ATHLETICS COMPLEX IMPROVEMENTS AT JARRELL HIGH SCHOOL FOR JARRELL I.S.D.

JARRELL, TEXAS

High School Stormwater Project
Detention and Water Quality Pond

PACKAGE 1 - CIVIL

Revision / Date

Project:
ATHLETICS COMPLEX IMPROVEMENTS
AT JARRELL HIGH SCHOOL
FOR
JARRELL I.S.D.
1100 FM 487, JARRELL, TEXAS 76537

10/28/2021

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COVER SHEET

PACKAGE 1

Job No.	Sheet No.
1836-06-01	G1.01
Drawn By: JMA	
Date: 10/28/2021	

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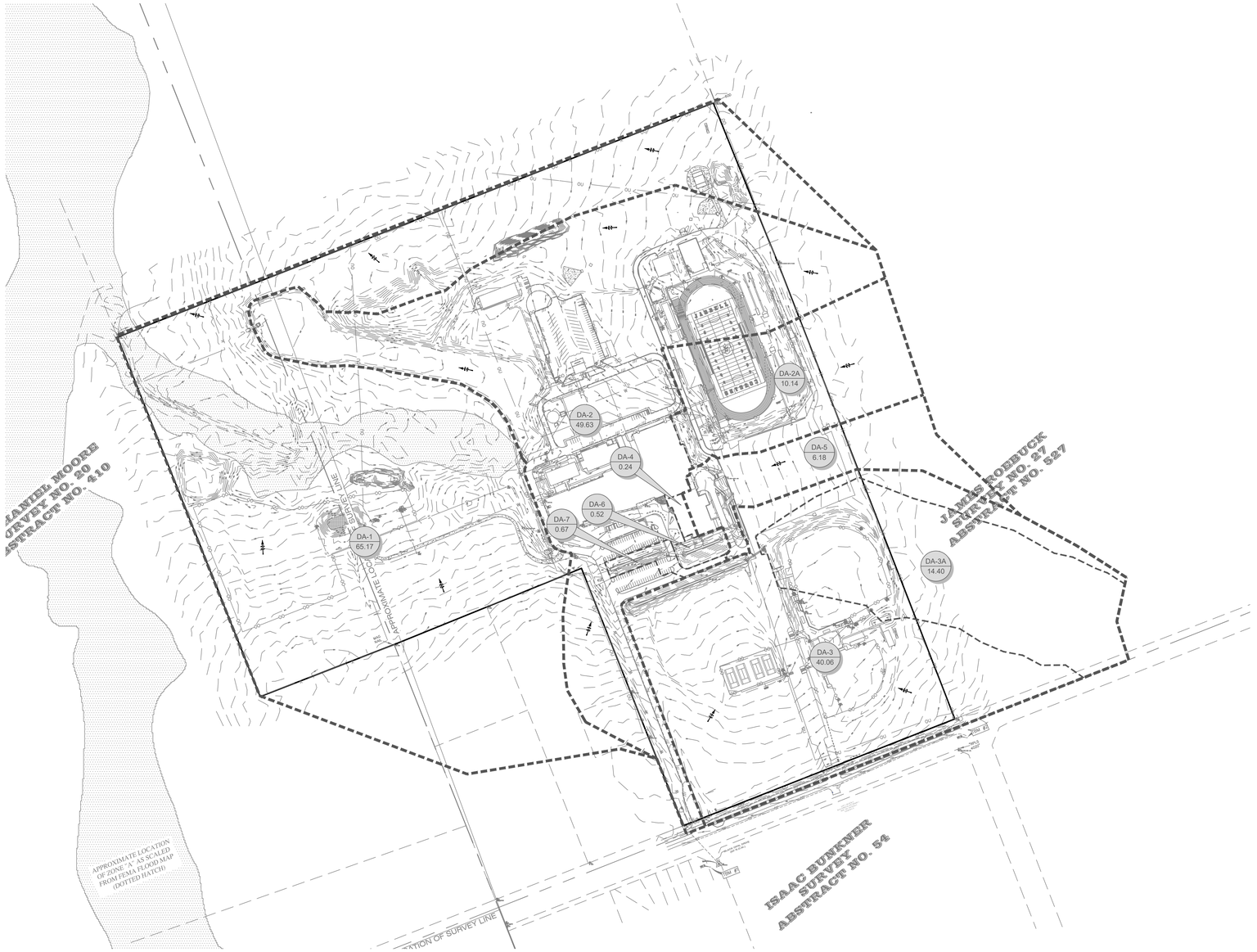

GRAPHIC SCALE

0 200 400 FEET

LEGEND

DRAINAGE BASIN — BASIN NAME / ACRES — DA-00 1.00

DRAINAGE AREA

EXISTING FLOW ARROW

POST-DEVELOPMENT DRAINAGE AREA CALCULATIONS

Drainage Area Designation	Drainage Area	Runoff Coefficient "C"				Time of Concentration	2-Year Rainfall Intensity (I2)	2-Year Peak Discharge (Q2)	10-Year Rainfall Intensity (I10)	10-Year Peak Discharge (Q10)	25-Year Rainfall Intensity (I25)	25-Year Peak Discharge (Q25)	100-Year Rainfall Intensity (I100)	100-Year Peak Discharge (Q100)	
-	(ac)	2-YR	10-YR	25-YR	100-YR	(min)	(in/hr)	(cfs)	(in/hr)	(cfs)	(in/hr)	(cfs)	(in/hr)	(cfs)	Comments
DA-1	65.17	0.35	0.38	0.44	0.51	49	1.97	45.53	3.02	75.69	3.65	105.85	4.85	162.57	Bypasses pond
DA-2	49.63	0.46	0.50	0.56	0.64	30	2.69	61.47	4.07	101.92	4.89	136.53	6.43	203.36	Overland & pipe to ex. pond
DA-2A†	*10.14*	*0.48*	*0.53*	*0.58*	*0.66*	*31*	*2.63*	*12.83*	*3.99*	*21.32*	*4.80*	*26.42*	*6.31*	*42.25*	*Overland and pipe to Pond 4*
DA-3	40.06	0.40	0.44	0.50	0.57	30	2.69	43.31	4.07	71.53	4.89	97.57	6.43	146.81	To Pond 2
DA-3A†	*14.40*	*0.36*	*0.39*	*0.45*	*0.52*	*18*	*3.56*	*18.43*	*5.34*	*30.08*	*6.39*	*41.47*	*8.27*	*62.06*	*Overland and pipe to Pond 2*
DA-4	0.24	0.75	0.83	0.88	0.97	10	4.62	0.83	6.89	1.38	8.19	1.74	10.40	2.43	To Pond 1
DA-5	6.18	0.55	0.60	0.65	0.73	20	3.37	11.36	5.07	18.78	6.07	24.56	7.88	35.77	To Pond 4
DA-6	0.52	0.75	0.83	0.88	0.97	10	4.62	1.82	6.89	3.00	8.19	3.78	10.40	5.29	To Pond 3
DA-7	0.67	0.75	0.83	0.88	0.97	10	4.62	2.32	6.89	3.84	8.19	4.83	10.40	6.76	To Pond 1
TOTAL	162.49							166.64		276.13		374.85		562.99	

† These areas are subcatchments to show flow to key points. These areas are not subtracted from the parent catchments.

!!!CAUTION!!!
EXISTING OVERHEAD & UNDERGROUND UTILITIES IN THE VICINITY.
VERIFY LOCATION OF EXISTING UNDERGROUND UTILITIES
BY VACUUM EXCAVATION OR OTHER POTHOLING TECHNIQUES.

811 Know what's below. Call before you dig.

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LANGAN | Adams

STATE OF TEXAS
JACK H. GARNER JR.
98447
LICENSED
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TBPE Registration #: F- 13,709

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PACKAGE 1

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Date: 10/28/2021
Sheet No. C3.01

