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: 23000 FM 306						**2. Regulated Entity No.:**			
3. Customer Name: April Wilkerson						**4. 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):**			8.99 acres
9. Application Fee:	$5,000		**10. Permanent BMP(s):**					Vegetated Swales, Extended Detention, Engineered Filter Strips, Batch Detention	
11. SCS (Linear Ft.):	N/A		**12. AST/UST (No. Tanks):**					N/A	
13. County:	Comal		**14. Watershed:**					Guadalupe	

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.)	___	___	___
Region (1 req.)	___	___	___
County(ies)	___	___	___
Groundwater Conservation District(s)	___Edwards Aquifer Authority ___Barton Springs/ Edwards Aquifer ___Hays Trinity ___Plum Creek	___Barton Springs/ Edwards Aquifer	NA
City(ies) Jurisdiction	___Austin ___Buda ___Dripping Springs ___Kyle ___Mountain City ___San Marcos ___Wimberley ___Woodcreek	___Austin ___Bee Cave ___Pflugerville ___Rollingwood ___Round Rock ___Sunset Valley ___West Lake Hills	___Austin ___Cedar Park ___Florence ___Georgetown ___Jerrell ___Leander ___Liberty Hill ___Pflugerville ___Round Rock

San Antonio Region					
County:	**Bexar**	**Comal**	**Kinney**	**Medina**	**Uvalde**
Original (1 req.)	___	1	___	___	___
Region (1 req.)	___	1	___	___	___
County(ies)	___	1	___	___	___
Groundwater Conservation District(s)	___ Edwards Aquifer Authority ___Trinity-Glen Rose	Edwards Aquifer Authority	___Kinney	___EAA ___Medina	___EAA ___Uvalde
City(ies) Jurisdiction	___Castle Hills ___Fair Oaks Ranch ___Helotes ___Hill Country Village ___Hollywood Park ___San Antonio (SAWS) ___Shavano Park	Bulverde ___Fair Oaks Ranch ___Garden Ridge ___New Braunfels ___Schertz	NA	___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. JAMES MCGARR, PE
Print Name of Customer/Authorized Agent
Signature of Customer/Authorized Agent 6-5-2023 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: James McGarr

Date: 06/01/2023

Signature of Customer/Agent:

Regulated Entity Name: 23000 FM 306

Project Information

1. County: Comal
2. Stream Basin: Potter Creek
3. Groundwater Conservation District (if applicable): _____
4. Customer (Applicant): Pierced Oak LLC

   Contact Person:
   Entity:
   Mailing Address:
   City, State: ake, Texas
   Telephone: 5510
   Email Address: @gmail.com

5. Agent/Representative (If any):

   Contact Person: James McGarr
   Entity: Civil Tech, PLLC
   Mailing Address: P.O. Box 2203
   City, State: Boerne, TX Zip: 78006
   Telephone: 210-365-5029 Fax: _____
   Email Address: jmcgarr@civiltechmc.com

6. Project Location:

   ☐ The project site is located inside the city limits of _____.
   ☒ The project site is located outside the city limits but inside the ETJ (extra-territorial jurisdiction) of Canyon Lake, TX.
   ☐ 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.

   23000 FM 306, Canyon Lake, TX

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): 8.99 Acres

Total disturbed area: 8.99 Acres

14. Estimated projected population: 73

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

Table 1 - Impervious Cover

Impervious Cover of Proposed Project	***Sq. Ft.***	***Sq. Ft./Acre***	***Acres***
Structures/Rooftops	3,062	÷ 43,560 =	0.07
Parking	69,922	÷ 43,560 =	1.61
Other paved surfaces	94,722	÷ 43,560 =	2.17
Total Impervious Cover	167,706	÷ 43,560 =	3.85

Total Impervious Cover 3.85 ÷ Total Acreage 8.99 X 100 = 42.8% 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 x W = _____Ft^2 ÷ 43,560 Ft^2/Acre = _____ acres.

21. Pavement Area:

Length of pavement area: _____ feet.
Width of pavement area: _____ feet.
L x W = _____Ft^2 ÷ 43,560 Ft^2/Acre = _____ acres.
Pavement area _____ acres ÷ R.O.W. area _____ acres x 100 = _____% 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 _____ (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

AST Number	*Size (Gallons)*	*Substance to be Stored*	*Tank Material*
1			
2			
3			
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

Length (L)(Ft.)	*Width(W)(Ft.)*	*Height (H)(Ft.)*	*L x W x H = (Ft3)*	*Gallons*

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" = 20'.

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 480091C0095F, Effective 09/02/2009.

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.

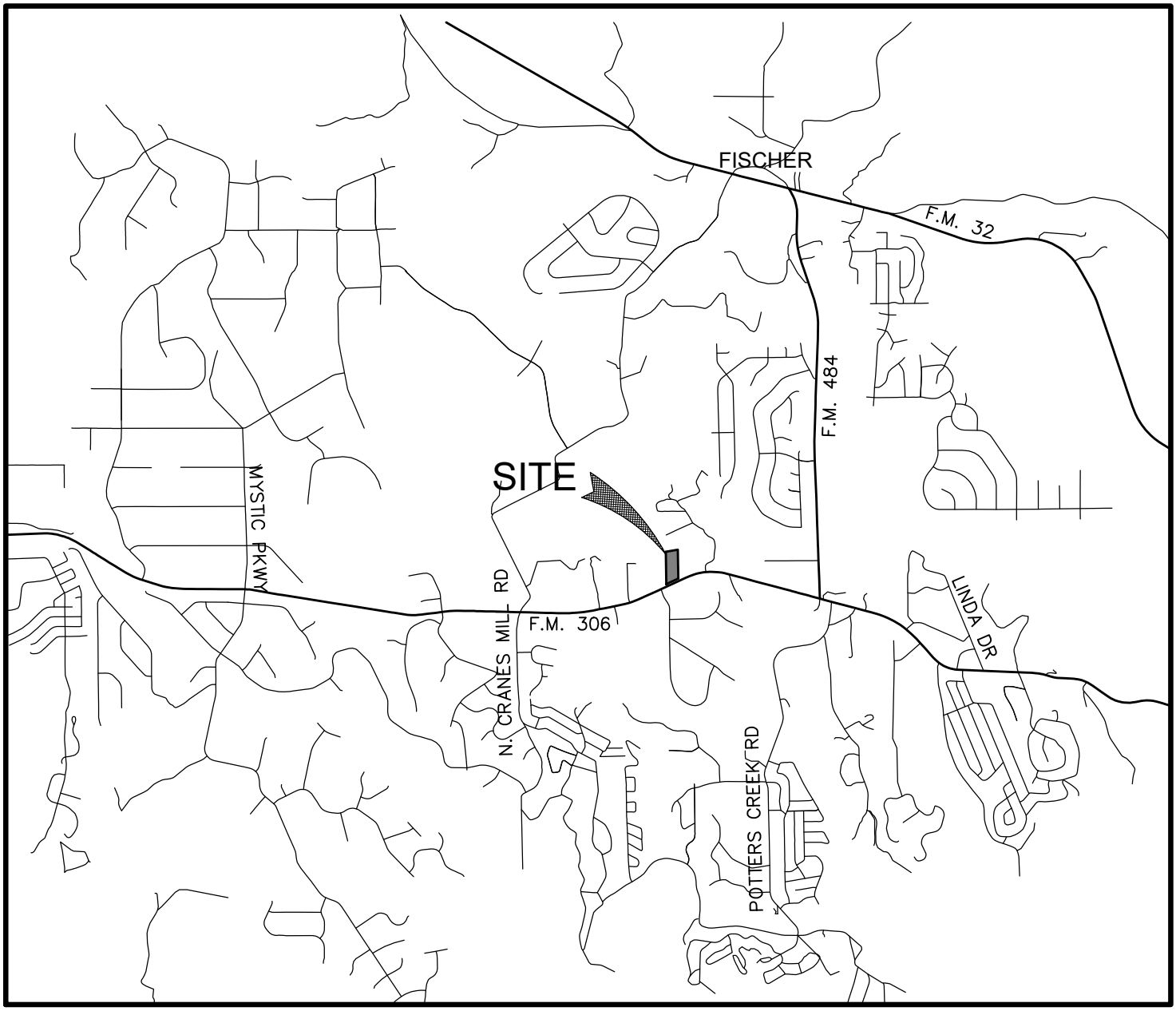
62. ☒ Any modification of this Contributing Zone Plan may require TCEQ review and Executive Director approval prior to construction, and may require submission of a revised application, with appropriate fees.

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.

ATTACHMENT A

Road Map



LOCATION MAP

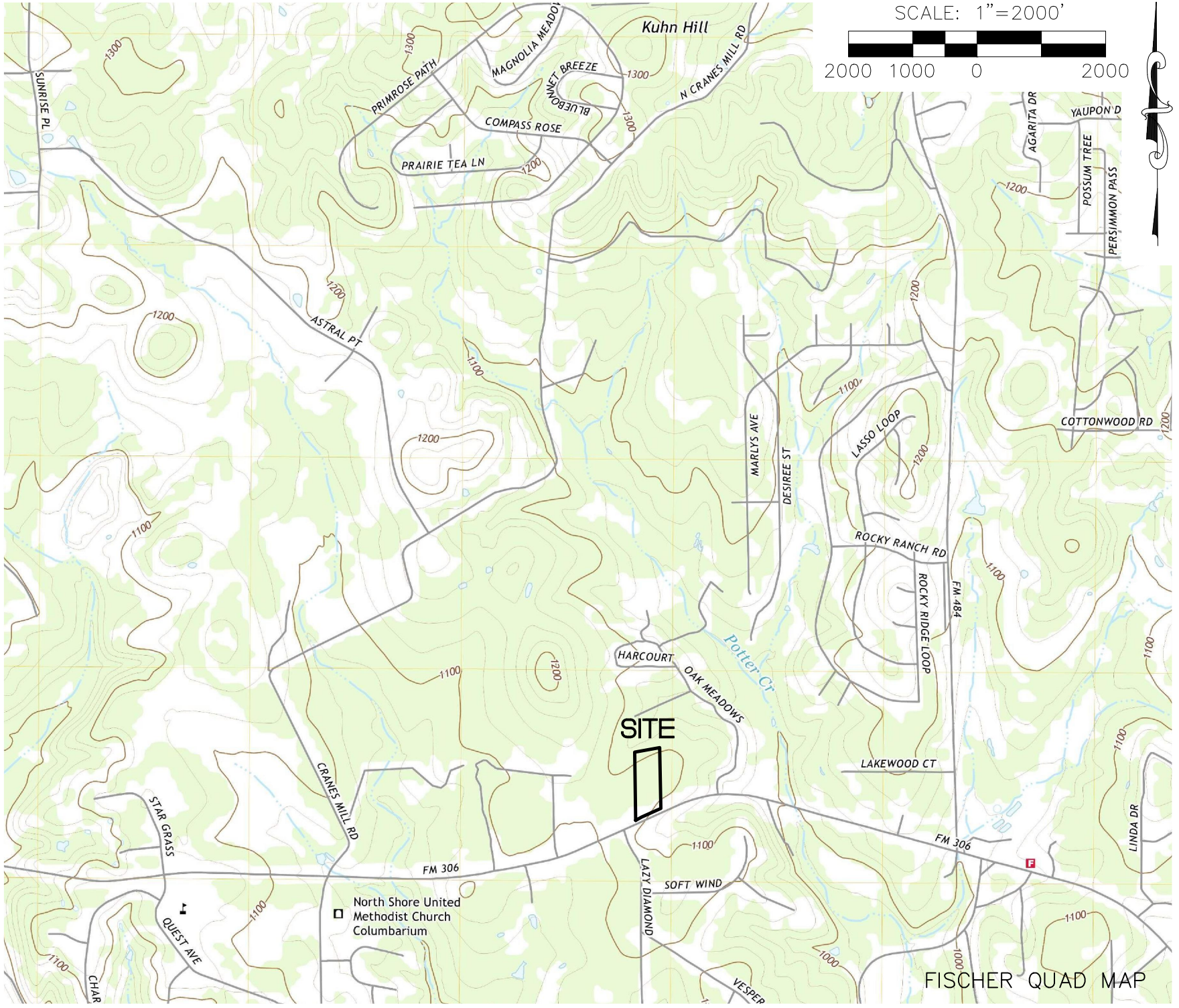
SCALE: 1" = 5000'

AXIS
CIVIL CAD SERVICES

SHEET NO.	LOCATION EXHIBIT	REVISIONS:	DATE	CIVIL TECH, PLLC.
EX1	PIERCED OAK RV PARK CANYON LAKE, TEXAS			ENGINEERS, CONSULTANTS, LAND PLANNERS Firm No. 13711 (210) 365-5029 P.O. BOX 2203 BOERNE, TX. 78006

ATTACHMENT B

USGS Quadrangle Map



FISCHER QUAD MAP

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029 P.O. BOX 2203 BOERNE, TX. 78006

REVISIONS:

PIERCED OAK RV PARK
23000 FM 306
CANYON LAKE, TEXAS

ATTACHMENT B – USGS/EDWARDS RECHARGE ZONE MAP

SHEET NO.
USGS

ATTACHMENT C

Project Narrative

Attachment C – Project Narrative

Pierced Oak PWC is proposing to develop 8.99 ± acres into a commercial RV Park located on FM 306 approximately 4,750 feet west of the intersection of FM 306 and FM 484. The property is located within the ETJ of Canyon Lake, Texas. The project site is identified as *23000 FM 306* (hereinafter referred to as the project site). The project site is bound by an unnamed tributary to Potters Creek to the north, 2 large residential lots on the west and east, and FM 306 to the south.

The current condition of the project site is large lot residential with several areas of brushy area with native grasses, some cleared pasture areas, and paved driveways. Average slopes across the site range from 3% to 7% typically with some areas of steep slopes (~33%) toward the northern and southern sections of the project site. The project site drains both to the north and to the south, the split is roughly equal. The proposed improvements include parking facilities, utilities, and drainage infrastructure. Two proposed on-site detention pond will mitigate peak flow rates to pre-project conditions. Since the property is located within the Edwards Aquifer Contributing Zone, best management practices (BMP) facilities will be provided to reduce total suspended solids (TSS) loading. The project site pre-development impervious cover equals 3.4%, while post-development impervious cover equals 47.1%.

BMPs provided include vegetated swales, two (2) batch detention facilities, an extended detention pond, and an engineered vegetative filter strip. Engineered filter strips are proposed on the downstream side of the private access road where other BMPs are impractical. Temporary BMP's will be installed and maintained to control sedimentation during all phases of construction, including but not limited to silt fences, rock berms, stabilized construction entrances, and concrete wash-out pits. Permanent BMP's will be installed within the beginning stages of their respective phase and have been designed to provide sufficient treatment of anticipated increases in sediment and contaminants as required in the TCEQ Technical Guidance Manual.

ATTACHMENT D

Factors Affecting Surface Water Quality

Attachment D – Factors Affecting Surface Water Quality

The major factors that may affect water quality during construction are:

- Sediment from disturbed soil;
- Sediment from stock piled material;
- Fluids from construction equipment;
- Trash from workers and material packaging;
- Rinse water from concrete trucks.

The major factors which may affect wate quality once development is complete are:

- Automotive fluids;
- Landscape products including fertilizer and herbacides;
- Pest control products.

The temporary and permanent BMP's for this project have been designed to conform to the TCEQ Technical Guidance Manual to treat the required amount of storm water runoff as to not significantly impact water quality entering surface or groundwater.

ATTACHMENT E

Volume and Character of Stormwater

Attachment E – Volume and Character of Stormwater

Increases in stormwater runoff from pre-project to post-project conditions necessitated the use of onsite above ground detention. The relatively small size of the watershed (less than 20 acres) allows the application of the modified rational method for detention pond sizing. Approximately 6.03 acres of the 8.99-acre project site is routed through three detention ponds, with the detention pond over-detaining to account for any uncontrolled portions of onsite runoff. The stage-storage curve is provided within the stormwater management plan.

The required versus actual water quality storage volume for each of the following systems were developed:

	Type	Required WQV (ft3)	Actual WQV (ft3)
Pond A	Extended Detention	3622	6086
Pond B	Batch Detention	5880	5973
Pond C	Batch Detention	4393	4705

The character of storm water generated onsite will be influenced by site features that generate non-point sources of pollution. Non-point sources will include oil and grease from the pavement areas, suspended solids, sedimentation, nutrients for landscape care and maintenance, pesticides, and herbicides. No unusual contaminants other than those typical with a commercial development are anticipated. The nearest downstream receiving stream is identified as Potters Creek (ephemeral) from the FEMA National Flood Hazard Layer

ATTACHMENT F

Suitability Letter from Authorized Agent

COMAL COUNTY
ENGINEER'S OFFICE

June 15, 2023

Mr. James McGarr, P.E.
Civil Tech PLLC
Via e-mail: jmcgarr@civiltechmc.com

Re: Pierced Oak RV Park Suitability Letter within Comal County Texas

Dear Mr. McGarr:

In accordance with TAC §213.24(8)(B), Comal County has found that the entire referenced site is suitable for the use of private sewage facilities and will meet the requirements for on-site sewage facilities.

If you have any questions or need additional information, please contact our office.

Sincerely,

Robert Boyd, P.E.
Comal County Assistant Engineer

cc: Jen Crownover, Comal County Commissioner, Precinct No. 4

195 David Jonas Dr, New Braunfels, Texas, 78132 – Phone (830) 608-2090

ATTACHMENT G

Alternative Secondary Containment Methods

Not Applicable

ATTACHMENT H

AST Containment Structure Drawings

Not Applicable

ATTACHMENT I

20% or Less Impervious Cover Waiver

Not Applicable

ATTACHMENT J

BMPs for Upgradient Stormwater

Attachment J – BMPs for Upgradient Stormwater

There is a small area of upgradient stormwater west of the project site that drains through the existing and proposed driveway of the project site at the southern property line. There is no impervious associated with this drainage area and the water is not routed through any of the proposed BMPs.

ATTACHMENT K

BMP’s for On-site Stormwater

Attachment K – BMPs for Onsite Stormwater

BMPs for treating onsite storm water include vegetated swales, batch detention facilities, extended detention facility, and engineered filter strips.

Below is a summary of TSS removal for the project site:

Total TSS Removal Required for Project Site:	**3,177 lbs/yr**
TSS Removal by Vegetated Swale (LID-PB-3)	172 lbs/yr
TSS Removal by Vegetated Filter Strip 1 (LID-PB-2)	144lbs/yr
TSS Removal by Vegetated Filter Strip 2 (LID-PA-4)	49 lbs/yr
TSS Removal by Pond A (Extended Detention) (LID-PA-2)	718 lbs/yr
TSS Removal by Pond B (Batch Detention) (LID-PB-4)	1297 lbs/yr
TSS Removal by Pond C (Batch Detention) (LID-PA-3)	830 lbs/yr
Total TSS Removal Provided for Project Site:	**3,210 lbs/yr**

The following supporting calculations are provided below.

- TSS Calculations by Vegetated Swale (LID-PB-3)
- TSS Calculations by Vegetated Filter Strip 1 (LID-PB-2)
- TSS Calculations by Vegetated Filter Strip 2 (LID-PA-4)
- TSS Calculations by Pond A (Extended Detention)(LID-PA-2)
- TSS Calculations by Pond B (Batch Detention) (LID-PB-4)
- TSS Calculations by Pond C (Batch Detention) (LID-PA-3)

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Pierced Oak RV Park
Date Prepared: 6/13/2023

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: $L_M = 27.2(A_N \times P)$

where:
$L_{M\ TOTAL\ PROJECT}$ = 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 =	Comal	
Total project area included in plan * =	8.99	acres
Predevelopment impervious area within the limits of the plan * =	0.31	acres
Total post-development impervious area within the limits of the plan* =	3.85	acres
Total post-development impervious cover fraction * =	0.43	
P =	33	inches
$L_{M\ TOTAL\ PROJECT}$ =	3177	lbs.

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

Number of drainage basins / outfalls areas leaving the plan area = 6

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

Drainage Basin/Outfall Area No. = LID-PB-3

Total drainage basin/outfall area =	0.57	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.21	acres
Post-development impervious fraction within drainage basin/outfall area =	0.37	
$L_{M\ THIS\ BASIN}$ =	188	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Grassy Swale
Removal efficiency = 70 percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

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 =	0.57	acres
A_I =	0.21	acres
A_P =	0.36	acres
L_R =	172	lbs

6/14/2023

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

Desired $L_{M\ THIS\ BASIN}$ = 172 lbs.

F = 1.00

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 =	4.00	inches
Post Development Runoff Coefficient =	0.29	
On-site Water Quality Volume =	2415	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 =	483	
Total Capture Volume (required water quality volume(s) x 1.20) =	2898	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.

