Bryan W. Shaw, Ph.D., P.E., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

June 24, 2016

RECEIVED

JUN 29 2016

COUNTY ENGINEER

Mr. Kenneth P. Wolf
Two Seventy Seven, Ltd.
8023 Vantage Dr. Suite 1200
San Antonio, Texas 78230-4726

Re: Edwards Aquifer, Comal County

NAME OF PROJECT: Park Village Waste Water Treatment Plant; Located approximately 5,900 feet due south of State Highway 46 and Blanco Road then 600 feet due east from Bulverde Road intersection; Bulverde, Texas

TYPE OF PLAN: Request for Approval of a Contributing Zone Plan (CZP); 30 Texas Administrative Code (TAC) Chapter 213 Subchapter B Edwards Aquifer

Regulated Entity No. RN105842298; Additional ID No. 13000066

Dear Mr. Wolf:

The Texas Commission on Environmental Quality (TCEQ) has completed its review of the CZP Application for the above-referenced project submitted to the San Antonio Regional Office by IDS Engineering Group on behalf of Two Seventy Seven, Ltd. on March 30, 2016. Final review of the CZP was completed after additional material was received on May 3, 2016 and May 25, 2016. As presented to the TCEQ, the Temporary and Permanent Best Management Practices (BMPs) were selected and construction plans were prepared by a Texas Licensed Professional Engineer to be in general compliance with the requirements of 30 TAC Chapter 213. These planning materials were sealed, signed and dated by a Texas Licensed Professional Engineer. Therefore, based on the engineer's concurrence of compliance, the planning materials for construction of the proposed project and pollution abatement measures are hereby approved subject to applicable state rules and the conditions in this letter. The applicant or a person affected may file with the chief clerk a motion for reconsideration of the executive director's final action on this Edwards Aquifer Protection Plan. A motion for reconsideration must be filed no later than 23 days after the date of this approval letter. *This approval expires two (2) years from the date of this letter unless, prior to the expiration date, more than 10 percent of the construction has commenced on the project or an extension of time has been requested.*

PROJECT DESCRIPTION

The proposed commercial project will have an area of approximately 4.6 acres. It will include the construction of a wastewater treatment plant with associated buildings and access drive. The impervious cover will be 1.0 acre (21.7 percent). Project wastewater will be disposed of by conveyance to the proposed Park Village Waste Water Treatment Plant owned by the Two Seventy Seven, Ltd.

PERMANENT POLLUTION ABATEMENT MEASURES

To prevent the pollution of stormwater runoff originating on-site or upgradient of the site and potentially flowing across and off the site after construction, one 15 foot wide engineered vegetative filter strip, and two 50 foot wide natural vegetative filter strips, designed using the TCEQ technical guidance document, Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices (2005), will be constructed to treat stormwater runoff. The required total suspended solids (TSS) treatment for this project is 898 pounds of TSS generated from the 1.0 acre of impervious cover. The approved measures meet the required 80 percent removal of the increased load in TSS caused by the project.

The two 50 foot wide natural vegetative filter strips shall remain in its natural state with a uniform slope of less than ten percent, and the 15 foot wide engineered vegetative filter strip will have a uniform slope of less than 20 percent, a vegetated cover of at least 80 percent, and will extend along the entire length of the contributing area.

SPECIAL CONDITIONS

I. Within 60 days of receiving written approval of an Edwards Aquifer Protection Plan, the applicant must submit to the San Antonio Regional Office, proof of recordation of notice in the county deed records, with the volume and page number(s) of the county deed records of the county in which the property is located. A description of the property boundaries shall be included in the deed recordation in the county deed records. A suggested format (Deed Recordation Affidavit, TCEQ-0625A) that you may use to deed record the approved CZP is enclosed.

II. All permanent pollution abatement measures shall be operational prior to occupancy of the facility.

STANDARD CONDITIONS

1. Pursuant to Chapter 7 Subchapter C of the Texas Water Code, any violations of the requirements in 30 TAC Chapter 213 may result in administrative penalties.
2. The holder of the approved Edwards Aquifer protection plan must comply with all provisions of 30 TAC Chapter 213 and all best management practices and measures contained in the approved plan. Additional and separate approvals, permits, registrations and/or authorizations from other TCEQ Programs (i.e., Stormwater, Water Rights, UIC) can be required depending on the specifics of the plan.
3. In addition to the rules of the Commission, the applicant may also be required to comply with state and local ordinances and regulations providing for the protection of water quality.

Prior to Commencement of Construction:

4. All contractors conducting regulated activities at the referenced project location shall be provided a copy of this notice of approval. At least one complete copy of the approved Contributing Zone Plan and this notice of approval shall be maintained at the project location until all regulated activities are completed.
5. Any modification to the activities described in the referenced CZP application following the date of approval may require the submittal of a plan to modify this approval, including the payment of appropriate fees and all information necessary for its review and approval prior to initiating construction of the modifications.
6. The applicant must provide written notification of intent to commence construction, replacement, or rehabilitation of the referenced project. Notification must be submitted to the San Antonio Regional Office no later than 48 hours prior to commencement of the regulated activity. Written notification must include the name of the approved plan and file number for the regulated activity,

the date on which the regulated activity will commence, and the name of the prime contractor with the name and telephone number of the contact person.

7. Temporary erosion and sedimentation (E&S) controls, i.e., silt fences, rock berms, stabilized construction entrances, or other controls described in the approved Storm Water Pollution Prevention Plan (SWPPP) must be installed prior to construction and maintained during construction. Temporary E&S controls may be removed when vegetation is established and the construction area is stabilized. If a water quality pond is proposed, it shall be used as a sedimentation basin during construction. The TCEQ may monitor stormwater discharges from the site to evaluate the adequacy of temporary E&S control measures. Additional controls may be necessary if excessive solids are being discharged from the site.

During Construction:

8. During the course of regulated activities related to this project, the applicant or his agent shall comply with all applicable provisions of 30 TAC Chapter 213, Edwards Aquifer. The applicant shall remain responsible for the provisions and conditions of this approval until such responsibility is legally transferred to another person or entity.
9. If sediment escapes the construction site, the 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). Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been significantly reduced. 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).
10. Intentional discharges of sediment laden water are not allowed. If dewatering becomes necessary, the discharge will be filtered through appropriately selected best management practices. These may include vegetated filter strips, sediment traps, rock berms, silt fence rings, etc.
11. The following records shall be maintained and made available to the executive director upon request: the dates when major grading activities occur, the dates when construction activities temporarily or permanently cease on a portion of the site, and the dates when stabilization measures are initiated.
12. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, and construction activities will not resume within 21 days. When the initiation of stabilization measures by the 14th day is precluded by weather conditions, stabilization measures shall be initiated as soon as practicable.
13. This approval does not authorize the installation of temporary aboveground storage tanks on this project. If the contractor desires to install a temporary aboveground storage tank for use during construction, an application to modify this approval must be submitted and approved prior to installation. The application must include information related to tank location and spill containment. Refer to Standard Condition No. 5, above.

After Completion of Construction:

14. Owners of permanent BMPs and measures must insure that the 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 San Antonio Regional Office within 30 days of site completion.
15. The applicant shall be 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. A copy of the transfer of responsibility must be filed with the executive director through the San Antonio Regional Office within 30 days of the transfer. A copy of the transfer form (TCEQ-10263) is enclosed.

16. Upon legal transfer of this property, the new owner(s) is required to comply with all terms of the approved Contributing Zone Plan. If the new owner intends to commence any new regulated activity on the site, a new Contributing Zone Plan that specifically addresses the new activity must be submitted to the executive director. Approval of the plan for the new regulated activity by the executive director is required prior to commencement of the new regulated activity.
17. A Contributing Zone Plan approval or extension will expire and no extension will be granted if more than 50 percent of the total construction has not been completed within ten years from the initial approval of a plan. A new Contributing Zone Plan must be submitted to the San Antonio Regional Office with the appropriate fees for review and approval by the executive director prior to commencing any additional regulated activities.
18. At project locations where construction is initiated and abandoned, or not completed, the site shall be returned to a condition such that the aquifer is protected from potential contamination.

This action is taken under authority delegated by the Executive Director of the Texas Commission on Environmental Quality. If you have any questions or require additional information, please contact Mr. Joshua Vacek of the Edwards Aquifer Protection Program of the San Antonio Regional Office at 210-403-4028.

Sincerely,

Lynn Bumguardner, Water Section Manager
San Antonio Region
Texas Commission on Environmental Quality

LB/JV/eg

Enclosures: Deed Recordation Affidavit, Form TCEQ-0625A
Change in Responsibility for Maintenance of Permanent BMPs, Form TCEQ-10263

cc: Mr. Jose Cantu, P.E., IDS Engineering Group
Mr. Thomas H. Hornseth, P.E., Comal County Engineer
The Honorable Bill Krawietz, City of Bulverde
Mr. Roland Ruiz, Edwards Aquifer Authority
Mr. George Wissman, Comal Trinity WCD
TCEQ Central Records, Building F, MC212

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

RECEIVED
MAY 09 2016
COUNTY ENGINEER

I **Todd A. Gold**,
Print Name

Manager of Two Seventy Seven GP, LLC, its General Partner,
Title - Owner/President/Other

of **Two Seventy Seven, Ltd.**,
Corporation/Partnership/Entity Name

have authorized **Jose A. Cantu , P.E.**
Print Name of Agent/Engineer

of **IDS Engineering Group**
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.

TCEQ R-13 2016 MAY 03 11:29

TCEQ R-13 2016 MAY 03 11:29

SIGNATURE PAGE:

Applicant's Signature

4-25-16
Date

THE STATE OF Texas §

County of Bexar §

BEFORE ME, the undersigned authority, on this day personally appeared Todd A Gold 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.

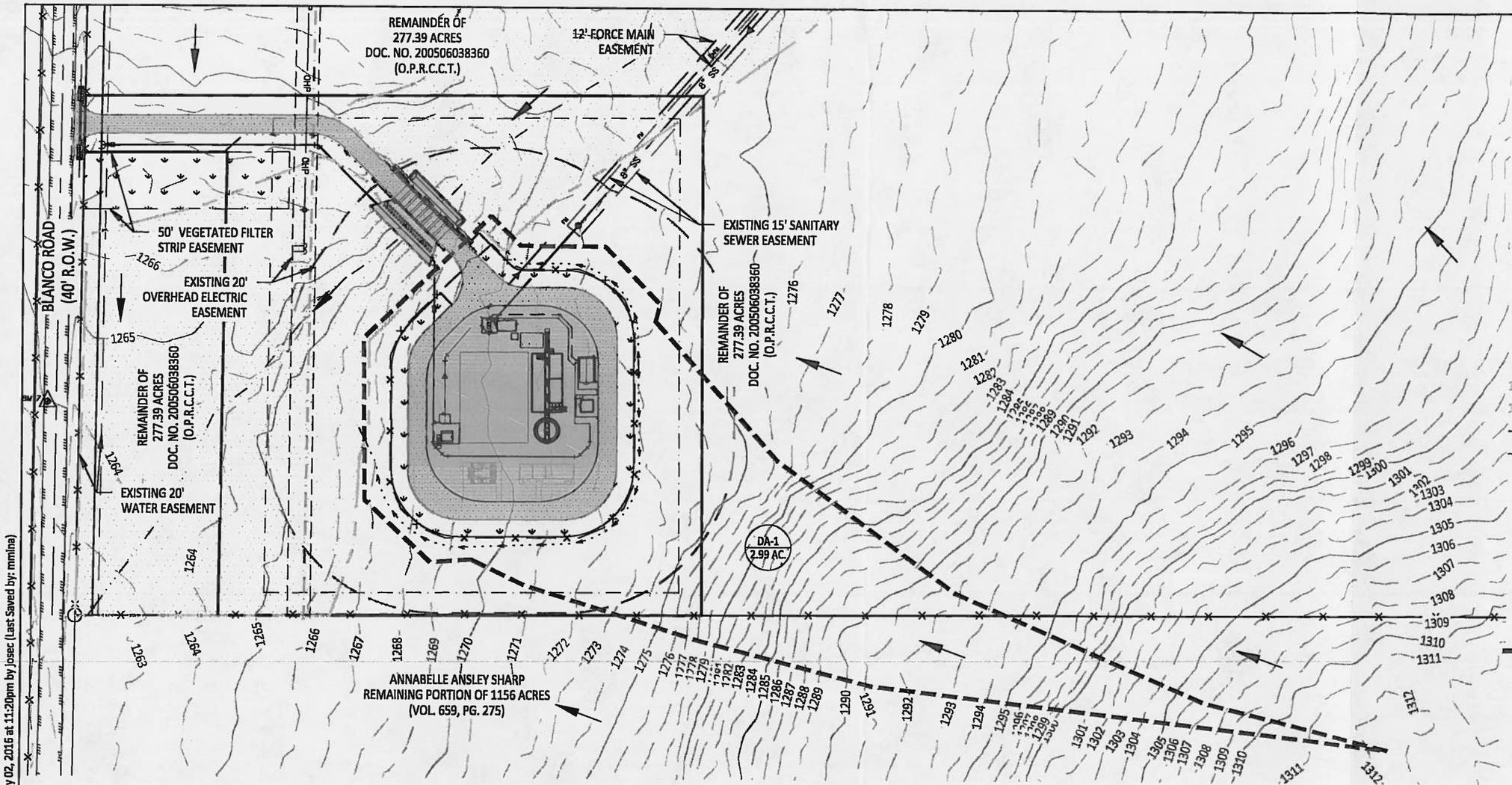
GIVEN under my hand and seal of office on this 25th day of April, 2016.

NOTARY PUBLIC

Elaina Brown
Typed or Printed Name of Notary

MY COMMISSION EXPIRES: 10-15-16

ELAINA BROWN
Notary Public, State of Texas
My Commission Expires
October 15, 2016



RUNOFF CALCULATIONS

Rational Method (Q = CIA)

Existing Conditions

[DA-1] Q = (0.49)(4.4)(2.99) = **6.44 CFS**

Proposed Conditions

[DA-1] Q = (0.57)(4.4)(2.99) = **7.50 CFS**

INTERCEPTOR SWALE CALCULATIONS

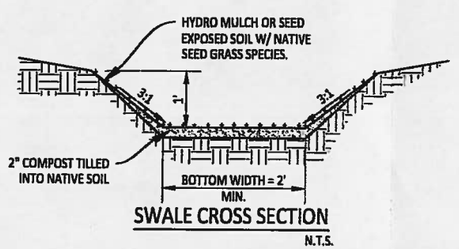
Channel Velocity

(V = Q/A)

V = 7.50 cfs / 3.45 sf = **2.17 ft/s**

IMPERVIOUS COVER

1.00 AC



SWALE CROSS SECTION

N.T.S.

NO	DATE:	REVISIONS	DWG	CHK
1	04/26/2016	IMPERVIOUS COVER	MGM	JAC

STATE OF TEXAS
JOSE CANTU
111818
LICENSED
PROFESSIONAL ENGINEER
5-21-16

IDS Engineering Group
TBPE F-002726 TBPLS 10110704
813 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

DRAINAGE AREA MAP

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	5

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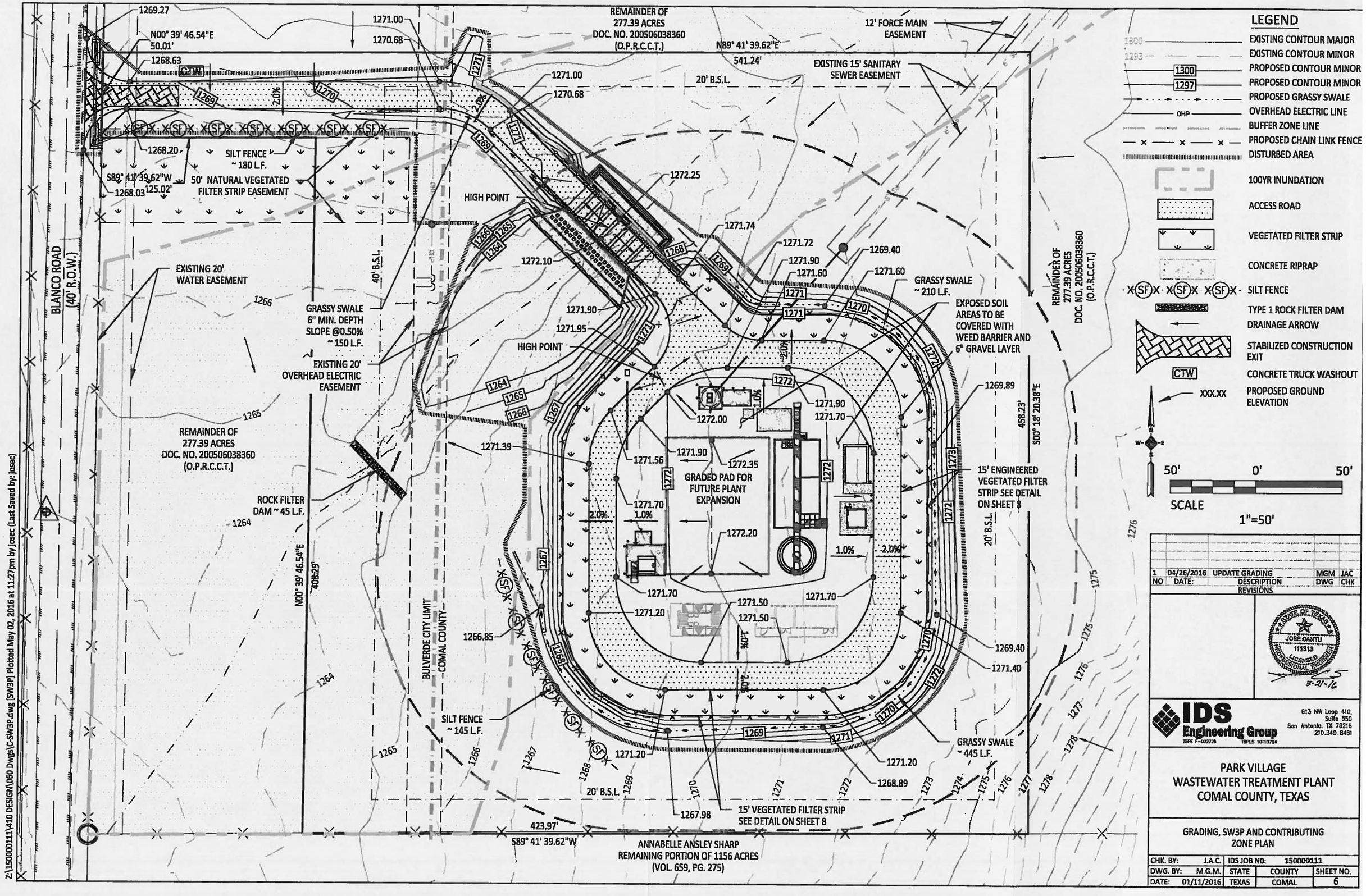
1269.27
N00° 39' 46.54"E
50.01'
1268.63
CTW
1271.00
1270.68
REMAINDER OF
277.39 ACRES
DOC. NO. 200506038360
(O.P.R.C.C.T.)
N89° 41' 39.62"E
541.24'
12' FORCE MAIN
EASEMENT
EXISTING 15' SANITARY
SEWER EASEMENT
20' B.S.L.
1271.00
1270.68
1268.20
SILT FENCE
~ 180 L.F.
S89° 41' 39.62"W
125.02'
1268.03
50' NATURAL VEGETATED
FILTER STRIP EASEMENT
HIGH POINT
1272.25
1271.74
1271.72
1269.40
1271.90
1271.60
1271.60
1272.10
GRASSY SWALE
~ 210 L.F.
EXPOSED SOIL
AREAS TO BE
COVERED WITH
WEED BARRIER AND
6" GRAVEL LAYER
BLANCO ROAD
(40' R.O.W.)
EXISTING 20'
WATER EASEMENT
40' B.S.L.
GRASSY SWALE
6" MIN. DEPTH
SLOPE @0.50%
~ 150 L.F.
1271.90
1271.95
HIGH POINT
EXISTING 20'
OVERHEAD ELECTRIC
EASEMENT
REMAINDER OF
277.39 ACRES
DOC. NO. 200506038360
(O.P.R.C.C.T.)
1269.89
1271.90
1271.70
1272.00
1271.39
1271.56
1271.90
1272.35
GRADED PAD FOR
FUTURE PLANT
EXPANSION
15' ENGINEERED
VEGETATED FILTER
STRIP SEE DETAIL
ON SHEET 8
ROCK FILTER
DAM ~ 45 L.F.
N00° 39' 46.54"E
406.29'
1271.70
1272.20
1271.70
1271.50
1271.20
1271.50
1271.70
1269.40
1271.40
BULVERDE CITY LIMIT
COMAL COUNTY
1266.85
SILT FENCE
~ 145 L.F.
GRASSY SWALE
~ 445 L.F.
1271.20
1271.20
1268.89
1267.98
15' VEGETATED FILTER STRIP
SEE DETAIL ON SHEET 8
20' B.S.L.
423.97'
S89° 41' 39.62"W
ANNABELLE ANSLEY SHARP
REMAINING PORTION OF 1156 ACRES
(VOL. 659, PG. 275)
S00° 18' 20.38"E
458.23'
REMAINDER OF
277.39 ACRES
DOC. NO. 200506038360
(O.P.R.C.C.T.)
LEGEND
EXISTING CONTOUR MAJOR
EXISTING CONTOUR MINOR
PROPOSED CONTOUR MINOR
PROPOSED CONTOUR MINOR
PROPOSED GRASSY SWALE
OVERHEAD ELECTRIC LINE
BUFFER ZONE LINE
PROPOSED CHAIN LINK FENCE
DISTURBED AREA
100YR INUNDATION
ACCESS ROAD
VEGETATED FILTER STRIP
CONCRETE RIPRAP
SILT FENCE
TYPE 1 ROCK FILTER DAM
DRAINAGE ARROW
STABILIZED CONSTRUCTION
EXIT
CONCRETE TRUCK WASHOUT
PROPOSED GROUND
ELEVATION
50'
0'
50'
SCALE
1"=50'
1 04/26/2016 UPDATE GRADING MGM JAC
NO DATE: DESCRIPTION DWG CHK
REVISIONS
STATE OF TEXAS
JOSE CANTU
111313
LICENSED
PROFESSIONAL ENGINEER
5-27-16
IDS Engineering Group
TBPE F-002726 TBPLS 10110704
613 NW Loop 410,
Suite 550
San Antonio, TX 78216
210.340.8481
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS
GRADING, SW3P AND CONTRIBUTING
ZONE PLAN
CHK. BY: J.A.C. IDS JOB NO: 150000111
DWG. BY: M.G.M. STATE COUNTY SHEET NO.
DATE: 01/11/2016 TEXAS COMAL 6
Z:\150000111\410 DESIGN\060 Dwgs\C-SW3P.dwg [SW3P] Plotted May 02, 2016 at 11:27pm by josec (Last Saved by: josec)

Bryan W. Shaw, Ph.D., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

March 31, 2016

RECEIVED
APR 04 2016
COUNTY ENGINEER

Mr. Thomas H. Hornseth, P.E.
Comal County Engineer
195 David Jonas Drive
New Braunfels TX 78132-3710

Re: Edwards Aquifer, Comal County

PROJECT NAME: Park Village Waste Water Treatment Plant, located approximately 5,900 feet due south of State Highway 46 and Blanco Road then 600 feet due east from Bulverde Road intersection, Bulverde, Texas

PLAN TYPE: Application for Contributing Zone Water Pollution Abatement Plan (CZP) 30 Texas Administration Code (TAC) Chapter 213; Edwards Aquifer Protection Program

Dear Mr. Hornseth:

The referenced application is being forwarded to you pursuant to the Edwards Aquifer Rules. The Texas Commission on Environmental Quality (TCEQ) is required by 30 TAC Chapter 213 to provide copies of all applications to affected incorporated cities and underground water conservation districts for their comments prior to TCEQ approval. More information regarding this project may be obtained from the TCEQ Central Registry website at http://www.tceq.state.tx.us/permitting/central_registry/.

Please forward your comments to this office by May 1, 2016.

The Texas Commission on Environmental Quality appreciates your assistance in this matter and your compliance efforts to ensure protection of the State's environment. If you or members of your staff have any questions regarding these matters, please feel free to contact the San Antonio Region Office at (210) 490-3096.

Sincerely

Todd Jones

Todd Jones, Water Section Work Leader
San Antonio Regional Office

TJ/eg

RECEIVED
APR 04 2016
COUNTY ENGINEER

CONTRIBUTING ZONE PLAN

FOR

PARK VILLAGE WASTE WATER TREATMENT PLANT

RECEIVED
TCEQ-R13 (EAPP)
MAR 30 2016
SAN ANTONIO

PREPARED BY:

IDS Engineering Group

TBPE F-002726

613 NW LOOP 410, SUITE 550

SAN ANTONIO, TEXAS 78216

PHONE: 210-340-8481

FAX: 210-340-3964

JANUARY 2016

IDS PROJECT NO.: 1500-001-11

RECEIVED
APR 04 2016
COUNTY ENGINEER

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 if not withdrawn the application will be denied and 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 to you:

- You can withdraw your application, and your fees will be refunded or credited for a resubmittal.
- 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 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 effected 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: **Park Village WWTP**						**2. Regulated Entity No.: 105842298**			
3. Customer Name: Two Seventy Seven, Ltd.						**4. Customer No.: 603589474**			
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):**			2.0
9. Application Fee:	$4,000		**10. Permanent BMP(s):**			VFS, Grassy Swales			
11. SCS (Linear Ft.):	N/A		**12. AST/UST (No. Tanks):**			N/A			

13. County:	Comal	14. Watershed:	N/A

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.)	___	___	___	___	___
Region (1 req.)	___	___	___	___	___
County(ies)	___	___	___	___	___
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	___Bulverde ___Fair Oaks Ranch ___Garden Ridge ___New Braunfels ___Schertz	NA	___San Antonio ETJ (SAWS)	NA

	__San Antonio (SAWS) __Shavano Park				

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.

Jose A. Cantu

Print Name of Customer/Authorized Agent

Signature of Customer/Authorized Agent — Date: 1/4/16

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):	

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I. Contributing Zone Plan – Application

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: Jose A. Cantu, P.E.

Date: 1/4/16

Signature of Customer/Agent:



RECEIVED
APR 04 2016
COUNTY ENGINEER

Regulated Entity Name: Park Village WWTP

Project Information

1. County: Comal
2. Stream Basin: Guadalupe River Basin
3. Groundwater Conservation District (if applicable): N/A
4. Customer (Applicant):

   Contact Person: Kenneth P. Wolf
   Entity: Two Seventy Seven, Ltd.
   Mailing Address: 8023 Vantage Dr. Suite 1200
   City, State: San Antonio, Texas Zip: 78230-4726
   Telephone: 210-524-1307 Fax: 210-524-4029
   Email Address: kwolf@reocsanantonio.com

5. Agent/Representative (If any):

Contact Person: Jose A. Cantu
Entity: IDS Engineering Group
Mailing Address: 613 NW Loop 410, Suite 550
City, State: San Antonio , Texas Zip: 78216
Telephone: 210-340-8481 Fax: 210-340-3964
Email Address: jcantu@idsengineeringgroup.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 City of Bulverde.
☐ 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.

_____

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: Waste Water Treatmen Plant

13. Total project area (size of site): 4.6 Acres

Total disturbed area: 2.0 Acres

14. Estimated projected population: N/A

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		÷ 43,560 =	
Parking		÷ 43,560 =	
Other paved surfaces	43560	÷ 43,560 =	1.0
Total Impervious Cover	43560	÷ 43,560 =	1.0

Total Impervious Cover 1.0 **÷ Total Acreage** 4.6 **X 100 =** 21.7**% 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" = 50'.

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): Computed 100year innundation as part of the Park Village Master Development Plan.

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

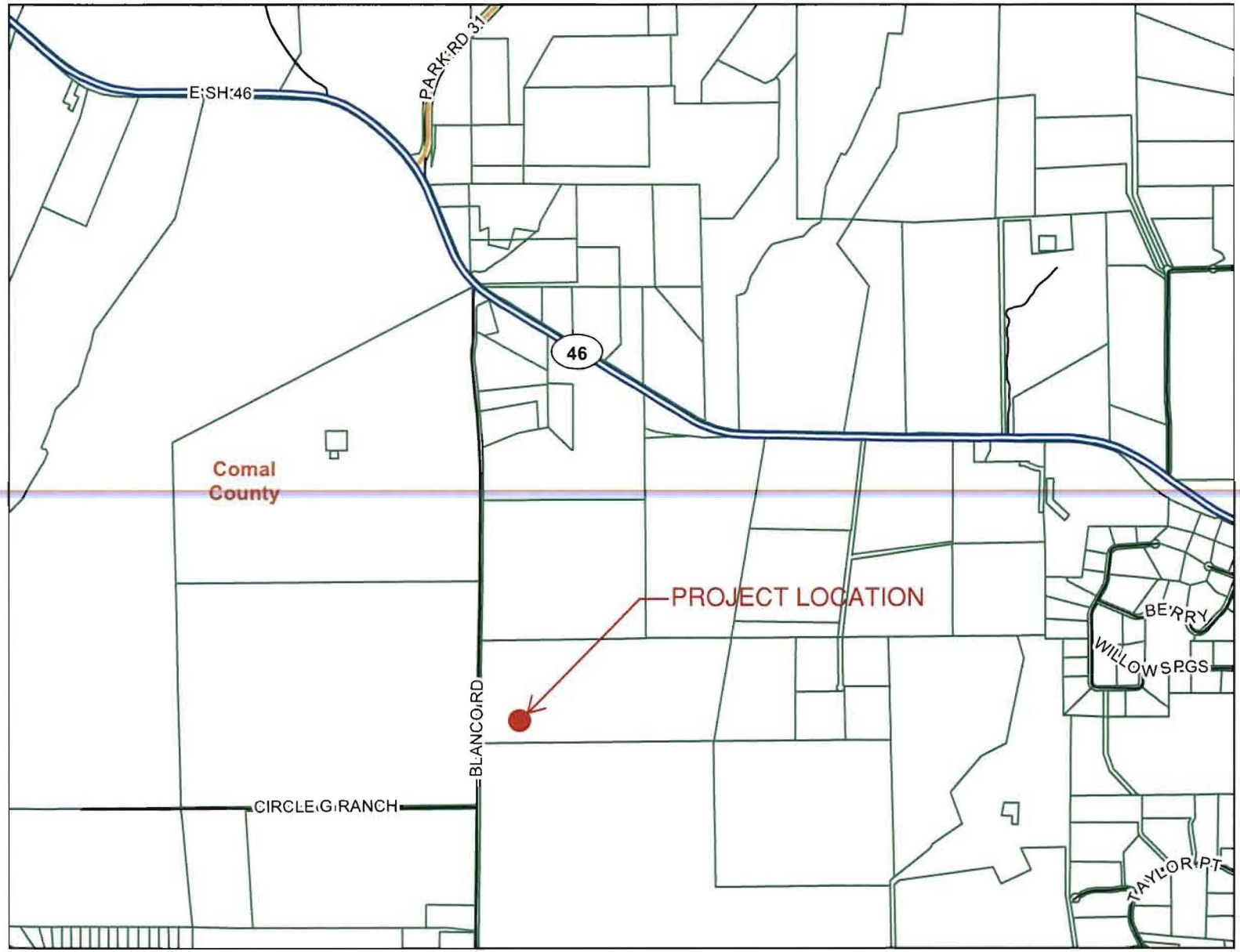
61. ☒ Submit one (1) original and one (1) copy of the application, plus additional copies as needed for each affected incorporated city, groundwater conservation district, and county in which the project will be located. The TCEQ will distribute the additional copies to these jurisdictions.

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.

II. ATTACHMENT A – LOCATION MAP



IDS Engineering Group

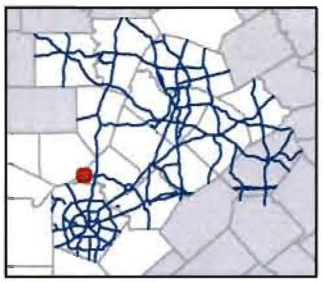
TBPE F-2726 | TBPLS 10110700 | TBPLS 10110704

Legend

- Pipelines (Reference Only)
- Wastewater Lines
- Stormwater Lines
- Cross Sections (HEC-RAS)
- Proposed Roads
- Rivers & Streams
- LiDAR or USGS Contours
- IDS - Tracts of Interest
- IDS - MUDs
- MUD Boundaries
- Watersheds
- Subwatersheds
- ISD Boundaries (TEA)
- Flood Control Easements
- Parcel Boundaries
- Abstracts (TNRIS/GLO)
- County Line
- City Limits
- ETJ

FEMA Floodplain

- Floodway
- 100 Year
- 500 Year



ROAD MAP

ATTACHMENT A

Print Date: 9/9/2015 1:55:22 PM

1 inch = 2,000 feet

N W E S

Disclaimer. This web site represents the information that has been made available for the use of this system and does not necessarily include the most complete and/or accurate data. IDS Engineering Group does not warrant its accuracy or completeness. Verification should be done as necessary.

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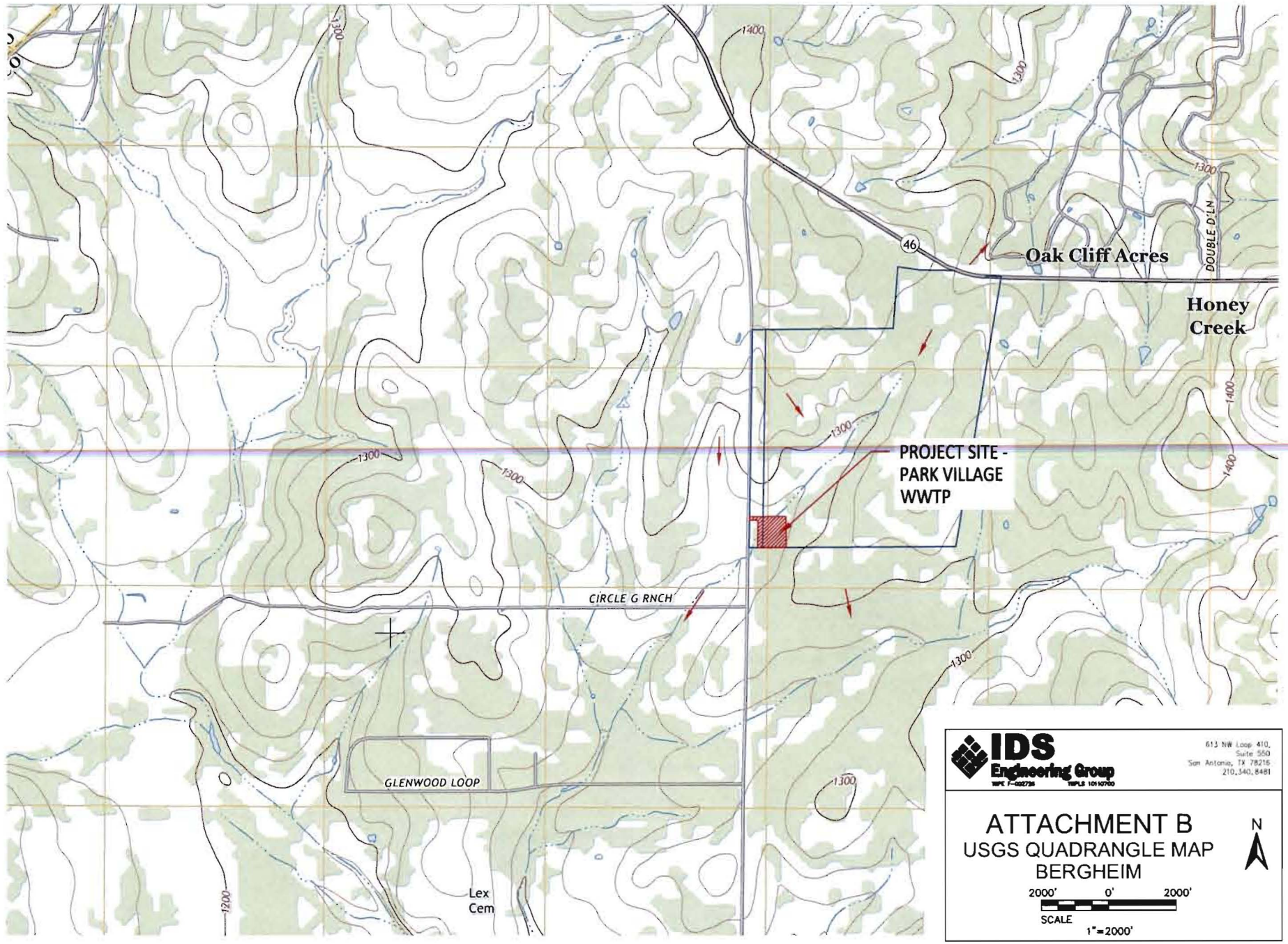
III. ATTACHMENT B – USGS QUADRANGLE MAP



IDS Engineering Group
TBPE F-002726 TBPLS 10107700
613 NW Loop 410,
Suite 550
San Antonio, TX 78216
210.340.8481

ATTACHMENT B

USGS QUADRANGLE MAP
BERGHEIM

N

2000' 0' 2000'

SCALE

1"=2000'

Z:\15000011\300 ENG REPTS\40 Drain\Contributing Zone Plan\Application Attachments\Attachment B-USGS Quadrangle Map.dwg [Layout1] Plotted Jan 14, 2018 at 3:56pm by Gromero (Last Saved by Gromero)

IV. ATTACHMENT C – Project Narrative

The proposed project site for the Park Village Waste Water Treatment Plant is located in Comal County, Texas inside the extra territorial jurisdiction of the City of Bulverde. The site is approximately 5900 feet south of the intersection with S.H. 46 and Blanco Road. The site is currently undeveloped. The proposed property boundary of the waste water treatment plant is about 4.6 acres of which 2.0 acres will be disturbed. The total impervious cover for the site is 1.0 acres which accounts for the ultimate build out of the wastewater treatment plant. The improvements include the waste water treatment plant, access road, and utilities required to run the plant such as potable water, drainage, and electricity. The waste water treatment plant will serve the Park Village Subdivision.

The storm water run-off from the site generally flows from the southeast to the northwest into a natural low which then flows to the southwest into a tributary of Cibolo Creek. Offsite areas which drain to the plant will be intercepted by channel and conveyed away from the site. Both temporary and permanent BMPs will be required for the site. Temporary BMPs such as silt fence and rock filter dams will be used to treat runoff during construction. Storm water runoff generated form the proposed site will be treated by using both vegetated filter strips and grassy swales.

V. ATTACHMENT D – Factors Affecting Surface Water Quality

The quality of storm water runoff from the site will be affected primarily form the paved areas of the facility and the access road to the plant.

VI. ATTACHMENT E – Volume and Character of Stormwater

Using the rational method, we can determine the increase of peak volume from the drainage area of the site.

Drainage Area 1

Frequency Storm	Undeveloped (C=49) runoff volume (cfs)	Developed (C=57) runoff volume (cfs)	Increase in runoff volume (cfs)
25-yr	7	8	1
100-yr	9	10	1

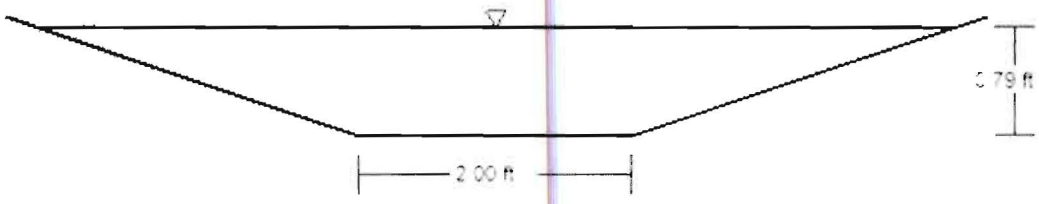
The runoff will contain small amounts of suspended solids from paved areas such as the treatment plant facility and the access road to the plant.

The grassy swales for this site intercept upgradient stormwater flow at a high point on the east side of the treatment plant, the runoff is diverted by the swales and conveyed towards the 100 year inundation area.

Swale parameters:

Roughness Coefficient	0.030	
Channel Slope	0.50000	%
Normal Depth	0.79	ft
Left Side Slope	3.00	ft/ft (H:V)
Right Side Slope	3.00	ft/ft (H:V)
Bottom Width	2.00	ft
Discharge	7.50	ft³/s

Cross Section Image



- Channel velocity

V = Q / A

V: velocity

Q: flow rate

A: cross sectional area

V = 7.50 cfs / 3.45 sf = **2.17 ft/s**

Velocity

✓ 2.17 ft/s < 6 ft/s (Velocity meets the minimum requirement)

Grade

✓ 0.50% < 2.00% (Grade meets the minimum requirement)

Per TCEQ RG-348 Page 1-11, interceptor swale stabilization is not required.

Load calculations for Permanent BMP's in Series:

Project name: **Park Village Wastewater Treatment Plant**

BMP Efficiency

Combination Vegetative Filter Strips & Grassy Swales

Two BMP's in series: $E_{TOT} = [1-((1-E_1) \times (1-0.5\ E_2))] \times 100$

E_1 = Vegetative filter strips efficiency

E_2 = Grassy swales efficiency

E_{TOT} = Total BMP efficiency

E_1 = **0.80**

E_2 = **0.70**

E_{TOT} = **0.87**

Load Calculation

RG-348 Page 3-33 Equation 3.7: L_R = (BMP efficiency) x P x (A_I x 34.6 + A_P x 0.54)

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

P = **33** inches

A_C = **2.99** acres

A_I = **1.00** acres

A_P = **1.99** acres

L_R = **1,024** lbs

Fraction of Annual Rainfall To Be Treated

$F = L / L_R$

L = **781** lbs

L_R = **1,024** lbs

F = **0.76**

VII. ATTACHMENT F – Suitability Letter from Authorized Agent

Not Applicable

VIII. ATTACHMENT G – Alternative Secondary Containment Methods

Not Applicable

IX. ATTACHMENT H – AST Containment Structure Drawings

Not Applicable

X. ATTACHMENT I – 20% or Less Impervious Cover Waiver

Not Applicable – The total impervious cover exceeds 20%, a waiver will not be requested.

XI. ATTACHMENT J – BMPs for Upgradient Stormwater

Upgradient stormwater does flow through the site under existing conditions. The upgradient flow will be intercepted and conveyed through proposed channels/swales to a natural low. This flow will bypass the site. Therefore, runoff which originates upgradient of the site will not be treated.

XII. ATTACHMENT K – BMPs for On-site Stormwater

Best Management Practices (BMPs) will be designed and implemented in order to minimize to the extent practicable the discharge of pollutants in stormwater associated with construction activity and in eligible non-storm water discharges. Erosion and sediment controls have been designed to retain sediment on-site to the extent practicable. Control measures will be properly selected installed and maintained according to the designer's specifications. Controls will be developed to minimize the offsite transport of litter, construction debris, and construction materials. If existing BMPs are modified or if additional BMPs are necessary, an implementation schedule will be described in the inspection report and wherever possible those changes implemented before the next storm event. If implementation before the next anticipated storm event is impracticable, these changes will be implemented as soon as practicable. For more specific information on BMPs please reference the temporary and permanent storm water sections in this report.

The following is a list of some of the BMP design elements implemented on this project.

Temporary BMPs include: Silt Fence, rock filter dams, construction exit, and concrete wash out areas.

Permanent BMPs include: Natural and Engineered Vegetative Filter Strips, and Grassy Swales.

XIII. ATTACHMENT L – BMPs for Surface Streams

Both temporary and permanent BMPs will be used on the site to prevent pollutants from entering surface streams. Temporary BMPs include silt fence, rock filter dams, concrete washout pits. The temporary BMPs will be put in place prior to major construction activities that will disturb soil. Permanent BMPs consist of a natural and engineered vegetated filter strips in addition to grassy swales. See site plan for details.

XIV. ATTACHMENT M – Construction Plans

The following construction plans are included for review:

Site Plan, SWPPP, Drainage and associated details.

XV. ATTACHMENT N – Inspection, Maintenance, Repair and Retrofit Plan.

See attached maintenance plans and schedules for permanent BMPs to include Engineered Vegetative Filter Strips and Grassy Swales.

XVI. ATTACHMENT O – Pilot-Scale Field Testing Plan

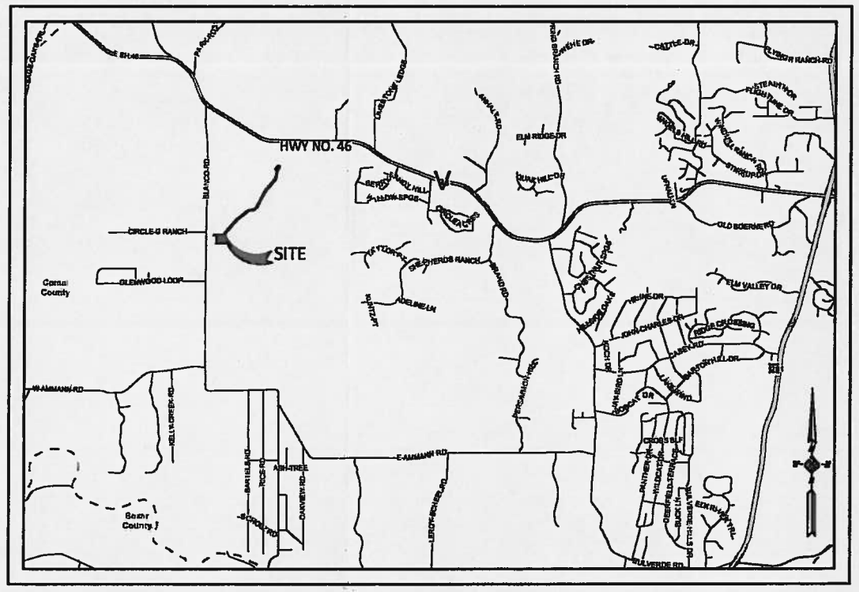
Not Applicable

XVII. ATTACHMENT P – Measures for Minimizing Surface Stream Contamination

All post construction runoff from the site will be treated through natural and engineered vegetated filter strips. Increase in velocities caused by concentrating flows into the proposed culverts will be reduced with concrete energy dissipators located on the downstream apron of the culverts. The reduction in velocities will help to prevent erosion from occurring downstream of the site. Any increase in runoff due to increase in impervious cover of the waste water treatment plant has been taken into account and mitigated for in the regional detention pond for the Park Village Subdivision. This will help to prevent increased stream flashing and reduce the velocities in stream.

PARK VILLAGE WASTEWATER TREATMENT PLANT
CONSTRUCTION PLANS
COMAL COUNTY, TEXAS.

IDS JOB NO. 1500-001-11



LOCATION MAP
N.T.S.

OWNER:
TWO SEVENTY SEVEN PARK VILLAGE, LTD.
8023 VANTAGE DR., Suite 1200
SAN ANTONIO, TEXAS 78230
PHONE : 210-524-4000
FAX: 210-524-4029

IDS Engineering Group
TBPE F-002726 TBPLS 10110704

613 NW Loop 410,
Suite 550
San Antonio, TX 78216
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SHEET INDEX

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	4	PROCESS FLOW DIAGRAM
	5	DRAINAGE AREA MAP
	6	GRADING, SW3P AND CONTRIBUTING ZONE PLAN
	7	SITE PLAN AND DIMENSION CONTROL PLAN
	8	MISCELLANEOUS DETAILS
	9	CULVERT A AND B PLAN AND PROFILE
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	20	FORCE MAIN PLAN AND PROFILE STA. 15+50 TO STA. 21+50
	21	FORCE MAIN PLAN AND PROFILE STA. 21+50 TO STA. 27+50
	22	FORCE MAIN PLAN AND PROFILE STA. 27+50 TO STA. 33+50
	23	FORCE MAIN PLAN AND PROFILE STA. 33+50 TO STA. 39+50
	24	FORCE MAIN PLAN AND PROFILE STA. 39+50 TO STA. 45+50
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* THE STANDARD SHEETS SPECIFICALLY IDENTIFIED ABOVE HAVE BEEN SELECTED BY ME OR UNDER MY RESPONSIBLE SUPERVISION AS BEING APPLICABLE TO THIS PROJECT.

STATE OF TEXAS
JOSE CANTU
111313
LICENSED
PROFESSIONAL ENGINEER
5-21-16

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GENERAL NOTES:

1. CONTRACTOR SHALL COMPLY WITH APPLICABLE BUILDING CODE AND REGULATIONS, AS WELL AS OTHER SAFETY CODES AND INSPECTION PROVISIONS APPLICABLE TO THIS PROJECT.

2. CONTRACTOR SHALL SECURE ALL PERMITS REQUIRED FOR CONSTRUCTION AND SHALL NOTIFY ALL RESPECTIVE GOVERNMENTAL OR UTILITY AGENCIES AFFECTED BY CONSTRUCTION PRIOR TO STARTING CONSTRUCTION.

3. CONTRACTOR IS REQUIRED TO VERIFY PROJECT ELEVATIONS. "MATCH EXISTING" SHALL BE UNDERSTOOD TO SIGNIFY VERTICAL AND HORIZONTAL ALIGNMENT.

4. EXISTING ABOVE GROUND UTILITIES HAVE BEEN PLOTTED BASED UPON DIRECT FIELD INVESTIGATION. UNDERGROUND UTILITIES HAVE BEEN COMPILED FROM VARIOUS SOURCES AND REQUIRE VERIFICATION BY THE CONTRACTOR TO ESTABLISH THEIR EXACT LOCATION AND DEPTH CONTRACTOR SHALL BE RESPONSIBLE FOR DAMAGE TO ALL EXISTING ABOVE GROUND OR UNDERGROUND UTILITIES, INCLUDING THOSE NOT SHOWN ON DRAWINGS. DEAD END UTILITY LINES SHALL BE SUITABLY CAPPED. THE CONTRACTOR SHALL NOTIFY THE GOVERNMENTAL AND/OR UTILITY AGENCIES REGARDING THE LOCATION OF EXISTING FACILITIES PRIOR TO CONSTRUCTION AND 48 HOURS PRIOR TO START OF CONSTRUCTION. STATE WIDE ONE CALL PROVIDER (TEXAS 811) - 1-800-DIG-TESS

5. CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE CONSTRUCTION OF THE PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS; AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER'S AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF THE WORK ON THIS PROJECT, EXCEPTING FROM LIABILITY ARISING FROM SOLE NEGLIGENCE OF THE OWNER OR ENGINEER.

6. ANY EXISTING IMPROVEMENT OR UTILITY REMOVED, DAMAGED OR UNDERCUT BY CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR REPLACED AS DIRECTED BY THE ENGINEER AND APPROVED BY THE RESPECTIVE UTILITY AT THE CONTRACTOR'S EXPENSE.

7. WHERE CONSTRUCTION IS IN THE PROXIMITY OF AN EXISTING UTILITY, THE CONTRACTOR WILL TAKE PRECAUTIONS TO PROTECT AND/OR SUPPORT THE UTILITY AND ANY DAMAGE THAT MIGHT OCCUR SHALL BE REPAIRED IMMEDIATELY. IF AT ANY TIME DURING THE CONSTRUCTION OPERATION A SEWER LINE HAS LESS THAN THREE (3) FEET OF COVER, IT SHALL BE ENCASED OR SADDLED WITH CONCRETE.

8. THE CONTRACTOR SHALL FURNISH ALL ASSISTANCE REQUIRED OF HIM BY THE INSPECTOR IN OBTAINING SAMPLES AT THE EXPENSE OF THE CONTRACTOR.

9. IF IN OPINION OF INSPECTOR, BASED ON TESTING SERVICE REPORTS AND INSPECTION, MATERIALS OR COMPACTION ARE BELOW THE SPECIFIED REQUIREMENTS THE CONTRACTOR SHALL PROVIDE ADDITIONAL SERVICES AND TESTING TO OBTAIN THE SPECIFIED PARAMETERS AT NO ADDITIONAL EXPENSE.

10. THE CONTRACTOR SHALL FOLLOW THE GENERAL INTENT OF THE GRADING PLANS. MINOR ADJUSTMENTS TO THE ACTUAL ELEVATIONS SHOWN ON THE PLANS MAY BE REQUIRED TO MATCH EXISTING GROUND ELEVATIONS.

11. ALL TRENCHES CUT BENEATH PROPOSED SIDEWALKS AND PARKING OR STREET PAVEMENT AREAS SHALL BE BACKFILLED IN 8" LIFTS, COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY, AND BE SUBJECT TO DENSITY TEST.

12. CONTRACTOR IS TO COORDINATE ALL CONSTRUCTION ACTIVITIES WITH THE ADJACENT PROPERTY OWNERS PRIOR TO COMMENCING ANY WORK ON SUCH PRIVATE PROPERTY.

13. BARRICADES AND WARNING SIGNS SHALL CONFORM TO THE TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND ARE GENERALLY LOCATED TO AFFORD MAXIMUM PROTECTION TO THE PUBLIC AS WELL AS CONSTRUCTION PERSONNEL AND EQUIPMENT AND TO ASSURE AN EXPEDITIOUS TRAFFIC FLOW AT ALL TIMES. DURING THE PROGRESS OF WORK, THE CONTRACTOR SHALL PROVIDE ACCESS FOR LOCAL TRAFFIC.

14. THE CONTRACTOR SHALL PROTECT EXISTING GRASS, LANDSCAPING AND TREES NOT IN DIRECT CONFLICT WITH PROPOSED IMPROVEMENTS DURING CONSTRUCTION. GRASSED AREAS DAMAGED DURING CONSTRUCTION SHALL BE RESTORED BY THE CONTRACTOR WITH THE TOPSOIL AND SODDING (NO SEPARATE PAYMENT).

15. TRENCH EXCAVATION PROTECTION: CONTRACTOR AND/OR CONTRACTOR'S INDEPENDENTLY RETAINED EMPLOYEE OR STRUCTURAL DESIGN/GEOTECHNICAL/SAFETY/ EQUIPMENT CONSULTANT, IF ANY, SHALL REVIEW THESE PLANS AND ANY AVAILABLE GEOTECHNICAL INFORMATION AND THE ANTICIPATED INSTALLATION SITE(S) WITHIN THE PROJECT WORK AREA IN ORDER TO DEVELOP THE CONTRACTOR'S PLANS TO IMPLEMENT THE PROJECT DESCRIBED IN THE CONTRACT DOCUMENTS. THE CONTRACTOR'S PLANS SHALL PROVIDE FOR ADEQUATE SAFETY EXCAVATIONS, SPECIFICALLY, CONTRACTOR AND/OR CONTRACTOR'S INDEPENDENTLY RETAINED EMPLOYEE OR SAFETY CONSULTANT SHALL DEVELOP AND IMPLEMENT A TRENCH SAFETY PROGRAM IN ACCORDANCE WITH OSHA STANDARDS GOVERNING THE PRESENCE AND ACTIVITIES OF INDIVIDUALS WORKING IN AND AROUND TRENCH EXCAVATION. THE CONTRACTOR'S PLANS AND OUTLINE FOR A TRENCH SAFETY PROGRAM SHALL BE FURNISHED BY THE CONTRACTOR TO THE OWNER, PRIOR TO EXECUTION OF THE CONTRACT, FOR INCLUSION AS PART OF THE CONTRACT DOCUMENTS. THE DOCUMENTS FURNISHED TO THE OWNER ARE NOT FOR THE OWNER'S REVIEW, APPROVAL OR ENDORSEMENT OF THE CONTRACTOR'S PLANS AND TRENCH SAFETY PROGRAM, BUT SOLELY FOR THE PURPOSE OF INCLUDING DETAILED TRENCH SAFETY PLANS FOR THE PROJECT IN THE CONTRACT DOCUMENTS.

16. THE CONTRACTOR SHALL MAINTAIN "AS-BUILT" DRAWINGS THROUGHOUT THE COURSE OF CONSTRUCTION AND SHALL SUBMIT SAME TO THE ENGINEER FOR APPROVAL PRIOR TO FINAL ACCEPTANCE OF WORK.

17. THE CONTRACTOR SHALL REMOVE ALL VEGETATION, TREES, STUMPS, GRASSES, ORGANIC SOILS, DEBRIS AND DELETERIOUS MATERIALS UNLESS DESIGNATED TO REMAIN.

18. ALL SITE CONCRETE SHALL HAVE A COMPRESSIVE STRENGTH OF 3000 P.S.I. IN 28 DAYS UNLESS OTHERWISE NOTED.

19. DIMENSIONS ARE TO THE PAVEMENT EDGE OF THE CURB, FACE OF BUILDING, PROPERTY LINE, OR STRIPING CENTERLINE. UNLESS OTHERWISE NOTED.

20. THE CONCRETE DRIVE APPROACHES AND SIDEWALKS WITHIN THE PUBLIC RIGHT-OF-WAYS ARE SUBJECT TO INSPECTION BY THE CONTROLLING ENTITY OF SAID ROW (I.E. CITY, COUNTY, TXDOT).

21. ALL WORK PERFORMED WITHIN CITY RIGHT-OF-WAYS TO BE IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS OF CONTROLLING ENTITY.

22. MAXIMUM CONTROL JOINT SPACING IS 5 FEET (SIDEWALKS).

23. MAXIMUM EXPANSION JOINT SPACING IS 40 FEET (SIDEWALKS).

24. CONTRACTOR MUST KEEP ALL PERMITS ON JOB SITE.

25. ALL EXISTING SIGNS AND BENCHES (WHETHER SHOWN ON PLANS OR NOT) WHICH CONFLICT WITH CONSTRUCTION SHALL BE RELOCATED

26. REMOVE ALL ASPHALT AND CONCRETE WITH A SMOOTH SAW-CUT.

27. COMPACT ALL PAVEMENT SUBGRADE TO 95% MAXIMUM DRY DENSITY. COMPACT AREAS TO RECEIVE LANDSCAPING AND/OR GRASS TO 90%.

28. PRIOR TO BIDDING, THE CONTRACTOR SHALL THOROUGHLY INVESTIGATE THE SITE AND FAMILIARIZE HIMSELF WITH ALL ASPECTS OF THE SITE WHICH MAY AFFECT HIS WORK. THIS INCLUDES ACCOUNTING FOR ALL VISIBLE FEATURES WHICH MAY IMPACT THE BID OR THE WORK.

29. CONTRACTOR SHALL CAREFULLY DEMOLISH AND REMOVE ALL ITEMS (ABOVE AND BELOW GROUND) AS REQUIRED TO CONSTRUCT THE PROJECT AS SHOWN. ALL REMOVAL AND DISPOSAL ACTIVITIES MUST COMPLY WITH APPLICABLE CODES, LAWS, AND ORDINANCES.

30. CONTRACTOR IS RESPONSIBLE FOR ALL VERTICAL AND HORIZONTAL CONTROL.

31. BASE MATERIAL TO BE INSTALLED ACCORDING TO TXDOT SPECIFICATION ITEM #247 (TYPE A). BASE COURSE SHALL BE PLACED IN LIFTS WITH A MAXIMUM THICKNESS OF 8" AND COMPACTED TO 95% MAXIMUM DRY DENSITY WITHIN THE RANGE OF 2% BELOW TO 2% ABOVE THE OPTIMUM MOISTURE CONTENT AS DETERMINED BY TEX-113-E.

32. PROPOSED CURBING TO BE TRANSITIONED SMOOTHLY TO MATCH EXISTING.

33. THE CONSTRUCTION SITE IS TO BE THOROUGHLY CLEANED BY THE CONTRACTOR PRIOR TO ISSUANCE OF PAYMENT BY THE OWNER.

34. CONTRACTOR SHALL INCLUDE ALL COSTS FOR ROUTING PEDESTRIAN AND VEHICULAR TRAFFIC IN THE BID AMOUNT.

35. REFERENCE DETAILS FOR HANDICAP SIGNAGE.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY CONTRIBUTING ZONE PLAN GENERAL CONSTRUCTION NOTES

1. WRITTEN CONSTRUCTION NOTIFICATION SHOULD BE PROVIDED TO THE APPROPRIATE TCEQ REGIONAL OFFICE NO LATER THAN 48 HOURS PRIOR TO COMMENCEMENT OF THE REGULATED ACTIVITY. INFORMATION SHOULD INCLUDE THE DATE ON WHICH THE REGULATED ACTIVITY WILL COMMENCE, THE NAME OF THE APPROVED PLAN FOR THE REGULATED ACTIVITY, AND THE NAME OF THE PRIME CONTRACTOR WITH THE NAME AND TELEPHONE NUMBER OF THE CONTACT PERSON.
2. ALL CONTRACTORS CONDUCTING REGULATED ACTIVITIES ASSOCIATED WITH THIS PROJECT SHOULD BE PROVIDED WITH COMPLETE COPIES OF THE APPROVED CONTRIBUTING ZONE PLAN AND THE TCEQ LETTER INDICATING THE SPECIFIC CONDITIONS OF ITS APPROVAL. DURING THE COURSE OF THESE REGULATED ACTIVITIES, THE CONTRACTOR(S) SHOULD KEEP COPIES OF THE APPROVED PLAN AND APPROVAL LETTER ON-SITE.
3. NO TEMPORARY ABOVEGROUND HYDROCARBON AND HAZARDOUS SUBSTANCE STORAGE TANK SYSTEM MAY BE INSTALLED WITHIN 150 FEET IF A DOMESTIC, INDUSTRIAL, IRRIGATION, OR PUBLIC WATER SUPPLY WELL.
4. PRIOR TO COMMENCING CONSTRUCTION, ALL TEMPORARY EROSION AND SEDIMENTATION (E&S) CONTROL MEASURES MUST BE PROPERLY SELECTED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND GOOD ENGINEERING PRACTICES. CONTROLS SPECIFIED IN THE SWPPP SECTION OF THE APPROVED EDWARDS AQUIFER CONTRIBUTING ZONE PLAN ARE REQUIRED DURING CONSTRUCTION.
   IF INSPECTIONS INDICATE A CONTROL HAS BEEN USED INAPPROPRIATELY, OR INCORRECTLY, THE APPLICANT MUST REPLACE OR MODIFY THE CONTROL FOR SITE SITUATIONS. THE CONTROLS MUST REMAIN IN PLACE UNTIL DISTURBED AREAS ARE REVEGETATED AND THE AREAS HAVE BECOME PERMANENTLY STABILIZED.
5. 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).
6. SEDIMENT MUST BE REMOVED FROM SEDIMENT TRAPS OR SEDIMENTATION PONDS NOT LATER THAN WHEN DESIGN CAPACITY HAS BEEN REDUCED BY 50%. A PERMANENT STAKE MUST BE PROVIDED THAT CAN INDICATE WHEN THE SEDIMENT OCCUPIES 50% OF THE BASIN VOLUME.
7. 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).
8. ALL SPOILS (EXCAVATED MATERIAL) GENERATED FROM THE PROJECT SITE AND STORED ON-SITE MUST HAVE PROPER E&S CONTROLS INSTALLED.
9. STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS PRACTICABLE IN PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED, AND CONSTRUCTION ACTIVITIES WILL NOT RESUME WITHIN 21 DAYS. WHEN THE INITIATION OF STABILIZATION MEASURES BY THE 14TH DAY IS PRECLUDED BY WEATHER CONDITIONS, STABILIZATION MEASURES SHALL BE INITIATED AS SOON AS PRACTICABLE.
10. THE FOLLOWING RECORDS SHOULD BE MAINTAINED AND MADE AVAILABLE TO THE TCEQ UPON REQUEST: THE DATES WHEN MAJOR GRADING ACTIVITIES OCCUR; THE DATES WHEN CONSTRUCTION ACTIVITIES TEMPORARILY OR PERMANENTLY CEASE ON A PORTION OF THE SITE; AND THE DATES WHEN STABILIZATION MEASURES ARE INITIATED.
11. THE HOLDER OF ANY APPROVED CONTRIBUTING ZONE PLAN MUST NOTIFY THE APPROPRIATE REGIONAL OFFICE IN WRITING AND OBTAIN APPROVAL FROM THE EXECUTIVE DIRECTOR PRIOR TO INITIATING ANY OF THE FOLLOWING:
    A. ANY PHYSICAL OR OPERATIONAL MODIFICATION OF ANY BEST MANAGEMENT PRACTICES OR STRUCTURE(S), INCLUDING BUT NOT LIMITED TO TEMPORARY OR PERMANENT PONDS, DAMS, BERMS, SILT FENCES, AND DIVERSIONARY STRUCTURES;
    B. ANY CHANGE IN THE NATURE OR CHARACTER OF THE REGULATED ACTIVITY FROM THAT WHICH WAS ORIGINALLY APPROVED;
    C. ANY CHANGE THAT WOULD SIGNIFICANTLY IMPACT THE ABILITY TO PREVENT POLLUTION OF THE EDWARDS AQUIFER AND HYDROLOGICALLY CONNECTED SURFACE WATER; OR
    D. ANY DEVELOPMENT OF LAND PREVIOUSLY IDENTIFIED IN A CONTRIBUTING ZONE PLAN AS UNDEVELOPED.

AUSTIN REGIONAL OFFICE :
2800 S. IH 35, SUITE 100 AUSTIN, TEXAS 78704-5712
PHONE (512) 339-2929
FAX (512) 339-3795

SAN ANTONIO REGIONAL OFFICE:
14250 JUDSON ROAD SAN ANTONIO, TEXAS 78233-4480
PHONE (210) 490-3096
FAX (210) 545-4329

GBRA CONSTRUCTION NOTES:

1. ALL WORK SHALL BE IN ACCORDANCE WITH GBRA PUBLISHED STANDARDS.
2. ALL SUBMITTALS SHALL BE REVIEWED AND APPROVED BY GBRA.
3. ALL WATER AND WASTEWATER INSTALLATIONS MUST BE INSPECTED AND APPROVED BY GBRA PRIOR TO BACKFILLING OR OTHERWISE COVERING THE WORK. THIS INCLUDES CROSSINGS OF WATER AND WASTEWATER BY OTHER UTILITIES. GBRA WILL PERFORM A MAXIMUM OF ONE (1) INSPECTION DAILY FOR ONE (1) HOUR DURATION BETWEEN 8:00AM AND 5:00PM EXCLUDING WEEKENDS AND HOLIDAYS.
   CALL 830-379-5822 TO SCHEDULE INSPECTIONS (48-HOURS ADVANCE NOTICE IS REQUIRED FOR ALL INSPECTIONS).
4. TRENCH EXCAVATION AND PIPE INSTALLATION WILL NOT BE PERMITTED UNTIL SUBGRADE HAS BEEN ESTABLISHED. SURVEY STAKING MUST BE INSTALLED PRIOR TO AND MAINTAINED DURING TRENCH EXCAVATION AND PIPE INSTALLATION. SURVEY STAKING SHALL INCLUDE HORIZONTAL AND VERTICAL CONTROL AT A MINIMUM OF 50 FOOT STATION INTERVALS. SURVEY STAKING SHALL BE PERFORMED BY THE CONTRACTOR.
5. BACKFLOW PREVENTION IN THE FORM OF A REDUCED PRESSURE BACKFLOW ASSEMBLY MUST BE PROVIDED FOR TEMPORARY CONNECTIONS TO EXISTING WATER LINES. BACKFLOW DEVICES SHALL BE TESTED BY A LICENSED BACKFLOW PREVENTION ASSEMBLY TESTER.
6. WATER AND WASTEWATER PIPE JOINTS SHALL BE CENTERED AT CROSSINGS WITH ALL OTHER UTILITIES. BOTH PIPE JOINTS SHALL BE CENTERED WHERE WATER CROSSES WASTEWATER, INCLUDING WASTEWATER LATERALS.
7. MAINTAIN A MINIMUM OF 10FT HORIZONTAL AND 12IN VERTICAL SEPARATION BETWEEN WATER/WASTEWATER AND OTHER UTILITIES. SHARED TRENCHES ARE NOT ALLOWED.
8. WATER AND WASTEWATER PIPING SHALL BE SLEEVED IF LOCATED UNDER BOX CULVERTS OR MULTIPLE BARREL STORM SEWER CROSSINGS REGARDLESS OF SIZE AND SINGLE BARRELS 30" OR LARGER.

TESTING

1. ALL TESTING SHALL BE ARRANGED AND PAID FOR BY THE CONTRACTOR.
2. ALL TESTING MUST BE COMPLETE PRIOR TO PAVING STREETS.
3. PERFORM TRENCH BACKFILL DENSITY TESTING AT INTERVALS SPECIFIED BY THE DESIGN ENGINEER. PROVIDE COPIES OF REPORTS TO GBRA.
4. FOLLOW AWWA PIPE TESTING PROCEDURES AND ALLOWABLE LEAKAGE FOR WATER LINES. TEST EVERY VALVED SECTION (I.E. BETWEEN VALVES). TEST PRESSURE SHALL BE THE MAXIMUM RATING OF MATERIAL INSTALLED. TEST DURATION SHALL BE 2-HOURS.
5. FOLLOW AWWA PROCEDURES FOR FLUSHING AND DISINFECTION OF WATER PIPING.
6. NEW PIPING MUST BE DISINFECTED PRIOR TO CONNECTION/TIE-IN TO THE EXISTING SYSTEM.
7. ALL GRAVITY WASTEWATER PIPING SHALL BE SUBJECT TO LOW PRESSURE AIR TESTING IN ACCORDANCE WITH TCEQ REQUIREMENTS. INFILTRATION AND EXFILTRATION TESTING ARE NOT ALLOWED.
8. MANDREL SHALL BE PULLED BY HAND THRU ALL GRAVITY WASTEWATER MAINS NO EARLIER THAN 30 DAYS AFTER BACKFILLING IS COMPLETE.
9. ALL MANHOLES, REGARDLESS OF VEHICULAR TRAFFIC DETOURING, SHALL BE VACUUM TESTED AFTER COMPLETION OF BACKFILL, COMPACTION, AND FINAL GRADING OF ROAD BASE BUT PRIOR TO INSTALLATION OF ASPHALT PAVING AND PRIOR TO INSTALLATION OF CORROSION RESISTANT MANHOLE LINING. VACUUM TESTING SHALL BE PERFORMED WITH A PLATE TYPE TEST HEAD PLACED ON TOP OF COMPLETED MANHOLE METAL CASTING RING WHICH HAS BEEN INSTALLED AND GROUTED AT FINAL GRADE. MANHOLES SHALL BE TESTED AT 10-INCHES OF MERCURY FOR 2-MINUTES DURATION. ALLOWABLE LOSS IS 1-INCH OF MERCURY. INFILTRATION AND EXFILTRATION TESTING ARE NOT ALLOWED.
10. PERFORM VIDEO INSPECTION OF GRAVITY WASTEWATER PIPING AFTER APPLICATION OF CORROSION RESISTANT MANHOLE LINING. FLOOD SYSTEM WITH WATER PRIOR IMMEDIATELY PRIOR TO PERFORMING VIDEO INSPECTION. HANG AND DRAG A GOLF BALL IN FRONT OF CAMERA. PIPE GRADE IS OUT OF TOLERANCE IF GOLF BALL BECOMES FULLY SUBMERGED. PROVIDE DVD'S AND WRITTEN REPORTS TO GBRA.
11. FOLLOW TCEQ PIPE TESTING PROCEDURES AND ALLOWABLE LEAKAGE FOR FORCEMAINS. TEST EVERY VALVED SECTION (I.E. BETWEEN VALVES). TEST PRESSURE SHALL BE THE MAXIMUM RATING OF MATERIAL INSTALLED.

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
JOSE CANTU
111313
LICENSED
PROFESSIONAL ENGINEER
3-21-16

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San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

GENERAL NOTES

CHK. BY: J.A.C.	IDS JOB NO: 150000111		
DWG. BY: M.G.M.	STATE	COUNTY	SHEET NO.
DATE: 01/11/2016	TEXAS	COMAL	2

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
LIFT STATIONS AND FORCE MAINS
GENERAL CONSTRUCTION NOTES

1. THIS LIFT STATION AND/OR FORCE MAIN MUST BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY'S (TCEQ) EDWARDS AQUIFER RULES 30 TEXAS ADMINISTRATIVE CODE (TAC) §213.5(C), THE DESIGN CRITERIA FOR DOMESTIC WASTEWATER SYSTEMS 30 TAC CHAPTER 217, AND THE GUADALUPE - BLANCO RIVER AUTHORITY STANDARD SPECIFICATIONS.

2. ANY MODIFICATION TO THE ACTIVITIES DESCRIBED IN THE REFERENCED LIFT STATION AND/OR FORCE MAIN SYSTEM APPLICATION FOLLOWING THE DATE OF APPROVAL MAY REQUIRE THE SUBMITTAL OF A FORCE MAIN SYSTEM APPLICATION TO MODIFY THIS APPROVAL, INCLUDING THE PAYMENT OF APPROPRIATE FEES AND ALL INFORMATION NECESSARY FOR ITS REVIEW AND APPROVAL.

3. PRIOR TO COMMENCING ANY REGULATED ACTIVITY, THE APPLICANT OR HIS AGENT MUST NOTIFY THE _____ REGIONAL OFFICE, IN WRITING, OF THE DATE ON WHICH THE REGULATED ACTIVITY WILL BEGIN.

4. UPON COMPLETION OF THE WET WELL EXCAVATION, A GEOLOGIST MUST CERTIFY THAT THE EXCAVATION HAS BEEN INSPECTED FOR THE PRESENCE OF SENSITIVE FEATURES AND THE CERTIFICATION MUST BE SUBMITTED TO THE APPROPRIATE REGIONAL OFFICE. FURTHER ACTIVITIES MAY NOT PROCEED UNTIL THE EXECUTIVE DIRECTOR HAS REVIEWED AND APPROVED THE METHODS PROPOSED TO PROTECT ANY SENSITIVE FEATURE AND THE EDWARDS AQUIFER FROM POTENTIALLY ADVERSE IMPACTS TO WATER QUALITY FROM THE LIFT STATION. CONSTRUCTION MAY CONTINUE IF THE GEOLOGIST CERTIFIES THAT NO SENSITIVE FEATURE OR FEATURES ARE PRESENT.

5. IF ANY SENSITIVE FEATURES ARE DISCOVERED DURING THE WASTEWATER LINE TRENCHING ACTIVITIES, ALL REGULATED ACTIVITIES NEAR THE SENSITIVE FEATURE MUST BE SUSPENDED IMMEDIATELY. THE APPLICANT MUST IMMEDIATELY NOTIFY THE APPROPRIATE REGIONAL OFFICE OF THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY OF THE FEATURE DISCOVERY. A GEOLOGIST'S ASSESSMENT OF THE LOCATION AND EXTENT OF THE FEATURE DISCOVERED MUST BE REPORTED TO THAT REGIONAL OFFICE IN WRITING WITHIN TWO WORKING DAYS. THE APPLICANT MUST SUBMIT A PLAN FOR ENSURING THE STRUCTURAL INTEGRITY OF THE SEWER LINE OR FOR MODIFYING THE PROPOSED COLLECTION SYSTEM ALIGNMENT AROUND THE FEATURE. THE REGULATED ACTIVITIES NEAR THE SENSITIVE FEATURE MAY NOT PROCEED UNTIL THE EXECUTIVE DIRECTOR HAS REVIEWED AND APPROVED THE METHODS PROPOSED TO PROTECT THE SENSITIVE FEATURE AND THE EDWARDS AQUIFER FROM ANY POTENTIALLY ADVERSE IMPACTS TO WATER QUALITY WHILE MAINTAINING THE STRUCTURAL INTEGRITY OF THE LINE.

6. LIFT STATIONS SHALL BE DESIGNED TO WITHSTAND AND OPERATE DURING A 100-YEAR FLOOD EVENT AND SHALL BE ACCESSIBLE DURING A 25-YEAR FLOOD. ALL LIFT STATIONS SHALL BE INTRUDER-RESISTANT WITH A CONTROLLED ACCESS.

7. DRY WELL SUMP PUMPS:
   (a) A DRY WELL MUST USE DUAL SUMP PUMPS, EACH WITH A MINIMUM CAPACITY OF 1,000 GALLONS PER HOUR AND CAPABLE OF HANDLING THE VOLUME OF LIQUID GENERATED DURING PEAK OPERATIONS.
   (b) A PUMP MUST HAVE A SUBMERSIBLE MOTOR AND WATERTIGHT WIRING.
   (c) A DRY WELL FLOOR MUST SLOPE TOWARD A SUMP SIZED FOR PROPER DRAINAGE.
   (d) THE MINIMUM SUMP DEPTH IS 6.0 INCHES AND MUST PREVENT STANDING WATER ON A DRY WELL FLOOR UNDER NORMAL OPERATION.
   (e) A SUMP PUMP MUST OPERATE AUTOMATICALLY BY USE OF A FLOAT SWITCH OR OTHER LEVEL-DETECTING DEVICE.
   (f) A SUMP PUMP MUST USE SEPARATE PIPES CAPABLE OF DISCHARGING MORE THAN THE MAXIMUM LIQUID LEVEL OF AN ASSOCIATED WET WELL.
   (g) A SUMP PUMP OUTLET PIPE MUST BE AT LEAST 1.5 INCHES IN DIAMETER AND HAVE AT LEAST TWO CHECK VALVES IN SERIES.

8. PUMP CONTROLS.
   (a) A LIFT STATION PUMP MUST OPERATE AUTOMATICALLY, BASED ON THE WATER LEVEL IN A WET WELL.
   (b) THE LOCATION OF A WET WELL LEVEL MECHANISM MUST ENSURE THAT THE MECHANISM IS UNAFFECTED BY CURRENTS, RAGS, GREASE, OR OTHER FLOATING MATERIALS.
   (c) A LEVEL MECHANISM MUST BE ACCESSIBLE WITHOUT ENTERING THE WET WELL.
   (d) WET WELL CONTROLS WITH A BUBBLER SYSTEM REQUIRE DUAL AIR SUPPLY AND DUAL CONTROLS.
   (e) MOTOR CONTROL CENTERS MUST BE MOUNTED AT LEAST 4.0 INCHES ABOVE GRADE TO PREVENT WATER INTRUSION AND CORROSION FROM STANDING WATER IN THE ENCLOSURE.
   (f) ELECTRICAL EQUIPMENT AND ELECTRICAL CONNECTIONS IN A WET WELL OR A DRY WELL MUST MEET NATIONAL FIRE PREVENTION ASSOCIATION 70 NATIONAL ELECTRIC CODE EXPLOSION PREVENTION REQUIREMENTS, UNLESS CONTINUOUS VENTILATION IS PROVIDED.

9. WET WELLS.
   (a) A WET WELL MUST BE ENCLOSED BY WATERTIGHT AND GAS TIGHT WALLS.
   (b) A PENETRATION THROUGH A WALL OF A WET WELL MUST BE GAS TIGHT.
   (c) A WET WELL MUST NOT CONTAIN EQUIPMENT REQUIRING REGULAR OR ROUTINE INSPECTION OR MAINTENANCE, UNLESS INSPECTION AND MAINTENANCE CAN BE DONE WITHOUT STAFF ENTERING THE WET WELL.
   (d) A GRAVITY PIPE DISCHARGING TO A WET WELL MUST BE LOCATED SO THAT THE INVERT ELEVATION IS ABOVE THE LIQUID LEVEL OF A PUMP'S "ON" SETTING.
   (e) GATE VALVES AND CHECK VALVES ARE PROHIBITED IN A WET WELL.
   (f) GATE VALVES AND CHECK VALVES MAY BE LOCATED IN A VALVE VAULT NEXT TO A WET WELL OR IN A DRY WELL.
   (g) PUMP CYCLE TIME, BASED ON PEAK FLOW, MUST EQUAL OR EXCEED THOSE IN THE FOLLOWING TABLE:

PUMP HORSEPOWER	MINIMUM CYCLE TIMES (MINUTES)
< 50	6
50-100	10
> 100	15

   (h) AN EVALUATION OF MINIMUM WET WELL VOLUME REQUIRES THE FOLLOWING FORMULA:

$$V = \frac{T \times Q}{4 \times 7.48}$$

   WHERE:
   V = ACTIVE VOLUME (CUBIC FEET)
   Q = PUMP CAPACITY (GALLONS PER MINUTE)
   T = CYCLE TIME (MINUTES)
   7.48 = CONVERSION FACTOR (GALLONS/CUBIC FOOT)

10. WET WELL SLOPES.
   (a) A WET WELL FLOOR MUST HAVE A SMOOTH FINISH AND MINIMUM SLOPE OF 10% TO A PUMP INTAKE.
   (b) A WET WELL DESIGN MUST PREVENT DEPOSITION OF SOLIDS UNDER NORMAL OPERATING CONDITIONS.
   (c) A LIFT STATION WITH GREATER THAN 5.0 MILLION GALLONS PER DAY FIRM PUMPING CAPACITY MUST HAVE ANTI-VORTEX BAFFLING.

11. DRY WELL ACCESS.
   (a) AN UNDERGROUND DRY WELL MUST BE ACCESSIBLE.
   (b) A STAIRWAY IN A DRY WELL MUST USE NON-SLIP STEPS AND CONFORM TO OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REGULATIONS WITH RESPECT TO RISE AND RUN.
   (c) A LADDER IN A DRY WELL MUST MADE OF NON-CONDUCTIVE MATERIAL AND RATED FOR THE LOAD NECESSARY FOR STAFF AND EQUIPMENT TO DESCEND AND ASCEND.

12. VENTILATION SHALL BE PROVIDED FOR LIFT STATIONS, INCLUDING BOTH WET AND DRY WELLS.

13. HOISTING EQUIPMENT. A LIFT STATION MUST HAVE PERMANENT HOISTING EQUIPMENT OR BE ACCESSIBLE TO PORTABLE HOISTING EQUIPMENT FOR REMOVAL OF PUMPS, MOTORS, VALVES, PIPES, AND OTHER SIMILAR EQUIPMENT.

14. A FLOOR DRAIN FROM A VALVE VAULT TO A WET WELL MUST PREVENT GAS FROM ENTERING A VALVE VAULT BY INCLUDING FLAP VALVES, "P" TRAPS, SUBMERGED OUTLETS, OR A COMBINATION OF THESE DEVICES.

15. PUMPS.
   (a) GENERAL REQUIREMENTS. A RAW WASTEWATER PUMP, WITH THE EXCEPTION OF A GRINDER PUMP, MUST:
   (1) BE DESIGNED TO PREVENT CLOGGING;
   (2) BE CAPABLE OF PASSING A SPHERE OF 2.5 INCHES IN DIAMETER OR GREATER; AND
   (3) HAVE GREATER THAN 3.0 INCH DIAMETER SUCTION AND DISCHARGE OPENINGS
   (b) SUBMERSIBLE AND NON-SUBMERSIBLE PUMPS.
   (1) A NON-SUBMERSIBLE PUMP MUST HAVE INSPECTION AND CLEANOUT PLATES ON BOTH THE SUCTION AND DISCHARGE SIDES OF EACH PUMPING UNIT THAT FACILITATE LOCATING AND REMOVING BLOCKAGE-CAUSING MATERIALS, UNLESS THE PUMP DESIGN ACCOMMODATES EASY REMOVAL OF THE ROTATION ELEMENTS.
   (2) A PUMP SUPPORT MUST PREVENT MOVEMENT AND VIBRATION DURING OPERATION.
   (3) A SUBMERSIBLE PUMP MUST USE A RAIL-TYPE PUMP SUPPORT SYSTEM WITH MANUFACTURER-APPROVED MECHANISMS DESIGNED TO ALLOW PERSONNEL TO REMOVE AND REPLACE ANY SINGLE PUMP WITHOUT ENTERING OR DEWATERING THE WET WELL.
   (4) SUBMERSIBLE PUMP RAILS AND LIFTING CHAINS MUST BE CONSTRUCTED OF A MATERIAL THAT PERFORMS TO AT LEAST THE STANDARD OF SERIES 300 STAINLESS STEEL.
   (c) LIFT STATION PUMPING CAPACITY. THE FIRM PUMPING CAPACITY OF A LIFT STATION MUST HANDLE THE EXPECTED PEAK FLOW.
   (d) PUMP HEAD CALCULATIONS.
   (1) THE PIPE HEAD LOSS CALCULATIONS WERE PREPARED USING THE HYDRAULIC INSTITUTE STANDARDS, PERTAINING TO HEAD LOSSES THROUGH PIPES, VALVES, AND FITTINGS, ARE BE INCLUDED IN THE REPORT.
   (2) THE SELECTED FRICTION COEFFICIENT (HAZEN-WILLIAMS "C" VALUE) USED IN FRICTION HEAD LOSS CALCULATIONS IS BASED ON THE PIPE MATERIAL SELECTED.
   (3) SYSTEM CURVES FOR BOTH THE NORMAL AND PEAK OPERATING CONDITIONS (DUPLEX STATION THEREFORE PEAK EQUALS NORMAL) AT C VALUES FOR PROPOSED PIPE ARE INCLUDED IN THE REPORT.
   (e) FLOW CONTROL.
   (1) A LIFT STATION OR A TRANSFER PUMPING STATION LOCATED AT OR DISCHARGING DIRECTLY TO A WASTEWATER TREATMENT SYSTEM MUST HAVE A PEAK PUMP CAPACITY EQUAL TO OR LESS THAN THE PEAK DESIGN FLOW, UNLESS EQUALIZATION IS PROVIDED.
   (2) A WASTEWATER TREATMENT SYSTEM WITH A PEAK FLOW THAT IS GREATER THAN 300,000 GALLON PER DAY MUST USE THREE OR MORE PUMPS, UNLESS DUPLEX, AUTOMATICALLY CONTROLLED, VARIABLE CAPACITY PUMPS ARE PROVIDED.
   (f) SELF-PRIMING PUMPS.
   (1) A SELF-PRIMING PUMP MUST BE CAPABLE OF PRIMING WITHOUT RELIANCE UPON A SEPARATE PRIMING SYSTEM, AN INTERNAL FLAP VALVE, OR ANY EXTERNAL MEANS FOR PRIMING.
   (2) A SELF-PRIMING PUMP MUST USE A SUCTION PIPE VELOCITY AT LEAST 3.0 FEET PER SECOND BUT NOT MORE THAN 7.0 FEET PER SECOND, AND MUST INCORPORATE ITS OWN SUCTION PIPE.
   (3) A SELF-PRIMING PUMP MUST VENT AIR BACK INTO THE WET WELL DURING PRIMING.
   (g) VACUUM-PRIMING PUMPS.
   (1) A VACUUM-PRIMED PUMP MUST BE CAPABLE OF PRIMING BY USING A SEPARATE POSITIVE PRIMING SYSTEM WITH A DEDICATED VACUUM PUMP FOR EACH MAIN WASTEWATER PUMP.
   (2) A VACUUM-PRIMING PUMP MUST USE A SUCTION PIPE VELOCITY AT LEAST 3.0 FEET PER SECOND BUT LESS THAN 7.0 FEET PER SECOND AND MUST HAVE ITS OWN SUCTION PIPE.
   (h) VERTICAL POSITIONING OF PUMPS. A RAW WASTEWATER PUMP MUST HAVE POSITIVE STATIC SUCTION HEAD DURING NORMAL ON-OFF CYCLING, EXCEPT A SUBMERSIBLE PUMP WITH "NO SUCTION" PIPES, A VACUUM-PRIMED PUMP, OR A SELF-PRIMING UNIT CAPABLE OF SATISFACTORY OPERATION UNDER ANY NEGATIVE SUCTION HEAD ANTICIPATED FOR THE LIFT STATION.
   (i) INDIVIDUAL GRINDER PUMPS. A GRINDER PUMP SERVING ONLY ONE RESIDENTIAL OR COMMERCIAL STRUCTURE THAT IS PRIVATELY OWNED, MAINTAINED, AND OPERATED IS NOT SUBJECT TO THE RULES OF THIS CHAPTER.
   (j) PUMP FOR LOW-FLOW LIFT STATION. A PUMP USED FOR A LIFT STATION WITH A PEAK FLOW OF LESS THAN 120 GALLONS PER MINUTE MUST BE SUBMERSIBLE AND INCLUDE A GRINDER.

16. PIPING.
   (a) HORIZONTAL PUMP SUCTIONS.
   (1) EACH PUMP MUST HAVE A SEPARATE SUCTION PIPE THAT USES AN ECCENTRIC REDUCER.
   (2) PIPES IN A WET WELL MUST HAVE A TURNDOWN TYPE FLARED INTAKE.
   (b) VALVES.
   (1) THE DISCHARGE SIDE OF EACH PUMP FOLLOWED BY A FULL-CLOSING ISOLATION VALVE MUST ALSO HAVE A CHECK VALVE.
   (A) A CHECK VALVE MUST BE A SWING TYPE VALVE WITH AN EXTERNAL LEVER.
   (B) A VALVE MUST INCLUDE A POSITION INDICATOR TO SHOW ITS OPEN AND CLOSED POSITIONS, UNLESS A FULL-CLOSING VALVE IS A RISING-STEM GATE VALVE.
   (2) A GRINDER PUMP INSTALLATION MAY USE A RUBBER-BALL CHECK VALVE OR A SWING-TYPE CHECK VALVE.
   (3) A BUTTERFLY VALVE, TILTING-DISC CHECK VALVE, OR ANY OTHER VALVE USING A TILTING-DISC IN A FLOW PIPE IS PROHIBITED.
   (c) PIPES.
   (1) A LIFT STATION PIPE MUST HAVE FLANGED OR FLEXIBLE CONNECTIONS TO ALLOW FOR REMOVAL OF PUMPS AND VALVES WITHOUT INTERRUPTION OF THE LIFT STATION OPERATIONS.
   (2) WALL PENETRATIONS MUST ALLOW FOR PIPE FLEXURE WHILE EXCLUDING EXFILTRATION OR INFILTRATION.
   (3) PIPE SUCTION VELOCITIES MUST BE AT LEAST 3.0 FEET PER SECOND BUT NOT MORE THAN 7.0 FEET PER SECOND.
   (4) PROVIDE TRACE WIRE (COPPER CLAD STEEL, 12 GAUGE, 30 MIL HDPE JACKET) FOR ALL BURIED PIPING.

17. EMERGENCY PROVISIONS FOR LIFT STATIONS.
   (a) A COLLECTION SYSTEM LIFT STATION MUST BE EQUIPPED WITH A TESTED QUICK-CONNECT MECHANISM OR A TRANSFER SWITCH PROPERLY SIZED TO CONNECT TO A PORTABLE GENERATOR, IF NOT EQUIPPED WITH AN ONSITE GENERATOR.
   (b) LIFT STATIONS MUST INCLUDE AN AUDIOVISUAL ALARM SYSTEM AND THE SYSTEM MUST TRANSMIT ALL ALARM CONDITIONS THROUGH USE OF AN AUTO-DIALER SYSTEM, SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM, OR TELEMETERING SYSTEM CONNECTED TO A CONTINUOUSLY MONITORED LOCATION.
   (c) AN ALARM SYSTEM MUST SELF-ACTIVATE FOR A POWER OUTAGE, PUMP FAILURE, OR A HIGH WET WELL WATER LEVEL.
   (d) A LIFT STATION CONSTRUCTED TO PUMP RAW WASTEWATER MUST HAVE SERVICE RELIABILITY BASED ON:
   (1) RETENTION CAPACITY.
   (A) THE RETENTION CAPACITY IN A LIFT STATION'S WET WELL AND INCOMING GRAVITY PIPES MUST PREVENT DISCHARGES OF UNTREATED WASTEWATER AT THE LIFT STATION OR ANY POINT UPSTREAM FOR A PERIOD OF TIME EQUAL TO THE LONGEST ELECTRICAL OUTAGE RECORDED DURING THE PAST 24 MONTHS, BUT NOT LESS THAN 20 MINUTES.
   (B) FOR CALCULATION PURPOSES, THE OUTAGE PERIOD BEGINS WHEN A LIFT STATION PUMP FINISHED ITS LAST NORMAL CYCLE, EXCLUDING A STANDBY PUMP.
   (2) ON-SITE GENERATORS. A LIFT STATION MAY BE PROVIDED EMERGENCY POWER BY ON-SITE, AUTOMATIC ELECTRICAL GENERATORS SIZED TO OPERATE THE LIFT STATION AT ITS FIRM PUMPING CAPACITY OR AT THE AVERAGE DAILY FLOW, IF THE PEAK FLOW CAN BE STORED IN THE COLLECTION SYSTEM.
   (3) PORTABLE GENERATORS AND PUMPS.
   (A) A LIFT STATION MAY USE PORTABLE GENERATORS AND PUMPS TO GUARANTEE SERVICE IF THE REPORT INCLUDES:
   (i) THE STORAGE LOCATION OF EACH GENERATOR AND PUMP;
   (ii) THE AMOUNT OF TIME THAT WILL BE NEEDED TO TRANSPORT EACH GENERATOR OR PUMP TO A LIFT STATION;
   (iii) THE NUMBER OF LIFT STATIONS FOR WHICH EACH GENERATOR OR PUMP IS DEDICATED AS A BACKUP; AND
   (iv) THE TYPE OF ROUTINE MAINTENANCE AND UPKEEP PLANNED FOR EACH PORTABLE GENERATOR AND PUMP TO ENSURE THAT THEY WILL BE OPERATIONAL WHEN NEEDED.
   (B) AN OPERATOR THAT IS KNOWLEDGEABLE IN OPERATION OF THE PORTABLE GENERATORS AND PUMPS SHALL BE ON CALL 24 HOURS PER DAY EVERY DAY.
   (C) THE SIZE OF A PORTABLE GENERATOR MUST HANDLE THE FIRM PUMPING CAPACITY OF THE LIFT STATION.
   (e) SPILL CONTAINMENT STRUCTURES.
   (1) THE USE OF A SPILL CONTAINMENT STRUCTURE AS A SOLE MEANS OF PROVIDING SERVICE RELIABILITY IS PROHIBITED.
   (2) A LIFT STATION MAY USE A SPILL CONTAINMENT STRUCTURE IN ADDITION TO ONE OF THE SERVICE RELIABILITY OPTIONS DETAILED IN THIS IN SUBSECTION (A) OF THIS SECTION.
   (3) THE REPORT MUST INCLUDE A DETAILED MANAGEMENT PLAN FOR CLEANING AND MAINTAINING EACH SPILL CONTAINMENT STRUCTURE.
   (4) A SPILL CONTAINMENT STRUCTURE MUST HAVE A LOCKED GATE AND BE SURROUNDED AN INTRUDER RESISTANT FENCE THAT IS 6.0 FEET HIGH CHAIN LINK, MASONRY, OR BOARD FENCE WITH AT LEAST THREE STRANDS OF BARBED WIRE OR 8.0 FEET HIGH CHAIN LINK, MASONRY, OR BOARD FENCE WITH AT LEAST ONE STRAND OF BARBED WIRE.
   (f) A LIFT STATION MUST BE FULLY ACCESSIBLE DURING A 25-YEAR 24-HOUR RAINFALL EVENT.
   (g) LIFT STATION SYSTEM CONTROLS MUST PREVENT OVER-PUMPING UPON RESUMPTION OF NORMAL POWER AFTER A POWER FAILURE. BACKUP OR STANDBY UNITS MUST BE ELECTRICALLY INTERLOCKED TO PREVENT OPERATION AT THE SAME TIME THAT OTHER LIFT STATIONS PUMPS ARE OPERATING ONLY ON THE RESUMPTION OF NORMAL POWER AFTER A POWER FAILURE.

GRADING GENERAL NOTES:

1. THE SOILS REPORT ON INDICATED SUBSURFACE CONDITIONS IS NOT IDENTIFIED AS REPRESENTATIONS OR WARRANTIES OF THE CONTINUITY OF SUCH CONDITIONS.

2. ADDITIONAL SOIL INVESTIGATIONS MAY BE MADE BY THE CONTRACTOR AT NO COST TO THE OWNER, PROVIDED SUCH OPERATIONS ARE ACCEPTABLE AND APPROVED IN WRITING BY THE ENGINEER OR ARCHITECT.

3. A TESTING LABORATORY SHALL BE EMPLOYED BY THE OWNER TO CHECK THE SUITABILITY OF MATERIAL SELECTED FOR CONTROLLED FILLS, TO TEST AND DETERMINE IF THE REQUIRED DENSITY IS BEING OBTAINED, AND TO TEST COMPACTION OF EXPOSED SUBGRADES. LABORATORY REPORTS ON TESTS PERFORMED SHALL INCLUDE COORDINATES AND ELEVATIONS OF FIELD TESTS.

4. TESTING SERVICE SHALL INSPECT AND CERTIFY IN WRITING ALL SUBGRADES AND FILL LAYERS. ALL COMPACTED FILLS SHALL CONSIST OF LABORATORY APPROVED MATERIALS PLACED IN HORIZONTAL LAYERS AND COMPACTED TO MINIMUM 95% STANDARD PROCTOR DENSITY AT A MOISTURE CONTENT RANGE FROM (-1% TO 3%).

5. WHEN TESTS INDICATE COMPACTION DOES NOT MEET REQUIREMENTS, FILL AND BACKFILL SHALL BE DRIED OUT OR MOISTENED AS NECESSARY, SCARIFIED, AND RECOMPACTED. RECOMPACTED AREAS SHALL BE RETESTED. THE PROCEDURE SHALL BE PROVIDED AT NO COST TO THE OWNER.

6. EXCAVATED MATERIAL THAT IS SUITABLE MAY BE USED FOR FILLS AND BACKFILLS. PROVIDE ANY ADDITIONAL FILL MATERIAL FROM OFF THE SITE AS MAY BE REQUIRED TO PRODUCE DESIGNATED LINES AND GRADES OF FILLS, BACKFILLS AND ROUGH GRADES. SITE SHALL BE TESTED FOR COMPLIANCE WITH THE SPECIFICATIONS.

7. FILL SHALL BE EARTH, FREE OF DEBRIS, CINDERS, COMBUSTIBLES, FROST, ICE, ROOTS, SOD, WOOD, CELLULOSE, ORGANIC MATERIALS, AND MATERIALS THAT MAY BE SUBJECT TO TERMITE ATTACK AND AS INDICATED IN THE SOILS REPORT.

8. PROVIDE THE REQUIRED MINIMUM DENSITY AND MOISTURE CONTENT OF COMPACTED FILL IN ACCORDANCE WITH THE SOILS REPORT AND THE REQUIREMENTS OF THE PROFESSIONAL ENGINEER.

9. GRADING, INCLUDING EXCAVATING AND FILLED SECTIONS AND ADJACENT TRANSITION AREAS SHALL BE REASONABLY SMOOTH, COMPACTED AND FREE FROM IRREGULAR SURFACE CHANGES. DEGREE OF FINISH SHALL BE THAT ORDINARILY OBTAINABLE FROM EITHER BLADE GRADER OPERATIONS, EXCEPT AS OTHERWISE SPECIFIED. SUBGRADE SHALL BE EVENLY SLOPED TO PROVIDE DRAINAGE AWAY FROM BUILDING WALLS IN ALL DIRECTIONS AT A GRADE NOT LESS THAT ¼ INCH (21 MM PER M) PER FOOT. REDRESS AND RECOMPACT ANY AREAS THAT SETTLE BELOW REQUIRED GRADES BECAUSE OF TRAFFIC, PRECIPITATION, OR STORAGE LOADING BEFORE EXECUTION OF OTHER WORK REQUIRED.

10. PERFORM EARTHWORK AND SITE GRADING IN A MANNER TO PREVENT SURFACE WATER AND SUBGRADE OR GROUND WATER FROM FLOWING INTO EXCAVATIONS, AND TO PREVENT WATER AND SEDIMENTATION FROM FLOODING THE PROJECT SITE AND SURROUNDING AREA.

11. DO NOT ALLOW WATER TO ACCUMULATE IN EXCAVATIONS. REMOVE ALL WATER FROM EXCAVATIONS USING DEWATERING METHODS WHICH WILL PREVENT SOFTENING OF FOUNDATION.

12. PROVIDE SUFFICIENT EQUIPMENT CAPABLE OF ADDING MEASURED AMOUNTS OF MOISTURE TO THE SOIL MATERIAL AS DETERMINED BY MOISTURE-DENSITY RELATIONS TESTS. MAINTAIN THE ACTUAL MOISTURE CONTENT IN THE SOIL MATERIAL AT THE TIME OF COMPACTION TO WITHIN THE LIMITS SPECIFIED FOR SATISFACTORY SOIL MATERIALS.

13. WHERE THE SUBGRADE OR LAYER OF SOIL MATERIAL MUST BE MOISTURE CONDITIONED BEFORE COMPACTION, UNIFORMLY APPLY THE REQUIRED AMOUNT OF WATER TO THE SURFACE OF SUBGRADE, OR LAYER OF SOIL MATERIAL, IN SUCH MANNER AS TO PREVENT FREE WATER APPEARING ON THE SURFACE DURING OR SUBSEQUENT TO COMPACTION OPERATIONS.

14. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO DISPOSE OF ANY EXCESS FILL MATERIAL RESULTING FROM THE SITE MASS GRADING OFF OF THE PROJECT SITE.

RECEIVED
APR 04 2016
COUNTY ENGINEER

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

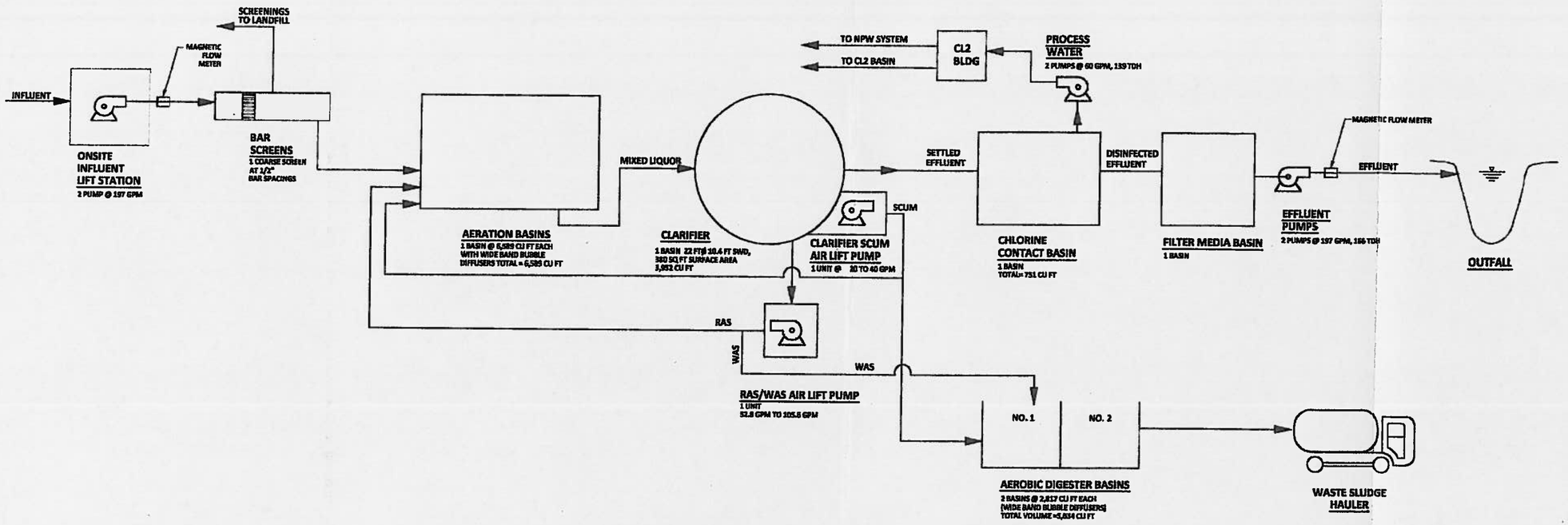
STATE OF TEXAS
JOSE CANTU
111313
LICENSED
PROFESSIONAL ENGINEER
8-21-16

IDS Engineering Group
TBPE F-002726 TBPLS 10110704
813 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

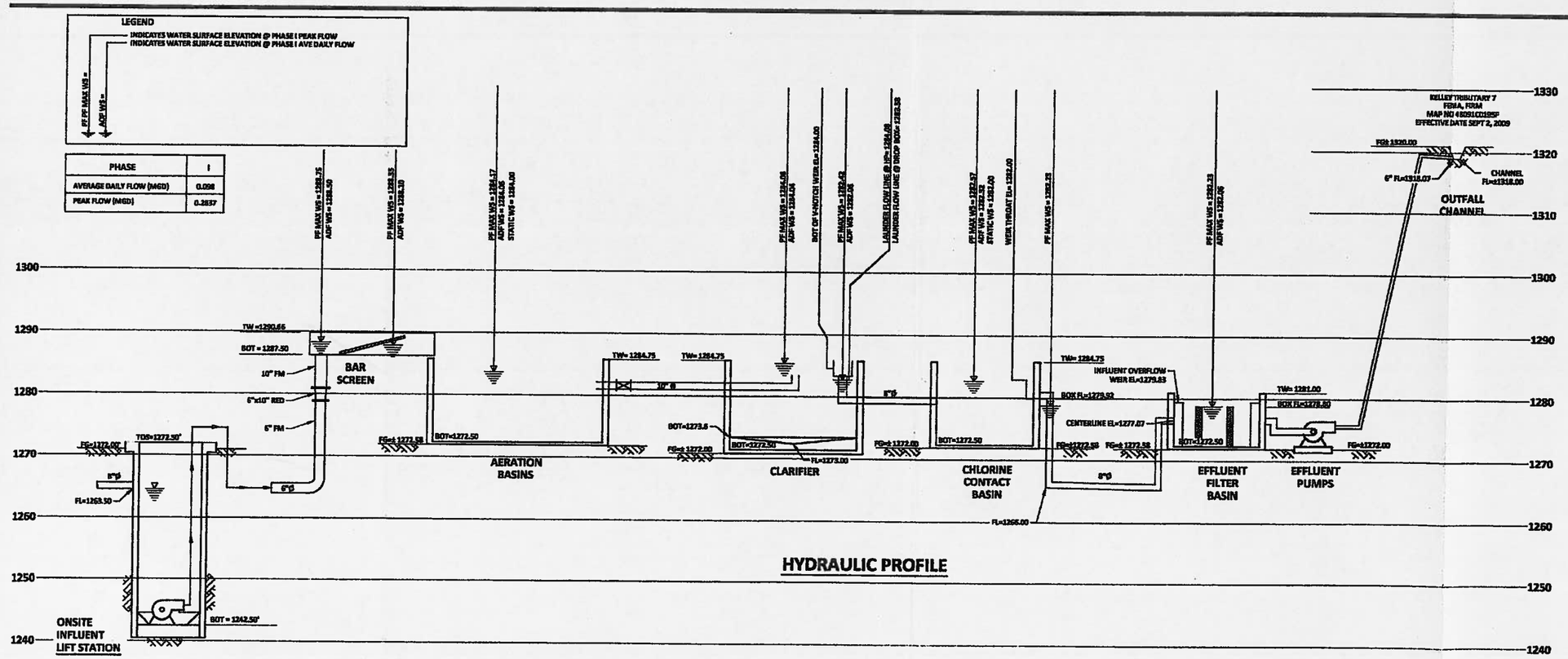
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

GENERAL NOTES 2

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	3



PROCESS FLOW DIAGRAM



HYDRAULIC PROFILE

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

DAVID J. ROSS 68267 LICENSED PROFESSIONAL ENGINEER
3/14/16

IDS Engineering Group
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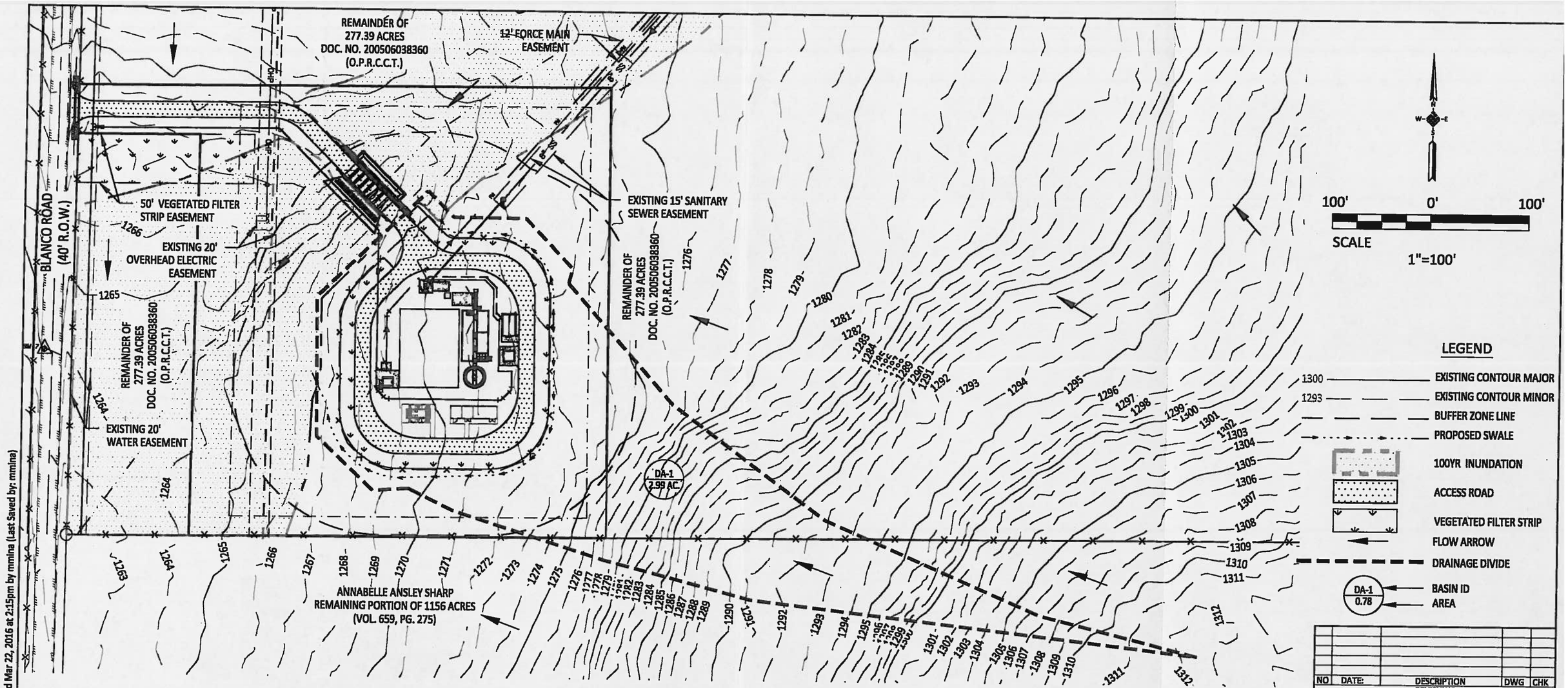
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

PROCESS FLOW DIAGRAM

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	4

\\SAN-DC01\projects\150000111\4.10 DESIGN\060 Dwgs\C-FLOW-DIA.dwg [Layout1] Plotted Mar 21, 2016 at 6:28pm by Jamesh (Last Saved by: Jamesh)



RUNOFF CALCULATIONS

Rational Method (Q = CIA)

Existing Conditions

[DA-1] Q = (0.49)(4.4)(2.99) = **6.44 CFS**

Proposed Conditions

[DA-1] Q = (0.57)(4.4)(2.99) = **7.50 CFS**

INTERCEPTOR SWALE CALCULATIONS

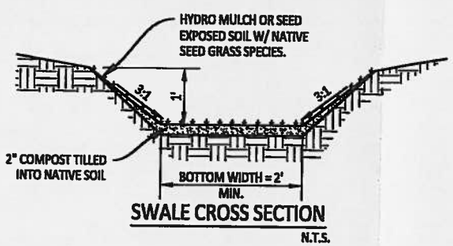
Channel Velocity

(V = Q /A)

V = 7.50 cfs / 3.45 sf = **2.17 ft/s**

IMPERVIOUS COVER

1.00 AC



SWALE CROSS SECTION

N.T.S.

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
JOSE CANTU
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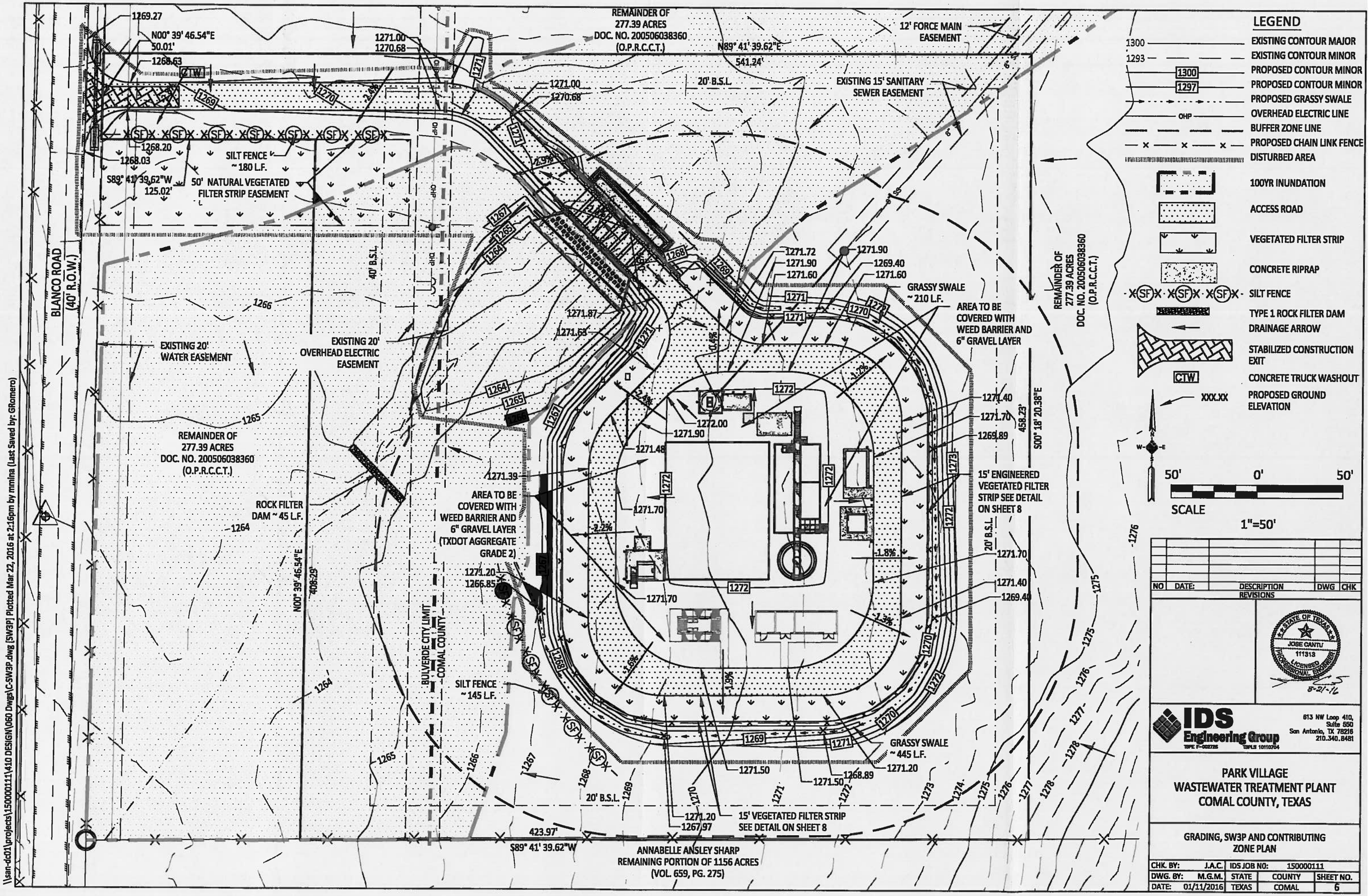
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

DRAINAGE AREA MAP

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	5

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-DAM.dwg [DAM] Plotted Mar 22, 2016 at 2:15pm by mmina (Last Saved by: mmina)



NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
JOSE CANTU
111313
LICENSED PROFESSIONAL ENGINEER
8-21-16

IDS Engineering Group
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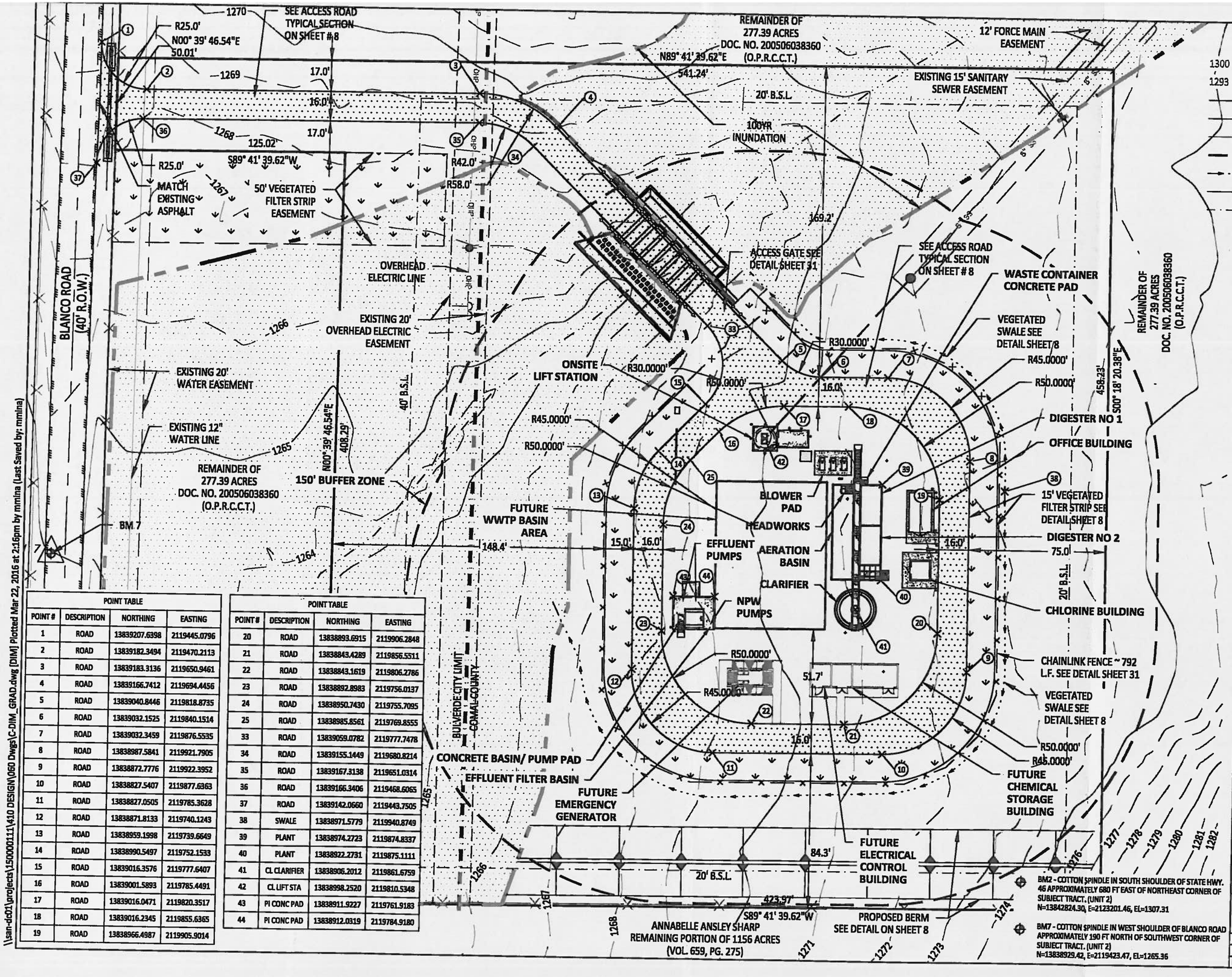
PARK VILLAGE WASTEWATER TREATMENT PLANT COMAL COUNTY, TEXAS

GRADING, SW3P AND CONTRIBUTING ZONE PLAN

CHK. BY: J.A.C.	IDS JOB NO: 150000111		
DWG. BY: M.G.M.	STATE	COUNTY	SHEET NO.
DATE: 01/11/2016	TEXAS	COMAL	6

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-SW3P.dwg [SW3P] Plotted Mar 22, 2016 at 2:16pm by mmina (Last Saved by: GRomero)



LEGEND

- 1300 — EXISTING CONTOUR MAJOR
- 1293 — EXISTING CONTOUR MINOR
- 1300 — PROPOSED CONTOUR MINOR
- 1297 — PROPOSED CONTOUR MINOR
- OHP — OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- PROPOSED GRASSY SWALE
- PROPOSED CHAIN LINK FENCE
- 20' B.S.L. — BUILDING SETBACK LINE
- 100YR INUNDATION
- ACCESS ROAD
- VEGETATED FILTER STRIP
- CONCRETE RIPRAP
- ① POINT NUMBER

50' 0' 50'

SCALE 1"=50'

POINT TABLE			
POINT #	DESCRIPTION	NORTHING	EASTING
1	ROAD	13839207.6398	2119445.0796
2	ROAD	13839182.3494	2119470.2113
3	ROAD	13839183.3136	2119650.9461
4	ROAD	13839166.7412	2119694.4456
5	ROAD	13839040.8446	2119818.8735
6	ROAD	13839032.1525	2119840.1514
7	ROAD	13839032.3459	2119876.5535
8	ROAD	13838987.5841	2119921.7905
9	ROAD	13838872.7776	2119922.3952
10	ROAD	13838827.5407	2119877.6363
11	ROAD	13838827.0505	2119785.3628
12	ROAD	13838871.8133	2119740.1243
13	ROAD	13838959.1998	2119739.6649
14	ROAD	13838990.5497	2119752.1533
15	ROAD	13839016.3576	2119777.6407
16	ROAD	13839001.5893	2119785.4491
17	ROAD	13839016.0471	2119820.3517
18	ROAD	13839016.2345	2119855.6365
19	ROAD	13838966.4987	2119905.9014

POINT TABLE			
POINT #	DESCRIPTION	NORTHING	EASTING
20	ROAD	13838893.6915	2119906.2848
21	ROAD	13838843.4289	2119856.5511
22	ROAD	13838843.1619	2119806.2786
23	ROAD	13838892.8983	2119756.0137
24	ROAD	13838950.7430	2119755.7095
25	ROAD	13838985.8561	2119769.8555
33	ROAD	13839059.0782	2119777.7478
34	ROAD	13839155.1449	2119680.8214
35	ROAD	13839167.3138	2119651.0314
36	ROAD	13839166.3406	2119468.6065
37	ROAD	13839142.0660	2119443.7505
38	SWALE	13838971.5779	2119940.8749
39	PLANT	13838974.2723	2119874.8337
40	PLANT	13838922.2731	2119875.1111
41	CL CLARIFIER	13838906.2012	2119861.6759
42	CL LIFT STA	13838998.2520	2119810.5348
43	PI CONC PAD	13838911.9227	2119761.9183
44	PI CONC PAD	13838912.0319	2119784.9180

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS — JOSE CANTU — 111313 — LICENSED PROFESSIONAL ENGINEER — 8-21-16

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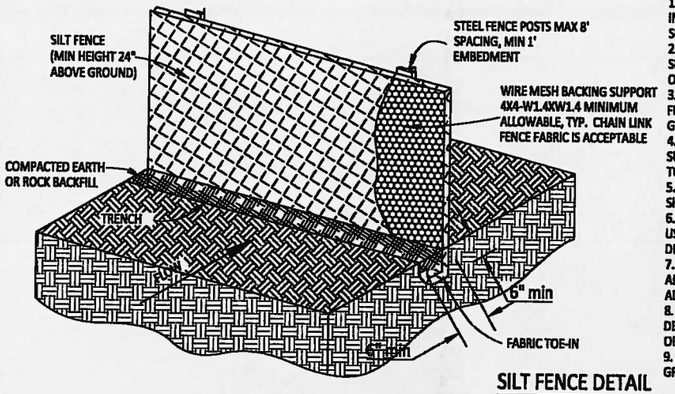
PARK VILLAGE WASTEWATER TREATMENT PLANT COMAL COUNTY, TEXAS

SITE PLAN AND DIMENSION CONTROL PLAN

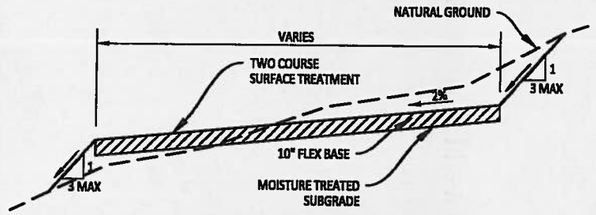
CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	7

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-DIM_GRAD.dwg [DIM] Plotted Mar 22, 2016 at 2:16pm by mmina (Last Saved by: mmina)

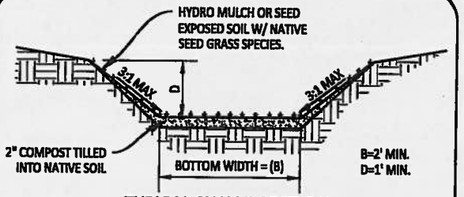


SILT FENCE DETAIL
N.T.S.

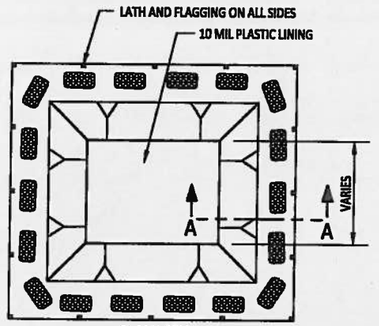
GENERAL NOTES:
1. STEEL POSTS WHICH SUPPORT THE SILT FENCE SHALL BE INSTALLED ON A SLIGHT ANGLE TOWARD THE ANTICIPATED RUNOFF SOURCE.
2. THE TOE OF THE SILT FENCE SHALL BE TRENCHED IN WITH A SPADE OR MECHANICAL TRENCHER, SO THAT THE DOWNSLOPE FACE OF THE TRENCH IS FLAT AND PERPENDICULAR TO THE LINE OF FLOW.
3. THE TRENCH SHOULD BE A MINIMUM OF 6 INCHES DEEP AND 3-4 FEET WIDE TO ALLOW FOR THE SILT FENCE TO BE LAID IN THE GROUND AND BACKFILLED.
4. SILT FENCE SHOULD BE SECURELY FASTENED TO EACH STEEL SUPPORT POST OR TO WOVEN WIRE, WHICH IS IN TURN ATTACHED TO THE STEEL FENCE POSTS.
5. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
6. SLIT FENCE SHALL BE REMOVED WHEN IT HAS SERVED ITS USEFULNESS, SO AS NOT TO BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
7. SEDIMENT TRAPPED BY THIS PRACTICE SHALL BE DISPOSED OF IN AN APPROVED SITE IN A MANNER THAT WILL NOT CONTRIBUTE TO ADDITIONAL SILTATION.
8. ACCUMULATED SILT SHALL BE REMOVED WHEN IT REACHES A DEPTH OF 6 INCHES AND DISPOSED OF IN AN APPROVED SPOIL SITE OR AS IN No. 7 ABOVE.
9. 30-INCH MINIMUM HEIGHT MEASURED FROM THE EXISTING OR GRADED GROUND.



ACCESS ROAD TYPICAL SECTION
N.T.S.

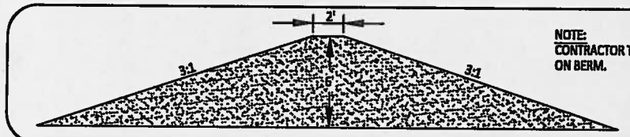


TYPICAL SWALE SECTION
N.T.S.



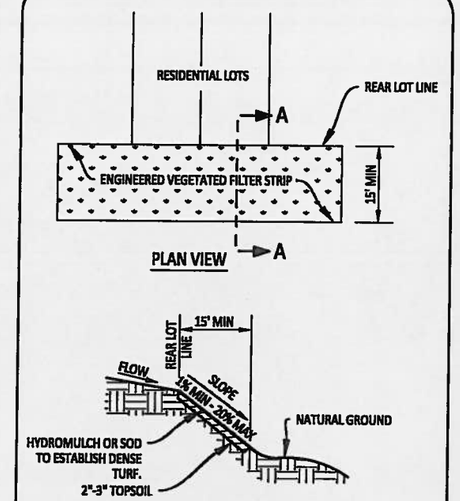
GENERAL NOTES:
1. INCORPORATE REQUIREMENTS FOR CONCRETE WASTE MANAGEMENT INTO MATERIAL SUPPLIER AND SUBCONTRACTOR AGREEMENTS.
2. AVOID MIXING EXCESS AMOUNTS OF FRESH CONCRETE.
3. PERFORM WASHOUT OF CONCRETE TRUCKS IN DESIGNATED AREAS ONLY.
4. DO NOT WASH OUT CONCRETE TRUCKS INTO STORM DRAINS, OPEN DITCHES, STREETS, OR STREAMS.
5. DO NOT ALLOW EXCESS CONCRETE TO BE DUMPED ONSITE, EXCEPT IN DESIGNATED AREAS.
6. FOR ONSITE WASHOUT, LOCATE WASHOUT AREA AT LEAST 50 FEET FROM SENSITIVE FEATURES, STORM DRAINS, OPEN DITCHES, OR WATER BODIES. DO NOT ALLOW RUNOFF FROM THIS AREA BY CONSTRUCTING A TEMPORARY PIT OR BERMED AREA LARGE ENOUGH FOR LIQUID AND SOLID WASTE.
7. WASH OUT WASTES INTO THE TEMPORARY PIT WHERE THE CONCRETE CAN SET, BE BROKEN UP, AND THEN DISPOSED PROPERLY.
8. PLASTIC LINING MATERIAL SHOULD BE A MINIMUM OF 10 MIL IN POLYETHYLENE SHEETING AND SHOULD BE FREE OF HOLES, TEARS, OR OTHER DEFECTS THAT COMPROMISE THE IMPERMEABILITY OF THE MATERIAL.
9. WHEN TEMPORARY CONCRETE WASHOUT FACILITIES ARE NO LONGER REQUIRED FOR THE WORK, THE HARDENED CONCRETE SHOULD BE REMOVED AND DISPOSED OF.
10. MATERIALS USED TO CONSTRUCT TEMPORARY CONCRETE WASHOUT FACILITIES SHOULD BE REMOVED FROM THE SITE OF THE WORK AND DISPOSED OF.
11. HOLES, DEPRESSIONS OR OTHER GROUND DISTURBANCE CAUSED BY THE REMOVAL OF THE TEMPORARY CONCRETE WASHOUT FACILITIES SHOULD BE BACKFILLED AND REPAIRED.

CONCRETE WASHOUT PIT- BELOW GRADE
N.T.S.



NOTE:
CONTRACTOR TO ESTABLISH VEGETATION ON BERM.

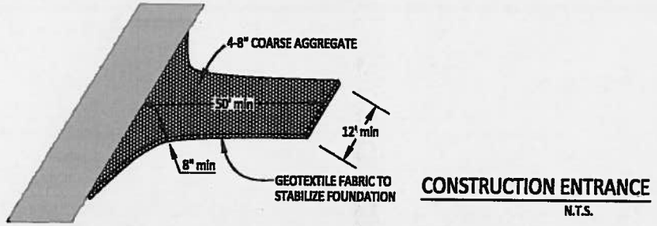
BERM DETAIL
N.T.S.



SECTION A-A
N.T.S.

NOTES:
1. VEGETATED FILTER STRIP SHALL BE A MINIMUM WIDTH OF 15' AND MAINTAIN 80% OF VEGETATED COVER.
2. THE STRIP AREA SHALL BE GRADED SMOOTHLY AND BE FREE OF GULLIES OR RILLS.
3. FILTER STRIP SHOULD BE LANDSCAPED AFTER OTHER PORTIONS OF THE PROJECT ARE COMPLETED.

ENGINEERED VEGETATED FILTER STRIP DETAIL
N.T.S.

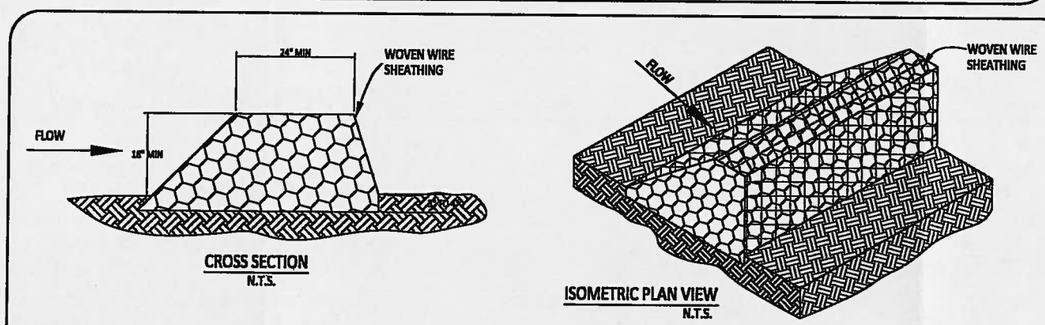


CONSTRUCTION ENTRANCE
N.T.S.

GENERAL NOTES:
MATERIALS
1) THE AGGREGATE SHOULD CONSIST OF 4 TO 8 INCH WASHED STONE OVER A STABLE FOUNDATION AS SPECIFIED IN THE PLAN.
2) THE AGGREGATE SHOULD BE PLACED WITH A MINIMUM THICKNESS OF 8 INCHES.
3) THE GEOTEXTILE FABRIC SHOULD BE DESIGNED SPECIFICALLY FOR USE AS A SOIL FILTRATION MEDIA WITH AN APPROXIMATE WEIGH OF 6 OZ/SQ YD, A MULLEN BURST RATING OF 140 LB/SQ IN, AND AN EQUIVALENT OPENING SIZE GREATER THAN A NUMBER 50 SIEVE.
4) IF A WASHING FACILITY IS REQUIRED, A LEVEL AREA WITH A MINIMUM OF 4 INCH WASHED STONE OR COMMERCIAL RACK SHOULD BE INCLUDED IN THE PLANS. DIVERT WASTEWATER TO A SEDIMENT TRAP OR BASIN.

INSTALLATION
1) AVOID CURVES ON PUBLIC ROADS AND STEEP SLOPES. REMOVE VEGETATION AND OTHER OBJECTIONABLE MATERIAL FROM THE FOUNDATION AREA. GRADE CROWN FOUNDATION FOR POSITIVE DRAINAGE.
2) THE MINIMUM WIDTH OF THE ENTRANCE/EXIT SHOULD BE 12 FEET OR THE FULL WIDTH OF THE EXIT ROADWAY, WHICHEVER IS GREATER.
3) THE CONSTRUCTION ENTRANCE SHOULD BE AT LEAST 50 FEET LONG.
4) IF THE SLOPE TOWARD THE ROAD EXCEEDS 2%, CONSTRUCTION A RIDGE OF 6 TO 8 INCHES HIGH WITH 3:1 (H:V) SIDE SLOPES, ACROSS THE FOUNDATION APPROXIMATELY 15 FEET FROM THE ENTRANCE TO DIVERT RUNOFF AWAY FROM THE PUBLIC ROAD.
5) PLACE GEOTEXTILE FABRIC AND GRADE FOUNDATION TO IMPROVE STABILITY, ESPECIALLY WHERE WET CONDITIONS ARE ANTICIPATED.
6) PLACE STONE TO DIMENSIONS AND GRADE SHOWN ON PLANS. LEAVE SURFACE SMOOTH AND SLOPE FOR DRAINAGE.
7) DIVERT ALL SURFACE RUNOFF AND DRAINAGE FROM THE STONE PAD TO A SEDIMENT TRAP OR BASIN.
8) INSTALL PIPE UNDER PAD AS NEEDED TO MAINTAIN PROPER PUBLIC ROAD DRAINAGE.

INSPECTION AND MAINTENANCE
1) THE ENTRANCE SHOULD BE MAINTAINED IN A CONDITION, WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2) ALL SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ON TO PUBLIC RIGHTS-OF-WAY SHOULD BE REMOVED IMMEDIATELY BY CONTRACTOR.
3) WHEN NECESSARY, WHEELS SHOULD BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY.
4) WHEN WASHING IS REQUIRED, IT SHOULD BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
5) ALL SEDIMENT SHOULD BE PREVENTED FROM ENTERING ANY STORM DRAIN, DITCH OR WATER COURSE BY USING APPROVED METHODS.



GENERAL NOTES:
MATERIALS
1) THE BERM STRUCTURE SHOULD BE SECURED WITH A WOVEN WIRE SHEATHING HAVING MAXIMUM OPENING OF 1 INCH AND A MINIMUM WIRE DIAMETER OF 20 GAUGE GALVANIZED AND SHOULD BE SECURED WITH SHOAT RINGS.
2) CLEAN, OPEN GRADED 3- TO 5-INCH DIAMETER ROCK SHOULD BE USED, EXCEPT IN AREAS WHERE HIGH VELOCITIES OR LARGE VOLUMES OF FLOW ARE EXPECTED, WHERE 5- TO 8-INCH DIAMETER ROCK MAY BE USED.

INSTALLATION
1) LAY OUT THE WOVEN WIRE SHEATHING PERPENDICULAR TO THE FLOW LINE. THE SHEATHING SHOULD BE 20 GAUGE WOVEN WIRE MESH WITH 1 INCH OPENINGS.
2) BERM SHOULD HAVE A TOP WIDTH OF 2 FEET MINIMUM WITH SIDE SLOPES BEING 2:1 (H:V) OR FLATTER.
3) PLACE THE ROCK ALONG THE SHEATHING AS SHOWN IN THE DIAGRAM TO A HEIGHT NOT LESS THAN 18 INCHES.
4) WRAP THE WIRE SHEATHING AROUND THE ROCK AND SECURE WITH TIE WIRE SO THAT THE ENDS OF SHEATHING OVERLAP AT LEAST 2 INCHES, AND THE BERM RETAINS ITS SHAPE WHEN WALKED UPON.
5) BERM SHOULD BE BUILT ALONG THE CONTOUR AT ZERO PERCENT GRADE OR AS NEAR AS POSSIBLE.
6) THE ENDS OF THE BERM SHOULD BE TIED INTO EXISTING UPSLOPE GRADE AND THE BERM SHOULD BE BURIED IN A TRENCH APPROXIMATELY 3 TO 4 INCHES DEEP TO PREVENT FAILURE OF THE CONTROL.

INSPECTION AND MAINTENANCE
1) INSPECTION SHOULD BE MADE WEEKLY AND AFTER EACH RAINFALL BY THE RESPONSIBLE PARTY. FOR INSTALLATIONS IN STREAMBEDS, ADDITIONAL DAILY INSPECTIONS SHOULD BE MADE.
2) REMOVE SEDIMENT AND OTHER DEBRIS WHEN BUILDUP REACHES 6 INCHES AND DISPOSE OF THE ACCUMULATED SILT IN AN APPROVED MANNER.
3) REPAIR ANY LOOSE WIRE SHEATHING.
4) THE BERM SHOULD BE RESHAPED AS NEEDED DURING INSPECTION.
5) THE BERM SHOULD BE REPLACED WHEN THE STRUCTURE CEASES TO FUNCTION AS INTENDED DUE TO SILT ACCUMULATION AMONG THE ROCKS, WASHOUT, CONSTRUCTION TRAFFIC DAMAGE, ETC.
6) THE ROCK BERM SHOULD BE LEFT IN PLACE UNTIL ALL UPSTREAM AREAS ARE STABILIZED AND ACCUMULATED SILT REMOVED.

ROCK BERMS
N.T.S.

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
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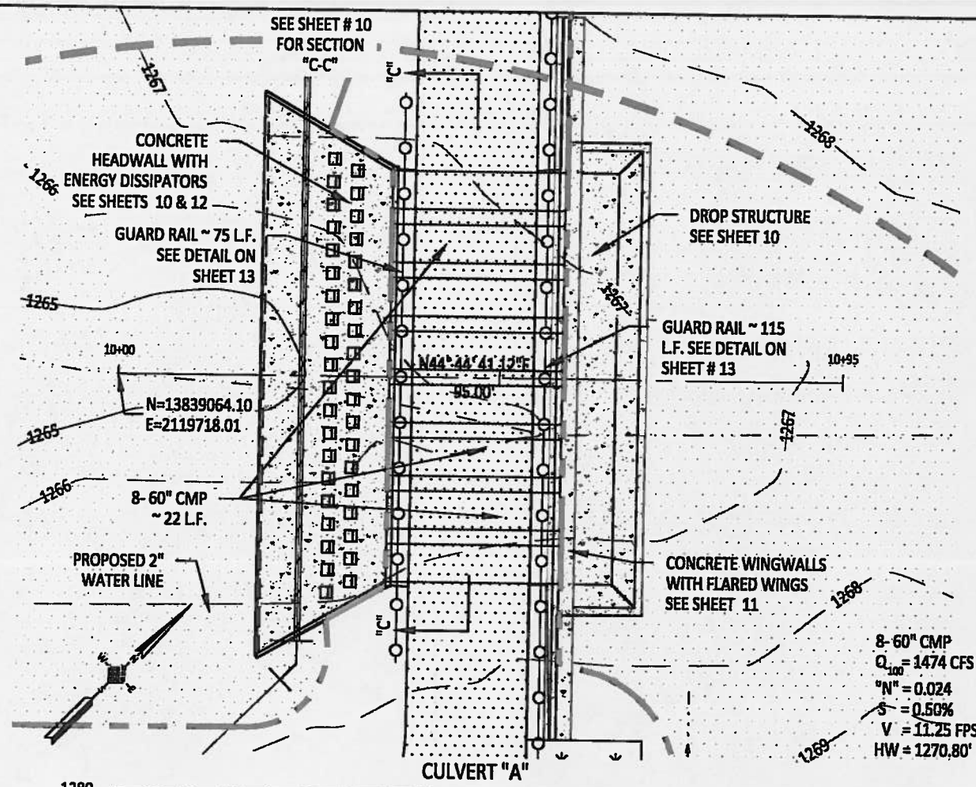
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

MISCELLANEOUS DETAILS

CHK. BY: J.A.C.	IDS JOB NO: 150000111		
DWG. BY: M.G.M.	STATE	COUNTY	SHEET NO.
DATE: 01/11/2016	TEXAS	COMAL	8

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-SW3P.dwg [SW3P DETAILS] Plotted Mar 22, 2016 at 2:16pm by mmina (Last Saved by: GRomero)



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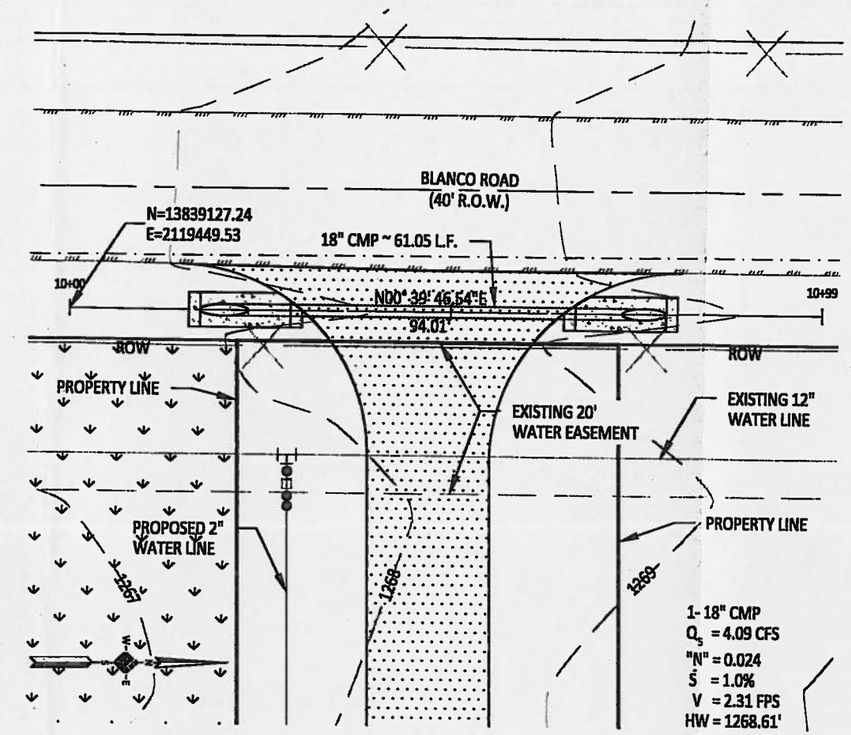

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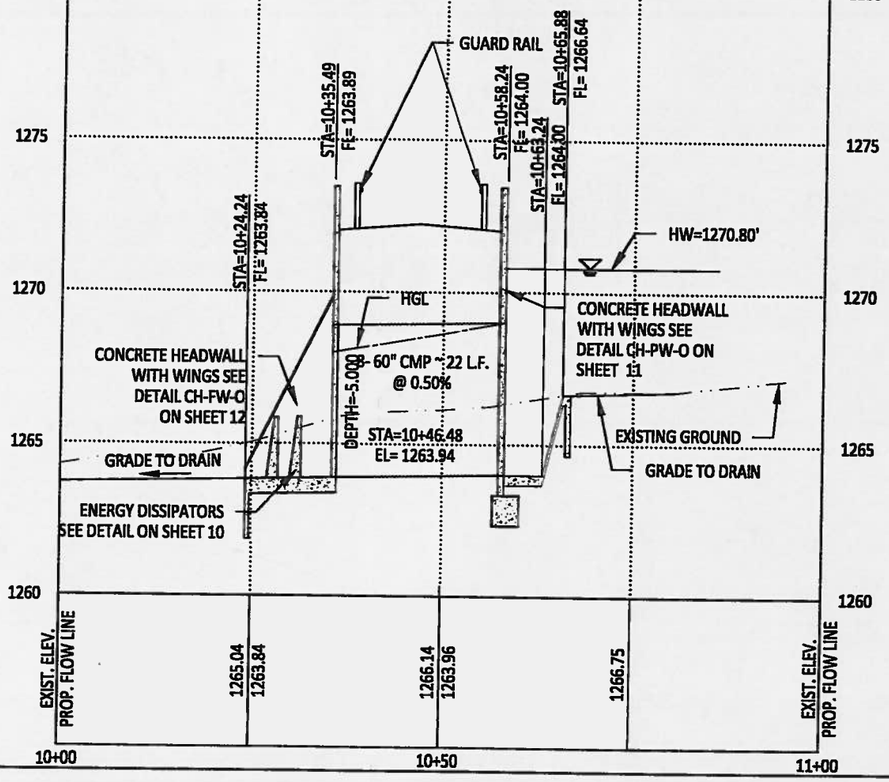

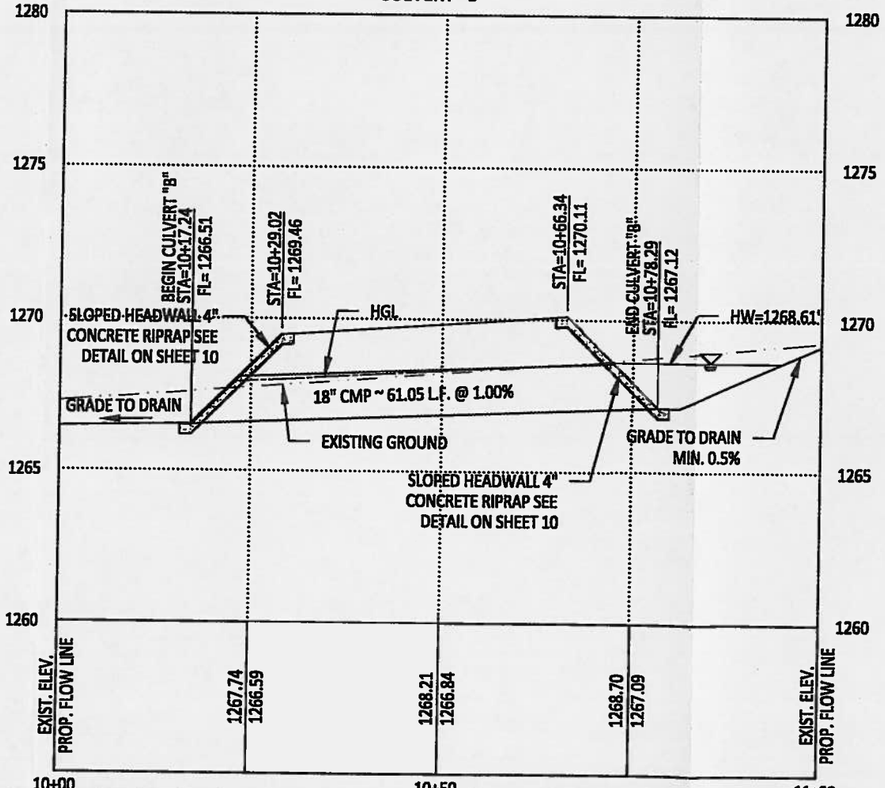

LEGEND

- 1300 — EXISTING CONTOUR MAJOR
- 1293 — EXISTING CONTOUR MINOR
- OHP — OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 100YR WATER SURFACE INUNDATION
- ACCESS ROAD
- VEGETATED FILTER STRIP
- CONCRETE RIPRAP

NOTE: RUNOFF CALCULATIONS USED WERE OBTAINED FROM PARK VILLAGE MASTER STORM WATER MANAGEMENT PLAN.