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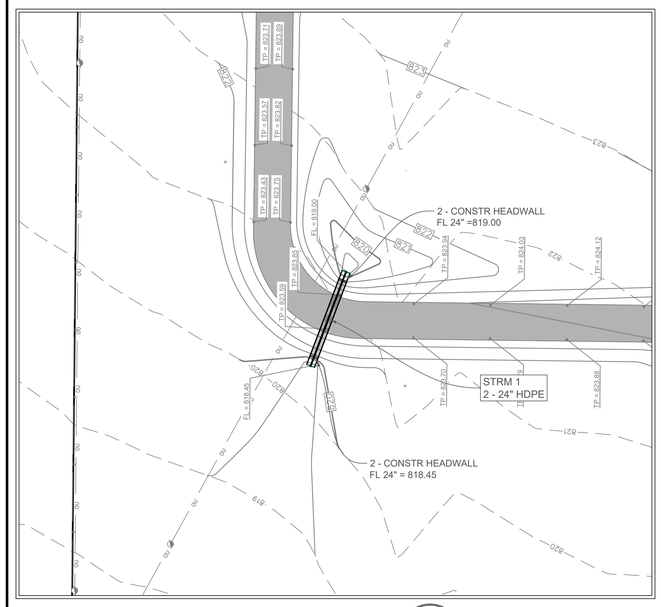
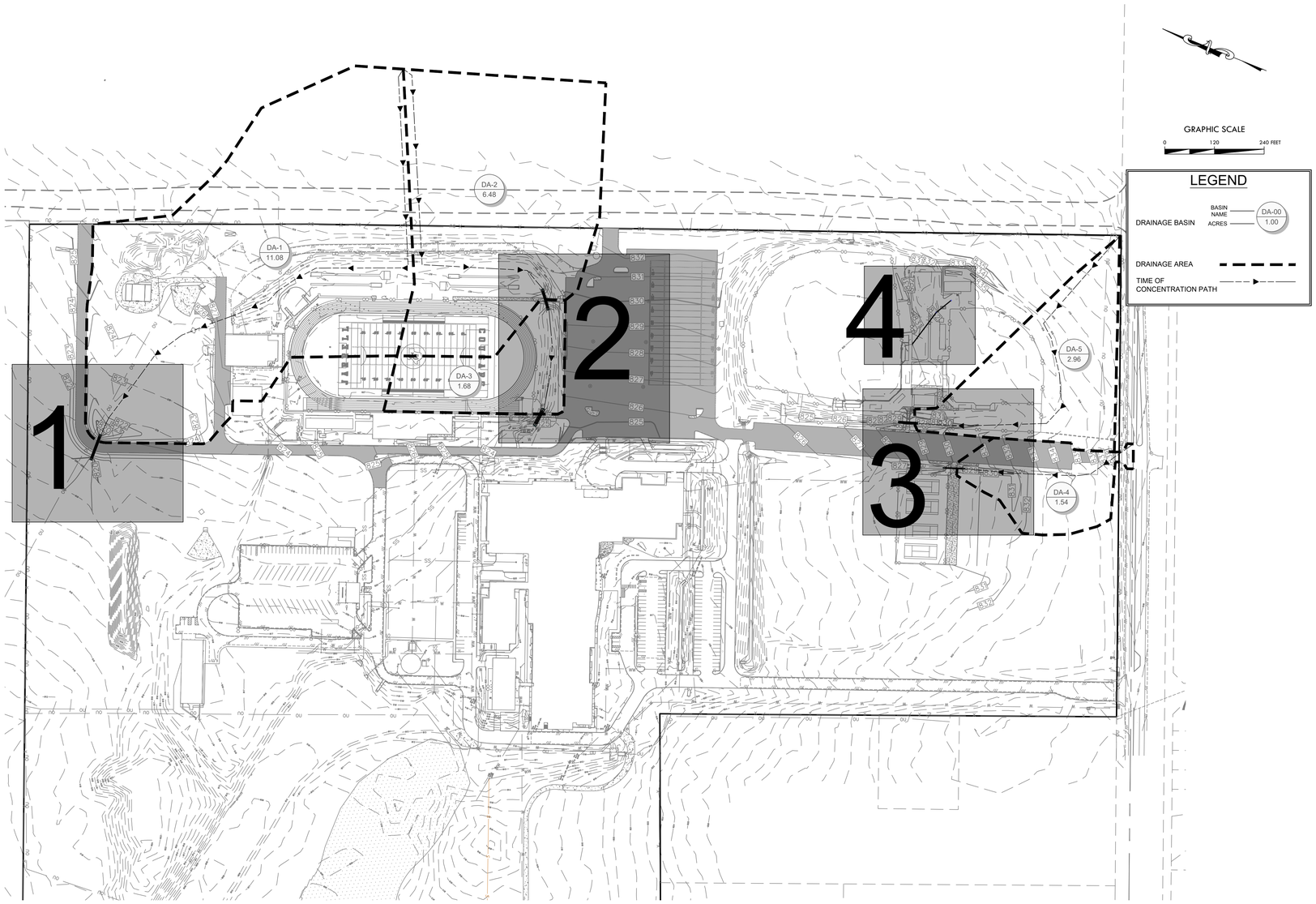
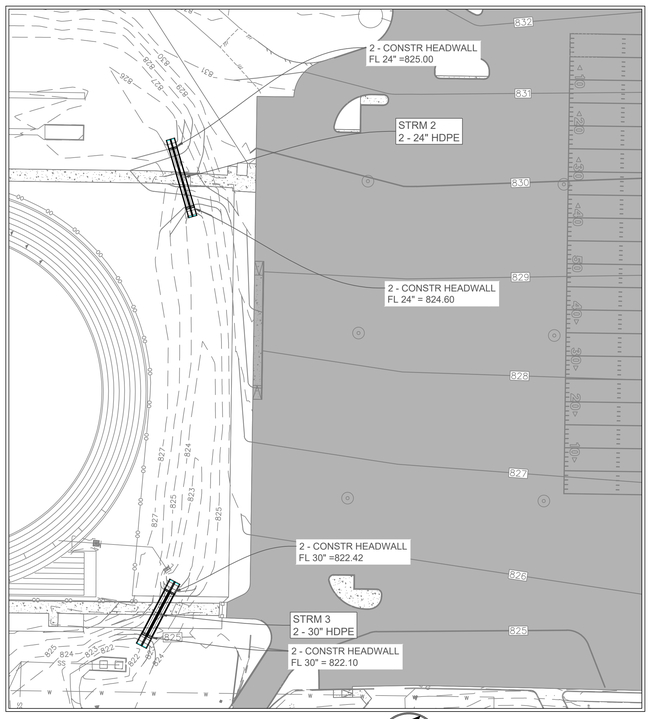
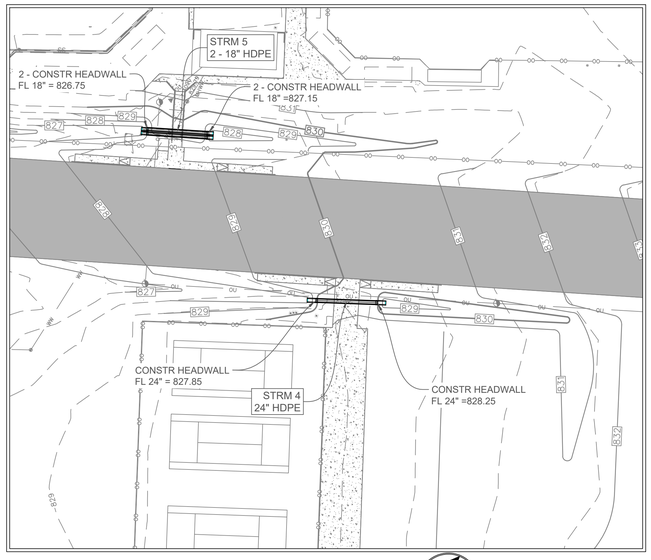


AREA 1
SCALE: 1" = 40'





AREA 2
SCALE: 1" = 40'

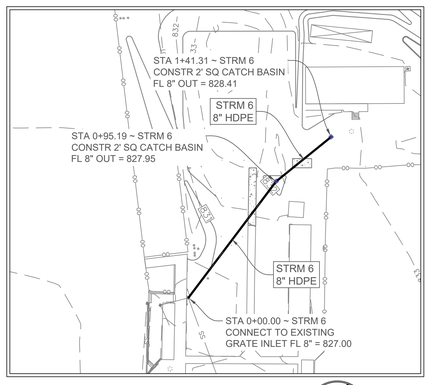


AREA 3
SCALE: 1" = 40'

PRE-DEVELOPMENT DRAINAGE AREA CALCULATIONS

Drainage Area Designation	Drainage Area	Runoff Coefficient "C"				Time of Concentration	2-Year Rainfall Intensity (I2)	2-Year Peak Discharge (Q2)	10-Year Rainfall Intensity (I10)	10-Year Peak Discharge (Q10)	25-Year Rainfall Intensity (I25)	25-Year Peak Discharge (Q25)	100-Year Rainfall Intensity (I100)	100-Year Peak Discharge (Q100)
-	(ac)	2- Yr	10- Yr	25- Yr	100- Yr	(min)	(in/hr)	(cfs)	(in/hr)	(cfs)	(in/hr)	(cfs)	(in/hr)	(cfs)
DA-1	11.08	0.42	0.48	0.51	0.59	25	3.31	15.31	4.93	26.30	6.09	34.73	8.05	52.44
DA-2	6.48	0.33	0.38	0.40	0.46	19	3.74	7.90	5.57	13.60	6.86	17.93	9.05	27.09
DA-3	1.68	0.45	0.52	0.55	0.63	19	3.78	2.86	5.64	4.88	6.94	6.41	9.15	9.61
DA-4	1.54	0.47	0.54	0.57	0.65	10	5.08	3.68	7.60	6.27	9.34	8.22	12.29	12.25
DA-5	2.96	0.36	0.42	0.45	0.52	10	5.02	5.31	7.51	9.27	9.22	12.22	12.14	18.60
Total	23.74							35.04		60.31		79.51		119.99

Note: Calculations based on the Rational Method: Q = C*I*A per the 2020 Round Rock Drainage Criteria Manual



AREA 4
SCALE: 1" = 40'

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COVER SHEET

PACKAGE 1

Job No.	Sheet No.
1836-06-01	C3.02
Drawn By:	
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Date:	
10/28/2021	

Texas Commission on Environmental Quality

TSS Removal Calculations 04-20-2009

Project Name: Jarrell ISD HS Additions
Date Prepared: 10/28/2021

1. The Required Load Reduction for the total project: Calculations from RG-348 Pages 3-27 to 3-30

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

where:

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

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

County =	Williamson	
Total project area included in plan * =	119.54	acres
Predevelopment impervious area within the limits of the plan * =	0.00	acres
Total post-development impervious area within the limits of the plan* =	77.70	acres
Total post-development impervious cover fraction * =	0.65	
P =	32	inches

$L_{M\ TOTAL\ PROJECT}$ = **67631** lbs.

Number of drainage basins / outfalls areas leaving the plan area = **1**

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

Drainage Basin/Outfall Area No. = **1**

Total drainage basin/outfall area =	119.54	acres
Predevelopment impervious area within drainage basin/outfall area =	0.00	acres
Post-development impervious area within drainage basin/outfall area =	77.70	acres
Post-development impervious fraction within drainage basin/outfall area =	0.65	
$L_{M\ THIS\ BASIN}$ =	67631	lbs.

3. Indicate the proposed BMP Code for this basin.

Proposed BMP = Wet Basin
Removal efficiency = 93 percent

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

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

where:

A_C = Total On-Site drainage area in the BMP catchment area
A_I = Impervious area proposed in the BMP catchment area
A_P = Pervious area remaining in the BMP catchment area
L_R = TSS Load removed from this catchment area by the proposed BMP

A_C =	119.54	acres
A_I =	77.70	acres
A_P =	41.84	acres
L_R =	80681	lbs

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

Desired $L_{M\ THIS\ BASIN}$ = 67631 lbs.

F = **0.84**

6. Calculate Capture Volume required by the BMP Type for this drainage basin / outfall area. Calculations from RG-348 Pages 3-34 to 3-36

Rainfall Depth =	1.26	inches
Post Development Runoff Coefficient =	0.46	
On-site Water Quality Volume =	251249	cubic feet

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

Off-site area draining to BMP =	0.00	acres
Off-site Impervious cover draining to BMP =	0.00	acres
Impervious fraction of off-site area =	0	
Off-site Runoff Coefficient =	0.00	
Off-site Water Quality Volume =	0	cubic feet
Storage for Sediment =	50250	
Total Capture Volume (required water quality volume(s) x 1.20) =	301499	cubic feet

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

Required capacity of Permanent Pool =	301499	cubic feet
Required capacity at WQV Elevation =	552748	cubic feet

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

Forebay Volume					
Stage	Elevation	Contour Area	Incremental Storage	Total Storage	AC-FT
0.00	792.50	9,197	0	0	0.00
1.00	793.50	10,941	10,056	10,056	0.23
2.00	794.50	12,785	11,851	21,907	0.50
3.00	795.50	14,729	13,746	35,653	0.82
4.00	796.50	17,619	16,152	51,805	1.19
5.00	797.50	19,064	18,337	70,142	1.61

Wet Pond Volume					
Stage	Elevation	Contour Area	Incremental Storage	Total Storage	AC-FT
0.00	790.50	24,052	0	0	0.00
1.00	791.50	26,570	25,301	25,301	0.58
2.00	792.50	29,188	27,869	53,169	1.22
3.00	793.50	31,907	30,537	83,707	1.92
4.00	794.50	34,727	33,307	117,014	2.69
5.00	795.50	37,646	36,177	153,190	3.52
6.00	796.50	41,072	39,347	192,537	4.42
7.00	797.50	43,267	42,165	234,702	5.39

Detention Volume					
Stage	Elevation	Contour Area	Incremental Storage	Total Storage	AC-FT
0.00	797.50	71,870	0	0	0.0
0.50	798.00	115,911	46,509	46,509	1.1
1.00	798.50	158,337	68,287	114,796	2.6
1.50	799.00	203,725	90,277	205,073	4.7
2.00	799.50	252,950	113,947	319,020	7.3
2.50	800.00	306,244	139,586	458,607	10.5
3.00	800.50	350,982	164,179	622,786	14.3
3.50	801.00	372,774	180,912	803,698	18.5
4.00	801.50	390,874	190,894	994,592	22.8
4.50	802.00	405,993	199,205	1,193,797	27.4
5.00	802.50	410,995	204,246	1,398,042	32.1
5.50	803.00	416,023	206,753	1,604,796	36.8

	Discharge (CFS)		
	100-yr	10-yr	2-yr
Pre-project	729.6	395.6	207.5
Post-project (Detention)	704.9	374.4	200.8
Difference	-24.7	-21.2	-6.7
% Difference	-3.40%	-5.40%	-3.20%

