project.

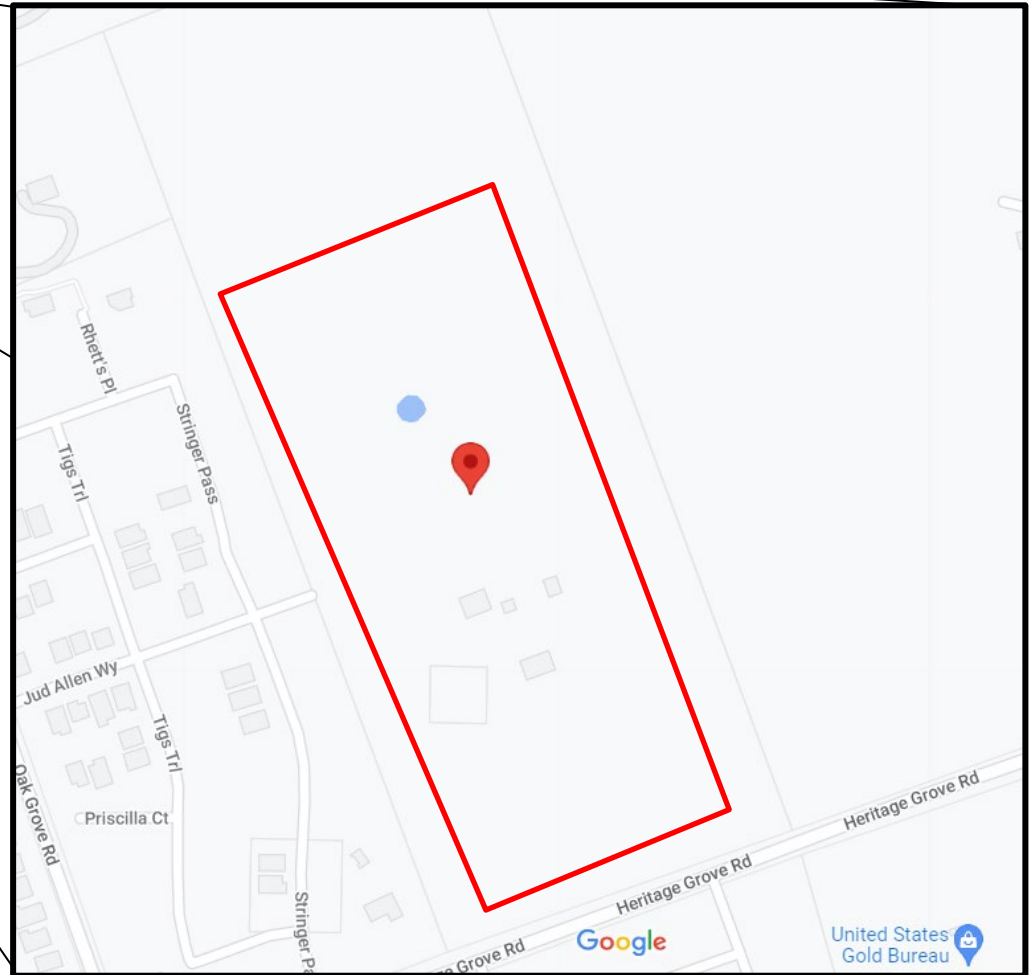
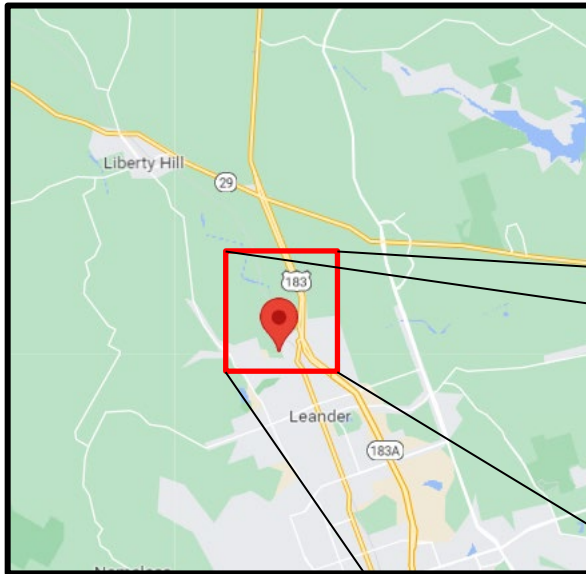
The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional Geotechnical Engineering practices in the local area. No other warranties are implied or expressed. This report may not be copied without the expressed written permission of PSI.

