



INSTALL BULLRUSH IN CLUMPS, WITH INDIVIDUAL PLANTS SPACED APPROXIMATELY THREE TO FOUR FEET ON CENTER. AT LEAST TWO OF THE FOLLOWING SPECIES SHALL BE USED:

INSTALL SPIKERUSH AT OR NEAR WATER'S EDGE, WITH INDIVIDUAL PLANTS SPACED  
APPROXIMATELY THREE TO SIX FEET ON CENTER. AT LEAST TWO OF THE FOLLOWING SPECIES  
SHALL BE USED:

<u>ELEOCHARIS MONTEVIDENSIS</u> SPIKERUSH	0" - 6"	1' TALL, RHIZOMATOUS, REDUCES EROSION AT THE POND EDGE
<u>ELEOCHARIS MACROSTACHYS</u> SPIKERUSH	0" - 6"	1' TALL, RHIZOMATOUS, REDUCES EROSION AT THE POND EDGE
<u>ELEOCHARIS QUADRANGULATA</u> SPIKERUSH	3" - 1'	2' TO 2.5 TALL, RHIZOMATOUS, CAN ACCOMMODATE DEEPER WATER, 4-ANGLED

AT LEAST TWO SPECIES OF THE FOLLOWING MARSH SPECIES SHALL BE USED (ADDITIONAL SPECIES ARE ENCOURAGED).  
INSTALL IN CLUMPS IN SHALLOW WATER, WITH INDIVIDUAL PLANTS SPACED AT APPROXIMATELY THREE FEET ON CENTER

1. <u>CYPHERUS OCHARCEUS</u> FLATSEDGE	2" - 6"	1' TO 2' TALL, CLUMP-FORMING, COMMON TO CENTRAL TEXAS
2. <u>DICHROMENA COLORATA</u> WHITE-TOPPED SEDGE	2" - 6"	1' TO 2' TALL, WHITE BRACTS DURING WARM SEASON
3. <u>ECHINODORUS ROSTRATUS</u> BURHEAD	3" - 1'	1' TO 2' TALL, ANNUAL, HEART-SHAPED LEAF FLOWER SIMILAR TO ARROWHEAD
4. <u>FLOCHORIS QUADRANGULATA</u> FOUR-SQUARE SPIKEBRUSH	6" - 1'	1' TO 2' TALL, COLONIES, INHABITS DEEPER WATER THAN SPIKEBRUSHES
5. <u>IRIS PSEUDOCARIS</u> YELLOW FLAG IRIS	1' - 2'	3' TO 4' TALL, CAN BE INVASIVE, DENSE GROWTH, YELLOW FLOWERS
6. <u>JUNCUS EFFLUSUS</u> SOFT RUSH	6" - 1'	3' TO 4' TALL, FORMS A TIGHT CLUMP, EVERGREEN, VERY ATTRACTIVE
7. <u>JUSTICIA AMERICANA</u> WATER-WILLOW	2" - 6"	3' TO 4' TALL, COMMON, WHITE FLOWERS, HERBACEOUS, COLONIZES
8. <u>MARSILEA MACROPODA</u> WATER CLOVER	2" - 6"	LOOKS LIKE FLOATING FOUR-LEAF CLOVER, ENDEMIC TO TEXAS
9. <u>NAJAS GUADALUPENSIS</u> WATER-NAJAD	1' - 4'	SUBMERGENT, VALUABLE TO FISH AND WILDLIFE
10. <u>PONTEDERIA CORDATA</u> PICKERLEWEED	2" - 1'	3' TALL, COLONIZES, COSMOPOLITAN, PURPLE FLOWERS
11. <u>RHYNCHOSPORA CORNICULATA</u> HORNED-RUSH	2" - 6"	2' TO 3' TALL, BRASS-COLORED FLOWERS IN M

INSTALL ARROWHEAD IN CLUMPS IN SHALLOW WATER, WITH INDIVIDUAL PLANTS SPACED APPROXIMATELY THREE FEET ON CENTER.

