



August 24, 2011

Mr. Johnny Grimaldo
Tom Green County Purchasing Agent
113 W. Beauregard
San Angelo, Texas 76903

Re: Pugh Park Boating Access Improvements Project
U.S. Army Corps of Engineers Individual Permit Application
Tom Green County, Texas

Dear Mr. Grimaldo:

Please see the attached applications for a U.S. Army Corps of Engineers Individual Permit for the Pugh Park Boating Access Improvements Project in Christoval. The permit application and associated construction plans have been assembled based on input from the County to meet the needs of the Christoval community.

There are four (4) places in the two forms for signature by the applicant, Judge Mike Brown. Please have Judge Brown sign these areas, and return the documents to our Austin office. We will then make copies, and formally submit the application to the U.S. Army Corps of Engineers office in Fort Worth.

Please contact me at (512) 708-9322 or via e-mail at aluke@naismith-engineering.com if you have any questions or need any additional information.

Sincerely,
NAISMITH ENGINEERING, INC.

Adam M. Luke, P.E.
Project Engineer

Enclosure: ENG Form 4345
Application for Department of the Army Individual Permit (with Attachments)

17. DIRECTIONS TO THE SITE

From San Angelo: Drive approximately 15 miles south on U.S. 277 to the town of Christoval. Turn left at TX-110 Loop S. and go about 160 feet. Turn right at Main St., Playland Park Rd./TX-110 Loop S. and go about 0.5 miles. Turn left at Church St./FM 2084/RR 2084/Toe Nail Trail and go about 0.1 miles. Pugh Park is on the right.

18. Nature of Activity (Description of project, include all features)

Tom Green County will construct new boating access facilities in the County-owned Pugh Park in the unincorporated community of Christoval by installing one two-lane pre-cast concrete boat ramp on the east bank of the South Concho River. Also to be installed are two 6-foot wide, 16-foot long floating docks and approximately 400 linear feet of bank stabilization and erosion control. One existing 10-foot wide deteriorated boat ramp will be converted into a canoe/kayak launch point. A small restroom facility may also be constructed if adequate funds are available.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

The purpose of the project is to provide access to water activities (boating and fishing) to the citizens of Tom Green County. A new boat ramp will be installed to provide safer boat launching. The existing boat ramp was constructed around 1960 out of asphalt that is currently deteriorating. The existing ramp is also too steep for safe vehicle use, and will be converted into a kayak/canoe launch point.

Another aspect of the project is to stabilize the river bank and provide erosion control. Because of dense tree canopies and heavy use during summer months, very little vegetation grows on the river bank. Geotextile materials and grass seeding will be installed to remedy this situation.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

A small amount of sediment will be discharged into the South Concho River during site preparation for the pre-cast concrete boat ramp.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type	Type	Type
Amount in Cubic Yards	Amount in Cubic Yards	Amount in Cubic Yards
Sediment: Less than 10 cubic yards		

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres
or
Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

24. Is Any Portion of the Work Already Complete? Yes No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address- Full List is Attached
City - State - Zip -

b. Address-
City - State - Zip -

c. Address-
City - State - Zip -

d. Address-
City - State - Zip -

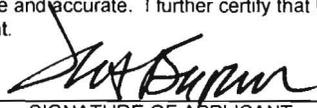
e. Address-
City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.


SIGNATURE OF APPLICANT

9-13-11
DATE


SIGNATURE OF AGENT

8/24/11
DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than \$10,000 or imprisoned not more than five years or both.

List of Landowners Adjacent to Pugh Park in Christoval, Texas
Source: Tom Green County Appraisal District, www.tomgreencad.com

Tom Green Co. CAD Account No.	Owner	Address
51-01945-0691-000-00	JONES E WILSON TRUSTEE	217 S WASHINGTON DR SAN ANGELO, TX 76901
51-01945-0235-000-00	CUSTER MORRIS D&SHIRLEY A FAM TRUST	PO BOX 173 CHRISTOVAL, TX 76935
50-82000-0003-000-00	LOWN JOSEPH WENDEL	PO BOX 888 SAN ANGELO, TX 76902
50-82000-0003-050-00	TORRES ROBERT R & ELFIDA R	1221 S OAKS SAN ANGELO, TX 76903
51-00173-0238-007-00	WARRINGTON BILL	PO BOX 3893 SAN ANGELO, TX 76902
51-00173-0238-008-00	DAVIS E FRANKLIN D & JILL A	PO BOX 312 CHRISTOVAL, TX 76935
51-00173-0238-009-00	WALLACE ROLAND	7346 LENOX AVE RIVERSIDE, CA 92504
51-00173-0238-010-00	WALLACE ROLAND	7346 LENOX AVE RIVERSIDE, CA 92504
51-00173-0238-011-00	BOON JOHN B	PO BOX 1 CHRISTOVAL, TX 76935
51-00173-0238-013-00	SCHROEDER ROSS	PO BOX 296 CHRISTOVAL, TX 76935
51-00173-0238-017-00	ALLEN STACY & MELODY	PO BOX 61992 SAN ANGELO, TX 76906
51-00173-0238-014-00	SCHROEDER ROSS	PO BOX 296 CHRISTOVAL, TX 76935
51-00173-0238-012-00	MC MILLAN MILES & LAURA	PO BOX 150 CHRISTOVAL, TX 76935
51-00173-0238-012-05	SCHROEDER ROSS	PO BOX 296 CHRISTOVAL, TX 76935
51-04217-1500-000-00	CHRISTOVAL I.S.D.	20454 TOE NAIL TRAIL CHRISTOVAL, TX 76935

U.S. Army Corps of Engineers (USACE) Fort Worth District



Application for Department of the Army Individual Permit

This form integrates the information in ENG Form 4345 with the items required by the Fort Worth District for Section 10 and Section 404 permits. Please consult instructions included at the end prior to completing this form.

Contents

- **Description of an Individual Permit**
- **Part I:** Project Information
- **Part II:** Alternative(s) Analysis
- **Part III:** Project Impacts and Mitigation
- **Part IV:** Attachments
- **Instructions**

DESCRIPTION OF AN INDIVIDUAL PERMIT

Authorities: 33 USC 401, Section 10 of the Rivers and Harbors Act of 1899; Section 404 of the Clean Water Act, and Section 103 of the Marine Protection Research and Sanctuaries Act of 1976 (not applicable in the Fort Worth District). Principal Purpose: These laws require permits authorizing activities in, or affecting, navigable waters of the U.S.; the discharge of dredged or fill material into waters of the U.S.; and the transportation of dredged material for the purpose of dumping it into ocean waters. Routine Uses: Information provided on this form will be used in evaluating the application for a permit. Disclosure: Disclosure of requested information is voluntary. If information is not provided, however, the permit application cannot be processed nor can a permit be issued.

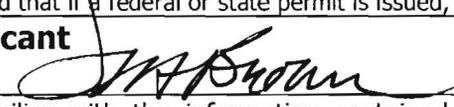
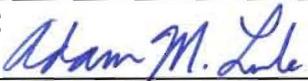
Activities that do not qualify for authorization under the General Permit program may qualify for authorization by Individual Permit (IP). Authorization under IP may be obtained only through application with the USACE. These permits are issued for activities that have more than minimal adverse impacts to waters of the U.S., and evaluation of each permit application involves more thorough review of the potential environmental and socioeconomic effects of the proposed activity.

An application for a Department of the Army IP under Section 404 or Section 10 will be determined to be complete when the USACE receives sufficient information to issue a public notice (see 33 CFR 325.1(d) and 325.3(a) for details and supporting information). The applicant should address all activities that the applicant plans to undertake that are reasonably related to the same project and for which a Department of the Army permit would be required. An alternatives analysis and a mitigation plan are not required for a complete application to prepare a public notice but are very helpful.

One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned.

Part I: Project Information

Box 1 Project Name: Pugh Park Boating Access Improvements Project		Applicant Name Mike Brown	
Applicant Title County Judge		Applicant Company, Agency, etc. Tom Green County	
Mailing Address 112 W. Beauregard San Angelo, TX 76903		Applicant's internal tracking number (if any)	
Work Phone with area code (325) 653-3318	Home Phone with area code	Fax # (325) 659-3258	E-mail Address mike.brown@co.tom-green.tx.us
Relationship of applicant to property: <input type="checkbox"/> Owner <input type="checkbox"/> Purchaser <input type="checkbox"/> Lessee <input checked="" type="checkbox"/> Other: Government Official			
Application is hereby made for a permit or permits to authorize the work as described herein. I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities. I hereby grant to the agency to which this application is made the right to enter the above-described location to inspect the proposed, in-progress, or completed work. I agree to start work <u>only</u> after all necessary permits have been received.			
Signature of applicant 			Date (mm/dd/yyyy) 9-15-11

Box 2 Authorized Agent/Operator Name and Signature: <i>(If an agent is acting for the applicant during the permit process)</i> Adam Luke, P.E.			
Agent/Operator Title Project Engineer		Agent/Operator Company, Agency, etc. Naismith Engineering, Inc.	
Mailing Address 600 W. 8 th St., Suite 300, Austin, TX 78701			
E-mail Address aluke@naismith-engineering.com			
Work Phone with area code (512) 708-9322	Home Phone with area code	Fax # (512) 708-9014	Cell Phone #
I hereby authorize the above-named agent to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application. I understand that I am bound by the actions of my agent, and I understand that if a federal or state permit is issued, I, or my agent, must sign the permit.			
Signature of applicant 			Date (mm/dd/yyyy) 9-13-11
I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true, complete, and accurate.			
Signature of authorized agent 			Date (mm/dd/yyyy) 8/24/11

Box 3 Name of property owner, if other than applicant:	
<input type="checkbox"/> Multiple Current Owners <i>(If multiple current property owners, check here and include a list in Attachment A)</i>	
Owner Title	Owner Company, Agency, etc.

Full Mailing Address	
Work Phone with area code	Home Phone with area code

Box 4 Name of adjoining property owner, lessee, etc. whose property adjoins the project site:

Multiple Adjoining Property Owners/Lessees and Full Mailing Addresses *(If multiple adjoining property owners/lessees, check here and include a list in Attachment B)*

Name and Full Mailing Address:

E. Wilson Jones Trustee	217 S. Washington, San Angelo, Tx 76901
Morris & Shirley Custer	PO Box 173, Christoval, Tx 76935
Joseph Lown	PO Box 888, San Angelo, Tx 76902
Robert & Elfida Torres	1221 S. Oaks, San Angelo, Tx 76903
Bill Warrington	PO Box 3893, San Angelo, Tx 76902
E. Franklin & Jill Davis	PO Box 312, Christoval, Tx 76935
Roland Wallace	7346 Lenox Ave., Riverside, CA 92504
John Boon	PO Box 1, Christoval, Tx 76935
Stacy & Melody Allen	PO Box 61992, San Angelo, Tx 76906
Miles & Laura McMillan	PO Box 150, Christoval, Tx 76935
Christoval I.S.D	20454 Toe Nail Trail, Christoval, Tx 76935

Box 5 Project location, including street address, city, county, state, and zip code where proposed activity will occur:

Tom Green County Pugh Park, 20400 Ranch Road 2084 (Toe Nail Trail), Christoval, TX 76935

Nature of Activity (Description of project; include all features; see instructions):
 Tom Green County will construct new boating access facilities in the County-owned Pugh Park in the unincorporated community of Christoval by installing one two-lane pre-cast concrete boat ramp on the east bank of the South Concho River. Also to be installed are two 6-foot wide, 16-foot long floating docks and approximately 400 linear feet of bank stabilization and erosion control. One existing 10-foot wide deteriorated boat ramp will be converted into a canoe/kayak launch point. A small restroom facility may also be constructed if adequate funds are available.

Project Purpose (Description of the reason or purpose of the project; see instructions):

Ensuring the availability of facilities for water-based recreation (fishing and boating) was identified as the eighth most requested recreational activity in the County's comprehensive parks master plan adopted by the Commissioner's Court in 2004. The existing Pugh Park boating facilities are in poor repair. The existing single-lane boat ramp was constructed around 1960. The slope of the current ramp is too steep for safe release of a boat during unloading and too short for safe departure of the towing vehicle. The slope is approximately 35 degrees, and the ramp is made of asphalt that is crumbling. Installation of a two-lane, pre-cast concrete boat ramp will correct this situation and provide new boating access and water sports opportunities to the citizens of Tom Green County.

Surface runoff from the park flows directly into the South Concho River. During heavy rain events and periods of high river flow, runoff and flood waters erode the bank. In recent years, this has caused over a dozen mature trees to fall into the river creating a hazard for swimmers and boaters. This situation will be corrected through installation of bank stabilization and erosion control geotextile materials. Two floating courtesy docks and gangways will also be installed for easy access to the water by boaters and swimmers.

Although not the primary intent of the project, the existing boat ramp will be converted into a canoe/kayak launch point. Bollards will block vehicle use of the old ramp.

Has a delineation of waters of the U.S., including wetlands, been completed? (see instructions)

Yes, in Attachment C No

If a delineation has been completed, has it been verified in writing by the USACE?

Yes, Date of approved or preliminary jurisdictional determination (mm/dd/yyyy):

USACE project:

No

Are color photographs of the existing conditions available? Yes, in Attachment D No

Are aerial photographs available? Yes, in Attachment D No

Complete the table in Attachment E for any waters of the U.S. impacted by the proposed project.

Waterbody(ies) (if known; otherwise enter "an unnamed tributary to"): South Concho River

Tributary(ies) to what known, downstream waterbody(ies): Twin Buttes Reservoir, Lake Nasworthy, Concho River, Colorado River

Latitude and longitude (Decimal Degrees at center of project):

31.186375, -100.497772

USGS Quad map name(s):

Christoval

Watershed(s) and other location descriptions, if known:

South Concho River

Directions to the project location:

From San Angelo: Drive approximately 15 miles south on U.S. 277 to the town of Christoval. Turn left at TX-110 Loop S. and go about 160 feet. Turn right at Main St., Playland Park Rd./TX-110 Loop S. and go about 0.5 miles. Turn left at Church St./FM 2084/RR 2084/Toe Nail Trail and go about 0.1 miles. Pugh Park is on the right.

Part II: Alternative(s) Analysis

Box 6 Describe the alternatives that would meet your overall project purpose in accordance with the Clean Water Act Section 404(b)(1) guidelines to demonstrate the proposed activity represents the least environmentally damaging practicable alternative: (See instructions)

Alternative(s) Analysis in Attachment F

No-Action Alternative: The no-action alternative would continue to provide inadequate water recreation facilities at Pugh Park, and the continued erosion of the banks of the South Concho River.

Cast-In-Place Alternative: Constructing a cast-in-place concrete boat ramp and retaining wall structures along the South Concho River would be very difficult, expensive, and time consuming. Although this alternative would provide excellent recreation facilities and erosion control, it would require lowering of the river level and thus increase disturbance to the river bed and shoreline.

Selected Alternative: The proposed project (pre-cast concrete boat ramp, geotextile slope stabilization and erosion control, and creation of a kayak/canoe launch point) has minimal environmental impacts, reasonable construction costs, and ease of construction.

Part III: Project Impacts and Mitigation

Box 7 Reason(s) for Discharge into waters of the U.S. (See instructions):

Minimal earthwork along the bank of the South Concho River will be required to provide an even surface for installation of the pre-cast concrete boat ramp and subbase materials.

Type(s) of material being discharged and the amount of each type in cubic yards:

On-site soil will be disturbed during placement of the boat ramp. Estimated excavation amount on the shore line to achieve final grade are approximately 50 cubic yards. Less than 10 cubic yards of sediment will be discharged into the river during construction.

Total surface area (in acres) of wetlands or other waters of the U.S. to be filled:

N/A

For activities involving dredging in navigable waters of the U.S., describe the type, composition, and quantity of the material to be dredged, the method of dredging, and the site and plans for disposal of the dredged material:

N/A

Indicate the proposed impacts to **waters of the U.S.** in ACRES (for wetlands and impoundments) and LINEAR FEET (for rivers and streams), and identify the impact(s) as permanent and/or temporary for each waterbody type listed below. The table below is intended as a tool to summarize impacts by resource type for planning compensatory mitigation and does not replace the table of waters of the U.S. in Attachment E.

Waterbody Type	Permanent		Temporary	
	Acres	Linear feet	Acres	Linear feet
Non-forested wetland				
Forested wetland				
Perennial stream				
Intermittent stream				
Ephemeral stream				
Impoundment		430		430
Other:				
Total:		430		430

Potential indirect and/or cumulative impacts of proposed discharge (if any):
None

Required drawings (see instructions):

Vicinity map: In Attachment G

To-scale plan view drawing(s): In Attachment G

To-scale elevation and/or cross section drawing(s): In Attachment G

Is any portion of the work already complete? Yes No

If yes, describe the work:

Box 8 Authority: (see instructions)

Is Section 10 of the Rivers and Harbors Act for projects affecting navigable waters applicable?

Yes No (see Fort Worth District Navigable Waters list)

Is Section 404 of the Clean Water Act applicable? Yes No

Box 9 Federally Threatened or Endangered Species (see instructions)

Please list any federally-listed (or proposed) threatened or endangered species or critical habitat potentially affected by the project (use scientific names (i.e., genus species), if known):

Black Capped Vireo (*Vireo atricapilla*)

Concho Water Snake (*Nerodia paucimaculata*)

Least Tern (*Sterna antillarum*)

Mountain Plover (*Charadrius montanus*)

Have surveys, using U.S. Fish and Wildlife Service (USFWS) protocols, been conducted?