20' 0' 20'

SCALE 1"=20' H: 1"=20' V: 1"=5'

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS — JOSE CANTU — 111318 — LICENSED PROFESSIONAL ENGINEER — 8-21-16

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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

CULVERT A AND B PLAN AND PROFILE

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	9

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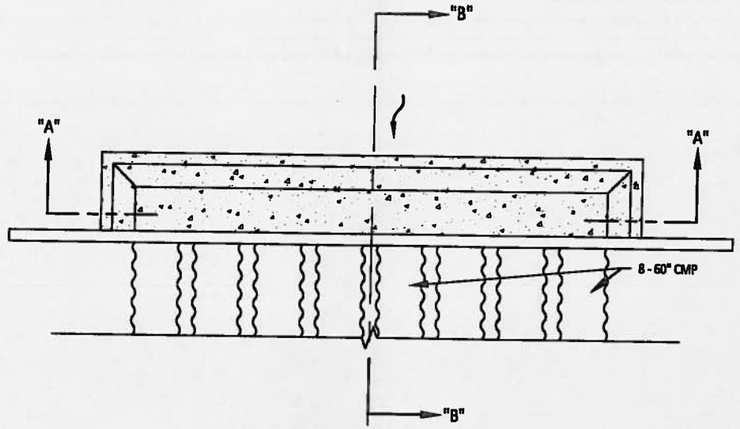
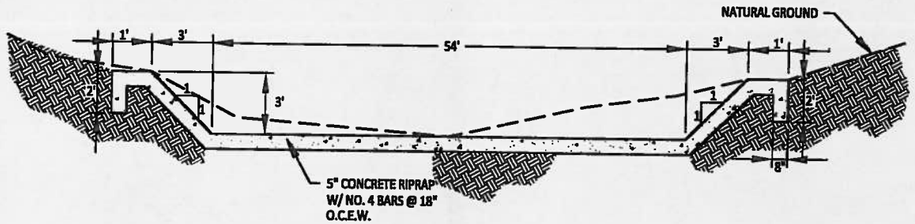
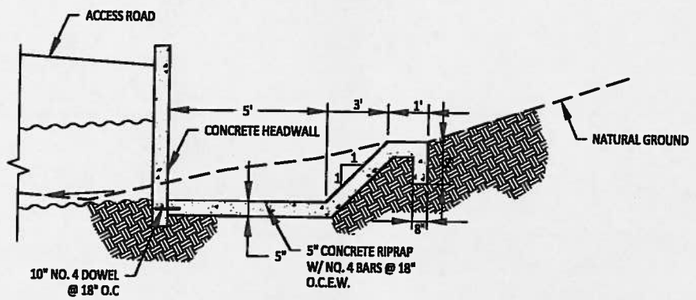


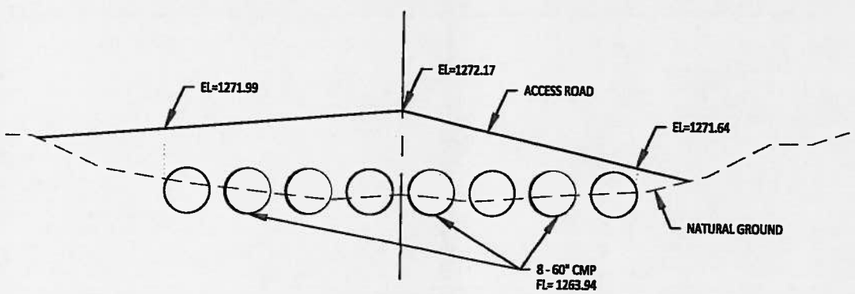
CONCRETE DROP STRUCTURE DETAIL
N.T.S.



SECTION "A-A"
N.T.S.



SECTION "B-B"
N.T.S.



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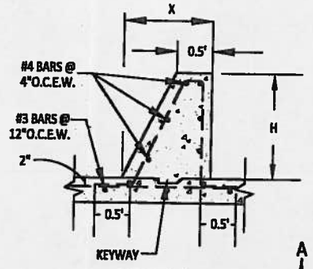
N.T.S.



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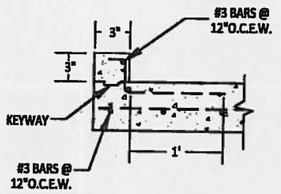

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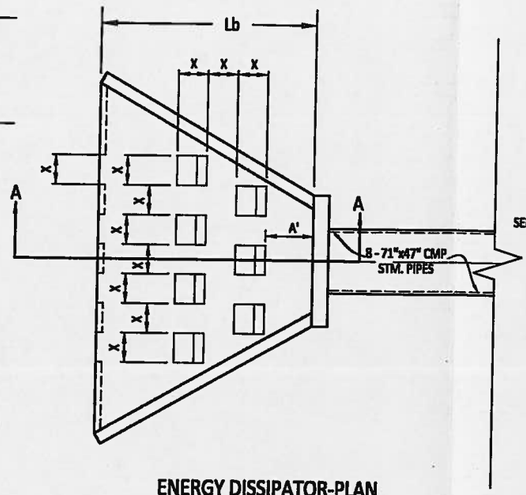
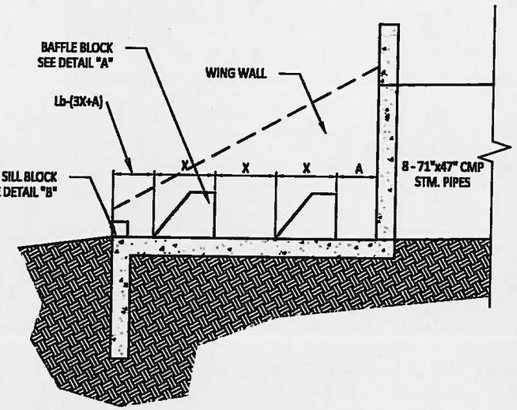


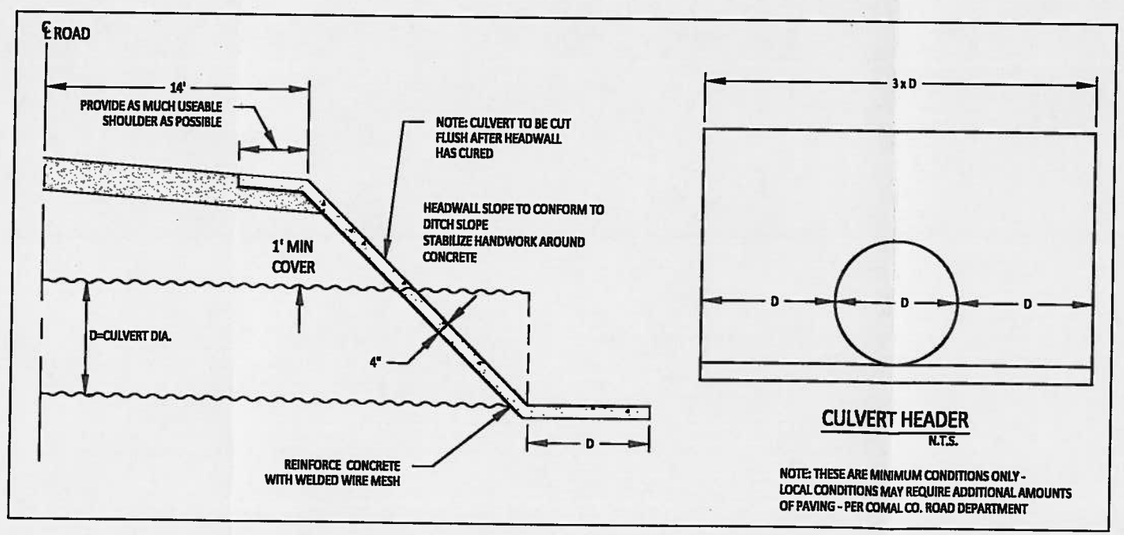
ENERGY DISSIPATOR-PLAN
N.T.S.



ENERGY DISSIPATOR SECTION "A-A"
N.T.S.

DIMENSION TABLE FOR ENERGY DISSIPATOR

OUTFALL SYSTEM	LB (FT)	A(FT)	X (FT)	H (FT)
CULVERT A	11.0	4.0	1.5	2.0'



CULVERT HEADER
N.T.S.

NOTE: THESE ARE MINIMUM CONDITIONS ONLY - LOCAL CONDITIONS MAY REQUIRE ADDITIONAL AMOUNTS OF PAVING - PER COMAL CO. ROAD DEPARTMENT

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS
JOSE CANTU
111313
LICENSED PROFESSIONAL ENGINEER
3-21-16

IDS Engineering Group
TBPE F-002785 TBPLS 10110704
613 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

DRAINAGE DETAILS 1

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	10

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-DTLS_DRN.dwg [DETAILS1] Plotted Mar 22, 2016 at 2:17pm by mmina (Last Saved by: mmina)

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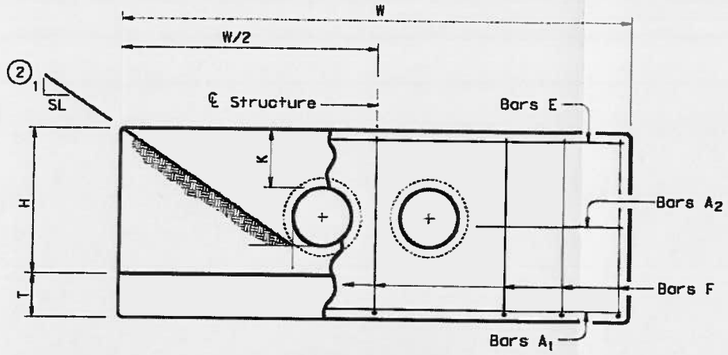
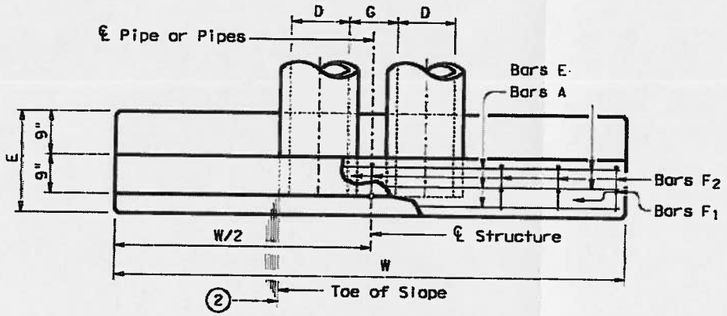
DATE:
FILE:

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

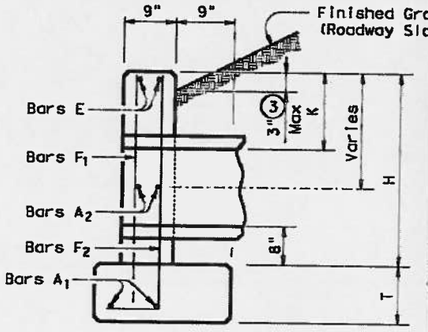
SLOPE	DIA OF PIPE, D	Values for one Pipe			Values to be added for each addt'l Pipe		
		W	Reinf (Lbs)	Conc (CY) (1)	W	Reinf (Lbs)	Conc (CY) (1)
2:1	12"	9'- 0"	122	1.1	1'- 9"	15	0.2
	15"	10'- 3"	136	1.3	2'- 2"	16	0.2
	18"	11'- 6"	163	1.5	2'- 8"	19	0.3
	21"	12'- 9"	200	1.8	3'- 1"	31	0.4
	24"	14'- 0"	217	2.1	3'- 7"	34	0.4
	27"	15'- 3"	254	2.4	3'-11"	37	0.5
	30"	16'- 6"	272	2.7	4'- 4"	40	0.6
	33"	17'- 9"	314	3.1	4'- 8"	43	0.6
	36"	19'- 0"	371	3.9	5'- 1"	46	0.8
	42"	21'- 6"	442	4.9	5'-10"	52	1.0
	48"	25'- 0"	569	6.4	6'- 7"	59	1.3
	54"	27'- 6"	701	7.5	7'- 6"	82	1.6
	60"	30'- 0"	794	8.8	8'- 3"	90	1.8
	66"	32'- 6"	894	10.2	8'- 9"	96	2.0
	72"	35'- 0"	1055	11.7	9'- 4"	103	2.3
3:1	12"	13'- 0"	175	1.6	1'- 9"	14	0.2
	15"	14'- 9"	193	1.9	2'- 2"	17	0.2
	18"	16'- 6"	228	2.2	2'- 8"	19	0.3
	21"	18'- 3"	299	2.6	3'- 1"	31	0.4
	24"	20'- 0"	323	3.0	3'- 7"	33	0.4
	27"	21'- 9"	371	3.5	3'-11"	37	0.5
	30"	23'- 6"	415	4.0	4'- 4"	40	0.5
	33"	25'- 3"	469	4.6	4'- 8"	43	0.6
	36"	27'- 0"	556	5.7	5'- 1"	46	0.8
	42"	30'- 6"	675	7.1	5'-10"	52	1.0
	48"	35'- 6"	837	9.2	6'- 7"	59	1.3
	54"	39'- 0"	1015	11.0	7'- 6"	84	1.6
	60"	42'- 6"	1171	12.9	8'- 3"	91	1.8
	66"	46'- 0"	1298	14.9	8'- 9"	98	2.0
	72"	49'- 6"	1561	17.1	9'- 4"	103	2.3
4:1	12"	17'- 0"	229	2.0	1'- 9"	15	0.2
	15"	19'- 3"	266	2.4	2'- 2"	17	0.2
	18"	21'- 6"	308	2.9	2'- 8"	19	0.3
	21"	23'- 9"	382	3.5	3'- 1"	31	0.3
	24"	26'- 0"	430	3.9	3'- 7"	34	0.4
	27"	28'- 3"	486	4.7	3'-11"	37	0.5
	30"	30'- 6"	539	5.2	4'- 4"	40	0.6
	33"	32'- 9"	603	6.0	4'- 8"	42	0.6
	36"	35'- 0"	738	7.5	5'- 1"	47	0.8
	42"	39'- 6"	881	9.3	5'-10"	52	1.0
	48"	46'- 0"	1102	12.1	6'- 7"	61	1.3
	54"	50'- 6"	1364	14.4	7'- 6"	84	1.6
	60"	55'- 0"	1547	16.9	8'- 3"	91	1.8
	66"	59'- 6"	1741	19.5	8'- 9"	98	2.0
	72"	64'- 0"	2069	22.4	9'- 4"	102	2.3
6:1	12"	25'- 0"	336	3.0	1'- 9"	14	0.2
	15"	28'- 3"	384	3.6	2'- 2"	17	0.2
	18"	31'- 6"	452	4.2	2'- 8"	19	0.3
	21"	34'- 9"	581	5.1	3'- 1"	31	0.4
	24"	38'- 0"	644	5.8	3'- 7"	34	0.4
	27"	41'- 3"	737	6.9	3'-11"	37	0.5
	30"	44'- 6"	807	7.7	4'- 4"	39	0.6
	33"	47'- 9"	912	8.9	4'- 8"	44	0.6
	36"	51'- 0"	1108	11.0	5'- 1"	48	0.8
	42"	57'- 6"	1318	13.7	5'-10"	54	1.0
	48"	67'- 0"	1674	17.9	6'- 7"	59	1.3
	54"	73'- 6"	2064	21.3	7'- 6"	83	1.6
	60"	80'- 0"	2343	24.9	8'- 3"	89	1.8
	66"	86'- 6"	2635	28.9	8'- 9"	96	2.0
	72"	93'- 0"	3123	33.1	9'- 4"	101	2.3



ELEVATION



PLAN OF NON-SKEWED PIPES



℄ SECTION

(1) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(2) Indicated slope is perpendicular to centerline Pipe or Pipes.

(3) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

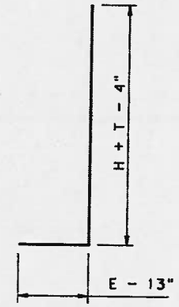
(4) Quantities shown are for one structure end only (one headwall).

TABLE OF CONSTANT DIMENSIONS

DIA OF PIPE, D	G	K	H	T	E
12"	9"	1'- 0"	2'- 8"	9"	1'- 9"
15"	11"	1'- 0"	2'-11"	9"	1'- 9"
18"	1'- 2"	1'- 0"	3'- 2"	9"	1'- 9"
21"	1'- 4"	1'- 0"	3'- 5"	9"	2'- 0"
24"	1'- 7"	1'- 0"	3'- 8"	9"	2'- 0"
27"	1'- 8"	1'- 0"	3'-11"	9"	2'- 3"
30"	1'-10"	1'- 0"	4'- 2"	9"	2'- 3"
33"	1'-11"	1'- 0"	4'- 5"	9"	2'- 6"
36"	2'- 1"	1'- 0"	4'- 8"	1'- 0"	2'- 6"
42"	2'- 4"	1'- 0"	5'- 2"	1'- 0"	2'- 9"
48"	2'- 7"	1'- 3"	5'-11"	1'- 0"	3'- 0"
54"	3'- 0"	1'- 3"	6'- 5"	1'- 0"	3'- 3"
60"	3'- 3"	1'- 3"	6'-11"	1'- 0"	3'- 6"
66"	3'- 3"	1'- 3"	7'- 5"	1'- 0"	3'- 9"
72"	3'- 4"	1'- 3"	7'-11"	1'- 0"	4'- 0"

TABLE OF REINFORCING STEEL (4)

Bar	Size	Spa	No.
A1	# 5	~	2
A2	# 5	1'-6"	~
E	# 5	~	2
F	# 5	1'-0"	~



BARS F2

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

Texas Department of Transportation | Bridge Division Standard

CONCRETE HEADWALLS WITH PARALLEL WINGS FOR NON-SKEWED PIPE CULVERTS

CH-PW-0

FILE: chpw0std.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO. 44

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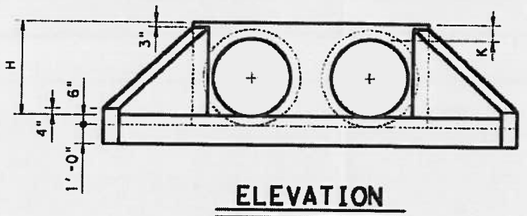
DATE:
FILE:

TABLE OF VARIABLE DIMENSIONS AND QUANTITIES FOR ONE HEADWALL (4)

SLOPE	DIA OF PIPE, D	Values for one Pipe						Values to be added for each addt'l Pipe		
		W	X	Y	L	Reinf (Lbs)	Conc (CY) (1)	X and W	Reinf (Lbs)	Conc (CY) (1)
2:1	12"	4'- 7 1/2"	2'- 6"	2'-10"	3'- 3 1/4"	84	0.6	1'- 9"	20	0.2
	15"	5'- 5 3/4"	2'- 9 1/2"	3'- 4"	3'-10 1/4"	99	0.7	2'- 2"	24	0.3
	18"	6'- 4 1/4"	3'- 1"	3'-10"	4'- 5"	120	0.9	2'- 8"	32	0.3
	21"	7'- 2 3/4"	3'- 4 1/2"	4'- 4"	5'- 0"	137	1.1	3'- 1"	43	0.4
	24"	8'- 2 1/2"	3'- 9 1/2"	4'-10"	5'- 7"	158	1.3	3'- 7"	50	0.5
	27"	9'- 1"	4'- 1"	5'- 4"	6'- 2"	173	1.5	3'-11"	56	0.6
	30"	9'-11 1/2"	4'- 4 1/2"	5'-10"	6'- 8 3/4"	197	1.7	4'- 4"	65	0.8
	33"	10'-10"	4'- 8"	6'- 4"	7'- 3 3/4"	216	2.0	4'- 8"	71	0.9
	36"	11'- 8 1/4"	4'-11 1/2"	6'-10"	7'-10 3/4"	241	2.2	5'- 1"	81	1.0
	42"	13'- 5 1/4"	5'- 6 1/2"	7'-10"	9'- 0 1/2"	290	2.8	5'-10"	97	1.3
	48"	15'- 9"	6'- 1 1/2"	9'- 4"	10'- 9 1/4"	350	3.8	6'- 7"	117	1.7
	54"	17'- 5 3/4"	6'- 8 1/2"	10'- 4"	11'-11 1/4"	415	4.5	7'- 6"	151	2.1
	60"	19'- 2 3/4"	7'- 3 1/2"	11'- 4"	13'- 1"	469	5.3	8'- 3"	174	2.5
	66"	20'-11 1/2"	7'-10 1/2"	12'- 4"	14'- 3"	530	6.2	8'- 9"	194	2.9
	72"	22'- 8 1/2"	8'- 5 1/2"	13'- 4"	15'- 4 3/4"	587	7.1	9'- 4"	213	3.3
3:1	12"	6'- 3"	2'- 6"	4'- 3"	4'-11"	114	0.8	1'- 9"	22	0.2
	15"	7'- 5"	2'- 9 1/2"	5'- 0"	5'- 9 1/4"	133	1.1	2'- 2"	28	0.3
	18"	8'- 6 3/4"	3'- 1"	5'- 9"	6'- 7 3/4"	166	1.3	2'- 8"	37	0.5
	21"	9'- 8 3/4"	3'- 4 1/2"	6'- 6"	7'- 6"	189	1.6	3'- 1"	48	0.6
	24"	11'- 0"	3'- 9 1/2"	7'- 3"	8'- 4 1/2"	221	2.0	3'- 7"	58	0.7
	27"	12'- 2"	4'- 1"	8'- 0"	9'- 2 3/4"	245	2.3	3'-11"	67	0.8
	30"	13'- 4"	4'- 4 1/2"	8'- 9"	10'- 1 1/4"	287	2.7	4'- 4"	77	1.0
	33"	14'- 5 3/4"	4'- 8"	9'- 6"	10'-11 3/4"	310	3.1	4'- 8"	84	1.2
	36"	15'- 7 3/4"	4'-11 1/2"	10'- 3"	11'-10"	343	3.5	5'- 1"	96	1.4
	42"	17'-11 1/2"	5'- 6 1/2"	11'- 9"	13'- 6 3/4"	424	4.5	5'-10"	119	1.7
	48"	21'- 1 3/4"	6'- 1 1/2"	14'- 0"	16'- 2"	527	6.1	6'- 7"	146	2.3
	54"	23'- 5 1/2"	6'- 8 1/2"	15'- 6"	17'-10 3/4"	618	7.3	7'- 6"	186	2.9
	60"	25'- 9 1/4"	7'- 3 1/2"	17'- 0"	19'- 7 1/2"	707	8.7	8'- 3"	219	3.4
	66"	28'- 1"	7'-10 1/2"	18'- 6"	21'- 4 1/4"	797	10.1	8'- 9"	242	3.9
	72"	30'- 4 3/4"	8'- 5 1/2"	20'- 0"	23'- 1 1/4"	910	11.7	9'- 4"	272	4.4
4:1	12"	7'-10 3/4"	2'- 6"	5'- 8"	6'- 6 1/2"	144	1.1	1'- 9"	24	0.3
	15"	9'- 4"	2'- 9 1/2"	6'- 8"	7'- 8 1/2"	177	1.5	2'- 2"	32	0.4
	18"	10'- 9 1/2"	3'- 1"	7'- 8"	8'-10 1/4"	217	1.9	2'- 8"	42	0.5
	21"	12'- 2 3/4"	3'- 4 1/2"	8'- 8"	10'- 0"	254	2.3	3'- 1"	57	0.7
	24"	13'- 9 1/2"	3'- 9 1/2"	9'- 8"	11'- 2"	295	2.8	3'- 7"	67	0.9
	27"	15'- 3"	4'- 1"	10'- 8"	12'- 3 3/4"	328	3.3	3'-11"	77	1.0
	30"	16'- 8 1/4"	4'- 4 1/2"	11'- 8"	13'- 5 3/4"	379	3.8	4'- 4"	89	1.3
	33"	18'- 1 3/4"	4'- 8"	12'- 8"	14'- 7 1/2"	417	4.5	4'- 8"	101	1.4
	36"	19'- 7"	4'-11 1/2"	13'- 8"	15'- 9 1/4"	464	5.1	5'-1"	115	1.7
	42"	22'- 5 3/4"	5'- 6 1/2"	15'- 8"	18'- 1"	575	6.5	5'-10"	141	2.1
	48"	26'- 6 1/4"	6'- 1 1/2"	18'- 8"	21'- 6 3/4"	720	8.9	6'- 7"	175	2.8
	54"	29'- 5"	6'- 8 1/2"	20'- 8"	23'-10 1/4"	863	10.7	7'- 6"	226	3.6
	60"	32'- 3 3/4"	7'- 3 1/2"	22'- 8"	26'- 2"	984	12.7	8'- 3"	264	4.3
	66"	35'- 2 1/2"	7'-10 1/2"	24'- 8"	28'- 5 3/4"	1126	14.9	8'- 9"	300	4.9
	72"	38'- 1 1/4"	8'- 5 1/2"	26'- 8"	30'- 9 1/2"	1283	17.3	9'- 4"	334	5.6
6:1	12"	11'- 2"	2'- 6"	8'- 6"	9'- 9 3/4"	220	1.9	1'- 9"	28	0.4
	15"	13'- 2 1/4"	2'- 9 1/2"	10'- 0"	11'- 6 1/2"	264	2.5	2'- 2"	37	0.5
	18"	15'- 2 1/2"	3'- 1"	11'- 6"	13'- 3 1/4"	326	3.2	2'- 8"	50	0.7
	21"	17'- 2 3/4"	3'- 4 1/2"	13'- 0"	15'- 0 1/4"	381	3.9	3'- 1"	69	0.9
	24"	19'- 4 1/2"	3'- 9 1/2"	14'- 6"	16'- 9"	447	4.8	3'- 7"	80	1.2
	27"	21'- 4 3/4"	4'- 1"	16'- 0"	18'- 5 3/4"	506	5.7	3'-11"	96	1.4
	30"	23'- 5 1/4"	4'- 4 1/2"	17'- 6"	20'- 2 1/2"	587	6.7	4'- 4"	110	1.7
	33"	25'- 5 1/2"	4'- 8"	19'- 0"	21'-11 1/4"	667	7.8	4'- 8"	127	2.0
	36"	27'- 5 3/4"	4'-11 1/2"	20'- 6"	23'- 8"	727	9.0	5'- 1"	144	2.3
	42"	31'- 6 1/4"	5'- 6 1/2"	23'- 6"	27'- 1 1/2"	914	11.5	5'-10"	179	3.0
	48"	37'- 3 1/2"	6'- 1 1/2"	28'- 0"	32'- 4"	1181	15.9	6'- 7"	231	4.0
	54"	41'- 4 1/4"	6'- 8 1/2"	31'- 0"	35'- 9 1/2"	1412	19.2	7'- 6"	300	5.0
	60"	45'- 4 3/4"	7'- 3 1/2"	34'- 0"	39'- 3"	1619	22.9	8'- 3"	353	6.0



ELEVATION
Showing dimensions

(1) Quantities shown are for concrete pipe and will increase slightly for metal pipe installations.

(2) For vehicle safety, curbs shall project no more than 3" above finished grade. Curb heights shall be reduced, if necessary, to meet these requirements. No changes will be made in quantities and no additional compensation will be allowed for this work.

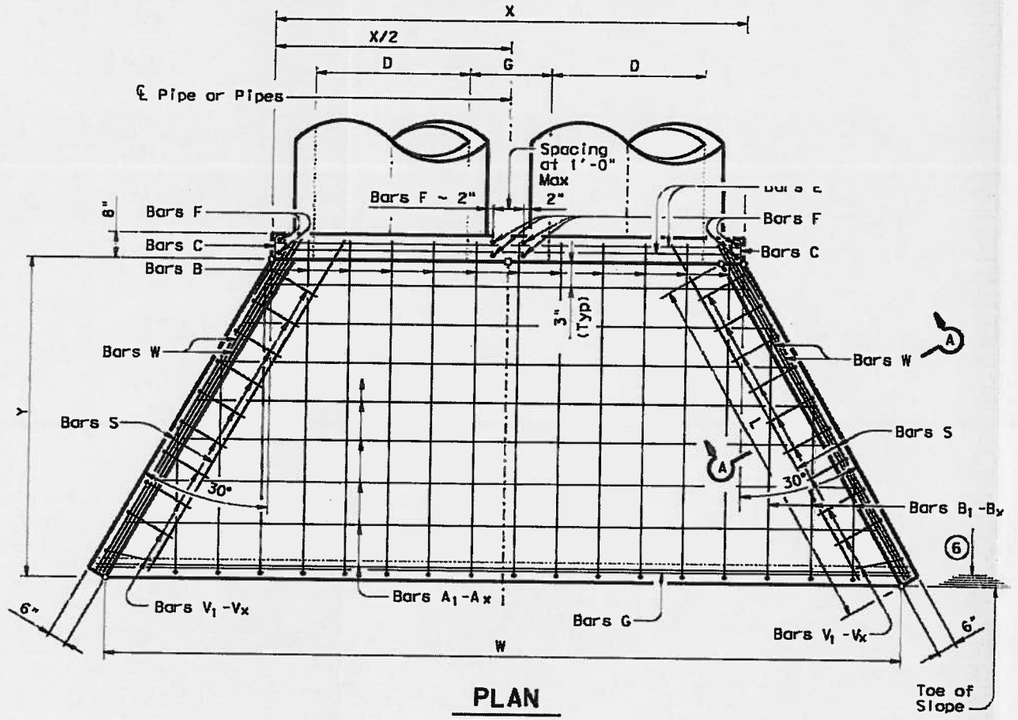
(3) Provide a 1'-0" footing as shown where required to maintain 4" Min cover for pipes.

(4) Quantities shown are for one structure end only (one headwall).

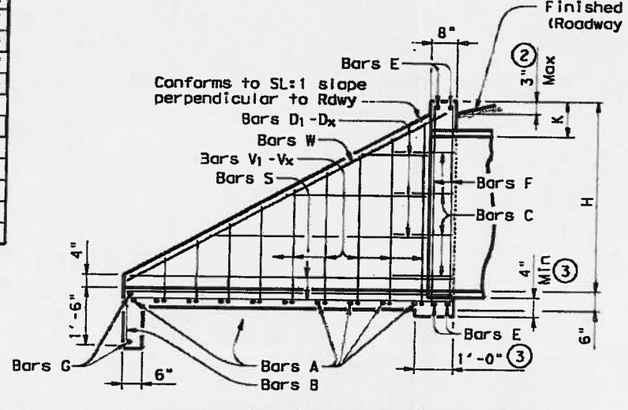
(5) Min Length = $6" + 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right)$

Max Length = $12 \times H - 3" \times \left(\frac{12 \times H - 7}{12 \times L}\right) - 1"$

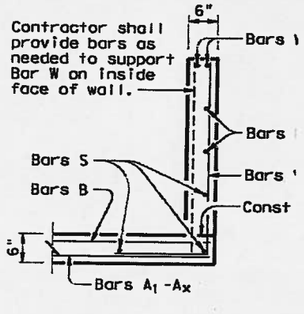
(6) Lengths of wings based on SL:1 Slope along this line.



PLAN



TYPICAL WING ELEVATION



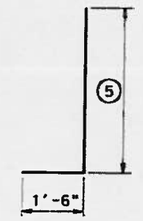
SECTION A-A

TABLE OF REINFORCING STEEL (4)

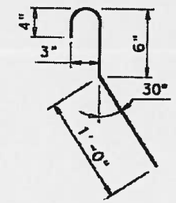
Bar	Size	Spa	No.
A	# 4	1'-0"	~
B	# 3	1'-6"	~
C	# 4	1'-0"	~
D	# 3	1'-0"	~
E	# 5	~	4
F	# 5	~	~
G	# 3	~	2
S	# 4	~	6
V	# 4	1'-0"	~
W	# 5	~	4

TABLE OF CONSTANT DIMENSIONS

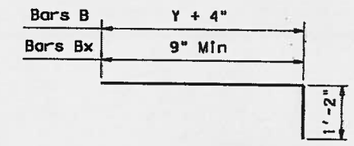
DIA OF PIPE, D	G	K	H
12"	9"	1'- 0"	2'- 0"
15"	11"	1'- 0"	2'- 3"
18"	1'- 2"	1'- 0"	2'- 6"
21"	1'- 4"	1'- 0"	2'- 9"
24"	1'- 7"	1'- 0"	3'- 0"
27"	1'- 8"	1'- 0"	3'- 3"
30"	1'-10"	1'- 0"	3'- 6"
33"	1'-11"	1'- 0"	3'- 9"
36"	2'- 1"	1'- 0"	4'- 0"
42"	2'- 4"	1'- 0"	4'- 6"
48"	2'- 7"	1'- 3"	5'- 3"
54"	3'- 0"	1'- 3"	5'- 9"
60"	3'- 3"	1'- 3"	6'- 3"
66"	3'- 3"	1'- 3"	6'- 9"
72"	3'- 4"	1'- 3"	7'- 3"



BARS V



BARS C
(2'-0" long)



BARS B & B_1-B_x

GENERAL NOTES:

Designed according to AASHTO LRFD Specifications.

Reinforcing steel shall be placed with the center of the outside layer of bars 2" from the surface of the concrete.

All reinforcing steel shall be Grade 60.

All concrete shall be Class "C" and shall have a minimum compressive strength of 3600 psi.

No bridge rails of any type may be mounted directly to these culvert headwalls.

Texas Department of Transportation | Bridge Division Standard

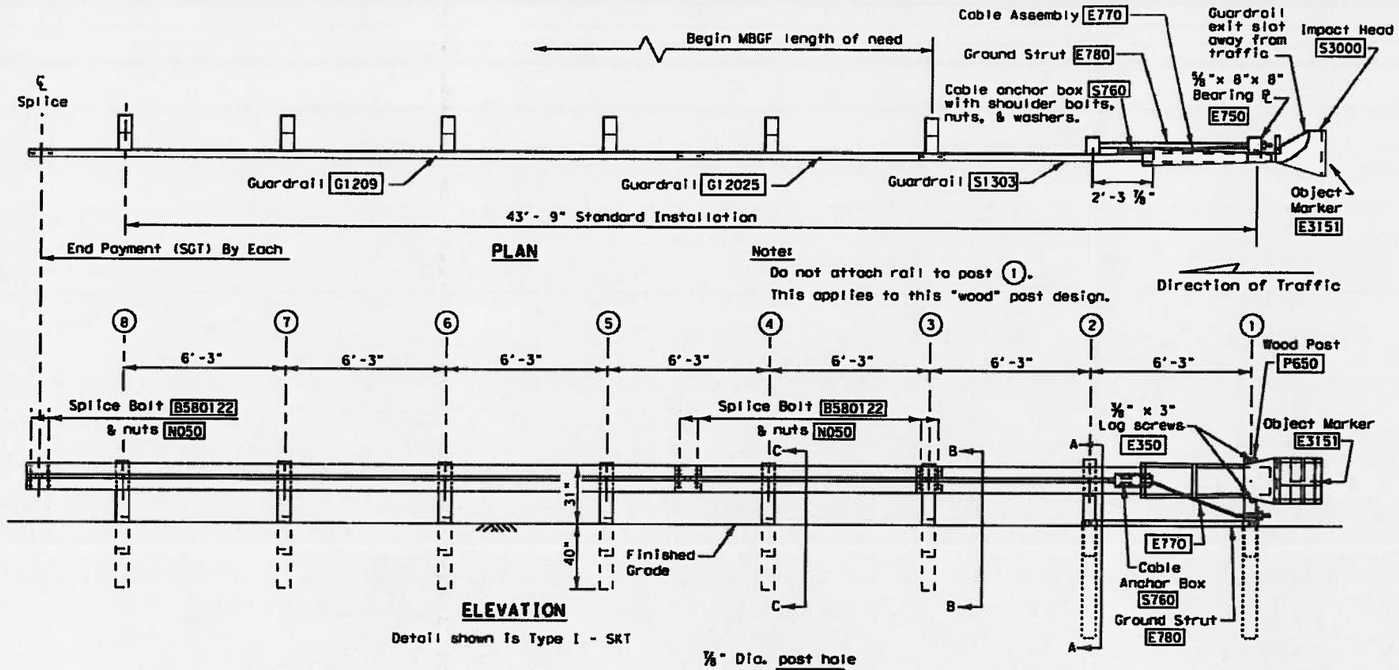
CONCRETE HEADWALLS WITH FLARED WINGS FOR 0° SKEW PIPE CULVERTS

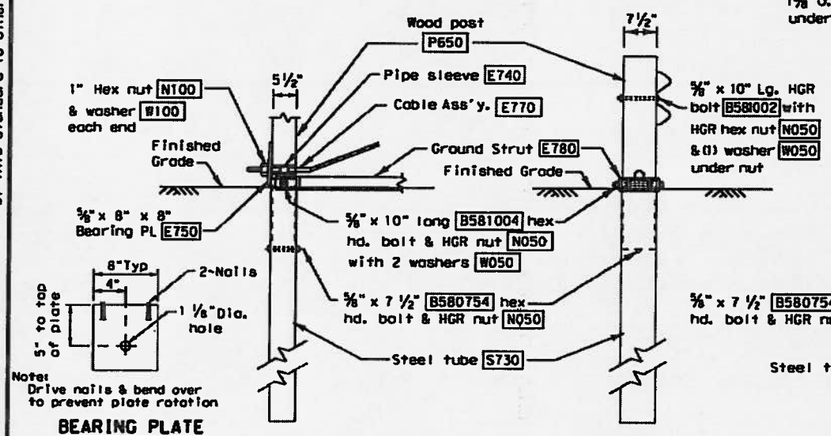
CH-FW-0

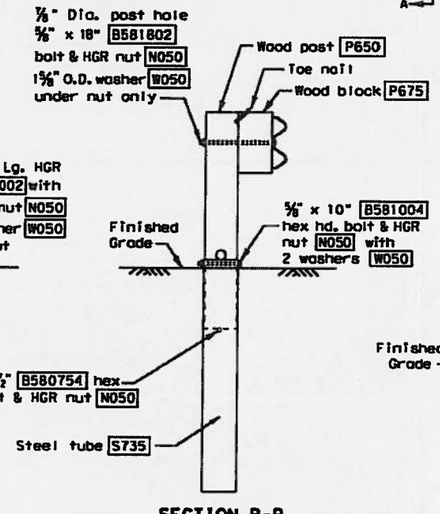
FILE: chfw00se.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: GAF
©TxDOT February 2010	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO.

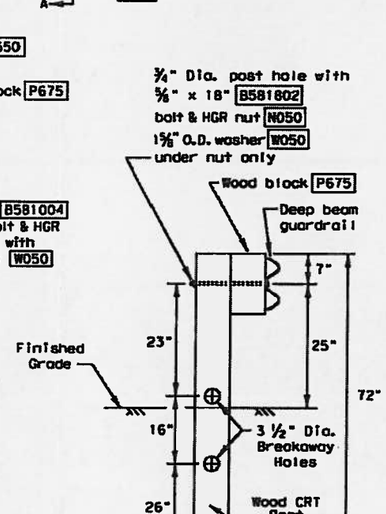
DISCLAIMER:
The use of this standard is governed by the "Texas Engineering Practice Act". No warranty of any kind is made by TxDOT for any purpose whatsoever. TxDOT assumes no responsibility for the conversion of this standard to other formats or for incorrect results or damages resulting from its use.

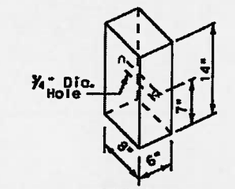
DATE:
FILE:

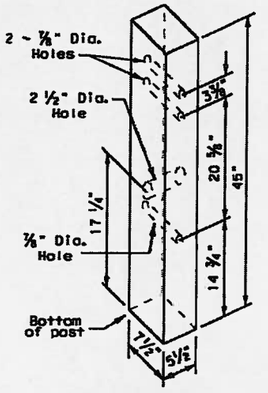












GENERAL NOTES

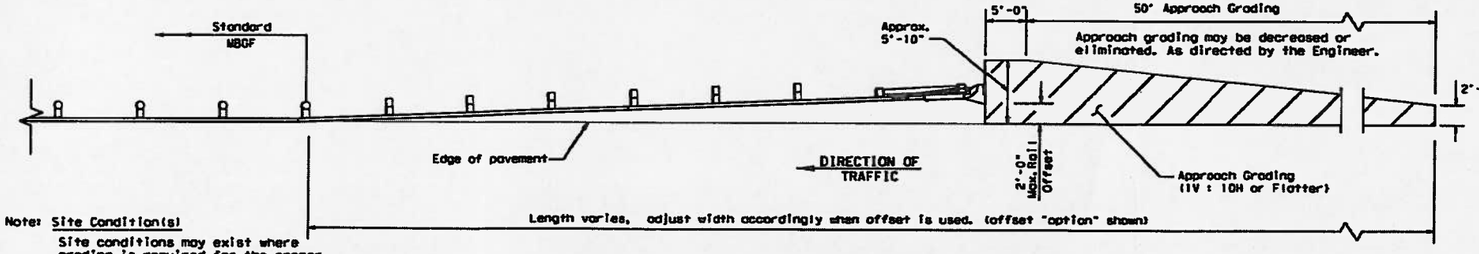
1. For additional information contact: Interstate Steel Inc. (432) 263-3725
2. The Type of SGT unit will be specified elsewhere in the plans. The numbers in the circles indicate post position. The Type of SGT unit chosen is a maintenance consideration and does not affect the systems performance.

	Post & Tube Options		Post Only
Type I	Posts (1) thru (2)	Posts (3) thru (8)
Type II	Posts (1) thru (4)	Posts (5) thru (8)
Type III	Posts (1) thru (8)	None

3. SGT's placed within the "minimum" 150 ft. radius, shall be installed straight. Standard rail elements may be installed within the radius, without special fabrication.
4. All bolts, nuts cable assemblies, cable anchors, steel tubes & bearing plates shall be galvanized.
5. A flare rate of 25:1 may be used over the first 50 ft. of the system to prevent the terminal head from encroaching the shoulder. The flare may be decreased or eliminated for specific installations, if directed by the Engineer.
6. The steel tubes shall not protrude more than 4 inches above ground. Site grading may be necessary to meet this requirement.
7. The steel tubes may be driven with an approved driving head. They shall not be driven with the wood post in the tube. If the steel tubes are placed in drilled holes, the backfill material must be satisfactorily compacted to prevent tube settlement.
8. If solid rock is encountered. See the Manufacturer's installation manual for the proper installation guidance.
9. The breakaway cable assembly must be taut. A locking device, (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening the nuts.
10. The wood blocks shall be "toe nailed" to the rectangular wood posts to prevent them from turning when the wood shrinks. The bearing plate on the front post shall also be "toe nailed" to prevent rotation.
11. For curb installations, the soil tubes and posts shall be installed at the proper ground elevation behind the curb. The posts will then require field drilling new holes to accommodate the rail to post connection bolt to maintain the proper height of the rail above the gutter pan. The excess post length above the rail will be removed if directed by the Engineer.
12. An object marker shall be installed on the front of the impact head as detailed on D&OM(VIA).

BILL OF MATERIAL

Item #	POST & TUBE OPTIONS Type I	Type II	Type III	DESCRIPTION
S1303	1	1	1	Guardrail (12 Ga.) 12'- 6" SKT
G12025	1	1	1	Guardrail (12 Ga.) 9'- 4 ½"
G1209	1	1	1	Guardrail (12 Ga.) 25'- 0"
S730	2	2	2	Steel Tube - 6" x 8" x 72" x ⅛" min. or ⅜"
S735	0	2	6	Steel Tube - 6" x 8" x 54" x ⅛" min. or ⅜"
P650	2	4	8	Wood Posts - 5 ½" x 7 ½" x 45"
P671	6	4	0	Wood CRT Posts - 6" x 8" x 72"
P675	6	6	6	Wood Block - 6" x 8" x 14"
E740	1	1	1	Pipe Sleeve - 2" Std. Pipe x 5 ½"
E750	1	1	1	Bearing Plate - ⅜" x 8" x 8"
S760	1	1	1	Cable Anchor Box
E770	1	1	1	Cable Assembly
E780	1	1	1	Ground Strut
S3000	1	1	1	Impact Head
				HARDWARE
B580754	2	4	8	⅝" x 7 ½" Hex Hd. Bolt
B581004	2	4	8	⅝" x 10" Hex Hd. Bolt (Top of Tubes)
W050	11	15	23	⅝" Washers
B581002	1	1	1	⅝" x 10" HGR Post Bolt (Post 2)
B580122	16	16	16	⅝" x 1 ¼" HGR Splice Bolt
B581802	6	6	6	⅝" x 18" HGR Post Bolt (Posts (3) thru (8))
N050	35	39	47	⅝" HGR Nut (24-Spl, Varies-Posts, 2-Strut)
E350	2	2	2	⅛" x 3" Lag Screw
N100	2	2	2	1" Hex Nut (Anchor Cable)
W100	2	2	2	1" Washer (Anchor Cable)
SB12A	8	8	8	Cable Anchor Box Shoulder Bolts
N012A	8	8	8	½" Structural Nut
W012A	8	8	8	½" Structural Washer
E3151	1	1	1	Object Marker - (18" x 18")



Note: Site Condition(s)
Site conditions may exist where grading is required for the proper installation of metal guard fence and end treatments.

APPROACH GRADING AT GUARDRAIL END TREATMENTS

POST & TUBE OPTIONS
Type I post (1) thru (2)
Type II post (1) thru (4)
Type III post (1) thru (8)

Texas Department of Transportation — Design Division Standard

SINGLE GUARDRAIL TERMINAL (SKT-31) (WOOD POST)

SGT(8)31-14

FILE: sgt83114.dgn	DN: TxDOT	CK: AM	DW: BD/VP	CK: VP
©TxDOT December 2011	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO. 13

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-YARD_PIPING.dwg [PIPING] Plotted Mar 22, 2016 at 2:18pm by mmina (Last Saved by: jamesh)

WATER METER SEE DETAIL ON SHEET 16

OVERHEAD ELECTRIC LINE

REMAINDER OF 277.39 ACRES DOC. NO. 200506038360 (O.P.R.C.C.T.)

12' FORCE MAIN EASEMENT

EXISTING 15' SAN. EASEMENT

N89° 41' 39.62"E 541.24'

20' B.S.L.

PROPOSED 6" EFFLUENT FORCE MAIN SEE SHEETS 18 TO 26

BLANCO ROAD (40' R.O.W.)

S89° 41' 39.62"W 50.01'

189.64' ~ 2" SCH 80 PVC W.L.

125.02'

12"X 2" TS&V, MJ-1EA
2" GATE VALVE, MJ-1EA
N=13839155.85
E=2119468.8666

2" 1/8 BEND, MJ-1EA
N=13839156.85
E=2119658.4994

145.49' ~ 2" SCH 80 PVC W.L.

100YR INUNDATION

S40° 57' 47.11"W 112.99'

EXISTING 8" SAN. LINE

MAGNETIC FLOW METER
YARD HYDRANT

POWER POLE

EXISTING 20' OVERHEAD ELECTRIC EASEMENT

8" STEEL SLEEVE ~ 75 L.F.

EXISTING MANHOLE
RIM=1272.45
FL=1265.45 IN
FL=1265.35 OUT
N=13839086.98
E=2119887.5637

458.23'

S00° 18' 20.38"E

REMAINDER OF 277.39 ACRES DOC. NO. 200506038360 (O.P.R.C.C.T.)

2" 1/8 BEND, MJ-1EA
N=13839054.44
E=2119761.8311

ASTM D3034 SDR26
112.99 LF 8" SAN @ 0.44%

20' B.S.L.

40' B.S.L.

EXISTING 20' WATER EASEMENT

BACKFLOW PREVENTER SEE DETAIL ON SHEET 32

ONSITE LIFT STATION
TOP WET WELL EL 1272.50
BOT WET WELL EL 1254.50
8" SAN FL 1264.50
4" DR FL 1266.43

6" C900 DR 18 SAN FM, CL 1266.75

4" DR
2" WL

BLOWER PAD

WASTE CONTAINER CONCRETE PAD

HEADWORKS

DIGESTER NO 1

OFFICE BUILDING

DIGESTER NO 2

YARD HYDRANT/ EMERGENCY SHOWER

CHLORINE BUILDING

CHLORINE CONTACT BASIN

NPW PUMPS

26.15' ~ 2" SCH 80 PURPLE PVC NPW

REMAINDER OF 277.39 ACRES DOC. NO. 200506038360 (O.P.R.C.C.T.)

N00° 39' 46.54"E 408.29'

EXIST. 12" W.L.

FUTURE TREATMENT BASINS

161.63' ~ 2" SCH 80 PVC W.L.

MAGNETIC FLOW METER
YARD HYDRANT
EFFLUENT PUMPS
EFFLUENT FILTER BASIN
CONCRETE BASIN/ PUMP PAD

6" SAN FM

3" SN
3" SC
4" RAS/WAS
4" AIR LIFT RAS/WAS
3" AIR LIFT SC
CO
10" ML

6" DE, CL 1264.34

8" DE, FL 1226.33

1" CLS

2" NPW

2" 1/8 BEND, MJ-1EA
N=13838892.67
E=2119761.8311

14.07' ~ 2" SCH 80 PVC W.L.

2" WL

POTABLE WATER

19.00' ~ 2" SCH 80 PVC W.L.

2" 1/4 BEND, MJ-1EA
N=13838912.40
E=2119899.1655

2" 1/8 BEND, MJ-1EA
N=13838893.41
E=2119899.2675

14.77' ~ 2" SCH 80 PVC W.L.

2" 1/8 BEND, MJ-1EA
N=13838882.91
E=2119888.8782

8" 1/8 BEND, MJ-1EA
N=13838888.91
E=2119775.0355

2" 1/8 BEND, MJ-1EA
N=13838882.91
E=2119771.8311

140.06' ~ 8" DIP CL 52 DE

117.05' ~ 2" SCH 80 PVC W.L.

BULVERDE CITY LIMIT
COMAL COUNTY

1264 1265 1266 1267 1268 1269 1270 1271 1272 1273 1274 1275 1276 1277 1278 1279 1280 1281 1282

FUTURE EMERGENCY GENERATOR

FUTURE ELECTRICAL CONTROL BUILDING

FUTURE CHEMICAL STORAGE BUILDING

FUTURE OFFICE BUILDING

20' B.S.L.

423.97'

S89° 41' 39.62"W

ANNABELLE ANSLEY SHARP
REMAINING PORTION OF 1156 ACRES
(VOL. 659, PG. 275)

LEGEND

- 1300 — EXISTING CONTOUR MAJOR
- 1293 — EXISTING CONTOUR MINOR
- OHP — OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 20' B.S.L. — BUILDING SETBACK LINE
- 100YR INUNDATION
- ACCESS ROAD
- VEGETATED FILTER STRIP

NOTES:
1. PVC MALE RADIATORS ARE NOT ALLOWED.
2. ALL NPW PIPING SHALL BE PURPLE PIPE.

50' 0' 50'

SCALE
1"=50'

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

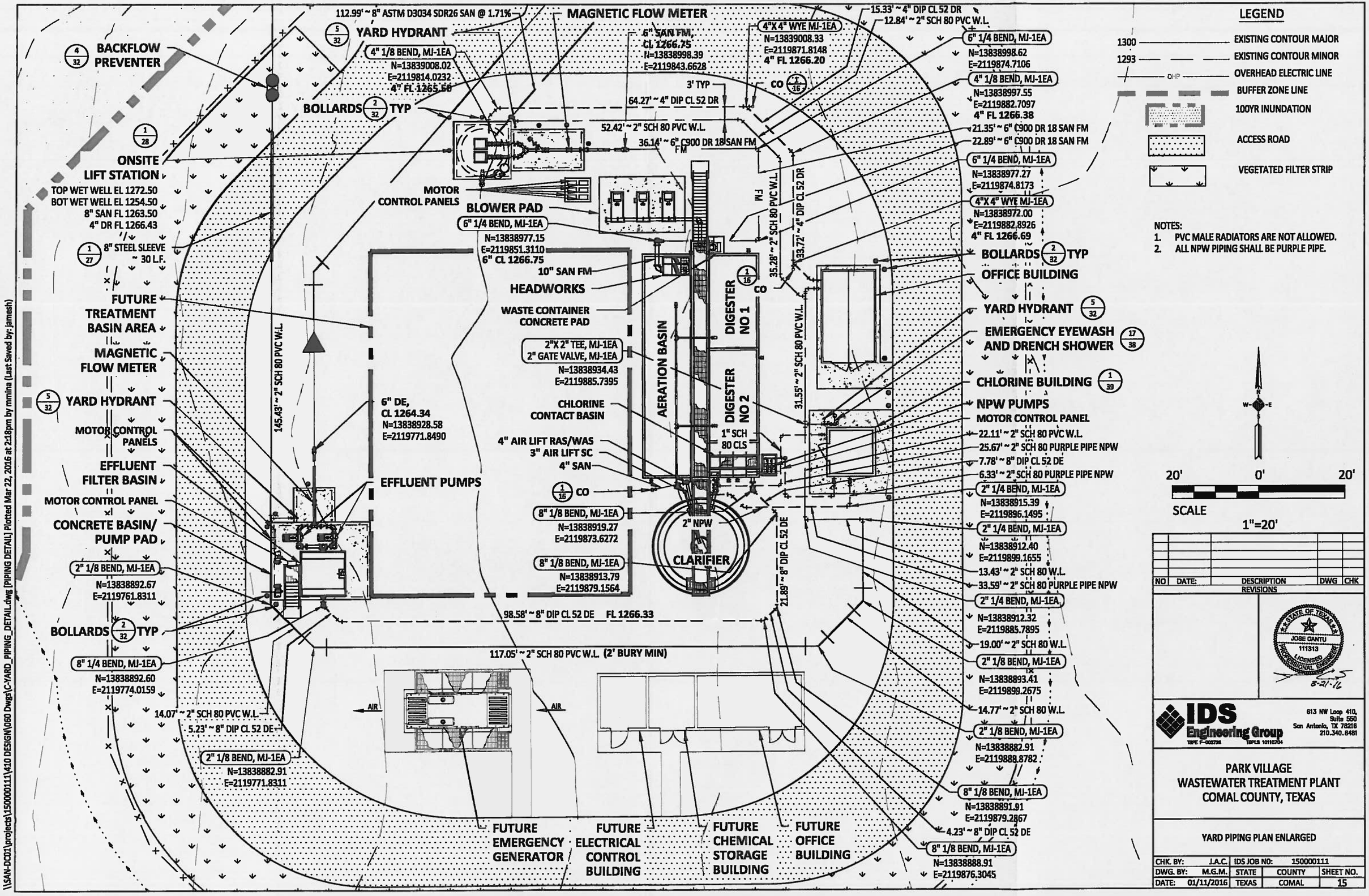
THIS DRAWING IS FOR REVIEW PURPOSES ONLY AND SHALL NOT BE USED FOR BIDDING, PERMITTING OR CONSTRUCTION
DAVID J. ROSS, P.E.
TEXAS REG. NO. 68267
DATE 12-15-15

IDS Engineering Group
TBPE F-002728 TBPLS 10110704
613 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

YARD PIPING PLAN

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	14



NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
JOSE CANTU
111313
LICENSED PROFESSIONAL ENGINEER
8-21-16

IDS Engineering Group
TBPE F-002726 TBPLS 10110704
613 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

YARD PIPING PLAN ENLARGED

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	15

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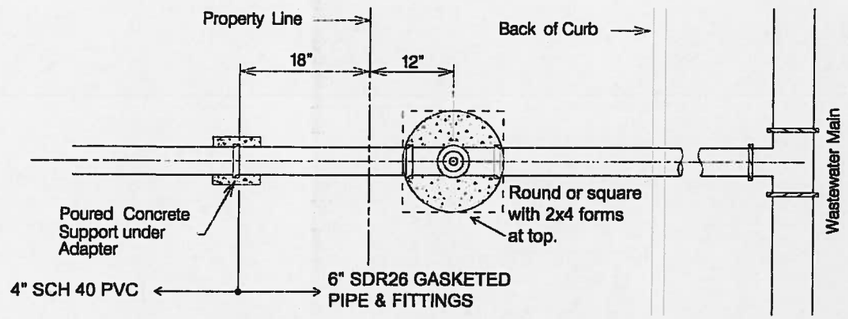
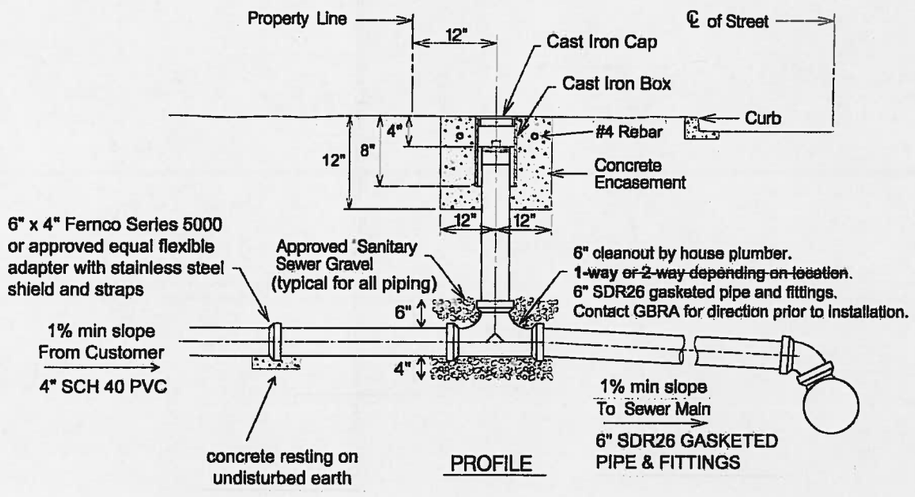


PLAN



PROFILE

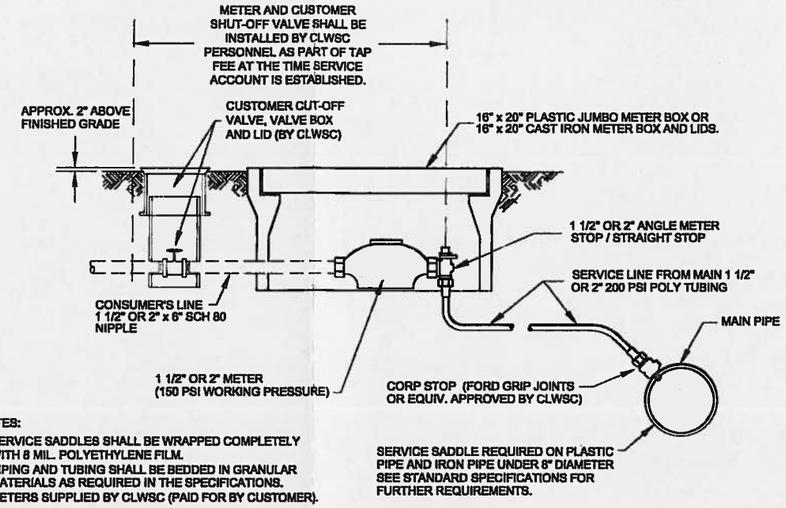


Cast Iron Box & Cap
East Jordan Iron Works
Model 1566 or approved equal

NOTES:
1) Plumber to install a separate 4" cleanout at house (2-way).
2) Use SAWS sewer gravel or approved equal bedding for all piping.
3) Obtain GBRA inspection prior to backfill (830-379-5822).

Guadalupe-Blanco River Authority	TYPICAL CLEANOUT DETAIL	APPROVED	REVISED
		C. LEWIS	APR. 17, 2014
			SHEET

DETAIL "1"



NOTES:
1. SERVICE SADDLES SHALL BE WRAPPED COMPLETELY WITH 8 MIL. POLYETHYLENE FILM.
2. PIPING AND TUBING SHALL BE BEDDED IN GRANULAR MATERIALS AS REQUIRED IN THE SPECIFICATIONS.
3. METERS SUPPLIED BY CLWSC (PAID FOR BY CUSTOMER).

GENERAL NOTES:
(1) FOR ADDITIONAL INFORMATION, SEE CANYON LAKE WATER SERVICE COMPANY'S STANDARD SPECIFICATIONS.

BY	REVISION	DATE	CK	AP	OPS
MH	UPDATE DRAWING	05-24-10			
MH	UPDATE DRAWING	04-25-10			

CLWSC
CANYON LAKE WATER SERVICE COMPANY
1399 Sattler Road
Canyon Lake, Texas 78133
(830) 964-3854

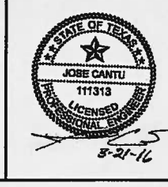
1 1/2" OR 2" SERVICES

BY: JW / M.HOMER
DATE: 02-11-09
CK:
SCALE: NONE

OPERATIONS / DATE
ENGINEERING / DATE
DIRECTOR OF ENGINEERING / DATE

REF. NOS.
DWG. NO SER-2
SHEET: 1 OF 1

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		



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613 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

WATER DETAILS 1

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	16

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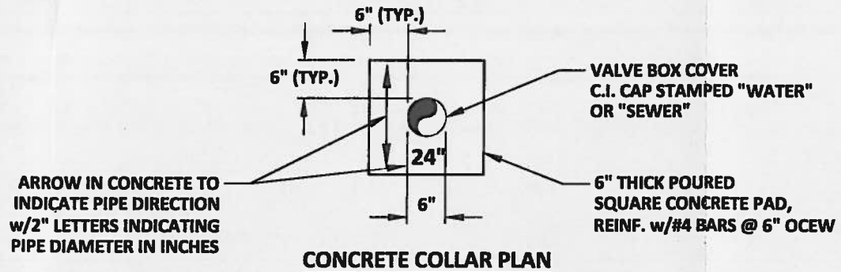
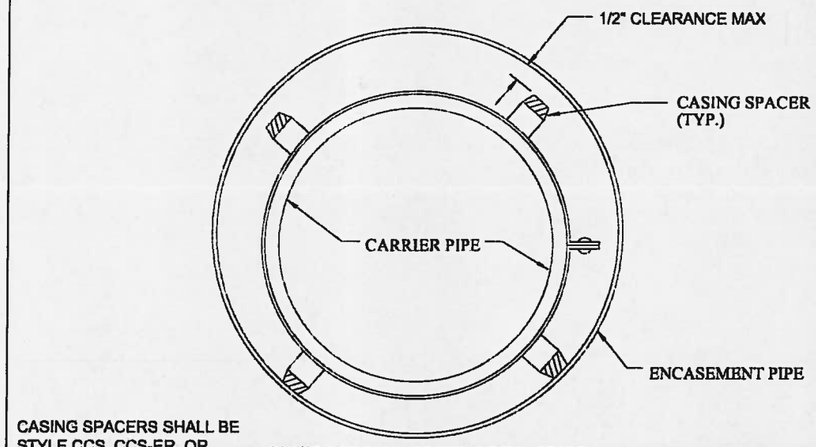
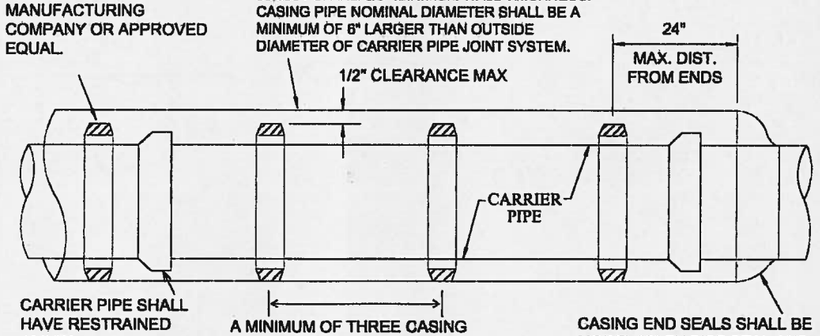


CONCRETE COLLAR PLAN



CASING SPACERS SHALL BE STYLE CCS, CCS-ER, OR CCS-JR BY CASCADE WATERWORKS MANUFACTURING COMPANY OR APPROVED EQUAL.

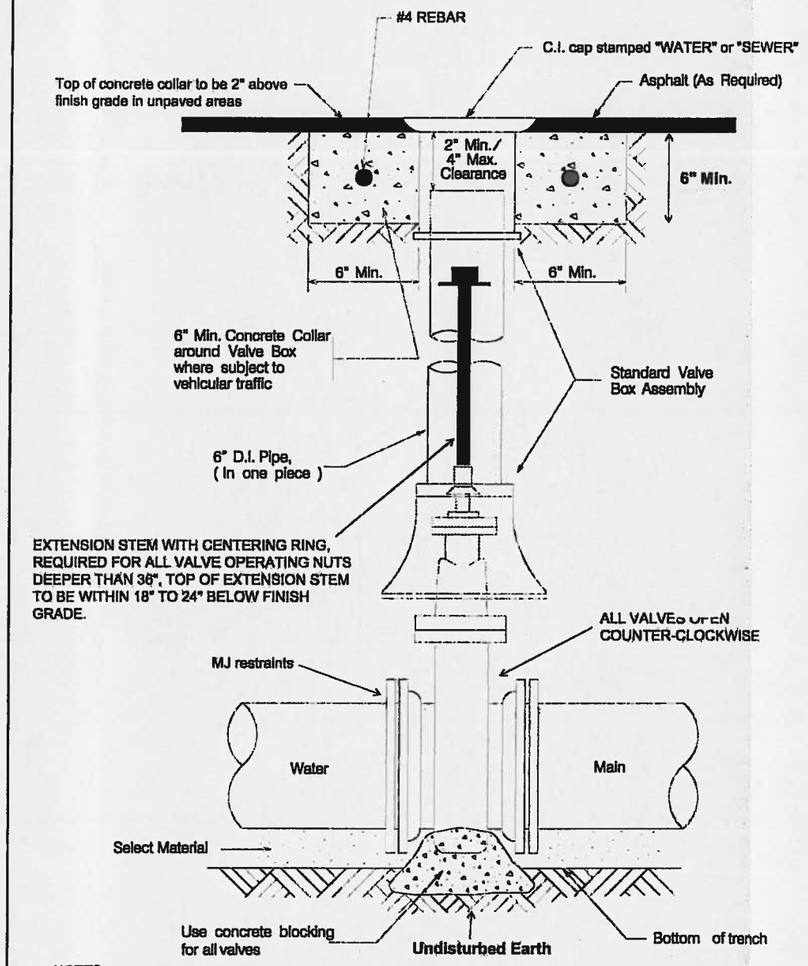
CASING PIPE SHALL BE STRUCTURAL GRADE STEEL WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI AND 3/8" MINIMUM WALL THICKNESS. CASING PIPE NOMINAL DIAMETER SHALL BE A MINIMUM OF 6" LARGER THAN OUTSIDE DIAMETER OF CARRIER PIPE JOINT SYSTEM.



NOTE:
MATERIALS SHOWN APPLY TO JACK AND BORE INSTALLATIONS AND STREAM/RIVER CROSSINGS. OPEN CUT SLEEVING OF PIPE WITHIN SUDIVISION ROADWAYS MAY BE CORRUGATED HDPE CASING AND PLASTIC SPACERS WITH 316SS HARDWARE. THE CLEARANCES AND DIMENSIONS SHOWN APPLY TO ALL INSTALLATIONS.

Guadalupe-Blanco River Authority	ENCASEMENT DETAIL W/ CASING SPACERS	
C. LEWIS — APR. 06, 2014	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO.

DETAIL "1"



NOTES:
1) USE MJ RESILIENT WEDGE GATE VALVES FOR WATER, AFC SERIES 2500 OR APPROVED EQUAL.
2) USE MJ ROUND PORT PLUG VALVES FOR FORCEMAIN BY CRISPIN, GA, MILLIKEN, OR PRATT WITH 304SS EXTERNAL BOLTS, NUTS, AND HARDWARE.
3) VALVE MARKERS ARE REQUIRED FOR ALL BURIED VALVES IN UNPAVED AREAS.
4) PVC MALE ADAPTERS ARE NOT ALLOWED IN BURIED LOCATIONS.

Guadalupe-Blanco River Authority	INSTALLATION OF VALVE WITH VALVE BOX AND EXTENSION	APPROVED	REVISED
		C. LEWIS	MAR. 04, 2015
			SHEET

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS — JOSE CANTU — 111313 — LICENSED PROFESSIONAL ENGINEER — 5-21-16

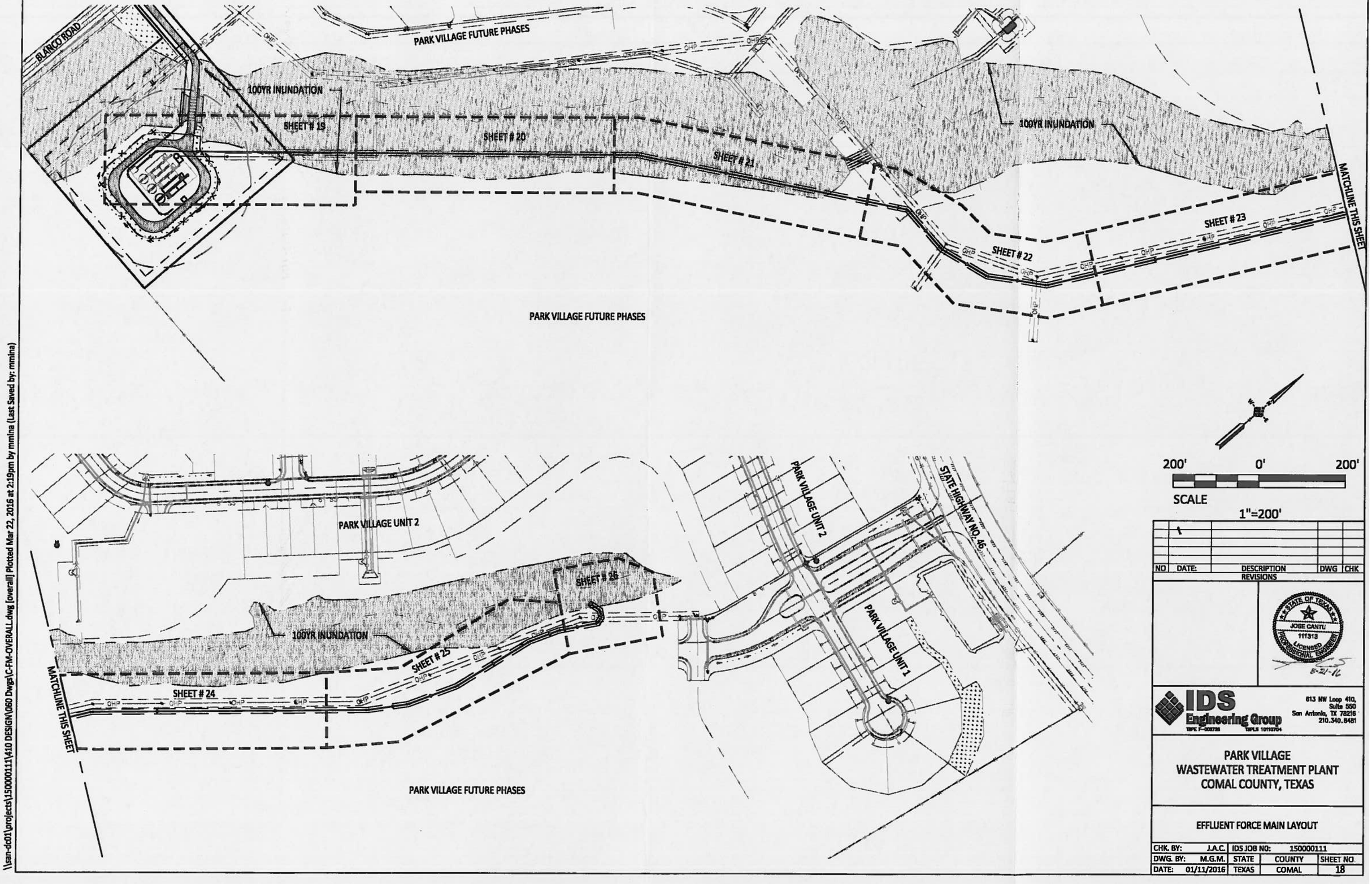
IDS Engineering Group
TBPE F-002726 TBPLS 10110704
613 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

WATER DETAILS 2

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	17

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-DTLS.dwg [CLWSC 2] Plotted Mar 22, 2016 at 2:19pm by mmina (Last Saved by: jamesh)



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NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

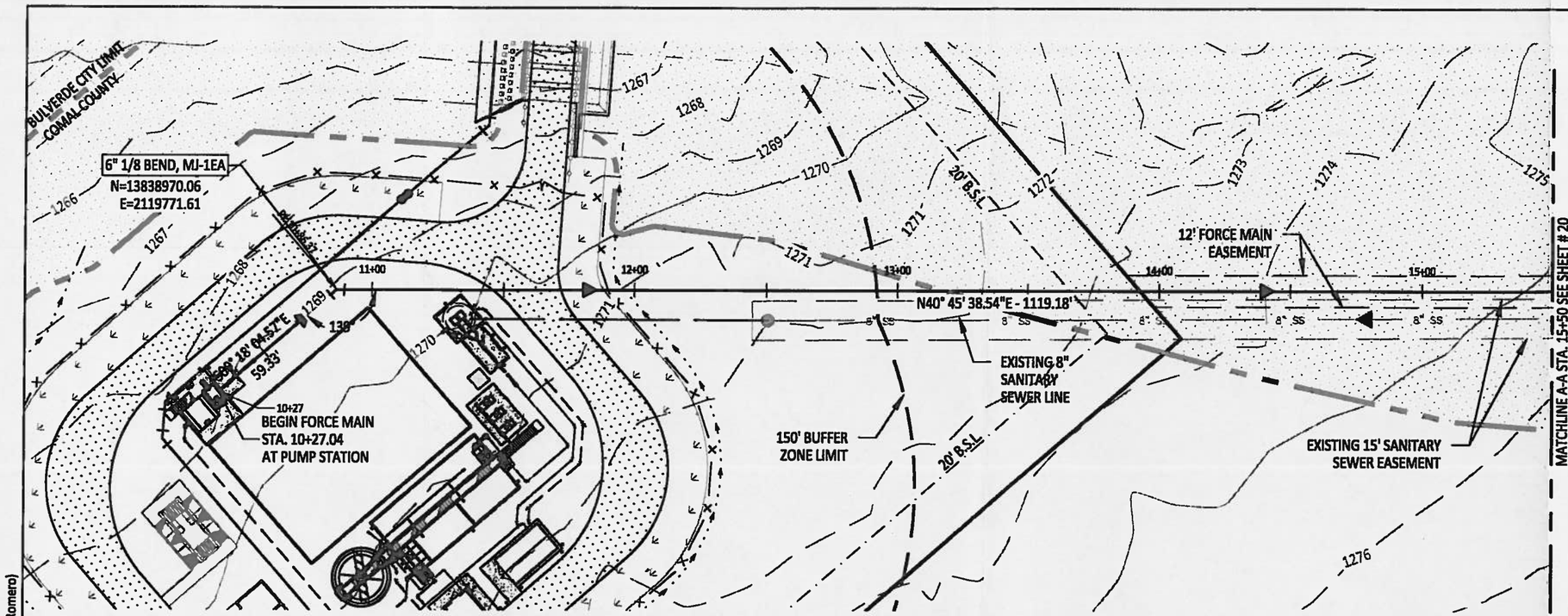
STATE OF TEXAS
JOSE CANTU
111313
LICENSED PROFESSIONAL ENGINEER
5-21-16

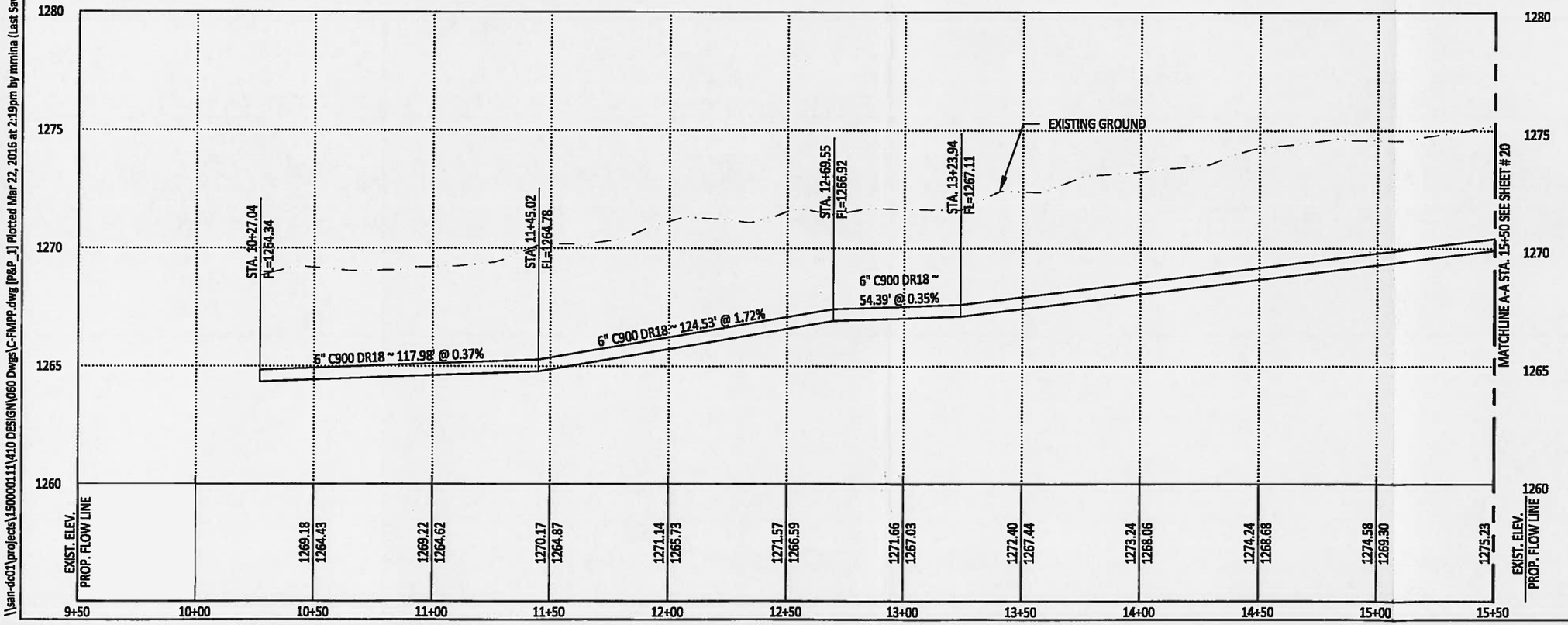
IDS Engineering Group
TBPE F-003726 TBPLS 10110704
613 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.5481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

EFFLUENT FORCE MAIN LAYOUT

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	18





LEGEND

- EXISTING GROUND (CENTER)
- 800 EXISTING CONTOUR MAJOR
- 802 EXISTING CONTOUR MINOR
- PROPOSED FORCE MAIN
- EASEMENT LINE
- OHP OHP OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 20' B.S.L. BUILDING SETBACK LINE
- PROPOSED FENCE LINE
- PROPOSED SWALE LINE
- 100YR INUNDATION

50' 0' 50'

SCALE 1"=50' H: 1"=50' V: 1"=5'

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
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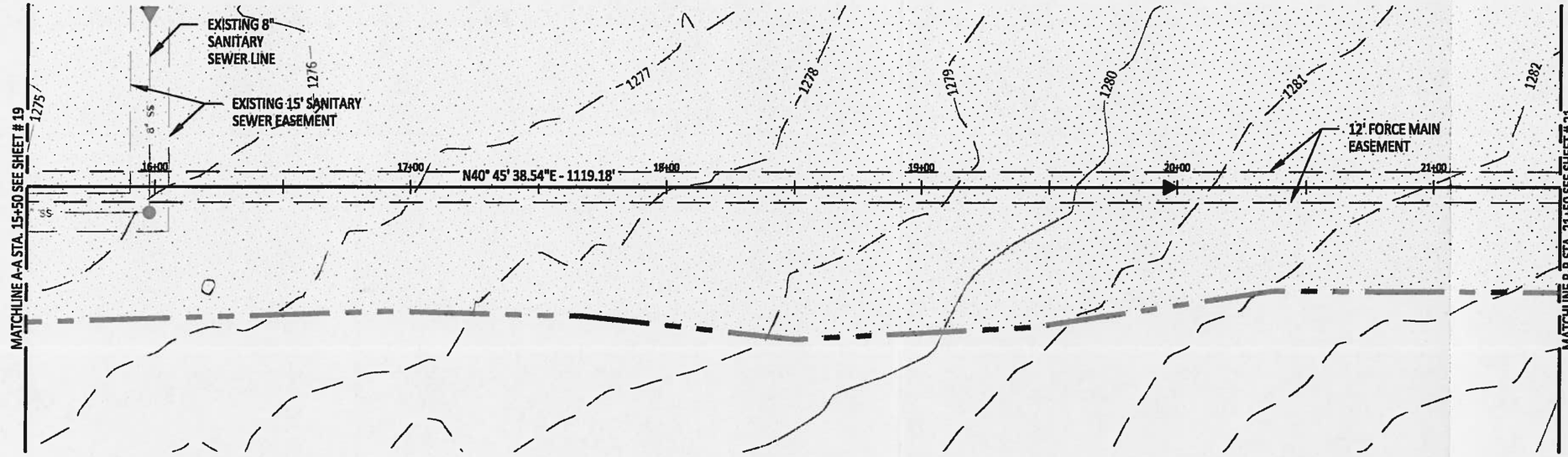
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

FORCE MAIN PLAN AND PROFILE
STA. 10+07.04 TO STA. 15+50

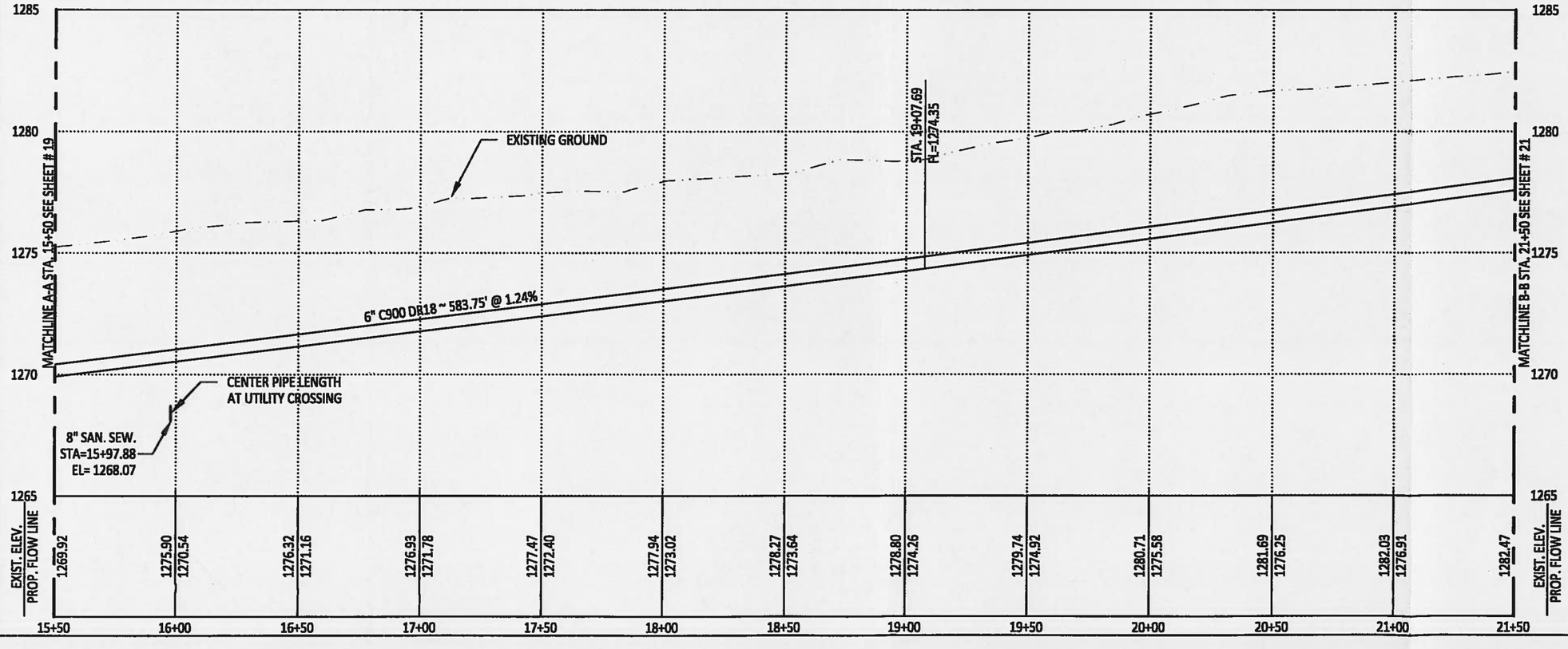
CHK. BY:	J.A.C.	IDS JOB NO:	150000111		
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.	
DATE:	01/11/2016	TEXAS	COMAL	19	

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-FMPP.dwg [P&P_1] Plotted Mar 22, 2016 at 2:19pm by mmina (Last Saved by: GRomero)



LEGEND

- EXISTING GROUND (CENTER)
- 800 EXISTING CONTOUR MAJOR
- 802 EXISTING CONTOUR MINOR
- PROPOSED FORCE MAIN
- EASEMENT LINE
- OHP OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 100YR INUNDATION



50' 0' 50'

SCALE 1"=50'

H: 1"=50'
V: 1"=5'

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
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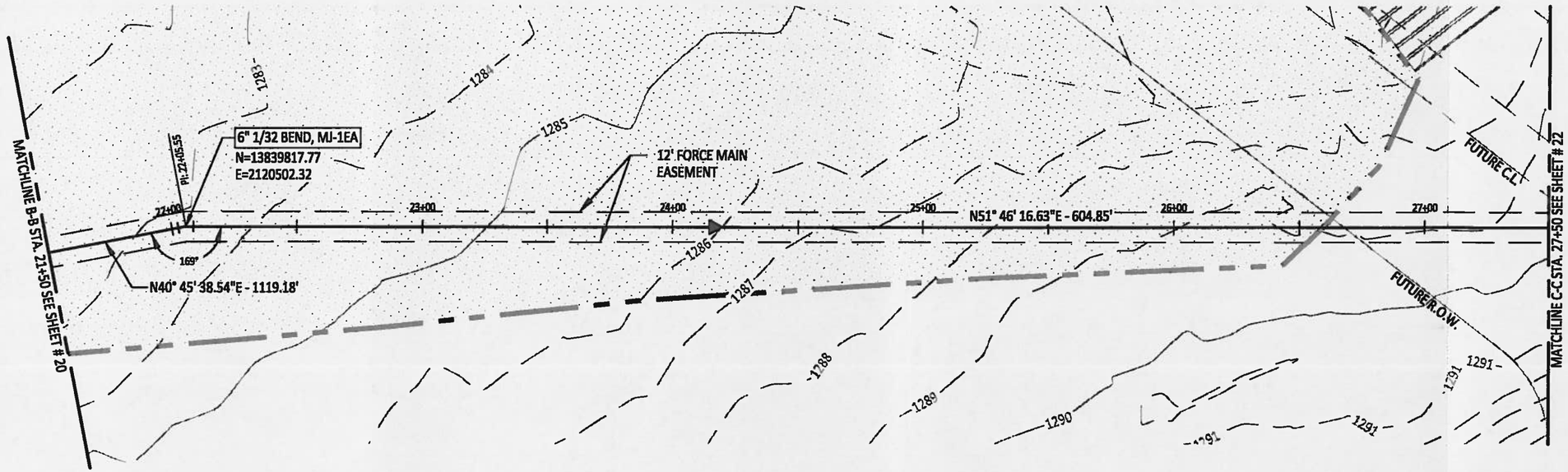
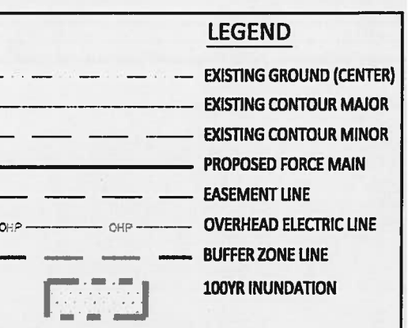
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

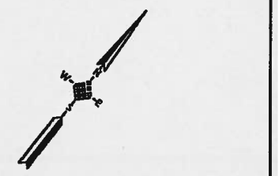
FORCE MAIN PLAN AND PROFILE
STA. 15+50 TO STA. 21+50

CHK. BY:	J.A.C.	IDS JOB NO:	150000111		
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.	
DATE:	01/11/2016	TEXAS	COMAL	20	

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-FMPP.dwg [P&P_2] Plotted Mar 22, 2016 at 2:19pm by mmina (Last Saved by: GRomero)







NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
JOSE CANTU
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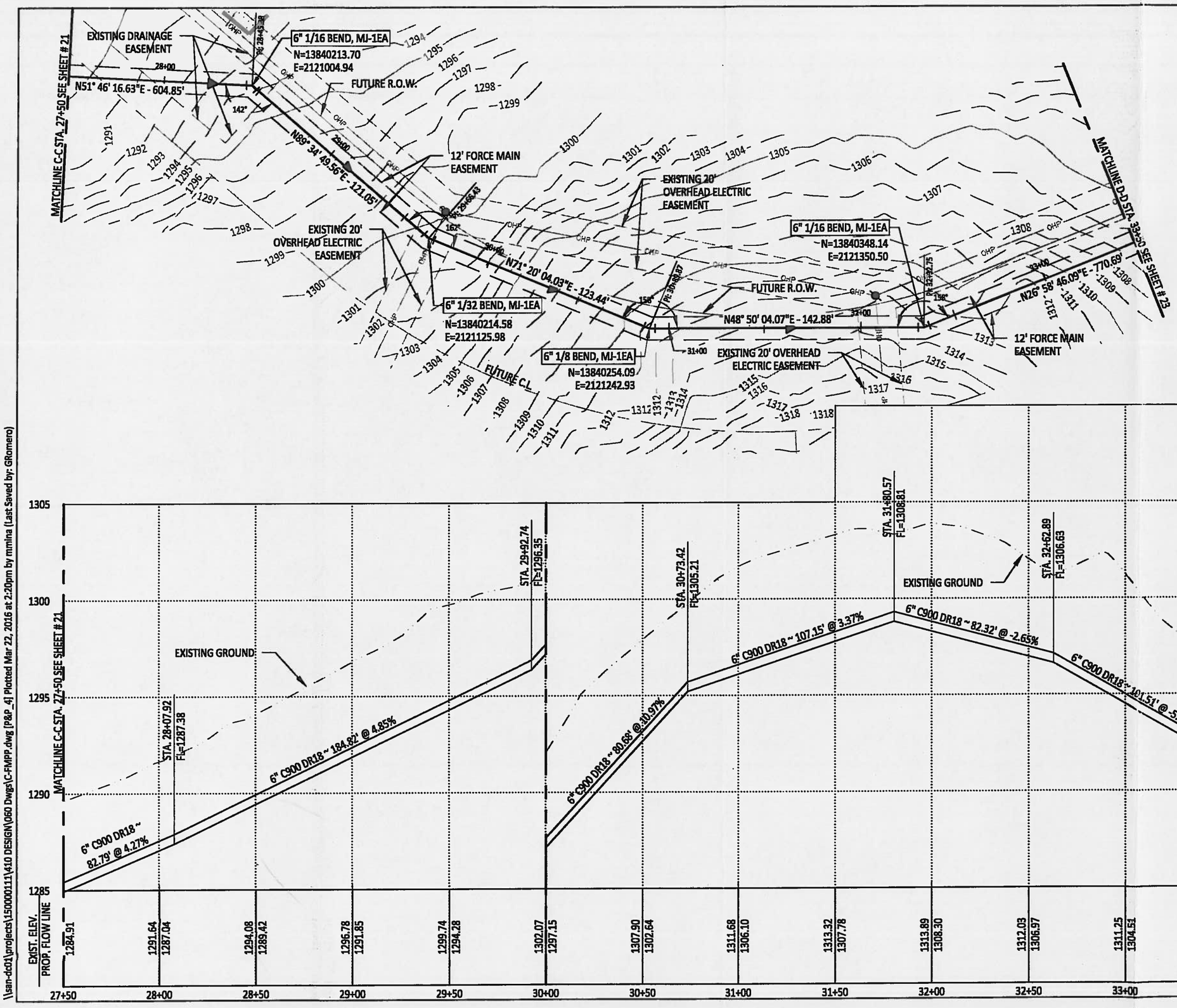
PARK VILLAGE WASTEWATER TREATMENT PLANT COMAL COUNTY, TEXAS

FORCE MAIN PLAN AND PROFILE STA. 21+50 TO STA. 27+50

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	21

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-FMPP.dwg (P&P_3) Plotted Mar 22, 2016 at 2:20pm by mmina (Last Saved by: GRomero)



LEGEND

- EXISTING GROUND (CENTER)
- 800 EXISTING CONTOUR MAJOR
- 802 EXISTING CONTOUR MINOR
- PROPOSED FORCE MAIN
- EASEMENT LINE
- OHP OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 100YR INUNDATION

50' 0' 50'

SCALE 1"=50' H: 1"=50' V: 1"=5'

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS — JOSE CANTU — 111313 — LICENSED PROFESSIONAL ENGINEER — 5-21-16

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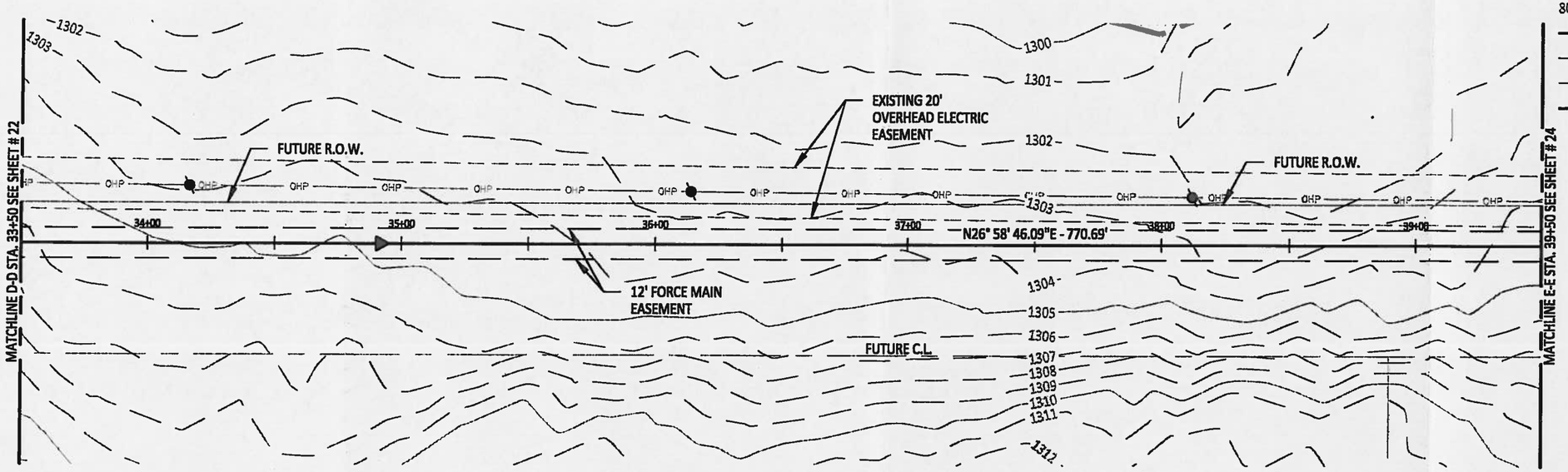
210.340.8481

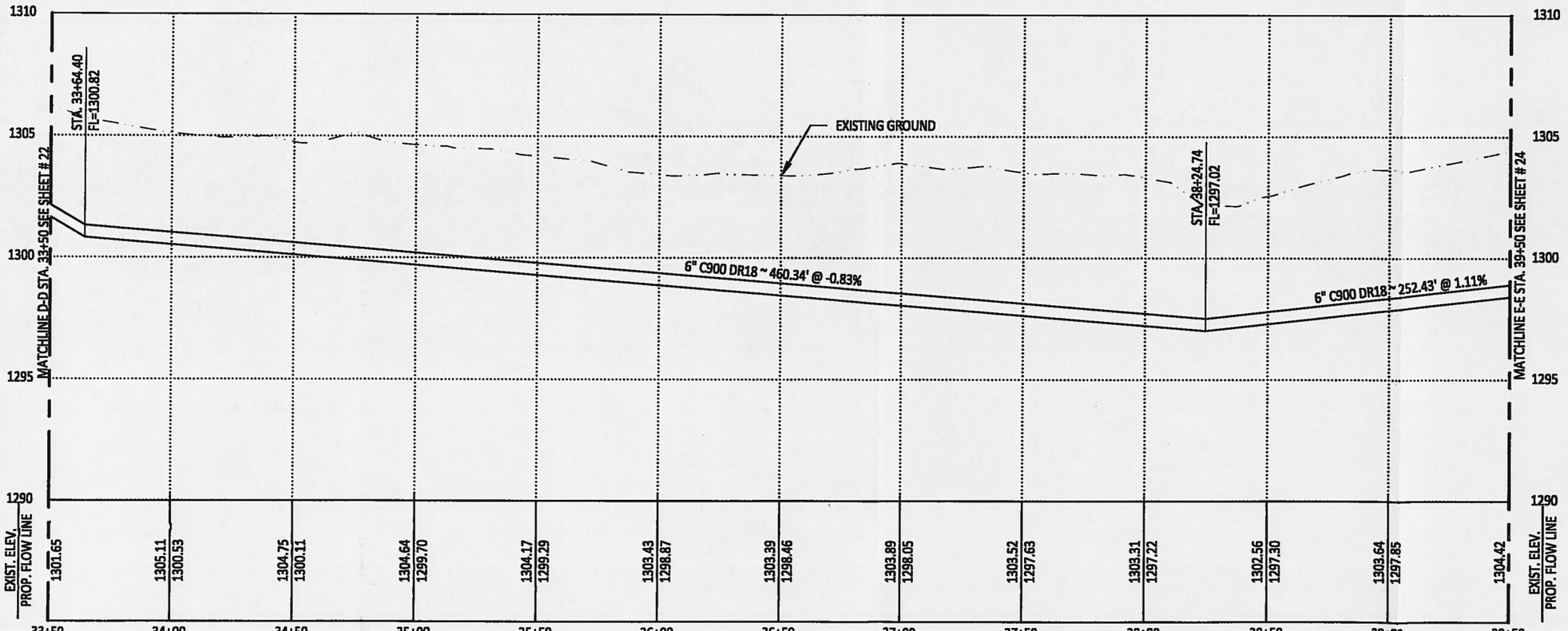
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

FORCE MAIN PLAN AND PROFILE
STA. 27+50 TO STA. 33+50

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	22

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-FMPP.dwg [P&P_4] Plotted Mar 22, 2016 at 2:20pm by mmina (Last Saved by: GRomero)





LEGEND

- EXISTING GROUND (CENTER)
- 800 EXISTING CONTOUR MAJOR
- 802 EXISTING CONTOUR MINOR
- PROPOSED FORCE MAIN
- EASEMENT LINE
- OHP OHP OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 100YR INUNDATION

50' 0' 50'

SCALE H: 1"=50' V: 1"=5'
1"=50'

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
JOSE CANTU
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LICENSED
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3-21-16

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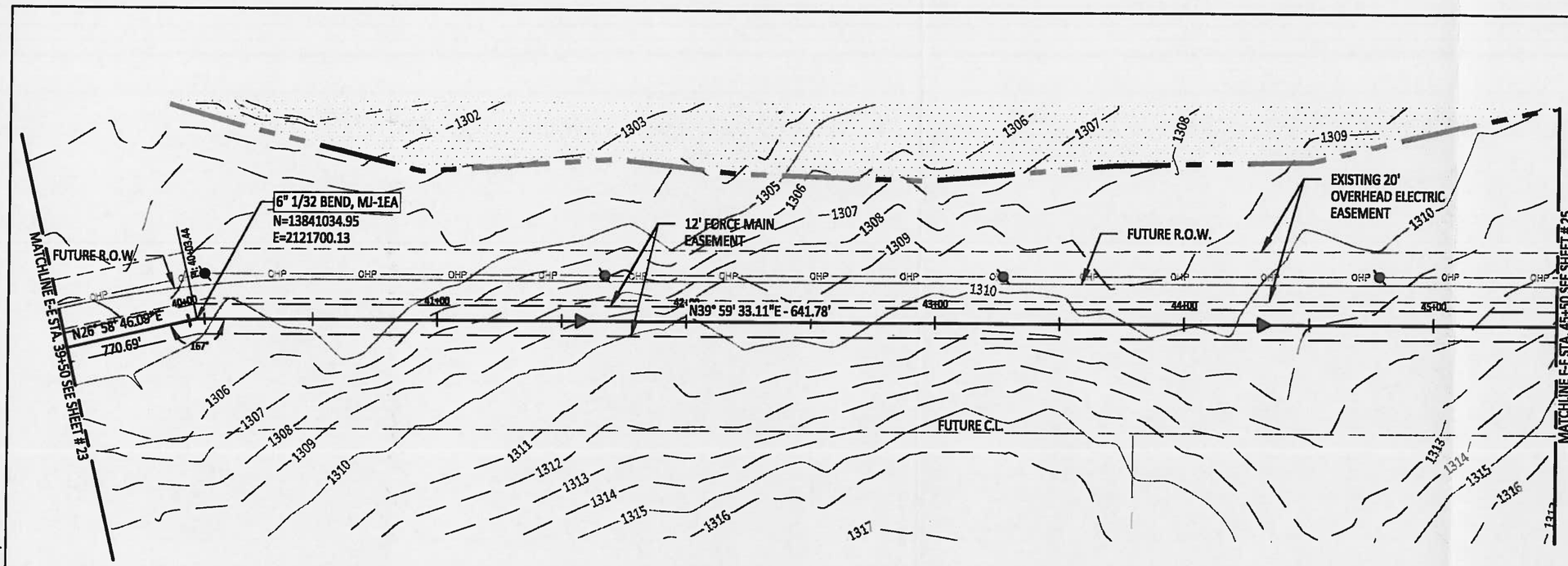
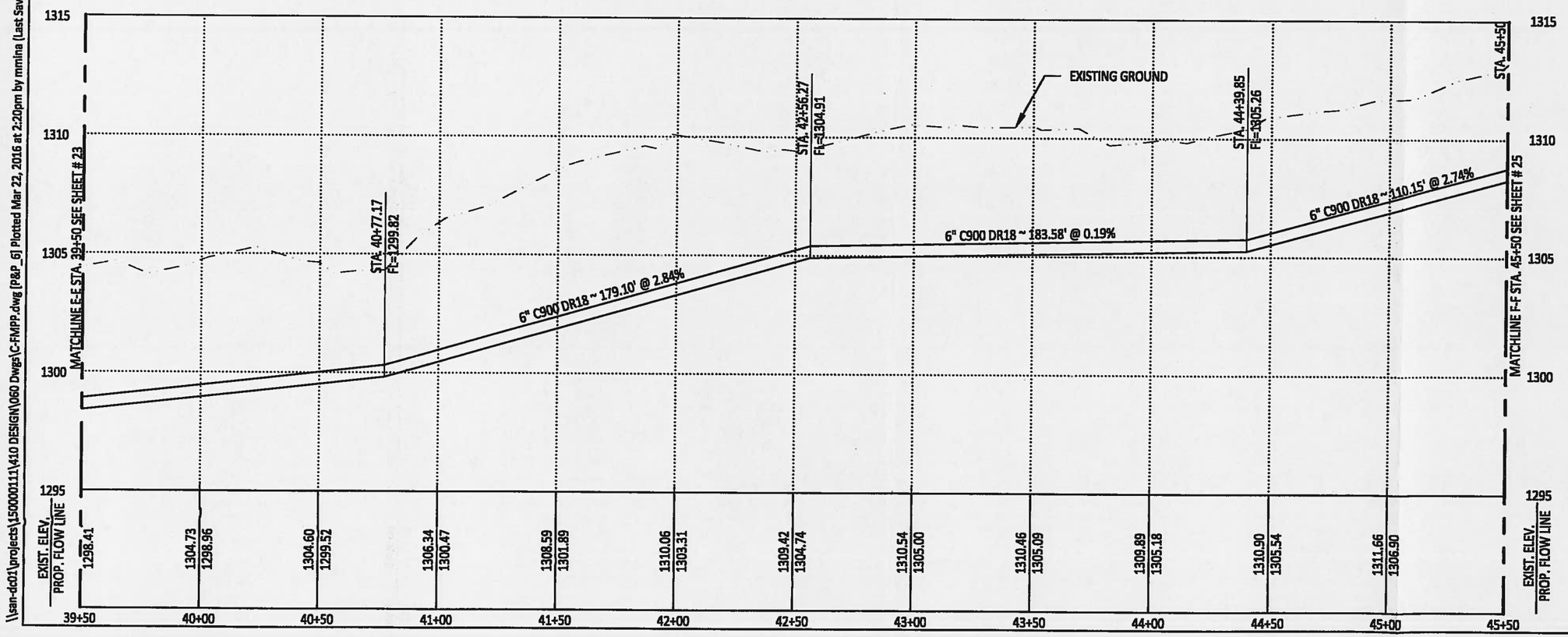
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

FORCE MAIN PLAN AND PROFILE
STA. 33+50 TO STA. 39+50

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	23

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-FMPP.dwg [P&P_S] Plotted Mar 22, 2016 at 2:20pm by mmina (Last Saved by: GRomero)





LEGEND

- EXISTING GROUND (CENTER)
- 800 EXISTING CONTOUR MAJOR
- 802 EXISTING CONTOUR MINOR
- PROPOSED FORCE MAIN
- EASEMENT LINE
- OHP OHP OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 100YR INUNDATION

50' 0' 50'

SCALE 1"=50'

H: 1"=50'
V: 1"=5'

NO	DATE:	REVISIONS DESCRIPTION	DWG	CHK

STATE OF TEXAS
JOSE CANTU
111319
LICENSED
PROFESSIONAL ENGINEER
8-21-16

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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

FORCE MAIN PLAN AND PROFILE
STA. 39+50 TO STA. 45+50

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	24

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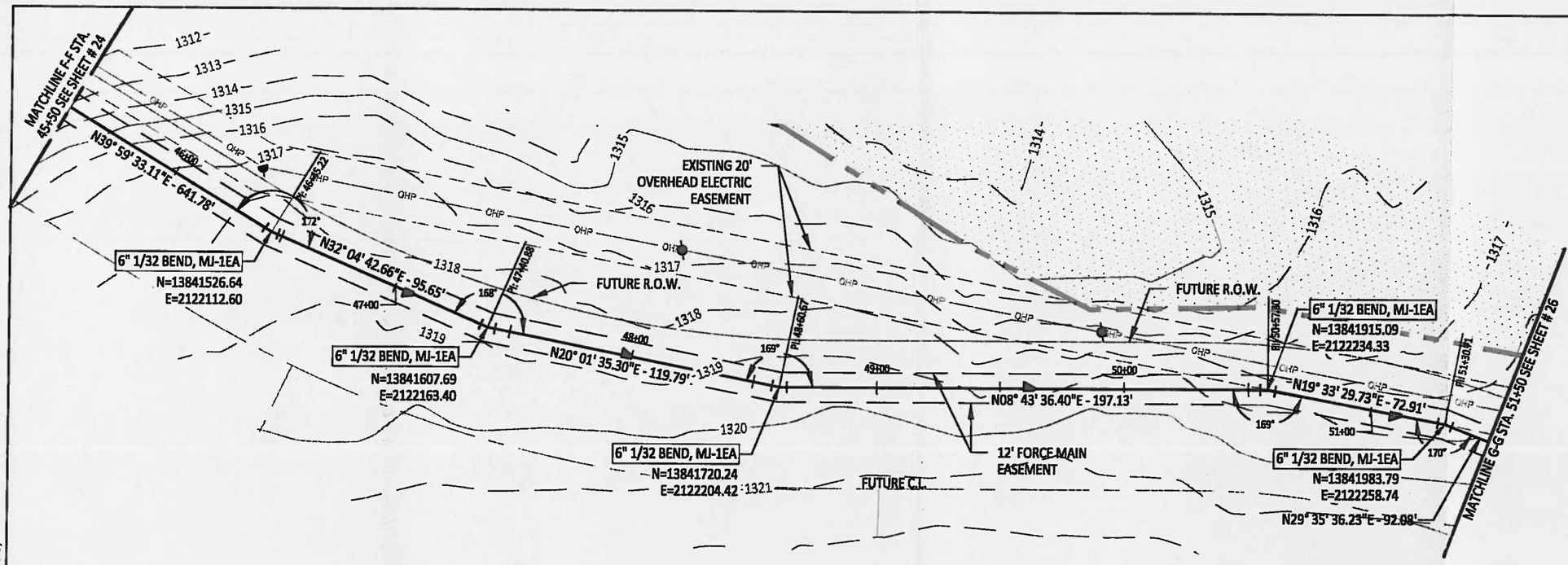

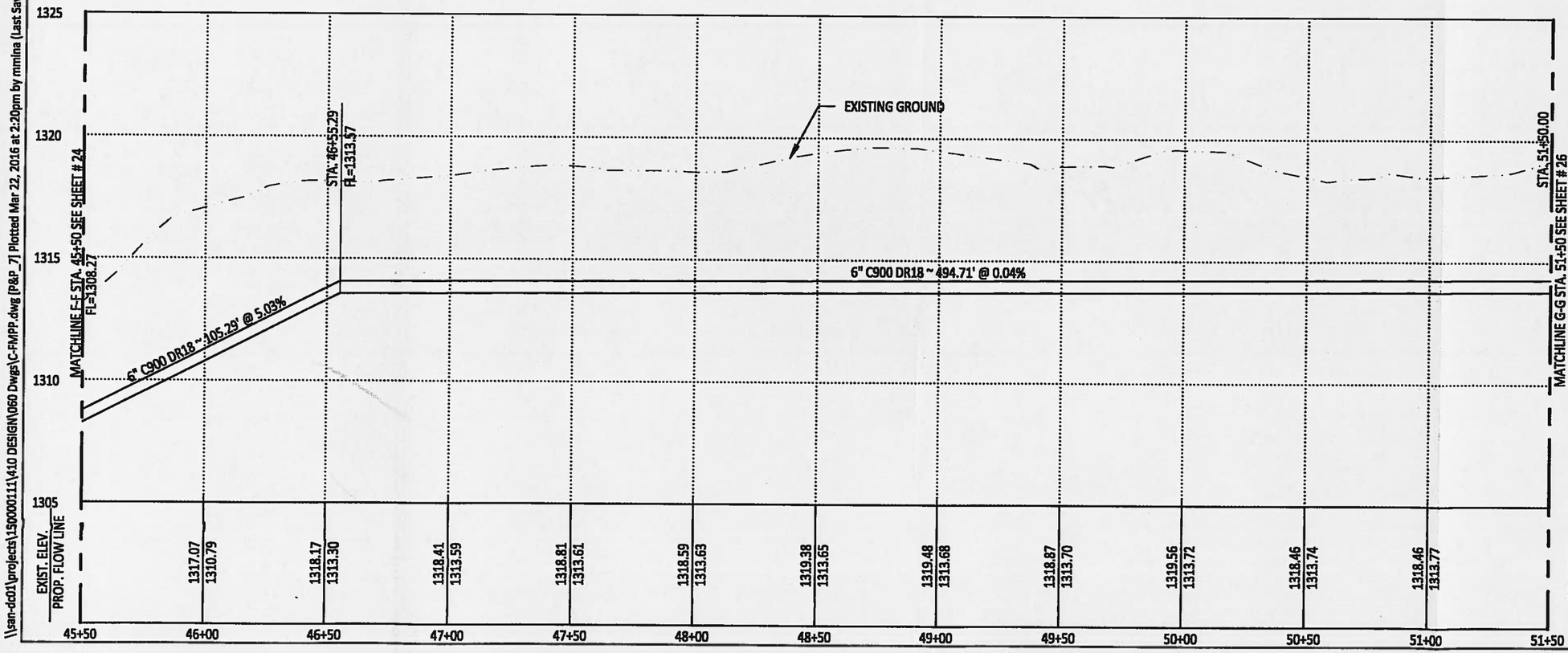

LEGEND

- EXISTING GROUND (CENTER)
- 800 EXISTING CONTOUR MAJOR
- 802 EXISTING CONTOUR MINOR
- PROPOSED FORCE MAIN
- EASEMENT LINE
- OHP OHP OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 100YR INUNDATION

50' 0' 50'

SCALE 1"=50' H: 1"=50' V: 1"=5'

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
JOSE CANTU
111313
LICENSED PROFESSIONAL ENGINEER
5-31-16

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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

FORCE MAIN PLAN AND PROFILE
STA. 45+50 TO STA. 51+50

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	25

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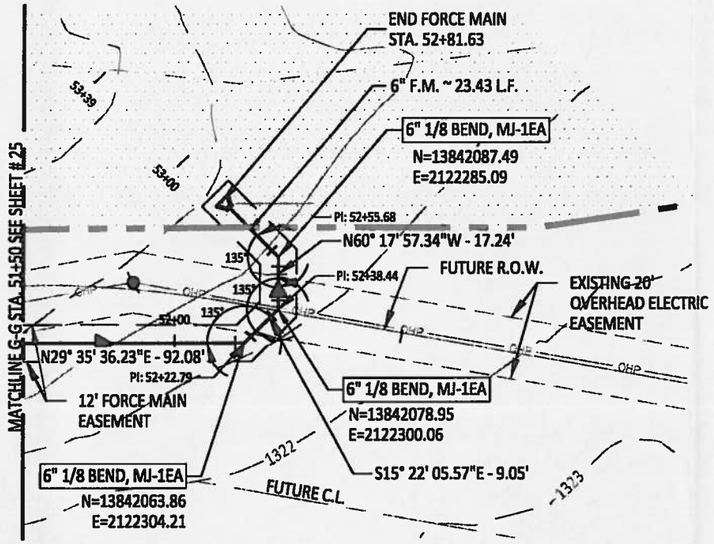

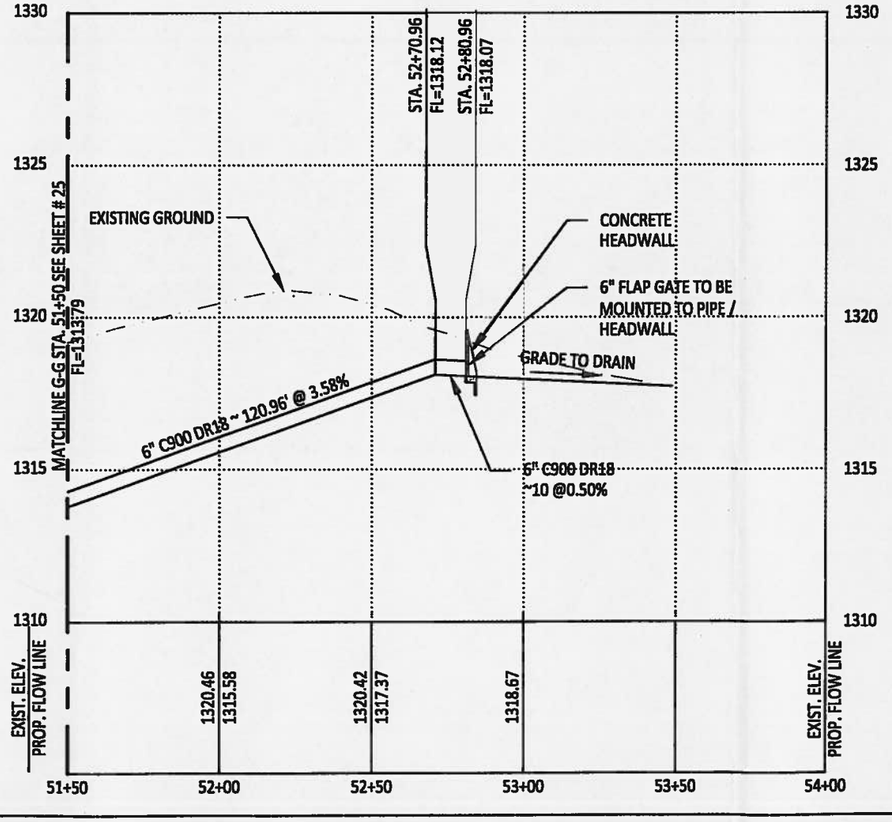

LEGEND

- EXISTING GROUND (CENTER)
- 800 EXISTING CONTOUR MAJOR
- 802 EXISTING CONTOUR MINOR
- PROPOSED FORCE MAIN
- EASEMENT LINE
- OHP OVERHEAD ELECTRIC LINE
- BUFFER ZONE LINE
- 100YR INUNDATION



50' 0' 50'

SCALE 1"=50'

H: 1"=50'
V: 1"=5'

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
JOSE CANTU
111313
LICENSED
PROFESSIONAL ENGINEER
8-21-16

IDS Engineering Group
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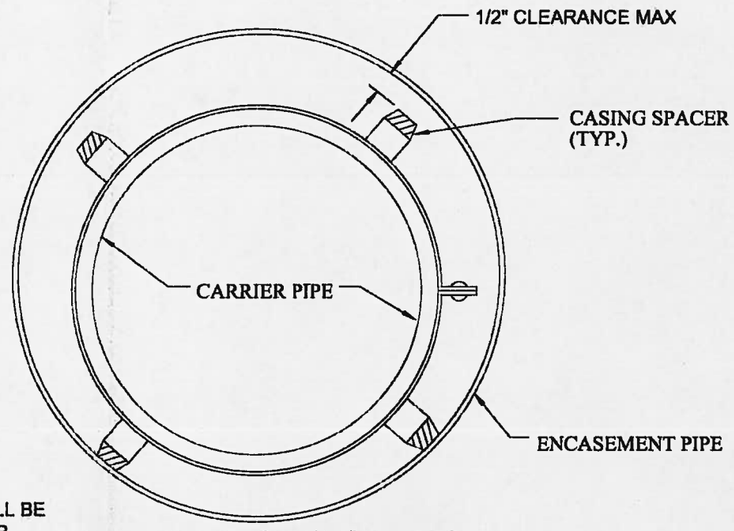
San Antonio, TX 78216
210.340.6481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

FORCE MAIN PLAN AND PROFILE
STA. 51+50 TO END

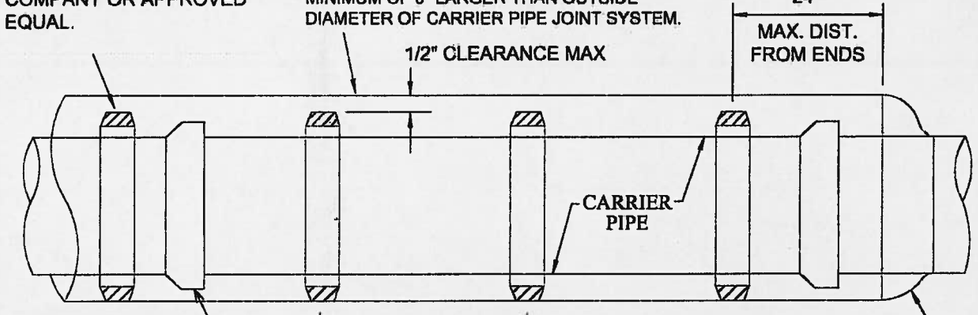
CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	01/11/2016	TEXAS	COMAL	26

\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-FMPP.dwg [P&P_8] Plotted Mar 22, 2016 at 2:20pm by mmina (Last Saved by: GRomero)



CASING SPACERS SHALL BE STYLE CCS, CCS-ER, OR CCS-JR BY CASCADE WATERWORKS MANUFACTURING COMPANY OR APPROVED EQUAL.

CASING PIPE SHALL BE STRUCTURAL GRADE STEEL WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI AND 3/8" MINIMUM WALL THICKNESS. CASING PIPE NOMINAL DIAMETER SHALL BE A MINIMUM OF 6" LARGER THAN OUTSIDE DIAMETER OF CARRIER PIPE JOINT SYSTEM.



CARRIER PIPE SHALL HAVE RESTRAINED JOINTS.

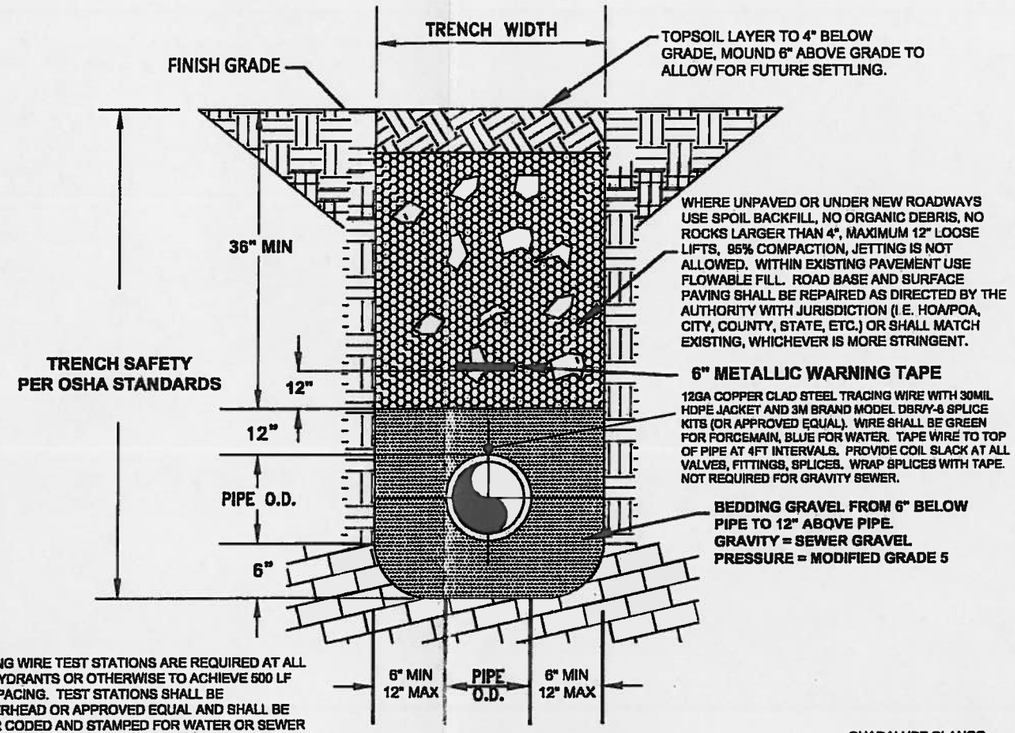
A MINIMUM OF THREE CASING SPACERS ARE REQUIRED PER FULL JOINT OF PIPE. MAXIMUM SPACING IS 8 FEET. INSTALL SPACERS A MAXIMUM OF 2 FEET ON EACH SIDE OF BELLS OR MECHANICAL JOINTS.

CASING END SEALS SHALL BE MODEL "S" BY PIPE SEAL AND INSULATOR, INC. OR APPROVED EQUAL.

NOTE:
MATERIALS SHOWN APPLY TO JACK AND BORE INSTALLATIONS AND STREAM/RIVER CROSSINGS. OPEN CUT SLEEVING OF PIPE WITHIN SUDIVISION ROADWAYS MAY BE CORRUGATED HDPE CASING AND PLASTIC SPACERS WITH 316SS HARDWARE. THE CLEARANCES AND DIMENSIONS SHOWN APPLY TO ALL INSTALLATIONS.

Guadalupe-Blanco River Authority	ENCASEMENT DETAIL W/ CASING SPACERS	
C. LEWIS — APR. 06, 2014	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO.

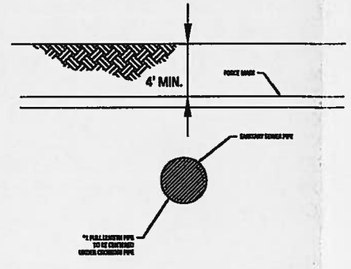
DETAIL "1"



NOTE:
TRACING WIRE TEST STATIONS ARE REQUIRED AT ALL FIRE HYDRANTS OR OTHERWISE TO ACHIEVE 500 LF MAX SPACING. TEST STATIONS SHALL BE COPPERHEAD OR APPROVED EQUAL AND SHALL BE COLOR CODED AND STAMPED FOR WATER OR SEWER SERVICE. INSTALL WITHIN VALVE BOX CONCRETE COLLARS WITH 6" MINIMUM CONCRETE COVER ON ALL SIDES. LEAVE 12" WIRE SLACK INSIDE TEST STATIONS. NOT REQUIRED FOR GRAVITY SEWER. TRACING WIRE TEST STATIONS TO BE COPPERHEAD MODEL RB14TP.

TYPICAL PIPE TRENCH

DETAIL "2"



SEWER CROSSING DETAIL
UNDER FORCE MAIN PIPE N.T.S.

DETAIL "3"

*NOTE:
(TCEQ 217.53)
- SEWER PIPE TO BE PVC WITH A PRESSURE RATING OF 150 PSI AND CENTERED OVER CROSSING, OR
- ENCASED IN 150 PSI PIPE 18 FT LONG TWO NOMINAL SIZES LARGER THAN THE WASTE WATER COLLECTION PIPE
- PIPE TO BE SUPPORTED BY SPACERS AT 5' INTERVALS, AND GROUTED AT BOTH ENDS WITH CEMENT, GROUT, OR MANUFACTURER SEAL.

GUADALUPE-BLANCO RIVER AUTHORITY
03/04/2015

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS — JOBE CANTU — 111313 — LICENSED PROFESSIONAL ENGINEER
5-21-16

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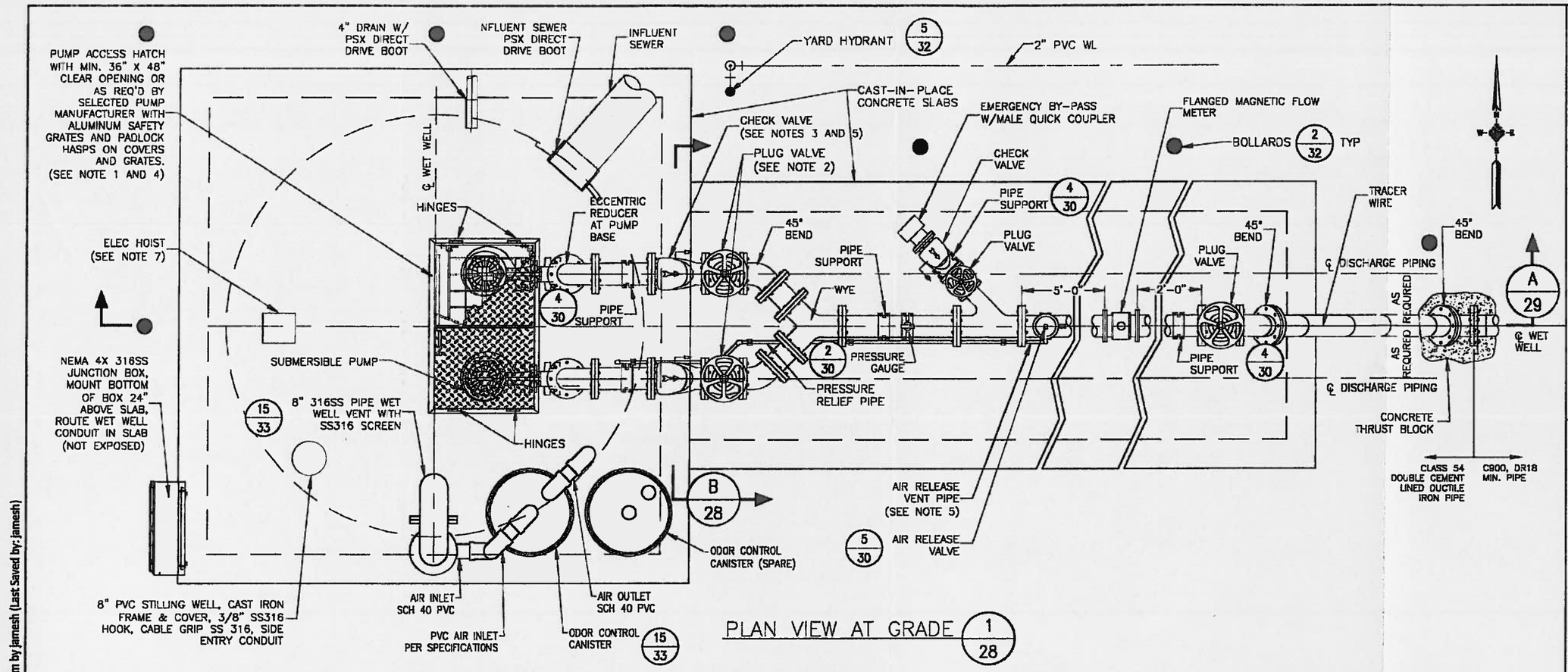
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

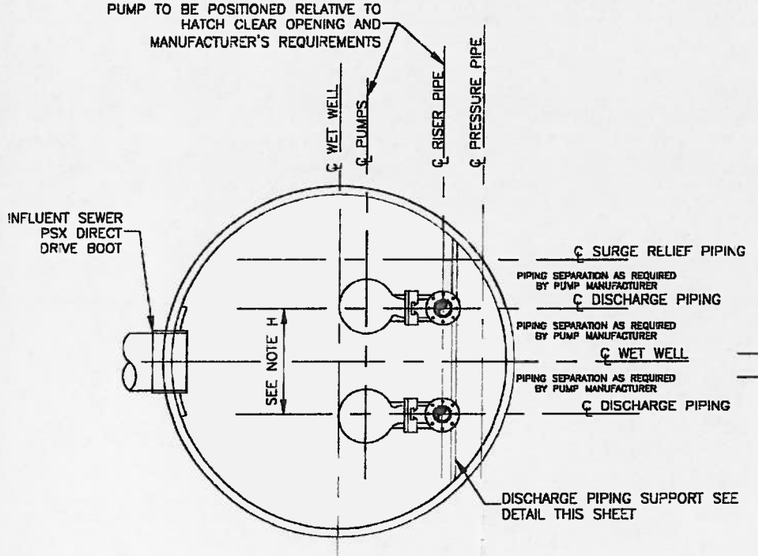
FORCE MAIN DETAILS

CHK. BY: J.A.C.	IDS JOB NO: 150000111			
DWG. BY: M.G.M.	STATE	COUNTY	SHEET NO.
DATE: 01/11/2016	TEXAS	COMAL	27

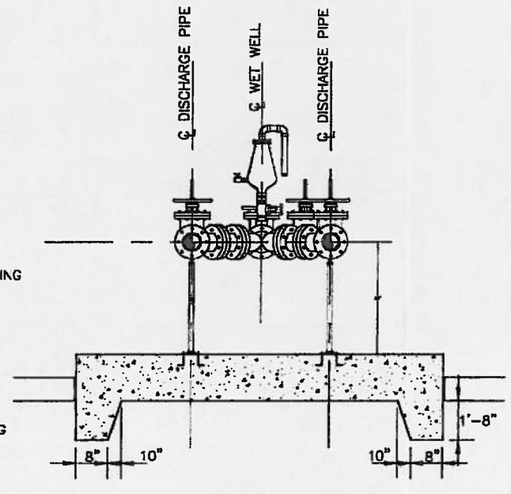
\\san-dc01\projects\150000111\410 DESIGN\060 Dwgs\C-DTLS.dwg [GBRA1] Plotted Mar 22, 2016 at 2:20pm by mmina (Last Saved by: jamesh)



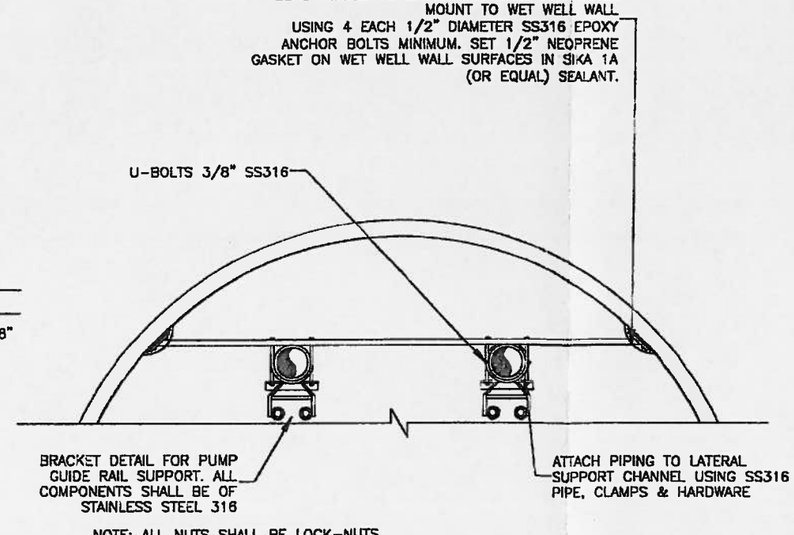
PLAN VIEW AT GRADE 1/28



SECTION C 28



SECTION B 28



WET WELL PIPING SUPPORT DETAIL D 28

KEY NOTES:

1. CONTRACTOR TO CONFIRM SIZE AND LOCATION OF WET WELL HATCHES PER SELECTED HATCH AND PUMP MANUFACTURERS' REQUIREMENTS (36" x 48" MIN.)
2. INSTALL FLANGED JOINT ROUND PORT PLUG VALVES.
3. INSTALL SWING TYPE CHECK VALVE WITH EXTERNAL LEVER AND WEIGHT.
4. ALL PUMP DISCHARGE PIPE AND FITTINGS WITHIN WET WELL SHALL BE FLANGED AND SHALL RECEIVE AFTER INSTALLATION A 100% SOLIDS COAL TAR EPOXY COATING SYSTEM IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS.
5. ALL PUMP DISCHARGE PIPE, VALVES AND FITTINGS OUTSIDE THE WET WELL, EXCEPT SS316 AND PVC, SHALL RECEIVE AFTER INSTALLATION A 100% SOLIDS EPOXY COATING SYSTEM WITH A TOP COAT OF POLYURETHANE IN ACCORDANCE WITH MANUFACTURERS' INSTRUCTIONS. COLOR SHALL BE GREY PANTONE #431-U.
6. ALL FASTENERS AND ANCHOR BOLTS SHALL BE SS316 WITH FIELD APPLIED ANTI-SIEZE COMPOUND. ANCHOR BOLTS INSIDE WET WELL SHALL BE EPOXY TYPE. DO NOT PAINT NUTS AND BOLTS.
7. ELECTRIC HOIST TO BE THERN MODEL 5124 OR APPROVED EQUAL AND OF SUFFICIENT LOAD RATING CAPACITY TO LIFT PUMPS, WITH HOT DIP GALV. CRANE AND BASE, EPOXY COATED WINCH, AND STAINLESS WIRE ROPE.

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		



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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

INFLUENT LIFT STATION PLAN VIEW

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	28

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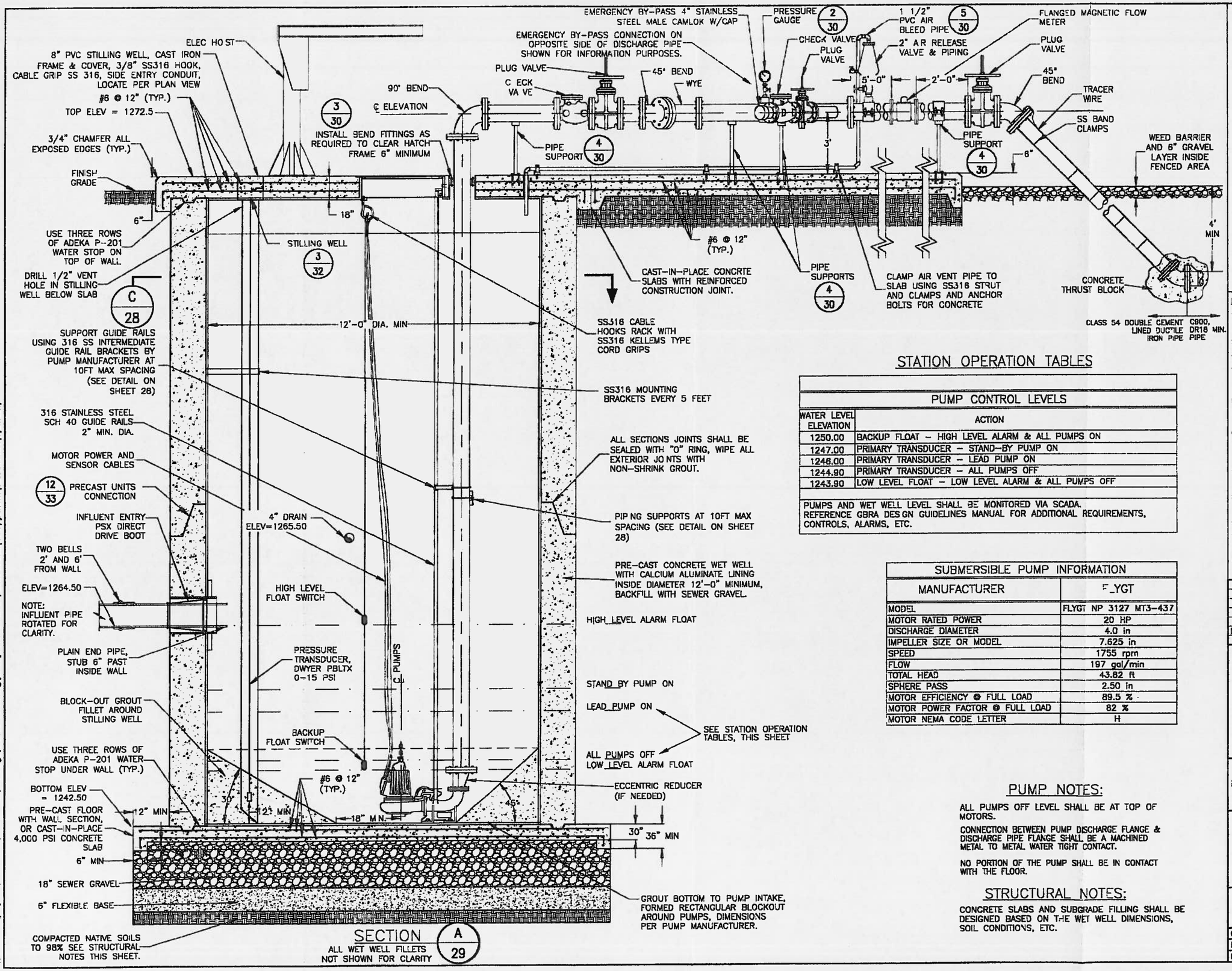

STATION OPERATION TABLES

PUMP CONTROL LEVELS	
WATER LEVEL ELEVATION	ACTION
1250.00	BACKUP FLOAT – HIGH LEVEL ALARM & ALL PUMPS ON
1247.00	PRIMARY TRANSDUCER – STAND-BY PUMP ON
1246.00	PRIMARY TRANSDUCER – LEAD PUMP ON
1244.90	PRIMARY TRANSDUCER – ALL PUMPS OFF
1243.90	LOW LEVEL FLOAT – LOW LEVEL ALARM & ALL PUMPS OFF

PUMPS AND WET WELL LEVEL SHALL BE MONITORED VIA SCADA.
REFERENCE GBRA DESIGN GUIDELINES MANUAL FOR ADDITIONAL REQUIREMENTS, CONTROLS, ALARMS, ETC.

SUBMERSIBLE PUMP INFORMATION	
MANUFACTURER	FLYGT
MODEL	FLYGT NP 3127 MT3-437
MOTOR RATED POWER	20 HP
DISCHARGE DIAMETER	4.0 in
IMPELLER SIZE OR MODEL	7.625 in
SPEED	1755 rpm
FLOW	197 gal/min
TOTAL HEAD	43.82 ft
SPHERE PASS	2.50 in
MOTOR EFFICIENCY @ FULL LOAD	89.5 %
MOTOR POWER FACTOR @ FULL LOAD	82 %
MOTOR NEMA CODE LETTER	H

PUMP NOTES:

ALL PUMPS OFF LEVEL SHALL BE AT TOP OF MOTORS.

CONNECTION BETWEEN PUMP DISCHARGE FLANGE & DISCHARGE PIPE FLANGE SHALL BE A MACHINED METAL TO METAL WATER TIGHT CONTACT.

NO PORTION OF THE PUMP SHALL BE IN CONTACT WITH THE FLOOR.

STRUCTURAL NOTES:

CONCRETE SLABS AND SUBGRADE FILLING SHALL BE DESIGNED BASED ON THE WET WELL DIMENSIONS, SOIL CONDITIONS, ETC.

KEY NOTES:

1. CONTRACTOR TO CONFIRM SIZE AND LOCATION OF WET WELL HATCHES PER SELECTED HATCH AND PUMP MANUFACTURERS' REQUIREMENTS (36" X 48" MIN.)
2. INSTALL FLANGED JOINT ROUND PORT PLUG VALVES.
3. INSTALL SWING TYPE CHECK VALVE WITH EXTERNAL LEVER AND WEIGHT.
4. SLEEVED OR CORED DISCHARGE PIPE SHALL BE SEALED WITH SEAL LINK AND BACKER ROD WITH SELF-LEVELING CAULK (OR APPROVED EQUAL). MAY BE SUBSTITUTED FOR POURED IN PLACE WALL PIPES TO ACCOMMODATE CONSTRUCTION METHOD.
5. ALL PUMP DISCHARGE PIPE AND FITTINGS WITHIN WET WELL SHALL BE FLANGED AND SHALL RECEIVE AFTER INSTALLATION A 100% SOLIDS COAL TAR EPOXY COATING SYSTEM IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS.
6. ALL PUMP DISCHARGE PIPE, VALVES AND FITTINGS OUTSIDE THE WET WELL, EXCEPT SS316 AND PVC, SHALL RECEIVE AFTER INSTALLATION A 100% SOLIDS EPOXY COATING SYSTEM WITH A TOP COAT OF POLYURETHANE IN ACCORDANCE WITH MANUFACTURERS' INSTRUCTIONS. COLOR SHALL BE GREY PANTONE #431-U.
7. ALL FASTENERS AND ANCHOR BOLTS SHALL BE SS316 WITH FIELD APPLIED ANTI-SEIZE COMPOUND. ANCHOR BOLTS INSIDE WET WELL SHALL BE EPOXY TYPE. DO NOT PAINT NUTS AND BOLTS.
8. ELECTRIC HOIST TO BE THERN MODEL 5124 OR EQUAL AND OF SUFFICIENT LOAD RATING CAPACITY TO LIFT PUMPS, WITH HOT DIP GALV. CRANE AND BASE, EPOXY COATED WINCH, AND STAINLESS WIRE ROPE.
9. ALL ANCHOR BOLTS INSIDE WET WELL TO BE EPOXY TYPE SS316.
10. SAND BLAST AND LINE INTERIOR OF WET WELL WITH SEWPERCOAT, REFRATTA HAC 100, OR APPROVED EQUAL. MINIMUM 1" THICKNESS. SMOOTH TROWEL FINISH.
11. PROVIDE TRACE WIRE (COPPER CLAD STEEL, 12 GAUGE, 30 MIL HDPE JACKET) FOR ALL BURIED PIPING.

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STATE OF TEXAS — DAVID J. ROSS — 68267 — LICENSED PROFESSIONAL ENGINEER — 12/21/15

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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

INFLUENT LIFT STATION PROFILE VIEW

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	29

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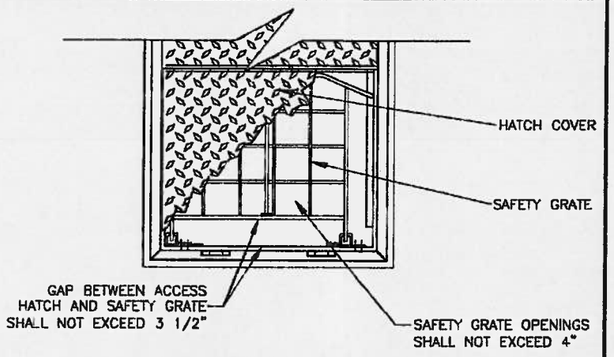
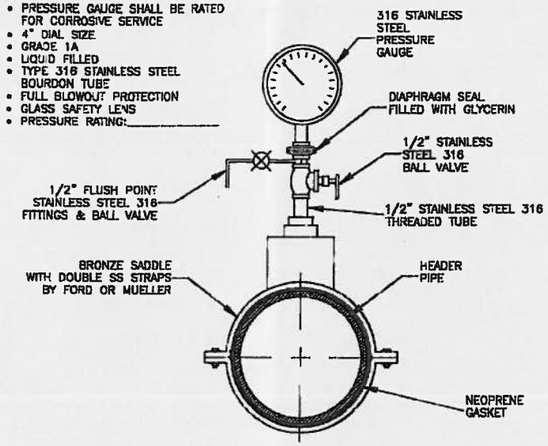


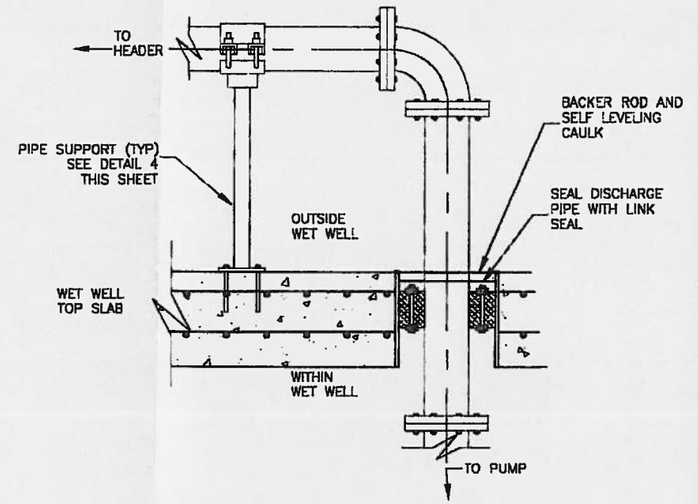
KEY NOTES:
- TOP OF SAFETY GRATES SHALL BE 1/2" MAXIMUM BELOW TOP OF CONCRTE SLAB.
- ACCESS HATCH COVER SHALL BE PERFECTLY LEVELED WITH TOP OF CONCRETE SLAB.

DETAIL 1:
SAFETY GRATE DETAILS

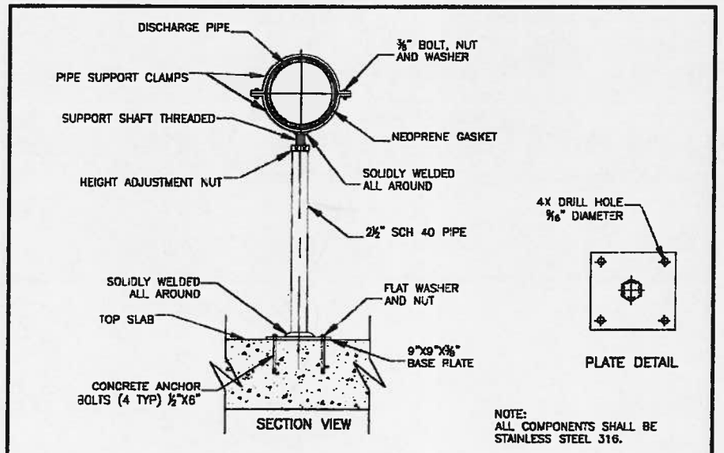
KEY NOTES:
- PRESSURE GAUGE SHALL BE RATED FOR CORROSIVE SERVICE
- 4" DIAL SIZE
- GRADE 1A
- LIQUID FILLED
- TYPE 316 STAINLESS STEEL BOURDON TUBE
- FULL BLOWOUT PROTECTION
- GLASS SAFETY LENS
- PRESSURE RATING:_____



DETAIL 2:
PRESSURE GAUGE INSTALLATION DETAIL

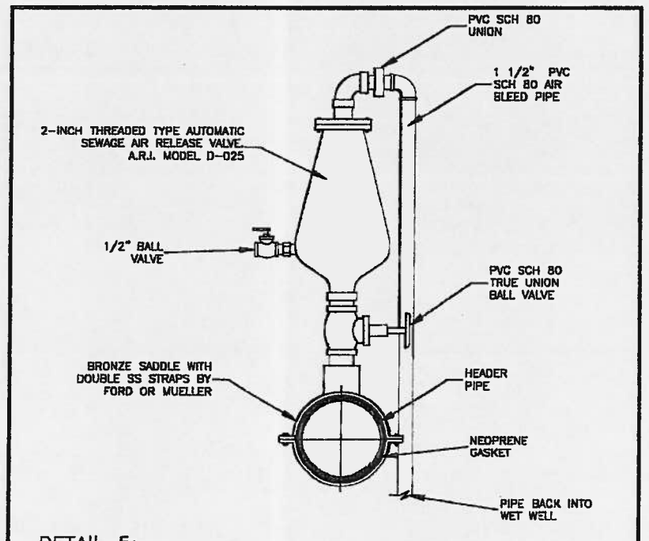


DETAIL 3:
TYPICAL PIPE PENETRATION DETAIL



NOTE:
ALL COMPONENTS SHALL BE STAINLESS STEEL 316.