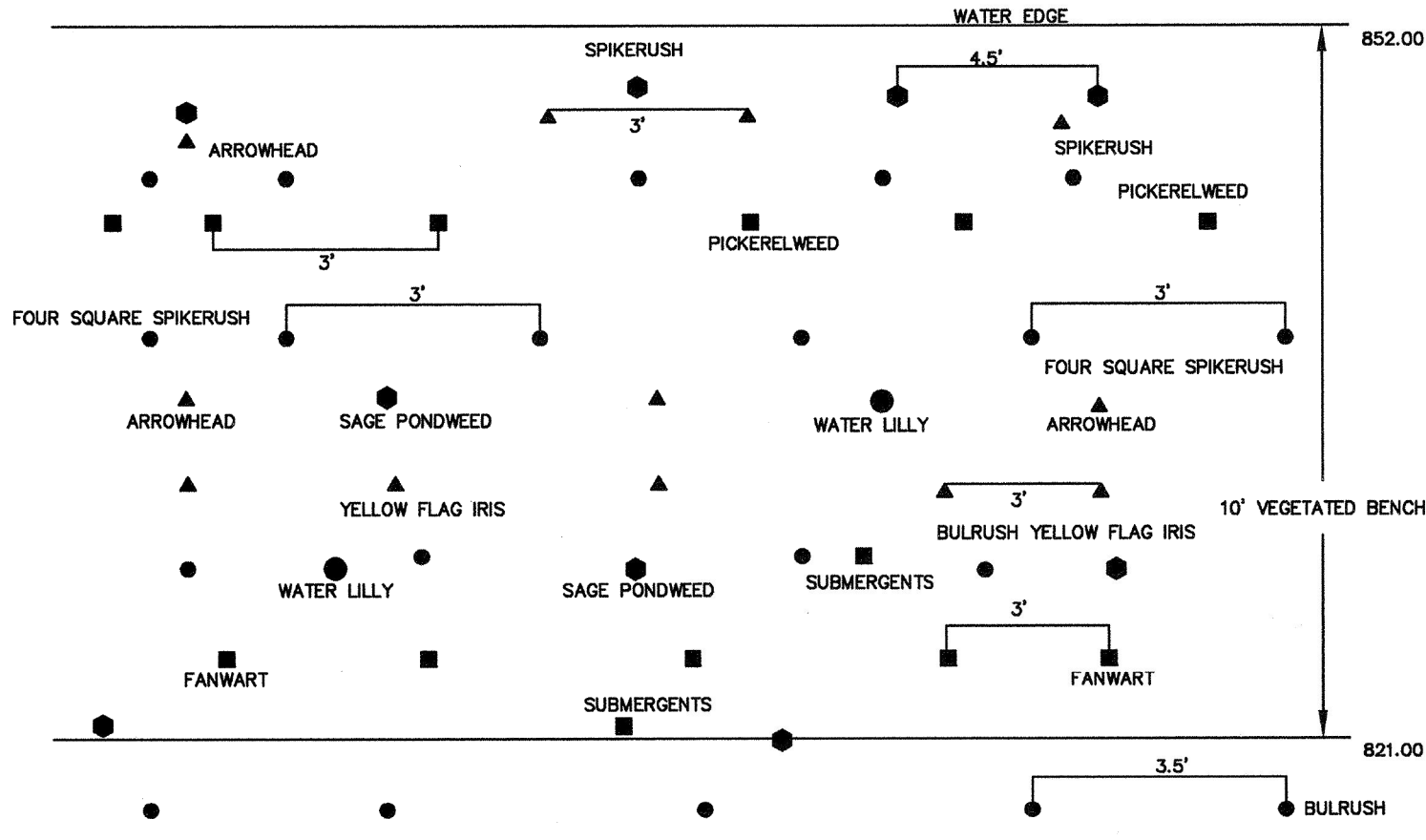
PLANTING PLAN			
SURFACE AREA OF PERMANENT POOL =		32,301 SF	
32,301 x 0.03 = 969 NUMBER OF PLANTS REQUIRED (MINIMUM)			
PLANT CATEGORY	RATIO	MINIMUM NO. OF PLANTS	MINIMUM SIZE
A. BULLRUSH	40%	388	2 GALLON
B. SPIKURUSH	20%	194	2.5-INCH LINER
C. MARSH DIVERSITY	20%	194	1 GALLON
D. ARROWHEAD	10%	97	1 GALLON
E. SUBMERGENTS	5%	48	1 GALLON
F. FLOATING AQUATICS	5%	48	1 GALLON
<b>TOTAL</b>		<b>969</b>	