Yes, Report in Attachment H No (explain):

If a federally-listed species would potentially be affected, please provide a description and a biological evaluation.
 Yes, Report in Attachment H Not attached

Has Section 7 consultation been initiated by another federal agency?
 Yes, Initiation letter in Attachment H No

Has Section 10 consultation been initiated for the proposed project?
 Yes, Initiation letter in Attachment H No

Has the USFWS issued a Biological Opinion?
 Yes, Report in Attachment H No
 If yes, list date Opinion was issued (mm/dd/yyyy):

Box 10 Historic Properties and Cultural Resources
 Please list any historic properties listed (or eligible to be listed) on the National Register of Historic Places which the project has the potential to affect:
 None

Has an archaeological records search been conducted?
 Yes, Report in Attachment I No (explain):

Are any cultural resources of any type known to exist on-site?
 Yes No

Has an archaeological pedestrian survey been conducted for the site?
 Yes, Report in Attachment I No (explain):

Has Section 106 or SHPO consultation been initiated by another federal or state agency?
 Yes, Initiation letter in Attachment I No

Has a Section 106 MOA been signed by another federal agency and the SHPO?
 Yes, in Attachment I No
 If yes, list date MOA was signed (mm/dd/yyyy):

Box 11 Proposed Conceptual Mitigation Plan Summary (see instructions)

Applicant proposes combination of one or more of the following mitigation types:
 Mitigation Bank On-site Off-site (Number of sites: _____) None

Applicant proposes to purchase mitigation bank credits: Yes No

Mitigation Bank Name:
 Number of Credits:

Indicate in ACRES (for wetlands and impoundments) and LINEAR FEET (for rivers and streams) the total quantity of waters of the U.S. proposed to be created, restored, enhanced, and/or preserved for purposes of providing compensatory mitigation. Indicate mitigation site type (on- or off-site) and number. Indicate waterbody type (non-forested wetland, forested wetland, perennial stream, intermittent stream, ephemeral stream, impoundment, other) or non-jurisdictional (uplands¹).

Mitigation Site Type and Number	Waterbody Type	Created	Restored	Enhanced	Preserved
<i>e.g., On-site 1</i>	<i>Non-forested wetland</i>	<i>0.5 acre</i>			
<i>e.g., Off-site 1</i>	<i>Intermittent stream</i>		<i>500 LF</i>	<i>1000 LF</i>	
	Totals:				

¹ For uplands, please indicate if designed as an upland buffer.

Summary of Mitigation Work Plan (Describe the mitigation activities listed in the table above):

Provide a detailed explanation of how appropriate and practicable steps have been taken to avoid, minimize, or mitigate, the adverse impact of the proposed project on the aquatic ecosystem:

Has a conceptual mitigation plan been prepared in accordance with the USACE regulations and guidelines? Yes, in Attachment J No (explain):

Mitigation site(s) latitude and longitude (Decimal Degrees at center of site): USGS Quad map name(s):

Other location descriptions, if known:

Directions to the mitigation location(s):

Box 12 Clean Water Act Section 401 Water Quality Certification (see instructions):

For Texas:

TCEQ Type of 401 Certification: Tier I Tier II

For Tier I, does the project incorporate the Best Management Practices (BMPs) and other requirements of the Tier I Checklist?

Yes (Include Completed Tier I Checklist in Attachment K) No

For Tier II, has a 401 Certification Questionnaire and Alternatives Analysis Checklist been completed? Yes, in Attachment K No

For Louisiana:

Applying for individual water quality certification? Yes No

Other information for individual water quality certification:

Box 13 List of other certifications or approvals/denials received from other federal, state, or local agencies for work described in this application:

Agency	Approval Type ²	Identification No.	Date Applied	Date Approved	Date Denied

² Would include but is not restricted to zoning, building, and floodplain permits

Part IV: Attachments

Included

- A. List of Project Site Property Owners
- B. List of Adjoining Property Owners, Lessees, etc.
- C. Delineation of Waters of the U.S., Including Wetlands
- D. Color Photographs
- E. Table of Waters of the U.S. Impacted by the Proposed Project
- F. Alternative(s) Analysis
- G. Required Drawings/Figures
- H. Federally Threatened or Endangered Species Information
- I. Historic Properties and Cultural Resources Information
- J. Conceptual Mitigation Plan
- K. Section 401 Water Quality Certification Information
- L. Other:

End of Form

Attachment D – Color Photographs



Pugh Park Aerial Photograph.

Proposed Boat Ramp Location.

Existing Boat Ramp.

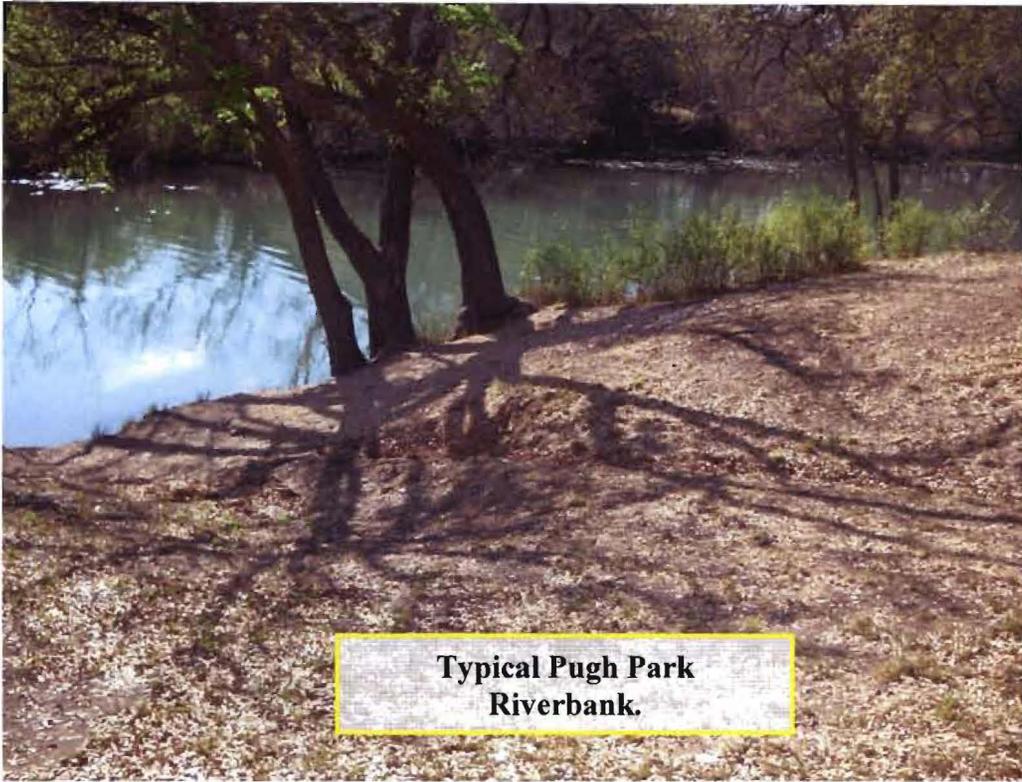
31.186375, -100.497772

Imagery Date: Feb 15, 2010

©2010 Google
31°11'01.45" N 100°28'45.96" W elev. 2048 ft

©2010 Google

Eye alt 4112 ft



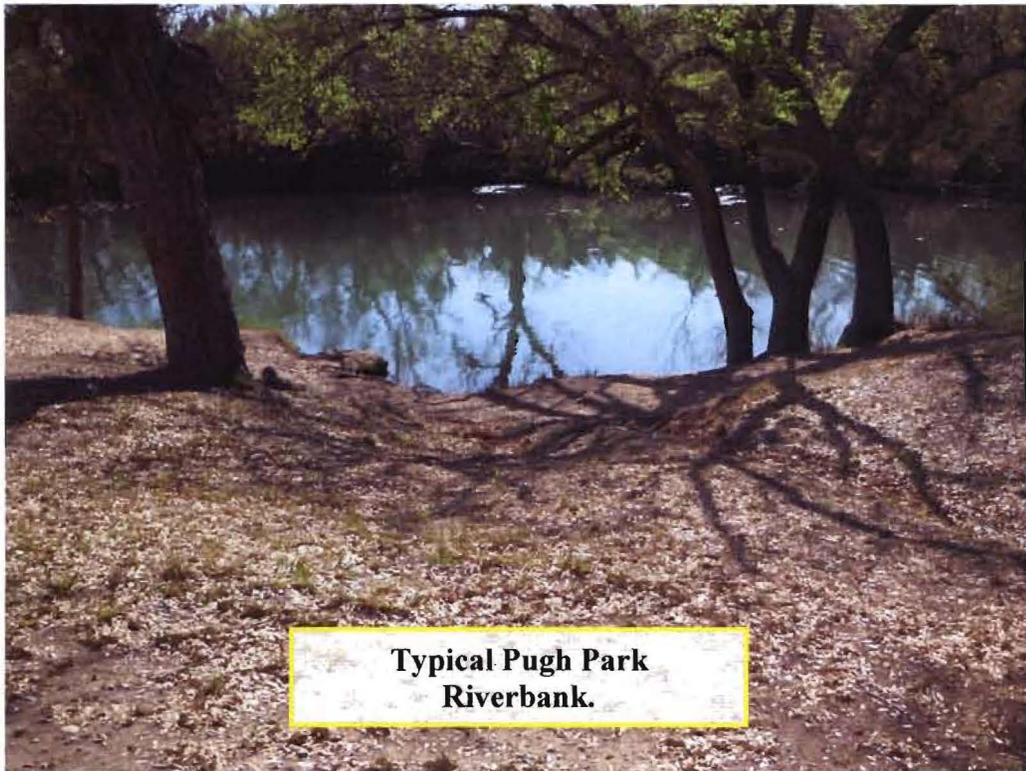
**Typical Pugh Park
Riverbank.**



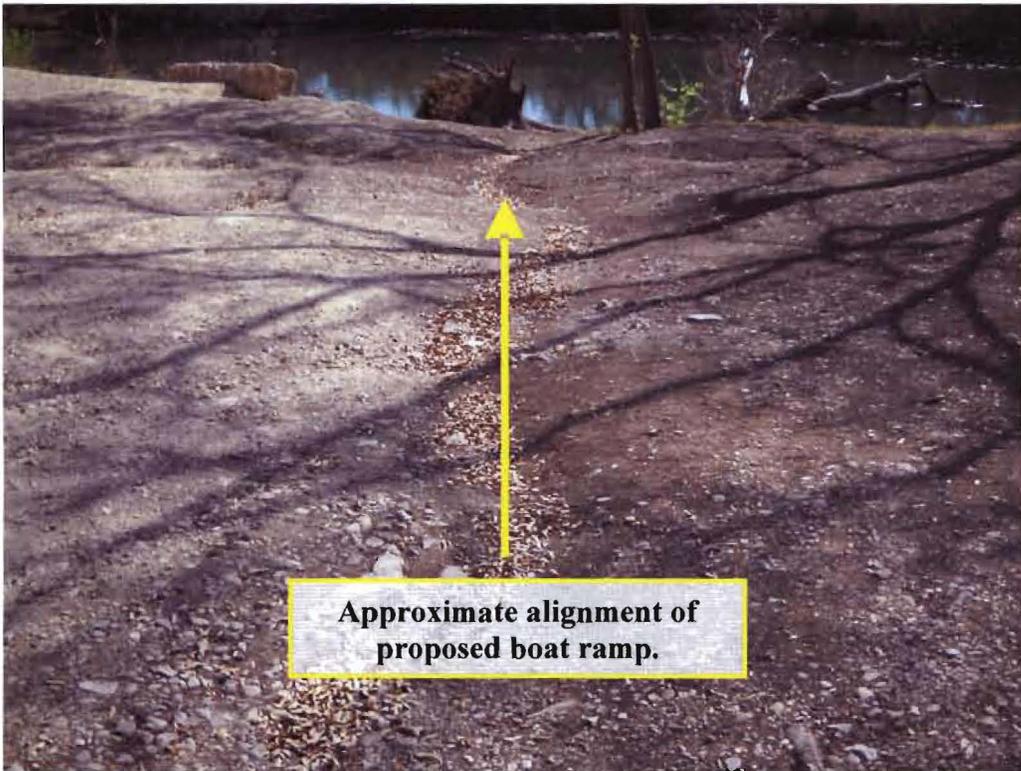
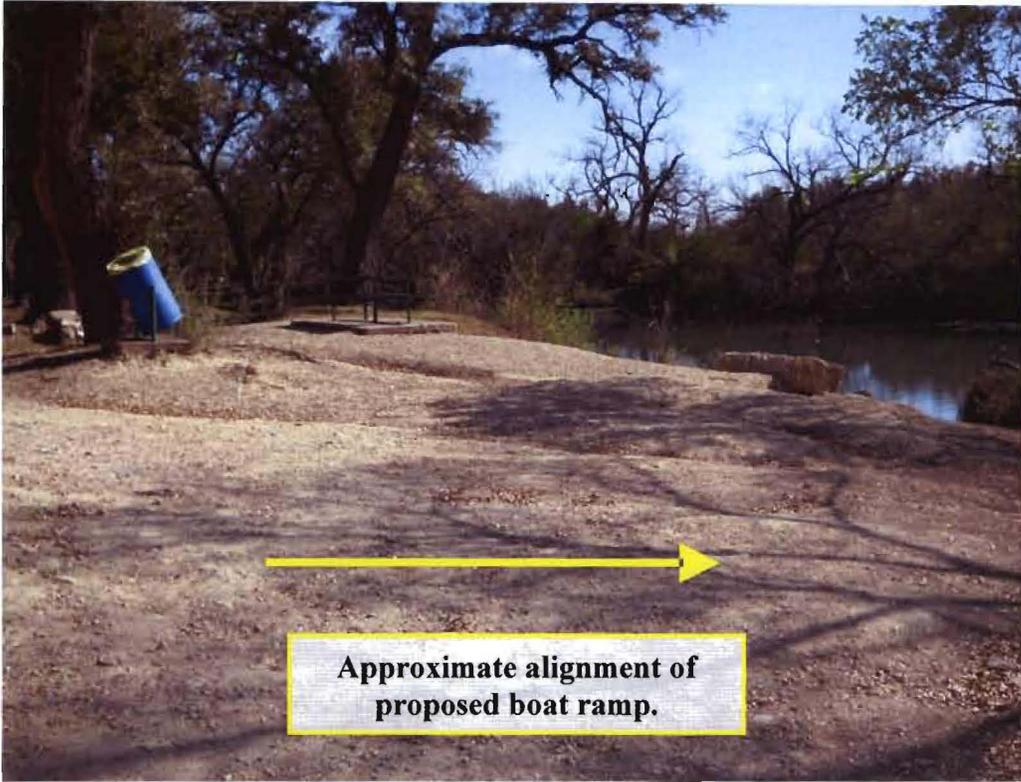
**Fallen Tree and Masonry
Structure to be Removed.**

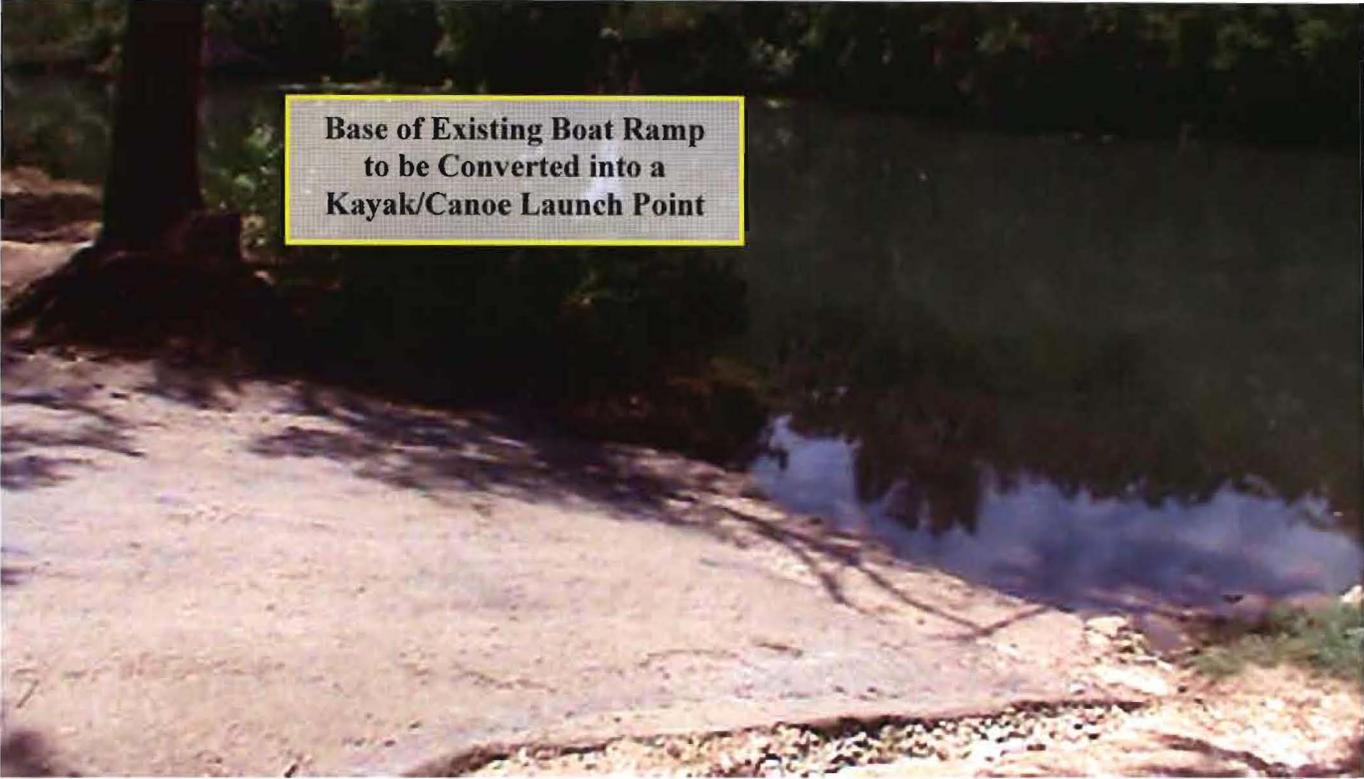


**Typical Pugh Park
Riverbank.**



**Typical Pugh Park
Riverbank.**



A photograph showing the base of an existing boat ramp. The ramp is a concrete structure that meets a body of water. The area is shaded by large trees, and the water is calm, reflecting the surrounding greenery. A yellow-bordered text box is overlaid on the image.