DETAIL 4:
PIPE SUPPORT DETAILS



DETAIL 5:
AIR RELEASE VALVE INSTALLATION DETAIL AT HEADER

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		REVISIONS		

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PARK VILLAGE
WASTEWATER TREATMENT PLANT
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WET WELL AND PIPING DETAILS

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	30

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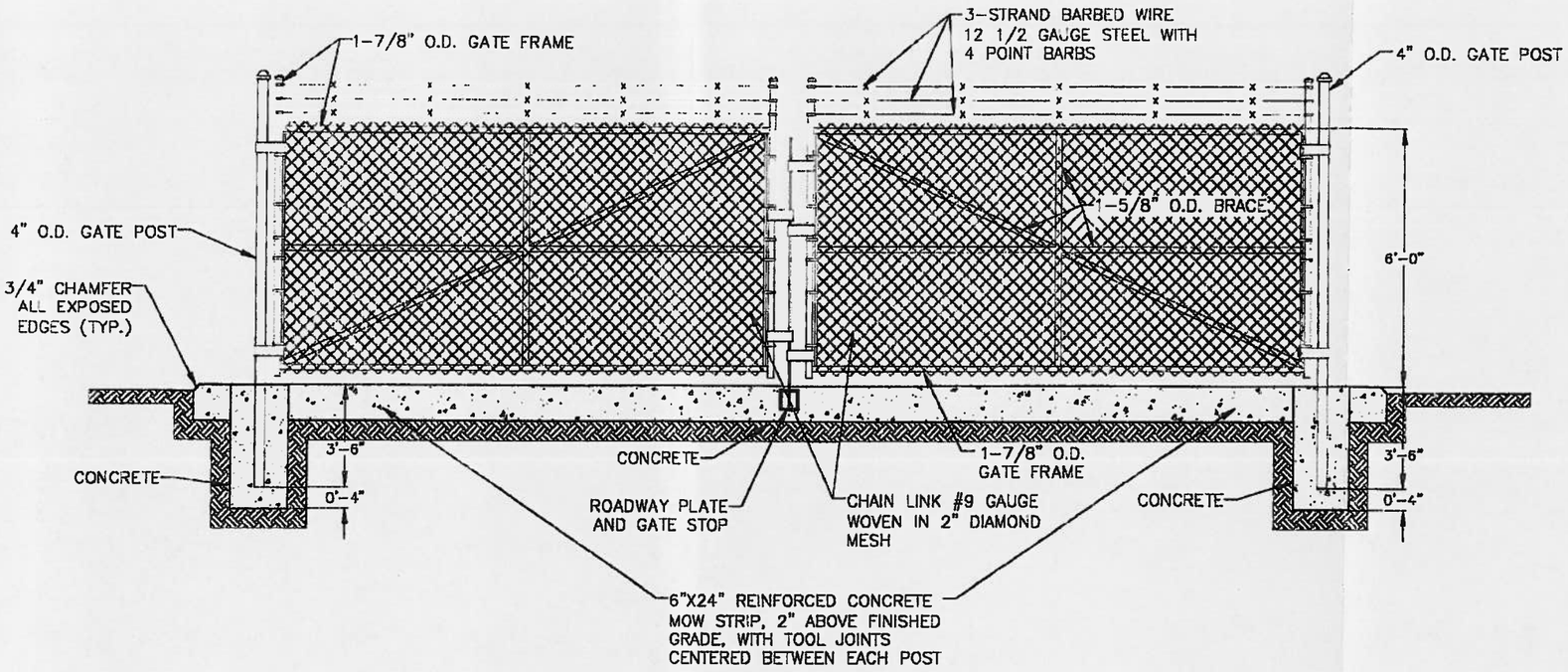

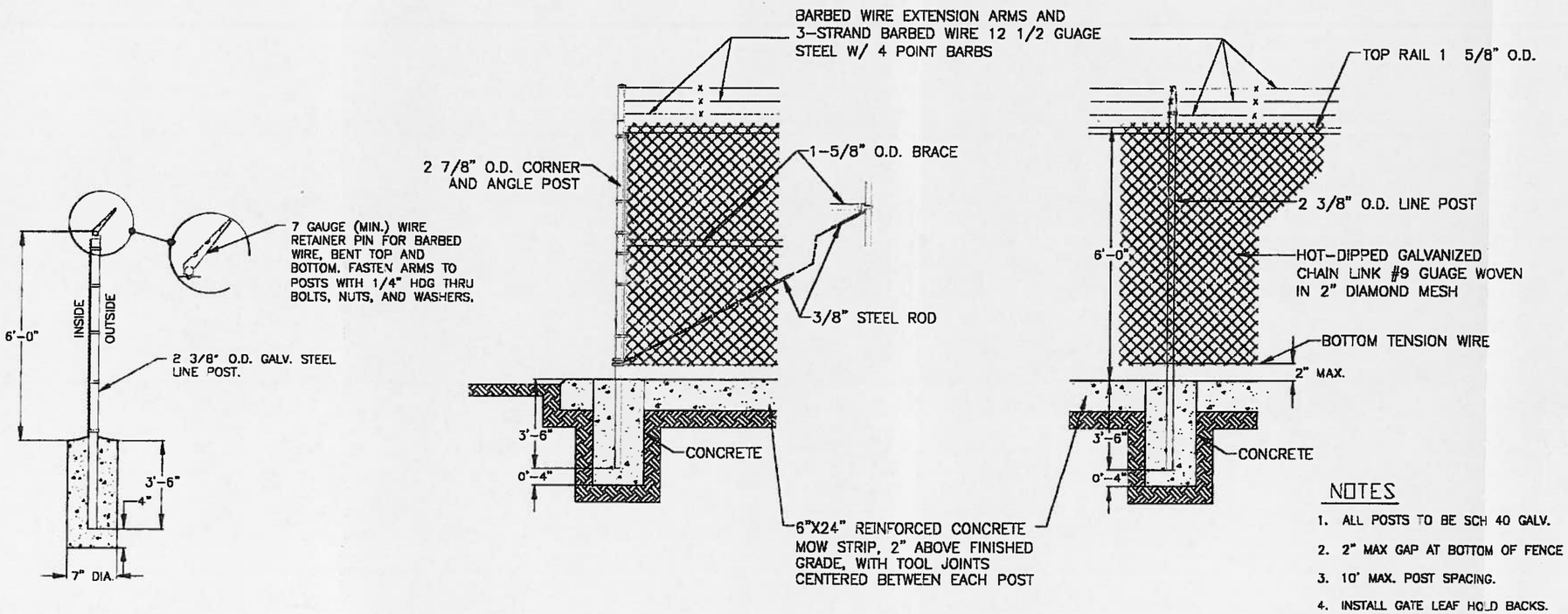

NOTES

1. ALL POSTS TO BE SCH 40 GALV.
2. 2" MAX GAP AT BOTTOM OF FENCE
3. 10' MAX. POST SPACING.
4. INSTALL GATE LEAF HOLD BACKS.

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS
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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

CHAIN LINK FENCE AND GATES DETAILS

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	31

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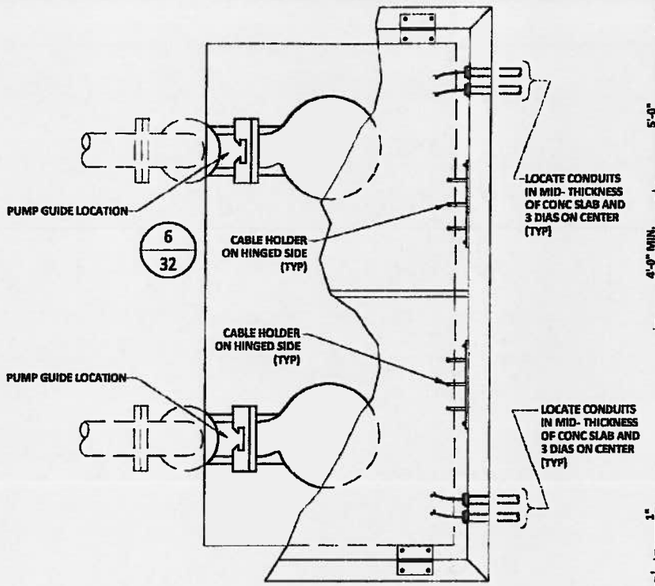
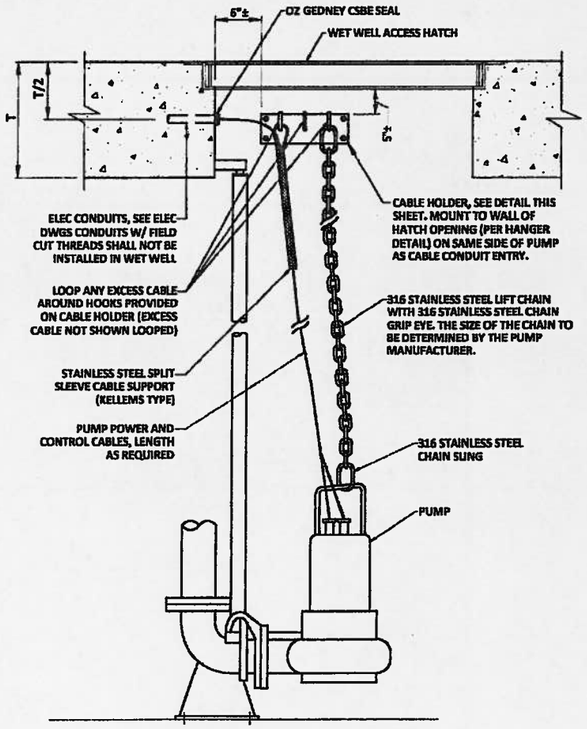
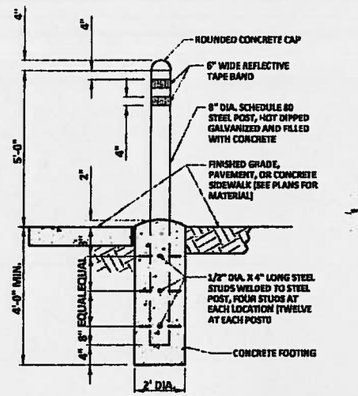


PUMP LIFTING AND CABLING PLAN

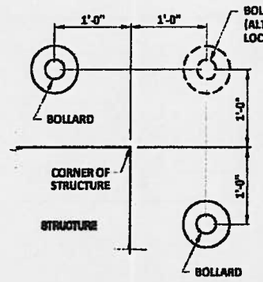


TYPICAL PUMP LIFTING AND CABLING DETAIL

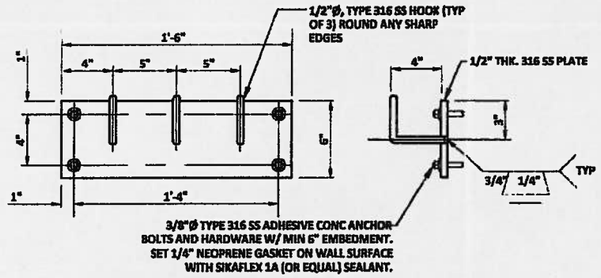
PUMP LIFTING AND CABLE DETAIL 1/32 N.T.S.



BOLLARD DETAIL 2/32 N.T.S.

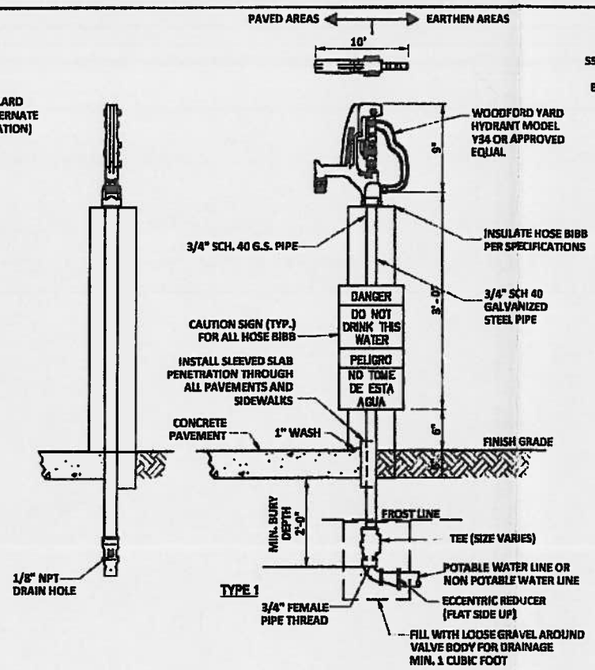


BOLLARD LOCATION



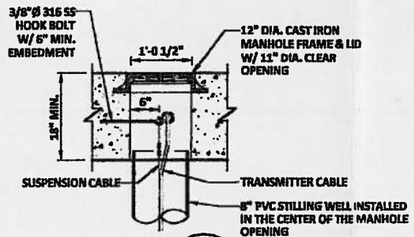
TYPICAL CABLE HOLDER ASSEMBLY

CABLE HOLDER DETAIL 6/32 N.T.S.

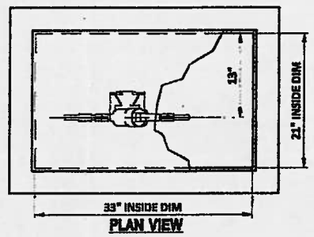


NOTE:
1. ALL EXPOSED PIPING 4" AND SMALLER CONVEYING LIQUIDS SHALL BE INSULATED, HEAT TRACED AND COVERED WITH AN ALUMINUM INSULATION JACKET COVER PER SPECIFICATION SECTION 15025 - PLANT PIPING AND FITTINGS, PARAGRAPH 2.02

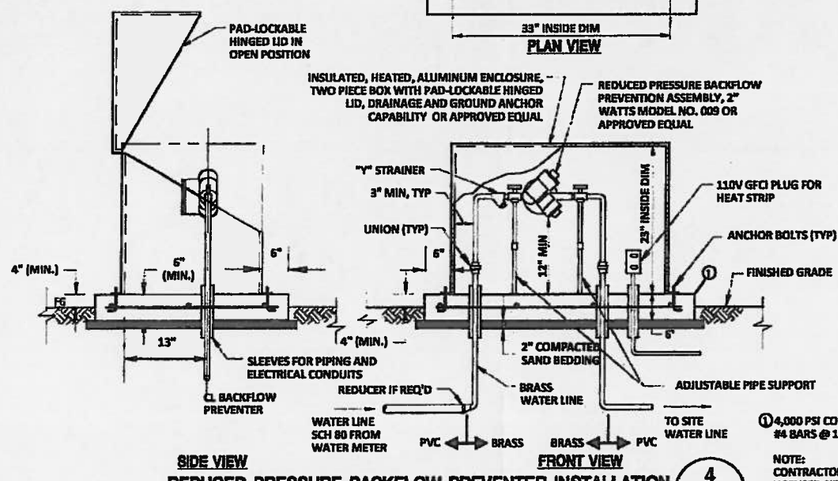
YARD HYDRANT DETAILS 5/32 N.T.S.



STILLING WELL 3/32 N.T.S.



PLAN VIEW



SIDE VIEW FRONT VIEW

REDUCED PRESSURE BACKFLOW PREVENTER INSTALLATION 4/32 N.T.S.

NOTE:
CONTRACTOR TO PROVIDE LICENSED FIELD TESTING AND CERTIFICATION AFTER INSTALLATION.

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

LIFT STATION AND MISCELLANEOUS DETAILS 1

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	32

GENERAL NOTES FOR STRUCTURES

CONCRETE

1. DESIGN AND INSTALLATION SHALL CONFORM TO THE LATEST BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE (ACI-318) WITH SPECIAL REQUIREMENTS OF ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES (ACI-350)
2. ALL REINFORCING BARS SHALL CONFORM TO ASTM A-615, GRADE 60. ARRANGEMENT AND DETAILS OF REINFORCING STEEL, INCLUDING BAR SUPPORTS AND SPACERS, SHALL BE IN ACCORDANCE WITH THE LATEST ACI DETAILING MANUAL, UNLESS OTHERWISE NOTED.
3. ALL SLAB AND BEAM REINFORCEMENT SHALL HAVE A MINIMUM EXTENSION INTO THE SUPPORT IN ACCORDANCE WITH THE LATEST ACI CODE. IF SUCH EXTENSION IS NOT POSSIBLE, BARS SHALL TERMINATE IN STANDARD HOOKS.
4. HORIZONTAL WALL REINFORCEMENT AND TEMPERATURE REINFORCEMENT SHALL LAP A MINIMUM OF 1.7 Ld AT SPLICES. WALL DOWELS AND WALL BAR EXTENSIONS AND ALL STRESS SPLICES SHALL LAP A MINIMUM OF 1.7 Ld, UNLESS OTHERWISE NOTED.
5. WALL OR COLUMNS SHALL HAVE DOWELS FROM FOUNDATIONS OR CONSTRUCTION BELOW OF SAME SIZE AND SPACING AS WALL OR COLUMN VERTICAL STEEL. SEE FOOTING SCHEDULE.
6. UNLESS OTHERWISE NOTED ON THE DRAWINGS, CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS SHALL NOT BE LESS THAN THE FOLLOWING:
   - STRUCTURAL MEMBERS, FOUNDATIONS, WALLS AND SUSPENDED SLABS— 4000 PSI
   - SLABS ON GRADE— 4000 PSI
   - LEAN CONCRETE — 1500 PSI
   - GROUT FILL — 3000 PSI
7. UNLESS OTHERWISE SHOWN, THE COVER FOR REINFORCING STEEL SHALL BE AS FOLLOWS:

SLABS	
TOP AND BOTTOM OF FORMED SLABS	2"
TOP OF WALK AND DRIVEWAY SLABS	2"
SURFACES IN CONTACT WITH LIQUID	4"
BOTTOM OF SLABS ON FILL OR SOIL	3"
FOOTINGS:	
TOP AND SIDES	2 1/2"
BOTTOM	3"
WALLS:	
LESS THAN 12" THICK	1 1/2"
12" OR OVER IN THICKNESS WITH POURS LESS THAN 10 FEET HIGH	2"
12" OR OVER IN THICKNESS WITH POURS MORE THAN 10 FEET HIGH	2 1/2"
BEAMS AND GIRDERS:	
COVER AT TOP, BOTTOM OR SIDES OF LONGITUDINAL REINF	2"
COLUMNS:	
COVER FOR VERTICAL BARS	2"

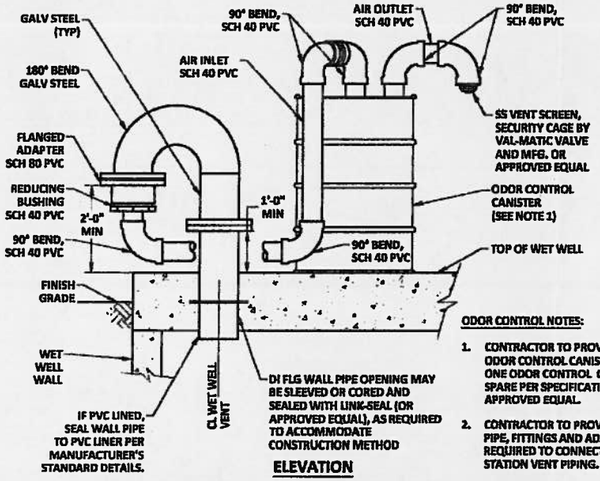
8. HORIZONTAL AND VERTICAL CONSTRUCTION JOINTS SHOWN OR NOTED ON THE PLANS ARE RECOMMENDED. ANY DEVIATION FROM THOSE SHOWN SHALL HAVE APPROVAL OF THE ENGINEER.
9. ANY STOP IN FRAMED CONCRETE WORK MUST BE MADE IN THE CENTER OF THE SPAN AND INCORPORATE AN APPROVED KEYWAY. REINFORCEMENT SHALL EXTEND THROUGH THESE JOINTS IF REQUIRED FOR CONTINUITY.
10. USE TYPE 'C2' JOINT FOR ALL CONSTRUCTION JOINTS IN WALLS AND SLABS BELOW GRADE AND WALLS WHICH SEPARATE AREAS OF SOIL OR LIQUID FROM PERMANENTLY DRY AREAS SUCH AS TUNNELS, GALLERIES, BASEMENT ROOMS, ETC. USE TYPE 'C1' JOINT AT ALL OTHER CONSTRUCTION JOINTS, UNLESS OTHERWISE NOTED ON DRAWINGS.
11. ALL CONCRETE SLABS OVER 8" IN THICKNESS, REINFORCED WITH BARS, AND POURED AGAINST SOIL SHALL BE POURED IN A STRIP PATTERN OF 40 FEET OR LESS IN EACH DIRECTION.
12. ALL EXPOSED EDGES OF BEAMS, COLUMNS, SLABS AND WALLS SHALL BE CHAMFERED 3/4" UNLESS MASONRY OR OTHER MEMBERS ARE ERECTED FLUSH WITH THEM.

STRUCTURAL STEEL

1. STRUCTURAL STEEL SHALL CONFORM TO THE LATEST AISC "SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS". ALL STRUCTURAL STEEL SHALL BE ASTM A36.
2. ELEVATIONS OF STEEL BEAMS SHOWN ON FRAMING PLANS REFER TO TOP OF FLANGE, UNLESS OTHERWISE NOTED.
3. ALL BOLTED CONNECTIONS SHALL BE MADE WITH 3/4" DIAMETER ASTM A-325 BOLTS EXCEPT AS OTHERWISE SHOWN OR NOTED. ALL CONNECTIONS SHALL BE CAPABLE OF SUPPORTING ONE HALF THE MAXIMUM ALLOWABLE UNIFORM LOAD FOR INDICATED BEAM SIZE AND SPAN IN AISC MANUAL OF STEEL CONSTRUCTION, EXCEPT AS OTHERWISE NOTED.
4. FIELD CONNECTIONS SHALL BE BOLTED, EXCEPT AS OTHERWISE SHOWN OR NOTED.
5. ALL WELDING SHALL CONFORM TO THE LATEST SPECIFICATION OF THE AMERICAN WELDING SOCIETY. ALL WELDED CONNECTIONS SHALL BE MADE WITH AWS A5.1 OR A5.5 E70 XX ELECTRODE.
6. ANCHOR BOLTS AND MISC EMBEDDED STEEL————ASTM A36.
   ANCHOR BOLTS WHICH ARE SUBMERGED, LOCATED ABOVE A LIQUID SURFACE, OR ARE IN A CORROSIVE ATMOSPHERE————316 SS.
7. ALL EQUIPMENT ANCHOR BOLT DIMENSIONS AND LOCATIONS SHALL BE VERIFIED FROM CERTIFIED VENDOR DRAWINGS, PRIOR TO CONSTRUCTION.

FOUNDATIONS

1. ALLOWABLE SOIL BEARING PRESSURE, EXCAVATION AND BACKFILL FOR FOUNDATIONS AND STRUCTURES SHALL BE AS RECOMMENDED IN THE GEOTECHNICAL REPORT.
2. ALL EXCAVATIONS SHALL BE CARRIED OUT IN THE DRY, AND PROVISIONS SHALL BE MADE TO PREVENT THE BOTTOM OF ALL EXCAVATIONS FROM FREEZING OR FLOODING AT ALL TIMES.
3. ALL FOUNDATIONS SHALL BE CONSTRUCTED IN EXCAVATIONS FREE OF STANDING WATER.
4. BACKFILL MATERIAL, PLACING AND COMPACTION OF BACKFILL SHALL BE IN ACCORDANCE WITH THE DRAWINGS, AND THE CONTRACT SPECIFICATIONS.



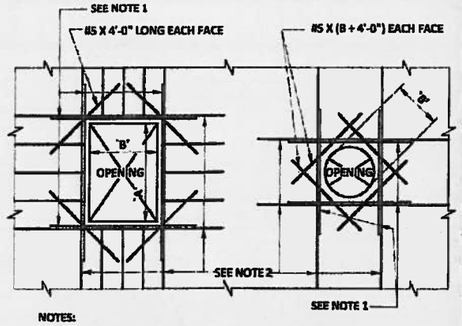
ELEVATION

ODOR CONTROL NOTES:

1. CONTRACTOR TO PROVIDE (1) ONE ODOR CONTROL CANISTER AND (1) ONE ODOR CONTROL CANISTER SPARE PER SPECIFICATIONS OR APPROVED EQUAL.
2. CONTRACTOR TO PROVIDE ALL PIPE, FITTINGS AND ADAPTERS REQUIRED TO CONNECT TO LIFT STATION VENT PIPING.

WET WELL VENT WITH ODOR CONTROL CANISTER

N.T.S. — 15 / 33

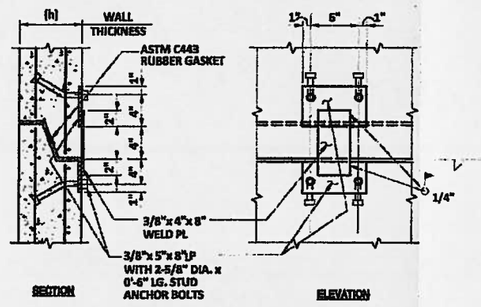


NOTES:

1. PROVIDE 2-#6 X (B+4'-0") ADDITIONAL REBARS @ TOP AND BOTTOM AND 2-#6 X (A+4'-0") ADDITIONAL REBARS AT EACH SIDE OF OPENING IN WALLS ONLY.
2. PROVIDE ADDL BARS EQUAL TO ONE-HALF OF BARS INTERRUPTED AT EACH SIDE OF OPENING AT 3" C/C. THESE BARS SHALL BE ORIGINAL SIZES AND LENGTHS AS THOSE OF THE INTERRUPTED BARS. (TYPICAL FOR OPENINGS IN SLABS AND PRESSURE WALLS.)

ADDITIONAL REINFORCING STEEL AT OPENINGS IN WALLS AND SLABS

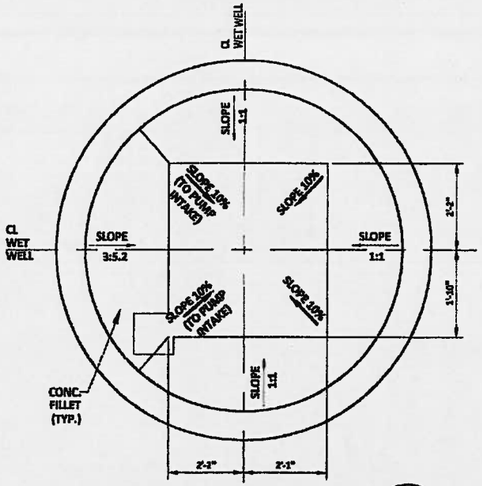
N.T.S. — 11 / 33



NOTE: CONNECTION CAPACITY T = 14 KIPS
PROVIDE MIN. 6 CONNECTIONS PER JOINT.

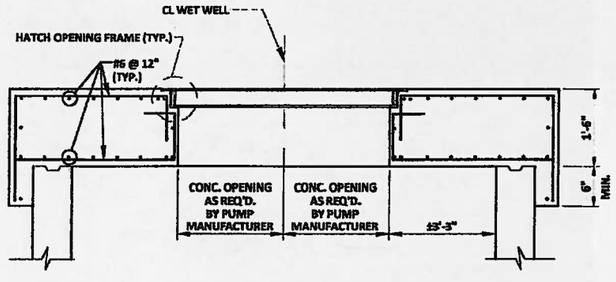
PRECAST UNITS CONNECTION DETAILS CAISSON CONSTRUCTION METHOD

N.T.S. — 12 / 33



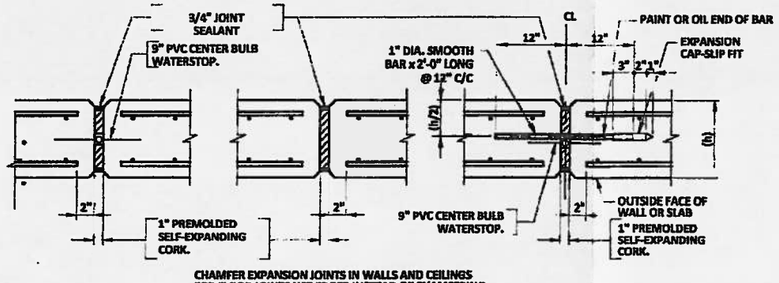
WET WELL - PLAN VIEW AT FLOOR

N.T.S. — 14 / 33



HATCH FRAME SECTION

N.T.S. — 10 / 33



CHAMFER EXPANSION JOINTS IN WALLS AND CEILINGS FOR FLOOR JOINTS USE EDGER INSTEAD OF CHAMFERING

TYPE 'B2' TYPE 'B3' TYPE 'B4'

EXPANSION JOINTS

N.T.S. — 13 / 33

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

DAVID J. ROSS 88287 LICENSED PROFESSIONAL ENGINEER STATE OF TEXAS
12/1/16

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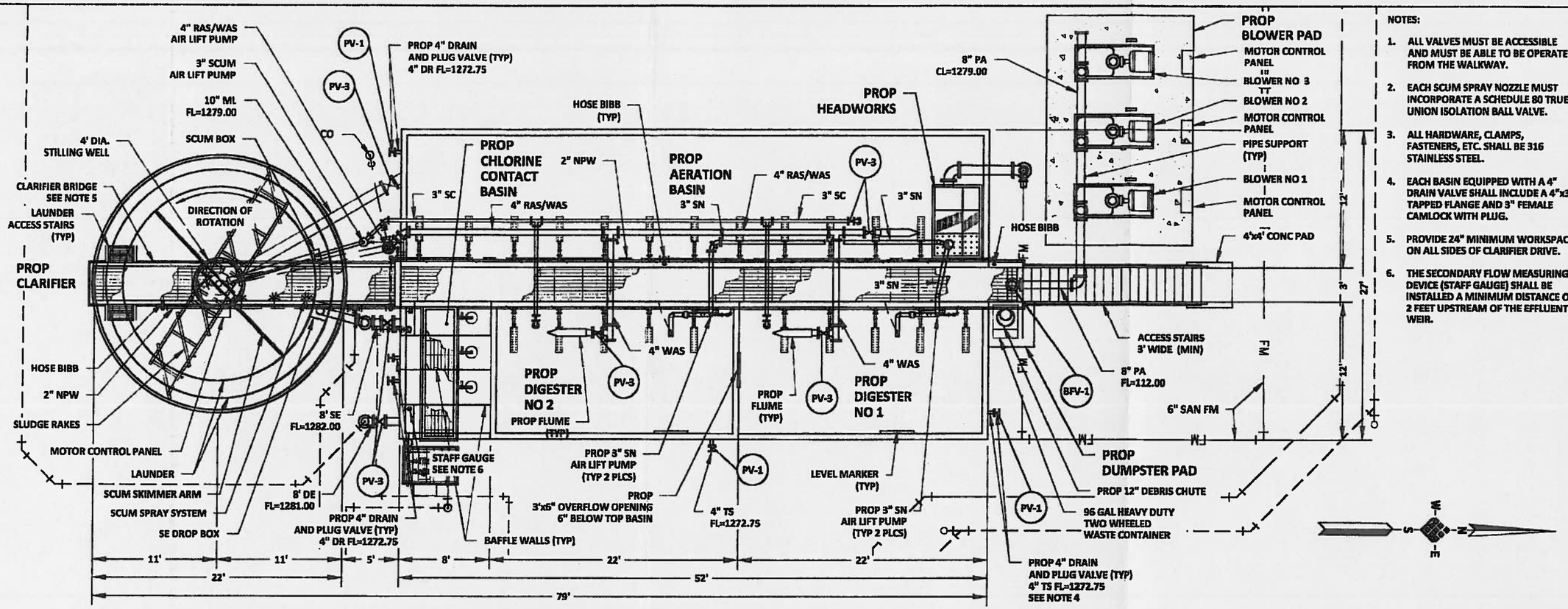
PARK VILLAGE WASTEWATER TREATMENT PLANT COMAL COUNTY, TEXAS

LIFT STATION AND MISCELLANEOUS DETAILS 2

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	33

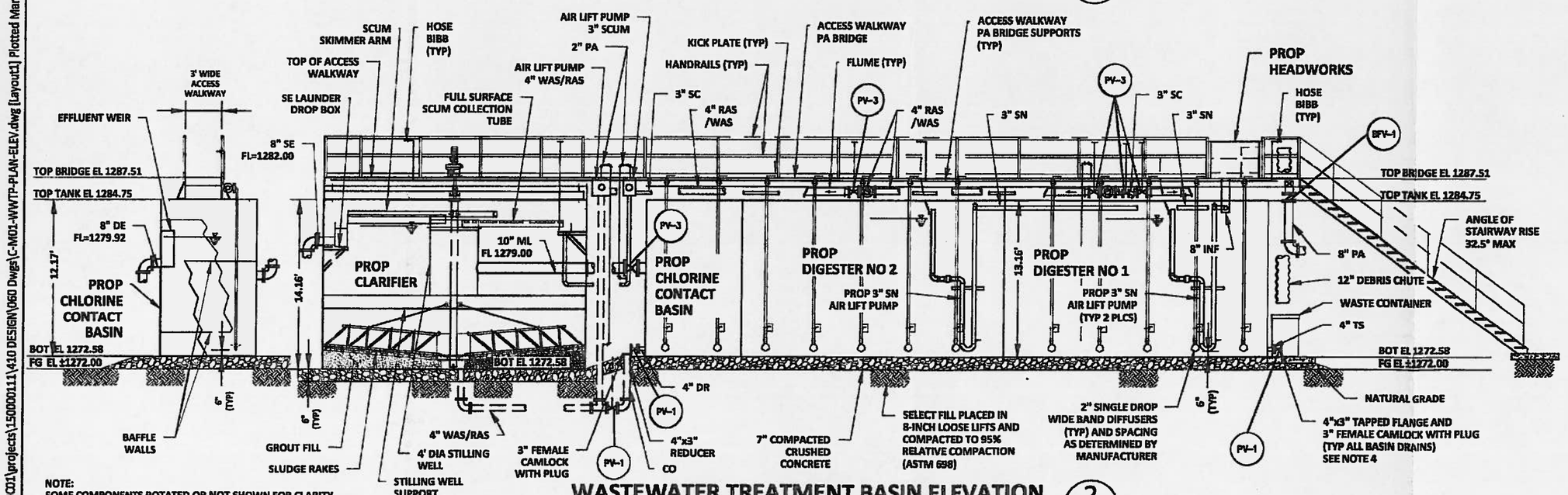
\\SAN-DC01\projects\150000111\410 DESIGN\060 Dwgs\C-DTLS-LIFT STATION.dwg [DETAIL 2] Plotted Mar 21, 2016 at 6:29pm by Jamesh (Last Saved by: Jamesh)



WASTEWATER TREATMENT BASIN PLAN (1)

SCALE: 1" = 10'

34



NOTE:
SOME COMPONENTS ROTATED OR NOT SHOWN FOR CLARITY

WASTEWATER TREATMENT BASIN ELEVATION (2)

SCALE: 1" = 10'

34

10' 0' 10'

SCALE

1"=10'

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS — DAVID J. ROSS — 88267 — PROFESSIONAL ENGINEER — 12/21/16

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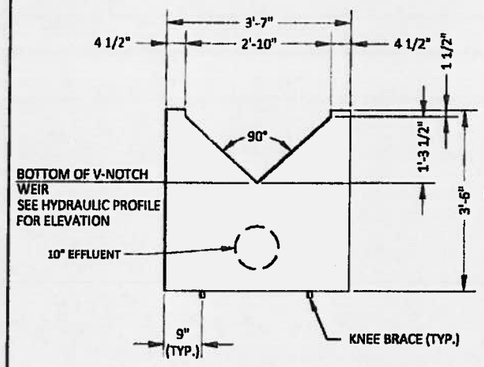
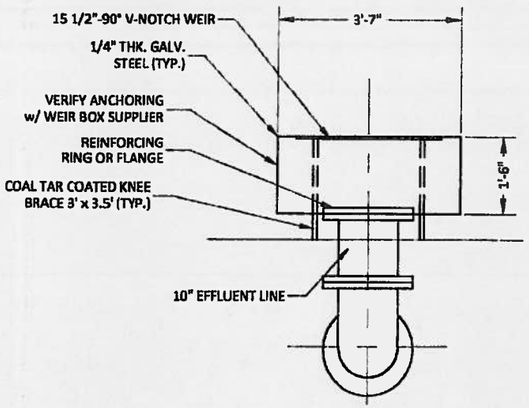
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

MECHANICAL BASIN PLAN AND ELEVATION

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	34

\\SAN-DC01\projects\150000111\410 DESIGN\060 Dwgs\C-M01-WWTP-PLAN-ELEV.dwg [Layout1] Plotted Mar 21, 2016 at 6:30pm by jamesh (Last Saved by: jamesh)





ELEVATION

PLAN

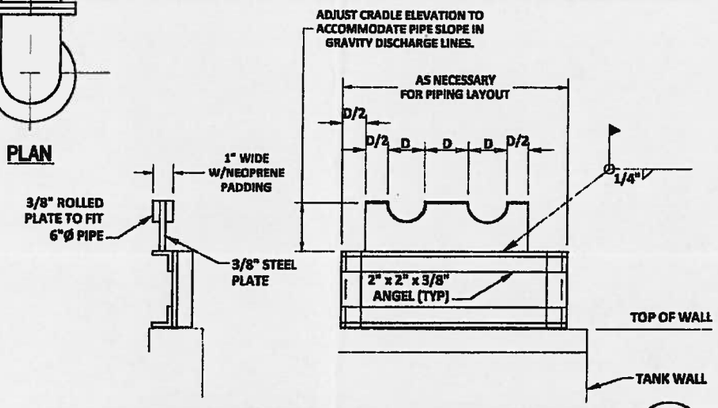
NOTES:

1. ALL FABRICATED METAL SHALL BE 1/4" MIN. GALVANIZED STEEL. MANUFACTURER TO USE STIFFENERS AS NECESSARY, GRIND OFF ALL ROUGH EDGES.

EFFLUENT WEIR BOX PLAN

N.T.S.

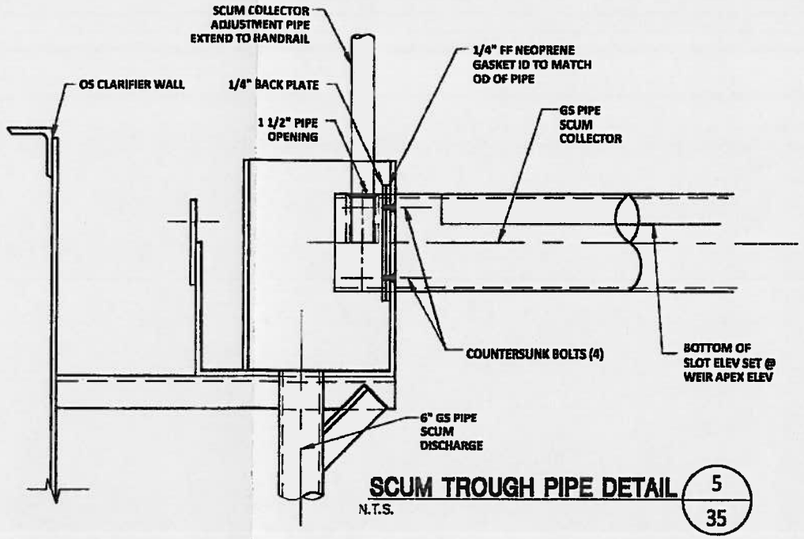
1 / 35



RAS CARRIER SUPPORTS FOR BASIN DISTRIBUTION

N.T.S.

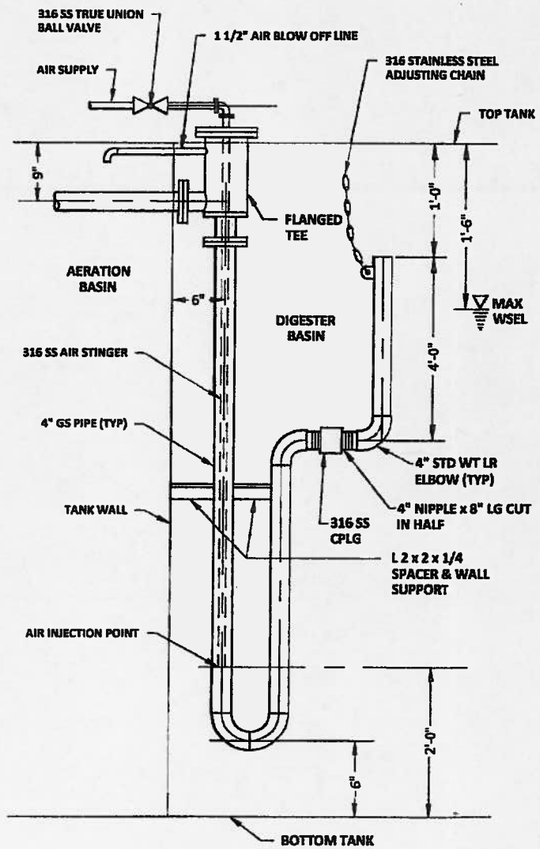
3 / 35



SCUM TROUGH PIPE DETAIL

N.T.S.

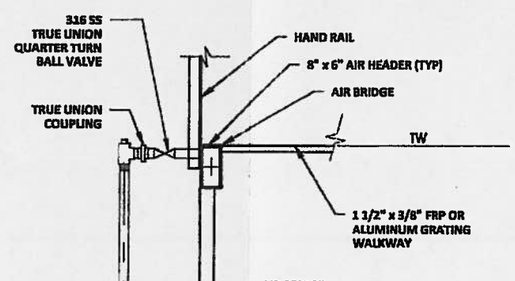
5 / 35

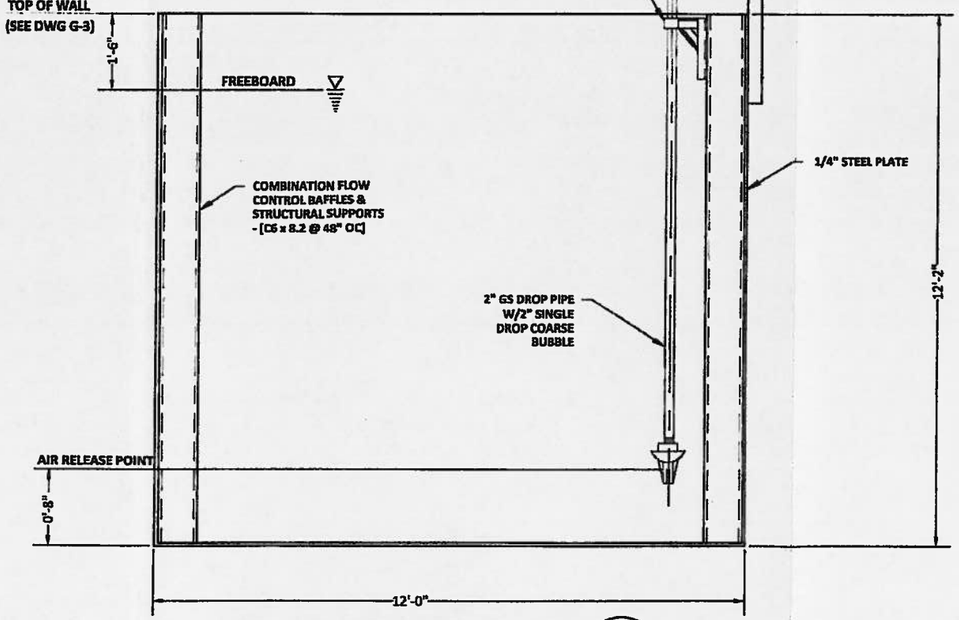


SUPERNATANT AIRLIFT DETAIL

N.T.S.

2 / 35





AERATION BASIN SECTION

N.T.S.

4 / 35

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS — DAVID J. ROSS — 68287 — PROFESSIONAL ENGINEER — 12/15/15

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San Antonio, TX 78216
210.340.8481

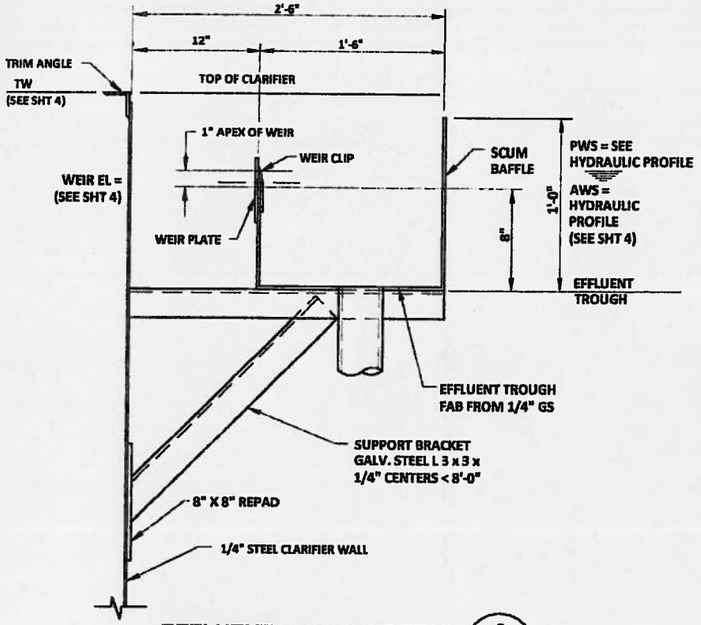
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

MECHANICAL MISCELLANEOUS DETAILS-1

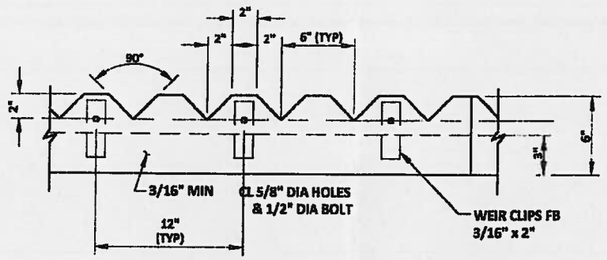
CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	35

\\SAN-DC01\projects\150000111\410 DESIGN\060 Dwgs\C-DTLS_MEC.dwg [details 1] Plotted Mar 21, 2016 at 6:30pm by jamesh (Last Saved by: jamesh)

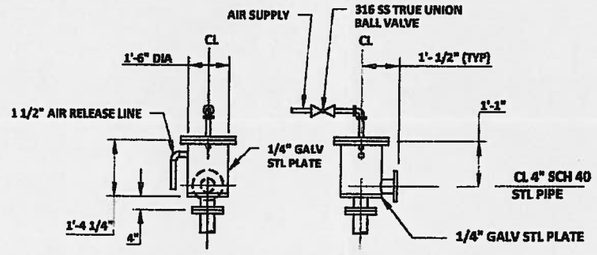
\\SAN-DC01\projects\150000111\410 DESIGN\060 Dwgs\C-DTLS_MEC.dwg [details 2] Plotted Mar 21, 2016 at 6:30pm by jamesh (Last Saved by: jamesh)



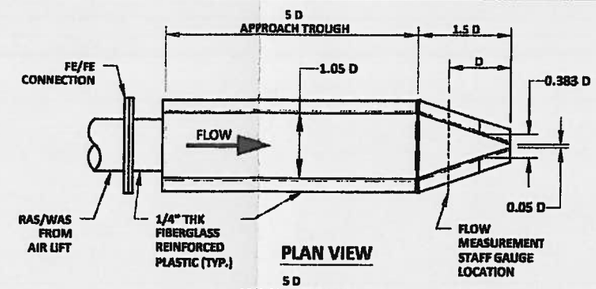
EFFLUENT TROUGH DETAIL 6/36
N.T.S.



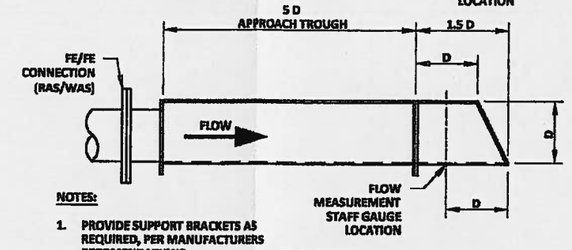
CLARIFIER WEIR PLATE DETAIL 7/36
N.T.S.



EXPANSION BOX DETAIL 9/36
N.T.S.

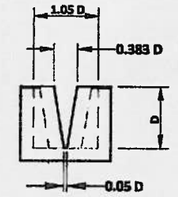


PLAN VIEW



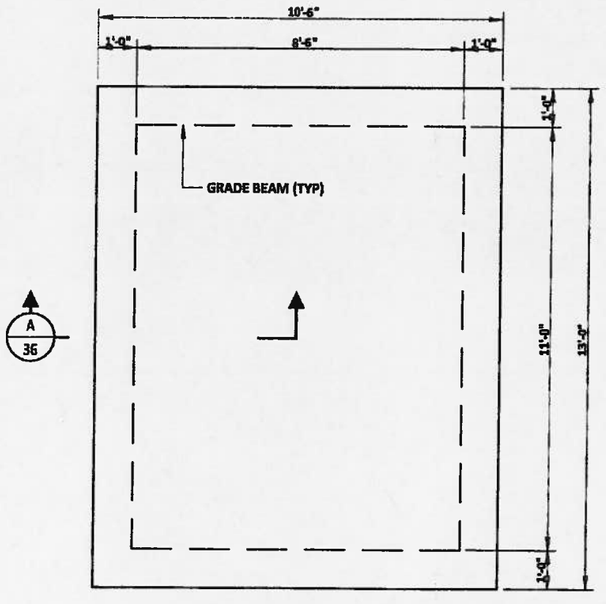
NOTES:
1. PROVIDE SUPPORT BRACKETS AS REQUIRED, PER MANUFACTURERS RECOMMENDATIONS.

ELEVATION

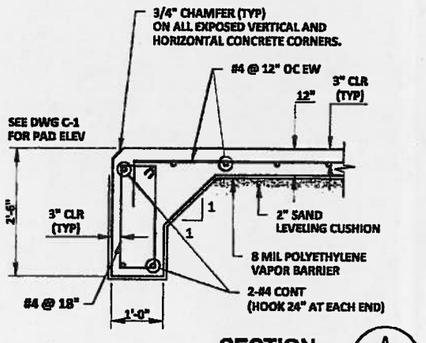


SIDE

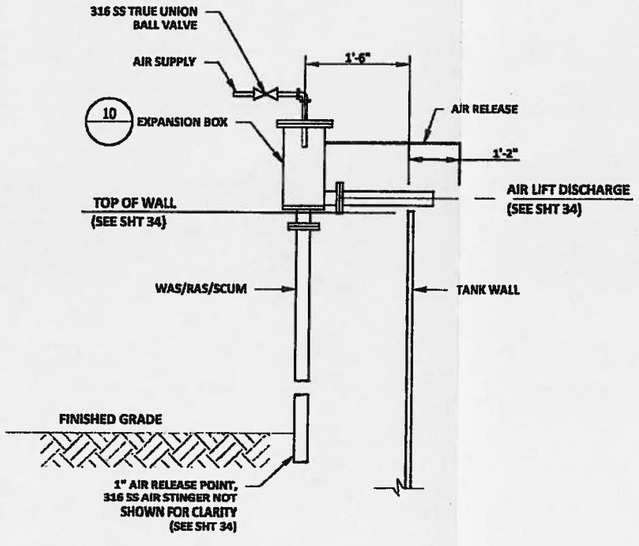
RETURN SLUDGE MEASUREMENT - HS FLUME 8/36
N.T.S.



BLOWER FOUNDATION PLAN 10/36
N.T.S.



SECTION A/36
N.T.S.



SCUM AND WASTE AND RETURN ACTIVATED SLUDGE AIRLIFT PUMP 9/36
N.T.S.

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS — DAVID J. ROSS — 68257 — LICENSED PROFESSIONAL ENGINEER — 12/21/15

David J. Ross

IDS Engineering Group
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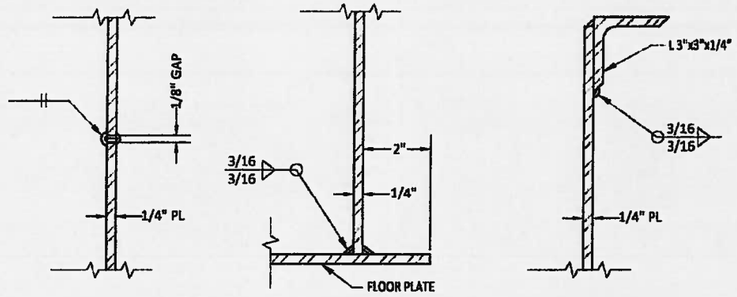
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

MECHANICAL MISCELLANEOUS DETAILS-2

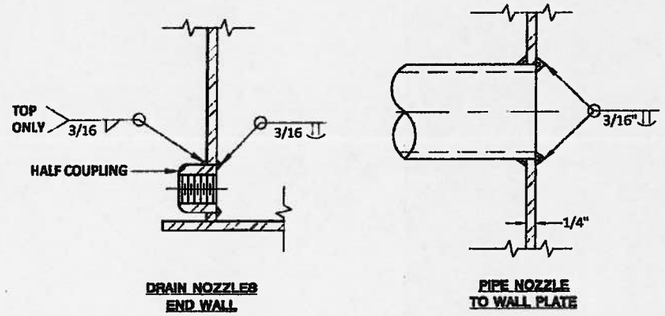
CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	36



WALL JOINT BUTT WELD

SHELL PLATE TO BOTTOM

TRIM ANGLE TO WALL PLATE

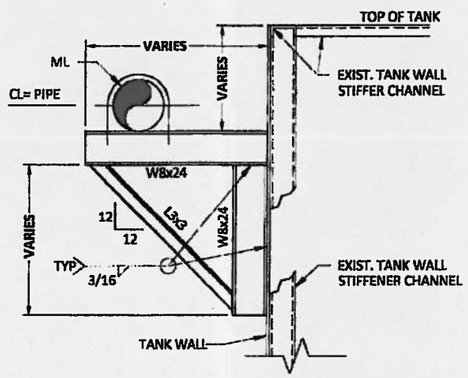


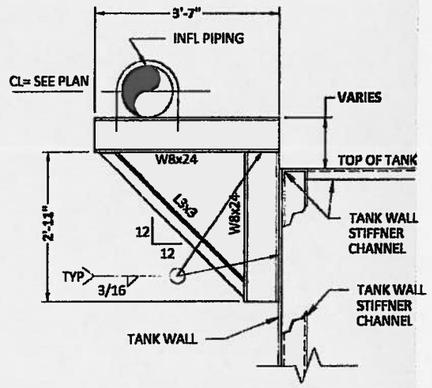
DRAIN NOZZLES END WALL

PIPE NOZZLE TO WALL PLATE

TYPICAL WELDING DETAILS 12/37

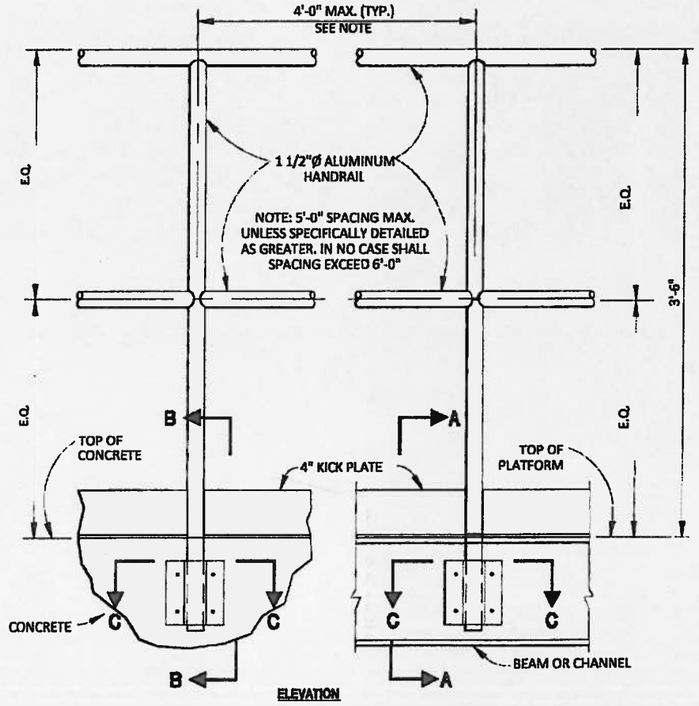
N.T.S.



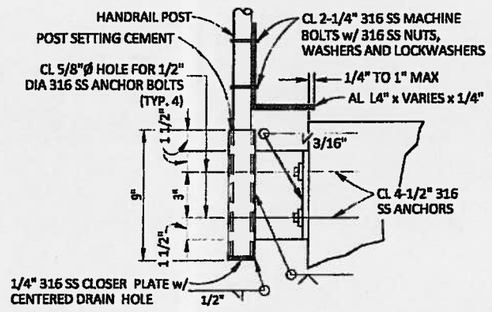


ELEVATED PIPE SUPPORT AT TANK WALL 14/37

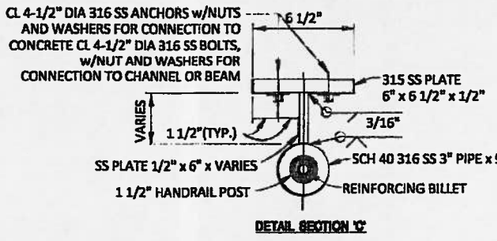
N.T.S.



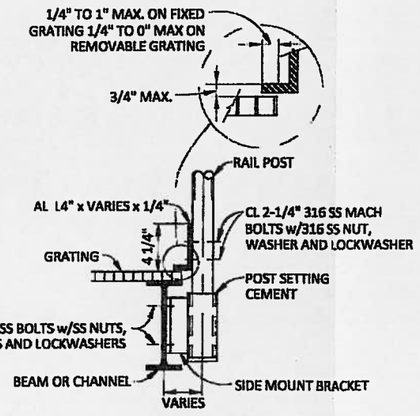
ELEVATION



DETAIL SECTION 'A'



DETAIL SECTION 'C'



DETAIL SECTION 'B'

MISCELLANEOUS METALS NOTE:

1. WHERE ALUMINUM OR ALLOY SURFACES, FITTINGS OR EXTRUSIONS ARE TO BE IN CONTACT WITH DISSIMILAR METALS, GROUT, CONCRETE, MASONRY OR WOOD, COAT ALUMINUM AND/OR ALLOYS SURFACES PER SPECIFICATIONS DIVISION 9. IF DIVISION 9 IS NOT INCLUDED IN THE SPECIFICATIONS OR DOES NOT ADDRESS CORROSION PROTECTION, AFTER PREPARATION OF SURFACES, COAT WITH A HEAVY COAT, MINIMUM THICKNESS OF 10 MILS, OF BITUMINOUS PAINT, OR INSTALL AN APPROVED NON_ABSORPTIVE ISOLATION PAD TO PREVENT CONTACT.

HANDRAIL SIDE MOUNT DETAIL 15/37

N.T.S.

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS — DAVID J. ROSS — 68267 — PROFESSIONAL ENGINEER — 12/21/16

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San Antonio, TX 78216
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PARK VILLAGE WASTEWATER TREATMENT PLANT COMAL COUNTY, TEXAS

MECHANICAL MISCELLANEOUS DETAILS-3

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	37

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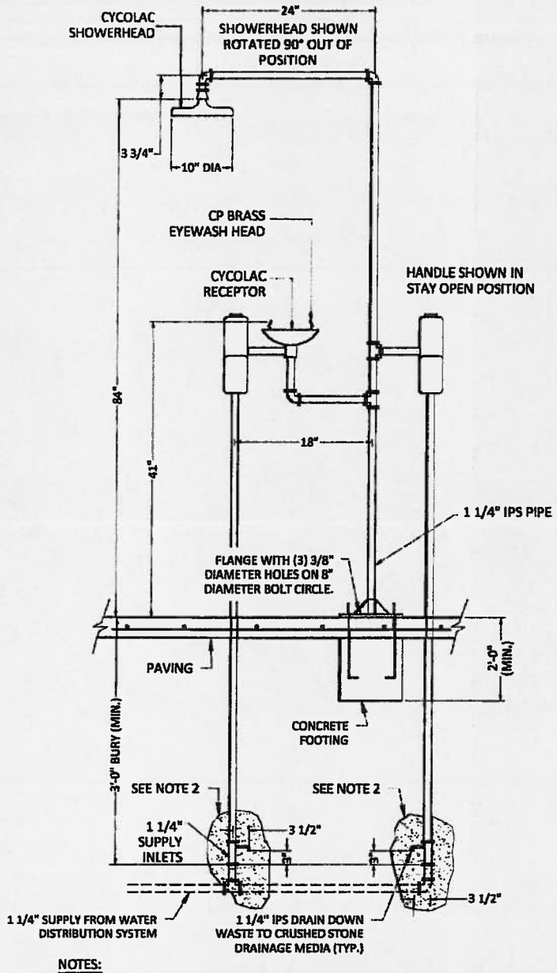


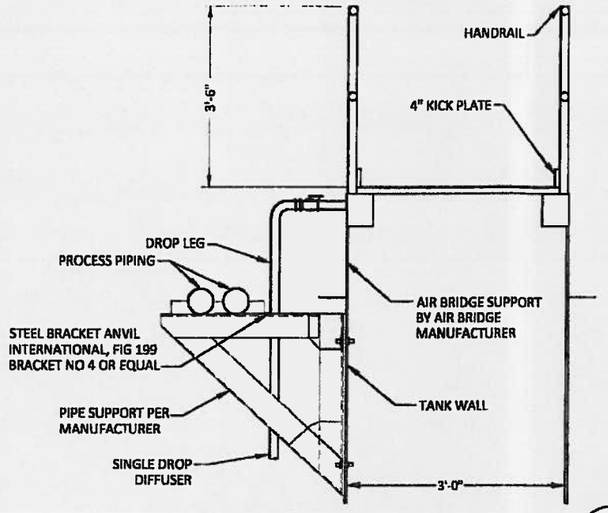
NOTES:

1. COMBINATION DRENCH SHOWER AND EYEWASH, UNIT TO BE "BRADLEY" MODEL S19-310NNSS OR APPROVED EQUAL.
2. NOT LESS THAN (3) CUBIC YARDS OF CRUSHED STONE AROUND AND BELOW DRAIN DOWN WASTE OUTLET FOR DRAINAGE

EMERGENCY SHOWER AND EYE WASH DETAIL

N.T.S.

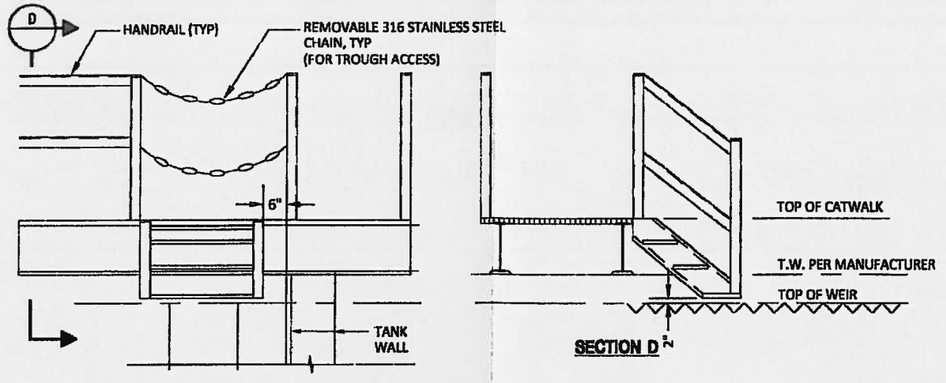
17 / 38



WALKWAY SECTION w/PIPE SUPPORT

N.T.S.

18 / 38

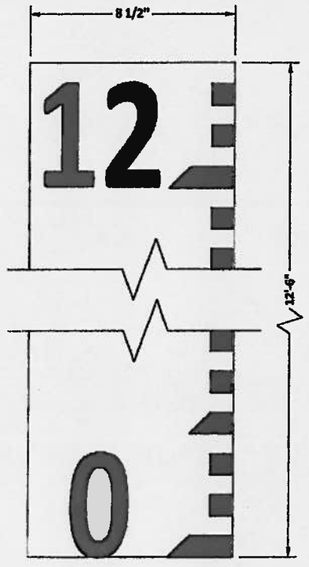


NOTE: NO CONNECTION BETWEEN THE STAIRS AND LAUNDER

CLARIFIER TROUGH ACCESS STAIRS

N.T.S.

19 / 38





RAS/WAS MARKER

DIGESTER MARKER

NOTES:

1. DIGESTER BASIN FRP STAFF GAUGE TO BE FULL HEIGHT OF WALL AND MOUNTED TO TANK STIFFENER CHANNELS ACROSS FROM DECANT PIPING. STAFF GAUGE TO HAVE (NOMINAL) 6 INCH HIGH NUMBERS AT FOOT INCREMENTS AND SECONDARY MARKS AT INCH INCREMENTS. PROVIDE ONE GAUGE AT EACH DIGESTER)
2. RAS AND WAS FRP STAFF GAUGE TO BE MOUNTED ON EACH MEASUREMENT DEVICE. GAUGE TO HAVE (NOMINAL) 3 INCH HIGH NUMBERS FOR FOOT INCREMENTS AND 1 INCH HIGH NUMBERS FOR INCH INCREMENTS.

STAFF GAUGE DETAILS

N.T.S.

20 / 38

NO	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS
DAVID J. ROSS
68267
PROFESSIONAL ENGINEER
12/21/15

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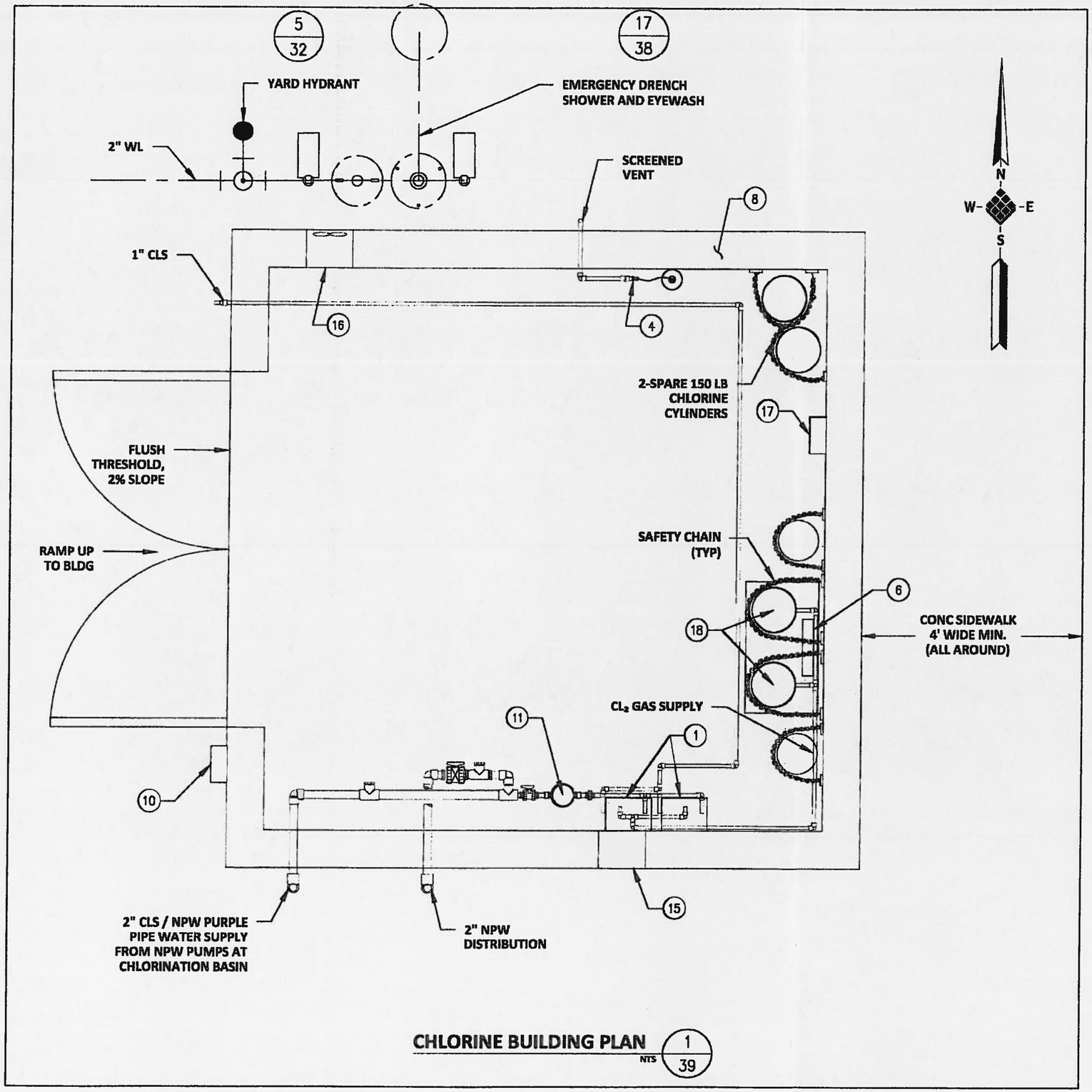
PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

MECHANICAL MISCELLANEOUS DETAILS-4

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	38

\\SAN-DC01\projects\150000111\410 DESIGN\060 Dwgs\C-DTLS_MEC.dwg [details 4] Plotted Mar 21, 2016 at 6:30pm by jamesh (Last Saved by: jamesh)



CHLORINE BUILDING PLAN 1/39
NTS

CHLORINE BUILDING EQUIPMENT SCHEDULE

ITEM NO	NO REQ'D	DESCRIPTION
1	1	CHLORINATOR
2	-	NOT USED
3	1	0-30 GPM ROTOMETER
4	1	REMOTE PRESSURE RELIEF VALVE
5	2	VACUUM EJECTOR
6	1	CYLINDER SCALE
7	1	REMOTE VACUUM SWITCH OVER
8	1	10'x10' ONE COMPARTMENT FIBERGLASS BLDG.
9	1	30 MINUTE SCBA PROVIDE FULLY CHARGED SCBA PRIOR TO START UP (SEE NOTE 2)
10	1	GAS MONITORING SYSTEM w/AUDIBLE & VISUAL ALARM BECON (LOCATE ABOVE ROOF) w/SENSOR LOCATED INSIDE BUILDING
11	1	2" PVC BASKET STRAINER
12	1	CHART RECORDER (SEE NOTE 2)
13	1	FLOWMETER (SEE NOTE 2)
14	-	NOT USED
15	1	LOUVER OPENING W/ RAIN SHEILD
16	1	SCREENED, LOUVERED OPENING WITH FAN SIZED TO PROVIDE 1 COMPLETE AIR EXCHANGE EVERY 3 MIN. AND WIRED TO TURN OFF WHEN CHLORINE LEAK IS DETECTED
17	1	PORTABLE HEATER TO MAINTAIN 65° F, YEAR ROUND (PLUG INTO DEDICATED RECEPTACLE)
18	2	CYLINDER MOUNTED VACUUM REGULATORS
19	-	NOT USED

NOTE:

1. USE SCHEDULE 80 PVC PIPE AND FITTINGS. PVC BALL VALVES SHALL BE SCHEDULE 80 TRUE UNION TYPE MANUFACTURED BY GF, HAYWARD, NIBCO OR SPEARS.
2. THE 30 MINUTE SCBA, THE CHART RECORDER AND THE FLOW METER ARE TO BE LOCATED IN THE OFFICE BUILDING.

NO.	DATE:	DESCRIPTION REVISIONS	DWG	CHK

STATE OF TEXAS
DAVID J. ROSS
68267
LICENSED PROFESSIONAL ENGINEER
3/21/16

IDS Engineering Group
TBPE F-002726 TBPLS 10110704
613 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

CHLORINE BUILDING PLAN

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	39

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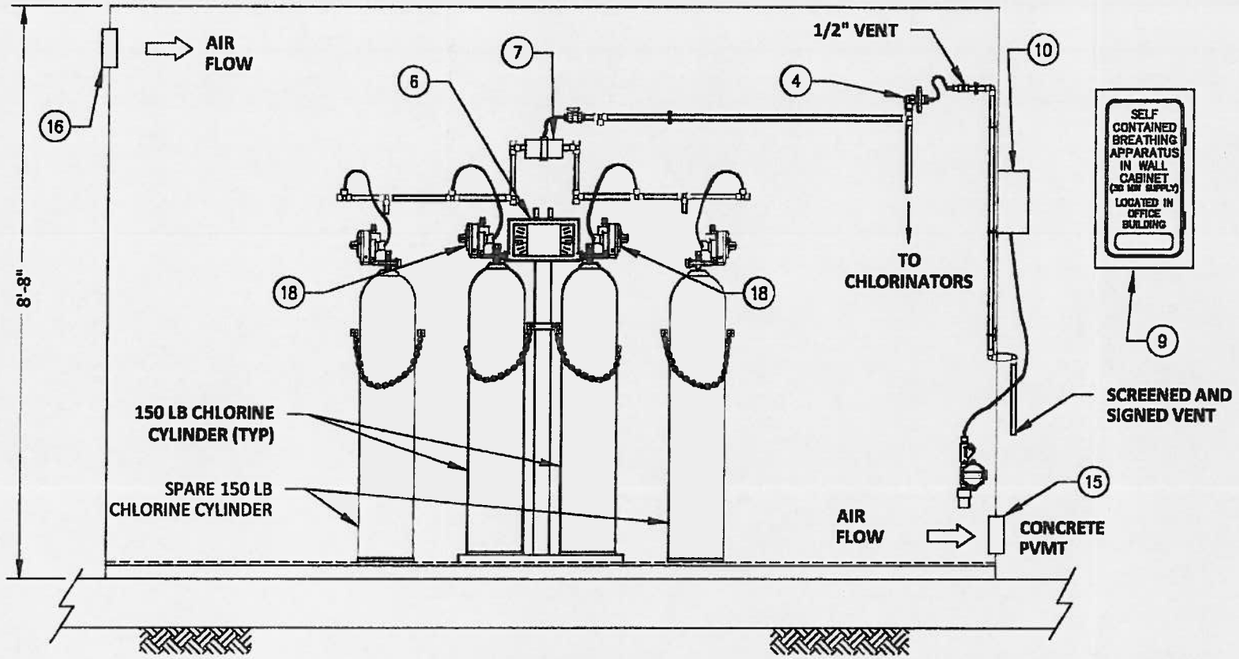
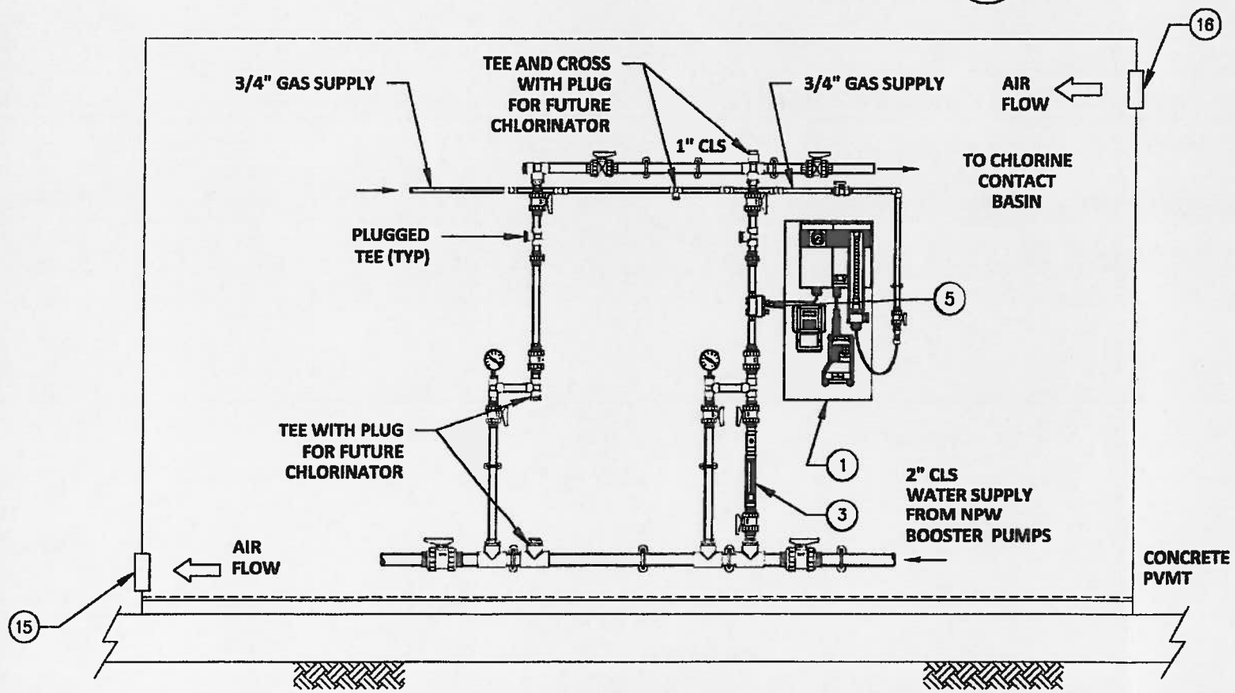


CHLORINE BUILDING CYLINDER ELEVATION

NTS

1/40



CHLORINE BUILDING FEEDER ELEVATION

NTS

2/40

NOTE:

1. USE SCHEDULE 80 PVC PIPE AND FITTINGS. PVC BALL VALVES SHALL BE SCHEDULE 80 TRUE UNION TYPE MANUFACTURED BY GF, HAYWARD, NIBCO OR SPEARS.
2. THE 30 MINUTE SCBA, THE CHART RECORDER AND THE FLOW METER ARE TO BE LOCATED IN THE OFFICE BUILDING.

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

CHLORINE BUILDING ELEVATIONS

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	40

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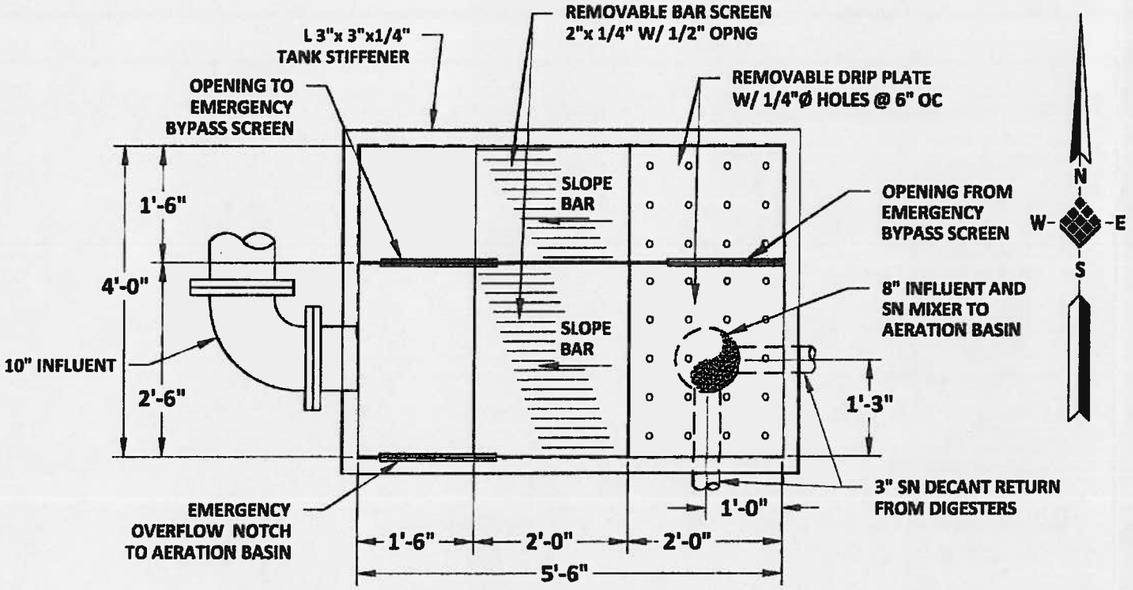
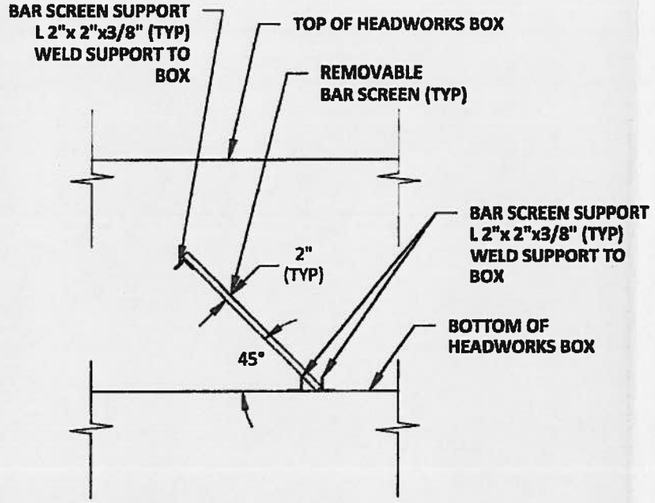


HEADWORKS PLAN

NTS

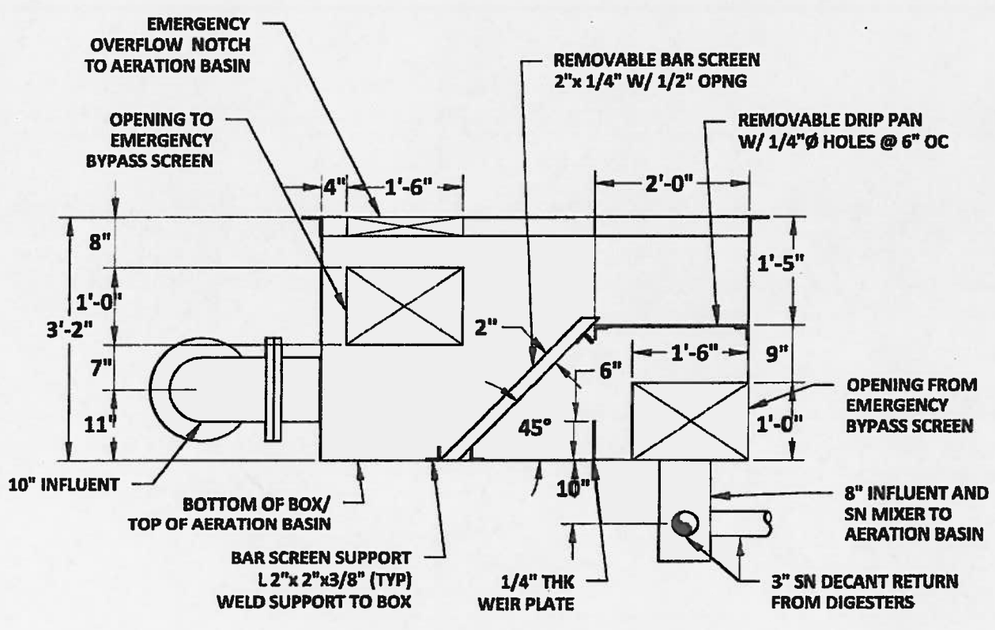
1/41



REMOVABLE BAR SCREEN SUPPORT

NTS

3/41



HEADWORKS SECTION

NTS

2/41

HEADWORKS NOTES:

1. HEADWORKS BAR SCREEN AND DRIP PLATE SHALL BE FABRICATED OF 1/4" THK STAINLESS STEEL OR ALUMINUM.
2. BAR SCREENS AND DRIP PAN SHALL BE REMOVABLE

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
DAVID J. ROSS
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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

HEADWORKS PLAN AND DETAILS

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	41

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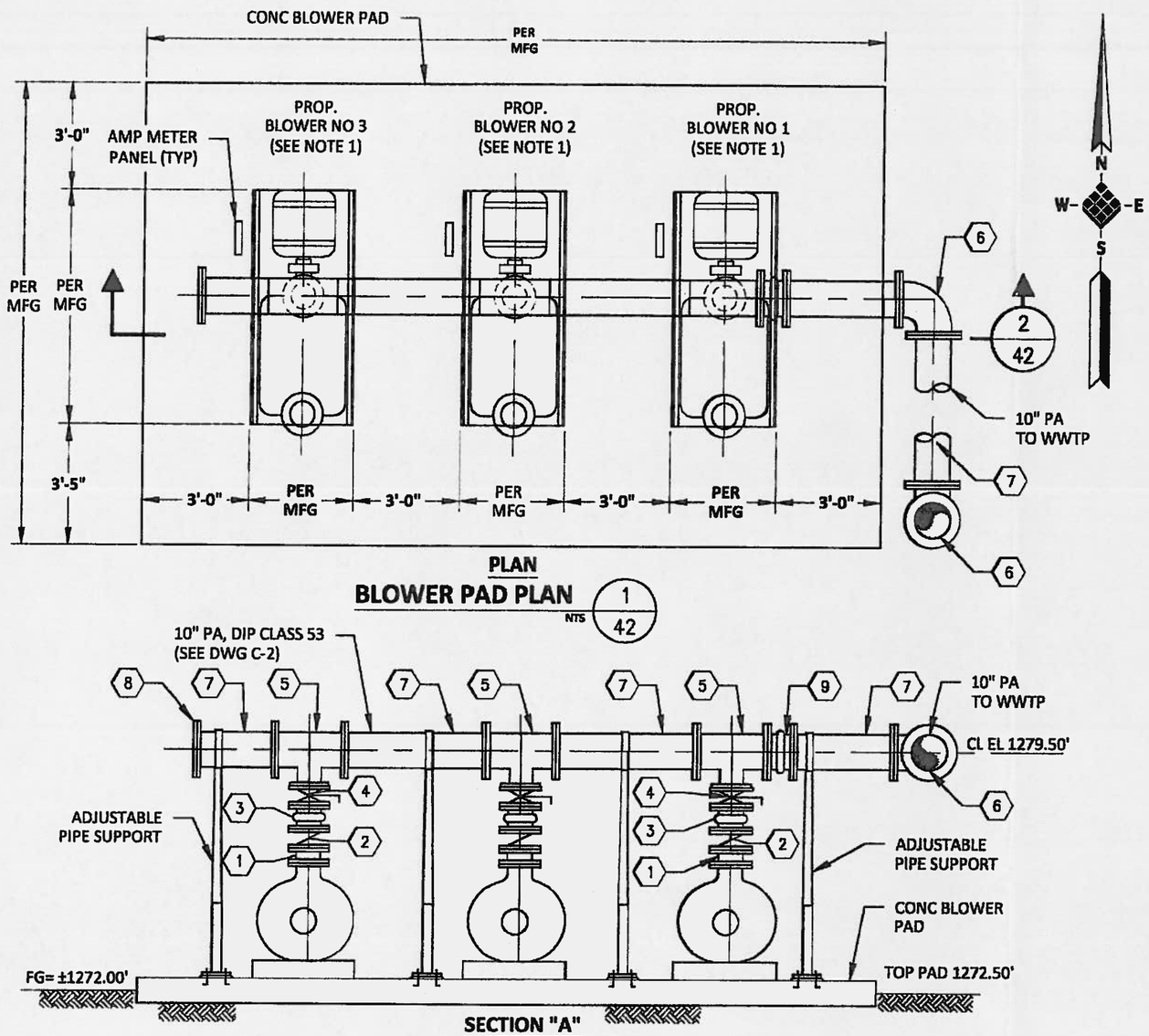


PLAN

BLOWER PAD PLAN

NTS 1/42

SECTION "A"

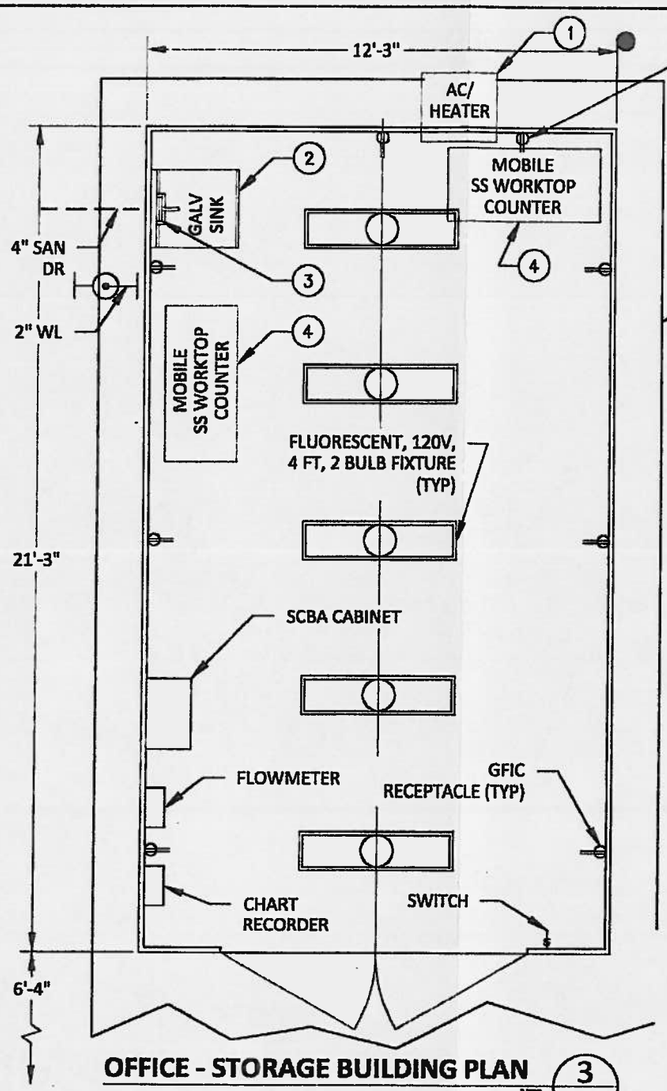
BLOWER PAD SECTION

NTS 2/42

PROPOSED BLOWER PIPING SCHEDULE			
No.	Qty.	Size	DESCRIPTION
1	3	8"	SPOOL PIECE - FLG/FLG
2	3	8"	CHECK VALVE - FLG/FLG
3	3	8"	FLEXIBLE JOINT - FLG/FLG
4	3	8"	LEVER ACTUATED BUTTERFLY VALVE - FLG/FLG
5	3	10"x8"	TEE - FLG/FLG
6	2	10"	90° BEND - FLG/FLG
7	5	10"	SPOOL PIECE - FLG/FLG
8	1	10"	BLIND FLANGE
9	1	10"	EPDM EXPANSION JOINT

BLOWER NOTES:

1. SUPPLY THREE (3) POSITIVE DISPLACEMENT BLOWERS.
2. PROVIDE AN AIR FLOW MONITOR ON BLOWER SYSTEM TO PROVIDE ALARM TO SCADA ON LOSS OF AIR FLOW.
3. PROVIDE INTAKE AIR FILTER MONITOR GAUGES FOR EACH BLOWER.
4. INCLUDE AN ADJUSTABLE PRESSURE RELIEF VALVE FOR EACH BLOWER.
5. INCLUDE BLOWER SKID VIBRATION ISOLATORS.
6. SECURE BLOWERS TO SLAB WITH 316 SS ANCHORS.
7. BLOWERS SHALL BE RATED FOR A MAXIMUM SOUND LEVEL OF 75 dba AT A DISTANCE OF 10 FEET.



OFFICE - STORAGE BUILDING PLAN

NTS 3/42

STORAGE BUILDING EQUIPMENT SCHEDULE		
No.	Qty.	DESCRIPTION
1	1	FRIGIDAIRE HOME COMFORT AIR CONDITIONER/HEATER MODEL FFRH1822Q2
2	1	REGENCY SINK MODEL 600S12424B
3	1	JUST MANUFACTURING CO. JS-47-TGSA WALL MOUNT FAUCET
4	2	APW WYOTT MOBILE SS WORK-TOP COUNTER MODEL PWT-3

BUILDING NOTES:

1. ANCHOR BUILDING TO CONCRETE SLAB PER MANUFACTURE'S RECOMMENDATIONS.
2. THE INTERIOR WALLS AND CEILING SHALL BE FINISHED WITH 1/4-INCH MARINE GRADE PLYWOOD AND COATED PER DIVISION 9 OF THE SPECIFICATIONS.
3. ADDITIONAL COLUMNS AND GIRDERS SHALL BE INSTALLED AS REQUIRED TO SUPPORT THE PLYWOOD AND AIR CONDITIONER/HEATER.
4. THE WALLS AND CEILINGS SHALL BE INSULATED TO ACHIEVE AN INSULATION RATING OF R-12.
5. THE WEST AND EAST (LONG) WALL SHALL EACH HAVE THREE GFI RECEPTACLES AND THE NORTH (BACK) WALL SHALL HAVE TWO (2) GFI RECEPTACLES.
6. LIGHTING SHALL BE INSTALLED TO PROVIDE A LIGHTING LEVEL OF 80-FOOT CANDLES (800 LX) MEASURED MID-HEIGHT OF THE WALL SURFACE.

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

STATE OF TEXAS
DAVID J. ROSS
68287
LICENSED PROFESSIONAL ENGINEER
3/11/16

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PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

BLOWER PAD AND STORAGE BUILDING PLAN

CHK. BY:	D.J.R.	IDS JOB NO:	150000111	
DWG. BY:	J.H.	STATE	COUNTY	SHEET NO.
DATE:	12/15/2015	TEXAS	COMAL	42

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APR 04 2016
COUNTY ENGINEER

MAINTENANCE PLAN AND SCHEDULE FOR PERMANENT BMP'S

PROJECT NAME: Park Village Wastewater Treatment Plant
Location: South of intersection of SH 46 and Blanco
County, State: Comal County, TX

Grassy Swales

- Seasonal Mowing and Lawn Care. Swales should be mowed as needed to limit vegetation height to 3 to 4 inches. If native grasses are used, the swales may require more frequent mowing. Grass clippings and brush debris should not be deposited on grassy swale areas. Regular mowing should also include weed control practices, however herbicide use should be kept to a minimum (Urbonas et al., 1992). Healthy grass can be maintained without using fertilizers because runoff usually contains sufficient nutrients. Irrigation of the site can help assure a healthy vegetative cover.
- Inspection. Inspect grassy swales weekly and on a daily basis during periods of prolonged rainfall until the vegetative cover is stabilized. Thereafter, swales should be inspected at least every two weeks. The swales should be checked for uniformity of grass cover, debris and litter, and areas of sediment accumulation. Inspect pea gravel diaphragm for clogging and correct the problem. Any erosion problems in the sand/soil bed of dry swales should be inspected. More frequent inspections of the grass cover during the first few years after establishment will help 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 must be replanted and necessary to reestablish shallow overland flow.
- Debris and Litter Removal. Remove trash and debris accumulated in the inflow forebay. Trash tends to accumulate in vegetated areas, particularly along highways. Swales should be kept free of obstructions to reduce floatables being flushed downstream, and for aesthetic reasons. The need for this practice is determined through periodic inspection, but should be performed no less than twice per year.
- Sediment Removal. Sediment build-up within the bottom of the swale should be removed once it has accumulated to 25 percent of the original design volume. Excess sediment should be removed by hand or with flat-bottomed shovels.
- Grass Reseeding and Mulching. A healthy grass should be maintained on the grassy swales. 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 swale establishment. If possible, flow should be diverted from the damaged areas until the grass is firmly established. Grass along side slopes should be checked for erosion and formation of rills or gullies and corrected if needed. Based on inspection, plant an alternative grass species if the original grass cover has not been successfully established. Replant wetland species (for wet swale) if not sufficiently established. Bare spots and areas of erosion identified during semi-annual inspections must be replanted and restored to meet specifications. Vegetation may require irrigation immediately after planting, and during particularly dry periods, particularly as the vegetation is initially established.
- Record Keeping. All inspections and maintenance activities must be documented in a written form.

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

Responsible Party: Two Seventy Seven, Ltd
Mailing Address: 8023 Vantage Dr., Suite 1200
City, State: San Antonio, Texas Zip: 78230
Telephone: (210) 524-4000 Fax: (210) 524-4029

Kenneth P. Wolf
Signature of Responsible Party

1/6/16
Date

Kenneth P. Wolf
Printed Name

MAINTENANCE PLAN AND SCHEDULE FOR PERMANENT BMP'S

PROJECT NAME: Park Village Wastewater Treatment Plant
Location: South of intersection of SH 46 and Blanco
County, State: Comal County, TX

Vegetative Filter Strips

- Seasonal Mowing and Lawn Care. If the filter strip is made up of turf grass, it should be mowed as needed to limit vegetation height to 18 inches, using a mulching mower (or removal of clippings). If native grasses are used, the filter may require less frequent mowing, but a minimum of twice annually. Grass clippings 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 (Urbonas et al., 1992). Healthy grass can be maintained without using fertilizers because runoff usually contains sufficient nutrients. Irrigation of the site can help assure a dense and healthy vegetative cover.
- Inspection. Inspect filter strips at least twice annually for erosion or damage to vegetation; however, additional inspection after periods of heavy runoff is most desirable. The strip should be checked for uniformity of grass cover, debris and litter, and areas of sediment accumulation. More frequent inspections of the grass cover during the first few years after establishment will help 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 must be replanted and necessary to reestablish shallow overland flow.
- Debris and Litter Removal. Trash tends to accumulate in vegetated areas, particularly along highways. Any filter strip structures (i.e. level spreaders) should be kept free of obstructions to reduce floatables being flushed downstream, and for aesthetic reasons. The need for this practice is determined through periodic inspection, but should be performed no less than 4 times per year.
- Sediment Removal. Sediment removal is not normally required in filter strips, since the vegetation normally grows through it and binds it to the soil. However, sediment may accumulate along the upstream boundary of the strip preventing uniform overland flow. Excess sediment should be removed by hand or with flat-bottomed shovels.
- Grass Reseeding 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. If possible, flow should be diverted 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 particularly dry periods, particularly as the vegetation is initially established.
- Record Keeping. All inspections and maintenance activities must be documented in a written form.

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

Responsible Party: Two Seventy Seven, Ltd
Mailing Address: 8023 Vantage Dr., Suite 1200
City, State: San Antonio, Texas Zip: 78230
Telephone: (210) 524-4000 Fax: (210) 524-4029

Kenneth P. Wolf
Signature of Responsible Party

1/6/16
Date

Kenneth P. Wolf
Printed Name

XVIII. Temporary Stormwater Section

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.

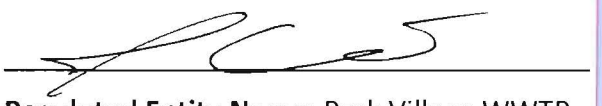
Signature

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: Jose A. Cantu

Date: 1/4/2016

Signature of Customer/Agent:



Regulated Entity Name: Park Village WWTP

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: Unnamed Tributary to Cibolo 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.

XIX. ATTACHMENT A – SPILL RESPONSE REACTIONS

1.4.16 Spill Prevention and Control

The objective of this section is to describe measures 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, 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 runoff 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. See the waste management BMPs in this section for specific information.

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:
5) Contain the spread of the spill.
6) Recover spilled materials.
7) 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 runoff 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 runoff 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.

XX. ATTACHMENT B – POTENTIAL SOURCES OF CONTAMINATION

Other potential sources of contamination include:

1) Oil and grease from the construction equipment.
2) Human wastes
   a) Must be disposed of properly (i.e. Port-O-Let with proper maintenance)
3) Food wastes
   a) Must be disposed of in an appropriate trash receptacle and emptied on a regular basis.
4) Concrete washout pits
   a) Concrete trucks will not be allowed to washout on site.

XXI. ATTACHMENT C – SEQUENCE OF MAJOR ACTIVITIES

The order of construction is:

1. Setup of temporary storm water controls
2. Clearing (2.0 acres)
3. Rough grading of the site, roadway, and channel excavation.
4. Install culvert crossings.
5. Finish construction of WWTP facility and access road.
6. Finish construction of permanent stormwater controls
7. Stabilizing disturbed areas (1.0 acres)
8. Removal of temporary stormwater controls

The area to be disturbed equals approximately 2.0 acres.

XXII. ATTACHMENT D – TEMPORARY BEST MANAGEMENT PRACTICES AND MEASURES

1) All upgradient storm water enters the property through the existing culverts under Stone Oak Pkwy. The storm water stays within the natural channels before exiting the site at the south eastern corner.
2) Silt fencing and rock berms will be placed at down gradient portions of the site to prevent contaminated storm water originating on-site to leave the site. See attached site plan for locations of the TBMP's.
3) There are no sensitive features or surface streams located on the site.

XXIII. ATTACHMENT E – REQUEST TO TEMPORARILY SEALING A FEATURE

Not Applicable.

XXIV. ATTACHMENT F – STRUCTURAL PRACTICES

Silt fencing and rock berms will be placed at locations shown on the CZP Site Plan.

XXV. ATTACHMENT G – DRAINAGE AREA MAP

See the Storm Drainage plan located at the end of this application for the drainage area map and proposed storm drainage facilities.

XXVI. ATTACHMENT H – TEMPORARY SEDIMENT POND(S) PLANS AND CALCULATIONS

Not Applicable

XXVII. ATTACHMENT I – INSPECTION AND MAINTENANCE FOR BMP'S

Silt Fencing Inspection and Maintenance*

1. Inspect all fencing weekly, and after any rainfall
2. Remove sediment when buildup reaches 6 inches, or install a second line of fencing parallel to the old fence.
3. Replace any torn fabric or install a second line of fencing parallel to the torn section.
4. Replace or repair any sections crushed or collapsed in the course of construction activity. If a section of fence is obstructing vehicular access, consider relocating it to a spot where it will provide equal protection, but not obstruct vehicles. A triangular filter dike may be preferable to a silt fence at common vehicle access points.

*Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices, June 2005

Rock Berm Inspection and Maintenance*

1. Inspection should be made weekly and after each rainfall by the responsible party. For installations in streambeds, additional daily inspections should be made.
2. Remove sediment and other debris when buildup reaches 6 inches and dispose of the accumulated silt in an approved manner.
3. Repair any loose wire sheathing.
4. The berm should be reshaped as needed during inspection.
5. The berm should be replaced when the structure ceases to function as intended due to silt accumulation among the rocks, washout, construction traffic damage, etc.
6. The rock berm should be left in place until all upstream areas are stabilized and accumulated silt removed.

*Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices, June 2005

Contractor is to keep written documentation on attached forms. Forms should be available on-site at all times when workers are present.

RECORD OF CONSTRUCTION ACTIVITIES

DATES OF:

Major Grading	Construction Temporarily Ceased	Construction Permanently Ceased	Stabilization Measures Initiated

Inspection Reports

Inspector/Date	Qualifications	Measures/Areas Inspected	Conditions	Changes to WPAP

XXVIII. ATTACHMENT J – SCHEDULE FOR INTERIM AND PERMANENT SOIL STABILIZATION

Whenever construction has stopped—temporarily or permanently—for 14 days in any part of your site, the contractor must begin stabilizing any exposed soil in that area. There are two exceptions to this requirement:

- If drought prevents you from meeting this requirement, the contractor does not have to try to stabilize the soil. However, the contractor must begin to stabilize the soil as soon as the weather allows.
- If excavation, grading, or any other earth-disturbing activity will resume in this area within another 7 days—a total of 21 days after construction stopped—the contractor does not have to stabilize the soil in the meantime.
- Contractor to utilize temporary vegetation to achieve temporary stabilization. Other methods are available in the TCEQ Technical Guidance Manual.

REMAINDER OF
277.39 ACRES
DOC. NO. 200506038360
(O.P.R.C.C.T.)

12' FORCE MAIN
EASEMENT

BLANCO ROAD
(40' R.O.W.)

50' VEGETATED FILTER
STRIP EASEMENT

EXISTING 20'
OVERHEAD ELECTRIC
EASEMENT

EXISTING 20'
WATER EASEMENT

EXISTING 15' SANITARY
SEWER EASEMENT

DA-1
2.99 AC.

ANNABELLE ANSLEY SHARP
REMAINING PORTION OF 1156 ACRES
(VOL. 659, PG. 275)

100' 0' 100'
SCALE
1"=100'

RUNOFF CALCULATIONS

Rational Method Q = CIA

Existing Conditions

[DA-1] Q = (0.49)(4.4)(2.99) = **6.44 CFS**

Proposed Conditions

[DA-1] Q = (0.57)(4.4)(2.99) = **7.50 CFS**

INTERCEPTOR SWALE CALCULATIONS

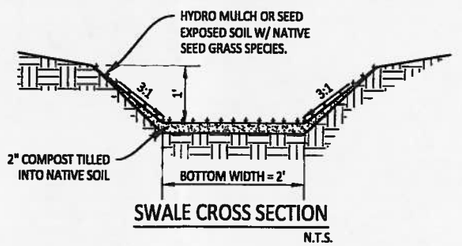
Channel Velocity

V = Q /A

V = 7.50 cfs / 3.45 sf = **2.17 ft/s**

IMPERVIOUS COVER

1.00 AC



SWALE CROSS SECTION
N.T.S.

LEGEND

- EXISTING CONTOUR MAJOR (1300)
- EXISTING CONTOUR MINOR (1293)
- BUFFER ZONE LINE
- PROPOSED SWALE
- 100YR INUNDATION
- ACCESS ROAD
- VEGETATED FILTER STRIP
- FLOW ARROW
- DRAINAGE DIVIDE
- BASIN ID (DA-1 / 0.78)
- AREA

NO	DATE:	DESCRIPTION	DWG	CHK
		REVISIONS		

THIS DRAWING IS FOR REVIEW PURPOSES ONLY AND SHALL NOT BE USED FOR BIDDING, PERMITTING OR CONSTRUCTION
JOSE CANTU, P.E.
TEXAS REG. NO. 111313
DATE 11-30-15

IDS Engineering Group
TBPE F-002728 TBPLS 10110704
613 NW Loop 410, Suite 550
San Antonio, TX 78216
210.340.8481

PARK VILLAGE
WASTEWATER TREATMENT PLANT
COMAL COUNTY, TEXAS

DRAINAGE AREA MAP

CHK. BY:	J.A.C.	IDS JOB NO:	150000111	
DWG. BY:	M.G.M.	STATE	COUNTY	SHEET NO.
DATE:	11/30/2015	TEXAS	COMAL	5

Z:\150000111\410 DESIGN\060 Dwgs\C-DAM.dwg [DAM] Plotted Dec 02, 2015 at 9:54am by mmina (Last Saved by: mmina)

Application Fee Form

Texas Commission on Environmental Quality
Name of Proposed Regulated Entity: Park Village WWTP
Regulated Entity Location: Comal County, Texas
Name of Customer: Two Seventy Seven, Ltd
Contact Person: Kenneth P. Wolf Phone: 210-524-1307
Customer Reference Number (if issued):CN 603589474
Regulated Entity Reference Number (if issued):RN 105842298

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	4.6 Acres	$ 4,000
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: Kenneth P. Wolf Date: 1/15/16

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

Application Fee Schedule

Texas Commission on Environmental Quality
Edwards Aquifer Protection Program 30 TAC Chapter 213 (effective 05/01/2008)

Water Pollution Abatement Plans and Modifications

Contributing Zone Plans and Modifications

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

Organized Sewage Collection Systems and Modifications

Project	*Cost per Linear Foot*	*Minimum Fee-Maximum Fee*
Sewage Collection Systems	$0.50	$650 - $6,500

Underground and Aboveground Storage Tank System Facility Plans and Modifications

Project	*Cost per Tank or Piping System*	*Minimum Fee-Maximum Fee*
Underground and Aboveground Storage Tank Facility	$650	$650 - $6,500

Exception Requests

Project	*Fee*
Exception Request	$500

Extension of Time Requests

Project	*Fee*
Extension of Time Request	$150

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

I **Kenneth P. Wolf**,
Print Name

Manager,
Title - Owner/President/Other

of **Two Seventy Seven, Ltd.**,
Corporation/Partnership/Entity Name

have authorized **Jose A. Cantu , P.E.**
Print Name of Agent/Engineer

of **IDS Engineering Group**
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:

Kenneth P. Wolf
Applicant's Signature

1/15/16
Date

THE STATE OF Texas §

County of Bexar §

BEFORE ME, the undersigned authority, on this day personally appeared Kenneth P Wolf 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 there in expressed.

GIVEN under my hand and seal of office on this 15th day of January, 2016.

Elaina Brown
NOTARY PUBLIC

Elaina Brown
Typed or Printed Name of Notary

ELAINA BROWN
Notary Public, State of Texas
My Commission Expires
October 15, 2016

MY COMMISSION EXPIRES: 10-15-16

TCEQ Core Data Form

TCEQ Use Only

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

SECTION I: General Information

1. Reason for Submission (If other is checked please describe in space provided.)

☒ New Permit, Registration or Authorization (Core Data Form should be submitted with the program application.)

☐ Renewal (Core Data Form should be submitted with the renewal form) ☐ Other

2. Customer Reference Number (if issued)	Follow this link to search for CN or RN numbers in Central Registry**	3. Regulated Entity Reference Number (if issued)
CN 603589474		RN 105842298

SECTION II: Customer Information

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

☐ New Customer ☐ Update to Customer Information ☐ Change in 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: e.g.: Doe, John) | If new Customer, enter previous Customer below:

Two Seventy Seven, Ltd.

7. TX SOS/CPA Filing Number	8. TX State Tax ID (11 digits)	9. Federal Tax ID (9 digits)	10. DUNS Number (if applicable)
0800549390	32035326902		

11. Type of Customer: ☐ Corporation ☐ Individual Partnership: ☐ General ☒ Limited

Government: ☐ City ☐ County ☐ Federal ☐ 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 ☐ Voluntary Cleanup Applicant ☐ Other:

15. Mailing Address: 8023 Vantage Drive, Suite 1200

City	San Antonio	State	TX	ZIP	78230	ZIP + 4	4726

16. Country Mailing Information (if outside USA) | 17. E-Mail Address (if applicable)

18. Telephone Number	19. Extension or Code	20. Fax Number (if applicable)
(210) 524 - 1307		(210) 524 - 4029

SECTION III: Regulated Entity Information

21. General Regulated Entity Information (If "New Regulated Entity" is selected below this form should be accompanied by a permit application)

☐ New Regulated Entity ☐ Update to Regulated Entity Name ☒ Update to Regulated Entity Information

The Regulated Entity Name submitted may be updated in order to meet TCEQ Agency Data Standards (removal of organizational endings such as Inc, LP, or LLC).

22. Regulated Entity Name (Enter name of the site where the regulated action is taking place.)

PARK VILLAGE WWTP

23. Street Address of the Regulated Entity: (No PO Boxes)								
	City		State	TX	ZIP		ZIP + 4	
24. County	Comal							

Enter Physical Location Description if no street address is provided.

25. Description to Physical Location:	Approximately 5900 ft. due south of the intersection ov SH-46 and Blanco Road, then 350 ft. east from Blanco Road.				
26. Nearest City			State	Nearest ZIP Code	
City of Bulverde			TX		
27. Latitude (N) In Decimal:	29.795608		28. Longitude (W) In Decimal:	-98.523788	
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
29	47	44.19	-98	31	25.64

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)
1623		221320	

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

Waste Water Treatment Plant to serve Park Village Subdivision

34. Mailing Address:	8023 Vantage Drive, Suite 1200							
	City	San Antonio	State	TX	ZIP	78230	ZIP + 4	4726
35. E-Mail Address:	kwolf@reocsanantonio.com							

36. Telephone Number	37. Extension or Code	38. Fax Number (if applicable)
(210) 524 - 1307		(210) 524 - 4029

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
		13-10072001		
☐ Municipal Solid Waste	☐ New Source Review Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS
☐ Sludge	☐ Storm Water	☐ Title V Air	☐ Tires	☐ Used Oil
☐ Voluntary Cleanup	☐ Waste Water	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:

SECTION IV: Preparer Information

40. Name:	Jose A. Cantu, P. E.		41. Title: Project Engineer
42. Telephone Number	43. Ext./Code	44. Fax Number	45. E-Mail Address
(210) 340 - 8481		(210) 340 - 3964	jcantu@idsengineeringgroup.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:	IDS Engineering Group	Job Title:	Project Engineer
Name(*In Print*):	Jose A. Cantu	Phone:	(210)340-8481
Signature:		Date:	11/18/2015

RECEIVED
APR 04 2016
COUNTY ENGINEER

Lift Station/Force Main System Application

Texas Commission on Environmental Quality

for Regulated Activities On the Edwards Aquifer Recharge Zone and Relating to 30 TAC §213.5(c)(3)(B)and(c), 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.

Regulated Entity Name: Park Village WWTP

Customer Information

(If different than customer information provided on core data form)

1. The person(s) responsible for providing the engineering certification to the TCEQ pursuant to 30 TAC §213.5(f)(2)(C) during construction and 30 TAC §213.5 (c)(3)(D) upon completion of construction is:

   Contact Person: Joe Cantu, P.E.
   Entity: IDS Engineering Group
   Mailing Address: 613 NW Loop 410, Suite 550
   City, State: San Antonio, TX Zip: 78216
   Telephone: (210)536-4022 Fax: 210-340-3964
   Email Address: jcantu@idseg.com

2. The engineer responsible for the design of this lift station and force main:

   Contact Person: David J. Ross, P.E., Jose A. Cantu, P.E.
   Entity: IDS Engineering Group
   Mailing Address: 613 NW Loop 410, Suite 550
   City, State: San Antonio, TX Zip: 78216
   Telephone: (210)536-4022 Fax: 210-340-3964
   Email Address: dross@idseg.com; jcantu@idseg.com
   Texas Licensed Professional Engineer's Serial Number: 68267;111313

Project Information

3. This project is for the construction or replacement of:

   ☐ Lift Station only.

[X] Lift Station and Force Main system.
[ ] Lift Station, Force Main, and Gravity system.

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

   [ ] Existing
   [X] Proposed

5. All components of this lift station/force main system will comply with:

   [X] G.B.R.A. standard specifications.
   [X] Other. Specifications are attached.

Site Plan Requirements

Items 6-14 must be included on the Site Plan.

6. [X] The Site Plan must have a minimum scale of 1" = 400'.

   Site Plan Scale: 1" = 50'. (See sheet #7, Construction Plans)

7. [X] Lift station/force main system layout meets all requirements of 30 TAC Chapter 217.

8. Geologic or Manmade Features:

   [X] No geologic or manmade features were identified in the Geologic Assessment.
   [ ] All geologic or manmade features identified in the Geologic Assessment (caves, solution openings, sinkholes, fractures, joints, porous zones, etc.) which exist at the site of the proposed lift station and along the path(s) or within **50 feet of each side** of a proposed force main line are shown on the Site Plan and are listed in the table below. Designs used to protect the integrity of the sewer line crossing each feature are described and labeled on the attached page. A detailed design drawing for each feature is shown on Plan Sheet _____ of _____.
   [ ] No Geologic Assessment is required for this project.

Table 1 - Geologic or Manmade Features

Line	*Station to Station*	*Type of Feature*
	to	
	to	
	to	
	to	
	to	
	to	
	to	
	to	

9. [X] Existing topographic contours are shown and labeled. The contour interval is 2 feet. (Contour interval must not be greater than 5 feet).

10. [X] Finished topographic contours are shown and labeled. The contour interval is 1 feet. (Contour interval must not be greater than 5 feet).

    [ ] Finished topographic contours will not differ from the existing topographic configuration and are not shown.

11. 100-year floodplain boundaries

    [ ] Some part(s) of the project site is located within the 100-year floodplain. The floodplain is shown and labeled.

    [X] 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): Computed 100-year innundation as part of the Park Village Master Development Plan

12. 5-year floodplain:

    [X] After construction is complete, no part of this project will be in or cross a 5-year floodplain, either naturally occurring or manmade. (Do not include streets or concrete-lined channels constructed above sewer lines.)

    [ ] After construction is complete, all sections of the force main located within the 5-year floodplain will be encased in concrete or capped with concrete. These locations are listed in the table below and are shown and labeled on the Site Plan. (Do not include streets or concrete-lined channels constructed above sewer lines.)

Table 2 - 5-Year Floodplain

Line	*Sheet*	*Station to Station*
	of	to
	of	to
	of	to
	of	to

13. All known wells (oil, water, unplugged, capped and/or abandoned, test holes, etc.):

    If applicable, this must agree with Item No. 15 on the Geologic Assessment Form.

    [ ] There are _____ (#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply)

    [ ] The wells are not in use and have been properly plugged.
    [ ] The wells are not in use and will be properly plugged.
    [ ] The wells are in use and comply with 16 TAC Chapter 76.

    [ ] There are no wells or test holes of any kind known to exist on the project site.

14. [X] Legal boundaries of the site are shown.

Plan and Profile Sheets

*The construction drawings and technical specifications will not be considered for review unless they are the **final plans and technical specifications** which will be used by the contractor for bidding and construction.*

Items 15 – 18 must be included on the Plan and Profile sheets.

15. [X] The equipment installation construction plans must have a minimum scale of 1" = 10'.

    Plan sheet scale: 1" = 10 '.

16. [X] Locations, descriptions and elevations of all required equipment and piping for the lift station and force main are shown and labeled.

17. [ ] Air Release/Vacuum Valves will be provided at all peaks in elevation of the proposed force main. These locations are listed in the table below and labeled on the appropriate plan and profile sheets.

Table 3 - Air Release/Vacuum Valves

Line	*Station*	*Sheet*
		of
		of
		of
		of
		of
		of

18. [X] The **final plans and technical specifications** are submitted for the TCEQ's review. Each sheet of the construction plans and specifications are dated, signed, and sealed by the Texas Licensed Professional Engineer responsible for the design on each sheet.

19. [X] **Attachment A - Engineering Design Report**. An engineering design report with the following required items is attached:

    - [X] The report is dated, signed, and sealed by a Texas Licensed Professional Engineer.
    - [X] Calculations for sizing system.
    - [X] Pump head calculations, including, but not limited to, system head and pump capacity curves, head loss calculations, and minimum and maximum static head C values for normal and peak operational conditions.
    - [X] 100-year and 25-year flood considerations.
    - [X] Total lift station pumping capacity with the largest pump out of service.
    - [X] Type of pumps, including standby units.
    - [X] Type of pump controllers, including standby air supply for bubbler controllers, as applicable.

[X] Pump cycle time.
[ ] Type of wet well ventilation; include number of air changes for mechanical ventilation.
[X] Minimum and maximum flow velocities for the force main.
[X] Lift station security.
[X] Lift station emergency provisions and reliability.

Administrative Information

20. [X] Upon completion of the wet well excavation, a geologist must certify that the excavation was inspected for the presence of sensitive features and submit the signed, sealed, and dated certification to the appropriate regional office.

21. [X] The TCEQ Lift Stations and Force Mains General Construction Notes (TCEQ-0591) are included on the General Notes Sheet of the Final Construction Plans for this lift station and/or force main system.

22. [X] 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. The copies must be submitted to the appropriate regional office.

23. [X] Any modification of this lift station/force main system application will require TCEQ approval, prior to construction, and may require submission of a revised application, with appropriate fees.

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 **Lift Station/Force Main System Application** is hereby submitted for TCEQ review and executive director approval. The system was designed in accordance with the requirements of 30 TAC §213.5(c)(3)(C) and 30 TAC Chapter 217, and prepared by:

Print Name of Licensed Professional Engineer: David J. Ross, P.E. Jose A. Cantu, P.E.

Place engineer's seal here:

STATE OF TEXAS
DAVID J. ROSS
68267
LICENSED
PROFESSIONAL ENGINEER

Date: 3/28/2016

Signature of Licensed Professional Engineer: David J. Ross

STATE OF TEXAS
JOSE CANTU
111313
LICENSED
PROFESSIONAL ENGINEER

Date: 3/28/16

Signature of Licensed Professional Engineer:

RECEIVED
APR 04 2016
COUNTY ENGINEER

ENGINEERING REPORT

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COUNTY ENGINEER

PRELIMINARY ENGINEERING DESIGN REPORT

COMAL COUNTY WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER 6

PARK VILLAGE 0.098 MGD WASTEWATER TREATMENT PLANT

February 2016
IDS Job No. 1500-001-11



2/29/2016
David Ross

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Exhibit No. 2	Service Area and District Boundary Map
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Exhibit No. 4	Wind Rose
Exhibit No. 5	FEMA, Firm Map
Exhibit No. 6	Proposed Facilities
Exhibit No. 7	Water Wells within 1,000 Feet of Comal County WC&ID No. 6 Map
Exhibit No. 8	Park Village Subdivision Land Plan

APPENDICES

APPENDIX A	TCEQ Discharge Permit No. WQ0014959-001
APPENDIX B	Treatment Plant Design Computations
APPENDIX C	Influent and Effluent Lift Station Calculations
APPENDIX D	Hydraulic Profile
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APPENDIX G	GeoSource 1,000 Feet Water Well Report

SECTION 1.0 INTRODUCTION/SUMMARY OF RECOMMENDATIONS

1.1 Purpose

This Preliminary Engineering Design Report describes the proposed Comal County Water Control and Improvement District Number 6 (District) 0.098 MGD Park Village Wastewater Treatment Plant (WWTP) to serve the Park Village Subdivision in accordance with Chapter 217 of the Texas Administrative Code (217 TAC).

1.2 Summary of Design

The proposed facility is a wastewater treatment plant with the capacity to treat an average daily flow of 0.098 MGD (68.06 gpm) with a 2-hour peak flow of 197 gpm (0.28368 MGD). The WWTP will be a complete mix, activated sludge plant designed for single stage nitrification with an effluent filter and pumped discharge. The facility will include one (1) 52' L x 12' W x 12.17' H steel aeration tank, (2) 22' L x 12' W x 12.17' H steel digester tanks, wide band diffused aeration system, a 22-foot diameter circular clarifier, a 12' L x 8' W x 12.17' H chlorine contact tank, three (3) 375 standard cubic feet per minute (scfm) blowers, one (1) disk tertiary filter, and two effluent pumps with a variable speed drive. The facility will be equipped with a v-notch effluent weir, flow paced gas chlorination facilities, non-potable water system, yard piping, site improvements, an access drive and associated electrical work.

SECTION 2.0 BACKGROUND INFORMATION

2.1 General

The Comal County Water Control and Improvement District Number 6 of Comal County, Texas (the "District"), was created to provide water, sanitary sewer, and drainage facilities to serve areas within the District. The District is located approximately 6 miles west Highway 281, bordering the south side of State Highway 46, east of and bordering Blanco Road and north of East Annann Road and lies partially within the extraterritorial jurisdiction of the City of Bulverde and entirely within the Comal Independent School District, and lies wholly within Comal County, Texas. A Location Map for the District is included as Exhibit No. 1. A Service Area Map is included as Exhibit No. 2.

The Park Village Wastewater Treatment Facility, SIC Code 4952, is located approximately 5,900 feet south of the intersection of State Highway 46 and Blanco Road, and approximately 600 feet east from the Blanco Road right-of-way, in Comal County, Texas 78163. Access to the WWTP is via an access driveway from Blanco Road. The proposed 98,000 gallon per day ("GPD") plant will serve approximately 327 equivalent single-family connections (based upon 300 GPD per equivalent single-family connection). The proposed capacity of the WWTP is owned wholly by the District. The 0.098 MGD Wastewater Treatment Plant will allow the District to provide capacity for Phase 1 of the Park Village Subdivision currently being developed.

2.2 Facilities in Surrounding Area of WWTP

Exhibit No. 3 is a portion of the United States Geological Survey map encompassing the District's service area indicating the locations of known water treatment facilities, water supply wells, present and proposed housing developments, present and proposed highways and streets, present and proposed parks, present and proposed schools, present and proposed recreational areas, and present and proposed shopping centers in the area of the WWTP.

As part of the discharge permit application GeoSearch performed a search of the United States Geological Survey National Water Information System, the State of Texas Water Utility Database, the Texas Water Development Board Groundwater Database, the Texas Commission on Environmental Quality Water Wells database and the Texas Department of Licensing and Regulation's State of Texas Well Report Submission and Retrieval System along with the District's information indicated that there are three wells within 1,000 feet of the District's boundary. Information related to the three wells is included as Appendix G and the wells are shown in Exhibit No. 7.

The prevailing winds are from the Southeast as shown on the Wind Rose included as Exhibit No. 4.

There are no known surface water intakes in the vicinity of the existing District WWTP.

The property within the District is currently undeveloped. The only known present or future proposed housing development in the vicinity of the proposed WWTP is the Park Village subdivision which will be north of and

served by, the proposed WWTP. The current land plan for the Park Village Subdivision is shown on Exhibit No. 8.

There are no known present industrial sites or proposed industrial sites in the vicinity of the District or the proposed WWTP.

Blanco Road is located approximately 600 feet west of the WWTP. The access proposed driveway will connect to Blanco Road. Other than Blanco Road and the streets shown in the Park Village Subdivision land plan there are no known or proposed highways or streets in the area surrounding the existing District WWTP.

There are no known present and proposed, public or private, kindergarten through twelfth grade schools in the area of the existing District WWTP.

In the area surrounding the existing District WWTP there are no known present and proposed parks or recreational areas.

On the property adjacent to the north and east sides of the WWTP property will be the Park Village Subdivision. Along the west side of the WWTP property is an unnamed tributary of Kelly Creek. Along the south side of the WWTP property is undeveloped ranch land.

2.3 Wastewater Treatment Plant Effluent Permit

The proposed Comal County Water Control and Improvement District Number 6 Park Village Wastewater Treatment Plant will operate in conformance with the Texas Commission on Environmental Quality (TCEQ), Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ000014959001 and NPDES Permit No. TX0135135. The permit was issued on October 8, 2014 by the TCEQ. The permitted effluent values, based on a 30-day average, are 5 mg/l $CBOD_5$, 5 mg/l TSS, 2 mg/l NH_3-N, 1 mg/l Total Phosphorus, 126 CFU or MPN of *E. coli* bacteria per 100 ml, and 4.0 mg/l minimum dissolved oxygen (DO). The effluent shall contain a chlorine residual of at least 1.0 mg/l and shall not exceed a chlorine residual of 4.0 mg/l after a detention time of at least 20 minutes based on 2-hour wet weather peak flow and there shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil. A copy of the Permit is included as Appendix A.

The treated effluent discharge route is from the plant site via pipe to a to a grassy swale; thence to an unnamed tributary; thence to Kelly Creek; thence to Upper Cibolo Creek in Segment No. 1908 of the San Antonio River Basin. The effluent discharge route to the unnamed tributary; along with the closest the 100-year flood event floodplain is shown on Exhibit No. 5.

SECTION 3.0 FINAL ENGINEERING DESIGN

3.1 WASTEWATER TREATMENT PLANT EXPANSION

3.1.1 Buffer Zone

The entire buffer zone will be within the WWTP property boundary. Exhibit No. 6 shows the proposed facilities and the respective buffer zone.

3.1.2 Floodplain Protection and Access

The WWTP site is NOT within the 100-year flood plain as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 48091C0195F, effective September 2, 2009. The entire site is located within unshaded Zone X on the FEMA FIRM panel. A copy of a portion of FEMA FIRM Panel No. 48091C0195F with the site location indicated on it is included in this report as Exhibit No. 5.

Access to the WWTP will be provided by an all-weather access driveway from Blanco Road. The driveway will be constructed to cross a natural channel on site. This driveway will be constructed as part of this project above the 100-year water surface elevation computed for the natural channel.

3.1.3 Storm Water Pollution Control Plan

Construction of the proposed WWTP facilities will disturb less than 3 acres. Soils are presently stabilized with a cover of grass. Specifications for this project will require the contractor to fine grade all disturbed or cleared areas and establish grass cover. The storm water run-off from the site generally flows from the southeast to the northwest into a natural low which then flows to the southwest into a tributary of Cibolo Creek. Due to the location of the site within the Edwards Aquifer Recharge zone, TCEQ requires a Contributing Zone Plan (CZP), which has been prepared by IDS Engineering Group, Inc. and will be submitted concurrently with the Engineering Design Report. The CZP describes the implementation of temporary BMP's such as silt fence, rock filter dams, construction exit, and concrete washout areas. Moreover, it outlines the implementation of permanent BMP's such as natural and engineering vegetative filter strips as well as grassy swales. Refer to the "Contributing Zone Plan for Park Village Waste Water Treatment Plant" for further details.

3.1.4 Storm Water Detention

Stormwater runoff is intercepted by a regional detention facility within the project limits that has been designed to treat runoff for a fully-developed subdivision. Construction will only take place in certain areas of the property at this stage; as part of the construction of Park Village Units I & II, IDS Engineering Group, Inc. prepared a drainage report in May 2014 supporting the complete development of the property, which has been approved by the City of Bulverde. The report demonstrates that the proposed detention facilities are sized adequately and will cause no adverse impact downstream of the proposed WWTP. The analysis incorporates the proposed WWTP in Drainage Area 3B (DA-3B). Additional detention for the impervious cover

increase of the WWTP is not necessary since drainage calculations have already accounted for it. Refer to the "Drainage Report for Park Village for Units I & II" for further explanation.

3.1.5 Influent characteristics and quantity

The flow for the proposed WWTP is 98,000 gallons per day (gpd) with a 2-hour wet weather peak flow of 197 gallons per minute (gpm). The plant will operate in a complete mix activated sludge mode, with single stage nitrification. Below is a table of the design influent characteristics.

Parameter	Influent Strength (mg/l)
5 Day Biochemical Oxygen Demand (BOD_5)	250
Total Suspended Solids (TSS)	250
Ammonia Nitrogen IC - (NH3-N)	25

3.1.6 Organic Loading Rate

The organic load to the proposed facility based on the table above and a design average daily influent flow of 98,000 gallons per day is listed in the table below.

Parameter	Influent Strength (mg/l)	Daily Loading (Lbs./day)
5 Day Biochemical Oxygen Demand (BOD_5)	250	205
Total Suspended Solids (TSS)	250	205
Ammonia Nitrogen IC - (NH3-N)	25	21

3.1.7 Permit Effluent Limitations

The table below lists the Interim Effluent Limitations from the existing permit. The existing permit expires March 1, 2018.

Parameter	Effluent Limitations
Permitted Flow, MGD	0.098
2-hour wet weather peak flow, gpm	197
5-Day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), mg/l	5
Total Suspended Solids (TSS), mg/l	5
Ammonia Nitrogen IC - (NH3-N), mg/l	2
Total Phosphorus	1
E. coli, CFU or MPH/100 ml	126
Chlorine Residual, mg/l after a minimum detention time of 20 minutes	1 to 4
pH, unitless	6 to 9
Minimum Dissolved Oxygen (DO), mg/l)	4

3.1.8 Proposed WWTP Facility

The on-site lift station is sized to pump 197 gpm (0.098 MGD with a 2.894 Q peak factor) to the headworks. From the headworks the screened influent will gravity flow into one (1) aeration basin. From the aeration basin, flow will continue into one (1) clarifier, thence to the chlorine contact basin for disinfection. The clarifier underflow is returned to the aeration basin or wasted into two (2) digester basins. Treated effluent will exit the plant via an effluent pump station which will pump the effluent to a 6-inch outfall pipe. Sludge will be transported by a TCEQ registered sludge hauler and disposed of at a TCEQ permitted facility. Below is a table of the units proposed and their capacities, detention times, surface loadings, and weir loadings pertinent to each wastewater treatment unit. The WWTP process calculations are included in this report as Appendix B.

Proposed Unit	Volume (cu ft)	Area (sq ft)	Surface Loading (gpd/sf)	Weir Loading (gpd/ft)	Detention Time (hours)
Aeration Basin	6,589	648	438	N/A	4.15
Chlorine Contact Basin	751	96	2,955	N/A	0.475
Digester Basins	5,634	528	N/A	N/A	N/A
Clarifiers	3,952	380	747	6,239	1.81

3.2 ON-SITE INFLUENT LIFT STATION

The proposed on-site influent lift station will have a circular wet well with an 8-foot diameter. The wet well is sized to accommodate the ultimate average daily flow of 195,000 gpd (542 gpm). The first phase lift station will have two (2) submersible 7.5 Hp, non-clog, sewage pumps each capable of pumping the 2-hour peak wet weather flow of 197 gpm. The lift station will have a firm capacity of 197 gpm which will meet the 2-hour Wet Weather Peak Flow 0.28368 MGD when the "largest" pump out of service. The lift station electrical controls will automatically alternate between the lead, lag and standby pump positions.

The proposed existing 6-inch force main will be routed to the headworks of the proposed WWTP. Lift Station calculations and pump information are provided in Appendix C.

3.3 HEADWORKS

The headworks will receive influent from the onsite lift station and will include a manual bar rack.

3.4 ACTIVATED SLUDGE FACILITIES

3.4.1 Activated Sludge Process

The proposed plant will be operated as a single stage nitrification activated sludge process to achieve effluent limitations. The proposed aeration basin will have the capacity to treat 0.098 MGD average daily flow. Influent entering the aeration basins will travel in a "complete mix" flow regime prior to entering the clarifier. The aeration basin will be fitted with a connection which will be utilized for the removal of liquids during basin

demucking/degritting operations, if ever required. A maximum organic loading rate of 35 pounds per day per 1,000 cubic foot of aeration basin volume was used per Texas Administrative Code (TAC) 217.154(b)(3). The minimum total aeration volume required and the total aeration volume supplied are listed in the table below.

The aeration basin will have a length of 52-feet a width of 12-feet with a side water depth of 10.67 feet (10'-8"). The WWTP process calculations are included in this report as Appendix B.

Aeration Basin Volumes		
	Required	**Supplied**
Minimum Aeration Volume, Cubic Feet (rounded)	5,411	6,589
Aeration Volume Gallons (rounded)	40,480	49,289

3.4.2 Air Supply Systems

The diffused air supply system for the aeration basin and digester basins will utilize stainless-steel wide band diffusers (e.g. Sanitaire D-24) or diffusers of equivalent quality. The minimum guaranteed oxygen transfer efficiency for the diffusers is 9% at the design diffuser submergence of 10-feet at the design air flow rate. The diffused air requirement for the single stage nitrification activated sludge process in accordance with TAC 317.4(g)(4)(A) is 2.2 O_2/lb. BOD_5/day. This results in an oxygen demand of 451 lbs. O_2/day.

Three (3) positive displacement blowers will be installed adjacent to the aeration and digester basins. Each of these blowers will be capable of producing 375 standard cubic feet per minute (scfm) at the design conditions. The firm capacity for the aeration basin, digesters, chlorine contact basin, and decant airlift pumps will be met by running two of these blowers. Detailed calculations for the air systems are presented in Appendix B and summarized in Table 1.

Table 1 – Summary of Air Requirements (includes factor of safety)

Treatment Unit Process	Basin Volume Provided	Minimum Air Required
	(cf)	(scfm)
Aeration Basin No. 1	6,589	516
Digester No. 1	2,817	84.5
Digester No. 2	2,817	84.5
Chlorine Contact Basin	751	30
Air Lift Pumps	N/A	35
Total Blower Air Requirement		750
Minimum Firm Blower Air Capacity		750
Capacity of each Proposed Positive Displacement Blowers		375

3.5 CLARIFIER

3.5.1 Proposed Clarifier

Mixed liquor will be transported to the proposed clarifier via a 10-inch clarifier influent line from the proposed

aeration basin. The inlet velocity through the 4-foot diameter stilling well will be less than 0.15 foot per second at the 2-hour wet weather peak flow. The proposed 20-foot diameter clarifier will be capable of conveying the proposed ADF (0.098 MGD) and proposed 2-hour wet weather peak flow (0.28368 MGD).

TAC 217.154(c)(1)Table F.2 requires a clarifier surface area such that at the 2-hour wet weather peak flow, the surface loading rate is less than 1,200 GPD/SF. To achieve these rates, a 17.4-foot diameter clarifier would be required to convey the 0.0.28368 MGD 2-hour wet weather peak flow. The proposed clarifier (22-foot diameter) surface loading flow will be 747 GPD/SF at the 2-hour wet weather peak flow.

TAC 217.154(c)(1)Table F.2 requires a clarifier detention time such that at the 2-hour wet weather peak flow, the detention time be greater than or equal to 1.8 hours. The required minimum diameter clarifier was 17.4-foot which TAC 217.152(g)(2)(A) requires to have a minimum of 10-foot side water depth. The provided 22-foot diameter clarifier has a 10-foot side water depth producing a 1.81 hour detention time at the 2-hour wet weather peak flow.

TAC 217.152(c)(4) requires that at 1.0 MGD ADF or less, clarifier weir 2-hour wet weather peak flow loading rate shall not exceed 20,000 gallons per day per linear foot of weir length. The provided weir plate for the 22-foot diameter clarifier (20-foot diameter at the weir) yields 6,239 gallon per day per linear foot of weir length at the 2-hour wet weather peak flow. Detailed clarifier calculations are presented in Appendix B.

Clarifier		
	Based on TAC 217 Criteria	**Supplied**
Minimum Clarifier Surface Area (sf)	236	380
Minimum Weir Length (lf)	14	62
Minimum Clarifier Volume Required (cf)	2,844	3,952
Minimum Clarifier Side Water Depth (ft)	10	10.4
Minimum Detention Time (hr)	1.8	1.81
Maximum Stilling Well Vertical Velocity with 100% recycle (fps)	0.15	0.047
Maximum Overflow Rate @ 2-hour Peak Flow (gpd/sf)	1200	747

3.5.2 Return Activated Sludge Pumps

Settled sludge from the clarifiers will be returned to the aeration basins or wasted to the digesters. Return activated sludge (RAS) from the proposed clarifier will be returned through an air lift pump. The air lift return sludge pump will be sized to produce at least 200 gpd/sf but not more than 400 gpd/sf based on the area of the activated sludge clarifier, including the stilling well area. The minimum RAS pump flow rate is 52.8 gpm and the maximum RAS pump flow rate is 105.6 gpm. The RAS pump flow rate has a range of 77.6 percent of the average daily flow to 155.2 percent of the average daily flow.

3.5.3 Scum Collection

The proposed clarifier will be equipped with a full surface skimmer which deposits floatable materials into a

scum trough which will flow into a scum drop which will be returned to the head of the aeration basin through a 4-inch air lift pump.

3.6 DISINFECTION FACILITIES

3.6.1 Chlorine Contact Basin

The chlorine contact basin will be sized to provide a storage volume which results in a minimum 20 minute detention time at the design 2-hour wet weather peak flow of 0.28368 MGD, thus satisfying TAC 217.281(b)(2). Short circuiting has been minimized by providing baffling. The minimum chlorine contact basin parameters and supplied chlorine contact basin parameters are listed in the table below. The WWTP process calculations are included in this report as Appendix B.

Chlorine Contact Basin Parameters Volumes		
	Required (rounded)	Supplied (rounded)
Chlorine Contact Basin Volume, cubic feet	527	751
Chlorine Contact Basin Volume gallons	3,940	5,618
Chlorine Contact Time, minutes	20	28.5

3.6.2 Proposed Chlorine Feed System and Appurtenances

Chlorination will be provided by chlorine gas stored in 150 pound cylinders fitted with an automatic switchover. Scales will be provided to measure the chlorine gas stored in the cylinders. Chlorine gas dosage will be regulated by two (2) flow paced chlorinators, with the means to automatically proportion the chlorine dosage based on the effluent flow rate. The non-potable water system will circulate plant effluent from the chlorine contact basin, through the chlorination injector where it will mix with the chlorine gas and back into the chlorine contact basin. The non-potable water pump suction takes in water from the chlorine contact basin and discharges chlorine solution at the influent point of the chlorine contact basin. Air diffusers will be provided for additional mixing as well as additional dissolved oxygen. The chlorination system will be calibrated to provide an effluent chlorine residual between 1.0 mg/l and 4.0 mg/l for the average daily and 2-hour wet weather peak flow per the WWTP's discharge permit.

3.7 EFFLUENT FLOW MEASUREMENT

Effluent flow measurement will be performed by an ultrasonic flow meter installed at the V-notch effluent weir. The measured flow will be sent via 4-20 mA signals to the chlorination system and plant effluent flow rate chart recorder. The flow meter will be calibrated for the proposed plant flow ranges.

3.8 AEROBIC DIGESTER AND SLUDGE DISPOSAL

Two (2) digesters will be provided to further process waste sludge produced during the activated sludge process. As noted previously, sludge can be wasted to either of the two digesters. The aerobic digester's air supply will be generated by proposed blowers through stainless-steel wide band diffusers (e.g. Sanitaire D-24)

or diffusers of equivalent quality. Waste activated sludge (WAS) from the proposed clarifiers will be wasted via an air lift pump to one of the two digesters. An overflow port will be provided to allow the digesters to overflow back into the aeration basins in the event that the digesters become over-filled. The digesters will be provided with decant lean pipes connected to air lift pumps which will return the supernatant to the headworks for further treatment. Once sludge has been adequately digested, an independent sludge disposal contractor will haul and dispose of the sludge. A quick disconnect and valve in each of the digester basin will be provided to be utilized by the sludge disposal contractor for normal sludge haul operations. The minimum total digester volume and the supplied total digester volume are listed in the table below.

Each digester basin will have a length of 22-feet a width of 12-feet with a maximum side water depth of 10.67-feet. The volume of each of the two (2) basins will be 2,817 cubic feet for a total volume of 5,334 cubic feet. The WWTP process calculations are included in this report as Appendix B.

Digester Basin Volumes		
	Required (rounded)	Supplied (rounded)
Minimum Digester Volume Required, cubic feet	5,411	5,634
Minimum Digester Volume Required, gallons	40,480	42,145

3.9 CONTROL OF BYPASSING

TAC 217.36(d) indicates that facilities may use lift stations and collection systems to store wastewater in lieu of on-site generators when the report calculations show that sufficient storage volume exists in the lift stations, upstream gravity wastewater collection system lines, and manholes to store the volume of wastewater during a peak diurnal event equal to the longest outage in the power records. TAC 217.63((d)(1)(A) indicates that the retention capacity in a lift station's wet well and incoming gravity pipes must prevent discharges of untreated wastewater at the lift station or any point upstream for a period of time equal to the longest electrical outage recorded during the past 24 months, but not less than 20 minutes. The Appendix E contains the Pedernales Electric Cooperative Incorporated's outage report on substation breaker operations for the Bergheim Substation feeder BG-20 during the past 24 months. Substation breaker BG20 currently serves the area east of Blanco Road and south of State Highway 46 to Boerne. This area includes the proposed Park Village Subdivision and the WWTP site. The substation device interruptions are reflected from July 1, 2013 through July 9, 2015. The records indicate the longest outage during that period was 10 minutes and 39 seconds. The GBRA indicated that delaying the installation of the generator until the ultimate phase is acceptable as long as the analysis of the power outage reports and the temporary storage requirements are met. GBRA indicates that they require a minimum of 6 hours of storage. Six hours of storage for the average daily flow of 4,083 gallons per hour is 3,275 cubic feet. The storage volume in the lift station, gravity wastewater collection system lines and manholes upstream of the proposed onsite lift station is approximately 3,282 cubic feet which is greater than the minimum required storage volume of 3,275 cubic

feet. This should prevent bypassing, insufficient treatment and insufficient disinfection due to power outages. The storage volume calculations are included as Appendix F.

3.10 HYDRAULIC PROFILE

The hydraulic profile has been calculated for 2-hour wet weather peak flow and the WWTP hydraulic calculations are included in this report as Appendix D.

EXHIBIT 1
LOCATION MAP

EXHIBIT 2
SERVICE AREA AND DISTRICT BOUNDARY MAP

EXHIBIT 3
USGS SURROUNDING AREA MAP

EXHIBIT 4
WIND ROSE

EXHIBIT 5
FEMA, FIRM MAP

EXHIBIT 6
PROPOSED FACILITIES

EXHIBIT 7
WATER WELLS WITHIN 1,000 FEET
OF COMAL COUNTY WC&ID No. 6 MAP

EXHIBIT 8
PARK VILLAGE SUBDIVISION LAND PLAN

APPENDIX A
TCEQ DISCHARGE PERMIT NO. WQ0012346-001

APPENDIX B
TREATMENT PLANT DESIGN COMPUTATIONS

APPENDIX C
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SECTION 1.0 INTRODUCTION/SUMMARY OF RECOMMENDATIONS

1.1 Purpose

This Preliminary Engineering Design Report describes the proposed Comal County Water Control and Improvement District Number 6 (District) 0.098 MGD Park Village Wastewater Treatment Plant (WWTP) to serve the Park Village Subdivision in accordance with Chapter 217 of the Texas Administrative Code (217 TAC).

1.2 Summary of Design

The proposed facility is a wastewater treatment plant with the capacity to treat an average daily flow of 0.098 MGD (68.06 gpm) with a 2-hour peak flow of 197 gpm (0.28368 MGD). The WWTP will be a complete mix, activated sludge plant designed for single stage nitrification with an effluent filter and pumped discharge. The facility will include one (1) 52' L x 12' W x 12.17' H steel aeration tank, (2) 22' L x 12' W x 12.17' H steel digester tanks, wide band diffused aeration system, a 22-foot diameter circular clarifier, a 12' L x 8' W x 12.17' H chlorine contact tank, three (3) 375 standard cubic feet per minute (scfm) blowers, one (1) disk tertiary filter, and two effluent pumps with a variable speed drive. The facility will be equipped with a v-notch effluent weir, flow paced gas chlorination facilities, non-potable water system, yard piping, site improvements, an access drive and associated electrical work.

SECTION 2.0 BACKGROUND INFORMATION

2.1 General

The Comal County Water Control and Improvement District Number 6 of Comal County, Texas (the "District"), was created to provide water, sanitary sewer, and drainage facilities to serve areas within the District. The District is located approximately 6 miles west Highway 281, bordering the south side of State Highway 46, east of and bordering Blanco Road and north of East Annann Road and lies partially within the extraterritorial jurisdiction of the City of Bulverde and entirely within the Comal Independent School District, and lies wholly within Comal County, Texas. A Location Map for the District is included as Exhibit No. 1. A Service Area Map is included as Exhibit No. 2.

The Park Village Wastewater Treatment Facility, SIC Code 4952, is located approximately 5,900 feet south of the intersection of State Highway 46 and Blanco Road, and approximately 600 feet east from the Blanco Road right-of-way, in Comal County, Texas 78163. Access to the WWTP is via an access driveway from Blanco Road. The proposed 98,000 gallon per day ("GPD") plant will serve approximately 327 equivalent single-family connections (based upon 300 GPD per equivalent single-family connection). The proposed capacity of the WWTP is owned wholly by the District. The 0.098 MGD Wastewater Treatment Plant will allow the District to provide capacity for Phase 1 of the Park Village Subdivision currently being developed.

2.2 Facilities in Surrounding Area of WWTP

Exhibit No. 3 is a portion of the United States Geological Survey map encompassing the District's service area indicating the locations of known water treatment facilities, water supply wells, present and proposed housing developments, present and proposed highways and streets, present and proposed parks, present and proposed schools, present and proposed recreational areas, and present and proposed shopping centers in the area of the WWTP.

As part of the discharge permit application GeoSearch performed a search of the United States Geological Survey National Water Information System, the State of Texas Water Utility Database, the Texas Water Development Board Groundwater Database, the Texas Commission on Environmental Quality Water Wells database and the Texas Department of Licensing and Regulation's State of Texas Well Report Submission and Retrieval System along with the District's information indicated that there are three wells within 1,000 feet of the District's boundary. Information related to the three wells is included as Appendix G and the wells are shown in Exhibit No. 7.

The prevailing winds are from the Southeast as shown on the Wind Rose included as Exhibit No. 4.

There are no known surface water intakes in the vicinity of the existing District WWTP.

The property within the District is currently undeveloped. The only known present or future proposed housing development in the vicinity of the proposed WWTP is the Park Village subdivision which will be north of and

served by, the proposed WWTP. The current land plan for the Park Village Subdivision is shown on Exhibit No. 8.

There are no known present industrial sites or proposed industrial sites in the vicinity of the District or the proposed WWTP.

Blanco Road is located approximately 600 feet west of the WWTP. The access proposed driveway will connect to Blanco Road. Other than Blanco Road and the streets shown in the Park Village Subdivision land plan there are no known or proposed highways or streets in the area surrounding the existing District WWTP.

There are no known present and proposed, public or private, kindergarten through twelfth grade schools in the area of the existing District WWTP.

In the area surrounding the existing District WWTP there are no known present and proposed parks or recreational areas.

On the property adjacent to the north and east sides of the WWTP property will be the Park Village Subdivision. Along the west side of the WWTP property is an unnamed tributary of Kelly Creek. Along the south side of the WWTP property is undeveloped ranch land.

2.3 Wastewater Treatment Plant Effluent Permit

The proposed Comal County Water Control and Improvement District Number 6 Park Village Wastewater Treatment Plant will operate in conformance with the Texas Commission on Environmental Quality (TCEQ), Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ000014959001 and NPDES Permit No. TX0135135. The permit was issued on October 8, 2014 by the TCEQ. The permitted effluent values, based on a 30-day average, are 5 mg/l $CBOD_5$, 5 mg/l TSS, 2 mg/l NH_3-N, 1 mg/l Total Phosphorus, 126 CFU or MPN of *E. coli* bacteria per 100 ml, and 4.0 mg/l minimum dissolved oxygen (DO). The effluent shall contain a chlorine residual of at least 1.0 mg/l and shall not exceed a chlorine residual of 4.0 mg/l after a detention time of at least 20 minutes based on 2-hour wet weather peak flow and there shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil. A copy of the Permit is included as Appendix A.

The treated effluent discharge route is from the plant site via pipe to a to a grassy swale; thence to an unnamed tributary; thence to Kelly Creek; thence to Upper Cibolo Creek in Segment No. 1908 of the San Antonio River Basin. The effluent discharge route to the unnamed tributary; along with the closest the 100-year flood event floodplain is shown on Exhibit No. 5.

SECTION 3.0 FINAL ENGINEERING DESIGN

3.1 WASTEWATER TREATMENT PLANT EXPANSION

3.1.1 Buffer Zone

The entire buffer zone will be within the WWTP property boundary. Exhibit No. 6 shows the proposed facilities and the respective buffer zone.

3.1.2 Floodplain Protection and Access

The WWTP site is NOT within the 100-year flood plain as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 48091C0195F, effective September 2, 2009. The entire site is located within unshaded Zone X on the FEMA FIRM panel. A copy of a portion of FEMA FIRM Panel No. 48091C0195F with the site location indicated on it is included in this report as Exhibit No. 5.

Access to the WWTP will be provided by an all-weather access driveway from Blanco Road. The driveway will be constructed to cross a natural channel on site. This driveway will be constructed as part of this project above the 100-year water surface elevation computed for the natural channel.