PROPERTY	TEST METHOD	UNIT	SPECIFICATION
PERMEABILITY	ASTM D-2434	CM/SEC	(DEPTH 0" TO 12") 1 x 10 <sup>-7</sup>
LIQUID INDEX OF CLAY	ASTM D-423 & D-424	%	NOT LESS THAN 30
PLASTIC LIMIT OF CLAY	ASTM D-2216	%	NOT LESS THAN 50
CLAY PARTICLES PASSING	ASTM D-422	%	NOT LESS THAN 60
CLAY COMPACTION	ASTM D-2216	%	95% OF STANDARD PROCTOR DENSITY

\* REFER TO RECOMMENDATION IN GEOTECHNICAL REPORT. ANY DISCREPANCIES BETWEEN THIS SET OF PLANS AND THE GEOTECHNICAL REPORT WILL FOLLOW THE RECOMMENDATION(S) OF THE GEOTECHNICAL REPORT.

<b>SAGITTARIA LATIFOLIA</b> ARROWHEAD	2" - 1'	2' HEIGHT, WILDLIFE VALUE, WHITE FLOWERS, PROVEN WATER QUALITY PERFORMER
<p>THE FOLLOWING CATEGORY, AQUATICS, INCLUDES SUBMERGENTS AND FLOATING-LEAVED AQUATICS. SUBMERGENTS ARE ROOTED IN THE SEDIMENT OF THE POND, AND ARE COMPLETELY SUBMERGED IN THE WATER. FLOATING-LEAVED AQUATICS ARE ROOTED IN THE SEDIMENT OF THE POND, AND HAVE FLOATING LEAVES ON THE SURFACE OF THE WATER. THESE LEAVES SHADE THE WATER, WHICH LIMITS POTENTIAL ALGAE GROWTH. AT LEAST TWO OF THE FOLLOWING SPECIES SHALL BE USED AND SHOULD BE PLACED AT RANDOM LOCATIONS THROUGHOUT THE POND:</p>		