**Base of Existing Boat Ramp
to be Converted into a
Kayak/Canoe Launch Point**

A photograph showing the top of an existing boat ramp. The ramp is a concrete structure that leads up to a grassy area. The area is shaded by large trees, and the sky is visible in the background. A yellow-bordered text box is overlaid on the image.

**Top of Existing Boat Ramp to
be Converted into a
Kayak/Canoe Launch Point**

**Attachment E – Table of Water of the U.S. Impacted by the
Proposed Project**

Attachment G – Required Drawings/Figures

CONSTRUCTION PLANS FOR PUGH PARK BOATING ACCESS IMPROVEMENT PROJECT

ADDRESS:
RANCH ROAD 2084
CHRISTOVAL, TX 76935

PROJECT SUMMARY

SITE No. 1: - CONSTRUCT NEW, PRE-CAST
CONCRETE BOAT RAMP
- INSTALL TWO (2) FLOATING DOCKS

SITE No. 2: - CONVERT EXISTING BOAT RAMP
TO A KAYAK LAUNCH

PARK-WIDE SLOPE STABILIZATION AND EROSION CONTROL

SUBMITTED FOR APPROVAL BY:
NAISMITH ENGINEERING, INC.:
TBPE REGISTERED FIRM No. F-355



ADAM M. LUKE, P.E.
LICENSED PROFESSIONAL ENGINEER NO. 98260
NAISMITH ENGINEERING, INC.
600 WEST 8TH STREET, SUITE 300
AUSTIN, TEXAS 78701
TBPE FIRM REGISTRATION No. F-355
PHONE: (512) 708-9322
FAX: (512) 708-9014

DATE

REVIEWED BY:

MIKE BROWN, COUNTY JUDGE

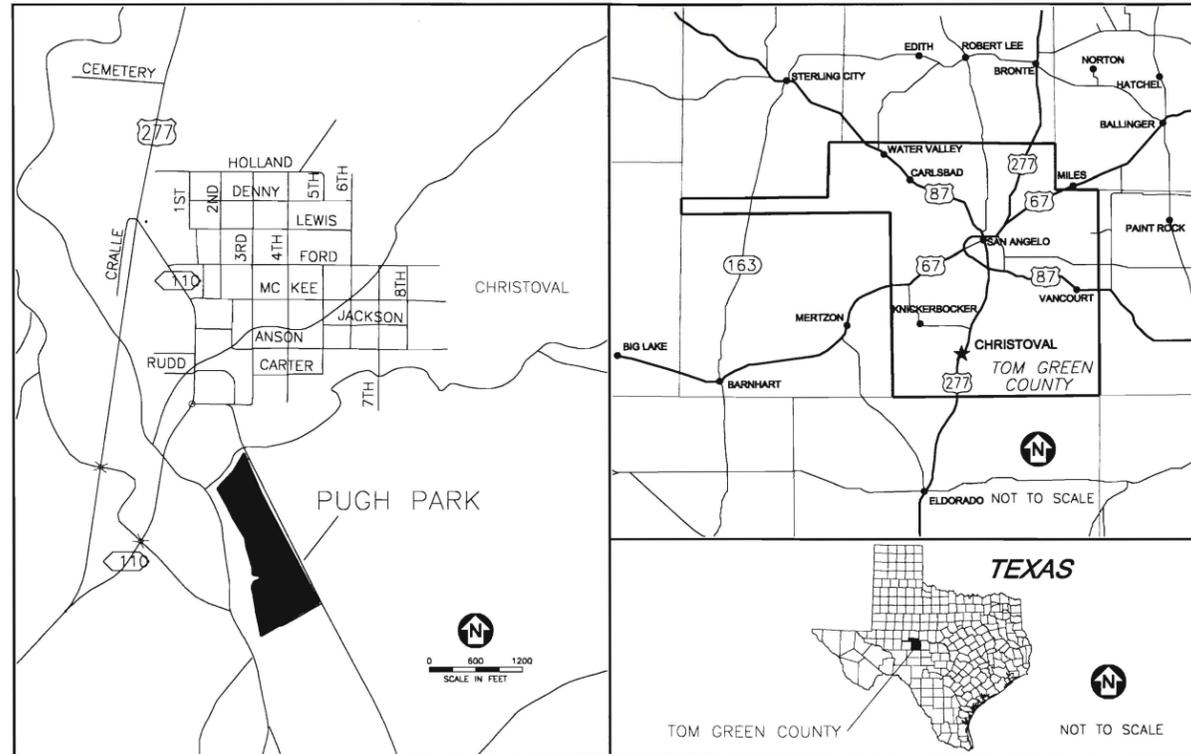
DATE

FLOODPLAIN NOTE:

THIS SITE IS LOCATED WITHIN ZONE AE OF THE 100-YR FLOODPLAIN BASED ON THE WATER SURFACE ELEVATIONS SHOWN ON THE FLOOD INSURANCE RATE MAP (FIRM) FOR TOM GREEN COUNTY, TEXAS NO. 480622 0430B, EFFECTIVE DATE, AUGUST 3, 1992, PREPARED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY.

WATERSHED NOTE:

THIS PROJECT IS LOCATED IN THE SOUTH CONCHO RIVER WATERSHED (TCEQ SEGMENT No. 1421 OF THE CONCHO RIVER BASIN).



SITE LOCATION MAP

TOM GREEN COUNTY COMMISSIONERS COURT:

COUNTY JUDGE	HONORABLE MIKE BROWN
PRECINCT 1 COMMISSIONER	RALPH HOELSCHER
PRECINCT 2 COMMISSIONER	AUBREY DeCORDOVA
PRECINCT 3 COMMISSIONER	STEVE FLOYD
PRECINCT 4 COMMISSIONER	YANTIS GREEN

Prepared by:



600 WEST 8TH STREET, STE 300, AUSTIN, TEXAS 78701
PHONE: (512) 708-9322 FAX: (512) 708-9014
TBPE No. F-355
NEI PROJECT No. 8545

INDEX OF DRAWINGS

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7	SLOPE STABILIZATION AND EROSION CONTROL
8	DETAILS



OWNER:

TOM GREEN COUNTY
112 WEST BEAUREGARD
SAN ANGELO, TEXAS 76903
(325) 659-6569

SHEET 1 of 8

NO.	REVISION	SHEET	BY	DATE

File: 8545_Cov.dwg DATE: 06/10/11

GENERAL CONSTRUCTION PLAN NOTES:

GENERAL NOTES:

- ALL CONSTRUCTION IS REQUIRED TO BE IN ACCORDANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS.
- PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL CONVEY A PRE-CONSTRUCTION CONFERENCE BETWEEN THE CONSULTING ENGINEER, THE TOM GREEN COUNTY PUBLIC WORKS DEPARTMENT, COUNTY ENGINEER (IF APPROPRIATE), UTILITY COMPANIES WITH SERVICES IN THE AREA, AND ANY OTHER AFFECTED PARTIES. NOTIFY ALL SUCH PARTIES AT LEAST 48 HOURS PRIOR TO THE TIME OF THE CONFERENCE AND 48 HOURS PRIOR TO THE BEGINNING OF CONSTRUCTION.
- THE CONTRACTOR SHALL GIVE THE TOM GREEN COUNTY PUBLIC WORKS DEPARTMENT A MINIMUM OF 48 HOURS NOTICE BEFORE BEGINNING EACH PHASE OF CONSTRUCTION INCLUDING CONNECTION TO EXISTING WATER OR WASTEWATER LINES AND ANY TESTING PHASE.
- NO BLASTING IS ALLOWED.
- MANHOLE FRAMES, COVERS, AND WATER VALVES SHALL BE RAISED TO FINISHED PAVEMENT GRADE BY THE UTILITY CONTRACTOR. ALL UTILITY ADJUSTMENTS SHALL BE COMPLETED PRIOR TO FINAL PAVING CONSTRUCTION.
- CONTRACTOR SHALL VERIFY EXACT DEPTH AND LOCATION OF ALL EXISTING UTILITIES PRIOR TO BEGINNING CONSTRUCTION. ANY DAMAGE TO OR REMOVAL OF EXISTING UTILITIES, DRIVEWAYS, PAVEMENT, CURB AND GUTTER, SIDEWALKS, ETC. SHALL BE REPAIRED TO ORIGINAL OR BETTER CONDITION BY THE CONTRACTOR OR THE UTILITY, AT UTILITIES OPTION, AND SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE BEFORE FINAL ACCEPTANCE OF THE PROJECT BY THE CITY.
- ALL FILL AREAS NOT UNDER PROPOSED ROAD AND OVER ALL UTILITIES, SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY IN ACCORDANCE WITH TEX-113-E METHOD.
- CRUSHED STONE MEETING THE CONTRACT PLANS AND SPECIFICATIONS IS TO BE USED AS BEDDING MATERIAL FOR ALL WATER AND/OR WASTEWATER MAINS.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE AND PROTECT ALL EXISTING UTILITIES SUCH AS GAS LINES, WATER LINES, VALVE BOXES, FIRE HYDRANTS, STRUCTURES, AND OTHER APPURTENANCES THAT LIE WITHIN THE RIGHT-OF-WAY OR EASEMENTS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR ALL UTILITIES, DRIVEWAYS, PAVEMENT, CURB AND GUTTER, SIDEWALKS, FENCES, AND ANY OTHER ITEMS DAMAGED DURING CONSTRUCTION REGARDLESS OF WHETHER ALL ITEMS ARE SHOWN ON THE PLANS AT HIS SOLE EXPENSE. THE LOCATIONS OF EXISTING OVERHEAD AND UNDERGROUND UTILITIES IS APPROXIMATE. IN ADDITION TO NORMAL PRECAUTIONS WHEN EXCAVATING, TAKE EXTRA CAUTION WHEN EXCAVATING WITHIN 25 FEET OF ANY UTILITIES SHOWN ON THE PLANS. THE CONTRACTOR SHALL CONTACT 1-800-DIG-TESS (1-800-344-8377) AND THE TOM GREEN COUNTY PUBLIC WORKS DEPARTMENT FOR UTILITY LOCATION ASSISTANCE.
- ALL CONSTRUCTION ACTIVITIES, INCLUDING ACCESS, EGRESS, TRAVEL, STOCKPILING, ETC. ARE TO BE CONFINED TO AREAS IDENTIFIED BY THE ENGINEER.
- THE CONTRACTOR SHALL FURNISH THE TOM GREEN COUNTY PUBLIC WORKS DEPARTMENT THREE SETS OF "AS-BUILT" PLANS REFLECTING ALL CHANGES MADE IN THE FIELD.
- CONTRACTOR AND HIS EMPLOYEES SHALL NOT ENTER ANY PRIVATE PROPERTY OR STORE ANY EQUIPMENT OR MATERIALS ON PRIVATE PROPERTY UNLESS HE HAS WRITTEN PERMISSION TO BE ON THE PROPERTY.
- REFER TO THE SURVEY CONTROL SHEET FOR HORIZONTAL AND VERTICAL DATUM AVAILABLE AT THE PROJECT SITE.
- THE CONTRACTOR SHALL DISPOSE OF ALL MATERIALS REMOVED WHICH ARE NOT TO BE REINSTALLED OR SALVAGED ON THE PROJECT. DISPOSAL OF MATERIALS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- UNLESS PRIOR PERMISSION IS OBTAINED FROM THE OWNER'S REPRESENTATIVE, THE CONTRACTOR SHALL CONFINE ALL CONSTRUCTION ACTIVITY, STAGING AREAS, ETC., WITHIN THE LIMITS OF CONSTRUCTION.
- ADEQUATE BARRICADES, WARNINGS AND LIGHTING WILL BE EMPLOYED FOR SAFETY AND TRAFFIC FLOW. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE TEXAS MANUAL OF UNIFORM CONTROL DEVICES FOR STREETS AND HIGHWAYS.
- EXCAVATIONS SHALL NOT BE MADE DURING INCLEMENT WEATHER. WATER ACCUMULATION IN EXCAVATIONS EXCEEDING 1 INCH SHALL BE PUMPED OUT BEFORE THE CONCRETE IS PLACED.

MATERIALS:

- ALL CONCRETE PROVIDED SHALL BE TXDOT CLASS "C", 3,600 PSI PORTLAND CEMENT CONCRETE MEETING THE REQUIREMENTS OF TXDOT STANDARD SPECIFICATION NO. 421.
- ALL REINFORCEMENT STEEL BE ASTM A615, GRADE 60 STEEL MEETING THE REQUIREMENTS OF TXDOT STANDARD SPECIFICATION NO. 440.

STREET AND DRAINAGE NOTES:

- ALL TESTING SHALL BE DONE BY AN INDEPENDENT LABORATORY. INITIAL TESTING SHALL BE PAID FOR BY THE OWNER. ANY SUBSEQUENT TESTING OR RETESTING SHALL BE PAID FOR BY THE CONTRACTOR. THE TOM GREEN COUNTY PUBLIC WORKS DEPARTMENT SHALL BE PRESENT DURING ALL TESTS. THE TOM GREEN COUNTY PUBLIC WORKS DEPARTMENT SHALL BE GIVEN A MINIMUM OF 48 HOURS NOTICE PRIOR TO ANY TESTING.
- BACKFILL BEHIND THE CURB SHALL BE COMPACTED TO OBTAIN A MINIMUM OF 95% MAXIMUM DENSITY TO WITHIN 3" OF TOP OF CURB. MATERIAL USED SHALL BE PRIMARILY GRANULAR WITH NO ROCKS LARGER THAN 6" IN THE GREATEST DIMENSION. THE REMAINING 3" SHALL BE CLEAN TOPSOIL FREE FROM ALL CLODS AND SUITABLE FOR SUSTAINING PLANT LIFE.
- DEPTH OF COVER FOR ALL CROSSINGS UNDER PAVEMENT INCLUDING GAS, ELECTRIC, TELEPHONE, CABLE TV, WATER SERVICES, ETC., SHALL BE A MINIMUM OF 36" BELOW SUBGRADE.
- STREET RIGHT-OF-WAYS SHALL BE GRADED AT A SLOPE OF 1/4" PER FOOT TOWARD THE CURB UNLESS OTHERWISE INDICATED. HOWEVER, IN NO CASE SHALL THE WIDTH OF RIGHT-OF-WAY AT 1/4" PER FOOT SLOPE BE LESS THAN 10 FEET UNLESS A SPECIFIC REQUEST FOR AN ALTERNATE GRADING SCHEME IS MADE TO AND ACCEPTED BY THE OWNER.
- BARRICADES BUILT TO THE OWNER STANDARDS SHALL BE CONSTRUCTED ON ALL DEAD-END STREETS AND AS NECESSARY DURING CONSTRUCTION TO MAINTAIN JOB AND PUBLIC SAFETY ACCORDING TO TEXAS DEPARTMENT OF TRANSPORTATION REQUIREMENTS AS DESCRIBED AND SHOWN IN THE BARRICADE AND CONSTRUCTION (BC) STANDARD SHEETS.

TRAFFIC MARKING NOTES:

- ANY METHODS, STREET MARKINGS AND SIGNAGE NECESSARY FOR WARNING MOTORISTS, WARNING PEDESTRIANS OR DIVERTING TRAFFIC DURING CONSTRUCTION SHALL CONFORM TO THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, LATEST EDITION.
- ALL PAVEMENT MARKINGS, MARKERS, PAINT, TRAFFIC BUTTONS, TRAFFIC CONTROLS AND SIGNS SHALL BE INSTALLED IN ACCORDANCE WITH THE TEXAS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION OF HIGHWAYS, STREETS AND BRIDGES AND, THE TEXAS MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, LATEST EDITIONS.