3.1.3 Storm Water Pollution Control Plan

Construction of the proposed WWTP facilities will disturb less than 3 acres. Soils are presently stabilized with a cover of grass. Specifications for this project will require the contractor to fine grade all disturbed or cleared areas and establish grass cover. The storm water run-off from the site generally flows from the southeast to the northwest into a natural low which then flows to the southwest into a tributary of Cibolo Creek. Due to the location of the site within the Edwards Aquifer Recharge zone, TCEQ requires a Contributing Zone Plan (CZP), which has been prepared by IDS Engineering Group, Inc. and will be submitted concurrently with the Engineering Design Report. The CZP describes the implementation of temporary BMP's such as silt fence, rock filter dams, construction exit, and concrete washout areas. Moreover, it outlines the implementation of permanent BMP's such as natural and engineering vegetative filter strips as well as grassy swales. Refer to the "Contributing Zone Plan for Park Village Waste Water Treatment Plant" for further details.

3.1.4 Storm Water Detention

Stormwater runoff is intercepted by a regional detention facility within the project limits that has been designed to treat runoff for a fully-developed subdivision. Construction will only take place in certain areas of the property at this stage; as part of the construction of Park Village Units I & II, IDS Engineering Group, Inc. prepared a drainage report in May 2014 supporting the complete development of the property, which has been approved by the City of Bulverde. The report demonstrates that the proposed detention facilities are sized adequately and will cause no adverse impact downstream of the proposed WWTP. The analysis incorporates the proposed WWTP in Drainage Area 3B (DA-3B). Additional detention for the impervious cover

increase of the WWTP is not necessary since drainage calculations have already accounted for it. Refer to the "Drainage Report for Park Village for Units I & II" for further explanation.

3.1.5 Influent characteristics and quantity

The flow for the proposed WWTP is 98,000 gallons per day (gpd) with a 2-hour wet weather peak flow of 197 gallons per minute (gpm). The plant will operate in a complete mix activated sludge mode, with single stage nitrification. Below is a table of the design influent characteristics.

Parameter	Influent Strength (mg/l)
5 Day Biochemical Oxygen Demand (BOD_5)	250
Total Suspended Solids (TSS)	250
Ammonia Nitrogen IC - (NH3-N)	25

3.1.6 Organic Loading Rate

The organic load to the proposed facility based on the table above and a design average daily influent flow of 98,000 gallons per day is listed in the table below.

Parameter	Influent Strength (mg/l)	Daily Loading (Lbs./day)
5 Day Biochemical Oxygen Demand (BOD_5)	250	205
Total Suspended Solids (TSS)	250	205
Ammonia Nitrogen IC - (NH3-N)	25	21

3.1.7 Permit Effluent Limitations

The table below lists the Interim Effluent Limitations from the existing permit. The existing permit expires March 1, 2018.

Parameter	Effluent Limitations
Permitted Flow, MGD	0.098
2-hour wet weather peak flow, gpm	197
5-Day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), mg/l	5
Total Suspended Solids (TSS), mg/l	5
Ammonia Nitrogen IC - (NH3-N), mg/l	2
Total Phosphorus	1
E. coli, CFU or MPH/100 ml	126
Chlorine Residual, mg/l after a minimum detention time of 20 minutes	1 to 4
pH, unitless	6 to 9
Minimum Dissolved Oxygen (DO), mg/l)	4

3.1.8 Proposed WWTP Facility

The on-site lift station is sized to pump 197 gpm (0.098 MGD with a 2.894 Q peak factor) to the headworks. From the headworks the screened influent will gravity flow into one (1) aeration basin. From the aeration basin, flow will continue into one (1) clarifier, thence to the chlorine contact basin for disinfection. The clarifier underflow is returned to the aeration basin or wasted into two (2) digester basins. Treated effluent will exit the plant via an effluent pump station which will pump the effluent to a 6-inch outfall pipe. Sludge will be transported by a TCEQ registered sludge hauler and disposed of at a TCEQ permitted facility. Below is a table of the units proposed and their capacities, detention times, surface loadings, and weir loadings pertinent to each wastewater treatment unit. The WWTP process calculations are included in this report as Appendix B.

Proposed Unit	Volume (cu ft)	Area (sq ft)	Surface Loading (gpd/sf)	Weir Loading (gpd/ft)	Detention Time (hours)
Aeration Basin	6,589	648	438	N/A	4.15
Chlorine Contact Basin	751	96	2,955	N/A	0.475
Digester Basins	5,634	528	N/A	N/A	N/A
Clarifiers	3,952	380	747	6,239	1.81

3.2 ON-SITE INFLUENT LIFT STATION

The proposed on-site influent lift station will have a circular wet well with an 8-foot diameter. The wet well is sized to accommodate the ultimate average daily flow of 195,000 gpd (542 gpm). The first phase lift station will have two (2) submersible 7.5 Hp, non-clog, sewage pumps each capable of pumping the 2-hour peak wet weather flow of 197 gpm. The lift station will have a firm capacity of 197 gpm which will meet the 2-hour Wet Weather Peak Flow 0.28368 MGD when the "largest" pump out of service. The lift station electrical controls will automatically alternate between the lead, lag and standby pump positions.

The proposed existing 6-inch force main will be routed to the headworks of the proposed WWTP. Lift Station calculations and pump information are provided in Appendix C.

3.3 HEADWORKS

The headworks will receive influent from the onsite lift station and will include a manual bar rack.

3.4 ACTIVATED SLUDGE FACILITIES

3.4.1 Activated Sludge Process

The proposed plant will be operated as a single stage nitrification activated sludge process to achieve effluent limitations. The proposed aeration basin will have the capacity to treat 0.098 MGD average daily flow. Influent entering the aeration basins will travel in a “complete mix” flow regime prior to entering the clarifier. The aeration basin will be fitted with a connection which will be utilized for the removal of liquids during basin

demucking/degritting operations, if ever required. A maximum organic loading rate of 35 pounds per day per 1,000 cubic foot of aeration basin volume was used per Texas Administrative Code (TAC) 217.154(b)(3). The minimum total aeration volume required and the total aeration volume supplied are listed in the table below.

The aeration basin will have a length of 52-feet a width of 12-feet with a side water depth of 10.67 feet (10'-8"). The WWTP process calculations are included in this report as Appendix B.

Aeration Basin Volumes		
	Required	**Supplied**
Minimum Aeration Volume, Cubic Feet (rounded)	5,411	6,589
Aeration Volume Gallons (rounded)	40,480	49,289

3.4.2 Air Supply Systems

The diffused air supply system for the aeration basin and digester basins will utilize stainless-steel wide band diffusers (e.g. Sanitaire D-24) or diffusers of equivalent quality. The minimum guaranteed oxygen transfer efficiency for the diffusers is 9% at the design diffuser submergence of 10-feet at the design air flow rate. The diffused air requirement for the single stage nitrification activated sludge process in accordance with TAC 317.4(g)(4)(A) is 2.2 O_2/lb. BOD_5/day. This results in an oxygen demand of 451 lbs. O_2/day.

Three (3) positive displacement blowers will be installed adjacent to the aeration and digester basins. Each of these blowers will be capable of producing 375 standard cubic feet per minute (scfm) at the design conditions. The firm capacity for the aeration basin, digesters, chlorine contact basin, and decant airlift pumps will be met by running two of these blowers. Detailed calculations for the air systems are presented in Appendix B and summarized in Table 1.

Table 1 – Summary of Air Requirements (includes factor of safety)

Treatment Unit Process	Basin Volume Provided	Minimum Air Required
	(cf)	(scfm)
Aeration Basin No. 1	6,589	516
Digester No. 1	2,817	84.5
Digester No. 2	2,817	84.5
Chlorine Contact Basin	751	30
Air Lift Pumps	N/A	35
Total Blower Air Requirement		750
Minimum Firm Blower Air Capacity		750
Capacity of each Proposed Positive Displacement Blowers		375

3.5 CLARIFIER

3.5.1 Proposed Clarifier

Mixed liquor will be transported to the proposed clarifier via a 10-inch clarifier influent line from the proposed

aeration basin. The inlet velocity through the 4-foot diameter stilling well will be less than 0.15 foot per second at the 2-hour wet weather peak flow. The proposed 20-foot diameter clarifier will be capable of conveying the proposed ADF (0.098 MGD) and proposed 2-hour wet weather peak flow (0.28368 MGD).

TAC 217.154(c)(1)Table F.2 requires a clarifier surface area such that at the 2-hour wet weather peak flow, the surface loading rate is less than 1,200 GPD/SF. To achieve these rates, a 17.4-foot diameter clarifier would be required to convey the 0.0.28368 MGD 2-hour wet weather peak flow. The proposed clarifier (22-foot diameter) surface loading flow will be 747 GPD/SF at the 2-hour wet weather peak flow.

TAC 217.154(c)(1)Table F.2 requires a clarifier detention time such that at the 2-hour wet weather peak flow, the detention time be greater than or equal to 1.8 hours. The required minimum diameter clarifier was 17.4-foot which TAC 217.152(g)(2)(A) requires to have a minimum of 10-foot side water depth. The provided 22-foot diameter clarifier has a 10-foot side water depth producing a 1.81 hour detention time at the 2-hour wet weather peak flow.

TAC 217.152(c)(4) requires that at 1.0 MGD ADF or less, clarifier weir 2-hour wet weather peak flow loading rate shall not exceed 20,000 gallons per day per linear foot of weir length. The provided weir plate for the 22-foot diameter clarifier (20-foot diameter at the weir) yields 6,239 gallon per day per linear foot of weir length at the 2-hour wet weather peak flow. Detailed clarifier calculations are presented in Appendix B.

Clarifier		
	Based on TAC 217 Criteria	**Supplied**
Minimum Clarifier Surface Area (sf)	236	380
Minimum Weir Length (lf)	14	62
Minimum Clarifier Volume Required (cf)	2,844	3,952
Minimum Clarifier Side Water Depth (ft)	10	10.4
Minimum Detention Time (hr)	1.8	1.81
Maximum Stilling Well Vertical Velocity with 100% recycle (fps)	0.15	0.047
Maximum Overflow Rate @ 2-hour Peak Flow (gpd/sf)	1200	747

3.5.2 Return Activated Sludge Pumps

Settled sludge from the clarifiers will be returned to the aeration basins or wasted to the digesters. Return activated sludge (RAS) from the proposed clarifier will be returned through an air lift pump. The air lift return sludge pump will be sized to produce at least 200 gpd/sf but not more than 400 gpd/sf based on the area of the activated sludge clarifier, including the stilling well area. The minimum RAS pump flow rate is 52.8 gpm and the maximum RAS pump flow rate is 105.6 gpm. The RAS pump flow rate has a range of 77.6 percent of the average daily flow to 155.2 percent of the average daily flow.

3.5.3 Scum Collection

The proposed clarifier will be equipped with a full surface skimmer which deposits floatable materials into a

scum trough which will flow into a scum drop which will be returned to the head of the aeration basin through a 4-inch air lift pump.

3.6 DISINFECTION FACILITIES

3.6.1 Chlorine Contact Basin

The chlorine contact basin will be sized to provide a storage volume which results in a minimum 20 minute detention time at the design 2-hour wet weather peak flow of 0.28368 MGD, thus satisfying TAC 217.281(b)(2). Short circuiting has been minimized by providing baffling. The minimum chlorine contact basin parameters and supplied chlorine contact basin parameters are listed in the table below. The WWTP process calculations are included in this report as Appendix B.

Chlorine Contact Basin Parameters Volumes		
	Required (rounded)	Supplied (rounded)
Chlorine Contact Basin Volume, cubic feet	527	751
Chlorine Contact Basin Volume gallons	3,940	5,618
Chlorine Contact Time, minutes	20	28.5

3.6.2 Proposed Chlorine Feed System and Appurtenances

Chlorination will be provided by chlorine gas stored in 150 pound cylinders fitted with an automatic switchover. Scales will be provided to measure the chlorine gas stored in the cylinders. Chlorine gas dosage will be regulated by two (2) flow paced chlorinators, with the means to automatically proportion the chlorine dosage based on the effluent flow rate. The non-potable water system will circulate plant effluent from the chlorine contact basin, through the chlorination injector where it will mix with the chlorine gas and back into the chlorine contact basin. The non-potable water pump suction takes in water from the chlorine contact basin and discharges chlorine solution at the influent point of the chlorine contact basin. Air diffusers will be provided for additional mixing as well as additional dissolved oxygen. The chlorination system will be calibrated to provide an effluent chlorine residual between 1.0 mg/l and 4.0 mg/l for the average daily and 2-hour wet weather peak flow per the WWTP's discharge permit.

3.7 EFFLUENT FLOW MEASUREMENT

Effluent flow measurement will be performed by an ultrasonic flow meter installed at the V-notch effluent weir. The measured flow will be sent via 4-20 mA signals to the chlorination system and plant effluent flow rate chart recorder. The flow meter will be calibrated for the proposed plant flow ranges.

3.8 AEROBIC DIGESTER AND SLUDGE DISPOSAL

Two (2) digesters will be provided to further process waste sludge produced during the activated sludge process. As noted previously, sludge can be wasted to either of the two digesters. The aerobic digester's air supply will be generated by proposed blowers through stainless-steel wide band diffusers (e.g. Sanitaire D-24)

or diffusers of equivalent quality. Waste activated sludge (WAS) from the proposed clarifiers will be wasted via an air lift pump to one of the two digesters. An overflow port will be provided to allow the digesters to overflow back into the aeration basins in the event that the digesters become over-filled. The digesters will be provided with decant lean pipes connected to air lift pumps which will return the supernatant to the headworks for further treatment. Once sludge has been adequately digested, an independent sludge disposal contractor will haul and dispose of the sludge. A quick disconnect and valve in each of the digester basin will be provided to be utilized by the sludge disposal contractor for normal sludge haul operations. The minimum total digester volume and the supplied total digester volume are listed in the table below.

Each digester basin will have a length of 22-feet a width of 12-feet with a maximum side water depth of 10.67-feet. The volume of each of the two (2) basins will be 2,817 cubic feet for a total volume of 5,334 cubic feet. The WWTP process calculations are included in this report as Appendix B.

Digester Basin Volumes		
	Required (rounded)	Supplied (rounded)
Minimum Digester Volume Required, cubic feet	5,411	5,634
Minimum Digester Volume Required, gallons	40,480	42,145

3.9 CONTROL OF BYPASSING

TAC 217.36(d) indicates that facilities may use lift stations and collection systems to store wastewater in lieu of on-site generators when the report calculations show that sufficient storage volume exists in the lift stations, upstream gravity wastewater collection system lines, and manholes to store the volume of wastewater during a peak diurnal event equal to the longest outage in the power records. TAC 217.63((d)(1)(A) indicates that the retention capacity in a lift station's wet well and incoming gravity pipes must prevent discharges of untreated wastewater at the lift station or any point upstream for a period of time equal to the longest electrical outage recorded during the past 24 months, but not less than 20 minutes. The Appendix E contains the Pedernales Electric Cooperative Incorporated's outage report on substation breaker operations for the Bergheim Substation feeder BG-20 during the past 24 months. Substation breaker BG20 currently serves the area east of Blanco Road and south of State Highway 46 to Boerne. This area includes the proposed Park Village Subdivision and the WWTP site. The substation device interruptions are reflected from July 1, 2013 through July 9, 2015. The records indicate the longest outage during that period was 10 minutes and 39 seconds. The GBRA indicated that delaying the installation of the generator until the ultimate phase is acceptable as long as the analysis of the power outage reports and the temporary storage requirements are met. GBRA indicates that they require a minimum of 6 hours of storage. Six hours of storage for the average daily flow of 4,083 gallons per hour is 3,275 cubic feet. The storage volume in the lift station, gravity wastewater collection system lines and manholes upstream of the proposed onsite lift station is approximately 3,282 cubic feet which is greater than the minimum required storage volume of 3,275 cubic

feet. This should prevent bypassing, insufficient treatment and insufficient disinfection due to power outages. The storage volume calculations are included as Appendix F.

3.10 HYDRAULIC PROFILE

The hydraulic profile has been calculated for 2-hour wet weather peak flow and the WWTP hydraulic calculations are included in this report as Appendix D.

EXHIBIT 1
LOCATION MAP

IDS Engineering Group
GIS Department

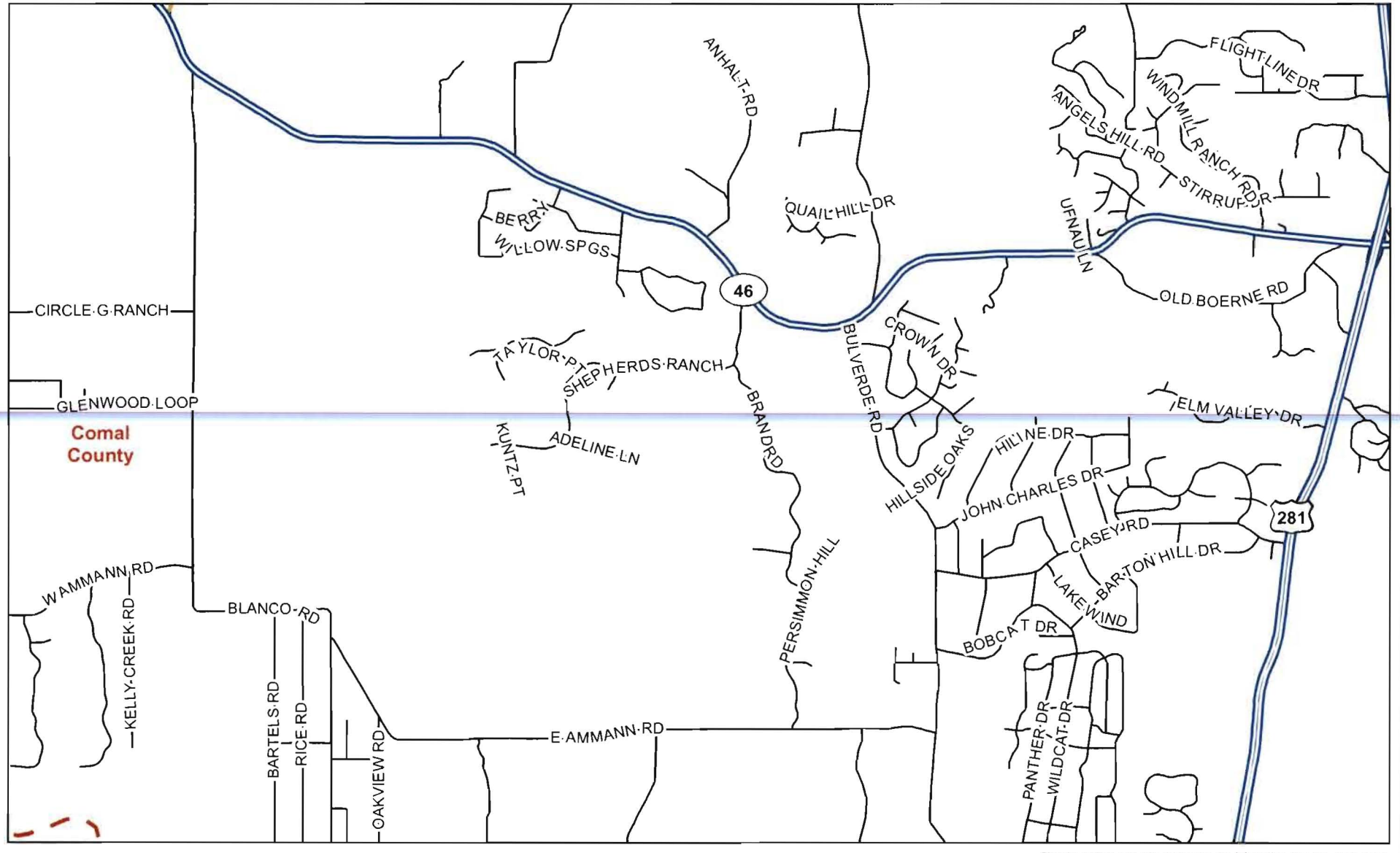

Exhibit 1 - Location Map

Print Date: 2/15/2016 8:41:36 AM

1 inch = 4,000 feet

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W E
S

Disclaimer: This web site represents the information that has been made available for the use of this system and does not necessarily include the most complete and/or accurate data. IDS Engineering Group does not warrant its accuracy or completeness. Verification should be done as necessary.

This GIS Exhibit may include copyrighted material (aerial photos) by the City of San Antonio, DigitalGlobe, or Aerials Express. All Rights Reserved.

EXHIBIT 2
SERVICE AREA AND DISTRICT BOUNDARY MAP

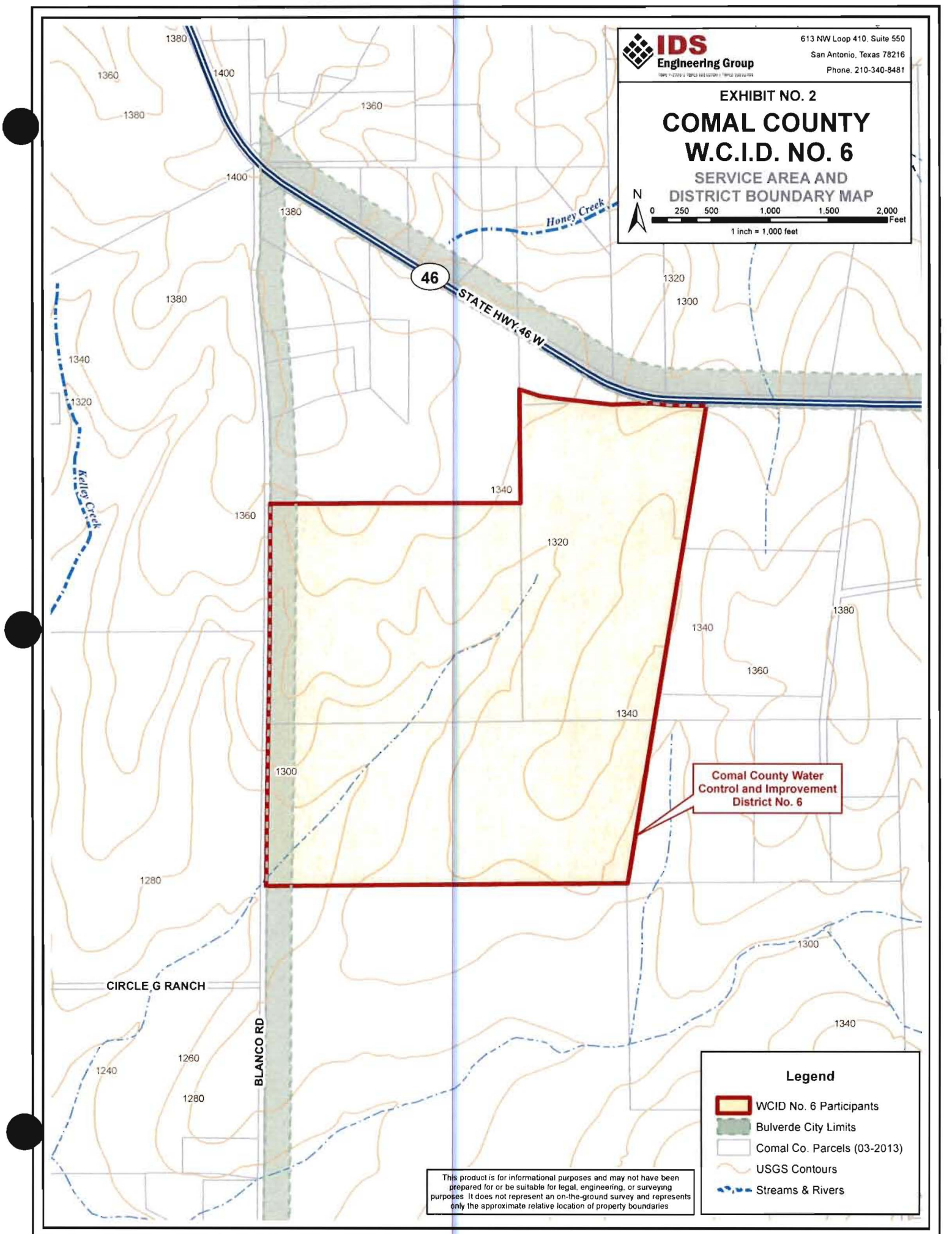
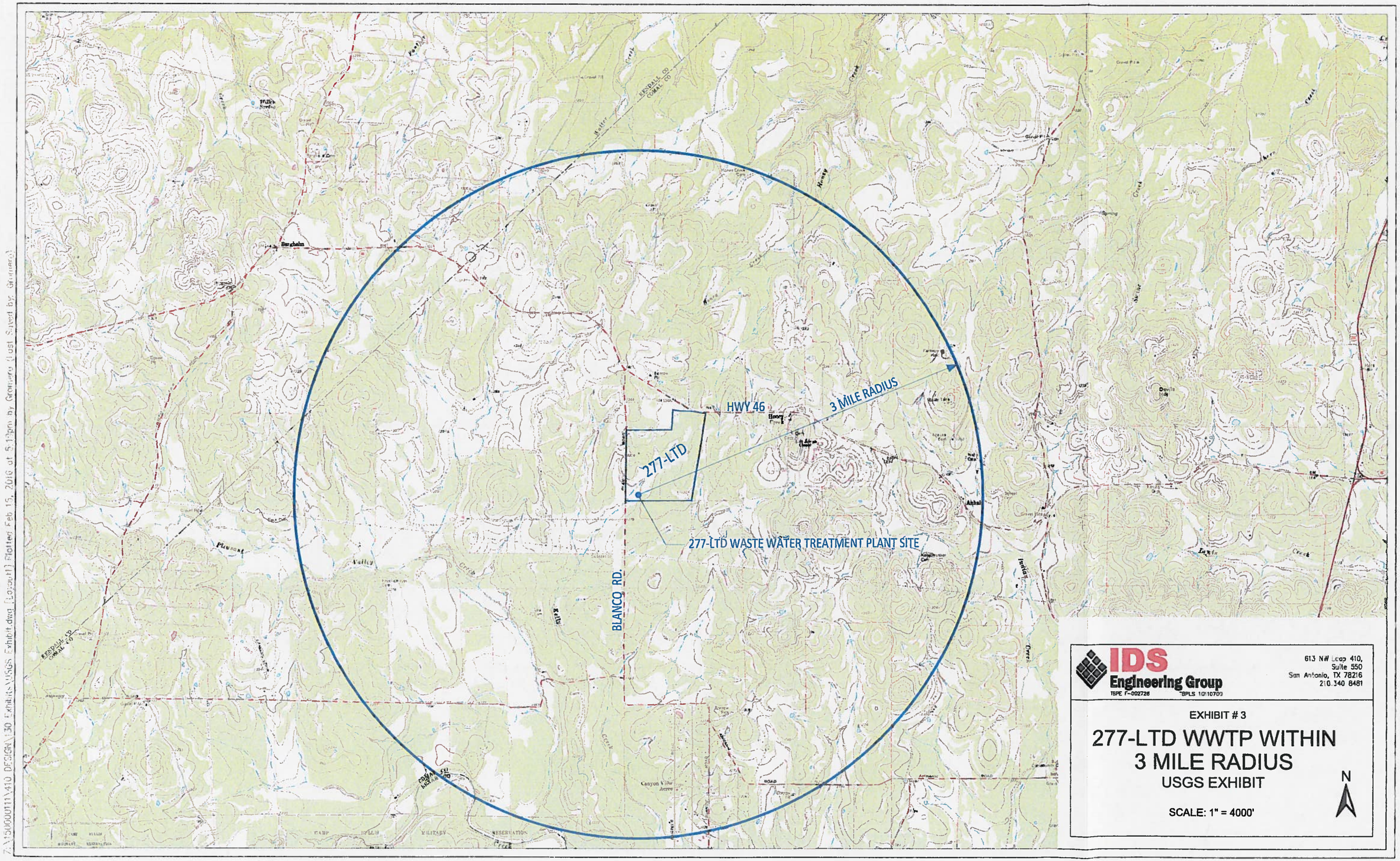

IDS Engineering Group
613 NW Loop 410, Suite 550
San Antonio, Texas 78216
Phone. 210-340-8481
EXHIBIT NO. 2
COMAL COUNTY
W.C.I.D. NO. 6
SERVICE AREA AND
DISTRICT BOUNDARY MAP
N
0 250 500 1,000 1,500 2,000 Feet
1 inch = 1,000 feet
46
STATE HWY 46 W
Honey Creek
Kelley Creek
BLANCO RD
CIRCLE G RANCH
Comal County Water Control and Improvement District No. 6
Legend
WCID No. 6 Participants
Bulverde City Limits
Comal Co. Parcels (03-2013)
USGS Contours
Streams & Rivers
This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries

EXHIBIT 3
USGS SURROUNDING AREA MAP

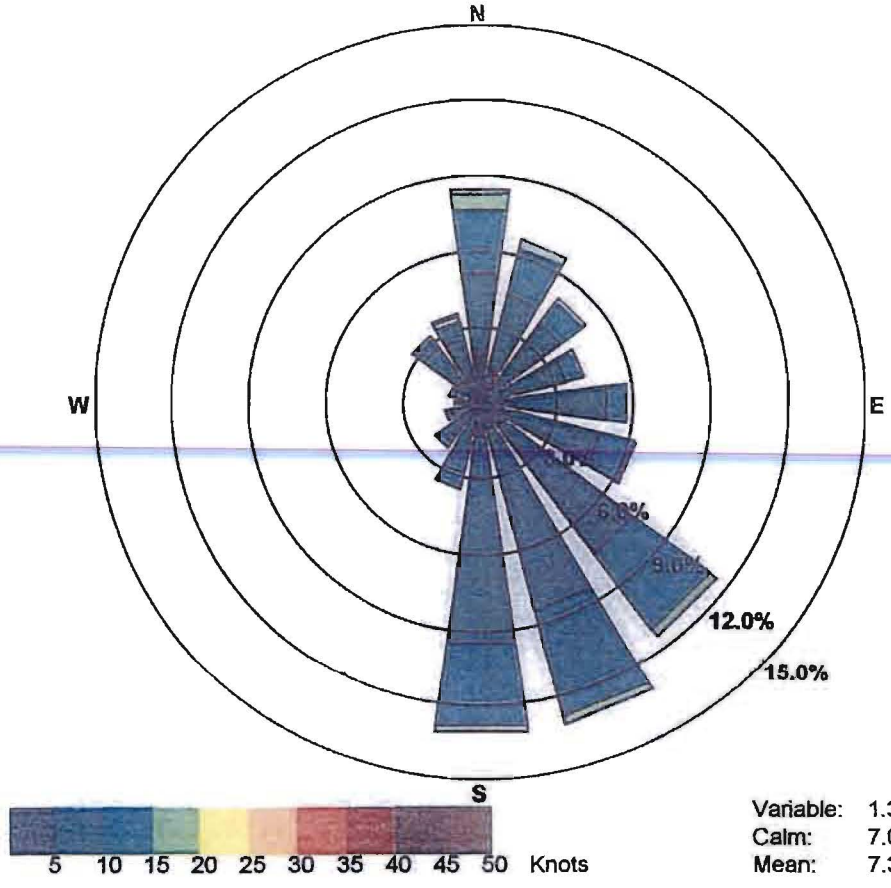


Z:\150000111\410 DESIGN\130 Exhibits\USGS Exhibit.dwg [Layout1] Plotted Feb 15, 2016 at 5:13pm by Gromero (Last Saved by: Gromero)

EXHIBIT 4
WIND ROSE

SAN ANTONIO INTL AP

30-year summary: 1978-2007



Variable: 1.3%
Calm: 7.0%
Mean: 7.3 KT

DATA; NOAA SATELLITE AND INFORMATION SERVICE

IDS Engineering Group
TBPE F-002726 TBPLS 10110700
613 NW Loop 410,
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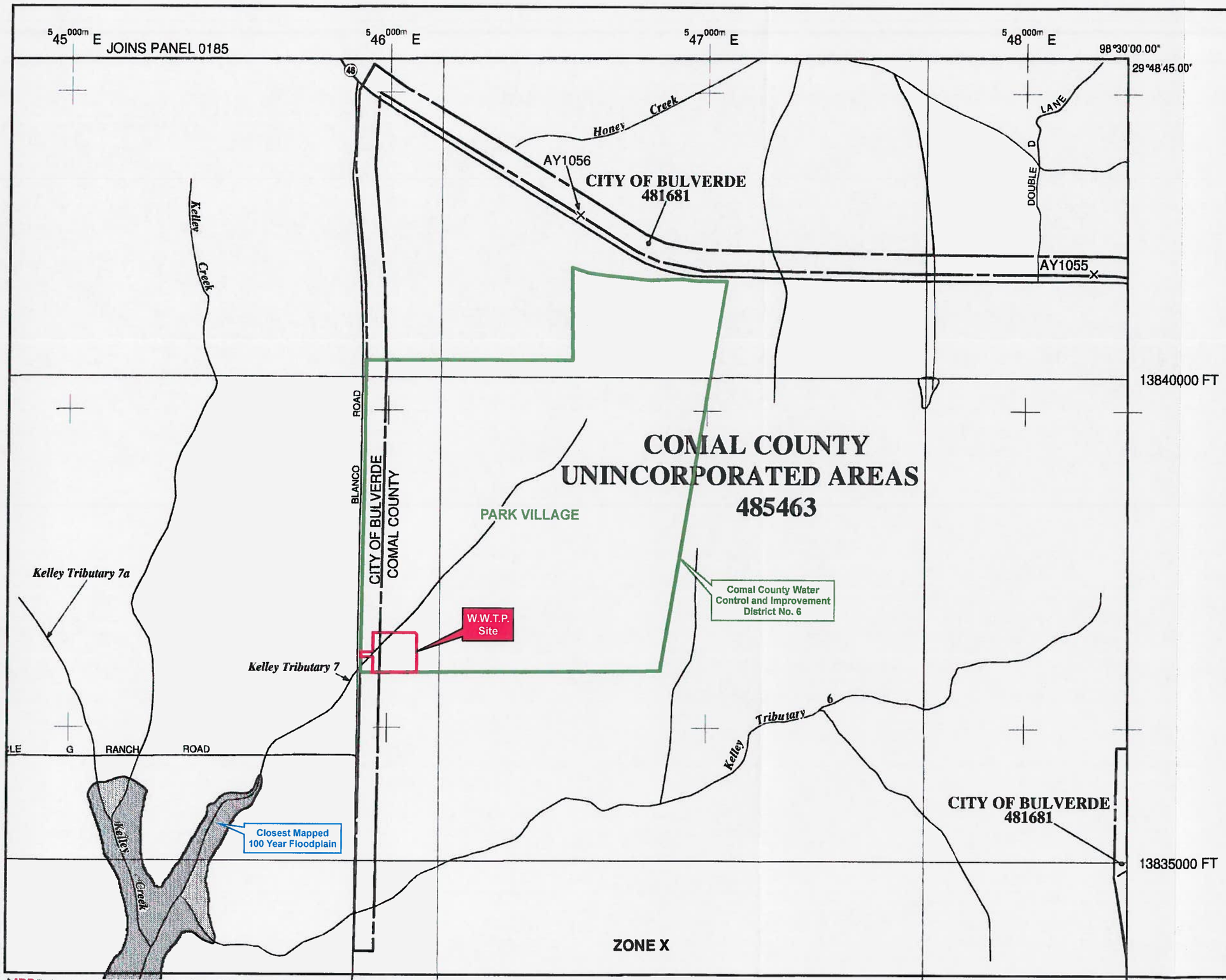
210.340.8481

EXHIBIT # 4

SAN ANTONIO INTL AIRPORT
WIND ROSE EXHIBIT

EXHIBIT 5
FEMA, FIRM MAP



National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A — No Base Flood Elevations determined.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0195F

FIRM
FLOOD INSURANCE RATE MAP
COMAL COUNTY, TEXAS
AND INCORPORATED AREAS

PANEL 195 OF 505

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COMAL COUNTY	485463	0195	F
BULVERDE CITY OF	481681	0195	F

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

MAP NUMBER
48091C0195F

EFFECTIVE DATE
SEPTEMBER 2, 2009

Federal Emergency Management Agency

IDS Engineering Group
613 NW Loop 410, Suite 550
San Antonio, Texas 78216
Phone: 210-340-8481

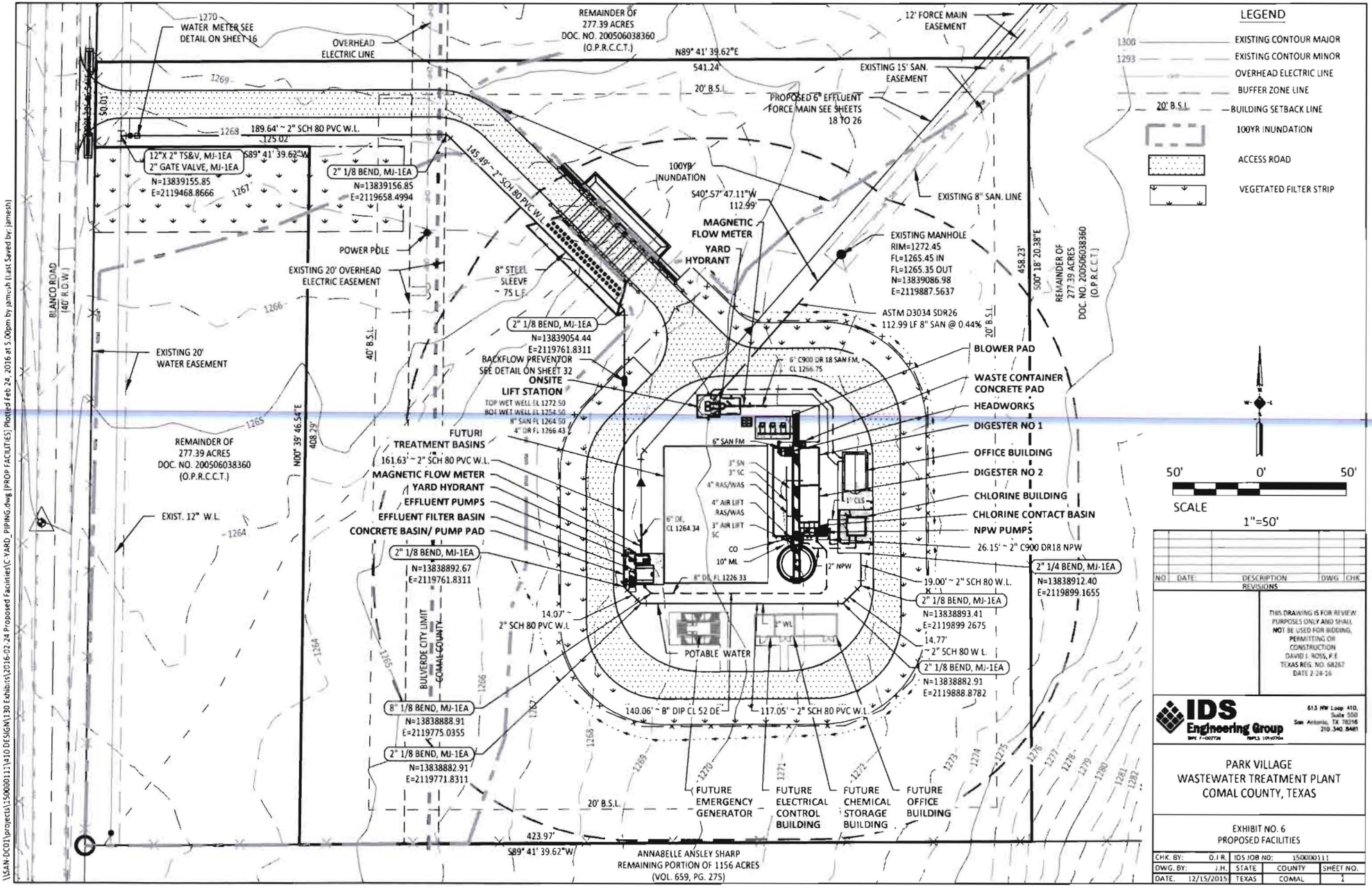
EXHIBIT NO. 5

COMAL COUNTY W.C.I.D. NO. 6
FEMA FIRM MAP

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

IDS Engineering Group Path: \\hou-sde01\Projects\1500\1500-001-11_ParkVillage_WWTP_PH1\Ex5-CCWID6_Firmette09_11x17.mxd Date: 2/3/2016 9:53:36 AM User: amandan

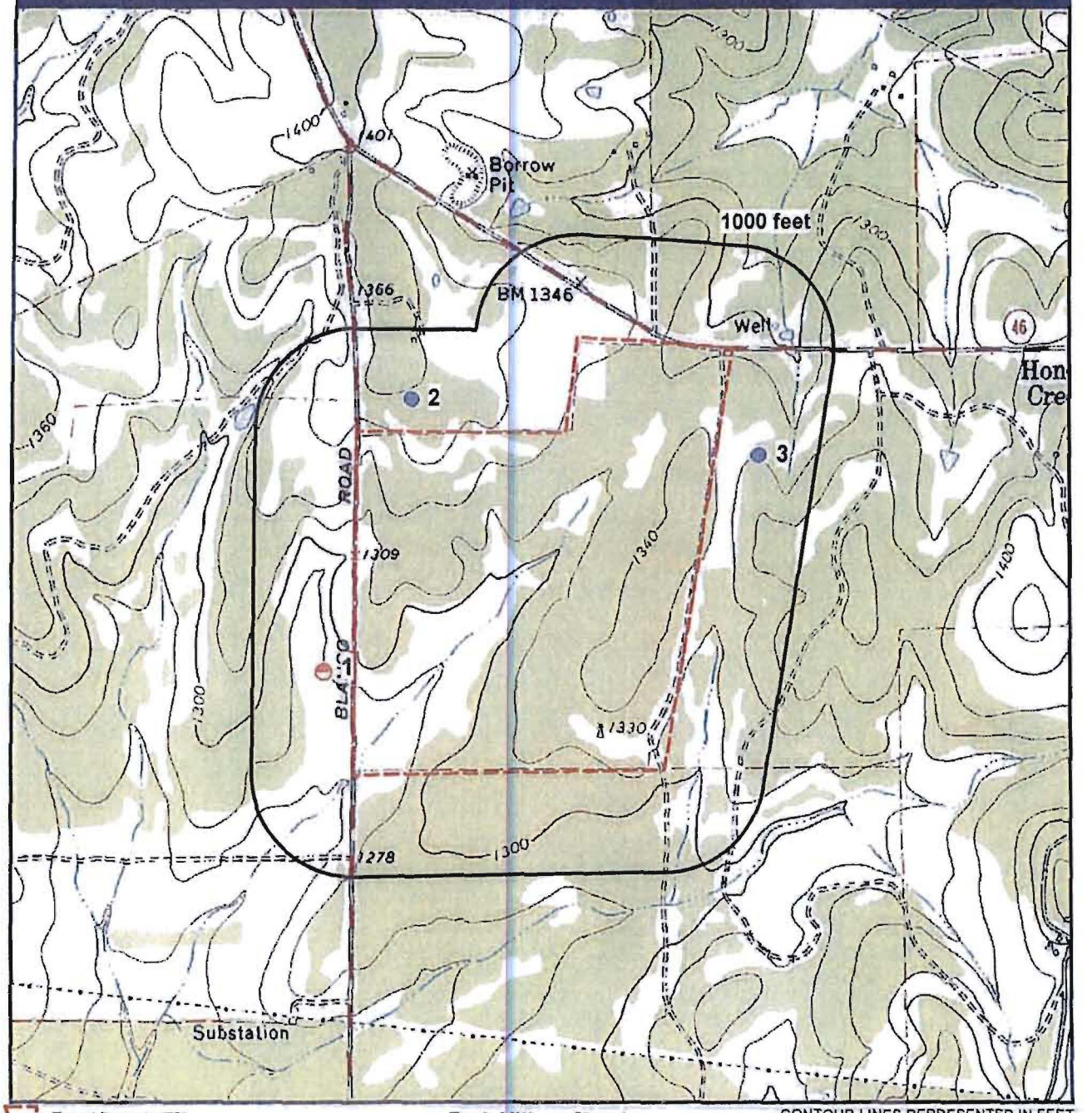
EXHIBIT 6
PROPOSED FACILITIES



\\SAN-DC01\projects\150000111\410 DESIGN\130 Exhibits\2016-02-24 Proposed Facilities\C YARD_ PIPING.dwg [PROP FACILITIES] Plotted Feb 24, 2016 at 5:00pm by jamesh (Last Saved by: jamesh)

EXHIBIT 7
WATER WELLS WITHIN 1,000 FEET
OF COMAL COUNTY WC&ID No. 6 MAP

WATER WELL MAP



Target Property (TP)
SDRD
TCEQ

Park Village Tract
SAN ANTONIO, Texas
78163

CONTOUR LINES REPRESENTED IN FEET

N
W E
S

0' 750' 1500' 2250'
SCALE: 1" = 1500'

GeoSearch 2705 Bee Caves Rd, Suite 330 - Austin, Texas 78746 - phone: 866-396-0042 - fax: 512-472-9967

JOB #: 5742 - 4/17/2009

EXHIBIT 8
PARK VILLAGE SUBDIVISION LAND PLAN

APPENDIX A
TCEQ DISCHARGE PERMIT NO. WQ0012346-001

TPDES PERMIT NO. WQ0014959001
[For TCEQ office use only - EPA I.D. No, TX0135135]

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
P.O. Box 13087
Austin, Texas 78711-3087

This amendment supersedes and replaces State TLAP Permit No. WQ0014959001 issued April 14, 2011.

PERMIT TO DISCHARGE WASTES
under provisions of
Section 402 of the Clean Water Act
and Chapter 26 of the Texas Water Code

Two Seventy Seven Limited and Guadalupe-Blanco River Authority

whose mailing address is

1826 North Loop 1604 West
San Antonio, Texas 78248

is authorized to treat and discharge wastes from the Park Village Wastewater Treatment Facility, SIC Code 4952

located approximately 5,900 feet south of the intersection of State Highway 46 and Blanco Road, and approximately 600 feet east from the Blanco Road right of way on the applicant's property, in Comal County, Texas 78163

to a grassy swale; thence to an unnamed tributary; thence to Kelly Creek; thence to Upper Cibolo Creek in Segment No. 1908 of the San Antonio River Basin

only according with effluent limitations, monitoring requirements and other conditions set forth in this permit, as well as the rules of the Texas Commission on Environmental Quality (TCEQ), the laws of the State of Texas, and other orders of the TCEQ. The issuance of this permit does not grant to the permittee the right to use private or public property for conveyance of wastewater along the discharge route described in this permit. This includes, but is not limited to, property belonging to any individual, partnership, corporation, or other entity. Neither does this permit authorize any invasion of personal rights nor any violation of federal, state, or local laws or regulations. It is the responsibility of the permittee to acquire property rights as may be necessary to use the discharge route.

This permit shall expire at midnight, March 1, 2018.

ISSUED DATE: October 8, 2014

For the Commission

INTERIM EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS Outfall Number 001

1. During the period beginning upon the date of issuance and lasting through the completion of the expansion to the 0.195 million gallons per day (MGD) facilities the permittees are authorized to discharge subject to the following effluent limitations:

   The daily average flow of effluent shall not exceed 0.098 MGD, nor shall the average discharge during any two-hour period (2-hour peak) exceed 197 gallons per minute (gpm).

Effluent Characteristic	Discharge Limitations					
	Daily Avg mg/1 (lbs/day)	7-day Avg mg/1	Daily Max mg/1	Single Grab mg/1	Report Daily Avg. & Max. Single Grab Measurement Frequency	Sample Type
Flow, MGD	Report	N/A	Report	N/A	Continuous	Totalizing Meter
Carbonaceous Biochemical Oxygen Demand (5-day)	5 (4-i)	10	20	30	One/week	Grab
Total Suspended Solids	5 (4-i)	10	20	30	One/week	Grab
Ammonia Nitrogen	2 (1.6)	5	10	15	One/week	Grab
Total Phosphorus	1 (0.82)	2	4	6	One/week	Grab
E. coli, CFU or MPN/100 ml	126	N/A	N/A	399	One/quarter	Grab

2. The effluent shall contain a chlorine residual of at least 1.0 mg/1 and shall not exceed a chlorine residual of 4.0 mg/1 after a detention time of at least 20 minutes (based on peak flow), and shall be monitored five times per week by grab sample. An equivalent method of disinfection may be substituted only with prior approval of the Executive Director.

3. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per month by grab sample.

4. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.

5. Effluent monitoring samples shall be taken at the following location(s): Following the final treatment unit.

6. The effluent shall contain a minimum dissolved oxygen of 4.0 mg/1 and shall be monitored once per week by grab sample.

FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS Outfall Number 001

1. During the period beginning upon the completion of the expansion to the 0.195 MGD facilities and lasting through the date of expiration, the permittees are authorized to discharge subject to the following effluent limitations:

   The daily average flow of effluent shall not exceed 0.195 MGD; nor shall the average discharge during any two-hour period (2-hour peak) exceed 542 gpm.

Effluent Characteristic	Discharge Limitations					
	Daily Avg mg/1 (lbs/day)	7-day Avg mg/1	Daily Max mg/1	Single Grab mg/1	Report Daily Avg. & Max. Single Grab Measurement Frequency	Sample Type
Flow, MGD	Report	N/A	Report	N/A	Continuous	Totalizing Meter
Carbonaceous Biochemical Oxygen Demand (5-day)	5 (8.1)	10	20	30	One/week	Grab
Total Suspended Solids	5 (8.1)	10	20	30	One/week	Grab
Ammonia Nitrogen	2 (3.2)	5	10	15	One/week	Grab
Total Phosphorus	1(1.6)	2	4	6	One/week	Grab
E. coli, CFU or MPN/100 ml	126	N/A	N/A	399	One/month	Grab

2. The effluent shall contain a chlorine residual of at least 1.0 mg/1 and shall not exceed a chlorine residual of 4.0 mg/1 after a detention time of at least 20 minutes (based on peak flow), and shall be monitored five times per week by grab sample. An equivalent method of disinfection may be substituted only with prior approval of the Executive Director.

3. The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored once per month by grab sample.

4. There shall be no discharge of floating solids or visible foam in other than trace amounts and no discharge of visible oil.

5. Effluent monitoring samples shall be taken at the following location(s): Following the final treatment unit.

6. The effluent shall contain a minimum dissolved oxygen of 4.0 mg/1 and shall be monitored once per week by grab sample.

DEFINITIONS AND STANDARD PERMIT CONDITIONS

As required by Title 30 Texas Administrative Code (TAC) Chapter 305, certain regulations appear as standard conditions in waste discharge permits. 30 TAC § 305.121 - 305.129 (relating to Permit Characteristics and Conditions) as promulgated under the Texas Water Code (TWC) §§ 5.103 and 5.105, and the Texas Health and Safety Code (THSC) §§ 361.017 and 361.024(a), establish the characteristics and standards for waste discharge permits, including sewage sludge, and those sections of 40 Code of Federal Regulations (CFR) Part 122 adopted by reference by the Commission. The following text includes these conditions and incorporates them into this permit. All definitions in TWC § 26.001 and 30 TAC Chapter 305 shall apply to this permit and are incorporated by reference. Some specific definitions of words or phrases used in this permit are as follows:

1. Flow Measurements

   a. Annual average flow - the arithmetic average of all daily flow determinations taken within the preceding 12 consecutive calendar months. The annual average flow determination shall consist of daily flow volume determinations made by a totalizing meter, charted on a chart recorder and limited to major domestic wastewater discharge facilities with one million gallons per day or greater permitted flow.

   b. Daily average flow - the arithmetic average of all determinations of the daily flow within a period of one calendar month. The daily average flow determination shall consist of determinations made on at least four separate days. If instantaneous measurements are used to determine the daily flow, the determination shall be the arithmetic average of all instantaneous measurements taken during that month. Daily average flow determination for intermittent discharges shall consist of a minimum of three flow determinations on days of discharge.

   c. Daily maximum flow - the highest total flow for any 24-hour period in a calendar month.

   d. Instantaneous flow - the measured flow during the minimum time required to interpret the flow measuring device.

   e. 2-hour peak flow (domestic wastewater treatment plants) - the maximum flow sustained for a two-hour period during the period of daily discharge. The average of multiple measurements of instantaneous maximum flow within a two-hour period may be used to calculate the 2-hour peak flow.

   f. Maximum 2-hour peak flow (domestic wastewater treatment plants) - the highest 2-hour peak flow for any 24-hour period in a calendar month.

2. Concentration Measurements

   a. Daily average concentration - the arithmetic average of all effluent samples, composite or grab as required by this permit, within a period of one calendar month, consisting of at least four separate representative measurements.

      i. For domestic wastewater treatment plants - When four samples are not available in a calendar month, the arithmetic average (weighted by flow) of all values in the previous four consecutive month period consisting of at least four measurements shall be utilized as the daily average concentration.

ii. For all other wastewater treatment plants - When four samples are not available in a calendar month, the arithmetic average (weighted by flow) of all values taken during the month shall be utilized as the daily average concentration.

b. 7-day average concentration - the arithmetic average of all effluent samples, composite or grab as required by this permit, within a period of one calendar week, Sunday through Saturday.

c. Daily maximum concentration - the maximum concentration measured on a single day, by the sample type specified in the permit, within a period of one calendar month.

d. Daily discharge - the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in terms of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the sampling day. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the average measurement of the pollutant over the sampling day.

The daily discharge determination of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily discharge determination of concentration shall be the arithmetic average (weighted by flow value) of all samples collected during that day.

e. Bacteria concentration (E. coli or Enterococci) - Colony Forming Units (CFU) or Most Probable Number (MPN) of bacteria per 100 milliliters effluent. The daily average bacteria concentration is a geometric mean of the values for the effluent samples collected in a calendar month. The geometric mean shall be determined by calculating the nth root of the product of all measurements made in a calendar month, where n equals the number of measurements made; or, computed as the antilogarithm of the arithmetic mean of the logarithms of all measurements made in a calendar month. For any measurement of bacteria equaling zero, a substituted value of one shall be made for input into either computation method. If specified, the 7-day average for bacteria is the geometric mean of the values for all effluent samples collected during a calendar week.

f. Daily average loading (lbs/day) - the arithmetic average of all daily discharge loading calculations during a period of one calendar month. These calculations must be made for each day of the month that a parameter is analyzed. The daily discharge, in terms of mass (lbs/day), is calculated as (Flow, MGD x Concentration, mg/1 x 8.34).

g. Daily maximum loading (lbs/day) - the highest daily discharge, in terms of mass (lbs/day), within a period of one calendar month.

3. Sample Type

a. Composite sample - For domestic wastewater, a composite sample is a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow, and collected at the intervals required by 30 TAC § 319.9 (a). For industrial wastewater, a composite sample is a sample made up of a minimum of three effluent portions collected in a continuous 24-hour period or during the period of daily discharge if less than 24 hours, and combined in volumes proportional to flow, and collected at the intervals required by 30 TAC § 319.9 (b).

b. Grab sample - an individual sample collected in less than 15 minutes.

4. Treatment Facility (facility) - wastewater facilities used in the conveyance, storage, treatment, recycling, reclamation and/or disposal of domestic sewage, industrial wastes, agricultural wastes, recreational wastes, or other wastes including sludge handling or disposal facilities under the jurisdiction of the Commission.

5. The term "sewage sludge" is defined as solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in 30 TAC Chapter 312. This includes the solids that have not been classified as hazardous waste separated from wastewater by unit processes.

6. Bypass - the intentional diversion of a waste stream from any portion of a treatment facility.

MONITORING AND REPORTING REQUIREMENTS

1. Self-Reporting

Monitoring results shall be provided at the intervals specified in the permit. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall conduct effluent sampling and reporting in accordance with 30 TAC §§ 319.4 - 319.12. Unless otherwise specified, a monthly effluent report shall be submitted each month, to the Enforcement Division (MC 224), by the 20th day of the following month for each discharge which is described by this permit whether or not a discharge is made for that month. Monitoring results must be reported on an approved self-report form that is signed and certified as required by Monitoring and Reporting Requirements No. 10.

As provided by state law, the permittee is subject to administrative, civil and criminal penalties, as applicable, for negligently or knowingly violating the Clean Water Act (CWA); TWC §§ 26, 27, and 28; and THSC § 361, including but not limited to knowingly making any false statement, representation, or certification on any report, record, or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, or falsifying, tampering with or knowingly rendering inaccurate any monitoring device or method required by this permit or violating any other requirement imposed by state or federal regulations.

2. Test Procedures

a. Unless otherwise specified in this permit, test procedures for the analysis of pollutants shall comply with procedures specified in 30 TAC §§ 319.11 - 319.12. Measurements, tests, and calculations shall be accurately accomplished in a representative manner.

b. All laboratory tests submitted to demonstrate compliance with this permit must meet the requirements of 30 TAC § 25, Environmental Testing Laboratory Accreditation and Certification.

3. Records of Results

a. Monitoring samples and measurements shall be taken at times and in a manner so as to be representative of the monitored activity.

b. Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503), monitoring and reporting records, including strip charts and records of calibration and maintenance, copies of all records required by this permit, records of all data used to complete the application for this permit, and the certification required by 40 CFR § 264.73(b)(9) shall be retained at the facility site, or shall be readily available for review by a TCEQ representative for a period of three years from the date of the record or sample, measurement, report, application or certification. This period shall be extended at the request of the Executive Director.

c. Records of monitoring activities shall include the following:

i. date, time and place of sample or measurement;

ii. identity of individual who collected the sample or made the measurement.

iii. date and time of analysis;

iv. identity of the individual and laboratory who performed the analysis;

v. the technique or method of analysis; and

vi. the results of the analysis or measurement and quality assurance/quality control records.

The period during which records are required to be kept shall be automatically extended to the date of the final disposition of any administrative or judicial enforcement action that may be instituted against the permittee.

4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit using approved analytical methods as specified above, all results of such monitoring shall be included in the calculation and reporting of the values submitted on the approved self-report form. Increased frequency of sampling shall be indicated on the self-report form.

5. Calibration of Instruments

All automatic flow measuring or recording devices and all totalizing meters for measuring flows shall be accurately calibrated by a trained person at plant start-up and as often thereafter as necessary to ensure accuracy, but not less often than annually unless authorized by the Executive Director for a longer period. Such person shall verify in writing that the device is operating properly and giving accurate results. Copies of the verification shall be retained at the facility site and/or shall be readily available for review by a TCEQ representative for a period of three years.

6. Compliance Schedule Reports

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of the permit shall be submitted no later

than 14 days following each schedule date to the Regional Office and the Enforcement Division (MC 224).

7. Noncompliance Notification

   a. In accordance with 30 TAC § 305.125(9) any noncompliance which may endanger human health or safety, or the environment shall be reported by the permittee to the TCEQ. Report of such information shall be provided orally or by facsimile transmission (FAX) to the Regional Office within 24 hours of becoming aware of the noncompliance. A written submission of such information shall also be provided by the permittee to the Regional Office and the Enforcement Division (MC 224) within five working days of becoming aware of the noncompliance. The written submission shall contain a description of the noncompliance and its cause; the potential danger to human health or safety, or the environment; the period of noncompliance, including exact dates and times; if the noncompliance has not been corrected, the time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance, and to mitigate its adverse effects.

   b. The following violations shall be reported under Monitoring and Reporting Requirement 7.a.:

      i. Unauthorized discharges as defined in Permit Condition 2(g).

      ii. Any unanticipated bypass that exceeds any effluent limitation in the permit.

      iii. Violation of a permitted maximum daily discharge limitation for pollutants listed specifically in the Other Requirements section of an Industrial TPDES permit.

   c. In addition to the above, any effluent violation which deviates from the permitted effluent limitation by more than 40% shall be reported by the permittee in writing to the Regional Office and the Enforcement Division (MC 224) within 5 working days of becoming aware of the noncompliance.

   d. Any noncompliance other than that specified in this section, or any required information not submitted or submitted incorrectly, shall be reported to the Enforcement Division (MC 224) as promptly as possible. For effluent limitation violations, noncompliances shall be reported on the approved self-report form.

8. In accordance with the procedures described in 30 TAC §§ 35.301 - 35.303 (relating to Water Quality Emergency and Temporary Orders) if the permittee knows in advance of the need for a bypass, it shall submit prior notice by applying for such authorization.

9. Changes in Discharges of Toxic Substances

   All existing manufacturing, commercial, mining, and silvicultural permittees shall notify the Regional Office, orally or by facsimile transmission within 24 hours, and both the Regional Office and the Enforcement Division (MC 224) in writing within five (5) working days, after becoming aware of or having reason to believe:

   a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant listed at 40 CFR Part 122, Appendix D,

Tables II and III (excluding Total Phenols) which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

i. One hundred micrograms per liter (100 pg/L);

ii. Two hundred micrograms per liter (200 pg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 pg/L) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;

iii. Five (5) times the maximum concentration value reported for that pollutant in the permit application; or

iv. The level established by the TCEQ.

b. That any activity has occurred or will occur which would result in any discharge, on a nonroutine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

i. Five hundred micrograms per liter (500 pg/L);

ii. One milligram per liter (1 mg/L) for antimony;

iii. Ten (10) times the maximum concentration value reported for that pollutant in the permit application; or

iv. The level established by the TCEQ.

10. Signatories to Reports

All reports and other information requested by the Executive Director shall be signed by the person and in the manner required by 30 TAC § 305.128 (relating to Signatories to Reports).

11. All Publicly Owned Treatment Works (POTWs) must provide adequate notice to the Executive Director of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to CWA § 301 or § 306 if it were directly discharging those pollutants;

b. Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit; and

c. For the purpose of this paragraph, adequate notice shall include information on:

i. The quality and quantity of effluent introduced into the POTW; and

ii. Any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

PERMIT CONDITIONS

1. General

   a. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in an application or in any report to the Executive Director, it shall promptly submit such facts or information.

   b. This permit is granted on the basis of the information supplied and representations made by the permittee during action on an application, and relying upon the accuracy and completeness of that information and those representations. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked, in whole or in part, in accordance with 30 TAC Chapter 305, Subchapter D, during its term for good cause including, but not limited to, the following:

      i. Violation of any terms or conditions of this permit;

      ii. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

      iii. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

   c. The permittee shall furnish to the Executive Director, upon request and within a reasonable time, any information to determine whether cause exists for amending, revoking, suspending or terminating the permit. The permittee shall also furnish to the Executive Director, upon request, copies of records required to be kept by the permit.

2. Compliance

   a. Acceptance of the permit by the person to whom it is issued constitutes acknowledgment and agreement that such person will comply with all the terms and conditions embodied in the permit, and the rules and other orders of the Commission.

   b. The permittee has a duty to comply with all conditions of the permit. Failure to comply with any permit condition constitutes a violation of the permit and the Texas Water Code or the Texas Health and Safety Code, and is grounds for enforcement action, for permit amendment, revocation, or suspension, or for denial of a permit renewal application or an application for a permit for another facility.

   c. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit.

   d. The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal or other permit violation that has a reasonable likelihood of adversely affecting human health or the environment.

   e. Authorization from the Commission is required before beginning any change in the permitted facility or activity that may result in noncompliance with any permit requirements.

f. A permit may be amended, suspended and reissued, or revoked for cause in accordance with 30 TAC §§ 305.62 and 305.66 and TWC§ 7.302. The filing of a request by the permittee for a permit amendment, suspension and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

g. There shall be no unauthorized discharge of wastewater or any other waste. For the purpose of this permit, an unauthorized discharge is considered to be any discharge of wastewater into or adjacent to water in the state at any location not permitted as an outfall or otherwise defined in the Other Requirements section of this permit.

h. In accordance with 30 TAC § 305.535(a), the permittee may allow any bypass to occur from a TPDES permitted facility which does not cause permitted effluent limitations to be exceeded or an unauthorized discharge to occur, but only if the bypass is also for essential maintenance to assure efficient operation.

i. The permittee is subject to administrative, civil, and criminal penalties, as applicable, under TWO §§ 7.051 - 7.075 (relating to Administrative Penalties), 7.101 - 7.111 (relating to Civil Penalties), and 7.141 - 7.202 (relating to Criminal Offenses and Penalties) for violations including, but not limited to, negligently or knowingly violating the federal CWA §§ 301, 302, 306, 307, 308, 318, or 405, or any condition or limitation implementing any sections in a permit issued under the CWA § 402, or any requirement imposed in a pretreatment program approved under the CWA §§ 402 (a)(3) or 402 (b)(8).

3. Inspections and Entry

a. Inspection and entry shall be allowed as prescribed in the TWC Chapters 26, 27, and 28, and THSC § 361.

b. The members of the Commission and employees and agents of the Commission are entitled to enter any public or private property at any reasonable time for the purpose of inspecting and investigating conditions relating to the quality of water in the state or the compliance with any rule, regulation, permit or other order of the Commission. Members, employees, or agents of the Commission and Commission contractors are entitled to enter public or private property at any reasonable time to investigate or monitor or, if the responsible party is not responsive or there is an immediate danger to public health or the environment, to remove or remediate a condition related to the quality of water in the state. Members, employees, Commission contractors, or agents acting under this authority who enter private property shall observe the establishment's rules and regulations concerning safety, internal security, and fire protection, and if the property has management in residence, shall notify management or the person then in charge of his presence and shall exhibit proper credentials. If any member, employee, Commission contractor, or agent is refused the right to enter in or on public or private property under this authority, the Executive Director may invoke the remedies authorized in TWC § 7.002. The statement above, that Commission entry shall occur in accordance with an establishment's rules and regulations concerning safety, internal security, and fire protection, is not grounds for denial or restriction of entry to any part of the facility, but merely describes the Commission's duty to observe appropriate rules and regulations during an inspection.

4. Permit Amendment and/or Renewal

   a. The permittee shall give notice to the Executive Director as soon as possible of any planned physical alterations or additions to the permitted facility if such alterations or additions would require a permit amendment or result in a violation of permit requirements. Notice shall also be required under this paragraph when:

      i. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in accordance with 30 TAC § 305.534 (relating to New Sources and New Dischargers); or

      ii. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are subject neither to effluent limitations in the permit, nor to notification requirements in Monitoring and Reporting Requirements No. 9;

      iii. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.

   b. Prior to any facility modifications, additions, or expansions that will increase the plant capacity beyond the permitted flow, the permittee must apply for and obtain proper authorization from the Commission before commencing construction.

   c. The permittee must apply for an amendment or renewal at least 180 days prior to expiration of the existing permit in order to continue a permitted activity after the expiration date of the permit. If an application is submitted prior to the expiration date of the permit, the existing permit shall remain in effect until the application is approved, denied, or returned. If the application is returned or denied, authorization to continue such activity shall terminate upon the effective date of the action. If an application is not submitted prior to the expiration date of the permit, the permit shall expire and authorization to continue such activity shall terminate.

   d. Prior to accepting or generating wastes which are not described in the permit application or which would result in a significant change in the quantity or quality of the existing discharge, the permittee must report the proposed changes to the Commission. The permittee must apply for a permit amendment reflecting any necessary changes in permit conditions, including effluent limitations for pollutants not identified and limited by this permit.

   e. In accordance with the TWC § 26.029(b), after a public hearing, notice of which shall be given to the permittee, the Commission may require the permittee, from time to time, for good cause, in accordance with applicable laws, to conform to new or additional conditions.

   f. If any toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is promulgated under CWA § 307(a) for a toxic pollutant which is present in the discharge and that standard or prohibition is more stringent than any limitation on the pollutant in this permit, this permit shall be

modified or revoked and reissued to conform to the toxic effluent standard or prohibition. The permittee shall comply with effluent standards or prohibitions established under CWA § 307(a) for toxic pollutants within the time provided in the regulations that established those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

5. Permit Transfer

   a. Prior to any transfer of this permit, Commission approval must be obtained. The Commission shall be notified in writing of any change in control or ownership of facilities authorized by this permit. Such notification should be sent to the Applications Review and Processing Team (MC 148) of the Water Quality Division.

   b. A permit may be transferred only according to the provisions of 30 TAC § 305.64 (relating to Transfer of Permits) and 30 TAC § 50.133 (relating to Executive Director Action on Application or WQMP update).

6. Relationship to Hazardous Waste Activities

   This permit does not authorize any activity of hazardous waste storage, processing, or disposal that requires a permit or other authorization pursuant to the Texas Health and Safety Code.

7. Relationship to Water Rights

   Disposal of treated effluent by any means other than discharge directly to water in the state must be specifically authorized in this permit and may require a permit pursuant to TWC Chapter 11.

8. Property Rights

   A permit does not convey any property rights of any sort, or any exclusive privilege.

9. Permit Enforceability

   The conditions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

10. Relationship to Permit Application

    The application pursuant to which the permit has been issued is incorporated herein; provided, however, that in the event of a conflict between the provisions of this permit and the application, the provisions of the permit shall control.

11. Notice of Bankruptcy

    a. Each permittee shall notify the Executive Director, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any chapter of Title 11 Bankruptcy) of the United States Code (11 USC) by or against:

i. the permittee;

ii. an entity (as that term is defined in 11 USC, § 101(14)) controlling the permittee or listing the permit or permittee as property of the estate; or

iii. an affiliate (as that term is defined in 11 USC, § 101(2)) of the permittee.

b. This notification must indicate:

i. the name of the permittee and the permit number(s);

ii. the bankruptcy court in which the petition for bankruptcy was filed; and

iii. the date of filing of the petition.

OPERATIONAL REQUIREMENTS

1. The permittee shall at all times ensure that the facility and all of its systems of collection, treatment, and disposal are properly operated and maintained. This includes, but is not limited to, the regular, periodic examination of wastewater solids within the treatment plant by the operator in order to maintain an appropriate quantity and quality of solids inventory as described in the various operator training manuals and according to accepted industry standards for process control. Process control, maintenance, and operations records shall be retained at the facility site, or shall be readily available for review by a TCEQ representative, for a period of three years.

2. Upon request by the Executive Director, the permittee shall take appropriate samples and provide proper analysis in order to demonstrate compliance with Commission rules. Unless otherwise specified in this permit or otherwise ordered by the Commission, the permittee shall comply with all applicable provisions of 30 TAC Chapter 312 concerning sewage sludge use and disposal and 30 TAC §§ 319.21 - 319.29 concerning the discharge of certain hazardous metals.

3. Domestic wastewater treatment facilities shall comply with the following provisions:

a. The permittee shall notify the Municipal Permits Team, Wastewater Permitting Section (MC 148) of the Water Quality Division, in writing, of any facility expansion at least 90 days prior to conducting such activity.

b. The permittee shall submit a closure plan for review and approval to the Municipal Permits Team, Wastewater Permitting Section (MC 148) of the Water Quality Division, for any closure activity at least 90 days prior to conducting such activity. Closure is the act of permanently taldng a waste management unit or treatment facility out of service and includes the permanent removal from service of any pit, tank, pond, lagoon, surface impoundment and/or other treatment unit regulated by this permit.

4. The permittee is responsible for installing prior to plant start-up, and subsequently maintaining, adequate safeguards to prevent the discharge of untreated or inadequately treated wastes during electrical power failures by means of alternate power sources, standby generators, and/or retention of inadequately treated wastewater.

5. Unless otherwise specified, the permittee shall provide a readily accessible sampling point and, where applicable, an effluent flow measuring device or other acceptable means by which effluent flow may be determined.

6. The permittee shall remit an annual water quality fee to the Commission as required by 30 TAC Chapter 21. Failure to pay the fee may result in revocation of this permit under TWC § 7.302(b)(6).

7. Documentation

   For all written notifications to the Commission required of the permittee by this permit, the permittee shall keep and make available a copy of each such notification under the same conditions as self-monitoring data are required to be kept and made available. Except for information required for TPDES permit applications, effluent data, including effluent data in permits, draft permits and permit applications, and other information specified as not confidential in 30 TAC §§ 1.5(d), any information submitted pursuant to this permit may be claimed as confidential by the submitter. Any such claim must be asserted in the manner prescribed in the application form or by stamping the words confidential business information on each page containing such information. If no claim is made at the time of submission, information may be made available to the public without further notice. If the Commission or Executive Director agrees with the designation of confidentiality, the TCEQ will not provide the information for public inspection unless required by the Texas Attorney General or a court pursuant to an open records request. If the Executive Director does not agree with the designation of confidentiality, the person submitting the information will be notified.

8. Facilities that generate domestic wastewater shall comply with the following provisions; domestic wastewater treatment facilities at permitted industrial sites are excluded.

   a. Whenever flow measurements for any domestic sewage treatment facility reach 75% of the permitted daily average or annual average flow for three consecutive months, the permittee must initiate engineering and financial planning for expansion and/or upgrading of the domestic wastewater treatment and/or collection facilities. Whenever the flow reaches 90% of the permitted daily average or annual average flow for three consecutive months, the permittee shall obtain necessary authorization from the Commission to commence construction of the necessary additional treatment and/or collection facilities. In the case of a domestic wastewater treatment facility which reaches 75% of the permitted daily average or annual average flow for three consecutive months, and the planned population to be served or the quantity of waste produced is not expected to exceed the design limitations of the treatment facility, the permittee shall submit an engineering report supporting this claim to the Executive Director of the Commission.

      If in the judgment of the Executive Director the population to be served will not cause permit noncompliance, then the requirement of this section may be waived. To be effective, any waiver must be in writing and signed by the Director of the Enforcement Division (MC 169) of the Commission, and such waiver of these requirements will be reviewed upon expiration of the existing permit; however, any such waiver shall not be interpreted as condoning or excusing any violation of any permit parameter.

b. The plans and specifications for domestic sewage collection and treatment works associated with any domestic permit must be approved by the Commission and failure to secure approval before commencing construction of such works or making a discharge is a violation of this permit and each day is an additional violation until approval has been secured.

c. Permits for domestic wastewater treatment plants are granted subject to the policy of the Commission to encourage the development of area-wide waste collection, treatment, and disposal systems. The Commission reserves the right to amend any domestic wastewater permit in accordance with applicable procedural requirements to require the system covered by this permit to be integrated into an area-wide system, should such be developed; to require the delivery of the wastes authorized to be collected in, treated by or discharged from said system, to such area-wide system; or to amend this permit in any other particular to effectuate the Commission's policy. Such amendments may be made when the changes required are advisable for water quality control purposes and are feasible on the basis of waste treatment technology, engineering, financial, and related considerations existing at the time the changes are required, exclusive of the loss of investment in or revenues from any then existing or proposed waste collection, treatment or disposal system.

9. Domestic wastewater treatment plants shall be operated and maintained by sewage plant operators holding a valid certificate of competency at the required level as defined in 30 TAC Chapter 30.

xo. For Publicly Owned Treatment Works (POTWs), the 30-day average (or monthly average) percent removal for BOD and TSS shall not be less than 85%, unless otherwise authorized by this permit.

11. Facilities that generate industrial solid waste as defined in 30 TAC § 335.1 shall comply with these provisions:

a. Any solid waste, as defined in 30 TAC § 335.1 (including but not limited to such wastes as garbage, refuse, sludge from a waste treatment, water supply treatment plant or air pollution control facility, discarded materials, discarded materials to be recycled, whether the waste is solid, liquid, or semisolid), generated by the permittee during the management and treatment of wastewater, must be managed in accordance with all applicable provisions of 30 TAC Chapter 335, relating to Iftdustrial Solid Waste Management.

b. Industrial wastewater that is being collected, accumulated, stored, or processed before discharge through any final discharge outfall, specified by this permit, is considered to be industrial solid waste until the wastewater passes through the actual point source discharge and must be managed in accordance with all applicable provisions of 30 TAC Chapter 335.

c. The permittee shall provide written notification, pursuant to the requirements of 30 TAC § 335.8(b)(1), to the Environmental Cleanup Section (MC 127) of the Remediation Division informing the Commission of any closure activity involving an Industrial Solid Waste Management Unit, at least 90 days prior to conducting such an activity.

d. Construction of any industrial solid waste management unit requires the prior written notification of the proposed activity to the Registration and Reporting Section (MC 129) of the Registration, Review, and Reporting Division. No person shall dispose of industrial solid waste, including sludge or other solids from wastewater treatment processes, prior to fulfilling the deed recordation requirements of 30 TAC § 335.5.

e. The term "industrial solid waste management unit" means a landfill, surface impoundment, waste-pile, industrial furnace, incinerator, cement kiln, injection well, container, drum, salt dome waste containment cavern, or any other structure vessel, appurtenance, or other improvement on land used to manage industrial solid waste.

f. The permittee shall keep management records for all sludge (or other waste) removed from any wastewater treatment process. These records shall fulfill all applicable requirements of 30 TAC § 335 and must include the following, as it pertains to wastewater treatment and discharge:

i. Volume of waste and date(s) generated from treatment process;
ii. Volume of waste disposed of on-site or shipped off-site;
iii. Date(s) of disposal;
iv. Identity of hauler or transporter;
v. Location of disposal site; and
vi. Method of final disposal.

The above records shall be maintained on a monthly basis. The records shall be retained at the facility site, or shall be readily available for review by authorized representatives of the TCEQ for at least five years.

12. For industrial facilities to which the requirements of 30 TAC § 335 do not apply, sludge and solid wastes, including tank cleaning and contaminated solids for disposal, shall be disposed of in accordance with THSC § 361.

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SLUDGE PROVISIONS

The permittee is authorized to dispose of sludge only at a Texas Commission on Environmental Quality (TCEQ) authorized land application site or co-disposal landfill. The disposal of sludge by land application on property owned, leased or under the direct control of the permittee is a violation of the permit unless the site is authorized with the TCEQ. This provision does not authorize Distribution and Marketing of sludge. This provision does not authorize land application of Class A Sludge. This provision does not authorize the permittee to land apply sludge on property owned, leased or under the direct control of the permittee.

SECTION I. REQUIREMENTS APPLYING TO ALL SEWAGE SLUDGE LAND APPLICATION

A. General Requirements

1. The permittee shall handle and dispose of sewage sludge in accordance with 30 TAC § 312 and all other applicable state and federal regulations in a manner that protects public health and the environment from any reasonably anticipated adverse effects due to any toxic pollutants that may be present in the sludge.

2. In all cases, if the person (permit holder) who prepares the sewage sludge supplies the sewage sludge to another person for land application use or to the owner or lease holder of the land, the permit holder shall provide necessary information to the parties who receive the sludge to assure compliance with these regulations.

3. The permittee shall give 180 days prior notice to the Executive Director in care of the Wastewater Permitting Section (MC 148) of the Water Quality Division of any change planned in the sewage sludge disposal practice.

B. Testing Requirements

1. Sewage sludge shall be tested once during the term of this permit in accordance with the method specified in both 40 CFR Part 261, Appendix II and 40 CFR Part 268, Appendix I [Toxicity Characteristic Leaching Procedure (TCLP)] or other method that receives the prior approval of the TCEQ for the contaminants listed in 40 CFR Part 261.24, Table 1. Sewage sludge failing this test shall be managed according to RCRA standards for generators of hazardous waste, and the waste's disposition must be in accordance with all applicable requirements for hazardous waste processing, storage, or disposal. Following failure of any TCLP test, the management or disposal of sewage sludge at a facility other than an authorized hazardous waste processing, storage, or disposal facility shall be prohibited until such time as the permittee can demonstrate the sewage sludge no longer exhibits the hazardous waste toxicity characteristics (as demonstrated by the results of the TCLP tests). A written report shall be provided to both the TCEQ Registration and Reporting Section (MC 129) of the Permitting and Remediation Support Division and the Regional Director (MC Region 13) within seven (7) days after failing the TCLP Test.

The report shall contain test results, certification that unauthorized waste management has stopped and a summary of alternative disposal plans that comply with RCRA standards for the management of hazardous waste. The report shall be addressed to: Director, Registration, Review, and Reporting Division (MC 129), Texas Commission on Environmental Quality, P.O. Box 13087, Austin, Texas 78711-3087. In addition, the permittee shall prepare an annual report on the results of all sludge toxicity testing. This annual report shall be submitted to the TCEQ Regional Office (MC Region 13) and the Water Quality Compliance Monitoring Team (MC 224) of the Enforcement Division by September 30 of each year.

2. Sewage sludge shall not be applied to the land if the concentration of the pollutants exceeds the pollutant concentration criteria in Table 1. The frequency of testing for pollutants in Table 1 is found in Section I.C.

TABLE 1

Pollutant	Ceiling Concentration (Milligrams per kilogram)*
Arsenic	75
Cadmium	85
Chromium	3000
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
PCBs	49
Selenium	100
Zinc	7500

* Dry weight basis

3. Pathogen Control

All sewage sludge that is applied to agricultural land, forest, a public contact site, or a reclamation site shall be treated by one of the following methods to ensure that the sludge meets either the Class A or Class B pathogen requirements.

a. Six alternatives are available to demonstrate compliance with Class A sewage sludge. The first 4 options require either the density of fecal coliform in the sewage sludge be less than 1000 Most Probable Number (MPN) per gram of total solids (dry weight basis), or the density of Salmonella sp. bacteria in the sewage sludge be less than three MPN per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed. Below are the additional requirements necessary to meet the definition of a Class A sludge.

Alternative 1- The temperature of the sewage sludge that is used or disposed shall be maintained at or above a specific value for a period of time. See 30 TAC § 312.82(a)(2)(A) for specific information.

Alternative 2 - The pH of the sewage sludge that is used or disposed shall be raised to above 12 std. units and shall remain above 12 std. units for 72 hours.

The temperature of the sewage sludge shall be above 520 Celsius for 12 hours or longer during the period that the pH of the sewage sludge is above 12 std. units.

At the end of the 72-hour period during which the pH of the sewage sludge is above 12 std. units, the sewage sludge shall be air dried to achieve a percent solids in the sewage sludge greater than 50%.

Alternative 2 - The sewage sludge shall be analyzed for enteric viruses prior to pathogen treatment. The limit for enteric viruses is less than one Plaque-forming Unit per four grams of total solids (dry weight basis) either before or following pathogen treatment. See 30 TAC § 3i2.82(a)(2)(C)(i-iii) for specific information. The sewage sludge shall be analyzed for viable helminth ova prior to pathogen treatment. The limit for viable helminth ova is less than one per four grams of total solids (dry weight basis) either before or following pathogen treatment. See 30 TAC § 3i2.82(a)(2)(C)(iv-vi) for specific information.

Alternative A - The density of enteric viruses in the sewage sludge shall be less than one Plaque-forming Unit per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed. The density of viable helminth ova in the sewage sludge shall be less than one per four grams of total solids (dry weight basis) at the time the sewage sludge is used or disposed.

Alternative 5 CPFRP") - Sewage sludge that is used or disposed of shall be treated in one of the processes to Further Reduce Pathogens (PFRP) described in 40 CFR Part 503, Appendix B. PFRP include composting, heat drying, heat treatment, and thermophilic aerobic digestion.

Alternative 6 (PFRP Equivalent) - Sewage sludge that is used or disposed of shall be treated in a process that has been approved by the U.S. Environmental Protection Agency as being equivalent to those in Alternative 5.

b. Three alternatives are available to demonstrate compliance with Class B criteria for sewage sludge.

Alternative 1

i. A minimum of seven random samples of the sewage sludge shall be collected within 48 hours of the time the sewage sludge is used or disposed of during each monitoring episode for the sewage sludge.

ii. The geometric mean of the density of fecal coliform in the samples collected shall be less than either 2,000,000 MPN per gram of total solids (dry weight basis) or 2,000,000 Colony Forming Units per gram of total solids (dry weight basis).

Alternative 2 - Sewage sludge that is used or disposed of shall be treated in one of the Processes to Significantly Reduce Pathogens (PSRP) described in 40 CFR Part 503, Appendix B, so long as all of the following requirements are met by the generator of the sewage sludge.

i. Prior to use or disposal, all the sewage sludge must have been generated from a single location, except as provided in paragraph v. below;

ii. An independent Texas Licensed Professional Engineer must make a certification to the generator of a sewage sludge that the wastewater treatment facility generating the sewage sludge is designed to achieve one of the PSRP at the permitted design loading of the facility. The certification need only be repeated if the design loading of the facility is increased. The certification shall include a statement indicating the design meets all the applicable standards specified in Appendix B of 40 CFR Part 503;

iii. Prior to any off-site transportation or on-site use or disposal of any sewage sludge generated at a wastewater treatment facility, the chief certified operator of the wastewater treatment facility or other responsible official who manages the processes to significantly reduce pathogens at the wastewater treatment facility for the permittee, shall certify that the sewage sludge underwent at least the minimum operational requirements necessary in order to meet one of the PSRP. The acceptable processes and the minimum operational and record keeping requirements shall be in accordance with established U.S. Environmental Protection Agency final guidance;

iv. All certification records and operational records describing how the requirements of this paragraph were met shall be kept by the generator for a minimum of three years and be available for inspection by commission staff for review; and

v. If the sewage sludge is generated from a mixture of sources, resulting from a person who prepares sewage sludge from more than one wastewater treatment facility, the resulting derived product shall meet one of the PSRP, and shall meet the certification, operation, and record keeping requirements of this paragraph.

Alternative 3 - Sewage sludge shall be treated in an equivalent process that has been approved by the U.S. Environmental Protection Agency, so long as all of the following requirements are met by the generator of the sewage sludge.

i. Prior to use or disposal, all the sewage sludge must have been generated from a single location, except as provided in paragraph v. below;

ii. Prior to any off-site transportation or on-site use or disposal of any sewage sludge generated at a wastewater treatment facility, the chief certified operator of the wastewater treatment facility or other responsible official who manages the processes to significantly reduce pathogens at the wastewater treatment facility for the permittee, shall certify that the sewage sludge underwent at least the minimum operational requirements necessary in order to meet one of the PSRP. The acceptable processes and the minimum operational and record keeping requirements shall be in accordance with established U.S. Environmental Protection Agency final guidance;

iii. All certification records and operational records describing how the requirements of this paragraph were met shall be kept by the generator for a minimum of three years and be available for inspection by commission staff for review;

iv. The Executive Director will accept from the U.S. Environmental Protection Agency a finding of equivalency to the defined PSRP; and

v. If the sewage sludge is generated from a mixture of sources resulting from a person who prepares sewage sludge from more than one wastewater treatment facility, the resulting derived product shall meet one of the Processes to Significantly Reduce Pathogens, and shall meet the certification, operation, and record keeping requirements of this paragraph.

In addition, the following site restrictions must be met if Class B sludge is land applied:

i. Food crops with harvested parts that touch the sewage sludge/soil mixture and are totally above the land surface shall not be harvested for 14 months after application of sewage sludge.

ii. Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of sewage sludge when the sewage sludge remains on the land surface for 4 months or longer prior to incorporation into the soil.

iii. Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of sewage sludge when the sewage sludge remains on the land surface for less than 4 months prior to incorporation into the soil.

iv. Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application of sewage sludge.

v. Animals shall not be allowed to graze on the land for 30 days after application of sewage sludge.

vi. Turf grown on land where sewage sludge is applied shall not be harvested for 1 year after application of the sewage sludge when the harvested turf is placed on either land with a high potential for public exposure or a lawn.

vii. Public access to land with a high potential for public exposure shall be restricted for 1 year after application of sewage sludge.

viii. Public access to land with a low potential for public exposure shall be restricted for 30 days after application of sewage sludge.

ix. Land application of sludge shall be in accordance with the buffer zone requirements found in 30 TAG § 312.44.

4. Vector Attraction Reduction Requirements

All bulk sewage sludge that is applied to agricultural land, forest, a public contact site, or a reclamation site shall be treated by one of the following Alternatives 1 through 10 for vector attraction reduction.

Alternative 1. The mass of volatile solids in the sewage sludge shall be reduced by a minimum of 38%.

Alternative 2 If Alternative 1 cannot be met for an anaerobically digested sludge, demonstration can be made by digesting a portion of the previously digested sludge anaerobically in the laboratory in a bench-scale unit for 40 additional days at a temperature between 30° and 370 Celsius. Volatile solids must be reduced by less than 17% to demonstrate compliance.

Alternative 3 - If Alternative 1 cannot be met for an aerobically digested sludge, demonstration can be made by digesting a portion of the previously digested sludge with percent solids of two percent or less aerobically in the laboratory in a bench-scale unit for 30 additional days at 20° Celsius. Volatile solids must be reduced by less than 15% to demonstrate compliance.

Alternative 4 - The specific oxygen uptake rate (SOUR) for sewage sludge treated in an aerobic process shall be equal to or less than 1.5 milligrams of oxygen per hour per gram of total solids (dry weight basis) at a temperature of 20° Celsius.

Alternative 5 Sewage sludge shall be treated in an aerobic process for 14 days or longer. During that time, the temperature of the sewage sludge shall be higher than 40° Celsius and the average temperature of the sewage sludge shall be higher than 450 Celsius.

Alternative 6 - The pH of sewage sludge shall be raised to 12 or higher by alkali addition and, without the addition of more alkali shall remain at 12 or higher for two hours and then remain at a pH of 11.5 or higher for an additional 22 hours at the time the sewage sludge is prepared for sale or given away in a bag or other container.

Alternative 7 - The percent solids of sewage sludge that does not contain unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 75% based on the moisture content and total solids prior to mixing with other materials. Unstabilized solids are defined as organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

Alternative 8 - The percent solids of sewage sludge that contains unstabilized solids generated in a primary wastewater treatment process shall be equal to or greater than 90% based on the moisture content and total solids prior to mixing with other materials at the time the sludge is used. Unstabilized solids are defined as organic materials in sewage sludge that have not been treated in either an aerobic or anaerobic treatment process.

Alternative 9 - i. Sewage sludge shall be injected below the surface of the land.

ii. No significant amount of the sewage sludge shall be present on

the land surface within one hour after the sewage sludge is injected.

iii. When sewage sludge that is injected below the surface of the land is Class A with respect to pathogens, the sewage sludge shall be injected below the land surface within eight hours after being discharged from the pathogen treatment process.

Alternative 10-

i. Sewage sludge applied to the land surface or placed on a surface disposal site shall be incorporated into the soil within six hours after application to or placement on the land.

ii. When sewage sludge that is incorporated into the soil is Class A with respect to pathogens, the sewage sludge shall be applied to or placed on the land within eight hours after being discharged from the pathogen treatment process.

C. Monitoring Requirements

Toxicity Characteristic Leaching Procedure (TCLP) Test	- once during the term of this permit
PCBs	- once during the term of this permit

All metal constituents and fecal coliform or Salmonella sp. bacteria shall be monitored at the appropriate frequency shown below, pursuant to 30 TAC § 312.46(a)(1):

Amount of sewage sludge (*) metric tons per a6s-dav period	Monitoring Frequency
0 to less than 290	Once/Year
290 to less than 1,500	Once/Quarter
1,500 to less than 15,000	Once/Two Months
15,000 or greater	Once/Month

(*) The amount of bulk sewage sludge applied to the land (dry wt. basis).

Representative samples of sewage sludge shall be collected and analyzed in accordance with the methods referenced in 30 TAC § 312.7

SECTION II. REQUIREMENTS SPECIFIC TO BULK SEWAGE SLUDGE FOR APPLICATION TO THE LAND MEETING CLASS A or B PATHOGEN REDUCTION AND THE CUMULATIVE LOADING RATES IN TABLE 2, OR CLASS B PATHOGEN REDUCTION AND THE POLLUTANT CONCENTRATIONS IN TABLE 3

For those permittees meeting Class A or B pathogen reduction requirements and that meet the cumulative loading rates in Table 2 below, or the Class B pathogen reduction requirements and contain concentrations of pollutants below listed in Table 3, the following conditions apply:

A. Pollutant Limits

Table 2

Pollutant	Cumulative Pollutant Loading Rate ("pounds per acre!*
Arsenic	36
Cadmium	35
Chromium	2677
Copper	1339
Lead	268
Mercury	15
Molybdenum	Report Only
Nickel	375
Selenium	89
Zinc	2500

Table 3

Pollutant	Monthly Average Concentration ("milligrams per kilogram)*
Arsenic	41
Cadmium	39
Chromium	1200
Copper	1500
Lead	300
Mercury	17
Molybdenum	Report Only
Nickel	420
Selenium	36
Zinc	2800

*Dry weight basis

B. Pathogen Control

All bulk sewage sludge that is applied to agricultural land, forest, a public contact site, a reclamation site, shall be treated by either Class A or Class B pathogen reduction requirements as defined above in Section I.B.3.

C. Management Practices

1. Bulk sewage sludge shall not be applied to agricultural land, forest, a public contact site, or a reclamation site that is flooded, frozen, or snow-covered so that the bulk sewage sludge enters a wetland or other waters in the State.

2. Bulk sewage sludge not meeting Class A requirements shall be land applied in a manner which complies with the Management Requirements in accordance with 30 TAC § 312.44.

3. Bulk sewage sludge shall be applied at or below the agronomic rate of the cover crop.

4. An information sheet shall be provided to the person who receives bulk sewage sludge sold or given away. The information sheet shall contain the following information:

   a. The name and address of the person who prepared the sewage sludge that is sold or given away in a bag or other container for application to the land.

   b. A statement that application of the sewage sludge to the land is prohibited except in accordance with the instruction on the label or information sheet.

   c. The annual whole sludge application rate for the sewage sludge application rate for the sewage sludge that does not cause any of the cumulative pollutant loading rates in Table 2 above to be exceeded, unless the pollutant concentrations in Table 3 found in Section II above are met.

D. Notification Requirements

1. If bulk sewage sludge is applied to land in a State other than Texas, written notice shall be provided prior to the initial land application to the permitting authority for the State in which the bulk sewage sludge is proposed to be applied. The notice shall include:

   a. The location, by street address, and specific latitude and longitude, of each land application site.

   b. The approximate time period bulk sewage sludge will be applied to the site.

   c. The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who will apply the bulk sewage sludge.

2. The permittee shall give 180 days prior notice to the Executive Director in care of the Wastewater Permitting Section (MC 148) of the Water Quality Division of any change planned in the sewage sludge disposal practice.

E. Recordkeeping Requirements

The sludge documents will be retained at the facility site and/or shall be readily available for review by a TCEQ representative. The person who prepares bulk sewage sludge or a sewage sludge material shall develop the following information and shall retain the information at

the facility site and/or shall be readily available for review by a TCEQ representative for a period of five years. If the permittee supplies the sludge to another person who land applies the sludge, the permittee shall notify the land applier of the requirements for record keeping found in 30 TAC § 312.47 for persons who land apply.

1. The concentration (mg/kg) in the sludge of each pollutant listed in Table 3 above and the applicable pollutant concentration criteria (mg/kg), or the applicable cumulative pollutant loading rate and the applicable cumulative pollutant loading rate limit (lbs/ac) listed in Table 2 above.

2. A description of how the pathogen reduction requirements are met (including site restrictions for Class B sludge, if applicable).

3. A description of how the vector attraction reduction requirements are met.

4. A description of how the management practices listed above in Section II.C are being met.

5. The following certification statement:

   "I certify, under penalty of law, that the applicable pathogen requirements in 30 TAC § 312.82(a) or (b) and the vector attraction reduction requirements in 30 TAC § 312.83(b) have been met for each site on which bulk sewage sludge is applied. This determination has been made under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information used to determine that the management practices have been met. I am aware that there are significant penalties for false certification including fine and imprisonment."

6. The recommended agronomic loading rate from the references listed in Section II.C.3. above, as well as the actual agronomic loading rate shall be retained. The person who applies bulk sewage sludge or a sewage sludge material shall develop the following information and shall retain the information at the facility site and/or shall be readily available for review by a TCEQ representative indefinitely. If the permittee supplies the sludge to another person who land applies the sludge, the permittee shall notify the land applier of the requirements for record keeping found in 30 TAC § 312.47 for persons who land apply:

   a. A certification statement that all applicable requirements (specifically listed) have been met, and that the permittee understands that there are significant penalties for false certification including fine and imprisonment. See 30 TAC § 3i2.47(a)(4)(A)(ii) or 30 TAC § 3i2.47(a)(5)(A)(ii), as applicable, and to the permittee's specific sludge treatment activities.

   b. The location, by street address, and specific latitude and longitude, of each site on which sludge is applied.

   c. The number of acres in each site on which bulk sludge is applied.

   d. The date and time sludge is applied to each site.

e. The cumulative amount of each pollutant in pounds/acre listed in Table 2 applied to each site.

f. The total amount of sludge applied to each site in dry tons.

The above records shall be maintained on-site on a monthly basis and shall be made available to the Texas Commission on Environmental Quality upon request.

F. Reporting Requirements

The permittee shall report annually to the TCEQ Regional Office (MC Region 13) and Water Quality Compliance Monitoring Team (MC 224) of the Enforcement Division, by September 30 of each year the following information:

1. Results of tests performed for pollutants found in either Table 2 or 3 as appropriate for the permittee's land application practices.
2. The frequency of monitoring listed in Section I.C. that applies to the permittee.
3. Toxicity Characteristic Leaching Procedure (TCLP) results.
4. Identity of hauler(s) and TCEQ transporter number.
5. PCB concentration in sludge in mg/kg.
6. Date(s) of disposal.
7. Owner of disposal site(s).
8. Texas Commission on Environmental Quality registration number, if applicable.
9. Amount of sludge disposal dry weight (lbs/acre) at each disposal site.
10. The concentration (mg/kg) in the sludge of each pollutant listed in Table 1 (defined as a monthly average) as well as the applicable pollutant concentration criteria (mg/kg) listed in Table 3 above, or the applicable pollutant loading rate limit (lbs/acre) listed in Table 2 above if it exceeds 90% of the limit.
11. Level of pathogen reduction achieved (Class A or Class B).
12. Alternative used as listed in Section I.B.3.(a. or b.). Alternatives describe how the pathogen reduction requirements are met. If Class B sludge, include information on how site restrictions were met.
13. Vector attraction reduction alternative used as listed in Section I.B.4.
14. Annual sludge production in dry tons/year.
15. Amount of sludge land applied in dry tons/year.
16. The certification statement listed in either 30 TAC § 3i2,47(a)(4)(A)(ii) or 30 TAC § 3i2.47(a)(5)(A)(ii) as applicable to the permittee's sludge treatment activities, shall be attached to the annual reporting form.
17. When the amount of any pollutant applied to the land exceeds 90% of the cumulative pollutant loading rate for that pollutant, as described in Table 2, the permittee shall report the following

information as an attachment to the annual reporting form.

a. The location, by street address, and specific latitude and longitude.

b. The number of acres in each site on which bulk sewage sludge is applied.

c. The date and time bulk sewage sludge is applied to each site.

d. The cumulative amount of each pollutant (i.e., pounds/acre) listed in Table 2 in the bulk sewage sludge applied to each site.

e. The amount of sewage sludge (i.e., dry tons) applied to each site.

The above records shall be maintained on a monthly basis and shall be made available to the Texas Commission on Environmental Quality upon request.

SECTION III. REQUIREMENTS APPLYING TO ALL SEWAGE SLUDGE DISPOSED IN A MUNICIPAL SOLID WASTE LANDFILL

A. The permittee shall handle and dispose of sewage sludge in accordance with 30 TAC § 330 and all other applicable state and federal regulations to protect public health and the environment from any reasonably anticipated adverse effects due to any toxic pollutants that may be present. The permittee shall ensure that the sewage sludge meets the requirements in 30 TAC § 330 concerning the quality of the sludge disposed in a municipal solid waste landfill.

B. If the permittee generates sewage sludge and supplies that sewage sludge to the owner or operator of a municipal solid waste landfill (MSWLF) for disposal, the permittee shall provide to the owner or operator of the MSWLF appropriate information needed to be in compliance with the provisions of this permit.

C. The permittee shall give 180 days prior notice to the Executive Director in care of the Wastewater Permitting Section (MC 148) of the Water Quality Division of any change planned in the sewage sludge disposal practice.

D. Sewage sludge shall be tested once during the term of this permit in accordance with the method specified in both 40 CFR Part 261, Appendix II and 40 CFR Part 268, Appendix I (Toxicity Characteristic Leaching Procedure) or other method, which receives the prior approval of the TCEQ for contaminants listed in Table 1 of 40 CFR § 261.24. Sewage sludge failing this test shall be managed according to RCRA standards for generators of hazardous waste, and the waste's disposition must be in accordance with all applicable requirements for hazardous waste processing, storage, or disposal.

Following failure of any TCLP test, the management or disposal of sewage sludge at a facility other than an authorized hazardous waste processing, storage, or disposal facility shall be prohibited until such time as the permittee can demonstrate the sewage sludge no longer exhibits the hazardous waste toxicity characteristics (as demonstrated by the results of the TCLP tests). A written report shall be provided to both the TCEQ Registration and Reporting Section (MC 129) of the Permitting and Remediation Support Division and the Regional Director (MC Region 13) of the appropriate TCEQ field office within 7 days after failing the TCLP Test.

The report shall contain test results, certification that unauthorized waste management has stopped and a summary of alternative disposal plans that comply with RCRA standards for the management of hazardous waste. The report shall be addressed to: Director, Registration, Review, and Reporting Division (MC 129), Texas Commission on Environmental Quality, P. O. Box 13087, Austin, Texas 78711-3087. In addition, the permittee shall prepare an annual report on the results of all sludge toxicity testing. This annual report shall be submitted to the TCEQ Regional Office (MC Region 13) and the Water Quality Compliance Monitoring Team (MC 224) of the Enforcement Division by September 30 of each year.

E. Sewage sludge shall be tested as needed, in accordance with the requirements of 30 TAC Chapter 330.

F. Record keeping Requirements

The permittee shall develop the following information and shall retain the information for five years.

1. The description (including procedures followed and the results) of all liquid Paint Filter Tests performed.

2. The description (including procedures followed and results) of all TCLP tests performed.

The above records shall be maintained on-site on a monthly basis and shall be made available to the Texas Commission on Environmental Quality upon request.

G. Reporting Requirements

The permittee shall report annually to the TCEQ Regional Office (MC Region 13) and Water Quality Compliance Monitoring Team (MC 224) of the Enforcement Division by September 30 of each year the following information:

1. Toxicity Characteristic Leaching Procedure (TCLP) results.

2. Annual sludge production in dry tons/year.

3. Amount of sludge disposed in a municipal solid waste landfill in dry tons/year.

4. Amount of sludge transported interstate in dry tons/year.

5. A certification that the sewage sludge meets the requirements of 30 TAC § 330 concerning the quality of the sludge disposed in a municipal solid waste landfill.

6. Identity of hauler(s) and transporter registration number.

7. Owner of disposal site(s).

8. Location of disposal site(s).

9. Date(s) of disposal.

The above records shall be maintained on-site on a monthly basis and shall be made available to the Texas Commission on Environmental Quality upon request.

OTHER REQUIREMENTS

1. The permittees shall employ or contract with one or more licensed wastewater treatment facility operators or wastewater system operations companies holding a valid license or registration according to the requirements of 30 TAC Chapter 30, Occupational Licenses and Registrations and, in particular, 30 TAC Chapter 30, Subchapter J, Wastewater Operators and Operations Companies.

   This Category C facility must be operated by a chief operator or an operator holding a Category C license or higher. The facility must be operated a minimum of five days per week by the licensed chief operator or an operator holding the required level of license or higher. The licensed chief operator or operator holding the required level of license or higher must be available by telephone or pager seven days per week. Where shift operation of the wastewater treatment facility is necessary, each shift that does not have the on-site supervision of the licensed chief operator must be supervised by an operator in charge who is licensed not less than one level below the category for the facility.

2. The facility is not located in the Coastal Management Program boundary.

3. This permit may be reviewed by the TCEQ after the completion of any new intensive water quality survey on Segment No. 1908 of the San Antonio River Basin and any subsequent updating of the water quality model for Segment No. 1908, in order to determine if the limitations and conditions contained herein are consistent with any such revised model. The permit may be amended, pursuant to 30 TAC § 305.62, as a result of such review. Effluent limits may be made more stringent at renewal based on, for example, any change to modeling protocol approved in the TCEQ Continuing Planning Process.

4. The permittees shall comply with the requirements of 30 TAC § 309.13 (a) through (d). In addition, by ownership of the required buffer zone area, the permittees shall comply with the requirements of 30 TAC § 309.13(e).

5. The permittee shall provide facilities for the protection of their wastewater treatment facilities from a 100-year flood.

6. In accordance with 30 TAC §319.9, a permittee that has at least twelve months of uninterrupted compliance with its bacteria limit may notify the commission in writing of its compliance and request a less frequent measurement schedule. To request a less frequent schedule, the permittees shall submit a written request to the TCEQ Wastewater Permitting Section (MC 148) for each phase that includes a different monitoring frequency. The request must contain all of the reported bacteria values (Daily Avg. and Daily Max/Single Grab) for the twelve consecutive months immediately prior to the request. If the Executive Director finds that a less frequent measurement schedule is protective of human health and the environment, the permittees may be given a less frequent measurement schedule. For this permit, 1/quarter may be reduced to 1/6 months in the Interim phase and 1/month may be reduced to 1/quarter in the Final phase. A violation of any bacteria limit by a facility that has been granted a less frequent measurement schedule will require the permittees to return to the standard frequency schedule and submit written notice to the TCEQ Wastewater Permitting Section (MC 148). The permittees may not apply for another reduction in measurement frequency for at least 24 months from the date of the last violation. The Executive Director may establish a more frequent measurement schedule if necessary to protect human health or the environment.

7. Prior to construction of the treatment facilities, the permittees shall submit to the TCEQ Wastewater Permitting Section (MC 148) a summary submittal letter in accordance with the requirements in 30 TAC Section 217.6(c). If requested by the Wastewater Permitting Section, the permittee shall submit plans, specifications and a final engineering design report which comply with 30 TAC Chapter 217,

Design Criteria for Domestic Wastewater Systems. The permittees shall clearly show how the treatment system will meet the final permitted effluent limitations required on Page 2 and 2a of this permit.

8. Reporting requirements according to 30 TAC Sections 319.1-319.11 and any additional effluent reporting requirements contained in this permit are suspended from the effective date of the permit until plant startup or discharge, whichever occurs first, from the facility described by this permit. The permittees shall provide written notice to the TCEQ Regional Office (MC Region 13) and the Applications Review and Processing Team (MC 148) of the Water Quality Division at least forty-five (45) days prior to plant startup or anticipated discharge, whichever occurs first and prior to completion of each additional phase on Notification of Completion Form 20007.

9. The permittees shall notify the TCEQ Regional Office (MC Region 13) and the Applications Review and Processing Team (MC 148) of the Water Quality Division, in writing at least forty-five (45) days prior to the completion of the new facilities on Notification of Completion Form 20007.

APPENDIX B
TREATMENT PLANT DESIGN COMPUTATIONS

Reference

A GIVENS AND ASSUMPTIONS

1 Design Criteria

Effluent Criteria	TAC 309.1 - 309.4
Location Standards	TAC 309.10 - 309.14
Design Criteria	TAC (Subchapter A); 217.31 - 217.39 (Subchapter B); 217.121 - 217.129 (Subchapter E); 217.151 - 217.164 (Subchapter F); 217.241 - 217.252 (Subchapter J); 217.321 - 217.333 (Subchapter M). March 2015 BGRA Design Guidelines for Interim WWTP and Permanent WWTP

2 Process Selection

Activated sludge process with single stage nitrification when reactor temperatures exceed 15° C
Aerobic Digester Basin, and
Offsite Sludge Disposal (through contract)

3 Abbreviations

BOD_5	5-day Biochemical Oxygen Demand concentration, mg/L
cf	Cubic Feet
Cf	Oxygen Saturation in Field (Includes temperature, dissolved solids, pressure, etc.)
cfs	cubic feet per second
CLAR	Clarifier
Clarifier Yield	lbs of Solids Wasted from Clarifier per lbs BOD_5 treated by Clarifier
CWOTE	Clean Water Oxygen Transfer Efficiency (decimal)
degree days	Digester's temperature C times Sludge Age (or SRT)
DIG	Digester
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
fps	feet per second
ft	foot or feet
FTE	Field Transfer Efficiency (decimal)
gpd	gallons per day
gpm	gallons per minute
l	Liter
MG	Million Gallons
mg	Milligram
MGD	million gallons per day
MLSS	Mixed Liquor Suspended solids
msel	Mean Sea Elevation
msl	Mean Sea Level
NH3-N	Ammonia nitrogen, mg/L
O2R	Oxygen requirement, lb O2/ lb BOD_5
ppm	parts per million
psi	Pounds per square inch
RAF	Required Airflow
scfm	standard cubic feet per minute
sf	Square Feet
SRT	Sludge Retention Time or Sludge Age
T	Temperature (degrees C)
Te	Test Efficiency
TPDES	Texas Pollution Discharge Elimination System
TSS	Total Suspended Solids
VSS	Volatile Suspended Solids
WAS	Waste Activated Sludge
WOTE	Wastewater Oxygen Transfer Efficiency (decimal)

4 Conversion Factors

1 mg/L x (8.34) = lb/MG,
1 mg/L = 1 ppm

Conversion, 1 lb/MG =	8.34	mg/l
Density of Water	62.4	lbs/cf
Hours in a day =	24	hours
Minutes in a day =	1440	minutes / day
Seconds in a day =	86400	seconds
Cubic foot to gallons conversion factor =	7.4805	gallons per cubic foot
Foot of Water =	0.4333	psi
pound per square inch =	2.31	ft water head

Daily flow rate is determined by taking the daily flow volume for a day and dividing it by 24-hours
Average Daily Flow Rate is determined by summing the daily flow rates in a calendar year and dividing by the number of days in that calendar year.
Design flow is the average daily flow rate for a treatment facility permitted by the commission. §§217.2(9)

	Reference
Annual average flow is the arithmetic average of all daily flow determinations taken within a period of 12 consecutive months	§§217.2(3)
Annual Average Flow (facility > 1 MGD) can be determined by per capita flow in Table B.1 x number of people in the service area	§§217.32(a)(1)(A)
Maximum 30-day average flow = Annual Average Flow x Permitted Flow Factor	§§217.32(a)(1)(B)
For a facility with a Average Daily Flow Rate less than 1 MGD the Permitted Flow Factor is 1.5	§§217.32(a)(1)(B)
Permitted Flow = Maximum 30-day average flow = Annual Average Flow x Permitted Flow Factor	§§217.32(a)(1)(B)
Instantaneous 2- Hour Peak Flow (**Peak Flow**) is the highest two-hour flow expected under any operational conditions including times of high rainfall based on a two-year 24-hour storm or a prolonged period of wet weather	§§217.2(38)
Peak Flow = Permitted Flow times the Peak Flow Factor	§§217.32(a)(2)
Peak Flow Factor = The ratio of the highest 2-Hour flow to the plant in 12 consecutive months / Annual Average Flow	§§217.34(1)(B)
Peak Flow Factor = 4 (Site specific data is not available)	§§217.32(a)(2)
Permitted Flow = Maximum 30-day average flow	§§217.32(a)(1)

5 Influent parameters

	Proposed			
Annual Average Flow =	98,000	gpd		Permit
	68.0556	gpm		
	0.15	cfs		
Permitted Flow Factor for plants > 1 MGD	1.5	unitless		§§217.32(a)(1)(B)
Peak Flow Factor =	2.89	unitless	calculated	§217.32.(a)(2)
	283,680	gpd		
	197	gpm		Permit
	0.4389	cfs		
100-yr Floodplain elevation		msl		
FEMA FIRM Panel Number				
FEMA FIRM Panel Date				
FIRM Panel nearest applicable 100 yr flood plain el				
Influent flow per EDU =	300	gallons per day per EDU		JAM
Influent Wastewater Strength - BOD_5 =	250	mg/l	Similar district data + 1 std deviation	Permit application
Influent Wastewater Strength - COD5 =		mg/l		
Influent Wastewater - TSS	250	mg/l	Similar district data + 1 std deviation	
Influent Wastewater Strength - ammonia-nitrogen	25	mg/l	Similar district data + 1 std deviation	§217.155()a)(3)

6 Effluent Permit Limitations

TPDES Permit Number	WQ0014959001		
$CBOD_5$, 30 Daily Average (mg/L)	5	mg/l	Current Permit
TSS, 30 Daily Average (mg/L)	5	mg/l	Current Permit
Ammonia Nitrogen NH3-N Daily Average (mg/L)	2	mg/l	Current Permit
Chlorine Residual Daily Average	≥1, ≤4	mg/l After 20 minutes	Current Permit
Dechlorinate to achieve	N/A	mg/l	Current Permit
Ph Range Daily Average	>6, <9	unitless	Current Permit
Minimum Dissolved Oxygen (mg/L)	4	mg/l	Current Permit
Phosphorus (mg/L)	1	mg/l	Current Permit
E. coli (CFU or MPN/10 ml)	126	CFU	Current Permit

7 Aeration Basin Assumptions

Aeration Basin Reactor Temperature =	20	°C		
	68	°F		
Minimum of number of Aeration Basins	2	unitless	§§217.153(c)(1) / To allow one to be taken out of service	
Maximum Organic Loading Rate =	35	(lbs/day/1,000cf)		§§217.154(b)(3)
Minimum dissolved oxygen concentration 2	2	mg/l		§§217.151(a)
Minimum Aeration Basin Freeboard =	1.5	feet		§§217.153(b)(1)
Ratio Aeration Basin width to the side water depth =	1	unitless		
Min O2R, Conventional activated sludge process = that ARE NOT intended to nitrify	1.2	pounds (lbs) O2/lb BOD_5		§217.155(a)(3) - Equation F.2
Min O2R, Conventional activated sludge process = that ARE intended to nitrify	4.3	pounds (lbs) O2/lb NH3-N		§217.155(a)(3) - Equation F.2
Min Airflow Requirements for Diffused Air =				
Default Clean Water Oxygen Transfer Efficiency =	4.00%	percent		§217.155(b)(2)(A)(i)
Max Clean Water Oxygen Transfer Efficiency Coarse	18.00%	percent	Coarse Bubble	§217.155(b)(2)(A)(iii)
Coarse Bubble WOTE Correction Factor =	0.65	unitless		§217.155(b)(2)(B)(i)
Fine Bubble WOTE Correction Factor =	0.45	unitless		§217.155(b)(2)(B)(i)
10' Submergence Airflow Correction Factor =	1.56	unitless		§217.155(b)(2)(D) -Table F.5.
Minimum Aeration Basin Diffuser Submergence =	10	feet		§§217.155(b)(5)(A) (ii)
Minimum Coarse Bubble Mixing Air Rate =	20	scfm/1000 cf		§§217.155(b)(3)(B)
Minimum Fine Bubble Mixing Air Rate =	0.12	scfm /square foot		§§217.155(b)(3)(B)
Distance Aeration diffuser above floor =	0.5	feet		
Pound of oxygen in a pound of air	0.23	#02/#air x		§§217.155(2)(C)Equation F.4

			Reference
Pounds of air in 1 cubic foot	0.075	lb air/cf x	§§217.155(2)(C)Equation F.4

8 Clarifier Assumptions

Clarifier Minimum freeboard at the peak flow =	1	feet	§§217.153(b)(2)
Min Clarifier Side Water Depth =	10	feet	§§217.152(g)(2)(A)
Minimum of number of Clarifiers	1	unitless	§§217.153(c)(1)
Max Stilling Well Vertical Flow Velocity =	0.15	feet per second at peak flow.	§§217.152(a)(4)
Min. dist. between clarifier weir and baffle =	6	inches	§§217.152(c)(2)
Max Clarifier Weir Loading .	20,000	gpd at the peak flow per linear foot of weir length	§§217.152(c)(4)
Minimum Clarifier Side Water Depth =	10	feet	§§217.152(g)(2)(A)
Min Clarifier RAS pumping system rate =	200	gpd/sf	§§217.152(j)(3)
Max Clarifier RAS pumping system rate =	400	gpd/sf	§§217.152(j)(3)
Maximum overflow rate at 2-Hour Peak Flow =	1200	gpd/sf	§§217.154(c)(1)Table F.2
Clarifier Side Water Depth (same as Aeration Basin)	12	ft	
Min Detention Time at 2-Hour Peak Flow =	1.8	hours	§§217.154(c)(1)Table F.2
V-Notch Weir Height	0.5	ft	
Firm Number of RAS pumps per clarifier =	1	unitless	

9 Digester Assumptions

Aerobic Digester system design temperature	20	Degrees Celsius	§§217.249(t)(2)
	68	°F	
Minimum Aerobic Digester Detention time @ 20°C =	40	days	§§217.249(t)(4)(B)
Minimum Degree days (20°C x 40-days)	800	degree-days	
Maximum solids concentration used to calculate the total detention time			
Minimum Digester volatile solids loading rate =	100	lb of volatile solids per 1,000 cf per day	§§217.249(t)(7) (D)
Maximum Digester volatile solids loading rate =	200	lb of volatile solids per 1,000 cf per day	§§217.249(t)(7) (D)
Minimum dissolved oxygen concentration =	0.5	mg/l	§§217.249(t)(7) (E)
Minimum Digester Mixing Air Rate =	20	scfm/1000 cf	§§217.249(t)(7) (G)
Rate of Solids Production from Upstream Biological Process to be Wasted from Clarifier (Yield) =	0.8	lbs/day per lb of BOD_5 removed	
Volatile Fraction of Total Suspended Solids (TSS) in WAS to Digester	70%	percent	
Type of Digester =	Aerobic		
Specific Gravity of Waste Sludge =	1.025	unitless	
Specific Gravity of Digester Supernatant =	1	unitless	
Percent Solids of Waste Activated Sludge Entering Digester =	2.00%	percent	
TSS of Digester Sludge =	20,000	mg/l	
TSS of Waste Activated Sludge entering Digester =	12,000	mg/l	
Estimated portion of volatile solids in Digester that is reducible based on 800 degree-days =	40.00%	percent per WEF, 1995a and Metcalf and Eddy fig 14-31	
Old TCEQ Digester Loading Rate =	20	cf per lbs COD5 / day	
Minimum Aeration Basin Diffuser Submergence =	10	feet	§§217.155(b)(5)(A)(i)
Assumed Hydraulic residence time =	15	days	217.249 (j) (4)
Distance Digester Basin diffuser is above floor =	1	foot	
Digester Solids Capture Rate = (captured to be wasted ephemerally)	90%	percent	
Assumed Percentage of Overflow Total SS that is BOD =	30%	percent	
Assumed solids from sludge in Digester Supernatant = for sludge overflowing digester in supernatant	0.50%	percent of supernatant	
Minimum Digester Basin Air Requirement Design Criteria	20	scfm / 1,000 cf	§§217.249(t)(7)(G)
Minimum of number of Digester Basins	2	unitless	
Will or does this facility include a sludge thickener? Yes (Y) / No (N)	N		

10 Chlorine Contact Basin Assumptions

Size of Chlorine Cylinders =	150	lbs	
Maximum Chlorine Gas Withdrawal Rate =	1	lbs / day / °F	§§217.273(a)
Minimum mean velocity gradient (G value) in Chlorine Contact Basin =	500	per second-1	§§217.281(a)(3)
Minimum time effluent is retained in a contact basin (Qpeak) =	20	minutes	§§217.281(b)(2)
Chlorine Contact Basin Diffuser Submergence =	7.32291667	feet	
Distance Chlorine Contact diffuser above floor =	1	feet	
Minimum Chlorine Basin Air Required (SCFM)	15	scfm / 1000 CF	
Minimum design CL2 Concentration needed for disinfection =	8	mg/l	§§217.272(b) Table K.1
Threshold Temperature for 150 # Cylinder Mounted Vacuum Regulators =	0	°F	§§217.273(a) Table K.2
Threshold Temperature for 150 # Manifold Syseems at 10-15 psig =	10	°F	§§217.273(a) Table K.3
Withdraual Facotr for 150 # Cylinder (F) =	1.0	lb/°F/day	§§217.273(a) Table K.4
Minimum Velocity through CL2 diffuser =	10.0	fps	§§217.279(f)

11 Blower Assumptions

B HYDRAULIC LOADING

1 Phase 1 hydraulic loading conditions

a Annual Average Flow

US Census data for 2010 indicates in Texas — 25,145,561 Total Population — From US Census Website
= 9,977,436 Total housing units — From US Census Website

1 People per household = Total Population of Texas / Total Texas Housing Units
= 25,145,561 People divided by 9,977,436 Housing unit
= 2.52 people / household

§§217.32(B) Table B.1

Source	Remarks	Daily Wastewater Flow gallons/person	Wastewater Strength mg/l BOD5
Municipality	**Residential**	**75-100**	**200-350**

2 Average annual flow = Daily Wastewater Flow gallons per person x number of persons per household x number of households §§217.32(a)
= 2.52 people / household x 326 households x 79.52 gallons per person
= **65,334 gallons per day**

b Determine the Permitted Flow which is the same as the Maximum 30-day average flow which is the same as the Design Flow §§217.32(a)
For a facility equal to or greater than 1.0 MGD, the permitted flow is the average annual flow value determined by multiplying the per capita flow in Table B.1. in paragraph (3) of this subsection by the number of people in the service area.
For a facility less than 1.0MGD, the permitted flow is the maximum 30-day average flow estimated by multiplying the average annual flow by a factor of at least 1.5.

1 Permitted Flow = Maximum 30-day average flow = Annual Average Flow x Permitted Flow Factor for plants less than 1 MGD §§217.32(a)(1)(B)
= 65,334 gallons per day times 1.5
= 98,000 gallons per day
= **98,000 gallons per day** USE
= **68** gpm
= **0.15** cfs

c Calculate the Peak Flow from historical flow data [if sufficient existing flow data is available]

1 Based on the existing plant flow data determine the ratio of the peak flow to the annual average flow.
Ratio = maximum monthly average flow divided by the annual average flow
= mgd divided by 1 mgd
= 0 unitless

To match the existing permit the 2-hour peak flow factor was determined by dividing the 2-hour peak flow by the average daily flow.
= 197 gpm divided by 0.098 MGD
= 197 gpm divided by 0.098 x 1000000 / 1440
= 197 gpm divided by 0.098 x 694.4444444
= 197 gpm divided by 68.0555556
= 2.894693878 unitless
The Peak flow factor for this WWTP is = **2.894693878** unitless

2 Peak Flow = Permitted Flow x Peak Flow factor
= 98,000 gallons per day times 2.89
= **283,681 gallons per day**
= **11,820** gallons per hour
= **197.00** gallons per minute
= **0.44** cfs

C EQUIVALENT DWELLING UNIT (EDU)

Based on Definition of EDU in the Developer's Bond Application Report Format (RG-178)

1 Determine the number of equivalent single family connections based on the average daily flow and the wastewater flow per EDU as defined in the Developer's Bond Application Report Format.

Reference

a The Developer's Bond Application Report Format (RG-178) defines the wastewater flow per EDU as 300 gallons per day per EDU

b Calculate the equivalent dwelling units (EDU) for the design average daily flow

1 Equivalent Dwelling Units = Permitted Flow / Flow per EDU
= 98,000 gallons per day divided by 300 gallons per day per EDU
= **327** (rounded)

D ORGANIC LOADING (O.L.)

1 Determine the total daily organic load to the wastewater treatment plant

a **The treatment plant service area will be primarily single-family residential.**
§§217.32(B) Table B.1 indicates that for residential areas in a municipality
the daily wastewater flow is 75-100
the daily wastewater strength is 200-350
The daily wastewater strength is 250 mg/l BOD5 Permit application

b Calculate the total daily organic load based on BOD_5 of influent

1 The total Organic Loading = (Wastewater strength x conversion factor x flow) / 1 x 10^6 parts

$$= \frac{\textbf{250}\ \text{mg/l} \times 8.34 \times 98{,}000\ \text{gallons per day}}{1 \times 10^6\ \text{parts}}$$

$$= \frac{204{,}330{,}721}{1{,}000{,}000}$$

= **205** lb. BOD_5 per day (rounded up)

c Calculate the daily total suspended solids based on TSS of influent

1 The total daily suspended solids Loading = (TSS in influent strength x conversion factor x flow) / 1 x 10^6 parts

$$= \frac{\textbf{250}\ \text{mg/l} \times 8.34 \times 98{,}000\ \text{unitless}}{1 \times 10^6\ \text{parts}}$$

$$= \frac{204{,}330{,}721}{1{,}000{,}000}$$

= **205** lb. TSS per day (rounded up)

d Calculate the daily total ammonia-nitrogen based on ammonia-nitrogen of influent

1 The total daily ammonia-nitrogen Loading = (ammonia-nitrogen wastewater strength x conversion factor x flow) / 1 x 10^6 parts

$$= \frac{\textbf{25}\ \text{feet} \times 8.34 \times 98{,}000\ \text{cfs}}{1 \times 10^6\ \text{parts}}$$

$$= \frac{20{,}433{,}072}{1{,}000{,}000}$$

= **21** lb. ammonia-nitrogen (rounded up)

E PHASE 1: PROCESS UNIT REQUIREMENTS

1 Minimum Aeration Basin Volume Required - Traditional Design

a Calculate the minimum aeration basin volume required based on the maximum loading rate

1 Maximum Organic Loading Rate = 35 (lbs/day/1,000cf) §§217.154(b)(3)
From Table F.1 for a Conventional activated sludge process with nitrification when reactor temperatures exceed 15° C

2 Minimum Volume required = total daily organic load / Maximum Organic Loading Rate

						Reference
=	205	lb. BOD_5 per day	/	35	(lbs/day/1,000cf)	
=	5.857142857	(1,000cf)				
=	**5,857**	cf	Rounded			
=	43,813	Gallons	Rounded			

2 Minimum Clarifier Required Dimensions - Traditional Design

a Clarifier surface area based on Maximum Overflow Rate

1 Minimum Surface Area = 2-Hour Peak Flow / Maximum Overflow Rate at 2-Hour Peak Flow

=	283,681	gallons per day	/	1200	gpd/sf	§§217.154(c)(1)Table F.2
=	**236**	sf				

b Clarifier volume based on Minimum Detention Time at 2-Hour Peak Flow

1 Minimum Volume = Peak Flow Rate / Minimum Detention Time at 2-Hour Peak Flow

=	11,820	gallons per hour	times	1.8	hours	§§217.154(c)(1)Table F.2
=	21,276	gallons				
=	**2,844.20**	cubic feet				

c Total Minimum Weir Length based on Maximum Weir Loading Rate at Peak Flow

1 Minimum Weir Length = Peak Flow / Maximum Weir Loading Rate

=	283,681	gallons per day	/	20,000	gpd at the peak flow per linear foot of weir length
=	14	Linear Feet			

3 Minimum Required Chlorine Contact Basin Volume

a Calculate the minimum required chlorine contact basin volume based on retention time

1 The minimum retention time is equal to 20 minutes

2 Minimum Volume Required = (Peak Flow gpd x minimum Detention Time min) / minutes in a day

$$= \frac{283{,}681 \text{ gallons per day} \times 20 \text{ minutes}}{1440 \text{ minutes per day}}$$

$$= \frac{5{,}673{,}620 \text{ gallons per day minutes}}{1440 \text{ minutes per day}}$$

= 3,940.01 gallons
= **526.70** cf

4 Minimum Required Digester Volume

a Assumptions

	Type of Digester =	Aerobic		
	Rate of Solids Production from Upstream Biological Process to be Wasted from Clarifier (Yield) =	0.8	lbs/day per lb of BOD_5 removed	
	Volatile Fraction of Total Suspended Solids (TSS) in WAS to Digester	70%	percent	
	Aerobic Digester system design temperature	20	Degrees Celsius	§§217.249(t)(2)
	Minimum Aerobic Digester Detention time @ 20°C =	40	days	§§217.249(t)(4)(B)
	Specific Gravity of Waste Sludge =	1.025	unitless	
1	Percent Solids of Waste Activated Sludge Entering Digester =	2%	percent	
	TSS of Digester Sludge =	20,000	mg/l	
	Estimated portion of volatile solids in Digester that is reducible based on 800 degree-days =	40%		

b Calculate the quantity of sludge to be treated per day or the daily quantity of WAS to Digester or the hydraulic Load to digester

1 Volatile Solids wasted from CLAR to digester = [Clarifier Yield (lb/day) x Organic Loading (lbs BOD_5/day)]

=	0.8	lbs/day per lb of BOD_5 removed	x	205	lb. BOD_5 per day
=	**164**	lbs/day			

1 Total Solids wasted from CLAR to digester = Volatile Solids wasted from CLAR to digester / volatile fraction of total solids in MLSS

164	lbs/day	x	70%

Reference

234 lbs/day

2 Total mass of VSS in digester = Volatile Fraction of Total Suspended Solids (TSS) in WAS to Digester x Solids wasted from CLAR to digester
= 70% x 234 lbs/day
= **164** lbs/day

3 Non-Volatile fraction of Total Suspended Solids in WAS to Digester = 100% - Volatile Fraction of the Total Suspended Solids in WAS to Digester
= 100% minus 70%
= **30%**

c Calculate the hydraulic load to the Digester (volume of sludge to be disposed of to digester per day) based on MLSS of WAS Sludge in Digester

1 Hydraulic Load to Digester (MGD) = [# solids wasted / (MLSS of Waste Activated Sludge entering Digester*8.34*SG)]

$$\frac{234 \text{ lbs/day}}{12{,}000 \text{ mg/l} \times 8.34 \text{ mg/l} \times 1.025}$$

234 lbs/day divided by 102,582.0
0.0023 MGD
2,284 gal/day
305 cf/day

c.1 Calculate the volume required to achieve 15 days detention time

Minimum Digester volume = Hydraulic load to digester times number of detention days
= 305 cf/day times 15 days
= **4,579** cf

d Compute the volatile solids reduction (destruction) for winter conditions -
this computation is based on WEF Manual, 1995 & Metcalf & Eddy 2003, Figure 14-31

1 Calculate the Digester degree-days based on Minimum Aerobic Digester Detention time @ 20°C
= 20 Degrees Celsius times 40 days
= **800** Degree-Days

2 Determine Estimated Volatile Solids reduction based on degree-days and figure in WEF Manual, 1995, Metcalf & Eddy 2003, Figure 14-31
800 Degree-Days yields a Volatile Solids Reduction of **40%**

e Compute the Solids Reduced (Destroyed) based on total Mass of VSS in the Digester above

1 Solids Reduced (Destroyed) = Total mass of VSS in digester x Estimated solids reduction percentage
= 164 lbs/day times 40%
= **66** lbs/day

f Compute the Solids NOT Reduced (Destroyed) in the Digester above
Solids NOT reduced (destroyed) in the digester = Total volatile solids to digester - Solids reduced (destroyed) in digester
= 164 lbs/day minus 66 lbs/day
= 98 lbs/day

g Calculate the Solids Wasted from digester
For steady state the [Output] = [Input} - [Decrease due to solids reduced (destroyed) in digester]. This is the non-volatile portion of the Solids wasted from CLAR to digester plus the portion of the volatile solids that was NOT destroyed in Step e

1 Total Solids wasting rate from digester = (Total mass of Solids wasted from clarifier to digester x Non-Volatile Fraction of digester TSS) + (Solids **NOT** Reduced (Destroyed) in digester)

= 234 lbs/day times 30% plus 98 lbs/day
= 70 lbs/day plus 98 lbs/day
= **169** lbs/day

h Will or does this facility include a sludge thickener? Yes (Y) / No (N) **N**
If thickener is to be installed the Digester volume required will be 70% of the calculated Digester volume

i Determine the Volume of Digester (based on Winter Conditions)

1 Digester wasting rate = {Total Solids wasting rate from digester / [(Conversion factor x TSS of Digester Sludge) x 1000000]}

$$= \frac{169 \text{ lbs/day}}{8.34 \text{ mg/l} \times 20{,}000 \text{ mg/l}} \times 1{,}000{,}000$$

= **1,012 gpd** Rounded

2 Minimum Digester Volume based on wasting rate = Minimum Aerobic Digester Detention time x Digester wasting rate
= 40 days times 1,012 gpd
= **40,480 gallons**
= **5,411 cf**

3 CHECK OF SRT - Solids Retention Time based on digester volume and Digester wasting rate = Digester volume / Digester wasting rate
= 40,480 gallons divided by 1,012 gpd
= 40 days

4 Volatile solids loading factor (VSLF) = Total mass of VSS in digester / digester volume
= 164 lbs/day divided by 5,411 cf
= **0.0303** lbs VSS / cu ft/ day

5 Volatile solids loading factor (VSLF) = total mass VSS in dig / 1,000
= 0.0303 lbs VSS / cu ft/ day times 1000 cf
= **30.31** lbs VSS / 1000 cf / day

6 Volume per unit Organic loading (cu ft / lbs BOD) = Digester Volume / Design Chemical Organic Loading [assumes 100% capture in clarifier]
5,411 cf divided by 205 lb. BOD_5 per day
26.40 cu ft / lbs BOD

j Determine the hydraulic residence time (HRT) of the digester unit based on the Digester Volume using the desired sludge retention time (SRT):

1 Calculated Hydraulic Retention Time = Digester Volume / Hydraulic Load to Digester
= 40,480 gallons divided by 2,284 gal/day
= **17.7** days

k Compute Minimum Digester Overflow Rate

1 Assumed solids from sludge in Digester Supernatant = 0.50%

2 Digester Overflow TSS = Solids wasted from CLAR to digester x (1- Digester Solids Capture Rate)
= 169 lbs/day times (1 minus 90%)
= 169 lbs/day times 10%
= 17 lbs/day Rounded

3 SUPERNATANT MIN Flow rate = Rate of overflow from Digester (gpd)

4 Minimum Supernatant Flow rate, OR the Rate of overflow from Digester (gpd) = [# overflow TSS / (% solids in O/F*8.34*SG)]
Rate of overflow from Digester (gpd) = [Digester Overflow TSS / (Assumed solids in Digester Supernatant*8.34*SG)]

$$= \frac{17 \text{ lbs/day}}{0.50\% \text{ times } 8.34 \text{ mg/l times } 1 \text{ unitless}}$$

$$= \frac{17 \text{ lbs/day}}{0.0417 \text{ mg/l}}$$

= 408 gal / day

5 Digester Overflow BOD = Digester Overflow TSS (TSS not captured) x Assumed Percentage of Overflow TSS that is BOD
= 17 lbs/day times 30%
= **5.1** lbs/day

5 Summary of Minimum Process Unit Requirements

	Total			
Minimum Aeration Basin Volume Required =	**5,857** cf	Rounded		**5838**
	43,813 Gallons	Rounded		
Minimum Clarifier Surface Area Required =	236 sf			**327**
Minimum Clarifier Volume Required =	2,844.20 cubic feet			
	21,276 gallons			
Minimum Weir Length Required =	14 Linear Feet			
Min Chlorine Contact Basin Volume Required	**527** cf			**728**
	3,940 gallons			
Minimum Digester Volume Required =	**5,411** cf			

Reference

Minimum Aeration plus Digester volume = 40,480 gallons
11,268 cf

F PHASE 1: PROCESS UNIT VOLUMES PROVIDED

1 Proposed Clarifier for increased flow

a A system will have a mechanical skimmer §§217.152(b)(5)

b Clarifier Surface Area

1 2-hr Peak Flow = Average Annual Flow for this expansion x Permitted Flow Factor for plants less than 1 MGD x Peak Flow Factor
= 65,334 gallons per day times 1.5 times 2.894693878
= 283,681 gallons per day

1 Minimum Surface Area = 2-Hour Peak Flow / Maximum Overflow Rate at 2-Hour Peak Flow
= 283,681 gallons per day / 1200 gpd/sf §§217.154(c)(1)Table F.2
= **236** sf

1 Minimum Clarifier Surface Area = Minimum Surface Area / number of Clarifiers
= 236 sf divided by **1**
= 236.4008346 sf

2 ONE Clarifier Minimum Surface Area = Minimum Clarifier Radius^2 x PI
Clarifier Radius = Square Root of (ONE Clarifier Surface Area / PI) =
= Square Root of (236.4008346 sf divided by PI)
= Square Root of (75.24872277 sf)
= 8.674602168 ft
= 9 ft rounded

3 Minimum Clarifier Diameter = Minimum Clarifier Radius x 2
= 9 ft times 2
= 18 ft
= 22 ft USE
= **22 ft**

4 Surface Area of Proposed Clarifier = (Radius squared x PI)
11 ft squared x 3.141592654
380 sf

4 Total Surface Area of Clarifiers = Area per clarifier x number of clarifiers
= 380 sf x 1
= **380** sf

5 Proposed Clarifier Surface Area > Minimum Clarifier Surface Area required for increased flow
380 sf > 236 sf
SUFFICIENT CLARIFIER SURFACE AREA - OK

c Clarifier Overflow Rate

1 Overflow Rate for increased flow = Peak Increased Flow / Proposed Clarifier Surface Area
= 283,681 gallons per day / 380 sf
= 746.3 gpd/sf

2 Maximum overflow Rate > Actual Over flow Rate
1,200 gpd/sf > 746.3 gpd/sf
ACCEPTABLE CLARIFIER OVERFLOW RATE - OK

d Clarifier Weir Length

1 Minimum Total Clarifier Weir Length for this expansion = Peak Flow / Maximum Clarifier Weir Loading
= 283,681 gpd / 20,000 gpd per linear foot of weir length
= 14.18405008 linear foot of weir length

3 Minimum Diameter based on Minimum Weir Length = One Clarifier Minimum Weir Length / PI

Reference

= 14.18405008 linear foot of weir leng / 3.141592654
= 5 ft

4 Proposed Clarifier Weir Diameter = Internal Diameter of Proposed Structure - (distance weir is away from wall x 2)
22 ft - 1 ft times 2
22 ft - 2 ft
20 ft

5 Proposed Individual Clarifier Weir Length = Proposed Clarifier Weir Diameter x PI()
= 20 ft x 3.141592654
= 63 ft

6 Proposed Total Clarifier Weir Length = Proposed Clarifier Weir Length x Number of Clarifiers
= 63 lf x 1
= 63 lf

7 Proposed clarifier Weir Length > Minimum clarifier Weir Length
63 lf > 14.1840501 linear foot of weir length

ACCEPTABLE CLARIFIER WEIR LENGTH - OK

d Clarifier Side Water Depth based on Minimum Detention Time

1 Peak Flow for this expansion= Peak Daily Flow for this expansion / hours in a day
= 283,681 gpd / 24 Hours per day
= 11,820 gallons per hour

2 Minimum Proposed Clarifier Volume = Peak Flow for this phase x Min Detention Time at 2-Hour Peak Flow
11,820 gph x 1.8 hours
21,276 gallons
2,844 cf

3 Minimum Side Water Depth = Minimum Clarifier Volume / Proposed Clarifier Surface Area
2,844 cf divided by 380 284.4204949
7.48 ft 90.53385535
7.48 ft 9.514928026
10.00 **ft** **USE**

4 Minimum Side Wall Height = Max water surface elevation plus 1-foot
10.00 ft plus 1 ft plus v-notch height
11 ft plus 0.5 ft
11.50 ft
11.50 ft USE

5 Maximum Side Water Depth = Side Wall Height of Clarifier - Minimum Freeboard - V notch height
11.50 ft minus 1 ft minus 0.5
10.00 ft

6 Actual Side Water Depth > Minimum Required Side Water Depth
10.00 ft ≥ 10.00 ft

ACCEPTABLE CLARIFIER SIDE WATER DEPTH - OK

f Check Clarifier Volume

1 One Clarifier Volume = Clarifier Surface Area x Actual Side Water Depth
= 380 sf times 10.00 ft
= 3,802 cf Rounded
28,441 gallons

2 Total Clarifier Volume = One Clarifier Volume x Number of Clarifiers
= 3,802 cf x 1
= **3,802** cf
28,441 gallons

3 Actual Clarifier Volume > Minimum Required Clarifier Volume
3,802 cf > 2,844 cf

ACCEPTABLE CLARIFIER VOLUME - OK

g Check Clarifier Volume based on Minimum Detention Time

Reference

1 Actual Detention time this phase = Proposed Clarifier Volume x number of clarifiers / Peak Flow rate for this phase

=	28,441	gallons	/	283,681	gallons per day
=	28,441	gallons	/	11,820	gph
=	3,802	cf	/	37,923	cf per day
=	3,802	cf	/	1580	cfh
	2.4	hours			

2 Actual Detention time > Min Detention Time at 2-Hour Peak Flow

2.41 hours > 1.80 feet

ACCEPTABLE MINIMUM CLARIFIER DETENTION TIME - OK

h Stilling Well Diameter

1 Flow to stilling well = peak flow + recycle flow / number of clarifiers

=	**0.44**	cfs	plus	0.15	cfs	divided by	1
=	**0.59**	cfs					

2 Minimum Stilling Well Area = Peak Flow into stilling well / Minimum Stilling Well Velocity

=	**0.59**	cfs	divided by	0.15	feet per second at peak flow.
=	**3.936735899**	square feet			

3 Minimum Diameter of Stilling Well = square root of (Minimum area of stilling well / (PI/4))

= Square root of	3.936735899	square feet	divided by	0.785398163
=	2.238840732			

USE A STILLING WELL DIAMETER = 4 feet

4 Actual Vertical velocity in stilling well = peak flow into stilling well /(PI x (stilling well diameter^2)/4)

=	**0.59 cfs**	divided by	12.56637061	sf
=	**0.047 fps**			

5 Actual Stilling well Vertical Velocity < Min Stilling Well vertical velocity at 2-Hour Peak Flow

0.047 fps < 0.15

ACCEPTABLE STILLING WELL DIAMETER - OK

5 Aeration Basin Traditional Design

a Minimum dissolved oxygen concentration of 2.0 milligrams per liter (mg/l) throughout the basin

b A facility with a design flow of equal to or greater than 0.4 million gallons per day (mgd) must have a minimum of two aeration basins

6589

c Assume number of Aeration Basins = 1 12

55

d Side Water Depth = Distance diffuser above floor + Diffuser submergence 9.983333333

=	0.5	feet	plus	10	feet
=	10.5	feet			

e Aeration Basin volume = Basin length x Basin width x Side Water depth x number of basins

=	52	times	12	times	**10.5**	times	1
=	6,552	cf					

g Total Aeration Volume available > Total Aeration Volume required

6,552 cf > 5,857 cf 49012 gallons

SUFFICIENT AERATION VOLUME - OK

h Average Daily Flow Hydraulic Retention Time = Volume / Average Daily Flow

=	6,552	cf	divided by	546 cf / hour
=	12.00	hours		

i Permitted Flow Hydraulic Retention Time = Volume / Permitted Flow

=	6,552	cf	divided by	546 cf / hour
=	12.00	hours		

j Peak Flow Hydraulic Retention Time = Volume / Peak flow

Reference

= 6,552 cf divided by 1,580 cf / hour
= 4.15 hours

6 Chlorine Contact Basin Sizing

a Minimum dissolved oxygen concentration in effluent = 4 mg/l Permit

b Side Water Depth = Distance diffuser above floor + Submergence
= 0.5 feet + 7.322916667 feet
= 7.822916667 feet

c Chlorine Contact Basin volume = Basin width x Basin length x Side Water depth x number of basins
= 12 times 8 times 7.822916667 times 1
= 751 cf

d Total Chlorine Contact Basin Volume available > Total Chlorine Contact Basin Volume required
751 cf > 527 cf
SUFFICIENT CHLORINE CONTACT BASIN VOLUME - OK

e Pound per day of CL2 required for treatment = Peak 2-hour flow in MGD x CL2 concentration from Table K.1 x 8.34
= 0.28368 MGD x 8 mg/l times 8.34
18.93 lb/day

f Maximum gas withdrawal rate per cylinder, lb/day = [Low ambient temperature, °F - Threshold temperature, °F] x Withdrawal factor, lb/°F/day
= 65 °F minus 0 °F times 1.0 lb/°F/day
= 65 °F times 1.0 lb/°F/day
= 65 lb/day

g Minimum velocity through chlorine diffuser = flow (cfs) divided by flow area (sf)
= 0.27 cfs divided by 0.02181662 sf
= 12.25 fps

7 Digester Sludge Processing

a Minimum dissolved oxygen concentration of 2.0 milligrams per liter (mg/l) throughout the basin

b A facility with a design flow of equal to or greater than 0.4 million gallons per day (mgd) must have a minimum of two aeration basins

c Assume number of Digester Basins = 2

d Side Water Depth = distance diffuser above floor + Submergence
= 0.5 foot plus 10 feet
= 10.50 feet

e Digester Basin volume = Basin length x Basin width x Side Water depth x number of basins
= 22 times 12 times 10.50 times 2
= 5,544 cf

f Individual Aeration Basin Volume = Total Volume Width / number of individual basins
= 5,544 cf divided by 2
2772 cf

g Total Digester Volume available > Total Aeration Volume required
5,544 cf > 5,411 cf
SUFFICIENT DIGESTER VOLUME - OK

h Hydraulic Load to Digester = 305 cf/day

i Calculated Actual Hydraulic Retention Time = Selected Digester Volume / Hydraulic Load to Digester
= 5,544 cf / 305 cf/day
18.16 days

j Calculate the digester's volatile solids loading rate
Digester volatile solids loading rate = volatile solids into digester (lbs/day) divided by digester volume divided by 1,000 (cf)
= 164 lbs/day / 5.544 cf
= 29.6 lb of volatile solids per 1,000 cf per day

Reference

8 Summary of Designed Process Unit Dimensions

	Side WALL Height ft	Length ft	Width ft	de WATER Dep ft	Number of Basins	Volume cf	
Aeration Basin(s)	12.17	52.00	12.00	10.50	1.00	6,552	OK
Digester(s)	12.17	22.00	12.00	10.50	2.00	5,544	OK
Chlorine Contact Basin(s)	12.17	8.00	12.00	7.82	1.00	751	OK
		Diameter ft	Area sf	ft			
Clarifier		22.00	380	10.00	1	3,802	OK

9 Aeration Basin Air Requirements

728 8 12 7.583333333 §217.155

a Oxygen Requirement (O2R) = [1.2(BOD_5) + 4.3 (NH3-N)] / BOD_5 §217.155 - Equation F.2.

= 1.2 times 250 mg/l + 4.3 times 25 mg/l / 250 mg/l

= 300 mg/l + 107.5 mg/l / 250 mg/l

= 407.5 mg/l / 250 mg/l

9
= **1.6300** lb O2/ lb BOD_5 14

b Wastewater Oxygen Transfer Efficiency (WOTE) = Clean Water Transfer Efficiency x Coarse Bubble Correction Factor

= **9.00%** x 0.65 GBRA pg 7/23

= 5.85% Coarse bubble

c Required Airflow (RAF) = [(PPD BOD_5) x (O2/lb BOD_5)] / [WOTE x 0.23 x 0.075 x 1440]

= 205 lb. BOD_5 per day x 1.6300 lb O2/ lb BOD_5 / 0.0585 0.23)2/#air @ 20° 0.075 lb air/cf 1440 min/day

= 334.15 lb O2 / day / 1.45314 lb O2 lb AIR min / lb AIR cf day

230 scfm (rounded up)

d Corrections to Required Airflow based on diffuser submergence depths

Table F.5. - Diffuser Submergence Correction Factors §217.155(b)(2)(D) -Table F.5.