Pond Results			
	100-yr	10-yr	2-yr
Peak Storage (ac-ft)	26.7	20	15.2
Peak Elevation	801.9	801.2	800.6

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WATER QUALITY & DETENTION POND CALCULATIONS

PACKAGE 1 1

Job No. 1838-06-01	Sheet No. C3.03
Drawn By: —	
Date: 10/28/2021	

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GENERAL SITE NOTES:

1. CONTRACTOR TO ENSURE EDWARDS AQUIFER (EA) PERMITTING IS IN PLACE AND REVIEWED BEFORE BEGINNING ANY SITE DISTURBANCE.
2. ALL TEMPORARY EROSION CONTROLS SHALL BE INSTALLED PER EA REQUIREMENTS PRIOR TO ANY SITE DISTURBANCE.
3. CONTRACTOR SHALL REVIEW AND REFERENCE SITE GEOTECHNICAL REPORT PREPARED BY ALLIANCE ENGINEERING GROUP AND TITLED "SUBSURFACE EXPLORATION AND GEOTECHNICAL EVALUATION FOR JARRELL HIGH SCHOOL STORMWATER PROJECT, JARRELL, TEXAS" OR ANY ADDITIONS OR ADDENDUMS TO THE ORIGINAL REPORT.
4. CONTRACTOR SHALL PROPERLY DISPOSE OF ANY DEMOLISHED SITE FEATURES OR UTILITIES OFFSITE. BURYING DEMOLISHED ELEMENTS WILL NOT BE ALLOWED.
5. CONTRACTOR SHALL WORK WITH PROJECT GEOTECHNICAL ENGINEER AND PROJECT CONSTRUCTION MATERIALS TESTING LAB TO IDENTIFY ONSITE CLAY SOIL TO USE IN CREATING THE PERMANENT CLAY LINER FOR THE POND.
6. ONSITE TOPSOIL IN THE AREA OF DISTURBANCE SHALL BE STRIPPED AND STOCKPILED FOR USE IN REVEGETATION OF DISTURBED AREAS. NO ADDITIONAL PAY ITEM WILL BE ALLOWED FOR TOPSOIL IMPORT. CONTRACTOR TO USE ONSITE SOILS SUITABLE FOR HEALTHY REVEGETATION OF PROJECT.
7. ALL ONSITE FILL AREAS SHALL BE STRIPPED, PROCESSED, AND COMPACTED UNDER THE DIRECTION OF THE PROJECT GEOTECH AND PROJECT CMT LAB. THE DISTRICT WILL USE UNKNOWN PORTIONS OF THE FILL AREAS AS FUTURE BUILDING EXPANSIONS. THEREFORE, CONTRACTOR WILL NEED TO PLACE ALL FILL IN A CONTROLLED MANNER AS DIRECTED BY THE PROJECT GEOTECH AND THE PROJECT CMT LAB.
8. CONTRACTOR TO WORK CLOSELY WITH THE PROJECT GEOTECHNICAL ENGINEERING/MATERIAL TESTING FIRM TO ENSURE MATERIAL USED TO CONSTRUCT ANY FEATURE USED TO IMPOUND WATER WILL REMAIN WATER TIGHT AND RESISTANT TO SOIL PIPING THROUGH THE FEATURE'S LIFE SPAN.
9. ALL CONDUITS ENTERING THE WATER IMPOUNDMENT STRUCTURE (WATER QUALITY POND) SHALL INCLUDE CLAY DAMS TO ENSURE THERE IS NO SOIL PIPING TO OR FROM THE CONDUIT EMBEDMENT MATERIAL.

GRAPHIC SCALE

0 60 120 FEET

KEY MAP
N.T.S.

LEGEND

PROPOSED CONTOUR	100
EXISTING CONTOUR	100
SPOT GRADE	100.00
PROPOSED FLOW ARROW	

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WATER QUALITY & DETENTION POND GRADING, AND DEMOLITION PLAN

PACKAGE 1 1

Job No. 1836-06-01	Sheet No. C3.04
Drawn By: —	
Date: 10/28/2021	

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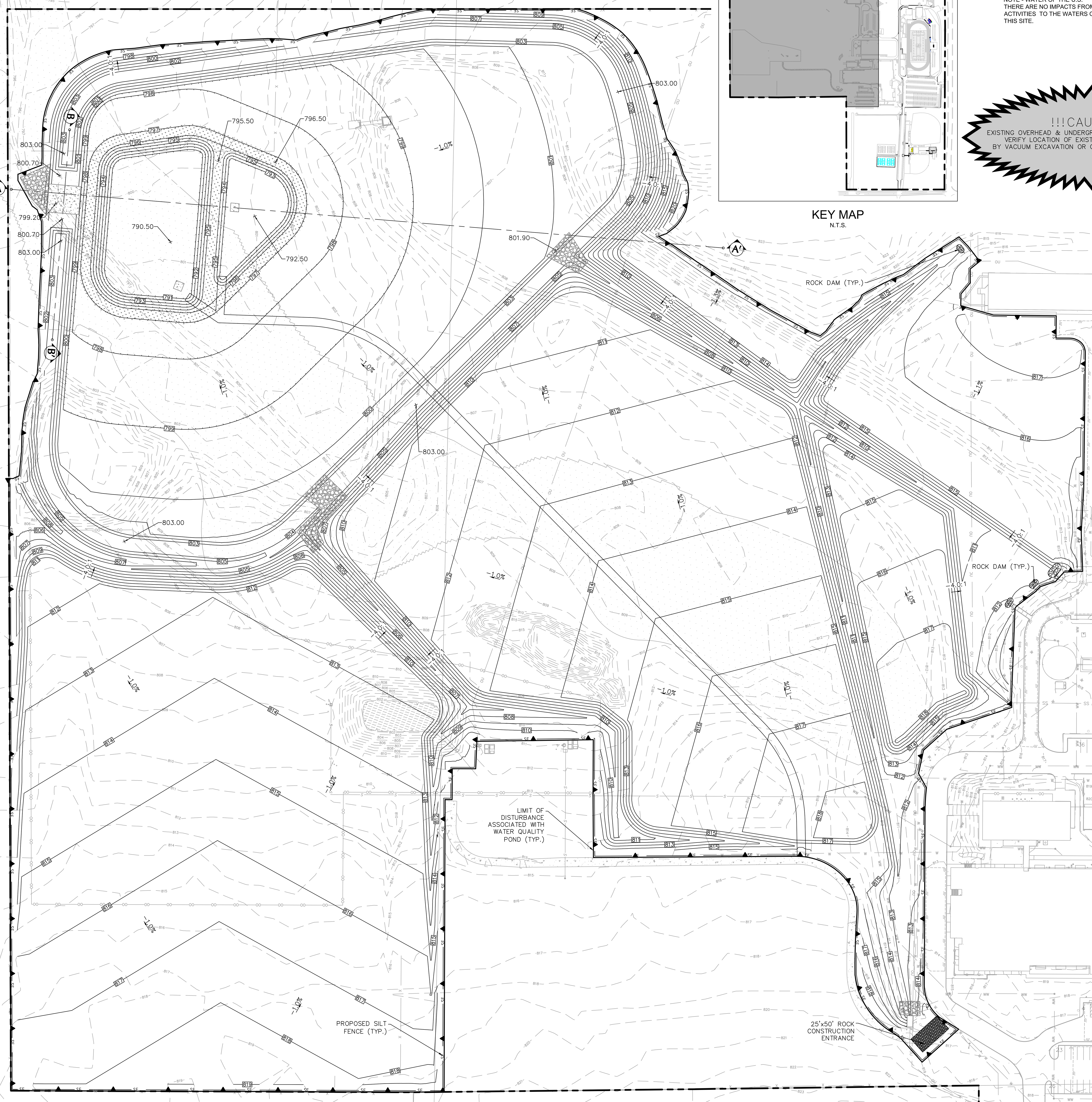
Date: 10/28/2021 Time: 11:45 User: emahoney Style Table: Langan.stb Layout: C3.04 Water Quality & Detention Pond Grading Plan Document Code: 531012001-0503-CG101-0103



KEY MAP
N.T.S.

NOTE - WATER OF THE U.S.
THERE ARE NO IMPACTS FROM CONSTRUCTION ACTIVITIES TO THE WATERS OF THE U.S. ON THIS SITE.

LEGEND

INLET PROTECTION	—IP—IP—
LIMITS OF DISTURBANCE	
SILT FENCE	—SF—
CONSTRUCTION EXIT	
ROCK CHECK DAM	
PROPOSED FLOW ARROW	

!!!CAUTION!!!
EXISTING OVERHEAD & UNDERGROUND UTILITIES IN THE VICINITY.
VERIFY LOCATION OF EXISTING UNDERGROUND UTILITIES
BY VACUUM EXCAVATION OR OTHER POTHOLING TECHNIQUES.

GRAPHIC SCALE
0 60 120 FEET

EROSION CONTROL NOTES

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

EROSION CONTROL MAINTENANCE NOTES

1. ALL MEASURES STATED ON THIS EROSION AND SEDIMENT CONTROL PLAN, AND IN THE STORM WATER POLLUTION PREVENTI0N PLAN, SHALL BE MAINTAINED IN FULLY FUNCTIONAL CONDITION UNTIL NO LONGER REQUIRED FOR A COMPLETED PHASE OF WORK OR FINAL STABILIZATION OF THE SITE. ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE CHECKED BY A QUALIFIED PERSON ON A SCHEDULE WHICH COMPLIES WITH THE GENERAL PERMIT REQUIREMENTS AND CLEANED AND REPAIRED WITHIN 48 HOURS OF THE INSPECTION IN ACCORDANCE WITH THE FOLLOWING:
   - 1.A. INLET PROTECTION DEVICES AND BARRIERS SHALL BE REPAIRED OR REPLACED IF THEY SHOW SIGNS OF UNDERMINING, OR DETERIORATION.
   - 1.B. ALL SEEDED AREAS SHALL BE CHECKED REGULARLY TO SEE THAT A GOOD STAND IS MAINTAINED. AREAS SHOULD BE FERTILIZED, WATERED AND RESEEDED AS NEEDED.
   - 1.C. SILT FENCES SHALL BE REPAIRED TO THEIR ORIGINAL CONDITIONS IF DAMAGED. SEDIMENT SHALL BE REMOVED FROM THE SILT FENCES WHEN IT REACHES ONE-HALF THE HEIGHT OF THE SILT FENCE.
   - 1.D. THE TEMPORARY PARKING AND STORAGE AREA (IF PRESENT) SHALL BE KEPT IN GOOD CONDITION (SUITABLE FOR PARKING AND STORAGE). THIS MAY REQUIRE PERIODIC TOP DRESSING OF THE TEMPORARY PARKING AS CONDITIONS DEMAND.
   - 1.E. OUTLET STRUCTURES IN THE SEDIMENTATION BASINS OR SEDIMENT TRAPS (IF PRESENT) SHALL BE MAINTAINED IN OPERATIONAL CONDITION AT ALL TIMES. SEDIMENT SHALL BE REMOVED FROM SEDIMENT BASINS OR TRAPS WHEN THE DESIGN CAPACITY HAS BEEN REDUCED BY 50%.
   - 1.F. MAINTENANCE PROCEDURES FOR THE EROSION AND SEDIMENTATION CONTROL SYSTEMS SPECIFIED ARE GIVEN IN SECTION 5 OF THE STORM WATER POLLUTION PREVENTION PLAN.