EROSION AND SEDIMENTATION CONTROL NOTES:

- EROSION CONTROL MEASURES, SITE WORK AND RESTORATION WORK SHALL BE IN ACCORDANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS.
- ALL SLOPES SHALL BE SODDED OR SEEDED WITH APPROVED GRASS, GRASS MIXTURES, OR GROUND COVER SUITABLE TO THE AREA AND SEASON IN WHICH THEY ARE APPLIED.
- SILT FENCES, ROCK BERMS, SEDIMENTATION BASINS AND SIMILARLY RECOGNIZED TECHNIQUES AND MATERIALS SHALL BE EMPLOYED DURING CONSTRUCTION TO PREVENT POINT SOURCE SEDIMENTATION LOADING OF DOWNSTREAM FACILITIES. SUCH INSTALLATION MAY BE REGULARLY INSPECTED FOR EFFECTIVENESS. ADDITIONAL MEASURES MAY BE REQUIRED IF, IN THE OPINION OF THE ENGINEER, THEY ARE WARRANTED.
- ALL TEMPORARY EROSION CONTROL MEASURES SHALL NOT BE REMOVED UNTIL FINAL INSPECTION AND APPROVAL OF THE PROJECT BY THE ENGINEER. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN ALL TEMPORARY EROSION CONTROL STRUCTURES AND TO REMOVE EACH STRUCTURE AS APPROVED BY THE TOM GREEN COUNTY PUBLIC WORKS DEPARTMENT.

SIDEWALKS, RAMPS AND TDLR ACCESSIBILITY REQUIREMENTS:

- ALL SIDEWALK SHALL BE A MINIMUM OF 4" THICK. SEE DETAILS FOR SUBGRADE PREPARATION, REINFORCING, JOINT PATTERNS AND OTHER INFORMATION.
- THE FOLLOWING GENERAL TEXAS DEPARTMENT OF LICENSING AND REGULATION (TDLR) CRITERIA APPLY TO MANEUVERING SURFACES AT DOORS, ENTRIES, PORCHES, RAMP LANDINGS, PARKING AREAS, WALKWAYS AND PAVEMENT WHICH ARE PART OF A REQUIRED ACCESSIBLE ROUTE OR ENTRY/EXIT.
 - THE REQUIRED CLEAR FLOOR SPACE AREA AT ACCESSIBLE ENTRY/EXIT DOORS SHALL NOT HAVE A SLOPE THAT EXCEEDS 1:50 (2%) IN ANY DIRECTION.
 - CROSS SLOPE FOR ACCESSIBLE WALKWAYS SHALL NOT EXCEED 1:50 (2%).
 - RUNNING SLOPE FOR ACCESSIBLE WALKWAYS SHALL NOT EXCEED 1:20 (5%).
 - PAVEMENT SURFACES THAT ARE PART OF A REQUIRED ACCESSIBLE ROUTE SHALL NOT EXCEED 1:50 (2%) CROSS SLOPE AND 1:20 (5%) RUNNING SLOPE.
 - CHANGES IN GRADE IN ACCESSIBLE ROUTES GREATER THAN 1:20 (5%) REQUIRE A RAMP.
 - ABRUPT CHANGES IN LEVEL IN EXCESS OF 1/4" ARE NOT PERMITTED.
- ACCESSIBLE ROUTE ELEVATIONS INDICATED ON THE GRADING PLAN ARE SCHEMATIC, AND ARE INTENDED TO COMPLY IN ALL RESPECTS WITH TDLR REQUIREMENTS. THE CONTRACTOR IS TO ADJUST GRADES AS NECESSARY TO FIT PARTICULAR CONDITIONS. NOTIFY ENGINEER AND REQUEST INSTRUCTIONS IF NON-COMPLIANT SITUATIONS ARE ENCOUNTERED OR ANTICIPATED.

SITE EXCAVATION, FILLING AND GRADING:

- COMPLETELY REMOVE ALL TREES, SHRUBS, AND STUMPS FROM THE CONSTRUCTION AREA AS IDENTIFIED ON THE GRADING PLAN. REMOVE ALL CONCRETE SLABS, CONCRETE WALLS, FOUNDATIONS, BRUSH PILES, ETC. ON THE SITE AS REQUIRED TO PROPERLY CONSTRUCT THE PROJECT.
- BEFORE EXCAVATION IS BEGUN, STRIP THE TOP 12" OF TOPSOIL FROM AREAS TO BE EXCAVATED OR OCCUPIED BY BUILDING, ROADS, WALKS ETC., AND PILE IN DESIGNATED LOCATIONS WHERE IT WILL NOT INTERFERE WITH BUILDING OR UTILITY OPERATIONS. STRIPPED TOPSOIL SHALL BE FREE FROM LARGE STONES AND DEBRIS. USE TOPSOIL FOR FINISH GRADING. EXCESS TOPSOIL MAY BE USED FOR COMMON SITE FILLS IF AN ADEQUATE STOCKPILE IS RETAINED FOR FINISH GRADING.
- ALL EXCAVATION IS TO BE UNCLASSIFIED; I.E., THE REMOVAL OF ALL MATERIALS AS ENCOUNTERED, WITH NO ADDITIONAL PAYMENTS FOR ROCK EXCAVATION EXCEPT FOR CHANGES IN WORK FROM THAT SHOWN ON THE CONTRACT DRAWINGS.
- PERFORM EXCAVATION OF EVERY TYPE OF MATERIAL ENCOUNTERED WITHIN THE LIMITS OF THE PROJECT, TO THE LINES, GRADES AND ELEVATIONS INDICATED AND AS SPECIFIED HEREIN. PERFORM EXCAVATION AND FILLING IN A MANNER AND SEQUENCE THAT WILL PROVIDE DRAINAGE AT ALL TIMES.
- KEEP ALL EXCAVATIONS DRY BY DIVERTING OR PUMPING SEEPAGE OR SURFACE WATER FROM EXCAVATIONS.
- COMPLETE ALL GRADING NECESSARY TO BRING THE ENTIRE AREA SHOWN ON THE DRAWINGS TO THE SUBGRADE LEVELS INDICATED ON THE PLANS AND DETAILS. GRADES NOT OTHERWISE INDICATED SHALL BE UNIFORM LEVELS OR SLOPES BETWEEN POINTS WHERE ELEVATIONS ARE GIVEN, OR BETWEEN SUCH POINTS AND EXISTING FINISH GRADES. ROUND OFF ABRUPT CHANGES IN SLOPES.
- THE SITE FILL MATERIAL SHALL BE PLACED IN 8 INCH LOOSE LIFTS, AT A MOISTURE CONTENT WITHIN 2 PERCENT OF OPTIMUM MOISTURE CONTENT, AS DETERMINED BY THE STANDARD PROCTOR METHOD (ASTM D698). THE FILL MATERIAL SHALL BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY, AS DETERMINED BY ASTM D698. THE CONTRACTOR MAY EITHER USE GRANULAR FILL OR CLAY FILL. THE GRANULAR FILL SHALL CONSIST OF WELL GRADED CLEAN SAND WITH A MAXIMUM PARTICLE SIZE OF 1 INCH. THE CLAY FILL SHALL BE FREE OF ORGANICS, TRASH, RUBBLE, OR OTHER DELETERIOUS MATERIALS; AND HAVE NO PARTICLE SIZE GREATER THAN 3 INCHES IN DIAMETER.
- STRIPPING TOP SOIL FROM FILL AREAS IS NOT REQUIRED. BEFORE STARTING THE FIRST LIFT OF FILL, SCARIFY, MOISTURE CONDITION AND COMPACT THE TOP 6" OF EXISTING MATERIAL TO A MINIMUM OF 95% OF STANDARD PROCTOR IN ACCORDANCE WITH ASTM D698 AT MOISTURE CONTENTS -1% TO +3% OF OPTIMUM.

TRENCH SAFETY NOTES:

- IN ACCORDANCE WITH THE LAWS OF THE STATE OF TEXAS (SUBCHAPTER C OF CHAPTER 756 OF THE HEALTH AND SAFETY CODE TITLED "TRENCH SAFETY") AND THE U. S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) REGULATIONS (UNITED STATES DEPARTMENT OF LABOR OSHA RULES 29 CFR PART 1926 - SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION), ALL TRENCHES OVER 5 FEET IN DEPTH IN EITHER HARD OR COMPACT OR SOFT AND UNSTABLE SOIL SHALL BE SLOPED, SHORED, SHEETED, BRACED OR OTHERWISE SUPPORTED. FURTHERMORE, ALL TRENCHES LESS THAN 5 FEET IN DEPTH SHALL ALSO BE EFFECTIVELY PROTECTED WHEN HAZARDOUS GROUND MOVEMENT MAY BE EXPECTED.
- PRIOR TO PERFORMING ANY EXCAVATION ON THE PROJECT, THE CONTRACTOR SHALL SUBMIT TO THE OWNER, AND THE OWNER SHALL ACKNOWLEDGE RECEIPT OF, A TRENCH SAFETY SYSTEM SPECIFICALLY DESIGNED FOR THIS PROJECT AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF TEXAS. A COPY OF THIS TRENCH SAFETY SYSTEM PLAN MUST BE MAINTAINED AT THE PROJECT SITE DURING CONSTRUCTION OF THE PROTECTIVE SYSTEM(S).
- IN ACCORDANCE WITH OSHA REGULATIONS, WHEN EMPLOYEES ARE REQUIRED TO BE IN TRENCHES 4- FEET DEEP OR MORE, ADEQUATE MEANS OF EXIT, SUCH AS A LADDER OR STEPS, MUST BE PROVIDED AND LOCATED SO AS TO REQUIRE NO MORE THAN 25 FEET OF LATERAL TRAVEL.
- IF A TRENCH SAFETY SYSTEM PLAN WAS NOT PREPARED BECAUSE TRENCHES AND/OR EXCAVATIONS WERE ANTICIPATED TO BE LESS THAN 5 FEET IN DEPTH AND DURING CONSTRUCTION IT IS FOUND THAT TRENCHES AND/OR EXCAVATIONS ARE IN FACT 5 FEET OR MORE IN DEPTH OR TRENCHES AND/OR EXCAVATIONS LESS THAN 5 FEET IN DEPTH ARE IN AN AREA WHERE HAZARDOUS GROUND MOVEMENT IS EXPECTED, ALL CONSTRUCTION SHALL CEASE, THE TRENCHED OR EXCAVATED AREA SHALL BE BARRICADED AND THE ENGINEER NOTIFIED IMMEDIATELY. CONSTRUCTION SHALL NOT RESUME UNTIL APPROPRIATE TRENCH SAFETY SYSTEM DETAILS, AS DESIGNED BY A LICENSED PROFESSIONAL ENGINEER LICENSED IN THE STATE OF TEXAS, ARE SUBMITTED BY THE CONTRACTOR TO AND THEIR RECEIPT IS ACKNOWLEDGED BY THE OWNER, AND, A BID ITEM FOR IMPLEMENTATION OF TRENCH SAFETY SYSTEMS IS ADDED TO THE CONTRACT BY CHANGE ORDER.

NOTE FOR COUNTY CONSTRUCTION CREWS/STAFF:
 NOTES INCLUDED ON THIS PLAN SHEET AND THROUGHOUT THIS CONSTRUCTION PLAN SET OFTEN REFER TO THE RESPONSIBILITIES OF THE 'CONTRACTOR'. FOR FORCE ACCOUNT WORK AND ALL CONSTRUCTION TO BE ACCOMPLISHED BY TOM GREEN COUNTY PERSONNEL THE DUTIES AND RESPONSIBILITIES ASSIGNED TO THE 'CONTRACTOR' IN THESE CONSTRUCTION PLANS MUST BE UNDERTAKEN BY THE APPROPRIATE COUNTY STAFF MEMBERS.

NO.	REVISION	BY	DATE

DESIGNED BY:	AML
DRAWN BY:	JBS
CHECKED BY:	AML
APPROVED BY:	AML
DATE DRAWN:	06/22/11

VERIFY SCALE
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 TBPE Registered Firm No. F-355

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 ADAM M. LUKE
 Texas P.E. 98260
 on August 18, 2011.

PUGH PARK BOATING ACCESS IMPROVEMENT PROJECT
 GENERAL CONSTRUCTION PLAN NOTES

JOB NO. 8545
DRAFT
SHEET <u>2</u> of <u>8</u>
DRWG. NO. 8545 B02

VOSS ADDITION
BLOCK 14

PARK ROAD

SOUTH CONCHO RIVER

Tree Survey							
Tree No.	Tree Size	Drip Line	Type	Tree No.	Tree Size	Drip Line	Type
1	12"	20'	Pecan	27	36"	30'	Oak
2	24"	30'	Pecan	28	4'	30'	Oak
3	12"	20'	Pecan	29	2'	30'	Oak
4	12"	20'	Pecan	30	4'	60'	Oak
5	24"	20'	Pecan	31	36"	30'	Oak
6	6'	60'	Oak	32	24"	20'	Unknown
7	12'	15'	Oak	33	36"	30'	Unknown
8	4'	50'	Pecan	34	4'	50'	Pecan
9	36"	30'	Pecan	35	24"	30'	Pecan
10	12"	15'	Pecan	36	36"	15'	Pecan
11	5'	60'	Oak	37	6"	15'	Pecan
12	36"	40'	Oak	38	12"	15'	Pecan
13	24"	20'	Pecan	39	12"	15'	Pecan
14	5'	60'	Oak	40	24"	30'	Pecan
15	4'	30'	Oak	41	12"	20'	Unknown
16	4'	50'	Oak	42	36"	20'	Oak
17	4'	50'	Oak	43	36"	30'	Pecan
18	12"	20'	Pecan	44	4'	50'	Oak
19	12"	15'	Pecan	45	5'	60'	Pecan
20	12"	15'	Pecan	46	36"	50'	Oak
21	12"	15'	Pecan	47	18"	30'	Oak
22	4'	50'	Oak	48	24"	30'	Pecan
23	12"	15'	Unknown	49	24"	50'	Oak
24	4'	30'	Oak	50	36"	20'	Oak
25	5'	60'	Oak	51	36"	20'	Oak
26	6'	50'	Oak	52	36"	40'	Pecan



LEGEND

- 2023 --- APPROXIMATE WATER EDGE
- 2023 --- CONTOUR LINE
- [Hatched Box] BUILDING
- [Stippled Box] CONCRETE

UTILITY LOCATIONS
The underground utilities shown hereon have been located from available field survey information, existing drawings, and from information obtained from third parties. The surveyor makes no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned and makes no guarantee that the underground utilities shown are in the exact location indicated. The surveyor has not physically located the underground utilities.

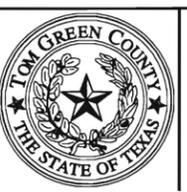
Surveyed on the ground April 7, 2011.
MAP SHOWING A TOPOGRAPHIC SURVEY OF AN AREA OUT OF VOSS ADDITION, BLOCK 14, TOM GREEN COUNTY, TEXAS.