After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that the engineering recommendations have been properly incorporated in the design documents. At this time, it may be necessary to submit supplementary recommendations. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project.

This report has been prepared for the exclusive use of Waterloo Real Estate Investments, Inc. for specific application to the proposed Leander Heritage Grove to be constructed at 0.5 mile to the West of US 183 & Heritage Grove Rd in Leander, Texas.



APPENDIX

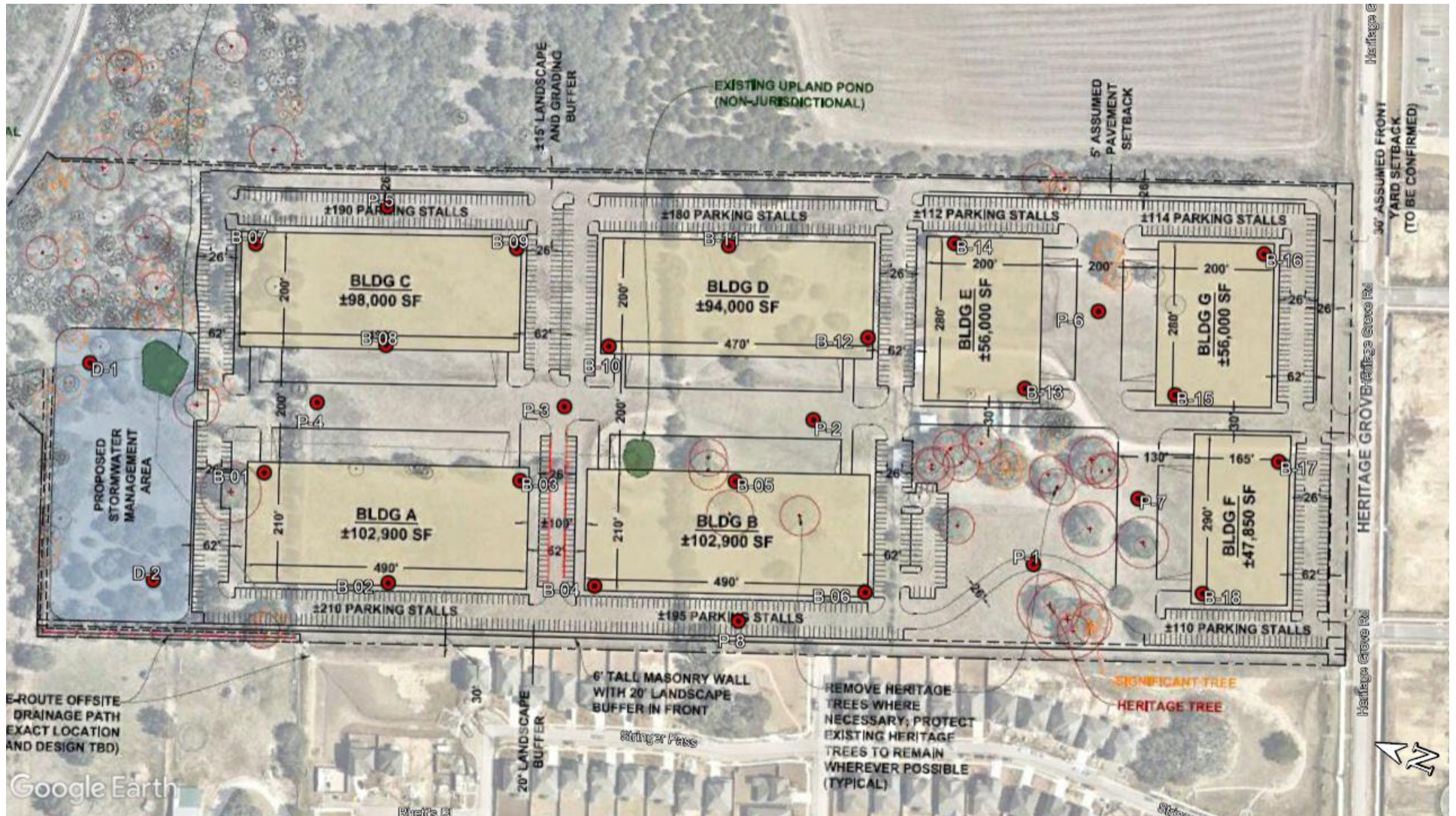


2600 McHale Ct. #125
Austin, Texas 78758
(512) 491-0200

Site Vicinity Map
PSI Project No.: 03031632

Heritage Grove Industrial
0.5 mile to the West of US 183 &
Heritage Grove Rd
Leander, Texas