Diffuser Submergence Depth (feet	Airflow Rate Correction Factor
8	1.82
10	1.56
12	1
15	0.91
18	0.73
20	0.64

Actual Submergence Depth = 10 ft

Corrected Required Airflow = Required Airflow x Submergence Correction Factor

= 230 scfm (rounded up) times 1.56

359.0 scfm (rounded up)

e Air Requirements based on mixing = (Aeration Basin Volume / 1000) x 20

= 6,552 cf / 20 scfm/1000 cf

= **132** scfm (rounded up)

f Airflow requirements based on Default values listed in Table F.4 §217.155(a)(3)

= Airflow / BOD_5 load x lb BOD_5 per day

Reference

= **3200** scf/day/lb x 205 lb. BOD_5 per day
= 656,000 scf / day
= **456** scfm (rounded up)

f Controlling Required Air Flow is larger of Required Air Flow based on Process and RAF based on Mixing

RAF Based on Process =	359.0	scfm (rounded up)
RAF Based on Mixing =	132.0	scfm (rounded up)
RAF based on Default values in Table F.4 =	456.0	scfm (rounded up)

RAF Based on Process = 456 scfm (rounded up)

g Table F.6. - Minimum Diffuser Submergence Depth

Design Flow (mgd)	Minimum Submergence Depth (feet)
<0.01	8
0.01 to 0.10	9
>0.10	10

Actual Submergence Depth > or = Minimum Diffuser Submergence Depth
10 ft > 10 ft

ACCEPTABLE DIFFUSER SUBMERGENCE DEPTH - OK

10 Chlorine Contact Basin Air Requirements

a Minimum chlorine contact basin air requirements scfm = (Minimum Chlorine Basin Air Required (SCFM/1000 CF) * Chlorine Contact Basin Volume) / 1000

$$= \frac{15 \text{ scfm / 1000 CF} \text{ times } 751 \text{ cf}}{1000}$$

$$= \frac{11{,}265.0 \text{ scfm}}{1{,}000.0}$$

= **12** scfm (rounded up)

11 Digester Basin Air Requirements

a Minimum Digester Basin Air Requirements scfm = (Minimum Digester Basin Design Criteria (SCFM/1,000 CF) * Total Digester Basin Volume) / 1000

$$= \frac{20 \text{ scfm / 1,000 cf} \text{ times } 5{,}544 \text{ cf}}{1000}$$

$$= \frac{110{,}880.0 \text{ scfm}}{1000}$$

= 111 scfm (rounded up)

12 Air Lift Pump Air Requirements

a Scum Skimmer Airlift Pumps
Assume a Sanitaire Airlift Pump - 4' EDUCTOR, 3" INLET PIPE, 70% Submergence
30 gpm requires **10** scfm
90 gpm requires **17** scfm

Total Scum Airlift pump requirements = Air required per pump x number of pumps
= 17 scfm times **1** pumps
= 17

b Minimum Return Activated Sludge Flow Rate
The minimum return sludge pumping system must be capable of pumping least 200 gpd/sf of clarifier surface area.
Min RAS pumping rate = (total clarifier surface area / number of clarifiers) x 200 gpd/sf
= 380 sf divided by 200 gpd/sf
= 76,027 gpd
= 52.796 gpm

c Maximum Return Activated Sludge Flow Rate
The maximum return sludge pumping system must be capable of pumping least 400 gpd/sf of clarifier surface area.
Maximum RAS pumping rate =(total clarifier surface area / number of clarifiers) x 400 gpd/sf
= 380 sf divided by 400 gpd/sf

Reference

= 152,053 gpd
= 105.6 gpm

d RAS Flow Rate Per RAS Pump

Firm number of air lift pumps per clarifier =
RAS flow rate = Maximum RAS pumping Rate / number of pumps
= 105.592 gpm divided by 1 pumps
= 105.6 gpm per pump

e Return Activated Sludge Airlift Pumps

Assume a Sanitaire Airlift Pump -4" EDUCTOR, 3" INLET PIPE, 70% Submergence
105 gpm requires **23** scfm

Total Return Activated Sludge Airlift pump requirements = Air required per pump x firm number of pumps
= 23 scfm times **1** pumps
= 23 scfm

f Waste Activated Sludge Airlift Pumps

Assume a Sanitaire Airlift Pump -4" EDUCTOR, 3" INLET PIPE, 70% Submergence
Hydraulic Load to Digester (from above) 2,284 gal/day divided by number of clarifiers
2,284 gal/day divided by 1
2,284 gal/day
1.59 gpm

Flow Rate for Constant Flow from Clarifier to Digester 1.59 gpm

Flow Rate to Waste in X hour = Hydraulic Load to Digester / "X" hours
= 2,284 gal/day / X hours

1 hour =	38 gpm	2283.887176
2 hours =	19 gpm	2283.887176
3 hours =	13 gpm	2283.887176
4 hours =	10 gpm	2283.887176
5 hours =	8 gpm	2283.887176
6 hours =	6 gpm	2283.887176
7 hours =	5 gpm	2283.887176
8 hours =	5 gpm	2283.887176
9 hours =	4 gpm	2283.887176
10 hours =	4 gpm	2283.887176
11 hours =	3 gpm	2283.887176
12 hours =	3 gpm	2283.887176
13 hours =	3 gpm	2283.887176

Pumping rate (gpm)	air required (scfm)	wasting time in minutes at pumping rate indicated
30	**10**	76.1 minutes
40	**11**	57.1 minutes

= 11 57.1 times **1** pumps
= 11 scfm

g Summary of Airlift Pump Air Requirements

	Minimum scfm	Maximum scfm	
Scum Skimmer Airlift Pumps	10	17	
Minimum Return Activated Sludge Flow Rate	23	23	
Waste Activated Sludge Airlift Pumps	10	11	
Total	43	51	scfm (rounded up)

13 Total Air Requirements

Aeration Basin Air Requirements =	456	scfm (rounded up)
Chlorine Contact Basin Air Requirements =	12	scfm (rounded up)
Digester Basin Air Requirements =	111	scfm (rounded up)
Airlift Pump Air Requirements =	51	scfm (rounded up)
	630	scfm (rounded up) At a pressure of 4.55 psi

Blowers

Reference

Total Number	Firm Number	Air flow per blower
2	1	630
3	2	315
4	3	210
5	4	158
6	5	126

Use total of 2 blowers at a minimum of 636 scfm @ 4.55 psi @ 100°F and 80% humidity

APPENDIX C
LIFT STATION CALCULATIONS

IDS Engineering Group
TBPE F-002726 TBPLS 10110707

Sanitary Lift Station Design and Cost Analysis

CLIENT: COMAL COUNTY WCID NO. 6 / 277, Ltd.
DISTRICT: COMAL COUNTY WCID NO. 6
PROJECT: Park Village WWTP On-Site Influent Lift Station Phase 1
JOB NO: 1500-001-11

Prepared By: *David J Ross* INITIAL HERE
Checked By: INITIAL HERE

Constants and Coefficients

Hazen-Williams Coefficient (C)
- 100 Old Ductile Iron/Cast Iron Pipe
- 120 Old PVC Pipe or New Ductile Iron/Cast Iron Pipe
- 140 New PVC Pipe (Typical Value)
- 160 New PVC Pipe (High-end Value)

Civil Design Criteria

I SITE CONDITIONS

A	**Existing Natural Ground Elevation =**	Enter. . . .	1,270.00	ft
B	**100-yr Floodplain elevation**		1271.00	
			1,271.00	msl el
	FEMA FIRM Panel Number	48091C0195F		
	FEMA FIRM Panel Date	September 2, 2009		
	Over Riding Data - (Drainage Study or Histroical High Water Level)	Enter. . . .	1,271.00	msl el
C	**Finished Grade Elevation of Pump Station =**	Enter. . . .	1,271.50	msl el
	Distance between finished grade and top of LS (typically 0.5-feet)	Enter. . . .	1.00	ft
	Top of Concrete at Pump Station (TOC) = Finished Grade = 0.5 feet =		1272.50	msl el
	Lowest Top of Rim for the nearest 3 influent non flood tight manholes =	Enter. . . .	1,272.00	msl el
D	**Enter Discharge Elevation of Riser Pipe**		**1275.50**	msl el
	VALVE PAD (typ. 1.5' to 2.0' above top of concrete at pump station)	Enter. . . .	3.00	ft
	VALVE PIT (typ. 3.0' below the top of concrete pump station)	Enter. . . .	0.00	ft
E	**Elevation of Force Main at Highest Point**		**1,288.35**	msl el
	Highest Top of Pipe		1,284.50	msl el
	Highest Top of Pipe at all Aerial Crossings = (enter	Enter. . . .	1,284.50	
	Highest ground elevation along route	Enter. . . .	1,272.00	msl el
	Depth of Cover over force main	Enter. . . .	4.00	ft
	Elevation of Discharge	Enter. . . .	1,288.35	ft
	Pipe Diameter **CHECK AGAINST FM SIZING IN PART II.C**	Enter. . . .	6.00	inches
	Highest ground elevation along route - cover - half pipe diameter		**1,267.75**	msl el
F	**Overflow Elevation**		1,271.00	msl el
	Thickness of lift station top slab	Enter. . . .	1.50	ft
	Underside of lift station top slab		1,271.00	msl el
	Highest top of rim of the closest 3 manholes upstream of the lift station		1,272.00	msl el
	Lower elevation of Underside of LS top slab and Highest MH top of rim		1271	msl el
G	**Sewer Influent Line Elevation =**			
	Flowline elevation	Enter. . . .	1,264.50	msl el
	Pipe Diameter	Enter. . . .	8	in
H	**INTERIM number of Required Connections =**		**326.67**	EDU
	Drainage Fixture Units	Enter. . . . 0	DFU	
	Flow per DFU	Enter. . . . 0.0608	gpm	
	Flow based on EDU	0	gpm	
	DFUs converted to EDUs	0	EDU	
	Single Family Homes or Equivalent Dwelling Unit	Enter. . . . 327	EDU	
	Office Building in EDU	Enter. . . . 0	EDU	
	Total undeveloped acreage	Enter. . . . 0.00	acre	
	EDUs per undeveloped acre	0	EDU	
	EDUs for Total Undeveloped Acreage =	0.00	EDU	
	Design Flow / EDU =	Enter. . . .	300	gpd / EDU
	Peak Factor =			
	Interim Peak Dry Weather Flow Factor, (PDWF) =	Enter. . . .	2.5	
	Interim Peak Wet Weather Flow Factor, (PDWF) =	Enter. . . .	2.9	

IDS Engineering Group
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Design Flows

Calculated Interim Average Daily Flow, (ADF) = 98,000 gpd =	68	gpm	98,000
Calculated Interim Peak Dry Weather Design Flow, (2-Hr PEAK of 2.5Q) = 245,000 gpd =	170	gpm	
Calculated Interim Peak Design Flow, (2-Hr PEAK of 2.89469387755102Q) = 283,680 gpd =	**197**	**gpm**	283,680
Calculated Interim Min Dry Weather Flow, (0.2*(0.0144*ADF)^0.198)*ADF) = 82,390 gpd =	57	gpm	

The Calculated Interim Min Dry Weather Flow is used to determine the maximum detention time in the wet well.

J Minimum Water Depth in Wet Well 2.416666667 ft

Base on ultimate flow pumps if different from Interim Flow pumps

Submersible Pump Manufacturer's Minimum Required Liquid Operation Depth = Enter. . . . 1.00 ft
Use zero for self priming centrifugal pumps

Dist between above level and Low Water Alarm Level (6" or 1 min pump flow vol) = Enter. . . . 1.00 ft

Pump Casing Height, Depth of "Dead" Storage, or Assume 2' initially and update from Pump Cut Sheet
Pump Manufacturer's Minimum Recommended Liquid Operation Depth = Enter. . . . 2.42 ft

K Cost of Electricity (City of Houston Rates) = Enter. . . . $0.1200 $ per kwh

L Wet Well Diameter

Calculated Ultimate Peak Design Flow from I.I above 542 gpm

PUMP RANGES, CAPACITY RANGES, DISHCARGE PIPING, WET WELL SIZE AND SITE SIZE FOR PROJECTS INSIDE THE CITY OF HOUSTON CITY LIMITS

Number of Pumps	Individual Pump Capacity - gpm		Lift Station Firm Design Capacity		Pump Discharge Piping - Inches		Wet Well Diameter	Minimum Lot Size
	From	To	From	To	From	To	ft	ft
2	0	199	0	199	4	4	6	55' x 55'
2	200	499	200	499	4	8	8	55' x 55'
2	500	999	500	999	8	10	10	70' x 70'
3	250	500	500	999	6	10	10	70' x 70'
3	500	999	1,000	1,998	8	10	12	75' x 75'
3	1,000	1,399	2,000	2,798	10	12	14	75' x 75'
3	1,400	1,999	2,800	3,998	12	16	16.5	75' x 75'
3	2,000	3,499	4,000	7,198	16	24	21	85' x 85'
4	800	3,499	2,400	10,497	10	20	21	85' x 85'
5	2,500	3,999	7,500	15,996	18	20	25	85' x 85'
6	3,000	5,299	15,000	21,196	18	20	28	90' x 90'

Number of Pumps	Lift Station Firm Design Capacity - gpm		Lift Station Firm Design Capacity - gpd		Lift Station Firm Design Capacity (EDUs) @ 300 gpd/EDU	
	From	To	From	To	From	To
2	0	199	0	286,560	0	239
2	200	499	288,000	718,560	240	599
2	500	999	720,000	1,438,560	600	1,199
3	500	999	720,000	1,438,560	600	1,199
3	1,000	1,998	1,440,000	2,877,120	1,200	2,398
3	2,000	2,798	2,880,000	4,029,120	2,400	3,358
3	2,800	3,998	4,032,000	5,757,120	3,360	4,798
3	4,000	7,198	5,760,000	10,365,120	4,800	8,638
4	2,400	10,497	3,456,000	15,115,680	2,880	12,596
5	7,500	15,996	10,800,000	23,034,240	9,000	19,195
6	15,000	21,196	21,600,000	30,522,240	18,000	25,435

Sanitary Lift Station Design and Cost Analysis

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DISTRICT: COMAL COUNTY WCID NO. 6
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JOB NO: 1500-001-11

Prepared By: *David J Ross* INITIAL HERE
Checked By: INITIAL HERE

M Number of Pumps

Total number of pumps in the lift station during INTERIM condition	Enter. . . . 2	pumps
Firm number of pumps in the lift station during **INTERIM** condition	1	pumps
Total number of pumps in the lift station during ULTIMATE condition	Enter. . . . 2	pumps
Firm number of pumps in the lift station during **ULTIMATE** condition	1	pumps

II WET WELL SIZING

A Preliminary Wet Well Diameter

This lift station is based on the above table for projects	IN THE COH ETJ	
Diameter of Wet Well for **INTERIM** condition	Enter. . . . 12	ft
Diameter of Wet Well for **ULTIMATE** condition	Enter. . . . 12	ft

Refer to the tables above to determine wet well diameter

B Preliminary Minimum Pump Cycle Time Determination

Pump Hp	Min Cycle Time Per Pump minutes
< 50	6
50-100	10
>100	15

Enter. . . . 10 minutes

VERIFY CYCLE TIME AFTER DESIGN PUMPS HAVE BEEN CHOSEN !

C Compute the Required Wet Well Volume

Note: If using a rectangular configuration do not enter a diameter, use rectangular entries below instead.

Circular Wet Well Configuration

Trial Diameter of Wet Well =	Enter. . . . 12	ft	CHECK AGAINST II.A ABOVE
Trial Circular Wet Well Configuration Area =	113	sq.ft	

Rectangular Wet Well Configuration

Length of Proposed Wet Well =	Enter. . . .	ft
Width of Proposed Wet Well =	Enter. . . .	ft
Trial Rectangular Wet Well Configuration Area =	0	sq.ft

Working Volumes (gal/VF) 846 gal /ft used in energy cost below (V.F)

D Minimum wet well depth below influent pipe at ULTIMATE conditions based on one pump's cycle time

Minimum Ultimate Storage Volume $\frac{\text{Qpeak (gpm) X Cycle Time (min)}}{\text{(4) 7.481 gal/cf}}$ = $\frac{542 \text{ gpm} \times 10 \text{ minutes}}{4 \times 7.481 \text{ gal / cf}}$

Minimum Ultimate Storage volume for first pump on = 181 cf

Minimum Ultimate Storage Depth for first pump on = Minimum Storage Volume for first pump on cf / Wet Well Area

Minimum Storage Depth = 181 cubic feet / 113 sq. ft

Minimum Storage Depth = 1.6 ft **ROUNDED TO 1 DECIMAL PLACE**

DOES NOT INCLUDE REDUCTION FOR

Min Required Storage Depth Below Influent Line = 1.6 ft **PIPING AND PUMP VOLUME**

For multiple pump lift stations to **estimate** the Minimum required storage at **ULTIMATE** condition multiply the number of firm pumps times the minimum required Storage Depth below Influent Line for the first pump on.

Estimated Minimum Required storage at ULTIMATE condition = number of firm pumps x Minimum Required Storage Depth

Estimated Minimum Required storage at ULTIMATE condition = 1.60 ft

USE Minimum Required storage at ULTIMATE condition = 1.60 ft CHECK AGAINST CELL M820

NOTE: REQUIRED DEPTH (ABOVE) SHOULD TYPICALLY BE BETWEEN 1' and 4'

Estimated Maximum Elevation of the Wet Well Floor = Influent Line flow line elevation
- Estimated Minimum Required storage at ULTIMATE condition
- Minimum Water Depth in Wet Well (see I J)

Estimated Maximum Elevation of the Wet Well Floor =	1,260.48	msl el
USE Maximum Elevation of the Wet Well Floor =	1,242.50	msl el

III LINE SIZING

A. Compute Riser Pipe Sizes

Pipe Dia. (inches)	Interim Velocity (fps)	Ultimate Velocity (fps)
4	5.03	13.83
6	2.24	6.15
8	1.26	3.46
10	0.80	2.21
12	0.56	1.54
14	0.41	1.13
16	0.31	0.86
18	0.25	0.68
20	0.20	0.55
22	0.17	0.46
24	0.14	0.38
26	0.12	0.33

Use Riser Pipe Diameter =	Enter. . . .	6	inches
Wet Well Bottom		1,242.50	msl el
Riser Pipe Length =		33.0	ft
Interim Peak Design Flow, Velocity =		2.24	fps
Ultimate Peak Design Flow, Velocity =		6.15	fps

FOR ACTUAL VELOCITY SEE FINAL HYDRAULIC CALCULATIONS
FOR ACTUAL WET WELL BOTTOM ELEVATION SEE PART IV-C

B. Riser Pipe Data

Riser Pipe	Riser No 1
TCEQ Information only FM Coefficient (C) =	100
Max. Riser Coefficient (C) =	120
Min. Riser Coefficient (C) =	140
Riser Pipe Diameter (in.) =	6
Riser Wetted Perimeter =	0.13

Riser	Quantity	K Values	Quantity*K
Riser Pipe Length =	33.00		
Increaser	0	0.25	0.00
Reducer	0	0.50	0.00
22.5 Degree Bends =	0	0.12	0.00
45 Degree Bends =	2	0.24	0.48
90 Degree Bends =	2	0.45	0.90
Standard "T's" =	0	0.90	0.00
Full Open Swing Check	1	1.50	1.50
Plug Valve	1	0.27	0.27
		K Value Sum	3.15

C Compute Force Main Sizes

§217.67 requires that, for a duplex pump station, the minimum velocity is 3.0 feet per second with one pump in operation

§217.67 requires that, for a lift station with three or more pumps,
the minimum velocity in a force main is 2.0 feet per second with only the smallest pump in operation and
a minimum flushing velocity of 5.0 feet per second or greater must occur in a force main at least once daily

Pipe Dia. (inches)	Interim Velocity (fps)	Ultimate Velocity (fps)
4	5.03	13.83
6	2.24	6.15
8	1.26	3.46
12	0.56	1.54
16	0.31	0.86
18	0.25	0.68
20	0.20	0.55
22	0.17	0.46
24	0.14	0.38
26	0.12	0.33
28	0.10	0.28
30	0.09	0.25
36	0.06	0.17
48	0.03	0.10
60	0.02	0.06

GO BACK AND INSERT THE CHOSEN FORCE MAIN SIZE IN PART I.E OF THESE CALCULATIONS

Force Main #1

Force Main #1 Diameter = Enter. . . . 6 inches
Length of Force Main #1 = Enter. . . . 60 ft

Interim Peak Design Flow, Velocity = 2.24 fps
Ultimate Peak Design Flow, Velocity = 6.15 fps
FOR ACTUAL VELOCITY SEE FINAL HYDRAULIC CALCULATIONS

Force Main #2

Force Main #2 Diameter = Enter. . . . inches
Length of Force Main #2 = Enter. . . . ft

Interim Peak Design Flow, Velocity = fps
Ultimate Peak Design Flow, Velocity = fps
FOR ACTUAL VELOCITY SEE FINAL HYDRAULIC CALCULATIONS

Force Main #3

Force Main #3 Diameter = Enter. . . . inches
Length of Force Main #3 = Enter. . . . ft

Interim Peak Design Flow, Velocity = fps
Ultimate Peak Design Flow, Velocity = fps
FOR ACTUAL VELOCITY SEE FINAL HYDRAULIC CALCULATIONS

D Determine Preliminary Minimum and Maximum Static Heads

Minimum PRELIMINARY Water Surface Level in Wet Well = Estimated Max Elev of the Wet Well Floor (II.F) + Min Water Depth in Well
= 1242.50 + 2.42
Minimum PRELIMINARY Water Surface Level in Wet Well = 1244.92

Maximum PRELIMINARY Static Head = Highest Point in Force Main - Minimum PRELIMINARY Water Surface Level in Wet Well
1288.35 - 1244.92
Maximum PRELIMINARY Static Head = 43.43

Maximum PRELIMINARY Water Surface Level in Wet Well = Estimated Max Elev of the Wet Well Floor (II.F) + Minimum Water Depth in Wet Well
+ Estimated Minimum Required storage at ULTIMATE condition
= 1242.50 + 2.42 + 1.6
Maximum PRELIMINARY Water Surface Level in Wet Well = 1,246.52

Minimum PRELIMINARY Static Head = Highest Point in Force Main - Maximum ESTIMATED Water Surface Level in Wet Well
= 1288.35 - 1246.52
Minimum PRELIMINARY Static Head = 41.83

E FORCE MAIN DATA

Force Main	System Characteristics FM No 1	FM No 2	FM No 3	
TCEQ Information only FM Coefficient (C) =	100	100	100	
Max. FM Coefficient (C) =	120	120	120	
Min. FM Coefficient (C) =	140	140	140	
Max. Static Head (ft) @ Designed GPM =	43.45	0.00	0.00	Replace with Values from IV C
Min. Static Head (ft) @ Designed GPM =	42.35	0.00	0.00	Replace with Values from IV C
Flooded Static Head (ft) @ Designed GPM =	17.35	0.00	0.00	Replace with Values from IV C
FM Pipe Diameter (in.) =	6	16	16	
FM Wetted Perimeter =	0.13	0.33	0.33	

Force Main	FM No. 1 Quantity	FM No. 1 K Values	FM No. 1 Quantity*K	FM No. 2 Quantity	FM No. 2 K Values	FM No. 2 Quantity*K	FM No. 3 Quantity	FM No. 3 K Values	FM No. 3 Quantity* K
Length (ft) =	60			0			0		
22.5° Bends =	0	0.12	0.00	0	0.10	0.00	0	0.10	0.00
45° Bends =	2	0.24	0.48	0	0.21	0.00	0	0.21	0.00
90° Bends =	3	0.45	1.35	0	0.39	0.00	0	0.39	0.00
Plug Valve	1	0.27	0.27	0	0.23	0.00	0	0.23	0.00
		K Value Sum	2.10		K Value Sum	0.00		K Value Sum	0.00

F System Head Curve Calculations

Incremental increase in flow (gpm) = 50

COH Required Curve Number 3

f.1 Table: High Normal Operation Level C=120 - Design

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	FM No. 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	42.35	0.00	0.00	0.00	0.00	0.00	42.35
50	0.03	0.57	42.38	0.57	0.00	0.00	0.00	0.00	42.38
100	0.10	1.13	42.47	1.13	0.00	0.00	0.00	0.00	42.47
150	0.23	1.70	42.60	1.70	0.00	0.00	0.00	0.00	42.60
200	0.40	2.27	42.78	2.27	0.00	0.00	0.00	0.00	42.78
250	0.61	2.84	43.01	2.84	0.00	0.00	0.00	0.00	43.01
300	0.88	3.40	43.29	3.40	0.00	0.00	0.00	0.00	43.29
350	1.18	3.97	43.61	3.97	0.00	0.00	0.00	0.00	43.61
400	1.54	4.54	43.98	4.54	0.00	0.00	0.00	0.00	43.98
450	1.93	5.11	44.39	5.11	0.00	0.00	0.00	0.00	44.39
500	2.37	5.67	44.85	5.67	0.00	0.00	0.00	0.00	44.85
550	2.86	6.24	45.35	6.24	0.00	0.00	0.00	0.00	45.35
600	3.38	6.81	45.89	6.81	0.00	0.00	0.00	0.00	45.89
650	3.96	7.38	46.48	7.38	0.00	0.00	0.00	0.00	46.48
700	4.57	7.94	47.11	7.94	0.00	0.00	0.00	0.00	47.11
750	5.23	8.51	47.78	8.51	0.00	0.00	0.00	0.00	47.78
800	5.93	9.08	48.49	9.08	0.00	0.00	0.00	0.00	48.49
850	6.68	9.65	49.25	9.65	0.00	0.00	0.00	0.00	49.25
900	7.47	10.21	50.05	10.21	0.00	0.00	0.00	0.00	50.05
950	8.30	10.78	50.89	10.78	0.00	0.00	0.00	0.00	50.89
1000	9.17	11.35	51.77	11.35	0.00	0.00	0.00	0.00	51.77
1050	10.09	11.92	52.70	11.92	0.00	0.00	0.00	0.00	52.70
1100	11.05	12.48	53.66	12.48	0.00	0.00	0.00	0.00	53.66
1150	12.05	13.05	54.67	13.05	0.00	0.00	0.00	0.00	54.67
1200	13.10	13.62	55.72	13.62	0.00	0.00	0.00	0.00	55.72
1250	14.18	14.18	56.81	14.18	0.00	0.00	0.00	0.00	56.81
1300	15.31	14.75	57.94	14.75	0.00	0.00	0.00	0.00	57.94
1350	16.49	15.32	59.11	15.32	0.00	0.00	0.00	0.00	59.11
1400	17.70	15.89	60.32	15.89	0.00	0.00	0.00	0.00	60.32
1450	18.96	16.45	61.57	16.45	0.00	0.00	0.00	0.00	61.57
1500	20.26	17.02	62.86	17.02	0.00	0.00	0.00	0.00	62.86
1550	21.60	17.59	64.19	17.59	0.00	0.00	0.00	0.00	64.19
1600	22.98	18.16	65.56	18.16	0.00	0.00	0.00	0.00	65.56
1650	24.41	18.72	66.98	18.72	0.00	0.00	0.00	0.00	66.98
1700	25.87	19.29	68.43	19.29	0.00	0.00	0.00	0.00	68.43
1750	27.38	19.86	69.92	19.86	0.00	0.00	0.00	0.00	69.92
1800	28.93	20.43	71.45	20.43	0.00	0.00	0.00	0.00	71.45
1850	30.53	20.99	73.03	20.99	0.00	0.00	0.00	0.00	73.03
1900	32.16	21.56	74.64	21.56	0.00	0.00	0.00	0.00	74.64
1950	33.84	22.13	76.29	22.13	0.00	0.00	0.00	0.00	76.29
2000	35.55	22.70	77.98	22.70	0.00	0.00	0.00	0.00	77.98
2050	37.31	23.26	79.71	23.26	0.00	0.00	0.00	0.00	79.71
2100	39.11	23.83	81.48	23.83	0.00	0.00	0.00	0.00	81.48
2150	40.96	24.40	83.29	24.40	0.00	0.00	0.00	0.00	83.29
2200	42.84	24.97	85.14	24.97	0.00	0.00	0.00	0.00	85.14
2250	44.77	25.53	87.03	25.53	0.00	0.00	0.00	0.00	87.03
2300	46.74	26.10	88.96	26.10	0.00	0.00	0.00	0.00	88.96
2350	48.74	26.67	90.92	26.67	0.00	0.00	0.00	0.00	90.92
2400	50.80	27.24	92.93	27.24	0.00	0.00	0.00	0.00	92.93
2450	52.89	27.80	94.97	27.80	0.00	0.00	0.00	0.00	94.97
2500	55.02	28.37	97.05	28.37	0.00	0.00	0.00	0.00	97.05

f.2 Table: Pump Curves

	KRT K 80-251/46XG-S; 10.04" Impeller	KRT K 80-251/46XG-S; 10.04" Impeller	KRT K 80-251/46XG-S; 10.04" Impeller	KRT K 80-251/46XG-S; 10.04" Impeller	KRT K 80-251/46XG-S; 10.04" Impeller	KRT K 80-251/46XG-S; 10.04" Impeller	Pump Brand & Model #	Pump Brand & Model #
Flow (gpm)	**Published Pump 1 Curve HL (ft)**	**Pub Curve w/Riser Losses ONE PUMP Head (ft)**	**Pub Curve w/Riser Losses TWO PUMPS Head (ft)**	**Pub Curve w/Riser Losses THREE PUMPS Head (ft)**	**Pub Curve w/Riser Losses FOUR PUMPS Head (ft)**	**Pub Curve w/Riser Losses FIVE PUMPS Head (ft)**	**Jockey Pump Head Loss (ft)**	**Adjusted Jockey Pump Loss (ft)**
0	33.3	33.3	33.3	33.3	33.3	33.3	0.0	0.0
50	31.9	31.9	32.6	32.8	33.0	33.0	0.0	0.0
100	30.7	30.6	31.9	32.4	32.6	32.8	0.0	-0.1
150	29.7	29.5	31.3	31.9	32.3	32.5	0.0	-0.2
200	28.5	28.1	30.6	31.5	31.9	32.2	0.0	-0.4
250	27.6	27.0	30.1	31.1	31.6	31.9	0.0	-0.6
300	26.6	25.7	29.5	30.6	31.3	31.7	0.0	-0.9
350	25.6	24.4	28.8	30.2	31.0	31.4	0.0	-1.2
400	24.7	23.2	28.1	29.9	30.6	31.1	0.0	-1.5
450	24.0	22.1	27.6	29.5	30.3	30.9	0.0	-1.9
500	23.2	20.8	27.0	29.0	30.1	30.6	0.0	-2.4
550	22.3	19.5	26.4	28.6	29.8	30.4	0.0	-2.9
600	21.5	18.1	25.7	28.1	29.5	30.2	0.0	-3.4
650	20.6	16.6	25.1	27.7	29.1	29.9	0.0	-4.0
700	19.9	15.3	24.4	27.4	28.8	29.7	0.0	-4.6
750	18.9	13.7	23.8	27.0	28.4	29.5	0.0	-5.2
800	18.2	12.3	23.2	26.6	28.1	29.2	0.0	-5.9
850	17.3	10.7	22.7	26.2	27.8	28.9	0.0	-6.7
900	16.8	9.4	22.1	25.7	27.6	28.7	0.0	-7.5
950	15.8	7.5	21.5	25.3	27.3	28.4	0.0	-8.3
1000	15.1	5.9	20.8	24.8	27.0	28.1	0.0	-9.2
1050	14.1	4.0	20.1	24.4	26.7	27.9	0.0	-10.1
1100	13.4	2.3	19.5	24.0	26.4	27.7	0.0	-11.0
1150	12.5	0.5	18.8	23.6	26.1	27.5	0.0	-12.1
1200	11.7	-1.4	18.1	23.2	25.7	27.2	0.0	-13.1
1250	10.8	-3.4	17.4	22.8	25.4	27.0	0.0	-14.2
1300	10.0	-5.4	16.6	22.5	25.1	26.8	0.0	-15.3
1350	9.1	-7.4	16.0	22.1	24.7	26.5	0.0	-16.5
1400	8.2	-9.5	15.3	21.7	24.4	26.3	0.0	-17.7
1450	7.0	-11.9	14.5	21.2	24.1	26.0	0.0	-19.0
1500	6.2	-14.1	13.7	20.8	23.8	25.7	0.0	-20.3
1550	5.2	-16.4	13.0	20.4	23.5	25.5	0.0	-21.6
1600	3.8	-19.2	12.3	19.9	23.2	25.2	0.0	-23.0
1650	2.7	-21.7	11.5	19.5	22.9	24.9	0.0	-24.4
1700	1.9	-24.0	10.7	19.0	22.7	24.7	0.0	-25.9
1750	0.7	-26.7	10.0	18.5	22.4	24.4	0.0	-27.4
1800		-28.9	9.4	18.1	22.1	24.2	0.0	-28.9
1850		-30.5	8.4	17.6	21.8	23.9	0.0	-30.5
1900		-32.2	7.5	17.1	21.5	23.7	0.0	-32.2
1950		-33.8	6.7	16.6	21.1	23.4	0.0	-33.8
2000		-35.6	5.9	16.2	20.8	23.2	0.0	-35.6
2050		-37.3	5.0	15.8	20.5	23.0	0.0	-37.3
2100		-39.1	4.0	15.3	20.1	22.8	0.0	-39.1
2150		-41.0	3.2	14.8	19.8	22.5	0.0	-41.0
2200		-42.8	2.3	14.2	19.5	22.3	0.0	-42.8
2250		-44.8	1.4	13.7	19.1	22.1	0.0	-44.8
2300			0.5	13.2	18.8	21.8	0.0	-46.7
2350			-0.5	12.7	18.4	21.6	0.0	-48.7
2400			-1.4	12.3	18.1	21.3	0.0	-50.8
2450			-2.4	11.7	19.7	21.1	0.0	-52.9
2500			-3.4	11.2	21.2	20.8	0.0	-55.0

COH Required Curve Number 4

f.3 Table: High Normal Operating Level C=140

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	FM No. 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	42.35	0.00	0.00	0.00	0.00	0.00	42.35
50	0.02	0.57	42.38	0.57	0.00	0.00	0.00	0.00	42.38
100	0.09	1.13	42.45	1.13	0.00	0.00	0.00	0.00	42.45
150	0.21	1.70	42.56	1.70	0.00	0.00	0.00	0.00	42.56
200	0.36	2.27	42.72	2.27	0.00	0.00	0.00	0.00	42.72
250	0.56	2.84	42.91	2.84	0.00	0.00	0.00	0.00	42.91
300	0.80	3.40	43.15	3.40	0.00	0.00	0.00	0.00	43.15
350	1.08	3.97	43.43	3.97	0.00	0.00	0.00	0.00	43.43
400	1.40	4.54	43.74	4.54	0.00	0.00	0.00	0.00	43.74
450	1.77	5.11	44.10	5.11	0.00	0.00	0.00	0.00	44.10
500	2.17	5.67	44.49	5.67	0.00	0.00	0.00	0.00	44.49
550	2.62	6.24	44.92	6.24	0.00	0.00	0.00	0.00	44.92
600	3.11	6.81	45.39	6.81	0.00	0.00	0.00	0.00	45.39
650	3.63	7.38	45.89	7.38	0.00	0.00	0.00	0.00	45.89
700	4.20	7.94	46.44	7.94	0.00	0.00	0.00	0.00	46.44
750	4.81	8.51	47.02	8.51	0.00	0.00	0.00	0.00	47.02
800	5.46	9.08	47.64	9.08	0.00	0.00	0.00	0.00	47.64
850	6.15	9.65	48.29	9.65	0.00	0.00	0.00	0.00	48.29
900	6.88	10.21	48.98	10.21	0.00	0.00	0.00	0.00	48.98
950	7.65	10.78	49.71	10.78	0.00	0.00	0.00	0.00	49.71
1000	8.46	11.35	50.48	11.35	0.00	0.00	0.00	0.00	50.48
1050	9.31	11.92	51.28	11.92	0.00	0.00	0.00	0.00	51.28
1100	10.20	12.48	52.12	12.48	0.00	0.00	0.00	0.00	52.12
1150	11.13	13.05	52.99	13.05	0.00	0.00	0.00	0.00	52.99
1200	12.10	13.62	53.90	13.62	0.00	0.00	0.00	0.00	53.90
1250	13.11	14.18	54.85	14.18	0.00	0.00	0.00	0.00	54.85
1300	14.16	14.75	55.83	14.75	0.00	0.00	0.00	0.00	55.83
1350	15.24	15.32	56.85	15.32	0.00	0.00	0.00	0.00	56.85
1400	16.37	15.89	57.90	15.89	0.00	0.00	0.00	0.00	57.90
1450	17.54	16.45	58.99	16.45	0.00	0.00	0.00	0.00	58.99
1500	18.75	17.02	60.11	17.02	0.00	0.00	0.00	0.00	60.11
1550	19.99	17.59	61.28	17.59	0.00	0.00	0.00	0.00	61.28
1600	21.28	18.16	62.47	18.16	0.00	0.00	0.00	0.00	62.47
1650	22.60	18.72	63.70	18.72	0.00	0.00	0.00	0.00	63.70
1700	23.97	19.29	64.97	19.29	0.00	0.00	0.00	0.00	64.97
1750	25.37	19.86	66.27	19.86	0.00	0.00	0.00	0.00	66.27
1800	26.82	20.43	67.61	20.43	0.00	0.00	0.00	0.00	67.61
1850	28.30	20.99	68.98	20.99	0.00	0.00	0.00	0.00	68.98
1900	29.82	21.56	70.39	21.56	0.00	0.00	0.00	0.00	70.39
1950	31.38	22.13	71.83	22.13	0.00	0.00	0.00	0.00	71.83
2000	32.98	22.70	73.31	22.70	0.00	0.00	0.00	0.00	73.31
2050	34.62	23.26	74.82	23.26	0.00	0.00	0.00	0.00	74.82
2100	36.30	23.83	76.37	23.83	0.00	0.00	0.00	0.00	76.37
2150	38.02	24.40	77.95	24.40	0.00	0.00	0.00	0.00	77.95
2200	39.78	24.97	79.57	24.97	0.00	0.00	0.00	0.00	79.57
2250	41.57	25.53	81.22	25.53	0.00	0.00	0.00	0.00	81.22
2300	43.41	26.10	82.90	26.10	0.00	0.00	0.00	0.00	82.90
2350	45.28	26.67	84.62	26.67	0.00	0.00	0.00	0.00	84.62
2400	47.19	27.24	86.38	27.24	0.00	0.00	0.00	0.00	86.38
2450	49.15	27.80	88.17	27.80	0.00	0.00	0.00	0.00	88.17
2500	51.14	28.37	89.99	28.37	0.00	0.00	0.00	0.00	89.99
2550	53.17	28.94	91.85	28.94	0.00	0.00	0.00	0.00	91.85
2600	55.23	29.50	93.75	29.50	0.00	0.00	0.00	0.00	93.75
2650	57.34	30.07	95.67	30.07	0.00	0.00	0.00	0.00	95.67
2700	59.49	30.64	97.63	30.64	0.00	0.00	0.00	0.00	97.63
2750	61.67	31.21	99.63	31.21	0.00	0.00	0.00	0.00	99.63

COH Required Curve Number 1

f.4 **Table: Low Normal Operation Level C=120 - Design**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	Headloss Total FM 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 C=120 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 C=120 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	43.45	0.00	0.00	0.00	0.00	0.00	43.45
50	0.03	0.57	43.48	0.57	0.00	0.00	0.00	0.00	43.48
100	0.10	1.13	43.57	1.13	0.00	0.00	0.00	0.00	43.57
150	0.23	1.70	43.70	1.70	0.00	0.00	0.00	0.00	43.70
200	0.40	2.27	43.88	2.27	0.00	0.00	0.00	0.00	43.88
250	0.61	2.84	44.11	2.84	0.00	0.00	0.00	0.00	44.11
300	0.88	3.40	44.39	3.40	0.00	0.00	0.00	0.00	44.39
350	1.18	3.97	44.71	3.97	0.00	0.00	0.00	0.00	44.71
400	1.54	4.54	45.08	4.54	0.00	0.00	0.00	0.00	45.08
450	1.93	5.11	45.49	5.11	0.00	0.00	0.00	0.00	45.49
500	2.37	5.67	45.95	5.67	0.00	0.00	0.00	0.00	45.95
550	2.86	6.24	46.45	6.24	0.00	0.00	0.00	0.00	46.45
600	3.38	6.81	46.99	6.81	0.00	0.00	0.00	0.00	46.99
650	3.96	7.38	47.58	7.38	0.00	0.00	0.00	0.00	47.58
700	4.57	7.94	48.21	7.94	0.00	0.00	0.00	0.00	48.21
750	5.23	8.51	48.88	8.51	0.00	0.00	0.00	0.00	48.88
800	5.93	9.08	49.59	9.08	0.00	0.00	0.00	0.00	49.59
850	6.68	9.65	50.35	9.65	0.00	0.00	0.00	0.00	50.35
900	7.47	10.21	51.15	10.21	0.00	0.00	0.00	0.00	51.15
950	8.30	10.78	51.99	10.78	0.00	0.00	0.00	0.00	51.99
1000	9.17	11.35	52.87	11.35	0.00	0.00	0.00	0.00	52.87
1050	10.09	11.92	53.80	11.92	0.00	0.00	0.00	0.00	53.80
1100	11.05	12.48	54.76	12.48	0.00	0.00	0.00	0.00	54.76
1150	12.05	13.05	55.77	13.05	0.00	0.00	0.00	0.00	55.77
1200	13.10	13.62	56.82	13.62	0.00	0.00	0.00	0.00	56.82
1250	14.18	14.18	57.91	14.18	0.00	0.00	0.00	0.00	57.91
1300	15.31	14.75	59.04	14.75	0.00	0.00	0.00	0.00	59.04
1350	16.49	15.32	60.21	15.32	0.00	0.00	0.00	0.00	60.21
1400	17.70	15.89	61.42	15.89	0.00	0.00	0.00	0.00	61.42
1450	18.96	16.45	62.67	16.45	0.00	0.00	0.00	0.00	62.67
1500	20.26	17.02	63.96	17.02	0.00	0.00	0.00	0.00	63.96
1550	21.60	17.59	65.29	17.59	0.00	0.00	0.00	0.00	65.29
1600	22.98	18.16	66.66	18.16	0.00	0.00	0.00	0.00	66.66
1650	24.41	18.72	68.08	18.72	0.00	0.00	0.00	0.00	68.08
1700	25.87	19.29	69.53	19.29	0.00	0.00	0.00	0.00	69.53
1750	27.38	19.86	71.02	19.86	0.00	0.00	0.00	0.00	71.02
1800	28.93	20.43	72.55	20.43	0.00	0.00	0.00	0.00	72.55
1850	30.53	20.99	74.13	20.99	0.00	0.00	0.00	0.00	74.13
1900	32.16	21.56	75.74	21.56	0.00	0.00	0.00	0.00	75.74
1950	33.84	22.13	77.39	22.13	0.00	0.00	0.00	0.00	77.39
2000	35.55	22.70	79.08	22.70	0.00	0.00	0.00	0.00	79.08
2050	37.31	23.26	80.81	23.26	0.00	0.00	0.00	0.00	80.81
2100	39.11	23.83	82.58	23.83	0.00	0.00	0.00	0.00	82.58
2150	40.96	24.40	84.39	24.40	0.00	0.00	0.00	0.00	84.39
2200	42.84	24.97	86.24	24.97	0.00	0.00	0.00	0.00	86.24
2250	44.77	25.53	88.13	25.53	0.00	0.00	0.00	0.00	88.13
2300	46.74	26.10	90.06	26.10	0.00	0.00	0.00	0.00	90.06
2350	48.74	26.67	92.02	26.67	0.00	0.00	0.00	0.00	92.02
2400	50.80	27.24	94.03	27.24	0.00	0.00	0.00	0.00	94.03
2450	52.89	27.80	96.07	27.80	0.00	0.00	0.00	0.00	96.07
2500	55.02	28.37	98.15	28.37	0.00	0.00	0.00	0.00	98.15
2550	57.19	28.94	100.28	28.94	0.00	0.00	0.00	0.00	100.28
2600	59.41	29.50	102.44	29.50	0.00	0.00	0.00	0.00	102.44
2650	61.67	30.07	104.64	30.07	0.00	0.00	0.00	0.00	104.64
2700	63.97	30.64	106.88	30.64	0.00	0.00	0.00	0.00	106.88
2750	66.31	31.21	109.15	31.21	0.00	0.00	0.00	0.00	109.15

This is not a COH required curve.

f.5 **Table: Low Normal Operating Level C=140**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	Headloss Total FM 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 C=140 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 C=140 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	43.45	0.00	0.00	0.00	0.00	0.00	43.45
50	0.02	0.57	43.48	0.57	0.00	0.00	0.00	0.00	43.48
100	0.09	1.13	43.55	1.13	0.00	0.00	0.00	0.00	43.55
150	0.21	1.70	43.66	1.70	0.00	0.00	0.00	0.00	43.66
200	0.36	2.27	43.82	2.27	0.00	0.00	0.00	0.00	43.82
250	0.56	2.84	44.01	2.84	0.00	0.00	0.00	0.00	44.01
300	0.80	3.40	44.25	3.40	0.00	0.00	0.00	0.00	44.25
350	1.08	3.97	44.53	3.97	0.00	0.00	0.00	0.00	44.53
400	1.40	4.54	44.84	4.54	0.00	0.00	0.00	0.00	44.84
450	1.77	5.11	45.20	5.11	0.00	0.00	0.00	0.00	45.20
500	2.17	5.67	45.59	5.67	0.00	0.00	0.00	0.00	45.59
550	2.62	6.24	46.02	6.24	0.00	0.00	0.00	0.00	46.02
600	3.11	6.81	46.49	6.81	0.00	0.00	0.00	0.00	46.49
650	3.63	7.38	46.99	7.38	0.00	0.00	0.00	0.00	46.99
700	4.20	7.94	47.54	7.94	0.00	0.00	0.00	0.00	47.54
750	4.81	8.51	48.12	8.51	0.00	0.00	0.00	0.00	48.12
800	5.46	9.08	48.74	9.08	0.00	0.00	0.00	0.00	48.74
850	6.15	9.65	49.39	9.65	0.00	0.00	0.00	0.00	49.39
900	6.88	10.21	50.08	10.21	0.00	0.00	0.00	0.00	50.08
950	7.65	10.78	50.81	10.78	0.00	0.00	0.00	0.00	50.81
1000	8.46	11.35	51.58	11.35	0.00	0.00	0.00	0.00	51.58
1050	9.31	11.92	52.38	11.92	0.00	0.00	0.00	0.00	52.38
1100	10.20	12.48	53.22	12.48	0.00	0.00	0.00	0.00	53.22
1150	11.13	13.05	54.09	13.05	0.00	0.00	0.00	0.00	54.09
1200	12.10	13.62	55.00	13.62	0.00	0.00	0.00	0.00	55.00
1250	13.11	14.18	55.95	14.18	0.00	0.00	0.00	0.00	55.95
1300	14.16	14.75	56.93	14.75	0.00	0.00	0.00	0.00	56.93
1350	15.24	15.32	57.95	15.32	0.00	0.00	0.00	0.00	57.95
1400	16.37	15.89	59.00	15.89	0.00	0.00	0.00	0.00	59.00
1450	17.54	16.45	60.09	16.45	0.00	0.00	0.00	0.00	60.09
1500	18.75	17.02	61.21	17.02	0.00	0.00	0.00	0.00	61.21
1550	19.99	17.59	62.38	17.59	0.00	0.00	0.00	0.00	62.38
1600	21.28	18.16	63.57	18.16	0.00	0.00	0.00	0.00	63.57
1650	22.60	18.72	64.80	18.72	0.00	0.00	0.00	0.00	64.80
1700	23.97	19.29	66.07	19.29	0.00	0.00	0.00	0.00	66.07
1750	25.37	19.86	67.37	19.86	0.00	0.00	0.00	0.00	67.37
1800	26.82	20.43	68.71	20.43	0.00	0.00	0.00	0.00	68.71
1850	28.30	20.99	70.08	20.99	0.00	0.00	0.00	0.00	70.08
1900	29.82	21.56	71.49	21.56	0.00	0.00	0.00	0.00	71.49
1950	31.38	22.13	72.93	22.13	0.00	0.00	0.00	0.00	72.93
2000	32.98	22.70	74.41	22.70	0.00	0.00	0.00	0.00	74.41
2050	34.62	23.26	75.92	23.26	0.00	0.00	0.00	0.00	75.92
2100	36.30	23.83	77.47	23.83	0.00	0.00	0.00	0.00	77.47
2150	38.02	24.40	79.05	24.40	0.00	0.00	0.00	0.00	79.05
2200	39.78	24.97	80.67	24.97	0.00	0.00	0.00	0.00	80.67
2250	41.57	25.53	82.32	25.53	0.00	0.00	0.00	0.00	82.32
2300	43.41	26.10	84.00	26.10	0.00	0.00	0.00	0.00	84.00
2350	45.28	26.67	85.72	26.67	0.00	0.00	0.00	0.00	85.72
2400	47.19	27.24	87.48	27.24	0.00	0.00	0.00	0.00	87.48
2450	49.15	27.80	89.27	27.80	0.00	0.00	0.00	0.00	89.27
2500	51.14	28.37	91.09	28.37	0.00	0.00	0.00	0.00	91.09
2550	53.17	28.94	92.95	28.94	0.00	0.00	0.00	0.00	92.95
2600	55.23	29.50	94.85	29.50	0.00	0.00	0.00	0.00	94.85
2650	57.34	30.07	96.77	30.07	0.00	0.00	0.00	0.00	96.77
2700	59.49	30.64	98.73	30.64	0.00	0.00	0.00	0.00	98.73
2750	61.67	31.21	100.73	31.21	0.00	0.00	0.00	0.00	100.73

COH Required Curve Number 2

f.6 **Table: High Normal Operating Level C=100 - Information Only (TCEQ)**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	FM No. 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	42.35	0.00	0.00	0.00	0.00	0.00	42.35
50	0.03	0.57	42.39	0.57	0.00	0.00	0.00	0.00	42.39
100	0.12	1.13	42.50	1.13	0.00	0.00	0.00	0.00	42.50
150	0.26	1.70	42.66	1.70	0.00	0.00	0.00	0.00	42.66
200	0.46	2.27	42.89	2.27	0.00	0.00	0.00	0.00	42.89
250	0.70	2.84	43.18	2.84	0.00	0.00	0.00	0.00	43.18
300	1.00	3.40	43.52	3.40	0.00	0.00	0.00	0.00	43.52
350	1.35	3.97	43.91	3.97	0.00	0.00	0.00	0.00	43.91
400	1.75	4.54	44.37	4.54	0.00	0.00	0.00	0.00	44.37
450	2.19	5.11	44.87	5.11	0.00	0.00	0.00	0.00	44.87
500	2.69	5.67	45.43	5.67	0.00	0.00	0.00	0.00	45.43
550	3.24	6.24	46.04	6.24	0.00	0.00	0.00	0.00	46.04
600	3.83	6.81	46.71	6.81	0.00	0.00	0.00	0.00	46.71
650	4.48	7.38	47.42	7.38	0.00	0.00	0.00	0.00	47.42
700	5.17	7.94	48.19	7.94	0.00	0.00	0.00	0.00	48.19
750	5.91	8.51	49.01	8.51	0.00	0.00	0.00	0.00	49.01
800	6.70	9.08	49.88	9.08	0.00	0.00	0.00	0.00	49.88
850	7.53	9.65	50.80	9.65	0.00	0.00	0.00	0.00	50.80
900	8.42	10.21	51.78	10.21	0.00	0.00	0.00	0.00	51.78
950	9.35	10.78	52.80	10.78	0.00	0.00	0.00	0.00	52.80
1000	10.32	11.35	53.87	11.35	0.00	0.00	0.00	0.00	53.87
1050	11.35	11.92	54.99	11.92	0.00	0.00	0.00	0.00	54.99
1100	12.42	12.48	56.16	12.48	0.00	0.00	0.00	0.00	56.16
1150	13.54	13.05	57.38	13.05	0.00	0.00	0.00	0.00	57.38
1200	14.71	13.62	58.65	13.62	0.00	0.00	0.00	0.00	58.65
1250	15.93	14.18	59.97	14.18	0.00	0.00	0.00	0.00	59.97
1300	17.19	14.75	61.34	14.75	0.00	0.00	0.00	0.00	61.34
1350	18.49	15.32	62.76	15.32	0.00	0.00	0.00	0.00	62.76
1400	19.85	15.89	64.22	15.89	0.00	0.00	0.00	0.00	64.22
1450	21.25	16.45	65.74	16.45	0.00	0.00	0.00	0.00	65.74
1500	22.70	17.02	67.30	17.02	0.00	0.00	0.00	0.00	67.30
1550	24.19	17.59	68.91	17.59	0.00	0.00	0.00	0.00	68.91
1600	25.73	18.16	70.56	18.16	0.00	0.00	0.00	0.00	70.56
1650	27.32	18.72	72.27	18.72	0.00	0.00	0.00	0.00	72.27
1700	28.95	19.29	74.02	19.29	0.00	0.00	0.00	0.00	74.02
1750	30.63	19.86	75.82	19.86	0.00	0.00	0.00	0.00	75.82
1800	32.35	20.43	77.67	20.43	0.00	0.00	0.00	0.00	77.67
1850	34.12	20.99	79.57	20.99	0.00	0.00	0.00	0.00	79.57
1900	35.94	21.56	81.51	21.56	0.00	0.00	0.00	0.00	81.51
1950	37.80	22.13	83.50	22.13	0.00	0.00	0.00	0.00	83.50
2000	39.71	22.70	85.54	22.70	0.00	0.00	0.00	0.00	85.54
2050	41.66	23.26	87.62	23.26	0.00	0.00	0.00	0.00	87.62
2100	43.66	23.83	89.75	23.83	0.00	0.00	0.00	0.00	89.75
2150	45.71	24.40	91.93	24.40	0.00	0.00	0.00	0.00	91.93
2200	47.80	24.97	94.15	24.97	0.00	0.00	0.00	0.00	94.15
2250	41.57	25.53	96.42	25.53	0.00	0.00	0.00	0.00	96.42
2300	43.41	26.10	98.74	26.10	0.00	0.00	0.00	0.00	98.74
2350	45.28	26.67	101.10	26.67	0.00	0.00	0.00	0.00	101.10
2400	47.19	27.24	103.51	27.24	0.00	0.00	0.00	0.00	103.51
2450	49.15	27.80	105.97	27.80	0.00	0.00	0.00	0.00	105.97
2500	51.14	28.37	108.47	28.37	0.00	0.00	0.00	0.00	108.47
2550	53.17	28.94	111.02	28.94	0.00	0.00	0.00	0.00	111.02
2600	55.23	29.50	113.61	29.50	0.00	0.00	0.00	0.00	113.61
2650	57.34	30.07	116.25	30.07	0.00	0.00	0.00	0.00	116.25
2700	59.49	30.64	118.94	30.64	0.00	0.00	0.00	0.00	118.94
2750	61.67	31.21	121.67	31.21	0.00	0.00	0.00	0.00	121.67

COH Required Curve Number 5

f.7 **Table: Emergency Flooded Operating Level C=140**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	Headloss Total FM 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 C=0 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 C=0 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	17.35	0.00	0.00	0.00	0.00	0.00	17.35
50	0.02	0.57	17.38	0.57	0.00	0.00	0.00	0.00	17.38
100	0.09	1.13	17.45	1.13	0.00	0.00	0.00	0.00	17.45
150	0.21	1.70	17.56	1.70	0.00	0.00	0.00	0.00	17.56
200	0.36	2.27	17.72	2.27	0.00	0.00	0.00	0.00	17.72
250	0.56	2.84	17.91	2.84	0.00	0.00	0.00	0.00	17.91
300	0.80	3.40	18.15	3.40	0.00	0.00	0.00	0.00	18.15
350	1.08	3.97	18.43	3.97	0.00	0.00	0.00	0.00	18.43
400	1.40	4.54	18.74	4.54	0.00	0.00	0.00	0.00	18.74
450	1.77	5.11	19.10	5.11	0.00	0.00	0.00	0.00	19.10
500	2.17	5.67	19.49	5.67	0.00	0.00	0.00	0.00	19.49
550	2.62	6.24	19.92	6.24	0.00	0.00	0.00	0.00	19.92
600	3.11	6.81	20.39	6.81	0.00	0.00	0.00	0.00	20.39
650	3.63	7.38	20.89	7.38	0.00	0.00	0.00	0.00	20.89
700	4.20	7.94	21.44	7.94	0.00	0.00	0.00	0.00	21.44
750	4.81	8.51	22.02	8.51	0.00	0.00	0.00	0.00	22.02
800	5.46	9.08	22.64	9.08	0.00	0.00	0.00	0.00	22.64
850	6.15	9.65	23.29	9.65	0.00	0.00	0.00	0.00	23.29
900	6.88	10.21	23.98	10.21	0.00	0.00	0.00	0.00	23.98
950	7.65	10.78	24.71	10.78	0.00	0.00	0.00	0.00	24.71
1000	8.46	11.35	25.48	11.35	0.00	0.00	0.00	0.00	25.48
1050	9.31	11.92	26.28	11.92	0.00	0.00	0.00	0.00	26.28
1100	10.20	12.48	27.12	12.48	0.00	0.00	0.00	0.00	27.12
1150	11.13	13.05	27.99	13.05	0.00	0.00	0.00	0.00	27.99
1200	12.10	13.62	28.90	13.62	0.00	0.00	0.00	0.00	28.90
1250	13.11	14.18	29.85	14.18	0.00	0.00	0.00	0.00	29.85
1300	14.16	14.75	30.83	14.75	0.00	0.00	0.00	0.00	30.83
1350	15.24	15.32	31.85	15.32	0.00	0.00	0.00	0.00	31.85
1400	16.37	15.89	32.90	15.89	0.00	0.00	0.00	0.00	32.90
1450	17.54	16.45	33.99	16.45	0.00	0.00	0.00	0.00	33.99
1500	18.75	17.02	35.11	17.02	0.00	0.00	0.00	0.00	35.11
1550	19.99	17.59	36.28	17.59	0.00	0.00	0.00	0.00	36.28
1600	21.28	18.16	37.47	18.16	0.00	0.00	0.00	0.00	37.47
1650	22.60	18.72	38.70	18.72	0.00	0.00	0.00	0.00	38.70
1700	23.97	19.29	39.97	19.29	0.00	0.00	0.00	0.00	39.97
1750	25.37	19.86	41.27	19.86	0.00	0.00	0.00	0.00	41.27
1800	26.82	20.43	42.61	20.43	0.00	0.00	0.00	0.00	42.61
1850	28.30	20.99	43.98	20.99	0.00	0.00	0.00	0.00	43.98
1900	29.82	21.56	45.39	21.56	0.00	0.00	0.00	0.00	45.39
1950	31.38	22.13	46.83	22.13	0.00	0.00	0.00	0.00	46.83
2000	32.98	22.70	48.31	22.70	0.00	0.00	0.00	0.00	48.31
2050	34.62	23.26	49.82	23.26	0.00	0.00	0.00	0.00	49.82
2100	36.30	23.83	51.37	23.83	0.00	0.00	0.00	0.00	51.37
2150	38.02	24.40	52.95	24.40	0.00	0.00	0.00	0.00	52.95
2200	39.78	24.97	54.57	24.97	0.00	0.00	0.00	0.00	54.57
2250	41.57	25.53	56.22	25.53	0.00	0.00	0.00	0.00	56.22
2300	43.41	26.10	57.90	26.10	0.00	0.00	0.00	0.00	57.90
2350	45.28	26.67	59.62	26.67	0.00	0.00	0.00	0.00	59.62
2400	47.19	27.24	61.38	27.24	0.00	0.00	0.00	0.00	61.38
2450	49.15	27.80	63.17	27.80	0.00	0.00	0.00	0.00	63.17
2500	51.14	28.37	64.99	28.37	0.00	0.00	0.00	0.00	64.99
2550	53.17	28.94	66.85	28.94	0.00	0.00	0.00	0.00	66.85
2600	55.23	29.50	68.75	29.50	0.00	0.00	0.00	0.00	68.75
2650	57.34	30.07	70.67	30.07	0.00	0.00	0.00	0.00	70.67
2700	59.49	30.64	72.63	30.64	0.00	0.00	0.00	0.00	72.63
2750	61.67	31.21	74.63	31.21	0.00	0.00	0.00	0.00	74.63

Max. Static Head (ft) @ Designed GPM = 43.45 ft Low water level in wet well
Min. Static Head (ft) @ Designed GPM = 42.35 ft High water level in wet well

Q= 200

Lift Station Condition	Riser Piping Total HL (ft)	Riser Piping Average HL (ft)	Design Point Phase 1 HL (ft)	Force Main Average HL (ft)	Force Main Total HL (ft)
High Normal Operation Level C=120 - Design	0.61				43.01
		0.49		42.87	
High Normal Operating Level C=140	0.36				42.72
		0.43	**43.79**	43.36	
Low Normal Operation Level C=120 - Design	0.40				43.88
		0.38		43.85	
Low Normal Operating Level C=140	0.36				43.82

High Normal Operating Level C=100 - Information Only (TCEQ)	0.46	42.89
Emergency Flooded Operating Level C=140	0.36	17.72

Q= 550.00

Lift Station Condition	Riser Piping Total HL (ft)	Riser Piping Average HL (ft)	Design Point Phase 2 HL (ft)	Force Main Average HL (ft)	Force Main Total HL (ft)
High Normal Operation Level C=120 - Design	2.86				45.35
		2.74		45.13	
High Normal Operating Level C=140	2.62				44.92
		2.74	**48.42**	45.68	
Low Normal Operation Level C=120 - Design	2.86				46.45
		2.74		46.23	
Low Normal Operating Level C=140	2.62				46.02

High Normal Operating Level C=100 - Information Only (TCEQ)	3.24	46.04
Emergency Flooded Operating Level C=140	2.62	19.92

IV PUMP CONTROL SETTINGS

A Compute the INTERIM Pumping Ranges in the Wet Well

Proposed Wet Well Diameter: 12 ft
Wet Well Surface Area: 113.10 SF
Detention Pond surface Area - SF
Wet Well Surface Area: 113.10 SF

Note: The following capacities should be taken from the system curves.

Pump No. 1 Capacity:	Enter. . . .	363	gpm	Flygt is the worst case	542
Pump Nos. 1 & 2 Capacity:	Enter. . . .	365	gpm		
Pump Nos. 1, 2 & 3 Capacity:	Enter. . . .	none	gpm		
Pump Nos. 1, 2, 3 & 4 Capacity:	Enter. . . .	none	gpm		

For Pump 1, V-1 = $\frac{10.0 \text{ min.} \times 363 \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 121.32 CF, h1 = 1.07 ft

For Pump 2, V-2 = $\frac{10.0 \text{ min.} \times (365 - 363) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 00.67 CF, h2 = 0.01 ft

For Pump 3, V-3 = $\frac{10.0 \text{ min.} \times (\text{none} - 365) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 00.00 CF, h3 = 0.00 ft

For Pump 4, V-4 = $\frac{10.0 \text{ min.} \times (\text{none} - \text{none}) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 00.00 CF, h4 = 0.00 ft

Total Wet Well Volume = 121.99 CF
Total Required Depth = 1.079 ft
Estimated Maximum Elevation of the Wet Well Floor = 1,242.500 msl el (from II.D)
Reality Check:

B Determine INTERIM Design Flow Pump Control Settings

Sewer Influent Line Elevation = 1264.50 msl el

Minimum Required Pump Settings

		Rising Water Level		Falling Water Level	
WL Elev	D H	Action	Pump Station	Action	Pump Status
1,242.08		P-3 on	P-1, P-2 & P-3 on		P-1, P-2 & P-3 on
1,242.08	0.00	P-2 on	P-1 & P-2 on	P-3 off	P-1 & P-2 on
1,242.07	0.01	P-1 on	P-1 on	P-2 off	P-1 on
1,241.0	1.07		All Stop	P-1 off	All Stop

Design Pump Settings (Engineer's Recommended Settings)

	Rising Water Level			Falling Water Level		
D H	Action	Pump Station	WL Elev	Action	Pump Status	D H
	Standby Pump On	All Pumps Running		None	All Pumps Running	
0.00						3.50
	High Level Alarm On	1, 2, & 3 (All Firm) On		High Level Alarm Off	All Pumps Running	
0.00						0.50
	Lag-Lag Pump On	1, 2, & 3 (All Firm) On		Standby off	Lead & Lag on	
-1,247.00						3.70
	Lag Pump On	1 & 2 On	1,247.00	None	Lead & Lag on	
1.00						4.00
	Lead Pump on	Lead on	1,246.00	Standby off	Lead on	
1.10						4.70
	Minimum Water Level - **Low Level Alarm Off**	All Stop	1,244.90	Lead off	All Stop, Standby set to Lead Pump	
1.00						0.30
	None	All Stop	1,243.90	Low Level Alarm On	All Stop	
1.40						4.80
	Wet Well Floor - None	All Stop	1,242.50	Wet Well Floor - None	All Stop	

Pump Manufacturer's Minimum Liquid Level Depth for Operation =	2.42 ft		From I J above
Enter pump height or minimum liquid depth to set all pumps off =	Enter. . . .	2.42 ft	
Influent Elevation at Wet Well =	1264.50 ft		From I G above
Lead Pump On (P-1) =	Enter. . . .	1,246.00 ft	
Lag or Standby Pump On (P-2) =	1247.00 ft		
Lag-Lag or Standby Pump On (P-3) =	0.00 ft		
Elevation of High Water Alarm (typ. 0.5' above Standby Pump On) =	0.00 ft		
Lag-Lag-Lag or Standby Pump On (P-4) =	**N/A** ft		
Discharge Elevation of Force Main (1.5' above slab) =	1275.50 ft		
Elevation of Force Main at Highest Point =	1288.35 ft		
Bottom Elevation of Wet Well (min 1.6' below all Pumps Off) =	Enter. . . .	1,242.50 ft	
Low Level Alarm (typ. halfway up Pump casing or min liquid operation depth) =	1243.71 ft		
All Pumps Off (slab elev + min liquid depth OR slab elev + pump height) =	1244.92 ft		

C Compute the INTERIM Pumping Ranges in the Wet Well

Proposed Wet Well Diameter: 12 ft
Wet Well Surface Area: 113.10 SF
Detention Pond surface Area - SF
Wet Well Surface Area: 113.10 SF

Note: The following capacities should be taken from the system curves.

Pump No. 1 Capacity:	Enter. . . .	363	gpm	Flygt is the worst case
Pump Nos. 1 & 2 Capacity:	Enter. . . .	615	gpm	
Pump Nos. 1, 2 & 3 Capacity:	Enter. . . .	none	gpm	
Pump Nos. 1, 2, 3 & 4 Capacity:	Enter. . . .	none	gpm	

For Pump 1, V-1 = $\frac{10.0 \text{ min.} \times 363 \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 121.32 CF, h1 = 1.07 ft

For Pump 2, V-2 = $\frac{10.0 \text{ min.} \times (365 - 363) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 84.22 CF, h2 = 0.74 ft

For Pump 3, V-3 = $\frac{10.0 \text{ min.} \times (\text{none} - 365) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 00.00 CF, h3 = 0.00 ft

For Pump 4, V-4 = $\frac{10.0 \text{ min.} \times (\text{none} - \text{none}) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 00.00 CF, h4 = 0.00 ft

Total Wet Well Volume =	205.55	CF	
Total Required Depth =	1.817	ft	
Estimated Maximum Elevation of the Wet Well Floor =	-	-	(from II.D)

Determine ULTIMATE Design Flow Pump Control Settings

Sewer Influent Line Elevation = 1264.50 2.42

Minimum Required Pump Settings

		Rising Water Level		Falling Water Level	
WL Elev	D H	Action	Pump Station	Action	Pump Status
1,258.80		P-3 on	P-1, P-2 & P-3 on		P-1, P-2 & P-3 on
1,258.80	0.00	P-2 on	P-1 & P-2 on	P-3 off	P-1 & P-2 on
1,258.80	0.00	P-1 on	P-1 on	P-2 off	P-1 on
1,258.8	0.00		All Stop	P-1 off	All Stop

Design Pump Settings (Engineer's Recommended Settings)

	Rising Water Level			Falling Water Level		
D H	Action	Pump Station	WL Elev	Action	Pump Status	D H
	Standby Pump On	All Pumps Running		None	All Pumps Running	
0.00						3.50
	High Level Alarm On	1, 2, & 3 (All Firm) On		High Level Alarm Off	All Pumps Running	
0.00						0.50
	Lag-Lag Pump On	1, 2, & 3 (All Firm) On		Standby off	Lead & Lag on	
-1,247.00						3.70
	Lag Pump On	1 & 2 On	1,247.00	None	Lead & Lag on	
1.00						4.00
	Lead Pump on	Lead on	1,246.00	Standby off	Lead on	
1.10						4.70
	Minimum Water Level -	All Stop	1,244.90	Lead off	All Stop, Standby set to Lead Pump	
1.00						0.30
	None	All Stop	1,243.90	Low Level Alarm On	All Stop	
1.40						4.80
	Wet Well Floor - None	All Stop	1,242.50	Wet Well Floor - None	All Stop	

Pump Manufacturer's Minimum Liquid Level Depth for Operation =			2.42	ft	From I J above
Enter pump height or minimum liquid depth to set all pumps off =	1,242.30	Enter. . . .	2.42	ft	
Influent Elevation at Wet Well =			1264.50	ft	From I G above
Lead Pump On (P-1) =		Enter. . . .	1,258.80	ft	
Lag or Standby Pump On (P-2) =			1259.80	ft	
Lag-Lag or Standby Pump On (P-3) =			12.80	ft	
Elevation of High Water Alarm (typ. 0.5' above Standby Pump On) =			12.80	ft	

Lag-Lag-Lag or Standby Pump On (P-4) =	N/A		ft
Discharge Elevation of Force Main (1.5' above slab) =		0.00	ft
Elevation of Force Main at Highest Point =		1288.35	ft
Bottom Elevation of Wet Well (min 1.6' below all Pumps Off) =	Enter. . . .	1,242.50	ft
Low Level Alarm (typ. halfway up Pump casing or min liquid operation depth) =		1243.71	ft
All Pumps Off (slab elev + min liquid depth OR slab elev + pump height) =		1244.92	ft

Replace with Actual & see table above

Maximum Static = Elevation of Force Main at Highest Point - All Pumps Off Elevation
= 1288.35 msel minus 1,244.90 msel
Maximum Static = 43.45 ft

Minimum Static = Elevation of Force Main at Highest Point - Lead Pump On Elevation
1288.35 msel minus 1,246.00 msel
Minimum Static = 42.35 ft

Flooded Static Head = Elevation of Force Main at Highest Point - Overflow Elevation
1,288.35 msel minus 1,271.00 msel
Flooded Static Head = 17.35 ft

D Compute the Detention Time at ADF for Interim and Ultimate Conditions

Existing / Interim Condition:

INTERIM Average Daily Flow = 326.666666666667 EDU @ 300 gpd =	68.1	gpm
Volume at Lead Pump (P-1) On = 1.10 ft x (845.97 gal/VF) =	930.56	gal
Calculated Detention Time at INTERIM ADF = 930.56 gal / 68.1 gal/min	13.7	min

Ultimate Condition:

ULTIMATE Average Daily Flow = 650 EDU @ 300 gpd =	135.4	gpm
Volume at Lead Pump (P-1) On = 1.10 ft x (845.97 gal/VF) =	930.56	gal
Calculated Detention Time at ULTIMATE ADF= 930.56 gal / 135.4 gal/min	6.9	min

Note: Wet Well will not turn septic if detention times are less than approximately 60 minutes. During low flow/no flow conditions (during the night for example), sewage may turn septic. Septic conditions may be problematic for homes located nearby the lift station. Odor control may therefore be required if detention times approach 60 minutes during interim conditions.

D Compute the Net Positive Suction Head at ULTIMATE Design Flow (NPSH):

Net Positive Suction Head Available (NPSHA)

A. Absolute Pressure, Ha =	Enter. . . .	33.10	ft
B. Static Height of Liquid Supply Level in Wet Well, Hst =		2.29	ft
C. Vapor Pressure of the Liquid, Hvpa =	Enter. . . .	0.75	ft
Submersible Pump Lift Station or Dry Pit Arrangement ?	Enter. . . . Sub or Dry	Sub	
D. Total Friction Headlosses in Riser Pipe (Dry Pit Pumps Only), Hfs =		0.00	ft
NPSHA = Ha - Hvpa + Hst - Hfs =		34.64	ft

Net Positive Suction Head Required (NPSHR)

A. NPSHR according to Pump Manufacturer = (Typically shown on pump curve)	Enter. . . .	13.50	ft

NPSHA > NPSHR, Pump OK

Note: Remember, NPSHA >= NPSHR

VI Compute Buoyancy Forces:

On page 20 of the geotechnical report (InTEC Project No. S151709) they state "Since permanent water table is not encountered at this site, uplift force need not be considered at this site." therefore Buoyancy is not considered in this design.

Desired Factor of Safety against flotation =		1.10	ETJ COH requires 1.10
Wet Well Diameter, =		12 ft	
Wall Thickness, =	Enter. . . .	11 inches	
Wet Well Roof Thickness, =	Enter. . . .	12 inches	
Wet Well Bottom Thickness, =	Enter. . . .	12 inches	
Circular Wet Well Bottom Slab Configuration		YES	
Wet Well is to be installed by open cut (in lue of caisson method)		NO	
Outside diameter of Wet Well, =		13.83333333 ft	
Base Slab diameter =		13.83 ft	
Circular Base Slab Area =		150.29 sq ft	
Rectangular Wet Well Bottom Slab Configuration		NO	
Length of Proposed Wet Well Base Slab =		0.00 ft	
Width of Proposed Wet Well Base Slab=		0.00 ft	
Rectangular Base Slab Area =		0.00 sq ft	
Vertical Height of Walls, =		29.00 ft	
Vertical Height (Total) of Wet Well, =		31.00 ft	
Antifloatation Ring Width	Enter. . . .	0 ft	
Antifloatation Ring Height	Enter. . . .	0 ft	
Antifloatation Ring Inside Diameter		13.83 ft	
Antifloatation Ring Outside Diameter		13.83 ft	
Distance from finished grade to top of antifloatation ring	Enter. . . .	0 ft	
Dry Soil Weight	Enter. . . .	0.085 kips / cu ft	
Saturaged Soil Weight		0.105 kips / cu ft	
Downward force due to saturated soil		0.043 kips / cu ft	

A Determine Uplift Forces due to Groundwater

Uplift Force due to Water =	290.73 kips

B Determine Downward Forces due to Weight of Structure

Top and Bottom Slab Material is Concrete with a Unit Weight of =	0.150 kips / cu ft
Wall Material is Concrete with a Unit Weight of =	0.150 kips / cu ft
Weight of Top Slab outside of outside diameter of the wet well (downward force) =	
Weight of Top Slab (downward force) =	22.54 kips
Weight of Bottom Slab (downward force) =	22.54 kips
Weight of Walls (downward force) =	161.81 kips
Weight of Antifloatation ring	0.00 kips
Weight of soil above antifloatation ring	0.00 kips
Total Weight of Lift Station Structure (downward force) =	206.90 kips
As Designed Factor of Safety Against Flotation =	0.71
Difference needed to overcome flotation including Desired Safety Factor =	112.91 kips
Value of additional adhesion and/or soil friction needed =	83.81 psf

Reality Check - Warning! 0.71 < 1.10 minimum required

VII DETERMINE THE MINIMUM SIZE OF THE PASSIVE AIR VENT PIPE

Maximum pumping capacity of the lift station from the pump curves — Enter. . . . 1,100 gpm (Phase 2 - FLYGT)
It is the intersection of the all pumps running pump curve — 147.05 cfm
and the Emergency Flooded Operating Level C=140 curve
§217.60(d)(1)(C) maximum air velocity through a passive ventilation system — 600 fpm

Vent Pipe Dia. (inches)	Air Velocity (fpm)
4	1685.06
6	748.91
8	421.26
10	269.61
12	187.23
14	137.56
16	105.32
18	83.21
20	67.40
24	46.81
30	29.96
36	20.80

Chosen passive ventilation system goose neck pipe size — Enter. . . . 8 in
421.26 fpm

Velocity below TCEQ maximum - OK - 421.26 fpm < 600.00 fpm maximum allowed

VIII DETERMINE THE CRITICAL TIME RELATED TO SURGE PRESSURE - WATER HAMMER CALCULATIONS

Surge pressure or "Water Hammer" in a force main is created by any change from a steady state flow condition. It is typically caused by the opening, closing or regulating of valves or by the starting and/or stopping of pumps. It may range from only a slight pressure and/or velocity changes to sufficiently high vacuum or pressure conditions which may cause the collapse of rupture of the pipeline, or cause damage to pumps and/or valves. This analysis of water hammer will include calculating the surge (pressure) wave velocity, flow velocity, critical time, determining the maximum pressure increase and selecting a method of control.

Calculate surge pressures and compare to the pressure rating of the force main pipe to determine the need for a surge relief valve.

A Calculate pressure wave velocity factor.

$a = 4660 / SQRT \{ (Ew * Di)/ (Ep * Tp) \}$

Where:

a =	pressure wave velocity factor
E_W =	water bulk modulus (300,000 psi)
D_i =	force main pipe inner diameter (inches)
T_P =	force main pipe wall thickness (inches)
E_P =	force main material modulus of elasticity

Young's Modulus of Elasticity for the pipeline material, E_P =

Ductile Iron	24,000,000
Steel	30,000,000
PVC	400,000
HDPE	130,000

E_W =	300,000 psi		
D_i =	6 inches	Based on AWWA C900 PVC Pipe	
T_P =	0.295 inches	Based on AWWA C900 PVC Pipe	
E_P =	400,000 psi	Based on AWWA C900 PVC Pipe	

a = 4660 / SQRT { (Ew * Di)/ (Ep * Tp) }
1193.137973 unitless

B Calculate the Firm flow velocity in the forcemain

Vel = Q / A
Where:
Q = Flow Quantity in cfs
363.000 gpm
0.809 cfs
A = Flow Area in sq. ft.
0.198 sq. ft. 6" double lined DIP pipe

Vel = Q / A
4.078145663 fps
4.078 fps

C Calculate the Water Hammer Pressure

P = [(a * V) / (2.31 * g)] + Operating Pressure

P = water hammer pressure (psi)
a = pressure wave velocity factor
V = flow velocity in force main at firm pumping capacity (ft/s)
g = acceleration of gravity (32.2 ft/sec^2)
2.31 = conversion factor
OP = Operating Pressure

a = 1,193.00 psi
V = 4.100 fps
g = 32.2 ft/sec^2
OP = 45 ft Read from curve w/ all pumps running
19.5 psi

P = [(a * V) / (2.31 * g)]
P = 65.76 psi

Reality Check based on EM 1110-3-173 (9 April 84)

Table of Typical Values of the Pressure Wave Speed from EM 1110-3-173 (9 April 84)				
	a, fps			Δ Surge Pressure per 1 fps Δ vel
Pipe Material	Low	High	Average	psi
Asbestos-Cement	2700	3400	3050	
Ductile Iron	3100	4200	3650	50
Steel	2700	3900	3300	45
Concrete	3300	3800	3550	
Plastic	1100	1500	1300	20
Fiberglass	1200	1600	1400	

Velocity change from firm pump flow to zero
Firm flow velocity in the forcemain = 4.078 fps

Δ Surge Pressure = Δ Surge Pressure per 1 fps Δ firm flow velocity times value from table above
50 psi/fps times 4.078 fps
203.9 psi

Calculated the Water Hammer Pressure = 65.76 psi
Reality check water hammer pressure = 203.9 psi

D Compare the water hammer pressure to the pipe's pressure rating

water hammer pressure (psi) < Pipe's pressure rating
P < PPR

Water Hammer Pressure =	203.91	psi
Pipe's pressure rating =	350	psi

203.91 psi < 350 psi

OK

E Calculate the Safety Factor

Pipe Pressure Rating / Water Hammer Pressure

SF = 150 psi divided by 203.91 psi

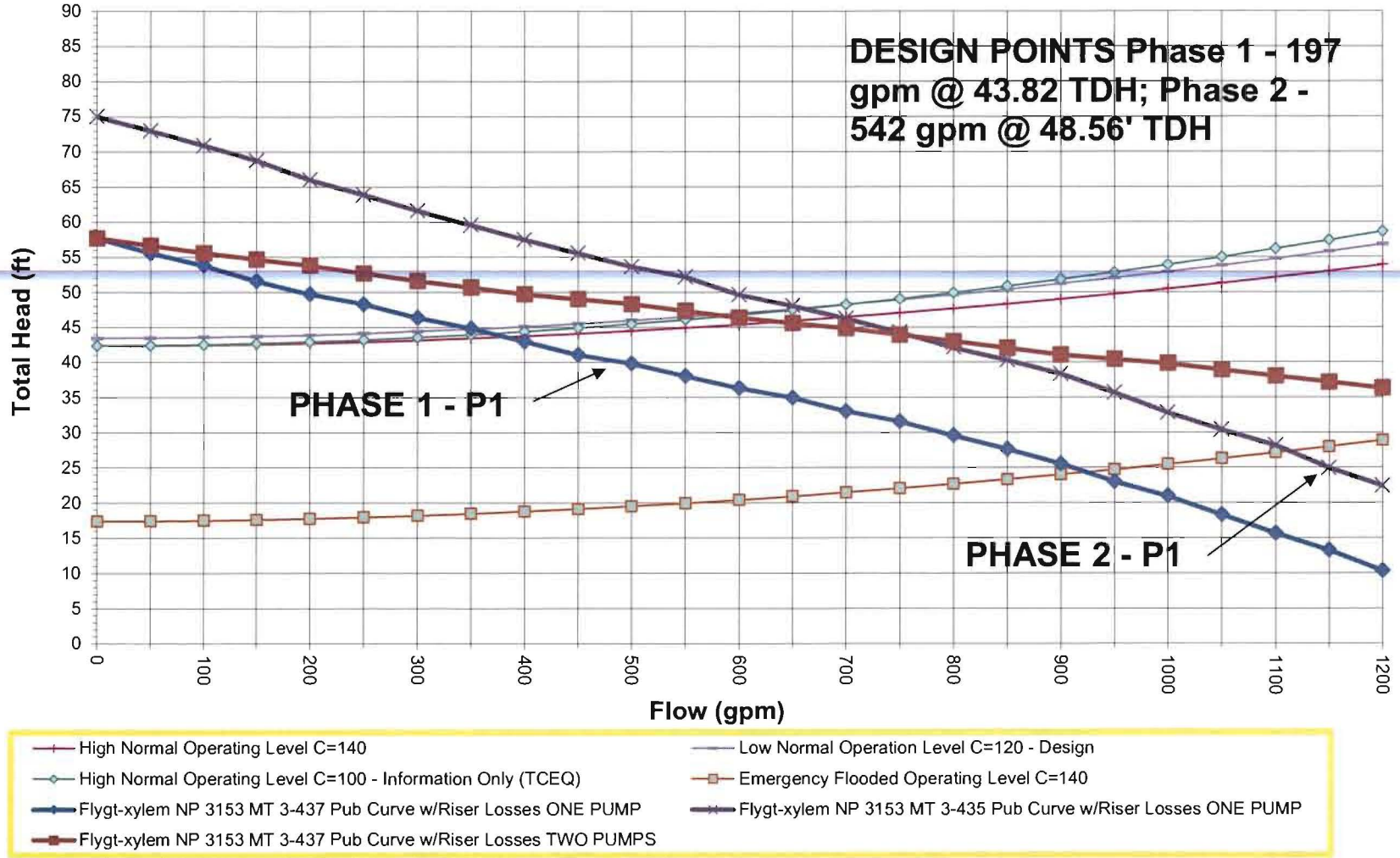
SF = 0.7 Unitless

IDS Engineering Group
TBPE F-002726 TBPLS 10110707

Sanitary Lift Station Design and Cost Analysis

CLIENT:	COMAL COUNTY WCID NO. 6 / 277, Ltd.		
DISTRICT:	COMAL COUNTY WCID NO. 6	Prepared By: *David J Ross*	INITIAL HERE
PROJECT:	Park Village WWTP On-Site Influent Lift Station Phase 1	Checked By:	INITIAL HERE
IDS JOB NO:	1500-001-11		

Park Village WWTP On-Site Influent Lift Station
Comal County WCID No. 6



f.2 Table: **INTERIM Pump Curves** 197 gpm 43.79 HL (ft)

Flygt-xylem NP 3153 MT 3-437	Flygt-xylem NP 3153 MT 3-437	Flygt-xylem NP 3153 MT 3-437	Flygt-xylem NP 3153 MT 3-437	Flygt-xylem NP 3153 MT 3-437	Flygt-xylem NP 3153 MT 3-437	Pump Brand & Model #	Pump Brand & Model #

Flow (gpm)	Published Pump 1 Curve HL (ft)	Pub Curve w/Riser Losses ONE PUMP Head (ft)	Pub Curve w/Riser Losses TWO PUMPS Head (ft)	Pub Curve w/Riser Losses THREE PUMPS Head (ft)	Pub Curve w/Riser Losses FOUR PUMPS Head (ft)	Pub Curve w/Riser Losses FIVE PUMPS Head (ft)	Jockey Pump Head Loss (ft)	Adjusted Jockey Pump Loss (ft)
0	57.7	**57.7**	**57.7**	**57.7**	**57.7**	**57.7**	0.0	
50	55.6	**55.6**	56.6	57.0	57.2	57.3	0.0	0.0
100	53.9	**53.8**	**55.6**	56.3	56.6	56.8	0.0	-0.1
150	51.8	**51.6**	54.7	**55.6**	56.1	56.4	0.0	-0.2
200	50.1	49.7	**53.8**	55.0	**55.6**	56.0	0.0	-0.4
250	48.9	**48.3**	52.7	54.4	55.1	**55.6**	0.0	-0.6
300	47.2	**46.3**	**51.6**	**53.8**	54.7	55.2	0.0	-0.9
350	46.0	**44.8**	50.6	53.1	54.2	54.9	0.0	-1.2
400	44.5	**43.0**	49.7	52.3	**53.8**	54.5	0.0	-1.5
450	43.0	**41.1**	49.0	**51.6**	53.2	54.2	0.0	-1.9
500	42.2	39.8	**48.3**	50.9	52.7	**53.8**	0.0	-2.4
550	40.9	**38.0**	47.3	50.3	52.1	53.4	0.0	-2.9
600	39.7	**36.3**	**46.3**	49.7	**51.6**	52.9	0.0	-3.4
650	38.9	**34.9**	45.6	49.2	51.1	52.5	0.0	-4.0
700	37.6	**33.0**	**44.8**	48.8	50.6	52.0	0.0	-4.6
750	36.8	**31.6**	43.9	**48.3**	50.2	**51.6**	0.0	-5.2
800	35.5	29.6	**43.0**	47.6	49.7	51.2	0.0	-5.9
850	34.3	**27.6**	42.0	47.0	49.3	50.8	0.0	-6.7
900	33.0	**25.5**	**41.1**	**46.3**	49.0	50.4	0.0	-7.5
950	31.3	**23.0**	40.4	45.8	48.6	50.1	0.0	-8.3
1000	30.1	**20.9**	39.8	45.3	**48.3**	49.7	0.0	-9.2
1050	28.4	**18.3**	38.9	**44.8**	47.8	49.4	0.0	-10.1
1100	26.7	15.7	**38.0**	44.2	47.3	49.1	0.0	-11.0
1150	25.3	**13.2**	37.2	43.6	46.8	48.9	0.0	-12.1
1200	23.4	**10.3**	**36.3**	**43.0**	**46.3**	48.6	0.0	-13.1
1250	21.7	**7.5**	35.6	42.3	45.9	**48.3**	0.0	-14.2
1300	20.1	**4.8**	**34.9**	41.7	45.6	47.9	0.0	-15.3
1350	19.2	**2.7**	34.0	**41.1**	45.2	47.5	0.0	-16.5
1400	17.1	-0.6	**33.0**	40.7	**44.8**	47.1	0.0	-17.7
1450	15.9	**-3.1**	32.3	40.2	44.4	46.7	0.0	-19.0
1500	14.6	-5.7	31.6	39.8	43.9	**46.3**	0.0	-20.3

1550	13.0	-8.6	30.6	39.2	43.4	46.0	0.0	-21.6
1600	11.9	-11.1	29.6	38.6	43.0	45.7	0.0	-23.0
1650	10.7	-13.7	28.6	38.0	42.5	45.4	0.0	-24.4
1700	9.2	-16.7	27.6	37.5	42.0	45.1	0.0	-25.9
1750	7.5	-19.9	26.6	36.9	41.5	44.8	0.0	-27.4
1800	6.3	-22.6	25.5	36.3	41.1	44.4	0.0	-28.9
1850	5.0	-25.5	24.3	35.9	40.8	44.1	0.0	-30.5
1900		-32.2	23.0	35.4	40.4	43.7	0.0	-32.2
1950		-33.8	22.0	34.9	40.1	43.3	0.0	-33.8
2000		-35.6	20.9	34.3	39.8	43.0	0.0	-35.6
2050		-37.3	19.6	33.7	39.4	42.6	0.0	-37.3
2100		-39.1	18.3	33.0	38.9	42.2	0.0	-39.1
2150		-41.0	17.0	32.5	38.5	41.8	0.0	-41.0
2200		-42.8	15.7	32.1	38.0	41.4	0.0	-42.8
2250		-44.8	14.4	31.6	37.6	41.1	0.0	-44.8
2270		-46.7	13.2					
2290		-48.7	11.8					
2310		-50.8	10.3					
2330		-52.9	8.9					
2350		-55.0	7.5					
2370		-57.2	6.2					
2390		-59.4	4.8					
2410		-61.7	3.8					
2430		-64.0	2.7					
2450		-66.3	1.1					

f.2 Table: **ULTIMATE Pump Curves** 542 gpm 48.42 HL (ft)

Flygt-xylem NP 3153 MT 3-435	Flygt-xylem NP 3153 MT 3-435	Flygt-xylem NP 3153 MT 3-435	Flygt-xylem NP 3153 MT 3-435	Flygt-xylem NP 3153 MT 3-435	Flygt-xylem NP 3153 MT 3-435	Pump Brand & Model #	Pump Brand & Model #

Flow (gpm)	Published Pump 1 Curve HL (ft)	Pub Curve w/Riser Losses ONE PUMP Head (ft)	Pub Curve w/Riser Losses TWO PUMPS Head (ft)	Pub Curve w/Riser Losses THREE PUMPS Head (ft)	Pub Curve w/Riser Losses FOUR PUMPS Head (ft)	Pub Curve w/Riser Losses FIVE PUMPS Head (ft)	Jockey Pump Head Loss (ft)	Adjusted Jockey Pump Loss (ft)
0	75.0	75.0	75.0	75.0	75.0	75.0	0.0	
50	73.0	73.0	74.0	74.3	74.5	74.6	0.0	-33.3
100	71.0	70.9	73.0	73.6	74.0	74.2	0.0	-31.9
150	69.0	68.8	71.9	73.0	73.5	73.8	0.0	-30.7
200	66.4	66.0	70.9	72.3	73.0	73.4	0.0	-29.7
250	64.5	63.9	69.8	71.6	72.5	73.0	0.0	-28.5
300	62.5	61.6	68.8	70.9	71.9	72.6	0.0	-27.6
350	60.8	59.6	67.4	70.2	71.4	72.1	0.0	-26.6

400	59.0	57.5	66.0	69.5	70.9	71.7	0.0	-25.6
450	57.5	55.6	64.9	68.8	70.4	71.3	0.0	-24.7
500	56.0	53.6	63.9	67.8	69.8	70.9	0.0	-24.0
550	55.0	52.1	62.8	66.9	69.3	70.5	0.0	-23.2
600	53.0	49.6	61.6	66.0	68.8	70.0	0.0	-22.3
650	52.0	48.0	60.6	65.3	68.1	69.6	0.0	-21.5
700	50.8	46.2	59.6	64.6	67.4	69.2	0.0	-20.6
750	49.5	44.3	58.5	63.9	66.7	68.8	0.0	-19.9
800	48.0	42.1	57.5	63.1	66.0	68.2	0.0	-18.9
850	47.0	40.3	56.5	62.4	65.5	67.7	0.0	-18.2
900	45.8	38.3	55.6	61.6	64.9	67.1	0.0	-17.3
950	44.0	35.7	54.6	60.9	64.4	66.6	0.0	-16.8
1000	42.0	32.8	53.6	60.3	63.9	66.0	0.0	-15.8
1050	40.5	30.4	52.9	59.6	63.3	65.6	0.0	-15.1
1100	39.2	28.2	52.1	58.9	62.8	65.2	0.0	-14.1
1150	37.0	24.9	50.9	58.2	62.2	64.7	0.0	-13.4
1200	35.5	22.4	49.6	57.5	61.6	64.3	0.0	-12.5
1250	34.0	19.8	48.8	56.8	61.1	63.9	0.0	-11.7
1300	32.0	16.7	48.0	56.2	60.6	63.4	0.0	-10.8
1350	30.5	14.0	47.1	55.6	60.1	63.0	0.0	-10.0
1400	28.5	10.8	46.2	54.9	59.6	62.5	0.0	-9.1
1450	27.5	8.5	45.2	54.3	59.0	62.1	0.0	-8.2
1500	26.5	6.2	44.3	53.6	58.5	61.6	0.0	-7.0
1550	24.0	2.4	43.2	53.1	58.0	61.2	0.0	-6.2
1600	22.0	-1.0	42.1	52.6	57.5	60.8	0.0	-5.2
1650	21.0	-3.4	41.2	52.1	57.0	60.4	0.0	-3.8
1700	19.0	-6.9	40.3	51.3	56.5	60.0	0.0	-2.7
1750	17.5	-9.9	39.3	50.5	56.0	59.6	0.0	-1.9
1800	16.0	-12.9	38.3	49.6	55.6	59.1	0.0	-0.7
1850	14.8	-15.7	37.0	49.1	55.1	58.7	0.0	0.0
1900	13.6	-18.6	35.7	48.6	54.6	58.3	0.0	0.0
1950	11.0	-22.8	34.3	48.0	54.1	57.9	0.0	0.0
2000	9.5	-26.1	32.8	47.4	53.6	57.5	0.0	0.0
2050	8.0	-29.3	31.6	46.8	53.3	57.1	0.0	0.0
2100		-39.1	30.4	46.2	52.9	56.7	0.0	0.0
2150		-41.0	29.3	45.6	52.5	56.3	0.0	0.0
2200		-42.8	28.2	44.9	52.1	55.9	0.0	0.0
2250		-44.8	26.5	44.3	51.5	55.6	0.0	0.0
2300		-46.7	24.9					
2350		-48.7	23.7					
2400		-50.8	22.4					
2450		-52.9	21.1					
2500		-55.0	19.8					
2550		-57.2	18.3					

2600		-59.4	16.7
2650		-61.7	15.4
2700		-64.0	14.0
2750		-66.3	12.4

IDS Engineering Group
TBPE F-002726 TBPLS 10110707

Sanitary Lift Station Design and Cost Analysis

CLIENT: COMAL COUNTY WCID NO. 6 / 277, Ltd.
DISTRICT: COMAL COUNTY WCID NO. 6
PROJECT: Park Village Wastewater Treatment Plant On-Site EFFLUENT Lift Station Pl
JOB NO: 1500-001-11

Prepared By: *David J Ross* INITIAL HERE
Checked By: INITIAL HERE

Constants and Coefficients

Hazen-Williams Coefficient (C)
- 100 Old Ductile Iron/Cast Iron Pipe
- 120 Old PVC Pipe or New Ductile Iron/Cast Iron Pipe
- 140 New PVC Pipe (Typical Value)
- 160 New PVC Pipe (High-end Value)

Civil Design Criteria

I SITE CONDITIONS

A Existing Natural Ground Elevation =		Enter. . . .	1,270.00	ft
B 100-yr Floodplain elevation			1271.00	
			1,271.00	msl el
FEMA FIRM Panel Number	48091C0195F			
FEMA FIRM Panel Date	September 2, 2009			
Over Riding Data - (Drainage Study or Histroical High Water Level)		Enter. . . .	1,271.00	msl el
C Finished Grade Elevation of Pump Station =		Enter. . . .	1,271.50	msl el
Distance between finished grade and top of LS (typically 0.5-feet)		Enter. . . .	1.50	ft
Top of Concrete at Pump Station (TOC) = Finished Grade = 0.5 feet =			1273.00	msl el
Lowest Top of Rim for the nearest 3 influent non flood tight manholes =		Enter. . . .	1,282.00	msl el
D Enter Discharge Elevation of Riser Pipe			**1276.00**	msl el
VALVE PAD (typ. 1.5' to 2.0' above top of concrete at pump station)		Enter. . . .	3.00	ft
VALVE PIT (typ. 3.0' below the top of concrete pump station)		Enter. . . .	0.00	ft
E Elevation of Force Main at Highest Point			**1,317.60**	msl el
Highest Top of Pipe			1,317.60	msl el
Highest Top of Pipe at all Aerial Crossings = (enter		Enter. . . .	1,317.60	
Highest ground elevation along route		Enter. . . .	1,321.00	msl el
Depth of Cover over force main		Enter. . . .	4.00	ft
Elevation of Discharge		Enter. . . .	1,317.60	ft
Pipe Diameter	**CHECK AGAINST FM SIZING IN PART II.C**	Enter. . . .	6.00	inches
Highest ground elevation along route - cover - half pipe diameter			**1,316.75**	msl el
F Overflow Elevation			1,272.99	msl el
Thickness of lift station top slab		Enter. . . .	0.01	ft
Underside of lift station top slab			1,272.99	msl el
Highest top of rim of the closest 3 manholes upstream of the lift station			1,282.00	msl el
Lower elevation of Underside of LS top slab and Highest MH top of rim			1272.99	msl el
G Sewer Influent Line Elevation =				
Flowline elevation		Enter. . . .	1,274.00	msl el
Pipe Diameter		Enter. . . .	8	in
H INTERIM number of Required Connections =			**326.67**	EDU
Drainage Fixture Units	Enter. . . . 0	DFU		
Flow per DFU	Enter. . . . 0.0608	gpm		
Flow based on EDU	0	gpm		
DFUs converted to EDUs	0	EDU		
Single Family Homes or Equivalent Dwelling Unit	Enter. . . . 327	EDU		
Office Building in EDU	Enter. . . . 0	EDU		
Total undeveloped acreage	Enter. . . . 0.00	acre		
EDUs per undeveloped acre	0	EDU		
EDUs for Total Undeveloped Acreage =	0.00	EDU		
Design Flow / EDU =		Enter. . . .	300	gpd / EDU
Peak Factor =				
Interim Peak Dry Weather Flow Factor, (PDWF) =		Enter. . . .	2.5	
Interim Peak Wet Weather Flow Factor, (PDWF) =		Enter. . . .	2.9	

Sanitary Lift Station Design and Cost Analysis

CLIENT: COMAL COUNTY WCID NO. 6 / 277, Ltd.
DISTRICT: COMAL COUNTY WCID NO. 6
PROJECT: Park Village Wastewater Treatment Plant On-Site EFFLUENT Lift Station Pl
JOB NO: 1500-001-11

Prepared By: *David J Ross* INITIAL HERE
Checked By: INITIAL HERE

Design Flows

Calculated Interim Average Daily Flow, (ADF) = 98,000 gpd =	68	gpm
Calculated Interim Peak Dry Weather Design Flow, (2-Hr PEAK of 2.5Q) = 245,000 gpd =	170	gpm
Calculated Interim Peak Design Flow, (2-Hr PEAK of 2.89469387755102Q) = 283,680 gpd =	**197**	**gpm**
Calculated Interim Min Dry Weather Flow, (0.2*(0.0144*ADF)^0.198)*ADF) = 82,390 gpd =	57	gpm

The Calculated Interim Min Dry Weather Flow is used to determine the maximum detention time in the wet well.

I ULTIMATE number of Required Connections = 650.00 EDU

Drainage Fixture Units	Enter. . . .	0	DFU
Flow per DFU		0.0608	gpm
Flow based on DFU		0	gpm
DFUs converted to EDUs		0	EDU
Single Family Homes or Equivalent Dwelling Unit	Enter. . . .	650	EDU
Office Building in EDU	Enter. . . .	0	EDU
Total undeveloped acreage	Enter. . . .	0.00	acre
EDUs per undeveloped acre		0	EDU
EDUs for Total Undeveloped Acreage =		0.00	EDU

Design Flow / EDU = Enter. . . . 300 gpd / EDU

Peak Factor =

Ultimate Peak Dry Weather Flow Factor, (PDWF) =	Enter. . . .	2.5
Ultimate Peak Wet Weather Flow Factor, (PDWF) =	Enter. . . .	4.0

Calculated Ultimate Average Daily Flow, (ADF) = 195,000 gpd =	135	gpm
Calculated Ultimate Peak Dry Weather Design Flow, (2-Hr PEAK of 2.5Q) = 245,000 gpd =	339	gpm
Calculated Ultimate Peak Design Flow, (2-Hr PEAK of 2.89469387755102Q) = 564,465 gpd =	**542**	**gpm**
Calculated Ultimate Min Dry Weather Flow, (0.2*(0.0144*ADF)^0.198)*ADF) = 82,390 gpd =	130	gpm

The Calculated Interim Min Dry Weather Flow is used to determine the maximum detention time in the wet well.

J Minimum Water Depth in Wet Well 1 ft

Base on ultimate flow pumps if different from Interim Flow pumps

Submersible Pump Manufacturer's Minimum Required Liquid Operation Depth = Enter. . . . 0.00 ft
Use zero for self priming centrifugal pumps

Dist between above level and Low Water Alarm Level (6" or 1 min pump flow vol) = Enter. . . . 1.00 ft

Pump Casing Height, Depth of "Dead" Storage, or Assume 2' initially and update from Pump Cut Sheet
Pump Manufacturer's Minimum Recommended Liquid Operation Depth = Enter. . . . 0.10 ft

K Cost of Electricity (City of Houston Rates) = Enter. . . . $0.1200 $ per kwh

L Wet Well Diameter

Calculated Ultimate Peak Design Flow from I.1 above 542 gpm

PUMP RANGES, CAPACITY RANGES, DISHCARGE PIPING, WET WELL SIZE AND SITE SIZE FOR PROJECTS INSIDE THE CITY OF HOUSTON CITY LIMITS

Number of Pumps	Individual Pump Capacity - gpm		Lift Station Firm Design Capacity		Pump Discharge Piping - Inches		Wet Well Diameter	Minimum Lot Size
	From	To	From	To	From	To	ft	ft
2	0	199	0	199	4	4	6	55' x 55'
2	200	499	200	499	4	8	8	55' x 55'
2	500	999	500	999	8	10	10	70' x 70'
3	250	500	500	999	6	10	10	70' x 70'
3	500	999	1,000	1,998	8	10	12	75' x 75'
3	1,000	1,399	2,000	2,798	10	12	14	75' x 75'
3	1,400	1,999	2,800	3,998	12	16	16.5	75' x 75'
3	2,000	3,499	4,000	7,198	16	24	21	85' x 85'
4	800	3,499	2,400	10,497	10	20	21	85' x 85'
5	2,500	3,999	7,500	15,996	18	20	25	85' x 85'
6	3,000	5,299	15,000	21,196	18	20	28	90' x 90'

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Number of Pumps	Lift Station Firm Design Capacity - gpm		Lift Station Firm Design Capacity - gpd		Lift Station Firm Design Capacity (EDUs) @ 300 gpd/EDU	
	From	To	From	To	From	To
2	0	199	0	286,560	0	239
2	200	499	288,000	718,560	240	599
2	500	999	720,000	1,438,560	600	1,199
3	500	999	720,000	1,438,560	600	1,199
3	1,000	1,998	1,440,000	2,877,120	1,200	2,398
3	2,000	2,798	2,880,000	4,029,120	2,400	3,358
3	2,800	3,998	4,032,000	5,757,120	3,360	4,798
3	4,000	7,198	5,760,000	10,365,120	4,800	8,638
4	2,400	10,497	3,456,000	15,115,680	2,880	12,596
5	7,500	15,996	10,800,000	23,034,240	9,000	19,195
6	15,000	21,196	21,600,000	30,522,240	18,000	25,435

M Number of Pumps

Total number of pumps in the lift station during INTERIM condition — Enter. . . . 2 pumps
Firm number of pumps in the lift station during **INTERIM** condition — 1 pumps
Total number of pumps in the lift station during ULTIMATE condition — Enter. . . . 2 pumps
Firm number of pumps in the lift station during **ULTIMATE** condition — 1 pumps

II WET WELL SIZING

A Preliminary Wet Well Diameter

This lift station is based on the above table for projects — IN THE COH ETJ
Diameter of Wet Well for **INTERIM** condition — Enter. . . . 10 ft
Diameter of Wet Well for **ULTIMATE** condition — Enter. . . . 10 ft
Refer to the tables above to determine wet well diameter

B Preliminary Minimum Pump Cycle Time Determination

Pump Hp	Min Cycle Time Per Pump minutes
< 50	6
50-100	10
>100	15

Enter. . . . 10 minutes — VERIFY CYCLE TIME AFTER DESIGN PUMPS HAVE BEEN CHOSEN !

C Compute the Required Wet Well Volume

Note: If using a rectangular configuration do not enter a diameter, use rectangular entries below instead.

Circular Wet Well Configuration
Trial Diameter of Wet Well = Enter. . . . ft — CHECK AGAINST II.A ABOVE
Trial Circular Wet Well Configuration Area = 0 sq.ft

Rectangular Wet Well Configuration
Length of Proposed Wet Well = Enter. . . . 7.00 ft
Width of Proposed Wet Well = Enter. . . . 9.00 ft
Trial Rectangular Wet Well Configuration Area = 63 sq.ft

Working Volumes (gal/VF) — 471 gal /ft — used in energy cost below (V.F)

D Minimum wet well depth below influent pipe at ULTIMATE conditions based on one pump's cycle time

Minimum Ultimate Storage Volume = $\frac{\text{Qpeak (gpm) X Cycle Time (min)}}{\text{(4) 7.481 gal/cf}}$ = $\frac{542 \text{ gpm} \times 10 \text{ minutes}}{4 \times 7.481 \text{ gal / cf}}$
Minimum Ultimate Storage volume for first pump on = 181 cf

Minimum Ultimate Storage Depth for first pump on = Minimum Storage Volume for first pump on cf / Wet Well Area
Minimum Storage Depth = 181 cubic feet / 63 sq. ft
Minimum Storage Depth = 2.9 ft **ROUNDED TO 1 DECIMAL PLACE**
DOES NOT INCLUDE REDUCTION FOR
Min Required Storage Depth Below Influent Line = 2.9 ft **PIPING AND PUMP VOLUME**

For multiple pump lift stations to **estimate** the Minimum required storage at **ULTIMATE** condition multiply the number of firm pumps times the minimum required Storage Depth below Influent Line for the first pump on.

Estimated Minimum Required storage at ULTIMATE condition = number of firm pumps x Minimum Required Storage Depth
Estimated Minimum Required storage at ULTIMATE condition = 2.87 ft

NOTE: REQUIRED DEPTH (ABOVE) SHOULD TYPICALLY BE BETWEEN 1' and 4'

Estimated Maximum Elevation of the Wet Well Floor = Influent Line flow line elevation
- Estimated Minimum Required storage at ULTIMATE condition
- Minimum Water Depth in Wet Well (see 1 J)

Estimated Maximum Elevation of the Wet Well Floor = 1,270.12698 msl el

III LINE SIZING

A. Compute Riser Pipe Sizes

Pipe Dia. (inches)	Interim Velocity (fps)	Ultimate Velocity (fps)
4	5.03	13.83
6	2.24	6.15
8	1.26	3.46
10	0.80	2.21
12	0.56	1.54
14	0.41	1.13
16	0.31	0.86
18	0.25	0.68
20	0.20	0.55
22	0.17	0.46
24	0.14	0.38
26	0.12	0.33

Use Riser Pipe Diameter = Enter. . . . 6 inches
Wet Well Bottom 1,270.13 msl el
Riser Pipe Length = 5 ft
REPLACE RISER LENGTH WITH ACTUAL DESIGN

Interim Peak Design Flow, Velocity = 2.24 fps
Ultimate Peak Design Flow, Velocity = 6.15 fps
FOR ACTUAL VELOCITY SEE FINAL HYDRAULIC CALCULATIONS
FOR ACTUAL WET WELL BOTTOM ELEVATION SEE PART IV-C

B. Riser Pipe Data

Riser Pipe	Riser No 1
TCEQ Information only FM Coefficient (C) =	100
Max. Riser Coefficient (C) =	120
Min. Riser Coefficient (C) =	140
Riser Pipe Diameter (in.) =	6
Riser Wetted Perimeter =	0.13

Riser	Quantity	K Values	Quantity*K
Riser Pipe Length =	5.00		
Increaser	0	0.25	0.00
Reducer	1	0.50	0.50
22.5 Degree Bends =	0	0.12	0.00
45 Degree Bends =	0	0.24	0.00
90 Degree Bends =	2	0.45	0.90
Standard "T's" =	0	0.90	0.00
Full Open Swing Check	1	1.50	1.50
Plug Valve	1	0.27	0.27
		K Value Sum	3.17

C Compute Force Main Sizes

§217.67 requires that, for a duplex pump station, the minimum velocity is 3.0 feet per second with one pump in operation

§217.67 requires that, for a lift station with three or more pumps,
the minimum velocity in a force main is 2.0 feet per second with only the smallest pump in operation and
a minimum flushing velocity of 5.0 feet per second or greater must occur in a force main at least once daily

Pipe Dia. (inches)	Interim Velocity (fps)	Ultimate Velocity (fps)
4	5.03	13.83
6	2.24	6.15
8	1.26	3.46
12	0.56	1.54
16	0.31	0.86
18	0.25	0.68
20	0.20	0.55
22	0.17	0.46
24	0.14	0.38
26	0.12	0.33
28	0.10	0.28
30	0.09	0.25
36	0.06	0.17
48	0.03	0.10
60	0.02	0.06

GO BACK AND INSERT THE CHOSEN FORCE MAIN SIZE IN PART I.E OF THESE CALCULATIONS

Force Main #1
Force Main #1 Diameter = Enter. . . . 6 inches
Length of Force Main #1 = Enter. . . . 4,600 ft

Interim Peak Design Flow, Velocity = 2.24 fps
Ultimate Peak Design Flow, Velocity = 6.15 fps
FOR ACTUAL VELOCITY SEE FINAL HYDRAULIC CALCULATIONS

Force Main #2
Force Main #2 Diameter = Enter. . . . inches
Length of Force Main #2 = Enter. . . . ft

Interim Peak Design Flow, Velocity = fps
Ultimate Peak Design Flow, Velocity = fps
FOR ACTUAL VELOCITY SEE FINAL HYDRAULIC CALCULATIONS

Force Main #3
Force Main #3 Diameter = Enter. . . . inches
Length of Force Main #3 = Enter. . . . ft

Interim Peak Design Flow, Velocity = fps
Ultimate Peak Design Flow, Velocity = fps
FOR ACTUAL VELOCITY SEE FINAL HYDRAULIC CALCULATIONS

D Determine Preliminary Minimum and Maximum Static Heads

Minimum PRELIMINARY Water Surface Level in Wet Well = Estimated Max Elev of the Wet Well Floor (II.F) + Min Water Depth in Wet Well
= 1270.13 + 0.10
Minimum PRELIMINARY Water Surface Level in Wet Well= 1270.23

Maximum PRELIMINARY Static Head = Highest Point in Force Main - Minimum PRELIMINARY Water Surface Level in Wet Well
1317.6 - 1270.23
Maximum PRELIMINARY Static Head = 47.37

Maximum PRELIMINARY Water Surface Level in Wet Well = Estimated Max Elev of the Wet Well Floor (II.F) + Minimum Water Depth in Wet Well + Estimated Minimum Required storage at ULTIMATE condition
= 1270.13 + 0.10 + 2.9
Maximum PRELIMINARY Water Surface Level in Wet Well = 1,273.10

Minimum PRELIMINARY Static Head = Highest Point in Force Main - Maximum ESTIMATED Water Surface Level in Wet Well
= 1317.60 - 1273.10
Minimum PRELIMINARY Static Head = 44.50

E FORCE MAIN DATA

Force Main	System Characteristics FM No 1	FM No 2	FM No 3	
TCEQ Information only FM Coefficient (C) =	100	100	100	
Max. FM Coefficient (C) =	120	120	120	
Min. FM Coefficient (C) =	140	140	140	
Max. Static Head (ft) @ Designed GPM =	47.37	0.00	0.00	Replace with Values from III F
Min. Static Head (ft) @ Designed GPM =	44.50	0.00	0.00	Replace with Values from III F
Flooded Static Head (ft) @ Designed GPM =	44.61	0.00	0.00	Replace with Values from III F
FM Pipe Diameter (in.) =	6	16	16	
FM Wetted Perimeter =	0.13	0.33	0.33	

Force Main	FM No. 1 Quantity	FM No. 1 K Values	FM No. 1 Quantity*K	FM No. 2 Quantity	FM No. 2 K Values	FM No. 2 Quantity*K	FM No. 3 Quantity	FM No. 3 K Values	FM No. 3 Quantity* K

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Length (ft) =	4,600			0			0			
22.5° Bends =	8.5	0.12	1.02	0	0.10	0.00	0	0.10	0.00	
45° Bends =	4	0.24	0.96	0	0.21	0.00	0	0.21	0.00	
90° Bends =	2	0.45	0.90	0	0.39	0.00	0	0.39	0.00	
Plug Valve	1	0.27	0.27	0	0.23	0.00	0	0.23	0.00	
		K Value Sum	3.15		K Value Sum	0.00		K Value Sum	0.00	

F System Head Curve Calculations

Incremental increase in flow (gpm) = 50

COH Required Curve Number 3

f.1 Table: High Normal Operation Level C=120 - Design

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	FM No. 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	44.50	0.00	0.00	0.00	0.00	0.00	44.50
50	0.02	0.57	46.09	0.57	0.00	0.00	0.00	0.00	46.09
100	0.07	1.13	50.22	1.13	0.00	0.00	0.00	0.00	50.22
150	0.16	1.70	56.62	1.70	0.00	0.00	0.00	0.00	56.62
200	0.28	2.27	65.15	2.27	0.00	0.00	0.00	0.00	65.15
250	0.43	2.84	75.71	2.84	0.00	0.00	0.00	0.00	75.71
300	0.62	3.40	88.25	3.40	0.00	0.00	0.00	0.00	88.25
350	0.84	3.97	102.71	3.97	0.00	0.00	0.00	0.00	102.71
400	1.09	4.54	119.04	4.54	0.00	0.00	0.00	0.00	119.04
450	1.38	5.11	137.20	5.11	0.00	0.00	0.00	0.00	137.20
500	1.71	5.67	157.18	5.67	0.00	0.00	0.00	0.00	157.18
550	2.06	6.24	178.93	6.24	0.00	0.00	0.00	0.00	178.93
600	2.45	6.81	202.44	6.81	0.00	0.00	0.00	0.00	202.44
650	2.87	7.38	227.68	7.38	0.00	0.00	0.00	0.00	227.68
700	3.33	7.94	254.64	7.94	0.00	0.00	0.00	0.00	254.64
750	3.82	8.51	283.28	8.51	0.00	0.00	0.00	0.00	283.28
800	4.34	9.08	313.60	9.08	0.00	0.00	0.00	0.00	313.60
850	4.90	9.65	345.58	9.65	0.00	0.00	0.00	0.00	345.58
900	5.49	10.21	379.20	10.21	0.00	0.00	0.00	0.00	379.20
950	6.12	10.78	414.46	10.78	0.00	0.00	0.00	0.00	414.46
1000	6.77	11.35	451.34	11.35	0.00	0.00	0.00	0.00	451.34
1050	7.47	11.92	489.82	11.92	0.00	0.00	0.00	0.00	489.82
1100	8.19	12.48	529.89	12.48	0.00	0.00	0.00	0.00	529.89
1150	8.95	13.05	571.55	13.05	0.00	0.00	0.00	0.00	571.55
1200	9.74	13.62	614.78	13.62	0.00	0.00	0.00	0.00	614.78
1250	10.56	14.18	659.58	14.18	0.00	0.00	0.00	0.00	659.58
1300	11.42	14.75	705.93	14.75	0.00	0.00	0.00	0.00	705.93
1350	12.31	15.32	753.83	15.32	0.00	0.00	0.00	0.00	753.83
1400	13.24	15.89	803.26	15.89	0.00	0.00	0.00	0.00	803.26
1450	14.19	16.45	854.22	16.45	0.00	0.00	0.00	0.00	854.22
1500	15.18	17.02	906.70	17.02	0.00	0.00	0.00	0.00	906.70
1550	16.21	17.59	960.70	17.59	0.00	0.00	0.00	0.00	960.70
1600	17.27	18.16	1016.20	18.16	0.00	0.00	0.00	0.00	1016.20
1650	18.36	18.72	1073.20	18.72	0.00	0.00	0.00	0.00	1073.20
1700	19.48	19.29	1131.69	19.29	0.00	0.00	0.00	0.00	1131.69
1750	20.64	19.86	1191.67	19.86	0.00	0.00	0.00	0.00	1191.67
1800	21.83	20.43	1253.13	20.43	0.00	0.00	0.00	0.00	1253.13
1850	23.05	20.99	1316.06	20.99	0.00	0.00	0.00	0.00	1316.06
1900	24.31	21.56	1380.45	21.56	0.00	0.00	0.00	0.00	1380.45
1950	25.60	22.13	1446.31	22.13	0.00	0.00	0.00	0.00	1446.31
2000	26.92	22.70	1513.63	22.70	0.00	0.00	0.00	0.00	1513.63
2050	28.28	23.26	1582.40	23.26	0.00	0.00	0.00	0.00	1582.40
2100	29.67	23.83	1652.61	23.83	0.00	0.00	0.00	0.00	1652.61
2150	31.10	24.40	1724.26	24.40	0.00	0.00	0.00	0.00	1724.26
2200	32.55	24.97	1797.35	24.97	0.00	0.00	0.00	0.00	1797.35
2250	34.04	25.53	1871.86	25.53	0.00	0.00	0.00	0.00	1871.86

f.2 Table: **Pump Curves**

Peerless 3AE9 - 3525 RPM	Peerless 3AE9 - 3525 RPM	Peerless 3AE9 - 3525 RPM	Peerless 3AE9 - 3525 RPM	Peerless 3AE9 - 3525 RPM	Peerless 3AE9 - 3525 RPM	Peerless 3AE9 - 2025 RPM	Peerless 3AE9 - 2025 RPM

Flow (gpm)	Published Pump 1 Curve HL (ft)	Pub Curve w/Riser Losses ONE PUMP Head (ft)	Pub Curve w/Riser Losses TWO PUMPS Head (ft)	Pub Curve w/Riser Losses THREE PUMP Head (ft)	Pub Curve w/Riser Losses FOUR PUMP Head (ft)	Pub Curve w/Riser Losses FIVE PUMPS Head (ft)	VFD Turned Down Pump Head (ft)	VFD Turn Down Pump Head (ft)
0	211.4	211.4	211.4	211.4	211.4	211.4	72.3	72.3
50	211.4	211.4	211.4	211.4	211.4	211.4	71.1	71.1
100	211.4	211.4	211.4	211.4	211.4	211.4	71.1	71.1
150	211.4	211.3	211.4	211.4	211.4	211.4	71.1	71.0
200	211.4	211.2	211.4	211.4	211.4	211.4	68.9	68.6
250	210.3	209.9	211.3	211.4	211.4	211.4	64.4	63.9
300	205.9	205.3	211.3	211.4	211.4	211.4	59.8	59.2
350	203.7	202.9	211.2	211.3	211.4	211.4	51.9	51.1
400	198.2	197.1	211.2	211.3	211.4	211.4	44.0	42.9
450	190.4	189.0	210.5	211.3	211.3	211.4	0.0	-1.4
500	181.5	179.8	209.9	211.2	211.3	211.4	0.0	-1.7
550	170.5	168.4	207.6	211.2	211.3	211.4	0.0	-2.1
600	159.4	157.0	205.3	211.2	211.3	211.3	0.0	-2.5
650	143.9	141.0	204.1	210.7	211.3	211.3	0.0	-2.9
700	129.5	126.2	202.9	210.3	211.2	211.3	0.0	-3.3
750		-3.8	200.0	209.9	211.2	211.3	0.0	-3.8
800		-4.3	197.1	208.4	211.2	211.3	0.0	-4.3
850		-4.9	193.0	206.8	210.8	211.2	0.0	-4.9
900		-5.5	189.0	205.3	210.5	211.2	0.0	-5.5
950		-6.1	184.4	204.5	210.2	211.2	0.0	-6.1
1000		-6.8	179.8	203.7	209.9	211.2	0.0	-6.8
1050		-7.5	174.1	202.9	208.7	210.9	0.0	-7.5
1100		-8.2	168.4	200.9	207.6	210.7	0.0	-8.2
1150		-8.9	162.7	199.0	206.4	210.4	0.0	-8.9
1200		-9.7	157.0	197.1	205.3	210.2	0.0	-9.7
1250		-10.6	149.0	194.4	204.7	209.9	0.0	-10.6
1300		-11.4	141.0	191.7	204.1	209.0	0.0	-11.4
1350		-12.3	133.6	189.0	203.5	208.1	0.0	-12.3
1400		-13.2	126.2	186.0	202.9	207.1	0.0	-13.2
1450		-14.2	61.2	182.9	201.4	206.2	0.0	-14.2
1500		-15.2	-3.8	179.8	200.0	205.3	0.0	-15.2
1550		-16.2	-4.1	176.0	198.5	204.8	0.0	-16.2
1600		-17.3	-4.3	172.2	197.1	204.3	0.0	-17.3
1650		-18.4	-4.6	168.4	195.1	203.8	0.0	-18.4
1700		-19.5	-4.9	164.6	193.0	203.3	0.0	-19.5
1750		-20.6	-5.2	160.8	191.0	202.9	0.0	-20.6
1800		-21.8	-5.5	157.0	189.0	201.7	0.0	-21.8
1850		-23.1	-5.8	151.7	186.7	200.5	0.0	-23.1
1900		-24.3	-6.1	146.3	184.4	199.4	0.0	-24.3
1950		-25.6	-6.4	141.0	182.1	198.2	0.0	-25.6
2000		-26.9	-6.8	136.1	179.8	197.1	0.0	-26.9
2050		-28.3	-7.1	131.1	177.0	195.5	0.0	-28.3
2100		-29.7	-7.5	126.2	174.1	193.8	0.0	-29.7
2150		-31.1	-7.8	82.9	171.3	192.2	0.0	-31.1
2200		-32.6	-8.2	39.5	168.42	190.6	0.0	-32.6
2250		-34.0		-3.8		189.0	0.0	-34.0

COH Required Curve Number 4

f.3 Table: **High Normal Operating Level C=140**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	FM No. 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	44.50	0.00	0.00	0.00	0.00	0.00	44.50
50	0.02	0.57	45.70	0.57	0.00	0.00	0.00	0.00	45.70
100	0.07	1.13	48.82	1.13	0.00	0.00	0.00	0.00	48.82

150	0.15	1.70	53.65	1.70	0.00	0.00	0.00	0.00	53.65
200	0.27	2.27	60.09	2.27	0.00	0.00	0.00	0.00	60.09
250	0.42	2.84	68.07	2.84	0.00	0.00	0.00	0.00	68.07
300	0.61	3.40	77.54	3.40	0.00	0.00	0.00	0.00	77.54
350	0.82	3.97	88.45	3.97	0.00	0.00	0.00	0.00	88.45
400	1.07	4.54	100.79	4.54	0.00	0.00	0.00	0.00	100.79
450	1.36	5.11	114.52	5.11	0.00	0.00	0.00	0.00	114.52
500	1.68	5.67	129.61	5.67	0.00	0.00	0.00	0.00	129.61
550	2.03	6.24	146.05	6.24	0.00	0.00	0.00	0.00	146.05
600	2.41	6.81	163.82	6.81	0.00	0.00	0.00	0.00	163.82
650	2.83	7.38	182.89	7.38	0.00	0.00	0.00	0.00	182.89
700	3.28	7.94	203.26	7.94	0.00	0.00	0.00	0.00	203.26
750	3.76	8.51	224.91	8.51	0.00	0.00	0.00	0.00	224.91
800	4.27	9.08	247.83	9.08	0.00	0.00	0.00	0.00	247.83
850	4.82	9.65	272.00	9.65	0.00	0.00	0.00	0.00	272.00
900	5.40	10.21	297.42	10.21	0.00	0.00	0.00	0.00	297.42
950	6.02	10.78	324.08	10.78	0.00	0.00	0.00	0.00	324.08
1000	6.67	11.35	351.95	11.35	0.00	0.00	0.00	0.00	351.95
1050	7.35	11.92	381.05	11.92	0.00	0.00	0.00	0.00	381.05
1100	8.06	12.48	411.35	12.48	0.00	0.00	0.00	0.00	411.35
1150	8.81	13.05	442.85	13.05	0.00	0.00	0.00	0.00	442.85
1200	9.59	13.62	475.53	13.62	0.00	0.00	0.00	0.00	475.53
1250	10.40	14.18	509.41	14.18	0.00	0.00	0.00	0.00	509.41
1300	11.24	14.75	544.46	14.75	0.00	0.00	0.00	0.00	544.46
1350	12.12	15.32	580.68	15.32	0.00	0.00	0.00	0.00	580.68
1400	13.03	15.89	618.06	15.89	0.00	0.00	0.00	0.00	618.06
1450	13.98	16.45	656.60	16.45	0.00	0.00	0.00	0.00	656.60
1500	14.96	17.02	696.29	17.02	0.00	0.00	0.00	0.00	696.29
1550	15.97	17.59	737.12	17.59	0.00	0.00	0.00	0.00	737.12
1600	17.01	18.16	779.10	18.16	0.00	0.00	0.00	0.00	779.10
1650	18.08	18.72	822.21	18.72	0.00	0.00	0.00	0.00	822.21
1700	19.19	19.29	866.45	19.29	0.00	0.00	0.00	0.00	866.45
1750	20.33	19.86	911.82	19.86	0.00	0.00	0.00	0.00	911.82
1800	21.51	20.43	958.31	20.43	0.00	0.00	0.00	0.00	958.31
1850	22.72	20.99	1005.91	20.99	0.00	0.00	0.00	0.00	1005.91
1900	23.96	21.56	1054.62	21.56	0.00	0.00	0.00	0.00	1054.62
1950	25.23	22.13	1104.44	22.13	0.00	0.00	0.00	0.00	1104.44
2000	26.54	22.70	1155.36	22.70	0.00	0.00	0.00	0.00	1155.36
2050	27.87	23.26	1207.38	23.26	0.00	0.00	0.00	0.00	1207.38
2100	29.25	23.83	1260.50	23.83	0.00	0.00	0.00	0.00	1260.50
2150	30.65	24.40	1314.70	24.40	0.00	0.00	0.00	0.00	1314.70
2200	32.09	24.97	1369.99	24.97	0.00	0.00	0.00	0.00	1369.99
2250	33.56	25.53	1426.37	25.53	0.00	0.00	0.00	0.00	1426.37

COH Required Curve Number 1

f.4 **Table: Low Normal Operation Level C=120 - Design**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	Headloss Total FM 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 C=120 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 C=120 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	47.37	0.00	0.00	0.00	0.00	0.00	47.37
50	0.02	0.57	48.96	0.57	0.00	0.00	0.00	0.00	48.96
100	0.07	1.13	53.09	1.13	0.00	0.00	0.00	0.00	53.09
150	0.16	1.70	59.49	1.70	0.00	0.00	0.00	0.00	59.49
200	0.28	2.27	68.02	2.27	0.00	0.00	0.00	0.00	68.02
250	0.43	2.84	78.59	2.84	0.00	0.00	0.00	0.00	78.59
300	0.62	3.40	91.12	3.40	0.00	0.00	0.00	0.00	91.12
350	0.84	3.97	105.58	3.97	0.00	0.00	0.00	0.00	105.58
400	1.09	4.54	121.91	4.54	0.00	0.00	0.00	0.00	121.91
450	1.38	5.11	140.08	5.11	0.00	0.00	0.00	0.00	140.08
500	1.71	5.67	160.05	5.67	0.00	0.00	0.00	0.00	160.05
550	2.06	6.24	181.81	6.24	0.00	0.00	0.00	0.00	181.81
600	2.45	6.81	205.32	6.81	0.00	0.00	0.00	0.00	205.32
650	2.87	7.38	230.56	7.38	0.00	0.00	0.00	0.00	230.56

700	3.33	7.94	257.51	7.94	0.00	0.00	0.00	0.00	257.51
750	3.82	8.51	286.15	8.51	0.00	0.00	0.00	0.00	286.15
800	4.34	9.08	316.47	9.08	0.00	0.00	0.00	0.00	316.47
850	4.90	9.65	348.45	9.65	0.00	0.00	0.00	0.00	348.45
900	5.49	10.21	382.08	10.21	0.00	0.00	0.00	0.00	382.08
950	6.12	10.78	417.33	10.78	0.00	0.00	0.00	0.00	417.33
1000	6.77	11.35	454.21	11.35	0.00	0.00	0.00	0.00	454.21
1050	7.47	11.92	492.69	11.92	0.00	0.00	0.00	0.00	492.69
1100	8.19	12.48	532.76	12.48	0.00	0.00	0.00	0.00	532.76
1150	8.95	13.05	574.42	13.05	0.00	0.00	0.00	0.00	574.42
1200	9.74	13.62	617.66	13.62	0.00	0.00	0.00	0.00	617.66
1250	10.56	14.18	662.45	14.18	0.00	0.00	0.00	0.00	662.45
1300	11.42	14.75	708.80	14.75	0.00	0.00	0.00	0.00	708.80
1350	12.31	15.32	756.70	15.32	0.00	0.00	0.00	0.00	756.70
1400	13.24	15.89	806.13	15.89	0.00	0.00	0.00	0.00	806.13
1450	14.19	16.45	857.09	16.45	0.00	0.00	0.00	0.00	857.09
1500	15.18	17.02	909.57	17.02	0.00	0.00	0.00	0.00	909.57
1550	16.21	17.59	963.57	17.59	0.00	0.00	0.00	0.00	963.57
1600	17.27	18.16	1019.07	18.16	0.00	0.00	0.00	0.00	1019.07
1650	18.36	18.72	1076.07	18.72	0.00	0.00	0.00	0.00	1076.07
1700	19.48	19.29	1134.56	19.29	0.00	0.00	0.00	0.00	1134.56
1750	20.64	19.86	1194.54	19.86	0.00	0.00	0.00	0.00	1194.54
1800	21.83	20.43	1256.00	20.43	0.00	0.00	0.00	0.00	1256.00
1850	23.05	20.99	1318.93	20.99	0.00	0.00	0.00	0.00	1318.93
1900	24.31	21.56	1383.33	21.56	0.00	0.00	0.00	0.00	1383.33
1950	25.60	22.13	1449.19	22.13	0.00	0.00	0.00	0.00	1449.19
2000	26.92	22.70	1516.50	22.70	0.00	0.00	0.00	0.00	1516.50
2050	28.28	23.26	1585.27	23.26	0.00	0.00	0.00	0.00	1585.27
2100	29.67	23.83	1655.48	23.83	0.00	0.00	0.00	0.00	1655.48
2150	31.10	24.40	1727.13	24.40	0.00	0.00	0.00	0.00	1727.13
2200	32.55	24.97	1800.22	24.97	0.00	0.00	0.00	0.00	1800.22
2250	34.04	25.53	1874.74	25.53	0.00	0.00	0.00	0.00	1874.74

This is not a COH required curve.

f.5 **Table: Low Normal Operating Level C=140**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	Headloss Total FM 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 C=140 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 C=140 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	47.37	0.00	0.00	0.00	0.00	0.00	47.37
50	0.02	0.57	48.57	0.57	0.00	0.00	0.00	0.00	48.57
100	0.07	1.13	51.69	1.13	0.00	0.00	0.00	0.00	51.69
150	0.15	1.70	56.52	1.70	0.00	0.00	0.00	0.00	56.52
200	0.27	2.27	62.96	2.27	0.00	0.00	0.00	0.00	62.96
250	0.42	2.84	70.94	2.84	0.00	0.00	0.00	0.00	70.94
300	0.61	3.40	80.41	3.40	0.00	0.00	0.00	0.00	80.41
350	0.82	3.97	91.33	3.97	0.00	0.00	0.00	0.00	91.33
400	1.07	4.54	103.67	4.54	0.00	0.00	0.00	0.00	103.67
450	1.36	5.11	117.39	5.11	0.00	0.00	0.00	0.00	117.39
500	1.68	5.67	132.49	5.67	0.00	0.00	0.00	0.00	132.49
550	2.03	6.24	148.92	6.24	0.00	0.00	0.00	0.00	148.92
600	2.41	6.81	166.69	6.81	0.00	0.00	0.00	0.00	166.69
650	2.83	7.38	185.77	7.38	0.00	0.00	0.00	0.00	185.77
700	3.28	7.94	206.14	7.94	0.00	0.00	0.00	0.00	206.14
750	3.76	8.51	227.79	8.51	0.00	0.00	0.00	0.00	227.79
800	4.27	9.08	250.70	9.08	0.00	0.00	0.00	0.00	250.70
850	4.82	9.65	274.88	9.65	0.00	0.00	0.00	0.00	274.88
900	5.40	10.21	300.30	10.21	0.00	0.00	0.00	0.00	300.30
950	6.02	10.78	326.95	10.78	0.00	0.00	0.00	0.00	326.95
1000	6.67	11.35	354.83	11.35	0.00	0.00	0.00	0.00	354.83
1050	7.35	11.92	383.92	11.92	0.00	0.00	0.00	0.00	383.92
1100	8.06	12.48	414.22	12.48	0.00	0.00	0.00	0.00	414.22
1150	8.81	13.05	445.72	13.05	0.00	0.00	0.00	0.00	445.72
1200	9.59	13.62	478.41	13.62	0.00	0.00	0.00	0.00	478.41
1250	10.40	14.18	512.28	14.18	0.00	0.00	0.00	0.00	512.28

1300	11.24	14.75	547.33	14.75	0.00	0.00	0.00	0.00	547.33
1350	12.12	15.32	583.55	15.32	0.00	0.00	0.00	0.00	583.55
1400	13.03	15.89	620.93	15.89	0.00	0.00	0.00	0.00	620.93
1450	13.98	16.45	659.47	16.45	0.00	0.00	0.00	0.00	659.47
1500	14.96	17.02	699.16	17.02	0.00	0.00	0.00	0.00	699.16
1550	15.97	17.59	740.00	17.59	0.00	0.00	0.00	0.00	740.00
1600	17.01	18.16	781.97	18.16	0.00	0.00	0.00	0.00	781.97
1650	18.08	18.72	825.09	18.72	0.00	0.00	0.00	0.00	825.09
1700	19.19	19.29	869.33	19.29	0.00	0.00	0.00	0.00	869.33
1750	20.33	19.86	914.69	19.86	0.00	0.00	0.00	0.00	914.69
1800	21.51	20.43	961.18	20.43	0.00	0.00	0.00	0.00	961.18
1850	22.72	20.99	1008.78	20.99	0.00	0.00	0.00	0.00	1008.78
1900	23.96	21.56	1057.49	21.56	0.00	0.00	0.00	0.00	1057.49
1950	25.23	22.13	1107.31	22.13	0.00	0.00	0.00	0.00	1107.31
2000	26.54	22.70	1158.23	22.70	0.00	0.00	0.00	0.00	1158.23
2050	27.87	23.26	1210.25	23.26	0.00	0.00	0.00	0.00	1210.25
2100	29.25	23.83	1263.37	23.83	0.00	0.00	0.00	0.00	1263.37
2150	30.65	24.40	1317.57	24.40	0.00	0.00	0.00	0.00	1317.57
2200	32.09	24.97	1372.87	24.97	0.00	0.00	0.00	0.00	1372.87
2250	33.56	25.53	1429.24	25.53	0.00	0.00	0.00	0.00	1429.24

COH Required Curve Number 2

f.6 **Table: High Normal Operating Level C=100 - Information Only (TCEQ)**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	FM No. 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	44.50	0.00	0.00	0.00	0.00	0.00	44.50
50	0.02	0.57	46.71	0.57	0.00	0.00	0.00	0.00	46.71
100	0.07	1.13	52.49	1.13	0.00	0.00	0.00	0.00	52.49
150	0.16	1.70	61.43	1.70	0.00	0.00	0.00	0.00	61.43
200	0.28	2.27	73.33	2.27	0.00	0.00	0.00	0.00	73.33
250	0.44	2.84	88.08	2.84	0.00	0.00	0.00	0.00	88.08
300	0.64	3.40	105.57	3.40	0.00	0.00	0.00	0.00	105.57
350	0.86	3.97	125.75	3.97	0.00	0.00	0.00	0.00	125.75
400	1.13	4.54	148.53	4.54	0.00	0.00	0.00	0.00	148.53
450	1.42	5.11	173.88	5.11	0.00	0.00	0.00	0.00	173.88
500	1.75	5.67	201.75	5.67	0.00	0.00	0.00	0.00	201.75
550	2.12	6.24	232.10	6.24	0.00	0.00	0.00	0.00	232.10
600	2.52	6.81	264.89	6.81	0.00	0.00	0.00	0.00	264.89
650	2.95	7.38	300.10	7.38	0.00	0.00	0.00	0.00	300.10
700	3.42	7.94	337.69	7.94	0.00	0.00	0.00	0.00	337.69
750	3.92	8.51	377.65	8.51	0.00	0.00	0.00	0.00	377.65
800	4.46	9.08	419.93	9.08	0.00	0.00	0.00	0.00	419.93
850	5.03	9.65	464.53	9.65	0.00	0.00	0.00	0.00	464.53
900	5.64	10.21	511.43	10.21	0.00	0.00	0.00	0.00	511.43
950	6.28	10.78	560.59	10.78	0.00	0.00	0.00	0.00	560.59
1000	6.95	11.35	612.01	11.35	0.00	0.00	0.00	0.00	612.01
1050	7.66	11.92	665.67	11.92	0.00	0.00	0.00	0.00	665.67
1100	8.40	12.48	721.55	12.48	0.00	0.00	0.00	0.00	721.55
1150	9.17	13.05	779.64	13.05	0.00	0.00	0.00	0.00	779.64
1200	9.98	13.62	839.91	13.62	0.00	0.00	0.00	0.00	839.91
1250	10.83	14.18	902.37	14.18	0.00	0.00	0.00	0.00	902.37
1300	11.70	14.75	966.99	14.75	0.00	0.00	0.00	0.00	966.99
1350	12.62	15.32	1033.77	15.32	0.00	0.00	0.00	0.00	1033.77
1400	13.56	15.89	1102.68	15.89	0.00	0.00	0.00	0.00	1102.68
1450	14.54	16.45	1173.73	16.45	0.00	0.00	0.00	0.00	1173.73
1500	15.55	17.02	1246.89	17.02	0.00	0.00	0.00	0.00	1246.89
1550	16.60	17.59	1322.16	17.59	0.00	0.00	0.00	0.00	1322.16
1600	17.68	18.16	1399.53	18.16	0.00	0.00	0.00	0.00	1399.53
1650	18.80	18.72	1478.98	18.72	0.00	0.00	0.00	0.00	1478.98
1700	19.95	19.29	1560.52	19.29	0.00	0.00	0.00	0.00	1560.52
1750	21.13	19.86	1644.12	19.86	0.00	0.00	0.00	0.00	1644.12
1800	22.35	20.43	1729.78	20.43	0.00	0.00	0.00	0.00	1729.78

1850	23.60	20.99	1817.50	20.99	0.00	0.00	0.00	0.00	1817.50
1900	24.88	21.56	1907.25	21.56	0.00	0.00	0.00	0.00	1907.25
1950	26.20	22.13	1999.05	22.13	0.00	0.00	0.00	0.00	1999.05
2000	27.55	22.70	2092.87	22.70	0.00	0.00	0.00	0.00	2092.87
2050	28.94	23.26	2188.71	23.26	0.00	0.00	0.00	0.00	2188.71
2100	30.36	23.83	2286.56	23.83	0.00	0.00	0.00	0.00	2286.56
2150	31.82	24.40	2386.42	24.40	0.00	0.00	0.00	0.00	2386.42
2200	33.30	24.97	2488.27	24.97	0.00	0.00	0.00	0.00	2488.27
2250	33.56	25.53	2592.12	25.53	0.00	0.00	0.00	0.00	2592.12

COH Required Curve Number 5

f.7 **Table: Emergency Flooded Operating Level C=140**

Flow (gpm)	Total Riser HL (ft)	Riser Velocity (ft/s)	Headloss Total FM 1 HL (ft)	FM No. 1 Velocity (ft/s)	FM No. 2 C=0 HL (ft)	FM No. 2 Velocity (ft/s)	FM No. 3 C=0 HL (ft)	FM No. 3 Velocity (ft/s)	Total FM HL (ft)
0	0.00	0.00	44.61	0.00	0.00	0.00	0.00	0.00	44.61
50	0.02	0.57	45.81	0.57	0.00	0.00	0.00	0.00	45.81
100	0.07	1.13	48.93	1.13	0.00	0.00	0.00	0.00	48.93
150	0.15	1.70	53.76	1.70	0.00	0.00	0.00	0.00	53.76
200	0.27	2.27	60.20	2.27	0.00	0.00	0.00	0.00	60.20
250	0.42	2.84	68.18	2.84	0.00	0.00	0.00	0.00	68.18
300	0.61	3.40	77.65	3.40	0.00	0.00	0.00	0.00	77.65
350	0.82	3.97	88.56	3.97	0.00	0.00	0.00	0.00	88.56
400	1.07	4.54	100.90	4.54	0.00	0.00	0.00	0.00	100.90
450	1.36	5.11	114.63	5.11	0.00	0.00	0.00	0.00	114.63
500	1.68	5.67	129.72	5.67	0.00	0.00	0.00	0.00	129.72
550	2.03	6.24	146.16	6.24	0.00	0.00	0.00	0.00	146.16
600	2.41	6.81	163.93	6.81	0.00	0.00	0.00	0.00	163.93
650	2.83	7.38	183.00	7.38	0.00	0.00	0.00	0.00	183.00
700	3.28	7.94	203.37	7.94	0.00	0.00	0.00	0.00	203.37
750	3.76	8.51	225.02	8.51	0.00	0.00	0.00	0.00	225.02
800	4.27	9.08	247.94	9.08	0.00	0.00	0.00	0.00	247.94
850	4.82	9.65	272.11	9.65	0.00	0.00	0.00	0.00	272.11
900	5.40	10.21	297.53	10.21	0.00	0.00	0.00	0.00	297.53
950	6.02	10.78	324.19	10.78	0.00	0.00	0.00	0.00	324.19
1000	6.67	11.35	352.06	11.35	0.00	0.00	0.00	0.00	352.06
1050	7.35	11.92	381.16	11.92	0.00	0.00	0.00	0.00	381.16
1100	8.06	12.48	411.46	12.48	0.00	0.00	0.00	0.00	411.46
1150	8.81	13.05	442.96	13.05	0.00	0.00	0.00	0.00	442.96
1200	9.59	13.62	475.64	13.62	0.00	0.00	0.00	0.00	475.64
1250	10.40	14.18	509.52	14.18	0.00	0.00	0.00	0.00	509.52
1300	11.24	14.75	544.57	14.75	0.00	0.00	0.00	0.00	544.57
1350	12.12	15.32	580.79	15.32	0.00	0.00	0.00	0.00	580.79
1400	13.03	15.89	618.17	15.89	0.00	0.00	0.00	0.00	618.17
1450	13.98	16.45	656.71	16.45	0.00	0.00	0.00	0.00	656.71
1500	14.96	17.02	696.40	17.02	0.00	0.00	0.00	0.00	696.40
1550	15.97	17.59	737.23	17.59	0.00	0.00	0.00	0.00	737.23
1600	17.01	18.16	779.21	18.16	0.00	0.00	0.00	0.00	779.21
1650	18.08	18.72	822.32	18.72	0.00	0.00	0.00	0.00	822.32
1700	19.19	19.29	866.56	19.29	0.00	0.00	0.00	0.00	866.56
1750	20.33	19.86	911.93	19.86	0.00	0.00	0.00	0.00	911.93
1800	21.51	20.43	958.42	20.43	0.00	0.00	0.00	0.00	958.42
1850	22.72	20.99	1006.02	20.99	0.00	0.00	0.00	0.00	1006.02
1900	23.96	21.56	1054.73	21.56	0.00	0.00	0.00	0.00	1054.73
1950	25.23	22.13	1104.55	22.13	0.00	0.00	0.00	0.00	1104.55
2000	26.54	22.70	1155.47	22.70	0.00	0.00	0.00	0.00	1155.47
2050	27.87	23.26	1207.49	23.26	0.00	0.00	0.00	0.00	1207.49
2100	29.25	23.83	1260.61	23.83	0.00	0.00	0.00	0.00	1260.61
2150	30.65	24.40	1314.81	24.40	0.00	0.00	0.00	0.00	1314.81
2200	32.09	24.97	1370.10	24.97	0.00	0.00	0.00	0.00	1370.10
2250	33.56	25.53	1426.48	25.53	0.00	0.00	0.00	0.00	1426.48

Q= 200

Design

Lift Station Condition	Riser Piping Total HL (ft)	Riser Piping Average HL (ft)	Point Phase 1 HL (ft)	Force Main Average HL (ft)	Force Main Total HL (ft)
High Normal Operation Level C=120 - Design	0.28				65.15
		0.27		62.62	
High Normal Operating Level C=140	0.27				60.09
		0.27	**64.33**	64.05	
Low Normal Operation Level C=120 - Design	0.28				68.02
		0.27		65.49	
Low Normal Operating Level C=140	0.27				62.96

High Normal Operating Level C=100 - Information Only (TCEQ)	0.28	73.33
Emergency Flooded Operating Level C=140	0.27	60.20

Q= 550

Lift Station Condition	Riser Piping Total HL (ft)	Riser Piping Average HL (ft)	Design Point Phase 2 HL (ft)	Force Main Average HL (ft)	Force Main Total HL (ft)
High Normal Operation Level C=120 - Design	2.06				178.93
		2.04		162.49	
High Normal Operating Level C=140	2.03				146.05
		2.04	**165.97**	163.93	
Low Normal Operation Level C=120 - Design	2.06				181.81
		2.04		165.37	
Low Normal Operating Level C=140	2.03				148.92

High Normal Operating Level C=100 - Information Only (TCEQ)	2.12	232.10
Emergency Flooded Operating Level C=140	2.03	146.16

IV PUMP CONTROL SETTINGS

A Compute the Pumping Ranges in the Wet Well

3
9
7
189

Proposed Wet Well Diameter: 0 ft
Wet Well Surface Area: 63.00 SF
Detention Pond surface Area - SF
Wet Well Surface Area: 63.00 SF

Note: The following capacities should be taken from the system curves.

Pump No. 1 Capacity:	Enter.	560	gpm
Pump Nos. 1 & 2 Capacity:	Enter.	622	gpm
Pump Nos. 1, 2 & 3 Capacity:	Enter.	none	gpm
Pump Nos. 1, 2, 3 & 4 Capacity:	Enter.	none	gpm

For Pump 1, V-1 = $\frac{10.0 \text{ min.} \times 560 \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 187.17 CF, h1 = 2.97 ft

For Pump 2, V-2 = $\frac{10.0 \text{ min.} \times (622 - 560) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 20.72 CF, h2 = 0.33 ft

For Pump 3, V-3 = $\frac{10.0 \text{ min.} \times (\text{none} - 622) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 00.00 CF, h3 = 0.00 ft

For Pump 4, V-4 = $\frac{10.0 \text{ min.} \times (\text{none} - \text{none}) \text{ gpm}}{7.48 \text{ gpm/CF} \times 4}$ = 00.00 CF, h4 = 0.00 ft

Total Wet Well Volume = 207.89 CF
Total Required Depth = 3.300 ft
Estimated Maximum Elevation of the Wet Well Floor = 1,270.127 msl el (from II.D)
Reality Check:

B Determine Pump Control Settings

Sewer Influent Line Elevation = 1274 msl el

Minimum Required Pump Settings

		Rising Water Level		Falling Water Level	
WL Elev	D H	Action	Pump Station	Action	Pump Status
1,261.30		P-3 on	P-1, P-2 & P-3 on		P-1, P-2 & P-3 on
1,261.30	0.00	P-2 on	P-1 & P-2 on	P-3 off	P-1 & P-2 on
1,260.97	0.33	P-1 on	P-1 on	P-2 off	P-1 on
1,258.00	2.97		All Stop	P-1 off	All Stop

Design Pump Settings (Engineer's Recommended Settings)

	Rising Water Level			Falling Water Level		
D H	Action	Pump Station	WL Elev	Action	Pump Status	D H
	Standby Pump On	All Pumps Running	1,261.70	None	All Pumps Running	
0.60						0.60
	High Level Alarm On	1, 2, & 3 (All Firm) On	1,261.10	High Level Alarm Off	All Pumps Running	
1,261.10						1,261.10
	Lag-Lag Pump On	1, 2, & 3 (All Firm) On		Standby off	Lead & Lag on	
0.00						0.00
	Lag Pump On	1 & 2 On		None	Lead & Lag on	
(1,260.40)						(1,260.40)
	Lead Pump on	Lead on	1,260.40	Standby off	Lead on	
2.40						2.40
	Minimum Water Level - **Low Level Alarm Off**	All Stop	1,258.00	Lead off	All Stop, Standby set to Lead Pump	
0.00						0.00
	None	All Stop	1,258.00	Low Level Alarm On	All Stop	
2.00						2.00
	Wet Well Floor - None	All Stop	1,256.00	Wet Well Floor - None	All Stop	

Pump Manufacturer's Minimum Liquid Level Depth for Operation =		0.10	ft	From I J above
Enter pump height or minimum liquid level to set all pumps off =	Enter. . . .	2.01	ft	
Influent Elevation at Wet Well =		1274.00	ft	From I G above
Lead Pump On (P-1) =	Enter. . . .	1,260.40	ft	
Lag or Standby Pump On (P-2) =		0.00	ft	
Lag-Lag or Standby Pump On (P-3) =	N/A	0.00	ft	
Elevation of High Water Alarm (typ. 0.5' above Standby Pump On) =		1261.10	ft	
Lag-Lag-Lag or Standby Pump On (P-4) =		1261.70	ft	
Discharge Elevation of Force Main (1.5' above slab) =		1276.00	ft	
Elevation of Force Main at Highest Point =		1317.60	ft	
Bottom Elevation of Wet Well (min 1.6' below all Pumps Off) =	Enter. . . .	1,270.13	ft	Replace with Actual & see table above
Low Level Alarm (typ. halfway up Pump casing or min liquid operation depth) =		1270.23	ft	
All Pumps Off (slab elev + min liquid depth OR slab elev + pump height) =		1272.14	ft	

C Compute the Detention Time at ADF for Interim and Ultimate Conditions

Existing / Interim Condition:

INTERIM Average Daily Flow = 326.666666666667 EDU @ 300 gpd =	68.1	gpm	
Volume at Lead Pump (P-1) On = -1260.40 ft x (471.24 gal/VF) =	-593950.90	gal	471.2715
Calculated Detention Time at INTERIM ADF = -593950.90 gal / 68.1 gal/min	-8727.4	min	

Ultimate Condition:

ULTIMATE Average Daily Flow = 650 EDU @ 300 gpd =	135.4	gpm
Volume at Lead Pump (P-1) On = -1260.40 ft x (471.24 gal/VF) =	-593950.90	gal
Calculated Detention Time at ULTIMATE ADF= -593950.90 gal / 135.4 gal/min	-4386.1	min

Note: Wet Well will not turn septic if detention times are less than approximately 60 minutes. During low flow/no flow conditions (during the night for example), sewage may turn septic. Septic conditions may be problematic for homes located nearby the lift station. Odor control may therefore be required if detention times approach 60 minutes during interim conditions.