SKG
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www.skge.com
11-S-0383

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DRAWN BY: JBS
CHECKED BY: AML
APPROVED BY: AML
DATE DRAWN: 06/22/11

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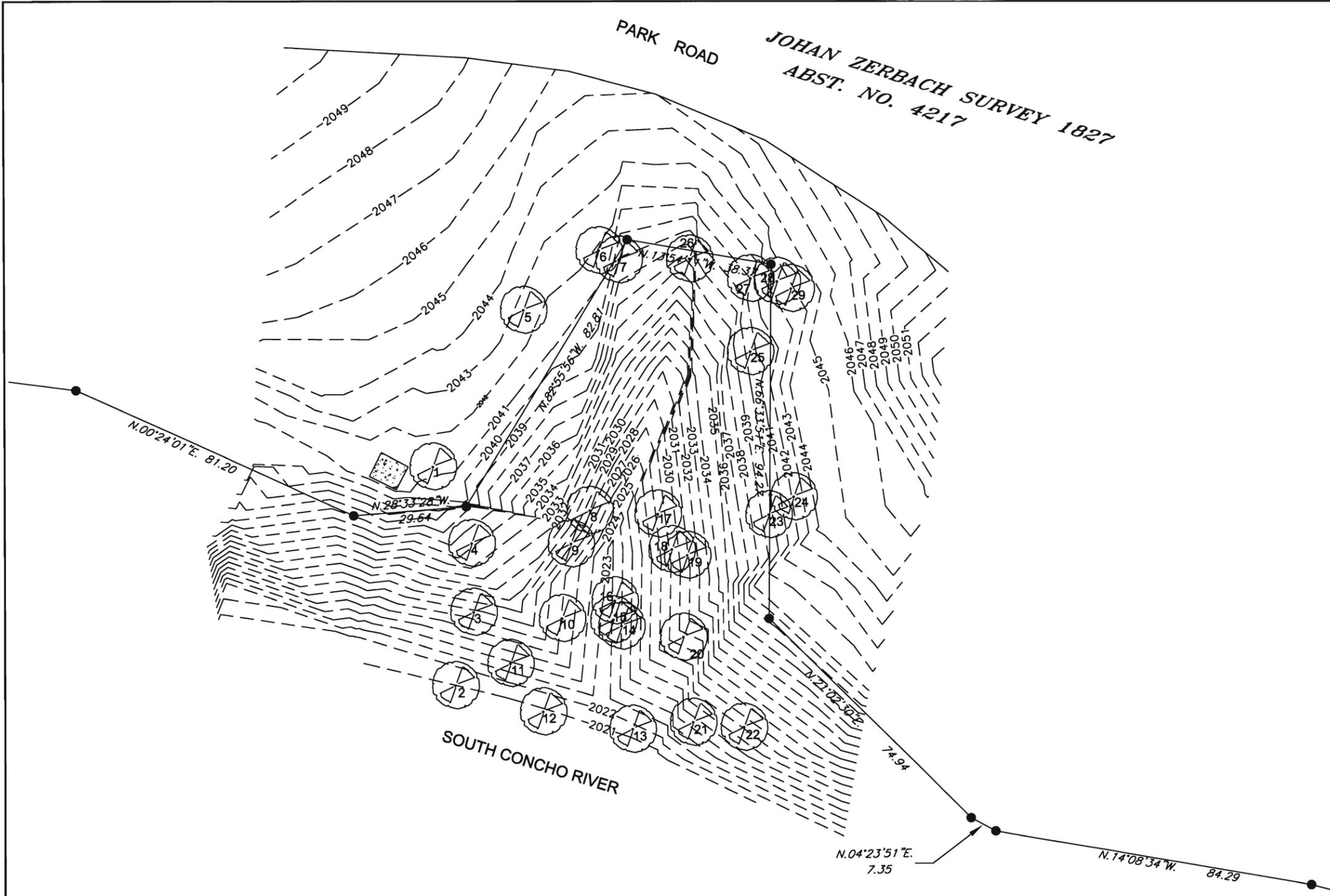
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PUGH PARK BOATING ACCESS
IMPROVEMENT PROJECT

SURVEYED SITE 1

JOB NO. 8545
DRAFT
SHEET 3 OF 8
DRWG. NO. 8545 B03



Tree Survey							
Tree No.	Tree Size	Drip Line	Type	Tree No.	Tree Size	Drip Line	Type
1	12"	15'	Pecan	16	36"	20'	Oak
2	24"	20'	Pecan	17	12"	20'	Pecan
3	24"	20'	Pecan	18	24"	30'	Pecan
4	36"	30'	Oak	19	24"	30'	Pecan
5	12"	15'	Pecan	20	12"	15'	Pecan
6	12"	15'	Pecan	21	24"	20'	Pecan
7	12"	15'	Pecan	22	36"	20'	Oak
8	24"	30'	Pecan	23	24"	20'	Pecan
9	12"	15'	Pecan	24	12"	20'	Pecan
10	24"	30'	Pecan	25	12"	20'	Pecan
11	12"	20'	Pecan	26	12"	12'	Pecan
12	24"	20'	Pecan	27	12"	12'	Pecan
13	24"	20'	Pecan	28	12"	12'	Pecan
14	24"	30'	Pecan	29	12"	12'	Pecan
15	12"	15'	Pecan				



- LEGEND**
- APPROXIMATE WATER EDGE
 - - - 2023 --- CONTOUR LINE
 - [Stippled Box] CONCRETE

UTILITY LOCATIONS
 The underground utilities shown hereon have been located from available field survey information, existing drawings, and from information obtained from third parties. The surveyor makes no guarantee that the underground utilities shown comprise all such utilities in the area, either in service or abandoned and makes no guarantee that the underground utilities shown are in the exact location indicated. The surveyor has not physically located the underground utilities.

Surveyed on the ground April 7, 2011.
 MAP SHOWING A TOPOGRAPHIC SURVEY OF AN AREA OUT OF JOHAN ZERBACH SURVEY 1827, ABST. NO. 4217, TOM GREEN COUNTY, TEXAS.

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NO.	REVISION	BY	DATE

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 CHECKED BY: AML
 APPROVED BY: AML
 DATE DRAWN: 06/23/11

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PUGH PARK BOATING ACCESS
 IMPROVEMENT PROJECT

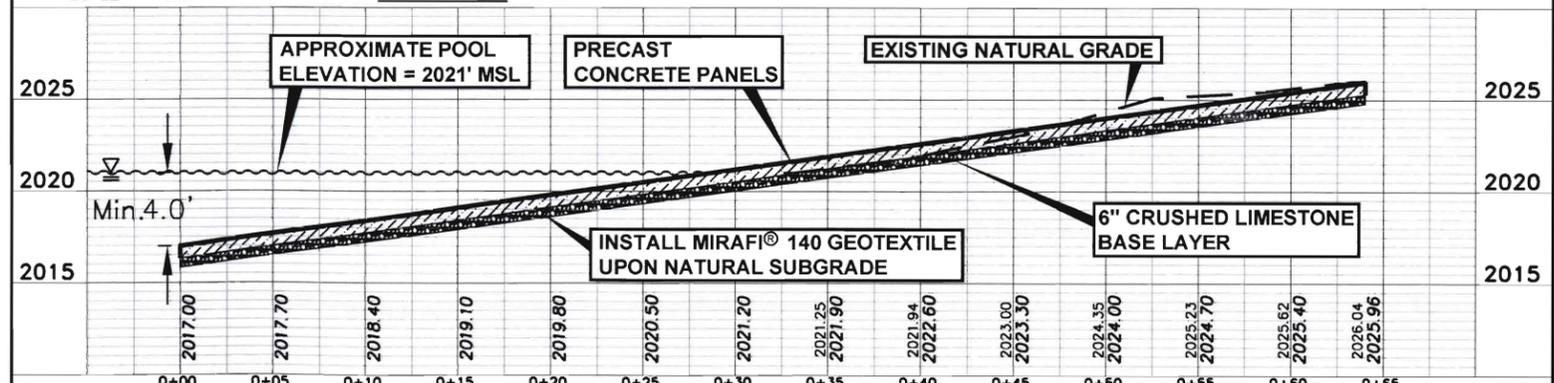
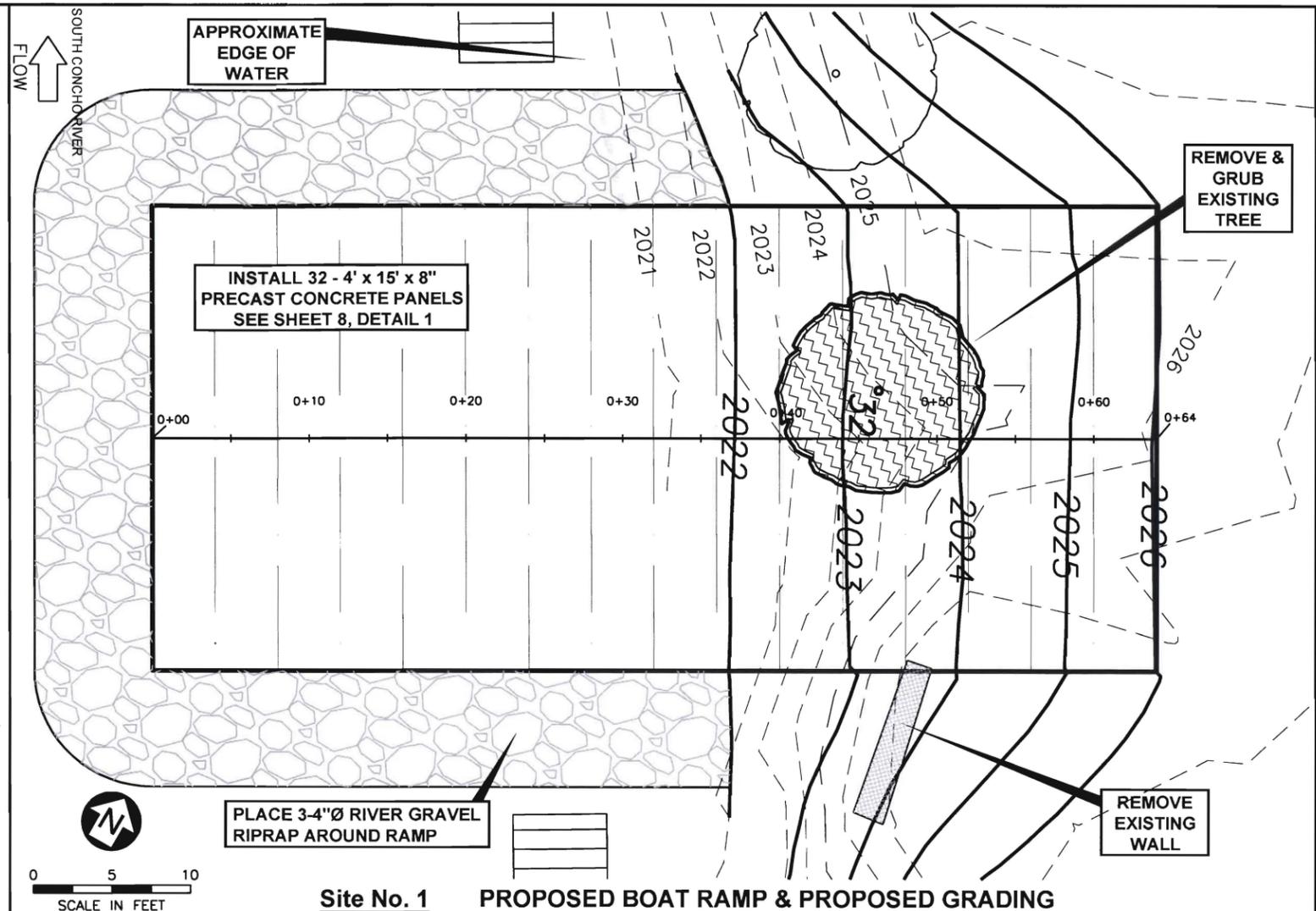
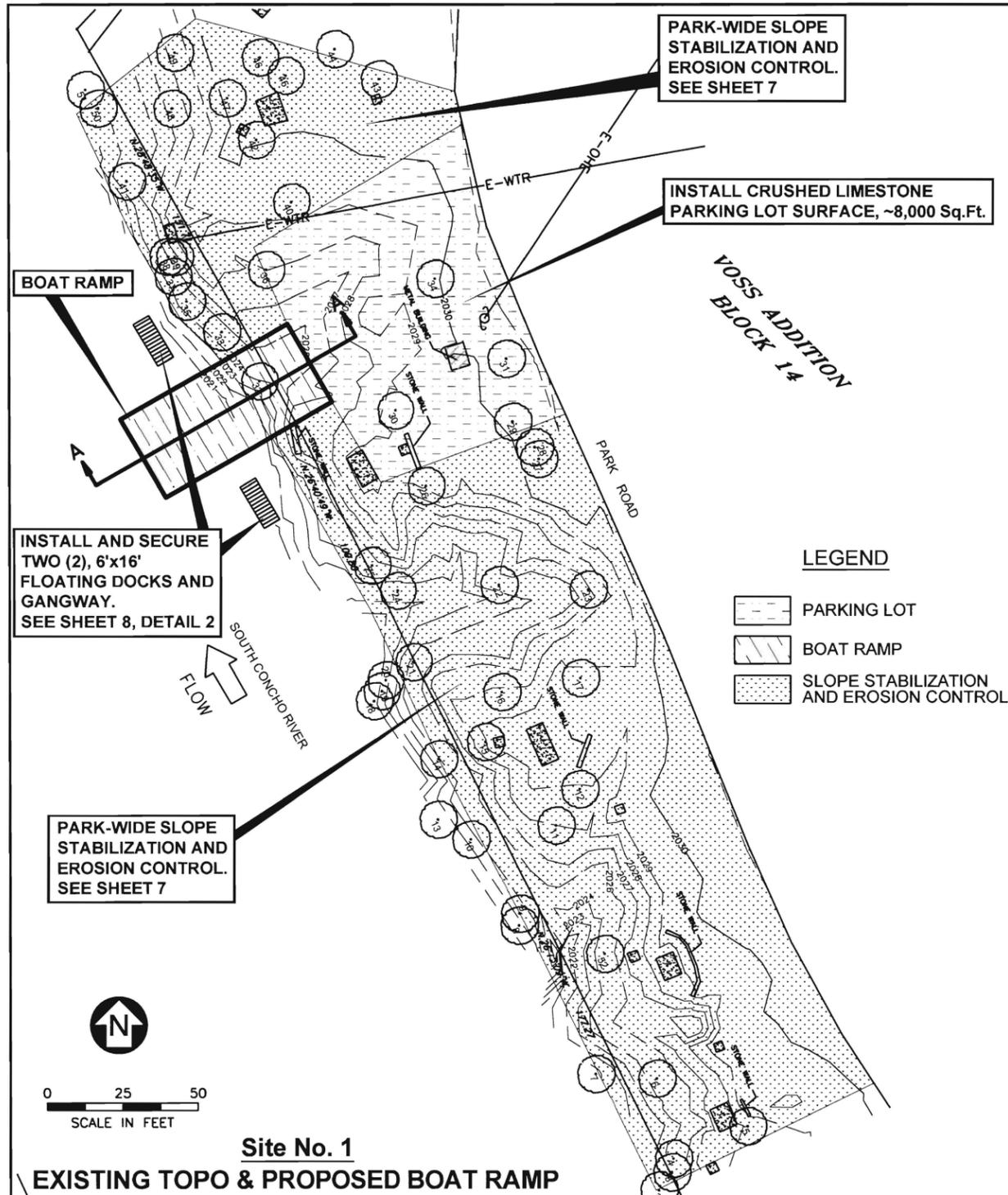
SURVEYED SITE 2

JOB NO. 8545

DRAFT

SHEET 4 of 8

DRWG. NO. 8545 B04



NO.	REVISION	BY	DATE

DESIGNED BY: AMI
 DRAWN BY: JBS
 CHECKED BY: AMI
 APPROVED BY: AMI
 DATE DRAWN: 05/26/11

VERIFY SCALE
 BAR IS ONE INCH ON ORIGINAL DRAWING.
 IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

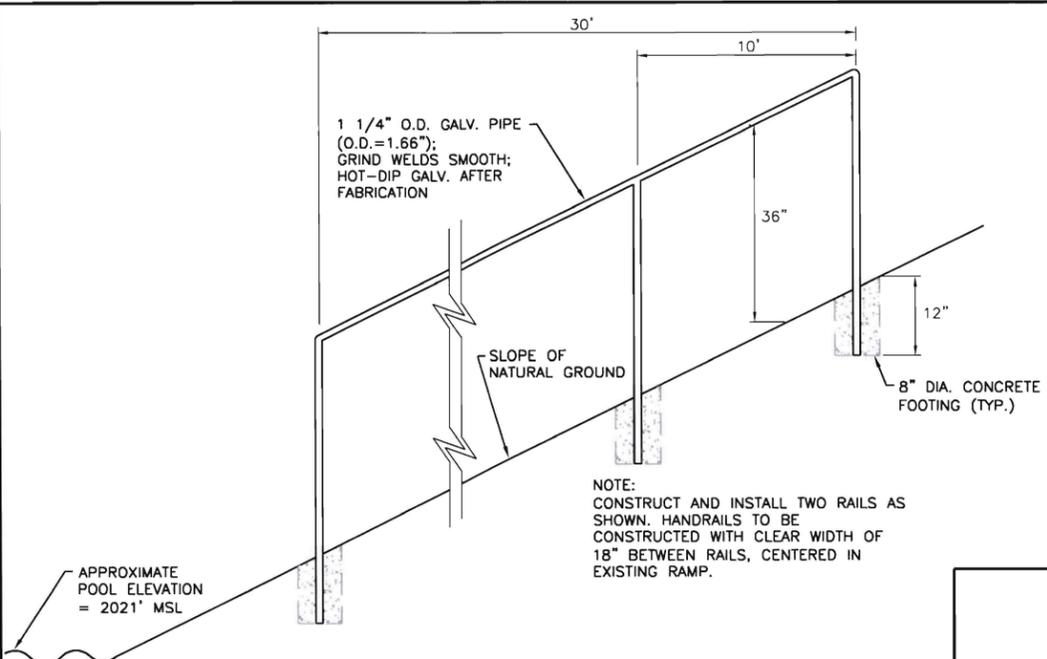


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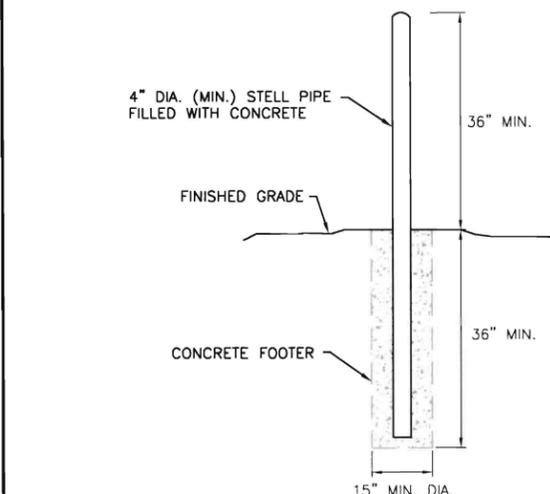
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 ADAM M. LUKE
 Texas P.E. 98260
 on August 18, 2011.