7. Retention/Irrigation System Designed as Required in RG-348 Pages 3-42 to 3-46

Required Water Quality Volume for retention basin = NA cubic feet

Irrigation Area Calculations:

Soil infiltration/permeability rate =	0.1	in/hr	Enter determined permeability rate or assumed value of 0.1
Irrigation area =	NA	square feet	
	NA	acres	

8. Extended Detention Basin System Designed as Required in RG-348 Pages 3-46 to 3-51

Required Water Quality Volume for extended detention basin = NA cubic feet

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9A. Full Sedimentation and Filtration System

Water Quality Volume for sedimentation basin =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin = NA cubic feet

11. Wet Basins Designed as Required in RG-348 Pages 3-66 to 3-71

Required capacity of Permanent Pool = **NA** cubic feet **Permanent Pool Capacity is 1.20 times the WQV**
Required capacity at WQV Elevation = **NA** cubic feet **Total Capacity should be the Permanent Pool Capacity plus a second WQV.**

12. Constructed Wetlands Designed as Required in RG-348 Pages 3-71 to 3-73

Required Water Quality Volume for Constructed Wetlands = **NA** cubic feet

13. AquaLogic™ Cartridge System Designed as Required in RG-348 Pages 3-74 to 3-78

**** 2005 Technical Guidance Manual (RG-348) does not exempt the required 20% increase with maintenance contract with AquaLogic™.**

Required Sedimentation chamber capacity = **NA** cubic feet
Filter canisters (FCs) to treat WQV = **NA** cartridges
Filter basin area (RIA_F) = **NA** square feet

14. Stormwater Management StormFilter® by CONTECH

Required Water Quality Volume for Contech StormFilter System = **NA** cubic feet

THE SIZING REQUIREMENTS FOR THE FOLLOWING BMPs / LOAD REMOVALS ARE BASED UPON FLOW RATES - NOT CALCULATED WATER QUALITY VOLUMES

15. Grassy Swales Designed as Required in RG-348 Pages 3-51 to 3-54

Design parameters for the swale:

Drainage Area to be Treated by the Swale = A = 0.55 acres
Impervious Cover in Drainage Area = 0.20 acres
Rainfall intensity = i = 1.1 in/hr
Swale Slope = 0.025 ft/ft
Side Slope (z) = 5
Design Water Depth = y = 0.33 ft
Weighted Runoff Coefficient = C = 0.48

A_{CS} = cross-sectional area of flow in Swale = 0.52 sf
P_W = Wetted Perimeter = 3.29 feet
R_H = hydraulic radius of flow cross-section = A_{CS}/P_W = 0.16 feet
n = Manning's roughness coefficient = 0.2

15A. Using the Method Described in the RG-348

Manning's Equation: $Q = \frac{1.49}{n} A_{CS} R_H^{.2/3} S^{0.5}$

$b = \frac{0.134 \times Q}{y^{1.67} S^{0.5}} - zy$ = -0.08 feet

Q = CiA = 0.29 cfs

To calculate the flow velocity in the swale:

V (Velocity of Flow in the swale) = Q/A_{CS} = 0.56 ft/sec

To calculate the resulting swale length:

L = Minimum Swale Length = V (ft/sec) * 300 (sec) = 168.42 feet

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters must be modified and the solver rerun.

15B. Alternative Method using Excel Solver

Design Q = CiA = 0.29 cfs

Manning's Equation Q = 1.24 cfs Error 1 = -0.95
Swale Width= 6.00 ft

Instructions are provided to the right (green comments).

Flow Velocity 0.56 ft/s
Minimum Length = 168.42 ft

Instructions are provided to the right (blue comments).

Design Width = 6 ft
Design Discharge = 1.26 cfs Error 2 = -0.97
Design Depth = 0.33 ft
Flow Velocity = 0.49 cfs
Minimum Length = 148.40 ft

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters may be modified and the solver rerun.
If any of the resulting values still do not meet the design requirement set forth in RG-348, widening the swale bottom value may not be possible.

To solve for bottom width of the trapezoidal swale (b) using the Excel solver:
Excel can simultaneously solve the "Design Q" (C217) vs "Manning's Q" (C219) by varying the "Swale Width" (C220).
The required "Swale Width" occurs when the "Design Q" = "Manning's Q"

First, highlight Cell F219 (Error 1 value). The equation showing in the fx screen for Cell F219 should be "= C217-C219"
Then click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F219 "Error 1 ="
The value in the "By Changing Cells" should be C220 "Swale Width"
Click on solve.

The resulting "Swale Width" must be less than 10 feet to meet the requirements of the TGM.
If the resulting "Swale Width" exceeds 10 feet then the design parameters must be revised and the solver run again.

If there is not the option for "Solver" under "Tools"
Click on "Tools" and "Add Ins" and then check "Solver Add-in"
Then proceed as instructed above.

If you would like to increase the bottom width of the trapezoidal swale (b):
Excel can simultaneously solve the "Design Q" (C217) vs "Design Discharge" (C232) by varying the "Design Depth" (C233).
The required "Design Depth" for a 10-foot bottom width occurs when the "Design Q" (C217) = the "Design Discharge" (C232).

First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"

Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F232 "Error 2"
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.
First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"
The value in the "Set Target cell" should be F232 "Error 2"
Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.

16. Vegetated Filter Strips Designed as Required in RG-348 Pages 3-55 to 3-57

There are no calculations required for determining the load or size of vegetative filter strips.
The 80% removal is provided when the contributing drainage area does not exceed 72 feet (direction of flow) and the sheet flow leaving the impervious cover is directed across 15 feet of engineered filter strips with maximum slope of 20% or across 50 feet of natural vegetation with a maximum slope of 10%. There can be a break in grade as long as no slope exceeds 20%.

If vegetative filter strips are proposed for an interim permanent BMP, they may be sized as described on Page 3-56 of RG-348.

17. Wet Vaults Designed as Required in RG-348 Pages 3-30 to 3-32 & 3-79

Required Load Removal Based upon Equation 3.3 = **NA** lbs

First calculate the load removal at 1.1 in/hour

RG-348 Page 3-30 Equation 3.4: Q = CiA

C = runoff coefficient for the drainage area = 0.22 **$C = 0.546 (IC)^2 + 0.328 (IC) + 0.03$**
i = design rainfall intensity = 1.1 in/hour
A = drainage area in acres = 1 acres

Q = flow rate in cubic feet per second = 0.25 cubic feet/sec

RG-348 Page 3-31 Equation 3.5: $V_{OR} = Q/A$

Q = Runoff rate calculated above = 0.25 cubic feet/sec
A = Water surface area in the wet vault = 150 square feet

V_{OR} = Overflow Rate = 0.00 feet/sec

Percent TSS Removal from Figure 3-1 (RG-348 Page 3-31) = 53 percent

Load removed by Wet Vault = #VALUE! lbs

If a bypass occurs at a rainfall intensity of less than 1.1 in/hours
Calculate the efficiency reduction for the actual rainfall intensity rate

Actual Rainfall Intensity at which Wet Vault bypass Occurs = 0.5 in/hour

Fraction of rainfall treated from Figure 3-2 RG-348 Page 3-32 = 0.75 percent
Efficiency Reduction for Actual Rainfall Intensity = 0.83 percent

Resultant TSS Load removed by Wet Vault = #VALUE! lbs

18. Permeable Concrete Designed as Required in RG-348 Pages 3-79 to 3-83

PERMEABLE CONCRETE MAY ONLY BE USED ON THE CONTRIBUTING ZONE

19. BMPs Installed in a Series Designed as Required in RG-348 Pages 3-32

Michael E. Barrett, Ph.D., P.E. recommended that the coefficient for E_2 be changed from 0.5 to 0.65 on May 3, 2006

E_{TOT} = [1 - ((1 - E_1) X (1 - 0.65E_2) x (1 - 0.25E_3))] X 100 =	86.38	percent	NET EFFICIENCY OF THE BMPs IN THE SERIES
EFFICIENCY OF FIRST BMP IN THE SERIES = E_1 =	75.00	percent	
EFFICIENCY OF THE SECOND BMP IN THE SERIES = E_2 =	70.00	percent	
EFFICIENCY OF THE THIRD BMP IN THE SERIES = E_3 =	0.00	percent	

THEREFORE, THE NET LOAD REMOVAL WOULD BE:
(A_I AND A_P VALUES ARE FROM SECTION 3 ABOVE)

L_R = E_{TOT} X P X (A_I X 34.6 X A_P X0.54) = 212.65 lbs

20. Stormceptor

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if multiple values provided in Calculated Model Size or if you are choosing a larger model size) =	0	Model Size
Surface Area =	#N/A	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

21. Vortech

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if choosing larger model size) =	Vx1000	Pick Model Size
Surface Area =	7.10	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Pierced Oak RV Park
Date Prepared: 6/13/2023

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: $L_M = 27.2(A_N \times P)$

where:
$L_{M\ TOTAL\ PROJECT}$ = 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 =	Comal	
Total project area included in plan * =	8.99	acres
Predevelopment impervious area within the limits of the plan * =	0.31	acres
Total post-development impervious area within the limits of the plan* =	3.85	acres
Total post-development impervious cover fraction * =	0.43	
P =	33	inches
$L_{M\ TOTAL\ PROJECT}$ =	3177	lbs.

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

Number of drainage basins / outfalls areas leaving the plan area = 6

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

Drainage Basin/Outfall Area No. = LID-PB-2

Total drainage basin/outfall area =	0.36	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	0.16	acres
Post-development impervious fraction within drainage basin/outfall area =	0.44	
$L_{M\ THIS\ BASIN}$ =	144	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Vegetated Filter Strips
Removal efficiency = 85 percent

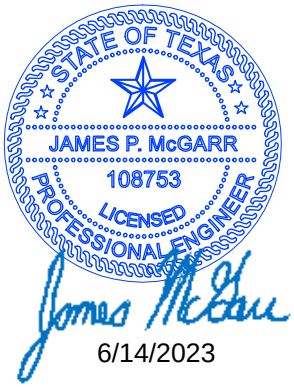
Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

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 =	0.36	acres
A_I =	0.16	acres
A_P =	0.20	acres
L_R =	158	lbs



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

Desired $L_{M\ THIS\ BASIN}$ = 144 lbs.

F = 0.91

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 =	1.80	inches
Post Development Runoff Coefficient =	0.33	
On-site Water Quality Volume =	773	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 =	155	
Total Capture Volume (required water quality volume(s) x 1.20) =	927	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.

7. Retention/Irrigation System Designed as Required in RG-348 Pages 3-42 to 3-46

Required Water Quality Volume for retention basin = NA cubic feet

Irrigation Area Calculations:

Soil infiltration/permeability rate =	0.1	in/hr	Enter determined permeability rate or assumed value of 0.1
Irrigation area =	NA	square feet	
	NA	acres	

8. Extended Detention Basin System Designed as Required in RG-348 Pages 3-46 to 3-51

Required Water Quality Volume for extended detention basin = NA cubic feet

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9A. Full Sedimentation and Filtration System

Water Quality Volume for sedimentation basin =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin = NA cubic feet

11. Wet Basins Designed as Required in RG-348 Pages 3-66 to 3-71

Required capacity of Permanent Pool = **NA** cubic feet **Permanent Pool Capacity is 1.20 times the WQV**
Required capacity at WQV Elevation = **NA** cubic feet **Total Capacity should be the Permanent Pool Capacity plus a second WQV.**

12. Constructed Wetlands Designed as Required in RG-348 Pages 3-71 to 3-73

Required Water Quality Volume for Constructed Wetlands = **NA** cubic feet

13. AquaLogic™ Cartridge System Designed as Required in RG-348 Pages 3-74 to 3-78

**** 2005 Technical Guidance Manual (RG-348) does not exempt the required 20% increase with maintenance contract with AquaLogic™.**

Required Sedimentation chamber capacity = **NA** cubic feet
Filter canisters (FCs) to treat WQV = **NA** cartridges
Filter basin area (RIA_F) = **NA** square feet

14. Stormwater Management StormFilter® by CONTECH

Required Water Quality Volume for Contech StormFilter System = **NA** cubic feet

THE SIZING REQUIREMENTS FOR THE FOLLOWING BMPs / LOAD REMOVALS ARE BASED UPON FLOW RATES - NOT CALCULATED WATER QUALITY VOLUMES

15. Grassy Swales Designed as Required in RG-348 Pages 3-51 to 3-54

Design parameters for the swale:

Drainage Area to be Treated by the Swale = A = 8.00 acres
Impervious Cover in Drainage Area = 4.00 acres
Rainfall intensity = i = 1.1 in/hr
Swale Slope = 0.01 ft/ft
Side Slope (z) = 3
Design Water Depth = y = 0.33 ft
Weighted Runoff Coefficient = C = 0.54

A_{CS} = cross-sectional area of flow in Swale = 13.17 sf
P_W = Wetted Perimeter = 40.62 feet
R_H = hydraulic radius of flow cross-section = A_{CS}/P_W = 0.32 feet
n = Manning's roughness coefficient = 0.2

15A. Using the Method Described in the RG-348

Manning's Equation: $Q = \frac{1.49}{n} A_{CS} R_H^{.2/3} S^{0.5}$

$b = \frac{0.134 \times Q}{y^{1.67} S^{0.5}} - zy$ = 38.51 feet

Q = CiA = 4.71 cfs

To calculate the flow velocity in the swale:

V (Velocity of Flow in the swale) = Q/A_{CS} = 0.36 ft/sec

To calculate the resulting swale length:

L = Minimum Swale Length = V (ft/sec) * 300 (sec) = 107.24 feet

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters must be modified and the solver rerun.

15B. Alternative Method using Excel Solver

Design Q = CiA = 4.71 cfs

Manning's Equation Q = 0.76 cfs Error 1 = 3.95
Swale Width= 6.00 ft

Instructions are provided to the right (green comments).

Flow Velocity 0.36 ft/s
Minimum Length = 107.24 ft

Instructions are provided to the right (blue comments).

Design Width = 6 ft
Design Discharge = 0.76 cfs Error 2 = 3.95
Design Depth = 0.33 ft
Flow Velocity = 0.32 cfs
Minimum Length = 97.48 ft

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters may be modified and the solver rerun.
If any of the resulting values still do not meet the design requirement set forth in RG-348, widening the swale bottom value may not be possible.

To solve for bottom width of the trapezoidal swale (b) using the Excel solver:
Excel can simultaneously solve the "Design Q" (C217) vs "Manning's Q" (C219) by varying the "Swale Width" (C220).
The required "Swale Width" occurs when the "Design Q" = "Manning's Q"

First, highlight Cell F219 (Error 1 value). The equation showing in the fx screen for Cell F219 should be "= C217-C219"
Then click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F219 "Error 1 ="
The value in the "By Changing Cells" should be C220 "Swale Width"
Click on solve.

The resulting "Swale Width" must be less than 10 feet to meet the requirements of the TGM.
If the resulting "Swale Width" exceeds 10 feet then the design parameters must be revised and the solver run again.

If there is not the option for "Solver" under "Tools"
Click on "Tools" and "Add Ins" and then check "Solver Add-in"
Then proceed as instructed above.

If you would like to increase the bottom width of the trapezoidal swale (b):
Excel can simultaneously solve the "Design Q" (C217) vs "Design Discharge" (C232) by varying the "Design Depth" (C233).
The required "Design Depth" for a 10-foot bottom width occurs when the "Design Q" (C217) = the "Design Discharge" (C232).

First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"

Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F232 "Error 2"
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.
First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"
Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F232 "Error 2"
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.

16. Vegetated Filter Strips Designed as Required in RG-348 Pages 3-55 to 3-57

There are no calculations required for determining the load or size of vegetative filter strips.
The 80% removal is provided when the contributing drainage area does not exceed 72 feet (direction of flow) and the sheet flow leaving the impervious cover is directed across 15 feet of engineered filter strips with maximum slope of 20% or across 50 feet of natural vegetation with a maximum slope of 10%. There can be a break in grade as long as no slope exceeds 20%.

If vegetative filter strips are proposed for an interim permanent BMP, they may be sized as described on Page 3-56 of RG-348.

17. Wet Vaults Designed as Required in RG-348 Pages 3-30 to 3-32 & 3-79

Required Load Removal Based upon Equation 3.3 = **NA** lbs

First calculate the load removal at 1.1 in/hour

RG-348 Page 3-30 Equation 3.4: Q = CiA

C = runoff coefficient for the drainage area = 0.28 **$C = 0.546 (IC)^2 + 0.328 (IC) + 0.03$**
i = design rainfall intensity = 1.1 in/hour
A = drainage area in acres = 1 acres

Q = flow rate in cubic feet per second = 0.31 cubic feet/sec

RG-348 Page 3-31 Equation 3.5: $V_{OR} = Q/A$

Q = Runoff rate calculated above = 0.31 cubic feet/sec
A = Water surface area in the wet vault = 150 square feet

V_{OR} = Overflow Rate = 0.00 feet/sec

Percent TSS Removal from Figure 3-1 (RG-348 Page 3-31) = 53 percent

Load removed by Wet Vault = #VALUE! lbs

If a bypass occurs at a rainfall intensity of less than 1.1 in/hours
Calculate the efficiency reduction for the actual rainfall intensity rate

Actual Rainfall Intensity at which Wet Vault bypass Occurs = 0.5 in/hour

Fraction of rainfall treated from Figure 3-2 RG-348 Page 3-32 = 0.75 percent
Efficiency Reduction for Actual Rainfall Intensity = 0.83 percent

Resultant TSS Load removed by Wet Vault = #VALUE! lbs

18. Permeable Concrete Designed as Required in RG-348 Pages 3-79 to 3-83

PERMEABLE CONCRETE MAY ONLY BE USED ON THE CONTRIBUTING ZONE

19. BMPs Installed in a Series Designed as Required in RG-348 Pages 3-32

Michael E. Barrett, Ph.D., P.E. recommended that the coefficient for E_2 be changed from 0.5 to 0.65 on May 3, 2006

E_{TOT} = [1 - ((1 - E_1) X (1 - 0.65E_2) x (1 - 0.25E_3))] X 100 = 86.38 percent NET EFFICIENCY OF THE BMPs IN THE SERIES

EFFICIENCY OF FIRST BMP IN THE SERIES = E_1 = 75.00 percent

EFFICIENCY OF THE SECOND BMP IN THE SERIES = E_2 = 70.00 percent

EFFICIENCY OF THE THIRD BMP IN THE SERIES = E_3 = 0.00 percent

THEREFORE, THE NET LOAD REMOVAL WOULD BE:
(A_I AND A_P VALUES ARE FROM SECTION 3 ABOVE)

L_R = E_{TOT} X P X (A_I X 34.6 X A_P X0.54) = 160.88 lbs

20. Stormceptor

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if multiple values provided in Calculated Model Size or if you are choosing a larger model size) =	0	Model Size
Surface Area =	#N/A	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

21. Vortech

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if choosing larger model size) =	Vx1000	Pick Model Size
Surface Area =	7.10	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Pierced Oak RV Park
Date Prepared: 6/13/2023

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: $L_M = 27.2(A_N \times P)$

where:
$L_{M\ TOTAL\ PROJECT}$ = 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 =	Comal	
Total project area included in plan * =	8.99	acres
Predevelopment impervious area within the limits of the plan * =	0.31	acres
Total post-development impervious area within the limits of the plan* =	3.85	acres
Total post-development impervious cover fraction * =	0.43	
P =	33	inches
$L_{M\ TOTAL\ PROJECT}$ =	3177	lbs.

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

Number of drainage basins / outfalls areas leaving the plan area = 6

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

Drainage Basin/Outfall Area No. = LID-PB-4

Total drainage basin/outfall area =	0.13	acres
Predevelopment impervious area within drainage basin/outfall area =	0.03	acres
Post-development impervious area within drainage basin/outfall area =	0.08	acres
Post-development impervious fraction within drainage basin/outfall area =	0.62	
$L_{M\ THIS\ BASIN}$ =	49	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Vegetated Filter Strips
Removal efficiency = 85 percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

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 =	0.13	acres
A_I =	0.08	acres
A_P =	0.05	acres
L_R =	78	lbs

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

Desired $L_{M\ THIS\ BASIN}$ = 49 lbs.

F = 0.63

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 =	0.64	inches
Post Development Runoff Coefficient =	0.43	
On-site Water Quality Volume =	130	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 =	26	
Total Capture Volume (required water quality volume(s) x 1.20) =	155	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.

7. Retention/Irrigation System Designed as Required in RG-348 Pages 3-42 to 3-46

Required Water Quality Volume for retention basin = NA cubic feet

Irrigation Area Calculations:

Soil infiltration/permeability rate =	0.1	in/hr	Enter determined permeability rate or assumed value of 0.1
Irrigation area =	NA	square feet	
	NA	acres	

8. Extended Detention Basin System Designed as Required in RG-348 Pages 3-46 to 3-51

Required Water Quality Volume for extended detention basin = NA cubic feet

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9A. Full Sedimentation and Filtration System

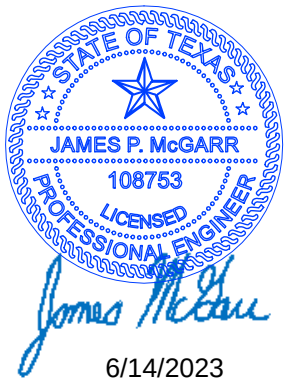
Water Quality Volume for sedimentation basin =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin = NA cubic feet



6/14/2023

11. Wet Basins — Designed as Required in RG-348 — Pages 3-66 to 3-71

Required capacity of Permanent Pool = **NA** cubic feet — **Permanent Pool Capacity is 1.20 times the WQV**
Required capacity at WQV Elevation = **NA** cubic feet — **Total Capacity should be the Permanent Pool Capacity plus a second WQV.**

12. Constructed Wetlands — Designed as Required in RG-348 — Pages 3-71 to 3-73

Required Water Quality Volume for Constructed Wetlands = **NA** cubic feet

13. AquaLogic™ Cartridge System — Designed as Required in RG-348 — Pages 3-74 to 3-78

**** 2005 Technical Guidance Manual (RG-348) does not exempt the required 20% increase with maintenance contract with AquaLogic™.**

Required Sedimentation chamber capacity = **NA** cubic feet
Filter canisters (FCs) to treat WQV = **NA** cartridges
Filter basin area (RIA_F) = **NA** square feet

14. Stormwater Management StormFilter® by CONTECH

Required Water Quality Volume for Contech StormFilter System = **NA** cubic feet

THE SIZING REQUIREMENTS FOR THE FOLLOWING BMPs / LOAD REMOVALS ARE BASED UPON FLOW RATES - NOT CALCULATED WATER QUALITY VOLUMES

15. Grassy Swales — Designed as Required in RG-348 — Pages 3-51 to 3-54

Design parameters for the swale:

Drainage Area to be Treated by the Swale = A = 0.55 acres
Impervious Cover in Drainage Area = 0.20 acres
Rainfall intensity = i = 1.1 in/hr
Swale Slope = 0.025 ft/ft
Side Slope (z) = 5
Design Water Depth = y = 0.33 ft
Weighted Runoff Coefficient = C = 0.48

A_{CS} = cross-sectional area of flow in Swale = 0.52 sf
P_W = Wetted Perimeter = 3.29 feet
R_H = hydraulic radius of flow cross-section = A_{CS}/P_W = 0.16 feet
n = Manning's roughness coefficient = 0.2

15A. Using the Method Described in the RG-348

Manning's Equation: $Q = \frac{1.49}{n} A_{CS} R_H^{.2/3} S^{0.5}$

$b = \frac{0.134 \times Q}{y^{1.67} S^{0.5}} - zy$ = -0.08 feet

Q = CiA = 0.29 cfs

To calculate the flow velocity in the swale:

V (Velocity of Flow in the swale) = Q/A_{CS} = 0.56 ft/sec

To calculate the resulting swale length:

L = Minimum Swale Length = V (ft/sec) * 300 (sec) = 168.42 feet

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters must be modified and the solver rerun.