D Compute the Net Positive Suction Head (NPSH):

Net Positive Suction Head Available (NPSHA)

A. Absolute Pressure, Ha =	Enter. . . .	33.10	ft
B. Static Height of Liquid Supply Level in Wet Well, Hst =		-9.83	ft
C. Vapor Pressure of the Liquid, Hvpa =	Enter. . . .	0.75	ft
Submersible Pump Lift Station or Dry Pit Arrangement ?	Enter. . . . Sub or Dry	Sub	
D. Total Friction Headlosses in Riser Pipe (Dry Pit Pumps Only), Hfs =		0.00	ft
NPSHA = Ha - Hvpa + Hst - Hfs =		22.52	ft

Net Positive Suction Head Required (NPSHR)

A. NPSHR according to Pump Manufacturer = (Typically shown on pump curve)	Enter. . . .	13.50	ft

NPSHA > NPSHR, Pump OK

Note: Remember, NPSHA >= NPSHR

V DETERMINE THE MOTOR EFFICIENCY AND COST OF PUMPING

Equations for Pumping as a function of Cost per Hour of Pumping (CPH).
CPH = (0.000189)(gpm)(TSH)($/kW-Hr)/(WWE)
Fixed Speed WWE = (PE)(ME)
Variable Speed WWE = (PE)(ME)(DE)

A. Pump Efficiency, (PE) =	Enter. . . .	73%		73.57894737
B. Motor Efficiency, (ME) =	Enter. . . .	95%		
C. Variable Speed Drive Efficiency, (DE) =	Enter. . . .			
D. Wire to Water Efficiency, WWE = (PE)(ME) =		69%		
Overall (Wire to Water) Efficiency from Pump Curve = 70%				
E. Number of Pumps =		1		
F. Total number of hours each pump operates per Day Interim Condition =		10	hours	
F. Total number of hours each pump operates per Day Ultimate Condition =		10	hours	
G. Cost of Electricity =		$ 0.1200	$/Kw-Hr	

The values for H and I are read from Table e.4 above. If the same force main will be used for ultimate flow values for K and L also are read from Table e.4.

H. Riser Piping Head at Design Flow =	Enter. . . .	1.71	feet	From Table e.4 Col E
I. Total Force Main Head at Maximum Static Head at design flow =	Enter. . . .	157.18	feet	From Table e.4 Col G
J. Total System Head at Maximum Static Head at design flow =		158.89	feet	
K. Riser Piping Head at Ultimate Design Flow =	Enter. . . .	12.31	feet	From Table e.4 Col E
L. Total Force Main Head at Maximum Static Head at Ultimate Design Flow =	Enter. . . .	753.83	feet	From Table e.4 Col G
M. Total System Head at Maximum Static Head at Ultimate Design Flow =		766.14	feet	

Interim Design Point of One Pump Running = 542 gpm @ 158.9 ft Total Head, CPH =	$	0.36	/ hr / pump
Interim ADF Cost Per Year = $0.36 x 1 Pumps x 9.99855138461539 hours/day x 365 days/year =	$	1,298.04	/ Year
Ultimate Design Point of One Pump Running = 542 gpm @ 766.1 ft Total Head, CPH =	$	0.71	/ hr / pump
Ultimate ADF Cost Per Year = $1298.04 x 9.99855138461539 Pumps x 0.12 hours/day x 365 days/year	$	2,582.83	/ Year

VI Compute Buoyancy Forces:

Desired Factor of Safety against flotation =		1.10		ETJ COH requires 1.10
Wet Well Diameter, =		0	ft	
Wall Thickness, =	Enter. . . .	11	inches	
Wet Well Roof Thickness, =	Enter. . . .	18	inches	
Wet Well Bottom Thickness, =	Enter. . . .	24	inches	
Circular Wet Well Bottom Slab Configuration		YES		
Wet Well is to be installed by open cut (in lue of caisson method)		NO		
Outside diameter of Wet Well, =		1.833333333	ft	
Base Slab diameter =		1.83	ft	

Circular Base Slab Area =	2.64 sq ft
Rectangular Wet Well Bottom Slab Configuration	NO
Length of Proposed Wet Well Base Slab =	0.00 ft
Width of Proposed Wet Well Base Slab=	0.00 ft
Rectangular Base Slab Area =	0.00 sq ft
Vertical Height of Walls, =	1.37 ft
Vertical Height (Total) of Wet Well, =	4.87 ft

A Determine Uplift Forces due to Groundwater

Uplift Force due to Water =	0.80 kips

B Determine Downward Forces due to Weight of Structure

Top and Bottom Slab Material is Concrete with a Unit Weight of =	0.150 kips / cu ft
Wall Material is Concrete with a Unit Weight of =	0.150 kips / cu ft
Weight of Top Slab outside of outside diameter of the wet well (downward force) =	
Weight of Top Slab (downward force) =	0.59 kips
Weight of Bottom Slab (downward force) =	0.79 kips
Weight of Walls (downward force) =	0.54 kips
Total Weight of Lift Station Structure (downward force) =	1.93 kips

As Designed Factor of Safety Against Flotation =	2.40
Difference needed to overcome flotation including Desired Safety Factor =	-1.05 kips
Value of additional adhesion and/or soil friction needed =	-37.29 psf

Reality Check - OK - 2.40 > 1.10 minimum required

VII DETERMINE THE MINIMUM SIZE OF THE PASSIVE AIR VENT PIPE

Maximum pumping capacity of the lift station from the pump curves — Enter. . . . 1,000 gpm
It is the intersection of the all pumps running pump curve — 133.67 cfm
and the Emergency Flooded Operating Level C=140 curve
§217.60(d)(1)(C) maximum air velocity through a passive ventilation system — 600 fpm

Vent Pipe Dia. (inches)	Air Velocity (fpm)
4	1531.77
6	680.79
8	382.94
10	245.08
12	170.20
14	125.04
16	95.74
18	75.64
20	61.27
24	42.55
30	27.23
36	18.91

Chosen passive ventilation system goose neck pipe size — Enter. . . . 6 in
680.79 fpm

Velocity below TCEQ maximum - Warning! 680.79 fpm > 600.00 fpm maximum allowed

DETERMINE THE CRITICAL TIME RELATED TO SURGE PRESSURE - WATER HAMMER CALCULATIONS

Surge pressure or "Water Hammer" in a force main is created by any change from a steady state flow condition. It is typically caused by the opening, closing or regulating of valves or by the starting and/or stopping of pumps. It may range from only a slight pressure and/or velocity changes to sufficiently high vacuum or pressure conditions which may cause the collapse of rupture of the pipeline, or cause damage to pumps and/or valves. This analysis of water hammer will include calculating the surge (pressure) wave velocity, flow velocity, critical time, determining the maximum

pressure increase and selecting a method of control.

Calculate surge pressures and compare to the pressure rating of the force main pipe to determine the need for a surge relief valve.

A Calculate pressure wave velocity factor.

a = 4660 / SQRT { (Ew * Di)/ (Ep * Tp) }

Where:

a =	pressure wave velocity factor
E_W =	water bulk modulus (300,000 psi)
D_i =	force main pipe inner diameter (inches)
T_P =	force main pipe wall thickness (inches)
E_P =	force main material modulus of elasticity

Young's Modulus of Elasticity for the pipeline material, E_P =

Ductile Iron	24,000,000
Steel	30,000,000
PVC	400,000
HDPE	130,000

E_W =	300,000 psi		
D_i =	6 inches	Based on AWWA C900 PVC Pipe	
T_P =	0.295 inches	Based on AWWA C900 PVC Pipe	
E_P =	400,000 psi	Based on AWWA C900 PVC Pipe	

a = 4660 / SQRT { (Ew * Di)/ (Ep * Tp) }
1193.137973 unitless

B Calculate the Firm flow velocity in the forcemain

Vel = Q / A
Where:
Q = Flow Quantity in cfs
540.000 gpm
1.203 cfs
A = Flow Area in sq. ft.
0.217 sq. ft.

Vel = Q / A
5.540204228 fps
5.540 fps

C Calculate the Water Hammer Pressure

P = [(a * V) / (2.31 * g)] + Operating Pressure

P = water hammer pressure (psi)
a = pressure wave velocity factor
V = flow velocity in force main at firm pumping capacity (ft/s)
g = acceleration of gravity (32.2 ft/sec^2)
2.31 = conversion factor
OP = Operating Pressure

a =	1,344.88 psi	
V =	5.540 fps	
g =	32.2 ft/sec^2	
OP =	28 ft	Read from curve w/ all pumps running
	11.7 psi	

P = [(a * V) / (2.31 * g)]
P = 100.1673406 psi

Reality Check based on EM 1110-3-173 (9 April 84)

Table of Typical Values of the Pressure Wave Speed from EM 1110-3-173 (9 April 84)				
				Δ Surge Pressure per 1 fps Δ vel
	a, fps			
Pipe Material	Low	High	Average	psi
Asbestos-Cement	2700	3400	3050	
Ductile Iron	3100	4200	3650	50
Steel	2700	3900	3300	45
Concrete	3300	3800	3550	
Plastic	1100	1500	1300	20
Fiberglass	1200	1600	1400	

Velocity change from firm pump flow to zero
Firm flow velocity in the forcemain = 5.540 fps

Δ Surge Pressure = Δ Surge Pressure per 1 fps Δ firm flow velocity times value from table above
20 psi/fps times 5.540 fps
110.8 psi

Calculated the Water Hammer Pressure = 100.17 psi
Reality check water hammer pressure = 110.8 psi

D Compare the water hammer pressure to the pipe's pressure rating

water hammer pressure (psi) < Pipe's pressure rating
P < PPR

Water Hammer Pressure = 110.80 psi
Pipe's pressure rating = 150 psi

110.80 psi < 150 psi
OK

E Calculate the Safety Factor
Pipe Pressure Rating / Water Hammer Pressure

SF = 150 psi divided by 110.80 psi
SF = 1.4 Unitless

IX DETERMINE DETENTION TIMES

A Calculate INTERIM detention times (td) for Average Dry Weather Flow, Maximum Wet Weather Flow and Maximum Dry Weather Flow

Td = Tf + Te
Tf = Vr / i
Te = Vr / (Q - i)

Where:
Time to fill wet well in minutes, Tf =
Time to Empthy wet well in minutes, Te =
Wet well volune from All pumps off to lead pump on, Vr =
Flow into the station for given condition, j =
INTERIM Average Pump capacity in gpm, Q = 540 gpm Replace with Actual from System Curve

B Maximum Detention Time based on INTERIM Minimum Dry Weather Daily Flow

INTERIM Minimum Dry Weather Daily Flow, i =	57 gpm
Cycle Time =	10 minutes
All pumps off elevation	2.0 msl el
lead pump on elevation	1,274.0 msl el
Delta lead pump on - all pumps off	1,272.0 ft

Wet Well Surface Area	63.0	sq ft
Wet well volune from All pumps off to lead pump on, Vr =	80,135.4	cu ft
	599,492.7	gallons
Tf = Vr / i	10,477.8	minutes
Te = Vr / (Q - i)	1,241.7	minutes
Td = Tf + Te	11,719.6	minutes

C Average Detention Time based on INTERIM Average Dry Weather Daily Flow

INTERIM Average dry weather daily flow, i =	68	gpm
Cycle Time =	10	minutes
All pumps off elevation	2.0	msl el
lead pump on elevation	1,274.0	msl el
Delta lead pump on - all pumps off	1,272.0	ft
Wet Well Surface Area	63.0	sq ft
Wet well volune from All pumps off to lead pump on, Vr =	80,135.4	cu ft
	599,492.7	gallons
Tf = Vr / i	8,808.9	minutes
Te = Vr / (Q - i)	1,270.3	minutes
Td = Tf + Te	10,079.1	minutes

D Detention Time based on INTERIM Peak Dry Weater Daily Flow

INTERIM Maximum Dry Weather Daily Flow, i =	170	gpm
Cycle Time =	10	minutes
All pumps off elevation	2.0	msl el
lead pump on elevation	1,274.0	msl el
Delta lead pump on - all pumps off	1,272.0	ft
Wet Well Surface Area	63.0	sq ft
Wet well volune from All pumps off to lead pump on, Vr =	80,135.4	cu ft
	599,492.7	gallons
Tf = Vr / i	3,523.5	minutes
Te = Vr / (Q - i)	1,620.9	minutes
Td = Tf + Te	5,144.4	minutes

E INTERIM Total Cycle Time

The pump is ON for one pumping cycle of Te and OFF for one storage cycle of Tf plus, because pumps alternate, OFF for one pumping cycle of Te and one storage cycle of Tf (for the alternating pump).

Pump OFF for (2 * Tf) + Te = 18,888.0 minutes

F ULTIMATE Average Pump capacity in gpm, Q = 540 gpm Replace with Actual from System Curves

G Maximum Detention Time based on ULTIMATE Minimum Dry Weather Daily Flow

ULTIMATE Minimum Dry Weather Daily Flow, I =	130	gpm
Cycle Time =	10	minutes
All pumps off elevation	2.0	msl el
lead pump on elevation	1,274.0	msl el
Delta lead pump on - all pumps off	1,272.0	ft
Wet Well Surface Area	63.0	sq ft
Wet well volune from All pumps off to lead pump on, Vr =	80,135.4	cu ft
	599,492.7	gallons
Tf = Vr / i	4,595.1	minutes
Te = Vr / (Q - i)	1,463.8	minutes
Td = Tf + Te	6,059.0	minutes

H Average Detention Time based on ULTIMATE Average Dry Weather Daily Flow

ULTIMATE Average dry weather daily flow, I =	135	gpm
Cycle Time =	10	minutes
All pumps off elevation	2.0	msl el
lead pump on elevation	1,274.0	msl el
Delta lead pump on - all pumps off	1,272.0	ft

Wet Well Surface Area	63.0	sq ft
Wet well volune from All pumps off to lead pump on, Vr =	80,135.4	cu ft
	599,492.7	gallons
Tf = Vr / i	4,427.0	minutes
Te = Vr / (Q - i)	1,481.8	minutes
Td = Tf + Te	5,908.8	minutes

I Detention Time based on ULTIMATE Peak Dry Weater Daily Flow

ULTIMATE Maximum Dry Weather Daily Flow, i =	300	gpm
Cycle Time =	10	minutes
All pumps off elevation	2.0	msl el
lead pump on elevation	1,274.0	msl el
Delta lead pump on - all pumps off	1,272.0	ft
Wet Well Surface Area	63.0	sq ft
Wet well volune from All pumps off to lead pump on, Vr =	80,135.4	cu ft
	599,492.7	gallons
Tf = Vr / i	1,998.3	minutes
Te = Vr / (Q - i)	2,497.9	minutes
Td = Tf + Te	4,496.2	minutes

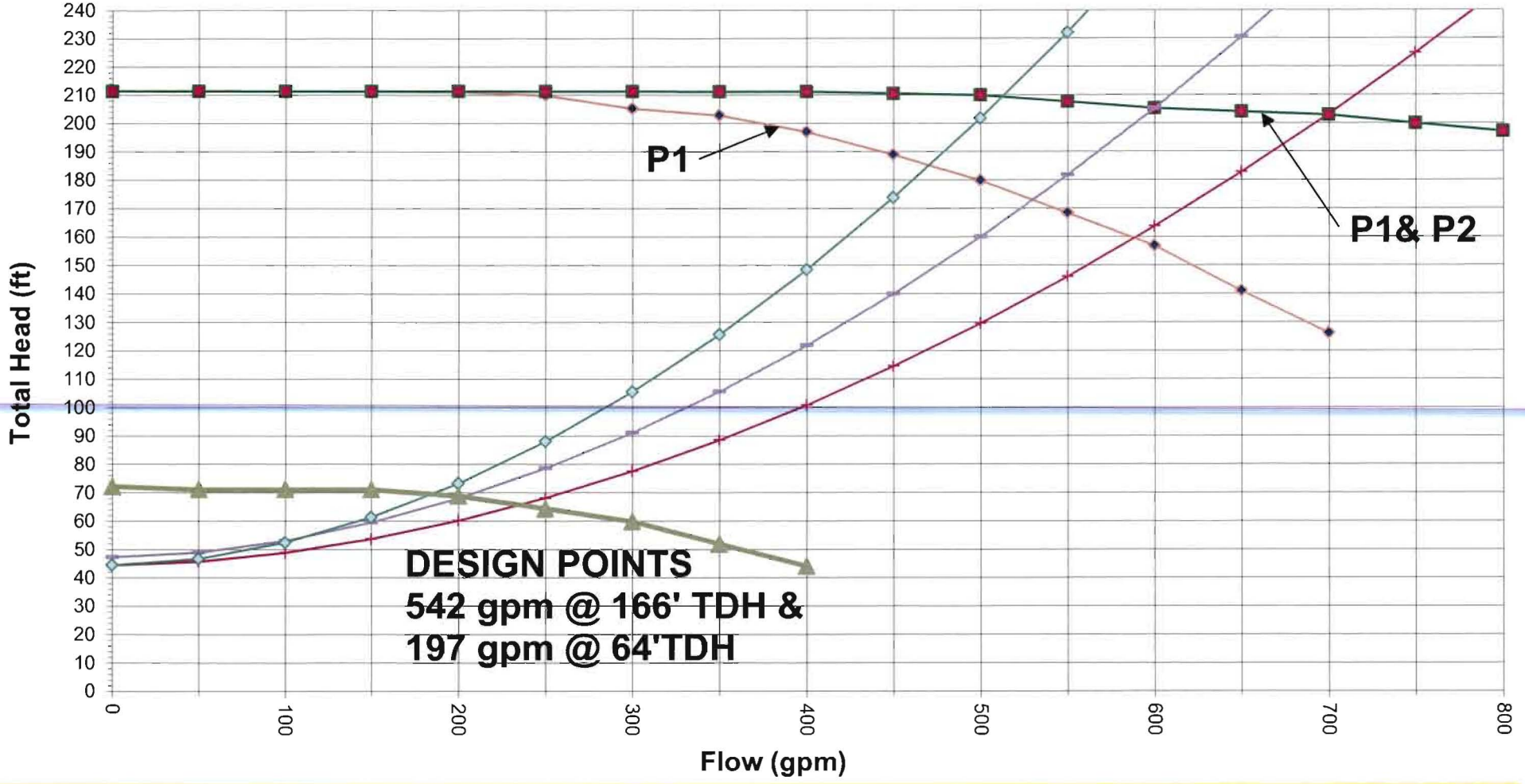
J ULTIMATE Total Cycle Time

The pump is ON for one pumping cycle of Te and OFF for one storage cycle of Tf plus, because pumps alternate, OFF for one pumping cycle of Te and one storage cycle of Tf (for the alternating pump).

Pump OFF for (2 * Tf) + Te = 10,335.8 minutes

C.2.1

Park Village WWTP On-Site Effluent Lift Station
Comal County WCID No. 6



APPENDIX D
HYDRAULIC PROFILE

Hydraulic Calculations

I. **FLOW**

Qavg =	68 GPM	98,000 GPD	0.152 CFS
Qpk =	272 GPM	392,000 GPD	0.607 CFS

II. **DISINFECTION CHAMBER** 90 ° "V" Notch

H_{avg} = 0.324 ft

H_{pk} = 0.567 ft

Depth of "V" notch weir = 12 inches

Static Elevation in Disinfection Chamber = 9.50 ft

W.S. Elevation @ Qavg = 9.82 ft
W.S. Elevation @ Qpk = 10.07 ft

III. **CLARIFIER**

Weir Diameter = 20 ft

Weir Length = 63 ft

Use two (2) 90° "V" notches per foot of weir = 126 notches

1 Elevation @ Qavg

Flow per Notch = 0.00121 CFS

H_{avg} = 0.046 ft

2 Elevation @ Qpk

Flow per Notch = 0.00483 CFS

H_{pk} = 0.081 ft

3 Minimum Depth of Wide Launder @ Qpk

Launder splits flow = Qpk ÷ 2 = 136 GPM

Launder Width = 12 inches

Depth = $0.65(GPM \div width)^{2/3}$ = 3.28 inches

Hydraulic Calculations Continued

IV. AERATION ZONE

Combined Flow Mix Liquor Transfer to Centerwell at Qpk

Return Activated Sludge RAS =	106 GPM
SCUM =	40 GPM
Qpk + RAS + SCUM =	418 GPM

Select pipe size to provide less than 2.5 ft/sec velocity 10 "

NOTE: With 10", Vel. = 1.708 ft/sec, transfer pipe losses = 0.094 ft

Δ Total = 0.094 ft

V. SUMMARY OF ELEVATIONS (in feet)

UNIT	ELEV.
100 Year Flood	XX
Structure Dimensions	
Foundation of Disinfection	1.25
Top of Disinfection	13.42
Foundation of Clarifier	0.00
Top of Clarifier Wall	1.25
Foundation of Aeration	1.25
Top of Aeration Wall	13.42
Foundation of Digester	1.25
Top of Digester Wall	13.42

Water Elevations in Tanks	STATIC	AVG	MAX
Chlorine Contact	9.50	9.82	10.07
Clarifier	11.75	11.79	11.83
Aeration	11.75	11.81	11.92
Digester	Varies from 8.92 to 11.92		

Notes

Elevation in 10" Clarifier Effluent Pipe @ Qpk	10.17
Bottom of Troughs Elevation	11.08
Clarifier Sidewater Depth @ Qpk	10.37

The sump is 3' in diameter, 8" tall, and in the clarifier.

APPENDIX E
PEDERNALES ELECTRIC COOPERATIVE
RELIABILITY LETTER

Pedernales Electric Cooperative, Inc.

P.O. Box 2226 Canyon Lake, Texas 78133-0009
(830) 964-3346 • 1-888-554-4732
www.pec.coop
Se habla español.

July 16, 2015

Mr. Gerry Romero, E.I.T.
IDS Engineering Group
613 NW Loop 410, Suite 550
San Antonio TX 78216

Re: Reliability Letter for a Lift Station in Bulverde

Mr. Romero:

The following is a report on substation breaker operations for the Bergheim Substation feeder BG-20 during the past 24 months. The substation device interruptions are reflected from July 1, 2013 through July 9, 2015. Line device operations, if any, are not reflected in this report.

Breaker	Date and Time Open	Date and Time Closed	Duration
BG20	1/14/2014 8:28:45	1/14/2014 8:39:24	0:10:39
BG20	6/23/2014 13:06:47	6/23/2014 13:06:49	0:00:02
BG20	6/23/2014 13:08:50	6/23/2014 13:08:53	0:00:03
BG20	7/30/2014 17:33:27	7/30/2014 17:33:45	0:00:18
BG20	1/2/2015 22:57:56	1/2/2015 10:57:58	0:00:02
BG20	5/17/2015 7:15:51	5/17/2015 7:15:53	0:00:02
BG20	5/25/2015 13:24:22	5/25/2015 13:27:24	0:03:02

Total Outage Duration the past 24 months: 00:14:08

Substation breaker BG20 currently serves the area east of Blanco Road and south of State Highway 46 to Boerne. This area includes the proposed Park Village Subdivision in Bulverde. If you have any questions, please feel free to contact me at 1-800-868-4791, Extension 7620.

Sincerely,

David S. Nelson
District Planning Supervisor
Pedernales Electric Cooperative, Inc.
Canyon Lake District

APPENDIX F
PHASE 1 SYSTEM STORAGE VOLUME CALCULATIONS

Sanitary Lift Station Design and Cost Analysis

IDS Engineering Group
TBPE F-002726 TBPLS 10110707

CLIENT: COMAL COUNTY WCID NO. 6 / 277, Ltd.
DISTRICT: COMAL COUNTY WCID NO. 6
PROJECT: Park Village WWTP On-Site Influent Lift Station Phase 1
JOB NO: 1500-001-11

Prepared By: *David J Ross* INITIAL HERE
Checked By: INITIAL HERE

I INFLUENT LIFT STATION REQUIRED STORAGE CALCULATIONS

98,000	gpd	Average daily flow
4,083.33	gph	Average daily flow
6.00	hr	GBRA outage time requirement
24,500.00	gal	Required GBRA 6-hour outage storage
3,275	cu ft	Required GBRA 6-hour outage storage volume

II INFLUENT LIFT STATION WET WELL STORAGE VOLUME AVAILABLE CALCULATIONS

12.00	ft	Dia of wet well
113.097336	sq ft	Area of wet well
1,272.50	msel	Top of Top Slab
1.00	ft	Top Slab thickness
1271.5	msel	Underside of top slab
1,245.60	msel	Lead pump on
25.9	ft	Dist between lead pump on and bottom of top slap
113.10	sq ft	Area of wet well
2,929.22	**cu ft**	**wet well storage available**
353.00	cu ft	Storage available in collection piping and manholes

Volume available = Wet Well Storage + Collection System Storage
= 2,929.22 cu ft plus 353.00
Volume available = 3,282.22 cu ft

III INFLUENT LIFT STATION WET WELL REQUIRED VOLUME CHECK CALCULATIONS

3,275.18	cu ft	Required GBRA 6-hour outage storage volume
3,282.22	cu ft	Volume available

Volume Available > Volume Required

3,282.22 cu ft ≥ 3,275.18 cu ft

APPENDIX G
GEOSOURCE 1000 FEET WATER WELL REPORT

GeoSearch

On time. On target. In touch.™

1000 Feet Water Well Report

http://www.geo-search.net/QuickMap/index.htm?DataID=Standard0000005742

Click on link above to access the map and satellite view of current property

Target Property:

Park Village Tract

SAN ANTONIO, Comal County, Texas 78163

Prepared For:

Pate Engineers, Inc.

Order #: 2517

Job #: 5742

Date: 04/17/2009

2705 Bee Caves Rd, Suite 330 · Austin, Texas 78746 · phone: 888-396-0042 · fax: 512-472-9967 · www.geo-search.net

TARGET PROPERTY SUMMARY

Park Village Tract
SAN ANTONIO, Comal County, Texas 78163

Centroid County: ***Comal***
Centroid Zipcode: ***78163***
Centroid State: ***TX***

USGS Quadrangle: ***Bergheim, TX***
Target Property Geometry: ***Area***

Target Property Longitude(s)/Latitude(s):
(-98.513075, 29.806228), (-98.513075, 29.806228), (-98.515299, 29.794985), (-98.524936, 29.794892), (-98.524813, 29.804066), (-98.518326, 29.804004), (-98.517955, 29.806537), (-98.515423, 29.806414), (-98.513106, 29.806228), (-98.513075, 29.806228)

County/Counties Covered:
Comal (TX)

Zipcode(s) Covered:
Bulverde TX: 78163
Spring Branch TX: 78070 —— ?

State(s) Covered:
TX

****Target property is located in Radon Zone 3 (Comal County, TX). Zone 3 counties have a predicted average indoor radon screening level less than 2 pCi/L.***

Disclaimer - The information provided in this report was obtained from a variety of public sources. GeoSearch cannot ensure and makes no warranty or representation as to the accuracy, reliability, quality, errors occurring from data conversion or the customer's interpretation of this report. This report was made by GeoSearch for exclusive use by its clients only. Therefore, this report may not contain sufficient information for other purposes or parties. GeoSearch and its partners, employees, officers And independent contractors cannot be held liable For actual, incidental, consequential, special or exemplary damages suffered by a customer resulting directly or indirectly from any information provided by GeoSearch.

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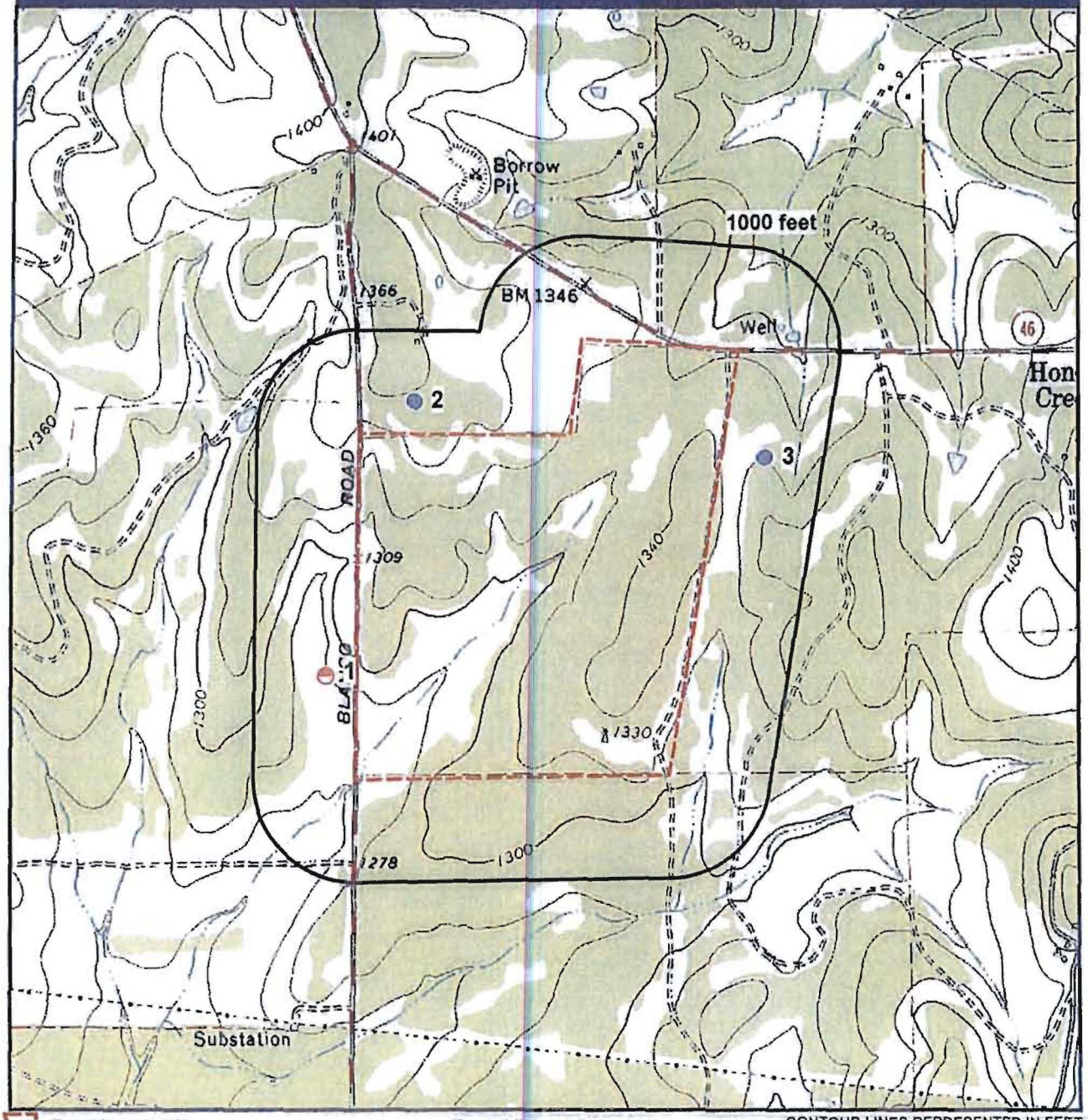
DATABASE FINDINGS SUMMARY (SOURCE)

DATABASE	ACRONYM	LOCA-TABLE	UNLOCA-TABLE	SEARCH RADIUS (miles)
FEDERAL				
UNITED STATES GEOLOGICAL SURVEY NATIONAL WATER INFORMATION SYSTEM	NWIS	0	0	0.1890
SUB-TOTAL		**0**	**0**	
STATE (TX)				
SUBMITTED DRILLERS REPORT DATABASE	SDRD	1	0	0.1890
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY WATER WELLS	TCEQ	2	0	0.1890
TEXAS WATER DEVELOPMENT BOARD GROUNDWATER DATABASE	TWDB	0	0	0.1890
WATER UTILITY DATABASE	WUD	0	0	0.1890
SUB-TOTAL		**3**	**0**	
TOTAL		**3**	**0**	

DATABASE FINDINGS SUMMARY (DETAIL)

ACRONYM	Target Property	SEARCH RADIUS (miles)	1/8 Mile (> TP)	1/4 Mile (> 1/8)	1/2 Mile (> 1/4)	1 Mile (> 1/2)	> 1 Mile	Total
FEDERAL								
NWIS		.1890	0	0	0	0	0	0
SUB-TOTAL			0	0	0	0	0	0
STATE (TX)								
SDRD		.1890	1	0	0	0	0	1
TCEQ		.1890	2	0	0	0	0	2
TWDB		.1890	0	0	0	0	0	0
WUD		.1890	0	0	0	0	0	0
SUB-TOTAL			3	0	0	0	0	3
TOTAL			3	0	0	0	0	3

WATER WELL MAP



Target Property (TP)
SDRD
TCEQ

Park Village Tract
SAN ANTONIO, Texas
78163

CONTOUR LINES REPRESENTED IN FEET

N
W E
S

0' 750' 1500' 2250'
SCALE: 1" = 1500'

GeoSearch 2705 Bee Caves Rd, Suite 330 - Austin, Texas 78746 - phone: 866-396-0042 - fax: 512-472-9967

JOB #: 5742 - 4/17/2009

REPORT SUMMARY OF LOCATABLE SITES

MAP ID#	DATABASE NAME	SITE ID#	DISTANCE FROM SITE	SITE NAME	ADDRESS	CITY, ZIP CODE	PAGE #
1	SDRD	TX33487	0.060 SW	BRAD NIEMEYER	33807 BLANCO ROAD	BULVERDE, 78163	1
2	TCEQ	TX216006	0.070 W	WALTER SCHWARZ			2
3	TCEQ	TX216007	0.090 S	WAYNE STEWART - JEANETTE BLOUNT			5

SUBMITTED DRILLERS REPORT DATABASE (SDRD)

MAP ID# 1 **Distance from Property: 0.06 mi. SW**

TRACK #: **33487**
DATE ENTERED: **03/03/2004**
OWNER NAME: **BRAD NIEMEYER**
OWNER ADDRESS: **33807 BLANCO ROAD**
BULVERDE, TX 78163
COUNTY: **COMAL**
LATITUDE: **29.7978** LONGITUDE: **-98.5258**

WELL LOG:
DRILLING DATE (STARTED): ***06/20/2003***
DRILLING DATE (COMPLETED): **06/20/2003**
DEPTH DRILLED: **385'**

WATER LEVEL:
STATIC LEVEL: **200'**
WATER LEVEL DATE: **NOT REPORTED**
TYPE OF WATER: **NOT REPORTED**

TYPE OF WORK:
NEW WELL: **X** REPLACEMENT WELL:
DEEPENING: RECONDITIONING:

PROPOSED USE:

MONITOR WELL:	DOMESTIC: **X**	ENVIRONMENTAL SOIL BORING:
TEST WELL:	INDUSTRIAL:	GEOTHERMAL HEAT LOOP:
IRRIGATION:	INJECTION:	PUBLIC SUPPLY:
DE-WATERING:	STOCK:	RIG SUPPLY:

COMPANY INFORMATION:
COMPANY NAME: **H.W. SCHWOPE & SONS, INC.**
COMPANY ADDRESS: **P. O. BOX 364**
BOERNE, TX 78006

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY WATER WELLS (TCEQ)

MAP ID# 2 **Distance from Property: 0.07 mi. W**

ID NUMBER:	*TX216006*
STATE ID :	68-12-6
OWNER NAME:	WALTER SCHWARZ
DATE DRILLED:	10/06/1995
DEPTH DRILLED:	480'
STATIC LEVEL:	250'
WATER USAGE:	DOMESTIC
LONGITUDE:	-98.523096000
LATITUDE:	*29.804951000*

2 PAGE(S) OF DRILLERS' LOGS

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY WATER WELLS (TCEQ)

Water Well ID: 216006

Send original copy by certified mail to: TNRCC, P.O. Box 7, Austin, TX 78711-3087 — Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas WELL REPORT

Texas Water Well Drillers Advisory Council, P.O. Box 13087, Austin, TX 78711-3087, 512-239-0530

1) OWNER: Walter Schwarz (Name) — ADDRESS: 8410 Dudley, San Antonio, Texas 78230 (Street or RFD) (City) (State) (Zip)

2) ADDRESS OF WELL: County: Comal — Blanco Rd., @ 46/ 1/4mile below Honey Creek Store (Street, RFD or other) (City) (State) (Zip) — GRID # 68126

3) TYPE OF WORK (Check): [X] New Well [ ] Deepening [ ] Reconditioning [ ] Plugging

4) PROPOSED USE (Check): [ ] Monitor [ ] Environmental Soil Boring [X] Domestic [ ] Industrial [ ] Irrigation [ ] Injection [ ] Public Supply [ ] De-watering [ ] Testwell
If Public Supply well, were plans submitted to the TNRCC? [ ] Yes [ ] No

5)

6) WELL LOG: Date Drilling: Started 10-2 19 95; Completed 10-6 19 95

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
7 7/8	Surface	460

7) DRILLING METHOD (Check): [ ] Driven [X] Air Rotary [ ] Mud Rotary [ ] Bored [ ] Air Hammer [ ] Cable Tool [ ] Jetted [ ] Other

From (ft.)	To (ft.)	Description and color of formation material
0	32	yellow caliche & tan lime layers
32	40	gray shaley limestone
40	43	tan limestone
43	49	yellow limestone
49	53	dark blue shaley limestone
53	82	medium gray chalky lime & shale layers
82	88	chalky yellow & tan limestone
88	92	hard tan & dark yellow limestone
92	102	hard white & tan lime/with calcite & oyster shell fossils
102	165	cream white limestone
165	175	very porous (lost circulation)
175	210	drilled blind
210	228	light gray limestone

(Use reverse side if necessary)

8) Borehole Completion (Check): [X] Open Hole [ ] Straight Wall [ ] Underreamed [ ] Gravel Packed [ ] Other
If Gravel Packed give interval ... from ____ ft. to ____ ft.

CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casting Screen
5 1/2"		SDR 17 pvc casing total 320'	0	318	

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 0 ft. to 318 ft. No. of sacks used 3yards total
____ ft. to ____ ft. No. of sacks used ____
Method used 8-sk grout
Cemented by H. W. Schwope & Sons, Inc.
Distance to septic system field lines or other concentrated contamination ____ ft.
Method of verification of above distance ____

RECEIVED APR 30 1996 (OVER)

13) TYPE PUMP: [ ] Turbine [ ] Jet [X] Submersible [ ] Cylinder [X] Other 1 1/2hp Red Jacket submersible pump set @ 421' (400' 1 1/4" #80pvc; 21' galv.)
Depth to pump bowls, cylinder, jet, etc. ____ ft.

10) SURFACE COMPLETION
[X] Specified Surface Slab Installed [Rule 338.44(2)(A)]
[ ] Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
[ ] Pitless Adaptor Used [Rule 338.44(3)(b)]
[ ] Approved Alternative Procedure Used [Rule 338.71]

14) WELL TESTS: Type test: [X] Pump [ ] Bailer [ ] Jetted [ ] Estimated
Yield: 10-12 gpm with ____ ft. drawdown after ____ hrs. after 45 minutes

11) WATER LEVEL: Static level 250 ft. below land surface Date ____
Artesian flow ____ gpm. Date ____

15) WATER QUALITY: Did you knowingly penetrate any strata which contained undesirable constituents?
[ ] Yes [X] No — If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? ____ Depth of strata ____
Was a chemical analysis made? [ ] Yes [X] No

12) PACKERS: Type Depth

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME: H. W. Schwope & Sons, INc. (Type or print) — WELL DRILLER'S LICENSE NO. 1566

ADDRESS: PO Box 364 (Street or RFD) Boerne (City) Texas (State) 78006 (Zip)

(Signed) John L. Schwope (Licensed Well Driller) — (Signed) ____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

TNRCC-0199 (Rev. 11-01-94) — TNRCC COPY

GeoSearch 2705 Bee Caves Rd, Suite 330 · Austin, Texas 78746 · phone: 888-396-0042 · fax: 512-472-9967

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING PRIVILEGE OF CONFIDENTIALITY

The Water Well Drillers Advisory Council and the Texas Natural Resource Conservation Commission are concerned that some persons having wells drilled may not be aware of the confidentiality privilege provisions of Section 32.005 of the Texas Water Code, the Reporting of Well Logs, reads as follows:

> "Every licensed driller drilling, deepening or otherwise altering a water well within this State shall make and keep a legible and accurate well log in accordance with the department rule on forms prescribed by the department. Not later than the 60th day after the completion or cessation of drilling, deepening, or otherwise altering the well, the licensed driller shall deliver or transmit by certified mail a copy of the well log to the department and to the owner of the well or the person for whom the well was drilled. Each copy of a well log, other than a department copy must include the name, mailing address, and telephone number of the department. The well log shall be recorded at the time of drilling, and must show the depth, thickness, and character of the strata penetrated, the location of water-bearing strata, the depth, size and character of casing installed, and any other information required by department rule. The department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner or person for whom the well was drilled."

The last sentence specifies the means whereby you can, if you wish, assure that logs of your wells will be kept confidential.

From (ft.)	To (ft.)	Description and color of formation material
228	252	tan cream limestone
252	278	medium gray limestone
278	291	blue gray shaley limestone
291	294	dark yellow gray limestone
294	305	dark hard porous yellow limestone
305	338	tan cream colored limestone
338	346	light gray limestone
346	371	dark blue gray limestone
371	388	dark blue gray shaley limestone
388	396	dark gray hard limestone
396	417	light tan lime/w oyster shell
417	436	light gray sandy lime/with oyster shell
436	460	medium gray sandy lime

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY WATER WELLS (TCEQ)

MAP ID# 3 **Distance from Property: 0.09 mi. S**

ID NUMBER:	**TX216007**
STATE ID :	**68-12-6**
OWNER NAME:	**WAYNE STEWART - JEANETTE BLOUNT**
DATE DRILLED:	**08/15/1989**
DEPTH DRILLED:	**400'**
STATIC LEVEL:	**355'**
WATER USAGE:	**DOMESTIC**
LONGITUDE:	**-98.512249000**
LATITUDE:	**29.803415000**

3 PAGE(S) OF DRILLERS' LOGS

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY WATER WELLS (TCEQ)

Water Well ID: 216007

Please use black ink. Send original copy by certified mail to the Texas Water Commission P.O. Box 13087 Austin, Texas 78711

State of Texas
WATER WELL REPORT
ATTENTION OWNER: Confidentiality Privilege Notice on Reverse Side

Texas Water Well Drillers Board P. O. Box 13087 Austin, Texas 78711

1) OWNER Wayne Stewart Jeanette Blount (Name) Address PO Box 790743, San Antonio, TExas 78279 (Street or RFD) (City) (State) (Zip)

2) LOCATION OF WELL County. Comal 14 miles in E (N.E., S.W., etc.) direction from Boerne (Town)

Driller must complete the legal description to the right with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ Legal description:
Section No. _____ Block No. _____ Township _____
Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____
☐ See attached map. # 2.

3) TYPE OF WORK (Check): ☒ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☒ Domestic ☐ Industrial ☐ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ Other _____

5) DRILLING METHOD (Check): ☐ Driven ☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored ☒ Air Rotary ☐ Cable Tool ☐ Other _____

6) WELL LOG:
Date Drilling: Started 8-15 19 89 Completed 8-15 19 89

Dia. (in.)	From (ft.)	To (ft.)
8 3/4	Surface	160
9"	160	400

From (ft.)	To (ft.)	Description and color of formation material
		0-1 topsoil to caliche
		1-8 white chalky caliche
		8-15 blue gray shaley lime
		15-21 yellow lime
		21-34 blue gray shale
		34-41 gray lime
		41-43 soft blue shale
		43-97 cream colored lime
		97-122 blue gray shaley lime
		122-160 gray lime
		160 changed bit from 8 3/4" to 9"
		160-171 gray lime
		171-182 cream colored lime
		182-186 blue gray lime
		186-206 cream colored lime
		206-216 gray lime
		216-228 cream colored lime
		228-233 gray lime
		233-239 cream colored lime
		239-243 tan gray lime
		243-245 yellow honeycomb lime (lost return)
		245-246 yellow hard lime
		246-247 porous yellow lime with orange clay
		UNDERREAMED 6" to 8" 160-262 feet
		247-262 medium soft lime

(Use reverse side if necessary) (OVER)

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7) BOREHOLE COMPLETION:
☒ Open Hole ☐ Straight Wall ☒ Underreamed
☐ Gravel Packed ☒ Other 6" to 8" 160' to
If Gravel Packed give interval from _____ ft. to 262 ft.

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfr., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
6 5/8"		steel casing 156 wall 264.09	0	262	

9) CEMENTING DATA (Rule 318.44(b))
Cemented from 0 ft. to 262 ft. No. of Sacks Used _____
_____ ft. to _____ ft. No. of Sacks Used _____
Method used grout
Cemented by H. W. Schwope & Sons, Inc.

10) SURFACE COMPLETION
☐ Surfaced Surface Slab Installed (Rule 318.44(c))
☐ Pitless Adapter Used (Rule 318.44(d))
☐ Approved Alternative Procedure Used (Rule 318.71)

11) WATER LEVEL:
Static level 355 ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: Type _____ Depth _____

13) TYPE PUMP:
☐ Turbine ☐ Jet ☒ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.
1 1/2hp Grundfos submersible pump

14) WELL TESTS: set @ 357' 1 1/4"
Type Test: ☐ Pump ☐ Bailer ☒ Jetted ☐ Estimated
Yield: 10 gpm with 400 ft. drawdown after _____ hrs.

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 12 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME H. W. Schwope & Sons, Inc (Type or Print) Water Well Driller's License No. 1566

ADDRESS PO Box 364 (Street or RFD) Boerne (City) Texas (State) 78006 (Zip)

(Signed) _____ (Licensed Water Well Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only Well No. 68-12-6 Located on map _____

WWD-012 (Rev.01-28-87) TEXAS WATER COMMISSION COPY

GeoSearch 2705 Bee Caves Rd, Suite 330 · Austin, Texas 78746 · phone: 888-396-0042 · fax: 512-472-9967

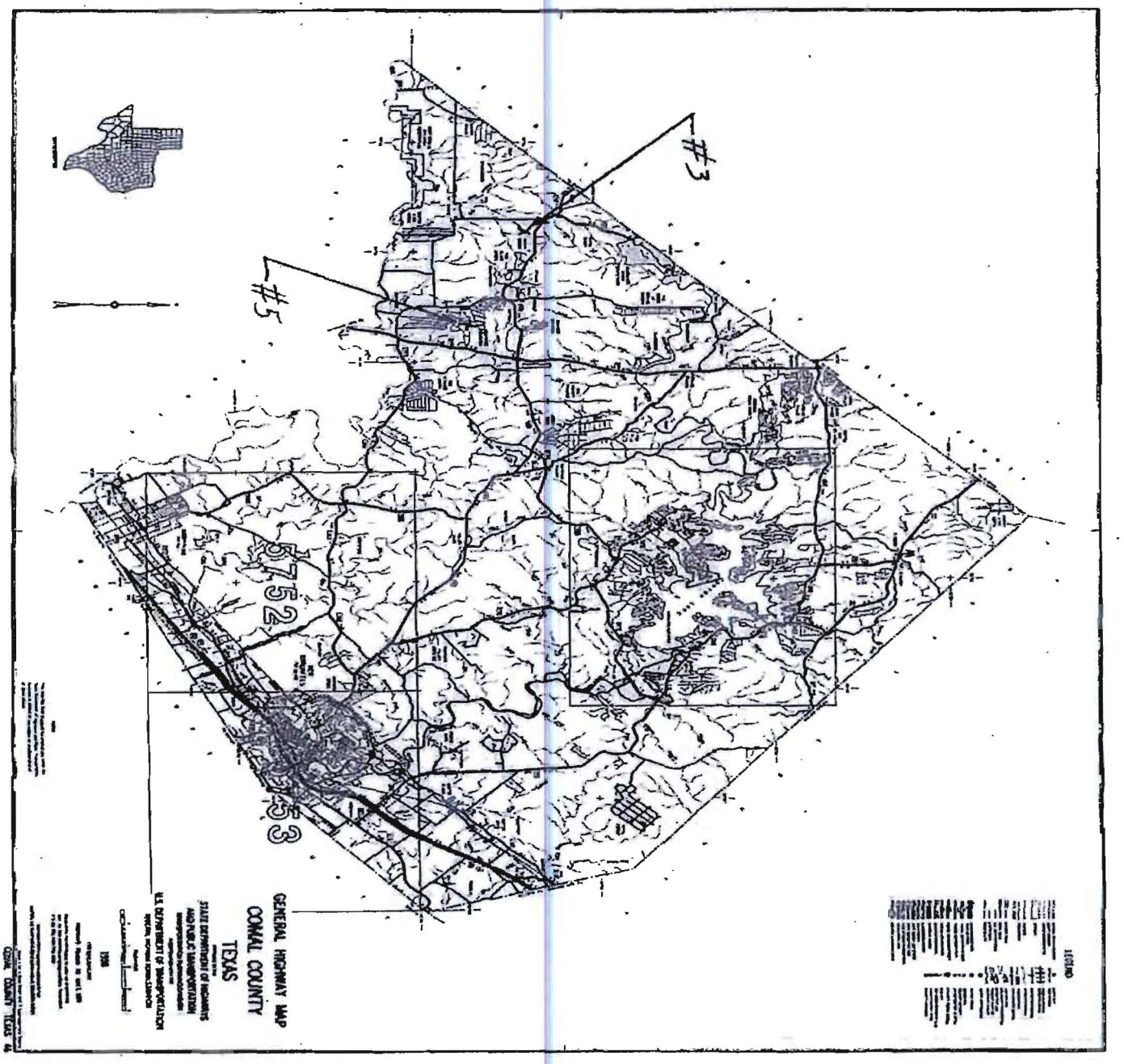
IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING PRIVILEGE OF CONFIDENTIALITY

The Water Well Drillers Board and the Texas Water Commission are concerned that some persons having water wells drilled may not be aware of the confidentiality privilege provision of Section 5 of the Water Well Drillers Act. Section 5, the Reporting of Well Logs, reads as follows:

> "Every licensed water well driller drilling, deepening or otherwise altering a water well within this State shall make and keep; or cause to be made and kept, a legible and accurate well log, and within 30 days from the completion or cessation of drilling, deepening or otherwise altering such a water well, shall deliver or transmit by certified mail a copy of such well log to the Commission, and the owner thereof or the person having had such well drilled. Each copy of a well log, other than a Commission copy, shall include the name, mailing address, and telephone number of the Board and the Commission. The well log required herein shall at the request in writing to the Commission, by certified mail, by the owner or the person having such well drilled be held as confidential matter and not made of public record."

The last sentence specifies the means whereby you can, if you wish, assure that logs of your wells will be kept confidential.

262-290 cream colored lime(about 6 gpm)
290-297 gray lime
297-328 dark blue sandstone (Hensell)
328-332 softer blue green sandstone
332-337 blue green sandstone & shell
337-345 greenish gray sandstone
345-365 white lime porous (Cow Creek) water
365-385 light tan gray lime
385-395 blue gray lime
395-400 greenish gray lime


#3
#5
GENERAL HIGHWAY MAP
COMAL COUNTY
TEXAS

ENVIRONMENTAL RECORDS DEFINITIONS - STATE (TX)

SDRD	Submitted Drillers Report Database	(11/2008)

This Texas Water Development Board database was created from the online Texas Well Report Submission and Retrieval System (A cooperative TDLR,TWDB system) that registered water-well drillers use to submit their required reports. This system was started in February 2001 and is optional for the drillers to use.

TCEQ	Texas Commission on Environmental Quality Water Wells	NR

The Texas Commission on Environmental Quality (TCEQ) maintains a filing system of plotted and unnumbered water wells. Plotted water wells are filed according to the County indicated by the driller and the state well number assigned by State of Texas personnel. Given the available location information provided by the driller, personnel identify where the approximate well location should be. After well placement a state well number is assigned indicating that the well lies within a specific 2.5' section of a 7.5' quadrangle. This method allows for quicker, more refined, reference when researching a specific area. Unnumbered water wells have not been assigned a state well number. This can occur for a variety of reasons; however it does not mean the well cannot be accurately spotted. Unnumbered water well records are filed according to County and are often broken up by year or by a span of years.

TWDB	Texas Water Development Board Groundwater Database	(2/2009)

The Texas Water Development Board Groundwater Database contains information for more than 123,500 sites in Texas including data on water wells, springs, oil/gas tests, water levels, and water quality. The purpose of the Board's data collection effort over the years has been to gain representative information about aquifers in the state in order to do water planning. It is very important, however, to realize that the wells in the database represent only a small percentage of the wells that actually exist in Texas. A registered water well driller is required by law to send in a report to the State for every well that is drilled. This requirement began in 1965, and we estimate that approximately 500,000 wells have been drilled in Texas since then. Of the 1,000,000 plus water wells drilled in Texas over the past 100 years, more than 130,000 have been inventoried and placed into the TWDB groundwater database. State well numbers have been assigned to these based on their location within numbered 7 1/2 minute quadrangles formed by lines of latitude and longitude. This database contains well information including location, depth, well type, owner, driller, construction and completion data.

WUD	Water Utility Database	NR

The Water Utility Database is defined as a collection of data from Texas Water Districts, Public Drinking Water Systems and Water and Sewer Utilities who submit information to the TCEQ. This database is an integrated database designed and developed to replace over 160 stand alone legacy systems representing over 5 million records of the former Texas Water Commission and the Texas Department of Health. The information in this report reflects the most current data available from the Water Utility Database at the time of this report.

SPECIFICATIONS

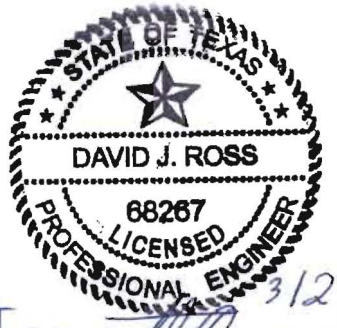
SPECIFICATIONS
FOR

COMAL COUNTY WCID NO. 6
PARK VILLAGE 0.098 MGD WASTEWATER TREATMENT PLANT

IDS JOB NO. 1500-001-11, CONTRACT NO. 1

The work covered by this contract is to be constructed in accordance with the specifications listed below. Only the Divisions listed below shall apply. All references to City of San Antonio (COSA), Canyon Lake Water Service Company Standard Specifications, San Antonio Water System(SAWS), or the Guadalupe-Blanco River Authority (GBRA) standard Specifications Division 1 specifications within these agency's standard specifications included herein shall be considered to reference applicable portions of this contract. All references to these agencies as Owner or to City Engineer shall be considered to reference the Owner and Engineer specific to this contract.

Documents	Title	No. of Pages
DIVISION 02 - SITE WORK		
02082	Precast Concrete Manholes	9
02084	Frames, Grates, Rings, and Covers	3
02226	Excavation and Backfill for Structures	7
02233	Clearing and Grubbing	2
02235	Waste Material Disposal	1
02251	Bedding and Backfill Material	4
02321	Cement Stabilized Sand	6
02322	Compacted Sand Fill under Tank Floor Plate	2
02558	Cleaning and Television Inspection	13
02621	Geotextile	2
02635	Polyethylene Wrap	4
02665	Disinfection of Waterlines	2
02686	Hydrostatic Testing of Pressure Lines	2
02821	Galvanized and Wood Fences/Gates	4



3/29/2016

David Ross

Documents	Title	No. of Pages
DIVISION 03 - CONCRETE		
03100	Concrete Formwork	11
03211	Reinforcing Steel	9
03250	Joints in Concrete Structures	12
03310	Structural Concrete	23
03350	Concrete Finishing	11
03390	Concrete Curing	4
03600	Grout	4
DIVISION 05 - METALS		
05500	Metal Fabrications	5
05503	Anchor Bolts, Expansion Anchors and Adhesive Anchors	3
05521	Aluminum Handrails	2
05532	Aluminum Grating	4
DIVISION 06 – WOOD AND PLASTICS		
06600	Fiberglass Grating	4
DIVISION 09 – FINISHES		
09900	Painting	7
09915	Protective Coatings (Wastewater)	19
DIVISION 11 - MAJOR EQUIPMENT		
11311	Sewage Pumps, Submersible	10
11400	Package Wastewater Treatment Plant	20
DIVISION 13 – SPECIAL CONSTRUCTION		
13134	Prefabricated Fiberglass Buildings	8
13222	Cloth Disk Filter Steel or Stainless Steel Tank	12
DIVISION 15 - MECHANICAL		
15025	Plant Piping and Fittings	9
15026	Pipe Insulation – Water & Chemical Service	2
15107	Gates and Valves	9
15140	Pipe Hangers, Supports, Knee Braces, and Restraints	4
15151	Magnetic Inductive Flowmeter (Wastewater)	5

CITY OF SAN ANTONIO (COSA) STANDARD SPECIFICATIONS FOR CONSTRUCTION JUNE 2008 WITH REVISIONS THERETO:

DIVISION I – EARTHWORK

100.1 Mobilization
100.2 Insurance and Bond
101.1 Preparing Right of Way
104.1 Street Excavation
107.1 Embankment

DIVISION II –BASE & SURFACE COURSES

200.1 Flex Base (10" Compacted Depth)
0316 2422 ASPH (AC-15P OR20-5TR OR20XP OR10-2TR)
0316 6224 AGGR (TY-PB GR-4 SAC-B)
0530 2075 DRIVEWAYS (GRAVEL)

DIVISION III –CONCRETE & CONCRETE STRUCTURES

307.5 Concrete Structure Miscellaneous (Headwalls)

DIVISION V MISCELANEOUS CONSTRUCTION

0460 2003 CMP (GAL STL 18 IN)
505.1 Concrete Riprap
507.5 Gates - Vehicular
515.1 Topsoil
540.1 Rock Filter Dams (Type I) (Install/Remove)
540.9 Silt Fence
540.6 Construction Exits (Install/Remove)
0540 2001 MTL W-BEAM GD FEN (TIM POST)

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Precast concrete sanitary sewer manholes.

B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes are specifically indicated in the Drawings.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings

B. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

C. ASTM C 270 - Specification for Mortar for Unit Masonry.

D. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

E. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.

F. ASTM C 923 - Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.

G. ASTM C 1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

H. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3)

I. ASTM D 2665 - Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.

J. ASTM D 2996 - Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

K. ASTM D 2997 - Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

L. AWWA C 213 - Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

1.04 SUBMITTALS

A. Submit manufacturer's data and details of following items for approval:

1. Shop drawings of manhole sections and base units and construction details, including reinforcement, jointing methods, materials, and dimensions.

2. Summary of criteria used in the manhole design including, as a minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.

3. Frames, grates, rings, and covers.

4. Materials to be used in fabricating drop connections.

5. Materials to be used for pipe connections at manhole walls.

6. Materials to be used for stubs and stub plugs, if required.

7. Materials and procedures for corrosion-resistant liner and coatings, if required.

8. Plugs to be used for sanitary sewer hydrostatic testing.

9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches.

PART 2 - P R O D U C T S

2.01 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of the manufacturer of the manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Provide barrels constructed from 48-inch-diameter standard reinforced concrete manhole sections unless otherwise indicated on Drawings. Combine various lengths of manhole sections to total the correct height with the fewest joints. Wall sections shall be designed for depth and loading conditions as required in Paragraph 2.01E, but shall not be less than 5 inches thick. Base section shall have a minimum thickness of 12 inches under the invert.

C. Provide cone tops to receive cast iron frames and covers designed to support an AASHTO H-20 loading, unless indicated otherwise.

D. Where the Drawings indicate that manholes larger than 48-inch diameter are required, precast base sections of the required diameter shall be provided with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric. The transition shall be located to provide a minimum of 7-foot head clearance from the top of bench to underside of transition.

E. Design Loading Criteria: The manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by the manufacturer, to the requirements of ASTM C 478 for the depth as shown on Drawings and to resist the following loads.

1. AASHTO H-20 loading applied to the manhole cover and transmitted down to the transition and base slabs.

2. Unit soil weight of 120 pcf located above all portions of the manhole, including base slab projections.

3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf.

4. Internal liquid pressure based on a unit weight of 63 pcf.

5. Dead load of manhole sections fully supported by the transition and base slabs.

F. Design: The manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to the requirements of ASTM C 478 and the following:

1. Design additional reinforcing steel to transfer stresses at openings.

2. Wall loading conditions:

   a. Saturated soil pressure acting on an empty manhole.

   b. Manhole filled with liquid to mid-height from invert to cover, with no balancing external soil pressure.

3. The minimum clear distance between any two wall penetrations shall be 12 inches or half the diameter of the smaller penetration, whichever is greater.

G. Provide joints between sections with o-ring gaskets conforming to ASTM C 443.

2.02 CONCRETE

A. Channel Inverts: Concrete for inverts not integrally formed with manhole base shall be either 5 sack premix (bag) concrete or Class A concrete, with a minimum compressive strength of 4000 psi.

B. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, where allowed.

C. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4000 psi for concrete foundation slab under manhole base section where indicated on Drawings.

2.03 REINFORCING STEEL

A. Reinforcing steel shall conform to requirements of Section 03211.

2.04 MORTAR

A. Conform to requirements of ASTM C 270, Type S using Portland Cement.

2.05 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Section 02084 - Frames, Grates, Rings and Covers.

2.06 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to the same pipe material requirements used in the main pipe, unless otherwise indicated on the Drawings.

2.07 PIPE CONNECTIONS FOR SANITARY SEWERS

A. Provide pipe to manhole boot PSX Direct Drive or approved equal.

B. Provide resilient connectors conforming to requirements of ASTM C 923. Metallic mechanical devices as defined in ASTM C 923 shall be made of the following materials:

1. External clamps: Type 304 stainless steel

2. Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11 gauge minimum.

3. Internal, expandable clamps on corrosion-resistant manholes:

a. Type 316 stainless steel, 11 gauge minimum, or

b. Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213.

C. Where rigid joints between pipe and a cast-in-place manhole base are specified or shown on the Drawings, provide polyethylene-isoprene waterstop meeting the physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.

2.08 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, such as Adeka Ultraseal P201, or approved equal.

2.09 MANHOLE LINING

A. The interior of all concrete manholes, other than those called out as corrosion resistant or PVC-lined manholes, shall be lined with SewperCoat, Refratta HAC 100, or approved equal calcium aluminate material.

B. Proposed substitutes must be equal in composition and manufacturer.

C. Product must be installed by a manufacturer certified applicator.

D. Lining Thickness

1. Minimum lining thickness for manholes shall be ½".

2. Minimum lining thickness for manholes which have a force main discharge shall be 1".

E. Prepare surface by sand blasting.

F. Provide smooth trowel finish.

2.10 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on the Drawings, provide one of the following:

1. PVC liner for precast cylindrical manhole section, base sections, and cone sections.

2. Precast base sections, as specified above, lined with PVC or equal.

2.11 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water.

B. Grout shall meet the requirements of ASTM C 1107 and shall have a minimum 28-day compressive strength of 7000 psi.

2.12 VENT PIPES

A. Provide external vent pipes for manholes where indicated on the Drawings.

B. Buried Vent Pipes: Provide 3-inch or 4-inch PVC drain, waste and vent (DWV) pipe and fittings conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for the vent outlet assembly.

C. Vent Outlet Assembly: Provide a vent outlet assembly as shown on the Drawings, constructed of the following specified materials:

1. FRP Pipe: Provide filament wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.

2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive.

3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on the Drawings. Flanges shall meet bolt pattern and dimensions for ANSI B 16.1, 125-pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B.

4. Coating: Provide a 2-component, aliphatic polyurethane coating using a primer or tie coat recommended by the manufacturer. Provide two or more coats to yield a dry film thickness of a least 3 mils. Provide Amershield, Tnemec 74, or approved equal. Color shall be selected by the Engineer from the manufacturer's standard colors.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of sanitary sewer manholes, including adjustment of manholes to grade. Use only specified materials listed above.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if the subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to

placement of foundation material and base section. If it cannot be compacted to that density, the subgrade shall be moisture conditioned until that density can be reached or shall be treated as an unstable subgrade.

C. Do not build sanitary sewer manholes in ditches, swales, or drainage paths unless directed by Engineer.

3.02 PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on Drawings.

B. Place manholes at points of change in alignment, grade, size, pipe intersections, and at end of sewer.

3.03 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on 12-inch-thick (minimum) foundation of crushed stone wrapped in filter fabric, cement stabilized sand, or a concrete foundation slab.

B. Unstable Subgrade Treatment: Notify Engineer when unstable subgrade is encountered, for examination to determine if the subgrade has heaved upwards after being excavated. If heaving has not occurred, the subgrade shall be over-excavated to allow for a 24-inch thick layer of crushed stone wrapped in filter fabric as the foundation material under the manhole base. If there is evidence of heaving, a pile-supported concrete foundation, shall be provided under the manhole base when indicated by the Engineer.

3.04 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust the finished elevation and to support the manhole frame.

C. Seal any lifting holes with non-shrink grout.

D. Where PVC liners are required, seal joints between sections in accordance with manufacturer's recommendations.

E. Do not incorporate manhole steps in manhole sections.

3.05 PIPE CONNECTIONS AT MANHOLES

A. Install pipe to manhole boot PSX Direct Drive resilient connectors or approved equal at each pipe entering and exiting sanitary sewer manholes in accordance with manufacturer's instructions.

B. Ensure that no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter the space between the pipe and the edge of the wall opening at and around the resilient connector on either the interior or exterior of the manhole. If necessary, fill the space with a compressible material to guarantee the full flexibility provided by the resilient connector.

C. Where a new manhole is to be constructed on an existing sewer, a rigid joint pipe may be used. Install a waterstop gasket around the existing pipe at the center of the cast-in-place wall. Join ends of split waterstop material at the pipe springline using an adhesive recommended and supplied by the waterstop manufacturer.

D. Test connection for watertight seal before backfilling.

3.06 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide a smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum

2. Depth of bench to invert:

a. Pipes smaller than 15-inches: one-half of the largest pipe diameter
b. Pipes 15 to 24-inches: three-fourths of the largest pipe diameter

c. Pipes larger than 24-inches: equal to the largest pipe diameter

3. Invert slope through manhole: 0.10-foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.07 DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form a solid mass. Extend cement stabilized sand or concrete encasement a minimum of 4 inches outside of bells.

B. Install a drop connection when a sewer line enters a manhole higher than 24 inches above the invert of a manhole.

3.08 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on the Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.09 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete adjustment rings so that the elevation of the installed casting cover matches the pavement surface. Seal between adjustment ring and the precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply a latex-based bonding agent to precast concrete surfaces to be joined with non-shrink grout. Set the cast iron frame on the adjustment ring in a bed of approved sealant. The sealant bed shall consist of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 3/4-inch wide.

B. For manholes in unpaved areas, top of frame shall be set a minimum of 6 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, encase the manhole frame in mortar or non-shrink grout placed flush with the face of the manhole ring and the top edge of the frame. Provide a rounded corner around the perimeter.

3.10 BACKFILL

A. Place and compact backfill materials in the area of excavation surrounding manholes in accordance with requirements of Section 02226 - Excavation and Backfill for Structures. Provide embedment zone backfill material, as specified for the adjacent utilities, from manhole foundation up to an elevation 12 inches over each pipe connected to the manhole. Provide trench zone backfill, as specified for the adjacent utilities, above the embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to the manhole, backfill under the existing sewer up to the springline of the pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide a minimum of 4 inches of topsoil and seed.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of manholes in accordance with requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

3.12 PROTECTION

A. Protect manholes from damage until work has been finally accepted. Repair damage to manholes at no additional cost to the Owner.

END OF SECTION

PART 1 - G E N E R A L

1.01 SECTION INCLUDES

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

B. Ring grates.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges.

B. ASTM A 48 - Specification for Gray Iron Castings.

C. ASTM A 615 - Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement.

D. AWS - D 12.1 Welding Reinforcing Steel.

1.04 SUBMITTALS

A. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

B. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 - P R O D U C T S

2.01 CASTINGS

A. Castings for frames, grates, rings and covers shall conform to ASTM A 48, Class 30. Provide locking covers if indicated on Drawings.

B. Castings shall be capable of withstanding the application of an AASHTO H-20 loading without permanent deformation.

C. Fabricate castings to conform to the shapes, dimensions, and with wording or logos shown on the Drawings. Standard dimensions for manhole covers are 30 inches in diameter.

D. Castings shall be clean, free from blowholes and other surface imperfections. Cast holes in covers shall be clean and symmetrical, free of plugs.

2.02 BEARING SURFACES

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for any position in which the casting may be seated in the frame.

2.03 SPECIAL FRAMES AND COVERS

A. Where indicated on the Drawings, provide watertight manhole frames and covers with a minimum of four bolts and a gasket designed to seal cover to frame. Supply watertight manhole covers and frames, Model R-1916H (32-inch cover diameter) manufactured by Neenah Foundry Company, Model V-2420 by Vulcan Foundry, or approval equal.

B. Where shown on the Drawing, provide manhole frames and covers with 48-inch-diameter clear opening, with inner cover for 22-inch diameter clear opening. Provide inner cover with pattern shown on Drawings, Vulcan Foundry V-7, Neenah Foundry, Model R-1741-F, or approved equal.

2.04 FINISH

A. Unless otherwise specified, coat iron castings with the manufacturer's standard asphaltic paint.

2.05 FABRICATED RING GRATES

A. Ring grates shall be fabricated from reinforcing steel conforming to ASTM A 615.

B. Welds connecting the bars shall conform to AWS D 12.1.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install castings according to approved shop drawings, instructions given in related specifications, and applicable directions from the manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in formwork until permanently set.

C. Ring grates shall be fabricated in accordance with the Guadalupe-Blanco River Authority Standard Detail and shall be set in mortar in the mouth of the pipe bell.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavation, backfilling, and compaction of backfill for structures.

1.02 UNIT PRICES

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, MH, PT, OH and OL according to ASTM D2487.

2. Materials that cannot be compacted to the required density due to either gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.

C. Select Material: Material as defined in Section 02251 – Bedding and Backfill Materials.

D. Backfill: Select material meeting specified quality requirements, placed and compacted under controlled conditions around structures.

E. Foundation Backfill Materials: Natural soil and geotextile filter fabrics as required to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for the structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

F. Foundation Base: For foundation base material, use crushed aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. The foundation base provides a smooth, level working surface for the construction of the concrete foundation.

G. Foundation Subgrade: Foundation subgrade is the surface of the natural soil which has been excavated and prepared to support the foundation base or foundation backfill, where needed.

H. Ground Water Control Systems: Installations external to the excavation such as well points, eductors, or deep wells. Ground water control includes dewatering to lower the ground water, intercepting seepage which would otherwise emerge from the side or bottom of the excavation, and depressurization to prevent failure or heaving of the excavation bottom.

I. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from the excavation. Remove rain water and surface water which accidentally enters the excavation as a part of excavation drainage.

J. Excavation Drainage: Removal of surface and seepage water in the excavation by sump pumping and using French drains surrounding the foundation to intercept the water.

K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below the foundation and backfilled with foundation backfill material.

L. Shoring (Shoring System): A structure that supports the sides of an excavation to maintain stable soil conditions and prevent cave-ins.

1.04 SUBMITTALS

A. Submit project record documents. Record location of utilities, as installed, referenced to survey benchmarks. Include location of utilities encountered, crossed or rerouted on the project record documents and on the Contractor's "Red-Line" Drawings. Give horizontal dimensions, elevations, inverts and gradients.

1.05 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of limits of excavation activities for the structure.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities are indicated on the Drawings.

PART 2 - P R O D U C T S

2.01 EQUIPMENT

A. Perform excavation with equipment suitable for achieving the requirements of this Specification.

B. Backfill within 3 feet of walls shall be compacted with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to the depth of the fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.02 MATERIAL CLASSIFICATIONS

A. Backfill materials shall conform to the classifications and product descriptions of Section 02251 – Bedding and Backfill Materials.

PART 3 - EXECUTION

3.01 PREPARATION

A. Conduct an inspection to determine condition of existing structures and other permanent installations.

B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Maintain barricades and warning devices at all times for streets and intersections where work is in progress, or where affected by the Work, and is considered hazardous to traffic movements.

C. Perform work in accordance with OSHA standards. Employ an excavation safety system in accordance with OSHA Requirements.

D. Install and operate necessary dewatering and surface water control measures.

3.02 EXCAVATION

A. Use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to the absolute minimum necessary. No additional payment will be made for excess excavation.

B. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work. Notify Engineer and obtain instructions before proceeding in such areas. Show discovered items on red-line drawings.

C. Immediately notify the agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Engineer and agency for any repairs or relocations, either temporary or permanent.

D. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.

E. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.

F. Conduct hauling operations so that trucks and other vehicles do not create a dirt nuisance in streets. Verify that truck beds are sufficiently tight and loaded in such a manner that objectionable materials will not spill onto streets. Promptly clear away any dirt, mud, or other materials that spill onto streets or are deposited onto streets by vehicle tires.

G. Maintain permanent benchmarks, monumentation and other reference points. Unless otherwise directed, replace those which are damaged or destroyed by the Work.

H. Provide sheeting, shoring, and bracing where required to safely complete the Work and to protect adjacent structures or improvements.

I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, concrete fill, cement stabilized sand, or other material approved by Engineer.

J. After completion of the structure, remove sheeting, shoring, and bracing. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to the Work and adjacent structures or improvements.

3.03 HANDLING EXCAVATED MATERIALS

A. Place material which is suitable for use as backfill in orderly piles at a sufficient distance from excavation to prevent slides or cave-ins.

3.04 DEWATERING

A. Maintain the ground water surface a minimum of two feet below the bottom of the foundation base.

B. Maintain ground water control until the structure is sufficiently complete to provide the required weight to resist hydrostatic uplift with a minimum safety factor of 1.2.

3.05 FOUNDATION EXCAVATION

A. Notify Engineer at least 48 hours prior to planned completion of foundation excavations. Do not place the foundation base until the excavation is accepted by the Engineer.

B. Excavate to elevations shown on Drawings, as needed to provide space for the foundation base, forming a level undisturbed surface, free of mud or soft material. Maintain material -1 to +3 of optimum moisture content. Proof Roll area and remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or a material as

directed by the Engineer. Prior to placing material over it, recompact the subgrade, scarifying as needed, to 95 percent of the maximum Standard Proctor Density according to ASTM D698. If the specified level of compaction cannot be achieved, moisture condition the subgrade and recompact until 95 percent is achieved, or over-excavate to provide a minimum layer of 24 inches of foundation backfill material, or other means acceptable to the Engineer.

C. Protect open excavations from runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in a satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.

D. Soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to the required subgrade, shall be removed and replaced with foundation backfill material, as directed by Engineer, at no additional cost to the Owner.

E. All crushed aggregate, and other free draining materials, shall have a geotextile filter fabric separating it from native soils or select material backfill. The fabric shall overlap a minimum of 12 inches beyond where another material stops contact with the soil.

F. Crushed aggregate, and other materials, shall be placed in uniform layers of 8-inch maximum thickness. Compaction shall be by means of at least two passes of a vibratory compactor.

3.06 FOUNDATION BASE

A. After the subgrade is properly prepared, including the placement of foundation backfill where needed, the foundation base shall be placed. The foundation base shall consist of a seal slab with a thickness equal to the greater of the thickness indicated on the drawings or 2-inches. The foundation base shall extend a minimum of 12 inches beyond the edge of the structure foundation.

B. Where the foundation base and foundation backfill are of the same material, both can be placed in one operation.

3.07 BACKFILL

A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Use existing material that qualifies as regular fill as defined in Section 02201 – Stripping and Fill, unless indicated otherwise.

B. Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that the concrete has reached a minimum of 85 percent of the specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until the slab or intermediate walls have been placed and concrete has attained sufficient strength.

C. Remove concrete forms before starting backfill and remove shoring and bracing as work progresses.

D. Maintain fill material at optimum moisture content -1 to +3 of optimum moisture content. Place fill material in uniform 8-inch maximum loose layers. Compaction of fill shall be to at least 95 percent of the maximum Standard Proctor Density according to ASTM D698 under proposed paved areas. Compact to at least 90 percent around structures below finished grade.

E. Where backfill is placed against a sloped excavation surface, run compaction equipment across the boundary of the cut slope and backfill to form a compacted slope surface for placement of the next layer of backfill.

3.08 FIELD QUALITY CONTROL

A. Tests will be performed initially on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.

B. In-place density tests of compacted subgrade and backfill will be performed according to ASTM D1556, or ASTM D2922 and ASTM D3017, and at the following frequencies and conditions:

1. A minimum of one test for every 100 cubic yards of compacted backfill material.

2. A minimum three density tests for each full work shift.

3. Density tests will be performed in all placement areas.

4. The number of tests will be increased if inspection determines that soil types or moisture contents are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density.

C. At least three tests for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D698. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.

D. If tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

3.09 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Specification Section 02235 - Waste Material Disposal.

3.10 PROTECTION

A. Prevent erosion of excavations and backfill. Do not allow water to pond in excavations.

B. Maintain excavation and backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Section includes clearing designated areas as called out on Contract Documents, as specified or as directed by the Owner's Representative of all timber, brush, debris, rubbish, spoil material and other objectionable materials.

B. Clearing and grubbing shall conform to the requirements specified in this Section.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

PART 2 - PRODUCTS - Not Used.

PART 3 - EXECUTION

3.01 CLEARING

A. All trees and brush within the plant fence line, access easement and clearing limits (except trees, shrubs and other landscaping features designated by Owner to remain) shall be cut at ground level and all trees, brush, debris and objectional materials shall be removed from the work site. All trees and shrubs outside of clearing limits shall be protected from damage, as necessary.

3.02 GRUBBING

A. All stumps, roots and buried logs, vegetation and rubbish within the plant fence line, access easement and clearing limits (except trees, shrubs and other landscape features designated by Owner to remain) shall be removed to a depth of two feet below natural ground.

B. Fill depressions resulting from clearing and grubbing operations with suitable backfill material and grade to drain. Place fill material in horizontal layers not exceeding 8 inch loose lifts, and thoroughly compact to 95 percent Standard Proctor density under proposed pavement, buildings, slabs, hydropneumatic tanks, ground storage tanks or other plant structures, and 90 percent Standard Proctor density outside future pavement.

3.03 DISPOSAL OF MATERIALS

A. Dispose of all refuse from clearing operations offsite in accordance with Section 02235 - Waste Material Disposal. Bury no refuse on Owner's property.

B. Contractor may elect to burn material on-site within limits designated by the Owner. Contractor shall be required to obtain all permits necessary for on-site burning, and shall provide documentation of permits to the Engineer. Contractor shall be responsible for complying with all regulatory agency requirements associated with on-site burning. In the event Contractor's on-site burning operations are suspended by regulatory agencies, Contractor shall be required to continue offsite disposal of refuse. Agency suspension of on-site burning shall not be justification for extension of the contract period.

3.04. LIMITS OF OPERATIONS

A. No clearing or grubbing shall be done beyond the limits of areas as shown on plans, as specified or as directed by Owner's Representative. All trees, shrubs and other landscape features designated by Owner to remain shall be protected against damage and trimmed when necessary.

END OF SECTION

PART 1 - G E N E R A L

1.01 DESCRIPTION

A. Waste material disposal consists of the following:

1. Disposal of trees, stumps, logs, brush, roots, grass, vegetation, humus, rubbish and other objectionable matter from operations such as clearing and grubbing, excavation and grading.

2. Disposal of unsuitable material or excess material from roadway excavation, road side-ditch excavation, open cut excavation, tunnel excavation, site construction and ditch excavation.

3. Disposal of material from work specified in the Plans or Specifications as removal and disposal.

B. This section shall not apply to the disposal of contaminated material.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 SUBMITTALS

A. If excess soil is deposited on private property, the Contractor must secure written permission from the property owner to do so.

PART 2 - P R O D U C T S - NOT USED.

PART 3 - E X E C U T I O N

3.01 DISPOSAL AREA

A. Waste material must be removed from the work site and disposed of in a manner not to damage the Owner or other persons.

1. The Contractor shall not dispose of any excavated materials within an area designated as being within the 100-Year Flood Hazard Area. It shall be the Contractor's responsibility to verify the flood plain status of any proposed disposal site.

2. If excess soil is deposited on private property, the Contractor must secure written permission from the property owner to do so. Written permission must include a description of the property on which the soil is deposited and a copy furnished to the Engineer.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Washed shell bedding and backfill.

B. Bank run sand cushion.

C. Concrete sand bedding.

D. Gem sand bedding.

E. Pea gravel bedding.

F. Pea gravel bedding.

G. Crushed limestone.

H. Crushed stone.

I. Cement Stabilized Sand.

1.02 UNIT PRICES

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 SUBMITTALS

A. Submit product data and representative sieve test results.

1.04 DELIVERY, STORAGE, AND HANDLING

A. When stockpiling of sand bedding and backfill material is approved at or near the Project site, use appropriate covers to eliminate blowing of sand into adjacent areas.

B. Stockpiles shall be made up of layers of processed aggregate materials. Load material by making successive vertical cuts through entire depth of stockpile.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bedding and backfill material shall be free of roots, trash, mud balls and conform to the following limits for deleterious materials:

1. Clay lumps: Less than 0.5 percent when tested in accordance with ASTM C142.

2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C123.

3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C40.

B. Washed Shell: Durable particles of oyster shell with natural binder or approved fine aggregate meeting the following requirements:

1. Grading within the following limits when washed and tested in accordance with ASTM C136:

Sieve	Percent Retained by weight
2 inch	0 to 8
1 inch	5 to 35
1/4 inch	45 to 75
No. 200	85 to 98

2. Material passing the 1/4-inch sieve shall meet the following requirements when tested in accordance with ASTM D4318:

a. Liquid limit not exceeding 35.

b. Plasticity index not exceeding 10.

C. Bank Run Sand Cushion: Durable bank run sand classified as SP, SW, or SM by the Unified Soil Classification System (ASTM D2487) meeting the following requirements for use under concrete structures as sand cushion where indicated on the drawings:

1. Less than 15 percent passing the number 200 sieve when tested in accordance with ASTM C136.

2. Material passing the number 40 sieve shall meet the following requirements when tested in accordance with ASTM D4318:

a. Liquid limit not exceeding 25

b. Plasticity index not exceeding 7.

D. Concrete Sand: Natural sand, manufactured sand, or a combination of natural and manufactured sand conforming to the requirements of ASTM C33 and graded within the following limits when tested in accordance with ASTM C136:

Sieve	Percent Passing
3/8 inch	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

E. Gem Sand: Sand conforming to the requirements of ASTM C33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C136:

Sieve	Percent Passing
3/8 inch	95 to 100
1/4 inch	60 to 80
No. 4	15 to 40
No. 10	0 to 5

F. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C136:

Sieve	Percent Passing
1/2 inch	100
3/8 inch	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

G. Crushed Limestone: Durable particles of crusher-run broken limestone obtained from an approved source and meeting the following requirements:

1. Los Angeles abrasion test percent of wear not to exceed 40 when tested in accordance with ASTM C131.

2. Plasticity Index for material passing the No. 4 sieve: Less than 12 when tested in accordance with ASTM D4318.

3. Grading in accordance with Tex-101-E and Tex-110-E within the following limits:

Sieve	Percent Passing
1/2 inch	100
3/8 inch	85 to 100
No. 4	10 to 30
No. 8	0 to 10

H. Crushed Stone: Material shall be crushed stone produced oversize quarried aggregate, size by crushing and produced from a naturally occurring single source. Crushed gravel or uncrushed gravel shall not be acceptable material.

1. Plasticity index shall be less than 12 when tested in accordance with ASTM D4318

2. Grading in accordance with Tex-101-E and Tex-110-E within the following limits:

Sieve	Percent Retained by weight
2 1/2 inch	0
1 3/4 inch	0 to 10
No. 4	45 to 75
No. 40	60 to 85

I. Cement Stabilized Sand

1. Conform to specification Section 02321 - Cement Stabilized Sand.

PART 3 - EXECUTION - NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cement stabilized sand material.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates (Fine Aggregate).

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

D. ASTM C 123 - Standard Test Method for Lightweight Pieces in Aggregate.

E. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

F. ASTM C 150 - Specification for Portland Cement.

G. ASTM D 558 - Standard Test Method for Moisture-Density Relations of Soil Cement-Mixtures.

H. ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

J. ASTM D 2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

K. ASTM D 3665 - Practice for Random Sampling of Construction Materials.

L. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

A. Submit proposed target cement content and production data for sand-cement mixture in accordance with the requirements of Paragraph 2.03, Material Qualifications.

B. Submit test reports in accordance with the requirements of Paragraph 3.02G.

1.05 DESIGN REQUIREMENTS

A. Sand-cement mixture shall produce a minimum unconfined compressive strength of 100 pounds per square inch in 48 hours.

1. Design will be based on strength specimens molded in accordance with ASTM D 558 at a moisture content within 3 percent of optimum and within 4 hours of batching.

2. Determine minimum cement content from production data and statistical history. Mix shall contain not less than 1.1 sacks of cement per ton of dry sand.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C 150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Section 02251 - Bedding and Backfill Material, and the following requirements:

1. Classified as SW, SP, SW-SM, SP-SM, or SM by the United Soil Classification System of ASTM D 2487.

2. Deleterious materials:

a. Clay lumps, ASTM C 142; less than 0.5 percent.

b. Lightweight pieces, ASTM C 123; less than 5.0 percent.

c. Organic impurities, ASTM C 40, color no darker than the standard color.

3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter, or other deleterious substances, meeting requirements of ASTM C 94.

2.02 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in a pugmill-type mixer.

B. Stamp batch ticket at plant with time of loading. Material not placed and compacted within 4 hours after mixing shall be rejected.

2.03 MATERIAL QUALIFICATIONS

A. Determine the target cement content of the material as follows:

1. Obtain samples of sand-cement mixtures at the production facility representing a range of cement content consisting of at least three points.

2. Complete the molding of samples within 4 hours after the addition of water.

3. Perform strength tests (average of two specimens) at 48 hours and 7 days.

4. Perform cement content tests on each sample.

5. Perform moisture content tests on each sample.

6. Plot average 48-hour strength vs. cement content

7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).

B. Test the raw sand for the following properties at the point of entry into the pug-mill:

1. Gradation.

2. Plasticity index.

3. Organic impurities.

4. Clay lumps and friable particles.

5. Lightweight pieces.

6. Moisture content.

7. Classification.

C. Present the data obtained in a format similar to that provided in the sample data form attached to this Section.

D. The target content may be adjusted if statistical history so indicates. For determination of minimum product performance use the formula:

f'_c - 1/2 standard deviation

PART 3 - EXECUTION

3.01 PLACING

A. Place sand-cement mixture in a maximum 12-inch-thick loose lift and compact to 95 percent of ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. The target moisture content during compaction is ± 3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at the plant.

B. Do not place or compact sand-cement mixture in standing or free water.

3.02 FIELD QUALITY CONTROL

A. Samples of delivered product will be taken in the field at point of delivery for testing in accordance with ASTM D 3665.

B. Four specimens shall be prepared and molded (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting the moisture content. Samples will be molded at approximately the same time the material is being used, but no later than 4 hours after water is added to mix.

C. After molding, specimens will be removed from the molds and sealed in a plastic bag or similar material to minimize moisture loss. Specimens will be cured at a room temperature between 60 and 80 degrees F until ready for testing.

D. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

E. A strength test will be the average of the strengths of two specimens molded from the same sample of material and tested at the same age. The average daily strength will be the average of the strengths of all specimens molded during one day's production and tested at the same age.

F. Precision and Bias: Test results shall meet the recommended guideline for precision in ASTM D 1633 Section 9.

G. Reporting: Test reports shall contain, as a minimum, the following information:

1. Supplier and plant number
2. Time material was batched
3. Time material was sampled
4. Test age (exact hours)
5. Average 48-hour strength
6. Average 7-day strength
7. Specification section number

8. Indication of compliance / non-compliance
9. Mixture identification
10. Truck and ticket numbers
11. The time of molding
12. Moisture content at time of molding
13. Required strength
14. Test method designations
15. Compressive strength data as required by ASTM D 1633
16. Supplier mixture identification
17. Specimen diameter and height, in.
18. Specimen cross-sectional area, sq. in.

3.03 ACCEPTANCE

A. The strength level of the material will be considered satisfactory if:

1. The average 48-hour strength is greater than 100 psi with no individual strength test below 60 psi, or

2. All 7-day individual strength tests exceed 100 psi.

B. The material will be considered acceptable for partial payment if any 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi.

C. The material will be considered unacceptable and subject to removal and replacement at the Contractor's expense if any individual strength test has a 7-day strength less than 70 psi.

D. If the moving average of any three daily 48-hour averages falls below 100 psi, the supplier shall discontinue shipment to the project until that plant is capable of producing a material which exceeds 100 psi at 48 hours. A total of five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E. The testing laboratory shall notify the Contractor, Engineer, and material supplier by facsimile of all tests indicating results falling below specified strength requirements.

Supplier: City Stabilized Sand	**Plant No:** 1 - Main Street	**Date of Tests:** January 1, 1997

Item	Raw Sand	1.1 Sack	100 psi	1.5 Sack	2.0 Sack
Moisture Content	10.9	15.7	14.0	13.8	13.7
Cement Feed Dial Setting	--	2.25	2.5	2.75	3.75
Silo Pressure (psi)	--	4	4	4	4
Batch Time	10:00	10:10	10:15	10:20	10:25
Sample Time	--	10:10	10:15	10:20	10:25
Molding Time	--	12:30	12:45	1:00	1:15
Cement Content (sacks/ton)	--	1.1	1.3	1.6	2.1
Compressive Strength at 48 hrs. (avg of 2)	--	80	120	160	220
Compressive Strength at 7 days(avg of 2)	--	135	200	265	365

Sieve size	**Percent Passing**	**Spec. Section**
3/8 Inch	100	--
No. 16	100	--
No. 40	100	--
No. 50	99	--
No. 100	41	--
No. 200	11	0 to 15
Raw Sand Tests	**Result**	**City**
Plasticity Index	Non-Plastic	4 Maximum
Organic Impurities	Passing	No Darker Than
Clay Lumps & Friable Parts (%)	0.0	0.5 % Maximum
Lightweight Pieces (%)	0.0	5.0 % Maximum
Classification	SP-SM	SW, SP, SW-SM, SP-SM, SM

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cleaning sewer lines to remove solids, roots, soil, sand, pieces of broken pipe, bricks, grease, grit from sewer lines and manholes and other debris, thus improving flow and facilitating television inspection for sewer evaluation.

B. Television inspecting the line to obtain quality video and Television Inspection Reports upon which the Owner's Representative can make decisions regarding needed sewer rehabilitation and repair.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Cleaning using Normal Cleaning Equipment: Measurement for cleaning sanitary sewer mains with normal cleaning equipment is on a linear-foot basis. The Contract unit price for cleaning with normal equipment is full payment for sewer line actually cleaned and accepted. Cleaning using normal cleaning equipment includes:

   a. Contractor may use Owner-provided water at no charge. Contractor shall coordinate with the Owner's operations company prior to using any Owner-provided water. Contractor shall provide a backflow preventor and meter for the Owner-provided water.

   b. Collection, removal, transportation and legal disposal of liquid wastes, soil, sand and other debris.

   c. Locating, exposing and opening manholes on sewers to be cleaned.

   d. Reconstruction of manholes dismantled for cleaning equipment access, and repair of damage caused by dismantling or cleaning equipment.

2. Cleaning Using Mechanical Cleaning Equipment: Measurement for cleaning sanitary sewer mains with mechanical cleaning equipment is on a linear-foot basis for the quantity approved by the Owner's Representative. The Contract unit price for cleaning sanitary sewer mains with mechanical cleaning equipment is paid in addition to the unit price for cleaning using normal cleaning equipment. Mechanical cleaning is limited to locations approved by the Owner's Representative on a case-by-case basis after normal cleaning methods have failed to produce satisfactory results, as determined by viewing videos.

a. Mechanical cleaning prior to normal cleaning does not relieve the Contractor of the responsibility for fully cleaning the pipe with normal cleaning equipment.

b. Reconstruction of manholes dismantled for cleaning equipment access, and repair of damage caused by dismantling or cleaning equipment is included in the unit price.

c. Unit price for cleaning using mechanical equipment is compensation in full for all collection, removal, transportation and legal disposal of liquid wastes, soil, sand and debris regardless of quantity of material.

3. Survey Television Inspection: Measurement of survey television inspection for pipe segments selected by the Owner's Representative is on a linear-foot basis from centerline to centerline of manholes. Payment for survey television inspection is made for the actual lengths of television inspection footage, as measured in the field at grade, as submitted for evaluation prior to final recommendations of sewer rehabilitation method. No separate payment will be made for the following:

a. Poor or unacceptable-quality videos. Hazy, unclear pictures will not qualify for payment.

b. Re-televising any segment without prior approval of the Owner's Representative.

c. Portions of sanitary sewer not televised. No payment will be made for length of sewer through which the camera could not pass.

d. Reverse setups required to bracket an obstruction.

e. Sewer flow control.

4. Survey Television Inspection by Floating Camera: Measurement of survey television inspection by floating camera for pipe segments selected by the Owner's Representative is on a linear-foot basis for actual footage televised from centerline to centerline of manholes. Such inspections may be required in 36-inch through 84-inch diameter sewer pipes, without any cleaning, for purely investigative studies. Payment for video inspection by floating camera shall be made based on a separate bid item for floating camera.

5. Footage paid for survey cleaning, under some circumstances, may exceed the footage paid for survey television inspection, as approved by the Owner's Representative.

1.03 DEFINITIONS

A. Normal Cleaning Equipment: Cleaning devices such as rods, metal pigs, porcupines, root saws, snakes, scooters, sewer balls, kites, and other approved equipment in conjunction with hand-winching devices and gas or electric rod-propelled devices. Variable-pressure water nozzles (3000 psi) are considered normal cleaning equipment.

B. Mechanical Cleaning Equipment: Buckets, scrapers, scooters, porcupines, kites, heavy-duty brushes, metal pigs and other debris-removing equipment and accessories used in conjunction with approved power winching machines. High-to very-high-pressure water nozzles (10,000 psi) are considered mechanical cleaning equipment.

C. Survey and Television Inspection: Video inspection of existing sanitary sewers to evaluate lines and determine whether conditions exist which would require line rehabilitation.

D. Television Inspection Report: A form that is filled out by each television operator for any television inspection effort that submitted to the Owner, on a form provided by the Contractor.

1.04 PERFORMANCE REQUIREMENTS

A. Clean designated sanitary sewers and manholes using mechanical, hydraulically-propelled or high-velocity sewer cleaning equipment. Select cleaning processes which will remove grease, soil, sand, silt, solids, rags and debris from each sewer segment and associated manholes.

1.05 SUBMITTALS

A. Submit equipment manufacturer's operational manuals and guidelines to the Owner's Representative for review. Strictly follow such instructions unless otherwise directed by the Owner's Representative.

B. Submit a list of lawful disposal sites proposed for dumping debris from cleaning operations.

C. Submit and maintain Liquid Waste Manifests conforming to all applicable health regulatory requirements. Send the owner's and regulator's copies of the completed manifests to the Owner's Representative within 24 hours after disposal of waste materials.

D. Submit Digital Videos and Television Inspection Reports to the Owner's Representative for review. Contractor may choose to provide the Digital Videos on digital video discs (DVD's) or digital video files on a portable hard drive that can be viewed on a personal computer (PC). Contractor shall provide any software required to view the digital videos.

1. Provide Digital Videos of quality sufficient for the Owner's Representative to evaluate the condition of the sanitary sewer, locate the sewer service connections and

verify cleaning. If quality is not sufficient, re-televise the sanitary sewer segment and provide new Digital Videos and report at no additional cost to the Owner. Camera distortion, inadequate lighting, dirty lens and blurred or hazy pictures will be causes for rejection of Digital Video and associated line segment.

2. Digital Videos submitted become the property of the Owner and will be retained by the Owner.

3. Contractor shall maintain the master originals of all Digital Videos and Television Inspection Reports submitted, until final acceptance of the Contract.

4. If a section of line cannot be televised, submit a written report identifying the location of the line.

1.06 QUALITY ASSURANCE

A. Qualifications: Use experienced personnel to operate cleaning equipment and devices.

B. Acceptance of sewer cleaning work is subject to successful completion of the television inspection. If video inspection shows solids, sand, grease, grit or other debris remaining in the line, the cleaning is considered unsatisfactory. Repeat cleaning, inspection and video inspection of the sewer line until cleaning is acceptable by the Owner's Representative.

PART 2 PRODUCTS

2.01 CLEANING EQUIPMENT

A. Select cleaning equipment and methods based on the condition of the sanitary sewer mains at the time work begins. More than one method or type of equipment may be required on a single project or at a single location.

B. When requested by the Owner's Representative, demonstrate the performance capabilities of cleaning equipment and methods proposed for use on the project. If results obtained by demonstration are not satisfactory, provide other equipment that will clean the sewer line.

C. For high-velocity cleaning use a water jet capable of producing a minimum volume of 50 gpm with a pressure of 1500 psi at the pump. Install a gauge to indicate working pressure on the discharge of high-pressure water pumps. In addition to conventional nozzles, use a nozzle which directs the cleaning force to the bottom of the pipe for sewers 18-inches and larger.

D. When hydraulic or high-velocity cleaning equipment is used, install a suitable sand trap, weir, dam or suction device in the downstream manhole so that solids and debris are trapped for removal.

2.02 CLEANING ACCESSORIES

A. When an additional quantity of water from the public water supply is needed to meet the cleaning requirements of the equipment and the sewer, obtain transient water meters from the Owner for installation on trucks or at fire hydrants.

B. Prior written approval from the Owner is needed to use fire hydrants located within the Owner's service area.

C. All cleaning equipment must be equipped with backflow preventers to prevent contamination to the public water supply.

2.03 VIDEO EQUIPMENT

A. Video Equipment: Select and use video equipment that will produce digital color videos.

B. DVD: If Contractor chooses DVD format, provide DVD recorded at Standard Play (SP). Permanently label each DVD with the following information:

Project No.: _____	Contractor's Name:
Inspection Type: [ ] Survey	[ ] Pre-Installation [ ] Post-Installation
DVD No.: _____	Date Televised: _____ Date Submitted:
Address: UPS: _____	DWN:
Pipe Diameter: _____	Pipe Length:
Manhole No.: From _____	To

C. Pipe Inspection Camera: Produce a video using a pan-and-tilt radial-viewing pipe inspection camera that pans ☐275 degr
footage counter which displays on the monitor the exact distance of the camera from the centerline of the starting manhole. Use a camera with camera height adjustment so that the camera lens is always centered at one-half the inside diameter, or higher, in the pipe being televised. Provide a lighting system that allows the features and condition of the pipe to be clearly seen. A reflector in front of the camera may be required to enhance lighting in dark or large diameter pipe.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin cleaning until both upstream and downstream manholes have been checked for flow monitors and other mechanical devices.

3.02 PREPARATION

A. Cleaning:

1. Take precautions to protect sanitary sewer mains and manholes from damage that might be inflicted by the improper selection of cleaning processes or improper use of equipment. When using hydraulically-propelled devices take precautions to ensure that the water pressure created does not cause damage to or flooding of public or private property. Do not surcharge any sanitary sewer to an elevation that could cause overflow of sewage into area waterways, homes or buildings, or onto the surface.

2. Do not use or obstruct fire hydrants when there is a fire in the area. Remove water meters, fittings and piping from fire hydrants at the end of each working day.

3. Exercise care to prevent contamination of the potable water system. Use an appropriately sized backflow preventer as required by local regulations when drawing water from a public hydrant.

4. Where possible, use the flow of wastewater present in the sanitary sewer main to provide fluid for hydraulic cleaning devices.

B. Document results of video inspections using the Television Inspection Report form following this Section.

3.03 CLEANING

A. Conserve Water. Do not waste water from the Owner (public water supply) through poor connections, hydrants left open, or any other cause.

B. Collapsible Dams: Use collapsible dams for hydraulically-propelled devices which require a head of water to operate. Dam shall be easily collapsible to prevent damage to the sewer, public property and private property.

D. High Velocity Cleaning: Operate high-velocity cleaning equipment so that the pressurized nozzle moves continuously. Turn off or reduce the flow to the nozzle to prevent damage to the line any time the nozzle becomes stationary.

E. Mechanical Cleaning: In addition to normal cleaning equipment, perform mechanical cleaning when required and approved using equipment and accessories as defined in this Section.

F. Debris Disposal: Remove sludge, soil, sand, rocks, grease, roots and other solid or semi-solid material resulting from the cleaning operation at the downstream manhole of the section being cleaned. Passing debris from any sewer section to any other sewer section is not allowed. Load debris from the manholes into an enclosed container permitted by the Houston Health Department for liquid waste hauling. Remove solids and semi-solids

resulting from cleaning operations from the site and dispose them lawfully at the end of each work day. Do not accumulate debris, liquid waste, or sludge on the site except in totally enclosed containers approved by the Owner's Representative.

G. Disposal Sites: Dispose of waste at a lawfully-permitted disposal site using a transporter having a valid Liquid Waste Transporter Permit.

3.04 TELEVISION INSPECTION

A. Immediately after cleaning, televise the sanitary sewer line to document the condition of the line and to locate existing service connections. Notify the Owner's Representative 24 hours in advance of any television inspection so that the Owner's Representative may observe inspection operations.

B. Perform television inspection of sanitary sewers as follows:

1. Perform a survey television inspection on sanitary sewers within the boundary of the project, as directed by the Owner's Representative. After reviewing survey video, the Owner's Representative will determine which sanitary sewers will be rehabilitated or need additional work.

2. Videos shall pan beginning and ending manholes to show that all debris has been removed. Camera operator shall slowly pan each service connection, clamped joint and pipe material transition from one material to another. Complete and submit a Television Inspection Report for every sewer segment video submitted to the Owner's Representative.

C. Survey television inspection videos shall be continuous for pipe segments between manholes. Do not leave gaps in the video of a segment between manholes and do not show a single segment on more than one video, unless specifically allowed by the Owner's Representative.

3.05 FLOW CONTROL

A. Perform survey television inspection on one manhole section at a time. Adequately control the flow in the section being televised. Do not exceed the depth of wastewater flow shown below:

Pipe Diameter (Inches)	Depth of Flow (Percentage of Pipe Diameter)
6 - 10	10
12 - 24	15
Over 24	20

1. If during survey television inspection of a manhole section, the wastewater flow depth exceeds the maximum allowable, reduce the flow depth to an acceptable level

by performing the survey television inspection during minimum flow hours, by diversion pumping, or by pulling a camera with swab, high-velocity jet nozzle or other acceptable dewatering device. Video made while floating the camera is not acceptable unless approved by the Owner's Representative.

3.06 PASSAGE OF VIDEO CAMERA

A. Do not pull or propel the video camera through the line at a speed greater than 30 feet per minute.

B. If during survey television inspection of a manhole section, the camera is unable to pass an obstruction even though flow is unobstructed, televise the manhole section from the other direction (reverse setup) in order to obtain a complete video of the line. Whenever such a condition arises, notify the Owner's Representative. [No point repairs are authorized in this contract.] If a point repair is authorized, repair the pipe at the designated location and then re-televise the manhole section to verify completion of the point repair, unless waived by the Owner's Representative.

1. When the camera is being pulled from the other direction in order to survey on either side of an obstruction, and a second obstruction or repair location is encountered away from the first obstruction, notify the Owner's Representative and request a review of the videotape. The Owner's Representative may direct the Contractor to make one or both point repairs. No downtime shall be allowed.

2. If two point repairs are allowed and completed, re-televise the manhole section. Generally, up to 20 feet of the sewer pipe from the finished end of the first point repair to the starting end of the second point repair may be lamped or physically inspected to verify the condition of the sewer without further television inspection.

3. The Owner makes no guarantee that the sanitary sewer designated for survey television after cleaning is clear for the passage of the camera set-up. Select the appropriate equipment, tools and methods for securing safe passage of the camera.

3.07 TELEVISION INSPECTION REPORT

A. For each television inspection video, provide a completed Television Inspection Report, as provided by the Contractor and approved by the Owner's Representative. The Report is a written narrative log of pipe defects, sags and service connection locations and conditions, indexed to the footage counter. Fill out the Television Inspection Report as follows providing the Owner's Representative with a sample report and any inspection codes used prior to TV&I.

B. HEADER SECTION

1. ADDRESS UPS/DWN: The upstream and downstream address of the line segment; an alpha-numeric field with 6 spaces available for the street number and 21 spaces available for the street name (e.g., UPS: 2150 Sunnyland DWN: 2110 Sunnyland).

2. WORK ORDER NO.: Since this number will be provided by the Owner, this field shall be left blank. This is a numeric field with 10 spaces available.

3. VIDEO DATE: The date that the video was produced (same as the date shown on the display screen), a numeric field with 8 spaces available (e.g., 2/21/95).

4. LINE SEGMENT: The name of the line segment; an alpha-numeric field with 10 spaces available (e.g., Line "A").

5. VIDEO CONTRACTOR: The Video Contractor's name.

6. WEATHER: The existing weather conditions at the time that the video was made; an alpha-numeric field with 10 spaces available (e.g., Cloudy).

7. VIDEO NUMBER: Each Digital Video or DVD produced must have a number for identification, affixed to the label. This number must not be duplicated in the same project. This is an alpha-numeric field with 6 spaces available (e.g., IA0101).

8. TIME INDEX: The numeric location (time) of the line segment on the Digital Video or DVD; an alpha-numeric field with 6 spaces available for each number (e.g., 1336 to 2185).

9. SUMMARY:

    a. Use for additional information about the line segment as follows:

        1) Type of video (e.g., Post, Survey, Pre-Rehabilitation)

        2) General Contractor's Name

        3) Pipe Trade Name for PVC, PEP or FRP pipe (e.g., Hobas, Drisco 1000, Lamson Vylon, Quail).

        4) Rehabilitation System Manufacturer or Trade Name when applicable (e.g., Insituform, Inliner II, PIM System, McConnell Pipe Crushing, U Liner).

    b. Note information according to the following examples:

        1) Post/Cullum/FF/U Liner/Quail (a typical listing for a **Fold and Form** line segment).

2) Post/Insituform/CPP/Insituform (a typical listing for a **Cured-in-Place** line segment).

3) Post/McLat/PB/McConnell Pipe Crushing/Drisco 1000 (a typical listing for a **Pipeburst** line segment).

4) Post/Kinsel/SL/Hobas (a typical listing for a **Sliplined** line segment).

5) Post/Texas Sterling/RR/Lamson Vylon (a typical listing for a **Removed and Replaced** line segment).

11. LOCATION: The physical location of the line segment (for the line segment, not the manholes). If the line segment covers more than one location, then state the location at the majority of line segment. This is an alpha-numeric field with 2 spaces available (e.g., C).

12. SURFACE COVER: The type of surface that covers the majority of the line segment. This is an alpha field with only 1 space available (e.g., F).

a. PIPE SIZE: The inside diameter of the liner or pipe in inches, based on new pipe size, material and SDR; a numeric field with 6 spaces available, including 2 spaces for decimals (e.g., 6.58 IN).

14. PIPE TYPE: The pipe or liner type installed; an alpha field with 3 spaces available (e.g., PEP, CPP, PVC).

15. LENGTH: The length of the line segment, in feet. The length shown on the Television Inspection Report must be the same as the length shown on the video. Also, the length on the top portion of the Television Inspection Report shall match that shown on the bottom portion of the Television Inspection Report. This is a numeric field with 4 spaces available, with no decimals (e.g., 305 FT).

16. UPS DEPTH: The depth, measured from the top of the manhole frame of the upstream manhole to the invert of the upstream manhole, in feet and tenths of a foot; a numeric field with 3 spaces available, including one space for a decimal (e.g., 6.9 FT).

17. DWN DEPTH: The depth, measured from the top of the manhole frame of the downstream manhole to the invert of the downstream manhole, in feet and tenths of a foot; a numeric field with 3 spaces available, including one space for a decimal (e.g., 7.4 FT).

18. JOINT LENGTH: The pipe joint length, in inches. Show "0" joint length for CPP, FF and PEP line segments (since they have no joints). This is an alpha field with 2 spaces available (e.g., 40 IN).

19. FLOW DEPTH: The pipe or liner flow depth shall be placed in this field. The unit of measure is inches. This is a numeric field with 3 spaces available, which includes one decimal place (e.g., 2.5 IN).

20. MASTER VIDEO NO.: Contractor's master video number (if one exists).

21. REVERSE SET UP: When a reverse set up is done on a line segment, check "yes"; if not check "no".

22. SKETCH: If a sketch of the line segment is included check "yes"; if not check "no".

23. PRIOR HISTORY: If any prior information exists on this line segment check "yes"; if not check "no".

24. EVALUATION VIDEO: If the Television Inspection Report is for line segment evaluation or survey purpose, indicate "yes"; if not indicate "no".

25. PRE-REHAB VIDEO: If the Television Inspection Report is for pre-installation video inspection to show that the line is ready for rehabilitation, indicate "yes"; if not indicate "no".

26. POST-REHAB VIDEO: If the Television Inspection Report is for post-rehab video inspection to document completion of the rehabilitation work, indicate "yes"; if not indicate "no".

27. LINE DETERIORATION: Indicate here the existence and extent of pipe deterioration,. If no deterioration, indicate "N"; if deterioration is light, indicate "L"; if medium, indicate "M"; if heavy, indicate "H".

28. DIRECTION OF FLOW: Indicate the direction of flow in the line segment. Typically, the larger number is the upstream manhole and the smaller number is the downstream manhole. Do not reverse the manhole designation; if a reverse set up is shown, check the "Reverse Setup" box.

C. CODE INPUT SECTION

1. TELEVISION INSPECTION CODES: Codes to be used in reports are to be submitted and defined on the Television Inspection Codes sheet (attached with the television inspection report).

2. FOOTAGE READING U/D: Show the up/down designation under the section titled "Footage Reading" in the boxes marked "U" and "D". This will make it clear what direction footage is measured from.

3. CLOCK POSITION: Show the clock position, with 12 o'clock straight up, of each defect (e.g., 12:00, 3:00). Also, show the clock position of each service connection and state the condition of the connection. Include the distance the connection is protruding into the pipe, when appropriate, and the type of connection, such as "plumber service".

4. CRACKS: List cracks in the pipe Television Inspection Codes. Report the size (length and width) of all cracks.

5. JOINTS: List misaligned and broken joints using Television Inspection Codes.

6. LATERALS: List all laterals using Television Inspection Codes.

7. ROOTS: List any root intrusions into the pipe using Television Inspection Codes.

8. DEBRIS: List any debris in the pipe using Television Inspection Codes.

9. INFLOW/INFILTRATION: Report any inflow and infiltration using Television Inspection Codes.

10. ALIGNMENT: Report the existence of any sags in the field using Television Inspection Codes. Report the beginning of sags for one-quarter pipe, one-half pipe and underwater, as well as where the camera pulls out of the sag.

11. STRUCTURAL: Report structural condition of the pipe using Television Inspection Codes.

12. PICTURE NO.: Leave this field blank.

13. COMMENTS: Place comments in this field. Comments must be accompanied by a corresponding footage reading. Items to report in this field: collapses in pipe, stabilized material, mineral deposits, changes in pipe material, reverse setup, drop stack, large voids, multiple cracks, when unable to continue video, etc.

14. CLAMP/SPLICE LOCATION: The clamp/splice location shall be shown in the Comments field. Clamp/splice location must be accompanied by a footage reading.

15. START SURVEY AT M.H. XYZ: Note the depth of the line segment in the Comments field. (e.g., "Start Survey at M.H. 021 - Line Depth 10.2 FT"). Measure depth from the top of the manhole frame to the invert of the pipe being televised in feet and tenths of a foot. (This depth may be different from the manhole depth).

16. END OF SURVEY AT M.H. XYZ: Note the depth of the line segment in the Comments field (e.g., End Survey at M.H. 022 - Line Depth 10.8 FT). Measure depth from the top of the manhole frame to the invert of the pipe being televised in feet and tenths of a foot. (This depth may be different from the manhole depth).

3.08 FIELD QUALITY CONTROL

A. Do not under any circumstances, allow sewage or solids removed in the cleaning process to be released onto streets or into ditches, catch basins, cleanouts, storm drains, or sanitary or storm sewer manholes.

B. Acceptance of sewer cleaning work is subject to successful completion of the television inspection. If the television inspection shows solids, soil, sand, grease, grit, or other debris remaining in the line, cleaning will be considered unsatisfactory. Repeat cleaning, inspection, and video of the sewer line until cleaning is judged satisfactory by the Owner's Representative.

3.09 MANHOLE REPAIR

A. Repair manholes dismantled or damaged during the cleaning process, and replace manhole frames and covers damaged during the cleaning process. No separate pay.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Geotextile, also called filter fabric in applications such as pipe embedment wrap, around the exterior of a tunnel liner, around the foundations of pipeline structures, and slope stabilization.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. AASHTO M 288 - Standard Specification for Geotextiles.

B. ASTM D 3776 - Standard Test Methods for Mass per Unit Area (Weight) of Woven Fabric.

C. ASTM D 3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Non-Woven Fabrics - Diaphragm Bursting Tester Method.

D. ASTM D 3787 - Test Methods for Bursting Strength of Knitted Good Constant Rate of Traverse (CRT Ball Burst Test).

E. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

F. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

G. ASTM D 4632 - Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).

H. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of Geotextiles.

I. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

J. Corps of Engineers, COE CW - 02215 - Geotextiles Used As Filters.

1.04 SUBMITTALS

A. Submit the standard manufacturer's catalog sheets and other pertinent information, for approval, prior to installation. At a minimum, the submitted material must document adherence to the referenced standards and the property requirements in Section 2 of this specification.

B. Submit installation methods, as a part of the work plan for tunneling or for excavation and backfill for utilities. Obtain approval from Engineer for filter fabric material and the proposed installation method prior to use of the filter fabric.

PART 2 - PRODUCTS

2.01 GEOTEXTILE

A. Provide a geotextile (filter fabric) designed for use in geotechnical applications. The filter fabric shall provide a permeable layer or media while retaining the soil matrix.

B. Use fabric which meets the physical requirements for Class A subsurface drainage installation conditions as defined in AASHTO M 288 and as specified in Paragraph 2.02, Properties.

2.02 PROPERTIES

A. Material: Nonwoven, nonbiodegradable, fabric consisting only of continuous chain polymer filaments or yarns, at least 85 percent by weight polyolefins, polyesters or polyamide, formed into a dimensionally stable network.

B. Chemical Resistance: Inert to commonly encountered chemicals and hydrocarbons over a pH range of 3 to 12.

C. Physical Resistance: Resistant to mildew and rot, ultraviolet light exposure, insects and rodents.

D. Minimum Test Values:

Property	Value (Min.)	Test Method
Grab Strength	180 lbs.	ASTM D 4632
Trapezoidal Tear Strength	50 lbs.	ASTM D 4533
Puncture Strength	80 lbs.	ASTM D 4833
Mullen Burst Strength	290 psi.	ASTM D 3786
Apparent Opening Size(1)	0.25 mm	ASTM D 4751
Permittivity	0.2 (sec^{-1})	ASTM D 4491

(1) Maximum average roll value.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Polyethylene wrap for cast and ductile iron pipe, valves, fittings and other appurtenances to be used only in open-cut construction when cathodic protection system is not required by Drawings.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCE

A. ASTM D1248 - Polyethylene Plastics Molding and Extrusion Materials.

B. AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.

1.04 SUBMITTALS

A. Submit the standard manufacturer's catalog sheets and other pertinent information, for approval, prior to installation. At a minimum, the submitted material must document adherence to the referenced standards and the property requirements in Section 2 of this specification.

B. Submit installation methods, as a part of the work plan for tunneling or for excavation and backfill for utilities. Obtain approval from Engineer for filter fabric material and the proposed installation method prior to use of the filter fabric.

PART 2 - P R O D U C T S

2.01 MATERIALS

A. Polyethylene Film: Tubular or sheet form without tears, breaks, holidays or defects; in accordance with ASTM D1248 and AWWA C105, Type I, Class C, Category 5, Grade J-3, 2.5 to 3 percent carbon black content.

B. Polyethylene Tape: Provide 3-inch wide, plastic-backed, adhesive tape; Polyken No. 900, Scotchwrap No. 50, or equal.

C. Polyethylene Film for sanitary force mains shall have the following characteristics:

1. 8 mil minimum thickness and minimum tensile strength of 1200 to 2500 psi with elongation up to 600 percent.

2. Dielectric strength of 500 to 850 volts per mil thickness.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Remove all lumps of clay, mud, cinders, etc., on pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

2. Fit polyethylene film to contour of pipe to effect a snug, but not tight, encasement with minimum space between polyethylene and pipe. Provide sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.

3. For installations below water table and/or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap.

B. Tubular Type (Method A):

1. Cut polyethylene tube to length approximately 2 feet longer than pipe section. Slip tube around pipe, centering it to provide 1-foot overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears pipe ends.

2. Lower pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene tube.

3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of new length of pipe, and secure in place. Then slip end of polyethylene from new pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points.

4. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Tubular Type (Method B):

1. Cut polyethylene tube to length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end.

Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.

2. Before making up joint, slip 3-foot length of polyethylene tube over end of preceding pipe section, bunching it accordion-fashion lengthwise. After completing joint, pull 3-foot length of polyethylene over joint, overlapping polyethylene previously installed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

D. Sheet Type:

1. Cut polyethylene sheet to a length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching it until it clears pipe ends. Wrap polyethylene around pipe so that it circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.

2. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

E. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.

F. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet under appurtenance and bringing it up around body. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

G. Repairs: Repair any cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

H. Openings in Encasement: Provide openings for branches, service taps, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with any resulting damaged areas being repaired as described above.

I. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or ductile iron pipe.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the disinfection of newly installed waterlines conveying potable water on the initial filling of pipe prior to being placed into service. This Section also includes the disinfection of connections to existing service lines. Water for disinfection to be provided by the Contractor unless otherwise shown on Plans.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. AWWA C651 - Standard for Disinfecting Water Mains (Latest Version)

B. TCEQ - Chapter 290 - Drinking Water Standards Governing Drinking Water Quality and Reporting Requirements for Public Water Supply Systems

1.04 SUBMITTALS

A. Submit sample and test requirements and include the information as further described under paragraph 3.02 Field Quality Control of this Specification Section.

B. Submit Testing Procedures/Plans as indicated in Appendix A, Chlorine Residual Testing of AWWA C651.

C. Submit Disposal of Heavily Chlorinated Water Procedures as indicated in Appendix B of AWWA C651.

PART 2 - PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

Chlorination agents to be in accordance with AWWA C651.

PART 3 - EXECUTION

3.01 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. Disinfecting procedures to be in accordance with the requirements of AWWA C651 and as specified hereinafter.

1. Minimal chlorine dosage to be 50 mg/l. Retain chlorine water in system until

completion of hydrostatic tests.

2. Minimum retention period to be 24 hours.

3. Open and close valves in line being disinfected several times during the contact period.

4. Following chlorination, flush treated water from piping until replacement water has chlorine content not more than 0.1 mg/l in excess of residual in water from supply line, and in any event not more than 0.2 mg/l total.

B. Furnish pump, pipe connections, and necessary apparatus, gauges, and meters. Furnish necessary labor, assistance, and chlorinating agent for disinfection. Prevent admission of contaminated water to previously disinfected lines. If contaminated water is admitted to previously disinfected lines, disinfect those lines at no additional cost to Owner.

C. Application of chlorine to be in accordance with AWWA C651 Table 4 for the size pipe indicated.

3.02 FIELD QUALITY CONTROL

A. Samples are to be taken in accordance with AWWA C651.

B. Bacterial analysis and other specific test requirements are to be in accordance with TCEQ Chapter 290 and submitted for final analysis and approval. The Engineer is to be present during water purge for the samples required.

C. Acceptance and placement in service will be based on the test results, which must adhere to the requirements of TCEQ Chapter 290. If additional tests are required to comply with TCEQ 290, the procedure is to be completed in accordance with paragraph 3.01. Additional testing is to be completed at no additional cost to the Owner.

END OF SECTION

PART 1 - G E N E R A L

1.01 DESCRIPTION

A. This Section includes furnishing and performing all operations in connection with hydrostatic testing of all pressure lines. Testing to be completed after pipe installation and backfilled, except prior to replacement of pavement, newly laid pipe to be subjected to hydrostatic testing described hereinafter.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 SUBMITTALS

A. Submit all hydrostatic testing results.

PART 2 - P R O D U C T S – NOT USED

PART 3 - E X E C U T I O N

3.01 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. Performance and Design Test Requirements

1. Test Pressure

Any section being tested, apply pressure such that, at highest point in section, pressure to be 125 pounds per square inch or pressures as shown on Plans.

2. Permissible Leakage

Leakage not to exceed that determined from the following formula:

$$Q = \frac{LD\sqrt{P}}{148{,}000}$$

Where Q = is the quantity of makeup water, in gallons per hour;
L = is the length of pipe section being tested, in feet;
D = is the nominal diameter of pipe, in inches; and
P = is the average test pressure during the hydrostatic test, in pounds per square inch

3. Leakage Defined

Leakage is quantity of water supplied into newly laid pipe, or any valved section thereto, necessary to maintain specified leakage test pressure after pipe has been filled with water and air expelled and the specified test pressure has been applied.

4. Duration of Pressure Test

Exposed joints to be tested for not less than 2 hours with no allowable leakage. Covered joints to be tested for a minimum of 6 hours. If leakage at the end of the 6-hour period exceeds the allowable by less than 25 percent, test to continue for not less than 18 additional hours.

B. Testing

1. Procedure

Fill each valved section of pipe slowly with water and apply specified test pressure, measured at point of highest elevation, by means of pump connected to pipe. Furnish pump, pipe connections, and necessary apparatus, gauge, and meters. Furnish necessary labor and assistance for conducting test, all subject to approval by Engineer.

2. Expelling Air Before Test

Before applying specified test pressure, expel air from pipe. To accomplish, make taps in pipe, if necessary, at points of highest elevation. On completion of tests, taps to be tightly plugged with brass fittings.

3. Examining Under Pressure

At intervals during test, inspect route of pipe to disclose leakage greater than that specified; locate and repair defective joints or defective pipe until test demonstrates that leakage is within specified allowance.

All repairs or replacement required to satisfy testing requirements is to be completed by the Contractor at no additional cost to the Owner.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Fence framework, fabric, and accessories.

B. Excavation for post bases, concrete foundation for posts.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. ASTM A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

B. ASTM A 116 - Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.

C. ANSI/ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A 392 - Zinc-Coated Steel Chain-Link Fence Fabric.

F. ASTM A 428 - Weight of Coating on Aluminum-Coated Iron or Steel Articles.

G. ANSI/ASTM F 567 - Installation of Chain-Link Fence.

H. ASTM C 94 - Ready-Mixed Concrete.

I. ASTM F 573 - Residential Zinc-Coated Steel Chain Link Fence Fabric.

J. ASTM F 668 - Poly (Vinyl Chloride) (PVC) Coated Steel Chain Link Fence Fabric.

K. ASTM F 900 – Industrial and Commercial Swing Gates

L. ASTM F 1043 – Strength and Protective Coating on Metal Industrial Chain Link Frame Work

M. ASTM F 1083 – Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

N. ASTM F 1184 – Industrial and Commercial Horizontal Slide Gates

O. Chain Link Fence Manufacturers Institute (CLFMI) - Product Manual.

P. FS RR-F-191 - Fencing, Wire and Post Metal (and Gates, Chain Link Fence Fabric, and

Accessories).

1.04 SYSTEM DESCRIPTION

A. Fence height shall be as indicated on Drawings or if not indicated on drawings to match height of existing.

B. Extension arms for barbed wire shall match existing, if not indicated on drawings.

C. Line post spacing shall not exceed distance indicated in the installation portion of this specification, or as shown on Drawings.

1.05 SUBMITTALS

A. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

B. Product Data: Provide data on fabric, posts, accessories, fittings, and hardware that indicates that items adhere to the specifications and match or exceed the quality of existing items.

C. A statement signed by the contractor, verifying that the field measurements are as indicated on the shop drawings.

D. A statement signed by the manufacturer indicating that they have a minimum of 3 years experience manufacturing the products specified in this section.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years experience.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

PART 2 – P R O D U C T S

2.01 GALVANIZED FENCING

A. Fence fabric shall be No. 9 steel wire, hot galvanized after weaving with a minimum coating of 2 ounces/sf, or one ounce/sf plus 30 micrograms/square-inch chromate conversion coating. Top and bottom to be twisted and barbed.

B. Barbed wire to be 3 lines of wire mounted on extension arms and conforming to ASTM A121, No. 12-1/2 W&M gage wire, with 4-point barbs, and Class 3 zinc coating. Space barbs 3-inches apart.

C. Tension wire shall be hot dipped galvanized, Type II Zinc-Coated, ASTM A817 Class 5 – 2.0 oz/ft^3, 7 gauge (0.177 in.) wire.

D. Framework shall be hot-dipped galvanized with a minimum coating of 2 ounces/sf, or one ounce/sf plus 30 micrograms/square-inch chromate conversion coating.

E. Line posts shall conform to ASTM F 1083, cold steel. Line posts shall be 2-3/8" (2.375-inch O.D.) diameter galvanized schedule 40 (min) steel pipe, minimum weight 3.65 pounds per foot.

F. End, corner, angle, and pull posts shall conform to ASTM F 1083, cold rolled steel for steel pipe. Posts shall be nominal 2-7/8" (2.875-inch O.D.) diameter galvanized schedule 40 (min) steel pipe.

G. Gates posts shall conform to ASTM F 1083, cold steel. Gate posts shall be 4" diameter galvanized schedule 40 (min) steel pipe.

H. Top rails and horizontal braces shall be 1-5/8-inch outside diameter steel pipe, 2.27 lbs/ft conforming to ASTM F 1083. Top rails shall pass through openings provided for that purpose in post tops.

I. Barbed wire extension arms to be standard 45 degree, one-piece, three wire capacity, with steel conforming to ASTM A36/A36M.

J. Fabric ties shall be hog rings, galvanized steel wire not less than 9-gauge with a zinc coating of not less than 1.2 ounces/sf.

K. Bolts and nuts shall be in conformance with ASTM A 307 and shall be galvanized in accordance with AASHTO M 232.

L. Install horizontal braces fabricated of 1-5/8-inch, 2.27-lb copper bearing steel pipe at all corner, gate, and end posts.

M. Hot-dip galvanize component metal parts of fence not covered by ASTM specifications above with minimum standard zinc coating in accordance with ASTM A153.

2.02 SWING OR SLIDE GATES

A. Gates shall be either swing or slide as shown on the plans. Swing gates shall conform to ASTM F 900 except as modified by these specifications. Slide gates shall conform to ASTM F 1084 except as modified by these specifications.

1. Swing gates shall be hinged to swing 90 degrees from closed to open or hinged to swing 180 degrees from close to open.

2. Slide gates shall be roller type with no vertical obstructions.

B. All gate leaves shall have intermediate members and 3/8" diameter diagonal stress rods as required

for rigid construction and shall be free from sag or twist.

C. All gates shall be fitted with vertical extension arms or shall have frame end member extended to carry barbed wire.

D. Gate frames and intermediate members shall be made of 1-7/8-inch outside diameter, castings.

E. Fabric shall be the same as for the fence.

F. Gates shall have malleable iron ball and socket hinges, catches, and stops.

G. Posts for single pedestrian gates shall be the same as end posts.

2.03 WOODEN FENCING (NOT USED)

2.04 ELECTRIC GATE OPERATOR (NOT USED)

PART 3 – EXECUTION

3.01 INSTALLATION (GALVANIZED FENCING)

A. Install chain link fence in accordance with the directions of the manufacturer and these Specifications.

B. Install fence posts at not more than 10-foot centers and at least 36 inches into the concrete base which extends a minimum of 40-inches into the ground in a concrete base. Allow concrete to cure for at least 7 days before erecting remainder of fence. Fasten fabric to line posts with wire ties spaced about 14-inches apart and to top rail spaced about 24-inches apart.

C. Use standard chain link fence stretching equipment to stretch the fabric before tying it to the rails and posts. Repeat the stretching and tying operations about every 100-feet.

D. Provide gate stops, gate catches and gate enter drop rod and assemble for each gate.

E. Erect gates so they swing or slide in the appropriate direction. Secure hardware, adjust, and leave in perfect working order. Adjust hinges and diagonal bracing so that gates will hang level. Adjust rollers and guides of sliding gates so that gates are level.

F. At small natural or drainage ditches where it is not practical for the fence to conform to the contour of the ground, span the opening below the fence with wire fastened to stakes of required length. The finished fence shall be plumb, taut, true to line and ground contour. When directed, stake down the chain link fence at several points between posts.

G. Where new fence joins an existing fence, set a corner post and brace post at the junction and brace as directed. If the connection is made at other than the corner of the new fence the contractor shall

install a brace and tension rod in the last span of the old fence.

H. The finished fence shall be plumb, true to line and ground contours.

I. Join top rails with suitable sleeve-type couplings, making rigid connections with provisions for expansion and contraction. Pass rail through base of line post barbed wire extension arm and fasten securely to terminal post.

J. Brace all terminal posts with brace member securely fastened to terminal and first line post. Tie terminal post, near ground line, to line post at brace member with steel tension rod of 3/8-inch minimum diameter, complete with turnbuckle.

K. Provide hole in barbed wire extension arms for top rail on line posts and for connection of top rail at corner posts. Extension arm to be capable of supporting 300-pound load at end of mounted arm.

L. Securely fasten chain link fence wire fabric as follows:

1. To terminal posts using 1/4-inch x 3/4-inch tension bars with 11-gage pressed steel bands spaced approximately 14-inches apart.
2. To line posts with 6-gage wire clips spaced approximately 14-inches apart.
3. To top rail with 9-gage tie wire spaced approximately 24-inches apart.

3.02 INSTALLATION (WOODEN FENCING) (NOT USED)

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Design, construction, erection and removal of structural concrete formwork.

1.02 UNIT PRICES

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 347 - Recommended Practice for Concrete Formwork.

C. U.S. Product Standard PS 1 Construction and Industrial Plywood.

D. U.S. Product Standard PS 20 American Softwood Lumber Standard.

1.04 SUBMITTALS

A. Shop Drawings: Show location, member size and loading of shoring. When reshoring is permitted, submit plans showing locations and member size of reshoring.

B. Product Data and Samples:

1. Corrugated Fiberboard Carton Forms: Submit certification of compliance with design criteria, description of forms, and one-foot-long sample.

2. Form-coating Materials: Submit trade or brand names of manufacturers and complete description of products.

3. Form ties and related accessories, including taper tie plugs, if taper ties are used. Form gaskets.

C. Detailed Layout for Slip-forming: Submit detailed layout of proposed slipforming, including description of equipment, rate of progress, and other data to show suitability of method. Show provisions for ensuring attainment of required concrete surface finish.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Smooth Forms: New plywood, metal, plastic, tempered concrete-form hardboard,

dressed lumber faced with plywood or fiberboard lining, or metal-framed plywood-faced panel material, to provide continuous, straight, smooth surfaces. Form material shall be free of raised grain, torn surfaces, worn edges, patches, dents or other defects. Furnish material in largest practical sizes to minimize number of joints and, when indicated on Drawings, conform to joint system indicated. Form material shall have sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.

B. Rough Forms: Plywood, metal, dressed or undressed lumber free of knots, splits or other defects, or other material acceptable to Owner's Representative of sufficient strength and thickness to withstand pressure of newly placed concrete without bow or deflection.

C. Plywood: Conform to PS 1, Class 1.

D. Lumber: Conform to PS 20.

E. Edge Forms and Intermediate Screed Strips: Type and strength compatible with the screed equipment and methods used.

F. Plastic Forms: One-piece forms for domes, beams and pan joists. Single lengths for columns not exceeding height of 7 feet 6 inches. For columns over 7 feet 6 inches, use 7-foot 6-inch sections and filler sections as needed. To facilitate removal of pan joist forms, taper sides one inch per foot.

G. Metal Pan Joist Forms: Removable type; fabricated of minimum 14-gauge steel; one piece between end closures. Adjustable forms not allowed. Taper sides one inch per foot to facilitate removal.

H. Earth Cuts for Forms:

1. Use earth cuts for forming unexposed sides of grade beams cast monolithically with slabs on grade.

2. Where sides of excavations are stable enough to prevent caving or sloughing, following surfaces may be cast against neat-cut excavations:

a. Sides of footings.

b. Inside face of perimeter grade beams not monolithic with slab on grade. When inside face is cast against earth, increase beam width indicated on Drawings by one inch.

c. Both faces of interior grade beams not monolithic with slab on grade. When grade beam is cast against earth, increase beam width indicated on Drawings by 2 inches.

I. Corrugated Fiberboard Carton Forms:

1. Corrugated fiberboard carton forms, when called for, are intended to form a void space beneath pile-supported and pier-supported slabs and other structural elements as shown.

2. Provide products of a reputable manufacturer regularly engaged in commercial production of double-faced corrugated fiberboard carton forms, constructed of waterproof paper and laminated with waterproof adhesive.

3. Fiberboard forms: Capable of supporting required dead load plus construction loads, and designed to lose their strength upon prolonged contact with moisture and soil bacteria.

4. Seal cuts and ends of each form section by dipping in waterproof wax, unless liners and flutes are completely impregnated with waterproofing.

5. Size forms as indicated on Drawings. Assemble as recommended by manufacturer, either with steel banding at 4 feet 0 inches maximum on centers, or, where liners and flutes are impregnated with waterproofing, with adequate stapling.

J. Circular Forms:

1. Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Provide manufacturer's seamless units to minimize spiral gaps and seams.

2. Fiberglass or steel forms may be used for round-section members.

K. Shores: Wood or adjustable metal, with bearing plates; with double wedges at lower end.

L. Form Ties:

1. Use commercially-manufactured ties, hangers and other accessories for embedding in concrete. Do not use wire not commercially fabricated for use as a form accessory.

2. Fabricate ties so ends or end fasteners can be removed without causing spalling of concrete faces. Depth from formed concrete face to the embedded portion: At least 1 inch, or twice the minimum dimension of tie, whichever is greater.

3. Provide waterstop feature for form ties used on liquid-containing structures and on concrete walls which will have earth backfill on one side.

4. Removable ties: Taper ties may be used when approved by the Owner's Representative. In the hole left by the removal of the taper tie, insert a preformed neoprene or polyurethane plug sized to seat at the center of the wall.

M. Form Coating: Commercial formulation of form oil or form-release agent having proven satisfactory performance. Coating shall not bond with, stain or otherwise adversely affect concrete surfaces, or impair their subsequent treatment, including application of bonding agents, curing compounds, paint, protective liners and membrane waterproofing.

N. Coating for Plastic Forms: Alkali-resistant gel-coat.

O. Chamfer Strips: Unless otherwise indicated on Drawings, provide 3/4-inch chamfer strips in corners of forms to produce beveled edges where required by Part 3, Execution.

P. Form Gaskets: Polyethylene rod, closed cell, one-inch diameter.

2.02 DESIGN OF FORMWORK

A. Conform to ACI 117, ACI 347 and building codes adopted by local, county or states as applicable, unless more restrictive requirements are specified or shown on Drawings. Contractor shall design and engineer concrete formwork, including shoring and bracing. Design formwork for applicable gravity loads, lateral pressure, wind loads and allowable stresses. Camber formwork to compensate for anticipated deflection during placement of concrete when required to maintain specified tolerances. Design formwork to be readily removed without impact, shock or damage to concrete surfaces and adjacent materials.

B. Slip Forming: Permitted on written approval of Owner's Representative. Contractor shall demonstrate suitability of method proposed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Formwork Construction

1. Construct and maintain formwork so that it will maintain correct sizes of members, shape, alignment, elevation and position during concrete placement and until concrete has gained sufficient strength. Provide for required openings, offsets, sinkages, keyways, recesses, moldings, anchorages and inserts.

2. Construct forms for easy removal without damage to concrete surfaces.

3. Make formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins. Provide gaskets for wall forms to prevent concrete paste leakage at their base.

4. Place chamfer strips in forms to bevel edges and corners permanently exposed to view, except top edges of walls, and slabs which are indicated on Drawings to be tooled. Do not bevel edges of formed joints and interior corners unless indicated on Drawings. Form beveled edges for vertical and horizontal corners of equipment bases. Unless otherwise indicated on Drawings, make bevels 3/4 inch wide.

5. Provide temporary openings at bases of column and wall forms and other points as required for observation and cleaning immediately before concrete is placed.

6. Where runways are required for moving equipment, support runways directly on the formwork or structural members. Do not allow runways or supports to rest on reinforcing steel.

7. Use smooth forms on formed concrete surfaces required to have smooth form finish or rubbed finish as specified in Section 03350 - Concrete Finishing.

8. Rough forms may be used on formed concrete surfaces indicated to have rough form finish as specified in Section 03350 - Concrete Finishing.

B. Forms for Surfaces Requiring Smooth Form Finish:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Uniformly space form ties and align in horizontal and vertical rows. Install taper ties, if used, with the large end on the wet face of the wall.

2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back up joints with extra studs or girts to maintain true, square intersections.

3. Form molding shapes, recesses and projections with smooth-finish materials and install in forms with sealed joints to prevent displacement.

4. Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines.

5. Provide exterior exposed edges with 3/4-inch chamfer or 3/4-inch radius.

6. Arrange facing material in orderly and symmetrical fashion. Keep number of joints to practical minimum. Support facing material adequately to prevent deflection in excess of allowable tolerances.

7. For flush surfaces exposed to view in completed structure, overlap previously-placed hardened concrete with form sheathing by approximately 1 inch. Hold forms against hardened concrete to maintain true surfaces, preventing offsets or loss of mortar.

C. Forms for Surfaces Requiring Rubbed Finish: Provide forms as specified in Paragraph 3.01B, Smooth Form Finish. Use smooth plywood or fiberboard linings or forms, in as large sheets as practicable, and with smooth, even edges and close joints.

D. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure supports for types of screeds required.

E. Circular Forms: Set forms in one piece for full height of member.

F. Surfaces to Receive Membrane Waterproofing: Coordinate surface finish, anchors, reglets and similar requirements with membrane waterproofing applicator.

G. Fireproofing Steel Member: Construct forms to provide not less than the concrete thickness necessary, measured from face of steel member, to provide the required fire rating. Forms for concealed surfaces may be unlined.

H. Tolerances:

1. Unless noted otherwise on Drawings, construct formwork so concrete surfaces will conform to tolerance limits listed in Tables 03100A and 03100B at end of this Section.

2. Establish sufficient control points and bench marks as references for tolerance checks. Maintain these references in undisturbed condition until final completion and acceptance of the Work.

I. Adjustment of Formwork:

1. Use wedges or jacks to provide positive adjustment of shores and struts. After final inspection and before concrete placement, fasten in position wedges used for final adjustment of forms.

2. Brace forms securely against lateral deflections. Prepare to compensate for settling during concrete placement.

3. For wall openings, construct wood forms that facilitate necessary loosening to counteract swelling of forms.

J. Corrugated Fiberboard Carton Forms:

1. Place on smooth firm bed of suitable material to prevent vertical displacement; set tight to prevent horizontal displacement. Exercise care to avoid buckling of forms. Install in accordance with manufacturer's directions and recommendations.

2. Fit carton forms tightly around piles and piers; completely fill the space between subgrade and concrete placement with carton forms to form a void space.

3. Protect carton forms from moisture and maintain in a dry condition until concrete is placed on them. If they become wet before placement of concrete, allow them to dry and carefully inspect for strength before concrete is placed.

4. Before concrete placement, replace damaged or deteriorated forms which are incapable of supporting concrete dead load plus construction live loads.

3.02 PREPARATION OF FORM SURFACES

A. Clean surfaces of forms and embedded materials before placing concrete. Remove accumulated mortar, grout, rust and other foreign matter.

B. Coat forms for exposed or painted concrete surfaces with form oil or form-release agent before placing reinforcement. Cover form surfaces with coating material in accordance with manufacturer's printed instructions. Do not allow excess coating material to accumulate in forms or to contact hardened concrete against which fresh concrete will be placed. Remove coating material from reinforcement before placing concrete.

C. Forms for unexposed surfaces, other than retained-in-place metal forms, may be wet with water immediately before concrete placement in lieu of coating. When possibility of freezing temperatures exists, however, the use of coating is mandatory.

3.03 REMOVAL OF FORMS

A. Time Limits:

1. When repair of surface defects or finishing is required before concrete is aged, forms on vertical surfaces may be removed as soon as concrete has hardened sufficiently to resist damage from removal operations.

2. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete. Leave formwork for water-retaining structures in place for at least 2 days. Formwork for non-water-retaining columns, walls, sides of beams and other formwork components not supporting weight of concrete may be removed after 12 hours, provided concrete has hardened sufficiently to resist damage from removal operations, and provided removal of forms will not disturb members supporting weight of concrete.

3. Forms and shoring supporting weight of concrete or construction loads: Leave in place until concrete has reached minimum strength specified for removal of forms and shoring. Do not remove such forms in less than 4 days.

B. Circular Paper or Spiral Tube Forms: Follow manufacturer's directions for form removal. Take necessary precautions to prevent damage to concrete surface. When removal is done before completion of curing time, replace form, tie in place and seal to retard escape of moisture.

C. Removal Strength:

1. Control Tests: Suitable strength-control tests will be required as evidence that concrete has attained specified strength for removal of formwork or shoring supporting weight of concrete in beams, slabs and other structural members. Furnish test cylinders and data to verify strength for early form removal.

a. Field-cured Test Cylinders: When field-cured test cylinders reach specified removal strength, formwork or shoring may be removed from respective concrete placements.

b. Laboratory-cured Test Cylinders: When concrete has been cured as specified for structural concrete for same time period required by laboratory-cured cylinders to reach specified strength, formwork or shoring may be removed from respective concrete placements. Determine length of time that concrete has been cured by totaling the days or fractions of days, not necessarily consecutive, during which air temperature surrounding concrete is above 50 degrees F and concrete has been damp or thoroughly sealed against evaporation and loss of moisture.

2. Compressive Strengths: The minimum concrete compressive strength for removal of formwork supporting weight of concrete is 75 percent of specified minimum 28-day strength for class of concrete involved.

3.04 RESHORING

A. When reshoring is permitted, plan operations in advance and obtain Owner's Representative's approval of such operations. While reshoring is under way, keep live load off new construction. Do not permit concrete in any beam, slab, column or other structural member to be subjected to combined dead and construction loads in excess of loads permitted for developed concrete strength at time of reshoring.

B. Place reshores as soon as practicable after form-stripping operations are complete but in no case later than end of day on which stripping occurs. Tighten reshores to carry required loads without over stressing construction. Leave reshores in place until tests representative of concrete being supported have reached specified strength at time of removal of formwork supporting weight of concrete.

C. Floors supporting shores under newly-placed concrete: Leave original supporting shores in place, or re-shore. Locate reshores directly under shore position above. Extend reshoring over a sufficient number of stories to distribute weight of newly-placed

concrete, forms and construction live loads in such manner that design superimposed loads of floors supporting shores are not exceeded.

3.05 FORM REUSE

A. Do not reuse forms that are worn or damaged beyond repair. Thoroughly clean and recoat forms before reuse. For wood and plywood forms to be used for exposed smooth finish, sand or otherwise dress concrete contact surface to original condition or provide form liner facing material. For metal forms, straighten, remove dents and clean to return forms to original condition.

3.06 GENERAL CONSTRUCTION NOTES

A. Methods, procedures and sequences of construction are the responsibility of the Contractor. The Contractor shall take all necessary precautions to maintain and insure the integrity of the structure at all stages of construction.

B. Refer to the mechanical drawings for sleeves, curbs, inserts, etc. not indicated on structural drawings. Openings in slabs with a maximum side dimension of 10 inch diameter or less shall not require additional framing or reinforcement unless noted otherwise. The Structural Engineer shall approve the location of sleeves or openings in structural members.

C. All erection procedures shall conform to OSHA standards, any deviation must be approved by OSHA prior to erection.

D. The structural integrity of any structure relies on the full interaction of all its component parts, with no provisions made for conditions and/or sequences of construction and the structural design is based on this premise. Therefore, the contractor shall provide adequate bracing of superstructure during construction.

Table 03100A

TOLERANCES FOR FORMED SURFACES CONCRETE IN BUILDINGS**				
VARIATION FROM	VARIATION IN	FOR ANY 10-FOOT LENGTH	FOR ANY 20-FOOT LENGTH OR ANY BAY	MAXIMUM FOR ENTIRE DIMENSION
PLUMB OR SPECIFIED BATTER	LINES AND SURFACES OF COLUMNS, PIERS, WALLS AND ARRISES	1/4"	---	1"
	EXPOSED CORNER COLUMNS, CONTROL JOINT GROOVES, AND OTHER CONSPICUOUS LINES	---	1/4"	1/2"
LEVEL OR SPECIFIED GRADE	SLAB SOFFITS, CEILINGS, BEAM SOFFITS, AND ARRISES (MEASURED BEFORE REMOVAL OF SHORES)	1/4"	3/8"	3/4"
	EXPOSED LINTELS, SILLS, PARAPETS, HORIZONTAL GROOVES AND OTHER CONSPICUOUS LINES	---	1/4"	1/2"
DRAWING DIMENSIONS	POSITION OF LINEAR BUILDING LINES, COLUMNS, WALLS, AND PARTITIONS	---	1/2"	1"
	SIZE AND LOCATION OF SLEEVES, FLOOR OPENINGS AND WALL OPENINGS	---	---	±1/4"
	CROSS SECTION OF COLUMNS, BEAMS, SLABS, AND WALLS	---	---	+1/2", -1/4"
	FOOTINGS* IN PLAN	---	---	+2", -1/2"
	FOOTING MISPLACEMENT OR ECCENTRICITY IN DIRECTION OF ERROR (THE LESSER OF)	---	---	2% OF WIDTH OR 2"
	FOOTING THICKNESS DECREASE	---	---	5%
	FOOTING THICKNESS INCREASE	---	---	NO LIMIT
	STEP RISE IN FLIGHT OF STAIRS	---	---	±1/8"
	STEP TREAD IN FLIGHT OF STAIRS	---	---	±1/4"
	CONSECUTIVE STEP RISE	---	---	±1/16"
	CONSECUTIVE STEP TREAD	---	---	±1/8"

* Footing tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items.

** Includes water and wastewater process structures.

TABLE 03100B

TOLERANCES FOR FORMED SURFACES CONCRETE IN BRIDGES, WHARVES AND MARINE STRUCTURES		
VARIATION FROM	VARIATION IN	MAXIMUM
PLUMB OR SPECIFIED BATTER	SURFACES OF COLUMNS, PIERS AND WALLS	1/2" in 10'
LEVEL OR SPECIFIED GRADE	TOP SURFACES OF SLABS	1/8" in 10'
	TOP SURFACES OF CURBS AND RAILINGS	3/16" in 10'
DRAWING DIMENSIONS	CROSS SECTION OF COLUMNS, CAPS, WALLS, BEAMS AND SIMILAR MEMBERS	+1/2", -1/4"
	THICKNESS OF DECK SLABS	+1/4", - 1/8"
	SIZE AND LOCATION OF SLAB AND WALL OPENINGS	± 1/2"
	FOOTINGS IN PLAN	+2", -1/2"
	FOOTING MISPLACEMENT OR ECCENTRICITY IN DIRECTION OF ERROR (THE LESSER OF)	2% of WIDTH OR 2"
	FOOTING THICKNESS DECREASE	5%
	FOOTING THICKNESS INCREASE	NO LIMIT
	STEP RISE IN FLIGHT OF STAIRS	±1/8"
	STEP TREAD IN FLIGHT OF STAIRS	±1/4"
	CONSECUTIVE STEP RISE	±1/16"
	CONSECUTIVE STEP TREAD	±1/8"

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Structural concrete reinforcement and grouting of reinforcement dowel bars into hardened concrete.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. ACI 315 - Details and Detailing of Concrete Reinforcement.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ASTM A 36 - Standard Specification for Structural Steel.

D. ASTM A 108 Standard Specification for Steel Bar Carbon and Alloy.

E. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

F. ASTM A 497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.

G. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

H. ASTM A 675 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

I. ASTM A 775/A 775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

J. ASTM A 1064 / A1064M - Standard Specification for Carbon-Steel Wire, and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

K. ASTM C 881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

L. AWS D 1.4 - Structural Welding Code - Reinforcing Steel.

M. WRI - Manual of Standard Practice for Welded Wire Fabric.

N. CRSI MSP-1 - Manual of Standard Practice.

1.04 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings detailing reinforcement fabrication, bar placement location, splices, spacing, bar designation, bar type, length, size, bending, number of bars, bar support type and other pertinent information, including dimensions. Provide sufficient detail for placement of reinforcement without use of Contract Drawings. Information shall correspond directly to data listed on bill of materials.