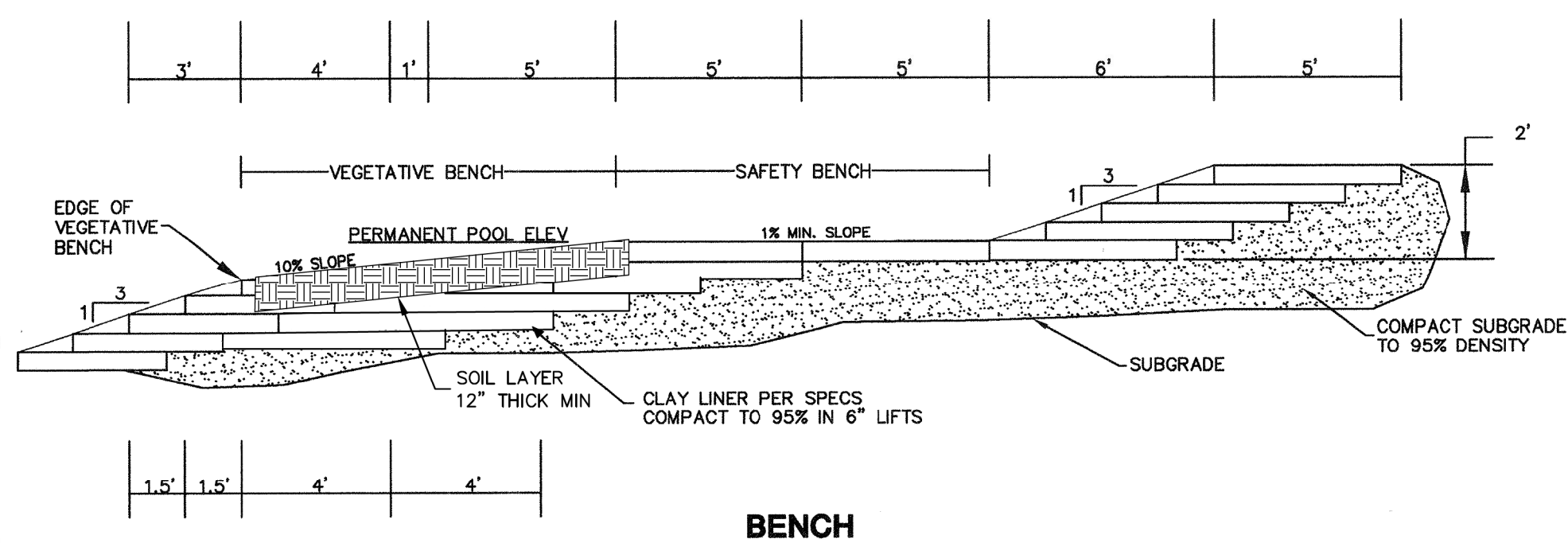
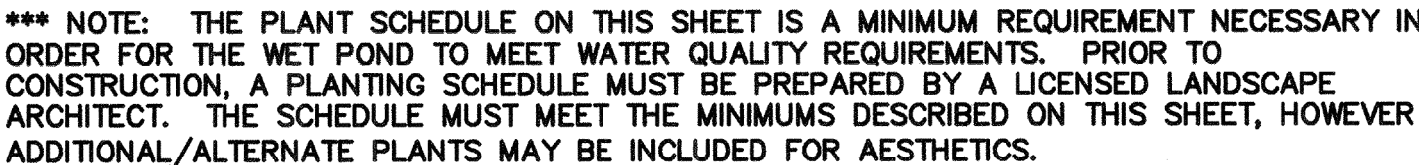
1. <u>CASOMBA CAROLINIANA</u> FANWORT	1' - 4'	APPROXIMATELY 6' LENGTH UNDERWATER, SUBMERGENT
2. <u>CERATOPHYLLUM SPP.</u> COON-TAIL	1' - 4'	MAXIMUM 8' LENGTH, TOLERANT OF TURBIDITY AND WATER FLUCTUATION, WILDLIFE FOOD
3. <u>NYMPHAEA ODORATA</u> WATER LILY	6" - 2'	A NATIVE, RELIABLY HARDY, FLOATING-LEAF AQUATIC, WITH WHITE FLOWERS
4. <u>OSTEOTROPION PECTINATUS</u> SAGO PONDWEED	8" - 3'	COLONIZES QUICKLY, VALUABLE TO FISH AND WILDLIFE, FLOATING-LEAVED AQUATIC



N.T.S.