EROSION CONTROL SEQUENCE

1. INSTALL SILT FENCES AROUND PERIMETER OF PROPERTY AND DISTURBED AREAS AS SHOWN.
2. INSTALL ROCK CHECK DAMS AT THE ENDS OF ALL EXPOSED STORM SEWER PIPES, IF PRESENT.
3. CONSTRUCT TEMPORARY CONSTRUCTION EXIT.
4. COMMENCE GRUBBING AND REMOVAL OF VEGETATION IN AREA TO RECEIVE CUT OR FILL.
5. COMMENCE GRADING OPERATION
6. INSTALL ALL PROPOSED STORM SEWER PIPES AND INSTALL INLET PROTECTION SILT FENCES AT ENDS OF EXPOSED PIPES.
7. COMPLETE PLANTING AND/OR SEEDING OF VEGETATED AREAS TO ACCOMPLISH STABILIZATION, IN ACCORDANCE WITH THE LANDSCAPING PLAN.
8. REMOVE TEMPORARY CONSTRUCTION EXIT, SILT FENCES & ROCK CHECK DAMS.

NOTE FOR CHANGES TO SWPPP
THE TXR15000 GENERAL PERMIT REQUIRES THAT THE PERMITTEE REVISE OR UPDATE THIS SWPPP WHENEVER THERE IS A CHANGE IN DESIGN, CONSTRUCTION, OPERATION, OR MAINTENANCE, OR WHENEVER THE RESULT OF AN INSPECTION INDICATES THAT THIS SWPPP IS INEFFECTIVE IN ELIMINATING OR SIGNIFICANTLY MINIMIZING POLLUTANTS IN STORMWATER DISCHARGES. HOWEVER, THE REGULATIONS OF THE TEXAS BOARD OF PROFESSIONAL ENGINEERS REQUIRE THAT CHANGES MADE BY THE CONTRACTOR DURING CONSTRUCTION MUST BE AUTHORIZED BY A LICENSED TEXAS ENGINEER. THESE CHANGES MAY BE AUTHORIZED BY THE ENGINEER OF RECORD THROUGH UPDATED DRAWINGS, WORK ORDER CHANGES, OR OTHER METHODS ACCEPTABLE TO THE ENGINEER; OR BY ANOTHER ENGINEER PROVIDED THAT THEY NOTIFY THE ENGINEER OF RECORD.

NOTE - STABILIZATION
ALL DISTURBED AREAS SHALL BE WATERED, FERTILIZED, AND SEEDED OR SODDED AS NECESSARY AND BY DEFINITION 'MAINTAINED' UNTIL AN ESTABLISHED STAND OF GRASS CAN BE RELEASED TO THE OWNER. REFERENCE LANDSCAPE/IRRIGATION PLAN (IF PROVIDED) TO COORDINATE PLANTING ENHANCEMENTS AND LIMITS OF IRRIGATION COVERAGE.

NOTE - MATERIAL STORAGE
THE CONTRACTOR SHALL NOTE ON SITE PLAN THE LOCATION OF ALL MATERIAL STORAGE AREAS, EQUIPMENT STORAGE AREAS, SOLID WASTE RECEPTACLES, SANITARY FACILITIES, ANY ON-SITE OR OFF-SITE BORROW OR STOCKPILE AREA, ANY ON-SITE OR OFF-SITE SUPPORT ACTIVITIES (SUCH AS ASPHALT OR CONCRETE PLANTS). CONTRACTOR SHALL ALSO PREPARE, KEEP ON SITE, AND MAINTAIN CURRENT A LIST OF MATERIALS WITH APPROXIMATE QUANTITIES, WHICH ARE STORED ON SITE.

811
Know what's below.
Call before you dig.

THESE PLANS ARE SUBJECT TO REVIEW & APPROVAL BY JURISDICTIONAL ENTITIES.

** NOTICE TO CONTRACTORS – TOPOGRAPHIC SURVEY **

TOPOGRAPHIC INFORMATION TAKEN FROM A TOPOGRAPHIC SURVEY PERFORMED BY 4WARD LAND SURVEYING. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY, IN WRITING, OF ANY DISCREPANCIES OR OMISSIONS TO THE TOPOGRAPHIC INFORMATION. THE CONTRACTOR(S) SHALL BE RESPONSIBLE FOR CONFIRMING THE LOCATION (HORIZONTAL/VERTICAL) OF ANY BURIED CABLES, CONDUITS, PIPES, AND STRUCTURES (STORM SEWER, SANITARY SEWER, WATER, GAS, TELEVISION, TELEPHONE, ETC.) WHICH IMPACT THE CONSTRUCTION SITE. THE CONTRACTOR(S) SHALL NOTIFY THE OWNER AND ENGINEER IF ANY DISCREPANCIES ARE FOUND BETWEEN THE ACTUAL CONDITIONS VERSUS THE DATA CONTAINED IN THE CONSTRUCTION PLANS. ANY COSTS INCURRED AS THE RESULT OF NOT CONFIRMING THE ACTUAL LOCATION (HORIZONTAL/VERTICAL) OF SAID CABLES, CONDUITS, PIPES, AND STRUCTURES SHALL BE BORNE BY THE CONTRACTOR. ADDITIONALLY, THE CONTRACTOR(S) SHALL NOTIFY THE OWNER AND ENGINEER IF ANY ERRORS OR DISCREPANCIES ARE FOUND ON THE CONSTRUCTION DOCUMENTS (PS&E), WHICH NEGATIVELY IMPACT THE PROJECT. THE ENGINEER AND OWNER SHALL BE INDEMNIFIED OF PROBLEMS AND/OR COST WHICH MAY RESULT FROM CONTRACTOR'S FAILURE TO NOTIFY ENGINEER AND OWNER.

Revision / Date

Project:
ATHLETICS COMPLEX IMPROVEMENTS AT JARRELL HIGH SCHOOL
FOR
JARRELL I.S.D.
1100 FM 487, JARRELL, TEXAS 76537

LANGAN | Adams

STATE OF TEXAS
JACK H. GARNER, JR.
98447
LICENSED PROFESSIONAL ENGINEER
10·28·2021
TBPE Registration #: F- 13,709

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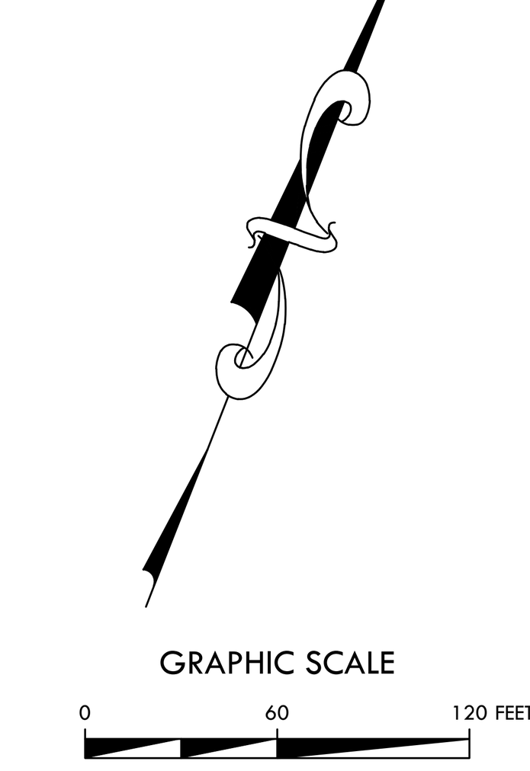
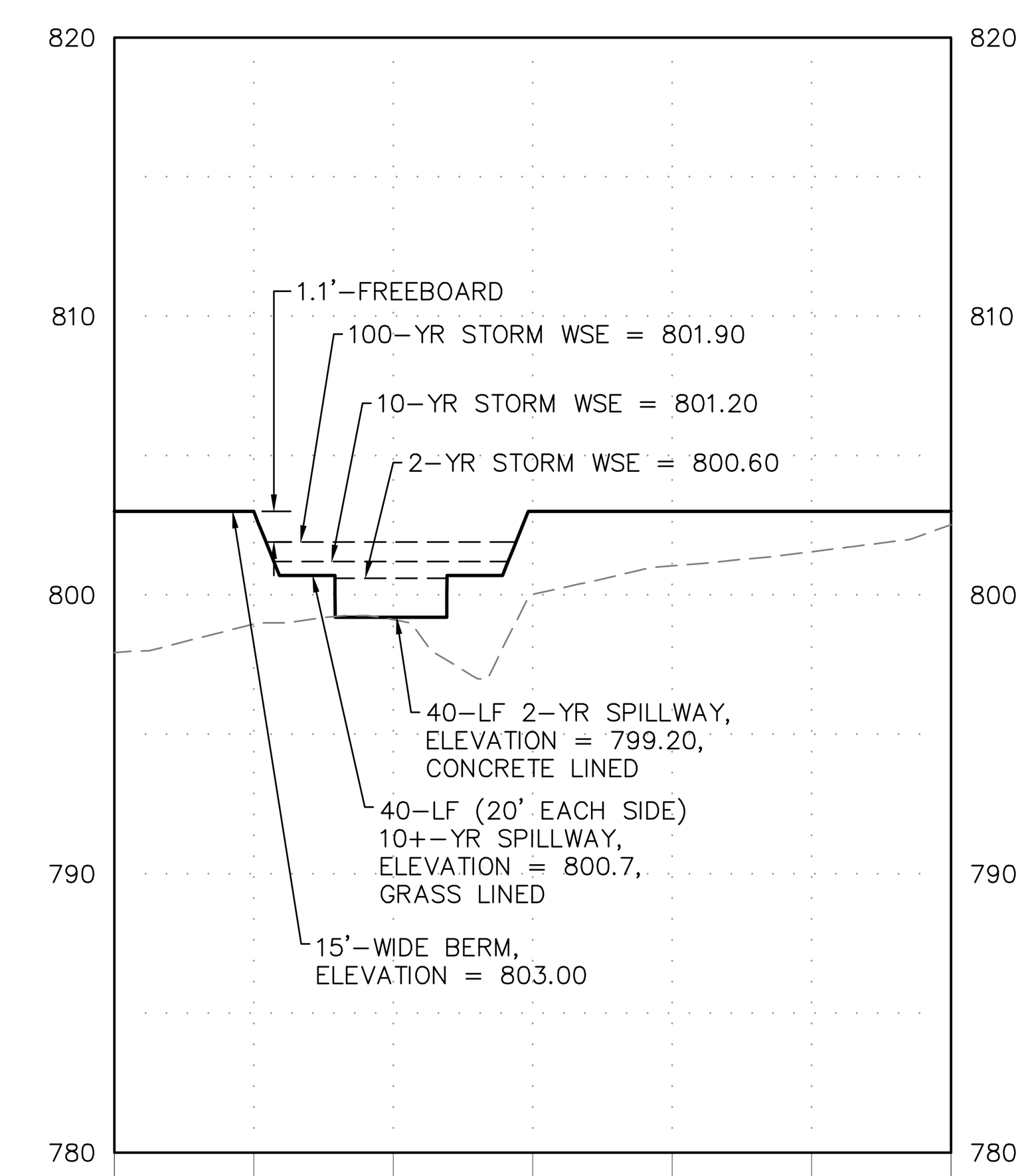
WATER QUALITY & DETENTION POND SWPPP