Boring Logs

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-02

LOCATION: Lat:30.6026°, Long: -97.8712°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 983.00												
				FAT CLAY (CH), stiff, dark brown	19			10								
					14			11								
5				MARL, hard, brown and tan, with clay seams embedded	21			84								
				LIMESTONE, moderately hard, light brown and tan, fairly continuous recovery and very poor rock quality -with marl layers, highly fractured at 6 ft to 10 ft					85	17						
10				-becomes to fair rock quality at 10 ft												
									100	60					>>●178	143
15				-becomes to gray and tan at 15 ft												
									100	65					>>●123	148
20																
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/28/22-7/28/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-03

LOCATION: Lat:30.6022°, Long: -97.8704°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														PL 20	WC 40	LL 60		
				Elevation: 984.00														
				FAT CLAY (CH), stiff, dark brown	14	0	96	11			72	28	44					
				FAT CLAY (CH), hard, light brown and tan, calcareous	6			34										
5				-becomes to very stiff, gravelly at 4 ft	11	23	56	21			53	18	35					
				MARL, hard, light brown and tan	10			21-50/2"										
10					10			50/2"										
				LIMESTONE, moderately soft, gray and tan	4			50/2"										
15																		
					8			50/1"										
20																		
25																		
30																		

COMPLETION DEPTH: 20.0 Feet

DATE: 8/1/22-8/1/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-04

LOCATION: Lat:30.6017°, Long: -97.8708°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) UNC CMP (TSF)			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														2.0	4.0	6.0		
														PL 20	WC 40	LL 60		
				Elevation: 992.00														
				FAT CLAY (CH), hard, dark brown and light brown	8			39										
				-becomes to very stiff, light brown and tan, calcareous at 2 ft to 4 ft	13			27										
5					12			65										
				MARL, hard, light brown and tan, with interbedded limestone seams and layers	7			41-50/6"										
					9			40-50/5.5"										
10																		
				LIMESTONE, moderately soft, light brown and tan	8			50/3"										
15																		
					10			50/2.5"										
20																		
25																		
30																		

COMPLETION DEPTH: 20.0 Feet

DATE: 7/28/22-7/28/22



DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-05

LOCATION: Lat:30.6013°, Long: -97.8700°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 995.00												
				FAT CLAY (CH), hard, dark brown and light brown	9			31								
				MARL, hard, light brown and tan	6	4	70	64			36	15	21			
5					7			30-50/1"								
					8			27-50/5"								
10				-with continuous fat clay seams embedded at 8.5 ft to 15 ft	10	4	89	56			59	17	42			
					15			20-50/2"								
15				LIMESTONE, moderately hard, gray												
					4			50/1"								
20																
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/27/22-7/27/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-06

LOCATION: Lat:30.6005°, Long: -97.8703°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														PL 20	WC 40	LL 60		
				Elevation: 1002.00														
				FAT CLAY (CH), stiff, dark brown	10			13										
				MARL, hard, light brown and tan, with continuous clay seams embedded	9			56										
5				-becomes to incompetent recovery and very poor rock quality at 5 ft to 10 ft -with interbedded limestone seams and layers at 5 ft	7			50/4"										
10				-becomes to continuous recovery and fair rock quality at 10 ft to 15 ft					28	0								
15				-becomes to competent recovery and very poor rock quality at 15 ft					93	55								
20				LIMESTONE, moderately soft, gray, incompetent recovery and very poor rock quality					43	18								
25																		
30																		

COMPLETION DEPTH: 20.0 Feet

DATE: 7/27/22-7/27/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-08

LOCATION: Lat:30.6031°, Long: -97.8700°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 981.00												
				CLAYEY SAND with GRAVEL (SC), dense, dark brown and light brown, with weathered limestone fragments	3	36	32	39			38	17	21			
				MARL, hard, light brown and tan, with weathered limestone fragments	6			50/5"								
5					9			50/4"								
				LIMESTONE, moderately soft, gray and tan	7			50/2"								
10					4			50/1.5"								
					9			50/2"								
15																
20																
25																
30																