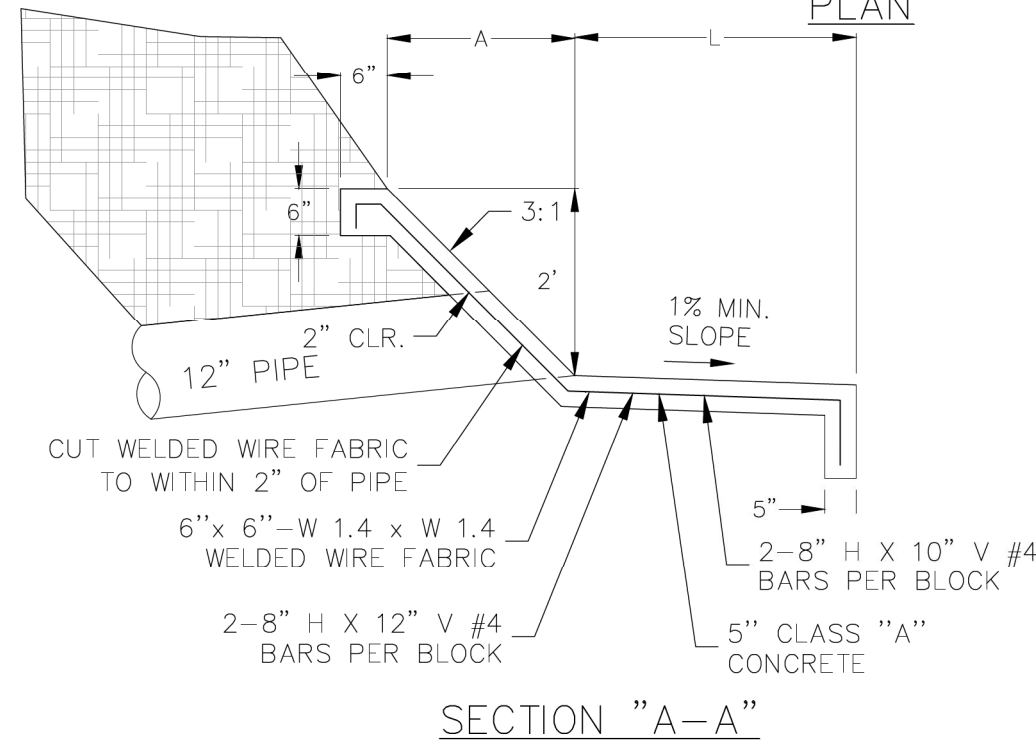
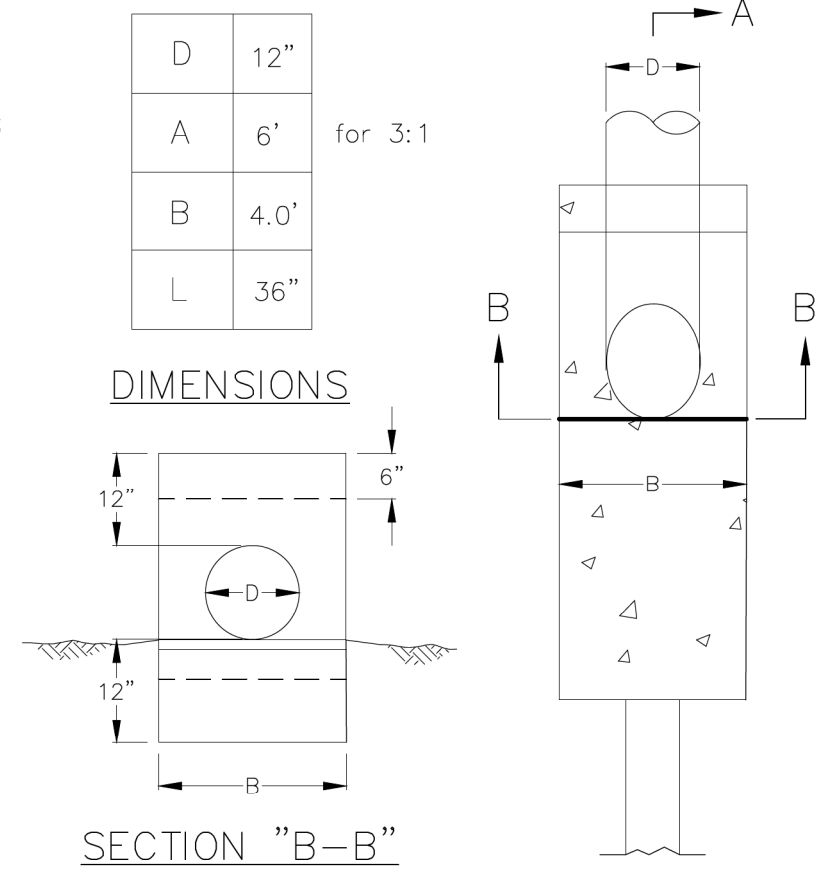