PUGH PARK BOATING ACCESS IMPROVEMENT PROJECT
 EXISTING TOPO, PROPOSED BOAT RAMP, PROPOSED GRADING & PROFILE A-A

JOB NO. 8545
DRAFT
 SHEET 5 of 8
 DRWG. NO. 8545 PP01



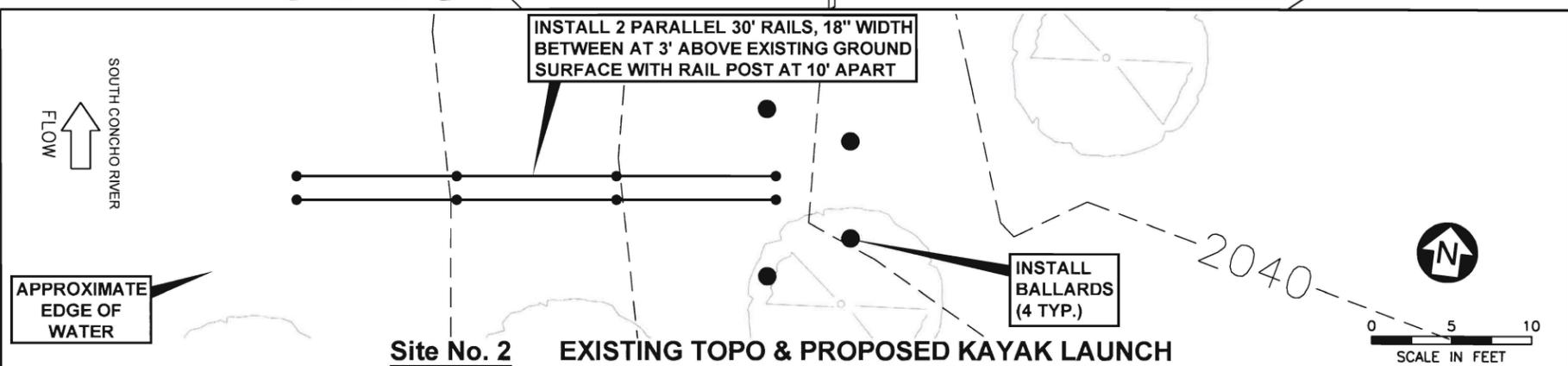
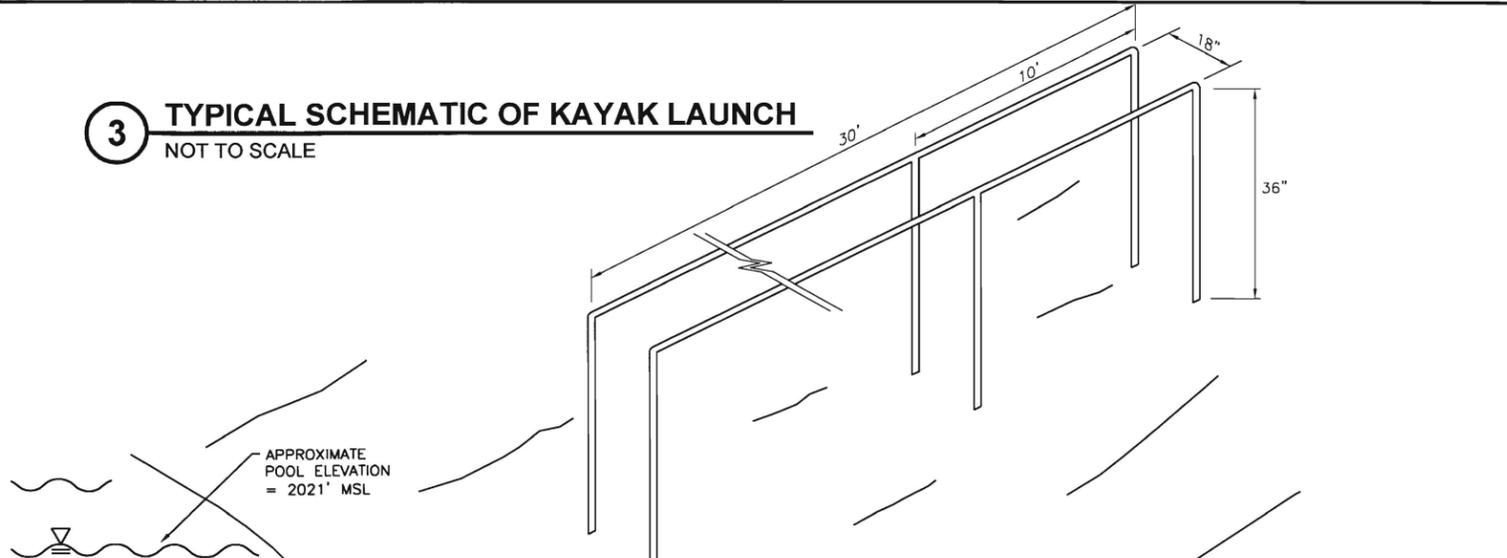
1 **TYPICAL SECTION RAILING DETAIL**
NOT TO SCALE



NOTES:
1. BOLLARDS SHALL BE SPACED NOT MORE THAN 4' O.C.
2. BOLLARDS SHALL BE LOCATED NOT LESS THAN 3' FROM THE PROTECTED OBJECT.

2 **TYPICAL BOLLARD DETAIL**
NOT TO SCALE

3 **TYPICAL SCHEMATIC OF KAYAK LAUNCH**
NOT TO SCALE



NO.	REVISION	BY	DATE

DESIGNED BY: AML
DRAWN BY: RPS
CHECKED BY: AML
APPROVED BY: AML
DATE DRAWN: 07/07/11

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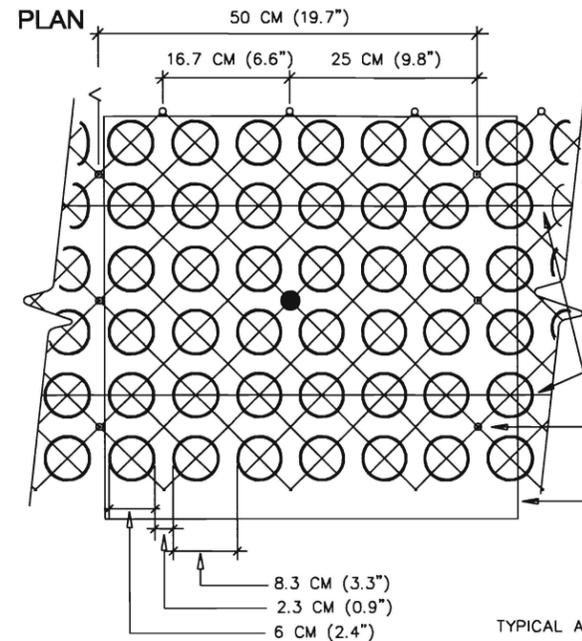


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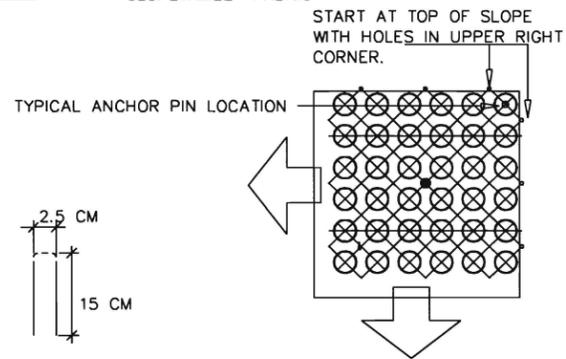
PUGH PARK BOATING ACCESS
IMPROVEMENT PROJECT
EXISTING TOPO, PROPOSED KAYAK LAUNCH,
& PROFILE OF PROPOSED KAYAK LAUNCH

JOB NO. 8545
DRAFT
SHEET 6 OF 8
DRWG. NO. 8545 PP02



SPECIFICATIONS
 UNITS
 UNIT SIZE - 50 CM X 50 CM X 2.5 CM
 (20" X 20" X 1")
 AVAILABLE IN 9 STANDARD ROLL SIZES
 UNIT WEIGHT - 558 GRAMS (19 OZ.)
 OR 2.2 KG (4.8 POUNDS)
 STRENGTH - 402 KG/CM (5720 PSI)
 COLOR - BLACK (STANDARD)
 RESIN - 95% POST-CONSUMER RECYCLED HDPE/LDPE
 FABRIC WEIGHT - 2.25 OZ./SY (76.3 GM/M²)
 TENSILE - 65 x 40 LB/FT (585 KG/M)

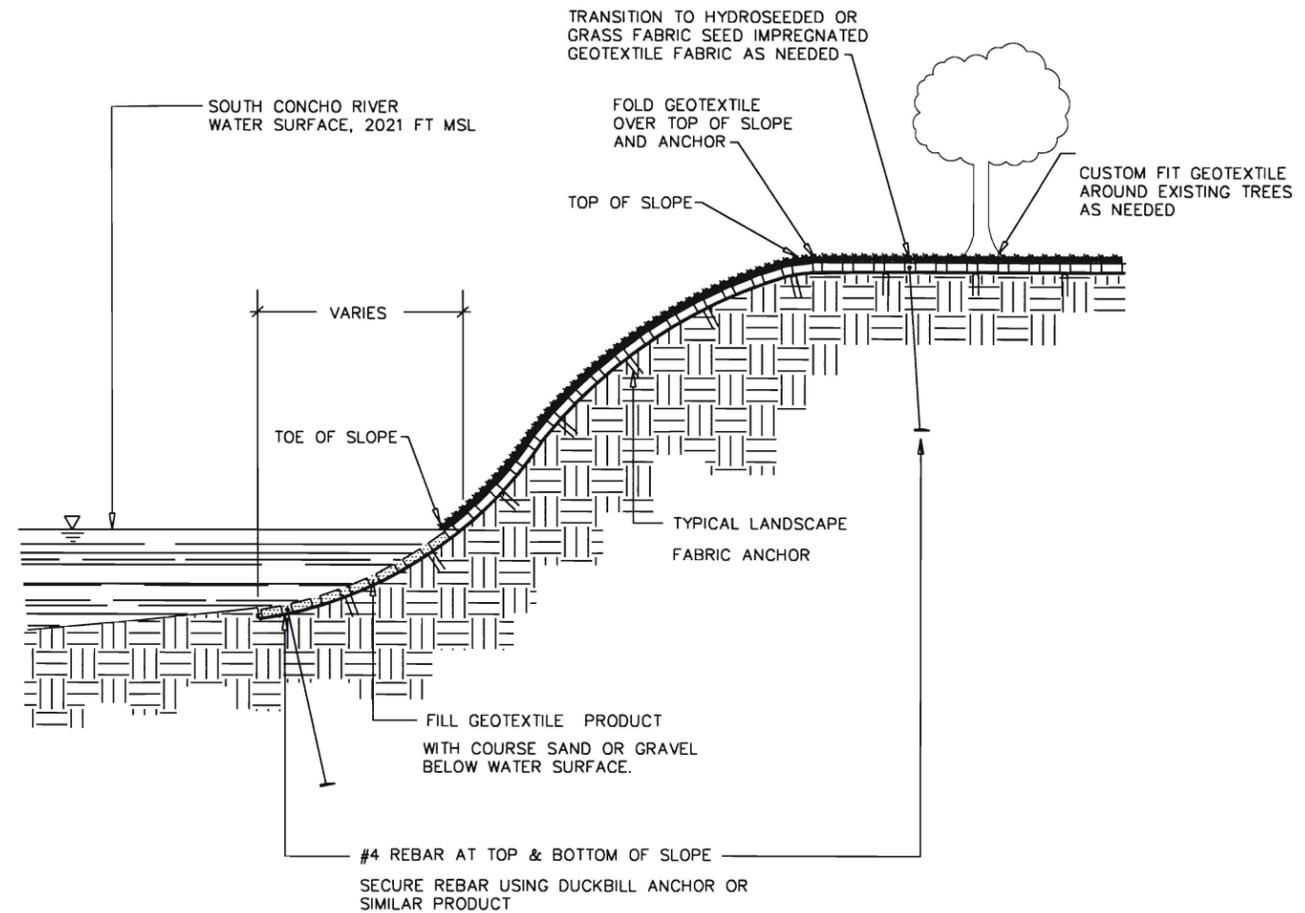
SLOPETAME2 CROSS-BRACING
 SLOPETAME2 UNITS
 SLOPETAME2 FABRIC



TYPICAL ANCHOR PIN

PLACE ROLLS GOING DOWN THE SLOPE WITH CROSS-BRACING RUNNING ACROSS THE SLOPE

NOTE:
 SLOPETAME2 PRODUCT OR ENGINEER APPROVED EQUAL



2 TYPICAL RIVERBANK CROSS-SECTION
 NOT TO SCALE

1 SLOPE STABILIZATION GEOTEXTILE DETAIL
 NOT TO SCALE

NO.	REVISION	BY	DATE

DESIGNED BY: AMI
 DRAWN BY: JBS
 CHECKED BY: AMI
 APPROVED BY: AMI
 DATE DRAWN: 07/08/11

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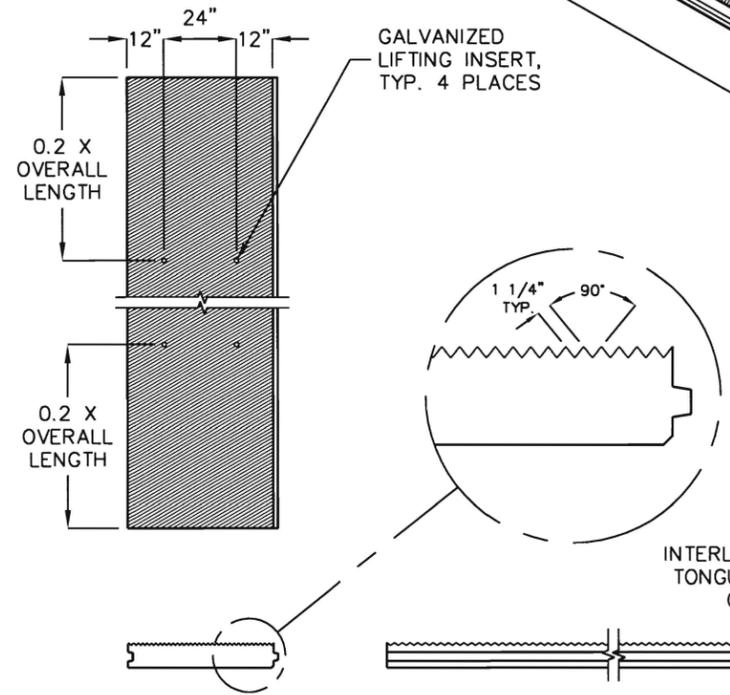
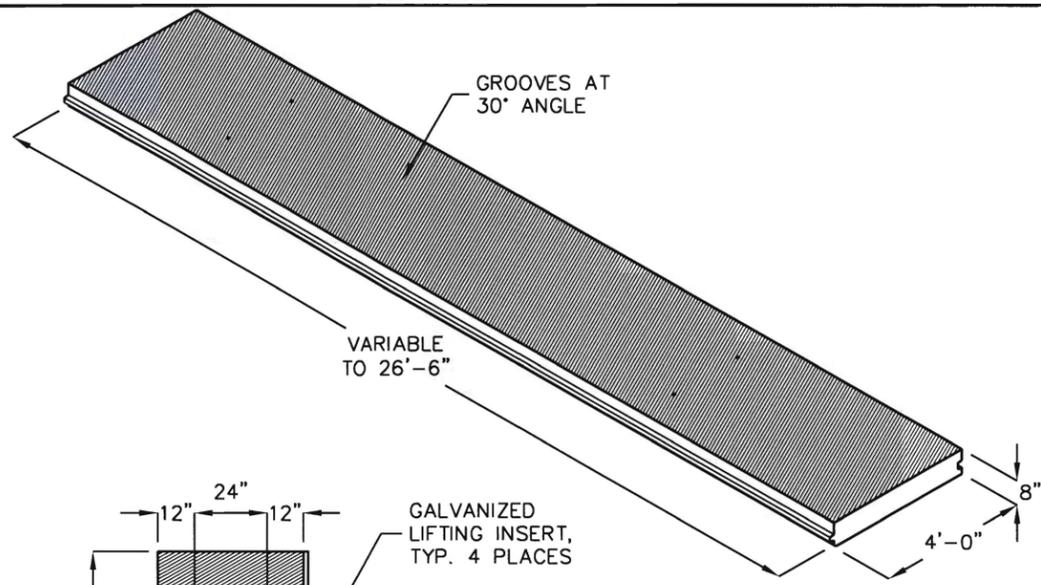


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PUGH PARK BOATING ACCESS IMPROVEMENT PROJECT
 SLOPE STABILIZATION AND EROSION CONTROL