2. Use of reproductions of Contract Drawings by Contractor, Subcontractor, erector, fabricator or material supplier in preparation of shop drawings (or in lieu of preparation of shop drawings) signifies acceptance by that party of information shown thereon as correct, and acceptance of obligation to pay for any job expense, real or implied, arising due to errors that may occur thereon. Remove references to Design Engineer, including seals, when reproductions of Contract Drawings are used as shop drawings.

3. Detail shop drawings in accordance with ACI 315, Figure 6.

B. Bill of Materials: Submit with shop drawings.

C. Product Data:

1. Mechanical Bar Splices: Submit manufacturer's technical literature, including specifications and installation instructions.

2. Epoxy grout proposed for anchoring reinforcing dowels to hardened concrete: Submit manufacturer's technical literature including recommended installation procedures.

D. Certificates:

1. Submit steel manufacturer's certificates of mill tests giving properties of steel proposed for use. List manufacturer's test number, heat number, chemical analysis, yield point, tensile strength and percentage of elongation. Identify proposed location of steel in work.

2. Submit manufacturer's mill certificates with each delivery ticket. This submittal is required for each day's delivery. Copies of certificates shall be attached to the first delivery ticket and provided to the Engineer's Representative on site. Provide specimens for testing when required by the Engineers.

3. Foreign-manufactured reinforcing bars shall be tested for conformance to ASTM requirements by a certified independent testing laboratory located in United States. Certification from any other source is not acceptable. Submit test reports

for review. Do not begin fabrication of reinforcement until material has been approved.

1.05 HANDLING AND STORAGE

A. Store steel reinforcement above ground on platforms, skids or other supports. Protect reinforcing from mechanical injury, surface deterioration and formation of excessive, loose or flaky rust caused by exposure to weather. Protect epoxy-coated reinforcing from formation of any amount of rust.

1.06 QUALITY ASSURANCE

A. Notify Owner's Representative at least 48 hours before concrete placement so that reinforcement may be inspected, and errors corrected, without delaying Work.

B. Complete reinforcing placement drawings shall be available at the job site prior to the pouring of concrete.

PART 2 – P R O D U C T S

2.01 MATERIAL

A. Reinforcing Bars: Deformed bars conforming to ASTM A 615 with supplementary requirements (S1), grade as indicated on Drawings, except column spirals and those shown on Drawings to be smooth bars. Where grade is not shown on Drawings, use Grade 60.

B. Smooth Bars: Where indicated on Drawings, use smooth bars conforming to ASTM A 36; ASTM A 615, Grade 60; or ASTM A 675, Grade 70.

C. Column Spirals: Bars conforming to ASTM A 615, Grade 60, or wire conforming to ASTM A 82.

D. Epoxy-Coated Deformed Bars, Column Spirals and Smooth Bars: Conform to ASTM A 775/A 775M.

E. Welded Wire Fabric:

1. Welded Wire Fabric: Conform to ASTM A 84.

2. Welded Smooth Wire Fabric: Conform to ASTM A 185.

3. Welded Deformed Wire Fabric: Conform to ASTM A 497.

4. Provide wire size, type and spacing as shown. Where type is not shown on Drawings, use welded smooth wire fabric.

5. Furnish welded wire fabric in flat sheets only.

F. Tie Wire: 16-1/2 gage or heavier annealed steel wire. Use plastic-coated tie wire with epoxy-coated reinforcing steel.

G. Bar Supports: Provide chairs, riser bars, ties and other accessories made of plastic or metal, except as otherwise specified. Use bar supports and accessories of sizes required to provide required concrete cover. Where concrete surfaces are exposed to weather, water or wastewater, provide plastic accessories only; do not use galvanized or plastic-tipped metal in such locations. Provide metal bar supports and accessories rated Class 1 or 2 conforming to CRSI MSP-1 Manual of Standard Practice. Use epoxy-coated bar supports with epoxy-coated reinforcing bars.

H. Slabs on Grade: Provide chairs with sheet metal bases or provide precast concrete bar supports 3 inches wide, 6 inches long, and thick enough to allow required cover. Embed tie wires in 3-inch by 6-inch side.

I. Mechanical Bar Splices:

1. Conform to ACI 318; use where indicated on Drawings.

a. Compression splices shall develop ultimate stress of reinforcing bar.

b. Tension splices shall develop 125 percent of minimum yield point stress of reinforcing bar.

2. Regardless of chemical composition of steel, any heat effect shall not adversely affect performance of reinforcing bar.

J. Welded Splices:

1. Provide welded splices where shown and where approved by the Owner's Representative. Welded splices of reinforcing steel shall develop a tensile strength exceeding 125 percent of the yield strength of the reinforcing bars connected.

2. Provide materials for welded splices conforming to AWS D1.4.

K. Epoxy Grout: High-strength rigid epoxy adhesive, conforming to ASTM C 881, Type IV, manufactured for purpose of anchoring dowels into hardened concrete and the moisture condition, application temperature and orientation of the hole to be filled. Unless otherwise shown, depth of embedment shall be as required to develop the full tensile strength (125 percent of yield strength) of dowel, but not less than 12 diameters.

L. Headed concrete anchors and shear connectors shall be Nelson or KSM headed concrete anchors (or approved equal), and shall conform to ASTM A108. Anchors shall be automatically end welded with suitable stud welding equipment in the shop or in the

field. Welding shall be in accordance with the recommendations of the American Welding Society.

M. Deformed bar anchors (D.B.A.) shall be Nelson or KSM deformed bar anchors (or approved equal), and shall be made from cold drawn wire conforming to ASTM A496. Anchors shall be automatically end welded with suitable welding equipment in the shop or in the field. Welding shall be in accordance with the recommendations of the American Welding Society.

2.02 FABRICATION

A. Bending: Fabricate bars to shapes indicated on Drawings by cold bending. Bends shall conform to minimum bend diameters specified in ACI 318. Do not straighten or rebend bars. Fabricate epoxy-coated reinforcing steel to required shapes in a manner that will not damage epoxy coating. Repair any damaged epoxy coating with patching material conforming to Item 4.4 of ASTM A 775/A 775M.

B. Splices:

1. Locate splices as indicated on Drawings. Do not locate splices at other locations without approval of Owner's Representative. Use minimum number of splices located at points of minimum stress. Stagger splices in adjacent bars.

2. Length of lap splices: As shown on Drawings.

3. Prepare ends of bars at mechanical splices in accordance with splice manufacturer's requirements.

C. Construction Joints: Unless otherwise shown, continue reinforcing through construction joints.

D. Bar Fabrication Tolerances: Conform to tolerances listed in ACI 315, Figures 4 and 5.

E. Standard Hooks: Conform to the requirements of ACI 318.

F. Marking: Clearly mark bars with waterproof tags showing number of bars, size, mark, length and yield strength. Mark steel with same designation as member in which it occurs.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean reinforcement of scale, loose or flaky rust and other foreign material, including oil, mud or coating that will reduce bond to concrete.

3.02 INSTALLATION

A. Placement Tolerances: Place reinforcement within tolerances of Table 03210A at the end of this Section. Bend tie wire away from forms to maintain the specified concrete coverage.

B. Interferences: Maintain 2-inch clearance from embedded items. Where reinforcing interferes with location of other reinforcing steel, conduit or embedded items, bars may be moved within specified tolerances or one bar diameter, whichever is greater. Where greater movement of bars is required to avoid interference, notify Owner's Representative. Do not cut reinforcement to install inserts, conduit, mechanical openings or other items without approval of Owner's Representative.

C. Concrete Cover: Provide clear cover measured from reinforcement to face of concrete as listed in Table 03210B at the end of this Section, unless otherwise indicated on Drawings.

D. Placement in Forms: Use spacers, chairs, wire ties and other accessory items necessary to assemble, space and support reinforcing properly. Provide accessories of sufficient number, size and strength to prevent deflection or displacement of reinforcement due to construction loads or concrete placement. Use appropriate accessories to position and support bolts, anchors and other embedded items. Tie reinforcing bars at each intersection, and to accessories. Blocking reinforcement with concrete or masonry is prohibited.

E. Placement for Concrete on Ground: Support bar and wire reinforcement on chairs with sheet metal bases or precast concrete blocks spaced at approximately 3 feet on centers each way. Use minimum of one support for each 9 square feet. Tie supports to reinforcing bars and wires.

F. Vertical Reinforcement in Columns: Offset vertical bars by at least one bar diameter at splices. Provide accurate templates for column dowels to ensure proper placement.

G. Splices:

1. Do not splice bars, except at locations indicated on Drawings or reviewed shop drawings, without approval of Owner's Representative.

2. Lap Splices: Unless otherwise shown or noted, Class B, conforming to ACI 318-89, Section 12.15.1. Tie securely with wire prior to concrete placement, to prevent displacement of splices during concrete placement.

3. Mechanical Bar Splices: Use only where indicated on Drawings or approved by the Owner's Representative. Install in accordance with manufacturer's instructions.

a. Couplers located at a joint face shall be of a type which can be set either flush or recessed from the face as shown. Seal couplers prior to concrete placement to completely eliminate concrete or cement paste from entering.

b. Couplers intended for future connections: Recess 1/2 inch minimum from concrete surface. After concrete is placed, plug coupler and fill recess with sealant to prevent contact with water or other corrosive materials.

c. Unless noted otherwise, match mechanical coupler spacing and capacity to that shown for the adjacent reinforcing.

H. Construction Joints: Place reinforcing continuous through construction joints, unless noted otherwise.

I. Welded Wire Fabric: Install wire fabric in as long lengths as practicable. Unless otherwise indicated on Drawings, lap adjoining pieces at least 6 inches or one full mesh plus 2 inches, whichever is larger. Lace splices with wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps. Conform to WRI - Manual of Standard Practice for Welded Wire Fabric.

J. Field Bending: Shape reinforcing bent during construction operations to conform to Drawings. Bars shall be cold-bent; do not heat bars. Closely inspect reinforcing for breaks. When reinforcing is damaged, replace, Cadweld, or otherwise repair, as directed by Owner's Representative. Do not bend reinforcement after it is embedded in concrete.

K. Epoxy-coated Reinforcing Steel: Install in accordance with Paragraph 3.02J, Field Bending, and in a manner that will not damage epoxy coating. Repair damaged epoxy coating with patching material as specified in Paragraph 2.02A, Bending.

L. Field Cutting: Cut reinforcing bars by shearing or sawing. Do not cut bars with cutting torch.

M. Welding of reinforcing bars is prohibited, except where shown on Drawings.

3.03 GROUTING OF REINFORCING AND DOWEL BARS

A. Use epoxy grout for anchoring reinforcing and dowel steel to existing concrete in accordance with epoxy manufacturer's instructions. Drill hole not more than 1/4 inch larger than steel bar diameter (including height of deformations for deformed bars) in existing concrete. Just before installation of steel, blow hole clean of all debris using compressed air. Partially fill hole with epoxy, using enough epoxy so when steel bar is inserted, epoxy grout will completely fill hole around bar. Dip end of steel bar in epoxy and twist bar while inserting into partially-filled hole.

Table 03210A

REINFORCEMENT PLACEMENT TOLERANCES

PLACEMENT	TOLERANCE IN INCHES
Clear Distance -	
To formed soffit:	-1/4
To other formed surfaces:	±1/4
Minimum spacing between bars:	-1/4
Clear distance from unformed surface to top reinforcement -	
Members 8 inches deep or less:	±1/4
Members more than 8 inches deep but less than 24 inches deep:	
Members 24 inches deep or greater:	-1/4, +1/2
Uniform spacing of bars (but the required number of bars shall not be reduced):	-1/4, +1
Uniform spacing of stirrups and ties (but the required number of stirrups and ties shall not be reduced):	±2
	±1
Longitudinal locations of bends and ends of reinforcement -	
General:	±2
Discontinuous ends of members:	±1/2
Length of bar laps:	-1-1/2
Embedded length -	
For bar sizes No. 3 through 11:	-1
For bar sizes No. 14 and 18:	-2

Table 03210B

MINIMUM CONCRETE COVER FOR REINFORCEMENT

SURFACE	MINIMUM COVER IN INCHES
Slabs and Joists -	
Top and bottom bars for dry conditions -	
No. 14 and No. 18 bars:	1-1/2
No. 11 bars and smaller:	1
Formed concrete surfaces exposed to earth, water or weather; over, or in contact with, sewage; and for bottoms bearing on work mat, or slabs supporting earth cover -	
No. 5 bars and smaller:	1-1/2
No. 6 through No. 18 bars:	2
Beams and Columns -	
For dry conditions -	
Stirrups, spirals and ties:	1-1/2
Principal reinforcement:	2
Exposed to earth, water, sewage or weather -	
Stirrups and ties:	2
Principal reinforcement:	2-1/2
Walls -	
For dry conditions -	
No. 11 bars and smaller:	1
No. 14 and No. 18 bars:	1-1/2
Formed concrete surfaces exposed to earth, water, sewage or weather, or in contact with ground -	
Circular tanks with ring tension:	2
All others:	2
Footings and Base Slabs -	
At formed surfaces and bottoms bearing on concrete work mat:	
At unformed surfaces and bottoms in contact with earth:	2
Over top of piles:	3
Top of footings -- same as slabs	2

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Joints in concrete at the locations shown. Joints required in concrete structures are of various types and will be permitted only where shown, unless specifically accepted by the Owner.

1.02 UNIT PRICES

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. Federal Specification TT-S-0227E(3) Sealing Compound, elastomeric type, Multi-component for Caulking, Sealing, and Glazing Buildings and Other Structures).

B. U.S. Army Corps of Engineers Specifications CRD-C572PVC Waterstop.

C. ASTM C920 - Specification for Elastomeric Joint Sealants

D. ASTM D412 - Test Methods for Rubber Properties in Tension

E. ASTM D624 - Test Method for Rubber Property -- Tear Resistance

F. ASTM D638 - Test Method for Tensile Properties of Plastics

G. ASTM D746 - Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

H. ASTM D747 - Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam

I. ASTM D1056 - Specification for Flexible Cellular Materials -- Sponge or Expanded Rubber

J. ASTM D1752 - Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

K. ASTM D2000 - Specification for Rubber Products in Automotive Applications

L. ASTM D2240 - Test Method for Rubber Property -- Durometer Hardness

M. ASTM D2241 - Specification for PVC Tubing

1.04 TYPES OF JOINTS

A. Construction Joints: When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint. Unless otherwise specified, all joints in water bearing members shall be provided with a waterstop and/or sealant groove of the shape specified and shown. The surface of the first pour may also be required to receive a coating of bond breaker as shown. Keyed construction joints shall be used in all cases. All laitance shall be removed. All vertical joints shall be thoroughly wetted and slushed with a coat of wet cement immediately before placing new concrete.

B. Contraction Joints: Contraction joints are similar to construction joints except that the fresh concrete shall not bond to the hardened surface of the first pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the second pour. Waterstop and/or sealant groove shall also be provided when specified or shown.

C. Expansion Joints:

1. To allow the concrete to expand freely, a space is provided between the two pours, the joint shall be formed as shown. This space is obtained by placing a joint filler material against the first pour, which acts as a form for the second pour. Unless otherwise specified, all expansion joints in water bearing members shall be provided with a center-bulb type waterstop as shown.

2. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.

3. The space so formed shall be filled with a joint sealant material as specified in the Paragraph in Part 2 entitled "Joint Sealant." In order to keep the two wall or slab elements in line the joint shall also be provided with a sleeve-type dowel as shown.

D. Control Joints: The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions shown, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material as specified in the Paragraph in Part 2 entitled "Joint Sealant."

1.05 SUBMITTALS

A. Waterstops: Prior to production of the material required under this contract, qualification samples shall be submitted. Such samples shall consist of extruded or molded sections of each size or shape to be used, and shall be accomplished so that the material and workmanship represents in all respects the material to be furnished under this contract. The balance of the

material to be used under this contract shall not be produced until after the Owner has reviewed the qualification samples.

B. Joint Sealant: Prior to ordering the sealant material, the Contractor shall submit to the Owner for the Owner's review, sufficient data to show general compliance with the requirements of the Contract Documents.

C. Certified test reports from the sealant manufacturer on the actual batch of material being supplied indicating compliance with the above requirements shall be furnished the Owner before the sealant is used on the job.

D. Shipping Certification: The Contractor shall provide written certification to the Owner from the manufacturer as an integral part of the shipping form, to show that all of the material shipped to this project meets or exceeds the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.

E. Joint Location: The Contractor shall submit placement shop drawings showing the location and type of all joints for each structure. Changes in location, additions or omissions of construction joints are subject to approval of engineer.

F. Guarantee: The Contractor shall submit a copy of the 5-year guarantee.

1.06 QUALITY ASSURANCE

A. Waterstop Inspection: All waterstop field joints shall be subject to rigid inspection, and no such work shall be scheduled or started without having made prior arrangements with the Owner to provide for the required inspections. Not less than 24 hours' notice shall be provided to the Owner for scheduling such inspections.

B. All field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. All defective joints shall be replaced with material which shall pass said inspection, and all faulty material shall be removed from the site and disposed of by the Contractor at its own expense.

C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:

1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less.

4. Misalignment of joint which result in misalignment of the waterstop in excess of 1/2-inch in 10 feet.

5. Porosity in the welded joint as evidenced by visual inspection.

6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)

D. Waterstop Samples: Prior to use of the waterstop material in the field, a sample of a fabricated mitered cross and a tee constructed of each size or shape of material to be used shall be submitted to the Engineer for review. These samples shall be fabricated so that the material and workmanship represent in all respects the fittings to be furnished under this contract.

E. Construction Joint Sealant: The Contractor shall prepare adhesion and cohesion test specimens as specified herein, at intervals of 5 working days while sealants are being installed.

F. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:

1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1-inch. Coated spacers (2-inch by 1-1/2-inch by 1/2-inch) shall be used to insure sealant cross-sections of 1/2-inch by 2 inches with a width of 1-inch.

2. Sealant shall be cast and cured according to manufacturer's recommendations except that curing period shall be not less than 24 hours.

3. Following curing period, the gap between blocks shall be widened to 1-1/2-inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.07 GUARANTEE

A. The Contractor shall provide a 5-year written guarantee of the entire sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that it agrees to repair or replace, to the satisfaction of the Owner, at no additional cost to the Owner, any such defective areas which become evident within said 5-year guarantee period.

PART 2 - PRODUCTS

2.01 GENERAL

A. All joint materials specified herein shall be classified as acceptable for potable water use, by the Environmental Protection Agency, within 30 days of application.

2.02 PVC WATERSTOPS

A. General: Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications. No reclaimed or scrap material shall be used. The Contractor shall obtain from the waterstop manufacturer and shall furnish to the Engineer for review, current test reports and a written certification of the manufacturer that the material to be shipped to the job meets the physical requirements as outlined in the U.S. Army Corps of Engineers Specification CRD-C572 and those listed herein.

B. Flatstrip and Center-Bulb Waterstops: Flatstrip and center-bulb waterstops shall be as detailed and as manufactured by: Kirkhill Rubber Co., Brea, California; Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal; provided, that at no place shall the thickness of flat strip waterstops, including the center bulb type, be less than 3/8-inch.

C. Multi-Rib Waterstops: Multi-rib waterstops, where required, shall be as detailed and as manufactured by Water Seals, Inc., Chicago, Illinois; Progress Unlimited, Inc., New York, New York; Greenstreak Plastic Products Co., St. Louis, Missouri; or equal. Prefabricated joint fittings shall be used at all intersections of the ribbed-type waterstops.

D. Other Types of Waterstops: When other types of waterstops, not listed above are required and shown, they shall be subjected to the same requirements as those listed herein.

E. Waterstop Testing Requirements: When tested in accordance with the specified test standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	Value	ASTM Std.
Tensile Strength-min (psi)	1750	D 638, Type IV
Ultimate Elongation-min (percent)	350	D 638, Type IV
Low Temp Brittleness-max (degrees F)	-35	D 746
Stiffness in Flexure-min (psi)	400	D 747
Accelerated Extraction (CRD-C572)		
Tensile Strength-min (psi)	1500	D 638, Type IV
Ultimate Elongation-min (percent)	300	D 638, Type IV

Physical Property, Sheet Material	Value	ASTM Std.
Effect of Alkalies (CRD-C572)		
Change in Weight (percent)	+0.25/-0.10	------
Change in Durometer, Shore A	+5	D 2240
Finish Waterstop		
Tensile Strength-min (psi)	1400	D 638, Type IV
Ultimate Elongation-min (percent)	280	D 638, Type IV

2.03 JOINT SEALANT

A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of liquid retaining structures.

B. Joint sealant material shall meet the following requirements (73 degrees F and 50 percent R.H.):

Work Life	45 - 180 minutes
Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity)	24 hours, maximum
Ultimate Hardness (ASTM D 2240)	20 - 45 Shore "A"
Tensile Strength (ASTM D 412)	200 psi, minimum
Ultimate Elongation (ASTM D 412)	400 percent, minimum
Tear Resistance (Die C ASTM D 624)	75 pounds per inch of thickness, minimum
Color Light Gray	

C. All polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:

1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ANSI/ASTM C 920 or Federal Specification TT-S-0227 E(3) for 2-part material, as applicable.

2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ANSI/ASTM C 920 Class 25, Grade NS, or Federal Specification TT-S-0227 E(3), Type II, Class A.

3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ANSI/ASTM C 920 Class 25, Grade P, or Federal Specification TT-S-0227 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.

4. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the sealant manufacturer.

D. All sealants, wherever shown, or required hereunder shall be PSI-270 as manufactured by Polymetric Systems Inc.; Elastothane 227R as manufactured by Pacific Polymers; Sikaflex 2C, as manufactured by Sika Corporation; or equal.

2.04 JOINT MATERIALS

A. Bearing Pad: Bearing pad to be neoprene conforming to ASTM D2000, Grade 2 or 3, Type BC, tensile strength 10 MPa, 60 durometer hardness unless otherwise noted.

B. Neoprene Sponge: Sponge to be neoprene, closed-cell, expanded, conforming to ASTM D 1056, Type 2C3-E1.

C. Preformed Joint Filler: Preformed joint filler material shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 for Type I, except as otherwise specified herein.

D. Control Joint Former: Control joint formers shall be continuous plastic insert strips with anchorage ribs located at the bottom and a removable enlarged upper portion sized to form a sealant groove. Joint former inserts shall be sized to extend to a minimum of 1/4 the slab depth. The upper portion shall be readily removable without damage to the concrete.

2.05 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.06 BOND BREAKER

A. Bond breaker shall be Super Bond Breaker as manufactured by Burke Company, San Mateo, California; Select Cure CRB as manufactured by Select Products Co., Upland, California; or equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable.

2.07 BENTONITE WATERSTOP

A. Where called for in the Contract Documents, bentonite type waterstop, which shall expand in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast, shall be provided.

B. The bentonite waterstop shall be composed of 75 percent bentonite. The balance of the material shall be butyl rubber-hydrocarbon with less than 1.0 percent volatile matter. The waterstop shall contain no asbestos fibers or asphaltics.

C. The manufacturer's rated application temperature range shall be from 5 to 125 degrees F. The service temperature range shall be from -40 to 212 degrees F.

D. The cross sectional dimensions of the unexpanded waterstop shall be one inch by 3/4-inch.

E. The waterstop shall be provided with an adhesive backing which will provide excellent adhesion to concrete surfaces.

2.08 SLIP DOWELS

A. Slip dowels in joints shall be A36 smooth epoxy-coated bars, conforming to ASTM A 775.

2.09 PVC TUBING

A. PVC tubing in joints shall be Sch. SDR 13.5, conforming to ASTM D 2241.

PART 3 - EXECUTION

3.01 GENERAL

A. Waterstops of the type specified herein shall be embedded in the concrete across joints as shown. All waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed instructions of manufacturer of the waterstops. The CONTRACTOR shall take suitable precautions and means to support and protect the waterstops during the progress of the work and shall repair or replace at its own expense any waterstops damaged during the progress of the work. All waterstops shall be stored so as to permit free circulation of air around the waterstop material.

B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

C. All construction joints in water bearing structures shall be keyed and waterstopped.

3.02 SPLICES IN WATERSTOPS

A. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that:

1. The material not be damaged by heat sealing.

2. The splices have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.

3. The continuity of the waterstop ribs and of its tubular center axis be maintained.

B. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.

C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated by the CONTRACTOR prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.

D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.03 JOINT CONSTRUCTION

A. Setting Waterstops:

1. In order to eliminate faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during the progress of the WORK and to insure the proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints.

2. In placing flat-strip waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Unless otherwise shown, all waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.

3. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.

4. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to for a future concrete placement.

B. Joint Location: Construction joints, and other types of joints, shall be provided where shown. When not shown, construction joints shall be provided at 25-foot maximum spacing for all concrete construction, unless noted otherwise. Where joints are shown spaced greater than 40 feet apart, additional joints shall be provided to maintain the 25-foot maximum spacing. The location of all joints, of any type, shall be submitted for acceptance by the Engineer.

C. Joint Preparation: Special care shall be used in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required. Unless otherwise shown, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03310 - Structural Concrete. Except on horizontal wall construction joints, wall to slab joints or where otherwise shown or specified, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as specified herein.

D. Construction Joint Sealant:

1. Construction joints in water-bearing floor slabs, and elsewhere as shown, shall be provided with tapered grooves which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sand-blasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. The primer used shall be supplied by the same manufacturer supplying the sealant. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.

2. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. All sealant shall achieve final cure at least 7 days before the structure is filled with water.

3. All sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations. Before work is commenced, the crew doing the WORK shall be instructed as to the proper method of application by a representative of the sealant manufacturer.

4. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, the Contractor shall arrange to have the crew doing the WORK carefully instructed as to the proper method of mixing and application by a representative of the sealant manufacturer.

5. Any joint sealant which, after the manufacturer's recommended curing time for the job conditions of the WORK hereunder, fails to fully and properly cure shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the specified joint sealant. All costs of such removal, joint treatment, re-sealing, and appurtenant work shall be at the expense of the Contractor.

E. Bentonite Waterstop:

1. Where a bentonite waterstop is called for in the Contract Documents, it shall be installed with the manufacturer's instructions and recommendations; except, as modified herein.

2. When requested by the Engineer, the manufacturer shall provide technical assistance in the field.

3. Bentonite waterstop shall only be used where complete confinement by concrete is provided. Bentonite waterstop shall not be used in expansion or contraction joints nor in the first 6 inches of any intersecting joint.

4. The bentonite waterstop shall be located as near as possible to the center of the joint and it shall be continuous around the entire joint. The minimum distance from the edge of the waterstop to the face of the member shall be 5 inches.

5. Where the thickness of the concrete member to be placed on the bentonite waterstop is less than 12 inches, the waterstop shall be placed in grooves formed or ground into the concrete. The groove shall be at least 3/4 inch deep and 1-1/4 inches wide. When placed

in the groove, the minimum distance from the edge of the waterstop to the face of the member shall be 2.5 inches.

6. Where a bentonite waterstop is used in combination with PVC waterstop, the bentonite waterstop shall overlap the PVC waterstop for a minimum of 6 inches and shall be placed in contact with the PVC waterstop.

7. The bentonite waterstop shall not be placed when the temperature of the waterstop material is below 40 degrees F. The waterstop material may be warmed so that it shall remain above 40 degrees F during placement; however, means used to warm the material shall in no way harm the material or its properties. The waterstop shall not be installed where the air temperature falls outside the manufacturer's recommended range.

8. The concrete surface under the bentonite waterstop shall be smooth and uniform. The concrete shall be ground smooth if needed. Alternately, the bentonite waterstop shall be bonded to the surface using an epoxy grout which completely fills all voids and irregularities beneath the waterstop material. Prior to installation, the concrete surface shall be wire brushed to remove any laitance or other materials that may interfere with the bonding of epoxy.

9. The bentonite waterstop shall be secured in place with concrete nails and washers at 12-inch maximum spacing. This shall be in addition to the adhesive backing provided with the waterstop.

F. Forming Control Joints:

1. Control joints shall be formed in slabs where indicated on the Drawings by preformed plastic inserts, sawcutting, or other means found acceptable by the Engineer. The depth of the insert or sawcut shall be a minimum of 1/4 of the slab depth.

2. Sawcutting shall be done during the curing period as soon as possible after the concrete has reached final set and is strong enough to support the sawcutting operation without damage. The slab must be fully saturated at the time of sawcutting.

3. The removable portion of plastic inserts shall remain in place and the sawcuts shall be protected against damage and intrusion of foreign material until the end of the curing period and until the concrete has dried sufficiently to allow sealant installation.

4. Sealant Installation: The formed or sawcut space shall be blown clean of any foreign material. A foam backer rod shall be inserted to form a sealant depth equal to the width of the space but not less than 3/8 inch. Sealant shall then be installed as specified elsewhere in the Contract Documents.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place normal-weight structural concrete and mass concrete.

1.02 UNIT PRICES

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 304.2R - Placing Concrete by Pumping Methods.

C. ACI 305R - Hot Weather Concreting.

D. ACI 306.1 - Standard Specification for Cold Weather Concreting.

E. ACI 309R - Guide for Consolidation of Concrete.

F. ACI 318 - Building Code Requirements for Reinforced Concrete.

G. ACI 350R - Environmental Engineering Concrete Structures.

H. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

I. ASTM C33 - Standard Specification for Concrete Aggregates.

J. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

K. ASTM C42 - Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

L. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

M. ASTM C94 - Standard Specifications for Ready-Mixed Concrete.

N. ASTM C127 - Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.

O. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

P. ASTM C136 - Sieve Analyses of Fine and Coarse Aggregates.

Q. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

R. ASTM C150 - Standard Specification for Portland Cement.

S. ASTM C157 - Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.

T. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.

U. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

V. ASTM C192 - Method of Making and Curing Concrete Test Specimens in the Laboratory.

W. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

X. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

Y. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

Z. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.

AA. ASTM C535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

AB. ASTM C567 - Standard Test Method for Unit Weight of Structural Lightweight Concrete.

AC. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

AD. Concrete Plant Manufacturer's Bureau (CPMB), Plant Mixer Manufacturers Division: Concrete Plant Mixer Standards.

AE. National Ready-Mixed Concrete Association (NRMCA): Certification of Ready-Mixed Concrete Production Facilities (checklist with instructions).

AF. John Wiley and Sons, Interscience Publishers Division, "Encyclopedia of Industrial Chemical Analysis," Vol. 15, Page 230 (alkalinity test procedure).

1.04 DEFINITIONS

A. Mass Concrete: Concrete sections 4 feet or more in least dimension.

B. Hot Weather: Any combination of high air temperature, low relative humidity and wind velocity tending to impair quality of fresh or hardened concrete or otherwise resulting in abnormal properties.

C. Cold Weather: Period when, for more than 2 successive days, mean daily temperature is below 40 degrees F.

1.05 SUBMITTALS

A. Conform to Part B – Special Conditions of the Agreement for submittal procedures.

B. Mill Certificates: Required for bulk cement. Submit concrete supplier cement mill certificates with each concrete delivery ticket. This submittal is required for each day's delivery. Copies of certificates shall be attached to the first delivery ticket and provided to the Project Manager's Representative on site. Provide specimens for testing when required by the Project Manager.

C. Design Mixes:

1. Concrete mix shall be designed by a qualified licensed engineer.

2. Submit test data on proposed design mixes for each type of concrete in the Work, including each class, and variations in type, source or quantity of material. Include type, brand and amount of cementitious materials; type, brand and amount of each admixture; slump; air content; aggregate sources, gradations, specific gravity and absorption; total water (including moisture in aggregate); water/cement ratio; compressive strength test results for 7 and 28 days; and shrinkage tests for Class C and D concrete at 21 or 28 days of drying.

3. Submit abrasion loss and soundness test results for limestone aggregate.

4. Testing of aggregates, including sieve analysis shall be performed by a certified independent testing laboratory. Tests shall have been performed no earlier than 3 months before Notice to Proceed.

5. Provide standard deviation data for plant producing concrete. Data shall include copies of laboratory test results and standard deviation calculated in accordance with ACI 318, Item 5.3.1. Laboratory tests shall have been performed within past 12 months. When standard deviation data is not available, comply with ACI 318, Table 5.3.2.2.

Review and acceptance of mix design does not relieve Contractor of responsibility to provide concrete of quality and strength required by these Specifications.

6. Submit information indicating that the mixing water adhere to the requirements of ASTM C94.

D. Admixtures: Submit manufacturer's technical information, including following:

1. Air-Entraining Admixture: Give requirements to control air content under all conditions, including temperature variations and presence of other admixtures.

2. Chemical Admixtures: Give requirements for quantities and types to be used under various temperatures and job conditions to produce uniform, workable concrete mix. Submit evidence of compatibility with other admixtures and cementitious materials proposed for use in design mix.

E. High-Range Water Reducer (Superplasticizer): When proposed for use, submit manufacturer's technical information and instructions for use of superplasticizer. State whether superplasticizer will be added at ready-mix plant or job site. When superplasticizer will be added at job site, submit proposed plan for measuring and adding superplasticizer to concrete mix at job site, and establish dosing area on site with holding tanks and metering devices. When superplasticizer is to be added at ready-mix plant, submit contingency plans for adding additional superplasticizer at job site when required due to delay in placing concrete. Identify portions of Work on which superplasticizer is proposed for use.

F. Hot and Cold Weather Concreting: Submit, when applicable, proposed plans for hot and cold weather concreting. Review and acceptance of proposed procedure will not relieve Contractor of responsibility for quality of finished product.

G. Project Record Drawings: Accurately record actual locations of embedded utilities and components which are concealed from view.

1.06 QUALITY ASSURANCE

A. Provide necessary controls during evaluation of materials, mix designs, production and delivery of concrete, placement and compaction to assure that the Work will be accomplished in accordance with Contract Documents. Maintain records of concrete placement. Record dates, locations, quantities, air temperatures, and test samples taken.

B. Code Requirements: Concrete construction for buildings shall conform to ACI 318. Concrete construction for water and wastewater treatment and conveying structures shall conform to ACI 318 with modifications by ACI 350R, Item 2.6. Where this Specification conflicts with ACI 318 or ACI 350R, this Specification governs.

C. Testing and Other Quality Control Services:

1. Concrete testing required in this section, except concrete mix design, limestone aggregate test data, and testing of deficient concrete, will be performed by an independent commercial testing laboratory employed and paid by the Owner.

2. Provide material for and cooperate fully with testing laboratory technician in obtaining samples for required tests.

3. Standard Services: The following testing and quality control services will be provided by the Laboratory:

   a. Verification that plant equipment and facilities conform to NRMCA "Certification of Ready-Mix Concrete Production Facilities".

   b. Testing of proposed materials for compliance with this Specification.

   c. Review of proposed mix design submitted by Contractor.

   d. Obtaining production samples of materials at plants or stockpiles during work progress and testing for compliance with this Specification.

   e. Strength testing of concrete according to following procedures:

      (1) Obtaining samples for field test cylinders from every 100 cubic yards and any portion less than 100 cubic yards for each mix design placed each day, according to ASTM C172, with each sample obtained from a different batch of concrete on a representative, random basis. Selecting test batches by any means other than random numbers chosen before concrete placement begins is not allowed.

      (2) Molding four specimens from each sample according to ASTM C31, and curing under standard moisture and temperature conditions as specified in Sections 7(a) and (b) of ASTM C31.

      (3) Testing two specimens at 7 days and two specimens at 28 days according to ASTM C39, reporting test results averaging strengths of two specimens. However, when one specimen evidences improper sampling, molding or testing, it will be discarded and remaining cylinder considered test result. When high-early-strength concrete is used, specimens will be tested at 3 and 7 days.

   f. Air content: For each strength test, determination of air content of normal weight concrete according to ASTM C231.

   g. Slump: For each strength test, and whenever consistency of concrete appears to vary, conducting slump test in accordance with ASTM C143.

   h. Temperature: For each strength test, checking concrete temperature in accordance with ASTM C1064.

   i. Lightweight concrete: For each strength test, or more frequently when requested by Owner's Representative, determination of air content by ASTM C567 and unit weight by ASTM C567.

j. Monitoring of current and forecasted climatic conditions to determine when rate of evaporation, as determined by Figure 2.1.5 of ACI 305R, will produce loss of 0.2 pounds of water, or more, per square foot per hour. Testing lab representative will advise Contractor to use hot weather precautions when such conditions will exist during concrete placement, and note on concrete test reports when Contractor has been advised that hot weather conditions will exist.

k. Class A and D Concrete Shrinkage Tests: Performance of drying shrinkage tests for trial batches as follows:

(1) Preparation and Testing of Specimens: Compression and drying shrinkage test specimens will be taken in each case from the same concrete sample; shrinkage tests will be considered a part of the normal compression tests for the project. 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C157, modified as follows:

(a) Wet curing: Remove specimens from molds at an age of 23 hours ±1 hour after trial batching and immediately immerse in water at 70 degrees F ±3 degrees F for at least 30 minutes;

(b) Measure within 30 minutes after first 30 minutes of immersion to determine original length (not to be confused with "base length");

(c) Then submerge in saturated limewater, at 73 degrees F ±3 degrees F, for 7 days;

(d) Then measure at age 7 days to establish "base length" for drying shrinkage calculations ("zero" days drying age);

(e) Calculate expansion (base length expressed as a percentage of original length);

(f) Immediately store specimens in a temperature- and humidity-controlled room maintained at 73 degrees F, ±3 degrees F and 50 percent ±4 percent relative humidity, for the remainder of the test.

(g) Measure to determine shrinkage, expressed as percentage of base length. Compute the drying shrinkage deformation of each specimen as the difference between the base length (at "zero" days drying age) and the length after drying at each test age. Compute the average drying shrinkage deformation of the

specimens to the nearest 0.0001 inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, disregard the results obtained from that specimen. Report results of shrinkage tests to the nearest 0.001 percent of shrinkage.

(h) Report shrinkage separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.

4. Additional Testing and Quality Control Services: The following will be performed by an independent commercial testing laboratory employed and paid by the Owner.

   a. Checking of batching and mixing operations.

   b. Review of manufacturer's report of each cement shipment and conducting laboratory tests of cement.

   c. Molding and testing reserve 7-day cylinders or field cylinders.

   d. Conducting additional field tests for slump, concrete temperature and ambient temperature.

   e. Alkalinity Tests: For concrete used in sanitary structures, one test for each structure. Perform alkalinity tests on concrete covering reinforcing steel on the inside of the pipe or structure in accordance with "Encyclopedia of Industrial Chemical Analysis," Vol. 15, page 230.

5. Contractor shall provide the following testing and quality control services:

   a. Employ an independent commercial testing laboratory, acceptable to Owner's Representative, to prepare and test design mix for each class of concrete for which material source has been changed.

   b. Notify commercial testing laboratory employed by the CONTRACTOR 24 hours prior to placing concrete.

6. Testing of deficient concrete in place:

   a. When averages of three consecutive strength test results fail to equal or exceed specified strength, or when any individual strength test result falls below specified strength by more than 500 psi, strength of concrete shall be considered potentially deficient and core testing, structural analysis or load testing may be required by the Engineer.

   b. When concrete in place proves to be deficient, Contractor shall pay costs, including costs due to delays and those incurred in providing additional testing and analysis services directed by the Engineer.

c. Replace concrete work judged inadequate by core tests, structural analysis or load tests at no additional cost to the OWNER.

d. Core Tests:

(1) Obtain and test cores in accordance with ASTM C42. Where concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for 7 days before test; test dry. Where concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning in accordance with ASTM C42.

(2) Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. Location of cores shall be determined by Engineer so as to least impair strength of structure. When, before testing, one or more cores shows evidence of having been damaged during or after removal from structure, replace the damaged cores.

(3) Concrete in area represented by core test will be considered adequate when average strength of cores is equal to at least 85 percent of specified strength, and when no single core is less than 75 percent of specified strength.

(4) Patch core holes in accordance with Section 03350 - Concrete Finishing.

e. Structural Analysis: When core tests are inconclusive or impractical to obtain, Engineer may perform additional structural analysis at Contractor's expense to confirm safety of structure.

f. Load Tests: When core tests and structural analysis do not confirm safety of structure, load tests may be required, and their results evaluated, in accordance with ACI 318.

g. Testing by impact hammer, sonoscope, probe penetration tests (Windsor probe), or other nondestructive device may be permitted by Engineer to determine relative strengths at various locations in structure, to evaluate concrete strength in place, or for selecting areas to be cored. However, such tests, unless properly calibrated and correlated with other test data, shall not be used as basis for acceptance or rejection of structure's safety.

1.07 STORAGE AND HANDLING OF MATERIALS

A. Cement: Store cement in weathertight buildings, bins or silos to provide protection from dampness and contamination and to minimize warehouse set. When there is any doubt as to

expansive potential of shrinkage-compensating cements because of method or length of storage and exposure, laboratory test cement before use.

B. Aggregate: Arrange and use aggregate stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before next is started.

C. Fine Aggregate: Before using, allow fine aggregate to drain until uniform moisture content is reached.

D. Admixtures: Store admixtures to avoid contamination, evaporation or damage. For those used in form of suspensions or nonstable solutions, provide suitable agitating equipment to assure uniform distribution of ingredients. Protect liquid admixtures from freezing and other temperature changes which would adversely affect their characteristics.

E. Lightweight Aggregates: Uniformly predampen lightweight aggregates as necessary to prevent excessive variations in moisture content. Allow predampened aggregates to remain in stockpiles, under continuous fog spray, for minimum of 24 hours before use. Provide adequate drainage in stockpile areas to eliminate excess water and accumulation of contaminated fines.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Cement:

1. Use same brand of cement used in concrete mix design. Use only one brand of each type in each structure, unless otherwise indicated on Drawings.

2. Portland Cement: ASTM C150, Type I or Type II, gray in color. Use Type III only when specifically authorized by Engineer in writing. Use Type II, including the requirements of Table 2, in construction of liquid-containing structures and cooling towers, unless shown otherwise on Drawings.

3. Fly Ash shall conform to AST C618. Concrete mixes using fly ash shall be proportioned to account for the properties of the specific fly ash used and to account for the specific properties of the fly ash concrete thus resulting.

B. Admixtures:

1. Do not use calcium chloride, thiocyanate or admixtures containing more than 0.05 percent chloride ions.

2. Air-Entraining Admixtures: ASTM C260, compatible with other admixtures used.

3. Chemical Admixtures: Polymer type, nonstaining, chloride-free admixtures conforming to ASTM C494, Type A, C, D or E.

4. High-Range Water Reducer (Superplasticizer): ASTM C494, Type F or G, compatible with and by the same manufacturer as other admixtures.

5. Fly Ash may be used as a pozzolan to replace a portion of the Portland cement in a concrete mix, subject to the approval of the Engineer. Fly Ash, when used, shall conform to ASTM C698. Concrete mixes using fly ash shall be proportioned to account for the properties of the specific fly ash used and to account for the specific properties of the fly ash concrete thus resulting. The ratio of the amount of the fly ash to the total amount of fly ash and cement in the mix shall not exceed ten (10) percent.

C. Mixing Water: Use clean, potable water, free from harmful amounts of oils, acids, alkalis or other deleterious substances, meeting requirements of ASTM C94.

D. Aggregates: Use coarse aggregate from only one source and fine aggregate from only one source, for exposed concrete in any single structure.

1. Coarse Aggregate: Gravel, crushed gravel or crushed limestone conforming to ASTM C33. For wastewater treatment and conveying structures, provide only crushed limestone.

2. Fine Aggregate: Natural sand complying with ASTM C33, except provide only crushed limestone for wastewater treatment and conveying structures.

3. Limestone aggregate shall conform to ASTM C33 and the following additional requirements: Clean, hard, strong and durable particles free of chemicals and coatings of silt, clay, or other fine materials that may affect hydration and bond of cement paste. Select crushed limestone: High-calcium limestone (minimum 95 percent $CaCO_3$ and maximum 3.5 percent $MgCO_3$) with maximum Los Angeles Abrasion loss of 38 percent, when tested in accordance with ASTM C131 or ASTM C535. Test aggregate for soundness in accordance with ASTM C88; maximum loss shall not exceed 18 percent after 5 cycles of magnesium sulfate test.

4. Maximum size of coarse aggregate:

a. Normal weight concrete, except as noted below: 1-1/2 inches.

b. Formed members 6 inches or less in least dimension: 1/5 least dimension.

c. Slabs: 1/3 depth of slab.

d. Drilled shafts: 1/3 clearance between reinforcing steel, but not greater than 3/4 inch.

e. Concrete fill, seal slabs and bonded concrete topping in clarifiers: 3/8 inch.

5. Coarse aggregate for lightweight concrete: ASTM C330. Grading limits: 3/4 inch to No. 4.

6. Abrasive Aggregate: Conform to requirements of Section 03350 - Concrete Finishing.

E. Calcium Chloride: Not permitted.

F. Evaporation Retardant: Masterbuilders "Confilm", Euclid "Eucobar", or equal.

G. Miscellaneous Materials:

1. Bonding Agent: Two-component modified epoxy resin.

2. Vapor barrier: 6 mil clear polyethylene film of type recommended for below-grade application.

3. Non-shrink grout: premixed compound consisting of non-metallic aggregate, cement and water-reducing and plasticizing agents; capable of developing minimum compressive strength of 2,400 psi in 48 hours and 7,000 psi in 28 days.

2.02 CONCRETE MIX

A. Objective: Select proportions of ingredients to produce concrete having proper placability, durability, strength, appearance and other specified properties.

B. Mix Design: Employ and pay an independent commercial testing laboratory, acceptable to Owner's Representative, to prepare and test mix designs for each type of concrete specified. Proportion mix design ingredients by weight. Submit mix designs and test results for approval.

1. During the trial batches, aggregate proportions may be adjusted by the testing laboratory using two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments shall be considered refinements to the mix design and shall not be the basis for extra compensation to the Contractor. Concrete shall conform to the requirements of this Section, whether the aggregate proportions are from the Contractor's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. Prepare trial batches using the aggregates, cement and admixtures proposed for the project. Make trial batches large enough to obtain 3 drying shrinkage test specimens and 6 compression test specimens from each batch. Shrinkage testing is required only for Class C and D concrete.

2. Determine compressive strength by testing 6-inch diameter by 12-inch high cylinders, made, cured and tested in accordance with ASTM C192 and ASTM C39. Test 3 compression test cylinders at 7 days and 3 at 28 days. Average compressive strength

for the 3 cylinders tested at 28 days for any given trial batch shall be not less than 125 percent of the specified compressive strength.

3. Perform sieve analysis of the combined aggregate for each trial batch according to of ASTM C136. Report percentage passing each sieve.

4. In mix designs for Class C and D concrete, fine aggregate shall not exceed 41 percent of total aggregate by weight.

C. Shrinkage Limitations, Class A and D Concrete:

1. Maximum concrete shrinkage for specimens cast in the laboratory from the trial batch: 0.036 percent as measured at 21-day drying age, or 0.042 percent at 28-day drying age. Use for construction only mix designs that meet trial batch shrinkage requirements. Shrinkage limitations apply only to Class A and D concrete.

2. Maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.

3. If the required shrinkage limitation is not met during construction, take any or all of the following actions, at no additional cost to the OWNER, for securing the specified shrinkage requirements: Changing the source or aggregates, cement or admixtures; reducing water content; washing of aggregate to reduce fines; increasing the number of construction joints; modifying the curing requirements; or other actions designed to minimize shrinkage or its effects.

D. Selecting Ingredient Proportions for Concrete:

1. Proportion concrete mix according to ACI 301, Chapter 3.

2. Establish concrete mix design by laboratory trial batches prepared by independent testing laboratory, or on basis of previous field experience in accordance with provisions of ACI 318, Item 5.3; however, minimum cement content for each class of concrete shall not be less than specified.

3. Concrete mix design data submitted for review shall have average 28-day compressive strength calculated in accordance with ACI 318, Item 5.3.2.1. When data is not available to determine standard deviation in accordance with ACI 318, Item 5.3.1, average 28-day strength of mix design shall conform to ACI 318, Table 5.3.2.2.

4. The ratio of the amount of the fly ash to the total amount of fly ash and cement in the mix shall not exceed 25 percent.

E. Water-Cement Ratios:

1. Maximum allowable water-cement ratios shall be as follows:

a. Concrete for liquid-containing structures: 0.45.

b. Concrete subjected to brackish water, salt spray or deicers: 0.40.

c. All other concrete: 0.55.

2. Superplasticizer may be added to maintain specified maximum water-cement ratios. Include free water in aggregate in water-cement ratio computations.

F. Adjustment of Mix Proportions: After sufficient data becomes available during construction, mix may be adjusted upon approval of Engineer, in accordance with ACI 318, Item 5.5; however, minimum cement content for each class of concrete shall not be less than specified.

G. Entrained Air: Air-entrain all concrete except drilled shafts. Total air content in accordance with ASTM C173: 4 to 6 percent.

H. Consistency, Workability, and Slump:

1. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce concrete which can be worked properly into place without segregation, and which can be compacted by vibratory methods as specified, to give the desired strength, density, impermeability and smoothness of surface. Change the quantity of water as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. Determine the consistency of the concrete in successive batches by slump tests in accordance with ASTM C 143. Slumps shall be as follows:

Concrete Type	Minimum Slump	Maximum Slump
Portland Cement Concrete:	2"	4"
Concrete to be dosed with superplasticizer:	1"	3"
Normal Weight Concrete after dosing with superplasticizer:	4"	9"
Lightweight Concrete after dosing with superplasticizer:	4"	7"
Drilled Shaft Concrete:	4"*	8"

* Minimum slump where drilled shafts are cast in temporary casings: 5 inches.

2. Specified slump shall apply at time when concrete is discharged at job site. Perform slump tests to monitor uniformity and consistency of concrete delivered to job site; however, do not use as basis for mix design. Do not exceed water-cement ratios specified.

I. Admixtures: Proportion admixtures according to manufacturer's recommendations. Use of accelerator is permitted when air temperature is less than 40 degrees F. Use of retarder is permitted when temperature of placed concrete exceeds 65 degrees F.

J. High-Range Water Reducers (Superplasticizers): Use superplasticizer to improve workability of concrete or delay hydration of cement, in accordance with requirements and recommendations of product manufacturer and approved submittals.

K. Concrete Classification and Strength:

1. Strength: Conform to values for class of concrete indicated on Drawings for each portion of Work. Requirements are based on 28-day compressive strength. If high early-strength concrete is allowed, requirements are based on 7-day compressive strength.

2. Classification:

Class (Normal-weight)	Minimum 28-Day Compressive Strength (psi)	Minimum Cement Content Pounds per Cubic Yard
Concrete for Structures Containing Water or Wastewater		
A	4000	564 (6 Sacks)
B	1500	423 (3-1/2 Sacks)
C	3000	470 (5 Sacks)
D	5000	658 (7 Sacks)
H	3000	610 (6-1/2 Sacks)
Concrete for Buildings, Slabs on Grade and Miscellaneous Structures		
AB	4000	Not Applicable
BB	1500	Not Applicable
CB	3000	Not Applicable
DB	5000	Not Applicable

Class (Light-weight)	Minimum 28-Day Compressive Strength (psi)	Minimum Cement Content Pounds per Cubic Yard
E	3000	Not Applicable
F	4000	Not Applicable
G	5000	Not Applicable

3. Maximum size aggregate for Class H concrete: 3/8 inch. Maximum size aggregate for all other normal-weight concrete: 1-1/2 inches, except as specified in Paragraph 2.01D.4.

4. When required strength is not obtained with minimum cement content as specified, add cement, lower water-cement ratio or provide other aggregates as necessary.

5. In addition to conforming to specified strength, lightweight concrete must be within specified unit weight limits. Maximum air-dry unit weight is 118 pounds per cubic foot; minimum is 110 pounds per cubic foot unless shown otherwise on Drawings. Determine air-dry unit weight in accordance with ASTM C567. Correlate air-dry unit weight with fresh unit weight of the same concrete as a basis for acceptance during construction.

L. Use of Classes of Concrete:

1. Use classes of concrete as indicated on the Drawings and in other specifications.

2. Liquid-containing structures: If not otherwise indicated, use the following classes for structures containing water or wastewater and for utility applications in the locations described:

a. Class A: All reinforced concrete and where not otherwise defined.

b. Class B: Unreinforced concrete used for plugging pipes, seal slabs, thrust blocks and trench dams, unless indicated otherwise.

c. Class H: Fill and topping. Where concrete fill thickness exceeds 3 inches in the majority of a placement and is not less than 1.5 inches thick, Class A concrete may be used.

3. All other structures: If not otherwise indicated, use the following classes in the locations described:

a. Class AB: All reinforced concrete and where not otherwise defined.

b. Class BB: Unreinforced concrete fill under structures.

2.03 MIXING NORMAL WEIGHT CONCRETE

A. Conform to ACI 301, Chapter 7.

B. Ready-Mixed Concrete:

1. Measure, batch, mix and transport ready-mixed concrete according to ASTM C94. Plant equipment and facilities shall conform to NRMCA "Certification of Ready Mixed Concrete Production Facilities".

2. Provide batch tickets with information specified in ASTM C94. Deliver batch ticket with concrete and give to Owner's on-site testing laboratory representative.

C. Batch Mixing at Site:

1. Mix concrete in batch mixer conforming to requirements of CPMB "Concrete Plant Mixer Standards". Use mixer equipped with suitable charging hopper, water storage tank and water measuring device. Batch mixer shall be capable of mixing aggregates, cement and water into uniform mass within specified mixing time, and of discharging mix without segregation. Operate mixer according to rated capacity and recommended revolutions per minute printed on manufacturer's rating plate.

2. Charge batch into mixer so some water will enter before cement and aggregates. Keep water running until one-fourth of specified mixing time has elapsed. Provide controls to prevent discharging until required mixing time has elapsed. When concrete of normal weight is specified, provide controls to prevent addition of water during mixing. Discharge entire batch before mixer is recharged.

3. Mix each batch of 2 cubic yards or less for not less than 1 minute and 30 seconds. Increase minimum mixing time 15 seconds for each additional cubic yard or fraction of cubic yard.

4. Keep mixer clean. Replace pick-up and throw-over blades in drum when they have lost 10 percent of original depth.

D. Admixtures:

1. Charge air-entraining and chemical admixtures into mixer as solution using automatic dispenser or similar metering device. Measure admixture to accuracy within $\pm$ 3 percent. Do not use admixtures in powdered form.

2. Two or more admixtures may be used in same concrete, provided that admixtures in combination retain full efficiency and have no deleterious effect on concrete or on properties of each other. Inject admixtures separately during batching sequence.

3. Add retarding admixtures as soon as practicable after addition of cement.

E. Temperature Control:

1. When ambient temperature falls below 40 degrees F, keep as-mixed temperature above 55 degrees F to maintain concrete above minimum placing temperature.

2. When water or aggregate has been heated, combine water with aggregate in mixer before cement is added. Do not add cement to mixtures of water and aggregate when temperature of mixture is greater than 100 degrees F.

3. In hot weather, maintain temperature of concrete below maximum placing temperature. When necessary, temperature may be lowered by cooling ingredients, cooling mixer drum by fog spray, using chilled water or well-crushed ice in whole or

part for added water, or arranging delivery sequence so that time of transport and placement does not generate unacceptable temperatures.

4. Submit hot weather and cold weather concreting plans for approval.

2.04 MIXING LIGHTWEIGHT CONCRETE

A. Determining Absorption of Aggregates: Mixing procedures vary according to total absorption by weight of lightweight aggregates. Determine total absorption by weight before predamping in accordance with ASTM C127.

B. Ten Percent or Less Absorption: Follow same requirements as for mixing normal-weight concrete when preparing concrete made with low-absorptive lightweight aggregates having 10 percent or less total absorption by weight. To be low-absorptive, aggregates must absorb less than 2 percent additional water in first hour after mixing.

C. More Than 10 Percent Absorption: Batch and mix concrete made with lightweight aggregates having more than 10 percent total absorption by weight, as follows:

1. Place approximately 80 percent of mixing water in mixer.

2. If aggregates are pre-dampened, add air-entraining admixture and all aggregates. Mix for minimum of 30 seconds, or 5 to 10 revolutions of truck mixer.

3. When aggregates have not been predampened, mix aggregates and water for minimum of 1 minute and 30 seconds, or 15 to 30 revolutions of truck mixer. Then add air-entraining admixture and mix for additional 30 seconds.

4. Then, in the following sequence, add specified or permitted admixtures (other than air-entraining agent), all cement, and mixing water previously withheld.

5. Complete mixing using procedures for normal-weight concrete.

2.05 MASS CONCRETE

A. Do not use high early-strength cement (Type III) or accelerating admixtures.

B. Use high-range water-reducing admixture (superplasticizer) to minimize water content and cement content.

C. Specified water-reducing retarding admixture may be required to prevent cold joints when placing large quantities of concrete, to permit revibration of concrete, to offset effects of high temperature in concrete or weather, and to reduce maximum temperature or rapid temperature rise.

2.06 EQUIPMENT

A. Select equipment of size and design to ensure continuous flow of concrete at delivery end. Conform to following equipment and operations requirements.

B. Truck mixers, agitators and manner of operation: Conform to ASTM C94. Use of non-agitating equipment for transporting concrete is not permitted.

C. Belt conveyors: Configure horizontally, or at a slope causing no segregation or loss. Use approved arrangement at discharge end to prevent separation. Discharge long runs without separation into hopper.

D. Chutes: Metal or metal-lined (other than aluminum). Arrange for vertical-to-horizontal slopes not more than 1 to 2 nor less than 1 to 3. Chutes longer than 20 feet or not meeting slope requirements may be used if concrete is discharged into hopper before distribution.

E. Do not use aluminum or aluminum-alloy pipe or chutes for conveying concrete.

PART 3 – EXECUTION

3.01 SPECIAL CONSIDERATIONS

A. Concreting Under Water: Not permitted except where shown otherwise on Drawings or approved by Engineer. When shown or permitted, deposit concrete under water by methods acceptable to the Engineer so fresh concrete enters mass of previously-placed concrete from within, causing water to be displaced with minimum disturbance at surface of concrete.

B. Protection from Adverse Weather: Unless adequate protection is provided or Engineer's approval is obtained, do not place concrete during rain, sleet, snow or freezing weather. Do not permit rainwater to increase mixing water or to damage surface finish. If rainfall occurs after placing operations begin, provide adequate covering to protect Work.

3.02 PREPARATION OF SURFACES FOR CONCRETING

A. Earth Surfaces:

1. Under interior slabs on grade, install vapor barrier. Lap joints at least 6 inches and seal watertight with tape, or sealant applied between overlapping edges and ends. Repair vapor barrier damaged during placement of reinforcing and inserts with vapor barrier material; lap over damaged areas at least 6 inches and seal watertight.

2. Other Earth Surfaces: Thoroughly wet by sprinkling prior to placing concrete, and keep moist by frequent sprinkling up to time of placing concrete thereon. Remove standing water. Surfaces shall be free from standing water, mud and debris at the time of placing concrete.

B. Construction Joints:

1. Definition: Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been interrupted so that, in the judgement of the Engineer, new concrete cannot be incorporated integrally with that previously placed.
2. Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, use forms or other means to shape the working face to secure proper union with subsequent work. Make construction joints only where acceptable to the Engineer.

3. Preparation: Give horizontal joint surfaces a compacted, roughened surface for good bond. Except where the Drawings call for joint surfaces to be coated, clean joint surfaces of laitance, loose or defective concrete and foreign material by hydroblasting or sandblasting (exposing aggregate), roughen surface to expose aggregate to a depth of at least 1/4 inch and wash thoroughly. Remove standing water from the construction joint surface before new concrete is placed.

4. After surfaces have been prepared cover approximately horizontal construction joints with a 3-inch lift of a grout mix consisting of Class C concrete batched without coarse aggregate; place and spread grout uniformly. Place wall concrete on the grout mix immediately thereafter.

C. Set and secure reinforcement, anchor bolts, sleeves, inserts and similar embedded items in the forms where indicated on Contract Drawings, shop drawings and as otherwise required. Obtain Engineer's acceptance before concrete is placed. Accuracy of placement is the sole responsibility of the Contractor.

D. Place no concrete until formwork, inserts, embedded items, reinforcement and surface preparation have been completed and accepted by the Engineer. Clean surfaces of forms and embedded items that have become encrusted with grout or previously-placed concrete before placing adjacent concrete.

E. Casting New Concrete Against Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), thoroughly clean and roughen the surface of the old concrete by hydro-blasting or sandblasting (exposing aggregate). Coat joint surface with epoxy bonding agent following manufacturer's written instructions unless indicated otherwise. Unless noted otherwise, this provision does not apply to vertical wall joints where waterstop is installed.

F. Protection from Water: Place no concrete in any structure until water entering the space to be filled with concrete has been properly cut off or diverted and carried out of the forms, clear of the work. Deposit no concrete underwater. Do not allow still water to rise on any concrete until concrete has attained its initial set. Do not allow water to flow over the surface of any concrete in a manner and at a velocity that will damage the surface finish of the concrete. Pumping, dewatering and other necessary operations for removing ground water, if required, are subject to Engineer's review.

G. Corrosion Protection: Position and support pipe, conduit, dowels and other ferrous items to be embedded in concrete construction prior to placement of concrete so there is at least a 2

inch clearance between them and any part of the concrete reinforcement. Do not secure such items in position by wiring or welding them to the reinforcement.

H. Where practicable, provide for openings for pipes, inserts for pipe hangers and brackets and setting of anchors during placing of concrete.

I. Accurately set anchor bolts and maintain in position with templates while they are being embedded in concrete.

J. Cleaning: Immediately before concrete is placed, thoroughly clean dirt, grease, grout, mortar, loose scale, rust and other foreign substances from surfaces of metalwork to be in contact with concrete.

3.03 HANDLING, TRANSPORTING AND PLACING CONCRETE

A. Conform to applicable requirements of Chapter 8 of ACI 301 and this Section. Use no aluminum materials in conveying concrete.

B. Rejected Work: Remove concrete found to be defective or non-conforming in materials or workmanship. Replace rejected concrete with concrete meeting requirements of Contract Documents, at no additional cost to the Owner.

C. Unauthorized Placement: Place no concrete except in the presence of the Engineer. Notify the Engineer in writing at least 24 hours before placement of concrete.

D. Placement in Wall Forms:

1. Do not drop concrete through reinforcing steel or into any deep form.

2. Do not place concrete in any form so as to leave an accumulation of mortar on form surfaces above the concrete.

3. Use hoppers and, if necessary, vertical ducts of canvas, rubber or metal (other than aluminum) for placing concrete in forms so it reaches the place of final deposit without separation. Free fall of concrete shall not exceed 4 feet below the ends of ducts, chutes or buggies. Uniformly distribute concrete during depositing.

4. Do not displace concrete in forms more than 6 feet in horizontal direction from place where it was originally deposited.

5. Deposit in uniform horizontal layers not deeper than 2 feet; take care to avoid inclined layers or inclined construction joints except where required for sloping members.

6. Place each layer while the previous layer is still soft. Rate of placement shall not exceed 5 feet of vertical rise per hour.

7. Provide sufficient illumination in form interior so concrete at places of deposit is visible from the deck or runway.

E. Conveyors and Chutes: Design and arrange ends of chutes, hopper gates and other points of concrete discharge in the conveying, hoisting and placing system so concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyors, if used, shall be of a type acceptable to the Engineer. Do not use chutes longer than 50 feet. Slope chutes so concrete of specified consistency will readily flow. If a conveyor is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyors and chutes shall be covered.

F. Placement of Slabs: In hot or windy weather, conducive to plastic shrinkage cracks, apply evaporation retardant to slab after screeding in accordance with manufacturer's instructions and recommendations. Do not use evaporation retardant to increase water content of the surface cement paste. Place concrete for sloping slabs uniformly from the bottom of the slab to the top, for the full width of the placement. As work progresses, vibrate and carefully work concrete around slab reinforcement. Screed the slab surface in an up-slope direction.

G. ConcreteTemperature: When placed, not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick, nor less than 50 degrees for all other sections. Do not heat concrete ingredients to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When concrete temperature is 85 degrees F or above, do not exceed 60 minutes between introduction of cement to the aggregates and discharge. When the weather is such that the concrete temperature would exceed 90 degrees F, employ effective means, such as pre-cooling of aggregates and mixing water, using ice or placing at night, as necessary to maintain concrete temperature, as placed, below 90 degrees F.

H. Cold Weather Placement: Conform to ACI 306.1 - Standard Specification for Cold Weather Concreting, and the following.

1. Remove snow, ice and frost from surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. Warm reinforcement and embedded items to above 32 degrees F prior to concrete placement.

2. Maintain concrete temperature above 50 degrees F for at least 3 days after placement.

3.04 PUMPING OF CONCRETE

A. If pumped concrete does not produce satisfactory results, in the judgement of the Engineer, discontinue pumping operations and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment: Use a 2-cylinder pump designed to operate with only one cylinder if one is not functioning, or have a standby pump on site during pumping.

C. The minimum hose (conduit) diameter: Comply with ACI 304.2R.

D. Replace pumping equipment and hoses (conduits) that do not function properly.

E. Do not use aluminum conduits for conveying concrete.

F. Field Control: Take samples for slump, air content and test cylinders at the placement (discharge) end of the line.

3.05 CONCRETE PLACEMENT SEQUENCE

A. Place concrete in a sequence acceptable to the Engineer. To minimize effects of shrinkage, place concrete in units bounded by construction joints shown. Place alternate units so each unit placed has cured at least 7 days for hydraulic structures, or 3 days for other structures, before contiguous unit or units are placed, except do not place corner sections of vertical walls until the 2 adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for other structures.

B. Level the concrete surface whenever a run of concrete is stopped. To ensure straight and level joints on the exposed surface of walls, tack a wood strip at least 3/4-inch thick to the forms on these surfaces. Carry concrete about 1/2 inch above the underside of the strip. About one hour after concrete is placed, remove the strip, level irregularities in the edge formed by the strip with a trowel and remove laitance.

3.06 TAMPING AND VIBRATING

A. Thoroughly settle and compact concrete throughout the entire depth of the layer being consolidated, into a dense, homogeneous mass; fill corners and angles, thoroughly embed reinforcement, eliminate rock pockets and bring only a slight excess of water to the exposed surface of concrete during placement. Use ACI 309R Group 3 immersion-type high-speed power vibrators (8,000 to 12,000 rpm) in sufficient number and with sufficient (at least one) standby units. Use Group 2 vibrators only when accepted by the Engineer for specific locations.

B. Use care in placing concrete around waterstops. Carefully work concrete by rodding and vibrating to make sure air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, work concrete under waterstops by hand, making sure air and rock pockets have been eliminated. Give concrete surrounding the waterstops additional vibration beyond that used for adjacent concrete placement to assure complete embedment of waterstops in concrete.

C. Concrete in Walls: Internally vibrate, ram, stir, or work with suitable appliances, tamping bars, shovels or forked tools until concrete completely fills forms or excavations and closes snugly against all surfaces. Do not place subsequent layers of concrete until previously-placed layers have been so worked. Provide vibrators in sufficient numbers, with standby units as required to accomplish the results specified within 15 minutes after concrete of specified consistency is placed in the forms. Keep vibrating heads from contact with form

surfaces. Take care not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.07 PLACING MASS CONCRETE

A. Observe the following additional restrictions when placing mass concrete.

1. Use specified superplasticizer.

2. Maximum temperature of concrete when deposited: 70 degrees F.

3. Place in lifts approximately 18 inches thick. Extend vibrator heads into previously placed layer.

3.08 REPAIRING SURFACE DEFECTS AND FINISHING

A. Conform to Section 03350 - Concrete Finishing.

3.09 CURING

A. Conform to Section 03390 - Concrete Curing.

3.10 PROTECTION

A. Protect concrete against damage until final acceptance by the Owner.

B. Protect fresh concrete from damage due to rain, hail, sleet or snow. Provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until all components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by the Engineer.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Repairing surface defects.

B. Finishing concrete surfaces including both formed and unformed surfaces.

C. Sealing concrete surfaces.

D. Installation of concrete fill and installation of concrete topping in bottoms of clarifiers and thickeners.

1.02 UNIT PRICES

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 REFERENCES

A. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.

B. ASTM C 881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

C. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

D. ASTM D 4587 - Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light-and Water-Exposure Apparatus.

E. ASTM E 1155 - Standard Test Method for Determining Floor Flatness and Levelness Using the F Number System.

1.04 SUBMITTALS

A. Submit manufacturer's technical literature on the following products proposed for use. Include manufacturer's installation and application instructions and, where specified, manufacturer's certification of conformance to requirements and suitability for use in the applications indicated.

1. Floor hardener.

2. Sealer.

3. Epoxy floor topping.

4. Epoxy penetrating sealer.

5. Latex bonding agent.

6. Abrasive aggregate.

7. Evaporation retardant.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Sealer/Dustproofer (VOC Compliant): Water-based acrylic sealer; non-yellowing under ultraviolet light after 200-hour test in accordance with ASTM D 4587. Conform to local, state and federal solvent emission requirements.

B. Epoxy Floor Topping: Two-component epoxy resin meeting ASTM C 881 Type III, resistant to wear, staining and chemical attack, blended with granite, sand, trap rock or quartz aggregate, trowel-applied over concrete floor. Topping thickness, 1/8 inch; color, gray.

C. Abrasive Aggregate for Nonslip Finish: Fused aluminum oxide grit, or crushed emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Material shall be factory graded, packaged, rustproof and nonglazing, and unaffected by freezing, moisture and cleaning materials.

D. Epoxy Penetrating Sealer: Low-viscosity, two-component epoxy system designed to give maximum penetration into concrete surfaces. Sealer shall completely seal concrete surfaces from penetration of water, oil and chemicals; prevent dusting and deterioration of concrete surfaces caused by heavy traffic; and be capable of adhering to floor surfaces subject to hydrostatic pressure from below. Color, transparent amber or gray; surface, nonslip.

E. Latex Bonding Agent: Non-redispersable latex base liquid conforming to ASTM C 1059. When used in water and wastewater treatment structures, bonding agent shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required.

F. Bonding Grout: Prepare bonding grout by mixing approximately one part cement to one part fine sand meeting ASTM C 144 but with 100 percent passing No. 30 mesh sieve. Mix with water to consistency of thick cream. At Contractor's option, a commercially-prepared bonding agent used in accordance with manufacturer's recommendations and instructions may be used. When used in water and wastewater treatment structures, bonding agent shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required. Submit manufacturer's technical information on proposed bonding agent.

G. Patching Mortar:

1. Make patching mortar of same materials and of approximately same proportions as concrete, except omit coarse aggregate. Substitute white Portland cement for part of gray Portland cement on exposed concrete in order to match color of surrounding concrete. Determine color by making trial patch. Use minimum amount of mixing water required for handling and placing. Mix patching mortar in advance and allow to stand. Mix frequently with trowel until it has reached stiffest consistency that will permit placing. Do not add water.

2. Proprietary compounds for adhesion or specially formulated cementitious repair mortars may be used in lieu of or in addition to foregoing patching materials provided that properties of bond and compressive strength meet or exceed the foregoing and color of surrounding concrete can be matched where required. Use such compounds according to manufacturer's recommendations. When used in water and wastewater treatment structures, material shall be suitable for use under continuously submerged conditions. Conformance and suitability certification by manufacturer is required.

H. Epoxy Adhesive: Two-component, 100 percent solids, 100 percent reactive compound developing 100 percent of strength of concrete, suitable for use on dry or damp surfaces. Epoxy used to inject cracks and as a binder in epoxy mortar shall meet ASTM C 881, Type VI. Epoxy used as a bonding agent for fresh concrete shall meet ASTM C 881, Type V.

I. Non-shrink Grout: See Specification Section 03600 - Grout.

J. Spray-Applied Coating: Acceptable products are Thoro System Products "Thoroseal Plaster Mix" or equal. Color: Gray.

K. Concrete Topping: Class H concrete with 3/8-inch maximum coarse aggregate size, as specified in Specification Section 03310 - Structural Concrete.

L. Concrete Fill: Class H concrete with 3/8-inch maximum coarse aggregate size, (Class C where fill thickness exceeds 3 inches throughout a placement), as specified in Specification Section 03310 – Structural Concrete.

M. Evaporation Retardant: Confilm, manufactured by Master Builders; Eucobar, manufactured by Euclid Chemical Company; or equal.

PART 3 – EXECUTION

3.01 AGGREGATE CONCEALMENT

A. Unless indicated otherwise on Drawings or approved by Owner's Representative, all surfaces to be finished shall be free of exposed aggregate.

3.02 REPAIRING SURFACE DEFECTS

A. Defective Areas: Repair immediately after removal of forms. Remove honeycombed and other defective concrete down to sound concrete but in no case to a depth less than one inch. Make edges of cuts perpendicular to concrete surface. Thoroughly work bonding grout into the surface with a brush as that the entire surface is covered. Alternatively, a proprietary bonding agent may be used. Use bonding agent in accordance with manufacturer's instructions. While bonding coat is still tacky, apply premixed patching mortar. Thoroughly consolidate mortar into place and strike off to leave patch slightly higher than surrounding surface. To permit initial shrinkage, leave undisturbed for at least 1 hour before final finishing. Keep patched area damp for 7 days. Alternatively, a proprietary cementitious repair mortar may be used and placed in accordance with manufacturer's instructions. Do not use metal tools in finishing patches in formed walls which will be exposed.

B. Tie Holes: Patch holes immediately after removal of forms. After cleaning and roughening with a wire brush on a rotary drill, thoroughly dampen tie hole and fill solid with patching mortar. Taper tie holes shall have the plug, specified in Specification Section 03100 – Concrete Formwork, driven into the hole to the center of the wall before grouting. Completely fill taper tie holes with patching mortar except that non-shrink grout shall be used for all walls in contact with soil or liquid. On wall faces exposed to view, fill the outer 2 inches of the taper tie hole with patching mortar blended to match adjacent concrete.

C. Cracks: Repair cracks in excess of 0.01 inch by pressure injection of moisture-insensitive epoxy-resin system. Submit proposed material and method of repair for approval prior to making repairs.

D. Structural Repair: When required, make structural repairs after prior approval of Owner's Representative as to method and procedure, using specified epoxy adhesive or approved epoxy mortar.

3.03 FINISHING OF FORMED SURFACES

A. Unfinished Surfaces: Finish is not required on surfaces concealed from view in completed structure by earth, ceilings or similar cover, unless indicated otherwise on Drawings.

B. Rough Form Finish:

1. No form facing material is required on rough form finish surfaces.

2. Patch tie holes and defects. Chip off fins exceeding 1/4 inch in height.

3. Rough form finish may be used on concrete surfaces which will be concealed from view by earth in completed structure, except concealed surfaces required to have smooth form finish, as shown on Drawings.

C. Smooth Form Finish:

1. Form facing shall produce smooth, hard, uniform texture on concrete. Use plywood or fiberboard linings or forms in as large sheets as practicable, and with smooth, even edges and close joints.

2. Patch tie holes and defects. Rub fins and joint marks with wooden blocks to leave smooth, unmarred finished surface.

3. Provide smooth form finish on the wet face of formed surfaces of water-holding structures, and of other formed surfaces not concealed from view by earth in completed structure, except where otherwise indicated on Drawings. Walls that will be exposed after future construction, at locations indicated on Drawings, shall have smooth form finish. Smooth form finish on exterior face of exterior walls shall extend 2 feet below final top of ground elevation. Exterior face of all perimeter grade beams shall have smooth form finish for full depth of grade beam.

D. Rubbed Finish:

1. Use plywood or fiberboard linings or forms in as large sheets as practicable, and with smooth, even edges and close joints.

2. Remove forms as soon as practicable, repair defects, wet surfaces, and rub with No. 16 carborundum stone or similar abrasive. Continue rubbing sufficiently to bring surface paste, remove form marks and fins, and produce smooth, dense surface of uniform color and texture. Do not use cement paste other than that drawn from concrete itself. Spread paste uniformly over surface with brush. Allow paste to reset, then wash surface with clean water.

3. Use rubbed finish at locations indicated on Drawings, except where rubbed finish is indicated for a wall which will be containing a liquid, use spray-applied coating.

E. Spray-applied Coating: At Contractor's option, in lieu of rubbed finish, spray-applied coating may be applied after defects have been repaired and fins removed. Remove form oil, curing compound and other foreign matter that would prevent bonding of coating.

Apply coating in uniform texture and color in accordance with coating manufacturer's instructions.

F. Related Unformed Surfaces: Tops of piers, walls, bent caps, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed. Float unformed surfaces to texture reasonably consistent with that of formed surfaces. Continue final treatment on formed surfaces uniformly across unformed surfaces.

3.04 HOT WEATHER FINISHING

A. When hot weather conditions exist, as defined by Specification Section 03310 - Structural Concrete and as judged by the Owner's Representative, apply evaporation retardant to the

surfaces of slabs, topping and concrete fill placements immediately after each step in the finishing process has been completed.

3.05 FINISHING SLABS AND SIMILAR FLAT SURFACES TO CLASS A, B, AND C TOLERANCES

A. Apply Class A, B, and C finishes at locations indicated on Drawings.

B. Shaping to Contour: Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to proper contour. See Specification Section 03100 – Concrete Formwork for edge forms and screeds.

C. Consolidation and Leveling: Concrete to be consolidated shall be as stiff as practicable, thoroughly consolidate concrete in slabs and use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade. Consolidate and level slabs and floors with vibrating bridge screeds, roller pipe screeds or other approved means. After consolidation and leveling, do not permit manipulation of surfaces prior to finishing operations.

D. Tolerances for Finished Surfaces: Check tolerances by placing straightedge of specified length anywhere on slab. Gap between slab and straightedge shall not exceed tolerance listed for specified class.

Class	Straightedge Length in Feet	Tolerance in Inches
A	10	1/8
B	10	1/4
C	2	1/4

E. Raked Finish: After concrete has been placed, struck off, consolidated and leveled to Class C tolerance, roughen surface before final set. Roughen with stiff brushes or rakes to depth of approximately 1/4 inch. Notify Owner's Representative prior to placing concrete requiring initial raked surface finish so that acceptable raked finish standard may be established for project. Protect raked, base-slab finish from contamination until time of topping. Provide raked finish for following:

1. Surfaces to receive bonded concrete topping or fill.

2. Steep ramps, as noted on Drawings.

3. Additional locations as noted on Drawings.

F. Float Finish:

1. After concrete has been placed, struck off, consolidated and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, or

when mix has stiffened sufficiently to permit proper operation of power-driven float. Consolidate surface with power-driven floats. Use hand floating with wood or cork-faced floats in locations inaccessible to power-driven machine and on small, isolated slabs.

2. After initial floating, re-check tolerance of surface with 10-foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots to Class B tolerance. Immediately re-float slab to a uniform, smooth, granular texture.

3. Provide float finish at locations not otherwise specified and not otherwise indicated on Drawings.

G. Trowel Finish:

1. Apply float finish as previously specified. After power floating, use power trowel to produce smooth surface which is relatively free of defects but which may still contain some trowel marks. Do additional troweling by hand after surface has hardened sufficiently. Do final troweling when ringing sound is produced as trowel is moved over surface. Thoroughly consolidate surface by hand troweling operations.

2. Produce finished surface free of trowel marks, uniform in texture and appearance and conforming to Class A tolerance. On surfaces intended to support floor coverings, remove defects which might show through covering by grinding.

3. Provide trowel finish for floors which will receive floor covering and additional locations indicated on Drawings.

H. Broom or Belt Finish:

1. Apply float finish as previously specified. Immediately after completing floated finish, draw broom or burlap belt across surface to give coarse transverse scored texture.

2. Provide broom or belt finish at locations indicated on Drawings.

3.06 FINISHING SLABS AND SIMILAR FLAT SURFACES TO "F-NUMBER SYSTEM" FINISH

A. Shaping to Contour: Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to proper contour. Edge forms and screeds: Conform to Specification Section 03100 - Concrete Formwork.

B. Consolidation and Leveling: Concrete to be consolidated shall be as dry as practicable. Thoroughly consolidate concrete in slabs and use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade. Consolidate and level slabs and floors with vibrating bridge screeds, roller pipe screeds or other approved means. After consolidation and leveling, do not manipulate surfaces prior to finishing operations.

C. Tolerances for Finished Surfaces: Independent testing laboratory will check floor flatness and levelness in accordance with Paragraph 3.12, Field Quality Control.

D. Float Finish:

1. After concrete has been placed, struck off, consolidated and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared, or when mix has stiffened sufficiently to permit proper operation of power-driven float. Consolidate surface with power-driven floats. Use hand floating with wood or cork-faced floats in locations inaccessible to power-driven machine and on small, isolated slabs.

2. Check tolerance of surface after initial floating with a 10-foot straightedge applied at not less than two different angles. Cut down high spots and fill low spots. Immediately refloat slab to uniform, smooth, granular texture to F_F20/F_L17 tolerance, unless shown otherwise on Drawings.

3. Provide "F-Number System" float finish at locations indicated on Drawings.

E. Trowel Finish:

1. Apply float finish as previously specified. After power floating, use power trowel to produce smooth surface which is relatively free of defects but which may still contain some trowel marks. Do additional trowelings by hand after surface has hardened sufficiently. Do final troweling when ringing sound is produced as trowel is moved over surface. Thoroughly consolidate surface by hand troweling operations.

2. Produce finished surface free of trowel marks, uniform in texture and appearance and conforming to an F_F25/F_L20 tolerance for slabs on grade and F_F25/F_L17 for elevated slabs, unless shown otherwise on Drawings. On surfaces intended to support floor coverings, remove defects, which might show through covering, by grinding.

3. Provide "F-Number System" trowel finish at locations indicated on Drawings.

3.07 BONDED CONCRETE TOPPING AND FILL

A. Surface Preparation:

1. Protect raked, base-slab finish from contamination until time of topping. Mechanically remove oil, grease, asphalt, paint, clay stains or other contaminants, leaving clean surface.

2. Prior to placement of topping or fill, thoroughly dampen roughened slab surface and leave free of standing water. Immediately before topping or fill is placed, scrub coat of bonding grout into surface. Do not allow grout to set or dry before topping or fill is placed.

B. Concrete Fill:

1. Where concrete fill intersects a wall surface at an angle steeper than 45 degrees from vertical, provide a 1.5-inch deep keyway in the wall at the point of intersection; size keyway so that no portion of the concrete fill is less than 1.5 inches thick. Form keyway in new walls; create by saw cutting the top and bottom lines and chipping in existing walls.

2. Apply wood float finish to surfaces of concrete fill.

3. Provide concrete fill at locations shown on Drawings.

C. Bonded Concrete Topping in Bottom of Clarifiers and Thickeners:

1. Minimum thickness of concrete topping: 1 inch. Maximum thickness when swept in by clarifier and thickener equipment: 3 inches.

2. Compact topping and fill by rolling or tamping, bring to established grade, and float. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. Coat surface with evaporation retardant as needed between finishing operations to prevent plastic shrinkage cracks.

3. Screed topping to true surface using installed equipment. Protect equipment from damage during sweeping-in process. Perform sweeping-in process under supervision of equipment manufacturer's factory representative. After topping has been screeded, apply wood float finish. During finishing, do not apply water, dry cement or mixture of dry cement and sand to the surface.

4. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by the Owner's Representative, fill the tank with sufficient water to cover the entire floor for 14 days.

5. Provide bonded concrete topping in bottom of all clarifiers and thickeners.

3.08 EPOXY PENETRATING SEALER

A. Surfaces to receive epoxy penetrating sealer: Apply wood float finish. Clean surface and apply sealer in compliance with manufacturer's instructions.

B. Rooms with concrete curbs or bases: Continue application of floor coating on curb or base to its juncture with masonry wall. Rooms with solid concrete walls or wainscots: Apply minimum 2-inch-high coverage of floor coating on vertical surface.

C. Mask walls, doors, frames and similar surface to prevent floor coating contact.

D. When coving floor coating up vertical concrete walls, curbs, bases or wainscots, use masking

tape or other suitable material to keep a neat level edge at top of cove.

E. Provide epoxy penetrating sealer at locations indicated on Drawings.

3.09 EPOXY FLOOR TOPPING

A. Surfaces to receive epoxy floor topping: Apply wood float finish unless recommended otherwise by epoxy floor topping manufacturer. Clean surface and apply epoxy floor topping in compliance with manufacturer's recommendations and instructions. Thickness of topping: 1/8 inch.

B. Rooms with concrete curbs or bases: Continue application of floor coating on curb or base to its juncture with masonry wall. Rooms with solid concrete walls or wainscots: apply 2-inch-high coverage of floor coating on vertical surface.

C. Mask walls, doors, frames and similar surfaces to prevent floor coating contact.

D. When coving floor coating up vertical concrete walls, curbs, bases or wainscots, use masking tape or other suitable material to keep a neat level edge at top of cover.

E. Finished surface shall be free of trowel marks and dimples.

F. Provide epoxy floor topping at locations indicated on Drawings.

3.10 SEALER/DUSTPROOFER

A. Where sealer or sealer/dustproofer is indicated on Drawings, just prior to completion of construction, apply coat of specified clear sealer/dustproofing compound to exposed interior concrete floors in accordance with manufacturer's instructions.

3.11 NONSLIP FINISH

A. Apply float finish as specified. Apply two-thirds of required abrasive aggregate by method that ensures even coverage without segregation and re-float. Apply remainder of abrasive aggregate at right angles to first application, using heavier application of aggregate in areas not sufficiently covered by first application. Re-float after second application of aggregate and complete operations with troweled finish. Perform finishing operations in a manner that will allow the abrasive aggregate to be exposed and not covered with cement paste.

B. Provide nonslip finish at locations indicated on Drawings.

3.12 FIELD QUALITY CONTROL

A Flatness and levelness of slabs and similar flat surfaces that are indicated on Drawings to receive "F-Number System" finish will be checked by independent testing laboratory employed by Owner in accordance General Conditions.

B. Tolerances for "F-Number System" finished surfaces:

1. Floor tolerance shall be determined in accordance with ASTM E 1155.

2. Floor flatness and levelness tolerances:

a. F_F defines maximum floor curvature allowed over 24 inches. Computed on the basis of successive 12-inch elevation differentials, F_F is commonly referred to as the "flatness F- Number."

$$F_F = \frac{4.57}{\text{Maximum difference in elevation, in decimal inches, between successive 12-inch elevation differences.}}$$

b. F_L defines relative conformity of floor surface to horizontal plane as measured over 10-foot distance. F_L is commonly referred to as "levelness F-number."

$$F_L = \frac{12.5}{\text{Maximum difference in elevation, in inches, between two points separated by 10 feet.}}.$$

3. Achieve specified overall slab tolerance. Minimum local tolerance (1/2 bay, unless otherwise designated by Owner's Representative): 2/3 of specified tolerance.

4. Tolerance for floated finish: F_F20/F_L17, unless otherwise shown on Drawings.

5. Tolerance for troweled finish: F_F25/F_L20 for slabs on grade, and F_F25/F_L17 for elevated slabs, unless otherwise shown on Drawings.

3.13 CURING

A. Conform to requirements of Specification Section 03390 - Concrete Curing.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Curing of structural concrete.

1.02 UNIT PRICES

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 REFERENCES

A. ACI 308 - Standard Practice for Curing Concrete.

B. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.

C. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

D. ASTM D 44587 - Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light-and Water-Exposure Apparatus.

1.04 DEFINITIONS

A. Mass Concrete: Concrete sections 4 feet or more in least dimension.

1.05 SUBMITTALS

A. Product Data: Submit description of proposed curing method for concrete. When use of membrane-forming compound is proposed, submit manufacturer's technical information including material specifications, installation instructions and recommendations, and evidence that compound is satisfactory for intended application. State locations where curing compound will be used.

B. When membrane-forming compounds are to be used, submit certification by the manufacturer of compliance with specified requirements and compatibility with toppings, coatings, finishes, and adhesives to be applied.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Membrane-forming Curing Compound: Conform to ASTM C 309, Type 1D, and following requirements.

1. Minimum solids content: 30 percent.

2. Compound shall not permanently discolor concrete. When used for liquid- containing structures, curing compound shall be white-pigmented.

3. When used in areas that are to be coated, or that will receive topping or floor covering, material shall not reduce bond of coating, topping, or floor covering to concrete. Curing compound manufacturer's technical information shall state conditions under which compound will not prevent bond.

4. Conform to local, state and federal solvent emission requirements.

B. Clear Curing and Sealing Compound (VOC Compliant): Conform to ASTM C 309, Type 1, Class B, and the following requirements: 30 percent solids content minimum; non-yellowing under ultraviolet light after 500-hour test in accordance with ASTM D 4587. Sodium silicate compounds are not permitted. Conform to local, state and federal solvent emission requirements.

C. Sheet Material for Curing Concrete: ASTM C 171; waterproof paper, polyethylene film or white burlap-polyethylene sheeting.

D. Curing Mats (for use in Curing Method 2): Heavy shag rugs or carpets, or cotton mats quilted at 4 inches on center; 12 ounce per square yard minimum weight when dry.

E. Water for curing: Clean and potable.

PART 3 - EXECUTION

3.01 CURING PROCEDURES

A. Comply with ACI 308 and the requirements specified herein. Protect freshly-deposited concrete from premature drying and excessively hot or cold temperatures. Maintain minimal moisture loss and relatively constant temperature during time necessary for hydration of cement and proper hardening of concrete.

B. Unformed Surfaces: For concrete surfaces not in contact with forms, use one of following procedures immediately after completion of placement and finishing.

1. Ponding or continuous sprinkling.

2. Absorptive mat or fabric kept continuously wet.

3. Sand or other covering kept continuously wet.

4. Continuous steam bath (not exceeding 150 degrees F at surface of concrete).

5. Vapor mist bath.

6. Membrane-forming curing compound applied according to manufacturer's recommendations. After the curing compound has dried, wet slab surfaces and cover with waterproof paper, polyethylene film, or white burlap-polyethylene sheeting after the application of the curing compound. Tape sheet seams together and provide sufficient weights to keep the sheeting in place. Wet the slab surface again if the sheeting becomes dislodged, and replace the sheeting.

7. Other moisture-retaining coverings as approved by Owner's Representative.

C. Restrictions on Use of Curing Compounds: Unless curing compound manufacturer certifies that curing compound will not prevent bond to cured surface, do not use curing compound on surfaces that will be rubbed or receive additional concrete, mortar, topping, terrazzo or other cementitious finishing materials, on slabs under resilient floors or built-up roofing, or on surfaces to be waterproofed, sealed, hardened or painted.

D. Curing and Sealing Compounds: At locations indicated, cure exposed interior slabs and troweled slabs receiving mastic-applied adhesives with specified clear curing and sealing compound in accordance with manufacturer's recommendations. Do not store materials directly on curing membranes. Use plywood to protect curing membrane from damage. Immediately repair membranes damaged by foot traffic or other operations.

E. Duration of Curing: Continue curing until cumulative number of days or fractions of days during which ambient temperature is above 50 degrees F has totaled 7. Continue curing of water-retaining structures for a total of 14 days. When high-early-strength concrete has been used, continue curing for total of 3 days. Prevent rapid drying at end of curing period.

F. Formed Surfaces: During the curing period keep wet steel forms heated by sun and wood forms in contact with concrete. When forms are to be removed during curing period, employ curing materials or methods immediately. Continue such curing for remainder of curing period.

G. Temperature:

1. Cold Weather. When mean daily temperature of atmosphere is less than 40 degrees F, maintain temperature of concrete between 50 and 70 degrees F for required curing period. When necessary, make arrangements for heating, covering, insulating or housing concrete work in advance of placement to maintain required temperature and moisture conditions. Prevent damage or injury due to concentration of heat. When combustion heaters are necessary in enclosed or protected area where concrete slabs are being placed, vent heaters.

2. Hot Weather. In advance of placement make arrangements for shading, fog spraying, sprinkling, ponding or installation of windbreaks or wet covering of light color. Take such protective measures as quickly as concrete hardening and finishing operations will allow.

3. Temperature Changes. Control so rate of change in temperature of concrete is as uniform as possible. Do not permit temperature change to exceed 5 degrees F in any one hour or 50 degrees F in any 24-hour period.

H. Protection from Mechanical Injury. During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration. Protect finished concrete surfaces from damage caused by construction equipment, materials or methods, and by rain or running water. Do not load self-supporting structures in a way that over stresses concrete.

3.02 CURING MASS CONCRETE

A. Observe the following additional restrictions when curing mass concrete.

1. Minimum curing period: 2 weeks.

2. When ambient air temperature falls below 32 degrees F, protect surface of concrete against freezing.

3. Do not use steam or other curing methods that will add heat to concrete.

4. Keep forms and exposed concrete continuously wet for at least the first 48 hours after placing, and whenever surrounding air temperature is above 90 degrees F during final curing period.

5. During 2-week curing period, provide necessary controls to prevent ambient air temperature immediately adjacent to concrete from falling more than 30 degrees F in 24 hours.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers requirements for grout for leveling baseplates of all types; piping block-outs; and other uses of grout and at all locations shown or reasonably implied by the Drawings and as directed. Unless otherwise specified, all grouting shall be done with non-shrinking grout.

B. Epoxy grout shall be used only as directed and/or approved by the Owner or Owner's authorized representative.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 SUBMITTALS

A. Complete placement data, together with detailed specifications and data covering materials used and other accessories forming part of the product furnished, shall be submitted.

1.04 PRODUCT, DELIVERY, STORAGE AND HANDLING.

A. Deliver and store all grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer. Prevent damage to or contamination of grouting materials during delivery, handling, or storage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-shrinking Grout

Grout shall be in-organic non-shrink, nonmetallic, nonstaining and noncorrosive. Gifford-Hill "Supreme Grout," U.S. Grout "Five Star Grout," Master Builders "Masterflow 713," or equal.

Parameters for Non-Shrinking Grout	Value
Minimum Tensile Strength (as per ASTM C-307-77 modified), psi	2,100
Minimum Compressive Strength, 28 days (As per ASTM C579-75 method B modified), psi	7,800

Parameters for Non-Shrinking Grout	Value
Maximum Coefficient of Expansion (As per ASTM C531-81) (75EF - 210EF), 10^{-6} in/in/EF	26.6
Maximum Water Absorption (ASTM C413-75), %	0.076
Minimum Bond Strength to Steel Shear, psi	2,100
Minimum Bond Strength to Steel Tensile, psi	2,100
Specific Gravity	2.2
Minimum Bond Strength to Concrete	Stronger than concrete
Minimum Impact Strength	Better than concrete
Minimum Abrasion Resistance	Better than concrete

B. Epoxy Grout

Adhesive	Ceilcote "648-I" or equal
Aggregate	Ceilcote "648-I" or equal
Minimum Tensile Strength (as per ASTM C-307-77 modified), psi	2,600
Minimum Compressive Strength, 28 days (As per ASTM C579-75 method B modified) psi	14,000
Maximum Shrinkage; unrestrained linear (As per ASTM D-2566-79), inch/inch	0.0017
Maximum Coefficient of Expansion (As per ASTM C531-81) (75E - 210EF), 10^{-6}in/in/EF	26.6
Maximum Water Absorption (ASTM C413-75), %	0.076
Minimum Bond Strength to Steel Shear, psi	2,400
Minimum Bond Strength to Steel Tensile, psi	2,400
Specific Gravity	2.20
Minimum Bond Strength to Concrete	Stronger than concrete

Minimum Impact Strength	Better than concrete
Minimum Abrasion Resistance	Better than concrete
Water	Clean and free from deleterious substances.

2.02 MIXING

A. Non-Shrinking Grout. Non-shrinking grout shall be factory premixed requiring only the addition of water at the jobsite. The amount of water used shall be as necessary to produce a flowable grout without exceeding the grout manufacturer's recommendation or causing bleeding or segregation of materials.

B. Epoxy Grout. Components shall be furnished separate from the factory and mixed on the jobsite. All mixing of components shall be in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.01 PREPARATION

A. Concrete surfaces to receive grout shall be cleaned of all defective concrete, laitance, dirt, oil, grease, and other foreign material by means of bush-hammering, chipping, sandblasting or other similar means, until a sound, clean, lightly roughened surface is achieved. Concrete shall be saturated with water for 24 hours prior to grouting with nonshrinking grout. Steel or other surfaces to be in contact with grout shall be entirely free of oil, grease and other foreign substances. Immediately before grouting, wet concrete or other moisture absorbing surfaces thoroughly with clean water, leaving the surface wet but free of excess or sanding water.

B. Formwork. Forms for grouting shall be strong, securely anchored, leakproof and provide sufficient clearance between form and space to be grouted to permit proper placement of grout.

3.02 PLACEMENT

A. Grout shall be placed in strict accordance with the directions of the manufacturer so that spaces and cavities are completely filled without voids. Forms shall be provided where structural components cannot confine the grout.

3.03 EDGE FINISHING

A. In locations where the edge of the grout will be exposed to view, finish the edge smooth after grout has attained its initial set.

B. Unless otherwise indicated on the Drawings, the grout shall be sloped at a 45 degree angle from the bottom of the baseplate, bedplate, member or piece of equipment.

3.04 CURING

A. Non-Shrinking Grout. Non-shrinking grout shall be protected from rapid loss of moisture by keeping it wet and covering it with curing paper or plastic sheet. After edge finishing is completed, the grout shall be wet cured for at least 7 days.

B. Epoxy Grout. Epoxy grout shall be cured as per the recommendations of the grout manufacturer.

END OF SECTION

PART I – GENERAL

1.01 DESCRIPTION

A. This section covers items fabricated from metal shapes, plates, sheets, rods, bars or castings and other wrought or cast metal except component parts or equipment and items covered by other sections.

Fabricated metal items which are shown on the Drawings but not mentioned specifically herein shall be fabricated in accordance with the applicable requirements of this section.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 SUBMITTALS

A. Submit shop drawings for fabrication and welding procedures.

B. Submit product data demonstrating compliance with the requirements of the specification.

PART 2 – PRODUCTS

2.01 MATERIALS. Materials shall be new and undamaged and shall conform to pertinent ASTM or other industry standard specifications, including the following:

Plates and Shapes	ASTM A36.
Sheets	ASTM A366 or A569, zinc coated.
Tubing	ASTM A500 Grade B-84.
Pipe	ASTM A53 grade B
High Strength Bolts	ASTM A325.
Low Strength Bolts	ASTM A307.
Self-Locking Nuts	Prevailing torque type. IFI-100 Grade A.
Flat Washers	ANSI B27.2.
Lock Washers	Spring Type, ANSI B27.1.

Beveled Washers	Table 1 of Specifications for Structural Joints Using ASTM A325 or A490 Bolts, AISC Steel Construction Manual.
Checkered Plate	Fed Spec QQ-F-461, Inland "4-Way Floor Plate," U.S. Steel "Multigrip Floor Plate," or equal.
Cast Iron	ASTM A48, Class 25 or better.
Stainless Steel	Min. 18 percent chromium and 10 percent nickel, Type 316
Plates	ASTM A167, Type 316.
Bolts	ASTM A193, Type 316.
Nuts	ASTM A194, Grade 8M.
Steel Grating	ANSI/MBG531, Type I rectangular, welded, galvanized after fabrication.
Aluminum Grating	ASTM B221, alloy 6063-T6, rectangular.
Chain	Welded 316 stainless steel, twist link style, short link pattern.
Handrail-Setting Cement	Hellemite "Por-Rok Cement," Randustrial Corp. "F-181 Anchor Sulfuset," or equal.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Connections. Connections not specifically detailed on the Drawings shall be as defined in Table I and III, Framed Beam Connections, in the eighth edition of the AISC manual. The shop fabricated portion of structural connections may be bolted, welded or riveted. Field connections on carbon steel shall be made with ASTM A325 high strength bolts. Field connections on stainless steel shall be made with ASTM A193 stainless steel bolts.

Connections for miscellaneous metal work not included in the AISC definition of structural steel may be made with unfinished bolts. Unfinished bolts shall be equipped with self-locking nuts or lock washers.

Carbon steel high strength bolts shall be installed using turn-of-nut tightening as described in "Specifications for Structural Joints Using ASTM A325 or A490 Bolts" as set forth in the AISC Manual. Stainless Steel bolts shall be installed as specified elsewhere. Beveled washers shall be used when the bearing faces of bolted parts shave a slope of 1:20 or greater with respect to a plane perpendicular to the bolt axis. A platform

or other means of access shall be provided at each field connection and shall be left in place until the connection has been inspected.

Field welded connections shall not be acceptable for structural steel unless shown on the Drawings or specifically permitted by the Engineer. Where structural or miscellaneous steel connections are welded, butt and miter welds shall be continuous and where exposed to view shall be ground smooth. In addition, intermittent welds shall have an effective length of at least 2 inches and shall be spaced not more than 6 inches apart unless otherwise noted on the Drawings.

All welding shall conform to all requirements of the American Welding Society Welding Code.

2.03 FABRICATION AND MANUFACTURE

A. Shop Fabrication. Structural steel, miscellaneous steel and metals shall be fabricated in conformity with dimensions, arrangement, sizes and weights or thicknesses shown on the Drawings or stipulated in the Specifications.

Members and parts, as delivered and erected, shall be free of winds, warps, local deformation, or unauthorized bends. Holes and other provisions for field connections shall be accurate and shop checked, so that a proper fit results when the units are assembled in the field. Erection drawings shall be prepared, and each separate piece shall be marked as indicated thereon. Field connection materials shall be furnished.

All welding shall conform to all requirements of the American Welding Society Welding Code and as specified in these Specifications.

B. Field Erection. Structural steel and miscellaneous metal shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads.

Before assembly, surfaces to be in contact with each other shall be thoroughly cleaned.

Parts shall be assembled accurately as shown on the Drawings. Light drifting shall be permitted to draw parts together, but drifting to match unfair holes shall not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills. Enlarging holes by burning is absolutely prohibited.

Temporary bracing shall be used wherever necessary to support all loads to which the structure may be subjected, including equipment and operation thereof. Such bracing shall be left in place as long as may be required for safety.

Erection bolts used in welded construction may be either tightened securely and left in place or removed and the holes filled with plug welds.

The Contractor shall give special attention to the handling of steel during construction to avoid overloading green floor slabs, etc.

Column bases and bearing plates for beams and similar structural members shall be aligned with wedges or shims. After alignment, column bases and bearing plates shall be grouted.

Structural steel frames shall be accurately assembled to the lines and elevations indicated, within the specified erection tolerance.

The various members forming parts of a complete frame or structure after being assembled shall be aligned and adjusted accurately before being fastened.

Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled.

Field correcting of fabrication by gas cutting shall not be permitted on any member without prior approval of the Engineer.

Structural steel shall be fabricated and erected so that individual pieces are plumb, level and aligned within a tolerance of 1:500. The elevation of the top of floor and roof members shall be within 1/16 inch of the elevation shown on the Drawings.

C. Shop Coating:

1. Cleaning. Surfaces shall be dry and proper temperature when coated, and free of grease, oil, dirt, dust, grit, rust, loose mill scale, weld flux, slag, weld spatter or other objectionable substances. Surfaces shall be cleaned by power wire brushing or blasting. Welds shall be scraped, chipped and brushed as necessary to remove weld spatter.

   Surfaces to have zinc rich primer shall be shop cleaned by sandblasting (SSPC SP10) or equivalent. Mill scale, rust and contaminants shall be removed before the shop primer is applied.

2. Edge Grinding. Sharp corners of cut or sheared edges which are to be submerged in operation shall be dulled by at least one pass of a power grinder to improve paint adherence.

3. Galvanizing shall be done by the hot-dip process after fabrication in conformity with requirements of ASTM A123, A153 and A385. Articles to be galvanized shall be pickled before galvanizing. A minimum of 2.5 ounces per square foot of zinc coating shall be applied.

   Where galvanized bolts are specified or required by Drawings, zinc plated bolts shall be acceptable provided zinc plating conforms to ASTM B633 classification Fe/Zn25 Service Condition SC4.

4. Castings. Miscellaneous iron castings shall be hot-dipped in asphalt varnish or given a shop coat of coal tar paint.

5. Steel. Unless otherwise specified, ungalvanized structural and miscellaneous steel shall be given a zinc rich primer coat in the shop after fabrication. Steel surfaces shall be primed, coated as soon as practical after cleaning. Painting shall be done in a heated structure if the outside air temperature is below 50°F. Steel shall not be moved or handled until the shop coat is dry and hard.

   Supports and frames for removable concrete floor slabs and stop plates and guides which are cast in concrete shall be hot dipped galvanized after fabrication.

6. Other Surfaces. No shop coating shall be required for zinc-coated steel, stainless steel or bronze surfaces.

7. Film Thickness. The dry film thickness of the shop coating shall be at least 1-1/2 mils for rust inhibitive primer, at least 3 mils for zinc rich primer and at least 6 mils for coal tar paint.

PART 3 - EXECUTION

3.01 FIELD PAINTING

A. All steel shall be painted as required by Division 9 - Finishes. The Contractor shall also be responsible for touch-up painting of all bolts, welding blemishes, shipping and erection damage. Cleaning and painting shall be compatible with primer used and performed in accordance with the Steel Structures Painting Council's recommendations.

3.02 FIELD QUALITY CONTROL

A. Inspection of Field Assembled High-Strength Bolted Construction shall be in accordance with Section 6, AISC Specification for Structural Joints.

B. Usual inspection of field welds shall be in accordance with Section 6 of the AWS Welding Code. In addition, the Engineer may require non-destructive testing of specific joints. The testing agency shall be selected and paid for by the Owner.

C. Correction of defective or unsound welds shall be in accordance with the AWS Welding Code. Cost of repairs shall be borne by the Contractor.

END OF SECTION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Scope. This section covers cast-in-place anchor bolts, adhesive anchor bolts and expansion anchors to be installed in hardened concrete.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 QUALITY ASSURANCE

A. Acceptable Manufacturers. Adhesive and Expansion Anchors shall be Hilti or Approved Equal.

1.04 SUBMITTALS

A. Submit anchor data and drawings.

PART 2 – PRODUCTS

2.01 MATERIALS

Bolts and Nuts	Stainless Steel ASTM A193, Grade 316.
Flat Washers	ANSI B27.2; of the same material as bolts and nuts.
Expansion Anchors	Stud type with three section wedge, Hilti 316 stainless steel Kwik-Bolt III, or approved equal.
Adhesive Anchors	A. Two-component slow-cure epoxy resin, contained in two plastic cartridges separating the resin from the hardener, Hilti HIT RE-500SD System with stainless steel threaded anchor or approved equal. B. Two-component fast cure adhesive anchoring system, contained in two plastic cartridges separating the two components from each other, Hilti HIT HY-200 System with stainless steel threaded anchor or approved equal.
Sleeves	Plastic or Stainless Steel.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Anchor Bolts. Except where specifically shown or specified otherwise, cast-in-place anchor bolts shall be a sleeved "J"' type 316 stainless steel at least 3/4 inch in diameter except where specifically shown or specified otherwise, the minimum embedment of a cast-in-place anchor bolt shall be 24 bolt diameters. Upon approval of the Engineer, plate type anchor bolts with a pullout strength equal to a fully developed, type "J" bolt shall be used where the minimum embedment length is not available. Contractor shall verify type, size and location of anchor bolts with Engineer prior to placement.

B. Expansion Anchors. Expansion anchors shall not be used except where explicitly called out on the Drawings or accepted in writing by the Engineer. Unless otherwise noted the expansion anchors shall be as follows:

Anchor Diameter, in.	Minimum Embedment, in.	Minimum Ultimate Tensile Strength, lbs.	Minimum Ultimate Shear Strength, lbs.
1/2	6	8,600	8,340
5/8	7	13,700	12,500
3/4	8	17,000	18,000
1	10	35,200	28,050

C. Adhesive Anchors. Adhesive anchors shall be used where shown on the Drawings or accepted by the Engineer. Unless otherwise noted the anchors shall be as follows:

Anchor Diameter, in.	Minimum Embedment. in.	Minimum Ultimate Bond Strength, lbs.
1/2	6 3/8	13,600
5/8	7 1/2	17,500
3/4	10	28,000
7/8	10	29,650
1	12 3/8	50,000

PART 3 – EXECUTION

3.01 ANCHOR BOLTS

A. All anchor bolts shall be delivered in time to permit setting when structural concrete is placed. Anchor bolts which are cast-in-place shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or supporting template. Two nuts shall be furnished for each anchor bolt. Clearance to edge of concrete shall be a minimum of six bolt diameters or 4 inches, whichever is greater.

3.02 EXPANSION ANCHORS

A. Expansion anchors shall not be used except where explicitly called out on the Drawings or accepted in writing by the Engineer. Install expansion anchors as per recommendation of manufacturer. Drilled hole diameters shall not exceed the bolt diameter. Clearance to edge of concrete shall be a minimum of six bolt diameters, or 4-inches, whichever is greater.

3.03 ADHESIVE ANCHORS

A. Install adhesive anchors as per recommendation of manufacturer.

B. Holes can be drilled with carbide tipped drill bits or Hilti's hollow drill bit. Special consideration should given in diamond cored holes.

C. Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive.

D. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components through static mixer nozzle. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface.

E. Remove excess adhesive from the surface.

F. Shim anchors with suitable device to center the anchor in the hole.

G. Do not disturb or load anchors before manufacturer specified cure time has elapsed.

H. Clearance to edge of concrete shall be a minimum of six bolt diameters or 4 inches, whichever is greater.

END OF SECTION

PART 1 – G E N E R A L

1.01 SECTION INCLUDES

A. Aluminum mechanical sub-assembled handrails and fittings.

1.02 UNIT PRICES

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 REFERENCES

A. ASTM 6061-T6 and/or ASTM 6063-T6.

1.03 DESIGN REQUIREMENTS

A. Railing assembly and attachments to resist a concentrated load of 200 pounds applied in any direction at any point and a uniform load of 50 pounds per lineal foot applied to the horizontal rails in any direction without deformation. The loads shall not be applied simultaneously.

B. Space support posts 6 feet on center, maximum.

1.04 SUBMITTALS

A. Submit Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.05 ACCEPTABLE MANUFACTURERS

1. Golden Railings, Inc.
2. Enerco Metal Products, "Alumrail"
3. Julius Bloom, "Connectorail"
4. Reynolds Metals, "Reynorail #2"
5. Or Approved Equal.

PART 2 – P R O D U C T S

2.01 RAILING SYSTEM

A. Railings shall be constructed 1-1/2 inch diameter aluminum pipe schedule 40 with anodized satin finish. Finish to be clear anodized (0.7 mil). All fittings shall be extruded aluminum pre-engineered for railing application.

B. All railing shall be mounted to the side of walkway surfaces using 1/2 inch diameter stainless steel anchors.

C. All hardware used on the railing system shall be stainless steel.

D. All railing surfaces in contact with concrete or dissimilar metals shall receive one coat of zinc chromate.

E. All fittings shall be secured to the post and railing with #17 x 1" 316 stainless steel set screws.

F. Railings shall be provided with two horizontal rails and a 4-inch high toe board.

G. The top rail shall be at least 42 inches above the adjacent finished walking surface. The toe board shall be located 1/4 inch above the walking surface.

H. Toe boards shall be 4 inch extruded aluminum "Z" shape. Toe boards shall be connected to each railing post with a minimum of two fasteners in horizontal slotted holes. Splices shall be located and detailed to allow for thermal expansion and contraction.

I. Openings in rail shall be provided for access to gates and valves. Provide double strand 3/16 inch diameter 316 stainless steel chain.

J. Provide expansion joints at maximum 24 ft. centers using splice sleeves.

PART 3 – E X E C U T I O N

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Beginning of installation means erector accepts existing conditions.

3.02 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors and sockets required for connecting railings to concrete.

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope.

1. This Section covers the furnishing and installation of fabricated aluminum grating.

2. Occupational Safety and Health Administration (OSHA), insurance, and Federal safety standards shall be followed

3. The Contractor shall furnish grating and stair treads, including clips and fasteners, as shown on the Drawings and as specified.

4. The Contractor shall check dimensions in the field after supports, concrete, piping and equipment are in place and shall determine the exact dimensions of gratings and location and sizes of openings and cutouts.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate payment will be made for work under this Section. Include payment in Lump Sum with price breakdown included in the Schedule of Values.

B. Stipulated Price (Lump Sum. If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 QUALITY ASSURANCE

A. Acceptable Manufacturers. Grating shall be as manufactured by IKG Industries, Ryerson Company, Ohio Grating or approved equal.

B. Governing Standards. Except as modified herein, grating manufacture, fabrication and installation shall comply with recommendations in the "Metal Bar Grating Manual" of the National Association of Architectural Metal Manufacturers.

1.04 SUBMITTALS

A. Shop Drawings: Submit shop drawings as specified in Division 1 - General Requirements. Shop drawings shall include setting plans, layouts, mark numbers, and anchorage details.

B. Manufacturer's Technical Information: Submit manufacturer's technical information on all fiberglass items.

C. Samples. Submit samples, taken from manufacturer's stock, as follows:

1. 12" x 12" section of grating.

2. Section of ladder with rung, side rails and connection member to structures

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be new and undamaged. Grating shall be rectangular and welded. Aluminum shall conform to ASTM B221 alloy 6063-T6.

B. Clips. Grating and side panel clips shall be 316 stainless steel, suitable for use in the presence of a corrosive environment such as hydrogen sulfide gas.

C. Expansion Anchors. Expansion Anchors shall not be used on this project without the expressed written consent of the Project Manager. If written consent is given by the Project Manager, provide drilled-in, concrete expansion anchors, which are externally threaded, wedge type expansion bolt anchors, complete with washers and nuts. Expansion anchors shall be stainless steel conforming to AISI Type 316. Install in accordance with manufacturer's instructions in areas which are not subject to sewer gases.

D. Concrete Anchors. Provide drilled-in, concrete anchors comprised of AISI Type 316 SS threaded rods set in concrete using the Hilti HIT C-100 system or equivalent. Embedment depth shall be the greater of the requirements of Specification Section – 5503, Anchor Bolts, Expansion Anchors, and Adhesive Anchors or the manufacturer's recommended depth plus the minimum cover shown on the drawing

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Unless otherwise noted, grating shall be designed for not more than 1/360 of the span or 1/4 inch deflection, whichever is least, with a uniform live load of 250 pounds per square foot.

B. Grating shall be a minimum of 1-1/2-inches in depth unless otherwise noted or required.

C. Bearing bars shall be at least 3/16 inch thick and spaced at 1 3/16 inch centers and tied with 3/16 inch minimum thick transverse bars spaced no more than 2 inches on center.

D. Grating stair treads shall be fabricated from aluminum steel grating having 1-1/2 inch by 3/16 inch bearing bars. Carrier plates shall be welded to the ends of the treads. Fastening devices shall be aluminum saddle clips.

E. All grating for trenches, pits, and other facilities at finished grade and/or subject to vehicular traffic shall be designed for not more than 1/4 inch deflection with an H20-44 live load.

2.03 FABRICATION AND MANUFACTURE

A. Gratings shall be of one piece, resistance welded construction and shall be accurately fabricated, free from warps, twists or other defects which affect the appearance and serviceability of the grating. The tops of the bearing bars and cross bars shall be in the same plane, and there shall be no acute angles at joints between bearing and transverse bars. All bearing bars shall be welded to the carrier plate at all support locations.

B. Panels shall be within 1/8 inch plus or minus of authorized length, within 1/8 inch plus or minus of authorized width, and shall have a maximum difference in length of opposite diagonals of 3/16 inch. The spacing of bearing bars shall be within 1/32 inch of authorized spacing. Cross bars and edge bars of adjacent panels shall align. After installation there shall be no more than 1/4 inch clearance between panels. Bearing bars shall be parallel.

C. Openings shall be provided for the passage of pipes or for other purposes. Grating shall be laid out so that openings are centered on a joint between Sections. Ends of bearing bars shall be banded to the full length of the grating with aluminum bars 3/16 inch thick. Bands on end bearing bars shall be welded to the first, last and every fourth intermediate bar unless the panel has been cut for reasons of joint between adjacent pipe placement around objects, in which case the bands shall be welded to all intersecting members. Transverse bars shall be cut off flush with the outside face of side bars.

2.04 ANODIZING

A. After fabrication and prior to anodizing, all sharp edges and corners of cut or sheared edges shall be dulled by at least one pass of a power grinder. All grating shall be anodized with color to be selected by the Project Manager.

PART 3 EXECUTION

3.01 FIELD ERECTION

A. Panels shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The panels shall be protected against bending under their own weight or superimposed loads.

B. Grating. Install in accordance with approved shop drawings. Set grating loose on grating seats without binding or rocking

C. Gratings shall be installed with each Section readily removable and replaceable. Adjacent panels shall be neatly fitted together. Minimum clearance shall be 3/16 inch with a maximum of 1/2 inch.

D. Grating shall lie flat with no tendency to rock when installed. Poorly fitting or damaged grating will be rejected.

E. Fastening devices shall be provided for all grating Sections. All Sections of grating shall be fastened down unless specifically designated as removable. Neoprene pad of 1/4 inch minimum thickness shall completely insulate all aluminum from any other dissimilar material such as concrete, grout, and steel. The neoprene pad shall be secured to the dissimilar material by means of an appropriate adhesive and in strict accordance with the adhesive manufacturer's recommendations. .

3.02 PROTECTION OF INSTALLED GRATING

After installation, the grating and ladders shall be protected as required to prevent damage during completion of the contract. Any damaged material must be replaced without additional cost to the Owner.

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope.

1. This section covers requirements for all materials, fabrication, and installation of fiberglass grating and ladders.

2. Occupational Safety and Health Administration (OSHA), insurance, and Federal safety standards shall be followed.

3. The Contractor shall furnish grating and stair treads, including clips and fasteners, as shown on the Drawings and as specified.

4. The Contractor shall check dimensions in the field after supports, concrete, piping and equipment are in place and shall determine the exact dimensions of gratings and location and sizes of openings and cutouts

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate payment will be made for work under this Section. Include payment in Lump Sum with price breakdown included in the Schedule of Values.

2. Refer to Section 01270 – Measurement and Payment and Section 01292 – Schedule of Values.

3. Measurement and payment for Extra Work is as defined in the Extra Unit Prices portion of the Schedule of Unit Price Work. Payment includes all accessories and all associated work performed in related Sections included in the Contract Documents.

B. Stipulated Price (Lump Sum. If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 QUALITY ASSURANCE

A. Acceptable Manufacturers. Acceptable manufacturers of fiberglass grating are

1. "Chem-Grate" by Chemical Proof Corporation, Woodinville, Washington;
2. "Firmaline" by John T. Ryerson & Son, Inc., Chicago, Illinois;

3. "Duradek" by AFC, Inc., Chatfield, Minnesota;
4. or approved equal.

B. Governing Standards. Except as modified herein, grating manufacture, fabrication and installation shall comply with recommendations in the "Metal Bar Grating Manual" of the National Association of Architectural Metal Manufacturers.

1.04 SUBMITTALS

A. Shop Drawings: Submit shop drawings as specified in Division 1 - General Requirements. Shop drawings shall include setting plans, layouts, mark numbers, and anchorage details.

B. Manufacturer's Technical Information: Submit manufacturer's technical information on all fiberglass items.

C. Samples. Submit samples, taken from manufacturer's stock, as follows:

1. 12" x 12" section of grating

2. Section of ladder with rung, side rails and connection member to structures

PART 2 PRODUCTS

2.01 MATERIALS

A. Fiberglass. Fiberglass products shall be manufactured from premium-type polyester resin and reinforced with fiberglass. The fiberglass shall be resistant to rot, fungi, bacterial growth, and adverse effects of acids, alkalis, and residential and industrial waste. A polyester veil shall be used on all surfaces. Color of fiberglass resin shall be safety yellow.

B. Clips. Grating and side panel clips shall be 316 stainless steel, suitable for use in the presence of a corrosive environment such as hydrogen sulfide gas.

C. Expansion Anchors. Expansion Anchors shall not be used on this project without the expressed written consent of the Project Manager. If written consent is given by the Project Manager, provide drilled-in, concrete expansion anchors, which are externally threaded, wedge type expansion bolt anchors, complete with washers and nuts. Expansion anchors shall be stainless steel conforming to AISI Type 316. Install in accordance with manufacturer's instructions in areas which are not subject to sewer gases.

C. Concrete Anchors. Provide drilled-in, concrete anchors comprised of AISI Type 316 SS threaded rods set in concrete using the Hilti HIT C-100 system or equivalent. Embedment depth shall be the greater of the requirements of Specification Section –

5503, Anchor Bolts, Expansion Anchors, and Adhesive Anchors or the manufacturer's recommended depth plus the minimum cover shown on the drawing.

2.02 PERFORMANCE AND DESIGN REQUIREMENTS

A. Unless otherwise noted, grating shall be designed for not more than 1/360 of the span or 1/4 inch deflection, whichever is least, with a uniform live load of 250 pounds per square foot.

B. Grating shall be a minimum of 1-1/2-inches in depth unless otherwise noted or required.

C. Bearing bars shall be at least 3/16 inch thick and spaced at 1 3/16 inch centers and tied with 3/16 inch minimum thick transverse bars spaced no more than 2 inches on center.

D. Fastening devices shall be aluminum saddle clips.

E. All grating for trenches, pits, and other facilities at finished grade and/or subject to vehicular traffic shall be designed for not more than 1/4 inch deflection with an H20-44 live load.

2.02 GRATING

A. Fabrication. Grating shall be made in either a mold of single-piece construction so that the reinforcing glass of the bearing bars are interwoven with the reinforcing glass of the crossbars, or of straight parallel bearing bars composed of a pultruded glass fiber and thermosetting resin composite. The bearing bars shall be placed edgewise and joined by structural crossties on 6-inch centers. The bearing and crossbars shall be a minimum of 1-1/2" x 3/8". Grating shall be banded all around.

B. Walking surface of the grating shall have a nonskid surface of quartz grit affixed to the surface by a baked epoxy resin.

C. All cut or sanded surfaces shall be coated with resin containing air-inhibiting additives.

D. All grating shall be removable. Sides of adjacent panels shall be tied together, to prevent differential deflection, with removable stainless steel clips.

PART 3 EXECUTION

3.01 FIELD ERECTION

A. Panels shall be stored on blocking so that no grating panel touches the ground and water cannot collect thereon. The panels shall be protected against bending under their own weight or superimposed loads.

B. Grating. Install in accordance with approved shop drawings. Set grating loose on grating seats without binding or rocking.

C. Gratings shall be installed with each Section readily removable and replaceable. Adjacent panels shall be neatly fitted together. Minimum clearance shall be 3/16 inch with a maximum of 1/2 inch.

D. Grating shall lie flat with no tendency to rock when installed. Poorly fitting or damaged grating will be rejected.

E. Fastening devices shall be provided for all grating Sections. All Sections of grating shall be fastened down unless specifically designated as removable.

3.02 PROTECTION OF INSTALLED GRATING

After installation, the grating and ladders shall be protected as required to prevent damage during completion of the contract. Any damaged material must be replaced without additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and field painting application of masonry, gypsum board and wood surfaces.

B. A free choice of manufacturer's standard factory mixed or mechanically proportioned intermixed colors. Colors will be chosen from the selected manufacturer's schedule.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 REFERENCES

A. ASTM D16 - Definitions of Terms Rating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D2016 - Test Method for Moisture Content of Wood.

C. National Paint and Coatings Association (NPCA) - Guide to U.S. Government Paint Specifications.

D. Painting and Decorating Contractors of America (PDCA) - Painting - Architectural Specifications Manual.

1.04 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section

1.05 SUBMITTALS

A. Product Data: Provide data on all finishing products.

B. Inspection Devices: Furnish inspection devices, in good working conditions for the detection of holidays, and the measurement of coating thickness (wet and dry).

C. Provide mask, gloves and other protective materials, and/or clothing recommended by the paint manufacturer.

D. Provide special, temporary, ventilation required by the paint manufacturer.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

B. Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience approved by manufacturer.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable locally adopted codes for flame and smoke rating requirements for finishes.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F in ventilated area, and as required by manufacturer's instructions.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Do not apply material when surface and ambient temperature are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperature for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 - P R O D U C T S

2.01 MANUFACTURERS

A. The following manufacturers (with the abbreviated name used in the Painting Schedule) are approved for use. Use the products of only one manufacturer.

1. AKZO Nobel / Devoe & Reynolds Co. (Devoe).
2. Carboline Corporation (Carboline)
3. Pittsburg Paint Group (PPG)
4. Pratt and Lambert, Inc. (P&L)
5. The Sherwin Williams Co., (Sherwin-Williams).
6. The Valspar Corporation, (Valspar).
7. or approved equal.

2.02 MATERIALS

A. Coatings: Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

C. Patching Materials: Latex filler.

D. Fastener Head Cover Materials: Latex filler.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.

B. Test shop applied primer for compatibility with subsequent cover materials.

C. Measure, record and submit moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3. Interior Wood: 15 percent, measured in accordance with ASTM D2016.

4. Exterior Wood: 15 percent, measured in accordance with ASTM D2016.

5. Starting work constitutes acceptance (on the Contractor's part) of conditions and substrates and full responsibilities for the quality and suitability for the finished work.

3.02 PREPARATION

A. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

B. Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

C. Seal with shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

F. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

H. Exterior Wood Scheduled to Receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand surfaces required lightly between coats to achieve required finish.

F. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

G. Allow applied coat to dry before next coat is applied.

H. Prime concealed surfaces of interior and exterior woodwork with primer paint.

3.04 CLEANING

A. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.05 DECORATIVE COATINGS SCHEDULE

A. Concrete Masonry Units.

1. Step one: Remove dust, mortar drippings, and other foreign matter.

2. Step two: Apply one of following alkyd system with the block filler indicated in sufficient coats and mill thickness to provide a uniform smooth surface.

a. Carboline:
   1) Carboline Sanitile 100 applied @ 10-12 mils DFT.
   2) Carbocrylic 3359 applied 2-3 mils DFT.

b. Devoe:
   1) 4000-1000 Heavy Duty Block Filler, tinted.
   2) One coat 1512-XX Ultrahide Eggshell Enamel, roller stippled, 1.7 mils DFT.

c. PPG:
   1) Heavy Duty Block Filler.
   2) One coat 50-65 Snolite Alkyd Stippling Eggshell, roller stippled, 1.9 mils DFT.

d. P & L:
   1) Primarily 200.
   2) One coat Vitra-Shield, roller stripped, 2.0 mils DFT.

e. Sherwin-Williams:
   1) Heavy Duty Block Filler, B42W46, not tinted, 12-18 mils DFT.
   2) Interior Topcoat – One coat Pro-Mar 200 Alkyd Eg-Shel Enamel, B20-2600 series, 2 mils DFT.
   3) Exterior Topcoat One Coat DTM Acrylic Coating B66-200 Series, 2.5 – 4.0 mils DFT.

f. Valspar:
   1) 79-W-8 Latex Block Filler, white or tinted if needed.
   2) One coat 31 Series Semi-Gloss Enamel, 2.0 mils DFT.

B. Drywall

1. Step one: Spackle all scratches, nail holes, dents, and other abrasions. When dry, sand surfaces smooth and vacuum clean.

2. Step two: Apply one of the following alkyd systems.

   a. Carboline: 5.5 mils DFT
      1) One coat: Sanitile 120 appied @ 1.5 mils DFT.
      2) Two coats: Carbocrylic 3359 satin applied @ 2 mils DFT.

   b. Devoe: 5.5 mils DFT:
      1) One coat 1030-1200 Ultrahide PVA Primer/Sealer, 1.5 mils DFT.
      2) Two coats 1512-XX Ultrahide Alkyd Eggshell Enamel, 2 mils DFT each.

   c. Sherwin-Williams: 4.8 – 5.0 mils DFT
      1) One coat: ProMar 200 Zero VOC Interior Latex Primer, B28 Series, 0.8-1.0 mils DFT.
      2) Two coats: ProMar 200 Zero VOC Interior Latex Eg-Shel, B20 Series, 2 mils DFT per coat.

C. Interior Wood Painted

1. Step One. Sand smooth, shellac knots and pitch streaks, fill holes, dents, joints, cracks, and irregularities with linseed oil putty. Sand smooth.

2. Step two: Apply one coat of one of the following primers.

   a. Carboline: Sanitile 120 applied @ 1-2 mils DFT.

   b. Devoe: 1120-1200 Ultrahide Alkyd Primer/Sealer, 1.5 mils DFT.

   c. PPG: 6-6 Quick Dry Enamel Undercoat, 1.4 mils DFT.

   d. P & L: Interior trim primer, 1 mils DFT.

   e. Sherwin-Williams: Premium Wall & Wood Primer, B28W8111, 2 mils DFT.

   f. Valspar: Alkyd First Coater 17-W-4, 2 mils DFT.

3. Step three: Apply two coats of same paint as adjacent walls.

D. Exterior Wood

1. Step one: Sand smooth, shellac knots and pitch streaks, fill holes, dents, joints, cracks, and irregularities with linseed oil putty. Sand smooth.

2. Step two: Apply one of the following alkyd enamel systems.

   a. Carboline: 5-6 mils DFT system
      1) One coat: Sanitile 120 applied @ 1-2 mils DFT.
      2) Two coats: Carbocrylic 3359 satin applied @ 2 mils DFT.

   b. Devoe: 4.7 mils DFT system
      1) One coat 2110-1200 Ultrahide Durus Alkyd Exterior Primer, 2.3 mils DFT.
      2) Two coats 3028-XX Dulux Ultrahide Durus Alkyd Gloss Enamel, 1.2 mils DFT each.

   c. PPG: 6 mils DFT system
      1) One coat 6-9 Speedhide Wood Primer-Exterior, 2 mils DFT.
      2) Two coats Speedhide Exterior-Interior Alkyd Gloss Enamel, 2 mils DFT each.

   d. P & L: 4.75 mils DFT system
      1) One coat Permalize Exterior Primer, 2.25 mils DFT.
      2) Two Coats Effecto Enamel, 1.25 mils DFT each.

   e. Sherwin-Williams: 6.4-9.4 mils DFT system
      1) One coat: Exterior Latex Wood Primer, B42W8041, 1.4 mils DFT.
      2) Two coats: DTM Acrylic Coating, B66-200 Series, 2.5-4.0 mils DFT per coat.

   f. Valspar: 5 mils DFT system
      1) One coat: Alkyd First Coated 17-W-4, 2 mils DFT.
      2) Two coats: 12 Series Alkyd Enamel, 1.5 mils DFT per coat.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparing surfaces, providing adequate conditions for proper workmanship, and furnishing and applying the protective coating materials required for metallic and plastic surfaces.

B. Color code painting of piping and piping identification signs and markers.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 REFERENCES

A. ANSI A13.1 - Color Schedule.

B. ANSI/AWWA C213 - Fusion-bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.

C. Federal Specification TT-P-28 - Paint, Aluminum, Heat Resisting (1200 degrees F).

D. Federal Standard 595A - Federal Standard Colors.

E. Military Specification DOD-P-23236 - Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast, Class 2.

F. NACE Standard TM-01-70 - Visual Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive.

G. NSF Standard 61 - Drinking Water System Components - Health Effects.

H. SSPC-PA1 - Paint Application Specification No. 1.

I. SSPC-PA2 - Paint Application Specification No. 2.

J. SSPC- Painting System Specification No. 11.01 – Black (or Dark Red) Coal Tar Epoxy – Polyamide Painting System.

K. SSPC-SP1 - Solvent Cleaning.

L. SSPC-SP2 - Hand Tool Cleaning.

M. SSPC-SP3 - Power Tool Cleaning.

N. SSPC-SP5 / NACE 1 - White Metal Blast Cleaning.

O. SSPC-SP6 / NACE 3- Commercial Blast Cleaning.

P. SSPC-SP7 / NACE 4- Brush-off Blast Cleaning.

Q. SSPC-SP10 / NACE 2 - Near-white Blast Cleaning.

R. SSPC-SP11 – Power Tool Cleaning to Bare Metal

S. SSPC-SP12 / NACE 5 – Surface Preparation and Cleaning of Steel and Other Hard Materials by High-and Ultrahigh-Pressure Water Jetting prior to Recoating.

T. SSPC-13 / NACE 6 – Concrete Preparation

U. SSPC-VIS 1-89 – Visual Standard for Abrasive Blast Cleaned Steel

V. SSPC-VIS 3 – Visual Standard for Power-and Hand-Tool Cleaned Steel

W. SSPC-QP 1 – Standard Procedure for Evaluating Qualifications of Painting Contractors

X. SSPC-QP 2 – Standard Procedure for Evaluating Qualifications of Painting Contractors to Remove Hazardous Paint

1.04 DEFINITIONS

A. Paint, coatings, or finishes as used in this Section include surface treatments, emulsions, enamels, paints, epoxy resins, and other protective coatings, with the exceptions of galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

B. DFT means minimum dry film thickness.

C. VOC means Volatile Organic Components

1.05 PERFORMANCE REQUIREMENTS

A. Do not apply protective coatings to the following surfaces unless specifically named or shown to be coated:

1. Concrete.

2. Stainless steel, bronze, or brass.

3. Machined surfaces.

4. Grease fittings.

5. Glass.

6. Equipment nameplates.

7. Platform gratings, stair treads, door thresholds, and other walk surfaces.

8. Galvanized steel electrical conduit and associated galvanized and factory-coated junction boxes and electrical panels.

9. Galvanized surfaces inside buildings and not exposed to view.

10. Manhole and valve covers and rings, storm water inlet gratings, covers, and frames.

B. Provide decorative and protective coatings for interior architectural surfaces such as wood, gypsum board, and masonry in accordance with Division 9.

1.06 SUBMITTALS

A. Submit the following information at least 10 days prior to protective coating work:

1. Coating Materials List: Four copies of a coating materials list naming the manufacturer and the coating number, keyed to the coating systems described in this Section. Submit the list prior to or at the time of sample submittal.

2. Paint Manufacturer's Information: For each coating system to be used, submit the following data:

a. Paint manufacturer's data sheet for each product proposed, including statements on the suitability of the material for the intended use.

b. Technical and performance information that demonstrates compliance with the system performance and material requirements.

c. Paint manufacturer's instructions and recommendations on surface preparation and application.

d. Colors available for each product, where applicable.

e. Compatibility of shop and field applied coatings, where applicable.

f. Material Safety Data Sheet for each product used.

g. VOC of each coating proposed in grams per liter.

3. Subcontractor References: Refer to qualification portion of this specification.

B. Contractor shall submit coating system to be used prior to beginning construction of the lift station for approval by the Engineer.

1.07 QUALIFICATIONS

A. Where protective coatings are to be applied by a subcontractor, employ a subcontractor who possesses experience for performance of painting and coating work called for in this Specification.

B. Submit 3 references which show that the painting subcontractor has previous successful experience with the indicated or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the painting subcontractor provided the protective coating.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Ventilate area where coating is being applied. Post and enforce "NO SMOKING OR OPEN FLAME" signs until coating has cured.

B. Provide lighting level of 80-foot candles (860 lx) measured mid-height at substrate surface.

C. Restrict worker access and construction traffic from area where coating is being applied or is curing.

D. Comply with all applicable OSHA Confined space entry regulations including but not limited to OSHA Permit-Required Confined Space Standard 1910.146.

1.09 WARRANTY INSPECTION AND MAINTENANCE

A. Warranty Inspection:

1. A warranty inspection may be conducted during the eleventh month following completion of coating and painting. The Contractor and a representative of the coating material manufacturer shall attend this inspection.

2. The Engineer may, by written notice to the Contractor, reschedule the warranty inspection to another date within the one-year correction period, or may cancel the warranty inspection altogether. Cancellation of the warranty inspection does not relieve the Contractor of his responsibilities under the Contract Documents.

3. Repair defective work discovered during the warranty inspection in accordance with these Specifications.

1.11 WASTEWATER TREATMENT PLANT PIPING CODES

A. Color codes used in painting wastewater plant piping shall conform to TCEQ Design Criteria for Domestic Wastewater Systems (§§217.329.Color Coding of Pipes) and other applicable TCEQ rules and regulations. The piping systems shall be labeled and painted in accordance with the following schedule.

Service	Color of Pipe
Sludge	Brown
Natural gas	Red
Potable Water	Light Blue
Chlorine	Yellow
Sulfur Dioxide	Lime Green with Yellow Bands
Sewage	Grey
Compressed Air	Light Green
Heated Water	Blue with 6-inch Red Bands spaced 30-inches apart
Power Conduit	In compliance with the National Electric Code
Reclaimed Water	Purple
Instrument Air	Light Green with Dark Green Bands
Liquid Alum	Yellow with Orange Bands
Alum (solution)	Yellow with Green Bands
Ferric Chloride	Brown with Red Bands
Ferric Sulfate	Brown with Yellow Bands
Polymers	White with Green Bands
Ozone	Stainless Steel with White Bands
Raw Water	Tan
Effluent after Clarification	Dark Green

B. The pipe labeling text size shall be stenciled letters, applied signs or markers at 15-foot centers, at both side of fittings, and in congested pipe layouts. The size of the text shall be in accordance with the following schedule. The Owner shall designate location of lettering.

Outside Pipe or Covering Diameter	Size of Letters	Length of Color Field
inches	inches	inches
¾" to 1 ¼"	½"	8
1 ½" to 2"	¾"	8
2 ½" to 6"	1 ¼"	12
8" to 10"	2 ½"	24
>10"	3 ½"	32

C. As pipe markers, use semi-rigid outdoor grade acrylic plastic, Seton Name Plate Corp., SetMark, or approved equal. Use Type SNA for outside diameters ¾ through 5 7/8 inches and Type STR for 6-inch outside diameter or larger. For pipes less than ¾-inch diameter, use applied marker of brass identification tags 1 ½ inches square with

depressed letters ¼ inch high, black filled. Apply tightly to pipeline with metal of plastic straps.

PART 2 - PRODUCTS

2.01 COATINGS CRITERIA

A. Suitability: Use suitable coating materials as recommended by the manufacturer.

B. Compatibility: In any coating system, use only compatible materials from a single manufacturer. Give particular attention to compatibility of primers, intermediate coats and finish coats. If necessary, apply a barrier coat or tie coat between existing prime coat and subsequent field coats to ensure compatibility.

C. Containers: Supply coating materials in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all plainly legible at the time of use.

D. Colors: Use colors and shades of colors of all coats of paint as indicated on the coating schedules or selected by the Engineer. Make each coat of a slightly different shade to facilitate inspection of surface coverage of each coat. The Engineer will select finish colors from the manufacturer's standard color samples.

2.02 INDUSTRIAL COATING SYSTEMS

A. Material Sources: Each of the following manufacturers is capable of supplying many of the specified industrial coating materials. Manufacturers and specific paint designations (numbers) are listed to indicate the required type and quality of coating. Contractors are to base their bid on the use of products supplied by one of the named manufacturers and products. These named manufacturers are designated to establish a level of acceptable product quality or manufacturing experience and are not to be construed as the only manufacturers of products acceptable for use.

1. Akzo Nobel / International Coatings
2. Akzo Nobel / Devoe Coatings
3. Ameron International / T-Lock
4. Carboline Coatings Company
5. Hempel Coatings USA, Inc.
6. PPG Protective & Marine Coatings / Amercoat
7. PPG Protective & Marine Coatings / Sigma Coatings
8. Tnemec Company
9. Sherwin Williams Co.

TABLE 1

Coating System	Coating Manufacturer	Prime Coat	Intermediate Coating	Finish Coat
3 Coat Inorganic Zinc / Epoxy / Polyurethane	PPG Protective & Marine Coating	Amercoat Dimetcote 9 (D-9)	Amercoat 385	Amercoat 450 H
	Carboline	Carbozinc 11	Carboguard 60	Carboline 134 HG
	TNEMEC	Tnemec 90-97 Tneme-Zinc	Tnemec Series 104 H.S.	Tnemec Series 74 Endura Shield
2 Coat, Coal Tar Epoxy	PPG Protective & Marine Coating	Amercoat 78 HB	---	Amercoat 78 HB
	Carboline	Carboguard 880	---	Bitmastic 300M
	TNEMEC	P66	---	46H-413
Cast in T-Lock	Ameron International Protective Lining Products			T-Lock
1-Coat, 100% Solids	Carboline	Semstone 110	---	Plasite 4500S
	Madewell	927 Penetrating Primer		Mainstay DS-5
	PPG Protective & Marine Coatings	Novaguard 840	---	Novaguard 840
	RLS	Ravens 155	---	Reaven 405
	RLS	Ravens 155	---	Aquata Poxy A-6 Superflex
3-Coat, Modified Epoxy Phenalkamine	Carboline	Carboguard 365	Carboguard 635	Carboguard 635
	PPG Protective & Marine Coating/	Amercoat 235	Novaguard 840	Novaguard 840
	Sherwin Williams	Dura-Plate 235 PW	Cor-Cote_SC	Cor-Cote_SC
2 Coat, Modified Epoxy Phenalkamine	Carboline	Carboguard 365	---	Carboguard 365
	Sherwin Williams	Cor-Cote_SC	---	Cor-Cote SC
	PPG Protective & Marine Coating/ Sigma Coatings	Novaguard 840	---	Novaguard 840

Coating System	Coating Manufacturer	Prime Coat	Intermediate Coating	Finish Coat
CMU Exterior	Carboline	Sanitile 100	Carbocrylic 3359	Carbocrylic 3359
	PPG Protective & Marine Coating	Heavy Duty Block Filler	16-90 PITT Glaze	90-1210 PITT-tech PLUS
	Sherwin Williams	Heavy Duty Block Filler	DMT Acrylic Semi-gloss	DMT Acrylic Semi-gloss

PART 3 - EXECUTION

3.01 MANUFACTURER'S SERVICES

A. Require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary to resolve field problems attributable to or associated with manufacturer's products.

B. For submerged and severe service coating systems, require the paint manufacturer to furnish the following services:

1. Provide at least 6 hours of on-site instruction on the proper surface preparation, use, mixing, application, and curing of the coating systems.

2. Observe the start of surface preparation, mixing, and application and curing of the coating systems.

3. Provide the services of a NACE Certified Coating Inspector at all times during the surface preparation, mixing, application, curing and testing of all coatings applied in submerged or acid spill areas.

3.02 WORKMANSHIP

A. Use skilled craftsmen and experienced supervision.

B. Apply coating to produce an even film of uniform thickness. Give special attention to edges, corners, crevices, and joints. Ensure thorough cleaning and an adequate thickness of coating material. Apply coatings to produce finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. Effect complete hiding so that the addition of another coat would not increase the hiding. Give special attention to ensure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas. Apply a brushed stripe coat to all edges and welds after priming submerged or severe service areas. Protect installations by use of drop cloths or other precautionary measures.

C. If surfaces are damaged, clean, repair, and refinish to original condition.

D. Remove, mask or otherwise protect hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, name plates on machinery, and other surfaces not to be painted. Provide drop cloths to prevent coating materials from falling on or marring adjacent surfaces. Protect the working parts of mechanical and electrical equipment from damage during surface preparation and coating operations. Mask openings in motors to prevent entry of coating or other materials.

E. Do not damage adjacent work during blast cleaning operations. Perform spray painting under carefully controlled conditions. Promptly repair any damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

F. Coordinate cleaning and coating so that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces

3.03 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer's Recommendations: Unless otherwise indicated, strictly comply with the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating.

B. Use protective coating materials within the manufacturer's recommended shelf life.

C. Storage and Mixing: Store coating materials under conditions recommended by the Material Safety Data Sheets. Keep coating materials thoroughly stirred, strained, and with uniform consistency during application. Do not mix coatings of different manufacturers.

3.04 PREPARATION FOR COATING

A. Cleaning and Touch-up: Clean surfaces to receive protective coatings. Examine surfaces to be coated. Correct surface defects before application of any coating material. Touch up marred or abraded spots on shop-primed and on factory-finished surfaces prior to coating application. Verify that surfaces to be coated are dry and free of visible dust.

B. Protection of Surfaces not to be Coated: Protect surfaces which are not to receive protective coatings during surface preparation, cleaning, and coating operations.

C. Remove, mask or otherwise protect hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces to be painted. Provide drop cloths to prevent coating materials from falling on or marring adjacent surfaces. Protect the working parts of mechanical and electrical equipment from damage during surface preparation and coating operations. Mask openings in motors to prevent entry of coating or other materials.

D. Do not damage adjacent work during blast cleaning operations. Conduct spray painting under carefully controlled conditions. Promptly repair any damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

E. Protection of Painted Surfaces: Coordinate cleaning and coating so that dust and other contaminants from the cleaning process will not fall on wet, newly-coated surfaces.

3.05 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation standards of the Steel Structures Painting Council form a part of this Specification:

1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.

2. Hand Tool Cleaning (SSPC-SP2): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.

4. White Metal Blast Cleaning (SSPC-SP5/NACE 1): Removal of visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products, and foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6/NACE 3): Removal of visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining is limited to no more than 33 percent of each square inch of surface area.

6. Brush-off Blast Cleaning (SSPC-SP7/NACE 4): Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose coating.

7. Near-white Blast Cleaning (SSPC-SP10/NACE 2): Removal of visible oil, grease, soil, dust mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining is limited to no more than 5 percent of each square inch of surface area.

8. Surface Preparation and Cleaning of Metals by Water Jetting Prior to Recoating (SSPC-SP 12/NACE No. 5): Removal of all loose rust, loose mill scale, and loose coatings and meeting WJ-1, WJ-2, WJ-3, and WJ-4 conditions by high- or ultra high-pressure water jetting.

9. Surface preparation of concrete (SSPC-SP13/NACE 6): Removal contaminates laitance efflorescence, concrete curing compound, form release agents, loosely

adhering concrete, dust and other detrimental foreign matter by, wet or dry abrasive blasting, high pressure cleaning or water testing.

3.06 METAL SURFACE PREPARATION (UNGALVANIZED)

A. Provide the minimum abrasive-blasted surface preparation as indicated in the coating system schedules at the end of this Section. Where there is a conflict between these specifications and the coatings manufacturer's printed recommendations for the intended service, the higher degree of cleaning applies.

B. Perform metal surface preparation in conformance with the current SSPC/NACE Standards and this Section. Blast cleaned surfaces must match standard samples in SSPC-VIZ 1.

C. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning using solving cleaning as per SSPC-SP1.

D. Round or chamfer sharp edges. Grind to smooth finish burrs, surface defects, and weld splatter prior to blast cleaning.

E. Select the type and size of abrasive to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. For abrasives for submerged and severe service coating systems use clean, hard, sharp cutting crushed slag. Do not use automated blasting systems and metal shot or grit for surfaces that will be in submerged service, even if subsequent abrasive blasting is planned with hard, sharp-cutting slag.

F. Do not reuse abrasive except when an automated blasting system is used for surfaces that will be in non-submerged service. For automated blasting systems, use clean, oil-free abrasives. In the abrasive mix, use at least 50 percent steel grit. Replenish abrasive mix with new shot/grit combination as necessary to maintain the anchor profile within 1/2 mil (13 microns) of the specified profile.

G. Comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

H. For air-blast cleaning, supply compressed air at adequate pressure from well-maintained compressors equipped with oil and a moisture separator which delivers oil and water-free air as checked with white blotter, white cloth, or plastic sheets at the beginning of each blasting sequence.

I. Clean surfaces of dust and residual particles of the cleaning operation using dry air-blast cleaning, vacuuming, or another approved method prior to painting. Vacuuming must be the final cleaning method immediately prior to painting areas that will go into submerged service.

J. In enclosed areas and other areas where dust may settle, vacuum the surface clean and wipe it with a tack cloth.

K. Remove damaged or defective coating by the specified blast or power tool cleaning to meet the clean surface requirements before recoating.

L. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be in submerged service, then SSPC-SP2 — Hand Tool Cleaning or SSPC-SP3 — Power Tool Cleaning, may be used. If the coated area to be cleaned is less than 100 square feet, and will be in submerged service, then SSPC-SP11 Power Tool Cleaning to Bare Metal may be used.

M. Completely remove shop-applied coatings of unknown composition before the specified coatings are applied. Examine valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment for the presence of shop-applied temporary coatings. Completely remove temporary coatings by solvent cleaning per SSPC-SP1 method before starting abrasive blast cleaning. Alternate cleaning methods such as Baking Soda Blasting or Sponge Jet Blasting may be used as appropriate.

N. Use the solvent cleaning method (SSPC-SP1) to clean shop-primed equipment in the field before finish coats are applied.

3.07 SURFACE PREPARATION FOR GALVANIZED FERROUS METAL

A. For galvanized ferrous metal, use the alkaline cleaning method per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of protective coatings. Alternate methods with biodegradable surfactant type cleaners followed by fresh water washing may be used as appropriate.

B. Apply pretreatment coatings of surfaces in accordance with the printed recommendations of the coating manufacturer.

3.08 SURFACE PREPARATION OF FERROUS SURFACES WITH EXISTING COATINGS

A. Preparatory Cleaning: Remove grease, oil, heavy chalk, dirt, or other contaminants by solvent or detergent cleaning prior to abrasive blast cleaning using solvent cleaning SSPC-SP1. Determine the generic type of the existing coatings by laboratory testing.

B. Abrasive Blast Cleaning: Provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not indicated in the schedule, remove deteriorated coatings by abrasive blast cleaning to SSPC-SP6 – Commercial Blast Cleaning. Clean areas of tightly adhering coatings to SSPC-SP7 – Brush-off Blast Cleaning, with the remaining thickness of existing coating not to exceed 3 mils.