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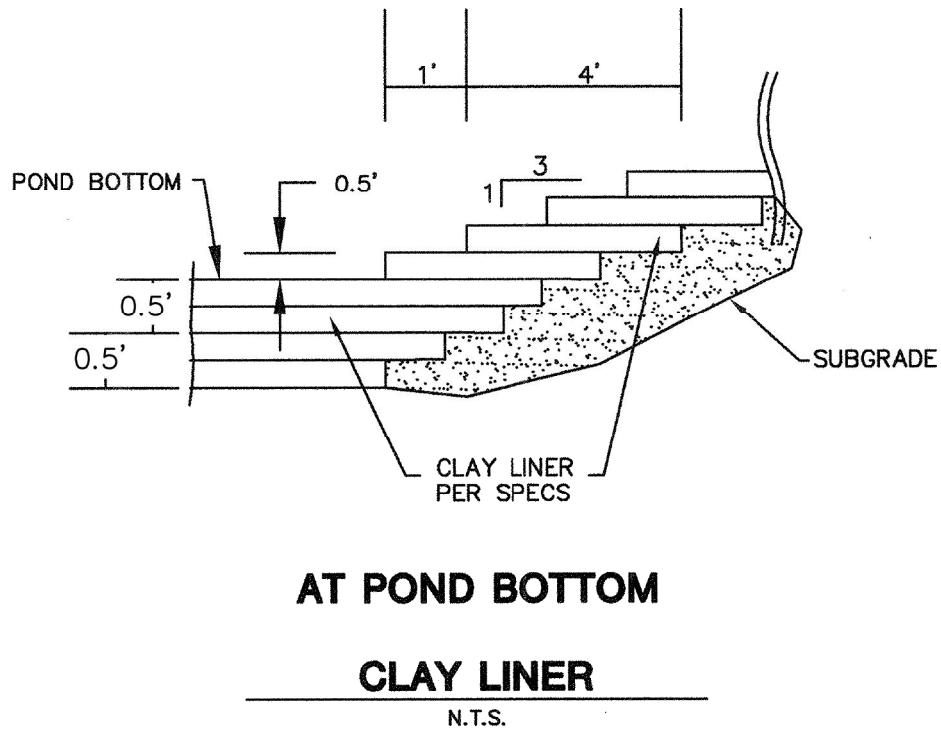