15B. Alternative Method using Excel Solver

Design Q = CiA = 0.29 cfs

Manning's Equation Q = 1.24 cfs — Error 1 = -0.95
Swale Width= 6.00 ft

Instructions are provided to the right (green comments).

Flow Velocity 0.56 ft/s
Minimum Length = 168.42 ft

Instructions are provided to the right (blue comments).

Design Width = 6 ft
Design Discharge = 1.26 cfs — Error 2 = -0.97
Design Depth = 0.33 ft
Flow Velocity = 0.49 cfs
Minimum Length = 148.40 ft

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters may be modified and the solver rerun.
If any of the resulting values still do not meet the design requirement set forth in RG-348, widening the swale bottom value may not be possible.

To solve for bottom width of the trapezoidal swale (b) using the Excel solver:
Excel can simultaneously solve the "Design Q" (C217) vs "Manning's Q" (C219) by varying the "Swale Width" (C220).
The required "Swale Width" occurs when the "Design Q" = "Manning's Q"

First, highlight Cell F219 (Error 1 value). The equation showing in the fx screen for Cell F219 should be "= C217-C219"
Then click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F219 "Error 1 ="
The value in the "By Changing Cells" should be C220 "Swale Width"
Click on solve.

The resulting "Swale Width" must be less than 10 feet to meet the requirements of the TGM.
If the resulting "Swale Width" exceeds 10 feet then the design parameters must be revised and the solver run again.

If there is not the option for "Solver" under "Tools"
Click on "Tools" and "Add Ins" and then check "Solver Add-in"
Then proceed as instructed above.

If you would like to increase the bottom width of the trapezoidal swale (b):
Excel can simultaneously solve the "Design Q" (C217) vs "Design Discharge" (C232) by varying the "Design Depth" (C233).
The required "Design Depth" for a 10-foot bottom width occurs when the "Design Q" (C217) = the "Design Discharge" (C232).

First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"

Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F232 "Error 2"
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.
First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"
The value in the "Set Target cell" should be F232 "Error 2"
Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.

16. Vegetated Filter Strips — Designed as Required in RG-348 — Pages 3-55 to 3-57

There are no calculations required for determining the load or size of vegetative filter strips.
The 80% removal is provided when the contributing drainage area does not exceed 72 feet (direction of flow) and the sheet flow leaving the impervious cover is directed across 15 feet of engineered filter strips with maximum slope of 20% or across 50 feet of natural vegetation with a maximum slope of 10%. There can be a break in grade as long as no slope exceeds 20%.

If vegetative filter strips are proposed for an interim permanent BMP, they may be sized as described on Page 3-56 of RG-348.

17. Wet Vaults — Designed as Required in RG-348 — Pages 3-30 to 3-32 & 3-79

Required Load Removal Based upon Equation 3.3 = **NA** lbs

First calculate the load removal at 1.1 in/hour

RG-348 Page 3-30 Equation 3.4: Q = CiA

C = runoff coefficient for the drainage area = 0.44 — **C = Runoff Coefficient = 0.546 (IC)^2 + 0.328 (IC) + 0.03**
i = design rainfall intensity = 1.1 in/hour
A = drainage area in acres = 1 acres

Q = flow rate in cubic feet per second = 0.48 cubic feet/sec

RG-348 Page 3-31 Equation 3.5: $V_{OR} = Q/A$

Q = Runoff rate calculated above = 0.48 cubic feet/sec
A = Water surface area in the wet vault = 150 square feet

V_{OR} = Overflow Rate = 0.00 feet/sec

Percent TSS Removal from Figure 3-1 (RG-348 Page 3-31) = 53 percent

Load removed by Wet Vault = #VALUE! lbs

If a bypass occurs at a rainfall intensity of less than 1.1 in/hours
Calculate the efficiency reduction for the actual rainfall intensity rate

Actual Rainfall Intensity at which Wet Vault bypass Occurs = 0.5 in/hour

Fraction of rainfall treated from Figure 3-2 RG-348 Page 3-32 = 0.75 percent
Efficiency Reduction for Actual Rainfall Intensity = 0.83 percent

Resultant TSS Load removed by Wet Vault = #VALUE! lbs

18. Permeable Concrete — Designed as Required in RG-348 — Pages 3-79 to 3-83

PERMEABLE CONCRETE MAY ONLY BE USED ON THE CONTRIBUTING ZONE

19. BMPs Installed in a Series Designed as Required in RG-348 Pages 3-32

Michael E. Barrett, Ph.D., P.E. recommended that the coefficient for E_2 be changed from 0.5 to 0.65 on May 3, 2006

E_{TOT} = [1 - ((1 - E_1) X (1 - 0.65E_2) x (1 - 0.25E_3))] X 100 =	86.38	percent	NET EFFICIENCY OF THE BMPs IN THE SERIES
EFFICIENCY OF FIRST BMP IN THE SERIES = E_1 =	75.00	percent	
EFFICIENCY OF THE SECOND BMP IN THE SERIES = E_2 =	70.00	percent	
EFFICIENCY OF THE THIRD BMP IN THE SERIES = E_3 =	0.00	percent	

THEREFORE, THE NET LOAD REMOVAL WOULD BE:
(A_I AND A_P VALUES ARE FROM SECTION 3 ABOVE)

L_R = E_{TOT} X P X (A_I X 34.6 X A_P X0.54) =	79.67	lbs

20. Stormceptor

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if multiple values provided in Calculated Model Size or if you are choosing a larger model size) =	0	Model Size
Surface Area =	#N/A	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

21. Vortech

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if choosing larger model size) =	Vx1000	Pick Model Size
Surface Area =	7.10	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Pierced Oak RV Park
Date Prepared: 6/13/2023

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: $L_M = 27.2(A_N \times P)$

where:
$L_{M\ TOTAL\ PROJECT}$ = 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 =	Comal	
Total project area included in plan * =	8.99	acres
Predevelopment impervious area within the limits of the plan * =	0.31	acres
Total post-development impervious area within the limits of the plan* =	3.85	acres
Total post-development impervious cover fraction * =	0.43	
P =	33	inches
$L_{M\ TOTAL\ PROJECT}$ =	3177	lbs.

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

Number of drainage basins / outfalls areas leaving the plan area = 6

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

Drainage Basin/Outfall Area No. = LID-PA-2

Total drainage basin/outfall area =	1.95	acres
Predevelopment impervious area within drainage basin/outfall area =	0.21	acres
Post-development impervious area within drainage basin/outfall area =	1.01	acres
Post-development impervious fraction within drainage basin/outfall area =	0.52	
$L_{M\ THIS\ BASIN}$ =	718	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Extended Detention
Removal efficiency = 75 percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

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 =	1.95	acres
A_I =	1.01	acres
A_P =	0.94	acres
L_R =	877	lbs

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

Desired $L_{M\ THIS\ BASIN}$ = 718 lbs.

F = 0.82

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 =	1.16	inches
Post Development Runoff Coefficient =	0.37	
On-site Water Quality Volume =	3018	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 =	604	
Total Capture Volume (required water quality volume(s) x 1.20) =	3622	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.

7. Retention/Irrigation System Designed as Required in RG-348 Pages 3-42 to 3-46

Required Water Quality Volume for retention basin = NA cubic feet

Irrigation Area Calculations:

Soil infiltration/permeability rate =	0.1	in/hr	Enter determined permeability rate or assumed value of 0.1
Irrigation area =	NA	square feet	
	NA	acres	

8. Extended Detention Basin System Designed as Required in RG-348 Pages 3-46 to 3-51

Required Water Quality Volume for extended detention basin = 3622 cubic feet

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9A. Full Sedimentation and Filtration System

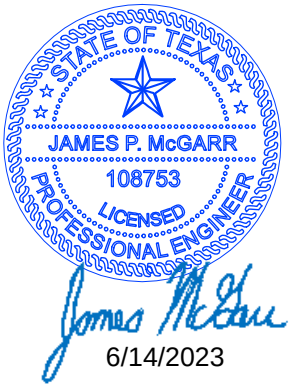
Water Quality Volume for sedimentation basin =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin = NA cubic feet



6/14/2023

11. Wet Basins — Designed as Required in RG-348 — Pages 3-66 to 3-71

Required capacity of Permanent Pool = **NA** cubic feet — **Permanent Pool Capacity is 1.20 times the WQV**
Required capacity at WQV Elevation = **NA** cubic feet — **Total Capacity should be the Permanent Pool Capacity plus a second WQV.**

12. Constructed Wetlands — Designed as Required in RG-348 — Pages 3-71 to 3-73

Required Water Quality Volume for Constructed Wetlands = **NA** cubic feet

13. AquaLogic™ Cartridge System — Designed as Required in RG-348 — Pages 3-74 to 3-78

**** 2005 Technical Guidance Manual (RG-348) does not exempt the required 20% increase with maintenance contract with AquaLogic™.**

Required Sedimentation chamber capacity = **NA** cubic feet
Filter canisters (FCs) to treat WQV = **NA** cartridges
Filter basin area (RIA_F) = **NA** square feet

14. Stormwater Management StormFilter® by CONTECH

Required Water Quality Volume for Contech StormFilter System = **NA** cubic feet

THE SIZING REQUIREMENTS FOR THE FOLLOWING BMPs / LOAD REMOVALS ARE BASED UPON FLOW RATES - NOT CALCULATED WATER QUALITY VOLUMES

15. Grassy Swales — Designed as Required in RG-348 — Pages 3-51 to 3-54

Design parameters for the swale:

Drainage Area to be Treated by the Swale = A = 0.55 acres
Impervious Cover in Drainage Area = 0.20 acres
Rainfall intensity = i = 1.1 in/hr
Swale Slope = 0.025 ft/ft
Side Slope (z) = 5
Design Water Depth = y = 0.33 ft
Weighted Runoff Coefficient = C = 0.48

A_{CS} = cross-sectional area of flow in Swale = 0.52 sf
P_W = Wetted Perimeter = 3.29 feet
R_H = hydraulic radius of flow cross-section = A_{CS}/P_W = 0.16 feet
n = Manning's roughness coefficient = 0.2

15A. Using the Method Described in the RG-348

Manning's Equation: $Q = \frac{1.49}{n} A_{CS} R_H^{.2/3} S^{0.5}$

$b = \frac{0.134 \times Q}{y^{1.67} S^{0.5}} - zy$ = -0.08 feet

Q = CiA = 0.29 cfs

To calculate the flow velocity in the swale:

V (Velocity of Flow in the swale) = Q/A_{CS} = 0.56 ft/sec

To calculate the resulting swale length:

L = Minimum Swale Length = V (ft/sec) * 300 (sec) = 168.42 feet

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters must be modified and the solver rerun.

15B. Alternative Method using Excel Solver

Design Q = CiA = 0.29 cfs

Manning's Equation Q = 1.24 cfs — Error 1 = -0.95
Swale Width= 6.00 ft

Instructions are provided to the right (green comments).

Flow Velocity 0.56 ft/s
Minimum Length = 168.42 ft

Instructions are provided to the right (blue comments).

Design Width = 6 ft
Design Discharge = 1.26 cfs — Error 2 = -0.97
Design Depth = 0.33 ft
Flow Velocity = 0.49 cfs
Minimum Length = 148.40 ft

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters may be modified and the solver rerun.
If any of the resulting values still do not meet the design requirement set forth in RG-348, widening the swale bottom value may not be possible.

To solve for bottom width of the trapezoidal swale (b) using the Excel solver:
Excel can simultaneously solve the "Design Q" (C217) vs "Manning's Q" (C219) by varying the "Swale Width" (C220).
The required "Swale Width" occurs when the "Design Q" = "Manning's Q"

First, highlight Cell F219 (Error 1 value). The equation showing in the fx screen for Cell F219 should be "= C217-C219"
Then click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F219 "Error 1 ="
The value in the "By Changing Cells" should be C220 "Swale Width"
Click on solve.

The resulting "Swale Width" must be less than 10 feet to meet the requirements of the TGM.
If the resulting "Swale Width" exceeds 10 feet then the design parameters must be revised and the solver run again.

If there is not the option for "Solver" under "Tools"
Click on "Tools" and "Add Ins" and then check "Solver Add-in"
Then proceed as instructed above.

If you would like to increase the bottom width of the trapezoidal swale (b):
Excel can simultaneously solve the "Design Q" (C217) vs "Design Discharge" (C232) by varying the "Design Depth" (C233).
The required "Design Depth" for a 10-foot bottom width occurs when the "Design Q" (C217) = the "Design Discharge" (C232).

First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"

Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F232 "Error 2"
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.
First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"
The value in the "Set Target cell" should be F232 "Error 2"
Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.

16. Vegetated Filter Strips — Designed as Required in RG-348 — Pages 3-55 to 3-57

There are no calculations required for determining the load or size of vegetative filter strips.
The 80% removal is provided when the contributing drainage area does not exceed 72 feet (direction of flow) and the sheet flow leaving the impervious cover is directed across 15 feet of engineered filter strips with maximum slope of 20% or across 50 feet of natural vegetation with a maximum slope of 10%. There can be a break in grade as long as no slope exceeds 20%.

If vegetative filter strips are proposed for an interim permanent BMP, they may be sized as described on Page 3-56 of RG-348.

17. Wet Vaults — Designed as Required in RG-348 — Pages 3-30 to 3-32 & 3-79

Required Load Removal Based upon Equation 3.3 = **NA** lbs

First calculate the load removal at 1.1 in/hour

RG-348 Page 3-30 Equation 3.4: Q = CiA

C = runoff coefficient for the drainage area = 0.35 — **C = Runoff Coefficient = 0.546 (IC)^2 + 0.328 (IC) + 0.03**
i = design rainfall intensity = 1.1 in/hour
A = drainage area in acres = 1 acres

Q = flow rate in cubic feet per second = 0.38 cubic feet/sec

RG-348 Page 3-31 Equation 3.5: $V_{OR} = Q/A$

Q = Runoff rate calculated above = 0.38 cubic feet/sec
A = Water surface area in the wet vault = 150 square feet

V_{OR} = Overflow Rate = 0.00 feet/sec

Percent TSS Removal from Figure 3-1 (RG-348 Page 3-31) = 53 percent

Load removed by Wet Vault = #VALUE! lbs

If a bypass occurs at a rainfall intensity of less than 1.1 in/hours
Calculate the efficiency reduction for the actual rainfall intensity rate

Actual Rainfall Intensity at which Wet Vault bypass Occurs = 0.5 in/hour

Fraction of rainfall treated from Figure 3-2 RG-348 Page 3-32 = 0.75 percent
Efficiency Reduction for Actual Rainfall Intensity = 0.83 percent

Resultant TSS Load removed by Wet Vault = #VALUE! lbs

18. Permeable Concrete — Designed as Required in RG-348 — Pages 3-79 to 3-83

PERMEABLE CONCRETE MAY ONLY BE USED ON THE CONTRIBUTING ZONE

19. BMPs Installed in a Series Designed as Required in RG-348 Pages 3-32

Michael E. Barrett, Ph.D., P.E. recommended that the coefficient for E_2 be changed from 0.5 to 0.65 on May 3, 2006

$E_{TOT} = [1 - ((1 - E_1) X (1 - 0.65E_2) x (1 - 0.25E_3))] X 100 =$ 86.38 percent NET EFFICIENCY OF THE BMPs IN THE SERIES

EFFICIENCY OF FIRST BMP IN THE SERIES = $E_1 =$ 75.00 percent

EFFICIENCY OF THE SECOND BMP IN THE SERIES = $E_2 =$ 70.00 percent

EFFICIENCY OF THE THIRD BMP IN THE SERIES = $E_3 =$ 0.00 percent

THEREFORE, THE NET LOAD REMOVAL WOULD BE:
(A_I AND A_P VALUES ARE FROM SECTION 3 ABOVE)

$L_R = E_{TOT} X P X (A_I X 34.6 X A_P X 0.54) =$ 1010.56 lbs

20. Stormceptor

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if multiple values provided in Calculated Model Size or if you are choosing a larger model size) =	0	Model Size
Surface Area =	#N/A	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

21. Vortech

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if choosing larger model size) =	Vx1000	Pick Model Size
Surface Area =	7.10	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Pierced Oak RV Park
Date Prepared: 6/13/2023

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: $L_M = 27.2(A_N \times P)$

where:
$L_{M\ TOTAL\ PROJECT}$ = 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 =	Comal	
Total project area included in plan * =	8.99	acres
Predevelopment impervious area within the limits of the plan * =	0.31	acres
Total post-development impervious area within the limits of the plan* =	4.23	acres
Total post-development impervious cover fraction * =	0.47	
P =	33	inches
$L_{M\ TOTAL\ PROJECT}$ =	3513	lbs.

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

Number of drainage basins / outfalls areas leaving the plan area = 6

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

Drainage Basin/Outfall Area No. = LID-PB-4

Total drainage basin/outfall area =	2.50	acres
Predevelopment impervious area within drainage basin/outfall area =	0.01	acres
Post-development impervious area within drainage basin/outfall area =	1.46	acres
Post-development impervious fraction within drainage basin/outfall area =	0.58	
$L_{M\ THIS\ BASIN}$ =	1297	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Batch Detention
Removal efficiency = 91 percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

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 =	2.50	acres
A_I =	1.46	acres
A_P =	1.04	acres
L_R =	1534	lbs

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

Desired $L_{M\ THIS\ BASIN}$ = 1297 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 =	0.41	
On-site Water Quality Volume =	4900	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 =	980	
Total Capture Volume (required water quality volume(s) x 1.20) =	5880	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.

7. Retention/Irrigation System Designed as Required in RG-348 Pages 3-42 to 3-46

Required Water Quality Volume for retention basin = NA cubic feet

Irrigation Area Calculations:

Soil infiltration/permeability rate =	0.1	in/hr	Enter determined permeability rate or assumed value of 0.1
Irrigation area =	NA	square feet	
	NA	acres	

8. Extended Detention Basin System Designed as Required in RG-348 Pages 3-46 to 3-51

Required Water Quality Volume for extended detention basin = NA cubic feet

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9A. Full Sedimentation and Filtration System

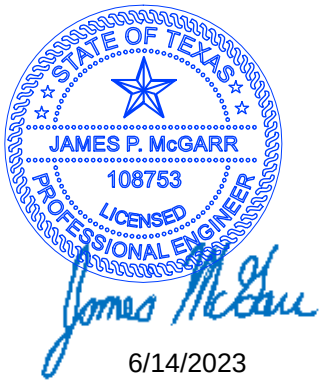
Water Quality Volume for sedimentation basin =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin = NA cubic feet



6/14/2023

11. Wet Basins Designed as Required in RG-348 Pages 3-66 to 3-71

Required capacity of Permanent Pool = **NA** cubic feet **Permanent Pool Capacity is 1.20 times the WQV**
Required capacity at WQV Elevation = **NA** cubic feet **Total Capacity should be the Permanent Pool Capacity plus a second WQV.**

12. Constructed Wetlands Designed as Required in RG-348 Pages 3-71 to 3-73

Required Water Quality Volume for Constructed Wetlands = **NA** cubic feet

13. AquaLogic™ Cartridge System Designed as Required in RG-348 Pages 3-74 to 3-78

**** 2005 Technical Guidance Manual (RG-348) does not exempt the required 20% increase with maintenance contract with AquaLogic™.**

Required Sedimentation chamber capacity = **NA** cubic feet
Filter canisters (FCs) to treat WQV = **NA** cartridges
Filter basin area (RIA_F) = **NA** square feet

14. Stormwater Management StormFilter® by CONTECH

Required Water Quality Volume for Contech StormFilter System = **NA** cubic feet

THE SIZING REQUIREMENTS FOR THE FOLLOWING BMPs / LOAD REMOVALS ARE BASED UPON FLOW RATES - NOT CALCULATED WATER QUALITY VOLUMES

15. Grassy Swales Designed as Required in RG-348 Pages 3-51 to 3-54

Design parameters for the swale:

Drainage Area to be Treated by the Swale = A = 0.55 acres
Impervious Cover in Drainage Area = 0.20 acres
Rainfall intensity = i = 1.1 in/hr
Swale Slope = 0.025 ft/ft
Side Slope (z) = 5
Design Water Depth = y = 0.33 ft
Weighted Runoff Coefficient = C = 0.48

A_{CS} = cross-sectional area of flow in Swale = 0.52 sf
P_W = Wetted Perimeter = 3.29 feet
R_H = hydraulic radius of flow cross-section = A_{CS}/P_W = 0.16 feet
n = Manning's roughness coefficient = 0.2

15A. Using the Method Described in the RG-348

Manning's Equation: $Q = \frac{1.49}{n} A_{CS} R_H^{.2/3} S^{0.5}$

$b = \frac{0.134 \times Q}{y^{1.67} S^{0.5}} - zy$ = -0.08 feet

Q = CiA = 0.29 cfs

To calculate the flow velocity in the swale:

V (Velocity of Flow in the swale) = Q/A_{CS} = 0.56 ft/sec

To calculate the resulting swale length:

L = Minimum Swale Length = V (ft/sec) * 300 (sec) = 168.42 feet

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters must be modified and the solver rerun.