PACKAGE 1 — 1

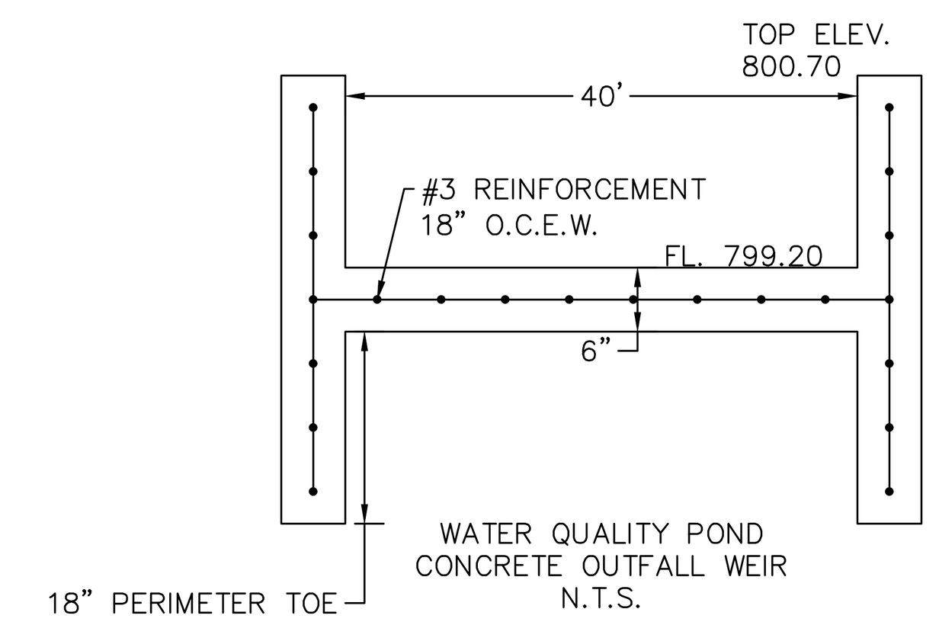
Job No. 1836-06-01	Sheet No. C3.05
Drawn By: ---	
Date: 10/28/2021	



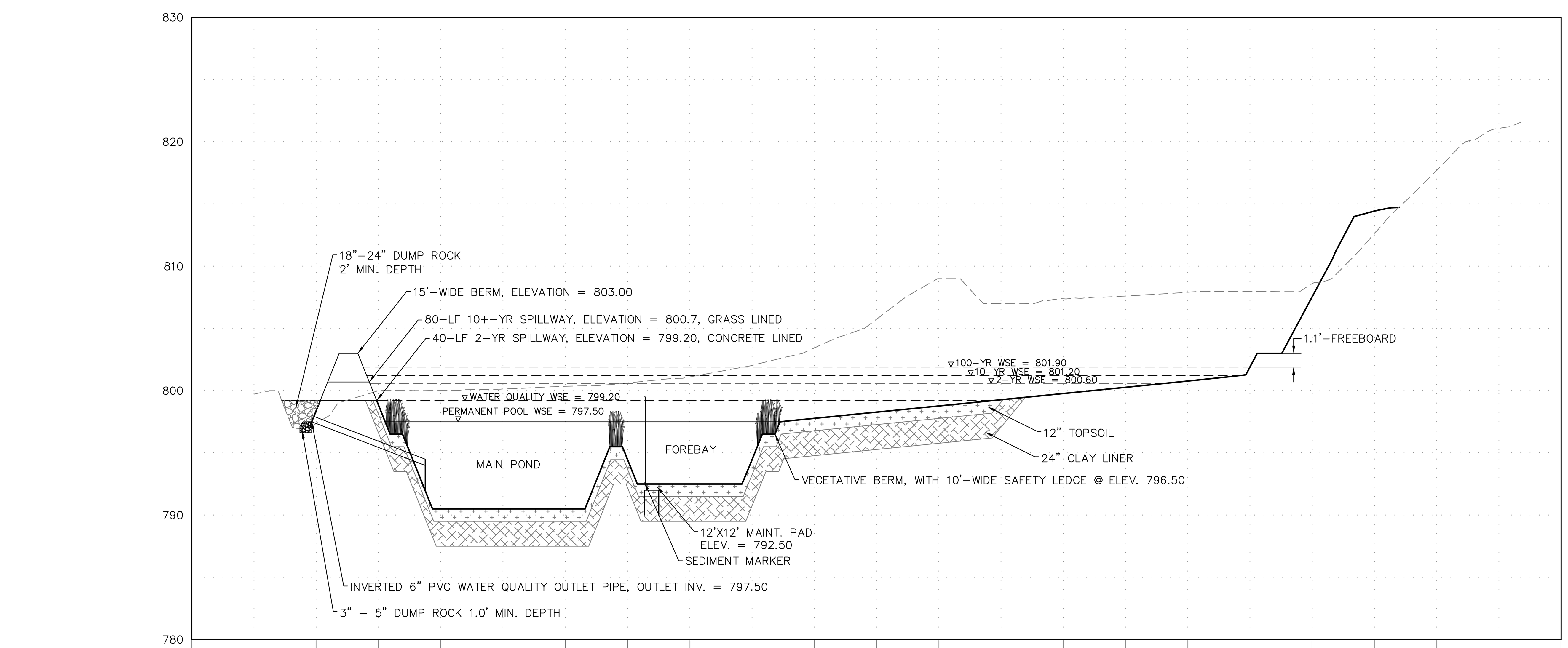


DISTANCE (FEET)	0		100		200		300
EXISTING ELEV (FEET)	797.9	799.0	799.1	800.0	801.1	801.6	802.5
PROPOSED ELEV (FEET)	797.93	798.96	799.12	800.02	801.05	801.56	802.53

B-B' (OUTLET) PROFILE



NOTE:
ALL EXPOSED CONCRETE THAT IS VISIBLE ALONG THE CONCRETE WEIR OR MORTARED ROCK IS REQUIRED TO BE MADE OF STONE OR CLAD IN STONE INCLUDING BUT NOT LMITED TO LEDGESTONE, FIELDSTONE, CAST STONE, OR OTHER DECORATIVE MATERIALS SUCH AS STAMPED AND TINTED CONCRETE THAT RESEMBLES STONE OR BRICK AS APPROVED BY THE DIRECTOR OF PLANNING. ALL OTHER EXPOSED CONCRETE IS REQUIRED TO BE MADE OF STONE OR CLAD IN STONE AS LISTED ABOVE OR TEXTURED AND TINTED IN EARTHEN COLORS.



DISTANCE (FEET)	-50	0		100		200		300		400		500		600		700		800		900		1000	1050
EXISTING ELEV (FEET)		799.7	797.4	800.0	800.0	800.1	800.3	800.6	801.1	802.0	803.4	805.7	809.0	807.0	807.4	807.6	807.9	808.0	808.6	812.6	817.7	821.1	
PROPOSED ELEV (FEET)		799.72	797.37	800.00	800.00	800.13	800.35	800.62	801.10	802.03	803.43	805.74	809.00	806.99	807.39	807.61	807.91	807.98	808.61	812.65	817.69	821.08	

A-A' (POND) PROFILE

Revision / Date

Project:
ATHLETICS COMPLEX IMPROVEMENTS
AT JARRELL HIGH SCHOOL
FOR
JARRELL I.S.D.
1100 FM 487, JARRELL, TEXAS 76537

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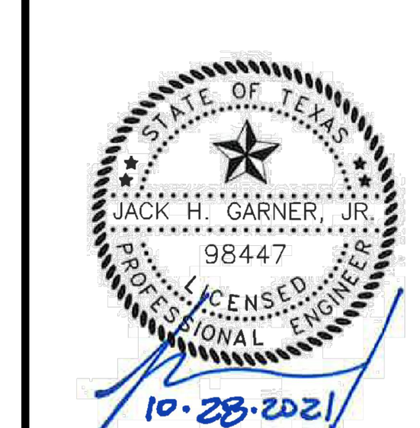

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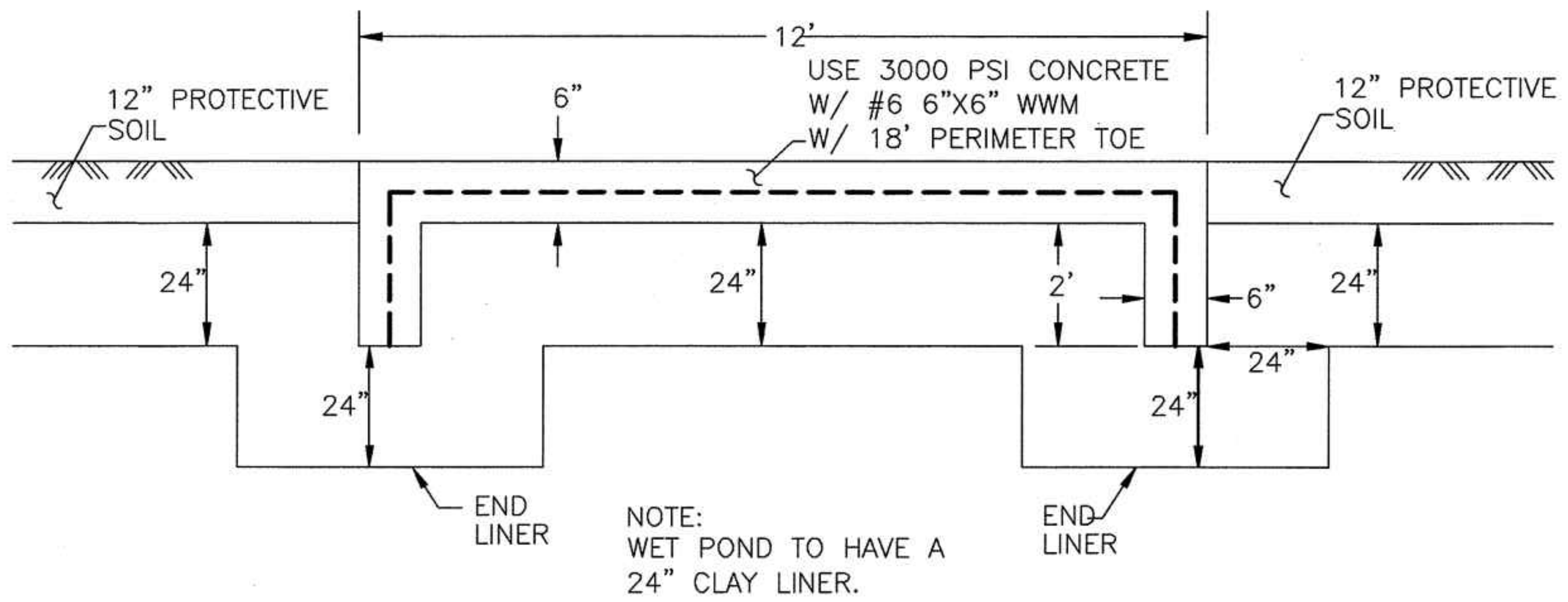
WATER QUALITY & DETENTION POND PROFILE VIEWS