1. THE CONTRACTOR IS TO CONSTRUCT ALL POND EMBANKMENT SECTIONS AND LINERS PER THE GEOTECHNICAL ENGINEERING STUDY FOR KINWOODOWN AS PREPARED BY TIL, INC.
2. WETLAND PLANTS PROVIDED IN BARE-ROOF FORM SHALL BE EQUAL IN ROOT BALL SIZE TO THE LISTED MINIMUM CONTAINER SIZES.
3. ALL WETLAND PLANTS WHICH FULFILL THE MINIMUM LANDSCAPE REQUIREMENTS SHALL BE PROPAGATED OR HARVESTED FROM REGIONALLY ADAPTED STOCK (WHENEVER POSSIBLE). THESE ARE PLANT SPECIES OR GENOTYPES WHICH ARE NATIVE TO A RANGE OF WITHIN 250 MILES OF THE PROJECT SITE.
4. A MINIMUM OF 90% OF THE VEGETATION SHALL BE ALIVE AND Viable FOR ONE YEAR FOLLOWING INSTALLATION.
5. WETLAND PLANTS MUST BE INSTALLED AT WATER DEPTHS APPROPRIATE TO THE SPECIES. THE WATER DEPTHS NOTED IN THE TABLE ON THIS SHEET SHOW THE RANGE OF NATURAL ZONES IN WHICH THESE PLANTS CAN BE FOUND. PLANTING DEPTHS ARE USUALLY SHALLOWER DUE TO THE FACT THAT THE PLANTS ARE GROWN IN CONTAINER. MINIMUM DEPTH FOR 10" DEEP PLANT MATERIAL. PLANTS SHALL BE INSTALLED AT THE SHALLOW WATER DEPTH LISTED.
6. CATTAILS (TYPHA SPP.) TEND TO INVASE ALMOST ALL WETLANDS AND AGGRESSIVELY COLONIZE THE SHALLOW WATER BENCH. THEREFORE CATTAILS SHALL NOT BE SPECIFIED ON THE PLANTING LIST.
7. THE DESIGNER IS NOT LIMITED TO THE SPECIES DESCRIBED. ADDITIONAL SPECIES USED FOR AESTHETIC REASONS, ETC. ARE ENCOURAGED. PLANTS NOT INTENDED TO MEET MINIMUM REQUIREMENTS DO NOT NEED TO BE NATIVE OR REGIONALLY ADAPTED STOCK.
8. MICROBIAL INTACTATION: A SUBSTANTIAL PORTION OF THE POLLUTANT REMOVAL IN WET POND SYSTEMS IS ACCOMPLISHED BY THE POTENTIAL OF SUCH MICROBIAL ACTIVITY. TO SUBSTRATE REMOVE NUTRIENTS THROUGH A PROCESS OF DENITRIFICATION, THESE MICROBIAL PROCESSES REQUIRE AN ORGANIC FOOD SOURCE, SUCH AS DECAYING PLANT LITTER. BECAUSE IT IS NOT FEASIBLE TO PROVIDE A CONSTANT SUPPLY OF ORGANIC NUTRIENT VIA CONSTANT UPLAKE BY LIVING PLANTS - DENITRIFICATION CAN BE EXPECTED TO CONTINUE EVEN DURING PERIODS OF LOW PLANT ACTIVITY. PLANT LITTER IS THE MOST EFFECTIVE AND ECONOMICALLY FEASIBLE PLANTS SUPPLY THE NECESSARY LITTER LAYER AND AEROBIC ZONE FOR MICROBIAL ACTIVITY. HOWEVER, SINCE NEW PLANTS LACK A SUFFICIENT SOURCE OF ORGANIC MATERIAL, AN APPROPRIATE LITTER LAYER MUST BE PROVIDED. PLANT LITTER CAN BE OBTAINED FROM ANY MATERIAL WHICH IS INSTALLED DURING CONSTRUCTION. AFTER THE POND LINER IS IN PLACE YET PRIOR TO ALLOWING THE POND TO BE FILLED, SPREAD A MINIMUM OF ONE INCH OF PLANT LITTER EVENLY ON THE POND SUBSTRATE. PLANT LITTER SHOULD BE SPREAD IN A MANNER WHICH CREATES A SHALLOW WATER BENCH IN THIS MANNER AND ALL POND SLOPES (RANGING FROM 3:1 TO 10:1). CRIMP THE PLANT LITTER INTO THE POND SUBSTRATE TO PREVENT THE MATERIAL FROM BEING TRANSPORTED BY WIND OR WATER.