C. Incompatible Coatings: If coatings to be applied are not compatible with existing coatings, apply intermediate coatings conforming to the paint manufacturer's recommendation for the indicated coating system or completely remove the existing

coating prior to abrasive blast cleaning. Make a small trial application for compatibility prior to painting large areas.

D. Unknown Coatings: Completely remove coatings of unknown composition prior to application of new coatings.

E. Water-abrasive or Wet-abrasive Blast Cleaning: Where specified or where job site conditions do not permit dry-abrasive blasting for industrial coating systems due to dust or air pollution considerations, water-abrasive blasting or wet-abrasive blasting may be used. In both methods, use paint-compatible corrosion inhibitors. Begin the coating application as soon as surfaces are dry. Perform water-abrasive blasting using high-pressure water with sand injection. In both methods, use equipment that is commercially-produced with successful service record. Do not use wet-blasting methods for submerged and severe- service coating systems, unless specified.

3.09 APPLICATION OF COATINGS

A. Apply protective coatings to steel substrates in accordance with SSPC-PA1 - Paint Application Specification No. 1.

B. Inspect cleaned surfaces and each coat prior to succeeding coats. Schedule inspections with the Engineer in advance.

C. Paint blast-cleaned ferrous metal surfaces before rusting or other deterioration of the surface occurs. Limit blast cleaning to only those surfaces that can be coated in the same working day.

D. Apply coatings in accordance with the manufacturer's instructions and this Section, whichever has the most stringent requirements.

E. Give special attention to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely occur. Use stripe painting for these areas. Apply stripe coat prior to primer.

F. Give special attention to materials which will be joined so closely that proper surface preparation and application are not possible. Coat such contact surfaces prior to assembly or installation.

G. Apply finish coats, including touch-up and damage repair coats, in a manner which will present a uniform texture and color matched appearance.

H. Do not apply coatings under the following conditions:

1. Temperature outside of the manufacturer's recommended minimum and maximum range.

2. Dust or smoke laden atmosphere.

3. When the substrate or air temperature is less than 5 degrees F above dew point.

4. When air temperature is expected to drop below 40 degrees F or less than 5 degrees F above the dew point within 8 hours after application of coating.

5. When wind conditions are not calm.

I. Determine the dew point by use of a sling psychrometer in conjunction with U. S. Department of Commerce, Weather Bureau psychometric tables.

J. For steel piping which will not be buried, have the surface abrasive blast cleaned and primed before installation.

K. Apply coating system after concrete, masonry, and equipment installation is complete and the work areas are clean and dust free. Mortar joints and concrete must have cured a minimum of 30 days @ 75° (24°C) unless an approved epoxy sealer has been applied to green concrete within 12 hours of finishing the concrete. The pH must be 10 or less. Surface must be clean, dry and in sound condition. Remove all oil, dust, grease, lose rust and other foreign material to insure adequate adhesion.

3.10 CURING OF COATINGS

A. Maintain curing conditions in accordance with the recommendations of the coating material manufacturer and this Section, whichever is the most stringent. Complete curing before placing the coating systems into service.

B. In the case of enclosed areas, forced air ventilation using heated air if necessary, may be required until the coatings have fully cured.

C. Forced Air Ventilation of Enclosed Hydraulic Structures: Forced air ventilation is required for the application and curing of coatings on the interior surfaces of enclosed hydraulic structures. During application and curing periods, continuously exhaust air from the lowest level of the structure using portable ducting. After interior coating operations have been completed, provide a final curing period for a minimum of 10 days, operating the forced air ventilation system continuously.

3.11 PAINT SYSTEM IDENTIFICATION

A. Use ready-to-apply decals to display the information below to the side of the tank near the flush clean-out door for GST, the access door for EST about 3 feet from the ground, and near the manway on a hydropneumatic tank, after completion of the painting operation. Letters are to be 0.75 inches in height; the color is to be black and adhesive is to be compatible with finish coat:

B. Date of coating application. Completion [month/year]

C. General Contractor, Painting Contractor

D. Interior coating system supplier and product number(s).
   1. Surface Preparation, Prime Coat, Intermediate Coat, Finish Coat, Caulking

E. Exterior coating system supplier and product number(s).

   1. Surface Preparation, Prime Coat, Intermediate Coat, Finish Coat

3.12 SHOP AND FIELD INSPECTION AND TESTING

A. Give the Engineer a minimum of 3 days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

B. Perform surface preparation and coating applications in the presence of the Engineer, unless the Engineer has granted prior approval in writing to perform such Work in his absence.

C. Inspection by the Engineer, or the waiver of inspection of any particular portion of the work, does not relieve the Contractor of his responsibility to perform the Work in accordance with these Specifications.

D. Erect and move scaffolding where requested by the Engineer to facilitate inspection. Provide additional illumination to light areas to be inspected.

E. Inspection Devices: Until final acceptance of coatings, furnish inspection devices in good working condition for the detection of holidays and measurement of dry-film thicknesses of protective coatings. Make dry-film thickness gauges available for the Engineer's use while coating is being done, until final acceptance of such coatings. Provide the services of a trained operator of the holiday detection devices until the final acceptance of such coatings. Operate holiday detection devices in the presence of the Engineer.

F. Perform holiday tests on coated ferrous surfaces inside a steel reservoir, other surfaces which will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures and surfaces coated with any of the submerged and severe service coating systems. Mark and repair or recoat areas which contain holidays in accordance with the coating manufacturer's printed instructions and then retest.

   1. Coatings with Thickness Exceeding 20 Mils: For surfaces having a total dry-film coating thickness exceeding 20 mils; use a pulse-type holiday detector such as Tinker & Rasor Model AP-W, D.E. Stearns Co. Model 14/20, or equal. Adjust the unit to operate at the voltage required to cause a spark jump across an air gap equal to twice the specified coating thickness.

   2. Coatings with Thickness of 20 Mils or Less: For surfaces having a total dry-film coating thickness of 20 mils or less, use Tinker & Rasor Model M1 non-

destructive type holiday detector, K-D Bird Dog, or equal. Use a unit that operates at less than 75-volts. For thicknesses between 10 and 20 mils, add a non-sudsing type wetting agent, such as Kodak Photo-Flo, or equal, to the water prior to wetting the detector sponge.

G. On ferrous metals, measure the dry-film coating thickness in accordance with the SSPC-PA2 using a magnetic-type dry-film thickness gauge such as Mikrotest Model FM, Elcometer Model 111/1EZ, or equal. Test each coat for the correct thickness. Do not take measurements until at least 8 hours after coating application. On non-ferrous metals and other substrates, measure the coating thicknesses at the time of application using a wet-film gauge.

H. Evaluation of blast-cleaned surface preparation work will be based upon comparison of the blasted surfaces with standard samples using NACE Standard TM-01-70.

3.13 FINISH SCHEDULE

A. Items to be coated are presented in Table 2, "Surface Preparation and Finish Schedule" below. Table 2 contains the required pre-cleaning procedures, the degree of surface preparation and coating system schedule for the various items.

TABLE NO. 2
SURFACE PREPARATION AND FINISH SCHEDULE

	Item:	Surface Preparation	Paint System	Additional Work Item	Comments
A.	All proposed lift station wet well fittings, valves and piping (excluding piping with galvanized or stainless steel coatings).	1	9		
B.	All proposed lift station valve vault fittings, valves and piping (excluding piping with galvanized or stainless steel coatings).	1	8		
C.	All proposed above grade fittings, valves and piping (excluding piping with galvanized, PVC, or stainless steel coatings).	1	8		
D.	Painted carbon steel plate or pipe modified by cutting or welding due to proposed modifications.	3, 7	8		
E.	Wet well concrete walls and ceiling (excluding lift station floor).	9	12		

Notes:
1. See Table 1 "Coatings Systems" for allowable coating manufacturers and products.
2. For concrete and reinforcing steel refer to the structural notes on the structural drawings.

B. Utilize the following legend for TABLE No. 2 "Surface Preparation and Finish Schedule":

Item Description

1. Prior to abrasive blasting, high pressure-wash to remove oily residue and/or remove loose matter present on these surfaces. Check with black light and reclean if necessary. If an emulsifying type degreaser is used, the pH of the surface shall be checked for neutrality. Corroded metal surfaces shall be cleaned using Near White Blast Cleaning (Item No. 4 below; SSPC-SP10 - NACE No. 2). Anchor profile for abrasive blasted surfaces shall have an AVERAGE of 2.0 to 3.0 mils with no individual reading greater than 4.0 mils or less than 1.5 mils.

2. Prior to abrasive blasting, solvent cleaning (SSPC-SP-1) shall be done to remove oil, grease and other detrimental foreign contaminants for interior and/or exterior surfaces as required.

3. Power Tool Clean (SSPC-SP-3) any new welds, flame cut surfaces, buckshot and/or weld splatter associated with tank repairs, modifications and other new work.

4. Near White Blast Cleaning (SSPC-SP10 - NACE No. 2). Anchor profile for abrasive blasted surfaces shall have an AVERAGE of 2.0 to 3.0 mils with no individual reading greater than 4.0 mils or less than 1.5 mils.

5. Commercial Blast (SSPC-SP6 - NACE No. 3) shall be performed on all surfaces. Anchor profile for abrasive blasted surfaces shall have an AVERAGE of 2.0 to 3.0 mils with no individual reading greater than 4.0 mils or less than 1.5 mils.

6. Brush-Off Blast (using 40-80 mesh abrasive) surfaces to remove poorly adhering coatings, mildew, dirt, soil and other detrimental foreign contaminants. Use of Devprep or equal will improve cleaning effectiveness.

7. Spot Repair by hand sanding and/or power tool cleaning any pinholed coatings, damaged coatings and/or rust spots. All repair areas are to be feathered into adjacent painted areas using the appropriate paint system specified for the applicable interior or exterior of the tank.

8. Three (3) Coat Inorganic Zinc / Epoxy / Polyurethane Paint System.

   a. Total system shall have a nominal dry film thickness of 9 to 14 mils.

      i. Prime coat to have a nominal 2.5 to 4 mils DFT.

      ii. Intermediate coat to have a nominal 4 to 6 mils DFT.

      iii. Finish coat to have a nominal 2.5 to 4 mils DFT.

c. All DFT measurements are to be performed in accordance with SSPC-PA2 and shall represent the DFT, adjusted for magnetic base readings of abrasive blast cleaned steel.

9. Two (2) Coat Coal Tar Paint System.

a. Use a high-build, 2-component amine or polyamide-cured coal tar epoxy with a solids content of at least 68 percent by volume.

b. Use a coating suitable for long-term immersion in wastewater or for coating of buried surfaces.

c. Coating must conform to Mil Spec DOD-P-23236, or to SSPC Paint 16.

d. Prime coasts are for use as a shop primer only. Omit prime coat when both surface preparation and coating are performed in the field.

e. All DFT measurements are to be performed in accordance with SSPC-PA2 and shall represent the DFT adjusted for magnetic base readings of abrasive blast cleaned steel.

f. Prime Coat: DFT – 1.5-2.5 mils (38-65 microns).

g. Finish Coats (2 or more):
   i. DFT = 14-18 mils (350-450 microns).

h. Total System DFT = 15.5-20.5 mils (387-513 microns).

10. Coatings work will be permitted during daylight hours only unless arrangements or permission has been granted in writing.

11. Continuous tank ventilation system must be able to prevent the vapor concentration from reaching the TLV (threshold limit values) of exposure to the solvent(s) used in accordance with the TLV values published by the American Conference of Governmental Industrial Hygienists, 1991-1992 Edition.

12. Wet Well Corrosion Protection

a. Corrosion protection shall be provided for the sanitary lift station interior concrete surfaces excluding the lift station floor.

b. The lift station wet well interior shall be lined with SewperCoat, Refratta HAC 100, or approved equal calcium aluminate material. Proposed substitutes must be equal in composition and manufacturer warranty.

c. Product must be installed by a manufacturer certified applicator.

d. Minimum thickness for lift stations and manholes which have a force main discharge shall be 1".

e. In addition to SSPC-13/NACE 6, prepare surface by sand blasting. Provide smooth trowel finish.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide, install, test and startup submersible, non-clog wastewater pumps capable of handling raw unscreened wastewater complete and operational including discharge elbow(s), guide rails, cables, access frame and covers, motors, control equipment, and accessories as shown on the drawings and specified herein.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the Bidsheet.

1.03 SUBMITTALS

A. Prior to shipment, submit to Owner for review:

1. Pump Submittals:

a. Descriptive literature, manufacturer's specifications, and catalog cuts.

b. Certified drawings including elevation drawings showing pump and pump sectional drawing with list of materials, parts and data.

c. Certified performance curves with pump and system operating point plotted, including Net Positive Suction Head (NPSH) requirements.

d. Submit test reports before pump(s) is delivered to the site and include in the operation and maintenance manual.

e. Layout showing relationship of discharge piping, wall pipe penetration, guide rails and hatch opening.

2. Motor submittals:

a. Descriptive literature, manufacturer's specifications, and catalog cuts, NEMA characteristics, weight and dimensions.

b. Performance data including locked rotor current; starting torque; full load current and speed; efficiency at ½, ¾ and full load; power factor at ½, ¾, and full load.

3. Manufacturer's Report: Upon completion of installation, a service Engineer employed by the manufacturer will provide the Owner with a written report of pump start-up points and calibrations. Final pump setting will be reviewed.

B. Operation and Maintenance Data: Submit operation and maintenance data which as a minimum contains the following information:

1. Description of Pumps
2. Assembly/Disassembly Drawings
3. Materials List
4. Normal Start-up/Shut-Down Procedures
5. Emergency Procedures
6. Maintenance Schedule
7. Trouble-shooting Guide
8. Recommended Spare Parts List for pump and control panel
9. Shop test results
10. A copy of the warranty
11. A complete copy of the approved submittal

Data shall also include name, address, and telephone number of local manufacturer's representative. Contractor shall submit five (5) bound copies to Owner upon approval of shop drawings.

1.04 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Provide pumping equipment that is a standard product in regular production by a manufacturer whose products have proven reliable in similar service for at least 5 years.

2. Manufacturer shall be capable of the following:

a. Providing local factory-trained personnel to service pumps and allied equipment within 48 hours of call for maintenance. Local is defined as maintaining an office within 100 miles of the limits of the plant site.

b. Providing needed spare parts for pumps within 48-hours.

B. Coordination Responsibility

1. For equipment compatibility, all submersible wastewater pumping equipment, including pump and motor, access frame and guides shall be provided by a single manufacturer.

2. Contractor shall retain overall responsibility for equipment coordination, installation, testing and operation.

C. Test pump(s) fully, with water, in manufacturer's shop in accordance with manufacture's standards. Pump shall be run in a submerged condition at the specified duty condition for 30 minutes minimum. Submit test report(s) before pump(s) are delivered to the site and include in Operations and Maintenance manual.

1.05 ACCEPTABLE MANUFACTURERS

A. Ebara
B. Grundfos / Yeomans-Chicago
C. KSB
D. Pentair / Hydromatic
E. Sulzer / ABS
F. Xylem / Flygt

1.06 WARRANTY

A. For a period of 12 months from final acceptance, the manufacturer shall warrant that the equipment shall be free of defects in material and workmanship under normal use and service, and when properly installed. The manufacturer shall repair or replace, F.O.B. point of shipment, such equipment or any part thereof furnished by the manufacturer and found defective after inspection by the manufacturer.

PART 2 - PRODUCTS

2.01 NON-CLOG SUBMERSIBLE PUMPS

A. Furnish two (2) non-clog submersible sewage pump(s) to be located inside the proposed wet well.

B. Pumps: Each pump shall meet the proposed Phase 1 condition characteristics listed below and with an impeller changeout meet the proposed Phase 2 condition listed below. The Phase 2 impeller will NOT be supplied as part of this contract:

	Characteristics	Pump Number			
		Phase 1		Phase 2	
		P-1	P-2	P-1	P-2
1.	Rated Total Dynamic Head (TDH), ft.	43.82	43.82	48.56	48.56
2.	Capacity at Rated TDH, gpm	197	197	542	542
3.	Minimum Pump Efficiency (wire to water) at Rated TDH	60	60	60	60
4.	Pump Nominal Operating Speed, rpm	1,750	1,750	1,750	1,750
5.	Maximum Brake Horsepower at Design Point	20	20	20	20
6.	Suction & Discharge Diameter, inches	4	4	4	4

7.	Minimum Diameter Test Sphere, inches	2.5	2.5	2.5	2.5
8.	Electrical Characteristics				
	Volts	460	460	460	460
	Phase	3	3	3	3
	Frequency, Hz	60	60	60	60
9.	Acceptable Products: Flygt or per listed:	NP	MT-3-437	NP-	MT-3-
	Acceptable Manufacturers	3153		3153	435

C. Pump Casing:

1. The pump casing shall be of volute type and made of cast iron. The casing shall be of one (1) piece construction and of center line discharge design to minimize clogging or flow interference.

2. Construct major pump components of fine grained gray cast iron, ASTM A48, Class 30 or better, which shall include cast iron for integral support legs, pumps casing, and impeller.

3. Pumps shall connect to a permanently mounted discharge by simple downward motion, guided by non-load bearing guide rails. Final connection shall insure zero leakage between the pump and its discharge connection by means of an O-ring seal.

4. Install replaceable wear rings on both volute and impeller to provide efficient sealing. Fabricate wear rings of AISI Series 300 or better heat-treated stainless steel or hardened steel. Select wear rings so that the relative hardness of the volute and impeller differ by at least 50 BHN. For pumps 10 horsepower and below, the pump may be equipped with brass or nitrile rubber volute wear ring.

5. Drill pump flanges to ANSI standard, class 125.

D. Power Cable

1. Use a design for the cable entry water seal which precludes specific torque requirements to ensure a watertight and submersible seal. Seal the cable entry by a combination of both an elastomer grommet and an epoxy potting material. Provide a cable entry sealing system with strain relief for the terminal connections and with access to the terminal connections without adversely affecting the integrity or function of the seal system.

2. Provide a power cable for each pump containing the power and control wiring. The cable should reach in one (1) continuous length to the control panel, or junction box as outlined on the contract drawings. Insulate the cable to protect it from the wastewater and the wet well environment.

3. Provide motors with reconnectable terminal blocks. Number all leads.

E. Submersible Motor

1. Pump Motor Characteristics:

a. NEMA Design B squirrel-cage, induction, shell type design, housed in an oil-filled or air-filled watertight chamber with a service factor of 1.15.

b. Stator winding and stator leads insulated with moisture resistant Class F insulation which will resist a temperature of 311 degrees F.

c. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.

d. Fabricate rotor bars and short circuit rings of aluminum.

e. Design for continuous duty, capable of sustaining a minimum of 10 starts per hour, evenly spaced.

f. Capable of operating at liquid temperature of 104 degrees F without overheating or operating in the service factor.

2. Provide each unit with a totally self-contained cooling system with no external mechanical devices. Select pumps designed to operate continuously with the fluid level at the top of the pump volute. Cooling jackets will not be allowed.

3. For sizes 20 horsepower and smaller, equip motor with dual voltage connections for 230/460 volts.

4. Use thermal sensors to monitor stator temperatures. Equip stator with 3 thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). Wire these sensors to the control panel for use in conjunction with and supplemental to external motor overload protection.

5. Equip the pump with moisture sensors in the oil-filled seal chamber or stator housing to indicate seal leakage.

F. Shaft: Fabricate pump shafts as one piece of AISI Series 400 stainless steel. Make shaft of sufficient diameter to assure rigid support of the impeller and to prevent excessive vibration at all speeds.

G. Pump Seal: Provide each pump with a tandem mechanical shaft seal system. Operate the upper seal of the tandem set of seals in an oil chamber located just below the stator housing. The upper seal functions as an independent secondary barrier between the pumped liquid and the stator housing. The lower seal of the tandem set of seals functions as the primary barrier between the pumped liquid and the oil housing. Form each seal with a stationary ring and a

positively driven rotating ring both fabricated of solid silicon carbide. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring action between upper and lower seal faces are not acceptable.

H. Bearings: Permanently lubricated ball or roller type rated in accordance with AFBMA for an L-10 duty life of at least 100,000 hours at the rated capacity.

I. Impeller:

1. Fabricate the impeller of fine grained gray cast iron, Class 30 or better. Balance the impeller both statically and dynamically. Provide double shrouded, non-clogging impeller design having a long thrulet without acute turns. Have the impeller hub accurately fitted and mechanically secured to the motor shaft.

2. Bolts, Studs and Nuts: 304 stainless steel for all fasteners on the submersible pump and motor casing.

2.02 ACCESS FRAMES AND COVERS

A. Access Frames and Covers

1. Floodtight/gastight access frame and cover: The cover shall have stainless steel quick release watertight cam locks (bolted hatches are not acceptable) to compress a gasket so the hatch does not leak from standing water as manufactured by U.S.F. Fabrication, series W-APS; or Walz & Krenzer, Inc. or approved equal for Pedestrian loading (Min. 150 psi live loading).

2. Have aluminum access frames and covers provided by the pump supplier. Use fasteners, hinges and other hardware of type 316 stainless steel. Fabricate the frame of extruded aluminum with an integral seat and anchor flange. Make door leaves of minimum 1/4-inch thick aluminum floor plate reinforced for 25 foot head of water.

3. Equip the access door with a flush, cast-aluminum drop handle which does not protrude above the cover surface. Also provide an automatic hold-open arm with a red vinyl release grip, that automatically holds the door in a 90 degree open position utilizing a stainless steel pin at the point where the door meets the hold open arm. If door weight equals or exceeds 90 lbs., equip doors with stainless steel spring operators for lift assist and to retard downward motion. Fabricate all parts of the spring operator of stainless steel or aluminum. Make spring operators the open type. Design and install spring operators so that in the event of slamlock failure, the door will remain closed. Set the force required to open any one door leaf at a minimum of 5 pounds and a maximum of 20 pounds.

4. Provide doors with a recessed padlock assembly that consists of a cast aluminum

enclosure sized to restrict access by bolt cutters, a stainless steel staple for a padlock, and a hinged stainless steel cover which does not protrude above cover surface.

5. Apply bituminous paint on all areas that come in contact with concrete.

6. The underside of the hatch shall have the following stenciled in RED paint "WARNING! CONFINED SPACE ENTRY."

7. Each access hatch shall be fitted with a permanently installed fall through prevention net system that is easily retractable for access to the opening below as manufactured by U.S.F. Fabrication, Inc., Walz & Krenzer, Inc., or approved equal. The fall prevention system shall consist of the following components:

   a. A safety net manufactured from high strength polyester netting that has been tested and certified to meet the current OSHA standard drop test.

   b. All stainless steel 316 hardware, hooks and anchors.

   c. A permanently attached metal tag with the following information: name of manufacturer; identification of net material; date of manufacture; and serial number.

2.03 PUMP GUIDE SYSTEM

A. Furnish slide rail mechanisms to guide submersible pumps from the bottom of the wet well to the slab at the surface for inspection and maintenance. The slide rail system shall consist of two (2) rails per pump. Single rail systems are not acceptable.

B. Elbow: The base elbow is cast in accordance with ASTM Specifications No. A-48, Class 30. All pipe flanges shall be faced and to the thickness required for compliance with 125 lb. American Standard. Bolt slots are acceptable in lieu of drilled hole. Provide bolt slots in the base for mounting the elbow to the concrete floor or sole plate. Design the base elbow to permit the slide mechanism to link up the pump with the base elbow.

C. Rail: The guide rail shall be constructed from pipe and shall be 316 stainless steel to prevent corrosion and maintain a smooth surface for the guide shoes. Provide an upper guide rail bracket to support the guide rail near the top of the wet well.

D. Guide Shoes: Provide coated shoes to guide each pump assembly down the guide rail.

E. Slide: The slide is connected to the pump on one (1) side and the guide shoes on to the other side. The slide is guided in its descent and ascent by the rail and guide shoes. Design the guide rail upper bracket to permit removal of the pump without having to disconnect the guide shoes.

F. The slide shall position the pump discharge flange to properly engage it with the discharge elbow and maintain a leak-tight joint.

G. Lifting Chain: Provide a minimum 316 stainless steel chain or cable to lift each pump/motor assembly from the wet well. Attach the chain on the upper end to a bolt bracket mounted just under the hatch cover.

2.04 PUMP PROTECTION SYSTEM

A. Have the pump manufacturer furnish a complete pump monitoring and protection system consisting of solid state monitoring to be installed in the motor starter enclosure, and independent probes integral to the pump/motor wired to a sealed cable entry terminal box for connection of submersible control cables.

B. Provide a solid state monitoring unit designed for mounting within the motor starter enclosure. Design the monitoring system to accept inputs from the sensors specified and outputs to independent contacts which close to alarm each condition, or separate independent output terminals suitable for direct connection to interposing relays for alarm contact development. Provide a separate normally closed alarm contact, rated at 120V, 5A inductive, which opens on any failure. Use a monitor system suitable for operation from a 24VAC unregulated, unlimited power supply. Supply any additional equipment or appurtenances required to provide current and voltage limited installation as specified. Configure the monitoring system to accept separate isolated normally open contacts which close to indicate pump running and to reset after pump trip.

C. Have sensors independently wired to the monitoring system. Make provision for the following sensors for each pump:

1. Seal leak (one required).

2. Stator temperature (one per phase, field test and connect to highest reading obtained).

3. Bearing temperature for pumps over 100 horsepower (one required).

2.05 SHOP PAINTING

A. Provide pump and motor with one of the following factory-applied exterior protective coating systems:

1. Coal tar epoxy: High-build 2-component amine or polyamide-cured coal tar epoxy with a solids content of at least 68 percent by volume. Suitable for long-term immersion in wastewater and for coating of buried surfaces conforming to SSPC Paint 16. Prime coats are for use as a shop primer only. Omit prime coat when both surface preparation and coating are performed in the field.

a. Prime Coat:

i. DFT = 1.5 mils
ii. Products: Ameron 83HS, Tnemec P66, or equal.

b. Finish Coats (2 or more):

i. DFT = 16 mils
ii. Products: Ameron 78 HB, Tnemec 46 H-413, or equal.

c. Total System DFT = 17.5 mils

2. Amine-cured epoxy: High-build, amine cured, epoxy resin with a solids content of at least 80 percent by volume. Suitable for long-term immersion service in potable water and municipal wastewater.

a. Prime Coat and finish coats (3 or more):

i. DFT = 16 mils
ii. Products: Ameron 39, Tnemec 139, or equal.

b. For coating of valves and nonsubmerged equipment, DFT= 12 mils.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the two (2) lift station pumps and accessories in the wet well as shown on the drawings. The Contractor shall supply a total of two (2) submersible pumps.

B. Install the electrical equipment as shown on the drawings.

C. Set the level control equipment at the elevations as shown on the plans.

3.02 CONTROL SYSTEM OPERATION

A. The Lead, Lag and standby pumps shall be defined as pumps P-1 and P-2 automatically cycled by the alternator between these pump operating positions.

B. The switch on each pump must be in the "automatic" position for the transducer to start the pump.

C. Each pump will be capable of running in automatic mode or manual/hand mode. If the pumps are in automatic mode there will be a mode selector switch that controls which of the

two (2) modes the pumps are operating in.

D. Activate the alarm, autodialer and appropriate indicating light on the control panel in the event of pump seal failure, power outage, motor overload, high water level, or low water level. This system shall have floats as a redundant backup as specified in Division 16.

E. Indicate operation of each pump on the control panel with respective pilot lights.

F. Indicate run time for each pump on the control panel with respective run time totalizer.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section provides for furnishing and delivering a complete, operational, factory fabricated, wastewater treatment plant, complete with piping and appurtenant work as specified herein. The plant supplied under the contract will have a minimum average daily flow capacity of 98,000 gpd and a minimum peak 2-hour flow capacity of 197 gpm (283,680 gpd).

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 SUBMITTALS

A. Products List. Deliver a complete list of all proposed materials and equipment to the Engineer for review, including catalog cut sheets and other descriptive literature.

B. Data Required. Submit shop drawings as required below. Submittal data and shop drawings must show published ratings or capacity data, detailed equipment drawing for fabricated items, panel diagrams, installation instructions and other pertinent data. Where literature is submitted covering a group or series of similar items, the applicable item must be clearly indicated.

C. Form of Submittal. Make the submittal for review before orders are released for manufacture. Submit data and drawings at one time in an indexed binder. Show any revisions to equipment layouts required by use of selected equipment. Reference specification paragraphs or drawings for all data submitted.

D. Engineer's Review. The list of materials and equipment, shop drawings, catalog sheets, diagrams and similar descriptive items requiring submittal shall be reviewed by the Engineer for general conformance with design concept. No product shall be furnished until the submittal data has been approved by the Engineer.

E. Items Required. Submittal data and shop drawings are required for, but not limited to, the following items:

1. A site layout, to scale, showing the size, spacing, and locations of all proposed process units, piping, wiring, and accessory equipment.
2. All process units showing maximum water surface elevations and wall height.
3. All accessory equipment including blowers, flowmeters, chart recorders, autodialers, and pumps, non-potable water system, air lift pumps, and chlorination equipment.

4. Schematic diagrams of the chlorine feed and non-potable water system piping.
5. Air diffusion equipment, air header layout and diffuser layout.
6. Process piping layout.
7. Headworks box.

F. Operation and Maintenance: A minimum of 30 days prior to plant completion, provide 4 copies, and searchable PDF(s) on compact disk of the operation and maintenance (O & M) manuals applicable to each item of equipment furnished. Hard copy O & M manuals shall be printed on 28# bond paper with reinforced holes and bound in D-Ring binders (maximum 4-inch binders per volume) with sheet lifters front and back, table of contents, and tabbed sections. O & M description, project name, contractor name, and specification section shall be printed on spine of binder. Submit electronic preliminary copies for review and approval prior to printing final copies. Each manual shall contain:

1. General arrangement drawings.
2. Erection drawings.
3. Cut sheet for all items of equipment purchased from other manufacturers.
4. Installation and maintenance instruction for the specific equipment including the erection sequence and maintenance and troubleshooting check points.
5. Written instruction and parts list for operating and maintaining all equipment and systems installed.
6. Instructions and a description of all normal adjustments.
7. A list of items to be lubricated with type and frequency of lubrication recommended.
8. Furnish to the Lessee all special servicing tools required for this equipment.
9. Manufacturers' lists of recommended spare parts and one (1) years' supply of all spare parts and lubricants recommended by equipment manufacturer(s).
10. Copies of all test reports and results.
11. Warranty certificates, both from contractor and from manufacturer(s), valid for one (1) year from date of project final acceptance.
12. Record drawings and other documents. Contractor shall provide one (1) complete full size set of "red-line" as-built drawings in hard copy and one digital copy of CD/searchable PDF format.
13. See contract documents for additional requirements.

G. Operation. Instruct the Lessee's operating personnel in the operation and maintenance of all equipment and systems furnished.

1.04 QUALITY ASSURANCE

A. Provide a plant by a manufacturer with at least five (5) years of experience in the design, building, and installation of water and wastewater treatment equipment. All components shall be new. No used equipment shall be allowed.

1.05 ACCEPTABLE MANUFACTURERS

A. Provide equipment as supplied by an acceptable manufacturer from those listed in the Proposal Section C of the contract documents.

1.06 WARRANTIES

A. Warrantees or guarantees by suppliers of various components will not be accepted in lieu of single source responsibility. The Lessor will be solely responsible for the guarantee of the plant and all components for the duration of the Lease. In addition, the Lessor must repair or replace any damaged or non-operational equipment at no additional cost to the Lessee. Non-operational equipment includes any piece of equipment that does not operate at the design conditions specified herein, including damage due to normal wear and tear.

PART 2 – P R O D U C T S

2.01 DESCRIPTION

A. The wastewater treatment plant shall be an activated sludge process capable of treating 98,000 GPD average daily flow with a minimum peak 2-hour flow of 197 gpm (283,680 gpd) of domestic sewage of 250 mg/l, five (5) day BOD and 250 mg/l total suspended solids and 25 mg/l NH_3 to produce 5 mg/l BOD_5 and 5 mg/l TSS, 2 mg/l NH_3, 1 mg/l Phosphorus and 126 CFU E.coli. The complete plant shall include screening, aeration, digestion, secondary clarification, chlorination, blowers and all appurtenances. The plant shall be designed to operate a Complete Mix single stage nitrification process.

B. The treatment plant shall be built of 1/4" minimum thickness ASTM A-36 structural steel plate and all piping to be Schedule 40 steel. The side walls and partition reinforcing shall be standard structural shapes and shall be designed to withstand normal soil pressure when installed below grade and hydrostatic pressure when installed above grade.

C. All tank(s) shall be anchored to the ground with screw type earth anchors designed to provide a minimum of 5,000 lb force each as shown on the plans. Tank anchoring system must be designed to withstand all wind and design loads.

D. At a minimum, the package wastewater treatment plant must be designed, constructed and installed in accordance with the requirements of the Texas Commission on Environmental Quality (TCEQ) and the Guadalupe-Brazos River Authority (GBRA).

E. All equipment and tankage supplied shall be new.

F. All exposed piping 4-inches in diameter and smaller conveying liquids shall be insulated, heat traced, and covered with an aluminum insulation jacket cover.

2.02 HEADWORKS

A. The facility should be provided with 1-inch bar screens (minimum) and drying deck.

B. The bar screens shall have 1" x ¼" bars as shown on the drawing.

C. It shall be installed at the influent port, and shall include a drying deck with drain for drying debris raked up the sloping bars.

D. Screens and deck shall be removable.

E. The screening area should be fabricated of stainless steel or aluminum. Hot dip galvanized or painted steel are not acceptable. Minimum thickness shall 3/16-inch.

F. Provisions should be made for surge control, especially during initial low-flow phases.

2.03 AERATION TANKS

A. The aeration tanks shall be rectangular structures designed with baffles to promote rapid rolling of the liquid in one direction by the movement of air from air diffuser drops, which shall be spaced along one side of the aeration tank.

B. At a minimum, Freeboard shall be 18".

C. For systems utilizing an internal recycle of MLSS, provide ability to measure and control recycle rate proportional to plant influent flow.

D. Provide means to measure airflow to aeration zone.

2.04 CLARIFIER

A. Description

1. The clarifier mechanism shall be suitable for a tank diameter of 20 ft. and a minimum side water depth of 10 ft. and a minimum floor slope 1:12.
2. The clarifier shall be of a size to provide surface loading not greater than 1200 gallons/day/square foot, based on peak flow.
3. The clarifier shall include a center feed well, a sludge collector mechanism, a drive unit, skimming equipment, an adjustable "V" notch weir plate and effluent trough, suppression scum spray bar and a support bridge.
4. Clarifiers, including piping, inlet, feed well, and sludge scrapers, shall be in accordance with recommendations of WEF MOP-8.
5. Provide valves on clarifier influent and effluent or other means of isolating clarifier to allow service of clarifier interior.

6. Provide spray nozzles as shown on the Drawings capable of scum suppression.

B. Circular Sludge Collectors

1. Under this item the Equipment Manufacturer shall furnish as an integral component a circular scraper type sludge collecting mechanism. The sludge collector unit shall be complete with drive mechanism, drive unit, support bridge, influent well, torque tube, rotating scraper arms, full surface skimmer, full surface scum trough, overload device and neoprene blades.
2. The clarifier mechanism shall be of the bridge supported type. Walkways shall be designed for a maximum deflection under 100 psf live load of L/360. The feed shall be the center well type with peripheral underflow. A central driving mechanism shall support and rotate a torque tube to which are attached two structural steel rake arms. The rake arms shall be designed to withstand twice the rated torque of the drive unit without overstressing the members. A structural steel bridge that spans the tank shall support the entire collector mechanism.
3. The drive mechanism shall consist of a triple reduction gear reducer equal to SEW Eurodrive gearmotor and provide a peripheral speed of not more than 10 ft/min. The torque rating shall be a minimum of 2040 ft. pounds running torque with a minimum ball race of 13 inches. A steel torque tube shall be connected to the output shaft of the final reducer and shall support the scraper mechanism. The final reduction gear and the anti-friction bearings shall run in an oil bath within the final gear reduction housing. This housing shall be effectively sealed against contaminants by leakproof gaskets. An oil filling opening along with a drain plug shall be furnished by the manufacturer as part of this unit. The gear reduction unit shall be driven by a vertical NEMA "C" face motor properly sized for the maximum gear box rating without overloading the gear box.

C. Field grouting of the clarifier shall be by the contractor under the supervision of the equipment manufacturer.

D. Influent Stilling Well. The influent stilling well shall be fabricated from 3/16" steel plate stiffened by steel angle welded to the shell periphery.

E. Skimmer. Scum Collection in Circular Setting Tanks with Mechanical Sludge Collectors:

1. Scum collector assembly shall include a blade skinner and a full radium scum trough.
2. Assembly shall continuously move surface scum to the scum trough.
3. The assembly shall discharge scum with a minimum discharge of water.
4. The skimmer shall be fabricated from structural steel sections and equipped with 1/4" thick flexible neoprene squeegee for entrapment of scum and flushing water through positive contact with the scum collector pipe.
5. It shall contain two (2) arms, each radiating 180° opposite from the center torque tube, extending through the stilling well and to the scum baffle to provide a full surface skimming of the clarifier.
6. The squeegee shall contact the tank scum baffle through its full travel.

7. Scum piping shall be provided to allow discharge to either the digester or the aeration basin.

F. Scum Removal:

1. The clarifier shall be equipped with a manually rotated 8" slotted pipe full surface scum trough extending through the center well to the scum baffle.
2. The adjustable operator shall be such as to be conveniently operated from the walkway.
3. The troughs shall drain into a drop box at the scum baffle.
4. The drop box shall be connected to a 4" (minimum) air lift.
5. Actuating air for the air lift shall be supplied by a 1" air line on the main plant air system.
6. The operation of the air lift shall be controlled by a manual throttling valve.

G. Scum Baffle And Effluent Trough. The scum baffle and effluent trough shall be 1/4" steel plate. The inner vertical wall of the trough shall act as a scum baffle with an adequate height above the surface to prevent overflow.

H. Effluent Weirs.

1. The effluent weirs shall be designed for vertical adjustment on the outer wall of the effluent trough.
2. It shall have a 4" wide x 2" deep "V" notches on 6" centers.
3. Weirs and scum baffle shall be fiberglass, aluminum, or stainless, with non-corrosive fasteners for adjustment.

I. RAS/WAS Pumping.

1. RAS/WAS Air-lift pumps shall be provided with sludge measurement box and weir.
2. Air-lift piping and box shall be hot-dip galvanized or stainless.

2.05 CHLORINE CONTACT BASIN

A. The chlorine contact tank shall have a minimum capacity of 20 minutes at peak flow.

1. The tank shall be constructed of 1/4" steel plate joined by arc welding with fillets of adequate strength for the joint involved. Wall shall be continuous and water tight.
2. The chlorine contact tank shall be constructed so that the applied chlorine (CL2) is thoroughly mixed with the wastewater prior to entry in a Chlorine Contact chamber. The disinfection system must provide a mean velocity gradient (G value) in the initial mixing area of at least 500 per second. The mixing zone with the CL2 contact basin shall not be considered as part of the volume needed for disinfection, nor considered as part of the volume required to treat 20 minutes of flow at the peak flow rate.
3. The tank shall have the same protective coating provided on the sewage treatment plant.

4. A 90° "V"-notch weir shall be provided at the chamber effluent.
5. One (1) or more baffle walls shall be installed across the floor of the basin. Two 3-inch valves shall be installed on both sides of the wall for drainage.
6. One or more baffle walls shall be installed across the basin, extending six (6) inches above the top of the over-flow weir and a minimum of twelve (12) inches below the bottom of the "V" notch outfall weir.

B. Post Aeration The Chlorine Contact Basin shall be equipped with an air distribution system and single drop coarse bubble diffusers to provide a minimum of 15 scfm per 1,000 c.f. of tank volume. The diffusers shall be located in the final chambers so as not to interfere with the flow measuring system.

2.06 AEROBIC DIGESTER

A. The digester tanks shall be rectangular structures designed with baffles to promote rapid rolling of the liquid in one direction by the movement of air from air diffuser drops, which shall be spaced along one side of the aeration tank.

B. Provide means to measure airflow to digester zone.

C. At a minimum, Freeboard shall be 18-inches.

D. The aerobic digester tank shall be designed to provide a minimum tank capacity of 20 cf/lb. BOD_5/day.

E. An overflow will be provided in the digester tank to permit overflow into the aeration tank, should the digester flood.

F. Supernatant Return.

1. An adjustable decanting 4" diameter airlift shall be provided to return aerobic digester supernatant liquor to the aeration chamber.
2. The airlift shall be capable of transferring not less than 75 gpm.
3. Digester decant supernatant shall be returned to plant headworks.

2.07 AERATION SYSTEM

A. Guaranteed oxygen transfer efficiency shall be 9% minimum at the design diffuser submergence at design air flow rate.

B. Oxygen transfer efficiency shall be guaranteed and substantiated by submission of test data compiled by a nationally recognized independent testing laboratory.

C. All air headers and gaskets must be able to withstand temperatures up to 250 degrees F.

D. The equipment manufacturer shall be solely responsible for proper design of the air diffusion orifices to provide:

1. Air distribution to suit Engineer's design requirements, and
2. Minimum pressure losses.
3. The system will be designed to uniformly distribute the air from the first drop to the last drop with no more than a 10% deviation in airflow.

E. Air shall be introduced into the tank(s) through diffusers, spaced the entire length of the tank. The diffuser spacing and air velocity shall assure that adequate mixing velocities are maintained. Each diffuser assembly shall be easily removable from the tank manually by a single person and shall be equipped with an air regulating valve to permit either adjustment of the air flow or complete shutoff. These valves must be easily and safely accessible from the walkway surface. The transfer system and total diffuser capacities shall be adequate to supply 150% of the specified blower capacity to the liquid.

F. Air supply mains and air headers furnishing air to the diffusers shall be fabricated from standard weight steel pipe and shall be hot dip galvanized after fabrication. Minimum wall thickness shall be 12 gauge. Air piping shall be sized so that the velocity of the air in the pipe at peak flow is less than the values in the following table:

Pipe Size	Max. Velocity at Standard Conditions
1" – 2½"	1,800 FPM
3" – 10"	3,000 FPM
12" – 24"	4,000 FPM
Greater than 24"	6,500 FPM

G. PVC piping is not allowable for aeration piping.

H. All diffusers shall be stainless-steel wide band diffusers (e.g. Sanitaire D-24) or of equivalent quality.

I. All aeration drop pipes shall be hot-dip galvanized, aluminum, or light-wall stainless steel pipe. PVC is not acceptable for aeration drops.

J. Hot-dip galvanized drop pipes shall be coated with minimum 16 mils of coal tar epoxy for a minimum of 12-inches above and below the normal water level in the aeration basin(s).

K. Each diffuser drop pipe assembly shall consist of a union to allow for ease of removal, a lever operated plug valve accessible from the walkway for the purpose of shut off and regulation of air supply, and the necessary pipe and fittings.

2.08 COATING AND CORROSION CONTROL

A. All vessels to be painted shall be properly prepared in a workmanlike manner to obtain a smooth, clean and dry surface. All rust, dust, and mill scale as well as other extraneous matter, shall be removed by sandblasting to SSPC-6 (commercial sandblast) on outside of vessel surfaces and to SSPC-10 (near-white blast) on inside of vessel surfaces.

B. Following surface preparation and within the time allowed by the paint manufacturers recommendations the inside of the tanks shall be coated with (2) two coat of coal tar epoxy 6 meeting the following requirements:

1. Total system shall have a nominal dry film thickness of 12 to 16 mils.
   a. Prime coat to have a nominal 6 to 8 mils DFT.
   b. Finish coat to have a nominal 6 to 8 mils DFT.

C. Following surface preparation and within the time allowed by the coating manufacture's recommendations the outside shall receive a three (3) coat inorganic zinc / epoxy / polyurethane coating system meeting the following requirements:.

1. Total system shall have a nominal dry film thickness of 9 to 14 miles.

   a. Prime coat to have a nominal 2.5 to 4 mils DFT.

   b. Intermediate coat have a nominal 4 to 6 mils DFT.

   c. Finish coat to have a nominal 2.5 to 4 mils DFT.

2. All DFT measurements are to be performed in accordance with SSPC-PA-2 and shall represent the DFT, adjust for magnetic base readings of abrasive blast cleaned steel.

D. Any painted or finished surface damaged during installation shall be recoated.

E. Paint Systems Identification

   a. Date of coating application. Completion [month/year]

   b. General Contractor, Painting Contractor

   c. Interior coating system supplier and product number(s).

      i. Surface Preparation, Prime Coat, Intermediate Coat, Finish Coat, Caulking.

   d. Exterior coating system supplier and product number(s).

      i. Surface Preparation, Prime Coat, Intermediate Coat Finish Coat.

2.09 FLOW MEASUREMENT

A. Flow measurement must use a combination of primary and secondary measuring devices.

B. Primary measuring devices

1. The primary flow measuring devices shall be a 90° "V"-notch weir shall be provided at the chamber effluent.
2. The primary measuring device must have a non-corrosive ruler (staff gauge) that is graduated in no greater than ¼ inch increments that are clearly visible.
3.. The primary measuring device must be installed upstream of the secondary measuring device to permit the manual measurement of water depth.
4. The channel approach section to a weir must be straight for at least 20 times the maximum expected head on a weir.
5. The minimum height between a channel bottom and a weir crest must be the greater of twice the maximum expected head on the weir or a minimum of 1.0 foot.
6. The crest of a weir must be exactly level to ensure a uniform depth of flow.
7. The upstream face of a weir must be smooth and perpendicular to the axis of the channel in both the horizontal and vertical directions.

C. Secondary measuring devices

1. Upstream of a primary measuring device ("V"-notch weir) there must be a secondary measuring device. The secondary measuring device shall be located a minimum distance of the greater: of three times the maximum expected head on a weir; or distance recommended by the equipment manufacturer.
2. The secondary measuring device must measure the liquid level in the primary measuring device, and must convert this liquid level into a flow rate that is integrated to a totalized flow.
3. The secondary measuring device must include a display of the instantaneous flow rate and a means of reading the totalized flow.
4. The secondary measuring device shall be an ultrasonic flow measuring device. The ultrasonic flow measuring device shall be a Milltronics, Hydroranger Model 200, 4-20 ma ultrasonic flow transmitter with transducer.
5. The secondary measuring device must be installed in accordance with the manufacturer's recommendations and in a manner that reduces turbulence and promotes laminar flow.
6. The secondary flow measuring device shall be located over a stilling well to ensure accurate measurements.
7. The secondary measuring device must send a signal to a flow recording device.

D. Flow Recording Device

1. The flow recording device shall be a Honeywell Seven (7) Day, 10" Circular Totalizing Flow Recorder Model DR-4300 with fiberglass enclosure.
2. The flow recording device must display the instantaneous flow rate as measured by the secondary measuring device.
3. The flow recording device must record the totalized flow.
4. Where the proposed chlorine contact basin is being added to an existing treatment facility and will operate in parallel with the existing treatment facility, the flow recorder must display the instantaneous flow rate of the proposed chlorine contact basin and the instantaneous flow rate of the entire wastewater treatment facility. All additional equipment, modifications to existing equipment, new conduit, duct banks, and conductors required for the proposed flow recorder to display and record the instantaneous flow rate of the proposed chlorine contact basin and instantaneous flow rate of the entire wastewater treatment facility shall be included (no separate pay).
5. Where the proposed chlorine contact basin is being added to an existing treatment facility and will operate in parallel with the existing treatment facility, the flow recorder must record the totalized flow of the proposed chlorine contact basin and record the totalized flow of the wastewater treatment facility. All additional equipment, modifications to existing equipment, new conduits, duct banks, and conductors required for the proposed low recorder to display and record the totalized conductors required for the proposed flow recorder to and record the totalized flow of the proposed chlorine contact basin and the totalized flow of the entire wastewater treatment facility shall be included (no separate pay).

2.10 CHLORINATION EQUIPMENT

A. Gas Chlorinator

1. Chlorination equipment shall be Hydro Instruments, Regal, or other GBRA-approved manufacturer.
2. Construct the chlorinators entirely of materials resistant to the corrosive attack of chlorine gas and containing the following control and safety components:
   a. Standby pressure relief valve
   b. Rate valve for local manual control of chlorine dosage
3. Each chlorinator to have a 200 lb. per day maximum capacity.
4. Gas shall be metered under vacuum created by ¾" injector located near each feeder. The injector shall be sized to operate against the appropriate back pressure at the point of injection, at the range of water flow rates and supply pressures produced by the non-potable water system.
5. Provide one chlorinator with proportional flow paced control v-notch and remote vacuum arrangement.
6. Special corrosion resistant materials shall be used for all parts which will be in contact with chlorine gas.
7. It shall be designed for cylinder or wall mounting and shall be furnished completely assembled and ready for operation.

8. A standard accessory kit shall be provided, which includes 25' of 3/8" O.D. plastic pipe, adapter, clamps, lead gaskets, instruction booklet, and all items necessary for a complete installation.
9. The chlorinator shall be readily adjusted for controlled feeding of chlorine gas at rates between 0 and 50 pounds of chlorine per day.
10. All equipment and hardware in chlorination rooms shall be PVC, FRP, or other approved materials resistant to chlorine gas.
11. Chlorinator equipment shall include a standby pressure relief valve and a rate valve for local manual control of chlorine dosage.
12. Provide cylinder mounted vacuum regulators and automatic vacuum regulator switchover module (standby, in use and empty indicator on front panel) where indicated on the drawings.
13. Provide and install all required Schedule 80 PVC chlorination piping, fittings, and valves for a complete operating system.

B. Chlorine Accessory Equipment.

1. Provide a chlorine cylinder scale that weighs the contents of two compressed gas cylinders independently.
2. Scale shall have separate weighing platforms and direct reading indicating dials, which shall have external adjustment to compensate the tare weight of gas remaining in the cylinders. Scale to be equal to Floquip Model No. 40150.
3. Scale shall provide stainless steel safety chains for each cylinder.
4. The scale shall be capable of handling cylinders 11 ¼ -inch or less in diameter, having a gross weight of 300 pounds or less.
5. Scale shall have two contacts (min) capable of being tied to the SCADA system to indicate low chlorine supply.
6. Provide small bottle of fresh ammonia solution for testing for chlorine leakage. The bottle shall be readily accessible outside the chlorinator room and immediately available to the Operator in an emergency.
7. Provide a full-face self-contained breathing apparatus with 30-minute supply or supplied air respirator that meets Occupational Safety and Health Administration (OSHA) standards for construction and operation. Provide Scott SCBA with carbon fiber tank. Locate the breathing apparatus in the office building.
8. Provide and install one (1) wye pattern strainer with 20 mesh monel cylindrical screen and plug inside the chlorinator room of the chlorine building on the water supply line to the chlorinator. The strainer shall be equipped with 4 ½ inch diameter suction and discharge gauges to indicate strainer condition. Arrange the cap for easy removal of the screen, and provide an opening for blowout. Install strainer in the water supply line with ball valves on each side.
9. Provide a Chlorine Leak Detector.

a. A chlorine leak detector shall be located in each room (or structure) containing chlorination equipment, including open frame-type ton container structures.
b. The chlorine leak detector shall activate an alarm circuit which includes as a minimum a red rotating beacon which can be seen by the plant operator upon entering the plant site.

10. Provide a freeze protected eye-wash station close to but outside rooms or structures containing chlorination equipment.

C. Chlorinator Building

1. The chlorine building shall be of fiberglass construction with a poured-in-place concrete base. The chlorine building shall adhere to the requirements of Specification 13184 – Pre-Fabricated Fiberglass Buildings.

The building shall include:

a. All door(s) open to the outside
b. Door(s) with panic hardware and 12-Inch kick plates
c. Door(s) with gas tight viewing window
d. Gas monitoring system in each room (or structure) containing chlorination equipment, including open frame-type ton container structures with audible/visual alarm with sensor run to cylinder room
e. Floor level louvers with rain-proof cover sized for three (3) minute air changes (both rooms) utilizing the contractor supplied intake fans
f. An intake fan with rain-proof cover located near the top of the room sized for three (3) minute air changes (both rooms). The intake fan shall automatically shutdown when a chlorine leak is detected.
g. Electrical heater with thermostat to maintain 65° F year round.
h. A vent from the gas feed system vented to an area-not frequented by facility staff
i. The vent line and discharge point must be clearly marked
j. "DANGER: sign on door indicating type of chemical present.
k. Ramp at entrance to the chlorine room

D. NON-POTABLE/RECLAIMED WATER PUMPS

1. Pumps shall be two (2) self-priming, constant-speed, single-stage, end-suction design of cast iron, bronze-fitted construction, equipped with mechanical shaft seal. The pumping unit shall be rated for a total system capacity of 80 gpm (minimum) at 65 psi with each individual pump in the system sized to deliver the total flow as demand varies. The two pumps shall be alternated between lead and lag positions with equally proportioned run times.
2. Each pump motor shall be TEPC and shall meet NEMA standards and operated within the available service factor at any point on the pump capacity head curve.

Each pump shall be driven by a 5Hp, 230/460 volt, 3 phase, 60 hertz, 3500 rpm motor.

3. Furnish a NEMA 3R power and control panel complete with starters, automatic two pump alternation, pump run time indicators, hand-off-auto switches, pump indicating lights and appurtenances. Components used will be as approved and found in Division 16 of the specifications. The complete assembly shall be the UL listing marked for industrial control panels.
4. Provide output contact for SCADA if non-potable water pump system fails to operate.
5. Furnish 4 ½-inch ASA grade A pressure gauges with snubbers for indicating system and suction pressure.
6. The equipment manufacturer shall provide a water strainer located as shown on the drawings. The strainer and strainer elements shall perform under all pump pressure discharge including startup surges. The strainer shall be designed to remove particles 0.06 inches (1.5 mm) and larger.
7. Each pump shall be equipped with an on-off switch and check valves on the discharge side of the pump.
8. The system shall include a meter to measure reclaimed water use at the facility.
9. All reclaimed water piping shall be purple in color.
10. Each hydrant and outlet for non-potable water must be clearly marked as "**NON-POTABLE WATER**" or "**UNSAFE WATER**".
11. Water must be reclaimed after it has been disinfected, if disinfection is part of the treatment.
12. The reclaimed water system must provide for screening or filtration, pumping backup with controls, and a minimum 250 gallon pressure-sustaining device such as a hydro-pneumatic tank.
13. The non-potable system must supply sufficient water volume and pressure to the chlorine mixing system to ensure a minimum velocity of 10 feet per second through any CL2 system diffuser or a mechanical mixer must be utilized.

2.11 BLOWER SPECIFICATIONS (Positive Displacement)

A. There shall be supplied three (3) positive displacement blowers complete with all accessories required for proper operation. Each blower shall have a minimum capacity of 400 cfm at a discharge pressure downstream of discharge silencer of 5.1 psig downstream of discharge silencer with inlet conditions of 115 msel, 80% relative humidity and 104˚F.

B. Positive displacement blowers, operating at a speed less than or equal to 1780 rpm, with inlet and discharge silencers and separate inlet filter.

C. Combined inlet filter/silencers are not acceptable.

D. Allowable sound level shall be 75 dBA at 10 feet. Provide insulated housings if necessary to meet this requirement.

E. The blowers shall be connected to the drive motors through a suitable flexible coupling or V-belt drive system. The manufacturer's representative shall check and if necessary, adjust the alignment of the couplings to a tolerance of ± 2 mils. Couplings shall be covered with sheet metal guards.

F. For belt-driven systems, provide V-belt with appropriate service factor. An OSHA approved guard shall be supplied to protect belt from service personnel and weather. Guard shall be easily removable for maintenances. Provide one extra belt for each blower.

G. The following accessories shall be provided for each blower:

1. Suitable flexible connections to fit standard steel pipe for both inlet and discharge piping. Flexible connectors shall be provided with all required reatraint due to expected forces in piping.
2. Flanged check valves suitable for mounting on the outlet of each blower.
3. Butterfly valve for mounting on the inlet and outlet.
4. One cfm-calibrated ammeter shall be supplied for each blower mounted adjacent to the blowers.
5. Inlet filter and the silencer shall be designed for 150% of the inlet design volume capable of removing 90.50% of all particles 10 micron and larger. The discharge silencer shall be equipped with a pressure relief valve and a pressure gauge. Relief valve setting shall be as recommended by manufacturer.
6. Provide a pressure gage on the inlet and outlet line of each blower with a 3-1/2-inch dial face. Pressure gauge shall have scale appropriate for conditions noted herein.
7. During blower testing, the pressure after travel through a clean filter shall be measured and placed (in weatherproof written form) along with manufacturer recommended maximum headloss near the gauge to assist operators in filter cleaning/replacement.

H. The blower motor units, with controls and accessories, shall be supplied by, and shall be the responsibility of the wastewater treatment plant manufacturer. Separate suppliers of blowers and related equipment will not be acceptable.

I. Construction

1. The blowers shall be of the rotary positive displacement type with inlet and outlet connections oriented as shown on the Plans. The blowers shall be skid-mounted for direct mounting onto concrete housekeeping pad.
2. The blower casing shall be one-piece with separate headplates constructed of ASTM A-126 close-grained cast iron.
3. The impellers shall be constructed of ASTM A-126 cast iron and shall be of the straight, two-lobe involute type. Impellers shall be dynamically balanced and shall rotate without rubbing, liquid seals, or lubrication.
4. The shafts shall be machined and finished to minimize stress concentrations. Shafts shall be constructed of SAE 4150 steel and shall be pressed and pinned into the

impellers. Shafts shall be supported by heavy-duty, double row spherical anti-friction designed for a minimum L-10 duty life and 75,000 hours. Bearings shall be provided with a lip-type oil seal designed to prevent lubricants from entering the air stream. Drive end bearings shall be grease lubricated and shall be provided with grease fittings. The gear end bearings shall be lubricated by splash from the gears dipping into an oil bath.

5. The impellers shall be timed by a pair of carburized and ground steel spur gears mounted on the shafts with a tapered fit. Gears shall be secured by a locknut. Gears shall be lubricated by splash from the gears dipping into an oil bath.

J. Drive System

1. Provide a motor meeting the following:
   a. NEMA Design B squirrel-cage, induction, shell type design.
   b. Stator winding and stator leads insulated with moisture resistant Class F insulation which will resist a temperature of 311 degrees F.
   c. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable.
   d. Fabricate rotor bars and short circuit rings of aluminum.
   e. Designed for continuous duty.
   f. Capable of operating in temperatures of 104 degrees F without overheating or operating in the service factor.
   g. Non-overloading over the entire range of the operating curve within the nameplate horsepower.

K. The motor shall the following performance characteristics:

Horsepower	40
Voltage	480
Speed (rpm)	$\leq$ 1780
Frequency (Hz)	60
Phase	3
Service Factor, minimum	1.10

2.12 AIR-BRIDGES

A. The contractor shall furnish and install air bridges as shown on the drawing. The bridge units, including walkway grating, handrails, toe plates, air distribution system and diffuser drops shall be supplied as complete unit.

B. Each unit shall be supplied in the minimum number of components. When field welding is required, the joints shall be inspected by the manufacturer, the surfaces shall then be properly prepared and coated.

C. The number, size and type of diffuser shall be as shown on the drawings and as specified elsewhere in these specifications.

D. Each diffuser drop shall be furnished with clean out tees and plugs at the top of each drop.

E. Each drop shall incorporate a ball valve and coupling for control and clean out purposes.

G. The diffusers shall be of the coarse-bubble design.

2.13 ELECTRICAL APPURTENANCES

A. Provide lights on top of the tanks to service and operate the plant equipment under all conditions.

B. Contractor shall provide field routed conduit for all electrical devices associated with the lease wastewater treatment plant. All applicable electrical codes shall be abided by.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General. Installation work shall include construction of the support pad(s); setting and anchoring of the treatment plant; construction of concrete pads for equipment not mounted on the plant; field installation of plant equipment, accessories, and appurtenances shipped unmounted to the project site; installation of piping from blowers to air header, piping connections to plant inlet and outlet, and installation of water service line; and installation of electrical wiring from electrical control system enclosure to motors and installation of electrical service to the electrical control system enclosure. The installation work covered by this section also includes earthwork operations as interrelated to plant installation. Except as modified or amplified herein, the wastewater treatment plant (WWTP) shall be installed in accordance with the recommendations of the manufacturer of the plant.

B. Install all equipment and connecting piping in accordance with manufacturer's instructions. Prior to testing and start-up, inspect to verify the system is complete.

C. No form of energy shall be turned on to any part of the system prior to approval of factory authorized service representative.

D. Clean all new piping prior to testing.

E. After installation, and in the presence of the Engineer, test all pipelines and tanks for tightness in acceptable manner. Furnish suitable testing plugs or caps, all necessary pipe connections, test fluids, gauges or other equipment and all labor required.

F. Remove or valve off from lines all instrumentation and appurtenant equipment which is not capable of withstanding the test pressures.

3.02 Chlorination Equipment

A. Pressurize chlorine supply system to 150 psig with dry air or nitrogen and test for leaks by application of soapy water to outside of all joints. After pressure testing all piping, gradually introduce chlorine gas and test the system for leaks as described below:

1. Test for chlorine leaks with commercial 26 degree Baume Ammonia.
2. After installation of equipment in the presence of the Engineer, operate each unit to demonstrate its ability to operate without leakage and to perform its specified functions satisfactorily.

B. Operate chlorinators over a continuous 2 hour period at varying rates to demonstrate that feed rate is within manufacturer's published range.

3.03 Positive Displacement Blowers

A. Install the blowers and blower equipment. Piping, with blind flanges, electrical, and all necessary appurtenances shall be constructed to allow installation of future blowers.

B. Conform with manufacturer's instructions and recommendations, and reviewed shop drawings.

C. The following tests shall be performed on each blower supplied:

1. Factory slip test - speed of blower needed to maintain a pressure of 1 psig.
2. Certified Performance test - test in accordance with ASME PTC-9

D. Start-up Data: Complete and submit the start-up records and maintenance data sheets. In addition, include start-up data in Operation and Maintenance Manuals.

3.04 Aeration System

A. The equipment manufacturer shall provide a factory-trained and fully qualified technical representative to work with the Owner during equipment erection to assure proper installation and operation of all equipment. The equipment manufacturer shall furnish complete operating and maintenance instruction, bound in a manual for use by the plant operating personnel. Four copies shall be required.

B. The manufacturer shall maintain a service organization available on call with spare parts from local stock.

C. All equipment provided under this specification shall be guaranteed against defects of material and workmanship for a period of one (1) year from the date of start-up.

D. Level aeration system such that all diffusers connected to a header are within plus or minus 3/8-inch of a common horizontal plane.

E. The manufacturer shall furnish all special stools to disassemble, service and adjust the equipment.

3.05 Manufacturer's Representative

A. The Contractor shall procure the services of an engineer representative of the manufacturer of the major portion of the treatment plant who is also familiar with the other equipment furnished.

B. Furnish the services of the manufacturer's technical representative to provide installation assistance as required for the equipment supplied and supervise initial operation. Furnish the representative for the additional time required to correct or supervise correction of any defects or malfunctions.

C. The representative shall inspect the equipment after erection, make adjustments in placing the equipment in operation, and shall be present during final inspection, start-up, and acceptance test.

D. The manufacturer's representative shall prepare and submit a start-up report documenting that the WWTP.

3.06 Sequence of Operations

Sequence of operations shall, in general, follow the recommendations of the plant manufacturer. All welding, alignment, water tightness testing, painting, and anchoring shall be completed, inspected, documented and approved by the manufacturer's representative in writing before start-up operations may begin. Include manufacturer's approval in the Operation and Maintenance Manual.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. This section governs furnishing all material, labor and equipment required for construction of a fiberglass reinforced plastic building, complete and ready for use as specified herein and as shown on the Drawings.
2. Prefabricated fiberglass buildings to house various equipment including chemical feed systems, air release valves, pressure transmitters, flow control valves, electrical, SCADA, and/or flow meters.

B. Related Sections include but are not necessarily limited to:
1. GBRA Design Guidelines.
2. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
3. Division 1 - General Requirements.
4. Division 3 - Concrete.
5. Division 7 - Thermal and Moisture Protection.
6. Division 8 - Doors and Windows.
7. Division 10 - Specialties.
8. Division 11 - Equipment
9. Division 13 - Special Construction.
10. Division 15 - Mechanical.
11. Division 16 - Electrical.

1.02 QUALITY ASSURANCE

A. Referenced Standards:
1. American Society for Testing and Materials (ASTM)
   a. C518, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   b. D256, Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
   c. D638, Standard Test Method for Tensile Properties of Plastics.
   d. D732, Standard Test Method for Shear Strength of Plastics by Punch Tool.
   e. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   f. 792, Standard Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.

g. D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics.
h. D2583, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
i. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

B. Qualifications:
1. Manufacturer's qualifications:
a. Manufacturer must have a minimum of five years of experience designing and fabricating structures of the type specified.

1.03 SYSTEM DESCRIPTION

A. Enclosure shall be one-piece insulated fiberglass shell-type enclosure complete with lighting, heating and ventilation systems. The enclosure shall have gas tight partition(s).

B. Design Requirements:
1. Building shall conform to all applicable building codes.
2. Building shall conform to the dimensions shown on drawings.
3. Building shall be completely waterproof, air and watertight, corrosion and chemical resistant, lightweight, and environmentally aesthetic.

1.04 SUBMITTALS

A. Shop Drawings:
1. Product technical data including:
a. Manufacturer's installation instructions.
b. Drawings showing layout, dimensions, anchorages, and accessories.
2. Fabrication drawings:
a. Details of anchor bolts, base plates, and all other components fastened to the foundation.
b. Details of wall panels, roof panels, finishes, lights, heater, louvers, trim, calking, and all other miscellaneous components.
3. Submit electrical components in accordance with Division 16.

B. Operation and Maintenance Manuals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store and protect on manufacturer's site, project site and during shipment and installation to prevent warping and fracturing.

B. Shrink-wrap the completed structure and/or building components with protective plastic for shipment and storage at the job site.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Prefabricated fiberglass enclosure:
      a. Jacobs Manufacturing Co.
      b. Warminster Fiberglass Co.
      c. or approved equal.

B. Submit requests for substitution in accordance with the Contract Documents.

2.02 DESIGN REQUIREMENTS

A. Design enclosure to withstand 125 mile per hour wind load and 30 PSF snow load.

B. Minimum inside dimensions:
   1. Length 12'-0", Width 8'-0", Wall Height 8'-0"
   2. Electrical and SCADA enclosures shall be installed inside the fiberglass building. The building size shall be as required to achieve NEC required clearances for all electrical and SCADA components and enclosures. All enclosures shall be NEMA 4X PVC or FRP.

C. Comply with Texas Commission on Environmental Quality (TCEQ) Rules.

D. All materials shall be chemical and corrosion resistant.

2.03 MATERIALS

A. Molded composite: Exterior and interior resin-fiberglass laminate with foam core.
   1. Laminate: Polyester resin and chopped strand fiberglass; minimum glass content of 25%.
      a. Provide gel coat with UV inhibitors.
      b. Exterior surface: White gel coat with low luster finish, smooth and free from fiber pattern, roughness, or other irregularities.
      c. Exterior laminate: 1/8" thick, minimum; chemically bonded to gel coat.
      d. Interior laminate: White color, encapsulate core in place:
      e. Laminate properties:
         1) Tensile strength (ASTM D638): 11,000 PSI

2) Flexural strength (ASTM D790): 18,000 PSI
3) Shear strength (ASTM D732): 12,000 PSI
4) Barcol hardness (ASTM D2583): 40.
5) Impact (ASTM D256): 12 ft. lbs/inch
6) Density/specific gravity (ASTM D792): 93.6 PCF/1.5
7) Surface burning characteristics (ASTM E84): Flame spread, less than 150; smoke density, less than 1000.

2. Core:
   a. Rigid closed cell, self-extinguishing, polyisocyanurate foam with a density of 2.0 pounds per cubic foot.
   b. 1" thick with a minimum insulating value of R-7.
   c. Core properties:
      1) Thermal conductivity (ASTM C518): 0.13 BTU inch / Hr. SF F.
      2) Density/specific gravity (ASTM D1622): 2.0 PCF/.03.
      3) Surface burning characteristics (ASTM E84): Flame spread, 35 smoke density, 240.
3. Coupons prepared in accordance with ASTM D 618 test method.

B. The manufacturer shall maintain a continuous quality control program and upon request shall furnish to the engineer certified test results of the physical properties.

2.04 FABRICATION

A. Assembly:
   1. Construct buildings using prefabricated molded composite wall and roof panels. Single-piece construction may be employed with the approval of the Engineer.
   2. Provide factory assembled buildings if panel construction is employed.

B. Encapsulated stainless steel 316 : extrusion 3" wide by 1 ½" high by 0.125" thick with a 1" wide side flange shall encapsulated into each corner of end panels (full height) and around the entire roof perimeter to maintain flatness, straightness, and structural integrity. Integral internal flanges on mating panels shall be provided for bolting the sides, ends, and roof to the encapsulated aluminum extrusions.
   1. Stainless steel 316: Incorporate threaded inserts on 12-inch centers for internal bolting to mating panel flange during assembly.
   2. Assembly bolts shall not penetrate the exterior wall of the structure.
   3. Assembly panels with 3/8" diameter stainless steel 316 bolts on 12" centers and a ¼" thick by 3" wide urethane foam gasket for a weather tight seal at all joints.
   4. Structurally reinforce wall and roof panels with stainless steel 316 or carbon graphite extrusions to meet loading conditions.

a. Stainless steel 316 steel mounting channel reinforcement: 0.078" thick by 13/16"high by 1 5/8" wide. Mechanically attach to the interior surface with Hastelloy-C or titanium pop rivets on 12-inch centers.

5. Reinforcement: ¼" thick by 1 ½" wide structural angle.
6. Stainless steel 316 reinforcement: Extruded channel sections 3" wide by 1 ½" high by 0.125" thick with a 1" wide side flange as required.
7. Encapsulate stainless steel 316 or carbon graphite aluminum and steel reinforcements to form a continuous, one-piece molded composite wall or roof panel.
8. Provide wall panels with an integral 4" wide internal mounting flange pre-drilled on 12" centers with 5/8" diameter holes for attaching to foundation.

C. Furnish wall and roof panels with white gel-coat finish on interior and exterior.

2.05 ACCESSORIES

A. Double Doors: One-piece, resin transfer molded (RTM) in matched metal molds to produce an industrial quality door which exhibits a smooth finished, seamless, monolithic, warp-free composite consisting of white gel-coat, fiberglass reinforcement, polyester resin, insulating core, and internal reinforcements with all mortises, openings, recesses, and pockets molded in place.

1. Mount each door with three 316 stainless steel mortise hinges 4 ½" long. Door hinges shall have non-removable hinge pins when the door is shut.
2. Door gaskets: Natural sponge rubber bulb type gasket with flexible lock to retain permanent grip.
3. Provide keyed stainless steel external lever and stainless steel floor mounted door stops with latches. Key system shall be Best brand.
4. Provide doors with stainless steel panic hardware and stainless steel hydraulic closers.
5. Provide one-piece purpose built 3" deep fiberglass drip caps above doors, extend 2" past doors on each side. Cut angle will not be acceptable.
6. Provide two silencers for each door on head of frame.
7. Provide single flap insert type neoprene sweeps.
8. Provide 4 ½" wide black vinyl thresholds.
9. Provide 12" stainless steel kick plates.
10. Provide 18" wide x 12" tall gas tight wire safety glass window in each door.
11. All fasteners shall be 316SS.
12. Door size: Pair of 2'6" wide, 7'0" high, 1-3/4" thick.
13. Door(s) shall open to the outside.
14. Install a "Danger" sign on the door(s) indicating the type of chemical present.

B. Single Doors: One-piece, resin transfer molded (RTM) in matched metal molds to produce an industrial quality door which exhibits a smooth finished, seamless, monolithic, warp-free composite consisting of white gel-coat, fiberglass reinforcement, polyester resin, insulating core, and internal reinforcements with all mortises, openings, recesses, and pockets molded in place.
   1. Mount each door with three 316 stainless steel mortise hinges 4 ½" long. Door hinges shall have non-removable hinge pins when the door is shut.
   2. Door gaskets: Natural sponge rubber bulb type gasket with flexible lock to retain permanent grip.
   3. Provide keyed stainless steel external lever and stainless steel floor mounted door stop with latch. Key system shall be Best brand.
   4. Provide doors with stainless steel panic hardware and stainless steel hydraulic closers.
   5. Provide one-piece purpose built 3" deep fiberglass drip caps above doors, extend 2" past doors on each side. Cut angle will not be acceptable.
   6. Provide three silencers for each door on strike jamb of frame.
   7. Provide single flap insert type neoprene sweeps.
   8. Provide 4 ½" wide black vinyl thresholds.
   9. Provide 12" stainless steel kick plates.
   10. Provide 18" wide x 12" tall gas tight wire safety glass window in each door.
   11. All fasteners shall be 316SS.
   12. Door size: Pair of 3'0" wide, 7'0" high, 1-3/4" thick.
   13. Door(s) shall open to the outside.
   14. Install a "Danger" sign on the door(s) indicating the type of chemical present.

C. Base Mounting Flange Gasket: Provide 3/8" thick by 3" wide closed cell neoprene sponge rubber gasket for a weather tight seal around the building perimeter. Caulk inside and outside perimeters with Sonneborn NP-1, Sikaflex, or approved equal.

D. Lifting Eye Bolts: Provide ¾" stainless steel 316 steel eye bolts in roof.

E. Anchor bolts for attaching structure to concrete pad:
   1. Buildings: ½" diameter stainless steel 316 threaded rod, flat washers, and nuts. Secure threaded rod in drilled opening with epoxy anchoring system.

F. Thermostatically controlled FRP intake fan with FRP gravity shutter, fiberglass canopy, remote power switch, and removable 316 stainless steel insect screen located in upper portion of building. The intake fan shall automatically shutdown when a chlorine leak is detected.
   1. 12" diameter, 775 CFM, wall mounted.

G. PVC exhaust louver: 12 IN square, wall mounted with FRP gravity shutter and removable 316 stainless steel insect screen located in lower portion of building.

H. Equipment mounting boards shall be 3/4" thick PVC or FRP.

I. Interior Light Fixtures: 48" fluorescent, 2-bulb non-metallic, T8 type with multi-tap electronic ballasts, vapor tight, FRP bond enclosed fixture with acrylic lens. Provide two per building.

J. Exterior Light Fixtures: Full cut-off wall pack with photocell and motion sensor, fast blow ballast fuse, (2) 42W CFL lamps, 120V, wall/surface mount above doors, Hubbell WGM-84F-MS42 or approved equal.

K. Fan and light switches: Weather-proof, outdoor rated, mount on building exterior beside door(s).

L. 120/240V, 18 Circuit panel board with 2P- 60A main breakers as required for loads in NEMA 4X PVC or FRP enclosure. Breakers not used in wiring of the building shall be 1P-20A, for use with additional loads as indicated on the Drawings. Panelboard neutral shall not be bonded to ground inside panel and shall remain separate.

1. Fill all unused spaces with 1P-20A circuit breakers.
2. Bus shall be tinned copper.
3. Breakers shall be bolt-on type.
4. Provide control circuits in low voltage panel for RTU cabinet.

M. Heater: 1500watt minimum, 120VAC, single phase, with thermostat and tip-over switch.

1. Heater shall be portable floor type.
2. Provide GFCI receptacle for heater.
3. Heater shall be suitable for use in a damp (corrosive) environment.

N. Three duplex GFCI receptacles, outdoor type, in-use covers, rated 120V, 20A, for convenience.

O. Electrical wiring shall be in ¾" minimum Type NM flexible seal tight conduit. Provide for:

1. Fan and thermostat.
2. Lights and switch.
3. Three duplex GFCI receptacles.
4. Heater.

P. Wiring shall meet the latest requirements of the National Electrical Code. All control panel wiring shall be flexible strand #14 AWG, 600V insulation, Type SIS tinned copper, and color coded. All other conductors shall be stranded copper XHHW-2. Phase colored insulation is required for all conductors. Label wiring with yellow heat shrink type markers with black machine printing. Labels shall be Raychem or Panduit.

Q. All electrical enclosures shall be NEMA 4X PVC or FRP. Mount all enclosures on strut.

R. Hardware, strut and straps shall be FRP.

S. All raceways for instrumentation, power, and wiring shall be installed by the electrical contractor.

T. Instrumentation shall be installed, terminated, tested, and calibrated by the instrumentation and controls contractor.
U. Label all enclosures and devices in accordance with GBRA standards.
V. Gas Monitoring System: Capable of monitoring each room with audible/visible and SCADA alarm with sensors installed into each room.
W. Ramp at entrance to chlorine storage room.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that foundations are installed correctly

B. Verify that anchor bolts are installed as indicated on shop drawings.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Building foundation/floor shall be cast-in-place reinforced concrete. Exposed corners shall be chamfered.
C. Install a floor drain in the center of the building.
D. Slope floor to drain.

3.02 ADJUSTING AND CLEANING

A. Touch up paint any scratched factory finished surfaces or remove and replace as directed by Owner.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment and incidentals required for automatic backwash filter system as shown on the plans and as specified herein, installed, tested, complete and ready for operation.

B. All components of the disk filtration system specified herein shall be furnished and tested by the manufacturer.

C. Each Disk Filter shall consist of individual disks of the number required; support columns and frames, a centrally located rotating shaft with vacuum shoe assemblies mounted thereto, 316 stainless steel swivel joints, filtrate pipes, drive mechanism complete with sprockets and non-metallic drive chain, automatic PLC control system with color touch screen and wireless communication system for data logging and remote control.

D. Filter system shall be designed for installation as shown on the contract drawings/plans and installed the coated steel tank.

1.02 MEASUREMENT AND PAYMENT

A. No separate payment will be made for work required under this section. Contractor will include all costs of the requirements of this section in the appropriate bid item(s) on the bid form.

1.03 QUALITY ASSURANCE

A. Applicable Standards

1. ASTM – American Society for Testing and Materials
2. AISI – American Iron and Steel Institute
3. AGMA – American Gear Manufacturer's Association
4. NEMA – National Electrical Manufacturer's Association
5. NEC – National Electrical Code
6. AWWA – American Water Works Association
7. SSPC – Steel Structures Painting Council
8. AWS – American Welding Society
9. AISC – American Institute of Steel Construction
10. UL – Underwriters Laboratories
11. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

B. To assure unity of responsibility, all components of the disk filter system shall be supplied by a single manufacturer.

C. Acceptable Manufacturer:

1. Five Star Filtration, LLC – Five Star Disk Filter,
2. Fluidyne FFP, or
3. Approved Equal

D. The filter system supplier shall demonstrate experience in the design, production and installation of cloth disk filters. The materials, method of construction, controls, etc., must be approved by the Engineer, and supported by full scale plants operating for a minimum of 5 years on waste streams where the removal of wastewater suspended solids from secondary treated effluent was the desired objective. A minimum of 5 successfully operating installations in the United States shall be required to demonstrate the required capability.

E. The acceptance of any specific system will be based on the proven ability of the system to meet the desired parameters listed above. The Engineer will be the sole authority in reviewing past performance data and in determining the acceptability and capability of any system to meet the performance requirements.

1.04 SUBMITTALS

A. Submit dimensioned, to-scale drawings of equipment showing its proposed installation in this facility. Where piping, structural components, etc. are involved, drawings shall show clearly that the proposed equipment will fit into the plant design without significant modifications and will function as intended in conjunction with other plant structures, piping, electrical, etc. shall be made at the Contractor's expense and only after approval by the Engineer.

B. Information required for approval by the Engineer prior to incorporation into the project shall include the following as a minimum requirement:

1. Certified dimension shop and erection drawings detailing important details of construction, dimensions, all required anchor bolt locations and conduit stub-outs.
2. Descriptive literature, bulletins, and/or catalogs of the equipment.
3. Test data indicating conformance with maximum clean cloth hydraulic loss requirements.
4. Data on the characteristics, features, and performance of backwash pumps, including performance curves, submitted on 8-1/2-in by 11-in sheets.
5. Complete master wiring diagrams, elementary or control schematics, including coordination with other electrical control devices operating in

conjunction with the filter equipment system. Suitable outline drawings shall be furnished for approval before proceeding with the manufacturer. Due to the complexity of the control function, it is imperative that the above drawings be clear and carefully prepared to facilitate interconnections with other equipment. Standard preprinted sheets or drawings simply marked to indicate applicability to this contract will not be acceptable.

6. Complete drawing(s) showing the layout of the filter equipment system. The layout shall indicate every device mounted on and in the control panels with complete identification.
7. The total weight of the equipment including the weight of the single largest item.
8. A complete total bill of materials for all equipment.
9. A complete installation manual detailing the procedures and practices to be used by the Contractor in order to assure a complete, satisfactory, successful operation.
10. Statement from the manufacturer that he has examined all factors affecting the performance of the filtering system, including all mechanical equipment and related piping and appurtenances and that he is either supplying all required equipment, or the Contractor is supplying manufacturer approved equipment and that he is satisfied that the performance criteria shall be met.
11. Manufacturer's recommended procedures for jobsite storage and handling of equipment.

C. Sample

1. Minimum of 2 square feet of filter cloth.

D. Test Reports

1. Submit to the Engineer three copies of full and complete test reports for all tests, describing the materials and units tested; the type of test; test set ups and procedures and instrumentation and test flow rates, pressures, levels and all other data and results as required to demonstrate that all items tested meet specified requirements.

E. Certificates

1. Submit a certificate notarized by the filter system manufacturer indicating the following:

a. The units were installed in direct accordance with the manufacturer's instructions.
b. The filter system has been satisfactorily test run in the presence of the Engineer, the Owner and the manufacturer and that the filter shall operate satisfactorily when operated in accordance with the equipment supplier's operating instructions.

F. Manufacturer's Field Report

1. Submit the manufacturer's field service report.

G. Project Record Documents

H. Warranties and Performance Guarantee

I. Operations and Maintenance Manual

Prior to delivery of equipment and updated as required during installation of the equipment, the manufacturer shall furnish complete and detailed installation, operation and maintenance manuals which shall include the following information as a minimum requirement:

1. Provide a Directory: Listing of names, addresses, and telephone numbers of Design Consultant, GENERAL CONTRACTOR, each Subcontractor, manufacturer's representative and service organization that can provide replacements most convenient to the project site and major equipment suppliers or manufacturers.
2. Parts list with catalog numbers of all components. Identify items on the parts list that have a long lead time to obtain.
3. Equipment technical, operation, and maintenance information. This section shall include:
4. List personnel hazards and equipment or product safety precautions for all operating conditions.
5. Manufacturer technical data including description for all components. If standard manufacturer literature is used, mark the appropriate portions that deal with the specific equipment installed in the project.
6. All equipment test and results (both factory and field), start-up report(s). Include completed prefunctional checklists, functional performance test forms, and

monitoring reports. Include recommended schedule for retesting and blank test forms.

7. Include a copy of all factory and field testing results.
8. Include a copy of all Manufacturer's reports and start-up reports.
9. All information distributed during training.
10. Provide the sign in sheet from each training session performed and signed by all training participants including the trainer.
11. Include a copy of all training materials used in the training sessions.
12. Installation or change-out procedures and diagrams for all components.
13. Operator Prestart procedures required to install, set up, and prepare each system for use.
14. Provide narrative description for startup, shutdown and post-shutdown operation procedures including the control sequence for each procedure.
15. Normal start up procedure including start up settings for this project, and shutdown procedure.
16. Provide narrative description of Normal Daily Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.
17. Provide narrative description of long-term operation procedure.
18. Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosions, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operations of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.
19. Include preventative maintenance lubrication data, in addition to instruction for lubrication. Include a table showing recommended lubricants for specific temperature ranges and applications, a lubrication schedule showing service interval frequency, recommended types and grades of lubricants, charts with a schematic diagram of the equipment showing lubrication points, and capacities.
20. Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
21. Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operations and to minimize corrective maintenance. The schedule shall be broken down to daily maintenance schedule, weekly maintenance schedule, monthly maintenance

schedule, annual maintenance schedule and any other time periods recommended by the manufacturer.

22. Include manufacturer's schedule for periodic calibrations; provide manufacturer's specified frequency and procedures for each separate operation.
23. Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.
24. Include a list of the manufacturer's recommended spare parts.
25. Include a complete copy of the approved submittal including submittal review form / comment sheet.

J. Warranty including one original of each warranty from Subcontractor's, suppliers, and manufacturers.

1.05 PERFORMANCE REQUIREMENTS

A. The disk filter system shall be capable of meeting the following performance requirements.

PERFORMANCE CRITERIA	VALUE
Average Daily Flowrate (MGD (gpm))	0.98 (68)
Maximum Influent TSS, mg/L	<50
Average Influent TSS, mg/L	15 to 30
Average Effluent Suspended Solids TSS, mg/L	<5
FILTER DESIGN DATA	
Filter Cloth Material	Polyester, multi-layer
Number of Filter Units	1
Number of Filter disk per unit	2
Filter Disk Diameter, ft.	6
Effective Filter Surface Area per disk, ft^2	72 minimum
Effective Filter Surface Area per unit, ft^2	288 minimum
Backwash Arm Rotational Speed, RPM	1.1
Materials of Construction	304 SS and plastics
FILTER DRIVE UNIT	
Drive Motor (1 per unit)	0.5 HP, 460v, 3 phase
Drive Motor Service Factor	1.3

	Parallel Helical Gear w/ Non-Metallic Chain and Sprocket
BACKWASH CLEANING SYSTEM	
Number of Backwash Vacuum Shoes per Disk	2
Backwash Pumps (2 per unit)	5 HP, 460v, 3 phase
Backwash Flowrate, gpm	350
Backwash Flow, % of Influent	<2

B. The automatic backwash disk filter system shall be suitable for filtering domestic wastewater after conventional treatment. Each filter shall be designed to operate on a continuous basis and shall be designed to operate while receiving varying flow rates.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All fabricated material shall be ANSI carbon steel or 304 stainless steel. All welding shall conform to the latest standards of the American Welding Society. Filter cloth shall be multi-layered polyester bags with seal arrangements to allow for easy removal and installation. Filter cloth support grid shall be non-metallic and have a deflection of less than 0.1 inches over the entire 7 foot span of the disk.

2.02 EQUIPMENT

A. Filter Tank

1. All exposed steel shall be painted with a minimum 3-coat system, consisting of zinc-rich primer, a high-build epoxy second coat and a top coat of polyurethane (for outdoor surfaces). The inside of the tank immersed steel shall be coated with minimum 14 mils coal tar epoxy.
2. All structural steel shapes shall be designed for the intended use and of adequate strengths to withstand all loads during fabrication, shipping and operations.
3. The filter tank shall incorporate a 12" inlet nozzle with an influent trough designed to evenly distribute the flow across the width or length of the filter tank.

4. The filter tank shall incorporate two (2) 12" effluent nozzles connected to a filtrate trough designed to remove the entire flow of the filter tank. The effluent trough shall incorporate a 2" drain with a manual ball valve.
5. The filter tank shall incorporate two 4" backwash nozzles connected to a center rotating backwash manifold within the tank. The backwash manifold shall be constructed of 304 stainless steel. Each end of the center rotating backwash manifold shall be connected to a 316 stainless steel swivel joint design for submerged service.
6. The filter tank shall incorporate a drain/sludge removal port with a minimum 2" nozzle. Inside the tank located within the sloped wall hopper shall be a perforated drain pipe sized adequately and designed to remove settled sludge from the filter tank.

B. Filter Disk

1. The filter disk frame shall be constructed from Type 304 stainless steel as an integral unit completely welded and supported for all operating and installation loads.
2. Each disk shall have a grid support structure incorporated and it shall be designed to secure the grid in place and minimize wear to the filter cloth bags.
3. Each disk shall have a single top mounted effluent pipe adequately sized for the application and shall include a lifting eye for easy removal and replacement of one piece disk assembly.
4. Each disk shall be attached to the effluent trough independently to allow disk isolation. Only one wall connection point per disk shall be allowed. The disk filter design shall insure the ability to sample filtrate from each disk independently.

C. Support Frame

1. Each disk shall be secured in place in the filter tank by a support column. The support column shall be designed to withstand all loads of the disk and the rotating shaft assembly.
2. The disk is also supported by a vertical frame designed to maintain the disk location on the center of the support column.
3. Each vertical frame member shall have UHMW wear strip securely fastened to the stainless steel guide frame angle to minimize damage to the filter disk and cloth as it is being installed and removed from the frame.

D. Rotating Backwash Assembly

1. Each filter unit shall incorporate a centrally located rotating backwash manifold that will operate as the rotating mechanism for the vacuum shoe assembly and also act as the transmission pipe for the backwash water being drawn by the backwash pumps located externally to the filter tank.

2. The center shaft/backwash manifold shall be constructed from 304 stainless steel pipe.
3. The center shaft shall be supported and secured at each end to a 316 stainless steel swivel joint designed for submersible service. This allows for a non-rotating connection at each end while the shaft is driven by a drive mechanism located above the top of the tank.
4. The backwash manifold / rotating shaft is welded to a sprocket hub constructed of 304 stainless steel with a UHMW split-ring sprocket designed for the rotational speed requirements of the application.
5. Each vacuum shoe (two for each filter disk) shall be adjustable to insure that the shoe is parallel to the disk face. The system shall incorporate a torsion spring/pivoting mechanism designed to maintain the proper tolerance of the vacuum shoe disk interface.
6. Each vacuum shoe assembly shall be located 180 degrees from the shoe on the opposite side of the disk.

E. Swivel Joints

1. The swivel joints shall be designed to allow rotation of the backwash assembly and center shaft during the backwash cycle.
2. Construction of the swivel joint shall be 316 stainless steel with a double row true ball bearing race alignment and o-rings designed to keep contaminants out while keeping in the lubricant. Stainless steel ball bearings are precision ground with raceways machined to precise tolerances.
3. Swivel joints shall be designed for submerged service.

F. Drive Mechanism

1. The drive assembly shall be designed to rotate the backwash assembly and center shaft during the backwash cycle.
2. The drive assembly shall consist of a parallel helical gear drive unit coupled to the shaft with a sprocket and chain assembly.
3. The gear motor shall be a SEW Eurodrive gearbox directly couple to a TEFC induction motor, SEW Model R57R37DT71C4-KS. Gear ratio to be 689.0. The motor shall be rated for 0.33 HP, 460v, 3 phase, 60Hz operation.
4. Reducer design end rating shall be equal or exceed AGMA requirements. Speed reducer shall be selected for not more than AGMA Class I service.
5. Drive chain shall be NH78 non-metallic with stainless steel pins.
6. Drive sprocket shall be a NH78, 11 tooth shear pin sprocket assembly, 9.26 inch P.D., nylon body with UHMW segmental rim, 304 stainless steel hardware and 6061 aluminum shear pins.
7. Reduction sprocket shall be a NH78, 30 tooth segmental sprocket rim, split UHMW.

8. The drive motor assembly shall be mounted on a 304 stainless steel motor bracket that incorporates adjustable placement capabilities and a removable chain guard.

G. Control Panel and Operation

1. The disk filter control system shall be supplied by the disk filter manufacturer and shall include but not limited to the following components:

   a. 36" x 24" x 8" NEMA 4X Fiberglass wall mounted enclosure with 3-point latching
   b. NEMA motor starter with over-current protective devices and overloads
   c. Selector switches and pilot lights
   d. Door mounted circuit breaker
   e. Magnetic circuit breakers
   f. Power transformer
   g. Stirring fan
   h. 20 amp quad receptacle
   i. PLC hardware
   j. 12 inch OIT color touch screen, panel mounted PC
   k. Relays
   l. Wireless communication system for data lagging and remote control
   m. Ultra-sonic water level sensing system

2. The automatic controls for the disk filter operation shall be furnished as an integral part and shall be provided in a NEMA 4X fiberglass enclosure with 3-point latching. The control panel shall be 460v, 3-phase, 60Hz with 120v, 1 phase, 60Hz control voltage.

3. The main disconnect shall be enclosed in the control panel, with a handle mechanism extending through the door.

4. The backwash cycle is initiated by the ultrasonic level sensor located in the filter tank. The filter drive unit and the backwash pumps are activated, and an electrical actuated valve opens to begin backwashing one side of the filter. After a pre-set time has elapsed, valve 1 closes and valve 2 opens to begin backwashing the other side of the filter; the system again reaches a pre-set time and the PLC then checks to insure the water level (headloss) has receded; if the water level (headloss) has indeed been reduced; then the system shuts down the backwash system; if not then the system will repeat the sequence until the water level (headloss) is reduced to an acceptable level.

5. The panel operational sequence shall include a sludge draw-off adjustable timer. This timer shall be pre-set and field adjustable from the touch screen panel.

6. All pre-set timers shall be adjustable from the touch screen without having to enter the control panel.

7. The control panel shall incorporate a wireless communication system capable of transmitting data collected from flow meters, turbidity meters, and TSS monitors. The control system PLC will store the data with the disk filter control panel for access from remote locations.

8. The control panel shall incorporate a complete manual override system and all switches, lights and necessary components shall be furnished.

H. Backwash Pumps

1. The two backwash pumps shall be Gorman-Rupp Model T4B-B-6 Super "T" Series Self-priming Centrifugal Pumps with suction and discharge spool flanges mounted on a fabricated galvanized steel vertical v-belt base with belts, sheaves, belt guards and aligned to a 5 HP, 1800 RPM, 460/3/60, TEFC NEMA Premium Efficiency Electric Motor.
2. Design duty condition: 350 GPM @ 30' TDH
3. Pump shall handle 2 ½" solids.
4. Pumps shall have 4" suction and 4" discharge flanges.
5. Pumps shall be provided with a 5 year manufactures warranty.

I. Automatic Backwash Control Valves

1. The backwash valves shall be Heyward Series EJM Electric Actuated Round Port Ball Valve.
2. Valves shall be 115 VAC operated and controlled by the PLC.
3. Valves shall have manual override and position indicator.
4. Valves shall be UL Listed and housed in a NEMA 4/4X enclosure and be permanently lubricated with a mechanical brake.
5. Valves shall move from fully closed to fully open in 15 seconds and have a stall torque of 800 in-lb. with a 25% duty cycle. Thermal overloads shall be included.

J. Manual Isolation Valves (Backwash Pumps)

1. The manual backwash valves shall be Hayward All-Plastic Round Port Ball Valves.
2. Valves shall be rated for 150 psi.
3. Valves shall have stainless steel shaft and shall be blow-out proof.

K. Spare Parts

1. One (1) set of filter cloths
2. Two (2) complete repair kits for swivel joints.
3. Twelve (12) shear pins for drive sprocket assembly.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General

1. Install the disk filter system per the manufacturer's directions and the drawings. Provide all supports and anchoring device required to install the disk filter unit. The Equipment Manufacturer will provide adequate crating and protection of the disk filter equipment for shipment to the project site.
2. Installation Instructions will be provided that specifically outline installation of the equipment.
3. Lifting instructions will be provided to assist the installing contractor.

B. Field Services: The equipment manufacturer shall furnish the service of a factory-trained representative for a minimum of four (4) working days and two (2) separate trips. These two trips shall consist of one (1) trip to monitor the installation and one (1) trip for start-up and instruction of the plant operating personnel.

C. Warranty: The equipment shall materially conform to the description in this Specification and the Contract Documentation and shall be free from defects in material and workmanship. Warranty periods are 12 months from final acceptance.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section provides for piping at lift stations, wastewater force mains, water and wastewater treatment plants. The work includes furnishing all labor, equipment and materials and performing all operations required for proper fabrication and installation of all pipe, fittings and accessories required to complete the work as shown on the drawings and specified herein. The drawings show flange, mechanical joint and push-on joint systems.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. ANSI A21.4 (AWWA C104) - Cement-Mortar Lining for Ductile-Iron and Fittings.

B. ANSI A21.5 (AWWA C105) – Polythylene Encasement for Ductile-Iron Pipe Systems.

C. ANSI A21.10 (AWWA C110) - Ductile-Iron and Gray-Iron Fittings (3-in. through 48-in) for Water and Wastewater and Reclaimed Water Systems.

D. ANSI A21.11 (AWWA C111) – Rubber-Gasket Joints for Ductile-Iron (and Gray-Iron) Pressure Pipe and Fittings.

E. ANSI A21.15 (AWWA C115) - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

F. ANSI A21.16 (AWWA C116) – Protective Fusion-Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings (for Water and Wastewater and Reclaimed Water Systems.)

G. ANSI A21.50 (AWWA C150) - Thickness Design of Ductile-Iron Pipe.

H. ANSI A21.51 (AWWA C151) - Ductile-Iron Pipe, Centrifugally Cast.

I. ANSI A21.53 (AWWA C153) – Rubber-Gasketed Joints for Ductile Iron Pressure Pipe and Fittings (3-inch through 24 inches and 54 inches through 64 inches for water and other liquids.

J. ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, 250 and 800.

K. ASTM D1248 - Polyethylene Plastics Extrusion Materials for Wire and Cable.

L. ASTM F 477 – Elastomeric Seals (gaskets) for Joining Plastic Pipe.

M. ASTM G62 - Test Methods for Holiday Detection in Pipeline Coatings.

N. AWWA C200 - Standard for steel water pipe 6" and larger

O. AWWA C206 - Standard for field welding of steel water pipe.

P. AWWA C208 - Standard for dimensions for fabricated steel water pipe fittings

Q. AWWA C600 - Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.

R. SSPC-SP6 - Steel Structures Painting Council, Commercial Blast Cleaning.

S. American Association of Highway Transportation Official (ASSHTO) S-20

T. American Railway Engineering and Maintenance-of-Way Association (AREMA) E-80.

1.04 SUBMITTALS

A. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings. Production of pipe and fittings prior to review by Engineer shall be at Contractor's risk.

B. Submit Manufacturer's Certifications of adherence to specification requirements.

C. Submit coating information documenting adherence with these specifications.

D. The Contractor shall submit a plan and procedure for pressure testing potable water piping for engineer's approval prior to initiating such testing.

1.05 QUALITY CONTROL

A. Provide manufacturer's certifications that all ductile-iron pipe and fittings meet provisions of this section and have been hydrostatically tested at factory and meet requirements of ANSI A21.51.

B. Provide certifications that all pipe joints have been tested and meet requirements of ANSI A21.11.

PART 2 - PRODUCTS

2.01 DUCTILE-IRON PIPE

A. Provide ductile iron pipe class 53 unless otherwise shown in the piping schedule, manufactured in accordance with ANSI A-21.51/AWWA C-151. Both pipe and joints shall be rated for a working pressure of -10 to 150 psi plus a surge pressure of 100 psi.

B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.

2.02 JOINTS

A. All above ground piping up to and including the first horizontal underground fitting shall have flanged joints with 304 or 316 stainless steel bolts, unless otherwise noted on the drawings. All flanged joints shall conform to ANSI A-21.15/AWWA C-115.

B. All below ground piping underneath a structure shall have restrained push-on joints as manufactured by Super-Lock Joint by Clow Corporation, Flex-Ring or Lok-Ring by American Iron Pipe Company, or TR-Flex or Field-Lok by U.S. Pipe and Foundry Company. Restrained push-on joints shall conform to ANSI A-21.11/AWWA C-111. Provide for restrained joints designed to meet test pressures required under Specification Section 02515 – Hydrostatic Testing of Pressure Lines. At a minimum, the restrained joints shall be designed to meet the test pressures required under Specification Section 02515 – Hydrostatic Testing of Pressure Lines.

C. Provide restrained joints for test pressure or maximum surge pressure as specified, whichever is greater for water lines. Do not use passive resistance of soil in determining minimum restraint lengths.

D. All other below ground piping shall have push-on joints unless otherwise specified as manufactured by Joint Tyton by U.S. Pipe, Super Bell-Tite Joint by Clow Corporation, or Fastite by American Cast Iron Pipe Company.

E. Air Supply Pipe Joints shall be installed with heat resistant EPDM gaskets rated at 250° F, submit gaskets for approval prior to installation. All air headers and gaskets must be able to withstand temperatures up to 250 degrees F.

F. Mechanical joints will only be allowed when matching connections to existing pipe which has mechanical joint fittings. Mechanical joints shall conform to ANSI 21.11.

G. Maximum allowable deflection for push-on type joints shall be as follows:

Size (IN)	Deflection (degree)
12	5
14, 16	4
18-36	3

2.03 FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Reduction in piping size will be made by reducing fittings. Line and coat fittings as specified for pipe they serve.

B. Push-on Fittings: ANSI A21.10 (long body fittings) ductile iron; ANSI 21.53 (compact fittings) ductile-iron ANSI A21.11 joints, gaskets and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI A21.10; ANSI B16.1 ductile-iron. Flanges: ANSI B16.1, Class 125; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A21-10 ductile iron joints, gaskets, bolts, and glands; pressure rated at 250 psi.

2.04 SLEEVES AND WALL PIPES

A. Sleeves for cast iron pipes through exterior walls: Cast iron sleeve with intermediate water stop, with M.J. fittings and joints as manufactured by American Ductile Iron Pipe or approved equal.

B. Wall pipe for cast iron pipes through exterior walls: Cast iron wall pipes with intermediate water stop, with M.J. fittings and joints as manufactured by American Ductile Iron Pipe or approved equal.

C. Wall pipe for cast iron pipes through interior walls: Cast iron wall pipe with intermediate water stop, with M.J., or flanged fittings and joints, as manufactured by American Ductile Iron Pipe or approved equal.

D. Wall sleeves for other than cast iron pipes through exterior walls: Cast iron pipe wall sleeves, Class 50, for 4"-16" pipes with rubber seal as manufactured by Thunderline Corp., or approved equal.

E. Sleeves through interior walls shall be 14-gauge unpainted galvanized steel.

F. Seal wall penetrations with ADEKA P-201 Hydraulic Compound and non-shrink grout.

2.05 COATINGS AND LININGS

A. Water Line Interiors:

1. The interior of all water line ductile iron pipe shall be cement mortar lined with seal coat in accordance with ANSI A-21.4/AWWA C-104; fusion bonded epoxy lining for interior ANSI A-21.16, comply with NSF61.

B. Sanitary Sewer and Force Main Interiors:

1. The interior of all ductile iron sanitary sewer force mains shall be cement mortar lined with seal coat in accordance with ANSI A-21.4/AWWA C-104; fusion bonded epoxy lining for interior ANSI A-21.16, comply with NSF61.

C. Interior Air Pipe: Underground air piping shall not be lined.

D. Exterior Coatings

1. All ductile iron pipe below ground shall be coated with asphaltic base bituminous conforming to ANSI A21.10, ANSI A21.15, ANSI A21.51, or ANSI A21.53.

2. All ductile iron pipe below ground shall be encased with polyethylene wrap unless otherwise specified or shown. The polyethylene wrap functions as an unbonded coating of the pipe. Conform to requirements of Specification Section 02528 - Polyethylene Wrap.

3. All ductile iron pipe above ground shall be coated in accordance with Division 9 - Finishes.

2.06 FLEXIBLE COUPLINGS

A. Unless otherwise noted, flexible couplings shall be the bolted compression type joints for joining plain-end, steel pipe. The coupling shall consist of one (1) cylindrical steel middle ring, two (2) steel follower rings, two (2) resilient gaskets and a set of steel trackhead bolts. The middle ring shall have a conical flare at each end to receive the wedge portion of the gaskets. Gasket sections shall be made generous enough to furnish more than adequate sealing surface and "pack" between coupling pipe. Bolts and nuts shall be of high grade, high strength steel. Flexible couplings shall be as manufactured by Dresser Style 38, Rockwell 411, Romac 400, or approved equal.

B. Flexible couplings for joining plain end stainless steel pipe shall be bolted compression type joint as described above however, all rings, sleeves, bolts, nuts and other items shall be constructed of Grade 316 stainless steel.

C. Space between pipe ends shall not be less than 1/4" or more than 1", unless otherwise noted on the drawings.

D. Buried couplings shall be coated a minimum of 12 mils (DFT) fusion bonded epoxy resin in accordance with AWWA C203. Type 316 stainless steel nuts, bolts and washers shall be used.

2.07 FLANGED COUPLING ADAPTERS

A. Flanged coupling adapter for pipe less than 14" in diameter shall be of the bolted compression type for joining plain end pipe to adjoining flange. Adapter shall consist of one flange body,

follower ring, compression gasket, and all necessary bolting. Bolting pattern shall match adjacent mating flange. Bolts and nuts shall be made of a high grade, high strength steel. Flanged coupling adapters shall be Smith Blair 911 for ductile iron and carbon steel pipe and Smith Blair 920 PVC pipe or approved equal.

B. Flanged coupling adapters for pipes 14" in diameter and greater shall be of the bolted compression type for joining plain end pipe to adjoining flange. Adapter shall consist of one flange body, follower ring, compression gasket, and all necessary bolting. Bolting pattern shall match adjacent mating flange. Bolts and nuts shall be made of a high grade, high strength steel. Flanged coupling adapters shall be Smith Blair 911 for ductile iron and carbon steel pipe and Smith Blair 920 PVC pipe or approved equal.

PART 3 - EXECUTION

3.01 JOINTING

A. Flanged Joints. When bolting, take care to insure that there is no restraint on the opposite end of the pipe or the fitting which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. Leave one (1) flange free to move in any direction while flange bolts are being tightened. Tighten bolts gradually and at a uniform rate, in such manner that gasket compression is uniform over the entire area of gasket.

1. Take special care when attaching suction and discharge piping flanges to pumping equipment. Insure that no stresses are transmitted to or imposed on the pump suction and discharge flanges by connected piping. Install and permanently support piping to provide accurate matching of bolt holes and uniform contact over the entire flange. In addition, leave pump connection piping free to move parallel to its longitudinal center line while the bolts in pump connection flanges are tightened.

2. Provide maximum flexibility and ease of alignment correction by taking advantage of the slack between the flange bolts and bolt holes for slight angular rotation of connecting flanges. Assemble pump connecting piping with gaskets in place, with only a portion of the flange bolts (no fewer than four (4) per joint) installed. After final alignment and before final bolting, test pump connections for applied piping stresses by loosening flange bolts which, if piping is properly installed, should result in no movement of piping relative to the pump, or opening of the pump connection joints.

B. Mechanical Joints. Carefully assemble mechanical joints in accordance with the manufacturer's recommendations. If seal is defective, disassemble the joint, thoroughly clean it, and reassemble the joint. Do not over tighten bolts to compensate for poor installation practice.

C. Push-On Joints. Remove lumps, blisters, and excess coating from the exterior spigot and interior bell surfaces. Wire brush such surfaces and wipe them clean and dry (free from oil and grease) before placing the gasket and spigot in the bell. Keep joint contact surfaces clean until jointing is

completed. Take every precaution to prevent foreign material from entering the pipe during installation. Do not place debris, tools, clothing, or other materials in the pipe. Observe and follow instructions of the manufacturer, relative to gasket installation and other jointing operations. Lubricate joint surfaces with heavy vegetable soap solution immediately before joint is completed. Suitably level each spigot end to facilitate assembly.

D. Restrained Push-On Joints - Follow the same instructions as for push-on joints.

E. Piping connections between dissimilar metals, e.g., ductile iron or cast iron and steel, etc., shall be provided with dielectric insulating kits consisting of dielectric gaskets, bolt sleeves, and washers to prevent any galvanic action between the dissimilar metals.

3.02 HANDLING

A. Handle pipe, fittings, and accessories to insure their installation in a sound, undamaged condition. Use equipment, tools and methods to prevent damage in unloading, reloading, hauling, and laying pipe and fittings. When using hooks in pipe ends, be sure that the contact surfaces are broad and well padded.

3.03 CUTTING

A. Cut pipe in a neat manner, without damage to the pipe. Make cuts smooth, straight, and at right angles to the pipe axis. Use mechanical pipe cutters of an approved type, except in locations where the use of mechanical cutters would be difficult or impracticable. In such locations, cut the pipe with diamond point chisels, saws, or other tools which can cut pipe without damaging impact or shock. Field cut push-on joint pipe shall have the cut end beveled to a 30° degree angle before joining. Remove any burrs from beveling prior to joining.

3.04 CLEANING

A. Thoroughly clean the interior of the pipe and fittings of foreign matter before installation. Keep the interior clean until the work has been accepted.

3.05 INSPECTION

B. During installation, while the pipe is suspended and hanging free, inspect each pipe and fitting for defects. Tap the pipe with a light hammer to detect cracks. Reject defective, damaged, or unsound pipe and fittings and remove them from the site.

3.06 LAYING PIPE

A. Protect the pipe from lateral displacement by means of pipe embedment material and/or thrust blocking as shown in the drawings.

B. Under no circumstances should pipe be laid in water. Do not lay pipe under unsuitable weather or trench conditions.

C. Lay pipe with bell ends facing in the direction of the laying except when making closures.

D. Process Pipe Bedding:

1. Excavate bottom of trench for pipe to line parallel to flow line of pipe and depth of 6-inch below outside of pipe barrel.

2. Spread and tamp bank sand for pipe embedment over trench bottom to flow line of pipe.

3. Shape pipe subgrade to lowest 90 degrees of pipe barrel.

4. Place Bank sand for pipe embedment, and tamp in layers around and over pipe to minimum of 6 inches above top of pipe.

3.07 COUPLING INSTALLATION AND TESTING

A. Installation of flexible connections shall be in strict accordance with the respective manufacturer's instructions and recommendation, subject to the approval of the Engineer, and in the locations shown on the Drawings.

B. Flexible connections shall be tested in place by the Contractor under conditions specified for the pipelines in which they are installed. Defects and leaks shall be corrected and repaired at the expense of the Contractor and lines retested to the satisfaction of the Engineer.

3.08 DISINFECTION AND FIELD HYDROSTATIC TEST (POTABLE WATER PIPING)

A. Conform to requirements of Specification 02514 - Disinfection of Waterlines.

B. Conform to requirements of Specification 02515 - Hydrostatic Testing of Pipelines and TCEQ regulations. Latest revision shall be used and more restrictive shall govern testing.

C. Each section of pipe shall be chlorinated as specified prior to hydrostatic testing.

D. It shall be the responsibility of the Contractor to furnish all required temporary blinds or other closures required to facilitate the chlorination and pressure testing.

E. The Contractor shall submit a plan and procedure for pressure testing for Engineer approval prior to initiating such testing. The plan shall include a diagram of the section (s) of pipe to be tested, isolation procedure, schematic of test set-up, and a Step-by-Step work plan.

F. There shall be no leakage for flanged joint pipe during the hydrostatic tests. All joints showing visible leaks shall be repaired.

3.09 HYDROSTATIC TEST & PIGGING OF SANITARY FORCE MAINS

A. After pipe and appurtenance have been installed, test line and drain. Prevent damage to Work or adjacent areas. Use clean water to perform tests.

B. Owner's Representative may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards.

C. Test pipe in presence of Owner's Representative.

D. Test pipe at 150 psig or 1.5 times design pressure of pipe, whichever is greater. Design pressure of force main shall be rated total dynamic head of lift station pump.

E. Test pipe at required pressure for minimum of 2 hours according to requirements of UNI-B-3.

F. Maximum allowable leakage shall be as calculated by following formula:

$$Q = \frac{LD\sqrt{P}}{148{,}000}$$

Where:	Q	=	Quantity of makeup water, gallons per hour.
	S	=	Length of pipe in feet.
	D	=	Nominal diameter of pipe in inches.
	P	=	Average test pressure during the hydrostatic test, in pounds per square inch.

G. Correct defects, cracks, or leakage by replacement of defective items or by repairs as approved by Project Manager.

H. Plug openings in force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering tested pipeline.

I. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200 feet by pigging to ensure piping is free of obstructions.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the furnishing and installation of insulation for water piping, chemical piping, instrument tubing containing water, and piping subject to condensation.

B. Contractor shall insulate/re-insulate all existing and proposed exposed potable and non-potable water line.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in the unit price for applicable work as noted on the Bidsheet.

1.03 SUBMITTALS

A. Submit bulletins and manufacturer certified data describing material to be used for insulation. Include manufacturer's printed installation instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. All insulation components to be delivered, stored, and handled per manufacturer's printed instructions.

1.05 ACCEPTABLE MANUFACTURERS

A. Insulation: Owens Corning Fiberglass, Knauf Fiber Glass, or Certainteed

B. Exterior Service Weather Jacket: Premetco or Childers Products Co.

PART 2 – PRODUCTS

2.01 MATERIALS AND/OR EQUIPMENT

A. All insulation system components to be asbestos free.

B. Pipe Insulation shall be molded heavy density one-piece insulation made from inorganic glass fibers bonded with a thermo-setting resin. Insulation shall include an all service jacket (ASJ) with vapor barrier. Minimum insulation thickness to be 1-inch for pipes 2-inch and smaller, 2 inches for lines 2-1/2 inches and larger.

C. All exterior insulation to be protected by minimum 0.016-inch thick stainless steel or aluminum all service jacket with laminated vapor and moisture barrier of polyethylene (Surlyn) or polyethylene-Kraft paper thermally bonded to the inside surface and shall have a self sealing lap (SSL) for longitudinal joint and similar factory furnished butt joint

sealing strip. Valve, fittings, and flanges are to have equal jacketing, vapor and moisture barrier protection.

D. Vapor Barrier Sealant shall be non-shrinking permanently flexible vapor barrier sealant, Childers CP-70 or equal.

E. Strapping shall be stainless steel or aluminum bands (match jacket material), minimum 0.020-inches thick by 3/4-inches wide with 0.034-inch thick wing seals.

PART 3 – EXECUTION

3.01 GENERAL

A. Pipes and tubing 4 inches and smaller to be insulated and jacketed when exposed to outside temperatures. All hot water lines 1/2 inch and larger shall be insulated. See PLANS for piping to be insulated for prevention of condensation.

B. Furnish all accessories required to complete the work.

3.02 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. Install insulation after piping has been installed, tested, and painted. Install in a neat manner, following manufacturer's printed instructions. All fittings and valves shall be carefully insulated and sealed. All joints shall be completely waterproof. Use only workman skilled in this trade.

B. Pipe Insulation: Butt all joints firmly together and secure self seal lap in accordance with manufacturer's recommendations. Ends of pipe insulation shall be sealed with vapor barrier sealant at all fittings, valves, and intervals not exceeding 21 feet on straight run pipe.

C. Valves and Fittings: Preformed insulation and fitting covers shall be used where possible. Where necessary, segments of pipe insulation to be carefully fitted, secured by 20 gauge corrosion resistant wire, and finished with vapor barrier sealant, so as not to interfere with operation of valve actuator.

D. Weather Jacket: Piping, valves, and fittings to be protected by preformed aluminum jacketing with vapor barrier installed in accordance with manufacturer's recommendations. All joints shall be made watertight with sealant.

E. Termination: Insulation to extend 6-inches below finish grade and terminate flush with all walls and slabs. All termination points to be completely waterproof.

END OF SECTION

PART 1 – GENERAL

1.01 DESCRIPTION.

A. This work includes furnishing all labor, equipment and materials and performing all operations required for proper completion, installation and fabrication of all gates, valves, and accessories required to complete the work associated with sanitary sewer lift stations, water plants, and wastewater treatment plants as shown on drawings and specified herein.

B. All components parts shall be of the type of materials specified and interchangeable where the size and material are the same without grinding, chipping or special fitting in the field. Epoxy coated seating surfaces will not be acceptable.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 QUALITY ASSURANCE.

A. Governing Standards. Except as modified or supplemented herein, all materials and construction methods shall comply with the applicable provisions of the following standards:

American National Standards Institute
American Standard Testing Methods
American Water Works Association

B. Length Tolerance. The actual length of valves shall be within 1/16 inch (plus or minus) of the specified or theoretical length.

1.04 SUBMITTALS

A. Complete drawings, details, specifications, and ASTM and AISI designation of materials covering the valves and their appurtenances shall be submitted to the Engineer. Drawings shall include dimensions, sectional views and bills of materials identifying and describing major components and accessories. The data and specifications shall include but not be limited to the following:

1. Dimensions
2. Size
3. Materials of construction
4. Weight
5. Protective coating
6. Actuator weight where applicable
7. Calculations for operator torque where applicable

B. Submit data on shop coating

C. Submit valve box data

D. Operation and Maintenance Manuals – The O&M Manual must contain a copy of the approved submittal and copies of all field test results.

1.05 DELIVERY, STORAGE AND HANDLING

A. The valves and appurtenances shall at all times be shipped, delivered, handled and stored in a manner to insure installation in a sound, undamaged condition. Store all valves and appurtenances off the ground in an enclosed shelter.

1.06 MISCELLANEOUS ITEMS

A. Include all supplementary parts necessary to complete each item even though such work may not be definitely shown or specified. No separate pay.

B. Make measurements of previously installed construction before fabrication of connecting work so that all work will fit properly.

1.07 ACCEPTABLE MANUFACTURERS

A. Provide equipment as supplied by the following acceptable manufacturers:
   1. Air & Vacuum Release Valves: A.R.I. Model D-025
   2. Round Port Plug Valves: Pratt, Crispin, GA Industries or Milliken with 316 External bolts, nuts and hardware
   3. Check Valves (swing disc): American Darling, APCO, Crane, Dresser, GA Industries, Kennedy (Clow), M&H Valve (Clow), Mueller, Stockham with 316 External bolts, nuts and hardware
   4. PVC Ball Valves SCH 80 True Union: GF, Hayward, NIBCO or Spears
   5. Stainless Steel Pressure Gauge Isolation Valves: Jamesbury Series 3A or approved equal

PART 2 – P R O D U C T S

2.01 GENERAL

A. Shop Painting. Finished aluminum, monel, nickel, brass, bronze, and stainless steel, shall not be shop coated. All exterior iron and steel surfaces, including faying surfaces of bolted joints (except machined and gasketed surfaces), shall be shop coated with an inorganic zinc rich primer. All interior iron and steel surfaces exposed to the flowing media shall be coated with a coal tar epoxy. The inorganic zinc rich primer and the coal tar epoxy and their application shall meet the requirements of Division 9, except as modified herein.

B. Marking and identification of valves shall conform to the standard specifications referred to or to the manufacturer's standard.

C. End connections of valves shall be flanged and drilled to ANSI Class 125 unless otherwise specified.

D. Valves for non-metallic pipelines shall be of the same material as the pipeline in which installed; or lined with or fabricated from a material satisfactory for the service intended.

E. Valve boxes shall be provided for buried valves unless contained in valve basins.

F. All valves when closed shall be thoroughly tight against leakage.

2.02 VALVE ACCESSORIES

A. Valve Operators.

1. All valves shall be provided with operators suitable for all operating conditions as specified herein. Operators shall produce the required torque with a maximum pull of 40 pounds on the lever or handwheel. Manual operator components shall withstand, without damage, a pull of 200 pounds on the handwheel or an input of 300 ft-lb on the operating nut. Operators shall be securely attached to the valve.

2. Operators shall be designed such that seal or packing leakage cannot enter gearing.

3. A readily visible position indicator shall be provided on each exposed operator and on each operating nut on an extension stem.

4. Operators buried or located outdoors shall be designed for submerged service to 20 feet.

a. Handwheel Operator. All valves 10" and larger shall be handwheel operated eccentric plug valves unless otherwise noted on the drawings with a totally enclosed worm gear operator and handwheel. Handwheels shall not be smaller than 6 inches or greater than 24 inches in diameter.

i. Operators shall be cast iron, fully enclosed, grease lubricated and fully gasketed.

ii. Operators shall have inspection covers.

iii. Gear material shall be bronze or ductile iron and worm material shall be hardened steel.

iv. Stop limiting devices shall be furnished.

v. Operators shall be furnished suitable for operation against the design pressure in either direction.

vi. Seals shall be provided on all shafts to prevent entry of dirt and water.

vii. Output shaft shall have one permanently lubricated bearing above and below the gear quadrant.

viii. The lower bearing shall also function as an axial thrust bearing.

b. Lever Operators. All valves 8" and smaller shall be lever operated unless otherwise noted on the drawing.

c. Wrench Nuts. Wrench nuts shall be provided on valves as noted on the drawings. All wrench nuts shall comply with Section 3.16 of AWWA C500-86.

d. Rotation. The direction of rotation of the handwheel, chainwheel, lever or wrench nut to open the valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the word OPEN and an arrow indicating the direction to open.

e. Chain wheels shall be installed on all overhead valves.

B. Extension Stems:

1. Extension stems and stem guides shall be provided where specified or required for proper operation.

2. Extension stems shall be fabricated from solid steel shafting not smaller in diameter than the stem of the valve or from galvanized steel pipe having an ID not smaller than the OD of the valve stem.

3. Extension stems shall be connected to the valve by a flexible socket type coupling. All connections shall be pinned, keyed or socket type. Pipe couplings will not be acceptable.

4. Stem guides shall be bronze bushed, cast iron construction and shall be adjustable in two directions. Where the length of an extension stem exceeds 10 feet or the weight exceeds 20 pounds, the top stem guide shall be designed to carry the weight of the extension stem and the extension stem shall have a collar to bear against the stem thrust guide.

C. Valve Boxes:

1. All buried valves shall be provided with valve boxes unless contained in valve vaults. Valve boxes shall be of cast iron or reinforced concrete, extension sleeve type, suitable

for the depth of cover shown on the Drawings or as required by the Engineer. Valve boxes shall be not less than 5 inches in diameter, shall have a minimum thickness at any point of 3/16 inch and shall be provided with suitable cast iron bases and covers. Covers shall have cast thereon an appropriate name designating the service for which the valve is used.

2. All buried valves and valve box installations must have a valve position indicator visible at grade.

3. All metal parts of valve boxes, bases and covers shall be coated by dipping in bituminous varnish.

4. Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves with the top of the box brought flush with the finished grade. After being placed in proper position, earth shall be filled in around each valve box and thoroughly tamped on each side of the box.

D. Valve Key:

1. The Contractor shall supply a valve key for each connection type on valves furnished and/or installed as part of this project.

2. The valve shall be installed such that the supplied valve key shall be capable of operating the valve without interference from surrounding items.

E. Riser Pipe:

1. Riser pipe shall be Class 51 Ductile Iron pipe or DR18 PVC pipe.

2.03 FABRICATED GATES (NOT USED)

2.04 PLUG VALVES

A. Materials:

Body and Plug	Semisteel, ASTM A126, Class B.
Journal Bearings	Sintered permanently lubricated stainless steel or reinforced teflon conforming to AWWA C507-85, Section 3.2.4.
Thrust Bearings	Delrin, stainless steel, bronze or reinforced teflon.
Plug Facing	Buna-N, 70 durometer hardness.
Body Seat	Stainless steel, Monel or Nickel (min. 90% pure Nickel).
Stem Seal	V-type packing, Buna-N or TFE; O-rings, Quad-X Seal, Buna-N.
External Bolts, Nuts And Hardware	316 Stainless Steel

B. Performance and Design Requirements:

1. All plug valves shall be round port plug valves.

2. Service Conditions. The valves shall be suitable for outdoor installation for stop service on raw sewage and sludge.

3. Design Requirements.

a. Valves shall be non-lubricated eccentric plug type. Valves shall be designed to provide bubble-tight shut-off service from either the upstream or the downstream direction. Above ground valves 10 inches and larger shall be worm gear operated. Equip buried valves with extended waterproof gear operators. Valve ends shall be as required to match connecting piping.

b. As a minimum valves shall be rated for working pressure of 150 psi. Minimum body thickness, not including flanges, shall be as per AWWA C-504. The opening motion shall be eccentric and shall move the plug away from the body seat. Fully adjustable plug position stops shall be provided. The valve body shall be plainly marked to indicate the seat end. All operators shall be designed for the required valve torque.

4. All fasteners and anchor bolts shall be heavy hex 316 Stainless Steel with field applied anti-seize compound.

2.05 SEWAGE AIR RELEASE AND VACUUM VALVES

A. Air and Vacuum valves shall be provided when specifically indicated on the contract drawings.

B. Valve shall be single float design; the float stem shuts off against the seat due to the lifting force of the float as liquid enters the valve body. Once closed and pressurized the valve will not open to release air.

C. Valve body, cover and baffles shall be of cast iron conforming to ASTM A48 Class 30. All internal parts shall be of brass conforming to ASTM B16. Float and float guide shall be of stainless steel conforming to ASTM A240. Valve seat shall be of Buna-N nitrile rubber.

D. Valve shall be fitted with blow off valves, quick disconnect couplings and minimum 6-feet of hose to permit back flushing after installation with dismantling valve.

E. Provide air release valves equal to Series 400/450 SARV by APCO, Figure 925 G.A. Industries, or approved equal for contact with sewage.

F. Provide A.R.I. Model D-025 air and vacuum valves or approved equal for contact with sewage.

2.06 AIR SUPPLY CHECK VALVES

A. Air Supply check valves shall be provided when specifically indicated on the drawings.

B. Provide flanged check valve equal to Lamson Centrifugal Blowers Part No. BA-100606 or approved equal.

2.07 TELESCOPIC SLUDGE VALVES (NOT USED)

2.08 GATE VALVES (RESILIENT SEAT) (NOT USED)

2.09 BUTTERFLY VALVES (AIR CONTROL)

A. Provide air tight resilient seat wafer body butterfly valves. Valves shall have self-lubricated stainless steel bearings and stainless steel shafts. Lever operated for four-inch (4") through 12-inch (12"); enclosed worm gear operated for 14-inch (14") and larger.

2.10 BUTTERFLY VALVES (POTABLE WATER CONTROL) (NOT USED)

2.11 SOLENOID VALVES

A. Solenoid valves shall be electrically operated, have a 304 stainless steel body and bonnet, and packless construction, without packing box or sliding seal. Solenoid coils shall be 120 volt AC, 60 Hz, encapsulated, Class H, for continuous duty at rated voltage plus or minus 10 percent (10%) and 40° C ambient, in a NEMA 4 enclosure.

2.12 MUD VALVES (NOT USED)

2.13 PRESSURE RELIEF VALVES (NOT USED)

2.14 SWING CHECK VALVES (WASTEWATER APPLICATIONS)

A. Check valves shall be swing type designed and manufactured in conformance with AWWA C508. Swing check valves shall prevent the backflow of water on pump shut-off or power failure and be tight seating. All internal parts shall be replaceable in the field, without removing the main valve from the pipeline. Check valves shall be provided with lever and weight.

B. Check valves shall be constructed of heavy cast iron body with aluminum bronze seat ring. The shaft shall be stainless steel, and shall have an o-ring seal at each end. The valve disc and disc arm shall be ductile iron with resilient (Buna-N) disc seat for drip tight shut-off. All external bolts, nuts, fasteners and hardware shall be 316 Stainless Steel.

C. All fasteners shall be heavy hex 316 Stainless Steel with field applied anti-seize compound.

D. All check valves larger than 3" shall be Class 125 Flanges.

2.15 SURGEBUSTER (NOT USED)

2.16 TWIN DISC CHECK VALVES (POTABLE WATER APPLICATIONS) (NOT USED)

2.17 KNIFE GATE VALVES (NOT USED)

2.18 FLAP VALVE

A. Description:

1. The flap valve shall be designed and installed in accordance with 30 TAC §290 and AWWA standards.

2. The flap valve shall be a gravity-hinged valve with a weighted cover. The cover shall fit tightly with no gap over 1/16 inch.

3. Valve shall swing open under direct pressure to release fluid, and close when direct pressure is relieved.

4. The weighted cover shall hold the gate against its seat.

B. Iron body, flange mounted, with bronze hinge pin, flap ring and seat ring.

C. Waterman Model PF25 spigot end, or approved equal.

D. All valves to be installed where shown on the drawings and in accordance with the manufacturer's recommendations.

2.19 ADJUSTABLE WEIRS (NOT USED)

PART 3 – EXECUTION

3.01 COATING

A. Valves and specialties shall be painted in accordance with applicable AWWA standard specified and per the Specifications.

3.02 INSTALLATION

A. Unless otherwise necessary for proper operation or permitted by the Engineer, all eccentric plug valves shall be installed with the shaft horizontal and the plug in the upper half of the valve body.

Valves in sewage or sludge lines shall be installed with the seat on the upstream end. Install valves in accordance with manufacturer's recommendations and instruction to permit intended performance.

B. Install all items to be embedded in concrete by template when structure is poured. Oil and grease moving parts. Install all gates, valves, and accessories in accordance with manufacturer's printed instructions, in such manner as to insure a watertight fit, complete and ready for operation. Operate gates and valves through one (1) cycle i.e., "open, close, open" or "close, open, close" to assure they have been properly lubricated and adjusted.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe and equipment hangers, supports, knee braces and associated anchors

B. Equipment bases and supports

C. Sleeves and seals

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the Bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 REFERENCES

A. ANSI/ASME B31.1 - Power Piping, Sections 120 and 121 of ASME B31.1.

1.04 SUBMITTALS

A. A layout of the systems including location on fixed and movable joints.

B. Details of design and fabrication of joints.

C. Details of support brackets, cradles, pads, thrust resisting elements, and other supporting elements.

D. Other pertinent elements necessary for a complete installation.

E. Design calculations for all items.

1.05 ACCEPTABLE MANUFACTURERS

A. All pipe hangers, supports, knee braces and associated anchors shall be the product of one manufacturer. Acceptable manufacturers shall be Anvil International Corporation or approved equal.

PART 2 - PRODUCTS

2.01 HANGERS AND SUPPORTS

A. Hangers for uninsulated lines 2 inches and less and for all drainage and downspout lines shall be adjustable swivel ring type fabricated of malleable iron.

B. Hangers for uninsulated lines larger than 2 inches and of insulated lines, except drainage and

downspout piping, shall be adjustable clevis type. Hangers shall be sized to allow insulation to extend unbroken through the hanger.

C. Hangers installed in valve vaults, wet wells, and other below grade areas shall be cadmium plated or stainless steel.

2.02 INSERTS

A. Inserts for individual hangers shall be galvanized malleable iron, and shall include removable nuts held in place by V-type teeth on the insert body and nut. Continuous slotted channel inserts shall be galvanized steel with integral anchors at 6-inch centers. Provide factory finished steel snap-on cover plates on channel inserts between support attachments.

2.03 ANCHOR BOLTS

A. Adhesive anchor bolts for support shall be stainless steel.

B. Expansion bolts may not be used without the expressed written consent of the Engineer. When allowed, anchor bolts for support shall be as per Section 05503 – Anchors Bolts Expansion Anchors & Adhesive Anchors. Expansion bolt anchors with lead shall not be used.

2.04 PIPE SADDLES

A. Pipe saddles shall be fabricated hot dip galvanized steel. Saddles for supporting pipe from the floor shall be at least 9 inches in length and as wide as the outside diameter of the pipe. Saddles shall have a bearing support of 120 degrees. Mount saddles on concrete pads at least 2-inches high.

2.05 FRAMES HANGERS

A. Framing for wall type hangers, trapeze hangers, and tunnel stanchions shall be factory fabricated metal framing systems with factory applied primer paint. Attach supports to structures with inserts for new concrete, with surface mounting methods for masonry or existing concrete, and with welding or clamps for structural steel. Pipe supports fabricated on the site shall be of structural steel members with all raw edges ground and dressed. Floor supports in areas with uncovered concrete floors shall rest on concrete pads not less than 2 inches high.

2.06 KNEE BRACES

A. Knee Braces installed in aeration, chlorine contact, or other wastewater treatment basins shall be galvanized welded steel unless otherwise indicated on the Drawings. Knee Braces shall be bolted to concrete wall with stainless steel anchoring bolts.

PART 3 - EXECUTION

3.01 GENERAL

A. Piping inside structures shall be hung, supported from the floor or racked adjacent to walls.

B. Inserts cast in concrete walls or slabs for hanging and supporting pipe shall be provided under this Section. Materials not galvanized or cadmium plated shall be primed and painted before installation.

C. Support components shall be designed fabricated and installed in general conformance with Sections 120 and 121 of ANSI B31.1, Power Piping, except as modified in this Section.

3.02 PIPE HANGERS AND SUPPORTS

A. Interior piping shall be supported, braced, and anchored to prevent movement in any direction because of pressure, temperature, flow, or water hammer, except at properly located expansion joints and fittings.

B. Provide two pipe guides on each side of expansion joints at which pipe movement occurs. The first guide shall be not more than 4-pipe diameters from the joint and the second not more than 14 diameters. Provide additional guides as required to maintain pipe alignment, spaced as required for the pipe size, fluid pressure and temperature inside the pipe, and as recommended by the expansion joint manufacturer or as shown.

C. Maximum support spacing and hanger rod sizes for metal pipe containing liquids shall be in accordance with the following:

Nominal Pipe Size Inches	Support Spacing Feet	Rod Diameter in Inches	
		One Rod	Two Rods
1 and Smaller	7		3/8
1-1/4 And 1-1/2	8	3/8	3/8
2	10	3/8	3/8
2-1/2	11	1/2	3/8
3	12	1/2	3/8
4 And 5	14	1/2	3/8
6 And 8	17	1/2	3/8
10	17	5/8	1/2
12	17	3/4	1/2
14	17	3/4	5/8
16	17	7/8	5/8
18 And 20	17	1	3/4
24	17	1 1/8	7/8

D. Valves 4 inches and larger in unburied horizontal lines shall have supports on both sides located within 18 inches of the valve or meter. Provide additional supports where required so that piping loads do not place damaging stresses on supports, valves, and equipment. Where necessary, block up pipe at supports to permit installation of insulation.

E. Support unburied horizontal runs of rubber hose and non-metallic pipe for the entire length by means of troughs consisting of structural steel channels or angles supported at not more than 10-ft intervals.

F. Support piping not included in the foregoing tabulation as indicated or in accordance with the pipe manufacturer's recommendations if not indicated.

G. Anchor buried pressure pipe at each fitting causing a change in direction of 10 degrees or more. Concrete thrust blocks or other restraining devices in any satisfactory combination may be used. Submit the details of the method proposed for use, together with design calculations, to Engineer for approval before installation.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The electronic magnetic inductive flowmeter shall be located as shown on the drawings. The electromagnetic flowmeter shall operate on electromagnetic induction principle and give an output signal directly proportional to the flowrate.

1.02 MEASUREMENT AND PAYMENT

A. Unless noted in the bidsheet, no separate payment will be made for work under this section. Include payment in unit price for applicable work as noted on the bidsheet.

1.03 SUBMITTALS

A. Prior to shipment, submit to Owner for review descriptive literature, manufacturer's specifications, catalog cuts, list of materials, parts, weight, and dimensions.

B. Contractor shall submit factory certified calibration certificates for all magnetic induction flowmeters

C. Operation and Maintenance Data: Submit operation and maintenance data which as a minimum contains the following information:

1. Description of Equipment
2. Assembly/Disassembly Drawings
3. Materials List
4. Normal Start-up/Shut-Down Procedures
5. Emergency Procedures
6. Maintenance Schedule
7. Trouble-shooting Guide
8. Factory certified calibration certificates for all magnetic induction flowmeters

Data shall also include name, address, and telephone number of local manufacturer's representative. Contractor shall submit five (5) bound copies to Owner upon approval of shop drawings.

1.03 QUALITY ASSURANCE

A. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:

1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
2. Physical conditions:
   a. Installation and mounting requirements

b. Location within the process.
c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

B. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

C. Manufacturer's Qualifications:

1. Provide equipment that is a standard product in regular production by a manufacturer whose products have proven reliable in similar service for at least 5 years.

2. The electromagnetic magmeter shall be of assured quality and provided by an ISO 9001 certified manufacturer.

D. A calibration certificate shall accompany each meter. Meter calibration shall be performed by a direct volumetric comparison method. Calibration facility shall be certified to 0.02% accuracy, and be traceable to National Institute of Standards and Technology (NIST) standards.

1.04 ACCEPTABLE MANUFACTURERS

1. ABB.
2. Badger
3. Endress + Hauser
4. Rosemount
5. Substitutions are not permitted.

1.05 WARRANTY

A. For a period of 12 months from final acceptance, the manufacturer shall warrant that the equipment shall be free of defects in material and workmanship under normal use and service, and when properly installed. The manufacturer shall repair or replace, F.O.B. point of shipment, such equipment or any part thereof furnished by the manufacturer and found defective after inspection by the manufacturer.

PART 2 - PRODUCTS

2.01 DESIGN AND FABRICATION:

A. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.

B. The metering tubes shall be constructed of stainless steel. All magnetic inductive flowmeters shall be designed to mount directly in the pipe between ANSI Class 150 flanges and shall

consist of a flanged pipe spool piece with laying length of at least 1-1/2 times the meter diameter.

C. Meter(s) shall have polyurethane liners with stainless steel electrodes.

D. High input impedance pre-amplifiers.

1. Minimum impedance: 10^{10} ohms.

E. Provide flanged end connections per ASME B16.5 rated for piping system operating and test conditions. Rating shall match pipe rating .

F. Meter shall be suitable for outdoors installation and shall be furnished complete with grounding rings and installation hardware including studs, nuts, gaskets, and flange adapter hardware.

G. Grounding requirements:

1. Nonmetallic or lined pipe:
   a. Inlet and outlet grounding rings or same material as electrode.
2. Conductive piping:
   a. Conductive path between the meter and piping flanges.

H. Provide cable between magnetic inductive flowmeter and transmitter. Cable length shall be 10 meters minimum. The Contractor shall cut cable in the field to suit actual field installation. Splicing is not permitted.

I. The signal converter shall be remotely mounted using a remote-mount kit provided by the manufacture. The transmitter shall be FM approved. Rating shall be at least NEMA 4X with separate electronics and termination areas.

J. Converter shall also include digital type switches for direct adjustment of scaling factor in engineering units along with integral calibration self-test feature to verify proper operation of the electronics.

K. Submergence: The meter housing shall be splash-proof and weather resistant design. The sensor shall be pedestal sealed against accidental submersion to 3 feet for 30 minutes standard, or permanently submerged to 30 feet when the terminal box is backfilled with a non-setting, transparent potting material.

L. Pulsed DC magnetic field excitation.

M. Automatic zero.

N. Adjustable Low flow cutoff

O. Minimum signal lock (empty tube zero) to prevent false measurements with tube is empty.

P. Inaccuracy
1. Above 10 percent of range: +/- 1.0 percent of rate.
2. Below 10 percent of range: +/- 0.1 percent of range setting.
3. Add +0.1 percent of range to above inaccuracies for analog outputs.

Q. 4-20 mA DC isolated output into maximum 800 ohms,

R. Power supply: 120V +/- 10 percent, 60 Hz.

S. Indication of Flow Indication of flow rate and totalized flow at transmitter.

T. Meter operable as specified in liquids with 5.0 micro ohm/cm or more conductivity.

U. Transmitter electronics shall use microprocessor based architecture and be configured using parameters.

V. Repeatability: +/- 0.1% of reading or better.

W. The meter shall be capable of automatically indicating zero flow under empty pipe conditions.

X. The magnetic inductive flowmeter performance shall be verified on a NIST traceable test facility. A computer printout of the actual calibration data giving indicated versus actual flows at a minimum of three flow rates shall be provided with the meter. A certification letter shall accompany the computer printout of the calibration data for each meter referencing the meter's serial number. The accuracy of the metering system shall be 1 percent of rate from 10 to 100 percent of flow for maximum flow velocities of 3 to 31 feet per second. Contractor shall submit factory certified calibration certificates for all magnetic inductive flowmeters before they are brought on site or included in the contractor's pay estimate.

Y. Instruments shall be designed and manufactured under the ISO 9001 series of quality standards.

Z. Provide local operator interface display.

AA. Menu or programming changes shall be capable of being performed without removing covers.

BB. Instruments shall be capable of storing data in non-volatile memory for a minimum of 10 years.

CC. The instrument shall have password protection to prevent unauthorized personnel from making settings and programming changes.

PART 3 - EXECUTION

3.01 SHIPMENT

A. Instruments shall not be shipped to the Work Site until two weeks prior to the scheduled installation.

B. The System Supplier shall be responsible for coordinating the installation schedule with the Installation Contractor.

C. Each shipment shall contain a listing of protective measures required to maintain sensor operation, including a listing of any common construction or cleaning chemicals that may affect instrument operation.

3.02 INSTALLATION

A. Furnish all equipment after factory testing, ready for installation.

B. In regard to flow disturbances and installation location, provide unobstructed upstream and downstream pipe clearances as recommended by the manufacturer.

C. Demonstrate performance of all instruments to the Engineer before commissioning.

3.03 FIELD SERVICES

A. Manufacturer's field services shall be provided for installation, field calibration, startup, and training.

B. The manufacturer's field services representative shall verify factory calibration of all instruments in accordance with the manufacturer's instructions. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

END OF SECTION

Bryan W. Shaw, Ph.D., P.E., *Chairman*
Toby Baker, *Commissioner*
Jon Niermann, *Commissioner*
Richard A. Hyde, P.E., *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

June 24, 2016

RECEIVED

JUN 29 2016

COUNTY ENGINEER

Mr. Kenneth P. Wolf
Two Seventy Seven, Ltd.
8023 Vantage Dr. Suite 1200
San Antonio, Texas 78230-4726

Re: Edwards Aquifer, Comal County

NAME OF PROJECT: Park Village Waste Water Treatment Plant; Located approximately 5,900 feet due south of State Highway 46 and Blanco Road then 600 feet due east from Bulverde Road intersection; Bulverde, Texas

TYPE OF PLAN: Request for Approval of a Contributing Zone Plan (CZP); 30 Texas Administrative Code (TAC) Chapter 213 Subchapter B Edwards Aquifer

Regulated Entity No. RN105842298; Additional ID No. 13000066

Dear Mr. Wolf:

The Texas Commission on Environmental Quality (TCEQ) has completed its review of the CZP Application for the above-referenced project submitted to the San Antonio Regional Office by IDS Engineering Group on behalf of Two Seventy Seven, Ltd. on March 30, 2016. Final review of the CZP was completed after additional material was received on May 3, 2016 and May 25, 2016. As presented to the TCEQ, the Temporary and Permanent Best Management Practices (BMPs) were selected and construction plans were prepared by a Texas Licensed Professional Engineer to be in general compliance with the requirements of 30 TAC Chapter 213. These planning materials were sealed, signed and dated by a Texas Licensed Professional Engineer. Therefore, based on the engineer's concurrence of compliance, the planning materials for construction of the proposed project and pollution abatement measures are hereby approved subject to applicable state rules and the conditions in this letter. The applicant or a person affected may file with the chief clerk a motion for reconsideration of the executive director's final action on this Edwards Aquifer Protection Plan. A motion for reconsideration must be filed no later than 23 days after the date of this approval letter. *This approval expires two (2) years from the date of this letter unless, prior to the expiration date, more than 10 percent of the construction has commenced on the project or an extension of time has been requested.*

PROJECT DESCRIPTION

The proposed commercial project will have an area of approximately 4.6 acres. It will include the construction of a wastewater treatment plant with associated buildings and access drive. The impervious cover will be 1.0 acre (21.7 percent). Project wastewater will be disposed of by conveyance to the proposed Park Village Waste Water Treatment Plant owned by the Two Seventy Seven, Ltd.

PERMANENT POLLUTION ABATEMENT MEASURES

To prevent the pollution of stormwater runoff originating on-site or upgradient of the site and potentially flowing across and off the site after construction, one 15 foot wide engineered vegetative filter strip, and two 50 foot wide natural vegetative filter strips, designed using the TCEQ technical guidance document, Complying with the Edwards Aquifer Rules: Technical Guidance on Best Management Practices (2005), will be constructed to treat stormwater runoff. The required total suspended solids (TSS) treatment for this project is 898 pounds of TSS generated from the 1.0 acre of impervious cover. The approved measures meet the required 80 percent removal of the increased load in TSS caused by the project.

The two 50 foot wide natural vegetative filter strips shall remain in its natural state with a uniform slope of less than ten percent, and the 15 foot wide engineered vegetative filter strip will have a uniform slope of less than 20 percent, a vegetated cover of at least 80 percent, and will extend along the entire length of the contributing area.

SPECIAL CONDITIONS

I. Within 60 days of receiving written approval of an Edwards Aquifer Protection Plan, the applicant must submit to the San Antonio Regional Office, proof of recordation of notice in the county deed records, with the volume and page number(s) of the county deed records of the county in which the property is located. A description of the property boundaries shall be included in the deed recordation in the county deed records. A suggested format (Deed Recordation Affidavit, TCEQ-0625A) that you may use to deed record the approved CZP is enclosed.

II. All permanent pollution abatement measures shall be operational prior to occupancy of the facility.

STANDARD CONDITIONS

1. Pursuant to Chapter 7 Subchapter C of the Texas Water Code, any violations of the requirements in 30 TAC Chapter 213 may result in administrative penalties.
2. The holder of the approved Edwards Aquifer protection plan must comply with all provisions of 30 TAC Chapter 213 and all best management practices and measures contained in the approved plan. Additional and separate approvals, permits, registrations and/or authorizations from other TCEQ Programs (i.e., Stormwater, Water Rights, UIC) can be required depending on the specifics of the plan.
3. In addition to the rules of the Commission, the applicant may also be required to comply with state and local ordinances and regulations providing for the protection of water quality.

Prior to Commencement of Construction:

4. All contractors conducting regulated activities at the referenced project location shall be provided a copy of this notice of approval. At least one complete copy of the approved Contributing Zone Plan and this notice of approval shall be maintained at the project location until all regulated activities are completed.
5. Any modification to the activities described in the referenced CZP application following the date of approval may require the submittal of a plan to modify this approval, including the payment of appropriate fees and all information necessary for its review and approval prior to initiating construction of the modifications.
6. The applicant must provide written notification of intent to commence construction, replacement, or rehabilitation of the referenced project. Notification must be submitted to the San Antonio Regional Office no later than 48 hours prior to commencement of the regulated activity. Written notification must include the name of the approved plan and file number for the regulated activity,

the date on which the regulated activity will commence, and the name of the prime contractor with the name and telephone number of the contact person.

7. Temporary erosion and sedimentation (E&S) controls, i.e., silt fences, rock berms, stabilized construction entrances, or other controls described in the approved Storm Water Pollution Prevention Plan (SWPPP) must be installed prior to construction and maintained during construction. Temporary E&S controls may be removed when vegetation is established and the construction area is stabilized. If a water quality pond is proposed, it shall be used as a sedimentation basin during construction. The TCEQ may monitor stormwater discharges from the site to evaluate the adequacy of temporary E&S control measures. Additional controls may be necessary if excessive solids are being discharged from the site.

During Construction:

8. During the course of regulated activities related to this project, the applicant or his agent shall comply with all applicable provisions of 30 TAC Chapter 213, Edwards Aquifer. The applicant shall remain responsible for the provisions and conditions of this approval until such responsibility is legally transferred to another person or entity.
9. If sediment escapes the construction site, the 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). Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been significantly reduced. 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).
10. Intentional discharges of sediment laden water are not allowed. If dewatering becomes necessary, the discharge will be filtered through appropriately selected best management practices. These may include vegetated filter strips, sediment traps, rock berms, silt fence rings, etc.
11. The following records shall be maintained and made available to the executive director upon request: the dates when major grading activities occur, the dates when construction activities temporarily or permanently cease on a portion of the site, and the dates when stabilization measures are initiated.
12. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, and construction activities will not resume within 21 days. When the initiation of stabilization measures by the 14th day is precluded by weather conditions, stabilization measures shall be initiated as soon as practicable.
13. This approval does not authorize the installation of temporary aboveground storage tanks on this project. If the contractor desires to install a temporary aboveground storage tank for use during construction, an application to modify this approval must be submitted and approved prior to installation. The application must include information related to tank location and spill containment. Refer to Standard Condition No. 5, above.

After Completion of Construction:

14. Owners of permanent BMPs and measures must insure that the 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 San Antonio Regional Office within 30 days of site completion.
15. The applicant shall be 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. A copy of the transfer of responsibility must be filed with the executive director through the San Antonio Regional Office within 30 days of the transfer. A copy of the transfer form (TCEQ-10263) is enclosed.

16. Upon legal transfer of this property, the new owner(s) is required to comply with all terms of the approved Contributing Zone Plan. If the new owner intends to commence any new regulated activity on the site, a new Contributing Zone Plan that specifically addresses the new activity must be submitted to the executive director. Approval of the plan for the new regulated activity by the executive director is required prior to commencement of the new regulated activity.
17. A Contributing Zone Plan approval or extension will expire and no extension will be granted if more than 50 percent of the total construction has not been completed within ten years from the initial approval of a plan. A new Contributing Zone Plan must be submitted to the San Antonio Regional Office with the appropriate fees for review and approval by the executive director prior to commencing any additional regulated activities.
18. At project locations where construction is initiated and abandoned, or not completed, the site shall be returned to a condition such that the aquifer is protected from potential contamination.

This action is taken under authority delegated by the Executive Director of the Texas Commission on Environmental Quality. If you have any questions or require additional information, please contact Mr. Joshua Vacek of the Edwards Aquifer Protection Program of the San Antonio Regional Office at 210-403-4028.

Sincerely,

Lynn Bumguardner, Water Section Manager
San Antonio Region
Texas Commission on Environmental Quality

LB/JV/eg

Enclosures: Deed Recordation Affidavit, Form TCEQ-0625A
Change in Responsibility for Maintenance of Permanent BMPs, Form TCEQ-10263

cc: Mr. Jose Cantu, P.E., IDS Engineering Group
Mr. Thomas H. Hornseth, P.E., Comal County Engineer
The Honorable Bill Krawietz, City of Bulverde
Mr. Roland Ruiz, Edwards Aquifer Authority
Mr. George Wissman, Comal Trinity WCD
TCEQ Central Records, Building F, MC212