15B. Alternative Method using Excel Solver

Design Q = CiA = 0.29 cfs

Manning's Equation Q = 1.24 cfs Error 1 = -0.95
Swale Width= 6.00 ft

Instructions are provided to the right (green comments).

Flow Velocity 0.56 ft/s
Minimum Length = 168.42 ft

Instructions are provided to the right (blue comments).

Design Width = 6 ft
Design Discharge = 1.26 cfs Error 2 = -0.97
Design Depth = 0.33 ft
Flow Velocity = 0.49 cfs
Minimum Length = 148.40 ft

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters may be modified and the solver rerun.
If any of the resulting values still do not meet the design requirement set forth in RG-348, widening the swale bottom value may not be possible.

16. Vegetated Filter Strips Designed as Required in RG-348 Pages 3-55 to 3-57

There are no calculations required for determining the load or size of vegetative filter strips.
The 80% removal is provided when the contributing drainage area does not exceed 72 feet (direction of flow) and the sheet flow leaving the impervious cover is directed across 15 feet of engineered filter strips with maximum slope of 20% or across 50 feet of natural vegetation with a maximum slope of 10%. There can be a break in grade as long as no slope exceeds 20%.

If vegetative filter strips are proposed for an interim permanent BMP, they may be sized as described on Page 3-56 of RG-348.

17. Wet Vaults Designed as Required in RG-348 Pages 3-30 to 3-32 & 3-79

Required Load Removal Based upon Equation 3.3 = **NA** lbs

First calculate the load removal at 1.1 in/hour

RG-348 Page 3-30 Equation 3.4: Q = CiA

C = runoff coefficient for the drainage area = 0.41 **C = Runoff Coefficient = 0.546 (IC)^2 + 0.328 (IC) + 0.03**
i = design rainfall intensity = 1.1 in/hour
A = drainage area in acres = 1 acres

Q = flow rate in cubic feet per second = 0.45 cubic feet/sec

RG-348 Page 3-31 Equation 3.5: $V_{OR} = Q/A$

Q = Runoff rate calculated above = 0.45 cubic feet/sec
A = Water surface area in the wet vault = 150 square feet

V_{OR} = Overflow Rate = 0.00 feet/sec

Percent TSS Removal from Figure 3-1 (RG-348 Page 3-31) = 53 percent

Load removed by Wet Vault = #VALUE! lbs

If a bypass occurs at a rainfall intensity of less than 1.1 in/hours
Calculate the efficiency reduction for the actual rainfall intensity rate

Actual Rainfall Intensity at which Wet Vault bypass Occurs = 0.5 in/hour

Fraction of rainfall treated from Figure 3-2 RG-348 Page 3-32 = 0.75 percent
Efficiency Reduction for Actual Rainfall Intensity = 0.83 percent

Resultant TSS Load removed by Wet Vault = #VALUE! lbs

18. Permeable Concrete Designed as Required in RG-348 Pages 3-79 to 3-83

PERMEABLE CONCRETE MAY ONLY BE USED ON THE CONTRIBUTING ZONE

To solve for bottom width of the trapezoidal swale (b) using the Excel solver:
Excel can simultaneously solve the "Design Q" (C217) vs "Manning's Q" (C219) by varying the "Swale Width" (C220).
The required "Swale Width" occurs when the "Design Q" = "Manning's Q"

First, highlight Cell F219 (Error 1 value). The equation showing in the fx screen for Cell F219 should be "= C217-C219"
Then click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F219 "Error 1 ="
The value in the "By Changing Cells" should be C220 "Swale Width"
Click on solve.

The resulting "Swale Width" must be less than 10 feet to meet the requirements of the TGM.
If the resulting "Swale Width" exceeds 10 feet then the design parameters must be revised and the solver run again.

If there is not the option for "Solver" under "Tools"
Click on "Tools" and "Add Ins" and then check "Solver Add-in"
Then proceed as instructed above.

If you would like to increase the bottom width of the trapezoidal swale (b):
Excel can simultaneously solve the "Design Q" (C217) vs "Design Discharge" (C232) by varying the "Design Depth" (C233).
The required "Design Depth" for a 10-foot bottom width occurs when the "Design Q" (C217) = the "Design Discharge" (C232).

First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"

Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F232 "Error 2"
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.
First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"
The value in the "Set Target cell" should be F232 "Error 2"
Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.

19. BMPs Installed in a Series Designed as Required in RG-348 Pages 3-32

Michael E. Barrett, Ph.D., P.E. recommended that the coefficient for E_2 be changed from 0.5 to 0.65 on May 3, 2006

E_{TOT} = [1 - ((1 - E_1) X (1 - 0.65E_2) x (1 - 0.25E_3))] X 100 = 86.38 percent NET EFFICIENCY OF THE BMPs IN THE SERIES

EFFICIENCY OF FIRST BMP IN THE SERIES = E_1 = 75.00 percent

EFFICIENCY OF THE SECOND BMP IN THE SERIES = E_2 = 70.00 percent

EFFICIENCY OF THE THIRD BMP IN THE SERIES = E_3 = 0.00 percent

THEREFORE, THE NET LOAD REMOVAL WOULD BE:
(A_I AND A_P VALUES ARE FROM SECTION 3 ABOVE)

L_R = E_{TOT} X P X (A_I X 34.6 X A_P X0.54) = 1455.90 lbs

20. Stormceptor

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if multiple values provided in Calculated Model Size or if you are choosing a larger model size) =	0	Model Size
Surface Area =	#N/A	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

21. Vortech

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if choosing larger model size) =	Vx1000	Pick Model Size
Surface Area =	7.10	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Pierced Oak RV Park
Date Prepared: 6/13/2023

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: $L_M = 27.2(A_N \times P)$

where:
$L_{M\ TOTAL\ PROJECT}$ = 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 =	Comal	
Total project area included in plan * =	8.99	acres
Predevelopment impervious area within the limits of the plan * =	0.31	acres
Total post-development impervious area within the limits of the plan* =	3.85	acres
Total post-development impervious cover fraction * =	0.43	
P =	33	inches
$L_{M\ TOTAL\ PROJECT}$ =	3177	lbs.

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

Number of drainage basins / outfalls areas leaving the plan area = 6

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

Drainage Basin/Outfall Area No. = LID-PA-3

Total drainage basin/outfall area =	1.49	acres
Predevelopment impervious area within drainage basin/outfall area =	0.01	acres
Post-development impervious area within drainage basin/outfall area =	0.93	acres
Post-development impervious fraction within drainage basin/outfall area =	0.62	
$L_{M\ THIS\ BASIN}$ =	830	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Batch Detention
Removal efficiency = 91 percent

Aqualogic Cartridge Filter
Bioretention
Contech StormFilter
Constructed Wetland
Extended Detention
Grassy Swale
Retention / Irrigation
Sand Filter
Stormceptor
Vegetated Filter Strips
Vortechs
Wet Basin
Wet Vault

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 =	1.49	acres
A_I =	0.93	acres
A_P =	0.56	acres
L_R =	975	lbs

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

Desired $L_{M\ THIS\ BASIN}$ = 830 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 =	0.44	
On-site Water Quality Volume =	3131	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 =	626	
Total Capture Volume (required water quality volume(s) x 1.20) =	3757	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.

7. Retention/Irrigation System Designed as Required in RG-348 Pages 3-42 to 3-46

Required Water Quality Volume for retention basin = NA cubic feet

Irrigation Area Calculations:

Soil infiltration/permeability rate =	0.1	in/hr	Enter determined permeability rate or assumed value of 0.1
Irrigation area =	NA	square feet	
	NA	acres	

8. Extended Detention Basin System Designed as Required in RG-348 Pages 3-46 to 3-51

Required Water Quality Volume for extended detention basin = NA cubic feet

9. Filter area for Sand Filters Designed as Required in RG-348 Pages 3-58 to 3-63

9A. Full Sedimentation and Filtration System

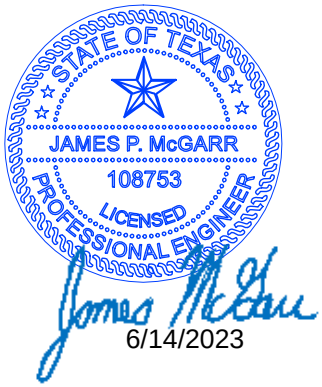
Water Quality Volume for sedimentation basin =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

9B. Partial Sedimentation and Filtration System

Water Quality Volume for combined basins =	NA	cubic feet	
Minimum filter basin area =	NA	square feet	
Maximum sedimentation basin area =	NA	square feet	For minimum water depth of 2 feet
Minimum sedimentation basin area =	NA	square feet	For maximum water depth of 8 feet

10. Bioretention System Designed as Required in RG-348 Pages 3-63 to 3-65

Required Water Quality Volume for Bioretention Basin = NA cubic feet



11. Wet Basins — Designed as Required in RG-348 — Pages 3-66 to 3-71

Required capacity of Permanent Pool = **NA** cubic feet — **Permanent Pool Capacity is 1.20 times the WQV**
Required capacity at WQV Elevation = **NA** cubic feet — **Total Capacity should be the Permanent Pool Capacity plus a second WQV.**

12. Constructed Wetlands — Designed as Required in RG-348 — Pages 3-71 to 3-73

Required Water Quality Volume for Constructed Wetlands = **NA** cubic feet

13. AquaLogic™ Cartridge System — Designed as Required in RG-348 — Pages 3-74 to 3-78

**** 2005 Technical Guidance Manual (RG-348) does not exempt the required 20% increase with maintenance contract with AquaLogic™.**

Required Sedimentation chamber capacity = **NA** cubic feet
Filter canisters (FCs) to treat WQV = **NA** cartridges
Filter basin area (RIA_F) = **NA** square feet

14. Stormwater Management StormFilter® by CONTECH

Required Water Quality Volume for Contech StormFilter System = **NA** cubic feet

THE SIZING REQUIREMENTS FOR THE FOLLOWING BMPs / LOAD REMOVALS ARE BASED UPON FLOW RATES - NOT CALCULATED WATER QUALITY VOLUMES

15. Grassy Swales — Designed as Required in RG-348 — Pages 3-51 to 3-54

Design parameters for the swale:

Drainage Area to be Treated by the Swale = A = 0.55 acres
Impervious Cover in Drainage Area = 0.20 acres
Rainfall intensity = i = 1.1 in/hr
Swale Slope = 0.025 ft/ft
Side Slope (z) = 5
Design Water Depth = y = 0.33 ft
Weighted Runoff Coefficient = C = 0.48

A_{CS} = cross-sectional area of flow in Swale = 0.52 sf
P_W = Wetted Perimeter = 3.29 feet
R_H = hydraulic radius of flow cross-section = A_{CS}/P_W = 0.16 feet
n = Manning's roughness coefficient = 0.2

15A. Using the Method Described in the RG-348

Manning's Equation: $Q = \frac{1.49}{n} A_{CS} R_H^{.2/3} S^{0.5}$

$b = \frac{0.134 \times Q}{y^{1.67} S^{0.5}} - zy$ = -0.08 feet

Q = CiA = 0.29 cfs

To calculate the flow velocity in the swale:

V (Velocity of Flow in the swale) = Q/A_{CS} = 0.56 ft/sec

To calculate the resulting swale length:

L = Minimum Swale Length = V (ft/sec) * 300 (sec) = 168.42 feet

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters must be modified and the solver rerun.

15B. Alternative Method using Excel Solver

Design Q = CiA = 0.29 cfs

Manning's Equation Q = 1.24 cfs — Error 1 = -0.95
Swale Width= 6.00 ft

Instructions are provided to the right (green comments).

Flow Velocity 0.56 ft/s
Minimum Length = 168.42 ft

Instructions are provided to the right (blue comments).

Design Width = 6 ft
Design Discharge = 1.26 cfs — Error 2 = -0.97
Design Depth = 0.33 ft
Flow Velocity = 0.49 cfs
Minimum Length = 148.40 ft

If any of the resulting values do not meet the design requirement set forth in RG-348, the design parameters may be modified and the solver rerun.
If any of the resulting values still do not meet the design requirement set forth in RG-348, widening the swale bottom value may not be possible.

To solve for bottom width of the trapezoidal swale (b) using the Excel solver:
Excel can simultaneously solve the "Design Q" (C217) vs "Manning's Q" (C219) by varying the "Swale Width" (C220).
The required "Swale Width" occurs when the "Design Q" = "Manning's Q"

First, highlight Cell F219 (Error 1 value). The equation showing in the fx screen for Cell F219 should be "= C217-C219"
Then click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F219 "Error 1 ="
The value in the "By Changing Cells" should be C220 "Swale Width"
Click on solve.

The resulting "Swale Width" must be less than 10 feet to meet the requirements of the TGM.
If the resulting "Swale Width" exceeds 10 feet then the design parameters must be revised and the solver run again.

If there is not the option for "Solver" under "Tools"
Click on "Tools" and "Add Ins" and then check "Solver Add-in"
Then proceed as instructed above.

If you would like to increase the bottom width of the trapezoidal swale (b):
Excel can simultaneously solve the "Design Q" (C217) vs "Design Discharge" (C232) by varying the "Design Depth" (C233).
The required "Design Depth" for a 10-foot bottom width occurs when the "Design Q" (C217) = the "Design Discharge" (C232).

First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"

Click on "Tools" and "Solver". The "Solver Parameters" screen pops up.
The value in the "Set Target cell" should be F232 "Error 2"
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.
First set the desired bottom width in Cell C231.
Highlight Cell F232. The equation showing in the fx screen for Cell F232 should be "= C217-C232"
The value in the "Set Target cell" should be F232 "Error 2"
The value in the "By Changing Cells" should be C233 "Design Depth"
Click on solve.

The resulting "Design Depth" must be equal to or less than 0.33 feet to meet the requirements of the TGM.
If the resulting "Design Depth" exceeds 0.33 feet then the design parameters must be revised and the solver run again.

16. Vegetated Filter Strips — Designed as Required in RG-348 — Pages 3-55 to 3-57

There are no calculations required for determining the load or size of vegetative filter strips.
The 80% removal is provided when the contributing drainage area does not exceed 72 feet (direction of flow) and the sheet flow leaving the impervious cover is directed across 15 feet of engineered filter strips with maximum slope of 20% or across 50 feet of natural vegetation with a maximum slope of 10%. There can be a break in grade as long as no slope exceeds 20%.

If vegetative filter strips are proposed for an interim permanent BMP, they may be sized as described on Page 3-56 of RG-348.

17. Wet Vaults — Designed as Required in RG-348 — Pages 3-30 to 3-32 & 3-79

Required Load Removal Based upon Equation 3.3 = **NA** lbs

First calculate the load removal at 1.1 in/hour

RG-348 Page 3-30 Equation 3.4: Q = CiA

C = runoff coefficient for the drainage area = 0.45 — **C = Runoff Coefficient = 0.546 (IC)^2 + 0.328 (IC) + 0.03**
i = design rainfall intensity = 1.1 in/hour
A = drainage area in acres = 1 acres

Q = flow rate in cubic feet per second = 0.49 cubic feet/sec

RG-348 Page 3-31 Equation 3.5: $V_{OR} = Q/A$

Q = Runoff rate calculated above = 0.49 cubic feet/sec
A = Water surface area in the wet vault = 150 square feet

V_{OR} = Overflow Rate = 0.00 feet/sec

Percent TSS Removal from Figure 3-1 (RG-348 Page 3-31) = 53 percent

Load removed by Wet Vault = #VALUE! lbs

If a bypass occurs at a rainfall intensity of less than 1.1 in/hours
Calculate the efficiency reduction for the actual rainfall intensity rate

Actual Rainfall Intensity at which Wet Vault bypass Occurs = 0.5 in/hour

Fraction of rainfall treated from Figure 3-2 RG-348 Page 3-32 = 0.75 percent
Efficiency Reduction for Actual Rainfall Intensity = 0.83 percent

Resultant TSS Load removed by Wet Vault = #VALUE! lbs

18. Permeable Concrete — Designed as Required in RG-348 — Pages 3-79 to 3-83

PERMEABLE CONCRETE MAY ONLY BE USED ON THE CONTRIBUTING ZONE

19. BMPs Installed in a Series Designed as Required in RG-348 Pages 3-32

Michael E. Barrett, Ph.D., P.E. recommended that the coefficient for E_2 be changed from 0.5 to 0.65 on May 3, 2006

E_{TOT} = [1 - ((1 - E_1) X (1 - 0.65E_2) x (1 - 0.25E_3))] X 100 =	86.38	percent	NET EFFICIENCY OF THE BMPs IN THE SERIES
EFFICIENCY OF FIRST BMP IN THE SERIES = E_1 =	75.00	percent	
EFFICIENCY OF THE SECOND BMP IN THE SERIES = E_2 =	70.00	percent	
EFFICIENCY OF THE THIRD BMP IN THE SERIES = E_3 =	0.00	percent	

THEREFORE, THE NET LOAD REMOVAL WOULD BE:
(A_I AND A_P VALUES ARE FROM SECTION 3 ABOVE)

L_R = E_{TOT} X P X (A_I X 34.6 X A_P X0.54) =	925.81	lbs

20. Stormceptor

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if multiple values provided in Calculated Model Size or if you are choosing a larger model size) =	0	Model Size
Surface Area =	#N/A	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

21. Vortech

Required TSS Removal in BMP Drainage Area=	**NA**	lbs
Impervious Cover Overtreatment=	0.0000	ac
TSS Removal for Uncaptured Area =	0.00	lbs

BMP Sizing

Effective Area =	NA	EA
Calculated Model Size(s) =	#N/A	
Actual Model Size (if choosing larger model size) =	Vx1000	Pick Model Size
Surface Area =	7.10	ft^2
Overflow Rate =	#VALUE!	V_o
Rounded Overflow Rate =	#VALUE!	V_o
BMP Efficiency % =	#VALUE!	%
L_R Value =	#VALUE!	lbs
TSS Load Credit =	#VALUE!	lbs
Is Sufficient Treatment Available? (TSS Credit > TSS Uncapt.)	#VALUE!	
TSS Treatment by BMP (LM + TSS Uncapt.) =	#VALUE!	