9. ALGAE: HIGH NUTRIENT LOADS IN WET POND MAY CAUSE ALGAE BLOOMS TO OCCUR. PUNGENT ODOR IS OFTEN ASSOCIATED WITH THESE ALGAE BLOOMS. HOWEVER, TREATING WITH AN ALGACIDE IS NOT RECOMMENDED BECAUSE BLOOMS ARE USUALLY SHORT LIVED AND ARE OFTEN THE RESULT OF NUTRIENT LEAKS FROM THE POND. THE USE OF ALGACIDE TO CONTROL FLOATING-LEAFED AQUATICS CAN REDUCE THE EXTENT OF ALGAE BLOOMS BY REDUCING NUTRIENT LOADS AND SHADING THE WATER.
10. NUTRIAL: WILDFISH, SUCH AS NUTRIAS, HAS BEEN REPORTED TO DESTROY THE VEGETATED POND SUBSTRATE. THEREFORE THE POTENTIAL OF SUCH WILDFISH INHABITING OR BEING ATTRACTED TO THE PROPOSED POND SITE IS REQUIRED. WHEN THERE IS A POTENTIAL FOR SUCH ACTIVITY, FENCING (SUCH AS CHAIN LINK) SHOULD BE PROVIDED.
11. MOSQUITO CONTROL: MOSQUITOES ARE PROBLEMS IN URBAN AREAS. STANDING WATER IN WET POND SYSTEMS CAN BECOME A MOSQUITO BREEDING AREA. MOSQUITOES ARE AT RISK WITH THE FISH SPECIES GAMBUSIA AFFINIS TO SERVE AS A BIOLOGICAL CONTROL FOR MOSQUITOES. GAMBUSIA IS EFFECTIVE CONTROL FOR MOSQUITOES ELIMINATING THE NEED FOR CHEMICAL CONTROL. GAMBUSIA IS AN INVASIVE SPECIES. THE INITIAL CONSTRUCTION OF THE POND SHOULD BE DESIGNED TO PREVENT MOSQUITOES FROM ENTERING THE POND.
12. DOMESTIC WATERFLOW: DOMESTIC WATERFLOW CAN DESTROY VEGETATION AND INCREASE POLLUTANT LOADING IN WET POND SYSTEMS IN ADDITION, WATERFLOW CAN BECOME NUISANCES TO PROPERTY OWNERS NEAR THE POND. FOR THESE REASONS, DOMESTIC WATERFLOW SHOULD NOT BE INTRODUCED OTHER THAN THE SYSTEM.
13. CARP AND GOLDFISH: CARP AND GOLDFISH ARE BOTTOM-FEEDERS THAT CAN CAUSE TURBIDITY. TURBIDITY SHOULD NOT BE INTRODUCED INTO A WET POND.
14. INITIAL FILLING: WHILE THE POND IS IN CONSTRUCTION, IT IS INTENDED THAT NON POTABLE WATER, NOT POTABLE WATER, BE USED TO FILL UP THE POND.
15. UTILITY LINES: UTILITY LINES MAY NOT BE LOCATED WITHIN THE LIMITS OF THE MAXIMUM WATER SURFACE ELEVATION OF A WET POND.
16. HAZARDOUS MATERIAL TRAP: SPILLS OF HAZARDOUS LIQUIDS CAN SEVERELY DAMAGE OR KILL THE BIOTA OF A WET POND. THEREFORE, DEVELOPMENTS WHERE THE TRANSPORTATION, STORAGE, OR USE OF HAZARDOUS MATERIALS IS INVOLVED SHOULD PROVIDE A HAZARDOUS MATERIAL TRAP IN THE DRAINAGE SYSTEM IMMEDIATELY UPSTREAM OF THE WET POND INLET.
17. 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 BEING AN ANAEROBIC ENVIRONMENT. THE POND SHOULD BE DESIGNED TO PREVENT THE POND FROM BEING AN ANAEROBIC ENVIRONMENT.

1. PRIOR TO INITIALLY FILLING THE PERMANENT POOL, THE CLAY LINER WITHIN THE PERMANENT POOL SHALL BE KEPT MOIST UNTIL THE PERMANENT POOL VOLUME HAS BEEN REACHED TO PREVENT CRACKS FROM FORMING IN THE LINER.
2. ALL BACK FILL FOR THE INVERTED OUTFALL PIPE AND MAKE-UP WATER LINE SHALL BE OF CLAY MATCHING THE SPECIFICATIONS LISTED
3. THE INVERTED OUTFALL PIPE SHALL HAVE WATER TIGHT JOINTS.
4. CONTRACTOR IS TO MONITOR THE SURFACE WATER ELEVATION OF THE PERMANENT POOL UNTIL CONSTRUCTION IS COMPLETE. THE CONTRACTOR SHALL CONTACT THE ENGINEER/OWNER IMMEDIATELY IF THE POND IS LOSING MORE THAN 1.5" OF WATER AT ANY GIVEN WEEK.



## SLOPING CONCRETE HEADWALL DETAIL



REFER TO THE COVER SHEET  
FOR BENCHMARK INFORMATION.