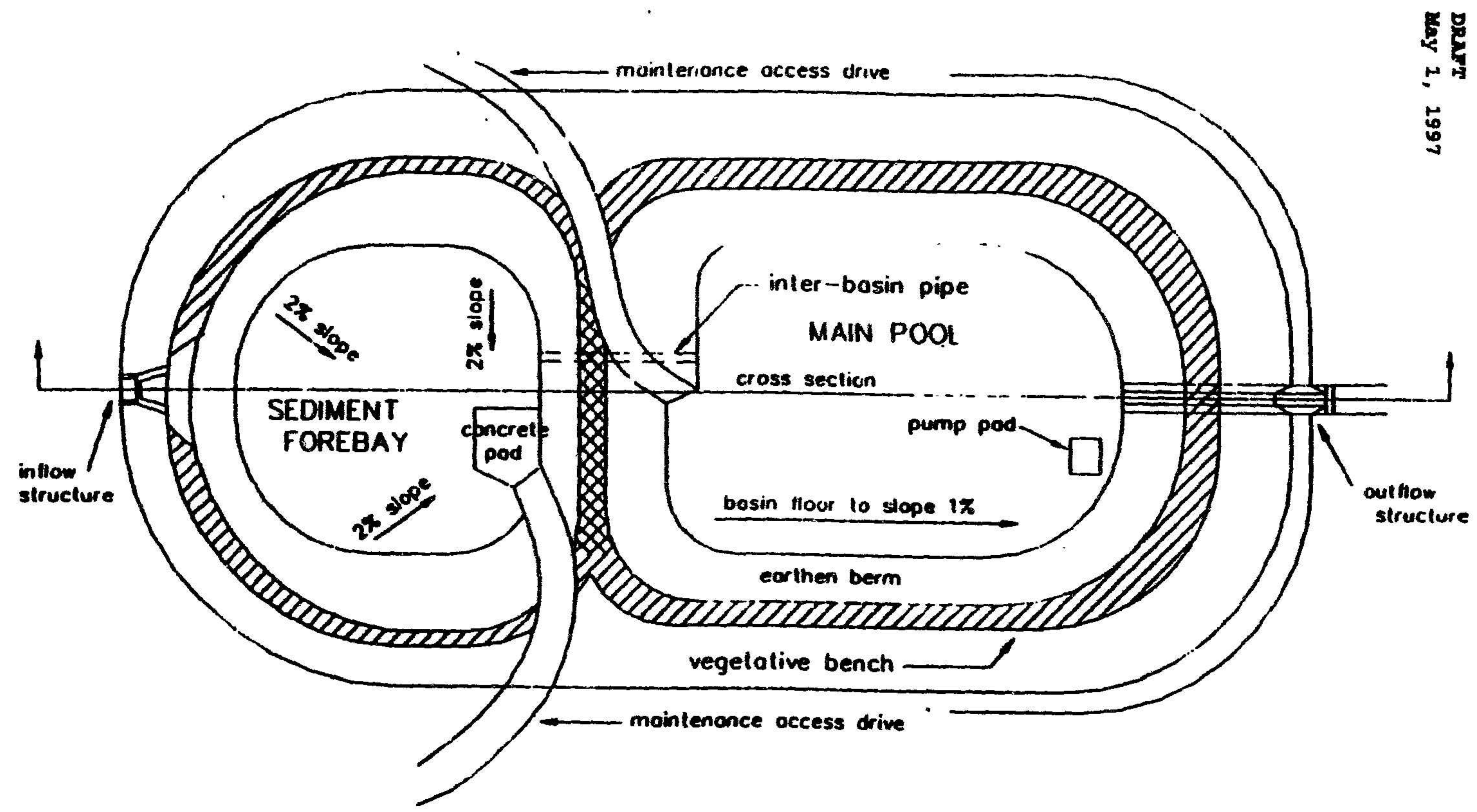
PACKAGE 1 1

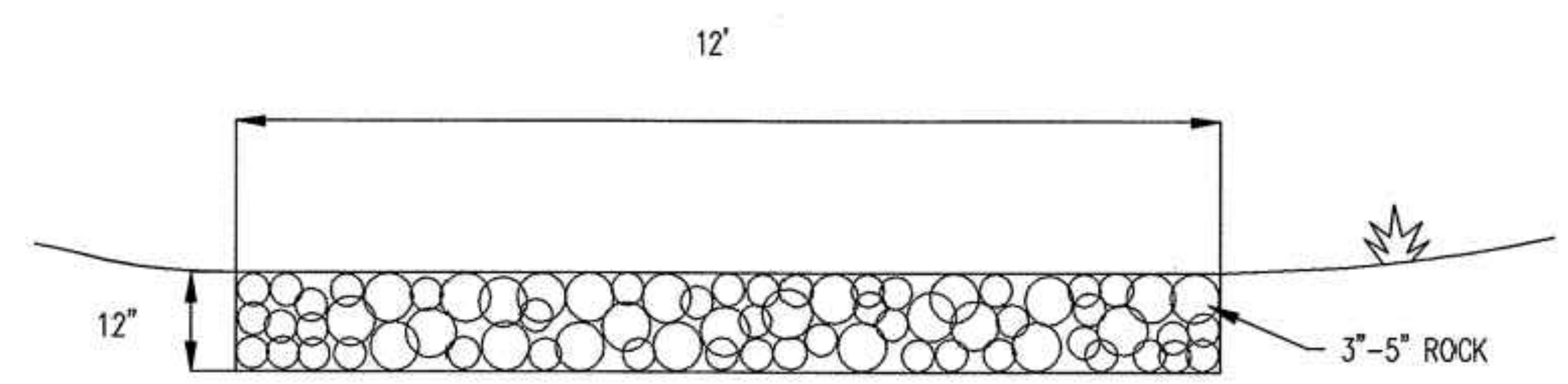
Job No. 1836-06-01	**Sheet No.**
Drawn By: ---	C3.06
Date: 10/28/2021	



12' X 12' CONCRETE MAINTENANCE PAD

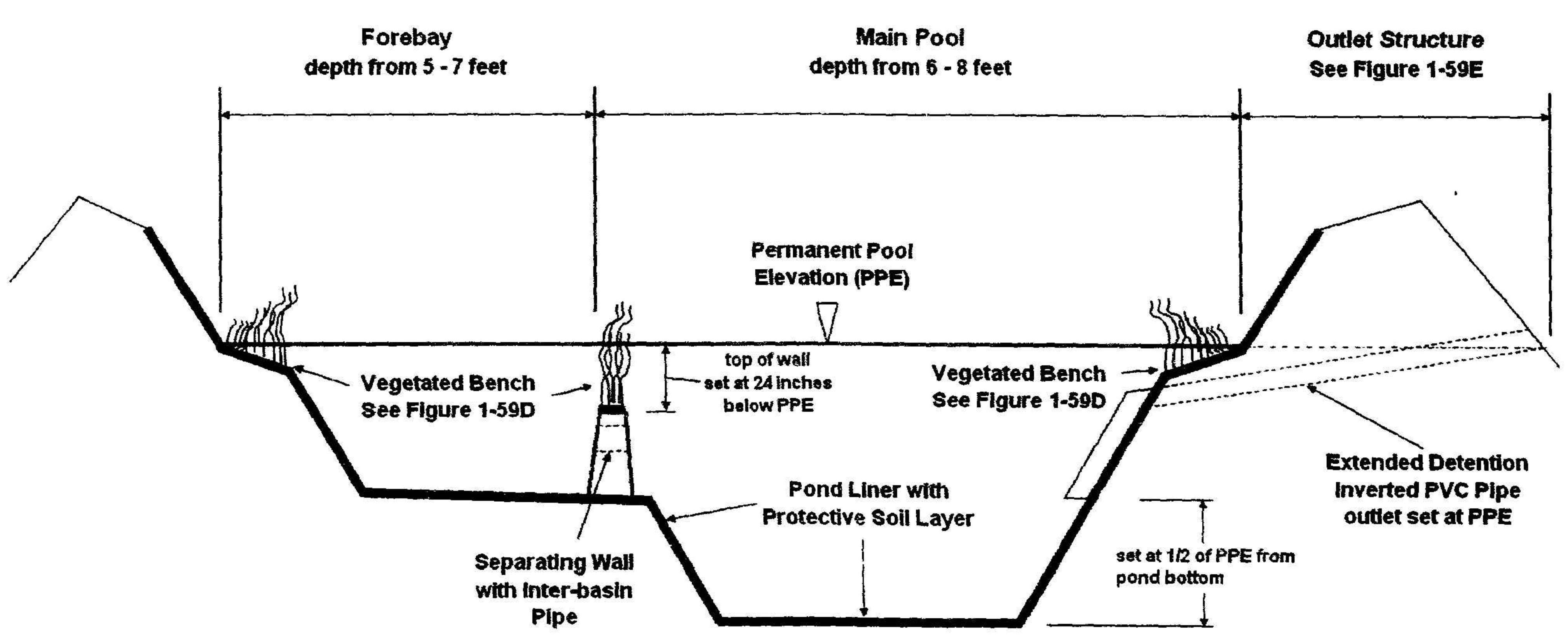
N.T.S.

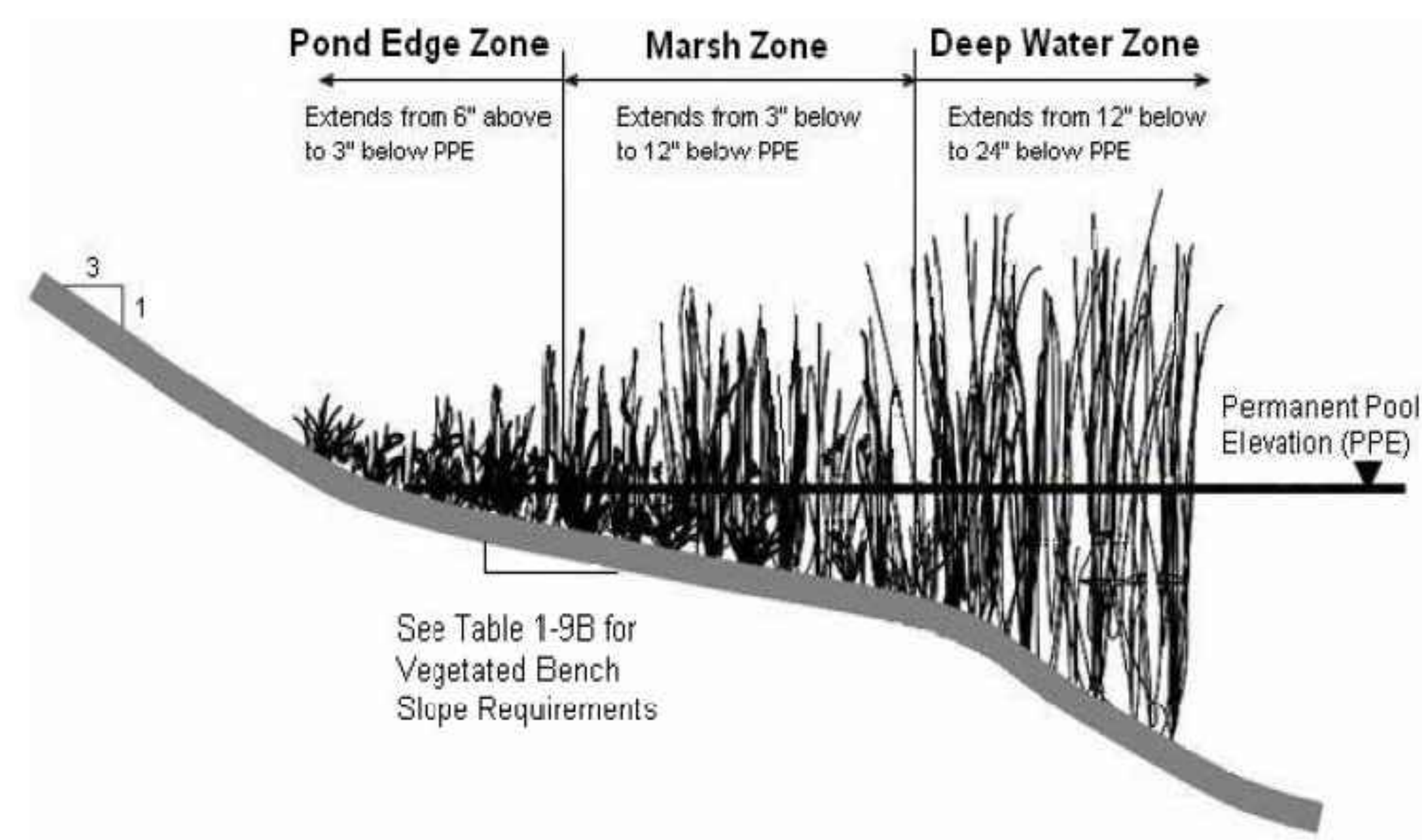




ROCK ACCESS DRIVE

N.T.S.