COMPLETION DEPTH: 15.0 Feet

DATE: 7/28/22-7/28/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-09

LOCATION: Lat:30.6026°, Long: -97.8693°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 983.00												
				FAT CLAY (CH), firm, dark brown	17			8			73	29	44			
				-becomes to very stiff, dark brown and tan, marly at 2 ft	18			20								
5				MARL, hard, light brown and tan, with weathered limestone fragments	8	8	66	50			34	16	18			
					11			29-50/6"								
10					7			50/2"								
15				LIMESTONE, moderately hard, gray and tan	4			50/1.5"								
20					9			50/0.5"								
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/28/22-7/28/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-10

LOCATION: Lat:30.6021°, Long: -97.8696°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 989.00												
				FAT CLAY (CH), stiff, dark brown	17			10			77	29	48			
				LEAN CLAY (CL), very stiff, light brown and tan, marly	7			27								
5					13	4	84	23			41	14	27			
				MARL, hard, light brown and tan	15			70								
10					12	9	77	54			35	13	22			
				-with interbedded limestone seams at 13.5 ft	5			50/1"								
15				LIMESTONE, moderately soft, gray, continuous recovery and poor rock quality												
									100	38					>>● 102	149
20																
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/28/22-7/28/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-11

LOCATION: Lat:30.6017°, Long: -97.8688°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 996.00												
				SANDY LEAN CLAY with GRAVEL (CL), very stiff, dark brown, with weathered limestone fragments	3	16	52	16			34	19	15	○ ●		
				MARL, hard, light brown and tan, with clay seams embedded	3			50/4"						○ ●		
5					7			60						○ ●		
					7			24-50/4"						○ ●		
				-with interbedded limestone seams at 7.5 ft	7	16	59	20-50/5"			30	16	14	○ ●		
10														○ ●		
					16			20-50/6"						○ ●		
15														○ ●		
				LIMESTONE, soft, gray										○ ●		
20					5			50/5"						○ ●		
														○ ●		
25														○ ●		
														○ ●		
30														○ ●		

COMPLETION DEPTH: 20.0 Feet

DATE: 7/26/22-7/26/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-12

LOCATION: Lat:30.6009°, Long: -97.8690°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) UNC CMP (TSF)			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														2.0	4.0	6.0		
														PL 20	WC 40	LL 60		
				Elevation: 1001.00														
				CLAYEY GRAVEL (GC), medium dense, light brown and tan, with weathered limestone fragments	5			27										
				-very dense at 2 ft	4			70										
5				MARL, hard, light brown and tan, with interbedded limestone seams and layers	5	17	57	50/6"			31	16	15					
					6			50/5"										
10					8			50/3.5"										
					5			50/2"										
15																		
				LIMESTONE, soft, gray	5			50/1.5"										
20																		
25																		
30																		

COMPLETION DEPTH: 20.0 Feet

DATE: 7/27/22-7/27/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-13

LOCATION: Lat:30.6002°, Long: -97.8690°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	HAND PEN (TSF) UNC CMP (TSF)			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														2.0	4.0	6.0		
														PL 20	WC 40	LL 60		
Elevation: 1002.00																		
				CLAYEY GRAVEL (GC), medium dense, dark brown and tan, with weathered limestone fragments	4			24						X				
				MARL, hard, light brown and tan, with intermittent and discontinuous limestone seams and layers	5			30-50/5"						X				
5					6			50/4.5"						X				
					14			37-50/5.5"						X				
					15			50/5.5"						X				
10				LIMESTONE, moderately soft, gray														
					5			50/3"						X				
15																		
					5			50/1"						X				
20																		
25																		
30																		

COMPLETION DEPTH: 20.0 Feet

DATE: 7/24/22-7/24/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-14

LOCATION: Lat:30.6007°, Long: -97.8684°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 1003.00												
				CLAYEY GRAVEL (GC), medium dense, brown, with weathered limestone fragments	3			27								
				MARL, hard, light brown and tan, with intermittent and discontinuous limestone seams	3			20-50/4.5"								
5					7			50/5"								
					7	21	58	50/6"			31	15	16			
10					7			50/6"								
				-becomes to continuous recovery and poor rock quality, with interbedded limestone layers at 10 ft												
15									100	28						
				LIMESTONE, soft, gray, continuous recovery and poor rock quality					95	40						
20																
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/25/22-7/25/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-15