ATTACHMENT L

BMP's for Surface Stream

Not Applicable

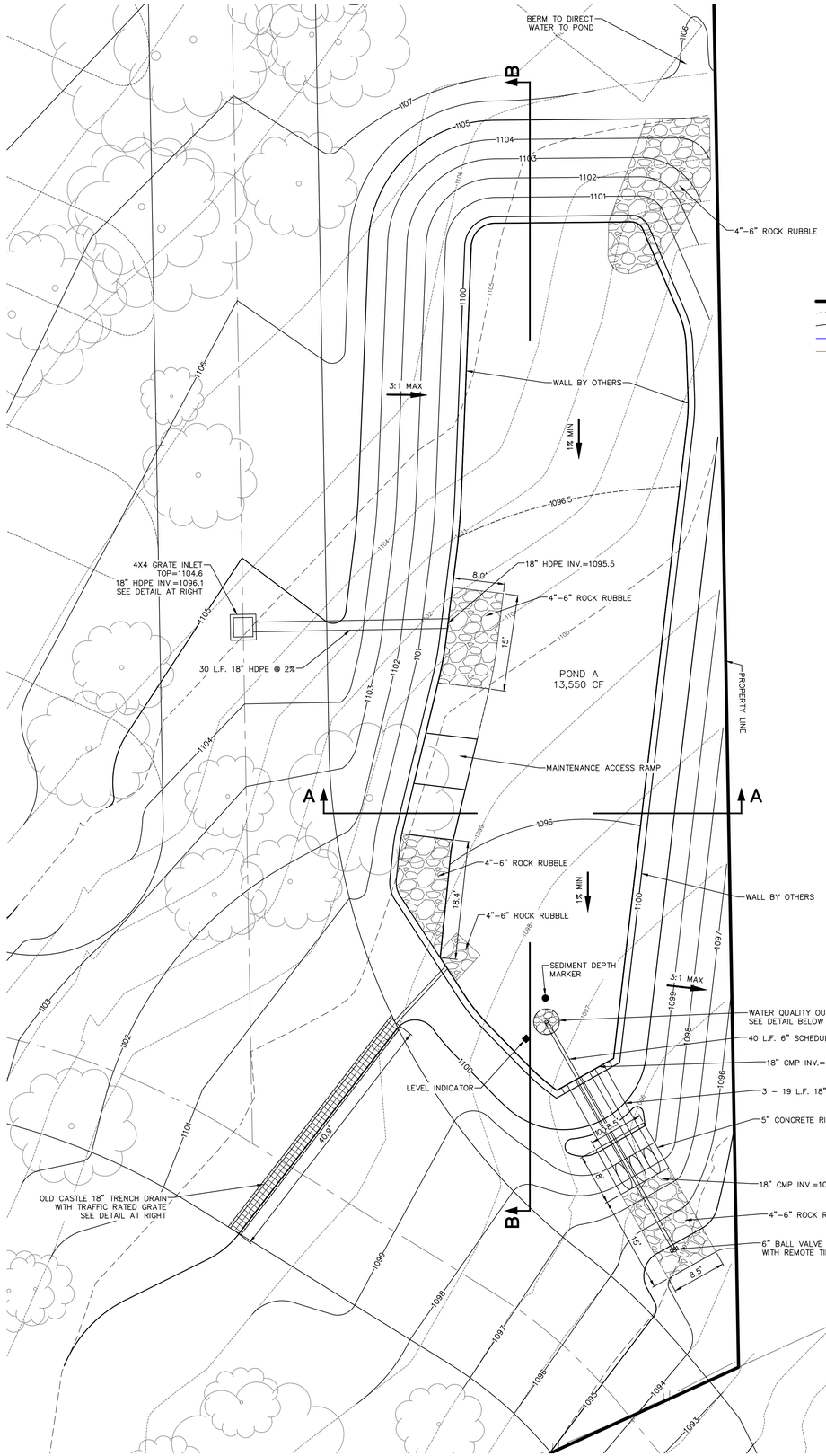
ATTACHMENT M

Construction Plans

Attachment M – Construction Plans

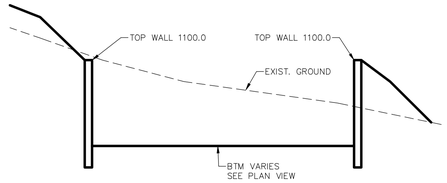
Construction Plans and TSS design calculations for proposed permanent BMPs are included in this section as follows:

- LID Construction Plans

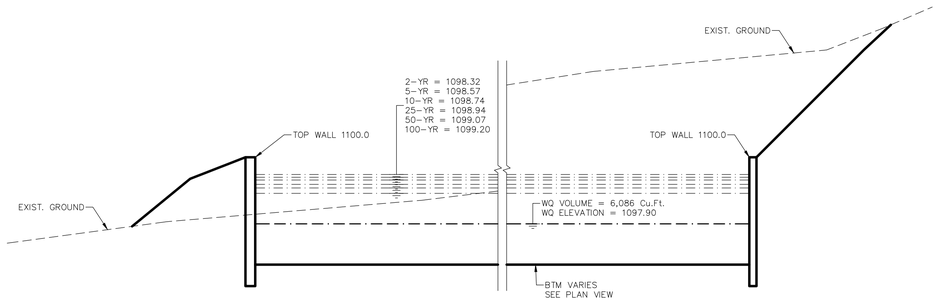


SCALE: 1"=10'
10 5 0 10

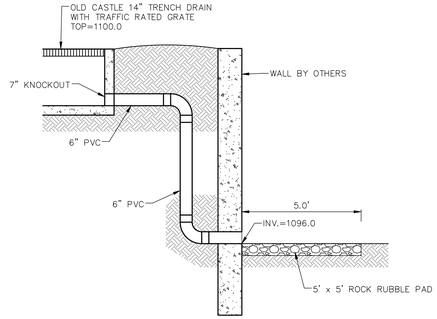
LEGEND:
- PROPERTY BOUNDARY
- 723 EXISTING 1' CONTOURS
- 723 PROPOSED CONTOURS
- 100-YR WATER SURFACE
- 25-YR WATER SURFACE



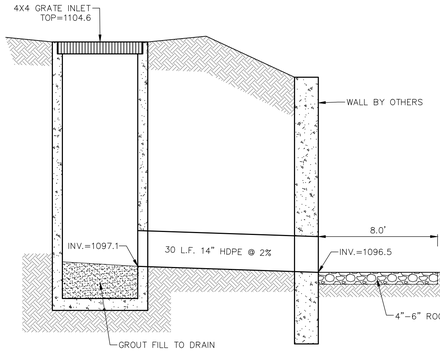
SECTION A-A
SCALE N.T.S.



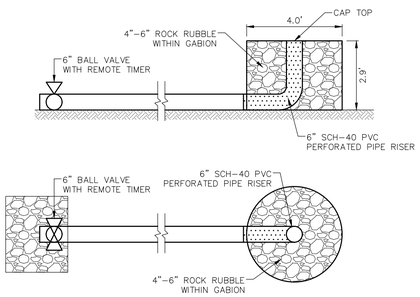
SECTION B-B
SCALE N.T.S.



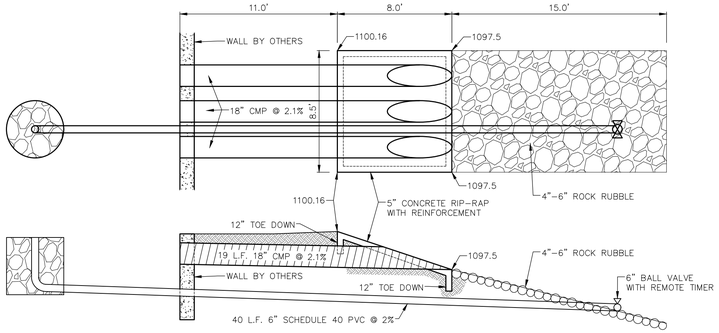
TRENCH DRAIN OUTLET DETAIL
SCALE N.T.S.



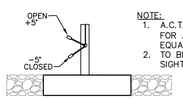
GRATE INLET DRAIN DETAIL
SCALE N.T.S.



WATER QUALITY OUTFALL DETAIL
SCALE N.T.S.

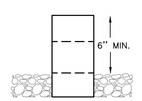


POND A OUTFALL DETAIL
SCALE N.T.S.



A.C.T. SWITCH
LEVEL INDICATOR

NOTE:
1. A.C.T. TILT SWITCH 70 SERIES WITH 10° DIFFERENTIALS SET FOR A DEPTH OF 2"-3" BETWEEN CYCLES, OR APPROVED EQUALS.
2. TO BE PLACED NEAR DRAIN AND PROTECTED FROM PLAIN SIGHT.



SEDIMENT DEPTH MARKER

SEDIMENT DEPTH MARKER:
TO BE PLACED IN THE BOTTOM OF THE POND AND EXTEND ABOVE POND FLOOR AT LEAST 6". IF MARKER IS GREATER THEN 6", INDEX MARKS SHALL BE PLACED AT 6" INTERVALS. DEPTH MARKERS CAN BE SIMILAR MATERIAL AS POND LINING TO BLEND IN. INDICATORS MUST BE VISIBLE FROM OUTSIDE POND.

AXIS CIVIL CAD SERVICES

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/13/2023

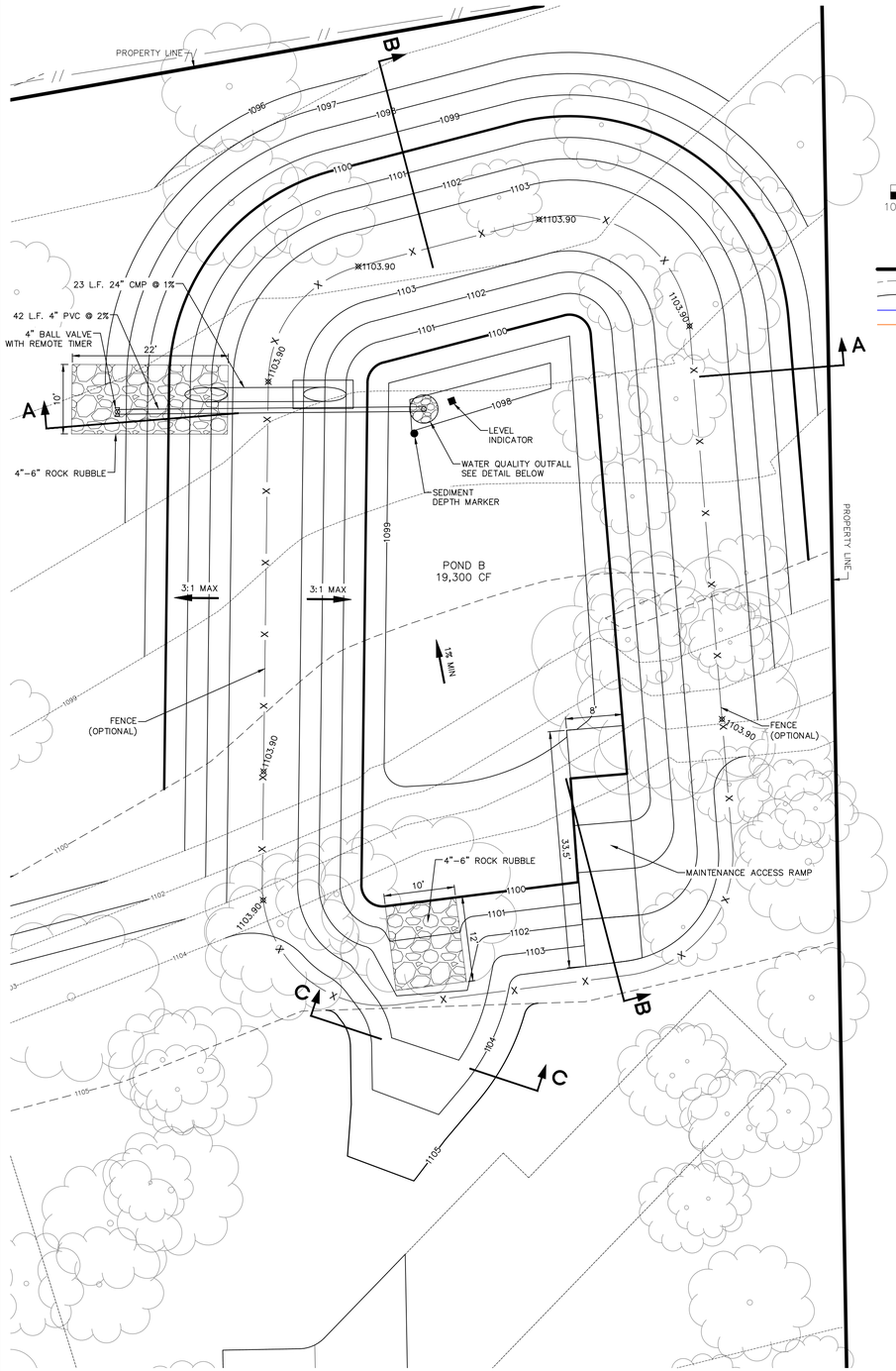
DATE

REVISIONS:

PIERCED OAK RV PARK
23000 FM 306
CANYON LAKE, TEXAS
POND A DETAILS

SHEET NO.
C2.4

O:\Users\Jason\Desktop\CAD_CIVIL TECH\CAD\23-100 PIERCED OAK RV PARK\23-100 CAD\23-100 BASE E.dwg

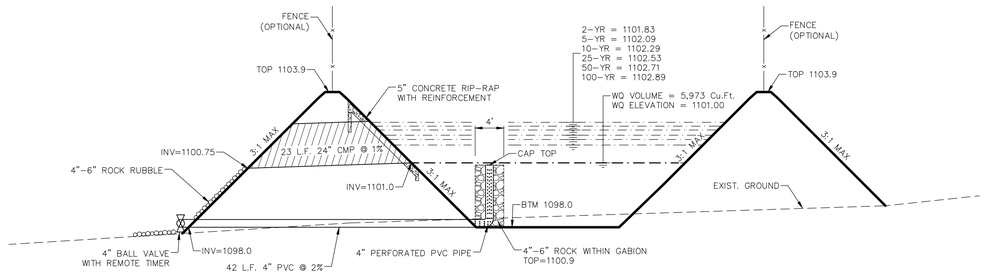


SCALE: 1"=10'

10 5 0 10

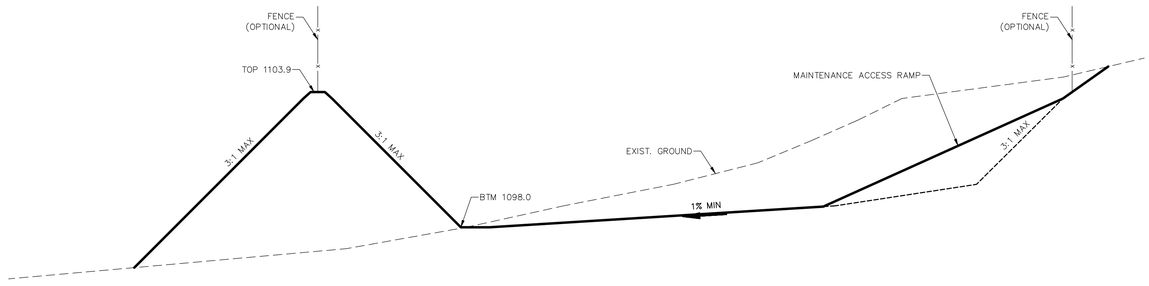
LEGEND:

- PROPERTY BOUNDARY
- EXISTING 1' CONTOURS
- PROPOSED CONTOURS
- 100-YR WATER SURFACE
- 25-YR WATER SURFACE



SECTION A-A

SCALE N.T.S.

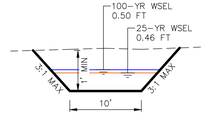


SECTION B-B

SCALE N.T.S.

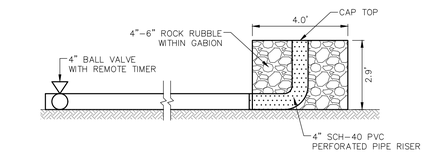
NOTES:

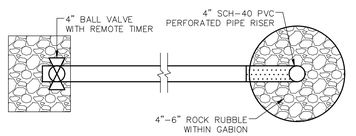
1. CONTRACTOR TO ADJUST VALVE TO DRAIN POND WATER QUALITY VOLUME WITHIN 12 TO 48 HOURS.
2. FILL TO BE PLACED IN MAXIMUM 8-INCH LIFTS AND COMPACTED TO 90% STANDARD PROCTOR.
3. ALL EARTHEN SLOPES TO BE RE-ESTABLISHED WITH GRASS VEGETATION.
4. ALL CONCRETE TO CONSIST OF 3500 PSI CONCRETE WITH #3 BARS AT 12-INCH O.C.E.W.



SECTION C-C

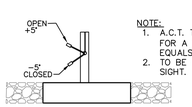
SCALE N.T.S.





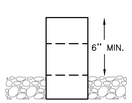
WATER QUALITY OUTFALL DETAIL

SCALE N.T.S.



NOTE:
1. A.C.T. TILT SWITCH 70 SERIES WITH 10° DIFFERENTIALS SET FOR A DEPTH OF 2"-3" BETWEEN CYCLES, OR APPROVED EQUALS.
2. TO BE PLACED NEAR DRAIN AND PROTECTED FROM PLAIN SIGHT.

A.C.T. SWITCH
LEVEL INDICATOR



SEDIMENT DEPTH MARKER:
TO BE PLACED IN THE BOTTOM OF THE POND AND EXTEND ABOVE POND FLOOR AT LEAST 6". IF MARKER IS GREATER THEN 6", INDEX MARKS SHALL BE PLACED AT 6" INTERVALS. DEPTH MARKERS CAN BE SIMILAR MATERIAL AS POND LINING TO BLEND IN. INDICATORS MUST BE VISIBLE FROM OUTSIDE POND.

SEDIMENT DEPTH MARKER

AXIS CIVIL CAD SERVICES

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/13/2023

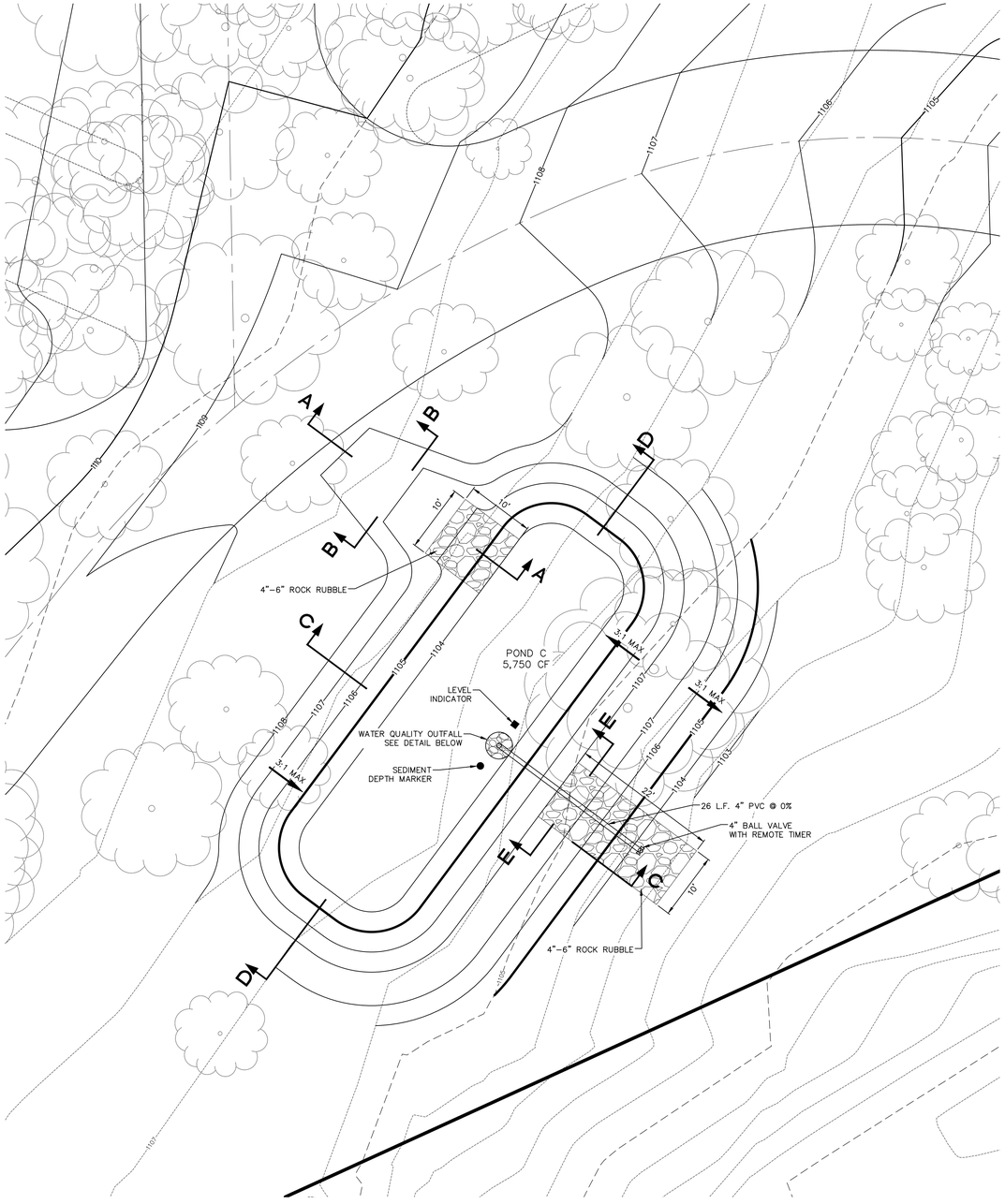
DATE

REVISIONS:

PIERCED OAK RV PARK
23000 FM 306
CANYON LAKE, TEXAS
POND B DETAILS

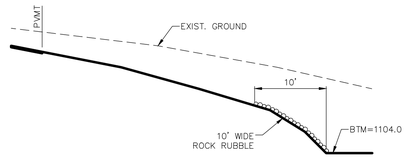
SHEET NO.
C2.5

C:\Users\jmcgarr\OneDrive\CAD_CIVIL TECH\CAD\23-103 PIERCED OAK RV PARK\23-103 CAD\23-103 BASE 4.dwg

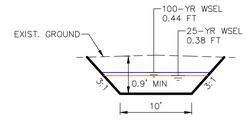


SCALE: 1"=10'
10 5 0 10

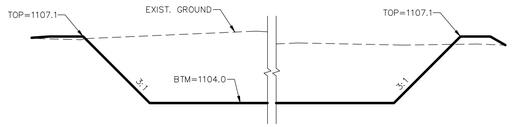
LEGEND:
- PROPERTY BOUNDARY
- 723 EXISTING 1' CONTOURS
- 723 PROPOSED CONTOURS
- 100-YR WATER SURFACE
- 25-YR WATER SURFACE



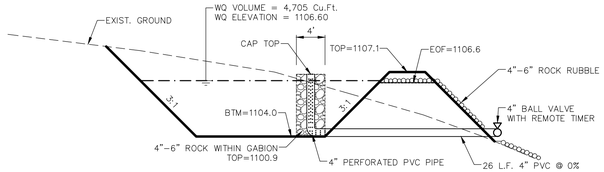
SECTION A-A
SCALE N.T.S.



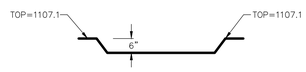
SECTION B-B
SCALE N.T.S.



SECTION C-C
SCALE N.T.S.

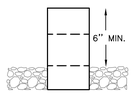


SECTION D-D
SCALE N.T.S.



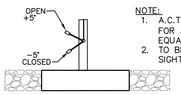
SECTION E-E
SCALE N.T.S.