JOB NO. 8545
DRAFT
 SHEET 7 OF 8
 DRWG. NO. 8545 B05



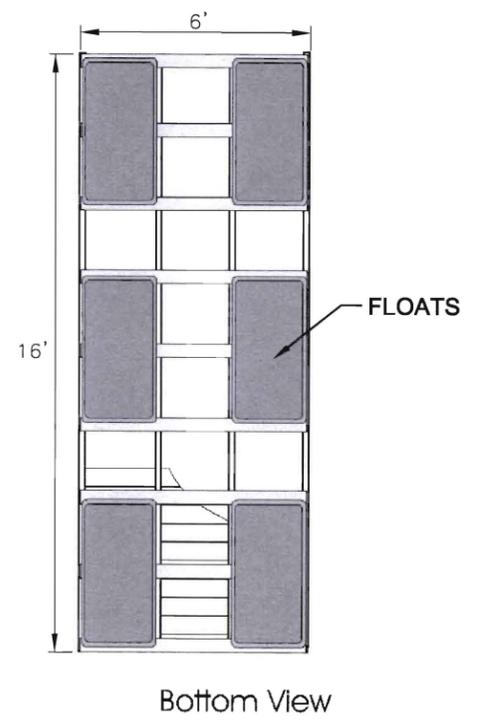
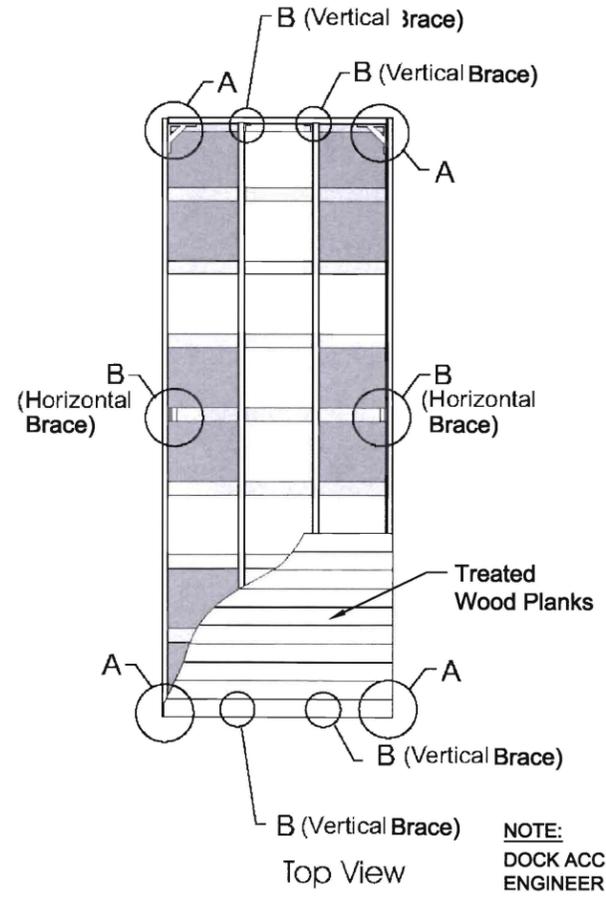
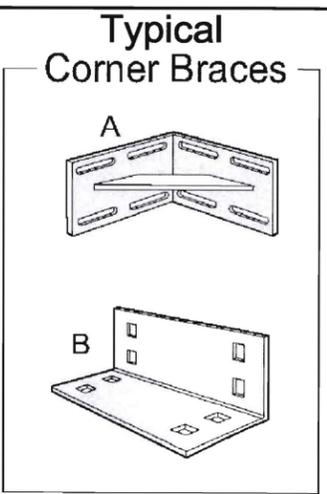
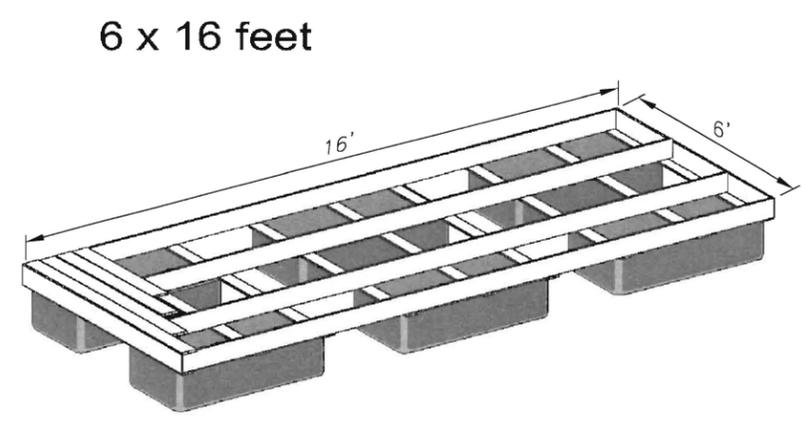
FOR COMPLETE DESIGN AND PRODUCT INFORMATION CONTACT JENSEN PRECAST.

5/30/06
BOAT RAMP_B.dwg
© 2006 Jensen Precast

NOTE:
JENSEN PRECAST, OR
ENGINEER APPROVED EQUAL



1 TYPICAL PRE-CAST BOAT RAMP DETAIL
NOT TO SCALE



NOTE:
DOCK ACCENTS, INC. OR
ENGINEER APPROVED EQUAL

2 TYPICAL FLOATING DOCK DETAIL
NOT TO SCALE

NO.	REVISION	BY	DATE

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DRAWN BY: JRS
CHECKED BY: AMI
APPROVED BY: AMI
DATE DRAWN: 07/08/11

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PUGH PARK BOATING ACCESS IMPROVEMENT PROJECT
DETAILS

JOB NO. 8545
DRAFT
SHEET 8 OF 8
DRWG. NO. 8545 B06

**Attachment K – Section 401 Water Quality Certification
Information**



TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Description of BMPs (Tier I Projects)

EROSION CONTROL BMPs

Temporary Vegetation

Description: Vegetation can be used as a temporary or permanent stabilization technique for areas disturbed by construction. Vegetation effectively reduces erosion in swales, stockpiles, berms, mild to medium slopes, and along roadways. Other techniques such as matting, mulches, and grading may be required to assist in the establishment of vegetation.

Materials:

- The type of temporary vegetation used on a site is a function of the season and the availability of water for irrigation.
- Temporary vegetation should be selected appropriately for the area.
- County agricultural extension agents are a good source for suggestions for temporary vegetation.
- All seed should be high quality, U.S. Dept. of Agriculture certified seed.

Installation:

- Grading must be completed prior to seeding.
- Slopes should be minimized.
- Erosion control structures should be installed.
- Seedbeds should be well pulverized, loose, and uniform.
- Fertilizers should be applied at appropriate rates.
- Seeding rates should be applied as recommended by the county agricultural extension agent.
- The seed should be applied uniformly.
- Steep slopes should be covered with appropriate soil stabilization matting.

Blankets and Matting

Description: Blankets and matting material can be used as an aid to control erosion on critical sites during the establishment period of protective vegetation. The most common uses are in channels, interceptor swales, diversion dikes, short, steep slopes, and on tidal or stream banks.

Materials:

New types of blankets and matting materials are continuously being developed. The Texas Department of Transportation (TxDOT) has defined the critical performance factors for these types of products and has established minimum performance standards which must be met for any product seeking to be approved for use within any of TxDOT's construction or maintenance activities. The products that have been approved by TxDOT are also appropriate for general construction site stabilization. TxDOT maintains a web site at <http://www.dot.state.tx.us/insdot/orgchart/cmd/erosion/contents.htm> which is updated as new products are evaluated.

Installation:

- Install in accordance with the manufacturer's recommendations.
- Proper anchoring of the material.
- Prepare a friable seed bed relatively free from clods and rocks and any foreign material.
- Fertilize and seed in accordance with seeding or other type of planting plan.
- Erosion stops should extend beyond the channel liner to full design cross-section of the channel.
- A uniform trench perpendicular to line of flow may be dug with a spade or a mechanical trencher.
- Erosion stops should be deep enough to penetrate solid material or below level of ruling in sandy soils.
- Erosion stop mats should be wide enough to allow turnover at bottom of trench for stapling, while maintaining the top edge flush with channel surface.

Mulch

Description: Mulching is the process of applying a material to the exposed soil surface to protect it from erosive forces and to conserve soil moisture until plants can become established. When seeding critical sites, sites with adverse soil conditions or seeding on other than optimum seeding dates, mulch material should be applied immediately after seeding. Seeding during optimum seeding dates and with favorable soils and site conditions will not need to be mulched.

Materials:

- Mulch may be small grain straw which should be applied uniformly.
- On slopes 15 percent or greater, a binding chemical must be applied to the surface.
- Wood-fiber or paper-fiber mulch may be applied by hydroseeding.

- Mulch nettings may be used.
- Wood chips may be used where appropriate.

Installation:

Mulch anchoring should be accomplished immediately after mulch placement. This may be done by one of the following methods: peg and twine, mulch netting, mulch anchoring tool, or liquid mulch binders.

Sod

Description: Sod is appropriate for disturbed areas which require immediate vegetative covers, or where sodding is preferred to other means of grass establishment. Locations particularly suited to stabilization with sod are waterways carrying intermittent flow, areas around drop inlets or in grassed swales, and residential or commercial lawns where quick use or aesthetics are factors. Sod is composed of living plants and those plants must receive adequate care in order to provide vegetative stabilization on a disturbed area.

Materials:

- Sod should be machine cut at a uniform soil thickness.
- Pieces of sod should be cut to the supplier's standard width and length.
- Torn or uneven pads are not acceptable.
- Sections of sod should be strong enough to support their own weight and retain their size and shape when suspended from a firm grasp.
- Sod should be harvested, delivered, and installed within a period of 36 hours.

Installation:

- Areas to be sodded should be brought to final grade.
- The surface should be cleared of all trash and debris.
- Fertilize according to soil tests.
- Fertilizer should be worked into the soil.
- Sod should not be cut or laid in excessively wet or dry weather.
- Sod should not be laid on soil surfaces that are frozen.
- During periods of high temperature, the soil should be lightly irrigated.
- The first row of sod should be laid in a straight line with subsequent rows placed parallel to and butting tightly against each other.

- Lateral joints should be staggered to promote more uniform growth and strength.
- Wherever erosion may be a problem, sod should be laid with staggered joints and secured.
- Sod should be installed with the length perpendicular to the slope (on the contour).
- Sod should be rolled or tamped.
- Sod should be irrigated to a sufficient depth.
- Watering should be performed as often as necessary to maintain soil moisture.
- The first mowing should not be attempted until the sod is firmly rooted.
- Not more than one third of the grass leaf should be removed at any one cutting.

Erosion Control Compost

Description: Erosion control compost (ECC) can be used as an aid to control erosion on critical sites during the establishment period of protective vegetation. The most common uses are on steep slopes, swales, diversion dikes, and on tidal or stream banks.

Materials:

New types of erosion control compost are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Material used within any TxDOT construction or maintenance activities must meet material specifications in accordance with current TxDOT specifications. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

ECC used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as an ECC, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for ECC to ensure that the products used will not impact public health, safety, and the environment and to promote production and

marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at http://tmecc.org/sta/STA_program_description.html.

Installation:

- Install in accordance with current TxDOT specification.
- Use on slopes 3:1 or flatter.
- Apply a 2 inch uniform layer unless otherwise shown on the plans or as directed.
- When rolling is specified, use a light corrugated drum roller.

Mulch Filter Berms and Socks

Description: Mulch filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, mulch filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Mulch filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Mulch filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occurs after installation, corrective action must be taken. Mulch filter socks may be installed in construction areas and temporarily moved during the day to allow construction activity provided it is replaced and properly anchored at the end of the day. Mulch filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

Materials:

New types of mulch filter berms and socks are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Mulch filter berms and socks used within any TxDOT construction or maintenance activities must meet material specifications in accordance with current TxDOT specifications. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

Mulch filter berms and socks used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used for mulch filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing

requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for mulch filter berms and socks to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at http://tmecc.org/sta/STA_program_description.html.

Installation:

- Install in accordance with current TxDOT specification.
- Mulch filter berms should be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Mulch filter socks should be in 8 inch, 12 inch or 18 inch or as directed. Sock materials should be designed to allow for proper percolation through.

Compost Filter Berms and Socks

Description: Compost filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, compost filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Compost filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Compost filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occur after installation, corrective action must be taken. Compost filter socks may be installed in construction areas and temporally moved during the day to allow construction activity provided it is replaced and properly anchored at the end of the day. Compost filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

Materials:

New types of compost filter berms and socks are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any

products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Compost filter berms and socks used within any TxDOT construction or maintenance activities must meet material specifications in accordance with TxDOT specification 1059. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

Compost filter berms and socks used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as compost filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for compost filter berms and socks to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at http://tmecc.org/sta/STA_program_description.html.

Installation:

- Install in accordance with TxDOT Special Specification 1059.
- Compost filter berms shall be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Compost filter socks shall be in 8 inch, 12 inch or 18 inch or as directed. Sock materials shall be designed allowing for proper percolation through.

SEDIMENT CONTROL BMPS

Sand Bag Berm

Description: The purpose of a sandbag berm is to detain sediment carried in runoff from disturbed areas. This objective is accomplished by intercepting runoff and causing it to pool behind the sand bag berm. Sediment carried in the runoff is deposited on the upstream side of the sand bag berm due to the reduced flow velocity. Excess runoff volumes are allowed to flow over the top of the sand bag berm. Sand bag berms are used only during construction activities in streambeds when the contributing drainage area is between 5 and 10 acres and the slope is less than 15%, i.e., utility construction in channels, temporary channel crossing for construction equipment, etc. Plastic facing should be installed on the upstream side and the berm should be anchored to the streambed by drilling into the rock and driving in "T" posts or rebar (#5 or #6) spaced appropriately.

Materials:

- The sand bag material should be polypropylene, polyethylene, polyamide or cotton burlap woven fabric, minimum unit weight 4 oz/yd², mullen burst strength exceeding 300 psi and ultraviolet stability exceeding 70 percent.
- The bag length should be 24 to 30 inches, width should be 16 to 18 inches and thickness should be 6 to 8 inches.
- Sandbags should be filled with coarse grade sand and free from deleterious material. All sand should pass through a No. 10 sieve. The filled bag should have an approximate weight of 40 pounds.
- Outlet pipe should be schedule 40 or stronger polyvinyl chloride (PVC) having a nominal internal diameter of 4 inches.

Installation:

- The berm should be a minimum height of 18 inches, measured from the top of the existing ground at the upslope toe to the top of the berm.
- The berm should be sized as shown in the plans but should have a minimum width of 48 inches measured at the bottom of the berm and 16 inches measured at the top of the berm.
- Runoff water should flow over the tops of the sandbags or through 4-inch diameter PVC pipes embedded below the top layer of bags.
- When a sandbag is filled with material, the open end of the sandbag should be stapled or tied with nylon or poly cord.
- Sandbags should be stacked in at least three rows abutting each other, and in staggered arrangement.
- The base of the berm should have at least 3 sandbags. These can be reduced to 2 and 1 bag in the second and third rows respectively.
- For each additional 6 inches of height, an additional sandbag must be added to each row width.
- A bypass pump-around system, or similar alternative, should be used on conjunction with the berm for

effective dewatering of the work area.

Silt Fence

Description: A silt fence is a barrier consisting of geotextile fabric supported by metal posts to prevent soil and sediment loss from a site. When properly used, silt fences can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. If not properly installed, silt fences are not likely to be effective. The purpose of a silt fence is to intercept and detain water-borne sediment from unprotected areas of a limited extent. Silt fence is used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. This fence should remain in place until the disturbed area is permanently stabilized. Silt fence should not be used where there is a concentration of water in a channel or drainage way. If concentrated flow occurs after installation, corrective action must be taken such as placing a rock berm in the areas of concentrated flow. Silt fencing within the site may be temporarily moved during the day to allow construction activity provided it is replaced and properly anchored to the ground at the end of the day. Silt fences on the perimeter of the site or around drainage ways should not be moved at any time.

Materials:

- Silt fence material should be polypropylene, polyethylene or polyamide woven or nonwoven fabric. The fabric width should be 36 inches, with a minimum unit weight of 4.5 oz/yd, mullen burst strength exceeding 190 lb/in², ultraviolet stability exceeding 70%, and minimum apparent opening size of U.S. Sieve No. 30.
- Fence posts should be made of hot rolled steel, at least 4 feet long with Tee or Y-bar cross section, surface painted or galvanized, minimum nominal weight 1.25 lb/ft², and Brindell hardness exceeding 140.
- Woven wire backing to support the fabric should be galvanized 2" x 4" welded wire, 12 gauge minimum.

Installation:

- Steel posts, which support the silt fence, should be installed on a slight angle toward the anticipated runoff source. Post must be embedded a minimum of 1 foot deep and spaced not more than 8 feet on center. Where water concentrates, the maximum spacing should be 6 feet.
- Lay out fencing down-slope of disturbed area, following the contour as closely as possible. The fence should be sited so that the maximum drainage area is ¼ acre/100 feet of fence.
- The toe of the silt fence should be trenched in with a spade or mechanical trencher, so that the down-slope face of the trench is flat and perpendicular to the line of flow. Where fence cannot be trenched in (e.g., pavement or rock outcrop), weight fabric flap with 3 inches of pea gravel on uphill side to prevent flow from seeping under fence.
- The trench must be a minimum of 6 inches deep and 6 inches wide to allow for the silt fence fabric to be laid in the ground and backfilled with compacted material.
- Silt fence should be securely fastened to each steel support post or to woven wire, which is in turn attached to the steel fence post. There should be a 3-foot overlap, securely fastened where ends of fabric meet.

Triangular Filter Dike

Description: The purpose of a triangular sediment filter dike is to intercept and detain water-borne sediment from unprotected areas of limited extent. The triangular sediment filter dike is used where there is no concentration of water in a channel or other drainage way above the barrier and the contributing drainage area is less than one acre. If the uphill slope above the dike exceeds 10%, the length of the slope above the dike should be less than 50 feet. If concentrated flow occurs after installation, corrective action should be taken such as placing rock berm in the areas of concentrated flow. This measure is effective on paved areas where installation of silt fence is not possible or where vehicle access must be maintained. The advantage of these controls is the ease with which they can be moved to allow vehicle traffic and then reinstalled to maintain sediment

Materials:

- Silt fence material should be polypropylene, polyethylene or polyamide woven or nonwoven fabric. The fabric width should be 36 inches, with a minimum unit weight of 4.5 oz/yd, mullen burst strength exceeding 190 lb/in², ultraviolet stability exceeding 70%, and minimum apparent opening size of U.S. Sieve No. 30.
- The dike structure should be 6 gauge 6" x 6" wire mesh folded into triangular form being eighteen (18) inches on each side.