LOCATION: Lat:30.5995°, Long: -97.8687°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 1002.00												
				CLAYEY GRAVEL (GC), dense, light brown and tan, with weathered limestone fragments	4			41								
				MARL, hard, light brown and tan, with intermittent and discontinuous limestone seams and layers	4			19-50/5"								
5					8			50/5.5"								
					8	12	65	24-50/2"			40	17	23			
10					12			50/6"								
								50/5"								
15				LIMESTONE, moderately hard, gray												
					4			50/2"								
20																
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/24/22-7/24/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-16

LOCATION: Lat:30.5993°, Long: -97.8678°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 1002.00												
				FAT CLAY (CH), very stiff, dark brown	17			16								
				MARL, hard, light brown and tan, with clay seams embedded	10	14	49	35-50/2"			38	17	21			
5					10			50/6"								
					8	21	55	46			46	18	28			
10					12			37-50/4"								
				WEATHERED LIMESTONE, soft, light brown and tan, competent recovery and very poor rock quality, with interbedded and discontinuous marl layers					47	7						
15																
				LIMESTONE, moderately hard, gray, continuous recovery and fair rock quality					100	58						
20																
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/24/22-7/24/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-17

LOCATION: Lat:30.5989°, Long: -97.8688°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 1003.00												
				LEAN CLAY with SAND (CL), very stiff, dark brown and light brown, with weathered limestone fragments	9			29								
				-becomes to hard, light brown and tan, marly at 2 ft	9	7	71	42			29	16	13			
5				MARL, hard, light brown and tan, with intermittent and discontinuous limestone seams	11			50/5"								
					10			26-50/2"								
10					11			50/3"								
					11			50/4"								
15				LIMESTONE, moderately hard, gray, with clay seams												
					5											
20																
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/27/22-7/27/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING B-18

LOCATION: Lat:30.5990°, Long: -97.8697°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 1003.00												
				FAT CLAY (CH), stiff, dark brown	13	5	88	11			74	27	47			
				- hard, dark brown and light brown, marly at 2 ft	15			34								
				MARL, hard, light brown and tan, with clay seams embedded	9			40-50/6"								
5					9			22-50/4"			38	17	21			
				-with weathered limestone fragments, gray and tan at 8.5 ft	9			50/3"								
10				WEATHERED LIMESTONE, soft, light brown and tan, continuous recovery and poor rock quality, with intermittent and discontinuous marl layers					92	38						
15				LIMESTONE, gray, continuous recovery and fair rock quality					100	72						
20																
25																
30																

COMPLETION DEPTH: 20.0 Feet

DATE: 7/27/22-7/27/22

intertek
psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING D-1

LOCATION: Lat:30.6043°, Long: -97.8710°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														PL 20	WC 40	LL 60		
				Elevation: 973.00														
				WEATHERED LIMESTONE, soft, light brown and tan	4			10-19-50/3"										
					2			50/2"										
5					10			50/3"										
					7			50/1.5"										
10					6			50/2"										
15																		
20																		
25																		
30																		

COMPLETION DEPTH: 10.0 Feet

DATE: 9/24/22-9/24/22



DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING P-1

LOCATION: Lat:30.5998°, Long: -97.8699°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 1003.00												
				FAT CLAY (CH), very stiff, dark brown and light brown, with weathered limestone fragments	8			24								
				MARL, hard, light brown and tan	4			27-50/1"								
5					8	6	83	50/3.5"			38	17	21			
10																
15																
20																
25																
30																

COMPLETION DEPTH: 6.0 Feet

DATE: 7/27/22-7/27/22



DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING P-2

LOCATION: Lat:30.6010°, Long: -97.8696°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														PL 20	WC 40	LL 60		
				Elevation: 998.00														
				FAT CLAY (CH), very stiff, dark brown and light brown	11			15										
				MARL, hard, light brown and tan, with weathered limestone fragments	4			50/6"										
5					2			50/1"										
10																		
15																		
20																		
25																		
30																		

COMPLETION DEPTH: 6.0 Feet

DATE: 7/27/22-7/27/22



DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING P-3

LOCATION: Lat:30.6022°, Long: -97.8700°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														PL 20	WC 40	LL 60		
				Elevation: 987.00														
				FAT CLAY with SAND (CH), very stiff, dark brown and light brown	8	4	82	17			67	24	43					
				-becomes to hard, marly at 2 ft	11			39										
5				MARL, hard, light brown and tan, with continuous clay seams embedded	8			21-50/2"										
10																		
15																		
20																		
25																		
30																		