SEDIMENT DEPTH MARKER:
TO BE PLACED IN THE BOTTOM OF THE POND AND EXTEND ABOVE POND FLOOR AT LEAST 6". IF MARKER IS GREATER THEN 6", INDEX MARKS SHALL BE PLACED AT 6" INTERVALS. DEPTH MARKERS CAN BE SIMILAR MATERIAL AS POND LINING TO BLEND IN. INDICATORS MUST BE VISIBLE FROM OUTSIDE POND.



SEDIMENT DEPTH MARKER

NOTES:
1. CONTRACTOR TO ADJUST VALVE TO DRAIN POND WATER QUALITY VOLUME WITHIN 12 TO 48 HOURS.
2. FILL TO BE PLACED IN MAXIMUM 8-INCH LIFTS AND COMPACTED TO 90% STANDARD PROCTOR.
3. ALL EARTHEN SLOPES TO BE RE-ESTABLISHED WITH GRASS VEGETATION.
4. ALL CONCRETE TO CONSIST OF 3500 PSI CONCRETE WITH #3 BARS AT 12-INCH O.C.E.W.



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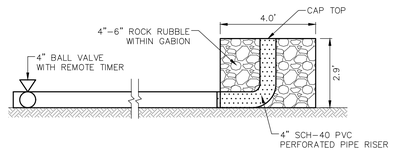
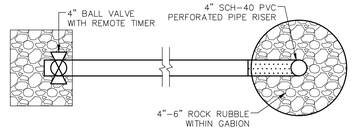
2. TO BE PLACED NEAR DRAIN AND PROTECTED FROM PLAIN SIGHT.

A.C.T. SWITCH
LEVEL INDICATOR





WATER QUALITY OUTFALL DETAIL
SCALE N.T.S.

AXIS CIVIL CAD SERVICES

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

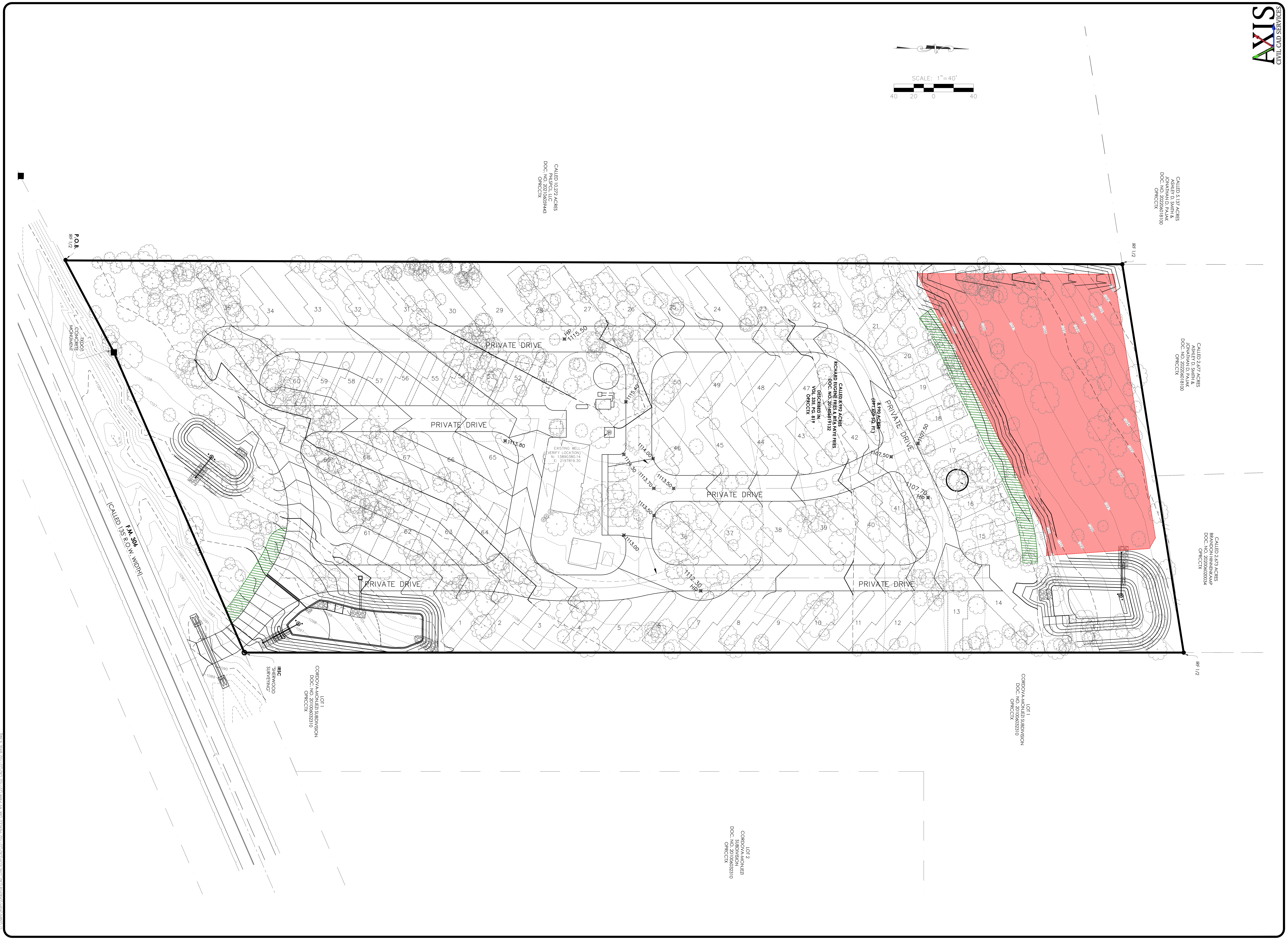
STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/13/2023

DATE

REVISIONS:

PIERCED OAK RV PARK
23000 FM 306
CANYON LAKE, TEXAS
POND C DETAILS

SHEET NO.
C2.6



CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/13/2023

DATE

REVISIONS:

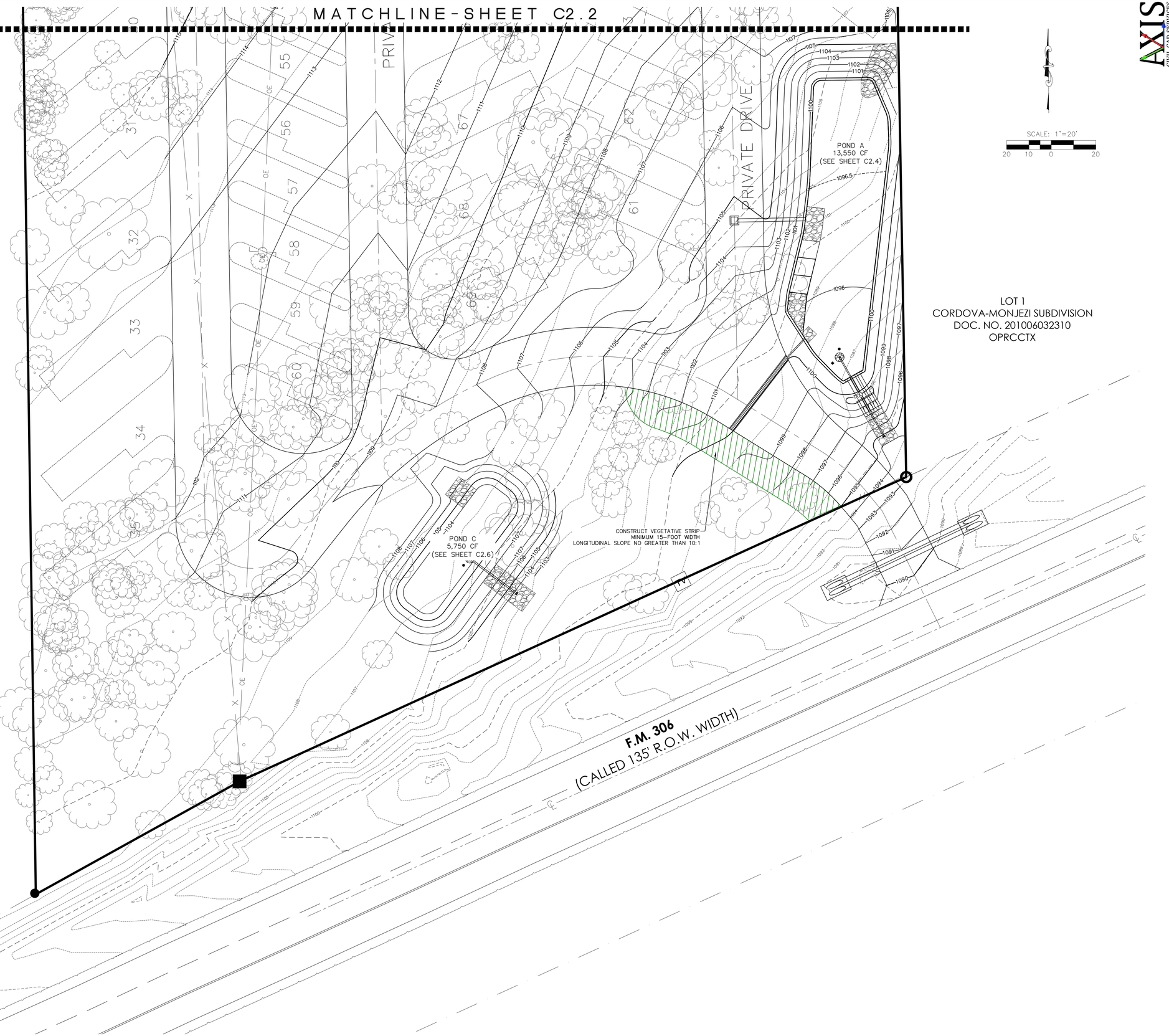
PIERCED OAK RV PARK

23000 FM 306
CANYON LAKE, TEXAS

OVERALL GRADING PLAN

SHEET NO.
C2.0

MATCHLINE - SHEET C2.2



LOT 1
CORDOVA-MONJEZI SUBDIVISION
DOC. NO. 201006032310
OPRCCTX

AXIS CIVIL CAD SERVICES

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/13/2023

DATE

REVISIONS:

PIERCED OAK RV PARK

23000 FM 306
CANYON LAKE, TEXAS

GRADING PLAN

SHEET NO.
C2.1

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MATCHLINE-SHEET C2.3

9.000 ACRES
(391,609 SQ. FT.)

CALLED 8.992 ACRES
RICHARD EUGENE FRIES & RITA FAYE FRIES
DOC. NO. 201406019132

DESCRIBED IN
VOL. 335, PG. 819
OPRCCTX

CALLED 10.272 ACRES
PHLSPCL, LLC
DOC. NO. 202106059443
OPRCCTX

PRIVATE DRIVE

EXISTING WELL
(VERIFY LOCATION)
N: 13893380.14
E: 2197819.30

DIVERSION BERM

SCALE: 1"=20'
20 10 0 20

MATCHLINE-SHEET C2.1

AXIS CIVIL CAD SERVICES

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/13/2023

DATE

REVISIONS:

PIERCED OAK RV PARK
23000 FM 306
CANYON LAKE, TEXAS
GRADING PLAN

SHEET NO.
C2.2

C:\Users\jmcgarr\OneDrive\CIVIL CAD_CIVIL TECH\CAD\23-103 (PIERCED OAK RV PARK)\23-103 C3D\23-103 BASE 8.dwg

CALLED 5.137 ACRES
ASHLEY D. SMITH &
JONATHAN D. PAJAK
DOC. NO. 202206018100
OPRCCTX

CALLED 2.677 ACRES
ASHLEY D. SMITH &
JONATHAN D. PAJAK
DOC. NO. 202206018100
OPRCCTX

CALLED 2.673 ACRES
BRANDON HINNENKAMP
DOC. NO. 202006020034
OPRCCTX

IRF 1/2

IRF 1/2

DIVERSION BERM

CONSTRUCT 170-LINEAR FOOT SWALE,
6-FOOT BOTTOM WIDTH
0.5-FOOT MIN. DEPTH
3.5% MAX. LONGITUDINAL SLOPE
5:1 SIDE SLOPES

CONSTRUCT VEGETATIVE STRIP-
MINIMUM 15-FOOT WIDTH
LONGITUDINAL SLOPE NO GREATER THAN 10:1

POND B
19,300 CF
(SEE SHEET C2.5)

TREE 2148

PRIVATE DRIVE

PRIVATE DRIVE

LOT 1
CORDOVA-MONJEZI SUBDIVISION
DOC. NO. 201006032310
OPRCCTX

9.999 ACRES

MATCHLINE-SHEET C2.2

SCALE: 1"=20'
20 10 0 20

AXIS CIVIL CAD SERVICES

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/13/2023

DATE

REVISIONS:

PIERCED OAK RV PARK
23000 FM 306
CANYON LAKE, TEXAS
GRADING PLAN

SHEET NO.
C2.3

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ATTACHMENT N

Inspection, Maintenance, Repair and Retrofit Plan

Attachment N – Inspection, Maintenance, Repair and Retrofit Plan

Batch Detention Facilities

Project Name: Pierced Oak RV Park

Address: 23000 FM 306

City, State, Zip: Canyon Lake, Texas, 78133

Regular and routine maintenance is essential to effective, long lasting performance of batch detention facilities. Neglect or failure to service batch detention facilities on a regular basis will lead to poor performance and eventually costly repairs. It is recommended that batch detention Best Management Practices (BMPs) be inspected on a quarterly basis and after large storm events for the first year of operation. This intensive monitoring is intended to ensure proper operation and provide maintenance personnel with a basis for the operational characteristics of the filter. Subsequent inspections may be limited to semi-annually or more often if deemed necessary. The bottom of the batch detention pond should be maintained level. The bottom of the batch detention pond shall be visually inspected for any areas of excessive surface deposits and/or disruptions in the uniformity of the batch detention area. Such problem areas shall be promptly repaired or corrected.

Inspections: Inspections should take place a minimum of twice a year. One inspection should take place during wet weather to determine if the basin is meeting the target detention time of 12 hours and a drawdown time of no more than 48 hours. The remaining inspections should occur between storm events so that manual operation of the valve and controller can be verified. The level sensor in the basin should be inspected and any debris or sediment in the area should be removed. The outlet structure and the trash screen should be inspected for signs of clogging. Debris and sediment should be removed from the orifice and outlet(s) as described in previous sections. Debris obstructing the valve should be removed. During each inspection, erosion areas inside and downstream of this BMP should be identified and repaired/revegetated immediately.

Mowing: The basin, basin side-slopes, and embankment of the basin must be mowed to prevent woody growth and control weeds. A mulching mower should be used, or the grass clippings should be caught and removed. Mowing should take place at least twice a year, or more frequently if vegetation exceeds 18 inches in height. More frequent mowing to maintain aesthetic appeal may be necessary in landscaped areas.

Litter and Debris Removal: Litter and debris removal should take place at least twice a year, as part of the periodic mowing operations and inspections. Debris and litter should be removed from the surface of the basin. Particular attention should be paid to floatable debris around the outlet structure. The outlet should be checked for possible clogging or obstructions and any debris removed. Erosion control. The basin side slopes and embankment all may periodically suffer from slumping and erosion. To correct these problems, corrective action, such as regrading and revegetation, may be necessary. Correction of erosion control should take place whenever required based on the periodic inspections.

Nuisance Control: Standing water or soggy conditions may occur in the basin. Some standing water may occur after a storm event since the valve may close with 2 to 3 inches of water in the basin. Some flow into the basin may also occur between storms due to spring flow and residential water use that enters the storm sewer system. Twice a year, the facility should be evaluated in terms of nuisance control (insects, weeds, odors, algae, etc.).

Structural Repairs and Replacement: With each inspection, any damage to structural elements of the basin (pipes, concrete drainage structures, retaining walls, etc.) should be identified and repaired immediately. An example of this type of repair can include patching of cracked concrete, sealing of voids, removal of vegetation from cracks and joints. The various inlet/outlet structures in a basin will eventually deteriorate and must be replaced.

Sediment Removal: A properly designed batch detention basin will accumulate quantities of sediment over time. The accumulated sediment can detract from the appearance of the facility and reduce the pollutant removal performance of the facility. The sediment also tends to accumulate near the outlet structure and can interfere with the level sensor operation. Sediment shall be removed from the basin at least every 5 years, when sediment depth exceeds 6 inches, when the sediment interferes with the level sensor or when the basin does not drain within 48 hours. Care should be taken not to compromise the basin lining during maintenance.

Logic Controller: The Logic Controller should be inspected as part of the twice yearly investigations. Verify that the external indicators (active, cycle in progress) are operating properly by turning the controller off and on, and by initiating a cycle by triggering the level sensor in the basin. The valve should be manually opened and closed using the open/close switch to verify valve operation and to assist in inspecting the valve for debris. The solar panel should be inspected and any dust or debris on the panel should be carefully removed. The controller and all other circuitry and wiring should be inspected for signs of corrosion, damage from insects, water leaks, or other damage. At the end of the inspection, the controller should be reset.

Following any required maintenance, the surface of the filtration basin shall be raked and leveled to restore the system to its designed condition. With each inspection, any damage to the structural elements of the system (pipes, retaining walls, etc.) must be identified and repaired immediately. “Proper” disposal of accumulated silt shall be accomplished following the Texas Commission on Environmental Quality (TCEQ) and City of San Antonio guidelines (if within jurisdiction of City of San Antonio) and specifications.

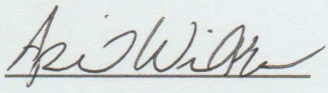
After all inspections, results shall be recorded and maintained. Records should be made available on request by TCEQ and/or SAWS officials. Upon transfer of ownership or maintenance responsibility: The seller must inform the buyer of all requirements of the BMP maintenance. TCEQ must be notified and receive the form “TCEQ-10623 change in responsibility for maintenance on permanent Best Management Practices and Measures.” In addition, TCEQ and SAWS Resource Protection Division shall receive a signed, dated copy of this maintenance plan from the new owner.

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’s entity having ownership or control of the property (such as without limitation, an owner’s association, new property owner or lessee, a district, or municipality) or the ownership of the property is transferred to the entity assumes such an obligation in writing or ownership is transferred.

An amended copy of this document will be provided to the Texas Commission on Environmental Quality within thirty (30) days of any changes in the following information.

Owner / Responsible Party:

Contact Person:	Owner
Entity:	Pierced Oak, LLC
Mailing Address:	1885 FM 2673
City, State and Zip:	Canyon Lake, Texas, 78133
Telephone:	817-713-6510
Email:	Wilker.ae@gmail.com

Signature of Owner/Responsible Party  Date: 6/27/23

Extended Detention Facilities

Project Name: Pierced Oak RV Park

Address: 23000 FM 306

City, State, Zip: Canyon Lake, Texas, 78133

Regular and routine maintenance is essential to effective, long lasting performance of extended detention facilities. Neglect or failure to service batch detention facilities on a regular basis will lead to poor performance and eventually costly repairs. It is recommended that batch detention Best Management Practices (BMPs) be inspected on a quarterly basis and after large storm events for the first year of operation. This intensive monitoring is intended to ensure proper operation and provide maintenance personnel with a basis for the operational characteristics of the filter. Subsequent inspections may be limited to semi-annually or more often if deemed necessary. The bottom of the batch detention pond should be maintained level. The bottom of the extended detention pond shall be visually inspected for any areas of excessive surface deposits and/or disruptions in the uniformity of the batch detention area. Such problem areas shall be promptly repaired or corrected.

Inspections: Inspections should take place a minimum of twice a year. One inspection should take place during wet weather to determine if the basin is meeting the target detention time of 12 hours and a drawdown time of no more than 48 hours. The remaining inspections should occur between storm events so that manual operation of the valve and controller can be verified. The level sensor in the basin should be inspected and any debris or sediment in the area should be removed. The outlet structure and the trash screen should be inspected for signs of clogging. Debris and sediment should be removed from the orifice and outlet(s) as described in previous sections. Debris obstructing the valve should be removed. During each inspection, erosion areas inside and downstream of this BMP should be identified and repaired/revegetated immediately.

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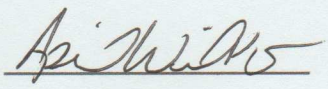
The applicant is responsible for maintaining the permanent BMPs after construction until such time as the maintenance obligation is either assumed in writing by another's entity having ownership or control of the property (such as without limitation, an owner's association, new property owner or lessee,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

An amended copy of this document will be provided to the Texas Commission on Environmental Quality within thirty (30) days of any changes in the following information.

Owner / Responsible Party:

Contact Person:	Owner
Entity:	Pierced Oak, LLC
Mailing Address:	1885 FM 2673
City, State and Zip:	Canyon Lake, Texas, 78133
Telephone:	817-713-6510
Email:	Wilker.ae@gmail.com

Signature of Owner/Responsible Party  Date: 6/27/23

Vegetative Filter Strips

Project Name: Pierced Oak RV Park

Address: 23000 FM 306

City, State, Zip: Canyon Lake, Texas, 78133

The care and maintenance a vegetated filter strip receives in the first few months are keys to establishing the viability of the filter strips. Once a vegetated area is well established, little additional maintenance is generally necessary, however, all vegetated Best Management Practices (BMPs) require some basic maintenance including:

Pest Management: An Integrated Pest Management Plan (IPM) should be developed for vegetated areas. This plan should specify how problem insects and weeds will be controlled with minimal or no use of insecticides and herbicides.

Seasonal Mowing and Lawn Care: If the filter strip is made of turf grass, it should be mowed as needed to limit vegetation height to 18 inches, using a mulching mower (or removal of clipping). If native grasses are used, the filter may require less frequent mowing, but a minimum of twice annually. Grass clipping and brush debris should not be deposited on vegetated filter strip areas. Regular mowing should also include weed control practices, however herbicide use should be kept to a minimum. Healthy grass may be maintained without using fertilizers because runoff usually contains sufficient nutrients. Irrigation of the site may also help assure a dense and healthy vegetative cover.