Revision / Date

Project: ATHLETICS COMPLEX IMPROVEMENTS AT JARRELL HIGH SCHOOL FOR JARRELL I.S.D. 1100 FM 487, JARRELL, TEXAS 76537

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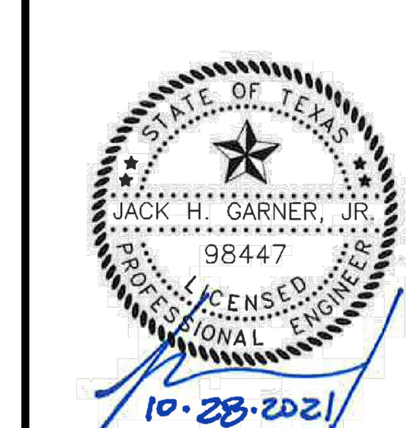

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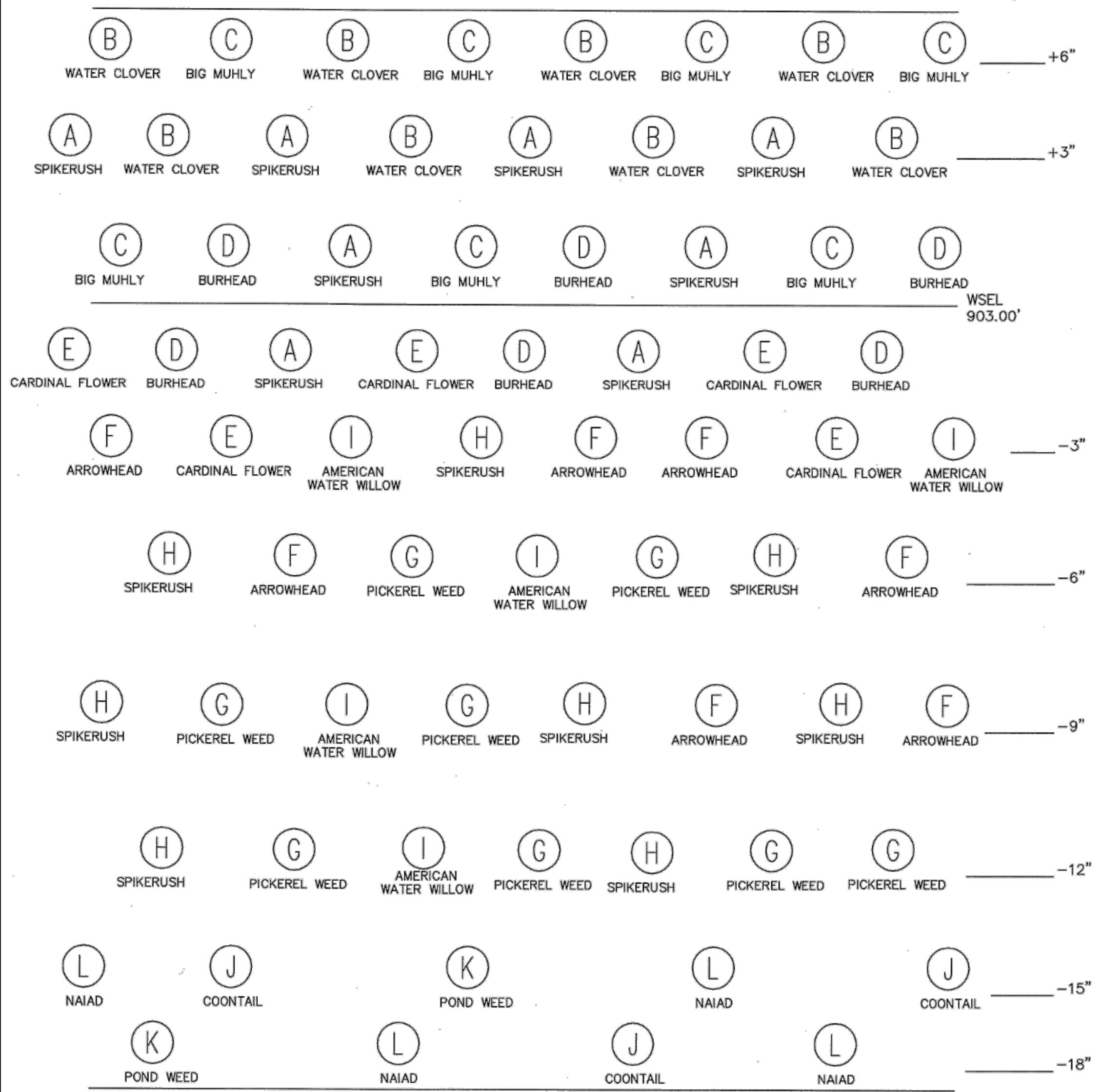
WATER QUALITY & DETENTION POND DETAILS

PACKAGE 1 1

Job No. 1836-06-01	Sheet No.
Drawn By:	C3.07
Date: 10/28/2021	

TYPICAL WET POND SPACING



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

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

WET POND J PLANTING PLAN

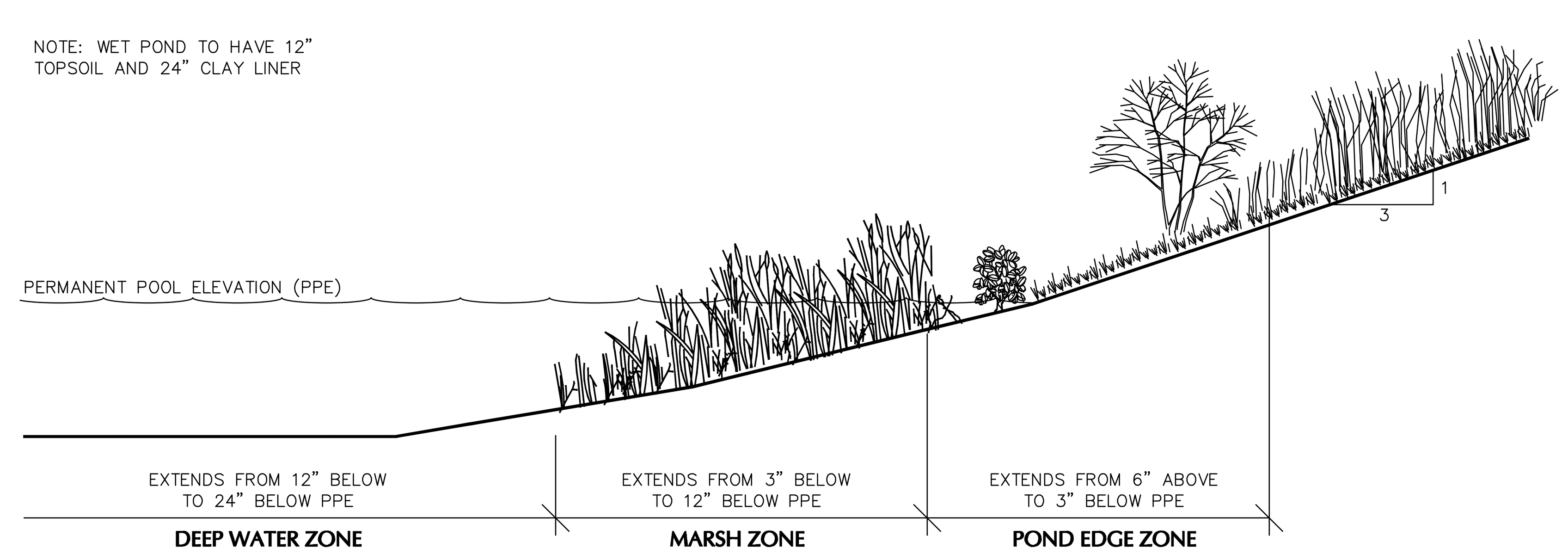
Surface Area of Permanent Pool = 1.03 ACRES
44834/2 x 0.03= 672 number of plants required (minimum)

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

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

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

NOTE: WET POND TO HAVE 12" TOPSOIL AND 24" CLAY LINER



1 CROSS SECTION OF A TYPICAL VEGETATED BENCH AREA

NTS

WETLAND PLANT LIST

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

Table 1-9E
Pond Edge Zone Plants

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

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

Table 1-9F
Marsh Zone Plants

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

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

Deep Water Zone Plants

Common Name	Latin Name	Height	Required	
American waterweed	Elodea canadensis	8'		Submergent oxygenator
Coontail	Ceratophyllum demersum	6'	x	Submergent for nutrients
Fanwort	Cabomba caroliniana	6'		Submergent oxygenator
Giant bulrush	Schoenoplectus* (tabernaemontani, californicus)	8'		Emergent 8 ht. Evergreen; 2 acre min. pond size
Pondweed	Potamogeton pectinatus (nodosus, diversifolia, illinoensis)	4'	x	Floating-leaved aquatic, benefits wildlife
Water lily	Nymphaea (odorata, elegans, mexicana)	8'		Floating-leaved aquatic; 2 acre min. pond size
Water-naiad	Najas guadalupensis	4'	x	Common submergent
Water star grass	Heteranthera dubia (Liebmannii)	5'		Submergent oxygenator

STANDARD NOTES

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

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

WET POND LINER RECOMMENDATION

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

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

2. COMPACTION SHOULD BE 95 PERCENT OF MAXIMUM LABORATORY DENSITY DETERMINED IN ACCORDANCE WITH AMERICAN SOCIETY OF TESTING MATERIALS, METHOD ASTM D 698, USING A COMPACTIVE EFFORT OF 7.16 FT.LBS/CU.IN.

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

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

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

GENERAL:

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

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

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

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

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

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

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

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

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

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

4. SOIL LINER MATERIAL MINIMUM PHYSICAL REQUIREMENTS
   REPRESENTATIVE SAMPLES OF THE SOILS TO BE USED FOR LINERS MUST FIRST BE TESTED, IN ACCORDANCE WITH THE FOLLOWING STANDARDS, IN A GEOTECHNICAL LABORATORY TO ENSURE THAT THEY MEET THE FOLLOWING MINIMUM REQUIREMENTS SET FORTH IN THE MSWR. TABLE I AT THE END OF THIS HANDBOOK LISTS THE REQUIRED QUALITY CONTROL TESTING AND MINIMUM REQUIREMENTS.
   A. SIEVE ANALYSIS – ASTM D 422 OR ASTM D 1140 – AT LEAST 60% PASSING THE #200 MESH SIEVE.
   B. ATTERBERG LIMITS – ASTM D 4318 – LIQUID LIMIT (LL) OF GREATER THAN 50 AND PLASTICITY INDEX (PI) OF GREATER THAN 30.
   C. COEFFICIENT OF PERMEABILITY – APPENDIX VII OF THE CORPS OF ENGINEERS MANUAL EM 1110–2–1906 OR ASTM D 5084 – 1x10–6CM/SEC, OR LESS.