Installation:

- The frame of the triangular sediment filter dike should be constructed of 6" x 6", 6 gauge welded wire mesh, 18 inches per side, and wrapped with geotextile fabric the same composition as that used for silt fences.
- Filter material should lap over ends six (6) inches to cover dike to dike junction; each junction should be secured by shoat rings.
- Position dike parallel to the contours, with the end of each section closely abutting the adjacent sections.
- There are several options for fastening the filter dike to the ground. The fabric skirt may be toed-in with 6 inches of compacted material, or 12 inches of the fabric skirt should extend uphill and be secured with a minimum of 3 inches of open graded rock, or with staples or nails. If these two options are not feasible the dike structure may be trenched in 4 inches.
- Triangular sediment filter dikes should be installed across exposed slopes during construction with ends of the dike tied into existing grades to prevent failure and should intercept no more than one acre of runoff.
- When moved to allow vehicular access, the dikes should be reinstalled as soon as possible, but always at the end of the workday.

Rock Berm

Description: The purpose of a rock berm is to serve as a check dam in areas of concentrated flow, to intercept sediment-laden runoff, detain the sediment and release the water in sheet flow. The rock berm should be used when the contributing drainage area is less than 5 acres. Rock berms are used in areas where the volume of runoff is too great for a silt fence to contain. They are less effective for sediment removal than silt fences, particularly for fine particles, but are able to withstand higher flows than a silt fence. As such, rock berms are often used in areas of channel flows (ditches, gullies, etc.). Rock berms are most effective at reducing bed load in channels and should not be substituted for other erosion and sediment control measures

further up the watershed.

Materials:

- 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.
- 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 rocks may be used.

Installation:

- Lay out the woven wire sheathing perpendicular to the flow line. The sheathing should be 20 gauge woven wire mesh with 1 inch openings.
- Berm should have a top width of 2 feet minimum with side slopes being 2:1 (H:V) or flatter.
- Place the rock along the sheathing to a height not less than 18".
- Wrap the wire sheathing around the rock and secure with tie wire so that the ends of the sheathing overlap at least 2 inches, and the berm retains its shape when walked upon.
- Berm should be built along the contour at zero percent grade or as near as possible.
- 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.

Hay Bale Dike

Description: The purpose of a hay or straw bale dike is to intercept and detain small amounts of sediment-laden runoff from relatively small unprotected areas. Straw bales are to be used when it is not feasible to install other, more effective measures or when the construction phase is expected to last less than 3 months. Straw bales should not be used on areas where rock or other hard surfaces prevent the full and uniform anchoring of the barrier.

Materials:

Straw: The best quality straw mulch comes from wheat, oats or barley and should be free of weed and grass seed which may not be desired vegetation for the area to be protected. Straw mulch is light and therefore must be properly anchored to the ground.

Hay: This is very similar to straw with the exception that it is made of grasses and weeds and not grain stems. This form of mulch is very inexpensive and is widely available but does introduce weed and grass seed to the area. Like straw, hay is light and must be anchored.

- Straw bales should weigh a minimum of 50 pounds and should be at least 30 inches long.

- Bales should be composed entirely of vegetable matter and be free of seeds.
- Binding should be either wire or nylon string, jute or cotton binding is unacceptable. Bales should be used for not more than two months before being replaced.

Installation:

- Bales should be embedded a minimum of 4 inches and securely anchored using 2" x 2" wood stakes or 3/8" diameter rebar driven through the bales into the ground a minimum of 6 inches.
- Bales are to be placed directly adjacent to one another leaving no gap between them.
- All bales should be placed on the contour.
- The first stake in each bale should be angled toward the previously laid bale to force the bales together.

Erosion Control Compost

Description: Erosion control compost (ECC) can be used as an aid to control erosion on critical sites during the establishment period of protective vegetation. The most common uses are on steep slopes, swales, diversion dikes, and on tidal or stream banks.

Materials:

New types of erosion control compost are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Material used within any TxDOT construction or maintenance activities must meet material specifications in accordance with current TxDOT specifications. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

ECC used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as an ECC, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for ECC to ensure that the products used will not impact public health, safety, and the environment and to promote production and

marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at http://tmecc.org/sta/STA_program_description.html.

Installation:

- Install in accordance with current TxDOT specification.
- Use on slopes 3:1 or flatter.
- Apply a 2 inch uniform layer unless otherwise shown on the plans or as directed.
- When rolling is specified, use a light corrugated drum roller.

Mulch Filter Berms and Socks

Description: Mulch filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, mulch filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Mulch filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Mulch filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occurs after installation, corrective action must be taken. Mulch filter socks may be installed in construction areas and temporarily moved during the day to allow construction activity provided it is replaced and properly anchored at the end of the day. Mulch filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

Materials:

New types of mulch filter berms and socks are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Mulch filter berms and socks used within any TxDOT construction or maintenance activities must meet material specifications in accordance with current TxDOT specifications. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

Mulch filter berms and socks used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used for mulch filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing

requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for mulch filter berms and socks to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at http://tmecc.org/sta/STA_program_description.html.

Installation:

- Install in accordance with current TxDOT specification.
- Mulch filter berms should be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Mulch filter socks should be in 8 inch, 12 inch or 18 inch or as directed. Sock materials should be designed to allow for proper percolation through.

Compost Filter Berms and Socks

Description: Compost filter berms and socks are used to intercept and detain sediment laden run-off from unprotected areas. When properly used, compost filter berms and socks can be highly effective at controlling sediment from disturbed areas. They cause runoff to pond which allows heavier solids to settle. Compost filter berms and socks are used during the period of construction near the perimeter of a disturbed area to intercept sediment while allowing water to percolate through. The berm or sock should remain in place until the area is permanently stabilized. Compost filter berms should not be used when there is a concentration of water in a channel or drainage way. If concentrated flows occur after installation, corrective action must be taken. Compost filter socks may be installed in construction areas and temporality moved during the day to allow construction activity provided it is replaced and properly anchored at the end of the day. Compost filter berms and socks may be seeded to allow for quick vegetative growth and reduction in run-off velocity.

Materials:

New types of compost filter berms and socks are continuously being developed. The Texas Department of Transportation (TxDOT) has established minimum performance standards which must be met for any products seeking to be approved for use within any of TxDOT's construction or maintenance activities. Compost filter berms and socks used within any TxDOT construction or maintenance activities must meet material specifications in accordance with TxDOT specification 1059. TxDOT maintains a website at <http://www.dot.state.tx.us/des/landscape/compost/specifications.htm> that provides information on compost specification data. This website also contains information on areas where the Texas Commission on Environmental Quality (TCEQ) restricts the use of certain compost products.

Compost filter berms and socks used for projects not related to TxDOT should also be of quality materials by meeting performance standards and compost specification data. To ensure the quality of compost used as compost filter berms and socks, products should meet all applicable state and federal regulations, including but not limited to the United States Environmental Protection Agency (USEPA) Code of Federal Regulations (CFR), Title 40, Part 503 Standards for Class A biosolids and Texas Natural Resource Conservation Commission (now named TCEQ) Health and Safety Regulations as defined in the Texas Administration Code (TAC), Chapter 332, and all other relevant requirements for compost products outlined in TAC, Chapter 332. Testing requirements required by the TCEQ are defined in TAC Chapter 332, including Sections §332.71 Sampling and Analysis Requirements for Final Products and §332.72 Final Product Grades. Compost specification data approved by TxDOT are appropriate to use for ensuring the use of quality compost materials or for guidance.

Testing standards are dependent upon the intended use for the compost and ensures product safety, and product performance regarding the product's specific use. The appropriate compost sampling and testing protocols included in the United States Composting Council (USCC) Test Methods for the Examination of Composting and Compost (TMECC) should be conducted on compost products used for compost filter berms and socks to ensure that the products used will not impact public health, safety, and the environment and to promote production and marketing of quality composts that meet analytical standards. TMECC is a laboratory manual that provides protocols for the composting industry and test methods for compost analysis. TMECC provides protocols to sample, monitor, and analyze materials during all stages of the composting process. Numerous parameters that might be of concern in compost can be tested by following protocols or test methods listed in TMECC. TMECC information can be found at <http://www.tmecc.org/tmecc/index.html>. The USCC Seal of Testing Assurance (STA) program contains information regarding compost STA certification. STA program information can be found at http://tmecc.org/sta/STA_program_description.html.

Installation:

- Install in accordance with TxDOT Special Specification 1059.
- Compost filter berms shall be constructed at 1-1/2 feet high and 3 foot wide at locations shown on plans.
- Routinely inspect and maintain filter berm in a functional condition at all times. Correct deficiencies immediately. Install additional filter berm material as directed. Remove sediment after it has reached 1/3 of the height of the berm. Disperse filter berm or leave in place as directed.
- Compost filter socks shall be in 8 inch, 12 inch or 18 inch or as directed. Sock materials shall be designed allowing for proper percolation through.

POST-CONSTRUCTION TSS CONTROLS

Retention/Irrigation Systems

Description: Retention/irrigation systems refer to the capture of runoff in a holding pond, then use of the captured water for irrigation of appropriate landscape areas. Retention/irrigation systems are characterized by the capture and disposal of runoff without direct release of captured flow to receiving streams. Retention systems exhibit excellent pollutant removal but can require regular, proper maintenance. Collection of roof runoff for subsequent use (rainwater harvesting) also qualifies as a retention/irrigation practice, but should be operated and sized to provide adequate volume. This technology, which emphasizes beneficial use of stormwater runoff, is particularly appropriate for arid regions because of increasing demands on water supplies for agricultural irrigation and urban water supply.

Design Considerations: Retention/irrigation practices achieve 100% removal efficiency of total suspended solids contained within the volume of water captured. Design elements of retention/irrigation systems include runoff storage facility configuration and sizing, pump and wet well system components, basin lining, basin detention time, and physical and operational components of the irrigation system. Retention/irrigation systems are appropriate for large drainage areas with low to moderate slopes. The retention capacity should be sufficient considering the average rainfall event for the area.

Maintenance Requirements: Maintenance requirements for retention/irrigation systems include routine inspections, sediment removal, mowing, debris and litter removal, erosion control, and nuisance control.

Extended Detention Basin

Description: Extended detention facilities are basins that temporarily store a portion of stormwater runoff following a storm event. Extended detention basins are normally used to remove particulate pollutants and to reduce maximum runoff rates associated with development to their pre-development levels. The water quality benefits are the removal of sediment and buoyant materials. Furthermore, nutrients, heavy metals, toxic materials, and oxygen-demanding materials associated with the particles also are removed. The control of the maximum runoff rates serves to protect drainage channels below the device from erosion and to reduce downstream flooding. Although detention facilities designed for flood control have different design requirements than those used for water quality enhancement, it is possible to achieve these two objectives in a single facility.

Design Considerations: Extended detention basins can remove approximately 75% of the total suspended solids contained within the volume of runoff captured in the basin. Design elements of extended detention basins include basin sizing, basin configuration, basin side slopes, basin lining, inlet/outlet structures, and erosion controls. Extended detention basins are appropriate for large drainage areas with low to moderate slopes. The retention capacity should be sufficient considering the average rainfall event for the area.

Maintenance Requirements: Maintenance requirements for extended detention basins include routine inspections, mowing, debris and litter removal, erosion control, structural repairs, nuisance control, and sediment removal.

Vegetative Filter Strips

Description: Filter strips, also known as vegetated buffer strips, are vegetated sections of land similar to grassy swales, except they are essentially flat with low slopes, and are designed only to accept runoff as

overland sheet flow. They may appear in any vegetated form from grassland to forest, and are designed to intercept upstream flow, lower flow velocity, and spread water out as sheet flow. The dense vegetative cover facilitates conventional pollutant removal through detention, filtration by vegetation, and infiltration.

Filter strips cannot treat high velocity flows, and do not provide enough storage or infiltration to effectively reduce peak discharges to predevelopment levels for design storms. This lack of quantity control favors use in rural or low-density development; however, they can provide water quality benefits even where the impervious cover is as high as 50%. The primary highway application for vegetative filter strips is along rural roadways where runoff that would otherwise discharge directly to a receiving water, passes through the filter strip before entering a conveyance system. Properly designed roadway medians and shoulders make effective buffer strips. These devices also can be used on other types of development where land is available and hydraulic conditions are appropriate. Flat slopes and low to fair permeability of natural subsoil are required for effective performance of filter strips. Although an inexpensive control measure, they are most useful in contributing watershed areas where peak runoff velocities are low, as they are unable to treat the high flow velocities typically associated with high impervious cover. The most important criteria for selection and use of this BMP are soils, space, and slope.

Design Considerations: Vegetative filter strips can remove approximately 85% of the total suspended solids contained within the volume of runoff captured. Design elements of vegetative filter strips include uniform, shallow overland flow across the entire filter strip area, hydraulic loading rate, inlet structures, slope, and vegetative cover. The area should be free of gullies or rills which can concentrate flow. Vegetative filter strips are appropriate for small drainage areas with moderate slopes.

Maintenance Requirements: Maintenance requirements for vegetative filter strips include pest management, seasonal mowing and lawn care, routine inspections, debris and litter removal, sediment removal, and grass reseeding and mulching.

Constructed Wetlands

Description: Constructed wetlands provide physical, chemical, and biological water quality treatment of stormwater runoff. Physical treatment occurs as a result of decreasing flow velocities in the wetland, and is present in the form of evaporation, sedimentation, adsorption, and/or filtration. Chemical processes include chelation, precipitation, and chemical adsorption. Biological processes include decomposition, plant uptake and removal of nutrients, plus biological transformation and degradation. Hydrology is one of the most influential factors in pollutant removal due to its effects on sedimentation, aeration, biological transformation, and adsorption onto bottom sediments.

The wetland should be designed such that a minimum amount of maintenance is required. The natural surroundings, including such things as the potential energy of a stream or flooding river, should be utilized as much as possible. The wetland should approximate a natural situation and unnatural attributes, such as rectangular shape or rigid channel, should be avoided.

Site considerations should include the water table depth, soil/substrate, and space requirements. Because the wetland must have a source of flow, it is desirable that the water table is at or near the surface. If runoff is the only source of inflow for the wetland, the water level often fluctuates and establishment of vegetation may be difficult. The soil or substrate of an artificial wetland should be loose loam to clay. A perennial baseflow must be present to sustain the artificial wetland. The presence of organic material is often helpful in increasing pollutant removal and retention. A greater amount of space is required for a wetland system than is required for a detention facility treating the same amount of area.

Design Considerations: Constructed wetlands can remove over 90% of the total suspended solids contained within the volume of runoff captured in the wetland. Design elements of constructed wetlands include wetland sizing, wetland configuration, sediment forebay, vegetation, outflow structure, depth of inundation during storm events, depth of micropools, and aeration. Constructed wetlands are appropriate for large drainage areas with low to moderate slopes.

Maintenance Requirements: Maintenance requirements for constructed wetlands include mowing, routine inspections, debris and litter removal, erosion control, nuisance control, structural repairs, sediment removal, harvesting, and maintenance of water levels.

Wet Basins

Description: Wet basins are runoff control facilities that maintain a permanent wet pool and a standing crop of emergent littoral vegetation. These facilities may vary in appearance from natural ponds to enlarged, bermed (manmade) sections of drainage systems and may function as online or offline facilities, although offline configuration is preferable. Offline designs can prevent scour and other damage to the wet pond and minimize costly outflow structure elements needed to accommodate extreme runoff events.

During storm events, runoff inflows displace part or all of the existing basin volume and are retained and treated in the facility until the next storm event. The pollutant removal mechanisms are settling of solids, wetland plant uptake, and microbial degradation. When the wet basin is adequately sized, pollutant removal performance can be excellent, especially for the dissolved fraction. Wet basins also help provide erosion protection for the receiving channel by limiting peak flows during larger storm events. Wet basins are often perceived as a positive aesthetic element in a community and offer significant opportunity for creative pond configuration and landscape design. Participation of an experienced wetland designer is suggested. A significant potential drawback for wet ponds in arid climates is that the contributing watershed for these facilities is often incapable of providing an adequate water supply to maintain the permanent pool, especially during the summer months. Makeup water (i.e., well water or municipal drinking water) is sometimes used to supplement the rainfall/runoff process, especially for wet basin facilities treating watersheds that generate insufficient runoff.

Design Considerations: Wet basins can remove over 90% of the total suspended solids contained within the volume of runoff captured in the basin. Design elements of wet basins include basin sizing, basin configuration, basin side slopes, sediment forebay, inflow and outflow structures, vegetation, depth of permanent pool, aeration, and erosion control. Wet basins are appropriate for large drainage areas with low to moderate slopes.

Maintenance Requirements: Maintenance requirements for wet basins include mowing, routine inspections, debris and litter removal, erosion control, nuisance control, structural repairs, sediment removal, and harvesting.