Inspection: Inspection of filter strips should be done at least twice annually for erosion or damage to vegetation; however, additional inspections after periods of heavy runoff are most desirable. The strip should be checked for uniformity of grass cover, debris and litter, and areas of sediment accumulation. More frequent inspections of grass cover will be made during the first few years after establishment to determine if any problems are developing, and to plan for long-term restorative maintenance needs. Bare spots and areas of erosion identified during semi-annual inspections should be replanted and restored to meet specifications. Construction of a level spreader device may be necessary to reestablish shallow overland flow.

Debris and Litter Removal: Any filter strip or filter strip structures (i.e. leveled spreaders) should be kept free of obstructions to reduce floatables from being flushed downstream, and for aesthetic reasons. The need for this practice will be determined through periodic inspection, but will be performed no less than four (4) times per year.

Sediment Removal: Sediment removal is not normally required in filter strips. However, sediment may accumulate along the upstream boundary of the strip preventing uniform overland flow. Excess sediment should be removed by hand, with flat-bottomed shovels, or light construction equipment.

Grass Re-seeding and Mulching: A healthy dense grass should be maintained on the filter strip. If areas are eroded, they should be filled, compacted and reseeded so that the final grade is level. Grass damaged during the sediment removal process should be promptly replaced using the same seed mix used during filter strip establishment. Flow should be diverted, if possible, from the damaged areas until the grass is firmly established. Bare spots and areas of erosion identified during semi-annual inspections must be replanted and restored to meet specifications. Corrective maintenance, such as weeding or replanting should be done more frequently in the first two to three years after installation to ensure stabilization. Dense vegetation may require irrigation immediately after planting, and during dry periods, particularly as the vegetation is initially established.

"Proper" disposal of accumulated silt shall be accomplished following the Texas Commission on Environmental Quality (TCEQ) and City of San Antonio guidelines (if within jurisdiction of City of San Antonio) and specifications.

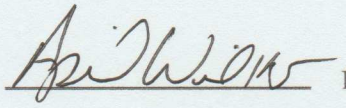
After all inspections, results shall be recorded and maintained. Records should be made available on request by TCEQ and/or SAWS officials. Upon transfer of ownership or maintenance responsibility: The seller must inform the buyer of all requirements of the BMP maintenance. TCEQ must be notified and receive the form "TCEQ-10623 change in responsibility for maintenance on permanent Best Management Practices and Measures." In addition, TCEQ and SAWS Resource Protection Division shall receive a signed, dated copy of this maintenance plan from the new owner.

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's entity having ownership or control of the property (such as without limitation, an owner's association, new property owner or lessee, a district, or municipality) or the ownership of the property is transferred to the entity assumes such an obligation in writing or ownership is transferred.

An amended copy of this document will be provided to the Texas Commission on Environmental Quality within thirty (30) days of any changes in the following information.

Owner / Responsible Party:

Contact Person:	Owner
Entity:	Pierced Oak, LLC
Mailing Address:	1885 FM 2673
City, State and Zip:	Canyon Lake, Texas, 78133
Telephone:	817-713-6510
Email:	Wilker.ae@gmail.com

Signature of Owner/Responsible Party  Date: 6/27/23

Grassy Swales

Project Name: Pierced Oak RV Park

Address: 23000 FM 306

City, State, Zip: Canyon Lake, Texas, 78133

The care and maintenance a grassy swale receives in the first few months are keys to establishing its long term viability. Once the swale vegetation is well established, little additional maintenance is generally necessary, however, all vegetated Best Management Practices (BMPs) require some basic maintenance including:

Pest Management: An Integrated Pest Management Plan (IPM) should be developed for vegetated areas. This plan should specify how problem insects and weeds will be controlled with minimal or no use of insecticides and herbicides.

Seasonal Mowing and Lawn Care: Mowing will be performed routinely as needed throughout the growing season. Grass will be mowed as needed to limit vegetation height to 2 inches, above the design water depth using a mulching mower (or removal of clipping). If native grasses are used, the swale may require less frequent mowing, but a minimum of twice annually. Grass clipping and brush debris will not be deposited within the channel. Regular mowing will also include weed control practices, however herbicide use should be kept to a minimum. Healthy grass may be maintained without using fertilizers because runoff usually contains sufficient nutrients. Irrigation of the site may also help assure a dense and healthy vegetative cover.

Inspection: Inspection of swales should be done at least twice annually for erosion or damage to vegetation. Additional inspections after periods of heavy runoff will also be made. The swale will be checked for uniformity of grass cover, debris and litter, and areas of sediment accumulation. More frequent inspections of grass cover will be made during the first few years after establishment to determine if any problems are developing, and to plan for long-term restorative maintenance needs. Bare spots and areas of erosion identified during semi-annual inspections will be replanted and restored to meet specifications. Construction of a level spreader device may be necessary to reestablish shallow overland flow.

Debris and Litter Removal: All swales or swale structures (i.e. check dams) will be kept free of obstructions to reduce floatables from being flushed downstream, and for aesthetic reasons. The need for this practice will be determined through periodic inspection, but will be performed no less than two (2) times per year.

Sediment Removal: Sediment accumulating near culverts and in channels will be removed when sediment build up exceeds three (3) inches, or when vegetation is covered. Excess sediment should be removed by hand, with flat-bottomed shovels, or light construction equipment. Areas that are significantly eroded will be filled, compacted, and reseeded so that the final grade is level with the bottom of the swale. Sediments will be removed in accordance with TCEQ guidelines.

Grass Re-seeding and Mulching: A healthy dense grass will be maintained on within the channel and side slopes. If areas are eroded, they will be filled, compacted and reseeded so that the final grade is level. Grass damaged during the sediment removal process will be promptly replaced using the same seed mix used during filter strip establishment. Bare spots and areas of erosion identified during semi-annual inspections must be replanted and restored to meet specifications. Corrective maintenance, such as weeding or replanting will be done more frequently in the first two to three years after installation to ensure stabilization. Dense vegetation may require irrigation immediately after planting, and during dry periods, particularly as the vegetation is initially established.

"Proper" disposal of accumulated silt shall be accomplished following the Texas Commission on Environmental Quality (TCEQ) and City of San Antonio guidelines (if within jurisdiction of City of San Antonio) and specifications.

After all inspections, results shall be recorded and maintained. Records should be made available on request by TCEQ and/or SAWS officials. Upon transfer of ownership or maintenance responsibility: The seller must inform the buyer of all requirements of the BMP maintenance. TCEQ must be notified and receive the form "TCEQ-10623 change in responsibility for maintenance on permanent Best Management Practices and Measures." In addition, TCEQ and SAWS Resource Protection Division shall receive a signed, dated copy of this maintenance plan from the new owner.

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's entity having ownership or control of the property (such as without limitation, an owner's association, new property owner or lessee, a district, or municipality) or the ownership of the property is transferred to the entity assumes such an obligation in writing or ownership is transferred.

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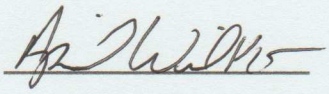
Signature of Owner/Responsible Party  Date: 6/27/23

ATTACHMENT O

Pilot-Scale Field Testing Plan

Not Applicable

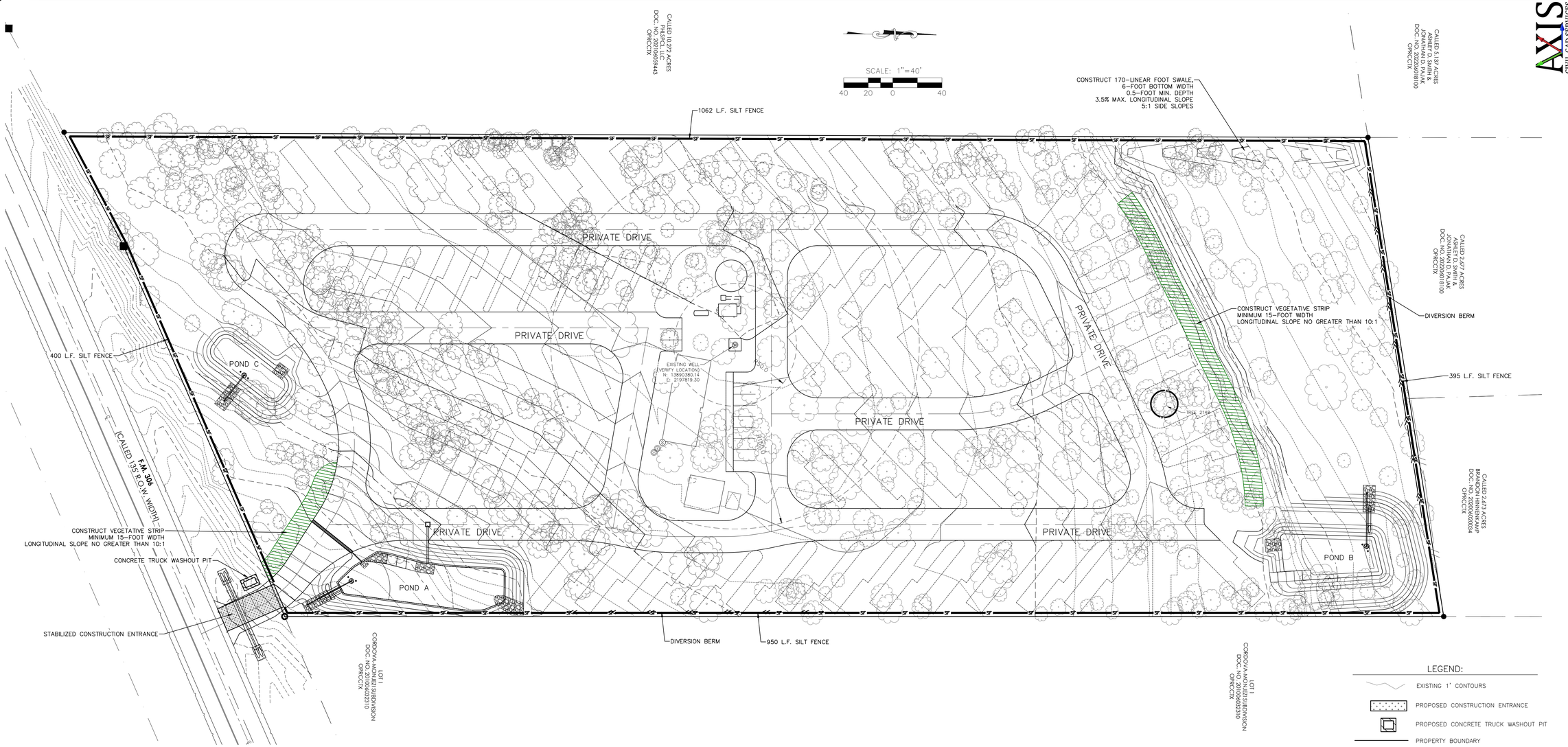
ATTACHMENT P

Measures for Minimizing Surface Stream Contamination

Not Applicable

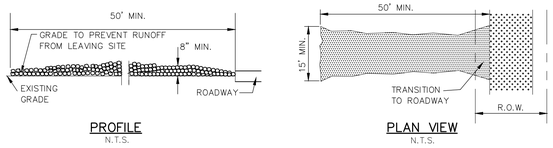
Storm Water Pollution Prevention Plan

(SWPPP)



LEGEND:

- EXISTING 1' CONTOURS
- PROPOSED CONSTRUCTION ENTRANCE
- PROPOSED CONCRETE TRUCK WASHOUT PIT
- PROPERTY BOUNDARY
- OHU — EXISTING OVERHEAD UTILITY LINES
- SF — PROPOSED SILT FENCE
- EXISTING TREE



PROFILE
N.T.S.

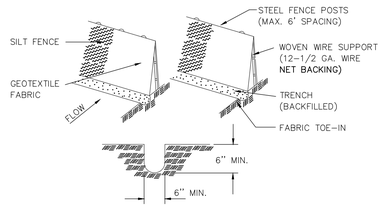
PLAN VIEW
N.T.S.

GENERAL NOTES:

1. STONE SIZE– 4 TO 6 INCH OPEN GRADED ROCK.
2. LENGTH– AS EFFECTIVE, BUT NOT LESS THAN 50 FEET.
3. THICKNESS– NOT LESS THAN 8 INCHES.
4. WIDTH– NOT LESS THAN FULL WIDTH OF ALL POINTS OF INGRESS OR EGRESS.
5. WASHING– WHEN NECESSARY, WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC ROADWAY. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED TRAP OR SEDIMENT BASIN. ALL SEDIMENT SHALL BE PREVENTED FROM ENTERING ANY STORM DRAIN, DITCH, OR WATERCOURSE USING APPROVED METHODS.
6. MAINTENANCE– THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC ROADWAYS. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND, AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC ROADWAY MUST BE REMOVED IMMEDIATELY.
7. DRAINAGE– ENTRANCE MUST BE PROPERLY GRADED OR INCORPORATE A DRAINAGE SWALE TO PREVENT RUNOFF FROM LEAVING THE CONSTRUCTION SITE.

STABILIZED CONSTRUCTION ENTRANCE

SCALE N.T.S.



TRENCH CROSS-SECTION

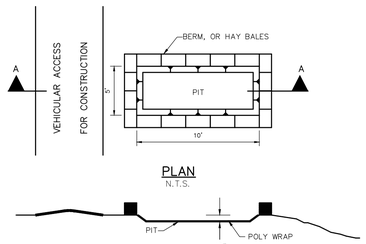
N.T.S.

GENERAL NOTES:

1. STEEL POSTS WHICH SUPPORT THE SILT FENCE SHALL BE INSTALLED ON A SLIGHT ANGLE TOWARD THE ANTICIPATED RUNOFF SOURCE. POST MUST BE EMBEDDED A MINIMUM OF ONE FOOT.
2. THE TOE OF THE SILT FENCE SHALL BE TRENCHED IN WITH A SPADE OR MECHANICAL TRENCHER, SO THAT THE DOWNSLOPE FACE OF THE TRENCH IS FLAT AND PERPENDICULAR TO THE LINE OF FLOW. WHERE FENCE CAN NOT BE TREATED IN (e.g. pavement) WEIGHT FABRIC FLAP WITH WASHED GRAVEL ON UPHILL SIDE TO PREVENT FLOW UNDER FENCE.
3. THE TRENCH MUST BE A MINIMUM OF 6 INCHES DEEP AND 6 INCHES WIDE TO ALLOW FOR THE SILT FENCE FABRIC TO BE LAID IN THE GROUND AND BACKFILLED WITH COMPACTED MATERIAL.
4. SILT FENCE SHOULD BE SECURELY FASTENED TO EACH STEEL SUPPORT POSTS OR TO WOVEN WIRE, WHICH IS IN TURN ATTACHED TO THE STEEL FENCE POST.
5. INSPECTION SHALL BE MADE WEEKLY OR AFTER EACH RAINFALL EVENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
6. SILT FENCE SHALL BE REMOVED WHEN THE SITE IS COMPLETELY STABILIZED SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
7. ACCUMULATED SILT SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6 INCHES. THE SILT SHALL BE DISPOSED OF IN AN APPROVED SITE AND IN SUCH A MANNER AS TO NOT CONTRIBUTE TO ADDITIONAL SILTATION.

SILT FENCE

SCALE N.T.S.



PLAN
N.T.S.

SECTION A-A
N.T.S.

GENERAL NOTES:

1. DETAIL ILLUSTRATES MINIMUM DIMENSIONS. PIT CAN BE INCREASED IN SIZE DEPENDING ON EXPECTED FREQUENCY OF USE.
2. IF HAY BALES ARE USED, THEY SHALL BE PLACED IN ACCORDANCE WITH DETAILS SHOWN ON EXHIBIT FOR HAY BALES.
3. POLY WRAP TO CONSIST OF 8 MIL. OR GREATER AND PLACED ON TOP OF VIRGIN SOIL.
4. WASHOUT PIT SHALL BE LOCATED IN AN AREA EASILY ACCESSIBLE TO CONSTRUCTION TRAFFIC.
5. WASHOUT PIT SHALL NOT BE LOCATED IN AREAS SUBJECT TO INUNDATION FROM STORM WATER RUNOFF.

CONCRETE TRUCK WASHOUT PIT

SCALE N.T.S.

AXIS CIVIL CAD SERVICES

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/13/2023

DATE

REVISIONS:

PIERCED OAK RV PARK
23000 FM 306
CANYON LAKE, TEXAS
STORM WATER POLLUTION PREVENTION PLAN

SHEET NO.
C5.0

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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: James McGarr, PE

Date: 6/1/2023

Signature of Customer/Agent:

Regulated Entity Name: 23000 FM 306, Canyon Lake, Texas

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: Potters Creek

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.

ATTACHMENT A

Spill Response Actions

Attachment A – Spill Response Actions

Site Specific Measures that will be taken to contain any spill of hydrocarbons or hazardous substances will include:

1. Immediate isolation of the substance source to keep additional spill or possible infiltration from occurring. Action will be taken to block the down gradient side using native earth material, absorbent blankets or absorbent socks.
2. The substance and contaminated materials will be excavated and placed within an impervious container or impervious-lined area that is protected from storm water runoff. Excavated materials will be covered to protect against rain.
3. The hazardous substance will be positively identified.
4. The spill area, after the excavation, will be sampled to verify that the hazardous substance has been properly and adequately remediated.
5. The excavated materials will be disposed of at an approved facility licensed to accept the substance identified. All transporting and disposal will follow State requirements for hazardous substances.
6. Fuels and Hazardous Substances are not to be stored on site.
7. Contractor shall become familiar with the Site Plan and confine activities with fuels and hazardous substances to locations that are adequate for the isolation and prevention of contamination in the event of a spill.

In addition to the above site specific measures, the following recommended measures from the Edwards Aquifer Technical Guidance Manual (RG-348, 2005); Section 1.4.16, Significant/Hazardous Spills section should also be followed and are provided herein. These measures are to prevent or reduce the discharge of pollutants to drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.
The following steps will help reduce the storm water impacts of leaks and spills:

Education

1. Be aware that different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills. Employees should also be aware of when spill must be reported to the TCEQ. Information available in 30 TAC 327.4 and 40 CFR 302.4.
2. Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
3. Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
4. Establish a continuing education program to indoctrinate new employees.
5. Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

1. To the extent that the work can be accomplished safely, spills of oil, petroleum products, and substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
2. Store hazardous materials and wastes in covered containers and protect from vandalism.
3. Place a stockpile of spill cleanup materials where it will be readily accessible.
4. Train employees in spill prevention and cleanup.
5. Designate responsible individuals to oversee and enforce control measures.

6. Spills should be covered and protected from storm water run-on during rainfall to the extent that it doesn't compromise cleanup activities.
7. Do not bury or wash spills with water.
8. Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
9. Do not allow water used for cleaning and decontamination to enter storm drains or watercourses. Collect and dispose of contaminated water in accordance with applicable regulations.
10. Contain water overflow or minor water spillage and do not allow it to discharge into drainage facilities or watercourses.
11. Place Material Safety Data Sheets (MSDS), as well as proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location.
12. Keep waste storage areas clean, well-organized, and equipped with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

1. Clean up leaks and spills immediately.
2. Use a rag for small spills on paved surfaces, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be disposed of as hazardous waste.
3. Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly.

Minor Spills

1. Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
2. Use absorbent materials on small spills rather than hosing down or burying the spill.
3. Absorbent materials should be promptly removed and disposed of properly.
4. Follow the practice below for a minor spill:
    a. Contain the spread of the spill.
    b. Recover spilled materials.
    c. Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities. Spills should be cleaned up immediately:

1. Contain spread of the spill.
2. Notify the project foreman immediately.
3. If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
4. If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
5. If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

For significant or hazardous spills that are in reportable quantities:

1. Notify the TCEQ by telephone as soon as possible and within 24 hours at 512-339-2929 (Austin) or 210-490-3096 (San Antonio) between 8 AM and 5 PM. After hours, contact the Environmental Release Hotline at 1-800-832-8224. It is the contractor's responsibility to have all emergency phone numbers at the construction site.
2. For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.
3. Notification should first be made by telephone and followed up with a written report.
4. The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.
5. Other agencies which may need to be consulted include, but are not limited to, the City Police Department, County Sheriff Office, Fire Departments, etc.

More information on spill rules and appropriate responses is available on the TCEQ website at: http://www.tnrcc.state.tx.us/enforcement/emergency_response.html

Vehicle and Equipment Maintenance

1. If maintenance must occur onsite, use a designated area and a secondary containment, located away from drainage courses, to prevent the run-on of storm water and the runoff of spills.
2. Regularly inspect onsite vehicles and equipment for leaks and repair immediately
3. Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
4. Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
5. Place drip pans or absorbent materials under paving equipment when not in use.
6. Use absorbent materials on small spills rather than hosing down or burying the spill. Remove the absorbent materials promptly and dispose of properly.
7. Promptly transfer used fluids to the proper waste or recycling drums. Don’t leave full drip pans or other open containers lying around.
8. Oil filters disposed of in trashcans or dumpsters can leak oil and pollute storm water. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
9. Store cracked batteries in a non- leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

1. If fueling must occur on site, use designated areas, located away from drainage courses, to prevent the run-on of storm water and the runoff of spills.
2. Discourage “topping off” of fuel tanks.
3. Always use secondary containment, such as a drain pan, when fueling to catch spills/ leaks.