COMPLETION DEPTH: 6.0 Feet

DATE: 8/1/22-8/1/22



DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING P-4

LOCATION: Lat:30.6033°, Long: -97.8704°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 980.00														
				FAT CLAY with SAND (CH), firm, dark brown	18			6										
					22	4	81	6			87	27	60					
5				SANDY FAT CLAY (CH), very stiff, brown and tan, marly	23			25										
10																		
15																		
20																		
25																		
30																		

COMPLETION DEPTH: 6.0 Feet

DATE: 8/1/22-8/1/22



DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING P-5

LOCATION: Lat:30.6033°, Long: -97.8693°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
														PL 20	WC 40	LL 60		
				Elevation: 976.00														
				FAT CLAY (CH), very stiff, dark brown and light brown, with weathered limestone fragments	11	7	84	17			76	28	48					
				MARL, hard, light brown and tan, with weathered limestone fragments	8			30-50/6"										
5					10			50/4"										
10																		
15																		
20																		
25																		
30																		

COMPLETION DEPTH: 6.0 Feet

DATE: 7/28/22-7/28/22



DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING P-6

LOCATION: Lat:30.6000°, Long: -97.8684°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60	UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 1002.00												
				CLAYEY GRAVEL with SAND (GC), medium dense, dark brown and light brown, with weathered limestone fragments	4			21								
				MARL, hard, light brown and tan	4			50/5.5"								
5					4			50/5.5"								
10																
15																
20																
25																
30																

COMPLETION DEPTH: 6.0 Feet

DATE: 7/26/22-7/26/22

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psi

DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

DELTED WATER LEVEL (FT): N/A

Leander Heritage Grove

0.5 mile to the West of US 183 and Heritage Grove Rd, Leander, Texas 78641

Project No. 03031632

BORING P-8

LOCATION: Lat:30.6010°, Long: -97.8707°

DEPTH, FT.	SYMBOL	SAMPLES	WATER	SOIL DESCRIPTION	MOISTURE CONTENT	% RETAINED #4	% PASSING #200	SPT (N) & TCP (T) VALUES	% REC	%RQD	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	○ HAND PEN (TSF) ● UNC CMP (TSF) 2.0 4.0 6.0 PL WC LL 20 40 60			UNCONF. COMP. (TSF)	UNIT DRY WT. (LB/CU FT)
				Elevation: 999.00														
				CLAYEY GRAVEL (GC) , very dense, dark brown and tan, with weathered limestone fragments	3			37-50/4"										
				MARL, hard, light brown and tan, with weathered limestone fragments	5	24	47	50			32	16	16					
5					7			50/6"										
10																		
15																		
20																		
25																		
30																		

COMPLETION DEPTH: 6.0 Feet

DATE: 7/27/22-7/27/22



DEPTH TO GROUND WATER

SEEPAGE (ft.): None Encountered

END OF DRILLING (ft.): None Encountered

DELAYED WATER LEVEL (FT): N/A

KEY TO TERMS AND SYMBOLS USED ON LOGS

ROCK CLASSIFICATION

RECOVERY

DESCRIPTION OF RECOVERY	% CORE RECOVERY
Incompetent	< 40
Competent	40 TO 70
Fairly Continuous	70 TO 90
Continuous	90 TO 100

ROCK QUALITY DESIGNATION (RQD)

DESCRIPTION OF ROCK QUALITY	RQD
Very Poor (VPo)	0 TO 25
Poor (Po)	25 TO 50
Fair (F)	50 TO 75
Good (Gd)	75 TO 90
Excellent (ExInt)	90 TO 100

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	N-VALUE (Blows/Foot)	SHEAR STRENGTH (tsf)	HAND PEN VALUE (tsf)
Very Soft	0 TO 2	0 TO 0.125	0 TO 0.25
Soft	2 TO 4	0.125 TO 0.25	0.25 TO 0.5
Firm	4 TO 8	0.25 TO 0.5	0.5 TO 1.0
Stiff	8 TO 15	0.5 TO 1.0	1.0 TO 2.0
Very Stiff	15 TO 30	1.0 TO 2.0	2.0 TO 4.0
Hard	>30	>2.0 OR 2.0+	>4.0 OR 4.0+