SOILS FOR CONSTRUCTED LINERS MOISTURE/DENSITY (M/D) TESTING
IN ADDITION TO THE MINIMUM TEST REQUIREMENTS IN 2.2, ABOVE, A MOISTURE/DENSITY RELATIONSHIP MUST BE DETERMINED FOR EACH SOIL BORROW SOURCE TO BE USED IN SOIL LINER CONSTRUCTION. THIS MOISTURE/DENSITY (M/D) COMPACTION CURVE MUST INCLUDE A ZERO–AIR–VOIDS LINE BASED UPON AN ESTIMATED OR MEASURED SPECIFIC GRAVITY OF THE COMPACTED SOIL. THE TWO ACCEPTABLE STANDARD MOISTURE/DENSITY RELATIONSHIP TEST PROCEDURES ARE:
A. ASTM D 698 (STANDARD PROCTOR) –– 12,400 FT–LBF/FT3 1(FOR LIGHT–WEIGHT EQUIPMENT), OR
B. ASTM D 1557 (MODIFIED PROCTOR) –– 56,000 FT–LBF/FT3 (FOR HEAVY EQUIPMENT)

SOIL LINER MATERIAL MINIMUM PHYSICAL REQUIREMENTS CONT.

IN ORDER TO DETERMINE THAT THE PROPOSED SOIL IS SUITABLE FOR USE AS LINER MATERIAL, PERMEABILITY TESTS MUST BE CONDUCTED ON SAMPLES COMPACTED UNDER THE ABOVE–LISTED COMPACTIVE–EFFORT TEST PROCEDURES. THESE SOILS SHALL BE PREPARED AND TESTED AS NEXT DESCRIBED.
A. THERE SHOULD BE NO CONSTRUCTED LINERS PARALLEL TO SIDE SLOPES WITH GREATER THAN 3:1 SLOPE ANGLE (3 HORIZONTAL TO 1 VERTICAL) DUE TO BOTH THE INHERENT LACK OF STABILITY OF THE COMPACTION EQUIPMENT ON THESE STEEP SLOPES AS–WELL–AS THE COMPACTION INEFFICIENCY. IT SHOULD BE REALIZED THAT SOIL LINERS CONSTRUCTED PARALLEL TO SIDE SLOPES HAVE INHERENT CONSTRUCTION PROBLEMS BECAUSE THE FULL COMPACTIVE FORCE OF THE COMPACTION EQUIPMENT IS NOT PERPENDICULAR TO THE SLOPE. THE ECCENTRIC WEIGHT OF THE EQUIPMENT (TENDENCY TO SLIDE DOWN THE SLOPE) MAY SHEAR THE UPPER PORTION OF THE LIFT UNDER COMPACTION NEAR ITS SURFACE. THE OVERALL UNIFORMITY OF THE PROCESSING AND COMPACTING EFFORT ON A SLOPE IS USUALLY OF LOWER QUALITY THAN ON AN ESSENTIALLY–FLAT SECTION. ACCORDINGLY, THE LARGE–SCALE HYDRAULIC CONDUCTIVITY TESTS PERFORMED ON A PRIMARILY–HORIZONTAL TEST PAD WILL NOT BE REPRESENTATIVE OF THE PROBABLE WORST–CASE LINER–CONSTRUCTION CONDITIONS WHERE SLOPED LINERS ARE INVOLVED.
B. A KEYWAY FOR CONSTRUCTED SIDEWALLS IS REQUIRED UNLESS ALTERNATE CONSTRUCTION PROCEDURES HAVE PRIOR WRITTEN APPROVAL BY THE EXECUTIVE DIRECTOR. THE CONSTRUCTED KEYWAY AT THE TOE OF THE SIDEWALL MAY BE ELIMINATED FOR THOSE SIDEWALLS CONSTRUCTED ON A SLOPE ANGLE OF 4:1 OR FLATTER; THOSE CONSTRUCTED WITH THE FLOOR AS ONE UNIT (MONOLITHICALLY); OR SIDEWALL PLACES IN HORIZONTAL LIFTS A MINIMUM OF 10 FT. IN WIDTH AND HAVING THE FIRST SIX INCH LIFT OF THE SIDEWALL COMPLETELY BONDED WITH THE TOP OF THE FLOOR LINER.
C. PLACEMENT OF CONSTRUCTED LINERS (CLAY–TYPE MATERIAL) SHOULD BE IN ACCORDANCE WITH THE FOLLOWING:
   1. ALL SURFACE AREAS SHOULD BE PROPERLY SCARIFIED A MINIMUM OF SIX INCHES AND PREPARED TO RECEIVE THE LINER.
   2. THE TOP OF EACH LIFT SHOULD BE ROUGHENED TO A SHALLOW DEPTH PRIOR TO THE PLACEMENT OF THE NEXT LIFT OF SOIL FOR COMPACTION.
   3. NO LOOSE LIFT SHOULD BE THICKER THAN THE PADS OF THE COMPACTOR SO THAT COMPLETE BONDING WITH THE TOP OF THE PREVIOUS LIFT IS ACHIEVED.
   4. EQUIPMENT AND SAFETY LIMITATION PROHIBIT FINISHED GRADES WITH SLOPES GREATER THAN 3:1 IF THE LINER IS CONSTRUCTED PARALLEL TO THE SURFACE. FOR AN EXCAVATED WALL WITH STEEPER THAN 3:1 SIDE SLOPES, THE SIDEWALL LINER MUST BE CONSTRUCTED IN SUCCESSIVE HORIZONTAL LIFTS.
   5. THE TOP SURFACE OF THE COMPLETED SOIL LINER MUST BE PROOF ROLLED WITH A SMOOTH–WHEEL ROLLER, PRIOR TO FINAL LINER–THICKNESS SURVEYING WHEN PLACEMENT OF A GEOMEMBRANE LINER IS REQUIRED.
   6. IT IS RECOMMENDED THAT THE SURFACE OF A SOIL LINER BE PROOF ROLLED WHEN CONSTRUCTION IS SHUT DOWN FOR MORE THAN 24 HOURS TO MITIGATE THE EFFECTS OF DESICCATION. IT IS FURTHER RECOMMENDED THAT IT BE DONE ON A ROUTINE BASIS DURING THE SUMMER MONTHS AT THE END OF EACH DAY'S LINER CONSTRUCTION.

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

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

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

16 COMPACTIVE EFFORT (SOILS COMPACTION)
ALL CONSTRUCTED SOIL LINERS MUST BE COMPACTED WITH A PAD/TAMPING–FOOT (PREFERABLE) OR PRONGFOOT ROLLER (§330.205(G), MSWR). NO OTHER TYPE OF EQUIPMENT IS SUITABLE FOR THE COMPACTION OF CONSTRUCTED SOIL LINERS.
2 THE LIFT THICKNESS SHALL BE CONTROLLED SO THAT THERE IS TOTAL PENETRATION THROUGH THE LOOSE LIFT UNDER COMPACTION INTO THE TOP OF THE PREVIOUSLY COMPACTED LIFT; THEREFORE, THE COMPACTED LIFT THICKNESS MUST NOT BE GREATER THAN THE PAD OR PRONG LENGTH. THIS IS NECESSARY TO ACHIEVE ADEQUATE BONDING BETWEEN LIFTS AND REDUCE SEEPAGE PATHWAYS. ADEQUATE CLEANING DEVICES MUST BE IN PLACE AND MAINTAINED ON THE COMPACTION ROLLER SO THAT THE PRONGS OR PAD FEET DO NOT BECOME CLOGGED WITH CLAY SOILS TO THE POINT THAT THEY CANNOT ACHIEVE FULL PENETRATION DURING INITIAL COMPACTION. THE FOOTED ROLLER IS NECESSARY TO ACHIEVE BONDING AND TO REDUCE THE INDIVIDUAL CLODS AND ACHIEVE A BLENDING OF THE SOIL MATRIX THROUGH ITS KNEADING ACTION. IN ADDITION TO THE KNEADING ACTION, WEIGHT OF THE COMPACTION EQUIPMENT IS IMPORTANT. WHEN USING ASTM TEST METHOD D 698 (STANDARD PROCTOR) DENSITY, THE MINIMUM WEIGHT OF THE COMPACTOR SHOULD BE 1500 POUNDS PER LINEAR FOOT OF DRUM LENGTH, AND A MINIMUM OF EIGHT PASSES IS RECOMMENDED FOR THE COMPACTION PROCESS. COMPACTION EQUIPMENT THAT DEVELOPS A COMPACTIVE EFFORT EQUAL TO ASTM D 1557 (MODIFIED PROCTOR) WILL RESULT IN GREATER COMPACTION, LOWER COEFFICIENT OF PERMEABILITY DUE TO DECREASED VOID SPACE, AND A LOWER OPTIMUM MOISTURE CONTENT NECESSARY TO ACHIEVE THE MAXIMUM DRY DENSITY. THIS LOWER OPTIMUM MOISTURE CONTENT MAY HELP IN CONTROLLING THE DESICCATION CRACKING OF HIGHLY PLASTIC CLAYS FREQUENTLY USED FOR LINER SOIL. ADEQUATE COMPACTION CANNOT BE ACHIEVED BY TRACK–TYPE (BULLDOZER) OR PNEUMATIC COMPACTORS. BULLDOZERS ARE BY THE NATURE OF THEIR WEIGHT DISTRIBUTION DESIGNED TO "FLOAT" ON THE SURFACE, RESULTING IN GREATLY DIMINISHED COMPACTION BY TRACK CONTACT AND THEREFORE SHOULD NOT BE USED TO COMPACT LINER SOILS. IN ADDITION, THE USE OF TRACKS OR RUBBER TIRES FOR COMPACTION DOES NOT ALLOW THE KNEADING ACTION REQUIRED TO REDUCE AND BLEND SOIL CLODS AS IS REALIZED BY PAD–FOOTED ROLLERS.

COMPACTION EQUIPMENT
THE COMPACTION OF SOIL LINERS MUST BE WITH APPROPRIATE EQUIPMENT.
1. PAD/TAMPING–FOOT ROLLERS, OR
2. PRONG–FOOT (SHEEPSFOOT) ROLLERS

THE FOLLOWING EQUIPMENT TYPES ARE EXAMPLES OF THAT WHICH IS NOT PERMITTED OR APPROPRIATE FOR THE COMPACTION OF SOIL LINERS.
1. BULLDOZER
2. RUBBER–TIRED (PNEUMATIC) ROLLERS
3. FLAT–WHEELED ROLLERS
4. RUBBER–TIRED SCRAPERS OR BELLY DUMPS

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

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

Revision / Date

Project:
ATHLETICS COMPLEX IMPROVEMENTS AT JARRELL HIGH SCHOOL
FOR
JARRELL I.S.D.
1100 FM 487, JARRELL, TEXAS 76537

LANGAN | Adams

STATE OF TEXAS
JACK H. GARNER, JR.
98447
LICENSED PROFESSIONAL ENGINEER
10·28·2021
TBPE Registration #: F- 13,709

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WATER QUALITY & DETENTION POND NOTES

PACKAGE 1 1

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