ATTACHMENT B

Potential Sources of Contamination

Attachment B – Potential Sources of Contamination

1. Contaminants and fluids may be dropped from the use of construction equipment
2. Contaminants and fluids may be dropped from vehicles entering the site during construction
3. Contaminants and fluids may be dropped or spilled by workers during construction
4. Mud or dirt may be tracked onto streets from construction areas
5. Fine particles may be washed from non-stabilized areas
6. Contaminants and fluids may be spilled with the use of chemical / portable toilets during construction
7. Contaminants and fluids may be spilled during the connection to the existing SCS

During construction of the infrastructure contamination could come from oil, grease and fuel drippings from construction equipment and also from the process of excavating materials and grading. Additionally, the use of chemical / portable toilets is a potential source of contamination.

If fuel or a hazardous substance spill occurs, the contaminants and contaminated soil will be removed and placed in an impervious container to be disposed of off-site at an approved disposal site. The placement of excavated materials will have appropriately sized erosion and sedimentation controls placed down gradient to prevent debris from the construction activity from washing down gradient of the site. The construction site will be cleaned of materials and debris at the end of each workday and/or at the completion of the infrastructure. The application of the prime coat and/or tack coat will be timed to avoid any occurrence of a rain event before placement of the HMAC, which would provide permanent soil stabilization for the street areas. Any concrete structures, flatwork, and formwork would also be similarly timed to avoid any occurrence of a rain event.

In any case of a spill or contamination, the Spill Response Actions identified in **ATTACHMENT A** of this section should be followed.

ATTACHMENT C

Sequence of Major Activities

Attachment C – Sequence of Major Activities

The project site will be constructed using the following general activities and sequences. Construction activities and order of construction is anticipated as follows:

1. Temporary BMPs – Installation of temporary control measures such as silt fence, rock berms, etc. (Disturbs approx. 0.065 acres)
2. Grubbing & Clearing – Underbrush & Trees removed as necessary: ROWs, utility easements, and drains. (Disturbs approx. 0.47 acres)
3. Drainage and Water Quality – Excavation and construction of drainage infrastructure and Water Quality permanent BMPs. (Disturbs approx. 0.88 acres)
4. Rough Grading and Excavation - The building pads, parking lots, and driveways will be brought to sub grade. (Disturbs approx. 2.5 acres)
5. Utilities – Trenching and installation of sanitary sewer lines, water lines, then Electric and dry utilities. Upon installation, the trenches will be backfilled. (Disturbs approx. 0.10 acres)
6. Asphalt and Curbs – Concrete curbs and street surfaces will be brought to final grade and installed. (Disturbs approx. 0.75 acres)
7. Final Utility Meters – Installation of water, electric meters, and other final utility terminations, as needed. (Disturbs approx. 0.03 acres)

Note: The excavated material from the trenches will be placed on the up-gradient side of the trench. The trench would serve as a temporary sedimentation and erosion control measure.

ATTACHMENT D

Temporary Best Management Practices and Measures

Attachment D – Temporary Best Management Practices and Measures

The Temporary Best Management Practices (TBMPs) and Measures that will be used:

- Silt Fences (Sediment Control Rolls may be substituted where appropriate)
- Stabilized Construction Entrances
- Equipment Staging Area
- Concrete Wash Out
- Inlet Protection
- Rock Berm or Gabion
- Preservation of Natural Areas
- Placement of Excavated Material on Up Gradient Side of Trench (Except in Floodplain)
- Permanent Planting, Sodding, and/or Re-seeding
- Regular Inspection & Maintenance
- Stabilization

All structural TBMPs will be installed prior to the beginning of construction as per the Sedimentation & Erosion Control Plan and Storm Water Pollution Prevention Plan. The TBMPs will remain in place and will be maintained until all construction has ceased and perennial vegetative cover with a density of 70 percent has occurred.

1. Install stabilized construction entrance; Establish equipment staging area and concrete washout
2. Installation of TBMPs - rock berm, inlet protection and silt fences as appropriate
3. Grubbing & Clearing
4. Excavation
5. Grading
6. Infrastructure Construction
7. Establish 70 percent vegetative cover
8. Remove TBMPs

The temporary measures to be used during construction to prevent pollution of surface water, groundwater, and storm water runoff will be the use of silt fencing, inlet protection, and rock berm, as necessary, generally located along the down gradient side of the project area as indicated in the Water Pollution Abatement Plan. The stabilized construction entrance, concrete wash out and equipment staging area will be located as practicable. The equipment staging area and concrete washout should be in the proximity of the construction entrance / exit and not located near a well, floodplain, or other potential sources of contamination. Structural practices, as applicable, will be installed prior to each phase of the project and will be maintained during the construction of that phase. Disturbed areas will be stabilized, re-vegetated if denuded, within 14 days after temporary (21 days) or permanent cessation of construction activities.

The weather will need to be monitored and the application of the prime coat and/or tack coat emulsions will be timed to avoid any occurrence of a rain event before placement of the HMAC on the streets. Any concrete, flatwork, and formwork would also be similarly timed to avoid any occurrence of a rain event.

ATTACHMENT E

Request to Temporarily Seal a Feature

Not Applicable

ATTACHMENT F

Structural Practices

Attachment F – Structural Practices

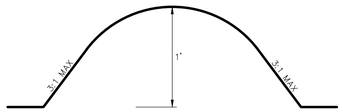
The structural practices proposed that will limit runoff discharge of pollutants from exposed areas of the site will be the use of silt fences (sediment control rolls may be substituted where appropriate), rock berms or gabions, inlet protection, concrete wash out, equipment staging area, and stabilized construction entrances to prevent the suspended solids and sediments from washing across the site.

1. A stabilized construction entrance with washout pit will be constructed at all locations where vehicular traffic enters and leaves the site. This will reduce tracking of sediments onto adjacent roadways and provide a stable area for entrance or exit from the construction site.
2. An equipment staging area will be established. This should be located in the proximity of the construction entrance / exit. This will provide a controlled and stable area to set-up materials and equipment.
3. Silt fencing will be installed adjacent to any drainage way which receives sheet flow from up gradient-disturbed areas and along the side slope perimeter of disturbed areas when no other TBMPs / Structural Practices are available.
4. Excavation for the permanent pond will be used to trap sediment until completion and acceptance of permanent storm drain piping.
5. Silt fencing will be installed in areas where up gradient flow from disturbed areas is concentrated, Washout of silt fencing may occur and should be monitored. Rock berms or gabions may also be installed along the side slope perimeter of disturbed areas if the up gradient flow is concentrated to prevent washout of silt fencing.
6. Sandbags filled with washed pea gravel will be used at storm drainage inlets prior to stabilization of the drainage areas. Alternative inlet protection may be utilized as appropriate.
7. Rock berms or gabions will be installed at points of concentrated flow to trap sediment prior to exiting the site and prevent down gradient erosion.

Although not anticipated, earthen berm/dikes may be constructed in some areas to divert up gradient flows around disturbed areas and onto natural drainage ways.

ATTACHMENT G

Drainage Area Map



SECTION #1
SCALE N.T.S.

AXIS CIVIL CAD SERVICES

SCALE: 1"=80'
80 10 0 80

PBO
38.30 AC.

PA0
2.90 AC.

PA1
0.62 AC.

PA2
1.95 AC.

PA3
1.49 AC.

PA4
0.13 AC.

PB1
1.37 AC.

PB2
0.36 AC.

PB3
0.57 AC.

PB4
2.50 AC.

POINT 1
POINT 2
POINT 3
POINT 4
POINT B
POND A
POND B
POND C
SWALE #2
BERM #1
SECTION #1

PROPOSED DRAINAGE AREA TABLE			
BASIN	AREA	IMPERVIOUS	PERVIOUS
PA1	0.62 AC.	--	0.62 AC.
PA2	1.95 AC.	1.01 AC.	0.94 AC.
PA3	1.49 AC.	0.93 AC.	0.56 AC.
PA4	0.13 AC.	0.08 AC.	0.05AC.
PAO	2.90 AC.	0.43 AC.	2.47 AC.
PB1	1.37 AC.	--	1.37 AC.
PB2	0.36 AC.	0.16 AC.	0.20 AC.
PB3	0.57 AC.	0.21 AC.	0.36 AC.
PB4	2.50 AC.	1.46 AC.	1.04 AC.
PBO	38.30 AC.	*1.91 AC.	*36.39 AC.

*ASSUMED 5% TOTAL EXISTING IMPERVIOUS COVER

LEGEND:
- PROPERTY BOUNDARY LINE
- ADJACENT PROPERTY LINE
- EXISTING 1' LIDAR CONTOURS
- DRAINAGE BASIN LIMITS
- DRAINAGE FLOW PATH

CIVIL TECH, PLLC.
ENGINEERS, CONSULTANTS, LAND PLANNERS
Firm No. 13711 (210) 365-5029
P.O. BOX 2203 BOERNE, TX. 78006

STATE OF TEXAS
JAMES P. McGARR
108753
LICENSED
PROFESSIONAL ENGINEER
6/6/2023

DATE
REVISIONS:

PIERCED OAK RV PARK
23000 FM 306
CANYON LAKE, TEXAS
PROPOSED DRAINAGE AREA MAP

SHEET NO.
DAM2

ATTACHMENT H

Temporary Sediment Pond(s) Plans and Calculations

Not Applicable

ATTACHMENT I

Inspection and Maintenance for BMPs

Attachment I – Inspection and Maintenance for BMPs

Following are recommended minimum site specific inspection and maintenance measures for the BMPs proposed with this project. The recommended measures are derived from the Edwards Aquifer Technical Guidance Manual (RG-348, 2005); *Section 1.3, Temporary Erosion Control BMPs* and *Section 1.4, Temporary Sediment Control BMPs.* More detailed guidance is contained within the sections referenced.

The following steps will help prevent or reduce the sediment transported by storm water runoff in areas of disturbance:

General

1. Silt fences (sediment control rolls may be substituted where appropriate), rock berms, gabions, inlet protection, and stabilized construction entrances must be in place prior to the start of construction and will remain in place until construction has been completed and the site stabilized from further erosion.
2. The contractor will keep a record of the inspections, noting the condition of the BMPs and any corrective action taken to maintain the erosion control structures. In addition to the inspection and maintenance reports, the operator should keep records of the construction activity on site. In particular the following information should be kept:
    - The dates when major grading activities occur in a particular area.
    - The dates when construction activity ceases in an area, temporarily or permanently.
    - The dates when an area is stabilized, temporarily or permanently.
3. All soil, sand, gravel, and excavated material stockpiled on-site will have appropriately sized silt fencing placed up gradient and down gradient.

Inspection

1. A qualified E & S inspector (representing the discharger) shall inspect the following items once every seven (7) days, and within 24 hours after storm event of a ½-inch or greater rainfall:
    - Disturbed areas of the construction site that have not been finally stabilized
    - Areas used for storage of materials that are exposed to precipitation
    - Structural and stabilization control measures
    - Construction entrance/exits
2. The E & S inspector shall have authority to require immediate action on the part of the Contractor to correct any nonconforming items found during inspections or to require revisions to the E & S controls if appropriate. If revisions are needed, they shall be implemented within 7 calendar days after the date of inspection.
3. The E & S inspector will provide written reports covering all items/areas inspected and outlining corrective measures if any.

Maintenance

1. All erosion and sedimentation (E & S) measures/controls shall be maintained in good working order by the Contractor. Written maintenance reports shall be prepared covering all inspections and maintenance affecting E & S controls. If repair(s) are necessary, they shall be initiated within 24 hours after report.
2. The *temporary construction entrance* maintenance guidelines are listed below:
    - Prevent/minimize tracking or flowing of sediments onto public roadways.
    - Sediments spilled, dropped, washed or tracked onto public roadways must be removed immediately.
    - Vehicle tires should be cleaned to remove sediment prior to entrance onto public right-of-way.

- If washing is required, it should be done on an area stabilized with crushed stone that drains to an approved sediment trap or basin.
- All sediment should be prevented from entering any storm drain, bar ditch, or water course by using approved methods.

3. *Temporary vegetation* inspection/maintenance guidelines are listed below:
    - Inspected weekly and after each rain event to locate and repair any erosion
    - Erosion from storms of other damage should be repaired immediately by regarding the area and applying new seed.
    - If vegetated cover is less than 80%, the area should be reseeded.
4. *Rock berm* inspection/maintenance guidelines are listed below:
    - Inspection should be done weekly and after each rainfall. For installations in streambeds, additional daily inspections should be conducted.
    - Remove sediment and other debris when buildup reaches 6 inches and dispose of the accumulated silt in an approved method that will not additional siltation.
    - Repair any loose wire sheathing.
    - Reshape the berm as needed during inspection.
    - The berm should be replaced when the structure is not functioning as intended due to silt accumulation among the rocks, washout, construction traffic damage, etc.
5. *Silt fence* inspection/maintenance guidelines are listed below:
    - Inspect silt fencing weekly, and after every rainfall.
    - Remove sediment when buildup reaches 6 inches.
    - Replace any torn fabric or install a second line of fencing parallel to the torn section.
    - Replace or repair any crushed or collapsed in the course of construction activity. If a section of fencing obstructs vehicular access, relocate the fencing to a place where it will provide equal protection without obstructing vehicles. A triangular filter dike may be preferred to a silt fence at common vehicle access points.
    - When construction is complete, sediment should be disposed of in a manner that doesn't cause additional siltation and the prior location of the silt fencing should be revegetated. The fence itself should be disposed of in an approved landfill.
6. *Curb Inlet Protection (Gravel Filter Bags)* inspection/maintenance guidelines are listed below:
    - Inspection should be conducted weekly and after each rainfall. Repair or replacement should be done promptly as needed by the contractor.
    - Remove sediment when buildup reaches a depth of 3 inches. Removed sediment should be deposited in a suitable area in a manner that will not erode.
    - Check placement of device to prevent gaps between device and curb.
    - Inspect filter fabric and patch or replace if torn or missing.
    - Structures should be removed and the area stabilized only after the remaining drainage area has been properly stabilized.
7. Trash receptacles will be placed onsite for the use of workmen.
8. Documentation of maintenance/inspection activities will be kept on site.

An example log sheet for the inspection, maintenance and repair of the BMPs follows. The sample document is as provided by the Environmental Protection Agency (EPA). The sample can be found and is available for download at www.epa.gov/. It should be modified for the project specific conditions and BMPs. At a minimum, the Inspection Log / Report utilized by the qualified E&S inspector should provide details related to the inspection, maintenance and repair of the BMPs including observations on the site conditions.

ATTACHMENT J

Schedule of Interim and Permanent Soil Stabilization Practices

Attachment J – BMPs for Upgradient Stormwater

The schedule of interim and permanent soil stabilization will be as follows:

1. Interim/permanent stabilization will be performed on denuded and/or disturbed areas within 14 days after temporary (21 days) or permanent cessation of construction activities.
2. Permanent stabilization will be done with the completion of the infrastructure construction and with the completion of the construction of the main building structure.

Refer to ATTACHMENT C in the TEMPORARY STORMWATER SECTION for a schedule summary.

The soil stabilization practices for this project may include: establishment of temporary vegetation, establishment of permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, and preservation of mature vegetation. Use of drought resistant wildflowers should be considered as a supplement to existing vegetation in appropriate areas. Permanent stabilization of the soil within the roadway is completed with the final pavement course and completion of the sidewalks.

The primary practice will be the establishment of vegetation and the protection of existing vegetation including trees. Seeding and/or sod will be done in areas ready for final landscaping, areas to final grade, and in areas that are otherwise practicable. Areas where final grading is not complete will either be re-vegetated or allowed to re-vegetate naturally. Blankets and matting along with mulch may be used to aid in the establishment of vegetation and/or provide erosion stops.

The Edwards Aquifer Technical Guidance Manual (RG-348, 2005); *Section 1.2, General Guidelines* recommends the following practice for soil stabilization in periods of drought or when vegetation cannot be established.

"During times of year when vegetation cannot be established, soil mulching should be applied to moderate slopes and soils that are not highly erodible. On steep slopes or highly erodible soils, multiple mulching treatments should be used. Interlocking ceramic materials, filter fabric, and netting are available for this purpose…"

"Because of the hardy drought-resistant nature of wildflowers, they may be more beneficial as an erosion control practice than turf grass. While not as dense as turfgrass wildflower thatches and associated grasses are expected to be as effective in erosion control and contaminant absorption. Because thatches of wildflowers do not need fertilizers, pesticides, or herbicides, and the need for watering is minimal, implementation of this practice may result in cost savings… A wildflower stand requires several years to become established; however, maintenance requirements are minimal once the area is established."

The recommended soil stabilization practices are derived from the Edwards Aquifer Technical Guidance Manual (RG-348, 2005); *Section 1.2, General Guidelines, Section 1.3, Temporary Erosion Control BMPs,Section 1.4, Temporary Sediment Control BMPs, and Section 2.5, Landscaping and Vegetative Practices.* More detailed guidance is contained within the sections referenced.

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

I April Wilkerson,
Print Name

Owner,
Title - Owner/President/Other

of Pierced Oak, LLC,
Corporation/Partnership/Entity Name

have authorized James McGarr, PE
Print Name of Agent/Engineer

of Civil Tech, LLC
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:

April Wilkerson — 7/5/23

Applicant's Signature — Date

THE STATE OF Texas §

County of Comal §

BEFORE ME, the undersigned authority, on this day personally appeared April Wilkerson 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 5TH day of July, 2023

Annette Broussard

NOTARY PUBLIC

ANNETTE BROUSSARD
Notary ID #125410606
My Commission Expires
August 24, 2025

Annette Broussard

Typed or Printed Name of Notary

MY COMMISSION EXPIRES: 8/24/2025

Application Fee Form

Texas Commission on Environmental Quality
Name of Proposed Regulated Entity: 23000 FM 306
Regulated Entity Location: 23000 FM 306, Canyon Lake, TX, 78133
Name of Customer: Pierced Oak, LLC
Contact Person: April Wilkerson Phone: 817-713-6510
Customer Reference Number (if issued):CN _____
Regulated Entity Reference Number (if issued):RN _____
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
☒ Mailed to: TCEQ - Cashier
Revenues Section
Mail Code 214
P.O. Box 13088
Austin, TX 78711-3088

☒ San Antonio Regional Office
☐ Overnight Delivery to: TCEQ - Cashier
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	8.99 Acres	$ 5,000
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: April Wilkerson

TCEQ-0574 (Rev. 02-24-15)

pd. $5,000.00
7/3/23
ck # 1074

TCEQ Use Only

TCEQ Core Data Form

For detailed instructions on completing 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 606159051		**RN 111770277**

SECTION II: Customer Information

4. General Customer Information | **5. Effective Date for Customer Information Updates** (mm/dd/yyyy) 4/20/2023

☒ New Customer ☐ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

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:*

Pierced Oak **INC.**

7. TX SOS/CPA Filing Number	**8. TX State Tax ID** (11 digits)	**9. Federal Tax ID** (9 digits)	**10. DUNS Number** *(if applicable)*
804412985	32082982318		

11. Type of Customer: ☐ Corporation ☐ Individual Partnership: ☐ General ☒ Limited
Government: ☐ City ☐ County ☐ Federal ☐ Local ☐ State ☒ Other ☐ Sole Proprietorship ☐ Other:

12. Number of Employees
☒ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher

13. Independently Owned and Operated?
☒ **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 ☐ VCP/BSA Applicant ☐ Other:

15. Mailing Address:

1885 FM 2673

City	Canyon Lake	**State**	TX	**ZIP**	78133	**ZIP + 4**	

16. Country Mailing Information *(if outside USA)*	**17. E-Mail Address** *(if applicable)*
	wilker.ae@gmail.com

18. Telephone Number	**19. Extension or Code**	**20. Fax Number** *(if applicable)*

(817) 713-6510		( ) -

SECTION III: Regulated Entity Information

21. General Regulated Entity Information *(If 'New Regulated Entity" is selected, a new permit application is also required.)*

☒ 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 Core 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.)*

Pierced Oak RV Park

23. Street Address of the Regulated Entity: ***(No PO Boxes)***	23000 FM 306							
	City	Canyon Lake	**State**	TX	**ZIP**	78133	**ZIP + 4**	
24. County	Comal							

If no Street Address is provided, fields 25-28 are required.

25. Description to Physical Location:					
26. Nearest City			**State**		**Nearest ZIP Code**

Latitude/Longitude are required and may be added/updated to meet TCEQ Core Data Standards. (Geocoding of the Physical Address may be used to supply coordinates where none have been provided or to gain accuracy).

27. Latitude (N) In Decimal:	29.940916		**28. Longitude (W) In Decimal:**	98.275944	
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
29	56	27.2970	98	16	33.4036

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)
7033	6515	721211	722330

33. What is the Primary Business of this entity? *(Do not repeat the SIC or NAICS description.)*

Recreational Vehicle Rental Spaces

34. Mailing Address:	**1885 FM 2673**							
	City	**Canyon Lake**	**State**	**TX**	**ZIP**	**78133**	**ZIP + 4**	
35. E-Mail Address:	**wilker.ae@gmail.com**							

36. Telephone Number	**37. Extension or Code**	**38. Fax Number** *(if applicable)*
(817) 713-6510		( ) -

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	☐ Wastewater	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:

SECTION IV: Preparer Information

40. Name:	James McGarr, P.E.	**41. Title:**	Engineer

42. Telephone Number	**43. Ext./Code**	**44. Fax Number**	**45. E-Mail Address**
(210 **)** 365-5029		**( )** -	jmcgarr@civiltechmc.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:	CivilTech, PLLC	**Job Title:**	Engineer	
Name *(In Print):*	James McGarr, P.E.		**Phone:**	**(** 210 **)** 365- **5029**
Signature:			**Date:**	5/9/2023