SOIL DENSITY OR CONSISTENCY

DENSITY (GRANULAR)	CONSISTENCY (COHESIVE)	THD (BLOWS/FT)	FIELD IDENTIFICATION
Very Loose (VLo)	Very Soft (VSo)	0 TO 8	Core (height twice diameter) sags under own weight
Loose (Lo)	Soft (So)	8 TO 20	Core can be pinched or imprinted easily with finger
Slightly Compact (SICmpt)	Stiff (St)	20 TO 40	Core can be imprinted with considerable pressure
Compact (Cmpt)	Very Stiff (VSt)	40 TO 80	Core can only be imprinted slightly with fingers
Dense (De)	Hard (H)	80 TO 5"/100	Core cannot be imprinted with fingers but can be penetrated with pencil
Very Dense (VDe)	Very Hard (VH)	5"/100 to 0"/100	Core cannot be penetrated with pencil

DEGREE OF PLASTICITY OF COHESIVE SOILS

DEGREE OF PLASTICITY	PLASTICITY INDEX (PI)	SWELL POTENTIAL
None or Slight	0 to 4	None
Low	4 to 20	Low
Medium	20 to 30	Medium
High	30 to 40	High
Very High	>40	Very High

BEDROCK HARDNESS

MORHS' SCALE	CHARACTERISTICS	EXAMPLES	APPROXIMATE THD PEN TEST	
5.5 to 10	Rock will scratch knife	Sandstone, Chert, Schist, Granite, Gneiss, some Limestone	Very Hard (VH)	0" to 2"/100
3 to 5.5	Rock can be scratched with knife blade	Siltstone, Shale, Iron Deposits, most Limestone	Hard (H)	1" to 5"/100
1 to 3	Rock can be scratched with fingernail	Gypsum, Calcite, Evaporites, Chalk, some Shale	Soft (So)	4" to 6"/100

MOISTURE CONDITION OF COHESIVE SOILS

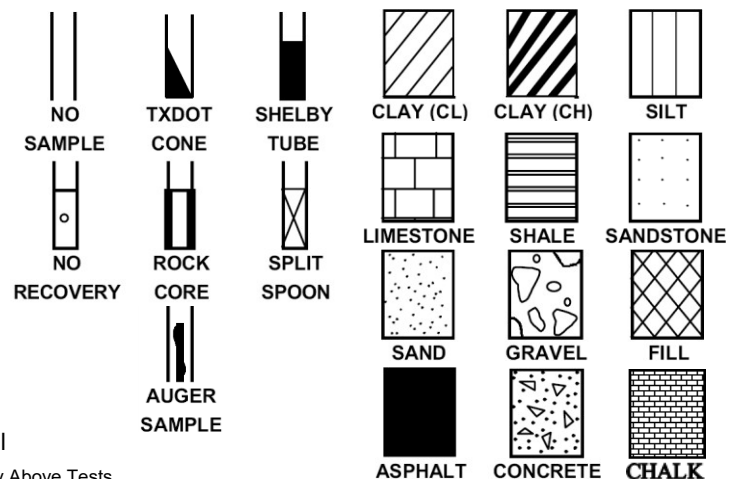
DESCRIPTION	CONDITION
Absence of moisture, dusty, dry to touch	DRY
Damp but no visible water	MOIST
Visible free water	WET

RELATIVE DENSITY FOR GRANULAR SOILS

APPARENT DENSITY	SPT (BLOWS/FT)	CALIFORNIA SAMPLER (BLOWS/FT)	MODIFIED CA. SAMPLER (BLOWS/FT)	RELATIVE DENSITY (%)
Very Loose	0 to 4	0 to 5	0 to 4	0 to 15
Loose	4 to 10	5 to 15	5 to 12	15 to 35
Medium Dense	10 to 30	15 to 40	12 to 35	35 to 65
Dense	30 to 50	40 to 70	35 to 60	65 to 85
Very Dense	>50	>70	>60	85 to 100

SAMPLER TYPES

SOIL TYPES



ABBREVIATIONS

PL – Plastic Limit
LL – Liquid Limit
WC – Percent Moisture
Q_P – Hand Penetrometer
Q_U – Unconfined Compression Test
UU – Unconsolidated Undrained Triaxial

Note: Plot Indicates Shear Strength as Obtained By Above Tests

▽ WATER SEEPAGE

▽ WATER LEVEL AT END OF DRILLING

CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

6"	3"	3/4"	4	10	40	200	
BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	CLAY
152	76.2	19.1	4.76	2.0	0.42	0.074	0.002